

Maharashtra Metro Rail Corporation Limited

(A Joint Venture of Government of India and Government of Maharashtra)

PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021


BIDDING DOCUMENTS

For

Project : PUNE METRO RAIL PROJECT

Employer : Maharashtra Metro Rail Corporation Limited

Country : India

 <p>महा मेट्रो PUNE METRO</p>	<p align="center">E-TENDER NOTICE MAHARASHTRA METRO RAIL CORPORATION LTD Pune Metro Rail Project (A joint venture of Govt. of India & Govt. of Maharashtra) 101, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune - 411001 E-mail: tenders.pmrp@mahametro.org Website: www.punemetroRail.org Telephone: 020-26051074</p>
Tender Notice No. P1-T06/2021	Dt. 27.11.2021
Name of work:	Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

KEYDETAILS:

This e-Tender Notice replaces all previous tender notices and corrigenda with regard to the above-mentioned tender. New bidders are free to purchase the tender package, for bidders that previously bought the tender documents no additional fee will be charged.

Completion Period	15 (Fifteen) Months (including Monsoon Period).
Documents on sale	Documents can be downloaded from 16.00 hrs. on 27.11.2021 to 16.00 Hrs. of 18.01.2022 from Maharashtra Metro Rail Corporation Limited's e-tender Portal.
Cost of documents	INR 59,000/- non-refundable (inclusive applicable taxes) through e-payment by RTGS/NEFT/Credit Card, as per procedure given in e-tender portal.
Source of funds	The Employer has applied loans from the European Investment Bank - EIB (hereinafter called "Funding Agency") towards the part cost of the Project and intends to apply a portion of the proceeds of the loans for payments under this Contract. Disbursement of the loans will be subject, in all respects, to the terms and conditions of the Loan Agreements, including the disbursement procedures and the applicable guidelines of EIB. http://www.eib.org/attachments/strategies/guide_to_procurement_en.pdf .
Pre-Bid Meeting	The pre-bid meeting shall be conducted on 15.12.2021 through video conferencing by software apps such as Zoom, Microsoft Team, etc. All Prospective bidders shall provide the details of the person(s) (maximum up to two) who will be participating in such virtual meeting at least one day before the meeting (latest by 1100 hrs on 14.12.2021) to the registered official email of Maha-Metro i.e. tenders.pmrp@mahametro.org , so that links having details such as software, meeting ID, password etc. can be mailed to these persons at least 12 hours before the scheduled pre-bid meeting. Further, bidder are requested to send Pre-bid clarifications on the registered official email of Maha-Metro i.e. tenders.pmrp@mahametro.org by 1600 hrs on 14.12.2021 Queries received after 1600 hrs on 14.12.2021 shall not be entertained.
Last date of submission of queries for pre-bid by the bidder.	Up till 22.12.2021 at 11.00 hrs in the soft copy by email tenders.pmrp@mahametro.org
Bid Securing Declaration	Bidders are required to submit Form of Bid Securing Declaration as per the format given in the Tender along with the Bid.
Date & Time of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).
Date & Time of Opening of Bid	On 18.01.2022 at 16.30 Hours or as decided by the authority at the Office of Maharashtra Metro Rail Corporation Limited, 1st Floor, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune-411001.

Eligibility Criteria	Tenders are open to nationals of all countries, who fulfil the criteria stipulated in Evaluation and Qualification Criteria (EQC). A firm, who has paid tender fee for the tender documents in their name, can submit the tender either as an individual firm or in JV/ Consortium.
Bid Validity	Tenders shall be valid for a period of 180 days (both days inclusive i.e., the date of submission of tenders and the last date of period of validity of the tender) from the latest date of online submission of Tenders, as described in ITB 18.1 of Instructions to Bidder.
Award of Contract	The Contract will be awarded to the preferred Bidder whose Tender has been determined to be substantially responsive and compliant to the requirements contained in the Tender Documents and who has offered the Lowest Evaluated Price as per ITB 36.1, subject to the quoted amount is considered to be acceptable.
Jurisdiction of Courts	Any suit or application, arising out of any dispute or differences on account of this Tender shall be filed in District and Sessions court at Pune, State Maharashtra/ High Court of Judicature at Bombay, State Maharashtra/ Supreme Court of India, New Delhi only and no other court or any other district of the country shall have any jurisdiction in the matter.
Sale of document, e-payment procedure, submission and other details are available on Maha-Metro tender portal under Pune Metro section in e-tenders https://mahametrorail.etenders.in . To view this tender notice, interested Agencies may visit the Pune Metro Rail website " www.punemetrorail.org ".	

**Executive Director (Procurement & Contracts)/PMRP
Maharashtra Metro Rail Corporation Limited**

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DISCLAIMER

The Bidding Documents for “**Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project**” contain brief information about the Project and the Works to be executed and various steps involved in the bidding process. The information contained in the Bidding Documents or subsequently provided to Bidders, whether verbally or in documentary or any other form by or on behalf of **Maharashtra Metro Rail Corporation Limited** (hereinafter referred as “**Maha-Metro**” or “the Company” or “Employer”) or any of its employees or advisors, is provided to Bidders on the terms and conditions set out in the Bidding Documents and such other terms and conditions subject to which such information is provided.

The Bidding Documents are not an agreement and is neither an offer nor invitation by **Maha-Metro** to the prospective Bidders or any other person. The purpose of the Bidding Documents is to provide interested parties with information that may be useful to them in making their Bids pursuant to the Bidding Documents. The Bidding Document include statements, which reflect various assumptions and assessments arrived at by **Maha-Metro** in relation to the Project or the work to be executed pursuant to this bidding process. Such assumptions, assessments & statements do not purport to contain all the information that each Bidder may require. The assumptions, assessments, statements & information contained in the Bidding Documents may not be complete, accurate, adequate or correct. Each Bidder should, therefore, conduct its own investigations & analysis and should check the accuracy, adequacy, correctness, reliability & completeness of the assumptions, assessments, statements and information contained in the Bidding Documents and obtain independent advice from appropriate sources.

Information provided in the Bidding Documents to the Bidders is on a wide range of matters, some of which may depend upon interpretation of law. The information given is not intended to be an exhaustive account of statutory requirements & should not be regarded as a complete or authoritative statement of law. **Maha-Metro** accepts no responsibility for the accuracy or otherwise for any interpretation or opinion on law expressed herein.

Maha-Metro, its employees and advisors make no representation or warranty and shall have no liability to any person, including any Bidder under any law, statute, rules or regulations or tort, principles of restitution or unjust enrichment or otherwise for any loss, damages, cost or expense which may arise from or be incurred or suffered on account of anything contained in the Bidding Documents or otherwise, including the accuracy, adequacy, correctness, completeness or reliability of the Bidding Documents & any assessment, assumption, statement or information contained therein or deemed to form part of the Bidding Documents or arising in any way for participation in this bidding stage.

Maha-Metro also accepts no liability of any nature whether resulting from negligence or otherwise howsoever caused arising from reliance of any Bidder upon the statements/information contained in the Bidding Documents.

Maha-Metro may in its absolute discretion, but without being under any obligation to do so, update, amend or supplement the information, assessment or assumptions contained in the Bidding Documents. **Maha-Metro** also reserves the right to change any or all conditions/ information set in the Bidding Documents at any time by way of revision, deletion, updation or annulment through issuance of appropriate addendum as **Maha-Metro** may deem fit without assigning any reason thereof.

The issue of the Bidding Documents does not imply that **Maha-Metro** is bound to select a Bidder or to appoint the selected Bidder for constructing the work envisaged under the Bidding Documents and **Maha-Metro** reserves the right to reject all or any of the Bidders or Bids without assigning any reason whatsoever.

The Bidders shall bear all its costs associated with or relating to the preparation and submission of its Bid including but not limited to preparation, copying, postage, delivery fees, expenses associated with any demonstrations or presentations which may be required by **Maha-Metro** or any other costs incurred in connection with or relating to its Bid. All such costs and expenses will remain with the Bid and **Maha-Metro** shall not be liable in any manner whatsoever for the same or for any other costs or other expenses incurred by a Bidder in preparation or submission of the Bid, regardless of the conduct or outcome of the bidding process.

Section I - Instructions to Bidders

Clause No	Description
A.	General
1.	Scope of Bid
1.1	In connection with the Invitation for Bids, specified in the Bid Data Sheet (BDS), the Employer, as specified in the BDS, issues these Bidding Documents for the procurement of works and Related Services incidental thereto as specified in Section VII , Schedule of Requirements. The name, identification & number of lots (contracts) of this International Competitive Bidding (ICB) procurement are specified in the BDS.
1.2	Throughout these Bidding Documents
	(a) the term "in writing" means communicated in written form (e.g. by mail, e-mail, fax, telex) with proof of receipt;
	(b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and
	(c) "day" means calendar day.
2.	Source of Funds
2.1	The Employer specified in the BDS has received or has applied for financing (hereinafter called "Funds") from the funding Agency (hereinafter called "the Agency") (status described in BDS) towards the project named in the BDS. The Employer intends to apply a portion of the "Funds" to eligible payments under the contract(s) for which these Bidding Documents are issued.
3.	Corrupt and Fraudulent Practices
3.1	The Purchaser requires compliance with its policy in regard to corrupt and fraudulent practices as set forth in Section V-A.
3.2	The Bidder/Contractor grants the Employer, the EIB and auditors appointed by either of them, as well as any authority or European Union Institution or body having competence under European Union law, the right to inspect and copy the books and records of the bidder, contractor, supplier or consultant in connection with any Bank-financed contract.
4.	Eligible Bidders
4.1	A Bidder may be a firm that is a private entity, a government-owned entity-subject to ITB 4.3 -or any combination of such entities in the form of a joint venture (JV) /Consortium under an existing agreement or with the intent to enter into such an agreement supported by a letter of intent. In the case of a joint venture all members shall be jointly and severally liable for the execution of the Contract in accordance with the Contract terms. The JV/CONSORTIUM shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the members of the JV/CONSORTIUM during the bidding process and, in the event the JV/CONSORTIUM is awarded the Contract, during contract execution. Unless specified in the BDS, there is no limit on the number of members in a JV/CONSORTIUM.
4.2	Conflict of Interest: "Bidders shall not have a conflict of interest. All bidders found to have a conflict of interest shall be disqualified. Bidders shall be considered to have a conflict of interest with one or more parties in this tendering process, if: a. A bidder has been engaged by the Employer to provide consulting services for the preparation related to the procurement of or on the implementation of the project. b. a bidder has any associates/ affiliates (inclusive of parent firms) mentioned in subparagraph (a) above. c. a bidder lends, or temporarily seconds its personnel to firms or organizations which are engaged in consulting services for the preparation related to the procurement of or on the implementation of the project, if the personnel would be involved in any capacity on the same project; or. d. the impartial and objective exercise of the functions of the Employer, or the respect of the principles of competition, non-discrimination or equality of treatment with regard to the procurement procedure or contract, is compromised for reasons involving family, emotional life, political or national affinity, economic interest or any other shared interest. The concept of conflict of interest covers any situation where staff members (or consultants acting on behalf) of the Employer who are involved in the conduct of the procurement procedure or may influence the outcome of that procedure have, directly or indirectly, a financial,

	economic or other personal interest which might be perceived to compromise their impartiality and independence in the context of the procurement procedure or contract execution.”
4.3	A Bidder shall be from any of the eligible source countries indicated in Section V, Eligible Source Countries of External Funding agency.
4.4	A Bidder that has been determined to be ineligible by funding agency in accordance with ITB 3.1 shall not be eligible to be awarded a Contract.
4.5	This bidding is open only to prequalified Bidders unless specified in the BDS .
4.6	A Bidder shall provide such evidence of eligibility satisfactory to the Employer, as the Employer shall reasonably request.
5.	Eligible Goods and Related Services
5.1	All the Goods and Related Services to be supplied under the Contract and financed by the Agency may have their origin in any country in accordance with Section V, Eligibility criteria and social and environmental responsibility.
5.2	For purposes of this Clause, the term "goods" includes commodities, raw material, machinery, equipment, & industrial plants; & "related services" includes services such as insurance, installation, training, and initial maintenance.
5.3	The term "origin" means the country where the goods have been mined, grown, cultivated, produced, manufactured or processed; or, through manufacture, processing, or assembly, another commercially recognized article results that differs substantially in its basic characteristics from its components.
B.	Contents of Bidding Document
6.	Section of Bidding Document
6.1	<ul style="list-style-type: none"> The Bidding Documents consist of Parts 1, 2, 3 and 4, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8. PART - 1 - BIDDING PROCEDURES Section I Instructions to Bidders (ITB) Section II Bidding Data Sheet (BDS) Section III Evaluation and Qualification Criteria Section IV Bidding Forms Section V Eligibility Criteria and Social and environment responsibility Section V-A Agency Policy Corrupt and Fraudulent Practices Section VI Pricing Document Annexure II-A Toolkit for using e-tender portal PART - 2 - WORKS REQUIREMENTS Section VII-A General Specification Section VII-B Particular Specification Section VII-C 5D BIM PART - 3 - CONDITIONS OF CONTRACT AND CONTRACT FORMS Section VIII General Conditions (GCC) Section IX Particular Conditions (PCC) Section X Contract Forms Section XI SHE Manual Section XII Authorized Vendors List PART - 4 - TENDER DRAWINGS
6.2	The Invitation for Bids issued by the Employer is not part of the Bidding Document.
6.3	Unless obtained directly from Bid portal of the Employer, the Employer is not responsible for the completeness of the document, responses to requests for clarification or Addenda to the Bidding Document in accordance with ITB 8 . In case of any contradiction, documents obtained directly from the Employer shall prevail.
6.4	The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Documents and to furnish with its Bid all information or documentation as is required by the Bidding Documents.
7.	Clarification of Bidding Documents, Site Visit, Pre-Bid Meeting
7.1	A Bidder requiring any clarification of the Bidding Document shall communicate within date and time the Employer in writing at the Employer's e-mail address as specified in the BDS or raise its enquiries during the pre-bid meeting if provided for in

	accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than 14 (fourteen) days prior to the deadline for submission of bids. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Documents in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. If so specified in the BDS, the Employer shall also promptly publish its response at e-Bid portal identified in the BDS and bidder shall not be informed individually.
7.2	The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.
7.3	The Bidder and any of its personnel or agents will be granted permission by the Employer to enter upon its premises and lands for the purpose of such visit, but only upon the express conditions that the Bidder, its personnel, and agents will release and indemnify the Employer and its personnel and agents from and against all liability in respect thereof, and will be responsible for death or personal injury, loss of or damage to property, and any other loss, damage, costs, and expenses incurred as a result of the inspection.
7.4	If so specified in the BDS, the Bidder's designed representative is invited to attend a pre-bid meeting. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
7.5	The Bidder is requested, as far as possible, to submit any questions in writing, to reach the Employer not later than one week before the meeting.
7.6	Minutes of the pre-bid meeting, if applicable, including the text of the questions asked by Bidders, without identifying the source, and the responses given, together with any response prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Documents in accordance with ITB 6.3. Any modification to the Bidding Documents that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an Addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting. Non-attendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.
8.	Amendment of Bidding Document
8.1	At any time prior to the deadline for submission of bids, the Employer may amend the Bidding Documents by issuing addenda.
8.2	Any addendum issued shall be part of the Bidding Documents and shall be communicated in writing to all who have obtained the Bidding Documents from the Employer in accordance with ITB 6.3. The Employer shall also promptly publish the addendum on the Employer's e-Bid portal in accordance with ITB 7.1(as specified in BDS).
8.3	To give Bidders reasonable time in which to take an addendum into account in preparing their bids, the Employer may, at its discretion, extend the deadline for the submission of bids, pursuant to ITB 22.2.
C.	Preparation of Bids
9.	Cost of Bidding
9.1	The Bidder shall bear all costs associated with the preparation and submission of its bid, and the Employer shall not be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.
10.	Language of Bid
10.1	The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS . Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages into the language specified in the BDS , in which case, for purposes of interpretation of the Bid, such translation shall govern.
11.	Documents Comprising the Bid
11.1	The Bid shall comprise the following: (a) Any addendum issued shall be part of the Bidding Documents and shall be communicated in writing to all who have obtained the Bidding Documents from the Purchaser in accordance with ITB 12; (b) completed schedules, in accordance with ITB 12 and 14; (c) Bid Securing Declaration, in accordance with ITB 19.1(as specified in BDS);

	<p>(d) alternative bids, if permissible, in accordance with ITB 13(as specified in BDS);</p> <p>(e) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;</p> <p>(f) documentary evidence in accordance with ITB 17 establishing the Bidder's continued qualified status or, if post-qualification applies, as specified in accordance with ITB 4.8, the Bidder's qualifications to perform the contract if its Bid is accepted;</p> <p>(g) Technical proposal in accordance with ITB 16;</p> <p>any other document required in the BDS</p>
11.2	In addition to the requirements under ITB 11.1, bids submitted by a JV/CONSORTIUM shall include a copy of the Joint Venture Agreement entered into by all members. Alternatively, a letter of intent to execute a Joint Venture Agreement in the event of a successful bid shall be signed by all members and submitted with the bid, together with a copy of the proposed Agreement.
11.3	The Bidder shall furnish in the Letter of Bid information on commissions and gratuities, if any, paid or to be paid to agents or any other party relating to this Bid (as specified in BDS).
12.	Letter of Bid, Covenant of Integrity and Price Schedules
12.1	The Letter of Bid, the Covenant of Integrity and Price Schedules shall be prepared using the relevant forms furnished in Section IV, Bidding Forms. The forms must be completed without any alterations to the text, and no substitutes shall be accepted except as provided under ITB 20.4. All blank spaces shall be filled in with the information requested.
13.	Alternative Bids
13.1	Unless otherwise specified in the BDS , alternative bids will not be considered.
13.2	When alternative times for completion are explicitly invited, a statement to that effect will be included in the BDS, as will the method of evaluating different times for completion.
13.3	Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Documents must first price the Employer's design as described in the Bidding Documents & shall further provide all information necessary for a complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.
13.4	When specified in the BDS , Bidders are permitted to submit alternative technical solutions for specified parts of the Works, & such parts will be identified in the BDS , as will the method for their evaluating, and described in Section VII , Works Requirements.
14.	Bid Prices and Discounts
14.1	Unless otherwise specified in the BDS, Bidders shall quote for the Works such that the total Bid Price covers all the Contractor's obligations mentioned in or to be reasonably inferred from the Bidding Documents in respect of the design, manufacture, including procurement and subcontracting (if any), delivery, construction, installation and completion of the Works. This includes all requirements under the Contractor's responsibilities for testing, pre-commissioning and commissioning of the plant and, where so required by the Bidding Documents, the acquisition of all permits, approvals and licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Bidding Documents, all in accordance with the requirements of the General Conditions. Items against which no price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed to be covered by the prices for other items.
14.2	Bidders are required to quote the price for the commercial, contractual and technical obligations outlined in the Bidding Documents.
14.3	Bidders shall provide price in each item in the manner and detail called for in the price schedules included in Section IV, Bidding Forms. Further, bidders may add breakdowns of items and provide the prices in each Price Schedule included in Section IV, Bidding Forms.
14.4	The price to be offered in the Letter of Bid, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts that may be offered.

14.5	Unless otherwise specified in the BDS and the Contract , the prices offered by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract. In such a case, the Bidder shall furnish the indices and weightings for the price adjustment formulae in the Schedule of Adjustment Data and the Employer may require the Bidder to justify its proposed indices and weightings.
14.6	If so specified in BDS 1.1, Bids are being invited for individual lots (contracts) or for any combination of lots (packages). Bidders wishing to offer discounts for the award of more than one Contract shall specify in their Bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all lots (contracts) are opened at the same time.
14.7	Unless otherwise provided in the BDS , all duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of the date twenty-eight (28) days prior to the deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.
14.8	Bidders wishing to offer any unconditional discount shall specify in their Letter of Price Bid the offered discounts and the manner in which price discounts will apply.
15.	Currencies of Bid and Payment
15.1	The currency(ies) of the bid & the currency(ies) of payments shall be as specified in the BDS .
15.2	Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the prices shown in the Schedule of Adjustment Data in the Appendix to Bid are responsible, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.
16	Documents comprising the Technical proposal
16.1	The Bidder shall furnish a technical proposal including a statement of work methods, equipment, personnel, schedule and any other information as stipulated in section IV - Bidding Forms, in sufficient detail to demonstrate the adequacy of the Bidder's proposal to meet the work requirements and the completion time.
17.	Documents Establishing the Eligibility and Conformity of the Goods and Related Services
17.1	To establish the eligibility of the Goods and Related Services in accordance with ITB 5, Bidders shall complete the country of origin declarations in the Price Schedule Forms, included in Section IV, Bidding Forms.
17.2	To establish the conformity of the Goods and Related Services to the Bidding Documents, the Bidder shall furnish as part of its Bid the documentary evidence that the Goods conform to the technical specifications and standards specified in Section VII, Schedule of Requirements.
17.3	The documentary evidence may be in the form of literature, drawings or data, and shall consist of a detailed item by item description of the essential technical and performance characteristics of the Goods and Related Services, demonstrating substantial responsiveness of the Goods and Related Services to the technical specification, and if applicable, a statement of deviations and exceptions to the provisions of the Section VII, Schedule of Requirements.
17.4	The Bidder shall also furnish a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period specified in the BDS following commencement of the use of the goods by the Purchaser.
17.5	Standards for workmanship, process, material, and equipment, as well as references to brand names or catalogue numbers specified by the Purchaser in the Schedule of Requirements, are intended to be descriptive only and not restrictive. The Bidder may offer other standards of quality, brand names, and/or catalogue numbers, provided that it demonstrates, to the Purchaser's satisfaction, that the substitutions ensure substantial equivalence or are superior to those specified in the Section VII, Schedule of Requirements.
17	Documents Establishing the Eligibility and Qualifications of the Bidder
17.1	To establish their eligibility in accordance with ITB 4, Bidders shall complete the Letter of Bid, included in Section IV, Bidding Forms.

17.2	<p>The documentary evidence of the Bidder's qualifications to perform the Contract if its bid is accepted shall establish to the Purchaser's satisfaction:</p> <p>(a) that, if required in the BDS, a Bidder that does not manufacture or produce the Goods it offers to supply shall submit the Manufacturer's Authorization using the form included in Section IV, Bidding Forms to demonstrate that it has been duly authorized by the manufacturer or producer of the Goods to supply these Goods in the Purchaser's Country;</p> <p>(b) that, if required in the BDS, in case of a Bidder not doing business within the Purchaser's Country, the Bidder is or will be (if awarded the contract) represented by an Agent in the country equipped and able to carry out the Supplier's maintenance, repair and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and</p> <p>that the Bidder meets each of the qualification criterion specified in Section III, Evaluation and Qualification Criteria.</p>
17.3	<p>Any change in the structure or formation of a Bidder after being prequalified and invited to Bid (including, in the case of a JV/CONSORTIUM, any change in the structure or formation of any member thereto) shall be subject to the written approval of the Employer prior to the deadline for submission of Bids. Such approval shall be denied if</p> <p>(i) as a consequence of the change, the Bidder no longer substantially meets the qualification criteria set forth in Section III, Qualification Criteria and Requirements; or</p> <p>(ii) in the opinion of the Employer, the change may result in a substantial reduction in competition. Any such change should be submitted to the Employer not later than fourteen (14) days after the date of the Invitation for Bids.</p>
18.	Period of Validity of Bids
18.1	<p>Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer in accordance with ITB 22.1. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.</p>
18.2	<p>In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request bidders to extend the period of validity of their bids. The request and the responses shall be made in writing. If a Bid Securing Declaration is requested in accordance with ITB 19, it shall also be extended for twenty-eight (28) days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its Bid Securing Declaration. A Bidder granting the request shall not be required or permitted to modify its bid, except as provided in ITB 18.3.</p>
18.3	<p>If the award is delayed by a period exceeding fifty-six (56) days beyond the expiry of the initial bid validity, the Contract price shall be determined as follows: -</p> <p>(a) In the case of fixed price contracts, the Contract price shall be the bid price adjusted by the factor specified in the BDS.</p> <p>(b) In the case of adjustable price contracts, no adjustment shall be made.</p> <p>(c) In any case, bid evaluation shall be based on the bid price without taking into consideration the applicable correction from those indicated above.</p>
19.	Bid Security
19.1	<p>The Bidder shall furnish as part of its bid a Bid-Securing Declaration as specified in the BDS, in original form.</p>
19.2	<p>A Bid Securing Declaration shall use the form included in Section-IV, Bidding Forms or as specified in BDS.</p>
19.3	<p>If a bid security is specified pursuant to ITB 19.1, the bid security shall be a demand guarantee in any of the following forms at the Bidder's option:</p> <ol style="list-style-type: none"> an unconditional guarantee issued by a bank or financial institution (such as an insurance, bonding or surety company); an irrevocable letter of credit; a cashier's or certified check; or another security specified in the BDS, <p>from a reputable source from an eligible country as specified in Section V-Eligibility criteria and social and environmental responsibility. If the unconditional guarantee is issued by a financial institution located outside the Purchaser's Country, the issuing financial institution shall have a correspondent financial institution located in the Purchaser's Country to make it enforceable. In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included in Section IV, Bidding Forms, or in another substantially similar format approved by the Purchaser prior to bid submission. The bid security shall be valid for twenty-eight (28) days beyond the</p>

	original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.
19.4	If a Bid Security is specified pursuant to ITB 19.1, any bid not accompanied by a substantially responsive Bid Security or Bid-Securing Declaration shall be rejected by the Purchaser as nonresponsive.
19.5	The Bid Security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's signing the contract and furnishing the Performance Security pursuant to ITB 42.
19.6	The Bid Security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the contract and furnished the required performance security.
19.7	The Bid Security may be forfeited, or the Bid Securing Declaration executed: <ul style="list-style-type: none"> (a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid, or any extension thereto provided by the Bidder; or (b) if the successful Bidder fails to: <ul style="list-style-type: none"> i. signs the Contract in accordance with ITB 42; or ii. furnish a performance security in accordance with ITB 43.
19.8	The Bid- Securing Declaration of a JV/CONSORTIUM must be in the name of the JV/CONSORTIUM that submits the bid. If the JV/CONSORTIUM has not been legally constituted into a legally enforceable JV/CONSORTIUM at the time of bidding, the bid security or Bid-Securing Declaration shall be in the names of all future members as named in the letter of intent referred to in ITB 4.1 and ITB 11.2 or as specified in BDS.
19.9	If a bid security is not required in the BDS , pursuant to ITB 19.1, and: <ul style="list-style-type: none"> (a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letter of Bid, or any extension thereto provided by the Bidder; or (b) if the successful Bidder fails to: sign the Contract in accordance with ITB 42; or furnish a performance security in accordance with ITB 43; <p>the Employer may, if provided for in the BDS, declare the Bidder ineligible to be awarded a contract by the Employer for a period of time as stated in the BDS.</p>
20.	Format and Signing of Bid
20.1	The Bidder shall prepare one original of the documents comprising the bid as described in ITB 11 and clearly mark it "ORIGINAL". Alternative bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE". In addition, the Bidder shall submit copies of the bid, in the number specified in the BDS and clearly mark them "COPY". In the event of any discrepancy between the original and the copies, the original shall prevail.
20.2	The original and all copies of the bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the bid where entries or amendments have been made shall be signed or initialed by the person signing the bid.
20.3	In case the Bidder is a JV, the Bid shall be signed by an authorized representative of the JV/CONSORTIUM on behalf of the JV/CONSORTIUM, and so as to be legally binding on all the members as evidenced by a power of attorney signed by their legally authorized representatives.
20.4	Any inter-lineation, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the bid.
D	Submission and Opening of Bids
21	Sealing and Marking of Bids
21.1	The Bidder shall enclose the original and all copies of the bid, including alternative bids, if permitted in accordance with ITB 13, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL", "ALTERNATIVE" and "COPY." These envelopes containing the original and the copies shall then be enclosed in one single envelope or as specified in BDS.
21.2	Unless specified in BDS, the inner and outer envelopes shall: <ul style="list-style-type: none"> (a) bear the name and address of the Bidder; (b) be addressed to the Employer in accordance with ITB 22.1;

	(c) bear the specific identification of this bidding process stated in ITB 1.1 ; and (d) bear a warning not to open before the time and date for bid opening
21.3	If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the bid.
21.4	The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bids.
21.5	The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer.
22.	Deadline for Submission of Bids
22.1	Bids must be received by the Employer at the address and no later than the date and time specified in the BDS. When so specified in the BDS, bidders shall have the option of submitting their bids electronically. Bidders submitting bids electronically shall follow the electronic bid submission procedures specified in the BDS.
22.2	The Employer may, at its discretion, extend the deadline for the submission of bids by amending the Bidding Documents in accordance with ITB 8 , in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
23.	Late Bids
23.1	The Employer shall not consider any bid that arrives after the dead line for submission of bids, in accordance with ITB 22 . Any bid received by the Employer after the deadline for submission of bids shall be declared late, rejected, and returned unopened to the Bidder.
24.	Withdrawal, Substitution and Modification of Bids
24.1	A Bidder may withdraw, substitute, or modify its Bid after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization (the power of attorney) in accordance with ITB 20.2 . The corresponding substitution or modification of the bid must accompany the respective written notice. All notices must be: (a) Prepared and submitted in accordance with ITB 20 and 21 (except that withdrawal notices do not require copies), & in addition, the respective envelopes shall be clearly marked "WITHDRAWAL," "SUBSTITUTION," or "MODIFICATION;" and or as specified in BDS . (b) received by the Employer prior to the deadline prescribed for submission of bids, in accordance with ITB 22 or as specified in BDS .
24.2	Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders or as specified in BDS.
24.3	No bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of bids and the expiration of the period of bid validity specified by the Bidder on the Letter of Bid or any extension thereof.
25.	Bid Opening
25.1	Except as in the cases specified in ITB 23 and 24 , the Purchaser shall publicly open and read out in accordance with ITB 25 all bids received by the deadline (regardless of the number of bids received), at the date, time and place specified in the BDS in the presence of Bidders' designated representatives and anyone who choose to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 22.1 , shall be as specified in the BDS.
25.2	First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding bid shall not be opened but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal & is read out at bid opening. Next, envelopes marked "SUBSTITUTION" shall be opened and read out and exchanged with the corresponding Bid being substituted, and the substituted Bid shall not be opened, but returned to the Bidder. No Bid substitution shall be permitted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out at bid opening. Envelopes marked "MODIFICATION" shall be opened and read out with the corresponding Bid. No Bid modification shall be permitted unless the corresponding modification notice contains a valid authorization to request the modification and is read out at Bid opening. Only bids that are opened and read out at Bid opening shall be considered further as specified in the BDS.
25.3	All other envelopes holding the Technical Bids shall be opened one at a time, reading out

	<p>a. the name of the Bidder;</p> <p>b. whether there is a modification;</p> <p>c. the Bid Price(s), including any discounts and alternative Bids; and</p> <p>d. Any other details as the Employer may consider appropriate.</p> <p>Only Technical Bids and alternative Technical Bids read out at Bid opening shall be considered for evaluation. The Employer shall neither discuss the merits of any Bid nor reject any Bid (except for late Bids, in accordance with ITB 23.1).</p>
25.4	The Employer shall prepare a record of the bid opening that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; the Bid Price, per lot (contract) if applicable, including any discounts, and alternative bids; and the presence or absence of a Bid-Securing Declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.
E.	Evaluation and Comparison of Bids
26.	Confidentiality
26.1	Information relating to the examination, evaluation, and comparison of the bids, and qualification of the Bidders and recommendation of contract award, shall not be disclosed to bidders or any other persons not officially concerned with the bidding process until information on Contract Award is communicated to all Bidders in accordance with ITB 40.
26.2	Any attempt by a Bidder to influence the Employer in the examination, evaluation, and comparison of the bids, and qualification of the bidders, or contract award decisions may result in the rejection of its Bid.
26.3	Notwithstanding ITB-26.2, from the time of bid opening to the time of Contract Award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it shall do so in writing.
27.	Clarification of Bids
27.1	To assist in the examination, evaluation, comparison of the bids, and qualification of the Bidders, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid, given a reasonable time for a response. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification & the response shall be in writing. No change, including any voluntary increase or decrease, in the prices or substance of the Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the Evaluation of the bids, in accordance with ITB 31.
27.2	If a Bidder does not provide clarifications of its bid by the date and time set in the Employer's request for clarification, its bid may be rejected.
28.	Deviation, Reservation and Omissions
28.1	During the evaluation of bids, the following definitions apply: (a) "Deviation" is a departure from the requirements specified in the Bidding Documents; (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Documents; and (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Documents.
29.	Determination of Responsiveness
29.1	The Employer's determination of a bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB 11.
29.2	A substantially responsive Bid is one that meets the requirements of the Bidding Documents without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that: (a) if accepted, would (i) affect in any substantial way the scope, quality, or performance of the Goods and Related Services specified in the Contract; or (ii) limit in any substantial way, inconsistent with the Bidding Documents, the Employer's rights or the Bidder's obligations under the proposed Contract; or (b) if rectified, would unfairly affect the competitive position of other bidders presenting substantially responsive bids.

29.3	The Employer shall examine the technical aspects of the bid submitted in accordance with ITB 16, in particular, to confirm that all requirements of Section VII, Schedule of Requirements have been met without any material deviation or reservation, or omission.
29.4	If a bid is not substantially responsive to the requirements of the Bidding Documents, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.
30.	Nonmaterial Nonconformities, Errors and Omissions
30.1	Provided that a Bid is substantially responsive, the Employer may waive any nonmaterial nonconformities in the Bid.
30.2	Provided that a bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the price of the Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.
30.3	Provided that a bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component as specified in the BDS.
31.	Correction of Arithmetical Errors
31.1	Provided that the bid is substantially responsive, the Employer shall correct arithmetical errors on the following basis: (a) Only for admeasurement contracts, if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected; (b) Only for admeasurement contracts, if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and (c) if there is a discrepancy between words and figures, the amount in words shall prevail, unless, only for admeasurement contracts, the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a) and (b) above.
31.2	Bidders shall be requested to accept correction of arithmetical errors. Failure to accept the correction in accordance with ITB 31.1, shall result in the rejection of the Bid.
32.	Conversion to Single Currency
32.1	For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted in a single currency as specified in the BDS.
33.	Margin of Preference
33.1	Unless otherwise specified in the BDS, a margin of preference shall not apply.
34.	Sub-Contractors
34.1	Unless otherwise stated in the BDS, the Employer does not intend to execute any specific elements of the Works by sub-contractors selected in advance by the Employer.
34.2	In case of Prequalification, the Bidder's Bid shall name the same specialized subcontractor as submitted in the prequalification application and approved by the Employer or may name another specialized subcontractor meeting the requirements specified in the prequalification phase.
34.3	In case of Post-qualification, the Employer may permit subcontracting for certain specialized works. When subcontracting is permitted by the Employer, the specialized subcontractor's experience shall be considered for evaluation as indicated in Section III 1.5 Specialized Sub-Contractors. Section III describes the qualification criteria for sub-contractors or as specified in BDS.
35.	Evaluation of Bids
35.1	The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.
35.2	To evaluate a bid, the Employer shall consider the following:

	<p>(a) the Bid Price, excluding Provisional Sums and the provision, if any, for contingencies in the Schedules, but including Day work items, where priced competitively;</p> <p>(b) price adjustment for correction of arithmetic errors in accordance with ITB 31.1;</p> <p>(c) price adjustment due to discounts offered in accordance with ITB 14.4;</p> <p>(d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 32;</p> <p>(e) price adjustment due to quantifiable nonmaterial nonconformities in accordance with ITB 30.3;</p> <p>(f) the additional evaluation factors as specified in Section-III, Evaluation and Qualification Criteria;</p>
35.3	The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in bid evaluation.
35.4	If these Bidding Documents allow Bidders to quote separate prices for different lots (contracts), the methodology to determine the lowest evaluated price of the lot (contract) combinations, including any discounts offered in the Letter of Bid Form, is specified in Section-III, Evaluation and Qualification Criteria.
35.5	If the bid, which results in the lowest Evaluated Bid Price, is significantly lower than the Employer's estimate, or seriously unbalanced or front loaded in the opinion of the Employer, the Employer may require the Bidder to produce detailed price analyses for any or all items of the Schedules, to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. If it turns out that the bid price is abnormally low, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.
36.	Comparison of Bids
36.1	The Employer shall compare the evaluated prices of all substantially responsive bids established in accordance with ITB 35.2 to determine the lowest evaluated bid.
37.	Qualification the Bidders
37.1	The Employer shall determine to its satisfaction whether Bidders meet the qualification criteria specified in Section III, Eligibility and Qualification Criteria, during the evaluation of Technical Bids. However, if prequalification was carried out prior to the bidding process, the Employer may carry out the assessment of the qualification criteria specified in Section III, Eligibility and Qualification Criteria, for the Bidder who submitted the lowest evaluated and substantially responsive Bid only.
37.2	The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 15.
37.3	An affirmative determination shall be a prerequisite for award of the Contract to the Bidder. A negative determination shall result in disqualification of the Bid in which event the Employer shall proceed to the next lowest evaluated bid to make a similar determination of that Bidder's qualification to perform satisfactorily.
37.4	The capabilities of the manufacturers and Subcontractors proposed in its Bid to be used by the Bidder will also be evaluated for acceptability in accordance with Section III, Evaluation and Qualification Criteria. Their participation should be confirmed with a letter of intent between the parties, as needed. Should a manufacturer or Subcontractor be determined to be unacceptable, the Bid will not be rejected, but the Bidder will be required to substitute an acceptable manufacturer or Subcontractor without any change to the Bid Price. Prior to signing the Contract, the corresponding Appendix to the Contract Agreement shall or be completed, listing the approved manufacturers or Subcontractors for each item concerned.
38.	Employer's Right to Accept Any Bid, and to Reject Any or All Bids
38.1	The Employer reserves the right to accept or reject any bid, and to annul the bidding process and reject all bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.
F.	Award of Contract
39.	Award Criteria

39.1	Subject to ITB 38.1, the Employer shall award the Contract to the Bidder whose bid has been determined to be the lowest evaluated bid and is substantially responsive to the Bidding Documents, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.
40.	Notification of Award
40.1	Prior to the expiration of the period of Bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted. The notification letter (hereinafter and in the Conditions of Contract and Contract Forms called the "Letter of Acceptance") shall specify the sum that the Employer will pay the Contractor in consideration of the execution and completion of the Works (hereinafter and in the Conditions of Contract and Contract Forms called "the Accepted Contract Amount"). Relating to award of work and issuance of LOA to the successful bidder, Maha-Metro shall post the details in the Maha-Metro website http://www.punemetroRail.org and as specified in BDS.
40.2	Until a formal Contract is prepared and executed, the notification of award shall constitute a binding Contract.
40.3	The Employer shall promptly respond in writing to any unsuccessful Bidder who, after notification of award in accordance with ITB 40.1, requests in writing the grounds on which its bid was not selected.
41	Grounds for Exclusion
41.1	<p>Bidders (either natural or legal persons including any of their subcontractors) shall not be awarded this contract if, on the date of submission of an application or of a bid or on the date of award of a contract, they have been the subject of a conviction by final judgment for one of the following reasons:</p> <ol style="list-style-type: none"> where the bidder is bankrupt or is the subject of insolvency or winding-up proceedings, where its assets are being administered by a liquidator or by the court, where it is in an arrangement with creditors, where its business activities are suspended or it is in any analogous situation arising from a similar procedure under national laws and regulations; bidder have not fulfilled their obligations regarding the payment of social security contributions or taxes in accordance with the legal provisions of the country where they are established or the Employer's country. where the Employer can demonstrate by any appropriate means a violation by the bidder of applicable obligations in the fields of environmental, social and labour law established by national law, collective agreements or by the international environmental, social and labour law provisions; where the Employer has sufficiently plausible indications to conclude that the bidder has entered into agreements with other bidder(s) aimed at distorting competition; where the bidder has shown significant or persistent deficiencies in the performance of a substantive requirement under a prior public contract, a prior contract with the Employer or a prior concession contract which led to early termination of that prior contract, damages or other comparable sanctions; bidder have been convicted within the past five years by a court decision, which has the force of residential jurisdiction in the country where the project is implemented, of fraud or corruption or any other Prohibited Conduct committed during the procurement or performance of a contract, unless they provide supporting information together with their Covenant of Integrity which shows that this conviction is not relevant in the context of this project; bidder is listed for financial sanctions by the United Nations and /or European Union for the purposes of fight against terrorist financing or threat to international peace and security; bidder including JV/ Consortium members should not be excluded by the EU Institutions or any major Multilateral Development Bank (including World Bank Group, African Development Bank, Asian Infrastructure Investment Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank or Inter-American Development Bank) from participation in a tendering procedure on the grounds of Prohibited Conduct as defined in the Covenant of Integrity. where the Employer can demonstrate by appropriate means that the bidder is guilty of grave professional misconduct, which renders its integrity questionable;

	<p>j. where a conflict of interest within the meaning of Sub-Clause Error! Reference source not found. in ITB cannot be effectively remedied by other less intrusive measures;</p> <p>k. where a distortion of competition from the prior involvement of the bidder in the preparation of the procurement procedure, as referred to in Sub-Clause 3.1 in ITB, cannot be remedied by other, less intrusive measures;</p> <p>l. where the bidder has been guilty of serious misrepresentation in supplying the information required for the verification of the absence of grounds for exclusion or the fulfilment of the selection criteria, has withheld such information or is not able to submit the supporting documents required pursuant to BDS ITB 4.18; or</p> <p>m. where the bidder has undertaken to unduly influence the decision-making process of the Employer, to obtain confidential information that may confer upon its undue advantages in the procurement procedure or to negligently provide misleading information that may have a material influence on decisions concerning exclusion, selection or award.</p> <p>Notwithstanding point (Error! Reference source not found.) above, Employer might not exclude a bidder which is in one of the situations referred to in that point, where the Employer has established that the bidder in question will be able to perform the contract, taking into account the applicable national rules and measures on the continuation of business in the case of the situations referred to in point (a). Any bidder that is in one of the situations referred to in the above paragraph may provide evidence to the effect that measures taken by the bidder are sufficient to demonstrate its reliability despite the existence of a relevant ground for exclusion. If such evidence is considered as sufficient, the bidder concerned will not be excluded from the procurement procedure.</p> <p>For this purpose, the bidder shall prove that it has paid or undertaken to pay compensation in respect of any damage caused by the criminal offence or misconduct, clarified the facts and circumstances in a comprehensive manner by actively collaborating with the investigating authorities and taken concrete technical, organizational and personnel measures that are appropriate to prevent further criminal offences or misconduct.</p> <p>The measures taken by the bidder will be evaluated taking into account the gravity and particular circumstances of the criminal offence or misconduct. Where the measures are considered to be insufficient, the bidder shall receive a statement of the reasons for that decision.</p> <p>Bidders will also be required to confirm and declare that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other items of work related to the award and performance of this contract.</p>
42.	Signing of Contract
42.1	Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.
42.2	In case the agreement is sent, within twenty-eight (28) days but no sooner than 10 days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.
43.	Performance Security
43.1	Within twenty-eight (28) days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the Performance Security in accordance with the GCC, using for that purpose the Performance Security Form included in Section X, Contract Forms, or another Form acceptable to the Employer. If the Performance Security furnished by the successful Bidder is in the form of a bond, it shall be issued by a bonding or insurance company that has been determined by the successful Bidder to be acceptable to the Employer. A foreign institution providing a bond shall have a correspondent financial institution located in the Employer's Country.
43.2	Failure of the successful Bidder to submit the above-mentioned Performance Security or sign the Contract shall constitute sufficient grounds for the annulment of the award and execution of the Bid-Securing Declaration. In that event the Employer may award the Contract to the next lowest evaluated Bidder, whose bid is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.

Maha Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART I: BIDDING PROCEDURE

SECTION II: BIDDING DATA SHEET

Section II. Bidding Data Sheet (BDS)

The following specific data for the goods to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB). Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

ITB Clause Reference	GENERAL
General	The following terms are used in the Bidding Documents shall have the same meaning and interpretations;
ITB 1.1	The number of the Invitation for Bids is: P1-T06/2021
ITB 1.1	The Employer is: Maharashtra Metro Rail Corporation Limited
ITB 1.1	<p>The name of the ICB is: - Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.</p> <p>The identification number is P1-T06/2021</p> <p>The number, identification of the lots (contracts) comprising this tender is: <i>Not applicable.</i></p>
ITB 1.3 (New Para)	<p>The brief scope of works in this contract is as under:</p> <p>The Contractor shall be responsible for all types of Track works in approximately 30 TKM of Ballastless Track on viaduct, ramp and underground section in Reach-3 and Reach-4.</p> <p>The Track on main line on viaduct and Underground shall be Ballastless Plinth (Cast-in-situ/Precast) with provision of Mass spring system on viaduct and Underground at sensitive locations for mitigation of noise and vibration including supply of MSS.</p> <p>The Ballastless plain Track shall be on reinforced concrete plinth/RCC slab and Ballastless Turnout on RCC slab, installing Track Fastening System, Derailing Switches, Buffer stops, Check Rails etc. to the stipulated tolerances on the running lines.</p>
ITB 1.4 (New Para)	<p>The detailed Scope of work for the Design, Supply, Installation, Testing and Commissioning of Ballasted and Ballast less Track of this contract is further described in the Para-2: Works Requirements and other documents. The Contractor has to design the complete system and execute the work accordingly with the approval of Employer.</p> <p>The Contractor shall also carry out effective interface & coordination with Designated Contractors and others appointed by the Employer from time to time, during the Contract period.</p> <p>The Bidders are particularly advised to pay attention to the IT Requirements of Employer (Part-III - Annexure-A - PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)).</p>
ITB 1.5 (New Para)	The successful Bidder has to establish its office at Pune if it does not have at present. The cost and expenses for setting up the said office(s) will be deemed to have been included in the Pricing Document and no separate / extra / additional payment will be made on this account.
ITB 2.1	<p>The name of the Project is: Pune Metro Rail Project</p> <p>Source of fund for the project: The project shall be funded from GOM and GOI along with bilateral funding from EIB Luxembourg and AFD France.</p> <p>Source of fund for this work tender: The Employer has applied loans from the European Investment Bank - EIB (hereinafter called "Funding Agency") towards the part cost of the Project and intends to apply a portion of the proceeds of the loans for payments under this Contract. Disbursement of the loans will be subject, in all respects, to the terms and conditions of the Loan Agreements, including the disbursement procedures</p>

	and the applicable guidelines of EIB. (http://www.eib.org/attachments/strategies/guide_to_procurement_en.pdf)”
ITB 3.1	The Bidders are required as a condition of admission to eligibility, to execute and attach a Covenant of Integrity and Environmental and Social Covenant in the form indicated in Section IV: Bidding Forms.
ITB 3.3 (New Para)	<p>Prohibited Conduct: In pursuance of the Funding Agency’s (EIB’s) Anti-Fraud Policy (refer http://www.eib.org/en/infocentre/publications/all/anti-fraud-policy.htm), Prohibited Conduct includes corruption, fraud, coercion, collusion, obstruction, money laundering and financing of terrorism defined as follows:</p> <ul style="list-style-type: none"> a) A corrupt practice, is the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party. b) A fraudulent practice, is any act or omission, including a misrepresentation that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation. c) A coercive practice is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party. d) A collusive practice, is an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party. e) An obstructive practice is (a) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (b) acts intended to materially impede the exercise of the EIB's contractual rights of audit or access to information or the rights that any banking, regulatory or examining authority or other equivalent body of the European Union or of its Member States may have in accordance with any law, regulation or treaty or pursuant to any agreement into which the EIB has entered in order to implement such law, regulation or treaty. f) Money laundering is, <ul style="list-style-type: none"> i. the conversion or transfer of property, knowing that such property is derived from criminal activity or from an act of participation in such activity, for the purpose of concealing or disguising the illicit origin of the property or of assisting any person who is involved in the commission of such activity to evade the legal consequences of his action; ii. the concealment or disguise of the true nature, source, location, disposition, movement, rights with respect to, or ownership of property, knowing that such property is derived from criminal activity or from an act of participation in such activity; iii. the acquisition, possession or use of property, knowing, at the time of receipt, that such property was derived from criminal activity or from an act of participation in such activity; iv. participation in, association to commit, attempts to commit and aiding, abetting, facilitating and counselling the commission of any of the actions mentioned in the foregoing points. g) Financing of terrorism is the provision or collection of funds, by any means, directly or indirectly, with the intention that they should be used or in the knowledge that they are to be used, in full or in part, in order to carry out any of the offences within the meaning of Articles 1 to 4 of the Council Framework Decision 2002/475/JHA of 13 June 2002 on combating terrorism. <p>The Employer will declare a firm ineligible, either indefinitely or for a stated period of time, for any Employer’s contract, if at any time determines that the firm has engaged in Prohibited Conduct in competing for, or in executing, a borrowed financed contract in general.</p> <p>The Bidder/Contractor grant the Employer, the Funding Agencies and auditors appointed by either of them, as well as any authority or European Union Institution or body having</p>

	<p>competence under European Union law, the right to inspect and copy the books and records of the bidder, contractor, supplier or consultant.</p> <p>If it is established to the required standards that a project-related party has engaged in Prohibited Conduct in the course of a procurement process or implementation of a contract to be financed, the Funding Agency:</p> <ol style="list-style-type: none"> may seek appropriate remediation of the Prohibited Conduct to its satisfaction; may declare ineligible such project-related party to be awarded the contract; and/or may withhold the Funding Agency's no objection to contract award and may apply appropriate contractual remedies, which may include suspension and cancellation, unless the Prohibited Conduct has been dealt with to the satisfaction of the Funding Agency. <p>Furthermore, within the framework of the Funding Agency's Exclusion Policy (see the EIB's Exclusion Policy: https://www.eib.org/en/publications/exclusion-policy.htm), the Funding Agency may declare such project related party ineligible to be awarded a contract under any EIB project or to enter into any relationship with the Funding Agency.</p> <p>IMPORTANT: It should be noted that, in the Covenant of Integrity, the bidder is requested to self-declare all sanctions and / or exclusions (including any similar decisions having the effect of imposing conditions on the bidder or its subsidiaries or to exclude the said bidder or its subsidiaries, such as temporary suspension, conditional non-exclusion, etc.) imposed by the European institutions or any multilateral development banks (including the World Bank Group, the African Development Bank, the Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank or Inter-American Development Bank), regardless of the date of issue and the expiration or not of such decisions and of the current status of any sanction and / or exclusion. In this regard, any omission or misrepresentation, made knowingly or recklessly, may be considered as fraud under the EIB Anti-Fraud Policy. Therefore, the Employer reserves the right to reject any offer presenting an inaccurate or incomplete Covenant of Integrity, and may cause the rejection of the offer for prohibited conduct.</p>
ITB 4.1	<p>Maximum number of members in the JV/Consortium shall be: Three</p> <p>Lead member shall have minimum 40% participation and other members shall have minimum 20% participation in the proposed JV / Consortium for this work. The lead member must be technical and have maximum participation in the JV/Consortium.</p> <p>In case of JV / Consortium, change in constitution or percentage participation of JV/Consortium shall not be permitted at any stage after their submission of Bid and thereafter.</p> <p>The authorized representative from lead member of JV/Consortium shall be signatory of the bid.</p>
ITB 4.2(e)	<p>No Bidder can be a subcontractor while submitting a Bid individually or as a partner of a JV / Consortium in the same bidding process. A Bidder, if acting in the capacity of subcontractor in any Bid, may participated in more than one Bid, but only in that capacity.</p>
ITB 4.5	<p>This Bidding process is in Single stage two-packet system through e-tender portal of Maharashtra Metro Rail Corporation Limited. Unless otherwise approved by the Employer, the Bids for this Contract will be considered only from those companies, corporation, partnerships, consortia and joint ventures who pass the Eligibility Criteria under Section-III based on submissions with the Bid. Technical bids of only such eligible Bidders will be evaluated.</p>
ITB 4.7 (New Para)	<p>A firm, who has purchased the Bidding Document in their name, can submit the Bid either as individual firm or in JV / Consortium.</p>
ITB 4.9 (New Para)	<p>In case, the Bidder is a JV/Consortium, a detailed JV/Consortium Agreement between the Members of such JV/Consortium stating clearly their inter-relationship and division of work and obligations among the Members as mentioned in ITB 4.13 below should be submitted along with the Bid for proper examination by Maharashtra Metro Rail Corporation Limited. The format of the JV/Consortium Agreement is provided in Section-IV: Bidding Form (Form 8).</p>
ITB 4.10 (New Para)	<p>Further, a Power of Attorney signed by all the JV/Consortium Members duly supported by their board resolutions must also accompany the Bid authorizing the Lead Member, inter-alia, to submit the Bid on their behalf. The formats of the Power of Attorney as well as</p>

	the board resolution are provided in Section IV: Bidding Form (Form 9). As the Contract Agreement will be required to be executed by all other Members of the Consortium also in addition to signing by the Lead Member, therefore each of such other Members is required to issue a Power of Attorney authorizing an individual as its authorized signatory, inter alia, to sign the Contract Agreement. The format of the Power of Attorney is provided in Section IV: Bidding Form (Form 9E).
ITB 4.11 (New Para)	Every Bidder, be it a single entity or a consortium, is required to submit along with its Bid a Power of Attorney duly signed and stamped and supported by its board resolution authorizing an individual as its authorized signatory, inter alia, to sign and submit the Bid. The formats of the Power of Attorney as well as the board resolution are provided in Section IV: Bidding Form (Form 9). In case of Consortium, such power of attorney and board resolution must be executed and passed respectively by the Lead Member.
ITB 4.12 (New Para)	<p>The mode of execution of the power of attorney should be in accordance with the procedure, if any laid down by the applicable law and the charter documents of the executant(s) and when it is so required the same should be under common seal affixed in accordance with the required procedure.</p> <p>For a Power of Attorney executed and issued overseas, the document will also have to be legalized by the Indian Embassy and/or notarized in the jurisdiction where the Power of Attorney is being issued. However, the Power of Attorney provided by a Bidder from a country which has signed The Hague Legislation Convention 1961 is not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.</p> <p>This power of attorney should be registered at appropriate authority & easily verifiable.</p>
ITB 4.13 (New Para)	<p>Where the Bidder is a Consortium or Joint Venture, the Bidder shall submit the following additional information to meet the qualification criteria for eligibility:</p> <ul style="list-style-type: none"> (a) A Memorandum of Understanding / Consortium Agreement shall be provided duly notarized by the notary public of country of origin and should be stamped by Embassy / High Commission. Bidders from Member Countries of Hague convention may submit all these documents with "Apostille" stamp instead of Embassy. (b) Nomination of one of the Members of the Consortium or Joint Venture to be in-charge ("Lead member"); and this authorization shall be covered in the Power of Attorney signed by the legally authorized signatories of all Members of Consortium or Joint Venture. (c) Details of the intended financial participation by each member shall be furnished with complete details of the proposed division of responsibilities and relationships among the individual Members. (d) The Lead member shall be authorized to incur liabilities, receive payment (if provided for in MoU / Consortium Agreement) and receive instructions for and on behalf of any or all Members of the Consortium / Joint Venture. (e) All members of the Consortium / Joint Venture shall be jointly and severally responsible for the execution of the Contract in accordance with the terms and conditions of the Contract. (f) In case of the Bidder being Successful, the JV / Consortium Agreement shall be registered at any place in India so as to be legally valid and binding on all partners / members (g) The Bid shall be signed so as to be legally binding on all the Members of the Consortium.
ITB 4.14 (New Para)	The Bidder shall submit with the Bid full details of its ownership and control or, if the Bidder is a Consortium, full details of ownership and control of each Member thereof. The required information should be submitted as per Form 4.11 in the Section IV: Bidding Forms.
ITB 4.15 (New Para)	Indian Bidders, or Indian Members of a Consortium shall submit, a copy of the Permanent Account Number (PAN) issued by the Income Tax Authorities and a certified copy of the last 3 years (including the latest Financial Year) income tax return, duly acknowledged by Income Tax department with their Bid and the Technical Package. In case the Indian member of a Consortium is a wholly owned 100% subsidiary of their foreign partner in the said Consortium and this Indian company has been formed less than 3 years ago, the certified copy of the latest Financial Year income tax return (applicable only if company was formed more than a year ago), duly acknowledged by Income Tax department shall be submitted in the Technical Package.

	The foreign partner of the JV/Consortium shall submit appropriate documents pertaining to their financial capability/ audited balance sheets and clearances of taxes as per the relevant law of the country of their origin.
ITB 4.16 (New Para)	Each Bidder (each Member in the case of a Consortium) is required to confirm and declare with its Bid that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other item or work related to the award and performance of this Contract. Such Bidder or Member will have to further confirm and declare in the Bid that no agency commission or any payment which may be construed as an agency commission has been, or will be, paid and that the Contract Price will not include any such amount. If the Employer subsequently finds to the contrary, the Employer reserves the right to declare the Bidder as non-compliant and declare any Contract if already awarded to the Bidder to be null and void. Specific declaration to this effect exactly as per Section IV: Bidding Form (Form 18) shall be submitted with the Technical Package.
ITB 4.17 (New Para)	Canvassing or offer of an advantage or any other inducement by any person with a view to influencing acceptance of a Bid will be an offence under laws of India. Such action will result in the rejection of the Bid, in addition to other punitive measures.
ITB 4.18 (New Para)	Each Bidder (each member in the case of joint venture or consortium or partnership) is required to confirm and declare with their Tender that they (as the case may be) have not engaged in any fraudulent and corrupt practice as defined in BDS ITB 3.3 and that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other item or work related to the award and performance of this Contract and declare that no agency commission or any payment which may be construed as an agency commission has been, or will be, paid and that the tender price will not include any such amount. To fulfil this requirement, the Bidder (each member in case of JV / Consortium) shall sign and execute the Covenant of Integrity given as Form - 2.2A and the declaration given as Form 23. If the Employer subsequently finds these has not been provided, the Employer reserves the right to declare the Bidder as non-compliant and declare any Contract if already awarded to the Bidder to be null and void.
ITB 5.2 (New Para)	Bidders are encouraged (Not mandatory & Binding) to adopt Indian sources to the maximum possible extent. However, all plant, materials, supplies, equipment and services shall be to the satisfaction of the Employer and Engineer. The information on all plant, materials, supplies, equipment and services included in the Contractor's Proposal and incorporated into the Contract shall not, in any event, be construed as a submission to the Employer under the Contract. Contractor will be required to take specific approval of the Employer for deployment of plant, materials, supplies, equipment and services in accordance with the Conditions of Contract and Employer's Requirements.
B. BIDDING DOCUMENTS	
ITB 6.1	<ul style="list-style-type: none"> The Bidding Documents consist of s 1, 2, 3 and 4, which include all the Sections indicated below, and should be read in conjunction with any Addenda issued in accordance with ITB 8. PART - 1 - BIDDING PROCEDURES <ul style="list-style-type: none"> Section I Instructions to Bidders (ITB) Section II Bidding Data Sheet (BDS) Section III Evaluation and Qualification Criteria Section IV Bidding Forms Section V Eligibility Criteria and Social and environment responsibility Section V-A Agency Policy Corrupt and Fraudulent Practices Section VI Pricing Document Annexure II-A Toolkit for using e-tender portal PART - 2 - WORKS REQUIREMENTS <ul style="list-style-type: none"> Section VII-A General Specification Section VII-B Particular Specification Section VII-C 5D BIM PART - 3 - CONDITIONS OF CONTRACT AND CONTRACT FORMS <ul style="list-style-type: none"> Section VIII General Conditions (GCC) Section IX Particular Conditions (PCC) Section X Contract Forms Section XI SHE Manual Section XII Authorized Vendors List PART - 4 - TENDER DRAWINGS

ITB 6.3	As this is a e-tender and all relevant document are available on E-tender Portal of Maharashtra Metro Rail Corporation Limited hence the Employer is not responsible for the completeness of the Bidding Documents, responses to requests for clarifications, the minutes of the pre-bid meeting (if any), or Addenda to the Bidding Documents in accordance with ITB 8 (Downloaded / Uploaded by Bidder). In case of any contradiction, documents available / uploaded on E-Tender portal of Employer shall prevail.
ITB 6.4	Following is added to existing ITB 6.4 Failure to comply with the requirements of the Bidding Documents and to furnish all information required by the Bidding Documents or submission of a Bid not substantially responsive to the Bidding Documents in every respect will be at the Bidder's risk and may result in rejection of its Bid.
ITB 6.5 (New Para)	The Bidder shall not make or cause to be made any alternation, erasure or obliteration to the text of the Bid Documents.
ITB 6.6 (New Para)	The document including the Bid Documents and all attached documents provided by Maharashtra Metro Rail Corporation Limited are and shall remain or becomes the property of Maharashtra Metro Rail Corporation Limited and are transmitted to the Bidders solely for the purpose of preparation and the submission of a Bid in accordance herewith. The provision of this Para shall also apply <i>mutatis mutandis</i> to the Bids and all other documents submitted by the Bidders, & Maharashtra Metro Rail Corporation Limited will not return to the Bidders any Bid, document or any information provided along therewith.
ITB 6.7 (New Para)	Contents of Supporting Documents
ITB 6.7.1 (New Para)	The references documents, reports, drawings containing site information included in the Bidding Documents are for general information only and any interpretation of the results shall be construed as opinions only and not as representations or warranties as to the actual site conditions. The Bidders' attention is specifically drawn to ITB 6.7.3 below.
ITB 6.7.2 (New Para)	The Bidders shall note the existence of over ground, at grade, utilities and infrastructure in the near vicinity of the Works to be constructed.
ITB 6.7.3 (New Para)	The accuracy or reliability of the documents and reports referred to in this Para ITB 6.7 and of any other information supplied, prepared or commissioned at any time by the Employer or others in connection with the Contract is not warranted. The Bidders' attention is drawn to Clause 4.10 of GC in this regard. The Bidder should visit, examine and assess the Site including working conditions and will be deemed to have satisfied himself of the risks and obligations under the Contract.
ITB 7.1	For Clarification of bid purposes only, all correspondence to be made through mail to the below mentioned email address & addressed to ED, Procurement & Contracts, Maharashtra Metro Rail Corporation Limited. Email address: -tenders.pmrp@mahametro.org All correspondence from Maharashtra Metro Rail Corporation Limited pertaining to this Bid till award of the work shall be done by authorized representative of Maharashtra Metro Rail Corporation Limited . The Bidders are advised to regularly check their email ID registered with their user account at e-tendering portal https://mahametroRail.etenders.in for any update/addendum/corrigendum/pre-tender and post-bid queries/any other correspondence by the Employer. The Bidder is requested, to submit any questions in writing, to reach the Employer before the date and time specified for Pre-Bid meeting in NIT & ITB 7.4. The bidder may send such queries either by post to the address mentioned in the bid document or send by mail to mahametroRail.etenders.in
ITB 7.1.1 (New Para)	Should the Bidder for any reason whatsoever, be in doubt about the meaning of anything contained in the Bid Documents or the extent of detail in the Works Requirements (General Specification and Technical Specification) and Bidding Drawings, the Bidder shall seek clarification from Maharashtra Metro Rail Corporation Limited, not later than the date specified. Bidders are advised to use the format attached in Section IV: Bidding Forms (Form for seeking clarification) while seeking clarifications.
ITB 7.1.2 (New Para)	Maharashtra Metro Rail Corporation Limited will comply with the principle of equal opportunity and fair treatment to respond to the questions / queries raised or clarifications sought by the Bidders on or before the date mentioned in BDS at ITB 7.1 above. All reply of queries and clarifications, in writing shall be up loaded on e-tender portal of Maharashtra Metro Rail Corporation Limited accessible to all prospective bidder.

	No verbal clarification shall be replied except the queries pertaining to the procedures of submission and uploading of bid on e-tender portal.
ITB 7.1.3 (New Para)	Maharashtra Metro Rail Corporation Limited may also on its own motion, if deemed necessary, issue interpretations and clarifications to all Bidders. All clarifications and interpretations issued by Maharashtra Metro Rail Corporation Limited shall be deemed to be part of the Bid Documents. Verbal clarifications and information given by Maharashtra Metro Rail Corporation Limited or its employees or representatives shall not in any way or manner be binding on Maharashtra Metro Rail Corporation Limited.
ITB 7.2	Following is added to existing ITB 7.2 Any site information given in this bidding document is for guidance only. It shall be deemed that the Bidder has undertaken a visit to the Site of the Works and is aware of and has ascertained itself, the site conditions, traffic, location, surroundings, climate, availability of power, water and other utilities for construction, access to Site, handling & storage of materials, weather data, applicable laws and regulations, and any other matter considered relevant by it prior to the submission of Bid.
ITB 7.4	A Pre-Bid meeting shall take place at the following date, time and place: As per NIT
ITB 7.5	Replace provisions of ITB 7.5 with the following The bidder may send such queries either by post to the address mentioned in the bid documents or by e-mail:- tenders.pmrp@mahametro.org
ITB 7.6	Responses to queries shall not be sent individually to each bidder. It shall be published on e-tender portal of Maharashtra Metro Rail Corporation Limited https://mahametroRail.etenders.in . However, email notices shall be sent to all bidders when new information is uploaded on e-tender portal of Maharashtra Metro Rail Corporation Limited https://mahametroRail.etenders.in .
ITB 7.7 (New Para)	Bidders should alert the Employer in writing with a copy to Funding Agency (EIB) to procurementcomplaints@eib.org in case they consider that certain clauses or technical specifications of the Tender Documents might limit international competition or introduce an unfair advantage to some bidders
ITB 8.2	Following is added to existing ITB 8.2 Such modification in the form of an addendum will be uploaded on the e-Bidding portal https://mahametroRail.etenders.in within the date given in NIT, which shall be available for all the prospective Bidders who have purchased the Bidding Documents in the Bid period. Without prejudice to the general order of precedence prescribed in the Clause 1.5 of GCC, the provisions in any such addenda shall take priority over the Invitation to Bidders and Bidding Documents previously issued. Bidder shall ensure these documents should be submitted along with their original Bid documents submission. These all addendums, corrigendum and clarifications shall be part of the contract agreement.
C. PREPARATION OF BIDS	
ITB 10.1	The language of the bid is English. All correspondence exchange shall be in the English language. Language for translation of supporting documents and printed literature is English. Supporting documents related to eligibility criteria enclosed with the bid, other than English Language, should be translated into English and will have to be endorsed by the Indian Embassy or notarized / registered with appropriate statutory authority in the jurisdiction where the supporting document is being issued. However, such documents provided by a Bidder from a country which has signed The Hague Legislation Convention 1961 is not required to be endorsed by the Indian Embassy, if it carries a conforming Apostille Certificate. The Bidder should provide the relevant contact number and E-mail ID along with the postal address, in English, of issuing authority / agency of such documents for verification purpose.
ITB 11	Documents Comprising the Bid. Replace the Para 11 and its Sub-Paras with the following:
ITB 11.1	General Requirements

ITB 11.1.1	All documents issued for the purposes of bidding as described in ITB 7, and any amendments issued thereof shall be deemed as incorporated in the Bid.
ITB 11.1.2	<p>The Bidder shall, on or before the date and time given in the Notice of Invitation to Bid upload his Bid on e-tendering portal https://mahametroRail.etenders.in in accordance with provisions in ITB 22.1.</p> <p>The Bidder shall, on or before the date given in NIT, submit his Bid online and follow the procedure and steps of E-Tender portal of Maharashtra Metro Rail Corporation Limited Details have been given in E-Toolkit given in Annexure-II-A.</p> <p>Cost of the Bid: Paid online through E-Tender portal. Bid Securing Declaration: As per format given in the Tender.</p> <p>Technical Package: To be submitted at appropriate place i.e. Technical Envelope on e-tender portal.</p> <p>Financial Package: Financial bid form to be duly filled up directly in the Commercial Envelope only on e-tender portal and not anywhere else.</p> <ul style="list-style-type: none"> • Bidder should ensure that the no part of the Financial Bid should be up-loaded anywhere in the Technical envelope, if the bidder does so then his bid will be rejected out rightly. • The original Bid Securing Declaration shall be submitted within three working days from the last date stipulated for submission of bid at the office of Maharashtra Metro Rail Corporation Limited at address given above. <p>For Bid Securing Declaration: Refer BDS ITB 19.1 below Bill of Quantities also referred to as the Pricing Document.</p>
ITB 11.1(d)	Alternative bid is not permissible.
ITB 11.1 (i)	The bid documents shall include the bid document including corrigendum/ addendum/ clarifications provided by the Employer during the course before submission of Bid. Failure by the bidder to upload the same shall render the bid to be considered as non-responsive and the bid shall not be validated.
ITB 11.2	Bid Securing Declaration: Refer BDS ITB 19.1 below
ITB 11.3	Pre-qualification Package
ITB 11.3.1	The pre-qualification documents shall comprise of all information and supporting documents as per Section-III: Evaluation and Qualification Criteria.
ITB 11.4	Technical Package/Technical Section
ITB 11.4.1 (Additional para)	<p>The Bidder shall submit/ upload (through digital signature in the “Technical Package”/ “Technical Section” in the e-tender portal of MAHA-METRO.</p> <ol style="list-style-type: none"> 1. Bidder shall first download the Complete Bid Document along with all Corrigendum/Addendum/Clarification etc. by logging in with E-Tender using his DSC (i.e. DSC of POA/ Owner) read & examine the document & process carefully. 2. For submission of Tender Document and Corrigendum, Tick (/) Submission Process has been enabled in Technical section of E-Tender Portal of MAHA-METRO. Bidders have to tick (/) the corresponding checkbox provided in the Technical Section of E-Tendering portal as a token of acceptance of these bid documents & corrigendum / Addendums. By clicking the tick (/) the bid documents & corrigendum /addendum shall automatically attach to offer of bidder. Further bidder may proceed for submission by clicking submit button. 3. If the bidder has completed the submission process of his bid before due date of submission and in between employer issues a corrigendum, in this circumstance the bidder has to re-submit his bid by “clicking tick (/)” to the new added corrigendum, in case the new corrigendum has any implications to his already submitted bid. Bidder may, at his option, amend his bid accordingly & re-submit it. 4. Physical Sign & seal of bidder on each page of Bid Documents available online is required. 5. Scanned copy of all enclosures required as described in the Bid Document at various places shall be uploaded in Technical Section / Technical Envelope of E-Tender Portal. 6. Each entity of Technical Section / Technical Envelope have a capacity to upload a document of 10 MB. 7. If any enclosure is more than 10 MB, it may be split by bidder to the size of 10 MB or less & proceed further for uploading in Technical Section / Technical Envelope.

	<p>8. If the technical enclosures are more in number than the fixed entity of Technical Section / Technical Envelope. Bidders have option to upload any number of documents in “Additional Document” section of “Technical Envelope/ Technical Section” of E-Tender Portal.</p> <p>9. No information pertaining to “Financial Bid” shall be uploaded or disclosed anywhere in “Technical Bid” Technical Section/ Technical Envelope of E-Tender Portal.</p> <p>10. All uploaded enclosures should bear page numbers and indexed properly. The first file uploaded by bidder in the technical section shall be “Index of Enclosures”.</p>
ITB 11.4.1.1	Scanned copies of Bid Securing Declaration and Bid Processing Fee
ITB 11.4.1.2	Attested Copy of Power of Attorney (from each Member in case of Consortium) to submit Bid.
ITB 11.4.1.3	Consortium Agreement (in case the Bidder is a Consortium) duly covering the details provided under BDS ITB 4.13;
ITB 11.4.1.4	Letter of Bid in accordance with ITB 12;
ITB 11.4.1.5	Statement of Deviation: No Deviations are allowed.
ITB 11.4.1.6	Certificate confirming submission of all documents of Financial Package in Technical Package with price left blank (as per format provided in Section-IV: Bidding Forms (Form 16).
ITB 11.4.1.7	Bidder’s Technical Proposal
(1)	The Bidder shall submit with its Bid its Technical Proposals as described in Section IV: Bidding Form (Form 4.4). The Technical Proposals to also include details of major component, equipment, sub-systems, assemblies and any specialized works proposed to be sub-contracted or bought-in (See ITB 34.4 below).
(2)	<p>The Bidder shall submit in his Technical Package a schedule of the main items of Contractor’s Equipment (refer Form 4.5 under Section IV. Bidding Forms), which he intends to use for carrying out the Works, indicating the activities for which each item will be used. The Bidder shall specify in each case:</p> <ul style="list-style-type: none"> • If he owns or intends to purchase such items, and • If he intends to enter into hire, hire purchase, or leasing or charter-party arrangements.
(3)	The Bidder may be requested by Maharashtra Metro Rail Corporation Limited in writing to amplify, explain and develop the Contractor’s Technical Proposals in substantially greater detail during the detailed technical package evaluation period such that they may be confirmed as complying clearly with Works Requirements and, in accordance with BDS ITB Para 8.4 herein, can be incorporated into the Contract. Only those aspects of the Contractor’s Technical Proposal that the Employer (at its sole discretion) considers clearly conforming will form part of the Contract.
ITB 11.4.1.8	<p>Outline Quality Plan (Form 4.7 under Section IV: Bidding Form): The Bidder shall submit as part of its Bid an Outline Quality Plan illustrating the intended means of compliance with the Clause 5.2 to 5.6 of General Specifications (Part 2, Section VII-A, Works Requirements, and setting out in summary form an adequate basis for the development of the more detailed document required under specifications of the Bid. The Outline Quality Plan shall contain sufficient information to demonstrate clearly the proposed method of achieving the Bidder’s quality objectives with regard to the requirement of the Contract.</p> <p>Overall responsibility of quality for manufacture, testing, commissioning and DLP shall be with the Consortium member based on whose experience and strength, the Bidder has qualified for this Bid.</p>
ITB 11.4.1.9	<p>Outline Safety Plan (Form 4.8 under Section IV: Bidding Form): The Bidder shall submit as part of its Bid an Outline Safety Plan which shall contain sufficient information to demonstrate clearly the Bidder’s proposals for achieving effective and efficient safety procedures in the design, manufacture, testing & commissioning of the Works. The Outline Safety Plan should include an outline of the safety procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring safety including Hazard Analysis, Fire Control, Electro Magnetic Compatibility/Electro-magnetic Interference control, reliability, availability and maintainability requirements</p>

	<p>as given in the Works Requirements (Clause 14.5 and 14.6 of General Specifications, Part 2, Section VII-A) and Clause 5 and 12 (Sub Clause 4.8, 4.22) of Part B - Specific Provisions of Section IX-Particular Conditions.</p> <p>The Outline Safety Plan shall be headed with a formal statement of policy in relation to safety and shall be sufficiently informative to define the Bidder's Safety Plans and set out in summary an adequate basis for the development of the Site Safety and Safety in transportation to be submitted in accordance with Works Requirements and Clause 12 (Sub Clause 4.8, 4.22) of Part B - Specific Provisions of Section IX-Particular Conditions. The Bidder may be requested by Maharashtra Metro Rail Corporation Limited in writing to amplify, explain or develop its Outline Safety Plan prior to the date of acceptance of the Bid and to provide more details with a view to reaching provisional acceptance of such Plan.</p>
ITB 11.4.1.10	<p>Outline Environmental Plan (Form 4.9 under Section IV: Bidding Form): The Bidder shall submit as part of its Bid an Outline Environmental Plan setting out in summary form its intended means of complying with the Employer's Safety, Health and Environment Manual and noise standards for the Works (refer Clause 9 - Sub Clause 4.8 of Part B - Specific Provisions of Section IX-Particular Conditions). This shall be an adequate basis for the development of the more detailed document to be submitted under Works Requirements. This shall form the basis for the submission of a detailed and comprehensive Environmental Plan to be submitted in accordance with Works Requirement (Clause 3.6.3 of General Specifications, Part 2, Section VII-A) at the time of detailed design.</p> <p>The Bidder may be requested by Maharashtra Metro Rail Corporation Limited in writing to amplify, explain or develop its Outline Environmental Plan prior to the date of acceptance of the Bid and to provide more detail with a view to reaching provisional acceptance of such a Plan.</p> <p>The Bidders (each member in case of JV / Consortium) shall sign and execute the Environmental and Social Covenant given as Appendix - 2.2B and submit with the Tender.</p>
ITB 11.4.1.11	<p>The Structure of the Bidder including details of ownership and control of the Bidder (Form 4.11 under Section IV: Bidding Form).</p>
ITB 11.4.1.12	<p>Project Management Plan (Form 4.10 under Section IV: Bidding Form): The Bidder shall submit with its Bid a Project Management Plan including staffing schedule as prescribed in Works Requirements (Clause 3.3 of General Specifications, Part 2, Section VII-A), inter-alia, indicating names, qualifications, professional experience and corporate affiliation of all proposed key management and engineering personnel (above the level of supervisor) and specialists. Details shall be included for all such personnel whether directly employed or engaged on a consultancy or advisory basis and whether associated with the design or the construction of the Works. The submission shall include a provisional management structure and organization chart showing areas of responsibility, relative seniorities and lines of reporting.</p> <p>The Bidder shall include its proposals for its Co-ordination Control Team and include the name and qualifications of the Team Leader responsible for the interface co-ordination with Designated Contractors. The key staff for design and construction shall be from that member of the JV / Consortium of the Subcontractor on the experience of which, the JV / Consortium has been pre-qualified.</p> <p>The successful Bidder shall deploy those proposed key management and engineering personnel. Should they be not available for the Work, the successful Bidder shall deploy an equivalent or superior expert (in qualification, experience and capability) acceptable to the Employer and subject to the written prior approval of Employer.</p>
ITB 11.4.1.13	<p>Staffing Schedule and Organization Chart as per ITB 11.4.1.13 above (refer Form 4.1 under Section IV: Bidding Form)</p>
ITB 11.4.1.14	<p>Bidder's Proposed Works and Design submission Programme.</p>
(1)	<p>The Bidder shall submit with its Bid, a Works Programme which shall indicate how the Bidder intends to organize and carry out the Works and achieve Stages and complete the</p>

	<p>whole of the Works by the appropriate Key Dates. Detailed requirements for the Works Programme are set out in Section IV: Bidding Forms (Form 4.3).</p> <p>Periods for each stage of work are given in Part 3, Section IX, PC Part A -Contract Data (Table - Summary of Sections). The Works Programme shall be prepared in terms of weeks from Commencement Date of Works.</p> <p>The Works Programme given in the Bid shall not in any event be construed as a submission of the Works Programme as required to be furnished according to the Works Requirements.</p>
(2)	<p>The Bidder shall submit with its Bid its proposed Design Submission Programme to cover the Design Phase. Such proposed Programme shall:</p> <ul style="list-style-type: none"> (a) be consistent with the Works Programme as detailed in Works Requirements; (b) Include a Schedule identifying, describing, cross-referencing and explaining the Design Packages and Submissions which the Bidder intends to submit; (c) take due account of the design co-ordination interface periods during which the Contractor shall be required to undertake and complete all aspects of design co-ordination with other contractors (Designated Contractors) engaged in the design of the Project such that each contractor can complete its coordinated design in the knowledge that such design will be compatible and coordinated with others and allowing adequate time for the Employer's assessments and decisions. <p>The proposed Design Submission Programme submitted at the time of Bid shall be modified and developed as necessary during the Contract Period to incorporate the Employer's programme requirements in respect of review by the Employer and the Engineer.</p>
(3)	<p>The Bidder's attention is drawn to the Works Requirements (Clause 2.5 of General Specifications, Part 2, Section VII-A) and the requirements that the initial Proposed Works Programme and Design Submission Programme shall be submitted within the period stipulated in Works Requirements. However, the Bidder should note that it may be requested by Maharashtra Metro Rail Corporation Limited in writing to amplify, explain & develop its proposed Works Programme prior to award of Contract.</p>
(4)	<p>The proposed Design Submission Programme and other submissions given in the Bid shall not, in any event, be construed as a submission as required to be furnished as per the Works Requirements.</p>
ITB 11.4.1.15	<p>Manufacture, Installation, Testing and Construction Methods: The Bidder shall submit with its Bid, the methods by which the Bidder intends to manufacture and test the systems/subsystems offshore as well as in India. Details shall be given of the locations and arrangements for offshore work, the facilities available and any understanding from others that the Bidder has in such matters. The manufacturing methods to be employed, the equipment's and facilities available or proposed to be set up off-shore and/or in India, will be analyzed during technical evaluation and shall be in sufficient detail to allow a full appreciation of the Bidder's proposals in relation to all aspects of the Works.</p>
ITB 11.4.1.16	<p>Undertaking regarding confidentiality of Bid information (as per format provided in Section IV: Bidding Forms (Form 13))</p>
ITB 11.4.1.17	<p>Certificate confirming receipt of all Bidding Documents addenda (as per format provided in Section IV: Bidding Forms (Form 17));</p>
ITB 11.4.1.18	<p>Declaration for non-engagement of any agent, middlemen or intermediary (as per format provided in Section IV: Bidding Forms (Form 18));</p>
ITB 11.4.1.19	<p>Certificate from the Bidder that all the contents of the Bidding Documents have been carefully examined by the Bidder and all the pages of Bidder's proposal have been signed and stamped as per pro-forma as given in Section IV: Bidding Forms (Form 19).</p>
ITB 11.4.1.20	<p>Letters of undertaking for ensuring supply of critical spares and availability of technical support (as per format provided in Section IV: Bidding Forms (Form 20));</p>
ITB 11.4.1.21	<p>Bid Index (Form 10 under Section IV: Bidding Form): The Bidder shall include with his Bid an index which cross refers all of the Employer's bidding requirements elaborated in these documents to all the individual sections of Technical Package and Financial Package which the Bidder intends to be the responses to each and every one of those requirements.</p>
ITB 11.4.1.22	<p>Details of providers of guarantees and warranties (refer BDS ITB 43)</p>

ITB 11.4.1.23	Clause by clause commentary as detailed below:
(1)	The Bidder shall provide a valid and fully compliant proposal for the Works as detailed in the Works Requirements. The Bidder shall submit a detailed clause-by-clause commentary on all the clauses of the Works Requirements.
(2)	<p>Bidders shall note that their comments to the clause-by-clause commentary wherever given shall only be in the following form:</p> <ul style="list-style-type: none"> • Complied: "Complied" shall be indicated by the Bidder where the Bidder is able to comply fully with the clause. • Noted: Where a clause merely provides information, and no other comment is necessary, "Noted" will suffice. • Not Complied: Where the Bidder is not able to comply fully with certain clauses or has any observation or proposes an alternative design, "Not Complied" shall be indicated and comments if any of the Bidder shall be indicated in detail. All Clauses with status as "Not Complied" shall be included in the statement of Deviations and shall be priced in Financial Package.
(3)	<p>Bidders shall also note that:</p> <ul style="list-style-type: none"> • Any comment by the Bidder in the Clause-By-Clause Commentary, other than either of "Complied", "Noted" or "Not Complied" shall be treated as "Not Complied". Unless Bidder prices against such clauses in the Financial Package, the comment shall be considered as unconditionally withdrawn with no financial implications and shall be considered as NULL and VOID.
(4)	A Bid without a Clause-by-Clause Commentary as stated above, is liable to be treated as unresponsive and be rejected.
(5)	Should any further document be required in pursuance to ITB 11.4.1.23, the Bidder will be instructed by the Employer which package of the Bid submission is to contain such document. The documents identified in BDS ITB 11.4.1.5, 11.4.1.13 and 11.4.1.21 will be used for the purpose of analyzing and evaluating the Bid but will not form part of the Contract unless same shall have been expressly incorporated into the Contract.
ITB 11.4.1.24	<p>Supporting Technical Documents: The Bidder shall submit with the Technical Package the documents that are identified in paragraphs below. These documents will be used for the purpose of evaluating and analyzing the Bid but will not form part of the Contract, unless the same shall have been expressly incorporated into the Contract.</p> <p>(a) Details of providers of guarantees and warranties (see ITB 43);</p> <p>(b) Proposals for use of Site and Site management (see ITB 11.4.1.25 below)</p> <p>(c) Understanding of scope of works (see Section VII-B Particular Specifications)</p> <p>(d) Details of works including specialized works if already decided to be subcontracted (see ITB 34 & submit details in Appendix 4.4-B of Form 4.4 under Section IV. Bidding Forms)</p> <p>(e) Documents amplifying the Bidder's Technical proposal as described in Section IV: Bidding Forms (Form 4.4)</p>
ITB 11.4.1.25	Proposal for use of Site and Site Management:
(1)	The Contractor will be given access to the Site in accordance with Clause 2.1 of GC. The Bidder shall submit with their Bid details of their proposed use of the works areas as described in the Works Requirements and such other areas in or in the vicinity of Pimpri Chinchwad Municipal Corporation & Pune Municipal Corporation which they propose to use for the purpose of executing the Works. Such details shall be subject to the provisions of the Works Requirements and shall include proposed preparatory work, arrangement for access to these temporary work sites or other areas and proposals for reinstatement on completion.
(2)	<p>The Bidder shall show, in outline, his proposed site layouts for:</p> <p>(a) Accommodation and other facilities</p> <p>(b) Fabrication and storage areas.</p> <p>(c) Temporary storage and unloading areas.</p>
(3)	The Bidder shall indicate his proposals for the provision of utility services to the Site. The Bidder is to note that the Contractor will be fully responsible for the provision of all utility services necessary for the construction and completion of works as described in the Works Requirements.
(4)	The Bidder's attention is drawn to the requirement that access to the Site or parts of the Site will, from time to time, have to be shared with other contractors carrying out

	works on, or in the vicinity of the Site including, without limitation, works relating to design and construction of stations; design, manufacture and installation of signaling, train control and telecommunications on the corridors; design, manufacture, supply and commissioning of rolling stock; design, manufacture and installation of lifts & escalators on the corridors; installation of Track work; design, manufacture, supply and installation of automatic fare collection / platform screen doors; construction, manufacture and installation of Depot and equipment's etc. Bidder may refer to Works Requirements - General Specifications and Works Requirements - Technical Specifications for details.
ITB 11.4.1.26	Any further documents which have been requested in accordance with ITB 8.4 above.
ITB 11.4.1.27	In case of an incorporated Bidder (or Consortium Members who are incorporated) copies, in English, of the Memorandum and Articles of Association or equivalent expression of corporate capacity.
ITB 11.4.1.28	Details of previous collaborations between JV/Consortium members in any other project.
ITB 11.4.1.29	PAN details as per ITB 4.15 above (for Indian companies)
ITB 11.4.1.30	One set of complete Bid Documents (including all addenda) un-tampered, signed and stamped on right hand bottom corner of each page and reference documents signed and stamped.
ITB 11.4.1.31	A declaration by the Bidders as per Section IV: Bidding Forms (Form 14) must be submitted stating that the Bid Documents have been downloaded from official website of e-tendering portal https://mahametroRail.etenders.in and no changes, what so ever, has been made by the Bidder. Bids received without the declaration are also liable to be rejected at any stage.
ITB 11.4.1.32	Any further documents which are requested in writing by Employer before submission of the Bid by way of evaluation documents, but which are not to form part of the Contract.
ITB 11.4.2	Designer
ITB 11.4.2.1	The design of the Works shall be undertaken by a Designer or the design wing of the Bidder (the Designer) who has experience in the design / design checking of similar works respectively as in scope of Bid. Approval of the proposed Designer intended to be engaged shall be obtained from Employer before engaging the Designer by the Contractor.
ITB 11.4.2.2	The Bidder shall submit with his Bid details of the agencies proposed to be hired and either the proposed terms and conditions upon which the Designer would be appointed in the event of acceptance of the Bid (excluding the financial and commercial terms thereof) or at least a statement of the heads (salient features) of such an agreement. The Bidder should note that, if heads of agreement are supplied with the Bid, the Bidder may be required to develop such heads into a full agreement during the Bid evaluation period and to submit the agreement in its final form prior to award of the Contract. Bidder should note that submission of the details of the agencies in the Bid does not mean approval of the agencies. The successful Bidder will be required to submit proposal for the agencies after award of the Contract for approval. Submission at Bid stage is only for the point of view of understanding of the offer of the Bidder.
ITB 11.4.2.3	The Bidder shall confirm that the terms for engagement of the Designer will include for certification of the As-Built drawings, and regular inspection of the Works to confirm that the construction complies with the intent of the design.
ITB 11.5	Financial Package
ITB 11.5.1	<p>(a) Summary sheet provided in the Commercial Envelope Section of E-Tender portal of Maharashtra Metro Rail Corporation Limited shall be duly filled up online.</p> <p>(b) Few prices schedules may require to be filled up physically and should be signed and stamped by authorized signatory/POA of bidder or POA of lead member of JV/consortium and scanned copies of such schedules may be uploaded as instructed in the BOQ or tender portals. (Deleted)</p> <p>The Bid Total Price includes all Taxes and Duties as per Goods & Service (GST) Act, net of input credit (if any) and Custom Tariff Act, Royalties, Cess etc. The price to be quoted shall be the total price of the Bid as elaborated in PART 1 Bidding Procedures, Pricing Documents Annexure IV-A.</p>

	<p>The Financial Package should be separately completed, each page duly signed and stamped and submitted / uploaded as per procedure in e-tender portal. No pricing information shall be submitted in any manner except in the Financial Proposal. The Pricing Document or any pricing information, if submitted by the Bidder along with the Technical Proposal or in any other manner other than the Financial Proposal Pricing Document envelope, will render the bid liable for rejection.</p> <p>The prices shall be entered at the prescribed place in the Pricing Document. These prices should include all costs associated with or required to be incurred for the purpose of execution of the Contract in accordance with the terms thereof.</p>
ITB 12.2 (New Para)	The Letter of Bid with all Schedules/ Forms shall be completed and signed by a duly authorized and empowered representative of the Bidder. If the Bidder comprises a Consortium the Letter of Bid shall be signed by a duly authorized representative of the Lead Member. Signatures on the Letter of Bid shall be witnessed and dated. Copies of relevant powers of attorney shall be attached.
ITB 13.1	Alternative bids shall not be permitted under ITB 13.2, ITB 13.3, or ITB13.4.
ITB 13.2	Alternative times for completion not permitted.
ITB 13.4	Alternative technical solutions shall not be permitted
ITB 14.1	No discounts are allowed and also not to be quoted by the bidder in the Letter of Bid and in the Schedules.
ITB 14.2	<p>Replace provisions of ITB 14.2 with the following:</p> <p>The Pricing Document is included in Part I of bid document as Pricing Documents Annexure IV-A.</p> <p>The Bidder shall complete the Pricing Document in accordance with the instructions given therein. The completed Pricing Document shall be submitted with the Letter of Financial Bid.</p> <p>The Bidder is to note that Key Dates are to be determined by reference to periods from the Commencement Date of the Works. Periods for each stage of Work are given in Section IX. Particular Conditions, Part A -Contract Data 'Table - Summary of Sections'. Milestones Dates shall be, likewise, determined by reference to the respective periods from the Commencement Date of the Works. It is the intention that, prior to Date of Commencement, Key Dates and Milestones will be converted to calendar dates.</p> <p>Prior to award of Contract, the successful Bidder shall reformat the Pricing Document, Schedule of Milestones, Key Dates / and the Work Programme, so as to correlate between these documents, as required by the Employer.</p>
ITB 14.3	The price quoted in the commercial envelope in e-tender portal of Maharashtra Metro Rail Corporation Limited shall be the total price bid.
ITB 14.4	No discounts or any either methodology shall be quoted by the bidder in the Letter of Bid by the bidder.
ITB 14.5	For price adjustment / variation, refer to instructions / conditions provided in the Section IX-Particular Conditions of Contract Sub-Clause 13.8.
ITB 14.7	The price quoted by bidders deemed to be inclusive of all kinds of duties, taxes, Cess and other levies payable as per GST, Custom tariff act etc. and as prevailing on 28 days (Base Date) prior to final date of submission of bid (Closing time & date of submission of online bid).
ITB 14.8 (New Para)	Bidders shall quote for the entire work on a "single responsibility" basis such that the Bid Price covers all Contractor's obligations mentioned in or to be reasonably inferred from the Bid Documents in respect this Contract P1-T06/2021 and completion of the whole of Works. This includes all requirements under the Contractor's responsibilities for testing & commissioning of the works including integrated testing & commissioning, the acquisition of all permits, approvals and tender licenses, etc.; the operation, maintenance and training services and such other items and services as may be specified in the Bid Documents.
ITB 14.9 (New Para)	The Bidder shall submit with its Bid (Financial Package) Milestone Payment Schedule, which shall show in tabular form the anticipated accumulated value of work done for all Cost Centers put together. The Bidder shall also submit monthly cash flows for the Contract. Both Milestone Payment Schedules and monthly cash flows shall be submitted

	for each currency of the Contract separately. The Milestone Payment Schedule shall be consistent with the proposed Works Programme.
ITB 14.10 (New Para)	If the Bidder is requested by Maharashtra Metro Rail Corporation Limited in writing to amplify & develop its proposed Work Programme & Design submission Programme pursuant to BDS ITB 11.4.1.14 above, the Bidder will be required to amend the Monthly Payment Schedule so as to be consistent with the Proposed Works and Design submission Programme with a view to reaching provisional acceptance of the amended version. If such provisional acceptance is notified, the Bidder shall be required, prior to award of Contract, to submit such amended versions as its proposed Monthly Payments conditional only upon acceptance of its Bid.
ITB 14.11 (New Para)	The Bidder should note Sub-clause 14.7 of the General Conditions (GC) and Clause 48 (Sub-Clause 14.2) from Part B- Specific Provisions of the Particular Conditions (PC) that describes the method of determining interim payments by reference to Milestone payments.
ITB 14.12 (New Para)	The Bidder shall submit its Bid without any deviations to the Bid Documents.
ITB 14.13 (New Para)	The Employer may get, from the Government, partial or complete waiver of taxes under GST, royalties, Labour, cess, and other levies payable to various authorities. The successful Bidder (the Contractor) shall maintain meticulous records of all the taxes and duties paid under GST etc. and provide the same with each running bill. In case the waiver becomes effective, the Contractor will be advised on the process to be followed to obtain the refund from the concerned authority. The Contractor shall arrange for the remit of the refund to the Employer. In case of failure by the Contractor to remit such amounts, the same shall be recovered from amounts due for payment to the Contractor. The Pro forma of undertaking is provided in Part-1: Bidding Form (Form 21).
ITB 14.14 (New Para)	With the Bid submission, the Bidder shall submit the Pro forma of undertaking provided in Part-1: Bidding Form (Form 22) stating that registrations under various fiscal and labour laws like GST, Profession Tax, Import Export Code, Employee State Insurance, Provident Fund, Maharashtra Labour Welfare Fund, shall be obtained by the bidders in the event of award of the work.
ITB 14.15 (New Para)	(DELETED)
ITB 14.16 (New Para)	Maharashtra Metro Rail Corporation Limited project is covered under Project Import Chapter 98.01 of Custom Tariff Act according to which only concessional custom duty is payable. The Bidder should avail this benefit and pass on the benefit of the same to Maharashtra Metro Rail Corporation Limited . As regards registration under Project Import, after the award of the contract, Maharashtra Metro Rail Corporation Limited at the written request of Contractor shall facilitate the Contractor for obtaining sponsoring / recommendation letter from the Ministry of Urban Development / Government of Maharashtra forgetting themselves registered for availing Project Import benefits. The responsibility to avail the concessional benefits under Project Import shall solely rest with the Contractor.
ITB 14.17 (New Para)	The Contractor shall maintain details of Taxes paid/payable under GST Law and submit: <ul style="list-style-type: none"> • Certificate of the Chartered Accountant in regard to turnover & other details of GST related to the project of Maharashtra Metro Rail Corporation Limited. • All payments will be subject to TDS provisions in force from time to time.
ITB 14.18 (New Para)	In view of above, the Bidders are advised to quote the price inclusive of all Taxes, and Duties as per Goods & Services (GST) Act, net of input credit (if any) and Custom Tariff Act etc., Royalties, Cess etc. and all other incidental charges required to fulfill the bidding conditions including statutory deduction viz., TDS towards Income Tax / Works Contract Tax etc. after considering ITB 14.7 to 14.18 above.
ITB 15.1	The currency(ies) of the bid and the payment currency(ies) shall be in Indian National Rupees (INR), USD, and Euro in which the Bid Price is expressed in the Bid of the successful Bidder.
ITB 15.3 (New Para)	Interim payments in relation to each Cost Centre will be certified and paid, in accordance with the provisions of Clause 14.7 of the GC and Clause 48 (Sub-Clause 14.2, Advance Payment) of Part B- Specific Provisions of the PC in the currency shown against the relevant Milestone.
ITB 16.2 (New Para)	The Bidder shall be required to amplify, explain and develop the Contractor's Technical Proposals in substantially great details during the Bid evaluation period such that they

	may be confirmed as complying clearly with the Works Requirements and, in accordance with BDS ITB 8.4 herein, can be incorporated into the Contract. Only those aspects of the Contractor's Technical Proposal that the Employer (at his sole discretion) considers clearly conforming, will form part of the Contract.
ITB 18.1	The bid validity period shall be 180 days
ITB 18.3 (a)	The bid price shall not be adjusted.
ITB 19.1	<p>The bidder shall submit Bid Securing Declaration along with the bid. In case of JV / Consortium, the Bid Securing Declaration must be in the name of all members of JV / Consortium that submits the bid. The bid shall be summarily rejected if Bid Securing Declaration is not found in order.</p> <p>A scanned copy of this Bid Securing Declaration is to be uploaded online and the Bidder should ensure physical submission of the original Bid Securing Declaration at the office of MAHA-METRO at address specified in Bidding Documents, within 3 working days from the time and last date scheduled for handing over the Bidding Documents (online).</p> <p>(d) If the Bidder fails to submit the scanned copy at the aforesaid (c. above) or fails to submit the original Bid Securing Declaration (c. above), his bid shall not be considered for opening & shall be rejected outright.</p>
ITB 19.8	The Bid Securing Declaration as specified in ITB 19.1 above shall be submitted by the lead member in case of JV/Consortium.
ITB 19.9	Not applicable as Bid Securing Declaration is required.
ITB 20.1	<p>Bids to be submitted through e-tender portal of Maharashtra Metro Rail Corporation Limited only. (No physical submission of bid is allowed)</p> <p>The Bidder shall prepare and upload scanned copy of the Bid Securing Declaration, the documents for Pre-Qualification (Initial Filter Package), Technical Package of the Bid, and the Financial Package of the Bid, as described in ITB 11. The Bid Securing Declaration in original is required to be submitted physically by bidders within 3 working days after online submission of bid.</p>
ITB 20.3	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of:</p> <p>A written power of attorney authorizing the signatories of the Bid to commit each member of the JV/Consortium. The power of attorney (ies) shall be substantially in the format provided under Section IV: Bidding Forms (Form 9) of these Bidding Documents.</p> <p>The entire bid documents along with the corrigendum / addendum issued from time to time & requisite enclosures signed by authorized signatory of bidder shall be uploaded on e-tender portal of Maharashtra Metro Rail Corporation Limited, failing which the bid shall be considered as non-responsive.</p> <p>'and'</p> <ol style="list-style-type: none"> A firm, who has purchased the Bid Document in his name shall submit the Bid in his own name by using his DSC. In case of JV / Consortium the power of attorney hold of lead member is authorized to sign all legal documents, bid documents and other enclosures. However, the digital signature (DSC) of any member of JV/Consortium may be used for accessing /downloading/uploading & submitting the tender documents. Such digital signature (DSC) holders who is submitting the bid / or whose DSC is being used for accessing / submitting the bid, shall be authorized by POA (Lead Partner) of JV/Consortium & a notarized authority letter should be enclosed with the bid. The facility in the e-tender portal of MAHA-METRO is also available for viewing & downloading the document free of cost.
D. SUBMISSION AND OPENING OF BIDS	
ITB 21.1	Deleted.
ITB 21.2	Deleted.
ITB 21.3	Deleted.
ITB 22.4 (New Para)	Bids shall be submitted through e-tender portal of Maharashtra Metro Rail Corporation Limited only with clearly marked 'Pre-qualification & Technical Proposal', containing documents comprising the Technical Proposal in accordance with the provisions of ITB

	16 , and the other clearly marked 'Financial Proposal', containing Schedule of Prices or the Pricing Documents in accordance with the provisions of ITB 14 .
ITB 22.1	<p>For bid submission purposes: - No physical submission of bid is allowed. The bid submission has to be strictly done through e-Bid portal of Maharashtra Metro Rail Corporation Limited.</p> <p>The deadline for online submission of bids is: As per NIT (as amended).</p> <p>Bidders must submit their bids electronically only. The electronic bidding submission procedures shall be:</p> <p>The electronic bidding submission procedures shall be as per (E-Tender procedure) Annexure-2A: (Toolkit for using Maharashtra Metro Rail Corporation Limited e-tender portal)</p> <p>The Bidder shall, on or before the date and time given in the Notice inviting Bid, upload his Bid on e-tendering portal (https://mahametroRail.etenders.in) Bidders may refer to e-tender procedures (Toolkit for using e-tender portal) at Annexure-2A</p> <p>The Bidders shall furnish the information strictly as per the formats given in the Bid documents without any ambiguity. The Maharashtra Metro Rail Corporation Limited shall not be held responsible if the failure of any Bidder to provide the information in the prescribed formats results in a lack of clarity in the interpretation and consequent disqualification of its Bid.</p> <p>In case of support or help required during online submission or difficulty encountered during online submission, the Bidders may contact the following official(s): 1. Prashant Jadhav (Consultant): 020-26051074</p>
ITB 23.2 (New Para)	Bids received after due date and time of submission shall not be accepted. Maharashtra Metro Rail Corporation Limited will not be responsible for any delay, internet connection failure or any error in uploading the Bid submission. The Bidders are advised to upload their submissions well before the due date and time of Bid submission to avoid any problems and last-minute rush.
ITB 23.3 (New Para)	The Employer may, at his discretion, extend the deadline for submission of Bids by issuing an amendment in accordance with ITB, in which case all rights and obligations of the Employer and the Bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.
ITB 25.1	<p>The bid opening shall take place at As per NIT (as amended).</p> <p>Executive Director Procurement & Contracts MAHARASHTRA METRO RAIL CORPORATION LIMITED Pune Metro Rail Project 101, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune - 411001 Telephone: 020-26051072</p> <p>The mode of bidding being only e-tendering mode no physical submission of bid is allowed. The electronic bid opening procedure shall be: The Technical Envelope/ Packages of Online Submitted Bids shall be opened (downloaded) first by the opening committee on due date and time of Bid opening in presence of bidders who choose to remain present.</p> <p>No minimum number of bids is required in order to proceed to bid opening.</p> <p>Add following paragraph below the existing paragraph of ITB 25.1:</p> <p>The Bid Securing Declaration will be checked for the submission of bid from the downloaded documents of technical bid submitted by the bidders and details will be read out for the information of representative of Bidders, present at the time of opening of Bid. The bidders present shall be informed to sign on attendance sheet about their presence for the bid opening (downloading).</p>

	After evaluation of Technical Bid received electronically via E-tender portal of Maharashtra Metro Rail Corporation Limited , the Financial/ Commercial Package/ Envelope of bid of technically successful bidder shall be opened. The date & time of opening of Financial Bid shall be communicated to Technically Successful bidder electronically (E-mail).
ITB 25.3	<p>Replace provisions of ITB 25.3 with the following:</p> <p>For the avoidance of doubt, all references to the opening envelopes and reading out in the preceding shall mean opening and reading out the corresponding Technical Proposal as applicable. The reading out of the Technical Proposal shall include the presence or absence of a bid securing declaration; and any other details as the Employer may consider appropriate. The Letter of Bid and the Schedules are to be initialed by a minimum of two representatives of the Employer attending bid opening. The Employer shall neither discuss the merits of any bid nor reject any bid (except for late bids, in accordance with ITB 23.1) at this stage.</p>
ITB 25.4	<p>Replace provisions of ITB 25.4 with the following:</p> <p>The Employer shall prepare a record of the bid opening that shall include, as a minimum: the name of the Bidder and whether there is a withdrawal, substitution, or modification; and the presence or absence of a bid securing declaration. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders.</p>
ITB 25.5 (New Para)	On opening of the Bid, it will be checked if they contain Pre-Qualification Package, Technical & Financial Packages. The Employer shall prepare a record of opening of the, Pre-Qualification and Technical Package, which shall include, the name of Bidder and presence or absence of a Bid Securing Declaration. The Bidder is advised that the Employer's policy in respect of comparison of Bids is that the Technical Packages will be opened and reviewed to determine their acceptability & responsiveness to the Works Requirements and Bidding Drawings. Unacceptable and unresponsive bids will be rejected, and the corresponding Financial Package will not be opened.
ITB 25.6 (New Para)	After the evaluation of the Technical Proposals in accordance with ITB 27,28, 29 and ITB 30, the Employer shall prepare a list of responsive Bidders for opening of their Financial Proposals. A date, time and venue will be electronically notified to all Bidders for announcing the result of evaluation and opening of Financial Proposals. The opening of Financial Proposals shall be done in presence of respective representatives of responsive Bidders who choose to be present.
ITB 25.7 (New Para)	<p>The Financial Bid(s)/Package(s) which bidder(s) have uploaded online will be opened on a subsequent date; at least seven (7) days after the evaluation results of Technical Bids are published on e-Tender portal of Maha Metro. Financial packages of only those Bidders whose submissions are found substantially responsive and technically compliant will be opened. The time of opening of Financial Package shall be informed separately to only the Bidders who have qualified during Pre-Qualification and Technical evaluation stages and Bidders can be present to witness opening of Financial Package.</p> <p>No Bid shall be rejected at the opening of Price Bids.</p> <p>The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum: the name of the Bidder, the 'BID TOTAL LUMPSUM PRICE' and Pricing for unqualified withdrawal as per Pricing Document.."</p>
E. EVALUATION, AND COMPARISON OF BIDS	
ITB 26.2	Bids shall be deemed to be under consideration immediately after they are opened and until such time Maharashtra Metro Rail Corporation Limited makes official intimation of award/rejection to the Bidders. While the Bids are under consideration, Bidders and/or their representatives or other interested parties are advised to refrain, save and except as required under the Bidding Documents, from contacting by any means, Maharashtra Metro Rail Corporation Limited and/ or their employees/representatives on matters related to the Bids under consideration.
ITB 26.4 (New Para)	The Bid Documents, as listed in ITB 6.1 above, and any addenda thereto, together with any further communications, are issued for the purpose of enabling the Bidders to submit the Bids only. The Bidder shall not disclose any information contained in the documents

	or otherwise supplied in connection with this Bid invitation to any third party except for the purpose of preparing its Bid. The Bidder shall maintain complete confidentiality till the Contract is awarded except otherwise stated in the Bidding Documents and the Contract. A letter of undertaking is attached in Section IV: Bidding Forms (Form 13) and shall be completed by the Bidder and returned in the Technical Package. In the event that such confidentiality is breached, the Employer may reject the Bid. Copyright in all plans and any other documents issued to the Bidder is reserved.
ITB 26.5 (New Para)	The Bid drawings and documentation prepared by the Employer shall be used solely for the design of the Works. They shall not be used in part, whole or altered form for any other purpose without the express permission in writing of the Employer. Information relating to the examination, clarification, evaluation and comparison of bids and recommendations for the award of a contract shall not be disclosed to bidders or any other persons not officially concerned with such process until the award to the successful bidder has been announced.
ITB 29.1.1 (New Para)	<p>General Evaluation: Prior to the detailed evaluation of Bids, the Employer will determine whether each Bid:</p> <ul style="list-style-type: none"> • has been properly signed; and • has been accompanied by a valid Bid Securing Declaration; and • meets the Eligibility and Qualification Criteria - Bidders, which do not qualify in any of the minimum eligibility criteria, shall not be considered for further evaluation of Technical packages and shall be rejected • meets the other aspects of general evaluation as per BDS ITB 4.9 to 4.17 • includes the signed copy of Covenant of Integrity, Environmental and Social Covenant (as per Form 2.2A and 2.2B under Section IV. Bidding Forms) and includes the signed Declaration of Undertaking (as per Form 23) under Section IV. Bidding Forms. <p>A 'NO' answer to any of the above items will disqualify the Bid/ Bidder.</p>
ITB 29.2.1 (New Para)	<p>Evaluation of qualifying conditions: Bids that include qualifications which:</p> <ol style="list-style-type: none"> 1. Seek to shift to the Employer, another government agency or another contractor all or part of the risk and/or liability allocated to the Contractor in the Bidding Documents; or 2. Which includes a deviation from the Bidding Documents which would render the Works, or any part thereof, unfit for their intended purpose; or 3. fails to submit a workable methodology to suit the local conditions"; or 4. which fails to commit to the date specified for the completion of the Works as specified under Section IX. Particular Conditions (PC) Part- A - Contract Data 'Table: Summary of Sections' will be deemed non-conforming and shall be rejected.
ITB 29.3.1 (New Para)	<p>Evaluation of Technical Package</p> <p>The Employer will evaluate the technical proposal to determine the technical suitability and acceptability as per Works Requirements-General Specifications and Technical Specifications of only such Bidders who qualify based on BDS ITB 29.1.1 above.</p> <p>The Technical Proposal as submitted in accordance with BDS ITB 11.4.1 (including its relevant sub-paragraphs) shall be evaluated for its Conformity with the General and Technical Requirements as per Part 2, Sections VII-A and VII-B. Furthermore, the adequacy and appropriateness of the Bidder's responses to the related requirements in Part 1 shall be evaluated.</p>
ITB 29.4	<p>Bids which are:</p> <ul style="list-style-type: none"> • not fulfilling the General Evaluation Criteria as per ITB 29.1.1 above, • not substantially responsive as per ITB 29.2 above • having material deviation or reservation as per ITB 29.2 above • not fulfilling the qualifying conditions as per ITB 29.2.1 above, and • not fulfilling the Employer's Requirements - General Specification and Technical Specification as per ITB 29.3.1 above <p>will be deemed non-conforming and shall be rejected by the Employer and shall not be allowed subsequently to be made responsive by correction or withdrawal of the nonconforming deviation or reservation.</p>
ITB 29.5 (New Para)	If any Bid is rejected, pursuant to ITB 29.4 above, the Financial Package of such Bidder shall be returned unopened.

ITB 29.6 (New Para)	Bidders may note that pursuant to their qualification in the 'Prequalification and Evaluation Criteria' and 'Technical Evaluation' as per ITB 29.3 above, any acts of the Bidder (applies to each individual member in case of a Joint Venture/Consortium) which constitute sufficient grounds for exclusion as mentioned under ITB 41 will result in disqualification of the Bidder and the Financial Package of such Bidder shall be returned unopened.
Replace existing ITB 31 and its sub-Para as under:	
ITB 31	Evaluation of Financial Package
ITB 31.1	The financial proposals of only those that comply with the General Evaluation Criteria as per ITB 29.1.1 above and whose Technical Package is found compliant as per ITB 29 (and its sub-Para) above, will be opened and evaluated.
ITB 31.2	<p>Bids determined to be substantially responsive will be checked by the Employer for any arithmetic errors. Errors will be corrected by the Employer on the following basis</p> <p>A. if there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected;</p> <p>B. If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail, and the total shall be corrected; and</p> <p>C. If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetical error, in which case the amount in figures shall prevail subject to (A) and (B) above.</p> <p>If the Bidder does not accept the corrected Bid, its Bid will be rejected, and the Bid Securing Declaration executed.</p>
ITB 32.1	Bids will be compared in Indian Rupees only. This will be achieved by conversion of the Foreign Currency portion of the Bid into Indian Rupees by using the Exchange Rates published by Financial Benchmarks India Pvt. Ltd (www.fbil.org.in) 30 (Thirty) days before the date specified for Bid opening, and then adding the same to the Indian Rupee portion of the Bid. In case this particular day happens to be a holiday, the exchange rate published by Financial Benchmarks India Pvt. Ltd (www.fbil.org.in) on the next working day will be considered.
ITB 34.1	At this time the Employer does not intend to execute certain specific parts of the Works by sub-contractors selected in advance.
ITB 34.4 (New Para)	<p>Sub-Contract</p> <p>Sub-contracting, excluding design work shall be generally limited to 50% of the lump sum price. The terms and conditions of subcontracts and the payments that have to be made to the Subcontractors shall be the sole responsibility of the Contractor.</p> <p>For sub-contracts exceeding Rs.5 million, it will be obligatory for the Contractor to obtain a "Notice of No-Objection" from the Engineer, to the identity of the Sub-contractor and Vendor. The Contractor shall certify that the cumulative value of the subcontracts (including those upto Rs.5 million each) awarded is within the aforesaid 50% limit. In this regard the Bidder's attention is drawn to Clause 4 of PC. Any proposals by the Bidders in their offer shall not be construed as an approval of the vendor.</p> <p>The terms & conditions of the sub-contract are the sole prerogative of the Contractor and are deemed to be included in the price(s) quoted by the Bidder. However, the Subcontractor / Vendor shall fully comply with the technical specifications included in the Works Requirements.</p>
ITB 35.2	<p>Replace the existing ITB 35.2 with the following:</p> <p>In evaluating the Bids, the Employer will determine for each Bid the evaluated Bid price by adjusting the Bid price as follows:</p> <p>A. making any corrections for errors pursuant to ITB 31.2;</p> <p>B. making appropriate adjustments for conditions, qualifications, deviations, etc. pursuant to ITB 14.12.</p>

	<p>C. converting the amount resulting from applying (A) & (B) above to a single currency in accordance with ITB 32.1;</p> <p>D. adding to (C) above the present worth of the capitalized cost of loss in transformer computed in accordance with Appendix 4.4-E of Form 4.4 under Section IV. Bidding Forms</p> <p>Price variation clause will not be considered for financial evaluation. Bidders may also note that Appendix N: Section OPT (Optional Items -AMC) of Pricing Document i.e. Annual Maintenance for 3 years will also not be included in the financial evaluation of the Bids.</p>
ITB 35.5	<p>Replace the existing ITB 35.5 with below</p> <p>An Abnormally Low Bid shall be the bid where the Bid price, in combination with other elements of the Bid, appears so low that it raises material concerns as to the capability of the Bidder in regards to the Bidder's ability to perform the Contract for the offered Bid Price or the bid, which results in the lowest Evaluated Bid Price, is significantly lower than the Employer's estimate, or the bid is seriously unbalanced or front loaded in the opinion of the Employer.</p> <p>In the event of identification of a potentially Abnormally Low Bid, the Employer shall seek written clarifications from the Bidder, including detailed price analyses of its Bid price in relation to the subject matter of the contract, scope, proposed methodology, schedule, allocation of risks and responsibilities and any other requirements of the Bidding document.</p> <p>After evaluation of the price analyses, in the event that the Employer determines that the Bidder has failed to demonstrate its capability to perform the Contract for the offered Bid Price, the Employer shall reject the Bid."</p>
ITB 35.6 (New Para)	The Employer reserves the right to accept or reject any variation, deviation or alternative offer. Variations, deviations, alternative offers and other factors which are in excess of the requirements of the Bidding Documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in Bid evaluation.
ITB 35.7 (New Para)	All stages of Bid Evaluation and Contract award stages i.e. Pre-qualification, Technical Evaluation, Financial Evaluation, Letter of Acceptance and Contract Agreement shall be subject to 'No-Objection' from EIB.
F. AWARD OF CONTRACT	
ITB 39.1	<p>Replace the existing ITB 39.1 with the following:</p> <p>Subject to ITB 38.1 and BDS ITB 39.2, bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the Lowest Evaluated Bid Price (refer BDS ITB 35.2 for comparison on equal terms for determination of Lowest Evaluated Bid Price), and whose offer is balanced in terms of ITB 35.6, provided that such Bidder has been determined to be eligible and qualified in accordance with provisions of ITB 4 for deciding the successful eligible Contractor to whom the Contract will be awarded.</p>
ITB 39.2 (New Para)	Deleted
ITB 39.3 (New Para)	In case, Successful Bidder is a Consortium, then the Performance Security may be furnished on behalf of the Consortium either by the Lead Member or by all the Members of such Consortium in such proportion as may be agreed to between them.
ITB 40.1	Deleted
ITB 40.3	Deleted
ITB 40.4 (New Para)	The "Letter of acceptance" will be sent in duplicate to the successful Bidder, who will return one copy to the Employer duly acknowledged and signed by the authorized signatory, within one week of receipt of the same by him. The Letter of Acceptance will constitute a part of the Contract.
ITB 40.5 (New Para)	<p>In the event of award of the Contract, the following will be the sequence of events in the order given below:</p> <p>Letter of Acceptance;</p> <p>Notice to Proceed;</p> <p>Signing of Contract;</p>

ITB 42.1	<p>Replace the existing ITB 42.1 with the following:</p> <p>Promptly upon notification of the Letter of Acceptance, the Employer shall send the successful Bidder the Contract Agreement.</p> <p>The Employer shall inform all the Bidders regarding the intent of contract award decision including the summary of the reasons of the decision at the time when publishing the evaluation results of the Financial Bids through the Maha-Metro e-tender portal.</p>
ITB 42.2	<p>Replace the existing ITB 42.2 with the following:</p> <p>The Bidder should note that after the acceptance of bid (technical and financial), the successful Bidder will be eligible for issuance of Letter of Acceptance.</p> <p>In the event of successful Bidder's acceptance of the LOA, the Bidder will be required to execute the Contract Agreement in the form specified in Section X Contract Forms with such modifications as may be considered necessary at the time of finalization of the Contract within a period of 28 days from the date of issue of the Letter of Acceptance.</p>
ITB 43.1	The Performance Guarantee required in accordance with Clause 4.2 of the GC shall be for an amount as specified in Section IX. Particular Conditions, Part A - Contract Data in the form of a bank guarantee issued from an Indian Scheduled bank (excluding Cooperative Banks) or from a scheduled Foreign Bank as defined in Section 2(e) of RBI Act 1934 read with Second Schedule in the types and proportions of currencies in which the Contract Price is payable.
ITB 43.3 (New Para)	The Bidder has to furnish other Guarantees, Undertakings, & Warranties, in accordance with the provisions of the General Conditions of Contract and Particular Conditions of Contract (refer ITB 44).
ITB 43.4 (New Para)	Failure of the successful Bidder to comply with the requirements of ITB 42 and ITB 43 shall constitute sufficient grounds for the annulment of the award and execution of the Bid Securing Declaration.
ITB 44 (New Para)	Guarantees and Warranties
ITB 44.1 (New Para)	<p>The Bidder shall submit full details of the identity of the proposed parties who would respectively provide or issue:</p> <ul style="list-style-type: none"> the Performance Security in accordance with Sub-Clause 4.2 of the GC; parent company Undertakings in accordance with Clause 3 (Sub-clause 4.2A) of Part-B Specific Provisions of the PC; parent company Guarantees in accordance with Clause 3 (Sub-clause 4.2A of Part-B Specific Provisions) of the PC;
ITB 44.2 (New Para)	The Contractor shall submit other Warranties and Guarantees in accordance with Clause 3 (Sub-clause 4.2A) of Part-B Specific Provisions of PC. All the Guarantees and Warranties shall be submitted prior to the signing of the Contract.
ITB 44.3 (New Para)	If the Bidder comprises a Consortium, a parent company of each Member of such Consortium will be required to execute the Undertakings and Guarantees referred to in sub-paragraphs (b) and (c) of ITB 44.1 above.
ITB 44.4 (New Para)	Forms of the above documents are given in the Schedules to the Particular Conditions of Contract.
ITB 44.5 (New Para)	The Contractor should note that all Guarantees, Undertakings and Warranties except Advance Payment Guarantee, Retention Money Guarantee shall be executed prior to signing of the Contract.
ITB 45 (New Para)	Insurance
ITB 45.1 (New Para)	The Bidder's attention is drawn to the provisions contained in Clause 18 of the General Conditions of Contract and Clause 56 (Sub-Clause 16.2), 57 (Sub-Clause 17.1) & 58 (Sub-Clause 18.1) of Part-B Specific Provisions of Particular Conditions of Contract.
ITB 46 (New Para)	Settlement of Disputes of the Tender Process: Any suit or application, arising out of any dispute or differences on account of this Tender shall be filed in District and Sessions court at Pune, State Maharashtra/ High Court of Judicature at Bombay, State Maharashtra/ Supreme Court of India, New Delhi only and no other court or any other district of the country shall have any jurisdiction in the matter.

Maharashtra Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO. P1-T06/2021

PART I: BIDDING PROCEDURE

SECTION III: EVALUATION AND QUALIFICATION CRITERIA

Section III. Evaluation and Qualification Criteria

This Section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders, in accordance with ITB 35 and ITB 37. The Bidder shall provide all the information requested in the forms included in Section IV, Bidding Forms.

1. General

Wherever a Bidder (foreign) is required to state a monetary amount, Bidders should indicate the INR equivalent using the rate of exchange determined as follows:

- For turnover or financial data required for each year - Exchange rate prevailing on the last day of the respective calendar year.
- Value of single contract - Exchange rate prevailing on the date of the Contract. Exchange rates shall be taken from the publicly available source identified in the ITB 32.1. Any error in determining the exchange rates in the Bid may be corrected by the Employer.

2. Qualification

The Bid submission of Bidders, who do not qualify the minimum eligibility criteria & bid capacity criteria stipulated hereunder, shall not be considered for further evaluation and therefore rejected. The mere fact that the Bidder is qualified as mentioned in sub clause 1 to 4 below shall not imply that his bid shall automatically be accepted. The same should contain all technical data as required for consideration of Bid prescribed in the ITB.

Eligibility and Qualification Criteria				Compliance Requirements			Documentat ion
Sr. No.	Subject	Requirement	Single Entry	Joint Venture (existing or intended)			Submission Requiremen ts
				All Parties Combined	Each Member	Any one memb er	
1. Eligibility							
1.1	Nationality	Nationality in accordance with ITB 4.3	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI - 1.1 and 1.2, with attachments
1.2	Conflict of Interest	No conflicts of interest in accordance with ITB 4.2	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
1.3	EIB Ineligibility	Not having been declared ineligible by EIB, as described in ITB 4.4	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form 2.2A
1.4	Government Owned Entity of the Borrower country	Meets conditions of ITB 4.3	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Forms ELI - 1.1 and 1.2, with attachments
2. Historical Contract Non-Performance							
2.1	History of Non-Performing Contracts	Non-performance of a contract ¹ did not occur as a result of supplier	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Form CON-2

		default in the past 5 years.					
2.2	Suspension Based on Execution of Bid Securing Declaration by the Employer or withdrawal of the Bid within Bid validity	Not under suspension based on execution of a Bid Securing Declaration pursuant to ITB 4.4 or withdrawal of a Bid pursuant ITB 19.9.	Must meet requirement	Must meet requirement	Must meet requirement	N/A	Letter of Bid
2.3	Pending Litigation	Bidder's financial position & prospective long-term profitability sound according to criteria established in 3.1 below & assuming that all pending litigation will be resolved against the Bidder. Note: All pending litigation shall in total not be more than 100% of the Bidder's Net Worth.	Must meet requirement	N/A	Must meet requirement	N/A	Form CON-2

1 Non-performance, as decided by the Employer, shall include all contracts where (a) non-performance was not challenged by the contractor, including through referral to the dispute resolution mechanism under the respective contract, and (b) contracts that were so challenged but fully settled against the contractor. Non-performance shall not include contracts where Employer's decision was overruled by the dispute resolution mechanism. Non-performance must be based on all information on fully settled disputes or litigation, i.e. dispute or litigation that has been resolved in accordance with the dispute resolution mechanism under the respective contract and where all appeal instances available to the Bidder have been exhausted.

² This requirement also applies to contracts executed by the Bidder as JV/Consortium member.

3. Financial Situation and Performance							
3.1	Financial Capabilities	i. The Bidder shall demonstrate that it has access to, or has available, liquid assets, unencumbered real assets, lines of credit, and other financial means (independent of any contractual	Must meet requirement	Must meet requirement	Must meet requirement as per their % share in JV	N/A	Form FIN-3.1 with attachment and Form FIN-3.3

		<p>advance payment) sufficient to meet the cash flow requirements estimated as INR 129 million for the subject contract(s) net of the Bidders other commitments.</p> <p>ii. The Bidder shall demonstrate to the satisfaction of the Employer, that it has adequate sources of finance to meet the cash flow requirements on works currently in progress and for future contract commitments.</p> <p>iii. The audited balance sheets or, if not required by the laws of the Bidder's country, other financial statements acceptable to the Employer, for the last 5 years shall be submitted and must demonstrate the current soundness of the Bidder's financial position and indicate its prospective long-term profitability.</p>	Must meet requirement	Must meet requirement	N/A	N/A	Form FIN-3.1. with Form FIN-3.4
			Must meet requirement	N/A	Must Meet Requirement	N/A	Form FIN-3.1 with attachment.
3.2	Average Annual Construction Turnover	The average annual turnover from construction of last three financial years	Must meet requirement	Must meet requirement	Must meet minimum [twenty] per cent [20%] of the	Must meet at least [forty] per cent [40%] of the requirement	Form FIN - 3.2

		should be \geq INR 1550 Millions (In terms of rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2021 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year)			requirement	nt (For Lead Member)	
3.3	CDR	The bidder having undergone Corporate Debt Restructuring (CDR) in last five years must submit their banker's certificate stating that their account with the bank is "standard account" as on base date i.e. 28 days before submission of bid. In case the bidder has not undergone CDR then he must submit an undertaking to the effect.	Must Submit	N/A	Must Submit	N/A	
3.4	Net Worth	Net Worth of Bidder ending 31.03.2021 should be minimum INR 323 Million. In case of JV, Net Worth will be evaluated only for the Lead member.	Must meet requirement	NA	NA	Must meet requirement (for Lead Member only)	Form FIN - 3.1
3.5	Bid Capacity Criteria	Bid Capacity: The Bidders will be qualified only if their available bid capacity is more than INR 969 million. Available bid capacity will be calculated based on the following formula:	Must meet requirement	Must meet requirement	NA	NA	Form FIN - 3.4

		Available Bid Capacity= $2 \times A \times N - B$ Where, A = Maximum of the value of construction works executed in any one year during the last five financial years (updated to 31.03.2021, 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year). N = No. of years prescribed for completion of this work. B = Value of existing commitments (as on 31.03.2021) for on-going construction works during next 18 months.					
3.6	Profitability	The Bidder should be a Profit (Net) making firm and should have made profit during any two of the last 5 financial years i.e. (FY 2016-17, 2017-18, 2018-19, 2019-2020 and 2020-21)	Must meet requirement	N/A	Must meet requirement	N/A	Form FIN-3.5
4. Experience							
4.1	General Construction Experience	Experience under construction contracts in the role of prime contractor, JV/Consortium member, sub-contractor, or management contractor for at least the last 5 years, ending 31.03.2021	Must meet requirement	N/A	Must meet requirement	N/A	Form EXP-4.1
4.2 (a)	Specific Construction & Contract Management Experience	The Bidder will be qualified only if they have completed work(s) during last 10 years					Form EXP-4.2(a)

		<p>ending 31.05.2021 as given below:</p> <p>(a) One work of value INR 339 Million or more which should include installation of minimum 13 TKm Ballastless Track in one work of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80Kmph.</p> <p>OR</p> <p>(b) Two works each of value INR 232 Million or more which should include installation and of minimum 10 TKm Ballastless Track in each of the two works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>OR</p> <p>(c) Three works each of value INR 194 Million or more which should include installation of minimum 7 TKm of Ballastless Track in each of the three works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>The experience on Ballastless</p>	Must meet requirement	Must meet requirement	N/A	N/A	
			Must meet requirement	Must meet requirement	N/A	N/A	
			Must meet requirement	Must meet requirement	N/A	N/A	

		<p>Track on a system having design axle load less than 12Tons, speed less than 80 kmph or Tramways shall not be considered.</p> <p>Components of Ballastless Track works in sidings, spurs and other non-passenger's portions shall also not be considered.</p> <p>And</p> <p>(d) The bidder shall have executed min. 2 Track-km of ballastless track in underground metro/railway.</p>					
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5. Environmental, Social, Health and Safety (ESHS)

5.1	Quality & Qualification Criteria	<p>1. The Bidder must have valid Environmental Management Certificate ISO:140001 or equivalent.</p> <p>2. The Bidder must have valid Quality Management Certificate ISO:9001/DNV/TUV / JAS-ANZ/ equivalent.</p> <p>3. The Bidder must have valid Health and Safety Certificate OHSAS:18001. The bidder must agree to deploy at least two key personnel having Environment expertise of minimum ten years in sites management measure and the second one in social works with min.10 years experience.</p>	Must meet requirement	N/A	NA	Lead member must meet requirement	Form PER-2 (for CV of EHS Personnel)
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Notes:

- 1) Bidder shall furnish year wise and contract wise details of work for last five years i.e. up to 31.03.2021.
- 2) Management Contractor is a firm which takes on the role of contract management as a “general” contractor of sort could do. It does not normally perform directly the construction work(s) associated with the contract. Rather, it manages the work of other (sub) contractors, while bearing full responsibility and the risk for price, quality and timely performance of the work contract.
- 3) The bidder shall also furnish the details of contract work for Installation and commissioning of Ballastless Track. Details should include a performance certificate duly certified from Railways or Metro rail project mentioning name of contract including length of installation of ballast less Track and contract value and completion date.
- 4) For ongoing Works, quantity of successfully completed portion of works executed up to 31.03.2021 will also be considered for qualification of experience criteria.
- 5) The completed value of work done shall be updated up to 31.03.2021 price level applying 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year.
- 6) Full (100%) experience for previous works of the JV shall be considered, if the claiming member of the JV/Consortium has at least 65% participation in previous consortium/JV for the relevant referred Work Experience, else proportionate quantum of experience of previous works up to the percentage participation of participation in the previous JV/Consortium shall be considered. However, if any member has less than 20% participation in previous JV/consortium, his experience shall not be considered for evaluation.
- 7) General construction Experience for this contract shall mean the construction work including All Civil construction of Metro Station /Metro Depot / Oil Depot/ Railway Workshops/ Airport / Oil Refineries/Industrial Unit for Central Govt./State Government/ PSU/ Urban Local Bodies/Private Corporates registered with NSE/BSE in India or other industrial units/ plant of comparable magnitude and similar activities of work having piling, Pre-fabricated /Pre-Engineered / fabricated Steel structures and Sheds, Architectural finishes, EMP works including installations of Machinery and Plants & Equipment involving interface with all systems.
- 8) Bidder to submit the audited financial statements for last five financial year up to 31.03.2021, and if audited financial statement of FY 2020-21 is not available, provisional statement to be submitted, duly certified by statutory auditor. For Foreign bidders, last five financial year is up to 31.12.2020 when financial year is January to December of the year.

3. Evaluation

In addition to the criteria listed in ITB 35.2 (a) - (e) the following criteria shall apply:

3.1 Assessment of adequacy of Technical Proposal with Requirements

The assessment of the Technical Proposal submitted by a Bidder shall comprise (a) evaluation of the Bidder's technical capacity to mobilize key equipment and key personnel to carry out the works, (b) construction method, (c) construction schedule (d) sufficiently detailed supply sources, in accordance with requirements specified in Section VII - Works Specifications and following items of Technical Proposal:

- 3.1.1 Evaluation of Tender Programme
- 3.1.2 Evaluation of Bidder Technical Proposals
- 3.1.3 Evaluation of Outline Quality Plan
- 3.1.4 Evaluation of Outline Safety Plan
- 3.1.5 Evaluation of Outline Environmental Plan
- 3.1.6 Evaluation of Outline Project Management Plan
- 3.1.7 Evaluation of Manufacture, Testing and Commissioning Plan

The Employer will evaluate the technical suitability and acceptability of the proposals. The financial proposals of only those Bids, which are technically compliant and substantially responsive, in accordance with paragraph ITB 29, will be evaluated.

- 3.2 Multiple Contracts - Not Applicable
- 3.3 Alternative Completion Times - Not Applicable
- 3.4 Technical alternatives - Not Applicable
- 3.5 Specialized Subcontractors

Only the specific experience of sub-contractors for specialized works permitted by the Employer will be considered. The general experience and financial resources of the specialized sub-contractors shall not be added to those of the Bidder for purposes of qualification of the Bidder.

3.6 Personnel

The Bidder must demonstrate that it has the personnel for the key positions that meet the following requirements for deployment: The numbers shown are only indicative and to be deployed more as per site requirement including other supervisors. In case of delay beyond one month as per the deployment schedule penalty will be imposed as below. However, imposition of penalty will not relieve bidder from the responsibility of deployment of requisite no. of personnel.

N o	Position	Qualification	Total work experienc e (years)	In Similar Works Experience (years)	Min. number require d	Penalty for non- deployment / delayed deployment as per the deployment schedule in INR.
1	Project Manager	Graduate/Diplom a in Civil Engg. With good knowledge of Railway Track Engineering & Track construction.	10 years (with Degree) 12 years (with Diploma)	5 years should be in projects of similar nature i.e. installation of ballasted/Ballastles s (Elevated and underground sections) and Turnout.	1	1 lakh / month
2	Deputy Project	Graduate/Diploma in Civil Engg. with good knowledge of	6 years (with Degree)	3 years should be installation of ballasted /	2	0.75 lakh / month each

	Manager - Ballastless Track	Railway Track Engineering & Ballastless Track construction	8 years (with Diploma)	Ballastless (Elevated and underground sections) Track		
3	Manager - Ballastless Turnout	Graduate/Diploma in Civil Engg. with good knowledge of Railway Track Engineering & Ballastless Track construction	3 years (with Degree) 5 years (with Diploma)	2 years should be in installation of Ballastless Turnout.	1	0.65 lakh / month
4	Rail Welding Expert	Graduate /Diploma in Civil/ Mechanical Engg.	6 years	4 years should be in Flash Butt Welding and Alumino-Thermic Welding	1	0.65 lakh / month
5	Chief Quality Assurance Manager - Quality	Graduate/Diploma in Civil Engg. and Diploma in Quality Assurance	6 years (with Degree) 8 years (with Diploma)	4 years should be in quality control in Infra Projects	1	0.75 lakh / month
6	Survey in-charge	Graduate/Diploma in Civil Engg.	5 years (with Degree) 8 years (with Diploma)	3 years should be in installation of Ballastless Track and surveyor should well convergent with using of total station and Track machine.	1	0.5 lakh / month
7	Chief SHE Manager	Graduate/Diploma Engg.	5 years (with Degree) 8 years (with Diploma)	3 years' experience in infrastructure projects including experience of Environmental works and social works.	1	0.75 lakh / month
8	Manager - Planning and Procurement	Graduate/Diploma in Civil Engg. with good knowledge of Railway Track Engineering & its planning	3 years (with Degree) 5 years (with Diploma)	2 years experience in the field of project planning.	1	0.65 lakh / month
9	Design co-ordination and Interface Engineer	Graduate/Diploma in Civil Engg. with design experience	3 years (with Degree) 5 years (with Diploma)	2 years' experience of design co-ordination or ballastless track installation	1	0.5 lakh / month

The Bidder shall provide details of the proposed personnel and their experience records using Forms PER-1 and PER-2 included in Section IV, Bidding Forms.

3.7 Equipment: - The Bidder must demonstrate that it has the key equipment listed hereafter: [Specify requirements for each lot as applicable]

No.	Equipment Type and Characteristics	Minimum Number required
1	The Bidder should either own a mobile flash butt Welding plant (RDSO approved) for deploying the same for this contract or should furnish a concrete proposal to hire /subcontract the same along with the names /details of source /agencies for the same.	One Mobile Flash Butt Welding Plant (RDSO approved)
2	The Bidder should furnish a concrete proposal to engage RDSO approved agency for carrying out A.T Welding of 880 grade/1080 grade rails as per AT Welding manual.	One set of AT Welding equipment.
3	Cranes, hydra, DG and anchor bolt tightening machine (trolley type or hand held)	Crane should have adequate capacity depending on the height of viaduct and weight of the materials to be lifted. Crane should not be more than 15 years old and must have all third-party certificates, insurances etc. Safety Engineer's approval is required If Contractor desires to deploy more than 15 years old crane. Second generation Hydra shall be deployed. All DGs shall be silent type. Anchor bolt tightening machine, two nos. trolley type or 6 nos. hand held type in working condition and more numbers if required to match the timeline.
4	Track linking equipment sets and Survey instrument sets.	Total Station, Auto Level etc.: Required numbers to match timelines

The Bidder shall provide further details of proposed items of equipment using Form EQU in Section IV, Bidding Forms.

Maha Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART I: BIDDING PROCEDURE

SECTION IV: BIDDING FORMS

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19.	Form of certificate confirming careful examination of all the contents of Bidding Documents and signing of all pages of Bidder's proposal
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23.	Declaration of Undertaking
24.	Quality Management / Environmental, Social, Health and Safety (ESHS) Certification.....

Letter of Bid

[The Bidder shall prepare his Letter of Bid on a Letterhead paper specifying his name and address]

Date: _____

ICB No.: _____

Invitation for Bid No.: _____

Alternative No.: _____

To: _____

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB8)
- (b) We have no conflict of interest in accordance with ITB 4;
- (c) We have not been suspended nor declared ineligible by the Employer based on execution of a Bid Securing Declaration in the Employer's country in accordance with ITB 4.4.
- (d) We offer to supply in conformity with the Bidding Documents and in accordance with the Delivery Schedule specified in the Schedule of Requirements the following Goods:
- (e) The total price of our Bid, excluding any discounts offered in item (f) below is:
In case of only one lot, total price of the Bid
In case of multiple lots, total price of each lot
In case of multiple lots, total price of all lots (sum of all lots)
- (f) The discounts offered and the methodology for their application are: NOT APPLICABLE
 - i. The discounts offered are:
 - ii. The exact method of calculations to determine the net price after application of discounts is shown below:
- (g) Our bid shall be valid for a period of **180days** from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period;
- (h) If our bid is accepted, we commit to obtain a performance security in accordance with ITB 42 of the Bidding Documents;
- (i) We are not participating, as a Bidder or a subcontractor, in more than one bid in this bidding process in accordance with ITB 4.2(e), other than alternative bids submitted in accordance with ITB13;
- (j) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract:

Name of Recipient	Address	Reason	Amount
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[If none has been paid or is to be paid, indicate "none."]

- (k) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed; and
- (l) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (m) We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in any type of fraud and corruption.

Name of the Bidder* _____

Name of the person duly authorized to sign the Bid on behalf of the Bidder** _____

Title of the person signing the Bid _____

Signature of the person named above _____

Date signed _____ day of _____

*: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder

**: Person signing the Bid shall have the power of attorney given by the Bidder to be attached with the bid

Note: Para (e) to (h) of letter of bid are not to be included in Technical Proposal

1A. Pro-Forma Letter of Participation from Each Partner of Joint Venture (JV) /Consortium

(On each Firm's Letter Head)

No....

Dated

From:

To,

THE MANAGING DIRECTOR,
MAHARASHTRA METRO RAIL CORPORATION LTD.,
Pune Metro Rail Project
101, The Orion, Opposite Don Bosco Youth Centre,
Koregaon Park, Pune - 411001

Sir,

Regarding:

Tender No. P1 - T06: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Ref: Your notice for Invitation for Bid (IFB)

We wish to confirm that our company/firm (delete as appropriate) has formed a Joint Venture with and for the purposes associated with IFB referred to above.

(Member(s) who are not the lead partner of the JV/Consortium should add the following paragraph)
*

‘This JV/Consortium is led by whom we hereby authorize to act on our behalf for the purpose of submission of Bid for and authorize to incur liabilities and receive instructions for an on behalf of any and all the partners or constituents of the Joint Venture.’

O R

*(Member being the lead member of the group should add the following paragraph) **

‘In this group we act as leader and, for the purposes of applying for qualification, represent the Joint Venture.’

In the event of our group being awarded the contract, we agree to be jointly with (Names of other members of our JV/Consortium)and severally liable to the MAHA METRO RAIL PROJECT, its successors and assigns for all obligations, duties and responsibilities arising from or imposed by the contract subsequently entered into between MAHA METRO RAIL PROJECT and our JV/Consortium.

*I/We further agree that entire execution of the contract shall be carried out exclusively through the lead partner.

Yours faithfully,

(Signature)

(Name of Signatory)

(Capacity of Signatory)

Seal

* Delete as applicable

Note: This form is applicable for Technical Package only.

2. Appendix to Bid

2.1 Schedule of Adjustment Data

(Refer to BOQ / Pricing Document)

2.2A COVENANT OF INTEGRITY

(The Bidder shall prepare his Letter of Bid on a Letterhead paper specifying his name and address)

We declare and covenant that neither we nor anyone, including any of our directors, employees, agents, joint venture partners or sub-contractors, where these exist, acting on our behalf with due authority or with our knowledge or consent, or facilitated by us, has engaged, or will engage, in any Prohibited Conduct (as defined below) in connection with the tendering process or in the execution or supply of any works, goods or services for [specify the contractor tender invitation] (the “Contract”) and covenant to so inform you if any instance of any such Prohibited Conduct shall come to the attention of any person in our organisation having responsibility for ensuring compliance with this Covenant. We shall, for the duration of the tender process and, if we are successful in our tender, for the duration of the Contract, appoint and maintain in office an officer, who shall be a person reasonably satisfactory to you and to whom you shall have full and immediate access, having the duty, and the necessary powers, to ensure compliance with this Covenant. We declare and covenant that neither we nor anyone, including any of our directors, employees, agents, joint venture partners or sub-contractors, where these exist, acting on our behalf with due authority or with our knowledge or consent, or facilitated by us, (i) is listed or otherwise subject to EU/UN Sanctions and (ii) in connection with the execution or supply of any works, goods or services for the Contract, will act in contravention of EU/UN Sanctions. We covenant to so inform you if any instance shall come to the attention of any person in our organisation having responsibility for ensuring compliance with this Covenant.

If (i) we have been, or any such director, employee, agent or joint venture partner, where this exists, acting as aforesaid has been, convicted in any court or sanctioned by any authority of any offence involving a Prohibited Conduct in connection with any tendering process or provision of works, goods or services during the five years immediately preceding the date of this Covenant, or (ii) any such director, employee, agent or a representative of a joint venture partner, where this exists, has been dismissed or has resigned from any employment on the grounds of being implicated in any Prohibited Conduct, or (iii) we have been, or any of our directors, employees, agents or joint venture partners, where these exist, acting as aforesaid has been excluded or otherwise sanctioned by the EU Institutions or any major Multi-lateral Development Bank (including World Bank Group, African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank or Inter-American Development Bank) from participation in a tendering procedure on the grounds of Prohibited Conduct, we give details of that conviction, dismissal or resignation, or exclusion below, together with details of the measures that we have taken, or shall take, to ensure that neither this company nor any of our directors, employees or agents commits any Prohibited Conduct in connection with the Contract [give details if necessary]. We acknowledge that if we are subject to an exclusion decision by the European Investment Bank (EIB), we will not be eligible to be awarded a contract to be financed by the EIB. We grant [indicate the name of the Project Promoter], the European Investment Bank and auditors appointed by either of them, as well as any authority or European Union institution or body having competence under European Union law, the right to inspect and copy our books and records and those of all our sub-contractors under the Contract. We accept to preserve these books and records generally in accordance with applicable law but in any case for at least six years from the date of tender submission and in the event we are awarded the Contract, at least six years from the date of substantial performance of the Contract.”

Name _____ In the capacity of _____

Signed _____

Duly authorised to sign the contract for and on behalf of _____

Date _____

Note: The Covenant of Integrity form shall be duly signed by the authorised signatory of the bidder, failing which the bid shall be liable for rejection.

2.2B ENVIRONMENTAL AND SOCIAL COVENANT

(The Bidder shall prepare his Letter of Bid on a Letterhead paper specifying his name and address)

We, the undersigned, commit to comply with - and ensuring that all of our sub-contractors comply with - all labour laws and regulations applicable in the country of implementation of the contract, as well as all national legislation and regulations and any obligation in the relevant international conventions and multilateral agreements on environment applicable in the country of implementation of the contract.

Labour standards. We further commit to the principles of the eight Core ILO standards¹⁹ pertaining to: child labour, forced labour, non-discrimination and freedom of association and the right to collective bargaining. We will (i) pay rates of wages and benefits and observe conditions of work (including hours of work and days of rest) which are not lower than those established for the trade or industry where the work is carried out; and (ii) keep complete and accurate records of employment of workers at the site.

Workers relations. We therefore commit to developing and implementing a Human Resources Policy and Procedures applicable to all workers employed for the project in line with Standard 8 of the EIB's Environmental and Social Handbook. We will regularly monitor and report on its application to *[insert name of the Contracting Authority]* as well as on any corrective measures periodically deemed necessary.

Occupational and Public Health, Safety and Security. We commit to (i) complying with all applicable health and safety at work laws in the country of implementation of the contract; (ii) developing and implementing the necessary health and safety management plans and systems, in accordance with the measures defined in the Project's Environmental and Social Management Plan (ESMP) and the ILO Guidelines on occupational safety and management systems²⁰; (iii) providing workers employed for the project access to adequate, safe and hygienic facilities as well as living quarters in line with the provisions of Standard 9 of the EIB's Environmental and Social Handbook for workers living on-site; and (iv) using security management arrangements that are consistent with international human rights standards and principles, if such arrangements are required for the project.

Protection of the Environment. We commit to taking all reasonable steps to protect the environment on and off the site and to limit the nuisance to people and property resulting from pollution, noise, traffic and other outcomes of the operations. To this end, emissions, surface discharges and effluent from our activities will comply with the limits, specifications or stipulations as defined in *[insert name of the relevant document]*²¹ and the international and national legislation and regulations applicable in the country of implementation of the contract.

Environmental and social performance. We commit to (i) submitting *[insert periodicity as indicated in the tender documents]* environmental and social monitoring reports to *[insert name of the Contracting Authority]*; and (ii) complying with the measures assigned to us as set forth in the environmental permits *[insert name of the relevant document if applicable]*²² and any corrective or preventative actions set forth in the annual environmental and social monitoring report. To this end, we will develop and implement an Environmental and Social Management

System commensurate to the size and complexity of the Contract and provide *[insert name of the Contracting Authority]* with the details of the (i) plans and procedures, (ii) roles and responsibilities and (iii) relevant monitoring and review reports.

We hereby declare that our tender price as offered for this contract includes all costs related to our environmental and social performance obligations as part of this contract. We commit to (i) reassessing, in consultation with *[insert name of the Contracting Authority]*, any changes to the project design that may potentially cause negative environmental or social impacts; (ii) providing *[insert name of the Contracting Authority]* with a written notice and in a timely manner of any unanticipated environmental or social risks or impacts that arise during the execution of the contract and the implementation of the project previously not taken into account; and (iii) in consultation with *[insert name of the Contracting Authority]*, adjusting environmental and social monitoring and mitigation measures as necessary to assure compliance with our environmental and social obligations.

Environmental and social staff. We shall facilitate the contracting authority's ongoing monitoring and supervision of our compliance with the environmental and social obligations described above. For this purpose, we shall appoint and maintain in office until the completion of the contract an Environmental and Social Management Team (scaled to the size and complexity of the Contract) that shall be reasonably satisfactory to the Contracting Authority and to whom the Contracting Authority shall have full and immediate access, having the duty and the necessary powers to ensure compliance with this Environmental and Social Covenant.

We accord the Contracting Authority and the EIB and auditors appointed by either of them, the right of inspection of all our accounts, records, electronic data and documents related to the environmental and social aspects of the current contract, as well as all those of our subcontractors.

Name _____ In the capacity of _____

Signed _____

Duly authorised to sign the contract for and on behalf of _____

Date _____

Note: The Environmental and Social Covenant form shall be duly signed by the authorised signatory of the bidder, failing which the bid shall be liable for rejection.

2.3 Copyright Undertaking
(To be submitted on Bidder's Letter head)

Date

To:

THE MANAGING DIRECTOR,
MAHARASHTRA METRO RAIL CORPORATION LIMITED,
101, The Orion, Opposite Don Bosco Youth Centre,
Koregaon Park, Pune - 411001

LETTER OF UNDERTAKING

Tender No. P1 - T06/2021: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

We, (name of Bidder / joint venture) hereby undertake that the tender drawings, both in hard copy /digitised format, and the Bid documents purchased as a necessary part of our preparation of this Bid shall be used solely for the preparation of the Bid and that if the Bid is successful, shall be used solely for the design of the temporary and permanent works.

We further undertake that the aforesaid tender drawings and documents prepared by **Maharashtra Metro Rail Corporation Limited** shall not be used in whole, in part or in any altered form on any other project, scheme, design or proposal that the joint venture, the joint venture parent companies or sub-contractors of the joint venture are or will be involved with either in India or any other country.

Signed.....

For and on behalf of
(Name of tender / joint venture)

3. Schedules

Refer to BOQ / Pricing Document

4. Technical Proposal

- 4.1 Site Organization
- 4.2 Method Statement
- 4.3 Works Programme
- 4.4 Bidder's Technical Submissions
- 4.5 Equipment - Form EQU
- 4.6 Personnel - Forms PER-1 and PER-2
- 4.7 Outline Quality Plan
- 4.8 Outline Safety Plan
- 4.9 Outline Environmental Plan
- 4.10 Outline Project Management Plan
- 4.11 Manufacture, Testing and Commissioning Plan
- 4.12 Statement of Deviations

4.1 Staffing Schedule and Organization Chart

The Bidder shall provide with the Bid a complete Schedule and Organization chart as required by BDSITB 11.4.1.13.

- (1) The name, background and professional experience of each key staff member to be assigned to this project, with particular reference to his experience of a nature similar to that of the proposed assignment.
- (2) An organization chart with assignment of each key staff member (identified by name), duration & timing together with clear description of the responsibilities of each key staff member within the overall work programme.
- (3) The Bidder to propose his design organization in detail and outline his manufacturing/testing organization. Also, the Bidders shall provide the necessary details on their staff for the project design phase. For the later phases, staff needs to be proposed for key positions.
- (4) The Bidder must demonstrate that it has the personnel for the key positions that meet the requirements as mentioned in section III Evaluation and Criteria.
- (5) The Bidder shall provide details of the proposed personnel and their experience records using Forms PER-1 and PER-2 included in Section IV, Bidding Forms.
 - a. Project Manager- Graduate having minimum 15 years of total experience out of which 10 years should be in projects of similar nature.
 - b. Deputy Project Manager (DPM) - Graduate having minimum 10 years of total experience out of which 5 years should be in projects of similar nature.
 - c. SHE Organization- As per the qualification and experience given in SHE manual (shall include an Accident Prevention Officer).
 - d. All other key staff shall be graduate with minimum 5 years' experience in relevant discipline.
- (6) Please note that in case Employer judges that the continuation of any person of the Bidder including its subcontractor(s) is not in the interest of the project, a written notice will be given to Bidder who will promptly remove the person within a week.
- (7) The Bidder shall submit the Site Organization Chart with narrative description and the relationship between Head Office and the Site Management clearly indicating the clear distribution of authority and responsibility between Head Office and Site Management.

We hereby confirm that this is minimum project specific mobilization, and these will be suitably augmented, as required for achieving the Works requirements and key dates. We also confirm to deploy manpower required for safety as per SHE Manual attached with the Bidding Documents.

SIGNATURE OF AUTHORIZED SIGNATORY
ON BEHALF OF BIDDER

4.2 Method Statement

Each Bidder shall set out details of the Method Statement for the Works to demonstrate how it will meet the Employer's objective and requirements. As a minimum, the Method Statement shall address the following:

- (a) Details of the arrangements and methods which the Bidder proposes to implement for the construction of the Works, in sufficient detail to demonstrate their adequacy to achieve the requirements of the Contract including completion within the Time for Completion stated in the Particular Conditions of Contract.
- (b) Outline of the arrangements of the Bidder to manage coordination of Site access.
- (c) Comments on the geotechnical and subsurface aspects of the Works including materials, material sources and any constraints
- (d) Not Used
- (e) Comments on logistics and traffic management *[as may be appropriate]*.
- (f) Outline of the arrangements and organisation of the Bidder to ensure compliance with the Works Requirements.
- (g) Outline of the arrangements of the Bidder to carry out testing upon completion as specified in the Works Requirements.
- (h) [Insert other information, as may be appropriate.]

4.3 Requirements of Works Programme

- (a) The Works Programme shall show how the Bidder proposes to organize and carry out the Works and to achieve Stages and complete the whole of the Works by the given Key Dates.
- (b) The Works Programme or Programmes shall be developed as a critical path network using suitable software. The network must be fully resourced and show the co-ordination with System Wide Contracts. **The Works Programme shall show achievement of all Key Dates and Works Area Access Dates.**
- (c) The Works Programme shall include the Bidder's Design Submission Programme and should indicate, wherever possible, dates and periods relating to interfaces with and between others including dates for submission of further documents required by the Contract and periods for their acceptance.
- (d) The Works Programme shall contain sufficient detail to assure the Employer of the feasibility of the plan and approach proposed by the Bidder.
- (e) The Bidder should have regard to the possibility that during the Bid evaluation period the Works Programme may be developed into a Programme which, in the event of award, would be the initial submission of the Works Programme. To facilitate this process, the Bidder shall, in the preparation of the Works Programme, take due account of the provisions of Works Requirements - General Specifications in so far as they concern the Works Programme.
- (f) The Works Programme shall be accompanied by a narrative statement that shall describe Programme activities, assumptions and logic, and highlight the Bidder's perception of the major constraints and critical areas of concern in the organization, construction and completion of the Works. This narrative statement shall also indicate which elements of the Works the Bidder intends to carry out off-Site and/or outside India with details of the proposed locations of where any such work is to be carried out, the facilities available.
- (g) The Bidder shall prepare logic diagrams providing the philosophy for shared access, shared areas with co-incident and adjacent work areas and submitted as part of his Bid. These logic diagrams shall be developed and submitted along with the Works Programmes as submitted during the course of the Works.
- (h) All programmes shall include design, procurement periods, major material, offsite production/ prefabrication, temporary construction, interface and periods for systemwide, utility and adjacent contractors etc.
- (i) The programme should show the makeup programme / cover up programme for slippage in availability of few of the access area dates to achieve the completion of different stretches as per schedule.

4.4 Bidder's Technical Submissions

A. Requirements for Bidder's Technical Submissions

- A1. The Bidder's attention is drawn to the List of Definitions and List of Abbreviations in the Works Requirements and to Clause 1 of the General Conditions in which terms are defined.
- A2. The Bidder's Technical Proposals shall comply or, subject to reasonable development, be capable of complying with the Works Requirements in all respects. The Bidder's Technical proposal shall demonstrate such compliance.

The Bidder's Technical Proposals shall establish the safety standards to be followed and installation and testing methods that will be employed.

The following paragraphs list the minimum documentation that shall be supplied by the Bidder as part of his technical package for technical evaluation of the Bid. The Bidder shall include any further information necessary to demonstrate the suitability of his proposal.

B. General Requirements

- B1. The Bidder shall submit a detailed clause by clause commentary on all the clauses of the Works Requirements when a clause merely provides information and no other comment is necessary "noted" will suffice. Where the Bidder is not able to comply fully with certain clauses and proposes an alternative, the deviations shall be consolidated and listed separately in the Statement of Deviations. Excepting the items listed in the statement of deviations, the Bidder shall give a Certificate of Compliance in the form Appendix A for all the items.
- B2. The Bidder shall also advise the conflicts, if any, in the Bid documents between various functional requirements or specifications.
- B3. The Bidder shall detail any potential problems or hazards that have been identified during the Bidder's assessment of the Works Requirement.
- B4. The Bidder shall submit:
 - a. Technical Information of Contractor's Equipment proposed by the Bidder such as equipment for mechanised handling of Rails, support systems for setting of Ballastless Track & Turnout for installation, various survey equipment, equipment for transport & delivery of concrete to the site of work etc.
 - b. Information for justifying the Proneness of the equipment proposed by the Bidder.
 - c. For the deployment of mobile flash butt plant, the Bidder shall submit a concrete and complete proposal as to whether he owns the plant or proposes to hire/subcontract the same along with details such as source of plant, its technical details and capabilities of Welding UIC 60,880 grade, 1080 HH grade Rails and also the detailed CV of the operator of the machine to demonstrate technical suitability & availability of the operator for Welding work.
 - d. Information for In-house or the sub-contract of manufacture or vending proposed by the Bidder in the format given in Appendix B.
 - e. The Bidder shall specifically submit the details / CV of all the Supervisors available with the Bidder for installation of ballasted Track separately for this contract, indicating their experience and the name of projects on which these supervisors have gained the experience / expertise;

C. Technical Requirements

- C1. The Bidder's Technical Proposals shall also cover the following:
 - (a) Normally Track structures (Cast-in-situ) are to be followed as given in tender drawing for viaduct. However, bidder may also propose other proven ballast less Track structure and submit detailed design for consideration of **Maharashtra Metro Rail Corporation Limited**. However proposed ballast less Track structure should not infringe the SOD. The proven improvement/innovation in design of plinth with the objective of improved performance, reduction in execution time shall be encouraged and no price advantage will be given on this account irrespective of life cycle claimed.

For this purpose, contractor will submit detailed design along with drawing and performance report of proposed system. The performance report shall only be considered for those systems which are substantially on elevated corridor & not less than 14T axle load which are in operation for public carriage of passenger for not less than year. The performance is in

- addition to suitability of design and not in lieu of design. The design has to conform to the prevalent International standards.
- (b) Detailed drawing and specification of proposed Ballastless Track structure on viaduct and Underground. Any Ballastless Track slab / plinth system proposed should have proven record on the viaduct and Underground. Details of same to be submitted.
 - (c) If any change to the Track structure proposed vide para (a) & (b) above to be used with MSS, then Details of Ballastless Track structure to be furnished. However, it is to be ensured that there should not be any infringement of SOD.
 - (d) Method adopted for topographic setting of final alignment on finished surface of depot layout for final setting of Track;
 - (e) Methodology for handling/re-handling, transportation of the P. Way materials imported by the Employer from Mumbai Port/ to the site, stacking/storage of such material, security of material against theft, loss and damage;
 - (f) Methodology for proper handling of Rails and Welded panels to site of work;
 - (g) Methodology of installation procedure including any other alternative construction method / scheme as proposed by Bidder for Ballastless Track with construction speed and finished tolerances of Track;
 - (h) Detailed design of RMC suitable for long distance pumping / transportation
 - (k) Methodology for installation of Ballastless turn outs & crossovers;
 - (l) Other technical information in support of the technical proposal.

C2. Deleted

D. Technical Documents

D1. The Bidder's Technical Proposals shall also include the following documents:

a. Deviation Statement

The deviation statement shall draw attention to any part or parts of the Works Requirements - Particular Specification which the Contractor intends to amend or omit and shall contain further material as required.

In producing the deviation statement, the Bidder shall ensure that clauses, paragraphs and any appendices therein are identified by their numbering as uniquely belonging to the deviation statement.

The Bidder should note that the Specifications submitted with the Bid as part of the Bidder's Technical Proposals will, prior to acceptance of Bid, be merged and consolidated into a single document for incorporation into the Contract.

The Bidder should note that the deviation statement forms a crucial part of the Bidder's Technical Proposals and shall be prepared in sufficient detail to demonstrate full compliance with the Works Requirements. The quality of the deviation statement will be paramount in evaluating technical compliance of Bids.

b. Codes and Standards

The Bidder shall provide justification for any codes or standards, it proposes in its list as alternatives or additions to those specified in the Works Requirements.

The Bidder will be required, during the Bid process, to provide a certified English translation of any codes or standards it proposes to use, and which are not normally available in English.

**Appendix A to Bidder's Technical Submissions
Certificate of Compliance and Schedule of Deviations**

**(TO BE SUBMITTED ON BIDDER'S LETTERHEAD)
CERTIFICATE OF COMPLIANCE**

This Certificate is issued in the full knowledge that the Technical Proposals submitted are in clause by clause compliance with the Works Requirements, except as noted in Statement of Deviations accompanying this Certificate.

Signed

Authorized Representative

**Appendix B to Bidder's Technical Submission
PROPOSALS FOR SUB-CONTRACTED WORKS**

Tender No. P1 T06/2021: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

INFORMATION TO BE FURNISHED BY CONTRACTOR FOR IN HOUSE MANUFACTURE, SUB- CONTRACTORS OR VENDORS

S. No.	Equipment	In-House Manufacture		Proposed Sub-contracted Works		Names of Proposed Vendors / Sub-contractors		
		%	Description	%	Description	A	B	C etc.
1	Welding of Rails (a) Flash butt Welding (b) Alumino Thermic Welding							
2	Ballastless Track construction							
3	Laying of Turnout							
4	Noise & Vibration mitigation system installation							
5	Noise & Vibration mitigation system supplier(s)							

*

4.5 Form EQU: Equipment

The Bidder shall provide adequate information to demonstrate clearly that it has the capability to meet the requirements for the key equipment listed in Section III, Evaluation and Qualification Criteria. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of equipment							
Equipment Information	Name of manufactures		Model and power rating				
	Capacity		Year of manufacture				
Current status	Current location						
	Details of current commitments						
Source	Indicate source of the equipment						
	<input type="checkbox"/>	Owned	<input type="checkbox"/>	Retired	<input type="checkbox"/>	Leased	<input type="checkbox"/>

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner	
	Address of owner	
	Telephone	Contract name and title
	Fax	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project.	

4.6 Personnel
Form PER-1: Proposed Personnel

Bidders should provide the names of suitably qualified personnel to meet the specified requirements stated in Section III. The data on their experience should be supplied using the Form below for each candidate.

1	Title of position *
	Name
2	Title of position *
	Name
3	Title of position *
	Name
4	Title of position *
	Name

* As listed in Section-III

Form PER-2: Resume of Proposed Personnel

Name of Bidder		
Position		
Personnel information	Name	Date of Birth
	Professional qualification	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	E-mail
	Job Title	Years with present employer

Summarize professional experience over the last 20 years, in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company / Project / Position / Relevant technical and management experience

4.7 Outline Quality Plan

The Bidder shall submit as part of his Bid an Outline Quality Plan illustrating the intended means of compliance with the Work's Requirements and setting out in summary form an adequate basis for the development of the more detailed Quality Plans required. The Outline Quality Plan shall contain sufficient information to demonstrate clearly the proposed method of achieving the Bidder's quality objectives with regard to the requirement of the Contract. The Bidder may be requested to amplify, explain or develop his Outline Quality Plan prior to the date of acceptance of the Bid due and to provide more details with a view to reaching provisional acceptance of such a Plan.

4.8 Outline Safety Assurance Plan

The Bidder shall submit as part of its Bid an Outline System Safety Assurance Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient safety procedures in the design, manufacture, transport, integrated testing and commissioning of Works. The Outline System Safety Assurance Plan should include an outline of the safety procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring safety including Hazard Analysis, Fire Control, Electromagnetic compatibility / Electro-magnetic Interference Control, reliability, availability and maintainability as given in this Bid.

The Bidder shall also include in the Outline Safety Plan sufficient information to demonstrate clearly the Bidder's proposal for the safety of the Works / Plant / Equipment and personnel at the site. On the basis of this information, the Contractor shall develop a Detailed Site Safety Plan as given in this Bid.

The Outline System Safety Assurance Plan shall be headed with a formal statement of policy in relation to safety and shall be sufficiently informative to define the Bidder's safety plans and set out in summary an adequate basis for the development of the Safety Plan to be submitted in accordance with the conditions of this Bid.

The Bidder may be requested to amplify, explain or develop its Outline System Safety Assurance Plan prior to the date of acceptance of the Bid and to provide more details with a view to reaching provisional acceptance of such a Plan.

4.9 Outline Safety, Health and Environmental Plan

The Bidder shall submit as part of his Bid an Outline Safety, Health & Environment Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient compliance to the conditions of contract on SHE manual. The Outline Plan should include an outline of the procedures and regulations to be developed and the mechanism by which they will be implemented for ensuring safety as required by Sub-Clause 4.18 of the GC and Clause 9 of PC.

The Outline Plan shall be headed with a formal statement of policy in relation to Safety, Health & Environment protection and shall be sufficiently informative to define the Bidder's plans and set out in summary an adequate basis for the development of the Site Safety, Health & Environment Plan to be submitted in accordance with Sub-Clause 4.18 of the GCC and Clause 9 of PCC.

The Bidder may be requested to amplify, explain or develop its Outline Environmental Plan prior to the date of issue of Letter of Acceptance and to provide more details with a view to reaching provisional acceptance of such a plan.

4.10 Outline Project Management Plan

The Bidder shall submit with his Bid a Project Management Plan as prescribed in Work's Requirement - inter-alia indicating names, qualifications, professional experience and corporate affiliation of all proposed key management and engineering personnel (above the level of supervisor) and specialists.

Project Director of the consortium shall be based in PUNE. Design Liaison Engineer, Interface Manager shall be continuously based in PUNE (India) Project Office throughout the Contract Period. Installation Engineers and Commissioning Engineers shall be continuously based in PUNE during the respective activities.

The Bidder shall include his proposals for his Co-ordination Control Team and include the name and qualifications of the Team Leader responsible for the interface co-ordination with Designated Contractors.

4.10 (A) Manufacture, Testing and Commissioning Plan

The Bidder shall submit with its Bid, the methods by which the Bidder intends to manufacture and test the components / equipment. Details shall be given of the locations and arrangements for offshore and indigenous works, the facilities available and any understanding from others that the Bidder has in such matters. The manufacturing methods to be employed, the equipment's and facilities available or proposed to be set up off-shore and or in India, will be analysed during technical evaluation and shall be in sufficient detail to allow a full appreciation of the Bidder's proposals in relation to all aspects of the Works. The extent of automation involved in manufacture, particularly in the area of Welding, shall be clearly stated for both off-shore and indigenous manufacture.

4.11 Structure of the Bidder

The Bidder shall supply a chart particularizing the structure of the Bidder (identifying all companies comprising the Bidder in the event that the Bidder is a JV/Consortium) and the ownership of the Bidder including the ownership of each of the companies comprising the Bidder, identifying all respective intermediate and ultimate holding companies.

COMPOSITION OF THE BIDDER

1. A notarized copy of JV/Consortium Agreement relating to the composition of the Bidder shall be submitted, if the Bidder is a Consortium. Should the Bidder be an entity established or to be established to Bid for this Contract, details of the shareholders' agreement or proposed shareholders' agreement or proposed shareholders' agreement shall be supplied together with the percentage participation and percentage equity in the agreements.
2. The contractual arrangements and copies of agreements in relation thereto must, as a minimum, provide information on all members or participants involved, their respective participation in the Bid, the management structure, ownership and control of the members or participants comprising the Bidder and the name of the Lead Member who would have overall lead management responsibility for the Works, the registered addresses of all parties and the names of their respective senior partners, chairmen or managing directors as appropriate. Such agreements should also reflect the joint and several liabilities of the members to the Employer in the event that the Contract is awarded to them and provide "deadlock" provisions in the event that decisions of the Consortium cannot be reached by unanimous agreement.
3. The Bidder shall confirm that the broad scope split of work amongst the Consortium members shall be as hereunder: **(Deleted)**

SN	Work & Responsibility	Partner Qualifying	Local Partner (if any)
1	Design	P	S
2	Engineering	P	S
3	QC for manufacturing - Off-shore and On shore	P	S
4	Manufacturing - Off shore	P	X
5	Manufacturing - On shore	S	P
6	Interfacing	P	S
7	Testing and commissioning	P	S
8	Design validation and type testing	P	S
9	Warranty services	P	S
10	Project management	P	S
11	Training (offshore & on shore)	P	S
12	Manuals	P	S

P - Responsible Partner - Primary Responsibility

S - Support Partner - Secondary Responsibility

X - No Role

Note: The responsibilities as confirmed in the table above are independent of the invoicing structure given in the Pricing Document of the financial package.

4. The Bidder shall provide written confirmation that:
 - (a) The agreement or agreements submitted represent the entire agreement between the members or participants comprising the Bidder as to the Bidder's legal persona;
 - (b) There is or are no other agreements relating to the Bidder's incorporation, powers or organization which may affect in any way its ability to carry out the Works; and
 - (c) No changes will be made to any such agreements during the Bidding period or during the contract period (if contract awarded) without first obtaining the Employer's agreement to the proposed change or changes

5. Bidders Qualification without prequalification

To establish its qualifications to perform the contract in accordance with Section III(Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

5.1 Form ELI -1.1
Bidder Information Form
 (To be submitted on Bidder's Letter head)

Date: _____
 ICB No. and title: _____
 Page _____ of _____ pages

Bidder's Name
In case of Joint Venture (JV/Consortium), name of each members :
Bidder's actual or intended country of registration: <i>[indicate country of Constitution]</i>
Bidder's actual or intended year of incorporation:
Bidder's legal address [in country of registration]:
Bidder's authorized representative information Name: _____ Address: _____ Telephone/Fax numbers: _____ E-mail address: _____
1. Attached are copies of original documents of <input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above. <input type="checkbox"/> In case of JV/Consortium, letter of intent to form JV/Consortium or JV/Consortium agreement, in accordance with ITB 4.1. <input type="checkbox"/> In case of Government-owned enterprise or institution, in accordance with ITB4.3 documents establishing: <input type="checkbox"/> Legal and financial autonomy <input type="checkbox"/> Operation under commercial law <input type="checkbox"/> Establishing that the Bidder is not dependent agency of the Employer 2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership

5.2 Form ELI -1.2

(To be submitted on Bidder's Letter head)

Bidder' JV/Consortium Information Form

Date: _____

ICB No. and title: _____

Page _____ of _____ pages

Bidder's JV/Consortium Name
JV/CONSORTIUM member's name
JV/CONSORTIUM member's country of registration:
JV/CONSORTIUM member's year of constitution:
JV/CONSORTIUM member's legal address in country of constitution:
JV/CONSORTIUM member's authorized representative information
Name: _____
Address: _____
Telephone/Fax numbers: _____
E-mail address: _____
<p>1. Attached are copies of original documents of</p> <p><input type="checkbox"/> Articles of Incorporation (or equivalent documents of constitution or association), and/or documents of registration of the legal entity named above.</p> <p><input type="checkbox"/> In case of Government-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and absence of dependent status, in accordance with ITB 4.3.</p> <p>2. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership</p>

5.3 Form CON-2:

Historical Contract Non-Performance, Pending Litigation and Litigation History
(to be completed by the Bidder and by each member of the Bidder's JV/ CONSORTIUM)

Bidder's Name: _____

Date: _____

JV/ CONSORTIUM Member's Name _____

ICB No. and title: _____

Page _____ of _____ pages

Non-Performed Contracts in accordance with Section III, Evaluation & Qualification Criteria			
.. Contract non-performance did not occur since 1 st January <i>[insert current year number less 5]</i> specified in Section III, Evaluation and Qualification Criteria, Sub-Factor 2.1. .. Contract(s) not performed since 1 st January <i>[insert current year number less 5]</i> specified in Section III, Evaluation and Qualification Criteria, requirement 2.1			
Year	Non-performed portion of contract	Contract Identification	Total Contract Amount (current value, currency, exchange rate and INR equivalent)
<i>[insert year]</i>	<i>[insert amount and percentage]</i>	Contract Identification: <i>[indicate complete contract name/ number, and any other identification]</i> Name of Employer: <i>[insert full name]</i> Address of Employer: <i>[insert street/city/country]</i> Reason(s) for non-performance: <i>[indicate main reason(s)]</i>	<i>[insert amount]</i>

Pending Litigation, in accordance with Sr. No. 2.3 of Section III, Qualification Criteria and Requirements			
Year of dispute	Amount in dispute (currency)	Contract Identification Name of Employer: Address of Employer: Matter in dispute: Party who initiated the dispute: Status of dispute:	Total Contract Amount (currency), INR Equivalent (exchange rate)

5.4 Form CON - 3
Historical Debarment/ Blacklisting/ Termination/ Rescind
(DELETED)

5.5 Form FIN - 3.1:

Financial Situation and Performance

Bidder's Name: _____

Date: _____

JV/CONSORTIUM Member's Name: _____

ICB No. and title: _____

Page _____ of _____ pages

1. Financial data

Type of Financial information in (currency)	Historic information for previous _____ years, _____ (amount in currency, currency, exchange rate*, INR equivalent)				
	Year 1	Year 2	Year 3	Year 4	Year 5
Statement of Financial Position (Information from Balance Sheet)					
Total Assets (TA)					
Total Liabilities (TL)					
Total Equity / Net Worth (NW)					
Current Assets (CA)					
Current Liabilities (CL)					
Working Capital (WC)					
Information from Income Statement					
Total Revenue (TR)					
Profits Before Taxes (PBT)					
Cash Flow Information					
Cash Flow from Operating Activities					

2. Financial documents

The Bidder and its parties shall provide copies of financial statements for 5 (*five*) years pursuant Section III, Evaluation and Qualifications Criteria, Sub-factor 3.1. The financial statements shall:

- (a) reflect the financial situation of the Bidder or in case of JV/CONSORTIUM member, and not an affiliated entity (such as parent company or group member).
 - (b) be independently audited or certified in accordance with local legislation.
 - (c) be complete, including all notes to the financial statements.
 - (d) correspond to accounting periods already completed and audited.
 - (e) The financial data in the prescribed format shall be certified by Chartered Accountant with his stamp and signature.
- ☐ Attached are copies of financial statements¹ for the 5 (*five*) years required above and complying with the requirements

¹ If the most recent set of financial statements is for a period earlier than 12 months from the date of bid, the reason for this should be justified.

**5.6 Form FIN - 3.2:
Average Annual Construction Turnover**

Bidder's Name: _____

Date: _____

JV/CONSORTIUM Member's Name _____

ICB No. and title: _____

Page _____ of _____ pages

Year	Annual turnover data (Construction only)		
	Amount Currency	Exchange rate	INR equivalent
<i>[indicates year]</i>	<i>[insert amount and indicate currency]</i>		
Average Annual Construction Turnover *			

The financial data in the prescribed format shall be certified by Chartered Accountant with his stamp and signature.

*See Sr. No.3.2 of Section III, Evaluation and Qualification Criteria.

**5.7 Form FIN - 3.3:
Financial Resources**

Specify proposed sources of financing, such as liquid assets, unencumbered real assets, lines of credit, and other financial means, net of current commitments, available to meet the total construction cash flow demands of the subject contract or contracts as specified in Section-III (Evaluation and Qualification Criteria)

Financial Resources		
No	Source of financing	Amount in INR Equivalent
1		
2		
3		

The financial data in the prescribed format shall be certified by Chartered Accountant with his stamp and signature.

5.8 Form FIN - 3.4:**i. Current Contract Commitments / Works in Progress**

Bidders and each member to a JV/CONSORTIUM should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

Current Contract Commitments					
No	Name of Contract	Employer's Contact Address, Tel. Fax	Value of Outstanding Work in INR	Estimated Completion Date	Average Monthly Invoicing Over Last Six Months in INR/month
1					
2					
3					
4					
5					

The financial data in the prescribed format shall be certified by Chartered Accountant with his stamp and signature.

ii. Bid Capacity**Bid Capacity Calculation of Single Entity or Members of Consortium/JV**

S. No	Each Member Name	Maximum value of similar works executed in any one year during the last three years (Updated to 31.03.2021 price level)	Value of Price level, of existing commitments and ongoing works (During the next 1.25 Years) starting from 28 days prior to date for submission of Bid	No. of years prescribed for Completion of the works for which tenders are invited	Bid Capacity (Rupees in Crores)	Remarks
		A	B	N	$(2 \times A \times N) - B$	

The above to be duly certified by Statutory Auditor under his signature & stamp.

5.8.1 Form FIN-3.5
Bidder's Profitability

Bidders and each member to a JV should provide information on their earnings before interest and tax in any two years out of the last five years. The financial data in the prescribed format shall be certified by Chartered Accountant with his stamp and signature.

	Profitability-earnings before interest and Tax in INR					Years in which Profitability-earnings before interest and Tax is +ve (Positive)
	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	
Member-1 (Lead Member)						
Member-2 (other than Lead Member)						
Member-3 (other than Lead Member)						

5.9 Form EXP - 4.1:**General Construction Experience****[Each Bidder or member of a JV/CONSORTIUM must fill this form]**

Bidder's Name: _____

Date: _____

JV/CONSORTIUM Member's Name _____

ICB No. and title: _____

Page _____ of _____ pages

Starting Year*	Ending Year	Contract Identification	Role of Bidder
		Contract name: _____ Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	
		Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	
		Contract name: _____ Brief Description of the Works performed by the Bidder: _____ Amount of contract: _____ Name of Employer: _____ Address: _____	

*See Section III Evaluation and Qualification Criteria - Sub Factor 4.1

5.10 Form EXP - 4.2(a):

Specific Construction and Contract Management Experience
[Each Bidder or member of a JV/CONSORTIUM must fill this form]

Bidder's Name: _____

Date: _____

JV/CONSORTIUM Member's Name _____

ICB No. and title: _____

Page _____ of _____ pages

Similar Contract No.	Information			
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor	Member in JV/CONSORTIUM	Management Contractor	Sub-Contractor
Total Contract Amount			In INR equivalent	
If member in a JV/CONSORTIUM or subcontractor, specify participation in total Contract amount				
Employer's Name:				
Address:				
Telephone / Fax number				
E-mail				

5.10 Form EXP - 4.2(a) (cont.):**Specific Construction and Contract Management Experience (cont.)**

Similar Contract No.		Information
Description of the similarity in accordance with Sub-Factor 4.2(a) of Section III:		
1.	Amount	
2.	Physical size of required works items	
3.	Complexity	
4.	Methods / Technology	
5.	Construction rate for key activities	
6.	Other Characteristics	

Notes:

Documentary proof such as completion certificates from client clearly indicating the nature/scope of work, actual completion cost and actual date of completion for such work should be submitted. The offers submitted without this documentary proof shall not be evaluated. In case the work is executed for private client, copy of work order, bill of quantities, bill wise details of payment received certified by CA, TDS certificates for all payments received and copy of final/last bill paid by client shall be submitted.

Value of successfully completed portion of any ongoing work up to date of Bid submission will also be considered for qualification of work experience criteria.

For completed works, value of work done shall be updated to Bid submission date assuming 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year. For the purpose of evaluation of work experience, all prices will be converted to Indian Rupees using the Exchange (selling) rates for those currencies at the close of business of the State Bank of India at 31st December of each year for the works completed in respective year. For the works completed in the latest year before 31st of December of current year, the exchange rates of foreign currency shall be applicable 28 days before the Bid submission date.

In case of JV / Consortium, full value the work, if done by the same JV / Consortium or any of members of the / Consortium shall be considered. If the work done by them in any other JV / Consortium, value of work as per his percentage participation in that JV / Consortium shall be considered.

**5.11 Form EXP - 4.2(b):
Construction Experience in Key Activities**

Bidder's Name: _____

Date: _____

Bidder's JV/CONSORTIUM Member's Name _____

Sub-contractor's Name (as per ITB 34.2 and 34.3): _____

ICB No. and title: _____

Page _____ of _____ pages

1. Key Activity No One : _____

Information				
Contract Identification				
Award date				
Completion date				
Role in Contract	Prime Contractor	Member in JV/CONSORTIUM	Management Contractor	Sub-Contractor
Total Contract Amount	In INR equivalent			
Quantity (Volume, number or rate of production, as applicable) performed under the contract per year or part of the year	Total quantity in the contract (i)	Percentage participation (ii)	Actual Quantity Performed(i) x (ii)	
Year 1				
Year 2				
Year 3				
Year 4				
Information				
Employer's Name				
Address:				
Telephone / Fax number				
E-mail				
Description of the key activities in accordance with Sub-Factor 4.2(b) of Section III:				

2. Key Activity No. Two

3.

Notes:

Documentary proof such as completion certificates from client clearly indicating the nature/scope of work, actual completion cost & actual date of completion for such work should be submitted. The offers submitted without this documentary proof shall not be evaluated. In case the work is executed for private client, copy of work order, bill of quantities, bill wise details of payment received certified by CA, TDS certificates for all payments received & copy of final/last bill paid by client shall be submitted. Value of successfully completed portion of any ongoing work up to date of Bid submission will also be considered for qualification of work experience criteria.

For completed works, value of work done shall be updated to Bid submission date assuming 5% inflation for Indian Rupees every year and 2% for foreign currency portions per year. For the purpose of evaluation of work experience, all prices will be converted to Indian Rupees using the Exchange (selling) rates for those currencies at the close of business of the State Bank of India at 31st December of each year for the works completed in respective year. For the works completed in the latest year before 31st of December of current year, the exchange rates of foreign currency shall be applicable 28 days before the Bid submission date.

In case of JV/Consortium, full value the work, if done by the same JV / Consortium or any of members of the JV/Consortium shall be considered. If the work done by them in any other JV/CONSORTIUM / Consortium, value of work as per his percentage participation in that JV / Consortium shall be considered.

6. Form of Bid Security

Deleted

7. Form of Bid-Securing Declaration
(To be submitted on Bidder's Letter head)

Date: _____
Bid No.: _____
Alternative No.: _____
To: _____

We, the undersigned, declare that:

We understand that, according to your conditions, bids must be supported by a Bid-Securing Declaration.

We understand that the breach of following obligation(s) shall constitute sufficient grounds for exclusion under ITB 41, and/or shall be treated as fraudulent practice of the "Prohibited Conduct" under BDS ITB 3.3:

- a. if the Bidder resiles or withdraws their Tender during the Tender validity.
- b. if the Bidder does not accept the correction of their Tender price, pursuant to BDS ITB 35.2,
- c. if the successful Bidder having been notified of the acceptance of their Tender by the Employer during the Tender validity, the successful Bidder,
 - i. fail or refuse to furnish the unconditional acceptance of Letter of Acceptance within the time limit specified in BDS ITB 40.4; and/or
 - ii. fail or refuse to furnish the Performance Security in accordance with ITB 43 and Sub-Clause 4.2 of General Conditions and Particular Conditions (if any); and/or
 - iii. fail or refuse to enter into a Contract within the time limit specified in ITB 42;

The Bidder (all constituent member(s) of the JV/ Consortium as the case may be) that is in any of the situations referred to in above paragraph, shall be excluded from participating in the re-tender of this work as well as may be excluded in any other tender of the Employer as the case may be.

We understand this Bid-Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) twenty-eight days after the expiration of our Bid validity period.

Name of the Bidder*

Name of the person duly authorized to sign the Bid on behalf of the Bidder** _____

Title of the person signing the Bid _____

Signature of the person named above _____

Date signed _____ day of _____, _____

*: In the case of the Bid submitted by joint venture specify the name of the Joint Venture as Bidder.

**: Person signing the Bid shall have the power of attorney given by the Bidder attached to the Bid.

[Note: In case of a Joint Venture, the Bid-Securing Declaration must be in the name of all members of the Joint Venture that submits the bid.]

8. Form of Joint Bidding Agreement

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution, duly signed on each page. Foreign entities submitting the Bid are required to follow the applicable law in their country)

FORM OF JV/CONSORTIUM AGREEMENT BETWEEN

M/S....., M/S.....,

M/S..... AND M/S.....

FOR (.....)

THIS JV/Consortium Agreement (hereinafter referred to as "Agreement") executed on this..... day of Two thousand Twelve between..... a company incorporated under the laws of..... and having its Registered Office at (hereinafter called the "Party 1", which expression shall include its successors, executors and permitted assigns), and..... a company incorporated under the laws of..... and having its Registered Office at (hereinafter called the "Party 2", which expression shall include its successors, executors and permitted assigns) and..... a Company incorporated under the laws of..... and having its Registered Office at..... (hereinafter called the "Party 3", which expression shall include its successors, executors and permitted assigns)

(The Bidding JV/ consortium should list the name, address of its registered office and other details of all the consortium Members)

for the purpose of submitting the Bid in response to the Bidding Documents and in the event of selection as Successful Bidder to execute the Contract Agreement and/or other requisite documents, and to carry out the '.....' ("Works") for Pune Metro Rail project to be awarded by Maharashtra Metro Rail Corporation Limited (hereinafter referred as "Maha-Metro "or "the Company").

Party 1, Party 2, and Party 3 are hereinafter collectively referred to as the "Parties" and individually as a "Party".

WHEREAS Maharashtra Metro Rail Corporation Limited desired to engage a contractor for [name of the Maharashtra Metro Rail Corporation Limited Works] for Pune Metro Rail Project.

AND WHEREAS the JV/Consortium of [.....] (insert the names of all the Members) intends to participate for the Bid, against the Bidding Documents issued to..... [Insert the name of Employer of Bidding Document].

AND WHEREAS Para BDS ITB 4.9 of the Instructions to Bidder stipulates that the Bidders bidding on the strength of a consortium shall submit a legally enforceable JV/Consortium Agreement in a format specified in the Bidding Documents.

NOW THEREFORE, THIS INDENTURE WITNESSTH AS UNDER:

In consideration of the above premises and agreement, all the parties in this JV/Consortium do hereby mutually agree as follows:

1. In consideration of the selection of the JV/Consortium as the Successful Bidder by the Company, we the Members of the JV/Consortium and Parties to the JV/Consortium Agreement do hereby unequivocally agree that M/s..... (Insert name of the Lead Member), shall act as the Lead Member as defined in the Bidding Documents for self and agent for and on behalf of (the names of all the other Members of the JV/Consortium to be filled in here) to do on behalf of the JV/Consortium, all or any of the acts, deeds or things necessary or incidental to the JV/Consortium's Bid for the Contract including submission of the Bid, participating in meetings, responding to queries, submission of information/ documents and generally to represent the JV/Consortium in all its dealings with Maharashtra Metro Rail Corporation Limited or any other Government Agency or any person, in connection with the Works until culmination of the process of bidding till the Contract is entered into with Maharashtra Metro Rail Corporation Limited and thereafter till the expiry of the Contract.

2. The Lead Member is hereby authorized by the Members of JV/Consortium and Parties to the JV/Consortium Agreement to bind the JV/Consortium, incur liabilities and receive instructions for and on behalf of all Members. It is agreed by all the Members that entire execution of the Contract including payment shall be carried out exclusively through the Lead Member.
3. The Lead Member shall be liable and responsible for ensuring the individual and collective commitment of each of the Members of the JV/Consortium in discharging all their respective obligations under the Contract with **Maharashtra Metro Rail Corporation Limited**. Each JV/Consortium Member further undertakes to be individually liable for the performance of its part of the obligations without in any way limiting the scope of collective liability envisaged in this Agreement.
4. In case of any breach of any of the obligations as specified under Clause 3 above by any of the JV/Consortium Members, the Lead Member shall be liable to fulfil such obligation.
5. It is agreed that sharing of responsibilities hereto among the JV/Consortium members shall not in any way be a limitation of responsibility of the Lead Member under these presents.
6. This JV/Consortium Agreement shall be construed and interpreted in accordance with the Laws of _____.
7. It is hereby agreed that the Lead Member shall furnish the Bid Securing Declaration, as stipulated in the Bidding Documents, on behalf of the JV/Consortium.
8. It is hereby agreed that in case of selection of bidding consortium as the Successful Bidder, the Parties to this JV/Consortium Agreement do hereby agree that the Lead Member shall furnish the Performance Security on behalf of the JV/Consortium, as stipulated in the Bidding Documents.
9. It is further expressly agreed that the JV/Consortium Agreement shall be irrevocable and, for the Successful Bidder, shall remain valid over the term of the Contract, unless expressly agreed to the contrary by the Company.
10. The Lead Member is authorized and shall be fully responsible for the accuracy and veracity of the representations and information submitted by the JV/Consortium Members respectively from time to time in response to the Bidding Documents for the purposes of the Bidding.
11. It is expressly understood and agreed between the Members that the responsibilities and obligations of each of the Members shall be as follows:
.....
.....
12. It is agreed by the Members that the above sharing of responsibilities and obligations shall not in any way be a limitation of joint and several responsibilities and liabilities of the Members, with regards to all matters relating to the execution of the Works as envisaged in the Bidding Documents and the Contract. The Parties shall be jointly and severally liable for execution of the Works in accordance with the terms of the Contract and the Bidding Documents.
13. It is clearly agreed that the Lead Member shall ensure performance under the Contract and if one or more JV/Consortium Members fail to perform its/their respective obligations under the agreement(s), the same shall be deemed to be a default by all the JV/Consortium Members.
14. It is hereby agreed that in case of selection of the JV/Consortium as the Successful Bidder, [the Lead Member shall furnish the Performance Security on behalf of the JV/Consortium as stipulated in the Bidding Documents] / [the Performance Security as stipulated in the Bidding Documents shall be furnished by the Members on behalf of the JV/Consortium in such proportion as may be agreed to between us]
15. It is agreed by all the Members that there shall be separate JV/Consortium Bank Account (distinct from the bank accounts of the individual Members) to which the individual Members shall contribute their share capital and/or working capital and the financial obligations of the JV/Consortium shall be discharged through the said JV/Consortium Bank Account only and also all the payments received by the JV/Consortium from the Employer shall be through that account alone.
16. It is hereby expressly agreed between the Parties to this JV/Consortium Agreement that neither Party shall assign or delegate its rights, duties or obligations under this Agreement except with prior written consent of the Company.
17. We hereby agree to ratify all acts, deeds and things lawfully done by the aforesaid Lead Member pursuant to this Agreement and that all acts, deeds and things done by the aforesaid Lead Member shall and shall always be deemed to have been done by us/Consortium.

This JV/Consortium Agreement

- (a) has been duly executed and delivered on behalf of each Party hereto and constitutes the legal, valid, binding and enforceable obligation of each such Party,
- (b) sets forth the entire understanding of the Parties hereto with respect to the subject matter hereof including the JV/Consortium/Bidder's legal persona and there is or are no other agreements

relating to the JV/Consortium/Bidder's incorporation, constitution, powers or organisation which may affect in any way its ability to carry out the Works;

- (c) may not be amended or modified except in writing signed by each of the Parties and with prior written consent of the Company.

IN WITNESS WHEREOF, the Parties to the JV/Consortium Agreement have, through their authorized representatives, executed these presents and affixed common seals of their respective companies on the Day, Month and Year first mentioned above.

Common Seal of For and on behalf of
has been affixed in my/our JV/Consortium Member (party 1)
presence pursuant to the M/s.....
Board of Director's resolution
dated

.....
(Signature) (Signature of authorized representative)
Name:
Designation:.....
Place:
Date:

.....
Name:
Designation:

Witness:

1.
(Signature)
Name
Designation.....
2.
(Signature)
Name
Designation.....

Common Seal of For and on behalf of
has been affixed in my/our JV/Consortium Member (Party 2)
presence pursuant to the M/s.....
Board of Director's
resolution dated

.....
(Signature) (Signature of authorized representative)
Name: Name:
Designation: Designation:
Place:
Date:

WITNESS

1.
(Signature)
Name
Designation.....
2.
(Signature)
Name
Designation.....

Attested:

.....
(Signature)
(Notary Public)
Place:
Date:

Common Seal of For and on behalf of
has been affixed in my/our JV/Consortium Member (Party 3)
presence pursuant to the M/s.....
Board of Director's
resolution dated

.....
(Signature) (Signature of authorized representative)
Name: Name:
Designation: Designation:
Place:
Date:

WITNESS

1.
(Signature)
Name
Designation.....
2.
(Signature)
Name
Designation.....

Attested:
.....
(Signature)
(Notary Public)

Place:.....
Date:.....

9. Form of Legal Capacity/ Power of Attorney*(Refer ITB20.2)**(To be forwarded on the letterhead of the Bidder/ Lead Member of Consortium)***Format for Board Resolution****(A) Format for the Board resolution to be passed by a Bidder (not applicable in case of consortium)**

The Board, after discussion, at the duly convened Meeting on (Insert date), with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956, passed the following Resolution:

RESOLVED THAT pursuant to the applicable provisions of the Companies Act, 1956 and as permitted under the Memorandum and Articles of Association of the Company, approval of the Board be and is hereby accorded to submit a Bid in response to the Bidding Documents dated _____ issued by Maharashtra Metro Rail Corporation Limited (**Maharashtra Metro Rail Corporation Limited**) for '.....' [name of the work] for **Pune Metro Rail Project**.

FURTHER RESOLVED THAT Mr./Ms....., (insert the name and designation of the concerned official of the Company) be and is hereby authorized to take all the steps required to be taken by the Company for submission of the aforesaid Bid, including in particular, signing the Bid, making changes thereto and submitting amended Bid, signing and executing all the documents related to the Bid, certified copy of this Board resolution or letter or undertakings, etc., required to be submitted to **Maharashtra Metro Rail Corporation Limited** as part of the Bid or such other documents as may be necessary in this regard and to do in our name and our behalf all or any of the acts, deeds or things necessary or incidental to submission of our said Bid including signing and executing the Contract Documents, making representations to **Maharashtra Metro Rail Corporation Limited** or any other authority, and providing information / responses to **Maharashtra Metro Rail Corporation Limited**, representing us in all matters before **Maharashtra Metro Rail Corporation Limited**, and generally dealing with **Maharashtra Metro Rail Corporation Limited** in all matters in connection with our Bid till the completion of the bidding process as per the terms of the above said Bidding Documents and further till the Contract is entered into with MahaMetro thereafter till the expiry of the Contract.

FURTHER RESOLVED THAT a power of attorney as per the draft attached to the Bidding Documents be issued in favour of the above named person, _____, to be executed by Mr. _____ or Mr. _____, Directors of the Company under the Common seal of the Company, affixation thereof to be witnessed by one or both of the above named Directors and by Mr. _____, (insert the name and designation of the concerned official of the Company) or as per the Memorandum and Articles of Association of the Company.

Signature and stamp of Company Secretary / Managing Director/Director of Bidder

Notes:

1. This certified true copy should be submitted on the letterhead of the Company, signed by the Company Secretary / Managing Director/Director of the Bidder.
2. The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution.
3. In the event the Board resolution is from a company incorporated outside India, the same needs to be notarized by a notary in the home country of company passing the resolution and legalized by the Indian Embassy there. However, in case such company is from a country which has signed The Hague Legislation Convention 1961, then the Board Resolution is not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.
4. This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act 1956 may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.

(B) Format for the Board resolution to be passed by Lead Member of Consortium (applicable in case the Bidder is a consortium)

The Board, after discussion, at the duly convened Meeting on (Insert date), with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956, passed the following Resolution:

RESOLVED THAT pursuant to the applicable provisions of the Companies Act, 1956 and as permitted under the Memorandum and Articles of Association of the Company, approval of the Board be and is hereby accorded to submit a Bid in response to the Bidding Documents dated _____ issued by Maharashtra Metro Rail Corporation Limited (**Maharashtra Metro Rail Corporation Limited**) for '.....' [name of the work] for **Pune Metro Rail Project** in consortium with _____ (insert the name and address of the other consortium members).

FURTHER RESOLVED THAT pursuant to the applicable provisions of the Companies Act, 1956 and as permitted under the Memorandum and Articles of Association of the Company, approval of the Board be and is hereby accorded to execute a Consortium Agreement as per the format annexed to the aforesaid Bidding Documents with _____ (insert the name and address of the other consortium members).

FURTHER RESOLVED THAT approval of the Board be and is hereby accorded to the Company to accept and act as the Lead Member of the aforesaid Consortium and also as true and lawful attorney to do in the name and on behalf of the Consortium, all such acts, deeds and things necessary in connection with or incidental to submission of Consortium's Bid in response to the Bidding Documents dated _____ issued by **Maharashtra Metro Rail Corporation Limited** for '.....' [name of the work] including signing and submission of the Bid and all documents related to the Bid as specified in the Bidding Documents, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document, which **Maharashtra Metro Rail Corporation Limited** may require us to submit and carrying out the Contract and doing all necessary deeds and things as maybe required in respect of the above and also for making representations to MAHA-METRO and providing information / responses to **Maharashtra Metro Rail Corporation Limited**, representing the Consortium in all matters before **Maharashtra Metro Rail Corporation Limited**, and generally dealing with MAHA-METRO and/or any other authority in all matters in connection with Consortium's Bid, till completion of the bidding process in accordance with the Bidding Documents and further till the Contract is entered into with **Maharashtra Metro Rail Corporation Limited** and thereafter till the expiry of the Contract.

FURTHER RESOLVED THAT Mr./Ms....., (insert the name and designation of the concerned official of the Company) be and is hereby authorized to take all the steps required to be taken by the Company for submission of the Consortium's Bid, including in particular, signing the Bid, making changes thereto and submitting amended Bid, signing and executing all the documents related to the Bid, certified copy of this Board resolution or letter or undertakings, etc., required to be submitted to **Maharashtra Metro Rail Corporation Limited** as part of the Bid or such other documents as may be necessary in this regard and to do in the name and on behalf the Consortium all or any of the acts, deeds or things necessary or incidental to submission of said Bid including signing and executing the Contract Documents, making representations to MAHA-METRO or any other authority, & providing information / responses to MAHA-METRO, representing the Consortium in all matters before **Maharashtra Metro Rail Corporation Limited**, and generally dealing with **Maharashtra Metro Rail Corporation Limited** in all matters in connection with our Bid till the completion of the bidding process as per the terms of the above said Bidding Documents and further till the Contract is entered into with the Company and thereafter till the expiry of the Contract.

FURTHER RESOLVED THAT a power of attorney as per the draft attached to the Bidding Documents be issued in favour of the above named person, _____, to be executed by Mr. _____ or Mr. _____, Directors of the Company under the Common seal of the Company, affixation thereof to be witnessed by one or both of the above named Directors and by Mr. _____, (insert the name and designation of the concerned official of the Company) or as per the Memorandum and Articles of Association of the Company.

Signature and stamp of Company Secretary / Managing Director/Director of Bidder

Notes:

1. This certified true copy should be submitted on the letterhead of the Company, signed by the Company Secretary / Managing Director/Director of the Bidder.

2. The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution.
3. In the event the Board resolution is from a company incorporated outside India, the same needs to be notarized by a notary in the home country of company passing the resolution and legalized by the Indian Embassy there. However, in case such company is from a country which has signed The Hague Legislation Convention 1961, then the Board Resolution is not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.
4. This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act 1956 may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.

(C) Format for the Board resolution to be passed by a Member other than the Lead Member of Consortium (applicable in case the Bidder is a consortium)

The Board, after discussion, at the duly convened Meeting on (Insert date), with the consent of all the Directors present and in compliance of the provisions of the Companies Act, 1956, passed the following Resolution:

RESOLVED THAT pursuant to the applicable provisions of the Companies Act, 1956 and as permitted under the Memorandum and Articles of Association of the Company, approval of the Board be and is hereby accorded to submit a Bid in response to the Bidding Documents dated _____ issued by Maharashtra Metro Rail Corporation Limited (**Maharashtra Metro Rail Corporation Limited**) for '.....' [name of the work] for **Pune Metro Rail Project** in consortium with _____ (insert the name and address of the other consortium members).

FURTHER RESOLVED THAT pursuant to the applicable provisions of the Companies Act, 1956 and as permitted under the Memorandum and Articles of Association of the Company, approval of the Board be and is hereby accorded to execute a Consortium Agreement as per the format annexed to the aforesaid Bidding Documents with _____ (insert the name and address of the other consortium members).

FURTHER RESOLVED THAT approval of the Board be and is hereby accorded to constitute, appoint and authorize _____ (name and registered office address of the Lead Member), which is one of the Members of the Consortium, to act as the Lead Member of the aforesaid Consortium and also as true and lawful attorney, to do in the name and on behalf of the Consortium, all such acts, deeds and things necessary in connection with or incidental to submission of Consortium's Bid in response to the Bidding Documents dated _____ issued by **Maharashtra Metro Rail Corporation Limited** for '.....' [name of the work] including signing and submission of the Bid and all documents related to the Bid as specified in the Bidding Documents, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document, which **Maharashtra Metro Rail Corporation Limited** may require us to submit and carrying out the Contract and doing all necessary deeds and things as may be required in respect of the above and also for making representations to **Maharashtra Metro Rail Corporation Limited** and providing information / responses to **Maharashtra Metro Rail Corporation Limited**, representing the Consortium in all matters before **Maharashtra Metro Rail Corporation Limited**, and generally dealing with **Maharashtra Metro Rail Corporation Limited** and/or any other authority in all matters in connection with our Bid, till completion of the bidding process in accordance with the Bidding Documents and further till the Contract is entered into with **Maharashtra Metro Rail Corporation Limited** and thereafter till the expiry of the Contract.

FURTHER RESOLVED THAT a power of attorney as per the draft attached to the Bidding Documents be issued in favour of the above said Lead Member, _____, to be executed by Mr. _____ or Mr. _____, Directors of the Company under the Common seal of the Company, affixation thereof to be witnessed by one or both of the above named Directors and by Mr. _____, (insert the name and designation of the concerned official of the Company) or as per the Memorandum and Articles of Association of the Company.

FURTHER RESOLVED THAT a power of attorney as per the draft attached to the Bidding Documents be issued in favour of Mr./Ms....., (insert the name and designation of the concerned official of the Company) to be executed by Mr. _____ or Mr. _____, Directors of the Company under the Common seal of the Company, affixation thereof to be witnessed by one or both of the above named Directors and by Mr. _____, (insert the name and designation of the concerned official of the Company) or as per the Memorandum and Articles of Association of the Company.

FURTHER RESOLVED THAT Mr./Ms....., (insert the name and designation of the concerned official of the Company) be and is hereby authorized to take all the steps required to be taken by the Company for submission of the aforesaid Bid, including in particular, signing and executing all the documents related to the Bid, certified copy of this Board resolution or letter or undertakings, etc., required to be submitted to **Maharashtra Metro Rail Corporation Limited** as part of the Bid or such other documents as may be necessary in this regard and to do in our name and our behalf all or any of the acts, deeds or things necessary or incidental to give effect to this resolution.

Signature and stamp of Company Secretary / Managing Director/Director of Bidder

Notes:

1. This certified true copy should be submitted on the letterhead of the Company, signed by the Company Secretary / Managing Director/Director of the Bidder.
2. The contents of the format may be suitably re-worded indicating the identity of the entity passing the resolution.
3. In the event the Board resolution is from a company incorporated outside India, the same needs to be notarized by a notary in the home country of company passing the resolution and legalized by the Indian Embassy there. However, in case such company is from a country which has signed The Hague Legislation Convention 1961, then the Board Resolution is not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.
4. This format may be modified only to the limited extent required to comply with the local regulations and laws applicable to a foreign entity submitting this resolution. For example, reference to Companies Act'1956 may be suitably modified to refer to the law applicable to the entity submitting the resolution. However, in such case, the foreign entity shall submit an unqualified opinion issued by the legal counsel of such foreign entity, stating that the Board resolutions are in compliance with the applicable laws of the respective jurisdictions of the issuing company and the authorizations granted therein are true and valid.

(D) Power of Attorney to be provided by each of the Members of the Consortium (other than the Lead Member) in favour of the Lead Member

WHEREAS Maharashtra Metro Rail Corporation Limited, (the Company) has issued the Bidding Documents on _____ for inviting Bids for '.....' [name of the work]for **Pune Metro Rail Project** on the terms and contained in the Bidding Documents;

AND WHEREAS, and (Insert names of all Members of Consortium) the Members of the Consortium are desirous of submitting a Bid in response to the Bidding Documents, and if selected, undertaking the responsibility of '.....' [name of the work] as per the terms of the Bidding Documents;

AND WHEREAS all the Members of the Consortium have agreed under the Consortium Agreement dated entered into between all the Members and submitted along with the Bid to appoint (Insert the name and address of the Lead Member) as Lead Member to represent all the Members of the Consortium for all matters regarding the Bidding Documents and the Bid;

AND WHEREAS pursuant to the terms of the Bidding Documents and the Consortium Agreement, we, the Members of the Consortium hereby designate M/s (Insert name of the Lead Member) as the Lead Member to represent us in all matters regarding the Bid and the Bidding Documents, in the manner stated below:-

Know all men by these presents, We (Insert name and address of the registered office of the Member-1)..... (Insert name and address of the registered office of the Member-2) (Insert name and address of the registered office of the Member-n) do hereby constitute, appoint and authorize.....(name

and registered office address of the Lead Member), which is one of the Members of the Consortium, to act as the Lead Member and our true and lawful attorney, to do in our name and on our behalf, all such acts, deeds and things necessary in connection with or incidental to submission of Consortium's Bid in response to the Bidding Document dated _____ issued by the Company for '.....'[name of the work] including signing and submission of the Bid and all documents related to the Bid as specified in the Bidding Documents, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document, which the Company may require us to submit and carrying out the Contract and doing all necessary deeds and things as may be required in respect of the above. The aforesaid Attorney shall be further authorized for making representations to the Company named in the Bidding Documents, and providing information / responses to the Company named in the Bidding Documents, representing us and the Consortium in all matters before the Company named in the Bidding Documents, and generally dealing with the Company named in the Bidding Documents and/or any other authority in all matters in connection with our Bid, till completion of the bidding process in accordance with the Bidding Documents and further till the Contract is entered into with the Company and thereafter till the expiry of the Contract.

We, as Members of the Consortium, hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

All the terms used herein but not defined shall have the meaning ascribed to such terms in the Bidding Documents.

Signed by the within named
[Insert the name of the executant company]
 through the hand of
 Mr.
 duly authorized by the Board to issue such Power of Attorney

Dated this day of

Accepted

 Signature of Attorney
 (Name, designation and address of the Attorney)
 Attested

.....
 (Signature of the executant)

(Name, designation and address of the executant)

.....
 Signature and stamp of Notary of the place of execution

Common seal of has been affixed in my/our presence pursuant to Board of Director's Resolution dated.....

WITNESS:

1.
 (Signature)
 Name
 Designation.....
 2.
 (Signature)
 Name
 Designation.....

Notes:

1. The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.
2. In the event, power of attorney has been executed outside India, the same needs to be notarized by a notary in the home country of company executing this power of attorney and legalized by the Indian Embassy there. However, in case such company is from a country which has signed The Hague Legislation Convention 1961, then the said power of attorney is not required to be legalized by the Indian Embassy if it carries a conforming Apostille certificate.
3. Also, wherever required, the executant(s) should submit for verification the extract of the chartered documents and documents such as a Board resolution / power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

(E) Format for PoA for Lead Member

POWER OF ATTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting Bids are required to follow the applicable law in their country)

Power of Attorney to be provided by the Bidder Company/ Lead Member in favour of its representative as evidence of authorized signatory's authority.

Know all men by these presents, We(name and address of the registered office of the Bidding Company or Lead Member of the Bidding Consortium, as applicable) do hereby constitute, appoint and authorize Mr./Ms.....(name and residential address) who is presently employed with us and holding the position of _____, as our Attorney to do in our name and our behalf all or any of the acts, deeds or things necessary or incidental to submission of our Bid for '.....' [name of the work] for **Pune Metro Rail Project** in response to the Bidding Document dated _____ issued by Maharashtra Metro Rail Corporation Limited (**Maharashtra Metro Rail Corporation Limited**) (the Company) including signing and submission of the Bid and all other documents related to the bidding, including but not limited to undertakings, letters, certificates, acceptances, clarifications, guarantees or any other document which the Company may require us to submit and also signing and executing the Contract Documents. The aforesaid Attorney is further authorized for making representations to the Company or any other authority, and providing information / responses to the Company, representing us in all matters before the Company, and generally dealing with the Company in all matters in connection with our Bid till the completion of the bidding process as per the terms of the Bidding Documents and further till the Contract is entered into with the Company and thereafter till the expiry of the Contract.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

(Add in the case of a Consortium)

Our firm is a Member/Lead member of the Consortium of _____, _____ and _____

All the terms used herein but not defined shall have the meaning ascribed to such terms under the Bidding Documents.

Signed by the within named

.....[Insert the name of the executant's company]

through the hand of

Mr.

duly authorized by the Board to issue such Power of Attorney

Dated this day of

Accepted

.....

Signature of Attorney

(Name, designation and address of the Attorney)

Attested

.....
 (Signature of the executant)
 (Name, designation and address of the executant)

Signature and stamp of Notary of the place of execution

Common seal of has been affixed in my/our presence pursuant to Board of Director's Resolution dated.....

WITNESS

1.
 (Signature)
 Name
 Designation.....
2.
 (Signature)
 Name
 Designation.....

Notes:

1. The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.
2. In the event, power of attorney has been executed outside India, the same needs to be duly notarized by a notary public of the jurisdiction where it is executed.
3. Also, wherever required, the executant(s) should submit for verification the extract of the charter documents and documents such as a board resolution / power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

(F) Format for PoA for Other Member(s)

POWER OF ATTORNEY

(To be on non-judicial stamp paper of appropriate value as per Stamp Act relevant to place of execution. Foreign companies submitting Bids are required to follow the applicable law in their country)

Power of Attorney to be provided by each Member other than the Lead Member in favour of its representative as evidence of authorized signatory's authority. (applicable to consortium only)

Know all men by these presents, We(name and address of the registered office of the Member of the Consortium, as applicable) do hereby constitute, appoint and authorize Mr./Ms.....(name and residential address) who is presently employed with us and holding the position of _____, as our Attorney to sign and execute the Contract Agreement and any other requisite document in our name and our behalf for '.....' [name of the work] for **Pune Metro Rail Project** in response to the Bidding Document dated _____ issued by Maharashtra Metro Rail Corporation Limited(**Maharashtra Metro Rail Corporation Limited**) (the Company) and to do all or any of the acts, deeds or things necessary or incidental to the above.

We hereby agree to ratify all acts, deeds and things done by our said attorney pursuant to this Power of Attorney and that all acts, deeds and things done by our aforesaid attorney shall be binding on us and shall always be deemed to have been done by us.

(Add in the case of a Consortium)

Our firm is a Member of the Consortium of _____, _____ and _____

All the terms used herein but not defined shall have the meaning ascribed to such terms under the Bidding Documents.

Signed by the within named

.....[Insert the name of the executant company]through the hand of Mr.
.....duly authorized by the Board to issue such Power of Attorney Dated this
..... day of

Accepted

.....
Signature of Attorney
(Name, designation and address of the Attorney)

Attested

.....
(Signature of the executant)
(Name, designation and address of the executant)

.....
Signature and stamp of Notary of the place of execution

Common seal of has been affixed in my/our presence pursuant to Board of Director's Resolution dated.....

WITNESS

1.
(Signature)
Name
Designation.....
2.

(Signature)

Name

Designation.....

Notes:

1. The mode of execution of the power of attorney should be in accordance with the procedure, if any, laid down by the applicable law and the charter documents of the executant(s) and the same should be under common seal of the executant affixed in accordance with the applicable procedure. Further, the person whose signatures are to be provided on the power of attorney shall be duly authorized by the executant(s) in this regard.
2. In the event, power of attorney has been executed outside India, the same needs to be duly notarized by a notary public of the jurisdiction where it is executed.
3. Also, wherever required, the executant(s) should submit for verification the extract of the charter documents and documents such as a board resolution / power of attorney, in favour of the person executing this power of attorney for delegation of power hereunder on behalf of the executant(s).

10. Bid Index

The Bidder shall include with its Bid an index which cross refers all of the Employer's bidding requirements elaborated in these documents to all the individual sections within Package 1: Technical Package and Package 2: Financial Package which the Bidder intends to be the responses to each and every one of those requirements.

The Packages submitted must be clearly presented, all pages numbered and laid out in a logical sequence with main and subheadings to facilitate evaluation.

11. Form for seeking clarification on Bidding Documents

Name of the Bidder:

S.No.	Volume No.	Clause No.	Bid Condition	Bidder's Queries
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

12. Not Used

13. Letter of Undertaking Regarding Confidentiality of Bid Information

(This document is to be prepared by the Bidder and submitted on Bidder's Letterhead as part of Technical Package as per Instructions to Bidder BDSITB 11.4.1.16)

To:**Date:****Managing Director**

Office of Maharashtra Metro Rail Corporation Limited,
1st Floor, The Orion,
Opposite Don Bosco Youth Centre,
Koregaon Park,
Pune-411001.
Maharashtra, INDIA

Sub: Tender No P1 - T06/2021: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Contract No. 2021P1-T06/2021 - Regarding Letter of Undertaking

We (Name of Bidder / Consortium) hereby undertake that the Bid drawings, both in hardcopy and digitized format, and the Bidding documents purchased as a necessary part of our preparation of this Bid shall be used solely for the preparation of the Bid and that if the Bid is successful, shall be used solely for the execution of Works.

We further undertake that the aforesaid Bid drawings and documents prepared by MAHAMETRO, shall not be used in whole, in part or in any altered form on any other project, scheme, design or proposal that the Bidder / Consortium / Members of Consortium or its/their parent companies or sub-contractors of the Bidder / Consortium are, or will be involved with either in India or in any other Country.

Signed:

For and on behalf of

(Name of Bidder / Joint Venture / Consortium)

(To be signed by each member of the Joint Venture / Consortium, as applicable)

14. Undertaking for Downloaded Bidding Documents

We hereby confirm that, we have downloaded the complete set of Bid Documents along with the set of enclosures hosted in e-tendering portal <http://mahametroRails.etenders.in>. We confirm that the Bidding Documents has not been edited or modified by us. In case, it is observed by **Maharashtra Metro Rail Corporation Limited** that the Bidding Documents have been edited or modified, we agree for the rejection of our Bid by **Maharashtra Metro Rail Corporation Limited**.

Company name
Name
Signature
Postal address
E-mail ID
Phone Fax

15. Sample Format for Banking Reference for Liquidity

(to be submitted on the letter head of the Bank with Contact details, Address, Phone Number, E Mail id, etc.)

BANK CERTIFICATE

This is to certify that M/s is a reputed company with a good financial standing

If the contract for the work, namely.....is awarded to the above firm, we shall provide overdraft / credit facilities to the extent of Rs..... to meet their working capital requirements for executing the above contract.

Signature: - _____
 Name of Bank: _____
 Senior Bank Manager _____
 Address of the Bank _____

Change the text as follows for Joint Venture / JVA / Consortium

This is to certify that M/s who has formed a JV / Consortium with M/s and M/sfor participating in this bid, is a reputed company with a good financial standing.

If the contract for the work, namely.....is awarded to the above joint venture / Consortium, we shall provide overdraft / credit facilities to the extent of Rs..... to M/s to meet their working capital requirements for executing the above contract.

Signature: - _____
 Name of Bank: _____
 Senior Bank Manager _____
 Address of the Bank _____

[This should be given by the JV/CONSORTIUM members in proportion to their financial participation]

16. Form of Certificate confirming submission of all documents of Financial Package in the Technical Package with prices left blank

1. This is to certify that the copy of all the documents of Financial Package, submitted with the Technical Package, is a true Copy of the Financial Package with prices left blank.
2. It is further certified that there are no additional comments, remarks, deviations, terms and conditions in our Financial Package and even if it is there, it shall be treated as NULL and VOID and stand withdrawn.

SIGNATURE OF BIDDER

17. Form of Certificate confirming receipt of all Bidding Documents and Addenda
(To be submitted on Bidder's Letter head)

This is to certify that we, M/s _____ [* Name of the Bidder] have received all Bidding Documents Addenda for Contract No. 2021P1-T06/2021 as listed below:

1. Addendum No.
2.
3.
4.

SIGNATURE OF BIDDER

* In case of a Consortium, to be submitted by the Authorized representative of the Lead Member.

18. Form of Declaration for non-engagement of any agent, middleman or intermediary
(To be submitted on Bidder's Letter head)

[We hereby declare / We hereby jointly and severally]@ declare that the submission of this Bid confirms that no agent, middleman or any intermediary has been, or will be engaged to provide any services, or any other item or work related to the award and performance of this Contract. We further confirm and declare that no agency commission or any payment, which may be construed as an agency commission, has been, or will be paid and that the Bid price does not include any such amount. We acknowledge the right of the Employer, if it finds to the contrary, to declare our Bid to be non-compliant and if the Contract has been awarded to declare the Contract NULL and VOID.

SIGNATURE OF THE BIDDER

(In case of a partnership, joint venture or consortium, to be submitted by each constituent member)@
Strike out whichever is not applicable

**19. Form of certificate confirming careful examination of all the contents of Bidding Documents
and signing of all pages of Bidder's proposal
(To be submitted on Bidder's Letter head)**

This is to certify that we, M/s_____ [*Name of the company/consortium] have carefully examined all the contents of the Bidding Documents including Addenda (if any) and all the pages of our proposal have been signed and stamped by our authorized signatory.

SIGNATURE OF BIDDER

@In case of a joint venture or consortium, such pages to be signed by authorized signatory of the Lead member.

20. Undertaking for ensuring supply of critical spares and availability of technical support

(To be submitted on Bidder's Letter head)

Dated:.....

To:

Managing Director
Office of Maharashtra Metro Rail Corporation Limited,
1st Floor, The Orion,
Opposite Don Bosco Youth Centre,
Koregaon Park,
Pune-411001.
Maharashtra, INDIA

Letter of Undertaking

Tender No.P1- T06 : Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

We hereby certify that we will make credible arrangements for ensuring supply of critical spares and availability of technical support for maintenance and up gradation of equipment / systems / Machinery & Plant / Software, etc., which will become part of the Permanent Works executed under the contract (2021P1-T06/2021) during their service life.

Signed.....
For on behalf of
(Name of Bidder / Consortium)

21. Undertaking for passing on benefits of exemptions to Maharashtra Metro Rail Corporation Limited and for adjustment of amounts due from balance due

(To be submitted on Bidder's Letterhead)

Dated:

Letter of Undertaking

Tender No .P1 - T06: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

I _____ (State Name of Director/Partner/ Karta/Authorized Person) in capacity of _____ of _____ (State name of the undertaking organization) here by undertake to reimburse / pass on benefit of any duty draw back / export, import incentive / exemption / concession / benefit etc. obtained for the **Maharashtra Metro Rail Corporation Limited** project to **Maharashtra Metro Rail Corporation Limited**. I will maintain proper records as required by **Maharashtra Metro Rail Corporation Limited** and relevant statute. I will furnish such records to **Maharashtra Metro Rail Corporation Limited** as and when required by them.

I agree to adjustment of any benefits/ duty draw back / export, import incentive / exemptions / concessions to be made from the balance due to me without any prejudice.

I also undertake to indemnify **Maharashtra Metro Rail Corporation Limited** in case of any loss caused due to non-reimbursement / passing on the benefit of duty draw back / export, import incentive / exemption / concession etc.

I state that everything declared by me is true and correct to my belief.

Signed.....

For on behalf of

(Name of Bidder / Consortium)

22. Undertaking for obtaining registrations under various fiscal and labour laws

(To be submitted on Bidder's Letterhead)

Dated:.....

Letter of Undertaking

Tender No. P1 -T06/2021: Design, Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

I _____ (State Name of Director/Partner/ Karta/Authorized Person) in capacity of _____ of _____ (State name of the undertaking organization) here by undertake to get registered under _____ (state the type of registration to be obtained) before _____ (state time line) (preferably immediately after award of Contract).

I also undertake to indemnify **Maharashtra Metro Rail Corporation Limited** in case of any loss caused due to non-registration.

I state that everything declared by me is true and correct to my belief.

Signed.....

For on behalf of

(Name of Bidder / Consortium)

23. Declaration of Undertaking

(To be submitted on Bidder's Letter head)

We underscore the importance of a free, fair and competitive procurement process that precludes abusive practices. In this respect we have neither offered nor granted directly or indirectly any inadmissible advantages to any public servant or other person nor accepted such advantages in connection with our bid, nor will we offer or grant or accept any such incentives or conditions in the present procurement process or, in the event that we are awarded the contract, in the subsequent execution of the contract. We also declare that no conflict of interest exists in the meaning of the kind described in the corresponding Guidelines ⁶. We also underscore the importance of adhering to minimum social standards ("Core Labour Standards") in the implementation of the project. We undertake to comply with the Core Labour Standards ratified by the country of @ (name of country). We will inform our staff about their respective obligations and about their obligation to fulfil this declaration of undertaking and to obey the laws of the country of @ (name of country). We also declare that our company/all members of the consortium has/have not been included in the list of sanctions of the United Nations, nor of the EU, nor of the German Government, nor in any other list of sanctions and affirm that our company/all members of the consortium will immediately inform the client and Funding Agency / Source if this situation should occur at a later stage.

We acknowledge that, in the event that our company (or a member of the consortium) is added to a list of sanctions that is legally binding on the client and/or Funding Agency / Source, the client is entitled to exclude our company/the consortium from the procurement procedure and, if the contract is awarded to our company/the consortium, to terminate the contract immediately if the statements made in the Declaration of Undertaking were objectively false or the reason for exclusion occurs after the Declaration of Undertaking has been issued.

..... (Place)..... (Date)

(Name of company)

(Signature(s))

⁶ See "Guidelines for the Assignment of Consultants in Financial Cooperation with Partner Countries" and "Guidelines for Procurement of Goods, Works and associated Services in Financial Cooperation with Partner Countries"

Annexure III - Deleted
Form CER
24 Quality Management / Environmental, Social, Health and Safety (ESHS) Certification

Bidder's Legal Name: _____ Date: _____
 Bidder's JV/CONSORTIUM Member name: _____ ICB No.: _____

DESCRIPTION	INFORMATION
Identification of the certificate	_____ [insert full name of the certificate]
First award date	_____ [insert day, month, year of first certificate award]
Last update of the certificate	_____ [insert day, month, year of latest renewal, if any]
Issuers Name	_____ [insert full name]
Address	_____ [insert street / number / town or city / country]
Telephone/fax number	_____ [insert phone/fax no., incl. country & city area codes]
E-mail	_____ [insert e-mail address, if available]
Compliance with international standards	The certificate is [ISO 9001, ISO 14001, OHSAS 18001] [select as appropriate] <div style="text-align: right;"><input type="checkbox"/> Yes / <input type="checkbox"/> No</div>
If no, proof of conformity with ISO standards by the Bidder	The Bidder shall provide a conformity assessment of its certificate by an internationally recognized Accredited Certification Body

The Bidder shall fill this Form for each Certification required under sub criteria 4.2(b) of Section III - Evaluation and Qualification Criteria

Maha Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

TENDER NO.

P1-T06/2021

PART I: BIDDING PROCEDURE

**Section V. Eligibility Criteria and Social and Environmental
responsibility**

Section V-A. Agency Policy - Corrupt and Fraudulent Practices

Section V. Eligibility Criteria and Social and Environmental responsibility

1. Natural or legal persons (including all members of a joint venture or any of their subcontractors) shall not be awarded contract if, on the date of submission of an application or of a bid or on the date of award of a contract, they:
 - i. are bankrupt or being wound up or ceasing their activities, are having their activities administered by the courts, have entered into receivership, or are in any analogous situation arising from a similar procedure;
 - ii. have been convicted within the past five years by court decision, which has the force of *res judicata* in the country where the project is implemented, of fraud or corruption or any other offence committed during the procurement or performance of a contract, unless they provide supporting information together with their Covenant of Integrity (Form available as Appendix to Letter of Bid) which shows that this conviction is not relevant in the context of this project;
 - iii. are listed for financial sanctions by the United Nations, the European Union and/or France for the purposes of fight against terrorist financing or threat to international peace and security;
 - iv. have committed serious professional misconduct within the past five years during the procurement or performance of a contract, as evidenced by any means by the Employer;
 - v. have not fulfilled their obligations regarding the payment of social security contributions or taxes in accordance with the legal provisions of Employer's country;
 - vi. have been convicted within the past five years by court decision, which has the force of *res judicata* of fraud or corruption or any other offence committed in contract procurement or performance;
 - vii. Are subject to an exclusion decision of the World Bank, and are listed on the website <http://www.worldbank.org/debarr>, unless they provide supporting information together with their Covenant of Integrity (Form available as Appendix to Letter of Bid)
 - viii. have committed misrepresentation in documentation requested by the Employer as part of the contract procurement procedure;

2. Bidders that are Government-owned enterprises or institutions may participate only if they can establish that they (i) are legally and financially autonomous (ii) operate under commercial law. To be eligible, a government-owned enterprise or institution shall establish to the Agency's satisfaction, through all relevant documents, including its Charter and other information the Agency may request, that it: (i) is a legal entity separate from their government (ii) does not currently receive substantial subsidies or budget support; (iii) operates like any commercial enterprise, and, inter alia, is not obliged to pass on its surplus to their government, can acquire rights and liabilities, borrow funds and be liable for repayment of its debts, and can be declared bankrupt.

3. In order to promote sustainable development, The Employer seeks to ensure that internationally recognised environmental and social standards are complied with. Candidates shall consequently undertake in the Covenant of Integrity to:
 - i. comply with and ensure that all their subcontractors comply with international environmental and labour standards, consistent with applicable law and regulations in the country of implementation of the Project, including the fundamental conventions of the International Labour Organisation (ILO) and international environmental treaties;
 - ii. adopt any environmental and social risk mitigations measures as defined in the environmental and social management plan or in the environmental and social impact notice issued by the Employer.

Section V-A. Agency Policy - Corrupt and Fraudulent Practices

1.1.1 Grounds for Exclusion

1.1.1.1 Bidders (either natural or legal persons including any of their subcontractors) shall not be awarded this contract if, on the date of submission of an application or of a bid or on the date of award of a contract, they have been the subject of a conviction by final judgment for one of the following reasons:

- a. where the bidder is bankrupt or is the subject of insolvency or winding-up proceedings, where its assets are being administered by a liquidator or by the court, where it is in an arrangement with creditors, where its business activities are suspended or it is in any analogous situation arising from a similar procedure under national laws and regulations;
- b. bidder have not fulfilled their obligations regarding the payment of social security contributions or taxes in accordance with the legal provisions of the country where they are established or the Employer's country.
- c. where the Employer can demonstrate by any appropriate means a violation by the bidder of applicable obligations in the fields of environmental, social and labour law established by national law, collective agreements or by the international environmental, social and labour law provisions;
- d. where the Employer has sufficiently plausible indications to conclude that the bidder has entered into agreements with other bidder(s) aimed at distorting competition;
- e. where the bidder has shown significant or persistent deficiencies in the performance of a substantive requirement under a prior public contract, a prior contract with the Employer or a prior concession contract which led to early termination of that prior contract, damages or other comparable sanctions;
- f. bidder have been convicted within the past five years by a court decision, which has the force of residential jurisdiction in the country where the project is implemented, of fraud or corruption or any other Prohibited Conduct committed during the procurement or performance of a contract, unless they provide supporting information together with their Covenant of Integrity which shows that this conviction is not relevant in the context of this project;
- g. bidder is listed for financial sanctions by the United Nations and /or European Union for the purposes of fight against terrorist financing or threat to international peace and security;
- h. bidder including JV/ Consortium members should not be excluded by the EU Institutions or any major Multilateral Development Bank (including World Bank Group, African Development Bank, Asian Infrastructure Investment Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank or Inter-American Development Bank) from participation in a tendering procedure on the grounds of Prohibited Conduct as defined in the Covenant of Integrity.
- i. where the Employer can demonstrate by appropriate means that the bidder is guilty of grave professional misconduct, which renders its integrity questionable;
- j. where a conflict of interest within the meaning of Sub-Clause 4.2 in ITB cannot be effectively remedied by other less intrusive measures;
- k. where a distortion of competition from the prior involvement of the bidder in the preparation of the procurement procedure, as referred to in Sub-Clause 3.1 in ITB, cannot be remedied by other, less intrusive measures;
- l. where the bidder has been guilty of serious misrepresentation in supplying the information required for the verification of the absence of grounds for exclusion or the fulfilment of the selection criteria, has withheld such information or is not able to submit the supporting documents required pursuant to sub-clause BDS ITB 4.18; or
- m. where the bidder has undertaken to unduly influence the decision-making process of the Employer, to obtain confidential information that may confer upon its undue advantages in the procurement procedure or to negligently provide misleading information that may have a material influence on decisions concerning exclusion, selection or award.

1.1.1.2 Notwithstanding point (a) of Sub-Clause 1.1.1.1 above, Employer might not exclude a bidder which is in one of the situations referred to in that point, where the Employer has established that the bidder in question will be able to perform the contract, taking into account the applicable national rules and measures on the continuation of business in the case of the situations referred to in point (a).

- 1.1.1.3 Any bidder that is in one of the situations referred to in the above paragraph may provide evidence to the effect that measures taken by the bidder are sufficient to demonstrate its reliability despite the existence of a relevant ground for exclusion. If such evidence is considered as sufficient, the bidder concerned will not be excluded from the procurement procedure.
- 1.1.1.4 For this purpose, the bidder shall prove that it has paid or undertaken to pay compensation in respect of any damage caused by the criminal offence or misconduct, clarified the facts and circumstances in a comprehensive manner by actively collaborating with the investigating authorities and taken concrete technical, organizational and personnel measures that are appropriate to prevent further criminal offences or misconduct.
- 1.1.1.5 The measures taken by the bidder will be evaluated taking into account the gravity and particular circumstances of the criminal offence or misconduct. Where the measures are considered to be insufficient, the bidder shall receive a statement of the reasons for that decision.
- 1.1.1.6 Bidders will also be required to confirm and declare that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other items of work related to the award and performance of this contract.
- 1.1.2 Prohibited Conduct
- 1.1.2.1 In pursuance of the Funding Agency's (EIB's) Anti-Fraud Policy (refer <http://www.eib.org/en/infocentre/publications/all/anti-fraud-policy.htm>), Prohibited Conduct includes corruption, fraud, coercion, collusion, obstruction, money laundering and financing of terrorism defined as follows:
- a. A corrupt practice, is the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party.
 - b. A fraudulent practice, is any act or omission, including a misrepresentation that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation.
 - c. A coercive practice, is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party.
 - d. A collusive practice, is an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.
 - e. An obstructive practice is (a) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or (b) acts intended to materially impede the exercise of the EIB's contractual rights of audit or access to information or the rights that any banking, regulatory or examining authority or other equivalent body of the European Union or of its Member States may have in accordance with any law, regulation or treaty or pursuant to any agreement into which the EIB has entered in order to implement such law, regulation or treaty.
 - f. Money laundering is,
 - i. the conversion or transfer of property, knowing that such property is derived from criminal activity or from an act of participation in such activity, for the purpose of concealing or disguising the illicit origin of the property or of assisting any person who is involved in the commission of such activity to evade the legal consequences of his action;
 - ii. the concealment or disguise of the true nature, source, location, disposition, movement, rights with respect to, or ownership of property, knowing that such property is derived from criminal activity or from an act of participation in such activity;
 - iii. the acquisition, possession or use of property, knowing, at the time of receipt, that such property was derived from criminal activity or from an act of participation in such activity;
 - iv. participation in, association to commit, attempts to commit and aiding, abetting, facilitating and counselling the commission of any of the actions mentioned in the foregoing points.
 - g. Financing of terrorism is the provision or collection of funds, by any means, directly or indirectly, with the intention that they should be used or in the knowledge that they are to be used, in full or in part, in order to carry out any of the offences within the meaning of Articles 1 to 4 of the Council Framework Decision 2002/475/JHA of 13 June 2002 on combating terrorism.
- 1.1.2.2 The Employer will declare a firm ineligible, either indefinitely or for a stated period of time, for any Employer's contract, if at any time determines that the firm has engaged in Prohibited Conduct in competing for, or in executing, a borrowed financed contract in general.
- 1.1.3 Each Bidder (each member in the case of joint venture or consortium or partnership) is required to confirm and declare with their Tender that they (as the case may be) have not

engaged in any fraudulent and corrupt practice as defined in 1.1.2.1 above and that no agent, middleman or any intermediary has been, or will be, engaged to provide any services, or any other item or work related to the award and performance of this Contract and declare that no agency commission or any payment which may be construed as an agency commission has been, or will be, paid and that the tender price will not include any such amount. To fulfil this requirement, the Bidder (each member in case of JV / Consortium) shall sign and execute the Covenant of Integrity given as Appendix - XX and the declaration given as Appendix - YY.

If the Employer subsequently finds these has not been provided, the Employer reserves the right to declare the Bidder as non-compliant and declare any Contract if already awarded to the Bidder to be null and void.

- 1.1.4 The Bidder/Contractor grant the Employer, the Funding Agencies and auditors appointed by either of them, as well as any authority or European Union Institution or body having competence under European Union law, the right to inspect and copy the books and records of the bidder, contractor, supplier or consultant.
- 1.1.5 Canvassing or offer of an advantage or any other inducement by any person with a view to influencing acceptance of a Tender will be an offence under laws of India. Such action will result in the rejection of the Tender, in addition to other punitive measures.
- 1.1.6 If it is established to the required standards that a project-related party has engaged in Prohibited Conduct in the course of a procurement process or implementation of a contract to be financed, the Funding Agency:
 - a. may seek appropriate remediation of the Prohibited Conduct to its satisfaction;
 - b. may declare ineligible such project-related party to be awarded the contract; and/or
 - c. may withhold the Funding Agency's no objection to contract award and may apply appropriate contractual remedies, which may include suspension and cancellation, unless the Prohibited Conduct has been dealt with to the satisfaction of the Funding Agency.
- 1.1.7 Furthermore, within the framework of the Funding Agency's Exclusion Policy (see the EIB's Exclusion Policy: <https://www.eib.org/en/publications/exclusion-policy.htm>), the Funding Agency may declare such project related party ineligible to be awarded a contract under any EIB project or to enter into any relationship with the Funding Agency.

Maha Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

TENDER NO.

P1-T06/2021

PART I: BIDDING PROCEDURE

SECTION VI: PRICING DOCUMENT / BOQ

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PART 1 - GENERAL PRINCIPLES

SECTION 1 PREAMBLE

1.1 General Requirements

The Bidder's attention is drawn to the General Conditions and Particular Conditions of Contract, Employers Requirements and Drawings, which are to be read in conjunction with the Bill of Quantities. This Preamble shall serve as a definitive guide to the measurement of quantities and payment.

The Bidder should quote the rates considering that this contract is on Turnkey basis. This Contract is a re-measurement (unit rate) Contract for **Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.**

The scope of work includes, but not limited to:

Mainline on viaduct and Underground including Ramp: [Reach-3 and Reach 4]

- Rails, Turnout and fastenings system shall be supplied by the Employer. The Contractor will make arrangements for mechanised handling and transportation of all materials (including the materials supplied by the Employer) to the site of work.
- The designs shall comply with Procedure for Safety Certification and Technical Clearance of Metro Systems (December 2015) on Metro Railways/MRTS system issued by M.O.R, Govt. of India unless instructed by Employer.
- Detailed design for track geometry for horizontal and vertical track alignment based on civil GAD for Reach-4, Design of plinth/slab for main line and Turnout Track structure on viaduct and Underground with and without MSS.
- The Track Structure and the fastening used shall be designed as to minimise the noise and vibration generated by the moving train on the Track. The Contractor shall interface with the concerned designated contractors, particularly the Rolling stock supplier, limit vehicle included noise and ground - borne vibration in structures in the vicinity of Railway alignment to acceptable level, as per legal and statutory requirement of India. The Contractor shall spell out the codal, legal and statutory provisions in this regard and justify that his design and proposal are in conformity with stipulations.
- Special noise and vibration mitigation measures (Mass Spring System) will be taken at selected locations in elevated sections as instructed by Employer.
- Setting-out final alignment.
- Welding of UIC 60 IRS-T-12-2009, 880 grade Rails and UIC 60, 1080 grade head hardened Rails using the specified Welding techniques.
- Provisions of shear connector, wherever required, between 1st pour and 2nd pour reinforced concrete for Ballastless Track.
- Laying of Ballastless plain Track on reinforced concrete plinth/RCC slab and Ballastless Turnout on RCC slab, installing Track fastener system, turn-outs, De-Railing switches, buffer stops, check Rails etc. to the stipulated tolerances on the running lines.
- Testing of components and installation methods.
- The Contractor shall carry out Reliability, Availability, Maintainability & Safety (RAMS) Study for Trackwork taking into account design of Track Plinths, Rails, Turnout, Fastening System, Weldings, Check Rails etc. The Ballastless Track shall be designed and constructed to meet the following RAMS targets during O&M Phase:
 - a. Reliability: The equipment being continuously in operation and shall achieve MTBSAF (Mean Time Between Service Affecting Failures) of no less than 5000 hours between any failures affecting the revenue train service.

- b. Availability: The equipment being continuously in use and achieving a minimum operating availability of 99.98%.
- c. Maintainability: The maintainability measure for the Track system shall be Mean Time To Restore (MTTR) and shall not be greater than 30 mins.
- d. Safety: The system shall provide the safe operation of train movements. The SIL 4 shall be maintained. Hazardous event shall not occur with a greater frequency than 1 in 104 years (as per latest version of IEC 61508-1).

- 1.2 Quantities:** - For the purpose of this Contract, all unit quantities given in the Bill of Quantities are the estimated quantities of the Works and are intended in the first instance to provide a common basis for Tendering and Tender Evaluation. When a contract has been entered into, the function of priced Bill of Quantities is to provide for the valuation of the work executed. No alteration of any rate or price shall be allowed on account of any difference between the quantities executed and the quantities measured from the drawings.

The Bidder shall make himself completely acquainted with all conditions, obligations, design, specifications, drawings, etc. of the Tender Documents before giving his prices. He shall have no right to claim any price revision on the basis of ignorance of the Tender documents or local conditions, or to make any claims as regards the integrity of the unit prices of the Bill of Quantities.

- 1.3 Units and Currency:** - All sizes and quantities entered in the Bill of Quantities are in metric units.

The Bidder shall fill in each column with unit rate or lump sum, whichever the case may be, for each bill item of the various Bills, provided that he should consider it a reimbursable item, on the basis of the Tender Documents and pre-tender survey. All rates shall be quoted in INR only.

1.3.1 Rates and Sums to be for Work Complete

Bidders shall be deemed to have read the Employer's Requirements and other parts of the Tender Documents and reviewed the Drawings to ascertain the full scope of the requirements included in each item prior to filling in the rates and prices. The entered rates and prices shall be deemed to include for the full scope of the Contract, including overheads and profits and shall bear a proper relationship to the cost of carrying out the work described.

Notwithstanding any limits that maybe implied by the wording of the individual items and/or the explanations in the Preamble, the rates and sums, which the Bidder enters in the Bill of Quantities shall be for the work finished complete in every respect.

The Bidder shall be deemed to have taken full account of all requirements, liabilities, obligations and risks, whether expressed or implied, and to have priced the items accordingly. The Items in the Bill of Quantities are the only items against which payment will be made. The cost of any item of work not specifically described or measured in the Bills of Quantities but required for the execution of the Contract shall be allowed for in the unit rates for the measured items in the Bills of Quantities. The rates and sums shall therefore include for all incidental and contingent expenses and risks of every kind necessary to supply, install, test and commission (including Integrated Testing and Commissioning) complete, and remedying any defects in the whole of the Works in accordance with the Contract.

1.3.2 Allowances in rates

Full allowance shall be made in the rates and sums against the various items in the Bills of Quantities for all costs involved including Contractor's profit, overheads and all type of risk and incidental charges in performing the following except to the extent that work is specifically described and paid for in the Bills of Quantities. The list below is not exhaustive, and the Bidders are expected to take all costs involved while quoting the rates that will not be subject to variation on any account.

- a) All setting out and survey work;
- b) Complete design & installation of Rail Plinth/slab of elevated Viaduct and Underground for up & down main line Track and depot Track on ramp acceptable to Railway Board / RDSO and other regulatory authorities.
- c) Temporary access roads and bridges, fencing, watching, lighting;

- d) Paying statutory fees and giving notices to Authorities;
- e) Payment of all patent rights and royalties;
- f) Reinstatement of the Site;
- g) Safety precautions and all measures to prevent erosion and suppress fire and other hazards;
- h) Interference to the Works by persons, vehicles, and the like being legitimate users of the facilities on or in the vicinity of the Site;
- i) The protection and safety of **Maharashtra Metro Rail Corporation Limited** trains & services;
- j) Supplying, maintaining and removing on completion the Contractors own accommodation, offices, Depot, stores, workshops, transport, welfare services and other facilities including telephones and facsimile machines and all charges in connection therewith;
- k) The supply, inspection, testing, packaging handling and transportation of materials and of the Works as specified including the provision and use of equipment and arrangements for the Engineer's Inspectors and others;
- l) Maintaining public thoroughfares and footpaths and maintaining access upon existing recognized routes;
- m) Providing, transporting to the Site, setting to work, operating (including all fuel and consumable stores), maintaining and removing from the Site upon completion all Construction Plant and Contractor's Equipment & machinery necessary for the execution of the Works and including the cost of all tests and other requirements in respect of such plant and equipment & machinery;
- n) Working adjacent to or across existing services and installations;
- o) Complying with the requirements of the Employer in regard to Safety and Health. Quality Assurance, Environmental, and project implementation plan;
- p) Co-ordination and interference to the works by the works of Designated contractors and others employed by **Maharashtra Metro Rail Corporation Limited** being legitimate users of the facilities on or in the vicinity of the Site;
- q) Remedying of defects and works of amendment, reconstruction, replacement of other faults, fair wear and tear excepted, during Defects Liability Periods
- r) Protections to be implemented against Electromagnetic interference effects following line energization;
- s) Insurance, including all risks in supply, erection, storage, transit, third party, Workmen's Compensation and others;
- t) All tools, equipment and other arrangement required for all tests prior and after delivery, and for testing and commissioning installed systems including for CRS inspection;
- u) Carrying out all modifications to the given drawings, preparing detailed construction drawings and supplying originals, copies, all mandatory documents of design, installation, CWP construction works procedure etc, and electronic files in accordance with Employer's Requirements. Also, the contractor shall provide soft copies (photos and videos) of all event of installation activity in chronological order as per requirement of employer. Carrying out design and laying of Track and witness of factory tests.

1.3.3 Non-priced Items

Items against which no rate or sum is entered by the Bidder, whether quantities are stated or not shall be regarded as covered by other rates in the Bills of Quantities. For such items rates, considered to be quoted by the bidders shall be zero.

1.3.4 Tender Pricing

The Bidder shall take regard of the actual site conditions and the estimated quantities entered in the various bills. The Bidder shall price his tender accordingly and the unit prices entered against a bill line item shall be the full and only price paid for all works performed against that item except as described in the Tender Documents.

The Bidder shall price the Bills of Quantities in Indian Rupees only.

1.3.5 Measurement and Payment

- 1) This Contract is primarily a re-measure contract with items that are described herein. For the re measure items the total price to be paid for a work item will be as per quantities actually performed.
- 2) The measurement and payment described is for the purpose of making a valuation of the work acceptable to the Engineer, and Interim Payments to the Contractor, as work proceeds. The works as executed will be measured for assessment of progress for interim payments in

accordance with the method adopted in the Specification, the Bills of Quantities and under the items as set forth notwithstanding any custom to the contrary.

- 3) Building works will be measured in accordance with the local practice as proposed by the Contractor and accepted & approved by the Engineer For the measurement of “Numbers” and “Sets” these shall be by count, using dimensions and contents as described in the specifications/BOQ.
- 4) Notwithstanding anything stated herein the Engineer retains the right to withhold payment on any item due for payment when the service to be performed is not performed or is not carried out to the Engineer’s satisfaction.
- 5) Prices for plans, programmes, documents, drawings, design calculations, test procedures, interface co-ordination documents, and the like for review by the Engineer shall be the full compensation for documents and the like in accordance with the specifications. Compensation shall include for the preparation, testing, design, submission, and all subsequent revisions, changes required and re-submittals as necessary as required by the design/specifications until accepted by the Engineer. Payment will be made for the plans, programmes, etc. accepted and approved by the Engineer. Subsequent payments of the same items will be made on acceptance by the Engineer of evidence that the Contractor has actively maintained and complied with the approved plans and procedures, etc., including provision of revisions and changes as required by the Engineer since the previous payment for the same item.
- 6) Prices for integrated Testing and Commissioning shall be full compensation for the integrated testing and commissioning of Track work under the Contract in accordance with the drawings and specifications. Compensation shall include for preparation, submittal, and revisions as required by the Engineer of testing plans and procedures; co-ordination with other Designated Contractors; conduct of approved tests as directed by the Engineer on installations, revisions, re-testing, fault finding, adjustments & reworking as necessary; submittal of all test reports and other documents all to the approval of the Engineer. Payment will be made for each Section after certification by the Contractor and acceptance of the Engineer that the Track works have successfully completed the test procedures and have been set-to work and all test results and other documentation; have been approved by the Engineer.
- 7) Prices for As-Built drawings shall be full compensation for the provision of As-Built drawings in accordance with the specifications. Compensation shall include for the preparation, submission and all subsequent revisions, changes required and re-submittals as necessary as required by the specifications until accepted by the Engineer. Payment shall be made when all the As-Built drawings have been reviewed and accepted by the Engineer.
- 8) Prices for supply terms shall be for the full compensation for supplying the items in accordance with the drawings and specifications. Compensation shall include for all costs incurred in procurement/manufacture, testing, inspection, shipping, hauling, loading/unloading, handling/re-handling & transportation by all means & storing at site in **Pune Metro Rail Project**. Payment will be made for the items delivered and stored in a place and manner approved by the Engineer. Payment will be made on the basis of delivery to the approved Depot under the joint custody of the contractor and engineer in **Pune Metro Rail Project**, The Depot will be set up by the contractor on his own cost. Receipt note will be signed by both the authorized representative of engineer & the contractor and integrated testing and commissioning as certified by the Engineer and as covered in BOQ. Payment on delivery will be made against the following documents:

- Certificate of all tests and inspections in accordance with the Employer’s Requirements;
- Proof of insurance; and
- Technical literature and manual.

Prices for installation items of Track work shall be for the full compensation for the installation of Track work in accordance with the drawings & specifications. Compensation shall include for all costs incurred for transporting to location, handling of all materials up to point of installation, survey, temporary work, form work, preparing for installation/erection and mounting, aligning, fastenings and securing devices; adjusting as necessary, making good and clearing the location on completion, all to the approval of the Engineer. Shall include testing and commissioning of all Track work forming the Works in accordance with the specifications. Payment will be made after certification by the Contractor and acceptance by the Engineer that the Track works have successfully been completed and the

test procedures, have been set-to-work & that all test results & other documentation, as described in the specifications, have been approved by the Engineer.

However, the Contractor shall be entitled for the part payment (percentage rate of the applicable BOQ items), as per attached part payment schedule of BOQ.

2. EXPLANATORY NOTES OF BOQ

The item description is intended to briefly describe the work to be performed under that item and to identify associated work. It is not a full and complete description of the work to be performed and the Contractor shall carry out all the work necessary to meet the requirements of the Specification.

The Bills of Quantity for Standard Gauge for the mainline, Underground & ramp of Reach-3 and Reach-4 have been split into the following parts:

- 2.1 General Requirements including Design (G1)
- 2.2 Installation of Ballastless Track (BLT1)
- 2.3 Deleted
- 2.4 Provision of Check Rail on sharp curve (CR1)
- 2.5 Miscellaneous items M1
- 2.6 Supply of Maintenance Equipment's & Other P. Way Materials (SPM1)

2.1 Bill No. G1 General Requirement

2.1.1 Item 1 to 2: Plans (as per Appendix 4 of GS)

Item 1: Plan submission & approval

Item 1.1: Quality Assurance System Plan (QASP)

This item shall cover the QASP as specified in the Employer's Requirements. It shall essentially include, but not limited to:

Quality manual;
Work instructions;

The price shall also include the QASP development, maintenance and implementation as well as cost of document originals, 5 copies, and electronic files.

Item 1.2: Health & Safety Management Plan (HSMP)

This item shall cover the HSMP as specified in the Employer's Requirements. It shall essentially include, but not limited to:

Health & Safety manual;
Site safety plan;
Risks assessments;
Method statements.

The price shall also include the HSMP development, maintenance and implementation as well as cost of documents originals, 5 copies, and electronic files.

Item 1.3: Environmental Plan

This item shall cover the Environmental Plan as specified in the Employer's Requirements. It shall essentially include, but not limited to:

Environmental Management plan;
Environmental Mitigation plan;

The price shall also include the plan development, maintenance and implementation as well as cost of documents originals, 5 copies, and electronic files.

Item 1.4: Project Implementation Plan including Method Statements as per Scope of Work

This item shall cover the Project Implementation plan as specified in the Employer's Requirements. It shall essentially include but not limited to:

Project implementation plan including works programme;
Interface management plan;
Procurement and manufacturing plan;
Installation plan;

The price shall also include the plan development, maintenance and implementation as well as cost of document originals, 5 copies, and electronic files.

Item 1.5: Inspection and Testing Procedure Plan

This item shall cover the Testing Procedure Plan including integrated testing and commissioning as specified in the Employer's Requirements Chapter 3 and Chapter 8 of General Specifications. It shall essentially include but not limited to the details of tests to be carried out and the procedures and acceptable values to perform them. The price shall also include the plan development, maintenance and implementation as well as cost of documents originals, 5 copies, and electronic files.

Item 1.6: Design of Rail plinth/ slab Track structure on Viaduct and Underground

Bidder need to design optimal design of Rail Plinth so as to carry trains at maximum permissible speed safely. The Rail plinth to take all forces Viaduct and Underground structure is subjected to including CWR forces. The Rails must be continuous Welded Rails for the entire section between Civil Court to Ramwadi and Range Hill to Swargate including passing through Turnout. Preparation of GFC and interface with other System contractors. This item also includes Submission of design note. Design of Rail plinth including forces exerted by Viaduct bearings, CWR, earthquake, wind & rain, etc. All design & document as needed by RB/RDSO to be submitted to **Maharashtra Metro Rail Corporation Limited**.

The price shall include the cost as per Employer's Requirements, mainly consisting, but not limited to the following:

- Prepare and submit technical reports and recommendations for detailed design for track geometry for horizontal and vertical track alignment based on civil GAD for Reach-4.
- Design of Track plinth / slab for Viaduct and Underground, restraint of lateral forces, restraint of longitudinal Rail forces, electrical resistance under wet conditions, mechanical endurance / fatigue resistance under repeated load applications, construction techniques, mechanization and other special considerations, concrete Track bed in Turnout and crossings, transitions and expansion joints, Rail structure interaction forces
- Interfacing with signaling contractor for electrical isolation for signaling Track circuits, electrical insulation levels etc., to be maintained.
- Design of Track slab at the sensitive locations identified by the Employer.

Item 2: As Built Drawings

The Price under this item shall include the cost of supplying As-Built drawings, as specified in the Tender Document. The As-built drawings shall be submitted as per General Specification in original, 5 copies (laminated) and electronic files.

2.2 Bill No. BLT1: Installation of Ballastless Track for Main Line on Viaduct, Underground & Ramp

Item 1A of BLT1.A and BLT1.B : Laying plinth and installation of Track work for plain Track with UIC 60 kg HH Rail with all fittings and fastenings etc. complete with all respect on Viaduct and Underground. (Rails, fittings and fastenings shall be supplied free by Maha-Metro.)

The Price of item No 1(a) shall include design mentioned in item 1.6 of 2.1 Bill G1 and complete laying of Track, on reinforced concrete plinth/Slab as per approved GFC mainly consisting of but not limited to the following:

- Design of Track Structure to suit proposed Ballastless Track Fittings and Maharashtra Metro Rail Corporation Limited requirements.
- Minimum Height of Track Structure including height of fitting, Rail and plinth/slab must be in 401 mm (185+216 mm) above FFL of Viaduct for cast in situ plinth. Standard Height of Track Structure including height of fitting, Rail and plinth/slab must be in 467 mm (251+216 mm) above FFL of Viaduct for cast in situ plinth. Further refer relevant clause of ITT which limits major deviation.
- Cost of survey and setting out including cost of deployment of all survey equipment, pegging markers, reference markers etc.
- Increase in height of corresponding concrete plinth for the other Rail due to super elevation is also covered in the rate. Maintaining minimum plinth depth of 401 mm (185+216 mm), incase as per site conditions if the contractor has to cast the plinth as per designed Rail level upto 550 +50mm plinth depth, for which no payment will be entertained for the extra quantity of concrete/steel involved. The extra quantity for plinth depth over and above 550+50mm will be paid extra as per item no. item 5 of BLT1A. Plinth concrete shall be measured based on linear length of cast plinth.
- Loading, handling/re-handling, transportation and unloading of all materials (including the materials supplied by the employer including all Rails, Turnout, fastenings etc) from its stacking place to site including cost of deployment of plant, equipment & machinery.

- Loading, handling/re-handling, transportation and unloading of pre-cast plinth/slab from its casting yard to site and installation at locations advised by the engineer, including cost of deployment of plant, equipment & machinery.
- Cost of steel reinforcement as per Rail plinth design by contractor.
- Cost of all temporary works including service/temporary Track & permanent works etc. to carry out the work.
- Setting up of formwork, false work including deployment of all equipment, plant & machinery and cost of Track supporting work including jigs and fixtures.
- Assembling and laying of Track with all fittings & fastenings including Glued Insulated Joints, Rail Expansion Joints (REJ) etc. complete.
- Transportation, lifting and shifting of Mobile Flash Butt Welding Plant with all accessories as per the approved Welding Plan.
- Rear work shall be carried on cast plinth repairing and attending all blow holes, honey combs etc. to obtain proper finishing as per IS specifications. The repairing during rear work shall be carried out as per approved procedure with approved material. All anchor bolts are to be checked for its looseness and are to be attended as per approved methodology and material. all the shuttering plate and GSF/fixtures used for plinth casting shall be attended, rectified/replaced periodically to obtain geometry and finishing.
- Rear work, final parameter and De-stressing of the CWR and final fastening down of Track including cost of deployment of necessary tools & equipment to comply with Track tolerances.
- Cost of supply & installation of all temporary/permanent markers, signage boards for all tracks-U/L, D/L, Sidings, Pocket track etc. including paint markers on Rail.
- Cost of cutting, drilling, jointing, except Rail Welded joints, Cost of all Rail Welding shall not be included in this item and shall be paid separately under the item of Rail Welding.
- Provision of Track drainage PVC pipes, as per Employer's Requirements.
- Inspection, measurement and acceptance tests.
- Cost of handling /re-handling, transportation/placement of Rail panels of all lengths at all height.
- Cost of earthing, reinforcement (20mm dia plain MS bar), as per **Maharashtra Metro Rail Corporation Limited** design.
- Shear connectors are coated with epoxy coating. Rate quoted shall include the cost of repairing the damaged coating if any, on the shear connectors. No separate payment will be made for the repair work done on coating on shear connectors.
- Detailed documentation and records. The payment of this item shall be made to the contractor after completion of all works required for making the Track to final form including compliance to laying tolerances
- Design, Procurement and Fixing of signs and markers
- Assembling the Track as per the approved design co-ordinates with Track master device or any other approved method and laying of Track with all fittings & fastenings including Glued Insulated Joints, etc. complete.
- Cost of RCC, supply & Welding of M.S. Plate to the slab reinforcement, connecting with approved copper/aluminum cables with M.S. Plates for electrical continuity.
- Installation of stray current collection mat including all Welding work, installation of MS strip connecting (with Welded connection) all nominated rebars, earth point (for connection to structure earth cable)
- Anti-corrosive Painting of Rails as per Employers requirement (shall be paid extra as mentioned in item no 6).
- Cost of drilling, chamfering etc. (in the running Rails) for cable connections, as required by S&T and Power Supply Contractors.
- As built checking to comply with Employers requirement, rectifying the deviations if any by the approved method statements.

The above cost shall also consider the following:

Item No.1A & 2 (a): Shear Connector already provided.

Item No.1A & 2 (b): Rates over and above 1(a) if, Shear Connector to be provided by contractor.

Item No.1A & 2 (c): Rates over and above 1(a) if reinforced shear key to be provided by contractor on viaduct as per approved design:

The price of item includes mainly consisting but not limited to the following:

- Design of reinforced shear key to withstand lateral forces exerted by plinth /slab and transfer it to viaduct structure safely.
- Connection of shear key to viaduct shall be by providing suitable no. of shear connector in shear key area as per design.
- Size of shear key has been given in the tender drawing (60*60*100mm) and it will be provided as per design requirement at site.

Loading, handling/re-handling, transportation and unloading of all materials \ from stock area to site including cost of deployment of machinery.

Setting up of formwork, false work including deployment of machinery.

Fixing of reinforcement for shear key.

Cost of RCC & Shear Connector including installation of shear connector by approved epoxy grouting, transportation and placing of RCC, its compaction, removal of form work and curing.

Grade of Concrete - M-35 and Grade of Steel for reinforcement in shear key and for shear connector-Fe-500D. The Steel, Cement and Admixture must be used as per approved list of Maharashtra Metro Rail Corporation Limited.

If concreting is from existing Batching plant, the batching plant must be exclusively nominated for Pune Metro work and work to be carried out in the batching plant as per approved Metro quality procedure and mix design. Use of SCC (Self compacting concrete) is the preferred choice for second pour concrete.) with the prior approval of Engineer.

Typical drawing of shear connector has been given in tender drawing (Part-IV) and epoxy grout & Welding with BOX Girder shall be used for fixing these in the viaduct.

Inspection, measurement, and acceptance tests.

Detailed documentation and records.

Item 1B of BLT1.A and BLT1.B: Same as Item No. 1A except that Track plinth/slab shall be precast. Precast Track plinth/slab shall be cast in precast yard and transported to site. Precast Track plinth/slab shall be stitched at site as per methodology proposed by contractor and approved by Engineer/MahaMetro. The item includes removing the shear connectors already provided by Civil Contractor if required.

Item No.2 of BLT1.A: Laying plinth / RCC Slab and installation of Turnout with UIC 60 head hardened Rail with all fittings and fastenings etc. complete in all respect for Viaduct and Underground. (Rails, fittings, and fastenings shall be supplied free by Maha-Metro.)

Item No.2.1: 1 in 9, R-300m Turnout (For Viaduct)

Item No.2.2: 1 in 9, R-190m Turnout

Item No.2.3: 1 in 7, R-190, Turnout on Viaduct

The Price shall include complete laying of Turnout on reinforced concrete plinth or slab (including steel and concrete) as per Employer's Requirements and drawings mainly consisting but not limited to the following:

Cost of survey and setting out including cost of deployment of all survey equipment, pegging markers, reference markers etc.

Loading, handling/re-handling, transportation, and unloading of all materials (including the materials supplied by the employer) from stock area to site including cost of deployment of plant, equipment & machinery. Turnouts (free issue) in knock down condition shall be taken over by the contractor as and when handed over by the Employer.

Cost of all temporary works including service/temporary Track & permanent works etc. to carry out the work.

Setting up of formwork, false work including deployment of all equipment, plant & machinery and cost of Track supporting work including jigs and fixtures.

Fixing of reinforcement for plinth.

Assembling and laying of Turnout with all fittings & fastenings including glued insulated joints etc. complete.

Cost of slab/plinth, supply & Welding of M.S. Plates to the slab reinforcement, with supply of galvanized M.S Plates with holes for electrical continuity.

- Providing cement concrete ramp of slope 1:12 (Top of Turnout slab / plinth to top of viaduct) at Turnout and crossover location along walkway to passengers for emergency evacuation with proper finishing.
- Concreting under the base plates upto 25mm and carrying out Epoxy grouting under the base plates up to 25mm with contractor's epoxy based grouting material approved by the Engineer duly ensuring correct alignment and level by grinding the top surface of epoxy.

Cost of cutting, drilling, jointing, except Rail Welded joints.

Cost of all Rail Welding shall not be included in this item and shall be paid separately under the item of Rail Welding.

Provision of Track drainage as per Employer's requirements and drawings.

Inspection, measurement and acceptance tests.

Detailed documentation and records.

Cost of earthing, reinforcement as per **Maharashtra Metro Rail Corporation Limited** design.

Cost of supply and fixating of shear connectors.

- Fixing of reinforcement for RCC slab as per the approved design.
- Installation of **stray current** collection mat including all Welding work (with the already provided shear connectors and others), installation of MS strip connecting (with Welded connection) all nominated rebars, earth point (for connection to structure earth cable).
- Incorporation of Turnout in CWR including cost of deployment of necessary equipment.
- Design, Procurement and Fixing of signs and markers.
- Cost of drilling, chamfering etc. (in the running Rails) for cable connections, as required by S&T and Power Supply Contractors
- Cost of mounting arrangement of S&T fixtures and point operating mechanism including second drive (in case of 1 in 9 turn out).

In case of Turnout - scope of work from SRJ (Stock Rail Joint) to BOC (Back of Crossing).

In case of crossover- scope of work from SRJ (Stock Rail Joint) to SRJ (Stock Rail Joint).

In case Scissor - Scope of work from SRJ (Stock Rail Joint) to SRJ (Stock Rail Joint) in both lines and complete diamond portion including normal Track between main line crossings and obtuse / acute crossings.

Item No.2.4 of BLT1A & Item No. 2 of BLT 1B: Point Clamps for turnout (60E1 Rail)

The cost of supplying & installation of Point clamps as instructed by the Employer.

Item 3 of BLT1.A : Supply & Installation of hybrid buffer stop having combination of sliding friction type and hydraulic type for elevated viaduct on 60E1 rail of standard gauge ballastless track.

Item 3.1: Supply of buffer stop of 40kmph Speed Potential

The price shall include the cost of design, manufacturing, inspection, testing and transportation (loading & unloading) of buffer stop to the site as per Employer's Requirements.

Item 3.2: Installation of buffer stops of 25 kmph/40kmph Speed Potential

The price shall include the cost of installation of buffer stop as per Employer's Requirements mainly consisting but not limited to the following:

Loading, handling / re-handling, transportation, and unloading of all materials from stock area to site including cost of deployment of plant, equipment & machinery.

Installation of the buffer stops with all fittings, fastenings and red luminous stickers etc. complete including torque testing along with installation certificate by manufacturer.

Inspection by manufacturer after installation of buffer stops at its final location.

Item 3 of BLT1.B : Installation of buffer stops of 25 kmph Speed Potential

The price shall include the cost of installation of buffer stop as per Employer's Requirements mainly consisting but not limited to the following:

Loading, handling / re-handling, transportation, and unloading of all materials from stock area to site including cost of deployment of plant, equipment & machinery.

Installation of the buffer stops with all fittings, fastenings and red luminous stickers etc. complete including torque testing along with installation certificate by manufacturer.

Inspection by manufacturer after installation of buffer stops at its final location.

Item 4 of BLT1.A and BLT1.B: Rail Welding**Item 4.1: Flash butt Welds**

The prices shall include carrying out of flash butt Welding of UIC 60 1080 grade, Head hardened Rails as per Employer's Requirements consisting of but not limited to the following:

Cost of arrangements including temporary arrangements, deployment/ redeployment of mobile flash butt Welding plant at the site of work. Such Welds must be carried out with FB plant having provision for air quenching so as to achieve the properties of the joint similar to HH Rail.

- Cost to include engagement of RDSO certified Welders for carrying out FB/AT Welding.

Cost involved in statutory fee from RDSO for approval of the Welding scheme.

Cost of operation, fuel, staffing, maintenance etc. complete for the plant.

Cost of cutting, straightening (pre-Weld and post Weld).

Cost of post Weld treatment.

Cost of carrying out all inspection and acceptance tests (as per latest FB Welding manual) at locations/labs nominated by RDSO including transportation, test Welds including 3rd Party (approved by RDSO) USFD Testing for all Welds. This shall include deployment of all necessary equipment, plant, machinery & staffing.

Cost of all labour, lead, lift, lifting tools, equipment and other related expenses.

Cost of re-testing and re-placement of defective Weld and associated Rail length.

Cost of handling/re-handling, transportation, placement of Rails for the purpose of Welding.

The payment under this item shall be made to the contractor only for the number of finished and accepted Welds in the Track.

Item 4.2: Carrying out of Alumino-Thermic Welding

The price shall include carrying out of Alumino-Thermic Welding of UIC 60, 1080 grade, Head hardened Rails as per Employer's Requirements, consisting but not limited to the following:

Cost of Welding material and equipment as per specifications including handling, transportation, loading, unloading, stacking/storing up to project site/work site.

Cost of carrying out all inspection and acceptance tests (as per latest FB Welding manual) at locations/labs nominated by RDSO including transportation, test Welds including 3rd Party (approved by RDSO) USFD Testing for all Welds. This shall include deployment of all necessary equipment, plant and machinery & staffing.

Cost of post Weld treatment.

Cost of cutting of Rails, cost of protective coating of AT Welds as per AT Weld manual and all labour, lead, lift, tools, equipment and other related expenses.

Cost of re-testing and re-placement of defective Weld and associated Rail length.

The payment under this item shall be made to the contractor only for number of finished and accepted Welds in the Track.

Item 5 of BLT1.A and BLT1.B: Payment for Additional / Extra RMC including other associated expenditure due to increase in plinth / slab heights only over and above given in Item 1 (no additional payment for increase in width of plinth / slab due to change in design of slab / plinth). This item includes additional requirement of steel, RMC, shuttering, manpower and other related expenses due to increase in height of plinth / slabs over and above the tender drawing. Quantity of additional / extra RMC shall be calculated from site survey of plinth/slab. Increase of plinth / slab height due to super elevation shall not be considered for calculation of extra RMC. Upper limit of variation of plinth / slab height without extra payment have been given in Item no. 1A. If bidder proposes different Track structure with enhanced minimum plinth / slab height, upper limit of plinth / slab given in tender drawing shall also be enhanced accordingly and quantity for extra RMC for payment shall be calculated over and above of enhanced upper limit of plinth / slab height. This clause is applicable only as per site conditions.

Item 6 of BLT1.A and BLT1.B : Carrying Out of Rail Paintings at stations at Viaduct, inspection pit.

- The Price shall include painting of Rail with Anti corrosive paint as per Employer's requirement. Consisting but not limited to the following:
- Painting of Rails: -
 - Gauge face side - foot and web and excluding gauge face surface.
 - Non-gauge face side - foot, web and non-gauge face of the rail.
- Surface preparation shall not be done unless the approved paints in sufficient quantities are available in stock at site. Sufficient care should be taken in preparing the surface and is, therefore, required to be done under process supervision. The surface shall be made free from oil, grease and dust. The surface shall be rubbed with wire brush and sand paper etc. The tools used may be hand or power operated such as scrappers, wire brushes, sand paper, pumice stones, etc. The surface prepared may be checked by visual observation for uniformity of surface.

- Anti-Corrosive Paint and methodology for Rail paintings shall approved by employer. However, paint already approved by Maharashtra Metro Rail Corporation Limited/RDSO shall be given preferences.
- Rail Surface shall be allowed to dry for sufficient time after application of one coat and before start of second coat say minimum 8 hours.
- Surface preparation / painting shall not be done in the following conditions:
 - When the ambient temperature is below 10⁰ centigrade or above 50⁰ centigrade.
 - In rainy season.
 - During night.
 - In winter before 8.00 A.M.
 - In summer between 11.00 AM and 3.00 PM on areas that are likely to be exposed to direct sun light.
 - Extremely windy / misty / dust blowing conditions.
- Chemicals should not be used for surface preparation.

Item No. 8 of BLT 1B: Design and Supply of an approved Mass Spring System/Low dynamic stiffness fastening system as per specifications given under clause, section, of Employer's Requirements.

The price of item includes mainly consisting of but not limited to the following:

- (i) Designing and providing an approved Mass Spring System below UG track. The shear keys if any will be covered with similar materials at top and appropriate material in all four sides.
- (ii) Each section of MSS will be equipped with the transition zone of adequate length on both sides.
- (iii) Design of Track slab with MSS.
- (iv) The rate of item includes the Cost of MSS materials and all types of labour. The cost of item includes procurement of MSS materials from approved supplier, dowels and labour. This includes procurement of materials, including shipping, handling, transportation to site inclusive of all duties, taxes and placing / fixing to the correct location below Track slab.
- (v) Inspection & acceptance test.
- (vi) The MSS experts should be arranged for assisting in installation of MSS.
- (vii) Any other expenditure if required for supply and installation of MSS/ Low dynamic stiffness fastening system complete at site.

2.3 Deleted

2.4 Provision of Check Rail on Sharp Curve (CR1)

Item No. 1: The rate includes cost of design, cost of supplying, providing and laying check Rail with all fittings and fastenings. See for detail description at 2.4 Bill No.CR-1.

2.5 Miscellaneous Items (M1)

Item No. 1: Miscellaneous items based on any of the latest CPWD-DSR/PWD-SOR/PMC-SOR/ USSOR-2011-CR schedules as approved by the Engineer. The rate for this item shall be fixed and shall be executed as per the rates of the schedule approved by the Engineer. The contractor has to carryout painting of curve details on web of Rail, CWR details, erection of luminous speed/ gradient/curve boards, Turnout board, fouling mark board on the entire section of Viaduct/UG section. The miscellaneous works as needed to comply CMRS observations but not covered in the other schedules are payable in this schedule. Some of the Items to be executed under this bill include Road Works, Concreting, Paving, Retroreflective sign boards etc.

For execution of items of retro-reflective boards under chapter 16 of DSR, the colour, size, letters/detailing of written matters on boards, signages etc. of boards shall be as instructed by Maharashtra Metro Rail Corporation Limited (which may differ from the description in the DSR) and the same shall be payable as per the per sqm rates. For boards of size smaller than those covered in DSR, rates of smallest square size covered in DSR, converted to per Sqm shall be paid. Similarly, for sizes larger than the biggest boards, rates of highest size board covered in DSR in Sqm shall be paid.

PART II - BILL OF QUANTITIES (BOQ)

TENDER PRICE

Grand Summary

BILL No. G1 General Requirements

BILL No. BLT1 Supply and Installation of Ballastless Track for Main Line & Ramp

BILL No. CR1 Provision of UIC 33 Check-Rails at Sharp curves

Bill No. M1 Miscellaneous Items

APPENDIX A Monthly Cash Flows for the Contract

APPENDIX B Schedule of Prices for Removal of Deviations,
Conditions, Qualifications, Reservations etc

APPENDIX C Part Payment Schedule

Annexure 2A Tendering Procedure

BILL OF QUANTITIES (BOQ)

The Bill of Quantities consists of five Bills. The Grand Summary collects all prices in the five bills and carries the total for all Bills forward to the Tender Price.

Bill No. G1 is not priced as it is deemed to be included in the total amount inserted into the Pricing Summary for Bill No. "BLT1 & CR1" and is included in this document for payment purposes only.

The prices shall be expressed in Indian Rupees.

The price quoted by bidders shall be deemed to be inclusive of all kinds of duties, taxes, Cess and other levies payable as per GST, Custom tariff act etc. and as prevailing on 28 days (Base Date) prior to final date of submission of bid (Closing time & date of submission of online bid).

The Bidder shall complete and submit all bill sheets endorsed by the signature of his representative.

TENDER PRICE**(THIS DOCUMENT IS TO BE PREPARED AND COMPLETED BY THE BIDDER)**

In accordance with the accompanying and signed Form of Tender, we offer to supply, install, test and commission including Integrated Testing and Commissioning and remedying any defects therein in the whole of the said Works in conformity with the said Drawings, Conditions of Contract, Employer's Requirements, and Bill of Quantities, for the sum of:

(In words) _____ Indian Rupees

(In figures) _____

Witness:

Signature:

Name:

Address:

Witness:

Signature:

Name:

Address:

Date:

Signature:

Name:

For and on behalf of:

Address:

Date:

Signature:

Name :

**GRAND SUMMARY
(Collection of Bills)**

Bill. No.	Item Description	Total Amount in INR/USD/Euro (with taxes)	Total Amount in INR/USD/Euro (with taxes)
BLT1	Total for BLT1 (A+B) - Installation of Ballastless Track :->		
CR1	Total for CR 1 Provision of UIC 33 Check Rails :->		
G1	Total for G1 - General Requirement - Ballastless Track :->		
M-1	Total for M-1 - Miscellaneous Items :->		
GRAND TOTAL :->			

Note:

The total quoted price for Bill No. G1 shall be fixed at 1.5% of the sum of total quoted price for the previous 02 bills i.e., Bill No. (BLT1+CR1).

2.1 Bill No. G1: General Requirements

Item no.	Description of Items	Unit	Total Quantity	% for Sub-Items
1	Plan submission & approval			
1.1	Quality System Assurance Plan	Set	1	5%
1.2	Health and Safety Management Plan	Set	1	5%
1.3	Environmental Management Plan	Set	1	5%
1.4	Project Implementation Plan including Method Statements as per Scope of Work.	Set	1	5%
1.5	Inspection and Testing Procedure Plan and operation and maintenance manual etc as per Scope of Work.	Set	1	5%
1.6	Design of Rail plinth/ slab track structure for plainline and turnouts on Viaduct including Proof checking. [Excluding the design and proof checking of track slab for Mass Spring System]	Track-meter	17000	35%
1.7	Design of track geometry including regrading as and when required, Rail plinth/ slab track structure for plainline and turnouts in the tunnel including Proof checking. [Excluding the design and proof checking of track slab for Mass Spring System]	Track-meter	13000	35%
2	As Built Drawings	Set	1	5%
Total (Carried forward from Grand Summary)				100%

Note:

1. The Detailed Design Consultant for Design of Track Plinth/Track Slab vide item no. 1.6 and 1.7 above will be carried out by an independent agency/ consultant proposed by the contractor and approved by Maharashtra Metro Rail Corporation Limited.
2. The Proof Checking of Design of Track Plinth/Track Slab vide item no. 1.6 and 1.7 above will be carried out by an independent agency/ consultant proposed by the contractor and approved by Maharashtra Metro Rail Corporation Limited.

2.2 Bill No. BLT1: Installation of Ballastless Track for Main line on Viaduct, Underground & Ramp

BLT1.A Bill No BLT 1. A: Installation of Ballastless Track for Main line on Viaduct & Ramp (Corridor -2, Reach-3: Civil Court to Ramwadi)					
Sr. No.	Item Description	Unit	Reach-3 for Corridor-2	Rate in INR/USD/Euro*	Total Amount in INR/USD/Euro
1A	Laying plinth & installation of Track work for plain Track with 60 E1 HH Rails with all fittings & fastenings, etc.				
(a)	Where Shear connectors are already provided	Track Meter	17,000		
(b)	Rate over and above (a) if shear connector to be provided by contractor	Track Meter	1700		
(c)	Rate over and above (a) if shear key to be provided by contractor at interval prescribed by Engineer.	Nos	100		
1 B	(i) "Extra over and above" (Use '+' sign to indicate above) or as (ii) 'lesser than the above' (Use '-' sign to indicate below) cast-in-situ on rates payable for item at Sr. 1A above, for laying precast track plinth/slab & installation of track work for Plain Track with 60 E1 HH rails with all fitting & fastening ,etc .(Rails , fittings & fastenings shall be supplied free by MAHA METRO.)				
(a)	Where Shear connectors are already provided	Track Meter	3400		
(b)	Rate over and above (a) if shear connector to be provided by contractor	Track Meter	340		
2	Laying RCC slab & installation of Turnout with 60 E1 head hardened Rails with all fittings and fastenings including grouting below base plates. (Rails, fittings and fastenings shall be supplied free by Maha-Metro.)				
2.1	a) 1 in 9 R-300m Turnouts on Viaduct	set	10		
2.2	b) 1 in 9 R-190m Turnout on Viaduct	set	1		
2.3	c) 1 in 7 R-190m Turnout on Viaduct	set	1		
2.4	Supply & Installation of Point clamps to clamp turnouts for 60 E1 Rails	Nos	24		
3	Supply & Installation of hybrid buffer stop having combination of sliding friction type and hydraulic type for elevated viaduct on 60E1 rail of standard gauge ballastless track.				
3.1	Supply of hybrid buffer stop having combination of sliding friction type and hydraulic type for elevated viaduct for impact speed of	Nos	1		

BLT1.A	Bill No BLT 1. A: Installation of Ballastless Track for Main line on Viaduct & Ramp (Corridor -2, Reach-3: Civil Court to Ramwadi)				
	40kmph and 6-coach empty train weight 246 T.				
3.2	Installation of hybrid buffer stop having combination of sliding friction type and hydraulic type or Friction Type Buffer Stops (impact speed 25kmph/40kmph) on elevated viaduct at any location of PMRP, Phase-I. A certification of installation for all the buffer stops shall be issued by the manufacturer.	Nos	12		
4	Welding of UIC 60, 1080 Grade HH Rails	Nos			
4.1	Flash Butt Welds as per Indian Railway Standard	Nos	1989		
4.2	Alumino Thermic Weld as per Indian Railway Standard	Nos	310		
5	Payments for all the expenditures over and above for plinths height specified in tender.	Cum	150		
6	Painting of Rail at Station (Viaduct) and tunnel with anti-corrosive bitumen black paint as per IS:9862 as per IRPWM	Track Meter	2400		
BLT1.A	Total for BLT1.A - Installation of Ballastless Track (SG Corridor)				

BLT1.B	Bill No BLT 1. B: Installation of Ballastless Track for Main line in UG (Corridor -1 Reach-4: Range Hill to Swargate)				
Sr. No.	Item Description	Unit	Reach-4 for Corridor-1	Rate in INR/USD/Euro*	Total Amount in INR/USD/Euro
1A	Laying RCC plinth/Slab & installation of track work for plain track with 60 E1 HH rails with all fittings & fastenings, etc. complete in underground				
(a)	Where Shear connectors are already provided	Track Meter	8770		
(b)	Rate over and above (a) if shear connector to be provided by contractor	Track Meter	877		
(c)	Rate over and above (a) if shear key to be provided by contractor at interval prescribed by Engineer.	Nos	100		

BLT1.B	Bill No BLT 1. B: Installation of Ballastless Track for Main line in UG (Corridor -1 Reach-4: Range Hill to Swargate)				
1B	(i) "Extra over and above" (Use '+' sign to indicate above) or as (ii) 'lesser than the above' (Use '-' sign to indicate below) cast-in-situ on rates payable for item at Sr. 1A above, for laying precast track plinth/slab & installation of track work for Plain Track with 60 E1 HH rails with all fitting & fastening ,etc .(Rails , fittings & fastenings shall be supplied free by MAHA METRO.)				
(a)	Where Shear connectors are already provided	Track Meter	1754		
(b)	Rate over and above (a) if shear connector to be provided by contractor	Track Meter	175		
(c)	Rate over and above (a) if shear key to be provided by contractor at interval prescribed by Engineer.	Nos	351		
2	Supply & Installation of Point clamps to clamp turnouts for 60 E1 Rails	Nos	8		
3	Installation of Friction Type Buffer Stops in underground section with 25 Kmph Speed Potential	Nos	10		
4	Welding of UIC 60, 1080 Grade HH Rails	Nos			
4.1	Flash Butt Welds as per Indian Railway Standard	Nos	1544		
4.2	Alumino Thermic Weld as per Indian Railway Standard	Nos	258		
5	Payments for all the expenditures over and above for plinths height specified in tender.	Cum	150		
6	Painting of Rail at Station (Viaduct) and tunnel with anti-corrosive bitumen black paint as per IS:9862 as per IRPWM	Track Meter	1800		
7	Deleted				
8	Design and Supply of an approved Mass Spring System as per specifications given under clause, section, of Employer's Requirements.				
8.1	Design, proof check, supply and installation of discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-D shall be so designed that the Natural Frequency of complete track system remains below 12 Hz.				

BLT1.B	Bill No BLT 1. B: Installation of Ballastless Track for Main line in UG (Corridor -1 Reach-4: Range Hill to Swargate)				
8.1a	For Plainline Track: Design* (LS), proof check, supply and installation of discrete PUR/rubber bearing, submission of O&M Manual. *Design means design of MSS including slab track.	Track Meter	1000		
8.1b	For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with discrete PUR/rubber bearing (per Track-Meter) for circular tunnel, cut & cover tunnel and NATM tunnel.	Track Meter	1000		
8.1c	For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed): Design* (LS), proof check, supply and installation of discrete PUR/rubber bearing, submission of O&M Manual. *Design means design of MSS including slab track.	Nos	1		
8.1d	For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. for circular tunnel, cut & cover tunnel and NATM tunnel. Scissors crossovers assembly consists of 4 turnout of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.	Nos	1		
8.2	Design, proof check, supply and installation of full surface Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-F shall be so designed that the Natural Frequency of complete track system remains below 12 Hz.				

BLT1.B	Bill No BLT 1. B: Installation of Ballastless Track for Main line in UG (Corridor -1 Reach-4: Range Hill to Swargate)				
8.2a	For Plainline Track: Design* (LS), proof check, supply and installation of full surface MSS, submission of O&M Manual. *Design means design of MSS including slab track.	Track Meter	1000		
8.2b	For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with full surface MSS for circular tunnel, cut & cover tunnel and NATM tunnel.	Track Meter	1000		
8.2c	For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed): Design* (LS), proof check, supply and installation of with full surface MSS, submission of O&M Manual. *Design means design of MSS including slab track.	Nos	1		
8.2d	For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with full surface MSS for circular tunnel, cut & cover tunnel and NATM tunnel. Scissors crossovers assembly consists of 4 turnouts of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.	Nos	1		
8.3	Design, proof check, supply and installation of discrete steel spring Slab Track Mass Spring System (STMSS) for vibration attenuation of 28 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-S shall be so designed that the Natural Frequency of complete track system remains below 6 Hz.				

BLT1.B	Bill No BLT 1. B: Installation of Ballastless Track for Main line in UG (Corridor -1 Reach-4: Range Hill to Swargate)				
8.3a	For Plainline Track: Design* (LS), proof check, supply and installation of discrete steel bearing system, submission of O&M Manual. *Design means design of MSS including slab track.	Track Meter	1400		
8.3b	For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. discrete steel bearing system for circular tunnel, cut & cover tunnel and NATM tunnel.	Track Meter	1400		
8.4	Supply and installation of Slab Track System with low dynamic stiffness fastening system (ST-LDS) for vibration attenuation of 14 VdB in the frequency range of 25 Hz to 45 Hz. The ST-LDS shall be so designed that the Natural Frequency of complete track system remains below 20 Hz. The dynamic stiffness of LDS fastenings shall be within 4KN/mm to 8KN/mm. The proposed system should be approved by MoR.				
8.4a	Supply of Low Dynamic Stiffness Fastening System including one set of special tools for installation of LDS, submission of O&M Manual	Track Meter	1000		
8.4b	Installation of Low Dynamic Stiffness Fastening System on already installed ballastless track with "Double resilient base plate fastening system" in the circular tunnel 5800mm finished internal dia., cut & cover tunnel and NATM tunnel.	Track Meter	1000		
Note: 1. The quantity of above group of items given under item nos. 8.1 to 8.4 may increase or decrease by 50% without any rate revision. 2. The design of Mass Spring System (MSS) Track vide item no. 8 above will be carried out by an agency having experience in the design of MSS Track. The name of design agency shall be proposed by the contractor and approved by Maharashtra Metro Rail Corporation Limited. 3. The Proof Checking of the design of Mass Spring System (MSS) Track vide item no. 8 above will be carried out by an independent agency/ consultant proposed by the contractor and approved by Maharashtra Metro Rail Corporation Limited.					
BLT1.B	Total for BLT1. B - Installation of Ballastless Track				
BLT1	Total for BLT1 (BLT1.A + BLT1.B) - Installation of Ballastless Track				

2.4 Bill No. CR1: Provision of UIC 33 Checkrails at Sharp curves, complete item.

Item no.	Description of Items	Unit	Total Quantity	Rate in INR/USD/Euro	Total Amount in INR/ USD/ Euro
1	Design, Supply, Installation, Testing and Commissioning of Check-Rails (UIC33 Rails Grade 900 minimum tensile Strength 880N/Sq.mm) at Pune, for sharp curves on Viaducts sections including without core cutting, fixing of galvanised anchor bolt with prescribed grouting material, fixing of hot dipped galvanised brackets and fixing/mounting of UIC 33 rail on brackets as per Contractor's approved design and drawings including supply and fabrication of all hot dipped galvanised brackets over 4 mm LDPE pad, hot dipped galvanised bolts, hot dipped galvanised fittings, machining of check rail at flared ends at various locations as per requirement, including supply of materials, transportation, insurance and all types of duties & taxes complete. The contractor has to fabricate and supply two different types of brackets (standard bracket and bracket with extra width of hole at the junction of check rail joints). Check rails shall have the facility for the adjustment of check rail clearances up-to 10mm over and above the initial designed clearance.	Running Metre (on one side of rail)	2297		
Total (Carried forward to Grand Summary)					

2.5 BILL NO. M1: Miscellaneous Items

Item no.	Description of Items	Unit	Basic fixed amount as per DSR etc rates (INR/USD/Euro)	Remarks
1	Miscellaneous items based on any of the latest CPWD-DSR/PWD-SOR/PMC-SOR/USSOR-2011-CR / Maharashtra Water Supply Board / MAHA DISSCOM schedules as approved by the Engineer. The rate for this item shall be fixed and shall be executed as per the rates of the schedule approved by the Engineer.	As per schedules as approved by the Engineer	1,50,00,000/-	This document i.e. BILL No. M1 must be signed by the authorised signatory of the Bidder and to be scanned and uploaded in financial package of the bid.
	Total (Carried forward to Grand Summary)		INR 1,50,00,000/-	

Note-1. Items to be executed under this bill may include Road Works, Concreting, Paving, and any other item not covered specifically in any of the other Bill.

The rate for this item shall be fixed based on any of following schedules as approved by the Engineer and shall be executed as per the rates of the schedule approved by the Engineer.

These items will be operated from any of the latest SOR published in the year 2018 or after in the order of:

1. PWD Pune Circle,
2. Maharashtra PWD,
3. Maharashtra Water Supply Board,
4. MAHA DISSCOM
5. USSOR-2011-CR and
6. CPWD schedules as approved by the Engineer.

Note 2: No rates to be quoted for this Bill no M1 by the bidder.

APPENDIX A

Monthly Cash Flow for the Contract

This Document is to be prepared by the Bidder and submitted as part of Appendix 2 to the Form of Tender.

APPENDIX B**Schedule of Prices for Removal of Deviations****(DELETED)**

To

Dear Sir,

Our prices given in the Bills of Quantity are subject to the following deviations, reservations, conditions, qualifications etc. These deviations, reservations, conditions, qualifications etc. are exhaustive. Except for these deviations, reservations, conditions, qualifications, etc., the entire work shall be performed as per the Tender Documents. We are also furnishing below the cost of unconditional withdrawal for the deviations, reservations, conditions, qualifications, etc. proposed by us. We confirm that we shall withdraw the deviations, reservations, conditions, qualifications etc. at the cost of withdrawal indicated in this statement failing which our Tender may be cancelled and the Tender Guarantee forfeited.

Sl. No	Deviations/reservations/Conditions/ Qualifications etc.	Cost of Unconditional Withdrawal	
		Foreign Currency Portion	Local Currency Portion (in Indian Rupees)

Date (Signature)

Place (Printed Name)

(Designation).....

(Common Seal)

APPENDIX C
PART PAYMENT SCHEDULE

Bill No. G1 General Requirement - All Items

Item. No	Description of Items	On Submission	On Approval
1.1 to 1.5	Submission & Approval of Plans	80%	20%
1.6	Design of Track plinth/slab on Viaduct and Submission & Approval (contractor shall submit the payment schedule for Engineer's approval)	70% (proportionally to the submission)	30%
2.	Submission & Approval of Drawings	80%	20%

Bill No. BLT1

Item No.1 of BLT1A & BLT1B: Laying plinth and installation of Track work for plain Track with UIC 60 HH Rails with all fittings and fastening etc. complete in viaduct.

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Surveying etc.	5%	5%
2	Provision of shear connectors, Rail setting, Plinth construction etc.	65%	70%
3	Rear work to achieve final tolerances, de-stressing, cleaning as per employer's requirement, etc.	20%	90%
4	Interface requirement of signalling contractor, measurement of final tolerances, acceptance tests, markers, <u>As-built records, RAMS Study, Submission of Ballastless Track stability report for installation of LWR/CWR Testing and Commissioning</u> , Employers another requirement etc.	10%	100%

Bill No. BLT-1

Item No.2 of BLT1A & BLT1B: Laying RCC slab & installation of Turnout with UIC 60 head hardened Rails with all fittings and fastenings

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Surveying etc.	5%	5%
2	Assembling, laying of T/O provision of Shear connectors, slab construction etc.	65%	70%
3	Rear work to achieve final tolerances, distressing, cleaning as per employer's requirement etc.	20%	90%
4	Interface requirement of signalling contractor, measurement of final tolerances, acceptance tests, markers, <u>As-built records, RAMS Study, Submission of Ballastless Track stability report for installation of LWR/CWR Testing and Commissioning</u> , Employers another requirement etc.	10%	100%

Bill No. BLT-1 - Item 3 of BLT1A & BLT1B:

Item 3.1 of BLT1B: Supply of buffer stop of 40kmph Speed Potential

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Submission & approval of design as per Employer's Requirements.	20%	20%

2	Manufacturing, inspection, and transportation (loading & unloading) of buffer stop to the site as per Employer's Requirements.	80%	100%
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Item 3.2 of BLT1A & BLT1B: Installation of buffer stop of 25/40kmph Speed Potential

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Surveying Loading, transporting, fixing at final location including Testing & Commissioning and submission of Test Certificate.	80%	80%
2	Submission of all records Check list for compliance of all items and employer's other requirement. Submission of Ballastless Track stability report for installation of LWR and CWR.	20%	100%

Bill No. BLT1- Item No.4.1

Welding of UIC 60 and 1080 grade HH Rail - Flash Butt Weld.

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Flash butt Welding by mobile flash butt Welding plant as per specifications.	60%	60%
2	Submission of results of test Weld.	10%	70%
3	Profile grinding and submission of tolerance	15%	85%
4	Submission of results of fatigue test, residual stress test, marking etc.	5%	90%
5	Submission of Weld record, USFD, Tolerances and Employers another requirement etc.	10%	100%

Bill No. BLT1-Item No.4.2

Alumino-Thermic Weld

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Alumino-Thermic Welding as per specifications.	60%	60%
2	Submission of results of test Weld.	10%	70%
3	Profile grinding and submission of tolerance	20%	90%
4	Submission of Weld record, USFD, Tolerances and Employers another requirement etc.	10%	100%

Bill No. BLT1-Item No.5 of BLT1A & BLT1B:

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Plinth construction etc.	90%	90%
2	Interface requirement of signalling contractor, measurement of final tolerances, acceptance tests, markers, As-built records, RAMS Study, Submission of Ballastless Track stability report for installation of	10%	100%

	<u>LWR/CWR Testing and Commissioning</u> , Employers another requirement etc.		
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Bill No. BLT1-Item No.6 of BLT1A & BLT1B:

Item. No	Description of Items	Percentage for Part Payment	Cumulative Percentage
1	Painting of rails including supply	100%	100%

Bill No. BLT1-Item No.8 of BLT1B:**Design and Supply of an approved Mass Spring System/Low dynamic stiffness fastening system**

Item No.	Description of items	Percentage for Part Payment	Cumulative Percentage
1.	On submission of ITP/QAP/Design/Method Statement for installation of MSS/ Low dynamic stiffness fastening system /Maintenance Manual and after receipt of material with all test reports at site	80%	80%
2.	After installation of MSS/ Low dynamic stiffness fastening system	10%	10%
3.	After Testing & Commissioning of the section	10%	10%

Bill No. CR1**Provision of UIC 33 Check-Rails at Sharp curves, complete item.**

Item No.	Description of items	Percentage for Part Payment	Cumulative Percentage
1.	On receipt of complete check rail bracket system ready for installation at site i.e. UIC 33 check rails, brackets with nuts & bolts, LDPE pads etc	80%	80%
2.	After installation	10%	90 %
3.	Testing and Commissioning of the section	10%	100 %

Annexure II-A
(Toll Kit For using E-Tender Portal of Pune Metro Rail Project)
TENDERING PROCEDURE

A] Tender Forms.

- i. Tender Forms can be purchased from the e-Tendering Portal of MAHA-METRO, i.e. <https://mahametrorail.etenders.in> after paying Tender Fees via online mode as Per the Tender Schedule.
- ii. Bidder should have valid class II/III digital signature certificates (DSC) obtain from any certifying authorities.
- iii. Bidder should install the Java and NxtCrypto service available on the Home Page of Download section URL :- <https://mahametrorail.etenders.in>

B] Pre-requisites to participate in the Tenders processed by MAHA-METRO:

i. Enrolment of Contractors on Electronic Tendering System:

The Contractors interested in participating in the Tenders of MAHA-METRO processed using the Electronic Tendering System shall be required to enroll on the Electronic Tendering System to obtain User ID.

If the information is found to be complete, the enrolment submitted by the Vendor shall be approved automatically.

The Contractors may obtain the necessary information on the process of enrolment either from Helpdesk Support Team or may visit the information published under the link Help manual and tutorials on the Home Page of the Electronic Tendering System.

ii. Obtaining a Digital Certificate:

The Bid Data that is prepared online is required to be encrypted and the hash value of the Bid Data is required to be signed electronically using a Digital Certificate (Class - II or Class -III). This is required to maintain the security of the Bid Data and also to establish the identity of the Contractor transacting on the System.

The Digital Certificates are issued by an approved Certifying Authority authorized by the Controller of Certifying Authorities of Government of India through their Authorized Representatives upon receipt of documents required to obtain a Digital Certificate.

Bid data / information for a particular Tender may be submitted only using the Digital Certificate which is used to encrypt the data / information and sign the hash value during the Tender Submission stage. In case during the process of preparing and submitting a Bid for a particular Tender, the Contractor loses his/her Digital Signature Certificate (i.e. due to virus attack, hardware problem, operating system problem); he / she may not be able to submit the Bid online.

Hence, the Users are advised to store his / her Digital Certificate securely and if possible, keep a backup at safe place under adequate security to be used in case of need.

In case of online tendering, if the Digital Certificate issued to an Authorized User of a Partnership Firm is used for signing and submitting a bid, it will be considered equivalent to a no objection certificate / power of attorney to that User to submit the bid on behalf of the Partnership Firm. The Partnership Firm has to authorize a specific individual via an authorization certificate signed by a partner of the firm (and in case the applicant is a partner, another partner in the same form is required to authorize) to use the digital certificate as per Indian Information Technology Act, 2000.

Unless the Digital Certificate is revoked, it will be assumed to represent adequate authority of the Authorized User to bid on behalf of the Firm for the Tenders processed on the Electronic Tender Management System of Government of Maharashtra as per Indian Information Technology Act, 2000. The Digital Signature of this Authorized User will be binding on the Firm. It shall be the responsibility of Partners of the Firm to inform the Certifying Authority or Sub Certifying Authority, if the Authorized User changes, and apply for a fresh Digital Signature Certificate. The procedure for application of a Digital Signature Certificate will remain the same for the new Authorized User.

The same procedure holds true for the Authorized Users in a Private / Public Limited Company. In this case, the Authorization Certificate will have to be signed by the Director of the Company or the Reporting Authority of the Applicant.

For information on the process of application for obtaining Digital Certificate, the Contractors may visit the section Digital Signature Forms on the Home Page of the Electronic Tendering System.

iii. Recommended Hardware and Internet Connectivity:

To operate on the Electronic Tendering System, the Contractors are recommended to use Computer System with at least 1 GB of RAM and broadband connectivity with minimum 512 kbps bandwidth.

iv. Set up of Computer System for executing the operations on the Electronic Tendering System:

To operate on the Electronic Tendering System of MAHA-METRO, the Computer System of the Contractors is required be set up. The Contractors are required to install Utilities available under the section Downloads on the Home Page of the System.

The Utilities are available for download freely from the above-mentioned section. The Contractors are requested to refer to the Help manual and Tutorials available online on the Home Page to understand the process of setting up the System, or alternatively, contact the Helpdesk Support Team on information / guidance on the process of setting up the System.

C) The e-tender portal contains two section Technical Bid Submission & Financial Bid Submission.

- i. **Technical Bid Section:** - Technical Bid Section shall contain all Documents and enclosures as directed in NIT, ITT and EQ. Bidder shall upload the PDF copy of such documents in Technical Section only.
- ii. **Financial Bid Section:** - All prices/Commercial offers/ or any information pertain to commercial offer required by MAHA-METRO from the bidders, shall be filled/uploaded (If directed by MAHA-METRO) in Financial bid Section only.
- iii. No information pertaining to Financial Bid section should be uploaded/disclosed in Technical Bid Section or vice versa.

D) Steps to be followed by Contractors to participate in the e-Tenders processed by MAHA-METRO.

i. Preparation of online Briefcase:

All Contractors enrolled on the Electronic Tendering System of MAHA-METRO are provided with dedicated briefcase facility to store documents / files in digital format. The Contractors can use the online briefcase to store their scanned copies of frequently used documents / files to be submitted as a part of their bid response. The Contractors are advised to store the relevant documents in the briefcase before starting the Tender Submission stage.

In case, the Contractors have multiple documents under the same type (e.g. multiple Work Completion Certificates) as mentioned above, the Contractors advised to either create a single .pdf file of all the documents of same type or compress the documents in a single compressed file in .zip or .rar formats and upload the same.

Note: Uploading of documents in the briefcase does not mean that the documents are available to MAHA-METRO at the time of Tender Opening stage unless the documents are specifically attached to the Tender during the Tender Submission stage.

ii. Online viewing of Detailed Notice Inviting Tenders:

The Contractors can view the Detailed **Tender Notice (NIT)** along with the Time Schedule (Key Dates) for all the Live Tenders released by MAHA-METRO and **Eligibility**

Criteria (EQ) on the home page of MAHA-METRO e-Tendering Portal on <https://mahametrorail.etenders.in> under the section Online Tenders. Viewing & downloading the NIT & EQ is free of cost.

iii. **Download of Tender Documents:**

After going through the NIT & EQ, if bidder finds himself eligible for the bidding, he may purchase the complete bid document via online mode by paying the cost of Tender Document by Debit Card/Credit Card/ Net Banking as described on E-Tender Portal. After paying the cost of the document, bidder may download the complete bid documents.

iv. **Online Submission of Bid:**

- a. At the stage of EMD Payment which bidder has to pay online (as per requirement of tender as specified in BDS in ITB) using any one online pay mode as **RTGS , NEFT, Debit Card, Credit Card & Net Banking** or payment get way . For EMD payment, if bidder use NEFT or RTGS then system will generate a challan (in two Copies) with unique challan No specific to the tender. Bidder will use this challan in his bank to make NEFT/RTGS Payment against the challan.
- b. Bidder should ensure the payment of online EMD, 72 Hours (Excepting Holiday if any) prior to the final submission date of the Bid.*
- c. Bidder have the option to pay EMD either at the initial stage of submission of bid or at the final stage of submission of bid, when all mandatory formats/ documents filled/ uploaded.
- d. Bidder shall download the Complete Bid Document along with all Corrigendum/Addendum/Clarification etc. by logging in with E-Tender Portal using his DSC (i.e. DSC of POA/ Owner) & read the all tender Instruction & clauses carefully.
- e. **For submission of Tender Document and Corrigendum, Tick (✓) Submission Process has been enabled in Technical section of E-Tender Portal of MAHA-METRO. Bidders have to tick (✓) the corresponding checkbox provided in the Technical Section of E-Tendering portal as a token of acceptance of these bid documents & corrigendum / Addendums. By clicking the tick (✓) the bid documents & corrigendum /addendum shall automatically attached to offer of bidder. Further bidder may proceed for submission by clicking submit button.**
- f. If the bidder has completed the submission process of his bid before due date of submission and in between employer issue a corrigendum, in this circumstances the bidder has to re-submit his bid by “clicking tick (✓)” to the new added corrigendum, in case the new corrigendum has any implications to his already submitted bid. Bidder may, at his option, amend his bid accordingly & re-submit it.
- g. Physical Sign & seal of bidder on each page of Bid Documents available online is not required.
- h. All required enclosures as per bid document shall be uploaded in “Technical Envelope” / “Technical Section” of E-Tender portal by using DSC of bidder.
- i. The “Technical Envelope” / “Technical Section” of E-Tender portal has been provided with facilities to upload a file of maximum size of 10 MB only at each entity.

- j. If bidder are desirous to upload a file more than 10mb size , he shall spilt the file in two or more parts of 10mb or lesser than 10mb each and can upload the same at appropriate **Technical Template** or **“Additional Document”** section of **“Technical Envelope/section”** of E-Tender Portal.

Note:-

- * Realization of NEFT/RTGS payment normally takes 24 hours, so it is advised to make Sure that NEFT/RTGS payment activity should be completed well before time.
- * NEFT/RTGS option will be depend on the amount of EMD.
- * Help File regarding use of e-Payment Gateway can be downloaded from e-Tendering Portal.

v. **Short listing of Contractors for Financial Bidding Process:**

The Tendering Authority will first open the Technical Bid documents of all Contractors and after scrutinizing these documents will shortlist the Contractors who are eligible for Financial Bidding Process. The shortlisted Contractors will be intimated by email.

vi. **Opening of the Financial Bids:**

The Contractors may remain present in the Office of the Tender Opening Authority at the time of opening of Financial Bids.

vii. **Tender Schedule (Key Dates):**

All the online activities are time tracked and the Electronic Tendering System enforces time-locks that ensure that no activity or transaction can take place outside the Start and End Dates and Time of the stage as defined in the Tender Schedule.

At the sole discretion of the Tender Authority, the time schedule of the Tender stages may be extended.

Note: - For details illustrations, please refer or down load the PPT demonstration available on E-Tender portal of <https://mahametrorail.etenders.in>

Terms and Conditions for Online-Payments

The Terms and Conditions contained herein shall apply to any person ("User") using the services of MAHA-METRO, hereinafter referred to as "Merchant", for making Tender fee and Earnest Money Deposit (EMD) payments through an online Payment Gateway Service ("Service") offered by ICICI Bank Ltd. in association with E Tendering Service provider and Payment Gateway Service provider through MAHA-METRO website i.e. <https://mahametrorail.etenders.in> Each User is therefore deemed to have read and accepted these Terms and Conditions.

Privacy Policy:

The Merchant respects and protects the privacy of the individuals that access the information and use the services provided through them. Individually identifiable information about the User is not willfully disclosed to any third party without first receiving the User's permission, as covered in this Privacy Policy.

This Privacy Policy describes Merchant's treatment of personally identifiable information that Merchant collects when the User is on the Merchant's website. The Merchant does not collect any unique information about the User (such as User's name, email address, age, gender etc.) except when you specifically and knowingly provide such information on the Website. Like any business interested in offering the highest quality of service to clients, Merchant may, from time to time, send email to the User and other communication to tell the User about the various services, features, functionality and content offered by Merchant's website or seek voluntary information from The User.

Please be aware, however, that Merchant will release specific personal information about the User if required to do so in the following circumstances:

- a) In order to comply with any valid legal process such as a search warrant, statute, or court order, or available at time of opening the tender.
- b) if any of User's actions on our website violate the Terms of Service or any of our guidelines for specific services, or
- c) to protect or defend Merchant's legal rights or property, the Merchant's site, or the Users of the site or;
- d) to investigate, prevent, or take action regarding illegal activities, suspected fraud, situations involving potential threats to the security, integrity of Merchant's website/offerings. General

Terms and Conditions for E-Payment

1. Once a User has accepted these Terms and Conditions, he/ she may register on Merchant's website and avail the Services.
2. Merchant's rights, obligations, undertakings shall be subject to the laws in force in India, as well as any directives/ procedures of Government of India, and nothing contained in these Terms and Conditions shall be in derogation of Merchant's right to comply with any law enforcement agencies request or requirements relating to any User's use of the website or information provided to or gathered by Merchant with respect to such use. Each User accepts and agrees that the provision of details of his/ her use of the Website to regulators or police or to any other
- 3.
4. in order to resolve disputes or complaints which relate to the Website shall be at the absolute discretion of Merchant.
5. If any part of these Terms and Conditions are determined to be invalid or unenforceable pursuant to applicable law including, but not limited to, the warranty disclaimers and liability limitations set forth herein, then the invalid or unenforceable provision will be

deemed superseded by a valid, enforceable provision that most closely matches the intent of the original provision and the remainder of these Terms and Conditions shall continue in effect.

6. These Terms and Conditions constitute the entire agreement between the User and Merchant. These Terms and Conditions supersede all prior or contemporaneous communications and proposals, whether electronic, oral, or written, between the User and Merchant. A printed version of these Terms and Conditions and of any notice given in electronic form shall be admissible in judicial or administrative proceedings based upon or relating to these Terms and Conditions to the same extent and subject to the same conditions as other business documents and records originally generated and maintained in printed form.
5. The entries in the books of Merchant and/or the Payment Gateway Service Providers kept in the ordinary course of business of Merchant and/or the Payment Gateway Service Providers with regard to transactions covered under these Terms and Conditions and matters therein appearing shall be binding on the User and shall be conclusive proof of the genuineness and accuracy of the transaction.
6. **Refund for Charge Back Transaction:** In the event there is any claim for/ of charge back by the User for any reason whatsoever, such User shall immediately approach Merchant with his/ her claim details and claim refund from Merchant alone. Such refund (if any) shall be affected only by Merchant via payment gateway or by means of a demand draft or such other means as Merchant deems appropriate. No claims for refund/ charge back shall be made by any User to the Payment Gateway Service Provider(s) and in the event such claim is made it shall not be entertained.
7. In these Terms and Conditions, the term "**Charge Back**" shall mean, approved and settled credit card or net banking purchase transaction(s) which are at any time refused, debited or charged back to merchant account (and shall also include similar debits to Payment Gateway Service Provider's accounts, if any) by the acquiring bank or credit card company for any reason whatsoever, together with the bank fees, penalties and other charges incidental thereto.
8. Refund for fraudulent/duplicate transaction(s): The User shall directly contact Merchant for any fraudulent transaction(s) on account of misuse of Card/ Bank details by a fraudulent individual/party and such issues shall be suitably addressed by Merchant alone in line with their policies and rules.
9. Server Slow Down/Session Timeout: In case the Website or Payment Gateway Service Provider's webpage, that is linked to the Website, is experiencing any server related issues like 'slow down' or 'failure' or 'session timeout', the User shall, before initiating the second payment,, check whether his/her Bank Account has been debited or not and accordingly resort to one of the following options:
 - i. In case the Bank Account appears to be debited, ensure that he/ she does not make the payment twice and immediately thereafter contact Merchant via e-mail or any other mode of contact as provided by Merchant to confirm payment.
 - ii. In case the Bank Account is not debited, the User may initiate a fresh transaction to make payment.

However, the User agrees that under no circumstances the Payment Gateway Service Provider shall be held responsible for such fraudulent/duplicate transactions and hence no claims should be raised to Payment Gateway Service Provider. No communication received by the Payment Gateway Service Provider(s) in this regard shall be entertained by the Payment Gateway Service Provider.

Limitation of Liability

1. Merchant has made this Service available to the User as a matter of convenience. Merchant expressly disclaims any claim or liability arising out of the provision of this Service. The User agrees and acknowledges that he/ she shall be solely responsible for his/ her conduct and that Merchant reserves the right to terminate the rights to use of the Service immediately without giving any prior notice thereof.
2. Merchant and/or the Payment Gateway Service Providers shall not be liable for any inaccuracy, error or delay in, or omission of (a) any data, information or message, or (b) the transmission or delivery of any such data, information or message; or (c) any loss or damage arising from or occasioned by any such inaccuracy, error, delay or omission, non-performance or interruption in any such data, information or message. Under no circumstances shall the Merchant and/or the Payment Gateway Service Providers, its employees, directors, and its third party agents involved in processing, delivering or managing the Services, be liable for any direct, indirect, incidental, special or consequential damages, or any damages whatsoever, including punitive or exemplary arising out of or in any way connected with the provision of or any inadequacy or deficiency in the provision of the Services or resulting from unauthorized access or alteration of transmissions of data or arising from suspension or termination of the Services.
3. The Merchant and the Payment Gateway Service Provider(s) assume no liability whatsoever for any monetary or other damage suffered by the User on account of:
(i) the delay, failure, interruption, or corruption of any data or other information transmitted in connection with use of the Payment Gateway or Services in connection thereto; and/ or (ii) any interruption or errors in the operation of the Payment Gateway.
4. The User shall indemnify and hold harmless the Payment Gateway Service Provider(s) and
Merchant and their respective officers, directors, agents, and employees, from any claim or
demand, or actions arising out of or in connection with the utilization of the Services.

The User agrees that Merchant or any of its employees will not be held liable by the User for any loss or damages arising from your use of, or reliance upon the information contained on the Website, or any failure to comply with these Terms and Conditions where such failure is due to circumstance beyond Merchant's reasonable control.

Miscellaneous Conditions:

Any waiver of any rights available to Merchant under these Terms and Conditions shall not mean that those rights are automatically waived.

1. The User agrees, understands and confirms that his/ her personal data including without limitation details relating to debit card/ credit card transmitted over the Internet may be susceptible to misuse, hacking, theft and/ or fraud and that Merchant or the Payment Gateway Service Provider(s) have no control over such matters.

2. Although all reasonable care has been taken towards guarding against unauthorized use of any information transmitted by the User, Merchant does not represent or guarantee that the use of the Services provided by/ through it will not result in theft and/or unauthorized use of data over the Internet.
3. The Merchant, the Payment Gateway Service Provider(s) and its affiliates and associates shall not be liable, at any time, for any failure of performance, error, omission, interruption, deletion, defect, delay in operation or transmission, computer virus, communications line failure, theft or destruction or unauthorized access to, alteration of, or use of information contained on the Website.
4. The User may be required to create his/ her own User ID and Password in order to register and/ or use the Services provided by Merchant on the Website. By accepting these Terms and Conditions the User agrees that his/ her User ID and Password are very important pieces of information and it shall be the User's own responsibility to keep them secure and confidential. In furtherance hereof, the User agrees to;
 - i. Choose a new password, whenever required for security reasons.
 - ii. Keep his/ her User ID & Password strictly confidential.
 - iii. Be responsible for any transactions made by User under such User ID and Password.

The User is hereby informed that Merchant will never ask the User for the User's password in an unsolicited phone call or in an unsolicited email. The User is hereby required to sign out of his/ her Merchant account on the Website and close the web browser window when the transaction(s) have been completed. This is to ensure that others cannot access the User's personal information and correspondence when the User happens to share a computer with someone else or is using a computer in a public place like a library or Internet cafe.

Debit/Credit Card, Bank Account Details

1. The User agrees that the debit/credit card details provided by him/ her for use of the aforesaid Service(s) must be correct and accurate and that the User shall not use a debit/ credit card, that is not lawfully owned by him/ her or the use of which is not authorized by the lawful owner thereof. The User further agrees and undertakes to provide correct and valid debit/credit card details.
2. The User may make his/ her payment (Tender Fee/Earnest Money deposit) to Merchant by using a debit/credit card or through online banking account. The User warrants, agrees and confirms that when he/ she initiates a payment transaction and/or issues an online payment instruction and provides his/ her card / bank details:
 - i. The User is fully and lawfully entitled to use such credit / debit card, bank account for such transactions;
 - ii. The User is responsible to ensure that the card/ bank account details provided by him/ her are accurate;
 - iii. The User is authorizing debit of the nominated card/ bank account for the payment of Tender Fee and Earnest Money Deposit

- iv. The User is responsible to ensure sufficient credit is available on the nominated card/ bank account at the time of making the payment to permit the payment of the dues payable or the bill(s) selected by the User inclusive of the applicable Fee.

Personal Information

1. The User agrees that, to the extent required or permitted by law, Merchant and/ or the Payment Gateway Service Provider(s) may also collect, use and disclose personal information in connection with security related or law enforcement investigations or in the course of cooperating with authorities or complying with legal requirements.
2. The User agrees that any communication sent by the User vide e-mail, shall imply release of information therein/ therewith to Merchant. The User agrees to be contacted via e-mail on such mails initiated by him/ her.
3. In addition to the information already in the possession of Merchant and/ or the Payment Gateway Service Provider(s), Merchant may have collected similar information from the User in the past. By entering the Website the User consents to the terms of Merchant's information privacy policy and to our continued use of previously collected information. By submitting the User's personal information to us, the User will be treated as having given his/her permission for the processing of the User's personal data as set out herein.
4. The User acknowledges and agrees that his/ her information will be managed in accordance with the laws for the time in force.

Payment Gateway Disclaimer: The Service is provided in order to facilitate payment of Tender Fees/Earnest Money Deposit online. The Merchant or the Payment Gateway Service Provider(s) do not make any representation of any kind, express or implied, as to the operation of the Payment Gateway other than what is specified in the Website for this purpose. By accepting/ agreeing to these Terms and Conditions, the User expressly agrees that his/ her use of the aforesaid online payment service is entirely at own risk and responsibility of the User.

Maharashtra Metro Rail Corporation Limited
(A Joint Venture of Government of India and Government of Maharashtra)
PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART II: WORK REQUIREMENTS

SECTION – VII - A

GENERAL SPECIFICATIONS

PART II: WORK REQUIREMENTS

- **GENERAL SPECIFICATIONS**
- **PARTICULAR SPECIFICATIONS**

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5.2	GENERAL REQUIREMENTS
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5.7	REVIEW, VERIFICATION & AUDIT
5.8	QUALITY CONTROL REGISTER
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6.2	MATERIALS
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8.2	ACTIVITY OF THE EMPLOYER AND THE ENGINEER
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14.1	HEALTH AND SAFETY PHILOSOPHY
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15.7	NOISE CONTROL ON WORKS SITE
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18.18	INSABILITY TO SUPPLY
19	MOCK-UPS, PROTO TPES AND SAMPLES
19.1	REQUIREMENTS
19.2	PURPOSE
19.3	REVIEW
1	MONTHLY PROGRESS REPORT
1.1	TOPICS
1.2	PROGRESS REPORTS
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2	CONTRACT SYSTEMS SAFETY MANAGEMENT
2.1	SAFETY ASSURANCE PROGRAMME
2.2	HAZARD ANALYSIS
2.3	RESULTS
3	SUBMISSION FOR REVIEW REQUEST FORM
4	SCHEDULE OF ITEMS TO BE SUBMITTED BY CONTRACTOR
5	REQUEST FOR INSPECTION OF WORKS FORM
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7.1	PROVISIONS BY OTHERS
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8	WORKS AREAS
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CHAPTER-1**1. GENERAL****1.1 Application of the General Specification (GS)**

1.1.1 The provisions contained in the Particular Specification (PS) and the Employer's Drawings shall prevail over the provisions contained in this GS.

1.1.2 The provisions contained in the GS shall prevail over the provisions contained in International Standards, European Standards, British Standards, Indian Standards, British Standard Codes of Practice and similar standard documents stated in the Contract.

1.1.3 This GS shall be read in conjunction with the other documents constituting the Contract.

1.2 Requirement of Track structure and approval of systems.

1.3 **Abbreviations:** - Common abbreviations used in the GS and the PS shall have the following meanings:-

BCC	Backup Control Centre	BS	British Standard
CADD	Computer Aided Design and Drafting	CAR	Corrective Action Request
CNP	Construction Noise Permits	COTS	Commercial Off the Shelf
CPM	Critical Path Method	CV	Curriculum Vitae
DLP	Defects Liability Period	PMRP	Pune Metro Rail Project
E&M	Electrical & Mechanical	EMC	Electromagnetic Compatibility
EMIP	Environmental Mitigation Implementation Plan	EMP	Environmental Management Plan
EMSD	Electrical and Mechanical Services Department	EMU	Electric Multiple Unit
EN	Euro-Norm (European Standards)	EPD	Environmental Protection Department
ETI	Employer's Training Instructors	FAT	Factory Acceptance Test(s)
GCC	General Conditions of Contract	GS	General Specification (this document)
HV	High Voltage	IEC	International Electro-Technical Commission
IP	Ingress Protection	IS	Indian Standards
ISO	International Standards Organisation	ITT	Instructions to Bidders
LV	Low Voltage	MC	Metro Corridor

MMI	Man-Machine Interface	MTR	Mass Transit Railway
NSR	Noise Sensitive Receivers	OCC	Operations Control Centre
OCS	Overhead Contact System (Rigid Conductor)	OSR	Operational Safety Report
OSR(S)	Operational Safety Report (Software)	OHE	Over Head Equipment (Flexible Catenary)
P3	Primavera Project Planner	PLC	Programable Logic Controller
PPE	Personal Protective Equipment	PS	Particular Specification
PVC	Polyvinyl Chloride	QA	Quality Assurance
RC	Rail Corridor	SAR	Special Administrative Region
SAT	Systems Acceptance Test(s)	SCC	Special Conditions of Contract
SIL	Safety Integrity Level	SQAP	Software Quality Assurance Plan
SRR	Submission Review Request	T/C	Time Chainage
TRIP	Track Related Installation Programme	MAHA-METRO	Maharashtra Metro Rail Corporation Limited (client)

1.3.1 Further abbreviations may be defined within the body of the General Specification (GS) or Particular Specification (PS) where there is only local applicability. Where such abbreviations exist, the Contractor shall exercise great care that the abbreviation is not used out of context when communicating with the Employer, the Engineer or any Third Party.

1.3.2 Abbreviations of units of measurement used in the GS shall have the meanings as defined under the SI system of units.

1.4 **Definitions:** - Words and phrases defined in the GCC or SCC shall retain the same meaning within the GS and PS unless specifically redefined within this GS or under the provisions of clause 1.1.1.1 above for the purpose of a particular clause or group of clauses.

(1) “**Access Dates**” are dates that are to be achieved by other than the Contractor and which are considered to be planned for the successful completion of the Contract as per the original planned schedule. However, the contractor will be required to interface with civil work contractors and if need be, plan the resources for successful achievement of key dates. A list of the activities completion, of which are considered to give rise to an Access Date are included in the PS.

(2) “**Commissioning**” means the process of setting to work the complete transportation system through a series of integrated tests that demonstrate the installation and performance in accordance with the specified criteria.

(3) “**Defined Area**” means an area within which Works Trains will be operated and the Employer’s defined area working safety rules are applicable.

(4) “**Installation Tests**” means the tests to be performed to verify the conformity of completion of an installation/assembly to the design documents previously reviewed

without objection by the Engineer prior to the start of Commissioning. Installation Tests do not form part of the Tests on Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section however they must be successfully completed before the Tests on Completion commence.

- (5) **"Service Trial"** means the phase after completion of the System Acceptance Tests where the training and operating procedures are validated through the running of the trains to the published timetable. Service Trial form part of the Tests on Completion to be performed under the Contract in order to achieve Employer's Taking Over of the Works or any Section.
- (6) **"Quality Control Point"** means a point in time when a notice or other document is to be submitted to the Engineer in accordance with the Contract before the Contractor can commence, proceed with or terminate an activity.
- (7) **"Quality Hold Point"** means a point in time when a notice of no objection by the Engineer is required.
- (8) **"Specification (the)"** means the aggregate sum of the documents and any amendments thereto, issued to Bidders by Employer as part of the Tender process before the final date for submission of Tenders. This shall include but not be limited to; Design Criteria,

Employer's Requirements, Employer's Tender Drawings, Preliminary Operating Plan and Clarification of Tender Documents issued in accordance with the ITT but shall not include the ITT itself nor any minutes of meetings.

- (9) **"Specification (this)"** means the particular document within which the reference is made.
- (10) **"Integrated Testing and Commissioning"** means those tests that demonstrate the integration of the complete transport system meeting the requirements of the Specification in an operating environment. Integrated Testing and Commissioning form part of the Tests on Completion to be performed by the Contractor in order to achieve Employer's Taking Over of the Works or any Section.
- (11) **"Validation"** means the process of confirmation by examination and provision of objective evidence that the application produced achieves the specified particular requirements.
- (12) **"Verification"** means the process of confirmation by examination and provision of objective evidence that the specified requirements have been incorporated within design.

1.5 Glossary of Terms

1.5.1 Words and expressions to which meanings are assigned in any paragraph of the GS shall have the same meanings in other paragraphs of the GS except when the context otherwise requires.

1.5.2 Utilities are electricity, lighting, traffic control, telephone & other communication cables, gas, water, sewage and drainage pipes and ducts, including all associated protection, supports, ancillary structures, fittings and equipment.

1.6 Submission for Review

1.6.1 Reference in the GS and PS to any submission made by the Contractor to the Engineer having been reviewed without objection by the Engineer shall mean the issue of a notice of no objection by the Engineer issued in response to a submission made by the Contractor. Documents, drawings, specifications, calculations, technical papers, material samples, methods of construction and any other matters which have been reviewed without objection by the Engineer shall not be changed without further submission for review to the Engineer of the proposed changes.

- 1.6.2 Clause 4.2 below prescribes the process to be adopted for submissions of documents, material samples and any other items to the Engineer. Schedules of items that are to be submitted to the Engineer for review are contained within this GS and/or the PS.
- 1.6.3 Submissions for review shall be made in accordance with the dates (relative to the Works Programme) stated in the GS and/or the PS, or in accordance with Appendix 4 of this Specification. For those items which are not given specific submission date in the Specification submissions shall be strictly in accordance with the agreed Submissions Programme or as directed by the Engineer.
- 1.7 Standards, Codes of Practice**
- 1.7.1 Unless otherwise stated in the Contract, reference in the GS to International Standards, European Standards, British Standards, British Standard Codes Standards, European Standards, British Standards, British Standard Codes of Practice and similar standards shall be to that edition of the document stated in the PS, including all latest amendments issued by the relevant authority. In the event that no specific edition reference is given, the current edition as at the date of opening of tender shall apply.
- 1.7.2 Later editions of International Standards, European Standards, other national or international Standards or Codes of Practice and other similar standards, or standards which are considered to be equivalent, shall not apply unless reviewed without objection by the Engineer. The Engineer shall give or Withhold his notice of no objection after the Contractor has provided him with a copy of the relevant standard for information. If a notice of no objection is given, the contractor shall provide two copies of the document for use by the Engineer.
- 1.7.3 Permanent Works, Temporary Works, Contractor's Equipment, Hardware, Firmware, software, apparatus of all kinds, and, where appropriate, materials and workmanship shall be in accordance with the Standards quoted in the Specification and the requirements identified in the PS or, where no Standard is identified, the Contractor shall make a proposal which shall be subjected to review by the Engineer.
- 1.7.4 Standards guaranteeing a level of quality or performance equivalent or superior to those indicated will also be accepted. Any product of equal or superior quality or performance to those indicated will also be acceptable.
- 1.8 Employer's Drawings**
- 1.8.1 The Employer's Drawings assist in general describing the scope of the Works and clarify constraints, interface arrangements and to define the nature of the finished structures/ system outline.
- 1.8.2 The Contractor shall carefully check all Employer's Drawings and advise the Engineer only discrepancies, omissions, errors or ambiguities if any be found.
- 1.8.3 The Contractor shall note that any drawings included but marked "For information only" do not form part of the Contract.
- 1.8.4 Dimensions shall not be obtained by scaling from the Employer's Drawings. Dimensions that are not shown or are not calculable from dimensions shown on Employer's Drawings shall be obtained from the Engineer.
- 1.8.5 The General Arrangement Drawings, Alignment drawings, Layout plans are for information & final alignment/layout plans may be obtained, interfacing with the relevant contractors.
- 1.9 Specifications in Metric and Imperial Units**
- 1.9.1 Specifications in imperial units shall not be substituted for specifications in metric units stated in the Contract without the prior consent of the Engineer.
- 1.9.2 Conversion of metric units to imperial units and of imperial units to metric units shall be in accordance with the Standard International Practice.
- 1.10 System Safety**
- 1.10.1 Safety philosophy**

1.10.1.1 Safety of passengers, staff and the general public is paramount for railway operation. Prime consideration shall be given to all issues that can have an effect on safety.

1.10.1.2 During the construction phase the safety of all staff involved in the Works and all members of the general public affected by the works shall be the prime feature of all working methods, including storage and transport to site as well as all temporary works not incorporated into the final construction.

1.10.2 Safety Management

The Contractor shall implement the Contract Systems Safety Management Requirements, as referenced in the Project Safety Manual and elsewhere in the tender document, in consultation with the Engineer. Risk Assessment and risk mitigation should be the part of all method statement and work procedures.

1.10.3 Prescriptive Safety Criteria

1.10.3.1 The Contractor shall identify and list all applicable statutory and regulatory requirements and codes of practice relevant to the installation of the works requirements and codes.

1.10.3.2 The safety of the Contractor's supplied systems and equipment shall be developed by the Contractor in accordance with the requirements contained in clause 3.4.4 below & the PS.

1.11 **Suitability for Purpose:** - Maharashtra Metro Rail Corporation Limited shall be operating high-density passenger trains with high volume of traffic in the proposed corridors commensurate with the stage opening of the sections.

1.11.1 **Interference and Compatibility:** - The Contractor shall ensure that all Works and Contractor's Equipment operate in a satisfactory manner without causing interference to other equipment and services including parties external to the Employer. The Contractor shall also ensure that the Permanent Works are physically and technically compatible with associated plant and in particular with that of other Contractors.

1.12 Climatic Condition / Operating Environment

1.12.1 General

1.12.1.1 The following information on climatic conditions in **Pune** shall be taken. The following information on climatic conditions in **Pune** shall be taken into account by the Contractor. The Contractor shall ensure that due allowance is made for more severe local conditions when Permanent Works are required to operate, for example, with restricted ventilation that may lead to higher local ambient temperatures, and any other factors that may affect the operating environment in any way.

(1) Unless specific figures are provided elsewhere, the Permanent Works will generally be required to function at its rated value with the values of ambient temperature and relative humidity appropriate to the location. Certain parts of the Permanent Works may need to be rated for more or less onerous conditions as required by the PS.

(2) Clause 1.12.2 below gives the different classifications of environment to be encountered. For any type of item, examples of which are installed in more than one environmental class, all examples of the type shall be suitable for installation in the most severe environmental class conditions encountered by any example of the type.

(3) The Contractor's attention is drawn to the more severe environmental conditions that may exist during the construction period and shall take adequate measures to protect the Permanent Works against any deleterious effects of such conditions during the time between installation and final completion of the project.

1.12.2 Details of Environment

Daily maximum and minimum temperature during winter, summer and rainy season (ever recorded):

	Max	Min
Winter (November to February)	30.2°C	12.2°C

Summer (March to June)	35.4 ⁰ C	20.3 ⁰ C
Rainy (July to October)	29.2 ⁰ C	20.7 ⁰ C

- 1.12.2.1 **Wind Pressure:** - The system is to be designed to give satisfactory service for a wind pressure as per relevant IS codes applicable.
- 1.12.2.2 **Sunshine and other meteorological details:** - Sunshine hours and other meteorological details can be obtained by placing a specific request to Meteorological Department.
- 1.12.2.3 **Relative Humidity:** - Daily maximum and minimum average values during winter, summer and rainy season are generally as under: -

	Max	Min
Winter	54.5 %	28%
Summer	47.5 %	16%
Rainy	97.3%	35%

- 1.13 **Survey and Site Investigations:** - For reference to surveys external to the Contract, the Contractor shall refer all levels w.r.t. Mean Sea Level (MSL) Datum, which is generally used all Levels w. r. t. The datum used for the Contract shall be Mean Sea Level Datum.

The Contractor shall carry out all further site investigations necessary for the Permeant works and to enable the determination of the method of construction and the nature, extent and design of Temporary works.

CHAPTER 2

2. PLANNING, PROGRAMME AND PROGRESS MONITORING

- 2.1 Planning:** - The Contractor shall develop in detail, a logical method of executing the Works taking into account their complex nature and different phases and shall provide programmes which reflect the detailed planning undertaken.
- 2.2.1.2** The programmes, shall start with the Commencement Date of the Works as day one. The programme is to be realistic, achievable as per key date given in PS and shall be accompanied by the detailed supporting Plans referred to in Chapter 3 Below.
- 2.2 Programming General Requirements:** - Programme activities shall be discrete items of work, which when combined, produce definable elements, components, Stages and Sections of the Works and clearly identify the completion obligations of the Contractor.
- 2.2.1** Key Dates shall be an integral part of all programmes and all activities, and sequencing and interrelationships required to achieve each completion obligation shall be shown.
- The critical path shall be clearly identified in the programme and fully described in the accompanying programme narrative. Activity descriptions shall clearly convey the nature and scope of the Works.
- 2.2.2** Programmes shall take into account the activities of precursor, concurrent, adjacent and follow on Project Contractors as well as utility service diversions, new utilities and connections and any other activity that may affect the progress of the works.
- 2.2.3** The Contractor shall also incorporate the Engineer's requirements for additional activities, to further explain or subdivide complex or long duration tasks, without affecting completion dates.
- 2.3 Progress Monitoring:** - The Contractor shall monitor its and its subcontractors' performance and against programmes to ensure its compliance with its obligations under the Contract. Monitoring of the Works shall include direct, daily monitoring of the progress of the Works and the preparation of written and computerised reports to be submitted to the Engineer. The reports shall include all necessary supporting data to apprise the Engineer of the status of the completion of the works as described in clause 2.10 below.
- 2.4 Works Programme:** - The Works Programme to be submitted under the Contract shall be developed from The Outline Works Program submitted and developed during the Tender period.
- 2.4.1 Submission Dates**
- 2.4.1.1** Within 7 days of the Commencement Date of the Works, the Contractor shall submit, proposed initial version of the works Programme for Engineer review. Works Programme which shall provide full programme details for the complete period of the contract.
- 2.4.1.2** Within 21 days of the Commencement Date of the Works, the Contractor shall submit for review by the Engineer the proposed full version of the Works Programme.
- 2.4.1.3** Programme within the time scales nominated above the Employer may nominate the Outline Works Programme as the first issue of the Works Programme required under the Contract.
- 2.4.1.4** In the event that the Employer nominate the Outline Works Programme as include any amendment that he sees fit to change external constraining dates, duration of activities by parties other than the Contractor and subdivide the Contractors own activities to provide additional detail and links to other activities but without altering the duration or sequencing of the activities shown on the Outline Works Programme.

2.4.1.5 Any initial or final Works Programme resulting from a nomination by the Contractor as his own work & any responsibility for further maintenance of the Works Programme as nominated shall remain with the Contractor.

2.4.2 Content

2.4.2.1 The Works Programme shall demonstrate by reference to its Sub- Programmes, Supplementary Programmes and associated Management Plans, the sequence and duration of activities and any restraints thereto, that the Contractor shall adopt to achieve Key Dates and to fulfil all Contract obligations. The Works Programme shall become the Engineer's basis of administration of the time-related aspects of the Contract.

2.4.2.2 The Contractor shall provide the Engineer with substantiation for each constraint whether target start, target finish or mandatory constraint Entered shall be kept to an absolute minimum in order that the CPM Networks developed can be freely analysed.

2.4.2.3 The Works Programme shall include activities for all the phases & stages development of the Contractor's procurement, installation, commissioning and setting to work. As a minimum, it shall include:

1. all work comprising the Permanent Works;
2. preparation and submission for review of mock-ups and prototypes;
3. procurement of all major materials and items of Contractor's Equipment for the Works, including the dates orders are to be placed, manufacture period and the expected delivery date to the Site for each item;
4. any software development requirements and Validation time frames;
5. all manufacture or prefabrication of materials or components;
6. all installation of major Temporary Works;
7. all activities associated with the securing of necessary permits and other statutory approvals for the Works;
8. access and availability dates for all Project Contractors;
9. all interfaces related to the Project that may affect the progress of the Works;
10. testing and commissioning activities which demonstrate an understanding of the interfaces and requirements of Chapter 8 below; and
11. Training

2.4.2.4 The Works Programme shall be divided into Sub-Programmes of manageable sizes addressing in more specific detail, the content of the Management Plans as stated in Chapter 3 below: -

The Sub-Programmes shall be as follows: -

1. procurement and manufacturing programme;
2. Installation Programme;
3. Testing and Commissioning Programme; and
4. Training

2.4.2.5 The submission of the full version of the Works Programme shall include the Procurement, Manufacturing Programme and Installation Programme and the Testing and Commissioning Programme identifying all major installation, testing activities & associated interfaces.

2.4.3 All programmes constituting the Works Programme shall be organised in a logical work breakdown structure including work stages or phases. Each activity shall be coded to indicate, as a minimum, the work group or entity responsible for the activity, the area, facility or location in which the activity is included, from information provided in the Pricing Document. activity is included, from information provided in the Pricing Document. Key Dates shall be coded so as to be separately identifiable. The Contractor may be required to assign additional activity codes as required by the Engineer.

2.5 Procurement and Manufacturing Programme

- 2.5.1 Within 15 days of the Commencement Date of the Works, the Contractor shall submit for review by the Engineer Procurement and Manufacturing Programme that shall be an integrated part of the overall Works Programme.
- 2.5.2 The Procurement and Manufacturing Programme shall show the interdependencies between engineering disciplines as well as between the Contractor and its sub-contractors and suppliers.
- 2.5.3 The Contractor shall submit a weighted bar chart of the Contractor's procurement and manufacturing activities. Each activity weight shall normally not be more than 5% of the total man-hour content or value of the respective work.
- 2.5.4 The Procurement and Manufacturing Programme shall include a separate breakdown, supported by the Material Control Schedule, which shall be a complete amplification of the Contractor's programme and equipment list, including those items which are subject to long lead time or component parts which are manufactured from countries outside the country of assembly testing.
- 2.5.5 The Material Control Schedule shall give details of the following information for each permanent major and minor material and significant component. The format of such a schedule shall include:
1. name, description, supplier/sub-supplier details;
 2. drawing information (where appropriate), title, drawing status, submission dates, shop drawings/ fabrication drawing preparation, submission dates, shop drawings/ fabrication drawing preparation, etc.
 3. manufacturing test pieces, trial production, Engineer's inspection, monthly production of components and monthly supply of components;
 4. transport to dock, shipment;
- 2.5.6 The Contractor shall continuously maintain this schedule and report upon the status of each item as part of the Contractor's regular progress reporting.
- 2.5.7 From this base data, the Contractor shall prepare an exception report detailing all components that are in delay. This report shall be annotated with the reason for the delay and indicate what action the Contractor is taking to recover the lost time.
- 2.5.8 The Contractor shall submit, as part of the Procurement and Manufacturing Programme, a Factory Testing Programme that shall support all aspects of the Factory Testing Plan within 15 days of the commencement date of the Factory Testing Plan within 15 days of the commencement date of works.
- 2.5.9 The Factory Testing Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.
- 2.5.10 The Factory Testing Programme shall demonstrate the logical dependencies between the individual tests of the Works and shall also show the interfaces and dependencies with the Contractor's delivery programme.
1. The Factory Testing Programme shall include details of inspection, testing and witnessing of the Contractor's and subcontractor's procurement and manufacturing activities.

2.6 Installation Programme

- 2.6.1 The Installation Programme shall be submitted within 30 days of the commencement date of works in initial version. The final version of installation, programme shall be submitted as stated in PS or as directed by Engineer.
- 2.6.2 The Installation Programme shall include detailed activities describing all aspects of the installation of the Works. It shall be clearly linked to the Procurement and Manufacturing Programme and Testing and Commissioning Programme to form an integrated part of the Works Programme.

- 2.6.3 The Installation Programme shall be fully supported by the Construction and Installation Management Plan as specified in clause 3.6 below.
- 2.6.4 The Installation Programme shall indicate the physical areas to which the Contractor requires access, access date, duration required and the required degree of completion for civil or architectural finishes prior to the Access date.
- 2.6.5 The Installation Programme shall take into account the requirements for arrival at port, delivery, storage, preservation & positioning of large items of Contractor's Equipment and Permanent Works and shall set out the Contractor's proposed delivery route for such items to the site.
- 2.6.6 Installation Tests shall be clearly shown in the Installation Programme and shall include those interface tests required to be carried out by others to establish a timetable for these tests.
- 2.6.7 Activities that may be expedited by the use of overtime, additional shifts or by any other means shall be identified and explained.
- 2.6.8 In preparing the Installation Programme, the Contractor should note that the following conditions shall apply: -
1. the Contractor shall not have exclusive access to any part of the Site except by the specific consent of the Engineer.
 2. the Contractor shall take note that concurrent time allocations for certain areas may be given to more than one contractor. The Contractor shall co-ordinate the Contractor's work in such area with that of Project designated Contractors through the Engineer.
 3. the absence of a programme date or installation period for the Contractor in a specific area shall not prejudice the right of the Engineer to establish a reasonable programme date or installation period for that area.
 4. the Contractor shall comply with the identified Key Dates.
- 2.7 Testing and Commissioning Programme**
- 2.7.1 The preliminary version of testing & Commissioning Programme shall be submitted within 30 days of commencement date of works. The final version of testing and commissioning programme shall be submitted as stated in the PS or as directed by the Engineer.
- 2.7.2 The Contractor shall submit the Testing and Commissioning Programme that shall fulfil all the on-Site testing and commissioning requirements.
- 2.7.3 The Testing and Commissioning Programme shall be fully detailed, with activities individually identifying all tests for which a certificate will be issued, and shall include activities for preparation, submittal and review of the test procedures.
- 2.7.4 The Testing and Commissioning Programme shall demonstrate the logical dependencies between the individual tests of the Works and shall also show the interfaces and dependencies with all of the Project Contractors' test required to commission the works and support the Commissioning Plan.
- 2.8 Training Programme**
- 2.8.1 The Contractor shall, within 120 days of the Commencement Date of the Works, submit for review by the Engineer, a Training Programme covering all proposed formal training courses, delivery of training equipment.
- 2.8.2 The Training Programme shall be developed to the Training Plan as required under clause 3.7.3 below.
- 2.8.3 The Training Programme shall be sufficiently detailed so that the Employer can ensure the availability of staff for all the courses required under clause 9.2.
- 2.8.4 The Training Programme shall include the requirements of Chapter 9.
- 2.9 Works Programme Revisions**

- 2.9.1 The Contractor shall immediately notify the Engineer in writing of the need for any change in the Works Programme, whether due to a change of Intention or circumstances or for any other reason. Where such a proposed change affects the timely completion of the Works or any Section or Stage; the Contractor shall within 14 days of the date of notifying the Engineer submit for the Engineer's review his proposed revised Works Programme and accompanying Programme Analysis Report. The proposed revised Works Programme shall show the sequence of operations of any and all work related to the change and the impact of changed work or changed conditions on the Works and Project Contractors and their works.
- 2.9.2 If at any time the Engineer considers the actual or anticipated progress of the work reflects a significant deviation from the works programme, he may request the contractor to submit proposed revised work programme. Upon receipt of such a request the Contractor shall submit within 14 days a revised Works Programme, together with an accompanying Programme Analysis Report and Narrative Statement that shall demonstrate the means by which the Contractor intends to eliminate the deviation.
- 2.10 Monthly Progress Report**
- 2.10.1 The Contractor shall prepare Monthly Progress Reports covering all aspects of the execution of the Works. Such Monthly Progress Reports shall be in writing and shall be delivered to the Engineer by the 5th day of the month following the month of the Monthly Progress Report. The Monthly Progress Report shall take account of work performed up to and including the last day of the month to which the Monthly Progress Report relates.
- 2.10.2 The Monthly Progress Report shall include an executive summary and contain clear and concise statements in respect of every significant aspect of the works including, without limitation, the requirements specified in Appendix 1 of this Specification.
- 2.10.3 The Monthly Progress Report shall contain evidence that documents and supports the progress of the Works, as stated in the Interim Payment Certificates, to the satisfaction of the Engineer.
- 2.10.4 The reports, documents and data provided shall be an accurate representation of the current status of the Works and of the work to be accomplished and shall provide the Engineer with a sound basis for identifying problems and deviations from planned work & for making decisions.
- 2.11 Key Date and Access Date**
- 2.11.1 The Key Date and Access Date shall be prepared in a format reviewed by the Engineer and identify and state the status of;
1. all Key Dates and Access Date that were planned to be achieved in the reporting period or earlier but have not been achieved;
 2. all Key Dates and Access Date that have been achieved in the reporting period;
 3. all Key Dates and Access Date that are planned to be achieved in the next reporting period; and
 4. any future Key Dates and Access Date that appear unlikely to be achieved on time.
- 2.11.2 The Key Date and Access Date shall identify, for all relevant Key Dates and Access Date, the planned dates, the actual dates achieved, and where the original planned dates are forecast to be unachieved, the revised dates identified in the contract, as the same may be revised from time to time in accordance with the contract.
- 2.11.3 The Key Date and Access Date shall also provide an explanation for any deviation from the planned dates. Measures taken or required to recover programme delays shall also be identified.
- 2.12 Progress Meetings**
- 2.12.1 The Employer will chair progress meetings every month with the Contractor. These meetings will be held at dates and times to be advised by the Engineer. Progress meetings shall not be later than 10 days after the issue of the Contractor's Monthly Progress Report.

- 2.12.2 The Engineer may convene at his discretion, at any time upon reasonable notice to the Contractor, any meeting, either on or off the Site, to discuss and address any aspect of the Works or the Contract. The Contractor shall attend any such meetings convened by the Engineer.
- 2.12.3 All meetings shall be convened in **Pune** unless directed otherwise by the Engineer. Meetings shall be attended by senior personnel from the Contractor who shall arrive properly briefed for all aspects of the meeting and shall be empowered to make executive decisions in respect of the execution of the Works.

CHAPTER 3

3. MANAGEMENT PLANS AND SUBMISSIONS

3.1 General

3.1.1 In order to organise the various submissions required by the Engineer, and to ensure the Contractor's understanding and compliance with the requirements of the Contract, a series of Management Plans shall be developed. These Management Plans will serve to structure the submittals in a manner that the Contractor can develop and prepare the submittals and the Engineer can review and comment on a prescribed programme.

3.1.2 The Management Plans shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below.

The plans and documents shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combines together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed. Unless otherwise stated in the PS, all plans and documents shall be submitted in preliminary form within 15 days of the Commencement Date of the Works followed by detailed plans within 30 days of the preliminary submission. Further submissions shall be made:

1. when required in accordance with the Works Programme;
2. in response to comments made by the Engineer in accordance with clause 4.3.6 below;
3. whenever any change occurs that invalidates the information contained in the previously submitted and reviewed document, within 14 days of the occurrence of such change; and
4. when requested by the Engineer from time to time.

3.2 General Organisation

3.2.1 The Plans listed below shall be developed and submitted by the Contractor for the Engineer's review:

- Project Management Plan
- Contractor's Project Plan
- Interface Management Plan
- Systems Assurance Plans
- Quality Plans
- Safety Plans
- Procurement, Manufacturing and Delivery Plan
- Construction and Installation Plan
- Health and Safety Documentation
- Environmental Qualities Management Plan
- Traffic Management Plan
- Completion Plan
- Training Plan
- Defect Liability Management Plan

3.3 Project Management Plan

The overall management of the Works shall be the Contractor's responsibility. The organisation of the resources for the procurement, manufacture, delivery, installation,

testing & commissioning, and setting to work is to be developed into a Project Management Plan. Each section of this plan shall fully describe the Contractor's understanding of the Works and management skills and structure required to achieve the same.

3.3.1 Contractor's Project Plan

3.3.1.1 The Contractor's Project Plan shall provide a clear overview of the Contractor's organisation, management systems and methods to be used for the complete execution of the Works.

3.3.1.2 The Contractor's Project Plan shall include a summary description of each and every stage of implementation of the Works, clearly showing the principal organisational interfaces both within the Contractor's own organisation (including sub-contractors of every tier) and with Other Contractors and Relevant Authorities, defining how each of these interfaces is to be managed and controlled. An organisation chart shall be produced to illustrate the subdivision of the work into elements for effective technical and managerial control, the reporting structure and the interface relationship among all parties involved. Names, addresses, telephone and fax numbers of all principal contacts shall be listed.

3.3.1.3 The Contractor's Project Plan shall contain structured organisation charts showing the hierarchical relationship of the Contractor's organisation (including sub-contractors of every tier). The organisation charts shall be produced as a "family" such that the basic chart shows the overall organisation structure supported by subsidiary charts detailing the internal structure of the various departments or sections of the overall organisation.

3.3.1.4 The Contractor's Project Plan shall include full details of the qualifications, experience, authority and responsibility of the personnel assigned to all key positions of the Contractor's organisation (including sub-contractors of every tier). As a minimum, this shall include all levels down to senior managers & shall include the personnel responsible for each individual department and functional group. A clear reference shall be given as to the location of staff (e.g. Site resident or factory based, etc.). Names, addresses, telephone and fax numbers of all principal contacts shall be listed. The Contractor's Project Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall, without limitation, identify and set out;

1. the procedures for the control of receipt and issue of all Works related correspondence so as to ensure traceability;
2. the procedures for the identification, production, verification, internal approval, review (when required) by the Engineer, distribution, implementation and recording of changes to all drawings, reports and specifications;
3. the procedures for the control, calibration and maintenance of inspection, testing and measuring equipment;
4. the procedures for the control of non-conformity.

3.3.1.5 Particulars of Contractor's Representative

1. The Contractor shall give and provide all necessary supervision during the execution of the Works as long as the Engineer considers necessary for the proper fulfilment of the Contractor's obligations under the Contract.
2. The Contractor shall ensure that he is at all times represented on the Site by a competent and authorised English/Hindi speaking Contractor's Representative who shall be deemed to have been reviewed without objection by the Engineer provided such Contractor's Representative is not expressly objected to by the Engineer in writing within 14 days from the service of a notice upon the Engineer by the Contractor of the appointment of such Contractor's Representative. Such Contractor's Representative shall remain constantly on the Site and shall give his full to the superintendence of the works.

3. Such authorised Contractor's Representative shall receive on behalf of the contractor directions and instructions from the Engineer.
4. The following particulars of the proposed Contractor's Representative shall be submitted to the Engineer for review:
 - (i) Name;
 - (ii) copy of Identity Card;
 - (iii) details of qualifications, including copies of certificates; and
 - (iv) details of previous experience.
5. The particulars of the Contractor's Representative shall be submitted 30 days before the agreed scheduled start of that part of the Works. Except in the case of a replacement agent (as provided for in clause 3.3.1.5.), in which case the said particulars shall be submitted forthwith.
6. The Contractor's Representative shall possess relevant academic or professional qualification and have at least 10 years' experience in relevant engineering works. The Engineer reserves the right to call upon the Contractor to prove such qualifications/ experience to the satisfaction of the Engineer.
7. The minimum qualification of the Contractor's Representative shall be as approved by the Engineer based on nature/importance of the work and experience of the person.

3.3.2 Interface Management Plan

- a) The Contractor shall interface and lease with other Contractors in accordance with the requirement of clause 12.3 below.
- b) Within 30 days of notification from the Engineer of the identity of each Other Contractor, the Contractor shall develop and submit to the Engineer an Interface Management Plan that is mutually acceptable to both the Contractor and the other Contractors. The Interface Management Plan shall:
 - 1) Identify the sub-systems as well as the civil works and facilities with interfacing requirements;
 - 2) Define the authority and responsibility of the Contractor's and other Contractors' (and any relevant sub-contractors') staff involved in interface management & development;
 - 3) Identify the information to be exchanged, together with the management and technical skills required for the associated development work, at each phase of the Contractor's and other Contractors' (and any relevant sub-contractors') project life-cycles;
 - 4) Include considerations of the Interface Hazard Analysis;
 - 5) Specify the configuration and version control procedures in accordance with the Contractor's and other Contractors' (and any relevant sub-contractors') quality management system; and
 - 6) Address supply, installation, testing and commissioning programme of the contracts to meet the key dates of each contract, and highlight any programme risks requiring management attention.
- c) Once the Interface Management Plan has been reviewed without objection by the Engineer, the Contractor shall execute the Works in accordance with the Interface Management Plan. The Contractor shall advise the Engineer immediately of any difficulty in developing a mutually acceptable Interface Management Plan.
- d) Within 30 days of notification from the Engineer of the identity of each Other Contractor, the Contractor shall develop and submit to the Engineer for review a Detailed Interface Document for each Other Contractor that is mutually acceptable to both contractors. The Detailed Interface Document shall address in detail how the dates identified in the Interface Management Plan shall be achieved and shall identify

the data required by the interfacing other Contractors to meet the requirements of the PS.

- e) The Detailed Interface Document shall specify the proposed method and schedule for verifying the interface integrity, the individual equipment/system performance and the combined system performance. The Detailed Interface Document shall include a programme of tests to demonstrate the performance and integrity of the integrated systems. The Interface Specification appended to the PS shall form the basis of the Detailed Interface Document but does not relieve the Contractor's obligation to identify any new interface to meet the Contract requirements. Any revision to the Detailed Interface Document shall be mutually acceptable by contractors and submitted to the Engineer for review.

3.4 Systems Assurance Plans

3.4.1 The Systems Assurance Plans shall be submitted for review to the Engineer in Preliminary and Final forms.

3.4.2 The various plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combines together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.

3.4.3 Quality Plans

The Contractor shall submit for review by the Engineer quality plans in accordance with the requirements of clause 5.2 below.

3.4.4 Safety Plans

3.4.4.1 Site Safety Plan

3.4.4.1.1 The Contractor shall prepare a Site Safety Plan incorporating the requirements of the Project Safety Manual and designed specifically for the various sites (including storage and overseas sites) on which work under the Contract is carried out.

3.4.4.1.2 The Site Safety Plan shall form a part of the Health and Safety Documentation referred to in Chapter 14 below.

3.5 Procurement and Manufacturing Plan

The Procurement and Manufacturing Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below. The plans shall be co-ordinated with each other & shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combines together to assure that the Works fully meet the requirements of the Specification in respect of the subjects listed.

3.5.1 Procurement, Manufacturing and Delivery Plan

3.5.1.1 The Contractor shall prepare procurement, manufacturing and delivery plans in respect of all items and goods. Separate parts of the plan shall be prepared for Contractor or sub-contractor off-Site activities. Each plan shall identify the scope of work to be applied. In relation to such scope of work, it shall, without limitation, define:

1. The organisation of the Contractor's staff directly responsible for the day-to-day management of the manufacturing activity on or off the Site;
2. The specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the work with particular reference to the supervision, inspection and testing of the work;
3. The interfacing or co-ordination required with the Contractor's other related plans;
4. The specific methods of manufacture to identify any relevant method statements & develop those method statements to a degree of sufficient detail reviewed by the Engineer; and

5. The list of procedures and work instructions to manage and control the quality of work during purchasing, manufacturing and delivery, including without limitation:
 - a) the purchasing of items and goods and ensuring they comply with the requirements of the Specification, including (without limit) purchasing documentation & specific Verification arrangements for Contractor/Engineer inspection of material or manufactured product prior to refer for use;
 - b) The manufacturing process so as to ensure compliance with the design.
 - c) The manufacturing process so as to ensure clear identification and traceability of material and manufactured parts;
 - d) The inspection and testing of incoming materials, in process and final product so as to ensure specified requirements for the material and/or manufactured product are met;
 - e) the identification of the inspection and test status of all material and manufactured products during all stages of the manufacturing process to ensure that only products that have passed the required inspections and tests are dispatched for use and/or installation;
 - f) Review and disposal of non-conforming material or product so as to avoid unintended use;
 - g) The assessment and disposal of non-conforming material and manufactured product and approval for reworking or rejection as scrap;
 - h) The identification of preventive action so as to prevent recurrence of similar non-conformance; and
 - i) The handling, storage, packaging, preservation and delivery of manufactured product.
- 3.5.1.2 The Contractor shall prepare and submit the inspection and testing plans to manage and control any test and inspection activities.
- 3.5.1.3 The Contractor shall propose a structured set of inspection hold points. The hold points shall be structured such that a formal hold point is allowed for each significant element of the manufacturing process. At each hold point, the Engineer shall hold a formal inspection or advise that the inspection has been waived.
- 3.5.1.4 Once the inspection and any required remedial actions are completed to the satisfaction of the Engineer, the Engineer shall give a notice of no objection for unit shipment. The Engineer will not withhold his notice of no objection for shipping unreasonably, provided all pre-delivery assembly and testing has been successfully completed.
- 3.5.1.5 Any unit delivered without the Engineer's notice of no objection shall be rejected at the Site and all expenses thereby incurred shall be borne by the Contractor.
- 3.6 Construction and Installation Management Plan**

The Construction and Installation Management Plan shall be configured as a family of "stand-alone" plans and associated documents each covering one of the subjects listed below. The plans shall be co-ordinated with each other and shall collectively define, describe & encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combines together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed.
- 3.6.1 Construction and Installation Plan**
 - 3.6.1.1 The Contractor shall prepare plans for the construction and installation activities on and off the site, as referenced in clause 10.1.1 below, and shall ensure that these are properly related to the subsequent testing and commissioning activity.
 - 3.6.1.2 Separate parts of the plan shall be prepared for other contractor(s) or sub- contractor(s) off-site activities.

- 3.6.1.3 Each construction plan shall identify the scope of activity to be controlled. In relation to such scope of activity, it shall, without limitation, define:
1. the organisation of the Contractor's staff directly responsible for the day-to-day management of the activity on or off the Site;
 2. the specific allocations of responsibility and authority given to identified personnel for the day-to-day management of the Works with particular reference to the supervision, inspection and testing of the Works;
 3. the interfacing or co-ordination required with the Contractor's other related plans;
 4. the specific methods of construction and installation to identify any relevant method statements and develop those method statements to a sufficient degree of detail reviewed by the Engineer;
 5. a detailed method statement which shall include but not be limited to:
 - a) description of main operations and sub-operations;
 - b) sequence of sub-operations;
 - c) quantities of the work and production rates to be achieved;
 - d) resources to be employed; and
 - e) quality checks to be carried out, supervision being exercised and safety precautions to be employed;
 6. the list of procedures and work instructions to manage and control the quality of construction and installation works, including without limitation:
 - a) the inspection and testing activities of incoming materials, in process and final product so as to ensure specified requirements for the material and/or product are met;
 - b) the purchasing of materials and ensuring that they comply with the requirements of the Specification, including purchasing documentation and specific Verification arrangements for Contractor/Engineer inspection of material or manufactured product prior to release for use/installation;
 - c) the construction processes including Temporary Works so as to ensure compliance with drawings and Specification. In addition, any software to be used in the construction, installation & commissioning process shall be identified and details of the Verification and Validation processes for the software application shall be given;
 - d) the construction and installation process so as to ensure clear identification and traceability of material and manufactured product;
 - e) the identification of the inspection and test status of all material and manufactured products during all stages of the construction and installation process to ensure that only products that have passed the required inspections and tests are despatched for use and/or installation;
 - f) review and disposition of non-conforming material or product so as to avoid unintended use/installation;
 - g) the assessment and disposition of non-conforming material and product and approval for reworking or rejection as scrap;
 - h) the identification of preventive action so as to prevent recurrence of similar non-conformance; and
 - i) the handling, storage, packaging, preservation and delivery of product; and
 7. the security control of the Site and the works area for Contractor's accommodation, storage, car park & other works facilities, etc. in accordance with clause 11.10 below.
- 3.6.1.4 The Contractor shall prepare and submit the inspection and test plans to manage and control any test and inspection activities in accordance with clause 5.6.1 below.

- 3.6.1.5** Where all or part of the Works is within the Maharashtra Metro Rail Corporation Limited Protection Zone, the Contractor shall follow the guidelines issued by the Employer's appropriate authority. The Contractor shall submit to the Engineer for review his construction method statement and detailed design of any Temporary Works proposed to be erected within this zone adjacent to Maharashtra Metro Rail Corporation Limited properties.
- 3.6.1.6** The following particulars shall be submitted to the Engineer for review within 14 days of the Commencement date of the work:
- i) drawings showing the layout within the Site of the Engineer's and Contractor's accommodation, Project signboards, access roads and major facilities required early in the Contract;
 - ii) drawings showing the layout & the construction details of the Engineer's accommodation; &
 - iii) drawings showing the details to be included on Project signboards.
- 3.6.1.7** Drawings showing the location of stores, storage areas, work areas and other major facilities shall be submitted to the Engineer for review as early as possible, but in any case, not later than 28 days before construction of the facilities.
- 3.6.2 Health and Safety Documentation**
- 3.6.2.1** The Contractor shall submit Health and Safety Documentation to fully comply with the requirements of the Project conditions and proposed work activities in accordance with Chapter 14 below.
- 3.6.2.2** The Contractor shall submit to the Engineer the Health and Safety Documentation for review within 30 days of the Commencement Date of the works.
- 3.6.3 Environmental Qualities Management Plan**
- 3.6.3.1** The Contractor shall submit an Environmental Plan based the Outline Environmental Plan submitted and adapted during the Tender period. The Environmental Plan shall comprise a set of Environmental Plans as detailed below;
- Environmental Management Plan;
 - Environmental Mitigation Implementation Schedule (if required);
 - Traffic Management Submissions
- 3.6.3.2** Environmental Plans shall include the Contractor's proposed means of complying with his obligations in regard to:
- a) The Site Environment as found; and
 - b) System Environment as described in the Specification.
- The Environmental Plan shall include as required detailed policies, procedures and applicable regulations.
- 3.6.3.3 Environmental Management Plan**
- 3.6.3.3.1** The Contractor shall submit for review by the Engineer, an Environmental Management Plan (EMP) which will set out in detail the approach for dealing with each of the potential environmental impacts arising from the various different construction activities.
- 3.6.3.3.2** The EMP shall address all the potential impacts outlined in the Employer's Final Assessment Report and shall follow the EMP Outline.
- 3.6.3.3.3** The Contractor shall submit the final EMP, for review by the Engineer, 30 days prior to the commencement of construction activities.
- 3.6.3.4 Environmental Mitigation Implementation Schedule**
- 3.6.3.4.1** The Contractor shall submit for review an Environmental Mitigation Implementation Schedule (EMIS) which is a plan for the provision of the mitigation measures identified in the EMP.

3.6.3.4.2 The Contractor shall submit the EMIS, for review by the Engineer in conjunction with the EMP, 30 days prior to the commencement of construction activities.

3.6.3.5 Traffic Management Submissions

Where the Contractor is required to become involved with traffic or footpath management activities, submissions shall be made by the Contractor Engineer's review 30 days prior to implementation proving Engineer's review 30 days prior to implementation proving all relevant details and implications.

3.7 Completion Management Plan

3.7.1 The Contractor shall organise the services required under the Contract to bring the Works into service under one plan. This co-ordinated approach shall allow the Engineer the ability to review all aspects of the Works and services in an integrated manner. The Completion Management Plan shall be configured as a family of "stand- alone" plans and associated documents each covering one of the subjects listed below. The plans shall be co-ordinated with each other and shall collectively define, describe and encompass the Contractor's proposed methods, procedures, processes, organisation, sequencing of activities, etc. and shall show how these combines together to assure that the Works truly meet the requirements of the Specification in respect of the subjects listed. Unless otherwise stated, all plans and documents shall be submitted in preliminary form within 15 days of the Commencement Date of the Works followed by detailed plans within 15 days of submission. Further submissions shall be made:

1. when required in accordance with the Contractor's Works Programme;
2. whenever the development of the Contractor's planning requires the plan to be developed further;
3. in response to comments made by the Engineer in accordance with clause 4.3.6 below;
4. whenever any change occurs that invalidates the information contained in the previously submitted and reviewed document, within 15 days of the occurrence of such change; and
5. when requested by the Engineer from time to time.

3.7.2 Commissioning Plan

3.7.2.1 The Contractor shall ensure the timely preparation of the Commissioning Plan. The Contractor shall submit the first draft of the Commissioning Plan to the Engineer within 120 days of the Commencement Date of the Works.

3.7.2.2 The Commissioning Plan shall consist of the following:

- a. Factory Testing Plan
- b. On-Site Testing and Commissioning Plan
- i) **Installation Tests Schedule:-** The Contractor shall submit to the Engineer a comprehensive schedule of Installation Tests as required by clause 8.1.5 below and the PS and in accordance with the Installation Programme as stated in clause 2.6 above. The schedule shall be submitted within the period of time laid down in the PS, or, if no time period is laid down then not later than two months in advance of the date for the commencement of the Installation Tests.
- ii) **Integration Testing & Commissioning Plan :-** The Contractor shall submit to the Engineer a comprehensive Integrated Testing & Commissioning Plan including all requirements detailed in clause 8.1.6 below and the PS. The plan shall be submitted within the period of time laid down in the PS, or, if none is given, not later than three months in advance of the date for the commencement of the Integrated Testing & Commissioning.

3.7.3 Training Plan

3.7.3.1 The Contractor shall ensure the timely preparation of the Contractor's Training Plan in a format and to a level of detail reviewed without objection by the Engineer.

3.7.3.2 The Contractor shall submit the Training Plan by the date stated in the PS, or, if none is given, not less than six (6) months prior to the issue of the Taking Over Certificate for the Works and also to suit the staged commissioning of the relevant systems.

3.7.4 Defects Liability Management Plan

The Contractor shall submit for review by the Engineer a Defects Liability Management Plan to repair, replace and perform any remedial item upon the Works identified by the Engineer during the Defects Liability Period (DLP). The first submission of this plan is required upon issuance of the Taking Over Certificate for the Works. The Contractor shall:

- a) endeavour to complete all necessary work in a timely responsible manner;
- b) not proceed with any remedial work without the consent of the Engineer;
- c) submit a plan that give details of the methods and timing of any proposed work; and update the plan monthly, showing progress of the work and the time to completion.

CHAPTER 4

4. DOCUMENTS SUBMISSION AND REVIEW

4.1 Documents, Submissions and Correspondence

Copies of correspondence relevant to the execution of the Works and not of a confidential nature received from or despatched to Government departments, utility undertakings and Project Contractors employed by the Employer shall be submitted to the Engineer for information as soon as possible but in any case, not later than 7 days after receipt or despatch.

4.2 Submissions to the Engineer

4.2.1 General requirements

4.2.1.1 All submissions shall be made to the Engineer in a format reviewed without objection by the Engineer and in accordance with the requirements in:

- 1) the Contract;
- 2) the Computer Aided Design & Drafting (CADD) Manual; and
- 3) the Document Submittal Instructions to Contractors.

4.2.1.2 Paper and drawing sizes shall be “A” series sheets as specified in BS 3429.

4.2.1.3 The following software (versions quoted or higher) compatible for use with Intel-Windows based computers shall be used, unless otherwise stated, for the various electronic submissions required:

Document Type	Electronic Document Format
Design files	.alg and .dtm etc in latest version
Text Documents	MS Word, Ver. 7.0
Spread Sheets	MS Excel, Ver. 7.0
Data Base Files	MS Access, Ver. 7.0
Presentation Files	MS PowerPoint, Ver. 7.0
Programmes	Primavera for Windows, Ver. 2.0b Corel Draw, Ver. 7.0/
AutoCAD	
AutoCAD Graphics	ver.14
Photographic	Adobe Photoshop, Ver.4.0

Media for Electronic File Submission

One copy shall be submitted unless otherwise stated.

Internet File Formats/Standards

The following guidelines shall be followed when the Contractor uses the Internet browser as the communication media to share information with the Employer. All the data formats or standards must be supported by Microsoft Internet Explorer version 3 or above running on Windows NT and Windows 95. The following lists the file types and the corresponding data formats to be used on Internet. The Contractor shall comply with them unless the Engineer has previously reviewed without objection the Contractors proposal to adopt an alternative:

File Type	Data Format
Photo Image	Joint Photographic Experts Group (JPEG)
Image other than Photo	GIF or JPEG
Computer Aid Design files (CAD)	Computer Graphics Metafile (CGM)
Project documents	refer to the document type in clause 4.2.1.3 above
Video	Window video (.avi)
Sound	Wave file (.wav)

The following states the standards to be used on Internet when connecting to database(s). The Contractor shall comply with them unless the Engineer has previously reviewed without objection the Contractors proposal to adopt an alternative:

Function to be Implemented	Standard to be Complied With
Database connectivity	Open Database Connectivity (ODBC)
Publishing hypertext language on the World Wide Web	Hypertext Mark-up Language (HTML)

- 4.2.1.4 The hard copy of all documents shall be the contractual copy. If required, two copies of all internal and external orders placed by the Contractor for equipment or materials required for the Works shall be forwarded to the Engineer at the time of issue.
- 4.2.1.5 All orders shall state the Engineer's requirements for inspection and testing, shall bear the Contract reference, Contractor's name and address and shall indicate, where applicable, the sub-section of the Works for which the equipment or material is required.
- 4.2.1.6 Distribution of copies of the orders shall be in accordance with the Engineer's instructions.
- 4.2.1.7 The Contractor shall have the obligation to upgrade, at his own cost, all the relevant software to the latest version upon instruction by the Engineer, after the new version of the relevant software has been launched for more than six months in **Pune**.
- 4.2.1.8 The Contractor shall submit a drawing register to the Engineer in electronic copy and hard copy with each submission of drawings and at an interval agreed by the Engineer.
- 4.2.1.9 The drawing register shall be in a format submitted for review and agreed without objection by the Engineer and shall include each document reference number, version, date, title and data-file name. Specific additional requirements in respect of the numbering scheme shall be as defined in the PS.
- 4.2.2 Contents
- 4.2.2.1 Unless otherwise specified or permitted by the Engineer, each submission shall comprise:
- (1)for drawings - one A1 master on vellum (signed by the contractor), one A1 copy on vellum, one paper A1 copy, six paper A3 copies and an electronic data copy of all drawings; and

- (2)for documents - the unbound original, six bound copies and an electronic copy when applicable.
- 4.2.2.2 The A3 copies of drawings shall be produced as reduced versions of the A1 original.
- 4.3. Reports and records**
- 4.3.1 Reports and records** that are to be submitted to the Engineer shall be in a format reviewed by the Engineer. Reports and records shall be signed by the Contractor's agent or by a representative authorised by the Contractor.
- 4.3.2 Within 15 days of the Commencement Date of the Works, the Contractor shall submit a Project document control procedure to the Engineer for review, which shall include but not be limited to the following:
1. a document approval system which shall specify the level of authority for approval of all documents and material before submission to the Engineer;
 2. a system of issuing documents to ensure that pertinent documents are issued to all appropriate locations;
 3. a document change or re-issue system to ensure that only the latest revision of a document can be used; and
 4. a submission identification system which identifies each submission uniquely by the following:
 - (a) contract number;
 - (b) discipline;
 - (c) submission number; and
 - (d) revision indicator.
- 4.3.3 Project records will eventually be used by the Employer to manage, operate and maintain the Works after the completion of the Project under construction and for future reference.
- 4.3.4 The Contractor shall submit the documents as required by the Engineer as Project records in full and on time. The Engineer shall determine the adequacy of the Project record.
- 4.3.5 Submission and review procedure
- 4.3.5.1 Except where specific procedures are given for certain items, all submissions shall be submitted and reviewed according to the procedure laid down in the following clauses.
- 4.3.5.2 Each submission shall be accompanied by a brief introduction to explain which sub-system, part or Section of the Works to which the submission refers, listing the documents enclosed with the submission, and describing in outline how all relevant requirements of the Specification are achieved by the proposals.
- 4.3.5.3 For each stage of submittal, the Contractor shall prepare a Submission Review Request (SRR) carrying the date of submission, the submission reference number as defined in clause 4.3.2.(4) above, the submission title, the stage of submission and the authorised signature of the Contractor's responsible engineer in the format shown in Appendix 3 of this Specification, to confirm that, in the opinion of the Contractor, the submission:
- (1) complies with all relevant requirements of the Specification;
 - (2) conforms to all interface requirements;
 - (3) contains, or is based on auditable and proven or verified calculations or design criteria;
 - (4) has been properly reviewed by the Contractor, according to the Contractor's QA system, to confirm its completeness, accuracy, adequacy and validity; and
 - (5) has taken account of all requirements for approval by statutory bodies or similar organisations, and that where required, such approvals have been granted.

4.3.5.4 The Engineer's response to the submission will normally be made within 30 calendar days of receipt of the submission. The Engineer may extend the review period depending on the amount of documentation accompanying the submission.

4.3.6 Engineer's Response

4.3.6.1 The Engineer will respond in one of the following three ways :

1. "Reviewed without Objection"
2. "Reviewed without Objection, Subject to"
3. "Rejected"

4.3.6.2 If the Engineer, having reviewed the submission, has not discovered any non-compliance with the Contract, the SRR will be returned endorsed with the Engineer's signature and the words "Reviewed without Objection".

Receipt of such notice of no objection does not in any way imply the Engineer's approval of the submission, nor does it remove any responsibility from the Contractor for complying with the Contract. Issue of a "Notice of No Objection" entitles the Contractor to proceed to the next stage of the programme of work.

4.3.6.3 If the Engineer discovers minor non-compliance, discrepancies, omissions, etc. that, in his opinion, are not of a fundamental nature, he may return the SRR endorsed with the Engineer's signature and the words "Reviewed without Objection Subject to" and including a list of the features that are required to be amended, included or improved to comply with the Contract. Issue of a "Notice of No Objection Subject to" entitles the Contractor to proceed to the next stage of the programme of work provided that all of the Engineer's comments are taken into account fully and implemented exactly.

4.3.6.4 If the Engineer issues a "Notice of No Objection Subject to", the Contractor shall resubmit the affected parts of the submission, clearly demonstrating how the Engineer's comments have been taken into account and resubmit amended or corrected material within 10 working days of issue of the Engineer's comments, using the process described in clause 4.3.5 above.

4.3.6.5 If the Engineer discovers major non-compliance, discrepancies, omissions, etc. that, in his opinion, are of a fundamental nature, he may return the SRR endorsed with the Engineer's signature and the word "Rejected" and including a list of the features that are required to be amended, included or improved to comply with the Contract. Issue of a "Notice of Rejection" does not entitle the Contractor to proceed to the next stage of the programme of work until all of the Engineer's comments are fully taken into account and a satisfactory re-submission has been made (i.e. one which results in a "Notice of No Objection" or "Notice of No Objection Subject to").

4.3.6.6 If the Engineer issues a "Notice of Rejection", the Contractor shall resubmit the complete submission, clearly demonstrating how the Engineer's comments have been taken into account and resubmit amended or corrected material within 10 working days of issue of the Engineer's comments, using the process described in clause 4.3.5 above.

4.4 Records

4.4.1 The Contractor shall establish and maintain a place for the storage and archiving of all the documents relating to the Works and not required to be submitted to the Engineer under clause 4.1 above which shall be:

- (1) the same place or office where the Contractor is performing the work and storing documents reviewed by the Engineer, or;
- (2) at the Site or elsewhere in **Pune**, a records office, which contains all other, documents that the Contractor is required to maintain in accordance with the Contract.

4.4.2 All documents shall be filed, indexed and suitably stored to permit easy identification and necessary audits.

4.4.3 The Contractor shall maintain in **Pune** his archive of all documents in connection with and arising out of the Contract, until 28 days after the issue of the Final Certificate or until final settlement of all Disputes, whichever is later.

CHAPTER 5

5. QUALITY MANAGEMENT

5.1 Introduction

- 5.1.1 The Contractor shall maintain and implement a Quality Management System that shall remain in effect during the execution of the Works. The Contractor's Quality Management System shall be based on the International Standard ISO 9001:1994 "Model for quality assurance in design, development, production, installation and servicing." The Contractor shall submit its Quality Management System documentation for the Engineer's review as specified in this Chapter. The Contractor shall adequately demonstrate their experience in handling Quality Assurance handled for similar scope of works and to submit the Copies of few Quality Assurance document formats.

The Quality Management System documentation shall include, but shall not be limited to the following:

1. quality manual;
2. quality procedures and work instructions;
3. quality plans; and
4. inspection and test plans

- 5.1.2 The Contractor shall plan, perform and record all quality control activities to ensure that all work is performed in accordance with the requirements of the Contract and is detailed in the quality plans which are required under this Chapter. Such activities shall include, without limitation, the inspections and/or tests expressly or implicitly required by the Contract.
- 5.1.3 Without prejudice to such requirements, the Engineer may from time to time instruct the Contractor in relation to such further or other inspections and/or test as are in his opinion appropriate.

5.2 General Requirements

- 5.2.1 All quality system documents and plans to be submitted shall embrace all activities of the Contractor & sub-contractors of any tier, including its suppliers & any design consultants.
- 5.2.2 Quality Plans
- 5.2.2.1 The quality plans to be submitted by the Contractor shall comprise of:
- (1)a Management Quality Plan, for the control of all management related activities;
 - (2)Manufacturing Quality Plan and Site Quality Plan, for the control of activities within each category of work or discrete element of procurement, manufacturing, delivery, construction and installation of the Works, including Temporary Works.
- 5.2.3 Within 30 days of the Commencement Date of the Works, the Contractor shall submit for review by the Engineer:
- (1)a quality manual;
 - (2)the quality system procedures and any associated system instructions and/or forms which he proposes to use for the Works; and
 - (3)the initial submission of quality plans shall be a development of that submitted at Tender stage and shall contain as a minimum, the Contractors' proposed Management Quality Plan as detailed further in this Chapter.
- 5.2.4 The Contractor shall submit separate Manufacturing Quality Plan and Site Quality Plan covering all elements of the Works. These shall be in accordance with the specific requirements of this Chapter and shall be submitted to the Engineer for review 30 days prior to the commencement of the manufacturing and construction works covered by the

quality plans. In addition, the Contractor shall prepare inspection and test plans for the management and control of the inspection and/or testing by the Contractor of the Works identified in each quality plan.

- 5.2.5 The Contractor shall promptly supply the Engineer with two (2) controlled copies of his quality manual, quality plans, inspection and test plans and related procedures/instructions/forms upon such documents being reviewed without objection by the Engineer. The Contractor shall maintain such controlled documents throughout the duration of the Contract. For any amendment to quality system documentation, the Contractor shall as soon as reasonably practicable prepare and submit the proposed amendment for review by the Engineer. In addition, the Engineer may request further copies of the quality system documents and these documents shall reach the Engineer's office within fourteen (14) days of notification.

5.3 Management Quality Plan

- 5.3.1 The Management Quality Plan shall define the Contractor's management structure for the execution of the Works and for the control of the quality of the Works and shall submit this plan within 30 days of commencement date of work. The management quality plan shall without limitation, define:

- (1) the organisation of the Contractor's managerial staff with particular reference to any joint venture partners and main sub-contractors. An organisation chart shall be produced to illustrate the sub-division of the Works into elements for effective technical and managerial control, the reporting structure and the interface relationship between all parties involved;
- (h) the hierarchy of the overall quality management system documentation to be applied to the Works;
- (i) the quality management system of the Contractor in monitoring and controlling sub-contractors and suppliers; and
- (j) the list of quality system procedures and work instructions to be applied to manage the quality of the Works.

5.4 Manufacturing Quality Plan

- 5.4.1 The Contractor shall prepare a Manufacturing Quality Plan for his manufacturing works and submit this plan 30 days prior to the commencement of manufacturing works. The Manufacturing Quality Plan shall, without limitation, define:

- (1) the organisation of the Contractor's staff directly responsible for the day-to-day management of the manufacturing activities on or off the Site;
- (2) the specific allocations of responsibilities and authorities given to identified personnel or sub-contractors for particular manufacturing work;
- (3) the hierarchy of quality management system documentation for managing and controlling manufacturing works, including manufacturing works of sub-contractors of any tier; and
- (4) the list of procedures and instructions to be applied to manage and control the manufacturing works, together with the procedures and instructions which have not been previously submitted for review.

- 5.4.2 The Contractor shall also prepare inspection and test plans to manage and control any test and inspection activities.

5.5 Site Quality Plan

- 5.5.1 The Contractor shall prepare a Site Quality Plan for its construction and installation works. The Site Quality Plan shall, without limitation, define:

- (1) the organisation of the Contractor's staff directly responsible for the day-to-day management of the construction and installation activities on or off the Site;
- (2) the specific allocations of responsibilities and authorities given to identified personnel or sub-contractors for particular construction and installation work;

- (3)the hierarchy of quality management system documentation for managing and controlling construction and installation works, including construction and installation works of sub-contractors of any tier; and
 - (4)the list of procedures and instructions to be applied to manage and control the construction and installation works together with the procedures and instructions that have not been previously submitted for review.
- 5.5.2 The Contractor shall also prepare inspection and test plans to manage and control any test and inspection activities in accordance with clause 5.6.1 below.
- 5.6 Inspection and Test Plans, Records and Reports**
- 5.6.1 Inspection and test plans shall be produced for every activity requiring test and/or inspection. Each inspection and test plan shall identify the quality objectives and include, without limitation:
- (1)the personnel responsible for undertaking and certifying the inspection and/or test;
 - (2)the procedure or instructions for the inspection and/or test;
 - (3)the test method or a reference to the relevant standard of testing;
 - (4)the inspection and/or test required prior to commencement of an activity;
 - (5)the inspection and/or test during an activity and its frequency;
 - (6)the inspection and/or test required to complete an activity;
 - (7)all Quality Control Points, Quality Hold Points and any notices or other documents to be given to the Engineer in relation to Quality Control Points and Quality Hold Points;
 - (8)the compliance criteria;
 - (9)the method of analysis of test data;
 - (10)the procedure for correction or disposal of any work which fails the compliance criteria;
 - (11)examples of the documentation to be used for reporting the results of inspections, tests and analysis of test data;
 - (12)examples of the documentation to be used for recording the status of inspections and tests in accordance with clause 5.8.1 below; and
 - (13)the procedure for the distribution, filing and storage of inspection reports, test reports and reports on analysis of test data.
- 5.6.2 Each report of the inspection and/or test shall be prepared in accordance with clause 8.3.6.1 below.
- 5.6.3 The Contractor shall ensure that a signed copy of each report of inspection and test is filed in his filing system within 3 (three) working days from the date of inspection and test and two copies furnished to Engineer or as directed by him.
- 5.6.4 In relation to all Quality Control Points and Quality Hold Points involving inspection and/or test by the Contractor, the Contractor shall give the Engineer notice of when the relevant work will be inspected and/or tested in accordance with clause 8.5.1 below.
- 5.7 Review, Verification & Audit**
- 5.7.1 The Contractor shall continuously monitor the performance of each quality plan related to the execution of the Works and shall include in each Monthly Progress Report the status of all quality system documentation, an up-to-date audit schedule and status and an up-to-date non-conformity register providing the status of all non-conformities identified by the Engineer and the Contractor.

The Contractor shall make an appraisal of such performance and identify in particular any non-conformities or other shortcomings in the quality management system, the actions being taken to dispose of these non-conformities, any necessary corrective action taken or proposed to be taken to prevent the re-occurrence of these non-conformities or shortcomings and, any other items as instructed by the Engineer.

5.7.2 The Contractor shall ensure that audits of all the activities in each quality plan are carried out at quarterly intervals, or at such other intervals as the Engineer may require, to ensure the continuing suitability and effectiveness of the quality management system. Reports of each such audit shall be submitted promptly for review by the Engineer.

5.7.3 The Engineer may, by notice to the Contractor, require external audits of the Contractor's quality management system to be carried out either by the Employer's staff or by his representative. In such case, the Contractor shall afford to such auditors all necessary facilities and access to the records to permit this function to be performed.

5.8 Quality Control Register

5.8.1 The Contractor shall provide and maintain at all stages of the Works a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates. Such registers shall be updated by the Contractor to show all activities in previous months and shall reach the Engineer's office before the 7th working day of each month. Each register shall:

- (1) list the certificates received for each batch of goods and materials incorporated in the Works and compare this against the certification required by the Contract and the Contractor's quality plans;
- (2) list the inspection and testing activities undertaken by the Contractor on each element of the Works and compare these activities against the amount of inspection and testing required by the Contract and the Contractor's quality plans;
- (3) show the results of each report of inspection and/or test and any required analysis of these results and compare these results against the pass/fail criteria; and
- (4) summarise any actions proposed by the Contractor to overcome any non-conformity identified in clauses 5.8.1.(1), (2) & (3) above.

5.9 Summaries of Inspection and/or Test

The Contractor shall submit to the Engineer for his information summaries based on quality control register in accordance with the Summaries of Inspection and/or Test described in clause 8.3.11 below.

5.10. Notification of Non-conformities

5.10.1 If, prior to the issue of the Taking Over Certificate for the Works or the relevant Section, the Contractor has used or proposes to use or repair any item of the Works which does not conform to the requirements of the Contract, he shall immediately submit to the Engineer such proposal, supplying full particulars of the non-conformity and, if appropriate, of the proposed means of repair which shall include any calculation analysis or other documentation to support the repair or acceptability of the non-conformity.

5.10.2 If the Engineer issues non-conformity reports or similar documents to notify the Contractor of any item of the Works which he considers to constitute a non-conformity and which has not been reported in accordance with clause 5.10.1 above, the Contractor shall promptly investigate the matter and, within 14 days of notification by the Engineer, submit to the Engineer for review the remedial measures to be taken and stating the reasons for such measures.

CHAPTER 6

6. MATERIALS AND EQUIPMENT

6.1 Materials and Equipment Provided by the Employer

- 6.11 Materials and equipment which are to be provided by the Employer will be as stated in the Contract.
- 6.1.2 Materials and equipment provided by the Employer shall be collected by the Contractor from the locations as per contract conditions. The Contractor shall inspect the materials and equipment before taking receipt and shall immediately inform the Engineer of receipt or any shortage or damage.
- 6.1.3 Materials or equipment provided by the Employer which are damaged/lost after collection shall be replaced by the Contractor and offered to the Engineer for approval. In case, the contractor fails to replace the damaged material, the cost of material with additional costs as per agreement will be recovered from the Bank Guarantees furnished by the Contractor for safe custody of the materials supplied by the Employer (ref.: SCC Clause 50) or any other payment due to the contractor.
- 6.1.4 The Contractor shall dispose of crates and containers for materials or equipment provided by the Employer.
- 6.1.5 Equipment / materials provided by the Employer, surplus to the requirements of the Works shall be returned at the earliest as directed by the Engineer.
- 6.1.6 The Contractor shall protect and maintain equipment provided by the Employer while it is on the Site and shall provide operatives, fuel and other consumables required to operate the equipment.

6.2 Materials

6.2.1 General

- 6.2.1.1 Materials for inclusion in the Permanent Works shall be new unless otherwise stated in the Contract or having been reviewed without objection by the Engineer.
- 6.2.1.2 Certificates of tests by manufacturers, which are submitted to the Engineer, shall relate to the material delivered to the Site. Certified true copies of certificates may be submitted if the original certificates cannot be obtained from the manufacturer. A letter from the supplier stating that the certificates relate to the material delivered to the Site shall be submitted with the Certificates.
- 6.2.1.3 Materials, which are specified by means of trade or proprietary names, may be substituted by materials from a different manufacturer, provided that the materials are of the same or better quality and comply with the specified requirements and have been reviewed without objection by the Engineer.
- 6.2.1.4 In addition to any special provisions in the Contract for the sampling and testing of materials, the Contractor shall submit samples of all materials and goods which he proposes to use or employ in or for the Works. Such samples, if having been reviewed without objection, shall be retained by the Engineer and shall not be returned to the Contractor or used in the Permanent Works unless reviewed by the Engineer. No materials or goods of which samples have been submitted shall be used in the Works unless and until the Engineer shall have reviewed such samples without objection.
- 6.2.1.5 The Engineer may reject any materials and goods which in his opinion are inferior to the samples previously reviewed and the Contractor shall promptly remove such materials and goods from the Site.
- 6.2.1.6 If any material required for this Contract is not available in metric specifications from any known sources, at the time the material is required for the Contract, the Engineer may, upon application from the Contractor, give permission to the use of an equivalent material in imperial specifications as a substitute, provided that:

- (1)no statutory specification shall be altered except in accordance with relevant legal provision, if any;
- (2)the Engineer is satisfied that the Contractor has made every reasonable effort to obtain the material in metric specifications;
- (3)in the opinion of the Engineer, the substitute material is suitable for the Works in all respects;
- (4)in the opinion of the Engineer, the substitute material complies with all the specifications for the material substituted, allowing minor discrepancies between the specified metric measurements and the corresponding imperial measurements of the substitute, provided that such discrepancies can be effectively and satisfactorily compensated for by the provision of extra quantity of the material; and
- (5)the Contractor shall be responsible for all extra quantities of the material required for meeting design and specification requirements of the Works due to the use of the substitute.

6.2.2 Notice of place of manufacture and/or source of supply

The Contractor shall notify the Engineer of the places of manufacture and/or the source of supply of all goods and materials previously reviewed without objection by the Engineer to be incorporated into the Permanent Works. The Contractor shall give reasonable notice (which shall not in any event be less than 56 days) to the Engineer before the start of any manufacturing and/or the supply of goods and materials.

6.2.3 Certificates for Manufactured Goods or Materials

The Contractor shall obtain certificates for each batch of goods and materials incorporated into the Permanent Works. Each certificate shall certify that the materials comply with the requirements of the Contract and shall include all reports of inspections and/or tests carried out at the place of manufacture.

6.3 Equipment

6.3.1 Identification labels

- 6.3.1.1 Each and every individual item of equipment forming part of the Permanent Works shall be fitted with permanent identification labels in accordance with a system based on the contract identification. In this respect, the term “individual item of equipment” refers to a complete assembly of components and to each removable sub-module within the complete assembly.
- 6.3.1.2 The proposed labelling system shall be submitted for review by the Engineer at least 1 months before the scheduled date for the shipment of the first item of equipment to site.
- 6.3.1.3 The identification label whenever possible shall be permanently attached in such a way that it shall not become detached or illegible during the lifetime of the system from any cause including wear and tear, environmental effects (such as rain, direct sunlight, etc.) or any other influence. Preference shall be given to embossed or engraved metallic labels mechanically fastened by riveting or similar means to the item to which they refer.
- 6.3.1.4 All labels shall be of the type that can be easily cleaned to remove dirt and debris (including grease and oil) without disturbing the legibility properties.

CHAPTER 7

7. PACKAGING, STORAGE, SHIPPING AND DELIVERY

7.1 Storage

7.1.1 The Contractor shall provide and maintain acceptable storage facilities for the Permanent Works, equipment and materials of all kinds intended for use in carrying out the Works or for incorporation into the Works.

7.1.2 The Contractor shall prepare, protect and store in an agreed manner all Permanent Works, Contractor's Equipment, equipment and materials so as to safeguard them against loss or damage from repeated handling, from climatic influences and from all other hazards arising during shipment or storage on or off the Site.

Secure and covered storage shall be provided by the Contractor for all Permanent Works, Contractor's Equipment, equipment and materials and materials provided by the Employer which are other than those having been reviewed without objection by the Engineer as suitable for open storage.

7.2 General Precautions

7.2.1 Appropriate precautions in accordance with the GCC, Contractor's safety regulations, the regulations of the Employer, and statutory regulations shall be taken in respect of all hazardous, toxic, inflammable, etc. materials.

7.3 Packaging Procedures

7.3.1 All required inspection/test certificates shall be supplied and packed together with individual material. All packaging materials and procedures shall be subject to review by the Engineer.

7.3.2 All empty cases, crates or packages, whether or not returnable, shall be removed from the Site by the Contractor or stored by the Contractor in such a way that they do not interfere with the progress of the works of Project Contractors.

7.3.3 Two copies of packing lists and quality certificates shall be attached to each case or package to be shipped. One copy shall be placed inside the package and the second copy shall be enclosed in a watertight enclosure on the outside of each case or package. A copy of packing lists and quality certificates shall be sent to the Engineer after each package of the Works, the equipment, spare parts and other items to be shipped have been shipped.

7.4 Shipping

7.4.1 Without prejudice to any other provisions of the Contract, the Contractor shall be responsible for all legal requirements, duties, dues, taxes and other such requirements and expenditures required for the importation of the Works. The equipment, spare parts and other items to be supplied under the Contract into **Pune**.

7.4.2 The Contractor shall clear the Works, the equipment, spare parts and other items to be supplied under the Contract through customs Authorities/Indian sea port in accordance with all Government of India Enactments.

7.5 Delivery

7.5.1 The Contractor shall deliver the Works and all items to be supplied under the contract to the Site.

7.5.2 The Contractor shall unload the Works and all items to be supplied under the contract at the designated delivery point and positioning or storing them.

7.5.3 Any part of the Works or any item to be supplied under the Contract that is damaged in transit shall not be considered as delivered until repairs or replacements have been made and all necessary spare parts or items have been delivered to the site.

7.5.4 All documents, manuals, drawings and other deliverables shall be delivered to an address in **Pune** to be designated by the Engineer in writing.

- 7.5.5 The Contractor shall store and secure the Works, equipment, spare parts and other item until the same have been inspected and are considered delivered at the designated point by the Engineer.
- 7.5.6 An item shall be considered delivered when all damage has been repaired and all documentation and post-delivery preparation have been completed to the satisfaction of the Engineer.

CHAPTER 8

8. TESTING AND COMMISSIONING

Testing & Commissioning shall comply with all the requirements of the GCC supplemented, amplified, modified or superseded as applicable by this Specification and the PS.

8.1 General

8.1.1 The Contractor shall perform all testing and commissioning activities to satisfactorily demonstrate the performance of the Works within the framework of the Completion Management Plan.

8.1.2 The Contractor's activities shall include but are not limited to the following:

- (1) provision of all labour and experienced supervision to perform all inspections and tests required to demonstrate the performance of the Works;
- (2) preparation of that portion of the Commissioning Plan that applies to the Works to a level of detail acceptable to the Engineer;
- (3) performance of all duties and responsibilities, as specified in the Commissioning Plan;
- (4) participation in the Commissioning Team that shall develop, review and implement the Commissioning Plan. As a participant of the Commissioning Team, the Contractor shall provide personnel and technical support to the Employer and the Engineer in the Commissioning of the Project;
- (5) performance of the testing and commissioning for all systems forming part of the Works in a manner which is fully co-ordinated with other designated Contractors, the Employer and the Engineer;
- (6) provision of all required testing and specialised equipment and materials including consumables required to support the testing and commissioning pre-operations activities; and
- (7) removal and appropriate disposal of any toxic or other spoils (e.g. cable drums, depleted filters, oils, and fluids) created as a result of the Contractor's construction, testing and commissioning activities.

8.1.3 The Contractor shall provide full access for the Employer and Engineer to witness any test or inspection.

8.1.4 The Employer and the Engineer will bear their own costs for attendance at witnessed inspections or tests (other than re-tests) scheduled in accordance with the agreed Works Programme and subject to notice in accordance with the Specification.

8.1.5 Installation Tests

8.1.5.1 The Installation Tests phase is defined as being the final stage of assembly/ installation before the start of commissioning itself. The Installation Tests are to be performed by the Contractor under the Contract and may be witnessed by the Employer or the Engineer.

During this phase, the Contractor shall perform static testing of components and/or systems in preparation for Partial Acceptance Testing.

8.1.5.2 The particular requirements for Installation Tests are prescribed in the PS. Where performance across interfaces to other Contractors or to other parties is required to be verified, the Contractor shall liaise with the interfacing party to co-ordinate the test procedures and programme in the manner prescribed in clause 3.3.2 above.

- 8.1.5.3 The Contractor shall prepare three copies of a test report immediately after the completion of each test whether or not witnessed by the Employer or the Engineer. If the Employer or the Engineer has witnessed the test, he will countersign the report to indicate his agreement to the information and conclusions (i.e. whether or not the equipment being tested has passed satisfactorily) contained therein. If the Employer or the Engineer has not witnessed the test (i.e. if a written waiver has been granted), the Contractor shall forward three copies of the test report without delay to the Engineer.
- 8.1.5.4 The Engineer will countersign the report to indicate his agreement to the information and conclusions (i.e. whether or not the equipment being tested has passed satisfactorily) and return one copy to the Contractor. Where the results of the test do not meet the requirements of the Specification, the Employer or the Engineer may call for a re-test.
- 8.1.5.5 Test equipment and instrumentation shall be subject to calibration test within a properly controlled calibration scheme, and signed calibration certificates shall be supplied to the Engineer in duplicate. Such calibration checks shall be undertaken prior to testing and, if required by the Employer or the Engineer, shall be repeated afterwards.
- 8.1.5.6 The Contractor shall submit to the Engineer a comprehensive schedule of tests as required by the PS giving full details and procedures for each test to be carried out under the Contract and including the pass / fail criteria (i.e. the standards or limits to be achieved).
- 8.1.6 Integration Testing & Commissioning**
- 8.1.6.1 Integrated Testing & Commissioning are defined as the final tests to be undertaken before the commencement of Service Trial. The Integrated Testing & Commissioning are part of the Tests on Completion to be performed by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. The Integrated Testing & Commissioning shall demonstrate the full compatibility between all interfacing systems. On satisfactory completion of the Integrated Testing & Commissioning, the tested items will be considered available for Service Trial.
- 8.1.6.2 The particular requirements for Integrated Testing & Commissioning are prescribed in the PS.
- 8.1.6.3 The Contractor shall submit to the Engineer a comprehensive Integrated Testing & Commissioning Plan as required by the PS. The plan shall be submitted on a logical section-by-section basis, using a "top-down" approach describing the testing and commissioning strategies and processes clearly showing how these serve to provide the full verification of the systems and equipment in context of the complete railway system.
- 8.1.6.4 The Contractor shall co-ordinate with the Employer and the Engineer and with all interfacing parties to ensure that the proposed test programme and schedule truly demonstrate that the full specified performance requirements are achieved.
- 8.1.6.5 The tests shall include, but shall not be limited to the following:-
- (1) test of all functional and performance requirements for the system;
 - (2) test to demonstrate compliance with all interface specifications; and
 - (3) test of behaviour under failure conditions (e.g. changeover to redundant hardware, initiation of re-configuration functions or reversionary modes of operation, recovery of systems and equipment from failure, demonstrations of planned emergency procedures, etc.).
- 8.1.6.6 The Integrated Testing & Commissioning Plan shall identify a comprehensive list of specifications, standards, method statements, procedures, pass/fail criteria, sample records, resources to be made available, drawings and records to be submitted to the Engineer, and a programme showing the dates for testing and for submission of each test procedure.
- 8.1.6.7 Test procedures shall be carefully planned to ensure that the work can be executed in the time available. If the available time is restricted, this planning shall include

contingency plans to be implemented if testing proceeds slower than anticipated or if defects are discovered that necessitate rectification and subsequent repeat testing, etc.

8.1.6.8 Immediately following the successful Integrated Testing & Commissioning of the system or any constituent part, the Contractor shall complete the appropriate commissioning records in the agreed format and submit 3 signed copies to the Engineer.

8.1.6.8 The Contractor shall include a complete schedule of all Integrated Testing & Commissioning records and their current status within the Monthly Progress Report.

8.1.7 Service Trial

8.1.7.1 Service Trial is defined as the final test of the fixed equipment, the rolling stock, and the operational procedures including the final elements of the Tests on Completion to demonstrate that the system in its entirety can operate satisfactorily. The Service Trial is performed by the Employer with attendance by the Contractor under the Contract in order to achieve Employer's Taking Over of the Works. During this phase, the system will be run to the published timetable but without fare-paying passengers. This phase also allows for Validation of the training procedures in a real time environment.

8.1.7.2 The Commissioning Team in conjunction with the Employer will develop the Service Trial Plan. Operations Department will organise and co-ordinate all on-Site activities.

8.1.7.3 The particular requirements for tests to be undertaken during the Service Trial are prescribed in the PS.

8.1.7.4 The Contractor shall provide special and general attendance to the Employer and the Engineer during the Service Trial period as required by the PS.

8.1.7.5 The Contractor shall co-operate with the Employer and the Engineer and with all interfacing parties to ensure that the proposed Service Trial programme & schedule truly demonstrates that the full, specified performance requirements and operating parameters are achieved.

8.1.7.6 The Contractor shall review and comment on the Engineer's Service Trial Plan and shall identify specifications, standards, method statements, procedures, pass / fail criteria, to the Engineer for inclusion in the Plan.

8.1.7.7 The Contractor shall not interfere with the Service Trial tests and Validations in any manner. Any need for remedial works required to be performed by the Contractor shall be co-ordinated with the Employer and the Engineer in advance.

8.1.7.8 Immediately following the successful tests of the system or any constituent part during Service Trial the Contractor shall complete the appropriate commissioning records in the agreed format, submit 3 signed copies to the Engineer and may then apply for the Taking Over Certificate in accordance with the requirements of the GCC.

8.1.7.9 The Contractor shall include a complete schedule of all Service Trial records and their current status within the Monthly Progress Report.

8.2 Activity of the Employer and the Engineer

8.2.1 The Employer and the Engineer will establish a Commissioning Team and a Site Co-ordination Team at appropriate stages of the Project. These teams will comprise representatives of all interested parties including not more than two representatives of the Contractor, subject to review by the Employer and the Engineer. In accordance with the Commissioning Plan, the Commissioning Team shall advise and plan to co-ordinate the activities of the Contractor to ensure the Employer and the Employer's requirements are met.

8.2.2 The Contractor shall participate in the activities of the Commissioning Team and Site Co-ordination Team in addition to its own testing and commissioning or as directed by the Employer or the Engineer.

8.3 Records and Reports

8.3.1 The Contractor shall submit to the Engineer for review not less than six (6) months prior to the commencement of commissioning activities, his proposed format for the

- commissioning records. The records shall be appropriately sub-divided to make provision for the various parts of the Permanent Works covered by the Contract.
- 8.3.2 The format of the records shall cover all mechanical and electrical tests, provide positive identification by serial number for assemblies and sub-assemblies of the Permanent Works and show modifications to Employer's Drawings and diagrams or "as built" data to be certified by the Employer or the Engineer in the course of installation, testing and setting to work of the Works.
- 8.3.3 The Contractor shall, during the execution of the Works, prepare such reports and records of manufacture, installation and testing as may be required in order that a licence may be issued, or statutory requirements may be met, or approval given. Such reports or records shall be adequate to enable each part of the Permanent Works to be commissioned and to meet the requirements of the licensing authority or any standing statutory regulations and shall be reviewed by the Employer and the Engineer.
- 8.3.4 The Contractor shall obtain reports of each inspection and/or test. Such reports shall show the results of all the inspections and/or tests carried out and shall certify that the work has been inspected and/or tested in accordance with the requirements of the Contract and that the work complies with the requirements of the Contract.
- 8.3.5 Any analysis of the results required to confirm that the work complies with the requirements of the Contract shall be compiled and reported to the Engineer in accordance with Chapter 4.
- 8.3.6 A representative of the Contractor who has been allocated the required authority under the relevant quality plans shall sign each report of inspection and/or test.
- 8.3.6.1 Each report of inspection and/or test shall include the appropriate details of:-
- (1) the description of the item or goods subjected to the test or inspection;
 - (2) if applicable, the batch from which the samples were taken for test, the size and description of samples and the method of sampling;
 - (3) the place of testing;
 - (4) the date and time of tests;
 - (5) the environmental conditions;
 - (6) the technical personnel supervising or carrying out the test or inspection;
 - (7) the properties tested or inspected;
 - (8) the method of testing or inspection;
 - (9) all relevant checklists and work sheets used during the inspection and/or test, including the readings and measurements taken during the tests; and
 - (10) the test results, including any calculations and graphs.
- 8.3.7 After Commissioning of a part of the Works, the Contractor shall complete each commissioning record in the agreed format and shall forward copies of the record to the Engineer for review.
- 8.3.8 The Contractor shall submit within its Monthly Progress Report a complete schedule of his commissioning records showing completion dates, target completion dates and status.
- 8.3.9 **Timing for Reports of Inspection and/or Test**
- The Contractor shall ensure that a signed copy of each report of inspection and test is filed in his filing system within 3 (three) working days of the date of inspection and test.
- 8.3.10 **Quality Control Register**
- The Contractor shall provide and maintain at all stages of the work a quality control register or registers to identify the status of inspections, sampling and testing of the work and all certificates in accordance with Quality Control Register in Chapter 5.
- 8.3.11 **Summaries of Inspection and/or Test**

The Contractor shall submit to the Engineer for his information summaries based on each quality control register showing the type and amount of certification received and the inspection and/or testing undertaken on each element of the Works. Such summaries shall reach the Engineer's office before the 7th working day of the month. The summaries shall identify and demonstrate the compliance of such certification, inspection and/or testing as per the requirements of the Contract and shall identify any item which does not conform to the requirements of the Contract.

8.4 Test Equipment and Facilities

The Contractor shall provide all equipment and services required for testing, including, but not limited to:

- i. Laboratory test instruments.
- ii. Special test equipment, emulators, simulators and test software, to permit full testing of System functions and performance.
- iii. Other items of the System specified elsewhere as being part of the Contractor's supply, even if not part of the Subsystem under test.
- iv. Consumables.

8.4.2 All test instruments shall be subject to routine inspection, testing and calibration by the Contractor.

8.4.3 Details of all test instruments shall be submitted for review by the Engineer and, if required by the Employer or the Engineer, shall be calibrated at the expense of the Contractor by an independent standards laboratory.

8.4.4 All test equipment must be capable of operating from the mains supply (230V AC 50Hz).

8.4.5 All test software shall be subject to formal quality assurance requirements stipulated elsewhere in the Specification.

8.4.6 The Contractor shall ensure that all inspection and test equipment is calibrated in accordance with the specified standards or, if such standards are not applicable to certain test and inspection equipment, with systems and programmes of calibration which have been reviewed without only objection by the Engineer.

8.4.7 The Contractor shall ensure that documented evidence of instrument calibration is maintained and made available to the Employer or the Engineer on request.

8.5 Witnessing by the Employer and the Engineer

8.5.1 Notice for Trial, Inspection and/or Test to the Engineer

8.5.1.1 In relation to all Quality Control Points and Quality Hold Points involving inspection and/or testing by the Contractor, the Contractor shall give the Engineer notice of when the relevant work will be inspected and/or tested using the form in appendix 5 of this Specification. The period of notice shall be as stated in the PS or such period as in the opinion of the Engineer is reasonable and notified to the Contractor. In the absence of any such statement or notice, a reasonable period of notice shall be given by the Contractor provided that:

- (1) in the case of on-Site work, such notice shall be given not less than 72 hours of normal working time before the work is to be inspected and/or tested;
- (2) in the case of work carried out off-Site in **Pune**, such notice shall be given not less than 5 days before the work is to be inspected and/or tested; and
- (3) in the case of work carried out outside **Pune**, such notice shall be given not less than 14 working days before the work is to be inspected and/or tested.

8.5.1.2 In relation to all inspection and/or testing notified by the Contractor, the Employer and the Engineer may elect to witness such inspections and/or tests, but the Contractor may proceed with the inspections and/or tests notwithstanding the absence of the Employer or the Engineer or of any response to the said notice.

- 8.5.1.3 If the Contractor is in any doubt whether inspection and/or testing by the Engineer is required as a Quality Hold Point, the Contractor shall request that the Engineer clarifies his requirements prior to submitting the relevant inspection and testing plan for review, and in any event not later than 30 days.
- 8.5.2 **Timing for Inspection and/or Test by the Employer and the Engineer**
- 8.5.2.1 The Contractor shall allow the Employer and the Engineer a reasonable time to carry out any inspection and/or testing and to assess the result of any inspection and/or test before proceeding with the Works.
- 8.5.2.2 Unless the Engineer's prior review without objection has been obtained, all inspections and/or tests to be carried out or witnessed by the Employer and the Engineer shall be carried out between 0800 and 1800 hours.
- 8.5.3 **Failure to Notify the Engineer**
- The Employer or the Engineer may reject the test and test results in question and require the test to be repeated in the event of any failure by the Contractor to notify the Engineer in accordance with clause 8.5.1.1 above.
- 8.6 **Failures**
- 8.6.1 The Contractor shall correct all faults found during testing and shall arrange for the relevant tests to be repeated. The relevant tests shall only be repeated when the fault has been remedied and the equipment demonstrated to function correctly.
- 8.6.2 Where remedial measures involve significant modifications that might, in the Engineer's opinion, affect the validity of earlier tests, the Contractor shall repeat the earlier tests and obtain results satisfactory to the Employer and the Engineer before repeating the test in which the fault was first identified.
- 8.6.2 The Employer or the Engineer shall have the right to order the repeat or abandonment of any test in the event that results and demonstrate that the equipment is significantly non-compliant with the Contract.
- 8.6.4 The Employer or the Engineer shall have the right to suspend any test in the event that errors or failures have become unacceptable. The Employer or the Engineer shall also have the right to suspend any test if a fault was detected by the Contractor but not reported to the Engineer within 24 hours of the detection. In this event, the suspension shall remain in effect until reporting has been brought up to date to the satisfaction of the Employer and the Engineer.
- 8.7 **Repeat Tests**
- 8.7.1 The Contractor shall correct and re-test every fault detected during the tests.
- 8.7.2 If the test results of the item under test fails, the provisions of GCC clause 7.5 shall apply.

CHAPTER 9

9. DELETED

CHAPTER 10

10. THE WORKS AND CARE OF THE WORKS

10.1. Methods of Construction

The Contractor shall, submit the Construction and Installation Plan as stated in the PS or if none is given within 20 days of the commencement date of works and in any case not less than 5 weeks prior to starting the construction of the Works on Site, Contractor shall submit to the Engineer the Construction and Installation Plan as specified in Chapter 3 above.

10.2. Temporary Works :- Upon receiving a written application from the Contractor, the Engineer may at his absolute discretion consent to certain Temporary Works of a minor nature being exempted from the requirements of this Chapter. Such exemption shall not relieve the Contractor of any of his obligations under the Contract.

10.3. Normal Working Hours

10.3.1. Normal working hours shall be defined as the period between 0700 hours and 1900 hours on all days excluding General Holidays. Work outside normal working hours shall not be carried out unless reviewed without objection by the Engineer and unless the Contractor has obtained any necessary permission or approval from Relevant Authorities.

10.3.2. The Contractor shall inform the Engineer 24 hours, or such shorter period reviewed without objection by the Engineer, in advance of any occasion when work outside normal working hours is proposed.

10.4. Drawings and Schedules

Detailed manufacturing drawings for the Permanent Works shall be submitted to the Engineer for review. Moreover, these drawings shall be available on the Contractor's or his sub-contractor's premises if required. The Contractor shall also maintain at the Site a comprehensive and up-to-date set of drawings properly indexed and catalogued, which shall include complete sets of detailed working and, where applicable, manufacturing drawings and shall permit free access to such drawings by the Engineer at any reasonable time.

10.5. Notification and Inspection of Works

10.5.1. The Works will be the subject of a formalised system of written applications for inspection.

10.5.2. Work that is carried out without being appropriately sanctioned by the Engineer could be classified as defective work.

10.6. Construction Restraints

10.6.1. The Contractor shall design and implement Temporary Traffic Management (TTM) in accordance with the provisions of the Enactments.

10.6.2. The Contractor shall ensure that the design, construction and performance of all Temporary Works and the design and construction of all Permanent Works shall be such that any ground movements in and around the Site will not result in settlement and/or subsidence of the ground that will cause damage to any buildings, structures, rail, roads, footpaths, slopes or utilities.

10.7. Protection from Water

10.7.1. Unless otherwise reviewed by the Engineer, all work shall be carried out, as near as may be practicable in the circumstances, in dry conditions, except where the work is required to be carried out in or with water or other fluids.

10.7.2. The Permanent Works, including materials for use in the Permanent Works, shall, where necessary and as near as may be practicable, be kept free of water and protected from damage due to water. Water on the Site and water entering the Site shall be disposed of by temporary drainage or pumping systems or by other methods capable of keeping the Works free of water and protected from damage due to water. Traps shall be provided by the Contractor to intercept silt and debris before water is discharged from the Site.

- 10.7.3. The discharge points of the temporary drainage and pumping systems shall be as those having been reviewed without objection by the Engineer. The Contractor shall make all arrangements with and obtain the necessary approvals and inspections from the Relevant Authorities for discharging water to drains, watercourses etc. The relevant work shall not start until the arrangements for disposal of the water previously reviewed without objection by the Engineer have been implemented.
- 10.7.4. Measures shall be taken to prevent flotation of new and existing structures.

10.8. Protection from Weather

- 10.8.1. Work shall not be carried out in weather conditions that may adversely affect the work unless protection by methods reviewed without objection by the Engineer is provided.
- 10.8.2. The Permanent Works, including materials for the Permanent Works, shall be protected by methods reviewed without objection by the Engineer from exposure to weather conditions which may adversely affect the Permanent Works.

10.9. Protection of Work

Finished work shall be protected by methods reviewed without objection by the Engineer from damage that could arise from the execution of adjacent work. Work shall be carried out in such a manner that work carried out by others, including Government departments, utility undertakings, Relevant Authorities & Project designated Contractors, is not damaged.

CHAPTER 11**11. SITE ESTABLISHMENT AND ATTENDANCE****11.1 Use of the Site**

- 11.1.1 The Site shall not be used by the Contractor for any purpose other than for executing the Works or carrying out other work which is associated with the Works and having been reviewed without objection by the Engineer.
- 11.1.2 Entry to and exit from the Site shall be obtained only at the locations stated in the Contract or other locations having been reviewed without objection by the Engineer.
- 11.1.3 All materials and equipment stored on Site shall be adequately protected against loss or damage due to any cause such as climatic effects, vandalism, shock and vibration, etc. according to the nature of the articles stored and the local Site condition.
- 11.1.4 The particular use to which the Site is put shall be submitted to the Engineer for review with the following for review with the following particulars:
- (1) drawings showing the layout within the Site of the Engineer's and Contractor's accommodation, access roads and major facilities required early in the Contract;
 - (2) drawings showing the layout and the construction details of the Engineer's accommodation; and
 - (3) proposals for the Contractor's Site accommodation (if applicable) as defined by clause 11.4 below.

11.2 Survey of the Site

On or before the Contractor is granted access to a certain portion of the Site, the Contractor shall carry out a survey jointly with the Other Contractors executing works on that portion of the Site. The Contractor shall advise the Engineer of the date of the joint survey at least 1 week in advance of the date.

11.3 Fences and Signs on the Site

- 11.3.1 Hoardings, fences, gates and signs on and at the Site shall be maintained in a clean, stable and secure condition.
- 11.3.2 Project signboards stated in the Contract shall be erected not more than 28 days, or such other period reviewed without objection by the Engineer, after the Commencement Date of the Works. Other advertising signs shall not be erected on the Site unless reviewed by the Engineer.
- 11.3.3 The permission of the Engineer shall be obtained before hoardings, fences, gates or signs are removed. Hoardings, fences, gates and signs which are to be left in position after Employer's Taking Over of the Works shall be repaired and repainted as instructed by the Engineer.

11.4 The Contractor's Site Accommodation

- 11.4.1 The Contractor's offices, sheds, stores, mess rooms, latrines & other accommodation on the Site shall be maintained in a clean, stable and secure condition. Living accommodation shall not be provided on the Site unless stated in the Contract or having been reviewed without objection by the Engineer. The Contractor's personnel shall not be allowed to live on the Site.
- 11.4.2 The Contractor shall provide and maintain all necessary offices, sheds, stores, mess rooms, latrines and other accommodation and remove the same from the Site on the Employer's Taking Over of the Works. These shall be to the satisfaction of the Engineer and shall be kept in a clean and sanitary condition. No structure shall be erected by the Contractor within the Site without the written consent of the Engineer and such consent will not relieve the Contractor of the responsibility of siting temporary structures clear of the Works.

- 11.4.3 A copy of the plan showing the extent and position of all offices, stores, sheds, etc. shall be prepared by the Contractor and retained for inspection in the Site office.
- 11.4.4 The works area for Contractor's accommodation will be available to the Contractor on dates set out in the PS, Employer's Drawings or Appendix of this Specification.
- 11.4.5 The Contractor shall not erect or operate canteen and kitchen facilities on the Site except with the consent of the Engineer and, where appropriate, the Relevant Authorities. Any such facilities shall, in particular but without limitation, conform to all regulations and standards to the extent required by the concerned city authorities of Pune and Pimpri-Chinchwad Municipal Corporations.
- 11.5 Site Utilities and Access**
- 11.5.1 Temporary water, electricity, telephone, sewerage and drainage facilities shall be provided for the Engineer's accommodation and for the Contractor's use in carrying out the Works. The Contractor shall make all arrangements with and obtain the necessary approvals from the Relevant Authorities for the facilities.
- 11.5.2 If, under the Contract, the Contractor is provided with Site utilities and access by any Other Designated Contractor under the attendance of the same or another Other Contractor, the Contractor shall ensure that all requirements in terms of use of such facilities, their upkeep and maintenance, etc. are properly observed. If the facilities provided under such attendance are insufficient for the Contractor's bona fide needs, the Contractor shall be solely responsible for providing such additional facilities he may require for the execution of the Works.
- 11.5.3 Access roads and parking areas shall be provided within the Site as required and shall be maintained in a clean, passable and stable condition.
- 11.6 Site Facilities for the Engineer**
- 11.6.1 Details of office accommodation, office facilities, equipment transport etc required are given in the PS.
- 11.6.2 Accommodation & Equipment**
- 11.6.2.1 If required under the Contract, the accommodation to be provided on the Site for the Engineer shall be in accordance with the Contract.
- 11.6.2.2 The accommodation shall be maintained in a clean, stable and secure condition and shall be cleaned at least daily. The services of a full-time attendant shall be provided for the Engineer.
- 11.6.2.3 Office facilities and equipment provided for the use of the Engineer shall be maintained in a clean & serviceable condition including refreshments, stationeries, printer & cartridges, etc, all consumables shall be replenished when required. Measuring and testing equipment shall be calibrated before it is used and at regular intervals reviewed by the Engineer. Survey equipment shall be maintained by the service agent and shall be regularly checked. Equivalent replacements shall be provided for equipment that is out of service.
- 11.6.2.4 The permission of the Engineer shall be obtained before accommodation or equipment is removed. Portable accommodation shall be moved at the times instructed by the Engineer.
- 11.6.2.5 The accommodation to be provided for the Engineer is for the exclusive use of the Engineer's staff associated with the Project.
- 11.6.2.6 All accommodation and equipment for the Engineer shall be provided throughout the course of the Works and for so long a period of time during the Defects Liability Period as the Engineer may require.
- 11.6.2.7 The Contractor's proposals for the construction of the offices shall be submitted for review by the Engineer within 14 days of the Commencement Date of the Works and erected within 42 days of the Commencement Date of the Works.

11.6.2.8 The Contractor's attention is drawn to the fact that if directed by the Engineer, resident site staff for the Project shall be allowed use of the Engineer's Site accommodation including the extension of servicing to these resident site staff.

11.6.3 **Transport** - Transport to be provided as mentioned in Annexure A " Site facilities for the Employer and the Engineer" of Particular conditions.

11.7 **Clearance of the Site**

Temporary Works, which are not to remain on the Site after the Employer's Taking Over of the Works, shall be removed on the Employer's Taking Over of the Works or at such other time(s) as instructed by the Engineer. The Site shall be cleared and reinstated to the lines and levels and to the same condition as existed before the Works started except as otherwise stated in the Contract.

11.8 **Attendance**

11.8.1 Offices for the Employer or the Engineer: Unless otherwise stated in the Contract, the Employer or the Engineer may supply his own temporary accommodation on the Site at locations indicated in the Contract or in writing. The Contractor shall afford, provide and maintain free and unhindered access to such Employer or the Engineer's Site offices and parking areas and for the Employer or the Engineer's Site officers, contractors and workmen as may be necessary for installation, inspection, maintenance, repair and removal of the aforesaid Employer or the Engineer's Site offices and the services thereto.

11.8.2 **Attendance on the Employer or the Engineer**

The Contractor shall provide all necessary assistance to the Employer or the Engineer, including adequate and safe means of access to all parts of the Site to assist him in carrying out his duties and responsibilities under the Contract. Such assistance shall not include the provision of full-time attendance upon the Employer or the Engineer.

11.8.3 Attendance on the Commissioner of Rail Safety or other inspecting authorities.

11.8.3.1 The Contractor shall afford all necessary attendance upon the Commissioner of Rail Safety or other inspecting authorities Inspectorate during their inspections including adequate and safe means of access to appropriate parts of the Site.

11.8.3.2 The Contractor shall provide all documents necessary for inspection as are requested by the above authorities.

11.8.4 **Attendance on Other Contractors**

11.8.4.1 The Contractor shall provide general and special attendance on Other Designated Contractors who will be carrying out the execution of electrical and mechanical and other works on the Site. Reference shall be made to the PS to determine the full extent of such attendance.

11.8.4.2 General attendance shall include but not be limited to providing for accepting deliveries, unloading and storing materials for the Other Contractors on the Site and allowing the Other Contractors space for their site offices, and all reasonable access and facilities for the proper execution of their work including the free use of access roads, craneage, scaffolding, ladders, stores, messrooms, sanitary and welfare facilities provided that these facilities are normally available on the Site at the time.

11.8.4.3 The Contractor shall allow the use of his Site services including ventilation, temporary water supply, temporary electricity supply, background lighting, pumping, watchmen, etc. by the Other Contractors. The Contractor shall ensure that his Site services referred to above shall be available for use by the Other Contractors until the commissioning of the relevant permanent installations or until the issue of the Taking Over Certificate for the Works, whichever is the later.

11.8.4.4 Special attendance shall include but not be limited to cutting of holes and other openings, forming chases, providing built-in sleeves, grouting in bolts, anchors, brackets, base plates, frames and the like, including making good to the disturbed work and cleaning after completion of the disturbed work.

11.8.5 Attendance by Other Contractors

- 11.8.5.1 Where provided for under the Contract, the Contractor shall receive attendance from Other Contractors. The Contractor shall ensure that by receiving such attendance, it does not hinder, obstruct or otherwise frustrate the Other Contractor that is providing the attendance in any way.

11.9 Contractor's Equipment

The Engineer reserves the right to order the immediate removal and replacement of any Contractor's Equipment that, in his opinion, is unsatisfactory for its purpose.

11.10 Security

- 11.10.1 The Contractor shall be responsible for the security of the works area for Contractor's accommodation and shall provide and maintain fencing to all works areas with designated entry /exit parts. The fencing shall be metal panels min. 2m heights and painted as directed by the engineer. Each entry /exit point shall be guarded by security staff on a 24 hrs. basis and fixed with a lockable gate. The Contractor shall provide adequate training to its security staff to ensure that they are able to discharge their security duties properly.
- 11.10.2 The Contractor shall establish and maintain contingency plans to cope with emergency situations such as fire, flooding, serious damage to the Works, etc.
- 11.10.3 The Employer's security staff will conduct inspections and security audits on the Site and the works area for Contractor's accommodation from time to time. The Engineer will give recommendations for improvement arising from the inspections and security audits to the Contractor. However, managing the security of the Site and the works area for Contractor's accommodation remain the Contractor's responsibility.

CHAPTER 12**12. LIAISON WITH OTHERS****12.1 Liaison with Others**

12.1.1 The Contractor shall make all necessary arrangements with and obtain the necessary approvals from Government departments, utility undertakings and other duly constituted authorities for the execution of the Works.

12.1.2 The Contractor shall maintain close liaison with Other Contractors and other contractors employed by the Employer, utility undertakings or other authorities who are carrying out work on or adjacent to the Site. The Contractor shall ensure as far as possible that the progress of the Works is not adversely affected by the activities of such other entities.

12.2 Work by Other Contractors

12.2.1 The contractor shall keep note of the works which may be proceeding on various adjacent areas by others include, but is not limited to, those listed in the PS. The Engineer will keep the Contractor informed of forthcoming work by Other Contractors in the proximity of the Site.

12.2.2 The Contractor shall provide reasonable access to such contractors and any other adjacent contractors & shall where necessary liaise with the appropriate contractors, utility undertakings and other duly constituted authorities on details of interdependent phasing. The Contractor shall notify the Engineer and other concerned entities at least 14 days in advance should he wish to alter these access arrangements during the course of the Works.

12.3 Interface Management

12.3.1 The Contractor shall co-ordinate with Relevant Authorities and Other Contractors in the execution of the Works.

12.3.2 The Contractor shall interface and liaise with Other Contractors to ensure the effective and compatible co-ordination of all aspects of the design, installation and testing of the Works. The Engineer shall be kept fully informed at all stages of the Works.

12.3.3 The Contractor shall assign a person as the interface contact for each Other Contractor to actively manage the progress of each interface to ensure adherence to the jointly developed Interface Management Plan.

12.3.4 The Engineer may, at his discretion, attend the Contractor's meetings with Other Interfacing Contractors. The Contractor shall give the Engineer a minimum of 7 days' notice of all meetings to be held with any Other Interfacing Contractors, or 14 days' notice if the meeting is to be outside **Pune**. If insufficient notice is given to the Engineer, he may require the meeting to be postponed to a later date to enable him to attend.

12.3.5 The Contractor shall provide the Engineer with two copies of the minutes of all meetings within 14 days of each meeting and also two copies of all correspondence with any Other Contractor.

12.3.6 The Contractor shall attend co-ordination meetings chaired by the Engineer at no greater than monthly intervals to discuss & ensure that designs are correct and that conflicts in E&M services requirements between the Contractor and Other Contractors are identified and resolved.

12.3.7 The Contractor shall co-ordinate his installation activities with the Other Contractors. The Contractor shall ensure that there is no interference to the work of the Other Contractors and shall maintain close co-ordination with Other Contractors working on or adjacent to the Works to ensure that their work can progress in a smooth and orderly manner.

12.3.8 The Contractor shall be given access to the various parts of the Site by the dates relative to the Works Programme defined in the ITT and the PS as Access Dates. The ITT and the PS specify certain Key Dates by which the Contractor shall complete certain parts of his Works to enable work to be undertaken by the Other Contractors. These dates may be

subject to adjustment by the Engineer in consultation with the Contractor and the Other Contractors to ensure the progress of the Project.

- 12.3.9 The Contractor's responsibility shall include provision of and receipt from Other Contractors or the Engineer of information required for construction of the Works and the installation of the Works and Contractor's Equipment, insofar as that requirement is specified in or can reasonably be inferred from the Contract. Where the execution of work by a Other Contractor depends upon the Contractor's Site management or upon information to be given by the Contractor, the Contractor shall provide the Other Contractor with either the required services or the correct and accurate information required to enable the Other Contractor to meet his programme for the construction or installation of his works.
- 12.3.10 In the event of any disagreement as to the extent of services or information required to be exchanged between the Contractor and Other Contractor, the Engineer shall determine the requirements and this determination shall be final and binding on the Contractor and the Other Contractor.
- 12.3.11 The Contractor shall co-ordinate his testing and commissioning activities with the Other Contractors. The Contractor shall ensure that there is no interference to the work of the Other Contractors and shall maintain close co-ordination with Other Contractors working on or adjacent to the Works to ensure that their testing and commissioning work can progress in a smooth and orderly manner.

CHAPTER 13

13. THE SITE

13.1 Access to Site : The Contractor will be given access to the Site in accordance with following conditions.

13.2 Site Restrictions

13.2.1 The particular use to which the Site is put shall be submitted to the Engineer for review within 14 days of the Commencement Date of the Works and the Contractor shall:

- (1) confine his use of the areas of the Site to purposes having been reviewed without objection by the Engineer who reserves the right to extend, amend or restrict the uses to which areas of the Site will be put;
- (2) where required under the Contract, provide and maintain fencing and lighting around and within the areas of the Site when or where necessary for the safety and convenience of the public or others or as directed;
- (3) refrain from depositing rubbish or causing nuisance or permitting nuisance to be caused and, except where reviewed without objection by the Engineer, depositing earth on or removing earth from areas of the Site;
- (4) on the Employer's Taking Over of the Works, or earlier if so instructed by the Engineer, remove all Temporary Works except where permitted and reinstate the areas of the Site to the extent, standards and details indicated in the Contract or as directed by the Engineer;
- (5) refrain from obstructing manholes, utility access points and the like; and
- (6) refrain from felling trees, other than those specifically identified in the Contract to be felled, and refrain from depositing earth around the trunks of trees and protect all trees remaining on Site to the satisfaction of the Engineer.

13.2.2 Work other than that necessary for completion of the Works shall not be carried out on the Site.

13.2.3 While the Contractor is being given access to the Site, he shall provide means of distributing loads imposed by Contractor's Equipment and prevent damage to utility services.

13.2.4 Except where otherwise provided, the Contractor shall not permit any person to reside on the Site.

13.2.5 Unless otherwise stated, the Contractor shall pay all rates and charges of any nature whatsoever arising out of his use of the Site and all work areas provided therein under the Contract.

13.2.6 The location and size of stockpile material, including excavated material within the Site, shall be submitted to the Engineer for review. All stockpiles shall be maintained at all times in a stable condition.

13.2.7 The Contractor shall not allow animals to be brought onto or kept on the Site.

13.2.8 The Contractor's attention is drawn to the Waste Disposal Regulation currently prevalent in **Pune**, regarding storage, transportation and disposal of chemical waste. The Contractor's proposed methods and chemicals to be used in cleaning shall be submitted for review by the Engineer.

13.2.9 No rock crushing or screening facilities shall be set up on Site unless reviewed by the Relevant Authorities and reviewed without objection by the Engineer.

13.3. Site Services

- 13.3.1 Where required under the Contract, the Contractor shall provide all Site services as necessary and appropriate for the construction of the Works, which shall include, but not necessarily be limited to:
- (1) electricity; (see Chapter 18 below)
 - (2) water;
 - (3) Site communication facilities; and
 - (4) temporary drainage and sewage disposal.
- 13.3.2 The Contractor shall provide such services for use solely in connection with the proper execution of the Works. The Contractor shall comply with all regulations of the utility companies and Government departments concerned.
- The Contractor shall provide and maintain installations associated with such services and in relation thereto and shall take all reasonable precautions to safeguard the safety and health of all persons and the security of the Site. The Engineer may demand the immediate disconnection or alteration of such installations or portions thereof he considers as being prejudicial to safety, health or security. As soon as any or all of the Contractor's installations are no longer required for the execution of the Works, they shall be entirely removed to the satisfaction of the Engineer.
- 13.3.3 All installations shall comply fully with all appropriate statutory requirements. Pipes, tubes, ducts or cables crossing highways, footpaths or rights of way shall be ramped over or recessed below the surface. Specific services shall comply with the following:-
- (1) Electricity :- The electricity supply shall comply with the requirements of Chapter 18 below.
 - (2) Water :- An adequate supply of potable water shall be provided at the Site, including provision to the satisfaction of the Water Authority of any storage tanks so that sufficient potable water is always available for the execution of the Works. Suitable provision shall be made where the Water Authority requires the use of salt water for flushing purposes.
 - (3) Site Communication Facilities :- Where required under the Contract, the Contractor shall install efficient means of Site communications including messenger, telephone and, where appropriate, two-way radio to the satisfaction of the Engineer.
 - (4) Temporary Drainage & Sewage Disposal :- Where required under the Contract, adequate provision shall be made for the discharge or disposal of all water from the site, surplus fluid sewage and waste products and the method of disposal shall be submitted to the Engineer for review. The Site shall be kept well drained and free from standing water. Where existing channels and gullies cannot be maintained, temporary drainage arrangements shall be provided.
- 13.3.4 The Engineer will instruct the Contractor as to the requirements for Site services to be connected to the Engineer's portable Site accommodation at any given location and the Contractor shall provide and maintain these services during his use of the Site.
- 13.4 Site Cleanliness :**
- 13.4.1 The Site shall be maintained in a clean and tidy condition. Materials, including materials required for Temporary Works shall be stored in an orderly manner. Rubbish, debris, cement bags, disused formwork and the like shall be disposed of at least once a day and the work area cleaned by flushing with water as necessary so that the Site is kept constantly clean and tidy. Notwithstanding the above, the Contractor shall place rubbish bins at strategic locations about the Site. The Contractor shall throughout the period of the Contract provide a central collection point on Site, as reviewed without objection by the Engineer, for collecting all empty cans, drums, packing and other receptacles capable of holding water. The Contractor shall procure the regular collection and removal of such debris from the Site. After every shift of works, all work areas shall be cleaned and made tidy to the satisfaction of the Engineer.

The Contractor shall ensure that no earth, debris, rock or empty cable drums are deposited on public or private rights of way as a result of the Works, including any deposits arising from the movement of Contractor's Equipment. All roads, both within and external to the Site which are affected by the Works shall be kept in a clean condition by the Contractor. All haul roads shall be regularly graded and watered, as necessary to minimise dust nuisance.

13.5 Prevention of Mosquito Breeding

13.5.1 Measures shall be taken to prevent mosquito breeding on the Site. The measures to be taken shall include the following:

- (1) empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and those not required for future use shall be removed from the Site regularly;
- (2) standing water shall be treated at least once every week with an environmental acceptable oil which will prevent mosquito breeding; and
- (3) Contractor's Equipment and other items on the Site that may retain water shall be stored, covered or treated in such a manner that water will not be retained.

13.5.2 Posters in both English and Hindi drawing attention to the dangers of permitting mosquito breeding shall be obtained from the **Pune** and displayed prominently on the Site, to the requirement of the Enactments. These posters shall be removed on Employer's Taking Over of the Works.

13.6 Prevention of Dust

Work shall be carried out in such a manner that avoidable dust is not generated. Areas of the Site in which dust is likely to be generated shall be sprayed with water regularly. Screens, dust sheets, tarpaulins or other methods reviewed by the Engineer shall be used to prevent generation of dust. Materials, including earthworks material, from which dust may be generated when being transported to or from the Site shall be sprayed with water or covered. The location and size of material stockpiles, including excavated materials within the Site, shall be subject to review by the Engineer. All stockpiles shall be maintained at all times in a safe manner.

13.7 Engineering Conditions for Temporary Land Allocation

The Contractor shall comply with the obligations, requirements and restrictions described in the PS in respect of the Contractor's work areas if any.

13.8 Attendance by Civil Works Project Contractor

13.8.1 Where supplies of electricity, water, compressed air, temporary ventilation, temporary lighting, etc. are installed by the Civil Works Project Contractor for use during construction of the structural components of the Project, these services may be made available to the Contractor for his own use during erection, installation and testing of the Works in accordance with Chapter 18 below.

13.8.2 The Contractor shall supply the Engineer with its requirements (if any) for such services within 90 days of the Commencement Date of the Works. Upon receipt of the Contractor's declaration, the Engineer will ascertain whether any of these requirements can be satisfied by the installations installed by the Civil Works Project Contractor. The Engineer will subsequently notify the Contractor of the result of these investigations.

13.8.3 Where services are required and are not available from the Civil Works Project Contractor, the Contractor shall provide, test, maintain and subsequently remove the services.

13.9 Transportation to Site

13.9.1 The Contractor shall use such routes and rights of entry to the Site as may be decided by the Engineer from time to time. Routes for very large or very heavy loads shall be discussed with the Engineer in advance of the need arising and all arrangements therefore shall be submitted for review by the Engineer.

13.9.2 In this context, the definition of the terms "very large" and "very heavy" refer to articles that cannot be transported by normal road vehicles or be handled by readily available

methods. Where doubt exists, it shall be the responsibility of the Contractor to notify and discuss the nature of the load in question with the Engineer in accordance with clause 13.9.1 above.

- 13.9.3 The Contractor shall comply with the requirements of the Commissioner of Transport and /or the Commissioner of Police and / or any other Relevant Authority regarding any special traffic arrangements that may be necessary. The Contractor's attention is drawn to the Road Traffic (Regulation and Licensing of Vehicles) Regulations and the Road Traffic (Construction and Use) Regulations currently in use at **Pune**.
- 13.9.4 Extra ordinary traffic may be moved from docks and between areas of the Site over public highways only by police escort and on a route and at a time determined by the Relevant Authority. The Contractor shall be responsible for obtaining permission from the Relevant Authorities to move extra ordinary loads & traffic and for arranging police escorts as necessary.
- 13.9.5 The Contractor shall make all arrangements and assume full responsibility for transportation to the Site of all Contractor's Equipment, materials and supplies needed for the proper execution of the Works.
- 13.9.6 While travelling to and from the Site, the Contractor shall observe all posted speed limits, traffic regulations, stop signs, etc., & adherence to the access route indicated on the Employer's Drawings or as instructed by the Engineer. No employee of the Contractor shall trespass into any part of the Employer's premises other than the Site or the designated route of access.
- 13.9.7 The Contractor shall ensure that all roads and pavements, etc. leading to and around the Site are kept free from obstructions and shall not cause inconvenience or hindrance to traffic or persons either by its vehicles or by its workmen, scaffolding, plant, materials, equipment, etc.
- 13.9.8 The Contractor shall repair damage to existing roads, footpaths, steps, cables, sewers, live drains, etc. and shall reinstate any damage caused by the Contractor's actions.
- 13.10 Contractor's Own Rolling Stock**
- 13.10.1 Where the Contractor is to provide rolling stock (either self-propelled or trailing) for use during the installation and testing of the Works, the requirements of clause 13.11 below shall apply. All the Contractor's own rolling stock shall not cause any infringement anywhere.
- 13.10.2 The Contractor shall submit full details of any rolling stock that is to be used during the installation and testing of the Works to the Engineer for review within 90 days of the Commencement Date of the Works. Such details shall include a full description and drawings of the rolling stock, details of axle load, stopping distance, fail-safe braking system, kinematic envelope, and operating and maintenance instructions.
- 13.10.3 The Contractor shall maintain its own rolling stock during the installation and testing of the Works. The maintenance work shall be carried out by qualified and experienced personnel, whose qualifications have been reviewed without objection by the Engineer, in accordance with the maintenance procedures that shall have been reviewed without objection by the Engineer.
- 13.10.4 Prior to use, and following each maintenance examination, the Contractor's qualified engineer shall certify the Contractor's own rolling stock as fit-to-run. Thereafter, the Contractor's qualified engineer shall issue a registration tag. The expiry date, i.e. the date of the next inspection, shall be shown on the registration tag. The Contractor's own rolling stock shall not be used without a valid registration tag.
- 13.10.5 The Contractor shall establish a maintenance programme for his own rolling stock and shall submit the maintenance programme for review by the Engineer prior to the delivery of his own rolling stock to the Site. The Engineer will periodically inspect the Contractor's own rolling stock to ensure it is properly maintained to the standards set out in the maintenance programme.

- 13.10.6 If the Contractor's own rolling stock is found to be operating in an unsatisfactory or unsafe condition, it shall be immediately removed until it has been restored to an acceptable condition to the satisfaction of the Engineer.
- 13.11 Defined Area Working and Works Train Operations**
- 13.11.1 When the Project under construction has been made available for Track related electrical and mechanical installation works, the area will be classified as a Defined Area within which Works Trains will be operated.
- 13.11.2 All persons whose duties require them to work within a Defined Area must observe safety rules and procedures to be provided by the contractor and reviewed without objection by the Engineer. It shall provide procedures and guidance for the safety of all persons in the Defined Area.
- 13.11.3 The Contractor shall establish communicate the rules and procedures, which shall be published from time to time, to their workers and/or agents on Site, and to ensure all such rules and procedures are being observed in the course of all works and construction activities.
- 13.11.4 Persons working on or near Tracks in a Defined Area, either by themselves or supervising a working party, must be suitably trained or qualified by the Employer or his delegates in the safety provisions of the Works Train Manual. Persons who are not qualified shall not attempt to gain access to the railway Tracks unless accompanied by a qualified person.
- 13.11.5 When overhead lines are energised, EMUs may be running at high speed for testing. No work may be undertaken on either the Up or Down Tracks when test trains are running. Procedures for gaining access to the energised Track will be detailed in the Works Train Manual. The Contractor shall make requests for gaining access to the energised Track at the weekly Works Train Meetings.

CHAPTER 14

14. HEALTH AND SAFETY

14.1 Health and Safety Philosophy

14.1.1 The health, safety and welfare of all personnel working on the Project, the general public and the avoidance of damage to property are of paramount importance to the Employer. Prime consideration shall be paid to construction activities to ensure that all operations shall be conducted in such a manner so as to eliminate the risks to persons and property. The Contractor shall treat safety measures as the first priority in all his activities with respect to executing the Works.

14.1.2 The Contractor will be issued the documents

Corporate Safety Standards, Safety Policy, Safety Plan, Safety Procedure Rule Book and Joint Operating Procedure as they become available. These documents set out the minimum standards to be achieved by the Contractor but do not relieve the Contractor of his liabilities and obligations under the Enactment. Where there is a discrepancy in the documents, the higher or stricter standards shall be applied.

14.1.3 The engineer will issue to the contractor the Employer's project safety manual and any revised version thereof as may from time to time be produced by the Employer. The contractor shall comply with the requirements of the Project Safety Manual provided by the standards set out in the project safety manual shall be regarded as the minimum to be achieved and shall not relieve the contractor of any of his statutory duties or his responsibilities under the contract.

14.1.4 The provisions of the Contract regarding safety shall apply and to be binding upon the Contractor for any part of the works and the person employed as sub-contractor of any tier. The contractor shall ensure that the requirements of the contract in respect of safety are included in all sub-contracts placed by him.

14.1.5 The Engineer reserves the right to order the immediate removal and replacement of any item of Contractor's Equipment or Temporary Works which in his opinion, is unsatisfactory for its purpose or is in unsafe condition.

14.2 Health and Safety Management

14.2.1 The Contractor shall be fully responsible for safety on the Site, for the Works, his personnel, sub-contractors' personnel, the public domain and all persons directly or indirectly associated with the Works, on or in the vicinity of the Site.

14.2.2 The Contractor shall submit reports, notices and information to Government bodies where there is a statutory requirement to do so.

14.2.3 The Contractor shall and will ensure that, his sub-contractors of any level, all persons employed by him on the Site and any person authorised by him to be on the Site shall comply in every respect with the provisions of relevant statutory requirements and the Employer's safety documents as listed in clause 14.1.2 above.

14.2.4 The provisions of the GS regarding health and safety shall apply to the Contractor and his sub-contractors of any level for any part of the Works.

14.2.5 The Contractor shall ensure that proper and adequate provisions to ensure compliance are included in all sub-contracts placed by him and into all sub-contract documentation.

14.2.6 The safety standards of the sub-contractors are to be properly assessed prior to the placing of contracts and the Contractor shall employ only sub-contractors with a Track record of maintaining the highest safety standards.

14.2.7 The Engineer reserves the right to order the immediate removal and replacement of any item of Contractor's equipment or temporary works, which in his opinion, is unsatisfactory for its purpose or is in an unsafe condition.

14.3 Legislation, Codes of Practice, Standards, etc.

14.3.1 The Contractor shall comply with all current and future Enactments, Codes of Practice and Safety Guides approved by the NCT of Pune, Maharashtra and National Government relating to the Works.

14.3.2 Where identified specifically in the GS and due safety Project Manual, Indian Standards are also to be complied with.

14.4 Breach of Health and Safety Obligations

14.4.1 Serious or repeated breaches of the Employer's safety documents as listed in clause 14.1.2 above, statutory regulations, or other disregard for the health and safety of any person, may be reasons for the Engineer to exercise his authority to require the removal from the Site of any employee of the Contractor or a sub-contractor of any level.

14.4.2 Once removed from the Site at the request of the Engineer, that person shall neither be re-employed on the Contract, nor allowed on the Site or on any other Maharashtra Metro Rail Corporation Limited related project.

14.4.3 The Engineer shall have the right to order the suspension of any or all of the Contractor's activities where the Engineer considers that to continue such activity or activities may pose a hazard to the safety of persons or property.

14.4.4 Where the Engineer orders such suspension as described in clause 14.4.3 above, such suspension shall continue until the Contractor has satisfied the Engineer that satisfactory corrective action has been taken to eliminate the hazard, the subject of the suspension.

14.5 Contractor's Health and Safety Documentation

14.5.1 **Outline Safety Plan** : For the purpose of this clause "Outline Safety Plan" means the Contract specific safety plan forming part of the tender setting out in summary form the Contractor's proposed means of complying with its obligation in relation to safety and industrial health, and "Site Safety Plan" means the site safety plan including all the supplements thereto, or any amended or varied version thereto, as submitted by the contractor in accordance with this clause and consented by the Engineer.

14.5.2 Site Safety Plan

14.5.2.1 The Contractor shall devise and implement a Site Safety Plan developed from the Outline Safety Plan submitted and developed during the Tender period.

14.5.2.2 The Site Safety Plan shall fully comply with the Health and Safety requirements of the Project conditions and proposed work activities, the GS, the Employer's Safety documents as listed in clause 14.1.2 above and all relevant Enactment, Regulations, Codes of Practice, Safety Guides and relevant Indian Standards. The plan shall be prepared and submitted to the Engineer for review within 30 days of the date of Notice to Proceed.

14.5.2.3 The Site Safety plan should contain as a minimum those items set out in the following clauses of the GS. The Site safety plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance with this clause 14.5.2. The Site Safety Plan shall include but not be restricted to:

- a) A statement of the Contractor's policy, organisation and arrangements for safety, health and welfare;
- b) The names & experience of persons within the contractors proposed management who would be responsible for co-ordinating and monitoring the Contractors Safety Performance;
- c) The number of safety staff who would be employed on the works, their responsibilities, authority and line of communication with the proposed contractors' agent.
- d) A statement of the contractor's policy & procedures for identifying and estimating hazards, and the measures for addressing the same;
- e) A list of safety hazards and health hazards anticipated for this contract and sufficient information to demonstrate the contractor's proposals for achieving effective and efficient health and safety procedures;

- f) A description of the training courses and emergency drills which would be provided by the contractor, with an outline of the syllabus to be followed.
 - g) Details of the safety equipment's which would be provided by the contractor, including personal protective equipment;
 - h) A statement of the contractor's policy & procedures for ensuring that contractors equipment used on the project site are maintained in a safe condition and are operated in a safe manner;
 - i) A statement of the contractor's disciplinary procedures for ensuring that sub-contractors comply with the contractor's safety plan.
 - j) A statement of the contractor's disciplinary procedures with respect to safety related matters, and
 - k) A statement of the contractor's procedures for reporting and investigating accidents, dangerous occurrences or occupational illness.
- 14.5.2.4 The contractor shall from time to time as necessary or required by the Engineer produce supplements to the Site Safety Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the contractor or its site safety and industrial health obligations, responsibilities, policies and procedures (under the laws of India or as stated in this clause or elsewhere in the contract) relating to the work on site. Any and all submissions to the Engineer of supplements to the Site Safety Plan shall be made in accordance with the agreed procedures.
- 14.5.2.5 If at any time the safety plan is, in Engineer opinion insufficient or requires revision or modification to ensure the security of the works and the safety of all workmen upon and visitors to the site the Employers Representative may instruct the contractor to revise the Safety Plan and the contractor shall within fourteen days submit the revised plan to Engineer for review.
- 14.5.2.6 Any omission and errors in the Site Safety Plan or the Engineer acceptance or rejection of the Site Safety Plan and/or supplements thereto shall be without prejudice to the contractor's obligations with respect to the Site safety and industrial health and shall not excuse any failure by the contractor to adopt proper and recognised safety practices throughout the execution of the works.
- 14.5.2.7 The contractor shall adhere to the Site Safety Plan and shall ensure, as far as practically possible, the all sub-contractors of all tiers require that as practically possible, the all sub-contractors of all tiers require that with its provisions.
- 14.5.2.8 The contractor shall provide all necessary access, assistance and facilities to enable the Employer Representative and the Employer to carry out surveillance to verify that the site Safety Plan is being properly and fully implemented.
- 14.5.2.9 The contractor shall provide its sub-contractors with copies of the Site Safety Plan and shall incorporate into all sub-contract documentations provisions to ensure the compliance with such plan at all tiers of the sub-contracting.
- 14.5.2.10 The contractor shall, unless the Engineer consent in writing is given, require all sub-contractors to appoint a safety representative who shall be available on the site throughout the operational period of the respective sub- contract. In the event of the Engineer consent being given, the Safety Officer or safety Staff, without prejudice to their duties and responsibilities, shall ensure, as far as is practically possible, the employees of sub-contractors of all tiers and conversant with appropriate parts of the Site Safety Plan and the statutory regulation.
- 14.5.3 Sub-Contractors documentation**
- 14.5.3.1 The Contractor's and his Sub-Contractors health and safety documentation shall be consistent. As new sub-contractors are mobilised on site the Contractor shall ensure that each is issued with copies of the Corporate Safety Documents and each sub-contractor complies with the established health and safety documentation procedures.

14.5.3.2 The Contractor shall submit to the Engineer for review a Works specific copy of his Health and Safety Manual and his Health and Safety Plan for review within 30 days of the Commencement Date of the Works.

14.5.3.3 The Contractor shall provide his sub-contractors with copies of the Health and Safety Manual and the Health and Safety Plan, risk assessments and method statements.

14.5.4 **Health and Safety Manual**

The Contractor's Health and Safety Manual shall contain the procedures required for carrying out the work activities on the Project and is to be regularly reviewed and updated to reflect changes to work practice and changes to Enactment. Copies of proposed changes are to be submitted to the Engineer for review prior to inclusion and implementation.

14.5.5 **Risk Assessments**

14.5.5.1 The Contractor shall carry out a detailed risk assessment covering the occupational health and safety aspects of the Works.

14.5.5.2 The documentation arising from this exercise shall contain a comprehensive schedule of all perceived risks and the proposed resolution or mitigation measures necessary to reduce these risks to a minimum.

14.5.5.3 The results of such assessments shall be recorded, and the records kept for inspection by the Engineer.

14.5.6 **Method Statements**

14.5.6.1 In order to ensure that health and safety has been properly considered at the planning stage, the Contractor shall submit to the Engineer for review, detailed method statements for each construction task as the Engineer requires.

14.5.6.1.1 The contractor shall produce & implement a permit to work system for all high-risk operations. The permit to work system shall be submitted to the Engineer for consent before application.

14.5.6.2 Method statements shall be logical construction guides designed for the use by the Engineer on Site. They shall contain a detailed risk assessment, which shall include the task or operation, a hazard analysis and methods for preventing injury, including personal protective equipment and any pertinent safety measures to be adopted.

14.5.6.3 Detailed programme showing what method statements will be written and when they will be submitted shall be produced and submitted to the Engineer within 30 calendar days of the Commencement Date of the Works or at a date reviewed by the Engineer.

14.5.6.4 Method statements shall be reviewed by the Engineer prior to any work commencing on the task described. Accordingly, the Contractor shall ensure that such statements are prepared in sufficient time to allow a review before the proposed programmed start date for the relevant task.

14.5.6.5 Before formal issue to the Engineer, the engineer in charge of the described works and the Contractor's authorised representative shall sign the method statement.

14.5.6.6 After review by the Engineer, a copy will be held in the safety office to facilitate monitoring of the work and a further copy shall be given to the engineer supervising the work. The original shall be retained in the Contractor's files for audit purposes.

14.6 **Contractor's Safety Arrangements**

14.6.1 Co-ordination of work activities.

14.6.1.1 The Contractor shall ensure that work is to be co-ordinated throughout the Project to ensure that the activities of one group of workers does not affect the safety of another group, e.g., scaffolders working above cable layers, etc.

14.6.1.2 Daily meetings are to be held to co-ordinate the work activities and permits to work are to be issued as and when required.

14.6.2 **Safety inspections**

- 14.6.2.1 The Contractor shall conduct formal, documented Site safety inspections (at least once a month) which are to be attended by the Contractor's most senior Site staff and safety staff.
- 14.6.2.2 A report of each safety inspection shall be made and shall include the actions taken to resolve any problems or shortcoming discovered during the inspection. The report shall be made available for audit purposes and be discussed at the relevant meetings.
- 14.6.2.3 A comprehensive health and safety inspection check-list for the use of the Contractor's Site staff when inspecting the Site is to be formulated and submitted for review by the Engineer.
- 14.6.2.4 The checklist shall indicate the standard to be achieved on any particular aspect of health and safety and be compiled in such a way that allows the inspector to enter his or her actual findings for comparison against the said statement and subsequent rectification.
- 14.6.2.5 When completed, the checklist shall be kept for record purposes and be made available to the Engineer for audit purposes.
- 14.6.2.6 A grading system is to be established which grades the area inspected as either "Very Good", "Good", "Acceptable", "Poor" or "Un-acceptable".
- 14.6.2.7 Where an area receives a grading below "Acceptable", immediate action is to be taken to rectify the problems raised and a further audit shall be conducted after 7 days to assess the conditions.
- 14.6.2.8 The Contractor is to advise the Engineer of the date of the monthly inspection. The Engineer may send a representative to assess the thoroughness of the inspection.
- 14.6.3 **Safety audits**
- 14.6.3.1 The Contractor will be subject to the Employer's Safety Performance Measurement Scheme, which is based upon a series of audits carried out or to be carried out, the extent, scope and at a frequency determined by the Engineer, to measure the Contractor's compliance with the provisions of the Employer's safety documents as listed in clause 14.1.2 above, the Enactments, Contractor's Health and Safety Manual and Site Plan.
- 14.6.3.2 The Employer's audit will be graded as follows: "Very Good", "Good", "Acceptable" or "Un-acceptable".
- 14.6.3.3 Where the Contractor receives a grading of "Un-acceptable", immediate action shall be taken to rectify the problems raised and a follow up audit shall be conducted within 30 days to assess conditions and ensure that remedial action has been taken.
- 14.6.3.4 The Contractor shall continue to be audited, every 30 days, until such time as a grade of "Acceptable" or above has been achieved.
- 14.6.3.5 The Employer's auditors shall be used for the follow up audit(s) and the Contractor shall be liable for the full costs incurred of all additional follow up audits.
- 14.6.3.6 The Contractor shall conduct regular (at least every 3 months) internal safety audits on both the safety management system and the physical Site conditions. The internal safety audits shall be performed to the same criteria and using the same grading and benchmarking as the Employer's audits.
- 14.6.3.7 The internal safety audits shall be conducted by person(s) reviewed without objection by the Engineer, who are qualified and competent to carry out safety audits. The documentation generated by the audit process, including score sheets, shall be made available to the Engineer for audit purposes.
- 14.6.3.8 The internal safety audits shall include the work of sub-contractors of all levels.
- 14.6.3.9 The Contractor shall advise the Engineer of the date of the internal safety audit. The Engineer may send a representative to assess the thoroughness of the internal safety audit.
- 14.6.4 **Reporting of accidents, incidents and dangerous occurrence**

The Contractor shall notify the Engineer immediately of any dangerous occurrences or accidents, which result in death, serious bodily injury or incapacity for more than 3 days. Such initial notification may be verbal but shall in any event be followed by a preliminary written report, in a format reviewed without objection by the Engineer, within 24 hours of the occurrence/accident and a detailed written report shall be submitted within 7 days. Copies of all accident, incident and dangerous occurrence reports shall be kept on file and made available for audit purposes.

14.6.5 Monthly reports

14.6.5.1 The Contractor shall, as part one of each Monthly Progress Report, submit a Site Safety Report duly signed by the Contractor's director responsible for the Contract.

14.6.5.2 The Site Safety Report shall comprehensively address all relevant aspects of occupational safety & health and shall contain certain standard forms and information, as directed by the Engineer, for statistical analysis.

14.6.5.3 The Contractor shall submit reports or accident analysis, in a format reviewed without objection by the Engineer, as and when required by the Engineer.

14.6.6 Safety staff

14.6.6.1 The contractor shall appoint a Safety Officer whose duties throughout the period of the contract shall be entirely connected with the safety and industrial health aspects of the Contractors activities on the site. The safety officer shall be suitably qualified and experienced person who shall supervise and monitor compliance with the site safety plan. The safety officer shall, in particular but without limitation, carry out auditioning of the operation of the site safety plan in accordance with a rolling program to be submitted, from time to time, the Engineer for his consent. The Safety officer's appointment shall be within twenty-eight (28) days of the date of acceptance of Tender and shall be subject to the Engineer written consent.

14.6.6.2 The contractor shall not undertake any works on the site until the safety officer has commended duties in Pune unless the Engineer has specifically consented in writing.

14.6.6.3 Without prejudice to the generality under clause of the General conditions of contract, the contractor shall not remove the Safety officer from the site without the express permission of the Engineer within fourteen (14) days of any such removal or notice if intent of removal, the contractor shall nominate a replacement Safety Officer for the Engineer consent.

14.6.6.4 The contractor shall provide the safety officer with supporting staff in accordance with the staffing levels set out in the site safety plan. The supporting staff shall include at least one (1) Deputy Safety officer whose appointments shall be subject to the Engineer consent under similar criteria to those contained under clause 14.6.6.1 above. The Deputy Safety Officer as contained in the Site Safety Plan whenever necessary.

14.6.6.5 The contractor shall empower the safety officer and safety staff to instruct employees of the contractor or of its sub-contractors of any tiers to cease operations and take urgent and appropriate action to make safe the site and prevent unsafe working practices or other infringements of the site safety plan or the statutory regulations.

14.6.6.6 The contractor shall ensure that the safety officer maintains a daily site safety diary, such diary comprehensive recording all relevant matters concerning site safety, safety inspections and audits, safety related incidents and the like. The site safety diary shall be reviewed and signed on a weekly basis by the site agent and shall be available at all times for inspection by the Engineer.

14.6.6.7 The contractor staff organisation plan shall show direct lines of communication and reporting between the safety officer and the site agent and between the safety officer and the director responsible for the contract. The contractor shall instruct and require the site agent and the Director responsible to be directly accountable in all matters concerning site safety.

14.6.7 Safety promotion and incentive schemes

The Contractor shall actively promote and encourage the standards of health and safety on the Site & implement safety incentives & award schemes at all levels of management, supervisors, foremen, workers, etc. The Contractor shall be able to demonstrate to the Engineer that this requirement is being carried out to the Engineer's satisfaction.

14.6.8 Safety information

14.6.8.1 The Contractor shall display in each of his Site offices, workshops and canteens a copy of the document on "A Guide to the Construction Sites (Safety) Regulations" published by the Government or a similar approved document. This document shall be translated into languages, which are understood by labour engaged by the Contractor or sub-contractors.

14.6.8.2 The Contractor shall ensure that safety, rescue and occupational health matters are given a high degree of publicity to all persons, regularly or occasionally on Site. Posters in English, Hindi and other languages understood by the workers, drawing attention to Site safety, rescue and occupational health, shall be made or obtained from appropriate sources and shall be displayed prominently in relevant areas of the Site.

14.6.8.3 Posters in both English and Hindi drawing attention to safety shall be obtained from the National Safety Council and displayed prominently throughout the Site.

14.6.8.4 The Contractor shall keep on Site a complete and up-to-date set of all relevant occupational health and safety legislation, relevant Codes of Practice and any relevant guides and safety pamphlets published by the National Safety Council.

14.6.9 Safety meetings

14.6.9.1 The Contractor shall establish a monthly Site Safety Management Committee to formally review the safety management on the project and monitor the implementation of the site and Safety Plan. The most senior site manager shall act as chairman of this committee with members of the Engineer's staff attending as appropriate.

14.6.9.2 Attendance from the Contractor shall include, but not be limited to, the senior Manager on Site and the Safety Manager/Officer/Supervisor and representatives from all sub-contractors.

14.6.9.3 The Contractor shall act without delay upon such decisions or recommendations as may be made by the committee on matters of health and safety.

14.6.9.4 The Engineer as appropriate may invite representatives from third parties.

14.6.9.5 The Contractor shall establish a tier of monthly safety meetings and shall ensure that all level of staff, all disciplines and all work areas are covered so that the dissemination of information is carried through to all levels of staff and workers.

14.6.9.6 Minutes of all tiers of Contractor safety meetings shall be issued to the Engineer of information.

14.6.10 Safety training

14.6.10.1 The Contractor shall ensure that induction training courses shall be provided for construction site workers or equivalent.

14.6.10.2 The induction course shall be conducted by suitably qualified persons and repeated at six-month intervals.

14.6.10.3 All workers must receive induction training before they are allowed to commence work on the Site.

14.6.10.4 The Contractor is to issue all Site workers with a Site pass once they have attended the induction course. The pass is to include the worker's name, HK, photograph, types of courses attended and expiry date of the card (maximum 6 months). The pass is to be carried at all times when on the Site.

14.6.10.5 The Contractor shall keep records of such training for health and safety audit purposes. Upon completion of their training, the Contractor's Site staff shall sign a copy of their assigned safety responsibility statement, which shall be kept by the Contractor for audit purposes.

14.6.10.6 The Contractor is to report the number of training sessions and employees trained each month, at the Site Safety Management Committee meeting and in the Monthly Progress Report.

14.6.11 Alcohol and drugs

14.6.11.1 The Contractor shall ensure that alcoholic drinks, drugs and other substance which may impair judgement are not sold introduced or consumed on the site.

14.6.11.2 The Contractor shall ensure that his personnel and those of his sub- contractors of any tier, are not under the influence of alcohol or any substance which may impair judgement whilst on the Site or otherwise engaged in the execution of the Works.

14.6.11.3 The Contractor shall immediately remove or cause to be removed from the Site any person employed by the Contractor or his sub-contractors of any tier who is found to be under the influence of alcohol, drugs or any other substance which may impair judgement. Such person shall not be employed again in connection with the Works or on the Project without the prior consent of the Engineer.

14.7 Site Conditions

14.7.1 Emergency procedures and facilities

14.7.1.1 The Contractor shall establish and implement emergency procedures which detail the organisation of rescue and/or damage limitation teams to deal with emergency situations on the Site such as, but not limited to, fire, loss of power, monsoon, flooding, stranding or the evacuation of a seriously injured person(s) from a remote or difficult Site location, etc. The emergency procedures shall specify what equipment is needed, where it will be located and who is responsible for its maintenance.

14.7.2 First aid facilities

14.7.2.1 The Contractor shall provide, or have access to, sufficient first aid provisions including trained personnel and facilities appropriate to the Site conditions. Arrangements for transporting the injured (ambulance, stretcher, etc.) shall be provided.

14.7.2.2 A Nurse or trained First-Aider is required at all times at the Site of working.

14.7.2.3 The Contractor shall maintain a register of all persons attending the clinic or receiving first aid treatment. Records are to be in a comprehensive format and shall be kept for audit purposes.

14.7.2.4 First aid kits, up to the standards required by the appropriate authority shall be carried in supervisor's vehicles and made available where work is in remote areas.

14.7.3 Lifting appliances and lifting gear

14.7.3.1 The contractor shall provide and maintain safe mechanical cranes. Hoists and conveying facilities for the lifting & transport of materials and shall comply with all relevant requirements of IS 807 Code of practice for the design & manufacturing testing and commissioning of cranes. All cranes, hoists and the like shall be fitted with audible overload warning devices. All such equipment's shall be regularly maintained in accordance with manufactures recommendations and standards having regard to local legislation and recommendations from the appropriate statutory authority.

14.7.3.2 Prior to use on site, all lifting appliances and lifting gear shall be tested to an approved safety margin and suitably identified in accordance with the requirements of the current legislation. The test certificates shall be submitted to the Engineer for review prior to the use of such equipment on site.

14.7.3.3 The safe working load shall be clearly and indelibly marked on all lifting appliances and lifting gear either by stamping or by the addition of permanently secured tag labels.

14.7.3.4 The contractor shall prepare and maintain an up-to-date register containing test certificates of all lifting & hoisting equipment used on the works. The contractor shall notify the register. The register shall, from the commencement of construction, be Engineer the person responsible for maintaining available on site for inspection by the Engineer and relevant Authorities.

- 14.7.3.5 The contractor shall prepare and maintain an up-to-date register containing test certificates of all lifting and hoisting equipment used on the works. The contractor shall notify the Engineer the person responsible for maintaining this register. The register shall, from the commencement of construction, be available on site for inspection by the Engineer and relevant Authorities.
- 14.7.3.6 A system is to be devised and implemented, such as colour coding, to identify the expiry of the certification of lifting appliances and lifting gear. This system is to be displayed in the cabs of all lifting appliances.
- 14.7.3.7 A trained banksman shall be in attendance at each lifting appliance or hoisting operation.
- 14.7.3.8 The banksman shall be equipped with a radio link to the crane or hoist operator and shall be easily identifiable from other workers.
- 14.7.3.9 The operators of shaft hoisting gear shall be in communication with the top and bottom of the shaft and each intermediate landing.
- 14.7.3.10 All crane hooks and other lifting devices used on or around the Site shall be fitted with a safety catch or other device to stop the lifting gear being detached.
- 14.7.3.11 The safe working load shall be clearly and indelibly marked on all lifting equipment, either by stamping or by the addition of permanently secured tag labels. Stamping shall not be permitted on any stress bearing part.
- 14.7.3.12 Slings, shackles and such-like equipment used in lifting shall be colour coded for identifying lifting gear which require re-inspection or disposal.

14.7.4 Fire Precautions

- 14.7.4.1 The **Pune** Fire Service prevention and fire safety act and any relevant regulations made there under and other requirements laid down in the Specification or as laid down from time to time by the Engineer shall be observed at all times.
- 14.7.4.2 The Contractor shall thoroughly assess the risk of fire throughout the Site and shall develop a comprehensive fire control strategy as a part of the Site Safety Plan, which will extend to all aspects of the Works. The fire control strategy shall be discussed regularly and reviewed with the Engineer.
- 14.7.4.3 Adequate and suitable fire extinguishers are to be positioned throughout the Site, with particular attention paid to offices, flammable storage areas, workshops, etc.
- 14.7.4.4 Adequate and suitable fire extinguishers are to be provided at all hot work locations.
- 14.7.4.5 The Contractor shall ensure that all persons on the Site are trained in and undergo regularly refresher courses in the use of fire extinguishers.
- 14.7.4.6 Fire points are to be clearly designated.

14.7.5 Dangerous goods, hazardous substances

- 14.7.5.1 The Contractor shall obtain the requisite licenses for the manufacture, storage, handling and use of all dangerous goods.
- 14.7.5.2 The Contractor shall ensure that all explosives, compressed gases, petrol and other dangerous substances, shall be stored and handled in accordance with the relevant legislation.
- 14.7.5.3 Before being brought on to Site, any materials proposed by the Contractor shall be assessed by the Contractor for their occupational health and environmental compatibility. Any material that is toxic, explosive or inflammable or may otherwise create a hazard shall, whenever possible, be replaced by a less hazardous product. Where this cannot be done, the Contractor shall conduct a risk analysis and produce a method statement specifying the safe method of use and all associated precautions including personal protective equipment.
- 14.7.5.4 All hazardous substances and dangerous goods brought onto the Site shall be entered into a Site register.

- 14.7.5.5 The Contractor shall ensure that material safety data sheets are available and issued to workers, for all hazardous substances brought onto the Site.
- 14.7.5.6 The Contractor shall make adequate provision for the storage and disposal of waste oils, de-greasing agents, etc.
- 14.7.5.7 Flash back arrestors and pressure gauges shall be fitted to all oxygen and acetylene cylinders.
- 14.7.5.8 Oxygen & acetylene cylinders shall be stored and used in a vertical position and be transported upon a trolley or in cage.

14.7.6 Radiation protection

- 14.7.6.1 The use of radioactive substances and radiating apparatus shall comply with the government regulatory requirements and all subsidiary legislation.
- 14.7.6.2 Operations involving ionising radiation shall only be carried out after having been reviewed without objection by the Engineer and shall be carried out in accordance with a method statement.
- 14.7.6.3 Each area containing irradiating apparatus shall have warning notices and barriers, as required by the Regulations, conspicuously posted at or near the area.
- 14.7.6.4 Radioactive substances will be stored, used or disposed shall be strictly in accordance with the Government Enactments.
- 14.7.6.5 The Contractor shall ensure that all Site personnel and members of the public are not exposed to radiation.

14.7.7 Excavations and floor openings

- 14.7.7.1 Before the commencement of any excavation work, sufficient information shall be obtained from the utility companies to identify the locations of buried services. Buried services are to be located using a cable detector, digging hand dug trial pits and by reference to the relevant drawings, before mechanical digging takes place.
- 14.7.7.2 Excavations shall be carried out by trained and experienced workers who shall be fully instructed on the possible dangers & safety precaution to be taken, before work is commenced.
- 14.7.7.3 The Engineer shall be notified immediately of any damage or interruption to a utility.
- 14.7.7.4 A Permit to Dig system shall be established and implemented prior to excavation starting.
- 14.7.7.5 The Contractor shall ensure that all temporary covers/decking to the trenches and barriers at the edges of excavations are safe and securely installed at all times, especially during adverse weather conditions.
- 14.7.7.6 Where there is a danger to the public, extra care must be taken to properly cover all temporary openings and adequately put barrier and sign on the excavation site. Flashing warning lights, signs and adequate lighting is to be installed where required.

14.7.8 Site transport

- 14.7.8.1 The Contractor shall ensure that all Site vehicles are regularly maintained and kept in a safe condition with fully working brakes, lights, exhaust, windscreen, windows and doors, etc.
- 14.7.8.2 Each vehicle, piece of plant or machinery shall be uniquely and clearly identified and registered for maintenance purposes.
- 14.7.8.3 When instructed by the Employer or the Engineer, the Contractor will remove any vehicle from the Site that is not up to the required standards.
- 14.7.8.4 The Contractor will remove from the Site immediately any vehicle that is beyond repair. The Site shall not to be used as a scrap yard.
- 14.7.8.5 The Contractor is to ensure that only vehicles fitted with seats with backrests and seat belts are used as Site transport. If required by law the carrying of passengers in vehicles

that have not been fitted with seat belts is strictly prohibited. No person shall ride in the back of vehicles not legally authorised to carry passengers. Drivers of vehicles permitting this practice are to be warned for a first offence then removed from the Site for the second offence.

14.7.8.6 The speed limit on the Site is to be restricted to 5 kmph and signs displayed advising drivers of the limits imposed.

14.7.8.7 Speed bumps are to be located at strategic points throughout the Site to enforce the speed limits.

14.7.9 Driving/operator's licenses

Drivers of vehicles and operators of the Contractor's Equipment shall hold the necessary license group for the vehicle or plant they are driving/operating. Where no such license group exists, drivers/operators shall have an equivalent group and undertake training in the vehicle/plant given by the Contractor's plant department. Records of the training given are to be retained.

14.7.10 Personal protective equipment (PPE)

14.7.10.1 The Contractor shall make available on Site at all times adequate provision of safety equipment including, but not limited to, safety helmets, goggles, ear protectors, safety belts, respiratory protection, safety equipment for working in sewers, drains and enclosed spaces, equipment for rescue from drowning, fire extinguishers, first aid equipment and other necessary safety equipment.

14.7.10.2 The Contractor shall ensure that safety footwear and safety helmets are worn at all times by all persons on site.

14.7.10.3 High visibility vests shall be worn

14.7.10.4 Persons shall sign for all PPE being issued and a register shall be kept recording the issue.

14.7.10.5 A suitable dry, clean and well-ventilated area shall be provided for the storage of the PPE.

14.7.11 Deleted.

14.7.12 Ladders, temporary access

14.7.12.1 The Contractor shall provide, register, maintain and use only ladders, which are purchased as proprietary products, on the Site. Site made ladders are not to be used under any circumstances.

14.7.12.2 All ladders shall be free from patent defects, secured against movement and installed in accordance with the relevant Codes of Practice.

14.7.12.3 Wooden access steps with handrails are to be installed and maintained as access where the use of mobile access staircases is impractical.

14.7.13 Temporary Works

14.7.13.1 The Contractor shall appoint an engineer as a Temporary Works Coordinator. His duties shall include, but not limited to, checking and certifying the design of all Temporary Works prior to erection and loading, ensuring that the erection work is carried out in accordance with the design, compiling a Temporary Works register, completing a suitably designed form or certificate which is to be displayed on the Temporary Works to display that it has been inspected and is safe to load.

14.7.13.2 The Temporary Works Co-ordinator shall not be the same person who designed the Temporary Works.

14.7.13.3 Suspended, cantilever, bracket type scaffolding or working platforms are to be designed, certified and inspected by an independent engineer, who may be the Temporary Works Co-ordinator, prior to loading.

14.7.14 Temporary buildings, sheds, workshops, etc.

14.7.14.1 No temporary structure is to be erected without the consent of the Engineer.

14.7.14.2 Except where consent is obtained from the Engineer, no person shall reside on the Site.

14.7.15 Temporary electricity

14.7.15.1 Temporary electricity supplies shall comply with Chapter 18 below.

14.7.15.2 Switchbox/distribution box construction shall be robust, corrosion proof, water proof and be of coated metal and shall be mounted on an integral frame at least 1000mm off the ground. In coming cables shall be secured by a waterproof gland.

14.7.16 Housekeeping

14.7.16.1 The Contractor shall clean the Site area on a daily basis and maintain it in a safe, tidy and sanitary condition.

14.7.16.2 Sufficient waste bins are to be provided throughout the area of work and a daily disposal regime is to be established and implemented.

14.7.16.3 The Contractor is responsible for enforcing the standards of housekeeping of its sub-contractors and their areas of work.

14.7.17 Site services

14.7.17.1 The Contractor shall provide, maintain and ensure the installation to the required standards, of all services entering and being used on Site.

14.7.17.2 All Government and utility company regulations and requirements shall be complied with.

14.7.17.3 The Engineer may require the immediate termination or alteration to an installation if he considers that they are prejudicial to safety or health.

14.7.17.4 The Contractor shall ensure that services used on the Site are so designed that there is no possibility of the users of such services surrounding the Site, being affected by loss of supply, contamination, power surges, etc.

14.7.18 Contractors Equipment

14.7.18.1 The contractor shall produce policy & procedures for ensuring that all his plant and equipment used on the works site is maintained in a safe condition and is operated in a safe manner.

CHAPTER 15

15. DAMAGE AND INTERFERENCE

15.1 Damage and Interference

15.1.1 Work shall be carried out in such a manner that, as far as is practicable, there is no damage to or interference with the following, other than such damage as is necessitated to enable the execution of the Works:

- (1) watercourses or drainage systems;
- (2) utilities;
- (3) structures, roads including street furniture, or other property;
- (4) public or private vehicular or pedestrian accesses;
- (5) trees, graves or burial urns; and
- (6) existing railways and railway systems.

The Contractor shall obtain prior approval of the concerned authority or party, if so required, for any work near properties under their ownership or management.

The Contractor shall inform the Engineer as soon as practicable of any item, utility or thing which is not stated in the Contract as requiring diversion, removal or relocation but which the Contractor considers as requiring diversion, removal or relocation to enable the Works to be executed. The Contractor shall not divert, remove or relocate any such item, utility or thing without such diversion, removal or relocation having been reviewed without objection by the Engineer.

15.1.2 Items which are damaged or interfered with as a result of the Works being carried out and items which are diverted, removed or relocated to enable the Works to be carried out, shall be reinstated to the same condition as existed before the Works started or to such condition as may be reviewed without objection or instructed by the Engineer.

15.1.3 The Contractor shall excavate by hand where damage may be caused by the operation of mechanical plant adjacent to any utilities.

15.1.4 Except with the prior approval of the **Pune** Fire Services, no damage or interference with existing fire hydrants and valves shall be caused.

15.1.5 Prior to trench excavation, the Contractor shall carry out investigations to locate utilities by means of hand-dug inspection pits. The locations and number of inspection pits required in meeting the Contractor's obligations to establish the location of existing utilities and underground features shall be determined by the Contractor. The Contractor shall note that many existing pipes/ducts/cables may not be shown in the records kept by the utility undertakings and may only be exposed as the excavation proceeds. The trench excavation shall be carried out by hand where there are utilities adjacent to or within the excavation works and the Contractor shall have allowed in his programme the time required for the exposing, temporary support and diversion of these recorded or unrecorded utilities should any pipes/ ducts/cables or cover tiles be exposed, the respective utility undertaking shall be contacted to determine if all the utilities have been located. Cover tiles and utilities shall only be removed by the utility undertakings concerned.

15.1.6 Where the Engineer has conducted utility and ground investigation on behalf of the Employer, the Contractor may obtain the data obtained from the investigations from the Engineer in accordance with clause 1.8.2 above and subject to the condition of clause 15.3 below.

15.2 Watercourses and Drainage Systems

- 15.2.1 Existing watercourses and drainage systems shall be temporarily diverted as required to enable the Works to be carried out. Particulars of the proposed diversions shall be submitted to the Engineer for review at least 14 days before the relevant work starts. Diversions shall be constructed to the satisfaction of the Engineer with such alignment and in such manner that the flow is discharged adequately and effectively without causing flooding or erosion to the adjacent area. The diversions shall be maintained while the work is being carried out and shall be reinstated, including the removal of any obstructions to flow, as soon as practicable after the work is complete.
- 15.2.2 Measures shall be taken to prevent excavated material, silt or debris from being deposited in existing drainage systems, watercourses or the river.
- 15.2.3 Under no circumstances shall foul sewage flow be diverted into existing storm-water drains and vice versa.
- 15.2.4 The Contractor shall adequately maintain the existing drainage and sewerage systems at all times including removal of solids in sand traps, manholes, gullies and streambeds.
- 15.2.5 The Contractor shall discharge water surface run-off from the Site into storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels or sandbag barriers shall be provided on Site to properly direct the storm water to such silt removal facilities. The Contractor shall remove all silt, which may have accumulated in the drainage or sewerage systems whether within the Site, or not. If at any time such provisions prove to be ineffective, the Contractor shall take such additional measures as the Engineer deems necessary.
- 15.2.6 Water pumped out of the trenches under construction shall be discharged into storm drains after the removal of silt in silt removal facilities.
- 15.2.7 The Contractor shall maintain the silt removal facilities, channels and manholes and remove the deposited silt and grit regularly, at the onset and after each rainstorm to ensure that these facilities are functioning properly at all times.
- 15.2.8 No obstruction to flow is to be left in position longer than is necessary for carrying out the Works. The Contractor shall ensure that adequate provisions are made for dealing with increased flow of water during the wet season.
- 15.2.9 The Contractor shall keep interruption or disturbance to the public due to the diversion works to a minimum.
- 15.2.10 If any mechanical equipment is required for the foul sewage diversion work, the Contractor shall suggest and provide precautionary measures to mitigate against consequences of breakdown of the equipment.
- 15.2.11 The Contractor shall at all times ensure that all existing stream courses and drains within and adjacent to the Site are kept safe and free from any debris and any excavated materials arising from the Works. The Contractor shall ensure that chemicals and concrete agitator washings are not deposited in watercourses.
- 15.2.12 The Contractor shall be responsible for the Temporary Works involved in training, diverting, or conducting of open streams or drains intercepted by the Works and the Site, for the maintenance of the Temporary Works and waterways as required by the Engineer, and for reinstating these to their original courses on Employer's Taking Over of the Works, when and where in the opinion of the Engineer such action is desirable.
- 15.2.13 The Contractor shall take all necessary precautions to prevent water entering upon or being discharged from the Site, from entering upon the works of adjacent contractors or adjacent properties.
- 15.2.14 The Contractor shall provide where necessary temporary water courses, floodwalls, flood gates, ditches, drains, pumping or other means of maintaining the Works and the Site free of water.

15.3 Utilities

- 15.3.1 The details of existing utilities are given by the employer for information only and the accuracy of the details is not guaranteed. The Contractor shall make his own enquiries and shall carefully excavate trial holes to locate accurately the utilities indicated to him by the utility undertakings.
- 15.3.2 Temporary supports and protection to utilities shall be provided by methods reviewed without objection by the Engineer. Permanent supports and protection shall be provided if instructed by the Engineer.
- 15.3.3 The Contractor shall inform the Engineer and the utility undertakings without delay of the following:
- (1) damage to utilities;
 - (2) leakage of utilities;
 - (3) discovery of utilities not shown on any drawings; and
 - (4) diversion, removal, repositioning or re-erection of utilities which is required to enable the execution of the Works.
- 15.3.4 The Contractor shall take all steps necessary to enable the utility undertakings to proceed in accordance with the programme agreed between the Contractor and the utility undertakings under clause 2.2.2 above. The Contractor shall maintain close liaison with the utility undertakings and shall inform the Engineer of any delays in works by the utility undertakings.
- 15.3.5 The Contractor shall keep records of existing utilities encountered on the Site and a copy provided for the Engineer. The records shall be submitted for review by the Engineer and shall contain the following details:
- (1) location of utility;
 - (2) date on which utility was encountered;
 - (3) nature and size of utility;
 - (4) condition of utility; and
 - (5) temporary or permanent supports provided.
- 15.3.6 The Contractor shall co-ordinate the activities of the utility undertakings in connection with the diversion of utility services necessary for the execution of the Works.
- 15.3.7 The Contractor shall set up and manage a Utilities Liaison Group for the duration of the Contract. The Group shall meet at a frequency to be as instructed by the Engineer but at least once a month and shall discuss and resolve matters associated with utility undertakings on programming, coordination and action. The Contractor shall ensure that all relevant utility undertakings and the Engineer are represented at the meetings.
- 15.3.8 The Contractor shall inform the Engineer of the date, time and place of every meeting with utility undertakings and he shall copy all correspondence and minutes of meetings to the Engineer.
- 15.3.9 The programme for any section of work to be carried out by a utility undertaking shall be confirmed in writing by the Contractor to the utility undertaking no more than four weeks and no less than one week before the agreed scheduled start date for that section of Works, such confirmation to be notified to the Engineer.
- 15.3.10 The Contractor shall monitor the progress of utility undertakings against the agreed programmes and shall notify the Engineer of any slippage to these programmes. The agreed programmes shall mean those programmes agreed in writing by the Contractor and the various utility undertakings described in 15.3.9 above.
- 15.3.11 In the event of any such slippage, the Contractor shall prepare and execute a plan of action with the relevant utility undertaking to redress the slippage. Such a plan may, if necessary, include provision of Contractor's labour resources, materials and/or plant to the utility undertaking.

- 15.3.12 The Contractor shall ensure that the peak particle velocity and amplitude of ground movement due to temporary sheet pile driving for trench excavation or any other construction activities, as measured by a vibrograph at all water mains within or adjacent to the Site shall not exceed the values specified in this GS.

Type of structure or installation	Peak particle velocity(mm/s)	Vibration amplitude (mm)
Water retaining structures	13	0.1
Water mains & Other structures and pipes	25	0.2

- 15.3.13 Hand digging method shall always be employed where there are utilities adjacent to or within the trench excavation works. Portable mechanical tools may be used but shall be restricted to the breaking of the pavement surface. Due care shall be exercised to prevent damage to the underground cables, water pipes, gas pipes or other utility installations.

- 15.3.14 Exposed utility installations shall be adequately supported and protected from accidental damage.

- 15.3.15 Smoking and use of naked flames shall be prohibited if gas pipes are present or pipes the use of which are not identified are present.

15.4 Structures, Roads and Other Property

- 15.4.1 The Contractor shall immediately inform the Engineer of any damage to structures, roads or other property that is not required for the execution of the Works.

- 15.4.2 The Contractor shall use every reasonable means to prevent any of the highways or bridges connecting with, or on the routes to, the Site from being damaged by any traffic of the Contractor or any of his sub-contractors of any tier and the Contractor shall, in particular, select routes, choose and use vehicles and restrict and distribute loads so that the moving of Temporary Works, Permanent Works and Contractor's Equipment from and to the Site shall be organised as far as reasonably possible so that no unnecessary damage or injury may be occasioned to such highways and bridges. The Contractor shall in selecting such routes take advice from and follow the instructions of the Commissioner for Transport and other Relevant Authorities of GNCTD and GOI.

- 15.4.3 Should the Commissioner for Transport or any other Relevant Authority or the Contractor be of the opinion that it should be necessary to move one or more loads of Temporary Works, Permanent Works or Contractor's Equipment over a highway or bridge the moving of which is likely to damage any highway or bridge unless special protection or strengthening is carried out then the Contractor shall, before moving the load on to such highway or bridge, give notice to the Engineer of the weight and other particulars of the load to be moved and request the protection or strengthening of the said highway or bridge. If within 14 (fourteen) days of receipt of such notice the Engineer directs in writing that such protection or strengthening is unnecessary then the Contractor may move the said load or loads over the said highway or bridge but otherwise the Contractor shall not move the said load or loads until notified by the Engineer of the route which he may use.

- 15.4.4 If during the execution of the Works or at any time thereafter the Contractor shall receive any claim arising out of the execution of the Works in respect of damage or injury to highways or bridges he shall immediately report the same to the Engineer and thereafter the Employer shall negotiate the settlement of and pay all sums due in respect of each claim and shall indemnify the Contractor in respect thereof and in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in relation thereto. Provided always that if and so far any such claim or part thereof shall in the opinion of the Engineer be due to any failure on the part of the Contractor to observe

and perform his obligations under clauses 15.4.2 above and 15.4.3 above, the amount certified by the Engineer to be due to such failure shall be paid by the Contractor to the Employer.

15.4.5 Where the nature of the Works is such as to require the use by the Contractor of water-borne transport, the foregoing provisions of this Clause shall be construed as though "highway" includes any river or other structure related to, on or beneath a waterway, and "vehicle" includes craft, vessels or platforms & shall be read and construed accordingly.

15.4.6 If in the course of or for the purposes of the execution of the Works or any part thereof any highway or road or way shall have been damaged, broken or broken into then notwithstanding anything herein contained:

(a) If the permanent reinstatement of such highway or road or way is to be carried out by the appropriate Relevant Authority or by some person other than the Contractor or any sub-contractor of any tier to him, the Contractor shall:

(i) at his own cost and independently of any requirement of or notice from the Engineer be responsible for the temporary reinstatement of such highway, road or way and the making good of any subsidence or shrinkage or other defect, imperfection, settlement or fault in the temporary reinstatement of such highway, road or way and for the execution of any necessary repair or amendment thereof from whatever cause the necessity arises until the end of the Defects Liability Period in respect of the part of the Permanent Works beneath or over such highway, road or way or until the Relevant Authority or such other person as aforesaid shall have taken possession of the highway, road or way for the purpose of carrying out permanent reinstatement, whichever is the earlier; and

(ii) indemnify and save harmless the Employer against and from any damage or injury to the Employer or claims by third parties arising out of or in consequence of any neglect or failure of the Contractor to comply with the foregoing obligations or any of them, and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto; and

(b) as from the end of such Defects Liability Period or the taking of possession of such highway, road or way referred to in clause 15.4.6(a)(i) above whichever shall first happen, the Employer shall indemnify and save harmless the Contractor against and from any damage or injury to the Contractor arising out of or in consequence of or in connection with the said permanent reinstatement or any defect, imperfection or failure of or in such permanent reinstatement and against and from all claims, demands, proceedings, damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

15.4.7 Where the Relevant Authority or other person referred to in clause 15.4.6 above shall take possession of the highway, road or way as aforesaid in sections or lengths, the responsibility of the Contractor under clause 15.4.6 above shall cease in regard to any such section or length at the time at which possession thereof is so taken. But shall during the continuance of the said Defects Liability Period continue to be responsible for any section or length of which possession has not been taken and the indemnities given by the Contractor and Employer respectively under clause 15.4.6 above shall be construed and have effect accordingly.

15.5 Access

Alternative access shall be provided if interference with existing public or private vehicular or pedestrian access is necessary to enable the execution of the Works. The arrangements for the alternative access shall be as reviewed without objection by the Engineer. The permanent access shall be reinstated as soon as practicable after the work is complete and the alternative access shall be removed as soon as practicable after it is no longer required.

15.6 Trees and Other Similar Obstructions

15.6.1 Trees which are to be retained or which are not required to be removed in order to carry out the Works, shall be protected from damage at all times by methods reviewed without

objection by the Engineer. Materials, including excavated materials, shall not be banked around such trees and they shall not be trimmed or cut without having been reviewed without objection by the Engineer.

- 15.6.2 If any trees or other obstructions are required to be removed during the execution of the Works which are not specifically required to be removed or otherwise catered for, the Contractor shall draw the attention of the Engineer to them and shall not remove them without having received a notice of no objection from the Engineer.

15.7 Noise Control on Works Site

- 15.7.1 All Contractor's Equipment shall be effectively "sound-reduced" by means of silencers, mufflers, acoustics linings or shields or acoustic sheds or screens to levels prescribed in the relevant Noise Control Ordinance and measured outside the nearest occupied property or to the satisfaction of the Engineer. The Contractor shall provide details of proposed noise control measures to the Engineer for review prior to the use of any Contractor's Equipment on the Site.
- 15.7.2 Provided that the provisions of this Paragraph shall not be applicable in the case of emergency work necessary to save life or property or for the safety of the Works or in the case of blasting operations necessitated by urgency and reviewed by the Engineer.
- 15.7.3 The Contractor shall provide a sound level meter (as specified in Appendix of this Specification) reviewed without objection by the Engineer, for the exclusive use of the Engineer at all times during the continuance of the Contract.

15.8 Spoil Disposal

- 15.8.1 The Contractor shall make his own enquiries and arrangements regarding the location and the availability of spoil disposal areas and reclamation and shall pay all costs of complying with all regulations and requirements of Relevant Authorities in connection with the use of such areas. These areas are not within the control of the Employer and no claims will be entertained in respect of non-availability of a particular area or changes in the costs of arrangements for the use thereof.
- 15.8.2 The Contractor shall be responsible for all necessary liaison to ensure compliance with the requirements of unproductive disposal of any surplus excavated rock or soft material which is suitable for filling.
- 15.8.3 The Contractor shall conform to all pertinent Environmental Protection Ordinances and be liable for any breach of such Ordinances committed by himself and/or his sub-contractors during the disposal of surplus excavated material and water from the Site.

CHAPTER 16**16. ENVIRONMENTAL PROTECTION REQUIREMENTS****16.1 GENERAL**

- 16.1.1 The Contractor shall conform to the Indian Environmental Laws and codes as applicable. The current national standards established by the Ministry of Environment and Forest, Government of India and other government agencies for control of environmental pollutants such as air, water, noise and visual impacts/aesthetics shall be followed for compliance during project construction.
- 16.1.2 The Contractor shall comply with all enactments and their amendments, which shall include but are not limited to:
1. Environment Protection Act, 1986
 2. Air (Prevention and control of Pollution) Act, 1981
 3. Water (Prevention and Control of Pollution) Act, 1974
 4. Notification on Control of noise from DG sets, 2002
 5. The Noise pollution (Regulation & Control) rules, 2000
 6. The Hazardous Waste (Management & handling) Rules, 1989
 7. Manufacture, storage and Import of hazardous chemicals Rules, 1989
 8. Regulation on Recycling of Waste Hazardous Materials
 9. Batteries (Management & Handling) Rules, 2001
 10. Maharashtra (Urban Areas) Protection and Preservation of Trees Act, 1975
- 16.1.3 The provisions listed herein regarding Environmental Protection shall apply to and be binding upon the Contractor for any works on the site and the persons employed by sub-Contractors. The Contractor shall ensure that proper and adequate provisions to this end are included in all sub-contracts placed by him.
- 16.1.4 The provisions of this Appendix however, shall not be applicable in the case of emergency works necessary for saving of life and property or safety of the Works.
- 16.1.5 The Contractor has been issued with the Employer's Environmental Quality Management Manual. Within 20 weeks of notification of acceptance of the Tender, the Contractor shall submit for review by the Employer's Representative, a draft of his own contract specific Site Environmental Plan based on the environmental protection requirements contained in this chapter and on the Employer's Environmental Quality Management Manual and his construction methodology. He shall submit a final version prior to the commencement of the works.
- 16.1.6 This contract specific Site Environmental Plan of the Contractor, as referred to in Chapter 3 above, shall be consistent with the provisions of the Environmental Management Plan outline, as given in the Employer's Environmental Quality Management Manual.
- 16.1.7 On account payment to be made after three months of issuance of Letter of Acceptance, shall be released, if site environmental plan has been submitted by the contractor and approved by Employer's Representative. Otherwise Rs.1,50,000 (Rupees one lac fifty thousand as lump sum amount shall be withheld from running bill till compliance of the above.
- 16.1.8 The Contractor shall ensure that audits of all the activities detailed in his Site Environmental Plan are carried out at weekly intervals or at such intervals as the Employer's Representative may require ensuring the continuing effectiveness and compliance with the Site Environmental Plan. The Contractor shall make available on request any document, which relates to his recent internal audits.

- 16.1.9 For closure of Non-Conformance Report, expeditious action shall be taken by the contractor for compliance and the contractor shall ensure closure of non-conformance report within 15 days of its issue. In case of non-closure of report, an amount of Rs.20,000/- (Rupees Twenty thousand only) shall be withheld from running on account bill for every non-closure of report till the same is closed satisfactorily.
- 16.1.10 The Employer's Representative may conduct quarterly Audits of the Contractor's Site Environmental Plan and its effective implementation on the works site. One-week notice will be given by the Employer's Representative before proceeding with the audit. During the audit by the Employer's Representative, the Contractor shall provide suitably qualified staff to accompany the auditor.
- 16.1.11 Milestone payments will be achieved for successful quarterly audits for which the Employer's Representative has issued a "Notice of No Objection" or a "Notice of No Objection subject to...."
- 16.1.12 The contractor shall carry out its own Environmental Audits after four months of issuance of Letter of Acceptance and every three months thereafter. Submission of Environmental Audit Report duly reviewed and accepted by Employer's Representative along with action taken shall be ensured within one month of due date of such audits. Otherwise a lump sum amount of Rs.1.00 lac (Rupees one lac) shall be recovered for each failure from running bill and this shall not be refunded.

16.2 HOUSEKEEPING

- 16.2.1 The Contractor shall take all precautions to avoid any nuisance arising from his operations. This shall be accomplished, wherever possible by suppression of nuisance at source rather than abatement of the nuisance once generated.
- 16.2.2 Following site clearing and before construction of its contracted activities, the Contractor shall remove all trash and debris.
- 16.2.3 The Contractor shall ensure that the work place is as far as practicable, maintained in a neat and tidy manner. The materials for use and tools and tackles shall be stacked and stored in a manner that is safe and does not cause obstruction to movement of men and machines at site.
- 16.2.4 The Contractor shall maintain the worksite free of trash, garbage and debris. He shall provide and ensure proper uses of refuse containers to ensure that rodents, flee and other pests are not harboured and attracted.
- 16.2.5 These may be metal or heavy-duty plastic 'Refuse Containers' with tight fitting lids for disposal of all garbage or trash associated with food. The containers shall not have openings that allow access by rodents. The refuse containers shall be kept upright with their lids shut tight. These containers shall be emptied at-least once daily by the Contractor to maintain site sanitation.
- 16.2.6 To keep the area free of litter & garbage, specific locations shall be designated for consuming food and snacks to prevent random disposal of waste. All waste shall be deposited in the refuse containers described in (16.2.5) above. Suitable notice shall be deployed prominently for strict compliance of these requirements.
- 16.2.7 Separate containers shall be used for non-biodegradable and reusable/recyclable wastes and properly labelled.
- 16.2.8 Measures shall be taken to prevent mosquito breeding at site. The measures to be taken shall include:
- (a) empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and shall be removed from the Site regularly;
 - (b) still waters shall be treated at least once every week with oil in order to prevent mosquito breeding;
 - (c) Contractor's Equipment and other items on the Site which may retain water shall be stored, covered or treated in such a manner that water could not be retained.

(d) Water storage tanks shall be suitably provided.

(e) Posters in both Hindi and English, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the Site.

16.3. AIR QUALITY

16.3.1 The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer's Representative.

16.3.2 The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer's Representative.

16.3.3 If after commencement of construction activity, Employer's Representative believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected, and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer's Representative and implemented.

16.3.4 In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional/ alternative equipment by the Contractor or maintenance/modification of existing equipment of the Contractor.

16.3.5 Dust generating materials shall be:

(i) Transported in closed containers or covered trucks.

(ii) Loaded and unloaded in closed systems or wind protected areas.

(iii) Watered as appropriate to minimise dust production.

16.3.6 Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India from time to time. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.

16.3.7 In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer's Representative may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.

16.3.8 The Contractor shall cover loads of materials, debris and soil transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tailboard or sideboards.

16.3.9 The Contractor shall be responsible for ensuring that no earth, rock or debris is deposited on public or private right of way as a result of his operations, including any deposits arising from the movement of loaded/unloaded trucks and/or other construction vehicles. In the event of it happening, the contractor shall clean the public/private right of way to the satisfaction of Employer's Representative.

16.3.10 The Contractor shall make his own arrangements for water for purposes stated in above clauses and wherever it may be required to control air pollution, dust and debris.

16.3.11 The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer's Representative.

16.3.12 The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer's Representative.

16.3.13 The Contractor shall protect structures, utilities, pavements, public and private right of way and other facilities from disfiguration and damage due to contractor's activities including movement of construction equipment and machinery. Should this happen, he

- shall make good the damage and remedy the situation to the satisfaction of the Employer's Representative.
- 16.3.14 The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- 16.3.15 The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for backfilling or as directed by Employer's Representative.
- 16.3.16 The Contractor shall place material in a manner that will minimise dust production. Material shall be stabilised each day and wetted, to minimise dust production.
- 16.3.17 During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.
- 16.3.18 The Contractor will make water sprinklers, water supply and water delivering equipment available at any time that it is required for dust control use.
- 16.3.19 Dust control activities shall continue even during any work stoppage.
- 16.3.20 At each construction site, the Contractor shall provide storage facilities for dust generating materials and shall be:
- (i) Closed containers/bins or;
 - (ii) Wind protected shelters or;
 - (iii) Mat covering or;
 - (iv) Walled.
- Or any combination of the above to the satisfaction of the Employer's Representative.
- 16.3.21 The Contractor shall submit to the Employer's Representative an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity at work sites insofar as it relates to monitoring, controlling and mitigating air pollution.
- 16.2.22 Deleted.
- 16.3.23 For its activities within the confined spaces, the contractor shall monitor flammable gases, oxygen, carbon monoxide, carbon dioxide, hydrogen sulphide, oxides of nitrogen, and aldehyde. The contractor shall also monitor for any other poisonous gas that the Employer's Representative shall deem appropriate and necessary.
- 16.3.24.1 Air monitoring in confined spaces shall be carried out as often as necessary, however, the duration between two sets of readings shall not be more than 4 hours.
- 16.3.25 Within the confined spaces, air shall be considered unfit for workmen to breathe if it contains any of the following:
- (i) Less than 19.5% and more than 22% oxygen by volume.
 - (ii) More than 0.5% carbon dioxide by volume.
 - (iii) More than 0.01% carbon monoxide by volume.
 - (iv) More than 0.001% hydrogen sulphide by volume.
 - (v) More than 0.003% oxides of nitrogen.
 - (vi) More than 0.5% of methane at any place.
 - (vii) More than 0.0005% of aldehyde.
- Any other poisonous gas in harmful amounts.
- 16.3.26 A record of all air quality monitoring containing location, date, time, substance, monitoring results and name of person conducting the tests shall be maintained by the contractor and made available for inspection by the Employer's Representative.
- 16.4 WATER QUALITY**

- 16.4.1 The Contractor shall comply with the Indian Government legislation and other State regulations in existence in **Pune** insofar as they relate to water pollution control and monitoring.
- 16.4.2 The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter.
- 16.4.3 In the event of any spoil or debris from construction works being deposited on adjacent land any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed, and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer's Representative.
- 16.4.4 Due to lowering of potable water supplies in **Pune** and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer's Representative. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either reused for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifers levels. The Contractor must submit his proposals for approval of Employer's Representative, on his proposed locations of dewatering of excavation and collection of water for either construction reuse or recharge directly to aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water re-used for construction.
- 16.4.5 The Contractor shall at all times ensure that all existing stream courses and drains within, and adjacent to the site are kept safe and free from any debris and any excavated materials arising from the Works. The Contractor shall ensure that earth, bentonite, chemicals, any mud slurry from drilling or grouting and concrete agitator washings etc. are not deposited in the watercourses and not discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. but are suitably treated and effluents and residue disposed-off in a manner approved by local authorities.
- 16.4.6 All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed-off at a location and in a manner that will cause neither pollution nor nuisance.
- 16.4.7 The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.
- 16.4.8 The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Drips pans placed on hard surface shall be used to store oil/grease drums.

16.5 NOISE

16.5.1 General

- (1) The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works. The Contractor shall, at his own expense, take all appropriate measures to ensure that work carried out by the Contractor and by his sub-Contractors, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise.
- (2) Without prejudice to the generality of the foregoing, noise level reduction measures shall include the following:
 - (a) the Contractor shall ensure that all powered mechanical equipment used in the Works shall be effectively sound reduced using the most modern techniques available including but not limited to silencers and mufflers.

- (b) the Contractor shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated.
 - (3) The Contractor shall ensure that, as far as ambient noise is concerned, noise generated by work carried out by the Contractor and his sub-Contractors during day time and night time shall not exceed the background noise levels by 10dB(A) or more when measured at a point outside the premises of the location of the source. When background noise levels are not available, the permissible noise levels shall meet the requirements as given in the Environmental Quality Management Manual. The same may be varied from time to time by and at the sole discretion of the Employer's Representative. In the event of a breach of this requirement, the Contractor shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.
 - (4) For ambient noise level compliance, number of monitoring locations shall be at least four. Number of locations can be increased or decreased by the Employer's Representative depending on the extent of construction activity and its proximity to noise sensitive receptors. The other noise monitoring requirements shall be as given in the Employer's Environment Quality Management Manual.
 - (5) For noise emanating from generators run with diesel, notification dated 17th May 2002 under Environmental (Protection) Act, 1986 shall apply which require acoustic treatment or acoustic enclosure such that insertion loss of 25dB(A) is obtained or ambient noise standards are met, whichever is on the higher side.
- 16.5.2 Protection against the effects of occupational noise exposure shall be provided when the sound levels exceed those shown in Table of this section when measured on the A-scale of a standard sound level meter at slow response.
- 16.5.3 When employees are subjected to sound levels exceeding those listed in Table of this section, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of the table, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.

TABLE
Permissible Noise Exposures

Duration per Day Hours	Sound Level (Slow Response)
8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or less	115

16.5.4 If the variations in noise level involve maxima at intervals of 1 second or less, it is to be considered continuous. In all cases where the sound levels exceed the values shown herein, a continuing, effective hearing conservation program shall be administered.

16.5.5 When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula as given below

$$F_e = (T_1 / L_1) + (T_2 / L_2) + \dots + (T_n / L_n) \text{ where:}$$

F_e = The equivalent noise exposure factor.

T = The period of noise exposure at any essentially constant level.

L = The duration of the permissible noise exposure at the constant level (from Table).

If the value of F_e exceeds unity (1) the exposure exceeds permissible levels.

16.5.6 A sample computation showing an application of the above formula is as follows. An employee is exposed at these levels for these periods:

110 db A 1/4 hour.

100 db A 1/2 hour.

90 db A 1 1/2 hours.

Then,

$$F_e = (1/4/1/2) + (1/2/2) + (1 1/2/8)$$

$$F_e = 0.500 + 0.25 + 0.188$$

$$Fe = 0.938$$

Since the value of Fe does not exceed unity, the exposure is within permissible limits.

- 16.5.7 Construction material should be handled and transported in such a manner as not to create unnecessary noise as outlined below.
- 16.5.8 Under the Contract, the Contractor shall:
- (1) Perform Work within the procedures outlined herein and comply with applicable codes, regulations, and standards established by the Central and State Government and their agencies.
 - (2) Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. Use equipment with effective noise-suppression devices and employ other noise control measures as to protect the public.
 - (3) Schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
 - (4) The Contractor shall submit to the Employer's Representative a Noise Monitoring and Control Plan (NMCP) under contract specific Site Environmental Plan. It shall include full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and night time, and of his proposed working methods and noise level reduction measures. The NMCP shall include detailed noise calculations to demonstrate the anticipated noise generation by the Contractor.
 - (5) The NMCP prepared by the Contractor shall guide the implementation of construction activity. The NMCP will be reviewed on a regular basis and updated as necessary to assure that current construction activities are addressed. It shall appear as a regular agenda item in project coordination meetings.
- 16.5.9 Vibration Level Limits : The vibration level limits at historical sites adjacent to the alignment shall conform to revised version of the German Standard (DIN 4150). The scheme for monitoring vibration level at these historical sites shall be submitted to Employer's Representative for his approval. The scheme shall include:
- (1) monitoring requirements for vibrations at regular intervals throughout the construction period.
 - (2) pre-construction structural integrity inspections of historic and sensitive structures in project activity.
 - (3) Information dissemination about the construction method, probable
 - (4) effects, quality control measures and precautions to be used.
- 16.6 WASTE**
- 16.6.1 The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimising potential for pollution.
- 16.6.2 The Contractor shall remove waste in a timely manner. Scrap and waste material shall be removed and disposed-off at landfill sites after obtaining approval of Conservancy & Sanitation Engineering Department of Municipal Corporation of **Pune** for its disposal.
- 16.6.3 Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with (2) above.
- 16.6.4 The Contractor shall maintain and clean waste storage areas regularly.
- 16.6.5 If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Wastes (Management & Handling) Rules, 1989" and chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of

Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed-off in a manner in compliance with the procedure given in the rules under the aforesaid act.

- 16.6.6 The contractor shall ensure that oily waste including oil-soaked rags/cotton is disposed-off to agency authorised to dispose such waste. The contractor shall sell discarded batteries to the authorised recycler of such items.

16.7 PREVENTION OF MOSQUITO BREEDING

- 16.7.1 Measures shall be taken to prevent mosquito breeding at site. The measures to be taken shall include:

- (a) empty cans, oil drums, packing and other receptacles which may retain water shall be deposited at a central collection point and shall be removed from the Site regularly;
- (b) still waters shall be treated at least once every week with oil in order to prevent mosquito breeding;
- (c) Contractor's Equipment and other items on the Site which may retain water shall be stored, covered or treated in such a manner that water could not be retained.
- (d) Water storage tanks shall be suitably provided.

- 16.7.2 Posters in both Hindi and English which draw attention to the dangers of permitting mosquito breeding shall be displayed prominently on the Site.

CHAPTER 17**17. PHOTOGRAPHS****17.1 Photographs**

- 17.1.1 Colour progress photographs showing the progress of the Works and the quality of the materials and workmanship shall be taken by the Contractor. The photographs shall be taken by a professional photographer, nominated by the Contractor and reviewed without objection by the Engineer. Processing shall be carried out by a competent processing firm, nominated by the Contractor and reviewed without objection by the Engineer. The photographs shall be taken under the direction of the Employer or the Engineer at locations selected by the Employer or the Engineer. Photographs shall be taken once every month and at other times instructed by the Employer or the Engineer.
- 17.1.2 One proof 3R print of each progress photograph shall be provided to the Engineer not more than 2 days after the photographs are taken. The Engineer shall select the sets of progress photographs to be provided. The selected sets shall be provided not more than 2 days after the Engineer has selected the sets. The following shall be provided for the Engineer:
- (1) one set of each selected progress photograph comprising the negatives and three 3R prints;
 - (2) albums for the photographs and negatives; and
 - (3) printed labels for each photograph.
- 17.1.3 The Contractor shall provide to the Engineer the photographs selected in clause 17.1.2 above on Photo Compact Disks with a minimum resolution of 64 Base (4096 x 6144).
- 17.1.4 The Contractor may propose to the Engineer the use of a digital photography system by handing over a digital camera to the engineer for such purposes to meet the requirements of this Chapter. The Engineer shall at his discretion, review the proposed system for practical and technical compliance.
- 17.1.5 Colour progress photographs shall provide a fair representation of the Works. A minimum of 24 photographs per month shall be submitted to the Engineer.

CHAPTER 18**18 TEMPORARY WATER AND ELECTRICITY SUPPLY****18.1 Deleted****18.2 Applicability**

18.2.1 Where the Contractor is required to provide temporary electrical supplies, or to use, extend or expand on temporary supplies installed by others, all such activity shall be executed in accordance with clauses 18.3 to 18.18 inclusive.

18.2.2 When the Contractor makes use of temporary electrical supplies provided by other, he will observe and comply with the requirements of this Chapter.

18.3 Work on Site

18.3.1 The Contractor shall nominate a representative whose name and qualifications shall be submitted in writing to the Engineer for review not later than 4 weeks before the appointment and who shall be solely responsible for ensuring the safety of all temporary electrical equipment on Site. The Contractor shall not install or operate any temporary Site electrical systems until this representative is appointed and has commenced duties.

18.3.2 The name and contact telephone number of the representative having been reviewed without objection by the Engineer shall be displayed at the main distribution board for the temporary electrical supply so that he can be contacted in case of an emergency.

18.3.3 The Contractor shall submit schematic diagrams and the details of the equipment for all temporary electrical installations, and these diagrams together with the temporary electrical equipment shall be submitted to the Engineer for review.

18.3.4 All electrical installation work on Site shall be carried out in accordance with the requirements laid down in BS 7375 and the Specification. All work shall be supervised or executed by qualified and suitably categorised electricians, who are registered as such under the Electricity Ordinance 1990/Electricity (Registration) Regulations 1990.

18.4 Electrical General

Temporary electrical Site installations and distribution systems shall be in accordance with:-

- (1) Indian Electrical Regulations;
- (2) The Power Companies' Supply Rules;
- (3) Electricity and its subsidiary Regulations;
- (4) IEE Wiring Regulations (16th Edition);
- (5) BS 7375 Distribution of Electricity on Construction and Building Sites;
- (6) BS 4363 Distribution Assemblies for Electricity Supplies for Construction and Building Sites;
- (7) BS 6164 Safety in the Construction Industry.
- (8) Any other applicable national standards

18.4.1 Materials, Appliances and Components

All materials, appliances and components used within the distribution system shall comply with BS 4363 and BS 7375 Appendix A.

18.4.2 Design Considerations

18.4.2.1 Distribution equipment utilised within the temporary electrical distribution system shall incorporate the following features:-

- (1) flexibility in application for repeated use;
- (2) suitability for transport and storage;

- (3) robust construction to resist moisture and damage; and
 - (4) safety in use.
- 18.4.2.2 All cabling shall be run at high level whenever possible and firmly secured to ensure they do not present a hazard or obstruction to people and equipment.
- 18.4.2.3 The installation on Site shall allow convenient access to authorised and competent operators to work on the apparatus contained within.
- 18.5 Mains Voltage**
- 18.5.1 The Site mains voltage shall be as the Electricity Companies' Utility supplies, 415V 3-phase 4 wire system.
- 18.5.2 Single-phase voltage shall be as the Electricity Companies' Utility supplies, 230V supply.
- 18.5.3 Reduced voltages shall conform to BS 7375.
- 18.6 Types of Distribution Supply**
- 18.6.1 The following voltages shall be adhered to for typical applications throughout the distribution systems:
 - (1) fixed plant - 415V 3 phase
 - (2) movable plant fed by trailing cable - 415V 3 phase;
 - (3) installations in Site buildings - 230V 1 phase;
 - (4) fixed flood lighting - 230V 1 phase;
 - (5) portable and handheld tools - 115V 1 phase;
 - (6) Site lighting (other than flood lighting) - 115V 1 phase; and
 - (7) portable hand-lamps (general use) - 115V 1 phase.
- 18.6.2 When the low voltage supply is energised via the Employer's transformer, any power utilised from that source shall be either 415V 3 phase or / 230V single phase as appropriate. The Contractor shall carry out any conversion that may be necessary to enable him to use power from that source.
- 18.7 Protection of Circuits**
- 18.7.1 Protection shall be provided for all main and sub-circuits against excess current, residual current and earth faults. The protective devices shall be capable of interrupting (without damage to any equipment or the mains or sub-circuits) any short circuit current that may occur.
- 18.7.2 Discrimination between circuit breakers, circuit breakers and fuses shall be in accordance with:-
 - (1) BS 88;
 - (2) BS EN 60898; and
 - (3) BS 7375;
 - (4) Any other appropriate Indian Standards.
- 18.8 Earthing**
- 18.8.1 Earthing and bonding shall be provided for all electrical installations and equipment to prevent the possibility of dangerous voltage rises and to ensure that faults are rapidly cleared by installed circuit protection.
- 18.8.2 Earthing systems shall conform to the following standards:-
 - (1) IEE Wiring Regulations (16th Edition);
 - (2) BS 7430;
 - (3) BS 7375; and
 - (4) IEEE Standard 80 Guide for Safety in AC Substation Grounding.

18.9 Plugs, Socket Outlets and Couplers

Low voltage plugs, sockets and couplers shall be colour coded in accordance with BS 7375, and constructed to conform to BS EN 60309. High voltage couplers and 'T' connections shall be in accordance with BS 3905.

18.10 Cables

18.10.1 Cables shall be selected after full consideration of the conditions to which they will be exposed and the duties for which they are required. Supply cables up to 3.3KV shall be in accordance with BS 6346. The cable armouring shall be used as the earth return in conditions where the cable is continuously extended and not subject to continuous movement after installation.

18.10.2 For supplies to mobile or transportable equipment where operation of the equipment subjects the cable to flexing, the cable shall conform to one of the following standards appropriate to the duties imposed on it:

- (1) BS 6708 flexible cables for use at mines and quarries;
- (2) BS 6007 rubber insulated cables for electric power and lighting; and
- (3) BS 6500 insulated flexible cords and cables.

18.10.3 Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for underground cables: - BS 6346 for armoured PVC insulated cables; and BS 6708 Flexible cables for use at mines and quarries.

18.10.4 All cables which have a voltage to earth exceeding 65 V (except for supplies from welding transformers to welding electrodes) shall be of a type having a metal sheath and/or armour which shall be continuous and effectively earthed. In the case of flexible or trailing cables, such earthed metal sheath and/or armour shall be in addition to the earth core in the cable and shall not be used as the sole earth conductor.

18.10.5 Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting and flame-retardant compound shall be used whenever there is a risk of mechanical damage occurring.

18.10.6 For resistance to the effects of sunlight, overall non-metallic covering of cables shall be black in colour.

18.10.7 Cables which have applied to them a voltage to earth exceeding 12 V but not normally exceeding 65 V shall be either one of the type as described in clause 0 above or alternatively of a type insulated and sheathed with a general purpose or heat resisting Elastomers.

18.10.8 All cables that are likely to be frequently moved in normal use shall be flexible cables.

18.10.9 Flexible cables shall be in accordance with BS 6500 and BS 7375.

18.11 Lighting Installation

18.11.1 Lighting circuits shall be run separate from other sub-circuits and shall be in accordance with BS 7375 and BS 4363.

18.11.2 Voltage shall not exceed 55 V to earth except when the supply is to a fixed point and where the lighting fixture is fixed in position.

18.11.3 Luminaries shall have a degree of protection not less than IP 54. In particularly bad environments where the luminaries are exposed to excesses of dust and water, a degree of protection to IP 65 shall be employed.

18.11.4 Where the Engineer requires Site inspection of the Works, the Contractor shall upgrade the lighting level to a minimum of 200 lux by localised lighting in all areas.

18.11.5 Use of wire guards or other such devices shall provide mechanical protection of luminaries against damage by impact whenever risk of damage occurs.

18.12 Electrical Motors

- 18.12.1 Totally enclosed fan cooled motors to BS 4999 : Part 105 shall be used.
- 18.12.2 Motor control and protection circuits shall be as stipulated in BS 6164. Emergency stops for machinery shall be provided.
- 18.13 Inspection and Testing**
- Electrical installations on Site shall be inspected and tested in accordance with the requirements of the IEE Wiring Regulations (16th Edition).
- 18.14 Identification**
- Identification labels of a type reviewed without objection by the Engineer shall be affixed to all electrical switches, circuit breakers and motors to specify their purpose.
- 18.15 Maintenance**
- Strict maintenance and regular checks of control apparatus and wiring distribution systems shall be carried out by an electrician (duly qualified to carry out the said checks) to ensure safe and efficient operation of the systems. The Contractor shall submit for review by the Engineer details of his maintenance schedule and maintenance works record.
- 18.16 Maintenance Record**
- All portable electrical appliances shall be permanently numbered (scarf tag labels or similar) and a record of the date of issue, date of the last inspection carried out and the recommended inspection period will be kept.
- 18.17 Metering**
- 18.17.1 For the purposes of the clause, “construction works” shall mean the Works excluding both the Contractor’s on and off Site, fabrication facilities, workshops, work-yards, offices and stores.
- 18.7.2 The Contractor shall install a separately metered and invoiced supply or supplies of electricity for:-
- (1) Site fabrication facilities;
 - (2) Site workshops and work-yards; and
 - (3) Site offices and stores.
- 18.18 Inability to Supply**
- Wherever, the Project (civil) Contractor is not in a position to supply construction power and water supply to the system wide Contractor, he (the system wide Contractor) shall arrange for his own separate construction power and water supply.

CHAPTER 19**19 MOCK-UPS, PROTOTYPES AND SAMPLES****19.1 Requirements**

- 19.1.1 The Contractor shall produce mock-ups, prototypes and samples as specified in the PS.
- 19.1.2 Samples may be subject to testing and investigation by the Employer and shall in no way be incorporated into the Permanent Works.
- 19.1.3 Samples shall become the property of the Employer.

19.2 Purpose

- 19.2.1 The mock-ups, samples and prototypes shall demonstrate the proposed design and/or design options. Any mock-ups shall increase in levels of detail and finish as the design progresses.
- 19.2.2 Mock-ups and prototypes may generally be produced initially with “dummy” equipment items unless otherwise specified, so long as there is sufficient detail to evaluate the operability and/or maintainability aspects of the proposed layout.
- 19.2.3 The mock-ups and prototypes shall be constructed at the Contractor's premises unless otherwise specified in the PS.

19.3 Review

- 19.3.1 The Engineer will conduct a minimum of three formal reviews initially at the place of manufacture.
- 19.3.2 The complete and agreed mock-ups and prototypes shall be suitable for transportation to, and display in **Pune** for final review by the Engineer and the Employer.
- 19.3.3 The Contractor shall transport and set up such mock-ups and prototypes at a nominated site in **Pune**. After each review, the Contractor shall incorporate the Engineer's review comments into the mock-ups and prototypes prior to the next scheduled review.

Appendix 1

1. MONTHLY PROGRESS REPORT

1.1 Topics

1.1.1 The Monthly Progress Report required under clause 2.16 of the GS shall include as a minimum the following sections and topics:

- (1) Executive Summary, highlighting any matters of concern and explaining corrective action to be taken
- (2) Safety and Quality issues (including any necessary corrective action taken or proposed to prevent the re-occurrence of the non-conformities)
- (3) Programme and overall progress
- (4) Physical progress report (see Paragraph 2.19 of the General Specification)
- (5) Manufacturing status
- (6) Materials ordered / in process / Statement of Materials supplied by employer and contractor (separately) showing receipt / consumption / transfer to other units and balances.
- (7) Equipment procured
- (8) Delivery status
- (9) Shipping / transportation activity
- (10) Deliveries to **Maharashtra Metro Rail Corporation Limited** (including release certificate reference)
- (11) Free issue items (where applicable)
- (12) Installation / erection on Site
- (13) Site surveys (where applicable)
- (14) Completion of remedial works / Site acceptance
- (15) Safety audit and safety report
- (16) Test and Commissioning
- (17) Commissioning activity
- (18) Planned vs. Actual Table
- (19) Remedial works
- (20) Documentation
- (21) As-built drawings
- (22) Training
- (23) Employer's Taking Over of Works (part or whole of Works)
- (24) Taking Over Certificate
- (25) Defects Liability
- (26) Contractual / Commercial
- (27) Payments / invoices
- (28) Engineer's instructions and variation orders
- (29) Claims / potential claims
- (30) Contractor's resources (details of all staff and sub-contractors engaged on the Works)
- (31) Progress photographs

1.2 Progress Reports : The Monthly Progress Reports shall be accompanied by:

- a) the Works Programme, marked to show the status of progress to date;
- b) control schedules for document submissions and issues of a repetitive or multiple nature;
- c) where appropriate, exception reports to highlight any problem areas including any submissions and design information which are overdue;
- d) identification and discussion of significant accomplishments, problem areas encountered, actions taken or planned to resolve actual or potential problems and conflicts, and other comments or proposals on matters (including the interfacing works) affecting or likely to affect the Works; and
- i. a critical items action list which identifies outstanding problems associated with the timely completion of the Works including anticipated actions for their resolution.

1.2.1 The programmes shall show current status to provide a comparison between the Works Programme and reported progress.

1.2.2 Actual progress shall be reported for each activity in the Works Programme in the following terms:

- (1) the percentage of the work which is complete;
- (2) the remaining duration of the work;
- (3) the actual start date; and
- (4) the actual completion date.

1.2.3 Actual progress shall reflect the physical scope of the work that has been completed and shall not be calculated based on elapsed time or hours worked. Any automatic statistical indications in the Contractor's software that is based on this principle shall be disabled.

1.3 Copies

1.3.1 The Contractor shall submit 1 unbound original and 9 bound hard copies of all Monthly Progress Reports and of the accompanying documents plus one copy in electronic format on PC compatible 3-1/2" diskettes compatible with Microsoft Office and Primavera P3 applications.

Appendix 2

2. CONTRACT SYSTEMS SAFETY MANAGEMENT

2.1 Safety Assurance Programme

- 2.1.1 The Contractor shall within 30 days of Notice to Proceed, submit his proposed Safety Assurance Programme Plan for review and acceptance by the Engineer.
- 2.1.2 The Safety Assurance Programme Plan shall cover manufacture, testing, integrated testing, and commissioning to ensure safe routing, spacing, movement and control of trains and meet the requirements as stipulated in the PS.
- 2.1.3 The Safety Assurance Programme Plan shall also address reliability, maintainability and availability of the system. This shall ensure the system has a high degree of reliability and minimise down time during routine and failure repair.
- 2.1.4 The Safety Assurance Programme Plan shall include a Fire Control Plan which shall evaluate and ensure *inter-alia* that the fire loading of the materials proposed to be used, and potential sources of combustion in case of failure are compatible with currently accepted international practice.
- 2.1.5 The Safety Assurance Programme Plan shall describe procedures required to perform the specific tasks necessary to achieve safety, reliability and maintainability requirements. These procedures shall be incorporated within the Contractor's Quality Assurance System, and shall be subject to review by the Engineer

2.2 Hazard Analysis

- 2.2.1 The Contractor shall take the lead role in the interface Hazard Analysis for Trackside equipment, to which the system is interfaced, provided by other contractors.
- 2.2.2 The Contractor shall produce the Hazard Analysis Schedule for the complete system including all interfacing systems and shall interface principally with the Rolling Stock, Signalling, Communication, Power Supply, Civil and Depot Contractor as well as any other Designated Contractors to obtain the information necessary, from their hazard analyses, to complete the analysis.
- 2.2.3 The Contractor shall, as part of the safety analysis, prepare analyses to identify Hazards and ensure their satisfactory resolution. The following analyses shall be prepared and submitted by the Contractor for the Engineer acceptance.
 - (i) Preliminary hazard analysis
 - (ii) Interface hazard analysis (excluding EMI)
 - (iii) Subsystem hazard analysis
 - (iv) Operating hazard analysis including maintenance
 - (v) Quantitative fault tree analysis
 - (vi) Failure modes effects and criticality analysis (FMECA)
- 2.2.4 The Hazard Analysis shall be carried out in accordance with MIL-STD-882C as the primary standard and Defence Standard 00-56, or equivalent, in areas not adequately addressed by the former standard.
- 2.2.5 The Contractor shall compile a list of critical and catastrophic items identified as a result of hazard analysis, FMECA or by other means.
- 2.2.6 All hazard resolution by procedural control shall be cross-referenced from the Critical and Catastrophic Items List to the appropriate manuals.
- 2.2.7 The qualitative measures of hazard severity are defined as follows:
 - (i) Hazard Category I - Catastrophic: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural

deficiencies may cause death or system loss. The safety target shall be based on internationally accepted standards.

- (ii) Hazard Category II - Critical: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies may cause severe injury to personnel, severe occupational illness or major system damage. The safety target for the occurrence of all Category II hazards summed together shall again be based on internationally accepted standards.
- (iii) Hazard Category III - Marginal: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies, may cause minor injury to personnel, minor occupational illness or minor system damage.
- (iv) Hazard Category IV - Negligible: Operating conditions such that personnel errors, environment, design deficiencies, subsystem or component failure or procedural deficiencies will not result in injury to personnel occupational illness or damage to the system.

The Contractor shall submit a Schedule for Hazard Analysis Submissions within 30 days of Notice to Proceed. The Preliminary Hazard Analysis shall be submitted within 6 months of Notice to Proceed. This draft shall include a comprehensive assessment of potential equipment failure modes during normal operating and overload conditions and assess the performance of the equipment for a range of hazard conditions. The final draft shall be submitted by the completion date of final design.

- 2.2.8** The Contractor shall prepare a Fire Safety Design Report for review and acceptance by the Engineer. This shall be submitted within 2 months after Notice to Proceed and revised and updated for the completion of the preliminary, pre-final and final design stages. Materials used in the Permanent Works of the system shall conform to fire safety requirements of BS 6853: 1999, or the latest edition of other equivalent international standards, subject to the acceptance of the Engineer.

N.B. Whichever Standard is selected for meeting the Fire Safety Criteria, then that standard shall be declared, and its requirements shall be met consistently throughout the Specification

2.3 Results

- 2.3.1 Source of all failure rates employed shall be indicated in the Hazard Analyses and shall be as far as possible independently established by recognised standards authorities.
- 2.3.2 All hazard analyses submitted to the Employer are to be standardised by the Contractor such that format and forms employed by all sub-contractors are the same.
- 2.3.3 The following targets shall be employed for the Fault Tree Analysis
 - (i) No single point failure shall lead to death.
 - (ii) No combination of undetected failure and double point failures shall result in death.
 - (iii) No combination of undetected failure and single point failure shall result in major injury.
- 2.3.4 The procedures for training and the Contractor's Quality Assurance manuals shall incorporate resolution of hazards identified from this hazard analysis. Proper cross-referencing to the hazards and resolution measures shall be provided in all these aforementioned documents.

Appendix 3**3. SUBMISSION FOR REVIEW REQUEST FORM**

Reference No. (see Paragraph 4.3.2) Date

Programme reference and scheduled date:

Submission Stage (see Paragraph 3.5.1.1)

Title

We hereby submit for review by the Engineer the documents or articles listed below:

(Introduction and list of items submitted - see Paragraph 4.3.5.2 - continue on separate sheet if necessary)

I confirm that the material submitted is in full compliance with the Contract.

Signed (Contractor's responsible engineer)

Engineer's Response Dated

The material submitted has been reviewed and the following decision is given:

“No Objection” / “No Objection Subject To” (see below) / “Rejected” (see below)

The following comments are made, and a re-submission is to be made by the Contractor within 10 working days demonstrating fully how all of these are taken into account:

(Engineer's comments)

Signed (Engineer)

Appendix 4

4. SCHEDULE OF ITEMS TO BE SUBMITTED BY CONTRACTOR

This Appendix lists the principal items to be submitted by the Contractor for review by the Engineer. This list is not exhaustive, and the Contractor is reminded to satisfy itself of the requirements for all submissions whether or not they are included within this Appendix.

Article	Reference Paragraphs(s)	To be submitted
Initial version of the Works Programme	2.4.1.1	Within 7 days of the Commencement Date of the Works
Works Programme	2.4.1.2	Within 21 days of the Commencement Date of the Works
Procurement and Manufacturing Programme	2.5.1	Within 15 days of the Commencement Date of the Works
Installation Programme	2.6.1	Preliminary version within 30 days of the Commencement Date of the Works. Full version as stated in the PS or as directed by the Engineer
Testing & Commissioning Programme	2.7.1	Preliminary version within 30 days of the Commencement Date of the Works. Full version as stated in the PS or as directed by the Engineer
Monthly Progress Report and supporting Documentation	2.10.1	The 5th day of each month.
Contractor's Project Plan	3.1.2	As stated in the PS, or if none is given, within 15 days of the Commencement Date of the Works
Particulars of Contractor's Representative	3.3.1.5	Within 30 days before the Commencement Date of the Works
Interface Management Plan	3.3.2 (b)	Within 30 days of notification from the Engineer of the identity of each Project Contractor
Detailed Interface Document	3.3.2 (d)	Within 30 days of notification from the Engineer of the identity of each Project Contractor
Procurement, Manufacturing and Delivery Plan	3.5.1	As stated in the PS, or if none is given, within 20 days of the Commencement Date of the Works

Contractor's Health and Safety Documentation	3.6.2.2	Within 30 days of the Commencement Date of the Works
Environmental Management Plan	3.6.3.3.3	30 days prior to the commencement of construction activities
Environmental Mitigation Implementation Schedule (EMIS)	3.6.3.4.2	30 days prior to the commencement of construction activities
Traffic Management Submissions	3.6.3.5	30 days before implementation proving all relevant details and implications
Commissioning Plan	3.7.2.1	First draft within 120 days of the Commencement Date of the Works
Installation Test Schedule	3.7.2.2 b (i)	As stated in the PS or if not given, not later than two months in advance of the Date scheduled for commencement of respective tests
Integration Tests & Commissioning Plan	3.7.2.2.b (ii)	As stated in the PS or if not given, not later than three months in advance of the Date scheduled for commencement of Tests on Completion
Training Plan	3.7.3.1	As stated in the PS or if not given, not later than six months prior to the issue of the Taking Over Certificate for the Works
Defects Liability Management Plans	3.7.4	Upon issuance of the Taking Over Certificate
Project Document Control Procedure	4.3.2	Within 15 days of the Commencement Date of the Works
Quality Manual	5.2.3	Within 30 days of the Commencement Date of the Works
Quality System Procedures	5.2.3	Within 30 days of the Commencement Date of the works.
Management Quality Plan	5.3	Within 30 days of the Commencement Date of the Works
Manufacturing Quality Plan	5.4	30 days prior to the commencement of the manufacturing works
Site Quality Plan	5.5	30 days prior to the commencement of the construction works
Reports of Quarterly Quality Audits	5.7.2	Every Three months

Quality Control Register	5.8	7th working day of every month
Packaging Materials & Procedures	7.3.1	As stated in the PS, or if none is given, within 30 days of the Commencement Date of the Works
Installation Tests Reports	8.1.5.3	Immediately after the completion of each test
Integration Tests & Commissioning Records	8.1.6.8	Immediately following the successful Tests on Completion of the system
Service Trial Records	8.1.7.8	Immediately following the successful Service Trial of the system
Summaries of Inspection and/or Test	8.3.11	7th day of the following month
Construction & Installation Plan	10.1.1	As stated in the PS, or if none is given, within 20 days of the Commencement Date of the Works, and in any case not less than 5 weeks before starting the construction of the Works on Site
Proposals for the construction of the Engineer's Site Offices	11.6.2.7	Within 14 days of the Commencement Date of the Works
Particular Uses of Site	13.2.1	Within 14 days of the Commencement Date of the works.
Method Statements Programme	14.5.6.3	Within 30 days of the Commencement Date of the Works or at a date reviewed by the Engineer
Detailed written report of accidents, incidents and dangerous occurrence	14.6.4.1	Within 7 days of occurrence/accident
Name and qualification of safety representative for temporary site electricity	18.3.1	Not later than 4 weeks before appointment

5. REQUEST FOR INSPECTION OF WORKS FORM

PUNE METRO RAIL PROJECT

CONTRACTOR

REQUEST FOR INSPECTION OF WORKS

To the Engineer

Date

* Location) Will be ready for your inspection

) on

* Description of Works) at prior to

)

) on at hrs

* Labour and plant to be
used

Signed for Contractor.

Received by

for Engineer

Date

Time

Filled in by Engineer Mr

Please arrange inspection

Mr

Please check setting out

Signed

Filled in by Inspector The above work was inspected and permission was given / not given
to proceed with next operation.* The following remedial works were
required

* Contractor informed verbally (to MR

by Mr on at hrs)

* Remedial works inspected, and permission given to proceed with next
operation on at hrs)

as supervised

by

Signed

Date

Time

Verbal or written permission by the Engineer or his staff shall in no way relieve the Contractor
of his responsibilities under the Contract.

* To be completed if applicable.

APPENDIX 6.**6. NOISE MONITORING INSTRUMENT**

- (1) Noise level meter, acoustic calibrator, portable wind speed meter and tripods shall be provided for the use of the Engineer.
- (2) Noise level meter shall comply with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804:1985 (Type 1), and other noise measuring, and analysis instrumentation shall be of a comparable professional quality.
- (3) The noise level meter shall measure noise in terms of the A-weighted equivalent sound pressure level (Leq).
- (4) The acoustic calibrator shall be able to generate a known sound pressure level at a known frequency.
- (5) The portable wind speed meter shall be capable of measuring the wind speed in m/s.

Appendix 7

7. FIRST AID REQUIREMENTS

7.1 Provisions by others

- (1) First aid bases will be located at the main Civil Works Contractor's principal Works Areas. The bases will consist of a treatment room fitted with two treatment couches, a hand wash basin, sterilising equipment and lockable cupboards to contain sufficient medical supplies for the Contractor's workforce, the Engineer's site supervisory staff, the Design Contractors working in the area and any visitors to the Site. The first aid post will be air-conditioned, with cooling capability sufficient to maintain the temperature of the inside of the building at 20oC.
- (2) A qualified doctor, nurse and assistant nurse will be in attendance at the first aid base during all times when work is being undertaken on the Site, including work by the Designated Contractors and periods when only emergency activities are being undertaken, such as during periods of inclement weather.
- (3) A fully equipped ambulance and driver will be provided at the first aid base during all working hours. The ambulance will be equipped with emergency life support equipment suitable for application in construction site accidents.

7.2 Provisions by the Contractor

- 7.2.1 The Contractor shall supply portable first aid boxes maintained fully equipped at each local site offices and any work locations where 20 or more persons work at a time.
- 7.2.2 In each site office and work location at least one of the Contractor's employees shall be trained in first aid and should be available at all working hours for purpose of attending to emergencies.
- 7.2.3 The Contractor shall be responsible for making his employees aware of the location and access route to the nearest first aid base and if necessary shall provide facilities for evacuating a workman by stretcher from the worksite.
- 7.2.4 The Contractor shall keep the first aid base personnel informed of the number and identity of staff working within the area of responsibility of each first aid base.

Appendix 8

8. WORKS AREAS

8.1 Works Areas

- (a) Temporary occupation of land is governed by Part VI of land acquisition Act 1894, which limits occupation to 3 years.
- (b) The Site is divided into a series of principal Works Areas that will be made available to the Contractor at different times and for various duration. These Works Areas are illustrated in the Drawings. In order to avoid doubt, should any discrepancies be found in the definition of the extent of these Works Areas between the Figures in this Appendix and the Drawings, the Drawings shall prevail.
- (c) The descriptions of the principal Works Areas given below are indicative and the Contractor shall satisfy its self as to the exact nature of the various Works Areas and the extent of works to be carried out prior to the execution of the Permanent Works or making use of the area as working space and/or for temporary site facilities.
- (d) In addition to these principal Works Areas, the Contractor will be required to establish secondary Works Areas at, for example, station locations. The Contractor shall submit to the Engineer proposals for the use and occupation of these secondary Works Areas, such submissions being at least sixty (60) days prior to the programmed use of the specific Works Area.
- (e) Prior to the Key Dates or the Works Area Handover Dates for returning any Works Area, the Contractor shall carry out the following works
 - i. construct all Permanent Works within the area, to the extent defined in this Appendix, in accordance with the requirements of the Contract,
 - ii. reinstate the area to the condition as close as possible to its condition when it was taken over,
 - iii. form the area to the approved lines and levels and carry out such other works as may be required by the Engineer,
 - iv. remove all rubbish, debris and other materials.

Maharashtra Metro Rail Corporation Limited (Maha-Metro)

**PUNE METRO RAIL PROJECT
BID DOCUMENTS
FOR**

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

TENDER NO.

P1-T06/2021

**PART II: WORK REQUIREMENTS
SECTION – VII - B
PARTICULAR SPECIFICATIONS**

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1. PROJECT OVERVIEW

1.1 INTRODUCTION

1.1.1 Scope and Purpose

This specification defines the objectives, guidelines and requirements for Contract **Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project**

The works to be executed under the contract include manufacture & supply of materials (except rails, Turnouts, derailing switches, fastenings System and fastenings for turnouts except for lead rail portion, which shall be supplied by the Employer), verification, delivery, installation, testing, including integrated testing and commissioning, technical support, training of Employer's staff and documentation for a complete system necessary to deliver the requirements of this specification.

- 1.1.2 **Relevant Documents:** - This specification should be read in conjunction with the General Conditions (GC) Section-VIII, the Particular Conditions Section-IX (PC), the General Specifications (GS), Employer's Drawings and any other document forming part of the Contract. In the event of a conflict between the GS and this Specification, this specification shall prevail.

The order of precedence, with item (a) below having the highest priority, is:

- a) Particular Specification
- b) General Specification
- c) Indian Railway Standards
- d) International Standards reference herein
- e) Other International Standards
- f) Indian Standards
- g) Other National Standards

Notwithstanding the precedence specified, the contractor shall always immediately seek advice from the Engineer in the event of conflicts between specifications.

1.1.3 Verification of Design /Drawings

Although the main responsibility for the design of the Ballastless Track (Track Structure and Alignments) lies with the *Contractor*, the contractor shall bring out any shortcomings (if any) to the notice of the Engineer before starting the work or as soon as it comes to their notice whichever is earlier and propose fine tuning / modifications in drawings / plans to suit the system at site.

1.2 OVER VIEW OF THE PROJECT

1.2.1 General

This chapter gives an overview of the Project and the information provided in this chapter is for reference only.

1.2.2 Reach-3, East-West Corridor-2 (Civil Court to Ramwadi) Sections of Elevated Ballastless Track of Pune Metro Rail Project.

Reach-4, North-South Corridor-1 (Range Hill to Swargate) Sections of Underground Ballastless Track of Pune Metro Rail Project.

1. There are total 7 Elevated Stations in Reach-3 and 5 Underground Stations in Reach-4 i.e. Total 13 stations.

2. 25 KV AC overhead traction system with Cab Signalling and Automatic Train Protection (ATP) / ATO will be provided on Standard Gauge.

1.2.3 Responsibility of the Contractor

1. The Contractor shall be responsible for all Track work for Pune Metro Rail Project of about 30TKM Tract length (Reach-3 = 17TKM Elevated and Reach-4 = 13TKM UG).
2. Stations are elevated with access from ground level. Access for Track laying will be made available to the contractor in stages (Refer chapter 4).
3. The Track on main line on Viaduct and UG section shall be Ballastless with provision of Mass spring system at sensitive locations for mitigation of noise and vibration including supply of MSS materials.
4. All the works shall comply with Maharashtra Metro Rail Corporation Limited's Schedule of Dimensions and other approved laid down Technical specifications.

- 1.2.4 In terms of section 7 of Metro Railways Act 2002, the Central Government has appointed the Commissioner of Metro Railway Safety (CMRS) and CMRS under section 8 shall inspect the metro railway with a view to determine whether it is fit to be opened for the public carriage of passengers and report there on to the Central Government as required by or under this Act. Under section 14 of the Act, the metro railway shall not be opened for the public carriage of passengers except with the previous sanction of Government under section 15 of the Act. The Commissioner shall inspect the metro railway and along with other aspects will examine that Track structure has been laid and comply with the requirements laid down by the Central Government (Ministry of Railways for this purpose). In view of the extent provisions of the Act, the Track structure and section should comply to schedule of Dimensions and relevant approvals by Ministry of Railways

2. SCOPE OF WORK

2.1 SCOPE

1. This specification establishes the requirements for the **Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.**

The details of curves, turnouts, gradients, etc. have been shown in alignment drawings, the exact locations and details of which shall be interfaced by the contractor with designated Civil and System contractors.

2. The work area will be made available for offsite activity to the contractor free of cost at Range Hill Depot of Pune City as per availability. Otherwise, any other locations along the alignment of Corridor for offsite activities will be arranged by contractor at his own cost. If any area is available with Maharashtra Metro Rail Corporation Limited, the same will be provided to contractor at nominal cost as decided by Maha-Metro.
3. The Contractor shall arrange his own mobile flash butt welding plant.
4. The contractor shall be required to interface closely with the various Detailed Design Consultants and the designated civil/structural and system contractors of **Pune Metro Rail Project** appointed by Employer for the purpose of executing this Contract.

The scope of work shall include but not limited to the following:

Mainline and Ramp: [Reach-3 and Reach-4]

- Rails, turnouts and fastenings system shall be supplied by the Employer. The contractor will make arrangements for mechanised handling and transportation of all materials (including the materials supplied by the Employer) to the site of work.
- The designs shall comply with Procedure for Safety Certification and Technical Clearance of Metro Systems (December 2015) on Metro Railways/MRTS system issued by M.O.R, Govt. of India unless instructed by Employer.
- Design of plinth/slab for main line and turnouts Track structure on viaduct with and without MSS.

- The Track Structure and the fastening used shall be designed as to minimise the noise and vibration generated by the moving train on the Track. The contractor shall interface with the concerned designated contractors, particularly the Rolling stock supplier, limit vehicle included noise and ground - borne vibration in structures in the vicinity of Railway alignment to acceptable level, as per legal and statutory requirement of India. The Contractor shall spell out the codal, legal and statutory provisions in this regard and justify that his design and proposal are in conformity with stipulations.
- Special noise and vibration mitigation measures (Mass Spring System) will be taken at selected locations in elevated sections as instructed by Employer.
- Setting-out final alignment.
- Welding of UIC 60 IRS-T-12-2009 UIC 60, 1080 grade head hardened rails using the specified welding techniques.
- Provisions of shear connector, wherever required, between 1st pour and 2nd pour reinforced concrete for Ballastless Track.
- Laying of Ballastless plain Track on reinforced concrete plinth/RCC slab and Ballastless turnouts on RCC slab, installing Track fastener system, turn-outs, derailing switches, buffer stops, check rails etc. to the stipulated tolerances on the running lines.
- Testing of components and installation methods.
- The Contractor shall carry out Reliability, Availability, Maintainability & Safety (RAMS) Study for Trackwork taking into account design of Track Plinths, Rails, Turnouts, Fastening System, Weldings, Check rails etc. The Ballastless Track shall be designed and constructed to meet the following RAMS targets during O&M Phase:
 - e. Reliability: The equipment being continuously in operation and shall achieve MTBSAF (Mean Time Between Service Affecting Failures) of no less than 5000 hours between any failures affecting the revenue train service.
 - f. Availability: The equipment being continuously in use and achieving a minimum operating availability of 99.98%.
 - g. Maintainability: The maintainability measure for the Track system shall be Mean Time To Restore (MTTR) and shall not be greater than 30 mins.
 - h. Safety: The system shall provide the safe operation of train movements. The SIL 4 shall be maintained. Hazardous event shall not occur with a greater frequency than 1 in 104 years (as per latest version of IEC 61508-1).

2.2 GENERAL CRITERIA AND TRACK PARAMETERS

2.2.1 General Criteria

A. Mainline & Ramp

SR NO	CRITERIA	DIMENSION
1	Gauge	1435 mm SG,
2	Max. train speed a) Design b) Operating	90 Kmph 80 Kmph
3	Max. Axle Load, loaded condition	16 tonnes SG,
4	Track centre	4.1 m (Reach-3) & 15.35 m (Reach-4)
5	Max. desirable gradient running Track Absolute max. gradient running Track	3% 4%

6	Minimum vertical curve radius Minimum horizontal curve radius Elevated and At Grade Sections (Main running Lines)	1500 m 120 m
7	Electric power collection	25KV AC overhead traction
8	Inclination of Rail	1 in 20
9	Wheel profile	IRS type to be interfaced with Rolling Stock Supplier.
10	Rail profile	60E1/UIC60

2.2.2 Track Structure Parameters [Mainline & Ramp]**A. Mainline & Ramp**

Description	Standard Gauge Corridor
	Ballastless (DFF)
Rail type main line	UIC 60, IRS-T-12-2009, 1080 grade head hardened
Base plate Spacing	Main line (viaduct) 600 +/- 10 mm
Standard Rail length Main line	18/25m
Maximum cant	110mm
Maximum cant deficiency Permissible	85 mm
Maximum cant gradient	1 in 440
Desirable	1 in 720
Rate of change of cant/cant deficiency Std Gauge	
Max.	55 mm/sec
Desirable	35 mm/sec
Type of turnout - SG	Turnout 1 in 9 types

2.2.3 Vertical Alignment**2.2.3.1 Points and Crossing**

No change of grade shall be permitted on points and crossing of Ballastless Track and upto 18 metre in approach of SRJ and heel of crossing of turnouts.

2.2.4 Continuous Welded Rail

- Long welded rail strings shall be joined to form continuous welded rails and finally fastened so that the zero-thermal stress temperature lies within the following range of rail temperature values:
- Surface (Ballastless) = 30 to 36-degree C
- Mean rail temperature (in open) = 33 deg C
- Max rail temperature (in open) = 70 deg C

2.3 SCHEDULE OF DIMENSION

The contractor shall ensure that no permanent structure is within the structure gauge profile and the material & installation of Track work shall comply with the provisions of schedule of dimensions. The Schedule of Dimensions (Version: D - July 2019 and correction slips approved by Ministry Of Railways (Railway Board) is enclosed Annexure-SOD to Part-II of Tender P1-T06/2020.

3.0 INTERFACES

3.1 OBJECT

1. This chapter describes the principal interfaces limit of scope between the **Civil Court to Ramwadi (Reach-3) East-West Corridor and Range Hills to Swargate (Reach-4) North-South** of Track work installation Contractor and designated contractors like, Civil Construction contractors: Station contractor, Viaduct contractor, Underground contractor and System contractors: Signalling contractor, Electrical traction contractor, Rolling Stock contractor, Telecom contractor and any other designated contractor.
2. This document refers to the following Contractors:

3.2 INTERFACE WITH DESIGNATED CONTRACTORS

3.2.1 Interface specification: Track work installation Contractor Vs Electrical Traction Contractor

Item No.	Purpose of Interface	Electrical Traction Contractor	Track Contractor
Mainline & Ramp			
1	Information regarding Track alignment, curves, levels etc.	Shall consider the information for progressing OCS layout plans / designs.	Provide Track alignment, Track slab layout and final alignment of Tracks in main line.
2	Electrical and physical clearances	Shall provide necessary designs and drawings	Shall respect the required clearances

3.2.2 Interface specification: Track work installation Contractor Vs PSI Contractor (Power Supply)

Item No.	Purpose of Interface	PSI Contractor (Power Supply)	Track Contractor
1	Cables and connections (at viaduct, Depot etc.)	Shall provide designs / drawings and coordinate with the Track Contractor for availability of suitable Track crossings at the desired locations. Electrical Traction Contractor shall supply and provide the pipes and interface with Track Contractor for correct location of pipes and verify before Track plinth / slab casting.	Shall possibly accommodate requirements of Electrical Traction Contractor for appropriate means for Track crossings and interface with Electrical Traction Contractor for finalizing location of pipe crossings.

2	Earthing and Bonding at Track plinth	Shall supply and connect all the left out MET of Track plinth with suitable size flexible conductor to next plinth MET in sequence.	Shall perform provision of earthing inside Track plinth (20mm dia Plain MS bar) to Viaduct segments and leave earthing MET strip on either side of plinths.
3	Return cable connections	Shall connect return cable to rails through CAD welding.	Shall coordinate the Electrical Traction Contractor requirement.
4	Rails and Track cross bonds and bonding at turnouts, points and crossings	Shall supply and install cross bonds and other bonds on Track, provide details of locations of cad weld required in Tracks for connecting the bonds	Shall allow Electrical Traction Contractor to install Track cross bonds and other bonds. Shall coordinate with the Electrical Traction Contractor requirement.

3.2.3 Interface specification: Track work installation Contractor Vs Civil Construction Contractors

Sr No.	Item No	Civil Construction Contractor	Track Contractor
A	STATIONS		
1	Installation of Track in stations	Shall supply the Track base according to layout drawing, prepare the Track base with shear connectors, grading and drainage, take care that all pipes and culvert crossing are laid.	Shall install Track based on layout drawings.
1a	Rail Level	Shall ensure the rail level	Shall provide the rail level
1b	Chainage	Shall furnish correct chainage of Station centre line	Shall fix chainages of the Turnouts /Crossover based on the chainage of Station Centre Line furnished by the Station Building contractor
1c	Drainage	Shall design the General drainage system in the Station area taking into Account Track Drainage whenever the viaduct is part of station.	Shall design Track drainage system and integrate with the General Drainage arrangement.
B	VIADUCT		
2	Construction of precast elements	Construction: Construction of precast elements for elevated structures (viaduct) in final position. Provision of vertical stirrups/connection (shear connector).	Construction of concrete plinth using the provisions of vertical stirrups/connection (shear connector) between precast elements and concrete plinth.
3	Details of Track drainage.	Design and construction of drainage system of line corridor except the drains required within Track. Furnish details of levels of drainage system.	Design and construction of Drains required within Track based on details of levels of drainage system provided by Civil Contractor.
4	Clearance of Track construction Envelope as per Structure Gauge	Clear and hand over the Track construction envelope as per the Structure Gauge	Ensure availability of Track construction envelope as per Structure Gauge in interface with Civil Contractor
5	Storage facilities and utilization of	Provide storage space and advise access period to Track to transport the Track material at site.	Transportation of Track material to site in interface with Civil Contractor in specified

	access period for transportation of material to site.		space and period so that the construction activities of designated contractor are not hampered after access period.
6	Details of Cant, girder levels and platform levels	Shall furnish the required details	Shall take into account these values for Track installation & determination of rail level / modification keeping in view the as constructed PF levels in accordance with schedule of Dimensions.
7	Design of Buffer stop	Shall ensure that Design of Viaduct caters to the Impact Loads on the Buffer stop if train overshoots and hits the Buffer stop.	Shall give details for locations of the Buffer stops at the ends of Track at Terminal Stations, Depot & Shunting Neck and design impact loads of the buffer stop.
8	Expansion joints	Shall ensure that the Design of Deck and Substructure including bearings and location of expansion joints of the deck caters to the Turnouts / Cross overs. Gap of expansion joint shall be as per approved drawing.	Shall provide locations and details of the Turnouts/ Crossovers with respect to the centre line of the Station, criteria for deck such as location of expansion joints.
C	Underground (UG)		
9	Provision of shear connectors	Provision of vertical stirrups/connection (shear connector) in first pour concrete/base slab as per drawing provided by Track contractor/Employer.	Construction of concrete slab/plinth using the provisions of vertical stirrups/connection (shear connector) above first pour concrete.
10	Details of Track drainage.	Design and construction of drainage system of UG section except the drains required within Track. Furnish details of levels of drainage system.	Design and construction of Drains required within Track based on details of levels of drainage system of UG section provided by Civil Contractor.
11	Clearance of Track construction Envelope as per Structure Gauge	Clear and hand over the Track construction envelope as per the Structure Gauge	Ensure availability of Track construction envelope as per Structure Gauge in interface with Civil Contractor
12	Storage facilities and utilization of	Provide storage space and advise access period to Track to transport the Track material at site. The	Transportation of Track materials, plant and machinery to site in

	access period for transportation of material to site.	required size of cut-outs/openings to be ensured in UG station areas for transport of Track materials, plant and machinery.	interface with Civil Contractor in specified space and period so that the construction activities of designated contractor are not hampered after access period.
13	Details of Cant, tunnel invert levels and platform levels	Shall furnish the required details	Shall take in to account these values for Track installation & determination of rail level / modification keeping in view the as constructed PF levels in accordance with schedule of Dimensions.
14	Design of Tunnel structure for Buffer stop Impact	Shall ensure that Design of tunnel structure caters to the Impact Loads on the Buffer stop if train overshoots and hits the Buffer stop.	Shall give details for locations of the Buffer stops at the ends of Track at Terminal Stations & any other location and design impact loads of the buffer stop.

Joint survey of viaduct/UG from station to station for the patch offered for the Track laying will be carried out by civil & Track contractor. Track contractor will ensure that the viaduct/UG for Track laying will be taken over only if as built Viaduct level are within tolerance $\pm 20\text{mm}$ limit of designed level as per GAD.

3.2.4 Interface specification: Track work installation Contractor Vs Signalling Contractor

Item No.	Subject	Signalling Contractor	Track Contractor
1	As planned and as built Track alignment & profile plans	Shall incorporate the same in Signalling System design. There would be multiple iterations of alignment plan and Signalling Contractor shall consider such eventualities and shall be responsible for feeding partially developed alignment plan including multiple iterations in line with the actual progress of the project.	Shall provide the same giving the details of curves & gradients and also civil speed restrictions
2	Turn out assemblies and their mounting & driving arrangements	Shall co-ordinate with Track Contractor(s) on design and mounting of the Turnout assemblies including point machines. Furnish and install the point machines suitable to drive the turnouts.	Shall supply and install the Turnout assemblies and provide for the mounting arrangements for point machines including second drive arrangements.

		Co-ordinate with Track Contractor(s) for design & installation of second drive arrangements.	
3	Scope of Supplies	Signalling Contractor shall supply & install the point machines, leading (1st) stretcher bar & co-ordinate with Track Contractor(s) for design and installation of second drive arrangement. Shall supply locking arrangement for second drive.	Turnout supplier shall supply all Track assemblies & Track fasteners, turnouts, all stretcher bars (except leading stretcher bar), second drive with all accessories, wherever required, for second pull & Track contractor shall install all Track assemblies & Track fasteners, turnouts, all stretcher bars (except leading stretcher bar), second drive with all accessories, wherever required, for second pull. The design of second drive arrangement shall be co-ordinated and interfaced with Signalling Contractor to ensure full compatibility.
4	Track crossing of Cables	Shall provide all Track crossings including pipes locations and coordinate at site.	Shall embed the HDPE pipe or conduit inside Track structure during casting wherever feasible.
5	Installation of Trackside equipment's, signal posts.	Shall furnish the final sizes of Trackside equipment's and co-ordinate with Track Contractor(s) to ensure the compliance of schedule of dimensions.	Shall co-ordinate with Signalling Contractor to ensure the compliance of schedule of dimensions
6	Track connections	Shall supply and install axle counter fixtures and point machine connections with Track in co-ordination with Track Contractor.	Shall co-ordinate with Signalling Contractor for axle counter fixtures and point machine connections with Track.
7	Installation of points operation mechanism	Shall check the proper gauge, housing of points and operating of switches and all other items necessary from signalling point of view, Signalling Contractor shall make necessary adjustment to points operating mechanism as required by Track contractor(s) at the time of Track parameters correction.	Shall provide proper gauge, housing of points and opening of switches and carry out all other works as required to make the point suitable for installation of point machine by Signalling Contractor.

8	Testing of points and crossings	Jointly test with Track contractor(s) during installation and while commissioning of point machines and during integrated testing & commissioning.	Jointly test with Signalling Contractor during installation and while commissioning of point machines and during integrated testing & commissioning and rectify all defects pertaining to Track, if any, identified during testing and commissioning of points.
9	Buffer Stop	Shall co-ordinate with Track Contractors for installation of Buffer Stop Signals	Shall supply and install the buffer stops at terminal stations and other locations in co-ordination with Signalling Contractor
10	Detection Point (DP)	Detection point location chainages are to be provided to Track work Contractor.	Necessary slot shall be made in Track plinth to pass the cables as per requirement of Signalling Contractor
11	TAG Pedestal drawings	TAG Pedestal drawings & its location chainages, type of TAG pedestal etc are to be provided and installed by signalling Contractor	Shall coordinate and facilitate the Signalling Contractor
12	Electrical properties of Track circuit assemblies, if any	Shall furnish the electrical requirements for Track circuits	Shall install the Track in compliance with requirement of Signaling Contractor
13	Testing of rail to rail, rail to sleeper and all insulated joints, if required	Shall arrange all testing after Installation, if required	Shall arrange, if required, for testing of individual components before installation, preferably at the supply stage. The structure (including the rail surface) as installed shall be thoroughly cleaned to an acceptable standard as approved by the Engineer immediately after installation and as required thereafter to maintain the standard until the arrangement of service trials so as to provide adequate levels of electric insulation & rail surface quality for correct performance of train control & signaling equipment under prevailing climate & environment conditions.

3.2.5 Interface specification: Track work installation Contractor Vs Telecom Contractor

Item No.	Item	Telecom Contractor	Track Contractor
1	Track crossing of Cables	Shall provide all Track crossing including pipes locations and co-ordinate at site.	Shall embed the HDPE pipe or conduit inside Track structure wherever feasible.

2	Installation of Track side equipment (Radio Masts)	Shall furnish the final size of Trackside equipment's and co-ordinate with Track contractor to ensure the compliance of SOD. All mechanical fixtures, fitting arrangements etc. for Trackside equipment shall be provided by Telecom Contractor.	Shall Co-ordinate with Telecom Contractor to ensure the compliance of schedule of dimensions.
3	Cyber security	The Telecom contractor shall engage a cyber-security consultant who will recommend cyber security guidelines complying the requirements of related standards.	The Track contractor shall provide the required track details to cyber security consultant.

3.2.6 Interface specification: Track work installation Contractor Vs Rolling Stock Contractor

Item no.	Purpose / Subject of interface	Rolling stock contractor	Track Contractor
1	Track alignment drawings	Rolling Stock Contractor shall use the information for his design and train running simulation.	Track Contractor shall provide the RS Contractor with the detailed Track alignment drawings
2	Kinematic Envelope / structure gauge	Shall provide kinematic envelope / structure gauge information to Track Contractor	Take into account for checking the infringement at construction stages
3	RST and Track parameters	The Rolling Stock Contractor shall provide the wheel profile details and other train parameters to the Track Contractor. The wheel and rail static and dynamic interface shall be optimized to achieve a good operational, maintenance and riding comfort performance. RS Contractor shall incorporate in its design the Track parameters.	Shall provide information regarding Track parameters including the Track form and Track work component stiffness, Track gauge, rail type, curve radius, cant and all the parameters together with the tolerance and limits of each parameter. Track Contractor shall consider RS parameters in Track design.
4	Gauge widening	RS Contractor shall provide necessary information.	The Track Contractor shall liaise with RS Contractor for the requirement and extent of Gauge widening on very sharp curves.

5	Flange way clearances	RS Contractor shall provide necessary information and carry out simulation study to ensure smooth negotiation of very sharp curves provided with check/restraining rails.	The Track Contractor shall liaise with RS Contractor for determining the requirement (including the required flange way clearances) for the provision of check / restraining rails, if considered, on very sharp curves.
6	Simulation Studies	Shall carry out simulation studies & provide results with respect to attainable speed along the alignment.	The values of cant to be provided on every curve shall be fine-tuned based on the attainable speeds. The Track contractor shall provide the cant accordingly during construction stage.
7	Buffer stops design	Shall provide details of Rolling Stock. Shall liaise with Track contractor to verify the design of friction buffer stops is interfaced satisfactorily with the car design.	The Track Contractor shall liaise with the Rolling Stock Contractor to design the buffer stop and shall consider such details for supply and installation of buffer stops.
9	Integrated testing & commissioning	Shall provide results of test runs including those pertaining to Track conditions.	Shall associate during integrated testing & commissioning and carryout necessary rectification of Track.

3.2.7 Interface with Turnout Supplier

- This contract includes design of turnout plinth/turnout slab as per the fastening decided. The complete responsibility of designing and checking the design lies with the track contractor. However, the plinth/slab design will also be validated by turnout supplier.
- Designing of fastening system for the turnout will be done by turnout supplier. Turn out supplier will supply turnout fastenings and Crossing fastenings. Fastenings of lead portion in Ballastless turn outs will be supplied by Maharashtra Metro Rail Corporation Limited. However, Turnout fastenings will be validated by Track contractor.
- If minor corrections are involved after the completion of concreting work of rail plinth, the same shall be carried out by Track contractor under the supervision of turnout supplier's representative.
- Turnout supplier shall supply all Track assemblies & Track fasteners, turnouts, all stretcher bars (except leading stretcher bar), second drive with all accessories, wherever required, for second pull. The design of second drive arrangement shall be co-ordinated and interfaced with Signalling Contractor to ensure full compatibility.

Method statement for assembly and laying turnout on Track slab/sleepers shall be submitted by the turnout supplier to Track contractor, Maharashtra Metro Rail Corporation Limited and executing agency etc. Track contractor will verify the method of statement and carry out the work as per interface between track contractor and turnout supplier.

Note: Above interface requirements are just indicative and not comprehensive. The contractors should follow the best practices of metro for the interface/integration during project execution.

4. INSTALLATION AND CONSTRUCTION SCHEDULE

4.1 REQUIREMENTS

4.1.1 General Requirements

1. The Contractor shall comply with all Enactments in executing the works, including but not limited to all statutory provisions on occupational health and safety.
2. The Contractor shall co-ordinate with designated Contractors in the execution of the Works.
3. The Contractor shall also co-operate with all relevant authorities in the execution of the works.
4. All machinery and equipment shall be operated at all times by suitably trained and competent employees of the contractor and to the satisfaction of the Engineer.
5. Only appropriate tools, plant, machinery and equipment and vehicles shall be used.
6. The contractor shall, prior to starting any installation and construction work, identify any possible hazards, and implement measures of eliminating and/or controlling such potential hazards, in line with safe working practices.
7. Further details on Site Safety management are described in Chapter 14 and Appendix 2 of the GS. The Contractor shall ensure that all areas of work are sufficiently illuminated for the works to be undertaken and that a safe system of working is employed for all activities.
8. The contractor shall operate a suitable system for the control of persons entering or working on the site. The system shall include as a minimum:
 - Register of all employees
 - Personal identification with photograph and signature/thumb impression
 - Levels of competence;
 - Date of joining
 - Date of discharge;
 - Register of all visitors.
9. The Contractor shall Co-operate, at all times, with the Engineer and designated Contractors to ensure that the site is protected from unauthorised admission, either wilfully or otherwise.
10. The Contractor shall make due provisions for safe access to and egress from the site of works for its staff and subcontractors. This access shall be maintained such that it is free of all hazards and is in a safe condition throughout the duration of the works.

4.1.2 Specification Requirements

The installation and construction work pertaining to this contract shall include, but not be limited to the following: -

- Survey on site and review the technical requirements shown in this specification and the Employer's drawings.
- Finalisation of the construction and installation program
- Production of the calculation sheets and installation drawings for site installation.
- Procurement of fastening system for Ballastless Track and installation in Track at specified density.
- Installation in accordance with the approved installation drawings.
- Co-ordination with designated contractors.
- Submission of the installation reports and records.
- Testing and commissioning as per finalised protocol and programme.
- Production of as built drawings, documents, calculations sheets, and records.

4.1.3 Construction and Installation Plan

1. The contractor shall undertake installation work in stages as shown in the detailed installation programme, Installation, testing and commissioning of later stages shall have no impact on revenue operations of earlier stages.
2. As a minimum, the detailed construction and installation plan shall include but not be limited to all the activities described in clause 3.6.1 of the GS, installation details and methods of all activities, equipment and tools to be used for installation, safety issues, supervision, temporary land occupation needed and the vehicles to be used for transportation of material & installation.

4.1.4 Temporary Works

1. The design of temporary works shall be submitted to the Engineer for approval.
2. All temporary works shall be removed on completion of permanent works, or as directed by the Engineer
3. All temporary works shall be clearly distinguishable from permanent works.

4.1.5 Site Supervision and Safety Issues

1. The contractor shall set up a site supervision system, which shall be part of the overall safety, system assurance and quality management system.
2. Details of Health and Safety requirements at site are described in Chapter 14 of the GS.

4.1.6 Quality Management

1. The Contractor shall adopt an appropriate quality management system to ensure that the System performance requirements as specified in this Particular Specification are achieved.
2. The Contractor shall provide sufficient number of suitably experienced supervisors and skilled workers to ensure that the progress and quality of the work, both on site and in the Contractor's workshops, are maintained to the satisfaction of the Engineer.
3. Key Supervisors shall have adequate previous experience in a supervisory capacity on similar projects.
4. The supervisors shall work on a fulltime basis during the entire installation process as directed by Engineer.
5. The Engineer reserves the right to undertake, at any time, checks on the proficiency of the Contractor's staff, licensing and all associated documentation. Should any of the Contractor's staff be found incompetent by the Engineer or unlicensed he shall be removed from the site until their competence has been established or competent staff are posted.

4.1.7 Workmanship

The style and procedure of workmanship shall be appropriate and consistent throughout the works.

4.2 PROGRAMME REQUIREMENTS

4.2.1 General

In addition to the requirements specified in the General Specification, the contractor shall program the works in accordance with a pre-determined sequence to meet various Key dates and Access Dates so as to meet the target Dates of commercial opening.

4.2.2 Key Dates

- 1) The work includes a number of stages. These stages, which are inter-related with, and essential to, the completion of the Supply, Installation and Commissioning of Track work for mainline corridor; Viaduct and UG sections are to be achieved by the Key Dates.
- 2) The Key Dates are indicated in the Schedule of Key Dates and the deliverables for each Key date shall be achieved by the midnight of the date mentioned.

- 3) If the identified stage is not achieved by the stated Key Date, liquidated damages may become applicable as set out in the Contract.
- 4) Description of each stage is as detailed below:

STAGE 1:

Shared access to Electrical Traction Contractor / Signalling Contractor shall be available, by this date. Interfacing Contracts: Civil Contractor for Stations and Viaduct; Rolling Stock Contractor; Electrical (Traction) and cabling work contractor; Train Control & Signalling and Telecom Contractor and Depot Contractor.

STAGE 2:

Completion of Track Work Achievement: Completion of Track work in all respect with final finishes Interfacing Contracts: Civil Contractor for Stations and Viaduct; Rolling Stock Contractor; Electrical (Traction) and cabling work contractor; Train Control & Signalling and Telecom Contractor and Depot Contractor.

STAGE 3:

Completion of Acceptance Tests and Taking Over of the System Achievement: Completion of Acceptance Tests after completing necessary integrated testing including final testing. This stage can be achieved after completion of all the above two stages by Signalling Contractor (fixing and testing of point machines).

Final taking over of the system after completing all the requirements of Operation and Maintenance including Training as laid down in the Employer's Requirements (GS and PS).

Interfacing Contracts: Contractor;	Civil Contractor for Stations and Viaducts; Rolling Stock Contractor; Electrical (Traction) and cabling work contractor; Train Control & Signalling and Telecom Contractor; Depot Contractor.
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4.2.3 Access Dates

1) The Track Contractor shall require access to information as well as to various locations at stations/Track, etc., in stages, in order to plan his activities for timebound completion of his obligations under the Contract. The dates on which such access becomes available are indicated in para 4.4 below. However, the Track contractor will be required to interface the access with relevant civil work contractors and plan the execution accordingly.

2) The Access Dates are defined as hereunder:

STAGE 1: Establish work site

STAGE 2: Track Work Installation

This represents the date by which the Track Contractor shall get shared access to work jointly with Civil and Electrical (Traction) Contractor at nominated area for Track work.

4.2.4 Scheduled dates for the Supply of Materials (to be supplied by the Employer)

4.2.4.1 Indicative Schedule for Supply of Turnouts

The turnouts shall be supplied in Pune at designated place or site in Pune periodically. P1-T06/2021 contractor of Ballastless shall have to interface with P1-T03R1/2019 contractor of Turnouts for proper accountal and taking over and shall have to issues taking over certificate of turnout in undamaged condition. If there is any shortage or damage, same has to be brought to the notice of Engineer and P1-T03R1/2019 contractor of Turnouts immediately. Further, it will be responsibility of P1-T06/2021 contractor for safe custody of these materials till these materials is installed in section and section is commissioned and taking over certificate is issued. Complete spare materials are to be handed over to Maharashtra Metro Rail Corporation Limited / O&M in undamaged condition at its operational Depot and nothing shall be paid on this account.

4.2.4.2 Indicative Schedule for Supply of UIC 60, 1080 grade HH Rails, turnout.

The Rails shall be supplied in Pune at designated place or site in Pune periodically. P1-T06/2021 contractor of Ballastless shall have to interface with P1-T01R/2019 contractor of 1080 HH Rails for proper accountable and taking over and shall have to issues taking over certificate of materials in undamaged condition. If there is any shortage or damage, same has to be brought to the notice of Engineer and P1-T01R/2019 contractor of 1080 HH Rails immediately. Further, it will be the responsibility of P1-T06/2021 contractor of Ballastless for safe custody of these rails till they are installed in section and the section is commissioned and taking over certificate is issued. Spare HH Rails are to be handed over to Maharashtra Metro Rail Corporation Limited / O&M in undamaged condition at its operational Depot and nothing shall be paid on this account.

4.2.4.3 Indicative Schedule for Supply of UIC 60, 880 grade Rails for depot: Deleted

4.2.4.4 Indicative Schedule for Supply of Fastenings for Main line

The Fastenings shall be supplied in Pune at designated place or site in Pune periodically. P1-T04/2018 contractor of Fastening shall have to interface with P1-T06/2021 contractor of Ballastless Track for proper accountal and taking over and shall have to issues taking over certificate of Fastenings in undamaged condition. If there is any shortage or damage, same has to be brought in the notice of Engineer and P1-T04/2018 contractor of Fastening immediately. Further, it will be responsibility of P1-T06/2021 contractor of Ballastless Track for safe custody of these materials till they are installed in section and the section is commissioned and taking over certificate is issued. Complete spare materials are to be handed over to Maharashtra Metro Rail Corporation Limited / O&M in undamaged condition at its operational Depot and nothing shall be paid on this account.

4.3 INDICATIVE CHAINAGES OF STATIONS

The indicative chainages for stations are given below, however for construction purpose, these details shall be interfaced by the contractor with designated civil contractor. The length of stations is 140m for elevated section. All the elevated stations are designed with side platforms. However, all the UG stations are designed with island platforms.

NAME OF STATION FOR REACH-3	UP LINE CHAINAGE				DN LINE CHAINAGE			
	STAR T (m)	CENT ER (m)	END (m)	INTER- STATIO N DISTAN CES (m)	STAR T (m)	CENT ER (m)	END (m)	INTER- STATIO N DISTAN CES (m)
CIVIL COURT	6541.1 73	6611.1 73	6681.1 73		6545.2 55	6615.2 55	6685.2 55	
				922.672				918.888
MANGALWAR PETH	7463.8 45	7533.8 45	7603.8 45		7464.1 43	7534.1 43	7604.1 43	
				778.474				778.496
PUNE STATION	8242.3 19	8312.3 19	8382.3 19		8242.6 39	8312.6 39	8382.6 39	
				671.415				674.311
RUBY CLINIC	8913.7 34	8983.7 34	9053.7 34		8916.9 5	8986.9 5	9056.9 5	
				1064.331				1065.42
BUND GARDEN	9978.0 65	10048. 065	10118. 065		9982.3 70	10052. 370	10122. 370	
				729.148				725.844
YERWADA	10707. 213	10777. 213	10847. 213		10708. 214	10778. 214	10848. 214	
				2175.447				2179.263
KALYANI NAGAR	12882. 66	12952. 66	13022. 66		12887. 477	12957. 477	13027. 477	
				1530.591				1528.37
RAMWADI	14413. 251	14483. 251	14553. 251		14415. 847	14485. 847	14555. 847	

NAME OF STATION FOR REACH-4	UP LINE CHAINAGE				DN LINE CHAINAGE			
	STAR T (m)	CENT ER (m)	END (m)	INTER- STATIO N DISTAN CES (m)	STAR T (m)	CENT ER (m)	END (m)	INTER- STATIO N DISTAN CES (m)
SHIVAJI NAGAR	11666. 783	11736. 783	11806. 783		11666. 459	11736. 459	11806. 459	
				1090.097				1106.400
CIVIL COURT	12756. 880	12826. 880	12896. 880		12772. 859	12842. 859	12912. 859	
				852.745				826.140
BUDHWAR-PETH	13609. 625	13679. 625	13749. 625		13598. 999	13668. 999	13738. 999	
				998.391				1006.935
MANDAI	14608. 016	14678. 016	14748. 016		14605. 934	14675. 934	14745. 934	

				1489.049				1483.283
SWARGATE	16097. 065	16167. 065	16237. 065		16089. 217	16159. 217	16229. 217	

4.4 DELETED

4.5 Survey Equipment

- 4.5.1 The contractor should provide the survey equipment, Track measuring equipment and other accessories as per the instructions of Engineer as and when required. He should also provide all necessary help and manpower as required by the Engineer for checking the works, whenever required.
- 4.5.2 For the equipment like the buffer stop etc.
- A complete set of documentation must be supplied with each System. The documentation should be self-tutorial in nature and be readily understood by non-computer personnel.
 - The following manuals must be supplied with the system:
 - Manual on how to operate the equipment; and
 - Manual on how to use the facilities and software provided by the supplier. (Including languages and utilities).

5. MATERIAL AND WORKMANSHIP: GENERAL

5.1 INTRODUCTION

- This Materials and Workmanship Specification for Track work shall be read in conjunction with all the documents forming part of the Contract.
- No Permanent Works shall be carried out until all methods and materials have been approved.
- Unless noted otherwise in the Contract, all components and materials shall be handled, transported and stored, in accordance with the manufacturer's recommendations with prior approval of Engineer.
- The test results of each test to be carried out as per Employer's requirement shall be recorded and submitted in a format approved by the Engineer and shall include graphical presentation of results as well as numerical base data where ever required
- All drawings, records, reports, documents, proforma etc. shall be submitted in both hard copy and electronic copy.

5.2 ABBREVIATIONS

Trackwork Abbreviations

CWR	Continuously Welded Rail
EVA	Ethyl Vinyl Acetate
FC	Flange way Clearance
HDPE	High Density Polyethylene
HH	Head Hardened
GIRJ	Glued Insulated Rail Joint
LWR	Long Welded Rail
HVN	High Viscosity Nylon
REJ	Rail Expansion Joint
P&C	Point & Crossing

Standards Abbreviations

EN	European Standards
DIN	German Standards
AREA	American Railway Engineering Association
UIC	International Union of Railways
IEC	International Electrotechnical Commission

Other Abbreviations

E&M	Electrical and Mechanical
OHL	Overhead Line
HTS	High Tensile Strength
DFF	Direct fixation fastener
BEC	Buried Earth Conductor
ETU	Electric traction unit

5.3 STANDARDS

Track work materials, components and assemblies shall comply with the requirements and Standards given in the present Specification, however, it shall be the responsibility of the contractor to adopt the latest version of the technical specification with all correction slips.

Codes and standards**1. International Union of Railways Standard Codes (UIC)**

UIC Code 860 -	0 Technical Specification for the supply of Rails
UIC Code 861-3	Standard 60 kg/m Rail Profiles Types : UIC 60 and 60 E
UIC Code 864 - 2	Technical Specifications for Supply of Steel Track Bolts
UIC Code 864 - 3	Technical Specifications for the supply of spring steel washers for use in Permanent Way.
UIC Code 864 - 4	Technical Specification for supply of Fishplates or sections for Fishplates made of rolled steel
UIC Code 864 - 5	Technical Specification for the Supply of Rail Seat Pads
UIC Code 864 - 8	Rolled Profiles for Fishplates for 52 kg/m and 60 kg/m Rails
UIC Code 866 - 0	Technical Specification for the supply of cast manganese steel crossings for switch and crossing work

2. International Organisation for Standardisation (ISO)

ISO 1113	Information Processing - Representation of the 7-bit coded character set on punched tape
ISO 1191	Plastics - Polyethylene's and Polypropylenes in dilute Solution-Determination of viscosity number and of limiting viscosity number.

3. Indian Standards (IS)

	IS 456 (2000)	Code of Practice for Plain and Reinforced Concrete
	IS 800 (1984)	Code of Practice for General Construction in Steel
4.	European Standards (EN)	
	EN 1561 Founding -	Grey Cast Iron
	EN 1562 Founding -	Malleable Cast Irons
	EN 1563 Founding -	Spheroidal Graphite Cast Irons
5.	(Deleted)	
6.	German Standard (DIN)	
	DIN 53455	Testing of Plastics - Tensile Test
	DIN 53479	Testing of Plastics and Elastomers - Determination of Density
	DIN 53508	Testing of rubber - Accelerated ageing
7.	International Electrotechnical Commission (IEC)	
	IEC 60093	Method of testing for volume resistivity and surface resistivity of solid electrical insulating materials (Formerly DIN 53482)
8.	(Deleted)	
9.	Indian Railway Standards	
	IRS T-1	Fish plate
	IRS T-10	Switches, crossing and REJs
	IRS T-12	Rails
	IRS T19	Fusion welding of rails by Alumino-Thermicprocess
	IRS T-23	Fish bolts and nuts
	IRS T-28	High Tensile steel fish bolts and nuts
	IRS T-29	CMS crossings
	IRS T-31	ERC
	IRS T-37	GR sole plate (for 6 mm sole plate pad and any other relevant specification)
	IRS T-44	GFN-66 liners
	IRS T-46	SGCI inserts

Indian Railway Manual for Alumino-ThermicWelding

Indian Railway Manual for flash butt Welding

Indian Railway Manual for Ultra Sonic Testing of Rails and Welds

Indian Railway Manual for LWR

Indian Railway Manual for Glued Insulated Joint

10. Fastening system for Ballastless Track will comply to the performance criteria circulated by Ministry of Railways vide letter No.2009/Proj/MAS/9/2 dated 21.05.2010 (Annexure '5' of ITT) or approved by Ministry of Railways.

OTHER

A. CEMENT

- IS : 269 specification for 33 grade ordinary Portland cement.
- IS : 650 specification for standard sand for testing of cement.
- IS : 4031 methods of physical tests for hydraulic cement
- IS : 4032 method of chemical analysis of hydraulic cement.
- IS : 6925 methods of test for determination of water soluble chlorides in concrete admixtures.
- IS:8112 specification for 43 grade ordinary Portland cement.
- IS : 12269 specifications for 53 grade ordinary Portland cement.

B. CONCRETE

- IS: 383 specification for coarse & fine aggregates from natural sources for concrete.
- IS : 456 code of practice for plain and reinforced concrete.
- IS: 516 methods of test of strength of concrete.
- IS : 1199 methods of sampling and analysis of concrete.
- IS : 2386 parts i to vii. methods of tests for aggregates for concrete.
- IS : 7861 parts i and ii. code of practice for extreme weather concreting.
- IS : 10262 recommended guidelines for concrete mix design
- IRS concrete bridge code
- IRC : 21-1987 standard specifications and code of practice for road bridge section - III cement concrete (plain & reinforced (first revision)
- IS : 9103 specifications for admixture for concrete

C. FORMWORK

- IS : 456 code of practice for plain and reinforced concrete
- IS: 4990 plywood for concrete shuttering work
- IRC : 87 guidelines for design & erection of false work for road bridge.
- IS : 806 code of practice for use of steel tubes in general building construction.
- IS : 1161 specification of steel tubes for structural purposes.
- IS : 1239 specification of mild steel tubes. tubular and other wrought steel fittings.
- IS :2750 specification for steel scaffoldings.

D. STEEL REINFORCEMENT

- IS : 280 mild steel wire for general engineering purposes.

- IS : 432 part I mild steel and medium tensile steel bars. part II hard drawn steel wire.
 - IS : 456 code of practice for plain and reinforced concrete.
 - IS : 814 PARTS I & II electrodes for metal arc welding of structural steel.
 - IS : 816 code of practice for use of metal arc welding for general construction in mild steel.
 - IS : 1566 hard-drawn steel wire fabric for concrete reinforcement
 - IS : 1786 specification for high strength deformed steel bars and wires for concrete reinforcement.
 - IS : 2502 code of practice for bending and fixing of bars for concrete reinforcement.
 - IS : 2629 recommended practice for hot-dip galvanising of iron & steel
 - IS : 4759 hot-dip zinc coating of structural steel and other allied products.
 - IS : 2751 code of practice for welding of mild steel plain and deformed bars for reinforced concrete construction.
 - IS : 9417 recommendations for welding cold-worked steel bars for reinforced concrete construction.
11. The relevant technical specifications and manuals etc. of Indian Railways have been mentioned in clause 5.3 (9), however, it shall be the responsibility of the contractor to adopt the latest revision of relevant technical specification/manual of Indian Railways with all correction slips and alterations. The contractor shall be responsible for collecting the relevant technical specification from Indian Railways at his own cost and shall submit them to the engineer for his approval before starting of work.
 12. The relevant RDSO Drawings shall be followed, wherever required, for those Track work / Track items which are required to be manufactured/procured based on Indian Railway specifications. However, it shall be the responsibility of the contractor to adopt latest RDSO Drawings with all corrections and alterations. The contractor shall be responsible for collecting the relevant drawings from RDSO at his own cost and shall submit them to the engineer for his approval before starting of the work.

5.4 TESTING AND INSPECTION

- 1) All materials and components shall be tested and inspected in accordance with Chapter 9.

5.5 PACKAGING, SHIPPING AND STORAGE

- 1) All materials, components or assemblies to be supplied by the contractor shall be packed & transported without causing any damage to it. The materials shall be offered for Engineer's inspection at contractor's storage depot for this project in Pune before installation. The material classified as damaged by Engineer shall not be used for the work.
- 2) All materials including the material supplied by the Employer shall be stored and protected in neat, well maintained stacks, bundles or enclosed stores with markings clearly visible.
- 3) Materials shall be so stored as to ensure no deterioration due to water or any other reason.
- 4) All material storage arrangements shall be with prior approval of the Engineer.
- 5) The materials and equipment having specific provisions of packaging & storage shall be packed and stored in accordance with their technical specifications in addition to that described above.

6. MATERIAL & WORKMANSHIP: MATERIALS AND COMPONENTS

6.1 Material to be supplied by the Employer

The 1080 grade HH rails, Fastenings for Ballastless Track & all types of turnouts with its fittings shall be provided by the Employer at Pune. The contractor shall also be responsible for their safe transportation from Maharashtra Metro Rail Corporation Limited Store to site at Pune without causing any damage to them duly taking proper care & precaution & following appropriate methods including loading, unloading, local transport and proper stacking/ storage with proper accountable etc. as directed by engineer. For small fittings (packed in sealed packages) supplied at Pune by the other contractor and also for the materials supplied by the Employer at store, the joint inspection by the contractor and the Engineer for the damaged materials, if any, shall be done on arrival of these materials at site in Pune.

6.2 RAILS

6.2.1 Rail Sections

- 1) The rail section shall be as per Table 1.

Table 1

Item	Rail type	Rail Profile
(i) Standard Rails on main line & ramp (ii) All turnouts of main line	60E1/UIC 60, 1080 grade Head Hardened Rails as per IRS-T-12-2009 (with up to date correction slips)	UIC 861-3 or 60 E-1
Standard Rails & lead rails of 1 in 9 R300, 1 in 9 R190, 1 in 7 R190 turnouts on Main lines (Viaduct & UG)	60E1/UIC 60, 1080 grade Rails as per IRS-T-12-2009 (with up to date correction slips)	UIC 861-3 or 60 E-1

- 2) The Contractor shall take necessary approval/permission from concerned authority for transportation of rails in Pune by Road.
- 3) The contractor shall be responsible for preparing the firm and level ground for stacking of Rails as approved by the engineer. The contractor shall also arrange the required wooden battens/ spacers for keeping rails in layers as directed by the engineer.

6.3 TRACK COMPONENTS

6.3.1 Rail Fastening System for Ballastless Track

- 1) All plain line Ballastless Track for main line shall be laid with approved fastening system.

6.3.2 Deleted

6.3.3 Joggled Fishplates

Standard joggled fishplates and clamps shall be suitable for use with UIC60 Kg rail section and shall be manufactured in accordance with the relevant technical specifications of Indian Railway.

6.4 TURNOUTS, CROSSOVERS AND DIAMONDS

6.4.1 Ballastless

- 1) On Standard Gauge main line, the following types of turnouts and diamond crossing shall be provided as indicated in the relevant drawings
 - a) 1 in 9 type turnout 300m and 190m radius and 1 in 7 turnout 190m radius (Ballastless)
 - b) Scissors x-over of 1 in 7 type 190m radius consisting of 4 turnouts and 1 diamond crossing (Ballastless) 15.35m Track centre.

- 2) All turnouts, diamond crossings shall be provided on reinforced concrete slab for Ballastless Track.
- 3) The Contractor shall be responsible to make provisions on reinforced concrete slab for fixation of point driving machines, 2nd drive arrangement (in case of 1 in 9 turnouts for SG) and any other arrangements required for fixation of S & T equipment duly interfacing with designated signalling contractor with prior approval of Engineer.
- 4) Turnouts shall be incorporated to take the LWR through turnouts.
- 5) The contractor is required to submit method statement/work procedure form handling of rails, and fixing the fastenings etc..
- 6) Detailed design of RCC plinth/slab will be carried out by the contractor.
- 7) The installation of turnout to correct/requisite Track parameters is the responsibility of Contractor including welding.
- 8) Minor corrections involved after the completion of concreting work of rail plinth/slab, shall be carried out by contractor.
- 9) Design of Turnout slab by contractor shall be validated by Employer / Engineer.
- 10) Provision of G.I Plate below the base plate of crossover in Viaduct.

6.5 Deleted

6.6 BUFFER STOPS

On main lines friction buffer stops with mechanical impact absorption (non-hydraulic type) shall be provided. The design and specification of friction buffers shall be submitted by the contractor for Engineer's approval. The contractor shall interface with the designated Rolling Stock Contractor for the details required for the design of friction buffer stops. However, the following details shall be followed.

Standard Gauge -

- Weight of empty train is equal to 246 tonnes for 6-car train set without passengers.
- Weight of train is equal to 384 tonnes for 6-car train set with passengers.
- Impact velocity for main line: 25/40 km/h
- Factor of Safety (FOS): 1.25 - 1.5, the philosophy behind FOS shall be to minimize the damage to train and buffer stop without compromising the desired safety.

6.7 Concrete Plinth (Ballastless Track)

6.7.1 General

Ballastless Track shall be with reinforced concrete plinth (cast in situ/precast) on viaduct section.

6.7.2 Concrete

The concrete shall be of M35 grade as per the Indian Standard IS-456 - 2000. The concrete shall be in accordance with the provisions mentioned in **Annexure "Q"** of PS. If concreting is from existing Batching plant, the batching plant must be exclusively nominated for Pune Metro work and work to be carried out in the batching plant as per approved Metro quality procedure and mix design. Use of SCC (Self compacting concrete) is the preferred choice for second pour concrete.) with the prior approval of Engineer.

6.7.3 Reinforcement

- 1) Reinforcement & shear connector between CW interface and concrete plinth shall be of IS1786 in accordance with relevant IS codes. The reinforcement shall be in accordance with the provisions mentioned in **Annexe "Q"** of PS.
- 2) Electrical Interface:
 - The plinth electrical continuity shall be ensured by the contractor. The Contractor shall supply M.S. flat (Galvanized) welded to the 20mm M.S. Plain bar provided along with

the plinth reinforcement. This M.S. flat shall be 160x40x6mm, pre-drilled with a 10-mm diameter hole, and shall be installed at each plinth / RCC slab unit extremity. These M.S. flats shall be connected by the Contractor as per interface matrix with equivalent 35 mm² bare copper cable to provide electrical continuity between consecutive plinths duly interfacing with the designated electrical contractor.

6.8 ALUMINO-THERMICWELDING PORTION

The welding portion and equipment required for the Alumino-Thermic Rail welding process shall be manufactured and tested in accordance with relevant Technical Specifications for approval of the process and supply of portions for Fusion welding of rails and performance and acceptance of Alumino-Thermic welding of rails of Indian Railways as mentioned in clause 5.3(9).

6.9 SIGNAL AND TRACTION RETURN RAIL BONDS

At locations shown on the Drawings, and/or specified, signalling and/or traction return rail bonds are to be attached to the rail through cad welding or any other suitable technique by designated contractors as approved by Engineer.

7. MATERIAL AND WORKMANSHIP: SURVEY AND SETTING OUT

The setting out of alignment for Track construction shall be the responsibility of the contractor; the following principles shall be adopted for setting out and execution.

7.1 FUNCTIONAL RESPONSIBILITIES

1. The planning organisation and process of surveys for transferring the alignment for Track construction on finished at viaducts/stations shall be the sole responsibility of the Contractor. He shall at all times maintain common survey interface with the Civil Contractors.
2. Survey and setting out of works shall be carried out by surveyors of appropriate experience and qualification as approved by the engineer.
3. The Engineer may carry out random checks to verify the accuracy of the setting out and Contractor's compliance of the completed works with given alignment and the specifications. Provisions and arrangement shall be made by the Contractor to facilitate the checks. However, full responsibility lies with the contractor for the accuracy of line and level of the Tracks.

7.2 SURVEY CONTROLS IN GENERAL

1. The contractor shall interface with designated civil contractors to take over the reference co-ordinates system (x,y,z) of the project area as defined by the **Pune Metro Rail Project**. The Secondary Survey Control Markers are additional points to be established by the contractor along alignment from the reference coordinate system including bench mark thus providing survey control for the work areas. The Contractor may also establish additional survey control Markers as local grids or reference system for setting out particular sub-set of work.

7.3 SECONDARY SURVEY CONTROLS

1. As each section of Track becomes available the contractor shall submit a schedule of secondary Control Markers and Bench marks for that area duly interfacing with designated contractor. The Survey Control Markers & Bench Markers shall be used for the control of the works. The Contractor shall verify the relative accuracy of the Survey Control Markers and Benchmarks prior to use.
2. All the Survey control markers and benchmarks provided within the project area by the designated civil contractors shall be surveyed, with survey computations based on the adopted co-ordinates system. Any changes in values shall be supported by technical evidence and on consultation with all affected parties.
3. In particular, any changes in co-ordinate values of secondary survey markers shall only be adopted with the concurrence of the Engineer. The contractor shall be responsible to prepare modified drawings/proposals in this regard for information to all concerned parties and for approval of the engineer.

4. It shall be the Contractor's responsibility to protect and preserve the integrity of the all Control Markers. In the event that any of the Secondary Control Markers or Benchmarks is damaged, the Contractor shall replace and re-establish the points at his own cost to the satisfaction of the Engineer.

7.4 SETTING OUT

1. Setting out points shall be established by transfer from the survey control Markers. The Contractor shall establish physically on site such Track siting marks that may be grid or offset points to be used as the reference system for the Track work. In the event the original structural grid line is destroyed or rendered unusable, the Contractor shall re-establish them at his own cost without delay.
2. At each site, the position of the site main reference setting out points shall be maintained throughout construction period. Such markers shall be checked against the Survey Control markers by the Contractor at regular intervals to ensure reliability of subsequent works.
3. The Track siting marks corresponding to both the theoretical centre of the Track and to the theoretical level of the Track running surface, as defined by the relevant topographical data on the documents relating to Track layout shall be marked at the beginning and end of each circular curve, transition curve and vertical curve both in the longitudinal and cross directions. The said markings shall be put in:
 - In straight sections: every 25-m,
 - In curved sections: every 10-m.

The Track siting marks for the centre of the Track shall be shown by plates or nails sealed on viaducts or as approved by Engineer. They shall be referenced by the Cartesian co-ordinates of each point identified in this manner and registered in the topographical logbook. Should there be any discrepancy found by the contractor with reference to the geometry of civil structure, the same should be interfaced with the civil contractor. The contractor shall be responsible to prepare details duly making necessary modifications in layout, if required as a solution to the discrepancy and submit the same to the Engineer for his final decision. The Track siting marks for the vertical siting of the Track running surface shall be shown by angle plates sealed on sidewalls. They shall be referenced with respect to the theoretical Track level as approved by Engineer. Given that the precision of the spatial siting of Track laid directly on concrete is of the utmost importance, the Contractor shall position the above markings as follows.

- a) Levelling - The markings show the Track altitude and shall be placed at a constant height in relation to the theoretical level of the Track running surface. They shall be placed at every temporary support frame of Track or 5 m, whichever is less.
- b) Layout - The markings show the centre line of each Track and shall be fitted at every temporary support frame of Track or 5 m whichever is less in straight sections, in circular curves and in transition curves.
4. The inner rail for curve and any rail for straight shall first be set out in its absolute position from Track siting marks using co-ordinates computed from the alignment geometry, the elevation of the rail shall be checked using a level, the other rail shall be set correctly relative to the first rail.

7.5 CONTROL OF TRACK WORKS

1. The Contractor shall ensure that critical dimensions for the Pune Metro Rail Project are met. Regular checking should be carried out during the construction stages to ensure that the specified permissible deviations are not exceeded.
2. The Contractor shall ensure that all survey and Track siting marks shall be established on Site to required accuracy. He shall also be responsible for each stage of the setting out work and for verifying compliance before construction starts.
3. The Contractor shall develop a detailed Surveyed Track Analysis spread sheet on Microsoft EXCEL. The detailed format of the Surveyed Track Analysis spreadsheet shall be submitted

to the Engineer for Acceptance at least one month prior to the commencement of Track laying.

4. The surveyed Track Analysis spread sheet shall tabulate against chainage, the vertical difference (high or low) and horizontal difference (left or right) between the actual surveyed Track centre line position and the design alignment computed from latest accepted alignment geometry. Derived cant, gauge and twist values shall also be compared against design values on the same spreadsheet.
5. Any out of tolerance condition shall be flagged up on the spreadsheet.

7.6 SURVEY INSTRUMENTS

- 1 Survey instruments used, and the methodology adopted shall be appropriate to the intended measurement task and accuracy specifications. Test measurements and instrument calibration shall be carried under local field conditions.
- 2 It is essential that before starting any initial surveys, and at frequent intervals of not more than three months, all measuring equipment should be tested for their accuracy.
- 3 All instrument deployed in the Contract shall be in good condition and properly calibrated. Calibration certificates and/or statements of services by local authorised instrument agents of not more than six months shall be the proof that the instruments are in good service conditions.
- 4 Notwithstanding the above, instruments shall again be checked to ensure good condition before the Contractor proceeds to carry out a critical survey task.
- 5 Horizontal control traverses shall be carried out with modern precise digital survey instruments consisting of co-axial total station with an accuracy not inferior to 2" arc and (2+2ppmxD) mm. Precise levelling runs shall be carried out in both directions using digital level with an accuracy not inferior to 1.5mm per Km double run. Digital data from the above instrument shall be recorded electronically in the field. For Track surveys non, co-axial total station shall not be permitted. Total stations used for Track surveys shall have onboard software permitting setting out and checking of points along a calculated alignment in the field. Survey instruments used by the Contractor shall meet all such standards.
- 6 For Track surveys Track master or its equivalent (to be approved by Maharashtra Metro Rail Corporation Limited) conforming to international standard will have to be used.

7.7 QUALITY PLAN

The Contractor shall submit to the Engineer, for acceptance a separate quality plan related specifically to survey matters. The plan shall address for following:

- Identification of the Contractor's key survey staff and the lines of communication
- Scope of the surveying section including interface with designated contractors
- List of proposed surveying equipment & computer hard/software;
- List of surveying procedures;
- List of detailed method statements for all critical surveying activities;
- Survey test and inspection plan;
- Control of survey data and records;

8. MATERIAL AND WORKMANSHIP: INSTALLATION

8.1 INTRODUCTION

8.1.1 General

- 1) The proposed method statements, installation procedures and installation plans for the Works shall be submitted for the Approval of the Engineer in accordance with this Chapter.

These submissions shall be summarised and detailed in the Contractor's Submission Schedule (CSS). The documents forming the submissions shall use a standard format which shall be submitted by the Contractor for the approval of the Engineer

- 2) Notwithstanding the nominal Track to supporting structure dimensions indicated on the Drawings, the as constructed dimensions may vary subject to the allowable tolerances. In addition, the supporting structure may contain ramps, steps, channels, drains, anchor bolts, manholes, upstands and the like. The methods of construction shall accommodate these constraints
- 3) All temporary/service Tracks, if required for Track work on main lines, shall be arranged & laid by the contractor with prior approval of the Engineer. The contractor shall remove these temporary/service Track after completing the Track work as approved by Engineer.

8.1.2 Track forms

- 1) The Ballastless Track form on main lines shall be direct fixation on reinforced concrete plinth for plain Track and in station area and RCC slab for all turnouts as shown on the Drawings.

8.2 METHODS OF WORKING

8.2.1 Method statements

- 1) Method statements detailing the proposed methods of working and incorporating all temporary works required shall be submitted to Engineer for his approval. No Permanent Work shall commence until the method statements are approved by the Engineer.
- 2) Method statements for Track laying shall, as a minimum cover the following items, where ever applicable:
 - (a) handling & transport (including for materials to be supplied by Employer)
 - (b) stacking/storage/accountable / reconciliation of materials (including for the materials to be supplied by the Employer)
 - (c) pre-assembly/assembly
 - (d) delivery
 - (e) surveying
 - (f) setting out
 - (g) welding
 - (h) Track installation
 - (i) concreting
 - (j) as-constructed records
 - (k) rear work, finishing removal of all type of anchor fasteners and cleaning/clearing
 - (l) Final parameter & de-stressing
 - (m) Cutting of rails, which may render generation of unusable small cut pieces.
- 3) Method statements shall, as a minimum, incorporate hold points, tolerances, finishes required, temporary works, false works, formworks, test and inspection plans and shall include safety and quality control requirements for each activity.
- 4) Method statements are also required as a minimum for the following production or installation activities:
 - (a) Each Track forms
 - (b) Turnouts, crossovers, and derailing switches
 - (c) Rail welding
 - (d) Buffer Stops & Check Rails

- (e) Surveying
 - (f) Tests on Completion
- 5) Method Statements shall be prepared and submitted in a standard format as described in Clause 8.1.1 with descriptions under the following minimum headings:
- (a) Safety
 - (b) Plant, Equipment & Tools
 - (c) Construction Method
 - (d) Protection to existing drainage facilities, cast-in items, etc.
 - (e) Tolerances & finishes
 - (f) Hold Points
 - (g) Proforma/check sheets
 - (h) False works/Formwork
 - (i) Temporary Works
 - (j) Reference Drawings
 - (k) Reference Documents/Clauses
- 6) Method Statements shall be itemized and have Document/Clause reference column as the right-hand side margin.
- 7) Each method statement shall be referenced to the relevant clauses of the documents forming the Contract.
- 8) Method statements which require the use of any specific/specialised equipment or Constructional Plant shall clearly specify the equipment or Constructional Plant and the operator's experience required.

8.3 FINAL CONDITION OF TRACK

- 1) Throughout construction generally and immediately after installation of the Track, the rails, rail fastenings, the concrete Track base, including ducts, Track drains and any exposed support structure shall be made clean. This cleaning shall include the use of air/water pressure jetting and vacuum cleaners as necessary.
- 2) Once a section has been cleaned, tested and the insulation values accepted by the Engineer, the accepted level of cleanliness shall be maintained until the taking over of the section.

8.4 TRACK INSTALLATION

8.4.1 General

- 1) The Track gauge throughout shall be 1435 mm or as per SOD measured between the running edge gauge point of each rail and normal to the centre line of the Track 14 mm below top of Rail.
- 2) The Contractor shall take due cognisance of his proposed rail jointing system and the rail fastening assembly spacing in the selection of the appropriate length of long welded rail panels.
- 3) The minimum closure rail length in plain line shall be 6 metres except for specific locations as shown on the Drawings or as approved by the Engineer.
- 4) No wastage allowance shall be permitted for the various materials supplied by the Employer except for the rails. The wastage allowance for rails shall be permitted in accordance with the provisions of para 8.4.2. (4) of PS.

8.4.2 Rail Jointing

- 1) All rail joints throughout the main lines, including turnouts, except at locations approved by the engineer, shall be welded.

- 2) The welding of nominal rail lengths into long welded rail panels for main lines shall be by flash butt welding. Alumino-Thermic (SKV process) welding shall only be used in exceptional circumstances with prior approval of the Engineer. Temporary joints between HH rails shall be by fish 1m long fish plates & clamps without drilling of holes in rails.
 - 3) All the welded joint for welding less than 18m rail length on main lines shall have prior approval of Engineer.
 - 4) The contractor shall obtain Engineer's prior approval for any rail cutting, which may render generation of unusable small cut pieces. These cut pieces shall also be properly accounted, collected and stacked at a nominated place approved by the Engineer before its handed over in acceptable condition.
- 8.4.3 Locations of Welds** - The spacing of welds and joints shall not be less than 6.0 m between any two welds and for any deviation to this, specific approval of Engineer shall be required in each case.
- 8.4.4 Long Welded Rails** - Long welded rail panels (LWR) shall generally be a minimum of about 360 m. Shorter panels shall only be permitted when dictated by site conditions/site constraints and as Approved by the Engineer.
- 8.4.5 Fish plated Rail Joints**
- 1) Standard fish plated joints wherever required in plain Track shall be square.
 - 2) Standard fishplates joints shall be installed centrally between two adjacent fastenings and shall be manufactured and installed to permit the use of standard rail fastening assemblies.
 - 3) All fish plated joints shall be fitted with the nuts on the inside of the Track.
- 8.4.6 Deleted**
- 8.4.7 Deleted**
- 8.4.8 Rail Temperature** - Rail temperatures shall be measured using appropriate dial type magnetic rail thermometers placed on the web of the rail on the shaded side. A minimum no of thermometers required to be used per rail for measuring average rail temperature\ of a segment of Track shall have the prior approval of Engineer. A rail embedded thermometer shall be kept at an approved location to calibrate the dial type thermometer and monitor the accuracy of the temperature measurements.
- 8.4.9 Deleted**
- 8.4.10 Deleted**
- 8.4.11 Cutting of Rails**
1. Rails shall only be cut by using rail, cutting machines. The proposed method and equipment for the cutting of rails shall have the prior approval of the Engineer.
 2. Rails required to be cut shall be cold sawn square and vertical across the rail. A deviation from square or vertical of more than 0.50 mm, measured about the rail head, shall not be permitted. All burrs shall be removed from the rail ends.
 3. Quality of cutting shall be such as to ensure tolerances in flash butt and alumino-thermic welding manual.
- 8.4.12 Drilling of Rails**
1. All fish bolt holes in rails, wherever required shall be drilled by using proper jigs and drilling machines. The proposed method and equipment for the drilling of rails shall have the prior approval of Engineer
 2. All holes in the rails shall be chamfered using chamfering kit & procedure approved by the Engineer.
- 8.5 BALLASTLESS TRACK INSTALLATION**
- 8.5.1 General**
- 1) The components of Ballastless system shall be:

- a) support structure
 - b) shear connector
 - c) reinforced concrete plinth / slab for plain Track & turnouts
 - d) Fastening system for Ballastless Track, approved by Employer at locating as shown in relevant drawings.
 - e) Provision of Mass spring system at selected locations as directed by employer.
- 2) A “Request for Inspection” shall be submitted to the Engineer, complete with all necessary information to allow assessment, after the following activities and Approval must be received prior to the commencement of any follow-on activity:
- a) Acceptance of support structure including specified surface treatment,
 - b) Acceptance of shear connector during CW structure acceptance by NT-1 Contractor.
 - c) Acceptance of the plinth reinforcement,
 - d) Acceptance of the Track for jigs, fixtures, supporting arrangement & concreting,
 - e) Acceptance of the Track for the movement of construction plant, equipment and machinery,
 - f) Acceptance of the Track for in situ welding,
 - g) Acceptance of the Track for final parameter and de-stressing.

8.5.2 Reinforced Concrete Plinth:

- 1) The surface of viaduct/1st pour concrete shall be surveyed to achieve the minimum depth (185 mm) of plinth below the rail seats. For such of those locations where minimum depth of 185 mm is not achievable, the contractor shall, with complete details, seek engineer’s decision.
- 2) The reinforced concrete plinth shall be connected with 1st pour concrete/precast concrete through shear connectors as shown in drawings. The contractor shall ensure that these shear connectors are in position before concreting the plinth. Wherever these shear connectors have not already been provided, the contractor shall provide the same by drilling & epoxying in 1st pour concrete/support concrete as shown in drawings and as directed/approved by Engineer.
- 3) The contractor shall prepare the surface of supporting structure for laying of plinth/RCC slab by its scrabbling for proper bonding as approved by engineer.
- 4) The Ballastless Track shall be constructed by top down method of construction. The laying tolerances for various Track parameters for the as installed Track shall be strictly achieved in accordance with the clause 8.11.2. For achieving these tolerances, the contractor may propose an alternative method/scheme of construction of Ballastless Track along with tender submissions, if he so desires for Employer’s consideration. However, the sole responsibility of achieving the stipulated Track laying tolerances lies with the contractor. The bidder shall submit the detailed construction methodology including the method of handling and transport of material with the details of temporary works, equipment, plant and machinery, as to the locations where such method/Scheme has been used for similar project/conditions to demonstrate its provenness. If the alternative method/ scheme as proposed by the bidder is accepted by Employer, the contractor shall ensure that same scheme is adopted for construction of Ballastless Track on the project. If the alternative method/ scheme as proposed by bidder is not accepted by the Employer, the contractor shall adopt the top down method for the construction of Ballastless Track.
- 5) The contractor shall be responsible to work out the actual height of plinth/slab at each location to maintain the designed rail level as shown in the relevant drawings and submit the same along with all relevant details for the approval of the Engineer. The reinforced concrete plinth shall be laid in the viaduct duly making the required provision for cant & vertical curve for all heights worked out above. The indicative values of cant adopted for horizontal curves have been shown in Vol.-4 Tender Drawings. However, the exact values

of cant for all the horizontal curves shall have to be obtained/interfaced by the Contractor with the designated civil Contractors with prior approval of the Engineer.

- 6) The reinforced concrete plinths shall normally be laid in approved minimum lengths on the overall length of viaduct span section.
- 7) During the concreting phase, the Track fastening device and the running rails shall be protected by movable covers against possible splattering of concrete.
- 8) Each plinth/slab unit shall be built in one single operation; the pouring of the concrete shall imperatively be completed in one go.
- 9) Twenty-four hours after pouring the plinth concrete, the formwork may be removed.
- 10) In case of top down method, the plinth construction shall be carried out by using perforated dummy plates of appropriate thickness as approved by the engineer, which shall later be replaced by intermediate pad and elastomeric pad after the concrete attains sufficient strength.
- 11) The Concreted surfaces of the plinth below the base plates shall be smooth, devoid of any inclusion, roughness crack, and without showing any aggregate at the surface.
- 12) The presence of smooth cavities caused by air bubbles in excess of the value mentioned below shall not be tolerated in case of top down construction method.
 - Maximum dimensions of the inscribing rectangle of a cavity: 20x30 mm,
 - Maximum defect depth 5 mm

8.5.3 Drainage - The contractor shall be responsible for provision of longitudinal & cross drainage within Ballastless Track form (in station areas and on turnouts) with connections to main drainage system duly interfacing with the designated civil contractors. The main drainage system shall be provided by designated civil contractors. The contractor shall submit the scheme of proposed Track drainage for each location for the approval of the Engineer

8.6 Deleted

8.7 TURNOUTS, CROSSOVERS, DIAMOND CROSSINGS, DERAILING SWITCHES

8.7.1 Ballastless Track

- 1) Turnouts on Ballastless Track shall be so set out that the line and level of both straight and turnout Track are within designed tolerances as approved by Engineer.
- 2) Check rails shall be set and checked to the correct clearance by using the running edge of the crossing as the datum.
- 3) The assembly sequence of turnouts and diamond crossings shall be submitted for Engineer's Approval as part of the overall method statement for pre-assembly, handling, storage, transportation, unloading and installation.
- 4) On completion of a turnout, the Contractor shall immediately scotch the switches with a custom-made hardwood timber scotch and securely clamp the switches for the through route with an appropriate clamp to be arranged by the contractor and as approved by the Engineer. The clamp shall be capable of being padlocked with the switch in the closed position.
- 5) No on-Track Constructional Plant, equipment and machinery shall be allowed to operate over a turnout until it has been inspected and approved by the Engineer.
- 6) The contractor shall interface & ensure the designed switch opening while fixation of the first stretcher bar by designated signalling contractor.
- 7) All stretcher bars for switches except first stretcher bar shall be installed by the Contractor duly interfacing with designated signalling contractor and approved by the Engineer.
- 8) Switches shall be installed to provide adequate flange way clearance between the stock rail and the switch rail with the switch rail in open position. The minimum flange way

clearance in switch portion shall not be less than 60 mm. For this purpose, 1 in 9 turnouts may have 2nd drive arrangement while the 1 in 7 turnout can be without 2nd drive. The contractor shall provide arrangements for mounting of point operating mechanism and 2nd drive and shall co-ordinate and interface with designated signalling contractor to ensure full compatibility with regards to installation requirements and point operating mechanism. The contractor shall also be responsible for fixation of 2nd drive on tongue rails and RCC slab. The opening of switch at toe of switch shall be kept as 160 mm.

- 9) Turnouts, Crossovers, Diamond Crossing will be laid on fastening system to be supplied by Turnout supplier under Contract P1-T03R1/2019. Fastening Pandrol DRB or equivalent for lead portion will be supplied by Employer. The contractor shall cast derailment guards along with Track plinths as per drawings approved by employer.
- 10) The contractor shall provide all gauges and measuring equipment and labour necessary to completely check the pre-assembled turnouts crossovers and diamond crossings.

8.7.2 Installation (Ballastless)

Installation of Ballastless turnouts, crossovers, and diamond crossings on RCC slab shall be done observing the provision of clause 8.5.2. (*The numbering has to be checked and recast.*) The turnouts, x-overs and diamond x-ing shall be installed without dummy plates, instead galvanised steel plates of appropriate thickness and dimensions shall be supplied & provided below the intermediate pad on all base plates by the contractor at the time of assembling these for installation. Concreting shall be done up to 15-20 mm below bottom of these plates and the gap shall be grouted with an appropriate material as approved by the engineer.

8.8 Noise and Vibration Mitigation Measures for slab track of underground

1. Philosophy of Noise & Vibration generation

The founding principle of rail transport is the low friction steel-steel solid contact between wheel and rail. Train running on the track generates vibrations in wheels as well as rails. The vibrations of wheel depend on the system above the wheel i.e. bogie and its springs and dampers as well as the load of the vehicles. The vibration of rail depends on the system below the rails i.e. track. The train wheels run across a series of peaks and troughs as neither the wheel nor the rail surface is smooth. This results in forced motion of wheel in vertical direction. Track also moves in vertical direction as it is also not entirely stiff. This in turn excites the rail pad, sleepers. Further, the rail vibrates freely between the fixing points as it is discretely supported on track. Thus, the vehicle and track together vibrate in many different frequencies.

When the rail and wheel are not maintained the level of vibrations increase exponentially. With brand new track and new rolling stock the noise is likely to be minimal, however as soon as there are even slight imperfections in the geometry and the surface of the wheel, or of the track, then vibrations arise. Zones with a lot of braking or acceleration, and in some cases train curving behaviour on curves can lead to rail corrugations, where a defect becomes replicated at short intervals along the track, causing even more noise and vibration disturbance. The inaccuracies in the track geometry like the alignment can also result in vibrations.

Further, the switches and crossings on the track are a source of significant noise and vibration, as they imply gaps and alignment changes to guide the wheels. The level of vibration will increase at the location of turnouts. As per Noise & Vibration guidelines issued by Ministry of Railways the vibration level increases by 10 VdB on special trackwork (turnout).

2. Objectives

In order to mitigate the noise and vibrations generated in the track, Mass Spring System (MSS) and Low Dynamic Stiffness (LDS) fastening system have been conceived for Pune Metro Rail Project. The total available depth from top of rail to tunnel base slab/1st stage concrete is

550mm (maxi). This depth is applicable for circular tunnel, cut & cover tunnel and NATM tunnel.

The method of installation slab track for MSS can be cast-in-place or pre-cast. The material of spring system should be durable under most hostile exposure conditions like ingress of water, oil, grease etc. The contractor shall submit the warranty of 50 years of service life for complete track system including MSS with desired performance of vibration attenuation during the service life. The contractor shall submit the inspection and maintenance philosophy of noise & vibration mitigation system for ensuring efficiency and efficacy of system during its service life of 50 years.

The noise & vibration mitigation system shall be designed according to Ultimate Limit State and Serviceability Limit State as per codes for concrete structures. The design shall not fail under fatigue loading condition. The design shall be proof checked by Proof Consultant engaged by the Contractor and approved by the Engineer/Employer. The Proof Consultant shall certify design of noise and vibration system and structural design of floating slab track.

The Technical Proposal shall consist of detailed Inspection and Test Plan (ITP) of vibration attenuation components. The ITP shall be approved by the Employer before commencement of the manufacturing.

The Technical Proposal shall cover the following aspects:

- a. Specification of noise and vibration mitigation system used for manufacturing discrete bearing.
- b. Calculations of natural frequency, transmissibility, insertion loss & rail deflection based on tender drawings.
- c. Method statement for laying & installation.
- d. Design of the transition zone to avoid the sudden change in stiffness of the track and smoothen out the rail deflection.
- e. Third Party test certificates of spring/fastening material as per the relevant standards.
- f. Provision of the drainage system. The ingress of water below track slab should be stopped by suitable means without any additional cost.
- g. Methodology to confirm that noise and vibration system is installed at desired location as per design and there is no slippage.
- h. The static and dynamic stiffness of the noise and vibration mitigation system.
- i. Methodology to ensure that nothing remains in the air gap below slab for MSS and below rail for LDS.
- j. The installation of noise and vibration mitigation system shall be carried out by a certified expert having reasonable experience of laying such system as per the approved guidelines.
- k. Submission of O&M manual.

The contractor shall submit the details of previous projects where the proposed proven system has been successfully commissioned. The performance certificate from Employer regarding in-service performance of noise and vibration mitigation system shall be part of the Technical Proposal. The submission of vibration attenuation reports of previous projects showing vibration attenuation values along with frequency range is mandatory.

3. Types of noise & vibration mitigation systems:

PMRP has envisaged 4 types of noise & vibration mitigation systems for UG section. The Employer may finalize any single system or combination of different systems based on the merits and economy of the scale. The vibration attenuation system shall be a proven system and in compliance with CT-38 of RDSO. A proven system is the one which have been used at least in 2 similar metros and should have been in-service for minimum 5 years with desired performance.

Sr. No.	Type of noise & vibration mitigation system	Installation Length (Track-Meter)	Transition length* (Track-Meter)
1.	Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D)	1000	2 x 15
2.	Full surface PUR/rubber mat Slab Track Mass Spring System (STMSS-F)	1000	2 x 15
3.	Steel spring (or similar type) Slab Track Mass Spring System (STMSS-S)	1400	2 x 15
4.	Slab Track System with low dynamic stiffness fastening system (ST-LDS)	1000	2 x 15

*Transition length is included in the installation length and may vary at the time of detailed design.

There are two nos. of scissors cross-over which will be installed either with discrete PUR bearing system or full surface PUR/rubber mat system. The location of installation of these systems will be confirmed by the Employer after award of the work.

4. Design Parameters

The input parameters for designing the noise and vibration mitigation system are given below:

- i. Underground corridor having length of **6.071 km U/L & 6.074 km D/L**.
- ii. Total Track Km including yards: **12.145 km ballastless**
- iii. Total track length of curves: **4.0186 km. (2.092km U/L & 2.093km D/L)**
- iv. Total track length of tangent track: **7.956 km (3.976 U/L & 3.980 D/L)**
- v. Length of ramp portion: **0.586 km.**
- vi. Rails: 60E1 R350HT or 1080 grade HH, UIC60
- vii. BHN Value of Rail Top Surface for R350HT: 340min - 390max
- viii. New Wheel Profile: **IRS Sketch no. 91146**
- ix. New wheel diameter: 860mm, Worn wheel diameter: 780mm
- x. New Rail Profile: **60E1**
- xi. Rail Cant: **1:20**
- xii. Wheel Cant: **1:20**
- xiii. Annual GMT: **15** as of now and will grow to **25** in future
- xiv. Standard gauge track: 1435 mm
- xv. Width of train: 2900 mm
- xvi. Over Head Electrification system: 25 kV/AC 50 cycle per second
- xvii. Wheel BHN Value on surface: 245min - 270max
- xviii. Fastening system: Pandrol DRB with e-2007 clip Assembly dynamic stiffness at low frequency=20kN/mm, Assembly vertical static stiffness=18kN/mm, Assembly vertical

- static stiffness $k_{SA,EN2002}=25.6\pm0.8\text{kN/mm}$ Clamping force per rail seat=19kN, Longitudinal rail restraint= 12.5kN
- xix. Fastening Base plate spacing: 600mm
 - xx. Track bed thickness available: TBM tunnel-580mm from TOR, NATM and Cut & Cover: 550mm from TOR
 - xxi. Axle load: 16MT
 - xxii. Train Exterior Noise level (LPAeq. 20 sec)
 - xxiii. Stationary Condition = 67 dBA (measured @ 7.5m from C/L of track at axle height)
 - xxiv. Running Condition @75 Kmph = 82 dBA (measured @ 7.5m from C/L of track at axle height)
 - xxv. Maximum operational speed: 80kmph
 - xxvi. Train configuration: 6 cars with 4 axles per car
 - xxvii. Bogie axle base: 2.4m
 - xxviii. Bogie wheel base: 14.6m
 - xxix. Ballastless track with concrete derailment guards.
 - xxx. Sharpest radius of curve: 300 m
 - xxxi. Steepest gradient: 4%.
 - xxxii. Stations: Cut & Cover
 - xxxiii. Crossover -NATM Technique
 - xxxiv. Entry Speed on Station: 50 Kmph
 - xxxv. Turnouts: **1 in 7 R190m Scissor Crossover 2 numbers.**
 - a. Operational speed on diversion track of crossover: **30 Kmph**
 - b. Operational speed on Straight track of crossover: **50 Kmph**
 - xxxvi. Switches are manufactured by 1080 grade HH or R350HT rails and CMS crossings are explosively depth hardened.
 - xxxvii. Inner dia. of Tunnel: **5.8m**
 - xxxviii. Unsprung mass of rolling stock: **11% - 15% of axle load**
 - xxxix. Maximum rail deflection: **6mm**
 - xl. Train emission frequency: **2 Hz - 250 Hz**
 - xli. Rolling stock service braking rate from 85 kmph to standstill up to fully loaded (AW3) train on level tangent track: 1.0 m/s/s
 - xl.ii. Emergency braking rate from 85 kmph to 0 km/h up to fully loaded train on level tangent track: 1.3 m/s/s
 - xl.iii. Jerk rate (maximum): 0.75 m/s/s/s
 - xliv. Minimum Design Average Acceleration rate for fully loaded (AW3) train on level tangent track shall be as under:
 - 0 kmph to 40 kmph: 1.0 m/s/s
 - 0 kmph to 60 kmph: 0.6 m/s/s
 - 0 kmph to 80 kmph: 0.3 m/s/s

- xlv. The maximum tare weights of a 3-car train (DM-T-DM) & 6-car train (DM-T-+M-T-DM) shall not exceed 128 tonnes & 256 tonnes (including IEC tolerances) respectively subject to gross axle load not exceeding 16 tonnes.

5. Performance Parameters

The noise and vibration system shall be designed, manufactured, supplied and installed considering cast-in-situ or pre-cast slab track system for achieving following performance parameters:

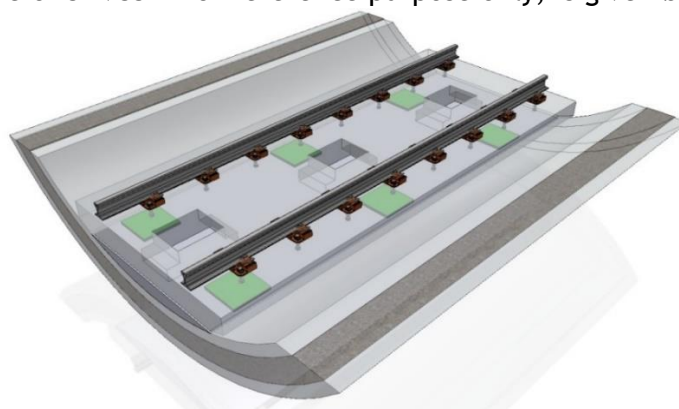
5.1 Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D)

Design, supply and installation of discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS shall be so designed that the Natural Frequency of complete track system remains below 12 Hz. The proposed MSS shall restrict the maximum rail deflection up to 6mm. The thickness of discrete bearing shall be below 50mm.

The design of STMSS includes design of complete track system including track slab and PUR/rubber bearing considering the technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The bearings shall be tested for fatigue as per approved ITP.

The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.

The indicative picture of STMSS-D for reference purpose only, is given below:



STMSS-D

5.2 Discrete Full surface PUR/rubber mat Slab Track Mass Spring System (STMSS-F)

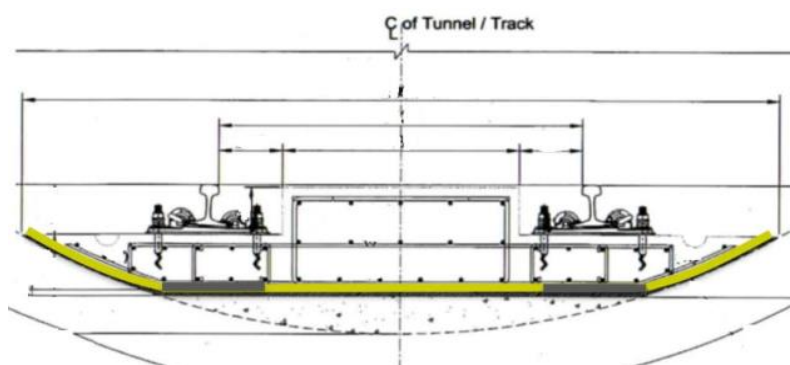
Design, supply and installation of full surface Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-F shall be so designed that the Natural Frequency of complete track system remains below 12 Hz. The proposed MSS shall restrict the maximum rail deflection up to 6mm.

The proposed STMSS-F shall be full surface type PUR/rubber mat. The full surface type PUR/rubber mat can be in the form of combination of two types of strips of different materials having different bedding modulus without facilitating formation of key after casting the track slab because of difference in the stiffness of different PUR/rubber mat materials. The primary strips shall be placed below the rails and responsible for attenuation of noise and vibration. The secondary strips shall be used as filler strips which do not take part in the mitigation of noise and vibration. However, the quality of secondary strips shall be such that it does not become hard in the long run and continue to be non-functional with respect to mitigation of vibration. The thickness of full surface mat shall be below 50mm.

The design of STMSS-F includes design of complete track system including track slab and rubber mat considering technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The mat shall be tested for fatigue as per approved ITP.

The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.

The indicative pictures of STMSS-F for reference purpose only are given below:



STMSS-F

5.3 Discrete steel spring (or similar type) Slab Track Mass Spring System (STMSS-S)

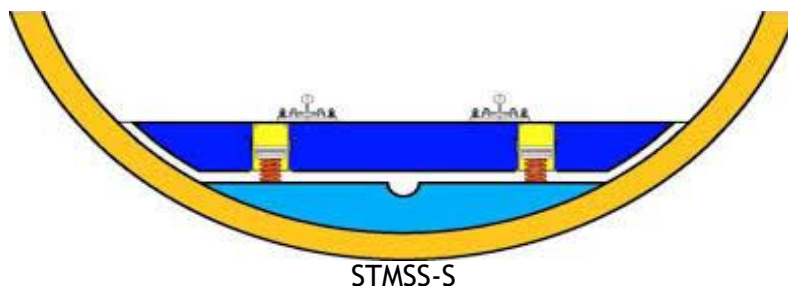
Design, supply and installation of discrete steel spring Slab Track Mass Spring System (STMSS) for vibration attenuation of 28 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-S shall be so designed that the Natural Frequency of complete track system remains below 6 Hz. The proposed MSS shall restrict the maximum rail deflection up to 6mm.

The proposed STMSS-S can be steel spring type or any other proven type. The steel spring type or any other proven type STMSS shall be designed for standard gauge track to suit the internal tunnel diameter of 5800mm and top of rail from tunnel invert level at 730mm (diagram enclosed). The air gap between bottom of slab track and top of tunnel base shall not be more than 50mm. There shall be no overlap between foot of rail and any part of steel spring system other than console.

The design of STMSS-S includes design of complete track system including track slab and steel spring or any other proven type considering technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. The total available depth from top of rail to tunnel base slab/1st stage concrete is 550mm (maxi). This depth is applicable for circular tunnel, cut & cover tunnel and NATM tunnel. Fatigue analysis of MSS shall be part of detailed design submission. The bearings shall be tested for fatigue as per approved ITP.

The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.

The indicative pictures of STMSS-S for reference purpose only is given below:



5.4 Slab Track System with low dynamic stiffness fastening system (ST-LDS)

Design, supply and installation of Slab Track System with low dynamic stiffness fastening system (ST-LDS) for vibration attenuation of 14 VdB in the frequency range of 25 Hz to 45 Hz. The ST-LDS shall be so designed that the Natural Frequency of complete track system remains below 20 Hz. The dynamic stiffness of LDS fastenings shall be within 4KN/mm to 8KN/mm.

The proposed MSS shall restrict the maximum rail deflection up to 6mm. The proposed LDS fastening system should be proven type and approved by Railway Board for use on passenger lines. The design of ST-LDS shall consider the sufficient transition length for facilitating gradual change in stiffness from “Double Resilient Base Plate Fastening System” to Low Dynamic Stiffness Fastening System and vice-versa. The total available depth from top of rail to tunnel base slab/1st stage concrete is 550mm (maxi). This depth is applicable for circular tunnel, cut & cover tunnel and NATM tunnel. Fatigue analysis of LDS shall be part of detailed design submission. The assembly shall be tested for fatigue as per approved ITP.

The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender. In addition, the proposed system should be approved by Ministry of Railways (MoR).

The indicative pictures of STLDS for reference purpose only are given below:



Note: The quantity of above group of items may increase or decrease by 50% of BOQ quantities without any rate revision. Thus, the rates quoted by the contractor shall be applicable to the quantity varying from 50% to 150%.

8.9 DESTRESSING OF CWR

8.9.1 General

- 1) The de-stressing of rails shall not be undertaken until it has been demonstrated to the Engineer's satisfaction that the Track has been completed to the specified standard & specification and the method of working for de-stressing of the relevant Track form has been approved by the Engineer.
- 2) The final welding of joints within turnouts shall be undertaken as per sequence as approved by Engineer and within the stress-free temperature range.

- 3) The elementary long welded rail shall be laid on rollers placed on the metal base plates or sleeper rail table, with the rollers at maximum 6.00-m intervals. In any case, rollers shall have suitable diameter to avoid contact between rail and intermediate metal base plates.
- 4) After placing the long-welded rail on rollers, it shall be stress relieved by hitting the rail on each side of the head with wooden mallets as approved by Engineer.
- 5) For de-stressing of CWR, guidance may be taken from LWR manual of Indian Railways.
- 6) The rails for continuously welded Track shall be de-stressed in accordance with temperature conditions as per LWR manual of Indian Railways.

8.9.2 Buffer stops

- 1) The installation details for friction buffer stops shall be submitted by contractor as per manufacturer's guideline for Engineer's approval.
- 2) Friction buffer stops shall not be installed until the Track is at the designed line and level, as approved. The following requirements shall be complied with:
 - There shall be no thermic weld within the rail length of the buffer stop or the rail sliding length of the buffer. Any weld that falls within the friction buffer stop rail sliding length shall be ground to produce a smooth and uniform standard rail cross section to ensure that the performance of the buffer stop is unaffected.
 - Friction buffer stops shall be assembled and installed with the sliding shoe bolts torqued strictly in accordance with the manufacturer's instructions.
 - After installation of buffer stop at site and inspection by manufacturer the contractor shall submit the buffer stop installation certificate issued by the manufacturer.

8.10 RAIL WELDING

8.10.1 General

- 1) All main lines shall be welded into a LWR by flash butt welding process except at location as approved by the Engineer. Alumino-Thermic welding shall only be permitted in exceptional circumstances when dictated by site conditions/ constraints and as approved by the Engineer. In terms of Manual of Flash Butt Welding issued by MOR (Latest) the contractor is required to obtain the approval of RDSO for the deployed Flash Butt Welding Plant.
- 2) The welding process shall be suitable for UIC60/ 60E-1 Rail sections of rail grades IRS-T-12-2009 1080 grade head hardened.
- 3) Weld records of all welds shall be submitted at intervals not exceeding 1 km of rail welded into long lengths. The proforma for the weld records plan shall be submitted by contractor for Engineer's approval. This record shall contain, as a minimum, the following information:
 - (a) Weld chainage to the nearest metre,
 - (b) Weld number,
 - (c) The rail grade and section,
 - (d) Date welded,
 - (e) Weld test record sheet reference (if different to the weld number),
 - (f) USFD test results
 - (g) Dimensional check results
- 4) Arrangements shall be made to have test welds and their testing for proving of the flash butt welding technique, the Alumino-Thermic weld process and competence of welders deployed for welding work.

- 5) The welds shall be finished to final profile by controlled profile grinding as approved by Engineer. The finished weld alignment shall be as per specified tolerances. Railhead profile grinding to produce the finished alignment shall not extend more than 300mm on either side of the weld.
- 6) All welds shall be numbered, and stickers provided as per the provisions of the relevant welding manuals as mentioned in AT Weld Manual.

8.10.2 Flash-butt welding

8.10.2.1 General

- 1) The Flash Butt Welding of rail joints shall be undertaken in accordance with the relevant Indian Railway Manual for Flash Butt Welding of rail as mentioned in clause 5.3(9). And as supplemented in this section.
- 2) For 1080 grade HH rails, the minimum breaking load and minimum deflection as mentioned in the relevant clause of Indian Railway manual for flash butt weld shall be such that the weld shall not show any sign of cracking up to the specified rail deflection and the load at this deflection shall be more than specified minimum breaking load. The values of specified deflection and specified minimum breaking load shall be as mentioned in the Indian Railway manual for flash butt weld (latest version). 3 samples of flash butt weld shall be got tested for fatigue test in laboratory approved by the engineer. The test scheme and arrangements should have prior approval of the engineer.
- 3) Rails outside the required end straightness tolerance shall not be welded. Rail ends that are out of tolerance for straightness after welding may be straightened by the use of a custom made rail end straightener as approved by Engineer and cause no damage/indentation to the rails, Alternatively the rail ends may be cut and rewelded, in which case the payment of such weld shall not be made to the contractor and the cost of associated rail length shall be recovered from the contractor.

8.10.2.2 Welder qualification - All flash-butt welding machine operators shall be trained and certified either by the manufacturer of the machine or by an independent Institution as approved by the Engineer

8.10.2.3 Flash-butt welding quality control - Depending upon the cause of any defective weld it may be necessary to test sample welds from the previous shift production run as directed by the Engineer. The necessary tests, as instructed by the Engineer, shall be at the Contractors expense. If any of these welds fails in testing, welding shall immediately stop until the cause is identified and rectified. After rectification it shall be demonstrated by the Contractor to the Engineer that all similarly affected welds have been removed from the Track.

8.10.2.4 Flash-butt welding plant

- 1) The flash-butt welding machine shall be mobile type (road cum rail) capable of welding even in situ welds.
- 2) The welding clamps of rail shall provide contact area along the entire web of rail and shall be fitted with spring-loaded balls for optimum alignment of rail ends.
- 3) The welding head shall be equipped with an integrated shearing device for shearing of the weld seam automatically, immediately after the welding process has been finished suitable for UIC 60/60 E-1 IRS-T-12-2009, 1080 HH grade.
- 4) A recorder system shall be provided for the simultaneous recording of butting pressure, upset, and magnitude of current and duration of welding.
- 5) Air quenching shall be done as per approved procedure for HH rail welding and contractor shall arrange plant and machinery etc for that.
- 6) All welders shall have competency certificate issue by manufacturer of the the approved welding process and as per prescribed by RDSO.

8.10.3 Alumino-Thermic welds

8.10.3.1 General

- 1) An Approved Alumino-Thermic short preheat welding process as per Indian Railway manuals shall be used for the welding of joints. The weld shall be undertaken in accordance with the relevant technical specification for approval of a process and portions supply for Thermit welding of rails and relevant technical specification for performance and acceptance of Thermit welding of rails of Indian Railways as mentioned in clause 5.3(9).
- 2) Where rails of dissimilar rail steel grade are to be welded together the weld portion to be used shall be that of the higher-grade rail.

8.10.3.2 Qualification of welders for Alumino-Thermic welds - All Alumino-Thermic welders shall have competency certificate issued by manufacturer of the approved welding process or by an independent institution as approved by the Engineer.

8.11 PERMANENT MARKERS

8.11.1 General

- 1) As the Track is completed permanent markers shall be provided and installed as follows:
 - (a) Kilometre markers,
 - (b) Hectometre markers.
 - (c) Change of gradient markers,
 - (d) Curve Reference markers,
 - (e) LWR/CWR reference markers
 - (f) Fouling point markers,
 - (g) Turnout markers.
 - (h) Creep Marker.
- 2) All permanent marker plates/boards shall be of high intensity retro-reflective micro prismatic and confirming to ASTM-4956. Size of permanent marker boards, colour scheme & fixation arrangement proposed to be used shall have prior approval of Engineer.
- 3) All information to be marked on the markers shall be submitted by the contractor for Engineer's approval.
- 4) All markers required to be painted on rail for curves and turnouts etc. shall be paint marked by the contractor. The scheme for which shall be submitted by the contractor for Engineer's approval.

8.12 TRACK TOLERANCES

8.12.1. General

- 1) The Track parameters of completed Track work shall be measured by contractor in the presence of the Engineer and the measurement recorded shall be in a format approved by the Engineer and submitted both in hard and electronic copy.
- 2) The variations in horizontal alignment, vertical alignment versine's, cross level/cant, twist and gauge shall not exhibit cyclic patterns.
- 3) All the Track parameter measurements shall be taken in the unloaded condition of the Track. The base of measurement shall be as below:
 - Each sleeper or base plate for the gauge,
 - 3 metres for the cant, cross-level and twist,
 - 20 metres (half overlapping) for lining and
 - 10 metres (half overlapping) for vertical profile
- 4) The contractor shall be solely responsible for achieving Track tolerances stipulated in clause 8.12.2 with the materials supplied by the contractor and the Employer as per contract.

8.12.2 Dimensional tolerances

1. Track tolerances shall comply with the following limits:

- a) Gauge (with reference to 1435 mm)
 - Maximum variation over the prescribed Track gauge Ballastless Track: +2mm, -1mm
 - Maximum variation in Track gauge 1mm /sleeper or base plate
- a) Maximum difference of any point in relation to the designed layout (vertical)
 - Ballastless Track: -4mm/+4mm
- c) Difference of any point in relation to the designed layout (horizontal)
 - Straight Ballastless Track: ± 4 mm
- d) On straight and curve, deviation of measured versine over its designed value on a 20 m chord (half overlapping):
 - Ballastless ± 2 mm
- e) On constant grade and vertical curves, Maximum deviation of measured versine (vertical) over its designed value on a 10 m chord (half overlapping)
 - i) Ballastless ± 2 mm and ± 3 mm on a 20 m chord
- f) Cant/Cross Level (to be measured at every 3m)
 - i) Straight Track and curved Track (Ballastless) ± 1.5 mm
Deviation from designed value
Base plate to base plate (Ballastless) variation of cant/x-level ± 1 mm
- g) Twist: maximum value on a base of 3 m (Ballastless)
 - Straight and circular portion of curve = 1mm/m
 - On transition portion of curve (over & above designed value) = 0.5mm/m
- h) Turnouts (Ballastless)
 - Stock rail joint (longitudinal location) ± 15 mm
 - Nose to nose of Xing in crossovers ± 10 mm
 - Flangeway clearance
at end of the switch planing ± 5 mm/-0mm
 - Switch toe opening ± 1 mm -0mm
 - Switch toe squareness 5 mm
 - Deviation of measured versine over its designed value for switches, lead Track (measured on 6 metre half overlapping chord) ± 2 mm
- i) Sleeper/Base plate
 - Spacing ± 10 mm -
 - Sleeper/base plate perpendicular to rail centre line (out of square) 5mm
- j) Rail joint squareness across the Track - (fish plated) 10mm

8.12.3 Methods of measuring and recording

- (1) The completed Track geometry shall be measured for the following Track parameters as a minimum:
 - (a) Gauge
 - (b) Horizontal Alignment (Versine) of minimum one rail
 - (c) Cross Level/Cant
 - (d) Twist
 - (e) Vertical unevenness (Right hand rail)
 - (f) Vertical unevenness (Left hand rail)

- (2) The proforma for the measurement of Track parameter submitted by contractor for Engineer's approval shall consist of the following as a minimum:
- A common base point for recording of location
 - Cross level/cant
 - Gauge
 - Horizontal alignment (versine)
 - Vertical unevenness both for right & left rail.

The proforma shall show the design figure, actual figure and the difference between design and actual and shall allow columns for marking of twist.

- The horizontal versine shall be measured every 10 m (half chord point) using a 20m chord and moving forward at 10 m intervals. The versines shall be measured on the inside running edge of the outside rail in curves and either rail of straight Tracks at points 14mm below top of rails. Where a recording changes its measuring rail there shall be a minimum overlap of readings of 60 meters.
- The as-built recordings of rail level and horizontal alignment along longitudinal direction with respect to the designed level & alignment shall be obtained by the use of appropriate electronic survey instruments as directed by the Engineer. Horizontal location readings shall be presented as coordinates. Deviation from designed co-ordinates shall also be shown.
- The vertical and horizontal rail location readings shall be taken at coincidental kilometrages. The recordings of rail level and horizontal location shall be taken at the intervals as proposed by the Contractor and Approved by the Engineer.
- Longitudinal locations shall additionally include, but not be limited to, switch and crossings locations.
- Rail inclination shall be measured using a custom made digital rail inclinometer and the recordings shall be submitted by contractor for the Engineer's approval.

8.13 RECORDS

The manual records of rail level, cross-level/cant, gauge, twist, versine along longitudinal location and horizontal alignment with reference to the designed locations shall be presented both electronically and in hardcopy.

8.14 Rail Gauge face lubricator

Rail Gauge face lubricator requirements:

- Rail Gauge face lubricators approved by Engineer shall be of mechanical lubricator to operate properly and efficiently with lubricant which its properties prescribed in Table-1.
- High pressure, low volume pump effectively covers the rail with just enough lubrication, no waste, no clogging of lubrication ports.
- Rail Gauge face lubricator reservoir shall be of 10 -15 kg .
- Pumping lubricant quantity per stroke shall be 0.1 -0.15 gram.
- Grease application: Positive displacement a constant, metered volume of grease is delivered equally to each lubrication port regardless of back pressure and/or cold weather conditions.
- Lubricator shall be installed to the Track without rail drilling.
- Lubricator shall include a means of checking and adjusting the amount and position of lubricant dispensed.
- The means of adjusting the height of the lubricant application unit shall be separate from the means of installing to the rail.
- Lubricator shall be on a safe distance from the on-Track vehicles, in such a way that it cannot be damaged as a result of rail maintenance work.

10. Lubricators shall be designed and manufactured from materials which the nature and main characteristics and chemical composite shall be stated and their fluffiness to the requirements of the relevant standards.
11. The means shall be provided in the lubricator to indicate the quantity of lubricant remaining in the lubricant reservoir.
12. Lubricant material shall be hot weather resistant materials, UV protected and corrosion free.
13. Lubrication systems shall apply to the rail and holds that lubricant in place allowing the wheels to grab and carry it around the Track curve.
14. Lubricant filler equipment shall be a manually device and shall be designed for quick and efficient lubricant filling with minimum hands dirty and soiling the ballast and the ground.
15. The lubricant filler equipment shall enable filling the lubricator reservoir efficiently. It shall include all means to pump lubricant from tanks (pails, Kegs, drums) with different sizes and capacities.

Lubricant requirements are in accordance with EN 1 6028, Annex A, table A.1:

Property	Unit	Test Method	Values
Appearance	-	Visual	Homogenous
Colour	-	ISO 2049 or equivalent	Homogenous
Consistency	-	ISO 6743 -99	1 or 1.5
Worked grease penetration 60 stroke @ 25 0C.	0.1 mm	ISO 2137 or equivalent	290 -340
Drop point	0C	ISO 2176 or IP 396 or equivalent	≥ 150
Flash point	0C	EN ISO 2592 or equivalent	≥200
Water Content	% mass	ISO 760 or DIN 51777-2 or ISO 3733 or equivalent	≤1.0
Water resistance @400C	Level	DIN 51807-1 or equivalent	1
Adhesion to sheet steel (0.05 mm, 24 h @ 600C)	Stage	EN 16028, Annex D	1
Volatile Components	% mass	EN 16028, Annex E	≤ 10
Oil Separation/" bleeding "(168 h (7 days) @400C)	% mass	DIN 51817 or its equivalent standards	7% maximum by weight for NLGI No. 1 grease

Corrosion test-steel	Rating	ISO 11007 using water or its equivalent standard	0;0
Corrosion test-copper	Grade	DIN 51811 or equivalent	1
Compatibility with elastomers (600c for 168 h) - change in hardness for NBR 1	IRHD	ISO06072 or its equivalent standard	± 8
Identity testing: Using Infra-red, or X-ray fluorescence, or Inductively coupled Plasma		Standard laboratory method: DIN 51418-1, DIN 51418-2, DIN 51451, DIN51820-1 or its equivalent standard	
Apparent viscosity (10 cone, s-300 s, D= 1000 s-1 @250 C	mPa. s	DIN 51810-1 or its equivalent standard	≥ 150
Apparent viscosity (10 cone, s-300 s, D= 1000 s-1 @ 00 C	mPa. s	DIN 51810-1 or its equivalent standard	≥ 400
Apparent viscosity (10	mPa. s	DIN 51810-1 or its equivalent standard	≥ 4000
Cone, s-300 s, D=1000 s_1@ - 250 C		Standard	
Four ball test-wear test rating (300 N, 1 h@ 1500 r/min	mm	DIN 51350-5; Method D or its equivalent standard ≤	≤0.8
Four ball test-Extreme pressure	Kg	DIN 51350-4	Weld load not less than 31 kg
Effect of water (water wash - off	Visual	EN 16028, Annex B	No corrosion after 72 h
Biodegradability	%	OECD suite or its equivalent standard	>60 after 28 days

9. MATERIAL AND WORKMANSHIP: TESTING AND INSPECTION

9.1 GENERAL (For the materials to be supplied by the contractor)

9.1.1 Laboratory testing

- (a) All materials, components and assemblies shall, unless otherwise noted, be inspected & tested by an Approved independent inspecting agency as approved by Engineer on case-to-case basis to demonstrate that they satisfy the Employer's requirements, when tested in accordance with the specified procedures. Where no procedure is specified, the Contractor shall propose suitable standard or particular procedures for Engineer's Approval.
- (b) The employer will select a few samples of material and the contractor will get these tested in an independent laboratory / Institution for ascertaining its compliance with the applicable performance criteria in presence of employer/authorised representative. Cost of such tests either in India or outside India along with travelling and accommodation of Engineers shall be borne by contractor.

9.1.2 Quality Assurance

1. All materials, components or assemblies shall be tested and inspected at the frequency stated within the present Specification.
2. A comprehensive schedule of all material inspection/tests at the required/specified frequency of testing shall be submitted by the Contractor for engineer's approval.
3. A sample Proforma, with typical examples, for the material inspections/tests shall be submitted by the Contractor for Engineer's approval.
4. On receiving Approval of the material inspection/test schedule, the Contractor shall follow the schedule to prepare the required individual test and inspection plans and submit for Engineer's approval.
5. Such of those tests and inspections, for which Engineer has opined to witness, shall be carried out only in the presence of Engineer. For other tests & inspections test/inspection results and certification thereof shall be submitted as directed by Engineer for his approval. However, Engineer may at his discretion conduct test checks to be organised by contractor for validation of test/inspection results.
6. Suitable Proforma for the recording and witnessing of all tests and inspections shall be submitted for Engineer's Approval. Confirmation of date of a test or inspection shall be presented on an Approved Proforma, not less than 21 Days prior to the date for test / inspection.
7. No material, component or assembly shall be shipped until the clearance for this has been obtained from the Engineer.
8. Should the items to be tested or inspected fail to meet the requirements of this Specification, necessitating additional visits to the laboratories or works for retesting or inspection the costs of these additional visits shall be at the expense of the Contractor.
9. Periodically, during the Contract the Engineer may conduct inspections of manufacturing activities at the premises of the Contractor and those of his suppliers and subcontractors. Such inspections shall include quality procedure checks, witness inspections, both routine and prototype, & shall also be for the purpose of monitoring progress. During each inspection suitably, qualified staff shall be provided by the Contractor.
10. Client reserves right to witness any test, quality procedure etc.

9.2 Material and components supplied by the contractor - All material and components supplied by the contractor shall be inspected and tested in accordance with the relevant technical specification of Indian Railways as mentioned in clause 5.3(9).

9.2.1 Welding

General

- 1) All Welds (Flash butt and alumino-thermic) shall be tested ultrasonically as per relevant Manual for Ultrasonic testing of rails and welds as mentioned in clause 5.3(9).
- 2) All the defective welds whether identified as a result of USFD testing or otherwise shall be removed from the Track and rewelded by the contractor. The cost of all the rewelding of the defective/rejected welds and that of associated rail length including cutting of rails, adjustments and all related works shall be borne by the contractor.

9.2.1.1 Welding materials - Welding materials for Alumino-Thermic welding shall be tested in accordance with the relevant technical specification for approval of a process and portion supply for thermit welding of rails if Indian Railways as mentioned in clause 5.3(9).

9.2.1.2 Flash-butt weld tests - Tests for Flash-Butt Welding shall be carried out in accordance with the Indian Railways Manual for Flash Butt Welding of Rails as mentioned in clause 5.3(9) and as detailed in clause 8.9.2.1 of PS. The contractor is liable to provide all relevant information to get clearance for FBW from RDSO.

9.2.1.3 Alumino-Thermic weld tests - Tests for Alumino-Thermic Welding shall be carried out in accordance with the Indian Railways Manual for Alumino-Thermic Welding of Rails as mentioned in clause 5.3(9).

9.3 SWITCHES AND CROSSINGS

9.3.1 Switch inspection & crossing inspection (installation tests)

1. Switches with fixed heel shall be checked as full sets. Running edge offsets and gauge shall be checked at coincidental locations, on both the main and turnout Track.
2. Running edge offsets shall be taken at maximum 1000 mm intervals. Running edge offsets shall be within +2mm/ - 1 mm of their design value.
3. The inspection of switches and derailing switches shall include, but not be limited to, the following:
 - (a) The switch rail evenly butts with the stock rail throughout the length of the switch planning with the switch lying naturally.
 - (b) The underside of the switches and stock rails bear evenly on all slide base plates.
 - (c) All dimensional checks of opening of switch, gauge, alignment, cross level offset, lead, check and wing rail clearances nose to nose and flange ways are within tolerance.
 - (d) The switch rails over their free length are not twisted/bent.
4. The switch toes shall not be out of square/beyond specified tolerances.
5. Crossings shall bear evenly on all base plates.

9.4 BUFFER STOPS

1. The fabricated buffer stops may be inspected by the Employer/Engineer at place of manufacturing (Factory). The buffer stops shall only be shipped after completion of Factory Acceptance Test (FAT). Necessary assistance shall be provided by contractor to facilitate the inspections. A minimum of 21 days' notice in writing of the dates on which the buffer stops will be available for inspection shall be given to the Engineer.
2. The buffer stops shall have the identification plates fixed, prior to the inspection, and these identification plates shall be maintained until the acceptance of the buffer stops in the Works.
3. Inspection sheets shall be prepared and submitted for Approval of each assembly clearly showing the design and actual dimensional checks, item number and identification marks.

9.5 TESTS ON COMPLETION

9.5.1 General

1. Tests on Completion are to be undertaken in accordance with the provisions of Clause 8.4 of General Specification. The Tests on Completion are deemed to include the submission and Approval of all of the documentation identified therein and in the specified format.

9.5.2 Submissions - Before any Section of the Works is put for inspection and sanction Commissioner Metro Railway accepted as complete the following information shall have been submitted for the approval of the Engineer:

- (a) Records and certification for all the tests and inspections identified in PS.
- (b) As-built records/drawings of the following:

- Vertical Alignment
- Horizontal alignment
- Recording unit traces of versine, gauge, twist, cant/cross-level & rail top longitudinal profiles
- Weld record plan
- All weld test results as detailed in this section, de-stressing records
- Distance in kilometres, co-ordinates, offsets of all permanent Track markers
- Rail Inclination records

(c) The results and reports of all tests and materials, assemblies and items/components.

(d) The results of all Tests shall be submitted in hard copy and electronic format in accordance with Clause 5.1(4) of PS.

9.5.3 Rail insulation to earth test

1. All Track work shall be subjected to a rail insulation to earth test. The Track shall have a minimum rail-to-earth value of 10 ohms/km of single Track for Ballastless Tracks in worst weather conditions.
2. The rail to earth test shall be undertaken after the Track has been completed and cleaned but before it is finally formed into a continuously welded system and before all the bonding is installed.
3. The test shall be undertaken on rail lengths up to maximum length of 1000 m.
4. The Track shall not be finally formed into a continuous length, until the rail insulation to earth tests have been undertaken and approved.

9.5.4 Rail to Rail insulation test

9.5.4.1 Deleted.

9.5.4.2 Ballastless Track base resistance test

1. A Ballastless Track base test shall be undertaken on all Track lengths over 50 metres as a check of the leakage of current through the Track base and rail fastening system from one rail to the other.
2. The Ballastless Track base resistance test shall be undertaken after the Track has been complete and cleaned but before it is finally formed into a continuous length & all the bonds are attached.
3. The testing procedure and the minimum resistance shall comply with the requirements proposed by interfacing with designated Signalling contractors.

9.5.5 Rail inclination inspection

1. Both rails of all Ballastless running line Tracks shall be checked, at maximum 10 m intervals, for inclination using a custom made Approved digital inclinometer in the presence of the Engineer.
2. Should any reading show the inclination to be outside the specified limits every alternate fastening assembly shall be further checked on either side of the non-compliant reading until compliant readings are consistently obtained.
3. If the length of rail outside the specified inclination exceeds 9 m, the out of tolerance lengths shall be rectified by the Contractor by a method approved by the Engineer.

9.5.6 The procedure / values mentioned in Para 9.5.3, 9.5.4.1 & 9.5.4.2 are indicative, and these tests are to be carried out by the designated contractors. The actual values / procedure of these tests shall be interfaced by the contractor with the designated Contractors.

10. Design of Track Structure

10.1 Arrangement - In general the elevated viaducts the rails will rest on individual plinth for plain Track with the derailment containment up-stand on the outside of the Track and in turnouts/ crossovers, the Track shall rest on RCC slab.

10.2 Not used.

10.3 Detailed Design of Track - On award of the contract, the contractor shall be required to submit a detailed design for the Track structure of all types and its various components and fixtures within the period stipulated. The design shall conform to the current International Railway practices and in various codes and specifications stipulated in this document. The Design shall also conform to the Approvals/Sanctions granted by the Ministry of Railways/RDSO, Government of India, for the components of the Track Structure.

On Viaduct structures plain line Tracks shall be supported by reinforced concrete plinths with integral derailment walls constructed on the outside of the running rails clear of the Track fastenings and to the same height as the top of the rails.

The plinths shall be discontinuous, no more than 5m long, with gaps of 100-200mm to permit drainage and cabling and to limit structural interaction with the viaduct decks.

If provision of check rails is necessary on the inside of curves, the plinths will be widened as necessary to accommodate the fixings of check rails. The check rail supports shall be located between the running rail fasteners and shall be installed after final alignment adjustment of the running rails on 4mm GI plates provided over approved grouting.

Turnouts and crossover layouts on the viaducts will be resiliently mounted on reinforced concrete Track slabs.

The key slabs will be monolithically connected to the viaduct by the shear connector reinforcements provided by Civil Contractor. Shear connectors of 16 mm diameter rebars at 200 or less mm spacing have been arranged to be provided on the viaduct segments by the civil contractor. The Track contractor shall consider this during his design of Track structure and any additional shear connectors required to be provided based on final design of Track shall be executed by the contractor. In cases where the viaduct construction is already in progress without provision for shear connectors, the Track contractor shall provide the shear connectors by drilling holes on the viaduct for housing shear connectors and grouting with suitable material. The Methodology of drilling on the viaduct shall be devised with the approval of the civil contractor.

11. The Contractor shall ensure drainage pipes, channels and basins/sumps included as part of the structural provisions within the first stage concrete poured in consultation with the Interface contractors in Viaduct and UG.

12. Loads and Requirements**12.1 General**

The railway loading applied to structures on the Project shall be as per “Modern rolling stock”. Dead loads shall be used that are in accordance with IRS Bridge Rules and IS 456 (for buildings) and IS 1911 for unit weights of materials.

- 12.2 Loading Combinations Each component of the structure shall be designed and checked for all possible combinations of applied loads and forces. They shall resist the effect of the worst combination. However, all combinations of rolling stock loading shall be coordinated by the Interface Contractors.

- 12.3 Types of Loads - For the purpose of computing stresses and deformations, the following minimum load types and consequential effects shall be taken into account as applicable.

- Dead loads (including notional loads) DL
- Live loads LL
- Dynamic (Impact) loads DY

- Earth pressure loads EP
- Track curvature or eccentricity CE
- Temperature loads TE
- Longitudinal (inclined traction, braking) loads LF
- Racking loads RF
- Wind loads WL
- Seismic loads EQ
- Erection loads ER
- Buoyancy BU
- Differential settlements DS

12.4 Dead or Static Load

This shall consist of loads due to:

- Track work: Load due to UIC rails and other fittings and accessories.
- Track bed: RCC blocks or concrete pour or precast slabs in RCC with inserts and fittings in case of ballast less Track.

Other loads: As per Indian Railway Standards (IRS) and Bureau of Indian Standards (BIS)

- 12.5 Fatigue Loading** - The nominal loading for the design of members in accordance with fatigue requirements shall comprise trains with six individual cars each having four axles, the axle loads, and vehicle lengths provided by the Rolling Stock Supplier. Fatigue load histories shall be evaluated to provide valid and representative design spectra, with stress histories analysed by the rain flow or equivalent method, both in conjunction with the projected annual tonnages of rail traffic per Track.
- 12.6 Dynamic Loading** - The static and fatigue loadings shall be multiplied by an appropriate dynamic load factor (or impact factor) for the design element under consideration. Dynamic load factors need not be applied to centrifugal loads or braking & traction loads. Horizontal components of vertical loads on canted rails are not considered as centrifugal loads.
- 12.7 Longitudinal Loads** - Longitudinal loads from braking and traction shall be a minimum of 18% of live load per Track. When a structure carries two Tracks, both Tracks shall be considered to be occupied simultaneously. Traction forces shall be considered as acting on one Track and braking forces acting on the other, with both forces acting in the same direction simultaneously to produce the worst loading condition in the rails and supporting elements. Longitudinal forces acting on the Track shall be considered to be dispersed through the Track before being transmitted to the substructure. This shall be calculated based on IRS Bridge Rules, IS Codes and other relevant Codes deemed applicable in relevant instances (ACI, AASHTO, ASCI, BSI-EN). Provisions shall be made in supporting elements for the effects of horizontal and longitudinal forces transferred to rails, especially in girders with ballast less deck. Additional stresses while considering this contingency may be proposed by the Contractor. Forces shall then be calculated for the case of interaction between continuous welded rails and a concrete structural support resulting from temperature differentials of the rail and concrete base. Longitudinal forces shall consider the effects on stability and safety of the applied axle-loading arising from a broken rail on ballast less Track.
- 12.9 Centrifugal loads** - Centrifugal loads acting transversely to line of rail movement due to Track curvature and rail cant are to be considered in the design. The effects are to be considered for the various Track, Track bed, structural elements and interface locations.
- 12.10 Train Derailment Loads** - The impact on adjacent structures due to derailment shall be considered at relevant locations for the appropriate quanta of impact loads specified by Authority. The adjacent structures are to be protected by direct means (e.g. strengthening) or indirect means (e.g. repositioning rail alignments or providing barriers) to ensure these structures are still functional after an impact occurs. It is required to mitigate impact effects on elements that may be adversely affected without enhancements.

- 12.11 Wind Loads** - Wind loading primarily affects elements of underground structures such as vent-shafts, entranceways, cooling towers and pedestrian bridges. It is also a factor on temporary structures during construction. The relevant Indian Standards shall be applied to determine the appropriate design wind loads in combination. Wind effects from venting in below-ground areas are to be designed for appropriately.
- 12.12 Temperature Loads** - Forces may arise from a thermal gradient within a structural element; this may be from external sources or, in the case of fresh concrete, from the internal heat of hydration during curing.

It is expected that these forces are considered in combination with those from other types of loads to determine the worst loading condition. 'Lock-in' forces from temperature effects (e.g. from curing of concrete) shall be considered as a permanent load and due allowance made in the design for forces from such loading.

Temporary works with structural steel bracing elements or similar may also suffer adverse effects from thermal strains; these may be required to be mitigated to avoid losses in preloading and subsequent excessive deformations in structural members.

- 12.13 Seismic Loads** - Seismic effects shall be considered on all structures, including underground structures. Details for evaluation of loading shall be in conformity with Indian Standards or alternatively, to other relevant seismic standards when the Indian Standards may not be applicable. The zone demarcations on levels of seismicity are required to be evaluated as per the relevant Indian Standard. Where two or more zones are deemed to act on a structure, the more onerous level of compliance shall be used in the design when a static lateral force analysis approach is used. Alternatively, the structural loads can be directly evaluated using a dynamic lateral force (response spectra) approach.

The structure is required to be evaluated as an 'essential facility' for the purposes of occupancy evaluation. Seismic design using a response-spectra approach requires adopting the more onerous loading from strong-motion data from recent seismic events in the Chennai region or any other strong motion data with similar geological conditions, suitably factored for intensity in the region. The effects of load changes dependant on soil behaviour (e.g. liquefaction) must be accounted for in the assessment and design where appropriate.

Assumptions and data on seismic impact are to be approved by the Engineer. Seismic event reporting and recording devices shall be provided to advise of and record a seismic event of sufficient intensity to cause potential damage to facilities. The devices shall be installed at intervals and locations to provide comprehensive coverage of the Metro Rail System. Unless otherwise directed by the Fire / Life Safety Committee, devices shall be set to be triggered when ground movement occurs that is equivalent to a pre-determined Modified Mercalli event acceptable to the Engineer. Seismic alarms shall be annunciating at OCCB.

- 12.14 Construction (Erection) Loads** - The weight of all permanent and temporary materials together with all other forces and effects which can operate on any part of structure during erection shall be taken into account. Allowances shall be made in the permanent design for lock-in stresses caused in any member during erection.
- 12.15 Shrinkage and Creep Loads** - Provisions shall be made for the effects of shrinkage and creep within concrete structures. This includes interface shear transfer mechanisms as a result of differential creep and residual shrinkage effects from staged casting of concrete elements. The evaluation of creep and shrinkage parameters can be carried out using the methods outlined in the relevant Indian Standards or by testing.
- 13. Electrical Interface** - The plinth / RCC slab electrical continuity shall be ensured by the Contractor duly interfacing with the designated Power Supply & Traction (PST) Contractor.
- 14. Noise and Vibration Mitigation During Construction**

- 14.1** The vibration levels should be restricted so as not to cause discomfort to human beings on the adjacent road as well as those in residences/work areas in the vicinity. The contractor shall work with the concerned Interface contractors to limit vehicle induced ground- borne vibration in structures in the vicinity of the railway alignment to acceptable level.

Maharashtra Metro Rail Corporation Limited (Maha-Metro)

PUNE METRO RAIL PROJECT

BID DOCUMENTS

FOR

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project

TENDER NO.

P1-T06/2021

ANNEXURE “Q”

TECHNICAL SPECIFICATION FOR LAYING OF CONCRETE AND REINFORCEMENT

SECTION - 1

GENERAL

1.1 General:

- 1.1.1 Absence of terms such as providing, supplying, laying, installing, fixing etc in the descriptions does not even remotely suggest that the Contractor is absolved of such providing, supplying etc unless an explicit stipulation is made in this contract. The Employer shall bear no costs of materials, labour, equipment, duties, taxes, royalties etc.
- 1.1.2 The specifications may have been divided into different sections / sub-heads for convenience only. They do not restrict any cross-references. The Contractor shall take into account inter-relations between various parts of works/trades. No claim shall be entertained on the basis of compartmental interpretations.
- 1.1.3 The classification of various items of works for purposes of measurements and payments shall be as per bills of quantities (BOQ) and apply to all heights, depths, sizes, shapes and locations. They also cater for all cuts and wastes
- 1.1.4 Contractor to Provide:

The Contractor shall provide and maintain at site throughout the period of works the following at his own cost and without extra charge, the cost being held to be included in the Contract Rates

 - 1. General works such as setting out, site clearance before setting out and on completion of works. All weather approach roads to the site office should also be constructed and maintained in good condition.
 - 2. All labour, materials, plant, equipment and temporary works, overhead charges as well as general liabilities, obligations, insurance and risks arising out of GCC, required to complete and maintain the works to the satisfaction of the Engineer.
 - 3. Adequate lighting for night work, and also whenever and wherever required by the Engineer.
 - 4. Temporary fences, barricades, guards, lights and protective work necessary for protection of workmen, supervisors, engineers, General public and any other persons permitted access to the site. Contractor shall provide proper signages as directed.

All fences, barricade shall be painted with colour shades as specified by the Engineer.
 - 5. All equipment, instruments, labour and materials required by the Engineer for checking alignment, levels, slopes and evenness of surfaces measurements and quality etc.
 - 6. Design mixes and testing them as per relevant clauses of specifications giving proportion of ingredients, sources of aggregates and binder along with accompanying trial mixes. Test results to be submitted to the Engineer for his approval before adoption on works.

7. Cost of Preparation and compliance with provision of a quality assurance control program.
8. Cost of safe guarding the environment.
9. A testing laboratory as specified by the Engineer equipped with the following minimum apparatus, materials and competent trained staff required for carrying out tests, as specified in the relevant sections of the specifications: -
 - i. 1 Set of standard sieves for testing and grading of sand with mechanical sieve shaker.
 - ii. Sieves with openings respectively of 4.75mm, 10mm, 20mm, 25mm, 30mm for testing grading of aggregates.
 - iii. Weighing Balance of capacity up to 10 Kg. reading up to 5 gm.
 - iv. Electric Thermostat controlled oven and pans for drying of sand and aggregates.
 - v. Glass measuring flasks of 1/2, 1 liter & 2 liter capacity.
 - vi. Flask for determining moisture content of sand.
 - vii. Slump cone with rod and V B Apparatus, flow table to measure slump.
 - viii. Apparatus to measure permeability of concrete as per Appendix 1700/II of MOST Specifications.
 - ix. Minimum 24 Nos. steel moulds for 150mm x 150mm x 150mm concrete test cubes. It may be necessary to provide more steel cube moulds depending upon concreting programme.
 - x. 25mm diam. vibrator for compaction of concrete in test cubes and also vibrating table.
 - xi. Concrete cube testing machine of 200 tons capacity with 3 dial gauges electrically operated.
 - xii. Work benches, shelves, desks, sinks and any other furniture and lighting as required by the Engineer.
 - xiii. Abrasion & Impact testing Equipment for Testing coarse aggregate.
 - xiv. Silt Testing Equipment.
 - xv. Any other equipment specified by Engineer.

1.1.5 Quality Assurance & Quality Control:

- 1 The work shall conform to high standards of and workmanship, shall be structurally sound & aesthetically pleasing. The Contractor shall conform to the Quality standards prescribed, which shall form the backbone for the Quality Assurance and Quality Control system.
- 2 At the site, the Contractor shall arrange the materials, their stacking/storage in appropriate manner to ensure the quality. The Contractor shall provide all the necessary equipment and qualified manpower to test the quality of materials,

assemblies etc., as directed by the Engineer. The tests shall be conducted at specified intervals and the results of tests properly documented. In addition, the Contractor shall keep appropriate tools and equipment for checking alignments, levels, slopes and evenness of the surfaces.

- 3 The Engineer shall be free to carry out such tests as may be decided by him at his sole discretion, from time to time, in addition to those specified in this document and the cost of these tests shall be born by the contractor. The Contractor may provide the samples and labour for collecting the samples. Nothing extra shall be payable to the Contractor for samples or for the collection of the samples.
 - (a) The test shall be conducted at the Site laboratory that may be established by the Contractor or at any other Standard Laboratory selected by the Engineer.
 - (b) The Contractor shall transport the samples to the laboratory for which nothing extra shall be payable. In the event of the Contractor failing to arrange transportation of the samples in proper time the Engineer shall have them transported and recover two times the actual cost from the Contractor's bills.
 - (c) All testing shall be performed in the presence of Engineer. Testing may be witnessed by the Contractor or his authorised representative if permitted by the Test House. Whether witnessed by the Contractor or not, the test results shall be binding on the Contractor.
4. The Engineer shall have the right at all times to inspect all operations including the sources of materials, procurement, layout and storage of materials, all equipment including the concrete batching and mixing equipment, and the quality control system. Such an inspection shall be arranged and the Engineer's approval obtained prior to starting of the particular item of work. This shall however, not relieve the Contractor of his responsibilities. All materials which do not conform to these specifications shall be rejected and shall be removed from the site immediately. The Engineer shall have the powers to cause the Contractors to purchase and use materials from any particular source, as may in the Engineer's opinion be necessary for the proper execution of work.

1.1.6 Dimensions:

- 1 Figured dimensions on drawings shall only be followed and drawings to a large scale shall take precedence over those to a smaller scale. Special dimensions or directions in the specifications shall supersede all others. All dimensions shall be checked on site prior to execution.
- 2 The dimensions where stated do not allow for waste, laps, joints, etc. but the Contractor shall provide at his own cost sufficient labour and materials to cover such waste, laps, joints, etc.
- 3 The levels, measurements and other information concerning the existing site as shown on the drawings are believed to be correct, but the Contractor should verify them for himself and also examine the nature of the ground as no claim or allowance whatsoever will be entertained on account of any errors or omissions in the levels or the description of the ground levels or strata turning out different from what was expected or shown on the drawings.

1.1.7 Materials:

- 1 Source of Materials: - The contractor shall indicate in writing the source of materials well in advance to the Engineer, after the award of the work and before commencing the work. If the material from any source is found to be unacceptable at any time, it shall be rejected by the Engineer and the contractor shall forthwith remove the material immediately from the site as directed by the Engineer.
- 2 Quality:- All materials used in the works shall be of the best quality of their respective kinds as specified herein, obtained from sources and suppliers approved by the Engineer and shall comply strictly with the tests prescribed hereafter, or where tests are not laid down in the specifications, with the requirements of the latest issues of the relevant Indian Standards.
- 3 Sampling and Testing: - All materials used in the works shall be subjected to inspection and test in addition to test certificates. Samples of all materials proposed to be employed in the permanent works shall be submitted to the Engineer for approval before they are brought to the site. Samples provided to the Engineer for their retention are to be labelled in boxes suitable for storage. Materials or workmanship not corresponding in character and quality with approved samples will be rejected by the Engineer.

Samples required for approval and testing must be supplied sufficiently in advance to allow for testing and approval, due allowance being made for the fact that if the first samples are rejected further samples may be required. Delay to the works arising from the late submission of samples will not be acceptable as a reason for delay in completion of the works.

Materials shall be tested before leaving the manufacturer's premises, quarry or resource, wherever possible. Materials shall also be tested on the site and they may be rejected if not found suitable or in accordance with the specification, notwithstanding the results of the tests at the manufacturer's works or elsewhere or test certificates or any approval given earlier. The contractor will bear all expenses for sampling and testing, whether at the manufacturer's premises at source, at site or at any testing laboratory or institution as directed by the Engineer. No extra payment shall be made on this account.

- 4 Test certificates:- All manufacturer's certificates of test, proof sheets, etc showing that the materials have been tested in accordance with the requirement of this specification and of the appropriate Indian Standard are to be supplied free of charge on request to the Engineer.
- 5 Rejection:- Any materials that have not been found to conform to the specifications will be rejected forthwith and shall be removed from the site by the Contractor at his own cost within two weeks or as instructed by the Engineer.
- 6 The Engineer shall have power to cause the Contractors to purchase and use such materials from any particular source, as may in his opinion be necessary for the proper execution of the work.

- 1.1.8 Storing of Materials at site: -The storage of materials shall be in accordance with IS 4082 "Recommendation on stacking and storage of construction materials on site" and

as per IS 7969 “Safety code for handling and storage of building materials”. The materials shall be stored in a proper manner at places at site approved by the Engineer. Should the place where material is stored by the Contractor be required by the Employer for any other purpose, the Contractor shall forthwith remove the material from that place at his own cost and clear the place for the use of the Employer.

1.1.9 Water:

- 1 Water from approved source:- Potable water only shall be used for the works. The water shall be free from any deleterious matter in solution or in suspension and be obtained from an approved source. The quality of water shall conform to IS 456.
- 2 Storage:- The Contractor shall make his own arrangements for storing water, if necessary, in drums or tanks or cisterns, to the approval of the Engineer. Care shall be exercised to see that water is not contaminated in any way.
- 3 Testing:- Before starting any concreting work and wherever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such Tests shall be borne by the contractor.

1.1.10 Workmanship:

- 1 All works shall be true to level, plumb and square and the corners, edges and arises in all cases shall be unbroken and neat.
- 2 Any work not to the satisfaction of the Engineer shall be rejected and the same shall be rectified, or removed and replaced with work of the required standard of workmanship at no extra cost.
- 3 During the period of construction or within the defect liability period the Engineer may at his discretion reject the concrete if he has reasonable doubts about the adequacy of the strength of such structure for any of the following reasons :
 - a) results of compressive strength on concrete test cubes falling below the specified strength.
 - b) premature removal of formwork.
 - c) inadequate curing of concrete.
 - d) over loading during the construction of the structure or part thereof.
 - e) carrying out concreting of any portion without prior approval of the Engineer.
 - f) honey combed or damaged concrete which in the opinion of the Engineer is particularly weak and will affect the stability of the structure to carry the design load, more so in important or critical areas of the structure.
 - g) any other circumstances attributable to alleged negligence of the contractor which in the opinion of the Engineer may result in the structure or any part thereof being of less than the expected strength.

1.2 Structural Work:

- 1.2.1 Unless specified, only controlled concrete with design mix and weigh batching is to be used for the work.
- 1.2.2 Minimum cement content specified in CPWD specification 1996 is purely from durability point of view. Larger content of cement shall have to be provided if demanded by mix design.
- 1.2.3 Procedure of mixing the admixtures shall be strictly as per the manufacturer's recommendations if not otherwise directed by the Engineer.
- 1.2.4 Special benches shall be provided at site for stacking reinforcement bars of= different sizes.
- 1.2.5 In the mobilisation period, the contractor shall carry out expeditiously and without delay the following works:
 - a. Material testing and mix designs of concrete as contemplated in the specifications.
 - b. Setting up of full-fledged site laboratory as per the requirements of these specifications.
 - c. Any other pre-requisite items required for final execution.

SECTION - 2

CONCRETE: PLAIN & REINFORCED

These specifications shall be read in conjunction with the CPWD specifications 1996, MOST Specifications and other relevant specifications described in the Section 1.1 of these Specifications.

2.1 MATERIALS

Before bringing to the site, all materials for concrete shall be approved by the Engineer. All approved samples shall be deposited in the office of the Engineer before placing orders for the materials with suppliers. The materials brought on to the works shall conform in every respect to their approved samples.

Fresh samples shall be deposited with Engineer whenever type or source of any material changes. The contractor shall check fresh consignment of materials as it is brought on to the works to ensure that they conform to the specifications and/or approved samples.

The Engineer shall have the option to have any of the materials tested to find whether they are in accordance with specifications at the contractor's expense. All bills vouchers and test certificates which in the opinion of the Engineer are necessary to convince him as to the quality of materials or their suitability shall be produced for his inspection when required.

Any materials which have not been found to conform to the specifications and not approved by the Engineer shall be rejected forthwith and shall be removed from the site by the contractor at his own cost within the time stipulated by the Engineer. The Engineer shall have the powers to cause the contractors to purchase and use materials from any particular source, as may in his opinion be necessary for the proper execution of work.

2.1.1 Cement

2.1.1.1 The cement used shall be 53 grade Ordinary Portland Cement conforming to IS: 12269.

2.1.1.2 Whenever possible all cements of each type shall be obtained from one constant source throughout the contract, cement of different types shall not be mixed together. Different brands of cement, or the same brand of cement from different sources, shall not be used without prior approval of the Engineer.

2.1.1.3 Packaged cement shall be delivered to the site in original sealed bags, which shall be labelled with the weight, name of manufacturer, brand and type. Cement received in torn bags shall not be used.

2.1.1.4 All cement shall be fresh when delivered and at ambient atmospheric temperature.

2.1.1.5 With each and every delivery of cement the contractor shall provide manufacturers certificate that the cement conforms to the relevant Indian standard. The contractor shall provide complete facilities at site for carrying out the following tests:

- a) Setting time by vicat's apparatus as per IS: 4031 and IS: 5513.
- b) Compressive strength on cement as per IS: 4031, IS: 650, IS: 10080.

2.1.1.6 Total chloride content in cement shall in no case exceed 0.05 percent by mass of cement. Also, total sulphur content calculated as sulphuric anhydride (SO₃), shall in no case exceed 2.5 percent and 3.0 percent when tri-calcium aluminate per cent by mass is upto 5 or greater than 5 respectively.

2.1.2 Aggregate

Aggregates from natural sources shall be in accordance with IS: 383. The contractor shall submit to the Engineer certificates of grading and compliance for all consignments of aggregate. In addition, at site from time to time, the contractor shall allow for carrying out such tests and for supplying test records to the Engineer. The aggregates shall be procured from approved sources only as directed by the Engineer from time to time. For fair-faced concrete, the contractor shall ensure that aggregates are free from iron pyrites and impurities, which may cause discoloration.

2.1.2.1 Fine Aggregate

The contractor shall provide complete facilities at site for determining grading of aggregates by sieves as per IS: 383, IS: 460, IS: 1607, and IS: 2386. The fine aggregate shall be river sand pit sand, stone dust or other approved sand. It shall be free from clay, loam, earth or vegetable matter and from salt or other harmful chemical impurities. It shall be clean, sharp, strong, angular and composed of hard siliceous material. The grading of fine aggregate when determined as described in IS:2386 (part I), shall be within the grading zones I, II, III. The contractor shall provide complete facilities at site for carrying out the following tests:

- A) Proportion of clay, silt and fine dust by sedimentation method as per IS: 2386 part II.
- B) Moisture content in fine aggregate as per IS: 2386 Part III.
- C) Bulk density/Bulkage.

2.1.2.2 Coarse Aggregate

The coarse aggregate shall be crushed stone. Crushed gravel, natural gravel or a suitable combination thereof. Coarse aggregate obtained from crushed or broken stone shall be angular, hard, strong, dense, durable, clean and free from soft, friable, thin plate, elongated or flaky pieces. River gravel or pit gravel shall be sound, hard, clean, non-porous, suitably graded in size with or without broken fragments and free from flat particles of shale, clay, silt, loam, and other impurities. Except where it can be shown to the satisfaction of the Engineer that a supply of properly graded aggregate of uniform quality can be maintained over the said period of the works, the grading of aggregate shall be controlled by obtaining the coarse aggregate in different sizes and blending them in correct proportions as and when

required. All coarse aggregate shall conform to IS: 383 and tests for conformity shall be carried out as per IS: 2386, Parts I to VIII. The maximum size of coarse aggregate shall be such that the concrete can be placed without difficulty so as to surround all reinforcement thoroughly and fill the corners of formwork. Unless otherwise permitted by the Engineer the nominal maximum size shall not exceed 20 mm.

2.1.2.3 Water

- 2.1.2.3.1 Water used in the works shall be potable water and free from deleterious materials. Water used for mixing and curing concrete and washing aggregate shall be fresh and clean free from injurious amounts of oil, salts, acids, alkali, other chemicals and organic matter. Water shall be from the source approved by the Engineer and shall be in accordance with IS: 456. Before starting any concreting work and wherever the source of water changes, the water shall be tested for its chemical and other impurities to ascertain its suitability for use in concrete for approval of the Engineer. No water shall be used until tested and found satisfactory. Cost of all such Tests shall be borne by the contractor.

2.2 Blending of aggregates:

In order to obtain optimum workability, individual aggregates of nominal size 20mm, 10mm, 4.75mm and 2.36mm will be blended in such a way that the grading curve for all in aggregates will be a smooth curve from size 0.15mm to 25mm falling within the established envelop grading curve. Contractor shall establish envelope grading curve for each grade of concrete for given maximum size of aggregates and get it approved by Engineer before finalising the mix design.

2.3 Admixtures:

- 1 Chemical admixtures are not to be used until permitted by the Engineer. In case their use is permitted, the type, amount and method of use of any admixtures proposed by the Contractor shall be submitted to the Engineer for approval. The minimum cement content specified shall not be reduced on account of the use of the Admixtures.
- 2 The contractor shall further provide the following information concerning each admixture to the Engineer
 - a. Normal dosage and detrimental effects if any of under dosage and over dosage.
 - b. The chemical names of the main ingredients in the admixtures.
 - c. The chloride content, if any, expressed as a percentage by weight of admixture.
 - d. Whether or not the admixture leads to the entrainment of air when used in the manufacturer's recommended dosage.
 - e. Where two or more admixtures are proposed to be used in any one mix, the manufacturer's written confirmation of their compatibility.

- 3 In reinforced concrete, the chloride content of any admixture used shall not exceed 2 percent by weight of the admixture as determined in accordance with IS:6925 and the total chloride and sulphate contents in concrete mix shall not exceed 0.15 and 4.0 percent respectively by weight of cement.
- 4 The admixtures when used shall conform to IS:9103. The suitability of all admixtures shall be verified by trial mixes.
- 5 The addition of calcium chloride to concrete containing embedded metal will not be permitted under any circumstances.
- 6 Retarding admixtures when used shall be based on lingo sus-Phonates with due consideration to clause 5.2 and 5.3 of IS: 7861.

2.4 Batching Plants, Mixers and Vibrators:

- 1 Unless specified in the schedule of items, for all structural concreting work the Contractor shall provide automatic weigh-batching plant of suitable capacity. The plant used shall conform to IS: 4925.
- 2 The Contractor shall provide Concrete mixers (IS: 1791 - Batch type concrete mixers, IS: 2438 - Roller Pan Mixer) and Vibrators (IS: 2505 - Concrete Vibrators Immersion Type, IS: 2506 - Screed board concrete vibrators, IS: 4656 - Form Vibrators for Concrete) supplied by recognized manufacturers.

2.5 Grade of Concrete:

The concrete is designated as follows: Concrete M 35 / 20

The letter M refers to the mix

The number 35 represents the characteristic compressive strength of 15cm cubes at 28 days in MPa (Mega Pascals : 1 MPa : 10 kg/cm² approximately). M35 concrete thus has a characteristic strength of 350 kg/cm². Other mix design will also denoted in same way.

The number 20 represents the nominal size of the aggregate in mm.

2.6 Mix Design :

It is the complete responsibility of the Contractor to design the concrete mixes by approved standard methods and to produce the required concrete conforming to the specifications and the strength, workability requirements approved by the Engineer.

Mix Design Once approved must not be altered without prior approval of Engineer. However, should the contractor anticipate any change in quality of future supply of materials than that used for preliminary mix design, he should inform the Engineer quite in advance and bring fresh samples sufficiently in advance, to carry out fresh

trial mixes. Design mix will indicate by means of graphs and curves etc., the extent of variation in the grading of aggregates which can be allowed.

2.7 Additional tests for Concrete:

As frequently as the Engineer may require, additional testing shall be carried out for concreting in addition to mandatory test specified in CPWD specifications 1996/relevant IS Code / MOST Specifications.

Permeability test for Concrete:

The concrete will be verified for permeability by the following procedure and shall confirm to IS:3085-1965-‘Permeability of Cement Mortar & Concrete’. Section 1716.5 of MOST Specification and DIN 1048.

- 1 The Engineer shall select random batches of concrete for examination at his discretion and sampling will generally be done at the point of discharge from the mixer and at placing point.
- 2 From the batches thus selected two concrete cylinders shall be made in accordance DIN 1048.
- 3 All cylinders shall be made, cured, stored, transported and tested in accordance with clause 1716.5 of MOST Specifications. The tests shall be carried out in a laboratory approved by the Engineer.
- 4 At least two cylinders shall be made on each day’s concreting until 60 cylinders have been made for each grade of concrete. This is in the initial period.
- 5 After the initial period, subject to the acceptance of the Engineer, the frequency at which the cylinders shall be made may be reduced as follows:

(1 set = two cylinders, representing concrete from a different batch.)

At least 1 set for each day’s concreting consisting of:

- i. 1 set for every 10 m3 or part thereof concrete for critical structural elements plus 1 set for every 40 m3 or part thereof for all other elements.
- ii. If concrete is batched at more than one point simultaneously the above frequency of making cylinders shall be followed at each point of batching. The cylinders will be tested as per the procedure, given in Clause 6 next.

6 Test Procedure:

The permeability of concrete will be verified by the following procedure:

- i. Prepare a cylindrical test specimen 150 mm dia and 160mm high.
- ii. After 28 days of curing, test specimen will be fitted in a machine such that the specimen can be placed in water under pressure up to 7 bars. The typical machine shall be similar to one shown in Appendix 1700/II of MOST.
- ii. At first a pressure of one bar is applied for 48 hours, followed by 3 bars for 24 hours and 7 bars for next 24 hours.

- iii. After the passage of the above period, the specimen is taken out and split in the middle by compression applied on two round bars on opposite sides above and below.
- v. The water penetration in the broken core is measured with scale and the depth of penetration assessed in mm (max permissible limit 25 mm).

7 Acceptability Criteria:

The concrete shall pass the permeability test if it is properly compacted and is not considered permeable when tested as per DIN, and the water penetration in the broken core is less than 25mm. No extra payment shall be made for this test and cost of the same will be included in his rate for concrete work.

2.8 Batching of Concrete Ingredients

Unless permitted by the Engineer, all concreting shall be either produced in automatic weigh batching plant installed at site or Ready-Mix Concrete manufactured in automatic weigh batching plant.

2.9 Placing temperatures

During extreme hot or cold weather, the concreting shall be done as per procedures set out in IS:7861, Parts I & II. In hot weather with temperature exceeding 40-degree C, the stock piles of fine and coarse aggregates for concreting shall be kept shaded from direct rays of sun and the concrete aggregates sprinkled with water for a sufficient time before concreting in order to ensure that the temperature of these ingredients is as low as possible prior to batching. The mixer and batching equipment shall be also shaded and if necessary painted white in order to keep their temperatures as low as possible. The placing temperature of concrete shall be as low as possible in warm weather and care shall be taken to protect freshly placed concrete from overheating by sunlight in the first few hours of its laying. The time of day selected for concreting shall also be chosen so as to minimise placing temperatures. In case of concreting in exceptionally hot weather the Engineer may in his discretion specify the use of ice either flaked and used directly in the mix or blocks used for chilling the mixing water. In either case, the Contractor shall not be paid extra for cost of ice, additional labour involved in weighing and mixing etc. All salt and saw dust shall be removed from ice before use. Quality of water used for making ice shall confirm to IS:456.

2.10 Transporting, Placing, Compacting and Curing

Transporting, placing, compacting and curing of concrete shall be in accordance with IS: 456.

- 1 **Transporting:** - The mix after discharging from the mixer shall be transported by wheel barrows, buckets, pumps etc. without causing segregation and loss of cement slurry and without altering its desired properties with regard to water cement ratio, slump, air content, cohesion and homogeneity. It should be ensured that the concrete is moved to its final destination before it attains an initial set.
- 2 **Placing:** - The method of placing shall be such as to prevent segregation. The thickness of horizontal layers shall not exceed 300mm. High velocity discharge of concrete causing segregation of mix shall be avoided. The concrete shall be placed in the forms gently and not dropped from a height.
- 4 **Curing:**
 - i. Curing of concrete shall be complete and continuous using water that is free of harmful amounts of deleterious materials that may attach, stain or discolour the concrete.

- ii. Immediately after compaction and completion of any surface finishes the concrete shall be protected from the evaporation of moisture by means of polythene sheathing, wet hessian or other material kept soaked by spraying. As soon as the concrete has attained a degree of hardening sufficient to withstand surface damage moist curing shall be implemented and maintained for a period of at least 15 days after casting.
- ii. Method of curing and their duration shall be such that the concrete will have satisfactory durability and strength and members will suffer a minimum distortion, be free from excessive efflorescence and will not cause undue cracking in the works by shrinkage.

2.11 Cracks

If cracks, which in the opinion of the Engineer may be detrimental to the strength of the construction, the contractor shall dismantle the construction, carry away the debris, replace the construction and carry out all consequential work thereto. The Contractor at his own expense shall grout the cracks with neat cement grout or with other composition as directed by Engineer and also at his own expense and risk shall make good to the satisfaction of the Engineer all other works such as plaster, moulding, surface finish, which in the opinion of the Engineer have suffered damage either in appearance or stability owing to such cracks. The Engineer's decision as to the extent of the liability of the Contractor in the above matter shall be final and binding.

2.12 Defective Concrete

Should any concrete be found honeycombed or in any way defective, such concrete shall on the instruction of the Engineer be cut out partially or wholly by the Contractor and made good at his own expense.

- 1.13 **Exposed Faces, Holes and Fixtures:-** On no account shall concrete surfaces be patched or covered up or damaged concrete rectified or replaced until the Engineer or his representative has inspected the works and issued written instructions for rectification. Failure to observe this procedure will render that portion of the works liable to rejection.
- 1.14 **Finishes:-** Unless otherwise instructed the face of exposed concrete placed against formwork shall be rubbed down immediately on removal of the formwork to remove irregularities. The face of concrete for which formwork is not provided other than slabs shall be smoothed with a float to give a finish equal to that of the rubbed down face, where formwork is provided. The top face of a slab which is not intended to be covered with other materials shall be levelled and floated to a smooth finish at the levels or falls shown on the drawings or as directed. The floating shall be done so as not to bring an excess of mortar to the surface of the concrete. The top face of a slab intended to be surfaced with other material shall be left with a spaded finish. Faces of concrete intended to be plastered shall be roughened by approved means to form of a key.

2.13 Ready Mix Concrete and Pumping:

- 1 **Course Aggregates :-** Ready-mixed concrete may be manufactured in a central automatic weigh Batching plant and transported to the place of work in agitating transit mixers. The maximum size of coarse aggregate shall be limited to one-third of the smallest inside diameter of the hose or pipe used for pumping. Provision shall be made for elimination of over-sized particles by screening or by careful selection of aggregates. To obtain proper gradation it may be necessary to combine and blend certain fractional sizes of aggregates. Uniformity of gradation throughout the entire job shall be maintained.

The quantity of coarse aggregate shall be such that the concrete can be pumped, compacted and finished without difficulty.

2. **Fine aggregates:-** The gradation of fine aggregate shall be such that 15 to 30 percent should pass the 0.30 mm screen and 5 to 10 percent should pass 0.15 mm screen so as to obtain pumpable concrete. Sands which are deficient in either of these two sizes should be blended with selected finer sands to produce these desired percentages. With this gradation, sands having a fineness modulus between 2.4 and 2.8 are generally satisfactory. However, for uniformity, the fineness modulus of the sand should not vary more than 0.2 from the average value used in proportioning.
3. **Water, Admixtures and Slump:-** The amount of water required for proper concrete consistency shall take into account the rate of mixing, length of haul, time of unloading, and ambient temperature conditions.

Additions of water to compensate for slump loss should not be resorted to nor should the design maximum water-cement ratio be exceeded. Additional dose of retarder be used to compensate the loss of slump at contractor's cost, when permitted by Engineer. Re-tempering water shall not be allowed to be added to mixed batches to obtain desired slump.

4. **Transportation:-** The method of transportation used should efficiently deliver the concrete to the point of placement without significantly altering its desired properties with regard to water-cement ratio, slump, and homogeneity.

The revolving-drum truck bodies of approved make shall be used for transporting the concrete. The number of revolutions at mixing speed, during transportation, and prior to discharge shall be specified and agreed upon. Reliable counters shall be used on revolving-drum truck units. Standard mixer uniformity tests, conforming to ASTM standards C 94-69 "Standard Specifications for Ready Mix Concrete", shall be carried out to determine whether mixing is being accomplished satisfactorily.

- 5 **Pumping of concrete:-** Only approved pumping equipment, in good working condition, shall be used for pumping of concrete. Concrete shall be pumped through a combination of rigid pipe and heavy-duty flexible hose of approved size and make. The couplings used to connect both rigid and flexible pipe sections shall be adequate in strength to withstand handling loads during erection of pipe system, misalignment, and poor support along the lines. They should be nominally rated for at least 3.5 Mpa pressure and greater for rising runs over 30 m. Couplings should be

designed to allow replacement of any section without moving other pipe sections and should provide full cross section with no construction or crevices to disrupt the smooth flow of concrete.

All necessary accessories such as curved sections of rigid pipe, swivel joints and rotary distributors, pin and gate valves to prevent backflow in the pipe line, switch valves to direct the flow into another pipe line, connection devices to fill forms from the bottom up, extra strong couplings for vertical runs, transitions for connecting different sizes of pipe, air vents for downhill pumping, clean-out equipment etc, shall be provided as and where required. Suitable power-controlled booms or specialized crane shall be used for supporting the pipe line.

- 6 **Field Control:-** Sampling at both truck discharge and point of final placement shall be employed to determine if any changes in the slump and other significant mix characteristics occur. However, for determining strength of concrete, cubes shall be taken from the placement end of line.
- 7 **Planning:-** Proper planning of concrete supply, pump locations, line layout, placing sequence, and the entire pumping operation shall be made and got approved. The pump should be as near the placing area as practicable, and the entire surrounding area shall have adequate bearing strength to support concrete delivery pipes. Lines from pump to the placing area should be laid out with a minimum of bends. For large placing areas, alternate lines should be installed for rapid connection when required. Standby power and pumping equipment should be provided to replace initial equipment, should breakdown occur. The placing rate should be estimated so that concrete can be ordered at an appropriate delivery rate. As a final check, the pump should be started and operated without concrete to be certain that all moving parts are operating properly. A grout mortar should be pumped into the lines to provide lubrication for the concrete, but this mortar shall not be used in the placement. When the form is nearly full, and there is enough concrete in the line to complete the placement the pump shall be stopped, and a go-devil inserted and shall be forced through the line by water under pressure to clean it out. The go-devil should be stopped at a safe distance from the end of the line so that the water in the line will not spill into the placement area. At the end of placing operation, the line shall be cleaned in the reverse direction.

SECTION - 3

FORM WORK

- 3.1** These specifications shall be read in conjunction with the CPWD specifications 1996, MOST Specifications and other relevant specifications described in the section 1.1 of these specifications.

3.2 Materials

Formwork shall be of steel or any other suitable material as approved by the Engineer. The formwork shall be capable of resisting damage to the contact faces under normal conditions of erecting forms, fixing steel and placing concrete. The selection of materials suitable for formwork shall be made by the Contractor based on the quality consistent with the specified finishes and safety. All formwork supports (cantering, props, scaffolds etc.) shall only be in structural steel and preferably of pipes conforming to IS:806, IS:1161, IS:1239, IS:2750.

Wooden ballies shall not be permitted as props/formwork supports. All props shall be properly braced using x & k bracings.

Steel formwork shall be made of minimum 4 mm thick black sheets stiffened with angle iron frame made out of M.S. angles 40 mm x 6 mm supported at suitable spacing.

3.3 Design & Drawings:

The formwork, falsework, jigs, fixtures and supports etc. shall be designed by the Contractor and approved by the Engineer before starting of work. It shall be constructed so that the concrete can be properly placed and thoroughly compacted to obtain the required shape, position and level subject to specified tolerances. Approval of the proposed formwork by the Engineer will not diminish the Contractor's responsibility for the satisfactory performance of the formwork, nor for the safety and co-ordination of all operations. Methodology for removal of form should be planned as a part of total form work design.

3.4 Erection of Formwork:

The following shall apply to all formwork:

- 1 The Contractor shall obtain the approval of the Engineer for the design of forms and the type of material used before fabricating the forms. (Ref. ACI 347 Formwork for Concrete or equivalent I.S. Code).
- 2 Provision shall be made for adjustment of supporting struts where necessary. When reinforcement passes through the formwork care should be taken to ensure close fitting joints against the steel bars so as to avoid loss of fines during the compaction of concrete.
- 3 Formwork shall be so arranged as to permit removal of forms without jarring the concrete. Wedges, clamps and bolts shall be used wherever practicable instead of nails.

- 4 Surfaces of forms in contact with concrete shall be oiled with a mould oil of approved quality or clean diesel oil. If required by the Engineer the contractor shall execute different parts of the work with different mould oils to enable the Engineer to select the most suitable. The use of oil which results in blemishes of the surface of the concrete shall not be allowed. Oil shall be applied before reinforcement has been placed and care shall be taken that no oil comes in contact with the reinforcement while it is being placed in position. The formwork shall be kept thoroughly wet during concreting and the whole time that it is left in place. Nothing extra shall be paid to contractor for oiling.
- 5 Immediately before concreting is commenced, the formwork shall be carefully examined to ensure the following :
 - a Removal of all dirt, shavings, sawdust and other refuse by brushing and washing.
 - b The tightness of joints between panels of sheathing and between these and any hardened core.
 - c The correct location of tie bars, bracing and spacers, and especially connections of bracing.
 - d That all wedges are secured and firm in position.
 - e That provision is made for traffic on formwork not to bear directly on reinforcing steel.

3.5 Concrete Finishes: - This section deals with the surface of concrete on which forms had been fixed while concreting.

In the event of finishing not being definitely specified herein or in the drawings, finishes to be adopted shall be as directed by the Engineer.

Completed concrete surface shall be tested, where necessary to determine whether surface irregularities are within the limits specified hereinafter. Surface irregularities are classified as "Abrupt" or "Gradual". Offsets caused by displaced or misplaced form sheathing, or form sections or by loose knots or otherwise defective timber form will be considered as abrupt irregularities and shall be tested by direct measurements. All other irregularities shall be considered as gradual irregularities and will be tested by use of template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template shall be 150 cm for testing of formed surfaces and 300 cm for testing of unformed surfaces.

The finish for plinth shall be manufactured in a skilful, workmanlike manner, accurately to dimensions. There should be no visible offsets, bulges or misalignment of concrete. At construction joints, the forms shall be rightly set and securely anchored close to the joint. Abrupt and gradual irregularities shall not exceed 3mm. Irregularities exceeding this limit shall be reduced by grinding to a level of 1:20 ratio of height to length. Jute bag subbing or sand blasting shall not be used.

The top of plinth shall be a trowelled finish and shall be used for tops of parapets, etc prominently exposed to view. When the floated surface has hardened sufficiently, steel trowelling shall be started. Steel trowelling on hardened, floated surface shall be performed with firm pressure to produce a dense uniform surface

free from blemishes and trowel marks and having slightly glossy appearance. Surface irregularities shall not exceed 5mm.

- 3.6 Exposed Concrete Work:** - Exposed concrete surfaces shall be smooth and even, originally as stripped without any finishing or rendering. Where directed by the Engineer, the surface shall be rubbed with carbonado stone immediately on striking the forms. The Contractor shall exercise special care and supervision of formwork and concreting to ensure that the cast members are made true to their sizes, shapes and positions and to produce the surface patterns desired. No honeycombing shall be allowed. Honeycombed parts of the concrete shall be removed by the Contractor as directed by the Engineer and fresh concrete placed without extra cost, as instructed by the Engineer. All materials, sizes and layouts of formwork including the locations for their joints shall have prior approval of the Engineer.
- 3.7 Age of Concrete at Removal of Formwork:** - In accordance with CPWD Specifications 96 or IS:456. The Engineer may vary the periods specified if he considers it necessary. Immediately after the forms are removed, they shall be cleaned with a jet of water and a soft brush.
- 3.8 Reuse of Formwork:** - The Contractor shall not be permitted reuse of timber facing formwork brought new on the works more than 5 times for exposed concrete formwork and 8 times for ordinary formwork. 5 or 8 uses shall be permitted only if forms are properly cared for, stored and repaired after each use. The Engineer may in his absolute discretion order rejection of any forms he considers unfit for use for a particular item irrespective of no of items the shuttering has been used and order removal from the site of any forms he considers unfit for use in the Works. Used forms brought on the site will be allowed proportionately fewer uses as decided by the Engineer. Use of different quality boards or the use of old and new boards in the same formwork shall not be allowed. If any other type of special or proprietary form work is used, the no. of times they can be used will be determined by the Engineer.

SECTION 4

REINFORCEMENT

- 4.1** These specifications shall be read in conjunction with the CPWD specifications 1996, MOST Specifications and other relevant specifications described in the section 1.1 of these specifications.

Any steel specified for reinforcement shall conform in every respect to the latest relevant Indian Standard Specifications and shall be of tested quality under the ISI Certification Scheme.

All reinforcement work shall be executed in conformity with the drawings supplied and instructions given by the Engineer and shall generally be carried out in accordance with the relevant Indian Standard Specifications IS:2502 - Bending and Fixing of Bars for Concrete Reinforcement.

4.2 Inspection & Testing

Every bar shall be inspected before assembling on the works and any defective, brittle, excessively rusted or burnt bars shall be removed. Cracked ends of bars shall be cut out. No work shall be commenced without the Engineer's approval of the bar bending schedule.

Specimens sufficient for Tensile Tests for each different size of bar for each consignment delivered, or as per relevant IS code, whichever is less shall be sampled and tested by the Contractor. Batches shall be rejected if the average results of each batch are not in accordance with the specifications.

4.3 Bar bending and Bar bending Schedule

All bars will be carefully and accurately bent by approved means in accordance with IS: 2502, and relevant drawings. It shall be ensured that depth of crank is correct as per the bar cutting and bending schedule. Bent bars are not straightened for use in any manner that will injure the material.

Prior to starting bar bending work, the Contractor shall prepare bar bending schedule from the structural drawings supplied to him and get the same approved by Engineer. Any discrepancies and inaccuracies found by the Contractor in the drawings shall be immediately reported to the Engineer whose interpretation and decision there to, shall be accepted.

4.4 Spacing, Supporting and Cleaning

- 1 All reinforcement shall be placed and maintained in the positions shown on the drawings.
- 2 All cover blocks shall be of concrete (not sand cement mortar) & of the same strength as that of the surrounding concrete and properly compacted. They shall be circular in shape for side cover and square for bottom cover. The cost of cover block shall be deemed to have been included in the rates.

- 3 Bars must be cleaned before concreting commences of all scale, rust or partially set concrete which may have been deposited there during placing of previous lift of concrete.
- 4 The HYSD bars shall be provided using cement and inhibitor using following procedure:
 - i In order to offer adequate resistance against corrosion, reinforcement bars shall be provided with a coating of "Truncated inhabited cement slurry (patent No.109784/67 of CERI, Karaikudi) for non-aggressive environments (Mild and Moderate)
 - ii. The rod should then be brushed with the phosphating jelly of approved quality by means of fibre brush. The jelly should be left on the surface for a period of 45-60 minutes and then removed by means of wet waste cloth. This should be followed by brushing the inhibitor solution of approved quality and thselfe first coat of cement slurry, prepared by mixing 500cc of inhibitor for each 1000gm of Portland cement. All the above steps should be applied in the same day and after 12-24 hours of air - drying the sealing solution of approved quality should be brushed followed by the second coat of cement slurry. Then be dried for 12-24 hours followed by a brush coat of the sealing solution which should be applied again after 4 hours of air-drying. Briefly following steps are involved in this process
 - (a) Derusting by dipping the rebars in pickling solution (patent no.465/CAL/75) for 30 minutes (pH of the solution is 1.04)
 - (b) Removal from acid tank and dipping in alkaline tank to neutralize and cleaning wit potable water for 2 minutes.
 - (c) Application of phosphate jelly coat (Patent no. 109897) and drying for 45-60 minutes (pH of the jelly is 2.5).
 - (d) Application of inhibitor solution A (patent no. 109784/67) for 2 minutes.
 - (e) Application of first coat of cement slurry coating with inhibitor solution A
 - (f) Air drying for 24 hours.
 - (g) Application of first coat of sealing solution B (Patent no. 112440/67) for 2 minutes.
 - (h) Application of 2nd coat of cement slurry solution A for 2 minutes.
 - (i) Air drying for 24 hours
 - (j) Another coat of sealing solution B and drying for 4 hours.
 - (k) Application of 3rd coat of sealing solution B for 2 minutes
 - (l) Air drying for 4 hours.

Detailed specification regarding quality control aspect and chemicals/solution used in the process may be obtained from Central Electrochemical Research Institute (CECRI) Karaikudi- 623 006 (Tamilnadu).
- 5 G.I. wire shall be used for binding reinforcement.

4.5 Welding:

- 1 Wherever specified all lap and butt-welding of bars shall be carried in accordance with IS: 2571. Only qualified welders shall be permitted to carry out such welding.
- 2 For cold twisted reinforcement welding operations must be controlled to prevent a supply of large amounts of heat larger than that can be dissipated. The extreme non-twisted end portion shall be cut off before welding. Electrodes with rutile coating should be used.
- 3 Bars shall be free from rust at the joints to be welded.
- 4 Slag produced in welding after alternative run should be chipped and removed by brush.
- 5 Electrode should not be lighted by touching the hot bar.
- 6 The welding procedure shall be approved by the Engineer and tests shall be made to prove the soundness of the welded connection.

Maharashtra Metro Rail Corporation Limited

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PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART II: WORK REQUIREMENTS

SECTION – VII – C

IT- 5D BIM

Maharashtra Metro Rail Corporation Limited

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TENDER NO.

P1-T06/2021

PART- III

CONDITIONS OF CONTRACT AND CONTRACT FORMS

SECTION - VIII

GENERAL CONDITIONS (GC)

GENERAL CONDITIONS OF CONTRACT

The General Conditions governing this Contract shall be the Conditions of Contract for Plant and Design-Build Projects, First Edition 1999 prepared by the Federation Internationale des Ingenieurs-Conseils (FIDIC). It is also called the FIDIC Yellow Book.

The General Conditions of Contract (GCC) are supplemented with the Particular Conditions of Contract (PCC) by the wherein reference to the numbering of the Clauses in GCC is given, so that the GCC and the PCC together comprise the rights and obligations of the parties. In the case of any discrepancy between the conditions contained in the GCC and the PCC, the conditions contained in the PCC shall prevail over that of the GCC.

As the Contractor is deemed familiar with this General Conditions of Contract, no copy will be attached to the Tender / Contract Documents.

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PART-III

CONDITIONS OF CONTRACT AND CONTRACT

FORMS

SECTION-IX

Section IX. Particular Conditions (PC)

The following Particular Conditions shall supplement the GC. Whenever there is a conflict, the provisions herein shall prevail over those in the GC.

Part A - Contract Data

SR No	Conditions	Sub-Clause	Data
1	Employer's name and address	1.1.2.2 & 1.3	Maharashtra Metro Rail Corporation Limited, Pune Metro Rail Project 101, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune - 411001
2	Engineer's name and address	1.1.2.4 & 1.3	Employer will nominate
3	Bank's name	1.1.2.11	Not Applicable.
4	Borrower's name	1.1.2.12	Maharashtra Metro Rail Corporation Limited through Government of India and Government of Maharashtra.
5	Time for Completion	1.1.3.3	Refer to Table: Summary of Sections below
6	Defects Notification Period (Defect Liability Period)	1.1.3.7	<p>24 months from the date of issue of Taking Over Certificate for the whole of the Works.</p> <p>During the Defects Liability Period the Contractor shall provide, free of cost, competent and skilled personnel as stated under <i>Part 1 - Section III - 3.6 Personnel</i> and maintain adequate stock of spares so as to promptly fulfil his obligations during the Defects Liability Period as laid down in GCC and Works Requirements</p>
7	Sections	1.1.5.6	Refer to Table: Summary of Sections below
8	Country	1.1.6.2	India
9	Site	1.1.6.7	Pune, Maharashtra

10	Electronic transmission systems	1.3	Electronic transmission shall be in the form of scanned original documents. In case of Price Bid, only the format in the commercial section of the Bid is to be filled up online.
11	Governing Law	1.4	Acts and Laws of India
12	Ruling language	1.4	English
13	Language for communications	1.4	English
14	Contract Agreement	1.6	Signing of the Contract by the Employer is subject to provision of a compliant Performance Security by the Contractor
15	Care and Supply of Documents	1.8	Documents to be supplied by the Contractor or the Employer under the Contract shall also be provided in digital form.
17	Inspections and Audit by the Bank	1.15	The Bidder/Contractor grants the Employer, the EIB and auditors appointed by either of them, as well as any authority or European Union Institution or body having competence under European Union law, the right to inspect and copy the books and records of the bidder, contractor, supplier or consultant in connection with any Bank-financed contract.
18	Time for access to the Site	2.1	Refer to Table: Summary of Sections below
19	Engineer's Duties and Authority	3.1	<p>The Engineer shall obtain the specific approval of the Employer before taking the following actions:</p> <p><i>[The Employer may decide to limit the authority of the Engineer by selecting one or several of the options below:]</i></p> <ul style="list-style-type: none"> • issuing a Variation for substantial technical modifications, increase of the Accepted Contract Amount or extension of time; • proceeding to Determination under clause 3.5 of the GCC; • issuing Interim Payment Certificate under clause 14.6 of the GCC; and

			<ul style="list-style-type: none"> • issuance of a Taking over Certificate under clauses 10.1 and 10.2 of the GCC.
20	Delegation by the Engineer	3.2	Delegation by the Engineer is subject to the provisions of the Contract between the Employer and the Engineer
21	Contractor's General Obligations	4.1	<p>4.1 The Contractor shall provide the following documents as part of the Contract:</p> <ul style="list-style-type: none"> • shop drawings to be approved by the Engineer prior to starting the Works; • as-built drawings to be approved by the Engineer prior to taking over of the Works; and • operation and maintenance manuals.
22	Performance Security	4.2	<p>The performance security will be 3% (three percent) of the Accepted Contract Amount and in the same currency(ies) of the Accepted Contract Amount. This performance security will be in the form of a demand guarantee <i>i.e. Bank Guarantee issued from a scheduled commercial bank of Indian or foreign origin having business office in India and in the same currency(ies) of the Accepted Contract Amount.</i></p> <p>In the event of variations during the execution of the contract, which result in payments to the Contractor over and above the contract price, the Performance</p> <p>Security shall be adjusted in accordance with clause 4.2 of GC.</p> <p>The performance security amount will be progressively decreased and finally released as under:</p> <ul style="list-style-type: none"> • 1. up to 30% reduced when the whole Works is commissioned • 2. a further 30% reduced on completion of 50% of DLP period i.e. 12 months from the date of issue of Taking Over Certificate for whole works • 3. the balance 40% shall be released as provided for in GC Clause 4.2
23	Contractor's Representative	4.3	Prior consent of the Employer is required for replacing the Contractor's Representative

24	Subcontractors	4.4	Prior consent of the Employer is required for other proposed Subcontractors.
25	Progress reports	4.21	Refer to Works Requirements - General Specifications
26	Normal working hours	6.5	The Contractor, if required, shall carry out work during night hours or in shifts. The Contractor shall not be entitled to any increase in the Accepted Contract Amount on account of night/shift working
27	Testing	7.4	The Engineer shall give the Contractor not less than one (1) working day notice of the Engineer's intention to attend the tests.
28	Commencement of Works	8.1	The Commencement Date shall be: Date given in LOA or Employer's Notice to Proceed
29	Extension of time	8.4	Granting any extension of time is subject to the Engineer's determination in accordance with sub-clause 3.5 - Determinations.
30	Delay damages for the Works	8.7 & 14.15(b)	(a) 0.05% of the original Contract Price per calendar day of delay of each Key Date. (b) There is no maximum limit in levy of LD for delays in individual Key Dates. However, maximum limit for cumulative LD for complete Contract shall not exceed 10% of the final Contract Price.
31	Maximum amount of delay damages	8.7	10 % of the final Contract Price.
32	Measurement and Evaluation	12	Shall be done and certified by Engineer.
33	Right to Vary	13.1	Additional work, plant, material or services not related to the Permanent Works shall not be entitled to a Variation.
34	Variation Procedure	13.3	Prior consent of the Employer is required on any proposed Variation issued for substantial technical modifications, additional cost or extension of time. Such Variation shall be consolidated in a signed Amendment to Contract.

			<p>Payment for works in quantities or amount which exceed the initial quantity or amount for a Bill of the Bill of Quantities or for a Schedule of the lump sum price shall require a signed Amendment to Contract, unless using Contract provisions for Contract Contingencies, Provisional Sums or Daywork.</p> <p>Last sentence of sub-clause 13.3 is deleted and replaced by: Upon instruction of approving a Variation, the Engineer shall proceed in accordance with Sub-Clause 3.5 to agree or determine adjustments to the Contract Price and to the schedule of payments under Sub-Clause 14.4. These adjustments shall include reasonable profit and shall take account of the Contractor's submissions under Sub-Clause 13.2 if applicable.]</p>
35	Provisional Sums	13.5(b)(ii)	<i>Not applicable</i>
36	Adjustments for Changes in Cost	13.8	Refer PC Part B - Clause no. 45
37	Contract Price	14.1 (a)	No change
		14.1(b)	The following taxes, duties and fees exemptions apply to the Contract: Refer PC Part B - Clause No.46
		14.1(d)	<p>If requested by the Engineer, the breakdown of all unit prices shall also be submitted by the Contractor within 28 days from the Commencement Date.</p> <p>Refer PC Part B - Clause No. 46</p>
38	Total advance payment	14.2	<p>15% (fifteen percent) in first instalment and 5% (five percent) in second instalment.</p> <p>The first instalment shall be paid after the award of Letter of Acceptance, submission of the Performance Security, undertaking and Guarantees, Advance Payment Bank Guarantee @110% of required advance payment issued from scheduled commercial bank of Indian or Foreign origin having business office in India and signing of the Contract Agreement. The second instalment shall be paid after satisfactory utilization of the first instalment. The Contractor shall be required to submit the 'Utilization</p>

			Certificate' for all Advances received by them from the Employer under the Contract.
39	Repayment amortization rate of advance payment	14.2(b)	<p>The repayment amortization rate (%) shall be as under:</p> <p>The recovery of the above Advance Payment shall be done in respective currencies and shall commence when 20% of the original contract value of the work has been paid in respective currencies (in addition to the Mobilization advance) and shall be recovered by deduction of 25% of the amount of each Interim Payment, until the total of the mobilization advance is recovered,</p> <p>Provided that the advance payment shall be completely repaid prior to the time when 75 percent (75%) of the Accepted Contract Amount Less Provisional Sums has been certified for payment.</p>
40	Percentage of Retention	14.2	0% (Zero percentage)
41	Limit of Retention Money	14.2	The aggregate amount of the Performance Security and the Retention Money shall not exceed 3% (three percent) of the Accepted Contract Amount
42	Plant and Materials	14.5(b)(i)	Not applicable
		14.5(c)(i)	Not applicable
43	Minimum Amount of Interim Payment Certificates	14.6	No restriction
44	Payment	14.7	<p>The Employer shall pay to the Contractor the amount certified in each Interim Payment Certificate.</p> <p>Payment to the Contractor of the amounts due in each currency shall be made into the following bank accounts:</p> <p><i>[insert bank account details at the time of contract signing]</i></p>

45	Publishing source of commercial interest rates for financial charges in case of delayed payment	14.8	As provided for in PC Part B- Clause No.49
46	Currencies of Payment	14.15	The Contract Price shall be paid in the currency(ies) named in the Contract.
48	Insurance cover for Contractor's All Risk and other requirements as specified in the GC	18	100% of the Total Contract Price
49	Periods for submission of insurance: a. evidence of insurance. b. relevant policies	18.1	14 days from Commencement Date 28 days from Commencement Date
50	Minimum amount of third party insurance	18.3	INR 0.50 Million for any one incident, with no. of incidents unlimited
51	Amount of Professional Indemnity Insurance (PII)	18.4 (PC)	AOA (any one accident) limit equal to 6% of the Contract Value with AOY (any one year) limit of 2 incidents in a year. In the Professional Indemnity Insurance Policy the deductible amount shall not be more than 5% AOA limit. All Policy shall be obtained within Four weeks from 'date of commencement' and shall be valid for five years after date of issue of 'Performance Certificate' or 3 years after commencement of commercial train operations whichever is later. Wherever the Contractor submits policy for shorter period / annual renewable policy, the same shall be renewed before its expiry date. In such situation, the performance guarantee shall be retained till required validity period. The Contractor's submission of such shorter period / renewable policy shall be construed as their

			irrevocable consent for retention of the performance guarantee.
52	Termination, Payment and Release	19.6	Determination by the Engineer shall be done in accordance with sub-clause 3.5 Determination.
53	Date by which the Dispute Board shall be appointed	20.2	Not Applicable. Dispute resolution shall be by Arbitration Act 1996 & further amendments time to time.
54	The Dispute Board shall be comprised of	20.2	Constitution of Dispute Board is not applicable in this Contract. The Disputes may be resolved by ADR methods i.e. mutual settlement/negotiations etc. Dispute resolution shall be by Arbitration Act 1996 & further amendments time to time.
55	List of potential Dispute Board sole members	20.2	Not applicable. Dispute resolution shall be by Arbitration Act 1996 & further amendments time to time.
56	Appointment (if not agreed) to be made by	20.3	After failure of negotiation / conciliations of mutual settlements the issues may be referred for arbitration.
57	Rules of arbitration	20.6(a)	The Rules of Arbitration are in accordance with the Arbitration and Conciliation Act 1996 & further amendments time to time.
		20.6(b)	Place of Arbitration : Pune
58	Failure to Comply with Dispute Board's Decision	20.7	Constitution of Dispute Board is not applicable in this Contract. The Disputes may be resolved by ADR methods i.e. mutual settlement/negotiations etc.
59	Contractor's Claims	20.1	Determination by the Engineer shall be done in accordance with sub-clause 3.5 Determination.

Table-1: Summary of Sections (KEY DATES)**1) Civil Court to Ramwadi (Reach-3) - Viaduct section**

KEY DATES (KD)	Description	Date
1	Completion of design of Track structure	Date of NTP + 45 days
2	Completion of first 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days
3	Completion of next 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days
4	Completion of next 3 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days
5	Completion of next 3 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days
6	Completion of balance scope of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days
7	Completion of Acceptance Tests, Submission of As-built records, Operation & Maintenance Manual	Date of completion of viaduct section(s)/entire

	(This will also be applicable for viaduct section(s) where commissioning is decided in stages)	Trackwork + 30 days
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Installation Schedule for Priority Sections:

Notwithstanding above, Contractor shall be required to design, supply, install, test and commission the Track for Priority Sections of length varying from 3km to 5km (route km) as decided by Employer. The chainages of Priority Sections may be communicated to the Contractor at the time of issue of LOA.

The above key dates are planned considering 2 Track Teams for plain line track and 1 Track Team for turnout along with required Track equipment for ballastless track installation. However, the Contractor may be required to deploy more Track Teams for completion of the Ballastless Track of Priority Sections including Turnouts/ Crossovers in all respects within 4 months from the date issue of LOA.

Table-3: Summary of Sections (KEY DATES)

1) Range Hill ramp to Swargate (Reach-4)-UG section

KEY DATES (KD)	Description	Date
1	Completion of design of Track structure	Date of NTP + 45 days
2	Completion of Trackwork installation from Ramp to Shivaji Nagar Station (UG section will be handed over in progressive manner)	Date of handing over of UG section + 60 days
3	Completion of Trackwork installation from Shivaji Nagar Station to Civil Court Station (UG section will be handed over in progressive manner preferably from station to station)	Date of handing over of UG section + 75 days
4	Completion of Trackwork installation from Civil Court Station to Budhwar Peth Station (UG section will be	Date of handing over of UG section + 75 days

	handed over in progressive manner preferably from station to station)	
5	Completion of Trackwork installation from Budhwar Peth Station to Mandai Station (UG section will be handed over in progressive manner preferably from station to station)	Date of handing over of UG section + 75 days
6	Completion of Trackwork installation from Mandai Station to Swargate Station (UG section will be handed over in progressive manner preferably from station to station)	Date of handing over of UG section + 75 days
7	Completion of Acceptance Tests, Submission of As-built records, Operation & Maintenance Manual (This will also be applicable for viaduct section(s) where commissioning is decided in stages)	Date of completion of UG section(s)/entire Trackwork + 30 days

Installation Schedule for Priority Sections:

Notwithstanding above, Contractor shall be required to design, supply, install, test and commission the Track for Priority Sections of length varying from 2km to 3km (route km) as decided by Employer. The chainages of Priority Sections may be communicated to the Contractor at the time of issue of LOA.

The above key dates are planned considering 2 Track Teams for plain line track and 1 Track Team for turnout along with required Track equipment for ballastless track installation. However, the Contractor may be required to deploy more Track Teams for completion of the Ballastless Track of Priority Sections including Turnouts/ Crossovers in all respects within 6 months from the date issue of LOA.

Notes regarding Changes in Key Dates

1. The Key Dates and Access Dates indicated above have been identified on the basis of discussions with various groups and agencies involved in the Project. Special attention is drawn to the following facts with respect to the possible changes in the Key Dates and Access Dates.
2. It is essential that the Contractor shall achieve the identified work by the specified Key Date mentioned against it, failing which Liquidated Damages shall become leviable as set out in the Contract.
3. The Access Dates are dependent on the other agencies e.g. civil contractor etc. involved in the project. The Contractor shall interface and maintain a close liaison with other agencies for timely availability of the access. In case the Contractor finds that there is slippage and the likely Access Dates may not be adhered to, the Contractor shall inform the Employer well in advance for the likely delays in access to site.

4. The Employer will, on his part, make all efforts to provide the Contractor with access to information as well as to various locations at stations/Track/viaduct/UG in stages, in order to plan/execute his activities for time-bound completion of his obligations under the Contract, as per the Access Dates mentioned above. If, however, due to any reasons, the Employer is not in a position to provide access or shared access, as per the stated Access Dates, the Employer, in these circumstances **and based on the information provided by Contractor vide point no. 3**, will inform the Contractor, in writing, about the proposed revised Access Dates, at least 8 weeks before the scheduled Access Date. The Contractor shall suitably make necessary changes in his Work Program and shall make all out efforts so that, irrespective of the revised Access Dates, the concerned Key Dates are adhered to.
5. Where Access Dates overlap, the Contractor shall ensure that there are sufficient resources to meet the Key Dates.

Notes regarding Key Dates

1. The achievement of a Key Date shall be subject to issue of “No Objection” from the Employer’s Representative upon notice of completion of each KD by Contractor.
2. Failure to meet any Key Date, Liquidated Damages (LD) will be imposed at a rate of 0.05% of the balance value of contract amount (to be executed) per week of delay reckoned from the stipulated date of completion of each KD.
3. All LD put together is subjected to a maximum of 10% of accepted contract amount.
4. Any imposition of LD on account of delay in any Key Date (KD) will be waived and LD amount if deducted will be returned (without interest) provided the Contractor is able to accomplish the “successive key date (KD)” along with the immediate preceding delayed Key Dates.
5. These penalties shall not relieve the Contractor from his obligation to complete the works or from any other obligations and liabilities under this contract.
6. Payment shall be made as per actual measured quantity of executed work, meeting the specifications & quality standards, acceptable to Engineer. The billing cycle shall be monthly or as agreed by Engineer.
7. Incentive Clause:
For earlier completion of the work as whole from the stipulated original date of completion reckoned as per LOA, an incentive payment of Rs. 2 (Two) Lakhs per day shall be paid to the Contractor, subject to a maximum 5% of contract value. The engineer’s decision is final and binding on the Contractor so far as incentive payment to the contractor is concerned. Even if incentive payment is made for final completion of the work earlier than the scheduled completion, the penalties imposed for delay caused to various intermediate Key Dates will not be refunded.

Part B - Specific Provisions

1	Sub-Clause 4.1 (d)	<p>The following is added to the existing clause:</p> <p>The Contractor shall prepare, and keep up-to-date, a complete set of "as-built" records of the execution of the Works, showing the exact "as-built" locations, sizes and details of the Works as executed, with cross references to relevant specifications and data sheets. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Six copies shall be submitted to the Engineer prior to the commencement of the Tests on Completion.</p> <p>In addition, the Contractor shall prepare and submit to the Engineer "as-built drawings" of the Works, showing all Works as executed. The drawings shall be prepared as the Works proceed and shall be submitted to the Engineer for his inspection. The Contractor shall obtain the consent of the Engineer as to their size, the referencing system, and other pertinent details.</p> <p>Prior to the issue of any Taking Over Certificate, the Contractor shall submit to the Engineer one microfiche copy, one full-size original copy and six printed copies of the relevant "as-built drawings", and any further Construction and/or Manufacture Documents specified in the Works Requirements. The Works shall not be considered to be completed for the purposes of Taking Over under Clause 10 until such documents have been submitted to the Engineer.</p> <p>Prior to commencement of the Tests on Completion, the Contractor shall prepare, and submit to the Engineer, Operation & Maintenance Manuals in accordance with the Works Requirements and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works. The Works shall not be considered to be completed for the purposes of Taking Over under Clause 10 until such Operation and Maintenance Manuals have been submitted to the Engineer and received his consent.</p> <p>The Operation and Maintenance Manuals and drawings submitted by the Contractor shall, if required, be updated by him during the Defects Notification Period and re-submitted for review and acceptance by the Engineer.</p>
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2	GC Sub-Clause 4.2 Performance Security	<p>Replace the GC Sub-Clause 4.2 with the provisions as under:</p> <p>The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount stated in the Contract Data and denominated in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.</p> <p>The Contractor shall deliver the Performance Security to the Employer within 28 days after receiving the Letter of Acceptance and shall send a copy to the Engineer. The Performance Security shall be issued by a scheduled Indian/Foreign bank in India acceptable to the Employer and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer.</p> <p>The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.</p> <p>The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract.</p> <p>The Employer shall indemnify & hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.</p> <p>The Employer shall return the Performance Security to the Contractor within 21 days after receiving a copy of the Performance Certificate.</p>
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		<p>Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer determines an addition or a reduction to the Contract Price as a result of a change in cost and/or legislation, or as a result of a Variation, amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.</p>
3	Sub-clause 4.2A (new subclause)	<p>Guarantees, Warranties and Undertakings</p> <p>Within 30 days of the date of Letter of Acceptance of the Bid, the Contractor shall submit to the Employer:</p> <p>(a) An Undertaking in the approved format from a parent company, the identity of which shall have been submitted in writing to the Employer prior to acceptance of the Bid and against which the Employer shall have raised no-objection.</p> <p>(b) A written Guarantee in the approved format from a parent company, the identity of which shall have been submitted in writing to the Employer prior to acceptance of the Bid and against which the Employer shall have raised no objection.</p> <p>(c) A warrantee in the approved format from the Contractor.</p> <p>In the event that the Contractor shall comprise two or more members, corporations acting in partnership, joint venture, consortium or otherwise each such member or corporation shall submit a parent company Undertaking and Guarantee.</p> <p>Notwithstanding any other provision of the Contract:</p> <p>(a) submission by the Contractor of the requisite Performance security, parent company Undertakings and written Guarantees shall be condition precedent to the</p>

		<p>Contractor's entitlement to any payment, under the Contract; and</p> <p>(b) failure by the Contractor to provide a Performance security or parent company Undertakings or parent company Guarantees shall entitle the Employer either to suspend the Works or to terminate the Contract forthwith by notice in writing to that effect, notwithstanding that the Contractor may have been to proceed with the Works, and the Contractor shall not be compensation whatsoever as a consequence of such suspension or termination</p> <p>The forms of Contractor warranty shall be in the format given in the Section X: Contract Forms.</p>
4	Sub-Clause4.4 Subcontractors	<p>The following is added to the existing clause:</p> <p>The Contractor shall not be required to provide to the Engineer the details of the pricing of their Sub-contracts.</p> <p>Sub-contracting, excluding design work shall be generally limited to 50% of the lump sum price. The terms and conditions of subcontracts and the payments that have to be made to the Subcontractors shall be the sole responsibility of the Contractor.</p> <p>For sub-contracts exceeding Rs.5 million, it will be obligatory for the Contractor to obtain a "Notice of No-Objection" from the Engineer, to the identity of the Sub-contractor and Vendor. The Contractor shall certify that the cumulative value of the subcontracts (including those upto Rs.5 million each) awarded is within the aforesaid 50% limit. Any proposals by the Bidders in their offer shall not be construed as an approval of the vendor.</p> <p>The terms and conditions of the sub-contract are the sole prerogative of the Contractor & are deemed to be included in the price(s) quoted by the Bidder. However, the Subcontractor / Vendor shall fully comply with the technical specifications included in the Works Requirements.</p> <p>It shall be obligatory for the Contractor to obtain Notice of No Objection from the Engineer for the selection of the Sub-contractor and vendors for all items of work, even if</p>

		<p>the name of the Subcontractor and vendor is named in the Contractor's Proposal and the works to be done including purchase of materials and equipment are in accordance with the Standards specified in the Contract. List of such major items for sub-contracting shall be drawn up by the Contractor in consultation with the Engineer. The terms and conditions of the sub-contract / vending agreement are the sole prerogatives of the Contractor and are deemed to be included in the Contract Price.</p> <p>The Contractor shall provide sufficient superintendence, whether on the site or elsewhere, to ensure that the work to be carried out by a Subcontractor complies with the requirements of the Contract.</p> <p>The proposed sub-contract terms and conditions shall impose on the sub-contractor such terms of the Contract as are applicable and appropriate to the part of the Works to be sub-contracted, to enable</p> <p>the Contractor to comply with his obligations under the Contract.</p> <p>Notwithstanding any consent to sub-contract given by the Engineer, if in his opinion it is considered necessary, the Engineer shall have full authority to order the removal of any sub-contractor from the Site or off-Site, place of manufacture/fabrication or storage.</p> <p>The Contractor shall ensure that their sub-contractors, material / equipment suppliers, consultants and other agencies deployed by them in connection with execution of the Contract do not make any claim or raise any dispute before Employer. For this, necessary provision is to be made in the agreement between Contractor and their Sub contractors / consultants / other agencies. Similarly, the agreement should also incorporate the provision of dispute resolution. An undertaking in the following format shall be submitted by Contractor in respect of each such agency:</p> <p>Name of work In connection with above work, M/s, Contractor has/is engaging M/s, as sub-contractor (or consultant or material / equipment supplier or service provider). For this, the terms and conditions of agreement</p>
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		include necessary provisions for resolution of dispute if any arising between Contractor and subcontractor. It is confirmed by the subcontractor that any claim/dispute arising out of the above work shall be resolved in terms of agreement and shall not be raised before Employer and also shall not make any claim against Employer before any forum/court.
5	Sub-clause 4.8 Safety and Subclause 6.7, Health and Safety	<p>The following is added to the existing clause:</p> <p>Within 8 weeks of the date of Notice to Proceed, the Contractor shall submit a detailed and comprehensive contract-specific Site Safety Plan based on the Employer's Safety, Health and Environment Manual (SHE Manual). The Contractor is required to make himself aware of all the requirements of the Employer's Safety, Health and Environment Manual in this regard and comply with them. The Site Safety Plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance with Sub-Clauses 4.8 and 6.7 of General Conditions of Contract.</p> <p>The Contractor shall, from time to time and as necessary or required by the Engineer, produce supplements to the Site Safety Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the Contractor of his site safety and industrial health obligations, responsibilities, policies and procedures (under the laws of India) or as stated in the Contract or elsewhere relating to work on Site.</p> <p>If at any time the Site Safety Plan is, in the opinion of the Engineer, insufficient or requires revision or modification to ensure the security of the Works and the safety of all workmen upon, and visitors to the Site, the Engineer may instruct the Contractor to revise the Site Safety Plan. The Contractor shall, within 14 days, submit the revised plan to the Engineer for review.</p> <p>Any omission, inconsistency or error in the Site Safety Plan or the Engineer concurrence or rejection of the Site Safety Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site safety and industrial health and shall not excuse any failure by the Contractor to adopt proper and recognized safety practices throughout the execution of the Works.</p>

		<p>The Contractor shall adhere to the Site Safety Plan and shall ensure, that all sub-contractors of all tiers have a copy of the Site Safety Plan and comply with its provisions.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer and the Employer to carry out surveillance to verify that the Site Safety Plan is being properly and fully implemented.</p> <p>The Contractor shall notify the Engineer immediately of any occurrence or incident that results in death or serious injury as defined in the Indian Penal Code. Such initial notification may be verbal and confirmed in writing thereafter and shall be followed by a comprehensive written report within 24 hours of the occurrence/incident. The Contractor shall duly complete standard forms as required by the Engineer and Statutory Authorities.</p> <p>The Contractor shall provide and maintain all necessary temporary fire protection and firefighting facilities on the Site during the construction of the Works in accordance with the statutory regulations and as required by the Engineer. The Contractor shall ensure that all gases, fuels and other dangerous Materials and goods are stored and handled in a safe manner and in accordance with the statutory regulations and as required by the Engineer.</p> <p>The obligations and requirements for safety and industrial health under this Contract are entirely without prejudice to, and do not derogate from, the Contractor's statutory obligations, with respect to safety and industrial health.</p> <p>The Contractor shall provide a training / workshop on Safety, Health and Environment (SHE) to all its workers / employees / subcontractors of atleast 2 weeks (96 hours) at the time of induction. Before posting any of his workers/staff/ employees /subcontractors, the Contractor shall give a certificate that the said person had undergone the requisite SHE is training. Non-</p>
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		compliance of the above will invoke penalties as per conditions of contract on SHE.
6	Sub-Clause 4.10 Site Data	<p>Replace the GC Sub-Clause 4.10 with the provisions as under:</p> <p>The Employer shall have made available to the Contractor with the Bidding documents such relevant data in Employer's possession on hydrological and sub-surface conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data, which come into the Employer's possession after the Base Date. The accuracy or reliability of the data/studies/reports and of any other information supplied at any time by the Employer or Engineer is not warranted with respect to the viability of his design and execution of Works and the Contractor shall be responsible for interpreting all such data. The Contractor shall conduct further investigations considered necessary by him at his own cost and any error, discrepancies if found in Employer's data at any stage will not constitute ground for any claim for extra time and costs.</p> <p>The Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works.</p> <p>The Contractor shall also be deemed to have inspected and examined the Site, its surroundings, the above data and other available information with respect to the viability of his design and execution of Works and to have satisfied himself before submitting the Tender, as to all the relevant matters including without limitation:</p> <ul style="list-style-type: none"> (a) the climatic conditions; (b) the extent and nature of the work, Plant, and Materials necessary for the execution and completion of the Works and the remedying of any defects; (c) the applicable laws, procedures and labour practices (d) The Contractor's requirement for access, accommodation, facilities, personnel, power, transport and other services.

		(e) the risk of injury or damage to property adjacent to the Site and to the occupiers of such property or any other risk.
7	Sub-Clause 4.12, Unforeseeable Physical Conditions	<p>The following is added to the existing clause:</p> <p>This provision applies if unforeseeable physical condition continues for more than a period of 60 days in continuation. Contractor shall be entitled to claim as per clause 8.4 & 20.1 both it is further clarified that if this unforeseeable condition remains less than 60 days then the Contractor is entitled to claim time extension only under sub-clause 8.4.</p>
8	Sub-clause 4.15 - Access Route	<p>The following is added to the existing clause:</p> <p>All operations for the execution of the Works shall be carried out so as not to interfere unnecessarily with the convenience of the public or the access to public or private roads or footpaths or properties owned by the Employer or by any other person. The Contractor shall select routes, choose and use such vehicles so that movement of Contractor's Equipment, Plant and Materials from and to the Site is so limited that traffic is not delayed and damage to highways and bridges is prevented. If there is any delay or damage or injury, the cost of rectification or reconstruction of highways or bridges shall be borne by the Contractor. The Contractor shall indemnify the Employer in respect of all claims, demands, proceedings, damages, costs, charges and expenses whatsoever arising out of or in relation to any such matters.</p> <p>If during the execution of the Works the Contractor shall receive any claim arising out of the execution of the Works in respect of damage to highways or bridges, he shall immediately report the facts to the Engineer. The Contractor shall negotiate a settlement in respect of such claims and indemnify the Employer in respect of all claims, proceedings, damages, costs, charges and expenses in relation thereto.</p>
9	Sub-clause 4.18 - Protection of The Environment	Add the following at the end of this sub-clause:

		<p>Outline Environmental Plan shall be in accordance with the provisions of Employer's Safety, Health & Environment (SHE) Manual and shall include in summary form, the Contractor's proposed means of complying with his obligations in relation to:</p> <ul style="list-style-type: none"> • the Site Environment; and • System Environment as described in Works Requirements. <p>Within 60 days of the date of the Notice to Proceed, the Contractor shall submit a detailed and comprehensive Environmental Plan based on the Outline Environmental Plan. The Environmental Plan shall include detailed policies, procedures and applicable regulations.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer and the Employer to monitor and conduct tests at site to verify that the Environmental Plan is being properly and fully implemented.</p>
10	Sub-clause 4.19 Electricity, Water and Gas	<p>The following is added to the existing clause:</p> <p>The Contractor shall be allowed, free of charge, traction power.</p>
11	Sub-clause 4.20, Employer's Equipment	<p>The following is added to the existing clause:</p> <p>The Employer will not provide any tools, plant, equipment and machinery or materials under the Contract.</p>
12	Sub-clause 4.22 - Security of Site and Safety of Works	<p>The following is added to the existing clause:</p> <p>The Contractor shall throughout the execution of the Works including the carrying out of any testing, commissioning (including Integrated Testing and Commissioning), or remedying of any defect:</p> <p>a. take full responsibility for the adequacy, stability, safety and security of the Works, Plant, Rolling Stock, Contractor's Equipment, Temporary Works, operations on</p>

		<p>Site and methods of manufacture, installation, construction and transportation;</p> <p>b. have full regard for the safety of all persons on or in the vicinity of the Site (including without limitation persons to whom access to the Site has been allowed by the Contractor), comply with all relevant safety regulations, including provision of safety gear, and insofar as the Contractor is in occupation or otherwise is using areas of the Site, keep the Site and the Works (so far as the same are not completed and occupied by the Employer) in an orderly state appropriate to the avoidance of injury to all persons and shall keep the Employer indemnified against all injuries to such persons.</p> <p>c. provide and maintain all lights, guards, fences and warning signs and watchmen when and where necessary or required by the Engineer or by laws or by any relevant authority for the protection of the Works and for the safety and convenience of the public and all persons on or in the vicinity of the Site; and</p> <p>d. where any work would otherwise be carried out in darkness, ensure that all parts of the Site where work is being carried out are so lighted as to ensure the safety of all persons on or in the vicinity of the Site and of such work.</p> <p>Contractor is required to take note of all the necessary provisions in Employer's Safety, Health and Environment Manual (SHE Manual) and the Contractor's price shall be inclusive of all the necessary costs to meet the prescribed safety standards. In the case, the Contractor fails in the above; the Employer may provide the necessary arrangements and recover the costs from the Contractor.</p> <p>The Contractor shall submit a detailed and comprehensive contract-specific Site Safety Plan and System Safety Assurance Plan in accordance with the provisions in Employer's Safety, Health & Environment (SHE) Manual and Employer's Requirements.</p> <p>The Contractor shall, from time to time and as necessary or required by the Engineer, produce supplements to the Site Safety and System Safety Assurance Plans such that they are at all times detailed, comprehensive and contemporaneous statements by the Contractor of his</p>
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		<p>site safety measures, policies and procedures under the laws of India) or as stated in the Contract or elsewhere.</p> <p>If at any time the Site Safety Plan and/or System Safety Assurance Plan is, in the Engineer's opinion, insufficient or requires revision or modification, the Engineer may instruct the Contractor to revise the appropriate Plan. The Contractor shall, within fourteen days, submit the revised plan to the Engineer for review.</p> <p>Any omission, inconsistency or error in the Safety Plans or the Engineer's consent or rejection of the Safety Plans and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to safety measures and shall not excuse any failure by the Contractor to adopt proper and recognized safety practices throughout the execution of the Works.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer and the Employer to carry out surveillance to verify that the Safety Plans are being properly and fully implemented</p>
14	Clause 5A Design (new Clause & subclauses)	<p>Design:- The clauses under the head 'Design' are applicable only in 'Design & Construct' contracts and in case of 'Part Design & Construct' contracts, these are applicable only to part of the Contract in which the design is the responsibility of the Contractor.</p>
15	Sub-clause 5A.1, General Obligations	<p>The Contractor shall design and provide all necessary specifications for the Works in accordance with the site plans and Works Requirements. Any design detail, plan, drawing, specifications, notes, annotations, and information required shall be provided in such sufficient format, details, extent, size and scale and within such time as may be required to ensure effective execution of Works and/or as otherwise required by the Engineer.</p> <p>The Contractor holds himself, and his designers as having the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times during the Contract Period.</p> <p>The designer shall be the same entity as proposed by the Contractor at the time of pre-qualification (in the Bid),</p>

		<p>unless otherwise approved by the Employer. The Contractor shall furnish Designer's Warranty in the format approved by the Employer.</p> <p>The Design and Construction Standards shall be in conformity with the requirements of "Rules for Opening of a Railway or a Section of a Railway for Public Carriage of Passengers" and "Rules for Introduction of New Type of Rolling Stock" and to the satisfaction of the Commissioner of Railway Safety whose sanction is mandatory for commissioning of the System.</p> <p>The Works shall be executed in conformity with the Employer's Requirements, Specifications and Drawings of the Contract issued to the Contractor by the Engineer from time to time. If the Contractor does any work or part in a manner contrary to the Specifications or Drawings, he shall bear all the costs arising there from including dismantling and reconstruction strictly in accordance with the Specifications and Drawings and shall be responsible for all loss to the Employer.</p> <p>If any ambiguity arises as to the meaning and intent of any portion of the Employer's Requirements, Specifications and Drawings or as to execution or quality of any work or material or as to the measurement of the Works, the decision of the Engineer thereon shall be final and binding.</p>
16	<p>Sub-clause 5A.2,</p> <p>Contractor's warranty of design</p>	<p>a. The Contractor shall be fully responsible, for the suitability, adequacy, integrity, durability & practicality of the Contractor's proposal.</p> <p>b. The Contractor warrants that the Contractor's Proposals meet the Works Requirements and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Works Requirements or any part thereof, the Contractor's Proposal shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost.</p> <p>c. The Contractor warrants that the Works have been or will be designed, manufactured, installed and</p>

		<p>otherwise constructed and to the highest standards available using proven up-to-date good practice.</p> <p>e. The Contractor warrants that the Works will, when completed, comply with enactments and regulations relevant to the Works.</p> <p>f. The Contractor warrants that the design of the Works and the manufacture of plant have taken or will have taken full account of the effects of the intended manufacturing and installation methods, Temporary Works and Contractor's Equipment</p> <p>g. The Contractor shall also provide a guarantee from the Designer for the design for suitability, adequacy, practicality of design for Works Requirements.</p> <p>h. The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause.</p> <p>i. The Contractor further specifies and is deemed to have checked and accepted full responsibility 'for the Contractor's Proposal and warrants absolutely that the same meets the Works Requirements:</p> <ul style="list-style-type: none"> • Notwithstanding that such design may be or have been prepared, developed or issued by the Employer, any of Contractor's consultants, his sub-contractors and/or his qualified personnel/persons or cause to be prepared, developed or issued by others. • Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person. • Notwithstanding that the same have been accepted by the Engineer <p>i. The Contractor shall be fully responsible for the Plants, Materials, goods, workmanship, preparing, developing and coordinating all design Works to enable that part of the Works to be constructed and/or to be fully operational in accordance with the Contract's requirements.</p> <p>j. Apart from the Contractor, the above warranty shall also be applicable for his designer. This warranty shall be a part of his sub contract with the designer and</p>
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		<p>should be made available at the time of signing of the Agreement.</p> <p>k. No claim for additional payment or extension of time shall be entertained and/or the Contractor shall not be relieved from any obligation/liability under the Contract, for any delay, suspension, impediment to or adverse effect upon the progress of the Works due to any mistake, inaccuracy, discrepancy or omission in or between the Contractor's, the Definitive Design and the final design, or any failure by the Contractor to prepare any Design Data or submit the same to the Engineer in due time and the Contractor shall promptly make good any such defect at his own cost.</p>
17	<p>Sub-clause 5A.3,</p> <p>Construction and/or</p> <p>Manufacture Documents</p>	<p>The Manufacture Documents shall comprise the technical documents specified in the Works Requirements, documents required to satisfy all regulatory approvals, documents described below (Sub-clause 5A.7: As Built Document), and (Sub-clause 5A.8: Operations and Maintenance Manuals). The Contractor shall prepare all Manufacture Documents in sufficient detail and shall also prepare any other document necessary to instruct the Contractor's personnel. The Engineer shall have the right to inspect the preparation of all these documents wherever they are being prepared.</p> <p>Each of the Construction and/or Manufacture Documents shall, when considered ready for use, be submitted to the Engineer for pre-construction or pre-manufacture review. Unless otherwise stated in Employer's Requirements, each review by the Engineer shall not exceed 21 days, calculated from the date on which the Engineer receives the Manufacture Document.</p> <p>The Engineer may during the review period, give notice to the Contractor that a Manufacture Document fails (to the extent stated) to comply with the Works Requirements, it shall be rectified, resubmitted & reviewed (and if specified, approved) in accordance with this Sub-Clause, at the Contractor's cost.</p> <p>For each part of the Works, and except to the extent that the prior consent of the Engineer shall have been obtained:</p>

		<p>(a) In the case of a Construction and/or Manufacture Document which has (as specified) been submitted for the Engineer's approval</p> <p>(i) The Engineer shall give notice to the Contractor that the Construction and/or Manufacture Document is provided with no objection, with or without comments, or that it fails (to the extent stated) to comply with the Contract;</p> <p>(ii) Execution of such part of the Works shall not commence until the Engineer has provided with no objection the Construction and/or Manufacture Document; and</p> <p>(iii) The Engineer shall be deemed to have provided with no objection the Construction and/or Manufacture Document upon the expiry of the review periods for all the Construction and/or Manufacture Documents which are relevant to the design and execution of such parts, unless the Engineer has previously notified otherwise in accordance with sub-paragraph (i)</p> <p>(b) construction and/or manufacture of such part of the Works shall not commence prior to the expiry of the review of the Construction and/or Manufacture Documents which are relevant to its design and execution;</p> <p>(c) construction and/or manufacture shall be in accordance with such reviewed (and if specified, approved) Construction and/or Manufacture Documents; and</p> <p>(d) if the Contractor wishes to modify any design or document which has previously been submitted for such pre-construction and/or pre-manufacture review, the Contractor shall immediately notify the Engineer, & based on Engineer's approval shall subsequently submit revised documents to the Engineer in accordance with the above procedure.</p> <p>If the Engineer instructs that further Construction and/or Manufacture Documents are necessary for carrying out the Works, the Contractor shall promptly and at Contractor's cost prepare such documents,</p> <p>Errors omissions, ambiguities, inconsistencies, inadequacies and other defects if found at any stage in construction or any operations manufacture documents, then shall be rectified by the Contractor at his own cost</p>
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		<p>and any approval or consent or review (under this sub-clause or otherwise) by the Employer/Engineer of the Manufacture and Construction Documents under this Sub-clause shall not relieve the Contractor from any obligations or responsibility under the Contract.</p> <p>Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Engineer has previously notified his consent, the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the Engineer, are necessary to remedy such noncompliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Engineer.</p>
18	<p>Sub-clause 5A.3.1,</p> <p>Submission of documents (other than Design Data)</p>	<p>The Contractor shall submit drawings and documents, as required by the Contract, to the Engineer in accordance with any submittal schedule agreed with the Engineer. This submittal shall be made sufficiently before the Works are to be carried out to give the Engineer and the Employer reasonable time to examine the drawings or other documents, to prepare comments and for any changes to be accommodated by the Contractor.</p> <p>Where the consent of the Engineer is required, the Engineer shall notify the Contractor in writing of his decision either within such period as may expressly be stipulated in the Contract or otherwise within a reasonable time.</p> <p>If the Engineer has reasonable cause for being dissatisfied with the proposals set out in the Contractor's drawings or documents, the Engineer shall, within a period of 28 days from the date of submittal, require the Contractor in writing to make such amendments thereto as the Engineer may consider necessary. The Contractor shall make and be bound by such amendments at no additional expense to the Employer and shall resubmit the amended drawings or documents for Engineer's consent.</p> <p>Within 14 days of notification of the Engineer's consent the Contractor shall provide the Engineer with the type and number of sets of the relevant drawings or documents as stipulated in the Employer's Requirement.</p>

		<p>Should it be found at any time after notification of consent that the relevant drawings or documents do not comply with the Contract or do not agree with drawings or documents in relation to which the Engineer has previously notified his consent, the Contractor shall, at his own expense, make such alterations or additions as, in the opinion of the Engineer, are necessary to remedy such noncompliance or non-agreement and shall submit all such varied or amended drawings or documents for the consent of the Engineer. No examination by the Engineer of the drawings or documents submitted by the Contractor, nor any consent of the Engineer in relation to the same, with or without amendment, shall absolve the Contractor from any of his obligations under the Contract or any liability for or arising from such drawings or documents.</p> <p>The Operation and Maintenance Manuals and drawings submitted by the Contractor shall, if required, be updated by him during the Defects Liability Period and re-submitted for review and acceptance by the Employer's Representative.</p>
19	<p>Sub-clause 5A.3.2, Submission of Design Data</p>	<p>In the case of submissions subsequent to the Definitive Design, the Design Data shall be in accordance with Employer's Requirements and the Definitive Design.</p> <p>The Contractor shall submit to the Engineer all Design Data, together with the relevant Design Certificates certified by the Contractor, on or before the respective dates for submission shown on the Design Submission Programme or, as the case may be, the Works Programme. In the event that a re-submission of Design Data is required, such re-submission shall be made as soon as practicable after the receipt of the relevant statement of objections. All submissions of Design Data shall include the copies as stipulated in the Employer's Requirements.</p> <p>Following receipt of a submission of Design Data the Engineer shall, within 28 days, return one copy of the Design Data to the Contractor, together with either a Notice of No-Objection, or a statement of objections which shall identify the aspects of the Design Data which do not conform to the above requirements. If the Engineer returns any Design Data with a Notice of No Objection, the Contractor shall proceed with the Works in accordance with the Contract.</p>

		<p>If the Engineer provides that revisions to a submission of Design Data/ are appropriate but that such revisions are of minor design significance, the Engineer may issue a Notice of No Objection subject to an appended schedule of comments identifying the relevant revisions. The Contractor shall revise such Design Data in accordance with such comments but shall not be obliged to resubmit such Design Data solely on account of such revisions.</p> <p>If the Engineer returns any Design Data with a statement of objections the Contractor shall revise the Design Data to take account of the stated objections and re-submit such Design Data to the Engineer, together with new Design Certificates signed by the Designer and the Contractor.</p> <p>The issue of a Notice of No Objection in relation to any submission of Design Data shall be entirely without prejudice to the review of subsequent submissions of Design Data or to any subsequent request for a Contractor's Variation, and shall not bind or fetter the Engineer in any manner whatsoever when deciding whether or not to raise objections in relation to any subsequent submission of Design Data or when dealing with a subsequent request for a Contractor's Variation.</p> <p>Neither an objection raised to the Design Data nor revisions of minor design significance under this Clause will, under any circumstances, constitute an Employer's Variation.</p>
20	Sub-clause 5A.4, Delayed Drawings or Instructions	<p>The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.</p> <p>If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the</p>

		<p>Contractor shall give a further notice to the Engineer and shall be entitled subject to Clause 20 to:</p> <p>(a) an extension of time for any such delay, if completion is or will be delayed, under Clause 8.4.</p> <p>(b) payment of any such Cost-plus profit, which shall be included in the Contract Price.</p> <p>After receiving this further notice, the Engineer shall proceed to agree or determine these matters.</p> <p>However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.</p>
21	Sub-clause 5A.5, Technical Standards and Regulations	<p>The design, the Construction and/or Manufacture Documents, the execution and the completed Works (including remedying of defects therein) shall comply with the specifications, technical standards, building construction, safety and environmental regulations and other standards specified in the Works Requirements applicable to the Works or defined by the applicable laws and regulations.</p>
22	Sub-clause 5A.6, Samples	<p>The Contractor shall submit at his own cost the following samples and relevant information to the Engineer for pre-construction and/or pre-manufacture review in accordance with the procedure for Construction and/or Manufacture Documents described in Sub- Clause above "Delayed Drawings or Instructions":</p> <ul style="list-style-type: none"> • manufacturer's standard samples of Materials • samples (if any) specified in the Employer's Requirements <p>Each sample shall be labelled as to origin and intended use in the Works.</p>
23	Sub-clause 5A.7, As-built drawings and Documents	<p>The Contractor shall prepare, and keep up-to-date, a complete set of "as-built" records of the execution of the Works, showing the exact "as-built" locations, sizes and details of the Works as executed, with cross references to relevant specifications and data sheets. These records shall be kept on the Site and shall be used exclusively for the purposes of this Sub-Clause. Six copies shall be</p>

		<p>submitted to the Engineer prior to the commencement of the Tests on Completion.</p> <p>In addition, the Contractor shall prepare and submit to the Engineer "as-built drawings" of the Works, showing all Works as executed. The drawings shall be prepared as the Works proceed and shall be submitted to the Engineer for his inspection. The Contractor shall obtain the consent of the Engineer as to their size, the referencing system, and other pertinent details.</p> <p>Prior to the issue of any Taking Over Certificate, the Contractor shall submit to the Engineer one microfiche copy, one full-size original copy and six printed copies of the relevant "as-built drawings", and any further Construction and/or Manufacture Documents specified in the Works Requirements. The Works shall not be considered to be completed for the purposes of Taking Over under Clause 10 until such documents have been submitted to the Engineer.</p>
24	Sub-clause 5A.8, Operation And Maintenance Manuals	<p>Prior to commencement of the Tests on Completion, the Contractor shall prepare, and submit to the Engineer, Operation and Maintenance Manuals in accordance with the Works Requirements and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair the Works. The Works shall not be considered to be completed for the purposes of Taking Over under Clause 10 until such Operation and Maintenance Manuals have been submitted to the Engineer and received his consent.</p> <p>The Operation and Maintenance Manuals and drawings submitted by the Contractor shall be updated by him during the Defects Liability Period and the Contractor shall re-submit the updated manuals at the end of the DLP for review and acceptance by the Engineer.</p>
25	Sub-clause 5A.9, Intellectual Property Rights and Royalties	<p>The Contractor shall indemnify the Employer and the Engineer from and against all claims and proceedings on account of infringement (or alleged infringement) of any patent rights, registered designs, copyright, design, trademark, trade name, know-how or other intellectual property rights in respect of the Works, Contractor's Equipment, machines, work method, or Plant, or Materials, or anything whatsoever required for the Works and from and against all claims, demands, proceedings,</p>

	<p>damages, costs, charges and expenses whatsoever in respect thereof or in relation thereto. The Contractor shall pay all traffic surcharges and other royalties, licence fees, rent and other payments or compensation, if any, for getting stone, sand, gravel, clay or other materials, machine, process, systems, work methods, or Contractor's Equipment required for the Works. The Contractor shall, in the event of infringement of Intellectual Property Rights, rectify, modify or replace at his own cost the Works, Plant or materials or anything whatsoever required for the Works so that infringement no more exist or in the alternative shall procure necessary rights/license so that there is no infringement of Intellectual Property Rights.</p> <p>The Contractor shall be promptly notified of any claim under this Sub-Clause made against the Employer. The Contractor shall, at his cost, conduct negotiations for the settlement of such claim, and any litigation or arbitration that may arise from it. The Employer or the Engineer shall not make any admission, which might be prejudicial to the Contractor, unless the Contractor has failed to take over the conduct of the negotiations, litigation or arbitration within a reasonable time after having been so requested. In the event of Contractor failing to act at Engineer's notice, the Employer shall be at full liberty to deduct any such amount of pending claim from any amount due to the Contractor under this Contract or any other Contract.</p> <p>Insofar as the patent, copyright or other intellectual property rights in any Plant, Design Data, plans, calculations, drawings, documents, Materials, know-how and information relating to the Works shall be vested in the Contractor, the Contractor shall grant to the Employer, his successors and assignees a royalty-free, nonexclusive and irrevocable licence (carrying the right to grant sublicenses) to use and reproduce any of the works, designs or inventions incorporated and referred to in such Plant, documents or Materials and any such know-how and information for all purposes relating to the Works (including without limitation the design, manufacture, installation, reconstruction, Testing, commissioning, completion, reinstatement, extension, repair and operation of the Works).</p>
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		<p>If any patent, registered design or software is developed by the Contractor specifically for the Works, the title thereto shall vest in the Employer and the Contractor shall grant to the Employer a nonexclusive irrevocable and royalty-free licence (carrying the right to grant sub-license) to use, repair, copy, modify, enhance, adapt and translate in any form such Software for his own use.</p> <p>If the Contractor uses proprietary software for the purpose of storing or utilising records the Contractor shall obtain at his own expense the grant of a licence or sub-license to use such software in favour of the Employer and shall pay such licence fee or other payment as the grantor of such licence may require provided that the use of such software under the licence may be restricted to use relating to the design, construction, reconstruction, manufacture, completion, reinstatement, extension, repair and operation of the Works or any part thereof. The Contractor's permission referred to above shall be given, inter alia, to enable the Employer to disclose (under conditions of confidentiality satisfactory to the Contractor) programmes and documentation for a third party to undertake the performance of services for the Employer in respect of such programmes and documentation.</p> <p>If any software is developed under the Contract or used by the Contractor for the purposes of storing or utilising records over which the Contractor or a third party holds title or other rights, the Contractor shall permit or obtain for the Employer (as the case may require) the right to use and apply that Software free of additional charge (together with any modifications, improvements and developments thereof) for the purpose of the design, manufacture, installation, reconstruction, testing, commissioning, completion, reinstatement, extension, repair, modification or operation of the Works, or any part thereof, or for the purpose of any Dispute.</p> <p>The Employer reserves the right to use other Software on or in connection with the Works.</p>
26	Sub-Clause 6.2 Rates of Wages and Conditions of Labour	Replace the GC Sub-Clause 6.2 with the provisions as under:

		<p>Full compliance of statutory requirements apart, the Contractor shall pay rates of wages and observe conditions of labour not less favourable than those established for the trade or the industry where the work is carried out.</p> <p>The Contractor shall, if required by the Employer, deliver to the Engineer or to his office, a return in detail, in such form and at such intervals as the Employer may prescribe, showing the number of labour employed in different categories by the Contractor on the Site.</p> <p>The Contractor shall make himself aware of all labour regulations and their impact on the cost and build up the same in the Contract Price. During the Contract Period no extra amount in this regard shall be payable to the Contractor, for whatsoever reason including any revision of rates payable to the labour due to revision of rates payable in Minimum Wages Act.</p> <p>Labour provided by the Contractor, either directly or through subcontractors, for the exclusive use of the Employer or the Engineer, shall, for the purpose of this Sub-Clause, be deemed to be employed by the Contractor.</p> <p>In the event of default being made in the payment of any money in respect of wages of any person employed by the Contractor or any of its sub-contractors of any tier in and for carrying out of this Contract and if a claim therefore is filed in the office of the Labour Authorities and proof thereof is furnished to the satisfaction of the Labour Authorities, the Employer may, failing payment of the said money by the Contractor, make payment of such claim on behalf of the Contractor to the said Labour Authorities and any sums so paid shall be recoverable by the Employer from the Contractor.</p>
27	Sub-Clause 6.4 Labour Laws	<p>The following is added to the existing clause:</p> <p>(a) In dealing with labour and employees, the Contractor and his Sub-Contractors (including piece rate and petty Contractors) shall comply fully with all laws and statutory regulations pertaining to engagement, payment and upkeep of the labour in India.</p>

		<p>(b) The Contractor shall have a Labour Welfare Organisation which shall be responsible for labour welfare and compliance with prevalent labour laws, statutes and guidelines. In this context, the Contractor is also required to familiarize himself with Maharashtra Metro Rail Corporation Limited's Labour Welfare Fund Rules as specified in PC or elsewhere in the Contract and comply with the same.</p> <p>(c) The Contractor shall prepare and submit compliance reports of adherence to labour laws as and when desired by the Engineer.</p> <p>(d) The Contractor will ensure to open bank accounts for each worker employed by him and his sub-contractors and all the payments to workers will be released through bank accounts.</p> <p>(e) The Contractor shall, if required by the Employer, deliver to the Engineer or to his office; a return in detail, in such form and at such intervals as the Employer may prescribe, showing the number of labour employed in different categories by the Contractor or his subcontractors on the Site.</p>
28	Sub-Clause 6.5 Working Hours	<p>Replace the GC Sub-Clause 6.5 with the provisions as under:</p> <p>The Contractor, if required, shall carry out work during night hours or in shifts, unless specifically provided otherwise in the Contract. No increase in rates or extra payments shall be admissible for night work. The Contractor shall provide adequate lighting and safety arrangements.</p>
29	Clause 7, Workmanship and Quality Control	<p>The following is added to the existing clause:</p> <p>Within 28 days of the issue of the Notice to Proceed, the Contractor shall submit to the Engineer, for his consent, his proposed Site Quality Plan based on the Outline Quality Plan and the Employer's Requirements. The quality manual should address the quality system as required by ISO 9001 or equivalent standard. Any supplement to the Site Quality Plan shall be submitted at least 14 days before commencement of the relevant work.</p> <p>Upon the Engineer notifying his consent to the Site Quality Plan, or any supplement thereto, the Contractor</p>

		<p>shall, adhere to the principles and procedures contained in such document, except where the Engineer gives his consent to any amended or varied version thereof. The Contractor shall cause any sub-contractors to adhere to this Plan.</p> <p>The Contractor shall appoint a suitably qualified and experienced person, not otherwise engaged in the performance of the Contract, to act as manager of the quality assurance system and shall provide such other personnel and resources as required to ensure effective operation of the quality assurance system. The said manager shall carry out audits of the application of the quality assurance system, and ensure effective quality control and delivery of quality assurance.</p> <p>The Contractor shall provide all necessary access, assistance and facilities to enable the Engineer to carry out surveillance visits both on and off the Site to verify that the quality assurance system is being properly and fully implemented. No extra payment shall be made in this regard and the cost of the Work under this element shall be deemed to be included in the Contract Price.</p>
30	Sub-Clause 7.1, Manner of Execution	<p>Add following at the end of GC Sub-Clause 7.1:</p> <p>The Contractor shall design and provide all necessary specifications for the Works in accordance with the site plans and Work's Requirements. Any design detail, plan, drawing, specifications, notes, annotations, and information required shall be provided in such sufficient format, details, extent, size and scale and within such time as may be required to ensure effective execution of Works and/or as otherwise required by the Engineer.</p> <p>The Contractor holds himself, and his designers as having the experience and capability necessary for the design. The Contractor undertakes that the designers shall be available to attend discussions with the Engineer at all reasonable times during the Contract Period.</p> <p>The designer shall be the same entity as proposed by the Contractor at the time of pre-qualification (in Bid), unless otherwise approved by the Employer. The</p>

		<p>Contractor shall furnish Designer's Warranty in the format enclosed in Section X Contract Forms.</p> <p>The Contractor further warrants that:</p> <ol style="list-style-type: none"> The Contractor shall be fully responsible, for the suitability, adequacy, integrity, durability and practicality of the Contractor's proposal. The Contractor warrants that the Contractor's Proposals meet the Work's Requirements and is fit for the purpose thereof. Where there is any inadequacy, insufficiency, impracticality or unsuitability in or of the Work's Requirements or any part thereof, the Contractor's Proposal shall take into account, address or rectify such inadequacy, insufficiency, impracticality or unsuitability at Contractor's own cost. The Contractor warrants that the Works have been or will be designed, manufactured, installed and otherwise constructed and to the highest standards available using proven up-to-date good practice The Contractor warrants that the Works will, when completed, comply with enactments and regulations relevant to the Works The Contractor warrants that the design of the Works and the manufacture of plant have taken or will have taken full account of the effects of the intended manufacturing and installation methods, Temporary Works and Contractor's Equipment The Contractor shall also provide a guarantee from the Designer for the design for suitability, adequacy, practicality of design for Work's Requirements The Contractor shall indemnify the Employer against any damage, expense, liability, loss or claim, which the Employer might incur, sustain or be subject to arising from any breach of the Contractor's design responsibility and/or warranty set out in this Clause. The Contractor further specifies and is deemed to have checked and accepted full responsibility 'for the Contractor' s Proposal and warrants absolutely that the same meets the Work's Requirements: Notwithstanding that such design may be or have been prepared, developed or issued by the Employer, any of Contractor's consultants, his sub-contractors and/or
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		<p>his qualified personnel/ persons or cause to be prepared, developed or issued by others.</p> <p>ii. Notwithstanding any warranties, guaranties and/or indemnities that may be or may have been submitted by any other person.</p> <p>iii. Notwithstanding that the same have been accepted by the Engineer.</p> <p>The Contractor shall be fully responsible for the Plants, Materials, goods, workmanship, preparing, developing and coordinating all design Works to enable that part of the Works to be constructed and/or to be fully operational in accordance with the Contract's requirements.</p> <p>Apart from the Contractor, the above warranty shall also be applicable for his designer. This warranty shall be a part of his sub contract with the designer and should be made available at the time of signing of the Agreement.</p> <p>No claim for additional payment or extension of time shall be entertained and/or the Contractor shall not be relieved from any obligation/liability under the Contract, for any delay, suspension, impediment to or adverse effect upon the progress of the Work due to any mistake, inaccuracy, discrepancy or omission in or between the Contractor's, the Definitive Design and the final design, or any failure by the Contractor to prepare any Design Data or submit the same to the Engineer in due time and the Contractor shall promptly make good any such defect at his own cost.</p>
31	Sub-Clause 7.6 Remedial Works	<p>Add the following at the end of this sub-clause:</p> <p>The Contractor shall not be released from any liability or obligation under the Contract by reason of any such inspection or testing or witnessing of testing, or by the submission of reports of inspection or testing to the Engineer.</p>
32	Sub-Clause 7.7 Ownership of Plant and	<p>Replace the GC Sub-Clause 7.7 with provisions as under:</p>

	Materials	The plant, goods and material not finally taken over as per GC Clause 10 but payment against which have been made in part or full against Indemnity Bond / Safety Custody Bank Guarantee will remain under the Contractor's custody. The Contractor shall be responsible for its safety and will bear all the risks till taken over by the Employer.
33	Sub-Clause 7.9 (additional subclause)	<p>Undertaking for manufacture and supply of spares</p> <p>The Contractor shall submit an undertaking for manufacture & supply of spares (including those of its Sub-Contractors / Vendors) for the equipment supplied in the Contract for at least 10 years from the date of completion of the Contract.</p>
34	Sub-Clause 8.1, Commencement of Works	<p>Replace the GC Sub-Clause 8.1 with the provisions as under:</p> <p>Except as otherwise provided in the Particular Conditions of Contract, the Commencement Date shall be the date indicated in the Letter of Acceptance.</p> <p>The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date and shall then proceed with the Works with due expedition and without delay.</p>
35	Sub-clause 8.3, Programme	<p>The following is added to the existing clause:</p> <p>The Contractor shall prepare and submit his detailed Programme of Work so as to achieve key dates of various activities. The Contractor shall complete the work in a phased manner fixing priorities to the different stages of the work as per the requirement of project from time to time.</p> <p>Consent by the Engineer to a Works Programme shall not relieve the Contractor of any of his duties or responsibilities under the Contract, nor in the event that a Works Programme indicates that a Key Date has not or will not be met, constitute any form of acknowledgement that the Contractor is or may be entitled to an extension of time in relation to such Key Date or a Mile Stone.</p>

		<p>Design Submission Program</p> <p>The Contractor shall submit to the Engineer, the Design Submission Programme and updated versions thereof in the form and content and at the times prescribed in the Contract, including the dates on which major decisions should be made.</p> <p>In the second and subsequent submissions of the Design Submission Programme, the Contractor shall not, without the prior written consent of the Engineer:</p> <ul style="list-style-type: none">(a) revise the description or content of any design package identified in the initial version of Design Submission Programme;(b) reduce the periods provided for review by the Engineer of any submission of Design Data as set out in the initial version of the Design Submission Programme;(c) revise the sequence of submissions of Design Data shown in the initial version of the Design Submission Programme. Any amendment of the Design Submission Programme in breach of the above requirements shall have no effect whatsoever under the Contract. <p>Manufacture, Installation and Construction Methods</p> <p>The Contractor shall submit complete documents and information pertaining to the methods of manufacture, installation and construction which the Contractor proposes to adopt or use, (and if applicable such calculations of stresses, strains and deflections and the like that will or may arise in the Works or to the other works comprising the Project or any parts thereof during installation from the use of such methods). The Engineer will then check to see whether, if such methods are adhered to, the Works can be executed in accordance with the Contract and without detriment to the Works (when completed) and to other works comprising the Project and, in a manner, which minimises disruption to road and pedestrian traffic.</p>
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		<p>The Engineer shall inform the Contractor in writing within 21 days after receipt of the above information;</p> <p>(a) that the Contractor's proposed methods of manufacture, installation and construction have the consent of the Engineer; Or</p> <p>(b) in what respects, in the opinion of the Engineer the Contractor's proposed methods of manufacture, installation and construction:</p> <p>a. fail to comply with the Employer's Requirements and/or the Definitive Design and/or the Final Design;</p> <p>b. would be detrimental to the Works and/or to the other works comprising the Project;</p> <p>c. do not comply with the other requirements of the Contract; or</p> <p>(c) as to the further documents or information which are required to enable the Engineer to properly assess the proposed methods of manufacture, installation and construction.</p> <p>In the event that the Engineer does not give his consent, the Contractor shall take such steps or make such changes in the said methods or supply such further documents or information as may be necessary to meet the Engineer's requirements and to obtain his consent. The Contractor shall not change the methods of manufacture, installation and construction which have received the Engineer's consent without further review and consent in writing of the Engineer.</p> <p>Notwithstanding the foregoing provisions of this Clause, or that certain of the Contractor's proposed methods of manufacture, installation and construction may be the subject of the consent of the Engineer, the Contractor shall not be relieved of any liability or obligation under the Contract.</p>
36	Sub-Clause 8.4, Extension of	Replace the GC Sub-Clause 8.4 with the provisions as under:

	Time for Completion	<p>The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:</p> <ul style="list-style-type: none"> (a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the Contract, (b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions, or (c) exceptionally adverse climatic conditions, (d) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors. <p>If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.</p>
37	Sub-clause 8.7, Delay Damages	<p>The following is added to the existing clause:</p> <p>The 'total Contract Value' used in the GCC sub clause 8.5 for the purpose of levy of liquidated damages on failure to achieve Key Dates shall mean the 'Awarded cost of the work'.</p>
38	Sub-Clause 8.9 Consequences of Suspension	<p>The following is added to the existing clause:</p> <p>The Contractor shall not be entitled to extra cost (if any), incurred by him, during the period of suspension of Work, if such suspension is</p> <ul style="list-style-type: none"> a. provided for in the Contract, or

		<p>b. necessary for proper execution of Works or by reasons of weather condition or by some default on the part of the Contractor, or</p> <p>c. necessary for the safety of Works or any part thereof or</p> <p>d. necessary for the safety of adjoining public or other property or safety of the public or workmen or those who have to be at the site or</p> <p>e. to ensure safety and to avoid disruption of traffic and utilities, as also to permit fast repairs and restoration of any damaged utilities, or</p> <p>f. on account of work carried out by the Contractor not in accordance with the directions of the Engineer; or</p> <p>g. on account of any other reason which is not attributable to the Employer</p>
39	<p>Sub-Clause 9.4, Failure to Pass Tests on Completion</p>	<p>Replace the GC Sub-Clause 9.4 with the provisions as under:</p> <p>If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:</p> <p>(a) order further repetition of Tests on Completion under Sub- Clause 9.3; or</p> <p>(b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects].</p>
40	<p>Sub-Clause 9.5 (additional subclause)</p> <p>Integrated Testing and Commissioning</p>	<p>Integrated Testing</p> <p>Tests on Completion shall also include Integrated Testing where applicable as per the contract conditions. The Contractor shall, following satisfactory completion of tests on his works, equipment, sub-systems or system, perform, at the direction of the Engineer, programme of tests to verify and confirm the compatibility and complete performance of his works, equipment, sub-systems or system with the works, equipment, sub-systems or system provided by others.</p>

		<p>Compilation of Test Results</p> <p>The results of the Integrated Testing and Commissioning shall be compiled and evaluated by the Engineer and the Contractor.</p> <p>Re-testing</p> <p>If the Works, or a part thereof, or a Section, fail to pass the Integrated Testing and Commissioning, the Engineer shall require such failed Tests, to be repeated under the same terms and conditions. If such failure and retesting result from a default of the Contractor and cause the Employer to incur additional costs, the same shall be recoverable from the Contractor by the Employer and may be deducted by the Employer from any monies due, or to become due, to the Contractor.</p> <p>Failure to pass Test</p> <p>If the Works, or a part thereof, or a Section, fail to pass Integrated Testing and Commissioning and the Contractor in consequence proposes to make any adjustment or modification to the Works or a part thereof, or a section, the Engineer may, with the approval of the Employer, instruct the Contractor to carry out such adjustment or modification, at his own cost and to satisfy the requirements of Integrated Testing and Commissioning within such time as the Employer / Engineer may deem to be reasonable.</p> <p>Statutory Requirements</p> <p>The Contractor along with others shall carry out all statutory tests and trials, under the supervision of the Engineer, necessary for obtaining sanction of the competent authority for opening the system for public carriage of passengers.</p> <p>The Contractor shall, if required by the Employer, deliver to the Engineer or to his office, a return in detail, in such form and at such intervals as the Employer may prescribe, showing the number of labour employed in different categories by the Contractor on the Site.</p> <p>The Design and Manufacture Standards to be adopted by the Contractor shall be in conformity with the requirements of tender specifications as well as "Rules for Opening of a Railway or a Section of a Railway for Public</p>
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		Carriage of Passengers” and “Rules for Introduction of New Type of Rolling Stock”. Contractor under the supervision of the Engineer, shall carry out all statutory tests and trials and shall prepare and submit all documents as required including the documents required for obtaining all approvals and sanction of the Commissioner of Metro Railway Safety (CMRS) and any other Statutory Authority, that may be required for introduction of Rolling Stock for Public Carriage of Passengers.
41	Clause 11 Defect Liability	<p>The following is added to the existing clause:</p> <p>During the Defects Liability Period the Contractor shall provide, competent and skilled personnel as stated under <i>1 - Section III - 3.6 Personnel</i> and maintain adequate stock of spares so as to promptly fulfil his obligations during the Defects Liability Period as laid down in GCC and Works Requirements at free of cost. A penalty of Rs.10000/- per day in DLP period will be imposed if Track failure (only that part which is as per scope of work of contract T06/2021) is not repaired/replaced within 24 Hrs of its failure.</p> <p>Maintenance during Defects Liability Period</p> <p>Contractor shall establish an office for the purpose with communication facility so as to facilitate communication for reporting failures and liaison with maintenance staff manning the stations round the clock. The supervisor in-charge should be provided with mobile communication facility to ensure his presence at the site immediately after reporting. Contractor shall ensure restoration /rectification/replacement, within reasonable time, to the satisfaction of Engineer. The Engineer in case of the delay as deems fit shall be empowered to carry out the maintenance at the risk and cost of the Contractor.</p> <p>Routine Maintenance</p> <p>Submit Monthly status report to the Engineer -in - Charge.</p> <p>Repairs</p> <p>All equipment that requires repairing shall be immediately serviced and repaired.</p>

		<p>Complaints</p> <p>The Contractor shall receive calls for any and all problems experienced in the operation of the systems, attend to these within 120 minutes of receiving the complaints and shall take steps to immediately correct any deficiencies that may exist.</p> <p>Maintenance Log Book</p> <p>The Contractor shall maintain a Maintenance Log Book at each Station, the format for which shall be approved by Engineer - in - charge. In the Maintenance Log book, the details about date of Routine Maintenance, Routine Maintenance activities performed, Details of Call - out visit / Break - down maintenance, etc. shall be maintained. Copy of relevant pages of the Log book to be submitted to the Engineer - in - charge with the Monthly status report.</p> <p>Failure Analysis Report</p> <p>The Contractor shall submit a report for the Failure Analysis in the format approved by the “Engineer” giving the details of the type of fault, cause of fault, analysis of faulty component, etc correlated with the details of last preventive maintenance activity performed.</p> <p>Operation and Maintenance</p> <p>The Contractor shall provide Expert team for Maintenance and operation till the end of DLP. The deployment of these Experts and team shall be continuous. These Experts and team shall work under the administrative control of the Employer. These Experts and team shall also ensure that the Client's maintenance staff acquire necessary skills and follow correct procedures and practices in the maintenance, overhaul and repair of various components for the system as well as for the maintenance of the related software (if any) after the DLP. The qualification and experience of the Experts to be deployed by the Contractor shall be as prescribed in the</p>
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		Works Requirements. Prior approval of the Employer shall be necessary before the Experts are deployed for maintenance and operation. The Contractor shall replace promptly, Contractor's experts who are not considered suitable by the Engineer.
42	Sub-Clause 11.4 Failure to Remedy Defects	<p>Replace the GC Sub-Clause 11.4 with the provisions as under:</p> <p>If the Contractor fails to remedy any defect or damage within such time as the Employer / Engineer may deem to be reasonable, the Employer or the Engineer may fix a date on or by which to remedy the defect or damage and give the Contractor reasonable notice of such date. If the Contractor fails to remedy the defect or damage by such date and the necessity for such work is due to a cause stated in Sub-Clause 11.2(a), (b) or (c), the Employer may (at his sole discretion):</p> <p>(a) carry out the work himself or by others, in a reasonable manner and at the Contractor's risk and cost, but the Contractor shall have no responsibility for such work: the costs incurred by the Employer in remedying the defector damage shall be recoverable from the Contractor by the Employer;</p> <p>(b) require the Engineer to determine and certify a reasonable reduction in the Contract Price ;or</p> <p>(c) if the defect or damage is such that the Employer has been deprived of substantially the whole of the benefit of the Works or parts of the Works, terminate the Contract in respect of such parts of the Works as cannot be put to the intended use ,the Employer shall then be entitled to recover all sums paid for such parts of the Works together with the cost of dismantling the same ,clearing the Site and returning Plant, Rolling Stock and Materials to the Contractor ,and Sub- Clause 13 shall not apply.</p>
43	Sub-clause 12.3.1 (New sub-clause)	<p><u>Variation in the Bill of Quantities</u></p> <p>i) The quantities of items shown in the Bill of Quantities are approximate, & liable to vary during the actual execution of the work. Some items/group of items may have to be altered, added or omitted. The Contractor shall be bound to carry out and complete the stipulated work as instructed by the Engineer, irrespective of the magnitude of variations including additions, alterations or omissions in the Bill of Quantities, individual items or</p>

		<p>group of items of Schedule-BLT1 and Schedule-CR1 specified in the Bill of Quantities.</p> <p>ii) Each of these Schedules BLT1 and CR-1 shall constitute a Group of items.</p> <p>iii) Such variations shall be paid as follows:</p> <p>a) At the accepted rates of the Contract for Positive variation in quantities to the extent of 25%. Unless otherwise specifically provided for in the Bill of Quantities or elsewhere in the Contract, the variation of 25% shall be applicable to a group of items mentioned therein and not to individual items. In case of variation in quantities on minus side, contract rates will be payable for executed quantities.</p> <p>b) Variation in the quantity of items individually costing upto 1% of the total contract value, shall be payable at the rates stated in the Contract notwithstanding the magnitude of variation upto 2% of the original Contract Value for each item.</p> <p>c) In case the variation in individual items or the group of items as stipulated above, is more than 25% on plus side, the rate for the varied quantity beyond 25% shall be negotiated between the Engineer and the Contractor and mutually agreed rates arrived at before actual execution of the extra quantity.</p> <p>d) In case Engineer introduces an item for which the Contract does not contain any rates or prices applicable to the varied Works, the rate of such items shall be derived, wherever possible, from rate for similar items available in the Bill of Quantities of the accepted Tender. In case this is not possible, the rate may be decided on the following basis:</p> <p>i. Cost of Materials at current market price, as actually utilised in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.</p> <p>ii. Cost of enabling works if any (unless provided for separately) worked out on the above basis but with less stringent quality. Specifications minus salvage value of serviceable material released after completion of work and cost of material released as scrap.</p> <p>iii. Cost of labour actually used at the site of work at rates under Payment of Minimum Wages Act for the area of work for each category of worker, further enhanced by a percentage of 10% of the aforesaid rates to account for labour not directly utilised at Site and other ancillary and incidental expenses on labour.</p> <p>iv. Hire charges for Plant & Machinery, scaffolding, shuttering, forms, etc., required to be used at the site of the work. The tools used by the various trades shall not be counted as Plant & Machinery for this purpose.</p>
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		<p>v. An amount of 20% of items (i), (ii), (iii) and (iv) above to allow for Contractor's overheads, profits and corporate taxes. This percentage shall also apply to estimated cost of Materials supplied free to the Contractor.</p> <p>vi. In all cases where extra items of work are involved, for which there are no rates in the accepted Bill of Quantities the Contractor shall give a notice to the Engineer, of at least 7 days before the need for their execution arises.</p> <p>In the event of disagreement in respect of items (c) and (d) above, the Engineer shall fix such rates of price as are, in his opinion appropriate and shall notify the Contractor accordingly, with a copy to the Employer. Until such time as rates or prices are agreed or fixed, the Engineer shall determine provisional rates or prices to enable on account payments to the Contractor. Alternatively, in the event of disagreement, the Contractor shall have no claim to execute extra quantities/new items and the Engineer shall be free to get such additional quantities beyond 25% new items executed through any other agency. However, if the Engineer or the Employer so directs the Contractor shall be bound to carry out any such additional quantities beyond the limits stated above original quantities and or new items and the disagreement or the difference regarding rates to be paid for the same shall be settled in the manner laid down under the conditions for the settlement of dispute.</p>
44	Sub-clause 13.2.1 (New sub-clause)	<p>Employer's Variation & Variation Procedure</p> <p>"Employer's Variation" means a change in the Works Requirements which makes necessary alteration or modification of the Design, quality or scope of Works as described by or referred to in the Works Requirements. Changes to any sequence, method or timing of manufacture, testing and Commissioning including Integrated Testing and Commissioning and changes to any part of the Site or access thereto will not constitute Employer's Variation.</p> <p>An Employer's Variation shall be requested and implemented in accordance with and subject to the following provisions:</p> <p>(a) within 14 days (or such other period as the Engineer may allow) of the Engineer informing the Contractor in writing of the intention to request an Employer's Variation, the Contractor shall notify the Engineer in</p>

		<p>writing whether in his opinion the Employer's Variation would, if ordered:</p> <ul style="list-style-type: none"> (i) give rise to any entitlement to an extension of time; or (ii) affect the achievement of any Milestone; or (ii) give rise to any entitlement to additional payment; or (iii) affect the warranties of the Contractor set out in Conditions of Contract and shall submit his proposals as to the terms upon which he would agree to implement the Employer's Variation. <p>(b) The Contractor shall furnish sufficient information in terms of rates/prices of the equipment/components manufactured by the contractor or sourced from the Vendors/Sub-contractors such as: estimated man-hours, man-hours rates for manufactured items, design costs, basic rate of materials, sub-assemblies, taxes, duties, overheads & profiles and inflation rate, so as to establish the reasonableness of the variation price. In assessing work covered by any sub-contract, the Engineer shall have, where he deems necessary, access to the original sub-contract conditions, rates, prices and details of the variation claimed and may direct the Contractor to provide a copy of the same, to assist in evaluating any Variations.</p> <p>(c) any agreement between the Engineer and the Contractor as to the terms upon which an Employer's Variation may be implemented shall have no contractual or other legal effect, until it is in writing and is signed by the Contractor and the Engineer. The Engineer before signing such agreement shall take prior approval of the Employer. The terms of this agreement will be binding upon the Contractor and the Employer. This agreement shall determine the amount which should be added to or deducted from the relevant Cost Centre Amount and/or the revisions (if any) which should be made to the Milestone Payment Schedules as a result of the Variation.</p> <p>In the event of the Engineer and the Contractor failing to reach agreement on the revisions to be made to the Cost Centre Amounts, the Engineer shall, with the approval of the Employer, determine the amount which should be added or deducted from the relevant cost centre amount which shall be binding on the contractor. In case the Contractor supplies part/ incomplete information or</p>
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		<p>refuses to supply the required information, Engineer shall determine the cost of Variation based on the information available to him from any sources which in his judgment can be used to determine the case. The Contractor shall proceed with the Work irrespective of whether an agreement between the Engineer and Contractor as to the terms and price of the variation have been reached or not but may submit his Claim if necessary, in accordance with Sub-clause 20 of GCC.</p> <p>(d) if the Engineer withdraws the request for an Employer's Variation, the Contractor shall have no claim of any kind whatsoever arising out of or in connection with any of the proposals made or any failure to reach agreement. In case the Employer's Variation involves omission of part of the Works, the agreement shall address the issue of reduction in the Contract Price.</p> <p>Note: The Contract Forms attached to PC may be modified as considered necessary at the time of finalization of the Contract.</p>
45	Sub-clause 13.7 Adjustments for Changes in Legislation	<p>The following is added to the existing clause:</p> <p>The Contract Price shall be adjusted to take into account any new taxes or any statutory variation in Custom Duty, GST etc. on finished product/item during the contractual completion period shall be to the Employer's account for which the Contractor shall furnish documentary evidence in support of their claims. However, any increase in the cost due to new taxes or change in the existing taxes & GST/Custom duty act etc. introduced during the extended contractual completion period due to the Contractor's fault shall be to the Contractor's account.</p>
46	Sub-Clause 13.8, Adjustments for Changes in Cost	<p>Replace the GC Sub-Clause 13.8 with the provisions as under:</p> <p>The rates as per the accepted Bill of Quantities / Pricing Document shall be applicable till the completion of the Works and will be varied only to the extent of permissible price variation under this clause. However, this adjustment shall be to the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the Price Variation formula, the rates in the accepted Bill of Quantities / Pricing Document shall be deemed to include amounts to cover the contingency of such rise or fall in costs.</p>

		<p>The price variation will be payable only on the Indian currency component (no adjustment for foreign currency component) of the Contract Price for Bill of Quantity bill no BLT -1 and CR -1 only of Price Bid as per the following price variation formula.</p> <p>Payment as per the Contract shall be subject to adjustment in accordance with the following Price Variation formula, and other terms given herein, to provide for variation in the market rates of inputs like labour, materials and fuel / energy during the currency of the Contract:</p> $V = V_L + V_S + V_C + V_F + V_M$ <p>Where</p>	
		V	Total adjustment on account of all components/factors
		V _L	Adjustment on account of labour component $= p * R * \frac{l - l_o}{l_o}$
		V _S	Adjustment on account of steel component $= q * R * \frac{W_S - W_{so}}{W_{so}}$
		V _C	Adjustment on account of cement component $= r * R * \frac{W_C - W_{co}}{W_{co}}$
		V _F	Adjustment on account of fuel / lubricant component $= s * R * \frac{W_f - W_{fo}}{W_{fo}}$

		V_m <p>Adjustment on account of other materials, machinery and machine tools component</p> $= t * R * \frac{W_m - W_{mo}}{W_{mo}}$
	p	Cost coefficient of labour to the total cost = 0.20
	q	Cost coefficient of Steel to the total cost = 0.25
	r	Cost coefficient of Cement to the total cost = 0.17
	s	Cost coefficient of Fuel & Lubricants to the total cost = 0.05
	t	Cost coefficient of other Materials, machineries, tools and plants = 0.18
	Note: p + q + r + s + t = 0.85, balance 0.15 shall be the fixed component	
	R	Gross value of the work done by the Contractor for the period of work under consideration, after excluding the reform the cost of any materials supplied free or at fixed rate to the Contractor.
	I_o	Consumer Price Index for Industrial workers, published in the Labour Bureau, Ministry of Labour and Employment, Government of India, as applicable to Pune area for the month preceding the month in which the last date prescribed for receipt of tender, falls.
	I	Average of monthly Consumer Price Index for Industrial workers published in the Labour Bureau, Ministry of Labour and Employment, Government of India, as applicable to Pune area for the month under consideration.
	W_{so}	Wholesale Price Index for Steel published by RBI Bulletin (with base 2011-12 = 100 for mild steel - long products) for the month preceding the month in which the last date prescribed for receipt of tender, falls
	W_s	Wholesale Price Index for Steel published by published by RBI Bulletin (with base 2011-12 = 100

			for mild steel - long products) for the month under consideration
		W_{co}	Wholesale Price Index for Cement, Lime, Plaster (with base 2011-12 = 100) issued by RBI Bulletin for the month preceding the month in which the last date prescribed for receipt of tender, falls.
		W_c	Wholesale Price Index for Cement, Lime, Plaster (with base 2011-12 = 100) issued by RBI Bulletin for the month under consideration.
		W_{fo}	Wholesale Price Index (Averages) for Fuel & Power (with base 2011-12 = 100), as published by RBI Bulletin for the month preceding the month in which the last date prescribed for receipt of tender, falls.
		W_f	Wholesale Price Index (Averages) for Fuel & Power (with base 2011-12 = 100), as published by RBI Bulletin for the month under consideration.
		W_{mo}	Wholesale Price Index (Averages) for Machinery and Machine Tools (with base 2011-12 = 100) as published by RBI Bulletin for the month preceding the month in which the last date prescribed for receipt of tender, falls.
		W_m	Wholesale Price Index (Averages) for Machinery and Machine Tools (with base 2011-12 = 100) as published by RBI Bulletin for the month under consideration.
		<p>Period of Work under consideration will mean as under:</p> <ul style="list-style-type: none"> • In the case of first "On-account Bill" the period from the months in which the Bid was opened to the month of measurement of first bill. • In the case of second and subsequent "On-account" and Final bills, the Period from the month of measurement for previous bill to the month of measurement of that bill. <p>Note: Responsibility of arranging the RBI Bulletins/CPWD notifications as desired by the Employer or the Engineer shall rest with the Contractor.</p>	

		<p>Procedure in case of delay in Availability of final RBI indices:</p> <p>Where the final Price Indices are not available in the Reserve Bank of India Bulletins, while making payment towards on-account bills, payment towards Price Variation will be made on provisional basis based on the indices available, to be adjusted in subsequent bills as and when the final indices figures become available.</p> <p>Price Variation for Varied Items:</p> <p>Normally, no price variation clause shall be applicable to any extra item/new rates not originally included in the accepted Bill of Quantities / Pricing Document and for which the rates are fixed separately under Clause 13 of GCC. It shall, however be open to the Engineer to accept price variation clause in such cases where the rates are not based on actuals and work is likely to continue for more than one year.</p> <p>Adjustment on account of Price Variation:</p> <p>Adjustment on account of Price Variations may be positive (in which case extra amount shall be paid to the Contractor), or negative (in which case the amount of Price Variation shall be recovered from the Contractor). Adjustment on account of Price Variation shall be calculated separately, for each period, between two successive dates of measurements for bills and paid along with each bill or separately as claimed by the Contractor.</p> <p>After verifying the bill, the Engineer shall certify the adjustment amount and advise the same to the Employer along with the 'On Account' bill. Should any extra amount be due to Contractor, the Employer shall pay the same as far as possible within 28 days of certification by Engineer. Any amount due from Contractor on account of negative adjustment shall be recovered from his pending or other bills at the earliest.</p> <p>Price Variation during extended period of completion:</p>
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		<p>The price adjustment as worked out above i.e. either increase or decrease will be applicable up to the stipulated date of completion of the work including the extended period of completion where such extension has been granted under Sub-Clause 8.4 & 8.5 of GC or it is specifically mentioned that extension is with price variation also. However, where extension has been granted under Sub-Clause 8.7 of GC, price adjustment will be due as follows:</p> <p>In case the indices increase above the indices applicable to a bill made on the last date of original completion period or the extended period under Sub-Clauses 8.4 & 8.5 of GC, the price adjustment for the period of extension under Sub-Clause 8.7 of GC will be limited to the amount payable as per the indices applicable to a bill made on the last date of the original completion period or the extended period under Sub-Clauses 8.4 & 8.5 of GC as the case may be.</p> <p>In case the indices fall below the indices applicable to a bill made on the last date of the original or extended period of completion, then the lower indices will be adopted for Price Adjustment for the period of extension under Clause 8.4 & 8.5 of GC unless the extension has been granted due to Contractor's fault.</p>
47	Sub-Clause 14.1, The Contract Price	<p>Replace the GC Sub-Clause 14.1 with the provisions as under:</p> <ul style="list-style-type: none"> (a) the Contract Price shall be the item rate Accepted Contract Amount and be subject to adjustments in accordance with the Contract; (b) the Contractor shall pay all taxes, levies, duties, cess as per GST/Custom Tariff Act etc, royalty, rates and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation]; (c) No change (d) Not applicable (e) The Contract Price, subject to any adjustment thereto in accordance with the Contract shall be all inclusive of GST, Custom duties, royalties etc.

		<p>The Bidder/Contractor is required to note the following regarding Contract prices:</p> <ul style="list-style-type: none"> • The Contractor shall submit the proof of registrations under various fiscal and labour laws like GST, Profession Tax, Import Export Code, Employee State Insurance, Provident Fund, Maharashtra Labour Welfare Fund and shall submit an undertaking that he will get registered with the competent authority/ies for complying with various laws that are applicable. • Deleted • The Contractor shall be solely responsible to find out and ascertain whether their supplies for Maharashtra Metro Rail Corporation Limited will qualify and be eligible for the concession duty benefit under Chapter 98.01 of custom Tariff Act for project Imports & shall manage the Custom Duty applicability and inclusion in their quoted price accordingly. After award of the Contract, Employer at the written request of a contractor shall facilitate the contractor for obtaining sponsoring / recommendation letter from the GOM for getting themselves registered for availing Project Import benefits. However, the responsibility to avail the concessional benefits under Project Import or otherwise as extended in accordance with the law of the land shall solely rest with the Contractor. • Should the Employer, during execution of the contract, obtain a waiver of GST/Custom Duty if applicable, in full or part thereof, the Contractor will be advised on the process to be followed to obtain exemption /refund of such taxes, duties etc., from the concerned Authorities. In case of failure by the Contractor to obtain and remit the refund within reasonable time (to be decided by the Employer & intimated to contractor) to the Employer, the same will be recovered by the Employer from the amounts due as payment to the Contractor or as debt due from the Contractor. The decision of the Employer shall be final and binding. If the Contractor fails to take the required action to obtain refund or exemption, the Employer may take action in accordance with condition of Contract. • The Contractor shall maintain details of GST /Custom Duty etc. paid to the concerned authority and submit: • Certificate of the Chartered Accountant in regard to turnover of the Contractor relating to Maharashtra Metro Rail Corporation Limited.
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		<ul style="list-style-type: none"> • GST return of the Contractor for the relevant period / periods along with detailed statement & copy of Challans in regard to deposit of tax. • The Contractor also will have to submit 'No Dues Certificate' for the year / period as and when required by Maharashtra Metro Rail Corporation Limited. • The full and final payment to Contractor will be made only after documents as required above are furnished by him and checked by Maharashtra Metro Rail Corporation Limited. • All payments will be subject to GST-TDS provisions, if applicable in force from time to time. • Deleted • Any duty drawback, export / import incentive, concession / exemption available to the Contractor to be passed on to Maharashtra Metro Rail Corporation Limited. • Labour Welfare Fund, ESI, PF and other labour related payments: • Primary responsibility for payment statutory dues or other dues within stipulated time shall be primary responsibility of the Contractor. • Maharashtra Metro Rail Corporation Limited at no point of time shall be responsible for the same. • Contractors shall certify on annual basis that there are no unpaid dues relating to persons working in Maharashtra Metro Rail Corporation Limited project. • Maharashtra Metro Rail Corporation Limited has a right to recover any unpaid dues from the Contractor in the event of default at his part. • Income tax • All payments shall be subject to TDS provisions in force from time to time. • The Bidders are expected to submit certificates from competent authorities for lesser / non-deduction of TDS. • Deleted • General Clause • In case if Maharashtra Metro Rail Corporation Limited project is approved for exemptions from any tax, duty, cess, levy at a date later than the date of award of Bid the benefit so accruing to the Bidder shall be passed
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		<p>on to Maharashtra Metro Rail Corporation Limited. Appropriate changes will be made to the Contract Price in such cases.</p> <ul style="list-style-type: none"> • The Contractor shall provide Maharashtra Metro Rail Corporation Limited an authority to deduct such amounts from any sum payable to the Contractor by Maharashtra Metro Rail Corporation Limited. • In case of change in taxation regime, the Contractor shall comply with the statutory requirements and provide Maharashtra Metro Rail Corporation Limited with such documents / certificates / declaration as may be stipulated by Maharashtra Metro Rail Corporation Limited from time to time. • All bill raised should specifically state the amount of taxes charged separately in detail. • The bills should mention all the required statutory details including the registration numbers with various statutory authorities, declarations, formats as required under various statutory laws / regulations. • Maharashtra Metro Rail Corporation Limited shall at no point of time will be responsible for payment of taxes, duties, cess, levy, rates, royalty other than which are mentioned in the Bidding Documents and recovered by the Contractor in their bills submitted periodically. No recoveries will be entertained by Maharashtra Metro Rail Corporation Limited for demands raised by the Contractor at later stage. <p>The Contractor has to maintain meticulous record of all the taxes and duties paid under GST, Custom Duty etc. and to submit the same when required by the Employer.</p>
48	Sub-Clause 14.2, Advance Payment	<p>Replace the GC Sub-Clause 14.2 with the provisions as under:</p> <p>The Employer shall make an advance payment, as an interest-free loan for mobilization and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the Contract Data.</p> <p>The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment after receiving a Statement (under</p>

		<p>Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by a Scheduled Commercial Bank based in India acceptable to the Employer and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer.</p> <p>The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.</p> <p>Unless stated otherwise in the Contract Data, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub- Clause 14.6 [Issue of Interim Payment Certificates], as follows:</p> <p>(a) deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount; and</p> <p>(b) deductions shall be made at the amortization rate stated in the Contract Data of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.</p> <p>If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior</p>
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		to termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Employer], except for Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], payable by the Contractor to the Employer.
49	Sub-clause 14.2.1	<p>Interest in case of delay in repayment of Advances</p> <p>Should there be delay in the progress and completion of work, as a result of which it is not possible to recover the advance and interest thereon, before the date of completion stipulated in the Contract, then the interest to be charged from the Contractor on the remaining portion of the advance beyond the original completion date specified in the Contract, shall be the State Bank of India Base Rate plus 3% per annum or 12% per annum, whichever is higher up to the date of actual recovery affected by the MAHA-METRO.</p> <p>If the contract is terminated due to default of the Contractor, the 'Mobilisation Advance' would be deemed as interest bearing advance at an interest rate equal to the State Bank of India Base Rate, prevailing on the date of issue of Notice of Invitation of Bids plus 3% per annum or 12% per annum, whichever is higher, to be compounded quarterly.</p> <p>The interest will be calculated from the first day of the month in which an advance is paid to the Contractor and it will be calculated up to the last day of the month in which the recovery is made. Interest for the month would be calculated on the month principal outstanding on the first day on the month.</p>
50	Sub-Clause 14.7, Payment	<p>Add following at the end of the Sub-Clause GC 14.7:</p> <p>The Employer may, at its sole discretion, authorise the Engineer to perform the functions of Employer specified in the GC Clause 14.7.</p> <p>The Employer may advise arrangements for payment through the lending Bank. The procedure to be followed for such payment through the Bank shall be advised to the Contractor by the Engineer.</p> <p>Add Further</p> <p>If and to the extent that the Pricing Document expressly specifies in relation to a Cost Centre that the Contractor</p>

		<p>is entitled to payment in a currency other than Indian Rupees, or the Engineer makes a determination of Cost in a currency other than Indian Rupees, all such payments shall be made in the relevant foreign currency.</p> <p>In calculating the amount payable to the Contractor for the Rupee portion, for each item, sums of less than Fifty Paise shall be omitted and sums of Fifty Paise and more, up to one Rupee, shall be reckoned as one Rupee. The net payments in foreign currencies, if applicable, shall also be rounded off to 'zero' decimal places.</p> <p>All the payments to the contractor/supplier for all currency shall be made by online mode/e-cheque. But no payment will be issued for an amount of less than Rs. 1000/-. This shall not apply to the final payment.</p> <p>Payment procedure shall be as under:</p> <p>a) The Contractor shall submit the monthly bill for payment to the Engineer.</p> <p>b) Immediately after the submission of bill 80 % amount of the bill shall be released within 7 working days.</p> <p>c) The remaining 20% of the bill shall be released after detail scrutiny and subsequent comments / Recommendations by Engineer within 28 days from the date of submission of bill by contractor.</p> <p>d) If any adverse comments regarding the workmanship or the quality of the work done in the previous bill is made by the Engineer then appropriate and suitable amount shall be recovered from successive bills.</p> <p>Add further</p>
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		<p>a) Application for payments in respect of part deliveries of completed items may be made by the Contractor as the work proceeds.</p> <p>b) Notwithstanding anything stated herein the Employer's Representative retains the right to withhold payment on any item due for payment when the services is to be performed is not performed or is not carried to satisfaction of Employers satisfaction.</p> <p>c) Stage Payment shall be made as under:</p> <p>For all items where Supply, Erection, Testing and Commissioning, all are combined in one item and rates are not identified separately, the following percentages shall apply:</p> <ul style="list-style-type: none"> • Delivery of material - 75% • Payment after erection - 15% • Payment after successful testing, commissioning and handing over - 10% <p>The maximum payment against the supply will be limited to 85% of the cost of item incurred by the Contractor.</p>
51	Sub-Clause 14.8-Delayed Payment	<p>Replace the GC Sub-Clause 14.8 with the provisions as under:</p> <p>If the Contractor does not receive payment/certificate for acceptance of payment in accordance with GC and PC Clause 14.7 above, the Contractor shall be entitled to receive interest on the amount unpaid during the period of delay. This period of delay shall be deemed to commence from the first working day after 56 calendar days from the date of issue of the Interim Payment Certificate.</p> <p>The interest shall be calculated at an interest rate equal to State Bank of India prime lending rate.</p> <p>The Contractor shall submit their claim for the interest for the above period of delay along with detailed reasons for the said delays to the Engineer within 14 days of the expiry of the 56 days period. The claimed interest shall be payable to the Contractor only if it is determined by the Engineer that the delays are solely attributable to the Employer.</p>

52	Sub-Clause 14.9	<p>Replace the GC Sub-Clause 14.9 with the provisions as under:</p> <p>When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.</p> <p>Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.</p> <p>However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.</p> <p>When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].</p> <p>Unless otherwise stated in the Particular Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and issued by a scheduled Indian/Foreign bank in India acceptable to the Employer, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the</p>
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		<p>Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub- Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify, and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release under the second paragraph of this Sub-Clause. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.</p> <p>If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security.</p>
53	Sub-Clause 14.15 Currencies of Payment	In item no. (e) of Sub-Clause 14.15 the “Central Bank of the country” would mean the Reserve Bank of India and the Base Date would be the date 28 days before the latest date of submission of Bid.
54	Sub-Clause 15.2	<p>Add the following at the end of this sub-clause:</p> <p>On termination of contract due to Contractor’s default the performance security shall be forfeited by encashing the bank guarantee and the balance work shall be got done independently without risk and cost of the failed Contractor. The failed Contractor shall be debarred from participating in the tender for executing the balance work. If the failed contractor is a JV/CONSORTIUM or a partnership firm, then every member/partner of such JV/CONSORTIUM or partnership firm shall be debarred from participating in the tender for the balance work either in his/her individual capacity or as a partner of any other JV/CONSORTIUM/partnership firm.</p> <p>In case the contractor fails to adhere to the agreed programme of work by margin of 10% of the stipulated</p>

		<p>period or 21 days, whichever is earlier, or fails to complete the Works or parts of the Works within the stipulated or extended period of completion, or is unlikely to complete the whole Work or part thereof within time because of poor record of progress, the Employer at its sole discretion may terminate only part of the contract also by taking out some part of the total scope of work and may complete or arrange for any other entity through the process of open/limited/single tender or by calling quotations, to do so at the risk and cost of the Contractor.</p>
55	<p>Sub-Clause 16.1, Contractor's Entitlement to Suspend Work</p>	<p>Replace the GC Sub-Clause 16.1 with the provisions as under:</p> <p>If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days' notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.</p> <p>The Contractor's action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].</p> <p>If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.</p> <p>If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:</p> <p>(a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and</p>

		<p>(b) payment of any such Cost-plus profit, which shall be included in the Contract Price.</p> <p>After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.</p>
56	Sub-Clause 16.2, Termination by Contractor	<p>Replace the GC Sub-Clause 16.2 with the provisions as under:</p> <p>The Contractor shall be entitled to terminate the Contract if:</p> <ul style="list-style-type: none"> (a) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate, (b) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer's Claims]), (c) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract, (d) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment], (e) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension], or (f) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events. (g) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the

		<p>Commencement of Works under Sub- Clause 8.1 [Commencement of Works].</p> <p>In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Employer, terminate the Contract. However, in the case of sub-paragraph (e) or (f), the Contractor may by notice terminate the Contract immediately.</p> <p>In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice.</p> <p>The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.</p>
57	<p>Sub-clause 17.1</p> <p>- Indemnities</p>	<p>Replace the GC Sub-Clause 17.1 with the provisions as under:</p> <p>“The Contractor shall indemnify and hold harmless the Employer (Maharashtra Metro Rail Corporation Limited), the Engineer, the Designated Contractors, representatives and employees from and against all actions, suits, proceedings, claims, damages, losses, expenses and demands of every nature and description, by reasons of any act or omissions of the Contractor, his representative or his employees in the execution of the Works, including professional services provided by the Contractor or in the guarding the same.</p> <p>These indemnification obligations shall include but not be limited to claims, damages, losses, damage</p>

		<p>proceedings, charges and expenses which are attributable to:</p> <ul style="list-style-type: none"> • sickness, or disease, or death of, or injury to any person; and • loss of, or damage to, or destruction of any property (other than the Works) including consequential loss of use; and • loss, damage or costs arising from the carriage of Plant, Rolling Stock and Materials and/or ownership or chartering of marine vessels by the Contractor, or any sub-contractor of any tier. <p>The Contractor shall also indemnify and save harmless the Employer from & against all claims & proceedings on account of infringements of patents rights, design, trademark name etc as detailed out in the GC.</p> <p>All sums payable by way of compensation under these conditions shall be considered reasonable compensation payable to the Employer, without reference to the actual loss or damage sustained, and whether or not any damage shall have been sustained.</p> <p>The decision of the Engineer as to compensation claimed shall be final and binding.”</p>
58	<p>Sub-Clause 18.1</p> <p>General Requirement for Insurances</p>	<p>Add the following at the end of this sub-clause:</p> <p>The Contractor shall obtain all insurances required in the Contract from Insurance companies operating in India. Insurances to cover risks within India as well as Marine and Transit Insurances shall invariably be effected with an Indian Insurance Company.</p>
59	<p>Sub-Clause 18.2 Insurance for Works and Contractor's Equipment</p>	<p>Add the following at the end of this sub-clause:</p> <p>The Contractor shall take Comprehensive All Risk (CAR) insurance policies duly covering Marine/Transit, Erection cum Storage insurance of cars for value equivalent to the contract value with deductibles not exceeding one (01) percent value. Insurance policy shall be valid till three</p>

		months after expiry of DLP. The policy shall include insurance for the complete contract value.
60	New Sub-clause 18.5, Professional Indemnity Insurance	<p>The Contractor shall effect and maintain professional, indemnity insurance, in the name of Maharashtra Metro Rail Corporation Limited, for the amount in Indian Rupees stipulated in Part A: Contract Data in respect of any design of the Works to be carried out by, or on behalf of the Contractor.</p> <p>This insurance, which shall ensure the Contractor's liability by reason of professional negligence and errors in the design of the works, shall be valid from the date of commencement of Works, until 5 years after the date of issue of Performance Certificate or 3 years after commencement of commercial train operations whichever is later. Alternatively, the Contractor shall redeem the insurance before the expiry of the Yearly Insurance in such a way that the entire validity period is covered.</p> <p>The Engineer will not issue Final Payment Certificate until the Contractor has produced evidence that coverage of the professional indemnity insurance has been provided for the aforesaid period.</p>
61	Sub-Clause 19.4, Consequences of Force Majeure	<p>Replace the GC Sub-Clause 19.4 with the provisions as under:</p> <p>If the Contractor is prevented from performing his substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:</p> <p>(c) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and</p> <p>(d) if the event or circumstance is of the kind described in subparagraphs (i) to (iii) of Sub-Clause 19.1 [Definition of Force Majeure] and, in sub-paragraphs (ii) and (iii), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure,</p>

		<p>to the extent they are not indemnified through the insurance policy referred to in Sub- Clause 18.2 [Insurance for Works and Contractor's Equipment].</p> <p>After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.</p>
62	Sub-clause 19.6: Optional Termination, Payment and Release	Replace "84 days" and "140 days" mentioned in the sub-clause with "184 days" and "340 days" respectively.
63	Sub-clause 19.8 (New Subclause)	Any loss or damage caused to Goods/Trains in manufacturer's works in India or abroad due to natural calamities like flooding, typhoons and heavy storms etc. including rioting, fire etc. shall be covered by an insurance policy by the Contractor and he shall not be entitled for any payment against the loss or damage from the Employer. The Employer may however consider an extension to the Contract on this account if it is established that all reasonable precautions were taken by the Contractor.
Replacement to Clause 20 of Section VIII - GCC: CLAIMS, DISPUTES & ARBITRATION		
64	Sub-Clause 20.1 Procedure of claim	<p>The following is added to the existing clause:</p> <p>If the Contractor intends to claim any additional payment under any clause of these Conditions or otherwise, the contractor shall give notice to the Engineer as soon as possible and in any event within 28 days of the start of the event giving rise to the claim.</p> <p>The Contractor shall keep such contemporary records to substantiate any claim, either on the Site or at any other location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer shall, on receipt of such notice, inspect such records and may instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all such records, and shall (if instructed) submit copies to the Engineer.</p> <p>Within 28 days of such notice, or such other time as may be agreed by the Engineer, the Contractor shall send to the Engineer an account, giving detailed particulars of the amount and basis of the claim. Where the event giving rise</p>

		<p>to the claim has a continuing effect, such amount shall be considered as interim. The Contractor shall then, at such intervals as the Engineer may reasonably require, send further interim accounts giving the accumulated amount of the claim and any further particulars. Where interim accounts are sent to the Engineer, the Contractor shall send a final account within 28 days of the end of the effects resulting from the event.</p> <p>If the Contractor fails to comply with this Sub-Clause, he shall not be entitled to claim any additional payment.</p>
65	Sub-Clause 20.2 Payment for Claims	<p>The following is added to the existing clause:</p> <p>The Contractor shall be entitled to have included in any Interim Payment Certificate such amount for any claim as the Engineer considers due, after taking approval from the Employer. If the particulars supplied are insufficient to substantiate the whole of the claim, the Contractor shall be entitled to payment for such part of the claim as has been substantiated.</p>
66	Sub-Clause 20.3 No legal action till Dispute Settlement Procedure is exhausted	<p>The following is added to the existing clause:</p> <p>Any and all Disputes shall be settled in accordance with the provisions of Clause 20. No action at law concerning or arising out of any Dispute shall be commenced unless and until all applicable Dispute resolution procedures set out in Clause 20 shall have been finally exhausted in relation to that Dispute or any Dispute out of which that Dispute shall have arisen with which it may be or may have been connected.</p>
67	Sub-Clause 20.4 Notice of Dispute	<p>The following is added to the existing clause:</p> <p>For the purpose of Sub-Clause 20.5, a Dispute shall be deemed to arise when one party serves on the other party a notice in writing (hereinafter called a ("Notice of Dispute") stating the nature of the Dispute provided that no such notice shall be served later than 28 days after the date of issue of Performance Certificate by the Engineer.</p>
68	Sub-Clause 20.5 Two stages for Dispute Resolution	<p>The following is added to the existing clause:</p> <p>Disputes shall be settled through two stages:</p> <ol style="list-style-type: none"> Conciliation procedures as established by "The Arbitration and Conciliation Act-1996" (as amended from time to time) and in accordance with this

		<p>Clause. In the event this procedure fails to resolve the Dispute then;</p> <p>b. Arbitration procedures undertaken as provided by "The Arbitration and Conciliation Act -1996" (as amended from time to time) and in accordance with this Clause.</p>
69	Additional Sub-Clause 20.5 Conciliation	<p>The following is added to the existing clause:</p> <p>Within 60 days of receipt of Notice of Dispute, either party shall refer the matter in dispute to conciliation.</p> <p>Conciliation proceedings shall be initiated within 30 days of one party inviting the other in writing to Conciliation. Conciliation shall commence when the other party accepts in writing this invitation. If the invitation is not accepted then Conciliation shall not take place. If the party initiating conciliation does not receive a reply within 30 days from the date on which he sends the invitation he may elect to treat this as a rejection of the invitation to conciliate and inform the other party accordingly.</p> <p>The Conciliation shall be undertaken by one Conciliator selected from a panel of Conciliators maintained by the Employer. The Conciliator shall assist the parties to reach an amicable settlement in an independent and impartial manner.</p>
70	Additional Sub-Clause 20.5 :Conciliation Procedure	<p>The following is added to the existing clause:</p> <p>The Employer shall maintain a panel of Conciliators, who shall be from serving or retired engineers of Government Departments, or of Public Sector Undertakings. Out of this panel, a list of three Conciliators shall be sent to the Contractor who shall choose one of them to act as Conciliator and conduct conciliation proceedings/ in accordance with "The Arbitration and Conciliation Act, 1996", of India.</p> <p>There will be no objection if conciliator so nominated is a serving employee of MAHA-METRO who would be Deputy level officer and above.</p> <p>The Employer and the Contractor shall in good faith co-operate with the Conciliator and, in particular, shall endeavor to comply with requests by the Conciliator to submit written materials, provide evidence and attend meetings. Each party may, on his own initiative or at the</p>

		<p>invitation of the Conciliator, submit to the Conciliator suggestions for the settlement of the dispute.</p> <p>When it appears to the Conciliator that there exist elements of a settle which may be acceptable to the parties, he shall formulate the terms possible settlement and submit them to the parties for their observations, receiving the observations of the parties, the Conciliator may reformulate the terms of a possible settlement in the light of such observations.</p> <p>If the parties reach agreement on a settlement of the dispute, they may draw up and sign a written settlement agreement. If requested by the parties, the Conciliator may draw up, or assist the parties in drawing up, the settlement agreement.</p> <p>When the parties sign the settlement agreement, it shall be final and binding on the parties and persons claiming under them respectively. The Conciliator shall authenticate the settlement agreement and furnish a copy thereof to each of the parties. As far as possible, the conciliation proceedings should be completed within 60 days of the receipt of notice by the Conciliator.</p>
71	Additional Sub-Clause 20.5 Termination of Conciliation Proceedings	<p>The following is added to the existing clause:</p> <p>The parties shall not initiate, during the conciliation proceedings, any arbitral or judicial proceedings in respect of a dispute that is the subject matter of the conciliation proceedings.</p> <p>The conciliation proceedings shall be terminated:</p> <ol style="list-style-type: none"> by the signing of the settlement agreement by the parties on the date of agreement; or by written declaration of the conciliator, after consultation with the parties, to the effect further efforts at conciliation are no longer justified, on the date of declaration; or by a written declaration of the parties to the conciliator to the effect that the conciliation proceedings are terminated, on the date of declaration; or by a written declaration of a party to the other party and the conciliator, if appointed, to the effect that the conciliation proceedings are terminated, on the date of declaration.

		Upon termination of the conciliation proceedings, the conciliator shall fix the costs of the conciliation and give written notice thereof to the parties. The costs shall be borne equally by the parties unless settlement agreement provides for a different apportionment. All other expenses incurred by a party shall be borne by that party.
72	Sub-Clause 20.6 Arbitration	<p>The following is added to the existing clause: If the efforts to resolve all or any of the disputes through conciliation fails, then such dispute or differences, whatsoever arising between the parties, arising out of touching or relating to construction/ manufacture, measuring operation or effect of the Contract or the breach thereof shall be referred to Arbitration in accordance with the following provisions:</p> <p>a. Matters to be arbitrated upon shall be referred to a sole Arbitrator if the total value of the claim is up to Rs.5 million and to a panel of three Arbitrators if total value of claims is more than Rs.5 million. The Employer shall provide a panel of three arbitrators which may also include MAHA-METRO officers for the claims up to Rs.5 million and a panel of five Arbitrators which may also include MAHA-METRO officers for claims of more than Rs.5 million. The Contractor shall have to choose the sole Arbitrator from the panel of three and/or one Arbitrator from the panel of five in case three Arbitrators are to be appointed. The Employer shall also choose one Arbitrator from this panel of five and the two so chosen will choose the third arbitrator from the panel only. The Arbitrator(s) shall be appointed within a period of 30 days from the date of receipt of written notice/ demand of appointment of Arbitrator from either party. Neither party shall be limited in the proceedings before such arbitrator(s) to the evidence nor did arguments put before the Engineer for the purpose of obtaining his decision. No decision given by the Engineer in accordance with the foregoing provisions shall disqualify him from being called as a witness and giving evidence before the arbitrator(s) on any matter, whatsoever, relevant to dispute or difference referred to arbitrator/s. The arbitration proceedings shall be</p>

		<p>held in Pune only. The language of proceedings that of documents and communication shall be English.</p> <p>b. The Employer at the time of offering the panel of Arbitrator(s) to be appointed as Arbitrator shall also supply the information with regard to the qualifications of the said Arbitrator nominated in the panel along with their professional experience, phone nos. and addresses to the contractor.</p> <p>The award of the sole Arbitrator or the award by majority of three Arbitrators as the case may be shall be binding on all parties. The award shall be made claim wise and will be a speaking award.</p>
73	Sub-Clause 20.6: Interest on Arbitration Award	<p>The following is added to the existing clause:</p> <p>Where the arbitral award is for the payment of money, no interest shall be payable on whole or any part of the money for any period, till the date on which the award is made.</p>
74	Sub-Clause 20.6: Arbitration from Time to Time	<p>The following is added to the existing clause:</p> <p>The cost of arbitration shall be borne by the respective parties. The cost shall, inter alia, include the fees of the Arbitrator(s) as per rates fixed by the Employer</p>
75	Sub-Clause 20.6: Jurisdiction of courts	<p>The following is added to the existing clause:</p> <p>Where recourse to a Court is to be made in respect of any matter, the jurisdiction of court shall be: District and Sessions Court, Pune/ High Court of Judicature at Bombay - Nagpur Bench, Nagpur/ Supreme Court of India, New Delhi.</p>
76	Additional Sub-Clause Suspension of Work on Account of Arbitration	<p>The following is added to the existing clause:</p> <p>The reference to Conciliation / Arbitration shall proceed not withstanding that the works shall not then be or be alleged to be complete, provided always that the obligations of the Employer, Engineer and the Contractor shall not be altered by reasons of arbitration being conducted during the progress of the Works. Neither party shall be entitled to suspend the work or part of the work to which the dispute relates on account of arbitration and payments to the Contractor shall continue to be made in terms of the Contract.</p>
77	Additional Sub-Clause :Notice of Contractor	<p>a. All notices to the Contractor, shall be served by post or telex or telefax or by hand to the Contractor or his authorized representatives. In case of notices delivered by post, they will be deemed to have been delivered after 7 days of dispatch.</p>

		b. The Contractor shall, on award of the Contract, furnish to the Engineer, the name, designation, address and telephone, telex and telefax numbers and e-mail address of his representative referred above.
78	Additional Sub-Clause : Notice to Employer & Engineer	All notices to the Employer or Engineer shall be served by post or telex or telefax, or by delivering by hand to the address nominated for the purpose.
79	Additional Sub-Clause Sub-Clause 20.9: Change of address	Parties to the contract may change the nominated address by employer with a notice to all concerned.
80	Additional Clause: Work by persons other than the Contractor	<p>Work by persons other than the Contractor</p> <p>If the Contractor shall fail to carry out any work required under the Contract or refuse to comply with any instruction or order given by the Engineer in accordance with the Contract within a reasonable time, the Engineer may give the Contractor 14 days' notice in writing to carry out such work or comply with such instruction. If the Contractor fails to comply with such notice, the Employer shall be entitled to carry out such work or instruction by his own workmen or by other contractors. Without prejudice to any other right or remedy, all additional expenditure properly incurred by the Employer in having such work or instruction carried out shall be recoverable by the Employer from the Contractor.</p> <p>If by reason of any accident or failure or other event occurring to, in, or in connection with the Works any remedial or other work shall, in the opinion of the Engineer, be urgently necessary and the Contractor is unable or unwilling at once to do such remedial or other work, the Engineer may authorize the carrying out of such remedial or other work by a person other than the Contractor. If the remedial or other work so authorized by the Engineer is work, which, in the Engineer's opinion, the Contractor was liable to do under the Contract, all expenses properly incurred in carrying out the same shall be recoverable by the Employer from the Contractor.</p>

		<p>Provided that the Engineer shall, as soon after the occurrence of any such emergency as may be reasonably practicable, notify the Contractor thereof in writing.</p>
81	<p>Additional clause:</p> <p>Confidentiality of Information</p>	<p>Confidentiality of Information</p> <p>The Contractor shall not use or divulge, except for the purpose of the Contract or with the written permission of the Employer, any information relating to the Works or the Project provided in the Contract or otherwise provided by the Employer, or the Engineer. The Contractor shall ensure that his sub-contractors of any tier shall be bound by a like confidentiality undertaking.</p> <p>The Employer, Engineer and any third party to whom an assignment has been made in accordance with Sub-clause 1.7 of General Conditions of Contract may use any information provided by the Contractor in accordance with the Contract. The Employer shall use reasonable endeavours to ensure that the Engineer and any third party- referred to in aforesaid Sub-Clause 1.7 shall not, divulge such information except for any purpose connected with the Contract.</p>
82	<p>Additional Clause:</p> <p>Maintaining the Site</p>	<p>In general, the cleanliness, lighting, safety, security, drinking water, first aid etc. will be the responsibility of the civil contractor as specified in the interface document.</p> <p>The Contractor shall be responsible for maintaining the site. The daily sweeping and cleaning of the area under his possession/work shall be his responsibility.</p> <p>In case of repeated aberrations notices by the Engineer, a minimum penalty of Rs.5000/- shall be imposed for each instance.</p>
83	<p>Additional Clause: EIA & SIA</p>	<p>The Employer will engage suitable agencies for performing Environmental Impact Assessment and Social Impact Assessment due to the Project. These agencies will suggest appropriate monitoring mechanism as well as mitigation measures for implementation by Maharashtra Metro Rail Corporation Limited. The Contractor will be required to implement these measures as part of its obligation under SHE Manual / other relevant conditions. In case, implementing these measures are beyond the scope of work as detailed in</p>

		Bidding Documents, the same shall be taken up as a Variation.
84	Additional Clause: Spares	<p>The Contractor shall supply spare parts as per the Employers requirement.</p> <p>(a) The Contractor shall submit a schedule of spare parts duly indicating, for each item of spares, its description, part number, drawing number, lead time, shelf life and number of units required for the system during the first ten years, principal as well as secondary sources of supply, and also the unit price with escalation/de-escalation clause.</p> <p>(b) The Employer may, during a period of ten years from the date of taking-over of the whole of the Works, purchase as many parts as required by him, at the rates indicated in the pricing document and accepted by the Employer.</p> <p>(c) If during the period of ten years, the Contractor intends to discontinue the manufacture of spare or replacement parts for the any equipment / Machine the Contractor shall immediately give notice to the Employer of such intention. The Employer shall be given the opportunity of ordering at reasonable prices such quantities of such spare or replacement parts as the Employer requires in relation to the anticipated life of the equipment.</p> <p>In the event of Contractor failing to supply the spare parts in accordance with this Clause, he shall in respect of each item of spare, furnish free of cost to the Employer, the drawings, specifications, patterns and other information to enable the Employer to make or have made such spare parts. The Employer shall be entitled to retain the aforesaid drawings etc., for such time only as is necessary for the exercise by the Employer of his rights under this clause and the drawings, if the Contractor so requires, shall be returned by the Employer to the Contractor in good order and condition (fair wear and tear excepted).</p> <p>Under such circumstances, the Contractor shall also grant to the Employer, without payment of any royalty or charge, full right and liberty to make or have made spare or replacement parts as aforesaid and for such purposes only to use, make and have made copies of all drawings, patterns, specifications and other information</p>

		<p>supplied by the Contractor to the Employer pursuant to the Contract.</p> <p>The Contractor will so far as it is reasonably able to bind his sub-contractors to conform with the requirements of this Clause and shall, prior to entry into any sub-contracts, provide the Employer with full details of any sub-contractor who will not so conform in which event the Employer may direct the Contractor to seek an alternative sub-contractor.</p> <p>If the Contractor fails to provide spare or replacement parts as described in this Sub-clause and these are available from the Contractor's sub-contractor, the Employer shall have the right to obtain such spare and replacement parts from the subcontractor or any other supplier and any additional cost incurred by the Employer shall be recoverable from the Contractor.</p> <p>(d) The Employer may require the Contractor to enter into a Maintenance Contract with the Employer for the System / Machine provided under the Contract under terms and conditions to be mutually agreed.</p>
85	Additional Clause: Deployment of the Personnel by the Employer	<p>The Contractor shall deploy personnel sponsored by the Employer during the Contract Period in areas stipulated in the Works Requirements.</p> <p>The travel expenses, salary and allowances, boarding and lodging expenses of these sponsored personnel shall be borne by the Employer, but the Contractor shall provide other facilities required for the purpose of performing their duties. The sponsored personnel shall be under the technical and administrative control of the Contractor.</p>
86	Additional Clause: Indemnity Bond	<p>The contractor shall submit a Indemnity Bond in the format given in Section X. Contract Forms against payments made for Plant and Equipment delivered to Pune.</p>

87	Additional Clause: Safe Custody Bank Guarantee	<p>(Applicable for items specifically mentioned in the contract).</p> <p>The Contractor shall submit a Safe Custody Bank Guarantee in the format given in Section X. Contract Forms against payments made for Plant and Equipment dispatched from manufacturer's works. The amount of safe custody Bank Guarantee shall be equal to 95% percent of the amount due as per relevant clause wherever applicable. The value of the Safe Custody Bank Guarantee would be adjusted for the equipment's already commissioned</p>
88	Additional clause: Safe Custody Bank Guarantee for materials to be supplied by the Employer.	<p>The Contractor shall submit the insurance Policy for the materials to be supplied by the Employer to the contractor at Pune for the work in the name of Maharashtra Metro Rail Corporation Ltd. The Insurance coverage shall be for an amount equal to rupees ----- million The said Insurance policy will be required to be submitted within 45 days of issue of " Letter of Acceptance" or from the date of issue of material whichever is earlier.</p> <p>The values of the materials to be supplied by Employer will be provided by the Employer at the time of award of contract as below:</p> <ol style="list-style-type: none"> 1. UIC 60/60E1 1080 grade HH Rails : 2. UIC 60 Kg Turn Outs (Various type of Turn outs) ; SCOs etc: 3. Ballastless fastenings: <p>This Insurance shall cover the contractor's responsibility towards safe transportation, safe custody, protection against all kinds of damage/loss/theft of materials, supplied by the Employer. The cost of any such loss/damage to the materials, irrespective of the reason thereof, shall raise the claim from the said insurance policy furnished by the contractor.</p> <p>The Insurance Policy shall be released after the materials are installed satisfactorily, the spare materials have been returned by the contractor satisfactorily and " Taking Over Certificate" is issued by the Employer.</p>

		The insurance policy shall be in addition to the insurance policies to be obtained by the contractor under Clause 18 of GCC.
89	Additional Clause: Interface Requirements	The Contractor shall be responsible to interface with the other contractors as per the interface table provided in the contract. Employer will supervise/facilitate the coordination between the Contractor and other designated contractors. However, the Contractor will allow for liaison with, and modifications to his design to cater for the work of such other contractors. The list of interface items is indicative only and the ultimate responsibility of commissioning lies with the Contractor.
90	Additional Clause: Part Termination	The Contractor shall be responsible for site progress for meeting the deadlines set by the Engineer for meeting the key dates/ROD. In the event of failure of the Contractor in the opinion of the Engineer for performance of any part activity, Employer reserves the right to notify the Contractor and if Contractor does not improve in the next 15 days, Employer may decide to off-load the part of the work and get this work done through other contractors. The additional cost of the work, if any, incurred by the Employer shall be recovered from the Contractor's payment
91	Additional Clause: Bought out Items	<p>For the bought-out items (items purchased from vendor) being incorporated in the system, Contractor shall ensure the following:</p> <ul style="list-style-type: none">) During Design stage, a confirmation from the vendor is to be submitted that the utilisation and associated system to the component / sub-component, being supplied by vendor are in line with their recommendations / design. i) During Installation, testing and commissioning of the equipment at site vendor's engineer shall supervise and certify that these activities have been carried out as per the manufacturer's recommendations. (iii) Operation and Maintenance requirements prescribed by the vendor for the component / sub-component must be included in O&M documents / Maintenance Manuals prepared by the contractor. (iv) (Details of maintenance set-up of vendor and a confirmation from vendor for ensuring availability of Maintenance support is submitted to Employer.

92	Additional Clause: Limit of Aggregate Damages on Employer	Notwithstanding anything to the contrary contained in the General Conditions of Contract, the Parties expressly agree that the aggregate “payment of any Cost-plus profit” (“Damages”) payable under Clauses 1.9, 2.1, 4.7, 7.4, 10.2, 10.3 and 16.1 shall not exceed 10% (ten per cent) of the Contract Price. For the avoidance of doubt, the Damages payable by the Employer under the aforesaid Clauses shall not be additive if they arise concurrently from more than one cause but relate to the same part of the Project.
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Annexure- A**SITE FACILITIES FOR THE EMPLOYER AND THE ENGINEER****1 GENERAL**

The Contractor shall provide for the use of the Employer / Engineer office accommodation, equipment, communication & drawing facilities throughout the course of the work and up to a period of 90 days after physical completion of work as certified by Engineer. The details of the accommodation & the other facilities are detailed below: The rate is deemed to be included in the itemized cost of work no separate payment for site facilities will be given to contract, Thereafter the Contractor shall dismantle the building and take away all the materials, office furniture, etc. which will be the property of the Contractor. The equipment and software provided during the currency of contract will be the property of the contractor on completion of 90 days after physical completion of work.

2 SITE OFFICES

- 2.1 Accommodation for the Employer / Engineer shall consist of one no. of site office to be constructed by the Contractor at a place decided by the Employer, within One (01) month from the date of commencement of the works. In case of delay beyond Two months in provision of the accommodation either through construction or hire, penalty @ Rs.20000/- per week or part thereof will be imposed.
- 2.3 The site office should remain open for 24 hours a day and 7 days a week i.e. round the clock up to a period of 90 days after physical completion of work as certified by Engineer.
- 2.4 Each Site Office will provide for the following rooms/ spaces: SITE OFFICE for Engineer/ Employer to be constructed by Contractor.

Sr. No.	Description	Carpet Area (Sqm)
(i)	Project -In-Charge of Maharashtra Metro Rail Corporation Limited with Air conditioning	12
(ii)	Other Officers of Maharashtra Metro Rail Corporation Limited Air Conditioning	30
(iii)	Project Manager with Air Conditioning	12
(iv)	Other officer of GC Air Conditioning	30
(v)	Office staff of Maharashtra Metro Rail Corporation Limited & GC Air Conditioning	15
(vi)	Conference/Visitor Room with Air conditioning	25
(vii)	Computer/Drawing Office with Air conditioning	12
(viii)	Pantry & Kitchen area	6
(ix)	File and Documents & Instruments Storage	10
(x)	Toilets	15
(xi)	TOTAL 'A'	167
(xii)	Common Area/Verandah @10% of "A" above	17
(xiv)	GRAND TOTAL	184

- 2.5 Materials used for the construction of the offices shall be new and of approved quality. Materials shall be chosen such that the buildings when erected shall give good ventilation, heat and sound insulation. Proper and due care must be insured for

- drainage and water proofing of/from the office structure. All windows and doors should be of good/approved quality to insure safety, security etc. of the office.
- 2.6 All buildings shall be supplied with continuous (24 hour) running potable water to the kitchens and wash rooms. The toilets may use raw water for flushing. The Contractor shall also arrange for the constant and hygienic disposal of all effluent, sewage and rubbish from the office buildings.
- 2.7 All buildings shall be supplied with electricity, AC 240 Voltage 50 Hz that shall be distributed to each room in accordance with the Regulations. Lighting and electrical power points shall be provided in each room. The disposition and location of light and power points will be as directed by the Engineer. 24-hour power supply is to be arranged by contractor to meet full power load. Fans and coolers etc will be provided as decided by the Engineer.
- 2.8 Firefighting equipment shall be provided in accordance with the local fire services office recommendations.
- 3 FURNITURE AND OTHER OFFICE EQUIPMENT AT EACH SITE OFFICE**
- 3.1 The Contractor shall supply and maintain the following good/approved quality new furniture and equipment to the Employer/Engineer's offices within one month of the date of commencement of the works up to a period of 90 days after physical completion of work as certified by Engineer.

Description of Item	Nos.
Conference table (4000mm x 1500mm)	1
Conference chairs	16
Glass-fronted lockable bookcase	4
1500mm x 900mm double pedestal desk	2
1200mm x 900mm single pedestal desks	8
Swivel office chair with armrests	12
Swivel office chair without armrests	4
Typist chair	2
Visitors chair	16
4-drawer filing cabinet	4
Plan chest (A 0 size)	1
Steel lockable cupboard 6ft high with internal shelves	4
Heavy Duty Paper Shredders	1
Tele-facsimile transmission/reception facility connected to a dedicated line with STD facility	1 sets
Telephone switchboard connected to 2 external Lines at each office with STD facility and with independent Internal Communication Facilities with conference facilities.	10 phones lines
First aid kits for up to 36 persons	2
Safety helmets	20
Safety harness	20
Safety Shoes	20
Day-glow waistcoat	20
Industrial safety goggles	6 Pairs
5 L kettles	2
2 L kettles	2
Potable water dispenser with hot/cold Taps	1
Cups and plates	3

Fire extinguishers- (As required confirming to the stipulations of Local authorities).	As per norms
Silent DG set of minimum power of 10 KVA	1

After successful completion of work with defect liability period, the furniture and equipment will be the property of the contractor.

Note: In case of failure to provide the above-mentioned equipment's within 6 Weeks, penalty @ Rs.10000/- per week or part thereof will be imposed.

4 TRANSPORTS

4.1 General

The Contractor shall provide 5 (Five) numbers of Swift Dezire or similar (for the use of the Employer and the Engineer within one month from the date of commencement of the works) at his own cost.

4.2 Road Transport

- (a) The vehicles shall not more than one year old, should have taxi permit and delivered and maintained by the Contractor in good roadworthy condition including daily cleaning.
- (b) The Contractor shall employ and make available competent drivers fully licensed to operate the vehicles as and when required by the Engineer/Employer. The Contractor shall replace drivers at the request of the Engineer/Employer. Alternate arrangement of drivers should be ensured by the contractor in case of emergency or excessive working hours due to demands of work.
- (c) The vehicles shall be licensed and insured for use on the public highway and shall have comprehensive insurance cover for any qualified driver authorised by the Engineer Employer together with any authorised passengers and the carriage of goods or samples. All the relevant and valid documents of the vehicle should any time be available with the driver and can be asked to show by the Employer any time.
- (d) The Contractor shall provide fuel, oil for running of each vehicle for 4000 kms monthly and ensure maintenance in conformity with the vehicle manufacturer's recommendations and all relevant toll and parking charges incurred in connection with the Works. The vehicle shall be provided day and night as required by the Engineer/Employer.
- (e) A suitable replacement shall be provided by the contractor for any vehicle out of service for more than 24 hours. If the contractor at any time fails to provide vehicle(s) or substitute vehicle(s) as specified, an amount of Rs.3000 per day for each vehicle (that the Contractor failed to provide) shall be recovered from the Contractor.

4.3 Number of Vehicles

- 4.3.1 The Contractor shall provide the following type of vehicles of as per requirement indicated by the Project Director within one month of date of commencement.

Type	Numbers
Swift Dezire or similar	5

4.3.2 DELETED

4.3.3 Duration of Transport Requirements

Transport for the Engineer / Employer shall be provided up to a period of 90 days after physical completion of work as certified by Engineer.

The transport so provided shall continue to be the property of the Contractor.

5 OFFICE MAINTENANCE AND SECURITY

5.1 The contractor is required to maintain the offices unto a period of 90 days after physical completion of work as certified by Engineer throughout the contract period and provide the following, but not limited to:

- i. Pay all electricity charges.
- ii. Reimburse telephone bills for the use of telephone, up to Rs.3000/- per month for each external landline connection
- iii. Pay all water charges.
- iv. Carry out necessary repairs to office and equipment as and when required.
- v. Day- to-day cleaning and maintenance and watch & ward etc

5.2 The contractor shall provide within one month from the Date of Commencement following personnel in EACH OF the office as required for watch and ward and running of the site office.

Watchmen / Security: (3 shifts of 2 men in a shift)

Office maintenance Personnel: (2 shifts of 2 men in a shift and 1 shifts of 1 men in a shift)

Note: In case of delay beyond Two-month, penalty @ Rs.10000/- Per week or part thereof will be imposed.

6 EQUIPMENT FOR THE USE IN SITE OFFICE

The Contractor shall provide new equipment and software as listed below and maintain them for the exclusive use of the Employer and the Engineer. The Contractor shall provide and maintain the following equipment for the use of the Engineer and the Employer within one month from the date of commencement of the works up to a period of 90 days after physical completion of work as certified by Engineer. The equipment shall be the property of the Contractor.

a. Laptop Computers -Three (03) Nos.

Windows 10 or latest edition with OEM with minimum specification of Quad Processor, 2.8 GHZ 3MB L2 cache and 64 bits computing, Minimum 4 GB DDR 3 RAM, 500 GB Hard Drive Disk, 2 GB Nvidia Graphic Card, In-built or external Wifi device, DVD Writer, 19" colour TFT monitor, 10/100 LAN Card, Modem Card, multimedia speakers, standalone UPS of minimum 800VA capacity

b. Printers, xerox, scanner - 1 no. (A3 size)

The A3 size coloured printer shall be Wi-Fi enabled e.g. Canon iR-C3020 or equivalent.

c. LARGE FORMAT PLOTTER - 01 No. (Model No. C6084A (3800CP 54 colour Plotter) or equivalent model.

d. Application Software (Licensed) with each computer

- i. Windows 10 or latest version with OEM
- ii. Microsoft Office 2019 or latest release with OEM
- iii. AUTOCAD 3D Latest Version with OEM
- iv. M S Project / Sure Track / Primavera - Latest Version on OEM.
- v. PDF Converter/Professional
- vi. Anti-Virus Latest Version

e. Colour scanners: Deleted

f. Xerox Machine- Deleted.

- g. Surge Protection Devices (one for each computer and printer as given above or as suitable to protect all equipment from voltage fluctuation)
- h. UPS system with sufficient power backup (with minimum backup time of 30 minute) to meet the sufficient power load in case of power disruption.
- i. Power supply for the systems is to be AC 240 volts, 50 Hz from normal building wiring circuit mains, power regulator, stabilizer or transformer should be supplied by the Contractor for the computer systems such that the systems can function efficiently.
- j. One Projector (BENQ model 9H.J6V77.13E or Equivalent model of Sony or other reputed brand) along with a white Screen for making presentation in the conference room.

Note: In case of failure to provide the equipment within one month, penalty @ Rs.5000/- per equipment per week or part thereof will be imposed.

7 Documentation

- 7.1.1 A complete set of documentation will be supplied with each System. The documentation should be self-tutorial in nature and be readily understood by non-computer personnel.
- 7.1.2 The following manuals will be supplied with the system:
 - a. Manual on how to operate the equipment; and
 - b. Manual on how to use the facilities and software provided by the supplier. (Including languages and utilities)

8. Auto CAD Operator: -

The contractor shall provide one experienced Auto CAD operator exclusively for the Office of the Engineer till six months beyond the date of completion of contract.

Annexure- B

PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

1. PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

The Contractor shall devise and utilize a PMIS such that all documents generated by the Contractor can be transmitted to the Engineer by electronic means (and vice versa) and that all documents generated by either party are electronically captured at the point of origin and can be reproduced later, electronically and in hard copy. A similar link shall also be provided between the Engineer office at site and the Employer's Office by the Contractor. 5D BIM Platform shall be invariably used by the Contractor for PMIS.

1.1 IT Requirement of Employer

- 1.1.1 Employer is in the process of implementing an Enterprise wide cloud-based IT system project titled "Integrated Project Management Platform". The objective of the IT project is to develop a working environment that enables higher efficiency and effectiveness, not only in internal functions, but also across the entire ecosystem of the Employer including Contractors. The IT project envisaged following application stack:
 - (a) Scheduling services (using Oracle Primavera P6 Enterprise Project Portfolio Management (EPPM) or equivalent)
 - (b) Collaborative document control and management services (using Bentley Project Wise and AssetWise solution or equivalent)

(c) Progress and performance reporting (using RIB iTWO 5D BIM solution or equivalent)

(d) Enterprise wide ERP implementation

1.1.2 The proposed IT system has been conceptualized for facilitating preservation of important artefacts (plans, drawings, notes, documents, reports etc.) in a secure and manageable environment in digitized format. Appropriate triggers shall generate dashboards and management reports every time an event causes a substantial shift in the project risk or a deviation in processes is developed. The envisaged system would expedite decision-making, ensure better planning and coordination between different functions, better data management, effective reporting, knowledge management etc. Program management shall provide senior management with critical information related to various contracts, activities and funds in the form of management dashboards with inbuilt triggers to ensure timely decision-making.

1.1.3 The effective use of such IT platform requires availability of front end of web-based system at

all requisite locations i.e. with Employers' various offices, Engineer's offices, Contractors' end, major sub-contractors' end, design consultant ends etc. with certain definite users' rights. Data uploading by various authorized and trained users is key to effective implementation of the IT system. Employer has recognized this aspect, and the Contractors are required to consider in their proposal the cost of software licenses (payable to Maharashtra Metro Rail Corporation Limited) and IT staff for data uploading as under

Contract value		User licenses (below or equivalent software packages)				IT staff
		P6	SAP ERP	Bentley Project Wise & AssetWise	RIB iTWO 5D BIM	
1	Rs.25 to Rs.50 crore	1	1	5	5	3 (three)
2	Rs.50 crore to Rs.100 crore	1	3	5	5	3 (three)
3	Rs.100 crore to Rs.250 crore	3	5	8	8	6 (six)

4	Rs.250 crore to Rs.400 crore	3	8	8	10	6 (six)
5	Rs.400 crore and above	3	10	10	10	6 (six)

1.1.4 In view of the above, the Contractor shall be required to:

- (a) Follow and comply the system guidelines to be issued by Employer
- (b) Comply all the software system competency requirement by taking training from Employer's Training Academy.
- (c) Upload / definition of Project Plans as per the template and using software defined by the Employer;
- (d) Maintenance and updating of uploaded Project Plans in software used by the Employer;
- (e) Upload of drawings / designs created by the Contractor as per the classification and on the software, platform defined by the Employer;
- (f) Key contract related communication and progress related data as per processes defined on the software platform deployed by the Employer
- (g) Asset details need to be updated in the system in the format prescribed by the Employer;

1.1.5 Employer, his IT Project Team and IT Implementation Agency shall render necessary assistance (including providing trained IT staff with requisite skills at Contractor's cost) and handhold the Contractor for usage of the IT system.

1.2 CONTRACTOR'S PROJECT ORGANISATION

- (1) The Contractor shall have a competent team of Managers, Engineers, Technical staff etc so as to complete the work satisfactory as per various requirements of the contract.
- (2) A control room with round the clock radio communication or telephone switch board links with all safety offices, works sites, site offices, batching plants, casting yards, workshops, fabrication yard, off site offices, Engineers site office, Resident Engineer's office, testing labs etc shall be maintained and manned round the clock. Residences of all senior project team members shall also be linked with the control room. Vehicles for emergency use should be on stand-by at the control room around the clock.
- (3) The designations of the various project organizations team members shall be got approved by the Engineer before adoption so as to avoid any duplication of the designations with those of the Employer or the Engineer.

1.3 TECHNOLOGY TRANSFER (Deleted)

- (1) The Contractor shall ensure that all local contractors and sub-contractors engaged in the works are given training, guidance and the necessary opportunity for transfer of technology in various areas of construction such as instrumentation, safety, quality assurance, viaduct etc.

1.4 MAINTENANCE REPORT

- (1) The Maintenance Report shall be submitted as part of the Definitive Design and shall include full details of the long-term inspection and maintenance operations for each major component of viaduct.
- (2) Deleted
- (3) For each area an inspection checklist shall be supplied giving inspection frequency, items to be inspected, criteria for acceptance, criteria for remedial works and details of the remedial works, including proposed materials and method statements. The recommended regular maintenance regime of each area shall also be given including cleaning methods and frequency for different Surfaces; removal of leakage borne salts from concrete surfaces; cleaning of drainage channels, sumps and pipes; repainting of metallic items;
- (4) A long-term monitoring regime shall also be included covering items such as
 - Viaduct
 - Differential movement at viaduct / station junctions or other areas identified in the design.
 - Loss of prestress in the girders with passage of time.
- (5) All instruments necessary to carry out the inspections and monitoring that are identified in the report shall be provided by the Contractor within the lump sum tender price.

Maharashtra Metro Rail Corporation Limited

(A Joint Venture of Government of India and Government of Maharashtra)

PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART-III

**CONDITIONS OF CONTRACT AND CONTRACT
FORMS**

SECTION-X

Section X. Contract Forms

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Indemnity Bond

Notification of Award**Letter of Acceptance***[letterhead paper of the Purchaser]**[date]*To: *[name and address of the Supplier]*Subject: **Notification of Award Contract No.**

This is to notify you that your Bid dated _____ *[insert date]* for execution of the

_____ *[insert name of the contract and identification number, as given in the SCC]*. for the Accepted Contract Amount of

[insert amount in numbers and words and name of currency], as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our institution.

You are requested to furnish the Performance Security within 14 days in accordance with the Conditions of Contract, using for that purpose one of the Performance Security Forms included in Section X, Contract Forms, of the Bidding Document.

Authorized Signature:

Name and Title of Signatory:

Name of institution:

Attachment: Contract Agreement

Contract Agreement

(Contract No:)

THIS AGREEMENT made on the ____ day of _____, _____, between Maharashtra Metro Rail Corporation Limited, a company incorporated under company act 2013, vide CIN U60100MH2015SGC262054 having its registered office at "Metro House, 28/2, Anand Nagar, C K Naidu Road, Civil Lines, Nagpur - 440001 and Project Office addressed as Pune Metro Rail Project, The Orion Building, 1st Floor, 101, Opp. Don Bosco Youth Centre, Koregaon Park, Pune-411001, hereinafter referred "the Employer" (which expression shall unless it be repugnant to the context or meaning thereof be deemed to including his heirs, successors and legal representative) of the one part,

and

_____ having its registered office at _____, India hereinafter referred "the Contractor" (which expression shall unless it be repugnant to the context or meaning thereof be deemed to including his heirs, successors and legal representative), of the other part:

WHEREAS the Employer desires that the Works known as "_____" should be executed by the Contractor as the Employer has accepted the Bid of the Contractor for the execution and completion of these Works and the remedying of any defects therein, for a sum including all taxes and duties, input credit (if any) royalties, levies, custom tariff, cess, Goods and Service Tax (GST) etc. as specified in Bid/Tender documents hereinafter referred as "the Contract Price" of INR _____.

The Employer and the Contractor agree as follows:

In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.

The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.

Performance Bank Guarantee No. _____ and valid up to _____ for INR _____ submitted by _____.

The Letter of Acceptance bearing No. _____ dated _____ along with all its annexures.

The Financial package opened on _____.

The Letter of Bid and Appendix to Bid.

Corrigendum _____ issued by Maha-Metro.

The entire bid documents issued by Maha-Metro by letter and e-mail.

The entire bid documents _____ along with Tender clarifications, confirmations, and other compliances, duly accepted and submitted by Contractor on-_____.

The completed Schedules and any other document forming part of the contract.

Invoicing and Bank Details of Contractor (Annexure Enclosed).

In consideration of the payments to be made by the Employer to the Contractor as specified in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.

The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with the laws of India on the day, month and year specified above.

Employer: Maharashtra Metro Rail Corporation Limited

Signature

Name of Signatory:

Designation:

Contractor:

Signature

Name of Signatory:

Designation:

In the presence of:

Witness:

Sign

Name

Address In the presence of:

Witness:

Sign

Name

Address

**Performance Security
(Demand Guarantee)**

Beneficiary: _____ Date: _____

PERFORMANCE GUARANTEE No.: _____

Guarantor: _____

We have been informed that _____ (hereinafter called "the Applicant") has entered into Contract No. _____ dated _____ with the Beneficiary, for the execution of _____ (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Applicant, we as Guarantor, waiving all objections and defences under the aforementioned contract, hereby irrevocably and independently undertake to pay the Beneficiary any sum or sums not exceeding in total an amount of _____ (____),¹ such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of the Beneficiary's first demand supported by the Beneficiary's statement, whether in the demand itself or in a separate signed document accompanying or identifying the demand, stating that the Applicant has failed to duly perform the aforementioned contract, without the Beneficiary needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the Day of, 2...², and any demand for payment under it must be received by us at this office indicated above on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees (URDG) 2010 Revision, ICC Publication No. 758, except that the supporting statement under Article 15(a) is hereby excluded.

[signature(s)]

¹ *The Guarantor shall insert an amount representing the percentage of the Accepted Contract Amount specified in the Letter of Acceptance, less provisional sums, if any, and denominated either in the currency(cies) of the Contract or a freely convertible currency acceptable to the Beneficiary.*

² *Insert the date twenty-eight days after the expected completion date. The Employer should note that in the event of an extension of this date for completion of the Contract, the Employer would need to request an extension of this guarantee from the Guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the Employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [six months][one year], in response to the Beneficiary's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."*

Note: All italicized text (including footnotes) is for use in preparing this form and shall be deleted from the final product.

**Advance Payment Security
Demand Guarantee**

To

Maharashtra Metro Rail Corporation Ltd.

PUNE METRO RAIL PROJECT

101, The Orion, Opposite Don Bosco Youth Centre,
Koregaon Park, Pune 411001.

Bank Guarantee No. _____, dt. _____ for
Rs. _____ (Rupees _____ only).

w.e.f. : _____
valid upto : _____
claim upto : _____

1. In Consideration of M/s Maharashtra Metro Rail Corporation Ltd., (hereinafter called "the Employer", which expression shall, unless repugnant to the context or subject thereof include his successor and assigns) having awarded M/s. _____ having its Registered Office at _____ (hereinafter referred to as "the Contractor", which expression shall unless repugnant to the context of meaning thereof include its successors, administrators, executors and assigns), a contract by issue of Employers Letter of Acceptance No. _____ dated _____ and the same having been mutually accepted by the Contractor, resulting in a Contract bearing No. _____ for Rs. _____ (Rupees _____ only) for Contract _____ : (Name of work) _____ (hereinafter called "the Contract") and the Employer has agreed to make an advance payment to the Contractor for performance of the said Contract amounting to Rs. _____ (Rupees _____ only) of Mobilisation Advance.
2. We, _____ constituted under the _____ Act, 1955 having it's Corporate Centre and Central Office at _____ and one of it's Local Head Office at _____ and Branch Office at _____ (hereinafter referred to as "the Bank", which

expression shall unless repugnant to the context of meaning thereof, include its successors, administrators, executors and assigns) do hereby guarantee and undertake to pay the Employer, immediately on demand any or all monies payable by the Contractor to the extent of Rs. _____ (Rupees _____ only) as aforesaid at any time upto _____ without any demur, reservation, context, recourse or protest and or without any reference to the Contractor.

3. Any such demand made by the Employer on the Bank shall be conclusive and binding notwithstanding any difference between the Employer and the Contractor or any dispute pending before any Court, Tribunal, Arbitrator and shall continue to be enforceable till the Employer discharges this guarantee. However, not later than expiry date of guarantee.
4. The Employer shall have the fullest liberty without affecting in any way the liability of the Bank under this Guarantee, from time to time to vary the advance or to extend the time for performance of the Contract by the Contractor. The Employer shall have the fullest liberty without affecting his guarantee, to postpone from time to time the exercise of any powers vested in them or of any right which they might have against the Contractor and to exercise the same at any time in any manner and either to enforce or to forebear to enforce any covenants, contained or implied, in the Contract between the Employer and Contractor or any other course or demand or security available to the Employer. The Bank shall not be redeemed to its obligation under these presents by any exercise by the Employer of its liberty with reference to the matters aforesaid of any of them or by reason of any other act or forbearance or other acts of omission or commission on the part of the Employer or any other indulgence shown by the Employer or by any other matter or thing whatsoever which under law would but for this provision have the effect of relieving the bank.
5. The Bank also agrees that the Employer at his option shall be entitled to enforce this Guarantee against this bank as a principal debtor, in the first instance without proceeding against the Contractor and notwithstanding any security or other guarantee that the Employer may have in relation to the Contractor's liabilities.

Notwithstanding anything contrary contained in any law for the time being in force or banking practice this guarantee shall not be assignable or transferable by the beneficiary. Notice or invocation by any person such as assignee, transferee or agent of beneficiary shall not be entertained by the bank any invocation of guarantee can be made only by the beneficiary directly.

Notwithstanding anything contained herein:

- a) Bank liability under this Bank Guarantee shall not exceed Rs. _____ (Rupees _____ only)
- b) This Bank Guarantee shall be valid upto _____.

- c) We are liable to pay the guarantee amount or part thereof under this Bank Guarantee only & only if you serve upon us a written claim or demand on or before _____.
- d) Thereafter all your rights under this guarantee shall be forfeited and we shall be released from all our liabilities hereunder irrespective of whether the guarantee in original is returned to us or not.

Dated _____.

Retention Money Security

Demand Guarantee

DELETED

Form of Designer's Warranty**(Refer. Sub - Clause 15 of the PC)****THIS AGREEMENT** is made the day of**BETWEEN:**

- (1) [] [whose registered office is at]/[of] [] ("the Designer"); and
- (2) The Maharashtra Metro Rail Corporation Limited (together with its successors and assigns, "the Employer") of _____ [address].

WHEREAS:

- (a) By a contract _____ dated [] ("the Contract") made between (1) Maharashtra Metro Rail Corporation Limited ("the Employer") and (2) [] ("the Contractor"), the Contractor has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works upon the terms and conditions contained in the Contract.
- (b) The Designer has had an opportunity of reading and noting the provisions of the Contract (other than details of the Contractor's prices and rates).
- (c) Pursuant to the Contract, the Contractor wishes to enter into an agreement with the Designer and Designer agrees to the wishes of the Contractor (the Consultancy agreement) to carry out the Contractor's obligations under the Contract in relation to the design and functions ascribed to the Designer in the Contract.
- (d) The Contract stipulates that the Contractor shall ensure that the Designer executes a warranty agreement in favour of the Employer.

NOW IT IS HEREBY AGREED as follows:

1. In consideration of the Employer not objecting to the Contractor and the Designer entering into the Consultancy Agreement, the Designer warrants and undertakes to the Employer that he has exercised and will continue to exercise all the skill and care to be expected of a professionally qualified and competent designer experienced in work of similar nature and scope as the Works in carrying out the design of the Works and in performing the other duties and functions ascribed to him in the Contract.
2. The Designer agrees that, in the event of the termination of the Contract by the Employer, the Designer will, if so required by notice in writing given by the Employer, except subject to Clause 4 the instructions of the Employer or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Works upon the terms and conditions of the Consultancy Agreement.

3. The Designer further agrees that he will not, without first giving the Employer not less than 21 days' previous notice in writing, exercise any rights it may have to terminate the Consultancy Agreement or to treat the same as having been repudiated by the Contractor or to discontinue the performance of any duties to be performed by the Designer pursuant thereto. The Designer's right to terminate the Consultancy Agreement or to treat the same as having been repudiated or to discontinue the performance thereof shall cease if, within such period of notice and subject to Clause 4, the Employer shall give notice in writing to the Designer requiring the Designer to accept the instructions of the Employer or his appointee to the exclusion of the Contractor in respect of the carrying out and completion of the Contract Works upon the terms and conditions of the Consultancy Agreement.
4. Any notice given by the Employer under Clause 2 or 3 shall state that the Employer or his appointee accepts liability for payment of the fees payable to the Designer under the Consultancy Agreement and for performance of the Contractor's obligations under the Consultancy Agreement, including payment of any fees outstanding at the date of such notice.
5. The Employer shall be entitled to assign the benefit of this Warranty at any time without the consent of the Designer being required.
6. All documents arising out of or in connection with this Warranty shall be served:
 - (1) upon the Employer at [] marked for the attention of [];
 - (2) upon the Designer at [].
7. The Employer and the Designer may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
9. Except to the extent (if any) expressly permitted by the Consultancy Agreement, the Designer shall not sub-contract any of the Designer's obligations under the Consultancy Agreement without the prior written consent of the Employer's Representative.
10. Without prejudice to its obligations under this Warranty, the Designer shall maintain with well established underwriters of repute and on terms and conditions reasonably acceptable to the Employer, professional indemnity insurance (as per sub-clause 18.1 of the General Conditions) in respect of the Designer and its sub-consultants for Indian Rupees (*in words..... Rupees*) in relation to his design of the Works for any one occurrence or series of occurrences arising out of any one event from the date of notification of acceptance until 5 years after the issue of Performance Certificate for the whole of works. The Designer shall immediately inform the Employer if for any reason professional indemnity insurance is not maintained in accordance with this Warranty or becomes void or unenforceable.
11. Insofar as the patent, copyright or other intellectual property rights in any Design Data (as defined in the Contract), plans, calculations, drawings, documents, materials, computer software, know-how and information relating to the Works shall be vested in the Designer, the Designer grants to the Employer his successors and assigns a royalty-free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs or inventions incorporated and referred to in such documents or materials and any such know-how and information for all purposes

relating to the Works (including without limitation the design, construction, reconstruction, completion, reinstatement, extension, repair and operation of the Works). To the extent beneficial ownership of any such patent, copyright or other intellectual property right is vested in anyone other than the Designer or the Contractor, the Designer shall use his best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. Any such licence granted shall not be determined if the Designer shall for any reason cease to be employed in connection with the Works.

12. (1) Any dispute or difference of any kind whatsoever between the Employer and the Designer arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with Clause 20 of GC "Claims, Disputes and Arbitration" as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and the Designer.
- (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed, the Employer may by notice in writing to the Designer require and the Designer shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, statement of objection, determination, certificate, assessment or valuation by the Employer's Representative or the Contractor, relating to the dispute or difference.

IN WITNESS whereof this Warranty has been executed as a deed on the date first before written.

THE COMMON SEAL of)

[Designer])

was affixed hereto in)

the presence of:-)

Parent Company Undertaking

THIS UNDERTAKING is issued on the _____ day of _____ BY _____
[whose registered office is at] / [of] _____ ("the Parent Company").

in favour of

Maharashtra Metro Rail Corporation Limited together with its successors and assigns, (the Employer"):

.....

.....

.....

WHEREAS

- (A) By a Contract for _____ in respect of Maharashtra Metro Rail Corporation Limited Contract No ____/____ ("the Contract") made between
- (1) Maharashtra Metro Rail Corporation Limited (the "Employer") and
- (2) _____ (the "Contractor") the Contractor has agreed to design, execute, complete and remedy any defects in the works ("the Works") upon the terms and conditions contained in the Contract.
- (B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of an undertaking in the terms hereof.
- (C) The Parent Company is the beneficial owner of ____ % [see Note 1] of the issued share capital of [the Contractor] [see Note 2].
- (D) At the request of the Contractor, the Parent Company has agreed to provide this undertaking.

NOW IT IS HEREBY UNDERTAKEN AND AGREED as follows:

1. In consideration of the Employer entering into the Contract with the Contractor, the Parent

Company hereby undertakes to the Employer that, without the written consent of the Employer, it will not [and will ensure that none of the companies referred to in Recital (C) will] [see Note 5]:

- a. Sell, transfer, assign or otherwise dispose of or deal with ownership of the whole or any part of EITHER [the share-holding or other interest in the [Contractor] [see Note 3] OR [the share holdings or other interests] [see Note 4] referred to in Recital (C) in any way which will affect the beneficial ownership and control in [the Contractor] [see Note 3] of the Parent Company [and the other companies referred to in Recital (C)] [see Note 5]; and
- b. take any action which may result in the Contractor being unable to comply with its obligations or perform in any way its duties under the Contract [or take any action which may result in [the Member forming part of the Contractor] [see Note 3] being unable to comply with its obligations or perform in any way its duties under the [Consortium or other relevant] agreement] [see Note 6]

until such time as the Works shall have been completed, all the Contractor's obligations under the Contract shall have been performed and the Defects Liability Period (as defined in the Contract) for the whole and every part of the Works shall have elapsed and further that it will ensure [that the Member forming part of the Contractor will take all steps necessary to ensure [see Note 6] compliance by the Contractor with the provisions of the Contract.

2. The obligations of the Parent Company under this Undertaking shall remain in full force and effect and shall not be affected or discharged in any way and the Parent Company hereby waives notice of:
 - a. any suspension of the Works, variation or amendment to the Contract (including without limitation extension of time for performance) or any concession or waiver by the Employer in respect of the Contractor's obligations [and/or the obligations of [_____] [see Note 7]
 - b. any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
 - c. the termination of the Contract or of the employment of the Contractor and/or [] [see Note 7] under the Contract for any reason;
 - d. any forbearance or waiver of any right of action or remedy the Employer may have against the Contractor [and/or [_____]] [see Note 7] or negligence by the Employer in enforcing any such right of action or remedy;
 - e. any bond, undertaking, security or other guarantee held or obtained by the Employer for any of the obligations of the Contractor [and/or [_____]] [see Note 7] under the Contract or any release or waiver thereof.
1. This Undertaking shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Employer and the Contractor [and/or [_____]] [see Note 7] and for the avoidance of doubt the Parent Company

hereby authorises the Employer and the Contractor [and/or [_____]] [see Note 7] to make any such amendment, variation or supplemental agreement.

4. All documents arising out of or in connection with this Undertaking shall be served:
 - a. upon the Employer, at _____ marked for the attention of _____;
 - b. upon the Parent Company, at _____
5. The Employer and the Parent Company may change their respective nominated addresses for service of documents to another address but only by prior written notice to each other. All demands and notices must be in writing.
6. This Undertaking shall be governed by and construed according to the laws for the time being in force in India and the Parent Company agrees to submit to the exclusive jurisdiction of the courts at **Pune**, Maharashtra, India.

IN WITNESS where of this Undertaking has been executed as a deed on the date first before written.

Name:

Designation:

Date of Board resolution authorizing executant to execute this undertaking

Place:

Notes:

(For preparation of but not for inclusion in the engrossment of this Undertaking)

1. If the Parent Company is not the immediate parent company, the chain of ownership must be recited, identifying each company in the chain and the shareholdings or other interests in each subsidiary.
2. If the Contractor is a Consortium, that fact and the Consortium or other relevant agreement must be recited. In such case, insert the name of the Members of the Consortium in respect of which the parent company undertaking is being given. In such a case, the parent company of each of the Members is required to give the undertaking.
3. If Note 2 applies, refer to the Member relating to that Parent Company (which is giving this undertaking) and not the Contractor.
4. If Note 1 applies, use this alternative.
5. If Note 1 applies, add this provision.
6. If Note 2 applies, add this provision.
7. If Note 2 applies, add this provision and insert the name of the Member.

8. The notarized copy of the board resolution of the Parent Company must also accompany this Undertaking. In case the Parent Company is a foreign entity, then such board resolution should be notarized by a notary in its home country followed by the casualisation by the Indian Embassy there, or apostatised as per Hague Convention, as the case may be.

Parent Company Guarantee

THIS GUARANTEE is made the _____ day of _____ BY _____ whose registered office is at _____ [and _____ whose registered office is at _____] ("the Guarantor").

To Maharashtra Metro Rail Corporation Limited together with its successors and assigns, "the Employer") of:

.....

.....

.....

WHEREAS

(A) By a Contract for _____ of Pune Metro Rail Project Contract No:P1-T05BR/2019 ("the Contract") made between

(1) Maharashtra Metro Rail Corporation Limited (the "Employer")

and

(2) _____ (the "Contractor") the Contractor has agreed to design, execute, complete and remedy any defects in the works ("the Works") upon the terms and on editions contained in the Contract.

(B) Pursuant to the terms of the Contract, the Contractor has agreed to procure the provision of a guarantee in the terms hereof. [see Note 1]

(C) At the request of the Contractor, the Guarantor has agreed to guarantee performance of the

Contract by the [Contractor] [see Note 2] as set out herein.

IT IS HEREBY AGREED AS FOLLOWS:

1. In consideration of the Employer entering into the Contract with the Contractor, the Guarantor irrevocably and unconditionally guarantees to the Employer as a primary obligation and not as a surety due performance by the [Contractor] [see Note 2] of all of its obligations and liabilities under and in accordance with the Contract save that nothing herein shall be construed as imposing greater obligations or liabilities on the Guarantor than are imposed on the [Contractor] [see Note 2] in the Contract.
2. The obligations of the Guarantor under this Guarantee shall remain in full force and effect and shall not be affected or discharged in any way by and the Guarantor hereby waives notice of:
 - a. any suspension of the Works, variation to or amendment of the Contract (including without limitation extension of time for performance) or any concession or waiver by the Employer

- in respect of the Contractor's obligations [and/or the obligations of _____] [see Note 3] under the Contract;
- b. any provision of the Contract being or becoming illegal, invalid, void, voidable or unenforceable;
 - c. the termination of the Contract or of the engagement of the Contractor [and / or _____] [see Note 3] under the Contract for any reason;
 - d. any forbearance or waiver of any right of action or remedy the Employer may have against the Contractor [and / or _____] [see Note 3] or negligence by the Employer in enforcing any such right of action or remedy;
 - e. any bond, undertaking, security or other guarantee held or obtained by the Employer for any of the obligations of the Contractor [and / or _____] [see Note 3] under the Contract or any release or waiver thereof.
3. This Guarantee shall extend to any variation of or amendment to the Contract and to any agreement supplemental thereto agreed between the Employer and the Contractor [and/or _____] [see Note 3] and for the avoidance of doubt the Guarantor hereby authorises the Employer and the Contractor [and/or _____] [see Note 3] to make any such amendment, variation or supplemental agreement.
4. This Guarantee is a continuing guarantee and accordingly shall cover all of the obligations and liabilities of the [Contractor] [see Note 2] under the Contract and remain in full force and effect until all the said obligations and liabilities of the Contractor shall have been carried out, completed and discharged in accordance with the Contract. This Guarantee is in addition to any other security which the Employer may at any time hold and may be enforced without first having recourse to any such security or taking any steps or proceedings against the Contractor.
5. Until expiry of the Defects Liability Period (as defined in the Contract) for the whole and every part of the Works, the Guarantor shall not on any ground whatsoever make any claim or threaten to make any claim whether by proceedings or otherwise against the Contractor [and/or _____] [see Note 3] for the recovery of any sum paid by the Guarantor pursuant to this Guarantee. Any such claim shall be subordinate to any claims (contingent or otherwise) which the Employer may have against the Contractor [and/or _____] [see Note 3] arising out of or in connection with the Contract until such time as such claims shall be satisfied by the Contractor [and/or _____] [see Note 3] or the Guarantor as the case may be. To that intent the Guarantor shall not claim or have the benefit of any security which the Employer holds or may hold for any monies or liabilities due or incurred by the Contractor [and/or _____] [see Note 3] to the Employer and, in case the Guarantor receives any sum from the Contractor [and/or _____] [see Note 3] in respect of any payment by the Guarantor hereunder, the Guarantor shall hold such sum in trust for the Employer for so long as any sum is payable (contingently or otherwise) under this Guarantee.
6. The Employer shall be entitled to assign the benefit of this Guarantee at any time without the consent of the Guarantor or the [Contractor] [see Note 2] being required.
7. All documents arising out of or in connection with this Guarantee shall be served:
- a. upon the Employer, at _____ marked for the attention of _____;

- b. upon the Guarantor, at _____ India [see Note 5]
8. The Employer and the Guarantor may change their respective nominated addresses for service of documents to another address but only by prior written notice to each other. All demands and notices must be in writing.
 9. This Guarantee shall be governed by and construed according to the laws for the time being in force in India and the Guarantor agrees to submit to the exclusive jurisdiction of the courts at **Pune**, Maharashtra, India.

IN WITNESS whereof this Guarantee has been executed as a deed on the date first before written

.....

Name:

Designation:

Date of Board resolution authorizing executant to execute this undertaking

Place:

Notes:

(For preparation of but not inclusion in the engrossment of this Guarantee)

1. If the Contractor is a Consortium, that fact and the Consortium or other relevant agreement and the relationship of the Guarantor to the concerned Members forming part of the Contractor must be recited.
2. If Note 1 applies, replace the word "Contractor" with name of the concerned Member of the Consortium being guaranteed.
3. If Note 1 applies, add additional wording and insert the name the concerned Member of the Consortium being guaranteed.
4. The notarized copy of the board resolution of the Guarantor must also accompany this Guarantee. In case the Guarantor is a foreign entity, then such board resolution should be notarized by a notary in its home country followed by the casualisation by the Indian Embassy here, or apostatised as per Hague Convention, as the case may be.
5. The address for service shall be in India.

Contractor's Warranty

THIS WARRANTY is made the _____ day of _____

BY _____ of _____ [and [see Note 1]] ([jointly] "the Contractor")

To Maharashtra Metro Rail Corporation Limited together with its successors and assigns, "the Employer") of:

.....

.....

.....

WHEREAS

(A) By a Contract for _____ of Pune Metro Rail Project

Contract No: _____ ("the Contract") made between

(1) Maharashtra Metro Rail Corporation Limited (the "Employer")

and

(2) _____ (the "Contractor"), the Contractor has agreed to design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defects in the works ("the Works") upon the terms and conditions contained in the Contract.

(B) [See Note 3].

(C) At the request of the Employer and pursuant to the terms of the Contract the Contractor has agreed to provide this Warranty.

NOW IT IS AGREED AS FOLLOWS:

1. The Contractor hereby warrants and undertakes that:

- a. the Contractor will design, execute, complete, test and commission (including Integrated Testing and Commissioning) and remedy any defect in the Works in accordance with the terms of the Contract; and
- b. the Contractor owes a duty of care to the Employer in relation to the performance of its duties under the Contract; and
- c. the Contractor will rectify or replace free of cost to the Employer any defect or failure of equipment provided in the Works for a period of 24 months from the date of taking over of section of the Works; and
- d. the Contractor agrees that should any modification be required to any part of the construction work as a consequence of failure analysis, the aforesaid period of 24 months shall re-commence from the date when the modified part is commissioned into service if the date of modification is later than the date of taking over of last trainset, and such modification shall be carried out free of cost to the Employer in all sections; and
- e. the Contractor shall maintain the manufacture & supply of spares (including those of its Sub-Contractors / vendors) for the equipment supplied in the Contract-work for at least 5 years from the date of Completion of the Contract; and
- f. the Contractor has exercised and will continue to exercise in the design of the Works all the skill and care to be expected of a professionally qualified and competent designer experienced in work of similar nature and scope as the Works; and
- g. the Works will, when completed, comply in all respects with the Employer's Requirements, the Contractor's Technical Proposals, the final Design Document and the intended use of the Works; and
- h. the Works has been or will be designed and manufactured to the highest standards available using internationally proven up-to-date good practice; and
- i. the Works will, when completed, comply with enactments and regulations relevant to the Works; and
- j. no Materials generally known to be deleterious or not in accordance with good engineering practice have been or will be specified or selected or incorporated in the Works by the Contractor.

2. The liability of [the companies comprising [see Note 3]] the Contractor under this Warranty [shall be joint and several and [see Note 3]] shall not be released, diminished or in any way affected by any independent inquiry or investigation into the Works or any matter related to the Contract whether carried out by or on behalf of the Employer or any liability or right of action which may arise out of such inquiry or investigation.

3. Insofar as the copyright or other intellectual property rights in any plans, calculations, drawings, documents, materials, plant, know-how and other information relating to the Works shall be vested in [the Contractor] [see Note 5], the [Contractor] [see Note 5] grants to the Employer its successors and assigns a royalty free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs, inventions or other information incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works of the PUNE METRO RAIL PROJECT including without limitation the design, manufacture, installation, completion, testing and commissioning (including Integrated Testing and Commissioning) reinstatement, extension and the remedy of any defect in the Works. To the extent that beneficial ownership of any such copyright or other intellectual property rights is vested in anyone other than the [Contractor] [see Note 5],, the [Contractor] [see Note 5], shall use best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. For the avoidance of doubt, any such licence granted shall not be determined if the [Contractor] [see Note 5], shall for any reason cease to be employed in connection with the Works.

4. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Employer may have against the Contractor, whether in tort or otherwise.

5. Nothing contained in this Warranty shall vary or affect the Contractor's rights and obligations under the Contract.

6. The address for service of all documents arising out of or in connection with this Warranty shall be:

a. Upon the Employer at:

.....

.....

.....

b. Upon the Contractor at _____ India. [Note 4]

7. The Employer and the Contractor may change their respective nominated addresses to another address in India but only by prior written notice to each other. All notices must be in writing.

8. This Warranty shall be governed by and construed according to the laws for the time being in force in India.

9.

(1) Any dispute or difference of any kind whatsoever between the Employer and the Contractor arising under out of or in connection with this Warranty shall be referred to arbitration in accordance with the provisions relating to 'Conciliation and Arbitration' as set out in the General Conditions of Contract. "Dispute" as defined in the Contract shall be deemed to include any such dispute or difference between the Employer and Contractor.

(2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed pursuant to Clause 9(1), the Employer may by notice in writing to the Contractor require and the Contractor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.

(3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objections relating to the dispute.

(4) Subject to the foregoing provisions of this clause 9, the Employer and the Contractor agree to submit to the exclusive jurisdiction of the Courts of India at Pune.

IN WITNESS whereof this Warranty has been executed as a deed on the date written at the head hereof.

.....

Name:

Designation:

Date of Board resolution authorizing executant to execute this undertaking

Place:

Notes:

(for preparation of and not inclusion in the engrossment of this Warranty)

1. If the Contractor is a Consortium, each Member of such Consortium shall be a party and liability under this warranty will be joint and several, with consequential grammatical changes.

2. If Note 1 applies, that fact and the Consortium or other relevant agreement must be recited.

3. Delete if Note 1 does not apply.

4. The address for service shall be in India.

5. If Note 1 applies, then insert the name of each Member.

Sub-Contractor's / Vendor's Warranty

(As applicable)

THIS WARRANTY is made the _____ day of _____

BY _____ [whose registered office is at] / [of] _____ ("the Sub-contractor")
and

TO Maharashtra Metro Rail Corporation Limited together with its successors and assigns,
"the Employer") of:

.....
.....
.....

WHEREAS

(A) By a Contract for _____ of Pune Metro Rail Project

Contract No: _____ ("the Contract") made between

(1) Maharashtra Metro Rail Corporation Limited (the “Employer”)

and

(2) _____ (the “Contractor”), the Contractor has agreed to _____ and remedy any defects in the works (“the Works”) upon the terms and conditions contained in the Contract.

(B) The Sub-contractor / vendor has had an opportunity of reading and noting the provisions of the Contract (other than details of the Contractor's prices and rates).

(C) Pursuant to the Contract, the Contractor wishes to enter into an agreement (“the Sub-contract”) with the Sub-contractor / Vendor to carry out and complete a part of the Works as more particularly described in the Sub-contract (“the Sub-contract Works”).

(D) The Contract stipulates that the Contractor shall obtain the consent of the Engineer before entering into the Sub-contract, and that the Contractor shall procure that the Sub-contractor executes a warranty in favour of the Employer.

NOW IT IS HEREBY AGREED as follows:

1. In consideration of the Engineer consenting to the Contractor and the Sub-contractor / Vendor entering into the Sub-contract, the Sub-contractor warrants and undertakes to the Employer that:
 - a. he will execute and complete the sub-contracted Works / supply, and will carry out each and all of the obligations, duties and undertakings of the Sub-contractor / Vendor under the Sub-contract when and if such obligations, duties and undertakings shall become due and performable, in accordance with the terms of the Sub-contract (as the same may from time to time be varied or amended with the consent of the Employer); and
 - b. he will supply to the Contractor and in specific cases wherever required to the Engineer with all information as may be required from time to time in relation to progress of the Sub-contract Works.
2. The Sub-contractor / Vendor undertakes to indemnify the Employer against each and every liability which the Employer may have to any person whatsoever and against any claims, demands, proceedings, loss, damages, costs and expenses sustained,

incurred or payable by the Employer provided that the Sub-contractor / Vendor shall have no greater liability to the Employer by virtue of this Warranty than the liability of the Contractor to the Employer under the Contract insofar as and to the extent that the same has arisen by reason of the execution of the Sub-Contract or any breach by the Sub-contractor / Vendor of his obligations under the Sub-contract.

3. No allowance/extension of time by the Employer hereunder or by the Contractor under the Sub-contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning this Warranty or the Sub-contract on the part of the Employer or the Contractor, nor anything that the Employer or the Contractor may do or omit or neglect to do, shall in any way release the Sub-contractor / Vendor from any liability under this Warranty.
4. The Sub-contractor / Vendor agrees that he will not without first giving the Employer not less than 21 day's prior notice in writing exercise any right he may have to terminate the Sub-contract or treat the same as having been repudiated by the Contractor or withhold performance of its obligations under the Sub-contract.
5.
 - (1) In the event that the Contract or the employment of the Contractor under the Contract is terminated for any reason whatsoever and if so requested by the Employer in writing within 21 days of such termination, the Sub-contractor / Vendor shall carry out and complete his obligations under this Warranty and shall enter into a novation agreement with the Employer and the Contractor in which the Sub-contractor will undertake inter alia to perform the Sub-contract and be bound by its terms and conditions as if the Employer had originally been named as a contracting party in place of the Contractor. The said novation agreement will be in such form as the Employer may reasonably require.
 - (2) In the event that the Employer does not require the Sub-contractor / Vendor to enter into a novation agreement as required by Sub-clause 5 (1), the Sub-contractor shall have no claim whatsoever against the Employer for any damage, loss or expense howsoever arising out of or in connection with this Warranty.
6. Insofar as the copyright or other intellectual property rights, in any plans, calculations, drawings, documents, materials, know-how and information relating to the Sub-contract Works shall be vested in the Sub-contractor / Vendor, the Sub-contractor / Vendor grants to the Employer, his successors and assignees a royalty free, non-exclusive and irrevocable licence (carrying the right to grant sub-licences) to use and reproduce any of the works designs, inventions or other information incorporated and referred to in such documents or materials and any such know-how and information for all purposes relating to the Works of the Pune Metro Rail Project, without limitation the design of enabling facilities, construction, installation, reconstruction, completion, reinstatement, extension, remedy of any defect of the Works. To the extent beneficial ownership of any such copyright or other intellectual

property right is vested in anyone other than the Sub-contractor / Vendor, the Sub-contractor shall use best endeavours to procure that the beneficial owner thereof shall grant a like licence to the Employer. For the avoidance of doubt, any such licence granted shall not be determined if the Sub-contractor / Vendor shall for any reason cease to be employed in connection with the Sub-contract Works.

7. In the event of any ambiguity or conflict between the terms of the Sub-contract and this Warranty, the terms of this Warranty shall prevail.
8. The provisions of this Warranty shall be without prejudice to and shall not be deemed or construed so as to limit or exclude any rights or remedies which the Employer may have against the Sub-contractor / Vendor whether in tort or otherwise.
9. Nothing contained in this Warranty shall vary or affect the Sub-contractor's / Vendor's rights and obligations under the Sub-contract.
10. The Employer shall be entitled to assign the benefit of this Warranty at any time without the consent of the Sub-contractor / Vendor being required.
11. All documents arising out of or in connection with this Warranty shall be served:
 - a. Upon the Employer at:

.....

.....
 - b. Upon the Sub-Contractor / Vendor at _____ India.
12. The Employer and the Sub-contractor / Vendor may change their respective nominated addresses for service of documents to another address in India but only by prior written notice to each other. All demands and notices must be in writing.
13. This Warranty shall be governed by and construed according to the laws for the time being in force in India.
14.
 - (1) Any dispute or difference of any kind whatsoever between the Employer and the Sub-contractor / Vendor arising out of or in connection with this Warranty shall be

referred to arbitration in accordance with the arbitration provisions as described in the Contract.

- (2) In the event that the Employer is of the opinion that the issues in such a dispute or difference will or may touch upon or concern a dispute or difference arising under out of or in connection with the Contract ("the Contract Dispute") then provided that an arbitrator has not already been appointed pursuant to Clause 14 (1), the Employer may by notice in writing to the Sub-contractor / Vendor require and the Sub-contractor / Vendor shall be deemed to have consented to the referral of such dispute or difference to the arbitrator to whom the Contract Dispute has been or will be referred.
- (3) Save as expressly otherwise provided, the arbitrator shall have full power to open up, review and revise any decision, opinion, instruction, notice, order, direction, withholding of approval or consent, determination, certificate, statement of objection, assessment or valuation by the Engineer or the Contractor relating to the dispute or difference.
- (4) Subject to the foregoing provisions of this clause 14, the Sub-Contractor agrees to submit to the exclusive jurisdiction of the Courts at Pune, Maharashtra.

IN WITNESS whereof this Warranty has been executed as a deed on the date first before written

.....

Name:

Designation:

Date of Board resolution authorizing executant to execute this undertaking

Place:

Note: The notarized copy of the board resolution of the Sub-Contractor/vendor must also accompany this Warranty. In case the Sub-Contractor/vendor is a foreign entity, then such board resolution should be notarized by a notary in its home country followed by the consularisation by the Indian Embassy there, or apostilised as per Hague Convention, as the case may be.

Indemnity Bond

THIS INDENTURE made onbetween(hereinafter called the Contractor) which expression shall where the context do admits or implies be deemed to include its executors, administrators and assigns of the one part and the Maharashtra Metro Rail Corporation Limited (hereinafter called MAHAMETRO) of the other part.

WHEREAS by the agreement (LOA No dated.....) (hereinafter called the said agreement) the contractor has agreed to “-----” and whereas the contractor has applied to the MAHAMETRO that they may be allowed advance on the security of materials absolutely belonging to them and brought by them to the site of the works covered under the project of the said agreement for use in the construction of such of the work as they have under taken to execute at rates fixed for the finished work (inclusive of the cost of materials and labour and other charges).

AND WHEREAS the MAHAMETRO has agreed to make stage payment to the contractor the total sum of Rs.----- (Rupees -----only) for stage payment Bill. The quantities and other particulars of which are detailed in this bill for the said works signed by the Contractor on “-----” and MAHAMETRO has reserved to itself option of making any further advances till date on the security of other materials brought by the contractor to site of the said work.

NOW THIS INDENTURE WITNESS that in pursuance of the said agreement and its consideration of the sum of Rs. ----- (Rupees -----only) on or before the execution of these present amount paid to the contractor by the MAHAMETRO (the receipt where of the contractor) both hereby acknowledge and of such further Stage payment, if any, as may be made to him so aforesaid to the contractor do the covenant and agreed with the MAHAMETRO and declare as follows:

1. That the said sum of Rs. ----- (Rupees ----- only) so Stage Payment by the MAHAMETRO to the contractors as aforesaid and all or any further sum or sum's advanced as aforesaid shall be employed by the contractor in or towards the execution of the said works and for no other purpose whatsoever.
2. That the Stage Payment detailed in the said running account bill which have been offered to and accepted by the MAHAMETRO as security are absolutely the contractor's own property and free from encumbrances of any kind and the contractor's shall not make any application for or receive any further payments on the security of work executed which are not absolutely his own property and free from encumbrances of any kind the Contractor indemnifies the MAHAMETRO against all claims on any materials in respect of which any Stage Payment has been made to him as aforesaid.
3. That the Stage Payment detailed in the said running account bill and all other stage payments on the security of which further payments or Stage Payment any hereafter be made as aforesaid (hereinafter called the said materials) shall be used by the contractor solely in the

execution of the said works in accordance with the directions of the Engineer / MAHAMETRO and in the terms of the said agreement.

4. That the contractor shall be fully liable for the materials/components and shall make at his own cost all necessary and adequate arrangement for the proper watch, safe custody and protection against all risks including, but not limited to acts of the God of the said materials/components.

5. That the contractor shall be liable to provide on approved insurance in favour of Maharashtra Metro Rail Corporation Limited for all such materials/components used for the purpose of entire Metro project. However, the takingover of the works will be governed by terms and conditions of GC clause 10 (Employer Taking Over) of the Contract. The said materials shall remain at the site of said works in the contractor's custody and on his own responsibility and shall at the time be open to inspection by the Engineer/ Maharashtra Metro Rail Corporation Limited. That the Contractor shall be responsible for all such losses incurred towards such damage and/ or loss of goods in storage and custody and shall indemnify MAHA-Metro towards the same.

This insurance will be valid for a period until this material is approved and fixed in the building or advance has been fully recovered from contractor and the validity of all such insurance documents shall be ensured by MAHA-Metro.

That the title to Material shall pass to Maha-Metro upon payment and shall become and remain sole property of Maha-Metro.

6. That the said materials/components in the Contractor's custody shall not on any account be removed and/or shifted except with the written permission of the Engineer/ Maharashtra Metro Rail Corporation Limited, obtained after cumulative inspection by Contractor, Engineer and Maha-Metro.

The said material shall be shifted to Maha Metro Store (In Depot or elsewhere as per Maha-Metro's discretion) constructed by the Contractor on the land allotted by Maha Metro only upon the instruction of Maha-Metro.

7. That issue of any Stage Payment excess of what is finally required to be used at site would be the contractor's property without any liability on Maharashtra Metro Rail Corporation Limited., who would recover the cost of this from the contractor.

8. That the contractor hereby charges all the said materials components with the repayment to the MAHAMETRO of the said sum of Rs. ----- (Rupees ---- -----only) and any further sum or sums advanced as aforesaid and all cost charges. Damages and expenses payable under these presents provided always and it is hereby agreed and declared that not with power contained therein, if any, whenever the convenient for payment, and repayment herein before contained shall become enforceable and the money owned shall not be paid in accordance therewith, the MAHAMETRO., may at any time thereafter adopt all or any of the following courses as he may deem best.

a. That if the contractor shall at any time not be able to complete any part of the Component / equipment as per provision in contract Agreement it shall be considered as the work being left incomplete by the contractor and action as per the conditions of the contract shall be taken.

b. Deduct all or any of the money owing out of the performance security or any sum due to the contractor under the said agreement.

That in the event of any conflict between the provisions of these presents and the said agreement the provisions of these presents shall prevail.

This widening shall be co-extensive to the agreement dated between Maharashtra Metro Rail Corporation Limited, _____. (Client) and (Contractor).

IN WITNESS where of the said contractor and by the order under the direction of MAHAMETRO has here set their respective hands the day and years first above written.

Signed, Sealed & Delivered by the said Contractor:

IN THE PRESENCE OF: WITNESS:

1. NAME: Signature:

SIGNED BY (ADDRESS)

BY THE ORDER AND DIRECTION OF THE MAHAMETRO IN THE PRESENCE OF:

SIGNATURE: WITNESS

(NAME AND ADDRESS)

Guarantee for Safe Custody

(To be stamped in accordance with Stamp Act, of the country of issuing bank)

To:

MAHARASHTRA METRO RAIL CORPORATION LIMITED,

WHEREAS - the Consortium/ Joint venture consisting of:

(Name of Lead Member of the Group and address)

(Name of Member of the Group and address)

(Name of Member of the Group and address) ^[1]_{SEP}

(hereinafter called “the Contractor”), with M/s----- as the lead member has undertaken, in pursuance of Contract No. [] datedfor [Note 4] (hereinafter called “the Contract”), ^[1]_{SEP}AND WHEREAS according to the said Contract the Employer is obliged to pay to the Contractor the sum of [] ([]) (“the Payment on delivery”) as set out in the priced Bill of Quantities.

(A) Pursuant to the said activities, [Note 4] are to be manufactured offshore or in India for subsequent delivery to the Contractor’s premises in Pune, India and held in safe custody by the Contractor.

(B) Pursuant to the terms of the Contract, the Contractor, as a condition precedent to his entitlement to receive any payment for items including an element of [Note 4] Contract [] to the Contractor’s premises in Pune, is obliged to provide a Guarantee in the terms hereof for 95 percent of the Payment. ^[1]_{SEP}

AND WHEREAS we (Insert name and address of scheduled commercial bank based in India) have agreed to give the Contractor such a Bank Guarantee:

NOW THEREFORE we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor up to a total of ----- (amount of Guarantee)----- (in words), such sum being payable in the types and proportion of currencies in which the Contract Price is payable and we hereby unconditionally, irrevocably and without demur undertake to immediately pay you, upon your first written demand and without cavil or argument any sum or sums within the limits of ----- (amount of guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand for the sum specified therein.

1. We hereby waive the necessity of your demanding the said debt from the Contractor before presenting us with the demand.

2. We further agree that no change or addition to or other modification of the terms of the contract or of the Works to be performed there under or of any of the contract documents which may be made between you and the Contractor shall in any way release us from any liability under the guarantee and we hereby waive notice of any such change, addition or modification.

3. The Bank shall pay to the Employer the amount thus demanded without requiring further evidence or proof of:

- a. the default of the Contractor; or
- b. the Employer's entitlement to terminate the Contract or the employment of the Contractor under the Contract; or
- c. any termination of the Contract or the employment of the Contractor under the contract; or
- d. of the amount due and payable under this bank Guarantee.

4. The liability of the Bank under this Guarantee shall remain in full force and effect and shall not be affected or discharged in any way by and the Bank hereby waives notice of:

- a. any suspension of the Works, variation to or amendment of the Contract (including without limitation extension of time for performance or adjustment to the Tender Total or other payment under the Contract) or any concession or waiver by the Employer in respect of the Contractor's obligations under the Contract;
- b. the termination of the Contract or of the employment of the Contractor under the Contract solely as a result of default by the Contractor under the Contract;
- c. any forbearance or waiver of any right of action or remedy the Employer may have against the Contractor or negligence by the Employer in enforcing any such right of action or remedy;
- d. any other security or guarantee held or obtained by the Employer for any of the obligations of the Contractor under the Contract or any release or waiver thereof;
- e. any act or omission of the Contractor pursuant to any other arrangement with the Surety.

5. The liability of the Bank under this Guarantee shall cease on whichever of the following events first occurs:

- a. payment by the Bank of the Guaranteed Sum in full to the Employer; or
- b. receipt of written notification from the Employer that the[Note 4] have been installed and tested to the satisfaction of the Employer.

6. Until the MAHAMETRO has issued an instruction to the Bank to the effect that this Guarantee can be released, the Bank undertakes to extend the validity under the same conditions for successive periods of six (6) calendar months at a time and to forward the appropriate extension sheets to the MAHAMETRO.

SIGNATURE AND SEAL OF THE GUARANTOR

NAME OF THE BANK-----

ADDRESS-----

DATE-----

Notes:

1. The stamp papers of appropriate value shall be purchased in the name of the Bank, who issues the 'Bank Guarantee'.
2. The Bank Guarantee shall be from a scheduled commercial bank based in India, acceptable to the Employer.
3. The amount payable under this Guarantee shall be 95 percent of the aggregate of the installments of the Payment made to the Contractor prior to the date of the written demand referred to above less the aggregate of any sums in respect of items installed, tested and certified by the Employer's Representative (as defined in the Contract) in accordance with the terms of the Contract.
4. Enter name of the Contract.

Maharashtra Metro Rail Corporation Limited

(A Joint Venture of Government of India and Government of Maharashtra)

PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

TENDER NO.

P1-T06/2021

PART-III

CONDITIONS OF CONTRACT AND CONTRACT

FORMS

SECTION-XI

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PART I: SHE MANAGEMENT**GENERAL****1.1 Scope**

- 1.1.1 This document defines the principal requirements of the Employer on Safety, Health and Environment (SHE) associated with the Contractor / sub-contractor and any other agency to be practiced at construction worksites at all time.

1.2 Definition / languages

- 1.2.1 The Environmental Quality Management Manual (EQM) forms an essential part of the overall Environmental Protection System employed by Maharashtra Metro Rail Corporation Limited for the construction of Pune Metro Rail Project.

1.2.2 Definition & Abbreviations

- (a) **“Environment”** means the total surroundings of an organism including water, air and land and other living creatures.
- (b) **“Environmental Pollutant”** means any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment.
- (c) **“Environmental Pollution”** means the presence in the environment of any environmental pollutant.
- (d) **“Nuisance”** is annoyance, which results from any construction activity that affects the material comfort and quality of life of the inhabitants of the area surrounding the construction site.
- (e) **“Monitoring”** is the use of direct or indirect reading field instrumentation to provide information regarding the levels of pollutants released during construction.
- (f) **“Construction Site”** is the contract limits for construction. It shall be all the area within the limits of the work as shown on the Plans. Construction Site shall also include staging, and debris disposal areas and transportation routes to and from these areas.
- (g) **“Noise”** is any unwanted sound disturbance of the environment around the area of construction operations.
- (h) **“Decibel”** is a measure on a logarithmic scale of the magnitude of a particular quantity (such as sound pressure, sound power) with respect to a standardized reference quantity.
- (i) **“A - weighted Noise levels”** in Decibels (referenced to 20 micro-Pascal) as measured with A-weighting network of standard sound level meter, abbreviated dB (A).
- (j) **“Energy Equivalent Level (L_{eq})”** is the level of a steady noise which has the same energy as the fluctuating noise level integrated over the period of measurement. L_{max} is the maximum Noise Level during the period of measurement. L_{10} and L_{90} are the percentile exceeding levels of sound which is exceeded 10% and 90% of the time of measurement.
- (k) **“Waste”** is unwanted surplus substance arising from the application of all construction operations and any substance or article, which is required to be disposed.
- (l) **“Suspended Particulate Matter”** is abbreviated as SPM and measured in $\mu\text{g}/\text{m}^3$.
- (m) **“Environmental Quality Management Manual”** is abbreviated as EQM.
- (n) **“Air Monitoring and Control Plan”** is abbreviated as AMCP.
- (o) **“Noise Monitoring and Control Plan”** is abbreviated as PMCP.
- (p) **“Ministry of Environment and Forests, Government of India”** is abbreviated as MOEF.
- (q) **“Central Pollution Control Board”** is abbreviated as CPCB.
- (r) Notwithstanding the definition of “Site” of Clause 1.1.6.7 of the GCC and in the context of the present specification the ESHS specifications, the word “Worksite(s)” means:

- (i) The land where work will be carried out, or
- (ii) the land necessary for the implantation of Worksite facilities (work camp, workshops, offices, storage areas, concrete production plants) and including special access roads, or
- (iii) quarries for aggregates, rock material and riprap, or
- (iv) borrow areas for sand and other selected material, or
- (v) stockpiling areas for backfill material or other demolition rubble, or
- (vi) any other location, specifically designated in the Contract as a Worksite

The term « Worksite(s) » encompasses any individual Worksite or all Worksites.

1.2.3 In this document:

- (i) The use of “**shall**” indicates a mandatory requirement.
- (ii) The use of “**should**” indicates a guideline that is strongly recommended.
- (iii) The use of “**may**” indicates a guideline that is to be considered.
- (iv) “**SHE**” means Safety, Health and Environment.
- (v) “**Employer**” means Maharashtra Metro Rail Corporation Limited
- (vi) “**Chief Safety Officer**” means an officer nominated by Maharashtra Metro Rail Corporation Limited who is overall responsible for monitoring all SHE functions prescribed in this document.
- (vii) “**BOCWA**” means Building & Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996
- (viii) “**BOCWR**” means Building & Other Construction Workers (Regulation of Employment and Conditions of Service) Central Rules, 1998
- (ix) “**DG**” means Director General of Ministry of Labour, Govt. of India.
- (x) “**BOCWWCA**” means Building & Other Construction Workers’ Welfare Cess Act, 1996
- (xi) “**BOCWWCR**” means Building & Other Construction Workers Welfare Cess Rules 1998
- (xii) “**MBOCWR**” means Maharashtra Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2003
- (xiii) “**Notifications**” (Central and state) - collection of cess.
- (xiv) “**CIIBC**” means Chief Inspector of Inspection of Building and Other Constructions of Government of Maharashtra
- (xv) “**HIRA**” means Hazard Identification and Risk Assessment

1.3 Application of this document

- 1.3.1 This document applies to all aspects of the Contractor’s scope of work, including all aspects conducted by sub-contractors and all other agencies. There shall be no activity associated to the Contract, which is exempted from the purview of this document.

Pursuant to Clause 4.4 of the GCC, the Contractor is fully liable for all actions, non-compliance and negligence by subcontractors, their representatives, employees and workers, to the same degree as it would be held liable for its own actions, non-compliance or negligence or that of its own representatives, employees or workers.

1.4 Purpose of this document

- 1.4.1 The objective of these guidelines is to ensure that adequate precautions are taken to avoid accidents, occupational illness and harmful effects on the environment during construction.
- 1.4.2 This document :-

- (i) Describes the SHE interfaces between Employer and the Contractor
- (ii) Details the processes by which the Contractor shall manage SHE issues while carrying out the work under the Contract.
- (iii) Describes by reference, the practices and procedures as given in the Maharashtra Metro Rail Corporation Limited Project Safety, Health & Environment Manual for best SHE performance.

1.4.3 These requirements shall be read together with Maharashtra Metro Rail Corporation Limited's Project SHE Manual, OHSAS 18001-1999 Occupational Health and Safety Management System and ISO 14001: 2004 Environmental Management Systems. Definition of key terms used in these requirements related to OHSAS 18001 & ISO 14001 standards are found in Maharashtra Metro Rail Corporation Limited's Project SHE Manual.

'SHE' TARGETS AND GOALS

1.5 The SHE targets, goals and aim for the Works are to achieve:

- (i) Zero total recordable injuries.
- (ii) Zero reportable environmental incidents
- (iii) All personnel inducted in accordance with the approved contractor SHE plans
- (iv) Total compliance of conducting inspections and audits as per approved SHE plan
- (v) 100% incident recording and reporting
- (vi) 100% adherence of usage of appropriate PPEs at work
- (vii) Executing construction work with least disturbance to the environment, adjoining area road users and traffic

COMPLIANCE

1.6 Memorandum of Understanding (MOU)

1.6.1 A Memorandum of Understanding placed at Appendix No. 1 shall be executed before the award of Contract by the Contractor with regard to various provisions on Safety, Health and Environment to be practiced during the construction work.

1.7 Maharashtra Metro Rail Corporation Limited's SHE Policy and Management Systems

1.7.1 The construction works shall be undertaken in accordance with Maharashtra Metro Rail Corporation Limited's SHE Policy and Management Systems as amended from time to time provided in Project SHE Manual.

1.8 Indian statutory requirements

1.8.1 Primary statutory regulations

1.8.1.1 Contractor shall develop thorough understanding about Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act 1996, Central Rules 1998, The Building & Other Construction Workers Welfare Cess Act 1996 and Central Welfare Rules 1998, Maharashtra Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Rules, 2003, Building and Other Construction Workers Welfare Cess act 1996 and Central Rules 1998, Notification [Central & State] - Collection of Cess, not only to satisfy the Inspectors' perspective but the use of legislation as the strong tool for effective SHE management at construction worksites. Contractor is strongly advised to practice the principle of voluntary compliance.

1.8.1.2 In order to facilitate the Contractor for better understanding on the various provisions of the above Act and Rules, a tabulated information highlighting the Sections/Rules referring to the corresponding registration of Contractors,

maintenance of registers and records, hours of work and wages, cess & welfare, medical facilities and safety requirements are given in Appendix No. 2. It is an indicative one and not a limiting list.

1.8.2 In addition, the construction works shall be undertaken in accordance with all applicable legislation and Indian statutory requirements listed below but not limiting to:

- (i) Indian Electricity Act 2003 and Rules 1956
- (ii) National Building Code, 2005
- (iii) Factories Act, 1948, Maharashtra Government Factories Rules, 1963
- (iv) Motor Vehicles Act as amended in 1994 and The Central Motor Vehicles Rules, 1989
- (v) The Motor Transport Workers Act 1961 & Maharashtra Rules 1965
- (vi) Indian Road Congress Code IRC: SP: 55-2001 'Guidelines on Safety in Road Construction Zones'
- (vii) The Petroleum Act, 1934 and Rules 1976
- (viii) Gas Cylinder Rules, 2003
- (ix) Indian Explosives Act, 1884, along with the Explosives Substance Act 1908 and the Explosives Rules 1983
- (x) The (Indian) Boilers Act, 1923
- (xi) The Public Liability Insurance Act 1991 and Rules 1991
- (xii) Minimum Wages Act, 1948 and The Minimum Wages (Maharashtra Rules) 1961
- (xiii) The Contract Labour (Regulation & Abolition) Act 1970 & The Contract Labour (P&R) (Maharashtra) Rules, 1972
- (xiv) The Child Labour (Prohibition & regulation) Act 1986 and Maharashtra Rules 1994
- (xv) Environment Protection Act, 1986 and Rules 1986
- (xvi) Air (Prevention and control of Pollution) Act, 1981
- (xvii) Water (Prevention and Control of Pollution) Act, 1974
- (xviii) The Noise Pollution (Regulation & Control) Rules, 2000
- (xix) Notification on Control of Noise from Diesel Generator (DG) sets, 2002
- (xx) Recycled Plastic Usage Rules, 1998
- (xxi) Notification, Central Ground Water Board, Act January 1997
- (xxii) The Manufacturing, Storage and Import of Hazardous Chemical Rules, 1989
- (xxiii) Chemical Accidents (Emergency Planning, Preparedness and Response) Rules, 1996
- (xxiv) The Hazardous Waste (Management, Handling & Trans-boundary Movement) Rules, 2007
- (xxv) Relevant Rules / Guidelines regarding Preservation of Trees
- (xxvi) Batteries (Management and Handling) Rules
- (xxvii) Fly ash utilization notification, Sept 1999 as amended in August 2003.
- (xxviii) Guidelines of Pune Urban Development Authority
- (xxix) Guidelines of Maharashtra Pollution Control Board

1.8.3 Workman Compensation Act, 1923 along with allied Rules :- The Contractor shall ensure that all his employees / workmen are covered under 'Workmen Compensation Act' and shall pay compensation to his workmen as and when the eventuality for the same arises.

1.8.4 Notwithstanding the above Act/Rules, there is nothing in those to exempt the Contractor from the purview of any other Act or Rule in Republic of India for the safety of men and materials.

1.8.5 The Contractor is responsible for the sanitary repatriation of Contractor's Personnel in the event of a serious injury or illness. The Contractor will take out the necessary insurance to cover the cost of the sanitary repatriation of its Contractor's Personnel.

1.9 International Standards, Guidelines & ISO Certifications

1.9.1 The Contractor complies with norms, standards and discharge limit values recommended by the specialised international organisations affiliated to the United Nations, as described in clause 3.4.2 below.

1.9.1.1 The specialised international organisations affiliated to the United Nations referred to in Clause 9.2 include:

- World Bank, including the IFC and its Environmental, Health and Safety guidelines available from <http://www.ifc.org/ehsguidelines>

For matters not addressed in the IFC above document, the norms, standards and discharge limit values of the following institutions shall apply:

- World Health Organization (WHO)
- Inter-national Labour Organization (ILO) (in particular in pursuance to Clauses 6.20, 6.21, 6.23 and 6.24 of the GCC)
- International Maritime Organization (IMO)

3.4.3 The works should be undertaken in accordance with the applicable international guidelines, standards and specifications on SHE and every contract shall aim to achieve ISO certifications listed below during the currency of the contract:

OHSAS 18001-1999 : Occupational Health and Safety Management System.

ISO 14001-2004 : Environmental Management Systems.

1.9.4 The process of certification shall start immediately after the award of the work and complete within reasonable time. Towards this, the Contractor shall undertake the required steps including appointment of ISO consultant for obtaining the certification on Occupational Health and Safety Management System and Environment Management System.

1.9.5 In case of failure on the part of the Contractor, the Employer at the cost of the Contractor shall do the same.

1.10 Method Statement and Risk Assessment

1.10.1 Method Statement should be submitted by the Contractor. The Method Statement should include activity list, job step, equipment list, HIRA (Hazard Identification and Risk Assessment) etc.

CONTRACTOR SHE POLICY AND PLAN

1.11 The Contractor as per Section 39 of the BOCW Act shall formulate a SHE policy and get it approved by DG/CIIBC and display it at conspicuous places at work sites in Hindi and local languages understood by the majority of construction workers.

1.12 Within 4 weeks of the notification of acceptance of the tender, the Contractor shall submit a detailed and comprehensive Contract specific SHE Plan. The SHE Plan shall include detailed policies, procedures and regulations which, when implemented, will ensure compliance of the contract provisions. The SHE Plan shall include the following but not be restricted to:

- (i) A statement of the Contractor's policy, organisation and arrangements for SHE including the resources available for the implementation of the same.
- (ii) The name(s) and experience of person(s) within the Contractor's proposed management who shall be responsible for co-ordinating and monitoring the Contractor's SHE performance;

- (iii) The number of SHE staffs who shall be employed on the Works, their responsibilities, authority and line of communication with the proposed Contractor's agent;
 - (iv) A statement of the Contractor's policy and procedures for identifying and estimating hazards, and the measures for addressing the same;
 - (v) A list of SHE hazards anticipated for this Contract and sufficient information to demonstrate the Contractor's proposals for achieving effective and efficient health and safety procedures;
 - (vi) A description of the SHE training courses and emergency drills which shall be provided by the Contractor, with an outline of the syllabus to be followed;
 - (vii) Details of the safety equipment which shall be provided by the Contractor, including personal protective equipment;
 - (viii) A statement of the Contractor's policy and procedures for ensuring that Contractor's Equipment used on the Project Site are maintained in a safe condition and are operated in a safe manner;
 - (ix) A statement of the Contractor's policy and procedures for ensuring that sub-contractors comply with the Contractor's safety plan;
 - (x) A statement of the Contractor's disciplinary procedures with respect to SHE related matters, and
 - (xi) A statement of the Contractor's procedure for reporting and investigating accidents, dangerous occurrences or occupational illnesses
- 1.13 The Contractor shall, from time to time and as necessary are required by the Employer to produce supplements to the SHE Plan such that it is at all times a detailed, comprehensive and contemporaneous statement by the Contractor of his site safety, industrial health and environment obligations, responsibilities, policies and procedures relating to work on Site. Any and all submissions of supplements to the SHE Plan shall be made to the Employer in accordance with the agreed procedures.
- 1.14 If at any time the SHE plans is, in the Employer's opinion, insufficient or requires revision or modification to ensure the security of the Works and the safety of all workmen upon and visitors to the Site, the Employer may instruct the Contractor to revise the SHE plans, and the Contractor shall within 7 days submit the revised plan to the Employer for review.
- 1.15 Any omissions, inconsistencies and errors in the SHE Plan or the Employer's acceptance or rejection of the SHE Plan and/or supplements thereto shall be without prejudice to the Contractor's obligations with respect to site safety, industrial health and environment and shall not excuse any failure by the contractor to adopt proper and recognised safety practices throughout the execution of the Work.
- 1.16 The Contractor shall adhere to the SHE Plan and shall ensure, as far as practically possible, that all sub-contractors of all tiers require that contracting parties each have a copy of the Site SHE Plan and comply with its provisions.
- 1.17 The details of contents to be covered in the site SHE plans are given in Appendix No. 3.

DESIGNER'S ROLE

1.18 Designer's role in Safety, Health and Environment

Designer's primary role includes to minimise the risk to health and safety of those who are going to construct, maintain, clean, repair, dismantle or demolish the structures and anyone else like adjoining road users/general public, who might be affected by the work.

- 1.19 **General Philosophy:** - When considering health and safety in designer's work, they shall be expected to do what is reasonable at the time the design is prepared. It may be possible for hazards, which cannot be addressed at the feasibility stage to be

looked at during detailed design. In deciding what is reasonably practicable, the risk to health and safety produced by a feature of the design has to be weighed against the cost of excluding the feature. The overall design process does not need to be dominated by a concern to avoid all risks during the construction phase and maintenance. However, a judgement has to be made by weighing up one consideration against another, so the cost is counted not just in financial terms, but also those of fitness for purpose, aesthetics, build ability or environmental impact. By applying these principles, it may be possible to make decisions at the design stage, which will avoid or reduce risks during construction work. In many cases, the large number of design considerations will allow a number of equally valid design solutions. What is important is the approach to the solutions of design problems. This should involve a proper exercise of judgement, which takes account of health and safety issues.

1.20 Hierarchy of Risk Control

1.20.1 Designers shall need, so far as reasonably practicable, to avoid or reduce risks by applying a series of steps known as the hierarchy of risk control or principles of prevention and protection. The steps to be adopted shall include the following:-

- (i) consider if the hazard can be prevented from arising so that the risk can be avoided (e.g., alter the design to avoid the risk);
- (ii) if this cannot be achieved, the risk should be combated at source (e.g., ensure the design details of items to be lifted include attachment points for lifting);
- (iii) failing this, priority should be given to measures to control the risk that will protect all people;
- (iv) only as a last resort should measure to control risk by means of personal protection be assumed (e.g., use of safety harnesses).

1.21 Duty to provide health and safety risks in the drawing itself

1.21.1 In case of situations where the designers have carried out the design work and concluded that there are risks, which are not reasonably practicable to avoid, detailed information shall be given about the health and safety risks, which remain. This information needs to be included with the design to alert others to the risks, which they cannot reasonably be expected to know. This is essential for the parties who have to use the design information.

1.21.2 If the designers' basic design assumptions affect health or safety, or health and safety risks are not obvious from the standard design document, the designer shall provide additional information. The information shall include a broad indication of the assumptions about the precautions for dealing with the risks. The information will need to be conveyed in a clear manner; it shall be included on drawings, in written specifications or outline method statements. The level of detail to be recorded will be determined by the nature of the hazards involved and the associated level of risk.

1.22 Employer's approval

1.22.1 Every structure like scaffold, false work, launching girder, earth retaining structures etc. shall have its design calculations included in the method statements in addition to health and safety risks. Employers' designer or his approved proof check consultants as applicable as per the contract conditions shall approve all these designs.

1.23 Any non-standard structures like trestles made up of re-bars or structures which are very old, corroded, repaired for many times etc. for which no design calculations can be made accurately from any national standards, shall not be allowed to be used at sites even for short duration.

1.24 If any of the above-mentioned clauses are not adhered penalty shall be imposed depending upon the gravity of the unsafe act and or condition

CONTRACTOR SHE ORGANISATION

1.25 Education and Experience

- 1.25.1 The Contractor shall appoint the required SHE personnel as prescribed in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/001 (enclosed at the end) based upon the statutory requirement and establish the safety organisation based upon the Contract value. The minimum educational qualification & the work experience are given in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/002.
- 1.25.2 In order to effectively interact on labour welfare matters with the Employer and the statutory authorities enforcing the labour welfare legislations every Contractor shall employ a full time Labour Welfare Officer duly qualified and experienced as per Clause 6.1.1.
- 1.26 Conduct and competency**
- 1.26.1 The conduct and functioning of the Contractor SHE personnel shall be monitored by the Employer. Any default or deficiency shall attract penalty as per details given under penalty Clause 56.0 of this document.
- 1.26.2 All Contractors Personnel are made aware and acknowledge their understanding of the rules of procedure and the associated provisions. Rules of procedure document are initialled by all contractors Personnel prior to the start of any physical work at any Project site.
- 1.26.3 The rules of procedure include a list of acts considered as serious misconduct and which must result in dismissal from any Project Area by the Contractor, or by the Engineer if the contractor is not acting in due course, should a contractor's Personnel repeatedly commit an offence of serious misconduct despite awareness of the rules of procedure, and this is without prejudice to any legal action by any public authority for non-compliance with applicable regulations
- a) Drunkenness during working hours, leading to risks for the safety of local inhabitants, customers, users and personnel.
 - b) Punishable statements or attitudes, and sexual harassment in particular.
 - c) Violent behaviour.
 - d) Intentional damage to the assets and interests of others, or the environment.
 - e) Repeated negligence or impudence leading to damage or prejudice to the environment, the population or properties, particularly breaching provisions intended to prevent the spreading of STD and AIDS.
 - f) Drug use
 - g) Possession and /or consumption of meat or any other part of an endangered animal or plant as defined in the Washington convention (CITES) and National Regulation.
- Serious misconduct such as organization of sex trade (pimping) committing paedophile, physical aggression, drug trafficking, deliberate and severe pollution, trading and /or trafficking in all or part of protected species, shall lead to immediate dismissal as of the first report of misconduct is detected, in application of the rules of procedure and labour laws.
- The contractor establishes a record for each case of serious misconduct and a copy will be provided to the contractors Personnel in question indicating all action taken to terminate the misconduct by the Contractor's personnel. This record will be shared with the Engineer.
- Any person suspected by the engineer to be under the influence of alcohol or controlled substance on any Project Area is immediately suspended from his position by the Contractor, pending the results of medical tests.

- 1.26.4 The Contractor shall ensure that all personnel are competent to perform the job assigned to them. In the event that the Contractor is unable to demonstrate the competency of any person whose activities can directly impact on the Works' SHE performance, the Employer shall remove that person from the site without any procedural formalities.
- 1.27 Approval from Employer**
- 1.27.1 The name, address, educational qualification, work experience and health condition of each personnel deployed for SHE jobs shall be submitted to the Employer in the format prescribed for the purpose for comments and approval well before the start of the work. Only on approval by the Employer these personnel are authorised to work. In case any of the SHE personnel leaves the Contractor the same shall be intimated to the Employer. The Contractor shall recruit new personnel and fill up the vacancy.
- 1.28 Responsibility of SHE personnel**
- 1.28.1 For all works carried out by the Contractor and his sub-contractors, the responsibility of ensuring the required SHE manpower lies with the main Contractor only. The minimum required manpower indicated by the Employer includes the sub-contractors' work also. It shall be the responsibility of the main Contractor to provide required SHE manpower for all the works executed by all Contractors. Necessary conditions shall be included in all sub-contract documents executed by the main Contractor.
- 1.29 Employment status of SHE personnel**
- 1.29.1 No Contractor shall engage SHE manpower from any outsourcing agencies in which case the effectiveness would be lost. All SHE manpower shall be on the payroll of the main Contractor only and not on the payroll of any subcontractor or outsourcing manpower agencies etc. This condition does not apply to positions like traffic marshals who are engaged almost on a daily requirement basis.
- 1.30 Reporting of SHE personnel**
- 1.30.1 All SHE personnel are to report to the Chief SHE Manager who shall report directly to the Chief Project Manager. The Employer shall monitor adherence to this procedure at all times. In case of non-adherence penalty shall be levied as indicated in the penalty clause.
- 1.31 Inadequate SHE personnel**
- 1.31.1 In case if the Contractor fail to provide the minimum required manpower as illustrated in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/001 or fail to fill up vacancies created within 14 days, the same shall be provided by the Employer at Contractor's cost. Any administrative expenses involved, providing the same like as paper advertisement or manpower consultant charges, etc shall also be at the cost of Contractor.
- 1.32 Prohibition of performance of other duties**
- 1.32.1 As per Schedule VIII of BOCWR, no SHE personnel shall be required or permitted to do any work which is unconnected to, inconsistent with or detrimental to the performance of the SHE duties for respective category mentioned in General Information Maharashtra Metro Rail Corporation Limited / SHE / GI / 001
- 1.33 Facilities to be provided to SHE personnel**
- 1.33.1 As per Schedule VIII of BOCWR, the Contractor shall provide all SHE personnel with such facilities, equipment and information that are necessary to enable him to dispatch his duties effectively.
- 1.33.2 The minimum Employer's requirements of such facilities / equipment's to be provided for SHE personnel are given in the General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/003

CONTRACTOR SHE COMMITTEE

- 1.34 All employees should be able to participate in the making and monitoring of arrangements for safety, industrial health and environment at their place of work. The establishment of site SHE committees in which employees and Contractor and sub-contractor management are represented can increase the involvement and commitment of employees. The Contractor shall ensure the formation and monitor the functioning of Contractor SHE committees.

1.35 Terms of Reference

- 1.35.1 The Terms of Reference for the committee shall be as follows:

- (i) To establish company safety policies and practices
- (ii) To monitor the adequacy of the contractor's site SHE plans and ensure its implementation
- (iii) To review SHE trainings
- (iv) To review the Contractor's monthly SHE report.
- (v) To identify probable causes of accident and unsafe practices in building or other construction work and to suggest remedial measures
- (vi) To stimulate interest of Employer and building workers in safety by organizing safety week, safety competition, talks and film-shows on safety, preparing posters or taking similar other measures as and when required or as necessary.
- (vii) To go around the Construction Site with a view to check unsafe practices and detect unsafe conditions and to recommend remedial measures for their rectifications including first-aid medical and welfare facilities.
- (viii) Committee team members should perform a site inspection before every committee meetings and to monitor SHE inspection reports.
- (ix) To bring to the notice of the Employer the hazards associated with use, handling and maintenance of the equipment used during the course of building and other construction work
- (x) To suggest measures for improving welfare amenities in the construction site and other miscellaneous aspect of safety, health and welfare in building or other construction work.
- (xi) To look into the health hazards associated with handling different types of explosives, chemicals and other construction materials and to suggest remedial measures including personal protective equipment.
- (xii) To review the last safety committee meeting minutes and to take action against persons/sub-contractors for non-compliance if any

- 1.36 Within 14 days of award of Contract, the SHE Committee shall be constituted and notification regarding the same shall be communicated to the members and employees as per the format provided in Form No. SF 001

- 1.37 Site SHE Committee meeting shall be conducted at least once in a month with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	<ol style="list-style-type: none"> i) Labour Welfare Officer ii) In charge of plant and machinery iii) In charge of site electrics iv) In charge of stores. v) Senior Managers/ Engineers heading different sub functions. vi) Sub - contractor's representative vii) Labour Contractor's representative viii) Workers' representative

	ix) Co-contractor representative. x) SHE staffs
Employer's Representatives	Maharashtra Metro Rail Corporation Limited SHE in charge and other representatives

- 1.38 Construction SHE Committee meeting shall be conducted at least once in a week with the minimum members listed below:

Chairman	Project Manager
Secretary	SHE Manager (In-charge)
Members	(i) Labour Welfare Officer (ii) In charge of plant and machinery (iii) In-charge of site electricity (iv) Senior Managers / Engineers heading different sub functions (v) Sub- Contractor's representative (vi) Labour contractor's representative (vii) Workers' representatives (viii) All SHE Staffs

1.39 Co-contractors' participation

- 1.39.1 In case of depot, station and other contiguous areas where more than one main contractors are working together, the Employer shall instruct the other contractors to join for the monthly SHE committee meeting of the main civil contractor, so as to discuss and decide about the common provision of security, lighting, toilet, drinking water etc. and sharing the maintenance cost of the same etc.

- 1.39.2 The general principle for sharing the cost shall be either based on the Contract value of works executed at the contiguous area or the daily average number of workmen employed by each contractor in the contiguous area.

1.40 Minimum time between two monthly SHE Committee meetings

- 1.40.1 A minimum period of 21 days shall be maintained between any two SHE monthly committee meetings.

1.41 Agenda

- 1.41.1 The Secretary shall circulate the agenda of the meeting at least seven working days in advance of the scheduled date of the meeting to all members.

- 1.41.2 The agenda should broadly cover the following:

- (i) Confirmation of minutes
- (ii) Chairman's review/overview of site SHE performance / condition
- (iii) Previous month SHE statistics
- (iv) Incident and Accident Investigation / dangerous occurrence / near miss report
- (v) Site SHE inspection
- (vi) Sub-contractors' SHE issues
- (vii) Safety presentation by Members
- (viii) Report from Employer
- (ix) Matters arising
- (x) Any other business

1.42 Minutes of the meeting

- 1.42.1 The Minutes of the meeting shall be prepared as per the format provided at Form No. SF-002 and sent to all members within 2 working days preferably by mail/fax followed by hardcopy. Safety Committee meeting minutes shall also be displayed in the notice board for wider publicity to all concerned.

1.43 Disciplinary Action

- 1.43.1 The chairman shall inform the members of any outstanding issues in the meeting and in case of repeated offence/ non-compliance by some members or other co/sub-contractors and propose suitable disciplinary action including provisions of monetary penalty as per the relevant contract clauses, the Employer shall ensure that the same is implemented.

ID CARD AND FIRST DAY AT WORK, SHE ORIENTATION TRAINING

- 1.44 The Contractor shall ensure that all personnel working at the site receive an induction SHE trainings explaining the nature of the work, the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation. The training shall cover the contents as given in the General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/004.
- 1.45 All personnel shall be issued a photo identity card of size 85mm x 55mm duly signed by the authorized representative of the Contractor before they are engaged for any work as per the format given in the General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/005
- 1.46 Contractor shall also issue some personnel SHE handbook in a language known to the workers, which provides information on SHE and emergency procedures that all personnel working on contract are required to know and the need to follow. Contractor shall ensure that this is distributed, and its content introduced to all personnel working at the site.

SHE TRAINING

- 1.47 The behaviour of people at all levels of the Contractor is critical for SHE performance.
- 1.48 The Contractor shall organise quality SHE training to engage Managers, supervisors and other personnel in behavioural change and improve safety performance.
- 1.49 Training sessions are two -fold: introductory sessions for starting work at the Project Area, and technical training as required in relation to the execution of the works.
- (i) Starting work sessions are organised for each Contractor's Personnel and shall cover as a minimum
 - a) Rules of procedure
 - b) Safety rules on Project Areas.
 - c) Protection of areas adjacent to Project Area
 - d) Risks relating to sexually transmitted diseases, prostitution, human trafficking and sexual
 - e) Basic health: combating malaria and water borne diseases, improving hygiene.
- 1.50 The Contractor shall analyse the training requirements for all the employees and initiate a training program to demonstrate that all persons employed, including subcontractors, are suitably qualified, competent and fit. This will include:
- (i) Orientation training -covering all the trainings mentioned in 9.3 above
 - (ii) Detailed Job descriptions for all personnel, to include their specific SHE responsibilities
 - (iii) Specification of qualifications, competency and training requirements for all personnel
 - (iv) Assessment and recording of training needs for all personnel, including subcontractors' employees in the workforce, vendor representatives and site visitors
 - (v) A system for assessing new hirers e.g. previous training
 - (vi) A means of confirming that the system is effective

- (vii) A matrix and schedule of training requirements, covering general, task-specific and SHE-related training, showing the training frequency and interval between refresher courses
 - (viii) Timely, competent delivery of training courses
- 1.51 The Contractor shall arrange behavioural-based training programmes for all the executives to identify, recognise and eliminate unsafe act and unsafe conditions.
 - 1.52 The minimum Employer's requirement of training needs for various categories of employees are given in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/006
 - 1.53 The contents of SHE training to Managers/Supervisors as given in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/007 shall be conducted.
 - 1.54 The refresher-training programme to all employees shall be conducted once in six months.
 - 1.55 Toolbox talk as given in the Employer's Project SHE Manual shall be conducted to all high-risk workmen every day.
 - 1.56 On-the spot practical skill development training on height safety including scaffold safety, crane safety, welding safety, electrical safety, traffic safety for marshals shall also be conducted to all foremen/ workmen who were associated to the concerned jobs.
 - 1.57 Every employee including workman shall take safety Oath daily without fail.
 - 1.58 All vehicle drivers including heavy vehicle operators shall be trained on defensive driving at training institute recognized by Maharashtra State Road Transport Corporation / Government of Maharashtra, or any other driving institute registered under Motor Vehicles Act.
 - 1.59 All the above listed training programmes except at Clause 9.11 shall be organised by the Contractor only after taking approval from the Employer for the training faculty / organisation, content and durations.
 - 1.60 In case of failure on the part of the Contractor to provide all the above-mentioned training programs to all employees in time, the same shall be provided by the Employer through accredited agencies if required by formulating a common scheme to all contractors. Any administrative expenses and training fee towards the same shall be at the cost of the Contractor.
 - 1.61 The Contractor detail in the training programme the actions and ESHS training for subcontractors and other members of the joint venture when applicable.

SHE INSPECTION

- 1.62 The Contractor shall evolve and administer a system of conducting SHE inspections and other risk management analysis on a periodical basis.
- 1.63 The purpose of SHE inspection is to identify any variation in construction activities and operations, machineries, plant and equipment and processes against the SHE Plan and its supplementary procedures and programs.
- 1.64 Following SHE inspections program shall be adopted:
 - (i) Planned General Inspection
 - (ii) Routine Inspection
 - (iii) Specific Inspection
 - (iv) Other Inspection

1.64.1 Planned General Inspection

1.64.1.1 Planned general inspections are performed at predetermined intervals and it usually involves the representation from both Contractor and the Employer.

1.64.1.2 Inspections that will be classified under this inspection program are:

- (i) Monthly contractor and sub-contractors site safety committee Inspection.
- (ii) Weekly safety inspection by construction supervisors (Contractors and Sub-contractors)
- (iii) Daily safety inspection by contractor site SHE team.

1.64.2 Routine Inspection

1.64.2.1 Routine inspections are often referring to the inspection of work site, equipment and temporary structures performed by site and equipment operators and temporary structure erectors.

Inspections that will be classified under this inspection program are:

- (i) Daily Inspection of plant and equipment by operator
- (ii) Weekly Inspection of scaffold by scaffolding supervisor
- (iii) Monthly Inspection of electrical hand tools by competent electrical supervisor
- (iv) Quarterly Inspection of temporary electrical systems by competent electrical supervisor
- (v) Half-yearly inspection of lifting machinery, lifting appliances, equipment and gears by Govt. approved competent person.

1.64.2.2 The list mentioned above is not exhaustive. Contractor may add additional categories. Contractors' Site SHE Manager will ensure that a system of routine inspections is carried out periodically to all plants, equipment, powered tools and any other temporary structures that will pose a hazard to operators and workmen.

1.64.3 Specific Inspection

1.64.3.1 Specific inspections are performed on activities without a predetermined date. Competent supervisors usually perform inspections for ensuring an activity whether it is executed in accordance to a general set of rules; method statement submitted or developed procedures.

The following are examples that will be commonly performed as required on the construction site:

- (i) Inspection performed before a heavy lifting operation.
- (ii) Inspection performed before and after the entry of person into a confined space.
- (iii) Inspection performed before and after a welding and gas cutting operation.
- (iv) Inspection of formwork before concreting by formwork erector.

The list mentioned above is not exhaustive. The Contractor shall ensure that a competent supervisor inspects all high-risk processes and activities.

1.64.4 Other Inspection

Other inspections include the following:

- (i) Mandatory Inspections by Labour Department of Government.
- (ii) Maharashtra Metro Rail Corporation Limited site SHE management team

1.64.5 The Contractor shall prepare all required safety inspection checklist for all activity operations and equipment. Checklists will be prepared based on the Indian standards, rules and regulations and Employer's requirements. The formats provided in the Project SHE manual may be referred.

1.64.6 All inspection records and reports will be properly kept and filed for audit purpose. Inspection reports of Planned General Inspection and Routine Inspection will be used for discussion during Safety Committee Meetings.

SHE AUDIT**1.65 General**

1.65.1 The purpose and scope of SHE audits is to assess potential risk, liabilities and the degree of compliance of construction Safety, Health & Environmental plan and its supplementary procedures and programs against applicable and current SHE legalisation regulations and requirements of the Employer.

1.65.2 Project Manager holds the ultimate responsibility in ensuring implementation of SHE audit program during the construction work.

1.66 Monthly Audit Rating Score (MARS)

1.66.1 Monthly Audit Rating Score (MARS) will be performed once in a month. A team consisting of Project Manager and Employer representative based on the pre-designed score-rating format will conduct it. The details of the pre-designed monthly audit score rating formats are given in the Project SHE Manual.

1.66.2 This Monthly SHE Audit Rating Score (MARS) report will enable the Employer to evaluate the general compliance by the Contractor with the Conditions of Contract, the Employer's Project SHE Manual and the Contractor's site specific SHE Plan.

1.66.3 Monthly Audits will be conducted in accordance with Maharashtra Metro Rail Corporation Limited Guidelines. The Project Manager accompanied by the Employer's Representatives shall carry out the Audit. The Contractor's senior manager and SHE in-charge should also be invited to attend.

1.66.4 **Timing** :- The Monthly Audit Rating Score (MARS) should be conducted at least 7 days prior to the scheduled date of Monthly SHE Committee meeting.

1.66.5 Evaluation

1.66.5.1 The numerical scoring has been weighed on a 1-10 scale. The audit team will use their observations noted in evaluating the points to be awarded against each of the

elements of the audited section. Wherever some topics and sub-topics are not applicable the score rating need not be given. The overall audit ratings shall be achieved by:

$$\text{Overall Audit Rating} = \frac{\text{Actual Score Achieved}}{\text{Max Possible Score}} * 100$$

1.66.5.2 The criticality of the required actions for the respective sections of the Audit will be classified as:

SN	Score	Description	Action
1	< 60%	Immediate	Require Contractor to rectify within 24 hours
2	< 75%	Improvement Necessary	Contractor rectification within 7 days and confirmed in writing to Employer
3	< 90%	Improvement Desirable	Contractor rectification within one month and confirmed in writing to Employer

1.66.3 **Report** :- A copy of each Audit Report will be sent to Employer and to all subcontractors, with whom it will then be discussed in detail at the Monthly SHE Committee Meeting in order to ensure that any corrective actions are agreed upon.

1.67 Monthly Electrical Safety Audit

1.67.1 A team comprising of Contractor's senior SHE (Electrical) engineer and Employer's Representative shall conduct monthly electrical safety audit covering the following and submit the report to Employer:

- (i) Electrical accidents investigation findings and remedy
- (ii) Adequacy of power generation and power requirements
- (iii) Power distribution and transmission system in place
- (iv) Updated electrical single line diagram showing the current condition of power source and distribution including the IP44 DBs arrangement.
- (v) Electrical protection devices - selection, installation and maintenance.
- (vi) Earth or ground connection and earth pit maintenance details
- (vii) Education and training of electrical personnel undertaken
- (viii) Routine electrical inspection details
- (ix) Electrical maintenance system and register.
- (x) Name plate details of major electrical equipment
- (xi) Classified zones in the site, if any.

1.68 External SHE Audit

1.68.1 External SHE audits are to be conducted by external agencies that are competent with ISO qualified auditors with the prior approval of the Employer.

1.68.2 Areas of competence of Audit team

1.68.2.1 Practical understanding of BOCW Act and Rules, statutory requirements on health/medical and welfare of workmen, construction hazards and its prevention and control, traffic management, electrical safety, rigging, safety of construction equipment and environment management.

1.68.2.2 Audit shall be conducted as per the guidelines of ISO, ILO, and national standards. Audit report shall also be presented as per the above formats.

1.68.3 External SHE audits shall be conducted on a quarterly basis throughout the currency of the Contract.

1.68.4 Targets of SHE Audit :- The contents and coverage of the external audit shall include the following items

1.68.4.1 SHE management

- (i) Organization
- (ii) Communication and Motivation
- (iii) Time office
- (iv) Inspection
- (v) Emergency preparedness
- (vi) Budget allocation
- (vii) Education and Training
- (viii) Work permit system

1.68.4.2 Technical

- (i) Building and Structure
- (ii) Construction operational safety
- (iii) Material safety
- (iv) Hand tools and Power tools
- (v) Electrical system
- (vi) Safety Appliances
- (vii) Fire prevention and control
- (viii) Housekeeping
- (ix) Maintenance and Machinery safety
- (x) First-aid and Medical Facilities
- (xi) Welfare measures
- (xii) Environmental Management

1.68.5 Audit Documents

1.68.5.1 Contractor shall make the below listed documents available for the review by the Audit team.

- (i) SHE policy
- (ii) SHE manual
- (iii) SHE Rules and Regulation
- (iv) SHE organization chart
- (v) Annual SHE objectives / programs
- (vi) Accident / near miss statistics and analysis
- (vii) SHE Training program / records for all personnel
- (viii) Operating manuals and maintenance manual of all equipment's
- (ix) Safe worthiness certificates of all lifting appliances and gears
- (x) Medical fitness record for all personnel
- (xi) Risk identification, assessment and control details
- (xii) Environmental management reports
- (xiii) Emergency management records including mock drill

1.68.6 Audit Preparation

- (i) Audit team members are required to gather information by observations through interviews and by checks of hardware and documentation.
- (ii) Audit team shall prepare checklist to cover all parts based on SHE legislations rules and regulations and Maharashtra Metro Rail Corporation Limited requirements.
- (iii) Audit team members shall verify the facts and findings leading to the identified gaps and weakness.
- (iv) Audit leader has overall responsibility for reaching a conclusion.

1.68.7 Reporting

1.68.7.1 Audit report shall be prepared and directly sent to the Employer within 7 days of conducting the audit with a copy to the contractor.

1.68.8 Report contents

- (i) Executing summary: Based on the finalized checklists as written the findings to the Employer by the audit team members, the audit leader will compile a concise and accurate summary of observations and findings.
- (ii) Introduction: This will contain basic information regarding the facilities or organization audited, the specific audit dates (inclusion of those for preparation and post-audit activities).
- (iii) Principal positive findings: This will contain the summary of positive aspects as observed by the auditors. It will also contain highlights of those issue, which may warrant dissemination as best practice regarding methodology used or achievement.
- (iv) Audit Findings: All audit findings as detailed in the audit checklists shall be grouped together as priority 1 and 2 as detailed below in a separate listing.
 - a. Priority 1: Actions to rectify gaps or weakness should generally be implemented within 2 - weeks, if risk potential is high or unacceptable.
 - b. Priority 2: Actions should be generally implemented or rectified with a maximum of 3 - 4 weeks, if not rectified would create a likelihood of minor injury or business loss.

1.68.9 Conformity Report & Action by Employer

1.68.9.1 The auditor shall inspect the site after 14 days of conducting initial audit for checking the adequacy of implementation of items maintained under priority 1 by

- the Contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the contractor.
- 1.68.9.2 The auditor shall again inspect after 28 days of conducting initial audit for checking the adequacy of implementation of items mentioned under priority 2 by the Contractor and shall submit a conformity / non-conformity report to the Employer with a copy to the Contractor.
- 1.68.9.3 In case of non-conformity of items mentioned by auditor, the Employer shall take necessary steps including stoppage of work and or imposing any penalty for getting the item implemented.
- 1.68.10 Failure of Contractor to conduct External SHE Audit
- 1.68.10.1 If the Contractor fails to conduct the external SHE audits in time, the Employer at the cost of Contractor shall get it done.

SHE COMMUNICATION

- 1.69 The Contractor shall take every effort to communicate the Safety, Occupational health and Environment management measures through posters campaigns / billboards / banners / glow signs being displayed around the work site as part of the effort to rise safety awareness amongst to the work force. Posters should be in Marathi, Hindi and English and. Posters / billboards / banners/ glow signs should be changed at least once in a month to maintain the impact.
- 1.70 The Contractor shall also observe important days as listed in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/008 and printing and displaying safety signage and posters as listed in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/009
- 1.71 The list indicated are the minimum requirements of the Employer and the Contractor is encouraged to further the SHE communication activities by formulating suitable reward schemes for safety performers and any other activities, which deem fit for the purpose.

SHE SUBMITTALS TO THE EMPLOYER

- 1.72 The Contractor's SHE management should send the following reports to the Employer periodically:
- (i) Daily Reporting of total number of workmen (as given in Clause 13.2)
 - (ii) Monthly SHE Report (as given in Clause 13.3)
 - (iii) SHE Committee Meeting Minutes (as given in Clause 7.9.1)
 - (iv) SHE Inspection Reports
 - (v) SHE Audit Reports
 - a. Monthly Audit Rating Score (MARS) report
 - b. External SHE Audit
 - c. Electrical Safety Audit
 - (vi) Air and Noise Quality monitoring report

1.73 Daily Reporting of total number of workmen

1.73.1 The Contractor shall report to the Employer the total number of workmen engaged by all including any subcontractor within 2 hours of starting of any shift in any day. This reporting shall be the primary duty of the Chief SHE Manager of the Contractor and reporting shall be through tele-fax / email. The onus of checking the receipt of the same by the Employer lies with the Contractor. If the information is not received or received more than 2 hrs after starting of the shift, penalty shall be levied as per relevant clause.

1.74 Monthly SHE Report

1.74.1 The Contractor shall prepare a monthly SHE reports consisting of the following and submit 3 copies within 7th of next month to the Employer as specified in the Project SHE Manual.

- (i) Monthly man-hour details as specified in the Project SHE manual
- (ii) Monthly accident / incident details as specified in the Project SHE manual
- (iii) SHE committee details
- (iv) Details of SHE trainings conducted in the month
- (v) SHE Inspection
- (vi) SHE internal audit details like electrical audit etc.
- (vii) SHE Communication activities under taken in the month indicating the number of posters displayed and balance availability in stock.
- (viii) Air quality
- (ix) Toolbox talks details
- (x) PPE details: Quantity purchased, issued to the workmen and stock available.
- (xi) Details on IP 44 panel boards, lighting poles, welding & cutting equipment's, Ladders, Hoists, tools & tackles.
- (xii) Monthly Lux meter study results
- (xiii) Housekeeping
- (xiv) Barricade maintenance details
- (xv) No of critical excavations
- (xvi) Health & Welfare activities
- (xvii) Safety walk conducted by Contractors' Project Manager in the month
- (xviii) SHE Activities Planned for next month

ACCIDENT REPORTING AND INVESTIGATION**1.75 Reporting to Employer**

1.75.1 All accidents, "near miss" and dangerous occurrences shall immediately be informed verbally to the Employer. This will enable the Employer to reach to the scene of accident / dangerous occurrences to monitor/assist any rescue work and/or start conducting the investigation process so that the evidences are not lost.

1.75.2 Reports of all accidents (fatal / injury) and dangerous occurrences shall also be sent within 24 hours as per approved format.

1.75.3 No accident / dangerous occurrences are exempted from reporting to the Employer.

1.75.4 Any wilful delay in verbal and written reporting to the Employer shall be penalised as per relevant clause.

1.75.5 Near Miss

An incident or a situation with clear potential for an undesirable outcome to occur, even though no actual negative consequences happened. In other words, it is an event with potential to cause injury, property damage, environmental release or an adverse community reaction. Generally, the following events are some examples of near miss when:

- (i) A person trips over an object and falls to the ground but did not get injured
- (ii) A person has to dive or jump out of the way to avoid a collision with a motorized vehicle, a moving object like a suspended part on a conveyor or from an uncontrolled suspended load;

- (iii) A person has to jump from a falling ladder;
- (iv) An object with significant mass falls from a distance of sufficient height that would cause injury to a person if they were struck;
- (v) A machine part becomes a projectile;
- (vi) A person works on a piece of equipment that he/EHS believes is de-energized and that equipment starts up putting that person in jeopardy;
- (vii) A low speed collision occurs, and an occupant of that vehicle is not wearing a seat belt and is not injured.
- (viii) Stored energy unexpectedly releases which could cause injury if a person were struck or contacted, e.g. a high-tension spring (like your garage door spring) breaks or a pocket of steam releases;
- (ix) Any steps of the vessel entry procedure are omitted in a vessel entry;
- (x) Any emergency equipment (fire extinguisher, Scott Air Pack, Oxygen sensor, eye wash, etc) fails to operate properly when called on in an emergency.

If Protective Equipment is called for and worn and it prevents an injury, then in this case it would not be a near miss. As an example, a mechanic is wearing a hard hat in a barricaded area where hard hats must be worn and a 100gram bolt falls from a height of 2 meters and strikes his hard hat and no injury occurs. That would not be a near miss. But if he were not wearing a hardhat and the bolt falls a meter away, then it would be a near miss.

- 14.1.6 Each non-conformity will be documented by a digital photograph with captions to provide a visual illustration, explicitly indicating the location, date of inspection and the non-conformity in question.

1.76 Reporting to Government organisations

- 1.76.1 In addition to the above verbal and written reporting to the Employer, as per Rule 210 of BOCWR, notice of any accident to a worker at the building or construction site that:

- (i) causes loss of life; or
- (ii) disables a worker from working for a period of 48 hours or more immediately following the accident;
- (iii) shall forthwith be sent by telegram, telephone, fax, or similar other means including special messenger within four hours in case of fatal accidents and 72 hours in case of other accidents, to:

- a. the Regional Labour Commissioner, wherein the Contractor has registered the firm/ work
- b. the board with which the worker involved was registered as a beneficiary;
- c. Director General and
- d. the next of kin or other relative of the worker involved in the accident;

- 1.76.2 Further, notice of accident shall be sent in respect of an accident which:

- (i) causes loss of life; or
- (ii) disables the injured worker from work for more than 10 days to
 - a. the officer-in-charge of the nearest police station;
 - b. the District Magistrate or, if the District Magistrate by order so desires, to
 - c. the Sub-Divisional Magistrate

- 1.76.3 In case of an accident causing minor injury, first-aid shall be administered, and the injured worker shall be immediately transferred to a hospital or other place for medical treatment.

- 1.76.4 Where any accident causing disablement that subsequently results in death, notice in writing of such death, shall be sent to the authorities mentioned in Clause 14.2.1 and 14.2.2 above within 72 hours of such death.

- 1.76.5 Reporting of dangerous occurrences

1.76.5.1 The following classes of dangerous occurrences shall be reported to the Inspector having jurisdiction, whether or not any disablement or death caused to the worker, namely:

- (a) collapse or failure of lifting appliances, or hoist, or conveyors, or similar equipment for handling of building or construction material or breakage or failure of rope, chain or loose gears; or overturning of cranes used in construction work;
- (b) falling of objects from height;
- (c) collapse or subsidence of soil, pipe lines, any wall, floor, gallery, roof or any other part of any structure, launching girder, platform, staging, scaffolding or means of access including formwork;
- (d) explosion of receiver or vessel used for storage of pressure greater than atmospheric pressure, of any gas or gases or any liquid or solid used as building material;
- (e) fire and explosion causing damage to any place on construction site where building workers are employed;
- (f) spillage or leakage of any hazardous substance and damage to their container;
- (g) collapse, capsizing, toppling or collision of transport equipment;
- (h) leakage or release of harmful toxic gases at the construction site;

1.76.6 In case of failure of launching girder, lifting appliance, loose gear, hoist or building and other construction work, machinery and transport equipment at a construction site, such appliances, gear, hoist, machinery or equipment and the site of such occurrence shall, as far as practicable, be kept undisturbed until inspected by the Authorities;

1.76.7 Every notice given for fatal accidents or dangerous occurrences shall be followed by a written report to the concerned Authorities under Section 39 of BOCWA and the Director General in the specified Form XIV of BOCWR.

1.77 Accident investigation

1.77.1 General

1.77.1.1 Investigations should be conducted in an open and positive atmosphere that encourages the witnesses to talk freely. The primary objective is to ascertain the facts with a view to prevent future and possibly more serious occurrences.

1.77.1.2 Accidents and Dangerous Occurrences which result in death, serious injury or serious damage must be investigated by the Contractor immediately to find out the cause of the accident/occurrence so that measures can be formulated to prevent any recurrence.

1.77.1.3 Near misses and minor accidents should also be investigated by the Contractor as soon as possible as they are signals that there are inadequacies in the safety management system.

1.77.2 Procedure of incident investigation

1.77.2.1 It is important after any accident or dangerous occurrence that information relating to the incident is gathered in an organised way. The following steps shall be followed:

- (a) take photographs and make sketches
- (b) examine involved equipment, workplace or material and the environmental conditions
- (c) interview the injured, eye-witnesses and other involved parties
- (d) consult expert opinion where necessary
- (e) identify the specific Contractor or sub-contractor involved.

1.77.2.2 Having gathered information, it is then necessary to make an analysis of incident

- (a) establish the chain of events leading to the accident or incident
- (b) find out at what stage the accident took place

- (c) consider all possible causes and the interaction of different factors that led up to the accident, and identify the most probable cause. The cause of an accident should never be classified as carelessness. The specific act or omission that caused the accident must be identified.

1.77.2.3 The next stage is to proceed with the follow-up action

- (a) report on the findings and conclusions
- (b) formulate preventive measures to avoid recurrence
- (c) publicise the findings and the remedial actions taken

1.78 Employers' independent incident investigation

- 1.78.1 In case of fatal / dangerous occurrence the Employer shall also conduct independent investigation. Contractor and his staff shall extend necessary co-operation and testify about the accident.
- 1.78.2 The Contractor shall take every effort to preserve the scene of accident till the Employer completes the investigation.
- 1.78.3 All persons summoned by the Employer in connection to witness recording shall obey the instructions without delay. Any wilful suppression of information by any person shall be removed from the site immediately and / or punishable as per relevant penalty clause.

EMERGENCY PREPAREDNESS PLAN

- 1.79 The Contractor shall prepare as required under Rule 36 of BOCWR, an Emergency Response Plan for all work sites as a part of the Contractor SHE Plan. The plan shall integrate the emergency response plans of the Contractor and all other subcontractors. The Emergency Response Plan shall detail the Contractor's procedures, including detailed communications arrangements, for dealing with all emergencies that could affect the Site. This include where applicable, injury, sickness, evacuation, fire, chemical spillage, severe weather and rescue.
- 1.80 The Contractor shall ensure that an Emergency Response Plan is prepared to deal with emergencies arising out of:
 - (i) Fire and explosion
 - (ii) Collapse of lifting appliances and transport equipment
 - (iii) Collapse of building, sheds or structure i.e.-structural failure
 - (iv) Gas leakage or spillage of dangerous goods or chemicals
 - (v) Bomb threatening, Criminal or Terrorist attack
 - (vi) Drowning of workers
 - (vii) Landslides getting workers buried floods, Earthquake, storms & other natural calamities.
 - (viii) Loss of containment of dangerous substance
- 1.81 Fire extinguishers are made available in each building at clearly identified locations, and fires are strictly forbidden outside of the cooking area.
- 1.82 Arrangements shall be made for emergency medical treatment and evacuation of the victim in the event of an accident or dangerous incident occurring, the chain of command and the responsible persons of the Contractor with their telephone numbers and addresses for quick communication shall be adequately publicized & conspicuously displayed in the workplace.
- 1.83 Contractors shall require to tie-up with the hospitals and fire stations located in the neighbourhood for attending to the casualties promptly and emergency vehicle kept on standby duty during the working hours for the purpose.
- 1.84 Contractor shall conduct an onsite emergency mock drill once in every month for all his workers and his subcontractor's workers.
- 1.85 It shall be the responsibility of the Contractor to keep the Local Law & Order Authorities informed and seek urgent help, as the case may be, so as to mitigate the consequences of an emergency. Prompt communication to Maharashtra Metro Rail

Corporation Limited, telephonically initially and followed by a written report, shall be made by the Contractor.

EXPERTS / AGENCIES FOR SHE SERVICES

- 1.86 Contractors may utilise the services of experts/agencies empanelled under Rule 250 of BOCWR for the purpose of training, internal audit and any other SHE services with prior approval of the Employer.
- 1.87 As an aide to contractors, a list of experts/agencies and the offered service are given in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/010 for ready reference. In addition to it if the Contractor would like to use any expert/agencies' services for any SHE activities the same can also be allowed provided that they are competent and meet to the general requirements of Employer. In every case prior approval of the Employer is mandatory.

PART II: SAFETY**HOUSEKEEPING**

- 1.88 Housekeeping is the act of keeping the working environment cleared of all unnecessary waste, thereby providing a first-line of defence against accidents and injuries.
- 1.89 Contractor shall understand and accept that improper housekeeping is the primary hazard in any construction site and ensure that a high degree of housekeeping is always maintained. Indeed “Cleanliness is indeed next to Godliness”
- 1.90 Housekeeping is the responsibility of all site personnel, and line management commitment shall be demonstrated by the continued efforts of supervising staff towards this activity.
- 1.91 General Housekeeping shall be carried out by the Contractor and ensured at all times at Work Site, Construction Depot, Batching Plant, Labour Camp, Stores, Offices and toilets / urinals. Towards this the Contractor shall constitute a special group of housekeeping personnel as per General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/001. This group shall ensure daily cleaning at work sites & surrounding areas and maintain a register as per the approved format by the Employer.
- 1.92 Adequate time shall be assigned to ensure that good housekeeping is maintained. Team of housekeeping squad shall carry out this.
- 1.93 The Contractor shall be responsible to provide segregated containers for disposal of debris at required places and regular cleaning of the same.
- 1.94 Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the surrounding area from excavated soil, rubbish etc, which may cause inconvenience to and endanger the public. The barricade especially those exposed to public shall be aesthetically maintained by regular cleaning and painting as directed by the Employer. These shall be maintained in one line and level.
- 1.95 The structure dimension of the barricade, material and composition, its colour scheme, Maharashtra Metro Rail Corporation Limited logo and other details shall be in accordance with specifications laid down in tender document.
- 1.96 All stairways, passageways and gangways shall be maintained without any blockages or obstructions. All emergency exits passageways, exits fire doors, break-glass alarm points, firefighting equipment, first aid stations, and other emergency stations shall be kept clean, unobstructed and in good working order.
- 1.97 Lumber with protruding nails shall be bent or removed and properly stacked.
- 1.98 All surplus earth and debris are removed/disposed-off from the working areas to officially designated dumpsites. Trucks carrying sand, earth and any pulverized materials etc. in order to avoid dust or odour impact shall be covered while moving. The tyres of the trucks leaving the site shall be cleaned with water, wherever the possibility of spillage on carriageways meant for regular road traffic exists.
- 1.99 No parking of trucks/trolleys, cranes and tRailers etc. shall be allowed on roads, which may obstruct the traffic movement. All truck drivers should generally be accompanied by a Cleaner.
- 1.100 Roads shall be kept clear and materials like: pipes, steel, sand boulders, concrete, chips and brick etc. shall not be allowed on the roads to obstruct free movement of road traffic.
- 1.101 Water logging or bentonite spillage on roads shall not be allowed. If bentonite spillage is observed on road endangering the safety of road users, the Contractor shall be penalised as per relevant clause.
- 1.102 Proper and safe stacking of material are of paramount importance at yards, stores and such locations where material would be unloaded for future use. The storage area shall be well laid out with easy access and material stored / stacked in an orderly and safe manner.

- 1.103 Unused/surplus cables, steel items and steel scrap lying scattered at different places within the working areas shall be removed to identified locations(s).
- 1.104 All wooden scrap, empty wooden cable drums and other combustible packing materials, shall be removed from work place to identified location(s).
- 1.105 Empty cement bags and other packaging material shall be properly stacked and removed.
- 1.106 The Contractor shall ensure that all his sub-contractors maintain the site reasonably clean through provisions related to house keeping

WORKING AT HEIGHT/BELOW GROUND

1.107 Definitions

- 1.107.1 “access” and “egress” include ascent and descent.
- 1.107.2 “fragile surface” means a surface, which would fail if any reasonably foreseeable loading were to be applied to it.
- 1.107.3 “line” includes rope, chain or webbing
- 1.107.4 “personal fall protection” means:
 - (i) a fall prevention, work restraint, work positioning, fall arrest or rescue system, other than a system in which the only safeguards are collective safeguards; or
 - (ii) rope access and positioning techniques;
- 1.107.5 “work at height” means:
 - (i) work in any place, including a place at or below ground level;
 - (ii) obtaining access to or egress from such place while at work, except by a staircase in a permanent workplace, where, if protective measures were not taken, a person could fall a distance liable to cause personal injury;
- 1.107.6 “work equipment” means any machinery, appliance, apparatus, tool or installation for use at work (whether exclusively or not) and includes:
 - (a) a guard-Rail, toe-board, barrier or similar collective means of protection
 - (b) a working platform
 - (c) a net, airbag or other collective safe guard for arresting falls
 - (d) personal fall protection system
 - (e) ladders
- 1.107.7 “working platform” means:
 - (i) any platform used as a place of work or as a means of access to or egress from a place of work;
 - (ii) includes any scaffold, suspended scaffold, cradle, mobile platforms, trestle, gangway, gantry and stairway which is so used.
- 1.108 **Organisation and planning** :- The Contractor shall ensure that work at height is:
 - (i) properly planned for any emergencies and rescue
 - (ii) appropriately supervised; and
 - (iii) carried out in a manner, which is reasonably practicable safe.
- 1.109 The Contractor shall ensure that work at height is carried out only when the weather conditions do not jeopardise the health or safety of persons involved in the work.
- 1.110 **Competence**:- The Contractor shall ensure that no person engages in any activity, including organization, planning and supervision, in relation to work at height or work equipment for use in such work unless he is competent to do so or, if being trained, is being supervised by a competent person.
- 1.111 **Avoidance of risks from work at height**:- The Contractor shall ensure that work is not carried out at height where it is reasonably practicable to carry out the work safely otherwise than at height.
- 1.112
- 1.113 Where work is carried out at height, the Contractor shall take suitable and sufficient measures as given below to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.
 - (i) his ensuring that the work is carried out:
 - a. from an existing place of work; or

- b. (in the case of obtaining access or egress) using an existing means, complying to the requirements as given in Clause 18.15

Where it is reasonably practicable to carry it out safely and under appropriate ergonomic conditions; and

- (ii) Where it is not reasonably practicable for the work to be carried out in accordance with sub-paragraph (a), his providing sufficient work equipment for preventing, so far as is reasonably practicable, a fall occurring.
- 1.114 Where the measures taken under Clause 18.6 do not eliminate the risk of a fall occurring, every Contractor shall:
- (i) So far as is reasonably practicable, provide sufficient work equipment to minimise:
 - a. The distance and consequences; or
 - b. Where it is not reasonably practicable to minimise the distance, the consequences, of a fall; and
 - (ii) Without prejudice to the generality of Clause 18.4, provide such additional training and instruction or take other additional suitable and sufficient measures to prevent, so far as is reasonably practicable, any person falling a distance liable to cause personal injury.
- 1.115 Selection of 'work equipment' for work at height
- (i) The Contractor, in selecting work equipment for use in work at height, shall:
 - a. Give collective protection measures priority over personal protection measures; and
 - b. Take account of:
 - 1. The working conditions and the risks to the safety of persons at the place where the work equipment is to be used;
 - 2. In the case of work equipment for access and egress, the distance to be negotiated;
 - 3. The distance and consequences of a potential fall;
 - 4. The duration and frequency of use;
 - 5. The need for easy and timely evacuation and rescue in an emergency; and
 - 6. Any additional risk posed by the use, installation or removal of that work equipment or by evacuation and rescue from it;
 - (ii) The Contractor shall select work equipment for work at height which:
 - a. has characteristics including dimensions which:
 - 1. Are appropriate to the nature of the work to be performed and the foreseeable loadings; and
 - 2. Allow passage without risk; and
 - b. Is in other respects the most suitable work equipment, having regard in particular to the purposes specified in Clause 18.5 and 18.6.

c. Special requirements for using cranes and hoists underground

1. underground hoists must be designed to allow powering of the hoist drum in both directions so that the brakes are automatically applied upon power release or failure.
2. Hoist operator must have a closed-circuit voice communication system with speaker microphone to communicate with individual landing station
3. When sinking shafts 22.8m or less, cages, skips and buckets may swing, bumper snag against shaft sides must be guided by fenders, Rails, ropes or a combination. If shaft is greater than 22.8m then hoisted objects must be rope guided for full length of travel.

1.116 Fragile surfaces

1.116.1 The Contractor shall ensure that no person at work passes across or near, or working on, from or near, a fragile surface where it is reasonably practicable to carry out work safely and under appropriate ergonomic conditions without his doing so.

1.116.2 Where it is not reasonably practicable to carry out work safely and under appropriate ergonomic conditions without passing across or near, or working on, from or near, a fragile surface, every Contractor shall:

- (i) ensure, so far as is reasonably practicable, that suitable and sufficient platforms, coverings, guard Rails or similar means of support or protection are provided and used so that any foreseeable loading is supported by such supports or borne by such protection;
- (ii) where a risk of a person at work falling remains despite the measures taken under the preceding provisions of this regulation, take suitable and sufficient measures to minimise the distances and consequences of his fall.

1.116.3 Where any person at work may pass across or near, or work on, from or near, a fragile surface, every Contractor shall ensure that:

- (i) prominent warning notices are so far as is reasonably practicable affixed at the approach to the place where the fragile surface is situated; or
- (ii) where that is not reasonably practicable, such persons are made aware of it by other means.

1.117 Falling objects

1.117.1 The Contractor shall, where necessary to prevent injury to any person, take suitable and sufficient steps to prevent, so far as is reasonably practicable, the fall of any material or object.

1.117.2 where it is not reasonably practicable to comply with the requirements of Clause 18.9, every Contractor shall take suitable and sufficient steps to prevent any person being struck by any falling material or object which is liable to cause personal injury.

1.117.3 The Contractor shall ensure that no material or object is thrown or tipped from height in circumstances where it is liable to cause injury to any person.

1.117.4 Every Contractor shall ensure that materials and objects are stored in such a way as to prevent risk to any person arising from the collapse, overturning or unintended movement of such materials or objects.

1.118 Danger areas

1.118.1 Without prejudice to the preceding requirements of these Regulations, every Contractor shall ensure that,

- (i) Where a workplace contains an area in which, owing to the nature of the work, there is a risk of any person at work;
 - a. falling a distance; or
 - b. being struck by a falling object,

which is liable to cause personal injury, the workplace is so far as is reasonably practicable equipped with devices preventing unauthorised persons from entering such area; and

- (ii) such area is clearly indicated.
- 1.119 Inspection of work equipment
 - 1.119.1 The Contractor shall ensure that, where the safety of work equipment depends on how it is installed or assembled, it is not used after installation or assembly in any position unless it has been inspected in that position.
 - 1.119.2 The Contractor shall ensure that work equipment exposed to conditions causing deterioration which is liable to result in dangerous situations is inspected
 - (i) at suitable intervals; and
 - (ii) each time that exceptional circumstances which are liable to jeopardise the safety of the work equipment have occurred,
 to ensure that health and safety conditions are maintained and that any deterioration can be detected and remedied in good time.
 - 1.119.3 Without prejudice to Clause 18.12.1, the Contractor shall ensure that a working platform
 - (i) used for construction work; and
 - (ii) from which a person could fall 2 metres or more,
 is not used in any position unless it has been inspected in that position or, in the case of a mobile working platform, inspected on the site, within the previous 7 days.
 - 1.119.4 The Contractor shall ensure that the reports of all inspections are properly maintained and shown to the Employer as and when required.
 - 1.119.5 In this clause "inspection",
 - (i) means such visual or more rigorous inspection by a competent person as is appropriate for safety purposes; and
 - (ii) includes any testing appropriate for those purposes,
- 1.120 **Inspection of places of work at height :-** The Contractor shall so far as is reasonably practicable ensure that the surface and every parapet, permanent Rail or other such fall protection measure of every place of work at height are checked on each occasion before the place is used.
- 1.121 Duties of persons at work
 - 1.121.1 Any workmen employed by the Contractor shall report to the supervisor about any defect relating to work at height which he knows is likely to endanger the safety of himself or another person.
 - 1.121.2 Every workman shall use any work equipment or safety device provided to him for work at height by the Contractor, in accordance with:
 - (i) any training in the use of the work equipment or device concerned which have been received by him; and
 - (ii) the instructions respecting that use which have been provided to him by the Contractor as per the requirements of the Employer
- 1.122 Requirements for existing places of work and means of access or egress at height every existing place of work or means of access or egress at height shall:
 - (i) be stable and of sufficient strength & rigidity for the purpose for which it is intended to be or is being used;
 - (ii) where applicable, rest on a stable, sufficiently strong surface;
 - (iii) be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work to be carried out there;
 - (iv) possess suitable and sufficient means for preventing a fall;
 - (v) possess a surface which has no gap
 - a. through which a person could fall;
 - b. through which any material or object could fall and injure a person; or
 - c. giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk;
 - (vi) be so constructed and used, and maintained in such condition, as to prevent, so far as is reasonably practicable:
 - a. the risk of slipping or tripping; or

- b. any person being caught between it and any adjacent structure;
 - (vii) where it has moving parts, be prevented by appropriate devices from moving inadvertently during work at height.
- 1.123 Requirements for guard Rails, toe-boards, barriers and similar collective means of protection
 - (i) Unless the context otherwise requires, any reference in this section to means of protection is to a guard Rail, toe-board, barrier or similar collective means of protection.
 - (ii) Means of protection shall
 - a. be of sufficient dimensions, of sufficient strength and rigidity for the purposes for which they are being used, and otherwise suitable;
 - b. be so placed, secured and used as to ensure, so far as is reasonably practicable, that they do not become accidentally displaced; and
 - c. be so placed as to prevent, so far as is practicable, the fall of any person, or of any material or object, from any place of work.
 - (iii) In relation to work at height involved in construction work
 - a. the top guard-Rail or other similar means of protection shall be at least 950 millimetres above the edge from which any person is liable to fall;
 - b. toe-boards shall be suitable and sufficient to prevent the fall of any person, or any material or object, from any place of work; and
 - c. any intermediate guard Rail or similar means of protection shall be positioned so that any gap between it and other means of protection does not exceed 470 millimetres.
 - (iv) Any structure or part of a structure which supports means of protection or to which means of protection are attached shall be of sufficient strength and suitable for the purpose of such support or attachment.
- 1.124 Requirements for all Working Platforms
 - (i) Every working platforms requires a supporting structure for holding it
 - (ii) Any surface upon which any supporting structure rests shall be stable, of sufficient strength and of suitable composition safely to support the supporting structure, the working platform and any loading intended to be placed on the working platform.
 - (iii) Stability of supporting structure
 - Any supporting structure shall**
 - a. be suitable and of sufficient strength and rigidity for the purpose for which it is being used;
 - b. in the case of a wheeled structure, be prevented by appropriate devices from moving inadvertently during work at height;
 - c. in other cases, be prevented from slipping by secure attachment to the bearing surface or to another structure, provision of an effective anti-slip device or by other means of equivalent effectiveness;
 - d. be stable while being erected, used and dismantled; and
 - e. when altered or modified, be so altered or modified as to ensure that it remains stable.
 - f. Have suitable base plates and properly footed thereby.
 - (iv) Stability of working platforms
 - A working platform shall**
 - a. be suitable and of sufficient strength and rigidity for the purpose or purposes for which it is intended to be used or is being used;
 - b. be so erected and used as to ensure that its components do not become accidentally displaced so as to endanger any person;
 - c. when altered or modified, be so altered or modified as to ensure that it remains stable; and
 - d. be dismantled in such a way as to prevent accidental displacement.
 - (v) Safety on working platforms

A working platform shall

- a. be of sufficient dimensions to permit the safe passage of persons and the safe use of any plant or materials required to be used and to provide a safe working area having regard to the work being carried out there;
 - b. possess a suitable surface and, in particular, be so constructed that the surface of the working platform has no gap
 1. through which a person could fall;
 2. through which any material or object could fall and injure a person; or
 3. giving rise to other risk of injury to any person, unless measures have been taken to protect persons against such risk; and
 - c. be so erected and used, and maintained in such condition, as to prevent, so far as is reasonably practicable
 1. the risk of slipping or tripping; or
 2. any person being caught between the working platform and any adjacent structure.
- (vi) **Loading :-** A working platform and any supporting structure shall not be loaded so as to give rise to a risk of collapse or to any deformation, which could affect its safe use.
- (vii) **Additional requirements for scaffolding**
Strength and stability calculations for scaffolding shall be carried out unless
- a. a note of the calculations, covering the structural arrangements contemplated, is available; or
 - b. it is assembled in conformity with a generally recognised standard configuration.
- (viii) Depending on the complexity of the scaffolding selected, a competent person shall draw up an assembly, use and dismantling plan. This may be in the form of a standard plan, supplemented by items relating to specific details of the scaffolding in question.
- (ix) A copy of the plan, including any instructions it may contain, shall be kept available for the use of persons concerned in the assembly, use, dismantling or alteration of scaffolding until it has been dismantled.
- (x) The dimensions, form and layout of scaffolding decks shall be appropriate to the nature of the work to be performed and suitable for the loads to be carried and permit work and passage in safety.
- (xi) While a scaffold is not available for use, including during its assembly, dismantling or alteration, it shall be marked with general warning signs in accordance with and be suitably delineated by physical means preventing access to the danger zone.
- (xii) Scaffolding may be assembled, dismantled or significantly altered only under the supervision of a competent person and by persons who have received appropriate and specific training in the operations envisaged which addresses specific risks which the operations may entail and precautions to be taken, and more particularly in:
- a. understanding of the plan for the assembly, dismantling or alteration of the scaffolding concerned;
 - b. safety during the assembly, dismantling or alteration of the scaffolding concerned;
 - c. measures to prevent the risk of persons, materials or objects falling;
 - d. safety measures in the event of changing weather conditions which could adversely affect the safety of the scaffolding concerned;
 - e. permissible loadings;
 - f. any other risks which the assembly, dismantling or alteration of the scaffolding may entail.

1.125 Requirements for collective safeguards for arresting falls

- (i) Collective safeguard is a safety net, airbag or other collective safeguard for arresting falls
- (ii) A safeguard shall be used only if
 - a. a risk assessment has demonstrated that the work activity can so far as is reasonably practicable be performed safely while using it and without affecting its effectiveness;
 - b. the use of other, safer work equipment is not reasonably practicable; and
 - c. a sufficient number of available persons have received adequate training specific to the safeguard, including rescue procedures.
- (iii) A safeguard shall be suitable and of sufficient strength to arrest safely the fall of any person who is liable to fall.
- (iv) A safeguard shall:
 - a. in the case of a safeguard which is designed to be attached, be securely attached to all the required anchors, and the anchors and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of safely supporting the foreseeable loading in arresting any fall and during any subsequent rescue;
 - b. in the case of an airbag, landing mat or similar safeguard, be stable; and
 - c. in the case of a safeguard, which distorts in arresting a fall, afford sufficient clearance.
- (v) Suitable and sufficient steps shall be taken to ensure, so far as practicable, that in the event of a fall by any person the safeguard does not itself cause injury to that person.

1.126 Requirements for personal fall protection systems

- (i) A personal fall protection system shall be used only if
 - a. a risk assessment has demonstrated that
 - 1. the work can so far as is reasonably practicable be performed safely while using that system; and
 - 2. the use of other safer work equipment is not reasonably practicable; and
 - b. the user and a sufficient number of available persons have received adequate training specific to the operations envisaged, including rescue procedures.
- (ii) A personal fall protection system shall
 - a. be suitable and of sufficient strength for the purposes for which it is being used having regard to the work being carried out and any foreseeable loading;
 - b. where necessary, fit the user;
 - c. be correctly fitted;
 - d. be designed to minimise injury to the user and, where necessary, be adjusted to prevent the user falling or slipping from it, should a fall occur; and
 - e. be so designed, installed and used as to prevent unplanned or uncontrolled movement of the user.
- (iii) A personal fall protection system designed for use with an anchor shall be securely attached to at least one anchor, and each anchor and the means of attachment thereto shall be suitable and of sufficient strength and stability for the purpose of supporting any foreseeable loading.
- (iv) Suitable and sufficient steps shall be taken to prevent any person falling or slipping from a personal fall protection system.
- (v) All fall protection system should be inspected weekly as a minimum.

1.127 Requirements for Ladders

- (i) Every Contractor shall ensure that a ladder is used for work at height only if a risk assessment has demonstrated that the use of more suitable work equipment is not justified because of the low risk and
 - a. The short duration of use; or
 - b. Existing features on site, which he cannot alter.
- (ii) Only metal ladders shall be allowed. Bamboo ladders are prohibited.
- (iii) Any surface upon which a ladder rests shall be stable, firm, of sufficient strength and of suitable composition safely to support the ladder so that its rungs or steps remain horizontal, and any loading intended to be placed on it.
- (iv) A ladder shall be so positioned as to ensure its stability during use
- (v) A suspended ladder shall be attached in a secure manner and so that, with the exception of a flexible ladder, it cannot be displaced, and swinging is prevented.
- (vi) A portable ladder shall be prevented from slipping during use by:
 - a. securing the stiles at or near their upper or lower ends;
 - b. an effective anti-slip or other effective stability device; or
 - c. any other arrangement of equivalent effectiveness.
- (vii) A ladder used for access shall be long enough to protrude sufficiently above the place of landing to which it provides access, unless other measures have been taken to ensure a firm handhold.
- (viii) No interlocking or extension ladder shall be used unless its sections are prevented from moving relative to each other while in use.
- (ix) A mobile ladder shall be prevented from moving before it is stepped on.
- (x) Where a ladder or run of ladders raises a vertical distance of 9 metres or more above its base, there shall, where reasonably practicable, be provided at suitable intervals sufficient safe landing areas or rest platforms.
- (xi) Every ladder shall be used in such a way that
 - a. a secure handhold and secure support are always available to the user; and
 - b. the user can maintain a safe handhold when carrying a load unless, in the case of a step ladder, the maintenance of a handhold is not practicable when a load is carried, and a risk assessment has demonstrated that the use of a stepladder is justified because of
 - 1. the low risk; and
 - 2. the short duration of use.
- (xii) Ladders should be inspected weekly for any damage or corrosion.

1.128 Detailed requirements for Scaffolding

1.128.1 **Scaffold General** :- This procedure provides general information about the competent person, erection, inspection, and use of both welded-frame and tube-and-coupler scaffolds.

- (i) Scaffolds are intended to provide safe working positions at elevations. To eliminate fall exposures, scaffolds must have complete hand Rails, mid-Rails, and decking. Do not use fall arrest equipment as a substitute for hand Rails, mid-Rails, or a complete deck.
- (ii) Before erecting scaffolds, consider all nearby or overhead hazardous energy sources such as electrical, mechanical, pneumatic, thermal, and chemical.
- (iii) Welded-frame scaffolds are made of basic prefabricated end frames, cross-bracing, and frame-connecting devices to hold the parts firmly in place. Tube and-coupler and system scaffolds are made of various lengths of tubing clamped together by special patented couplers to support working platforms of various shapes.
- (iv) All complete scaffolds will have a top hand Rail approx. 1.1 meter above the platform, mid Rail approx. 0.6 meter above the platform & a toe plate 10 cm tall from the platform.

- (v) Do not inter mix scaffold components manufactured by different manufacturers unless the component parts fit together without force or modification.
- (vi) Bamboo components are not permitted on Maharashtra Metro Rail Corporation Limited Sites.

Competent person: one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, & who has authorization to take prompt, corrective measures to eliminate those.

Qualified person: one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his or her ability to solve or resolve problems related to the subject matter, the work, or the project.

1.128.2 Erecting Scaffolds

- (i) Only employees who have been trained by and are under the supervision of a competent person will erect scaffolds. The Maharashtra Metro Rail Corporation Limited Project Safety Manager must approve scaffolds higher than 50 feet (15 meters) above the base plates.
- (ii) Where fall hazards cannot be eliminated, use fall-arrest systems while erecting, modifying, and dismantling scaffolds. It is the responsibility of the competent person to determine the feasibility and type of fall-arrest system to be used.
- (iii) Set scaffold legs on base plates placed on foundations or mudsills that are adequate for supporting the maximum intended loads. Scaffold boards and masonry blocks are not appropriate scaffold foundations. The total load on a scaffold consists of the sum of the weight of the workers and materials on a scaffold plus the weight of the scaffold.
- (v) Install adjusting screws only between the base plate and the vertical frame section. Never use adjusting screws together with casters. Do not extend adjusting screws beyond 12 inches (30 centimetres).
- (vi) The position and number of braces used on a scaffold not only restricts the amount of side movement, but also determines the strength of the scaffold. Never use cross-braces as substitutes for hand Rails or mid Rails.
- (vii) When the height of a scaffold exceeds three times the smallest width of the base, secure it to the building or structure at every other lift and every 9 meters horizontally. The scaffold should be secured by both ties and braces to prevent movement Equip scaffold working platforms with hand Rails approximately one-meter-high, mid Rails, and toe boards, all secured rigidly. Working platforms should be completely decked with safety planks, manufactured scaffold decking, or laminated wooden planks.
- (viii) To allow access to the working platform of a tubular welded frame scaffold, the ladder built into the end frames can be used if it has been specifically designed and constructed by the manufacturer for the purpose of access.
- (ix) Employees engaged in erecting or dismantling tubular-welded frame scaffolds may use the end-frame horizontal members for access provided they are parallel, level, and are not more than 22 inches apart vertically. Hook-on attachable ladders shall be installed as soon as scaffold erection has progressed to a point that permits safe installation and use. Consideration should be given to breaking the ladder at approximately 6-meter intervals. Retractable or vertical lifelines should be used for fall protection while climbing more than 20-feet.
- (x) When portable straight or extension ladders are used for access to tube-and coupler scaffolds, the 4-to-1 slope should be maintained to avoid a horizontal tube interfering with the use of the ladder.

- (xi) Scaffold users should be able to step off the scaffold access ladder directly onto the working platform. Provide entry gates for scaffolds to eliminate the need for users to climb over handrails.
- (xii) Tag or otherwise identify scaffolds that should not be occupied or that require particular safety precautions. The tag should indicate special requirements, the date of erection, and the signature of the competent person.
- (xiii) Scaffolds and their components must be capable of supporting, without failure, at least four times the maximum intended load. Materials should be evenly distributed on platforms and not concentrated in one small area.
- (xiv) During erection of scaffolds, the electrical clearances shall be maintained as per the tabulation mentioned herein in this document

1.128.3 Scaffold Inspection

- (i) A competent person shall visually inspect all components of the scaffold for defects prior to each shift's use and following any occurrence that could affect the scaffold's structural integrity. Defective components will be immediately discarded.
- (ii) Before erecting and while dismantling scaffolds, inspect all components. Scaffold components should be straight and free from bends, kinks, dents, and severe rusting. Immediately discard defective components. Inspections should include an evaluation of the following components:
 - a. Hand Rails, mid-Rails, toe boards, cross-bracing and steel tubing for nicks and other damage, especially near the centre span, and for signs that welding arcs may have struck the equipment
 - b. weld zones on the scaffold frame for cracks
 - c. the end of tubing for splits or cracks
 - d. manufactured decks for loose bolts or rivet connections and bent, kinked, or dented frames
 - e. safety planks for rot, cracks, cuts, and other external damage
 - f. tie rods or bolts and angle iron cleats
 - g. cams, springs, threaded connection, toggle pins, or other quick-connecting devices
 - h. Casters for rough rolling surfaces, "sticky" swivels & defective locking mechanisms.
- (iii) Scaffold Inspection Tag, Boards, identifying that the scaffold is "Safe for Use" or "Scaffolds Under Construction" must be attached to all scaffolds.

1.128.4 Scaffold Training

- (i) Employees involved in the erection, dismantling, moving, repairing, etc., of scaffolding shall receive training from a competent person. The purpose of the training is to recognize any hazards associated with the work in question. Training shall consist of:
 - a. The nature of scaffold hazards
 - b. The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold.
 - c. The design criteria, maximum intended load-carrying capacity, and intended use of the scaffold.
- (ii) Employees who perform work while on a scaffold shall be trained by a qualified person, so they will recognize hazards associated with the type of scaffold being used and understand the procedures to control those hazards. Training will cover the following topics as necessary:
 - a. The nature of any electrical hazards, fall hazards, & falling object hazards in the work area.
 - b. The correct procedures for dealing with electrical hazards and for erecting, maintaining, and disassembling the fall protection systems and falling object protection systems used.

- c. The proper use of the scaffold and the proper handling of materials on the scaffold.
- d. The maximum intended load and the load-carrying capacities of the scaffolds used.

1.128.5 Suspended Scaffolding

Swinging stages, toothpicks, boatswain chairs, float, and needle beams require special approval prior to use.

Attach & secure safety harness before stepping on these scaffolds & do not remove until clear of the scaffold. Tie off to independent lifeline or building structure. One lifeline per person.

OVERHEAD PROTECTION

- 1.129 All contractors shall provide overhead protections as per Rule 41 of BOCWR.
- 1.130 Overhead protection should be erected along the periphery of every building which is under construction and the building height shall be 15m or above after construction.
- 1.131 Overhead protection shall be minimum 2m wide and the outer edge shall be 150mm higher than the inner edge and an angle not more than 20° to its horizontal sloping into the building.
- 1.132 Overhead protection shall not be erected more than a height of 5m from the base of the building.
- 1.133 Areas of inadvertent hazard of falling of material shall be guarded or barricaded or roped-off thereby by the Contractor.

SLIPPING, TRIPPING, CUTTING, DROWNING & FALLING HAZARDS :- As per Rule 42 of BOCWR:

- 1.134 All places should be free from dust, debris or similar materials.
- 1.135 Sharp projections or any protruding nails or similar objects shall be suitably guarded or shall even be avoided to make the place safe to work.
- 1.136 Contractor shall not allow workmen to work or use platforms, scaffolds/passageways or any walkways, which has water, or oil or similar substances spilt and has a slipping hazard, unless it is cleaned off or covered or sanded or saw dusted or make it safe with any suitable material.
- 1.137 When workers are exposed to areas where fall into water is possible, the Contractor shall provide suitable and adequate equipment for saving the workers from drowning and rescuing from such hazard. If the Employer considers, the Contractor shall provide well-equipped boat or launch, manned with trained personnel at the work place.
- 1.138 Open side or opening where worker, equipment, vehicle or lifting appliance may fall at a building or outside shall be guarded suitably except in places of free access by reasons of nature of work.
- 1.139 Suitable safety net shall be provided at places of material / man falling is possible in accordance with national standards.
- 1.140 The collapse of formwork in the construction industry has the potential for severe injury and death. The four stages of the use of formwork (erection, adjustment, concrete placement and dismantling) all need to be managed in a risk assessment framework. Implementing suitable control measures can eliminate or reduce the potential for events such as the collapse of formwork. Suitable control measures include:
 - (i) keeping the documentation for the formwork at the workplace;
 - (ii) following the formwork documentation;
 - (iii) planning to ensure that all elements of the process are conducted in a safe manner - eg ensuring operators such as crane operators, concrete placers are

- suitably licensed and trained, appropriate personal protective equipment is used etc;
- (iv) erecting the formwork on foundations which will support the loads to be imposed on the formwork;
- (v) not erecting formwork near excavation;
- (vi) ensuring materials used in the erection of formwork are not defective;
- (vii) securing loose material which may be dislodged as a result of inclement weather;
- (viii) inspecting the formwork assembly before and during the placement of concrete;
- (ix) not attaching equipment to the formwork assembly unless specifically designed for this purpose; and not using a stripping process which may cause damage to the permanent structure.

LIFTING APPLIANCES AND GEAR

- 1.141 Lifting appliances means a crane, hoist machinery, derrick, winch, gin pole, sheer legs, jack, hoist drum, slewing machinery, slewing bearing fasteners, luffing machinery sheaves, pulley blocks, hooks or other equipment used for lifting materials, objects or building workers and lifting gears means ropes, chain slings, shackles, hooks, lifting lugs, wire ropes, lifting eyebolts and eyenuts and other accessories of a lifting appliance.
- 1.142 No machine shall be selected to do any lifting on a specific job until its size and characteristics are considered against:
- (i) the weights, dimensions and lift radii of the heaviest and largest loads
 - (ii) the maximum lift height, the maximum lift radius and the weight of the loads that must be handled at each
 - (iii) the number and frequency of lifts to be made
 - (iv) how long the crane will be required on site
 - (v) the type of lifting to be done (for example, is precision placement of loads important?)
 - (vi) the type of carrier required (this depends on ground conditions and machine capacity In its operating quadrants) capacity is normally greatest over the rear, less over the side, and non-existent over the front
 - (vii) whether loads will have to be walked or carried
 - (viii) whether loads will have to be suspended for lengthy periods
 - (ix) the site conditions, including the ground where the machine will be set up, access roads and ramps it must travel, space for erection and any obstacles that might impede access or operation
- 1.143 The Contractor shall ensure that a valid certificate of fitness issued as per Clause 21.5 is available for all lifting appliances including synchronised mobile jacks, pre-stressing hydraulic jacks, jacks fitted with launching girders etc. and Employer's approval before inducting to the site. Only after obtaining the approval from the Employer any lifting appliances and gear shall be used.
- 1.144 The laminated photocopies of fitness certificate issued by competent person, the Employers' approval letter, the operators' photo, manufacturer's load chart and competency certificate shall always be either kept in the operator cabin or pasted on the visible surface of the lifting appliances.
- 1.145 All lifting appliances and loose gears shall be clearly marked for its safe working load and identification by stamping or other suitable means.
- 1.146 The Contractor shall also maintain a register containing a system of identification of all tools & tackles, its date of purchase, safe working load, competent person date of examination etc.
- 1.147 Test and periodical examination of lifting appliances and gears

- 1.147.1 All lifting appliances including all parts and gears thereof, whether fixed or movable shall be thoroughly tested and examined by a competent person once at least in every six months or after it has undergone any alterations or repairs liable to affect its strength or stability. Within the validity, if the lifting appliances are shifted to a new site, re-examination by the same competent person for ensuring its safety shall also be done.
- 1.147.2 Contractors can utilise the services of any competent person as defined in Factories Act, 1948 and approved by Chief Inspector of Factories with the permission of the Employer.
- 1.147.3 All alarms and signals like automatic safe load indicators (SLI), boom angle indicators, boom extension indicators, over lift boom alarm, swing alarm, hydraulic safety valves, mechanical radius indicators, load moment indicators etc. shall be periodically examined and maintained always in working condition
- 1.148 Automatic safe load indicators
- 1.148.1 As stipulated in relevant Rule of GBOCWR 2003, no lifting appliances gear or any other material handling appliance is used, if:
- (i) the Inspector having jurisdiction is not satisfied with reference to a certification of test or examination or to an authenticated record maintain as provided under these rules; and
 - (ii) in the view of such Inspector, the lifting appliance, lifting gear or any other material handling appliance is not safe for use in building or other construction work; and
 - (iii) no pulley block is used in building or other construction work unless the safe working load and its identification are clearly marked on such block.
- 1.148.2 Every lifting appliances and gears like cranes, hydras etc, if so constructed that the safe working load may be varied by raising or lowering of the jib or otherwise shall be attached with an automatic indicator of safe working loads approved by Bureau of Indian standards/ International certifying bodies which gives a warning to the operator and arrests further movements of the lifting parts.

1.149 Qualification of operator of lifting appliances and of signaller etc.

1.149.1 The Contractor shall not employ any person to drive or operate a lifting machine-like crane, hydra etc whether driven by mechanical power or otherwise or to give signals to work as a operator of a rigger or derricks unless he:

- (i) is above twenty-one years of age and possesses a valid heavy transport vehicle driving licence as per Motor Vehicle Act and Rules.
- (ii) is absolutely competent and reliable
- (iii) possesses the knowledge of the inherent risks involved in the operation of lifting appliances by undergoing a formal training at any institution of national importance acceptable to Employer
- (iv) is medically examined periodically as specified in Schedule VII of BOCW Rules.

1.150 General requirements of appliances

1.150.1 **Out-off level** :- One of the most severe effects of being out-off fit level is that side loads develop in the boom. Because of side loads all mobile cranes lose capacity rapidly as the degree of out-of-level increases & therefore control of out-of-level is of utmost importance.

1.150.2 Boom

- (i) The boom is one of the more critical elements of the crane and must be in perfect condition at all time. No boom section with a bent lattice member shall be allowed
- (ii) All welds shall be crack and corrosion free
- (iii) No member of the boom shall be bent
- (iv) All telescopic boom shall be free from cracks, rust, flaking or cracked paint, bulges, greases or varnishes

1.150.3 The sweep area (work area) of the construction machinery shall be always free from obstructions.

1.150.4 All hydraulic piping and fittings shall be maintained leak proof.

1.150.5 The operator cab shall posses good and safe:

- (i) structure, windows and windshield wipers
- (ii) Drivers chair and foot rest
- (iii) Control handles
- (iv) Cab instrumentation
- (v) Telecommunication
- (vi) Cab out fitting
- (vii) wind indicator with an adjustable set point shall be in a position representative for the wind on the crane. The indicator shall give continuous information regarding constant speeds and gusts.

1.151 Mandatory rigging requirements

1.151.1 Rigging shall be done under experienced and qualified rigger only.

1.151.2 The primary requirement in rigging shall be to assess the weight of load before attempting any lift.

1.151.3 All hooks shall be fitted with Master Rings having certificate of fitness from the competent person, so that the hooks are subjected to balanced vertical loading only.

1.151.4 Only four legged slings shall be allowed which includes master link (ring), intermediate master link (ring) if necessary, chain / wire rope sling, sling hook or other terminal fitting.

1.151.5 Hand spliced slings up to 32mm diameter shall not be used at site for any lifting purpose.

1.151.6 No load shall be slewed over public areas without stopping the pedestrians and road traffic first.

1.151.7 Requirements of outriggers

- (i) All outriggers shall be fully extended and at all tyres are clear of the ground
- (ii) Heavy duty blocking having large bearing area shall be necessary to prevent sinking of floats

- 1.151.8 All loads shall have tag-lines attached in order to ensure that the load can be controlled at all times.
- 1.151.9 No close working to any live overhead power line is permitted without the operation of a strict Permit to Work.
- 1.151.10 Minimum lighting is to be ensured at all lifting operations.
- 1.152 Failure to do any of the above shall attract penalty from the Employer as per relevant clause

LAUNCHING OPERATION

- 1.153 As launching operation is one of the riskiest job, the Contractor shall take utmost precaution at all stages like; planning, establishing casing yard, casting segments, transporting segments, fabrication and erection of launching girders, launching of segments, pre-stressing, auto launching of girders and dismantling of launching girders.
- 1.154 The Contractor shall prepare a comprehensive Method Statement for the launching operation, adhering to the SHE conditions laid down in conditions of contract on SHE and Project SHE Manual. Particular reference shall be made to the provisions on working at height. As the entire process of launching has to be undertaken at an elevated level, the safety of workers and the girder is paramount important. The following general guidelines shall be adhered throughout the launching operation.
- (i) Necessary 'working platforms' and fall protection anchorage arrangement shall be provided in the launching girder itself.
 - (ii) Provisions for mounting light fittings shall also be made available in the launching girder.
 - (iii) The casting yard shall be established ensuring the provision given in Clause 38.0
 - (iv) The workmen engaged in fabrication of reinforcement, concreting the segment shall be provided with necessary PPEs including compulsory hand protection gloves.
 - (v) Casting and curing of segment shall be undertaken under the direct supervision of the responsible engineer of the Contractor.
 - (vi) Trucks with valid registration, licence, safe worthiness certificate, Employer's approval certificate, and pollution under check certificate shall only be used for transport of segments.
 - (vii) All vehicle drivers including heavy vehicle operators shall be trained on defensive driving at training institute recognized by Maharashtra State Road Transport Corporation / Government of Maharashtra, or any other driving institute registered under Motor Vehicles Act.
 - (viii) Drivers shall also have undergone proper medical examination as per relevant clause mentioned under 'Medical Facilities'.
 - (ix) The segments shall be rigidly secured to the truck with necessary wooden wedges and necessary red indicators/safety tapes provided so that the vehicle is clearly seen by other road users both in day / night time. Further, necessary arrangements / modification should be made in the tRailer and Engineer / Employer approval shall be obtained before the transportation starts.
 - (x) Every launching girder shall have a responsible engineer on duty all the time.
 - (xi) All the time from erection to dismantling the area between the two piers wherein launching is in progress shall always be barricaded.
 - (xii) Unloading of segments from trucks, lifting of segments, shifting of segments, gluing shall be done under the direct supervision of the approved engineer of the Contractor.
 - (xiii) Auto launching shall be done only after approval from the Employer. After every auto launching the stability of launching girder shall be ensured.
 - (xiv) The vertical deflection of launching girder shall be monitored at all critical stages like with/without loads and after every auto launching.

- (xv) A register containing all important operational details from erection to dismantling of launching girders shall be maintained and made available to Employer whenever called for.
 - (xvi) Test certificate for all lifting gears including Macalloy bars shall be maintained at a location closer to the launching girder itself so that it can be referred during all inspections.
 - (xvii) Adequate lighting at all time shall be ensured in the entire area of operation.
 - (xviii) Access to drinking water & toilet shall be ensured to all workmen engaged for launching process.
 - (xix) Proper access ladders/stairways shall be maintained for safe ascending / descending of workmen / engineers.
- 1.155 Non-adherence to any of the clauses mentioned above shall be viewed seriously by the Employer and penalty levied as per relevant clause.

CONSTRUCTION MACHINERY

- 1.156 Construction machineries may include dumpers and dump trucks, lift trucks and telescopic handlers piling rigs, vibro hammers, Rail welding equipment's, mobile elevating work platforms, cranes, tipper lorries, lorry loaders, skip wagons, 360° excavators, 180° backhoe loaders, crawler tractors, scrapers, graders, loading shovels, trenchers, side booms, pavers, planers, chippers, road rollers, locomotives, tankers and browsers, tRailers, hydraulic and mechanical breakers etc.
- 1.157 Safe worthiness certificate
- 1.157.1 Every construction equipment shall be in sound mechanical working condition and certified by either competent person under Factories Act or manufacturers' warranty in case of brand new equipment's or authorized persons / firms approved by Employer before induction to any site.
- 1.157.2 Every such certificate shall have the date of purchase, main overhauling undertaken in the past, any accident to the equipment, visual examination details, critical components safety check, list of safety devises and its working condition, manufacturer's maintenance checklist, past projects wherein the equipment's were used etc as its minimum content.
- 1.158 **Reverse Horns :-** All Vehicles shall be fitted with audible reverse alarms and maintained in good working condition. Reversing shall be done only when there is adequate rear-view visibility or under the directions of a banks man
- 1.159 General operating procedures
- (i) Drivers entering site shall be instructed to follow the safe system of work adopted on site. These shall be verbal instructions or, preferably, written instructions showing the relevant site rules, the site layout, delivery areas, speed limits, etc.
 - (ii) No passengers shall be carried, unless specific seating has been provided in accordance with the manufacturers' recommendations.
 - (iii) Working on gradients beyond any equipment's capability shall not be allowed.
 - (iv) Prevention of dumper and dump truck accidents should be managed by providing wheel stops at a sufficient distance from the edges of excavations, spoil heaps, pits, etc.
 - (v) The manufacturer's recommended bucket size must not be exceeded in excavators.
 - (vi) If excavators operating on a gradient which cannot be avoided, it must be ensured that the working cycle is slowed down, that the bucket is not extended too far in the downhill direction, and that travel is undertaken with extreme caution. A large excavator must never be permitted to travel in a confined area, or around people, without a banks man to guide the driver, who should have the excavator attachment close in to the machine, with the bucket just clear of the ground. On wheeled excavators, it is essential that the tyres are

- in good condition and correctly inflated. If stabilizing devices are fitted, they should be employed when the machine is excavating.
- (vii) When the front shovel of the 180° backhoe loaders is being employed, the backhoe attachment shall be in its “travel” position, with the safety locking device in place.
 - (viii) When operating the backhoe in poor ground conditions, the stabilisers tend to sink into the surface of the ground, reducing stability. Therefore, frequent checks shall be made for the stability of the machine. The loading shovel should always be lowered to the ground to stabilise the machine when the backhoe is employed.
 - (ix) The netting operation of the skip wagons should be carried out prior to lifting the skip to reduce the risks of working on the rear platform.
 - (x) If a tractor dozer is employed on clearing scrub or felling trees, it shall be provided with adequate driver protection.
 - (xi) When two or more scrapers are working on the same job, a minimum distance of at least 25m shall be kept between them.
 - (xii) In case of hydraulic breakers, hydraulic rams & hoses shall be in good working condition.
- 1.160 All wood working machines shall be fitted with suitable guards and devices such as top guard, riving knife, push stick, guards for drive belts and chains, and emergency stop switch easily accessible by the operator.
- 1.161 Requirements related to use of Bulldozers
- 1.161.1 General
- (i) Be careful when working near the edge of banks, ditches, cuts or fills, or near overhanging material. The vibration and weight of the machine may cause the edge to give way or overhanging material to fall.
 - (ii) Before starting work, ensure that an observer is present when plant is required to work in water where the depth may endanger the operator.
 - (iii) Avoid obstacles such as rocks or logs. If forced to cross them, use extreme caution and change to the lowest gear.
 - (iv) Ease up to the balance point and ease down to minimise the jolt on contact with the other side.
 - (v) When receiving a wire rope on a drum or through Sheaves, operators should disengage the master clutch, idle the engine, and lock the brakes.
- NOTE: All operators should stop engines before working with ropes wound on front-mounted drums.
- 1.161.2 Clearing Operations
- (i) When clearing trees, watch out for dead branches in treetops.
 - (ii) Dozer operators should make sure that all persons are standing clear before pushing over trees, dozing rocks or rolling logs.
 - (iii) A long rope should be used to pull over large dead trees. (Make sure in advance that a falling tree will clear the machine and operator).
 - (iv) In excavation work, operators should be alert to dangers from overhanging dirt and rocks. In such cases, dozers should be equipped with the relevant overhead protection.

1.162 Requirements related to use of Excavators

- (i) When excavating trenches, place the excavated material at a distance of one and a half times the depth of the trench from the edge of that trench. Where this is not practicable, place excavated materials at least one (1) metre from the edge of the trench.
- (ii) Ensure the ground beneath the machine is not undercut.
- (iii) Watch boom clearance when travelling. Uneven ground may cause the boom to weave and collide with obstructions.
- (iv) Avoid jerky slewing or sudden braking. These can make the machine unstable and overload machine components.
- (v) Ensure the operator has the appropriate restricted operator's licence if the excavator is to be used in the crane mode.
- (vi) When an excavator is used in the crane mode, check that the lifting weight is well within the approved lifting capacity for the machine. This lifting capacity shall be clearly and permanently marked on each machine.
- (vii) Only operate attachments while stationary, as operation during travelling may starve one of the Track drive motors and result in an unintended turn.
- (viii) Consider implementing a 'Permit to Work' system, particularly when working near power lines or underground power for example: - that the height of power lines is known; - that the underground location is known; and - visible measure, such as tiger tails, are put in place.

1.163 Requirements related to use of Trucks

1.163.1 General

- (i) Drive defensively
- (ii) Obey road signs
- (iii) Never race with other vehicles
- (iv) When following another vehicle, always allow enough distance to stop safely.
- (v) One truck length for every 10 km per hour of truck speed should be the minimum distance between vehicles.
- (vi) Reversing is the most hazardous truck operation. Reversing alarms, which are fitted on some trucks, are effective in warning persons of the danger. Reverse trucks only when they are under the direction of a signaller or when satisfied that the way is clear and will remain clear.
- (vii) Be cautious of spillage from loaded units and any hazards the spillage might present to people on the ground and to the tyres of other plant.
- (viii) Trucks sometimes fall over a tip head because the driver backs over the edge or the edge collapses under the weight of the truck.
- (ix) Use a protective beam or timber baulk or back under the control of a signaller in order to avoid this happening.
- (x) Principal Contractors should provide an earth mound to at least half the wheel diameter. This is a known control that is also used in the mining industry.
- (xi) Where ground conditions are soft, or the tip head is likely to subside, dump loads back from the edge and have a dozer move the material over the edge.

1.163.2 Loading

- (i) Never enter or leave the cab during loading.
- (ii) Watch for and avoid other vehicles, personnel and rock outcrops on entering or leaving the loading area.

- (iii) Stay a safe distance from trucks ahead at the loading point and follow the directions of the signalman or loader operator before moving into the loading position.
- (iv) Move off when signalled that loading is complete.
- (v) Load material, e.g. timber, so that it does not project beyond the truck body and present a hazard to other plant, people or structures.
- (vi) Where material is to be transported on a public road, maintain a distance of 1.2 metre or more beyond the front or rear of the vehicle, or 150 mm on either side, shall have a visible red flag or object fastened to the projecting end.
- (vii) Unusually wide or long loads require a permit from the Police Department.
- (viii) Secure loads at the lowest possible level on the tray with ropes or chains and take special care when the truck is to travel over rough terrain.
- (ix) Truck operators are responsible for giving load placement requirements to crane operators before loading operations begin.
- (x) The load should be placed so that it will remain stable during loading, unloading and travelling.

1.163.3 Unloading

- (i) Lower truck bodies before leaving the dump area.
- (ii) Only raise truck bodies to unload materials on surfaces where the vehicle will remain stable and upright.
- (iii) Never raise truck bodies to within a specified distance of overhead power line.
- (iv) Take special care when tipping a load or spreading screenings on a road.
- (v) With the tray up, trucks are less stable and are more likely to roll over, particularly on hilly sections or roads with surface irregularities or steep shoulders.
- (vi) Check that the raised tray will not foul overhead power lines or telephone wires.
- (vii) Never place part of your body under a raised truck body unless the truck body is securely propped.

1.163.4 Transporting personnel

- (i) Trucks shall not be used to transport personnel unless they are specifically designed to do so.
- (ii) Where a bus is employed for the transportation of personnel, the bus shall: -be enclosed; have seats which are attached to the vehicle; have a safe means of access and exit; and, have two means of exit in case of emergency.
- (iii) Drivers transporting personnel should be alert, dependable and careful.
- (iv) Relevant safety rules include: never allow passengers to ride with their arms outside the vehicle; only start the vehicle after everyone is seated; persons should only get on or off the vehicle when it is stationary; tools, plant or gear should be stored in a compartment separate from passengers, i.e. compartments that are designed for storage and transportation and are separate from where personnel are seated.
- (v) All items stored in this compartment should be secured against movement; and ensure that exhaust fumes do not enter the passengers' compartment.

1.163.5 Towing

- (i) When towing another vehicle, take the following precautions: ensure the towing cable is undamaged and has a safe working load adequate for the job.
- (ii) Slings, straps or chains which are used for towing should not be used for lifting any gear or materials and should be identified as such, e.g. slings and chains, etc. should be tagged "not for use in hoisting operations";
- (iii) Before reversing, ensure everyone is clear. Get help from a signalman if the rear view is obstructed;

- (iv) Attach the towing cable securely to the machines at the points recommended by the manufacturer.
- (v) If these are not known, ensure fixing points are selected that will not damage the tow cable or the machine;
- (vi) check what brakes are operational on the towed vehicle. There is unlikely to be any power assistance available for the brake system. Do not rely on parking brakes as a means of control;
- (vii) When moving off, take up the slack carefully. Do not jerk the cable, and keep it taut to avoid damage;
- (viii) keep towing speed down and as constant as possible;
- (ix) Keep clear of the area between the towing vehicle and the towed vehicle; & attach a warning sign on the rear of the towed vehicle or machine which reads "Vehicle Under Tow".

1.164 Penalty:- If any of the above clauses are not adhered, penalty shall be imposed as per relevant clause depending upon the gravity of the unsafe act and or condition.

MACHINE AND GENERAL AREA GUARDING

1.165 The Contractor shall ensure at the construction site all motors, cogwheels, chains and friction gearing, flywheels, shafting, dangerous and moving parts of machinery are securely fenced or legged. The fencing of dangerous part of machinery is not removed while such machinery is in motion or in use.

MANUAL LIFTING AND CARRYING OF EXCESSIVE WEIGHT

1.166 The Contractor shall ensure at his construction site of a building or other construction work that no building worker lifts by hand or carries overhead or over his back or shoulders any material, article, tool or appliances exceeding in weight as said below as per Rule 38 of BOCWR, unless aided by another building worker or device.

Person	Maximum weight in kg
Adult man	55
Adult woman	30

1.167 No building worker aided by other building worker shall lift or carry weight higher than or exceeding the sum of total of maximum limits set out for each building worker separately as mentioned in the table above.

SITE ELECTRICITY

1.168 Competency of Electrical personnel

1.168.1 The Contractor shall employ qualified and competent electrical personnel as specified in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/001.

1.169 Assessment of power

1.169.1 The Contractor shall assess the size and location of the electrical loads and the manner in which they vary with time during the currency of the Contract.

1.169.2 The Contractor shall elaborate as to how the total supply is to be obtained / generated. The details of the source of electricity, earthing requirement, substation / panel boards, distribution system shall be prepared and necessary approval from Employer obtained before proceeding of the execution of the job.

1.169.3 The main Contractor shall take consideration, the requirements of the sub / petty contractors' electric power supply and arrive at the capacity of main source of power supply from diesel generators.

- 1.169.4 As the sub / petty contractors' small capacity generators create more noise and safety hazard, no small capacity diesel generators shall be allowed for whatsoever the type of job to be executed under this contract.
- 1.169.5 If any unsafe noise making small capacity diesel generators are found used by sub / petty contractors the main contractor shall only be penalised.
- 1.170 **Work on site :-** The Contractor shall also submit electrical single line diagram, schematic diagram and the details of the equipment for all temporary electrical installation and these diagrams together with the temporary electrical equipment shall be submitted to the Employer's for necessary approval. Failure to do so shall invite penalty as per relevant clause.
- 1.171 **Strength and capability of electrical equipment:-** No electrical equipment shall be put into use where its strength and capability may be exceeded in such a way as may give rise to danger.
- 1.172 **Adverse or hazardous environments:-** Electrical equipment, which may reasonably foreseeably be exposed to:
- (a) Mechanical damage;
 - (b) the effects of the weather, natural hazards, temperature or pressure;
 - (c) the effects of wet, dirty, dusty or corrosive conditions; or
 - (d) any flammable or explosive substance, including dusts, vapours or gases,
- shall be of such construction or as necessary protected as to prevent, so far as is reasonably practicable, danger arising from such exposure.
- 1.173 Distribution system
- 1.173.1 The Contractor shall provide distribution system for control and distribution of electricity from a main AC supply of 50Hz for typical appliances:
- (a) Fixed plant - 400V 3 phase
 - (b) Movable plant fed via trailing cable over 3.75 kW - 400V, 3 phases
 - (c) Installation in site buildings - 230V single phase
 - (d) Fixed flood lighting - 230V single phase
 - (e) Portable and hand tools - 115V single phase
 - (f) Site lighting - 115V single phase
 - (g) Portable hand lamps - 115V single phase
- 1.174 Electrical protection circuits
- 1.174.1 Precautions shall be taken, either by earthing or by other suitable means, to prevent danger arising when any conductor (other than a circuit conductor) which may reasonably foreseeable become charged as a result of either the use of a system, or a fault in a system, becomes so charged. A conductor shall be regarded as earthed when conductors of sufficient strength and current-carrying capability to discharge electrical energy to earth connect it to the general mass of earth.
- If a circuit conductor is connected to earth or to any other reference point, nothing which might reasonably be expected to give rise to danger by breaking the electrical continuity or introducing high impedance shall be placed in that conductor unless suitable precautions are taken to prevent that danger.
- 1.174.2 Appropriate electrical protection shall be provided for all circuits, against over load, short circuit and earth fault current.
- 1.174.3 The Contractor shall provide sufficient ELCBs (maintain sensitivity 30 mA) / RCCBs for all the equipment's (including Potable equipment's), electrical switchboards, distribution panels etc. to prevent electrical shocks to the workers.
- 1.174.4 All protection devices shall be capable of interrupting the circuit without damage to any equipment's and circuits in case of any fault may occur.
- 1.174.5 Rating of fuses and circuit breakers used for the protection of circuits should be coordinate with equipment power ratings.
- 1.174.6 Protection against lightning shall be ensured to all equipment kept in open at sites.
- 1.175 Cables

- 1.175.1 Cables shall be selected after full consideration of the condition to which they shall be exposed and the duties for which they are required. Supply cable up to 3.3 kV shall be in accordance with BS 6346.
- 1.175.2 For supplies to mobile or transportable equipment where operating of the equipment subjects the cable to flexing, the cable shall conform to any of these codes BS 6007/BS 6500/BS 7375.
- 1.175.3 Flexible cords with a conductor cross sectional area smaller than 1.5 mm² shall not be used and insulated flexible cable shall conform to BS 6500 and BS 7375.
- 1.175.4 Where low voltage cables are to be used, reference shall be made to BS 7375. The following standards shall also be referred to particularly for underground cables BS 6346 and BS 6708
- 1.175.5 Cables buried directly in the ground shall be of a type incorporating armour or metal sheath or both. Such cables shall be marked by cable covers or a suitable marking tape and be buried at a sufficient depth to avoid their being damaged by any disturbance of the ground. Cable routes shall be marked on the plans kept in the site electrical register.
- 1.175.6 Cabling passing under the walk way and across way for transport and mobile equipment shall be laid in ducts at a minimum depth of 0.6 meters.
- 1.175.7 Cables that need to cross open areas, or where span of 3m or more are involved, a catenary wire on poles or other supports shall be provided for convenient means of suspension. Minimum height shall be 6m above ground.
- 1.175.8 Cables carrying a voltage to earth in excess of 65V other than supply for welding process shall have metal armour or sheath, which has been effectively earthed and monitored by the contractor. In case of flexible and trailing cables such earthed metal sheath and/or armour should be in addition to the earth core in the cable and shall not be used as the protective conductor.
- 1.175.9 Armoured cables having an over-sheath of polyvinyl chloride (PVC) or an oil resisting, and flame-retardant compound shall be used whenever there is a risk of mechanical damage occurring
- 1.176 Plugs, socket-outlets and couplers
- 1.176.1 The Contractor shall ensure plugs, socket-outlets, and couplers available in the construction site as "splash proof" type. The minimum degree of Ingress Protection should be of IP44 in accordance with BS EN 60529.
- 1.176.2 Only plugs and fittings of the weatherproof type shall be used, and they should be colour coded in accordance with the Internationally recognised standards for example as detailed as follows:
 - (i) 110 volts: Yellow
 - (ii) 240 volts: Blue
 - (iii) 415 volts: Red
- 1.177 Connections
- 1.177.1 Every joint and connection in a system shall be mechanically and electrically suitable for use to prevent danger. Proper cable connectors as per national/international standards shall only be used to connect cables.
- 1.177.2 No loose connections or tapped joints shall be allowed anywhere in the work site, office area, stores and other areas. Penalty as per relevant clause shall be put in case of observation of any tapped joints.
- 1.178 **Portable and hand-held equipment's:-** The Contractor shall ensure the use of double insulated or all-insulated portable electrical hand equipment may be used without earthing (i.e. two core cables), but they shall still be used only on 110V because of the risk of damage to Railing leads.
- 1.179 Other equipment's:
- 1.179.1 All equipment shall have the provision for major switch/cut-off switch in the equipment itself.
- 1.179.2 All non-current carrying metal parts of electrical equipment shall be earthed through insulated cable

- 1.179.3 Isolate exposed high-voltage (over 415 Volts) equipment, such as transformer banks, open switches, & similar equipment with exposed energized parts & prevent unauthorised access.
- 1.179.4 Approved perimeter markings shall be used to isolate restricted areas from designated work areas and entryways and shall be erected before work begins and maintained for entire duration of work. Approved perimeter marking shall be installed with either red barrier tape printed with the words "DANGER—HIGH VOLTAGE" or a barrier of yellow or orange synthetic rope, approximately 1 to 1.5 meter above the floor or work surface.
- 1.180 **Work on or near live conductors:-** No person shall be engaged in any work activity on or so near any live conductor (other than one suitably covered with insulating material so as to prevent danger) that danger may arise unless:
- it is unreasonable in all the circumstances for it to be dead; and
 - it is reasonable in all the circumstances for him to be at work on or near it while it is live; and
 - suitable precautions (including where necessary the provision of suitable protective equipment) are taken to prevent injury.
- 1.181 Inspection and Maintenance
- 1.181.1 All electrical equipment should be permanently numbered, and a record kept of the date of issue, date of last inspection and recommended inspection period.
- 1.181.2 Fixed installations shall be inspected at least at three monthly intervals; routine maintenance being carried out in accordance with equipment manufactures recommendations.

LIGHTING

- 1.182 The Contractor shall provide sufficient site lighting, of the right type and at the right place for it to be properly effective. Lighting ought not to introduce the risk of electric shock. Therefore, 230V supplies should be used for those fittings, which are robustly installed, and well out of reach e.g. flood lighting or high-pressure discharge lamps.
- 1.183 **Selection of Luminaries:-** The Contractor shall select the luminaries as per the area requirement indicated below:

SN	Type of Lighting	Area of Requirement	Luminaries
1	Area Lighting	Workmen and vehicles to move about in safely.	<ul style="list-style-type: none"> Shovel type: non-symmetrical Symmetrical or non-symmetrical tungsten halogen
2	Beam flood lighting	Concentrated light over an area from a relatively great distance.	<ul style="list-style-type: none"> Portable flood light (Conical beam) Wide angle flood (fan shaped beam) Medium or narrow angle flood (Conical beam)
3	Dispersive lighting	Lighting for indoor	<ul style="list-style-type: none"> Dispersive (Mercury florescent) Cargo cluster Florescent trough
4	Walkway lighting	Lighting for stairways, ladder ways, corridors, scaffold access routes, etc.	<ul style="list-style-type: none"> Well glass unit Bulkhead unit (tungsten filament) Bulk head unit (Florescent)
5	Local lighting	Lighting on sites and fittings are generally accessible to operatives	<ul style="list-style-type: none"> PAR (Parabolic Aluminised Reflector) lamp cluster Festoons (with or without shades) Adjustable florescent work lamp

			• Portable flood lamp (mounted on own cable drum)
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- 1.184 The Contractor shall ensure that luminaries should always be placed so that no person is required to work in their own shadow and so that the local light for one person is not a source of glare for the others. Strongly made clamps should be available for attaching luminaries to poles and other convenient supports.
- 1.185 Luminaries should be robust, resistant to corrosion and rain proof especially at the point of the cable entry.
- 1.186 The correct type of lamp for each luminary should always be used and when lamps need to be replaced it shall be in accordance with the supply voltage.
- 1.187 Lamp holders not fitted with a lamp should be capped off.
- 1.188 The Contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/011.

HAND TOOLS AND POWER TOOLS

1.189 General

- 1.189.1 The Contractor is wholly responsible for the safe condition of tools and equipment used by his employees and that of his sub-contractors.
- 1.189.2 Use of short / damaged hand tools shall be avoided and the Contractor shall ensure all his hand tools used at his worksite are safe to work with or stored and shall also train his employees (including his sub-contractors) for proper use thereby.
- 1.189.3 All hand tools and power tools shall be duly inspected before use for safe operation.
- 1.189.4 All hand tools and power tools shall have sufficient grip and the design specification on par with national/international standards on anthropometrics.
- 1.190 Hand tools
- 1.190.1 Hand tools shall include saws, chisels, axes and hatches, hammers, hand planes, screw drivers, crow bars, nail pullers.
- 1.190.2 The Contractor shall ensure that,
- (a) For crosscutting of hardwood, saws with larger teeth points (no. of points per inch) shall be preferred to avoid the saw jumping out of the job.
 - (b) Mushroom headed chisels shall not be used in the worksite where the fragments of the head may cause injury.
 - (c) Unless hatchet has a striking face, it shall be used as a hammer.
 - (d) Only knives of retractable blades shall be used in the worksite.
 - (e) No screwdrivers shall be used for scraping, chiselling or punching holes.
 - (f) A pilot hole shall always be driven before driving a screw.
 - (g) Wherever necessary, usage of proper PPEs shall be used by his employees.

1.191 Power tools

- 1.191.1 Power tools include drills, planes, routers, saws, jackhammers, grinders, sprayers, chipping hammers, air nozzles and drills.
- 1.191.2 The Contractor shall ensure that:
- (i) Electric tools are properly grounded or / and double insulated.
 - (ii) GFCIs/ RCCBs shall be used with all portable electric tool operated especially outdoors or in wet condition.
 - (iii) Before making any adjustments or changing attachments, his workers shall disconnect the tool from the power source.
 - (iv) When operating in confined spaces or for prolonged periods, hearing protection shall be required. The same shall also apply to working with equipment's, which gives out more noise as mentioned in Clause 43.0 of this document.

- (v) Tool is held firmly, and the material is properly secured before turning on the tool.
- (vi) All drills shall have suitable attachments respective of the operations and powerful for ease of operation.
- (vii) When any work / operation need to be performed repeatedly or continuously, tools specifically designed for that work shall be used. The same is applicable to detachable tool bit also.
- (viii) Size of the drill shall be determined by the maximum opening of the chuck in case of drill bit.
- (ix) Attachments such as speed reducing screwdrivers and buffers shall be provided to prevent fatigue and undue muscle strain to his workers.
- (x) Stock should be clamped or otherwise secured firmly to prevent it from moving.
- (xi) Workers shall never stand on the top of the ladder to drill holes in walls / ceilings, which can be hazardous, instead standing on the fourth or fifth rung shall be recommended.
- (xii) Electric plane shall not be operated with loose clothing or long scarf or open jacket.
- (xiii) Safety guards used on right angle head or vertical portable grinders must cover a minimum of 180° of the wheel and the spindle / wheel specifications shall be checked.
- (xiv) All power tools / hand tools shall have guards at their nip points.
- (xv) Low profile safety chain shall be used in case of wood working machines and the saw shall run at high rpm when cutting and also correct chain tension shall be ensured to avoid “kickback”.
- (xvi) Leather aprons and gloves shall be used as an additional personal protection auxiliary to withstand kickback.
- (xvii) Push sticks shall be provided and properly used to hold the job down on the table while the heels move the stock forward and thus preventing kickbacks.
- (xviii) Air pressure is set at a suitable level for air actuated tool or equipment being used. Before changing or adjusting pneumatic tools, air pressure shall be turned off.
- (xix) Only trained employees shall use explosive actuated tools and the tool shall also be unloaded when not in use.
- (xx) Usage of such explosive actuated tools shall be avoided in case of places where explosive/flammable vapours or gases may be present.
- (xxi) Explosive actuated tools and their explosives shall be stored separately and be taken out and loaded only before the time of immediate use.
- (xxii) Misfired cartridges of explosive actuated tools must be placed in a container of water and be removed safely from the project.
- (xxiii) No worker shall point any power operated / hand tool to any other person especially during loading / unloading.

WELDING, GOUGING AND CUTTING

- 1.192 Gas cylinders in use shall be kept upright on a custom-built stand or trolley fitted with a bracket to accommodate the hoses and equipment or otherwise secured. The metal cap shall be kept in place to protect the valve when the cylinder is not connected for use.
- 1.193 Hose clamp or clip shall be used to connect hoses firmly in both sides of cylinders and torches.
- 1.194 All gas cylinders shall be fixed with pressure regulator and dial gauges
- 1.195 Non-return valve and Flashback arrester shall be fixed at both end of cylinder and torch.
- 1.196 Domestic LPG cylinders shall not be used for Gas welding and Cutting purpose.

- 1.197 DCP or CO2 type Fire Extinguisher not less than 5 kg shall be fixed at or near to welding process zone in an easily accessible location. Fire Extinguisher should confirm to IS 2190: 1992.
- 1.198 Use firewatchers if there is a possibility of ignition unobserved by the operator (e.g. on the other side of bulkheads).
- 1.199 Oxygen cylinders and flammable gas cylinders shall be stored separately, at least 6.6 meters (20 feet) apart or separated by a fire proof, 1.5 meters (5 feet) high partition. Flammable substances shall not be stored within 15 meters of cylinder storage areas.
- 1.200 Transformer used for electrical arc welding shall be fixed with Ammeter and Voltmeter and also fixed with separate main power switch.
- 1.201 Welding grounds and returns should be securely attached to the work by cable lugs, by clamps in the case of stranded conductors, or by bolts for strip conductors. The ground cable will not be attached to equipment or existing installations or apparatus.
- 1.202 Use a low voltage open circuit relay device if welding with alternating current in constricted or damp places.
- 1.203 Take precautions against the risk of increased fume hazards when welding with chrome containing fluxed consumables or high current metal inert gas (MIG) or tungsten inert gas (TIG) processes.
- 1.204 Avoid being in contact with water or wet floors when welding. Use duckboards or rubber protection.
- 1.205 All electrical installations shall meet the IS: 5571: 1997 and NFPA 70 for gas cylinder storage area and other hazardous areas.
- 1.206 The current for Electric arc welding shall not exceed 300 A on a hand welding operation.

DANGEROUS AND HARMFUL ENVIRONMENT

- 1.207 A confined space is any space that:
 - (i) Is large enough and so configured that an worker can bodily enter (any portion of the body) and perform assigned work,
 - (ii) Has limited or restricted mean for entry and/or exit,
 - (iii) Is not designed for continuous occupancy
 - (iv) Contains or has the potential to contain a hazardous atmosphere,
 - (v) Contains a material that has the potential for engulfing an entrant,
 - (vi) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section, or
 - (vii) Contains other recognized serious safety or health hazard.
- 1.208 Contractors must ensure all confined spaces are identified and managed using documented site confined space management methods.
- 1.209 As per BOCWR Rule 40:
 - (i) No worker shall be allowed into any confined space or tank or trench or excavation wherein there is given off any dust, fumes / vapours or other impurities which is likely to be injurious or offensive, explosive or poisonous or noxious or gaseous material or other harmful articles unless steps are carried out by the Contractor and certified by the responsible person to be safe.
- 1.210 Dangerous Substances: -
- 30.4.1 A substance is considered dangerous if one or several of its properties render it dangerous. The Contractor identifies and manages dangerous substances planned for use on the Worksite in the manner described in the present Clause.
- 1.210.2 The transport to the Worksite and use of dangerous substances requires prior authorisation from the Engineer.
- 1.210.3 Details of risks and related prevention and protection measures are included in the health and safety plan.

- 1.210.4 The Contractor obtains all necessary authorisations and/or licenses for the storage and use of dangerous substances from local authorities. A copy of the authorisations is provided to the Engineer.
- 1.210.5 For each dangerous substance used, the Contractor will implement the recommendations described (i) in the Material Safety Data Sheets (MSDS), and (ii) by the Globally Harmonized System of Classification and Labelling of Chemicals established by the United Nations for hazardous chemicals.
- 1.210.6 Copies of MSDSs are kept on the Worksite and made available to personnel. The Contractor provides the Engineer with copies of all MSDSs.
- 1.210.7 **Storage of Dangerous substances :-** Storage area are designed and equipped by the Contractor based, not only on the chemical and physical properties of the products, but also on the types of containers stored, the number of people requiring access, and the quantities of the substance used.

Pursuant to SHE Clause 53.11, the Contractor anticipates and plans for the storage and management of hazardous waste.

Storage areas for dangerous substances are subject to strict rules, which are regularly checked by the SHE manager appointed. The rules include the following as a minimum:

- a) Access to the storage area is limited to trained and authorised individuals.
- b) An inventory is maintained up-to-date.
- c) MSDSs must be available for all stored dangerous substances, and the substances must be clearly labelled.
- d) A strict and methodical storage system is implemented (storage plan posted, large or heavy packaging may not be stored at heights, equipment and tools may not be stored in the dangerous substance storage room).
- e) Compliance with product expiry dates and implementation of a disposal procedure for substances which are not needed, or which have expired.
- f) Entrances, exits and access to emergency equipment are kept clear at all times.

Storage areas are clearly identified with warning signs at the entrance. The Contractor displays the storage plan (location of the different products, maximum inventory), a summary of labelling system and information on chemical incompatibilities.

Chemicals which could react together (leading to explosions, fire, projections or the emission of dangerous gases) are physically separated.

Products that react violently with water are stored so as to prevent contact with water, even in the event of flooding.

Inflammable products are stored separately in a dedicated area with adequate ventilation at all times.

Buildings used to store large quantities of dangerous substances are isolated from other buildings to avoid the spreading of fire. Such buildings are constructed using solid and non-combustible building materials and are equipped with evacuation systems and the appropriate firefighting equipment. Access to the buildings is clear, allowing for rapid evacuation in the event of an accident. The electrical systems are

reduced to the essential minimum, and access points are equipped with adequate lighting (300 lux).

All storage areas are equipped with secondary retentions. Each storage area acts as a general secondary retention. Suitable absorbents (neutralising and non-combustible) are available in the storage area to clean up any spills and leaks.

The Contractor maintains the storage area at a suitable temperature for dangerous substances to prevent overpressure and bursting of containers.

FIRE PREVENTION, PROTECTION AND FIGHTING SYSTEM

- 1.211 The Contractor shall ensure that construction site is provided with fire extinguishing equipment sufficient to extinguish any probable fire at construction site. An adequate water supply is provided at ample pressure as per national standard.
- 1.212 Recharging of fire extinguishers and their proper maintenance should be ensured and as a minimum should meet Indian National Standards
- 1.213 All drivers of vehicles, foreman, supervisors and managers shall be trained on operating the fire extinguishers and fire-fighting equipment.
- 1.214 As per the GBOCW Rules 2003, all lifting appliances' driver cabin should be provided with a suitable portable fire extinguisher.
- 1.215 Combustible scrap and other construction debris should be disposed-off site on a regular basis. If scrap is to be burnt on site, the burning site should be specified and located at a distance no less than 12 metres from any construction work or any other combustible material.
- 1.216 Every fire, including those extinguished by Contractor personnel, shall be reported to the Employer representatives.
- 1.217 Emergency plans and Fire Evacuation plans shall be prepared and issued. Mock drills should be held on a regular basis to ensure the effectiveness of the arrangements and as a part of the programme, the Telephone Number of the local fire brigade should be prominently displayed near each telephone on site.

CORROSIVE SUBSTANCES: - As per BOCWR Rule 44, corrosive substances including alkalis and acids shall be stored and used by a person dealing with such substances at a building / construction site in a manner that it does not endanger the building worker and suitable PPE shall be provided by the Contractor to the worker during such handling and work. In case of spillage of such substances on building worker, the Contractor shall take immediate remedial measures.

DEMOLITION

- 1.218 The Contractor shall ensure that:
 - (i) all demolition works be carried out in a controlled manner under the management of experienced and competent supervision.
 - (ii) the concerned department of the Government or local authority be informed, and permission obtained wherever required. Media shall also be informed regarding this concern.
 - (iii) all glass or similar materials or articles in exterior openings are removed before commencing any demolition work and all water, steam, electric, gas and other similar supply lines are put-off and such lines so located or capped with substantial coverings so as to protect it from damage and to afford safety to the building workers and public.
 - (iv) examine the walls of all structures adjacent to the structure to be demolished to determine thickness, method of support to such adjacent structures

- (v) no demolishing work be performed if the adjacent structure seems to be unsafe unless and until remedial measures like sheet piling, shoring, bracing or similar means be ensured for safety and stability for adjacent structure from collapsing.
 - (vi) debris / bricks and other materials or articles shall be removed by means of:
 - a. chutes
 - b. buckets or hoists
 - c. through openings through floors or
 - d. any other safe means
 - (vii) no person other than building workers or other persons essential to the operation of demolition work shall be permitted to enter a zone of demolition and the area be provided with substantial barricades.
- 1.219 Damages to people and property.**
- 3.2.1** Pursuant to Clauses 4.14 and 17.1 of the GCC, the Contractor is responsible for damages to people and property caused by the execution of the works or the procedures used for execution.
- 3.2.2** The Engineer is informed of any damage caused to people, or the property of individuals, other than the Contractor's personnel, within 6 hours of the event, regardless of the value of the prejudice.
- 3.2.3** Housing existing before the start of the works, located within a minimum radius of 800 m around the perimeter of the quarries and within a minimum radius of 500 m around the other Worksites that will be subject to blasting, will be examined by a bailiff unless agreed upon otherwise with the Engineer.
- 3.2.4** The bailiff's sworn statement is prepared and provided to the Engineer with the SEPP.
- 3.2.5** Should any problems be detected due to the intensity of blasting, the Engineer is entitled to request that the Contractor carry out seismic measurements of the intensity of the vibrations induced by the blasting, at variable distances from the blasting points, under the supervision of the Engineer, and at the cost of the Contractor.

EXCAVATION

- 1.220** Excavation: The Contractor shall ensure:
- (i) where any construction building worker engaged in excavation is exposed to hazard of falling or sliding material or article from any bank or side of such excavation which is more than one 1.5 m above his footing, such worker is protected by adequate piling and bracing against such bank or side.
 - (ii) where banks of an excavation are undercut, adequate shoring is provided to support the material or article overhanging such bank.
 - (iii) excavated material is not stored at least 0.65 m from the edge of an open excavation or trench and banks of such excavation or trench are stripped of loose rocks and the banks of such excavation or trench are stripped of loose rocks and other materials which may slide, roll or fall upon a construction building worker working below such bank.

- (iv) metal ladders and staircases or ramps are provided, as the case may be, for safe access to and egress from excavation where, the depth of such excavation exceeds 1.5 m and such ladders, staircases or ramps comply with the IS 3696 Part 1&2 and other relevant national standards.
- (v) trench and excavation are protected against falling of a person by suitable measures if the depth of such trench or excavation exceeds 1.5 m and such protection is an improved protection in accordance with the design and drawing of a professional engineer, where such depth exceeds 4m.

1.221 Piling

1.221.1 General Precautions

There are certain hazards which are common to all types of piling, and the following precautions are necessary:

- (i) prior to piling, all underground services should be located and made safe. A check should be made to ensure there are no cellars, underground water courses or ground conditions which might cause hazards; there should be a firm level base for the crane, or crane mats provided;
- (ii) when working on piling operations one must wear a safety helmet, and ear and eye protection where necessary;
- (iii) All cranes, lifting appliances and lifting gear must have appropriate certificates of testing and thorough examination, and should be large enough for the job;
- (iv) particular attention should be paid to the risk of damage to lifting gear from sharp edges;
- (v) Cranes used for raising or lowering workers must be fitted with a dead man's handle and lowering should be done under power; you must be carried in properly constructed cages which cannot spin or tip;
- (vi) piling contractors should be asked to provide a written method statement setting out the precautions relevant to the type of piling they are to employ;
- (vii) Induction training and information for you as supervisor or operative should be specifically related to the method statement.

1.221.2 **Bored Piles:** - Workers may need to enter a borehole for inspection or for clearing out in undercuts, and there are certain precautions which must be taken prior to entry:

- (i) the borehole should be at least 75 cm in diameter;
- (ii) the borehole should be treated as a confined space and the precautions which are advised elsewhere to ensure a satisfactory atmosphere must be closely followed;
- (iii) waste material from the borehole should be kept clear of the borehole;
- (iv) Descent into a borehole should be in properly designed skips, chains or cages fitted with an anti-spin device. The power source of the lifting appliance should be kept running throughout the time someone is underground;
- (v) while a worker is working down a borehole he/she must wear a safety harness;
- (vi) all workers concerned must be trained and competent in rescue from deep boreholes, and emergency rescue drills should be carried out at regular intervals;
- (vii) A banksman who can see workers in the borehole should be present at all times;
- (viii) There must be adequate lighting at safe reduced voltage and a means of communication from the borehole.
- (ix) Wherever possible, the need for workers to enter pile boreholes should be avoided by the use of television cameras and other techniques for remote inspection.

1.222 **Warning signs and notices:-** The Contractor shall ensure that:

- (i) suitable warning signs or notices, required for the safety of building workers carrying out the work of an excavation, shall be displayed or erected at

- conspicuous places in Hindi and in a language understood by majority of such building workers at such building such excavation work.
- (ii) such warning signs and notices with regard to compressed air working shall include
 - a. the danger involved in such compressed air work
 - b. fire and explosion hazard
 - c. the emergency procedures for rescue from such danger or hazards.

WORK PERMIT SYSTEM

- 1.223 The Contractor shall develop a Work Permit system, which is a formal written system used to control certain types of work that are potentially hazardous. A work permit is a document, which specifies the work to be done, and the precautions to be taken. Work Permits form an essential part of safe systems of work for many construction activities. They allow work to start only after safe procedures have been defined and they provide a clear record that all foreseeable hazards have been considered. Permits to Work are usually required in high-risk areas as identified by the Risk Assessments.
- 1.224 A permit is needed when construction work can only be carried out if normal safeguards are dropped or when new hazards are introduced by the work. Examples of high-risk activities include but are not limited to:
- (i) Entry into confined spaces
 - (ii) Work in close proximity to overhead power lines and telecommunication cables.
 - (iii) Hot work
 - (iv) To dig where underground services may be located
 - (v) Work with heavy moving machinery
 - (vi) Working on electrical equipment
 - (vii) Work with radioactive isotopes
 - (viii) Heavy lifting operations and lifting operations closer to live power line
- 1.225 The permit-to-work system should be fully documented, laying down:
- (i) How the system works;
 - (ii) The jobs it is to be used for;
 - (iii) The responsibilities and training of those involved; and
 - (iv) How to check its operation;
- 1.226 A Work Permit authorisation form shall be completed with the maximum duration period not exceeding 12 hours.
- 1.227 A copy of each Permit-to-Work shall be displayed, during its validity, in a conspicuous location in close proximity to the actual works location to which it applies.

TRAFFIC MANAGEMENT

- 1.228 The basic objective of the following guidelines is to lay down procedures to be adopted by Contractor to ensure the safe and efficient movement of traffic and also to ensure the safety of workmen at construction sites.
- 1.229 All construction workers should be provided with high visibility jackets with reflective tapes as most of viaduct and station works or either above or under right-of-way. The complicity of workmen at all times shall be increased so as to protect from speeding vehicular traffic.
- 1.230 The guiding principles to be adopted for safety in construction zone are to:
- (i) Warn the road user clearly and sufficiently in advance.
 - (ii) Provide safe and clearly marked lanes for guiding road users.
 - (iii) Provide safe and clearly marked buffer and work zones
 - (iv) Provide adequate measures that control driver behaviour through construction zones.
- 1.231 Legal permission

- 1.231.1 In all cases, the Contractor shall employ proper precautions. Wherever operations undertaken are likely to interfere with public traffic, specific traffic management plans shall be drawn up and implemented by the Contractor in consultation with the approval of local police authorities and/or the concerned metropolitan/civil authorities as the case may be.
- 1.231.2 Such traffic management plans shall include provision for traffic diversion and selection of alternative routes for transport of equipment. If necessary, the Contractor shall carry out road widening before commencement of works to accommodate the extra load.
- 1.232 The primary traffic control devices used in work zones shall include signs, delineators, barricades, cones, pylons, pavement markings and flashing lights.
- 1.233 The road construction and maintenance signs which fall into the same three major categories as do other traffic signs, that are Regulatory Signs, Warning Signs and Direction (or guidelines) Signs shall only be used. The IRC: 67 (Code of Practice for Road Signs) provide a list of traffic signs. The size, colours and placement of sign shall confirm to IRC: 67.
- 1.234 **Regulatory signs** :- Regulatory signs impose legal restriction on all traffic. It is essential, therefore, that they are used only after consulting the local police and traffic authorities.
- 1.235 Warning signs
- 1.235.1 Warning signs in the traffic control zone shall be utilised to warn the drivers of specific hazards that may be encountered.
- 1.235.2 The Contractor shall place detour signage at strategic locations and install appropriate warning signs. In order to minimize disruption of access to residences and business, the Contractor shall maintain at least one entrance to a property where multiple entrances exist.
- 1.235.3 A warning sign as given in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/012 shall be installed at all secondary road which merges with the primary road where the construction work is in progress at sufficient distance before it merges with the primary road so as to alert the road users regarding the 'Metro Work in Progress'.
- 1.235.4 Materials hanging over / protruded from the chassis / body of any vehicle especially during material handling shall be indicated by red indicator (red light/flag) to indicate the caution to the road users.
- 1.236 **Delineators** :- The delineators are the elements of a total system of traffic control and have two distinct purposes:
- (i) To delineate and guide the driver to and along a safe path
- (ii) As a taper to move traffic from one lane to another.
- 1.236.1 These channelizing devices such as cones, traffic cylinders, tapes and drums shall be placed in or adjacent to the roadway to control the flow of traffic. These should normally be retro-reflectors complying with IRC: 79 - Recommended Practice for Road Delineators.
- 1.236.2 **Traffic cones and cylinders** :- Traffic cones of 500mm, 750mm and 1000mm high and 300mm to 500mm in diameter or in square shape at base and are often made of plastic or rubber and normally have retro-reflectorized red and white band shall be used wherever required.
- 1.236.3 **Drums** :- Drums about 800mm to 1000mm high and 300mm in diameter can be used either as channelizing or warning devices. These are highly visible, give the appearance of being formidable objects and therefore command the respect of drivers.
- 1.236.4 Barricades
- (i) Full height fence, barriers, barricades etc. shall be erected around the site in order to prevent the working area from the risk of accidents due to speedy vehicular movement. Same the way barricades protect the road users from the danger due to construction equipment and other temporary structures.

- (ii) The structure dimension of the barricade, material and composition, its colour scheme, Maharashtra Metro Rail Corporation Limited logo & other details shall be in accordance with specifications laid down in tender document.
 - (iii) All barricades shall be erected as per the design requirements of the Employer, numbered, painted and maintained in good condition and also Barricade in-charge maintains a barricade register in site.
 - (iv) All barricades shall be conspicuously seen in the dark/night time by the road users so that no vehicle hits the barricade. Complicity shall be ensured by affixing retro reflective stripes of required size and shape at appropriate angle at the bottom and middle portion of the barricade at a minimum gap of 1000mm. In addition, minimum one red light or red-light blinker should be placed at the top of each barricade.
- 1.236.5 The Contractor shall ensure that all his construction vehicles plying on public roads (like dump trucks, trailers, etc.) have proper license to ply on public roads from the State Transport Authority. Drivers holding proper valid license as per the requirements of Motor Vehicles Act shall drive these vehicles.
- 1.236.6 The Contractor shall not undertake loading and unloading at carriageways obstructing the free flow of vehicular traffic and encroachment of existing roads by the contractor applying the excuse of work execution.
- 1.236.7 **Tow away vehicle :-** The Contractor shall make arrangements keeping tow away van / manpower to tow away any breakdown vehicle in the traffic flow without losing any time at his cost.
- 1.236.8 **Cleaning of roads :-** The Contractor shall ensure the cleanliness of roads and footpaths by deploying proper manpower for the same. The Contractor shall have to ensure proper brooming, cleaning washing of roads and footpaths on all the time throughout the entire stretch till the currency of the contract including disposal of sweepage.

WORK ADJACENT TO LIVE RAILWAYS

- 1.237 Whenever work is to be conducted in close proximity to the live Railways then the following measures shall need to be addressed:
- (i) The rules provided for in the Railway's manual should be followed.
 - (ii) No persons are allowed to encroach onto the Railway unless the owner has given specific authority.
 - (iii) Adequate protection in accordance with the Railway owner's requirements shall be followed. (Provision of Block Inspectors, Flagmen and Lookouts)
 - (iv) All persons shall wear high visibility clothing at all times.
 - (v) Any induction training requirements of the Railways shall be strictly observed

BATCHING PLANT AND CASTING YARD LAYOUT

- 1.238 The batching plant / casting yard shall be effectively planned for smooth flow of unloading and stacking the aggregates reinforcements and cement, batching plant, transport of concrete, casting the segment, stacking the segment and loading the segments to the trucks. As far as possible the conflicts should be avoided.
- 1.239 The batching plant / casting yard shall be barricaded and made as a compulsory PPE zone
- 1.240 If in case of material unloading area is not maintainable as PPE zone, the same shall be segregated properly and made as a non-PPE zone with appropriate barrications.
- 1.241 Electrical system shall also be suitably planned so that location of diesel generator, if any, location of DBs, routing of cables and positioning of area lighting poles/masts does not infringe on any other utility and pose danger.
- 1.242 Drainage shall be effectively provided, and waste water shall be disposed after proper treatment

- 1.243 Time office, canteen, drinking water, toilet and rest place shall be suitably located for the easy access to workers. All the facilities shall be properly cleaned and maintained during the entire period of operation.
- 1.244 Manual handling of cement shall be avoided to a larger extent. Whenever it is absolutely necessary the workmen shall be given full body protection, hand protection and respiratory protection as a basic measure of ensuring better health.
- 1.245 The PPEs provided to cement handling workmen shall conform to international standards.
- 1.246 Access roads and internal circulation roads shall be well laid and maintained properly at all time.
- 1.247 Non-adherence to any of the above provision shall be penalised as per relevant penalty clause.

PERSONAL PROTECTIVE EQUIPMENTS (PPEs)

- 1.248 The Contractor shall provide required PPEs to workmen to protect against safety and / or health hazards. Primarily PPEs are required for the following protection
- (i) Head Protection (Safety helmets)
 - (ii) Foot Protection (Safety footwear, Gumboot, etc)
 - (iii) Body Protection (High visibility clothing (waistcoat/jacket), Apron, etc)
 - (iv) Personal fall protection (Full body harness, Rope-grap fall arrester, etc)
 - (v) Eye Protection (Goggles, Welders glasses, etc)
 - (vi) Hand Protection (Gloves, Finger coats, etc)
 - (vii) Respiratory Protection. (Nose mask, SCBAs, etc.)
 - (viii) Hearing Protection (Ear plugs, Ear muffs, etc)
- 1.249 The PPEs and safety appliances provided by the Contractor shall be of the standard as prescribed by Bureau of Indian Standards (BIS). If materials conforming to BIS standards are not available, the Contractor as approved by the Employer shall procure PPE and safety appliances.
- 1.250 All construction workers should be provided with high visibility jackets with reflective tapes confirming to the requirement specified under BS EN 471: 1994 as most of viaduct and station works are executed either above or under right-of-way. The complicity of workmen at all times shall be increased so as to protect them from speeding vehicular traffic.
- 1.251 The Contractor shall provide safety helmet, safety shoe and high visibility clothing for all employees including workmen, traffic marshal and other employees who are engaged for any work under this contract as per the following requirement.

All employees of the Contractor including workmen	Traffic marshals
Hard hat with company Logo	Hard hat with reflective tape
Safety boots	Safety boots
Hi-visibility waistcoat covering upper body and meeting the following requirements as per BS EN 471:1994:	Hi-visibility jacket covering upper body and meeting the following requirements as per BS EN 471:1994:
(a) Background in fluorescent orange-red in colour	(a) Background in fluorescent orange-red in colour
(b) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm ²	(b) Jackets with full-length sleeves with two bands of retro reflective material, which shall be placed at the same height on the garment as those

All employees of the Contractor including workmen	Traffic marshals
(c) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm ² (d) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. (e) The bottom strip shall be at a distance of 5cm from the bottom of the vest. (f) Strips must be retro reflective and fluorescent (g) Waistcoat shall have a side adjustable fit and a side and front tear-away feature on vests made of nylon.	of the torso. The upper band shall encircle the upper part of the sleeves between the elbow and the shoulder; the bottom of the lower band shall not be less than 5cm from the bottom of the sleeve. (c) Two vertical green strips of 5cm wide on front side, covering the torso at least 500 cm ² (d) Two diagonal strips of 5 cm wide on back in an 'X' pattern covering at least 570cm ² (e) Horizontal strips not less than 5cm wide running around the bottom of the vertical strip in front and 'X' pattern at back. (f) The bottom strip shall be at a distance of 5cm from the bottom of the vest. (g) Strips must be retro reflective and fluorescent.

1.251.1 Colour coding for helmets

Safety Helmet Colour Code (Every Helmet should have the LOGO* affixed /painted)	Person to use
White	Maharashtra Metro Rail Corporation Limited staffs
Grey	All Designers, Architect, Consultants, etc.
Violet	Main Contractors (Engineers / Supervisors)
Blue	All Sub-contractors (Engineers / Supervisors)
Red	Electricians (Both Contractor and Sub-contractor)
Green	Safety Professionals(Both Contractor & Sub-contractor)
Orange	Security Guards / Traffic marshals
Yellow	All workmen
White (with "VISITOR" sticker)	Visitors

Note: LOGO*

- (i) Logo shall have its outer dimension 2"×2" and shall be conspicuous
- (ii) Logo shall be either painted or affixed
- (iii) No words shall come either on Top / Bottom of Logo

Logo of the corresponding main contracting company for their employees and sub-contracting company for their employees shall only be used.

- 1.252 In addition to the above any other PPE required for any specific jobs like, welding and cutting, working at height etc shall also be provided to all workmen and also ensure that all workmen use the PPEs properly while on the job.
- 1.253 The Contractor shall not pay any cash amount in lieu of PPE to the workers/sub-contractors and expect them to buy and use during work.
- 1.254 The Contractor shall at all time maintain a minimum of 10% spare PPEs and safety appliances and properly record and show to the Employer during the inspections. Failing to do so shall invite appropriate penalty as per the provisions of the contract.
- 1.255 It is always the duty of the Contractor to provide required PPEs for all visitors. Towards this required quantity of PPEs shall be kept always at the security post.

VISITORS TO SITE

- 1.256 No visitor is allowed to enter the site without the permission of the Employer. All authorised visitors should report at the site office. Contractor shall provide visitor's helmet (White helmet with visitor sticker) and other PPEs like Safety Shoe, reflective jacket, respiratory protection etc. as per requirement of the site.
- 1.257 All Visitors shall be accompanied at all times by a responsible member of the site personnel.
- 1.258 The Contractor shall be fully responsible for all visitors' safety and health within the site.
- 1.259 As indicated earlier in this Manual, the Engineer shall undertake regular audits at quarterly intervals, of the Contractor's onsite practices and procedures as a means of assessing the ongoing performance of the Contractor.
- 1.260 The criteria against which the audits will be undertaken shall be derived from the clauses within the Environment Protection Requirements, contract-specific Site Environmental Plan and previous site inspection results.
- 1.261 In addition to the quarterly audits by the Engineer, site inspection shall be undertaken by the Contractor's staff to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control measures are properly followed and implemented.
- 1.262 The frequency of site inspection shall be at least once a week.
- 1.263 The Contractor shall prepare an 'Environmental Inspection and Action Reporting System' and submit to the Engineer for approval and make amendments as suggested. It shall contain a contract specific comprehensive Environment Inspection checklist as requirement of Site Environmental Plan.
- 1.264 The area of inspection shall not be limited to environmental compliance within the site but areas outside the site which are likely to be affected, directly or indirectly by activities at site.
- 1.265 Results of inspection shall be discussed with Engineer and his recommendations on better environmental protection shall be notified to the Contractor for taking immediate action and rapid resolution of identified non-compliance.
- 1.266 If significant environmental problems are identified or if there is an environmental complaint or as a part of investigation work, then the Engineer shall also carry out ad hoc site inspection which shall be attended by Contractor's Representative.
- 1.267 Reporting System
 - 1.267.1 Reporting under the Environmental Management System will contain results of monitoring and inspection programs.
 - 1.267.2 In Site Environmental Plan, the Contractor shall prepare and submit monthly Environmental Quality Management Reports in accordance with requirements as per Contract.
 - 1.267.3 The monthly report shall include (but not limited to) the following:
 - a. Executive Summary
 - b. Brief mention of construction activities

- c. Monitoring results under AMCP
 - d. Interpretation of monitoring results, significance and influencing factors
 - e. Graphical representation of monitored results over past four reporting periods.
 - f. Measures to control spill under Spill Prevention and Control Plan (SPCP).
 - g. Action taken on recommendations under site inspection programme or specific directions.
 - h. Summary of complaints, results of investigations and follow-up action
 - i. Future key issues
- 1.268 Complaint Response Process
- 1.268.1 Inquiries, complaints and requests for information can be expected from a wide range of individuals and organizations both private and government. The majority of complaints are likely to be received by Maharashtra Metro Rail Corporation Limited, although the site offices are also likely to be contacted.
- 1.268.2 The objective of complaint process is to ensure that public and agency complaints are addressed and resolved consistently and expeditiously.
- 1.268.3 The Contractor's Site Manager will be notified immediately on receipt of complaint that may relate to environmental impacts. The Site Manager will immediately inform the Engineer and through him the Maharashtra Metro Rail Corporation Limited.
- 1.268.4 Field investigation should determine whether the complaint has merit, and if so action should be taken to address the impact.
- 1.268.5 The outcome of the investigation and the action taken shall be documented on a complaint Performa prepared by the Contractor and approved by the Engineer in advance of the works.
- 1.268.6 Where possible, a formal response to each complaint received shall be prepared by the Contractor within seven days in order to notify the concerned person(s) that action has been taken.
- 1.269 Completion of the EQM Programme
- 1.269.1 The construction of Project will be undertaken as a series of individual construction contracts with necessarily different construction program and completion dates.
- 1.269.2 The Engineer shall maintain an overview of the 'impact causing potential' of each site or contract and monitoring parameter with a view to maintaining the most cost-effective use of the environmental resources dedicated to the Project.
- 1.269.3 Termination of EQM should focus on the percentage contract completion status and on the basis of a history of environmental impact arising from the site over a representative period of monitoring.
- 1.269.4 Justifiable application for termination of EQM shall be put forward by the Contractor to the Engineer, as necessary throughout the construction period.

PART III : OCCUPATIONAL HEALTH AND WELFARE**PHYSICAL FITNESS OF WORKMEN**

- 1.270 The Contractor shall ensure that his employees / workmen subject themselves to such medical examination as required under the law or under the contract provision and keep a record of the same.
- 1.271 The Contractor shall not permit any employee / workmen to enter the work area under the influence of alcohol or any drugs.

MEDICAL FACILITIES**1.272 Medical Examination**

1.272.1 The Contractor shall arrange a medical examination of all his employees including his sub-contractor employees employed as drivers, operators of lifting appliances and transport equipment before employing, after illness or injury, if it appears that the illness or injury might have affected his fitness and, thereafter, once in every two years up to the age of 40 and once in a year, thereafter.

- (i) The Contractor shall maintain the confidential records of medical examination or the physician authorized by the Employer.
- (ii) No building or other construction worker is charged for the medical examination and the cost of such examination is borne by Contractor employing such building worker.
- (iii) The medical examination shall include:
 - a. Full medical and occupational history
 - b. Clinical examination with particular reference to:
 - (a) General Physique;
 - (b) Vision: Total visual performance using standard Orth orator like Titmus Vision Tester should be estimated and suitability for placement ascertained in accordance with the prescribed job standards.
 - (c) Hearing: Persons with normal must be able to hear a forced whisper at twenty-four feet. Persons using hearing aids must be able to hear a warning shout under noisy working conditions.

Contractors personnel exposed to noise levels above 80dB(A) in order to establish initial audiograms. Annual tests are carried out to monitor any changes and detect any deterioration.

- (d) Breathing: Peak flow rate using standard peak flow meter and the average peak flow rate determined out of these readings of the test performed. The results recorded at pre-placement medical examination could be used as a standard for the same individual at the same altitude for reference during subsequent examination.
 - (e) Upper Limbs: Adequate arm function and grip
 - (f) Spine: Adequately flexible for the job concerned.
 - (g) Lower Limbs: Adequate leg and foot concerned.
 - (h) General: Mental alertness and stability with good eye, hand and foot coordination.
- c. Any other tests which the examining doctor considers necessary and requested by engineer. All costs to be born by Contractor
- 1.272.2 If the Contractor fails to get the medical examination conducted as mentioned above, the Employer will have the right to get the same conducted by through an agency with intimation to the Contractor and deduct the cost and overhead charges.

- 1.273 **Occupational Health Centre** :- The Contractor shall ensure at a construction site an occupational health centre, mobile or static is provided and maintained in good order. Services and facilities as per the scale lay down in Schedule X of BOCWR. A construction medical officer appointed in an occupational health centre, possess the qualification as laid down in Schedule XI of BOCWR.
- 1.274 **Ambulance van and room** :- The Contractor shall ensure at a construction site of a building or other construction work that an ambulance van and room are provided at such construction site or an arrangement is made with a nearby hospital for providing such ambulance van for transportation of serious cases of accident or sickness of workers to hospital promptly and such ambulance van and room are maintained in good repair and is equipped with standard facilities specified in Schedule IV and Schedule V of BOCWR.
- 1.275 **First-aid boxes** :- The Contractor shall ensure at a construction site one First-aid box for 100 workers provided and maintained for providing First-aid to the building workers. Every First-aid box is distinctly marked "First-aid" and is equipped with the articles specified in Schedule III of BOCWR.

The Contractor equips the Project Area with a communication system exclusively for the purpose of communication with the first aid services. Information on how to communicate with the first aid services is clearly indicated near the communication equipment.

- 1.276 HIV/ AIDS prevention and control
- 1.276.1 The Contractor shall adopt the Employer's Policy on "HIV / AIDS Prevention and Control for Workmen Engaged by Contractors" and the copy of the policy is given in Appendix No. 4.
- 1.276.2 The Employer will engage a professional agency for implementing the guidelines laid down in the policy and communicate to the Contractor.
- 1.276.3 The Contractor shall extend necessary support to the appointed agency by deputing the workmen to attend the awareness creation programmes.
- 1.276.4 The Contractor shall also extend necessary organizational support to the appointed agency for the effective implementation of the Employers' workplace policy on HIV/AIDS for workmen of the Contractors.
- 1.276.5 As laid down in the policy the Contractor shall identify peer educators (1 for every 100 workers) and refer them for professional training to the Employers' appointed agency for the purpose.
- 1.276.6 The peer educators on completion of the training shall serve as the focal point for any information, education & awareness campaign among the workmen throughout the contract period.
- 1.276.7 The peer educators will be paid a monthly honorarium as fixed by the Employer for rendering his services in addition to his regular duty.
- 1.276.8 The total number of peer educators (1 for 100 workers) shall always be maintained by the Contractor.
- 1.276.9 In case if these peer educators leave the Contractor by creating vacancy, then the Contractor at his own expense train the new replacement peer educator from the Employers' appointed agency for the purpose.
- 1.276.10 It is suggested to the Contractor that due care should be taken to select the peer educators from among the group of workmen so that they remain with the Contractor throughout the contract period.
- 1.277 Prevention of mosquito breeding
- 1.277.1 Measures shall be taken to prevent mosquito breeding at site. The measures to be taken shall include:
- (i) Empty cans, oil drums, packing and other receptacles, which may retain water shall be deposited at a central collection point and shall be removed from the site regularly.

- (ii) There should not be accumulation of still water at any site, In case of still water, it should be covered by earth and levelled.
- (iii) Contractor's equipment and other items on the site, which may retain water, shall be stored, covered or treated in such a manner that water could not be retained.
- (iv) Water storage tanks shall be provided.
- 1.277.2 Posters in Hindi and English, which draw attention to the dangers of permitting mosquito breeding, shall be displayed prominently on the site.
- 1.277.3 The Contractor at periodic interval shall arrange to prevent mosquito breeding by fumigation / spraying of insecticides. Most effective insecticides shall include SOLFAC WP 10 or Baytex, The Ideal Larvicide etc.
- 1.278 Alcohol and drugs
- 1.278.1 The Contractor shall ensure at all times that no employee is working under the influence of alcohol / drugs which are punishable under Government regulations.
- 1.278.2 Smoking at public worksites by any employee is also prohibited as per Government regulations.

NOISE

- 1.279 The Contractor shall consider noise as an environmental constraint in his design, planning and execution of the Works and provide demonstrable evidence of the same on Employer's request. The Contractor shall, at his own expense, take all appropriate measures to ensure that work carried out by the Contractor and by his sub-Contractors, whether on or off the Site, will not cause any unnecessary or excessive noise which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise.
- 1.279.1 Without prejudice to the generality of the foregoing, noise level reduction measures shall include the following:
 - (i) The Contractor shall ensure that all powered mechanical equipment used in the Works shall be effectively sound-reduced using the most modern techniques available including but not limited to silencers and mufflers.
 - (ii) The Contractor shall construct acoustic screens or enclosures around any parts of the Works from which excessive noise may be generated.
- 1.279.2 The Contractor shall ensure that noise generated by work carried out by the Contractor and his sub-Contractors during daytime and night time shall not exceed the maximum permissible noise limits, whether continuously or intermittently, as given in the project SHE Manual. The same may be varied from time to time by and at the sole discretion of the Employer. In the event of a breach of this requirement, the Contractor shall immediately re-deploy or adjust the relevant equipment or take other appropriate measures to reduce the noise levels and thereafter maintain them at levels which do not exceed the said limits. Such measures may include without limitation the temporary or permanent cessation of use of certain items of equipment.
- 1.279.3 The noise monitoring requirements are given in the project SHE Manual and the monitoring locations shall be identified.
- 1.280 Noise Monitoring
- 1.280.1 The activities which are expected to cause noise during the construction of Project, include noise from construction equipment, construction activities such as portal construction, boring for piling, earthwork excavation, concreting, viaduct construction (including shifting of launching truss / girder) and removal of spoil and movement of construction vehicles and delivery vehicles, travelling to and from the construction and disposal sites.
- 1.280.2 The level of impact of these noise sources depends upon the noise characteristics of the equipment and activities involved the construction schedule, and the distance from noise sensitive receptors.

- 1.280.3 The Noise Monitoring Control Plan (**PMCP**) will provide guidance for construction activity. It shall also address noise performance criteria used in the selection of construction equipment.
- 1.280.4 The Noise Control Plan shall provide for:
- (i) Definition of noise-sensitive uses in the zones affected by construction;
 - (ii) Calculation of future noise levels at the closest noise-sensitive receptors to the construction activity based on construction activity and ambient noise levels;
 - (iii) Evaluation and specification of the noise abatement measures that can be applied to meet the noise objectives;
 - (iv) Monitoring construction activity and providing adjustments to noise abatement controls that may be required to increase their effectiveness;
 - (v) It shall specify the night-time and daytime construction activities.
- 1.280.5 In defining the requirements of the **PMCP**, available measures for noise control, such as, the use of equipment with special exhaust silencers or enclosures, and the construction of temporary enclosures or noise barriers around specific construction site activity areas shall be considered. It should also specify the measures to be adopted to counter the impact of noise pollution for public and workers working at site during construction.
- 1.280.6 If the measured noise levels exceed the noise limits, the noise levels shall be reduced by appropriate abatement measures.
- 1.280.7 The Engineer shall monitor Contractor's performance of tasks specified and will inspect the procedures related to the control of noise.
- 1.280.8 In no case shall the Contractor expose the public to construction noise levels exceeding 90dBA (slow) or to impulsive noise levels with a peak sound pressure level exceeding 140dB as measured on an impulse sound level meter.
- 1.280.9 Limit for construction noise is based on the existing ambient noise levels in areas adjoining the construction sites.
- 1.280.10 The noise levels emanating from any source during construction, shall not exceed 5 dBA or more above existing ambient pre-construction noise levels. The same may be varied from time to time by and at the sole discretion of the Engineer.
- 1.280.11 Where there are no ambient noise measurements, the construction activities shall be limited to levels at a distance of 200 feet from the construction limits or at the nearest affected building, whichever is closer, as given in Table-2.

Table 2: Allowable Construction Noise

Land Use	Maximum Noise Level L_{max} dBA	
	Day Time	Night Time
Residential	75	65
Commercial (all times)	85	
Industrial (all times)	90	

- 1.280.12 At the surface of the construction site during night time hours, the Contractor shall use only equipment that operating under full load meets the noise limits specified in Table3, if a sensitive receptor would be affected.

Table 3: Noise Emission Limits for Construction Equipment used during night hours (Measured at 50 feet from Construction Equipment)

SN	Equipment Category	L_{max} Level dBA
1.	Backhoe	80
2.	Bar Bender	75

3.	Chain Saw	81
4.	Compactor	80
5.	Compressor	80
6.	Concrete Mixer	85
7.	Concrete Pump	82
8.	Crane	85
9.	Dozer	85
10.	Front end loader	80
11.	Generator	82
12.	Gradall	85
13.	Grader	85
14.	Paver	85
15.	Pneumatic tools	85
16.	Scraper	85
17.	Tractor	84

Noise emission limits apply to equipment used at surface of the construction site during night time hours of 9 pm to 6 am.

- 1.280.13 The adjustments for close-in equipment noise shall be made in accordance with Table 4.

Table 4: Adjustments for Close-in Equipment Noise

Distance (Feet)	Level to Estimate Sound Level at 50 Feet dB (A)
19-21	8
22-23	7
24-26	6
27-29	5
30-33	4
34-37	3
38-42	2
43-47	1
48-50	0

Table 5: Construction Vibration Limits (Vibration Type and Permissible)

Aggregate Duration	Limit
Sustained (1 hour / day)	0.01 in/sec (80 VdB re 10 ⁻⁶ in/sec)
Transient (< 1 hour / day)	0.03 in/sec (90 VdB re 10 ⁻⁶ in/sec)

Aggregate Duration	Limit
Transient (< 10 minutes / day)	0.10 in/sec (100 VdB re 10 ⁻⁶ in/sec)

- 1.280.14 When Diesel Generator (DG) Sets are used for operation of equipment and machinery, then 'Standards and Guidelines for control of Noise Pollution from Stationary DG Sets', under Environment (Protection) Act, 1986 shall apply.
- 1.280.15 Where the Engineer determines that the recorded Noise level is significantly greater than the acceptable levels, the Engineer may direct the Contractor to take effective remedial measures including, but not limited to, reviewing noise sources and modifying working procedures.
- 1.280.16 The Contractor shall inform the Engineer of all steps taken to investigate cause of exceedance & immediate action taken to avoid further exceedance through written reports and proposals for action under an Event Contingency Plan.
- 1.281 Control Requirements
- 1.281.1 Construction material should be operated and transported in such a manner as not to create unnecessary noise as outlined below:
- Perform Work within the procedures outlined herein and comply with applicable codes, regulations, & standards established by the Central & State Govt.& their agencies.
 - Keep noise to the lowest reasonably practicable level. Appropriate measures will be taken to ensure that construction works will not cause any unnecessary or excessive noise, which may disturb the occupants of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. Use equipment with effective noise-suppression devices and employ other noise control measures as to protect the public.
 - Schedule and conduct operations in a manner that will minimize, to the greatest extent feasible, the disturbance to the public in areas adjacent to the construction activities and to occupants of buildings in the vicinity of the construction activities.
 - The Contractor shall submit to the Employer a Noise Monitoring and Control Plan (**PMCP**) under contract specific Site Environmental Plan. It shall include full and comprehensive details of all powered mechanical equipment, which he proposes to use during daytime and night time, and of his proposed working methods and noise level reduction measures. The **PMCP** shall include detailed noise calculations and vibration levels to demonstrate the anticipated noise generation and vibrations by the Contractor.
 - The **PMCP** prepared by the Contractor shall guide the implementation of construction activity. The **PMCP** will be reviewed on a regular basis and updated as necessary to assure that current construction activities are addressed. It may appear as a regular agenda item in project coordination meetings, if noise is an issue at any location in the contract.
- 1.282 Occupational Noise
- Protection against the effects of occupational noise exposure should be provided when the sound level exceeds the threshold values as provided in Project SHE Manual.
 - When employees are subjected to sound levels exceeding those listed in the Table above, feasible administrative or engineering controls should be utilized as given in this document and Maharashtra Metro Rail Corporation Limited's Project SHE Manual.
 - If such controls fail to reduce sound levels within the levels of the table, personal protective equipment shall be provided and used to reduce sound levels within the levels of the table.

- (iv) When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. Exposure to different levels for various periods of time shall be computed according to the formula and sample computations, as given in project SHE Manual.

1.283 Vibration Level

- 1.283.1 In locations where the alignment is close to historical / heritage structures, the Contractor shall prepare a monitoring scheme prior to construction at such locations. This scheme for monitoring vibration level at such historical / heritage sites shall be submitted to Employer for his approval. This scheme shall include:
- (i) Monitoring requirements for vibrations at regular intervals throughout the construction period;
 - (ii) Pre-construction structural integrity inspections of historic and sensitive structures in project activity;
 - (iii) Information dissemination about the construction method, probable effects, quality control measures and precautions to be used;
 - (iv) The vibration level limits at work sites adjacent to the alignment shall conform to the permitted values.

VENTILATION AND ILLUMINATION

1.284 Ventilation

- 1.284.1 The Contractor shall ensure at a construction site of a building or other construction work that all working areas in a free tunnel are provided with ventilation system as approved by the DG/CIIBC and the fresh air supply in such tunnel is not less than 6m³/min for each building worker employed underground in such tunnel and the free air flow movement inside such tunnel is not less than 9m/min.
- 1.284.2 The oxygen level shall not be less than 19.5% in the working environment.

1.285 Illumination

- 1.285.1 The Contractor shall take every effort to illuminate the work site as per the Employer's requirement illustrated in General Instruction MAHA-METRO/SHE/GI/011.
- 1.285.2 The Contractor shall conduct a monthly illumination monitoring by lux meter for all the locations and the report shall be sent to the Employer within 7th of the next month and the same shall be reviewed during the monthly SHE committee meeting.

RADIATION

- 1.286 The use of radioactive substances and radiating apparatus shall comply with the Government regulatory requirements and all subsidiary legislation
- 1.287 Operations involving ionising radiation shall only be carried out after having been reviewed without objection by the Employers representative and shall be carried out in accordance with a method statement.
- 1.288 Each area containing irradiated apparatus shall have warning notices and barriers, as required by the Regulations, conspicuously posted at or near the area.
- 1.289 Radioactive substances will be stored, used or disposed shall be strictly in accordance with the Government Enactments.
- 1.290 The Contractor shall ensure that all site personnel and members of the public are not exposed to radiation.
- 1.291 **Asbestos** :- Asbestos fibres are naturally occurring and extremely aerodynamic. Because of this, almost everyone is exposed to asbestos. Asbestos fibres can become a health risk if inhaled at high concentrations over extended periods of time. Asbestos is only dangerous if it becomes airborne. As long as asbestos-containing

materials are not damaged, the asbestos fibres do not become airborne, and do not pose a health hazard to building occupants.

As a preventive action, no asbestos containing material will be used during any of the site activity mitigate the hazard

- 1.292 **Lead-Based Paint** :- Lead-based paint is a source of lead poisoning. Ingestion and inhalation of lead dust that is created as lead-based paint chips and peels, or from improper sanding or scraping of lead-based painted surfaces can lead to exposure. Paints and other chemicals used for painting should be stored in a proper contained area.
Empty Paint containers, waste paint brushes, clothes stained with paint should be properly disposed.

WELFARE MEASURES FOR WORKERS

1.293 Latrine and Urinal Accommodation

- 1.293.1 The Contractor shall provide one latrine seat for every 20 workers up to 100 workers and thereafter one for every additional 50 workers. In addition, one urinal accommodation shall be provided for every 100 workers.
- 1.293.2 When women are employed, separate latrine and urinals accommodation shall be provided on the same scale as mentioned above.
- 1.293.3 Latrine and urinals shall be provided as per Section 33 of BOCWA and maintained as per Rule 243 of BOCWR and shall also comply with the requirements of public health author
- 1.293.4 **Moving sites** :- In case of works like Track laying, the zone of work is constantly moving at elevated level. In such cases mobile toilets with proper facility to drain the sullage shall be provided at reasonably accessible distance.
- 1.293.5 In case if the Contractor fail to provide required number of urinals and latrines or fail to maintain it as per the requirements of Public Health laws, the Employer shall have the right to provide/maintain through renowned external agencies at the cost of the Contractor.
- 1.294 **Canteen** :- In every workplace wherein not less than 250 workers are ordinarily employed, the Contractor shall provide an adequate canteen conforming to Section 37 of BOCWA, Rule 244 of BOCWR and as stipulated in Rule 247 of BOCWR the charges for food stuff shall be based on 'no profit no loss' basis. The price list of all items shall be conspicuously displayed in such canteen.

The contractor defines and implements actions in order to guarantee (i)the quality and quantity of food stuff(ii)compliance with health rules when preparing meals (iii)fitting out and servicing premises and equipment, both in the kitchen and food storage areas.

Contractor inspects the cleanliness of food transport vehicles, temperature control and the cold chain, as well as best before dates and takes the necessary corrective actions. The temperature of chillers is regularly checked.

The contractor checks that health requirements are met for food storage conditions in the kitchen or other locations, food prepared products are left prior to consumption, to ensure no health risks. Prepared food is eaten or thrown away, no food remains are reused.

The contractor recruits trained canteen personnel and ensures that supervisors monitor compliance with sanitary instructions. The Contractor ensures that canteen personnel have means of ensures that supervisors monitor compliance with sanitary instructions. The Contractor ensures that canteen personnel have means of ensuring compliance with health rules (changing rooms,linen,hand washers,condition of

flooring and paint and existence of a cleaning plan.). This area needs to be checked every three months.

- 1.295 **Serving of tea and snacks at the workplace :-** As per Rule 246 of BOCWR, at a building or other construction work where a workplace is situated at a distance of more than 200 m from the canteen provided under Rule 244(1) of BOCWR, the Contractor employing building works shall make suitable arrangement for serving tea and light refreshment to such building works at such place.

Proper Housekeeping should be maintained at such locations where tea & snacks are served.

- 1.296 Drinking water

- 1.296.1 As per Section 32 of BOCWA the Contractor shall make in every worksite, effective arrangements to provide sufficient supply of wholesome drinking water with minimum quantity of 5 litres per workman per day. Quality of the drinking water shall conform to the requirements of national standards on Public Health IS 10500

- 1.296.2 While locating these drinking water facilities due care shall be taken so that these are easily accessible within a distance of 200m from the place of work for all workers at all location of work sites.

- 1.296.3 All such points shall be legible marked "Drinking Water" in a language understood by a majority of the workmen employed in such place. Unless the supply of drinking water is provided by a certified supplier, the quality of the drinking water provided to workers is tested at least at the start of the works and then on a monthly basis. The protocol for taking and analysing samples is based on the recommendation of the World Health Organization. The results shall be documented and made available on the Project Area.

- 1.297 **Labour Accommodation :-** The Contractor shall provide free of charges as near as possible, temporary living accommodation to all workers conforming to provisions of Section 34 of BOCWA. These accommodations shall have cooking place, bathing, washing and lavatory facilities.

The Contractor provides one drinking water tap per 10 personnel, one toilet for 15 contractors Personnel as a minimum and one toilet per 15 persons.

Hygiene-Sanitary areas (sinks, toilets, bathing areas, wash basins) are cleaned & disinfected by the contractors cleaning service at least once every 24 hours.

The canteen, kitchen and kitchen utensils are cleaned after each meal service.

- 1.298 **Creches :-** In every workplace where in more than 50 female workers are ordinarily employed, there shall be provided and maintained a suitable room for use of children under age of 6 yrs, conforming to the provisions of Section 35 of BOCWA.

- 1.299 **Heat Stress :-** Contractors/Subcontractors shall establish the necessary programs to ensure that project employees work safely in heat stress conditions. The reduction of adverse health effects can be accomplished by engineering controls, work practices, training, acclimatization, monitoring, water & electrolyte balance and the recognition and treatment of heat stress emergencies.

PART- IV ENVIRONMENTAL MANAGEMENT

Protection of adjacent areas

- 47.1.1 The Contractor uses construction methods and means of protection in order to avoid or minimize adverse effects that are incurred on vegetation, soils, groundwater and surface water ,biodiversity, natural drainage and the water quality in areas within any Project Area and its surroundings for the entire duration of the works.
- 47.1.2 Wetland areas include marshes, fens, mires or natural or artificial bodies of water ,whether permanent or temporary, where water is stagnant or flowing, fresh, saline or briny, including seawater with a low -tide depth of six meters or less .Filling of all or part of a wetland area is not permitted, unless the works are necessary according to the provisions of the Contract or the instructions of the Engineer.
- 47.1.3 With the exception of access situated around the site with a distance specified srxistence and conditions of residential building roads, or unless instructed otherwise by the Engineer ,the entire perimeter of land sites with a a surface area of less than 2 hectares is physically demarcated by a perimeter Track, road, signs or any other means leaving no possible ambiguity as to the location of the Project Area perimeter.
- 47.1.4 Unless instructed otherwise by the Engineer, the Contractor defines the perimeter of the Project Area at a distance of at least:
- a) 50 m from any permanent water course and outside of floodable areas.
 - b) 300 m from sensitive urban services and buildings (health centre, school, water-supply for populations)
 - c) 200 m from any housing and
 - d) 300 m from housing in the specific case of work requiring the use of explosives.
- 47.1.5 If the footprint of the works are located in the situations a) to d) above and unless agreed otherwise by the Engineer, the Contractor will contract a bailiff to make a sworn statement regarding the existence and conditions of residential buildings situated around the site with a distance specified in the above paragraph from b)to d).
- 47.1.6 The bailiff's sworn statement is prepared and provided to the Engineer with the Environment Protection Plan.
- 47.2 Selection of Borrow Areas, Backfill material stockpiles sites and access road.
- 47.2.1 The Contractor will submit to the Engineer for prior approval (i) the location of proposed borrow areas or areas to be excavated, or (ii)proposed backfill material stockpile locations or zones designated for the rubble from demolition works.
- 47.2.2 This requirement also applies to the side casting during the construction of linear infrastructure (roads, pipelines, transport routes) and which are included in the category of stockpiling of waste material.
- 47.2.3 The opening or rehabilitation of all access routes between Project Areas Will be shown on a map and approved by the Engineer prior to the start of the corresponding works.
- 47.3 Environmental Monitoring

- 47.3.1 The Contractor's Environmental Team shall carry out the monitoring of environmental impacts during construction. Representative sensitive receivers in the vicinity of the works shall be monitored for air quality impacts.
- 47.3.2 For carrying out impact monitoring for air, equipment shall be provided, operated and maintained by the Contractor. The equipment shall be kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring program.
- 47.3.3 The calibration of monitoring instruments and their respective calibrators shall be carried out in accordance with the manufacturer's requirements to ensure they perform to the same level of accuracy as stated in the manufacturer's specifications.
- 47.3.4 Suspended Particulate Matter (SPM) levels shall be measured by following the standard high volume sampling method as set out in High Volume Method for Suspended Particulate, BIS: 5182-1981
- 47.3.5 24-hour average SPM concentration shall be measured by drawing air through a High Volume Sampler (HVS) fitted with pre-weighted Glass Fibre filter paper at an average flow rate not less than 1.1m³ per minute.
- 47.3.6 The minimum requirements to the specifications of sound level meter should be as given in IS: 9779-1981. (However, monitoring is deleted).
- 47.3.8 Engineer will undertake baseline monitoring to establish background levels. Action Level of the Contractor shall be based on the results of baseline monitoring program, which will be made available to him prior to start of construction.
- 47.3.9 The Contractor's monitoring program is summarized in Table 1.

Table 1: Summary of Contractor's Monitoring Programme

Parameter	Air
Sampling	RSPM, SPM 24-hours of the day CO: 12 hours from 0800 to 2000 hrs
Frequency at each location	Two 24-hour samples every 15 days at uniform intervals
Locations	To be determined by the Contractor based on air sensitive receptors
Number of locations	Two locations
Duration of Monitoring by Contractor	During civil construction
Additional Requirements	Ad hoc monitoring as required

Monitoring Reports should be submitted every month along with the Monthly SHE Report

- 47.4 **Event Contingency Plan :-** The Contractor shall prepare an Event Contingency Plan under his Site Environmental Plan. The purpose is to provide, in addition to monitoring activities, procedures for ensuring that if any environmental exceedance of limiting values (either accidental or through inadequate implementation of mitigation measures on part of the Contractor) does occur, the cause is quickly identified and remedied, and that the risk of a similar event recurring is reduced.

47.5 Air Quality

- 47.5.1 The Contractor shall take all necessary precautions to minimise fugitive dust emissions from operations involving excavation, grading, and clearing of land and disposal of waste. He shall not allow emissions of fugitive dust from any transport, handling, construction or storage activity to remain visible in atmosphere beyond the property line of emission source for any prolonged period of time without notification to the Employer.
- 47.5.2 The Contractor shall use construction equipment designed and equipped to minimise or control air pollution. He shall maintain evidence of such design and equipment and make these available for inspection by Employer.
- 47.5.3 If after commencement of construction activity, Employer believes that the Contractor's equipment or methods of working are causing unacceptable air pollution impacts then these shall be inspected, and remedial proposals shall be drawn up by the Contractor, submitted for review to the Employer and implemented.
- 47.5.4 In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to air pollution. Remedial measures include use of additional / alternative equipment by the Contractor or maintenance / modification of existing equipment of the Contractor.

In the event that approved remedial measures are not being implemented and serious impacts persist, the Employer may direct the Contractor to suspend work until the measures are implemented, as required under the Contract.

- 47.5.5 Contractor's transport vehicles and other equipment shall conform to emission standards fixed by Statutory Agencies of Government of India or the State Government from time to time. The Contractor shall carry out periodical checks and undertake remedial measures including replacement, if required, so as to operate within permissible norms.
- 47.5.6 The Contractor shall establish and maintain records of routine maintenance program for internal combustion engine powered vehicles and equipment used on this project. He shall keep records available for inspection by Employer.
- 47.5.7 The Contractor shall cover loads of dust generating materials like debris and soil being transported from construction sites. All trucks carrying loose material should be covered and loaded with sufficient free-board to avoid spills through the tailboard or sideboards.
- 47.5.8 The Contractor shall promptly transport all excavation disposal materials of whatever kind so as not to delay work on the project. Stockpiling of materials will only be allowed at sites designated by the Employer. The Contractor shall place excavation materials in the dumping/disposal areas designated in the plans as given in the specifications.
- 47.5.9 The temporary dumping areas shall be maintained by the Contractor at all times until the excavate is re-utilised for backfilling or as directed by Employer. Dust control activities shall continue even during any work stoppage.
- 47.5.10 The Contractor shall place material in a manner that will minimize dust production. Material shall be minimized each day and wetted, to minimize dust production. During dry weather, dust control methods must be used daily especially on windy, dry days to prevent any dust from blowing across the site perimeter.
- 47.5.11 The Contractor shall water down construction sites as required to suppress dust, during handling of excavation soil or debris or during demolition. The Contractor will make water sprinklers, water supply and water delivering equipment available

at any time that it is required for dust control use. Dust screens will be used, as feasible when additional dust control measures are needed especially where the work is near sensitive receptors.

- 47.5.12 The Contractor shall provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from work sites such as construction Depot and batching plants. At such facility, high-pressure water jets will be directed at the wheels of vehicles to remove all spoil and dirt.
- 47.5.13 The Contractor shall design and implement his blasting techniques so as to minimise dust, noise, vibration generation and prevention fly rock.
- 47.5.14 Blasting technique should be consistent not only with nature and quantity of rock to be blasted but also the location of blasting.
- 47.5.15 Contractor shall give preference to explosives with better environmental characteristics.
- 47.5.16 The Contractor shall protect structures, utilities, pavements roads and other facilities from disfiguration and damage as a result of his activities. Where this is not possible, the Contractor shall restore the structures, utilities, pavements, roads and other facilities to their original or better, failing which the rectification/restoration work shall be carried out at the risk and cost of the Contractor.
- 47.5.16 The Contractor shall submit to the Employer an Air Monitoring and Control Plan (AMCP) under contract specific Site Environmental Plan to guide construction activity insofar as it relates to monitoring, controlling and mitigating air pollution.

47.6 Air Monitoring

- 47.6.1 Construction activities that will generate dust impacts include excavation (including related activities), material handling and stockpiling, vehicular movement, and wind erosion of unpaved work areas.
- 47.6.2 The impact of fugitive dust on ambient air pollution depends on the quantity generated, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and smaller particles are likely to undergo dispersal over greater distance from the sources and impeded settling. SPM levels will be monitored to evaluate the dust impact during the construction phase of the Project.
- 47.6.3 The Air Quality Monitoring and Control Plan (AMCP) in contract-specific Site Environmental Plan prepared by the Contractor shall establish procedures to monitor impact air quality and measures to control air pollution including dust suppression due to construction activities at work sites. This plan shall contain description of activities that will cause degradation in air quality, environmental procedures to manage pollutants to minimise the air pollution, monitoring program, record keeping and reporting.
- 47.6.4 The Engineer shall monitor Contractor's performance of tasks specified, and will inspect necessary records, reports & procedures related to the control of air quality given in AMCP.
- 47.6.5 Information gathered during the AMCP will be catalogued and maintained by the Contractor and shall be available for review by the Engineer.
- 47.6.6 The exact location of the air monitoring stations located near air sensitive receptors adjoining the construction sites, such as residences, schools, hotels and hospitals and placement of monitoring equipment thereat shall be agreed with the Engineer prior to commencement of air monitoring program.
- 47.6.7 Impact monitoring during the course of the Works shall be carried out at the monitoring stations for two days (continuous twenty-four hours) every fifteen days and where there is a perceived air quality problem.

- 47.6.8 The Contractor shall construct suitable fence, lockable gate, 220V AC power point and suitable access at each air monitoring station. Monitoring stations shall be free from local obstructions or sheltering.
- 47.6.9 Should impact monitoring record dust levels which are:
- indicative of a deteriorating situation such that closer monitoring is reasonably indicated, or
 - when in the opinion of the Engineer additional measurements are required in view of deteriorating air quality,
- Then the Engineer may require the Contractor to increase the frequency of impact monitoring at any one or more of the monitoring stations until the results indicate an improving and acceptable level of air quality.
- 47.6.10 The Contractor shall keep records of air quality monitoring (including location, date, time). The Contractor shall submit a copy of monitoring results to the Engineer. The results should represent a statistical evaluation of data by calculating maximum, minimum, mean, standard deviation, geometric mean and percentile calculations for evaluation of frequency distribution, trends, and comparison with emission standards.
- 47.6.11 The National Ambient Air Quality Standards given in Air (Prevention and Control of Pollution) Act, 1981 may be referred by the Contractor for Limit Levels of SPM in ambient air which may be followed in estimating the pollution level caused by Contractor's activities.
- 47.6.12 Where the Engineer determines that the recorded dust level is significantly greater than the Limit levels, the Engineer may direct the Contractor to take effective remedial measures including, but not limited to, reviewing dust sources and modifying working procedures.
- 47.6.13 Where the recorded baseline levels exceed the ambient air quality standards, then at such locations the action level is the recorded base line. Contractor shall take all effective remedial measures to contain the levels to their baseline value as a result of his activities. The action level may be varied by and at the sole discretion of the Engineer.
- 47.6.14 The Contractor shall inform the Engineer of all steps taken to investigate cause of accident and immediate action taken to avoid further accident through written reports and proposals for action under an Event Contingency Plan.

WATER QUALITY

- 1.300 The Contractor shall comply with the Indian Government legislation and other State regulations in existence in Pune insofar as they relate to water pollution control and monitoring. A drainage system should be constructed at the commencement of the Works, to drain off all surface water from the work site into suitable drain outlet.
- 1.301 The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or existing stream courses and drains within or adjacent to the site. In the event of any spoil or debris from construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed, and the affected land and areas restored to their natural state by the Contractor to the satisfaction of the Employer.
- 1.302 Due to lowering of potable water supplies in Pune and subsequent contamination of ground water, the Contractor is not allowed to discharge water from the site without the approval of the Employer. The Contractor must comply with the requirements of the Central Ground Water Board for discharge of water arising from dewatering. Any water obtained from dewatering systems installed in the works must be either re-used for construction purposes and this water may subsequently be discharged to the drainage system or, if not re-used, recharged to the ground water at suitable aquifer

levels. The Contractor must submit his proposals for approval of Employer, on his proposed locations of dewatering of excavation and collection of water for either construction re-use or recharge directly to aquifers. The Contractor's recharge proposals must be sufficient for recharging of the quantity of water remaining after deduction of water re-used for construction. During dewatering, the Contractor shall monitor ground water levels from wells to ensure that draw down levels do not exceed allowable limits. The Contractor will not be permitted to directly discharge, to the drainage system, unused ground water obtaining from the excavation without obtaining approval of Employer or the Agency controlling the system.

- 1.303 The Contractor shall ensure that earth, bentonite, chemicals and concrete agitator washings etc. are not deposited in the watercourses but are suitably collected and residue disposed off in a manner approved by local authorities.
- 1.304 All water and waste products (surface runoff and wastewater) arising on the site shall be collected and removed from the site via a suitable and properly designed temporary drainage system and disposed off at a location and in a manner, that will cause neither pollution nor nuisance.
- 1.305 Any mud slurry from drilling, diaphragm wall construction or grouting etc. shall not be discharged into the drainage system unless treatment is carried out that will remove silt, mud particles, bentonite etc. The Contractor shall provide treatment facilities as necessary to prevent the discharge of contaminated ground water.
- 1.306 The Contractor shall discharge wastewater arising out of site office, canteen or toilet facilities constructed by him into sewers after obtaining prior approval of agency controlling the system. A wastewater drainage system shall be provided to drain wastewater into the sewerage system.
- 1.307 The bentonite mixing, treatment and handling system shall be established by the Contractor giving due regard to its environmental impacts. The disposal of redundant bentonite shall be carefully considered whether in bulk or liquid form. The disposal location will be advised and agreed with the relevant authorities.
- 1.308 The Contractor shall take measures to prevent discharge of oil and grease during spillage from reaching drainage system or any water body. Oil removal / interceptors shall be provided to treat oil waste from workshop areas etc.
- 1.309 The Contractor shall apply to the appropriate authority for installing bore wells for water supply at site.

ARCHAEOLOGICAL AND HISTORICAL PRESERVATION

- 1.310 The Contractor shall seek to accommodate archaeological and historical preservation concerns that may arise due to the construction of the project especially in close vicinity of such areas where such monuments may be located.
- 1.311 The Contractor shall consult the Archaeological Survey of India (ASI) and other parties, on the advise of the Employer, to identify and assess construction effects and seek ways to avoid, minimize or mitigate adverse effects on such monuments.
- 1.312 Adverse effects may include reasonably foreseeable effects caused by the construction that may occur later in time, be farther removed in distance or those that alter, howsoever temporarily, the significance of the structure.

LANDSCAPE AND GREENERY

- 1.313 As far as is reasonably practicable, the Contractor shall maintain ecological balance by preventing deforestation and defacing of natural landscape. In respect of ecological balance, the Contractor shall observe the following instructions.
- 50.1.2 Specific agreement from the Engineer is obtained prior to any clearing works.
- 50.1.3 Vegetation clearing chemicals is not permitted
- 50.1.4 Vegetation clearing using bulldozer is not permitted in zones less than 30 m from areas designated as sensitive by the Engineer, where only manual clearing is authorised.

- 50.1.4 Unless otherwise specified in the Contract or if otherwise instructed by the Engineer, burning vegetation is not permitted.
- 50.1.5 Areas cleared prior to undertaking earthworks are shown on a plan with a minimum scale of 1/10,000. Plans are submitted to the Engineer for validation prior to starting clearing works.
- 50.1.6 Clearing is undertaken without damage to adjacent non -cleared areas. Topsoil is stored within the cleared areas at the vedge of the cleared zone. Clearing is undertaken working from the edge of the zone inwards.
- 1.314 The Contractor shall, so conduct his construction operations, as to prevent any avoidable destruction, scarring or defacing of natural surroundings in the vicinity of work.
- 1.315 Where destruction, scarring, damage or defacing may occur as a result of operations relating to Permanent or Temporary works, the same shall be repaired, replanted or otherwise corrected at Contractor's expense. All work areas shall be smoothed and graded in a manner to conform to natural appearance of the landscape as directed by the Employer.
- 1.316 A suggested list of trees / shrubs suitable for planting and landscaping is found in Employer's Project SHE Manual.

FELLING OF TREES

- 1.317 The Contractor shall identify the number and type of trees that are required to be felled as a result of construction of works and facilities related to Project and inform the Employer.
- 1.318 All trees and shrubbery, which are not specifically require to be cleared or removed for construction purposes, shall be preserved and shall be protected from any damage that may be caused by Contractor's construction operations and equipment. The Contractor shall not fell, remove or dispose of any tree or forest produce in any land handed over to him for the construction of works and facilities related to Project except with the previous permission obtained from the Forest Department.
- 1.319 The Employer shall arrange permission from the forest department for trees to be felled or transplanted. The Employer will permit the removal of trees or shrubs only after prior approval.
- 1.320 Special care shall be exercised where trees or shrubs are exposed to injuries by construction equipment, blasting, excavating, dumping, chemical damage or other operation and the Contractor shall adequately protect such trees by used of protective barriers or other methods approved by the Employer. Trees shall not be used for anchorage.

FLY ASH

- 1.321 The Employer may require the Contractor to use fly ash as a percentage substitution of cement, in concrete for certain structures and works.
- 1.322 In all such uses of Fly Ash, the Contractor shall maintain a detailed record of usage of Fly Ash. The Contractor shall also collect related details and provide to the Employer.
- 1.323 The reporting details on consumption of Fly Ash are found in Employer's SHE Manual.

Biodiversity- :- Contractor shall ensure that all personnel are informed and aware of the importance to protect Fauna and flora. Information and awareness training is documented.

- 1.324 The Contractor shall ensure that all personnel are informed and aware of wildlife encounters procedures. Information and awareness training is documented.
- 1.325 Wherever possible areas shall be cleared from one side to another, or from the inside out, to prevent animals becoming trapped.

- 1.326 The Contractor personnel shall not approach, injure, hunt capture, possess feedc, transport, rear or trade wild animal and /or collect birds eggs while working on the project.
- 1.327 The con tractors personnel shall not collect flora species while working on the project.
- 1.328 The Contractor shall protect excavations with temporary fencing to prevent injury to animal.
- 1.329 The contractor shall release any trapped uninjured animals immediately and report the same to the Engineer.
- 1.330 The Contractor shall not start forest fires.
- 1.331 The Contractor shall not introduce invasive alien species
- 1.332 All construction machinery imported from overseas shall be inspected to detect IAS and washed before dispatching to the Project Areas.
- 1.333 The Contractor plans earthworks and optimises the management of space to ensure that all cleared surfaces and areas exposed to soil erosion are minimised on all Project Areas.

54 Erosion and Sediment Transport

- 54.1 The Contractor plans earthworks and optimises the management of space to ensure that all cleared surfaces and areas exposed to soil erosion are minimised on all Project Areas.
- 54.2 Top soil -unless indicated otherwise by the Engineer, the top 25 centimetres of the soil start of works and removal of topsoil. Barriers can be used for the will be considered as top soil.
- 54.3 Earthworks for the temporary occupation of the Project Area are preceded by the clearing of topsoil and the storage of this soil separately from underlying sterile soil.
- 54.4 Topsoil is stored according to the provision approved by the Engineer to enable reuse during Project Area rehabilitation.
- 54.2 Draining and rainwater run -off**
 - 54.2.1 The gradient of Project Area allows the collection and drainage of rainwater from the entire surface area to one or several discharge points. No pools of water are created.
 - 54.2.2 Suspended solids in rainwater are removed using sediment traps/settling ponds. Rainwater from vehicle parking areas, machinery areas, workshops is subject to treatment with only water separators.
 - 54.2.3 Rainwater pre -treatment units are sized, cleaned, maintained and accessible to ensure compliance with the effluent quality criteria.
 - 54.2.3 The Contractor installs sediment control barriers to slow the flow of water and control sediment transport at Project Areas with (i) a gradient of more than 20%and (ii) where land is disturbed by the works or where stockpiled mineral material exposed to sheer or rill erosion.
 - 54.2.4 Sediment control barriers are installed on the slope or at the v base of the slope to protect the natural drainage system from sediment accumulation at levels higher than the natural situation. These barriers comply with the followi9ng principles
 - a) Made with geo textiles or straw bales or any other means pre -approved b y the Engineer.
 - b) Deployed before the physical demarcation of working areas.
 - c) Installed cleaned, maintained & replaced according to manufacturer recommendations.

- d) Drainage surface area does not exceed 1,000 m² per 30 m of barrier. The length of the slope behind the barrier is less than 30 m and is not used for flows in excess of 30l/s.

54.3 Back filling and stockpiling of backfill materials

- 54.3.1 To ensure stability and resistance to rainwater runoff erosion. mineral material stockpiles do exceed a height of 6m, with a maximum slope of 3H:2V (height : volume).The slope is crossed at a height of 3 m by a berm with a minimum width of 2m and with a peripheral drainage trench.
- 54.3.2 For permanent backfill material stockpiles, the stockpiles is shaped and compacted every 30 cm to ensure long -term stability.
- 54.3.3 Temporary stockpiles for more than 60 days are protected against runoff erosion by (i) revegetation using fast growing grass species, either by direct seeding or by hydro seeding or (ii) using other natural anti-erosion cover with prior approval from the Engineer.
- 54.4.4 Side casting during the construction of linear structures (roads, pipelines, transport lines) will be permitted in the following conditions
- 54.4.5 For natural gradients with a slope <40% the side cast materials are piled to create a slope of less than 2H:IV

For natural gradients with a slope >40% to ensure stability 3m wide berms will be installed perpendicular to the slope and onto which the side cast material is deposited. Regular earthwork s to maintain the form of the side case and long term stability of the side cast is carried out .The slope of the side cast in general does not exceed 3H:2V

55 WASTE

- 55.1.1 The Contractor is required to develop, institute and maintain a Waste Management Programme (WMP) during the construction of the project for his works, which may include:
- (i) Identification of disposal sites
 - (ii) Identification of quantities to be excavated and disposed off
 - (iii) Identification of split between waste and inert material
 - (iv) Identification of amounts intended to be stored temporarily onsite location of such storage.
 - (v) Identification of intended transport means and route.
 - (vi) Obtaining permission, where required, for disposal.
- 55.1.2 Such a mechanism is intended to ensure that the designation of areas for the segregation and temporary storage of reusable and recyclable materials are incorporate into the WMP. The WMP should be prepared and submitted to the Engineer for approval.
- 55.1.3 The Contractor shall handle waste in a manner that ensures they are held securely without loss or leakage thus minimizing potential for pollution. The Contractor shall maintain and clean waste storage areas regularly.
- 55.1.4 The Contractor shall remove waste in a timely manner and disposed off at landfill sites after obtaining approval of the competent authorities namely Pune Municipal Corporation etc.
- 55.1.6 Burning of wastes is prohibited. The Contractor shall not burn debris or vegetation or construction waste on the site but remove it in accordance with Clause50.1 above.

- 55.1.7 The Contractor shall make arrangement to dispose of metal scrap and other saleable waste to authorized dealer and make available to the Employer on request, records of such sales.
- 55.1.8 The Contractor selects suppliers having a voluntary and documented policy to reduce the volume and weight of packaging, and to select recyclable or biodegradable packaging.
- 55.1.9 The Contractor establishes and maintains a waste register which is at the disposal of the Engineer. This register will record all waste management operations: production, collection, transport, treatment. The following aspects are documented in this register:
- a) Type of waste, using the nomenclature specified in Clause 53.12;
 - b) Waste quantities ;
 - c) Name and address of the third-party waste management facilities receiving waste or parties taking possession of the substances no longer considered as waste;
 - d) Name and address of waste transport contractors;
 - e) Planned waste treatment.
- 55.1.10 The contractor files and maintains at the disposition of the Engineer the waste manifests for the collection, transport, treatment and/or elimination of waste.
- 55.1.11 The waste register is established and available as of the Contractors mobilisation to the Worksite. This register will be archived for at least 1 year after the provisional acceptance of the works.
- 55.1.12 The Contractor implements specific waste management practices adapted to the level of danger for human health or the natural environment. Three waste categories are identified for Worksites and in Tracking documents:
- a) Hazardous waste: any waste with one or several dangerous properties as listed in appendix 2 of these SHE specifications.
 - b) Non-hazardous waste: any waste with no properties rendering it hazardous. Non-hazardous waste contaminated by hazardous material will be considered as hazardous waste, unless indicated otherwise by the Engineer.
 - c) Inert waste: any waste unaffected by any significant physical, chemical or biological modifications, which does not decompose burn or produce any physical or chemical reaction, is not biodegradable and does not damage any substance with which it comes into contact in a manner likely to cause damage to the environment or human health.
- 55.1.13 The Contractor assesses, document and effectively implements any local recycling or re-use options for its waste.
- 55.1.14 Waste is categorised and stored separately prior to removal from the Worksites, depending on the level of danger, phase (liquid, solid or gas), the waste management solution to be applied and its potential in terms of recycling or reuse.
- 55.1.15 Waste is collected from each Worksite at the same rate that it is produced and is placed in temporary locations meeting the following criteria:
- a) Located at a distance of over 100 m from any natural sensitive area and over 500 m from any socioeconomic sensitive area (school, market, healthcare centre, water well or catchment area), with the exception of waste storage area in camps.
 - b) Protected from moving machinery and vehicles, but easy to access for regular collection.
 - c) Located on a flat impervious surface to prevent infiltrations.
 - d) Under cover for non-inert waste.

- e) Stored in containers of the appropriate size, tightness and level of resistance depending on the danger and phase (solid, liquid, gas) of the waste.
 - f) Liquid wastes storage is equipped with secondary retention with a volume at least equal to the volume of the waste contained in the containers.
 - g) Hazardous waste stored pursuant to Clause 30.4.7 of the present SHE specifications.
- 55.1.16 Waste is removed from Worksites and transported to recycling, treatment and waste management facilities on a regular basis. The frequency of removal, approved by the Engineer, guarantees:
- a) No over flow from containers.
 - b) No unpleasant odour or emissions which are dangerous for human health.
 - c) No proliferation of insects, rodents, dogs or other animals which are harmful or dangerous for human health.
 - d) Regular cleaning of containers and surfaces on which they are located.
- 55.2 Unless otherwise specified in the Contract or instructed by the Engineer, waste incineration is prohibited on Worksites. Two exceptions are medical waste and green waste, which unless instructed to the contrary by the Engineer, are managed.
- 55.2.1 The use of third party waste management services is subject to a documented prior audit of the treatment, storage and recycling facilities by the Contractor, to guarantee the conformity with the provisions of the present ESHS specifications on waste.
- 55.2.2 The provisions applicable to the Contractor regarding waste management also apply to any third part waste management contractors. The Engineer reserves the right to inspect third party waste management facilities and prohibit the Contractor from using the facilities if considered unacceptable.
- 55.2.3 The management of non-hazardous waste complies with the following conditions.
- 55.2.4 Non-contaminated inert waste is removed and can be disposed of to landfill with unused backfill material. The location, capacity & environmental protection measures, particularly for water courses, implemented by the Contractor or subcontractor, will comply with the provisions of the present ESHS specifications.
- 55.2.5 Non-hazardous waste that cannot be recycled is disposed of to landfill, and complying with the following criteria :
- a) Walls and base sealed by a geo-membrane or a layer of compacted clay with a permeability 10^{-7} cm/s.
 - b) Drained for the recovery of leachates, which are routed to a lagoon aerobic/anaerobic treatment prior to discharge into the natural environment or collected in a temporary storage prior to regular collection and transfer to a treatment unit (septic tank or wastewater treatment plant).
 - c) Regularly compacted and covered by earth to limit odours and the proliferation of insects.
 - d) When the landfill has reached full capacity, vents are installed to evacuate gases, and the landfill covered by a geo-membrane with a minimum thickness of 1 mm, or a layer of compacted clay, and a top layer of 1.5 m of topsoil, which is revegetated.

a. HAZARDOUS WASTE MANAGEMENT

56. If encountered or generated as a result of Contractor's activity, then waste classified as hazardous under the "Hazardous Waste (management, handling and trans-boundary movement) rules, 2007 and amendment 2008" shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 56.1 Chemicals classified as hazardous chemicals under "Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 of Environment (Protection) Act, 1986 shall be disposed off in a manner in compliance with the procedure given in the rules under the aforesaid act.
- 56.2 The Contractor shall identify the nature and quantity of hazardous waste generated as a result of his activities and shall file a 'Request for Authorisation' with State Pollution Control Committee along with a map showing the location of storage area.
- 56.3 Outside the storage area, the Contractor shall place a 'display board', which will display quantity and nature of hazardous waste, on date. Hazardous Waste needs to be stored in a secure place.
- 56.4 It shall be the responsibility of the Contractor to ensure that hazardous wastes are stored, based on the composition, in a manner suitable for handling, storage and transport. The labelling and packaging is required to be easily visible and be able to withstand physical conditions and climatic factors.
- 56.5 The Contractor shall approach only Authorised Recyclers of Hazardous Waste for disposal of Hazardous Waste, under intimation to the Employer.
- 56.6 Submittal of all environment related documents and records pertaining to monitoring and trend analysis on key parameters such as but not limited to consumption/efficient use of resources such as energy, water, material such as cement, fly ash, iron and steel, recycle/reuse of waste etc. that shall have demonstrated continual improvement in the implementation of Environmental Management System. In case of failure to do so, the Employer shall impose appropriate penalty as indicated under penalty clause.

b. ENERGY MANAGEMENT

- 57.1 The Contractor shall use and maintain equipment so as to conserve energy and shall be able to produce demonstrable evidence of the same upon Employer's request.
- 57.2 Measures to conserve energy include but not limited to the following:
1. Use of energy efficient motors and pumps
 2. Use of energy efficient lighting, which uses energy efficient luminaries
 3. Adequate and uniform illumination level at construction sites suitable for the task
 4. Proper size and length of cables and wires to match the rating of equipment
 5. Use of energy efficient air conditioners

The Contractor shall design site offices maximum daylight and minimum heat gain. The rooms shall be well insulated to enhance the efficiency of air conditioners and the use of solar films on windows may be used where feasible.

58 Part v- Local Labour and Relations with Local Communities

- 58.1 Labour Conditions- The Contractor should ensure decent labour conditions for workers and notably compliance with applicable Indian law and regulations. This includes Workers rights related to wages, working hours, rest and leave, overtime,

minimum age, regular payment, compensation and benefits .The Contractor should respect and facilitate workers rights to organise & provide a grievance mechanism for all direct and indirect workers. The Contractor should implement non-discrimination and equal opportunity practices, and ensure prohibition of child or forced labour.

58.2 Local Recruitment

- 58.2.1 Local recruitment is defined as the number of positions actually allocated to people residing in the region of the Works (less than two hours by land transport to the Project Area) for more than one year and Indian Citizen.
- 58.2.2 The Contractor implements a voluntary local recruitment policy for its personnel for the duration of the Works and shall enforce this policy to its Subcontractors.
- 58.2.3 The Contractor demonstrates the effective implementation of this voluntary policy to the Engineer in its monthly activity report.
- 58.2.4 The Contractor develops a training programme aiming to support the voluntary local recruitment policy.
- 58.2.5 This training programme must be available to women and adjusted to their level of education.
- 58.2.6 An incentive mechanism to increase the share of women recruited by the Contractor and Sub Contractor may be established.
- 58.2.7 Local labour needs are estimated prior to the start of works and described in the worksite with following information
- a) Identification of positions that could be filled by local staff and the level of qualification required.
 - b) Definition of the planned procedure for the effective recruitment of these members of staff
 - c) Establishment of mechanisms to ensure non-discrimination of women in accessing recruitment procedures.
 - d) Deployment schedule for these positions.
 - e) Initial training to be provided by the Contractor for each job description.
- 58.2.8 In order to prevent outsiders from entering the Project Area, local recruitment at the Project Area, including at the entrance is prohibited.

59 Local Recruitment office

- 59.1.1 One month prior to the start of works, the contractor establishes a local recruitment office in the district where the main Project Area is located, at a location pre-approved by the Engineer.
- 59.1.2 A representative of the Contractor is present in this office at least two mornings each week, from the start of the works to a date pre-approved by the engineer.
- 59.1.3 The representative provides information on job vacancies with the Contractor for the execution of the works (required qualifications, duration and location) and on the information to be provided in applications.
- 59.1.4 Lists of local candidates are drafted by the representative allocated to the office and forwarded to the Contractor's human Resources manager on a weekly basis.
- 59.1.5- The Contractors Human Resources manager selects candidates listed by the local recruitment office based on requirements for the Works and the Contractor's

recruitment procedures. A written contract between the Contractor and the local Contractors Personnel is drafted, signed and archived by the contractor.

- 59.1.6 If the Project Areas are located near to several different communities, the Human Resources manager ensures a fair distribution of local recruitment between the different communities.
- 59.1.7 The Human Resources manager will ensure that recruitment campaigns in local communities have been spread to women and that the latter have not been discriminated in recruitments.
- 59.1.8 The Contractor maintains one record per local Contractors Personnel indicating the housekeeper person allocated to the works, the type of tasks carried out, the wages paid, and any training provided. Records are available at the main Project Area at all times, so the Engineer and the authorised representatives of the government can assess the content.

60 Transport & Accommodation

- 60.1 Unless specified otherwise in the Contract, or instructed otherwise by the Engineer, the Contractor provides or enables access to daily transport for Contractor's Personnel not housed in the camps managed by the Contractor and living more than fifteen minutes' walk from the Project Area and less than one hour by land transport.
- 60.2 The transport is organised under conditions which comply with local regulations and which ensure the safety of the people transported.
- 60.3 The Contractor organises collective transport: pick -up times and locations are defined and services organised appropriately.
- 60.4 If the Project Area is moved during the working season and if the contractor retains the local personnel trained at the start of the works, the accommodation of the Contractor's Personnel is managed by the Contractor
 - a) Within a mobile camp with the other non -local Contractor's Personnel: or
 - b) In villages located near to the mobile Project Area, in this case, each local Contractor's Personnel will receive a housing allowance in addition to his wages.

Part VI

61 Damage to People and Property

- 61.1 The Contractor shall not disturb or interfere with the inhabitants of local communities close to or in the Project Area, and shall respect their houses, cultures, animals, properties, customs and practices..
- 61.2 The Contractor is responsible for damages to people and property caused by the execution of the works or the procedures used for execution.
- 61.3 Access to the Project Area is prohibited to unauthorised persons. The Contractor is responsible for the security and access control of the Project Areas.
- 61.4 The Engineer is informed of any damage caused to people, or the property of individuals, other than the Contractor's personnel, within 6 hours of the event regardless of the value of the prejudice.
- 61.5 Housing existing before the start of the works, located within a minimum radius of 800 m around the perimeter of the quarries and within a minimum radius of 500 m around the other Project Areas that will be subject to blasting, will b e examined by a bailiff unless agreed upon otherwise with the Engineer.
- 61.6 The Bailiff's sworn statement is prepared and provided to the engineer with the Environmental Protection Plan.

- 61.7 Should any problem be detected due to the intensity of blasting, the Engineer is entitled to request that the Contractor carry out seismic measurements of the intensity of the vibrations induced by the blasting, at variable distances from the blasting points, under the supervision of the Engineer, and at the cost of the contractor.

Part VII

62 Land Acquisition and Land Take

- 62.1 The Contractor will cover (1) occupancy indemnities for the extraction or use of construction materials & (2) the cost of acquiring the necessary land to stockpile excess backfill material.
- 62.2 The Contractor provides compensation for any prejudice suffered by the owners of the land mentioned in clause 60.1 above but also for any prejudice incurred by users of this land, if these users are not the same parties as the owners.
- 62.3 The Contractor demonstrates to the Engineer (i) who are the owner and the users, if different parties have been identified and (ii) a written agreement governing the temporary occupancy or acquisition of this land has been negotiated and duly paid up to the two parties, if different.

Part VIII

63. Traffic

- 63.1 The Contractor defines the characteristics of its fleet of vehicle and site machinery in the worksite, in the form of traffic management plan.
- 63.2 The Contractor defines in the traffic management plan the itineraries used on a map for each route between the different Project Areas and for each phase of the construction works, and obtains the validation of the Engineer. The Contractor requests that the Employer obtain the authorisations of the competent administrative authorities if public roads are used. Any Engineer's instruction to update the traffic management plan shall be implemented.
- 63.3 Within one month of the physical start of works, the Contractor informs the administrative authorities of areas crossed by the Contractor's vehicles, of the itinerary and characteristics (frequency of passing, size and weight of trucks, materials carried) of the Contractor's fleet of vehicles.
- 63.4 If public roads are used, unless approved otherwise by the Engineer, the Contractor mandates the bailiff to make a sworn report regarding the state of road prior to use by the Contractor's vehicles. The report is annexed to the work site.
- 63.5 The Contractor describes in the traffic management plan the expected traffic created by its fleet of vehicles (frequency of trips between Project Areas, working hours, convoys)
- 63.6 The Contractor also describes the number and positioning of flagmen.
- 63.7 Unless specified otherwise in the Contract or instructed otherwise by the Engineer, heavy vehicles (i.e. With a GVWR of more than 3.5 tons) may not be used at night between 22.00 and 06.00
- 63.8 **Speed Limits**
- 63.8.1 The Contractor takes action to limit and check the speed of all vehicles and machinery used to execute the works.
- 63.8.2 The maximum speed of all machinery and vehicles of the Contractor comply with the lowest of the following. The speed limit defined according to the employer's country regulations or the following limits

- a) 10km/h within the Project Areas,
 - b) 30km/h in villages or hamlets, in towns, from 100 m before the first house.
 - c) 80km/h on unpaved roads outside of towns, villages, hamlets and camps.
- 63.8.3 In coordination with the competent Authorities, the Contractor provides and installs signs for the fleet of vehicles along public roads , when public signs are inadequate.
- 63.8.4 The Contractor provides each of its drivers with a map at the appropriate scale of the roads authorised for the execution of the works clearly indicating the maximum speeds authorised, and ensures their understanding.
- 63.9 It is strictly prohibited to transport people, equipment or products other than those required for the works and the management of Project Areas on board any of the Contractor's vehicles. The provision also applies to the transport of live animal and meat obtained from hunting, fishing or poaching.
- 63.10 The trailers, and skips used to carry materials which could be projected (sand, crushed material, aggregates, selected materials are covered with a tarpaulin for the entire itinerary between two Project Areas.
- 63.11 The Contractor carries out a regular inspection along the roads used by its fleet of vehicles to ensure compliance with the provisions of its clause 61.7 to 61.10 of the above specification. The Contractor records these inspections and the results and transmits a summary of checks carried out for the previous month to the Engineer on a monthly basis.

PART - VI: PENALTY AND AWARDS

64. CHARGES TO BE RECOVERED FROM CONTRACTOR FOR UNSAFE ACT OR CONDITION

- a. Maharashtra Metro Rail Corporation Limited intends to build an image of safety conscious organisation. Any reportable accident (fatality / injury) results in loss of life and/or property damage. These accidents not only result in loss of life but also damage the reputation of Maharashtra Metro Rail Corporation Limited. Most of the accidents are avoidable and caused preliminarily due to Contractors' negligence. Hence Maharashtra Metro Rail Corporation Limited shall recover the cost of damages from the Contractors for every reportable incident (fatality / injury).
- b. In addition, every Maharashtra Metro Rail Corporation Limited work site is exposed to public scrutiny as the work is executed just on the right-of-way. Any unsafe act / unsafe condition observed by public further damage Maharashtra Metro Rail Corporation Limited's reputation. In view of this, Maharashtra Metro Rail Corporation Limited has decided to establish safety-enforcing organisation. The cost of establishing such organisation is to be recovered from Contractors for all observed safety violations at sites.
- c. The following table indicates the Safety, Health and Environment violation (unsafe act / unsafe condition) and charges to be recovered from contractors.
- d.

SN	Topic	Unsafe Act / Unsafe condition	Range of Levels	Deductible Amount
1.	SHE Policy & Plan	i) SHE policy. a) non-compliance of clause 4.1	L1→L2	L1- Rs 5,000 per single violation, compounded to a maximum of Rs 25,000 at any single instance. L2- Rs 10000 per single violation, compounded to a maximum of Rs 50,000 at any single instance.
		ii) SHE Plan	L1→L2	L1- Rs 100000 per single violation, compounded to a maximum of Rs 200000 at any single instance. L2- Rs 200000 per single violation, compounded to a maximum of Rs 400000 at any single instance.
		a) Not as per Employers' content and coverage (Clause 4.2, 4.7)		
		b) Delay in submission (Clause 4.2, 4.4)		
		c) Not updated as per Employer's instruction as per Clause 4.4		
		d) Copies not provided to all required supervisors/engineers		
2.	SHE Organisation	Not complying to the minimum manpower requirements as mentioned in General Instruction Maharashtra Metro Rail Corporation Limited /SHE/GI/001 (Clause 6.1.1)	L1→L2	L1- Rs.100000 per month for first month and Rs 200000 for subsequent months. L2- Rs.250000 per month for first month and Rs 500000 for subsequent months.
		Not filling up the vacancies created due to SHE personnel leaving the Contractor within 14 days. (Clause 6.7)		L1-Rs 50000 for first month and Rs 100000 for subsequent months. L2-Rs 150000 for first month and Rs 300000 for subsequent months.
		SHE organization not provided with required Audiovisual and other equipment's as per		L1- Rs 50000 for first violation and Rs 100000 for

		General Instruction. Maharashtra Metro Rail Corporation Limited /SHE/GI/012 (Clause 6.9.2)		subsequent violations.
		Employing through outsourcing agencies and SHE personal are not in the payroll of the main Contractor. (Clause 6.5.1)		L2- Rs 150000 for first violation and Rs 300000 for subsequent violations.
		Disobedience/Improper conduct of any SHE personnel. (Clause 6.2)		
		Chief SHE Manager not reporting directly to CPM of Contractor. (Clause 6.6)		
3.	SHE Committee	Failed to formulate or conduct SHE Committee meeting for any month (Clause 7.4)	L1→L2	L1- Rs 100000 for the first violation and Rs 500000 for the subsequent violations. L2- Rs 200000 for the first violation and Rs 1000000 for the subsequent violations.
		Contractor and Sub-contractor representatives not attending SHE Committee meetings (Clause 7.10)		L1- Rs 5000 to the contractor of the member who had not attended the meeting for first violation and Rs 25000 for subsequent violations. L2- Rs 10000 to the contractor of the member who had not attended the meeting for first violation and Rs 50000 for subsequent violations.
		Failed to conduct Site inspection before conducting SHE Committee meeting (Clause 7.2.1 (viii))		L1-Rs 25000 for first violation and Rs 50000 for subsequent violations.
		Failed to send SHE Committee Meeting minutes or Agenda to Employer in time (Clause 7.8.1, 7.9.1)		L2-Rs 50000 for first violation and Rs 100000 for

		Non-adherence of Clause 7.7.1		subsequent violations.
		Non-adherence of Clause 7.9		
4.	ID Card	Non-adherence of Clause 8.1, 8.2 and 8.3	L1→L2	<p>L1- Rs 100000 for first violation and Rs 200000 for subsequent violations.</p> <p>L2- Rs 250000 for first violation and Rs 500000 for subsequent violations.</p>
5.	SHE Training	<p>Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual with regard to :</p> <p>a) Induction training not given (Clause 8.1)</p> <p>b) Supervisor/engineer/manager training not conducted as per Clause 9.6</p> <p>c) Refresher training as per Clause 9.7 & 9.11 not conducted</p> <p>d) Tool-box talk not conducted as per Clause 9.8</p> <p>e) Skill development training not conducted as Clause 9.9</p> <p>f) Daily Safety Oath not conducted as per Clause 9.1</p> <p>g) Under ground construction training not given clause 13.2</p> <p>h) Top management behavior based SHE training conducted (Clause 9.4)</p>	L1→L2	<p>L1- Rs 50000 for first violation on & Rs 100000 for subsequent violations.</p> <p>L2- Rs 150000 for first violation on & Rs 300000 for subsequent violations.</p>
6.	SHE Inspection	i) Not complying to the requirements as mentioned in conditions of contract on SHE and project SHE manual as per Clause 10.0	L1→L2	L1- Rs 50000 for first violation on and Rs 100000 for subsequent violations.

		ii) Non-compliance of clause 10.3.6		L2- Rs 150000 for first violation on and Rs 300000 for subsequent violations.
7.	SHE Audit	Internal Audit : MARS i) Not conducted as per SHE Plan (Clause 11.2.1) ii) Report not sent to Employer (Clause 11.2.6) iii) Action not taken for any month (Clause 11.2.4)	L1→L2	L1- Rs 50000 for first violation on and Rs 100000 for subsequent violations. L2- Rs 150000 for first violation on and Rs 300000 for subsequent violations.
		External Audit i) Not conducted as per SHE Plan (Clause 11.4.3) ii) Report not sent to Employer (Clause 11.4.7) iii) Action not taken for any quarter (Clause 11.4.9)		L1-Rs 100000 for first violation and Rs 200000 for subsequent violations. L2-Rs 250000 for first violation and Rs 500000 for subsequent violations.
8.	SHE Communication	Important days to be observed for SHE awareness as furnished by Employer not observed (Clause 12.2)	L1→L2	L1-Rs 10000 for first violation and Rs 50000 for subsequent violations. L2- Rs 20000 for first violation and Rs 100000 for subsequent violations.
		Posters as furnished by Employer not printed and displayed (Clause 12.2)		L1- 2,00,000 per contract L2- 4,00,000 per contract
9.	SHE Submittals	Non-compliance of Clause 13.1	L1→L2	L1- Rs 50000 for first violation on & Rs 100000 for subsequent violations. L2- Rs 150000 for first violation on & Rs 300000 for subsequent violations.

		Non-compliance of Clause 13.2		<p>L1-Rs 100000 for first violation and Rs 200000 for subsequent violations.</p> <p>L2-Rs 250000 for first violation and Rs 500000 for subsequent violations.</p>
		Non-compliance of Clause 13.3		
10.	Injury and Incidence reporting	Fatal Accidents	L3	L3-Rs.500000 penalty & enforcement of embargo for first fatality, and Rs 1000,000 penalty and enforcement of embargo for every subsequent fatality.
		Injury Accident	L2→L3	<p>L2-Rs 100000 for first grievously injured person and Rs 200000 for every subsequent grievously injured person (Grievous Injury as defined by Workmen Compensation Act).</p> <p>L3- Rs 250000 for first grievously injured person and Rs 500000 for every subsequent grievously injured person</p>
		Abnormal delay in reporting accidents or willful suppression of information about any accidents/dangerous occurrence as per Clause 14.1.4	L2→L3	<p>L2-Rs 100000 for first violation and Rs 200000 for subsequent violations.</p> <p>L3-Rs 250000 for first violation and Rs 500000 for subsequent violations.</p>
		Non-compliance of the Clause 14.4	L2→L3	L2- Rs 50000 for first violation on & Rs 100000 for subsequent violations.
		The contractor shall create a fund to cater, from which in any case of fatal accident or		

		permanent disability, payments will be made to the aggrieved party over and above the statutory requirements.		L3- Rs 200000 for first violation on & Rs 400000 for subsequent violations.
11.	Emergency preparedness Plan	Non-compliance of the Clause 15.1, 15.2, 15.3, 15.4, 15.5 and 15.6	L2→L3	L2- Rs 100000 for non-compliance of any of the clauses. L3- Rs 200000 for non-compliance of any of the clauses.
12.	House keeping	Housekeeping maintenance register not properly maintained up to date (Clause 17.4)	L1→L2	L1- Rs 10000 per single violation Compounded to a maximum of Rs.100000 at any single instance. L2- Rs 20000 per single violation Compounded to a maximum of Rs 200000 at any single instance.
		Surrounding areas of drinking water tanks/taps not hygienically cleaned/maintained(Clause17.4)		
		Office, stores, toilet/urinals not properly cleaned & maintained. (Clause 17.4)		
		Required dustbins at appropriate places not provided/not cleaned. (Clause 17.6)		
		Stairways, gangways, passageways blocked. (Clause 17.9)		
		Lumber with protruding nails left as such (Clause 17.10)		
		Openings unprotected (Clause 17.7)		
		Excavated earth not removed within a reasonable time. (Clause 17.15)		
		Truck carrying excavated earth not covered / tires not cleaned. (Clause 17.11)		
		Vehicles / equipment's parked / placed on roads obstructing free flow of traffic (Clause 17.13)		

		Unused surplus cables / steel scraps lying scattered (Clause 17.17)		
		Wooden scraps, empty wooden cable drums lying scattered (Clause 17.18)		
		Water stagnation leading to mosquito breeding(Clause42.6.1)		
13.	Working at Height / Ladders and Scaffolds	Not using or anchoring Safety Belt (Clause 18.9)	L2→L3	L1-Rs 10000 per single violation Compounded to a maximum of Rs 100000 at any single instance. L2-Rs 20000 per single violation Compounded to a maximum of Rs 200000 at any single instance.
		Not using Safety Net (Clause 18.18)		
		Absence of life line or anchorage point to anchor safety belt (Clause 18.19)		
		Non-compliance of Clause 18.17		
		Using Bamboo ladders (Clause 18.20)	L1→L2	L3-Rs 30000 per single violation
		Painting of ladders	L1→L2	Compounded to a maximum of Rs 300000 at any single instance.
		Improper usage (less than 1m extension above landing point, not maintaining 1:4 ratio) (Clause 18.20)	L2→L3	
		Aluminum ladders without base rubber bush (Clause 18.20)		
		Usage of broken / weak ladders (Clause 18.20)		
		Usage of re-bar welded ladders (Clause 18.20)		
		Improper guardRail, toe board, barriers and other means of collective protection (Clause 18.16)		
		Improper working platform (Clause 18.17)		
		Working at unprotected fragile surface (Clause 18.9)		

		Working at unprotected edges (Clause 20.0)		
14.	Lifting appliances and gear	Non-availability of fitness certificate as per Clause 21.3	L2→L3	L2-Rs 50000 per single violation Compounded to a maximum of Rs 500000 at any single instance. L3-Rs 100000 per single violation Compounded to a maximum of Rs 1000000 at any single instance.
		Documents not displayed on the machine or not available with the operator as per Clause 21.4		
		Maximum Safe Working Load not written on the machine as per Clause 21.5		
		Non-compliance of Clause 21.6		
		Non-compliance of Clause 21.7		
		Automatic safe load indicator not provided or not in working condition as per Clause 21.8		
		Age of the operator less than 21 years or without any license and non-compliance of other item as per Clause 21.9		
		Non-compliance of Clause 21.10		
		Non-compliance of any of the items mentioned regarding rigging requirements as per Clause 21.11		
		Failure to submit method statement in case of all critical lifting (Clause 21.3)		
		Person riding on crane. (Clause 23.4)		
		Creating more noise and smoke (Clause 43.1.1)		
		Absence of portable fire extinguisher in driver cabin (Clause 31.5)		
		Fail to guard hoist platform (Clause 24.0)		
		No fencing of hoist rope movement area (Clause 24.0)		

		Hoist platform not in the horizontal position (Clause 21.2)		
15.	Launching operation	Non-adherence of any of the provisions mentioned in Clause 22.2	L2→L3	<p>L2-Rs 50000 for first violation and Rs 100000 for subsequent violations.</p> <p>L3-Rs 150000 for first violation and Rs 300000 for subsequent violations.</p>
16.	Site Electrical Safety	<p>Non-compliance of Clause 26.1.1</p> <p>Non-compliance of Clause 26.2.3, 26.2.4 & 26.2.5</p> <p>Non-compliance of Clause 26.3.1</p> <p>Non-compliance of Clause 26.7, 26.8 and 26.9.1</p> <p>Non-compliance of Clause 26.10 and 26.13</p> <p>Non-compliance of Clause 28.3.2</p> <p>Exposed electric lines (fermentative damage) and circuits in the workplace. (Clause 26.5.1)</p> <p>Inserting of wires directly into the socket</p> <p>Improper grounding for the electrical appliances Clause 26.7.1)</p> <p>Electrical cables running on the ground (clause 26.8.5 & 26.8.6)</p> <p>Non-compliance Clause 27.0</p>	L2→L3	<p>L2-Rs 10000 per single violation Compounded to a maximum of Rs 100000 at any single instance.</p> <p>L3-Rs 20000 per single violation Compounded to a maximum of Rs 200000 at any single instance</p>

17.	Hand tools and Power tools	Non-compliance of Clause 28.0	L2→L3	<p>L2-Rs 10000 per single violation Compounded to a maximum of Rs 50000 at any single instance.</p> <p>L3-Rs 20000 per single violation Compounded to a maximum of Rs 100000 at any single instance.</p>
18.	Gas Cutting	<p>Wrong colour coding of cylinder.</p> <p>Cylinders not stored in upright position. (Clause 29.1) Flash back arrester, non-return valve and regulator not present or not in working condition. (Clause 29.3 & 29.4)</p> <p>Fail to put cylinders in a cylinder trolley. (Clause 29.1)</p> <p>Damaged hose and fail to use hose clamps (Clause 29.2)</p> <p>Using domestic LPG cylinders (Clause 29.5)</p> <p>Fail to store cylinder 6.6m away from fire prone materials (Clause 29.8)</p> <p>Fire extinguisher not placed in the vicinity during operation (Clause 29.6)</p>	L2→L3	<p>L2-Rs 10000 per single violation Compounded to a maximum of Rs 50000 at any single instance.</p> <p>L3-Rs 20000 per single violation Compounded to a maximum of Rs 100000 at any single instance.</p>
19.	Welding	<p>Voltmeter and Ammeter not working (Clause 29.9)</p> <p>Non-availability of separate switch in the transformer (Clause 29.9)</p> <p>Improper grounding and return path. (Clause 29.10)</p> <p>Damaged and bare openings in the welding cable. (Clause 29.10)</p> <p>Damaged holder (Clause 29.10)</p>	L2→L3	<p>L2-Rs 10000 per first violation and Rs 50000 for subsequent violations.</p> <p>L3-Rs 100000 per first violation and Rs 500000 for subsequent violations.</p>

		Fire extinguisher not placed in the vicinity during operation (Clause 29.6)		
20.	Fire precaution	Smoking and open flames in fire prone area (Clause 31.6)	L2→L3	L2-Rs 5000 per single violation Compounded to a maximum of Rs 25000 at any single instance. L3-Rs 10000 per single violation Compounded to a maximum of Rs 500000 at any single instance.
		Using more than 24V portable electrical appliances in the fire prone area (Clause 34.2.3)		
		Not proper ventilation in cylinder storage area. (Clause 29.8)		
		Absence of fire extinguishers (Clause 31.1)		
		Fire extinguishers not refilled once in a year. (Clause 31.2)		
		Fire extinguisher placed in a not easily accessible location		
21.	Excavation and confined space	Non-compliance of Clause 34.1.1	L2→L3	L2-Rs 10000 per single violation Compounded to a maximum of Rs 50000 at any single instance. L3-Rs 20000 per single violation Compounded to a maximum of Rs 100000 at any single instance.
		Non-compliance of Clause 34.2.3		
		Non-compliance of Clause 34.4		L2-Rs 10000 per first violation and Rs 50000 for subsequent violations. L3-Rs 100000 per first violation and Rs 500000 for subsequent violations.
22.	Work permit system	Non-compliance of Clause 35.2	L2→L3	L2- Rs 50000 per first violation and Rs 100000 for subsequent violations. L3- Rs 100000 per first violation and Rs
		Non-compliance of Clause 21.11.9		

				200000 for subsequent violations.
23.	Traffic Management	Non-compliance of Clause 36.4.1	L2→L3	L2-Rs 100000 per first violation and Rs 200000 for subsequent violations. L3-Rs 250000 per first violation and Rs 500000 for subsequent violations.
		Non-compliance of Clause 36.8.3		
		Non-compliance of Clause 36.9.2		
		Non-compliance of Clause 36.9.3		
		Non-compliance of Clause 36.9.7		
		Non-compliance of Clause 36.9.8		
		Barricades (Clause 36.9.4) i) Not Cleared, ii) Not in alignment, iii) Not numbered, iv) Not Painted, v) Red lights / reflectors not working, vi) Damages not repaired, vii) Not secured properly, viii) Barricade inspector not employed, ix) Protruding parts / portions repaired, x) Barricades maintaining register not properly maintained up to date	L2	Rs 25000 per single violation Compounded to a maximum of Rs 100000 at any single instance
		Contractor Vehicles (Clause 36.9.5 & 36.9.6) i) Over loading of vehicles, ii) Unfit drivers or operators, iii) Unlicensed vehicles, iv) Absence of traffic marshals v) Absence of reversing alarm vi) Absence of fog light (at winter) vii) Power / hand brakes not in working condition.	L2	Rs 25000 per single violation Compounded to a maximum of Rs 100000 at any single instance
		Splashing of Bentonite on roads / non-cleaning of tyres of dumpers and transit mixers (Clause 17.11 & 17.14) i) Mishandling of bentonite like splashing of bentonite outside specified width of barricading, ii) Non-cleaning of tyres of dumpers and transit mixers before leaving the site and thereby creating a traffic safety hazard to road users.	L2	a) Rs 100000 on first observation. b) Rs 200000 on second observation. c) Rs.300000 on third and subsequent observations

24.	Batching plant / Casting yard	Non-adherence of any of the provisions mentioned in Clause 38.0.	L2	Rs 10000 for single violation compounded to a maximum of Rs 100000 at any single instant.
25.	PPE (Personal Protective Equipment)	Not having (Clause 39.1)	L2→L3	L2-Rs 200 per single violation. L3-Rs 400 per single violation.
		Not wearing (or) using and kept it elsewhere (Clause 39.1)		
		Using damaged one (Clause 39.2)		
		Using wrong type (Clause 39.5)		
		Using wrong colour helmet or helmet without logo (Clause 39.4.1)	L1→L2	
		Using for other operation (e.g. Using safety helmet for storing materials or carrying water from one place to other) (Clause 39.5)	L2→L3	L2-Rs 10000 for first violation and Rs 50000 for subsequent violations. L3-Rs 100000 for first violation and Rs 200000 for subsequent violations
		Not conforming to BIS standard (Clause 39.2)		
Non-compliance of Clause 39.6, 39.7 and 39.8		L2-Rs 50000 for first violation and Rs 100000 for subsequent violations. L3-Rs 100000 for first violation and Rs 200000 for subsequent violations.		
26.	Occupational Health	Fail to conduct Medical examination to workers (Clause 42.1)	L1→L2	L1-Rs 10000 per single violation Compounded to a maximum of Rs 100000 at any single instance. L2-Rs 20000 per single violation
		Absence of ambulance van & room (Clause 42.3)		
		Workers not having ID card (Clause 8.2)		

		Absence of first-aid person in work site (Clause 42.4)	L2→L3	Compounded to a maximum of Rs 200000 at any single instance. L3-Rs 30000 per single violation Compounded to a maximum of Rs 300000 at any single instance.
		Absence or inadequacy of first-aid box (Clause 42.4)		
		Misuse of first-aid box (Clause 42.4)	L1→L2	
		First-aid box not satisfy the minimum Indian standard. (Clause 42.4)		
		Smoking inside the construction site (Clause 42.7.2)		
		Drink and drive or work (Clause 42.7.1)		
		Fumigation / insecticides not sprayed to prevent Mosquito breeding (Clause 42.6.3)		
		Non-compliance of Clause 44.1 and 44.2		
27.	Labour Welfare measures	Inadequate number of toilets (Clause 46.1.1)	L1→L2	L1-Rs 10000 per single violation Compounded to a maximum of Rs 50000 at any single instance. L2-Rs 20000 per single violation Compounded to a maximum of Rs 100000 at any single instance.
Toilets not cleaned properly (Clause 46.1.3)				
Toilet placed more than 500m from the work site (Clause 46.1.3)				
Absence of water facilities for toilets and washing places (Clause 46.1.3)				
Accommodation not provided as per BOCWA (Clause 46.5.1))				
Absence of drinking water (Clause 46.4)				
Excessive noise and vibration (Clause 43.0)				
Canteen not provided (Clause 46.2)				
Food stuff not served on no loss no profit basis (Clause 46.3)				

		Creche not provided (Clause 46.6)		
		Non-adherence of Labour welfare provisions of BOCWA (Clause 3.3.1.2)		
		Fail to register establishment and display the registration certificate at workplace (Clause 3.3.1.2)		
		Absence of workers register and records (Clause 3.3.1.2)		
		Absence of muster roll and wages register (Clause 3.3.1.2)		
		Fail to display an abstract of BOCWA and BOCWR (Clause 3.3.1.2)		
28.	Environmental Management	Tyre wash facility not provided (Clause 47.12)	L1→L2	L1-Rs 10000 per single violation Compounded to a maximum of Rs 50000 at any single instance.
		Spillage from vehicles not arrest (Clause 48.9)		
		Air monitoring not practiced (Clause 47.17)		L2-Rs 20000 per single violation
		The values of air monitoring not within acceptable limits (Clause 47.17, 43.2.1)		Compounded to a maximum of Rs 100000 at any single instance.
		Dust control measures at sites not practiced (Clause 47.13)		
		Improper disposal of debris / residues		
		Non-compliance of Clause 53.0 & 54.0		

- e. Without limiting to the unsafe acts and or conditions mentioned above in Clause 56.3 the Employer shall have the right to deduct charges for any other unsafe act and or condition depending upon the gravity of the situation on a case-to-case basis. The charges shall be in comparison with that of the similar offence indicated in Clause 56.3.
- f. Non-conformities detected during inspections carried out by the Engineer are subject to a process adapted to the severity of the situation. Non-conformities are divided into 4 categories as follows:

- i. Notification of observation of minor non-conformities. The non-conformity results in a notification to the on-site Contractor's representative, followed-up by a signed notification of observation prepared by the Engineer. The multiplication of notifications of observation at the Worksite, or absence of corrective actions by the Contractor, can result in the severity of the non-conformity being raised to that of level 1.
- ii. Level 1 non-conformity: Non-conformities that do not represent a serious immediate risk for health and environment. The non-conformity is the subject of a report addressed to the Contractor and which shall be resolved within five (5) days. The Contractor addresses to the Engineer a report explaining how the non-conformity has been corrected. Further to an inspection and a favourable evaluation of effectiveness of the corrective action, the Engineer signs a close-out report for the non-conformity. In all cases where a non-conformity of level 1 is not resolved within one (1) month, the severity of the non-conformity is raised to level 2.
- iii. Level 2 non-conformities: applies to all non-conformities that have resulted in damage to health or the environment or which represent a high risk to health and the environment. The same procedure as for level 1 non-conformities is applied. Corrective action shall be taken by the Contractor within three (3) days. The Contractor addresses a report explaining the corrective actions implemented. All level 2 non-conformities which are not resolved within one (1) month, are raised to level 3.
- iv. Level 3 non-conformities: applies to all non-conformities that represent a risk with major consequences to health and the environment. The highest levels of the Contractor's and Engineer's hierarchies present in the Employer's country are informed immediately and the Contractor has twenty-four (24) hours to bring the situation under control. Clause 14.7 of the Particular Conditions of Contract (PC), a level 3 non-conformity results in the suspension of interim payments until the non-conformity has been resolved. If the situation requires, and in pursuance to Clause 8.8 of the PC, the Engineer can order the suspension of work until the resolution of the non-conformity.

65. STOPPAGE OF WORK


- g. The Employer shall have the right to stop the work at his sole discretion, if in his opinion the work is being carried out in such a way that it may cause accidents and endanger the safety of the persons and / or property, and / or equipment's. In such cases, the Contractor shall be informed in writing about the nature of hazards and possible injury / accident.
- h. The Contractor shall not proceed with the work until he has complied with each direction to the satisfaction of Employer.
- i. The Contractor shall not be entitled for any damages / compensation for stoppage of work, due to safety reasons and the period of such stoppage of work shall not be taken as an extension of time for Completion of the Facilities and will not be the ground for waiver of levy of liquidated damages.

66. AWARDS

The following categories will be considered for awards as per the scheme in practice of Employer:

- (i) For every safe million-man hour working without any reportable incidents
- (ii) Zero fatality contracts
- (iii) 100% adherence to voluntary reporting of all accidents throughout the currency of contract

- (iv) Safest project team of the year.
- (v) Best SHE team of the year.
- (vi) Safest Contractor of the year.

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
A. APPENDIX NO.: 1	

A.1 Memorandum of Understanding between Maharashtra Metro Rail Corporation Limited and the Contractor for safe execution of contract work

This Memorandum of Understanding is made and executed by and between **MAHARASHTRA METRO RAIL CORPORATION LIMITED (MAHA-METRO)**, a Company registered under the Companies Act 1956 & having its registered office at XXXX or their authorized representative(s), hereinafter referred to as “**EMPLOYER**” (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the one party

AND

M/s _____ having its registered office at _____ hereinafter referred to as the “**CONTRACTOR**” (which expression shall wherever the context so requires or admits be deemed to mean and include its successors in business and assigns) of the other party

WITNESSETH THAT

WHEREAS the EMPLOYER gives highest importance to the occupational safety, health and environment during execution of work, seeks cooperation from the CONTRACTOR in this endeavour.

Thus, this Memorandum of Understanding is for promoting the safety, health and environment aspects required to be followed at workplace/site and will be applicable to any site job to be done by the CONTRACTOR

AND

WHEREAS the CONTRACTOR has read all the terms and conditions of the EMPLOYER and whereas the CONTRACTOR has studied the following documents:

- (i) Tender Documents, including Notice Inviting Tender, General Conditions, Special Conditions;
- (ii) Conditions of Contract on Safety, Health and Environment and Project Safety, Health and Environment Manual;
- (iii) Building and Other Construction Workers (Regulations of Employment and Conditions of Service) Act 1996, Central Rules 1998 and subsequent Maharashtra BOCW Rules 2003, Building and Other Construction Workers Welfare Cess Act 1996 and Rules 1998 and notification [Central & State] Collection of cess.
- (iv) Indian Electricity Act 2003 and Rules 1956;
- (v) Corresponding International / Bureau of Indian Standard Codes.

Including the amendments to any of the above rules and any other rules & regulations or procedures, circulars, notices & advices laid down by the EMPLOYER from time to time.

Now it is hereby AGREED AND DECLARED by and between the EMPLOYER and the CONTRACTOR as follows:

- Clause - I The CONTRACTOR shall abide by the terms and conditions stipulated in Condition of Contract on Safety, Health & Environment and Project Safety, Health & Environment Manual.
- Clause - II The CONTRACTOR shall undertake full responsibility for safe execution of job at work place/site and safety of his personnel and adjoining road users during work.
- Clause - III Without giving any prior notice, the EMPLOYER shall from time to time be entitled to add/or amend any or all terms and conditions with a view to improving safety and occupational health of personnel and safety of work, with immediate effect and the same shall be binding on the CONTRACTOR. The Contractor agrees to implement all such amendments, which shall be laid down by the EMPLOYER.
- Clause - IV Besides following the guidelines, safety rules and regulations, safety codes given in various safety procedures/documents mentioned above, the CONTRACTOR shall also prepare detailed method statement which includes job safety analysis wherever there are complicated and hazardous/high risk working involved and get it approved from Employer before execution of work.
- Clause - V Any negligence or violation in implementing any of the provision of the conditions of contract on Safety, Health & Environment and Maharashtra Metro Rail Corporation Limited Safety, Health & Environment Manual shall be viewed seriously, and the Contractor is liable to compensate the Employer for the loss of reputation. The cost of damage shall be fixed on case-to-case basis.

In witness thereof, the Parties hereto by representatives duly authorised have executed this Memorandum of Understanding on _____ day of _____ 20____.

Signed on

Signed on

For and on behalf of Maharashtra Metro Rail Corporation Limited

For and on behalf of (Contractor)

Signature:


Signature:

Name:

Name:

Title:

Title:

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
B. APPENDIX NO.: 2	

B.1 Safety, Welfare and Occupational Health requirements as per BOCW Act 1996 and Rules 1998 and Maharashtra BOCW Rules 2003

(This list has been prepared in chronological order with primary importance to Section of Act and secondary importance to Rules)


- S - Refers relevant Sections in BOCWA
 R - Refers relevant Rules in BOCWR
 C - Refers relevant Chapter No. in BOCWR
 P - Refers to relevant rules in BOCWWCR 1998
 G - Refers to relevant rules in Maharashtra BOCWR 2003

SN	Items	Relevant Sections / Rules in BOCWA and MBOCWR 2003
1.	Registration of establishment	S - 7, R - 23 to 27
2.	Display of registration certification at workplace	R - 26 (5)
3.	Hours of work	S - 28 R - 234 to 237
4.	Register of overtime	S - 28; S - 29 R - 241(1) Form XXII
5.	Weekly rest and payment at rest	R - 235
6.	Night shift	R - 236
7.	Maintenance of workers registers and records	S - 30 R - 238
8.	Notice of commencement and completion	S - 46 R - 239
9.	Register of persons employed as building workers	R - 240
10.	Muster roll and wages register	R - 241(1) (a); Form XVI and XVII
11.	Payment of wages	R - 248
12.	Display of notice of wages regarding	R - 249
13.	Register of damage or loss	R - 241(1)(a); Form XIX, XX, XXI
14.	Issue of wages book	R - 241(2)(a); Form XXIII
15.	Service certificate for each worker	R - 241(2)(b); Form XXIV

SN	Items	Relevant Sections / Rules in BOCWA and MBOCWR 2003
16.	Display an abstract of BOCWA and BOCWR	R - 241(5)
17.	Deduction of welfare cess by the government agencies	P - 4(3)
18.	Annual return	R - 242; Form XXV
19.	Drinking water	S - 32
20.	Latrines and Urinals	S - 33 R - 243
21.	Accommodation	S - 34
22.	Creches	S - 35
23.	First-aid boxes	S - 36 R - 231 and Schedule III
24.	Canteens	S - 37 R - 244
25.	Food stuff and other items served in the canteens	R - 245
26.	Supply of tea and snacks in work place	R - 246
27.	Food charges on no loss no profit basis	R - 247
28.	GBOCWR 2003 welfare Board Rules	
29.	Safety committee	S - 38 R - 208
30.	Safety officer	S - 38 R - 209 and Schedule VII
31.	Reporting of accidents and dangerous occurrences	S - 39 R - 210
32.	Procedure for inquiry in to the causes of accidents	R - 211
33.	Responsibility of employer	S - 44 R - 5
34.	Responsibility of Architects, Project engineer & Designers	R - 6
35.	Responsibility of workmen	R - 8
36.	Responsibility for payment of wages and compensation	S - 45
37.	Penalties and Procedures	S - 47; S - 55
38.	Excessive noise, vibration etc	R - 34
39.	Fire Protection	R - 35
40.	Emergency action plan	R - 36
41.	Fencing of motors	R - 37
42.	Lifting of carrying of excessive weight	R - 38
43.	Health, Safety and Environmental Policy	R - 39
44.	Dangerous and Harmful Environment	R - 40

SN	Items	Relevant Sections / Rules in BOCWA and MBOCWR 2003
45.	Overhead protection	R - 41
46.	Slipping, Tripping, Cutting, Drowning and Falling Hazards	R - 42
47.	Dust, Gases, Fumes, etc	R - 43
48.	Corrosive substance	R - 49
49.	Eye Protection	R - 45
50.	Head Protection and other protection apparel	R - 46; R - 54
51.	Electrical Hazards	R - 47
52.	Vehicular traffic	R - 48
53.	Stability of structure	R - 49
54.	Illumination	R - 50; R - 124
55.	Stacking of materials	R - 51
56.	Disposal of debris	R - 52
57.	Numbering and marking of floors	R - 53
58.	Lifting appliances and gears	C - VII; R - 55 to 81
59.	Runways and Ramps	C - VIII; R - 82 to 85
60.	Working on or adjacent to water	C - IX; R - 86 & 87
61.	Transport and earthmoving equipment's	C - X; R - 88 to 95
62.	Concrete work	C - XI; R - 96 to 107
63.	Demolition	C - XII; R - 108 to 118
64.	Excavation works	C - XIII; R - 119 to 168
65.	Ventilation	R - 153
66.	Construction, repair and maintenance of step roof	C - XIV; R - 169 to 171
67.	Ladders and Step ladders	C - XV; R - 172 to 174
68.	Catch platform & hoardings, chutes, safety belts and nets	C - XVI; R - 175 to 180
69.	Structural frame and formworks	C - XVII; R - 181 to 185
70.	Stacking and unstacking	C - XVIII; R - 186 & 187
71.	Scaffold	C - XIX; R - 188 to 205
72.	Cofferdams and Caissons	C - XX; R - 206 to 211
73.	Explosives	C - XXI; R - 212 & 213
74.	Piling	C - XXII; R - 214 to 222
75.	Medical Examination for building & other construction worker, Crane operator a Transport vehicle driver	R - 81; R - 223(a)(iii) and Schedule XII
76.	Medical examination for occupational health hazards	R - 223(a)(iv)
77.	Charging of workers for Medical Examination	R - 223(b)

SN	Items	Relevant Sections / Rules in BOCWA and MBOCWR 2003
78.	Occupational health centres and Medical officers	R - 225 and Schedule X &XI
79.	Ambulance van & room	R - 226 & 227 and Schedule IV & V
80.	Stretchers	R - 228
81.	Occupational health service for building workers	R - 229
82.	Medical examination for occupational health hazards	R - 223(a)(iv)
83.	Emergency care services and emergency treatment	R - 232
84.	Panel of experts and agencies	Central Rule 250
85.	Power of inspectors	Central rule 251 Maharashtra State Rules


	MAHARASHTRA METRO RAIL CORPORATION LIMITED
C. APPENDIX NO.: 3	

C.1 SITE SHE PLAN

Contract No	
Contractor Name	
Project Name	

1.	Project Highlights i) Title of the content ii) Contractor Number iii) Brief scope of work iv) Location map/ key plan v) Period of the project
2.	SHE Policy
3.	Site Organisation Chart Chart indicating reporting of SHE personnel
4.	Roles & Responsibility Individual responsibility of the: i) Project Manager ii) Construction Manager iii) Construction Supervisors iv) SHE Committee Members v) SHE In charge vi) Site Engineers vii) First Line Supervisors viii) Sub-contractors
5.	SHE Committee i) Details - Chairman, Members, Secretary and Employer's representative ii) Procedures for effective conduct of meeting
6.	SHE Training

7.	Subcontractor Evaluation, Selection and Control
8.	SHE Inspection
9.	SHE Audit
10.	Accident Investigation And Reporting Procedures
11.	Occupational Health Measures
12.	Labour Welfare Measures
13.	Risk assessment and mitigation procedures
14.	Safe Work Procedures <ul style="list-style-type: none"> i) Work at Height ii) Structural Steel Erection iii) Launching of segments iv) Floor, Wall Openings and Stairways v) Welding, Cutting and Bracing vi) Lifting appliances vii) Work Permit Systems viii) Electrical Equipment's ix) Mechanical Equipment's x) Excavation xi) Fire Prevention xii) Hazardous Chemicals and Solvents xiii) Ionising Radiation xiv) Lighting xv) Abrasive Blasting
15.	Work Permit System
16.	List of standard job specific PPEs to be used in the site
17.	Maintenance of Regime for construction Equipment and Machinery
18.	Traffic management
19.	Housekeeping
20.	Environmental Management
21.	Emergency Management
22.	Visitors and Security arrangement

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
D. APPENDIX NO.: 4	


**D.1 WORKPLACE POLICY ON HIV/AIDS PREVENTION & CONTROL FOR
WORKMEN ENGAGED BY CONTRACTORS**

“Being mobile in and of itself is not a risk factor for HIV infection. It is the situations encountered and the behaviours possibly engaged in during mobility or migration that increase vulnerability and risk regarding HIV / AIDS.”

UNAIDS, Technical update on ‘Population, Mobility and AIDS’, February 2001, p.5

Maharashtra Metro Rail Corporation Limited recognizes HIV / AIDS as a developmental challenge and realizes the need to respond to it by implementing regular HIV / AIDS prevention programmes and creating a non-discriminatory work environment for HIV infected workmen engaged by contractors. For the purpose, of making conscientious, sensitive and compassionate decision in addressing the realities of HIV / AIDS, Maharashtra Metro Rail Corporation Limited has established these guidelines based on ILO code of practice on HIV / AIDS.

- Creating awareness through professional agency using IEC (Information, Education and Communication) package specially designed for migrant workers.
- Institutional capacity building by training the project implementation team, Safety, Health & Environment (SHE) Managers, establishing linkages for efficient diagnosis and treatment of the affected workers, effective monitoring of implementation and documentation for further learning.
- Establishing peer educators by selecting them in consultation with Contractors and training them through professional agencies so that they become focal point for any information, education and awareness campaigns among the workmen throughout the contract period.
- Promotion of social marketing of condoms through State Aids Control Society

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
E. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/001	

E.1 MINIMUM MANPOWER REQUIREMENTS OF SHE ORGANIZATION BASED ON CONTRACT VALUE

	1	2	3	4	5	6	7	8	9	10	11	12	13	
Awarded Contract value (in Rs Cr.)	Chief SHE Manager	Senior SHE Manager	Junior SHE Manager	Safety Steward	Senior SHE (Electrical) Engineer	Junior SHE (Electrical) Engineer	* Junior SHE (Fire) Manager / **Senior SHE (Fire) Engineer	Occupational Health officer with Necessary Nursing	Environmental Manager	Senior SHE (Traffic) Engineer Refer Note 4)	Barricade Maintenance Squad Refer Note 4)	House Keeping Squad	Labour Welfare Officer	
Upto 2	-	-	1	Refer Note 1	-	1	-	-	-	-	Refer Note 5	Refer Note 6	-	
Upto 10	-	1	Refer Note 1		1	Refer Note 2	-	1 (PT)	1	1			1	1
Upto 25	1	Refer Note 1			1		1*	1 (PT)	1	1			1	1
Upto 100	1				1		1*	1 (FT)	1	1			1	1
Upto 250	1				1		1**	2 (FT)	1	1			1 with support staff	1
More than 250	1	Refer Note 1	Refer Note 1	Refer Note 1	1	Refer Note 2	2**	2 (FT)	1 with support staff	1	Refer Note 5	Refer Note 6	1 with support staff	

Note 1: Adequate, qualified and trained SHE Professionals with required support staff to be deployed at each worksite at each shift.

Note 2: Adequate, qualified and trained Electrical Engineers / supervisors to be deployed at each worksite at each shift.

Note 3: (PT) means Part-Time and (FT) means Full-time.


Note 4: Senior SHE (Traffic) Engineer Post & Barricade Manager (including the staff) Posts are applicable to contracts where the work has to be executed either below or over the

right-of-way like Viaduct Contracts wherein erection and maintenance of barricades are paramount important.

Note 5: One Barricade Manager supported by required supervisors and workmen.

Note 6: One Housekeeping Manager supported by required supervisors and workmen.

Note 7: The Contractor appoints a person responsible for relations with external stakeholders for the site: local communities, administrative authorities, and representatives of economic activities located within one-hour travel from the Worksite. This person will be based on the Worksite on a permanent basis. Administrations and local authorities will be informed of the existence of this person as of the start of works and will be provided with telephone contact details so as to be able to contact this person if a problem arises during the execution of works or concerning the behaviour of the Contractor's employees outside the Worksite.

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
F. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/002	

F.1 MINIMUM QUALIFICATION AND EXPERIENCE FOR (SHE) SAFETY, ELECTRICAL, ENVIRONMENTAL, TRAFFIC ENGG. AND OCCUPATIONAL HEALTH PROFESSIONALS

SN	Designation	Qualification	Experience (in years)
1	Chief SHE Manager	<p>The Chief SHE Manager shall have qualified in any of the following degree/diploma:</p> <ul style="list-style-type: none"> i) Post Graduate Diploma in Industrial Safety & Environmental Management (PGDISEM) from National Institute of Industrial Engineering, Mumbai ii) M.E.in Industrial Safety from NIT, Trichy, Tamil Nadu iii) M.E. in Industrial Safety from MepcoSchlenk Engineering College, Sivakasi, Tamil Nadu iv) B.E. in Fire and Safety Engg. From Cochin University of Science and Engg. Cochin, Kerala v) B.E. with advanced Safety Management Diploma from CLI/RLI Mumbai/Chennai/Kolkata and Kanpur. vi) B.E / B.Arch., with one year <u>Full Time</u> advanced Safety diploma from NICMAR, Hyderabad. vii) B.E / B.Tech with any other equivalent State and Central Govt. recognized full time Degree / Diploma in Safety. viii) International qualifications like CSP (Certified Safety Professional), NEBOSH, MIOSH, MSISO etc. 	2 {for all category except (iv) and 5yrs for category (iv)}
2	Senior SHE Manager	As stated in SN1 & in addition the following categories:	2 {for category (i), (ii) and (iii) only}

SN	Designation	Qualification	Experience (in years)
		i) B.Sc.(Physics/Chemistry/Maths) with one year Full Time advanced Safety diploma from NICMAR, Hyderabad ii) B.Sc. / Diploma in Engg with advanced Safety Management Diploma from CLI / RLI / Mumbai / Chennai / Kolkata and Kanpur. iii) B.Sc. (Physics/Chemistry/Maths) with One year Full Time diploma in Safety Engineering offered by West Bengal State Technical Education Departments and similar courses by other states. iv) Any Graduate or diploma holder with 7 years of work experience in full fledged SHE department of any Public Sector/Leading Private Sector/MNC/with prior approval of employer on a case to case basis	
3	Junior SHE Manager	i) Degree in Science/Diploma in Engineering with Govt. recognized safety diplomas from Correspondence course of NICMAR, Annamalai University, National & State Productivity Councils, Other State Technical Education Boards etc. ii) Any Graduate or diploma holder with 5 years of work experience in full fledged SHE department of any Public Sector / Leading Private Sector / MNC / with prior approval of employer on a case to case basis	2 (for category (i) only)
4	Safety Steward	Any basic qualification with any SHE related certificate courses.	2
5	Senior SHE (Electrical) Manager	Degree in Electrical Engineering + Govt. recognized Electrical Licence holder	2
6	Junior SHE (Electrical) Manager	Diploma in Electrical Engineering + Govt. recognized Electrical Licence holder	1
7	Senior SHE (Fire) Manager	i) B.E. (Fire) from National Fire Service College, Pune ii) B.E (Fire & Safety) from Cochin University iii) Graduate with any Govt. recognized diploma in Fire Safety with 5 years of experience	2 (for category (i) and (ii) only)


SN	Designation	Qualification	Experience (in years)
8	Junior SHE (Fire)Manager	Any Diploma holder with any Govt. recognized diploma in Industrial Fire Safety.	1
9	Occupational Health Officer	MBBS with Govt. recognized degree/diploma in Industrial/ occupational health	1
10	Environment Manager	Govt. recognized PG Degree / PG Diploma / Degree in Environmental Engineering / Science	2
11	Senior SHE (Traffic) Engineer	Govt. recognized PG Degree / Degree / Diploma in Traffic/Transportation Engineering or Planning	1
12.	House Keeping Squad - Manager	Any Diploma in Engineering	1
13	Barricade Manager	Any Diploma in Engineering	1
14	Labour Welfare Officer	Any Degree with Govt. Recognized Degree / Diploma / P G Diploma in Labour Welfare related fields like Law, Personnel / Industrial Relations etc.	2

Note 1: In some extraordinary cases where the candidate had earlier worked in any metro projects in India, they can be considered for the following posts:

- Senior SHE Manager
- Junior SHE Manager
- Safety Steward

depending upon the qualification and number of years of experience on a case-to-case basis even if they do not possess the prescribed qualification as listed above.

Note 2: In all other cases other than listed under Note 1 irrespective their earlier experience with metro projects in India the candidates shall qualify as specified above.

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
G. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/003	

G.1 MINIMUM REQUIREMENTS OF SHE MONITORING AND AUDIO-VISUAL EQUIPMENTS

- For the purpose of minimum requirements of Audio-visual and Other equipment the contracts are categorized into the following groups:


Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

- Every contractor falling into the above groups shall provide the following minimum required audio-visual aids for conducting weekly review, monthly safety committee and other post review meeting of all fatal and major incidences effectively. These audio-visual equipment's are a must for conducting periodical in-house safety presentations in the training programmes.
- In addition to the above portable hand held digital sound level meter (SLM) and portable hand held digital lux meter are also to be provided.

SN	SHE monitoring and Audio-Visual Equipment details	SHE monitoring and Audio-Visual equipment required for			
		Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Portable hand held Digital Sound Level Meter (SLM) Noise Monitoring deleted	1	1	1	1
2.	Portable hand held Digital Lux Meter	1	1	1	1

SN	SHE monitoring and Audio-Visual Equipment details	SHE monitoring and Audio-Visual equipment required for			
		Group A Contract	Group B Contract	Group C Contract	Group D Contract
3.	Laptop Computer with standard configuration including multimedia facilities	1	1	1	1
4.	Colour Printer	1	1	1	1
5.	Computer projector with screen	-	1	1	1
6.	Overhead projector	1			
7.	35mm Camera (For taking accident investigation photos in which case the images cannot be easily altered)	1	1	1	1
8.	Digital camera with flash of minimum 4 mega pixel and video facility	1	1	1	2
9.	Digital still camera with flash of minimum 4 mega pixels	1	2	4	6
10.	Portable loudspeaker (for tool-box talk and emergency purpose)	1	1	2	6
11.	Communication facility like mobile phone, walky-talky etc	For all supervisors and managers/engineers working in Safety, Health & Environment			
12.	Accident investigation Kit containing the following:	1	1	1	2
a)	Chalk piece for marking				
b)	Measuring tape for measuring Flexible tape - 2m length Metal Foot long scale and Metal tape - 30m				
c)	Equipment tags				
d)	Multipurpose Flash light				
e)	Barrier tape of 20m length				
f)	Accident investigation Forms and checklists				

SN	SHE monitoring and Audio-Visual Equipment details	SHE monitoring and Audio-Visual equipment required for			
		Group A Contract	Group B Contract	Group C Contract	Group D Contract
g)	Enough Paper for witness recording and other noting				
h)	Emergency Phone Numbers list				

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
H. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/004	

H.1 Topics for First day at work SHE orientation training of Workmen

1. Hazard Identification Procedure

Hazards on site:

- Falls
- Earthing work
- Electricity
- Machinery
- Handling materials
- Transport
- Site housekeeping
- Fire

2. Personal Protective Equipment

- What is available?
- How to obtain it?
- Correct use and care

3. Health


- Site welfare facilities
- Potential health hazards
- First Aid/Cardio-Pulmonary Resuscitation (CPR)

4. Duties of the Contractor

- Brief outline of the responsibilities of the Contractor by law
- Details of Contractor's accident prevention policy
- **Maharashtra Metro Rail Corporation Limited's SHE manual**
- Building and other Constructions Welfare Law

5. Employee's Duties

- Brief outline of responsibilities of employee under law
- Explanation of how new employees fit into the Contractor's plan for accident prevention. (Induction and orientation).

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
I. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/005	

I.1 ID Card Format

(85 mm x 55mm)

Front side of ID card:

Pune Metro Rail Project

Name & Address of Main / Sub / Labour contractor

Name:

Designation:

Blood Group:

Valid up to:

Photo

Authorised Signatory

Backside of ID card:


Employee Address: _____

1 This card is the property of "XX"(Main / Sub / Labour Contractor) and must be returned on demand and on transfer / cancellation of employment.

2 A charge will be levied for replacement of the card due to loss or theft

3 If found please return it to:

Main contractors' Address


	MAHARASHTRA METRO RAIL CORPORATION LIMITED
J. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/006	

J.1 SHE Training details for Managers and Supervisors

1. The Law and Safety	2. Policy and Administration
Statutory requirement Appropriate regulations Duties of employer and employee	Effect of incentive on accident prevention Human relations Consultation Safety Officer: duties, aims, objectives
3. Safety and the Supervisor	4. Principles of Accident Prevention
Safety and efficient production go together Accidents affect morale and public relations	Attitudes of management, supervision and operations Methods of achieving safe operations Accident and injury causes
5. Site Inspection	6. Human Behaviour
The role of management Hazard Identification Procedure Records results Follow-up procedures Feedback	Motivating agencies Individual behaviour Environmental effects Techniques of persuasion
7. Site housekeeping	8. Health
Site organization Relationship of site housekeeping to accident occurrence Site access Equipment storage Material stacking	Medical examination Hazard to health on site Sanitation and welfare Protective clothing First Aid/CPR

Materials handling	
9. Personal Protective Equipment	10. Electricity
Eye, face, hands, feet and legs Respiratory protective equipment Protection against ionizing radiation	Appreciation of electrical hazards Power tools Arc welding Low voltage system Lighting and power system on sites ELCB, RRCB, Grounding/Ground fault circuit interrupters (GFCIs)
11. Oxygen and Acetylene Equipment	12. Equipment
Cylinder storage and maintenance Condition and maintenance of valves, regulators, and gauges Condition and maintenance of hoses and fittings Pressures	Accidents related to moving parts of machinery Appreciation of principles of guarding Importance of regular maintenance
13. Transportation	14. Excavations
Transport to and from site Hazard connected with site transport Competent drivers Dumpers Tipping trucks Movement near excavations	Method of shoring Precautions while shoring Precautions at edge of excavations Removal of shoring Sheet steel piling
15. Working platforms, Ladders, and Scaffolding	16. Cranes and other Lifting Machines
Hazards connected with the use of ladders Maintenance and inspection Type of scaffold Overloading Work on roofs Fragile material Openings in walls and floors	Licensing, certification and training required for operation of cranes Slings methods Signalling Access to crane(s) Maintenance and examination Ground conditions

Use of safety belts and nets	Hazards and accident prevention methods connected with the use of different types of cranes/heavy equipment
	Crane Lift Plan for all lifts
17. Lifting Tackle	18. Fire Prevention and Control
Slings - single and multi-legged Safe working loads (SWLs) Safety hooks and eyebolts Cause of failure Maintenance and examination	Principle causes determining fire Understanding fire chemistry Fire fighting equipment Fire fighting training
19. Communications	20. Manual Handling
Effective methods of communication (particular interest to non-English speaking workers) Method and preparation of reports Safety committees Safety meeting	Body posture and procedure for lifting, pushing, pulling, dragging, sitting and walking Ergonomics Stretching exercises


 MAHARASHTRA METRO RAIL CORPORATION LIMITED
K. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/007

K.1 SHE Training Matrix

Types of training	Management														Supervisor						Specific																									
	SHE Orientation	SHE Leadership	SHE Plan	SHE Improvement Plan	Management of Change	SHE Audit & Inspection	SHE Emergency Response & Preparedness	Incident/Accident Investigation & Reporting	SHE Communication	SHE Promotion & Incentives	Traffic Management	Hazard Identification & Risk Analysis	Permit to work system	Confined space entry	Scaffolding	Waste Management	Environment Monitoring	Labour welfare measures	Behavioural Based Safety	Job/Task Safety Analysis (JSA)	Safety Training Observation	Industrial First Aid & CPR	Incident / Accident Investigation & Fire fighting	Confined Space Testing & Inspection	Scaffold Erection & Inspection	Rigging	Wire Rope Inspection	Crane Inspection	Electrical / Mechanical Isolation	Permit to Work System	Confined Space Working	Explosive Handling & Control	Heavy Lifting Operation	Radiography (X-Ray)	HAZMAT Handling & Control	Welding, Cutting & Bracing	Power Actuated Hand Tool	Electrical/Mechanical Isolation	Roofing Work	Steel erection work	Scaffold Erection/Dismantling	False-work Erection / Dismantling	Painting in Confined Area			
Project Manager	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•																								
Sr. Construction Managers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•								•																		
Quality Manager	•	•	•	•	•	•	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Planning engineer	•	•	•		•	•	•	•	•			•	•	•	•							•	•	•	•	•																				
Construction Managers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Construction Supervisors	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Construction Foreman	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Machinery Operators	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Material Handlers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Station Building Workers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Steel workers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Mechanical workers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Other Civil workers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Electrical workers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Radiographers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Transportation Drivers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Security Officers	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Clerical Staff	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Medical Doctor	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•


[illegible]

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
L. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/008	

L.1 DAYS TO BE OBSERVED FOR CREATING SHE AWARENESS

1 st Monday to Sunday of January	Road Safety Week (Subjected to confirmation from Ministry of Road Transport, Govt. of India every year.)
16 th February	Kyoto Protocol Day
March	Red Cross Month
4 th March	National Safety Day
7 th April	World Health Day
14 th April	Fire Safety Day
April 18 to 22	Earth Week
20 th April	Earth Day
20 th April	Noise Awareness Day
28 th April	ILO World Day for Safety and Health at Work
May 1 to 7	Emergency Preparedness Week

5 th June	World Environmental Day
12 th June	World Day against Child Labours
9 th July	Occupational Health Day
17 th October	World Trauma Day
1 st December	World AIDS Day

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
M. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/009	

M.1 Minimum Requirements of SHE Communication Posters / Signages / Video

1. For the purpose of Minimum requirements of SHE Communication Posters / Signages / Video the contracts are categorized into the following groups:

Contract Value (Initial awarded value of contract)	Group
Upto 25 Cr	A
Upto 100 Cr	B
Upto 250 Cr	C
More than 250 Cr	D

2. Every contractor falling into the above groups shall prepare a SHE Communication Plan as a part of site specific SHE Plan and shall include the following minimum requirement of Posters / Signage's / Video as applicable. In case readymade posters are available in any of the category from National Safety Council, Loss Prevention Association of India or any other safety related organisations they may procure the same and display it. In case the same is not available then the contractors shall make necessary arrangements to get the posters designed and printed on their own.

All the above are to be detailed in the Site SHE Plan and get an approval from the Employer before displaying the posters.

Table 1: Minimum number of Posters

SN	SHE Poster Title	Min No. of concepts in each title	No. of Posters / Signage / Video			
			Group A Contract	Group B Contract	Group C Contract	Group D Contract
1.	Safety Culture	5	Each 10	Each 50	Each 75	Each 100
2.	Daily Safety Oath	1 English, 1 Hindi	Each 100	Each 200	Each 500	Each 1000
3.	Mandatory PPE Usage					
a)	Signages to display the messages like PPE ZONE, NO PPE ZONE, HARD HAT AREA etc.	2 types of sizes made up of metal sheet to be mounted at different locations	Each 25	Each 50	Each 75	Each 200
b)	Helmet	5	Each 25	Each 50	Each 75	Each 200
c)	Shoe	5	Each 25	Each 50	Each 75	Each 200
d)	Goggles & Ear Protection	5	Each 25	Each 50	Each 75	Each 200
e)	Full Body Harness	5	Each 25	Each 50	Each 75	Each 200
f)	Hi-Vi Jacket	5	Each 25	Each 50	Each 75	Each 200
4.	Emergency Management Plan	5	Each 25	Each 50	Each 75	Each 200
5.	Working at Heights	10	Each 25	Each 50	Each 75	Each 200
a)	Ladder, Stairway, Scaffold - Signages to display the messages like SAFE, UNSAFE, FIT FOR USE, AVOID USE etc.	5 types of sizes made up of metal sheet to be mounted at	Each 25	Each 50	Each 75	Each 200

SN	SHE Poster Title	Min No. of concepts in each title	No. of Posters / Signage / Video			
			Group A Contract	Group B Contract	Group C Contract	Group D Contract
		different locations				
6.	Site Electricity	5	Each 25	Each 50	Each 75	Each 200
7.	Fire and Explosion	5	Each 25	Each 50	Each 75	Each 200
8.	Crane Safety	5	Each 25	Each 50	Each 75	Each 200
9.	Slings	5	Each 25	Each 50	Each 75	Each 200
10.	Rigging Procedures	5	Each 25	Each 50	Each 75	Each 200
11.	Excavation	5	Each 25	Each 50	Each 75	Each 200
12.	Occupational Health (Mosquito Control, HIV/AIDS awareness, Dust Control, Noise Control, No Smoking/Spitting, etc.)	10	Each 25	Each 50	Each 75	Each 200
13.	First - Aid	3	Each 25	Each 50	Each 75	Each 200
14.	Labour Welfare Measures (Payment of Minimum Wages, Avoidance of Child labour, signing in the Muster Roll, in case of accidents- what to do? Etc	5	Each 25	Each 50	Each 75	Each 200
15.	Importance of "Safety Handbook"	1	25	50	75	200
16.	Traffic Safety (Speed limit, safe crossing and working within barricaded area etc.	5	Each 25	Each 50	Each 75	Each 200
17.	Environmental Monitoring	5	Each 25	Each 50	Each 75	Each 200

SN	SHE Poster Title	Min No. of concepts in each title	No. of Posters / Signage / Video			
			Group A Contract	Group B Contract	Group C Contract	Group D Contract
	(Spillage of Muck, hazardous material, Improper drainage, water spray for dust containment etc.)					
18.	Video in Hindi on PPE usage - 15 minutes duration	1	-	-	-	1

Note 1: Items mentioned under 17 is video. Items under 3 (a) and 5 (a) are metal signage boards and all other items are posters.


Table 2: Size of Posters / Signages

SN	Item	Size
1.	Posters - Standard	17"x22" -135 GSM 4 Colour Printing
2.	Posters - Special (Wherever required)	17"x22" card laminated FA Poster
3.	Posters - Mega size (Wherever required)	32"x40" Flex FA Poster
4.	First-Aid Booklet	6"x4"
5.	Safety Handbook	6"x4"
6.	Signages	Small : 12"x6" Big : 24"x12"
7.	Road Traffic Sign Boards	Strictly as per Indian Road Congress (IRC) specifications

Table 3: Safety Signage Colour (as per IS 9457)

SN	Type of signage	Colour
1	Mandatory	Blue
2	Danger	Yellow

3	Prohibit	Red
4	Safe conditions	Green

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
N. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/010	

N.1 Experts / Agencies for SHE Services
N.2

SN	Organisation	Services
1.	Bureau Veritas Industrial Services (India) Pvt. Ltd., B-21 & 22, First Floor, Sector-16, NOIDA-201 301 (U.P.) Phone: 0120 - 2515055, Fax: 0120 - 2515248 E-mail: enp.delhi@in.bureauveritas.com	<ul style="list-style-type: none"> • External SHE Audit • SHE Management / Technical Training
2.	Central Labour Institute Post box no: 17851, NS Monkikar Marg Sion , Mumbai- 400 022 Tel.: 022- 4092203, Fax: 022 - 4071986 E-mail: cli@dgfasli.nic.in	SHE Management / Technical Training
3.	Construction Industry Development Council 801, 8th Floor, Hemkunt Chambers, 89, Nehru Place, New Delhi - 110 019 E-mail: cidc@vsnl.com	SHE Management / Technical Training
4.	Delhi Productivity Council 1E/10, Swami Ramtirath Nagar New Delhi - 110 055 Tel.: 23522835	SHE Management / Technical Training
5.	Det Norske Veritas AS, 203, Savitri Sadan 1, 11 Preet Vihar Community Centre, New Delhi-110 092	<ul style="list-style-type: none"> • External SHE Audit • SHE Management / Technical Training


SN	Organisation	Services
	Phone: 011-22531502/2253/1503, 22427688/22531278 Fax: 011-2253 0247 Website: www.dnv.com	
6.	Dr AV Baliga Memorial trust Link House, Bagadur Shah Zafar Marg Press Area, New Delhi - 110 002 Phone: 011 - 23311119	HIV / AIDS awareness
7.	Dr.Cris Research Centre For Occupational Health & Safety 306, Guru Arjuna Dev Bhawan, Ranjit Nagar Complex, New Delhi - 110 008 Phone: 9810040406, Fax: 011 - 25702929 E-mail: team@drcri.com Website: www.drcri.com	<ul style="list-style-type: none"> • Ambulance Room & Van • Communication Materials • First-aid box • First-aid Training • HIV / AIDS awareness • ID Card • Medical Facilities • SHE Orientation Training
8.	DuPont Safety Resources, E.I. DuPont India Private Limited, Arihant Nitco Park 6th Floor, 90, Dr.Radha krishnan Salai, Mylapore, Chennai-600 004 Phone: 044-2847 2800, 2847 3752 Fax: 044-2847 3800 Mobile: 9381201040 Website: in.dupont.com	SHE Management Training
9.	EQMS INDIA PVT. LTD. 304 & 305, 3rd Floor, Rishabh Towers, Plot No. 16, Community Centre, Karkardooma, Delhi - 110092. Phone: 011 - 22374729 / 22374775 Fax: 011- 22374662 E-mail: eqms@eqmsindia.org Website: www.eqmsindia.com	<ul style="list-style-type: none"> • ISO Certification • SHE Management / Technical Training

SN	Organisation	Services
10.	Green Cross Consultants 59, 7th Cross, 1st Floor, Jai Bharath Nagar, Bangalore-560 033 Phone: 080-2549 6782 E-mail: etgrangan@yahoo.com	SHE Management / Technical Training
11.	HSRTC, PENTASAFE, 201, 2nd Floor, Town Centre, AndheriKurla Road, Marol, Andheri (East), Mumbai-400 059 Phone: 022-2850 2210/20/50 Fax: 022-2850 2260 E-mail: training@penta-safe.com	SHE Practical Field Training for Height Safety
12.	Institute of Driving Training & Research, Wazirabad Road, Adjoining Loni Road flyover. New Delhi - 110 094 Phone: 011 - 22813474, 22815833 Fax: 011 - 22811131	SHE Technical Training for Vehicle Drivers.
13.	Institute for Research, Development & Training of Construction Trades & Management, An Educational Institute, Society and Trust, 1st Floor, UVCE Alumni Association Building, K.R. Circle, Bangalore-560 001 Phone: 080-22294291/22243257 Fax: 080-22243257 E-mail: ubrco@vsnl.com Website: www.instructindia.org	SHE Technical /Field Training
14.	International Engineering Company K - 10, South Extension, Part - 2, New Delhi - 110 049 Phone: 011 - 26254761, 26258130 Mobile: 9312260130	<ul style="list-style-type: none"> • Crane and Lifting appliances and Gears Certification • SHE Practical Field Training for Crane Safety

SN	Organisation	Services
	E-mail: ashok@intenco.net	
15.	L & T Eutectic 32, Sivaji Marg, New Delhi - 110 015 Phone: 011 - 51419538, 51419539 Fax: 011 - 51419600 Website: www.lnteutecticwelding.com	SHE Practical Field Training for Welding Safety
16.	Loss Prevention Association of India Ltd. Warden House, Sir P.M. Road, Mumbai - 400 001 Website: www.lpaindia.org	SHE Management / Technical Training
17.	MFA Crucial Moments Healthcare Pvt. Ltd., 42, Okhla Industrial Estate, Phase - II New Delhi - 110 020 Phone: 011 - 55624000 Fax: 011 - 55624010 E-mail: contact@crucialmoments.net	First-aid Training
18.	Modi care Foundation 4 Community Centre, New Friends Colony, New Delhi - 110 065 Phone: 011 - 5167235059 Fax: 011 - 26915469 E-mail: nivedita@modi.com nivedita@gmavil.com Website: www.modicarefoundation.org	HIV / AIDS awareness
19.	National Safety Council HQ and Institute Building 98A, Sector 15, industrial Area C.B.D Belapur, Navi Mumbai - 400614 Phone: 27579924	SHE Management / Technical Training
20.	NICMAR (National Institute of Construction Management and Research) 910,9th Floor, Hemkunt Chambers,	SHE Management / Technical Training

SN	Organisation	Services
	89, Nehru Place, New Delhi - 110 019 Phone: 011 - 51618415, 51618417, 51618418 Fax: 011 - 51618416	
21.	Quality Growth Services Pvt. Ltd. H-13, Kirti Nagar, New Delhi - 110 015 Fax: 011 - 25431737 / 25438598 / 25918332 E-mail: qgs@qgspl.com Website: www.qgspl.com	ISO Certification
22.	Safety Engineers Association / Safety Educational Trust - India 2/257, First Floor, Dr.Ambedkar Nagar, Manapakkam, Chennai - 600 116 Phone: 044 - 22523461 E-mail: safetrustindia@rediffmail.com	SHE Management / Technical Training
23.	SHE Management Consultancy & Support Services, 145 A, Pocket-VI, (DDA Flats), KondliGharoli, MayurVihar-II, Delhi-110 096 Fax: 011-2262 5015 Mobile: 9811153873 E-mail: r_k_p@vsnl.net	SHE Management / Technical Training
24.	St. Johns' Ambulance Red Cross Road New Delhi - 110 001	First-aid Training
25.	Vexil Business Process Services Pvt. Ltd. 208, A/4, Savitri Nagar, New Delhi - 110 017 Mobile: 9350232714, 98102832201, 9350232716 E-mail: info@vexilbps.com	<ul style="list-style-type: none"> • Emergency Preparedness Mock drill • SHE Management / Technical Training

SN	Organisation	Services
	Website: www.vexilbps.com	
26.	Welding Research Institute Bharat Heavy Electricals Ltd. (BHEL) Trichirappalli, Tamil Nadu - 620 014 Phone: 0431 - 2577029, 2577283 Fax: 0431 - 2520770 E-mail: wri@bheltry.co.in	SHE Practical Field Training for Welding Safety


	MAHARASHTRA METRO RAIL CORPORATION LIMITED
O. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/011	

O.1 Minimum Lighting Requirements

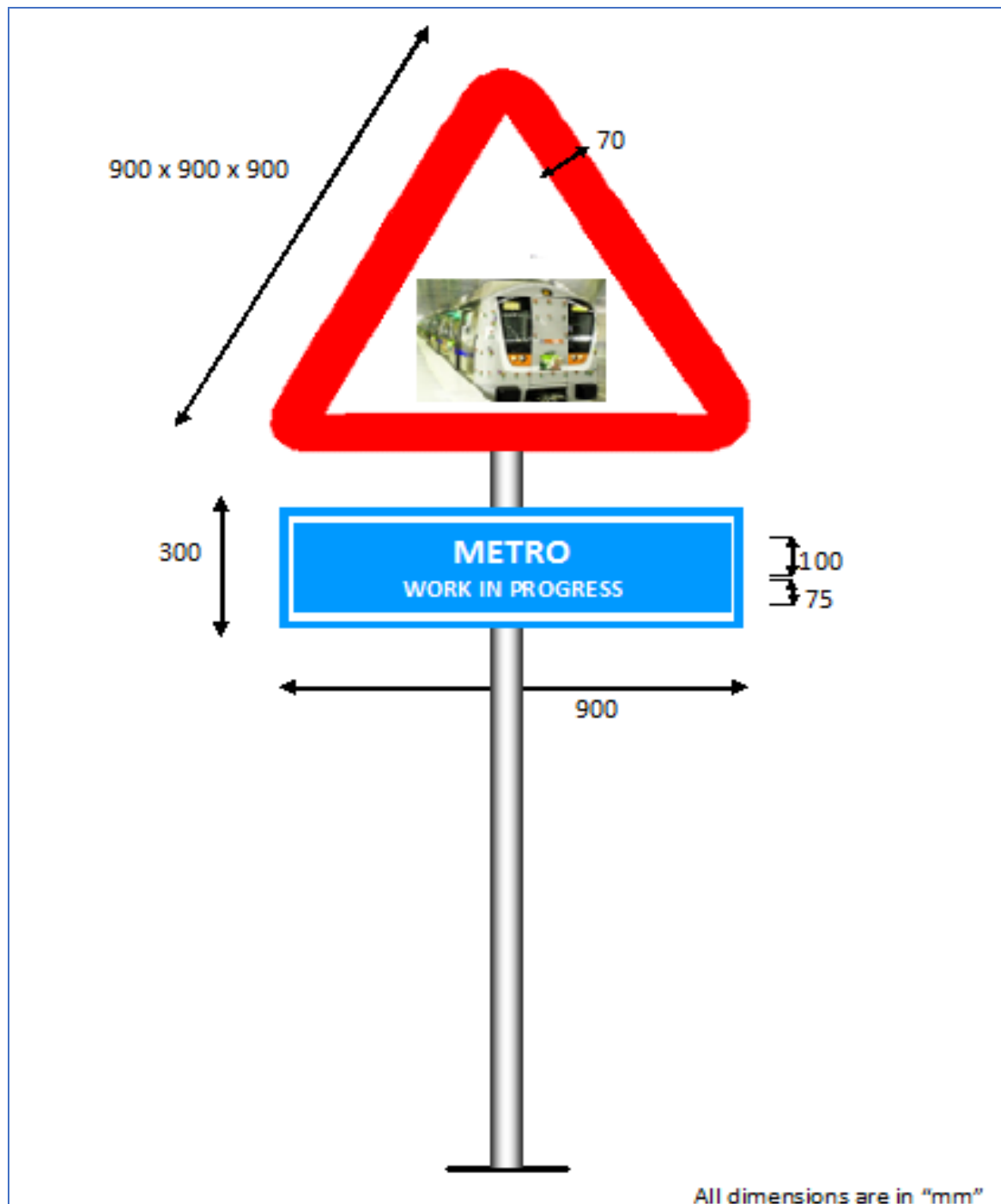
O.2


SN	Facility or Function	Luminance - lx (lm/ft ²)
1.	Administrative areas (offices, drafting and meeting rooms, etc.)	540 (50)
2.	Construction areas <ul style="list-style-type: none"> general indoor general outdoor 	55 (5) 33 (3)
3.	Access ways <ul style="list-style-type: none"> exit ways, walkways, ladders, stairs 	110 (10)

4.	Maintenance / Operating areas / shops <ul style="list-style-type: none"> vehicle maintenance shop carpentry shop outdoors field maintenance area refueling area, outdoors shops, fine details work shops, medium detail work welding shop 	325 (30) 110 (10) 55 (5) 55 (5) 540 (50) 325 (30) 325 (30)
5.	Mechanical/electrical equipment rooms	110 (10)
6.	Hoists, Elevators, freight and passenger	215 (20)
7.	Warehouses and storage rooms/area <ul style="list-style-type: none"> indoor stockroom, active/bulk storage indoor rack storage outdoor storage 	110 (10) 270 (25) 33 (3)
8.	Health Centers and First aid stations and infirmaries	325 (30)
9.	Toilets, wash and dressing rooms	110 (10)
10.	Work areas - general (not listed above)	325 (30)
11.	Parking areas	33 (3)
12.	Visitor areas	215 (20)
13.	Laboratories	540 (50)

	MAHARASHTRA METRO RAIL CORPORATION LIMITED
P. General Instruction: Maharashtra Metro Rail Corporation Limited /SHE/GI/012	

P.1 Warning Traffic Sign




 नागरी मेट्रो NAGPUR METRO	MAHARASHTRA METRO RAIL CORPORATION LIMITED
Q. Form No. SF/001	

Q.1 FORMATION OF SITE SHE COMMITTEE	
Contract No.	
Contractor Name	
Contract Title	

<u>CIRCULAR</u>
<u>Committee</u> The following SHE Committee is constituted with immediate effect: Chairman: Members: 1. 2. 3. 4. 5. Secretary
<u>Periodicity</u> The committee will meet at least once in a month on the day (specify date)
<u>Agenda</u> Secretary will circulate agenda of the meeting at least two days in advance of the schedule date of the meeting.
<u>Circulation</u> Gist of the meeting will be minuted in the standard format and circulated to the following under the signature of the secretary

1. Chairman	3. <u>Maharashtra Metro Rail Corporation Limited</u> Representatives
2. Members	4. Others concerned

Date:	Signed By:
CHAIRMAN	

 MAHARASHTRA METRO RAIL CORPORATION LIMITED
R. Form No. SF/002

R.1 MINUTES OF SHE COMMITTEE MEETING			
Contract No.			
Contractor Name			
Contract Title			
Meeting No.		Date of Meeting	
Location of Meeting			

MEMBERS PRESENT		INVITEES		MEMBERS ABSENT	
REPORT SENT TO					
No. of Copies	Name / Dept.	No. of Copies	Name / Dept.	No. of Copies	Name / Dept.
Prepared by: _____ Location: _____ Date: _____					

MINUTES OF SHE MEETING

Item No.	Description of Discussion	Action By	Target	Remarks
1	Complaints received from Clients and corrective and preventive action			
2	Review of MOM of previous meeting			
3	NCR's / Observation from third party			
4	First - Aid cases / Reportable accident cases			
5	Future jobs and specific requirement			
6	Status of implementation of Safety plan			
7	Sub-contractor performance			
8	Analysis of first-aid cases			
9	Need for any specific system / training / PPE's / resources			
10	Observation of SHE committee during last walk down			
<p>Next SHE Meeting is scheduled on:</p> <p>Date:</p> <p style="text-align: right;">Chief SHE Manager (Signature & Name)</p>				
<p>Date:</p> <p style="text-align: right;">Project Manager (Signature & Name)</p>				



(B) Environment and Social Management
Plan (ESMP) for
Pune Metro Rail Project

This report is based on environmental and social management plan proposed for construction phase of Pune Metro Rail Project

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1.	INTRODUCTION
1.1	Environmental and Social Management Plan for Pune Metro Rail project (PMRP)
2.1	Organization Structure
1.1	General Conditions for Environment and Social Welfare

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Table 1-	Environmental Management/Monitoring Plan.....
Table 2-	Social Management/Monitoring Plan
Table 3 -	General Conditions for Environment and Social Welfare

Charts

Chart 1 -	Contractor SHE Organization
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Annexures

Annexure 1 -	Guidelines for Waste Management.....
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1. INTRODUCTION

Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA) documents, issued to contractors/bidders along with tender document are integral part of the project documentation and are submitted to various authorities and presented at various forums in context of this project. The environmental/social management plans are primarily devised from environmental impact assessment and social impact assessment documents prepared and approved for this project and SHE Manual given in the tender document.

This ESMP is a generic document, applicable for all packages of Pune Metro Rail Project (PMRP). The contractors/bidders should consider this document as guidebook for environment/ social management during construction phase. In case further reference/ discussion is required over any issue given in this document, provisions of EIA/SIA reports, SHE manual and tender/contract document shall prevail.

The EIA and SIA documents discuss the environmental and social impacts of the project during the design, construction and operational phases of the project. It identifies the positive and negative impacts on environmental and social conditions during different phases of project and also proposes the measures to minimize the impacts.

In addition to identification of impacts and proposing mitigation measures it also proposes the monitoring plan to monitor the suitability of implemented mitigation measures. Mitigation measures and monitoring plan for a particular impact combined termed as Environmental Management Plan (EMP) or Social Management Plant (SMP) for that particular impact. Implementation of EMP/SMP for construction phase is responsibility of the civil contractor throughout the period of construction till the handover of the unit to PMRCL.

1.1 Environmental and Social Management Plan for PMRP

Table 1 and Table 2 given below presents the EMP and SMP for the PMRP. It identifies various environmental and social aspects/receptors which are likely to be impacted on account of project activity during construction phase and proposed the management and monitoring plan for each of them. The environmental/social management plans are primarily devised from environmental impact assessment and social impact assessment documents prepared and approved for this project and SHE Manual given in the tender document.

It is expected that contractor shall be primarily responsible for implementation of EMP/SMP and monitoring plans as given in Table 1 & Table 2 for PMRP. Contractor shall also be responsible for submitting the monitoring reports as outlined in the EMP/SMP.

2.1 Organization Structure

To implement EMP/SMP contractor shall employ adequate number of skilled SHE staff throughout the construction period. Number of staff required at various levels of contractor's SHE organization depends on value of contract awarded to contractor. Educational qualifications required for key SHE staff and number of SHE personnel required is given in clause 70 of SHE Manual. The proposed structure for contractor's

SHE Organization is given in Chart 1 below.



Chart 1 - Contractor SHE Organization

Table 1- Environmental Management/Monitoring Plan

Sr. No.	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
1	Ambient and Workplace Air Quality	To ensure that ambient and workplace air quality during construction works is within permissible limits	Excavated materials to be disposed on a regular basis so that it does not accumulate at worksite;	In Charge / Project Manager/ SHE Personnel PME in charge	Workplace dust shall be visually noted and ensured that it does not aggravate; Ambient Air Quality to be monitored two (02) Site times in a month (for 1 st fortnight & 2nd fortnight), at suitably identified location. Every Diesel Generator stack to be monitored for air emissions at least once in a six month Maintenance records for DGs shall be kept for inspection as and when required by GC/PMRP
			Water to be sprinkled on stored soil/sand on daily basis to avoid dust emissions;		
			Height of heaps of accumulated excavated materials should not be more than height of barricade.		
			If for some reason soil is stored on site for more than 72 hours it has to be covered to avoid dust emissions;		
			Diesel Generators operated within the sites to be suitably maintained at regular intervals;		

Sr. No.	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
			Internal Combustion Engine equipment operated within site must comply with minimum Bharat Stage III emission standards.		
2	Ambient and Workplace Noise Quality	To ensure that ambient and workplace noise quality during construction works is within permissible limits	Impact piling should not be allowed for piling works other than in very hard rock strata	Project Manager / Site In Charge / P&M In charge / SHE personal	Internal Workplace noise levels to be taken on weekly basis. Authenticated record to be verified by third party.
			Internal Combustion Engine equipment operated within site must comply with Govt. of India Emission standards		
			Diesel Generators to be operated with the suitable noise abating enclosures;		Third party ambient noise levels to be measured at least once in a month at the suitable location decided by SHE personnel/site in charge
			Provision of earplugs for workers working within the site boundaries;		

Sr. No.	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
			Height of barricade needs to ensure as per standards given by PMRP		
			Barricades to be aligned properly to minimize the dissipation of sound;		
3	Vibration Control	To reduce the degree of impact due to vibration during construction phase.	Latest piling technologies to be deployed by contractor to reduce the impacts on nearby structures;	Project Manager /Site In charge/P&M In charge/SHE personal	Vibration monitoring to be done on a monthly basis though planned preventive maintenance with the help of professional third-party service provider
			Impact piling should not be allowed for piling works other than in very hard rock strata;		
4	Waste Management (At Construction Site and at Utility works)	To ensure the environment ally acceptable disposal /recycling of wastes generated during construction	The contractor shall prepare the waste management plan and submit the PMRP/GC for concurrence. The guidance for preparing the waste management plan is given in Annexure-1 of this ESMP document.	Project Manager /Site In charge/SHE personal	Proper records shall be maintained for disposal of hazardous wastes, solid wastes, C&D waters, liquid (site runoff) wastes etc.
			Contractor shall dispose-off hazardous wastes as per the provisions of SHE Volume 8 Clause No. 66. For further guidance please refer to Annexure 1 of this ESMP document.		

Sr. No.	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
			<p>Contractor shall dispose-off <i>non-hazardous solid wastes, non-hazardous liquid wastes, biomedical wastes</i> as per the provisions of SHE Volume 8 Clause No. 65. For further guidance please refer to Annexure-1 of this document.</p> <p>Contractor shall dispose-off construction and demolition wastes as per the provisions of SHE Volume 8 Clause No. 66. For further guidance please refer to Annexure 1 of this document.</p>		
5	Sanitation and Sewage Management at construction and utility facilities	<p>To ensure hygienic sanitary conditions for workers at worksites and in camps.</p> <p>To ensure</p>	<p>Sufficient number of urinals as given in SHE Volume 8 Clause No. 51 should be provided at camp and worksites for construction workers;</p> <p>Contractor shall make sufficient arrangements as given in SHE Volume 8 Clause 51.4 for drinking water facilities for construction workers</p>	Project Manager / Site In charge / SHE personal	<p>Location plans to be submitted for sanitary facilities at casting yard and batching plants;</p> <p>Cleaning schedule and records to be maintained and to be made available for inspection of GC/PMRP as and when demanded.</p> <p>Site housekeeping shall be always maintained at generally acceptable</p>

		Environmentally acceptable Disposal of domestic wastes generated at construction sites and	Worker camps and canteen facilities should be protected from airborne and soil born insects and pests by taking suitable measures as described in SHE Volume 8 Clause 56. & Clause 57.0 and its subsections		levels throughout the construction period
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S r · N	Environmental Aspect/Receptor s	General Intent	Management Plan	Onsite Responsibilit y	Monitoring Plan
			<p>General Housekeeping shall be carried out by the Contractor and ensured at all times Site, Construction area, Batching Plant, Labor at Work Camp Stores, Offices and toilets/ urinals.</p> <p>Towa special group of housekeeping personnel as per rds this the Contractor shall constitute a General Instruction .PMRP/SHE/GI/001.</p> <p>In compliance to Clause 40.5 of SHE Volume 8, for disposal of sanitary waste generated at worker camps at batching plant, casting yards, suitable sanitary treatment like bio digester or equivalent /disposal to existing sewage system.</p> <p>Mobile sanitary facilities shall bedeployed at construction sites for workers</p> <p>Authorized agencies shall be deployed for disposal of sewage and other solid waste generated at worker camps and construction sites</p>		

S r .	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
6	Drainage System at Construction/utili ty sites	To ensure that suitable drainage is planned at construction sites and at utility sites. So that public drainage systems and surface and GW quality are not affected.	<p>All the provisions of Clause 60 of SHE Volume 8 regarding Water Quality are applicable to the contractor at all sites wherever he is performing the work.</p> <p>As per provisions of Clause 60.1 of SHE Volume 8, Contractor shall construct a drainage system at the commencement of the works, to drain off all surface water from the work site into suitable drain outlet.</p> <p>The Contractor shall provide adequate precautions to ensure that no spoil or debris of any kind is pushed, washed, falls or deposited on land adjacent to the site perimeter including public roads or Existing stream courses and drains within or adjacent to the site.</p> <p>Contractor is not allowed to discharge water from the site without the approval of the Employer. The Contractor must comply with the requirements of the</p>	ProjectManager /SiteIncharge/ SHE personal/Plann er	Layout plans to be submitted for sanitary facilities at casting yard and batching plants; Cleaning schedule and records to be maintained and to be made available for inspection of GC/PMRP as and when demanded. Monsoon preparedness plan to be submitted prior to onset of monsoon for approval of GC/PMRP

Sr. No.	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
			Central Ground Water Board for discharge of water arising from dewatering (refer Clause 60.3 of SHE Volume 8)		
			In the event of any spoil or debris from construction works being deposited or any silt washed down to any area, then all such spoil, debris or material and silt shall be immediately removed and the affected land and areas restored to their natural state by the Contractor to the satisfaction of GC/PMRP (refer Clause 60.2 of SHE Manual)		
			Prior to arrival of monsoon (in month of May) suitable monsoon preparedness plan shall be prepared by the contractor and suitable resources to be made available prior to onset of monsoon		
7	Disposal of Muck from sites/Soil	To ensure that	Contractor shall dispose the muck/dry soil generated at construction sites at a mutually agreed location by	ProjectManager	

	Erosion Control Plan	soil erosion from construction site is prevented to check the ambient air quality, public inconvenience and general aesthetics outside the construction/utility sites	<p>The boundaries of identified and mutually agreed disposal location shall be earmarked by contractor. Initial levels of (prior to start of soil/muck disposal) disposal area has to be recorded by the contractor with the help of surveyors and to be submitted to PMRP/GC.</p> <p>Contractor shall carry out the reconciliation for the disposed soil and quantities shall submit to PMRP on quarterly basis.</p>	/Site Incharge/ SHE personal/Planner	<p>Reconciliation records for soil disposal shall be submitted to GC/PMRP once in a three months;</p> <p>Records for dumpers shall be kept for inspection at sites which shall include the safety checklist for dumpers disposing the soil;</p>
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SN	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
			<p>Wheel wash facilities shall be provided at every exit gate to clean or wash the wheels of every outgoing vehicle from site.</p> <p>Sufficient staff shall be made available at site to control the disposal of muck/soil from site such as a supervisor, labors for wheel cleaning, brooms for wheel cleaning and concrete pad where wheels will be cleaned.</p> <p>The dumpers carrying the muck/dry soil has to be covered while plying on the roads on the way to disposal location.</p> <p>Resources have to be provided for road cleaning for accidental soiling of roads during muck disposal.</p> <p>The resources include raw water, labors, traffic marshal, brooms for road cleaning</p>		

S r .	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
8	Tree protection/Cutti ng and Disposal	To ensure that overall green cover of city is maintained	<p>Contractor is only allowed to cut the trees which are falling in a ROW and which are already identified.</p> <p>For the trees which needs to be cut during construction activities but for which prior approval is not taken, necessary approval from concerned authorities shall be arranged by the PMRP</p>	ProjectManager /SiteIncharge/ SHE personal/ Planner	Records of trees which are cut and protected shall be submitted in monthly environmental reports and as and when demanded by GC/PMRP
			<p>Contractor shall keep necessary records for the disposal of biomass which is generated from tree cutting.</p> <p>Biomass shall not be stored at site for more than 15 days.</p> <p>Contractor shall protect the tree which are located within the site boundaries, but which are not required to be cut during the construction phase</p>		

9	Soil and Water Quality	To ensure that soil and groundwater and surface water quality are not affected on account of project	Contractor shall take all necessary precautions such that construction material, diesel, grease, waste oil, Chemicals etc. does not spill on ground. Suitable storage area for such materials shall be prepared and equipment shall be made available for handling of these materials.	ProjectManager /SiteIncharge/ SHE personal/ Planner	Soil and Ground water quality shall be checked at the locations identified by GC/PMRP or independent environmental experts and records shall be submitted. The GW and Soil leachate quality shall be checked once in six months
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Sr. No	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
		construction	Latest version of Hazardous waste disposal and handling rules and guidelines given in SHE Manual Clause 66 shall be referred for the storage areas and for provision of PPEs and other equipment.		
10	Energy Management// Conservation	To ensure that best practices are adopted during construction phase to optimize energy consumption	<p>Contractor shall try and reduce the direct consumption of fossil fuels on site through use of energy efficient equipment at their project office and at construction sites. Construction Equipment shall be duly serviced to ensure that they are operated at optimum level of fuel efficiency. DGs shall be regularly serviced for energy efficient outputs;</p> <p>Only Five star labeled equipment by BEE/or its equivalent shall be used at project offices.</p> <p>Maximum use of grid power shall be planned at construction sites and at project offices</p>	Project Manager/PME Head/SHE Personnel	Monthly consumption of diesel and power units shall be compiled and submitted to GC/PMRP

S r .	Environmental Aspect/Receptors	General Intent	Management Plan	Onsite Responsibility	Monitoring Plan
11	Water Management/ Conservation	To ensure that best practices are adopted during construction phase to optimize energy consumption	<p>Contractor shall try and reduce the water consumption through use of energy efficient water fixtures at sites and project offices.</p> <p>Leakage of water should not be allowed through pipes and valves.</p> <p>Reuse of water used for curing and for other uses to be planned</p>	PME/SHE Heads/In charge	Monthly records for consumption of water for domestic and construction purposes shall be submitted in environmental reports

Table 2- Social Management/Monitoring Plan

S. N	Project related Issues	General Intent	Management Plan	Monitoring Plan	Responsibility
1	Management of Economic suffering by adjoining Businesses along barricading	Minimize the adverse impact on adjoining businesses	The buyers of shops will park their vehicles in by-lanes and visit shops thereby managing the economic sufferings to the business adjoining construction sites. PMRCL will coordinate with NMC to allow short term parking of vehicles at designated places in by-lanes.	Public Relations Department of PMRCL	PMRP
2.	Labor Camps	Providing safe Habitation to workers	The project Contractor shall construct a labor camp site which is duly confirming the labor laws. Emergency response plan will be in place towards meeting unforeseen emergencies.	GC would monitor that Contractor comply through routine site visits	Contractor's Project Manager/Admin/SHE
3	Residential /Commercial and CPR	Ensure that all persons displaced permanently or temporarily are settled as per the Govt of Maharashtra Guidelines for R&R	All possible effort will be made to minimize displacement of persons and land acquisition of private persons .Social Impact assessment consultant would provide the information and Metro samwad to make people aware of metro project and grievance address system for persons being displaced. Ensure that persons being displaced have the same or better living conditions.	GC and Land Acquisition team from PMRP to work with PMC or R&R issues	PMRP

S. N	Project related	General Intent	Management Plan	Monitoring Plan	Responsibility
3.	Sanitation, Sewerage and waste disposal in worker's camp.	Providing hygienic Conditions in Labor camps and adequate Housekeeping in Labor camps	<p>Proper sanitation facilities at the construction workers camp shall be provided.</p> <p>Provision of Bio-digesters/treatment units to achieve the desired quality of treated waste disposal and shall be taken care by contractor for workers camp.</p> <p>The municipal solid wastes generated in worker's camp shall be collected and stored at designated place and shall be disposed-off at nearest identified disposal / landfill sites of local authority. Domestic refuse shall be collected separately for bio-degradable waste and inert waste and the same shall be sent for the disposal as per municipal requirement.</p> <p>Sufficient measures shall be taken in the construction camps, i.e. provision of garbage bins, no open drains and sanitation facilities. Drinking water shall meet IS 10500. And be tested once a month for portability. Garbage shall be disposed of daily. Camps will be located at a minimum distance of 200 m from waste disposal site.</p>	GC would monitor that contractor comply through routine site visits	Contractor's Project Manager/Admin/SHE
4.	Wastage of water	Please refer Table 1- Environmental Management/Monitoring Plan (Water Management/Conservation)			

5.	Traffic management	Avoid and minimize inconvenience to public due to congestion and traffic jams during construction	<p>Location specific Traffic management plan shall be prepared to handle traffic flow particularly during peak hours. Coordination and securing assistance from local police for traffic control during the construction. Providing traffic marshals along construction sites/ openings in barricades to manage and assist traffic.</p> <p>Safety measures shall also be undertaken by installing road signs and markings for safe and smooth movement of traffic.</p> <p>Communicate to the public through radio, TV & newspaper announcements regarding the construction activities causing disruptions or access restrictions in advance to minimize public inconvenience and smooth construction activities.</p>	GC would monitor that contractor comply	Contractor's Project Manager/Admin/SHE
6.	Dust suppression	Please refer Table 1- Environmental Management/Monitoring Plan			
7.	Noise level	Please refer Table 1- Environmental Management/Monitoring Plan			
8.	Air Quality	Please refer Table 1- Environmental Management/Monitoring Plan			
9.	Occupation Health & Safety and Safety with vehicles, people And livestock and signage		Workers shall be equipped with proper safety gears like helmets, gloves and gum boots. Periodic health checkup of construction workers. Safety education and fines.	GC would monitor that contractor comply	Contractor's Project Manager/SHE/Stores

1.1 General Conditions for Environment and Social Welfare

In addition to implementation of EMP as outlined in the Table 1, contractor is expected to comply with the general conditions outlined under various clauses of SHE Conditions Volume 8 of tender document. The general conditions and reference SHE clauses are listed below :

Table 3 - General Conditions for Environment and Social Welfare

Sr. No.	General Condition	Reference from SHE manual of PMRCL	Responsibility
1	The Contractor as per Rule 69 of the MBOCW shall formulate a Safety & Health policy and get it approved by Chief Inspector and display it at conspicuous places at work sites in Hindi and Marathi i.e. languages understood by the majority of construction workers.	PART I SHE Management Clause 4.0 and its subsections	Corporate SHE Head/Project Manager
2	Contractor shall set the goals for environmental performance for certain periods of project duration and shall develop the plans to improve the performance and monitor it	PART I SHE Management Clause 2.0 and its subsections	Corporate SHE Head/Project Manager/SHE Head
3	Contractor shall prepare the method statement for major activities which will be undertaken at sites. It should be ensured that environmental risk assessment should be done for every activity and suitable plan is developed to mitigate the impact.	PART I SHE Management Clause 3.0 and its subsections	Project Manager/SHE Head/Quality Head
4	Contractor shall ensure that designer (appointed by the contractor) shall include/prepare designs in a way that minimize the risk to health and safety of those who are going to construct, maintain, clean, repair, dismantle or demolish the structures and anyone else like adjoining road users/general public, who might be affected by the work.	PART I SHE Management Clause 5.0 and its subsections	Project Manager/Designed /SHE Head

5	The Contractor shall appoint the required SHE personnel as prescribed in General Instruction PMRP/SHE/GI/001 based upon the statutory requirement and establish the safety organization based upon the Contract value. The minimum educational qualification and the work experience are given in General Instruction PMRPL/SHE/GI/002.	PART I SHE Management Clause 6.0 and its subsections	Corporate SHE Head/Project Manager/SHE Head
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Sr. No.	General Condition	Reference from SHE manual of	Responsibility
6	The Contractor shall ensure the formation and monitor the functioning of Contractor SHE committees..All employees should be able to participate in the making and monitoring of arrangements for safety, industrial health and environment at their place of work.	PART I SHE Management Clause 7.0 and its subsections	Corporate SHE Head/Project Manager/SHE Head
7	The Contractor shall ensure that all personnel working at the site receive an induction SHE trainings explaining the nature of the work, the hazards that may be encountered during the site work and the particular hazards attached to their own function within the operation. The training shall cover the contents as given in the General Instruction PMRP/SHE/GI/004.	PART I SHE Management Clause 8.0 and its subsections	Corporate SHE Head/Project Manager/SHE Head
8	The Contractor shall organize SHE training to engage managers, supervisors and other personnel in behavioral change and improve safety performance. The environmental training module shall be approved by PMRP/GC.	PART I SHE Management Clause 9.0 and its subsections	Corporate SHE Head/Project Manager/SHE Head
9	The Contractor shall evolve and administer a system of conducting environmental inspections twice in a month. Contractor key personnel including the project manager shall attend the site environmental inspections and necessary compliance shall be arranged for GC/PMRCL observations	PART I SHE Management Clause 10 and its subsections	Project Manager/SHE Head
10	Monthly environmental report shall be submitted by the contractor to GC/PMRP on or before 10th of day of every month. The report shall Track the progress in brief, compliance status of observations given by GC/PMRP during site visits, general compliance with ESMP/EMP, monitoring records and other notable environmental issues related to site. The report shall include the demonstrative site photographs to highlight the issue.	PART I SHE Management Clause 11 and its subsections	Project Manager/SHE Head
11	Contractor shall develop the work permit system such that it considers the environmental aspects of major activities carried on site.	PART I SHE Management Clause 11 and its subsections	Project Manager/SHE Head

Sr. No.	General Condition	Reference from SHE manual of	Responsibility
12	The Contractor shall take every effort to communicate the Environment management measures through posters campaigns / billboards / banners / glow signs being displayed around the work site as part of the effort to raise environmental/social awareness amongst the work force. Posters should be in Hindi, English, and other suitable language as deemed appropriate. Posters / billboards / banners/ glow signs should be changed at least once in a month to maintain the impact. The Contractor shall also observe important days as listed in General Instruction PMRP/SHE/GI/008 and printing and displaying safety Signage and posters as listed in General Instruction PMRP/SHE/GI/009	PART I SHE Management Clause 11 and its subsections	Project Manager/SHE Head
13	Contractor shall report significant environmental incidents to PMRP/GC within 8hrs of event and shall necessary measures to rectify it as soon as possible. The environmental incident shall include but not limited to excessive road soiling, excessive oil spills, excessive dust generation etc.	PART I SHE Management Clause 14 and its subsections	

	Waste Type	Example of Waste Items	Storage Methods	Disposal Method
Solid Waste	Hazardous Solid Waste	Waste Oil, Used Batteries, Oil Contaminated Clothes, used filters etc.	Dedicated storage area as per provisions of Hazardous Waste Handling and Disposal rules issued by MoEF	To be disposed with the help of authorized (by MPCB) recyclers.
	Non-Hazardous Solid Waste	Scrap Steel, Wooden Material Steel Material etc.	Earmarked open storage within site boundaries	Disposed to recyclers.
	Construction and Demolition Waste	Concrete Debris, broken bricks etc.	Earmarked open storage within site boundaries	To be disposed as per PMC guidelines.
	Domestic Waste	Tea Cups, Refreshment packets, biomass	Color Coded waste bins to be provided for storage Biomass could be stored at earmarked open/shaded storage within site boundaries	Domestic waste to be disposed with help of PMC approved waste disposal agency Biomass to be delivered free of cost to user operated by PMCs
Liquid Waste	Process Water	Wash water, curing water, seepage from muck	Should be collected through a suitable drainage system within site boundaries. Reuse after primary treatment, if possible	Could be disposed to public drain only if, after primary treatment water complies with municipal standards of disposal to public drains.
	Surface Runoff	Wash water, seepage from muck, rainwater runoff	Should be collected and disposed after sedimentation.	Could be disposed to sewers if it complies with domestic discharge standards
	Domestic Liquid Effluent	Domestic Waste generated from urinals and toilet boxes.	Should be collected through a suitable drainage system within site boundaries. Reuse after primary	Could be disposed to public rain only if, after primary treatment water complies with municipal standards of

			treatment, if possible.	disposal to public drains.
Biomedical Wastes	First Aid Wastes	Chemically contaminated cottons, syringes, bandages etc.	Should be stored in colour coded storage bin at first aid facility.	Could be disposed with the help of hospitals who have tied up with authorized biomedical wastes disposers.

Annexure 1 - Guidelines for Waste Management

LIST OF APPROVED MANUFACTURERS / VENDORS

All materials and products shall conform to the relevant standards/specifications of IS code, BS Code etc. and shall be of approved make and design. A list of manufacturers / vendors is given herein below for guidance. The approval of a manufacturer/vendor shall be given only after review of the sample / specimen by the Engineer. The complete system and installation shall also be in conformity with the – **“Applicable Codes, Standards and Publications”**.

List of approved makes for products and materials is given below. Other equivalent manufacturers may be considered with prior approval.

.No.	Details of Materials/Products	Manufacturer's Name
1.	Epoxy / Polyester resin For fixing anchor fasteners in soffits	<ul style="list-style-type: none">• “Lokset” of Forsoc Chemicals (India) Limited• STP MBT• Apple chemie
2.	Fire stop Sealant	<ul style="list-style-type: none">• Dow Corning's “Firestop Sealant 700: by• Universal Silicones Lubricants Pvt Ltd.• GE Silicone's Pensil 300 Fire stop Sealant”
3.	Ply wood	<ul style="list-style-type: none">• Uniply• Europly• Archidply• Century ply• Hunsurply• Corbett• Duroply (Green marked, BWR Grade) of Sarda Plywood Industries Ltd.,• Green Plywood Kitply
4.	Block board	<ul style="list-style-type: none">• Uniply• Euro Board• Green blockboard• Century board• Archid blockboard• Duroboard of Sarada Plywood• Bhutan Board

5.	Veneers	<ul style="list-style-type: none"> • Greenply • Euro make • Jackson • Timex • Legend • Sarda Plywood Industries Ltd.
6.	Burl Veneer	<ul style="list-style-type: none"> • Green • Euro make • Jackson • Venture Enterprise • Kitply Industries Ltd.
7.	Adhesive	<ul style="list-style-type: none"> • “Pidilite • Araldite • Jivanjor • Apple chemie • Don Construction Chemical Pvt Ltd
	Cement based Adhesive	<ul style="list-style-type: none"> • Ultratech
	Tiles adhesives	<ul style="list-style-type: none"> • Don Construction Chemical Pvt Ltd
8.	Flush Doors	<ul style="list-style-type: none"> • Kutty, • Karnataka State forest department, • Green, Decorative Duroply (Green marked), • Kitply
9.	Plastic Laminates	<ul style="list-style-type: none"> • Formica • Greenlam • Vir • Sundeck • Neoluxe • Bakelite Hylam
10.	Aluminium Sections	<ul style="list-style-type: none"> • Indian Aluminium Co. • Hindustan Aluminium / • Jindal, • Bhoruka
11.	Aluminium Composite Panel	<ul style="list-style-type: none"> • Flexibond • Alucobond • AluKbond • Eurobond • AlucoPanel • Viva
12.	Float Glass/Toughened Glass Insulating Glass	<ul style="list-style-type: none"> • Float Glass India Ltd • Modiguard • Saint Gobain

13.	Bevelled and Embossed Glass/Mirrors	<ul style="list-style-type: none"> • Gujarat Guardian Ltd. • Modi • Saint Gobain
14.	Powder Coatings	<ul style="list-style-type: none"> • Berger • Nerocoat • Jenson & Nicholson
15.	Asphalt Emulsion	<ul style="list-style-type: none"> • Karnak Chemical Corporation • STP
16.	Tile Joint Filler	<ul style="list-style-type: none"> • Bal Adhesives & Grouts • “Roff Rainbow Tile mate” of Roff construction Chemicals Pvt Ltd. • Winsil 20/Silicon Sealant of GE Bayer Silicon • “Zentrival FM” of MC-Bauchemie (IndiaPvt Ltd) • Apple Chemie • BASF
17.		<ul style="list-style-type: none"> • Kajaria Ceramics Limited • Arpitha Exports
18.	Heavy Duty Chequered Tiles	<ul style="list-style-type: none"> • NITCO • Modern Tiles
19.	Ceramic Tiles	<ul style="list-style-type: none"> • Kajaria • Bell • Spartek • Goldcoin • Johnson • Somany • RAK Ceramics • Murudeshwar Ceramics
20.	Vitrified Tiles	<ul style="list-style-type: none"> • “Naveen Diamontile” of Murudeshwar Ceramics Ltd. • “Granamite” of Restile Ceramics Limited • “Marbo Granit” of Bell Granito Ceramica Ltd • Johnson Tiles • Somany Tiles
21.	Marble blended Vinyl Tiles/Sheet	<ul style="list-style-type: none"> • Armstrong of Inarco Ltd • Terkett Floorings • Krishna Vinyl

22.	Glass Mosaic Tiles	<ul style="list-style-type: none"> • Mridul Enterprises • Italia • Palladio
23.	Marble Mosaic Tiles	<ul style="list-style-type: none"> • Nitco • Basant Tiles
24.	Aluminum Linear Ceiling	<ul style="list-style-type: none"> • Luxalan • Interarch • J C Industries • Hunter Douglas • Fundermax • Armstrong
25.	Steel Panel Ceilings	<ul style="list-style-type: none"> • Interarch • Armstrong • Metckaft
26.	Resin Bonded Glass Wool	<ul style="list-style-type: none"> • Rockloyd • Kingsway • LLYOD Insulations (INDIA) Ltd.
27.	MS Tubes	<ul style="list-style-type: none"> • Tata • Lloyd Metal & Engineering Co. • NSL Limited
28.	Modified Bituminous	<ul style="list-style-type: none"> • “Multiplas Standard” of Integrated Waterproofing Membrane Limited • “SUPER THERMOLAY”/”POLYFLEX’ of STP Limited . • “LOTUS-3” of the Structural Waterproofing Co. Limited • “HEAVY DUTY POLYPLY” of Ana Roofings Private Ltd • Apple chemie • Shell • Hincola
29.	Epoxy Putty	<ul style="list-style-type: none"> • “Techoxy” by Choksey Chemicals Pvt Ltd. • Apple chemie
30.	Polysulphide Sealants	<ul style="list-style-type: none"> • Pidilite Industries Ltd . • STP • Fosroc • Choksey • Apple chemie

		<ul style="list-style-type: none"> Supreme Bituchem India Pvt. Ltd.
	Polyurethane sealant	<ul style="list-style-type: none"> Supreme Bituchem India Pvt. Ltd
31.	Silicone Sealants	<ul style="list-style-type: none"> G.E. Bayer Silicone Dow Corning Waclear
32.	Sealant Joints	<ul style="list-style-type: none"> Watson Bowman Acme Corporation “Silpray” of G.E. Bayer Silicare Don Construction Chemicals pvt ltd
33.	Paints	<ul style="list-style-type: none"> I.C.I. Berger Jonson & Nicholson Asian Paints Dulux Nerolac Surfa
34.	Emulsion Paint	<ul style="list-style-type: none"> ICI Dulux Velvet Luxol Silk Jonson & Nicholson Asian Paints Dulux Nerolac Surfa
35.	Synthetic Enamel	<ul style="list-style-type: none"> I.C.I. Berger Jonson & Nicholson Asian Paints Dulux Nerolac Surfa
36.	Texture Paints	<ul style="list-style-type: none"> Spectrum Unitile Surfa Birla
37.	Polyurethane Paint	<ul style="list-style-type: none"> MRF Berger

38.	Wax Polish	<ul style="list-style-type: none"> • Reckitt & Colman • Asian • Berger
39.	Melamine	<ul style="list-style-type: none"> • ICI Delux Timberstone Melamine Coating • Asian / • Berger
40.	Membrane Water Proofing	<ul style="list-style-type: none"> • Padmaja Engineering Services, INC • Bitumat • Apple Chemie • Supreme Bituchem India Pvt. Ltd • Don Construction Chemicals pvt ltd
		<ul style="list-style-type: none"> • BASF • Pidilite • Hindcom Chemicals Limited
	Cement based water proofing	<ul style="list-style-type: none"> • Ultratech
41.	Cement Bonded Particle Board	<ul style="list-style-type: none"> • Bison Panel Board • Everest Industries
42.	Stainless Steel Railings	<ul style="list-style-type: none"> • Salem Steel • Jindal Stainless steel • GM 2 metal works • Entarchcon Infratech Pvt. Ltd.
43.	Raised (Access) Floor / Cavity floor	<ul style="list-style-type: none"> • Hewetson • United Insulation • Proactive Systems • Universal Infrastructure Systems
44.	Fire Check Doors	<ul style="list-style-type: none"> • Godrej • Shakthi Hormann Pvt.Ltd.
45.	Pressed Steel Door Frames	<ul style="list-style-type: none"> • Deccan Structural Systems Pvt. Ltd, • Agew • San-Harvic
46.	Ceramic Claustra	<ul style="list-style-type: none"> • Scindia Potteris
47.	Interlocking Paving Tiles	<ul style="list-style-type: none"> • Pavestone Marketing Pvt Ltd • Nitco Marble & Granite Pvt. Ltd
48.	Ashford Formula	<ul style="list-style-type: none"> • JB Associates
49.	Eleganstone	<ul style="list-style-type: none"> • Bubna Commodities (P) Ltd
50.	Roc Wool	<ul style="list-style-type: none"> • Lloyd Insulation (India) Ltd • ROCKWOOL

51.	Cavity Block	<ul style="list-style-type: none"> • Apco Concrete Block • Besser Concrete Systems Ltd • Sobha Concrete Products
52.	AAC Blocks	<ul style="list-style-type: none"> • Hyderabad Industries Ltd • Ballarpur Industries Ltd • Ultratech
53.	Cement concrete designer tile	<ul style="list-style-type: none"> • Eurocon tiles, • Duracrete • Ultra tiles.
54.	Polycarbonate sheets	<ul style="list-style-type: none"> • GE Plastics (Lexan) • Tuflite
55.	Iron Mongery	<ul style="list-style-type: none"> • Dorma • Ozone
		<ul style="list-style-type: none"> • Kich • Yale • Dorset • Henderson • Ebco
56.	AAC Block joint adhesive	<ul style="list-style-type: none"> • Ultratech • Apple Chemie
57.	Readymade Plastering	<ul style="list-style-type: none"> • Ultratech • Apple Chemie
58.	Cement base grouting	<ul style="list-style-type: none"> • Ultratech • Apple Chemie • BASF • Supreme Bituchem India Pvt. Ltd • Don Construction Chemicals pvt ltd
59.	Baffel Celing	<ul style="list-style-type: none"> • Armstrong • Hunter Douglas
60.	Exterior cladding	<ul style="list-style-type: none"> • Hunter Douglas • Fundermax
61.	Perforated metal ceiling	<ul style="list-style-type: none"> • Hunter Douglas • Fundermax • Armstrong
62.	Glass Dome	<ul style="list-style-type: none"> • Entrachcon Infratech Pvt. Ltd.
63.	Tensile Roofing	<ul style="list-style-type: none"> • Saint Gobain
64.	Roof Latches	<ul style="list-style-type: none"> • LATCHWAYS
65.	AL Roof Vents	<ul style="list-style-type: none"> • Agaris Airvent Systems

66.	Roofing 1. Galvalume 2. Zinalume	<ul style="list-style-type: none"> • Tata Blue Scope • JSW Steel • LLYOD Insulations (INDIA) Ltd. • VM Zinc • VIJAYANATH • LLYOD Insulations (INDIA) Ltd. • Tata Blue Scope
67.	Toilet Cubicles	<ul style="list-style-type: none"> • Macro Enterprises
68.	Tactile Flooring	<ul style="list-style-type: none"> • Johnson Tiles
69.	CEM Board	<ul style="list-style-type: none"> • USG Boral • NCL
70.	Calcium Silicate Board	<ul style="list-style-type: none"> • Promat
71.	AL windows & Glazing	AJIT INDIA (Madras) Pvt. Ltd.
72.	Cement	ACC, Ultratech, Gujarat, Ambuja, Grasim, JK Lakshmi
73.	Reinforcement Bars	SAIL Plants, Rashtriya Ispat Nigam Ltd. Vizag Steel Plant, , Tata Steel , Ispat Industries , JSW Steel , JSPL, Essar Steel , Electrosteel steels limited (for use in non-dynamic structure)
74.	Epoxy	FOSROC, SIKA QUALCRETE, Araldite, BASF
75.	Expansion Joints	Prequalified Manufacturers as per RDSO's latest approved list or as approved by NMRCL.
76.	Admixtures	FOSROC, MBT. MC Baucheme, Sika, APEX, Pidilite, BASF
77.	Pile Integrity Testing Agency	CBRI. Pile Dynamic. AIMIL, Geo dynamic.
78.	Anchor Fastener	HILTi. FISHER, BAUCH
79.	Structural Steel	TATA, SAIL, ESSAR, Jindal Steel & Power Ltd, JSW
80.	Stainless Steel	Jindal. SAIL
81.	Pre-stressing Strand (LRPC)	TATA SSL Ltd, USHA Martin,
82.	Welding Electrodes	ESAB. Advani - Orlikon Weld Alloy. Modi L&T Eutectic,
83.	Pot/Elastomeric Bearings	Prequalified Manufacturers as per RDSO's latest approved list
84.	Horizontal Tie Bars/Shear Bars	BB Bars System, BBV Systems ,Dextra

85.	HDPE Sheathing	Rex Polyextrusion, Gwalior Polypipes Ltd, M/s Dynamic Prestress
86.	Formwork Release Agent	FOSROC, MBT, MC Baucheme, Ado Conmat, CICO, SWC, Choksey, BASF, Adoadditives, STP
87.	Prestressing System	Freyssinet, BBR, VSL, Dynamic, Killick Nixon, Tensacciai (India Ltd.), Usha Martin, Posten, VSIL
88.	Reinforcement Couplers	Dextra, Moment
89.	Hollow Sections, Pipes	Surya Pipes, Hi-Tech Pipes, JSW, JSPL,
90.	Drainage Pipes	Tirupati Plastomatics, Duraline, REX, STIPL
91.	Acrylic Textured Coatings	Spectrum, Renova, Wallz, Surfa Nova, Jotun, Asian Paints
92.	Non shrink Grout	Fosroc Chemical (India). Sika BASF, ELCHEM, MBT. Sika.
93.	Bonding Coat	CICO, FOSROC, Sunanda speciality coating Pvt. Ltd., BASF, SWC. TAM
94.	Polysuphide Sealant	CICO. Pidilite. BASF. FOSROC. SWC, STP, Sika, Fairmate
95.	Steel Structural Fasteners	Pooja Forge, Sundram Fasteners, Unbrako, Nelson, Panchsheel
96.	Paints	Berger, Johnson Nicholson, Nerclac, Asian,
97.	Micro Silica	Sika, Elkem, FOSROC. MAPEI. Comiche, Star Silica, TAM, CALIPAR, CICO
98.	Fire Resistant Paints	Akzo Noble, PPG or equivalent, Jotun
99.	External Acrylic Emulsion	Berger, Apex, Asian, Nerolac, Jenson & Nicklson
100.	Integral Crystalline Waterproofing Method	Don Construction Chemicals pvt ltd
101.	Water stopper/Bar	Kanta Rubber. Greenstreak, Maruti, Duron
102.	Liquid polymer membrane waterproofing	INTEGRITANK, BASF. MAPEI, PIDILITE. DAVCO, CICO, Supreme Bituchem India Pvt. Ltd
103.	Curing Compound	Clean tech concure, SINAK, FOSROC, Ado additives, TAM, STP SWC.CICO, Rheoplast Technologies pvt. Ltd.
104.	Polycarbonate Sheets	M/s Gallina Acroplus. Coxwell, Poly U, Fabric, SABIC I.DANPALON
105.	Fly ash	Thermal plant. Ashcrete, Ultra pozz, star pozz, (the fly ash shall be as per our specifications)
106.	False Ceiling	Hunter Douglas

107.	ACP	Hunter Douglas, Durobuild
108.	Aluminum Louvers	Hunter Douglas-LUXALON H-3 , CS-RS-1605
109.	SS Railing	Sanvijay
110.	Barbed Wire / Chain-link fencing	Krishna Industries Bhilwara, / Concertina Coils New Delhi,
111.	PEB/Steel Structures/Pipe Structure	TT, Framecad, Voltagreen, Everest, ZAMIL
112.	Cement (For Brick Works, & General Work, Wall/Boundary Wall only)	Birla Gold (Manikgarh Cements)
113.	MS Angles & Flats	Ramson Steel (For general purpose only, not for dynamic & heavy loading structures)
114.	Corrosion Inhibitors -	Krishna Conchem Product Pvt. Ltd.
115.	Coal tar epoxy for sub-structure protection.	Krishna Conchem Product Pvt. Ltd.
116.	Porotherm lightweight clay hollow block/bricks	Wienrberger Bangalore
117.	Fibrillated polypropylene fibers	Bajaj Steel Industries Limited (for non-dynamic structure)
118.	Pre Engineering Building Pre fabricated Structural steel	M/S Kirby Building India Ltd
119.	Cold Rolled, Galvanized, Galvalume, Color Coated, HRPO, HRSP, Plain, Corrugated, Profilled, Sheets and Coils	M/s JSW Steel Coated Product Ltd
120.	Centrifugally Cast (Spun) iron pipes and fittings as per IS 15905 & ISO 6595 standards. Centrifugally cast iron pipes and fittings as per IS 3989 specifications. Ductile iron manhole covers, frames & gratings as per EN-124 standards. Cast iron manhole covers, frames & gratings (ISI Marked) as per IS: 1726.	M/S Jayaswal Neco Industries Ltd
121.	Aluminium Composite. Aluminium Colour Coated Coils.	M/S Alstrong Enterprses Pvt. Ltd

122.	Pre Engineering Building, Pre Fabricated Structural Steel Grade	M/S PHENIX Construction Technologies(A Division Of M&B Engineering Limited)
123.	Waterproofing Membranes	M/S Tiki Tar Danosa (India) Private Limited
124.	Fire rated Steel Doors, Fire rated timbers Doors ,Fire Barriers, Fire rated Sliding Doors and Fire rated Rolling Shutters	M/S Signum Fire Protection India PVT Ltd
125.	ALCCOFINE 1203 Micro fine additive for concrete and mortars	M/S Counto Microfine Products Pvt Ltd
126.	Profiling of Galvanized and Colour Coated Roofing and Decking Sheet from approved Manufactures of sheets	M/S Aditya Profiles Pvt Ltd
127.	Manual Metal Arc Welding (MMAW) Electrodes	M/S Weldfast Electrodes Pvt Ltd
128.	MS ERW Black, Galvanized Round Pipes Hollow Sections	M/S APL Apollo Tubes Limited
129.	Manhole Covers, Gully Covers, Overhead water tank covers, Underground water tank covers & Gratings	M/S HP International
130.	Chemical Anchoring FriuIsider Mechanical Anchoring System	M/S Ripple Construction Products Pvt Ltd
131.	Bronze and Brass gate Globe check strainers and ball valves and ductile iron and Aluminium Butterfly valves	M/S Kitz Corporation
132.	Steel Wire Ropes	M/S ORION ROPES Pvt Ltd
133.	Pre Engineered Structures and Structural Steel	M/S Apex Buildsys Turnkey Solution
134.	Industrial and decorative Paints, Powder Coating, Emulsion Paint, Synthetic Enamel and Polyurethane Paint	M/S Kansai Nerolac Paints Limited

135.	SHELLOXY-Crack bridging, decorative, flexible, anti-carbonation and waterproofing coating for concrete SUPER SHIELD SELFPROTEK – Heavy Duty ,Cold applied, self adhesive water proofing membrane with HMHDPE laminated for electric insulation	M/S Supreme Bituchem India Pvt Ltd
136.	Rerolling of steel section, column section , Wide flange beam, channel section ,angle section for Non Dynamic Structures	M/s Shri Bajrang Alloys Ltd.
137.	Hot Rolled Structural Steel , Beam - 200mm to 600mm, Channel- 200mm to 600 mm ,Angle -130 mm to 200 mm and H-Beam -150 mm to 200 mm for Non Dynamic Structures	M/s Topworth steel &power Pvt Ltd.
138.	Pre Engineered Building (Steel Column & steel Roof)	M/s Richa Industries Ltd.
139.	Integral waterproofing compound, Wall putty, Floor hardeners, Grouts for machine foundation, Epoxy bonding agent and structural repair product	M/s Perma Construction Aids Pvt Ltd.

140.	Expansion joints, Epoxy Formwork Release Agent , Segment Bonding Agent , Acrylic Textured Coating, Bonding Coat or Bonding Agent, Polysulphide Sealant, Water Stopper /Bar, Liquid Polymer membrane Waterproofing, Curing Compound, Waterproofing Systems, Polymer	M/s Fair Mate Chemicals Pvt Ltd.
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The above list is not exhaustive. Contractor may proposes similar product of other reputed vendor too for the works. However the approval /acceptance / rejection of proposed vendor rest with NMRCL.

Vendor List for MEP Works

Sl. No.	Item	Proposed vendor List for NMRCL
Vendor List for Electrical items:		
1.1	MS/GI Conduits ISI embossed black enamelled / galvanized	AKG BEC,
1.2	MS/GI Conduit accessories superior type as per approved samples	Sharma Sales Corporation Super Sales Corporation
1.3	PVC rigid conduit and accessories ISI embossed	BEC, AK
1.4	PVC flexible conduit and accessories	PMA-SSK
1.5	MS Raceways and raceway accessories.	V K Industries Steelways
1.6	Cable trays & Cable ladder	Indo Asian Profab Patny Innospace Rattan Omcara Emco Mahaveer,kalkatta Technofab Engineers Sunrise Electrical Industries M K Industries Sai Cable Tray Pinnacle metals
2	Wires, cables and cable accessories	
2.1	Wires	
2.1.1	1100 volt grade FRLSZH /FR PVC insulated stranded copper conductor wires	Finolex Polycab Bon Ton KEI RR cable Anchor RPG Universal Leoni Lapp
2.2	1100 volt grade Cables	
2.2.1	1100 volt grade ,armoured, XLPE FRLSZH/Fire Resistant cable, Copper/Aluminium Conductor cables	Poly cab Havells Finolex KEI RR cable Anchor RPG Universal Leoni

		Lapp Cords Rallison Govind cables
2.3	Cable Accessories	
2.3.1	1100 volts Doubles compression brass cable glands	Dowells, Peeco, Comet Siemens
2.3.2	1100 volts Doubles compression PVC cable glands	Trinity Touch (Jacob)
2.3.3	1100 volt Cable lugs	Dowell's (Biller India Pvt. Ltd)
2.3.4	Terminal blocks & cage clamps	ELMEXX, PHOENIX, WAGO, Connectwel
3	Wiring accessories	
3.1	Modular grid plate wiring accessories (switches, socket outlets bells etc.) with boxes.	Siemens Honeywell Wraparound Plus Legrand Mosaic
3.2	Metal clad Socket Outlets with boxes	Anchor MK Legrand Crabtree
3.3	Under floor junction boxes and cable management system	Legrand
3.4	Weather Proof plugs and sockets (IP 65 / 66)	Neptune Legrand
4.	Distribution equipment	
4.1	Switchgear	
4.1.1	MCB's/RCCB's	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.1.2	Earth leakage circuit breaker	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.1.3	Timers in Distribution Boards	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.1.4	Distribution Boards	Schneider Siemens Legrand Lexic
4.2	Circuit Breakers	
4.2.1	Moulded Case Circuit Breakers, Motor protection circuit breaker	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.2.2	Switch Fuse Units and Isolators	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.2.3	Change over switch / Isolators	L&T HH Elcon
4.2.4	Air Circuit Breaker	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.2.5	Automatic transfer switch (ATS)	Tricolite ASCO Cummins Socomac
4.2.6	Power/auxiliary, Capacitor control Contactors, overload relays	L&T, GE, ABB, Siemens, Schneider, Merlin Gerin
4.2.7	MPP heavy duty Capacitors	Siemens (Epcos), Neptune Ducati
4.3	Accessories	

4.3.1	Protection relays electromechanical	Areva, ABB, L&T,
4.3.2	Protection Relays Numeric	Areva, ABB, Siemens
4.3.3	APFC relay 3 phase	L&T, Ducati Neptune Konzerv,
4.3.4	Single phase preventer, overload relays	Siemens ABB, Schneider Electric,
4.3.5	Current Transformer	Gillbert & Maxwell, Precise, AE,
4.3.6	Control / Potential Transformer	Gillbert & Maxwell, Precise, AE
4.3.7	Push Buttons, Indicating lamps LED	L&T, GE, Siemens, Schneider,
4.3.8	Selector switches	L&T, Siemens,
4.3.9	Instruments – analogue	L&T Rishab, AE,
4.3.10	Digital meters	L&T, Schneider,
4.3.11	Power and harmonic analyzer	Konzerv Secure Neptune Ducati
4.3.12	Programmable Logic Controller (PLC)	Allen Bradley, Siemens
4.4	LT 415 volt switchboards	
4.4.1	Main LT switchboards PLC Panels Capacitor Panels Floor LT panels	Dricolite, EMCO Switchgear, Power control, Bajaj, Lotus, Pragathi control, Pyrotech
5.	Bus Trunking	
5.1	Lighting Bus Trunking	Dricolite, EMCO Switchgear, Power control, Bajaj, Lotus, Pragathi control, Pyrotech
6.	Light Fixture & Accessories	
6.1	Light fittings	Philips, Wipro, GE
6.2	Area Lighting Masts	Wipro, Philips, GE
6.3	Circulator fans/exhaust fans	Crompton Greaves, Orient, Khaitan, Almonard

6.4	Lighting Control system	Hubbell, Dynalite, Wipro
6.5	Ceiling Fans	Crompton Greaves, Orient, Khaitan
6.6	LED	Nichia, Lumileds, Citizen, Cree, LG
7.	UPS System	
7.1	UPS System	Emerson Delta Socomac Hireal
7.2	UPS Battery	Exide, Farukawa, Standard, Aamaraja
8.	Miscellaneous Sub Station equipment	
8.1	Rubber mats	
8.2	CO2 Fire extinguishers	Fire Traces Tyco
8.3	Battery banks maintenance free VRLA	HBL Nife Exide, Amar Raja, Standard Furukawa
8.4	Battery charger	HBL Nife AE Caldyne, Amar Raja
9	Miscellaneous	
9.1	Anchor Fastener	Hilti, Fisher
9.2	Welding rods	Advani Oerlikon L&T
9.3	Paints	ICI, Asian, Shalimar
9.4	Fire sealing material	Hilti Birla 3M Roxtec
10	BMS / SCADA	GE Honey well Mitsubishi Siemens Rockwell Automation ABB
11	DG SET	Sudhir Powerica Mahindra Jackson
Vendor List for Fire Fitting Systems:		
1	Fire hydrant valves	Inter Valves Lehary Kartar Zotoisi

		Sant
2	Piping	TATA ,Jindal, Apollo,Values
3	Fire hose pipes with Stainless Steel coupling	New Age Ind. CRC Jayshree
4	Rubber hose reel	Jyoti Maruti
5	First aid fire hose reels	
6	Fire extinguishers	Minimax Safex
7	Sprinkler heads	
	(a) Sidewall type	
	(b) Sprinkler intelligent (auto start / shut)	Tyco Reliable Grinnell
8	Horizontal centrifugal pumps	Kirlosker WILO KSB Grundfos Becon CRI
9	Electric motors	Siemens, KEC, CGL
10	Electrical switch gear & starter	As per electrical works
11	Cables	As per electrical works
12	Flow switch	System Sensor, Potter
13	Suction strainer	Leader / Zoloto
14	Vibration eliminator connectors	Resistoflex
15	Fire alarm detectors	Edwards Notifier
16	Panel Flooding(CO2)	FireDe Tech Fire Traces
Vendor list for HVAC System		
1	VRV Unit	Toshiba Blue star Voltas Daikin Mitsubishi
2.	Fans	Flakt, Kruger, System Air, Marathon
3	Grille/diffuser and fire damper	Caryaire, Ravistar, Air Flow
4	Factory fabricated ducting	Rolastar, Zeco,Techno Fabriduct

5	Fiber glass Insulation	UP Twiga, Kimco, Owens Corning
6	Anchor Fasteners	Hilti, Fischer
7	MS/GI Conduits ISI embossed black enamelled / galvanized	As per Electrical works
8	Cable trays & Cable ladder	As per Electrical works
9	1100 volt grade XLPE Insulated Aluminium Conductor cables	As per Electrical works
10	1100 volts Doubles compression brass cable glands	As per Electrical works
11	MCB's/RCCB's	As per Electrical works
12	Moulded Case Circuit Breakers, Motor protection circuit breaker	As per Electrical works
13	Main LT switchboards PLC Panels Capacitor Panels Floor LT panels	As per Electrical works
14	Electrical motors	CGL, Siemens, KEC
15	Welding rods	Advani Oerlikon, L&T
Vendor list for Public Health Engineering		
1	Sanitary Fittings	Parryware Jaquware Hindware
2	Water Cooler	Blue star Daiken Volts
3	Water heater	Bajaj Smith
4	Piping	TATA Jindal

		Apollo Values
5	Horizontal centrifugal pumps	Kirlosker WILO KSB Grundfos Becon CRI
6	Valves	Inter Valves Lehary Kartar Zotoisi Sant

Maharashtra Metro Rail Corporation Limited

(A Joint Venture of Government of India and Government of Maharashtra)

PUNE METRO RAIL PROJECT

Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

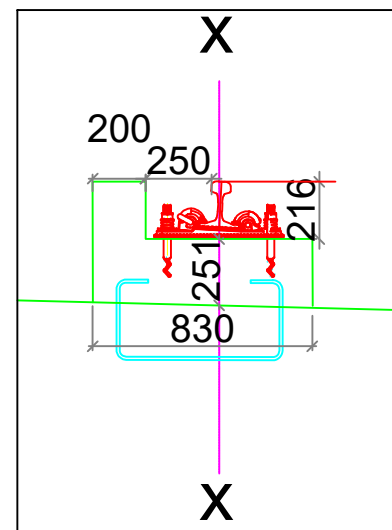
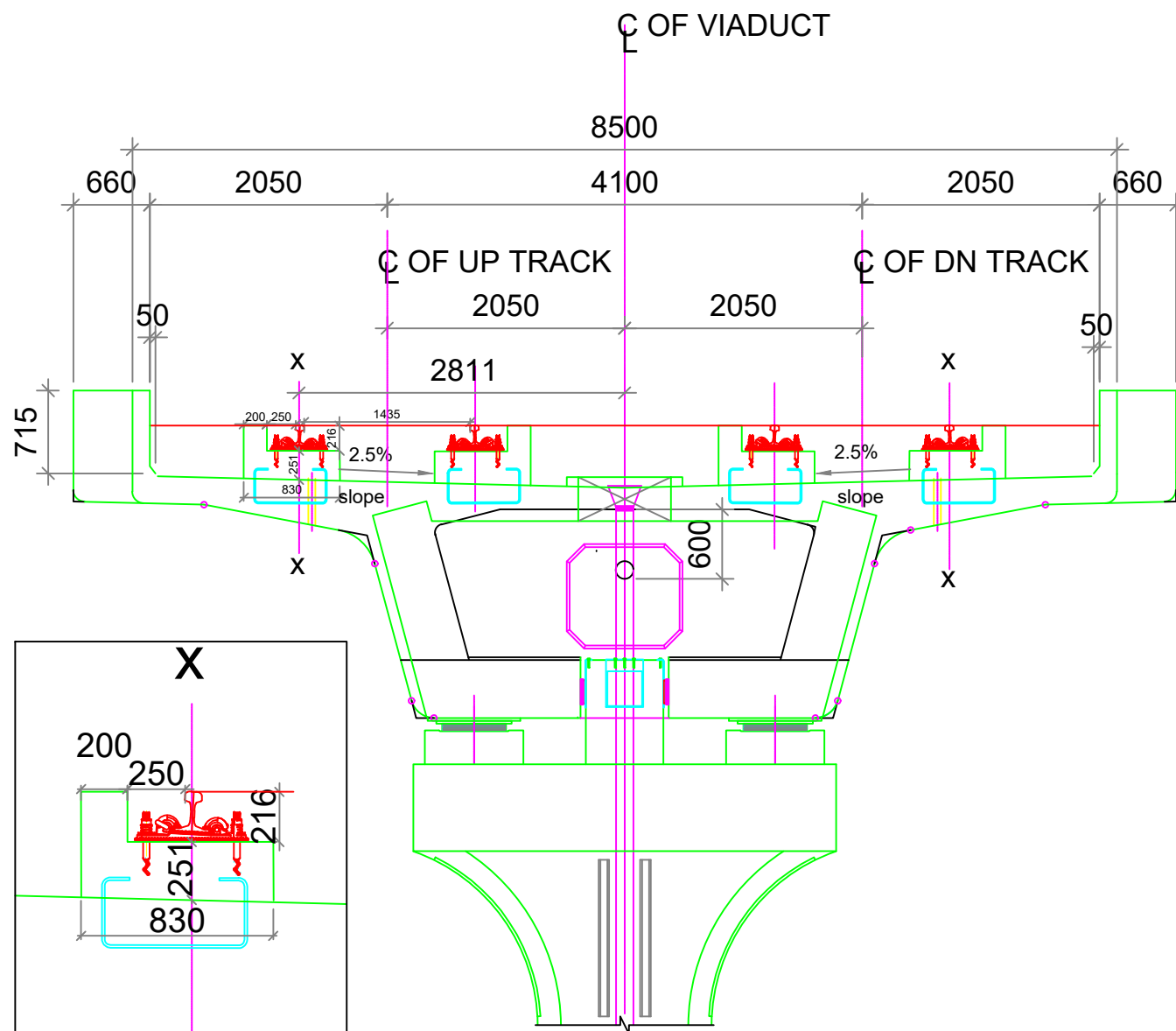
TENDER NO.

P1-T06/2021

PART- IV

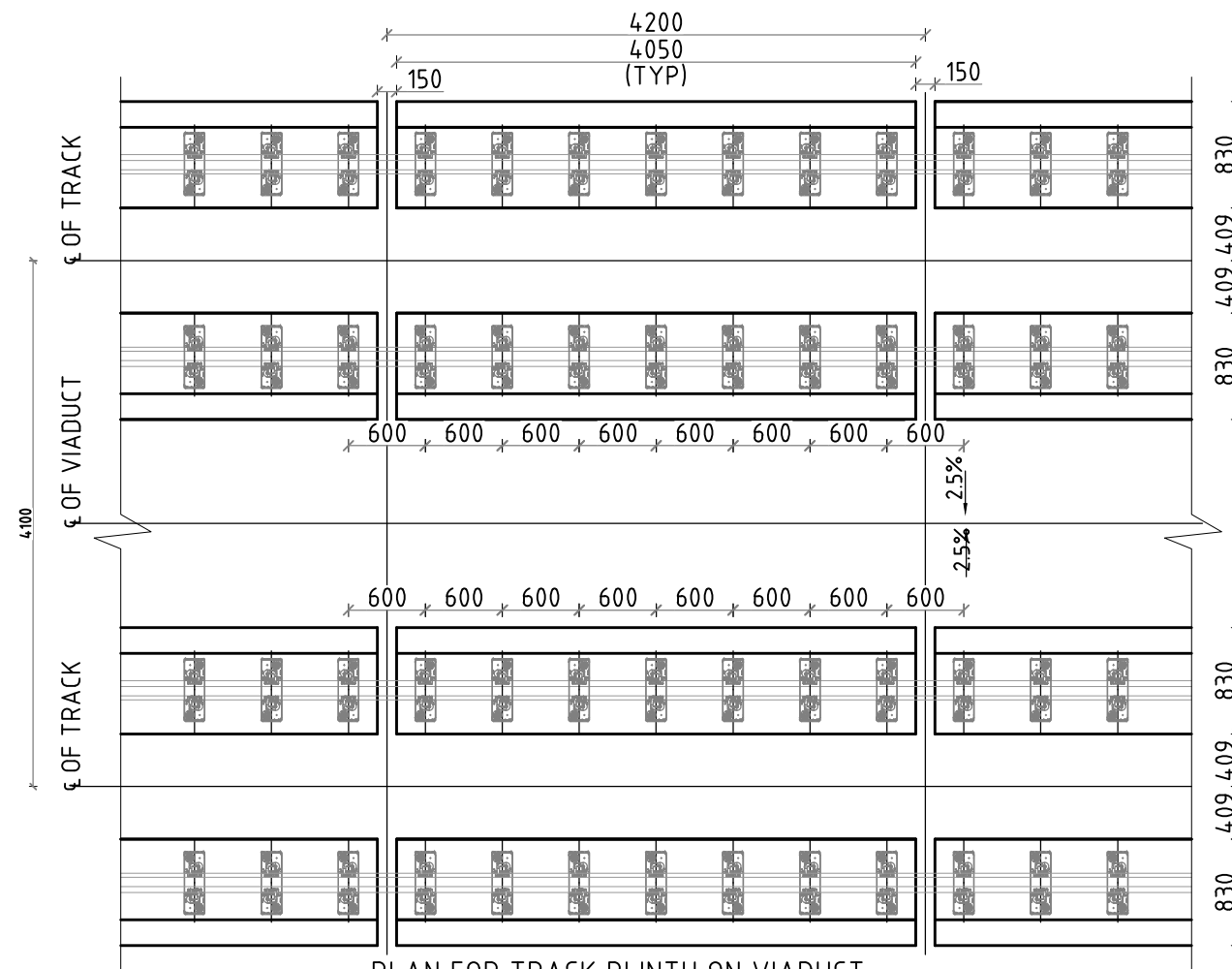
TENDER DRAWINGS

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021




TYPICAL VIADUCT CROSS-SECTION WITH STANDARD TRACK PLINTH
DEPTH 467 mm (251+216 AT X-X).

NOTE: OTHER DIMENSIONS TO BE CALCULATED AS PER CROSS SLOPE

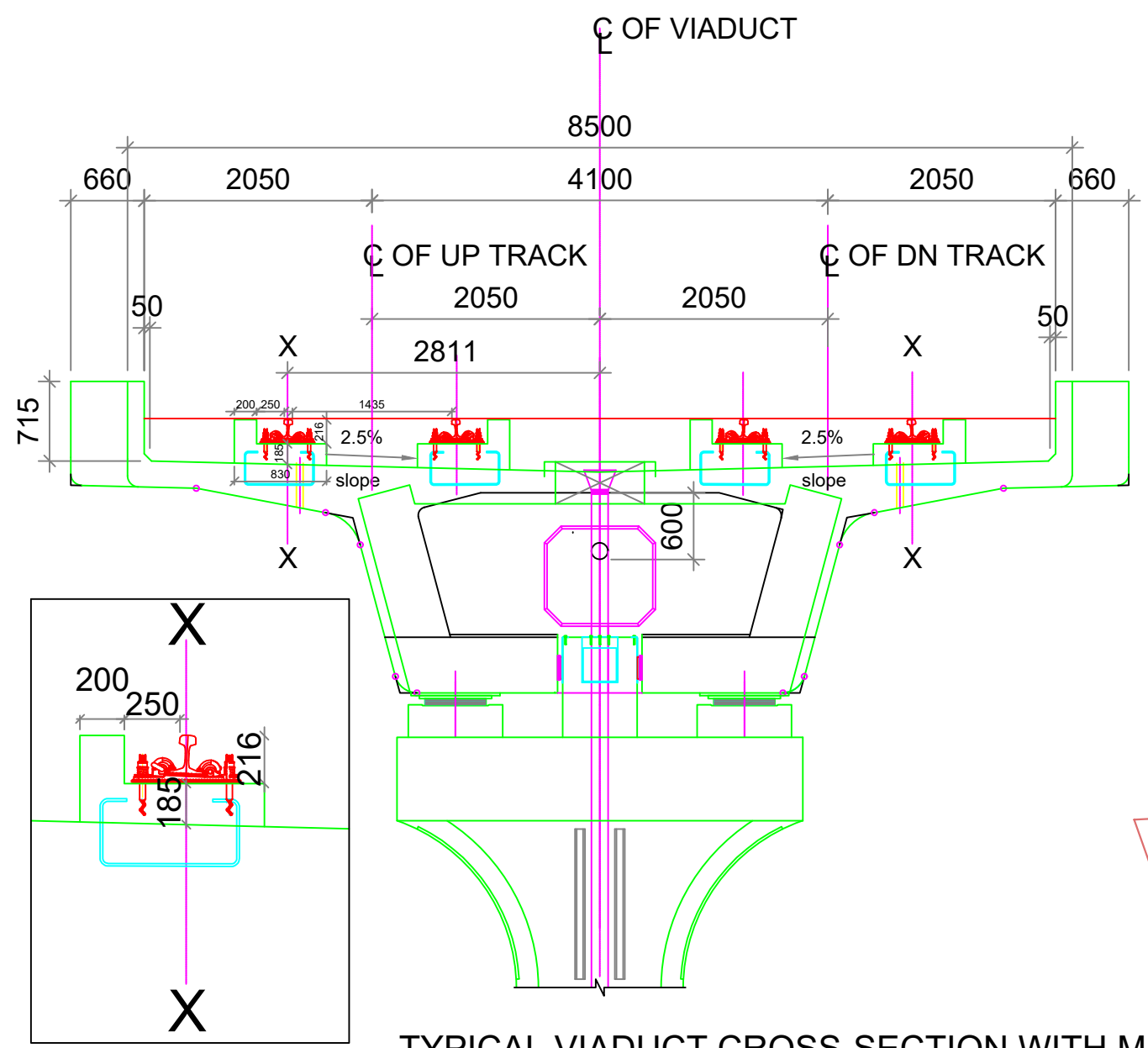


PLAN FOR TRACK PLINTH ON VIADUCT

SCALE - 1:30

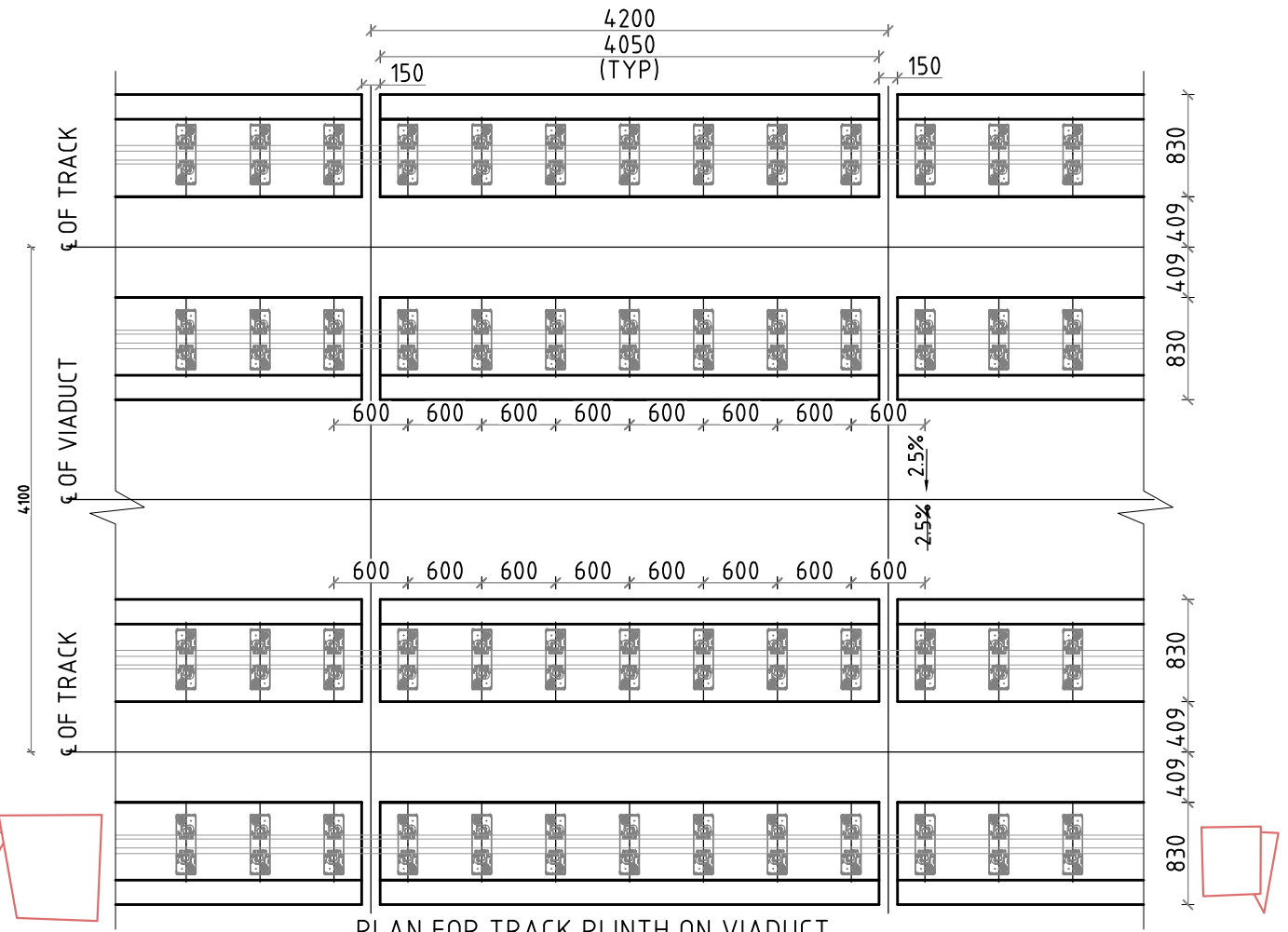
PROJECT:	 PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India		
CLIENT:	MAHARASHTRA METRO RAIL CORPORATION LTD.		
LOCATION:	LOCATION		
TITLE:	TYPICAL VIADUCT CROSS-SECTION WITH STANDARD TRACK PLINTH DEPTH 467mm AT X-X.		
SCALE:	DATE:	STATUS:	REVISION NO:
DRG NO:			

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021





**TYPICAL VIADUCT CROSS-SECTION WITH MINIMUM TRACK PLINTH
DEPTH 401 mm.(185+216 mm AT X-X) .**

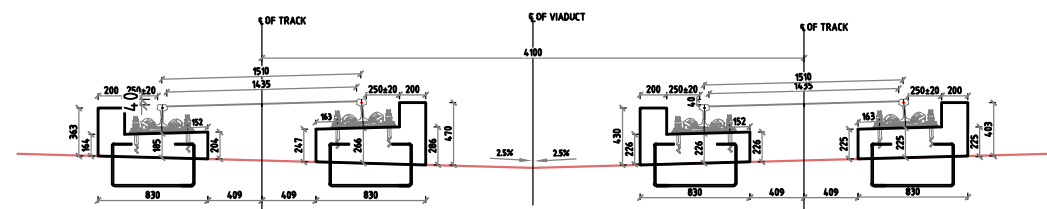
NOTE: OTHER DIMENSIONS TO BE CALCULATED AS PER CROSS SLOPE



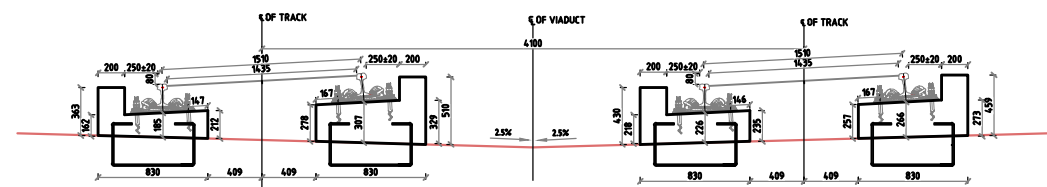
**PLAN FOR TRACK PLINTH ON VIADUCT
SCALE - 1:30**

PROJECT:		<div><div><p>PUNE METRO</p></div><div><p>PUNE METRO RAIL PROJECT</p><p>The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</p></div></div>	<div><div><p>PUNE METRO</p></div><div><p>महा मेट्रो</p></div></div>
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.	
LOCATION:		LOCATION	
TITLE:		TYPICAL VIADUCT CROSS-SECTION WITH MINIMUM TRACK PLINTH DEPTH 401 mm. UNDER RAIL	
SCALE:	DATE:	STATUS:	
DRG NO:			

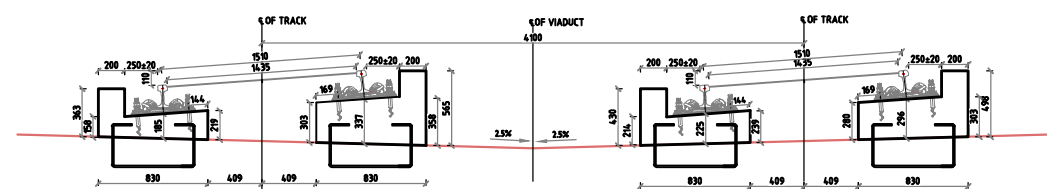
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



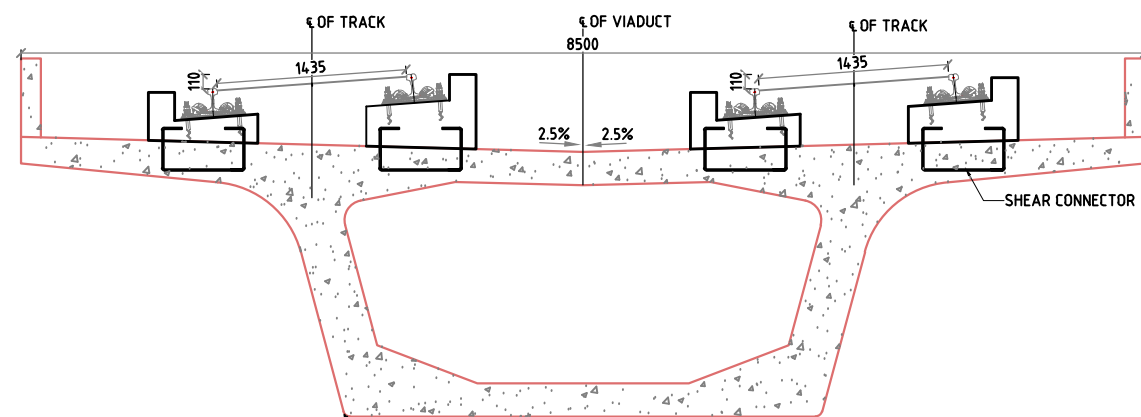
DIMENSIONAL DETAILS OF TRACK PLINTH - "40"mm CANT
SCALE(1:15)



DIMENSIONAL DETAILS OF TRACK PLINTH - "80"mm CANT
SCALE(1:15)

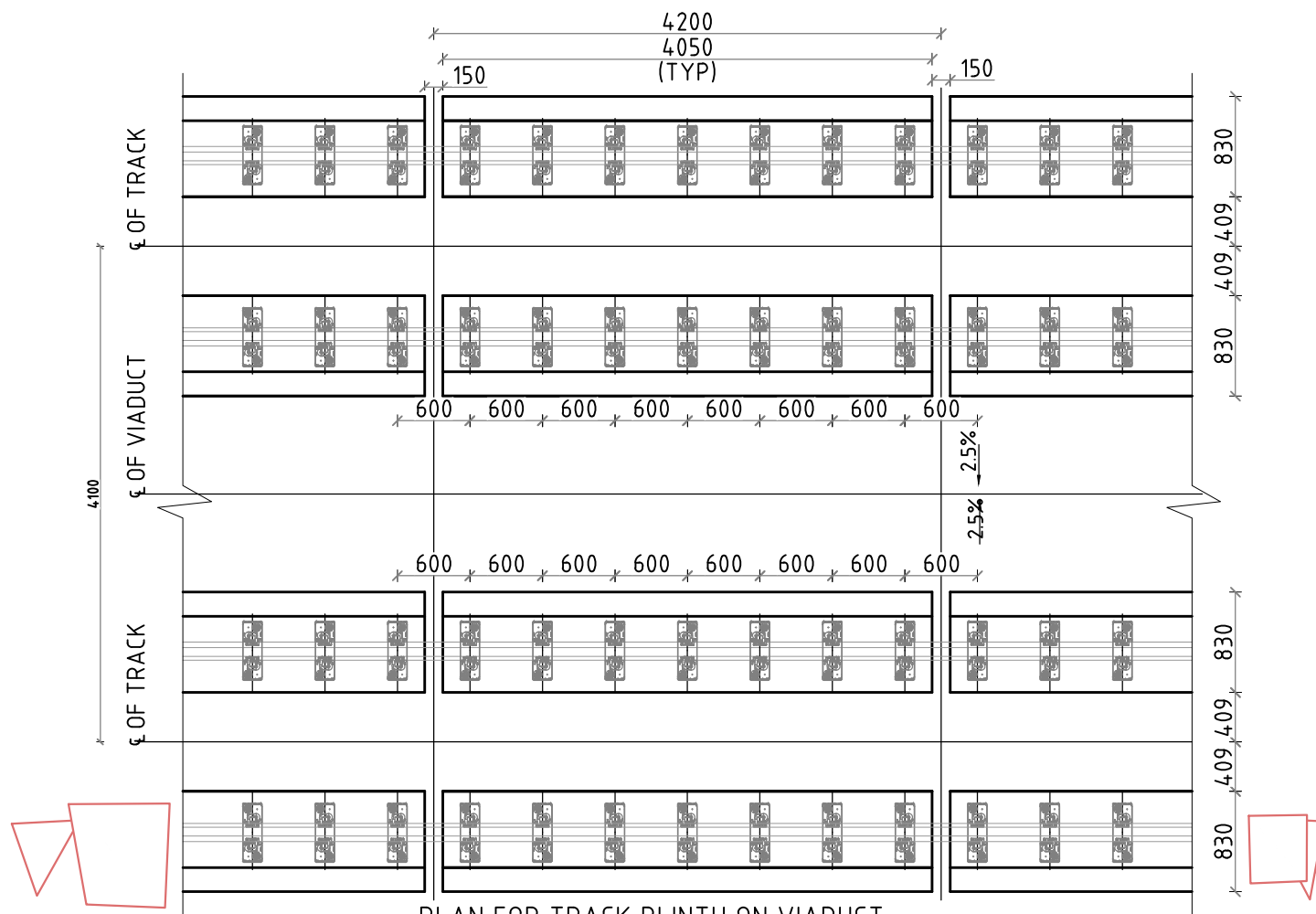


DIMENSIONAL DETAILS OF TRACK PLINTH - "110"mm CANT
SCALE(1:15)





GENERAL ARRANGEMENT OF TRACK PLINTH OVER VIADUCT
SCALE(1:25)

TYPICAL CROSS SECTION OF PLINTH IN CURVE ALIGNMENT



PLAN FOR TRACK PLINTH ON VIADUCT
SCALE - 1:30

PROJECT:	<div>PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div>			<div>महाराष्ट्र मेट्रो PUNE METRO</div>
CLIENT:	MAHARASHTRA METRO RAIL CORPORATION LTD.			
LOCATION:	LOCATION			
TITLE:	TYPICAL CROSS SECTION OF PLINTH IN CURVE ALIGNMENT			
SCALE:	DATE:	STATUS:	REVISION NO:	
DRG NO:				

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

Theor. Running edge distance

Sum of baseplate distances (measured in rail center line)

Distance between plates (measured in rail center line)

Baseplate Numbering

Acc. detail stock rail machining

Rail Seat Numbering

Baseplate Numbering

Distance between plates (measured in rail center line)

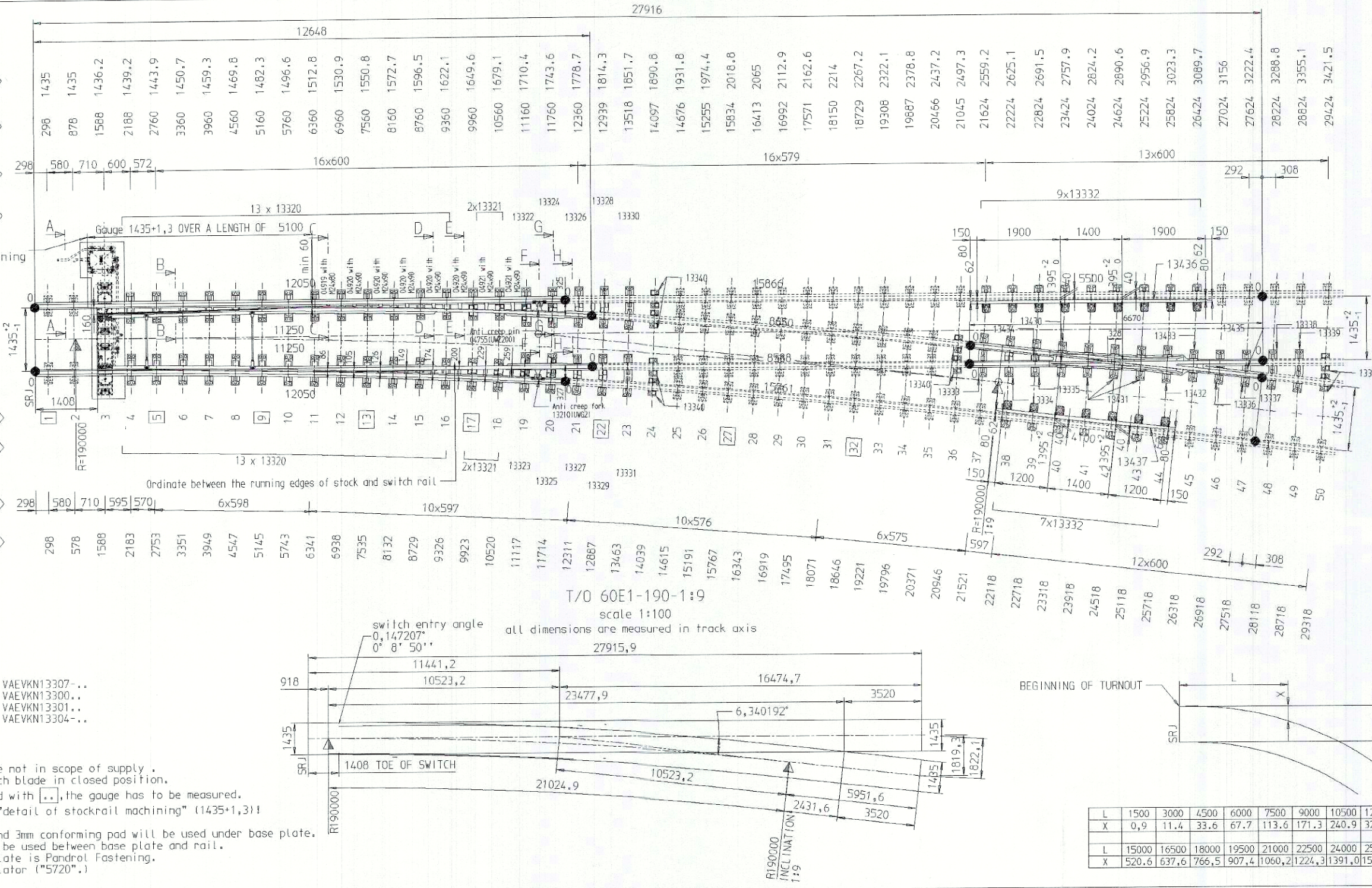
Sum of baseplate distances (measured in rail center line)

● welding joint

Weldable CMS Crossing
Section Switch device
Guard rail assembly
Switch drive assembly

8. Item shown in dotted line are not in scope of supply.
7. Stress free position of switch blade in closed position.
6. On Rail Seat Numbering marked with [..], the gauge has to be measured.
Except: Numbers 3 to 11 see "detail of stockrail machining" (1435+1,3)!!
5. Rail gap 0mm.
4. 10mm thick elastomeric pad and 3mm conforming pad will be used under base plate.
3. 10mm Thick EVA Rail Pad will be used between base plate and rail.
2. Standard Fastening on Base Plate is Pandrol Fastening.
(Pandrol Clip "e2007" & Insulator ("5720").)
1. All dimensions are in mm.

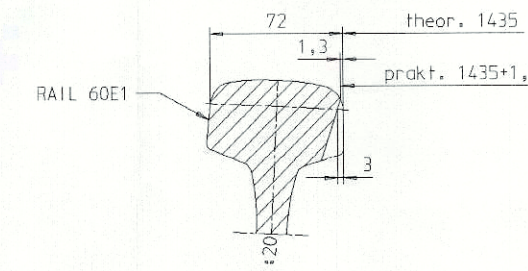
NOTE



Location of plastic pads in turnout

Baseplate	Rail Pad 1	Pcs	Rail Pad 2	Pcs	Pad 1 (10mm) (under base plate)	Pcs	Pad 2 (3mm) (under base plate)	Pcs
VAEVKN13320	VAEVKN09305	1	-	-	VAEVKN13442	1	VAEVKN13462	1
VAEVKN13321	VAEVKN13140	1	-	-	VAEVKN13443	1	VAEVKN13463	1
VAEVKN13322/VAEVKN13323	VAEVKN13140	1	VAEVKN13208	1	VAEVKN13444	1	VAEVKN13464	1
VAEVKN13324/VAEVKN13325	VAEVKN13140	1	VAEVKN13208	1	VAEVKN13445	1	VAEVKN13465	1
VAEVKN13326/VAEVKN13327	VAEVKN09307	2	-	-	VAEVKN13446	1	VAEVKN13466	1
VAEVKN13328/VAEVKN13329	VAEVKN09307	2	-	-	VAEVKN13447	1	VAEVKN13467	1
VAEVKN13330/VAEVKN13331	VAEVKN11820	2	-	-	VAEVKN13448	1	VAEVKN13468	1
VAEVKN13333	VAEVKN11820	2	-	-	VAEVKN13449	1	VAEVKN13469	1
VAEVKN13334	VAEVKN09307	2	-	-	VAEVKN13450	1	VAEVKN13470	1
VAEVKN13335	VAEVKN09305	2	-	-	VAEVKN13451	1	VAEVKN13471	1
VAEVKN13336	VAEVKN09305	2	-	-	VAEVKN13452	1	VAEVKN13472	1
VAEVKN13337	VAEVKN09305	2	-	-	VAEVKN13453	1	VAEVKN13473	1
VAEVKN13338	VAEVKN11820	2	-	-	VAEVKN13454	1	VAEVKN13474	1
VAEVKN13339	VAEVKN11820	2	-	-	VAEVKN13455	1	VAEVKN13475	1
VAEVKN13340	VAEVKN09304	1	-	-	VAEVKN13456	1	VAEVKN13476	1
VAEVKN13332	VAEVKN11817	1	-	-	VAEVKN13457	1	VAEVKN13477	1
VAEVKN13430	VAEVKN13438	1	-	-	VAEVKN13458	1	VAEVKN13478	1
VAEVKN13431	VAEVKN13439	1	-	-	VAEVKN13459	1	VAEVKN13479	1
VAEVKN13432	VAEVKN13440	1	-	-	VAEVKN13460	1	VAEVKN13480	1
VAEVKN13433	VAEVKN13441	1	-	-	VAEVKN13461	1	VAEVKN13481	1

Detail of stockrail machining
scale 1:2



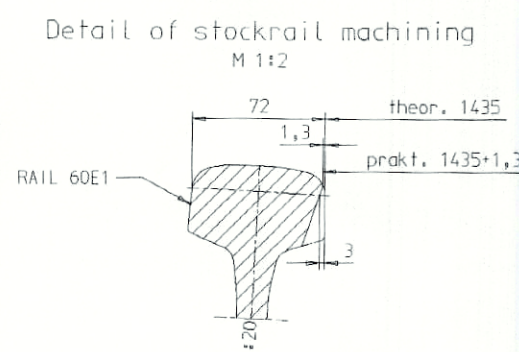
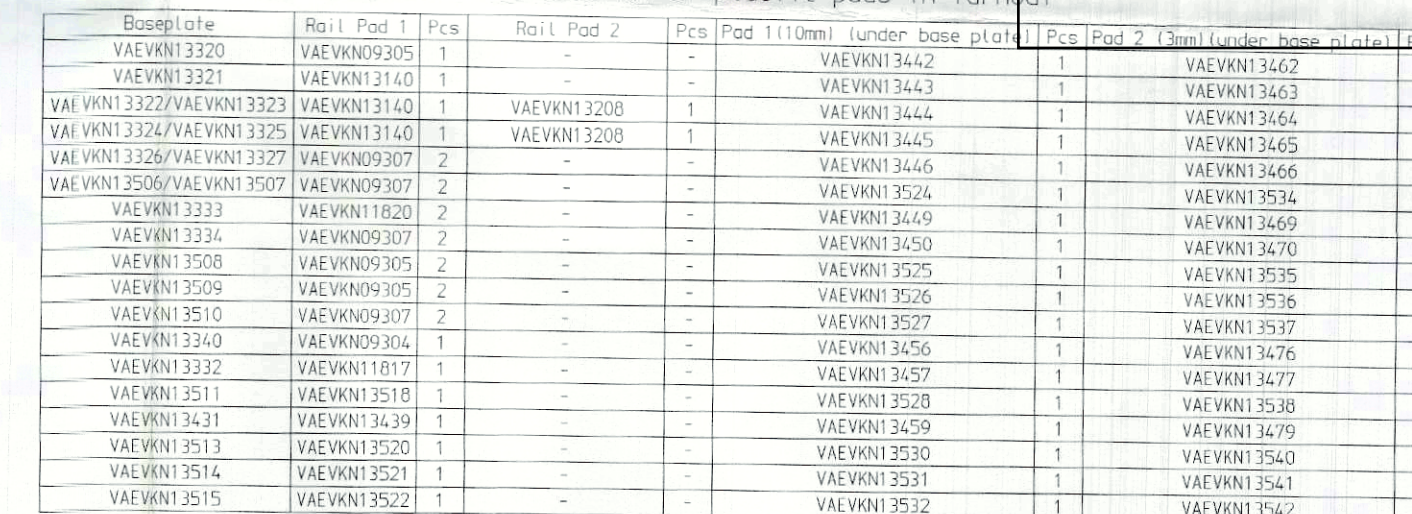
"RH" TURNOUT AS DRAWN
"LH" MIRROR IMAGE (EXCEPT PLATES)

SIGNALLING CONTRACTOR:- ALSTOM-MCEM91-52(Machine)
+ V.C.C CLAMP LOCK



PROJECT:-PUNE METRO

ITEM REF.	QUANTITY	MATERIAL DESCRIPTION	WT. - Kg
DESIGNED BY	VIKAS GOSWAMI	21-08-2020	
CHECKED BY	RANJIT SINGH	22-08-2020	
APPROVED BY	RANJIT SINGH	22-08-2020	
SHEET	01 OF 01	SIZE A0-A2	SCALE 1:50
FILE:-	13218.prj		

voestalpine VAE VKN INDIA PVT. LTD.
BAHALGARH, SONEPAT, HARYANA
INDIA
LAYOUT FOR 1 IN 9-190R, 1:20 CANTED TURNOUT FOR 1435mm TRACK GAUGE WITH 60E1 AND 60E1A1 SWITCH BLADE RAILS ON BALLASTLESS TRACK
DRAWING NO:- VAEVKN13218-00
REF. DRG:-
THIS DRAWING IS THE PROPERTY OF voestalpine VAE VKN INDIA PVT. LTD. AND SHALL NOT BE USED, COPIED OR REPRODUCTION IN PART OR WHOLE WITHOUT PRIOR CONSENT.



9. Torque required for tightening the bolt (M24-337Nm & M27-900Nm)
6. Item shown in dotted line are not in scope of supply
7. Stress free position of switch blade in closed position.
6. On Rail Seat Numbering marked with [...], the gauge has to be measured.
Except: Numbers 1 to 10 see "detail of stockrail machining" (1435-1,31)
5. Rail gap 0mm.
4. 10mm thick elasticomeric pad and 3mm conforming pad will be used under base plate
3. 10mm thick EVA Rail Pad will be used between base plate and rail.
2. Standard Fastening on Base Plate is Pandrol Fastening,
(Pandrol Clip "e2007" & Insulator "S720r")
1. All dimensions are in mm.

ITEM REF.		QUANTITY	MATERIAL DESCRIPTION -		WT. - Kg
NAME		DATE	SIGN		
DESIGNED BY	VIKAS GOSWAMI	26-08-2020		voestalpine VAE VKN INDIA PVT, LTD	
CHECKED BY	RANJIT SINGH	27-08-2020		BAHALGARH, SONPAT, HARYANA	
APPROVED BY	RANJIT SINGH	27-08-2020		INDIA	
	SHEET 01 OF 01	SIZE A0-A1	SCALE 1:50 1:10 (1:15)	LAYOUT FOR 1 IN 7-190R, 1:20 CANTED THROUOUT FOR 1:435mm TRACK GAUGE WITH 60E1 AND 60E1/1 SWITCH BLADE RAILS ON BALLASTLESS TRACK	
DRAWING NOT-			VAEVKN13219-00		REF. DRG.
FILE:- 13219.pdf			ALL DIM. IN "MM"		
			THE PROPERTY OF voestalpine VAE VKN INDIA PVT. LTD. AND SHALL NOT BE USED, COPIED		

Qurban
Nikhil
Sharma



REV NO	REVISION NOTE	DATE	CHANGED BY	CHECKED BY
01	GUARD RAIL ASSEMBLY DRAWING NO REVISED	05-09-2020	CHETAN	RANJIT SINGH

Sum of baseplate distances
(measured in rail center line)

Distance between plates
(measured in rail center line)

theor. Running edge
distance

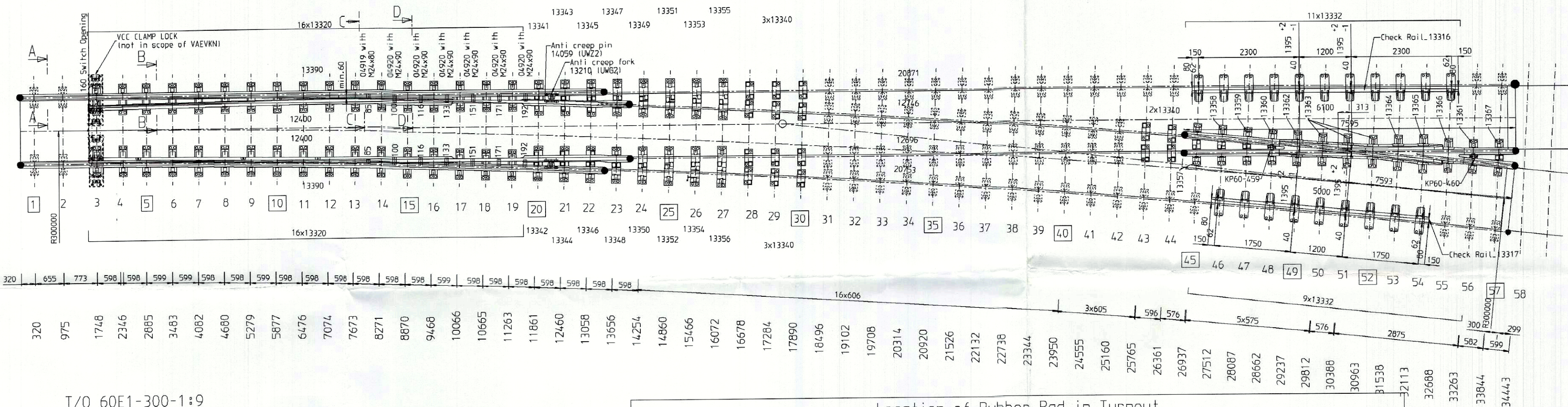
Baseplate Numbering

Sleeper Numbering

Baseplate Numbering

Distance between plates
(measured in rail center line)

Sum of baseplate distances
(measured in rail center line)



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

Signature
Date
Name
Sharma

VAEVKN India Pvt. Ltd.
BHALGARH, SONEPAT, HARYANA
INDIA

PROJECT:-PUNE METRO

"RH" TURNOUT AS DRAWN
"LH" MIRROR IMAGE (EXCEPT PLATES)
SIGNALLING CONTRACTOR:- ALSTOM-MCEME 91-52(Machine)
CLAMP LOCK VCC

ITEM REF.	QUANTITY	MATERIAL DESCRIPTION	WT. - Kg
DESIGNED BY	NAME	DATE	SIGN
CHECKED BY	RANJIT SINGH	24-08-2020	
APPROVED BY	RANJIT SINGH	24-08-2020	
	SHEET	SIZE	SCALE
FILE:-	13217.pr		

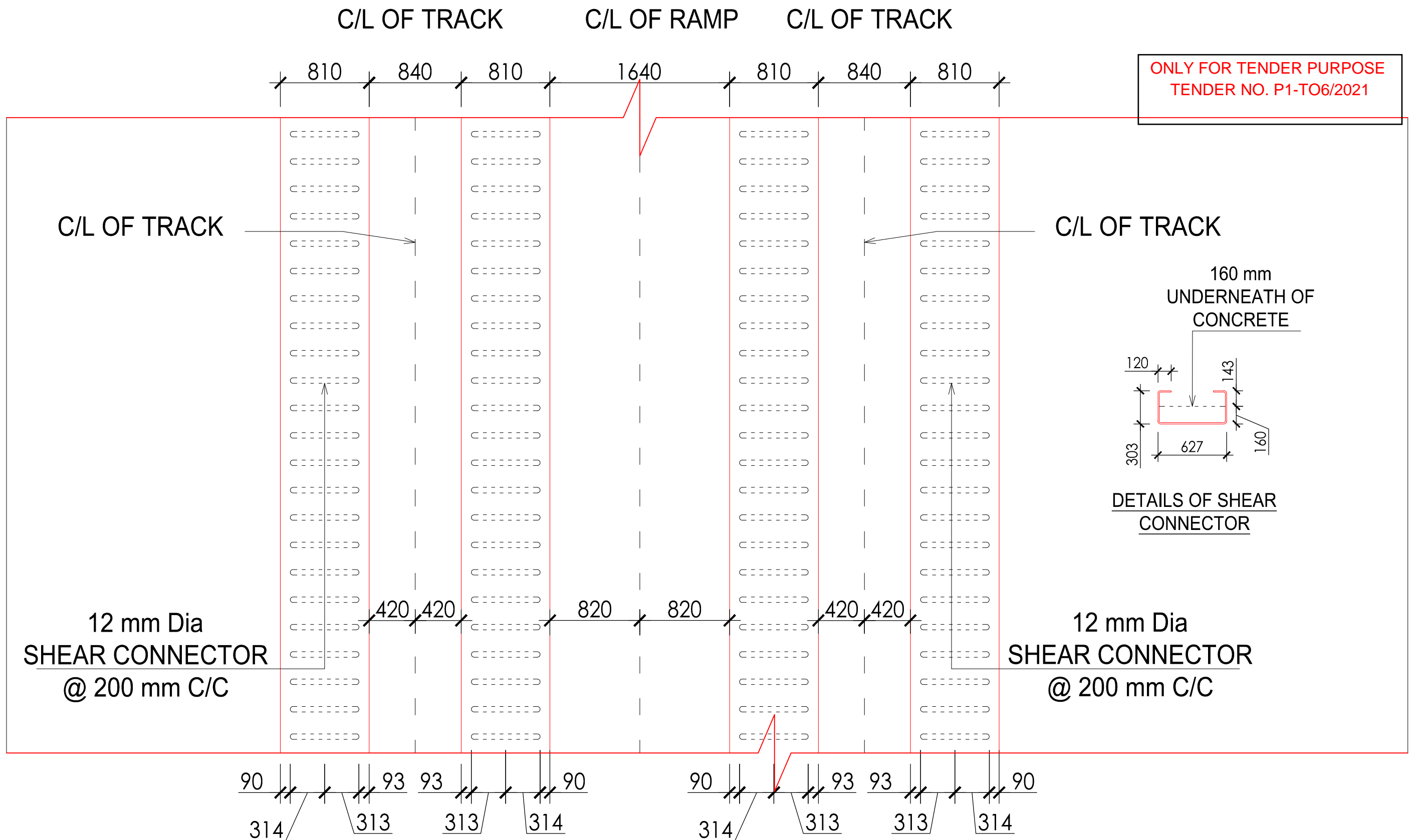
voestalpine VAE VKN INDIA PVT. LTD.
BAHALGARH, SONEPAT, HARYANA
INDIA

LAYOUT FOR 1 IN 9 - 300R, 1:20 CANTED TURNOUT FOR 1435mm
TRACK GAUGE WITH 60E1 AND 60E1A1 SWITCH BLADE RAILS ON
BALLASTLESS TRACK.

DRAWING NO:- VAEVKN13217-01 REF. DRG:-



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OR REPRODUCTION IN PART OR WHOLE WITHOUT PRIOR CONSENT.

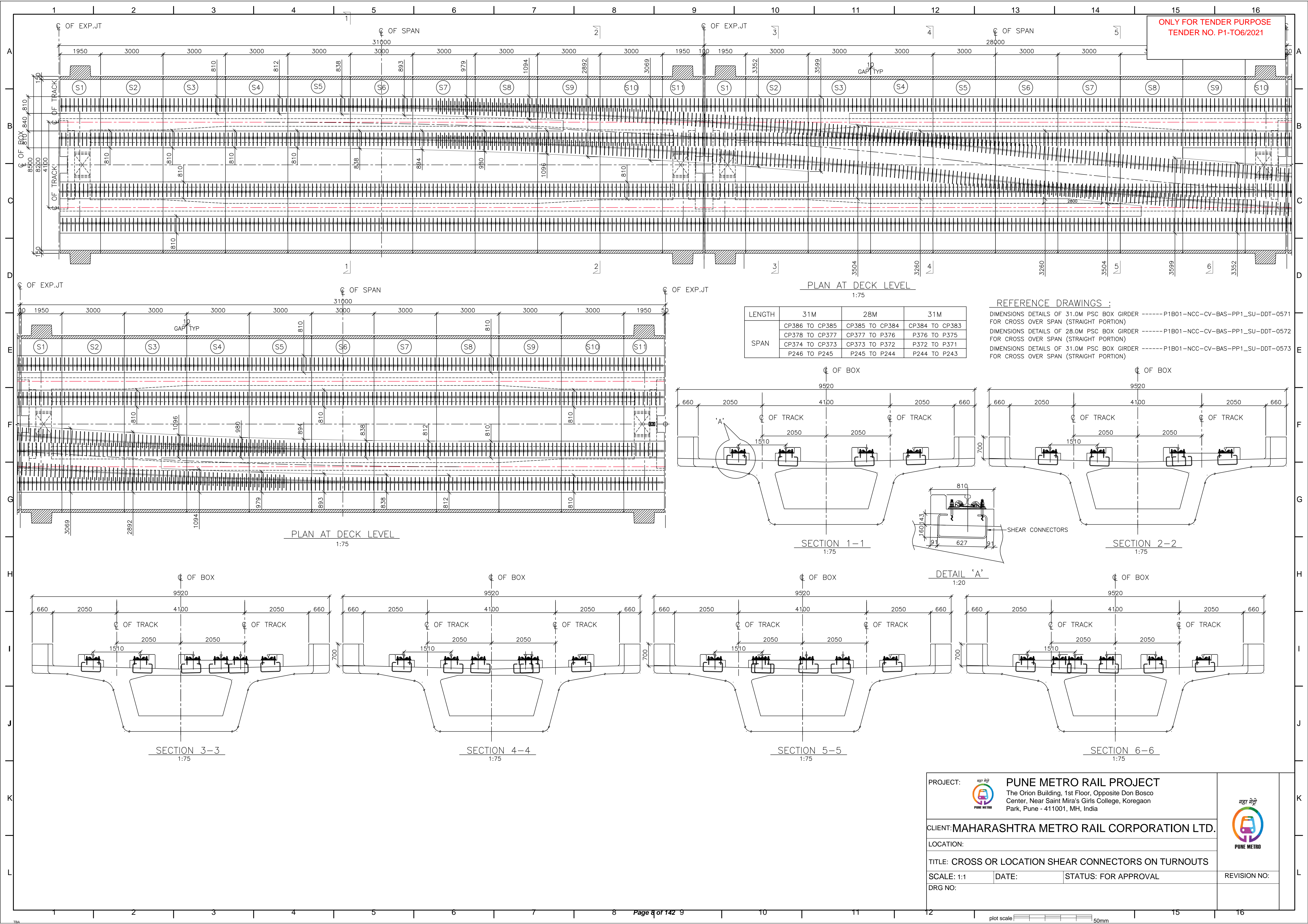
- Item shown in dotted line are not in scope of supply.
 - Stress free position of switch blade in closed position.
 - On Rail Seat Numbering marked with [..], the gauge has to be measured.
Except: Numbers 3 to 11 see "detail of stockrail machining" (1435+1,3)!
 - Rail gap 0mm.
 - 10mm thick elastomeric pad and 3mm conforming pad will be used under base plate.
 - 10mm Thick EVA Rail Pad will be used between base plate and rail.
 - Standard Fastening on Base Plate is Pandrol Fastening.
(Pandrol Clip "e2007" & Insulator ("5720".)
 - All dimensions are in mm.
- welding joint
- Weldable CMS Crossing
Section Switch device
Guard rail assembly
Switch drive assembly
- dwg.No.: VAEVKN13303-..
dwg.No.: VAEVKN13300..
dwg.No.: VAEVKN13653..
dwg.No.: VAEVKN13305-..




PLAN OF STRAIGHT TRACK
(AT THE LEVEL OF BOTTOM OF TRACK PLINTH)

**DRILLING AND GROUTING OF SHEAR CONNECTORS
POST CONCRETING OF VIADUCT/ TUNNEL/ RAMP**

PROJECT:		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div><div><div>PUNE METRO RAIL PROJECT</div><div>The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div></div></div>		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div></div>	
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.			
LOCATION:		LOCATION			
TITLE:		SHEAR CONNECTOR IN VIADUCT/TUNNEL/RAMP SECTION			
SCALE:	DATE:	STATUS:	REVISION NO:		
DRG NO:					



PROJECT:



PUNE METRO

CLIENT:

MAHARASHTRA METRO RAIL CORPORATION LTD.

LOCATION:

TITLE:

CROSS OR LOCATION SHEAR CONNECTORS ON TURNOUTS

SCALE: 1:1


DATE:

STATUS: FOR APPROVAL

DRG NO:

PUNE METRO RAIL PROJECT

The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India



PUNE METRO

REVISION NO:

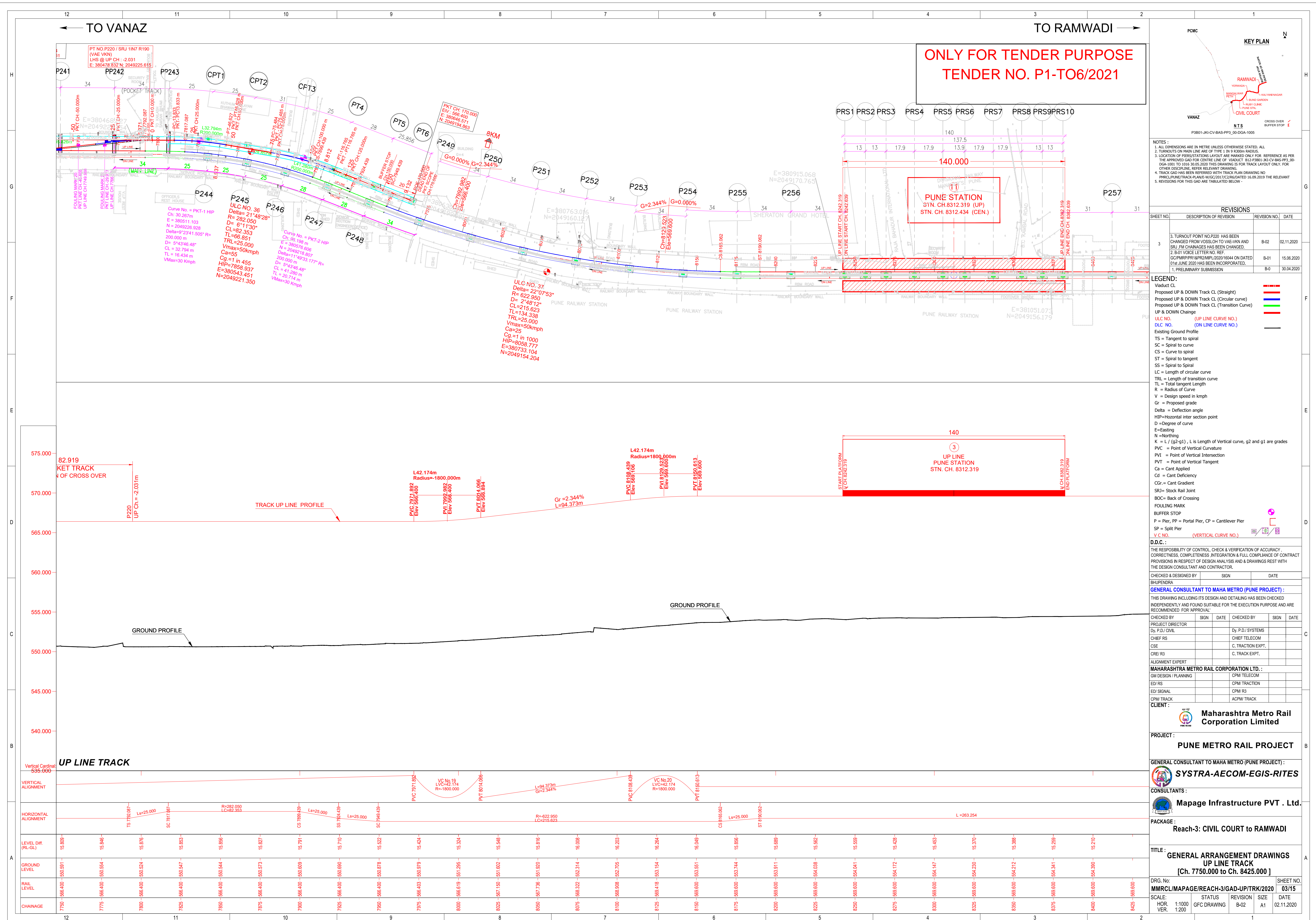
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TENDER NO. P1-TO6/2021

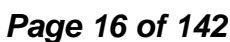
REACH 3- CIVIL COURT TO RAMWADI - UP TRACK

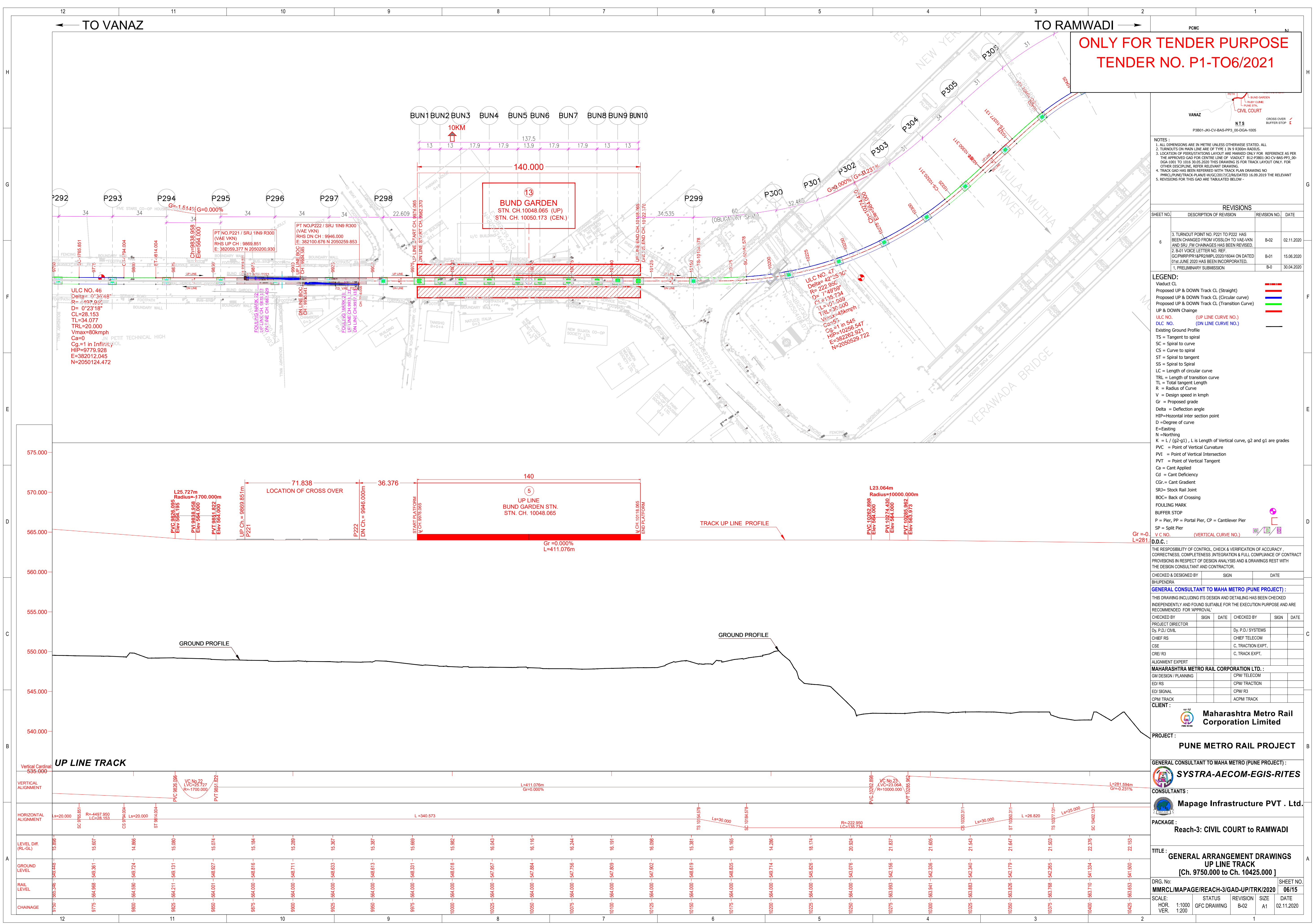
Cur ve No.	HIP											Transition length required with (1:720) (Rate of change of cant/deficiency = 35mm/sec)			Desirable transition length with (1:440) (Rate of change of cant/deficiency = 55mm/sec)			Required Transition		Provide d Transiti on Length (In & Out both are same) TL	Shift S= L ² /24R	Total Tangent length R.tan(Ø/2)+ (TL/2)	Circular Curve length (π.R.Ø/180)- TL	Maximu m Design Speed Vmax	Provide d Speed Vm	Cant Details			Cant Gradient		Checks		
	Chainage	Easting	Northing	Deflection Angle Ø	Curve Directi on	Applied Radius	BS (Tangent to Spiral Point)	SC (Spiral to Curve)	CS (Curve to Spiral)	ST (Spiral to Tangent)	Total Length of Curve [(9-8) + (10- 9) + (11- 10)]	Degree of Curvatu re	Ca-1 Ls= 0.008 x Ca x Vm	Cd Ls=0.008 x Cd x Vm	Ca-2 Ls= 0.6 x Ca	Ca-1 Ls = 0.005 x Ca x Vm	Cd Ls=0.005 x Cd x Vm	Ca-2 Ls= 0.4 x Ca	(1:720) Max (14, 15, 16)							(1:440) Max (17, 18, 19)	Eq cant= 11.8*Vm ²/R	Provide d Cant Ca			Applied Cant Deficien cy Cd =Eq- Ca	%	Slope
																													m	m			
32	6988.242	379658.753	2049163.184	57.761	Right	197.050	6866.981	6891.981	7065.630	7090.630	223.649	8.881	18	13	33	11	8	22	33	22	25	0.132	121.189	173.649	80	40	96	55	41	0.220	455	OK	OK
33	7134.4514	379823.668	2049155.776	8.469	Left	422.950	7090.630	7115.630	7153.150	7178.150	87.519	4.138	8	6	15	5	4	10	15	10	25	0.062	43.817	37.519	80	40	45	25	20	0.100	1000	OK	OK
34	7246.707	379935.452	2049167.322	8.067	Left	442.950	7202.968	7227.968	7265.335	7290.335	87.368	3.951	26	20	33	17	12	22	33	22	25	0.059	43.736	37.368	80	60	96	55	41	0.220	455	OK	OK
35	7392.4783	380077.022	2049202.527	11.654	Right	482.050	7330.781	7355.781	7428.826	7453.826	123.045	3.630	29	25	33	18	16	22	33	22	25	0.054	61.692	73.045	80	65	103	55	48	0.220	455	OK	OK
36	7858.9374	380543.451	2049221.350	21.808	Right	282.050	7792.087	7817.087	7899.439	7924.439	132.353	6.205	22	20	33	14	12	22	33	22	25	0.092	66.834	82.352	80	50	105	55	50	0.220	455	OK	OK
37	8058.7771	380733.104	2049154.204	22.131	Left	622.950	7924.439	7949.439	8165.062	8190.062	265.623	2.809	10	9	15	6	6	10	15	10	25	0.042	134.330	215.623	80	50	47	25	22	0.100	1000	OK	OK
38	8535.5698	381212.443	2049176.261	40.892	Left	152.950	8453.316	8503.316	8562.478	8612.478	159.161	11.442	44	33	66	28	21	44	66	44	50	0.681	82.022	59.161	80	50	193	110	83	0.220	455	OK	OK
39	8703.5024	381338.078	2049295.597	2.284	Left	1147.950	8670.620	8690.620	8716.379	8736.379	65.759	1.524	14	3	18	9	2	12	18	12	20	0.015	32.883	25.759	80	60	37	30	7	0.150	667	OK	OK
40	8771.1405	381385.228	2049344.101	5.136	Right	552.050	8736.379	8756.379	8785.867	8805.867	69.488	3.170	19	18	24	12	11	16	24	16	20	0.030	34.760	29.488	80	60	77	40	37	0.200	500	OK	OK
41	8876.1763	381464.917	2049412.583	2.273	Left	1132.950	8843.703	8863.703	8888.643	8908.643	64.940	1.545	18	17	18	11	12	18	12	20	20	0.015	32.473	24.940	80	75	59	30	29	0.150	667	OK	OK
42	9173.8481	381682.811	2049615.399	14.929	Left	197.950	9137.902	9157.902	9189.480	9209.480	71.579	8.841	11	9	24	7	6	16	24	16	20	0.084	35.936	31.579	80	35	73	40	33	0.200	500	OK	OK
43	9267.6494	381732.856	2049695.106	4.868	Right	532.050	9235.031	9255.031	9280.238	9300.238	65.207	3.289	15	14	21	10	9	14	21	14	20	0.031	32.617	25.206	80	55	67	35	32	0.175	571	OK	OK
44	9332.7165	381772.025	2049747.100	4.416	Left	582.950	9300.238	9320.238	9345.171	9365.171	64.933	3.002	15	12	21	10	7	14	21	14	20	0.029	32.478	24.933	80	55	61	35	26	0.175	571	OK	OK
45	9519.0707	381872.372	2049904.159	0.202	Left	12997.950	9486.200	9506.200	9531.942	9551.942	65.742	0.135	0	4	0	0	2	0	4	2	20	0.001	32.867	25.734	80	80	6	0	6	-	Infinity	OK	OK
46	9779.928	382012.045	2050124.472	0.613	Left	4497.950	9745.852	9765.852	9794.004	9814.004	68.153	0.389	0	11	0	0	7	0	11	7	20	0.004	34.077	28.154	80	80	17	0	17	-	Infinity	OK	OK
47	10256.547	382262.921	2050529.722	42.592	Left	222.950	10154.578	10184.578	10320.311	10350.311	195.734	7.849	20	19	33	12	12	22	33	22	30	0.168	101.906	135.734	80	45	107	55	52	0.183	545	OK	OK
48	10548.377	382206.537	2050824.412	88.764	Right	162.050	10377.132	10402.132	10628.183	10653.183	276.051	10.799	18	20	33	11	12	22	33	22	25	0.161	171.091	226.051	80	40	117	55	62	0.220	455	OK	OK
49	11049.4205	382761.480	2050943.055	11.964	Left	227.950	11015.528	11035.528	11063.125	11083.125	67.597	7.677	14	12	27	9	8	18	27	18	20	0.073	33.886	27.597	80	40	83	45	38	0.225	444	OK	OK
50	11199.1227	382898.378	2051004.096	66.716	Right	157.050	11083.125	11108.125	11265.997	11290.997	207.872	11.143	18	21	33	11	13	22	33	22	25	0.166	115.891	157.872	80	40	120	55	65	0.220	455	OK	OK
51	11392.7437	383058.440	2050856.474	36.071	Left	197.950	11318.264	11338.264	11442.885	11462.885	144.621	8.841	14	16	27	9	10	18	27	18	20	0.084	74.453	104.621	80	40	95	45	50	0.225	444	OK	OK
52	11922.8826	383589.361	2050794.915	19.937	Right	282.050	11855.781	11890.781	11953.923	11988.923	133.141	6.205	31	25	42	19	16	28	42	28	35	0.181	67.072	63.141	80	55	127	70	57	0.200	500	OK	OK
53	12063.7085	383716.286	2050731.495	9.598	Left	297.950	12026.187	12051.187	12076.100	12101.100	74.913	5.873	20	20	30	13	12	20	30	20	25	0.087	37.515	24.913	80	50	99	50	49	0.200	500	OK	OK
54	12168.5132	383816.661	2050700.899	7.608	Left	377.950	12130.879	12155.879	12181.066	12206.066	75.187	4.630	22	20	30	14	12	20	30	20	25	0.069	37.631	25.187	80	55	94	50	44	0.200	500	OK	OK
55	12312.5867	383958.904	2050677.494	2.694	Right	1102.050	12274.170	12299.170	12325.993	12350.993	76.822	1.588	22	21	21	14	13	14	22	14	25	0.024	38.416	26.823	80	80	69	35	34	0.140	714	OK	OK
56	12472.89	384115.693	2050644.059	0.246	Left	11797.950	12435.032	12460.032	12485.748	12510.748	75.716	0.148	0	4	0	0	3	0	4	3	25	0.002	37.858	25.716	80	80	6	0	6	-	Infinity	OK	OK
57	12785.5505	384421.755	2050580.166	77.148	Left	152.950	12653.480	12673.480	12859.425	12879.425	225.945	11.442	13	14	27	8	9	18	27	18	20	0.109	131.985	185.945	80	35	95	45	50	0.225	444	OK	OK
58	13079.4172	384560.217	2050881.983	31.622	Left	152.950	13026.076	13046.076	13110.490	13130.490	104.414	11.442	13	14	27	8	9	18	27	18	20	0.109	53.312	64.414	80	35	95	45	50	0.225	444	OK	OK
59	13163.8804	384549.679	2050968.073	4.239	Right	632.050	13130.490	13150.490	13177.248	13197.248	66.758	2.769	6	1	12	4	1	8	12	8	20	0.026	33.390	26.759	80	35	23	20	3	0.100	1000	OK	OK
60	13339.0513	384541.306	2051143.067	2.004	Left	1497.950	13302.855	13322.855	13355.242																								

12														11														10														9														8														7														6														5														4														3														2														1													
PROJECT:		PUNE METRO REACH -3 (CIVIL COURT - RAMWADI) VERTICAL CURVE DETAIL - UP LINE																																																																																																																														ONLY FOR TENDER PURPOSE TENDER NO. P1-TO6/2021																																							
Note: All units in this report are in meters unless specified otherwise. +ve indicates Rising gradient in the direction of increasing chainage. -ve indicates Falling gradient in the direction of increasing chainage. PVC = Point of the start of a vertical curve in the direction of increasing chainage. PVI = Point of the intersection of tangents. PVT = Point of the start of tangent in the direction of increasing chainage.																																																																																																																																																																							
VERTICAL ALIGNMENT: UP LINE																																																																																																																																																																							
Sr.No.		PVC		PVI		PVT		GRADE LENGTH	RADIUS	VERTICAL CURVE LENGTH	PVI COORDINATES		GRADE%																																																																																																																																																										
		CHAINAGE	ELEVATION	CHAINAGE	ELEVATION	CHAINAGE	ELEVATION				EASTING	NORTHING	IN	OUT																																																																																																																																																									
START		6679.923	563.500					299.161					0.000%																																																																																																																																																										
17		6979.084	563.500	7000.565	563.500	7022.046	563.654	362.755	-6000.000	42.962	379691.222	2049146.508	0.000%	0.716%																																																																																																																																																									
18		7384.800	566.251	7405.565	566.400	7426.330	566.400	545.562	5800.000	41.530	380090.536	2049201.691	0.716%	0.000%																																																																																																																																																									
19		7971.892	566.400	7992.982	566.400	8014.066	566.894	94.373	-1800.000	42.174	380671.865	2049178.602	0.000%	2.344%																																																																																																																																																									
20		8108.439	569.106	8129.523	569.600	8150.613	569.600	1304.725	1800.000	42.174	380806.786	2049159.489	2.344%	0.000%																																																																																																																																																									
21		9455.337	569.600	9468.958	569.600	9482.577	569.394	343.518	1800.000	27.240	381845.391	2049861.929	0.000%	-1.514%																																																																																																																																																									
22		9826.095	564.195	9838.958	564.000	9851.822	564.000	411.076	-1700.000	25.727	382043.116	2050174.663	-1.514%	0.000%																																																																																																																																																									
23		10262.898	564.000	10274.430	564.000	10285.962	563.973	281.594	10000.000	23.064	382249.597	2050554.504	0.000%	-0.231%																																																																																																																																																									
24		10567.556	563.324	10577.935	563.300	10588.314	563.300	346.302	-9000.000	20.757	382304.480	2050832.919	-0.231%	0.000%																																																																																																																																																									
25		10934.615	563.300	10953.958	563.300	10973.300	563.150	653.523	5000.000	38.685	382668.127	2050923.097	0.000%	-0.774%																																																																																																																																																									
26		11626.823	558.094	11638.958	558.000	11651.093	558.024	735.625	-2500.000	24.270	383307.326	2050827.616	-0.774%	0.197%																																																																																																																																																									
27		12386.719	559.474	12400.000	559.500	12413.281	559.644	342.680	-3000.000	26.562	384044.406	2050659.261	0.197%	1.083%																																																																																																																																																									
28		12755.961	563.354	12769.492	563.500	12783.024	563.500	299.910	2500.000	27.063	384555.771	2050898.510	1.083%	0.000%																																																																																																																																																									
29		13082.933	563.500	13093.958	563.500	13104.982	563.581	590.008	-3000.000	22.049	384524.790	2051508.291	0.000%	0.735%																																																																																																																																																									
30		13694.991	567.918	13706.212	568.000	13717.433	568.138	418.782	-4500.000	22.442	384574.981	2051945.071	0.735%	1.234%																																																																																																																																																									
31		14136.214	573.305	14147.378	573.443	14158.541	573.622	198.278	-6000.000	22.327	384729.902	2052101.380	1.234%	1.606%																																																																																																																																																									
32		14356.819	576.807	14368.862	577.000	14380.906	577.000	206.675	1500.000	24.087	384919.118	2052231.445	1.606%	0.000%																																																																																																																																																									
33		14587.581	577.000	14598.500	577.000	14609.418	577.159	204.812	-1500.000	21.838	385119.177	2052337.853	0.000%	1.456%																																																																																																																																																									
34		14814.230	580.141	14825.148	580.300	14836.068	580.300	146.351	1500.000	21.838	385120.889	2052338.559	1.456%	0.000%																																																																																																																																																									
End		14982.419	580.300										0.000%																																																																																																																																																										
D.D.C. : THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND & DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.																																																																																																																																																																							
CHECKED & DESIGNED BY BHUPENDRA GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :																																																																																																																																																																							
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL																																																																																																																																																																							
CHECKED BY PROJECT DIRECTOR Dy. P.D./ CIVIL CHIEF RS CSE CSE/ R3 ALIGNMENT EXPERT MAHARASHTRA METRO RAIL CORPORATION LTD. : GM DESIGN/ PLANNING ED/ RS ED/ SIGNAL CPM/ TRACK CLIENT :																																																																																																																																																																							
SIGN DATE Dy. P.D./ SYSTEMS CHIEF TELECOM C. TRACTION EXPT. C. TRACK EXPT. CPM/ TELECOM CPM/ TRACTION CPM/ R3 ACPM/ TRACK																																																																																																																																																																							
Maharashtra Metro Rail Corporation Limited																																																																																																																																																																							
PROJECT : PUNE METRO RAIL PROJECT																																																																																																																																																																							
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) : SYSTRA-AECOM-EGIS-RITES																																																																																																																																																																							
CONSULTANTS : Mapage Infrastructure PVT . Ltd.																																																																																																																																																																							
PACKAGE : Reach-3: CIVIL COURT to RAMWADI																																																																																																																																																																							
TITLE : GENERAL ARRANGEMENT DRAWINGS UP LINE TRACK VERTICAL CURVE LIST																																																																																																																																																																							
DRG. No: MMRCL/MAPAGE/REACH-3/GAD-UP/TRK/2020 SCALE: HOR. 1:1000 VER. 1:200 STATUS GFC DRAWING REVISION B-01 SIZE A1 DATE 15.08.2020																																																																																																																																																																							
SHEET NO. 1/1																																																																																																																																																																							









ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

NOTES :
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9.8300m RADIUS.
3. LOCATION OF PIERS/STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER
THE APPROVED GAD FOR CENTRE LINE OF VIADUCT. B13-P3801-JKS-CV-BAS-P13_00-
DGA-1001 TO 1016 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR
OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO
P3801-JKS-CV-BAS-P13_00-1005 DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW

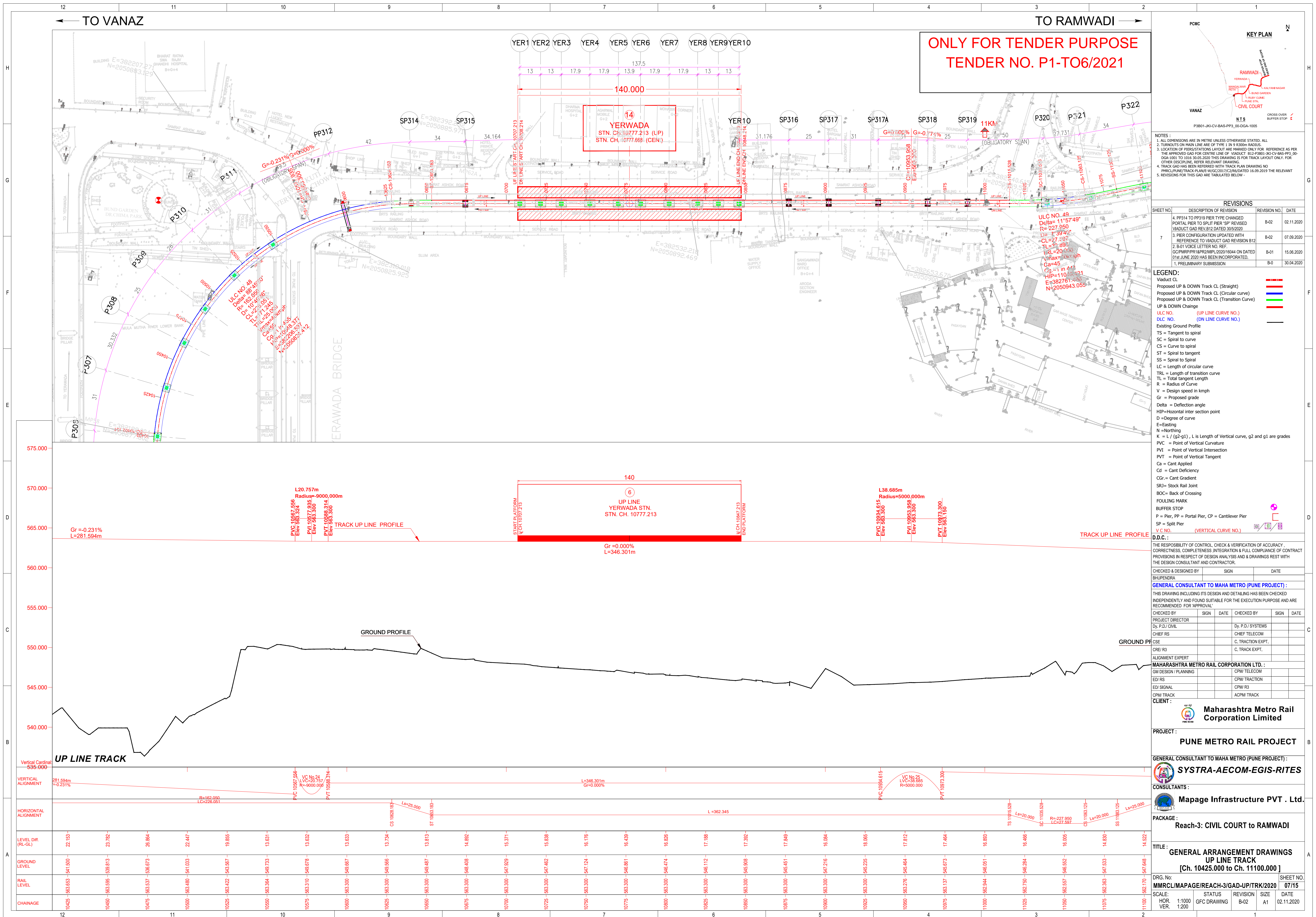
REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
6	3. TURNOUT POINT NO. P221 TO P222 HAS BEEN CHANGED FROM VOSSLOH TO VAE-VKN AND SRJ. FM CHANGES HAS BEEN REVISED.	B-02	02.11.2020
	2. 501 VOICE LETTER NO. REF GCMRPPR1&PR2/MPL/2020/1604 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.06.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

LEGEND:
Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition Curve)
UP & DOWN Chaise
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)
Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TRL = Length of transition curve
TL = Total tangent length
R = Radius of curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP = Horizontal inter section point
D = Degree of curve
E = Easting
N = Nothing
K = L / (g2 - g1) , L is Length of Vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
CGR = Cant Gradient
SRJ = Stock Rail Joint
BOC = Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V.C. NO. (VERTICAL CURVE NO.)

D.C.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY,
CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT
PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH
THE DESIGN CONSULTANT AND CONTRACTOR.
CHECKED & DESIGNED BY : SIGN : DATE :
BHUPENDRA
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED
INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE
RECOMMENDED FOR APPROVAL.
CHECKED BY : SIGN : DATE :
PROJECT DIRECTOR : SIGN : DATE :
Dy. P.D./ CIVIL : Dy. P.D./ SYSTEMS :
CHIEF RS : CHIEF TELECOM :
CSE : C. TRACTION EXPT. :
CRE/ R3 : C. TRACK EXPT. :
ALIGNMENT EXPERT :
MAHARASHTRA METRO RAIL CORPORATION LTD. :
GM DESIGN / PLANNING : CPWM TELECOM :
ED/ RS : CPWM TRACTION :
ED/ SIGNAL : CPWM R3 :
CPWM TRACK : ACPWM TRACK :
CLIENT :
Maharashtra Metro Rail Corporation Limited

PROJECT :
PUNE METRO RAIL PROJECT
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
SYSTRA-AECOM-EGIS-RITES
CONSULTANTS :
Mapage Infrastructure PVT. Ltd.
PACKAGE :
Reach-3: CIVIL COURT TO RAMWADI

TITLE :
GENERAL ARRANGEMENT DRAWINGS
UP LINE TRACK
[Ch. 9750.000 to Ch. 10425.000]
DRG. No. :
MMRCL/MAPAGE/REACH-3/GAD-UP/TRK/2020 06/15
SCALE :
HOR. 1:1000
VER. 1:200
STATUS :
GFC DRAWING
REVISION :
B-02
SIZE :
A1
DATE :
02.11.2020



NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9.830m RADIUS.
3. LOCATION OF PIERS/STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT. B12-P3801-JKS-CV-BAS-P13_00-DGA-1001 TO 1016 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. P3801-PUNE/TRACK-PLAN-HW/2017/CJ/01 DATED 16.09.2019 THE RELEVANT 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
4	PP314 TO PP318 PIER TYPE CHANGED	B-02	02.11.2020
7	PORTAL PIER TO SPLIT PIER "SP" REVISED VIADUCT GAD REV.B12 DATED 30/5/2020	B-02	07.09.2020
	3. PIER CONFIGURATION UPDATED WITH REFERENCE TO VIADUCT GAD REVISION B12	B-01	15.06.2020
	2. 801 VOICE LETTERING NO. REF. GCM/MPR/PR/PR/2020/16044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-0	30.04.2020
	1. PRELIMINARY SUBMISSION		

LEGEND:

VIADUCT CL

PROPOSED UP & DOWN TRACK CL (Straight)

PROPOSED UP & DOWN TRACK CL (Circular Curve)

PROPOSED UP & DOWN TRACK CL (Transition Curve)

UP & DOWN CHARGE

ULC NO. (UP LINE CURVE NO.)

DLN NO. (DN LINE CURVE NO.)

EXISTING GROUND PROFILE

TS = Tangent to spiral

SC = Spiral to curve

CS = Curve to spiral

ST = Spiral to tangent

SS = Spiral to spiral

LC = Length of circular curve

TRL = Length of transition curve

TL = Total tangent length

R = Radius of curve

V = Design speed in kmph

Gr = Proposed grade

Delta = Deflection angle

HIP = Horizontal inter section point

D = Degree of curve

E = Easting

N = Nothing

K = $L/L_1 (g_2 - g_1)$, L is Length of Vertical curve, g2 and g1 are grades

PVC = Point of Vertical Curvature

PVI = Point of Vertical Intersection

PVT = Point of Vertical Tangent

Ca = Cant Applied

 Cd = Cant Deficiency CGR = Cant Gradient SRJ = Stock Rail Joint BOC = Back of Crossing FOULING MARK BUFFER STOP P = Pier, PP = Portal Pier, CP = Cantilever Pier SP = Split Pier V.C. NO. (VERTICAL CURVE NO.) |

D.C. :

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :		
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL		
CHECKED BY	SIGN	DATE
PROJECT DIRECTOR		
Dy. P.D./ CIVIL		
CHIEF RS		
CSE		
CRE/ R3		
ALIGNMENT EXPERT		
MAHARASHTRA METRO RAIL CORPORATION LTD. :		
GM DESIGN / PLANNING		
ED/ RS		
ED/ SIGNAL		
CPWM TRACK		
CLIENT :		

Maharashtra Metro Rail Corporation Limited

PROJECT : **PUNE METRO RAIL PROJECT**

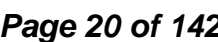
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) : **SYSTRA-AECOM-EGIS-RITES**

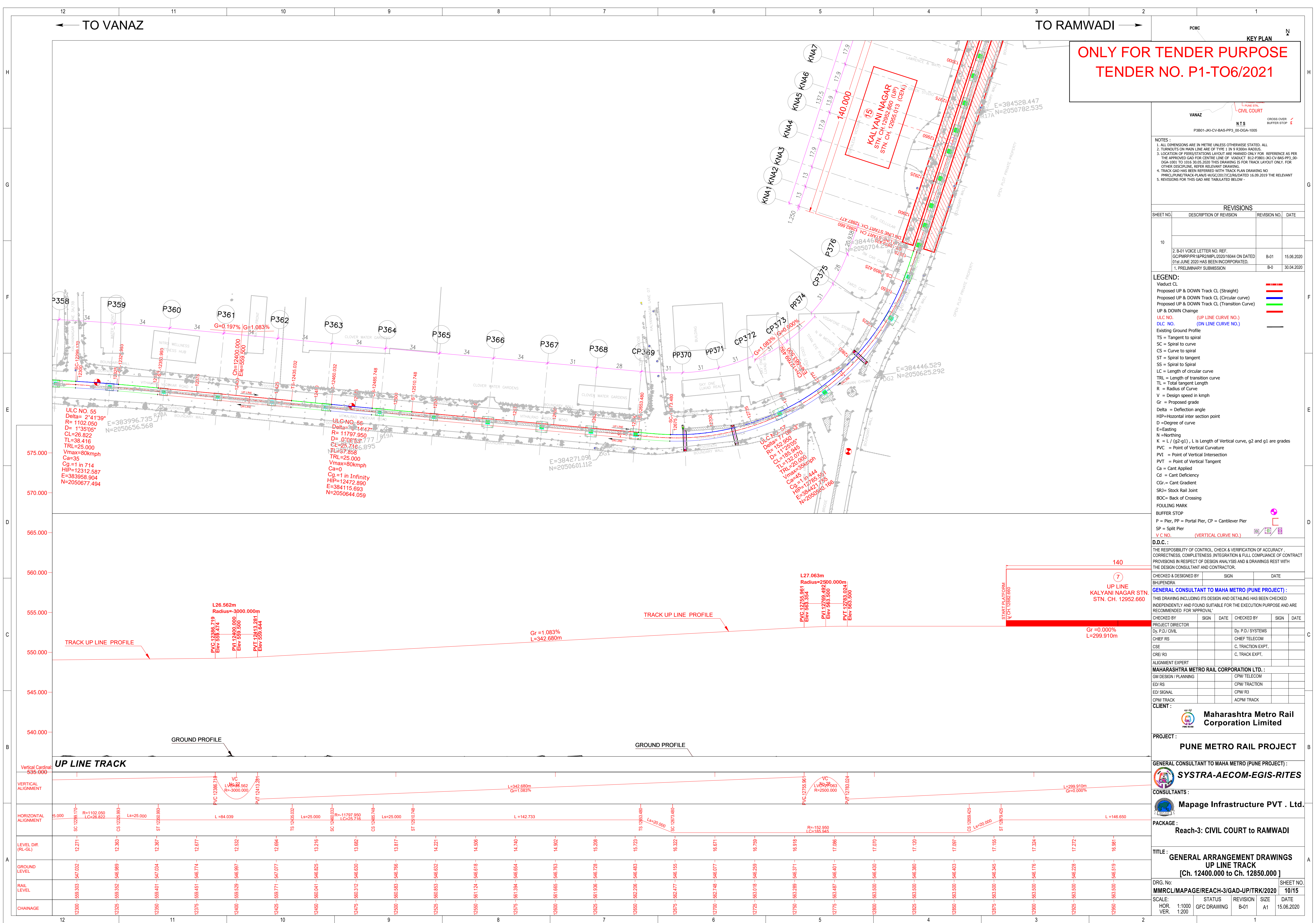
CONSULTANTS : **Mapage Infrastructure PVT . Ltd.**

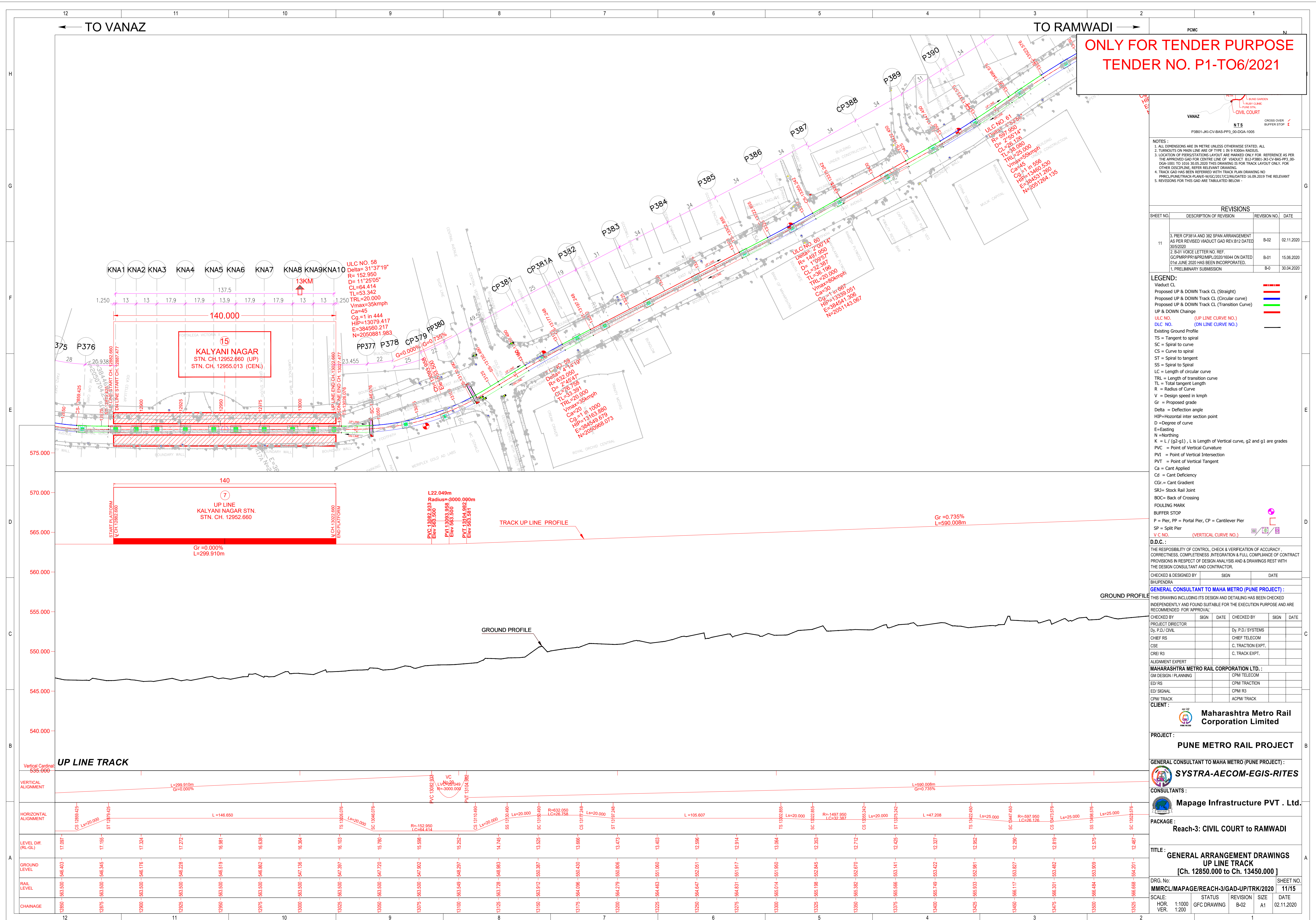
PACKAGE : **Reach-3: CIVIL COURT TO RAMWADI**

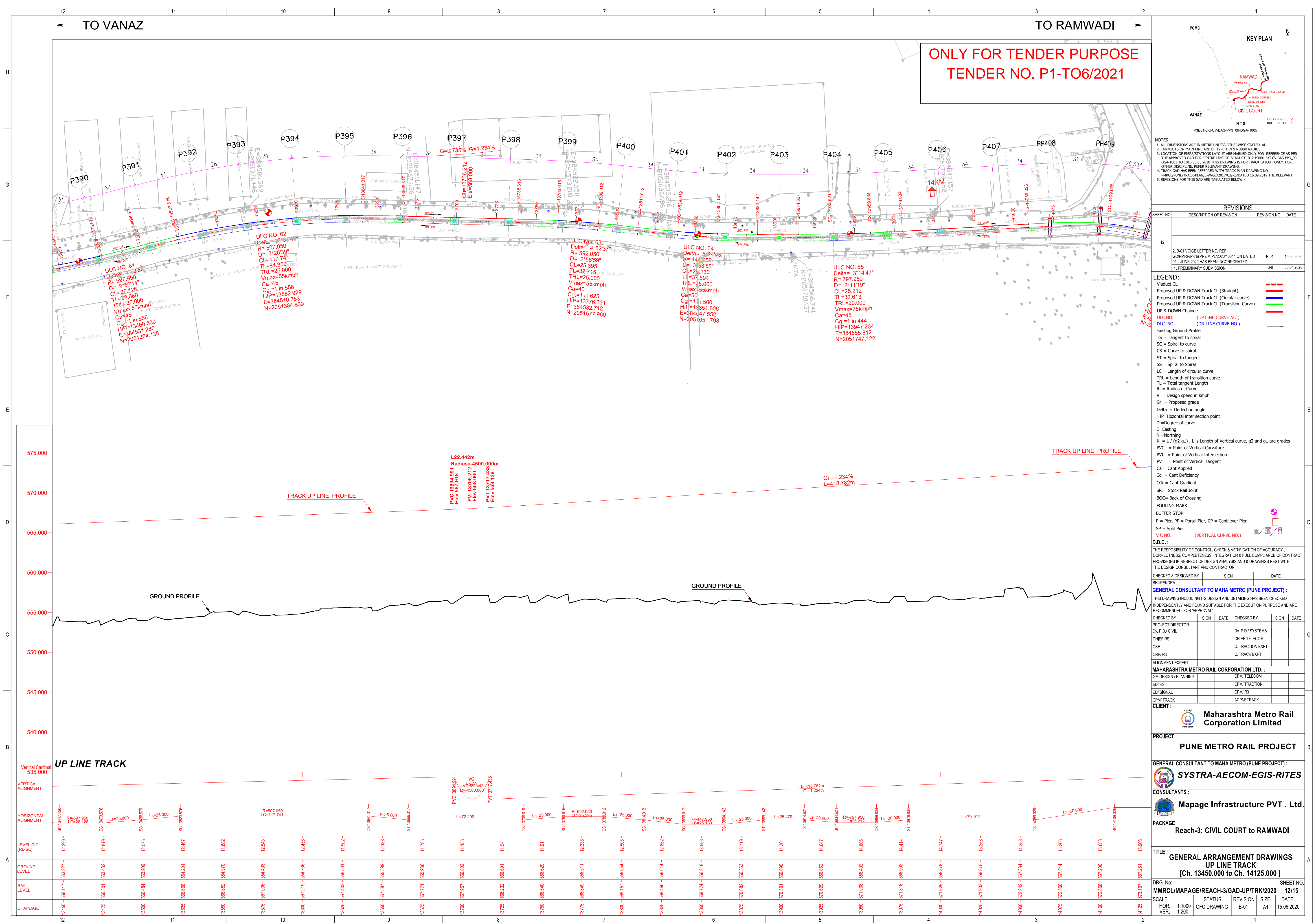
TITLE : **GENERAL ARRANGEMENT DRAWINGS UP LINE TRACK [Ch. 10425.000 to Ch. 11100.000]**

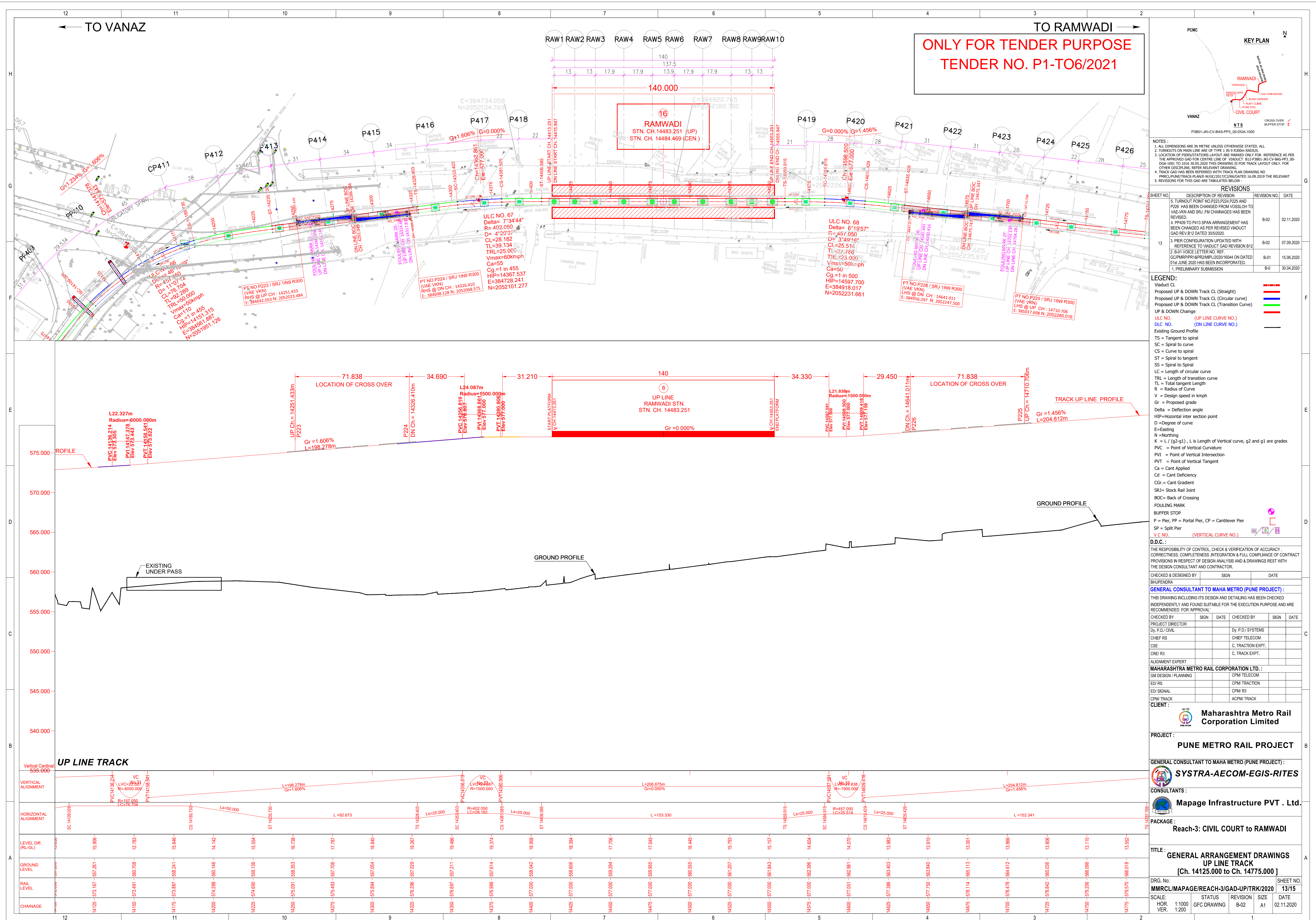
DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-UP/TRK/2020	GFC DRAWING	B-02	A1	07/15
SCALE:	HOR. 1:1000	VER. 1:200		
SHEET NO.				02.11.2020













12			11			10			9			8			7			6			5			4			3			ONLY FOR TENDER PURPOSE TENDER NO. P1-TO6/2021				
REACH 3- CIVIL COURT TO RAMWADI - DOWN TRACK																																		
Curve No.	HIP												Transition length required with (1:720) (Rate of change of cant/deficiency = 35mm/sec)			Desirable transition length with (1:440) (Rate of change of cant/deficiency = 55mm/sec)			Required Transition		Provided Transition Length (In & Out both are same) TL	Shift S= L ² /24R	Total Tangent length R.tan(Ø/2)+ (TL/2)	Circular Curve length (π.R.Ø/180)-TL	Maximum Design Speed Vmax	Provided Speed Vm	Cant Details						Cant Gradient	
	Chainage	Easting	Northing	Deflection Angle Ø	Curve Direction	Applied Radius	BS (Tangent to Spiral Point)	SC (Spiral to Curve)	CS (Curve to Spiral)	ST (Spiral to Tangent)	Total Length of Curve [(9-8) + (10-9) + (11-10)]	Degree of Curvature	Ca-1 Ls= 0.008 x Ca x Vm	Cd Ls=0.008 x Cd x Vm	Ca-2 Ls= 0.6 x Ca	Ca-1 Ls = 0.005 x Ca x Vm	Cd Ls=0.005 x Cd x Vm	Ca-2 Ls= 0.4 x Ca	(1:720) Max (14, 15, 16)	(1:440) Max (17, 18, 19)							Eq cant= 11.8*V m ² /R	Provided Cant Ca	Applied Cant Deficiency Cd =Eq- Ca	Remark s Minimum Transition Length Required d ≤	Cant Gradient Check with exceptional limit 1:440			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
32	6990.076	379660.836	2049158.998	57.764	Right	192.95	6871.1	6896.1	7065.6	7090.6	219.525	9.070	18	14	33	11	9	22	33	22	25	0.135	106.57	169.525	80	40	98	55	43	0.220	455	OK	OK	
33	7134.729	379823.813	2049151.669	8.472	Left	427.05	7090.6	7115.6	7153.7	7178.7	88.1461	4.098	8	6	15	5	4	10	15	10	25	0.061	31.69	38.146	80	40	44	25	19	0.100	1000	OK	OK	
34	7247.551	379936.160	2049163.274	8.067	Left	447.05	7203.5	7228.5	7266.5	7291.5	87.9449	3.915	26	19	33	17	12	22	33	22	25	0.058	31.58	37.945	80	60	95	55	40	0.220	455	OK	OK	
35	7393.192	380077.606	2049198.447	11.654	Right	477.95	7331.9	7356.9	7429.1	7454.1	122.2114	3.661	29	26	33	18	16	22	33	22	25	0.054	48.83	72.211	80	65	104	55	49	0.220	455	OK	OK	
36	7858.454	380542.836	2049217.222	21.808	Right	277.95	7792.4	7817.4	7898.2	7923.2	130.7919	6.296	22	20	33	14	13	22	33	22	25	0.094	53.64	80.792	80	50	106	55	51	0.220	455	OK	OK	
37	8058.324	380732.500	2049150.071	22.131	Left	627.05	7923.2	7948.2	8165.4	8190.4	267.2063	2.791	10	9	15	6	6	10	15	10	25	0.042	122.67	217.206	80	50	47	25	22	0.100	1000	OK	OK	
38	8537.419	381214.158	2049172.235	40.892	Left	157.05	8453.6	8503.6	8565.7	8615.7	162.0877	11.143	44	31	66	28	19	44	66	44	50	0.663	59.21	62.088	80	50	188	110	78	0.220	455	OK	OK	
39	8706.840	381340.959	2049292.679	2.284	Left	1152.05	8673.9	8693.9	8719.8	8739.8	65.9233	1.519	14	3	18	9	2	12	18	12	20	0.014	22.98	25.923	80	60	37	30	7	0.150	667	OK	OK	
40	8774.376	381388.038	2049341.110	5.136	Right	547.95	8739.8	8759.8	8788.9	8808.9	69.121	3.194	19	18	24	12	11	16	24	16	20	0.030	24.61	29.121	80	60	78	40	38	0.200	500	OK	OK	
41	8879.311	381467.651	2049409.526	2.273	Left	1137.05	8846.8	8866.8	8891.9	8911.9	65.1027	1.539	18	17	18	11	11	12	18	12	20	0.015	22.57	25.102	80	75	58	30	28	0.150	667	OK	OK	
42	9177.602	381685.998	2049612.764	14.929	Left	202.05	9141.1	9161.1	9193.8	9213.8	72.6473	8.661	11	9	24	7	6	16	24	16	20	0.082	26.56	32.647	80	35	72	40	32	0.200	500	OK	OK	
43	9271.769	381736.240	2049692.786	4.868	Right	527.95	9239.3	9259.3	9284.2	9304.2	64.8585	3.315	15	14	21	10	9	14	21	14	20	0.032	22.47	24.859	80	55	68	35	33	0.175	571	OK	OK	
44	9336.820	381775.399	2049744.767	4.416	Left	587.05	9304.2	9324.2	9349.4	9369.4	65.2495	2.981	15	11	21	10	7	14	21	14	20	0.028	22.66	25.249	80	55	61	35	26	0.175	571	OK	OK	
45	9523.331	381875.831	2049901.957	0.202	Left	13002.05	9490.5	9510.5	9536.2	9556.2	65.7565	0.135	0	4	0	0	2	0	4	2	20	0.001	22.88	25.749	80	80	6	0	6	-	Infinity	OK	OK	
46	9784.217	382015.519	2050122.296	0.613	Left	4502.05	9750.1	9770.1	9798.3	9818.3	68.1965	0.389	0	11	0	0	7	0	11	7	20	0.004	24.10	28.198	80	80	17	0	17	-	Infinity	OK	OK	
47	10262.456	382267.248	2050528.923	42.592	Left	227.05	10159	10189	10328	10358	198.7814	7.708	20	18	33	12	11	22	33	22	30	0.165	88.67	138.782	80	45	105	55	50	0.183	545	OK	OK	
48	10551.726	382221.318	2050821.241	88.764	Right	157.95	10384	10409	10629	10654	269.6993	11.079	18	21	33	11	13	22	33	22	25	0.165	154.74	219.699	80	40	120	55	65	0.220	455	OK	OK	
49	11050.834	382762.740	2050939.132	11.966	Left	232.05	11017	11037	11065	11085	68.4636	7.541	14	12	27	9	7	18	27	18	20	0.072	24.39	28.464	80	40	81	45	36	0.225	444	OK	OK	
50	11198.276	382897.574	2050999.260	66.719	Right	152.95	11085	11110	11263	11288	203.1044	11.442	18	22	33	11	14	22	33	22	25	0.170	100.87	153.105	80	40	123	55	68	0.220	455	OK	OK	
51	11391.160	383056.642	2050852.555	36.071	Left	202.05	11315	11335	11443	11463	147.2023	8.661	14	16	27	9	10	18	27	18	20	0.082	65.87	107.202	80	40	93	45	48	0.225	444	OK	OK	
52	11921.825	383588.173	2050790.926	19.937	Right	277.95	118739																											

PUNE METRO REACH -3 (CIVIL COURT - RAMWADI) VERTICAL CURVE DETAIL - DOWN LINE														ONLY FOR TENDER PURPOSE TENDER NO. P1-TO6/2021																																																																																																			
Note: All units in this report are in meters unless specified otherwise. +ve indicates Rising gradient in the direction of increasing chainage. -ve indicates Falling gradient in the direction of increasing chainage. PVC = Point of the start of a vertical curve in the direction of increasing chainage. PVI = Point of the intersection of tangents. PVT = Point of the start of tangent in the direction of increasing chainage.																																																																																																																	
VERTICAL ALIGNMENT: DN LINE																																																																																																																	
Sr.No.	PVC		PVI		PVT		GRADE LENGTH	RADIUS	VERTICAL CURVE LENGTH	PVI COORDINATES		GRADE%																																																																																																					
	CHAINAGE	ELEVATION	CHAINAGE	ELEVATION	CHAINAGE	ELEVATION				EASTING	NORTHING	IN	OUT																																																																																																				
START	6684.005	563.500					295.079					0.000%																																																																																																					
17	6979.084	563.500	7000.565	563.500	7022.046	563.654	362.755	-6000.000	42.962	379691.157	2049142.116	0.000%	0.716%																																																																																																				
18	7384.800	566.251	7405.565	566.400	7426.330	566.400	545.562	5800.000	41.530	380090.407	2049197.548	0.716%	0.000%																																																																																																				
19	7971.892	566.400	7992.982	566.400	8014.066	566.894	94.373	-1800.000	42.174	380671.716	2049174.411	0.000%	2.344%																																																																																																				
20	8108.439	569.106	8129.523	569.600	8150.613	569.600	1304.725	1800.000	42.174	380806.654	2049155.392	2.344%	0.000%																																																																																																				
21	9455.337	569.600	9468.958	569.600	9482.577	569.394	343.518	1800.000	27.240	381846.556	2049856.138	0.000%	-1.514%																																																																																																				
22	9826.095	564.195	9838.958	564.000	9851.822	564.000	411.076	-1700.000	25.727	382044.333	2050168.840	-1.514%	0.000%																																																																																																				
23	10262.898	564.000	10274.430	564.000	10285.962	563.973	281.594	10000.000	23.064	382253.077	2050547.949	0.000%	-0.231%																																																																																																				
24	10567.556	563.324	10577.935	563.300	10588.314	563.300	346.302	-9000.000	20.757	382304.661	2050828.050	-0.231%	0.000%																																																																																																				
25	10934.615	563.300	10953.958	563.300	10973.300	563.150	653.523	5000.000	38.685	382668.005	2050918.878	0.000%	-0.774%																																																																																																				
26	11626.823	558.094	11638.958	558.000	11651.093	558.024	735.625	-2500.000	24.270	383307.188	2050823.505	-0.774%	0.197%																																																																																																				
27	12386.719	559.474	12400.000	559.500	12413.281	559.644	342.680	-3000.000	26.562	384044.260	2050655.100	0.197%	1.083%																																																																																																				
28	12755.961	563.354	12769.492	563.500	12783.024	563.500	299.910	2500.000	27.063	384405.184	2050615.181	1.083%	0.000%																																																																																																				
29	13082.933	563.500	13093.958	563.500	13104.982	563.581	590.008	-3000.000	22.049	384559.409	2050891.945	0.000%	0.735%																																																																																																				
30	13694.991	567.918	13706.212	568.000	13717.433	568.138	423.419	-4500.000	22.442	384528.173	2051501.749	0.735%	1.234%																																																																																																				
31	14140.851	573.362	14152.000	573.500	14163.148	573.679	194.813	-6000.000	22.297	384578.645	2051943.181	1.234%	1.606%																																																																																																				
32	14357.961	576.807	14370.000	577.000	14382.041	577.000	207.892	1500.000	24.079	384731.084	2052097.092	1.606%	0.000%																																																																																																				
33	14589.932	577.000	14600.852	577.000	14611.770	577.159	204.812	-1500.000	21.838	384921.234	2052227.933	0.000%	1.456%																																																																																																				
34	14816.582	580.141	14827.500	580.300	14838.419	580.300	145.326	1500.000	21.838	385121.313	2052334.299	1.456%	0.000%																																																																																																				
End	14983.745	580.300										0.000%																																																																																																					
<div>D.D.C. : THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND & DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR. CHECKED & DESIGNED BY: <div>BRUPENDRA</div><div>GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :</div><div>THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL</div><table><tr><td>CHECKED BY:</td><td>SIGN</td><td>DATE</td><td>CHECKED BY:</td><td>SIGN</td><td>DATE</td></tr><tr><td>PROJECT DIRECTOR</td><td></td><td></td><td>Dy. P.D./ SYSTEMS</td><td></td><td></td></tr><tr><td>Dy. P.D./ CIVIL</td><td></td><td></td><td>CHIEF TELECOM</td><td></td><td></td></tr><tr><td>CHIEF RS</td><td></td><td></td><td>C. TRACTION EXPT.</td><td></td><td></td></tr><tr><td>CSE</td><td></td><td></td><td>C. TRACK EXPT.</td><td></td><td></td></tr><tr><td>CRE/ RS</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>ALIGNMENT EXPERT</td><td></td><td></td><td></td><td></td><td></td></tr><tr><td colspan="6">MAHARASHTRA METRO RAIL CORPORATION LTD. :</td></tr><tr><td>GM DESIGN/ PLANNING</td><td></td><td></td><td>CPM/ TELECOM</td><td></td><td></td></tr><tr><td>ED/ RS</td><td></td><td></td><td>CPM/ TRACTION</td><td></td><td></td></tr><tr><td>ED/ SIGNAL</td><td></td><td></td><td>CPM/ RS</td><td></td><td></td></tr><tr><td>CPM/ TRACK</td><td></td><td></td><td>ACPM/ TRACK</td><td></td><td></td></tr></table><div>CLIENT :<div><div></div><div>Maharashtra Metro Rail Corporation Limited</div></div><div>PROJECT :<div>PUNE METRO RAIL PROJECT</div></div><div>GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :<div><div></div><div>SYSTRA-AECOM-EGIS-RITES</div></div><div>CONSULTANTS :<div><div></div><div>Mapage Infrastructure PVT . Ltd.</div></div><div>PACKAGE :<div>Reach-3: CIVIL COURT to RAMWADI</div></div><div>TITLE :<div>GENERAL ARRANGEMENT DRAWINGS DN LINE TRACK VERTICAL CURVE LIST</div></div><table><tr><td colspan="5">DRG. No:</td><td>SHEET NO.</td></tr><tr><td colspan="5">MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020</td><td>1/1</td></tr><tr><td>SCALE:</td><td>STATUS</td><td>REVISION</td><td>SIZE</td><td colspan="2">DATE</td></tr><tr><td>HOR. 1:1000 VER. 1:200</td><td>GFC DRAWING</td><td>B-01</td><td>A1</td><td colspan="2">15.06.2020</td></tr></table></div></div></div></div>																		CHECKED BY:	SIGN	DATE	CHECKED BY:	SIGN	DATE	PROJECT DIRECTOR			Dy. P.D./ SYSTEMS			Dy. P.D./ CIVIL			CHIEF TELECOM			CHIEF RS			C. TRACTION EXPT.			CSE			C. TRACK EXPT.			CRE/ RS						ALIGNMENT EXPERT						MAHARASHTRA METRO RAIL CORPORATION LTD. :						GM DESIGN/ PLANNING			CPM/ TELECOM			ED/ RS			CPM/ TRACTION			ED/ SIGNAL			CPM/ RS			CPM/ TRACK			ACPM/ TRACK			DRG. No:					SHEET NO.	MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020					1/1	SCALE:	STATUS	REVISION	SIZE	DATE		HOR. 1:1000 VER. 1:200	GFC DRAWING	B-01	A1	15.06.2020	
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12												11												10												9												8												7												6												5												4												3												2												1											
PROJECT:		PUNE METRO REACH -3 (CIVIL COURT - RAMWADI) SPEED DETAILS - DOWN LINE										Project:		PUNE METRO REACH -3 (CIVIL COURT - RAMWADI) TURNOUT & FM DETAILS										ONLY FOR TENDER PURPOSE TENDER NO. P1-TO6/2021																																																																																																																							
Note: All units in this report are in meters unless specified otherwise.																																																																																																																																															
ALIGNMENT: DN LINE																																																																																																																																															
CURVE / STRAIGHT / STATION		START CHAINAGE		END CHAINAGE		RADIUS		LENGTH OF ELEMENT		TRACK SPEED		TURNOUT No.		CHAINAGE OF SRJ		TYPE OF TURNOUT		FM No.		CHAINAGE OF FM (m)		REMARKS																																																																																																																									
NAME		(m)		(m)		(m)		(m)		(kmph)				(m)						UP CH.		DN CH. / PKT LINE CH.																																																																																																																									
END OF CIVIL COURT STATION - STRAIGHT ELEMENT		6685.255		6871.069				185.814		90																																																																																																																																					
DLC 32		6871.069		7090.594		192.950		219.525		40																																																																																																																																					
DLC 33		7090.594		7178.740		427.050		88.146		40																																																																																																																																					
STRAIGHT		7178.740		7203.522				24.782		90																																																																																																																																					
DLC 34		7203.522		7291.467		447.050		87.945		60																																																																																																																																					
STRAIGHT		7291.467		7331.913				40.445		90																																																																																																																																					
DLC 35		7331.913		7454.124		477.950		122.211		65																																																																																																																																					
STRAIGHT		7454.124		7464.143				10.019		90																																																																																																																																					
MANGALWARPETH		7464.143		7604.143				140.000		70																																																																																																																																					
STRAIGHT		7604.143		7792.393				188.250		90																																																																																																																																					
DLC 36		7792.393		7923.185		277.950		130.792		50																																																																																																																																					
DLC 37		7923.185		8190.391		627.050		267.206		50																																																																																																																																					
STRAIGHT		8190.391		8242.639				52.248		90																																																																																																																																					
PUNE RAILWAY STATION		8242.639		8382.639				140.000		70																																																																																																																																					
STRAIGHT		8382.639		8453.643				71.004		90																																																																																																																																					
DLC 38		8453.643		8615.730		157.050		162.088		50																																																																																																																																					
STRAIGHT		8615.730		8673.875				58.144		90																																																																																																																																					
DLC 39		8673.875		8739.798		1152.050		65.923		60																																																																																																																																					
DLC 40		8739.798		8808.919		547.950		69.121		60																																																																																																																																					
STRAIGHT		8808.919		8846.757				37.838		90																																																																																																																																					
DLC 41		8846.757		8911.860		1137.050		65.103		75																																																																																																																																					
STRAIGHT		8911.860		8916.950				5.091		90																																																																																																																																					
RUBY CLINIC		8916.950		9056.950				140.000		70																																																																																																																																					
STRAIGHT		9056.950		9141.118				84.168		90																																																																																																																																					
DLC 42		9141.118		9213.765		202.050		72.647		35																																																																																																																																					
STRAIGHT		9213.765		9239.325				25.560		90																																																																																																																																					
DLC 43		9239.325		9304.183		527.950		64.859		55																																																																																																																																					
DLC 44		9304.183		9369.433		587.050		65.249		55																																																																																																																																					
STRAIGHT		9369.433		9490.452				121.020		90																																																																																																																																					
DLC 45		9490.452		9556.209		13002.050		65.756		80																																																																																																																																					
STRAIGHT		9556.209		9750.119				193.910		90																																																																																																																																					
DLC 46		9750.119		9818.315		4502.050		68.197		80																																																																																																																																					
STRAIGHT		9818.315		9982.370				164.055		90																																																																																																																																					
BUND GARDEN		9982.370		10122.370				140.000		70																																																																																																																																					
STRAIGHT		10122.370		10158.890				36.520		90																																																																																																																																					
DLC 47		10158.890		10357.671		227.050		198.781		45																																																																																																																																					
STRAIGHT		10357.671		10384.489				26.818		90																																																																																																																																					
DLC 48		10384.489		10654.188		157.950		269.699		40																																																																																																																																					
STRAIGHT		10654.188		10708.214				54.026		90																																																																																																																																					
YERWADA		10708.214		10848.214				140.000		70																																																																																																																																					
STRAIGHT		10848.214		11016.507				168.293		90																																																																																																																																					
DLC 49		11016.507		11084.971		232.050		68.464		35																																																																																																																																					
DLC 50		11084.971		11288.075		152.950		203.104		35																																																																																																																																					
STRAIGHT		11288.075		11315.345				27.270		90																																																																																																																																					
DLC 51		11315.345		11462.548		202.050		147.202		40																																																																																																																																					
STRAIGHT		11462.548		11855.444				392.897		90																																																																																																																																					
DLC 52		11855.444		11987.159		277.950		131.715		55																																																																																																																																					
STRAIGHT		11987.159		12024.423				37.264		90																																																																																																																																					
DLC 53		12024.423		12100.023		302.050		75.600		50																																																																																																																																					
STRAIGHT		12100.023		12129.802				29.779		90																																																																																																																																					
DLC 54		12129.802		12205.533		382.050		75.732		55																																																																																																																																					
STRAIGHT		12205.533		12273.638				68.104		90																																																																																																																																					
DLC 55		12273.638		12350.267		1097.950		76.630		80																																																																																																																																					
STRAIGHT		12350.267		12434.307				84.039		90																																																																																																																																					
DLC 56		12434.307		12510.040		11802.050		75.733		80																																																																																																																																					
STRAIGHT		12510.040		12652.775				142.735		90																																																																																																																																					
DLC 57		12652.775		12884.240		157.050		231.466		35																																																																																																																																					
STRAIGHT		12884.240		12887.477				3.237		90																																																																																																																																					
KALYANI NAGAR		12887.477		13027.477				140.000		70																																																																																																																																					
STRAIGHT		13027.477		13030.886				3.409		90																																																																																																																																					
DLC 58		13030.886		13137.557		157.050		106.670		35																																																																																																																																					
DLC 59		13137.557		13203.984		627.950		66.428		35																																																																																																																																					
STRAIGHT		13203.984		13309.632				105.648		90																																																																																																																																					
DLC 60		13309.632		13382.163		1502.050		72.530		80																																																																																																																																					
STRAIGHT		13382.163		13429.360				47.198		90																																																																																																																																					
DLC 61		13429.360		13505.841		602.050		76.480		55																																																																																																																																					
DLC 62		13505.841		13672.430		502.950		166.590		55																																																																																																																																					
STRAIGHT		13672.430		13744.744				72.313		90																																																																																																																																					
DLC 63		13744.744		13819.789		587.950		75.045		55																																																																																																																																					
DLC 64		13819.789		13895.377		452.050		75.588		55																																																																																																																																					
STRAIGHT		13895.377		13920.848				25.471		90																																																																																																																																					
DLC 65		13920.848		13986.293		802.050		65.445		75																																																																																																																																					
STRAIGHT		13986.293		14065.479				79.186		90																																																																																																																																					
DLC 66		14065.479		14238.875		152.950		173.396		50																																																																																																																																					
STRAIGHT		14238.875		14331.541				92.666		90																																																																																																																																					
DLC 67		14331.541		14409.181		397.950		77.640		60																																																																																																																																					
STRAIGHT		14409.181		14415.847				6.666		90																																																																																																																																					
RAMWADI		14415.847		14555.847				140.000		70																																																																																																																																					
STRAIGHT		14555.847		14562.511				6.664		90																																																																																																																																					
DLC 68		14562.511		14637.572		452.950		75.061		60																																																																																																																																					
STRAIGHT		14637.572		14781																																																																																																																																											

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND & DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY

SIGN

DATE

BHUPENDRA

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY

SIGN

DATE

CHECKED BY

SIGN

DATE

PROJECT DIRECTOR

Dy. P.D./ CIVIL

CHIEF RS

CHIEF TELECOM

CSE

C. TRACTION EXPT.

CRE/ R3

C. TRACK EXPT.

ALIGNMENT EXPERT

MAHARASHTRA METRO RAIL CORPORATION LTD. :
GM DESIGN/ PLANNING

CPM/ TELECOM

ED/ RS

CPM/ TRACTION

ED/ SIGNAL

CPM/ R3

CPM/ TRACK

ACPM/ TRACK

CLIENT :

MAHARASHTRA METRO RAIL CORPORATION LIMITED

PROJECT :

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :

Mapage Infrastructure PVT . Ltd.

PACKAGE :

Reach-3: CIVIL COURT to RAMWADI

TITLE :

GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
TURNOUTS DETAILS & SPEED TABLE

DRG. No:

MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020

SHEET NO.

1/1

SCALE:

HOR. 1:1000
VER. 1:200

STATUS

GFC DRAWING

REVISION

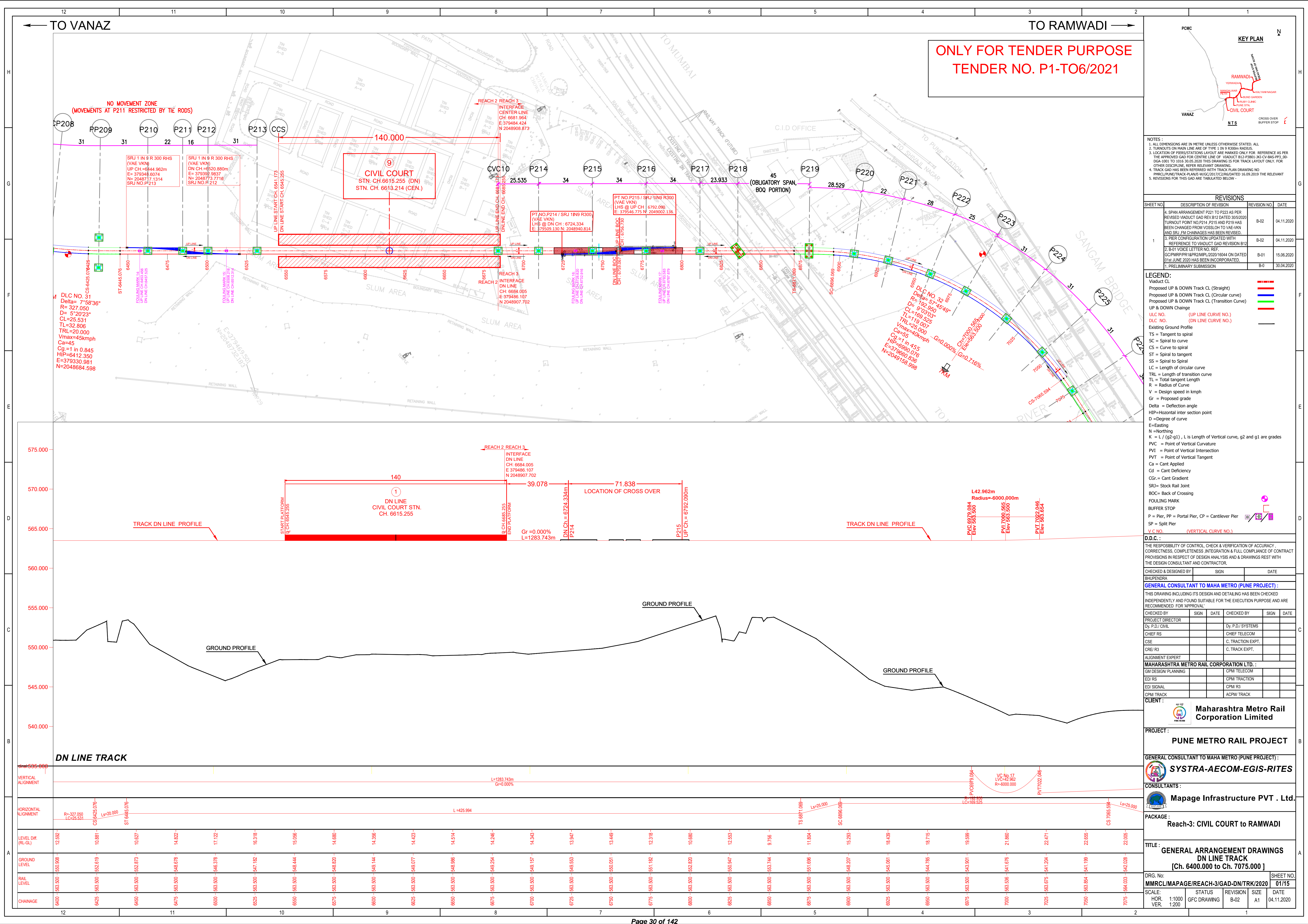
B-02

SIZE

A1

DATE

04.11.2020



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

NOTES :
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300M RADIUS.
3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER
THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAG-PP3_00-
05A-1001 TO 1015.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR
OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO
P1RC1/PUNE/TRACK-PLANE-WGZ/2017/C2/R6/DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
1	4. SPAN ARRANGEMENT P221 TO P223 AS PER REVISED VIADUCT GAD REV B12 DATED 30/5/2020 TURNOUT POINT NO.P214, P215 AND P219 HAS BEEN CHANGED FROM VOSSLOH TO VAE-VKN AND SRJ FRI CHANGES HAS BEEN REVISED. 3. PIER CONFIGURATION UPDATED WITH REFERENCE TO VIADUCT GAD REVISION B12 2. B-01 VOICE LETTER NO. REF. COM/PRP/PR/18/02/2019/2020/1804 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED. 1. PRELIMINARY SUBMISSION	B-02	04.11.2020
		B-02	04.11.2020
		B-01	15.08.2020
		B-0	30.04.2020

LEGEND:
Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition Curve)
UP & DOWN Change
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)
Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TRL = Length of transition curve
TL = Total tangent length
R = Radius of Curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP=Horizontal inter section point
D = Degree of curve
E=Eastings
N=Northings
K = L / (g2-g1) , L is Length of vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
CGr = Cant Gradient
SRJ= Stock Rail Joint
BOC= Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V C NO. (VERTICAL CURVE NO.)

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY,
CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT
PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH
THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY SIGN DATE

BHUPENDRA

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED
INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE
RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			DR. P.D. SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD. :					
GM DESIGN/ PLANNING			CPM/ TELECOM		
ED/ RS			CPM/ TRACTION		
ED/ SIGNAL			CPM/ R3		
CPM/ TRACK			ACPM/ TRACK		

CLIENT :
Maharashtra Metro Rail Corporation Limited

PROJECT :
PUNE METRO RAIL PROJECT

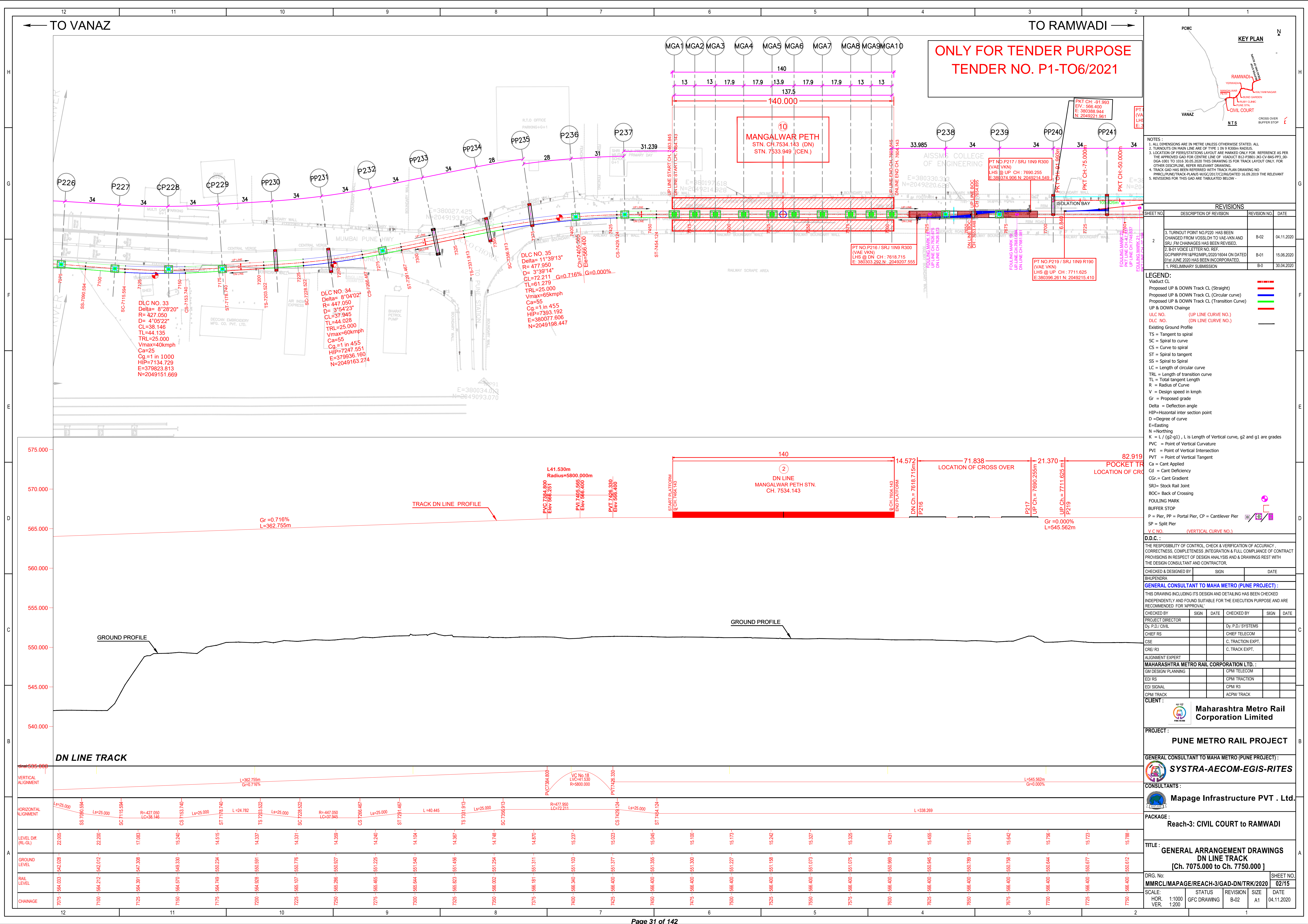
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :
Mapage Infrastructure PVT . Ltd.

PACKAGE :
Reach-3: CIVIL COURT to RAMWADI

TITLE :
GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 6400.000 to Ch. 7075.000]

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-02	A1	04.11.2020
SCALE:	HOR. 1:1000	VER. 1:200		



NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300m RADIUS.
3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-301-CV-BAG-PP3_00-00A-1001 TO 1015.00.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLANE-WG/2017/C2/6(DATED 16.09.2019) THE RELEVANT 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
2	3. TURNOUT POINT NO.P220 HAS BEEN CHANGED FROM VOSSLOH TO VAE-VKN AND SRJ FM CHAINAGES HAS BEEN REVISED.	B-02	04.11.2020
	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/02/2019/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.08.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

LEGEND:

Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition curve)
UP & DOWN Change
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)

Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TRL = Length of transition curve
TL = Total tangent Length
R = Radius of Curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP=Horizontal inter section point
D = Degree of curve
E=Eastings
N =Northings
K = L / (g2-g1) , L is Length of Vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
Cgr = Cant Gradient
SRJ= Stock Rail Joint
BOC = Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V.C NO. (VERTICAL CURVE NO.)

D.D.C. :

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY SIGN DATE

BHUPENDRA

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD. :					
GM DESIGN/ PLANNING			CPM/ TELECOM		
ED/ RS			CPM/ TRACTION		
ED/ SIGNAL			CPM/ R3		
CPM/ TRACK			ACPM/ TRACK		

CLIENT :



PROJECT :

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :

Mapage Infrastructure PVT . Ltd.

PACKAGE :

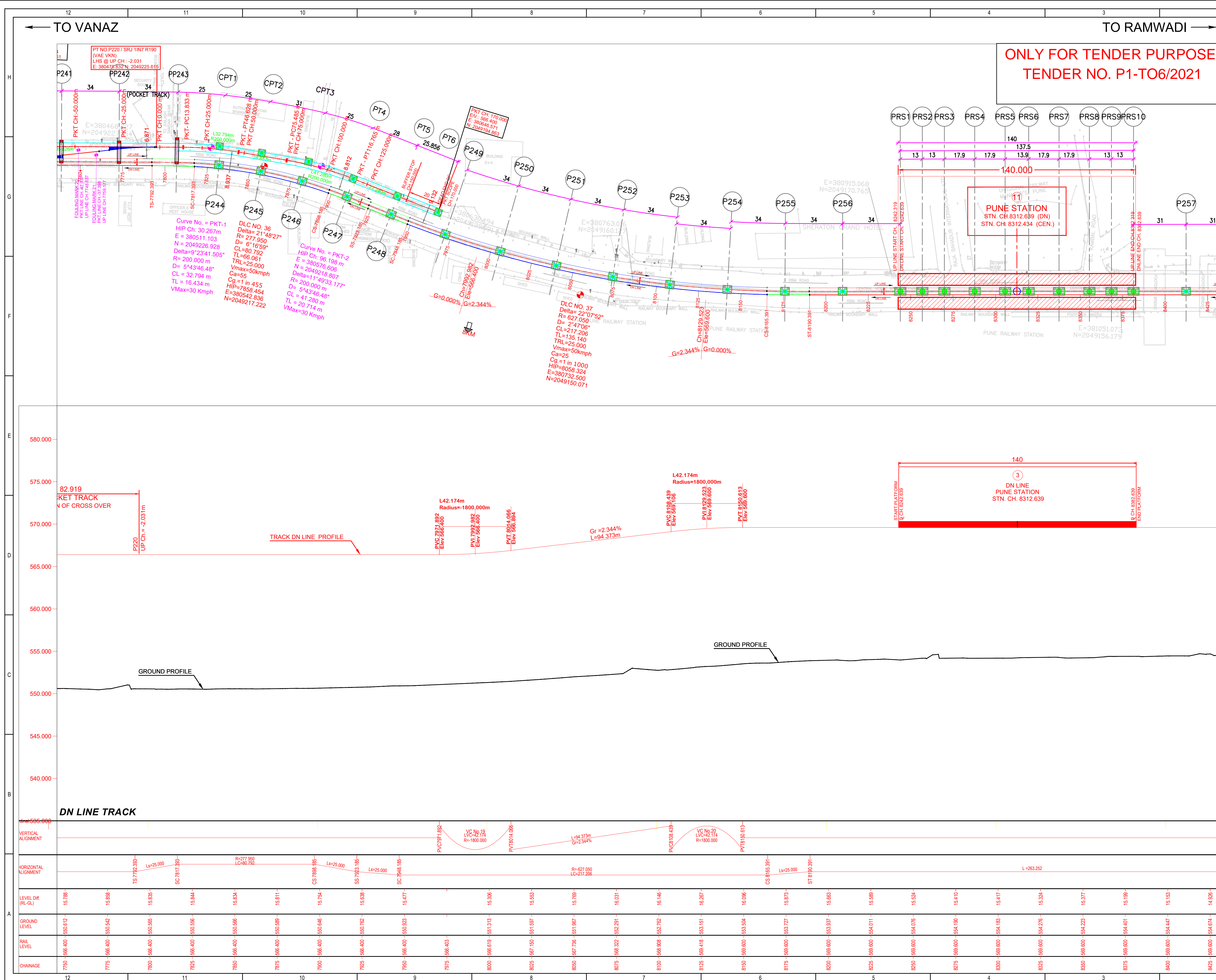
Reach-3: CIVIL COURT to RAMWADI

TITLE :

GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 7075.000 to Ch. 7750.000]

DRG. No. MMRL/MAPAGE/REACH-3/GAD-DN/TRK/2020 02/15

SCALE: HOR. 1:1000 GFC DRAWING STATUS REVISION B-02 SIZE A1 DATE 04.11.2020



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

TO VANAZ **TO RAMWADI**

KEY PLAN

NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R200m RADIUS.
3. LOCATION OF PIERSTATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-JCI-CV-BAS-PP3_00-DS4-1001 TO 1015.00.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLANE-WGZ/2017/C2/RS/2019 DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
3	3. TURNOUT POINT NO.P220. HAS BEEN CHANGED FROM VOSSLOH TO VAE-VKN AND SRJ FM CHAINAGES HAS BEEN CHANGED.	B-02	04.11.2020
	2. B-01 VOICE LETTER NO. REF. COTRMP/PR/18/02/2019/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.08.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

LEGEND:

- Viaduct CL
- Proposed UP & DOWN Track CL (Straight)
- Proposed UP & DOWN Track CL (Circular curve)
- Proposed UP & DOWN Track CL (Transition curve)
- UP & DOWN Change
- ULC NO. (UP LINE CURVE NO.)
- DLN NO. (DN LINE CURVE NO.)
- Existing Ground Profile
- TS = Tangent to spiral
- SC = Spiral to curve
- CS = Curve to spiral
- ST = Spiral to tangent
- SS = Spiral to spiral
- LC = Length of circular curve
- TRL = Length of transition curve
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- V = Design speed in kmph
- Gr = Proposed grade
- Delta = Deflection angle
- HIP = Horizontal inter section point
- D = Degree of curve
- E = Easting
- N = Northing
- K = $L / (g_2 - g_1)$, L is Length of Vertical curve, g2 and g1 are grades
- PVC = Point of Vertical Curvature
- PVI = Point of Vertical Intersection
- PVT = Point of Vertical Tangent
- Ca = Cant Applied
- Cd = Cant Deficiency
- CGR = Cant Gradient
- SRJ = Stock Rail Joint
- BOC = Back of Crossing
- FOULING MARK
- BUFFER STOP
- P = Pier, PP = Portal Pier, CP = Cantilever Pier
- SP = Split Pier
- V.C. NO. (VERTICAL CURVE NO.)

D.D.C. :

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL.

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./ SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		

ALIGNMENT EXPERT

MAHARASHTRA METRO RAIL CORPORATION LTD. :

GM DESIGN/ PLANNING	CPM/ TELECOM
ED/ RS	CPM/ TRACTION
ED/ SIGNAL	CPM/ R3
CPM/ TRACK	ACPM/ TRACK

CLIENT :

Maharashtra Metro Rail Corporation Limited

PROJECT :

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :

Mapage Infrastructure PVT . Ltd.

PACKAGE :

Reach-3: CIVIL COURT to RAMWADI

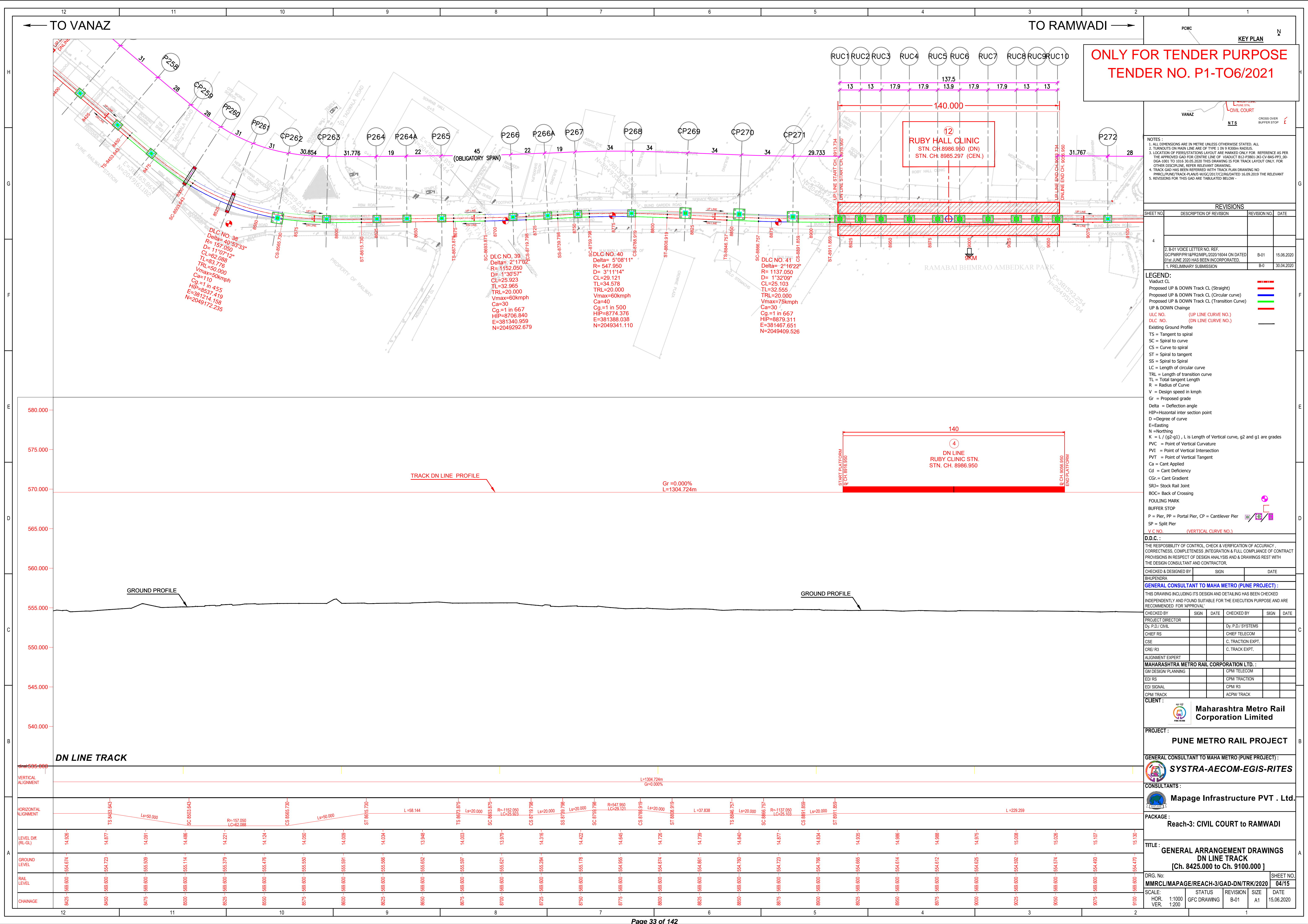
TITLE :

GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 7750.000 to Ch. 8425.000]

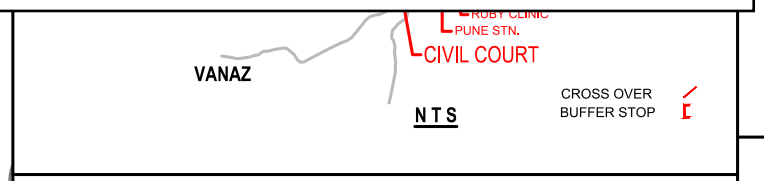
DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-02	A1	04.11.2020

SCALE: HOR. 1:1000
VER. 1:200

Page 32 of 142



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



NOTES:
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300R RADIUS.
3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER
THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3_00-
00-00-100 TO 1015.30.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR
OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO
P3801/PUNE/TRACK-PLANE-WGZ/2017/C2/6/06 DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
4	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/02/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED. 1. PRELIMINARY SUBMISSION	B-01	15.06.2020
		B-0	30.04.2020

- LEGEND:**
- Viaduct CL
 - Proposed UP & DOWN Track CL (Straight)
 - Proposed UP & DOWN Track CL (Circular curve)
 - Proposed UP & DOWN Track CL (Transition curve)
 - UP & DOWN Change
 - ULC NO. (UP LINE CURVE NO.)
 - DLC NO. (DN LINE CURVE NO.)
 - Existing Ground Profile
 - TS = Tangent to spiral
 - SC = Spiral to curve
 - CS = Curve to spiral
 - ST = Spiral to tangent
 - SS = Spiral to Spiral
 - LC = Length of circular curve
 - TRL = Length of transition curve
 - TL = Total tangent Length
 - R = Radius of Curve
 - V = Design speed in kmph
 - Gr = Proposed grade
 - Delta = Deflection angle
 - HIP = Horizontal inter section point
 - D = Degree of curve
 - E = Easting
 - N = Northing
 - K = $L / (g_2 - g_1)$, L is Length of Vertical curve, g2 and g1 are grades
 - PVC = Point of Vertical Curvature
 - PVI = Point of Vertical Intersection
 - PVT = Point of Tangent Intersection
 - Ca = Cant Applied
 - Cd = Cant Deficiency
 - CGr = Cant Gradient
 - SRJ = Stock Rail Joint
 - BOC = Back of Crossing
 - FOULING MARK
 - BUFFER STOP
 - P = Pier, PP = Portal Pier, CP = Cantilever Pier
 - SP = Split Pier
 - V.C.NO. (VERTICAL CURVE NO.)

D.D.C.:
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY: SIGN: DATE:

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL.

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD.:					
GM DESIGN/ PLANNING			CPM/ TELECOM		
ED/ RS			CPM/ TRACTION		
ED/ SIGNAL			CPM/ R3		
CPM/ TRACK			ACPM/ TRACK		

CLIENT:
Maharashtra Metro Rail Corporation Limited

PROJECT:
PUNE METRO RAIL PROJECT

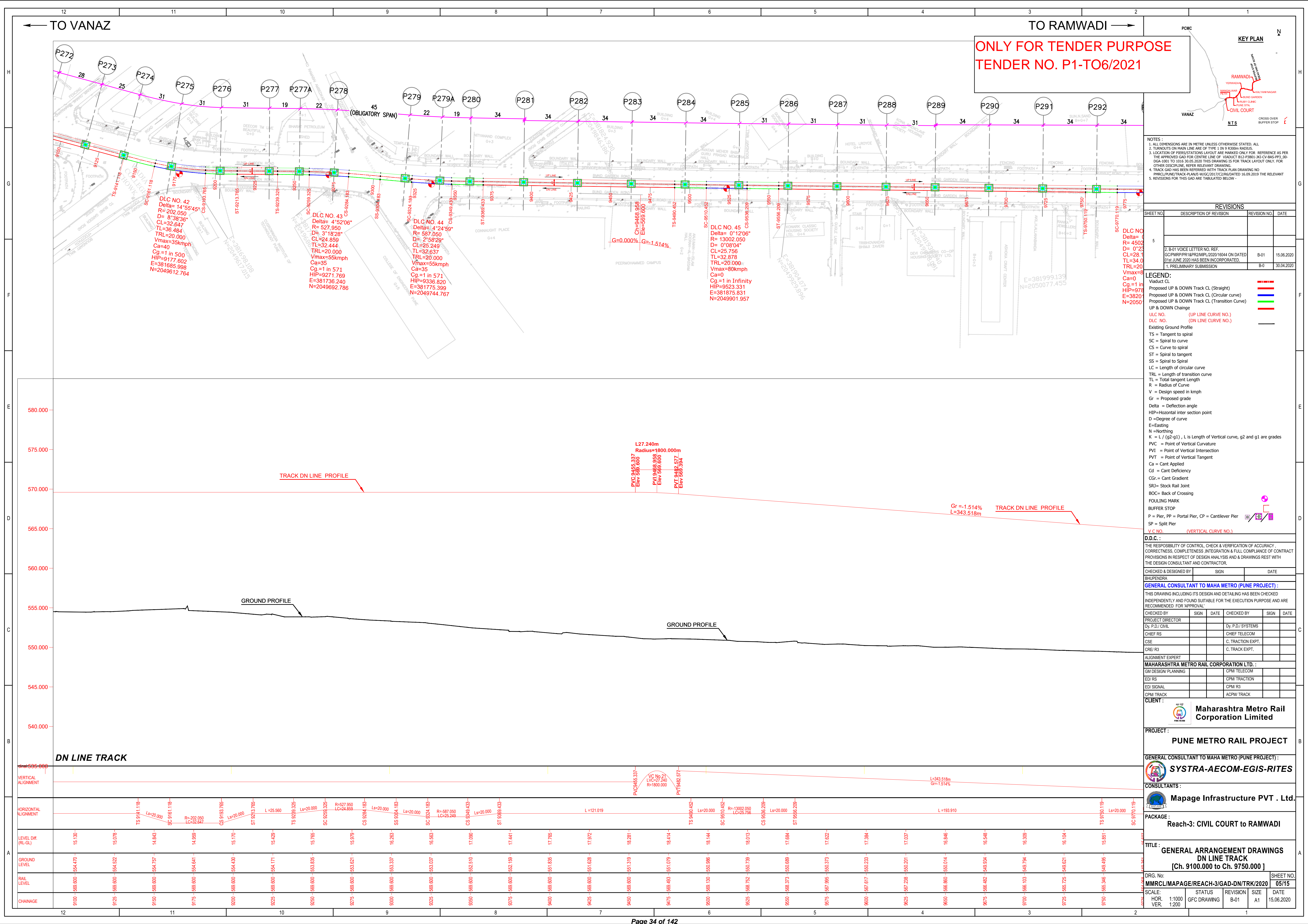
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):
SYSTRA-AECOM-EGIS-RITES

CONSULTANTS:
Mapage Infrastructure PVT. Ltd.

PACKAGE:
Reach-3: CIVIL COURT to RAMWADI

TITLE:
GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 8425.000 to Ch. 9100.000]

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-01	A1	15.06.2020
SCALE:	HOR. 1:1000	VER. 1:200		



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

- NOTES :
- 1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
 - 2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R3000 RADIUS.
 - 3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3_00-00A-1001 TO 10030.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
 - 4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLANE-WGZ/2017/C2/R6/DATED 16.09.2019 THE RELEVANT
 - 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
5	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/PPR/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.06.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

- LEGEND:
- Viaduct CL
 - Proposed UP & DOWN Track CL (Straight)
 - Proposed UP & DOWN Track CL (Circular curve)
 - Proposed UP & DOWN Track CL (Transition Curve)
 - UP & DOWN Change
 - ULC NO. (UP LINE CURVE NO.)
 - DLN NO. (DN LINE CURVE NO.)
 - Existing Ground Profile
 - TS = Tangent to spiral
 - SC = Spiral to curve
 - CS = Curve to spiral
 - ST = Spiral to tangent
 - SS = Spiral to spiral
 - LC = Length of circular curve
 - TRL = Length of transition curve
 - TL = Total tangent Length
 - R = Radius of Curve
 - V = Design speed in kmph
 - Gr = Proposed grade
 - Delta = Deflection angle
 - HIP = Horizontal inter section point
 - D = Degree of curve
 - E = Easting
 - N = Northing
 - K = L / (g2-g1), L is Length of Vertical curve, g2 and g1 are grades
 - PVC = Point of Vertical Curvature
 - PVI = Point of Vertical Intersection
 - PVT = Point of Vertical Tangent
 - Ca = Cant Applied
 - Cd = Cant Deficiency
 - CGR = Cant Gradient
 - SRJ = Stock Rail Joint
 - BOC = Back of Crossing
 - FOULING MARK
 - BUFFER STOP
 - P = Pier, PP = Portal Pier, CP = Cantilever Pier
 - SP = Split Pier
 - V.C.NO. (VERTICAL CURVE NO.)

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		

ALIGNMENT EXPERT			
MAHARASHTRA METRO RAIL CORPORATION LTD. :			
GM DESIGN/ PLANNING		CPM/ TELECOM	
ED/ RS		CPM/ TRACTION	
ED/ SIGNAL		CPM/ R3	
CPM/ TRACK		ACPM/ TRACK	

CLIENT :
 Maharashtra Metro Rail Corporation Limited

PROJECT :
PUNE METRO RAIL PROJECT

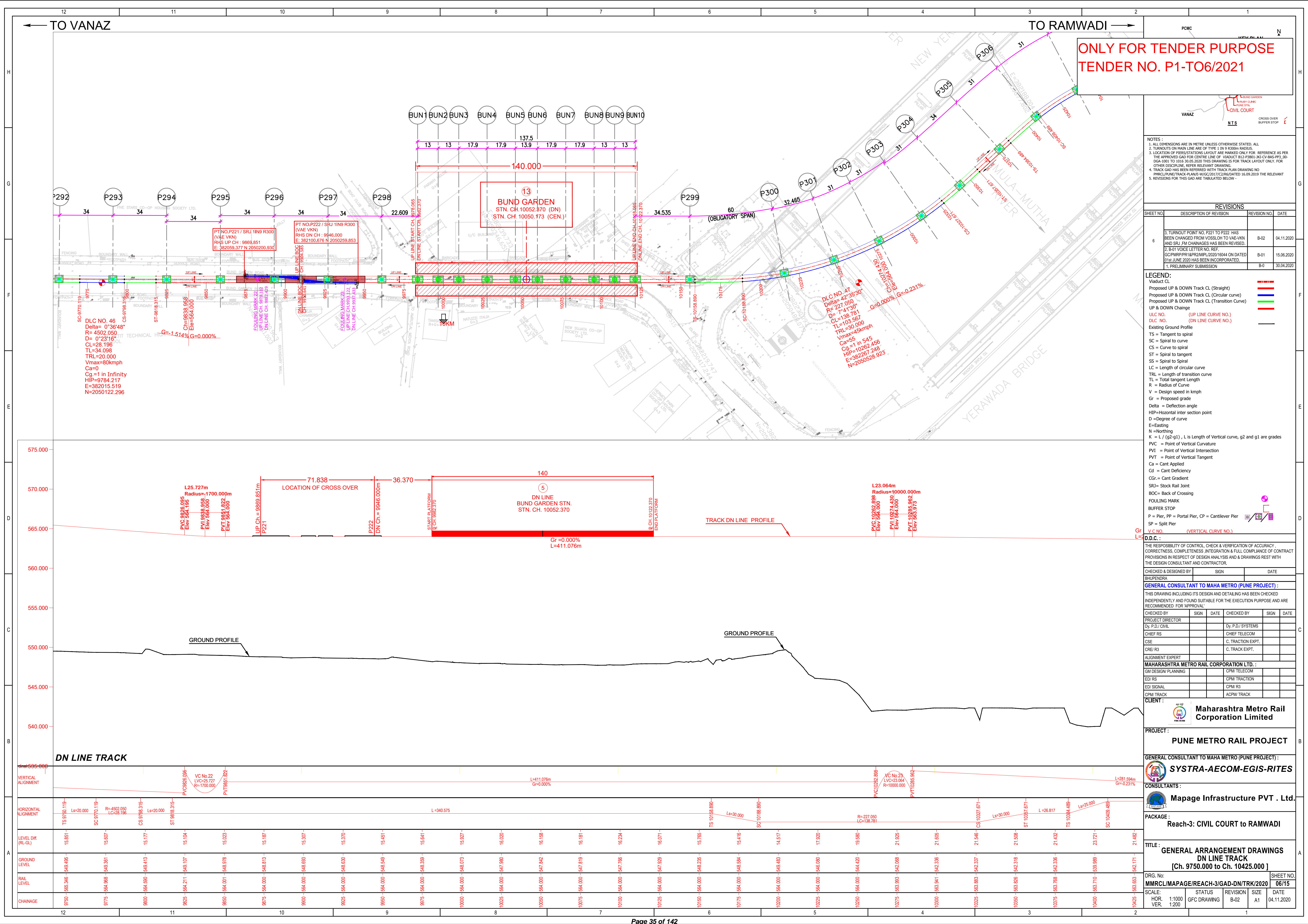
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
 SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :
 Mapage Infrastructure PVT. Ltd.

PACKAGE :
Reach-3: CIVIL COURT to RAMWADI

TITLE :
**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 9100.000 to Ch. 9750.000]**

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-01	A1	15.06.2020
SCALE:	HOR. 1:1000 VER. 1:200			



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

NOTES :
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300M RADIUS.
3. LOCATION OF PIERS/STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER
THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-30-CV-BAS-PP3_00-
00-00-00 TO 1016.00.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR
OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO
P3801/30-CV-BAS-PP3_00-00-00/00-00-00 DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW

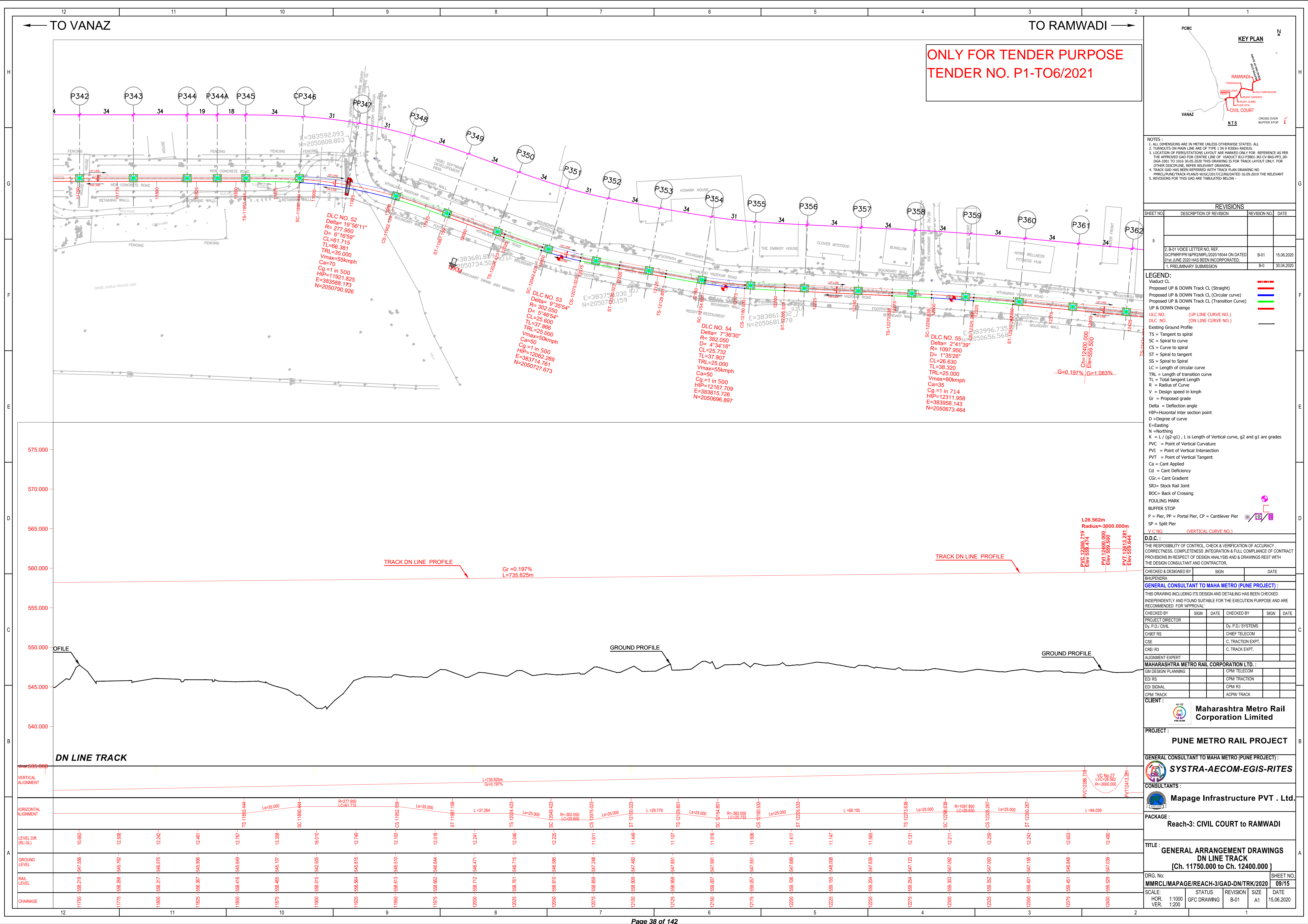
REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
6	3. TURNOUT POINT NO. P221 TO P222 HAS BEEN CHANGED FROM VOSSLOH TO VAE-VKN AND SRJ FM CHAINAGES HAS BEEN REVISED. 2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/02/2019/1804 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED. 1. PRELIMINARY SUBMISSION	B-02	04.11.2020
		B-01	15.08.2020
		B-0	30.04.2020

LEGEND:
Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition Curve)
UP & DOWN Change
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)
Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TRL = Length of transition curve
TL = Total tangent length
R = Radius of Curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP = Horizontal inter section point
D = Degree of curve
E = Easting
N = Northing
K = L / (g2-g1) , L is Length of Vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
CGR = Cant Gradient
SRJ = Stock Rail Joint
BOC = Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V.C.NO. (VERTICAL CURVE NO.)
D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY,
CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT
PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH
THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :		
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL		
CHECKED BY	SIGN	DATE
PROJECT DIRECTOR		
CHIEF RS		
CSE		
CRE/ R3		
ALIGNMENT EXPERT		
MAHARASHTRA METRO RAIL CORPORATION LTD. :		
GM DESIGN/ PLANNING		
ED/ RS		
ED/ SIGNAL		
CPM/ TRACK		

CLIENT :
Maharashtra Metro Rail Corporation Limited
PROJECT :
PUNE METRO RAIL PROJECT
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
SYSTRA-AECOM-EGIS-RITES
CONSULTANTS :
Mapage Infrastructure PVT . Ltd.

PACKAGE :
Reach-3: CIVIL COURT to RAMWADI
TITLE :
**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 9750.000 to Ch. 10425.000]**
DRG. No.:
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020
SCALE:
HOR. 1:1000
VER. 1:200
STATUS
GFC DRAWING
REVISION
B-02
SIZE
A1
DATE
04.11.2020



KEY PLAN

NOTES :

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300m RADIUS.
3. LOCATION OF PIERS/STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-301-CY-BAS-PP3_00-00-00-00 TO 1016 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLAN-11/07/2017/C2/06/DATED 16.09.2019 THE RELEVANT PMRCL/PUNE/TRACK-PLAN-11/07/2017/C2/06/DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS									
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE						
9	2. B-01 VOICE LETTER NO. REF. GOMR/PMR/PR/18/02/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED. <tr><td></td><td>1. PRELIMINARY SUBMISSION</td><td>B-01</td><td>15.06.2020</td></tr> <tr><td></td><td></td><td>B-0</td><td>30.04.2020</td></tr>		1. PRELIMINARY SUBMISSION	B-01	15.06.2020			B-0	30.04.2020
	1. PRELIMINARY SUBMISSION	B-01	15.06.2020						
		B-0	30.04.2020						

LEGEND:

- Viaduct CL
- Proposed UP & DOWN Track CL (Straight)
- Proposed UP & DOWN Track CL (Circular curve)
- Proposed UP & DOWN Track CL (Transition Curve)
- UP & DOWN Change
- ULC NO. (UP LINE CURVE NO.)
- DLN NO. (DN LINE CURVE NO.)
- Existing Ground Profile
- TS = Tangent to spiral
- SC = Spiral to curve
- CS = Curve to spiral
- ST = Spiral to tangent
- SS = Spiral to spiral
- LC = Length of circular curve
- TRL = Length of transition curve
- TL = Total tangent length
- R = Radius of Curve
- V = Design speed in kmph
- Gr = Proposed grade
- Delta = Deflection angle
- HIP = Horizontal inter section point
- D = Degree of curve
- E = Easting
- N = Northing
- K = L / (g2-g1) , L = Length of Vertical curve, g2 and g1 are grades
- PVC = Point of Vertical Curvature
- PVI = Point of Vertical Intersection
- PVT = Point of Vertical Tangent
- Ca = Cant Applied
- Cd = Cant Deficiency
- CGR = Cant Gradient
- SRJ = Stock Rail Joint
- BOC = Back of Crossing
- FOULING MARK
- BUFFER STOP
- P = Pier, PP = Portal Pier, CP = Cantilever Pier
- SP = Split Pier
- V.C. NO. (VERTICAL CURVE NO.)

D.D.C. :

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL.

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			Dy. P.D./ SYSTEMS		
Dy. P.D./ CIVIL			CHIEF TELECOM		
CHIEF RS			C. TRACTION EXPT.		
CSE			C. TRACK EXPT.		
CRE/ R3					
ALIGNMENT EXPERT					

MAHARASHTRA METRO RAIL CORPORATION LTD. :

GM DESIGN/ PLANNING	CPM TELECOM
EDI RS	CPM TRACTION
EDI SIGNAL	CPM R3
CPM TRACK	ACPM TRACK

CLIENT :

Maharashtra Metro Rail Corporation Limited

PROJECT :

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :

Mapage Infrastructure PVT. Ltd.

PACKAGE :

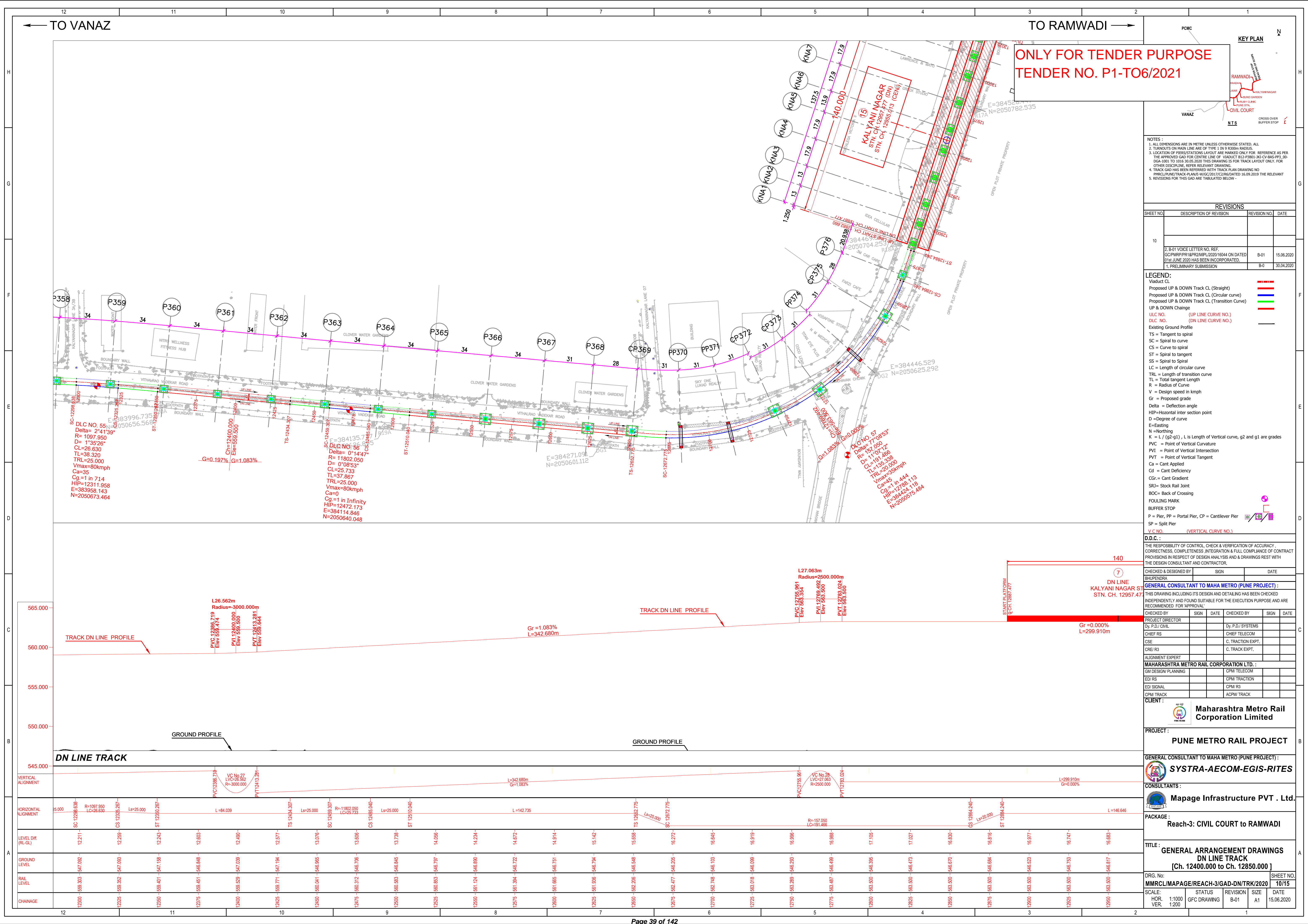
Reach-3: CIVIL COURT to RAMWADI

TITLE :

GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 11750.000 to Ch. 12400.000]

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-01	A1	15.06.2020

SCALE: HOR. 1:1000
VER. 1:200



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

- NOTES :
- 1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
 - 2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R200M RADIUS.
 - 3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3-00-00A-1001 TO 1016 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
 - 4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLAN/11/02/2017/C2/6/6 DATED 16.09.2019 THE RELEVANT 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
10	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/02/2019/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.06.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

- LEGEND:
- Viaduct CL
 - Proposed UP & DOWN Track CL (Straight)
 - Proposed UP & DOWN Track CL (Circular curve)
 - Proposed UP & DOWN Track CL (Transition curve)
 - UP & DOWN Change
 - ULC NO. (UP LINE CURVE NO.)
 - DLN NO. (DN LINE CURVE NO.)
 - Existing Ground Profile
 - TS = Tangent to spiral
 - SC = Spiral to curve
 - CS = Curve to spiral
 - ST = Spiral to tangent
 - SS = Spiral to spiral
 - LC = Length of circular curve
 - TRL = Length of transition curve
 - TL = Total tangent length
 - R = Radius of Curve
 - V = Design speed in kmph
 - Gr = Proposed grade
 - Delta = Deflection angle
 - HIP = Horizontal inter section point
 - D = Degree of curve
 - E = Easting
 - N = Northing
 - K = $L / (g_2 - g_1)$, L = Length of Vertical curve, g_2 and g_1 are grades
 - PVC = Point of Vertical Curvature
 - PVI = Point of Vertical Intersection
 - PVT = Point of Vertical Tangent
 - Ca = Cant Applied
 - Cd = Cant Deficiency
 - CGR = Cant Gradient
 - SRJ = Stock Rail Joint
 - BOC = Back of Crossing
 - FOULING MARK
 - BUFFER STOP
 - P = Pier, PP = Portal Pier, CP = Cantilever Pier
 - SP = Split Pier
 - V.C. NO. (VERTICAL CURVE NO.)

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			DR. P.D. CIVIL		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACK EXPT.		
CRE/ R3			C. TRACK EXPT.		

MAHARASHTRA METRO RAIL CORPORATION LTD. :					
GM DESIGN/ PLANNING		CPM/ TELECOM			
ED/ RS		CPM/ TRACTION			
ED/ SIGNAL		CPM/ R3			
CPM/ TRACK		ACPM/ TRACK			

CLIENT :
Maharashtra Metro Rail Corporation Limited

PROJECT :
PUNE METRO RAIL PROJECT

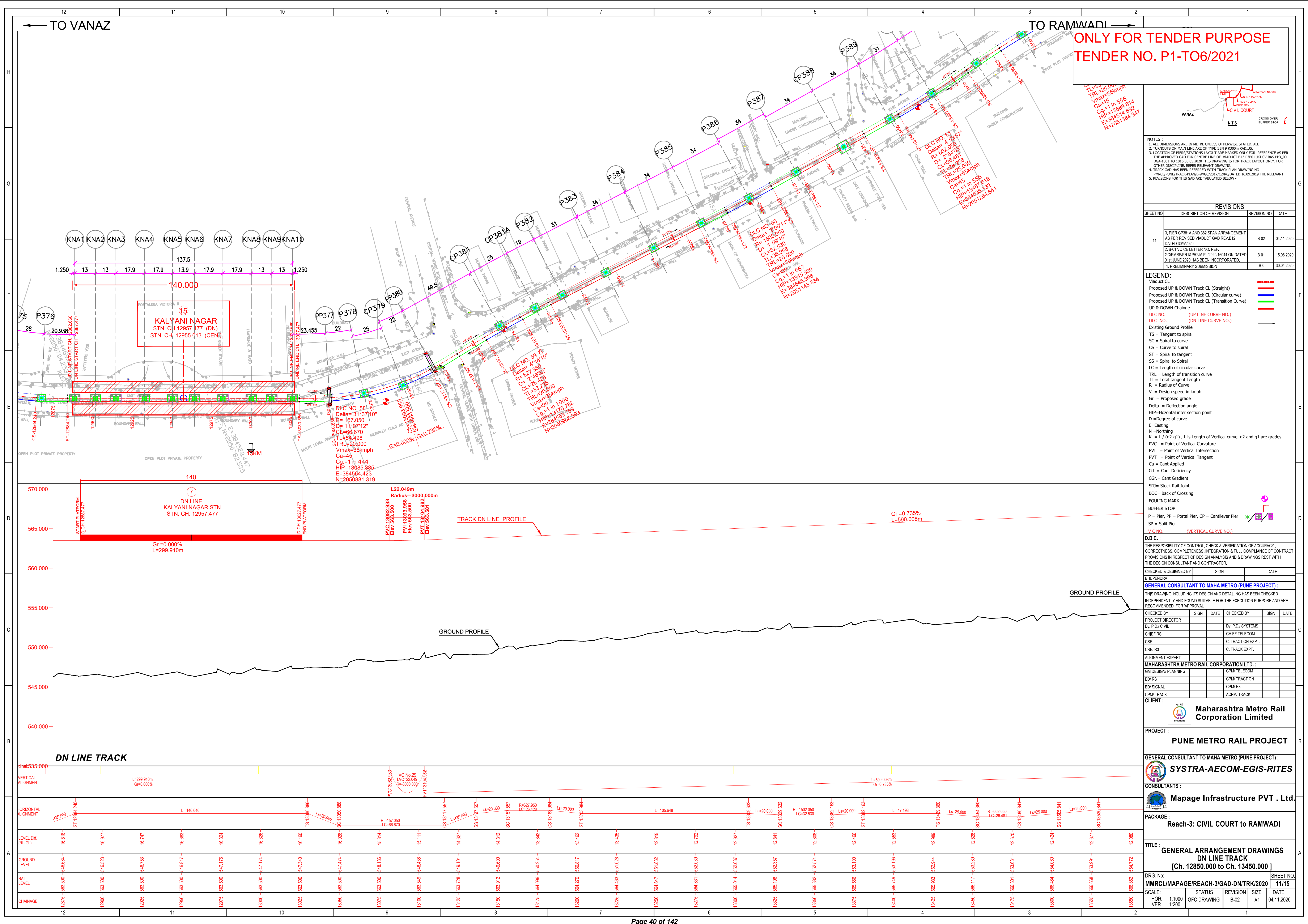
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
SYSTRA-AECOM-EGIS-RITES

CONSULTANTS :
Mapage Infrastructure PVT . Ltd.

PACKAGE :
Reach-3: CIVIL COURT to RAMWADI

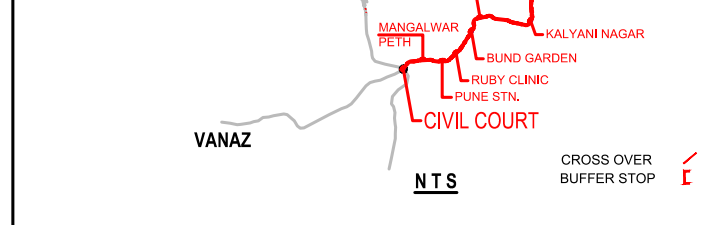
TITLE :
GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 12400.000 to Ch. 12850.000]

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-01	A1	15.06.2020
SCALE:	HOR. 1:1000	VER. 1:200		



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

TL=25.00
TRL=25.00
Vmax=55kmph
Ca=45
Cg=1 in 556
HIP=13588.514
E=38451.492
N=2051384.947



NOTES:
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300M RADIUS.
3. LOCATION OF PERSISTENCE LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER
THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3_00-
00A-1001 TO 1016.30.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR
OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO
P3801/PUNE/TRACK-PLAN-NGC/2017/C2/R6/DATED 16.09.2019 THE RELEVANT
5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
11	3. PIER CP381A AND 382 SPAN ARRANGEMENT AS PER REVISED VIADUCT GAD REV B12 DATED 30/5/2020	B-02	04.11.2020
	2. B-01 VOICE LETTER NO. REF: GO/MPR/PR/18/02/MP/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.08.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

LEGEND:
Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition curve)
UP & DOWN Change
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)
Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TL = Length of transition curve
TL = Total tangent Length
R = Radius of Curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP=Horizontal inter section point
D = Degree of curve
E=Easting
N=Northing
K = L / (g2-g1) , L is Length of Vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
CGR = Cant Gradient
SRJ = Stock Rail Joint
BOC = Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V C NO. (VERTICAL CURVE NO.)

D.D.C.:
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY,
CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT
PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH
THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED
INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE
RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD.:					
GM DESIGN/PLANNING			CPM/TELECOM		
ED/RS			CPM/TRACTION		
ED/SIGNAL			CPM/R3		
CPM/TRACK			ACPM/TRACK		

CLIENT:



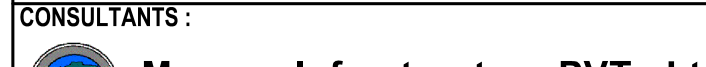
PROJECT:

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS:



PACKAGE:

Reach-3: CIVIL COURT to RAMWADI

TITLE:

GENERAL ARRANGEMENT DRAWINGS

DN LINE TRACK

[Ch. 12850.000 to Ch. 13450.000]

DRG. No:

MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020

SHEET NO.

11/15

SCALE:

HOR. 1:1000

VER. 1:200

STATUS

REVISION

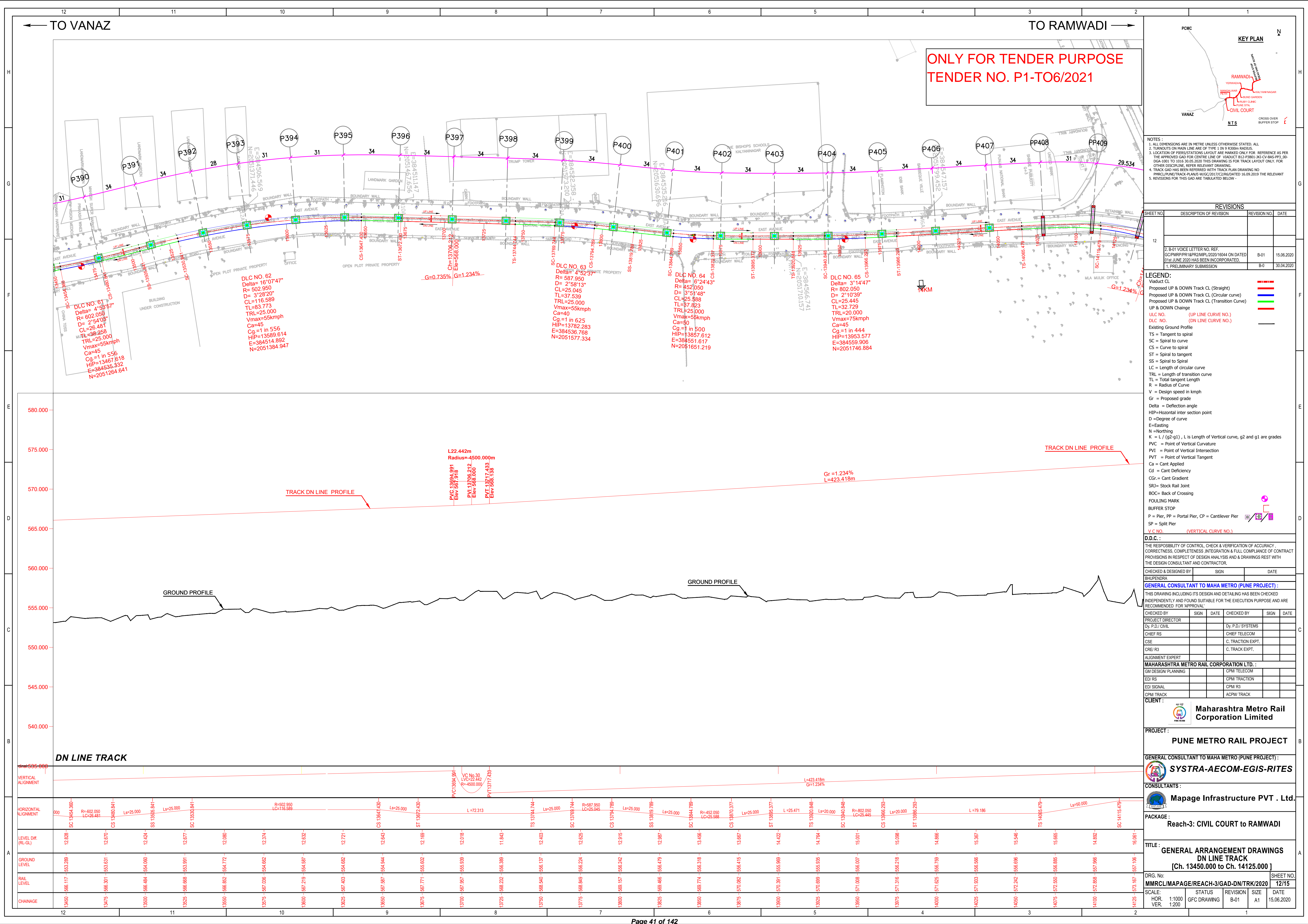
B-02

SIZE

A1

DATE

04.11.2020



KEY PLAN

NOTES:

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R300R RADIUS.
3. LOCATION OF PERSISTENT LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3_00-00A-1001 TO 1016.00.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. P3801/PUNE/TRACK-PLANE-WGZ/2017/C2/REV.06 DATED 16.09.2019 THE RELEVANT 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW.

REVISIONS									
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE						
12	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/2020/MP/2020/18044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED. <tr><td></td><td>1. PRELIMINARY SUBMISSION</td><td>B-01</td><td>15.06.2020</td></tr> <tr><td></td><td></td><td>B-0</td><td>30.04.2020</td></tr>		1. PRELIMINARY SUBMISSION	B-01	15.06.2020			B-0	30.04.2020
	1. PRELIMINARY SUBMISSION	B-01	15.06.2020						
		B-0	30.04.2020						

LEGEND:

VIADUCT CL

Proposed UP & DOWN Track CL (Straight)

Proposed UP & DOWN Track CL (Circular curve)

Proposed UP & DOWN Track CL (Transition curve)

UP & DOWN Change

ULC NO. (UP LINE CURVE NO.)

DLN NO. (DN LINE CURVE NO.)

Existing Ground Profile

TS = Tangent to spiral

SC = Spiral to curve

CS = Curve to spiral

ST = Spiral to tangent

SS = Spiral to spiral

LC = Length of circular curve

TRL = Length of transition curve

TL = Total tangent length

R = Radius of curve

V = Design speed in kmph

Gr = Proposed grade

Delta = Deflection angle

HIP = Horizontal inter section point

D = Degree of curve

E = Easting

N = Northing

K = L / (g2-g1) , L is Length of Vertical curve, g2 and g1 are grades

PVC = Point of Vertical Curvature

PVI = Point of Vertical Intersection

PVT = Point of Vertical Tangent

Ca = Cant Applied

Cd = Cant Deficiency

CGR = Cant Gradient

SRJ = Stock Rail Joint

BOC = Back of Crossing

FOULING MARK

BUFFER STOP

P = Pier, PP = Portal Pier, CP = Cantilever Pier

SP = Split Pier

V.C.NO. (VERTICAL CURVE NO.)

D.D.C.:

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL:

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		

ALIGNMENT EXPERT

MAHARASHTRA METRO RAIL CORPORATION LTD.:

GM DESIGN/ PLANNING	CPM/ TELECOM
ED/ RS	CPM/ TRACTION
ED/ SIGNAL	CPM/ R3
CPM/ TRACK	ACPM/ TRACK

CLIENT:

Maharashtra Metro Rail Corporation Limited

PROJECT:

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS:

Mapage Infrastructure PVT. Ltd.

PACKAGE:

Reach-3: CIVIL COURT to RAMWADI

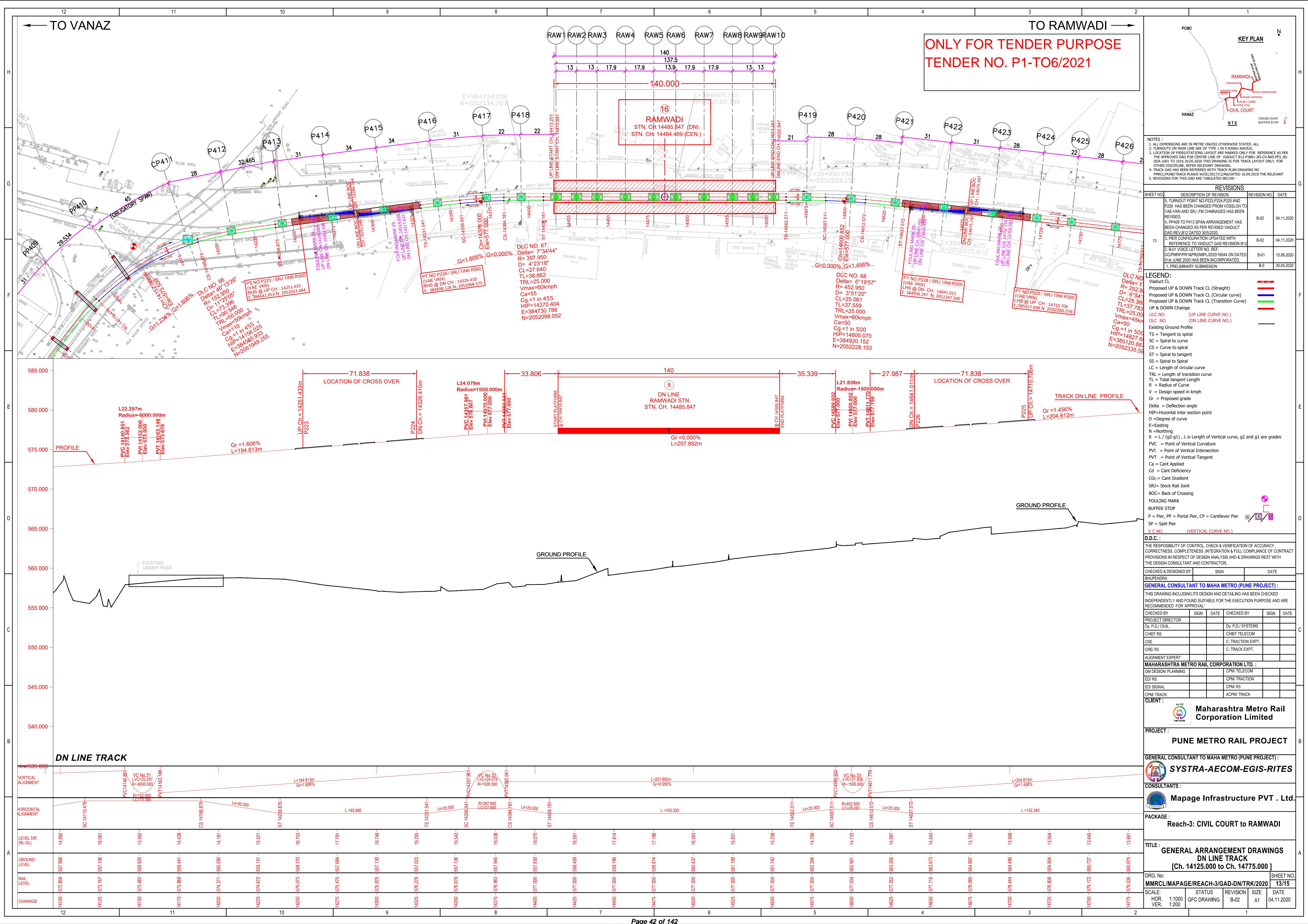
TITLE:

**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 13450.000 to Ch. 14125.000]**

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-01	A1	15.06.2020

SCALE:	HOR. 1:1000	VER. 1:200
DATE	15.06.2020	

Page 41 of 142



NOTES:

1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R3000 RADIUS.
3. LOCATION OF PERS/STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-JCI-CV-BAG-PP3_00-DS&A-1001 TO 1016.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRCL/PUNE/TRACK-PLAN-WGZ/2017/C2/6(DATED 16.09.2019) THE RELEVANT 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW.

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
13	5. TURNOUT POINT NO. P223, P224, P225 AND P226 HAS BEEN CHANGED FROM VOSSLOH TO VAE-VN AND SRJ FM CHANGES HAS BEEN REVISED.	B-02	04.11.2020
	4. PP409 TO P413 SPAN ARRANGEMENT HAS BEEN CHANGED AS PER REVISED VIADUCT GAD REV B12 DATED 30.05.2020.	B-02	04.11.2020
	3. PIER CONFIGURATION UPDATED WITH REFERENCE TO VIADUCT GAD REVISION B12.	B-01	15.08.2020
	2. B-01 VOICE LETTER NO. REF. GOMPR/PR/18/2020/MP/2020/18044 ON DATED 01/JUNE/2020 HAS BEEN INCORPORATED.	B-0	30.04.2020
	1. PRELIMINARY SUBMISSION		

LEGEND:

Viaduct CL
Proposed UP & DOWN Track CL (Straight)
Proposed UP & DOWN Track CL (Circular curve)
Proposed UP & DOWN Track CL (Transition curve)
UP & DOWN Change
ULC NO. (UP LINE CURVE NO.)
DLC NO. (DN LINE CURVE NO.)

Existing Ground Profile
TS = Tangent to spiral
SC = Spiral to curve
CS = Curve to spiral
ST = Spiral to tangent
SS = Spiral to spiral
LC = Length of circular curve
TL = Length of transition curve
TL = Total tangent length
R = Radius of Curve
V = Design speed in kmph
Gr = Proposed grade
Delta = Deflection angle
HIP = Horizontal inter section point
D = Degree of curve
E = Easting
N = Northing
K = L / (g2-g1), L is Length of Vertical curve, g2 and g1 are grades
PVC = Point of Vertical Curvature
PVI = Point of Vertical Intersection
PVT = Point of Vertical Tangent
Ca = Cant Applied
Cd = Cant Deficiency
CGR = Cant Gradient
SRJ = Stock Rail Joint
BOC = Back of Crossing
FOULING MARK
BUFFER STOP
P = Pier, PP = Portal Pier, CP = Cantilever Pier
SP = Split Pier
V.C. NO. (VERTICAL CURVE NO.)

D.D.C.:
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL.

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			DR. P.D. SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		

ALIGNMENT EXPERT

MAHARASHTRA METRO RAIL CORPORATION LTD.:

GM DESIGN/ PLANNING	CPM/ TELECOM
ED/ RS	CPM/ TRACTION
ED/ SIGNAL	CPM/ R3
CPM/ TRACK	ACPM/ TRACK

CLIENT:

Maharashtra Metro Rail Corporation Limited

PROJECT:

PUNE METRO RAIL PROJECT

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT):

SYSTRA-AECOM-EGIS-RITES

CONSULTANTS:

Mapage Infrastructure PVT. Ltd.

PACKAGE:

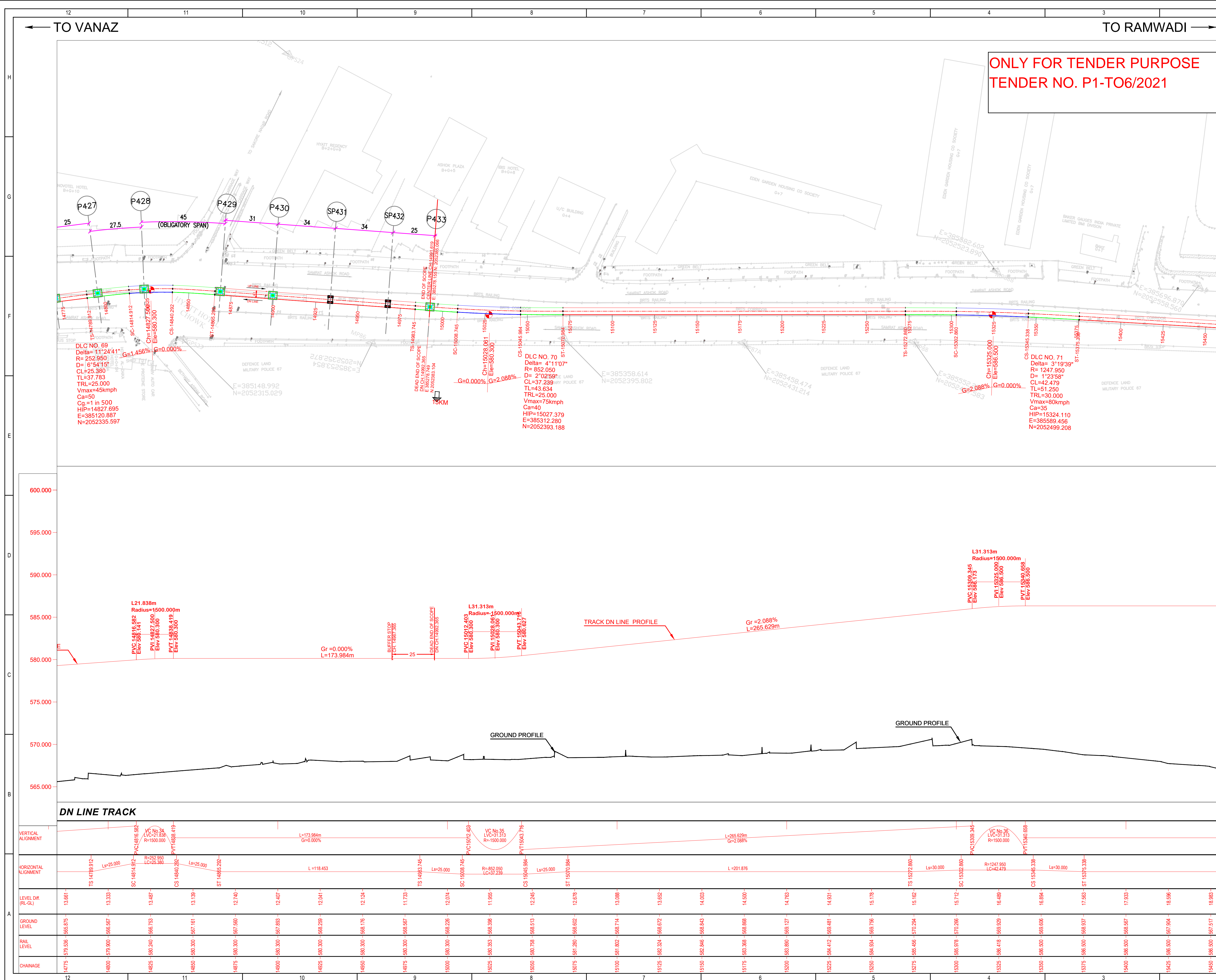
Reach-3: CIVIL COURT to RAMWADI

TITLE:

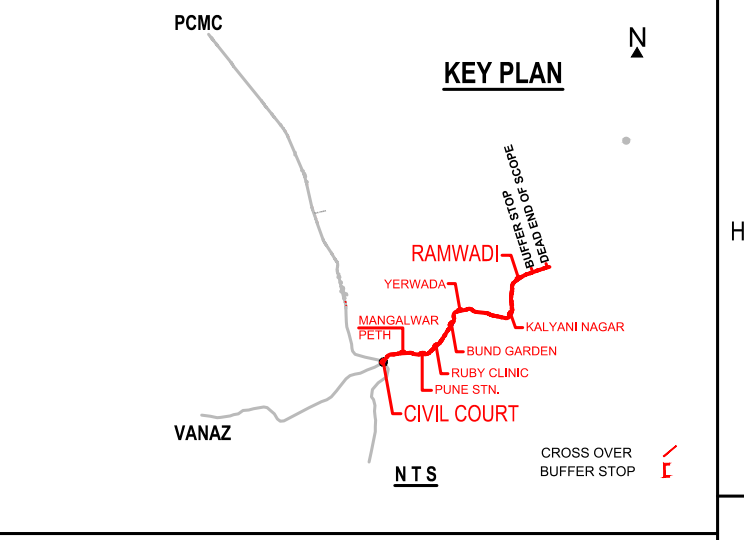
**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 14125.000 to Ch. 14775.000]**

DRG. No: **MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020** SHEET NO. **13/15**

SCALE:	STATUS:	REVISION:	SIZE:	DATE:
HOR. 1:1000 VER. 1:200	GFC DRAWING	B-02	A1	04.11.2020



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



- NOTES :
1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
 2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R200M RADIUS.
 3. LOCATION OF PIER STATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-301-CY-BAG-PP3_00-05A-1001 TO 1016 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
 4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO. PMRC/PUNE/REACH-3/GAD-DN/TRK/2020/16844 ON DATED 15.06.2020 HAS BEEN INCORPORATED.
 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
14	3. PIER CONFIGURATION UPDATED WITH REFERENCE TO VIADUCT GAD REVISION B12	B-02	04.11.2020
	2. B-01 VOICE LETTER NO. REF. CPMR/PPR/18/02/2019/16844 ON DATED 01.06.2020 HAS BEEN INCORPORATED.	B-01	15.06.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

- LEGEND:
- Viaduct CL
 - Proposed UP & DOWN Track CL (Straight)
 - Proposed UP & DOWN Track CL (Circular curve)
 - Proposed UP & DOWN Track CL (Transition curve)
 - UP & DOWN Change
 - ULC NO. (UP LINE CURVE NO.)
 - DLN NO. (DN LINE CURVE NO.)
 - Existing Ground Profile
 - TS = Tangent to spiral
 - SC = Spiral to curve
 - CS = Curve to spiral
 - ST = Spiral to tangent
 - SS = Spiral to spiral
 - LC = Length of circular curve
 - TRL = Length of transition curve
 - TL = Total tangent Length
 - R = Radius of Curve
 - V = Design speed in kmph
 - Gr = Proposed grade
 - Delta = Deflection angle
 - HIP = Horizontal inter section point
 - D = Degree of curve
 - E = Easting
 - N = Northing
 - K = L / (g2-g1) , L is Length of Vertical curve, g2 and g1 are grades
 - PVC = Point of Vertical Curvature
 - PVI = Point of Vertical Intersection
 - PVT = Point of Vertical Tangent
 - Ca = Cant Applied
 - Cd = Cant Deficiency
 - CGr = Cant Gradient
 - SRJ = Stock Rail Joint
 - BOC = Back of Crossing
 - FOULING MARK
 - BUFFER STOP
 - P = Pier, PP = Portal Pier, CP = Cantilever Pier
 - SP = Split Pier
 - V.C. NO. (VERTICAL CURVE NO.)

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :
THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./SYSTEMS		
CHIEF RS			CHIEF TELECOM		
CSE			C. TRACTION EXPT.		
CRE/ R3			C. TRACK EXPT.		
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD. :					
GM DESIGN/ PLANNING			CPM/ TELECOM		
ED/ RS			CPM/ TRACTION		
ED/ SIGNAL			CPM/ R3		
CPM/ TRACK			ACPM/ TRACK		

CLIENT :

PROJECT :
PUNE METRO RAIL PROJECT

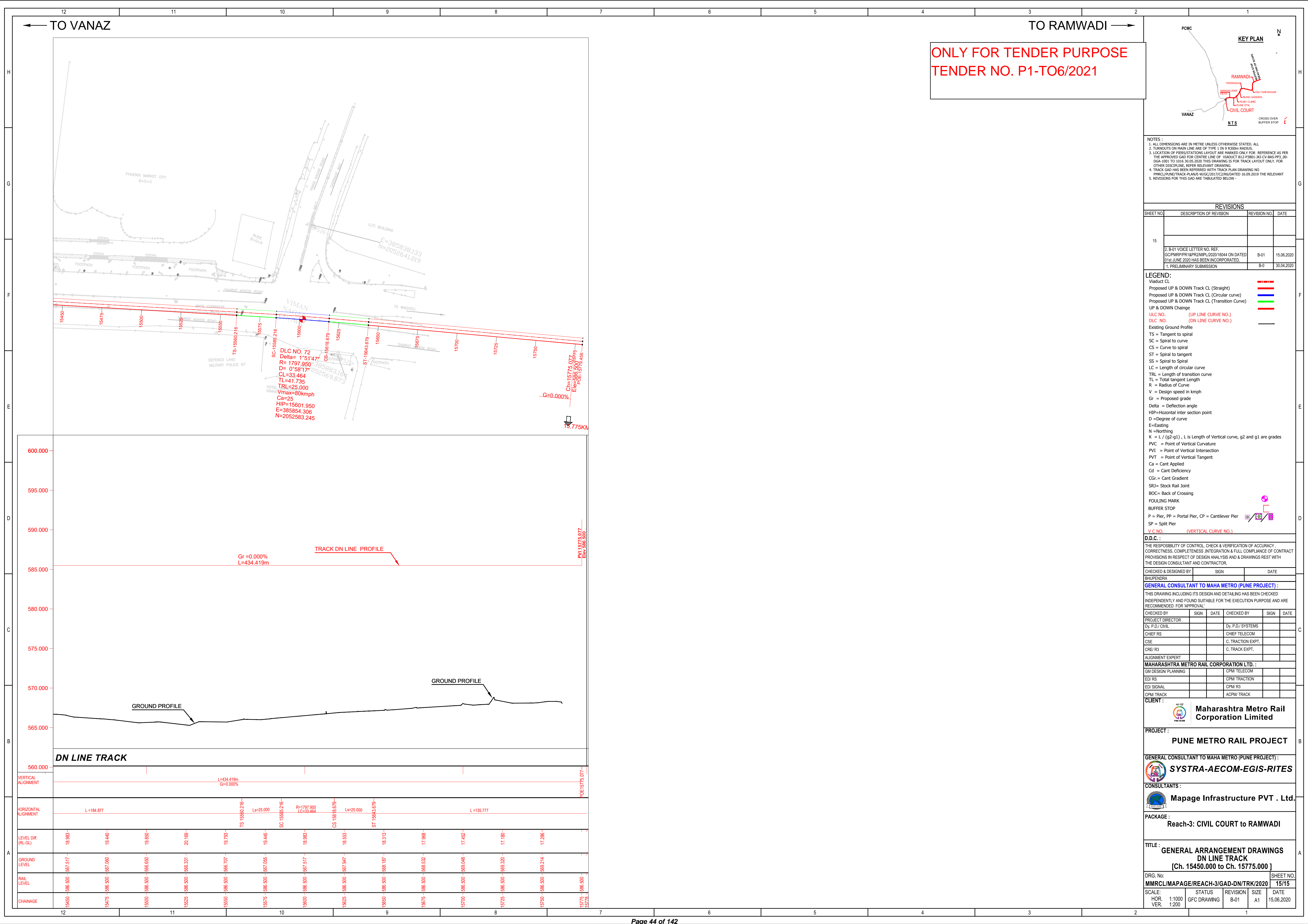
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

CONSULTANTS :

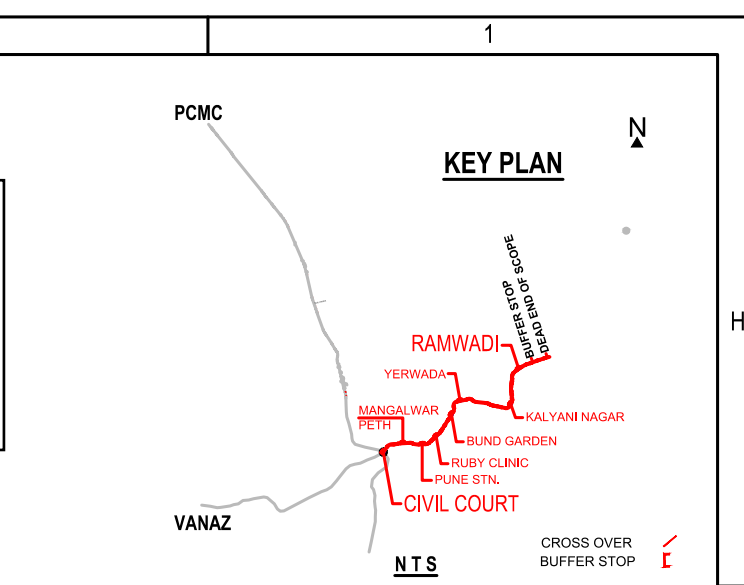
PACKAGE :
Reach-3: CIVIL COURT to RAMWADI

TITLE :
**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 14775.000 to Ch. 15450.000]**

DRG. No.	STATUS	REVISION	SIZE	DATE
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	GFC DRAWING	B-02	A1	04.11.2020
SCALE:	HOR. 1:1000 VER. 1:200			



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



- NOTES :
- 1. ALL DIMENSIONS ARE IN METRE UNLESS OTHERWISE STATED. ALL
 - 2. TURNOUTS ON MAIN LINE ARE OF TYPE 1 IN 9 R200M RADIUS.
 - 3. LOCATION OF PIERSTATIONS LAYOUT ARE MARKED ONLY FOR REFERENCE AS PER THE APPROVED GAD FOR CENTRE LINE OF VIADUCT B12-P3801-KC-CV-BAS-PP3_00-05A-1001 TO 1015 30.05.2020 THIS DRAWING IS FOR TRACK LAYOUT ONLY. FOR OTHER DISCIPLINE, REFER RELEVANT DRAWING.
 - 4. TRACK GAD HAS BEEN REFERRED WITH TRACK PLAN DRAWING NO PMRC/PUNE/TRACK-PLAN-11/02/2017/C2/06/DATED 16.09.2019 THE RELEVANT
 - 5. REVISIONS FOR THIS GAD ARE TABULATED BELOW -

REVISIONS			
SHEET NO.	DESCRIPTION OF REVISION	REVISION NO.	DATE
15	2. B-01 VOICE LETTER NO. REF. GOMR/PPR/18/02/2019/15044 ON DATED 01st JUNE 2020 HAS BEEN INCORPORATED.	B-01	15.06.2020
	1. PRELIMINARY SUBMISSION	B-0	30.04.2020

- LEGEND:
- Viaduct CL
 - Proposed UP & DOWN Track CL (Straight)
 - Proposed UP & DOWN Track CL (Circular curve)
 - Proposed UP & DOWN Track CL (Transition curve)
 - UP & DOWN Change
 - ULC NO. (UP LINE CURVE NO.)
 - DLC NO. (DN LINE CURVE NO.)
 - Existing Ground Profile
 - TS = Tangent to spiral
 - SC = Spiral to curve
 - CS = Curve to spiral
 - ST = Spiral to tangent
 - SS = Spiral to Spiral
 - LC = Length of circular curve
 - TRL = Length of transition curve
 - TL = Total tangent Length
 - R = Radius of Curve
 - V = Design speed in kmph
 - Gr = Proposed grade
 - Delta = Deflection angle
 - HIP=Horizontal inter section point
 - D =Degree of curve
 - E=Easting
 - N =Northing
 - K = $L / (g_2 - g_1)$, L is Length of Vertical curve, g2 and g1 are grades
 - PVC = Point of Vertical Curvature
 - PVI = Point of Vertical Intersection
 - PVT = Point of Vertical Tangent
 - Ca = Cant Applied
 - Cd = Cant Deficiency
 - CGr = Cant Gradient
 - SRJ= Stock Rail Joint
 - BOC= Back of Crossing
 - FOULING MARK
 - BUFFER STOP
 - P = Pier, PP = Portal Pier, CP = Cantilever Pier
 - SP = Split Pier
 - V C NO. (VERTICAL CURVE NO.)

D.D.C. :
THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF CONTRACT PROVISIONS IN RESPECT OF DESIGN ANALYSIS AND DRAWINGS REST WITH THE DESIGN CONSULTANT AND CONTRACTOR.

CHECKED & DESIGNED BY	SIGN	DATE
BHUPENDRA		

GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND ARE RECOMMENDED FOR APPROVAL

CHECKED BY	SIGN	DATE	CHECKED BY	SIGN	DATE
PROJECT DIRECTOR			By P.D./ SYSTEMS		
By P.D./ CIVIL			CHIEF TELECOM		
CHIEF RS			C. TRACTION EXPT.		
CSE			C. TRACK EXPT.		
CRE/ R3					
ALIGNMENT EXPERT					
MAHARASHTRA METRO RAIL CORPORATION LTD. :					
GM DESIGN/ PLANNING			CPM/ TELECOM		
ED/ RS			CPM/ TRACTION		
ED/ SIGNAL			CPM/ R3		
CPM/ TRACK			ACPM/ TRACK		

CLIENT :

PROJECT :
PUNE METRO RAIL PROJECT

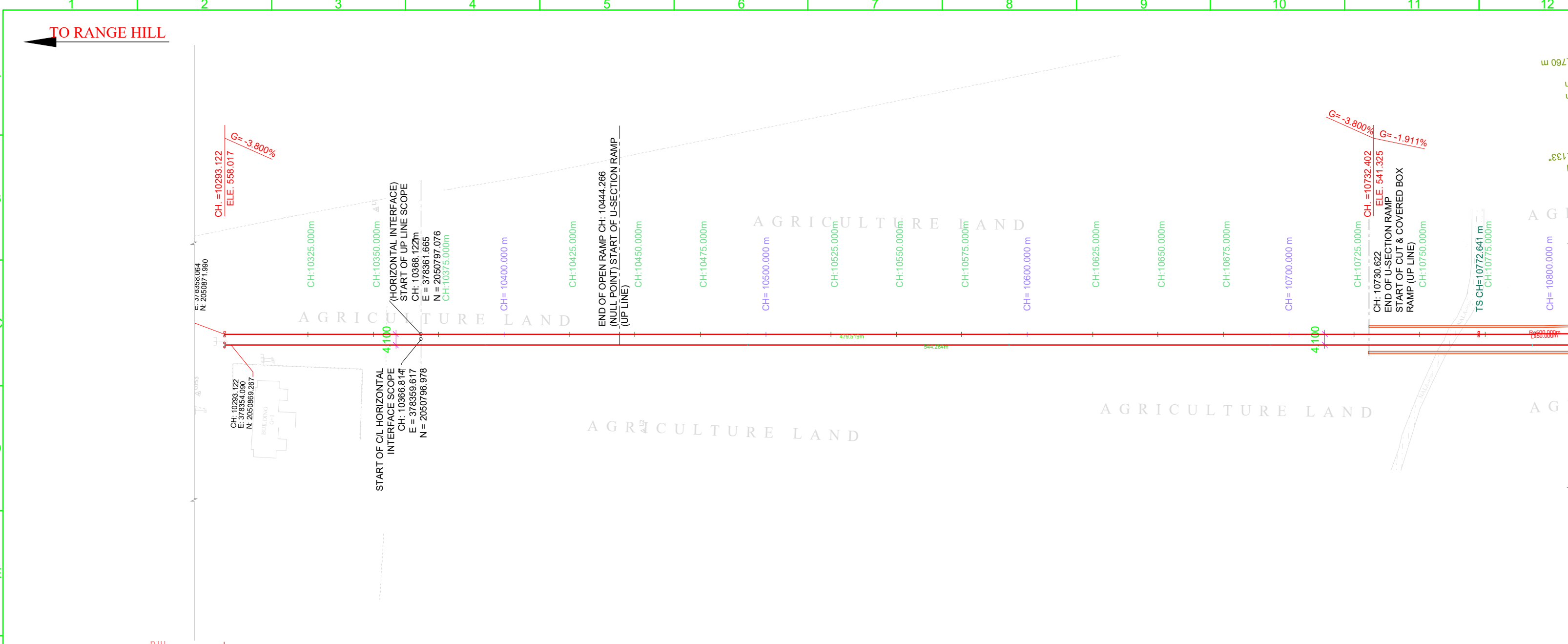
GENERAL CONSULTANT TO MAHA METRO (PUNE PROJECT) :

CONSULTANTS :

PACKAGE :
Reach-3: CIVIL COURT to RAMWADI

TITLE :
**GENERAL ARRANGEMENT DRAWINGS
DN LINE TRACK
[Ch. 15450.000 to Ch. 15775.000]**

DRG. No.	SHEET NO.				
MMRCL/MAPAGE/REACH-3/GAD-DN/TRK/2020	15/15				
SCALE:	STATUS	REVISION	SIZE	DATE	
HOR. 1:1000 VER. 1:200	GFC DRAWING	B-01	A1	15.06.2020	



TO SWARGATE

LEGEND :

CS : CURVE TO SPIRAL
ST : SPIRAL TO TANGENT
TS : TANGENT TO SPIRAL
SC : SPIRAL TO CURVE
SS : SPIRAL TO SPIRAL
SL : STRAIGHT LENGTH
ELE : ELEVATION
E : EASTING
N : NORTHING
G : GRADIENT
--- : ALIGNMENT CENTER LINE
o : TRANSITION START & END

HIP : HORIZONTAL INTERSECTION POINT
D : DEFLECTION ANGLE
L : GRADE LENGTH
TRL : TRANSITION LENGTH
TL : TANGENT LENGTH
R : RADIUS
CA : APPLIED CANT
CD : CANT DEFICIENCY
PVI : POINT OF VERTICAL INTERSECTION
SRJ : STOCK RAIL JOINT
CH : CHAINAGE
CL : CURVE LENGTH

NOTES:

- THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
- ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
- THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
- THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

VERTICAL_ALIGN UP LINE																						
HORIZONTAL_ALIGN	SL479.519m *																					
DIFF. IN ELE. Cut Depth(-)	3.555	2.482	1.408	1.241	0.665	0.175	-0.315	-1.033	-1.346	-2.091	-2.441	-3.125	-3.875	-5.287	-6.023	-8.050	-7.913	-8.559	-8.520	-8.738	-9.687	
RAIL LEVELS	557.756	556.806	555.856	554.906	553.956	553.006	552.056	551.106	550.156	549.206	548.256	547.306	546.356	545.406	544.456	543.506	542.556	541.639	540.989	540.511	540.033	
GROUND LEVELS	554.201	554.324	554.448	554.665	554.621	554.831	554.771	554.939	554.856	554.656	554.356	553.956	553.456	552.856	552.156	551.356	550.456	549.509	548.509	547.249	545.349	
CHAINAGES	10300	10325	10350	10375	10400	10425	10450	10475	10500	10525	10550	10575	10600	10625	10650	10675	10700	10725	10750	10775	10800	

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

REV NO

DATE

DESCRIPTION

SIGN

B07

06.06.2020

1. Curve no.5 R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path.

B06

16.09.2019

1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 30m tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Change have been updated as per Reach-1 (PCMC- RANGE HILL section) A) Interface chainage has been modified with respect to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shivaji nagar station location revised and coordinates updated.

B05

14.08.2019

A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.

B04

11.06.2019

B03

07.06.2019

B02

17.05.2019

B01

13.12.2018

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.

SIGN:

SIGN:

SIGN:

SIGN:

SIGN:

DATE:

DATE:

DATE:

DATE:

DATE:

NAME: SHW

NAME: RVS

NAME: RPG

NAME: VLD

NAME:

DRAWN BY

DESIGN BY

CHECKED BY

APPROVED BY

ACCEPTED BY

CONSULTANTS

TCPL-GEO CONSULT-JV

GULERMAK-TPL-JV

xxxx

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN **PROOF CHECKED** INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.

PROOF CHECKED & APPROVED BY GC

BEING GIVEN NO OBJECTION

ISSUED AS GOOD FOR CONSTRUCTION.

PROOF CONSULTANT

SIGN:

SIGN:

DATE:

DATE:

NAME: ---

NAME: ---

SIGN:

SIGN:

DATE:

DATE:

NAME: ---

NAME: ---

REVIEWED BY (STRUCT. ENGG.)

APPROVED BY (TEAM LEADER)

REVIEWED BY

APPROVED BY

SYSTRA-AECOM-EGIS-RITES

(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)

COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.

DY. HOD

HOD

HIMANSHU GOSWAMI GM/DESIGN

PROJECT:

PUNE METRO RAIL PROJECT

THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA

CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.

LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE

TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH.: 10300m TO 10800m

SCALE: 1:1

DATE: 06.06.2020

STATUS: DEFINITIVE DESIGN STAGE

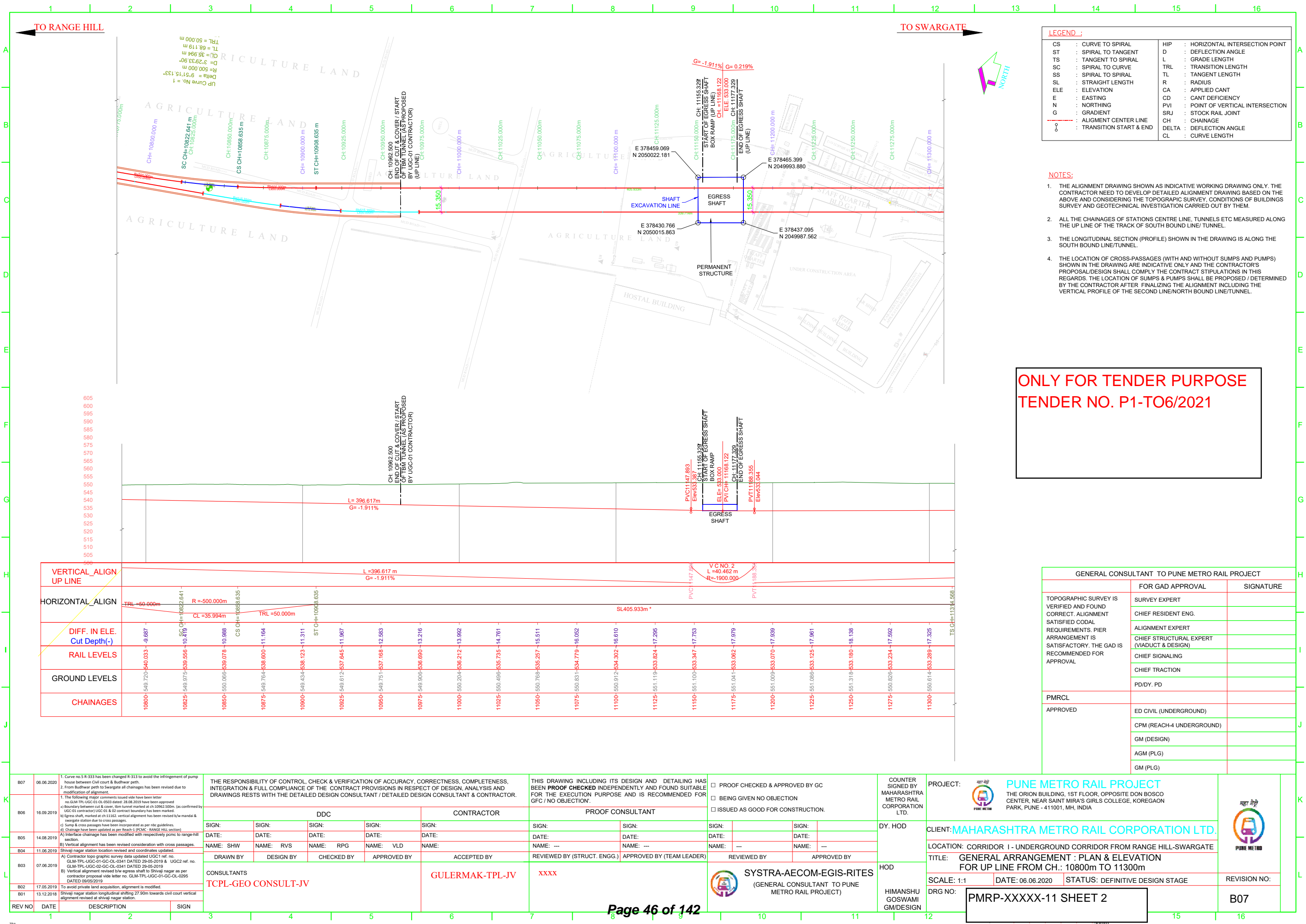
DRG NO: PMRP-XXXXX-11 SHEET 1

REVISION NO:

B07

Page 45 of 142

plot scale 50mm




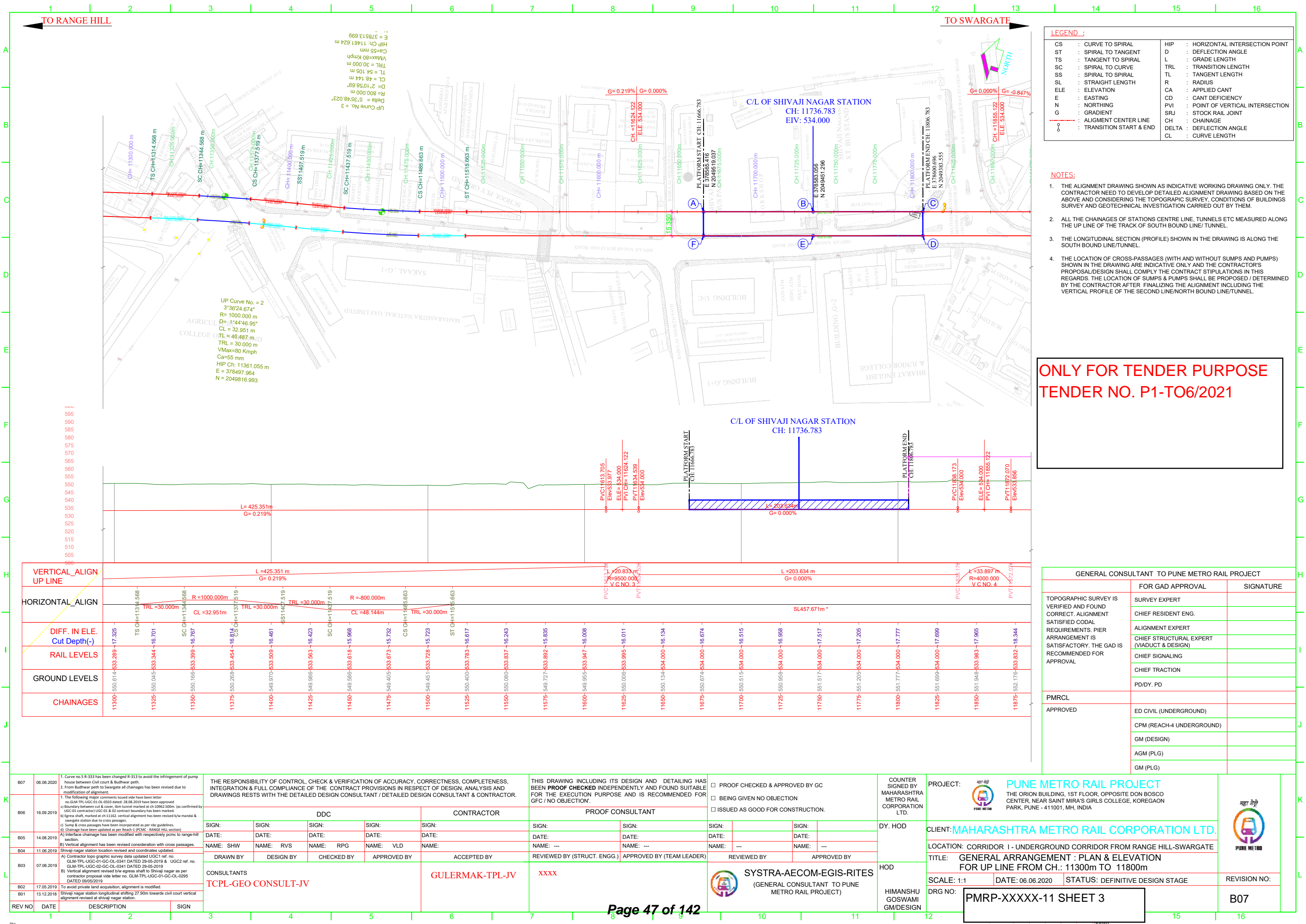
LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
- - -	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
o	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

- NOTES:**
1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 3. THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/ TUNNEL.
 4. THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

K	B06	16.09.2019	1. Curve no.5-R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment. 3. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-GC-003 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbn tunnel marked at ch:10962.500m. (as confirmed by UGC-03 contractor) UGC-01 & 02 contract boundary has been marked b) Egress shaft, marked at ch:11162, vertical alignment has been revised by f/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Change have been updated as per Reach-1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respectvely pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages. C) Shivali nagar station location has been revised and coordinates updated. D) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 E) Vertical alignment revised b/w egress shaft to Shivali nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivali nagar station longitudinal shifting 27.50m towards civil court vertical alignment revised at shivali nagar station.				THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.				COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA		K																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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L	B05	14.08.2019	NAME: SHW				NAME: RVS				NAME: RPG				NAME: VLD				NAME:				NAME: ---		NAME: ---		HOD		SCALE: 1:1		DATE: 06.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

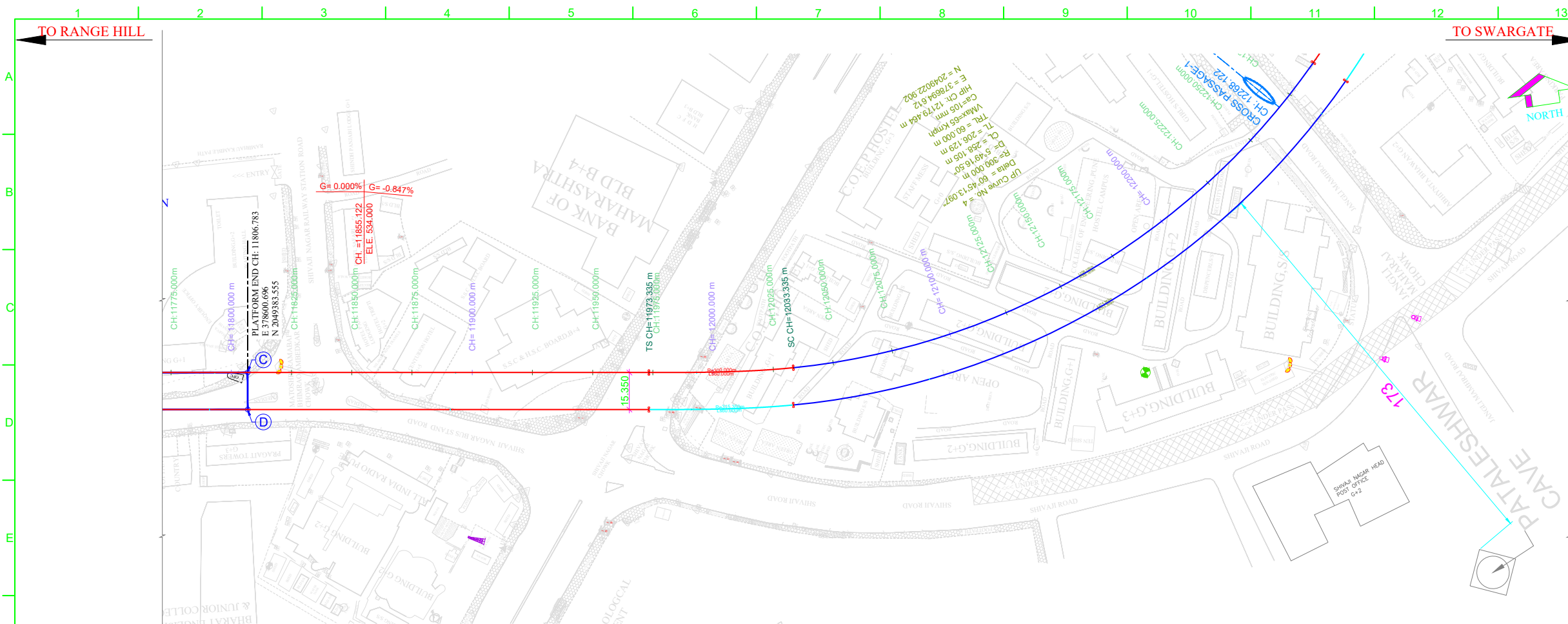
- NOTES:**
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
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	CHIEF RESIDENT ENG.	
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PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

K	B07	06.06.2020	1. Curve no.5-R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to skidate all chainages has been revised due to modification of alignment. 3. The following major comments issued vide have been letter no.GM-TPL-UGG-01-GC-0203 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 1bm tunnel marked at ch:10962.500m. (as confirmed by UGC-02 contractor) UGC-01 & 02 contract boundary has been marked b) Egress shaft, marked at ch:11562. vertical alignment has been revised b/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGE HILL section) E) Interface chainage has been modified with respectvely pcmc to range-hill section F) Vertical alignment has been revised consideration with cross passages. G) Shivali nagar station location updated and coordinates updated			THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.			THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.			<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.			PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA			K																							
	B06	16.09.2019				DDC			CONTRACTOR			PROOF CONSULTANT																																
L	B05	14.08.2019	DATE: _____			SIGN: _____			DATE: _____			SIGN: _____			DATE: _____			SIGN: _____			DY. HOD			CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.																				
	B04	11.06.2019	NAME: SHW			NAME: RVS			NAME: RPG			NAME: VLD			NAME: ---			NAME: ---			HOD				LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE																			
L	B03	07.06.2019	DRAWN BY			DESIGN BY			CHECKED BY			APPROVED BY			ACCEPTED BY			REVIEWED BY (STRUCT. ENGG.)			APPROVED BY (TEAM LEADER)			REVIEWED BY			APPROVED BY			TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH.: 11300m TO 11800m														
	B02	17.05.2019	CONSULTANTS			TCPL-GEO CONSULT-JV			GULERMAK-TPL-JV			XXXX			SYSTRA-AECOM-EGIS-RITES			(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)			HIMANSHU GOSWAMI GM/DESIGN			SCALE: 1:1			DATE: 06.06.2020				STATUS: DEFINITIVE DESIGN STAGE			REVISION NO: B07										
	B01	13.12.2018	REV NO			DATE			DESCRIPTION			SIGN																																
			1			2			3			4			5			6			7			8			9			10			11			12			15			16		

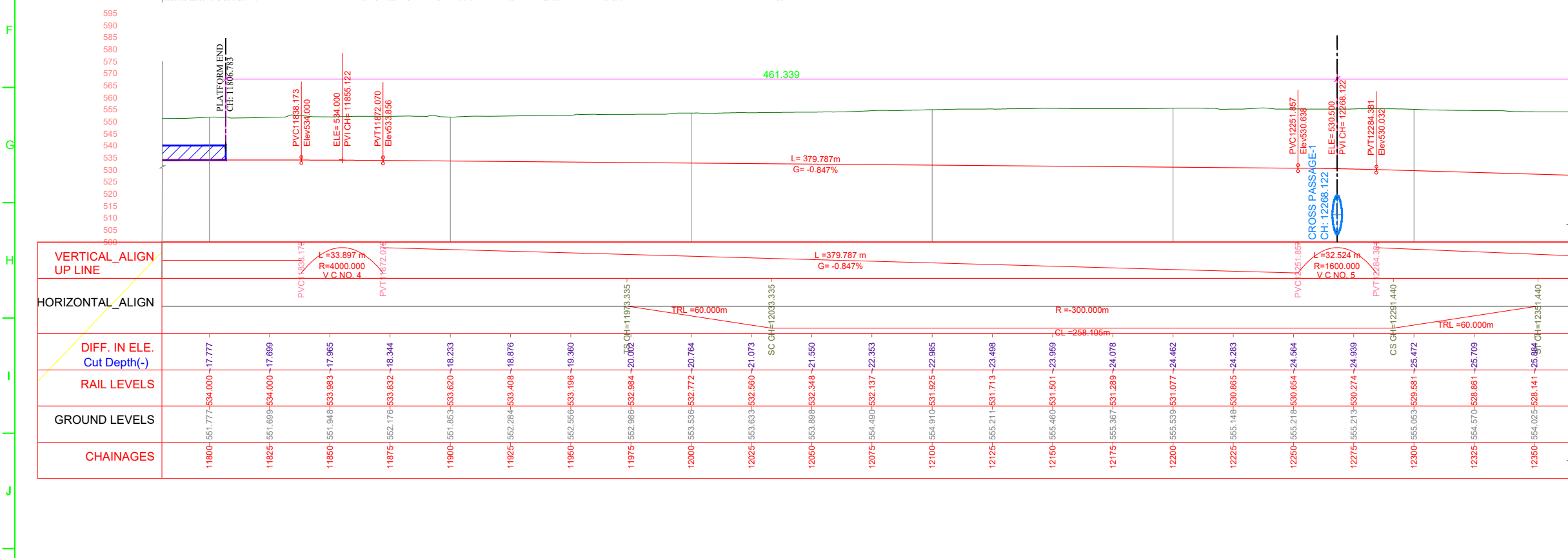
Page 47 of 142






LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
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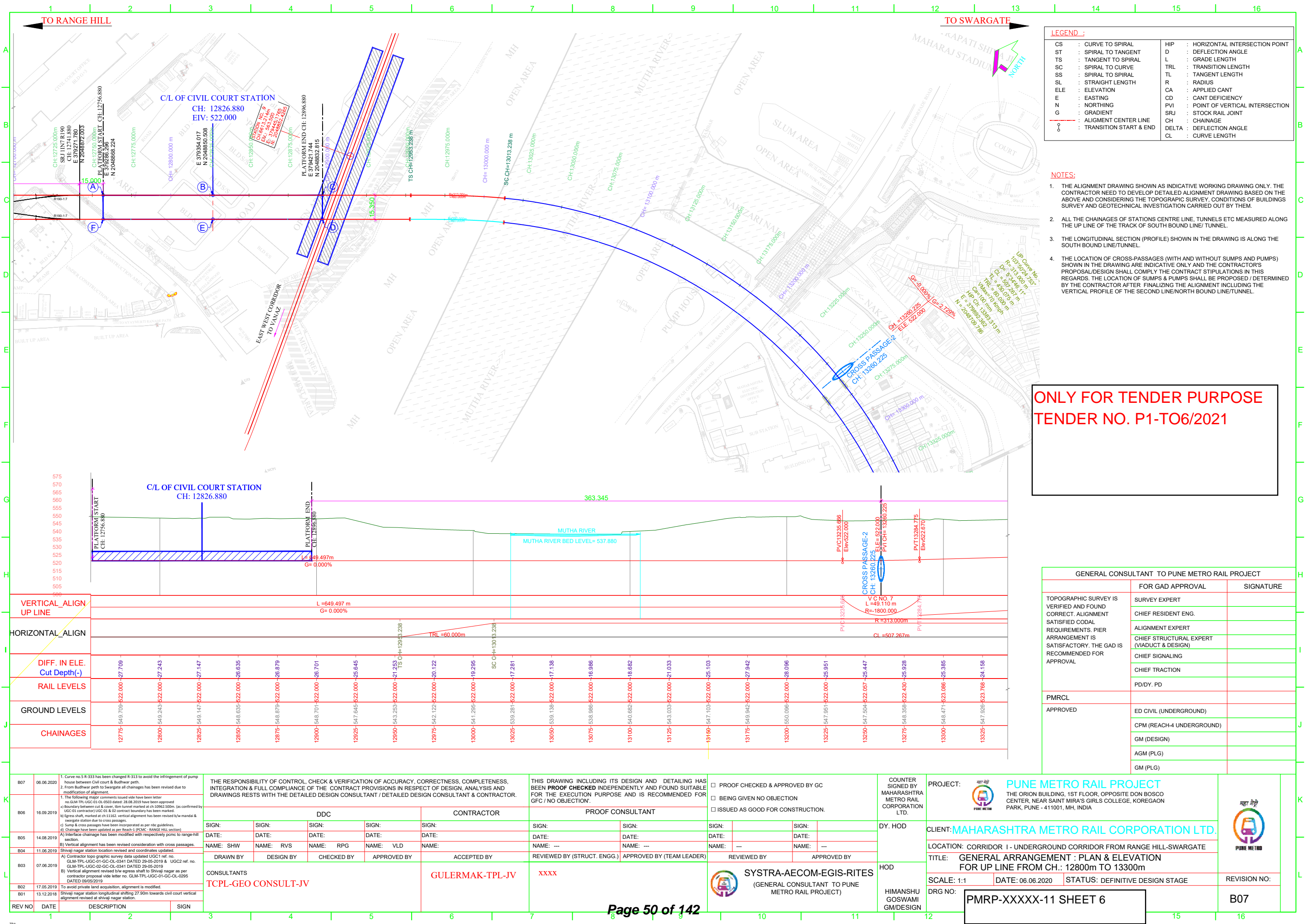
- NOTES:**
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
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	CHIEF RESIDENT ENG.	
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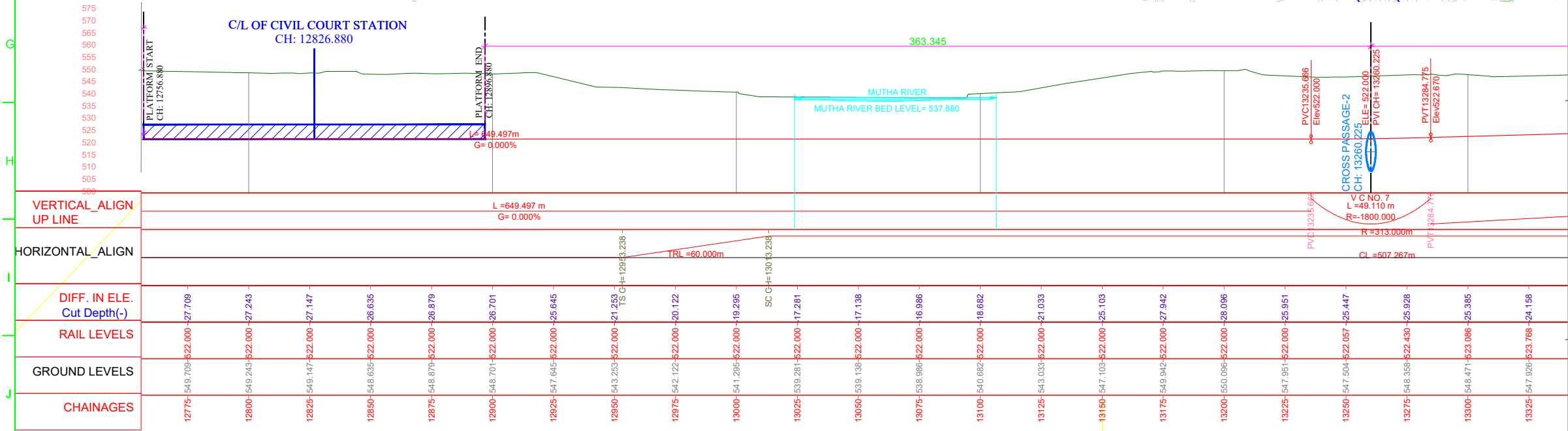
K	B07	16.09.2020	1. Curve no.5-R-333 has been changed R-313 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all changes has been revised due to modification of alignment. 3. The following major comments issued will have been letter no.GLM-TPL-UGC-01-CL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 80m turned marked at ch:10952.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:1162, vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrb guidelines. d) Changes have been updated as per Section-3 (PCMC - RANGE HILL SECTION) A) Interface change has been modified with respectvely pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.				THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.				COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.				PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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	B05	14.08.2019					SIGN: _____ DATE: _____ NAME: SHW				SIGN: _____ DATE: _____ NAME: RVS				SIGN: _____ DATE: _____ NAME: RPG				SIGN: _____ DATE: _____ NAME: VLD				SIGN: _____ DATE: _____ NAME: ---				SIGN: _____ DATE: _____ NAME: ---																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	B04	11.06.2019	Shivaji nagar station location revised and coordinates updated.				DRAWN BY				DESIGN BY				CHECKED BY				APPROVED BY				ACCEPTED BY				REVIEWED BY (STRUCT. ENGG.)				APPROVED BY (TEAM LEADER)				REVIEWED BY				APPROVED BY				HOD				LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
L	B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019				CONSULTANTS				GULERMAK-TPL-JV				xxxx				 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)				HIMANSHU GOSWAMI GM/DESIGN				TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH.: 11800m TO 12300m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	B02	17.05.2019	To avoid private land land acquisition, alignment is modified.				TCPL-GEO CONSULT-JV																				SCALE: 1:1				DATE: 06.06.2020				STATUS: DEFINITIVE DESIGN STAGE				REVISION NO:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

- NOTES:**
- THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 - ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 - THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
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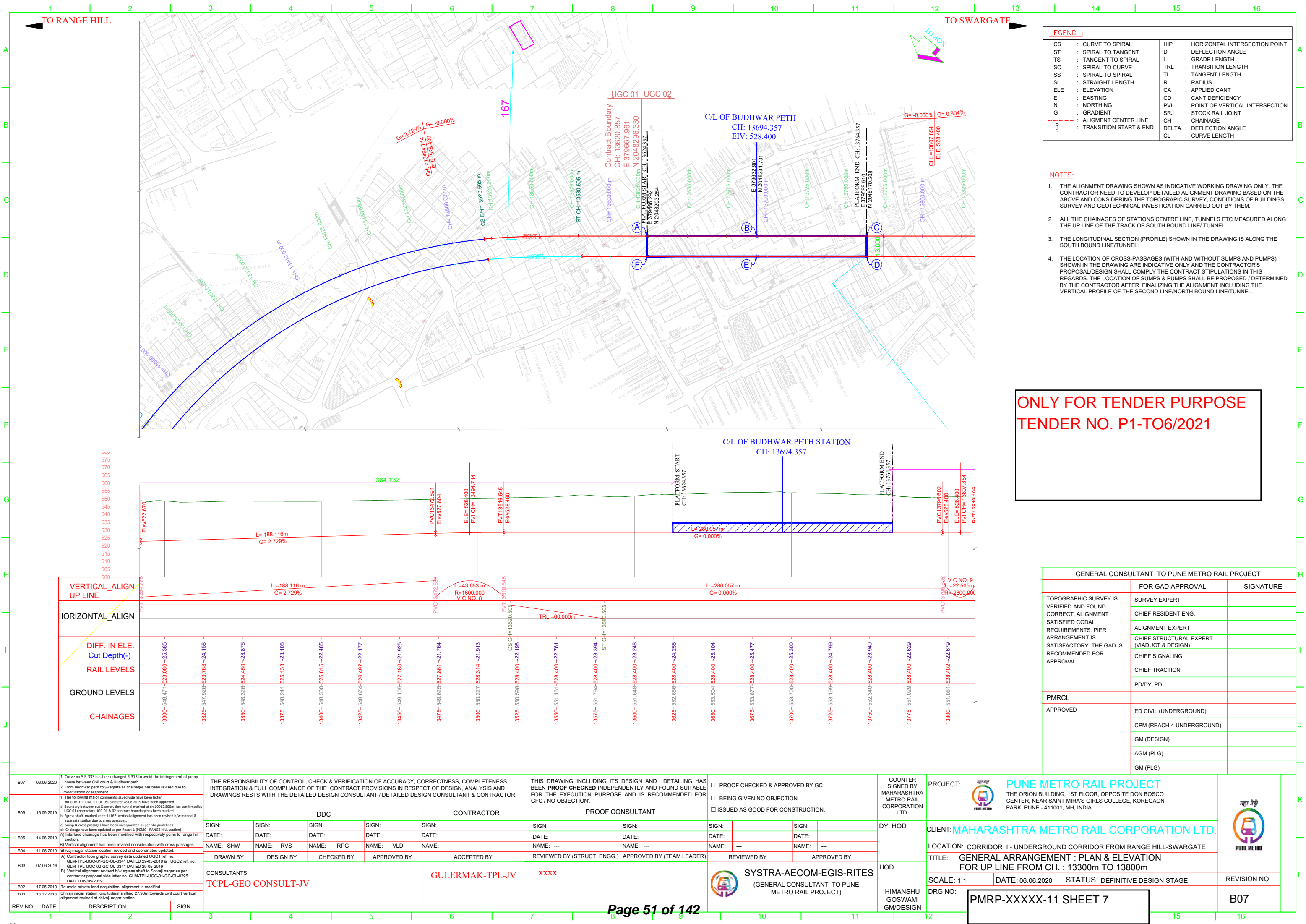
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07		1. Curve no.5-R-333 has been changed R-311 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all changes has been revised due to modification of alignment.		THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.					<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.					COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA										
K	B06	16.09.2019	1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-CL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 30m tunnel marked at ch:12962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised by/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respectvely pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shrivaji nagar station location revised and coordinates updated.	DDC					CONTRACTOR					PROOF CONSULTANT					DY. HOD		CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.										
	B05	14.08.2019		SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE									
L	B04	11.06.2019	A) Contractor topographic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shrivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.	DRAWN BY DESIGN BY CHECKED BY APPROVED BY					ACCEPTED BY					REVIEWED BY (STRUCT. ENGG.) APPROVED BY (TEAM LEADER)					REVIEWED BY APPROVED BY		HOD		TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH.: 12800m TO 13300m		REVISION NO:						
	B03	07.06.2019		CONSULTANTS					GULERMAK-TPL-JV					XXXX					 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HOD HIMANSHU GOSWAMI GM/DESIGN		SCALE: 1:1		DATE: 06.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:		
	B02	17.05.2019		TCPL-GEO CONSULT-JV																											
	B01	13.12.2018																													
REV NO		DATE	DESCRIPTION	SIGN																											

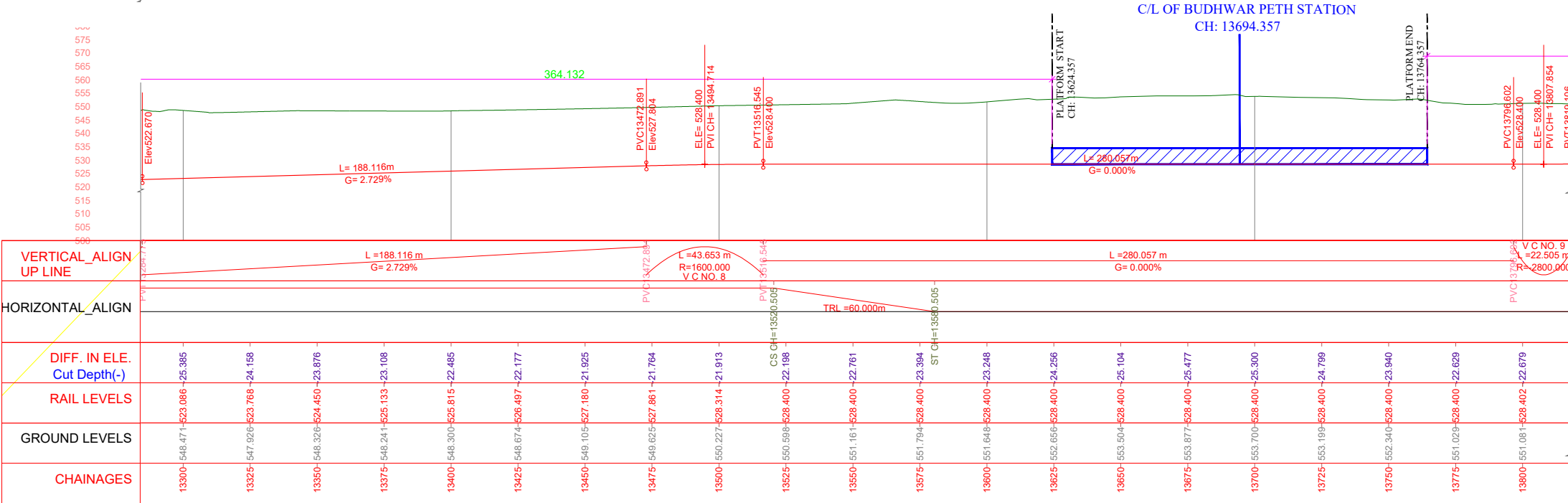
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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
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ELE	: ELEVATION	CA	: APPLIED CANT
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N	: NORTHING	SRJ	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
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- NOTES:**
1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 3. THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	06.06.2020	1. Curve no 5 R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar peth. 2. From Budhwar peth to Swargate all chainages have been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT: PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA	
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 6m tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per reach-1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respectively pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shivaji nagar station location revised and coordinates updated.	DDC				CONTRACTOR				PROOF CONSULTANT		DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.	
B05	14.08.2019		SIGN: DATE: NAME: SHW				SIGN: DATE: NAME: RVS				SIGN: DATE: NAME: ---			LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE	
B04	11.06.2019		SIGN: DATE: NAME: SHW				SIGN: DATE: NAME: RVS				SIGN: DATE: NAME: ---			TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 13300m TO 13800m	
B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-06-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-06-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.	DRAWN BY DESIGN BY CHECKED BY APPROVED BY				NAME: SHW NAME: RVS NAME: RPG NAME: VLD				REVIEWED BY (STRUCT. ENGG.) APPROVED BY (TEAM LEADER)		HOD	SCALE: 1:1 DATE: 06.06.2020 STATUS: DEFINITIVE DESIGN STAGE	
B02	17.05.2019		CONSULTANTS				GULERMAK-TPL-JV				XXXX		SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)	REVISION NO:	
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	TCPL-GEO CONSULT-JV										HIMANSHU GOSWAMI GM/DESIGN	DRG NO: PMRP-XXXXXX-11 SHEET 7	
REV NO	DATE	DESCRIPTION	SIGN												B07

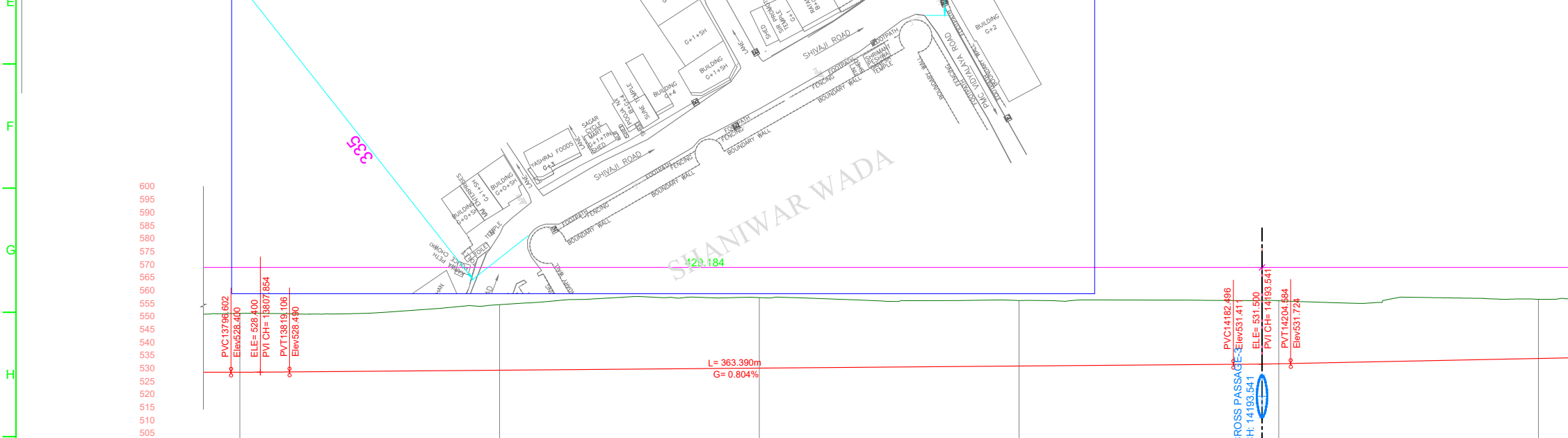


LEGEND :

CS : CURVE TO SPIRAL	HIP : HORIZONTAL INTERSECTION POINT
ST : SPIRAL TO TANGENT	D : DEFLECTION ANGLE
TS : TANGENT TO SPIRAL	L : GRADE LENGTH
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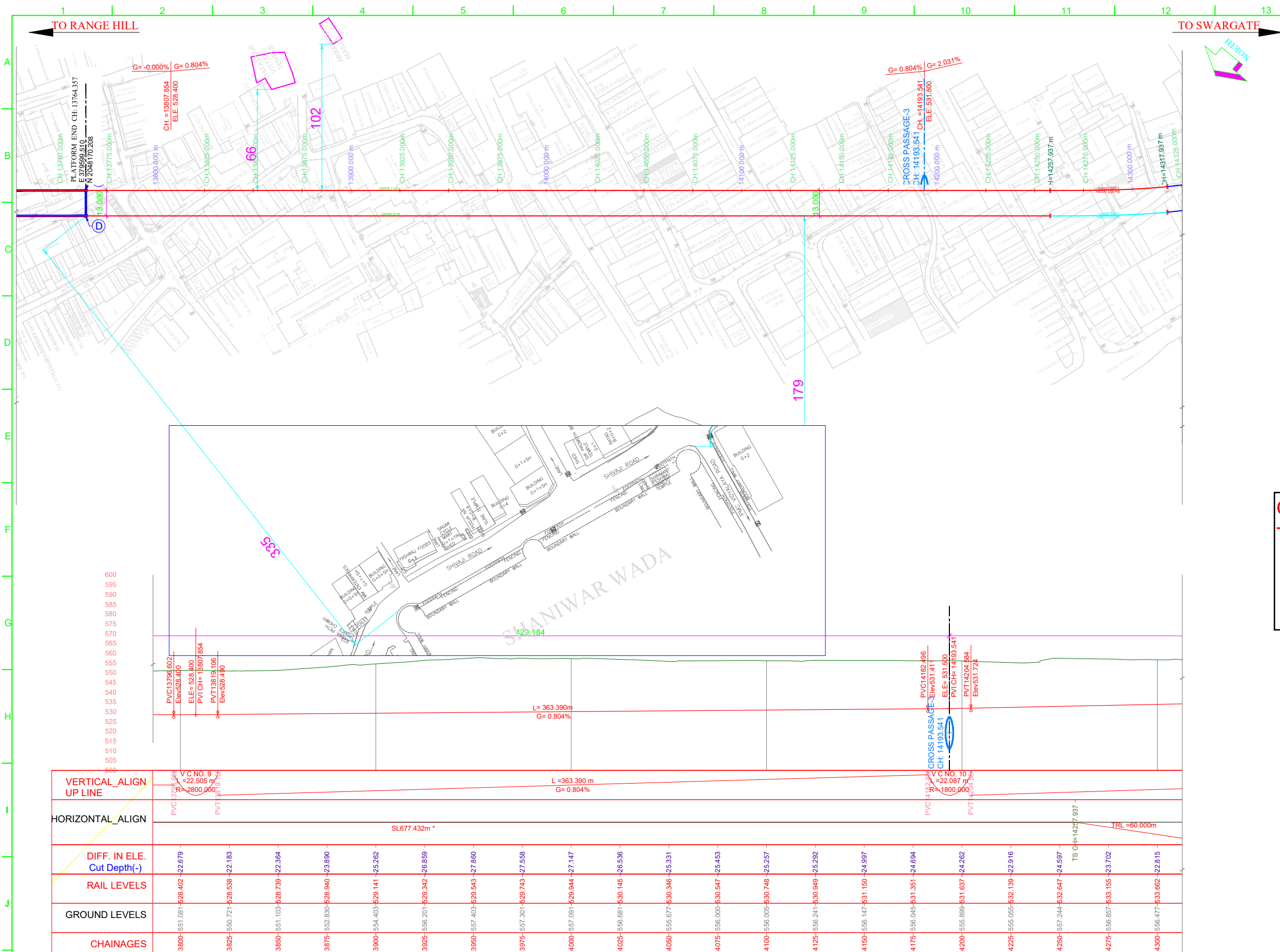
**ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021**



VERTICAL_ALIGN UP LINE	VC NO. 9 L=363.390m G=0.804%	VC NO. 10 L=1800.000m G=0.804%
HORIZONTAL_ALIGN	SL677.432m *	TRL=60.000m
DIFF. IN ELE. Cut Depth(-)	-22.679	-24.694
RAIL LEVELS	528.02	531.351
GROUND LEVELS	551.081	556.899
CHAINAGES	13800	14300

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

REV NO	DATE	DESCRIPTION	SIGN	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT: PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																	
				DDC				CONTRACTOR				PROOF CONSULTANT				DY. HOD																																																															
				SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	HOD																																																																			
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B02	17.05.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.																																																																													
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REV NO	DATE	DESCRIPTION	SIGN	DRAWN BY				DESIGN BY				CHECKED BY				APPROVED BY				ACCEPTED BY				REVIEWED BY (STRUCT. ENGG.)				APPROVED BY (TEAM LEADER)				REVIEWED BY				APPROVED BY				HOD				HIMANSHU GOSWAMI GM/DESIGN				CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.				LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE				TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 13800m TO 14300m				SCALE: 1:1				DATE: 06.06.2020				STATUS: DEFINITIVE DESIGN STAGE				REVISION NO:				B07			



LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
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G	: GRADIENT	SRJ	: STOCK RAIL JOINT
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

VERTICAL_ALIGN UP LINE	HORIZONTAL_ALIGN														
	SL677.432m *														
DIFF. IN ELE. Cut Depth(-)	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679	-22.679
RAIL LEVELS	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02	528.02
GROUND LEVELS	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081	551.081
CHAINAGES	13800	13825	13850	13875	13900	13925	13950	13975	14000	14025	14050	14075	14100	14125	14150

B07	06.06.2020	1. Curve no S R-333 has been changed R-313 to avoid the infringement of pump house between civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages have been revised due to modification of alignment.	
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B05	14.08.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.	
B04	11.06.2019	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	
B03	07.06.2019		
B02	17.05.2019		
B01	13.12.2018		
REV NO	DATE	DESCRIPTION	SIGN

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.

DDC				CONTRACTOR				PROOF CONSULTANT			
SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:	SIGN:
DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:	DATE:
NAME: SHW	NAME: RVS	NAME: RPG	NAME: VLD	NAME:	NAME:	NAME:	NAME:	NAME:	NAME:	NAME:	NAME:
DRAWN BY	DESIGN BY	CHECKED BY	APPROVED BY	ACCEPTED BY	REVIEWED BY (STRUCT. ENGG.)	APPROVED BY (TEAM LEADER)	REVIEWED BY	APPROVED BY			

CONSULTANTS
TCPL-GEO CONSULT-JV

GULERMAK-TPL-JV
XXXX

☐ PROOF CHECKED & APPROVED BY GC
☐ BEING GIVEN NO OBJECTION
☐ ISSUED AS GOOD FOR CONSTRUCTION.

COUNTER SIGNED BY
MAHARASHTRA
METRO RAIL
CORPORATION
LTD.

PROJECT:
 PUNE METRO RAIL PROJECT
THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA

CLIENT: **MAHARASHTRA METRO RAIL CORPORATION LTD.**

LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE

TITLE: **GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 13800m TO 14300m**

SCALE: 1:1
DATE: 06.06.2020
STATUS: DEFINITIVE DESIGN STAGE

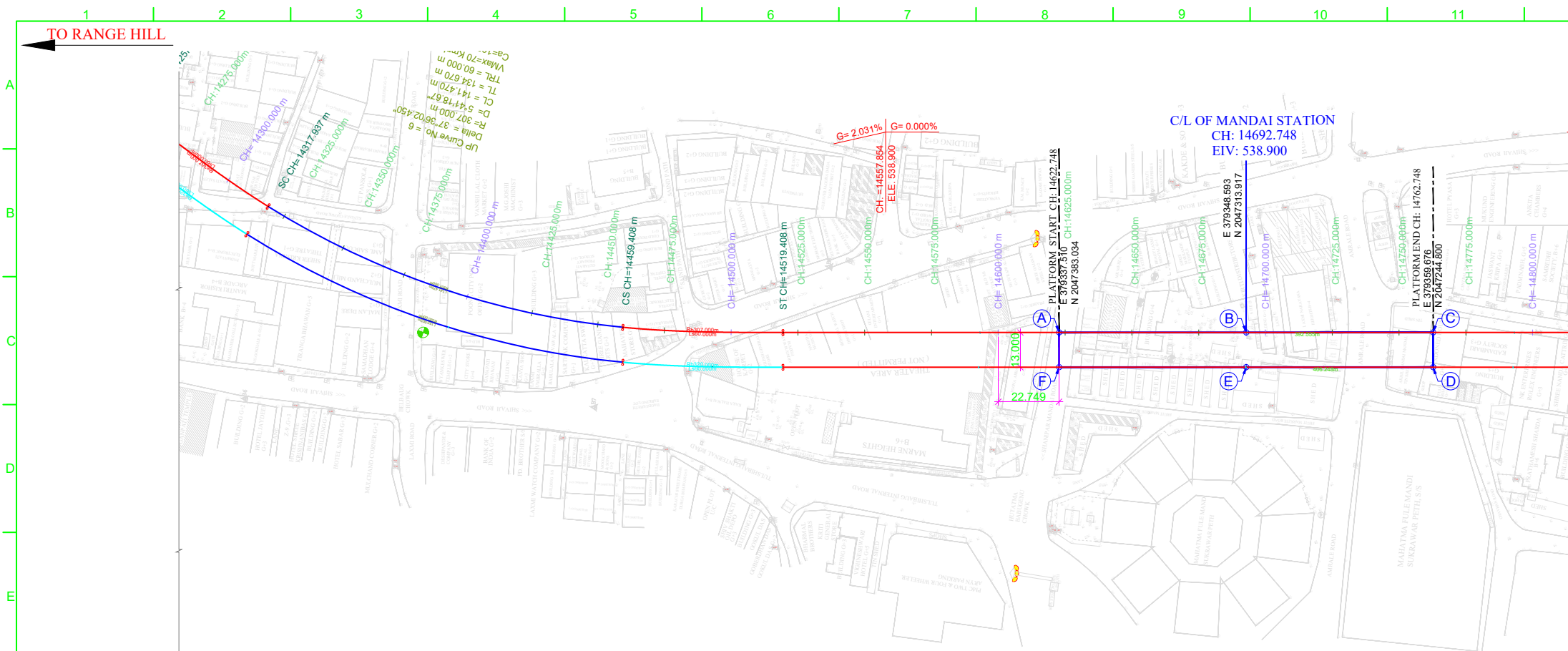
DRG NO: **PMRP-XXXXX-11 SHEET 9**

REVISION NO:
B07

SYSTRA-AECOM-EGIS-RITES
(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)

DM/DESIGN
HIMANSHU
GOSWAMI

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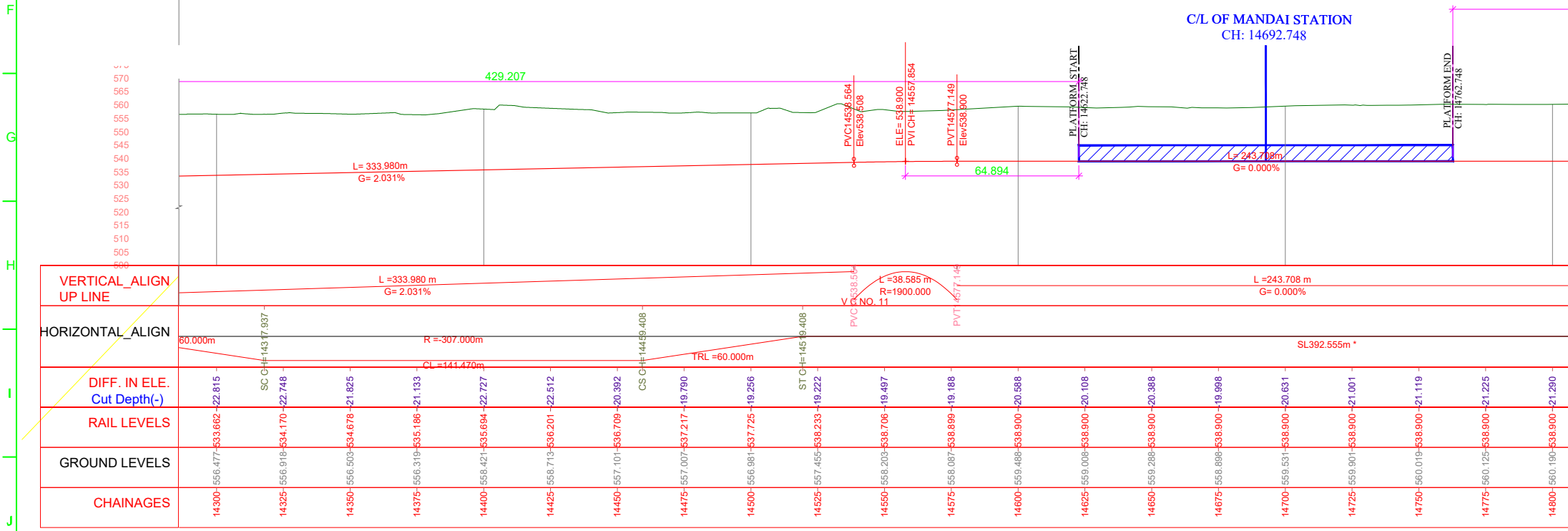


TO SWARGATE


LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
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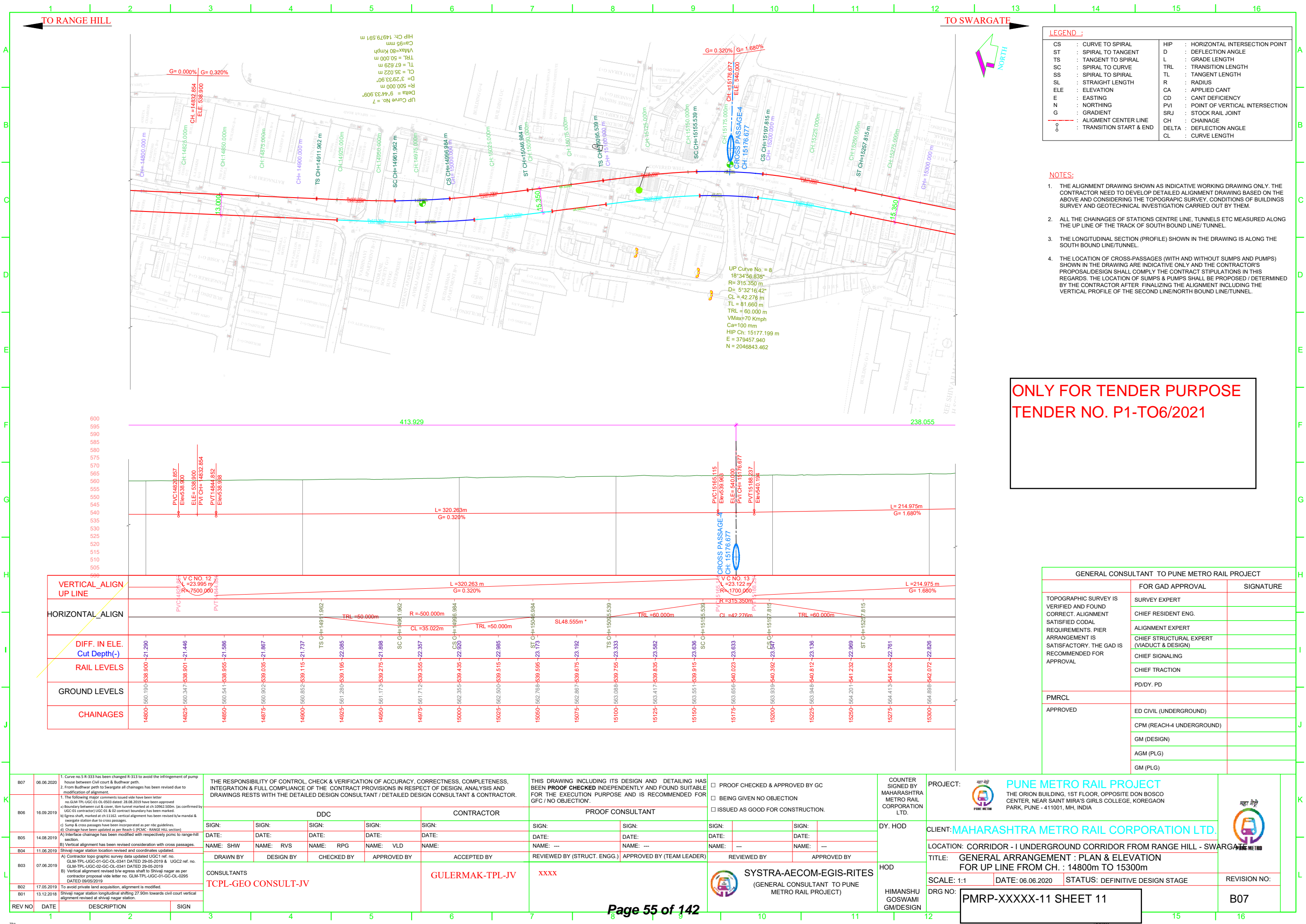
- NOTES:**
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	

K	B07	06.06.2020	1. Curve No.5 R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment. 3. The following major connections issued vide have been letter no.GLM-TPL-UGC-01-CL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 1bm tunnel marked at ch.10962.500m. (as confirmed by UGC-03 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch.11162. Vertical alignment has been revised by/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGSI HILL section) A) Interface chainage has been modified with respectively pome to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shivaji nagar station location revised and coordinates updated C) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.		THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.		THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.		<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA		DRG NO: PMRP-XXXXX-11 SHEET 10		REVISION NO: B07							
	B06	16.09.2019	DDC		CONTRACTOR		PROOF CONSULTANT		DY. HOD		CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.		LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE		TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 14300m TO 14800m		SCALE: 1:1		DATE: 06.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO: B07	
	B05	14.08.2019	NAME: SHW		NAME: RVS		NAME: RPG		NAME: VLD		NAME: ---		NAME: ---		NAME: ---		NAME: ---		NAME: ---		NAME: ---		NAME: ---	
	B04	11.06.2019	DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		HOD		HIMANSHU GOSWAMI GM/DESIGN	
B03	07.06.2019	CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		SYSTRA-AECOM-EGIS-RITES		(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HOD		HIMANSHU GOSWAMI GM/DESIGN		DRG NO: PMRP-XXXXX-11 SHEET 10		REVISION NO: B07		REVISION NO: B07		
B02	17.05.2019	SHIVAJI NAGAR STATION LONGITUDINAL SHIFTING 27.90m TOWARDS CIVIL COURT VERTICAL ALIGNMENT REVISED AT SHIVAJI NAGAR STATION.		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		
B01	13.12.2018	SHIVAJI NAGAR STATION LONGITUDINAL SHIFTING 27.90m TOWARDS CIVIL COURT VERTICAL ALIGNMENT REVISED AT SHIVAJI NAGAR STATION.		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		
REV NO	DATE	DESCRIPTION		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		SIGN		






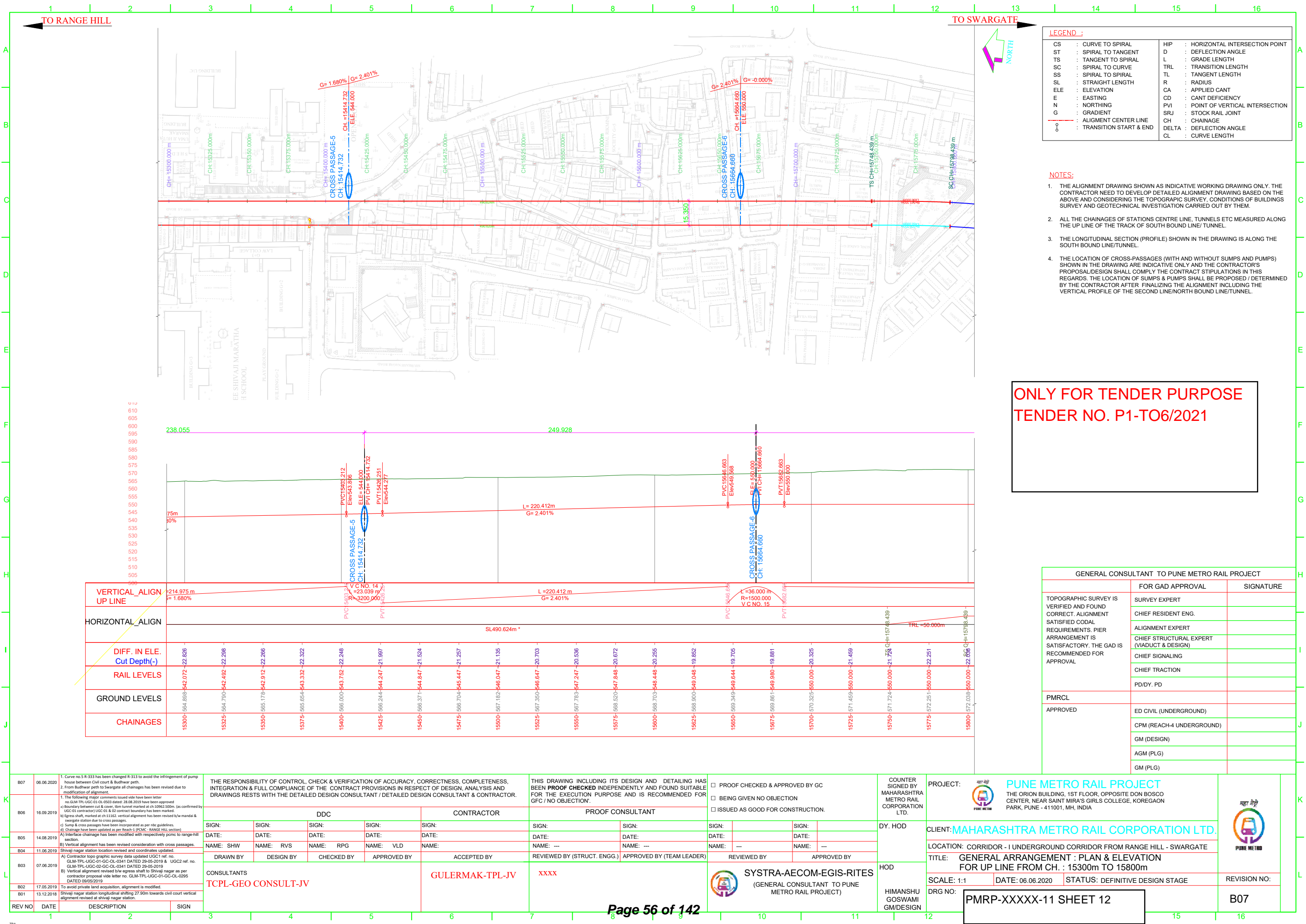
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TENDER NO. P1-TO6/2021

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
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	B06	16.09.2019				DDC		CONTRACTOR		PROOF CONSULTANT		SIGN: <table><tr><td></td><td></td></tr><tr><td>DATE:</td><td></td></tr><tr><td>NAME: SHW</td><td>NAME: RVS</td></tr></table>					DATE:		NAME: SHW	NAME: RVS		SIGN: <table><tr><td></td><td></td></tr><tr><td>DATE:</td><td></td></tr><tr><td>NAME: ---</td><td>NAME: ---</td></tr></table>				DATE:		NAME: ---	NAME: ---	SIGN: <table><tr><td></td><td></td></tr><tr><td>DATE:</td><td></td></tr><tr><td>NAME: ---</td><td>NAME: ---</td></tr></table>				DATE:		NAME: ---	NAME: ---	SIGN: <table><tr><td></td><td></td></tr><tr><td>DATE:</td><td></td></tr><tr><td>NAME: ---</td><td>NAME: ---</td></tr></table>				DATE:		NAME: ---	NAME: ---	SIGN: <table><tr><td></td><td></td></tr><tr><td>DATE:</td><td></td></tr><tr><td>NAME: ---</td><td>NAME: ---</td></tr></table>				DATE:		NAME: ---	NAME: ---	DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD. 																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
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B05	14.08.2019				DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		HOD	LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 14800m TO 15300m	SCALE: 1:1	DATE: 06.06.2020	STATUS: DEFINITIVE DESIGN STAGE	REVISION NO:	L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
B04	11.06.2019				CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)				HIMANSHU GOSWAMI GM/DESIGN		DRG NO: PMRP-XXXXX-11 SHEET 11		B07																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										






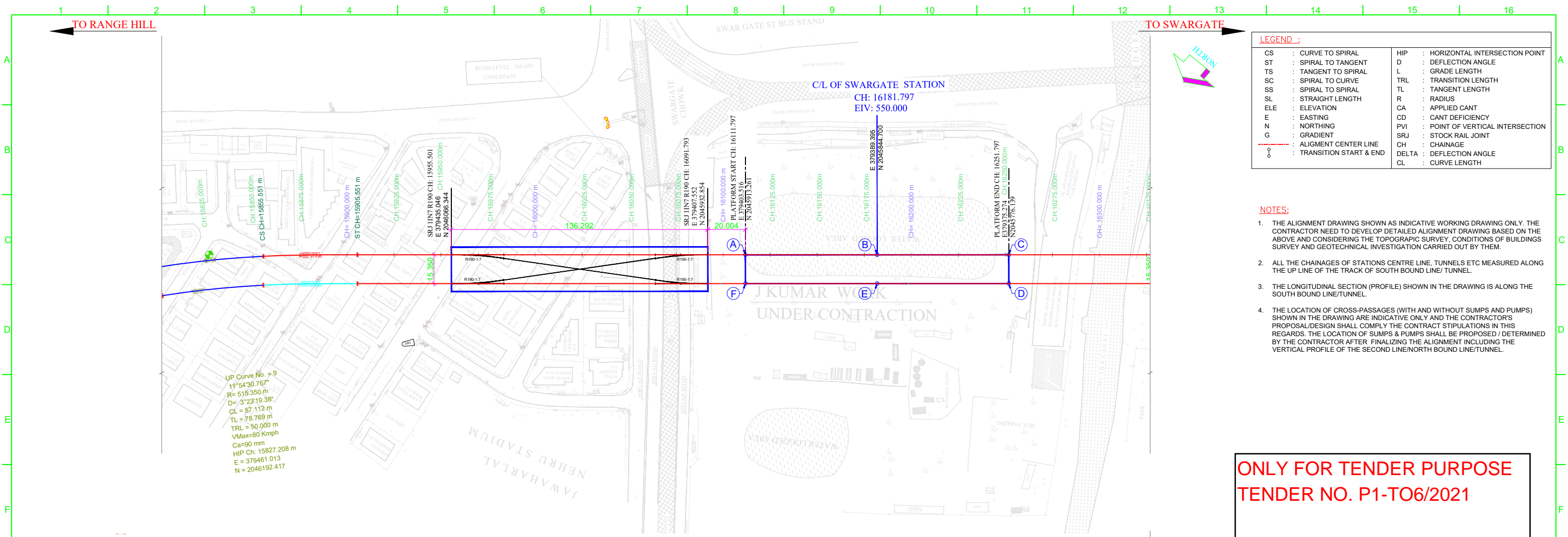
LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
o	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

- NOTES:
1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 3. THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
 4. THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
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	AGM (PLG)	
	GM (PLG)	

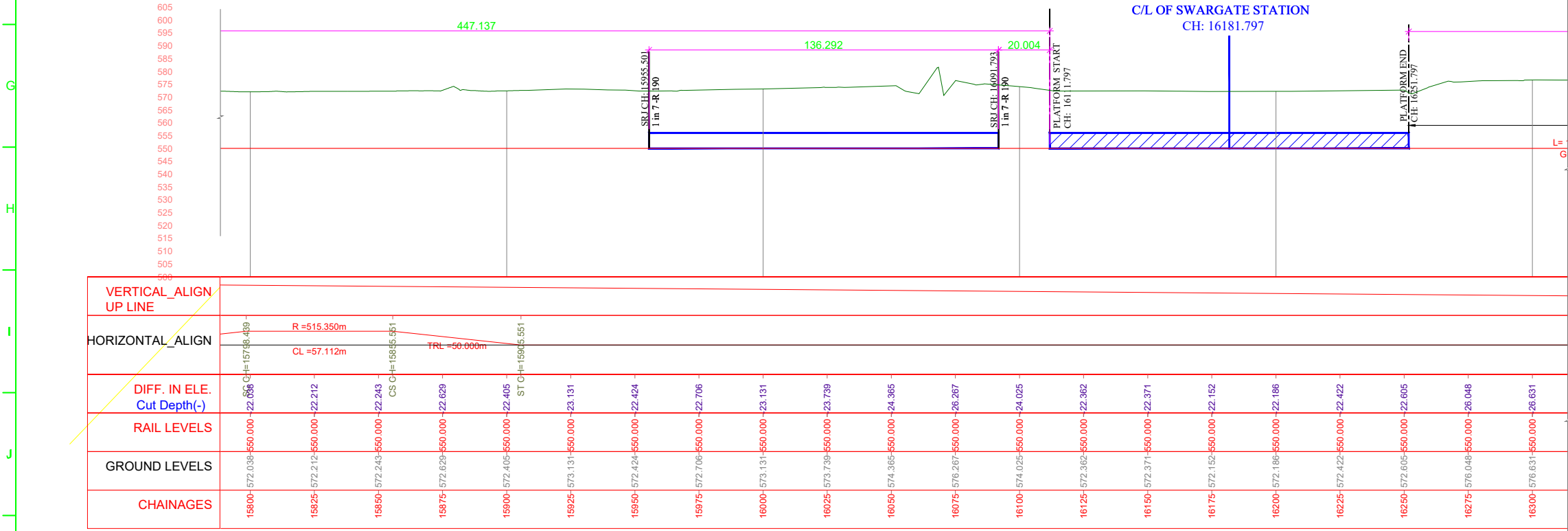
K	B07	06.06.2020	1. Curve no.5 R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment. 3. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 10m tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:1162. vertical alignment has been revised b/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respect to pccm to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shivaji nagar station location revised and coordinates updated.			THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.					<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA		K																								
	B06	16.09.2019				DDC		CONTRACTOR		PROOF CONSULTANT							DY. HOD		CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.		 PUNE METRO																										
	B05	14.08.2019				SIGN: DATE: NAME: SHW	SIGN: DATE: NAME: RVS	SIGN: DATE: NAME: RPG	SIGN: DATE: NAME: VLD	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	HOD		LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE																											
	B04	11.06.2019				DRAWN BY DESIGN BY CHECKED BY APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 15300m TO 15800m		REVISION NO: ---																											
L	B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified.			CONSULTANTS TCPL-GEO CONSULT-JV					GULERMAK-TPL-JV					XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN		SCALE: 1:1		DATE: 06.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO: ---		L																	
	B02	17.05.2019																																													
	B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.																																												
	REV NO	DATE	DESCRIPTION			SIGN																																									
		1			2			3			4			5			6			7			8			9			10			11			12			15			16						
																										Page 56 of 142																					





LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
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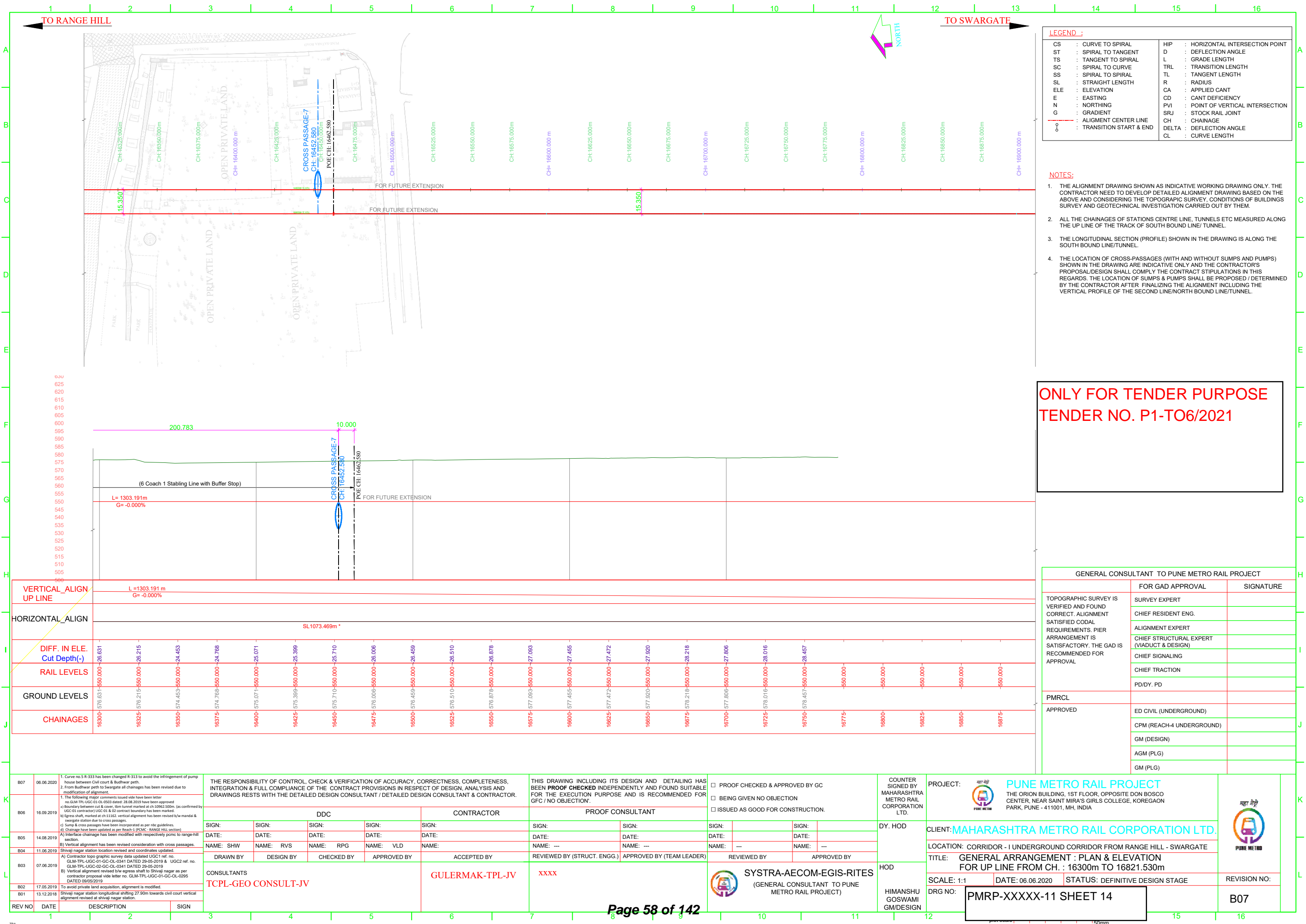
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
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	CHIEF RESIDENT ENG.	
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PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
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	AGM (PLG)	
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B07	06.06.2020	1. Curve no. S-R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages have been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.				COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																																																																																																																																																																																																																																																																											
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
LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—+—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

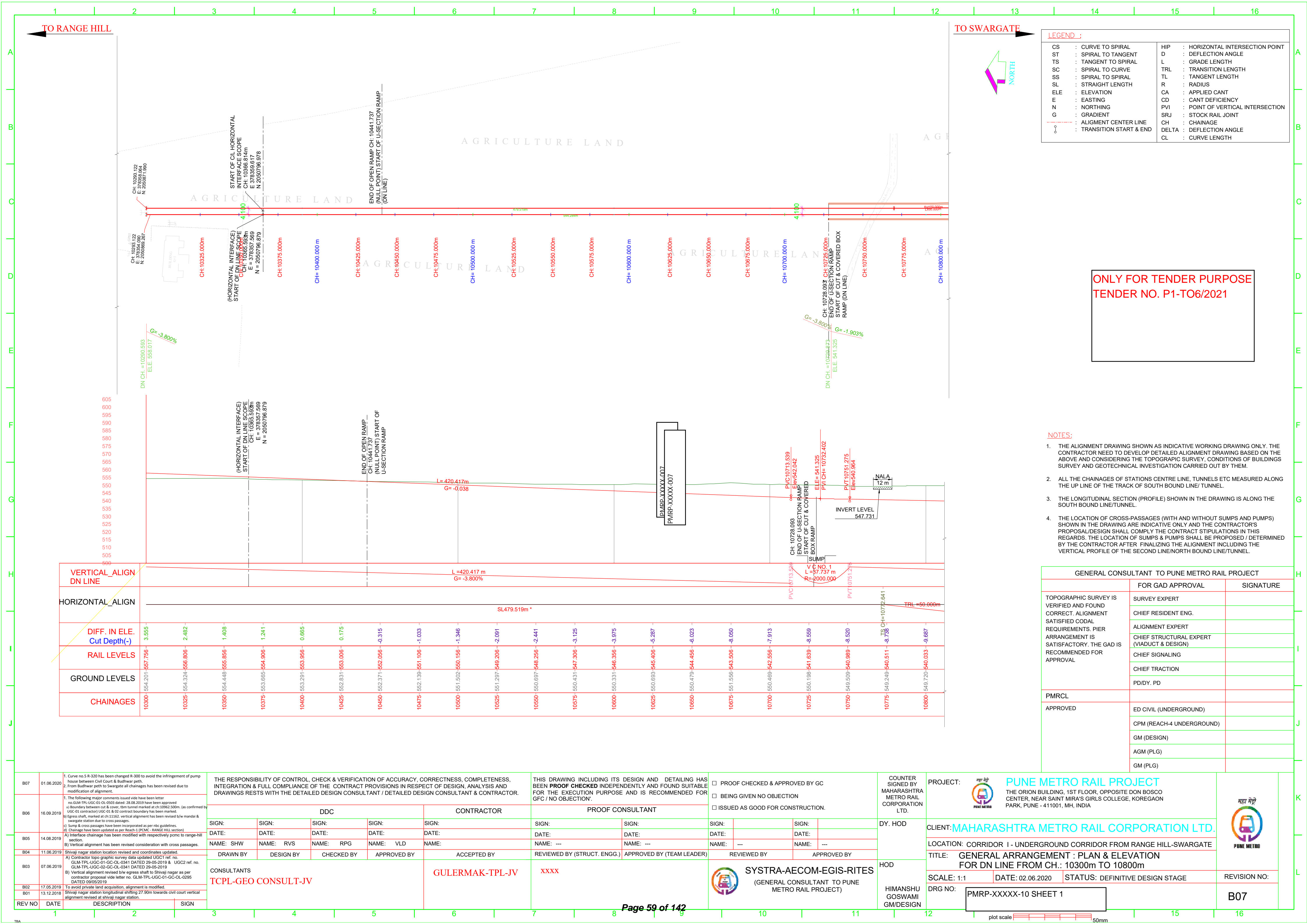
- NOTES:**
1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 3. THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
 4. THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

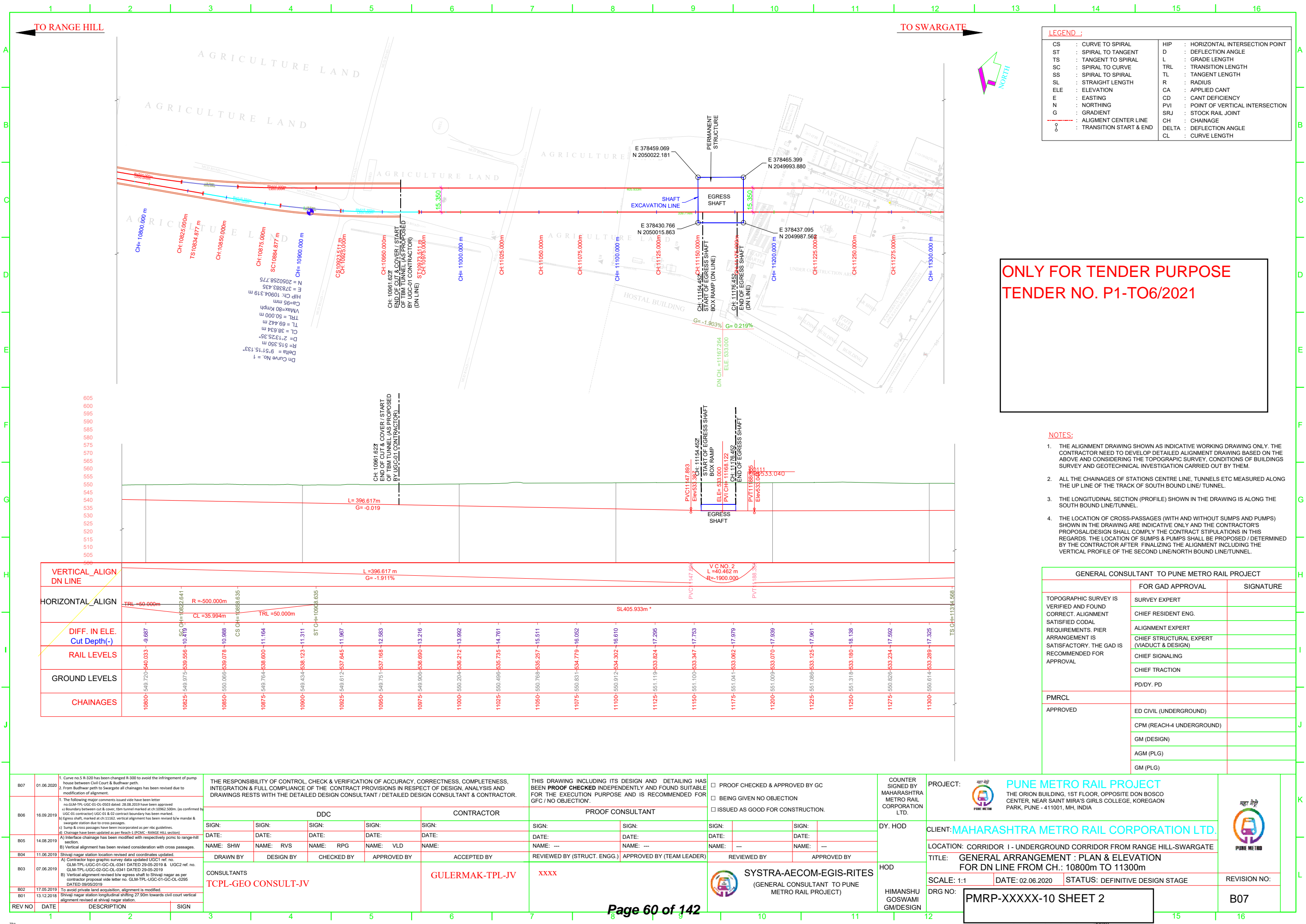
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

VERTICAL_ALIGN UP LINE	L=1303.191 m G=-0.000%														
HORIZONTAL_ALIGN	SL1073.469m *														
DIFF. IN ELE. Cut Depth(-)	-26.631	-26.215	-24.453	-24.768	-25.071	-25.399	-25.710	-26.006	-26.459	-26.510	-26.878	-27.093	-27.455	-27.472	-27.920
RAIL LEVELS	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000	-550.000
GROUND LEVELS	576.631	576.215	574.453	574.768	575.071	575.399	575.710	576.006	576.459	576.510	576.878	577.093	577.455	577.472	577.920
CHAINAGES	16300	16325	16350	16375	16400	16425	16450	16475	16500	16525	16550	16575	16600	16625	16650

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

K	B07	06.06.2020	1. Curve no 5 R-333 has been changed R-313 to avoid the infringement of pump house between Civil court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment. 1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, 6m tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandal & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respectively pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages. Shivaji nagar station location revised and coordinates updated.			THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.					<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA	K																																							
	B06	16.09.2019				DDC		CONTRACTOR		PROOF CONSULTANT		SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: SHW						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: RVS							SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: RPG						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: VLD						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: ---						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: ---						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: ---						SIGN: <table><tr><td></td><td></td></tr></table> DATE: <table><tr><td></td><td></td></tr></table> NAME: ---					
	B05	14.08.2019				DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		HOD	LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE																																			
L	B04	11.06.2019												GULERMAK-TPL-JV		XXXX		SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)				HIMANSHU GOSWAMI GM/DESIGN			TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR UP LINE FROM CH. : 16300m TO 16821.530m																																			
	B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.			CONSULTANTS			TCPL-GEO CONSULT-JV																	SCALE: 1:1	DATE: 06.06.2020	STATUS: DEFINITIVE DESIGN STAGE	REVISION NO:																															
	B02	17.05.2019																								DRG NO:	PMRP-XXXXX-11 SHEET 14																																	
	B01	13.12.2018																									B07																																	
	REV NO	DATE	DESCRIPTION			SIGN																																																						
		1	2			3			4			5			6			7			8			9			10		11		12		13		14		15		16																					







LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

NOTES:

- THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
- ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
- THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	01.06.2020	1. Curve no.5 R=320 has been changed R=300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA				
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-1 (PDMC - RANGE HILL section) A) Interface chainage has been modified with respectively pmrc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DDC		CONTRACTOR		PROOF CONSULTANT						DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.				
B05	14.08.2019		SIGN: DATE: NAME: SHW	SIGN: DATE: NAME: RVS	SIGN: DATE: NAME: RPG	SIGN: DATE: NAME: VLD	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---		LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE				
B04	11.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019	DRAWN BY	DESIGN BY	CHECKED BY	APPROVED BY	ACCEPTED BY	REVIEWED BY (STRUCT. ENGG.)	APPROVED BY (TEAM LEADER)	REVIEWED BY	APPROVED BY	REVIEWED BY	APPROVED BY	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH.: 10800m TO 11300m				
B03	07.06.2019		CONSULTANTS TCPL-GEO CONSULT-JV				GULERMAK-TPL-JV				XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)	HOD	SCALE: 1:1	DATE: 02.06.2020	STATUS: DEFINITIVE DESIGN STAGE	REVISION NO:
B02	17.05.2019	To avoid private land acquisition, alignment is modified.												DRG NO: PMRP-XXXXX-10 SHEET 2				
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.																
REV NO	DATE	DESCRIPTION	SIGN															B07
1																		
2																		
3																		
4																		
5																		
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9																		
10																		
11																		
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13																		
14																		
15																		
16																		

TO RANGE HILL

TO SWARGATE

LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
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SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
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G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
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TENDER NO. P1-TO6/2021

- NOTES:
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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	

VERTICAL_ALIGN
DN LINE


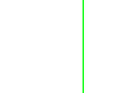
HORIZONTAL_ALIGN

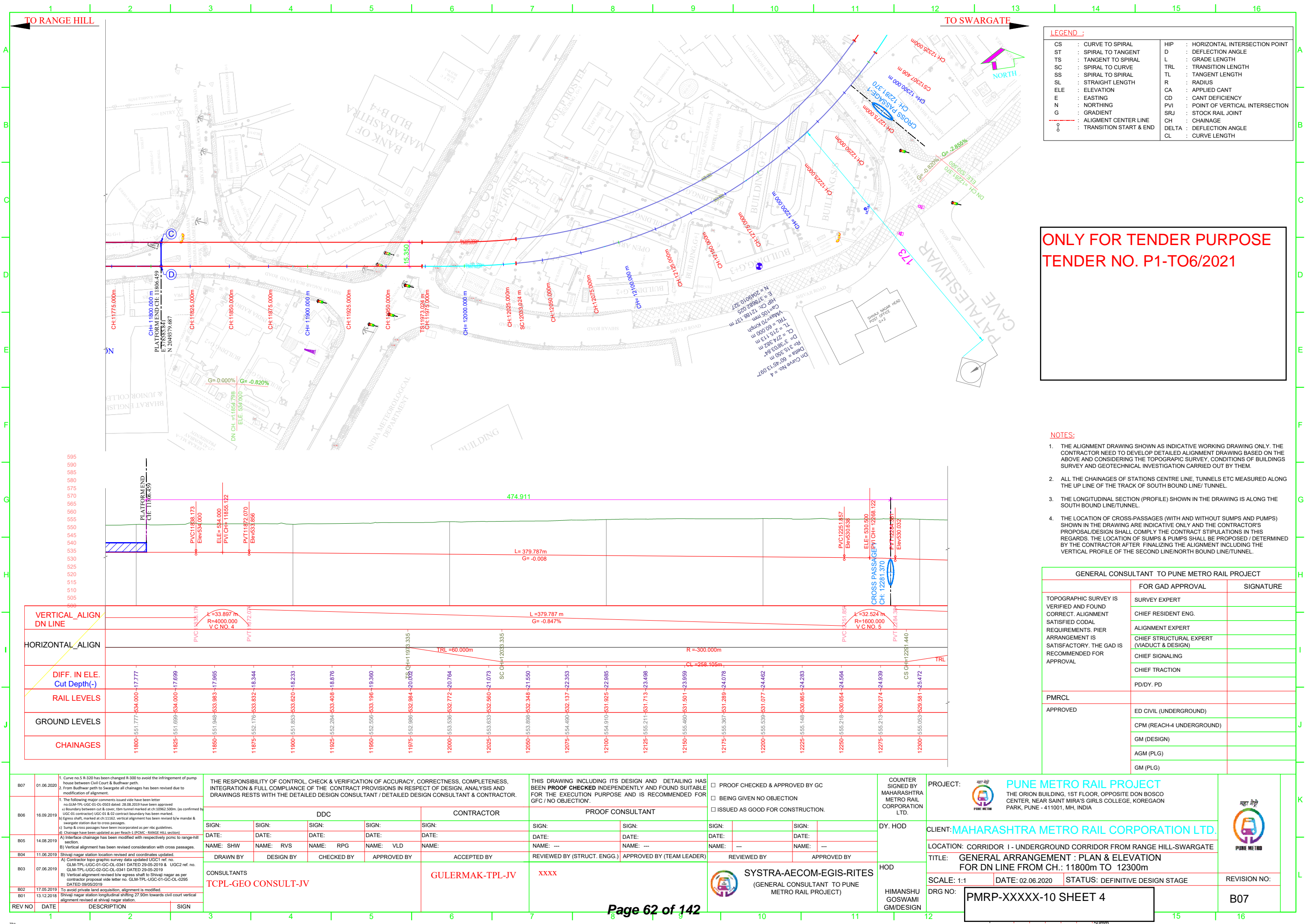
DIFF. IN ELE.
Cut Depth(-)

RAIL LEVELS

GROUND LEVELS

CHAINAGES

07	01.06.2020	1. Curve no.5 R=320 has been changed R=300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.				COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
06	16.09.2019	1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-CL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-G1 contractor) UGC-G1 & G2 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-1 (PMCM - RANGE HILL section) A) Interface chainage has been modified with respectively pmcm to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DDC					CONTRACTOR				PROOF CONSULTANT				DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.	LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH.: 11300m TO 11800m	SCALE: 1:1	DATE: 02.06.2020	STATUS: DEFINITIVE DESIGN STAGE	REVISION NO:																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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05	14.08.2019	A) Vertical alignment has been modified with respectively pmcm to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DRAWN BY					DESIGN BY					CHECKED BY					APPROVED BY					ACCEPTED BY					REVIEWED BY (STRUCT. ENGG.)					APPROVED BY (TEAM LEADER)					HOD	HIMANSHU GOSWAMI GM/DESIGN	DRG NO: PMRP-XXXXX-10 SHEET 3	B07																																																																																																																																																																																																																																																																																																																																																																																																																																														
			NAME: SHW	NAME: RVS	NAME: RPG	NAME: VLD	NAME:	NAME:	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---					NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---	NAME: ---





LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
CH	: CHAINAGE	CH	: CHAINAGE
Δ	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
CL	: CURVE LENGTH		

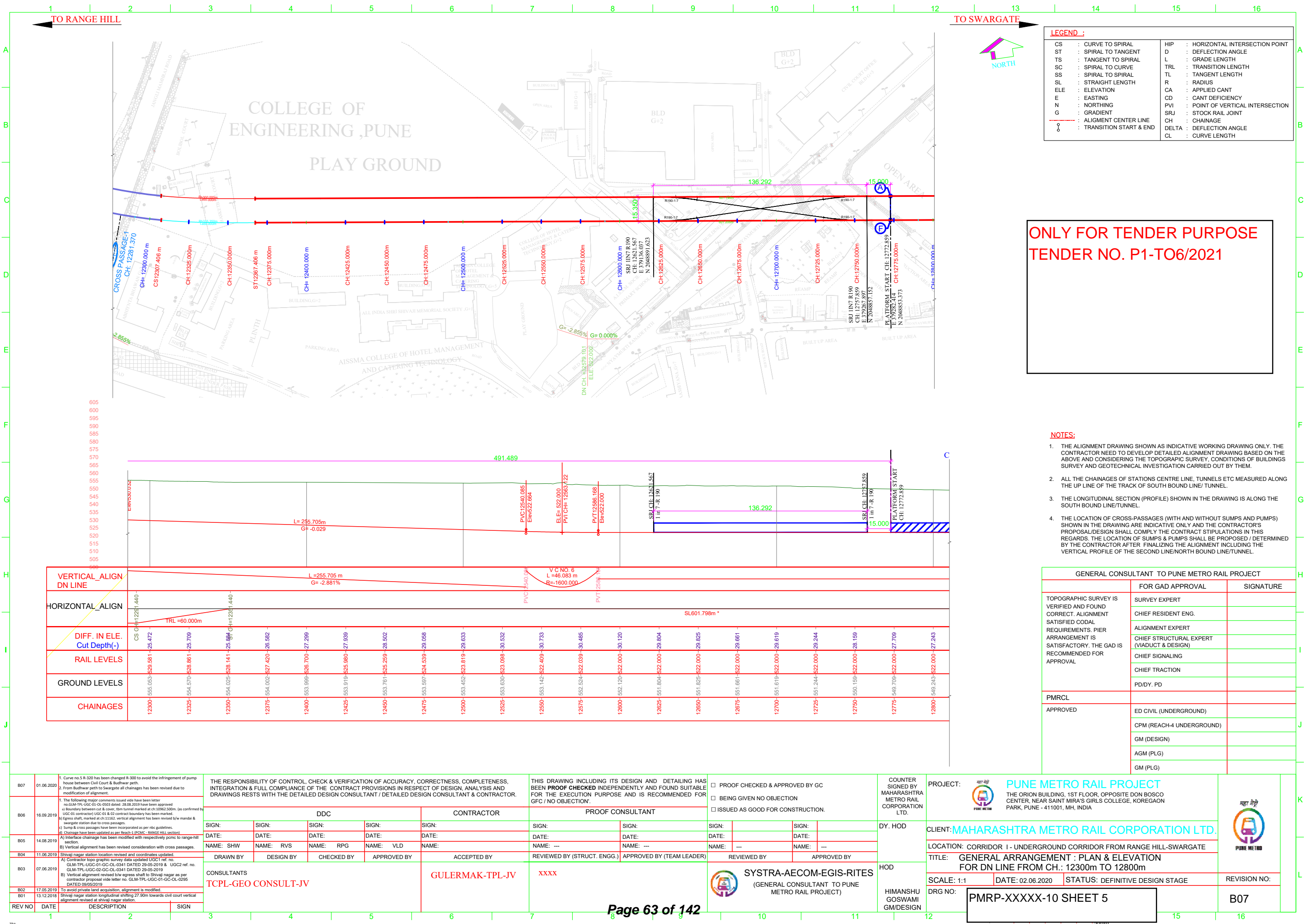
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
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	CHIEF SIGNALING	
PMRCL	CHIEF TRACTION	
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APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	01.06.2020	1. Curve no.5 R=320 has been changed R=300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-OL-0341 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbn tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nbc guidelines. d) Chainage have been updated as per Reach-4 (PMRCL - RANGE HILL section) A) Interface chainage has been modified with respectively pmrc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DDC		CONTRACTOR		PROOF CONSULTANT				DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.		
B05	14.08.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	SIGN: DATE: NAME: SHW	SIGN: DATE: NAME: RVS	SIGN: DATE: NAME: RPG	SIGN: DATE: NAME: VLD	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---		LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE		
B04	11.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	DRAWN BY	DESIGN BY	CHECKED BY	APPROVED BY	ACCEPTED BY	REVIEWED BY (STRUCT. ENGG.)	APPROVED BY (TEAM LEADER)	REVIEWED BY	APPROVED BY	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH.: 11800m TO 12300m		
B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	CONSULTANTS TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HOD	SCALE: 1:1 DATE: 02.06.2020 STATUS: DEFINITIVE DESIGN STAGE		
B02	17.05.2019	To avoid private land acquisition, alignment is modified.									HIMANSHU GOSWAMI GM/DESIGN	REVISION NO:		
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.										DRG NO: PMRP-XXXXX-10 SHEET 4		
REV NO	DATE	DESCRIPTION	SIGN									B07		

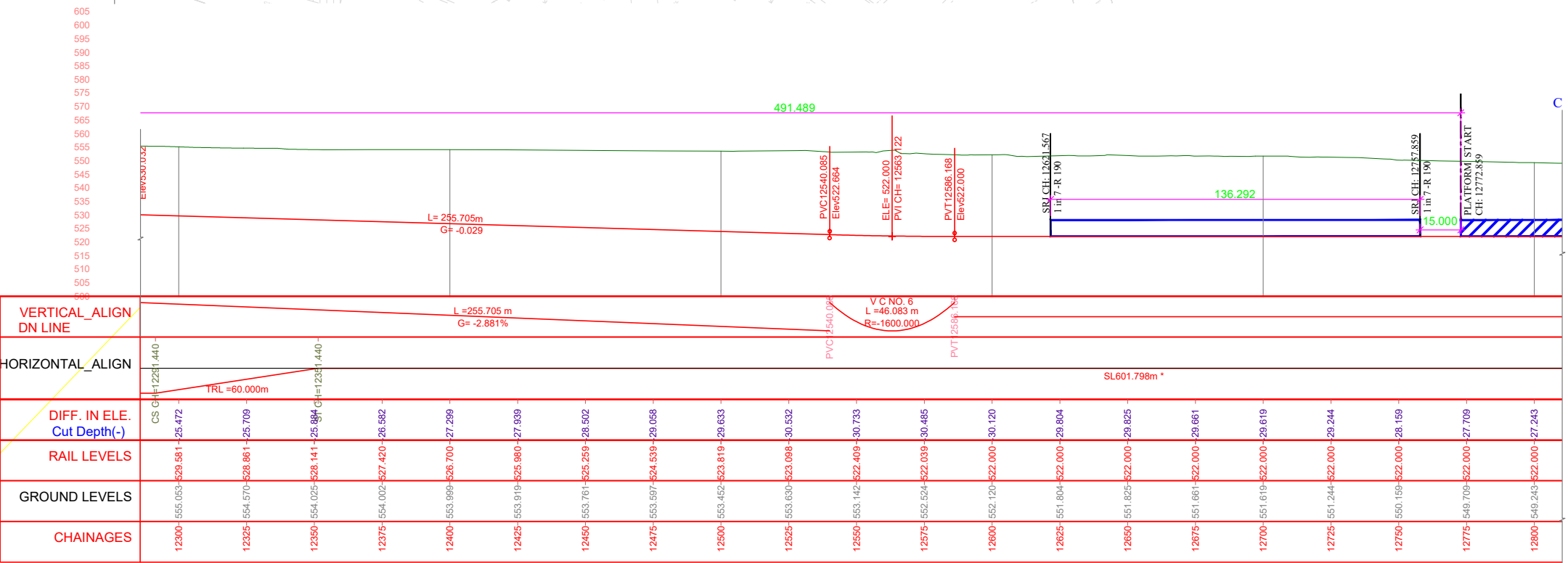
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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
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ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

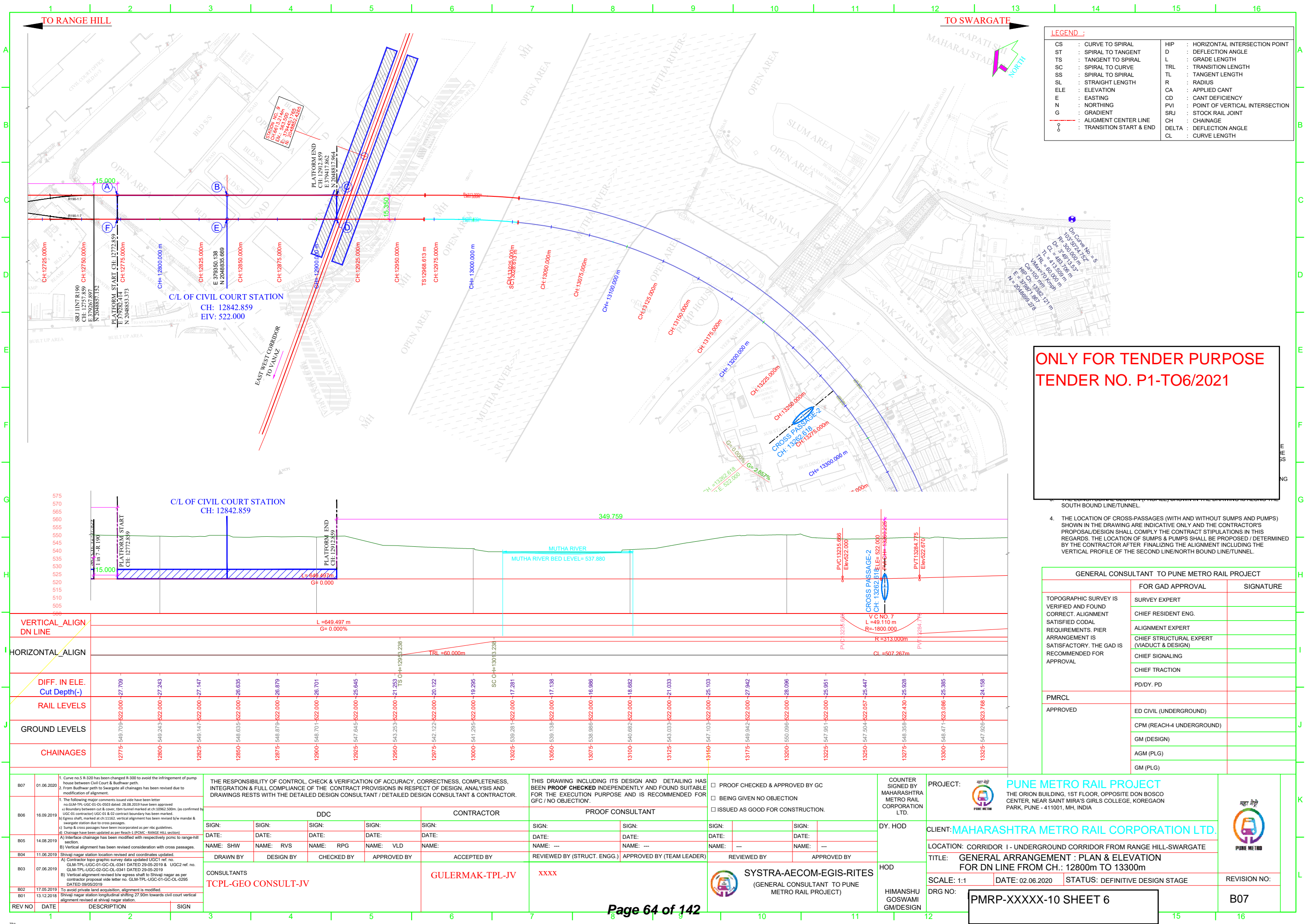
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VERTICAL_ALIGN DN LINE	L=255.705 m G=-2.881%														
HORIZONTAL_ALIGN	SL601.798m *														
DIFF. IN ELE. Cut Depth(-)	CS CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440	CH=12341.440
RAIL LEVELS	555.053	554.570	554.087	553.604	553.121	552.638	552.155	551.672	551.189	550.706	550.223	549.740	549.257	548.774	548.291
GROUND LEVELS	555.053	554.570	554.087	553.604	553.121	552.638	552.155	551.672	551.189	550.706	550.223	549.740	549.257	548.774	548.291
CHAINAGES	12300	12325	12350	12375	12400	12425	12450	12475	12500	12525	12550	12575	12600	12625	12650

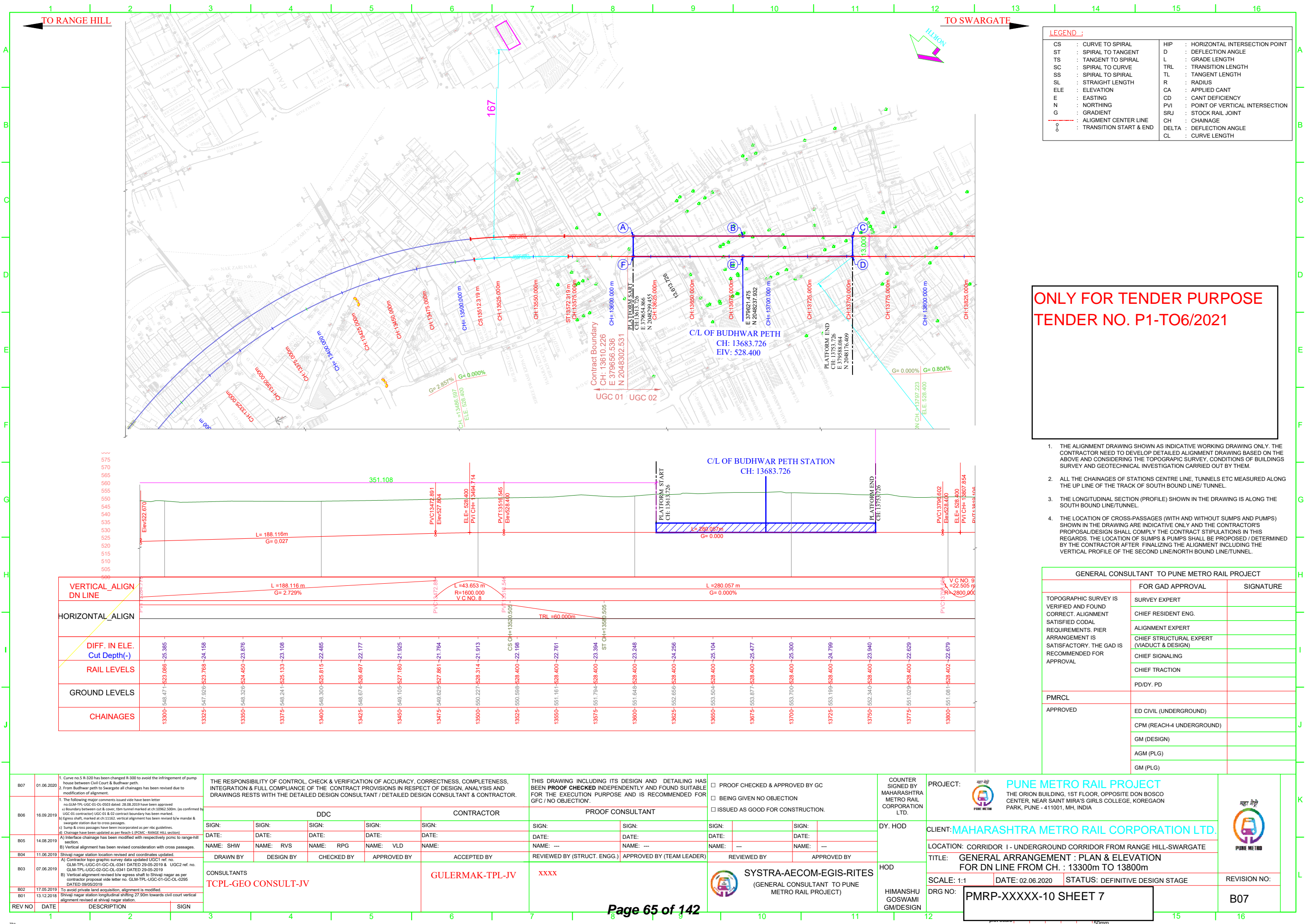
B07			01.06.2020			1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.			THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.						THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION'.						□ PROOF CHECKED & APPROVED BY GC □ BEING GIVEN NO OBJECTION □ ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.			PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
B06			16.09.2019			1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-GC-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, dam tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162, vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per rbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGEL HILL section) A) Interface chainage has been modified with respect to range-hill section. B) Vertical alignment has been revised consideration with cross passages.						DDC			CONTRACTOR			PROOF CONSULTANT			SIGN: _____			SIGN: _____			SIGN: _____			SIGN: _____			DY. HOD			CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
B05			14.08.2019			NAME: SHW						NAME: RVS			NAME: RPG			NAME: VLD			NAME: ---			NAME: ---			NAME: ---			NAME: ---			LOCATION: CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
B04			11.06.2019			Shivaji nagar station location revised and coordinates updated.						DRAWN BY			DESIGN BY			CHECKED BY			APPROVED BY			ACCEPTED BY			REVIEWED BY (STRUCT. ENGG.)			APPROVED BY (TEAM LEADER)			REVIEWED BY			APPROVED BY			HOD			TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH.: 12300m TO 12800m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
B03			07.06.2019			A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.						CONSULTANTS TCPL-GEO CONSULT-JV						GULERMAK-TPL-JV xxxxx						SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)									HIMANSHU GOSWAMI GM/DESIGN			SCALE: 1:1			DATE: 02.06.2020			STATUS: DEFINITIVE DESIGN STAGE			REVISION NO: B07																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
B02			17.05.2019																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL		
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07		01.06.2020		1. Curve no 5-R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment. 3. The Following major comments issued vide have been letter no GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, item turned marked at ch.10962.500m, (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked b) Egress shaft, marked at ch.11612, vertical alignment has been revised b/w mandal & Swargate station due to cross passages. c) Pump & cross passages have been incorporated as per ric guidelines. d) Chainage have been updated as per bench 1 (PCMC - RANGE HILL section) A) Interface chainage has been modified with respectively pcmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.		THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.						THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.						<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.		PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA			
B06		16.09.2019				DDC		CONTRACTOR		PROOF CONSULTANT						DY. HOD		CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.							
B05		14.08.2019				SIGN: _____		SIGN: _____		SIGN: _____		SIGN: _____		SIGN: _____		SIGN: _____		DATE: _____		DATE: _____					
B04		11.06.2019				NAME: SHW		NAME: RVS		NAME: RPG		NAME: VLD		NAME: ---		NAME: ---		NAME: ---		NAME: ---					
B03		07.06.2019				DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY					
B02		17.05.2019				CONSULTANTS						GULERMAK-TPL-JV		XXXX				SYSTRA-AECOM-EGIS-RITES		HOD					
B01		13.12.2018				TCPL-GEO CONSULT-JV												(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN					
REV NO		DATE		DESCRIPTION		SIGN														PMRP-XXXXXX-10 SHEET 6					
1		2		3		4		5		6		7		8		9		10		11					



LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—+—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
3. THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
4. THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
	PD/DY. PD	
PMRCL		
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	01.06.2020	1. Curve no.5 R=320 has been changed R=300 to avoid the infringement of pump house between Civil Court & Budhwar peth. 2. From Budhwar peth to Swargate all chainages has been revised due to modification of alignment.
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-OL-0501 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbn tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:13162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per rbc guidelines. d) Chainage have been updated as per Reach-1 (PMCL - RANGE HILL section) A) Interface chainage has been modified with respectively pmcl to range-hill section. B) Vertical alignment has been revised consideration with cross passages.
B05	14.08.2019	Shivaji nagar station location revised and coordinates updated.
B04	11.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019
B02	17.05.2019	To avoid private land acquisition, alignment is modified.
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.
REV NO	DATE	DESCRIPTION
		SIGN

THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.			
DDC			
SIGN:	SIGN:	SIGN:	SIGN:
DATE:	DATE:	DATE:	DATE:
NAME: SHW	NAME: RVS	NAME: RPG	NAME: VLD
DRAWN BY	DESIGN BY	CHECKED BY	APPROVED BY
CONSULTANTS			
TCPL-GEO CONSULT-JV			

CONTRACTOR			
SIGN:	SIGN:	SIGN:	SIGN:
DATE:	DATE:	DATE:	DATE:
NAME: ---	NAME: ---	NAME: ---	NAME: ---
REVIEWED BY (STRUCT. ENGG.)	APPROVED BY (TEAM LEADER)	REVIEWED BY	APPROVED BY
GULERMAK-TPL-JV			
XXXX			

THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.			
PROOF CONSULTANT			
SIGN:	SIGN:	SIGN:	SIGN:
DATE:	DATE:	DATE:	DATE:
NAME: ---	NAME: ---	NAME: ---	NAME: ---
REVIEWED BY	APPROVED BY	REVIEWED BY	APPROVED BY
SYSTRA-AECOM-EGIS-RITES			
(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)			

COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.
DY. HOD
HOD
HIMANSHU GOSWAMI GM/DESIGN

PROJECT:

PUNE METRO RAIL PROJECT

CLIENT:

MAHARASHTRA METRO RAIL CORPORATION LTD.

LOCATION:

CORRIDOR I - UNDERGROUND CORRIDOR FROM RANGE HILL-SWARGATE

TITLE:

GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 13300m TO 13800m

SCALE: 1:1

DATE: 02.06.2020

STATUS: DEFINITIVE DESIGN STAGE

DRG NO:

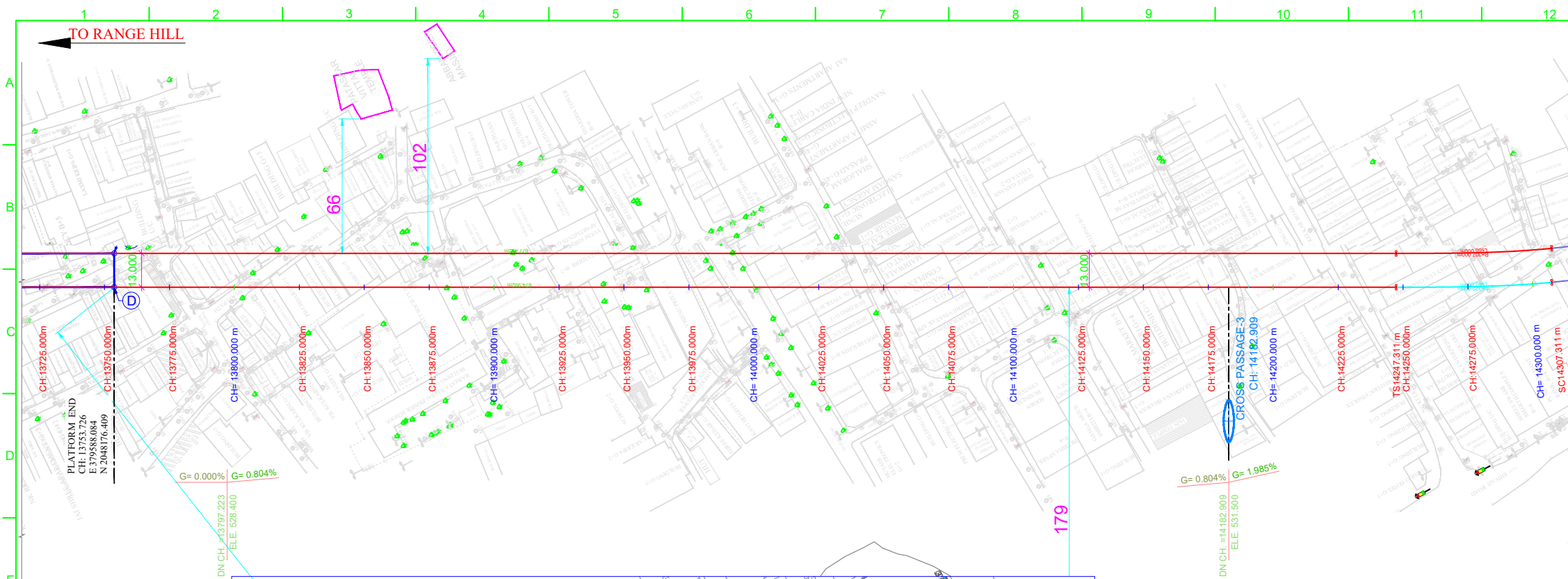
PMRP-XXXXX-10 SHEET 7

PUNE METRO

THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA

REVISION NO:

B07



TO RANGE HILL

TO SWARGATE

NORTH

LEGEND :

CS : CURVE TO SPIRAL
ST : SPIRAL TO TANGENT
TS : TANGENT TO SPIRAL
SC : SPIRAL TO CURVE
SS : SPIRAL TO SPIRAL
SL : STRAIGHT LENGTH
ELE : ELEVATION
E : EASTING
N : NORTHING
G : GRADIENT
--- : ALIGNMENT CENTER LINE
o : TRANSITION START & END


HIP : HORIZONTAL INTERSECTION POINT
D : DEFLECTION ANGLE
L : GRADE LENGTH
TRL : TRANSITION LENGTH
TL : TANGENT LENGTH
R : RADIUS
CA : APPLIED CANT
CD : CANT DEFICIENCY
PVI : POINT OF VERTICAL INTERSECTION
SRJ : STOCK RAIL JOINT
CH : CHAINAGE
DELTA : DEFLECTION ANGLE
CL : CURVE LENGTH

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

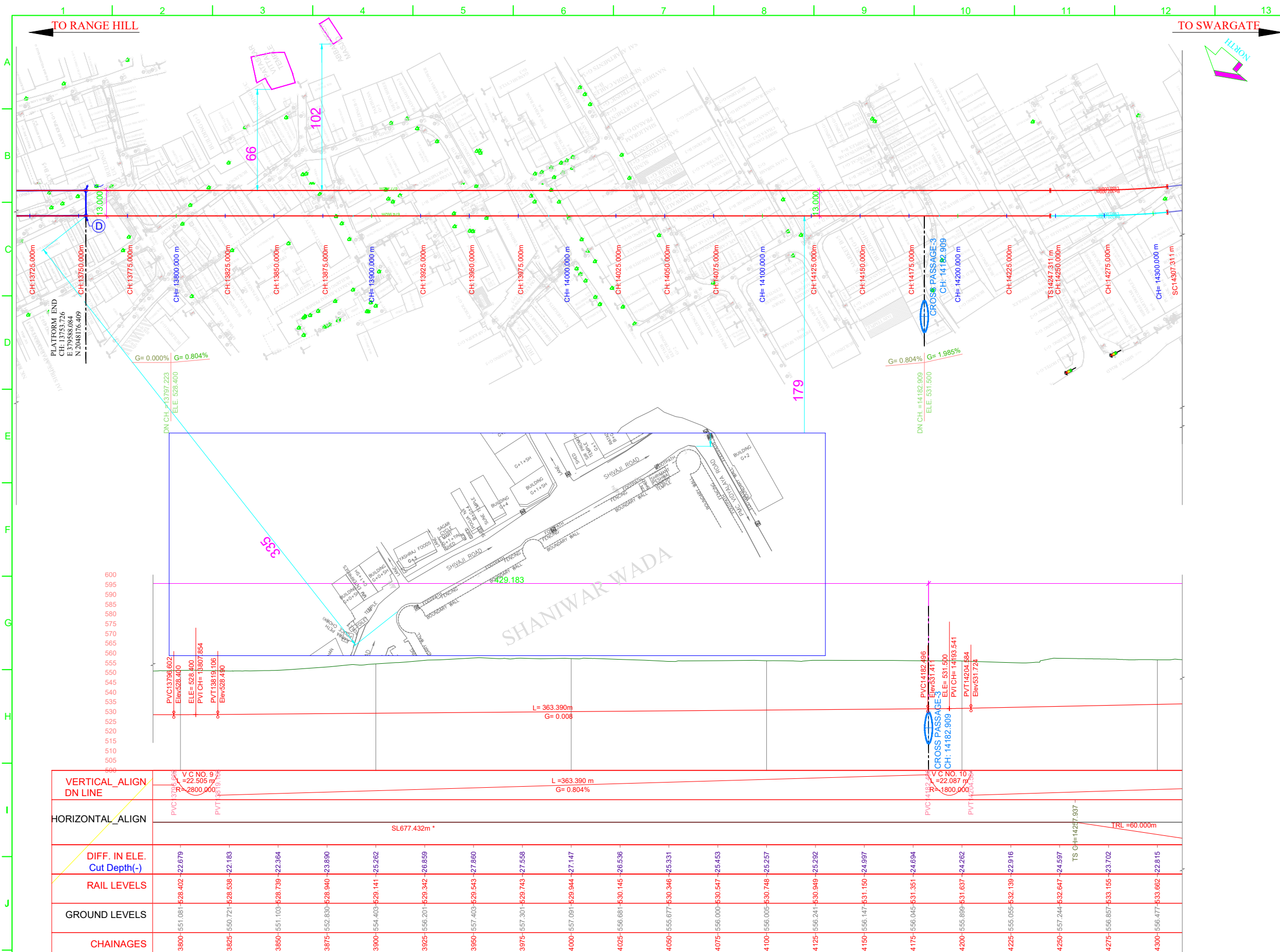
- ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
- ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
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	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

VERTICAL_ALIGN DN LINE	VC NO. 9 L=2800.000m G=0.804%																
HORIZONTAL_ALIGN	SL677.432m * L=363.390m G=0.008																
DIFF. IN ELE. Cut Depth(-)	-22.679	-22.364	-23.890	-25.262	-26.859	-27.660	-27.598	-27.147	-26.538	-25.331	-25.453	-25.257	-24.997	-24.694	-24.262	-22.916	-22.815
RAIL LEVELS	528.02	528.79	528.94	529.44	529.34	529.43	529.43	529.44	530.14	530.34	530.34	530.34	531.15	531.35	531.35	532.19	532.81
GROUND LEVELS	551.081	551.103	552.830	554.403	556.201	557.403	557.301	557.091	556.681	556.005	555.889	555.855	557.244	556.857	556.857	557.477	556.477
CHAINAGES	13800	13825	13850	13875	13900	13925	13950	13975	14000	14025	14050	14075	14100	14125	14150	14175	14200

B07	01.06.2020	1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.					THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.					<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJ		
B06	16.09.2019	1. The following major comments issued vide have been letter no.GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per rbc guidelines. d) Chainage have been updated as per Reach-1 (PCMC - RANGE HILL section) e) Interface chainage has been modified with respectively pcmc to range-hill section. f) Vertical alignment has been revised consideration with cross passages.	DDC					CONTRACTOR					PROOF CONSULTANT			DY. HOD	CLIE		
B05	14.08.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	SIGN: DATE: NAME: SHW					SIGN: DATE: NAME: RVS					SIGN: DATE: NAME: ---				LOCA		
B04	11.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	DRAWN BY DESIGN BY CHECKED BY APPROVED BY					ACCEPTED BY					REVIEWED BY (STRUCT. ENGG.) APPROVED BY (TEAM LEADER)			REVIEWED BY APPROVED BY	TITLE		
B03	07.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	CONSULTANTS TCPL-GEO CONSULT-JV					GULERMAK-TPL-JV XXXX								HOD	SCALE		
B02	17.05.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.															DRG		
B01	13.12.2018	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.																	
REV NO	DATE	DESCRIPTION	SIGN														 SYSTRAC AECOM EGIS RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)	HIMANSHU GOSWAMI GM/DESIGN	

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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021


- THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
- ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
- THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/TUNNEL.
- THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL	PD/DY. PD	
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	01.06.2020	1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.		<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-CH-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbn tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:13162, vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per rbc guidelines. d) Chainage have been updated as per Reach-1 (PMCL - RANGE HILL section) e) Interface chainage has been modified with respectively pmcl to range-hill section. f) Vertical alignment has been revised consideration with cross passages.	DDC				CONTRACTOR		PROOF CONSULTANT		DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.
B05	14.08.2019	A) Vertical alignment has been revised consideration with cross passages.	SIGN: DATE: NAME: SHW				SIGN: DATE: NAME: RVS		SIGN: DATE: NAME: ---		HOD	LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE
B04	11.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019	DRAWN BY DESIGN BY CHECKED BY APPROVED BY				ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.) APPROVED BY (TEAM LEADER)		HIMANSHU GOSWAMI GM/DESIGN	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 13800m TO 14300m
B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019	CONSULTANTS TCPL-GEO CONSULT-JV				GULERMAK-TPL-JV		XXXX			SCALE: 1:1 DATE: 02.06.2020 STATUS: DEFINITIVE DESIGN STAGE
B02	17.05.2019	To avoid private land acquisition, alignment is modified.										REVISION NO:
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.										DRG NO: PMRP-XXXXX-10 SHEET 9
REV NO	DATE	DESCRIPTION	SIGN									B07

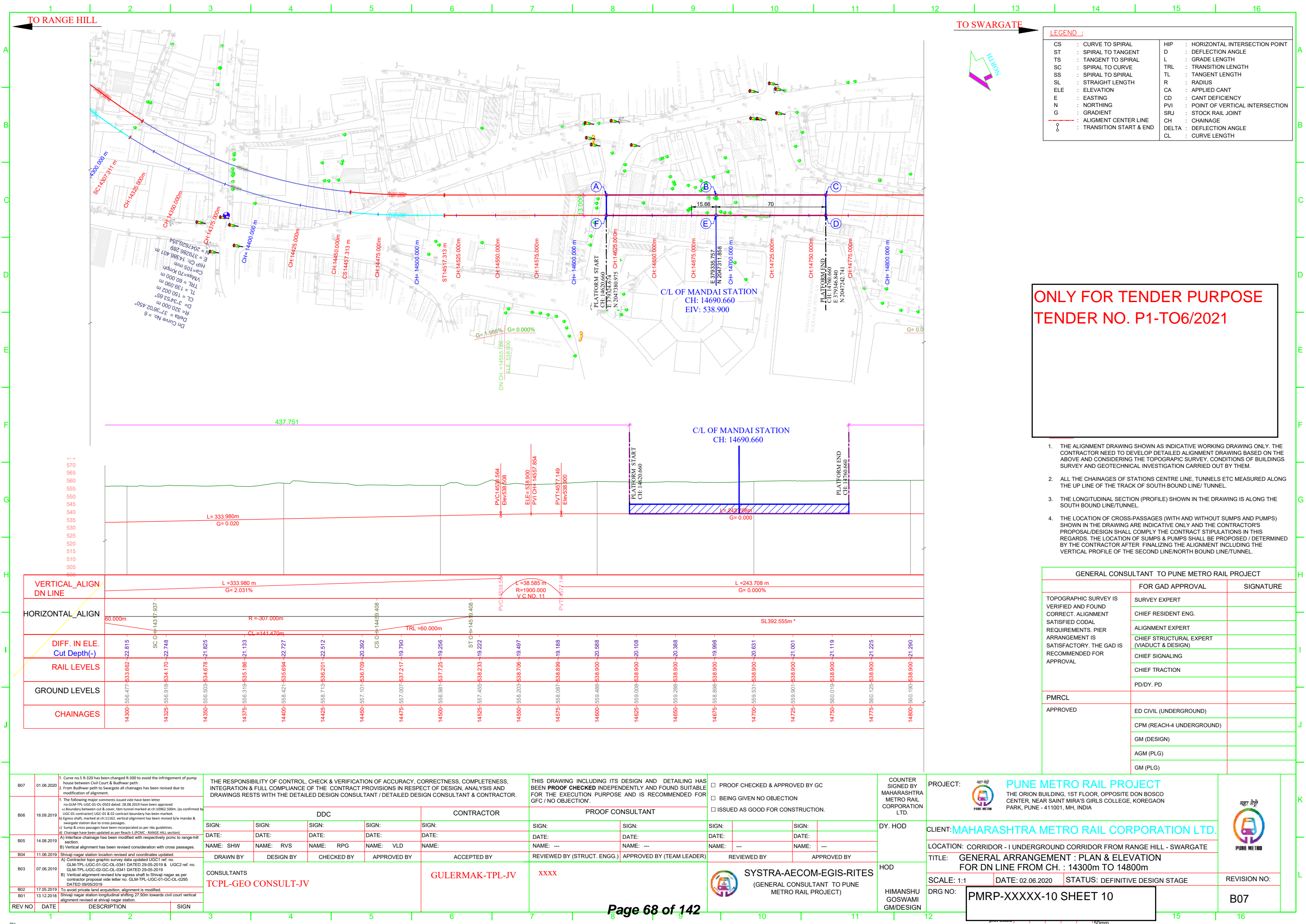


PUNE METRO RAIL PROJECT
THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA



MAHARASHTRA METRO RAIL CORPORATION LTD.

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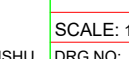


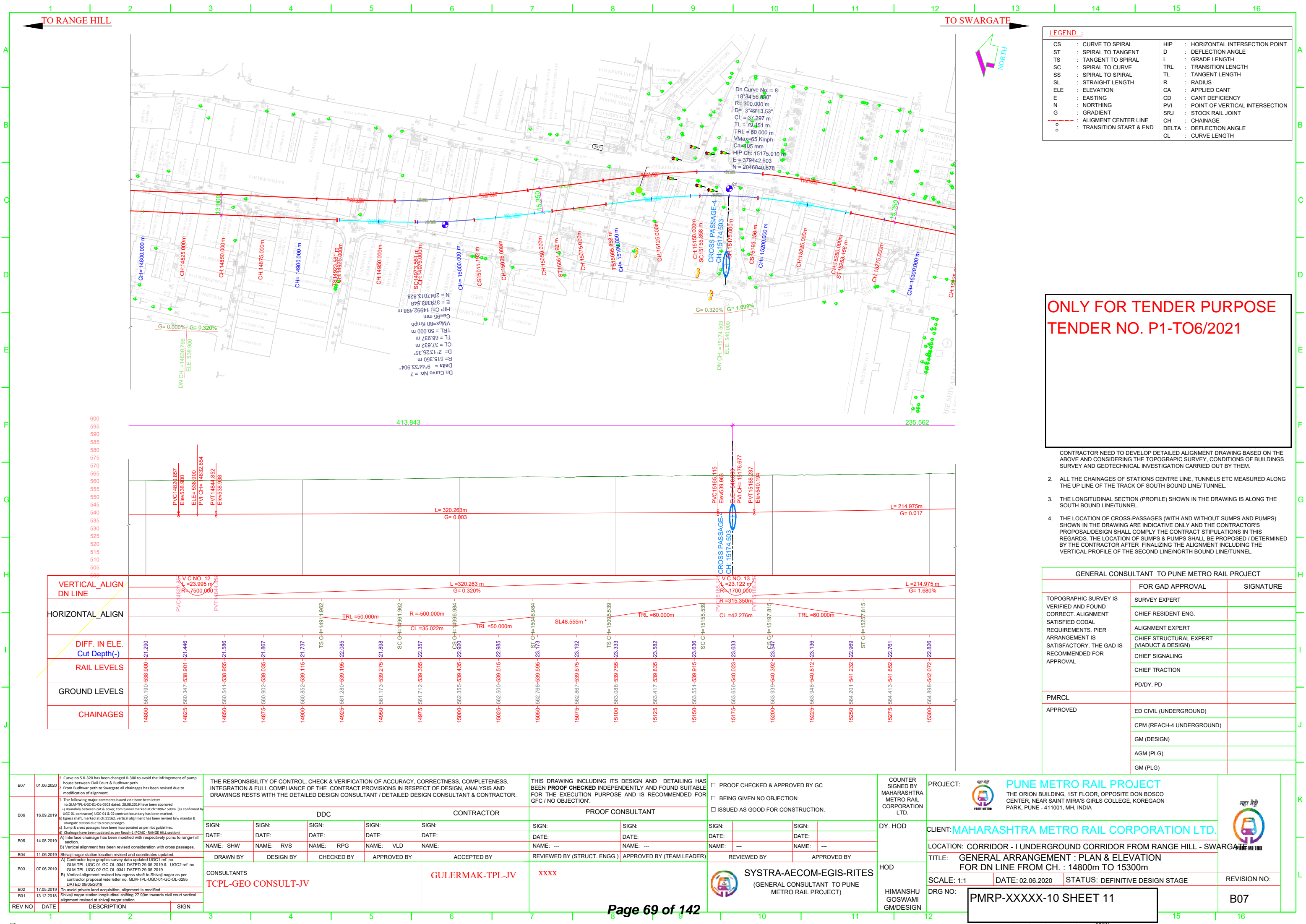
LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
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ELE	: ELEVATION	CA	: APPLIED CANT
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ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
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PMRCL	CHIEF TRACTION	
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APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
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


B07			01.06.2020			1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.			THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.			THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.			<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.			COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.			PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
B06			16.09.2019			1. The following major comments issued vide have been letter no. GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:13162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-4 (PDMC - RANGE HILL section) A) Interface chainage has been modified with respectively pmmc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.			DDC			CONTRACTOR			PROOF CONSULTANT			DY. HOD			CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
B05			14.08.2019			SIGN: DATE: NAME: SHW			SIGN: DATE: NAME: RVS			SIGN: DATE: NAME: RPG			SIGN: DATE: NAME: VLD			SIGN: DATE: NAME: ---			SIGN: DATE: NAME: ---						LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
B04			11.06.2019			Shivaji nagar station location revised and coordinates updated.			DRAWN BY			DESIGN BY			CHECKED BY			APPROVED BY			ACCEPTED BY						REVIEWED BY (STRUCT. ENGG.)			APPROVED BY (TEAM LEADER)			REVIEWED BY			APPROVED BY			HOD			TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 14300m TO 14800m																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
B03			07.06.2019			A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.			CONSULTANTS TCPL-GEO CONSULT-JV			GULERMAK-TPL-JV			XXXX			 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)			HIMANSHU GOSWAMI GM/DESIGN						SCALE: 1:1			DATE: 02.06.2020			STATUS: DEFINITIVE DESIGN STAGE			REVISION NO:																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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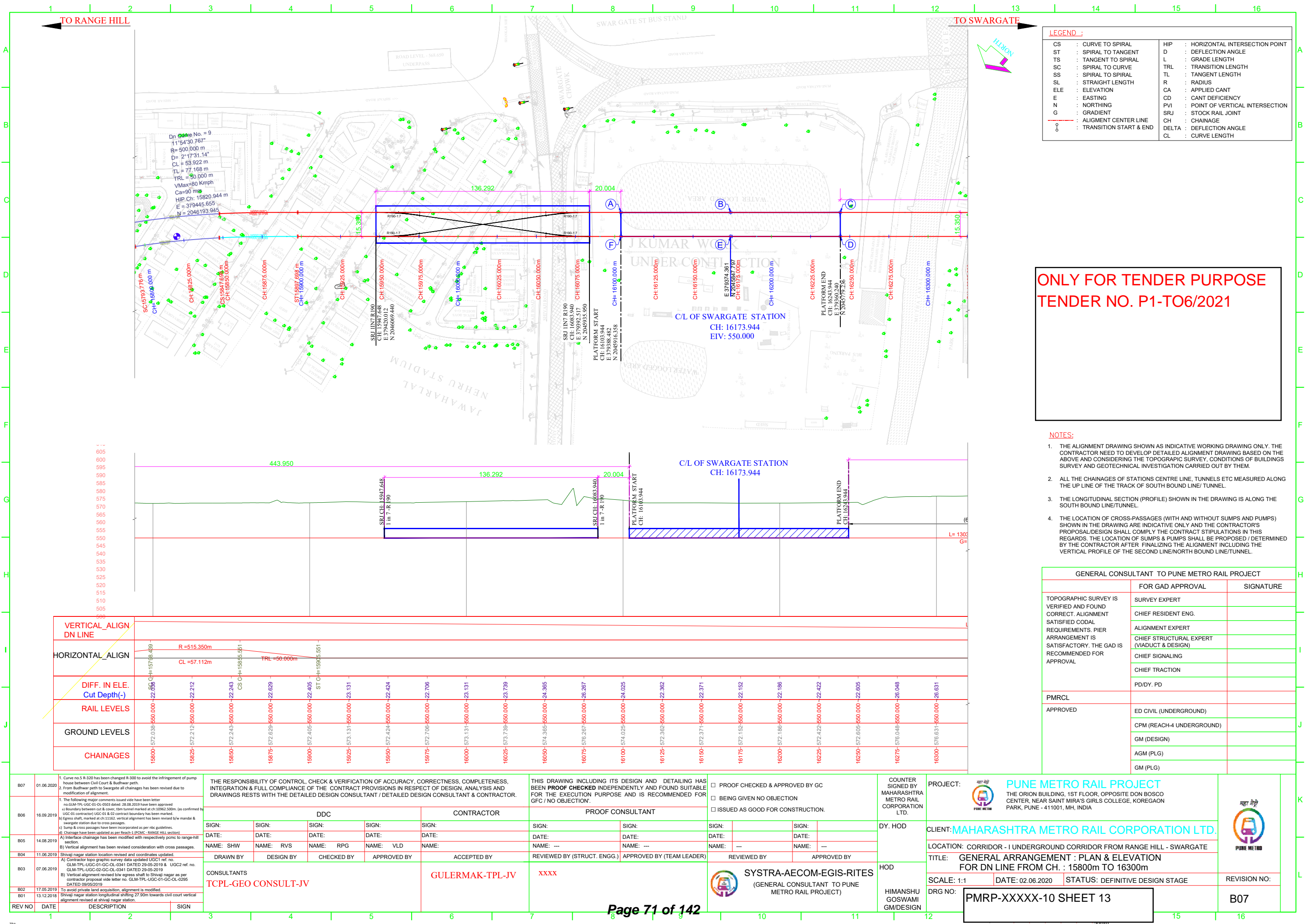
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

- CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
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GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
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TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
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	CHIEF TRACTION	
PD/DY. PD		
PMRCL		
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
GM (PLG)		

B07	01.06.2020	1. Curve no.5 R=320 has been changed R=300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA						
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-GC-OL-0341 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-4 (PDMC - RANGE HILL section) A) Interface chainage has been modified with respectively pmrc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DDC		CONTRACTOR		PROOF CONSULTANT				DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.	MAHARASHTRA METRO RAIL CORPORATION LTD. LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE							
B05	14.08.2019		SIGN: DATE: NAME: SHW	SIGN: DATE: NAME: RVS	SIGN: DATE: NAME: RPG	SIGN: DATE: NAME: VLD	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---	SIGN: DATE: NAME: ---		HOD		TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 14800m TO 15300m	REVISION NO: B07			
B04	11.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	DRAWN BY	DESIGN BY	CHECKED BY	APPROVED BY	ACCEPTED BY	REVIEWED BY (STRUCT. ENGG.)	APPROVED BY (TEAM LEADER)	REVIEWED BY	APPROVED BY	REVIEWED BY		APPROVED BY		DRG NO:		PMRP-XXXXX-10 SHEET 11		
B03	07.06.2019		CONSULTANTS TCPL-GEO CONSULT-JV				GULERMAK-TPL-JV				XXXX					 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)			HIMANSHU GOSWAMI GM/DESIGN	
B02	17.05.2019																			
B01	13.12.2018																			
REV NO	DATE	DESCRIPTION	SIGN																	
1																				
2																				
3																				
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15																				
16																				

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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
SL	: STRAIGHT LENGTH	R	: RADIUS
ELE	: ELEVATION	CA	: APPLIED CANT
E	: EASTING	CD	: CANT DEFICIENCY
N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

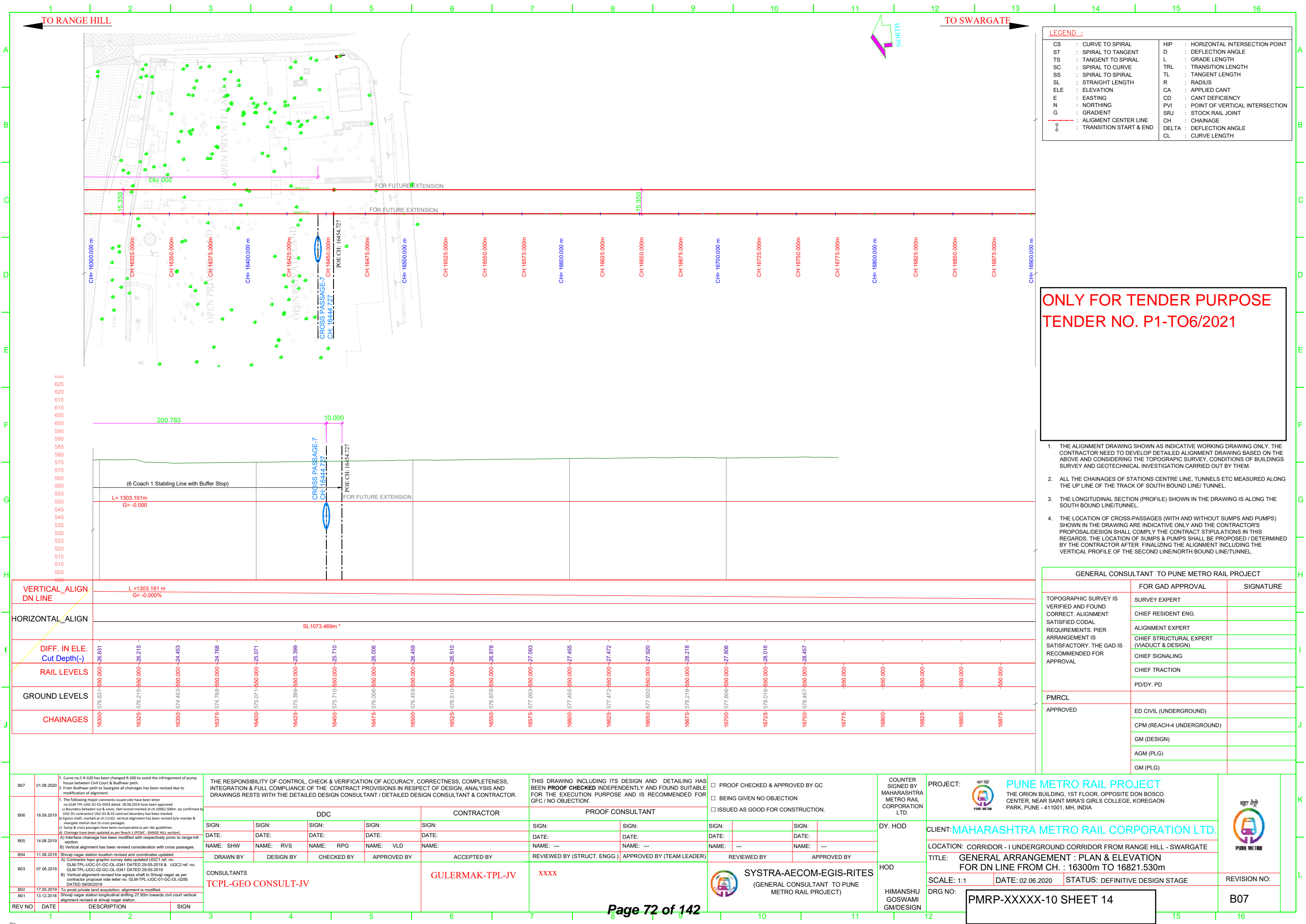
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

- NOTES:
- THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
 - ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
 - THE LONGITUDINAL SECTION (PROFILE) SHOWN IN THE DRAWING IS ALONG THE SOUTH BOUND LINE/ TUNNEL.
 - THE LOCATION OF CROSS-PASSAGES (WITH AND WITHOUT SUMPS AND PUMPS) SHOWN IN THE DRAWING ARE INDICATIVE ONLY AND THE CONTRACTOR'S PROPOSAL/DESIGN SHALL COMPLY THE CONTRACT STIPULATIONS IN THIS REGARDS. THE LOCATION OF SUMPS & PUMPS SHALL BE PROPOSED / DETERMINED BY THE CONTRACTOR AFTER FINALIZING THE ALIGNMENT INCLUDING THE VERTICAL PROFILE OF THE SECOND LINE/NORTH BOUND LINE/TUNNEL.

GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
	PD/DY. PD	
PMRCL		
APPROVED	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	

B07	01.06.2020	1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages have been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:	 PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA	 पुणे मेट्रो								
B06	16.09.2019	1. The following major comments issued vide have been letter no GLM-TPL-UGC-01-GL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbn tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162. vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per rbc guidelines. d) Chainage have been updated as per Reach-4 (PMCL - RANGE HILL section) e) Interface chainage has been modified with respectively pmcl to range-hill section. f) Vertical alignment has been revised consideration with cross passages.	DDC		CONTRACTOR		PROOF CONSULTANT		SIGN: DATE: NAME: SHW		SIGN: DATE: NAME: RVS		SIGN: DATE: NAME: RPG		SIGN: DATE: NAME: VLD		SIGN: DATE: NAME: ---		SIGN: DATE: NAME: ---		DY. HOD	CLIENT:	MAHARASHTRA METRO RAIL CORPORATION LTD.	
B05	14.08.2019		DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)		APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		HOD	LOCATION: CORRIDOR - I UNDERGROUND CORRIDOR FROM RANGE HILL - SWARGATE		
B04	11.06.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GL-0295 DATED 09/05/2019	CONSULTANTS		GULERMAK-TPL-JV		XXXX		SYSTRA-AECOM-EGIS-RITES		(GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN		TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 15800m TO 16300m		SCALE: 1:1		DATE: 02.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:	
B02	17.05.2019	To avoid private land acquisition, alignment is modified.	TCPL-GEO CONSULT-JV																					
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.																						
REV NO	DATE	DESCRIPTION	SIGN															PMRP-XXXXXX-10 SHEET 13		B07				

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LEGEND :			
CS	: CURVE TO SPIRAL	HIP	: HORIZONTAL INTERSECTION POINT
ST	: SPIRAL TO TANGENT	D	: DEFLECTION ANGLE
TS	: TANGENT TO SPIRAL	L	: GRADE LENGTH
SC	: SPIRAL TO CURVE	TRL	: TRANSITION LENGTH
SS	: SPIRAL TO SPIRAL	TL	: TANGENT LENGTH
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ELE	: ELEVATION	CA	: APPLIED CANT
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N	: NORTHING	PVI	: POINT OF VERTICAL INTERSECTION
G	: GRADIENT	SRJ	: STOCK RAIL JOINT
—+—	: ALIGNMENT CENTER LINE	CH	: CHAINAGE
○	: TRANSITION START & END	DELTA	: DEFLECTION ANGLE
		CL	: CURVE LENGTH

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

1. THE ALIGNMENT DRAWING SHOWN AS INDICATIVE WORKING DRAWING ONLY. THE CONTRACTOR NEED TO DEVELOP DETAILED ALIGNMENT DRAWING BASED ON THE ABOVE AND CONSIDERING THE TOPOGRAPHIC SURVEY, CONDITIONS OF BUILDINGS SURVEY AND GEOTECHNICAL INVESTIGATION CARRIED OUT BY THEM.
2. ALL THE CHAINAGES OF STATIONS CENTRE LINE, TUNNELS ETC MEASURED ALONG THE UP LINE OF THE TRACK OF SOUTH BOUND LINE/ TUNNEL.
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VERTICAL_ALIGN DN LINE	L=1303.191 m G=-0.000%														
HORIZONTAL_ALIGN	SL1073.469m *														
DIFF. IN ELE. Cut Depth(-)	-26.631	-26.215	-24.453	-24.768	-25.071	-25.399	-25.710	-26.006	-26.459	-26.510	-26.878	-27.093	-27.455	-27.472	-27.920
RAIL LEVELS	16300	16325	16350	16375	16400	16425	16450	16475	16500	16525	16550	16575	16600	16625	16650
GROUND LEVELS	576.63	576.21	574.45	574.76	575.07	575.39	575.71	576.00	576.45	576.51	576.87	577.09	577.45	577.47	578.92
CHAINAGES	16300	16325	16350	16375	16400	16425	16450	16475	16500	16525	16550	16575	16600	16625	16650

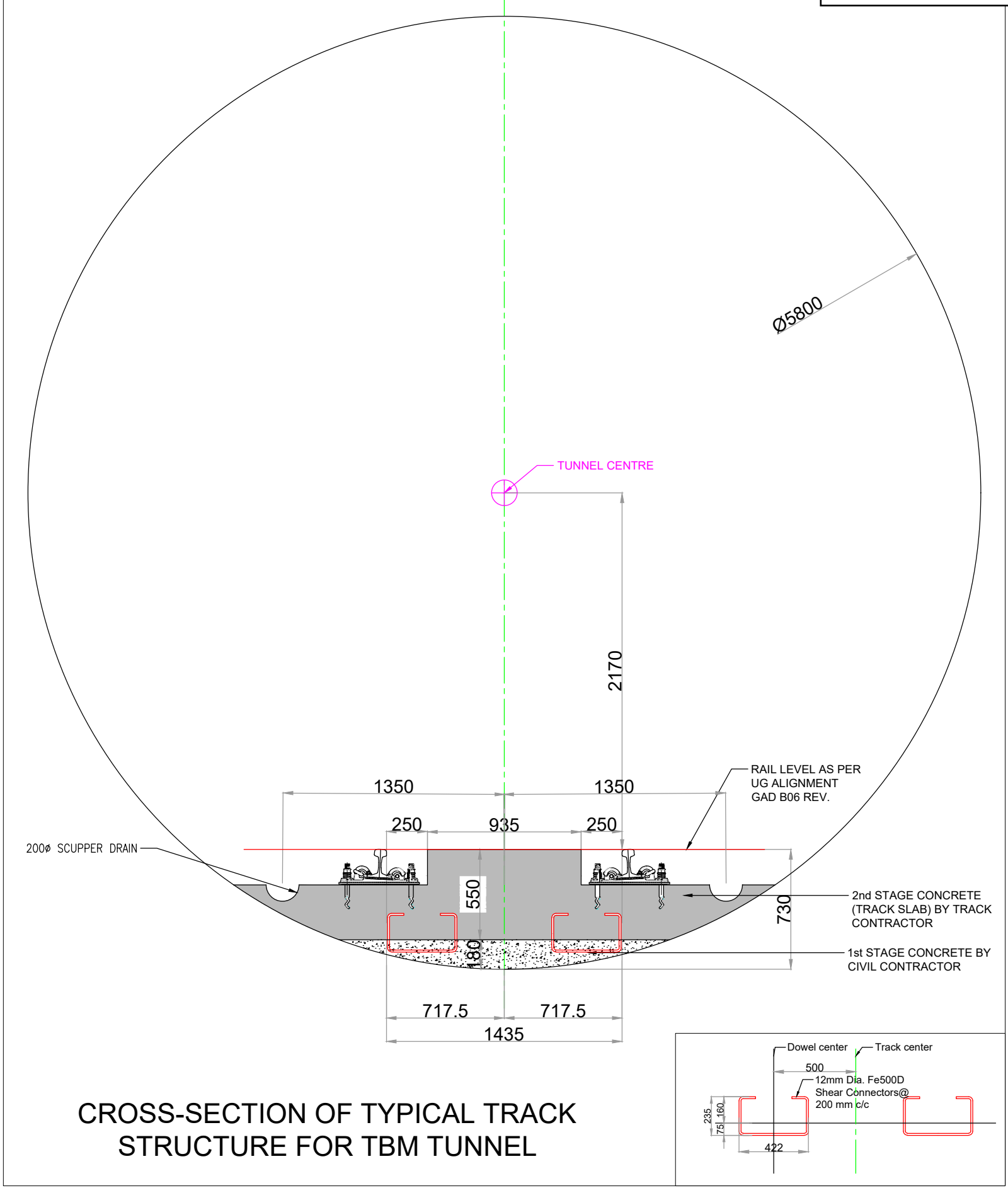
GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT		
	FOR GAD APPROVAL	SIGNATURE
TOPOGRAPHIC SURVEY IS VERIFIED AND FOUND CORRECT. ALIGNMENT SATISFIED CODAL REQUIREMENTS. PIER ARRANGEMENT IS SATISFACTORY. THE GAD IS RECOMMENDED FOR APPROVAL	SURVEY EXPERT	
	CHIEF RESIDENT ENG.	
	ALIGNMENT EXPERT	
	CHIEF STRUCTURAL EXPERT (VIADUCT & DESIGN)	
	CHIEF SIGNALING	
	CHIEF TRACTION	
PMRCL APPROVED	PD/DY. PD	
	ED CIVIL (UNDERGROUND)	
	CPM (REACH-4 UNDERGROUND)	
	GM (DESIGN)	
	AGM (PLG)	
	GM (PLG)	


B07	01.06.2020	1. Curve no.5 R-320 has been changed R-300 to avoid the infringement of pump house between Civil Court & Budhwar path. 2. From Budhwar path to Swargate all chainages has been revised due to modification of alignment.	THE RESPONSIBILITY OF CONTROL, CHECK & VERIFICATION OF ACCURACY, CORRECTNESS, COMPLETENESS, INTEGRATION & FULL COMPLIANCE OF THE CONTRACT PROVISIONS IN RESPECT OF DESIGN, ANALYSIS AND DRAWINGS RESTS WITH THE DETAILED DESIGN CONSULTANT / DETAILED DESIGN CONSULTANT & CONTRACTOR.				THIS DRAWING INCLUDING ITS DESIGN AND DETAILING HAS BEEN PROOF CHECKED INDEPENDENTLY AND FOUND SUITABLE FOR THE EXECUTION PURPOSE AND IS RECOMMENDED FOR GFC / NO OBJECTION.				<input type="checkbox"/> PROOF CHECKED & APPROVED BY GC <input type="checkbox"/> BEING GIVEN NO OBJECTION <input type="checkbox"/> ISSUED AS GOOD FOR CONSTRUCTION.		COUNTER SIGNED BY MAHARASHTRA METRO RAIL CORPORATION LTD.	PROJECT:  PUNE METRO RAIL PROJECT THE ORION BUILDING, 1ST FLOOR, OPPOSITE DON BOSCO CENTER, NEAR SAINT MIRA'S GIRLS COLLEGE, KOREGAON PARK, PUNE - 411001, MH, INDIA													
B06	16.09.2019	1. The following major comments issued vide have been letter no. GLM-TPL-UGC-01-OL-0503 dated: 28.08.2019 have been approved a) Boundary between cut & cover, tbm tunnel marked at ch:10962.500m. (as confirmed by UGC-01 contractor) UGC-01 & 02 contract boundary has been marked. b) Egress shaft, marked at ch:11162, vertical alignment has been revised b/w mandai & swargate station due to cross passages. c) Sump & cross passages have been incorporated as per nrc guidelines. d) Chainage have been updated as per Reach-4 (RDMC - RANGE HILL section) A) Interface chainage has been modified with respectively pmrc to range-hill section. B) Vertical alignment has been revised consideration with cross passages.	DDC		CONTRACTOR		PROOF CONSULTANT		SIGN: DATE: NAME: SHW		SIGN: DATE: NAME: RVS		SIGN: DATE: NAME: RPG			SIGN: DATE: NAME: VLD		DY. HOD	CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.								
B05	14.08.2019	Shivaji nagar station location revised and coordinates updated. A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	DRAWN BY		DESIGN BY		CHECKED BY		APPROVED BY		ACCEPTED BY		REVIEWED BY (STRUCT. ENGG.)			APPROVED BY (TEAM LEADER)		REVIEWED BY		APPROVED BY		HOD	TITLE: GENERAL ARRANGEMENT : PLAN & ELEVATION FOR DN LINE FROM CH. : 16300m TO 16821.530m				
B04	11.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN			SCALE: 1:1		DATE: 02.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:					
B03	07.06.2019	A) Contractor topo graphic survey data updated UGC1 ref. no. GLM-TPL-UGC-01-GC-OL-0341 DATED 29-05-2019 & UGC2 ref. no. GLM-TPL-UGC-02-GC-OL-0341 DATED 29-05-2019 B) Vertical alignment revised b/w egress shaft to Shivaji nagar as per contractor proposal vide letter no. GLM-TPL-UGC-01-GC-OL-0295 DATED 09/05/2019 To avoid private land acquisition, alignment is modified. Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN			SCALE: 1:1		DATE: 02.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:					
B02	17.05.2019	To avoid private land acquisition, alignment is modified.	CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN		SCALE: 1:1		DATE: 02.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:						
B01	13.12.2018	Shivaji nagar station longitudinal shifting 27.90m towards civil court vertical alignment revised at shivaji nagar station.	CONSULTANTS		TCPL-GEO CONSULT-JV		GULERMAK-TPL-JV		XXXX		 SYSTRA-AECOM-EGIS-RITES (GENERAL CONSULTANT TO PUNE METRO RAIL PROJECT)		HIMANSHU GOSWAMI GM/DESIGN		SCALE: 1:1		DATE: 02.06.2020		STATUS: DEFINITIVE DESIGN STAGE		REVISION NO:						
REV NO	DATE	DESCRIPTION	SIGN																								

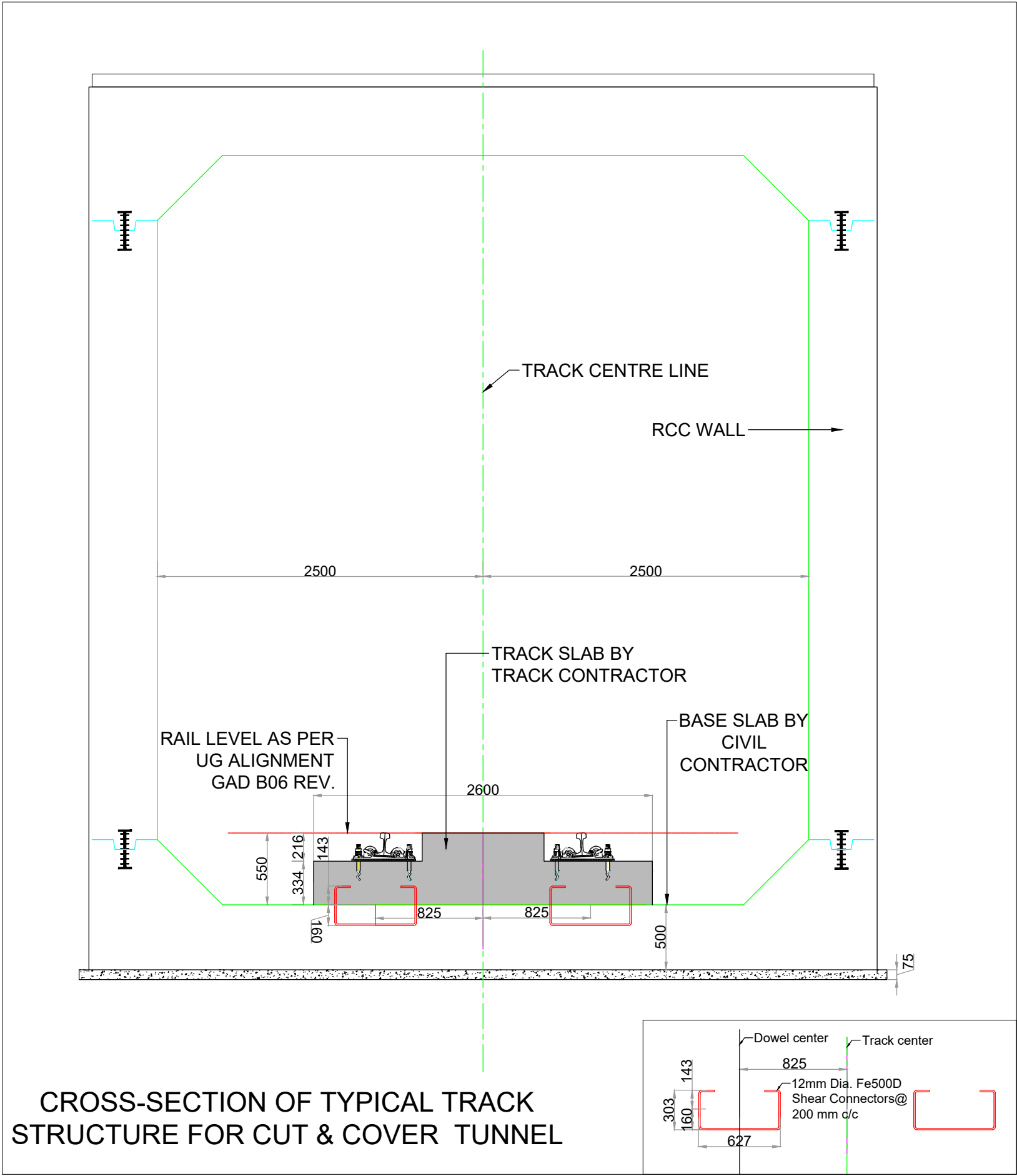
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B07

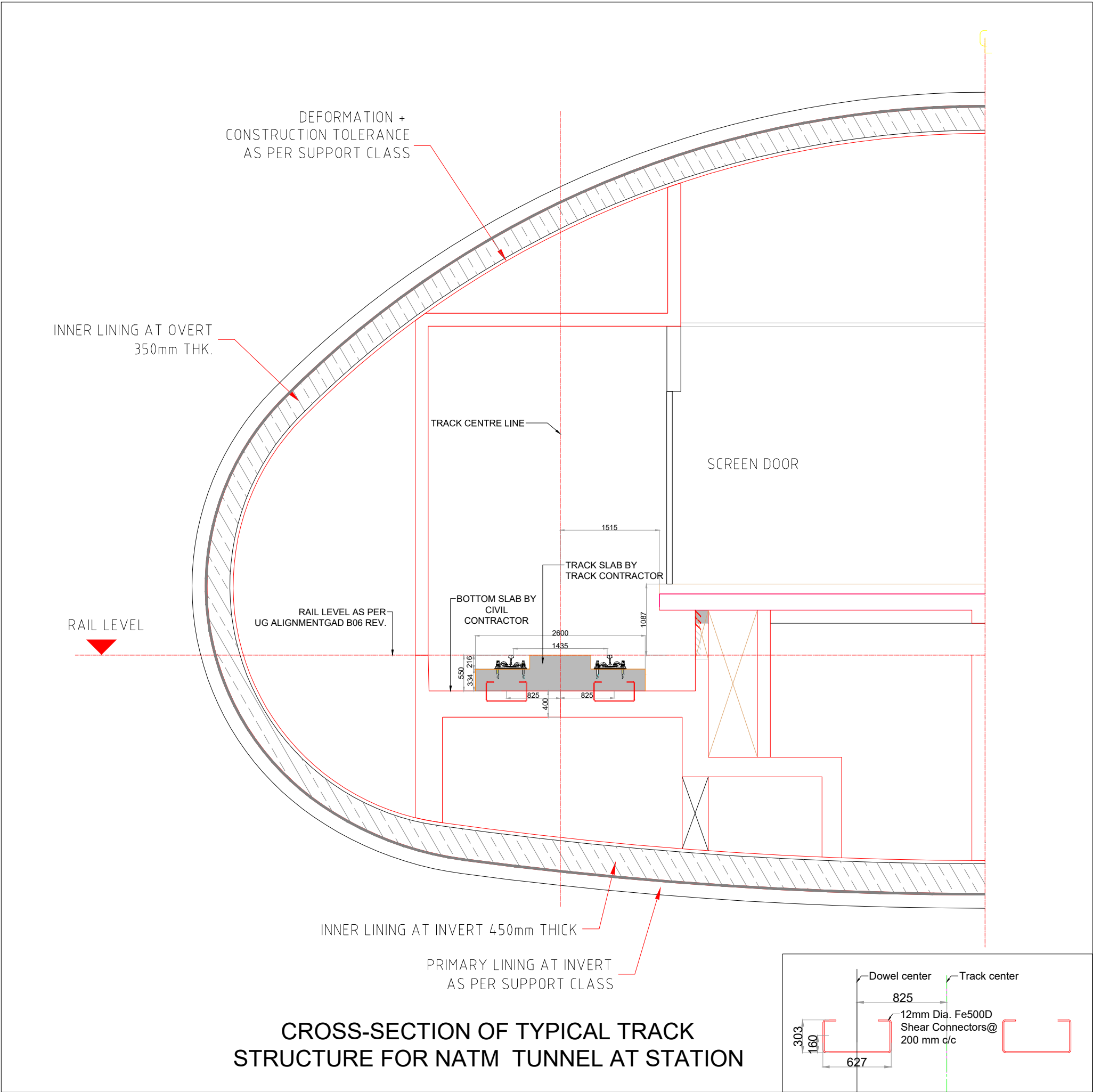


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R0	18.02.2020	-					
REV NO	DATE	DESCRIPTION	SIGN				
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				SCALE: NOT TO SCALE	DATE: 18.02.2020		REVISION NO:
DRAWN BY		REVIEWED BY	APPROVED BY	DRG NO: PMRCL/PUNE/TRACK/UG/PLN/2020/C1			R0

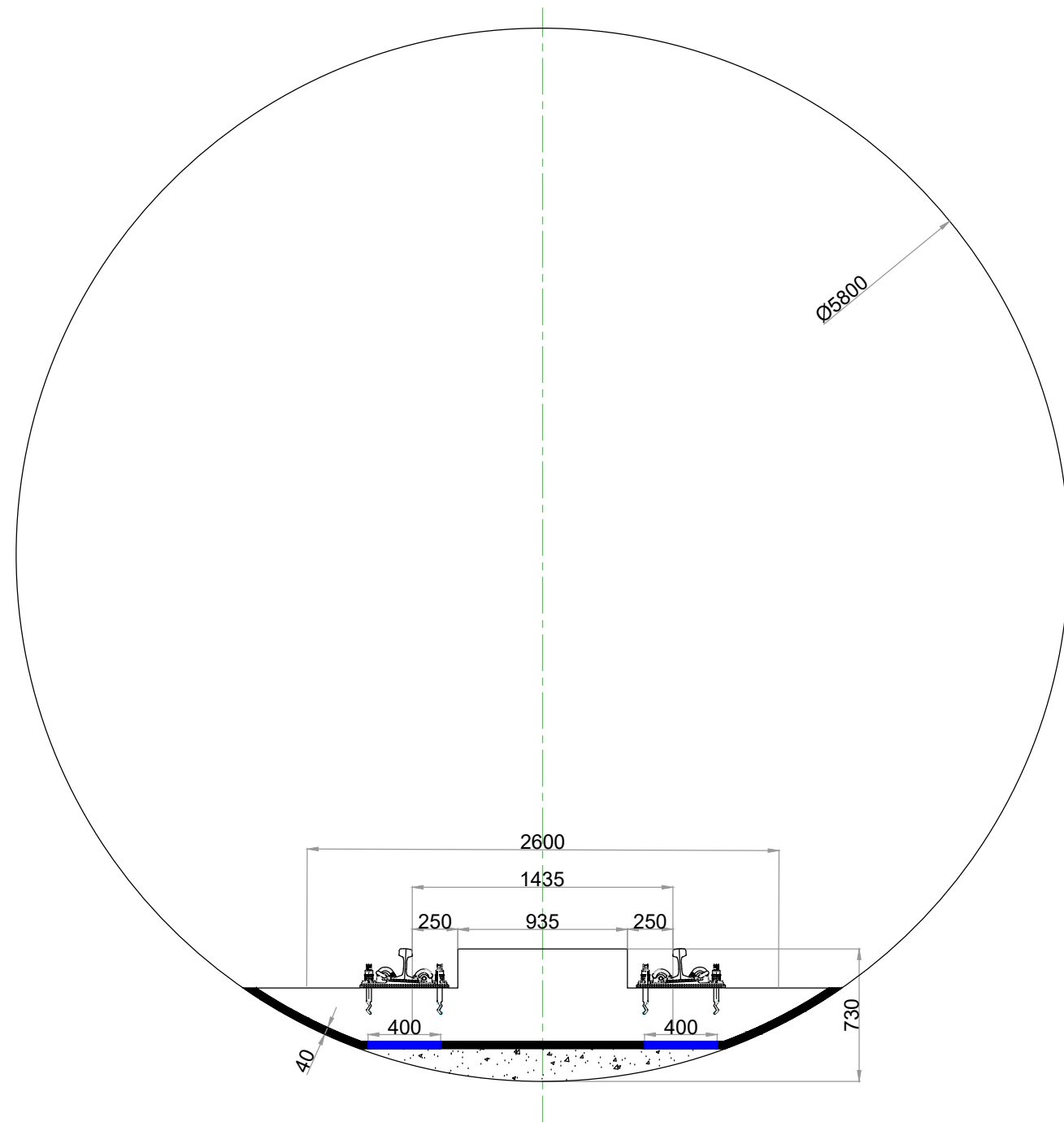


CROSS-SECTION OF TYPICAL TRACK
STRUCTURE FOR CUT & COVER TUNNEL

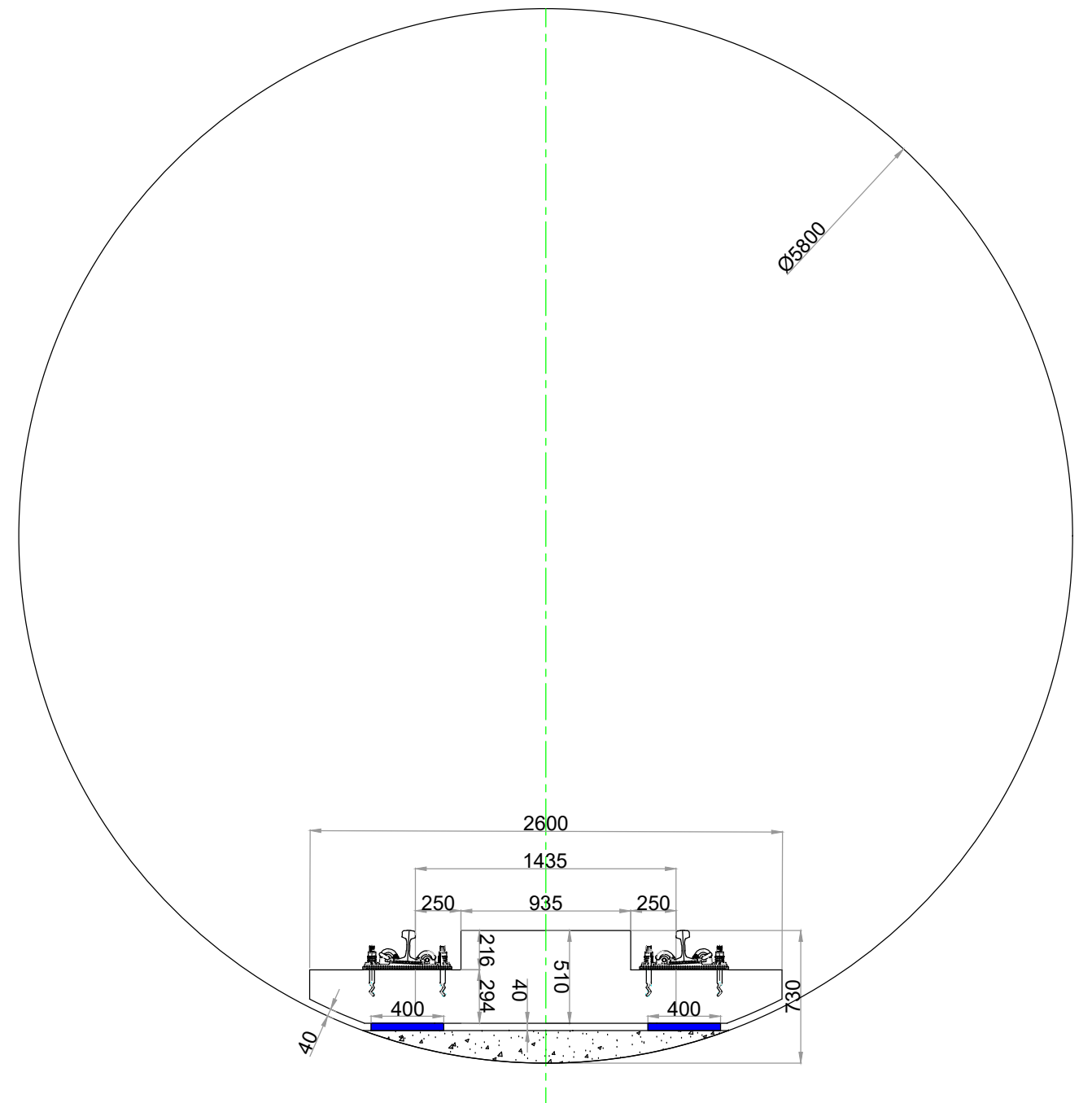
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REV NO	DATE	DESCRIPTION		SIGN					
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				SCALE: NOT TO SCALE					
DRAWN BY		REVIEWED BY	APPROVED BY	DRG NO: PMRP-XXXXX-013					



R018.02.2020-				CLIENT: MAHARASHTRA METRO RAIL CO. LTD.			
REV NO	DATE	DESCRIPTION	SIGN				
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				SCALE: NOT TO SCALE	DATE: 18.02.2020	REVISION NO:	
DRAWN BY		REVIEWED BY		DRG NO: PMRP-XXXXX-014		R0	





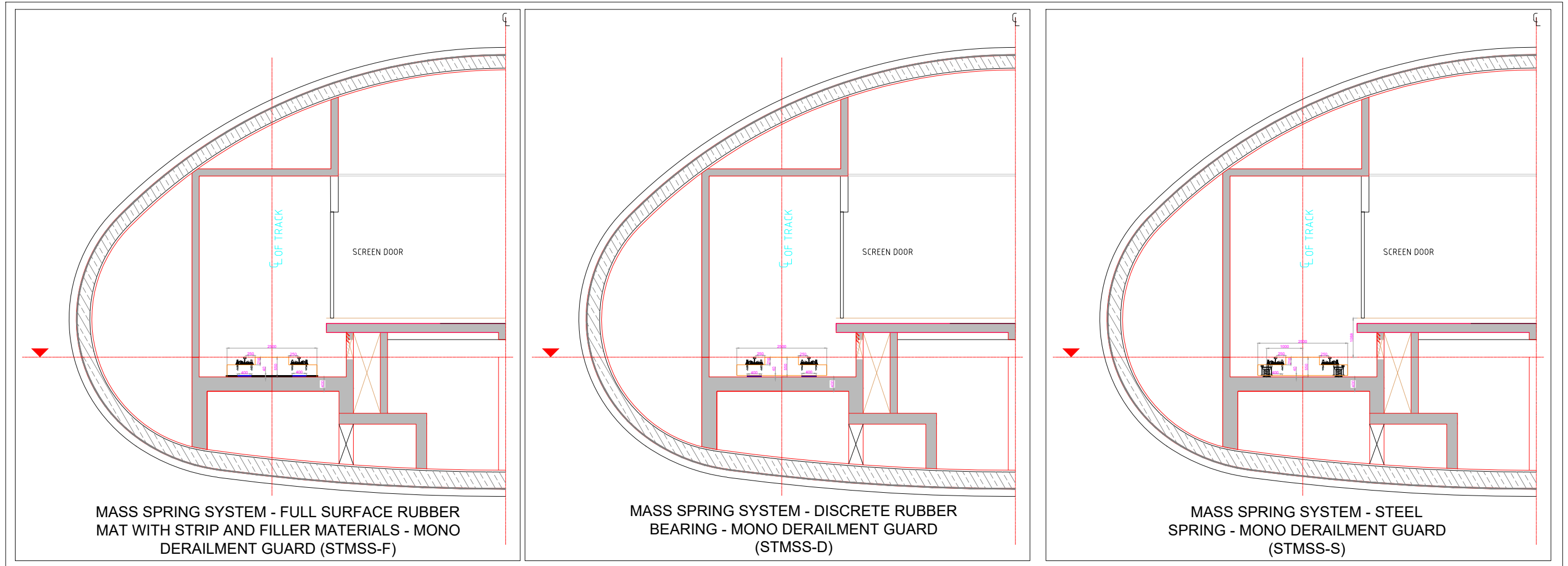
**MASS SPRING SYSTEM - FULL SURFACE RUBBER
MAT WITH STRIP AND FILLER MATERIALS - MONO
DERAILMENT GUARD (STMSS-F)**





**MASS SPRING SYSTEM - DISCRETE
RUBBER BEARING - MONO DERAILMENT
GUARD (STMSS-D)**

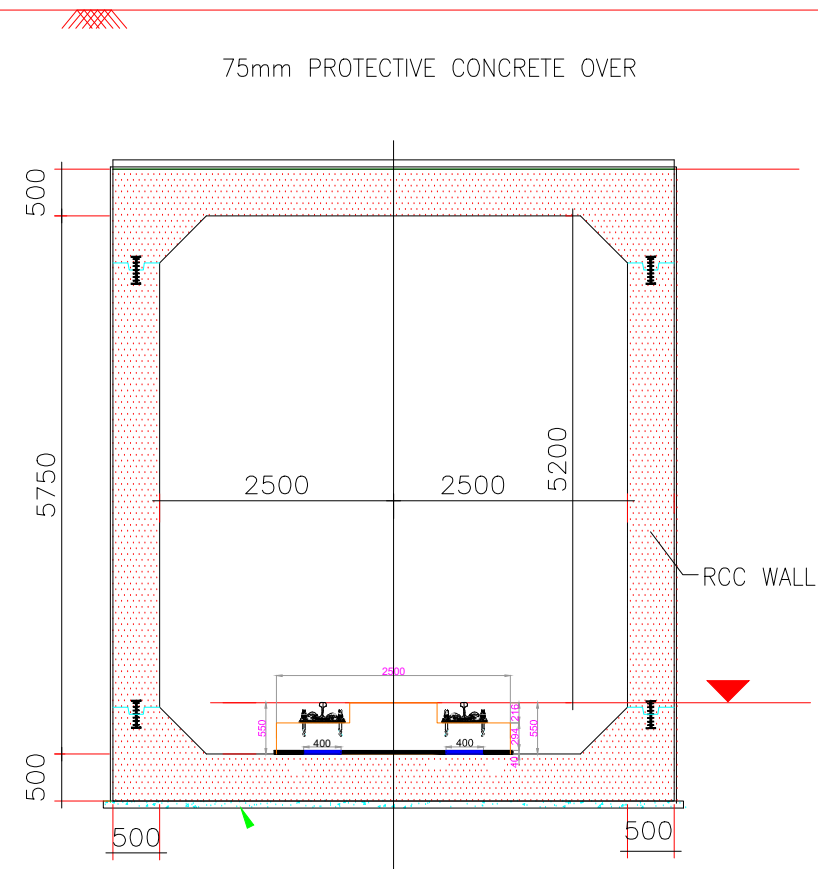
**ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021**

PROJECT:		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div><div><div>PUNE METRO RAIL PROJECT</div><div>The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div></div></div>		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div></div>
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.		
LOCATION:		LOCATION		
TITLE:		MASS SPRING SYSTEM IN CIRCULAR TUNNEL		
SCALE:	DATE:	STATUS:	REVISION NO:	
DRG NO:				

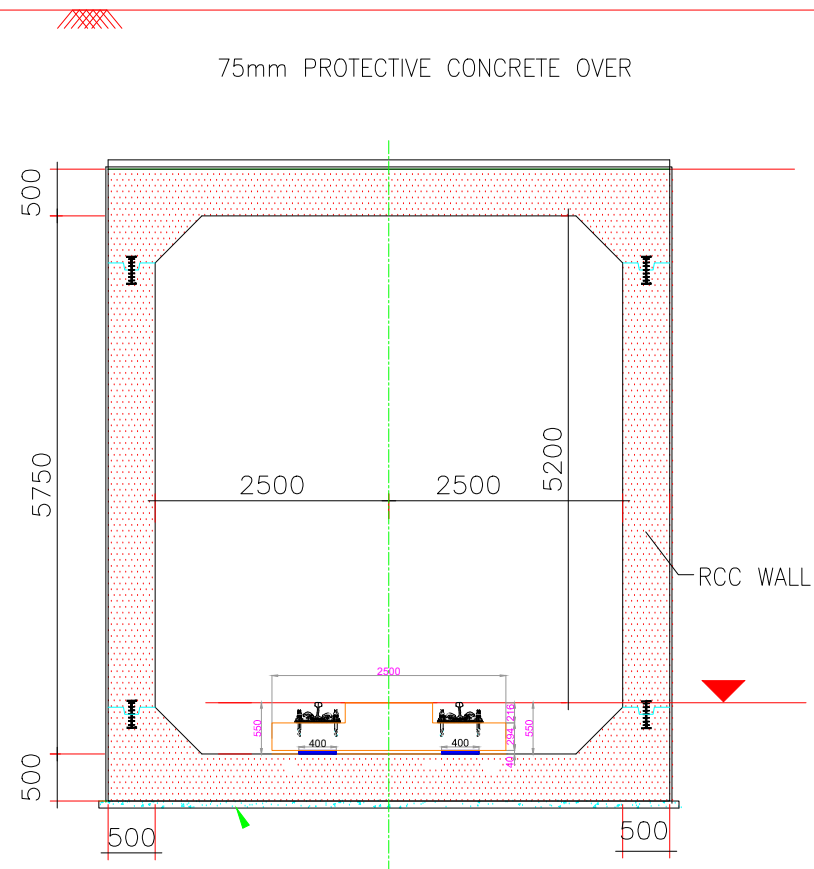


ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

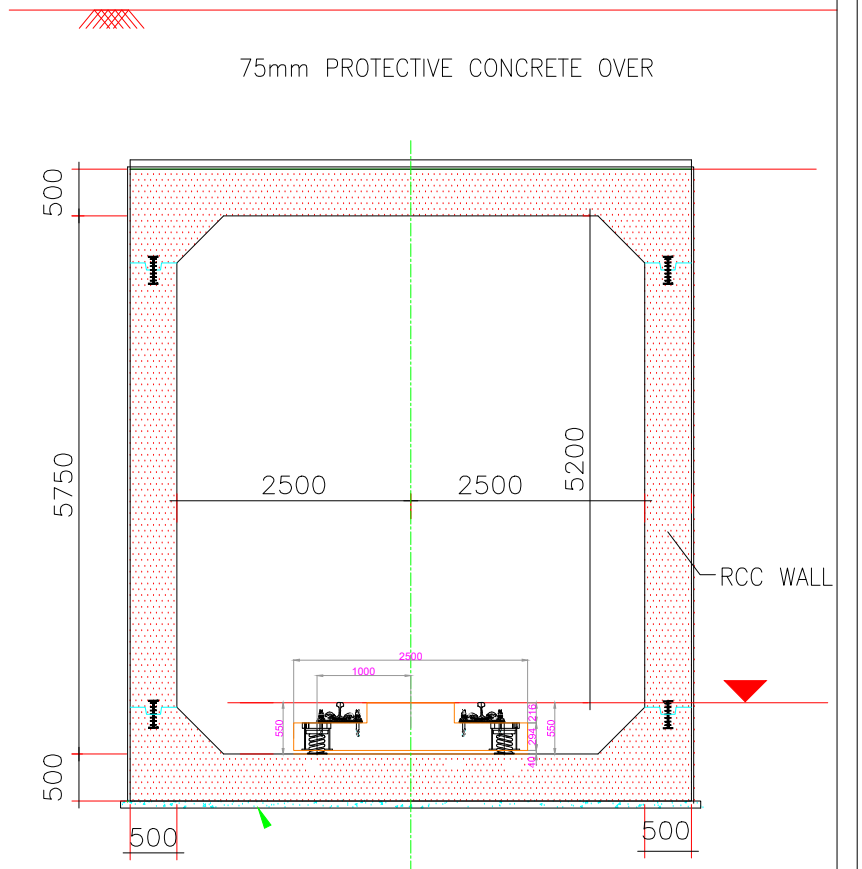
PROJECT:		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div><div><div>PUNE METRO RAIL PROJECT</div><div>The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div></div></div>		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div></div>	
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.			
LOCATION:		LOCATION			
TITLE:		MASS SPRING SYSTEM AT STATION			
SCALE:	DATE:	STATUS:		REVISION NO:	
DRG NO:					



MASS SPRING SYSTEM - FULL SURFACE RUBBER MAT WITH STRIP AND FILLER MATERIALS - MONO DERAILMENT GUARD (STMSS-F)



MASS SPRING SYSTEM - DISCRETE RUBBER BEARING - MONO DERAILMENT GUARD (STMSS-F)



MASS SPRING SYSTEM - STEEL SPRING - MONO DERAILMENT GUARD (STMSS-F)

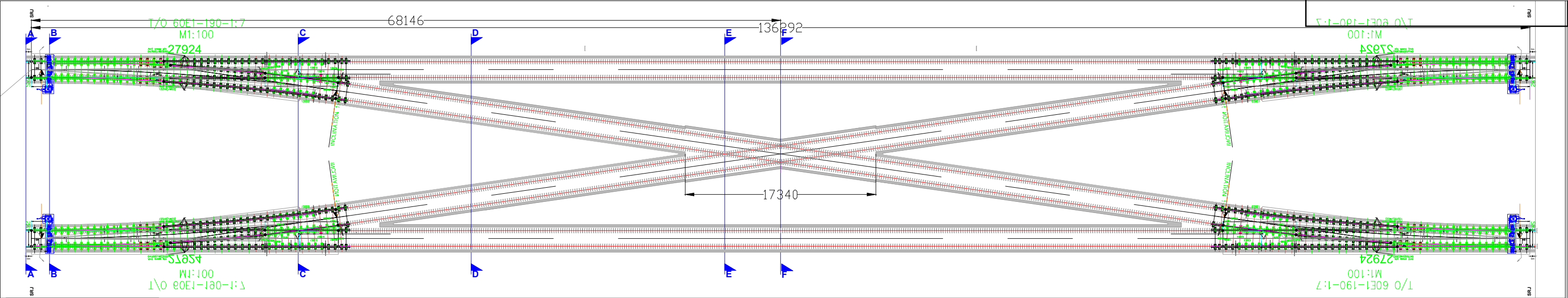
ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

PROJECT:		<div>PUNE METRO RAIL PROJECT</div> <div>The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div>	
<div><div><div><div></div><div></div><div></div><div></div><div></div></div><div>पुणे मेट्रो</div><div>PUNE METRO</div></div></div>			
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.	
LOCATION:		LOCATION	
TITLE:		MASS SPRING SYSTEM IN CUT & COVER SECTION	
SCALE:	DATE:	STATUS:	
DRG NO:			



REVISION NO:

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

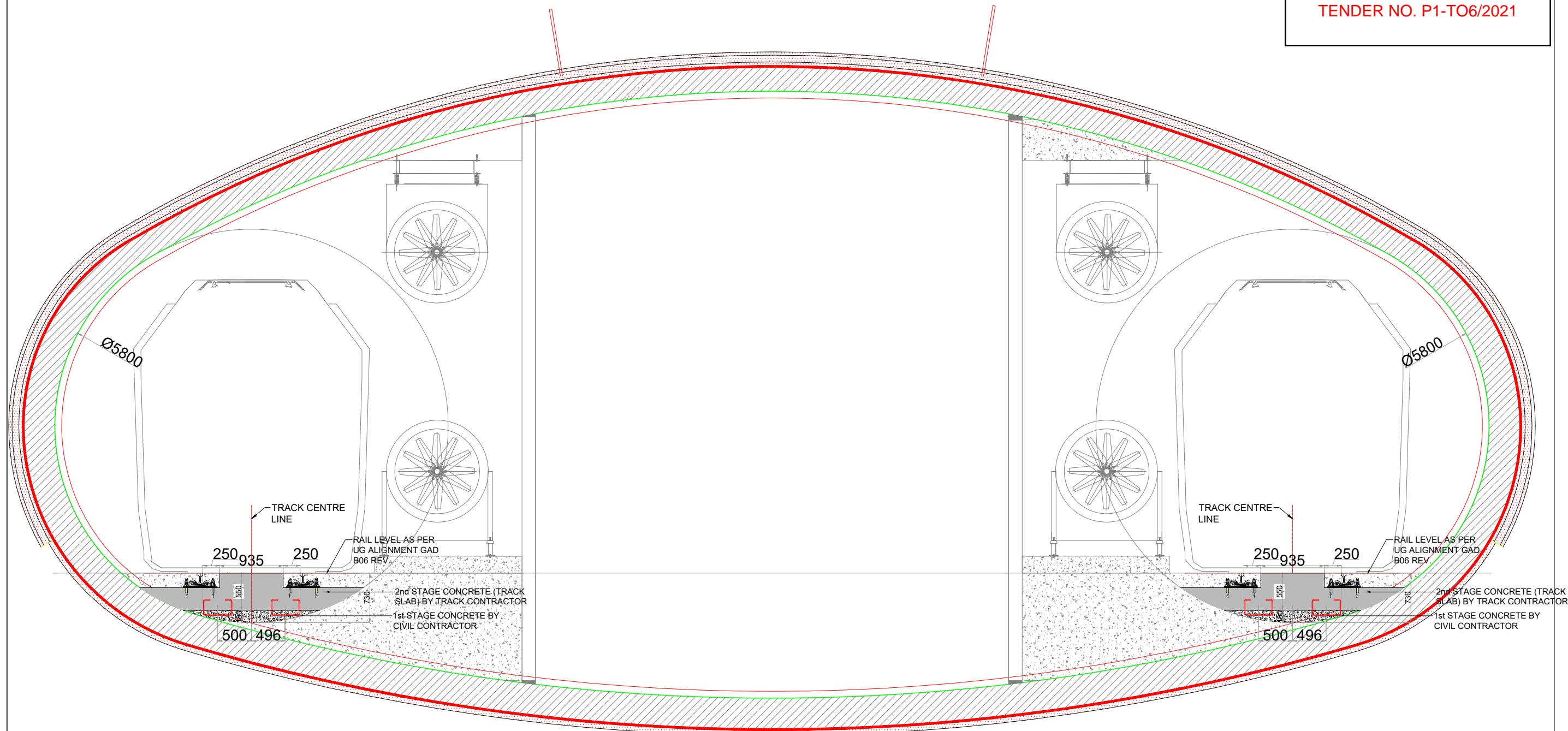


DETAILS OF SCISSOR CROSSOVER AT CIVIL COURT & SWARGATE STATION		
1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

NOTE:
SHEAR CONNECTORS (MS TOR STEEL) OF 12mm DIA. 500D SHALL BE INSTALLED @ 200mm c/c .
PLEASE REFER DRAWINGS FOR VARIOUS SECTIONS (A-A, B-B, C-C, D-D, E-E, F-F) AS SHOWN ABOVE.

1 IN 7 R 190 SCISSOR CROSSOVER FOR UNDERGROUND SECTION (NATM CONSTRUCTION)

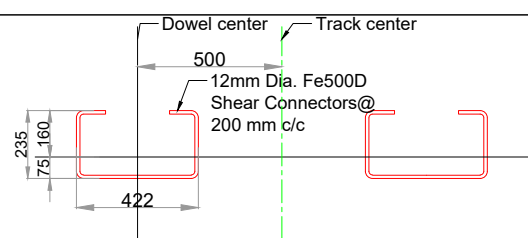
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TENDER NO. P1-TO6/2021



TRACK STRUCTURE FOR CROSS-SECTION A-A FROM DRG.NO. PMRP-016 OF
SCISSOR CROSSOVER IN UNDERGROUND SECTION
(JUNCTION OF CIRCULAR TUNNEL & NATM CONSTRUCTION)

DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

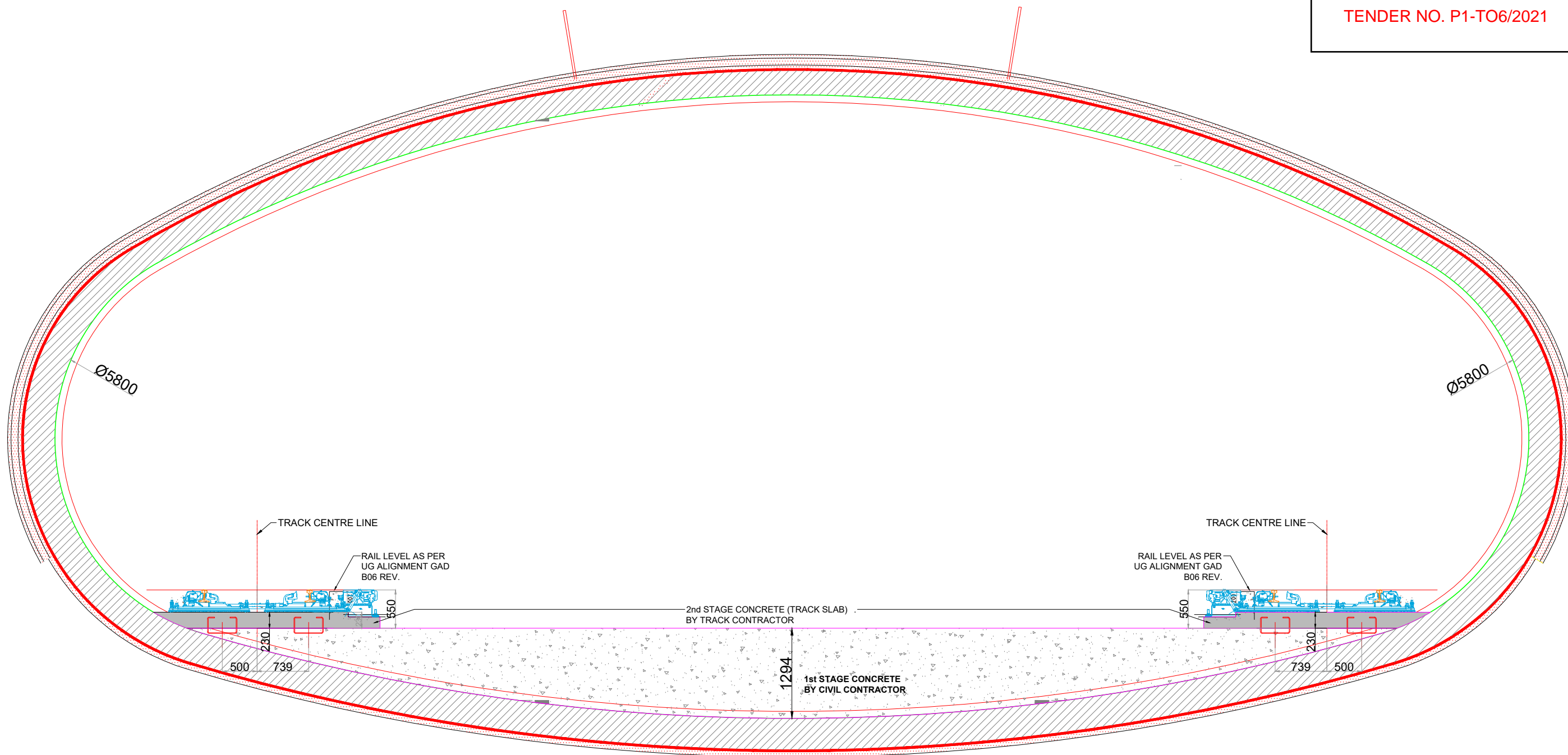
1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m



R0	04.03.2020	-		CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.
REV NO	DATE	DESCRIPTION	SIGN	TITLE: TRACK STRUCTURE FOR CROSS-SECTION A-A OF SCISSOR CROSSOVER IN UNDERGROUND SECTION (JUNCTION OF CIRCULAR TUNNEL & NATM CONSTRUCTION)
				SCALE: NOT TO SCALE DATE: 14.03.2020
				DRG NO: DRAWING NO. PMRP-XXXXX-017
DRAWN BY	REVIEWED BY	APPROVED BY		REVISION NO: R0



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TENDER NO. P1-TO6/2021



TRACK STRUCTURE FOR CROSS-SECTION B-B FROM
DRG.NO. PMRP-016 OF SCISSOR CROSSOVER IN
UNDERGROUND SECTION (NATM CONSTRUCTION)

DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

A METRO RAIL CORPORATION LTD.



REVISION NO:

R0

TITLE: TRACK STRUCTURE FOR CROSS-SECTION B-B OF
SCISSOR CROSSOVER IN UNDERGROUND SECTION
(NATM CONSTRUCTION)

SCALE: NOT TO SCALE DATE: 14.03.2020

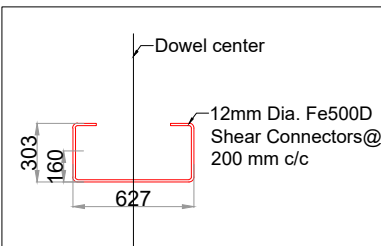
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REV NO	DATE	DESCRIPTION	SIGN

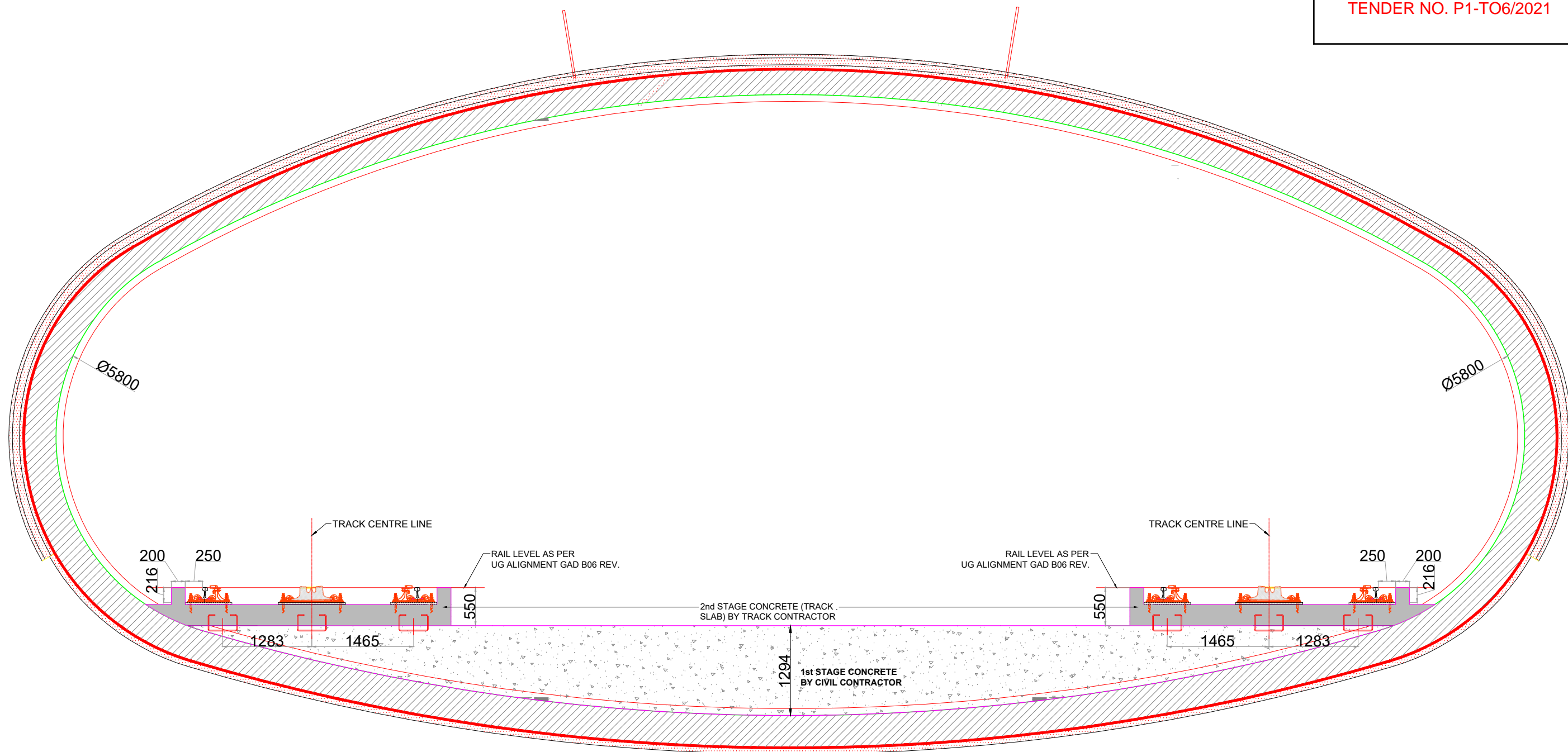
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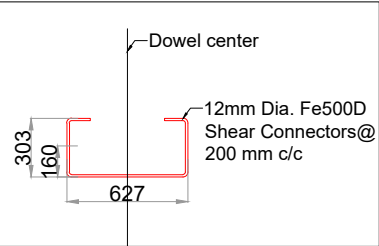
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TRACK STRUCTURE FOR CROSS-SECTION C-C FROM
DRG.NO. PMRP-016 OF SCISSOR CROSSOVER IN
UNDERGROUND SECTION (NATM CONSTRUCTION)


DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

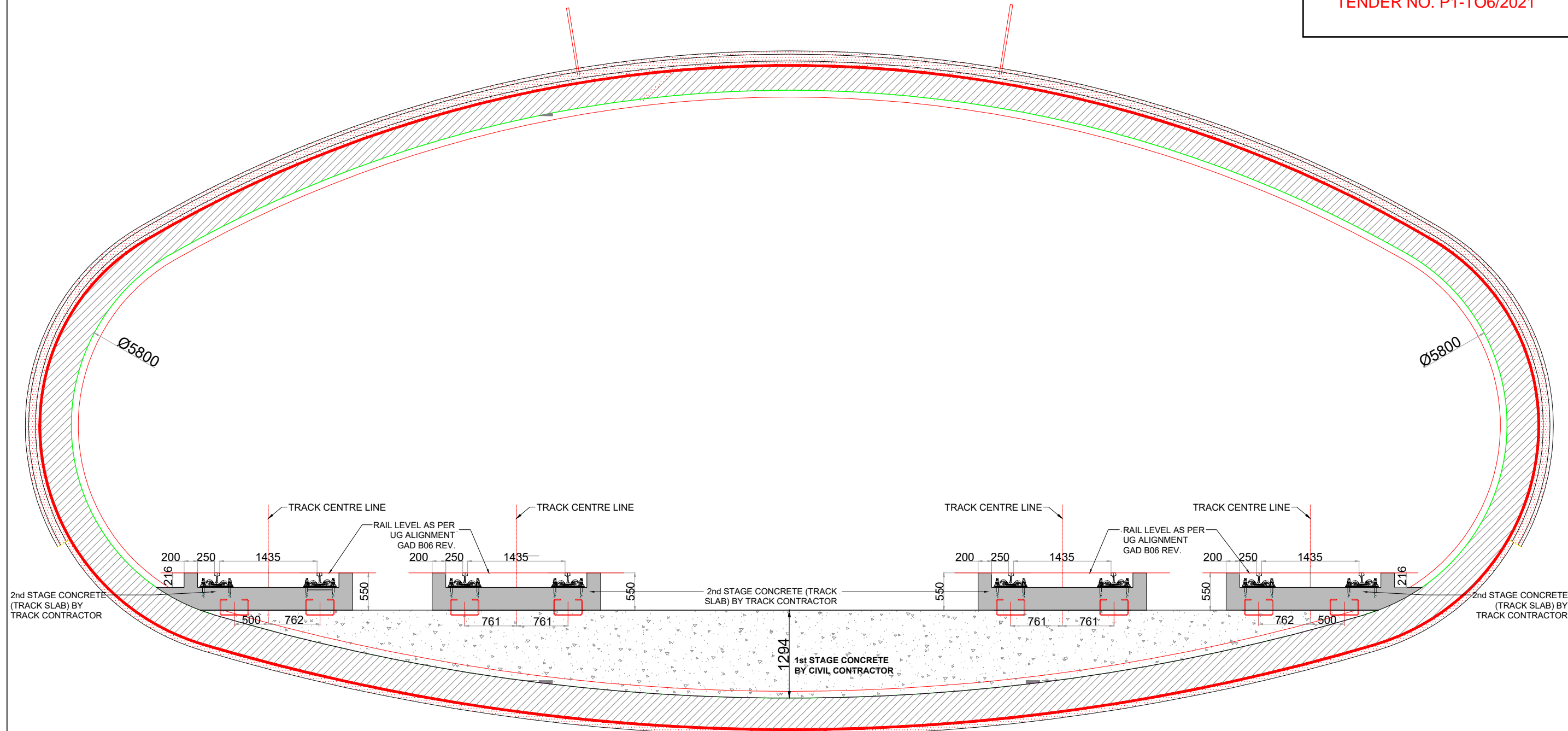


R0	04.03.2020	-	
REV NO	DATE	DESCRIPTION	SIGN
DRAWN BY	REVIEWED BY	APPROVED BY	

CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.			
TITLE: TRACK STRUCTURE FOR CROSS-SECTION C-C OF SCISSOR CROSSOVER IN UNDERGROUND SECTION (NATM CONSTRUCTION)			
SCALE:	NOT TO SCALE	DATE:	14.03.2020
DRG NO:	DRAWING NO. PMRP-XXXXX-019		

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TRACK STRUCTURE FOR CROSS-SECTION D-D FROM
DRG.NO. PMRP-016 OF SCISSOR CROSSOVER IN
UNDERGROUND SECTION (NATM CONSTRUCTION)

DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

METRO RAIL CORPORATION LTD.

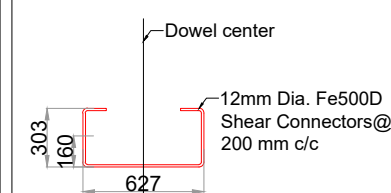


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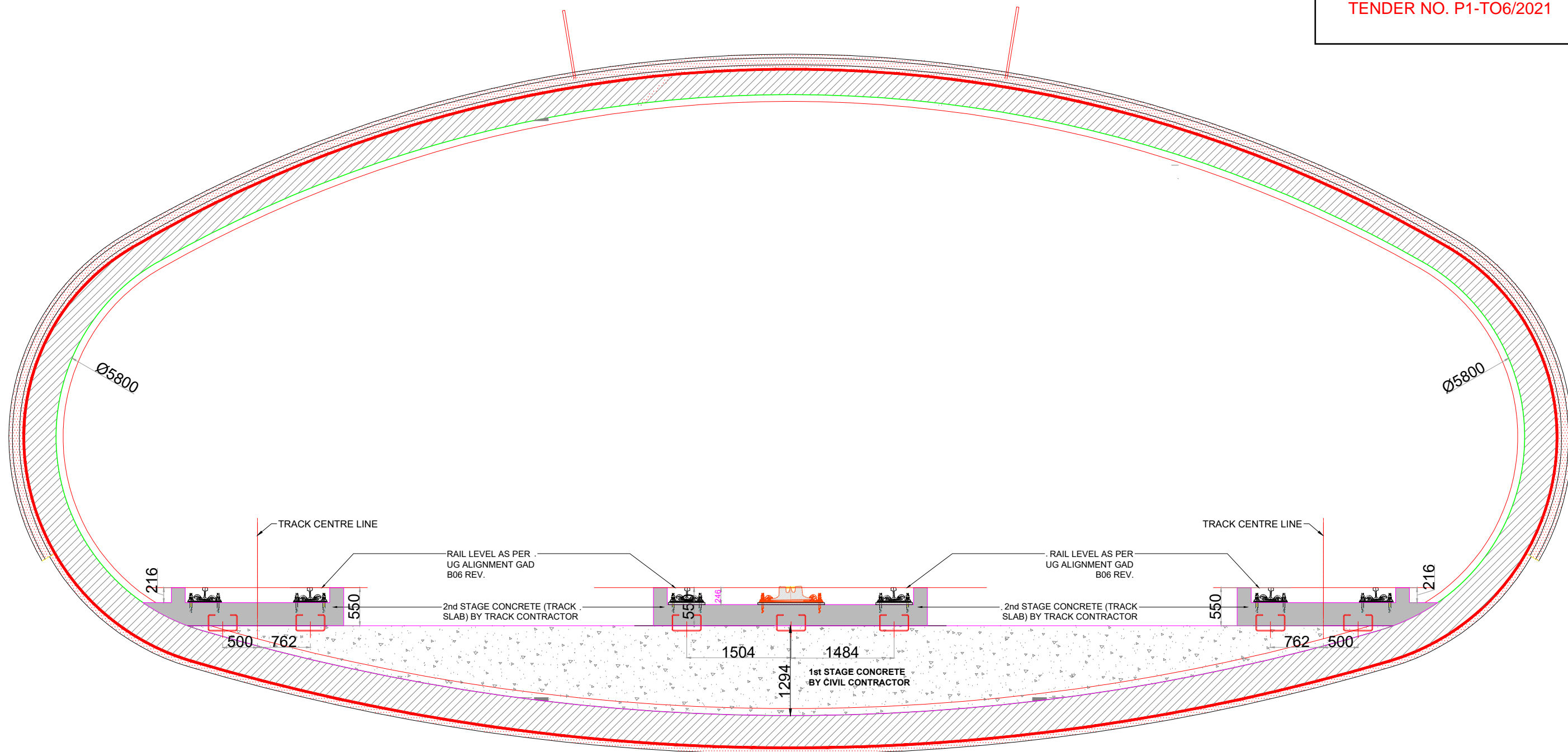
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REV NO	DATE	DESCRIPTION	SIGN
DRAWN BY	REVIEWED BY	APPROVED BY	

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SCALE:	NOT TO SCALE
DATE:	14.03.2020
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TRACK STRUCTURE FOR CROSS-SECTION E-E FROM
DRG.NO. PMRP-016 OF SCISSOR CROSSOVER IN
UNDERGROUND SECTION (NATM CONSTRUCTION)

DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

BY METRO RAIL CORPORATION LTD.



REVISION NO:

R0

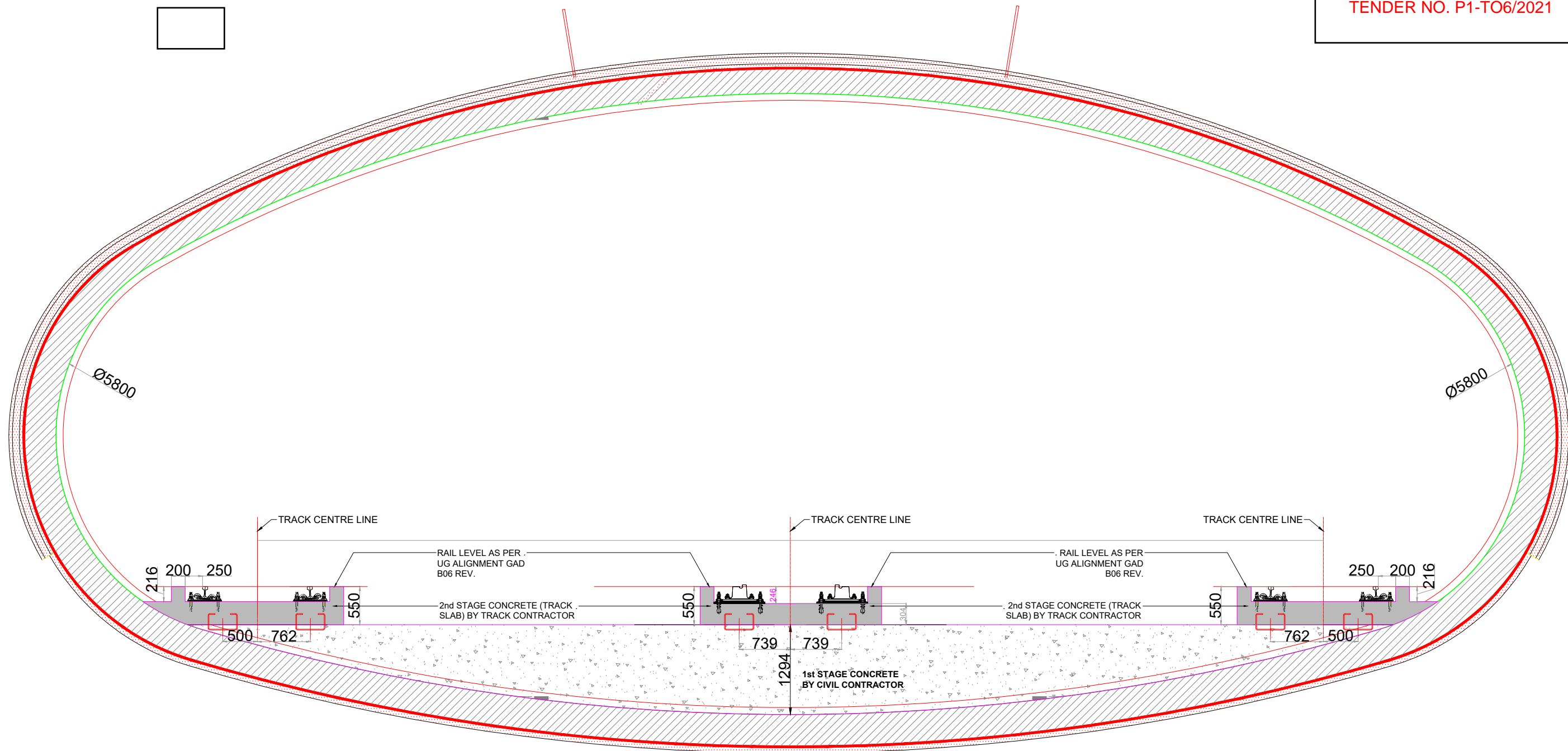
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(NATM CONSTRUCTION)

SCALE: NOT TO SCALE DATE: 14.03.2020

DRG NO: DRAWING NO. PMRP-XXXXX-021

REV NO	DATE	DESCRIPTION	SIGN

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TRACK STRUCTURE FOR CROSS-SECTION F-F FROM
DRG.NO. PMRP-016 OF SCISSOR CROSSOVER IN
UNDERGROUND SECTION (NATM CONSTRUCTION)

DETAILS OF SCISSOR CROSSOVER AT
CIVIL COURT & SWARGATE STATION

1.	TYPE	1 IN 7 R190
2.	TOTAL LENGTH (SRJ TO SRJ)	136.292 m

A METRO RAIL CORPORATION LTD.

FOR CROSS-SECTION F-F OF
SCISSOR CROSSOVER IN UNDERGROUND SECTION
(NATM CONSTRUCTION)



REVISION NO:

R0

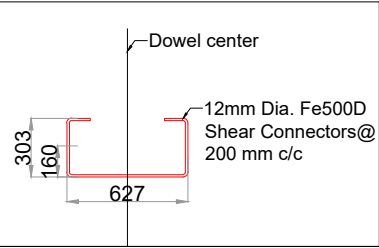
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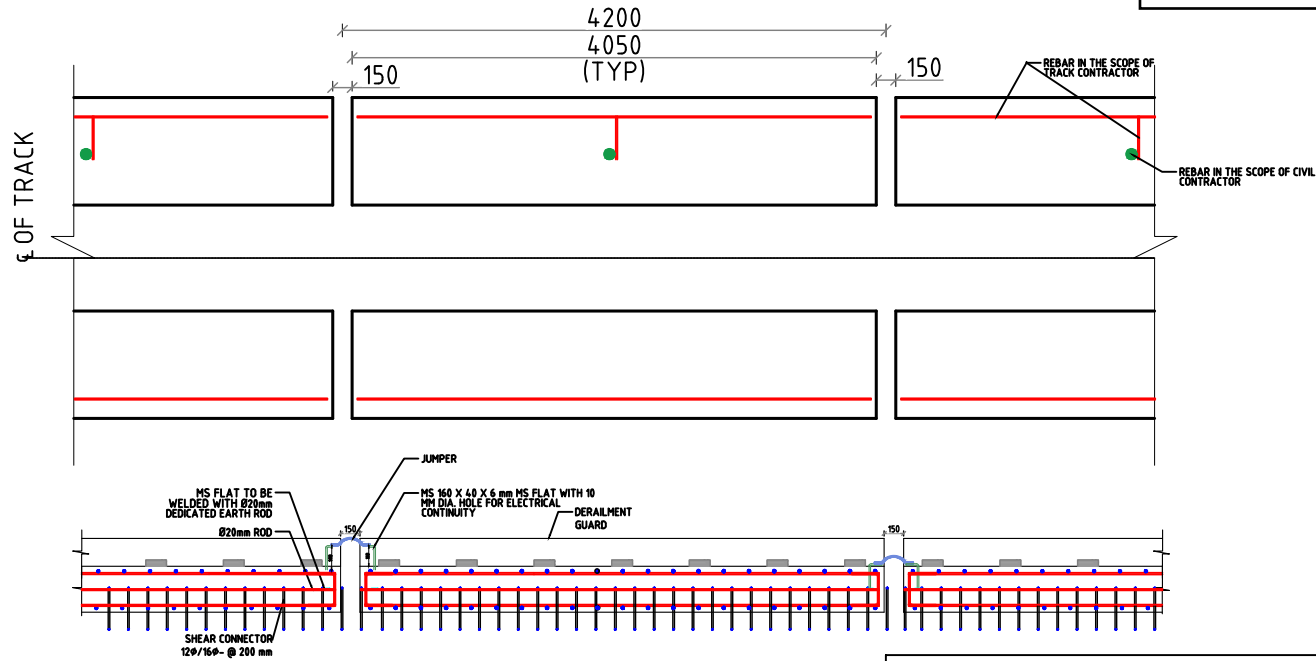
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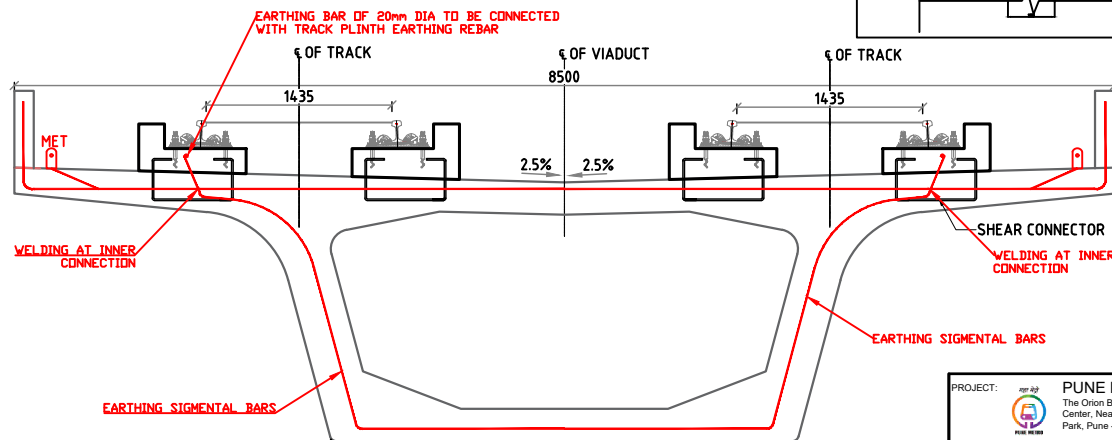
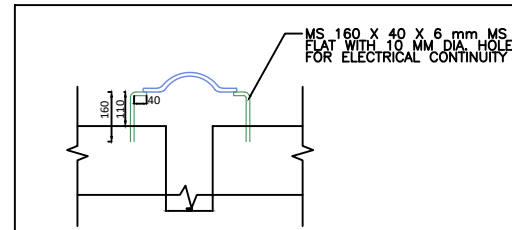


EARTHING ARRANGEMENT FOR BALLASTLESS TRACK

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



TYPICAL LONGITUDINAL REINFORCEMENT DETAILS
SECTION A-A
SCALE - 1:20

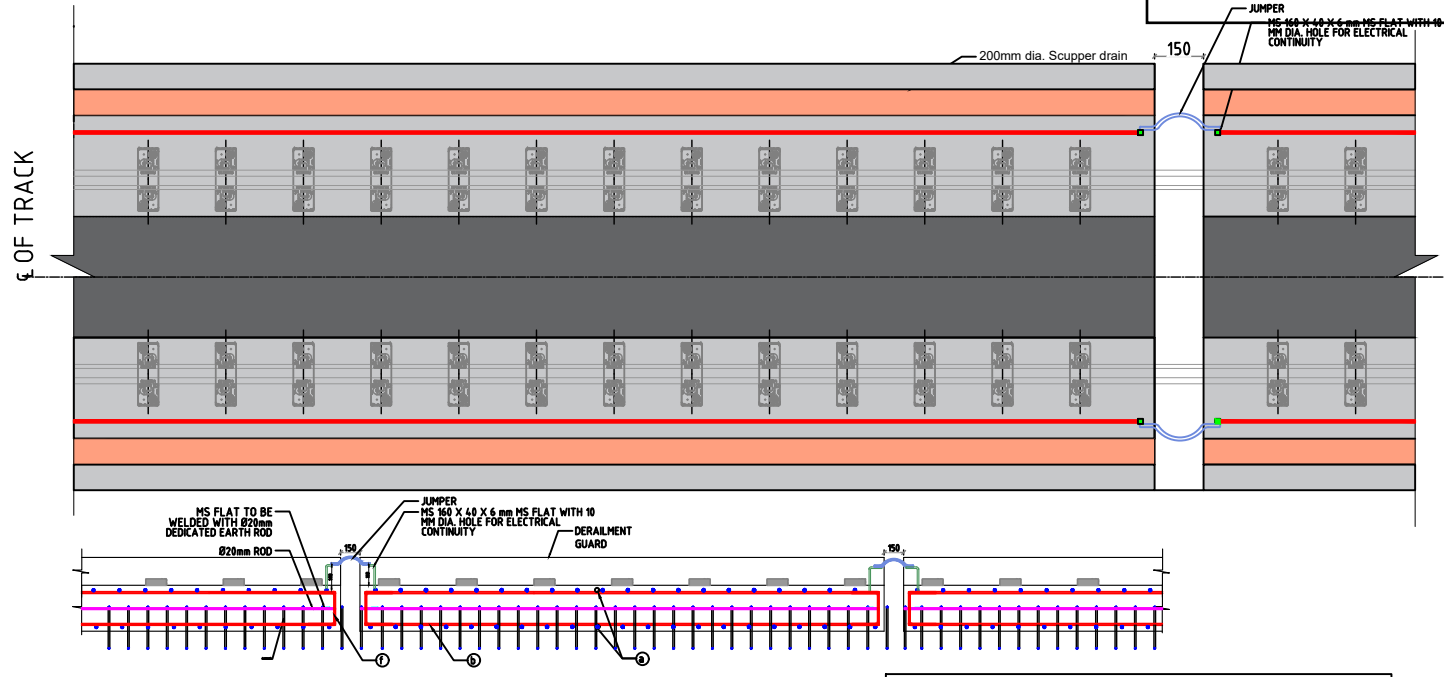


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SCALE(1:25)

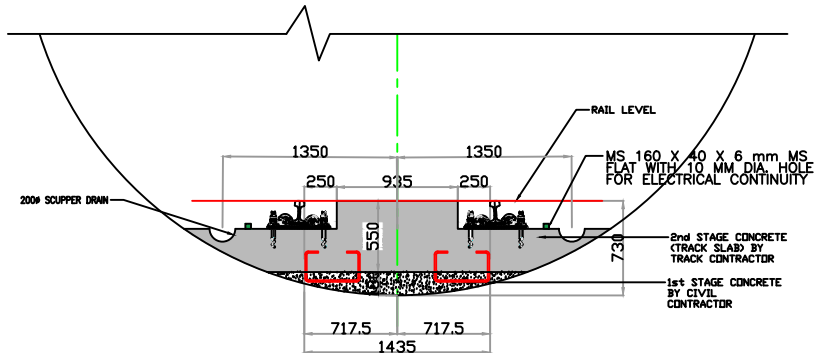
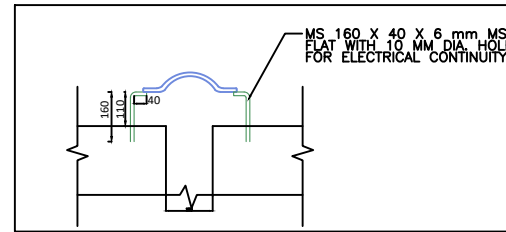
PROJECT:		PUNE METRO RAIL PROJECT	
		The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India	
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.	
LOCATION:		LOCATION	
TITLE:		EARTHING ARRANGEMENT FOR BALLASTLESS TRACK	
SCALE:	DATE:	STATUS:	REVISION NO:
DRG NO:			

EARTHING ARRANGEMENT FOR BALLASTLESS TRACK

ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021



TYPICAL LONGITUDINAL REINFORCEMENT DETAILS
SECTION A-A
SCALE - 1:20



CROSS-SECTION OF TYPICAL TRACK
STRUCTURE FOR TBM TUNNEL

PROJECT:	PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India		
CLIENT:	MAHARASHTRA METRO RAIL CORPORATION LTD.		
LOCATION:	LOCATION		
TITLE:	EARTHING ARRANGEMENT FOR BALLASTLESS TRACK		
SCALE:	DATE:	STATUS:	REVISION NO:
DRG NO:			



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

2019/Proj./PUNE/SoD/30/03

New Delhi, dated 19.11.2020

Managing Director,
Maharashtra Metro Rail Corporation Limited,
(Maha-Metro), Metro House, 28/2,
C.K Naidu Marg, Anand Nagar, Civil Lines,
Nagpur, Maharashtra -440001

Sub:- Advance Correction Slip to the Schedule of Dimensions (SoD) for Standard Gauge (1435mm), 25kV AC OHE Traction (2900mm Wide Rolling Stock), for Elevated, AT-Grade and Underground Section (Version: D - July, 2019) for Pune Metro Rail Project of Maharashtra Metro Rail Corporation Limited (Maha-Metro).

Ref:-(i) Board's letter of even number dated 26.08.2019

(ii) Maha-Metro Pune's letter No. Maha-Metro/Pune/PL/SoD/2020/P-1559 dated 03.11.2020

Ministry of Railways (Railway Board) has decided that corrections/deletion as indicated in the enclosed Advance Correction Slip No. 01 dated 19.11.2020 to the Schedule of Dimensions (SoD) for Standard Gauge (1435mm), 25kV AC OHE Traction (2900mm Wide Rolling Stock), for Elevated, AT-Grade and Underground Section (Version: D - July, 2019) for Pune Metro Rail Project of Maharashtra Metro Rail Corporation Limited (Maha-Metro), be made.

Receipt of this letter may please be acknowledged.

19/11/2020
(D.K Mishra)
Director/MTP
Railway Board
☎ 011-47845480

Copy to:

1. **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow w.r.t RDSO's letter No. UTHS/108/Pune Metro/Civil dated 03.11.2020
2. **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhawan, New Delhi-11000

ADVANCE CORRECTION SLIP TO THE SCHEDULE OF DIMENSIONS (SOD) FOR STANDARD GAUGE (1435MM), 25KV AC OHE TRACTION (2900MM WIDE ROLLING STOCK), FOR ELEVATED, AT-GRADE AND UNDERGROUND SECTION (VERSION: D - JULY, 2019) FOR PUNE METRO RAIL PROJECT OF MAHARASHTRA METRO RAIL CORPORATION LIMITED (MAHA-METRO)

ADVANCE CORRECTION SLIP NO. 01 DATED 19.11.2020

Para	Clause	Existing Clause	Existing Value	New/Modified Clause	Modified Value
2.2.4	(iii)	Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping if platform screen door is provided	2000 mm	(iii) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping if platform screen door is provided	2500 mm
	(iv)	Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping if platform screen door is provided	2500 mm	(iv) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping if platform screen door is provided.	3000 mm

Deletion of the following sentence of Para 2.2.4:-

"For (iii) and (iv) above: Supporting columns for station structure may be provided along alignment of Platform screen doors and coping stones. In this case a minimum clearance of 2000 will be maintained between inner face of columns and continuous structures on Platforms".



**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)**

2019/Proj./PUNE/SoD/30/03

New Delhi, dated 26.08.2019

Managing Director,
Maharashtra Metro Rail Corporation Limited,
(Maha-Metro), The Orion Building, 01st Floor,
Opposite Don Bosco Center,
Near Saint Mira's Girls College,
Koregaon Park, Pune-411001
(Maharashtra)

**Sub: Approval of Schedule of Dimensions (SoD) for Pune Metro Rail
Project of Maharashtra Metro Rail Corporation Limited (Maha-Metro).**

Ref: Pune Metro's letter No. Maha-Metro/Pune/PL/SOD/2019/1126 dated 08.07.2019

The Schedule of Dimensions (SoD) for Standard Gauge (1435mm), 25kV AC OHE Traction (2900mm Wide Rolling Stock), for Elevated, AT-Grade and Underground Section (Version: D - July, 2019) for Pune Metro Rail Project of Maharashtra Metro Rail Corporation Limited (Maha-Metro) has been examined in consultation with RDSO and approval of Railway Board is hereby conveyed.

Accordingly, approved copy of SoD is enclosed.

Encl: As above

26/08/19
(D.K Mishra)
Director/MTP
Railway Board
☎ 011 -47845480

Copy to: (i) **Executive Director/UTHS**, RDSO, Manak Nagar, Lucknow w.r.t letter No. UTHS/108/Pune Metro/Civil dated 09.08.2019

(ii) **OSD/UT & Ex-Officio Joint Secretary**, Ministry of Housing & Urban Affairs (MoHUA), Nirman Bhavan, New Delhi-110001

MAHA METRO



MAHARASHTRA METRO RAIL CORPORATION LIMITED

(A JOINT VENTURE OF GOVT. OF INDIA & GOVT. OF MAHARASHTRA)

Pune Metro Rail Project

SCHEDULE OF DIMENSIONS FOR

STANDARD GAUGE
(1435 mm)

(25 kV AC OHE TRACTION)

(FOR 2900 mm WIDE ROLLING STOCK)

(ELEVATED, AT-GRADE & UNDERGROUND SECTION)

Examined & Found in Order
Date

Auth. Sign. : ADE/Civil/UTHS/RDSO

Version: D - July 2019

MAHARASHTRA METRO RAIL CORPORATION LIMITED

The Orion Building, 1st Floor, 5, Koregaon Road,
Pune - 411001



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July 2019

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SCHEDULE OF DIMENSIONS

STANDARD GAUGE (1435 mm)

PREAMBLE

Pune Metro rail has adopted Standard Gauge with 25 kV AC OHE Traction System. The Schedule of Dimensions has been prepared based on following factors: -

1. The Kinematic Envelope and other infringements have been calculated for 2900 mm wide and 4048mm high (pantograph in locked down position) rolling stock, based on the Kinematic Envelope calculations. The track and vehicle maintenance shall conform to the clearances indicated therein, during the period these Rolling Stocks are in operation.
2. Track shall be maintained to the tolerances taken for calculation of Kinematic Envelope.
3. The clearances are based on assumption that windows are sealed, and all doors are closed during movement / operation.
4. The Structure Gauge indicated in the SoD shall not be violated under any circumstances except for platform coping, Platform Screen Door, track access gate, platform screen doors and hand railing in back-of-house of platform edge.
5. The Kinematic Envelope(s) indicated in the SoD shall not be violated under any circumstances.
6. The Vehicle Kinematic Envelope for 70 Kmph shall be applied only within the confines of stations. At all other locations, the Kinematic Envelope corresponding to 90 kmph vehicle speed with 100 kmph side wind speed shall be used for determining the Structure Gauge and Electrical clearances. When side wind speed exceeds 100kmph, train movement shall be halted, preferably at platform. Stationary trains shall not be started until the wind speed reduces consistently below 100kmph.
7. The maximum speed for passenger operation shall be 80 kmph.
8. Maximum operating speed through platform shall be 50 kmph and Kinematic Envelope will not be infringed under any circumstances.
9. This SoD is applicable for ballasted/ballastless track on mainline and ballasted/ballastless track in Depots.
10. For evacuation of passengers, in case of emergency, including in cases of derailment of the end coaches, emergency doors provided at both ends (front & rear) of the train shall be used for evacuation. The emergency doors will open and rest between or onto the track-plinth and the space available between the track-plinths shall be used as walkway. The evacuation will be done under the supervision of train operator and/or station staff.
11. No workman/equipment/structure is allowed between vehicle and structure gauge during operation/movement of train.

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Pune Metro Rail Project
Pune Metro Rail Project

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July 2019

INTRODUCTION

The dimensions given in this Schedule of Dimensions are to be observed in all works on 1435 mm gauge (STANDARD GAUGE), unless prior sanction has been obtained from the Railway Board through the Commissioner of Metro Railway Safety/Chief Commissioner of Railway Safety (as per applicability) to execute works which infringe this Schedule of Dimensions.

This Schedule of Dimensions is applicable to Elevated, At-Grade and Underground sections of Pune Metro Rail, which shall be with 25 kV AC Traction system and Over Head current collection. The Rolling Stock shall be 2900 mm wide and 4048 mm high (maximum with pantograph in locked down condition or without pantograph) with sealed windows and doors closed while in motion.

Elevated Systems shall be with suitable over ground structure such as Viaduct. Elevated section shall have suitably designed Ballastless (DFF) Track. The Underground System maybe with a circular tunnel or Rectangular box or of any other suitable shall have suitably designed Ballastless (DFF) Track. The At-Grade system and the Depot area may have either Ballasted Track or Ballastless Track.

The Schedule of Dimensions (SoD) has been divided into five chapters as under

Chapter-I	-----	General
Chapter-II	-----	Stations
Chapter-III	-----	Rolling Stock
Chapter-IV	-----	Overhead electric traction-25 kV AC 50 Hz
Chapter-V	-----	Platform Screen Doors (PSD)



Examined & Found in Order
Date

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CHAPTER-I GENERAL

1.1 SPACING OF TRACKS

Minimum centre to centre distance of tracks without any structure in between tracks for tangent (straight) track for:

- (a) Elevated sections and At-grade sections.....3650 mm
- (b) Underground Sections.....3500 mm

Note: See Appendix-1 for minimum track centers distance on curves.

1.2 CURVES

1.2.1 Minimum radius of curves (horizontal)

- i) On main running lines
 - (a) Elevated and At-Grade Sections 120 m
 - (b) Underground Section 200 m
- ii) Depot and other non-passenger Lines 100 m
- iii) At passenger platforms 1000 m

1.2.2 Check Rail / Restraining Rail

1.2.2.1 Check Rail / Restraining Rail shall be provided on curves on main line where radius is 190m or less on standard gauge. The clearance between check rail/restraining rail and running rail shall be suitably decided by Metro Authority.

1.2.2.2 Check rail/Restraining rail shall not be mandatory for curves in depots, yards and non-passenger lines, where speed is not more than 25 kmph. However, decision in this regard may be taken by Metro Authority based on layout and maintenance requirement.

1.2.3 Minimum radius of Vertical Curve

On Main Line 1500 m

Note:

No vertical curve shall be provided in platform area.

1.2.4 Cant and Cant Deficiency

- a) Maximum Cant on curves 110 mm
- b) Maximum Cant Deficiency 85 mm

1.3 GRADIENTS

Examined & Approved by
Pune Metro Rail Project Director
Date

Page 3 of 47

July 2019

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1.3.1 The maximum grade (compensated) shall be 4%.

Note:

- (i) There will be no change of gradient in transition portion of curves.
- (ii) The gradient will be compensated for curvature at the rate of 0.04% per degree of curve.

1.3.2 Maximum permissible gradient on turnouts

- | | | |
|------|----------------------|-------|
| (i) | On Ballasted Track | 0.25% |
| (ii) | On Ballastless Track | 3.0% |

Note:

- (i) There shall be no change of gradient (i.e. Vertical curve) on and within 15.0m (desirable)/3.0 m (minimum) of any turnout on Ballastless track. In case of ballasted track, there shall be no change of grade on and within 30 meters of any turnout.
- (ii) There shall be no horizontal curve within 15.0m (desirable)/3.0 m (minimum) of any turnout on Ballastless track and 30 meters of any Turnout on Ballasted Track.
- (iii) Turnout shall normally be installed on straight track. In exceptional situations, turnout may take off from curve provided that the radius of lead curve (main line as well as diverging line) is not less than 190m. The negotiability of rolling stocks on such turnout must be certified by rolling stock supplier and confirmed through oscillation trial and a suitable speed restriction should be imposed on main and/or diverging track based on track geometry and other considerations, if required. In case of turnout installed on curved track, the minimum distance from commencement of vertical curve or another horizontal curve shall be 15m for Ballastless track. Turnout shall not be laid on transition curve.
- (iv) The limit of turnout for above purposes shall be taken from Stock Rail Joint (SRJ) to end (i.e. heel) of crossing for Ballastless track. For Ballasted track, it shall be from SRJ to last common sleeper behind end of crossing.
- (v) The maximum permissible gradient on turnout and the location of turnout with respect to vertical/horizontal curves in vicinity shall be confirmed from rolling stock supplier for the negotiability of rolling stock.
- (vi) The above stipulations shall also be applicable for turnout to be laid outside station limit, if any.

1.4 BUILDINGS AND STRUCTURES

1.4.1 Minimum horizontal distance from centre of track to any structure (except at passenger platform) for heights above rail level on level/constant grade tangent track shall be as under: -

(a) Elevated and At-Grade Sections

Height from rail level

Horizontal distance from C.L. of track

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i. Up to 65 mm	1465 mm
ii. 65 mm to 200 mm	1465 mm increasing to 1640 mm
iii. 200 mm to 305 mm	1640 mm
iv. 305 mm to 930 mm	1640 mm increasing to 1735 mm
v. 930 mm to 1095 mm	1735 mm increasing to 1740 mm
vi. 1095 mm to 3310 mm	1740 mm increasing to 1825 mm
vii. 3310 mm to 3775 mm	1825 mm decreasing to 1546 mm
viii. 3775 mm to 6200 mm	1546 mm

Also refer to Figure No. PMSG-2

(b) Underground Sections

(i) Circular Tunnels

<u>Height from rail level</u>	<u>Horizontal distance from C.L. of track</u>
i. Up to 65 mm	1465 mm
ii. 65 mm to 200 mm	1465 mm increasing to 1585 mm
iii. 200 mm to 305 mm	1585 mm
iv. 305 mm to 940 mm	1585 mm increasing to 1670 mm
v. 940 mm to 1095 mm	1670 mm increasing to 1675 mm
vi. 1095 mm to 3305 mm	1675 mm increasing to 1740 mm
vii. 3305 mm to 3965 mm	1740 mm decreasing to 1250 mm
viii. 3965 mm to 4675 mm	1250 mm
ix. 4675 mm to 4970 mm	1250 mm decreasing to zero along an arc of circle of radius of 2800 mm

Also refer to Figure No. PMSG-9

(ii) Rectangular Box Tunnels

<u>Height from rail level</u>	<u>Horizontal distance from C.L. of track</u>
i. Up to 65 mm	1465 mm
ii. 65 mm to 200 mm	1465 mm increasing to 1585 mm
iii. 200 mm to 305 mm	1585 mm
iv. 305 mm to 940 mm	1585 mm increasing to 1670 mm
v. 940 mm to 1095 mm	1670 mm increasing to 1675 mm
vi. 1095 mm to 3305 mm	1675 mm increasing to 1740 mm
vii. 3305 mm to 3965 mm	1740 mm decreasing to 1250 mm
viii. 3965 mm to 4838 mm	1250 mm

Also refer to Figure No. PMSG-9

Note:

- i) Extra clearances shall be provided for curves as laid down at Para-1.7.



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- ii) The term 'structure' covers any item including light ones like ladders, isolated posts, cables etc. erected alongside the track except for passenger platform.
- iii) Minimum lateral clearance for OHE masts for tangent track shall be 2150 mm from centre line of nearest track.
- iv) Minimum lateral clearance for OHE masts for tangent track at depot shall be 1950 mm from centre line of nearest track.
- v) For passenger platform and PSD, refer to Para-2.2.1 to 2.2.3 of Chapter-II and Chapter-V respectively.

1.5 KINEMATIC ENVELOPE

For the Kinematic Envelope for level or constant grade tangent track, refer to:

- a) Figure No. PMSG-1 for At-Grade and Elevated Sections
- b) Figure No. PMSG-1A for At-Grade and Elevated sections at passenger platform.
- c) Figure No. PMSG-8 for Underground Sections (Outside stations)
- d) Figure No. PMSG-11 for Underground sections at Passenger Platform

Note:

Extra clearances shall be provided for curves as laid down at Para-1.7

1.6 STRUCTURE GAUGE

(a) Elevated and At-Grade Sections

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing minimum clearance of 150 mm to Kinematic Envelope and minimum electrical clearance of 340mm from 25 kV live parts conforming to the stipulations in Chapter-IV of this SoD.

Refer to Figure No. PMSG-2 for Structure Gauge for outside stations on level or constant grade tangent track.

(b) Underground Section

The Structure Gauge (Fixed Structure Line) has been arrived at by allowing minimum clearance of 100 mm to Kinematic Envelope and minimum electrical clearance of normally 270 mm from 25 kV live parts conforming to the stipulations in Chapter-IV of this SoD.

Refer to figure No. PMSG-9 for structure Gauge for Underground sections (Outside stations) with ballast less track for level or constant grade tangent track.

Note:

Extra clearances shall be provided for curves as laid down at Para-1.7

1.7 EXTRA CLEARANCES ON CURVES

Following are the extra clearances considered for curves.

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Abbreviations used in Para-1.7:

- C is the distance between centres of bogies in meters,
 C_1 is the coach (vehicle) length in meters,
 R is the radius of curve in meters,
 C_a is the Cant applied in mm,
 h is the height from rail level in mm and
 g is the distance between centres of rails in mm

1.7.1 INSIDE OF CURVE

A. Curvature effect

- i) Mid throw at the center of the vehicle = V (in mm) = $125 \times C^2 / R$
- ii) Clearance due to gauge widening on curves

For values of items (i) and (ii) above, refer to Appendix-2

Note:

Lateral shift of 26 mm due to nosing is included in Kinematic Envelope for tangent track (and as a result, included in Structure Gauge also) shall be subtracted from the total extra clearance worked out as at Para-1.7.1(A)-i & ii above for inside of a curve in case the value of mid throw (V) is equal to or greater than 26 mm. In case the value of mid throw (V) is less than 26 mm, the curvature effect shall be due to widening of the gauge only. (The Mid throw minus 26 mm shall be taken as zero).

B. Clearance for Cant

a) Underground (Box Structure), Elevated and At-Grade Sections

The lean ' L ' due to Cant at any point at height ' h ' above rail level is given by:

$$L = C_a \times h / g \text{ (all in mm)}$$

For values of Structure Gauge (E_1) for inside of a curve with cant effect only, (as shown in Figure No. PMSG-3A), refer to Appendix-3A for Elevated and At-grade Sections and Appendix 3(UG) for Underground Sections.

b) Circular Tunnels

In the case of circular tunnel, cant is provided by raising the outer rail and suitably shifting the center of the circular tunnel towards inside of curve and upwards. This has same effect as assuming rotation of the circular tunnel about mid-point of top of inner rail resulting in shift of Tunnel center laterally towards inside of curve and also vertically upwards.

The Rigid OCS shall also be rotated with the tunnel so as to be along the center line of canted track

For values of horizontal and vertical shifts of center of circular tunnel for different values of cant, refer to Appendix-5.



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C. Clearance for vertical curve (vertical throw)

Vertical Throw V_1 and V_2 (in mm) for vertical curve shall be calculated as under:

V_1 (with vehicle centre in sag or vehicle end on summit)

$$= 125xC^2/R$$

V_2 (with vehicle centre on summit or vehicle end in sag)

$$= (125xC_1^2/R) - (125xC^2/R)$$

For values of vertical throw V_1 & V_2 due to vertical curves of different radii, refer to PMSG-4.

1.7.2 OUTSIDE OF CURVE

A. Curvature effect

i) End throw at the end of vehicle = V_o (in mm)

$$= [125xC_1^2/R] - [125xC^2/R]$$

ii) Clearance due to gauge widening on curves

iii) Additional nosing due to gauge widening on curves

The values of items (i) to (iii) are shown in Appendix-2

B. Clearance for Cant

a) Underground (Box structures), Elevated and At-Grade sections

The lean 'L' due to Cant at any point at height 'h' above rail level is given by:

$$L = (-) Ca \times h/g \text{ (all in mm)}$$

-ve sign indicates relief due to cant or reduction in clearance required.

Note:

Full relief for lean due to cant (Ca) is to be taken into account only for calculation of track spacing without any structure between tracks. In case there is a structure adjacent to track, relief for lean is to be taken into account only if the cant provided is greater than 50 mm and shall be limited to a value = $(Ca - 50) \times h/g$.

For values of Structure Gauge (F_1) on outside of curve with Cant effect only (as shown in Figure No. PMSG-3A), refer to Appendix-3A for Elevated and At-Grade Sections and Appendix-3 (UG) for Box tunnel sections.

b) Circular Tunnel

In the case of circular tunnel, cant is provided by raising the outer rail and suitably shifting the center of the circular tunnel towards inside of curve and upwards. This has same effect as assuming rotation of the circular tunnel about mid-point of top of inner rail resulting in shift of Tunnel center laterally towards inside of curve and also vertically upwards.

The Rigid OCS shall also be rotated with the tunnel so as to be along the center line of canted track.

For values of horizontal and vertical shifts of center of circular tunnel for different values of cant, refer to Appendix-5.

C. Clearance for vertical curve (Vertical throw)

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The provisions at Para-1.7.1 (C) above shall be applicable in this case also.

For values of vertical throws V_1 & V_2 due to vertical curves of different radii, refer to PMSG-4.

1.8 MINIMUM TRACK SPACING ON CURVES

Underground Section, Elevated and At-Grade sections:

The worst case will be when the end of a bogie carriage on the inner track is opposite the center of a similar carriage on the outer track.

1.8.1 Without any structure between tracks

The minimum track spacing on curves without any structure between tracks shall be the sum of the following:

- i) $(E + F)$,
- ii) T_1 (Extra lateral clearance due to curvature on inside of curve)
- iii) T_2 (Extra lateral clearance due to curvature on outside of curve)
- iv) Minimum clearance between adjacent Kinematic Envelopes stipulated is as under:-
300 mm for Elevated and At-Grade Sections
200 mm for Underground Section

Where,

'E' is the distance from vertical axis of center line of canted track to canted Kinematic Envelope on inside of curve at a height 'h' (from rail level) for a given cant (Figure No. PMSG-3)

and

'F' is the distance from vertical axis of centre line of canted track to canted Kinematic Envelope on outside of curve at a height 'h' (from rail level) for a given cant (Figure No. PMSG-3)

Notes:

- i) The value of 'F', calculated from the formula at Figure No. PMSG-3 includes full relief due to Cant.
- ii) The sum of 'E' and 'F' for same height (which are with Cant effect only) shall be the maximum of values calculated for various heights from rail level.

For values of E, F, T_1 and T_2 , refer to the Appendices as shown below:

SECTIONS	For E & F	For T_1 & T_2
Underground	4 (UG)	2
Elevated and At-Grade	3 for 90 kmph KE	2



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1.8.2 With a structure between adjacent tracks

The minimum track spacing on curves with a structure between tracks shall be the sum of the following:

- $(E_1 + T_1)$ Minimum clearance to the structure from center line of track on inside of curve (for outer track)
- $(F_1 + T_2)$ Minimum clearance to the structure from center line of track on outside of curve (for inner track)
- Width of structure between adjacent tracks (measured across the tracks).

Where,

E_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on inside of curve for a given cant, (Ref Fig no: PMSG-3A)

F_1 is the horizontal distance from vertical axis of centre line of track to canted Structure Gauge on outside of curve for a given cant, (Ref Fig no: PMSG-3A)


T_1 is extra lateral clearance due to curvature on inside of curve

T_2 is extra lateral clearance due to curvature on outside of curve.

Notes:

- The values of ' E_1 ' and ' F_1 ' for a given cant Ca , shall each be the maximum of values at different heights of structure from rail level. In case the cant provided is greater than 50 mm on inner track, the value of F_1 shall be for the cant of $(Ca-50)$ mm. In case the cant provided is 50 mm or less on inner track, the value of F_1 shall be for ZERO cant.
- Minimum track spacing, so worked out with a structure between the adjacent tracks shall not be less than that calculated as per Para 1.8.1 for tracks without any structure between adjacent tracks.

For values of E_1 , F_1 , T_1 and T_2 , refer to the Appendices as shown below:



SECTIONS	For E_1 & F_1	For T_1 & T_2
Underground	3 (UG)	2
Elevated and At-Grade	3A for Structure Gauge corresponding to 90 kmph KE.	2

1.9 DERAILMENT GUARD

- The derailment guard should be provided inside/outside of running rail on viaduct as well as in tunnel having multiple tracks and at grade section locations specified by the Metro railway. For single track tunnel, location for providing derailment guard is

given in note. In tunnels, the derailment guard should preferably be provided inside the track, so that it permits less sway of coach towards tunnel wall in case of derailment.

NOTE:

Location for providing Derailment Guard in single track tunnel

1. Entry of tunnel: 200 m from tunnel portal outside the tunnel to 50 m inside the tunnel.
2. Exit of tunnel: 50 m from inside of tunnel portal to 200 m outside the tunnel.
3. In curved track having radius 500 m or less including transition portion but excluding locations where check rail is provided.
4. Covering locations of all important installations e.g. Location of any sub-station or hazardous structures inside the tunnel, etc damage to which in the assessment of metro rail administration can result into serious loss of life or/and infrastructure as a result of derailment in tunnel.

The above is subject to the condition that metro railway shall carry out the risk assessment analysis for derailment in tunnels and ensure that the maintenance practices in the maintenance manual are as per the risk assessment mitigation plan.

- 1.9.2 Lateral Clearance between the running rail and the derailment guard shall be 210 ± 30 mm. It shall not be lower than 25 mm below the top of running rail and shall be clear of the rail fastenings to permit installation, replacement and maintenance.
- 1.9.3 In case of Double Resilient Base Plate Assembly Fastening System as approved by MoR, the lateral clearance between running rail and the derailment guard shall be 250 ± 20 mm. This fastening system, if used in tunnels having multiple tracks, Metro Administration should ensure that KE for adjacent tracks is not infringed so long as the wheels of any derailed vehicle are within the main rail and derailment guard.
- 1.9.4 Derailment guard shall be designed such that in case of derailment:
 - (i) The wheels of a derailed vehicle under crush load, moving at maximum speed are retained on the viaduct or tunnel.
 - (ii) Damage to track and supporting structures is minimum.



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CHAPTER - II

STATIONS

2.1 SPACING OF TRACKS AT STATIONS

Minimum spacing of tracks at station on straight and on curve of radius of 1000 m and flatter, without any structure between tracks

Elevated sections, At-grade sections	3700 mm
Underground Section	3550 mm

Note:

'Station Limits' means platform portion only from SoD point of View

2.2 PLATFORMS

2.2.1 Maximum horizontal distance from centre of track to face of passenger platform coping

(i) For Elevated/At-Grade section	1525 mm
(ii) For Underground Section	1515 mm

2.2.2 Minimum horizontal distance from centre of track to face of passenger platform coping

(i) For Elevated/At-Grade section	1520 mm
(ii) For Underground Section	1510 mm

Notes:

- Platform faces shall be flared away smoothly from the centre line of the track at either end for a distance of 1500 mm beyond passenger area so as to give from centre of track a dimension:
 - 1590 \pm 5 for At grade and Elevated Stations
 - 1575 \pm 5 for Underground Stations
- For additional clearance for platforms on curves, refer to Para-2.7
- The track access gates at the end of platform up to a height of one meter from top of platform shall not infringe the Kinematic Envelope.

2.2.3 Height above rail level for passenger platform:

	<u>Maximum</u>	<u>Minimum</u>
(a) Ballasted Track	1085 mm	1075 mm
(b) Ballastless Track (DFF)	1095 mm	1085 mm

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- | | |
|--|---------|
| 2.2.4 (i) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping if platform screen door is not provided. | 2500 mm |
| (ii) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping if platform screen door is not provided. | 3000 mm |
| (iii) Minimum horizontal distance of any isolated structure on a passenger platform from the edge of coping if platform screen door is provided. | 2000 mm |
| (iv) Minimum horizontal distance of any continuous structure on a passenger platform from the edge of coping if platform screen door is provided. | 2500 mm |

For (iii) and (iv) above: Supporting columns for station structure may be provided along alignment of Platform screen doors and coping stones. In this case a minimum clearance of 2000 will be maintained between inner face of columns and continuous structures on Platforms.

Notes:

- Platform Screen Door (PSD) maybe installed at platform as per design of PSD but shall have minimum clearance of 10 mm from the kinematic envelope.
- The structure on the platform is treated as isolated if the length along the platform length is 2000 mm or less. Any structure having a length exceeding 2000 mm is treated as continuous structure. The clocks/mirrors/CCTV screens etc shall not be considered structures and shall be located at a minimum horizontal distance of 1000 mm from platform edge/coping with minimum height of 2000 mm from top of platform.
- For platform structure setting out dimensions at underground stations, refer Fig. no. PMSG-10. No fixed structure should infringe the structural gauge except for designated railway operational structures which includes platform coping, platform screen doors, hand railing in back of house platform edge, track access gates. Such designated railway operational structure should not infringe the kinematic envelope under any circumstances.

2.2.5 For Structure Gauge at stations refer to following figures:

- Elevated and At-Grade Stations, refer to figure no. PMSG-5 & PMSG-6.
- Underground Stations, refer to figure no. PMSG-10

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2.3 TRACK GRADIENT IN PLATFORM

Gradient of track in station platform length shall be as under:

- | | |
|----------------------|----------|
| (a) Maximum gradient | 1 in 400 |
| (b) Desirable | Level |

Note: There shall be no change in gradient in platform line.

2.4 INTERLOCKING AND SIGNAL GEAR

Maximum height above rail level of any part of interlocking or signal gear on either side of centre of track subject to the restrictions embodied in Note below shall be as under:

For Underground, At-Grade and Elevated Stations

- | | |
|---------------------------------|----------------------------|
| • From C.L. of track to 1330 mm | 25 mm |
| • From 1330 mm to 1465 mm | 25 mm increasing to 65 mm |
| • From 1465 mm to 1640 mm | 65 mm increasing to 200 mm |

Note:

Except for check rails on curves, ordinary and diamond crossings or wing rails and point rails of crossings leading to snag dead ends, or such parts of signalling gear as are required to be actuated by the wheels, no gear or track fittings shall project above rail level for a distance of 229 mm outside and 140 mm inside the gauge face of the rails.

2.5 POINTS & CROSSINGS

- | | |
|--|--------|
| 2.5.1 Maximum clearance of check rail opposite nose of crossing | 42 mm |
| 2.5.2 Minimum clearance of check rail opposite nose of crossing | 40 mm |
| 2.5.3 Minimum clearance between switch rail and stock rail at heel of Switch | 60 mm |
| 2.5.4 Maximum clearance of wing rail at nose of crossing | 43 mm |
| 2.5.5 Minimum clearance of wing rail at nose of crossing | 41 mm |
| 2.5.6 Minimum clearance between toe of open switch and stock rail | 160 mm |

Note: The Point Machine shall be provided, considering the para 2.5.6 i.e. nominal clearance between toe of open switch and stock rail.

- | | |
|--|-------|
| 2.5.7 Minimum radius of curvature for slip points, turnouts and crossovers | 140 m |
|--|-------|

- | | |
|---|--|
| 2.5.8 On main lines, the turnouts and diamond Crossings shall be of the following types | |
|---|--|

- | | |
|------------------------|--|
| a) 1 in 9 type turnout | 300 m radius |
| | 190 m radius
(Exceptional circumstances)* |
| b) 1 in 7 type turnout | 190 m radius
(Desirable) |
| | 140 m radius
(Exceptional circumstances)* |

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- c) Scissors cross-over of 1 in 9 type consisting of 4 acute turnouts of 1 in 9 and 1 diamond crossing.
- d) Scissors cross-over of 1 in 7 type consisting of 4 acute turnouts of 1 in 7 and 1 diamond crossing.

2.5.9 On depot lines, non-passenger lines like pocket track, depot entry lines etc, the turnouts and diamond Crossings shall be of the following types:

- a) 1 in 7 type turnout 190 m radius
140 m radius
- b) Scissors cross-over of 1 in 7 type consisting of 4 acute turnouts of 1 in 7 and 1 diamond crossing.
- c) 1 in 7 derailing switches/ 1 in 7 type symmetrical split turnout.

* Exceptional circumstances - applicable for space constraint areas and pocket track on main line.

2.5.10 Diamond crossings not to be flatter than 1 in 4.444.

Note:

- a) The above restrictions shall not apply to moveable diamond crossings.
- b) Switches and crossings shall not be located on transition curves & vertical curves.
- c) There must be no change of super elevation (of outer over inner rail) between points 18 m outside toe of switch rail and nose of crossings respectively, except in the case of special crossing leading to snag dead-ends or under circumstances as provided for in item 2.6 below.

2.5.11 Minimum length of tongue rail 9000 mm

2.6 SUPER-ELEVATIONS AND SPEED AT STATIONS ON CURVES WITH TURNOUTS OF CONTRARY AND SIMILAR FLEXURE.

2.6.1 Main Line:

Subject to the permissible run through speed based on the standard of interlocking, the equilibrium super-elevation, calculated for the speed of the fastest train may be reduced by a maximum amount of 85 mm without reducing speed on the main line.

2.6.2 Turnouts:

- i) Curves of contrary flexure

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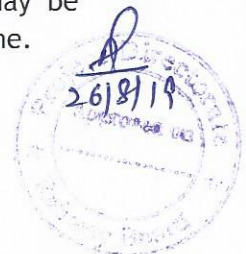
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The equilibrium super-elevation (s) in mm should be = $(1510/127) \cdot (V^2 / R)$ Where,

R = Radius of turnout in meters and V is speed on turnout in Kmph.

The permissible negative super-elevation on the turnout (which is also the actual super-elevation of the main line) may then be = $(85 - s)$ mm.

ii) Curves of similar flexure

The question of reduction or otherwise of super-elevation on the main line must necessarily be determined by the administration concerned. In the case of a reverse curve close behind the crossing of a turnout, the super-elevation may be run out at the maximum of 1 mm in 400 mm.

2.7 ADDITIONAL CLEARANCE FOR PLATFORMS ON CURVES

The additional clearance for platforms on curves shall be provided as shown at Appendix-4

Note:

- (i) As the minimum radius of curve for stations is 1000 m, there will be no super elevation and gauge widening on passenger platform lines.

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CHAPTER - III ROLLING STOCK

3.1 PASSENGER ELECTRIC MULTIPLE UNITS

3.1.1	(a) Maximum Length of the coach body (including end fairings)	21940 mm
	(b) Maximum width of the vehicle	2900 mm
	(c) Maximum height at pantograph level in locked down position	4048 mm
3.1.2	Distance between bogie centers	14850± 250 mm
3.1.3	Kinematic Envelope for level tangent track	
	a. For At-Grade and Elevated Sections except for passenger platform	Figure No. PMSG-1
	b. For At-Grade and Elevated Sections at passenger platform.	Figure No. PMSG-1A
	c. For Underground sections except for passenger platform.	Figure No. PMSG-8
	d. For Underground sections at passenger platform.	PMSG-11
3.1.4	Minimum clearance above rail level under dynamic condition of fully loaded vehicle under worst condition** for bogie and axle mounted equipment.	65 mm
3.1.5	Minimum clearance above rail level under dynamic condition of fully loaded vehicle under worst condition*** for body mounted equipment.	102 mm
	**The "worst condition" means it is with deflection of primary suspension and maximum tread wear.	
	***The "worst condition" means it is with deflection of primary suspension and, deflated air spring and maximum tread wear.	
3.1.6	Wheel	
	a) Maximum wheel gauge back to back distance	1360 mm
	b) Minimum wheel gauge back to back distance	1358 mm
3.1.7	a) Maximum diameter on the tread (measured at 70 mm from inner gauge face)	860 mm



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	b) Minimum diameter on the tread (measured at 70 mm from wheel gauge face)	780 mm
3.1.8	a) Minimum projection for flange of new wheel (measured at 70 mm from wheel gauge face)	28 mm
	b) Maximum projection for flange of worn wheel (measured at 70 mm from wheel gauge face)	36 mm
3.1.9	a) Maximum thickness of flange of wheel measured from wheel gauge face at 18 mm from outer edge of flange.	32.5 mm
	b) Minimum thickness of flange of wheel measured from wheel gauge face at 18 mm from outer edge of flange.	22 mm
3.1.10	Minimum width of wheel	135±1 mm
3.1.11	Incline of tread	1 in 20
3.1.12	Floor Height	
	a) Maximum height above rail level for floor of any unloaded vehicle	1130 mm
	b) Minimum height above rail level for floor of fully loaded normal vehicle	1100 mm
3.1.13	a) Maximum height of centre coupler above rail level for unloaded vehicle	815 mm
	b) Minimum height of centre coupler above rail level for fully loaded vehicle	740 mm
3.1.14	Maximum length over couplers	22600 mm
3.1.15	Length of rigid wheel base for single bogie	2200 to 2600 mm
3.1.16	Maximum distance between any two adjacent axles	12900 mm

3.2 LOCOMOTIVES AND ENGINEERING SERVICE VEHICLES

Other items of rolling stock, viz shunting locomotives, OHE maintenance and inspection cars, emergency re-railing vans, track machines, etc., used on Pune Metro System (where these cars would be plying) will conform with the Kinematic Envelope of the Passenger Electric Multiple Units as shown in Drawing No PMSG-1 for Elevated & At-Grade sections, Drawing No. PMSG-1A for Elevated & At-Grade sections at Platforms, Figure No. PMSG-8 for Underground sections and Figure No. PMSG-11 for Underground section at platforms.



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CHAPTER - IV ELECTRIC TRACTION

(OVERHEAD ELECTRIC TRACTION 25 kV/AC 50 CYCLES PER SECOND)

Note: Special precautions must be taken to maintain following clearances:

4.1 ELECTRICAL CLEARANCES FOR AT-GRADE AND ELEVATED SECTIONS

- 4.1.1 The clearances between 25 kV live parts and earthed parts of fixed structures or moving loads shall be as large as possible. The minimum electrical clearances (vertical and horizontal) to be maintained under the worst condition of temperature, wind, etc. between any live part of the overhead equipment or pantograph and parts of any fixed structures (earthed or otherwise) or moving loads shall be below:

Vertical Clearance:

(i)	Long Duration	320 mm
(ii)	Short Duration	200 mm

Horizontal/Lateral Clearance:

(i)	Long Duration	320 mm
(ii)	Short Duration	200 mm

Note:

- (a) Long duration means when the conductor is at rest and Short Duration means when the conductor is not at rest.
- (b) A minimum vertical distance of 340 mm shall normally be provided between rolling stock and contact wire to allow for a 20 mm temporary raising of the tracks during maintenance. Wherever the allowance required for track maintenance exceeds 20 mm, the vertical distance between rolling stock and contact wire shall correspondingly be increased.
- (c) Where adoption of above clearance is either not feasible or involves abnormally high cost, a minimum vertical distance of 250 mm shall be provided between rolling stock and contact wire. At such locations, the following factors shall be maintained.
 - (i) Track to be frozen by providing permanent bench mark to indicate the level of track to be maintained.
 - (ii) Erection tolerance shall be taken as zero.

- 4.1.2 Maximum variation of the live conductor wire on either side of the centre line of the track under static conditions:

i)	On straight	$\pm 200\text{mm}$
ii)	On Curves	$\pm 300\text{mm}$

Note:

These limits would not apply to special locations like insulated overlaps and out of run wires.

- 4.1.3 Maximum width of pantograph collector:

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The Kinematic Envelope with the size of Pantograph adopted shall be within the Kinematic Envelope shown at Figure No. PMSG-1.

4.1.4 Height of Contact wire:

Minimum height from rail level to underside of the live conductor wire:

- | | |
|---|--------|
| i. In the open | 5000mm |
| ii. Special location (under bridges) for locked
down height of pantograph | 4800mm |
| iii. In the depot open area | 5200mm |
| iv. In carriage sheds and depots where the staff will likely to be
working on the roof of rolling stock during the maintenance | 5500mm |
| v. At level crossing | 5500mm |

Note:

- The normal height from rail level to the underside of contact wire in elevated section is 5000mm.
- On curves, all vertical distances specified in sub-para 4.1.4 above, shall be measured above level of inner rail, increased by half the super elevation.

4.2 ELECTRICAL CLEARANCES FOR UNDERGROUND SECTIONS

- 4.2.1 Minimum height from rail level to underside of wearing copper/
metal conductor of rigid OCS (Overhead contact system) in Tunnel 4318mm

Note:-

- Location of exit crossing from exit point of the tunnel will take into the considerations the OHE height of 4318 mm at the tunnel exit and the permissible contact wire gradient.
- In the depot deck portion, if rigid OCS is provided and track is ballastless, the electrical clearances laid down at para 4.2.1 to 4.2.4 shall be applicable.
- For location of rigid OCS in circular tunnel with canted track, refer to Para 1.7.1 (B)-b and 1.7.2 (B)-b
- It shall be ensured that environment level inside the tunnel is controlled suitably so that no extra air clearance, over and above the minimum separation prescribed in Para 4.2.3 and 4.2.4 on account of pollution, fog etc., is required.

- 4.2.2 Stagger of rigid OCS conductor in tunnels shall not be more than

- | | |
|-----------------|--------------|
| (i) On Straight | ± 200 mm |
|-----------------|--------------|

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(ii) On Curves

+300mm

4.2.3 Prescribed minimum clearances between live parts of contact lines and bodies of structures

Air clearance between bodies of structures and live un-insulated body parts of contact lines, feeders and current collectors for 25KV shall be as per IEC 60913 as under:

S. No	Condition	Minimum Clearance between live parts and structures	Absolute minimum dynamic clearance between live parts and structures
(A)	Long duration (Static)	270 mm	-
(B)	Short duration (Dynamic)	170 mm	150mm*

*In exceptional cases and operating in climatic conditions (Ref: IEC 60913)

4.2.4 Prescribed minimum clearances between live parts of contact lines and bodies of vehicles

Minimum air clearance between bodies of vehicles and the live un-insulated parts of the contact line or feeders for 25 kV.

S. No	Condition	Clearance (mm)
(A)	Long duration (Static)	290 mm
(B)	Short duration (Dynamic)	190 mm

4.2.5 Maximum width of pantograph - Under dynamic conditions

The kinematic envelope for underground sections in Ballastless tracks is shown in Fig. PMSG-8. The pantograph adopted should be such that its actual half KE width does not exceed 820 mm and 980 mm at the top and the bottom respectively in pantograph raised condition for a contact wire height of 4318 mm to fulfill electrical clearance as per item 4.2.3

Note:

These limits would not apply to special locations like insulated overlaps and out of run wires.



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CHAPTER-V PLATFORM SCREEN DOOR (PSD)

5.1 SETTING OUT DIMENSIONS

Minimum Platform Screen Door width (clear opening)	2000 mm
Minimum Platform Screen Door height from Platform level	1500 mm
Maximum Platform Screen Door height from Platform level	2100 mm
Maximum Platform Screen Door threshold offset from track centerline - straight track (Elevated / At-Grade)	1530 mm
Minimum Platform Screen Door threshold offset from track centerline - straight track (Elevated / At-Grade)	1525 mm
Minimum Platform Screen Door panel offset from track centerline - straight track (Elevated / At-Grade)	1545 mm
Minimum Platform Screen Door header offset from track centerline (Elevated / At-Grade/)	1583 mm
Minimum Platform Screen Door threshold offset from track centerline - Straight track (Underground)	1515 mm
Minimum Platform Screen Door panel offset from track centerline - Straight track (Underground)	1545 mm

Note:

- (a) Assumed plus/minus 300 mm stopping accuracy.
- (b) Platform Screen Door at stations on curves shall be considered separately taking into account the additional clearance as per Appendix-4.
- (c) Platform Screen Door are designated as railway operational structures. Therefore, Platform Screen Door may infringe the Structure Gauge, but does not infringe the kinematic envelope and having minimum clearance of 10 mm from kinematic envelope to Platform Screen Door (refer PMSG-7).
- (d) The deflector attached to the bottom of the sliding door shall be designed in order not to protrude beyond the Platform Screen Door threshold.

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Appendix-1

PERMISSIBLE SPEED, CANT AND MINIMUM TRACK SPACING ON CURVES

ELEVATED AND AT-GRADE SECTIONS

RADIUS OF CURVE	CANT	MAXIMUM PERMISSIBLE SPEED	MINIMUM DISTANCE BETWEEN ADJACENT TRACKS See note (a)
(m)	mm	kmph	mm
3000 or more	15	80	3650
2800	15	80	3650
2400	20	80	3650
2000	20	80	3650
1600	25	80	3650
1500	30	80	3650
1200	35	80	3650
1000	40	80	3700
800	55	80	3700
600	70	80	3750
500	90	80	3750
450	95	75	3750
400	105	75	3800
350	110	70	3800
300	110	65	3850
200	110	50	3950
190	110	50	3950
175	110	50	4000
150	110	45	4050
150*	0	30	4050
120	110	40	4150
120*	0	30	4150
100*	0	25	4250

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RADIUS OF CURVE	CANT	MAXIMUM PERMISSIBLE SPEED	MINIMUM DISTANCE BETWEEN ADJACENT TRACKS See note (a)
(m)	mm	kmph	mm
>3000	-	80	3500
3000	15	80	3500
2800	15	80	3500
2400	20	80	3500
2000	20	80	3500
1600	25	80	3500
1500	30	80	3510
1200	35	80	3510
1000	45	80	3550

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800	55	80	3550
600	70	80	3570
500	85	80	3600
450	95	80	3610
400	105	80	3650
350	110	75	3650
300	110	70	3700
200	110	55	3800
150	110	50	4000
150*	0	30	4000
120	110	45	4000
120*	0	30	4000
100*	0	15	4000

Notes:

- The track spacing shown in the table above is without any column/structure between two tracks and is with equal cant for both outer and inner tracks.
- Track spacing shown in Table above is not applicable to stations which should be calculated depending on specific requirement but should not be less than spacing specified in para 2.1.
- Track spacing is calculated as per Para 1.8 (E+F+T1+T2+300mm for Elevated & At-Grade sections; E+F+T1+T2+200mm for Underground sections)
- Figures for any intermediate radius of curvature may be obtained by adopting the value for sharper curve.
- Cant provided is limited to desirable value of 110 mm.
- Maximum cant deficiency is 85 mm.
- Check rail / Restraining Rail shall be provided on curve on main line where radius is 190 m or less.

* Curves to be provided in depots.

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Appendix-2

EXTRA HORIZONTAL CLEARANCE ON CURVES
(CURVATURE EFFECT)

INSIDE OF CURVE

REFERENCE: PARA 1.7.1

RADIUS OF CURVE	MID-THROW (28500/R)	NOSING INCLUDED IN K.E/ STRUCTURE GAUGE FOR TANGENT TRACK	EXTRA GAUGE TOLERANCE ON CURVES	EXTRA HORIZONTAL CLEARANCE ON CURVE	REMARKS
(m)	(mm)	(mm)	(mm)	(mm)	
(R)	(V)	(N)	(G)	(T ₁)	
100	285.0	26.0	9.0	268	(G) EXTRA GAUGE TOLERANCE ON CURVES SHARPER THAN 1000 m RADIUS: 9 mm FOR CURVES WITH RADII SHARPER THAN 500 m AND 5 mm FOR CURVES WITH RADII OF 500 m TO LESS THAN 1000 m.
120	237.5	26.0	9.0	221	
150	190.0	26.0	9.0	173	
175	162.9	26.0	9.0	146	
190*	150.0	26.0	9.0	133	
200	142.5	26.0	9.0	126	
250	114.0	26.0	9.0	97	
300	95.0	26.0	9.0	78	
350	81.4	26.0	9.0	64	
400	71.3	26.0	9.0	54	
450	63.3	26.0	9.0	46	
500	57.0	26.0	5.0	36	
600	47.5	26.0	5.0	27	
700	40.7	26.0	5.0	20	
800	35.6	26.0	5.0	15	
900	31.7	26.0	5.0	11	
1000	28.5	26.0	0.0	3	T ₁ =V-N+G for V EQUAL TO OR GREATER THAN (N) AND T ₁ = G for V < (N)
1200	23.8	26.0	0.0	0	
1500	19.0	26.0	0.0	0	
1600	17.8	26.0	0.0	0	
2000	14.3	26.0	0.0	0	
2400	11.9	26.0	0.0	0	
2800	10.2	26.0	0.0	0	
3000 or more	9.5	26.0	0.0	0	

Note:

Mid throw (in mm) $V = (125 \times C^2) / R = 28500/R$

Where 'C' is the distance between bogie centers=14.850+0.250=15.100m OR 14.85 - 0.250=14.600 m

The worst case will be with C=15.100 m

R is the radius of curve in metres.

Mid throw (in mm) $V = (125 \times C^2) / R = 28500/R$

* Check Rail / Restraining Rail shall be provided on curves on main line where radius is 190m or less.



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OUTSIDE OF CURVE

REFERENCE: PARA 1.7.2

RADIUS OF CURVE	END-THROW (33525/R)	EXTRA GAUGE TOLERANCE ON CURVES	EXTRA NOSING DUE TO EXTRA GAUGE TOLERANCE	EXTRA HORIZONTAL CLEARANCE ON CURVE	REMARKS
(m)	(mm)	(mm)	(mm)	(mm)	
(R)	(Vo)	(G)	(EN)	(T ₂)	
100	335.3	9.0	2.3	347	
120	279.4	9.0	2.3	291	
150	223.5	9.0	2.3	235	
175	191.6	9.0	2.3	203	
190*	176.4	9.0	2.3	186	
200	167.6	9.0	2.3	179	
250	134.1	9.0	2.3	145	
300	111.8	9.0	2.3	123	
350	95.8	9.0	2.3	107	
400	83.8	9.0	2.3	95	
450	74.5	9.0	2.3	86	
500	67.1	5.0	1.3	73	
600	55.9	5.0	1.3	62	
700	47.9	5.0	1.3	54	
800	41.9	5.0	1.3	48	
900	37.3	5.0	1.3	44	
1000	33.5	0.0	0.0	34	
1200	27.9	0.0	0.0	28	
1500	22.4	0.0	0.0	22	
1600	21.0	0.0	0.0	21	
2000	16.8	0.0	0.0	17	
2400	14.0	0.0	0.0	14	
2800	12.0	0.0	0.0	12	
3000 or more	11.2	0.0	0.0	11	

(G) EXTRA GAUGE TOLERANCE ON CURVES SHARPER THAN 1000 m
RADIUS: 9 mm FOR CURVES WITH RADII SHARPER THAN 500 m AND 5 mm FOR CURVES WITH RADII OF 500 m TO LESS THAN 1000 m.

$T_2 = V_o + G + EN$
 $EN = G \times 0.251986301$

Note:

End Throw (in mm) $V_o = (125 \times C_1^2) / R - (125 \times C^2) / R = 33525 / R$

Where 'C' is the distance between bogie centres = 14.850+0.250=15.100m OR 14.850-0.250=14.600 m

Worst case will be with C=14.600 m

'C₁' is length of coach in meters = 21.940 m and

'R' is radius of curve in meters.

* Check Rail / Restraining Rail shall be provided on curves on main line where radius is 190m or less.

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APPENDIX-3

CANT EFFECT ON KINEMATIC ENVELOPE-HORIZONTAL (VEHICLE SPEED - 90 kmph)
AT-GRADE AND ELEVATED SECTIONS

REF: PARA 1.8.1

REF: PARA 1.8.1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Height above rail level measured perpendicular to plane of track				938				987				1130				2876				3296				4014				4866				5018																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Distance from center line of track to K.E for tangent track.				1.582				1.584				1.590				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1.658				1			

Refer to Figure PMSG-3

$$E = [Ab - (h \times \tan \alpha)] \times \cos \alpha$$

$$F = [Ab - (h \times \tan \alpha)] \times \cos \alpha$$

$$H_1 = (Ca/2) \times (h / \cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$$

$$H_2 = (Ca/2) \times (h / \cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$$

ab=Ab=Distance from center line of vehicle to K.E for Tangent track at height 'h' from rail level

ac=Ac=Distance from center line of canted track to K.E for Tangent track at height 'h' from rail level

bc=hx tan α = Lateral increment due to cant (measured along the line parallel to line joining top of rails.



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APPENDIX-3A

CANT EFFECT ON STRUCTURE GAUGE (CORRESPONDING TO 90 kmph KE)-HORIZONTAL
AT-GRADE AND ELEVATED SECTIONS
REFERENCE: PARA 1.8.2

ALL FIGURES ARE IN mm

Height above rail level measured perpendicular to plane of track Distance from center line of track to Structure Gauge for tangent track.					h= 305 ab= 1640			h= 930 ab= 1735			h= 3310 ab= 1825			h= 3775 ab= 1546			h= 6200 ab= 1546				
Cant	Angle α degrees	Sine	cosa	tana	E ₁	F ₁	H ₁	H ₂	E ₁	F ₁	H ₁	H ₂	E ₁	F ₁	H ₁	H ₂	E ₁	F ₁	H ₁	H ₂	
110	4.178	0.073	0.997	0.07	1658	1613	479	240	1798	1663	1109	856	2061	1579	3489	3933	3707	1994	1090	6351	6126
105	3.987	0.070	0.998	0.07	1657	1615	471	243	1795	1666	1101	860	2051	1590	3481	3926	3711	1973	1111	6345	6130
100	3.797	0.066	0.998	0.07	1657	1616	463	246	1793	1670	1093	863	2040	1602	3474	3919	3714	1953	1132	6339	6134
95	3.607	0.063	0.998	0.06	1656	1618	455	249	1790	1673	1085	867	2030	1613	3466	3912	3718	1933	1153	6332	6138
90	3.417	0.060	0.998	0.06	1655	1619	447	252	1787	1676	1077	870	2019	1624	3458	3905	3721	1913	1174	6326	6142
85	3.227	0.056	0.998	0.06	1655	1620	439	255	1785	1680	1069	873	2008	1636	3450	3899	3724	1893	1195	6320	6146
80	3.037	0.053	0.999	0.05	1654	1622	431	258	1782	1683	1061	877	1998	1647	3442	3892	3728	1872	1215	6313	6149
75	2.847	0.050	0.999	0.05	1653	1623	424	261	1779	1687	1053	880	1987	1658	3434	3885	3731	1852	1236	6307	6153
70	2.657	0.046	0.999	0.05	1652	1624	416	264	1776	1690	1044	884	1976	1670	3426	3878	3734	1832	1257	6300	6157
65	2.467	0.043	0.999	0.04	1652	1625	408	267	1773	1693	1036	887	1966	1681	3418	3871	3737	1811	1278	6293	6160
60	2.277	0.040	0.999	0.04	1651	1627	400	270	1771	1697	1028	890	1955	1692	3410	3863	3741	1791	1298	6287	6164
55	2.087	0.036	0.999	0.04	1650	1628	392	273	1768	1700	1020	894	1944	1703	3402	3856	3744	1771	1319	6280	6167
50	1.898	0.033	0.999	0.03	1649	1629	384	276	1765	1703	1012	897	1934	1714	3394	3849	3747	1750	1340	6273	6170
45	1.708	0.030	1.000	0.03	1648	1630	376	278	1762	1707	1004	900	1923	1726	3385	3842	3750	1730	1361	6266	6174
40	1.518	0.026	1.000	0.03	1648	1631	368	281	1759	1710	996	904	1912	1737	3377	3835	3753	1710	1381	6259	6177
35	1.328	0.023	1.000	0.02	1647	1632	360	284	1756	1713	987	907	1901	1748	3369	3827	3756	1689	1402	6252	6180
30	1.138	0.020	1.000	0.02	1646	1634	353	287	1753	1716	979	910	1890	1759	3361	3820	3759	1669	1423	6244	6183
25	0.949	0.017	1.000	0.02	1645	1635	345	290	1750	1719	971	914	1880	1770	3352	3813	3761	1648	1443	6237	6186
20	0.759	0.013	1.000	0.01	1644	1636	337	293	1747	1723	963	917	1869	1781	3344	3805	3764	1628	1464	6230	6189
15	0.569	0.010	1.000	0.01	1643	1637	329	296	1744	1726	955	920	1858	1792	3335	3798	3767	1608	1484	6223	6192
10	0.379	0.007	1.000	0.01	1642	1638	321	299	1741	1729	946	923	1847	1803	3327	3790	3770	1587	1505	6215	6195
5	0.190	0.003	1.000	0	1641	1639	313	302	1738	1732	938	927	1836	1814	3319	3783	3772	1567	1525	6208	6197
0	0.000	0.000	1.000	0	1640	1640	305	305	1735	1735	930	930	1825	1825	3310	3775	3775	1546	1546	6200	6200

Refer to Figure PMSG-3A

$$E_1 = [ab + (h \times \tan \alpha)] \times \cos \alpha$$

$$F_1 = [ab - (h \times \tan \alpha)] \times \cos \alpha$$

$$H_1 = (Ca/2) + (h / \cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$$

$$H_2 = (Ca/2) + (h / \cos \alpha) + (ab + h \times \tan \alpha) \times \sin \alpha$$

$$ab = \text{Distance from center line of vehicle to Structure gauge for Tangent track at height 'h' from rail level}$$

$$ac = \text{Distance from center line of canted track to Structure Gauge for Tangent track at height 'h' from rail level}$$

$$bc = h \times \tan \alpha = \text{Lateral increment due to cant (measured along the line parallel to line joining top of rails)}$$



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Pune Metro

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Where:

6/18/19

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APPENDIX - 4 (UG): CANT EFFECT ON KINEMATIC ENVELOPE-HORIZONTAL CURVE (VEHICLE SPEED - 90 kmph)
UNDER GROUND SECTION (Rectangular Box/Circular Tunnel)

Cant	α	α	$\sin \alpha$	$\cos \alpha$	$\tan \alpha$	$h =$		$ab =$	1570		$h =$		1576		$h =$		$ab =$		1629		$h =$		4005		$ab =$		1089		$h =$		4158		$ab =$		980		$h =$		4318		$ab =$		820	
	Degree	Radians				E	F		H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2	E	F	H1	H2		
110	4.178	0.073	0.073	0.997	0.073	1635	1497	885	1114	1297	1654	1416	1834	3051	4129	2814	3970	1376	796	809	4123	4269	3970	1279	676	4131	1131	505	4421	505	4421	4302	H2											
105	3.987	0.070	0.069	0.998	0.069	1632	1501	888	1106	1289	1650	1425	1825	3044	4123	2818	3972	1364	809	823	4118	4264	3972	1265	690	4133	1117	519	4417	519	4417	4303	H2											
100	3.797	0.066	0.066	0.998	0.066	1629	1504	891	1099	1282	1647	1435	1816	3036	4118	2821	3974	1351	823	836	4113	4259	3974	1252	704	4134	1103	533	4413	533	4413	4304	H2											
95	3.607	0.063	0.063	0.998	0.063	1626	1508	894	1091	1274	1644	1445	1807	3029	4113	2825	3976	1338	836	849	4108	4259	3976	1239	718	4136	1089	548	4409	548	4409	4306	H2											
90	3.417	0.060	0.059	0.998	0.059	1624	1511	897	1084	1267	1640	1455	1797	3022	4108	2828	3978	1325	849	863	4102	4244	3978	1225	731	4137	1075	562	4404	562	4404	4307	H2											
85	3.227	0.056	0.056	0.998	0.056	1621	1514	900	1076	1259	1637	1465	1789	3015	4102	2831	3980	1312	863	876	4097	4244	3980	1212	745	4139	1061	576	4400	576	4400	4308	H2											
80	3.037	0.053	0.053	0.999	0.053	1618	1518	903	1069	1252	1633	1474	1779	3007	4097	2835	3982	1299	876	889	4092	4234	3982	1198	759	4140	1047	591	4395	591	4395	4309	H2											
75	2.847	0.050	0.050	0.999	0.050	1615	1521	905	1061	1244	1630	1484	1770	3000	4092	2838	3985	1286	889	903	4086	4229	3985	1185	773	4142	1033	605	4391	605	4391	4310	H2											
70	2.657	0.046	0.046	0.999	0.046	1612	1525	908	1054	1237	1627	1494	1761	2992	4086	2841	3987	1273	903	916	4081	4229	3987	1158	800	4145	1005	634	4382	634	4382	4311	H2											
65	2.467	0.043	0.043	0.999	0.043	1609	1528	911	1046	1229	1616	1504	1751	2985	4069	2845	3990	1260	916	934	4069	4208	3990	1131	828	4147	977	662	4372	662	4372	4313	H2											
60	2.277	0.040	0.040	0.999	0.040	1606	1531	914	1039	1224	1613	1523	1753	2970	4058	2851	3993	1250	934	952	4058	4202	3993	1103	856	4149	948	691	4363	691	4363	4314	H2											
55	2.087	0.036	0.036	0.999	0.036	1603	1535	917	1031	1219	1610	1522	1733	2955	4052	2858	3993	1234	952	970	4052	4202	3993	1103	870	4151	934	705	4358	705	4358	4315	H2											
50	1.897	0.033	0.033	0.999	0.033	1599	1541	922	1016	1214	1607	1534	1722	2947	4047	2861	3995	1220	970	988	4047	4192	3995	1090	883	4157	920	720	4353	720	4353	4315	H2											
45	1.708	0.030	0.030	0.999	0.030	1597	1544	926	1009	1209	1604	1546	1711	2939	4041	2864	3996	1206	988	1006	4041	4186	3996	1076	911	4153	906	734	4348	734	4348	4316	H2											
40	1.518	0.026	0.026	0.999	0.026	1594	1547	929	1001	1204	1601	1557	1700	2932	4035	2867	3999	1192	1006	1024	4035	4186	3999	1062	897	4152	891	748	4343	748	4343	4316	H2											
35	1.328	0.023	0.023	0.999	0.023	1591	1549	931	994	1196	1598	1565	1686	2924	4035	2870	3999	1179	1024	1042	4035	4186	3999	1050	911	4155	891	748	4343	748	4343	4316	H2											
30	1.138	0.020	0.020	0.999	0.020	1588	1550	935	985	1191	1595	1577	1677	2916	4035	2873	3999	1167	1042	1060	4035	4186	3999	1035	925	4155	877	763	4338	763	4338	4317	H2											
25	0.949	0.017	0.017	0.999	0.017	1585	1553	938	978	1186	1592	1586	1667	2909	4035	2876	3999	1155	1060	1078	4035	4186	3999	1021	939	4155	863	777	4333	777	4333	4317	H2											
20	0.759	0.013	0.013	0.999	0.013	1582	1556	941	970	1181	1589	1599	1658	2893	4035	2882	3999	1142	1078	1096	4035	4186	3999	1008	952	4156	849	791	4328	791	4328	4317	H2											
15	0.569	0.010	0.010	0.999	0.010	1579	1559	944	955	1177	1586	1600	1648	2885	4035	2885	3999	1129	1096	1114	4035	4186	3999	1008	952	4156	849	791	4328	791	4328	4317	H2											
10	0.379	0.007	0.007	0.999	0.007	1576	1564	947	947	1170	1583	1619	1639	2893	4035	2885	3999	1115	1114	1132	4035	4186	3999	1008	952	4156	849	791	4328	791	4328	4317	H2											
5	0.190	0.003	0.003	0.999	0.003	1573	1567	947	947	1166	1580	1629	1629	2885	4035	2885	3999	1089	1089	1107	4035	4186	3999	980	980	4162	791	4318	791	4318	791	4318	4318	H2										
0	0.000	0.000	0.000	0.000	0.000	1570	1570	947	947	1166	1576	1629	1629	2885	4035	2885	3999	1089	1089	1104	4035	4186	3999	980	980	4162	791	4318	791	4318	791	4318	4318	H2										

Where:

 $g =$ 1510 Rail centre to centre distance $h =$ Height above rail level measured perpendicular to plane of track $E =$ $[ab + (h \times \tan \alpha)] \times \cos \alpha$ $F =$ $[ab - (h \times \tan \alpha)] \times \cos \alpha$ $H1 =$ $(Ca/2) + (h/\cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$ $H2 =$ $(Ca/2) + (h/\cos \alpha) - (ab + h \times \tan \alpha) \times \sin \alpha$ $ab =$ Distance from centre line of vehicle to Kinematic Envelop for Tangent track at height 'h' from rail level $ac =$ Distance from centre line of canted track to Kinematic Envelop for Tangent track at height 'h' from rail level $bc =$ $h \times \tan \alpha =$ Lateral increment due to cant (measured along the line parallel to line joining top of rails)

REFER TO FIGURE NO. PMSG-3

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APPENDIX - 4
ADDITIONAL CLEARANCES FOR PLATFORMS ON CURVES
UNDERGROUND, ELEVATED AND AT GRADE STATIONS

REF: PARA 2.7

Radius of Horizontal Curve	Cant (mm)	Extra Clearance										Outside of Curve					
		Inside of Curve					At Edge of Curve					At End of coach	At edge of open door farthest from C.L. of Boggles				
		At Center line of Boggles			At Edge of open door nearest to C.L. of Boggles		At Edge of open door nearest to C.L. of Boggles		At edge of open door farthest from C.L. of Boggles								
		Mid Throw = 28500/R	Nosing	Additional Clearance	Additional Clearance Rounded Off to upper 5mm	Throw = 28498/R	Nosing = 13*0.873/10.97	Additional Clearance	Additional Clearance Rounded Off to upper 5mm	End Throw = 33525/R	Throw = 19340/R		Nosing = 13*9.59/10.97	Difference between N and N ₂	Additional Clearance	Additional Clearance Rounded Off to upper 5mm	
R		V	N	V-N	V-N	V ₃	N ₁	V ₃ -(N-N ₁)	V ₃ -(N-N ₁)	V ₆	V ₄	N ₂	N-N ₂	V ₄ -(N-N ₂)	V ₄ -(N-N ₂)		
meters		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
1		2	3	4a	4	5	6	7a	7	8	9	10	11	12a	12		
3000	15	9.5	13.0	-3.5	0	9.5	1.0	-2.5	0	11	6.4	11.4	1.6	4.8	5		
2800	10	10.2	13.0	-2.8	0	10.2	1.0	-1.8	0	12	6.9	11.4	1.6	5.3	10		
2400	25	11.9	13.0	-1.1	0	11.9	1.0	-0.1	0	14	8.1	11.4	1.6	6.4	10		
2000	30	14.3	13.0	1.3	5	14.2	1.0	2.3	5	17	9.7	11.4	1.6	8.0	10		
1800	35	15.8	13.0	2.8	5	15.8	1.0	3.9	5	19	10.7	11.4	1.6	9.1	10		
1600	40	17.8	13.0	4.8	5	17.8	1.0	5.8	10	21	12.1	11.4	1.6	10.5	15		
1500	30	19.0	13.0	6.0	10	19.0	1.0	7.0	10	22	12.9	11.4	1.6	11.3	15		
1200	35	23.8	13.0	10.8	15	23.7	1.0	11.8	15	28	16.1	11.4	1.6	14.5	15		
1000	40	28.5	13.0	15.5	20	28.5	1.0	16.5	20	34	19.3	11.4	1.6	17.7	20		

Notes:-

1. For outside of curve, the difference between clearance required at coach end that at the farthest door edge is less than 25mm. As half width of coach at ends is at least 25mm less than that at door locations, additional clearance to be provided is additional clearance required at the farthest door edge. (column 12).

2. Values of additional clearances (columns 4, 7 and 12) are rounded off to upper 5mm.

3. Negative values of additional clearance are taken as Zero in columns 4 and 7 with rounded off figures.

4. Extra clearance for curves:

(a) Inside of curve:

$$V = (125 \times C^2) / R = 28500/R$$

Where 'C' is the distance between bogie centers = 14.850+0.250=15.100m or 14.85-0.25=14.600m. The worst case will be with C=15.100 m

R is the radius of curve in metres.

$$V_3 = \{(125 \times C_1^2) / R\} - (125 \times C^2) / R = 28498/R$$

$$N_1 = N \times (X)/(C_1/2) = 13 \times 0.873 / 10.97 = 1.03$$

Minimum distance 'X' for the nearest edge of an open door from the center line of Boggies is 0.873metre. Higher of (i) column 4 and (ii) column 7 shall be adopted.

(b) Outside of curve:

$$V_0 = (125 \times C_1^2) / R - (125 \times C^2) / R = 33525/R$$

Where 'C' is the distance between bogie centers = 14.850+0.250=15.100m OR 14.850-0.250=14.600m; Worst case will be with C=14.600

'C₁' is length of coach in meters = 2x10.97 = 21.94 m and 'R' is radius of curve in meters.

$$V_4 = \{(125 \times C_1^2) / R\} - (125 \times C^2) / R = 19340/R \text{ for farthest edge of end door in open position; with } C_1 = 2 \times 9.590 = 19.18 \text{ meters and } C = 14.60 \text{ metres for the worst case}$$

$$N_2 = \text{Nosing at the farthest edge of an open door} = N \times (X)/(C_1/2) = 13 \times 9.59 / 10.97 \text{ mm} = 11.3 \text{ mm}$$

R=Radius of curve in meters

Maximum distance (X) for the farthest edge of open door from centre line of two bogies = 9.590 metres.

5. There will be no superelevation on curves in platform portion.

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APPENDIX - 5
LATERAL AND VERTICAL SHIFT OF CENTER OF CIRCULAR TUNNEL FOR DIFFERENT CANT VALUES
(WITH $D_1 = 630\text{mm}$)

REFER TO FIGURE: MSG-12 AND PARA NO. 1.7.1 B AND 1.7.2 B

All figures are in mm

Cant	$\sin \alpha = \frac{\text{Cant}}{1510}$	Angle α	$\tan \theta = (r-D_1)/(g/2)$	Angle θ	Lateral Shift of Tunnel Center=X	Vertical Shift of Tunnel Center=Y	Remarks
mm		Degree		Degree	mm	mm	
110	0.0728	4.1776	2.8742	70.8159	160	49	
105	0.0695	3.9874	2.8742	70.8159	153	47	
100	0.0662	3.7972	2.8742	70.8159	145	45	
95	0.0629	3.6071	2.8742	70.8159	138	43	
90	0.0596	3.4170	2.8742	70.8159	131	41	
85	0.0563	3.2270	2.8742	70.8159	123	39	
80	0.0530	3.0370	2.8742	70.8159	116	37	
75	0.0497	2.8470	2.8742	70.8159	109	35	
70	0.0464	2.6570	2.8742	70.8159	101	33	
65	0.0430	2.4671	2.8742	70.8159	94	30	
60	0.0397	2.2773	2.8742	70.8159	87	28	
55	0.0364	2.0874	2.8742	70.8159	80	26	
50	0.0331	1.8976	2.8742	70.8159	72	24	
45	0.0298	1.7077	2.8742	70.8159	65	22	
40	0.0265	1.5179	2.8742	70.8159	58	19	
35	0.0232	1.3282	2.8742	70.8159	51	17	
30	0.0199	1.1384	2.8742	70.8159	43	15	
25	0.0166	0.9486	2.8742	70.8159	36	12	
20	0.0132	0.7589	2.8742	70.8159	29	10	
15	0.0099	0.5692	2.8742	70.8159	22	7	
10	0.0066	0.3794	2.8742	70.8159	14	5	
5	0.0033	0.1897	2.8742	70.8159	7	2	
0	0.0000	0.0000	2.8742	70.8159	0	0	

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1. ALL DIMENSIONS ARE IN mm
 2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER
- APPENDIX-2
3. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA.
 4. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION
 5. THE CONDUCTOR HEIGHT ABOVE RAIL LEVEL SHALL ALSO TAKE INTO CONSIDERATION PRESCRIBED ELECTRICAL CLEARANCES BETWEEN ALL LIVE OVERHEAD EQUIPMENT AND PANTOGRAPH / VEHICLE AND ALL PARTS THEREOF.
 6. A TYRE OR ATTACHMENT OF A WHEEL MAY PROJECT BELOW THE MINIMUM HEIGHT OF KINEMATIC ENVELOPE FOR A DISTANCE OF 51 mm INSIDE AND 216 mm OUTSIDE OF THE GAUGE FACE OF THE WHEEL.
 7. KINEMATICS ENVELOPE FOR 90 kmph VEHICLE SPEED AND SIDE WIND SPEED OF 100 kmph.
 8. MAXIMUM WIND SPEED OF TRAIN OPERATION: 100 kmph
 9. DESIGN SPEED OF METRO STRUCTURE: 90 kmph
 10. MAXIMUM OPERATIONAL SPEED OF ROLLING STOCK: 80 kmph
 11. MINIMUM LATERAL CLEARANCE FOR OHE MASTS FOR TANGENT TRACK FROM CENTRE LINE OF NEAREST TRACK: 2150mm
 12. MINIMUM ELECTRICAL CLEARANCES BETWEEN ANY LIVE PART OF THE OVER HEAD EQUIPMENT OR PANTOGRAPH AND PARTS OF ANY FIXED STRUCTURES (EARTHED OR OTHERWISE) OR MOVING LOADS FOR AT-GRADE AND ELEVATED SECTION:
HORIZONTAL AND VERTICAL CLEARANCE
i) STATIC 320mm; ii) DYNAMIC 200mm
 13. THE MAXIMUM MOVING DIMENSIONS OF ANY ATTACHMENT TO ROLLING STOCK SHOULD NOT INFRINGE TO KINEMATIC ENVELOPE OF ROLLING STOCK.

TITLE: KINEMATIC ENVELOPE FOR 90 kmph
AT-GRADE AND ELEVATED SECTIONS
ON LEVEL OR CONSTANT GRADE TANGENT TRACK
EXCEPT FOR PASSENGER PLATFORM

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FIGURE No. PMSG-1

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REF: PARA 1.5, 3.1, 3.2 & 4.1.4

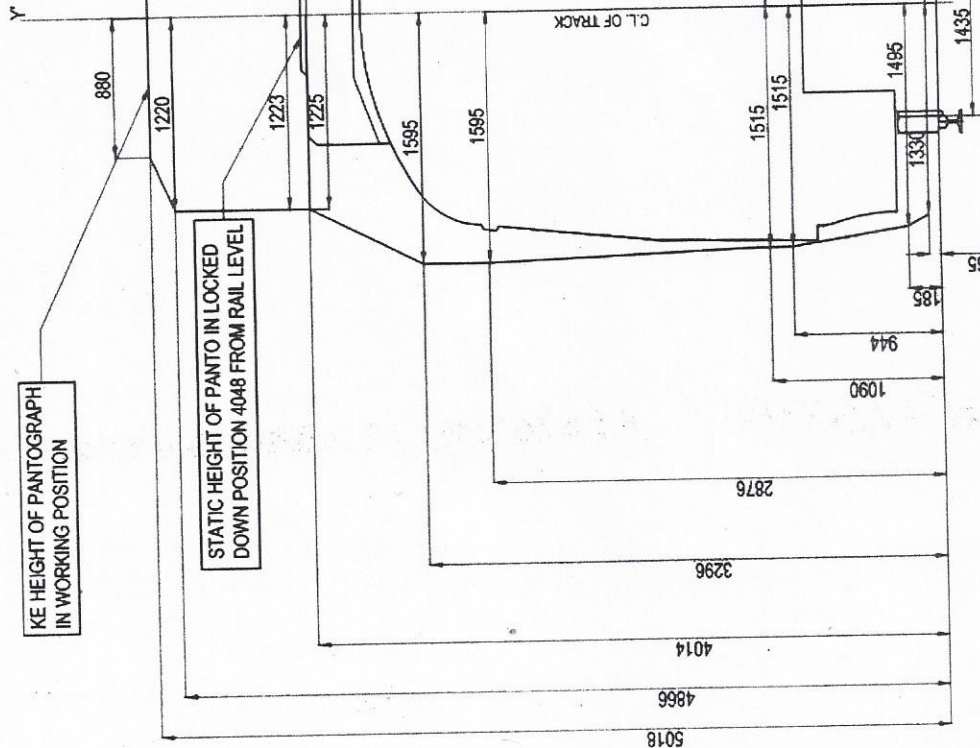
SCALE: NOT TO SCALE

STANDARD GAUGE
(1435 mm)
25 kV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED



KE HEIGHT OF PANTOGRAPH
IN WORKING POSITION



NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER APPENDIX-2
3. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA.
4. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHEN IN MOTION.
5. KINEMATIC ENVELOPE IS VALID FOR 70 kmph OPERATING SPEED AND WIND SPEED OF 70 kmph
6. DESIGN SPEED OF METRO STRUCTURE: 90 kmph
7. MINIMUM LATERAL CLEARANCE FOR OHE MASTS FOR TANGENT TRACK FROM CENTRE LINE OF NEAREST TRACK: 2150mm
8. MINIMUM ELECTRICAL CLEARANCES BETWEEN ANY LIVE PART OF THE OVER HEAD EQUIPMENT OR PANTOGRAPH AND PARTS OF ANY FIXED STRUCTURES (EARTHED OR OTHERWISE) OR MOVING LOADS FOR AT-GRADE AND ELEVATED SECTION: HORIZONTAL AND VERTICAL CLEARANCE
i) STATIC 320mm; ii) DYNAMIC 200mm
9. THE MAXIMUM MOVING DIMENSIONS OF ANY ATTACHMENT TO ROLLING STOCK SHOULD NOT INFRINGE TO KINEMATIC ENVELOPE OF ROLLING STOCK.

CO-ORDINATES	
X'	Y'
0.00	5018.00
880.00	5018.00
1220.00	4866.00
1225.00	4014.00
1595.00	3296.00
1595.00	2876.00
1515.00	1090.00
1515.00	944.00
1495.00	185.00
1330.00	65.00
0.00	65.00

COACH PROFILE

KINEMATIC ENVELOPE AT PLATFORM
FOR OPERATING SPEED OF 70 KMPH
AND WIND SPEED OF 70KMPH

PLATFORM

1090 ± 5 BALLASTLESS TRACK
1080 ± 5 BALLASTED TRACK

TOP OF RAIL

Examined & Found in Order
Date

Auth. Sign. : ADE/Civil/UTHS/RD/50

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL
CORPORATION LIMITED

STANDARD GAUGE
(1435 mm)
25 KV A.C. TRACTION

KINEMATIC ENVELOPE FOR 70 KMPH
AT GRADE AND ELEVATED SECTIONS
ON LEVEL OR CONSTANT GRADE TANGENT TRACK
AT PASSENGER PLATFORM

FIGURE NO. PMSG-1A

REF: PARA 1.5.3.1 & 3.2

SCALE: NOT TO SCALE



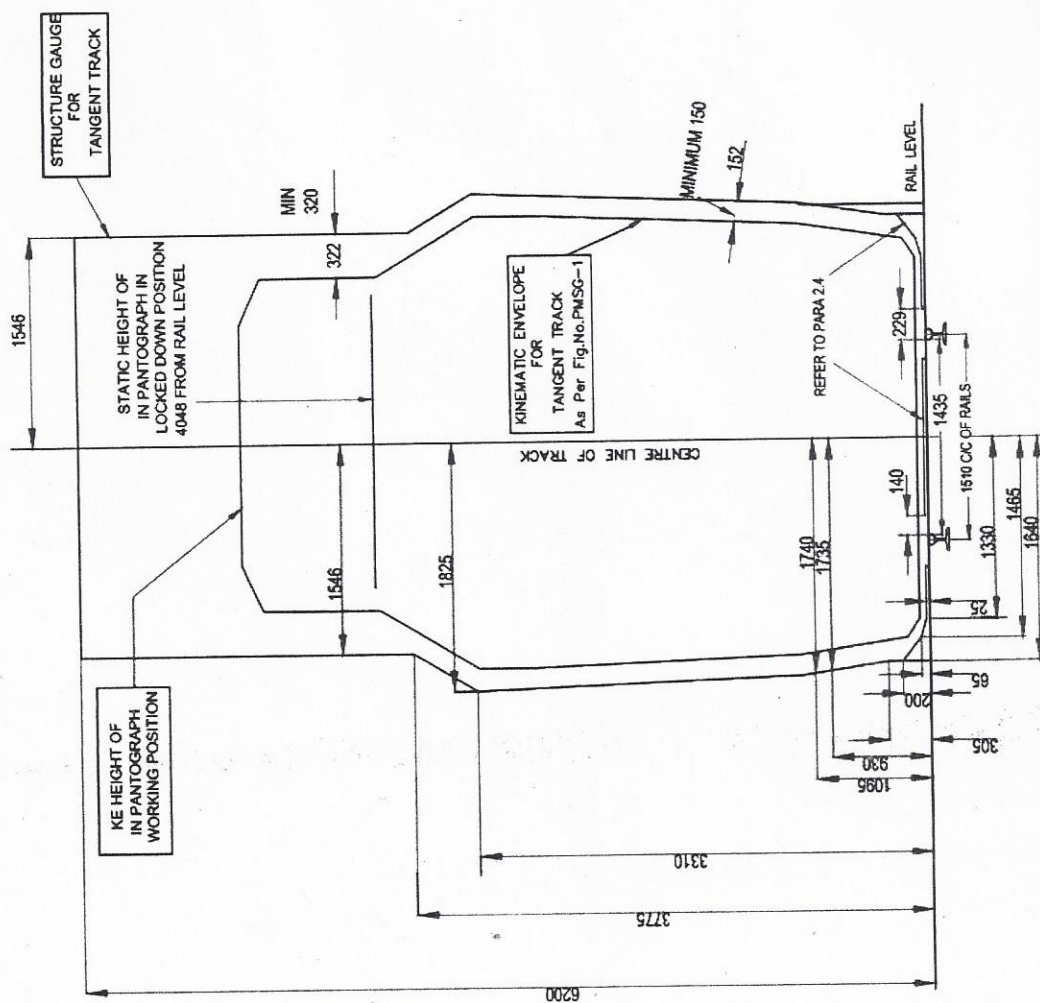


1. ALL DIMENSIONS ARE IN mm.

1. ALL DIMENSIONS ARE IN mm.
2. THIS STRUCTURE GAUGE WILL ALSO BE APPLICABLE FOR ROB&FOB_s AT STATIONS WITHOUT THE MAST UNDER THE STRUCTURES. IN CASE THE CONTACT WIRE IS HIGHER, THE HEIGHT OF THE ROB/FOB SHALL BE INCREASED ACCORDINGLY.
3. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE AND STRUCTURE GAUGE WILL BE 150 mm. MINIMUM ELECTRICAL CLEARANCE OF 320 mm SHALL BE MAINTAINED BETWEEN 25 KV LIVE PARTS AND THE EARTHED STRUCTURES.
4. MINIMUM LATERAL CLEARANCE FOR ONE MAST WILL BE 2150 mm FROM THE CENTRE OF NEAREST TRACK.
5. MINIMUM LATERAL CLEARANCE FOR ONE MAST WILL BE 1950 mm FROM THE CENTRE OF TRACK FOR AT GRADE AND DEPOT.
6. THE KINEMATIC ENVELOPE AND STRUCTURE GAUGE ARE VALID FOR ROLLING STOCK WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
7. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER APPENDIX-2.
8. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA.
9. FOR KINEMATIC ENVELOPE, REFER TO FIGURE-PMSG-1
10. THIS STRUCTURE GAUGE IS VALID FOR 90 kmph VEHICLE SPEED

Examiné & Found in Order
Date

Auth. Sign. : ADE/Civil/UTHS/RDSO



TITLE: STRUCTURE GAUGE
AT-GRADE AND ELEVATED SECTIONS
(OUTSIDE STATION)
ON
LEVEL OR CONSTANT GRADE TANGENT TRACK

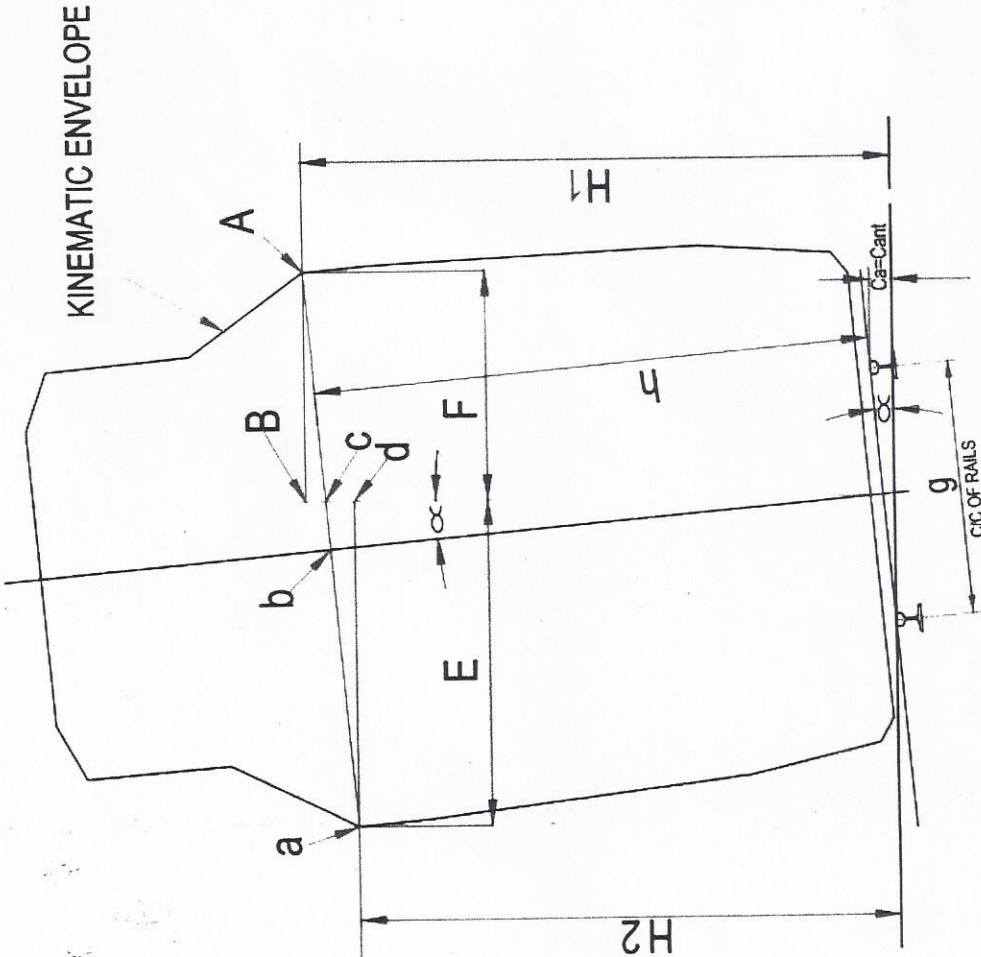
FIGURE No. PMSG-2

SCALE: NOT TO SCALE

STANDARD GAUGE
(1435 mm)
25 kV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED





ab=Ab= Distance from centerline of track to Kinematic Envelope for Tangent Track at height 'h'

$\sin \alpha = \text{cant}/g$

$g = 1510 \text{ mm}$

Ca = Cant applied

$E = [ab + (h \times \tan \alpha)] \times \cos \alpha$

$F = [Ab - (h \times \tan \alpha)] \times \cos \alpha$

$H_1 = (Ca/2) + (h/\cos \alpha) + (Ab - h \times \tan \alpha) \times \sin \alpha$

$H_2 = (Ca/2) + (h/\cos \alpha) - (ab + h \times \tan \alpha) \times \sin \alpha$

For values of E, F, H₁ and H₂, refer to Appendix 3 and Appendix 4 (UG)

NOTES:

KINEMATIC ENVELOPE FOR AT-GRADE/ELEVATED SECTIONS HAS BEEN SHOWN AS A TYPICAL FIGURE.

THE FORMULAE FOR E, F, H₁ AND H₂ SHOWN IN THIS FIGURE WILL ALSO APPLY TO UNDER GROUND RECTANGULAR BOX / CIRCULAR TUNNEL

TITLE: EFFECT OF CANT

ON

KINEMATIC ENVELOPE

Examined & Found in Order

Signature: ADE/Civil/UTS/RDSO

STANDARD GAUGE

(1435 mm)

25 KV A.C. TRACTION



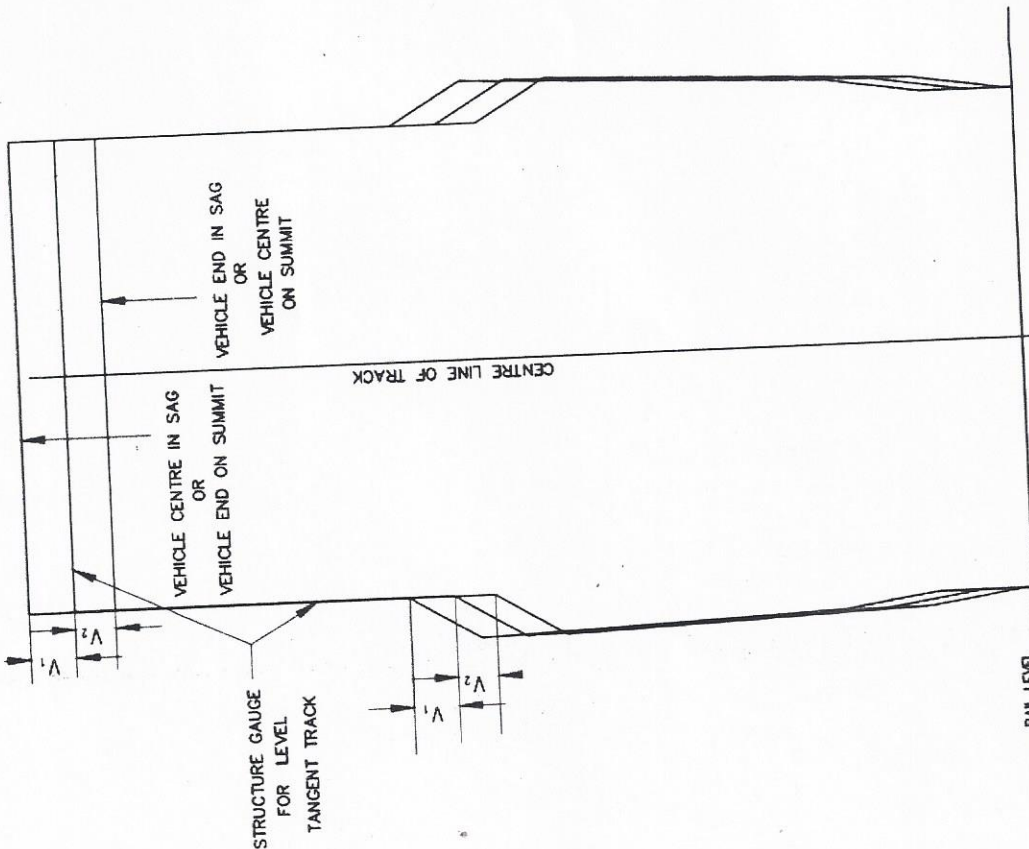
PUNE METRO RAIL PROJECT

MAHARASHTRA METRO RAIL CORPORATION LIMITED

FIGURE No. PMSG-3

SCALE: NOT TO SCALE

REF: PARA 1.8.1



VERTICAL THROW:

RADIUS OF VERTICAL CURVE metres	V ₁ mm	V ₂ mm
1500	19	22
1600	18	21
1700	17	20
1800	16	19
1900	15	18
2000	14	17
2100	14	16
2200	13	15
2300	12	15
2400	12	14
2500	11	14
2600	11	13
2700	11	12
2800	10	12
2900	10	12
3000	10	11

NOTE:

THE FIGURE IS TYPICAL AND WILL APPLY TO ELEVATED, UNDERGROUND AND AT-GRADE SECTIONS.

Examined & Found
Date

Auth. Sign.: ADE/CH/UTHSRDS

TITLE: EFFECT OF VERTICAL CURVE ON STRUCTURE GAUGE

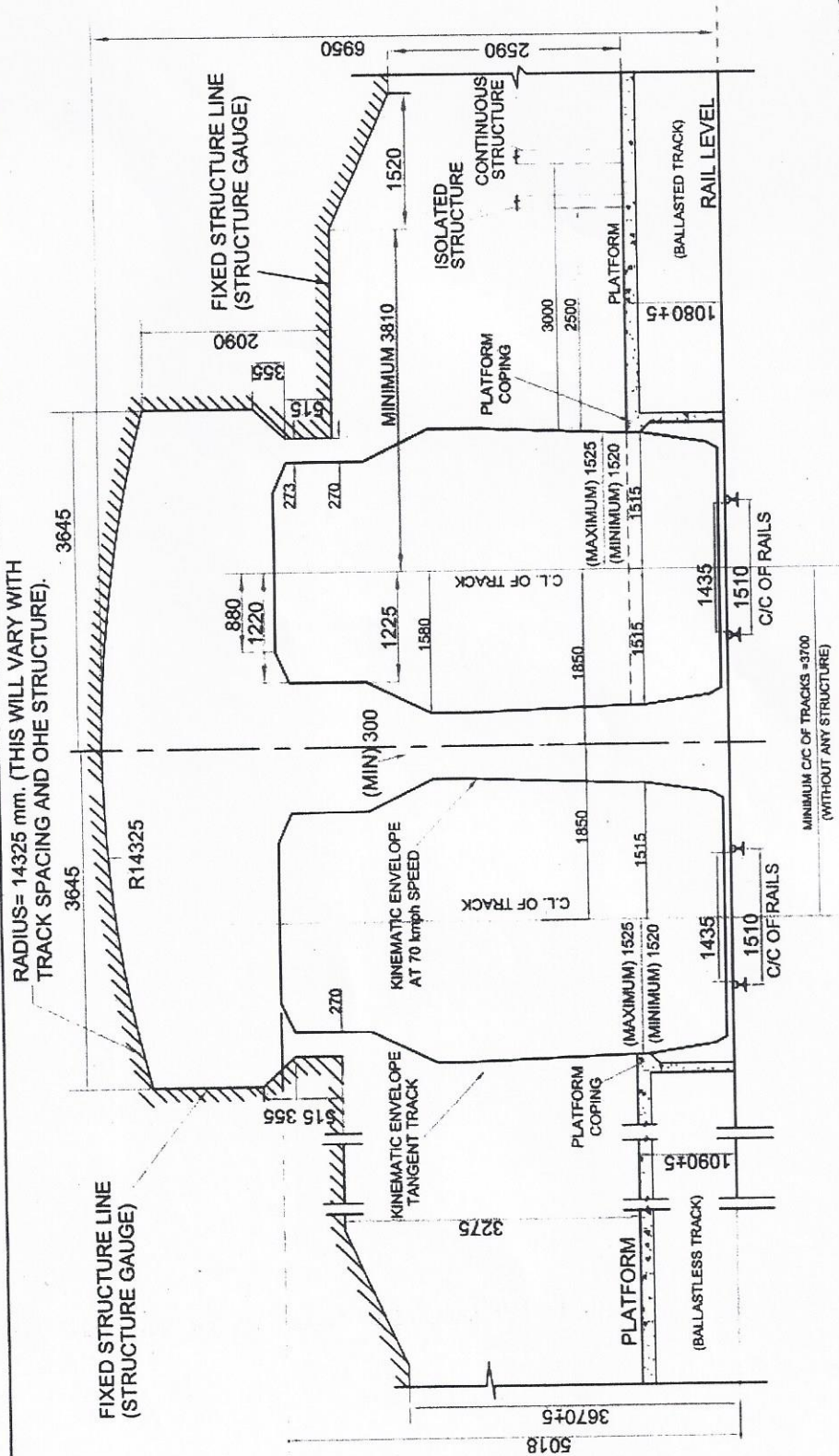
FIGURE No. PMSG-4

SCALE: NOT TO SCALE REF: PARA 1.7.1(C) & 1.7.2(C)

STANDARD GAUGE
(1435 mm)
25 KV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED





NOTES:

1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER APPENDIX-4
3. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA
4. THE TRACK CENTRES AT STATION WILL NOT INCREASE WITH CURVES OF RADIUS OF 1000 m AND ABOVE.
5. STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION
6. OHE IS SUSPENDED FROM CEILING BY DROP ARM.

Examined & Found in Order
Date

Auth. Sign. : ADE/CI/UTHS/IRDSO

TITLE: STRUCTURE GAUGE AT
ELEVATED/AT-GRADE STATION
WITH SIDE PLATFORMS
LEVEL OR CONSTANT GRADE TANGENT TRACK

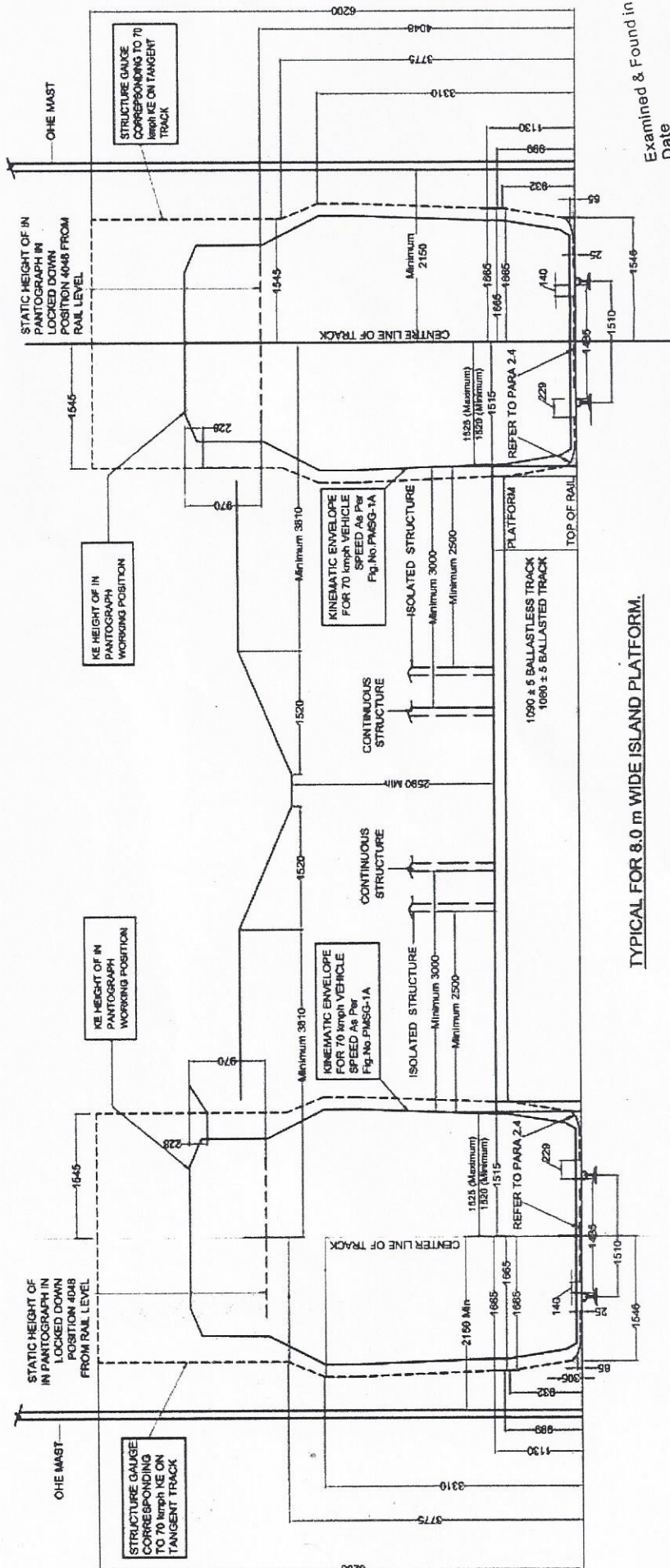
FIGURE NO. PMSG-5

SCALE: NOT TO SCALE

REF: PARA 2.2.4



PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED



TYPICAL FOR 8.0 m WIDE ISLAND PLATFORM.

Examined & Found in Order
Date

NOTES:

- All Dimensions are in mm.
- Allowance for curve shall be extra.
- Structure gauge is valid for vehicles with sealed windows and doors closed while in motion.
- Distance of platform coping from center of track as per the Para-2.2

Auth. Sign.: ADE/GWILLIAMS/IRDSO

TITLE: STRUCTURE GAUGE AT ELEVATED STATION
WITH ISLAND PLATFORM
ON LEVEL OR CONSTANT GRADE TANGENT TRACK

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED

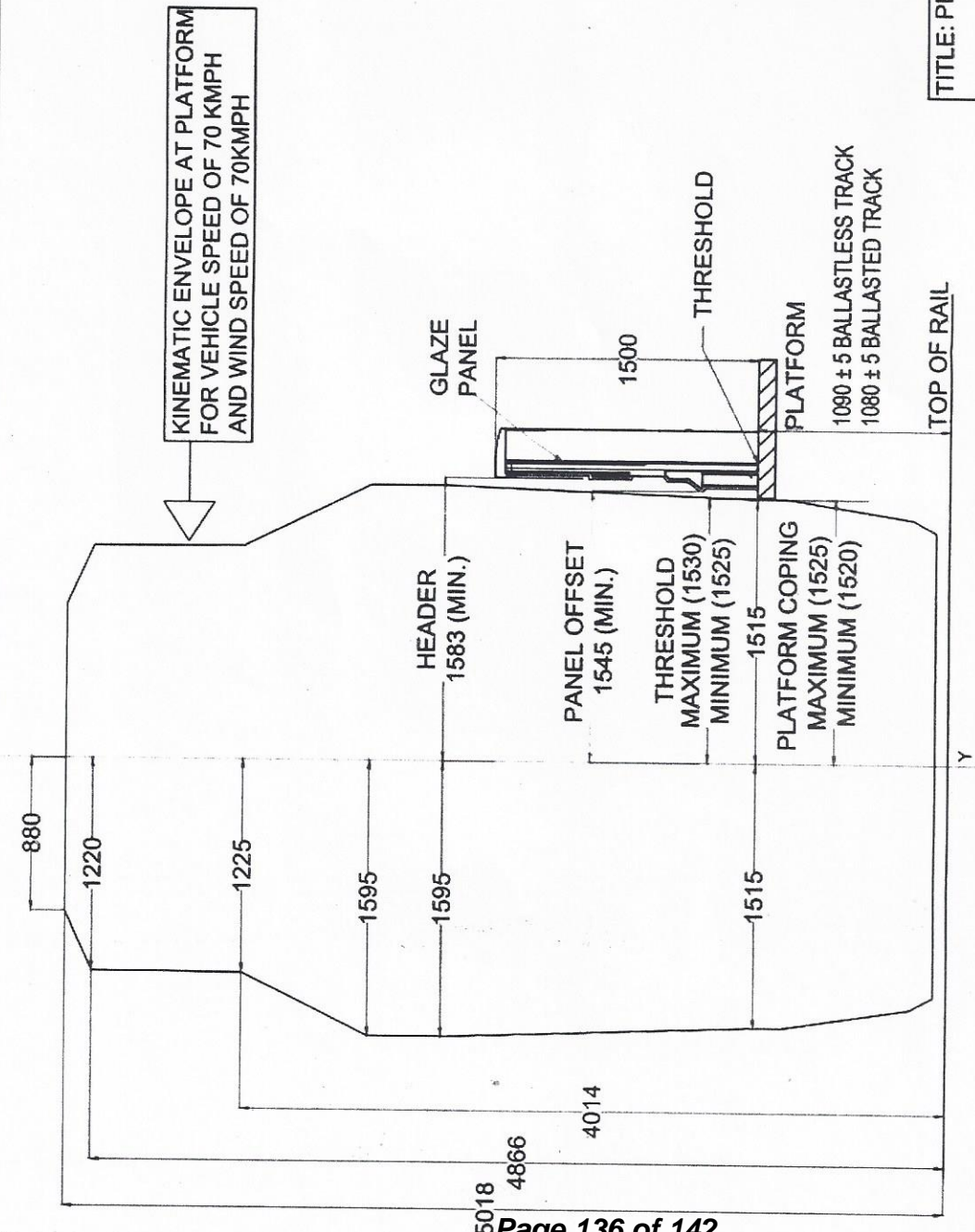
STANDARD GAUGE
(1435mm)
25 KV A.C. TRACTION

FIGURE NO PMSG - 6

SCALE: NOT TO SCALE

REFER PARA 2.2.4





Examined & Found in Order
Date

NOTES:

1. ALL DIMENSION ARE IN mm.
2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE WITH 10% EXTRA AS PER APPENDIX 4
3. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHEN IN MOTION.
4. MINIMUM GAP OF 10 mm SHALL BE MAINTAINED BETWEEN KE AND PLATFORM SCREEN DOOR AT ANY POINT.

TITLE: PLATFORM SCREEN DOOR ELEVATED/AT GRADE
(PLATFORM) ON LEVEL OR CONSTANT
GRADE TANGENT TRACK

FIGURE No. PMSG - 7

SCALE: NOT TO SCALE

REF: PARA 5.1

STANDARD GAUGE
(1435 mm)
25 KV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED





Order

Exam Date	_____
_____	_____

KINEMATIC ENVELOPE UNDER GROUND SECTION
(TUNNELS) (OUTSIDE STATION)

30

FIGURE NO. PMSG-8

25 KV A.C. TRACTION

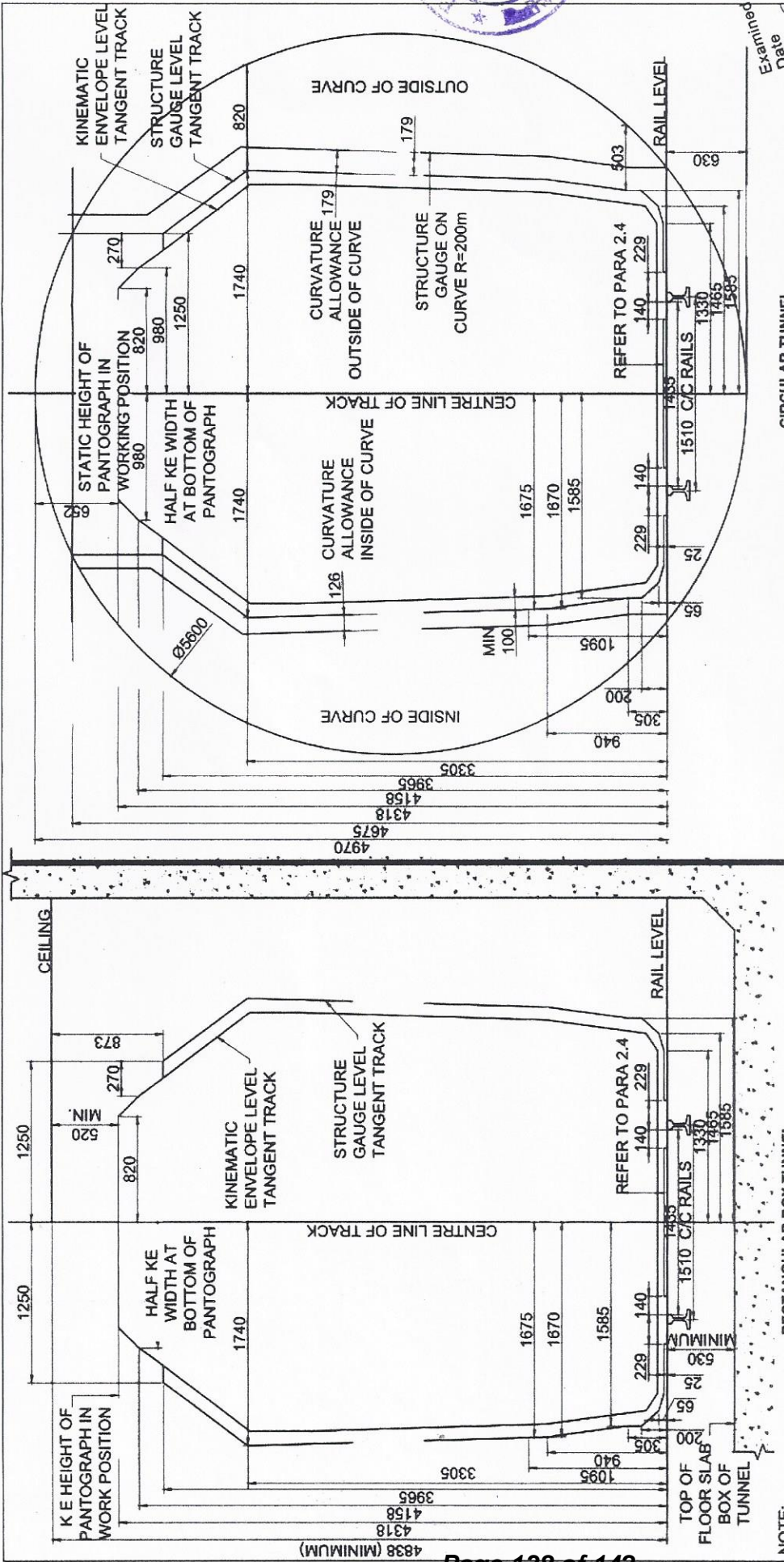
PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED

REF: PARA 1.5.3.1, 3.2 & 4.2.5

Pune Metro Rail Project

Page 42 of 47

July 2019



NOTE:

1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER APPENDIX-2
3. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA
4. KINEMATIC ENVELOPE AND STRUCTURE GAUGE ARE VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHILE IN MOTION.
5. STRUCTURE GAUGE FOR CURVE DOES NOT INCLUDE LATERAL SHIFT (LEAN) DUE TO CANT.
6. CANT WILL BE PROVIDED BY RAISING OUTER RAIL ONLY AND SHIFTING OF THE CENTRE OF THE CIRCULAR TUNNEL ABOUT THE MID POINT OF TOP OF INNER RAIL THE CURVE AND UPWARDS. THIS WILL BE SAME AS ROTATING THE CIRCULAR TUNNEL ABOUT THE MID POINT OF TOP OF INNER RAIL.

7. MINIMUM CLEARANCE BETWEEN KINEMATIC ENVELOPE AND STRUCTURE GAUGE=100mm. THE ELECTRICAL CLEARANCE FROM 25 KV LIVE PARTS AND EARTHED STRUCTURES SHALL BE 270mm.
8. VERTICAL THROW DUE TO VERTICAL CURVE HAS NOT BEEN SHOWN IN THE FIGURE AND SHALL BE EXTRA.

CIRCULAR TUNNEL

TITLE: STRUCTURE GAUGE
ON LEVEL OR CONSTANT GRADE TRACK (OUTSIDE STATION)
CIRCULAR TUNNEL (5800 DIA) ON TANGENT TRACK AND ON CURVE
OF RADIUS R=200 M BALLASTLESS TRACK RECTANGULAR BOX
TUNNEL ON TANGENT TRACK

STANDARD GAUGE
(1435 mm)
25 KV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED



FIGURE NO. PMSG-9

SCALE: NOT TO SCALE REF: PARA 1.4, 1.6



ADDED TO THE RECORDS
Date 3/28
Examined & Found in Order

1. ALL DIMENSION ARE IN MM.

2. HORIZONTAL CLEARANCE DUE TO CURVES AS PER APPENDIX-4 SHALL BE ADDED IF PLATFORM IN CURVE.
3. VERTICAL THROW DUE TO VERTICAL CURVE IF ANY SHALL BE EXTRA.
4. THE STRUCTURE GAUGE IS VALID FOR VEHICLES WITH SEALED WINDOW AND DOORS CLOSED WHILE IN MOTION.
5. A TYRE OR AN ATTACHMENT OF A WHEEL MAY PROJECT BELOW THE MINIMUM HEIGHT OF KINEMATIC ENVELOPE FOR DISTANCE OF 51mm INSIDE AND 216mm OUTSIDE THE WHEEL GAUGE FACE.
6. DIMENSION 'd' SHALL BE 65mm (MINIMUM) FOR BOGIE MOUNTED EQUIPMENT FOR FULLY LOADED STATIC VEHICLE 102mm (MINIMUM) IN FULLY LOADED CONDITION FOR BODY MOUNTED EQUIPMENT EXCEPT AS LAID DOWN AT ITEM 5 ABOVE. AND 50mm UNDER DYNAMIC CONDITION.

STRUCTURE GAUGE AT UNDERGROUND
STATION WITH ISLAND PLATFORM
LEVEL OR CONSTANT GRADE TANGENT TRACK



PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED

STANDARD GAUGE
(1435 mm)
25 kV A.C. TRACTION

FIGURE NO. PMSG-10

SCALE: NOT TO SCALE

REF: PARA 2.2.4

NOTES:-

1. ALL DIMENSIONS ARE IN mm.
2. HORIZONTAL CLEARANCES DUE TO CURVES SHALL BE EXTRA AS PER APPENDIX-4
3. VERTICAL CLEARANCE DUE TO VERTICAL CURVES AND CANT SHALL BE EXTRA
4. KINEMATIC ENVELOPE IS VALID FOR VEHICLES WITH SEALED WINDOWS AND DOORS CLOSED WHEN IN MOTION.
5. KINEMATIC ENVELOPE IS VALID FOR 70 KM/H VEHICLE SPEED
6. MAXIMUM WIND SPEED FOR TRAIN OPERATION: NIL
7. DESIGN SPEED OF METRO STRUCTURE: 90 kmph
8. MINIMUM ELECTRICAL CLEARANCES BETWEEN LIVE PARTS OF CONTACT LINES AND BODIES OF STRUCTURES FOR UNDERGROUND SECTION:
i) STATIC 270mm; ii) DYNAMIC 170mm
9. MINIMUM ELECTRICAL CLEARANCES BETWEEN LIVE PARTS OF CONTACT LINES AND BODIES OF VEHICLES FOR UNDERGROUND SECTION:
i) STATIC 290mm; ii) DYNAMIC 190mm
10. THE MAXIMUM MOVING DIMENSIONS OF ANY ATTACHMENT TO ROLLING STOCK SHOULD NOT INFRINGE TO KINEMATIC ENVELOPE OF ROLLING STOCK

CO-ORDINATES

POINT #	EASTING (X')	NORTHING (Y')
0	0	4318
1	820	4318
2	980	4158
3	1089	4005
4	1579	3287
5	1579	2885
6	1505	1090
7	1495	185
8	1330	65
9	0	65

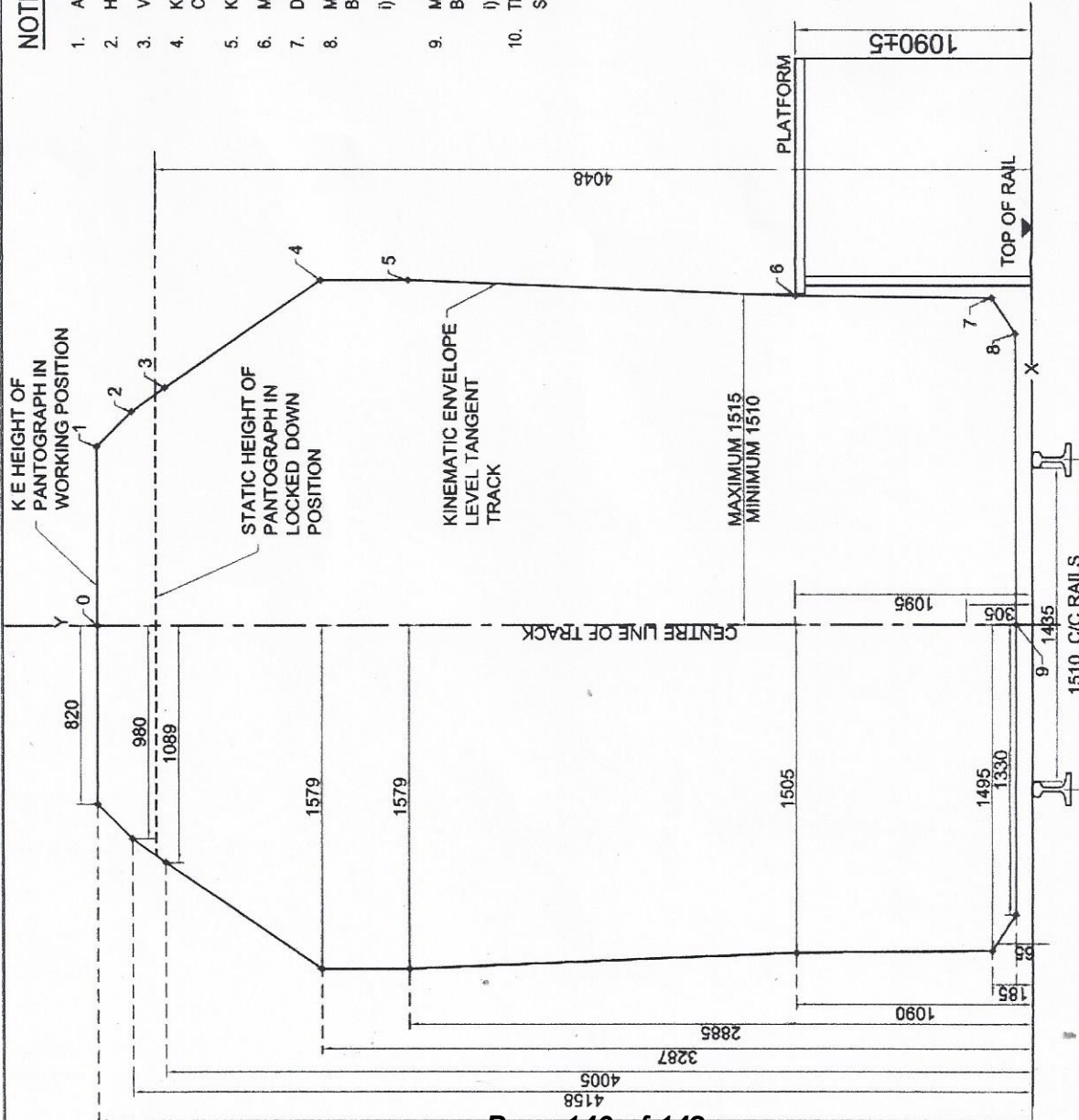
TITLE:

KINEMATIC ENVELOPE
UNDERGROUND SECTION
ON
LEVEL OR CONSTANT GRADE TANGENT
TRACK AT PLATFORM

FIGURE NO. PMSG-11

SCALE: NOT TO SCALE

REF: PARA 1.5, 3.1 & 3.2



STANDARD GAUGE
(1435 mm)
25 kV A.C. TRACTION

PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL CORPORATION LIMITED



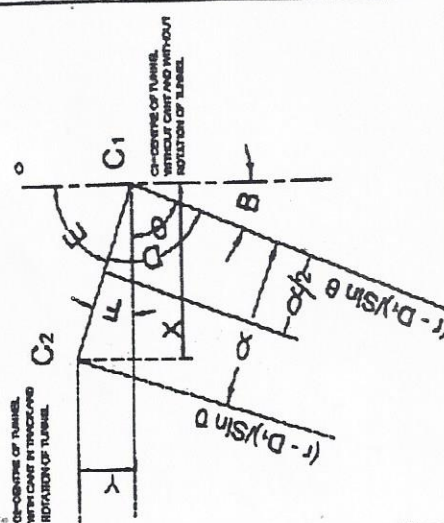


Q

$$\begin{aligned} \tan \theta &= (r-D_1)/(g/2) \\ \theta &= \tan^{-1} [(r-D_1)/(g/2)] \\ \sin \alpha &= g \sin \theta / g \\ \alpha &= \sin^{-1} (\sin \theta) \\ \text{Chord } C_1 C_2 &= 2 \times [(r-D_1) \sin \theta] \times (\sin \alpha/2) \\ X &= C_1 C_2 \times \cos (90^\circ - \theta - \alpha/2) \\ &= 2 \times [(r-D_1) \sin \theta] \times \cos (90^\circ - \theta - \alpha/2) \\ Y &= 2 \times [(r-D_1) \sin \theta] \times (\sin \alpha/2) \times \sin (90^\circ - \theta - \alpha/2) \\ \text{Where } Y & \text{ is internal radius of tunnel,} \\ D_1 &= \text{depth from Rail level to invert of tunnel} \\ g &= \text{distance between centres of rails} \\ &= 1510 \text{ mm} \end{aligned}$$

DETAIL AT CENTRE OF TUNNEL

$$\begin{aligned} \text{Angle } B &= (90^\circ - \theta) \\ \text{Angle } D &= (90^\circ - \alpha/2) \\ \text{Angle } E &= (90^\circ - \alpha/2) \\ \text{Angle } F &= (90^\circ - \theta - \alpha/2) \end{aligned}$$



STANDARD GAUGE
(1435 mm)
25 KV A.C. TRACTION



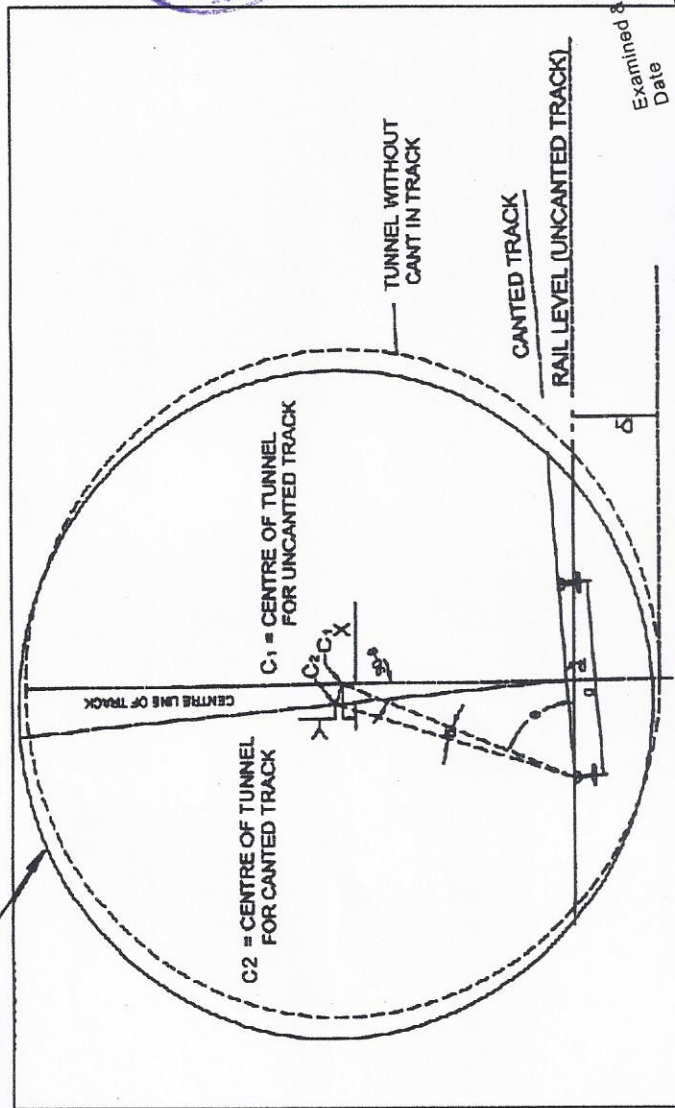
PUNE METRO RAIL PROJECT
MAHARASHTRA METRO RAIL
CORPORATION LIMITED

STANDARD GAUGE
(1435mm)
25 KV A.C. TRACTION

NOTES:-

1. THE CIRCULAR TUNNEL IS ROTATED ABOUT THE MID POINT OF TOP OF INNER RAIL FOR CANT.
2. FOR VALUES OF SHIFT 'X' AND 'Y' FOR VARIOUS VALUES OF CANT, REFER TO APPENDIX-5
3. THE SOD IS PROPOSED FOR THE MAXIMUM SPEED OF 90 KMPH AND OPERATING SPEED OF 80 KMPH OF THE ROLLING STOCK

TUNNEL WITH
CANT IN TRACK



TUNNEL WITHOUT
CANT IN TRACK

CANTED TRACK

RAIL LEVEL (UNCANTED TRACK)

Examined & Found in Order
Date

Auth. Sign. *[Signature]*
Date

SHIFT OF THE CENTER OF CIRCULAR TUNNEL DUE TO
ROTATION OF TUNNEL TO PROVIDE CANT

FIGURE NO PMSG - 12

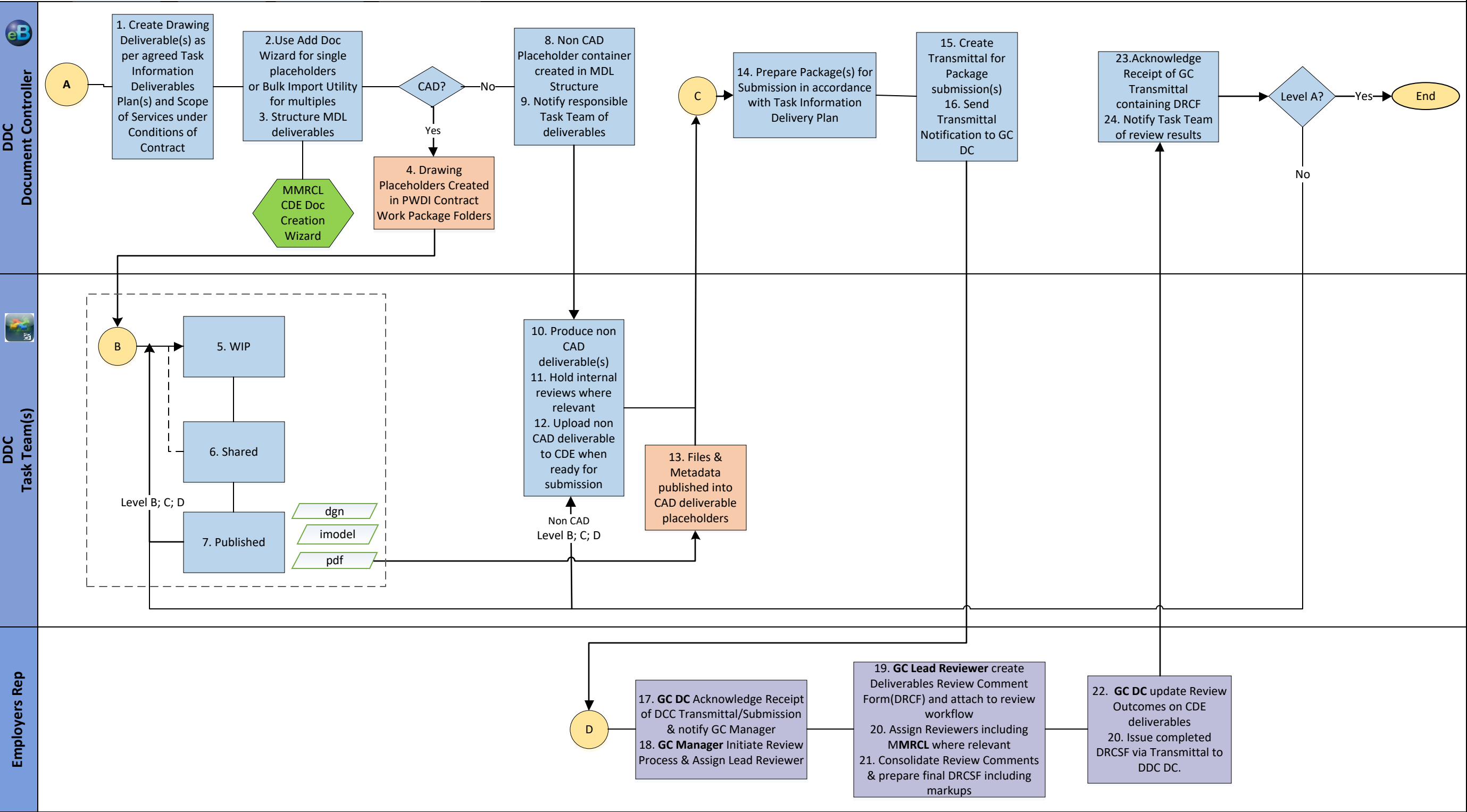
SCALE: NOT TO SCALE



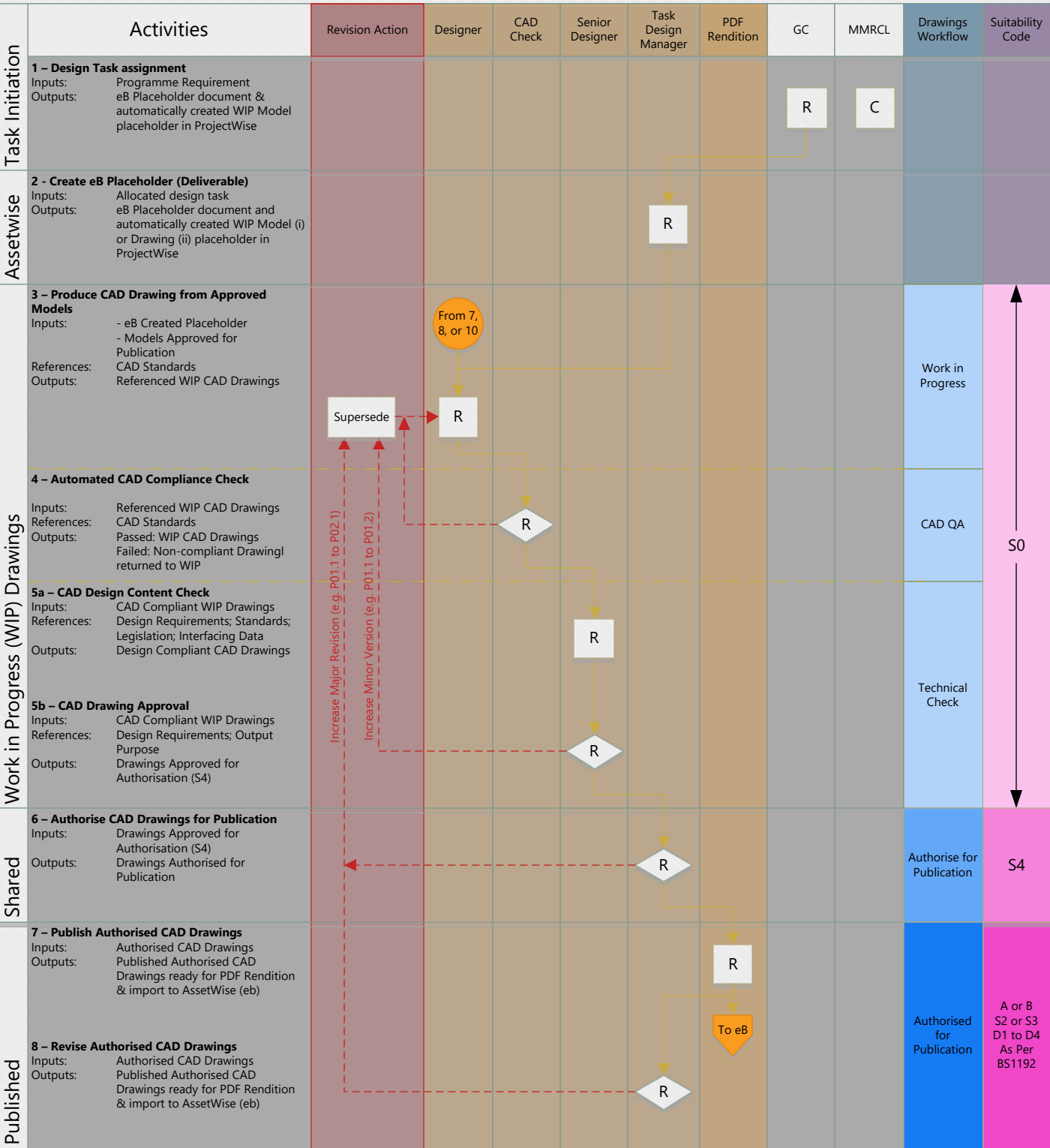
END OF TENDER DOCUMENT

BIM CDE End to End Deliverables Workflow Process

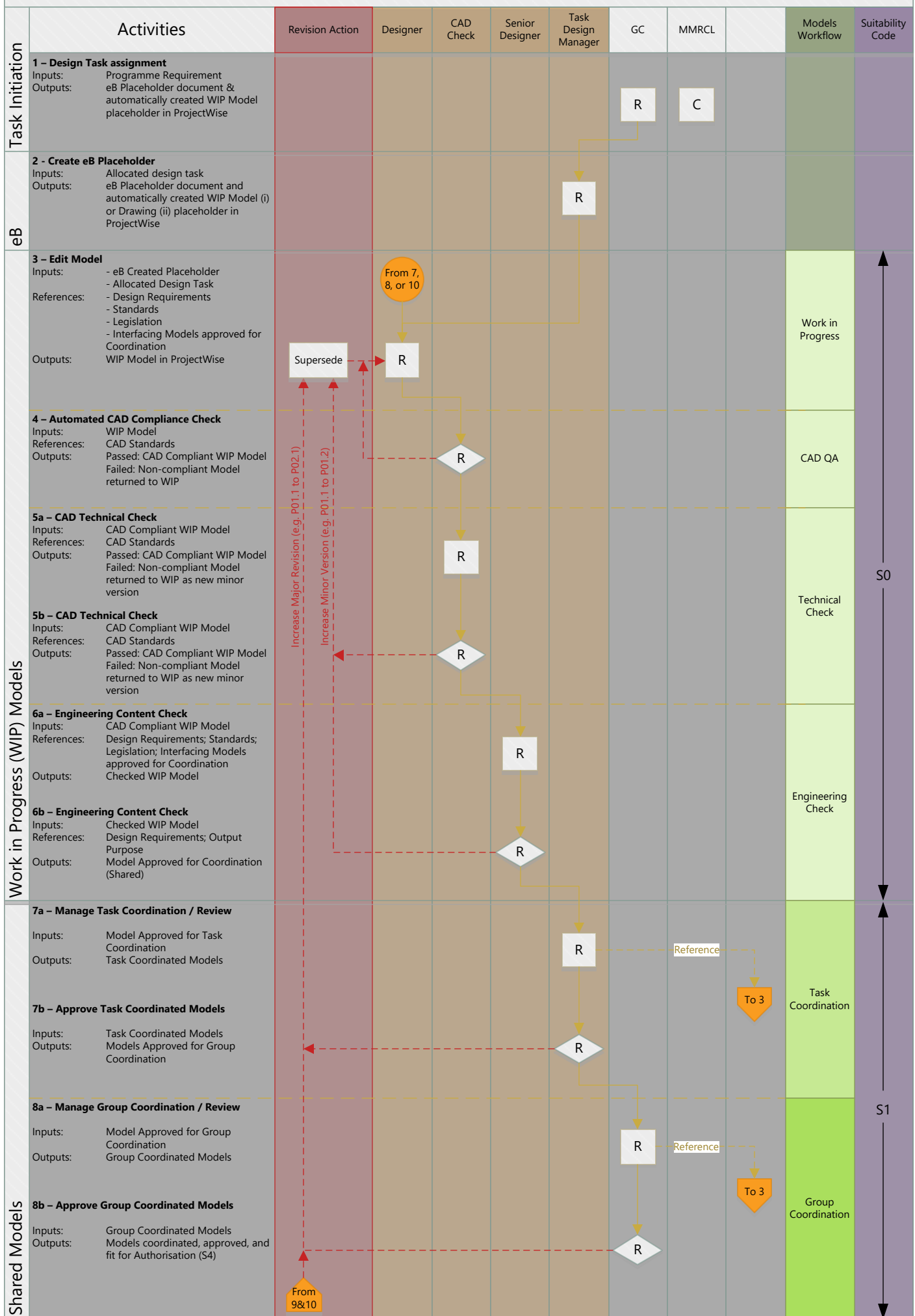
Key/Legend DDC Contractor GC/MMRCL CDE Custom eB-PW Connector



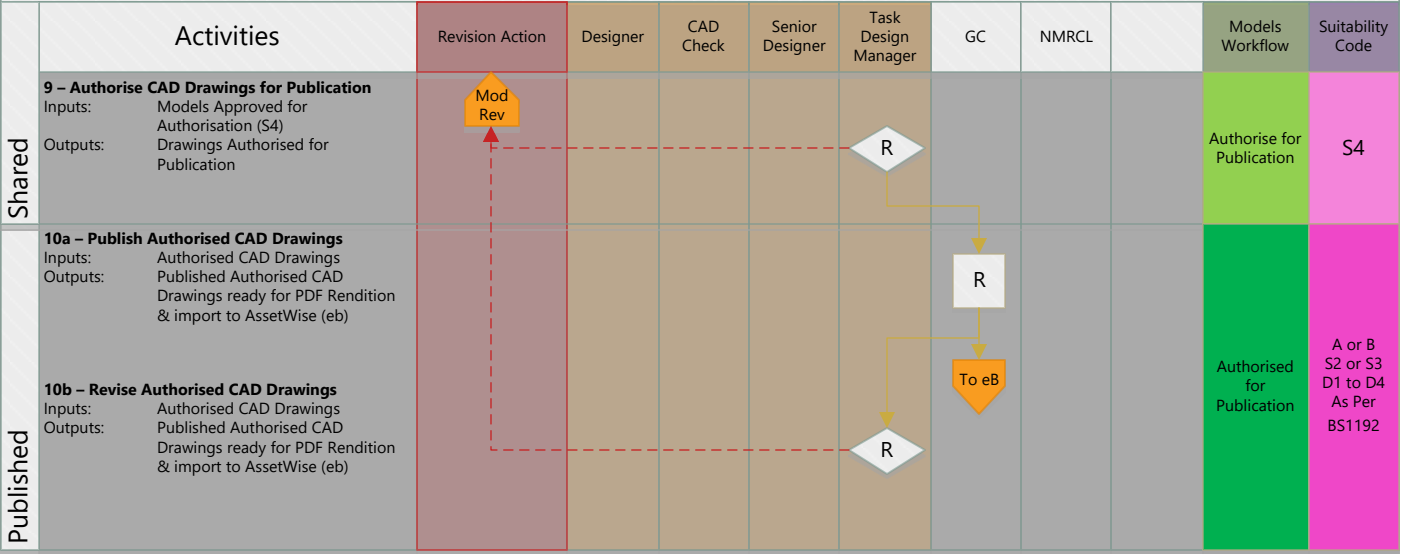
Management of Drawing Data



Management of Model Data



Management of ProjectWise Model Data



MMRCL EIR (Employers Information Requirements)



Document Status	
Document Title	MMRCL Employers Information Requirements
Document Number	MMRCL-Pune Metro-EIR V1.0
Publication Date	20-April-2017
Issue Status	For MMRCL acceptance
Prepared by	
Reviewed by	
Approved by	

Revision Status			
Date	Revision Made	Revision by	Approved by

References			
No	Title	Version	Date
1	MMRCL EIR Standards, Methods and Procedures		20-April-2017
2	BS1192:2007+A2:2016 Collaborative production of architectural, engineering and construction information. Code of practice	2007+A2	2016
3	PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling		2013
4	MMRCL CAD Standard	V1.0	20-April-2017
5	MMRCL - Engineering Assurance File Naming Convention	V1.0	20-April-2017
6	MMRCL Design Review and Acceptance Procedure		
7	MMRCL Master Information Delivery Plan Template (MIDPT)	V1.0	20-April-2017
8	MMRCL Master Delivery List	V1.0	20-April-2017
9	MMRCL Master Production Delivery Table	V1.0	20-April-2017
10	MMRCL Level 2 BIM E2E Workflow Process	V1.0	20-April-2017
11	MMRCL Level 3 Drawing Process	V1.0	20-April-2017
12	MMRCL Level 3 Model Process	V1.0	20-April-2017

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1. PURPOSE

The purpose of this Employer Information Requirements (EIR) document (as a part of “**Business Requirement Document**”) is to provide specific details and instructions relating to Production Information and Handover Information [**Information Artefacts**] about the engineering solution of the MMRCL (Maha Metro Rail Corporation Ltd) asset and how these shall be captured, authored, managed and submitted to MMRCL or its agent [**the Employer**] by the Supplier / Detailed Design Consultant / Contractor [**the Supplier**] .

The EIR sets out MMRCLs EIR standards, methods and procedures to be used for producing and managing Information Artefacts during each project phase, to make sure that the developed engineering solution meets project objectives and desired outcomes and benefits.

As such, it is incumbent on the Supplier to explain:

Pre-contract (if applicable):

As part of the Supplier tender submission and scope of services, and specifically within the pre-contract BEP (BIM Execution Plan):

- how the Supplier intends complying with the MMRCL Design, Review and Acceptance procedure
- how the Supplier intends complying with MMRCL EIR SMP (Standards, Methods and Procedures)
- how the Supplier will help MMRCL achieve its BIM objectives in a manner which helps eliminate risk from the project and which promotes collaboration, innovation and right first time design
- how the Supplier intends producing and delivering Information Artefacts in compliance with MMRCL standards

Post Contract:

As part of the Supplier post-contract BEP (BIM Execution Plan) and in addition to the pre-contract points listed above:

- how the Supplier intends developing the scope and delivery schedule for the MIDP (Master Information Delivery Plan) for agreement with MMRCL
- how the supplier intends to make sure that Information Artefacts are submitted in accordance with the MIDP, to the required schedule, LOD and quality
- how the Supplier intends publishing Drawing information to support Design Reviews, costing or any other identified purpose
- how the Supplier intends sharing and publishing Modelling information for Coordination and Collaboration purposes
- how the Supplier intends working collaboratively with interfacing disciplines and contracts in order to eliminate coordination issues, design clashes and constructability issues
- how the Supplier intends satisfying the Level of Definition (LOD) requirements

The EIR sets out Level of Definition requirements. This is a collective term used to describe both the '**Level of Model Detail**' and the '**Level of Information Detail**' to be authored and issued to the Employer by the Supplier.

The '**Level of Model Detail**' is the description of **graphical** content of models which is required during each (applicable) project phase (for example during CONCEPT DESIGN, PRELIMINARY DESIGN, DETAILED DESIGN etc)

The '**Level of Model Information**' is the description of **non-graphical** content of models which is required during each project phase.

The LOD principles and requirements are set out in sections 3.4 and 3.5 respectively.

Note that this EIR document has been produced in alignment with BS1192 [Ref 2] and PAS 1192:2-2013 [Ref 3] and uses terminology consistent with this standard including:

- Task Team
- Master Information Delivery Plan (MIDP)
- Master Production Delivery Table (MPDT)
- BIM Execution Plan (BEP)

A glossary of key terms used in this EIR can be found in section 8 Definitions.

The following sections of this EIR document describe the Employers Objectives, the EIR Standards Methods and Protocols and Supplier obligations in more detail.

2. THE EMPLOYERS 5D BIM OBJECTIVES

It is MMRCL's objective to have a common strategy for the adoption of 5D BIM. The strategy includes an approach to describing information requirements across all aspects of the asset lifecycle with the Information Requirements (EIR) for such, being described in this document.

2.1 The Employer's Objectives

- To achieve a world-class quality of service, achieve efficiency and practice better control over the financial transactions and project activities
- Establish uniform standards for excellence in operations, project management, human resource management, financial management and performance reporting
- To drive efficiencies in the production, modification, operation and decommissioning of its engineered assets through data driven information, improving decision making and delivering best value to its stakeholders
- To institutionalise the use of the 5D BIM processes and solutions with the expectation that the solutions to become the backbone of the project during the design and build phase and subsequently for operations upon go-live of the project; with no change in the platforms envisaged unless the technology solution is declared obsolete and out of support

- To make sure that project execution stays within the defined timelines and budgets with the best of quality resulting from world-class practices on scheduling, estimation and engineering
- To institute good practise, collaborative techniques and behaviours which results in on-time and within budget project execution as follows:
 - A focus on design beyond 2D drafting and 3D modelling
 - Early visualisation and comprehension by MMRCL – enabling faster approval cycles
 - Ease of coordination between construction documents
 - Spatial Coordination between disciplines
 - Clash detection and conflict resolution limiting issues on-site and during construction.
 - Extraction of intelligent data and automated schedules
 - Ability to take-off materials and quantities
 - Ability to link Models, Projects Schedules and Construction Sequencing
 - Projecting future construction sequence conflicts
 - Tracking and identifying location of material and pieces on-site in a simulated environment
 - Transparent and realistic picture of the actual activities in the Project
 - Visualisation of construction-sites for contractors, sub-contractors and clients onsite
 - Integration of BIM with mobile-devices for managing construction and commissioning / hand-over.
 - View the current cost and compare it to the estimated total target cost of projects as well as interim costs against design during design phases
 - Effective strategic and operational setup right from the beginning of the Project
 - Implementation of an effective Operational Excellence in Initialisation & Execution
 - True and fair view on financials, reliable forecast and what-if-scenarios
 - Cost and Time optimised Program Management with early warning system in place for on-time management action
- To procure / produce, manage and maintain data and information about the MMRCL engineered assets that is complete, consistent and can be trusted and re-used for operational purposes and for future business intelligence

2.2 Project Objectives

The Employer's 5D BIM objectives for the Pune Metro Project / Contracts are to:

- achieve target capital delivery cost
- deliver best value through innovation
- obtain digital assurance and evidence, through the use of Information Artefacts, verifying the integrity and completeness of the design of the engineered solution at each stage of the Project / Contract
- obtain digital assurance and evidence, through the use of Information Artefacts, validating the buildability of the engineered solution

- obtain digital assurance and evidence, through the use of Information Artefacts, verifying that (and how) the asset(s) can be efficiently constructed / installed
- obtain digital assurance and evidence, through the use of Information Artefacts that health and safety and CDM requirements have been identified and met
- obtain digital assurance and evidence, validating the integrity and completeness of the (Handover) Information Artefacts
- obtain structured (Asset) data to populate Asset Management Information Systems

3. INFORMATION UTILISATION AND PLANNING

3.1 Primary Uses of Data and Information

The Employer's primary uses for the Information Artefacts, throughout the lifecycle of the asset(s), are as detailed in Table 3-1.

Table 3.1 – Primary Use	
Reference	Description
PU01	Assurance To verify that MMRCL assurance requirements are satisfied and evidenced
PU02	Project Coordination To verify coordination and integration between disciplines and with adjacent works / contracts
PU03	Business Case and Whole Life Cost To validate the business case and whole life cost forecasts, making sure they are robust and outcomes and benefits can be / will be achieved.
PU04	Cost Facilitate the population of the cost and estimating systems
PU05	Operations and Maintenance To validate that the assets will meet the operational and maintenance requirements as set out in the (Asset sections of the) Model Production and Delivery Table (MPDT)
PU06	Asset Registration To facilitate the asset registration process and subsequently populate the Asset Management Information Systems
PU07	Benefits Management To help verify that the project outcomes and benefits have been achieved

3.2 Stage Gate Digital Assurance

All Information Artefacts, as explicitly defined in the MIDP, shall be submitted to MMRCL using the MMRCL Common Data Environment (CDE), in order to:

- provide the requisite level of assurances in accordance with the Employers Requirements
- inform stage gate decisions, as defined below to enable Stage Gate sign-off:
 - **Stage 1: INITIATION**

Have business outcomes and benefits (that the projects must deliver) been established?
 - **Stage 2: CONCEPT DESIGN**

Are the business outcomes and benefits achievable?

Is there an option that delivers optimum value?
 - **Stage 3: PRELIMINARY DESIGN**

Have the design principles been defined?

Can the scope of the project be frozen?
 - **Stage 4: DETAILED DESIGN**

Will the designed solution deliver the required outcomes?

Can the detailed design be used for contracting delivery of the works?
 - **Stage 5: CONSTRUCTION (INSTALLATION)**

Have all (Production) Information Artefacts been provided and verified?
 - **Stage 6: HANDOVER**

Have all (Handover) Information Artefacts been provided and verified?

Have the assets been accepted by the end user?
 - **Stage 6: OPERATIONS**

Note: the table below provides a cross-reference between the generic project stages listed above and contract specific project stages

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Stage 7
	INITIATION	CONCEPT DESIGN	PRELIMINARY DESIGN	DETAILED DESIGN	CONSTRUCTION (INSTALLATION)	HANDOVER	OPERATIONS
Viaduct	Initiation	Concept Design	Preliminary Design	Detailed Design	Construction	Commissioning & Handover	Operation & Maintenance
Station	Initiation	Concept Design	Preliminary Design	Detailed Design	Construction	Commissioning & Handover	Operation & Maintenance
Traction	Initiation		Preliminary	Detailing	Material/ Equipment Procurement Installation & Testing	Commission	Operations & Maintenance
Electrical & Mechanical	Initiation		Preliminary	Detailed	Procurement (Manufacturing & Inspection) Supply Installation	Testing & Commissioning Integrated Testing Handing Over	Operations & Maintenance
Telecom	Initiation	Concept	Preliminary	Detailed	Delivery Installation Test Procedures Own Commissioning & Configuration Partial Acceptance System Configuration System Acceptance Test	Interface test & Configuration ITC (Final Testing) Trail Runs	Revenue Operations Date
Rolling Stocks	Initiation	Preliminary	Pre-final	Detail	Mock Production Testing & Commissioning	Integrated Testing & Commissioning Trail Run	Operations
Signalling	Initiation		Preliminary	Detail	FAT Delivery Installation	Testing & Commissioning As-Built	Operations
Depot							
Track							

- facilitate the primary uses as set out in Table 3-1
- deliver the required types of documentation as part of the (Handover) Information Artefacts, as defined in the MIDP (Master Information Delivery Plan).

NOTE: The Supplier shall identify and capture within the MIDP, the Information Artefacts that will be delivered to support and inform the stage decisions and assurances, as set out within the **MMRCL Design Review and Acceptance Procedure** [Ref 6].

For details of the required types of documents to be delivered as part of the Handover Information, refer to the Operations and Maintenance section of the MIDP.

3.3 Technical and Design Reviews

All Technical and Design Reviews are to be undertaken in accordance with the **MMRCL Design, Review and Acceptance procedure** [Ref 6]. This procedure specifically identifies the types, frequency and events at which reviews will be undertaken.

The **MMRCL Design, Review and Acceptance procedure** [Ref 6] provides a comprehensive list of questions which are to be answered at each Design Review. The Supplier shall provide the agreed Information Artefacts needed to adequately answer all design review questions and provide the requisite evidence of assurance.

All Information Artefacts for Technical and Design Reviews shall be submitted by the Supplier through the CDE in accordance with the relevant **MMRCL EIR Standards, Methods and Procedures** [Ref 1]

3.4 LOD (Level of Definition) - Principles and Requirements

3.4.1 Purpose and Scope

The purpose of this section is to define the LOD principles and requirements for each of the primary systems and components within each Discipline for each project stage.

The Employer's LOD requirements are specified in the Employer's MDPT (Master Delivery Plan Table) – which is provided as a referenced document to this EIR document. The Employers MDPT declares:

- The list of systems for which models are required
- The project stage or stages (eg DETAILED DESIGN) at which models are to be developed by the Supplier

NOTE: see section 3.5 Master Production and Delivery Table (MPDT): The Employers Requirement, for the stages at which models are to be developed by the Supplier

- the required LOD for each of the systems models
- the intended purpose of the models
- the native and deliverable formats in which the models are to be issued to the CDE

NOTE: The Supplier shall develop the MIDP and BEP to provide assurances and evidence as to how the points above will be addressed

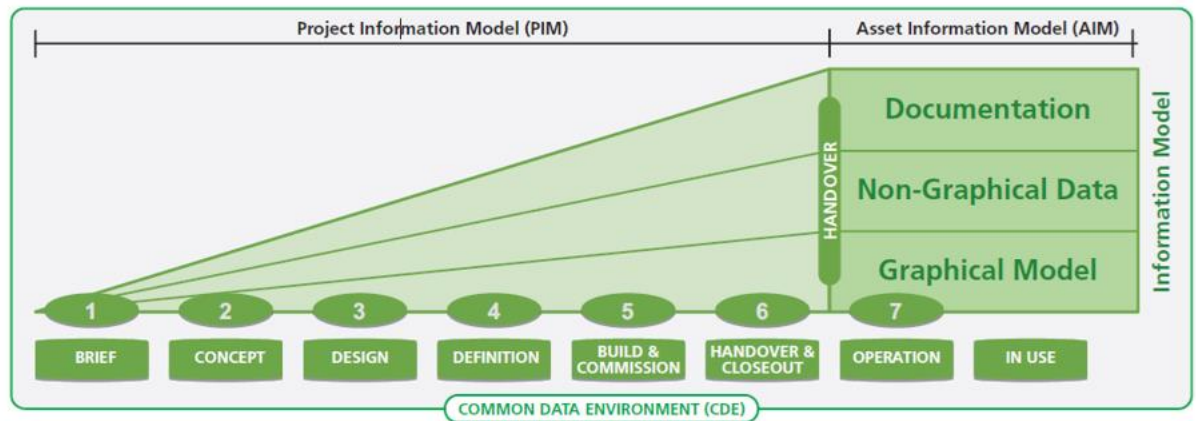
3.4.2 LOD Principles

The Level of Definition is a collective term used to describe both the '**Level of Model Detail**' [LOD] and the '**Level of Information Detail**' [LOI] to be authored and issued to the Employer by the Supplier.

The '**Level of Model Detail**' is the description of **graphical** content of models which is required during each (applicable) project stage (for example during DETAILED DESIGN etc)

The '**Level of Model Information**' is the description of **non-graphical** content of models which is required during each project phase.

These principles are based on PAS1192-2 [Ref 3] as illustrated below:



In principle, the LOD and LOI and matures progressively throughout the project lifecycle as illustrated in the diagram below.

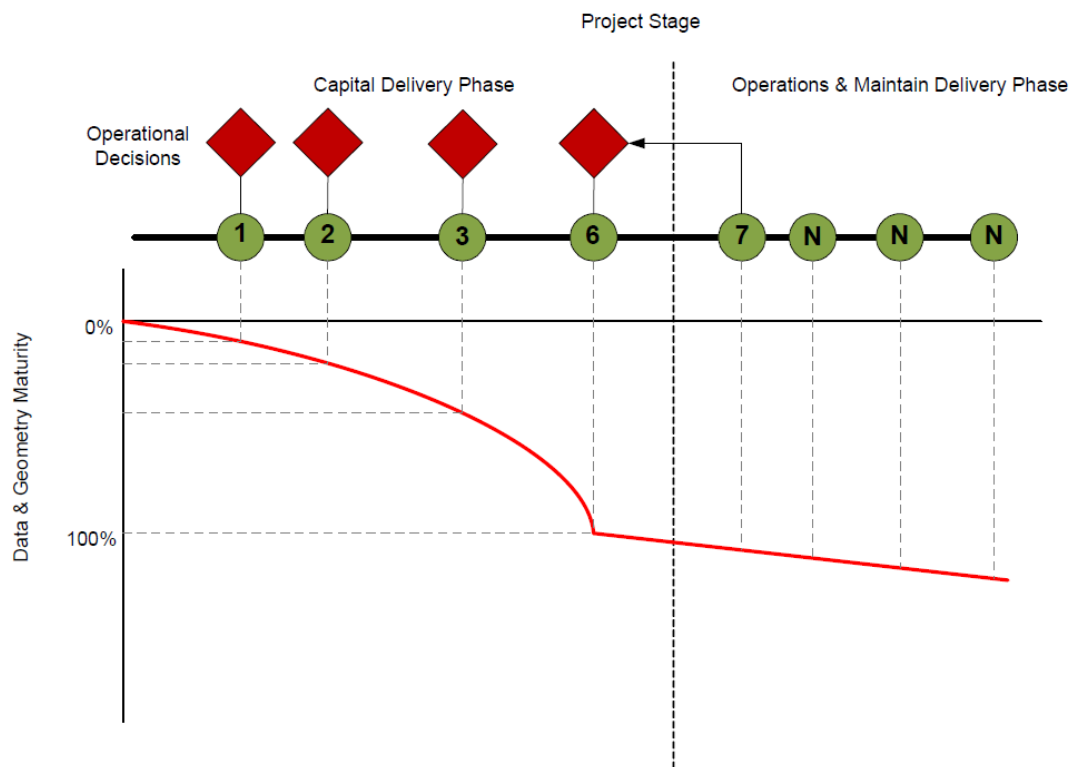


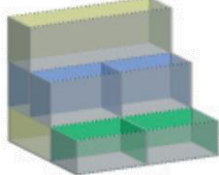

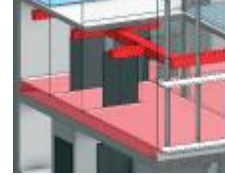


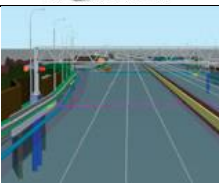
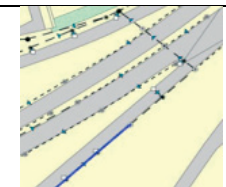

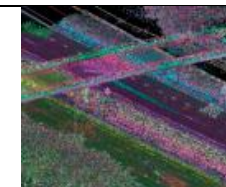


Figure 1. Plan of Work and the progressive Level of Definition.

Table 3.4.1 below declares MMRCL's overall vision and principles for modelling, LOD and LOI across the project lifecycle.

Table 3.4.1 - Generic principles of Levels of Model definition for building and infrastructure projects							
Stage Number	1	2	3	4	5	6	7
Model Number	INITIATION	CONCEPT DESIGN	PRELIMINARY DESIGN	DETAIL DESIGN	CONSTRUCTION	HANDOVER	OPERATIONS
Systems to be covered	N/A	As per MPDT requirements	As per MPDT requirements	As per MPDT requirements	As per MPDT requirements	As per MPDT requirements	As per MPDT requirements
Graphical Illustration (Building Project)							
Graphical Illustration (Infrastructure Project)							
What the model can be relied upon for	Model information communicating the brief, performance requirements, performance benchmarks and site constraints	Models which communicate the initial response to the brief, aesthetic intent and outline performance requirements. The model can be used for early design development, analysis and co-ordination. Model content is not fixed and may be subject to further design development. The model can be used for co-ordination, sequencing and estimating purposes.	A dimensionally correct and coordinated model which communicates the response to the brief, aesthetic intent and some performance information that can be used for analysis, design development and early contractor engagement. The model can be used for co-ordination, sequencing and estimating purposes including the agreement of a first stage target price	A dimensionally correct and model that can be used to verify compliance with regulatory requirements. The model can be used as the start point for the incorporation of specialist contractor design models and can include information that can be used for fabrication, co-ordination, sequencing and estimating purposes, including the agreement of a target price/guaranteed maximum price.	An accurate model of the asset before and during construction incorporating coordinated specialist subcontract design models and associated model attributes. The model can be used for sequencing of installation and capture of as installed information	An accurate record of the asset as a constructed at handover, including all information required for operation and maintenance.	An updated record of the asset at a fixed point in time incorporating any major changes made since handover, including performance and condition data and all information required for operation and maintenance.
Output	Project brief and procurement strategy	Refined project brief and concept approval	Approval of coordinated developed design		Integrated production information. Complete fabrication and manufacturing details, system and element verification, operation and maintenance information Modify to represent as installed model with all associated references.	As constructed systems, operation and maintenance information. Agreed final account Building Log Book Information gathered as key elements are completed to feed installation information for the later packages.	Agreed final account. In use performance compared against Project Brief. Project process feedback: risk; procurement information management, soft landings

Stage Number	1	2	3	4	5	6	7
Model Number	INITIATION	CONCEPT DESIGN	PRELIMINARY DESIGN	DETAIL DESIGN	CONSTRUCTION	HANDOVER	OPERATIONS
Parametric Information	<p>Project needs update: definition of function(s), operation, quality and time.</p> <p>Benchmarking updated: capital cost, maintenance cost, time, health & safety, risk procurement contract.</p> <p>Performance requirements: Priorities and aspirations for: function, mix of uses, scale, location, quality, performance in use, cost (CAPEX & OPEX), value, time, health & safety, embodied and in use carbon, energy and resources needs, standard designs. Site constraints: geo-spatial, available site information.</p>	<p>Sufficient data to estimate per square metre rates and other similar metrics.</p> <p>Wireframe for surfaces/solids.</p> <p>Concepts, site context placeholder/ volumes/ package volumes, system routings, site selection, datum points & levels. Integrated concept for the project setting scope, scale, form and primary design criteria: architectural form and spatial arrangements, services philosophy and special arrangements preliminary assessment of energy use and embodied/in-use carbon, incorporation of standard systems</p>	<p>Co-ordinated Developed Design for the project setting: generic systems, objects, or assemblies represented with, detailed form, function, cost, defining all components in terms of overall size, typical detail, performance and outline specification, primary geometry frozen, integration of standard designs and systems, builders work strategy for significant interfaces, energy use, embodied and in use carbon.</p> <p>Maintenance plan Detailed design and construction program.</p>	<p>Production information for the project: Specific systems, objects and assemblies accurate in terms of specification, size, form, function and location. Critical interfaces flagged Fixing Methodology Confirmed clash free detailed production program sequence. Updated: energy use and embodied and in use carbon, detailed design and construction program</p>	<p>Production record for the project: Specific systems, objects and assemblies accurate in terms of specification, size, form, function and location with detailing, fabrication, assembly, and installation information Detailed routing of system Fixings and interfaces details to be used. Updated: energy use and embodied and in use carbon, detailed design and construction program.</p>	<p>Updated: Geometry and installed product information, "as constructed"</p> <p>Accuracy/resolution of information. Commissioned performance for: OPEX, energy, and carbon Detailed maintenance methodology. Snagging action status.</p>	<p>Revisions for modifications to the facility during its life.</p>
Employer activities							

Stage Number	1	2	3	4	5	6	7
Model Number	INITIATION	CONCEPT DESIGN	PRELIMINARY DESIGN	DETAIL DESIGN	CONSTRUCTION	HANDOVER	OPERATIONS
Critical Interfaces and logic	N/A	Environmental control philosophy and special allocations for ventilation; Availability of the site and outline construction methodology assumptions; Services capacity for the site Permitted working hours on site	Assumed procurement package performance ad spatial boundaries; Other relationships between procurement packages; Assumed design codes regarding dimensional tolerances of related systems; Foundation tolerances for use of off-site modular system; Assessment of predicted movements (thermal, loading, creep, shrinkage etc.)	Allocated procurement package relationships, performance and special boundaries; Actual dimensional interface requirements; Records of any derogations approved; Actual on-site to offsite interface specifications.	Progressive capture of actual dimensional data for critical interface dimensions. Progressive capture of information for calculating material requirements for follow on packages. Capture of object status for progress reporting and collaborative planning.	As constructed 3D scan Element performance test results. System Commissioning status.	As modified survey data.
Construction requirements (Examples)	N/A	Crane use zones; Traffic diversions	Confirmed crane (or other lifting system) zones framework details. Traffic diversion details.	Actual crane (or other lifting system) zones and movement sequences. Construction methodology, sequence and movements, critical to how the production design is developed.	Status of construction requirements. Safety briefing information. Construction methodology, sequence and movements, critical to installation. Formwork details including install and removal sequence. Actual traffic diversion details.	Confirmed status that the construction aids have been removed.	Design of any construction requirements, eg: temporary safety supports or restraint supports or restraint systems if structural defects have been discovered.
Project Costs	Initial project budget. Order of cost estimate.	Feasibility cost plan. Feasibility life cost plan.	Commitment Cost Plan. Contractor's first stage bid submission. Detailed whole life cost plan.	Contract Sum/Target price/ Agreed Maximum Price. Pre-construction whole life cost plan	Contract Sum/ Target Price/ Agreed Maximum Price. Pre-construction whole life cost plan.	Final account.	Actual in-use costs. Asset replacement sinking fund.
Project Logistics and off site activities (examples)	Client requirements, eg to avoid impact on other operations.	Assumed access and egress points; Potential delivery and lay down zones.	A feasible logistics sequence for the construction sequence; Confirmed modular strategy (volumetric, panelised, hybrid or other)	Finalised logistics sequences. Details of actual off-site system to be used.	Object status progress recording to initiate demand pull signals for deliveries.	Remote monitoring systems status.	Remote monitoring systems status.

Stage Number	1	2	3	4	5	6	7
Model Number	INITIATION	CONCEPT DESIGN	PRELIMINARY DESIGN	DETAIL DESIGN	CONSTRUCTION	HANDOVER	OPERATIONS
Project facilities (Welfare, IT Infrastructure, security etc) onsite and offsite (examples)	Collaboration tools; Data standards	Assumed access and welfare zones; Design team collocation.	Confirmed access zones and design team collocation.	Finalized, costed plan, Critical lead times confirmed. Off-site manufacturing capacity reserved.	Recording status of security critical areas (EG unchecked, sweep in progress, screened and secured)	Security system operational, potentially using model information for lines of sight from cameras, PAVA zone controls, etc.	Security system operational. Facilities management systems running on model generated information Geometry for letting activities accessed from "as constructed" model
Notes and associated project documents, based on model information	Management systems for information and decision making Approval policies.	Technical strategy studies. Commissioning philosophy NRM1 capital cost plan NRM3 maintenance cost plan	Provides the basis for Integrated Production Information to be produced on a package basis with limited risk of changes to primary coordination Room Information sheets, Detailed construction methodology NRM2 and NRM3 cost plans Health and safety risk management Risk Management plan.	Updated: maintenance plan, risk management plan, detailed construction methodology, NRM2 procurement pricing schedule, NRM3 maintenance cost an, health and safety risk management plan, risk management plan.	Detailed construction methodology, Updated health and safety risk management plan NRM3 maintenance cost plan	Approximate final account Maintenance procurement pricing Remedial works, handover and maintenance program.	N/A (project closed)

3.5 Master Production and Delivery Table (MPDT): The Employers Requirement

The Employers MPDT Requirements define the minimum LOD and LOI required for each System. These are explicitly defined in the Employers MDPT, which are referenced by to this EIR document.

NOTE: It is MMRCL's requirement that **model** Information Artefacts should be developed from the start of **DETAILED DESIGN** stage of the project. 2D drawings approved at the end of the preliminary stage should be used for developing the 3D Model which is only to be submitted for Review. On Final approval (Level A or Level B) of the 3D Model, 2D drawings are extracted and submitted for review with 3D drawings for Construction certification.

The Supplier shall develop the MIDP and BEP to provide assurances and evidence as to how the points below will be addressed:

- How models shall be developed to the required LOD/LOI.
- How models (and 2D drawings) shall be developed and issued to the CDE in the identified native and deliverable formats
-
- How the Supplier intends working collaboratively with interfacing disciplines and contracts in order to eliminate coordination issues, interface and design clashes and constructability and construction sequencing issues
- How all information artefacts (both models and drawings) shall comply with the **MMRCL - Engineering Assurance File Naming Convention** [Ref 5]
- How all information artefacts (both models and drawings) shall comply with the **MMRCL CAD Standard** [Ref 4]

3.6 Value Engineering

NOTE: The Supplier shall provide details of how Information Artefacts will be used to show the effectiveness (and provide assurance and evidence) of value engineering.

Value engineering must be integrated into the Design Review procedure. An MMRCL Operations Representative must have access to all relevant Information Artefacts and attend all value engineering reviews.

NOTE: The Supplier shall provide details of how Information Artefacts will be presented and approved during the review process.

3.7 Health and Safety and Construction Design Management (CDM)

NOTE: The Supplier shall provide details of how Information Artefacts will be utilised to support health and safety and CDM obligations; identifying, eliminating and reducing hazards and risks and providing better safety management.

Where the Supplier is contracted to carry out Detailed Design they shall provide details of process for integrating the construction plan with other components of the Production Information. Details shall include how safety measurements will be validated and how compliance with safety regulations will be checked.

3.8 Asset Information

Table 3-5 provides details of the Employer's corporate solutions for the management of Asset Information and the vehicle for delivery of the required information.

Table 3.5 – Asset Information		
Description		
System	Data / Information	Information Exchange Format
Bentley AssetWise	Documentation	Word/Excel/PDF
Bentley ProjectWise	Graphical Data	Refer to Table 6.2
	Non-Graphical Data	Excel

Note: Where the MMRCL MPDT Requirements extend to the CONSTRUCTION, HANDOVER or OPERATIONS phases, the Supplier shall develop and include a MDPT response within the Suppliers BEP providing assurances and evidence as to how the points below will be addressed:

- How Asset Information Artefacts shall be developed to the required LOD/LOI for each of the listed systems and project stages
- How Asset Information Artefacts (and 2D drawings) shall be developed and issued to the CDE in the identified native and deliverable formats
- How Asset Information Artefacts shall comply with the **MMRCL - Engineering Assurance File Naming Convention** [Ref 5]
- How Asset Information Artefacts (drawings) shall comply with the **MMRCL CAD Standard** [Ref 4]

3.9 Training Arrangements

The Supplier is responsible for making sure that their staff (and that of their Sub-contractors of any tier) are adequately briefed and trained to undertake the Information Management and Information Modelling aspects of the project.

The Supplier shall provide details of how they will make sure (and manage and maintain) their staff (and that of their Sub-contractors) have the capability and competency to provide verified and coordinated Information Artefacts in accordance with these EIRs.

4. STANDARDS, METHODS AND PROCEDURES

4.1 Standards

All Information Artefacts, as specified in the MPDT and as defined and agreed in the MIDP, shall be produced, managed and submitted into the CDE in accordance with the standards and procedures listed below and in any case in compliance with the **MMRCL EIR Standards, Methods and Procedures** [Ref 1].

Table 4.1 – Industry Standards		
Standard Ref	Title	Revision

BS 1192:2007+A2:2016	Collaborative production of architectural, engineering and construction information. Code of practice	N/A
BIP2207	Standard Framework and Guide to BS1192:2007	
PAS 1192-2:2013	Specification for information management for the capital/delivery phase of construction projects using building information modelling	
Digital Plan of Work (NBS Toolkit)	https://toolkit.thenbs.com/	
CIC BIM Protocol 2013		
Table 4.1 – Project Standards & Procedures		
Standard Ref	Title	Revision
MMRCL CAD Standard	MMRCL CAD Standard	V1.0

4.2 Security

NOTE: The Supplier shall provide details and assurances within the BEP of how the following potential security concerns will be addressed:

Note: that the scope and context of these security concerns relates to the Suppliers production and management of Information Artefacts, in particular when working outside of the MMRCL CDE

- How the Supplier will comply with all relevant MMRCL security policies
- How the Supplier will protect MMRCL IP (Intellectual Property)
- How the Supplier will make sure that access to Information Artefacts will be restricted only to the relevant, authorised personnel
- How the Supplier will protect Information Artefacts against malicious attack

4.3 Roles and Responsibilities

The role of a Project Information Manager shall be appointed by the Supplier.

The responsibilities of the Project Information Manager include:

- making sure that the BEP has been completed and agreed with the Employer and (where appropriate) briefed to Sub-contractors or suppliers of the Supplier and the relevant the Project / Task Team members
- making sure that the BEP is updated as works progress, in compliance with project change control procedures
- making sure that all Employer standards, methods and procedures are fully complied with
- promoting collaborative behaviours
- providing the focal point for all Information Artefact management issues on the project

-
- making sure that all Information Artefacts are compliant with the requirements of the contract and all relevant Employer standards
 - making sure that all Information Artefacts are managed and submitted through the CDE and that all mandatory meta-data has been populated
 - making sure that the Supplier, Sub-contractors or suppliers of the Contractor / Consultant, and the relevant the Project / Task Team members (as applicable) have continued and appropriate access to the Project Data Environment
 - providing clear instructions, including on the following areas:
 - which Information Artefacts are required, by whom and for what purpose;
 - who will generate the Information Artefacts and maintain them;
 - how Information Artefacts will be sorted and distributed;
 - how frequently Information Artefacts will be shared (for example for inter-disciplinary coordination purpose); and
 - what actions should be taken on receipt of Information Artefacts

The Roles and Responsibilities relating to the authoring, checking, sharing, publishing and management of the Information Artefacts can be found in the **MMRCL EIR Standards, Methods and Procedures** [Ref 1].

The Supplier shall assure MMRCL that that responsibilities have been adequately allocated and that a contact list of those assigned to the project, including Curriculum Vitaes (CV) is maintained for assurance purposes.

4.4 Naming Conventions

The Supplier shall make sure that a single File Naming convention is used for all Information Artefacts and that File Names are unique across the Project.

The File Naming Convention is defined in **MMRCL EIR Standards, Methods and Procedures** document [Ref 1].

4.5 Classification

The Supplier shall structure all Information Artefacts; categorising the functional and physical characteristics of the assets such that they can be efficiently identified, grouped and utilised

5. INFORMATION MANAGEMENT

5.1 System Performance and Constraints

The Supplier shall provide details of any limitations / restrictions of all IT systems; this should as a minimum determine limitations on files size and any restrictions on the use of the MMRCL recommended software platforms.

The Supplier is responsible for procuring, testing and implementing any required IT infrastructure, hardware and software in advance of project mobilisation and on-boarding.

5.2 Planning and Work Segregation

Zoning and Volume Strategy

The Contractor / Consultant shall provide details of their massing strategy in accordance with Section 3.4 **Level of Definition – Principles and Requirements** which shall define the extents of the proposed design, including:

- shape
- general size
- location
- orientation.

Modelling Strategy

The Supplier shall provide details of their modelling strategy, which must explicitly define how Information Artefacts will be developed to allow;

- parallel working across discipline / Task Teams
- coordination within (and across) interfacing disciplines / Task Teams and all adjacent works /contracts
- efficient Information Artefact exchange through the CDE
- delivery of graphical information in accordance with the **MMRCL CAD Standard** [Ref 4]

Volume Strategy

The Supplier shall provide details of their volume strategy, which must explicitly define how the extents of the massing strategy are sub-divided into spaces within which discipline / Task Teams can effectively coordinate their designs (i.e. rooms, horizontal and vertical circulation, structures, service routes).

The Supplier shall provide details of their processes for utilising the volume strategy to:

- federate models
- provide assurances and evidence of coordination between interfacing disciplines / Task Teams and all adjacent works / contracts
- design within each volume
- provide assurances and evidence of the coordination and integration between the volumes

Please refer to Section 3.4 **Level of Definition – Principles and Requirements** for more details.

5.3 Common Data Environment (CDE)

All Information Artefacts shall be authored, checked, shared, published and managed through the CDE, in accordance with **MMRCL EIR Standards, Methods and Procedures** [Ref 1] – but see qualifying notes below with respect to authoring and checking.

The CDE comprises:

- **A Project Data Environment**

MMRCL will provide a designated system accessible to all Task Teams and other relevant stakeholders (as authorised by MMRCL), which shall be used as a managed 'single source of truth' for all Information Artefacts **shared** for (non-contractual) coordination and collaboration purposes and for all Information Artefacts **published** for (contractual) MMRCL Design Review and Acceptance purposes

- **Task Team Data Environment(s)**

MMRCL will provide each Task Team with a dedicated, secure working area (the Task Team Data Environment) where Information Artefacts shall be Shared and Published, in accordance with the Master Information Delivery Plan (MIDP).

All Shared and Published Information Artefacts shall first be approved by the Task Team Manager before issue to the relevant Shared or Published Area of the Project Data Environment

All Shared and Published Information Artefacts shall first be approved by the Task Team Manager before issue to the relevant Shared or Published Area of the Project Data Environment

MMRCL shall provide the Project Data Environment as described in **MMRCL EIR Standards, Methods and Procedures** [Ref 1]. All other details relating to the Collaboration Tools used to support the CDE are documented below.

The Employer Collaboration tool is declared in Table 6.1a. Details of how the Supplier (and their Sub-contractors) shall access and interact with the system, including the security model, access rights and training and support to be provided is documented in the **MMRCL EIR Standards, Methods and Procedures** [Ref 1].

5.3.1 Task WIP (Work in Progress) Team Data Environment

Note that Suppliers may optionally choose to develop WIP Information Artefacts within the MMRCL Task Team Data Environment.

On request, MMRCL shall provide each Task Team with a secure WIP (Work in Progress) working area, where the Supplier can author and check Information Artefacts in advance of issuing to the relevant Shared or Published Area of the Project Data Environment should the Supplier choose to work this way – the Supplier shall notify and document this intent within the Suppliers BEP response

5.4 Collaboration Process

The Supplier shall make sure that all Information Artefacts are checked, approved and verified as Information Artefacts are issued to or are passed through the CDE.

The types of checks and approvals shall be determined by the purpose for which the Information Artefacts is being shared (refer to Section 8 of the SMP for further details).

The Supplier shall provide the following details:

- processes for checking, approving and verifying Information Artefacts within the CDE
- triggers for sharing / exchanging Information Artefacts
- purposes of sharing / exchanging Information Artefacts
- assurances of compliance against the prescribed information exchange format
- frequency and purpose of each design review / coordination workshop

5.5 Compliance Plan

The Supplier shall provide details and evidence of how Information Artefacts, delivered through the CDE, are:

- verified against Project Requirements (including the EIR)
- compliant with the standards set out in section 4.1,
- progressed to the agreed LOD as set out in the MIDPs and BEP
- spatially coordinated in relation to the assets physical space, operational space and maintenance space
- useable by the software platforms identified in Table 6-1
- in the information exchange formats identified in Table 6-2; and
- checked and approved for technical content, in accordance with the MMRCL Design, Review and Acceptance Procedure [Ref 6]

6. DIGITAL ENGINEERING

6.1 Software Platforms

6.1.1 Collaboration Platforms

The Employers Collaboration Platforms are listed in Table 6-1.

Table 6.1 – Employer Collaboration Platforms		
Use	Platform	Version
CDE: Project Data Environment – Collaboration Tool	Bentley ProjectWise	
CDE: Project Data Environment – DMS (Document Management System)	Bentley AssetWise	
3D/4D/5D integration	RIBiTwo	
Project Scheduling	Primavera	
Enterprise Reporting	SAP	

6.1.2 Content Development and Analysis Platforms

The Employer shall not place any restrictions on the content development or analysis tools to be used by the Supplier.

However, in order to minimise compatibility and interoperability issues, the Employers mandates that any DWG format which is issued to the CDE is published using AutoCAD version 14 or higher.

The Supplier shall document assurances to this affect through the BEP response.

6.2 Information Exchange Formats

The Supplier shall deliver Information Artefacts (issued through the CDE), in accordance with the MIDP and in the exchange formats declared in Table 6-2 and where appropriate in accordance with **NRMCL CAD Standard** [Ref 4].

Data/Information	Exchange Format
Documentation	PDF, DOC, XLS
2D Drawings (Design & Construction)	DGN, PDF
2D Drawings (As Built & Operations & Maintenance)	DGN, PDF
Native 3D discipline based models (Graphical Data)	DGN
Deliverable 3D models (Graphical Data)	iModel
4D Simulation (Graphical Data and Non-Graphical Data)	iModel, DGN
Survey data (for Design & Engineering context)	3MX, CSV, SHP
Cost Data (Non-Graphical Data)	XLS
Programs	XER, PLF, MPP, PDF, XLS

If necessary, the Supplier shall provide details of how interoperability issues will be addressed to make sure that Information Artefacts are delivered in the formats prescribed above.

6.3 Coordinates

All geographical Information Artefacts shall be exchanged, through the CDE, in compliance with the MMRCL Project Grid:

- Survey information, including mapping
- All Information Artefacts which represent the fixed geographical location of an asset or assets.

Details relating to the MMRCL Project Grid are listed below:

Geographic Coordinate System Properties	
Coordinate System	
Name	UTM84-44N
Description	UTM-WGS 1984 datum, Zone 44 North, Meter, Cent. I
Projection	Universal Transverse Mercator
Source	Snyder, J.P. 1987, Map Projections - A Working Man
Units	Meter
UTM Zone	44
Hemisphere	Northern
Minimum Longitude	77°30'00.0000"E
Maximum Longitude	84°30'00.0000"E
Minimum Latitude	01°00'00.0000"S
Maximum Latitude	84°00'00.0000"N
Datum	
Name	WGS84
Description	World Geodetic System of 1984
Source	US Defense Mapping Agency, TR-8350.2-B, Deceml
Conversion Method	WGS84 - no shift required
Ellipsoid	
Name	WGS84
Description	World Geodetic System of 1984, GEM 10C
Equatorial Radius	6378137
Polar Radius	6356752.3142
Eccentricity	0.081819190928906743
Source	US Defense Mapping Agency, TR-8350.2-B, Deceml
Coordinate System Modifiers	
Vertical Datum	Matches Datum
Local Transform Type	No Transform

Details relating to the dimensional consistency / units of measure are found in the **MMRCL CAD Standard** [Ref 4].

7. COMMERCIAL REQUIREMENTS

The Supplier shall respond to this EIR in the form of a BIM Execution Plan (BEP); the template for which shall be provided by MMRCL.

8. DEFINITIONS

Table 8 – Definitions	
Term	Definition
Asset Management Information System	Systems used to store and manage data about assets.
BEP (BIM Execution Plan)	A document within which the proposed approach, capability, capacity and competencies of the prospective or selected Contractor / Consultant sets out the response to the EIRs
CDE (Common Data Environment)	The agreed solution for the production, use and management of Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s), as set out in the SMP, BEP and MIDP(s)
Composite Model	Computer Aided Design (CAD) file(s) displaying one or more Model Files (attached as references), for the purpose of performing coordination activities and / or compiling Document Definitions.
Data Authoring	Creation of Production Information and Handover Information
Data Capture	Collecting, from various sources, Graphical Data and Non-Graphical Data relating to asset(s)
Data Coordination	Use of Graphical Data and Non-Graphical Data, about the asset(s), to virtually assure and evidence coordination across all task teams, existing infrastructure and adjacent works
Data Simulation	Use of Graphical Data and Non-Graphical Data to virtually test the design, construction, operation and maintenance of the asset(s)
Data Validation	Rule based tools used to validate and check all Production Information and Handover Information against the EIR and Standards
Data Visualisation	Visually representing Graphical Data and Non-Graphical Data to support decision making.
Document Definition	Data file produced, containing a view of the Non-Graphical Data and / or Model File(s) and / or Composite Model(s), to derive meaning for a specific purpose
Document Rendition	A data file in an immutable format, derived from a Document Definition
Handover Information	Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which have been agreed between the Parties to be produced, updated, maintained and delivered as set out in the Master Information Delivery Plan(s) in accordance with the Employers requirements
Information Artefacts	The collective term for Production Information, Handover Information and any other model or drawing deliverables identified in the within the MIDP and MPDT – all Information Artefacts shall be authored, shared, published and archived within the CDE

MIDP (Master Information Delivery Plan)	A forward looking schedule of the Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which are to be produced, maintained and delivered as Information Artefacts
Model File	Computer Aided Design (CAD) file(s) containing shape(s) with defined origin, orientation and dimensions, communicating the physical characteristic of the assets. A Model File may also include Non-Graphical Data, associate to the CAD file(s) and / or shape(s), identifying the functional characteristics of the asset(s)
Non-Graphical Data	Data file containing alphanumeric characters, communicating the physical and functional characteristics of the asset(s)
Primavera	MMRCL Project Planning Tool
Production Information	<p>The Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s), including Engineering Information which have been agreed between the Parties to be produced, updated and maintained in order to provide the Works and be delivered during the design and construction stages of the Project, as set out in the MIDP(s).</p> <p>Referred to within PAS1192-2 as the PIM (Project Information Model).</p>

MMRCL EIR Standards, Methods and Procedures



Document Status	
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1	MMRCL-Pune Metro-EIR V1.0	2007 + A2	20-April-2017
2	BS1192:2007+A2:2016 Collaborative production of architectural, engineering and construction information. Code of practice		2016
3	PAS 1192-2:2013 Specification for information management for the capital/delivery phase of construction projects using building information modelling		2013
4	MMRCL CAD Standard	V1.0	20-April-2017
5	MMRCL - Engineering Assurance File Naming Convention	V1.0	20-April-2017
6	MMRCL Design Review and Acceptance Procedure		20-April-2017
7	MMRCL Master Information Delivery Plan Template (MIDP)	V1.0	20-April-2017
8	MMRCL Master Delivery List (MDL)	V1.0	20-April-2017
9	MMRCL Master Production Delivery Table (MPDT)	V1.0	20-April-2017
10	MMRCL Level 2 BIM E2E Workflow Process	V1.0	20-April-2017
11	MMRCL Level 3 Drawing Process	V1.0	20-April-2017
12	MMRCL Level 3 Model Process	V1.0	20-April-2017

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1. PURPOSE

The purpose of this document is to set out the MMRCL SMP (**Standards, Methods and Procedures**), for the Pune Metro Project, including those relating to the MMRCL CDE (Common Data Environment), the means by which Information Artefacts, as set out in the MIDPs (Master Information Delivery Plans), are to be produced, used and managed.

The intent is to provide a common set of processes (including those in relation to the Common Data Environment) for the production, use and management of the Model Files, Composite Models, Non-Graphical Data and Document / Drawing Renditions.

This document shall be read in conjunction with **MMRCL-Pune Metro-EIR V1.0** [Ref 1], **BS1192:2007+A2:2016** [Ref 2] and **PAS 1192-2:2013** [Ref 3].

2. SCOPE

This SMP applies to all parties (including the Employer) involved in the Pune Metro Project, who are engaged in the production, use and management of Information Artefacts as set out and agreed in the MIDP(s).

3. PROJECT DOCUMENTS

See Appendix A: Document Map for the relationship between this and other EIR related documentation.

4. MASTER INFORMATION DELIVERY PLAN

The Supplier / Detailed Design Consultant / Contractor [**the Supplier**] shall provide one MIDP per organisation, per organisational role (as applicable).

The MIDP shall be populated and agreed and included as part of the Suppliers BEP response, during the mobilisation period, prior to commencement of any production information.

Note that all updates to the MIDP shall follow project change control procedures.

5. COMMON DATA ENVIRONMENT (CDE) PROCEDURES

5.1 General

The Supplier shall produce, use and manage all Information Artefacts in accordance with the procedures set out in Section 5.2 below.

The CDE comprises:

- **A Project Data Environment**

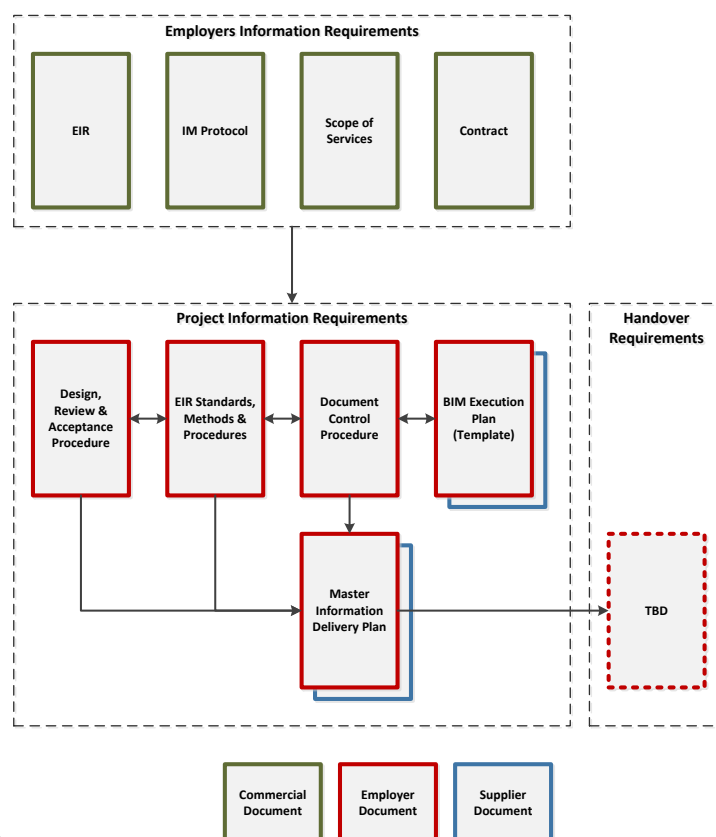
MMRCL will provide a designated system accessible to all Task Teams and other relevant stakeholders (as authorised by MMRCL), which shall be used as a managed 'single source of truth' for all Information Artefacts **shared** for (non-contractual) coordination and collaboration purposes and for all Information Artefacts **published** for (contractual) MMRCL Design Review and Acceptance purposes

- **Task Team Data Environment(s)**

MMRCL will provide each Task Team with a dedicated, secure working area (the Task Team Data Environment) where Information Artefacts shall be Shared and Published, in accordance with the Master Information Delivery Plan (MIDP).

All Shared and Published Information Artefacts shall first be approved by the Task Team Manager before issue to the relevant Shared or Published Area of the Project Data Environment

Note that on request, MMRCL will provide each Task Team with a secure WIP (Work in Progress) working area, where the Supplier can author and check Information Artefacts in advance of issuing to the relevant Shared or Published Area of the Project Data Environment should the Supplier choose to work this way – the Supplier shall notify and document this intent within the Suppliers BEP response.



Please refer to

5.2 CDE Procedure

5.2.1 Task Team WIP (Work in Progress) Area (Optional)

Note that Suppliers may optionally choose to develop WIP Information Artefacts within the MMRCL Task Team Data Environment.

On request, MMRCL shall provide each Task Team with a secure WIP (Work in Progress) working area, where the Supplier can author and check Information Artefacts in advance of issuing to the relevant Shared or Published Area of the Project Data Environment should the Supplier choose to work this way

The Task Team WIP Area of the CDE is where a Task Team can develop content using their organisations systems and tools. This is the only area of the CDE where Information Artefacts are to be produced and / or edited.

Access to each Task Team's WIP Area shall be restricted to those Task Team members who are authorised (by the Task Team Manager) to author Information Artefacts. Information Artefacts within this area of the CDE are not to be disseminated or used by other Task Teams, or the Employer, for any purpose.

All WIP Information Artefacts shall carry a preliminary revision that includes the major revision and minor version and the suitability 'S0 – Non Verified Data' (refer to Appendix D: CDE – High Level Workflow).

Before Information Artefacts are shared with other Task Teams and other parties including the Employer, the Task Team Manager shall make sure that all checks and reviews, as applicable for the purpose for which the Information Artefact is being shared (as set out in Section 8), have been carried out. The Task Team Manager shall then approve the Information Artefacts for issuing to the Project Shared Area (forming part of the Project Data Environment).

Before issuing Information Artefacts to the Project Shared Area, the Task Team Manager shall make sure that the applicable suitability code and revision have been designated (refer to Section 8).

5.2.2 Project Shared Area

The purpose of the Project Shared Area (of the Project Data Environment), is to serve as a 'single source of truth' for each Task Team's issued Information Artefacts. Only Information Artefacts within this area of the CDE are to be referenced by other Task Teams and other parties including the Employer. The Information Artefacts are to be used in accordance with assigned suitability codes. Refer to **MMRCL CAD Standard** [Ref 4] for a list of suitability codes.

Only Information Artefacts with applicable suitability code and revision, refer to **MMRCL CAD Standard** [Ref 4], that have been approved by the applicable Task Team Manager are to be held within the Project Shared Area of the CDE.

All Information Artefacts in the Project Shared Area of the CDE shall be read-only and shall not to be edited by any Task Team or any other party (including the Employer).

Where changes to the Information Artefacts are required, a new version shall be created and the revision incremented, '+1' and the minor version reinstated. Refer to **MMRCL CAD Standard** [Ref 4]. The new version shall be placed in the Task Team WIP Area and the old version retained in the Project Archive Area of the CDE.

Before accepting the Information Artefacts and issuing to the Project Published Area, the Project Manager shall make sure that:

- all relevant approvals are in place and the acceptance criteria have been met
- the applicable suitability code and revision have been assigned

5.2.3 Project Published Area

As part of the Project Data Environment, the Project Published Area of the CDE holds all the Information Artefacts which have been accepted by the Project Manager.

Only Information Artefacts that have been accepted, meet the acceptance criteria and have been assigned an applicable suitability code and revision (refer to **MMRCL CAD Standard** [Ref4]) are to be held within the Project Published Area.

All Information Artefacts in this area of the CDE shall be read-only and shall not to be edited by any Task Team, or any other party (including the Employer).

Where changes to the Information Artefacts are required a new version of the file shall be:

- created, its revision incremented, '+1' from its previous revision and the minor version reinstated (refer to **MMRCL CAD Standard** [Ref 4])
- placed in the WIP Area and the old version retained in the Archive area of the CDE

5.2.4 Archive

The Archive area of the CDE (within both the Task Team Data Environment and Project Data Environment) shall hold inactive and / or superseded Information Artefacts.

Information Artefacts in the Archive area are not to be amended or updated.

5.3 Information Security and Access

5.3.1 General

Security and access to the data and information held in each area of the CDE shall be assigned according to CDE Roles and Competencies.

5.3.2 CDE Roles and CDE Competencies

All Task Team members and other parties including the Employer's team shall be assigned to a CDE Role as defined in Section 7. Access to the Area(s) of the CDE shall be determined by these Roles.

Persons who are required to perform specific tasks (create, edit, approve, or accept) in a given area of the CDE shall be assigned the appropriate CDE Role.

Note: Although a project team member can be assigned one or more Competency, they shall not approve Information Artefacts that they have authored.

6. INFORMATION EXCHANGES

6.1 Task Team Data Environment

When Information Artefacts to be shared with others shall be:

- approved by the Task Team Manager
- issued to the Project Data Environment and a version retained in the Task Team Shared Area

6.2 Project Data Environment

Information Artefacts shall only to be shared with other Task Teams or other parties include the Employer, through the Project Data Environment.

Information Artefacts to be shared, can be copied from the Project Data Environment to the Task Team's Shared Area for (read-only) use, in accordance with the assigned suitability.

The MMRCL CDE is to be used as the Project Data Environment. The Project Data Environment has been configured to allow all Task Team Managers and the Employer to issue Information Artefacts, approved by the Task Team Manager, to the Project Shared Area; all other Task Team members have read-only access to the Project Shared Area.

Information Artefacts shall be shared, as a minimum:

- when a change to the design occurs which may impact another Task Team
- when a Task Team needs more space than that which has been allocated in order to meet design requirements and / or connection points / location of integration changes
- for design review meetings
- at each of the agreed project stages (in line with the Accepted Programme), at which time the Production Information and / or Handover Information shall be in accordance with MMRCL Standards (see Section 12.1).

Details of information exchanges between the Supplier and Sub-contractor(s) are to be included within the BIM Execution Plan, to be provided by the Supplier.

6.3 Supplier Responsibility

Before publishing Information Artefacts to the Project Shared Area Task Team Managers shall:

- make sure that Information Artefacts are review and checked in accordance with the suitability code for which Artefact is being shared
- make sure that the appropriate suitability code is assigned
- make sure that the appropriate revision code is assigned
- make sure that all mandatory metadata is assigned

In addition to the above, the Supplier shall make sure that all Information Artefacts, to be shared for Employer review and acceptance are:

- developed to a level of detail, as agreed within the MDPT and in accordance with agreed acceptance criteria
- checked, reviewed and approved in accordance with all relevant standards
- delivered in accordance with agreed project dates, the MIDP(s), MDPT, SMP and BEP

6.4 Site Information (including Survey)

6.4.1 Site Information

If Site Information is to be provided to the Supplier then this shall be documented within the MIDP and issued as part of the tender documents.

A list of the available Site Information to be provided by the Employer, along with its suitability for purpose, shall be documented in the MIDP by the Employer.

All Site Information shall be distributed through the Employer's Project Data Environment.

6.5 Employer Document Control (Employer use only)

The following systems are the Employer's internal solutions for the management of Information Artefacts.

Table 6.1 – Data / Information Systems		
System	Data	Contact
Bentley AssetWise	Non-Graphical Data and Document renditions	OSO
Bentley ProjectWise	CAD data	OSO
CMS (TBD)	Non-Graphical Data	OSO

All Information Artefacts, as per the agreed MIDP shall be distributed, by the Employer's Document Controller, through the applicable system (as per Table 6-1).

7. ROLES AND RESPONSIBILITIES (for Information Artefacts)

The purpose of this section is to define the roles and responsibilities anticipated to be required in order to produce and manage Information Artefacts. The emphasis is on ownership, responsibility and authority. These are in addition to roles and responsibilities already defined within the contract.

The Supplier shall maintain a list of persons assigned to each of these roles. It should be noted that project team members can be allocated one or more of these responsibilities as necessary.

7.1 Design Coordination Manager (appointed by the Supplier)

The Design Coordination Manager (also known as the Design Manager on some contracts) responsibilities include:

- providing the single point of contact for all communications between the design and construction teams
- making sure that all design deliverables, including that of sub-contractors, designers and specialist designers are integrate with the construction programme

-
- making sure that that design deliverables are delivered in accordance with the agreed programme and MIDP(s).

7.2 Lead Designer (appointed by the Supplier)

The Lead Designer responsibilities include:

- making sure that all Information Artefacts have been listed in the MIDP(s) and agreed by all parties
- making sure that the project Zones (used to segment the project into manageable subdivisions) are defined and maintained for the duration of the works (it is anticipated that a shared Zone Model File shall be maintained for this purpose)
- managing coordination and integration of the design, including the development and approvals of the Information Artefacts
- making sure the design is fully co-ordinated and integrated across all disciplines, existing infrastructure and any adjacent works
- Make sure all Information Artefacts are strictly controlled and shared through the Project Data Environment

7.3 Task Team Managers (appointed by the Supplier)

The Task Team Manager responsibilities include:

- the production of the design output for a particular task, or set of tasks allocated to the Task Team
- making sure that all checks and reviews, as applicable for the purpose for which the Information Artefact is to be shared (refer to Section 8), have been carried out
- approving of the Task Team Information Artefacts for issuing to the Project Shared Area
- providing authorisation for access to the Task Team WIP Area

7.4 Interface Manager (appointed by the Supplier)

The Interface Manager responsibilities include:

- as part of the Task Team, managing the spatial interface with other Tasks (the volume strategy determines the spatial allocation for each Task Team)
- proactively proposing resolutions to co-ordination clashes

For example: If a task requires additional space (i.e. the mechanical task team need to increase the area required for ventilation units) the interface manager for that task will discuss the impact of making additional space available with interface managers whose tasks are/or maybe affected

7.5 Project Information Manager (appointed by the Supplier)

The Project Information Manager responsibilities include:

- making sure that the BEP:
 - has been completed
 - is agreed with the Employer
 - is briefed to all Task Teams and other Parties including the Employer
 - is managed through the project change control procedures
- making sure that project processes are fully complied with and that collaborative behaviours pervade across the project
- providing the focal point for all Information Artefacts management issues on the project
- making sure that all Information Artefacts are compliant with the requirements of the contract and all applicable MMRCL Standards
- making sure that all Information Artefacts are managed through the CDE including that all mandatory meta-data have been captured and populated
- making sure that the Supplier, sub-contractors or supplier of the Supplier and others (as applicable) have continued and appropriate access to the Project Data Environment
- providing clear instructions to the Project Team including on the following areas:
 - what Information Artefacts are required, by whom and for what purpose
 - who will generate the Information Artefacts and maintain them
 - how it will be sorted and distributed
 - how frequently it is shared
 - what actions should be taken on receipt of the Information Artefacts

7.6 CAD Coordinator (appointed by the Supplier)

The CAD Coordinator responsibilities include:

- making sure that there is a consistent approach to modelling assets physical and functional characteristics across the project
- coordinating the project needs for IT solutions
- responsibility to the Task Team Managers and the Project Information Manager

7.7 CAD Manager (appointed by the Supplier)

CAD Manager responsibilities include:

- making sure that CAD Information Artefacts are compliant with agreed standards
- making sure that all CAD files are shared using the agreed IT solutions

7.8 Project Manager (appointed by the Employer)

The Project Manager responsibilities include:

- Making sure that that only compliant Information Artefacts are accepted and if applicable, making sure that any concessions required are in place before hand

7.9 Designated Technical Lead / Manager (appointed by the Employer)

The Designated Technical Lead / Manager responsibilities include:

- Registration of notifications and submittals
- Making sure that the Information Delivery Plan (comprising the Task Information Delivery Plan and Modelling Information Delivery Plan) covering submittals from the Supplier has been prepared
- Distributing within GC and MMRCL as appropriate
- Distributing to internal parties including Operations and Maintenance and external parties through MMRCL as required
- Collating comments and responses and convening working group meetings with the Supplier to resolve issues in presence of MMRCL representatives wherever required and receive resubmissions as required
- Convening technical, cost, value management and programming meetings within GC and MMRCL to properly review the content of deliverables
- Preparing reports on submissions, summarizing key issues, cost variations and programming impacts with associated recommendations

7.10 Lead Reviewer (appointed by the Employer)

The Lead Reviewer responsibilities include:

- Preparing a check list of reviewable data and inputs required by/from other disciplines
- Responding to the deliverables by the stipulated deadlines, and signing off as acceptable or otherwise each aspect of the design submission
- Delegating responsibility for acceptance and sign-off in cases of leave or other absence
- Identifying other parties or reviewers that require to have input into the review
- Reviewing comments provided by reviewers before issuing to back to the Supplier

7.11 Employer Information Manager (appointed by the Employer)

The Employer Information Manager responsibilities include:

- Completing, maintaining and implementing this document and making sure that it is available to all Task Teams and other Parties including the Employer
- managing the processes for information exchanges between the Supplier and Employer
- making sure that project processes are being followed by all Task Teams and other Parties, including the Employer
- providing the focal point for Information Modelling and Management issues

-
- making sure that collaborative behaviours are embraced

7.12 Document Controller (appointed by the Employer)

The Document Controller responsibilities include:

- making sure that project document control procedures are being followed by all Task Teams members and any other relevant Parties
- making sure that all Information Artefacts are delivered using the agreed IT solutions
- making sure that only Information Artefacts listed and agreed to be delivered in the MIDP(s), are delivered and accepted
- making sure all Information Artefacts, accepted by, or on behalf of the Project Manager, are distributed to the applicable MMRCL system (refer to Section 6.5)

8. INFORMATION ARTEFACTS: CHECKS, APPROVALS & ACCEPTANCE

8.1 Checks and Approvals

Before any Information Artefact is issued to the Project Shared Area, it shall first be checked and approved by the Task Team Manager. The level of checking and approval required will depend on the purpose for which the Information Artefact is being shared.

See Appendix D: High Level Workflow

- **Sharing for Coordination**

Information Artefacts shall be shared for coordination purposes (with the suitability, S1 – Issued for Coordination) in accordance with the MIDPs.

Before being issued to the Project Shared Area, all Information Artefacts to be shared for coordination purposes shall be:

- checked and verified against all applicable data and information standards (including the SMP and BEP)
- checked for technical content (in accordance with the Design Management Plan)
- approved for issue by the Task Team Manager

Information Artefacts, which have been shared for coordination, shall be used by other Task Teams and / or stakeholders to coordinate their design

- **Sharing for Review and Comment**

Information Artefacts shall be shared for review and comment purposes (with the suitability 'S3 - For Review and Comment') in accordance with the MIDPs.

The Circumstances under which Information Artefacts are issued for review and comments shall be specifically identified within the MIDPs but these may include:

-
- If there is a change to a Task Team's design which potentially impacts on other Task Teams and / or stakeholders
 - the Task Team requires additional space than that already allocated and / or connection points
 - The Task Team requires location integration changes

Where Information Artefacts are to be used, for example in Design Reviews, Coordination meetings, Inter-Disciplinary Design Review, Inter-Disciplinary Design Checks, they shall be shared for comment.

Before being issued to the Project Shared Area, all Information Artefacts to be shared for review and comment purposes shall be:

- checked and verified against all applicable data and information standards (including the SMP and BEP)
- checked for technical content (in accordance with the Design Management Plan)
- approved for issue by the Task Team Manager

Task Teams and / or other Parties, including the Employer, shall comment as applicable to make sure issues are identified and resolved.

Note that, Task Teams and / or other Parties, including the Employer, shall not change or coordinate their design based on Information Artefacts which have been issued for Review and Comment.

- **Sharing for Employer Review and Acceptance**

Information Artefacts shall be shared for Employer Review and Approval (S4 – Issued for Approval) in accordance with the MIDPs.

At the agreed project stages, as captured in the MIDP(s) and aligned with the accepted programme, Information Artefacts shall be shared using the suitability, S4 – Issued for Approval.

Before being approved, by the Task Team Manager and published to the Project Shared Area for Employer Review and Acceptance, the Supplier shall make sure that all Information Artefacts:

- are checked and verified against all applicable data and information standards (including the SMP and BEP)
- have the technical content checked (in accordance with the agreed DMP)
- meet design requirements (appropriate for the stage of the project at which it is being accepted)
- comply with all applicable MMRCL Standards
- are developed to the Level of Development, agreed within the MIDP(s)
- are approved by the Lead Designer as a coordinated and complete dataset; CAD files, Non-Graphical Data and Documentation cross-referenced and aligned
- all Model File content is approved by the Lead Designer as being spatially coordinated

8.2 Employer Acceptance

Prior to Information Artefacts being accepted by the Project Manager and moved to the Project Published Area (of the Project Data Environment), all acceptance criteria shall be in place; and any comments returned to the Supplier for incorporation prior to acceptance.

When accepted, the Employer shall move the Information Artefacts to the Project Published Area, in accordance with the Document Control procedure.

Document Renditions are **NOT** to be accepted until the Model File(s), Composite Model(s), Non-Graphical Data and Document Definition(s) used to produce them have first been accepted.

9. UNIQUE FILE IDENTIFICATION

All Information Artefacts shall be allocated a unique file identifier (file ID).

The file ID shall be composed of joining the fields (metadata) as defined in compliance with the **MMRCL - Engineering Assurance File Naming Convention** [Ref 5]

10. METADATA

In addition to the metadata required for the unique file ID, all Information Artefacts shall be attributed the metadata shown in Table 10-1.

Table 10.1 – Mandatory Metadata	
Field	Example
Unique File Identification	See Section 9 Unique File Identification
Revision	P04
Suitability	S3 (For Comment)
Title	Station Lift Shaft 1
Created (Author)	
Approved	
Authorised	
Grid Reference System	MMRCL Project Grid
Security Classification	MMRCL Restricted

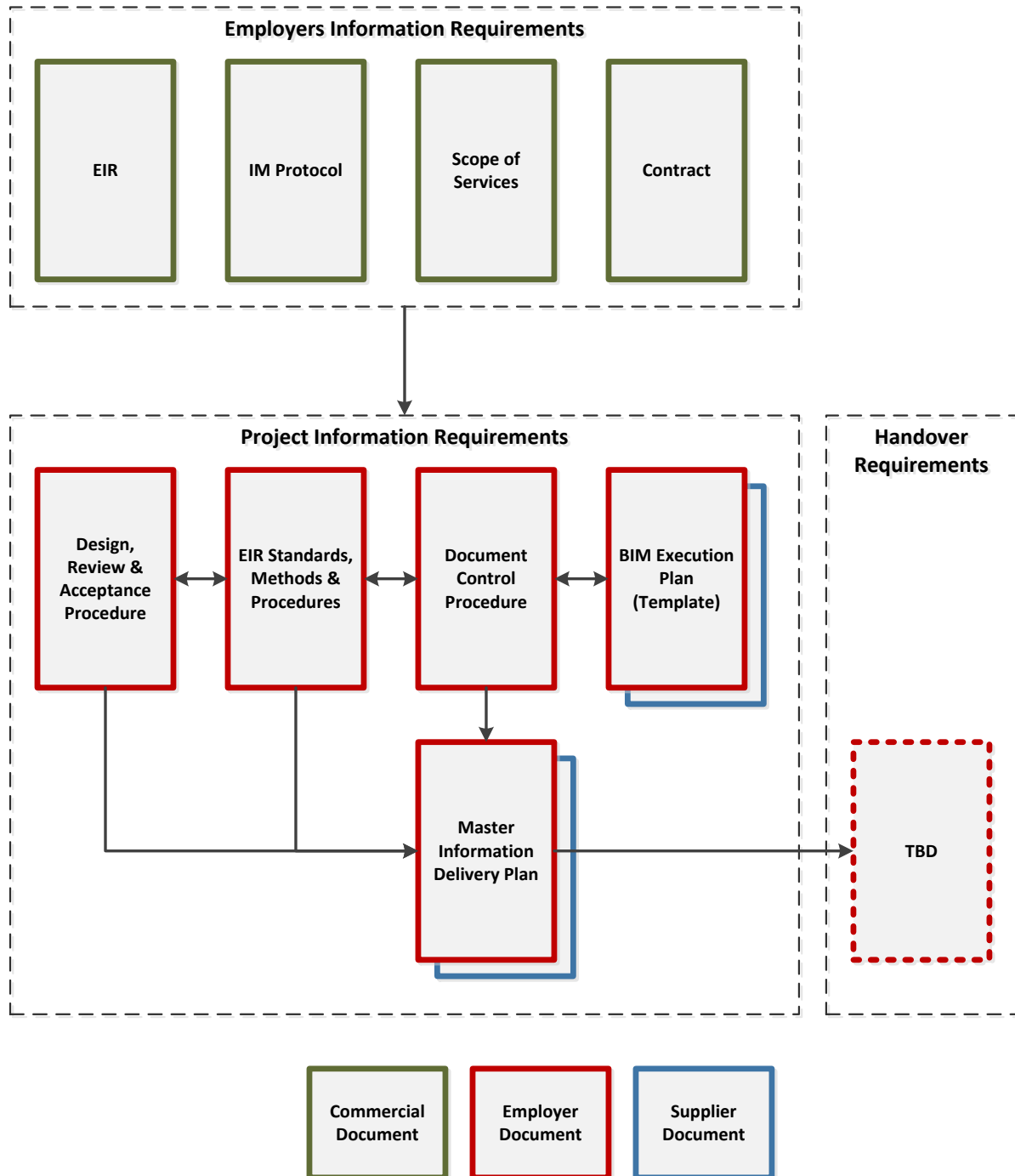
Lifecycle Stage	Detailed Design
Project / Contract	

11. DEFINITIONS

Table 12.1 – Definitions	
Term	Definition
BIM Execution Plan (BEP)	A document within which the proposed approach, capability, capacity and competencies of the prospective or selected Supplier sets out the response to the EIRs
CAD (Computer Aided Design) File	Electronic file produced using a CAD application (such as MicroStation or AutoCAD)
CDE (Common Data Environment)	The environment, which encapsulates the processes set out in SMP and BIM Execution Plan, for the production, use and management of Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) as agreed between the Parties and set out in the MIDP(s)
Composite Model	Computer Aided Design (CAD) file(s) displaying one or more Model Files (attached as references), for the purpose of performing coordination activities and / or compiling Document Definitions
Documentation	A collection of Document Renditions
Document Definition	Data File produced, containing a view of the Non-Graphical Data and / or Model File(s) and / or Composite Model(s), to derive meaning for a specific purpose
Document Rendition	A data file in an immutable format, derived from a Document Definition
Handover Information	Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which have been agreed between the Parties to be produced, updated, maintained and delivered as set out in the MIDP(s) until the Defects Certificate has been issued
Information Artefacts	The collective term for Production Information, Handover Information and any other model or drawing deliverables identified in the within the MIDP and IMPDT – all Information Artefacts shall be authored, shared, published and archived within the CDE
MIDP (Master Information Delivery Plan)	A forward looking schedule of the Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which are to be produced, updated, maintained and delivered as Information Artefacts by the Supplier
Model File	Computer Aided Design (CAD) file(s) containing shape(s) with defined origin, orientation and dimensions, communicating the physical characteristics of the works. A Model File may also include Non-Graphical Data, associated to the CAD file(s) and / or shape(s), identifying the functional characteristics of the works
Non-Graphical Data	Data file containing alphanumeric characters, communicating the physical and functional characteristics of the works

Production Information	<p>The Model File(s), Composite Model(s), Non-Graphical Data, Document Definition(s) and Document Rendition(s) which have been agreed between the Parties to be produced, updated and maintained in order to provide the Works and be delivered, during the design and construction stages of the Project, as set out in the MIDP(s).</p> <p>Referred to within PAS1192-2 as the PIM (Project Information Model).</p>
Task Team	<p>Any team assembled to complete a task, which is typically discipline based (e.g. architectural task team, structural task team, bridge task team, track task team etc.)</p>

APPENDIX A: DOCUMENT MAP

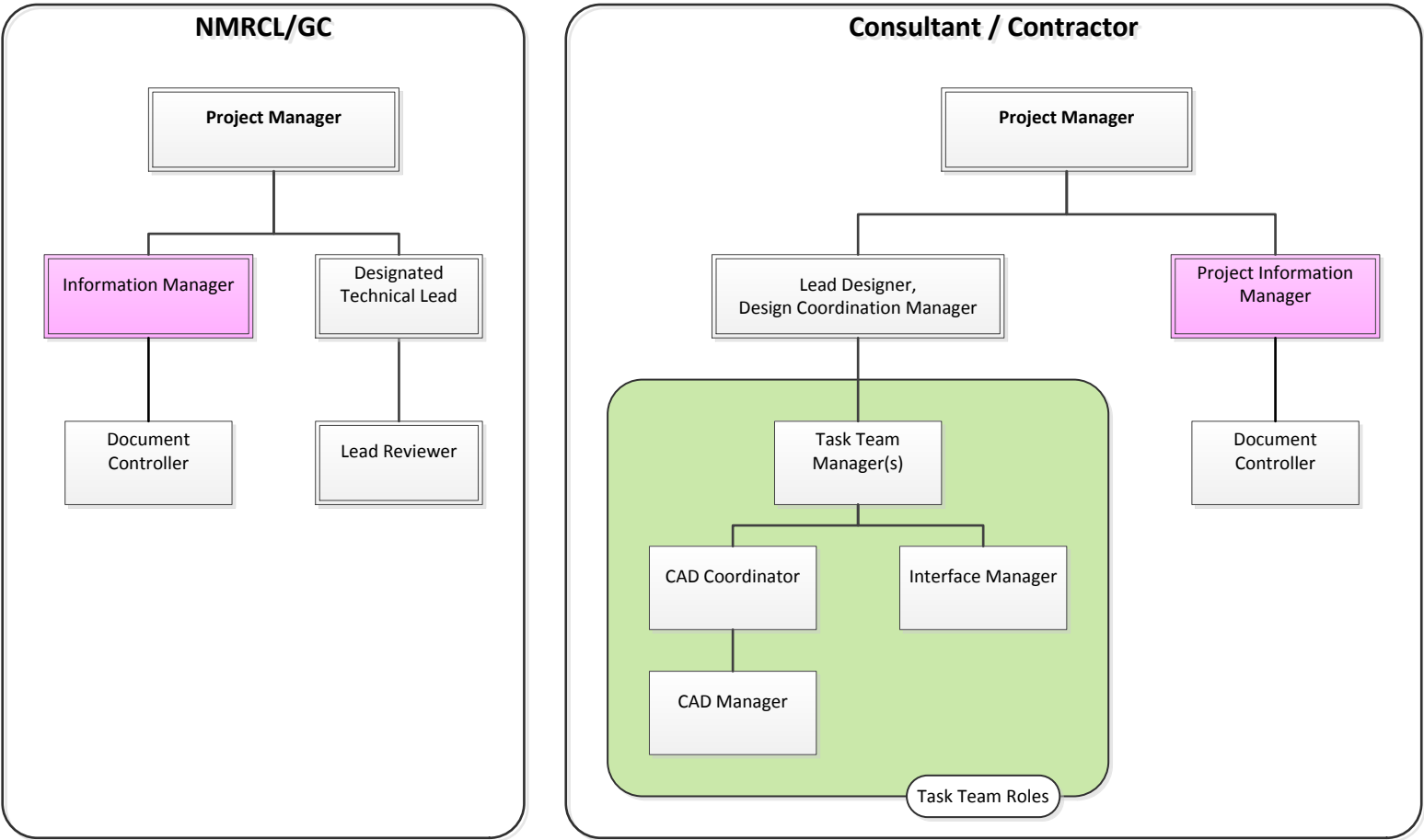


APPENDIX B: CDE (COMMON DATA ENVIRONMENT)

For the CDE End to End Process please refer to the following procedure:

- ***MMRCL Level 2 BIM E2E Workflow Process*** [Ref 10]

APPENDIX C: INFORMATION ROLES AND RESPONSIBILITIES



Notes:

The purpose of this diagram is only to illustrate the primary information management roles
Lines of authority may vary
An individual may undertake one or more roles

APPENDIX D: CDE – HIGH LEVEL WORKFLOW

For the CDE High Level Workflows please refer to the following procedures:

- Drawing Information Artefacts: **MMRCL Level 3 Drawing Process** [Ref 11]
- Model Information Artefacts: **MMRCL Level 3 Model Process** [Ref 13]

1.1 IT Requirement of Employer - MMRCL Digital Project management platform to be used for PMRCL

1.1.1 Employer's Enterprise wide IT system i.e. "Digital Project Management Platform" will be the working environment that enables higher efficiency and effectiveness, not only in internal functions, but also across the entire ecosystem of the Employer including Contractors and DDC's. The digital platform has following application stack:

- (a) Collaborative drawing, transmittals and related document control and management services (using Bentley ProjectWise and AssetWise solution)
- (b) Scheduling services (using Oracle Primavera P6 Enterprise Project Portfolio Management (EPPM))
- (c) Project Management with progress and performance reporting (using Primavera P6 & Unifier solution)
- (d) Progress and performance reporting with visualization (using RIB iTWO)
- (e) RFI's RA Bills, document submissions to GC and PMRCL (letters , daks, files etc.) using Enterprise wide ERP SAP implementation
- (f) Asset Information management in O&M phase

1.1.2 The proposed IT system has been conceptualized for facilitating preservation of important artifacts (3D virtual construction federated BIM Models in line with "Modelling guidelines", drawings, notes, documents, plans, reports etc.) in a secure and manageable environment in digitized format. Appropriate triggers shall generate dashboards and management reports every time an event causes a substantial shift in the project risk or a deviation in processes is developed. The envisaged system would expedite decision-making, ensure better planning and coordination between different functions, better data management, effective reporting, knowledge management etc. Program management shall provide senior management with critical information related to various contracts, activities and funds in the form of management dashboards with inbuilt triggers to ensure timely decision-making. Clause 1.1.6 details out the bidder's expected involvement on PMRCL's Digital platform

1.1.3 The effective use of such IT platform requires availability of system at all requisite locations i.e. with Employers' various offices, Engineer's offices, Contractors' end, major sub-contractors' end, design consultant ends etc. with certain definite users' rights. Data uploading by various authorized and trained users is key to effective use of the IT system. Employer has recognized this aspect, and the Contractors are required to consider in their proposal the cost of PMRCL's software usage as 'IT administrative charge's.

1.1.4 In view of the above, the Contractor (or it's approved sub-vendor) shall be required to:

- (a) Follow and comply the system guidelines to be issued by Employer
- (b) Comply all the software system and required BIM competency which include appropriate BIM technology, BIM enabled resources & BIM process as per BS 11922007+A2:2016 (shall have to submit pre-contract "BIM Execution Plan"; BEP in prescribed format and be subjected to precontract BIM assessment process to be qualified for bidding) requirement by taking training from Employer and/or Employer's recommended Agency .
- (c) Upload f Project Plans as per the template and using software defined by the Employer;
- (d) Maintenance and updating of uploaded Project Plans in software used by the Employer;
- (e) Upload models, drawings / designs created by the Contractor as per the classification and on the software platform defined by the Employer;
- (f) Key contract related communication and progress related data as per processes defined on the software platform deployed by the Employer
- (g) Asset creation and tagging to be done in the BIM models in line with Employer's "Asset Strategy/Asset Information Requirement" & "Modelling guidelines" along with details need to be updated in the system in the format prescribed by the Employer;

Bidder is expected to review section 1.1.6 for more details for bidder's expected involvement on Employer's Digital platform

- 1.1.5 Employer, his IT Project Team and IT Implementation Agency shall render necessary assistance for the training of contractor staff.
- 1.1.6 Bidder will need to be accessing Employer's digital platform for at least the mentioned functions as applicable as per bidder's respective scope of work. However the function list is indicative and precise activities from bidder on Employer's digital platform will be updated and communicated to bidder on time to time basis.

Following are the deliverables in form of collaboration with 5D BIM by Bidder:

- 1.1.6.1 Creation of 3D engineered intelligent Models using discipline specific modeling/engineering applications.
- 1.1.6.2 Creating 2D drawings extracted from 3D engineered intelligent Models, in CAD – plan, section, elevation and other relevant details (based on specific engineering disciplines) to be accessed by the contractors for construction.
- 1.1.6.3 Bidder need to comply with the following requirements in regards to the production of all the CAD (3D/2D) data files and building information modeling (BIM) work.

1.1.6.3.1 Model file production principles

- 1) Bidder need to follow British Standard BS 1192:2007+A2:2016 for Collaborative production of architectural, engineering and construction information - Code of practice as a guide for drawing practice, convention, CAD data structure and translation.
- 2) Bidder need to model all design and construction information as an individual discipline model and then collaborate it in single master 3D composite model (free from any clashes both soft & hard), using object based software, allowing for 2D models to be extracted as required.
- 3) Bidder need to create and share details of individual components of 3D models for each discipline involved.
- 4) Bidder need to share all individual discipline models as well the collaborated single master model through the Engineering Information & Collaborative document control and management services (using Bentley ProjectWise and AssetWise solution) in specified file format (Refer "Employer's Information Requirement"; EIR) System for review by GC/PMRCL. Clash detection and resolution process will run in this composite area. All 3D model data together with all 2D drawing extractions needs to be spatially coordinated with the Geospatial System.WGS84/UTM Zone 43N coordinate system (refer "Employer's Information Requirement"; EIR) needs to be followed for proper geo-referencing of all the engineered 3D models that will be created.

1.1.6.3.2 Model file composition

- 1) Bidder need to generate model files using seed files/template (2D and 3D) in line with Employer's "modelling guidelines". Seed files/template will standardize all the new drawings that one creates. It will standardize the same global origin, color table, cell library attachments, working units, views etc.
- 2) All graphical elements need to be placed in the model view
- 3) Model files need to have a title box placed in the sheet view
- 4) All model files need to be created at 1:1 scale

1.1.6.3.3 Model Outputs

- 1) Within the engineering collaboration system the central premise is that only approved data is

shared. Each discipline WIP area can only reference data from the shared area i.e. approved data. When this data comes together in the composite model it can be fully coordinated and composite renditions can be produced in 3D.

1.1.6.3.4 Model Reviews

- 1) Bidder needs to ensure that the level of complexity and granularity for each discipline CAD model is appropriate for the stage of Works.
- 2) DDC's/D&C's needs to ensure that all disciplines integrate and coordinate their outputs in terms of both spatial and functional provision. This shall be demonstrated through the extensive use of coordinated design review sessions which shall include for the coming together of all relevant discipline models into a common master model (model composite) where engineering assurance and coordination checks shall take place.

1.1.6.3.5 Existing Infrastructure data sets

- 1) Bidder need to model existing infrastructure and systems in sufficient detail as to provide integration with the works under contract
- 2) Bidder need to clearly highlight the unresolved areas of non-coordination in structure/services/finishes/clashes on the drawings and the model at all times in case of existing infrastructure data sets
- 3) Bidder need to report back to the owner any discrepancy with the existing data for their action

1.1.6.3.6 Coordination and integration – Drawing Packages

- 1 Within the BIM environment each of the disciplines need to reference other models in a timely manner for coordination purposes. The head of each discipline group shall decide the extent and nature of supporting discipline data that shall be displayed in each of their own discipline drawing submissions. Clash detection software routines needs to be run on the multi-discipline model and on combined master models and any clashes resolved. The reports of which will be submitted on request of the Engineer
- 2 Specific drawing packages are required from each discipline. The drawings need to comprise of 2D extractions of the 3D models from the engineering collaboration system.
- 3 All CAD drawings need to be comprised of 2D models extracted from the 3D master model. Any subsequent design scheme changes that are required to be fully coordinated shall be modelled in 3D and the drawing extraction re-run to produce revised plots.
- 4 All plot composition files need to be checked as prescribed by the workflow setup in the engineering collaboration system before submission to the Engineer.

1.1.6.4 The bidder shall take full advantage of the 3D object attributes available in the BIM environment to prove cost, constructional logic, fabrication, and program as required by the PMRCL/GC. Engagement modality expected for Project Management works including 4D & 5D BIM requirements: -

1. Bidder will access Project Monitoring application (Primavera) of PMRCL
2. Bidder will have to create Work Breakdown Structure (WBS) for its scope of work in the master project prepared and released by PMRCL on Primavera.
3. Bidder will have to create all the relationships between various activities to generate a Critical Path Network on Primavera.
 - The project plan will be detailed to reflect the planned construction progress as per the elements defined in the 3D BIM model. Primavera plan will get linked to 3D BIM collaborated intelligent model to reflect and review time based planned progress of project on a BIM model. Bidder's project plan on PMRCL Primavera platform will be required at this level.
4. Once the network has been scheduled and baseline by PMRCL, the Project Coordinator will

have to provide periodical updates for various activities.

5. Bidder will also be required to furnish key cost / budget details along with resources on PMRCL's Primavera platform. Level of details for time plan, cost, and resources from bidder will be communicated to bidder at appropriate stage.
6. During the execution stage bidder will be required to operate on PMRCL's Primavera platform to reflect details towards work performed, progress achieved, resources consumed, forecast dates, forecast resources, remaining work along with any other key details as required by PMRCL / GC. PMRCL will be communicating on level of details as well frequency of such interactions at appropriate stage.
7. Bidder shall update and revise their work program on the integrated master schedule of the project subject to directions & approval from PMRCL.
8. Bidder will be required to periodically capture actual progress visualization of respective package work using suitable technology which can be updated in 5D BIM platform.

1.1.6.5 In order to adopt 5D BIM platform bidder need to follow Employer's Information Requirement (EIR), Standards Methods & Procedures (SMP), BIM Execution stage Plan (BEP) template, CAD standards, BIM Assessment Form and Asset Information Requirement (AIR) Documents. prepared Bidder has to collect and comply with all these requirements while bidding. The EIR will enlist the standards, methods and procedures that one has to follow in order to be BIM Compliant. EIR will have details such as file naming convention, CAD file transfer format, geo-coordinate system, Common Data Environment (CDE) process, Roles & Responsibilities, Level Of Definition (LOD) requirements etc. along with other artefacts e.g. Document Review & Acceptance (DRA) process, CAD standards along with layer naming convention, Attribute Standards, etc., BIM standards, modelling guidelines, Asset Information Requirement (AIR) along with asset data Dictionary, Asset Classes, etc.

1.1.6.6 Bidder shall access the enterprise wide Maha metro's SAP system to create/provide/ submit the data and documents for RFI, Billing, Quality inspection records, safety compliance, & communications with PMRCL & GC like file, dak, letter etc.

1.1.6.7 Bidder shall comply to the requirements in case of changes to the digital platform done to towards process improvements and statutory compliances.

1.1.6.8 Minimum login credentials (as decided by PMRCL) per bidder will be provided by PMRCL to the bidder to access PMRCL digital platform as per against 'IT administrative charges' as mentioned in clause 1.1.3. In case, bidder envisages more user licenses for their internal data preparation through their internal user (like detailed drawing or project plan preparation by multiple users) which is required for finalizing data to be entered in PMRCL's digital platform, then it will be bidder's responsibility to ensure own licenses. However the access to PMRCL's digital platform will be through provided user credential only.

1.1.6.9 Penalty of 0.5% from the bills will be levied in case of non compliance of the process & data on the MMRCL Digital platform .

1.1.6.10 The engineering collaboration platform will be provided by PMRCL and is mandated for the structure and the controlled sharing of the information created during the process

- | | |
|------------|--|
| 1.1.6.11 | Reference documents : |
| 1.1.6.11.1 | EIR (Employers Information Requirement) including SMP |
| 1.1.6.11.2 | CAD Standards template |
| 1.1.6.11.3 | BEP (BIM Execution Plan) including BIM assessment form |
| 1.1.6.11.4 | Model Guidelines |



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Category 1 Standard Computer Aided Design (CAD) Data

Issue No.: A0

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1 Purpose

- 1.1 The purpose of this standard is to define requirements for data contained within, and Meta-data associated with, Computer Aided Design (CAD) files.

2 Scope

- 2.1 This standard applies to CAD data and meta-data captured, created or generated by MMRCL or on behalf of MMRCL by its Suppliers.

3 Requirements

3.1 General requirements

- 3.1.1 CAD files shall be delivered in Bentley's v8i DGN / DWG (Acad 2014 or Newer) file format.
- 3.1.2 Designs that have been developed using other CAD file formats, shall:
- a) Have layers, line-types, line-weights, fonts and colors mapped to those fully Compatible with Bentley's v8i DGN / DWG (Acad 2014 or Newer) file format; and
- 3.1.3 Ownership of the data contained within CAD files shall be clear. (As per EIR)
- 3.1.4 CAD files meta-data, defined within 3.2.9 shall be displayed in both electronic and printed form.
- 3.1.5 Where CAD layers (see 3.10) are required, but not supplied by MMRCL, these shall be added to the contracted organization's library.
- 3.1.6 Each contracted organization is responsible for the entire content of their CAD files.
- 3.1.7 Each contracted organization is responsible for ensuring their CAD files are compliant with this standard.

3.2 CAD File requirements

- 3.2.1 CAD file requirements shall apply to model files, composite models and drawing Definition files.
- 3.2.2 Document numbers shall be assigned following the CAD file naming convention (see 3.9). (See EIR)
- 3.2.3 CAD files shall carry the meta-data, 'Created', to identify the author at each revision.
- 3.2.4 CAD files shall carry the meta-data, 'Approved', to identify the approver at each revision.
- 3.2.5 CAD files shall carry the meta-data, 'Authorised', to identify who has accepted each revision, on behalf of MMRCL.
- 3.2.6 Custom line styles shall use a scale factor of 1 (one) and be delivered to MMRCL within a



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design library file.

3.2.7 A tag shall be placed in each CAD file containing the following mandatory file meta-data:

	Field	Clause
a)	Project	As per Naming Convention in EIR
b)	Owner Organization	As per Naming Convention in EIR
c)	Asset Class	As per Naming Convention in EIR
d)	Location (LCS Level 1) / Level	As per Naming Convention in EIR
e)	Suitability	3.7.2
f)	Revision	3.7.3
g)	Drawing Number	3.2.2
h)	Created (Author)	3.2.3/4.1
i)	Approved	3.2.4/4.2
j)	Authorized	3.2.5/4.3
k)	Title	3.3.1/3.4.1

Notes: Tags containing fields for the mandatory file meta-data will be supplied by the Client.

3.2.8 Additional mandatory meta-data shall be captured against the CAD file (but not placed within the file), as shown in the table below:

	Field	Clause
a)	Level	As per Naming Convention in EIR
b)	Type (of information)	As per Naming Convention in EIR
c)	Organizational Role	As per Naming Convention in EIR
d)	Number	As per Naming Convention in EIR
e)	Pathway Project Code (supplied by Client)	N/A
f)	Lifecycle Stage	3.6

3.2.9 Should CAD files pass through an environment that cannot track meta-data (MS Windows, CD, email etc.) then the mandatory file meta-data shall be delivered with the associated CAD files, within an approved import / export spread sheet.



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3.2.10 CAD files shall have file settings set to the values shown below:

	Setting	Value
a)	2D Global Origin offset from Design Plane Centre (excludes Drawing Definition files (DR))	-214748.3648, -214748.3648
b)	3D Global Origin offset from Design Plane Centre (excludes Drawing Definition files (DR))	-214748.3648, -214748.3648, 0
c)	Resolution	10000 per Distance Meter
d)	Working units - Accuracy	0.1234
	Spatial Data	
e)	Working units - Master units	Meters (label m)
f)	Working units - Sub units	Millimeters (label mm)
	Non-Spatial Data	
g)	Working units - Master units	Millimeters (label mm)

3.3 Model files requirements (Please also see detailed EIR)

- 3.3.1 All model files (including Composite Models) shall be given a title to identify the contents, captured as file meta-data.
- 3.3.2 Model files (including Composite Models) shall contain a single model design only.
- 3.3.3 Elements shall be placed in the model file at a scale of 1:1.
- 3.3.4 All references within Model Files shall have display turned off when issued to MMRCL.

3.4 Drawing definition requirements

- 3.4.1 All drawing definition files shall be given a title to identify the contents, captured as file meta-data.
- 3.4.2 Drawings shall be composed through the use of a 'Drawing Definition File', which contains only the relevant annotation, dimensions etc. with all design information attached as reference file(s), via a composite model (with the exception of schematics and details) (see 7.1).
- 3.4.3 Drawing definition CAD files shall contain a single drawing definition only.
- 3.4.4 Drawing borders shall be referenced in the sheet model at a scale of 1:1.



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- 3.4.5 Annotation, dimensioning etc. shall be placed on presentational CAD layers as defined in 3.13.8.
- 3.4.6 Dimensions shall be associative for all 'drawn to scale'.
- 3.4.7 Non-displaying references shall be detached prior to being issued to MMRCL.

Note: i. Wherever possible (e.g. for 'drawn to scale' design drawings), dimensioning should be associative. Indicative or not to scale dimensions should have, 'NTS' placed next to them

3.5 Presentational requirements

- 3.5.1 Fonts for texts : ISOCP and ARIAL
The texts width factor cannot be changed. Italics not to be used
The texts must be in « TEXT » layer

- 3.5.2 Text shall be written in sentence case.

- 3.5.3 Text height shall conform to BS EN ISO 3098.

- Text heights (For A1 sheet)
2.0mm, 2.5 mm and 3.5 mm: Dimensional text & General text, Notes.

5.0 mm: Normal titles

7.0 mm: Major titles

The recommended minimum text height is 2.5mm or 3.5mm for A1 drawings in case these need to be printed in A3 size also.

- Text heights (For A3 sheet)
1.8mm, Dimensional text & General text, Notes.

2.5 mm: Normal titles

3.5 mm: Major titles

- 3.5.4 All measurements (dimensions, volumes, weights etc.) shall be expressed using units based on the metric system (international system of units, SI).

Dimensions

- All dimensions shall be associative.
- Unit is millimeter
- The styles are the styles defined in the template file and shall not be modified.
- The dimensions must be in layer « DIM »
- The dimensions with forced values are not allowed.

- 3.5.5 Scales used on drawings shall confirm to BS EN ISO 5455, preferred scales shown below:



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Recommended Metric Scales		
1:2	1:5	1:10
1:20	1:50	1:100
1:200	1:500	1:1000
1:250	1:5000	1:1250
1:2000		1:10000
1:2500		

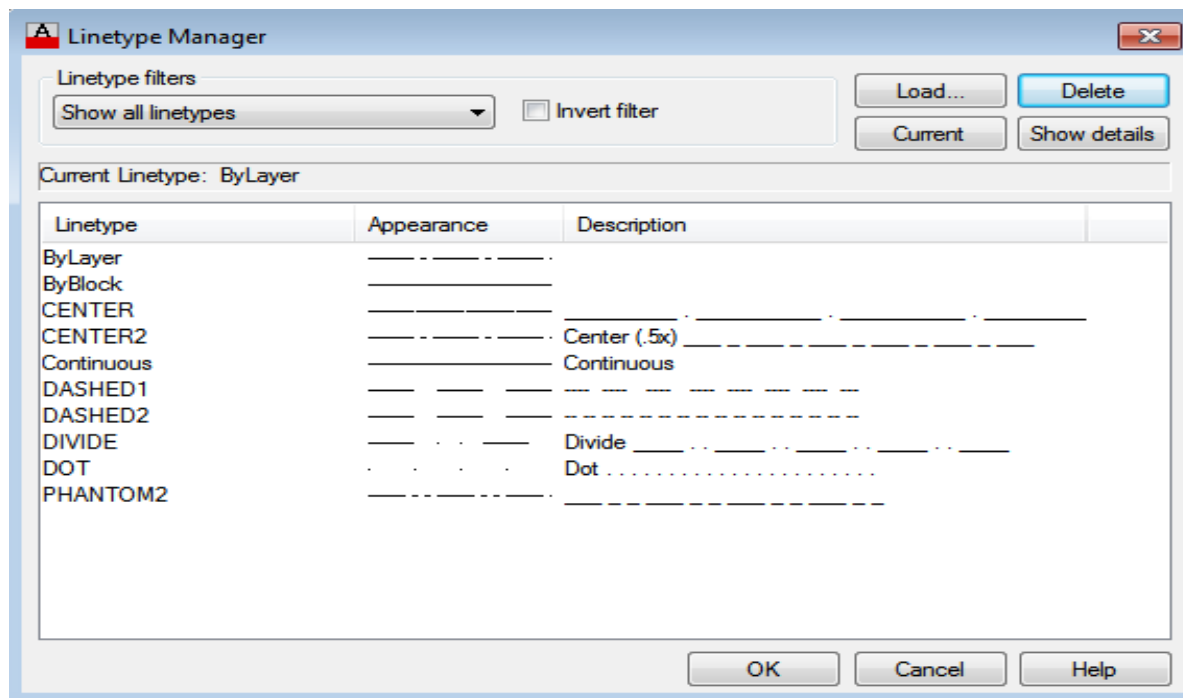


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3.5.6 Terms and abbreviations not defined shall be clearly defined on the associated drawing sheet.

3.5.7 Line types

- They shall conform to the file of line types located in Support directory of the project
- The scale of the line types shall be 1 whatever paper space scale is used
- Line Styles will be accordance with the style defined in the CAD Modele.dwt file.the for example :



3.5.8 Frame and title Block

- Layout will be composed of two parts.

First, a block containing the attributes of the drawing: Titles, numbers, dates ...and a table with the list of all Xref used to produce the drawing.

The second part will be a reference file containing the non-amendable objects of the drawing: Frame, logos, Project name

- These two parts will be set in the paper space, at scale 1=1 mm.
- The block will not be split.
- The reference file of the Title Block will not be merged.
- Only one title block in one file is permitted.
- One File = One Paper space drawing = One Title block



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3.5.9 Drawing sheets shall state clearly the following information:

- | | |
|-------------------------|---------------------|
| a) Asset Classification | g) Purpose of Issue |
| b) Drawing number | h) Revision |
| c) File name | i) Scale(s) |
| d) Location | j) Suitability |
| e) Originator | k) Title |
| f) Project | |

3.5.10 Drawing definitions shall be presented to allow drawing renditions and printed drawings to be derived as an exact copy.

Note: i. If drawing renditions / printed drawings are intended to be displayed as monochrome, the drawing definition shall be presented in monochrome, not color.

3.6 Lifecycle stages

3.6.1 CAD files shall carry the meta-data of 'Lifecycle Stage', to indicate the stage within the Project that the contained information has been approved for use.

3.6.2 One of the following Lifecycle Stages shall be used:

- Initiation
- Concept Stage
- Preliminary Stage
- Detailed Design Stage
- Construction (Installation)
- Handover
- Operations and Maintenance

3.7 Status

3.7.1 CAD files shall be assigned a status, consisting of:

- a) Suitability (see 3.7.2); and
- b) Revision (see 0).



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3.7.2 Suitability Status

3.7.2.1 CAD files shall carry the meta-data of 'suitability', to indicate the approved use of the contained information.

3.7.2.2 Suitability codes shall be one or two alpha-numeric and shall be reserved for use with a specific phase of the collaboration process, as defined in the table below:

	Code	Description	Model Files	Drawing Renditions
Work in Progress (Non-Contractual)				
	S0	Non Verified Design The File is in Work in Progress, not be shared with others	yes	yes
Shared (Non-Contractual)				
	S01	Coordination (for Use) The file is shared and can be used by others for the purpose of design coordination and / or MMRCL acceptance	yes	yes
	S02	For Comment The file is shared and is to only be used, by others, to identify and communicate potential impacts of the change to the design	yes	yes
Published (Contractual)				
	GFC	Good for Construction The file contents has been accepted and verified by MMRCL for construction purposes.	yes	yes
	AB	As Built The file contents have been accepted by MMRCL, as being verified as to what has been built/ installed.	yes	yes

Note: i. 'As Surveyed' and 'As Designed' are additional to the requirements of BS1192. 'For Information' has been removed to prevent ambiguity around the suitability of use of that data / information.



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3.7.3 Revision

- 3.7.3.1 CAD files shall carry the meta-data of 'revision', indicating the issue sequence of the contained information.
- 3.7.3.2 as with suitability codes, different sets of revision codes shall be reserved for use within each section of the defined Common Data Environment (CDE) process.
- 3.7.3.3 Within 'Work in Progress', preliminary revisions shall be 1.1, 1.2, or 2.1, 2.2, etc. The suffix (.1, .2 etc.) is known as a 'minor version' and shall be used to track the iterative progress of the file prior to being approved for sharing.
- 3.7.3.4 CAD files approved for sharing shall carry a preliminary revision, 1.0, 2.0, 3.0, etc.

3.8 CAD File & layer naming

- 3.8.1 Names assigned with CAD files and layers within the CAD file shall be created by joining together codes in the specified fields, in the specified order, using only the "-" Hyphen character, which is therefore not allowed in any code.
- 3.8.2 The only exceptions to 3.10.1 shall be the codes for 'level' and 'description' which are appended following an underscore "_".
- 3.8.3 Codes shall be selected from field codes (defined within 3.13).
- 3.8.4 Codes shall not imply meaning that may be duplicated in other fields.
- 3.8.5 Characters shall be uppercase.
- 3.8.6 Codes shall be generated and governed by the MMRCL CAD Support Team.

Notes: i. CAD files and layer naming is compliant with BS1192.
See 3.9 and 3.10.

3.8 CAD File naming convention

Please refer to EIR Documents for File Naming Convention.



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3.10 CAD Layer naming convention

- 3.10.1 Layer names within CAD files shall be composed by joining the fields shown in the table below:



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3.10.1 Examples of CAD Layers Discipline-wise (Final shall be as per Project requirement) :- CAD layers (Architecture)

LAYER NAME	LINE & COLOUR	PEN LINE WEIGHT (CTB)	DESCRIPTION	LAYER NAME	LINE & COLOUR	PEN LINE WEIGHT (CTB)	DESCRIPTION
C_SOUTH_X	7	0.1		ARC_FLOORING	50	0.13	flooring
ARC_AROVE	8	0.10	above	ARC_FURNITURE	152	0.09	furniture
ARC_BELOW	60	0.13	below	ARC_GLASS	142	0.13	glass
ARC_COLUMN	151	0.30	column	ARC_GRASS	100	0.15	grass
ARC_CON-CH_S	90	0.15	concrete height	ARC_GRID	240	0.10	grid
ARC_CON-CUT_S	130	0.3	concrete cut	ARC_GRID 100	255	0.1	grid dimensioning in scale 1:100
ARC_CON-VIEW_S	180	0.2	concrete view	ARC_GRID 200	255	0.1	grid dimensioning in scale 1:200
ARC_CUTOUT	100	0.15	slab cutout	ARC_GRID 25	255	0.1	grid dimensioning in scale 1:25
ARC_D-WALL	4	0.30	wall	ARC_GRID 50	255	0.1	grid dimensioning in scale 1:50
ARC_DOOR	140	0.25	door view	ARC_GRID TAG	255	0.1	grid tags
ARC_DOOR TAG	255	0.1	door tag	ARC_HIDDEN	255	0.1	hidden
ARC_ELEV 1	251	0.4	elevations	ARC_LANDSCAPE	250	0.05	landscape
ARC_ELEV 2	131	0.35	elevations	ARC_LEVEL	255	0.1	level symbol
ARC_ELEV 3	52	0.05	elevations	ARC_MELT-CUT_S	42	0.3	metal sectional structure
ARC_ELEV 4	51	0.15	elevations	ARC_MELT-PROJECT_S	31	0.15	metal structure projection
ARC_ELEV 5	53	0.13	elevations	ARC_MELT-VIEW_S	21	0.13	metal structure with a view
ARC_ELEV 6	255	0.05	elevations	ARC_PARKING	9	0.13	parking
ARC_ELEVATION	90	0.15	elevations	ARC_PEDESTRIAN	91	0.15	pedestrian
ARC_ESCALATOR	1	0.25	escalator equipments	ARC_RAILING	230	0.13	railing
ARC_FINISHES	201	0.13	finishes	ARC_RAMP	MEGENTA	0.13	ramp
ARC_FITURES	152	0.05	fitures	ARC_ROC WALL	4	0.30	roc wall
LAYER NAME	LINE & COLOUR	PEN LINE WEIGHT (CTB)	DESCRIPTION	LAYER NAME	LINE & COLOUR	PEN LINE WEIGHT (CTB)	DESCRIPTION
ARC_REVISION CLOUD	255	0.1	revision cloud	HATCH 3_ARC	41	0.05	hatching equipment room
ARC_ROOF	90	0.15	roof	INSERT	8	0.01	insert
ARC_ROOM TAG	255	0.1	tag	MARK1	10	0.05	marking
ARC_RWP	153	0.13	rain water pipe	PHOTOWS	90	0.15	
ARC_SERVICES	BLUE	0.13	services	TEXT 100_ARC	255	0.1	text in scale 1:100
ARC_SITE	YELLOW	0.15	site	TEXT 200_ARC	255	0.1	text in scale 1:200
ARC_STAIRCASE	100	0.15	staircase view	TEXT 25_ARC	255	0.1	text in scale 1:25
ARC_TAG	255	0.1	tag	TEXT 50_ARC	255	0.1	text in scale 1:50
ARC_TREE1	100	0.15	trees above 3m. ht.	TEXT 500_ARC	255	0.1	text in scale 1:500
ARC_TREE2	100	0.15	trees below 3m. ht.	TITLE_BLOCK	7	0.35	title block
ARC_WALL	34	0.30	wall	XREFS	7	0.25	xrefs
ARC_WINDOW TAG	255	0.1	window tag	ARC_CLNG	251	0.25	ceiling information
ARC_WIND_S	151	0.1	window	ARC_CLNG_GRID	255	0.1	ceiling grid
DM 100_ARC	255	0.1	dimension in scale 1:100	ARC_CLNG_OPEN	8	0.25	ceiling/roofs penetrations
DM 200_ARC	255	0.1	dimension in scale 1:200	ARC_CLNG_PATT	201	0.13	ceiling patterns
DM 25_ARC	255	0.1	dimension in scale 1:25	ARC_CLNG_LITE	152	0.05	light fixtures
DM 50_ARC	255	0.1	dimension in scale 1:50	ARC_CLNG_MECH	152	0.05	supply/return diffusers
DM 500_ARC	255	0.1	dimension in scale 1:500	ARC_CLNG_SYMB	255	0.1	symbols
HATCH 1_ARC	51	0.05	hatching trade zone				



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3.10.2 CAD layers (Architecture Landscaping)

LAYER NAME	LINE & COLOUR	PPM LINE WEIGHT (CTB)	LAYER NAME	LINE & COLOUR	PPM LINE WEIGHT (CTB)
LW_DOLLARD LIGHT-1	212	0.15	LW_ARROW-1	32	0.15
LW_DOLLARD LIGHT-2	215	0.15	LW_ARROW-2	32	0.15
LW_DOLLARD LIGHT-3	214	0.15	LW_ARROW-3	30	0.15
LW_FLOOD LIGHT-1	220	0.15	LW_ARROW-4	40	0.15
LW_FLOOD LIGHT-2	223	0.15	LW_ARROW-5	34	0.15
LW_FOUNTAIN LIGHT-1	222	0.15	LW_ARROW-6	34	0.15
LW_FOUNTAIN LIGHT-2	224	0.15	LW_ARROW-7	245	0.15
LW_STREET LIGHT-1	190	0.15	LW_FURNITURE-1	225	0.15
LW_STREET LIGHT-2	228	0.15	LW_FURNITURE-2	30	0.15
LW_SHRUB-1	80	0.05	LW_FURNITURE-3	30	0.15
LW_SHRUB-2	82	0.05	LW_FURNITURE-4	201	0.15
LW_SHRUB-3	82	0.05	LW_FURNITURE-5	201	0.15
LW_SHRUB-4	82	0.05	LW_FURNITURE-6	201	0.15
LW_TICTORIAL PLANT-1	80	0.05	LW_FURNITURE-7	165	0.15
LW_TICTORIAL PLANT-2	80	0.05	LW_FOUNTAIN-1	1	0.15
LW_WIND BREAK HEDGES-1	80	0.05	LW_FOUNTAIN-2	180	0.15
LW_WIND BREAK HEDGES-2	82	0.05	LW_WATER BODY-1	180	0.15
LW_WIND BREAK HEDGES-3	88	0.05	LW_WATER BODY-2	180	0.15
LW_BUSHES-1	80	0.05	LW_ELEV 1	201	0.15
LW_BUSHES-2	80	0.05	LW_ELEV 2	1	0.15
LW_BUSHES-3	82	0.05	LW_ELEV 3	1	0.15
LW_TREE-1	104	0.05	LW_ELEV 4	155	0.15
LW_TREE-2	80	0.05	LW_ELEV 5	157	0.15
LW_FIXED PLANTERS-1	20	0.05	LW_ELEV 6	157	0.15
LW_FIXED PLANTERS-2	20	0.05	LW_BUILDING BLOCK	1	0.15
LW_WOOD WORK-1	34	0.15	LW_SAND FILL-1	40	0.15
LW_WOOD WORK-2	34	0.15	LW_SAND FILL-2	44	0.15
LW_WOOD WORK-3	28	0.15	LW_SAND FILL-3	38	0.15
LW_STONE WORK-1	14	0.15	LW_GRAVEL FILL-1	40	0.15
LW_STONE WORK-2	18	0.15	LW_GRAVEL FILL-2	44	0.15
LW_METAL WORK-1	181	0.15	LW_TAG-1	1	0.15
LW_METAL WORK-2	200	0.15	LW_TAG-2	1	0.15
LW_SEATING-1	241	0.15	LW_TAG-3	1	0.15
LW_SEATING-2	221	0.15	LW_TAG-4	1	0.15
LW_SEATING-3	181	0.15	LW_TAG-5	1	0.15
LW_PVC WORK	160	0.15	LW_TAG-6	1	0.15
LW_LANDSCAPE BLOCK	21	0.15	LW_TAG-7	1	0.15
LW_PANDOLA	21	0.15	LW_TAG-8	1	0.15
LW_TRELLIS	213	0.05	LW_TAG-9	1	0.15
LW_CANYON WORK	80	0.15	LW_TAG-10	1	0.15
LW_KINGDOM LUMBER	18	0.15	LW_TAG-11	1	0.15
LW_FCC WORK-1	171	0.15	LW_TAG-12	1	0.15
LW_FCC WORK-2	175	0.15	LW_TAG-13	1	0.15
LW_FCC WORK-3	180	0.15	LW_TAG-14	1	0.15
LW_EMBANKMENT WORK_1	24	0.15	LW_TAG-15	1	0.15
LW_EMBANKMENT WORK_2	32	0.15	LW_TAG-16	1	0.15
LW_EMBANKMENT WORK_3	14	0.15	LW_TAG-17	1	0.15
LW_DRAINAGE-1	211	0.15	LW_TAG-18	1	0.15
LW_DRAINAGE-2	203	0.15	LW_TAG-19	1	0.15
LW_VEHICLE GATE	1	0.05	LW_TAG-20	1	0.15
LW_FOOTPATH GATE	1	0.05	LW_TAG-21	1	0.15
LW_ROAD BARRIERS	162	0.15	LW_TAG-22	1	0.15
LW_BOUNDARY	12	0.15	LW_TAG-23	1	0.15
LW_SIGNAGE-1	201	0.15	LW_TAG-24	1	0.15
LW_SIGNAGE-2	181	0.15	LW_TAG-25	1	0.15
LW_RAMP	22	0.15	LW_TAG-26	1	0.15
LW_WALKWAY-1	30	0.15	LW_TAG-27	1	0.15
LW_WALKWAY-2	30	0.15	LW_TAG-28	1	0.15
LW_WALKWAY-3	34	0.15	LW_TAG-29	1	0.15
LW_AREA1	1	0.15	LW_TAG-30	1	0.15
LW_AREA2	2	0.15	LW_TAG-31	1	0.15
LW_AREA3	3	0.15	LW_TAG-32	1	0.15
LW_GRASS-1	83	0.15	LW_TAG-33	1	0.15
LW_GRASS-2	83	0.15	LW_TAG-34	1	0.15
TEXT1_LW	7	0.15	LW_TAG-35	1	0.15
TEXT2_LW	7	0.15	LW_TAG-36	1	0.15
TEXT300_LW	7	0.15	LW_TAG-37	1	0.15
TEXT350_LW	7	0.15	LW_TAG-38	1	0.15
TEXT380_LW	7	0.15	LW_TAG-39	1	0.15
TEXT390_LW	7	0.15	LW_TAG-40	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-41	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-42	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-43	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-44	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-45	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-46	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-47	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-48	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-49	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-50	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-51	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-52	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-53	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-54	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-55	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-56	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-57	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-58	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-59	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-60	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-61	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-62	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-63	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-64	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-65	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-66	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-67	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-68	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-69	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-70	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-71	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-72	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-73	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-74	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-75	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-76	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-77	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-78	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-79	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-80	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-81	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-82	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-83	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-84	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-85	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-86	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-87	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-88	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-89	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-90	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-91	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-92	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-93	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-94	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-95	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-96	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-97	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-98	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-99	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-100	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-101	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-102	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-103	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-104	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-105	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-106	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-107	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-108	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-109	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-110	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-111	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-112	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-113	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-114	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-115	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-116	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-117	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-118	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-119	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-120	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-121	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-122	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-123	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-124	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-125	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-126	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-127	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-128	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-129	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-130	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-131	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-132	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-133	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-134	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-135	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-136	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-137	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-138	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-139	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-140	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-141	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-142	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-143	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-144	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-145	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-146	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-147	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-148	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-149	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-150	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-151	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-152	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-153	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-154	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-155	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-156	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-157	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-158	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-159	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-160	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-161	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-162	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-163	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-164	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-165	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-166	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-167	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-168	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-169	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-170	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-171	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-172	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-173	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-174	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-175	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-176	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-177	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-178	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-179	1	0.15
TEXT3900_LW	7	0.15	LW_TAG-180	1	0.15
TEXT390					



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3.10.3 CAD layers (Electrical)

LAYER NAME	LINE & COLOUR	LINE WEIGHT	LAYER NAME	LINE & COLOUR	LINE WEIGHT
0_BDORTH0_X	WHITE	0.15	EL_S&T TRENCH (2)	240	0.05
DIM_EL	WHITE	0.15	EL_SB NO.	175	0.13
EL_ARROW	9	0.13	EL_SECTION	252	0.05
EL_BMS TRAY	172	0.20	EL_SKT-E	80	0.13
EL_BMS TRAY HATCH	172	0.20	EL_SKT H-N	140	0.13
EL_BUS DUCT	RED	0.20	EL_SKT L-N	200	0.13
EL_CABLE ROUTE	226	0.13	EL_SKT M-N	30	0.13
EL_CIRCUIT	200	0.13	EL_SLD	80	0.13
EL_CIRCUIT-B	BLUE	0.13	EL_SLD FEEDER	10	0.15
EL_CIRCUIT-E	100	0.13	EL_SLD LOAD SHEET	9	0.13
EL_CIRCUIT-R	20	0.13	EL_SWITCH BOARD	WHITE	0.15
EL_CIRCUIT-Y	30	0.13	EL_SYMBOL	153	0.09
EL_CONDUIT	11	0.15	EL_TRAY DATA	CYAN	0.20
EL_CONDUIT-E	MEGENTA	0.18	EL_TRAY DATA (1)	150	0.20
EL_CUTOUT	210	0.13	EL_TRAY DATA (2)	152	0.05
EL_EARTH-B	40	0.20	EL_TRAY LADDER (1)	42	0.05
EL_EARTH-N	BLUE	0.13	EL_TRAY LADDER (2)	43	0.05
EL_EARTH-STRIP	150	0.20	EL_TRAY LAYOUT	RED	0.20
EL_EARTH MAT	70	0.20	EL_TRAY LT (1)	44	0.20
EL_EARTH ELECTRODE	54	0.20	EL_TRAY LT (2)	42	0.05
EL_ECS TRAY	118	0.20	EL_TRAY S&T POWER (1)	14	0.20
EL_EQUIPMENT	RED	0.20	EL_TRAY S&T POWER (2)	12	0.05
EL_EXT-LTG POLE	180	0.15	EL_TRAY SUPPORT	45	0.13
EL_FUTURE	WHITE	0.15	EL_TRENCH	202	0.20
EL_GRID	8	0.05	EL_TV5 TRAY	46	0.20
EL_HT TRAY	GREEN	0.20	HATCH-ECS TRAY_EL	8	0.05
EL_HUME PIPE	24	0.15	HATCH-HT TRAY_EL	8	0.05
EL_LIGHT-E	GREEN	0.20	HATCH-POWER TRAY_EL	8	0.05
EL_LIGHT-N	GREEN	0.20	HATCH-S&T TRAY_EL	8	0.05
EL_LIGHT FIXT-E	RED	0.20	HATCH-S&T TRAY_EL	8	0.05
EL_LIGHT FIXT-N	BLUE	0.13	HATCH BMS TRAY_EL	8	0.05
EL_LIGHT FIXT-U	70	0.20	HATCH TRAY DATA_EL	8	0.05
EL_LIGHT FIXTURE	180	0.18	HATCH TV5 TRAY_EL	8	0.05
EL_LTNG ARSTR	130	0.18	INSERT	8	0.05
EL_N-CIRCUIT	200	0.13	TEXT-ARCH_EL	8	0.05
EL_N-CONDUIT	11	0.15	TEXT-TRAY_EL	WHITE	0.15
EL_N-EXT-CIRCUIT	200	0.13	TEXT CUTOUT_EL	WHITE	0.15
EL_NOTE	WHITE	0.15	TEXT EARTH STRIP_EL	WHITE	0.15
EL_PANELS	RED	0.20	TEXT EARTH_EL	WHITE	0.15
EL_POWER TRAY	RED	0.20	TEXT EQUIPMENT_EL	WHITE	0.15
EL_POWER CKT	140	0.13	TEXT GENERAL_EL	WHITE	0.15
EL_POWER SOCKET	CYAN	0.20	TEXT PANEL_EL	WHITE	0.15
EL_RACEWAY(1)	22	0.18	TEXT SLD_EL	WHITE	0.15
EL_RACEWAY(2)	21	0.05	TEXT_EL	WHITE	0.15
EL_S&T TRAY	MAGENTA	0.18	TITLE_BLOCK	WHITE	0.15
EL_S&T TRENCH (1)	242	0.20	XREFS	WHITE	0.15

Electrical CAD Laying System



Maha Metro Rail Project

3.10.4 CAD layers (Fire Detection)

FIRE-FIGHTING LAYING SYSTEM

LAYER NAME	LINE & COLOUR	LINE WEIGHT
0_BDORTHO_X	WHITE	default
ARCH-XREF_FA	8	0.00
DIM_FA	WHITE	0.25
DIM_FF	WHITE	0.25
FA_ALARM CONDUIT	92	0.20
FA_CLOUD	WHITE	0.25
FA_DETECTOR	141	0.20
FA_EQUIPMENT	160	0.18
FA_HOOTER CABLE	BLUE	0.20
FA_POWER CABLE	20	0.20
FA_RI	81	0.20
FA_SKETCH	215	0.13
FA_SYMBOL	173	0.15
FA_ZONE	WHITE	0.25
FF_CENTER LINE	9	0.09
FF_CLOUD	WHITE	0.25
FF_CUT OUT	30	0.15
FF_GRID	8	0.09
FF_HYDRANT PIPE	20	0.15
FF_HYDRANT PIPE-PD	142	0.15
FF_PUMPS	173	0.20
FF_SKETCH	215	0.15
FF_SRINKLER PIPE	160	0.15
FF_SRINKLER PIPE-PD	21	0.15
HATCH_FA	160	0.09
HATCH_FF	20	0.09
INSERT	8	0.09
TEXT_FA	WHITE	0.25
TEXT_FF	WHITE	0.25
TITLE_BLOCK	WHITE	0.25
XREFS	255	0.09

Fire Detection CAD Laying System



Maha Metro Rail Project

3.10.4 CAD layers (HVAC)

LAYER NAME	LINE & COLOUR	LINE WEIGHT	LAYER NAME	LINE & COLOUR	LINE WEIGHT
0_BDORTHO_X	WHITE	0.2500	VAC-GRID	8	0.0000
DIM-VAC	255	0.1500	VAC-PUMP	RED	0.1500
HATCH-RAD-VAC	31	0.0000	VAC-RA DIFFUSER	RED	0.1500
HATCH-SAD-VAC	70	0.0000	VAC-RA DUCT	32	0.2000
HATCH-SED-VAC	231	0.0000	VAC-REFRIGERANT PIPE (CKT-1)	180	0.1500
INSERT	253	0.0000	VAC-REFRIGERANT PIPE (CKT-2)	210	0.1500
TEXT-ARCH-VAC	252	0.0500	VAC-REFRIGERANT PIPE (CKT-3)	60	0.1500
TEXT-FCU-VAC	WHITE	0.2500	VAC-SA DIFFUSER	GREEN	0.1500
TEXT-GENERAL-VAC	WHITE	0.2500	VAC-SA DUCT	GREEN	0.1500
TEXT-RA-VAC	WHITE	0.2500	VAC-SE DUCT	241	0.1500
TEXT-SA-VAC	WHITE	0.2500	VAC-SEF-FAN	241	0.1500
TEXT-SE-VAC	WHITE	0.2500	VAC-SPLIT UNIT	RED	0.1500
TEXT-VAC	WHITE	0.2500	VAC-VALVE	RED	0.1500
TEXT-VE-VAC	WHITE	0.2500	VAC-VE-FAN	213	0.1300
TEXT-VS-VAC	WHITE	0.2500	VAC-VE-DUCT	213	0.1300
TITLE_BLOCK	WHITE	0.2500	VAC-VE-FAN	87	0.1300
VAC-AHU	BLUE	0.1500	VAC-VS DIFFUSER	87	0.1300
VAC-ARROW	20	0.0000	VAC-VS DUCT	87	0.1300
VAC-CHILLER	RED	0.1500	VAC-WALL-OPENING	BLUE	0.1500
VAC-CHWR-PIPE	RED	0.1500	VS-VE DIFFUSER	213	0.1300
VAC-CHWS-PIPE	GREEN	0.1500			
VAC-COOLING TOWER	RED	0.1500	XREFS	255	0.1500
VAC-CUTOUT	BLUE	0.1500			
VAC-CWR-PIPE	MAGENTA	0.1000			
VAC-CWS-PIPE	142	0.1300			
VAC-DAMPER	RED	0.1500			
VAC-DRAIN PIPE	130	0.1000			
VAC-EQUIPMENT	RED	0.1500			
VAC-FA-FAN	GREEN	0.1500			
VAC-FCU	RED	0.1500			
VAC-FCU DUCT	GREEN	0.1500			
VAC-GENERAL	116	0.1000			

HVAC CAD Laying System



Maha Metro Rail Project

3.10.5 CAD layers (Plumbing)

PLUMBING LAYING SYSTEM

LAYER NAME	LINE & COLOUR	LINE WEIGHT	LAYER NAME	LINE & COLOUR	LINE WEIGHT
0_BDORTHQ_X	WHITE	0.15	TEXT	50	0.18
DIM_PHE	WHITE	0.15	TEXT DR_PHE	WHITE	0.15
HATCH	8	0.05	TEXT WS_PHE	WHITE	0.15
HATCH_PHE	8	0.05	TEXT_PHE	WHITE	0.15
INCH_PT	200	0.05	TITLE_BLOCK	WHITE	0.15
PHE_AC CENTRE LINE	45	0.09	XREFS	WHITE	0.15
PHE_AC DRAINAGE	84	0.18			
PHE_ACCESS	140	0.18			
PHE_ARROW	15	0.13			
PHE_CLOUD	WHITE	0.15			
PHE_CLOUD REVISION	WHITE	0.15			
PHE_COVERED DRAIN CHANNEL	160	0.18			
PHE_CWS	130	0.18			
PHE_CWS CENTRE LINE	45	0.09			
PHE_DRAIN CHANNEL	142	0.18			
PHE_DRAIN PIPE	170	0.18			
PHE_DRAIN PIPE CENTRE LINE	45	0.09			
PHE_EQUIPMENT	96	0.18			
PHE_GI PIPE	WHITE	0.15			
PHE_GRATING	162	0.18			
PHE_GUTTER	210	0.18			
PHE_HWS	12	0.18			
PHE_HWS CENTRE LINE	45	0.09			
PHE_PT	204	0.18			
PHE_PUMP DR	30	0.18			
PHE_PUMP WS	90	0.18			
PHE_RWP	210	0.18			
PHE_RWP CENTRE LINE	45	0.09			
PHE_RWS	90	0.18			
PHE_RWS CENTRE LINE	45	0.09			
PHE_SAUCER CENTRE LINE	45	0.09			
PHE_SAUCER DRAIN	30	0.18			
PHE_SAUCER DRAIN PIPE	30	0.18			
PHE_SEEPAGE CENTRE LINE	45	0.09			
PHE_SEEPAGE PIPE	180	0.18			
PHE_SEWAGE CENTRE LINE	180	0.09			
PHE_SEWAGE PIPE	20	0.18			
PHE_SEWER CENTRE LINE	45	0.09			
PHE_SEWER DRAINAGE	22	0.18			
PHE_SLEEVE	132	0.18			
PHE_SOIL CENTRE LINE	45	0.09			
PHE_SOIL PIPE	45	0.18			
PHE_STORM CENTRE LINE	45	0.09			
PHE_STORM DRAINAGE	45	0.18			
PHE_VENT CENTRE LINE	45	0.09			
PHE_VENT PIPE	92	0.18			
PHE_WASTE CENTRE LINE	45	0.09			
PHE_WASTE PIPE	180	0.18			
SYMBOL	153	0.18			

Plumbing CAD Laying System

Maha Metro Rail Project

3.10.6 CAD layers (Highways)

	SL NO.	LAYER NAME	LINE & COLOUR	LINE WEIGHT	SL NO.	LAYER NAME	LINE & COLOUR	LINE WEIGHT	SL NO.	LAYER NAME	LINE & COLOUR	LINE WEIGHT
1	000-00000	WHITE	0.5	00000000	10	000-00000	WHITE	0.5	00	000-00000	WHITE	0.5
2	000-00000	WHITE	0.5	00000000	11	000-00000	WHITE	0.5	01	000-00000	WHITE	0.5
3	000-00000	WHITE	0.5	00000000	12	000-00000	WHITE	0.5	02	000-00000	WHITE	0.5
4	000-00000	WHITE	0.5	00000000	13	000-00000	WHITE	0.5	03	000-00000	WHITE	0.5
5	000-00000	WHITE	0.5	00000000	14	000-00000	WHITE	0.5	04	000-00000	WHITE	0.5
6	000-00000	WHITE	0.5	00000000	15	000-00000	WHITE	0.5	05	000-00000	WHITE	0.5
7	000-00000	WHITE	0.5	00000000	16	000-00000	WHITE	0.5	06	000-00000	WHITE	0.5
8	000-00000	WHITE	0.5	00000000	17	000-00000	WHITE	0.5	07	000-00000	WHITE	0.5
9	000-00000	WHITE	0.5	00000000	18	000-00000	WHITE	0.5	08	000-00000	WHITE	0.5
10	000-00000	WHITE	0.5	00000000	19	000-00000	WHITE	0.5	09	000-00000	WHITE	0.5
11	000-00000	WHITE	0.5	00000000	20	000-00000	WHITE	0.5	10	000-00000	WHITE	0.5
12	000-00000	WHITE	0.5	00000000	21	000-00000	WHITE	0.5	11	000-00000	WHITE	0.5
13	000-00000	WHITE	0.5	00000000	22	000-00000	WHITE	0.5	12	000-00000	WHITE	0.5
14	000-00000	WHITE	0.5	00000000	23	000-00000	WHITE	0.5	13	000-00000	WHITE	0.5
15	000-00000	WHITE	0.5	00000000	24	000-00000	WHITE	0.5	14	000-00000	WHITE	0.5
16	000-00000	WHITE	0.5	00000000	25	000-00000	WHITE	0.5	15	000-00000	WHITE	0.5
17	000-00000	WHITE	0.5	00000000	26	000-00000	WHITE	0.5	16	000-00000	WHITE	0.5
18	000-00000	WHITE	0.5	00000000	27	000-00000	WHITE	0.5	17	000-00000	WHITE	0.5
19	000-00000	WHITE	0.5	00000000	28	000-00000	WHITE	0.5	18	000-00000	WHITE	0.5
20	000-00000	WHITE	0.5	00000000	29	000-00000	WHITE	0.5	19	000-00000	WHITE	0.5
21	000-00000	WHITE	0.5	00000000	30	000-00000	WHITE	0.5	20	000-00000	WHITE	0.5
22	000-00000	WHITE	0.5	00000000	31	000-00000	WHITE	0.5	21	000-00000	WHITE	0.5
23	000-00000	WHITE	0.5	00000000	32	000-00000	WHITE	0.5	22	000-00000	WHITE	0.5
24	000-00000	WHITE	0.5	00000000	33	000-00000	WHITE	0.5	23	000-00000	WHITE	0.5
25	000-00000	WHITE	0.5	00000000	34	000-00000	WHITE	0.5	24	000-00000	WHITE	0.5
26	000-00000	WHITE	0.5	00000000	35	000-00000	WHITE	0.5	25	000-00000	WHITE	0.5
27	000-00000	WHITE	0.5	00000000	36	000-00000	WHITE	0.5	26	000-00000	WHITE	0.5
28	000-00000	WHITE	0.5	00000000	37	000-00000	WHITE	0.5	27	000-00000	WHITE	0.5
29	000-00000	WHITE	0.5	00000000	38	000-00000	WHITE	0.5	28	000-00000	WHITE	0.5
30	000-00000	WHITE	0.5	00000000	39	000-00000	WHITE	0.5	29	000-00000	WHITE	0.5
31	000-00000	WHITE	0.5	00000000	40	000-00000	WHITE	0.5	30	000-00000	WHITE	0.5
32	000-00000	WHITE	0.5	00000000	41	000-00000	WHITE	0.5	31	000-00000	WHITE	0.5
33	000-00000	WHITE	0.5	00000000	42	000-00000	WHITE	0.5	32	000-00000	WHITE	0.5
34	000-00000	WHITE	0.5	00000000	43	000-00000	WHITE	0.5	33	000-00000	WHITE	0.5
35	000-00000	WHITE	0.5	00000000	44	000-00000	WHITE	0.5	34	000-00000	WHITE	0.5
36	000-00000	WHITE	0.5	00000000	45	000-00000	WHITE	0.5	35	000-00000	WHITE	0.5
37	000-00000	WHITE	0.5	00000000	46	000-00000	WHITE	0.5	36	000-00000	WHITE	0.5
38	000-00000	WHITE	0.5	00000000	47	000-00000	WHITE	0.5	37	000-00000	WHITE	0.5
39	000-00000	WHITE	0.5	00000000	48	000-00000	WHITE	0.5	38	000-00000	WHITE	0.5
40	000-00000	WHITE	0.5	00000000	49	000-00000	WHITE	0.5	39	000-00000	WHITE	0.5
41	000-00000	WHITE	0.5	00000000	50	000-00000	WHITE	0.5	40	000-00000	WHITE	0.5
42	000-00000	WHITE	0.5	00000000	51	000-00000	WHITE	0.5	41	000-00000	WHITE	0.5
43	000-00000	WHITE	0.5	00000000	52	000-00000	WHITE	0.5	42	000-00000	WHITE	0.5
44	000-00000	WHITE	0.5	00000000	53	000-00000	WHITE	0.5	43	000-00000	WHITE	0.5
45	000-00000	WHITE	0.5	00000000	54	000-00000	WHITE	0.5	44	000-00000	WHITE	0.5
46	000-00000	WHITE	0.5	00000000	55	000-00000	WHITE	0.5	45	000-00000	WHITE	0.5
47	000-00000	WHITE	0.5	00000000	56	000-00000	WHITE	0.5	46	000-00000	WHITE	0.5
48	000-00000	WHITE	0.5	00000000	57	000-00000	WHITE	0.5	47	000-00000	WHITE	0.5
49	000-00000	WHITE	0.5	00000000	58	000-00000	WHITE	0.5	48	000-00000	WHITE	0.5
50	000-00000	WHITE	0.5	00000000	59	000-00000	WHITE	0.5	49	000-00000	WHITE	0.5
51	000-00000	WHITE	0.5	00000000	60	000-00000	WHITE	0.5	50	000-00000	WHITE	0.5
52	000-00000	WHITE	0.5	00000000	61	000-00000	WHITE	0.5	51	000-00000	WHITE	0.5
53	000-00000	WHITE	0.5	00000000	62	000-00000	WHITE	0.5	52	000-00000	WHITE	0.5
54	000-00000	WHITE	0.5	00000000	63	000-00000	WHITE	0.5	53	000-00000	WHITE	0.5
55	000-00000	WHITE	0.5	00000000	64	000-00000	WHITE	0.5	54	000-00000	WHITE	0.5
56	000-00000	WHITE	0.5	00000000	65	000-00000	WHITE	0.5	55	000-00000	WHITE	0.5
57	000-00000	WHITE	0.5	00000000	66	000-00000	WHITE	0.5	56	000-00000	WHITE	0.5
58	000-00000	WHITE	0.5	00000000	67	000-00000	WHITE	0.5	57	000-00000	WHITE	0.5
59	000-00000	WHITE	0.5	00000000	68	000-00000	WHITE	0.5	58	000-00000	WHITE	0.5
60	000-00000	WHITE	0.5	00000000	69	000-00000	WHITE	0.5	59	000-00000	WHITE	0.5
61	000-00000	WHITE	0.5	00000000	70	000-00000	WHITE	0.5	60	000-00000	WHITE	0.5
62	000-00000	WHITE	0.5	00000000	71	000-00000	WHITE	0.5	61	000-00000	WHITE	0.5
63	000-00000	WHITE	0.5	00000000	72	000-00000	WHITE	0.5	62	000-00000	WHITE	0.5
64	000-00000	WHITE	0.5	00000000	73	000-00000	WHITE	0.5	63	000-00000	WHITE	0.5
65	000-00000	WHITE	0.5	00000000	74	000-00000	WHITE	0.5	64	000-00000	WHITE	0.5
66	000-00000	WHITE	0.5	00000000	75	000-00000	WHITE	0.5	65	000-00000	WHITE	0.5
67	000-00000	WHITE	0.5	00000000	76	000-00000	WHITE	0.5	66	000-00000	WHITE	0.5
68	000-00000	WHITE	0.5	00000000	77	000-00000	WHITE	0.5	67	000-00000	WHITE	0.5
69	000-00000	WHITE	0.5	00000000	78	000-00000	WHITE	0.5	68	000-00000	WHITE	0.5
70	000-00000	WHITE	0.5	00000000	79	000-00000	WHITE	0.5	69	000-00000	WHITE	0.5
71	000-00000	WHITE	0.5	00000000	80	000-00000	WHITE	0.5	70	000-00000	WHITE	0.5
72	000-00000	WHITE	0.5	00000000	81	000-00000	WHITE	0.5	71	000-00000	WHITE	0.5
73	000-00000	WHITE	0.5	00000000	82	000-00000	WHITE	0.5	72	000-00000	WHITE	0.5
74	000-00000	WHITE	0.5	00000000	83	000-00000	WHITE	0.5	73	000-00000	WHITE	0.5
75	000-00000	WHITE	0.5	00000000	84	000-00000	WHITE	0.5	74	000-00000	WHITE	0.5
76	000-00000	WHITE	0.5	00000000	85	000-00000	WHITE	0.5	75	000-00000	WHITE	0.5
77	000-00000	WHITE	0.5	00000000	86	000-00000	WHITE	0.5	76	000-00000	WHITE	0.5
78	000-00000	WHITE	0.5	00000000	87	000-00000	WHITE	0.5	77	000-00000	WHITE	0.5
79	000-00000	WHITE	0.5	00000000	88	000-00000	WHITE	0.5	78	000-00000	WHITE	0.5
80	000-00000	WHITE	0.5	00000000	89	000-00000	WHITE	0.5	79	000-00000	WHITE	0.5
81	000-00000	WHITE	0.5	00000000	90	000-00000	WHITE	0.5	80	000-00000	WHITE	0.5
82	000-00000	WHITE	0.5	00000000	91	000-00000	WHITE	0.5	81	000-00000	WHITE	0.5
83	000-00000	WHITE	0.5	00000000	92	000-00000	WHITE	0.5	82	000-00000	WHITE	0.5
84	000-00000	WHITE	0.5	00000000	93	000-00000	WHITE	0.5	83	000-00000	WHITE	0.5
85	000-00000	WHITE	0.5	00000000	94	000-00000	WHITE	0.5	84	000-00000	WHITE	0.5
86	000-00000	WHITE	0.5	00000000	95	000-00000	WHITE	0.5	85	000-00000	WHITE	0.5
87	000-00000	WHITE	0.5	00000000	96	000-00000	WHITE	0.5	86	000-00000	WHITE	0.5
88	000-00000	WHITE	0.5	00000000	97	000-00000	WHITE	0.5	87	000-00000	WHITE	0.5
89	000-00000	WHITE	0.5	00000000	98	000-00000	WHITE	0.5	88	000-00000	WHITE	0.5
90	000-00000	WHITE	0.5	00000000	99	000-00000	WHITE	0.5	89	000-00000	WHITE	0.5
91	000-00000	WHITE	0.5	00000000	100	000-00000	WHITE	0.5	90	000-00000	WHITE	0.5
92	000-00000	WHITE	0.5	00000000	101	000-00000	WHITE	0.5	91	000-00000	WHITE	0.5
93	000-00000	WHITE	0.5	00000000	102	000-00000	WHITE	0.5	92	000-00000	WHITE	0.5
94	000-00000	WHITE	0.5	00000000	103	000-00000	WHITE	0.5	93	000-00000	WHITE	0.5
95	000-00000	WHITE	0.5	00000000	104	000-00000	WHITE	0.5	94	000-00000	WHITE	0.5
96	000-00000	WHITE	0.5	00000000	105	000-00000	WHITE	0.5	95	000-00000	WHITE	0.5
97	000-00000	WHITE	0.5	00000000	106	000-00000	WHITE	0.5	96	000-00000	WHITE	0.5
98	000-00000	WHITE	0.5	00000000	107	000-00000	WHITE	0.5	97	000-00000	WHITE	0.5
99	000-00000	WHITE	0.5	00000000	108	000-00000	WHITE	0.5	98	000-00000	WHITE	0.5
100	000-00000	WHITE	0.5	00000000	109	000-00000	WHITE	0.5	99	000-00000	WHITE	0.5
101	000-00000	WHITE	0.5	00000000	110	000-00000	WHITE					

Highway CAD Laying System



Maha Metro Rail Project

3.10.7 CAD layers (Structure)

LAYER NAME	LINE & COLOUR	LINE WEIGHT	LAYER NAME	LINE & COLOUR	LINE WEIGHT
AXIS	10	0.05	TRACK		0.25
BARLIST	255	0.25	TRACK-AXIS		0.09
BEARING	153	0.09	TRACK-RAILS		0.13
BLD	magenta	DEFAULT	UT_DRAIN		0.15
CON-CUT	130	0.30	UT_POWER		0.15
CON-HIDE	50	0.20	UT_SEWER		0.15
CON-VIEW	90	0.25	UT_SUI		0.15
CULVERT	154	DEFAULT	UT_TELECOM		0.15
CURB STONE	141	DEFAULT	UT_WATER SUPPLY		0.15
			WALL		DEFAULT
DIM	255	0.15	XREF		DEFAULT
EL_TRAY LADDER (1)	40	0.20			
EP	blue	DEFAULT			
FOUNDATION	52	DEFAULT			
GAS_LINE	45	DEFAULT			
GASE POINT	34	DEFAULT			
GATE	90	DEFAULT			
GREEN BELT	94	DEFAULT			
GROUND-BIG	130	0.30			
GROUND-HIDE	50	0.15			
GROUND-SMALL	90	0.25			
HATCH		0.09			
INSERT		0.09			
INSERT-HIDE		0.09			
JACKING		0.09			
LP		DEFAULT			
MARK1		0.09			
MARK2		0.25			
OIL TANK		DEFAULT			
PATROL PUMP		DEFAULT			
PNTDES		DEFAULT			
PNTLV		DEFAULT			
PNTNO		DEFAULT			
POINTS		DEFAULT			
PRECAST-CUT		0.30			
PRECAST-HIDE		0.15			
PRECAST-VIEW		0.25			
PYLON		DEFAULT			
REV		0.25			
ROAD		DEFAULT			
SOLING		DEFAULT			
STEEL-CUT		0.30			
STEEL-HIDE		0.18			
STEEL-VIEW		0.20			
SYMBOL		0.09			
TENDON		0.20			
TEXT		0.15			
TITLE_BLOCK		DEFAULT			
TOWER		DEFAULT			
TP		DEFAULT			

Structure CAD Laying System



Maha Metro Rail Project

3.11 APPENDIX 1 – CAD Symbols & Blocks

3.11.1 ARCHITECTURE SYMBOLS & ABBREVIATIONS

ARCHITECTURE SYMBOLS				ARCHITECTURE SYMBOLS	
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	COLUMN GRID		LEVEL		W.C.
	BUILDING SECTION		FINISH ROAD LVL.		URNAL
	WALL SECTION		FINISH PAVING LVL.		URNAL IN SECTION
	ELEVATION		FINISH CEILING LVL.		WASH BASIN
	INTERIOR ELEVATION		FINISH FLOOR LVL.		DOOR
	CALLOUTS FOR ENLARGED PLAN/ELEVATION / SECTION		STRUCTURAL SLAB TOP LVL.		WINDOW
	GLASS TYPE		TOP OF PARAPET		NORTH ARROW
	FALSE CEILING SOFFIT HEIGHT		RIDGE LVL.		
	MATCH LINE		EAVES LVL.		
	KEY NOTE		LEVEL		
	EQUIPMENT REFERENCE		FLOOR DRAIN		
	REVISION		FLOOR TRAP		
	WALL PARTITION TYPE		FLOOR CLEANOUT		
	230 THK HOLLOW BLOCK WORK WALL		ALUMINUM		
	150 THK CONC. FILLED HOLLOW BLOCK WORK WALL		BRASS/ BRONZE		
	100 THK CONC. FILLED HOLLOW BLOCK WORK WALL		STEEL		
	R.C.C. WALLS & COL. (IN PLANS AND SECTIONS)		BLOCKING		
	ACOUSTICAL CEILING PANEL		CONTINUOUS WOOD		
	GYPSUM BOARD		PLYWOOD		
	INSULATION (BATT)		FINISH WOOD		
	INSULATION (RIGID)		CONCRETE		
	WATER PROOFING		CRUSHED ROCK/ GRAVEL		
	CERAMIC TILE		DOOR TAG		
	SAND FILL		WINDOW TAG		

Architecture Symbols & Abbreviation



Maha Metro Rail Project

3.11.2 ELECTRICAL SYMBOLS & ABBREVIATIONS (SH-1)

ELECTRICAL			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	1A SINGLE POLE SWITCH		AIR CIRCUIT BREAKER
	15A SINGLE POLE SWITCH		MOULDED CASE CIRCUIT BREAKER
	2x20W FLUORESCENT FIXTURE RECESS TYPE		MINIATURE CIRCUIT BREAKER
	2x20W FLUORESCENT FIXTURE SURFACE MOUNTED		EARTH LEAKAGE CIRCUIT BREAKER
	2x18W LED FLUORESCENT FIXTURE SURFACE		RESIDUAL CURRENT CIRCUIT BREAKER
	1x10W CFL FIXTURE SURFACE MOUNTED		CURRENT TRANSFORMER
	1x200W MH FIXTURE SURFACE MOUNTED		STAR-DELTA STARTER
	1x100W MH FIXTURE SURFACE MOUNTED		DIGITAL AMMETER
	1x10W MH FIXTURE SURFACE MOUNTED		DIGITAL VOLTMETER
	4x14W FLUORESCENT FIXTURE RECESS TYPE DIRECT / INDIRECT		INVERSE TIME OVER CURRENT RELAY
	4x14W FLUORESCENT FIXTURE RECESS TYPE WITH ACRYLIC COVER		INVERSE TIME EARTH FAULT RELAY
	LED FIXTURE RECESS TYPE		OVER LOAD RELAY
	20x18W FLUORESCENT FIXTURE RECESS TYPE		AUTOMATIC POWER FACTOR CORRECTION RELAY
	20x20W FLUORESCENT FIXTURE RECESS TYPE		EARTH BUS
	10x20W FLUORESCENT FIXTURE SURFACE MOUNTED		INDICATION LIGHT
	1x8W BULK HEAD LIGHT WALL MOUNTED		ON / OFF / TRIP
	BRACKET LIGHT		START / STOP
	MIRROR LIGHT		AUTOMATIC TRANSFER SWITCH
	WALL WASHER		DO SET
	LV DOWNLIGHT		PIPE EARTH ELECTRODE
	PICTURE LIGHT		G.I. PLATE ELECTRODE
	CHANDIELIER		C/I PLATE ELECTRODE
	LIGHTING CONTROL MODULE		EARTH ELECTRODES
	LIGHTING CONTROL PANEL		SURGE PROTECTION DEVICE
	WALL MOUNTED ADJUSTABLE LIGHTING POINT		LIGHTNING ARRESTOR
	OVER DOOR WARNING LIGHT		EARTH BOND PIT
	WALL MOUNTED FLOODLIGHT		EARTH POINT
	POLE MOUNTED FLOODLIGHT		
	ROLLARD LIGHT		
	FIBRE OPTIC PROJECTOR & LENSE		
	LIGHTING TRACK		
	COLD CATHODE OR NEON LIGHTING		
	STRIP LIGHT		

ABBREVIATION	DESCRIPTION
LTC	LIGHTING
PWR	POWER
CT	CABLE TRAY
ELV	EXTRA LOW VOLTAGE










Electrical Symbols & Abbreviation (Sh-1)

Maha Metro Rail Project

3.11.3 ELECTRICAL SYMBOLS & ABBREVIATIONS (SH-2)



























SYMBOL	DESCRIPTION
	15A 1W-SWITCHED FUSED CONNECTION UNIT & NEON IND
	20/30A DOUBLE POLE SWITCH
	20/30A DOUBLE POLE SWITCH & NEON INDICATOR
	15A SINGLE SWITCHED SOCKET OUTLET - UPS
	5A,10 240V SWITCHED SOCKET OUTLET
	15/15A 10 240V SOCKET OUTLET WITH SWITCH
	15A,10 240V WEATHER PROOF SOCKET OUTLET
	63A,30 WEATHER PROOF INDUSTRIAL SOCKET OUTLET
	ISOLATOR
	STARTER SWITCH
	CHANGEOVER SWITCH
	FAN ISOLATOR SWITCH
	FAN STOP/START CONTROLLER
	CONTACTOR
	BUS BAR TAP OFF UNIT
	ELECTRICITY METER
	FLOOR BOX
	DISTRIBUTION BOARD
	SUB MAIN DIST BOARD / MCC





















ABBREVIATION	DESCRIPTION
ACS	ACCESS CONTROL SYSTEM
HV	HIGH VOLTAGE
LV	LOW VOLTAGE
DB	DISTRIBUTION BOARD
SMDB	SUBMAIN DISTRIBUTION BOARD
TA	TO ABOVE
TB	TO BELOW
UPS	UNINTERRUPTIBLE POWER SUPPLY
WP	WEATHER PROOF
WH	WATER HEATER
HD	HAND DRYER
VCB	VACUUM CIRCUIT BREAKER
ACB	AIR CIRCUIT BREAKER
MCCB	MOULDED CASE CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTRE
MCB	MAIN DISTRIBUTION BOARD

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	FOR SYMMETRICAL
	FOR SECTION
	FOR UCS
	FOR TITLE
	FOR LEVEL
NOTES:-	(1) GENERAL NOTES (2) GENERAL NOTES (3) GENERAL NOTES
	NORTH DIRECTION
	DETAIL MARK
	DETAIL MARK - 1
	FOR DRAFT COPY

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3.11.4 FIRE DETECTION AND FIRE FIGHTING SYMBOLS & ABBREVIATIONS (SH-1)

FIRE-FIGHTING	
SYMBOL	DESCRIPTION
	SINGLE HYDRANT VALVE
	BRANCH PIPE WITH NOZZLE
	FIRST AID HOSE REEL (THERMOPLASTIC)
	SYNTHETIC HOSE WITH STAINLESS STEEL COUPLING
	FIRE HOSE CABINET
	FLOW SWITCH
	INSPECTION AND TEST CONTROL VALVE
	SPRINKLER HEAD
	SIDE WALL SPRINKLER HEAD
	UP-RIGHT SPRINKLER HEAD
	GATE VALVE
	BUTTERFLY VALVE
	DOUBLE HYDRANT
	FIRE EXTINGUISHER, DRY CHEMICAL
	FIRE EXTINGUISHER, FOAM TYPE
	PRESSURE SWITCH
	PRESSURE GAUGE
	FOUR WAY FIRE BRIGADE INLET
	DRAWOUT CONNECTION
	EXPANSION BELLOW
	NON-RETURN VALVE
	Y STRAINER
	HYDRANT PIPE
	SPRINKLER PIPE
	FIRE WATER PIPE
	ALARM VALVE

FIRE-ALARM SYSTEM	
SYMBOL	DESCRIPTION
	MULTI SENSOR OPTICAL SMOKE THERMISTOR BASED CUM HEAT DETECTOR BELOW FALSE CEILING / SLAB
	MULTI SENSOR OPTICAL SMOKE THERMISTOR BASED CUM HEAT DETECTOR ABOVE FALSE CEILING
	MULTI SENSOR OPTICAL SMOKE THERMISTOR BASED CUM HEAT DETECTOR BELOW FALSE FLOOR
	HEAT DETECTOR ABOVE FALSE CEILING
	HEAT DETECTOR BELOW FALSE CEILING
	MANUAL CALL BOX RECESSED IN WALL
	HOOTER CUM STROBE
	RESPONSE INDICATOR WITH TWIN HIGH INTENSITY LEDS MOUNTED ABOVE DOORWAY AT CENTRE
	OUT PUT MODULE
	IN PUT MODULE
	MANUAL GAS ABORT BUTTON
	MANUAL GAS RELEASE BUTTON
	HOOTER CUM SPEAKER
	CONDUIT FOR FIRE ALARM
	CONDUIT FOR STROBE
	CONDUIT FOR HOOTER CUM SPEAKER
	FIRE ALARM PANEL
	REPEATER PANEL
	1x240 WATT AMPLIFIER & SELECTOR SWITCH FOR PA SYSTEM
	FAULT ISOLATOR

FIRE-ALARM SYSTEM	
ABBREVIATIONS	DESCRIPTION
FI	FAULT ISOLATOR
FACP	FIRE ALARM CONTROL PANEL
IM	INPUT MODULE
OM	OUTPUT MODULE
MC	MANUAL CALL POINT

Fire Detection & Fire Fighting Symbols & Abbreviation (Sh-1)



Maha Metro Rail Project

3.11.5 FIRE DETECTION AND FIRE FIGHTING SYMBOLS & ABBREVIATIONS (SH-2)

FIRE-FIGHTING	
ABBREVIATIONS	DESCRIPTION
FIA	FROM ABOVE
FIB	FROM BELOW
TJA	TO ABOVE
TJB	TO BELOW
UP	PIPE UP
DN	DROP DOWN
BOP	BOTTOM OF PIPE
BOS	BOTTOM OF SLEEVE
F/C	FALSE CEILING
FWP	FIRE WATER PIPE

UNIT ABBREVIATIONS	
UNIT	DESCRIPTION
mm	MILLIMETER
Mtr.	METER
KL	KILOLITER
Ltrs.	LITRE

SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	FOR SYMMETRICAL
	FOR SECTION
	FOR UCS
PLAN VIEW SCALE: 1/1	FOR TITLE
0.000 m ▽	FOR LEVEL
NOTES:-	(1) GENERAL NOTES (2) GENERAL NOTES (3) GENERAL NOTES
	NORTH DIRECTION
	DETAIL MARK
	DETAIL MARK - 1
DRAFT COPY	FOR DRAFT COPY

Fire Detection & Fire Fighting Symbols & Abbreviation (Sh-2)



Maha Metro Rail Project

3.11.6 HVAC SYMBOLS & ABBREVIATIONS (SH-1)

LEGEND HVAC			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	SUPPLY AIR DIFFUSER		FOR LWB
	RETURN AIR DIFFUSER		FOR TITLE
	SUPPLY AIR GRILLE		FOR LEVEL
	SLOT LINEAR DIFFUSER	NOTES:-	(1) GENERAL NOTES (2) GENERAL NOTES (3) GENERAL NOTES
	ISD VALVE SUPPLY		NORTH DIRECTION
	ISD VALVE EXHAUST		DETAIL MARK
	LINEAR BAR GRILLE		DETAIL MARK - 1
	SQUARE SUPPLY GRILLE		FOR DRAFT COPY
	SQUARE RETURN GRILLE		FOR SYMMETRICAL
	VOLUME CONTROL DAMPER		FOR SECTION
	FIRE DAMPER		
	NON RETURN DAMPER / BACKDRAFT DAMPER		
	SUPPLY AIR DUCT		
	FRESH AIR DUCT		
	KITCHEN EXHAUST DUCT		
	TOILET EXHAUST DUCT		
	VOLUME CONTROL DAMPER (SCHEMATIC)		
	BELL MOUTH WITH WIRE MESH & VOLUME CONTROL DAMPER		
	TURNING VANES		
	FLEXIBLE DUCT		
	DOOR UNDER GLT		
	EXHAUST AIR LOUVERS WITH SAND TRAP		
	EXHAUST LOUVERS		
	GRAVITY LOUVERS		
	SOUND ATTENUATOR		
	ACCESS PANEL		
	SUPPLY / RETURN FAN		
	REF-REFRIGERANT PIPE & CONNECTION		
	DRAIN PIPE		
	REMOTE SENSOR		
	DUCTABLE INDOOR UNIT		
	FRESH AIR HANDLING UNIT		
	CASSETTE UNIT		
	PROPELLER FAN		
	VAV / VAV OUT DOOR UNIT		
	AXIAL FLOW FAN		
	DOOR TRANSFER GRILLE		

HVAC Symbols & Abbreviation (Sh-1)



Maha Metro Rail Project

3.11.7 HVAC SYMBOLS & ABBREVIATIONS (SH-2)






















ABBREVIATION	DESCRIPTION
DV	DISC VALVE
SD	SUPPLY DIFFUSER
RD	RETURN DIFFUSER
SQ	SUPPLY GRILLE
RG / EG	RETURN / EXHAUST GRILLE
FD	FIRE DAMPER
MSFD	MOTORISED SMOKE & FIRE DAMPER
MFD	MOTORISED FIRE DAMPER
MD	MOTORISED DAMPER
NRD	NON RETURN DAMPER
VCD	VOLUME CONTROL DAMPER
FAD	FRESH AIR DUCT
SAD	SUPPLY AIR DUCT
RAD	RETURN AIR DUCT
TED	TOILET EXTRACT / EXHAUST DUCT
KED	KITCHEN EXTRACT / EXHAUST DUCT
DUC	DOOR UNDER CUT
IL	INTAKE LOUVRE
EL	EXHAUST LOUVRE
ODU	OUT DOOR UNIT
IDU	INDOOR UNIT
FAHU	FRESH AIR HANDLING UNIT
KEF	KITCHEN EXHAUST FAN
TEF	TOILET EXHAUST FAN
AP	ACCESS PANEL
HL	HIGH LEVEL
LL	LOW LEVEL
T/A	TO ABOVE
T/B	TO BELOW
F/A	FROM ABOVE
F/B	FROM BELOW
L/S	LITER PER SECOND
m ³ /s	CUBIC METER PER SECOND
m/s	METER PER SECOND
Pa/kPa	PASCAL / KILO PASCAL
mm	MILLIMETER
m	METER
°C	DEGREE CELSIUS
DB	DRY BULB TEMPERATURE
WB	WET BULB TEMPERATURE
RH	RELATIVE HUMIDITY
NC	NOISE CRITERIA
dB	DECIBEL
RPM	REVOLUTION PER MINUTE
W/kW	WATTS/KILOWATTS
L	LITER
B.O.D	BOTTOM OF DUCT
B.O.U	BOTTOM OF UNIT
B.O.F/C	B.O.FALSE CEILING
B.O.DRAIN PIPE	BOTTOM OF DRAIN PIPE

LEGENDS	ABBREVIATIONS
RWP	RAIN WATER PIPE
SWWP	STORM WATER PIPE
F.F.L	FINISH FLOOR LEVEL
F.G.L	FINISH GROUND LEVEL
G.L	GROUND LEVEL
I.L	INVERT LEVEL
IC	INSPECTION CHAMBER
SWMH	STORM WATER MANHOLE

HVAC Symbols & Abbreviation (Sh-2)

Maha Metro Rail Project

3.11.8 PLUMBING SYMBOLS & ABBREVIATIONS (SH-1)









PLUMBING				(DRAINAGE)
SYMBOL	DESCRIPTION	ABBREVIATIONS	DESCRIPTION	
	SOIL PIPE	SP	SOIL PIPE	
	WASTE PIPE	WP	WASTE PIPE	
	VENT PIPE	VP	VENT PIPE	
	RAIN WATER PIPE	RWP	RAIN WATER PIPE	
	SEWERAGE WATER PIPE	SWP	SEWERAGE WATER PIPE	
	STORM WATER PIPE	SWMP	STORM WATER PIPE	
	DROP DOWN	DD	DROP DOWN	
	DIRECTION OF FLOW			
	CLEAN OUT	CO	CLEAN OUT	
	FLOOR CLEAN OUT	FCO	FLOOR CLEAN OUT	
	FLOOR TRAP	FT	FLOOR TRAP	
	FLOOR DRAIN	FD	FLOOR DRAIN	
	ROOF DRAIN	RD	ROOF DRAIN	
	URINAL TRAP	UT	URINAL TRAP	
	GULLY TRAP (300x300)	GT	GULLY TRAP	
	INSPECTION CHAMBER (800x800mm)	IC	INSPECTION CHAMBER	
	SEWER MANHOLE	SMH	SEWER MANHOLE	
	SEWER CIRCULAR TYPE MANHOLE	SMH	SEWER CIRCULAR TYPE MANHOLE	
	STORM WATER MANHOLE	SWMH	STORM WATER MANHOLE	
	STORM WATER CIRCULAR TYPE MANHOLE	SWMH	STORM WATER CIRCULAR TYPE MANHOLE	
	GREASE TRAP			
		SP	SOIL PIPE	
		WP	WASTE PIPE	
		VP	VENT PIPE	
		SVP	SOIL VENT PIPE	
		WVP	WASTE VENT PIPE	
		RWP	RAIN WATER PIPE	
		SWP	SEWERAGE WATER PIPE	
		SWMP	STORM WATER PIPE	
		FA	FROM ABOVE	
		FB	FROM BELOW	
		TA	TO ABOVE	
		TB	TO BELOW	
		H/L	HIGH LEVEL	
		F.F.L	FINISH FLOOR LEVEL	
		F.G.L	FINISH GROUND LEVEL	
		G.L	GROUND LEVEL	
		I/L	INVERT LEVEL	
		FC	FALSE CEILING	
		FD	FLOOR DRAIN	
		FT	FLOOR TRAP	
		UT	URINAL TRAP	
		RD	ROOF DRAIN	
		CO	CLEAN OUT	
		FCO	FLOOR CLEAN OUT	
		WCO	WALL CLEAN OUT	
		DD	DROP DOWN	
		DP	DRAIN POINT	
		GT	GULLY TRAP	
		IC	INSPECTION CHAMBER	
		SMH	SEWER MANHOLE	
		SWMH	STORM WATER MANHOLE	
		BOP	BOTTOM OF PIPE	
		BOS	BOTTOM OF SLEEVE	
		UP	PIPE UP	
		CDP	CONDENSATE DRAIN PIPE	
		Ø	DIA	

Plumbing Symbols & Abbreviation (Sh-1)












Maha Metro Rail Project

3.11.9 PLUMBING SYMBOLS & ABBREVIATIONS (SH-2)

PLUMBING		(WATER SUPPLY)	
SYMBOL	DESCRIPTION	ABBREVIATIONS	DESCRIPTION
CWS 	COLD WATER SUPPLY	CWS	COLD WATER SUPPLY
HWS 	HOT WATER SUPPLY	HWS	HOT WATER SUPPLY
DN 	DROP DOWN	FA	FROM ABOVE
UP 	RISE UP	FB	FROM BELOW
IV 	ISOLATING VALVE	TA	TO ABOVE
GV 	GATE VALVE	TB	TO BELOW
NRV 	NON RETURN VALVE	GV	GATE VALVE
EWB 	ELECTRIC WATER HEATER	NRV	NON RETURN VALVE
		IV	ISOLATING VALVE
		BV	BALL VALVE
		FV	FLUSH VALVE
		FS	HAND SPRAY
		STR	STRAINER
		HB	HOSE BB
		DN	DROP DOWN
		EWB	ELECTRIC WATER HEATER
		WHA	WATER HAMMER ARRESTOR
		AAV	AUTOMATIC AIR VENT
		BOP	BOTTOM OF PIPE
		BOB	BOTTOM OF SLEEVE
		UP	PIPE UP
		AV	ANGLE VALVE
		AT	ABLUTION TAP
		Ø	DIA

UNIT ABBREVIATIONS	
UNIT	DESCRIPTION
mm	MILLIMETER
Mtr.	METER
KL	KILOLITER
LTR	LITRE

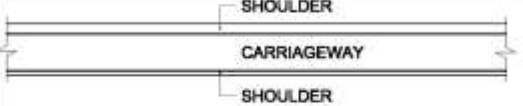










SYMBOL LEGEND	
SYMBOL	DESCRIPTION
	FOR SYMMETRICAL
	FOR SECTION
	FOR UCS
	FOR TITLE
	FOR LEVEL
NOTES:-	(1) GENERAL NOTES (2) GENERAL NOTES (3) GENERAL NOTES
	NORTH DIRECTION
	DETAIL MARK
	DETAIL MARK - 1
	FOR DRAFT COPY

Plumbing Symbols & Abbreviation (Sh-2)



Maha Metro Rail Project

3.11.10 HIGHWAYS LEGEND & ABBREVIATIONS

HIGHWAY ABBREVIATIONS		HIGHWAY LEGEND	
ABBREVIATIONS	DESCRIPTION		
AC	ASPHALTIC CONCRETE		SHOULDER
BC	BINDER/BASE COURSE		CARRIAGEWAY
B/L	BASE LINE		SHOULDER
C/C	CENTRE TO CENTRE OR CENTRE OF CIRCLE		BASELINE
CC	CURVE TO CURVE		RETAINING WALL/CONCRETE BARRIER
CW	CARRIAGEWAY		LANE MARKING
CH	CHAINAGE		LIMIT OF WORK
CL	CENTERLINE		EDGE OF RIGHT OF WAY
CS	CURVE TO SPIRAL		TRAFFIC DIRECTION
e	SUPERELEVATION		HORIZONTAL CURVE POINT
FGL	FINISHED GROUND LEVEL		VERTICAL CURVE POINT
FRL	FINISHED ROAD LEVEL		PROPOSED PIER
G	GRADE		PIER NUMBER
K	K-VALUE		
L	LENGTH		
LOW	LIMIT OF WORK		
LVL	LEVEL		
LM	LIGHTING MAST		
L.m	LINEAR METER		
ML	MAINLINE		
MHHW	MEAN HIGHER HIGH WATER		
MSL	MEAN SEA LEVEL		
N	NORTH/NORTHING		
NA	NOT APPLICABLE		
NB	NORTH BOUND		
NO.	NUMBER		
NTS	NOT TO SCALE		
PGL	PROFILE GRADE LINE		
PC	TANGENT TO CURVE		
PT	CURVE TO TANGENT		
R	RADIUS		
SB	SOUTH BOUND		
SC	SPIRAL TO CURVE		
ST	SPIRAL TO TANGENT		
SS	SPIRAL TO SPIRAL		
SH	SHOULDER		
TS	TANGENT TO SPIRAL		
WC	WEARING COURSE		

Highway Symbols & Abbreviation (Sh-1)



Maha Metro Rail Project

3.11.11 CIVIL (STRUCTURE) SYMBOLS

STRUCTURAL SYMBOLS			
SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	FOR SYMMETRICAL		
	SLEEVE OR HOLE		
	SLAB THK		
	SUNK SHOWN IN PLAN		
	SUNK THK. SHOWN IN PLAN		
	CUTOUT		
	COLUMN GRID		
	SLAB LEVEL SHOWN IN PLAN		
	CL ALIGNMENT STYLE		
	NORTH DIRECTION		
	SECTION MARKED IN PLAN		
	REVISION		
	LEVEL		
	WATER PROOFING		
	FOR UCS		
	CONTINUE RETAINING WALL		
	CONTINUE COLUMN		
	COMPACTED DESERT SOIL		
	ROCK		
	EARTH/SAND FILLING		
	CONCRETE		



Maha Metro Rail Project

4 Responsibilities

4.1 Author

- 4.1.1 Accuracy of graphical and non-graphical elements within a CAD file.
- 4.1.2 Compliance with this standard.

4.2 Approver

- 4.2.1 Approving CAD files to be shared and used for the suitability (see 3.7.2) indicated.
- 4.2.2 Maintaining an audit trail to capture the checks and reviews carried out to gain approvals.

4.3 Authorizer

- 4.3. 1 On behalf of MMRCL, authorizing (accept / reject) CAD files submitted to MMRCL for publishing for the suitability (see 3.7.2) indicated.

4.4 MMRCL CAD Support Team

- 4.4.1 Generation and governance of field codes.
- 4.4.2 Supply and management of MMRCL CAD data, resources and licensed mapping.

4.5 MMRCL Principal Infrastructure Protection Engineer

- 4.5.1 Approving external requests to MMRCL for CAD data, not originating from within an MMRCL project.

4.6 MMRCL Procurement Agent

- 4.6.1 The MMRCL Procurement Agent shall be responsible for incorporating the requirements of this engineering standard in any contract to which it is relevant and shall stipulate that a programme of audits is implemented by the contractor which ensures that these requirements are complied with.

5 Supporting information

5.1 Background

- 5.1.1 The requirements within this document shall be read in conjunction with the reference documents listed in 6.1.1.
- 5.1.2 If you need any technical assistance with any of the requirements within this document, you can contact the MMRCL CAD Support Team at



Maha Metro Rail Project

6 References

6.1 References

6.1. Refer to EIR

6.1.2 Industry standards

Document no.	Title
BS 1192	Collaborative production of AEC information
BS 8888	Technical product specification - Specification
BS EN ISO 5455	Technical drawings - Scales
EN ISO 3098-5	CAD lettering of the Latin alphabet, numerals and marks
BS ISO 12006-2	Unified Classification for the construction industry (Uniclass)
BS EN ISO 5457	Sizes and layout of drawing sheets
PAS-1192(2)	Collaborative production of AEC information For BIM
PAS-1192(3)	Collaborative production of AEC information for Asset Information



Maha Metro Rail Project

6.2 Abbreviations

The following abbreviations are created:

- a) Within MMRCL Glossary of Terms (a Category 1 Standard);
- b) From published sources that are clearly identified.

Abbreviation	Definition	Source
AEC	Architectural, Engineering and Construction	a
CAD	Computer Aided Design	a
MMRCL	Maha Metro Rail Corporation Limited	a
OS	Ordnance Survey	a

6.3 Definitions

Topic specific definitions

Term	Definition
Asset Class	Highest level of classification of London Underground's Engineering Assets, as defined in CAT 1 Standard S1041
CAD Computer Aided Design) File	Electronic file produced by a CAD application (such as MicroStation or AutoCAD). Examples of CAD files include Drawing Definitions and Model files.
Classification	Systematic arrangement of design and construction activities and assets, including construction elements, systems and products
Common Data Environment (CDE)	A designated environment with a defined process used to manage all relevant information. A CDE may comprise of one or more systems supporting a consistent collaborative approach.
Composite Model	Computer Aided Design (CAD) file that contains one or more Model Files, as references, for the purpose of spatial coordination; there is no 'live' geometry within the file. It may form part of a Drawing Definition.
Data	Set of digital values stored, but not yet interpreted or analysed (un-processed), in a form that is convenient to move or process. Data is generally represented in a structured and often tabulated form (rows and columns). 'Raw Data' is a relative term and therefore not used.
DGN	Proprietary Bentley Systems file format
Document	Information recorded for a specific purpose, providing a means to communicate the briefing, design, construction, operation, maintenance or decommissioning of an asset. This includes, but is not limited to, correspondence, Drawing Renditions, schedules, specifications, calculations, spreadsheets. Note: Documentation must either be in an immutable format or incorporate a means of controlling changes.



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Term	Definition
Drawing Definition	A CAD file created solely for the purpose of creating a Drawing Rendition or Printed Drawing. The graphical content of the drawing definition is contained in other CAD files (e.g. Model Files and/or Composite Models) which are attached as References. Only annotation and dimensions are 'live' within the Drawing Definition file. Examples may include As-built Drawing Definitions.
Drawing Rendition	Electronic file, in an immutable format such as PDF, derived from a Drawing Definition. Examples may include As-built Drawing Renditions.
Drawing Sheet	CAD file containing the graphics of a blank drawing border and title block, of Predefined paper sizes. Used as a reference by all drawing definitions.
Information	Data which has been interpreted and processed (such as formatting and printing) to take on meaning in some context for its intended receiver.
Layer	Synonymous with the level functionality in the DWG File format.
Level	Floor level within a building (refer to S0135, Location Coding System)
Meta-data	'Data about the data'. Information about one or more aspects of certain items content. For example: size of document, date created etc.
Model File	A Computer Aided Design (CAD) file which consists of geometry that represents the physical characteristics (may also include functional characteristics) of the works, produced at a scale of 1:1. It may form part of the Composite Model and/or Drawing Definition.
Model rendition	An immutable file, in a format such as PDF, which is derived from a Model File or Composite Model.
Newlyn	Mean sea level (MSL) calculated from observation taken at Newlyn, Cornwall and used as the official basis for height calculation.
Printed Drawing	Static, hard-copy document, derived from a Drawing Definition (as an exact copy) or Drawing Rendition.
Project	A unique set of co-ordinated activities, with definite starting and finishing points, undertaken by an individual or organization to meet specific objectives within defined schedule, cost and performance parameters.
Reference	An Auto Cad/Bentley MicroStation term meaning a CAD file attached to another CAD file such that all or part of its graphical content is visible but not editable in the file to which it is attached.
Status	Defines the suitability of information.
Spatial Data	Geometry aligned to the physical location of an asset, to a specified grid system.
Tag	An Auto Cad /Bentley MicroStation term meaning a non-graphical attribute attached to an element within a CAD file.



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6.4 Technical content manager

Paragraph number	Technical content manager
All	Head of Engineering Information

6.5 Document history

Issue no	Date	Changes	Author
A1	October 2016	Authorised for use	



Maha Metro Rail Project



Maha Metro Rail Corporation

Pune Metro

Post Contract-Award Building Information Modelling (BIM) Execution Plan (BEP)

Contract Name:

Contract Description:

Contract Address:

Contract Number:

Date:

Document No:

Date: October 2016

Revision: R0

Status: Published



Maha Metro Rail Project

Document Control Sheet

Rev.	Status	Page Nos.	Amendment	Date	By

Authored by:



The Post Contract-Award Building Information Modelling Execution Plan (BEP)

Preface

The BEP shall be prepared for each contract and shall be utilised by the supply chain within each contract for the Project Information Model authoring, coordination, quality assurance and sharing/publishing processes. The BEP shall list the supplier, Detailed design consultant, contractor [the supplier] agreed targets for responsibility, timely delivery, exchange, reuse and final handover to MMRCL or its agents [**the Employer**]. It will also list all agreed elements as outlined in MMRCL's Employers Information Requirements.

This BEP is structured in accordance with MMRCL EIR which is guided by PAS 1192-2-2013

Project Delivery Manager

This document is owned and maintained by the current Project Delivery Manager listed below.

Project Delivery Manager - Name	Company Responsible

Project Team Representatives and Role

Company Name	Representative and Authorised Responsible Agent	Role

Document Authority

This project plan has been agreed by the representatives of the project team as listed above with the authority of their parent companies to accept this document as the agreed **BIM Execution Plan**.



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1 Contract Information

Table 1 – Contract information

Contract Name	
Contract Address	
Contract Number (Clients Project Number or reference)	
Contract Form	
Contract Design Start Date	
Contract Construction Start Date	
Contract Completion and Handover Date	
Contract Description	
Contract Brief and Health and Safety requirements (Construction Design and Management)	[reference]
Contract Deliverable	Refer To EIR



2 Information required by the EIR

The following subsections of the BEP respond to the parts of the EIR specifically requesting the suppliers response.

2.1 *Planning of work and data segregation*

The management of the modelling process (e.g.model management, naming conventions, etc.) needs to explicate the compliance strategy to the EIR requirements.The planning of work and data segregation aspects of the project are described in later parts of the BEP, in particular Section 3 Management, Section 4 Planning and documentation and Section 5 Standard method and procedure.

2.2 *Co-ordination and clash detection*

This section of the BEP contains the bidders" proposals for managing the co-ordination process. The requirements for co-ordination are stated in EIR.

2.3 *Collaboration process*

This section of the BEP contains the agreed strategy for the management of the collaboration process in compliance to the EIR requirements.

This is described in Section 4.2. Refer to the EIR for the requierements.

2.4 *Health and safety management*

This section of the BEP contains the bidders" proposals for using BIM and the Common Data Environment to support the management of Health and Safety requirements and the related Health and Safety artifacts.

2.5 *Compliance plan*

This section of the BEP contains the bidders" proposals for managing the co-ordination process and the strategies for compliance to the EIR requirements.



3 Management

This section of the BEP covers the requirements of Employers Information Requirements in a reference to the management procedures:

- roles, responsibilities and authorities;
- major contract milestones consistent with the contract programme and the overall MMRCL programme;
- project information model deliverable strategy in compliance to the EIR;
- survey strategy including the use of point clouds, photogrammetry, light detecting and ranging (LIDAR) or global navigation satellite systems (GNSS);
- existing legacy data use;
- approval of information; and
- Project Information Model authorization process;

3.1 Roles, responsibilities and authorities

At the start of a project it is important to identify the roles and responsibilities of the design teams. Table 2 is used to record the names and contact details of the individuals fulfilling the necessary project roles

Table 2 – Roles and responsibilities

Role Company	Name	Email and Telephone number
Lead Designer Representative Company.....		
Employer Information Manager Company.....		
Document Controller Company.....		
Design Coordination Manager Company		
Construction Manager / Project Manager Company.....		
Designated Technical Lead / Manager Company.....		
Project Information Manager Company..... Company.....		
Task Team Manager * Company..... Company.....		
Task Team Information Manager * Company..... Company.....		
Task Team Interface Manager * Company..... Company.....		



CAD Coordinator Company.....		
CAD Manager Company.....		
Task Team BIM Authors * Company..... Company..... Company.....		

* Note – specify these roles for each task team involved in the project

The responsibilities of the different roles related to production and management of information are described in the MMRCL EIR Standards, Methods and Procedures (SMP) document.

The standard authorities of the different roles related to production and management of information are described in the table 3.

Table 3 – Role authorities

Role	Authority
Employers Information Manager	Enforce the application of the Employers Information Requirements and ensure the delivery of the information in compliance to standards from the Employer side.
Project Information Manager	Enforce the BEP and the other Governance Procedures and ensure delivery of the Information requirements specified in the EIR from the Supplier side
Lead Designer	Enforce spatial coordination
Task Team Manager	Enforce documentation standards
Interface Manager	Negotiate space allocation
Task Team Information Manager	Reject non compliant models, drawings & documents
CAD Coordinator and Manager	Enforce CAD related Project BIM Standards
Design Coordination Manager	Ensure the timely delivery of the deliverables.
Project Manager	Enforce the timely delivery of the deliverables.
... other authorities as required per contract	

3.2 Major project milestones

Table 4 – Major project milestones

Start Date	Design Completion	Detail Design Completion + Fabrication	Construction	As Constructed Models, Documents and Data	Handover.



Only the Major milestones are listed. A more detail and co-ordinated MIDP and Project Plan must be developed and agreed with the stakeholders.

3.3 ***Project information model delivery strategy***

The major goals and objectives for the BIM implementation must be considered and stated as a project strategy document, append to this document, under the headings listed in Table 5.

Table 5 – Strategy for information delivery

Brief	Concept	Definition	Design	Build & Commission	Handover & Closeout	In use

[specify and/or refer the process here]



3.4 Survey strategy

Table 6 – Survey strategy

Survey Method	Delivery Format	Survey Origin	Details, notes
Point cloud			
Light detecting and ranging (LIDAR)			
Global navigation satellite systems (GNSS)			
<<others as appropriate>>			

[specify and/or refer the process here]

3.5 Approval of information

To ensure that model, drawing files and spreadsheet extraction are adequately checked, some form of agreed approvals process needs to be in place to enable the design teams and the contractor (or client) to approve and sign-off the development of the design information for a project and to assign responsible team members.

Table 7 – Schedule of information approval responsibilities

Role or Title	Models	Drawings	Peer Review	Lead Designer/Lead Contractor	Client Review Team

[specify and/or refer the process here]



3.6 Production Information authorisation process

The design and construction approval process should be specified, agreed and documented as early as possible in the project. This includes the sign off of specialist design completion information.

Sign off and authorisation process to be agreed and published in coordination with the abilities of the collaboration or EDMS solution and inserted here.

[specify and/or refer the process here]

4 Planning and documentation

This section of the BEP covers the requirements of Employers Information Requirements and in specific the requirements for planning and documentation:

- revised Project Implementation Plan confirming the capability of the supply chain;
- agreed project processes for collaboration and information modelling;
- agreed matrix of responsibilities across the supply chain;
- TIDP; and
- MIDP;

4.1 Revised Project Implementation Plan

The revised PIP confirms the capability of the supply chain.

i Supply chain capability readiness

The PIP consists of the following completed supply chain assessment forms documentation:

- Supply chain capability summary form, which summarises the contents of ...
- Supplier building information management assessment form(s)
- Supplier IT assessment form(s)
- Supplier resource assessment form(s)

These are available as separate templates provided by MMRCL.

S

The supplier resource for the project shall be summarised as per the example in Table 8. *Table 8 – Supplier resource summary*

Supplier	Discipline	Resource numbers	Levels of competence	Years of Experience	Names of individuals
<<name 1>>	Qualified Architect	2	RIBA, CAD/BIM, Specification Author		
	Architectural Technologist (CIAT)	3	CIAT, CAD/BIM Trained		
	Architectural Technician	5	Certificate of CAD or Model Competence		



<<name 2>>	Qualified Structural Engineer	3	MIStructE,		
Etc					

ii Supply Chain Capability development and support

The supply chain capability must be continuously developed and supported (e.g. training and support). The related strategy shall be referenced here.

4.2 Agreed project processes for collaboration and information modelling

Table 9 – Processes for collaboration and information modelling

Company	Solution	Network	Database	File based	Comments

[specify and/or refer the process here]

The clash rendition viewer to be used across the whole contract.

Table 10 – Clash rendition viewer

Agreed clash rendition viewer	Version

This section of the BEP also covers the agreed authorisations for security and extranet access and authority to distribute documents.

Table 11 – Authorisations for security, extranet and document distribution

Company	Authorised Manager	Authority (Upload, download, change Access/Distribution)



4.3 Agreed matrix of responsibilities across the supply chain

It is important to define who models what (the BIM Author) and to what Level of Definition (LOD).

There are 7 levels of definition defined in the EIR which do not reflect specific modelling guidelines for any particular software, rather a generic definition of model detail (graphical), how individual objects display themselves and the level of information as a minimum to answer the English question stated in the EIR.

The responsibility matrix will specify who is responsible for the production of the deliverables related to the specific systems as per the MPDT (Master Production Delivery Table) Requirements issued with the EIR.

The deliverables list and their responsibility will be specified in the MIDP (Master Information Delivery Plan) which will be reflected, monitored and maintained in **Bentley AssetWise**.

The production of the 3D deliverables in alignment with the table 12 below and the MPDT Requirement will be enforced via MIDP.

Refer to the EIR section 3.4 for more guidance.

Table 12 – Responsibility matrix for information production

[illegible]

[illegible]



4.4 (Task and) Master Information Delivery Plan (MIDP)

A task information delivery plan (TIDP) for each task (performed by a specific sub-contractor/sub-consultant) within the Contract shall be prepared using the template below and shall be agreed with the Lead Supplier/Contractor.

The master information delivery plan (MIDP) shall be developed by combining the separate Task Information Delivery Plans (TIDP) produced for each task within the contract. The detailed, co-ordinated MIDP must be developed and agreed with all the stakeholders producing information within the Contract. When completed the MIDP should be

- appended to this document inserted into Bentley AssetWise environment for monitoring. The Supply Chain will deliver the information in accordance to the MIDP into the CDE (Common Data Environment) as per the Employer Information Requirements. Refer to the “MMRCL Task and Master Information Delivery Plan – Template” for more details.

5 Standard method and procedure

This section of the BEP covers the requirements for the standard method and procedure:

- the volume strategy;
- Production Information origin and orientation (which may also be geo-references to the earth’s surface using a specified projection);
- file naming convention;
- layer naming convention, where used;
- agreed construction tolerances for all
- disciplines;
- drawing sheet templates;
- annotation, dimensions, abbreviations and symbols; and attribute data;

5.1 Production Information origin and orientation

The origin and orientation of the project are based on the Contract location and its reference to other global or local grids,

Refer to the EIR for the requirements.

. Table 14 – Record of information model origin and orientation

Point	Grid intersection notation	Easting (m)	Northing (m)	Elevation or site Datum
Site local grid origin				
Grid origin Bottom Left Intersection				
Grid Intersection Bottom Right				
Grid Intersection Top Left				

5.2 Engineering Assurance File Naming Convention

Refer to the EIR for the requirements.

5.3 Agreed construction tollerances for all disciplines

Refer to the CAD Standard.



5.4 Drawing sheet templates

Refer to the CAD Standard.

5.5 Annotations, dimensions, abbreviations and symbols

Refer to the CAD Standard.

5.6 Attribute data

Refer to the EIR for the requirements and to the MPDT.

6 IT solutions

This section of the BEP is intended to demonstrate the supply chain IT capability and understanding of the requirements included within the Employers Information requirements, clause 6.

6.1 Software versions

The CAD software and versions that will be used by the design teams shall be agreed before starting the project.

Table 30 – Agreed software versions

Company	Database	CAD software	Version	Format	Comments

6.2 Exchange formats

The agreed formats for model and drawing file exchange are

Refer to the EIR.

[specify and/or refer any additional process here]

6.3 Process and data management systems

The process and data management systems shall be described under section 4.2 Agreed project processes for collaboration and information modelling.



MAHARASHTRA METRO RAIL CORPORATION LIMITED

Pune Metro Rail Project

Joint Venture of Govt. of India & Govt. of Maharashtra

CIN: U60100MH2015SGC262054

Date: 05 Jan 2022

CORRIGENDUM-I

Tender No.: P1T-06/2021 dated 27 Nov 2021

Name of Work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Reference: Further to **Tender Documents** dated 27 Nov 2021

Following Documents shall be construed to be a part of Corrigendum-I:

1. Replies to Pre-Bid Queries (Eighteen (18) Pages)
2. Corrigendum No. – 1 (Eight (08) Pages)
3. Annexure to Corrigendum No. – 1 (Two (02) Pages)



ED (Procurement & Contracts),
Pune Metro Rail Project,
Maharashtra Metro Rail Corporation Limited.

REPLIES TO PRE-BID QUERIES DATED 05 JAN 2022

Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
1		<p>1. The Bidder must have valid Environmental Management Certificate ISO:140001 or equivalent.</p> <p>3. The Bidder must have valid Health and Safety Certificate OHSAS: 18001.</p>	<p>1. The Bidder must have valid Environmental Management Certificate ISO:14001 or equivalent. We feel this is a typing error</p> <p>3. The Bidder must have valid Health and Safety Certificate ISO 45001. OHSAS:18001 certification has now been upgraded to ISO 45001. Request you to kindly amend the same.</p>	Please Refer Corrigendum No-1 Sr. 4
2	Section - III Evaluation and Qualification Criteria 4.2 a Specific Construction & Contract Management Experience (d)	The bidder shall have executed min. 2 Track-km of ballast less track in underground metro/railway.	We understand that construction of ballast less track on viaduct & in tunnel portion in terms of construction are broadly same. Hence, we request authority to waive off the mandatorily requirement of " <i>Execution of 2 Track-km of ballast less track in underground metro/railway.</i> "	Tender conditions prevail.
3	EXPLANATORY NOTES OF BOQ			
3.1	2.2 Bill No. BLT1: Installation of Ballastless Track for Main Line on Viaduct, Underground &	Assembling and laying of Track with all fittings & fastenings including Glued Insulated Joints, Rail Expansion Joints (REJ) etc. complete	As it is not mentioned anywhere in BOQ about supply of Insulated joints and Rail Expansion Joints (REJ), we understood that Glued Insulated joints and Rail Expansion Joints (REJ) will be supplied free of cost by Pie MAHAMETRO.	Maha-metro will supply the insulated joints and REJs free of cost if required during execution of contract. However, normally these joints and REJs are not used in

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro												
	Ramp Note 10 - Page No 141		Please confirm	Metro system having CBTC signalling.												
3.2	2.2 Bill No. BLT1: Installation of Ballastless Track for Main Line on Viaduct, Underground & Ramp Note 24 - Page No 141	Installation of stray current collection mat including all Welding work, installation of MS strip connecting (with Welded connection) all nominated rebars, earth point (for connection to structure earth cable)	We understand that stray current collection mat and MS strip will be supplied free of cost by Pune MAHAMETRO. Please confirm	This is a part of installation of track work. So, the scope of supply of required materials come under bidder's scope as per Maha-Metro approved drawings. Please Refer Corrigendum No-1 Sr. no. 8.												
3.3	Clause No 1.1 - General Requirement - The scope of work includes, but not limited to: Note 1- Page No 281	The scope of work includes, but not limited to: Rails, Turnout and fastenings system shall be supplied by the Employer. The Contractor will make arrangements for mechanized handling and transportation of all materials supplied by the Employer) to the site of work.	We request you to provide list of fastenings, free issued by MAHAMETRO along with location of store from where the Rails, T/outs, and fastenings will be supplied.	Maha-Metro will supply the following materials to successful contractor from the materials store location as tabulated below; <table><tr><th>Sr. No</th><th>Track Materials</th><th>Location</th></tr><tr><td>1</td><td>Fastening system</td><td>Range Hill Depot,Civil court and Hill view car park depot</td></tr><tr><td>2</td><td>Turnouts & Scissor cross over</td><td>Range hill depot and Hill view car park depot</td></tr><tr><td>3</td><td>1080 Grade of HH Rails (18m/25m)</td><td><ul style="list-style-type: none">Range hill depotHill view car park depot,Between Pier No P-334 to P-344 of</td></tr></table>	Sr. No	Track Materials	Location	1	Fastening system	Range Hill Depot,Civil court and Hill view car park depot	2	Turnouts & Scissor cross over	Range hill depot and Hill view car park depot	3	1080 Grade of HH Rails (18m/25m)	<ul style="list-style-type: none">Range hill depotHill view car park depot,Between Pier No P-334 to P-344 of
Sr. No	Track Materials	Location														
1	Fastening system	Range Hill Depot,Civil court and Hill view car park depot														
2	Turnouts & Scissor cross over	Range hill depot and Hill view car park depot														
3	1080 Grade of HH Rails (18m/25m)	<ul style="list-style-type: none">Range hill depotHill view car park depot,Between Pier No P-334 to P-344 of														

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro		
						Reach-3 section (GL) and • Between Pier no P-212 to P-224 of Reach-1 section (GL).
				4	Buffer stops	Range hill depot & Hill view car park depot.
3.4	Section III. Evaluation and Qualification Criteria - Clause 4.2 (a) - Specific Construction & Contract Management Experience	In this clause only experience of Ballast less. Track is required to fulfil qualification criteria	<p>The work of ballast-less track is the combination of track and concrete works.</p> <p>We have vast experience of ballasted track, presently executing Pune - Miraj track linking works of 216 Km excluding loop lines which is at completion stage.</p> <p>At the same time we have executed large quantity of structural concrete about 1.5 lakh cum, till date.</p> <p>Considering requirement of experience of ballast-less track, the competition will be limited. For wider competition we request you to allow experience of ballasted track with key activity of</p>	Tender conditions prevail.		

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
			concrete also to meet the qualification criteria.	
4				
4.1	Section III. Evaluation and Qualification Criteria Note 4 pg. 51	For ongoing Works, quantity of successfully completed portion of works executed up to 31.03.2021 will also be considered for qualification of experience criteria.	Since the tender is invited in November 2021 and bids are to be submitted in January 2022, we request that Bidders be allowed to utilize experience of all work executed up to 31.12.2021 for meeting qualification as per experience	Please Refer Corrigendum No-1 Sr. no. 6.
4.2	Section III. Evaluation and Qualification Criteria Clause No.5 Environmental, Social, Health and Safety (ESHS) Clause No.5.1 Quality & Qualification Criteria Pg 50 & 51	1. The Bidder must have Valid Environmental Management Certificate ISO 140001 or equivalent. 2. The Bidder must have valid Quality Management Certificate ISO: 9001/DNV/TUV/JAS-ANZ/equivalent. 3. The Bidder must have valid Health and Safety Certificate OHSAS:18001. The bidder must agree to deploy at least two key personnel having Environment expertise of minimum ten years in sites management measure and the second one in social works with min.10 years experience.	We request to allow the bidder to submit an Undertaking, agreeing to submit the required certificates under Sl. No. 1 (Certificate ISO:140001 or equivalent) & 3 (Health and Safety Certificate OHSAS:18001) after award of contract.	Tender conditions prevail.
4.3	SECTION VI: Pricing Document / BOQ Buffer Stop (BOQ Item No 3.1 under schedule BLT 1A)	Supply of hybrid buffer stop having combination of sliding friction type and hydraulic type for elevated viaduct for impact speed of 40kmph and 6-coach empty train weight 246 Ton	It is observed that 40 KMPH buffer stops are required to be supplied under the tender. Request you to provide the required sliding/stopping distance to get the appropriate quote/ cost from the supplier.	10m sliding/ stopping distance shall be considered for designing of hydraulic type buffer stop for elevated viaduct for impact speed of 40kmph and 6-coach empty train weight 246 Ton

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
4.4	PART- IV Tender Drawings Employer Drawing	In tender drawing, the dimension of the plinth/slab structure like width, height and its shape arrangement are pre-defined.	As it's a design and construction tender, kindly confirm whether the dimension and shape arrangement which are defined in the tender drawing to be followed in estimation or bidder have the relaxation to change dimension and free to choose the width of track plinth and shape arrangement as per their design requirement.	The tender drawings are self-explanatory please refer tender drawings.
4.5	SECTION-VII-B PARTICULAR SPECIFICATION S Clause no 4 Transportation of material supplied by the employer (Section VII-B	Rails, turnouts and fastenings system shall be supplied by the Employer. The contractor will make arrangements for mechanised handling and	Request you to provide detail of the designated location/place from where the material to be transported.	Please refer Maha-Metro's reply vide above Sl.no 3.3
4.6	PART-III CONDITIONS OF CONTRACT AND CONTRACT FORMS SECTION-IX Clause No.88 Additional clause: Safe custody Bank Guarantee for materials to be supplied by the Employer.	The contractor shall submit the insurance policy for the materials to be supplied by the Employer to the contractor at Pune for the work in the name of Maharashtra Metro Rail Corporation Ltd. The Insurance coverage shall be for an amount equal to rupees ----- million.	Request you to provide the amount of Insurance coverage to be taken, for the material supplied by the employer.	Tender Conditions Prevail. However, the cost of materials will be approx. 550 million.
5				

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
5.1	Section III: Evaluation and Qualification Criteria, 4.Experience 4.1 General Experience, Notes 7	General construction Experience for this contract shall mean the construction work including all Civil construction of Metro Station /Metro Depot/Oil Depot/Railway Workshops/ Airport/Oil Refineries/ Industrial Unit for Central Govt./State Government/ PSU/ Urban Local Bodies/Private Corporates registered with NSE/BSE in India or other industrial units/ plant of comparable magnitude and similar activities of work having piling, Prefabricated / Pre-Engineered / fabricated Steel structures and Sheds, Architectural finishes, EMP works including installations of Machinery and Plants & Equipment involving interface with all systems.	Note 7 to EQC describes definition of General Construction experience in some specific sector only. Kindly clarify whether construction experience in other fields such as Railway/metro civil works, track works, electrifications works and other construction works will be qualified as General Construction Experience.	Tender condition Prevail
5.2	Section III: Evaluation and Qualification Criteria, 3.Financial Situation and Performance	General	In case of Foreign JV partner whose last financial year (Jan to Dec) i.e. year 2020 has not been audited or finalised due to ongoing COVID situation, kindly clarify whether the financial reports of only 4 years from 2016 to 2019 will be considered for evaluation under Financial situation and performance.	Please Refer Corrigendum No-1 Sr. no. 7
6				

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
6.1	Section III. Evaluation and Qualification Criteria - Item 3.2 - Average annual construction turnover	The average annual turnover from construction of last three financial years should be \geq INR 1550 Millions (In terms of rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2021 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year)	<p>Condition of Rs 1550 crores is excessive and not commensurate with the value of work. In the earlier tenders invited by Maha metro in Pune and Nagpur (4 track tenders) the average annual turnover of last 3 years is between 25% to 60% of the estimated cost of the tender. Same is the condition with all other Metro's like UP Metro, Chennai Metro, Delhi Metro, Gujarat Metro etc. The turnover condition nowhere is more than 60% of the cost of the tender. Even the CVC stipulates that the average annual turnover condition should not be more than expected value of the work divided by completion period. Procurement policy for services, Order issue by Govt of India also stipulate turnover between 50% to 60% of the estimated value.</p> <p>It is also to inform that the turnover figures in the balance sheet are without GST figures, therefore the turnover figure for qualification criteria should also be based on basic cost, i.e. without GST. It is noted that the turnover will be updated to value of 31.3.21, whereas the tender is being invited by end of 2021 and therefore the figure should be updated to the level of 31.03.22.</p> <p>So we request change of tender condition as under: The average annual turnover from construction of last three financial years should be \geq INR 600 Millions (In terms of</p>	Please Refer Corrigendum No-1 Sr. no. 1

Sr no	Clause no	Tender terms				Bidder Query				Reply of Maha-Metro
						rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2022 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year)				
6.2	Bill No. BLT1-Item No.4.1 Welding of UIC 60 and 1080 grade HH Rail – Flash Butt Weld.	Bill No. BLT1- Item No.4.1 Welding of UIC 60 and 1080 grade HH Rail – Flash Butt Weld				Payment of welds is very restrictive and involves a lot of negative cash flow. We request payment terms as under:				Tender conditions prevail.
		Item. No	Description of Items	Percent age for Part Payme nt	Cumu lative Perce ntage	Ite m. No	Descriptio n of Items	Percenta ge for Part Payment	Cumulati ve Percenta ge	
		1.	Flash butt Welding by mobile flash butt Welding plant as per specifications	60%	60%	1.	Flash butt Welding by mobile flash butt Welding plant as per specifications	60%	60%	
		2.	Submission of results of test Weld.	10%	70%					
		3.	Profile grinding and submission of tolerance	15%	85%					
		4.	Submission of results of fatigue test, residual stress test, marking etc.	5%	90%	2.	Submission of results of test Weld.	20%	80%	
		5.	Submission of Weld record, USFD, Tolerances and	10%	100%	3.	Profile grinding and	10%	90%	

Sr no	Clause no	Tender terms				Bidder Query				Reply of Maha-Metro
			Employers another requirement etc.				submissio n of tolerance			
						4.	Submissio n of Weld record, USFD, Tolerances and Employers another requireme nt etc.	10%	100%	
						This is also the normal practice at other Metros.				
6.3	EXPLANATORY NOTES OF BOQ – 2.6	2.6 Supply of Maintenance Equipment's & Other P. Way Materials (SPM1)				Supply of maintenance material and other P-way material is not given in the BOQ. Please confirm whether there are any items for this section.				Supply of maintenance material and other P-way material is not given in the BOQ and are not in the scope of contractor.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
6.4	Table-1: Summary of Sections (KEY DATES)	Civil Court to Ramwadi (Reach-3) – Viaduct section	In the various key dates for the viaduct it is indicated that 0.5 km length of viaduct section will be given. We feel that it is too small a section and will involve frequent shifting of teams/welding plants. In 0.5km section if Flash butt welding is to be done, then only very few welds can be done and no casting will be possible on such a small length due panel placement availability. This will cause a lot of wastage of manpower and delay in work, extra cost of FBW working and heavy cranes working. This will increase the overall cost of the works. We request that minimum 1 route km length should be considered as the access.	Please Refer Corrigendum No-1 Sr. no. 13
6.5	Notes regarding Key Dates		Completion period – 15 months: it is normally noted that site access for the track work is delayed, resulting in extended completion period. It increases the cost of work due to extended deployment of manpower, establishment, plant and machinery, especially FBW, Boom Placers, cranes. There should be a suitable clause in the contract for compensation to be paid for such items due to delay in access/completion period beyond a reasonable period. This should also include the cost of Engineer facilities. We request for addition of following clause:	Tender Condition Prevail

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
			8. If contract period is extended beyond 15 months due to non-availability of site access, contractor will be compensated for expenses incurred by him as determined by Engineer in-charge.	
6.6	Section VI: Pricing Document/BOQ	<p>8.1d-For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. for circular tunnel, cut & cover tunnel and NATM tunnel.</p> <p>Scissors crossovers assembly consists of 4 turnout of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.</p>	<p>We request that for correct appreciation of the works involved this item may be split into two parts- One for laying of complete normal scissor crossover and one for extra items involved in MSS like extra, steel, concrete, T&P and labour.</p> <p>8.1d(1)-For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. for circular tunnel, cut & cover tunnel and NATM tunnel. Scissors crossovers assembly consists of 4 turnout of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.</p>	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
			8.1d(2)-Extra over and above 8.1d(1) for installation of MSS Discrete PUR in scissor bearing including all extra reinforcement, concrete, labour, special arrangements etc.	
6.7	Section VI: Pricing Document/BOQ	<p>8.2d- For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with full surface MSS for circular tunnel, cut & cover tunnel and NATM tunnel.</p> <p>Scissors crossovers assembly consists of 4 turnouts of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.</p>	<p>We request that for correct appreciation of the works involved this item may be split into two parts- One for laying of complete normal scissor crossover and one for extra items involved in MSS like extra, steel, concrete, T&P, and labour.</p> <p>8.2d(1)-For Scissors Cross-Over 1 in 7 R190 with 15.35m track c/c and 136m length (Layout enclosed) Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. for circular tunnel, cut & cover tunnel and NATM tunnel. Scissors crossovers assembly consists of 4 turnout of 1 in 7 and diamond crossing and associated track work between SRJ to SRJ) with 60 E1 rail with all Fittings and Fastenings etc. complete including reinforcement, concrete, GI dummy plate, base plate grouting etc as per standard ballastless specifications.</p>	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
			8.2d(2)-Extra over and above 8.2d(1) for installation of full surface MSS in scissor including all extra reinforcement, concrete, labour, special arrangements etc.	
6.8	Section VI: Pricing Document/BOQ	8.1b For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with discrete PUR/rubber bearing (per Track-Meter) for circular tunnel, cut & cover tunnel and NATM tunnel	<p>We request that for correct appreciation of the works this item may be revised to only cover extra works associated with MSS like extra steel, concrete, labour and T&P.</p> <p>8.1b-Extra over and above BLT1.B 1A(a) for installation of discrete PUR bearing MSS in plain underground track including all extra reinforcement, concrete, labour, special arrangements etc.</p>	Tender conditions prevail.
6.9	Section VI: Pricing Document/BOQ	8.2b For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. with full surface MSS for circular tunnel, cut & cover tunnel and NATM tunnel.	<p>We request that for correct appreciation of the works this item may be revised to only cover extra works associated with MSS like extra steel, concrete, labour and T&P.</p> <p>8.2b-Extra over and above BLT1.B 1A(a) for installation of full surface MSS in plain underground track including all extra reinforcement, concrete, labour, special arrangements etc.</p>	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
6.10	Section VI: Pricing Document/BOQ	8.3b For Plainline Track: Installation of Slab Track including setting of track geometry, reinforcement, concrete, formwork etc. discrete steel bearing system for circular tunnel, cut & cover tunnel and NATM tunnel.	<p>We request that for correct appreciation of the works this item may be revised to only cover extra works associated with MSS like extra steel, concrete, labour and T&P.</p> <p>8.3b-Extra over and above BLT1.B 1A(a) for installation of discrete steel bearing system in plain underground track including all extra reinforcement, concrete, labour, special arrangements etc.</p>	Tender conditions prevail.
6.11	BLT 1.B 8.4	Supply and installation of Slab Track System with low dynamic stiffness fastening system (ST-LDS) for vibration attenuation of 14 VdB in the frequency range of 25 Hz to 45 Hz. The ST-LDS shall be so designed that the Natural Frequency of complete track system remains below 20 Hz. The dynamic stiffness of LDS fastenings shall be within 4KN/mm to 8KN/mm. The proposed system should be approved by MoR.	As specified in item 8.4 There is no MoR approval for Low dynamic stiffness fastening and we request that this clause should be removed and a proven system that meets the technical requirements be allowed as per the specifications of CT-38.	Tender conditions prevail.
6.12	BLT 1.B 8.4(a)	Supply of Low Dynamic Stiffness Fastening System including one set of special tools for installation of LDS, submission of O&M Manual	The unit should be per set of fitting and not per track meter as the suppliers quote their rates per set. The spacing of fittings vary and unit of per track metre will not give exact quantity.	Tender conditions prevail. However, number of sets required for one track meter to be calculated by 600mm c/c of base plate.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
6.13	BLT 1.B Note 1	The quantity of above group of items given under item nos. 8.1 to 8.4 may increase or decrease by 50% without any rate revision.	<i>This will cause a lot of uncertainty and foreign vendors do not accept such conditions. Variations may be minimized to 10% to remove the uncertainty factor.</i>	Tender conditions prevail.
6.14	N/A	N/A	Due to uncertain conditions all over the world over Covid issue, contractor should be compensated for lockdown due to covid or restriction on the work. Metro should also take responsibility for compensation to labour/staff of the contractor. In case of any casualty/treatment the cost should be covered as it will encourage the staff to work during such a period. It is noted that during last two years work has suffered for months due to Covid resulting in extra cost.	Please refer Maha-Metro's reply vide above Sl.no 6.5.
6.15	Para 8.8	Noise and Vibration Mitigation Measures for slab track of underground	We request that N&V mitigation measures as per RDSO document C-38 may be permitted to be used for N&V mitigation.	This has been considered under tender condition 8.8 (3) Types of noise & vibration mitigation systems.
6.16	BLT1.B Item 8	Design, proof check, supply and installation of discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS-D shall be so designed that the Natural Frequency of complete track system remains below 12 Hz.	Rubber as a MSS material is not acceptable technically and only Closed Cell Polyurethane of high quality also known as PUR are used in MSS material internationally. Even Open Cell Polyurethane Material as a MSS material for track slab bearing is not technically suitable.	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
			"Rubber" word may be deleted from all the places and only PUR may mentioned.	
6.17	Clause 8.8 Item 3 Types of Noise & Vibration Mitigation Systems,	<p>a) PMRP has envisaged 4 types of Noise & Vibration Mitigation Systems based on merits</p> <p>1. Discrete PUR /Rubber Bearing Slab Bearing.....</p> <p>2. Full Surface PUR / Rubber Mat Slab Track</p>	<p>a) 1) Rubber as a MSS material is not acceptable technically and only Closed Cell Polyurethane of high quality also known as PUR are used in MSS material internationally. Even Open Cell Polyurethane Material as a MSS material for track slab bearing is not technically suitable.</p> <p>"Rubber" word may be deleted from all the places and only PUR may mentioned.</p> <p>2) The Word Rubber in Full surface Rubber Mat Slab may be deleted as Rubber for Full Surface solution is technically not acceptable and only Closed Cell Polyurethane, also known as PUR, are used in MSS material internationally. Even Open Cell Polyurethane Material as a MSS material for track slab bearing is also not technically suitable, as open cell Polyurethane loses its elasticity properties and becomes stiff over a period of time due to degradation under moisture/water.</p> <p>The word "Rubber" may be deleted and only PUR word can be retained.</p>	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
7	Section III. Evaluation and Qualification Criteria. Clause 3.2 Average Annual Construction Turnover	The average annual turnover from construction of last three financial years should be \geq INR 1550 Millions (In terms of rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2021 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year).	In current tender, the Section III. Evaluation and Qualification Criteria, Clause 3.5 Bid Capacity Criteria states that the Available Bid Capacity shall be more than INR 969 million. Usually, the required bid capacity is equivalent to the estimated cost. Considering this INR 969 Million as estimated cost, the turnover requirement is coming around 159% which is not as per current practice in any Metro Railway or not even in Indian Railway. Tender No: C-01 and C-02 floated by Nagpur Metro (Maharashtra Metro Rail Corporation Limited) can also be referred to wherein Average Annual Turnover is around 80% of Estimated Value of Tender. You are requested to kindly review the condition and amend the same as per current prevailing practice. This will increase the participation and enhance the competition as well.	Please refer Maha-Metro's reply vide above Sl.no 6.1.
8	Mass Spring System			
8.1	1. Clause 8.8, Sub Clause 5, point 5.1 Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D)	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.	Pune Metro to confirm whether desired performance period is 15 years as per above clause OR 5 years as mentioned in clause no 8.8, sub clause 3 of the referred document.	Please Refer Corrigendum No-1 Sr. no. 9,10,11 & 12

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
8.2	2. Sub Clause 5.4. Slab Track System with low dynamic stiffness fastening system 1ST-LDS}	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender. In addition, the proposed system should be approved by Ministry of Railways (MoR).	Pune Metro to confirm whether desired performance period is 15 years as per above clause OR 5 years as mentioned in clause no 8.8, sub clause 3 of the referred document	Please Refer Corrigendum No-1 Sr. no. 9,10,11 & 12
9				
9.1	Section III: Evaluation and Qualification Criteria, 3.Financial Situation and Performance	General	With regards to the Audited accounts submission up to 2021. We are unable to comply because ever since the Covid 19 pandemic broke out our Country Malaysia was one of the worst effected and many companies and services were working from home. Therefore the Accounts and hiring of the Auditors were not done by our Parent company and the accounts for 2020 is yet to be made available. We will be able to provide audited accounts from 2015 to 2019. WE also have sought similar exclusion from NHAI and MORTH which we are allowed to do so and submit for 2015 to 2019 Audited accounts. Kindly consider the situation which is much a global issue.	Please refer Maha-Metro's reply vide above Sl.no 5.2.

Corrigendum No-1 dated 05 Jan 2022

Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast-less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

Sr no	Volume & Clause no	Existing Bid Document	Revised
1	Part I: Bidding Procedure Section - III Evaluation and Qualification Clause no.3.2 Average Annual Construction Turnover	The average annual turnover from construction of last three financial years should be ≥ INR 1550 Millions (In terms of rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2021 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year)	The average annual turnover from construction of last three financial years should be ≥ <u>INR 580 Millions</u> (In terms of rupee equivalent adjusted to last date of financial year that ended on or before 31.03.2021 by applying 5% escalation for Indian Rupees and 2% for foreign currency per year)
2	Part I: Bidding Procedure Section – III Evaluation and Qualification Criteria Clause 4.1 General Construction Experience	Experience under construction contracts in the role of prime contractor, JV/Consortium member, subcontractor, or management contractor for at least the last 5 years, ending 31.03.2021	Experience under construction contracts in the role of prime contractor, JV/Consortium member, subcontractor, or management contractor for at least the last 5 years, ending <u>31.12.2021</u>
3	Part I: Bidding Procedure Section – III Evaluation and Qualification Criteria Clause 4.2 (a) Specific	The Bidder will be qualified only if they have completed work(s) during last 10 years ending 31.05.2021 as given below: (a) One work of value INR 339 Million or more which should include installation of minimum 13 TKm Ballastless Track in one work of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80Kmph.	The Bidder will be qualified only if they have completed work(s) during last 10 years ending <u>31.12.2021</u> as given below: (a) One work of value INR 339 Million or more which should include installation of minimum 13 TKm Ballastless Track in one work of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80Kmph.

Sr no	Volume & Clause no	Existing Bid Document	Revised
	Construction & Contract Management Experience	<p>OR</p> <p>(b) Two works each of value INR 232 Million or more which should include installation and of minimum 10 TKm Ballastless Track in each of the two works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>OR</p> <p>(c) Three works each of value INR 194 Million or more which should include installation of minimum 7 TKm of Ballastless Track in each of the three works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>The experience on Ballastless Track on a system having design axle load less than 12Tons, speed less than 80 kmph or Tramways shall not be considered. Components of Ballastless Track works in sidings, spurs and other non-passenger's portions shall also not be considered.</p> <p>And</p> <p>(d) The bidder shall have executed min. 2 Track-km of ballastless track in underground metro/railway.</p>	<p>OR</p> <p>(b) Two works each of value INR 232 Million or more which should include installation and of minimum 10 TKm Ballastless Track in each of the two works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>OR</p> <p>(c) Three works each of value INR 194 Million or more which should include installation of minimum 7 TKm of Ballastless Track in each of the three works of Metro or Main Line Passenger Railway System which is designed for the speed not less than 80 Kmph.</p> <p>The experience on Ballastless Track on a system having design axle load less than 12Tons, speed less than 80 kmph or Tramways shall not be considered. Components of Ballastless Track works in sidings, spurs and other non-passenger's portions shall also not be considered.</p> <p>And</p> <p>(d) The bidder shall have executed min. 2 Track-km of ballastless track in underground metro/railway.</p>
4	Part I: Bidding Procedure Section - III Evaluation and Qualification Clause no. 5.1 Quality & Qualification Criteria	<p>1. The Bidder must have valid Environmental Management Certificate ISO:140001 or equivalent.</p> <p>2. The Bidder must have valid Quality Management Certificate ISO:9001/DNV/TUV / JAS-ANZ/ equivalent.</p> <p>3. The Bidder must have valid Health and Safety Certificate OHSAS:18001. The bidder must agree to deploy at least two key personnel having Environment expertise of minimum ten years in sites management</p>	<p>1. The Bidder must have valid Environmental Management Certificate ISO:14001 or equivalent.</p> <p>2. The Bidder must have valid Quality Management Certificate ISO:9001/DNV/TUV / JAS-ANZ/ equivalent.</p> <p>3. The Bidder must have valid Health and Safety Certificate OHSAS:18001/ISO45001. The bidder must agree to deploy at least two key personnel having Environment expertise of minimum ten years in sites management and the second one in social works with min.10 years experience.</p>

Sr no	Volume & Clause no	Existing Bid Document	Revised
		measure and the second one in social works with min.10 years experience.	
5	Part I: Bidding Procedure Section - III Evaluation and Qualification Criteria Note: 01	Bidder shall furnish year wise and contract wise details of work for last five years i.e. up to 31.03.2021.	Bidder shall furnish year wise and contract wise details of work for last five years i.e. up to <u>31.12.2021.</u>
6	Part I: Bidding Procedure Section - III Evaluation and Qualification Criteria Note: 04	For ongoing Works, quantity of successfully completed portion of works executed up to 31.03.2021 will also be considered for qualification of experience criteria.	For ongoing Works, quantity of successfully completed portion of works executed up to <u>31.12.2021</u> will also be considered for qualification of experience criteria.
7	Part I: Bidding Procedure Section – III Evaluation and Qualification Criteria Note: 08	Bidder to submit the audited financial statements for last five financial year up to 31.03.2021, and if audited financial statement of FY 2020-21 is not available, provisional statement to be submitted, duly certified by statutory auditor. For Foreign bidders, last five financial year is up to 31.12.2020 when financial year is January to December of the year.	Bidder to submit the audited financial statements for last five financial year up to 31.03.2021, and if audited financial statement of FY 2020-21 is not available, provisional statement to be submitted, duly certified by statutory auditor. For Foreign bidders, last five financial year is up to 31.12.2020 when financial year is January to December of the year. <u>If audited financial statement of FY 2020 i.e. January 2020 to December 2020 is not available, provisional statement to be submitted, duly certified by statutory auditor.</u>
8	PART I: BIDDING PROCEDURE SECTION VI: PRICING DOCUMENT / BOQ Clause no. 2.2 Bill No. BLT1:	Cost of RCC, supply & Welding of M.S. Plate to the slab reinforcement, connecting with approved copper/aluminum cables with M.S. Plates for electrical continuity.	<u>Supply & Welding of M.S. Plate (as shown in the revised tender drawing no.PMRP23 & 24 attached.)</u> to the slab reinforcement, connecting with approved copper/aluminum cables with M.S. Plates for electrical continuity.

Sr no	Volume & Clause no	Existing Bid Document	Revised
	Installation of Ballastless Track for Main Line on Viaduct, Underground & Ramp		
9	PART II: WORK REQUIREMENTS SECTION – VII - B PARTICULAR SPECIFICATIONS Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground Sub Clause no. 5.1 Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D) Para no. 3	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 5 years . A certificate from the metro/railway on this account shall be submitted along with the tender.
10	PART II: WORK REQUIREMENTS SECTION – VII - B PARTICULAR SPECIFICATIONS Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground Sub Clause no. 5.2 Discrete Full surface PUR/rubber mat	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 5 years . A certificate from the metro/railway on this account shall be submitted along with the tender.

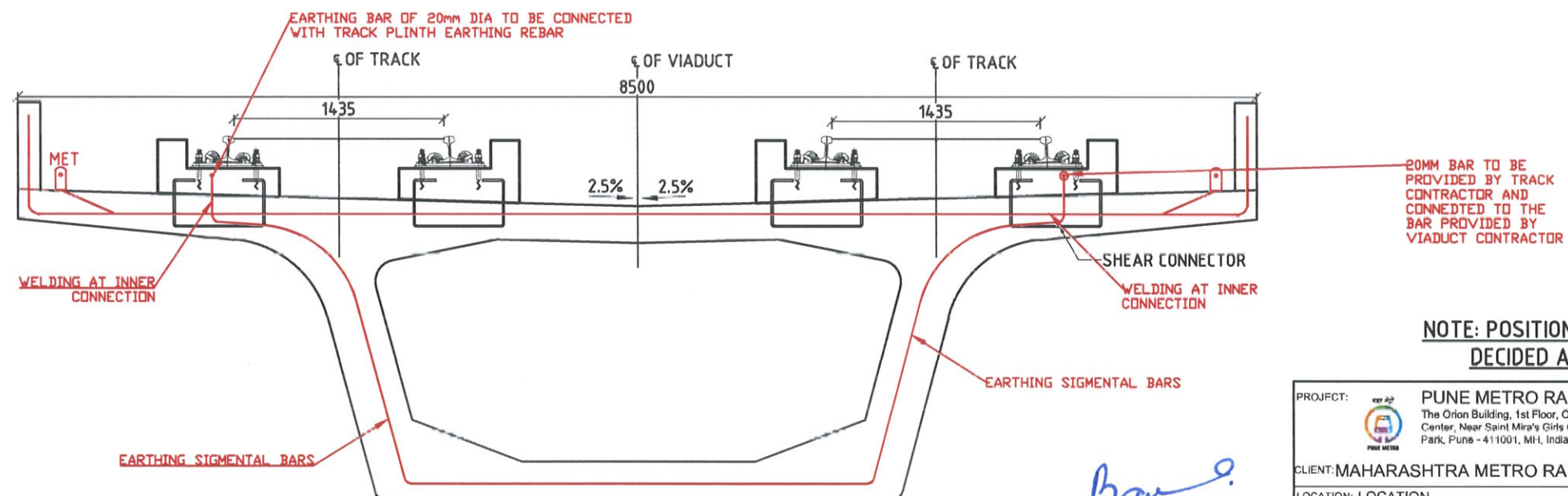
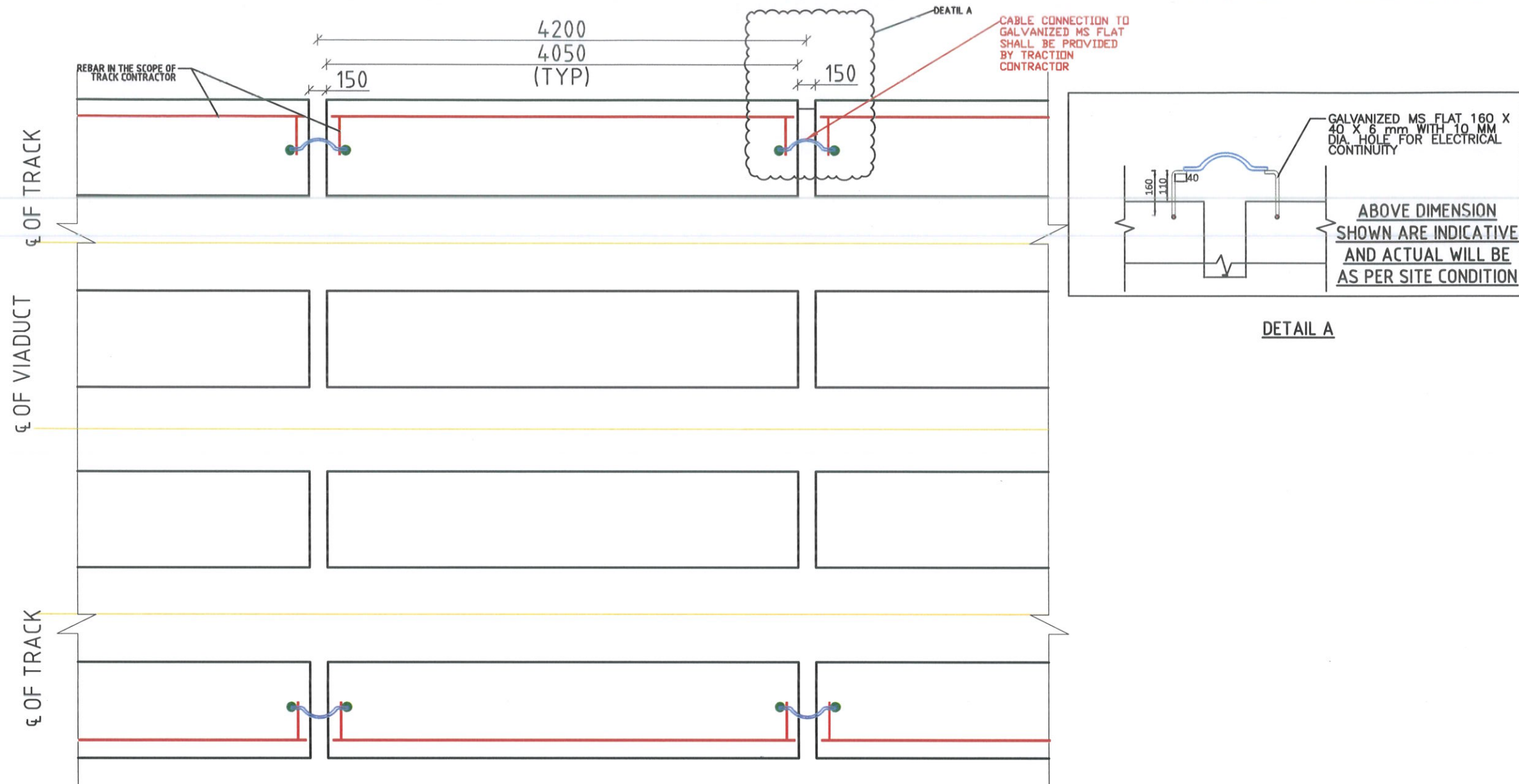
Sr no	Volume & Clause no	Existing Bid Document	Revised
	Slab Track Mass Spring System (STMSS-F) Para no. 4		
11	PART II: WORK REQUIREMENTS SECTION – VII - B PARTICULAR SPECIFICATIONS Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground Sub Clause no. 5.3 Discrete steel spring (or similar type) Slab Track Mass Spring System (STMSS-S) Para no. 4	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender.	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects having 12 T or higher axle load and working satisfactorily in service for past 5 years . A certificate from the metro/railway on this account shall be submitted along with the tender.

Sr no	Volume & Clause no	Existing Bid Document			Revised		
12	PART II: WORK REQUIREMENTS SECTION – VII - B PARTICULAR SPECIFICATIONS Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground Sub Clause no. 5.4 Slab Track System with low dynamic stiffness fastening system (ST-LDS) Para no. 3	The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects and working satisfactorily in service for past 15 years. A certificate from the metro/railway on this account shall be submitted along with the tender. In addition, the proposed system should be approved by Ministry of Railways (MoR).			The system shall be directly procured from OEM having successfully implemented the system in minimum 2 metro/railway projects and working satisfactorily in service for past 5 years . A certificate from the metro/railway on this account shall be submitted along with the tender. In addition, the proposed system should be approved by Ministry of Railways (MoR).		
13	PART- III CONDITIONS OF CONTRACT AND CONTRACT FORMS SECTION - VIII GENERAL CONDITIONS (GC) Table-1: Summary of Sections (KEY DATES) 1) Civil Court to Ramwadi (Reach-3) – Viaduct section	KEY DATES (KD)	Description	Date	KEY DATES (KD)	Description	Date
		1	Completion of design of Track structure	Date of NTP + 45 days	1	Completion of design of Track structure	Date of NTP + 45 days
		2	Completion of first 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be	Date of handing over of viaduct section + 45 days	2	Completion of first 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, <u>minimum 1 Km length of viaduct section i.e. 2 Track-Km will be handed over at a time for Trackwork</u>)	Date of handing over of viaduct section + 45 days

Sr no	Volume & Clause no	Existing Bid Document			Revised		
			handed over at a time for Trackwork)		3	Completion of next 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, <u>minimum 1 Km length of viaduct section i.e. 2 Track-Km will be handed over at a time for Trackwork)</u>	Date of handing over of viaduct section + 45 days
		3	Completion of next 4 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days			
		4	Completion of next 3 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, minimum 0.5 Km length of viaduct section i.e. 1 Track-Km will be handed over at a time for Trackwork)	Date of handing over of viaduct section + 45 days	4	Completion of next 3 Track-Km of Trackwork installation (Viaduct section will be handed over in progressive manner however, <u>minimum 1 Km length of viaduct section i.e. 2 Track-Km will be handed over at a time for Trackwork)</u>	Date of handing over of viaduct section + 45 days



ONLY FOR TENDER PURPOSE
TENDER NO. P1-TO6/2021

EARTHING ARRANGEMENT FOR BALLASTLESS TRACK

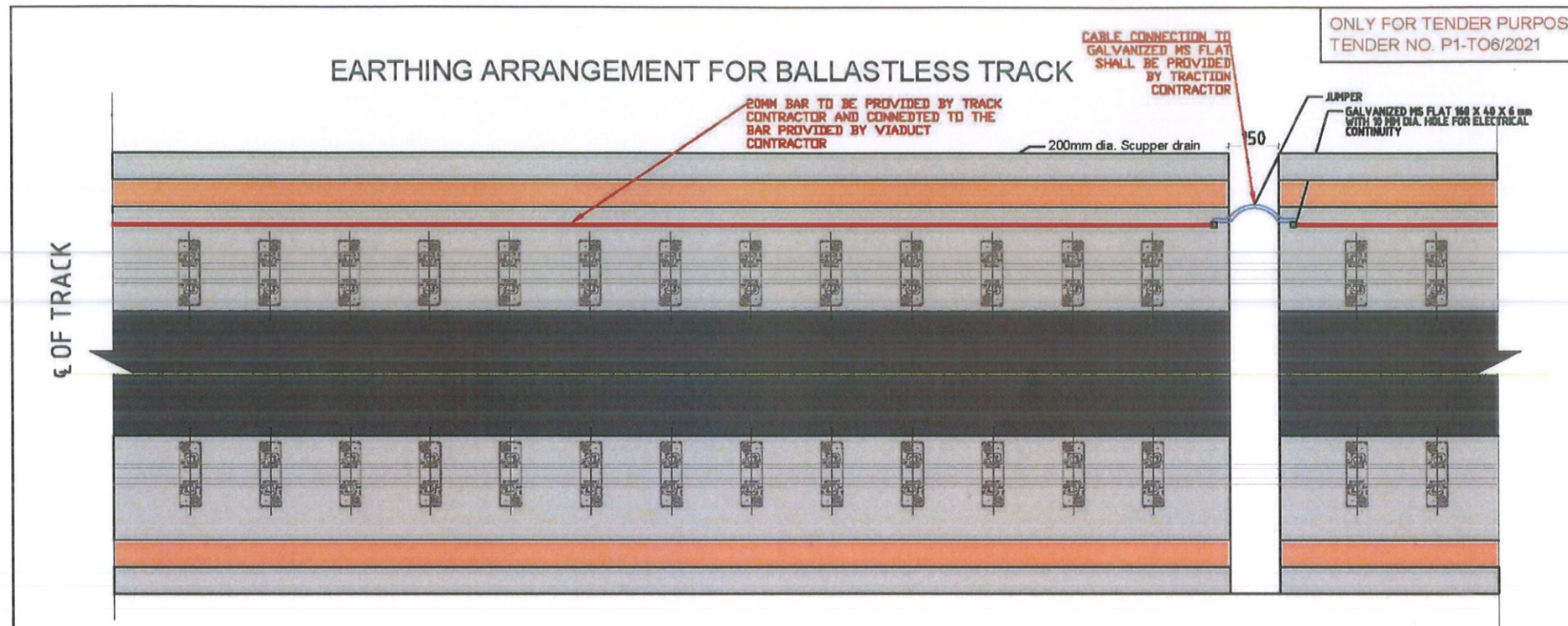


NOTE: POSITION OF 20mm MS BAR WILL BE
DECIDED AS PER SITE CONDITION

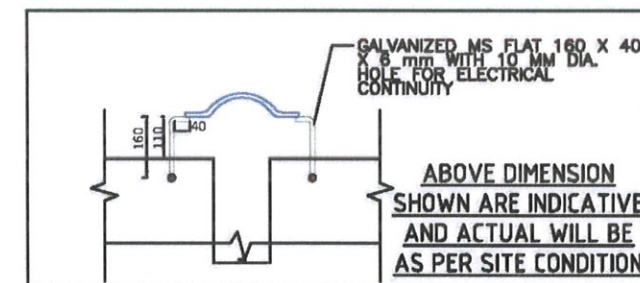
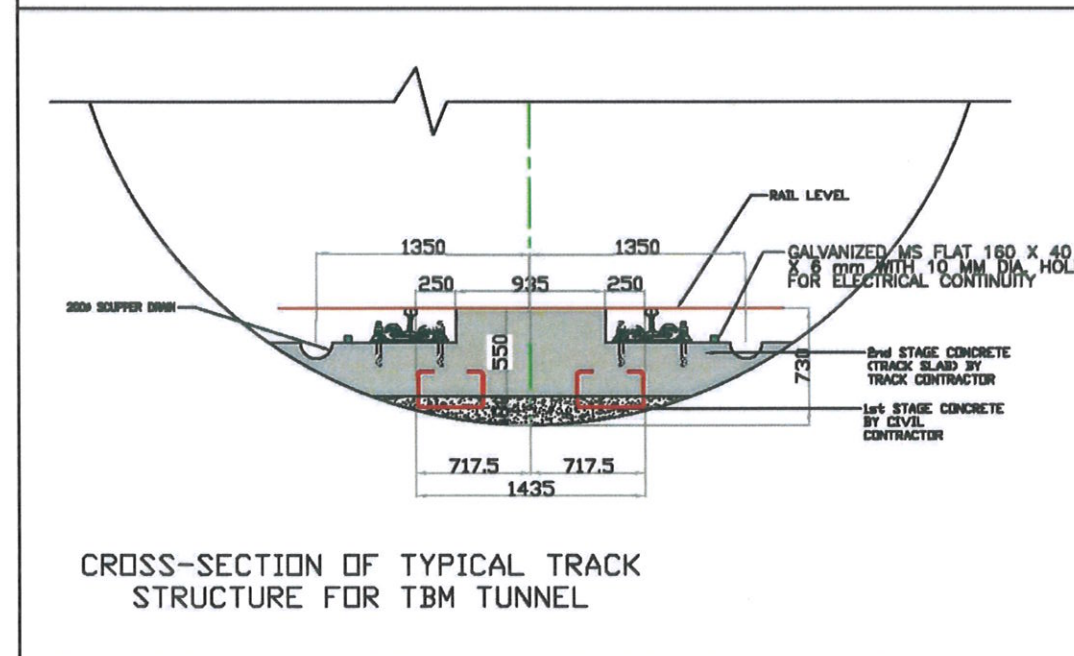
EARTHING ARRANGEMENT OF VIADUCT
SCALE(1:25)

PROJECT:  PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India		
CLIENT: MAHARASHTRA METRO RAIL CORPORATION LTD.		
LOCATION: LOCATION		REVISION NO:
TITLE: EARTHING ARRANGEMENT FOR BALLASTLESS TRACK		
SCALE:	DATE:	STATUS:
DRG NO: PMRP/23		R1



*Bar
GC/Track*



**TYPICAL LONGITUDINAL REINFORCEMENT DETAILS
SECTION A-A
SCALE - 1:20**



NOTE: POSITION OF 20mmMS BAR WILL BE DECIDED AS PER SITE CONDITION

PROJECT:	<div><div>PUNE METRO</div></div> <div>PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div>			<div><div>PUNE METRO</div></div>
CLIENT:	MAHARASHTRA METRO RAIL CORPORATION LTD.			
LOCATION:		LOCATION		
TITLE:		EARTHING ARRANGEMENT FOR BALLASTLESS TRACK		
SCALE:	DATE:	STATUS:		REVISION NO:
DRG NO:	PMRP/24			R1

*Base
90/Track*



MAHARASHTRA METRO RAIL CORPORATION LIMITED

Pune Metro Rail Project

Joint Venture of Govt. of India & Govt. of Maharashtra

CIN: U60100MH2015SGC262054

Date: 17 Jan 2022

CORRIGENDUM-II

Tender No.: P1T-06/2021 dated 27 Nov 2021

Name of Work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Reference: Further to **Tender Documents** dated 27 Nov 2021, **Corrigendum I** dated 05 Jan 2022

Following Documents shall be construed to be a part of Corrigendum-II:

1. Replies to Pre-Bid Queries (Two (02) Pages)
2. Corrigendum No. – 2 (Three (03) Pages)
3. Annexure to Corrigendum No. – 2 (One (01) Page)



ED (Procurement & Contracts),
Pune Metro Rail Project,
Maharashtra Metro Rail Corporation Limited.

REPLIES TO PRE-BID QUERIES DATED 17 JAN 2022

Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
1	SECTION VI: Pricing Document / BOQ Buffer Stop (BOQ Item No 3.1 under schedule BLT 1A)	Supply of hybrid buffer stop having combination of sliding friction type and hydraulic type for elevated viaduct for impact speed of 40kmph and 6-coach empty train weight 246 T.	Pre- bid Clarification regarding buffer stop, "10m sliding/ stopping distance shall be considered for designing of hydraulic type buffer stop for elevated viaduct for impact speed of 40kmph and 6-coach empty train weight 246 Ton". Please confirm whether the rolling stock has anti-climber? If, so please share the details of the same. The query has been communicated by M/s. OLEO India for suitable designing. You are kindly requested to clarify the same at the earliest.	Rolling Stock has the anti-climber facility.
2	ITB 32.1, Page 40	Bids will be compared in Indian Rupees only. This will be achieved by conversion of the Foreign Currency portion of the Bid into Indian Rupees by using the Exchange Rates published by Financial Benchmarks India Pvt. Ltd (www.fbil.org.in) 30 (Thirty) days before the date specified for Bid opening, and then adding the same to the Indian Rupee portion of the Bid. In case this particular day happens to be a holiday, the exchange rate published by Financial Benchmarks India Pvt. Ltd (www.fbil.org.in) on the next working day will be considered.	We request your kind attention towards a fact that Financial Benchmarks India Pvt. Ltd (www.fbil.org.in) gives conversion rate for only USD, Euro, GBP and JPY (only 4 currencies). We request you to kindly consider XE.com or OANDA.com for conversion of other currencies like MYR (Malaysian Ringgit) and RUB (Russian Rubble), which is very important for Malaysian or Russian (international) bidders.	Tender conditions prevail.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
3	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	<p>While reviewing Corrigendum 1, prebid queries uploaded on 05-01-2022, we have come across many changes in technical specification due to which our bidding strategy needs to be revised.</p> <p>Considering above facts, we request you to kindly extend the bid submission by minimum 2 weeks i.e till 1st Feb 2022, so that we can make and submit compliant proposal</p>	Please Refer Corrigendum No-2 Sr. no.4.
4	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	We are keen to participate your tender for line 3 and 4. In this connection we are in need of rates, terms and conditions from MSS suppliers, who are mainly based out of India. Due to Christmas and New Year the offices of these vendor were closed, and due to this we could not get the rates from them and they have requested for extension of the submission date for about two weeks. The tender is due for submission on 18.01.22. We request you to kindly extend the submission date by 15 days.	Please Refer Corrigendum No-2 Sr. no.4.

Corrigendum No-2 dated 17 Jan 2022

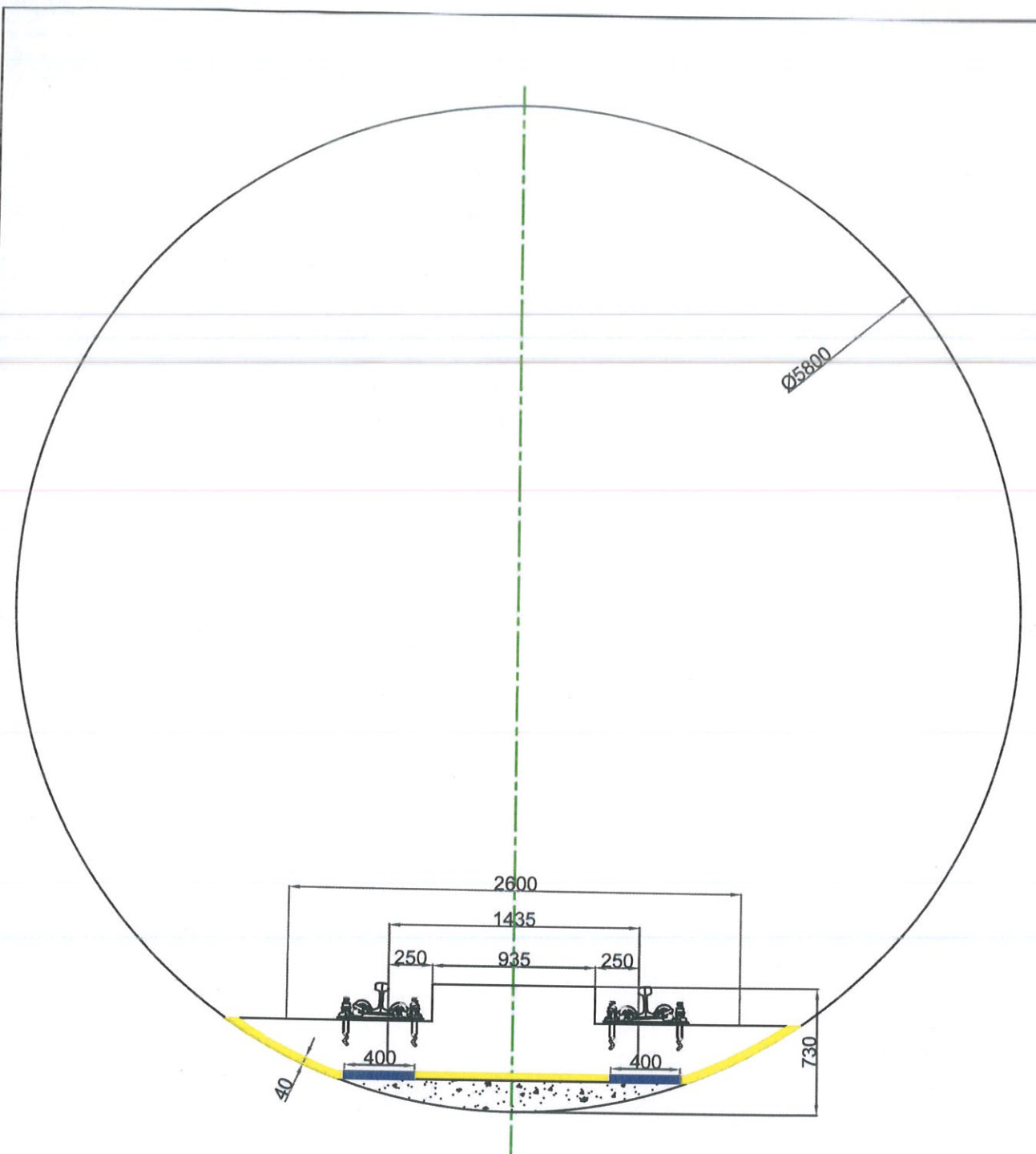
Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

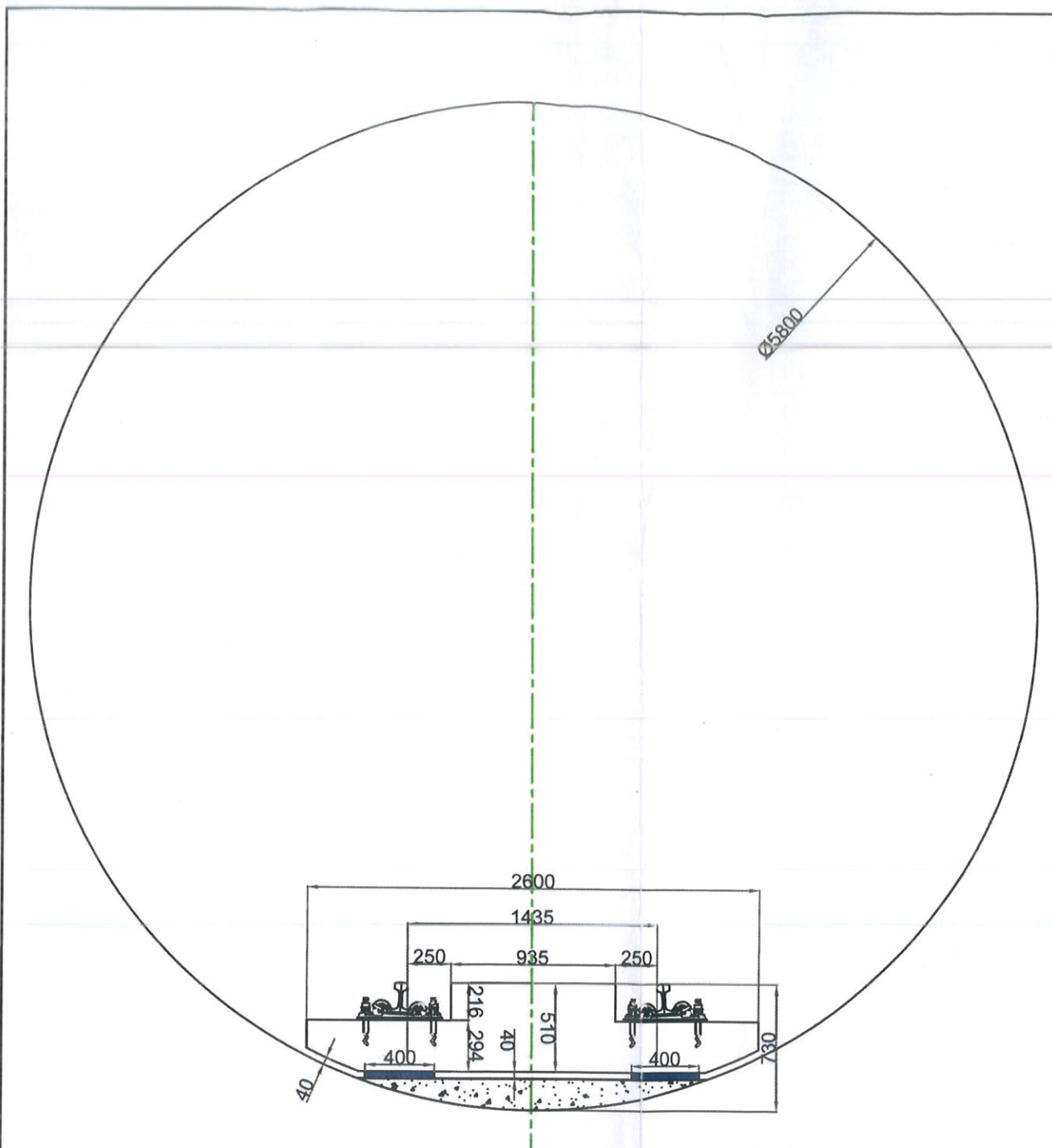
Sr no	Volume & Clause no	Existing Bid Document	Revised
1	<p>PART II: WORK REQUIREMENTS</p> <p>SECTION – VII - B PARTICULAR SPECIFICATIONS Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground</p> <p>Sub Clause no. 5.1 Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D) Para no. 1 & 2.</p>	<p>5.1 Discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS-D)</p> <p>Design, supply and installation of discrete PUR/rubber bearing Slab Track Mass Spring System (STMSS) for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS shall be so designed that the Natural Frequency of complete track system remains below 12 Hz. The proposed MSS shall restrict the maximum rail deflection up to 6mm. The thickness of discrete bearing shall be below 50mm.</p> <p>The design of STMSS includes design of complete track system including track slab and PUR/rubber bearing considering the technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The bearings shall be tested for fatigue as per approved ITP.</p>	<p><u>5.1 Discrete PUR Pads/Bearing Slab Track Mass Spring System (STMSS-D)</u></p> <p>Design, supply and installation of discrete <u>PUR Pads/bearing Slab Track Mass Spring System (STMSS)</u> for maximum vibration attenuation of 20 VdB in the frequency range of 25 Hz to 45 Hz. The STMSS shall be so designed that the Natural Frequency of complete track system remains below 12 Hz. The proposed MSS shall restrict the maximum rail deflection up to 6mm. The thickness of discrete bearing shall be below 50mm.</p> <p>The design of STMSS includes design of complete track system including track slab and <u>PUR Pads/bearing</u> considering the technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The <u>Pads/bearings</u> shall be tested for fatigue as per approved ITP.</p> <p><u>(Revised Tender Drawing is enclosed here with as Annexure -A)</u></p>
2	<p>PART II: WORK REQUIREMENTS</p> <p>SECTION – VII - B PARTICULAR SPECIFICATIONS</p>	<p>5.2 Discrete Full surface PUR/rubber mat Slab Track Mass Spring System (STMSS-F)</p> <p>The proposed STMSS-F shall be full surface type PUR/rubber mat. The full surface type PUR/rubber mat can be in the form of combination of two types of strips of different materials having</p>	<p><u>5.2 Discrete Full surface PUR mat Slab Track Mass Spring System (STMSS-F)</u></p> <p><u>The proposed STMSS-F shall be full surface type PUR materials. The full surface type PUR materials</u> can be in the form of combination of two types of strips of different materials</p>

Sr no	Volume & Clause no	Existing Bid Document	Revised
	<p>Clause no. 8.8 Noise and Vibration Mitigation Measures for slab track of underground</p> <p>Sub Clause no. 5.2 Discrete Full surface PUR/rubber mat Slab Track Mass Spring System (STMSS-F) Para no. 2 & 3.</p>	<p>different bedding modulus without facilitating formation of key after casting the track slab because of difference in the stiffness of different PUR/rubber mat materials. The primary strips shall be placed below the rails and responsible for attenuation of noise and vibration. The secondary strips shall be used as filler strips which do not take part in the mitigation of noise and vibration. However, the quality of secondary strips shall be such that it does not become hard in the long run and continue to be non-functional with respect to mitigation of vibration. The thickness of full surface mat shall be below 50mm.</p> <p>The design of STMSS-F includes design of complete track system including track slab and rubber mat considering technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The mat shall be tested for fatigue as per approved ITP.</p>	<p>having different bedding modulus without facilitating formation of key after casting the track slab because of difference in the stiffness of different PUR materials. The primary strips shall be placed below the rails and responsible for attenuation of noise and vibration. The secondary strips shall be used as filler strips which do not take part in the mitigation of noise and vibration. However, the quality of secondary strips shall be such that it does not become hard in the long run and continue to be non-functional with respect to mitigation of vibration. The thickness of full surface mat shall be below 50mm.</p> <p><u>The design of STMSS-F includes design of complete track system including track slab and PUR materials</u> considering technical specifications of “Double Resilient Base Plate Fastening System” approved by Railway Board. A transition stiffness of sufficient length shall be designed to gradually cross-over from Non-STMSS to STMSS and vice-versa. Fatigue analysis of MSS shall be part of detailed design submission. The mat shall be tested for fatigue as per approved ITP. <u>(Revised Tender Drawing is enclosed here with as Annexure -A)</u></p>
	Tender Notice (NIT) KEYDETAILS:		
3	Documents on sale	Documents can be downloaded from 16.00 hrs. on 27.11.2021 to 16.00 Hrs. of 18.01.2022 from Maharashtra Metro Rail Corporation Limited's e-tender Portal.	Documents can be downloaded from 16.00 hrs. on 27.11.2021 to <u>16.00 Hrs. of 25.01.2022</u> from Maharashtra Metro Rail Corporation Limited's e-tender Portal.
4	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	Online submission <u>up to 16.00 Hrs. on 25.01.2022</u> at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).

Sr no	Volume & Clause no	Existing Bid Document	Revised
5	Date & Time of Opening of Bid	On 18.01.2022 at 16.30 Hours or as decided by the authority at the Office of Maharashtra Metro Rail Corporation Limited, 1st Floor, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune-411001.	<u>On 25.01.2022 at 16.30 Hours</u> or as decided by the authority at the Office of Maharashtra Metro Rail Corporation Limited, 1st Floor, The Orion, Opposite Don Bosco Youth Centre, Koregaon Park, Pune-411001.





MASS SPRING SYSTEM - FULL SURFACE PUR MAT
WITH STRIP AND FILLER MATERIALS - MONO
DERAILMENT GUARD (STMSS-F)



MASS SPRING SYSTEM - DISCRETE PUR
PAD/BEARING - MONO DERAILMENT
GUARD (STMSS-D)

Signature
08/01/2022
S.V. LEWIS
CTE/Track

ONLY FOR TENDER PURPOSE
TENDER NO.P1-T06/2021

PROJECT:		<div><div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div><div>PUNE METRO RAIL PROJECT The Orion Building, 1st Floor, Opposite Don Bosco Center, Near Saint Mira's Girls College, Koregaon Park, Pune - 411001, MH, India</div></div>		<div><div>महा मेट्रो</div><div></div><div>PUNE METRO</div></div>
CLIENT:		MAHARASHTRA METRO RAIL CORPORATION LTD.		
LOCATION:		LOCATION		
TITLE:		MASS SPRING SYSTEM IN CIRCULAR TUNNEL		
SCALE:	DATE:	STATUS:	REVISION NO:	
DRG NO:				



MAHARASHTRA METRO RAIL CORPORATION LIMITED

Pune Metro Rail Project

Joint Venture of Govt. of India & Govt. of Maharashtra

CIN: U60100MH2015SGC262054

Date: 17 Jan 2022

CORRIGENDUM-III

Tender No.: P1T-06/2021 dated 27 Nov 2021

Name of Work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballastless Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Reference: Further to **Tender Documents** dated 27 Nov 2021, **Corrigendum I** dated 05 Jan 2022, **Corrigendum II** dated 17 Jan 2022

Following Documents shall be construed to be a part of Corrigendum-III:

1. Replies to Pre-Bid Queries (Three (03) Pages)
2. Corrigendum No. – 3 (Three (03) Pages)



ED (Procurement & Contracts),
Pune Metro Rail Project,
Maharashtra Metro Rail Corporation Limited.

REPLIES TO PRE-BID QUERIES DATED 17 JAN 2022

Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
1	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	<p>While reviewing Corrigendum 1, prebid queries uploaded on 05-01-2022, we have come across many changes in technical specification due to which our bidding strategy needs to be revised.</p> <p>We are also unable to meet the deadline because ever since the Covid 19 pandemic broke out our Country Malaysia was one of the worst effected and many companies and services were working from home. Now with the new Omicron and Delta strain, we have new outbreak and lock-downs. Staff is unable to move and get documents from the office file and records, therefore we need to get special permission to move from home to office and back.</p> <p>Considering above facts, we request you to kindly extend the bid submission by minimum 4 weeks i.e till 7th Feb 2022, so that we can make and submit compliant proposal</p>	Please Refer Corrigendum No-2 Sr. no.4.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
2	PART II: WORK REQUIREMENTS SECTION -VII - B 6.6 BUFFER STOPS	<p>On main lines friction buffer stops with mechanical impact absorption (non-hydraulic type) shall be provided. The design and specification of friction buffers shall be submitted by the contractor for Engineer's approval. The contractor shall interface with the designated Rolling Stock Contractor for the details required for the design of friction buffer stops. However, the following details shall be followed.</p> <p>Standard Gauge –</p> <ul style="list-style-type: none"> Weight of empty train is equal to 246 tonnes for 6-car train set without passengers. Weight of train is equal to 384 tonnes for 6-car train set with passengers. Impact velocity for main line: 25/40 km/h Factor of Safety (FOS): 1.25 – 1.5, the philosophy behind FOS shall be to minimize the damage to train and buffer stop without compromising the desired safety. 	<p>Sl. No. 1a has been clarified vide BOM and Corrigendum</p> <p>SI No. 1b: Mass of train has not been defined in 1(b) above and there is a vague indication of speed (25kmph/ 40kmph). The exact parameters are important for the correct buffer stops since these are safety items. Kindly clarify the same with CRS or any other Metro of body before finalising the conditions for this requirement of buffer stops for the mentioned tender.</p> <p>Kindly note the difference between the tender documents mentioning “non-hydraulic type” and the BoM mentioning combination of sliding friction and hydraulic type OR friction type.</p>	Please Refer Corrigendum No-3 Sr. no.1 to 3.
3	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	<p>We here by wish to request for your consideration and approval in extending the deadline for submission of the bid. Sudden spread of COVID-19 Coronavirus in our country has created significant limitations, resulting delay in site visits and in arranging quotations from various vendors, in preparing our most competitive bid.</p> <p>In this regard, we request you to kindly provide us the additional time to prepare our bid and to kindly extend the bid submission date by at least two (2) weeks.</p>	Please Refer Corrigendum No-2 Sr. no.4.

Sr no	Clause no	Tender terms	Bidder Query	Reply of Maha-Metro
4	Date & Time Of submission of Bid	Online submission up to 16.00 Hrs. on 18.01.2022 at Maharashtra Metro Rail Corporation Limited's e-tender portal(https://mahametroRail.etenders.in).	<p>We are very much hopeful to participate for this work but in order to respond to the latest corrigendum, issued on 5th Jan 2022, where there is a change in Eligibility Criteria, we need some response time.</p> <p>Moreover, due to latest outbreak of COVID-19 in various parts of the Country, the day-to-day working is very much affected due to imposition of local restrictions. The Private Offices in Delhi are closed till further notice by District Disaster Management Authority, Delhi due to which the day-to-day operation are very much restricted vide there order No F.60/DDMA/ COVID-19/2022/509 dated 11th Jan 2022.</p> <p>Also, the interactions with various vendor needs to be done for this kind of specialized job but due to imposition of local restrictions the meetings and discussion are delayed.</p> <p>Keeping above scenario in consideration we request you to kindly extend the Bid Submission Date for at least Four Weeks and enable us to participate and provide you a best competitive techno- commercial offer.</p>	Please Refer Corrigendum No-2 Sr. no.4.

Corrigendum No-3 dated 17 Jan 2022

Name of work: Design, Supply, Installation, Testing and Commissioning of Standard Gauge Ballast less Track for the Elevated Section of Reach-3 (Civil Court to Ramwadi) and Underground Section of Reach-4 (Range Hill to Swargate) of Pune Metro Rail Project.

Tender No: P1-T06/2021 dated 27 Nov 2021

Sr. No	Volume & Clause no	Existing Bid Document						Revised					
1	PART I: BIDDING PROCEURE SECTION VI: PRICING DOCUMENT / BOQ PART II - BILL OF QUANTITIES (BOQ) Bill No BLT 1. A: Item No-3.2	Sr. No.	Item Description	Unit	Reah-3 for Corridor-2	Rate in INR/ USD /Euro	Total Amount in INR / USD/ Euro	Sr. No.	Item Description	Unit	Reach-3 for Corridor-2	Rate in INR/ USD/ Euro*	Total Amount in INR/ USD /Euro
		3.2	Installation of hybrid buffer stop having combination of sliding friction type and hydraulic type or Friction Type Buffer Stops (impact speed 25kmph/40kmph) on elevated viaduct at any location of PMRP, Phase-I. A certification of installation for all the buffer stops shall be issued by the manufacturer.	Nos	12			3.2	<u>Installation of hybrid buffer stop having combination of sliding friction and hydraulic type (impact speed 40 Kmph) (or) Friction Type Buffer Stops (impact speed 25kmph) on elevated viaduct at any location of PMRP, Phase-I.</u>				
								3.2 (a)	<u>Installation of Friction Type Buffer Stops (impact speed 25kmph) on elevated viaduct at any location of PMRP, Phase-I.</u>	Nos	11		

Sr. No	Volume & Clause no	Existing Bid Document	Revised			
			<u>3.2 (b)</u> <u>Installation of hybrid buffer stop having combination of sliding friction and hydraulic type (impact speed 40kmph) on elevated viaduct at any location of PMRP, Phase-I. Along with Installation certification shall be issued by the manufacturer for the buffer stop.</u>	<u>N o s</u> <u>01</u>		
2	PART I: BIDDING PROCEDURE SECTION VI: PRICING DOCUMENT / BOQ SECTION 2 – EXPLANATORY NOTES OF BILL OF QUANTITIES	<p>Item 3.2: Installation of buffer stops of 25 kmph/40kmph Speed Potential The price shall include the cost of installation of buffer stop as per Employer's Requirements mainly consisting but not limited to the following:</p> <p>Loading, handling / re-handling, transportation, and unloading of all materials from stock area to site including cost of deployment of plant, equipment & machinery.</p> <p>Installation of the buffer stops with all fittings, fastenings and red luminous stickers etc. complete including torque testing along with installation certificate by manufacturer.</p> <p>Inspection by manufacturer after installation of buffer stops at its final location.</p>	<p><u>Item 3.2 (a) & (b): Installation of 25 kmph Speed Potential Friction Type Buffer Stops (or) Installation of 40kmph Speed Potential hybrid buffer stop having combination of sliding friction and hydraulic type</u></p> <p>The price shall include the cost of installation of buffer stop as per Employer's Requirements mainly consisting but not limited to the following:</p> <p>Loading, handling / re-handling, transportation, and unloading of all materials from stock area to site including cost of deployment of plant, equipment & machinery.</p> <p>Installation of the buffer stops with all fittings, fastenings and red luminous stickers etc. complete including torque testing.</p> <p><u>Installation certificate by manufacturer to be submitted for 40kmph Speed Potential hybrid buffer stop having</u></p>			

Sr. No	Volume & Clause no	Existing Bid Document	Revised
			<u>combination of sliding friction and hydraulic type after installation of buffer stops at its final location.</u>
3	PART II: WORK REQUIREMENTS SECTION – VII - B 6.6 BUFFER STOPS	<p>On main lines friction buffer stops with mechanical impact absorption (non-hydraulic type) shall be provided. The design and specification of friction buffers shall be submitted by the contractor for Engineer's approval. The contractor shall interface with the designated Rolling Stock Contractor for the details required for the design of friction buffer stops. However, the following details shall be followed.</p> <p>Standard Gauge –</p> <ul style="list-style-type: none"> • Weight of empty train is equal to 246 tonnes for 6-car train set without passengers. • Weight of train is equal to 384 tonnes for 6-car train set with passengers. • Impact velocity for main line: 25/40 km/h • Factor of Safety (FOS): 1.25 – 1.5, the philosophy behind FOS shall be to minimize the • damage to train and buffer stop without compromising the desired safety. 	<p>On main lines <u>hybrid buffer stop having combination of sliding friction and hydraulic type 40kmph Speed Potential</u> shall be provided. The design and specification of <u>hybrid buffer stop</u> shall be submitted by the contractor for Engineer's approval. The contractor shall interface with the designated Rolling Stock Contractor for the details required for the design of <u>hybrid buffer stop</u>. However, the following details shall be followed.</p> <p>Standard Gauge –</p> <ul style="list-style-type: none"> • Weight of empty train is equal to 246 tonnes for 6-car train set without passengers. • Weight of train is equal to 384 tonnes for 6-car train set with passengers. • Impact velocity for main line: <u>40 km/h</u> • Factor of Safety (FOS): 1.25 - 1.5, the philosophy behind FOS shall be to minimize the • damage to train and buffer stop without compromising the desired safety.