JAIPUR METRO RAIL CORPORATION LIMITED

Bidding Document: Contract ICB No.JP/EW/1C(Underground)/03

Contract ICB No.JP/EW/1C(Underground)/03: "Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar dead end Ch:10387.860 to Underground ramp end Ch:13040 of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, water supply, Sanitary Installations and Drainage Works at Jaipur, Rajasthan, India.

ADDENDUM/ CORRIGENDUM No.1
Summary Sheet

SN	Bidding Document	Page No	Clause No/Item No	Addendum/ Corrigendum	Remarks
1.	Volume-1 of 7: Notice Inviting Bid (NIB)	5	Clause: 1.1.2 Key Details	Last Date of Bid Submission and Opening is revised as **09.08.2023**(18:00 Hrs) and **10.08.2023**(16:00Hrs) respectively.	Replace Page 5 with 5 R1
2.	Volume-1 of 7: Instructions to Bidders (ITB):	10	C 5.4(c)	Clause-C 5.4(c) is modified.	Replace Page 10 with 10 R1
3.	Volume-1 of 7: Instructions to Bidders (ITB):	12	C 12.3	Clause- C 12.3 is modified.	Replace Page 12 with 12 R1
4.	Volume-1 of 7: Instructions to Bidders (ITB):	13	C 14.1	Clause- C 14.1 is modified.	Replace Page 13 with 13 R1
5.	Volume-1 of 7: Instructions to Bidders (ITB):	23	E 5.4	Clause- E 5.4 is Deleted.	Replace Page 23with 23 R1
6.	Volume-1 of 7: Instructions to Bidders (ITB):	41-42	Annexure-6	Annexure-6 Is modified.	Replace Page 41-42 with 41 R1 to 42 R1
7.	Volume-1 of 7: Instructions to Bidders (ITB):	46, 48	Annexure-7	Annexure-7 Is modified.	Replace Page 46 and 48 with 46 R1 and 48 R1
8.	Volume-1 of 7: Instructions to Bidders (ITB):	51	Annexure-7A	Annexure-7A Is modified.	Replace Page 51 with 51 R1
9.	Volume-1 of 7: Instructions to Bidders (ITB):	56	Annexure-7C	Annexure-7C Is modified.	Replace Page 56 with 56 R1
10.	Volume-1 of 7: Instructions to Bidders (ITB):	57-58	Annexure-7D	Annexure-7D Is modified.	Replace Page 57-58 with 57 R1 to 58 R1

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SN	Bidding Document	Page No	Clause No/Item No	Addendum/ Corrigendum	Remarks
11.	Volume-1 of 7: Form of Bid(FOB):	48-49	Appendix-30	Appendix-30 Is modified.	Replace Page 48-49 with 48 R1 to 49 R1
12.	Volume-2 of 7: Special Conditions of Contract (SCC)	3	Clause 2 Sub-Clause-3.2	Clause 2 Sub-Clause-3.2 Is modified.	Replace Page 3 with 3R1
13.	Volume-2 of 7: Special Conditions of Contract (SCC)	4-5	Clause 6 Sub-Clause-4.11	Clause 6 Sub-Clause-4.11 Is modified.	Replace Page 4-5 with 4 R1 to 5 R1
14.	Volume-2 of 7: Special Conditions of Contract (SCC)	19	Schedule-1	Schedule-1 Is modified.	Replace Page 19 with 19R1
15.	Volume-2 of 7: Special Conditions of Contract (SCC)	22-23	Schedule-2	Schedule-2 Is modified.	Replace Page 22-23 with 22 R1 to 23 R1
16.	Volume-2 of 7: General Conditions of Contract (GCC)	15-16	Clause-4.2 Sub Clause-4.2.1 [1,2,3,4(2)] Sub Clause-4.2.2 Sub Clause-4.2.3 (i)	Clause-4.2 Sub Clause-4.2.1 [1,2,3,4(2)] Sub Clause-4.2.2 Sub Clause-4.2.3 (i) are modified.	Replace Page 15-16 with 15 R1 to 16 R1
17.	Volume-2 of 7: General Conditions of Contract (GCC)	20	Clause-4.6	Clause-4.6 is modified.	Replace Page 20 with 20 R1
18.	Volume-2 of 7: General Conditions of Contract (GCC)	26-27	Clause-4.33.1 Sub-Clause(c): Debarment from bidding: (2)& (3)	Clause-4.33.1 Sub-Clause(c): Debarment from bidding: (2)& (3) is modified.	Replace Page 26-27 with 26 R1 to 27 R1
19.	Volume-2 of 7: General Conditions of Contract (GCC)	44, 45,46 & 48	Clause-10.10 Clause-11; Sub Clause-11.1.1(iii); Sub-Clause-11.1.4(ii); Sub-Clause-11.2.1 (2nd Para);Sub-Clause-11.3.3.	Clause-10.10; Clause-11; Sub Clause-11.1.1(iii); Sub-Clause-11.1.4(ii); Sub-Clause-11.2.1 (2nd Para); Sub-Clause-11.3.3; are modified.	Replace Page 44,45,46 & 48 with 44R1, 45 R1, 46R1 and 48 R1

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SN	Bidding Document	Page No	Clause No/Item No	Addendum/ Corrigendum	Remarks
20.	Volume-2 of 7: General Conditions of Contract (GCC)	53 and 54	Clause-12.1[2,4(i), 4(i)(c) and 5]	Clause-12.1[2,4(i), 4(i)(c) and 5] are modified	Replace Page 53 and 54 with 53 R1 and 54 R1
21.	Volume- 3 of 7: Employer's Requirement (Functional)	24	Clause No-2.8 Construction Depot and Dumping Area	Clause No-2.8 Is modified.	Replace Page 24 with 24 R1
22.	Volume- 4 of 7: Outline Construction Specifications (OCS) Part-1	96	Clause-6.4.8 Anchorages	Clause-6.4.8 Is modified.	Replace Page 96 with 96R1
	Part-1	150	Clause-8.1.6 Pile Cap	Clause-8.1.6 Is modified.	Replace Page 150 with 150R1
	Part-1	151	Clause-8.1.7 (iii)	Clause-8.1.7 (iii) is modified.	Replace Page 151 with 151R1
	Part-1	179	Clause-9.1.3 (a)	Clause-9.1.3 (a) is modified.	Replace Page 179 with 179 R1
	Part 1	309	Annexure-A	Annexure-A is modified.	Replace Page 309 with 309 R1
23.	Volume- 4 of 7: Outline Design Specifications	17	Clause 6.7.5 Computation of Fundamental period of vibration	Clause- 6.7.5 Computation of Fundamental period of vibration is modified.	Replace Page 17 with 17 R1
24.	Volume- 4 of 7: Outline Design Specifications	81A to 90	Clause-7. Annexure-A: Load Combination	Clause-7. Annexure-A: Load Combination is modified.	Replace Pages 81A to 90 with 81AR1 to 90R1
25.	Volume-5 of 7: Bid Drawings	Bid Drawing No GEN-JMRC-TD-003-R0	LIST OF DRAWINGS FOR UNDER GROUND STRETCH	Bid Drawing No GEN-JMRC-TD-003-R0 is revised.	Replace Bid Drawing No-GEN-JMRC-TD-003-R0 with GEN-JMRC-TD-003-R1

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SN	Bidding Document	Page No	Clause No/Item No	Addendum/ Corrigendum	Remarks
26.	Volume-5 of 7: Bid Drawings	Drawing SNo: 14,15,16,17 as per Index of Drawings. (GEN-JMRC-TD-003-R0 (01 of 01))	Bid Drawing Nos. GEN-JMRC-1C-ALG-TD-001-R0; GEN-JMRC-1C-ALG-TD-002-R0; GEN-JMRC-1C-ALG-TD-003-R0; GEN-JMRC-1C-ALG-TD-004-R0	Bid Drawing Nos. GEN-JMRC-1C-ALG-TD-001-R0; GEN-JMRC-1C-ALG-TD-002-R0; GEN-JMRC-1C-ALG-TD-003-R0; GEN-JMRC-1C-ALG-TD-004-R0 Are revised.	Replace Bid Drawing Nos. GEN-JMRC-1C-ALG-TD-001-R0 with R1; GEN-JMRC-1C-ALG-TD-002-R0 with R1; GEN-JMRC-1C-ALG-TD-003-R0 with R1; GEN-JMRC-1C-ALG-TD-004-R0 with R1.
27.	Volume-5 of 7: Bid Drawings	Drawing SNo: 20 as per Index of Drawings CCV-JMRC-1C-STR-TD-14003-R0	Bid Drawing Nos OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT (SHEET 1 OF 2), CCV-JMRC-1C-STR-TD-14003-R0	Bid Drawing Nos OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT (SHEET 1 OF 2), CCV-JMRC-1C-STR-TD-14003-R0 Is revised.	Replace Bid Drawing Nos OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT (SHEET 1 OF 2), CCV-JMRC-1C-STR-TD-14003-R0 with R1
28.	Volume-7 of 7: Geotechnical Investigation Report	Page No-01, 05 to 06	Point No-02 of Chapter-01: Details of Site & General Geological History. Point No-4.2: Field Investigation in Soil Strata.	Point No-02: Details of Site & General Geological History is modified. Point No-4.2: Field Investigation in Soil Strata.	Replace Page No-01, 05 to 06 with 01R1, 05R1 to 06R1
29.	Volume-7 of 7: Geotechnical Investigation Report	----	-------	Picture of Rock Core Samples obtained from Bore Hole No-18	Page No 293 added to the report.
30.	Volume-7 of 7: Geotechnical Investigation Report	----	-------	Geotechnical Investigation Report for Chainage 12490 m to 13040 m added with alignment drawing of the section.	Geotechnical Investigation Report for Chainage 12490 m to 13040 m added with alignment drawing of the section. (Total Pages 131)

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SN	Bidding Document	Page No	Clause No/Item No	Addendum/ Corrigendum	Remarks
31.	Volume-7 of 7: Topography Survey Report	----	-------	Survey Report of section from Chainage 12440 m to 13040 m is added.	Survey Report of section from Chainage 12440 m to 13040 m is added. (Total Pages 01)
32.	Reply to bidder's queries received up to 11.07.2023 (12:00 Hrs)	----	----	----	Total Pages 35 Nos.

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	will be participating in such virtual meeting at least one day before the meeting (latest by 1100 hrs on **08.07.2023**) to the registered official email of JMRC i.e. **i.e. jmrc.phase1c.ug@ jaipurmetrorail.in** so that link having details such as software, meeting ID, password etc. can be mailed to these persons at least 12 hours before the scheduled virtual pre- bid meeting.
Last date of issuing addendum (if any)	**20.07.2023**
Date & time of Submission of Bid online	Bid submission start date: **21.07.2023** (0900 hrs). Bid submission end date: **09.08.2023** (1800 hrs).
Date & time of opening of Bid online	**10.08.2023** at 1600 hrs.
Authority for purchase of Bid documents (in case of physical Bids), seeking clarifications and submission of completed Bid documents	**Director Project,** Jaipur Metro Rail Corporation Ltd., 1st Floor, A-Wing, Admin Building, Bhrigu Path, Mansarovar Metro Depot, Mansarovar, Jaipur-302020 **Contact; +91-141-2822781 / 2822786** **E-Mail id: - jmrc.phase1c.ug@ jaipurmetrorail.in;**

To facilitate payment of Bid Fee**, E-Bidding Processing Fee** and Bid Security through RTGS, NEFT & IMPS, the details of bank account of JMRC is mentioned below

Name of Bank	Bank's Address	Account Name & No.	Account Type	IFSC code
ICICI Bank. Branch:-Tilak Marg, C-Scheme, Jaipur.	Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur-302005, Rajasthan	Jaipur Metro Rail Corporation A/C:678605111973	Current	ICIC0006786

1.1.3 QUALIFICATION CRITERIA:

1.1.3.1 Eligible Applicants:

i. The bids for this work will be considered only from those bidders (proprietorship firms, partnerships firms, companies, corporations, consortia or joint ventures) who meet requisite eligibility criteria prescribed in the sub-clauses of Clause 1.1.3 of NIB. In the case of a JV or Consortium, all members of the Group shall be jointly and severally liable for the performance of whole contract. Also, each member shall be individually responsible for its duties as specified in the MOU/JV agreement submitted by the bidder in terms of clause 1.1.3.1 vii d.

Performance of each JV/Consortium partner shall also be judged on quarterly basis. In case, the performance of the partner(s) is not found satisfactory, actions as deemed appropriate by the Employer may be taken including termination of contract or termination of any of JV/Consortium member(s) from the contract i.e Part Termination of the contract. In case of part termination of contract, the Performance Security(ies) submitted by the member(s) for their portion of work in contract as per their share in JV/Consortium shall be forfeited and the

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C3 Form of Bid

The Form of Bidder shall be completed and signed by a duly authorized and empowered representative of the Bidder. If the Bid comprises a partnership, consortium or a joint venture the Form of Bid shall be signed by a person who is duly authorized by each member or participant thereof or by authorized signatory of each member. Signatures on the Form of Bid shall be witnessed and dated. Copies of relevant powers of attorney shall be attached.

C4 Outline Quality Plan

The Bidder shall submit **Appendix-3** of Forms of Bid to form part of his Bid an Outline Quality Plan illustrating the intended means of compliance with the Employer's Requirements (Volume 3) and setting out in summary form an adequate basis for the development of the more detailed document required under Clause 16 of the SCC. 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 requirements of the Contract.

C5 Outline Safety & Health Plan and Outline Environment Plan

C5.1 The Bidder shall submit Appendix-4 of Forms of Bid to form part of its Bid an Outline Safety & Health Plan and Outline Environment Plan which shall contain sufficient information to demonstrate clearly the Bidder's proposals for achieving effective and efficient safety & health and environment procedures. The Outline Safety & Health Plan and Outline Environment 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 & Health and Environment as required by the Employer's Requirements (Volume 3) and **Clause 8 & 9 of the SCC**.

C5.2 The Outline Safety & Health Plan and Outline Environment Plan shall be headed with a formal statement of policy in relation to safety & health and environment 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 Contract specific Site Safety & Health Plan and Site Environment Plan to be submitted in accordance with **Clause 8 & 9 of the SCC**.

C5.3 The Bidder may be requested by JMRC in writing to amplify, explain or develop his Outline Safety & Health Plan and Outline Environment Plan prior to the date of acceptance of the Bid and to provide more details with a view to reaching provisional acceptance of such plans.

C5.4 **C&D Waste Management and Use of Recycled Products in Jaipur/Rajasthan. -**

Regarding Construction and Demolition(C&D) Waste management and use of recycled products in Jaipur / Rajasthan, the bidders must note that;

a) They have to devise appropriate measures for management of Construction and Demolition(C&D) Waste generated including its processing and for using the recycled products in the best possible manner. The Bidder shall adhere Construction & Demolition (C&D) Waste Management Rules, 2016 notified by Govt. of India. The bidder should also take note of advisory of Govt. of Rajasthan in combating and mitigating climate change phenomenon and giving high priority to Swachh Bharat Mission of Govt. of India.

b) Refer Clause No. 52.7.3 of Conditions of contract on Safety & Health and Environment.

c) Compliance certificate and details of compliance of these conditions shall be submitted by the Contractor along with respective running account bill. **The payment of running account bill shall be released by the Employer after verification and certification by the Engineer.**

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C9.2 Maintenance

C9.2.1 The Contractor shall be responsible for maintaining the Works until final hand over to the Employer and for the provision of relevant maintenance manuals and drawings.

C9.2.2 The Contractor shall be responsible for making good any and all defects of materials and workmanship, in the Works for the period stated in the General Conditions of Contract

C9.2.3 The Contractor shall be responsible for the security of the Site during the construction phase of the Contract, until the issuance of a Taking-Over Certificate.

C10. Payment Schedule:

The payment for items given in Bill of Quantity (Volume 6) shall be made on the basis of actually executed quantities.

C11. Sub-Contracts

C11.1 Sub-contracting, excluding design work shall be generally limited to 50% of the Contract price. The terms and conditions of sub-contracts and the payments that have to be made to the sub-contractors shall be the sole responsibility of the Contractor.

C11.2 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. The value of each sub-contract shall be provided by the Contractor to the Engineer. The Contractor shall certify that the cumulative value of the sub-contracts (including those up to Rs. 5 million each) awarded is within the aforesaid 50% limit. In this regard the Bidder's attention is invited to Clause 4 of SCC.

C11.3 The Terms and Conditions of the sub-contract are the sole prerogative of the Contractor and are deemed to be included in the contract price.

C12. Staffing Schedule and Related Details

C12.1 The Bidder shall submit with his Bid (**Appendix-7** of Form of Bid) a staffing schedule containing the names, qualifications, professional experience and corporate affiliation of all proposed management personnel (above the level of shift supervisor) and specialists for this work. 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. The proposed staffing plan shall be in conformity with the **Annexure 3 and Annexure 4** of ITB.

C12.2 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.

C12.3 The key staff for execution of this work shall be from that member of the JV/Consortia who has the experience of similar work and on whose experience the JV/Consortia qualifies the criteria of work experience. If the JV qualifies on the credentials of work eligibility by the foreign partner, then the Project Manager deployed shall be an expatriate having minimum 15 years of total experience out of which 05 years should be in projects of similar nature as mentioned in Annexure-3 & Annexure-4 of ITB. The Project Manager must be involved actively in the project execution. He will be required to attend all meetings/inspections conducted by JMRC officials or Its Engineer. **He must take prior permission from Engineer for obtaining leave during his tenure as Project Manager**. In case the JV do not follow these instructions, action shall be initiated under the conditions of contract to impose penalty or to terminate the contract. The JV/Consortium members shall submit undertaking to this effect in Appendix-6A of Form of Bid.

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In case the successful bidder is a JV/Consortium having a foreign partner and if the experience of civil works for the purpose of qualifying the minimum eligibility criteria is fulfilled by the foreign partner then the foreign partner shall submit an additional Bank Guarantee (In addition of performance security) of an amount equal to 1% of the contract value as per LOA for the fulfillment of the condition of deployment of key staff and the expatriate Project Manager for the project.

The foreign partner shall submit bank guarantee from their respective bank account. Bank guarantee executed from the bank accounts of JV/Consortium or any other bank account shall not be accepted.

This bank guarantee shall be valid up to the completion period of the contract and shall be from Scheduled commercial Bank (including Scheduled Commercial Foreign Banks) in India in the currency in which the contract price is payable. This Bank Guarantee shall be furnished to the employer within 30 (thirty) days of receipt of the Letter of Acceptance. The form of this Bank Guarantee provided in **Annexure-7A** of ITB.

C13. Contractor's Equipment

C13.1 The contractor shall deploy plants and equipment required to complete the work as per the schedule and within the completion period with minimum of numbers given in **Annexure-5 of ITB.**

C14. Proposals for Use of Work Areas

C14.1 The Bidder shall note the requirements of **Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013.**

C14.2 The Bidder shall note the provision contained in Employer's Requirements.

C14.3 The Bidder is to note that the Contractor will be fully responsible for the provision of all utility services like water, electricity, sewerage etc necessary for the construction and completion of the Works.

C15. Pricing Document

C15.1 The Pricing Document is included in Bill of Quantities; Volume 6. The Bidder shall complete the Pricing Document in accordance with the instructions given in Bill of Quantity/Pricing Document.

The completed Pricing Document including price of minor deviations in **Annexure-13A** of BOQ for such deviation as mentioned in **Appendix-13** of FOB shall be submitted.

C15.2 The price of each such minor deviation will be the price which the bidder agrees to offer to the employer from his quoted offer in BOQ if deviation is agreed by the employer. Any such deviation without a price shall not be considered and will be treated as withdrawn by the bidder. Any other deviation mentioned anywhere in the submission other than in **Appendix-13** of FOB shall be considered as if mentioned inadvertently by the bidder and shall be considered as withdrawn without any confirmation from the bidder.

C15.3 The Bidder is to note the S.No. (iv) of **Appendix-1 of FOB** for Liquidated Damage for delay in completion of the work.

C16. Currencies of Bid and Payment

C16.1 The Bidder shall give his priced offer for BOQ in Indian Rupees Only.

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E5.2 Correction of Errors (Rule-64 of RTPPR-2013)

E5.2.1 Bids determined to be technically acceptable after technical evaluation will be checked by the Employer for any arithmetical errors in computation and summation during financial evaluation. Errors will be corrected by the Employer as follows:

a) If there is a discrepancy between the unit price and the total amount derived from the multiplication of the unit price and the quantity, the unit price as quoted will normally govern unless in the opinion of the Employer there is an obviously gross misplacement of the decimal point in the unit price, in which event, the total amount as quoted will govern; and

b) if there is a discrepancy in 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 amounts in figures and in words, the amount in words will govern in case of physical form of bidding unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to clause (a) and (b) above. However, in case of e-bidding, amount in figures will govern: and

E5.2.2 If a Bidder does not accept the correction of errors as outlined above, his Bid will be rejected and the Bid security shall be forfeited.

E5.3 Comparison of Bids

Bids will be compared in **Indian Rupees** only.

E5.4 Deleted.

E5.5 For the purpose of comparative evaluation of bids received, the sum total of following shall be considered:-

(i) The amount quoted as lump sum by the bidder for the given schedule-A, and

(ii) The total amount worked out from the quoted percentage (above/below/at par) by the bidder for the given Schedule-B & C.

The total value of above thus obtained in equivalent INR shall be compared amongst various bidders to determine the lowest evaluated bid. Provision of clause 1.2.1 (ix) of NIB shall also be considered for financial evaluation.

E5.6 If the lowest bidder as evaluated as per E5.5 has given some minor deviations then the Employer has right to accept some or all such minor deviation and the offer of the lowest will be reduced by the price of such accepted deviations.

E5.7 The Employer reserves the right to accept or reject any variation, deviation. Variations, deviations and other factors which are in excess of the requirements of the Bid Documents or otherwise result in the accrual of unsolicited benefits to the Employer shall not be taken into account in bid evaluation.

E6 Indigenisation

E6.1 Bidders are encouraged to involve domestic firms in the Contract organization and procurement processes.

Instructions to Bidders

Annexure 6 (As per Clause C 18.1)

FORM OF BANK GUARANTEE FOR BID SECURITY

(To be stamped in accordance with Stamp Act, if any, of the country of issuing bank)

1. KNOW ALL MEN by these presents that we ……..... (Name of Bank) having our registered office at …… (**Name of country and its office address in India**) (hereinafter called "the Bank") are bound unto Jaipur Metro Rail Corporation Limited (hereinafter called "the Employer") in the sum of Rs. …….. for which payment will and truly to be made to the said Employer, the Bank binds itself, its successors and assigns by these presents.

2. WHEREAS……(Name of Bidder) (hereinafter called "the Bidder") has submitted its bid dated……. for ……..(Name of the work as per clause 1.1.1 of NIB) hereinafter called the bid. AND WHEREAS the Bidder is required to furnish a Bank Guarantee for the sum of Rs. ……. as Bid Security against the Bidder's offer as aforesaid. AND WHEREAS……(Name of Bank) have, at the request of the Bidder, agreed to give this guarantee as hereinafter contained.

3. We further agree as follows:

   a. **Deleted.**

   b. That the guarantee hereinbefore contained shall not be affected by any change in the constitution of our Bank or in the constitution of the Bidder.

   c. That any account settled between the Employer and the Bidder shall be conclusive evidence against us of the amount due hereunder and shall not be questioned by us.

   d. That this Guarantee commences from the date hereof and shall remain in force till ……. (date to be filled up)(date to be filled as mentioned in Clause 1.1.2 of NIB)

   e. That the expression 'the Bidder' and 'the Bank' herein used shall, unless such an interpretation is repugnant to the subject or context, include their respective successors and assigns.

4. **THE CONDITIONS OF THIS OBLIGATION ARE**:

   a. if the Bidder withdraws his Bid during the period of Bid validity specified in the Form of Bid, or

   b. if the Bidder does not accept the correction of his bid price in terms of Clause **E5.2** of the "Instructions to Bidders ".

   c. if the Bidder having been notified of the acceptance of his bid by the Employer during the period of bid validity:

      i. fails or refuses to furnish the Performance Security in accordance with Clause **F 5.1** of the "Instructions to Bidders" and/or

      ii. fails or refuses to enter into a Contract within the time limit specified in Clause **F4** of the" Instructions to Bidders".

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d. **if the Bidder withdraws his bid after opening of his financial package (in two package system during the period of validity of his bid or breaches any provision of code of integrity prescribed for bidders specified in the RTPP-Act-2012 and Chapter VI of RTPP-Rules-2013, or in case of (c) above, beside forfeiture of Bid Security, the bidder shall not only be debarred from participating in the re-bid of same work but also will be debarred from participating in any bid of JMRC for a period of three years from the date of withdrawal of his bid or from the date of issue of letter of annulment of LOA, as the case may be.**

We undertake to pay to the Employer mere on demand without demur up to the above amount upon receipt of his first written demand, without the Employer having to substantiate his demand provided that in his demand the Employer will note that the amount claimed by him is due to him owing to the occurrence of any one or more of the conditions (a), (b), (c) **and (d)** mentioned above, specifying the occurred condition orconditions.

5. Notwithstanding anything contained herein:

a) Our liability under this Bank Guarantee shall not exceed Rs……(Rupees……)

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) The amount covered under the above Bank Guarantee shall be automatically credited in the accounts of Jaipur Metro Rail Corporation in ICICI BANK LTD, Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur-302005 through IFSC: ICIC0006786. Bank Account No. 678605111973 on the date of expiry or its validity, unless the agencies get it re-validated well before its expiry date or produce NOC from Jaipur Metro Rail Corporation Ltd. in writing for its release.

	Signature of **Authorized Official of the Bank**
Signature of Witness Name : ……..……. Address : ……	Name of Official …….. Designation …….. Stamp/Seal of the Bank ……

Notes:

1 Please note that, as per clause C18.1, any deviation in Bid security with regard to amount, validity and format shall be considered as material deviation and bid shall be dealt accordingly.

2 The stamp papers of appropriate value shall be purchased in the name of the Bank, who issues the 'Bank Guarantee'.

3 The 'Bank Guarantee' shall be from the Scheduled Commercial Bank based in India, acceptable to Employer.

4 Bid Security to be furnished on appropriate non-judicial stamps & should be valid for the next 07 months from the bid opening date.

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Instructions to Bidders

Annexure 7 (As per ClauseF5.1)

FORM OF PERFORMANCE SECURITY (GUARANTEE) BY BANK

(To be given by a Scheduled Bank in India)

(To be executed on non-judicial stamp)

(Rule-75 & 75A of RTPPR-2013)

(Refer Clause F5 of "Instructions to Bidders")

(Rule-75 of RTPPR-2013)

1. This deed of Guarantee made this day of …….. (month &year) between Bank of……..…….(herein after called the "Bank")of the one part ,and Jaipur Metro Rail Corporation Limited (hereinafter called "the Employer") of the other part.

2. Whereas Jaipur Metro Rail Corporation Limited has awarded the contract for_____(Name of work as per Clause 1.1.1 of NIB) (hereinafter called the contract) to …… (Name of the Contractor) hereinafter called the Contractor.

3. AND WHEREAS the Contractor is bound by the said Contract to submit to the Employer a Performance Security for a total amount of Rs……(Amount in figures and words).

4. Now we the Undersigned…….(Name of the Bank) being fully authorized to sign and to incur obligations for and on behalf of and in the name of…….. (Full name of Bank), hereby declare that the said Bank will guarantee the Employer the full amount of Rs. …… (Amount in figure sand Words) as stated above.

5. NOW THEREFORE, we hereby affirm that we are the Guarantor and responsible to you, on behalf of the Contractor and we hereby unconditionally, irrevocably and without demur undertake to immediately pay to the Employer upon first written demand and without cavil or argument, any sum or sums within limits of …….. (Amount of Guarantee) as aforesaid without reference to the Contractor and without your needing to prove or show grounds or reasons for your demand for the sum specified therein. The Bank shall pay to the Employer any money so demanded notwithstanding any dispute/disputes raised by the Contractor in any suit or proceedings pending before any Court, Tribunal or Arbitrator/s relating thereto and the liability under this guarantee shall be absolute and unequivocal.

6. This Guarantee is valid till …….. (The initial period for which this Guarantee will be valid shall be as stated in Clause 4.2.1 of the "General Conditions of Contract".)

7. At any time during the period in which this Guarantee is still valid, if the Employer **agrees to grant a time extension to the Contractor or if the Contractor fails to complete** the Works within the time of completion as stated in the Contract, or fails to discharge himself of the liability or damages or debts as stated under Para 5, above, it is understood that the Bank will extend this Guarantee under the same conditions for the required time on demand by the Employer and at the cost of the Contractor.

8. The Bank agrees that no change, addition, modifications to the terms of the contract Agreement or to any documents, which have been or may be made between the Employer and the Contractor, will in no way release us from the liability under this Guarantee; and the Bank, hereby, waives any requirement for notice of any such change, addition or modification to the Bank.

Jaipur Metro Rail Corporation Director (Project) JAIPUR

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 the Scheduled Commercial Bank based in India, acceptable to Employer

3 The 'Bank Guarantee' must be issued on the Structured Financial Messaging System (SFMS) platform.

4 A separate copy of the BG has to be sent by the issuing bank to the Employer's bank through SFMS. The details of Employer's bank are as under.

ICICI BANK LTD; Jaipur Metro Rail Corporation.
Branch:-Tilak Marg, C-Scheme, Jaipur.
Khanij Bhawan, Tilak Marg, C-Scheme, Jaipur-302005, Rajasthan.
A/C:678605111973
IFSC: ICIC0006786

5. Following codes are to be used by issuing bank for the purpose of Confirmation and amendment in Bank Guarantees:-

Code	Purpose
MT760	Confirmation of bank guarantee
MT767	Amendment in bank guarantee

6. Bank Guarantee issued on the SFMS platform with any other code other than mentioned above for the purposes shall not be acceptable to the employer.

Jaipur Metro Rail Corporation Director (Project) JAIPUR

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Jaipur Metro Rail Corporation Director (Project) JAIPUR

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Jaipur Metro Rail Corporation Director (Project) JAIPUR

Instructions to Bidders
(Annexure – 7D Clause F5.1.1)
Performance Security Declaration (Rule-75 of RTPPR-2013)
(To be executed on a non-judicial stamp)

Date: _____ [insert date (as day, month and year)]
Contract Name and No.: _____ **[insert** name and number of Contract]
To: _____ [insert Designation and complete address of Procuring Entity]
We, the undersigned, declare that :

1. We are a (Strike out which is not applicable. Please enclose an authentic certificate issued by the Administrative Department of respective government under which the bidder entity is constituted.):

   (i) Departments/Boards of the State Government or Central Government; or

   (ii) Government Companies as defined in clause (45) of section 2 of the Companies Act, 2013; or

   (iii) Company owned or controlled, directly or indirectly, by the Central Government, or by any State Government or Governments, or partly by the Central Government and partly by one or more State Governments which is subject to audit by the Auditor appointed by the Comptroller and Auditor-General of India under sub-section (5) or (7) of section 139 of the Companies Act, 2013; or

   (iv) Autonomous bodies, Registered Societies, Cooperative Societies which are owned or controlled or managed by the State Government or Central Government.

2. We understand that we are eligible for submission of a Performance Securing Declaration in lieu of Performance Security under Rule 75 (1) of RTPP Rules, 2013.

3. We understand that, according to your conditions, the Contract must be supported by a Performance Security Declaration as a guarantee to ensure fulfillment of our all performance obligations under the Contract for _____ [insert name of subject matter of procurement]

4. We accept that we will automatically be suspended from being eligible for bidding in any contract with you for the period of time of 3 years as per section 46 of RTPP Act, 2012 [Procuring Entity to indicate here the period of time for which the Procuring Entity will declare a Bidder ineligible to be awarded a Contract if the performance Security Declaration is to be executed] starting on the date that we receive a notification from you, the bid accepting authority, MD / CMD, JMRC [Designation of the Procuring Entity] that our Performance Security Declaration is executed, if we are in breach of any of our performance obligation under the conditions of the Contract.

5. We understand this Performance Security Declaration shall expire after 60 days of completion of our all obligations under the Contract including Defect Liability, warranty/ Guarantee, operation, maintenance, etc. in accordance with the conditions of the Contract.

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Signed: _____ [insert signature of person whose name and capacity are shown]
In the capacity of: _____ [insert legal capacity of person signing the Performance Security Declaration]
Name: _____ [insert complete name of person signing the Declaration]
Duly authorized to sign the Contract for and on behalf of: _____ [insert complete name and address of the Bidder]
Dated on day of _ [insert date of signing]
Corporate Seal _____

FORM OF BID - Appendix-30

Power of Attorney for Authorized Signatory of Bidder Firm.

POWER OF ATTORNEY FOR SIGNING THE BID

Know all men by these presents, We……(name of the firm and address of the registered office) do here by irrevocably constitute, nominate, appoint and authorize Mr./Ms.(name)…… Son/daughter/wife of…… and presently residing at……., who is presently employed with us and holding the position of…… …….as our true and lawful attorney (hereinafter referred to as the "Attorney")to do in our name and on our behalf, all such acts, deeds and things as are necessary or required in connection with or incidental to submission of our **CONTRACT ICB No.JP/EW/1C(Underground)/03: "Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar dead end Ch:10387.860 to Underground ramp end Ch:13040 of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, water supply, Sanitary Installations and Drainage Works at Jaipur, Rajasthan, India."** including but not limited to signing and submission of all Bids, bids and other documents and writings, and other conferences and providing information/ responses to JMRC or its Engineer, representing us in all matters before JMRC or its Engineer, signing and execution of all contracts including the Contract and undertakings consequent to acceptance of our bids, and generally dealing with the JMRC or its Engineer in all matters in connection with or relating to or arising out of our Bid for the said Projects and/or upon award thereof /or till the entering into of the Contracts with JMRC.

AND we hereby agree to ratify and confirm and do hereby ratify and confirm all acts, deeds and things lawfully done or caused to be done by our said Attorney pursuant to and in exercise of the powers conferred by this Power of Attorney and that all acts, deeds and things done by our said Attorney in exercise of the powers hereby conferred shall and shall always be deemed to have been done us.

IN WITNESS WHEREOF WE , ……..THE ABOVE NAMED PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON THIS ……DAY OF……..,(Month & Year).

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

For (Signature)

(Name, Title and Address) Witnesses:

Accepted

……Signature)

(Name, Title and Address of the Attorney)

(Notarized)

Notes:

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 chartered documents of the executants and when it is so required, the same should be under common seal affixed in accordance with the required procedure. Also, wherever required, the Applicant should submit for verification the extract of the chartered documents and documents such as a resolution/power of attorney in favors of the person executing this Power of Attorney for the delegation of power hereunder on behalf of the Applicant.

The Applicant should submit Board of Directors resolution in which proposal of authorizing a particular signatory was passed.

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1 **Sub-Clause 1.4** **Contract Agreement** The Form of Contract Agreement shall be in the format given in Schedule 2 to these Special Conditions of Contract.

2 **Sub-Clause 3.2** **Functions of Engineer**

In addition to the duties mentioned in Clause 3.2 of General Conditions of Contract:

(i) **Engineer** shall watch and inspect the Works, monitor the test results and examine any material to be used and workmanship employed by the Contractor in connection with the Works;

(ii) **Engineer** shall carry out such duties and exercise such powers vested in the Engineer in accordance with the provisions of the Contract;

(iii) **Engineer** shall issue instructions which in his opinion are necessary for the execution of the Works; and

(iv) **Engineer** may issue any other instruction which in his opinion is desirable in connection with the Works.

(v) Engineer will assist in Technical , Contractual and in Arbitration matter **and judicial forums**.

(vi) Engineer shall submit one set of updated GFC to Employer as and when updated

In case The Engineer is employee of any agency hired by the Employer, the Engineer shall take the approval of the Employer for all technical and financial matters otherwise he shall be deemed to have taken the approval of the Employer.

3 **Sub-Clause 4.2.4** **Guarantees, Warranties and Undertakings**

The forms of Contractor warranty shall be in the format given in the Schedule-1 of these Special Conditions of Contract.

4 **Sub-Clause 4.5** **Sub-Contractors**

The sub-contracting, excluding design work shall be limited to 50% of the Contract Value. The value of a sub-contract, other than for Design work as when awarded, should be intimated by the Contractor to the Engineer and it should also be certified that the cumulative value of the sub-contracts awarded so far is within the aforesaid limit of 50%. A copy of the contract between the Contractor and Sub-Contractor shall be given to the Engineer within 15 days of signing and in any case 7 days before the Sub Contractor starts the Work and thereafter the Contractor shall not carry any modification without the consent in writing of the Engineer. The terms and conditions of sub-contracts and the payments that have to be made to the sub-contractors shall be the sole responsibility of the Contractor. Payments to be made to such sub-contractors will be deemed to have been included in the Contract price. However, for major sub-contracts (each costing over Rs. 50 lacs), it will be obligatory on the part of the Contractor to obtain consent of the Employer. The Employer will give his consent after assessing and satisfying himself of the capability, experience and equipment

Jaipur Metro Rail Corporation Director (Project) JAIPUR

resources of the sub-contractor. In case the Employer intends to withhold his consent, he should inform the Contractor within 15 days to enable him to make alternative arrangements to fulfil his programme.

The Contractor shall provide sufficient superintendence, whether on the site or elsewhere, to ensure that the work to be carried out by a sub-contractor complies with the requirements of the Contract.

In the case of sub-contracts for electrical and mechanical works, which the Contractor intends to procure on the basis of outline design, design briefs and performance specification, the Contractor shall, prior to inviting bids from sub-contractors, submit such documents to the Engineer for review.

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 the Contractor to comply with his obligations under the Contract.

Notwithstanding any consent to sub-contract given by the Engineer, if in his opinion it is consider necessary, the Engineer shall have full authority to order the removal of any sub-contractor from the Site or off-Site place of manufacture or storage.

5 **Sub-Clause 4.9** **Site Data**

The Geotechnical and other related data provided by the Employer are based on the investigation conducted by JMRC and are for reference purposes only. The Bidder should satisfy himself with the data furnished and make his own investigations, if required, for submitting his offer. Any change in design or construction methodology later during execution on account of change will be borne by the Contractor.

The Contractor shall not be relieved from any risk or obligation imposed on or undertaken by him under the Contract on any such ground or on the ground that he did not or could not foresee any matter which may affect or have affected the execution of the Works, or compliance with his other obligations under the Contract.

6 **Sub-Clause 4.11** **Access Route**

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 vehicles so that movement of Contractor's Equipment, Plant and Materials from and to the Site is limited so 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 what so arising out of or in relation to any such matters.

If during the execution of the Works the Contractor shall receive any

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claim arising out of the execution of the Works in respect of damage to highways or bridges **or any other public utility or private property,** 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.

7 **Sub-Clauses 4.13** **Programmes**

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 stretches of the work to give access to other interfacing contracts as per the requirement of project from time to time.

The Engineer on receipt of a programme shall inform the Contractor in writing within 21 days after receipt of the above information;

(a) that the programme has received his consent; or

(b) that the programme is rejected, in which case reasons for such rejection shall be given; or

(c) that further information is required to clarify or substantiate the programme or to satisfy the Engineer as to its reasonableness, or

(d) that the programme has received his consent subject to incorporation of comments attached to the Notice of No Objection.

Provided that if none of the above actions is taken within the 30 day period, the Engineer shall be deemed to have given consent to the programme submitted.

The Contractor shall, within 21 days of receiving notification under sub-paragraphs (c) or (d) above, provide further information requested or the programme shall be deemed to have been rejected. The Engineer shall, within 21 days of receipt of such further information, either reject the programme or give his consent.

In the event of a programme being rejected, or deemed to have been rejected, the Contractor shall, within 21 days thereafter, submit a revised programme taking account of the reasons given for the rejection or incorporating further information requested by the Engineer, as the case may be.

The Contractor, following receipt of consent to the Works Programme, may at any time, submit to the Engineer an amended version. In the event that the Engineer grants an extension of time, instructs an Employer's Variation, or on the occurrence of any event or happening or situation, which could materially affect the progress of the Works, the Contractor shall submit a revised programme to the Engineer for his consent.

If the Engineer feels that there is a significant deviation between the actual or anticipated progress of the Works and the Works programme, the Engineer may require the Contractor to submit a revised/modified programme to ensure timely completion of Whole of Works or a Key Date or a milestone. The Contractor shall submit such revised

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SCHEDULE- 1

CONTRACTOR'S WARRANTY

(Refer clause 3 of SCC and Sub-Clause 4.2.4 of GCC)

THIS WARRANTY is being issued on the …… day of ……Month …… Year

(1) **in favour of Jaipur Metro Rail Corporation by ..... [Name of Contractor] [and [see Note 1]] ([Jointly] "the Contractor")**

(2) [Jaipur Metro Rail Corporation Limited] [of]/[whose registered office is at] [1st Floor, A-Wing, Admin Building,bhrigu Path, Mansarovar Metro Depot, Jaipur-302020] (together with its successors and assigns, "the Employer").

WHEREAS

(A) By a contract ____ dated [ ] ("the Contract") made between (1) the Jaipur 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) [See Note 3].

(C) At the request of the Employer and pursuant to the terms of the Contract the Contractor has agreed to enter into this Warranty.

NOW IT IS AGREED AS FOLLOWS:

1. The Contractor hereby warrants and undertakes that:

   (a) He 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) he owes a duty of care to the Employer in relation to the performance of its duties under the Contract; and

   (c) he will replace free of cost to the Employer any defect or failure of equipment provided in the Works for a period of _____ (as specified) months from the date of Taking Over of the last Section of the Works; and

   (d) he agrees that should any design modification be required to any section or component due to any defect, the period of _____ (as specified) months shall re-commence from the date when the modified part is commissioned into service, and such modification shall be carried out free of cost to the Employer in all sub-systems and systems for all sections; and

   (e) he shall maintain the manufacture or spare of replacement parts for at least **10** years.

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.

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SCHEDULE 2

FORM OF CONTRACT AGREEMENT

(Refer Clause F4 of ITB)

This Agreement is made at Jaipur on the …….. day of …….. (month**) 2023** Between Jaipur Metro Rail Corporation Limited, 1st Floor, A-Wing, **Admin Building,bhrigu Path, Mansarovar Metro Depot, Jaipur-302020**

hereinafter called "the Employer" of the one part and **a company incorporated under the provisions of Companies Act, 1956** ……..…. (Name & Address of Contractor **or partnership firm or sole proprietorship firm or an individual)** hereinafter called "the Contractor" of the other part. Whereas the Employer is desirous that (*** certain Goods and Services should be provided and) the Works should be executed, viz.……(Name of work as mentioned under Clause 1.1 of NIB) hereinafter called "the Works" and has accepted a Bid by the Contractor for the execution and completion of such works (*** as well as guarantee of such works) and the remedying of defects therein.

This agreement is signed between ……. (for and on behalf of the Employer) and ……. (for and on behalf of the Contractor).

NOW THIS AGREEMENT WITNESSETH as follows:

1. In this Agreement words and expression shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. These documents shall be signed by…….. (for and on behalf of the Employer) and …… (for and on behalf of the Contractor).
    a) Notice Inviting Bid (NIB)
    b) Instructions to Bidders (ITB)(Including Annexures)
    c) Special Conditions of Contract (SCC)
    d) General Conditions of Contract (GCC)
    e) Conditions of contract on Safety & Health & Environment (SHE).
    f) Outline Design Specifications
    g) Outline Construction Specification for Civil Works
    h) Technical Specification for Architecture & Finishing Works
    i) Bid Drawings
    j) Bill of Quantities
    k) Form of Bid with Appendix
    l) Letter of acceptance (LOA)
    m) Contractor's proposal submitted along with the bid
    n) Any other item as applicable

    The modifications to the biddocuments communicated through the Addenda (……. Numbers) hosted on the e-bidding portal at the time of bid have been incorporated in the consolidated contract documents.

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3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Employer to execute and complete the works by **…… and remedy any defects therein in conformity in all respects with the provisions of the Contract.

4. 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 Total Contract Price of **` ……. being the sum stated in the letter of acceptance subject to such additions thereto or deductions there from as may be made under the provisions of the Contract at the times and in the manner prescribed by the Contract.

5. **OBLIGATION OF THE CONTRACTOR**

The contractor shall ensure full compliance with **all applicable laws in force in India including but not limited to** tax laws with regard to this contract and shall be solely responsible for the same. The contractor shall submit copies of acknowledgements evidencing filing of returns every year and shall keep the Employer fully indemnified against liability of tax, interest, penalty etc. of the contractor in respect thereof, which may arise.

6. **JURISDICTION OF COURT**

The Courts at Jaipur,Rajasthan , India shall have the exclusive jurisdiction to try all disputes arising out of this agreement between the parties.

IN WITNESS WHEREOF the parties hereto have caused their respective Common Seals to be hereunto affixed / (or have hereunto set their respective hands and seals) the day and year first above written.

For and on behalf of the Contractor	For and on behalf of the Employer
Signature of the authorized official	**Signature of the authorized official**
Name of the official	Name of the official
Stamp/Seal of the Contractor	Stamp/Seal of the Employer
SEALED, SIGNED & DELIVERED	
By the said ……(Name) on behalf of the Contractor in the presence of :	By the said ……(Name) on behalf of the Employer in the presence of :
Witness	Witness
Name : ……..	Name : ……..
Address : ……..	Address : ……..

Note :

* To be made out by the Employer at the time of finalization of the Form of Agreement.

** Blanks to be filled by the Employer at the time of finalization of the Form of Agreement.

*** To be deleted if not applicable

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f) the location of and the authorisation required for and the means of diversion of any services and facilities required for the purposes of the Works.

The Contractor shall whenever be required by the Engineer, submit details of the arrangement and methods which the Contractor proposed to adopt for the execution of the Works. No alteration to these arrangements or methods shall be made without the approval of the Engineer.

Performance Security Amount **4.2**

4.2.1 (1) Performance security shall be **furnished within 30 days from the date of issue of LOA by the** successful bidder except the:-

(i) Departments/Boards of the State Government or Central Government;

(ii) Government Companies as defined in clause (45) of section 2 of the Companies Act, 2013;

(iii) Company owned or controlled, directly or indirectly, by the Central Government, or by any State Government or Governments, or partly by the Central Government and partly by one or more State Governments which is subject to audit by the Auditor appointed by the Comptroller and Auditor-General of India under sub-section (5) or (7) of section 139 of the Companies Act, 2013; or

(iv) Autonomous bodies, Registered Societies, Cooperative Societies which are owned or controlled or managed by the State Government or Central Government. However, a performance security declaration shall be taken from them. The State Government may relax the provision of performance security in a particular procurement or any class of procurement.

(2) The amount of performance security shall be ten percent of the amount of work order in case of procurement of works. In case of Small-Scale Industries of Rajasthan it shall be one percent of the amount of quantity ordered for supply of goods and in case of sick industries, other than Small Scale Industries, whose cases are pending before the Board of Industrial and Financial Reconstruction (BIFR), it shall be two percent of the amount of supply order.

(2A) Notwithstanding anything contained in sub-rule (2) above, where the State Government being of the opinion that there exist grave situations such as natural calamity or Pandemic or Epidemic diseases or floods etc. in which the economy is adversely affected, the State Government may, by order, direct the procurement entity to reduce the performance security taken in case of existing contracts of ongoing projects, from such date and on such conditions as may be specified in the order.

(3) Performance security shall be furnished in any one of the following forms-

(a) [Deleted]

(b) Bank Draft or Banker's Cheque of a scheduled bank;

(c) National Savings Certificates and any other script/instrument under National Savings Schemes for promotion of small savings issued by a Post Office in Rajasthan, if the same can be pledged under the relevant rules. They shall be accepted at their surrender value at the time of bid and formally transferred in the name of **Employer** with the approval of Head Post Master.

(d) Bank guarantee/s of a scheduled bank. It shall be got verified from the issuing bank. Other conditions regarding bank guarantee shall be same as mentioned in the rule 42 of RTPPR, 2013;

(e) Fixed Deposit Receipt (FDR) of a scheduled bank. It shall be in the name of **Employer** on account of bidder and discharged by the bidder in

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advance. The procuring entity shall ensure before accepting the Fixed Deposit Receipt that the bidder furnishes an undertaking from the bank to make payment/premature payment of the Fixed Deposit Receipt on demand to the **Employer** without requirement of consent of the bidder concerned. In the event of forfeiture of the performance security, the Fixed Deposit shall be forfeited along with interest earned on such Fixed Deposit.

(f) In case of procurement of works, the successful bidder at the time of signing of the contract agreement, may submit option for deduction of performance security from his each running and final bill @ 10% of the amount of the bill

(4) Performance security furnished in the form specified in clause (b) to (e) of sub-rule (3) shall remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the bidder, including warranty obligations and maintenance and defect liability period.

Additional Performance Security-

(1) In addition to Performance Security as specified in clause 4.2.1, an Additional Performance Security shall also be taken from the successful bidder in case of unbalanced bid. The Additional Performance Security shall be equal to fifty percent of Unbalanced Bid Amount. The Additional Performance Security shall be deposited in lump sum by the successful bidder before execution of Agreement. The Additional Performance Security shall be deposited through Demand Daft, Banker's Cheque, Government Securities or Bank Guarantee. Explanation : For the purpose of this rule,-

i. Unbalanced Bid means any bid below more than fifteen percent of Estimated Bid Value.
ii. Estimated Bid Value means value of subject matter of procurement mention in bidding documents by the Procuring Entity.
iii. Unbalanced Bid Amount means positive difference of eighty five percent of Estimated Bid Value minus Bid Amount Quoted by the bidder.

Enhanced performance security for variation: If the original contract price increased either by due to contractor's or due to employer's variation, the 10 % amount shall be deducted from the each running bill equal to amount of variation of the original contract price.

(2) **Performance Security and Additional Performance Security shall be payable and encashable at Jaipur only.**

Forfeiture **4.2.2** Failure of the successful Bidder to furnish the required Performance Security **and Additional Performance Security** shall be a ground for the annulment of the award of Contract and forfeiture of the Bid Security.

The whole of the Performance Security **including Additional Performance Security** amount shall be liable to be forfeited by the Employer at the discretion of the Employer, in the event of any breach of contract on the part of the Contractor. The forfeiture of the Performance Security amount by the Employer would be without prejudice to any amount(s) of money that the Employer may recover as Liquidated Damages or any other damages from the Contractor. The forfeiture of Performance Security amount by the Employer, would not operate as bar/set off/ adjustment from any amount of money which becomes recoverable or is recovered by the Employer. In case of the Performance Security Amount Bank Guarantee being invoked and forfeited by the Employer, the Contractor would immediately replenish the amount of Performance Security.

Release **4.2.3** (i) On completion of the entire Work/part Work, one half of the proportionate Performance Security **including Additional Performance Security** shall be refunded to the Contractor, on issue of Taking

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matters and payments amicably and speedily with the Sub-contractors.

4.5.4 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 JMRC. 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:-

"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 include necessary provisions for resolution of dispute if any arising between Contractor and Sub-contractor.

It is confirmed by the Sub-contractor that any claim/dispute arising out of the above Work shall be resolved in terms of agreement and shall not be raised before JMRC and also shall not make any claim against JMRC before any forum/court.

Signature of Contractor

Assignment of Contractor's and Sub- contractor's Obligations **4.6** The Contractor shall not assign a right or benefit under the Contract without first obtaining Employer's prior written consent, otherwise than by **charge in favour of the Contractor's bankers of any money due or to become due under the Contract.**

a. **Deleted.**
b. **Deleted.**

If a Sub-contractor's obligations extend beyond the expiry date of Defects Liability Period then the Contractor shall assign the benefits of such obligations to the Employer.

In the event that a Sub-contractor of any tier provides to the Contractor or any other Sub-contractor a warranty in respect of Plant, Materials or Services supplied in connection with the Works, or undertakes a continuing obligation of any nature whatsoever in relation to such Plant, Materials or Services (including without limitation an obligation to maintain stocks of spare parts) extending for a period exceeding that of the Defects Liability Period or where there is more than one Defects Liability Period exceeding that of the latest Defects Liability Period, and if the Engineer so directs in writing within 21 days of the expiry of the Defects Liability Period or the latest Defects Liability Period (as the case may be), the Contractor shall immediately assign or obtain the assignment of the benefit of such warranty or obligation to the Employer or at the direction of the Employer, to any third Party referred to in Sub- Clause 2.4.

Compensation for Breach **4.7** Any breach of Sub-clauses 4.5 to 4.6 shall entitle the Employer to rescind the Contract under Clause 13.2 of these conditions and also render the Contractor liable for loss or damage arising due to such cancellation.

Setting Out **4.8**

Accurate Setting Out **4.8.1** The Contractor shall be responsible for

a) the accurate setting out of the Works in relation to the original points, lines and levels of reference given by the Engineer in writing
b) the correctness of position, levels, dimensions and alignments of all parts of the Works
c) the provisions of all necessary instruments, equipment, apparatus and

a) the Contractor shall be responsible for keeping unauthorised persons off the Site; and

b) Authorized persons shall be limited to the Employees of the Contractor, Sub-contractor or persons authorized by the Engineer.

Contractor's Operations on Site **4.28** The Contractor shall confine his operations to the Site, and to any additional area which may be provided to the Contractor and agreed by the Engineer as working areas. The Contractor shall take all necessary precautions to keep his personnel and equipment within the Site and such additional areas, and to keep and prohibit them from encroaching on adjacent land.

Discoveries **4.29** All fossils, coins, articles of value or antiquity, structures and other remains or things of geological or archaeological interest, in addition to oil and other minerals discovered on the Site shall be the absolute property of the Government of India. The Contractor shall take all the necessary precautions to prevent its workmen or its Sub-contractors' workmen or any other person from removing or damaging any such article or thing and shall immediately upon discovery thereof, acquaint the Engineer of such discovery and carry out the instructions of the Engineer.

Publicity **4.30** The Contractor shall not publish or otherwise circulate alone or in conjunction with any other person, any articles, photographs or other materials relating to the Contract, the Site, the Works, the Project or any part thereof, nor impart to the Press, or any radio or television network any information relating thereto, nor allow any representative of the media access to the Site, Contractor's Works Areas, or off-Site place of manufacture, or storage except with the permission, in writing, of the Employer. The Contractor shall ensure that his Sub-contractors of any tier shall be bound by similar obligation and shall, if so required by the Employer, enforce the same at his own expense. The provisions of this Sub-clause shall not exempt the Contractor from complying with any statutory provision in regard to the taking and publication of photographs.

Disclosure of Relationship **4.31** If the Contractor or any partner of the Contractor or Director of the Contractor's company is closely related to any of the Officers of the Employer or the Engineer, or alternatively, if any close relative of an officer of the Employer or the Engineer has financial interest/stake in the Contractor's firm, the same shall be disclosed by the Contractor at the time of filing his Bid. Any failure to disclose the interest involved, shall entitle the Employer to rescind the Contract, without payment of any compensation to the Contractor**.** The Contractor shall note that he is prohibited from developing such interest during the Contract period **also**.

Use of Explosives **4.32** Explosives if required on the Work shall be used by Contractor only with prior Approval of the Engineer and in the manner and to the extent permitted by him. The Contractor shall be responsible for safe upkeep of such explosives in a special magazine as per the law on explosives as well as for taking all the precautions in the usage of the explosives with proper license and at Contractor's cost, sole risk and responsibility. The Contractor shall hold the Employer harmless and indemnify for the above.

Corrupt / Fraudulent/ Collusive/ Coercive Practices **4.33**

Definition **4.33.1** The Employer requires that the Bidders/Contractors, their designated Contractors and/or their Agents observe the highest standards of ethics during Biding and execution of this Contract. In pursuance with this Policy, the Employer:

a. defines, for the purpose of these provisions, the terms set forth below as follows:

i) "Corrupt practice" means the offering, giving, receiving or soliciting of

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anything of value to any officer/employee of JMRC or Engineer or to any other person to influence in the procurement process or in Contract execution and/or after the execution of the Contract.

ii) "fraudulent practice" means a concealment or misrepresentation of facts in order to influence a procurement process or during the execution of a Contract and/or after the execution of the Contract, which may or may not be to the detriment of the Employer and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Employer of the benefits of free and open competition and further includes concealment or misrepresentation of facts leading to breach of any of the Contract condition during execution of the Contract which may or may not be to the detriment of the Employer.

iii) "Collusive practice" means amongst Bidders (prior to or after bid submission) a scheme or arrangement designed to establish bid prices at artificial non-competitive levels and to deprive JMRC of the benefits of free and open competition.

iv) "coercive practice" means impairing or harming or threatening to impair or harm directly or indirectly, any Agency or JMRC or its employees/ consultants or its property, to influence improperly the actions of an Agency or JMRC or its employees/ consultants, obstruction of any investigation or auditing of a Procurement/ Contract process.

v) [Deleted].

vi) [Deleted].

vii) [Deleted].

b. If it is found that the Bidder/Contractor has indulged in corrupt/fraudulent/ collusive/coercive practices, actions such as rejection of bid/forfeiture of Bid Security or rescission/termination of Contract/forfeiture of Performance Sec**urity etc.**

c. Debarment from bidding.-

(1) A bidder shall be debarred by the State Government if he has been convicted of an offence -

(i) under the Prevention of Corruption Act, 1988 (Central Act No. 49 of 1988); or

(ii) under the Indian Penal Code, 1860 (Central Act No. 45 of 1860) or any other law for the time being in force, for causing any loss of life or property or causing a threat to public health as part of execution of a public procurement contract.

(2) A bidder debarred under sub-section (1) **of section 46 of RTPP Act-2012** shall not be eligible to participate in a procurement process of any procuring entity **of the State/JMRC** for a period not exceeding three years commencing from the date on which he was debarred.

(3) If a procuring entity finds that a bidder has breached the code of integrity prescribed in terms of section 11 **of RTPP Act-2012**, it may debar the bidder for a period not exceeding three years.

(4) Where the entire bid security or the entire performance security or any substitute thereof, as the case may be, of a bidder has been forfeited by a procuring entity in respect of any procurement process or procurement contract, the bidder may be debarred from participating in any procurement process undertaken by the procuring entity for a period not exceeding three years.

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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 10.2(a), (b) or (c), the Employer may (at his sole discretion):

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 defect or damage shall be recoverable from the Contractor by the Employer;

b) require the Engineer to determine and certify a reasonable reduction in the Contract Price; or

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.

Notwithstanding anything contained herein the Employer would be entitled in urgent and critical situation(s)/events to remedy the defects in the Work by himself or through others, at the Contractor's risk and cost. The cost incurred by the Employer in remedying the defect or damage shall be recoverable from the Contractor by the Employer.

Removal of Defective Work **10.5** If the defect or damage is such that it cannot be remedied expeditiously on the Site and if the Employer gives consent, the Contractor may, remove from the Site for the purposes of repair any part of the Works, which is defective or damaged. This consent may require the Contractor to increase the amount of Performance Security by the full replacement cost of these items or to provide other appropriate Security acceptable to the Employer.

Further Tests **10.6** If the remedying of any defect or damage is such that it may affect the performance of the Works, the Engineer may require that Tests on Completion, including Integrated Testing, be repeated to the extent necessary. The requirement shall be made by notice within 28 days after the defect or damage is remedied. Such Tests shall be carried out in accordance with Clause 7.11

Right of Access **10.7** Until the Performance Certificate has been issued, the Contractor shall have the right of access to all parts of the Works and to records of the working and performance of the Works, except as may be inconsistent with any reasonable security restrictions by the organisation responsible for operating the Works.

Contractor to Search **10.8** The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is one for which the Contractor is liable, the Cost of such search shall be added to the Contract Price.

Performance Certificate **10.9** The Contract shall not be considered to be completed until the Performance Certificate has been signed by the Engineer or authorized official of the Employer and delivered to the Contractor at the end of 'Defect Liability Period, stating the date on which the Contractor completed his obligations related to completion of works and rectification of defects during Defect Liability Period to the Engineer's satisfaction. Only the Performance Certificate shall be deemed to constitute approval of the Works.

Notwithstanding anything contained herein the Contractor would continue to remain liable to the Employer for any cost, loss, damage or compensation which arises from hidden or latent defect in the work executed by the Contractor under the Contract, even if such hidden and latent defects arise after the expiry of Defect Liability period or grant of Performance Certificate by the Employer under the Contract to the Contractor.

Unfulfilled Obligations **10.10** After the Performance Certificate has been issued, the Contractor and the Employer shall remain liable for the fulfilment of any obligation, which remains unperformed at that **time**. For the purposes of determining the nature and

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extent of any such obligation, the Contract shall be deemed to remain in force.

Emergency defect rectification **10.11** If any defect or damage is one requiring immediate attention from safety, environmental or operational viewpoint, the Engineer has the authority to proceed with rectification in any manner suitable and deduct such sums from the Contract Price.

11 Contract Price and Payment

The Contract Price Inclusions/ Exclusions **11.1**

11.1.1

i) Unless otherwise stated in the Special Conditions of Contract, the Contract Price, subject to any adjustment thereto in accordance with the Contract, shall be all inclusive (including all taxes, duties, royalties etc.)

ii) Nothing extra shall be payable over the quoted rates, notwithstanding any provision to the contrary in any law for the time being in force, save and except what is specifically provided in General or Special Conditions of Contract.

iii) The payment (as per this Sub-clause) of whatsoever nature shall be provided only for Permanent Works. No **payment** (as per this Sub-clause) shall be provided for Temporary Works and fuel.

Maintaining Records and Availing Exemptions **11.1.2**

i) In the event of exemption of custom duties, GST (CGST/IGST/SGST etc.) or any other cess/levy being granted by the Government in respect of the Works, the benefit of the same shall be passed on to Employer. The Contractor shall therefore maintain meticulous records of all the taxes and duties paid and provide the same as and when required by the Employer, so that the Employer is able to avail the reimbursement for which JMRC may issue a procedure order separately. Alternatively, the Employer may direct the Contractor to get the reimbursements based on exemption certificates / government's order and it shall be obligatory on part of the Contractor to get the reimbursements from the statutory authorities and pass on the benefit to JMRC.

ii) In case of Contractor's failure in availing the exemptions as stipulated above, the recovery of equivalent amount will be made from Contractor's dues.

Adjust in Contract Price **11.1.3** Adjustment in Contract price shall be done if a "Price Variation Formula" is given in the Special Conditions Of Contract otherwise it will be a fixed price contract.

Change in Taxes/Duty **11.1.4**

i. The liability, if any, on account of quarry fees, royalties, octroi and any other taxes and duties in respect of materials actually consumed **on** public work, shall be borne by the Contractor.

ii. If any rates of Tax are increased or decreased, a new tax is introduced in India only, an existing Tax is abolished, or any change in interpretation or application of any Tax resulting from a change or Introduction in India only due to any National or State Statute, Ordinance, Decree or other law or any regulation or bye-law of any local or other duly constituted authority in India only, in the course of performance of contract, which was or will be assessed on the Contractor, in connection with the performance of the Contract, an equitable adjustment of the Contract price shall be made to fully take into account any such change by addition to the Contract Price or deduction there from, as the case may be. However, these adjustments would be restricted to direct transactions between the **Employer** and Contractor only those items which are included in bid. Further, no adjustment of the Contract Price shall be made on account of variation in deemed export benefits, if any. Any increase or decrease which is included in price variation formula incorporated

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in the contract shall not be accounted for this purpose. Such increase including GST shall not be made in the extended period of contract for which the contractor alone is responsible for delay as determined by authority for extension of time.

Advances **11.2**

Mobilisation Advance **11.2.1** In respect of works costing more than Rs. 50.00 Crore (Rs. Fifty Crore) only the JMRC will, if provided in bidding document and requested by the Contractor to make mobilization advance, payment to the Contractor (at 9% per annum interest compounded annually basis) to assist in defraying the initial expenses that necessarily be incurred by the Contractor for mobilization. The total of such advance payments and the number & timing of installments is stated here under-

The total amount of Advance shall not be more than 10% of the **original contract value**. Payment of Mobilization Advance shall be made in two equal installments, **the** first installment shall not be more than 5% of the **original contract value** and on compliance of the requisite conditions as stated in the bid document, the remaining amount of **original contract value** shall be in second installment.

Release of Mobilization Advance:
On recommendation of the Engineer-in-charge, Mobilization Advance shall be released, as follows:
(i) Execution of the Agreement by the parties thereto,
(ii) Submission by the Contractor of an unconditional and irrecoverable bank guarantee in amounts and currencies equal to the advance payment being requested. Such bank guarantee shall be issued either by a Nationalized or Scheduled Bank as declared by the RBI, should be encashable in Rajasthan and acceptable to JMRC. The guarantee shall remain effective until the full recovery of the advance payment with total interest payable thereon. If the advance payment has not been repaid by the date 28 days prior to expiry date of B.G. the contractor shall extend the validity of B.G. until the advance payment has been repaid.

(iii) The mobilization advance payments shall be made in two installments as stated above, subject to the conditions described below. The advance payments shall be used by the Contractor exclusively for mobilization expenses, as per the programme approved by the Engineer-in-charge.

(iv) For this purpose, the Contractor shall open a dedicated Contract Bank Account in a bank located at office headquarter or in case of non-functioning of bank's branch at office headquarter than at the nearest place to office headquarter in Rajasthan and the JMRC will transfer or deposit the advance payments directly into the aforesaid dedicated Bank Account of the Contractor. The Contractor will not be permitted to use these funds for any purpose other than for expenditures under the Contract and the JMRC will be entitled to verify that the transactions from this account are used exclusively for the purposes for which they are intended. In case the advance payment is not utilized by the Contractor as per the approved programme and within the stipulated period to the satisfaction of the Engineer-in-charge, default proceedings as per the relevant clause of Contract, shall be initiated against the Contractor.

Release of First Installment: The JMRC will make, payment of the first installment of the mobilization advance only after the Contractor has fulfilled the following conditions :-
(a) Contractor has executed the agreement with JMRC
(b) Requisite Bank Guarantee has been deposited by the contractor.
(c) Established the dedicated Contract Bank Account.
(d) Any other condition mentioned in bid document in order to release installment.

Release of Second Installment: After the first installment of the advance payment has been utilized as per the approved programme, substantiated by

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Contract in this regard.

The Contractor, if required by the Engineer shall provide the details of utilisation of Mobilization Advance.

Provisional Payment Against Material at Site **11.3**

11.3.1 A provisional payment on account of main construction materials required for the Permanent Works, shall be paid on request of the Contractor after these materials are brought to Site, against an Indemnity Bond in a form acceptable to Employer is duly executed. The payment shall be limited to 80% of the actual value or assessed value of these materials and the total of such provisional payment on account of construction materials at a time shall be limited to three percent of Original Contract Value or likely average consumption of such materials for three months, whichever is less and at any time the total outstanding provisional payment against material at site shall not exceed four percent of the Original Contract Value. The valuation of the average consumption of such main construction materials shall be approved by the Engineer, whose decision shall be final.

Written Request for Advances/ Provisional Payment against Material at Site **11.3.2** The provisional payments as admissible, shall be payable only on Contractor's written request to the Employer/Engineer.

Recovery of Provisional Payment against Material at Site **11.3.3**

a. **Deleted.**

b. **Deleted.**

c. In case of provisional payment against Materials, the amount consumed every month shall be recovered from the next month's on-account bill and the recovery to be completed in 3 monthly installments. In case recovery could not be made due to any reason, interest will be charged at the rate equal to State Bank of India's Marginal Cost of fund based Lending Rate (MCLR) applicable for tenure of 01 year prevailing on the due date of recovery.

Application for Interim Payment Certificates **11.4**

11.4.1 In case of 'Lump Sum' Contract with cost centre and Milestone payment, the fixed Lump Sum Price shall be apportioned by the Contractor amongst the various Cost Centres. The amount thus apportioned under each Cost Centre will be further apportioned amongst various Milestones with the approval of the Employer. The Contractor shall be entitled to submit to the Engineer requests for interim payments only upon the achievement of one or more of the Milestones described in the Cost Centre.

At the beginning of each month, the Engineer shall issue to the Contractor certificate in respect of each Milestone due to be achieved in the preceding month stating:

(i) the date on which the Milestone was achieved; or

(ii) the non-achievement of the Milestone.

The Contractor shall submit a statement in three copies to the Engineer at the beginning of each month, in a form approved by the Engineer, showing

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procures less than the quantity specified in the bidding documents due to change in circumstances, the bidder shall not be entitled for any claim or compensation except otherwise provided in the bidding documents.
(2) Orders for extra items may be placed by the procuring entity in accordance with the Schedule of Powers of JMRC, up to 5% of the value of the original contract, if allowed in the bidding documents. The fair market value of such extra items payable by the procuring entity to the contractor shall be determined by the procuring entity in accordance with guidelines prescribed by the **administrative** deptt.
(3) Orders for additional quantities may be placed, if allowed in the bidding documents, on the rates and conditions given in the contract and the original order was given after inviting open competitive bids. Delivery or completion period may also be proportionately increased. The limits of orders for additional quantities shall be as under :-
(a) 50% of the quantity of the individual items and 50% of the value of original contract in case of works; and
(b) 50% of the value of goods or services of the original contract.
Provided that in exceptional circumstances and without changing the scope of work envisaged under the contract, a procuring entity may procure additional quantities beyond 50% of the quantity of the individual items as provided in the original work order with prior approval of the administrative deptt. as follows :-
(i) the procuring entity shall obtain prior approval for revised requirements from the competent authority for reasons to be recorded in writing. Wherever necessary, due to the quantum of orders for additional quantities, the procuring entity shall obtain prior and revised technical, financial and administrative sanctions from the competent authorities;
(ii) that the additional quantities so procured shall be part and parcel of the work being executed;
(iii) that the limit of 50% of the value of original contract shall not be exceeded in any case

(4) Deriving Rates For New Items / Negotiation :

This Sub-clause shall be applicable to all Schedules of BOQ including Lump-Sum Schedule.

(i) 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:

a) Cost of Materials at current market price, as actually utilized in the final finished Permanent Works, including a reasonable percentage for wastage and transportation.

b) 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.

c) 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.
d) 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.
An amount of 20% of items **4**(i) a), b), c) and d) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the

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estimated cost of Materials supplied free of cost to the Contractor.

f) 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 its execution arises.

(5).Value Engineering:

The Contractor may, at any time, submit to the Engineer-in- charge a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the Cost to the **Employer** of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the **Employer** of the completed Works, or (iv) otherwise be of benefit to the **Employer**.

The proposal shall be prepared at the Cost of the Contractor and shall include the items such as Deviations, Variations and Pricing.

If a proposal, which is approved by the Engineer-in-charge, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

i. the Contractor shall design this part,
ii. Contractor's General Obligations as per GCC 4.1 shall apply, and
iii. If this change results in a reduction in the Contract value of this part, the Engineer-in-charge shall proceed in accordance with Clause 3.5 to agree or determine a fee, which shall be included in the Contract Price.

13 Termination of the Contract

Notice to Contractor **13.1** If the Contractor fails to carry out any of his obligations, or if the Contractor is not executing the Works in accordance with the Contract, the Engineer may give notice to the Contractor requiring him to make good such failure and remedy the same within such time as the Employer / Engineer may deem to be reasonable.

Termination of Contract Due to Contractor's Default **13.2**

Conditions Leading to termination of Contract **13.2.1** The Employer shall be entitled to terminate the Contract if the Contractor or any one of its constituents,

a) fails to comply with a notice under Sub-clause 13.1
b) abandons or repudiates the Contract
c) without reasonable excuse acceptable to the Engineer, fails to commence the Works in accordance with the Contract
d) Sub-contracts the whole of the Works or assigns the Contract without approval of the Employer
e) becomes bankrupt or insolvent or goes into liquidation except voluntary liquidation for the purpose of amalgamation or reconstruction
f) persistently disregards instructions of the Engineer or contravenes any

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(a) Provision in NIT,

(b) Outline Design Specifications / Outline Construction Specifications for Civil Works, Technical specifications Architectural & Finishing works

(c) MORTH Specification for road & Bridges,

(d) CPWD specifications,

(e) Standard Codes of Practice

In case of discrepancy among Standard Codes of Practice, the order of precedence will be IRS, IRC, IS, EURO, DIN, BS.

2.6 DIMENSIONS

2.6.1 As regards errors, omissions and discrepancies in Specifications and Drawings, relevant clause of Special Conditions of Contract will apply.

2.6.2 The levels, measurements and other information concerning the existing site as shown on the conceptual / layout 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 strata turning out different from what is shown on the drawings.

2.7 ASSOCIATED WORKS

Works to be performed shall also include all general works, preparatory works for the construction and works of any kind necessary for the design and satisfactory construction, completion and maintenance of the works to the intent and meaning of the drawings adopted and Outline Construction Specifications for Civil Works & Technical specifications Architectural & Finishing works, to best Engineering standards and orders that may be issued by the Engineer from time to time, compliance by the agency with all Conditions of Contract, supply of all materials, apparatus, plants, equipment, tools, fuel, water, strutting, timbering, transport, offices, stores, workshop, staff, labour and the provision of proper and sufficient protective works, diversion, temporary fencing, lighting and watching required for the safety of the public and protection of works on adjoining land; first-aid equipment, sanitary accommodation for the staff and workmen, effecting and maintenance of all insurances, the payment of all wages, salaries, fees, royalties, duties or the other charges arising out of the erection of works and the regular clearance of rubbish, clearing up, leaving the site perfect and tidy on completion.

2.8 **CONSTRUCTION DEPOT & DUMPING AREA**

For casting yard, batching plant and other activities a plot of land of approx. **35000 Sqm**. will be made available by JMRC on as is where is basis within **45 Km** from the work site free of cost. This land shall be made good for such offsite activities as needed by the Contractor at no extra cost to the employer. The land shall be cleared from debris, all structures made by the contractor including, RCC footings and rafts etc. and reinstated to the line, level and to the same conditions as existed before the work started before handing over back to the Employer within 60 days after Taking over Certificate. The final bill shall be released to the contractor after all structures from the construction depot are removed & clearance of site. The cost of setting of yard & reinstatement is included in lump sum price in schedule 'A'.

A mechanical tyre washing plant shall have to be installed by the contractor for the vehicles leaving the depot and construction sites to avoid the spillage on the connecting roads.

C&D waste generated from construction depot, site and station during construction to be transported to location designated for this purpose by JMRC within 25 Km lead from the

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6.4.5 Protection of Prestressing Steel

Prestressing steel shall be continuously protected against corrosion, until grouted. 'The corrosion protector shall have no deleterious effect on the steel or concrete or on the bond strength of steel to concrete. Grouting shall conform to these specifications or as directed by the Engineer.

6.4.6 Sheathing

The joints of all sheathings shall be water-tight. Special attention shall be paid to the junction at the anchorage end, where the sheathing must tightly fit on the protruding trumpet end of anchorage and thereafter sealed preferably with adhesive water proof tape as per approved manufacturer.

The sheathing and all joints shall be water tight. Any temporary opening in the sheathing shall be satisfactorily plugged and all joints between sheathing and any other part of the prestressing system shall be effectively sealed to prevent entry of mortar, dust, water or other deleterious matter. Sheathing shall be neatly fitted at joints without internal projection or reduction of diameter. Sheathing shall be firmly tied so that while concreting they should not float up. Sheathing shall be aligned accurately with respect to vertical and horizontal coordinate. Enlarged portions of the sheathing at couplings or anchorages shall be of sufficient length to provide for the extension of the tendons.

6.4.7 Grout Vents

Grout vents of at least 20 mm diameter shall be provided at both ends of the sheathing and at all valleys and crests along its length. Additional vents with plugs shall also be provided along the length of sheathing such that the spacing of consecutive vents does not exceed 20 m. Each of the grout vents shall be provided with a plug or similar device capable of withstanding a pressure of 1.0 MPa without the loss of water, air pressure or grout.

6.4.8 Anchorages

All bearing surfaces of the anchorages shall be cleaned prior to concreting and tensioning. Anchor cones, blocks and plates shall be securely positioned and maintained during concreting such that the centre line of the duct passes axially through the anchorage assembly. The anchorages shall be recessed from the concrete surface as per drawings.

After the prestressing operations are completed and prestressing strands are cut, the surface shall be painted with two coats of epoxy of suitable formulation having a dry film thickness of 80 microns per coat and entire recess shall be filled with concrete or non-shrink/pre-packaged mortar or epoxy concrete **within 7 days of grouting(in case of stressing and grouting are done in two or more stages, the recess filling should be done within 7 days of last stage grouting but in no case it shall be more than 14 days)**

6.4.9 Handling and Storage

Care shall be taken to avoid mechanically damaging, work-hardening or heating prestressing tendons while handling. All prestressing tendons shall be stored clear of the

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8.1.5 Alignment of Piles:

i) Piles shall be installed as accurately as possible according to the drawings either vertically or to the specified batter. All deviations will be measured at the cut off level of the piles. The deviation from the true axis shall not be more than 1.5% for vertical piles and 4% for rake piles. Piles should not deviate in location by more than 75mm when used in groups. For single or 2 piles used under columns, deviation shall not be more than 50mm.

ii) The Contractor shall maintain a record of actual pile locations in the form of drawing and submit the information to the Engineer at suitable intervals.

8.1.6 Pile Cap:

Pile caps shall be of reinforced concrete. A minimum offset of 250 mm shall be provided beyond the outer faces of the outer most piles in the group. If the pile cap is in contact with earth at the bottom, a leveling course of minimum 75 mm thickness of PCC of grade M15 shall be provided or as shown in the drawings.

The attachment of the pile head to the cap shall be adequate for the transmission of loads and forces. A portion of pile top may be stripped of concrete and the reinforcement anchored into the cap. Manual chipping may be permitted after three days of pile casting while pneumatic tools for chipping shall not be used before seven days after pile casting. The top of pile after stripping shall project at least **50mm** into the pile cap. Concreting of the pile cap shall be carried out in dry conditions. All the operations and tools required for making the pile in dry condition is included in the item.

The road surface after casting of pile cap should be repaired immediately. If the surface is not repaired immediately, penalty will be imposed as decided by the Engineer.

8.1.7 Testing of Piles:

iii) The load tests shall be in accordance with the Indian Standard Code of Practice for Design and Construction of Pile Foundations IS 2911 (Part IV) Load Tests on Piles. For initial load test, test load will be 2.5 times the theoretical designed capacity of pile. For initial load, test arrangement to be designed shall also cater for additional 25% above test load and nothing extra will be paid on this account. Permissible stresses in test arrangement (steel truss or plate girder) to cater for test load plus additional 25% load shall be within permissible stresses as per IS: 800 (as for permanent structure). For test frame, steel of Grade –B conforming to IS: 2062 shall be used.

iv) Engineer will decide the locations of initial and routine horizontal and vertical load test. One no. initial load test is to be performed in each km for each diameter of pile being used in viaduct. The contractor shall undertake test piles required for initial pile load test in the initial stages of work using the same methodology and equipment"s which will be subsequently used for working piles. These tests shall be undertaken well in advance of working pile. No working pile would be allowed to undertaken till initial satisfactory initial pile load tests have been completed.

Non-granting of permission for pile/ pile cap by Engineer in such respect will not be considered as reason for delay or any claim thereof. The test arrangement to be employed shall be of nature which is quick to install and remove and easily transferable. **At every one KM of viaduct initial load test both vertical and horizontal are to be performed by the contractor for each type of pile. Also one initial load test both vertical and horizontal per station are to be performed by the contractor for each type of pile.**

iii) Routine horizontal & vertical load tests are performed as a check on the load carrying capacity and settlements of the pile foundations. At least one routine test shall be performed for every 100 piles unless otherwise specified by the Engineer. **Initial and routine vertical and horizontal load test shall be conducted on different piles.**

iv) The Contractor shall give the Engineer at least 48 hours notice of the commencement of construction of these piles which are to be subjected to Initial Tests.

v) The load tests shall not normally be conducted unless the concrete is at least 28 days old. However in special circumstances, permission can be given by Engineer for prior testing.

vi) All testing shall be done under the direction of experienced personnel conversant with the equipment and the testing procedure.

vii) Before the commencement of the tests all the particulars regarding the test pile including boring data and concrete cube strengths shall be made available at site and shall form a part of the test report.

viii) On completion of each load test the Contractor shall submit a report of the load test which shall include the following information.

a) Description of soil conditions, ground water table, actual boring and installation records, concrete cube test results.

b) Method of load application

c) Load settlement readings during loading and unloading

d) Time load-settlement curve

e) All other observation relevant to the test being conducted.

ix) Integrity test

Two types of pile integrity tests will be performed:

Dynamic Integrity Test:

The Dynamic Integrity test using pile driving analyser or approved equivalent for pile integrity shall be performed on all the piles. The top of the pile shall be made accessible, chipped off up to hard concrete, levelled by trimming it back as far as practicable. The reinforcing bars of the piles tested shall be bent sideways. The test shall be performed after removal of bad/ weak concrete at top so that the wave propagation is steady through hard concrete. The test shall be carried out at minimum 3 locations on each pile in such a way that the entire cross section of the pile is covered. The test shall be conducted with a minimum age of

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Grades of raw elastomer of proven use in elastomeric bearings, with low crystallization Grades of raw elastomer of proven shelf life ~~**(e.g. Neoprene WRT, Bayprene 110 Skyprene B- and Denka S-40V)**~~ **as indicated in latest revision of IRC-83, Part II)** shall be used.

No reclaimed rubber or vulcanized wastes or natural rubber shall be used.

The raw elastomer content of the compound shall not be lower than 60 per cent by its weight. The ash content shall not exceed 5 percent (as per tests conducted in accordance with ASTM D-297, sub-section 10).

EPDM and other similar candidate elastomer for bridge bearing use shall not be permitted.

b) Properties

The elastomer shall conform to the properties specified in Clause 4.3.1 of the IRICEN publication titled "Bearings for Railway Bridges" and those specified in Table 2000-1 of the publication titled "Specifications for Road and Bridge Works", published by IRC on behalf of MORTH (Roads Wing).

c) Fabrication and Tolerances

Fabrication and Dimensional tolerances shall be governed by the specifications laid down in Clause 4.3.2 of the IRICEN publication & Clause 2005.3 of the MORTH specifications mentioned above.

d) Acceptance Specifications

For inspection and testing requirement Clause 4.4 of the above mentioned IRICEN publication shall be referred with modifications of lot size as mentioned below:-

Sampling testing and acceptance consideration will be made on a lot basis. A lot shall be defined as those bearings presented for inspection at a specific time or date. A lot shall be further defined as the smallest number of bearings as determined by the following criteria.

i. A lot shall not exceed a single contract or project quantity;

ii. A lot shall not exceed 50 bearings;

iii. A lot shall consist of those bearing of the same type regardless of load capacity.

Accepting and testing requirements shall also conform to the specifications laid down in Clause 2005.4 of the referred MORTH specifications.

In addition to tests mentioned above, all bearings shall be also weight actually and compared with the theoretical weight.

All bearings shall carry a warrantee of not less than 15 years in an approved format. The contractor shall be responsible for immediate repair or replacement of the bearings in case of failure / distress to the satisfaction of the owner at no extra cost to the Owner within the warrantee period.

Criteria for Selection of bearing manufacturer shall conform to requirement of Most letter No-RW/NH-34057(1) / 95-(S & R) dated 2nd November,2000. It is necessary that all manufacturers of all elastomeric bearings shall have in house facilities for carrying out Infrared Spectro-Photometry as per ASTM D-3677.

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ANNEXURE A

SPECIFICATION OF CRYSTALLINE PRODUCTS

Product - **Integral Crystalline Waterproofing/Durability Admixture**

CRYSTALLINE ADMIX

Dosage - minimum 0.8% by weight of cement + cementitious material (OR such lower dosage as recommended by Manufacturer at which product meets the product qualification criteria listed in this document- Duly approved by JMRC).

Integral Waterproofing/ Durability admixture should be SINGLE part cementitious powder consisting of hydrophilic chemicals. When added to plastic mix, will permanently create impermeable hardened concrete by developing insoluble needle like crystals to seal the pores, capillaries, micro-cracks in the whole mass of concrete and enhances the durability of concrete. The crystalline admixture must be compatible with any other concrete admixture confirming to ASTM D494 and IS 9103. It shall be used for all underground structures (including shortcrete in tunnel lining). In addition, the waterproofing admixture must confirm to the following requirements:

i. It shall possess CE approval as per EN934-2.

ii. The crystalline admixture shall be compatible with any other concrete admixture confirming to ASTM D494. ~~**The product shall be approved by MORTH & must have IRC accreditation for durability enhancement.**~~

iii. At the manufacturer's recommended dosage, material must fulfil the requirements of American Concrete Institute Guidelines ACI-212-3R-10 Chapter 15 and fall under PRAH (Permeability reducing Admixtures for HYDROSTATIC conditions) and must reduce Coefficient of Permeability of concrete by more than 90%(preferably zero permeability) , when compared to control concrete and tested as per DIN 1048 Part 5 by carrying out 4 cycles each of 5 bar Hydrostatic Pressure for 72 hours and drying for 48 hours between the cycles & Coefficient of Permeability calculated as per Darcy's Formula/ Valenta equation by incorporating penetration values obtained at the end of fourth cycle pressure.

iv. At the manufacturer's recommended dosage rate, the material must reduce Chloride Diffusion Co-efficient by minimum 45% when tested as per ASTM C 1556 -4 / or its equivalent and compared with the control concrete, thereby prolonging the durability & service life of the treated concrete structure.

v. At the manufacturer's recommended dosage rate, the crystalline admixture treated concrete must be able to withstand high hydrostatic pressure of 16 bar (156 M of water head) when tested as per DIN 1048

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6.7.4 Response Reduction Factor

Response Reduction Factor "R" as per IRS Seismic code Table -3 shall be as given below

S.No.	Elements	Response Reduction Factor "R"
1	RCC Pier with ductile detailing	3.0
2	PSC Pier/Pier cap/Portal beam	2.0
3	Portal Pier with ductile detailing (Beam integral with pier)	3.0-In Longitudinal direction 4.0-In transverse direction
4	Bearing/Superstructure	2.0
5	Stopper	1.0
6	Foundations	2.0

Note: In addition to the response reduction factor given above, reinforcement detailing of Piers/Portal Piers shall conform to ductility/capacity design requirements as per Annexure-B of IRS Seismic Code.

6.7.5 Vertical Seismic Coefficient

The seismic zone factor & time period (of Vertical motion) for calculating vertical seismic coefficient shall be considered as per clause 7.3.2 & 9.4.2 of IRS seismic code. The Zone factor for calculating the vertical seismic coefficient will be 2/3*Zone factor i.e. $2/3*0.1=0.067$. For Pier & foundations, while calculating vertical seismic coefficient R=1 shall be considered.

6.7.6 Computation of Fundamental period of vibration

The fundamental time period shall be calculated by any rational method of analysis. Each pier is considered as a single degree of freedom oscillator with mass placed at the Centre of Gravity (COG) of the deck.

The time period can also be calculated based on expression given in Clause 8.1 of IRS Seismic Code, which is as follows:

$$T = 2\pi\sqrt{\frac{\delta}{g}}$$

Where δ = horizontal displacement at the top of pier due to horizontal force (= mg)
Where m = lumped mass at the top of pier.

a) Mass

- Permanent masses (Self Weights, SIDL) of:
  (a) Full span longitudinally, which can be resisted by reaction blocks of POT/Spherical bearings during earthquake, at one side of the pier or half of span on either side of pier in case seismic is resisted by bearings (For longitudinal seismic)
  (b) Half of spans on either side of pier (For transverse seismic)

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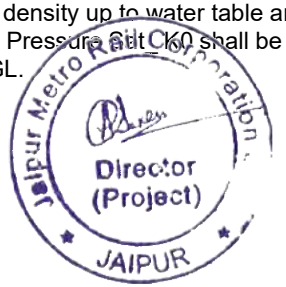
7. ANNEXURE-A : LOAD COMBINATION

L/C No.	Descriptions of Load Case	ULS STATIC									
		1001	1002	1003	1004	1005	1101	1102	1103	1104	1105
		Submerged Soil -Design Water Level Case					Saturated / Dry Case				
		(MAX H - MAX V)	(MAX H - MAX V) without LL	(MAX H - MIN V)	(MIN H - MAX V)	(MIN H - MAX V) without LL	(MAX H - MAX V)	(MAX H - MAX V) without LL	(MAX H - MIN V)	(MIN H - MAX V)	(MIN H - MAX V) without LL
1	Self Weight	1.5	1.5	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.5
2	SIDL	1.5	1.5	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.5
3	Soil Back Fill	1.5	1.5	1.0	1.5	1.5	1.5	1.5	1.0	1.5	1.5
4	Live Load on concourse & platform	1.5	0	0	1.5	0	1.5	0	0	1.5	0
5	Train Live Load	1.5	0	0	1.5	0	1.5	0	0	1.5	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1.5	1.5	1.5	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	1.0	1.0	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	1.5	1.5	1.5	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1.0	1.0
10	Vertical Surcharge Load	1.5	1.5	0	1.5	1.5	1.5	1.5	0	1.5	1.5
11	Lateral Surcharge load (Towards Right)	0	0	0	0	0	0	0	0	0	0
12	Lateral Surcharge load (Towards Left)	0	0	0	0	0	0	0	0	0	0
13	Lateral Surcharge load (Both Sides)	1.5	1.5	1.5	0	0	1.5	1.5	1.5	0	0
14	Water Pressure at Design Water Level* (Lateral)	1.5	1.5	1.5	1.0	1.0	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1.5	1.5	1.0	1.5	1.5	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0

Note:
* During Construction stage HRL shall be considered instead of Design water table for all load combinations. Lateral Earth pressure shall be calculated based on submerged density up to water table and saturated density above water table.
# Lateral Earth Pressure Sat_ K0 shall be calculated with saturated soil density up to GL and Lateral Earth Pressure Dry_ Ka shall be calculated with dry soil density up to GL.



L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.075g											
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
		Without LL											
		Submerged Soil -Design Water Level Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
2	SIDL	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
3	Soil Back Fill	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
4	Live Load on concourse & platform	0	0	0	0	0	0	0	0	0	0	0	0
5	Train Live Load	0	0	0	0	0	0	0	0	0	0	0	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	0	0	0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	0	0	0	0
10	Vertical Surcharge Load	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
11	Lateral Surcharge load (Towards Right)	1.5	0	1.5	0	1.5	0.0	1.5	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.5	0	1.5	0	1.5	0	1.5	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
16	0.075 g Racking Point Force (Towards Right)	1.5	0	0	0	1.5	0	0	0	1.0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	1.5	0	0	0	1.5	0	0	0	1.0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	1.5	0	0	0	1.5	0	0	0	1.0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	1.5	0	0	0	1.5	0	0	0	1.0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0

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L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.075g											
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
		Without LL											
		Saturated / Dry Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
2	SIDL	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
3	Soil Back Fill	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
4	Live Load on concourse & platform	0	0	0	0	0	0	0	0	0	0	0	0
5	Train Live Load	0	0	0	0	0	0	0	0	0	0	0	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
10	Vertical Surcharge Load	1.5	1.5	1.5	1.5	1.0	1.0	1.0	1.0	1.5	1.5	1.5	1.5
11	Lateral Surcharge load (Towards Right)	1.5	0	1.5	0	1.5	0.0	1.5	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.5	0	1.5	0	1.5	0	1.5	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	0	0	0	0	0	0	0	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	0	0	0	0	0	0	0	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	1.5	0	0	0	1.5	0	0	0	1.0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	1.5	0	0	0	1.5	0	0	0	1.0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	1.5	0	0	0	1.5	0	0	0	1.0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	1.5	0	0	0	1.5	0	0	0	1.0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0

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L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.15g											
		2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112
		Without LL											
		Submerged Soil -Design Water Level Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	SIDL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	Soil Back Fill	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	Live Load on concourse & platform	0	0	0	0	0	0	0	0	0	0	0	0
5	Train Live Load	0	0	0	0	0	0	0	0	0	0	0	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	0	0	0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	0	0	0	0
10	Vertical Surcharge Load	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	Lateral Surcharge load (Towards Right)	1.0	0	1.0	0	1.0	0.0	1.0	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	1.0	0	0	0	1.0	0	0	0	1.0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	1.0	0	0	0	1.0	0	0	0	1.0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	1.0	0	0	0	1.0	0	0	0	1.0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	1.0	0	0	0	1.0	0	0	0	1.0

L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.15g											
		2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136
		Without LL											
		Saturated / Dry Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	SIDL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	Soil Back Fill	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	Live Load on concourse & platform	0	0	0	0	0	0	0	0	0	0	0	0
5	Train Live Load	0	0	0	0	0	0	0	0	0	0	0	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
10	Vertical Surcharge Load	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	Lateral Surcharge load (Towards Right)	1.0	0	1.0	0	1.0	0.0	1.0	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	0	0	0	0	0	0	0	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	0	0	0	0	0	0	0	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	1.0	0	0	0	1.0	0	0	0	1.0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	1.0	0	0	0	1.0	0	0	0	1.0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	1.0	0	0	0	1.0	0	0	0	1.0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	1.0	0	0	0	1.0	0	0	0	1.0

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L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.075g											
		2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212
		With LL											
		Submerged Soil -Design Water Level Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
2	SIDL	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
3	Soil Back Fill	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
4	Live Load on concourse & platform	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
5	Train Live Load	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	0	0	0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	0	0	0	0
10	Vertical Surcharge Load	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
11	Lateral Surcharge load (Towards Right)	1.2	0	1.2	0	1.2	0.0	1.2	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.2	0	1.2	0	1.2	0	1.2	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
16	0.075 g Racking Point Force (Towards Right)	1.2	0	0	0	1.2	0	0	0	1.0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	1.2	0	0	0	1.2	0	0	0	1.0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	1.2	0	0	0	1.2	0	0	0	1.0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	1.2	0	0	0	1.2	0	0	0	1.0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0

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L/C No.	Descriptions of Load Case	ULS SEISMIC (RACKING) CORRESPONDING TO 0.075g											
		2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236
		With LL											
		Saturated / Dry Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
2	SIDL	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
3	Soil Back Fill	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
4	Live Load on concourse & platform	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
5	Train Live Load	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
10	Vertical Surcharge Load	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2
11	Lateral Surcharge load (Towards Right)	1.2	0	1.2	0	1.2	0.0	1.2	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.2	0	1.2	0	1.2	0	1.2	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	0	0	0	0	0	0	0	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	0	0	0	0	0	0	0	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	1.2	0	0	0	1.2	0	0	0	1.0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	1.2	0	0	0	1.2	0	0	0	1.0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	1.2	0	0	0	1.2	0	0	0	1.0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	1.2	0	0	0	1.2	0	0	0	1.0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0

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23	0.15 g Racking	0	0	0	0	0	0	0	0	0	0	0	0
	Distribution Force (Towards Left)												

L/C No.	Case Descriptions of Load	ULS SEISMIC (RACKING) CORRESPONDING TO 0.15g											
		2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312
		With LL											
		Submerged Soil -Design Water Level Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	SIDL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	Soil Back Fill	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	Live Load on concourse & platform	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	Train Live Load	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	0	0	0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	0	0	0	0
10	Vertical Surcharge Load	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	Lateral Surcharge load (Towards Right)	1.0	0	1.0	0	1.0	0.0	1.0	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	1.0	0	0	0	1.0	0	0	0	1.0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	1.0	0	0	0	1.0	0	0	0	1.0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	1.0	0	0	0	1.0	0	0	0	1.0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	1.0	0	0	0	1.0	0	0	0	1.0

L/C No.	Descriptions of	ULS SEISMIC (RACKING) CORRESPONDING TO 0.15g

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	Load Case	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336
		With LL											
		Saturated / Dry Case											
		(MAX H - MAX V)				(MAX H - MIN V)				(MIN H - MAX V)			
		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force		Point Raking Force		Distributed Raking Force	
		Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left	Surcharge/ Raking Towards Right	Surcharge/ Raking Towards Left
1	Self Weight	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
2	SIDL	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
3	Soil Back Fill	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
4	Live Load on concourse & platform	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
5	Train Live Load	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	0	0	0	0	0	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	0	0	0	0	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0	0	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1.0	1.0	1.0	1.0
10	Vertical Surcharge Load	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
11	Lateral Surcharge load (Towards Right)	1.0	0	1.0	0	1.0	0.0	1.0	0.0	1.0	0	1.0	0
12	Lateral Surcharge load (Towards Left)	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0	0	1.0
13	Lateral Surcharge load (Both Sides)	0	0	0	0	0	0	0	0	0	0	0	0
14	Water Pressure at Design Water Level* (Lateral)	0	0	0	0	0	0	0	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	0	0	0	0	0	0	0	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	1.0	0	0	0	1.0	0	0	0	1.0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	1.0	0	0	0	1.0	0	0	0	1.0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	1.0	0	0	0	1.0	0	0	0	1.0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	1.0	0	0	0	1.0	0	0	0	1.0

L/C		SLS								
		3001	3002	3003	3004	3005	3101	3102	3103	3104	3105
		Submerged Soil -Design Water Level Case					Saturated / Dry Case				

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

No.	Descriptions of Load Case	(MAX H - MAX V)	(MAX H - MAX V) without LL	(MAX H - MIN V)	(MIN H - MAX V)	(MIN H - MAX V) without LL	(MAX H - MAX V)	(MAX H - MAX V) without LL	(MAX H - MIN V)	(MIN H - MAX V)	(MIN H - MAX V) without LL
1	Self Weight	1	1	1	1	1	1	1	1	1	1
2	SIDL	1	1	1	1	1	1	1	1	1	1
3	Soil Back Fill	1	1	1	1	1	1	1	1	1	1
4	Live Load on concourse & platform	1	0	0	1	0	1	0	0	1	0
5	Train Live Load	1	0	0	1	0	1	0	0	1	0
6	Lateral Earth Pressure (WL @ Design Water Level*) K0	1	1	1	0	0	0	0	0	0	0
7	Lateral Earth Pressure (WL @ Design Water Level*) Ka	0	0	0	1	1	0	0	0	0	0
8	Lateral Earth Pressure Sat_ K0 (#)	0	0	0	0	0	1	1	1	0	0
9	Lateral Earth Pressure Dry_ Ka (#)	0	0	0	0	0	0	0	0	1	1
10	Vertical Surcharge Load	1	1	0	1	1	1	1	0	1	1
11	Lateral Surcharge load (Towards Right)	0	0	0	0	0	0	0	0	0	0
12	Lateral Surcharge load (Towards Left)	0	0	0	0	0	0	0	0	0	0
13	Lateral Surcharge load (Both Sides)	1	1	1	0	0	1	1	1	0	0
14	Water Pressure at Design Water Level* (Lateral)	1	1	1	1	1	0	0	0	0	0
15	Water Pressure at Design Water Level* (Vertical) (Uplift)	1	1	1	1	1	0	0	0	0	0
16	0.075 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
17	0.075 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
18	0.075 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
19	0.075 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
20	0.15 g Racking Point Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
21	0.15 g Racking Point Force (Towards Left)	0	0	0	0	0	0	0	0	0	0
22	0.15 g Racking Distribution Force (Towards Right)	0	0	0	0	0	0	0	0	0	0
23	0.15 g Racking Distribution Force (Towards Left)	0	0	0	0	0	0	0	0	0	0

LIST OF DRAWINGS FOR UNDER GROUND STRETCH			
S.NO.	**DRAWING TITLE**	**DRAWING NO.**	**REVISION**
1	LIST OF DRAWINGS FOR UNDER GROUND STRETCH	GEN-JMRC-TD-003	R1
2	GENERAL NOTES	GEN-JMRC-TD-004	R0
ARCHITECTURE DRAWING			
RAMGANJ CHAUPAR STATION			
3	FINISHING SCHEDULE	JMRC-STN-RGC-TED-ARP-11000	R0
4	GROUND LEVEL PLAN	JMRC-STN-RGC-TED-ARP-11001	R0
5	CONCOURSE LEVEL PLAN	JMRC-STN-RGC-TED-ARP-11002	R0
6	PLATFORM LEVEL PLAN	JMRC-STN-RGC-TED-ARP-11003	R0
7	UNDERCROFT LEVEL PLAN	JMRC-STN-RGC-TED-ARP-11004	R0
8	TOP OF BOX LEVEL PLAN	JMRC-STN-RGC-TED-ARP-11005	R0
9	ANCILLARY BLOCK PLANS & SECTION	JMRC-STN-RGC-TED-ARP-11006	R0
10	CROSS SECTION	JMRC-STN-RGC-TED-ARP-13001	R0
11	LONG SECTION	JMRC-STN-RGC-TED-ARP-13002	R0
12	ENTRY STRUCTURE DETAILS	JMRC-STN-RGC-TED-ARP-15001	R0
13	SS RAILING WITH GLASS PANELS (AT PUBLIC STAIRCASE) TYPICAL DETAIL (UNDERGROUND STATION)	JMRC-STN-TYT-TED-ARP-19001	R0
STRUCTURE DRAWING			
GENERAL ARRANGEMENT DRAWING			
14	GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH(SHEET 1 OF 4)	GEN-JMRC-1C-ALG-TD-001	R1
15	GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH(SHEET 2 OF 4)	GEN-JMRC-1C-ALG-TD-002	R1
16	GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH(SHEET 3 OF 4)	GEN-JMRC-1C-ALG-TD-003	R1
17	GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH(SHEET 4 OF 4)	GEN-JMRC-1C-ALG-TD-004	R1
UNDER GROUND TUNNEL, CUT & COVER, UG RAMP, CROSS PASSAGE DRAWINGS			
18	DETAILS OF TBM SEGMENT LINING (SHEET 1 OF 2)	TUN-JMRC-1C-STR-TD-14001	R0

LIST OF DRAWINGS FOR UNDER GROUND STRETCH			
S.NO.	**DRAWING TITLE**	**DRAWING NO.**	**REVISION**
19	DETAILS OF TBM SEGMENT LINING (SHEET 2 OF 2)	TUN-JMRC-1C-STR-TD-14002	R0
20	OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT (SHEET 1 OF 2)	CCV-JMRC-1C-STR-TD-14003	R1
21	OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT (SHEET 2 OF 2)	CCV-JMRC-1C-STR-TD-14004	R0
22	BORED TUNNEL - WALKWAY (SHEET 1 OF 3)	TUN-JMRC-1C-STR-TD-14005	R0
23	BORED TUNNEL - WALKWAY (SHEET 2 OF 3)	TUN-JMRC-1C-STR-TD-14006	R0
24	BORED TUNNEL - WALKWAY (SHEET 3 OF 3)	TUN-JMRC-1C-STR-TD-14007	R0
25	DETAILS OF TEMPORARY BARRICADING(1m.HEIGHT)	TUN-JMRC-1C-STR-TD-14008	R0
26	DETAILS OF TEMPORARY BARRICADING(2m.HEIGHT)	TUN-JMRC-1C-STR-TD-14009	R0
27	DIMENSION DETAIL OF TWIN BORED TUNNEL	TUN-JMRC-1C-STR-TD-14010	R0
28	INSTRUMENTATION AND MONITORING GENERAL NOTES	INT-JMRC-1C-STR-TD-15001	R0
29	INSTRUMENTATION AND MONITORING DETAILS OF ARRAYS (SHEET 1 OF 3)	INT-JMRC-1C-STR-TD-15002	R0
30	INSTRUMENTATION AND MONITORING DETAILS OF ARRAYS (SHEET 2 OF 3)	INT-JMRC-1C-STR-TD-15003	R0
31	INSTRUMENTATION AND MONITORING DETAILS OF ARRAYS (SHEET 3 OF 3)	INT-JMRC-1C-STR-TD-15004	R0
32	TYPICAL DETAILS OF SHEAR CONNECTORS	GEN-JMRC-1C-STR-TD-16001	R0
33	RUNNING TUNNELS SUMP CROSS PASSAGE GENERAL ARRANGEMENT	TUN-JMRC-1C-STR-TD-17001	R0
34	RUNNING TUNNELS CROSS PASSAGE GENERAL ARRANGEMENT	TUN-JMRC-1C-STR-TD-17002	R0
35	RUNNING TUNNELS CROSS PASSAGE GENERAL ARRANGEMENT (SHOWING SERVICES)	TUN-JMRC-1C-STR-TD-17003	R0
36	TYPICAL DETAILS OF STEEL GRILL	TUN-JMRC-1C-STR-TD-18001	R0
37	TYPICAL DETAILS OF BOUNDARY WALL	TUN-JMRC-1C-STR-TD-19001	R0
38	UNDERCROFT LEVEL - EARTHMAT LAYOUT (SHEET 1 OF 2)	RGC-JMRC-1C-STR-TD-00601	R0
39	UNDERCROFT LEVEL - EARTHMAT LAYOUT (SHEET 2 OF 2)	RGC-JMRC-1C-STR-TD-00602	R0

TENDER DRAWING

यह चित्रांकन जयपुर मेट्रो रेल कॉर्पोरेशन लि. जयपुर की संपत्ति है।
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ISSUED DRAWINGS

दिनांक DATE	संशोधन REV.	विवरण DESCRIPTION	बिक्त DRAWN	जांच CHECKED	सत्यापित APPROVED
12-07-2023	R1	RAMGANJ STATION LAYOUT UPDATE	MC	RS	AS
06-05-2023	R0	FIRST ISSUE	JS	RS	AS

Director (Project) JAIPUR

चित्रांकन संदर्भ
REFERENCE DRAWINGS

क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

NOTICE OF NO OBJECTIONS' FROM EMPLOYER'S REPRESENTATIVE.

GENERAL CONSULTANTS (DMRC)		JMRC
Dy.HODs	HODs	
Dy.CE/CRE/JP	PD/JP	
Dy.CA	CA/BD	
Dy.CE/Design	CE/DESIGN-I	
Dy.CEE/TR		
Dy.CEE/E&M		
JGM/Track		
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डी० डी० सी० प्राधिकृत हस्ताक्षरकर्ता
Authorised Signatory for DDC.

CLIENT:- JAIPUR METRO RAIL CORPORATION LTD.

GENERAL CONSULTANT:- DELHI METRO RAIL CORPORATION LTD.

DDC:-
Ayesa India Private Limited
D 99, 3rd Floor, Sector 2, Noida -201301,Gautam Budh Nagar, Uttar Pradesh
Tel.: +(91) 120 490 8800, Email: dcdd05@ayesa.com

PROJECT:-"Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar (excluding) to Transport Nagar dead end of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, Water supply, Sanitary Installations and Drainage Works at Jaipur"

स्टेशन : STATION NAME :

चित्रांकन शीर्षक : DRAWING TITLE: LIST OF DRAWINGS FOR UNDER GROUND STRETCH

दिनांक DATE : 12-07-2023	संशोधन REV : R1	चित्रात्मक पैमाना GRAPHICAL SCALE:	स्थिति STATUS : TENDER	
चित्रांकन संख्या DRAWING NUMBER: GEN-JMRC-TD-003			पृष्ठ संख्या SHEET NO: 01 OF 01	SHEET SIZE: A1

सामान्य GENERAL

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PLAN

SCALE : 1:1000

CHAINAGE	GROUND LEVELS	RAIL LEVELS	ELEVATION DIFF.
10387.860	-999.000	421.500	
10400.000	440.735	421.500	-19.235
10420.000	440.673	421.500	-19.173
10440.000	440.604	421.500	-19.103
10460.000	440.595	421.534	-19.060
10480.000	440.709	421.714	-18.994
10500.000	440.585	421.929	-18.657
10520.000	440.495	422.143	-18.353
10540.000	440.371	422.357	-18.013
10560.000	440.229	422.571	-17.658
10580.000	440.022	422.786	-17.237
10600.000	439.897	423.000	-16.897
10620.000	439.809	423.214	-16.595
10640.000	439.674	423.429	-16.245
10660.000	439.495	423.643	-15.853
10680.000	439.405	423.857	-15.548
10700.000	439.458	424.071	-15.387
10720.000	439.469	424.262	-15.207
10740.000	439.589	424.279	-15.309
10760.000	439.613	424.096	-15.516
10780.000	439.573	423.740	-15.834
10800.000	439.712	423.360	-16.352
10820.000	439.686	422.980	-16.707
10840.000	439.518	422.600	-16.919
10860.000	439.607	422.220	-17.388
10880.000	439.451	421.840	-17.611
10900.000	439.548	421.460	-18.089
10920.000	439.368	421.080	-18.289
10940.000	439.412	420.790	-18.622
10960.000	439.361	420.700	-18.660
10980.000	439.338	420.700	-18.638
11000.000	439.281	420.700	-18.581
11020.000	439.226	420.700	-18.526
11040.000	439.238	420.700	-18.538
11060.000	439.385	420.700	-18.685
11080.000	439.620	420.700	-18.919
11100.000	439.683	420.700	-18.982
11120.000	439.752	420.700	-19.051
11140.000	439.768	420.700	-19.068

LONGITUDINAL ELEVATION

TENDER DRAWING

यह चित्रांकन जयपुर मेट्रो रेल कार्पोरेशन लिमिटेड की धरोहर है। THIS DRAWING IS THE PROPERTY OF JAIPUR METRO RAIL CORPORATION LTD.

जारी किये गए चित्रांकन
ISSUED DRAWINGS

दिनांक DATE	संशोधन REV.	विवरण DESCRIPTION	विकृत DRAWN	जांच CHECKED	सत्यापित APPROVED
12-07-23	R1	RAMGANJ STATION LAYOUT UPDATE	MC	RS	AS
06-05-23	R0	FIRST ISSUE	MC	RS	AS

चित्रांकन संदर्भ
REFERENCE DRAWINGS

क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

NOTICE OF NO OBJECTIONS' FROM EMPLOYER'S REPRESENTATIVE.

GENERAL CONSULTANTS (DMRC)		JMRC
Dy.HODs	HODs	
Dy.CE/CRE/JP	PD/JP	
Dy.CA	CA/BD	
Dy.CE/Design	CE/DESIGN–I	
Dy.CEE/TR		
Dy.CEE/E&M		
JGM/Track		
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डी० डी० सी० प्राधिकृत हस्ताक्षरकर्ता
Authorised Signatory for DDC.

CLIENT:- JAIPUR METRO RAIL CORPORATION LTD.

GENERAL CONSULTANT:- DELHI METRO RAIL CORPORATION LTD.

DDC:- Ayesa India Private Limited
D 99, 3rd Floor, Sector 2, Noida -201301, Gautam Budh Nagar, Uttar Pradesh
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स्टेशन : STATION NAME :

चित्रांकन शीर्षक : DRAWING TITLE: GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH

दिनांक DATE : 12-07-23	संशोधन REV : R1	चित्रात्मक पैमाना GRAPHICAL SCALE: 1:1000	स्थिति STATUS : TENDER
चित्रांकन संख्या DRAWING NUMBER: GEN-JMRC-1C-ALG-TD-001		पृष्ठ संख्या SHEET NO: 1 OF 4	SHEET SIZE: A1

संरचना STRUCTURE

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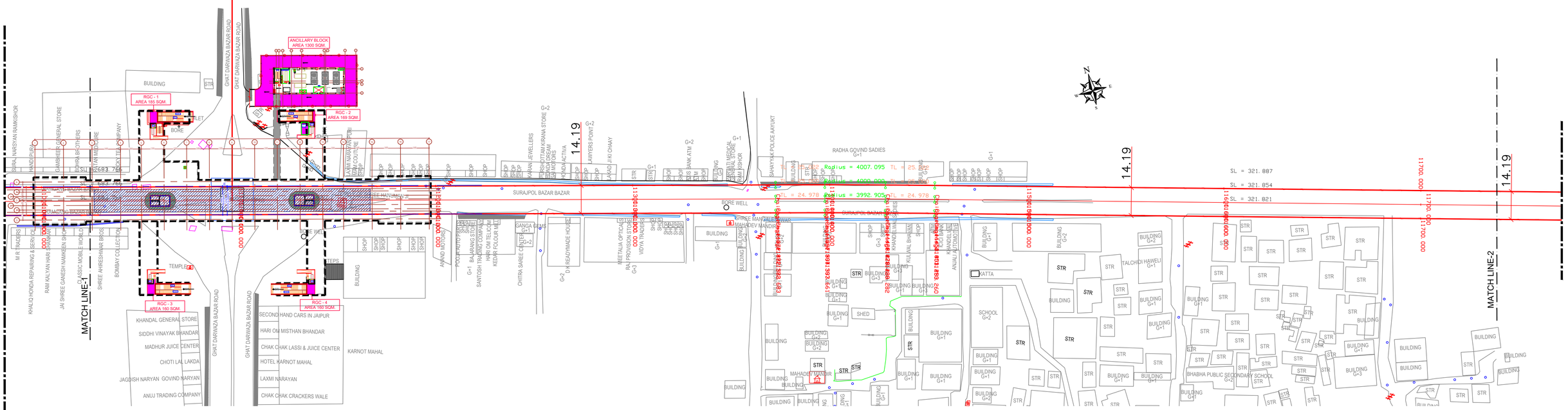
BADI CHAUPAR

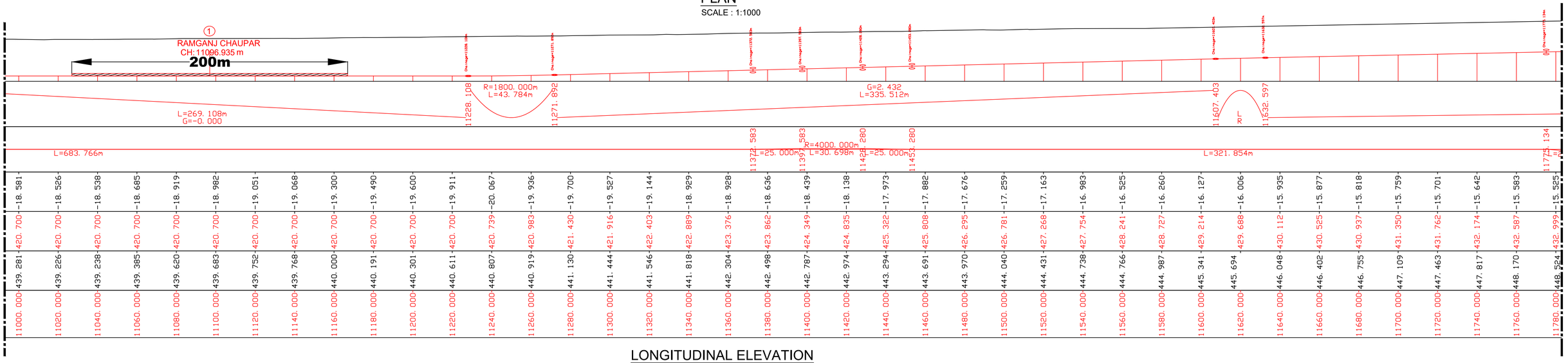
TRANSPORT NAGAR

1

RAMGANJ CHAUPAR
CH: 11096.935m



PLAN
SCALE : 1:1000



LONGITUDINAL ELEVATION

TENDER DRAWING

जारी किये गए चित्रांकन ISSUED DRAWINGS					
दिनांक DATE	संशोधन REV.	विवरण DESCRIPTION	विकृत DRAWN	जांच CHECKED	सत्यापित APPROVED
12-07-23	R1	RAMGANJ STATION LAYOUT UPDATE	MC	RS	AS
06-05-23	R0	FIRST ISSUED	MC	RS	AS

चित्रांकन संदर्भ REFERENCE DRAWINGS		
क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

NOTICE OF NO OBJECTIONS' FROM EMPLOYER'S REPRESENTATIVE.		
GENERAL CONSULTANTS (DMRC)		JMRC
Dy.HODs	HODs	
Dy.CE/CRE/JP	PD/JP	
Dy.CA	CA/BD	
Dy.CE/Design	CE/DESIGN–I	
Dy.CEE/TR		
Dy.CEE/E&M		
JGM/Track		
JGM/AFC		
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Dy.CSTE/Sig.		

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CLIENT:- JAIPUR METRO RAIL CORPORATION LTD.

GENERAL CONSULTANT:- DELHI METRO RAIL CORPORATION LTD.

DDC:- Ayesa India Private Limited
D 99, 3rd Floor, Sector 2, Noida -201301,Gautam Budh Nagar, Uttar Pradesh
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स्टेशन : STATION NAME :

चित्रांकन शीर्षक : GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH
DRAWING TITLE:

दिनांक DATE : 12-07-23	संशोधन REV : R1	चित्रात्मक पैमाना GRAPHICAL SCALE: 1:1000	स्थिति STATUS : TENDER	संरचना STRUCTURE
चित्रांकन संख्या DRAWING NUMBER: GEN-JMRC-1C-ALG-TD-002			पृष्ठ संख्या SHEET NO: 2 OF 4	SHEET SIZE: A1

यह ड्राइंग जयपुर मेट्रो रेल कॉर्पोरेशन लिमिटेड (जेएमआरसी) की संपत्ति है
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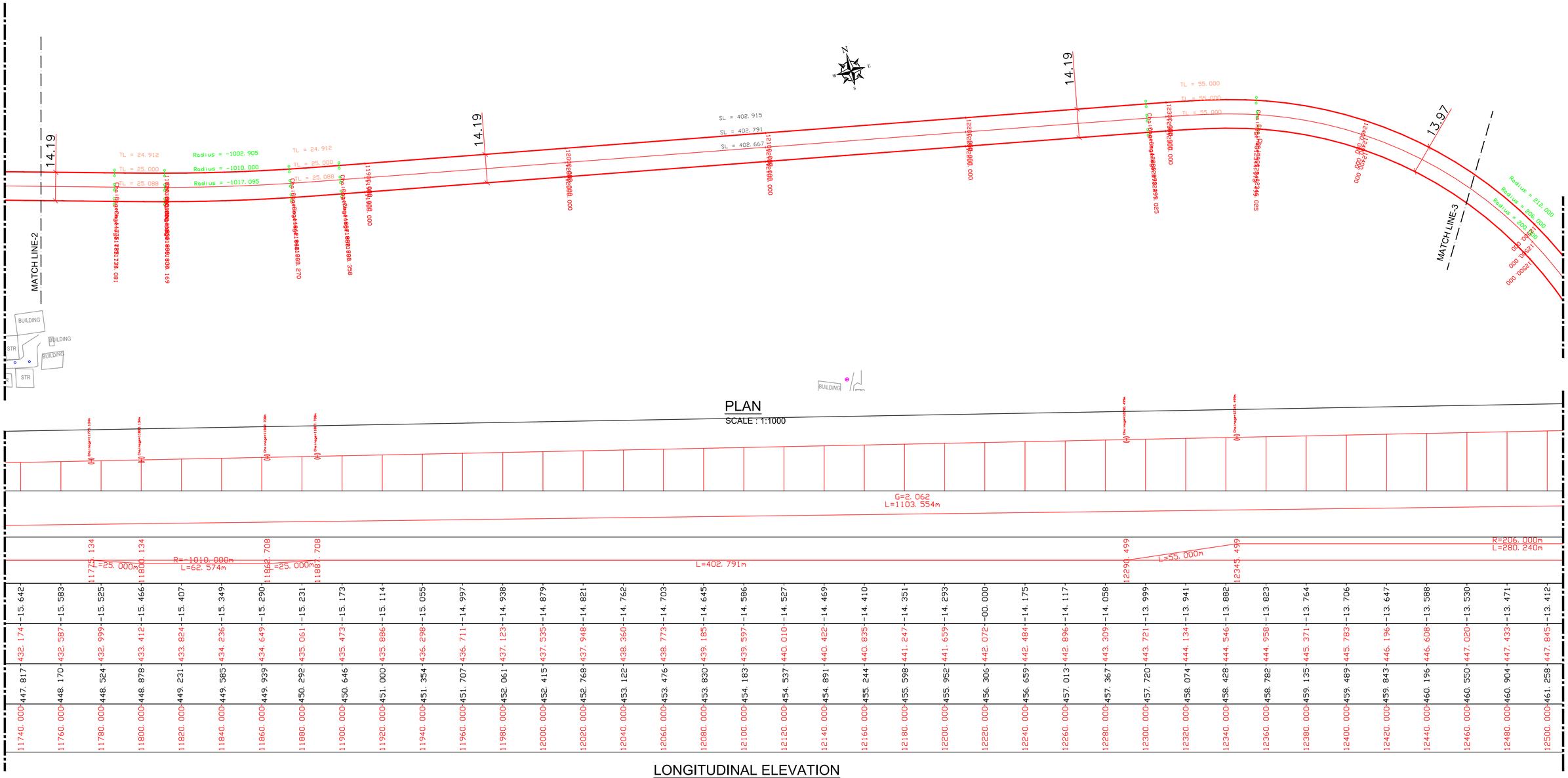
RAMGANJ CHAUPAR

TRANSPORT NAGAR



LONGITUDINAL ELEVATION

TENDER DRAWING

जारी किये गए चित्रांकन ISSUED DRAWINGS						
दिनांक DATE	संशोधन REV.		विकृत DRAWN	जांच CHECKED	सत्यापित APPROVED	
12-07-23	R1	RAMGANJ STATION LAYOUT UPDATE	MC	RS	AS	
06-05-23	R0	FIRST ISSUE	MC	RS	AS	

चित्रांकन संदर्भ REFERENCE DRAWINGS		
क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

NOTICE OF NO OBJECTIONS' FROM EMPLOYER'S REPRESENTATIVE.		
GENERAL CONSULTANTS (DMRC)		JMRC
Dy.HODs	HODs	
Dy.CE/CRE/JP	PD/JP	
Dy.CA	CA/BD	
Dy.CE/Design	CE/DESIGN-I	
Dy.CEE/TR		
Dy.CEE/E&M		
JGM/Track		
JGM/AFC		
Dy.CSTE/Tel.		
Dy.CSTE/Sig.		

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DDC:- Ayesa India Private Limited
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PROJECT:-"Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar (excluding) to Transport Nagar dead end of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, Water supply, Sanitary Installations and Drainage Works at Jaipur"

स्टेशन : STATION NAME :

चित्रांकन शीर्षक : GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH
DRAWING TITLE:

दिनांक DATE : 12-07-23	संशोधन REV : R1	चित्रात्मक पैमाना GRAPHICAL SCALE: 1:1000	स्थिति STATUS : TENDER	
चित्रांकन संख्या DRAWING NUMBER: GEN-JMRC-1C-ALG-TD-003			पृष्ठ संख्या SHEET NO: 3 OF 4	SHEET SIZE: A1

संरचना STRUCTURE

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यह ड्राइंग जयपुर मेट्रो रेल कॉर्पोरेशन लिमिटेड की संपत्ति है।
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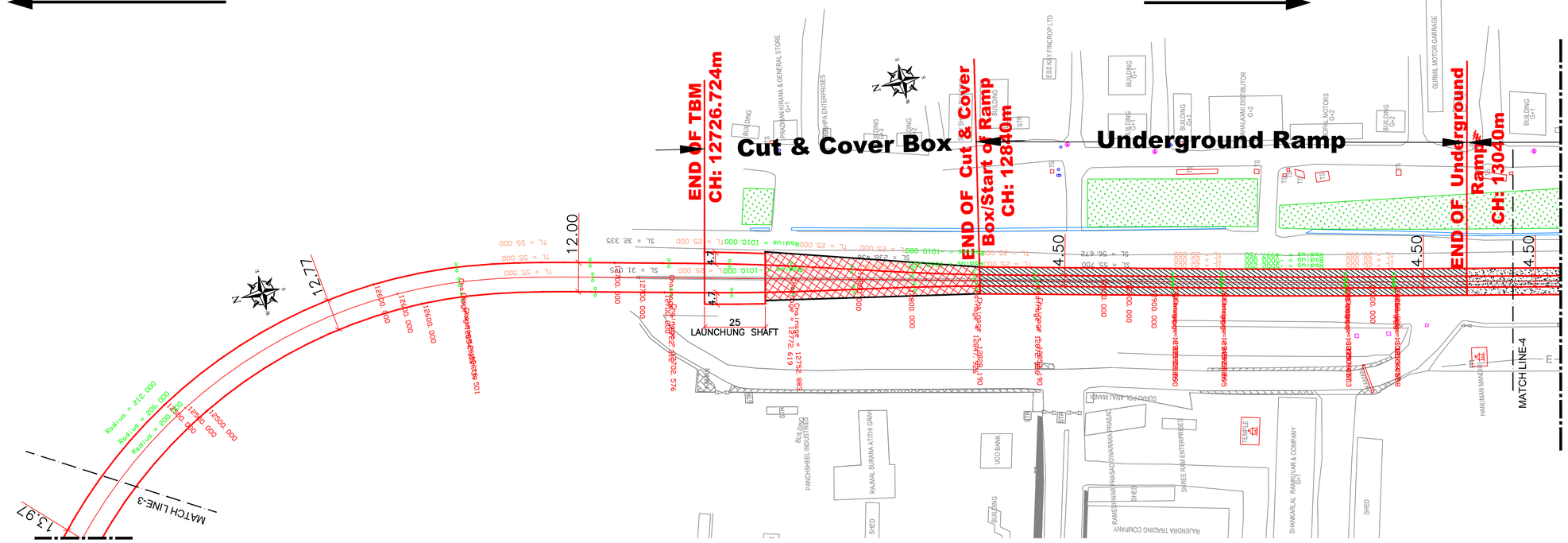
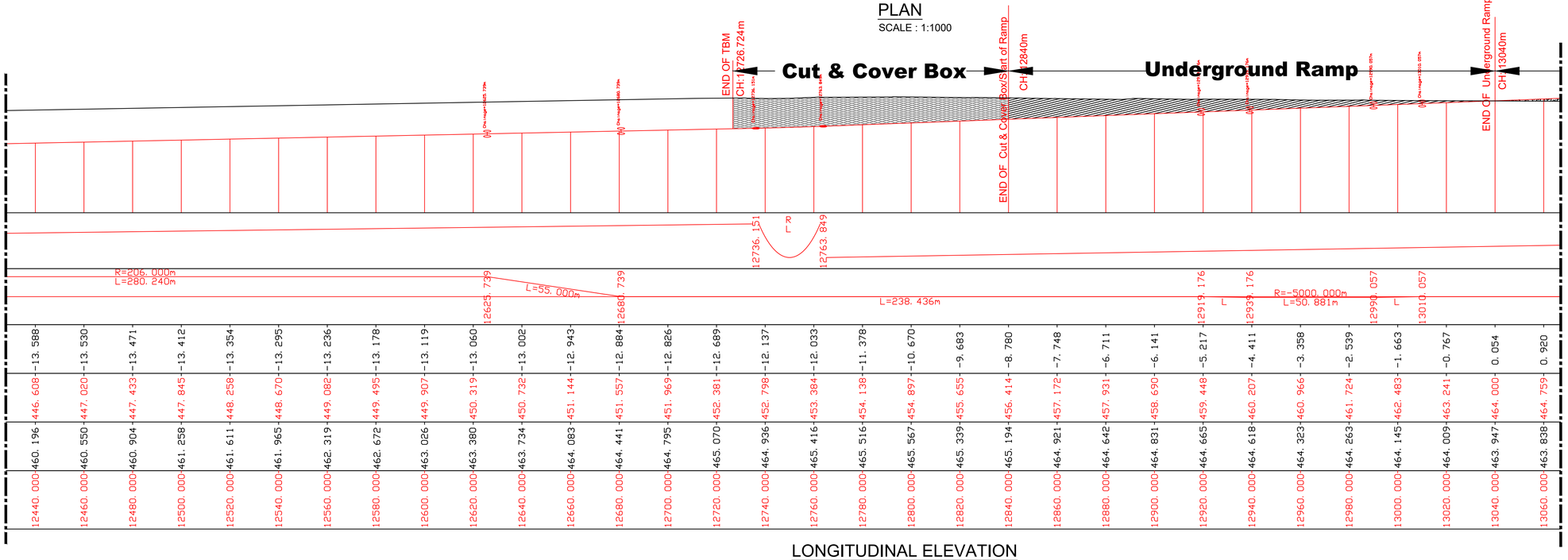
RAMGANJ CHAUPAR

TRANSPORT NAGAR



PLAN

SCALE : 1:1000



LONGITUDINAL ELEVATION

TENDER DRAWING

यह ड्राइंग/डिज़ाइन जयपुर मेट्रो रेल कॉर्पोरेशन लिमिटेड की संपत्ति है।
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जारी किये गए चित्रांकन
ISSUED DRAWINGS

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12-07-23	R1	RAMGANJ STATION LAYOUT UPDATE	MC	RS	AS
06-05-23	R0	FIRST ISSUE	MC	RS	AS

Director (Project) Rail Corp. Ltd. JAIPUR

चित्रांकन संदर्भ
REFERENCE DRAWINGS

क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

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Dy.CE/CRE/JP	PD/JP	
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Dy.CE/Design	CE/DESIGN–I	
Dy.CEE/TR		
Dy.CEE/E&M		
JGM/Track		
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Certified that this document has been designed and checked in accordance with DDC Quality Assurance Plan.

डी० डी० सी० प्राधिकृत हस्ताक्षरकर्ता
Authorised Signatory for DDC.

CLIENT:- JAIPUR METRO RAIL CORPORATION LTD.

GENERAL CONSULTANT:- DELHI METRO RAIL CORPORATION LTD. MC

DDC:- Ayesa India Private Limited
D 99, 3rd Floor, Sector 2, Noida -201301,Gautam Budh Nagar, Uttar Pradesh
Tel.: +(91) 120 490 8800, Email: dcdd05@ayesa.com AS RS

PROJECT:-"Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar (excluding) to Transport Nagar dead end of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, Water supply, Sanitary Installations and Drainage Works at Jaipur"

स्टेशन : STATION NAME :

चित्रांकन शीर्षक : GENERAL ARRANGEMENT DRAWING FOR UNDER GROUND STRETCH
DRAWING TITLE:

दिनांक DATE :	संशोधन REV. :	चित्रात्मक पैमाना GRAPHICAL SCALE:	स्थिति STATUS :
12-07-23	R1	1:1000	TENDER

चित्रांकन संख्या DRAWING NUMBER:	पृष्ठ संख्या SHEET NO:	SHEET SIZE:	संरचना STRUCTURE
GEN-JMRC-1C-ALG-TD-004	4 OF 4	A1	

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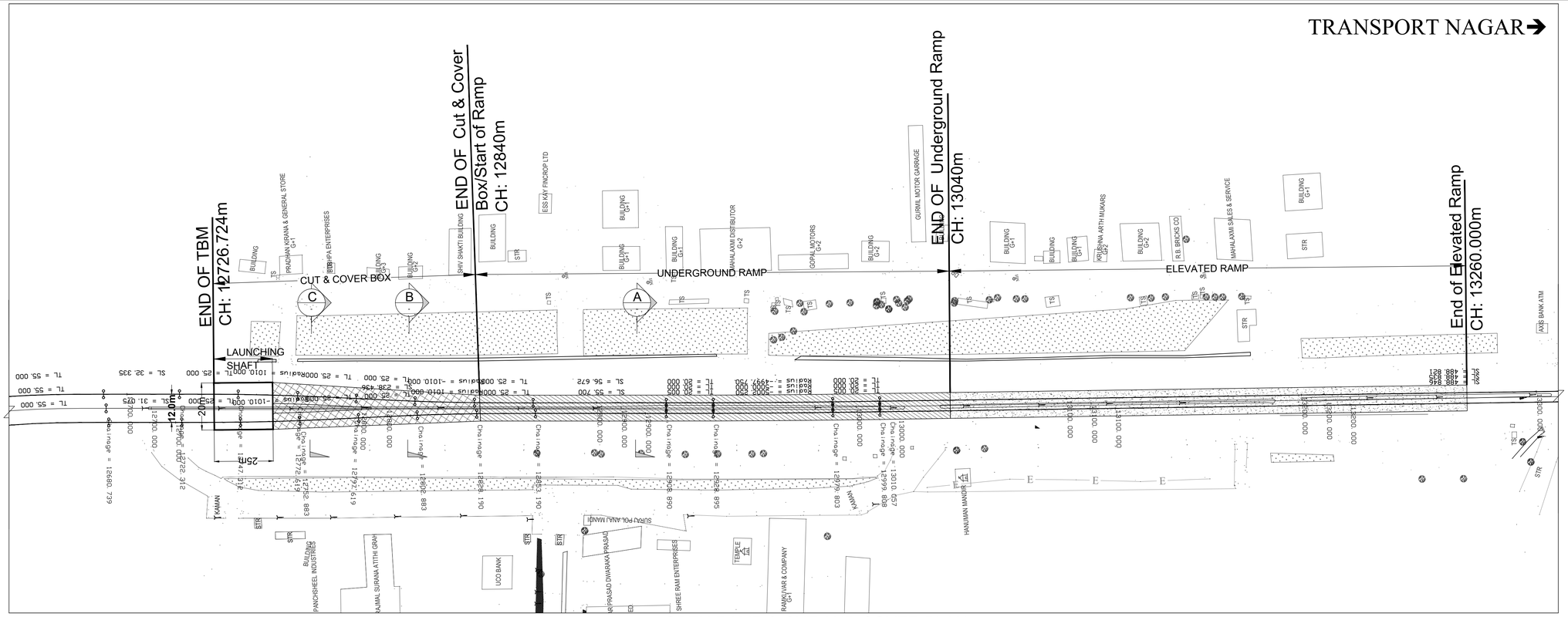


OPEN RAMP & CUT AND COVER PLAN

(SCALE 1:600)

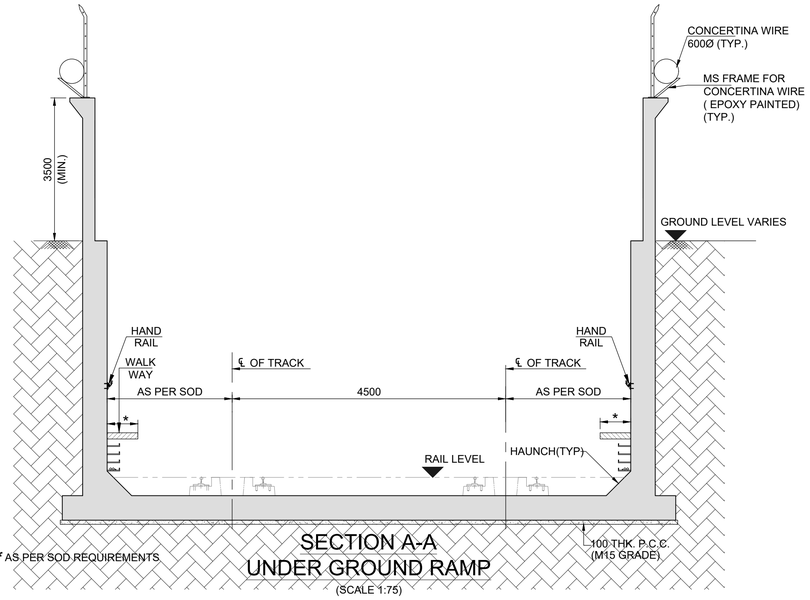
NOTES:

1. ALL DIMENSIONS ARE IN MM AND LEVEL IN METERS UNLESS OTHERWISE STATED.
2. ALL DIMENSIONS ARE TO BE READ FROM FIGURE AND NOT TO BE MEASURED.
3. THE SECTION SHOWN IN THE FIGURE IS INDICATIVE AND CONTRACTOR SHALL ENSURE COMPLIANCE TO ALL CONTRACTS PROVISION.
4. CHAINAGE BOUNDARIES AND DIMENSIONS SHOWN FOR DIFFERENT CROSS SECTIONS ARE TENTATIVE ONLY.
5. THE CONTRACTOR SHALL ENSURE THAT SOD REQUIREMENTS ARE SATISFIED.

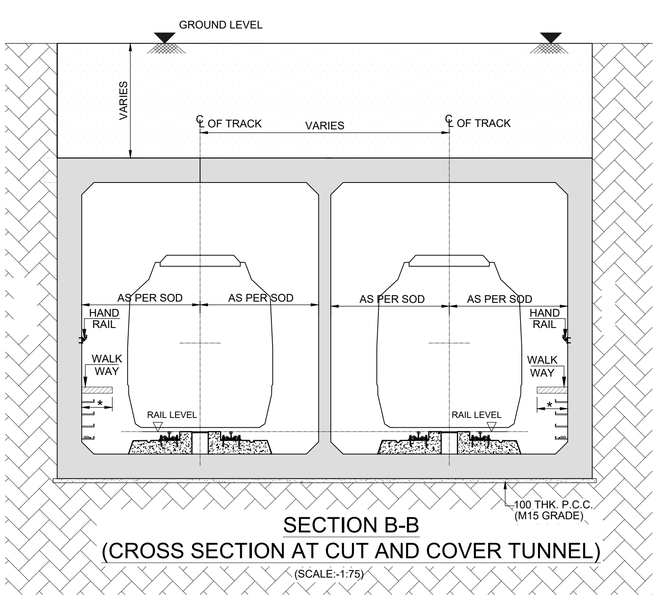
DIMENSION OF ALL STRUCTURAL ELEMENTS ARE MINIMUM. THE SAME SHALL BE INCREASED, IF REQUIRED, WITHOUT ANY EXTRA COST AFTER GETTING APPROVAL FROM EMPLOYER.

SPECIAL NOTES:

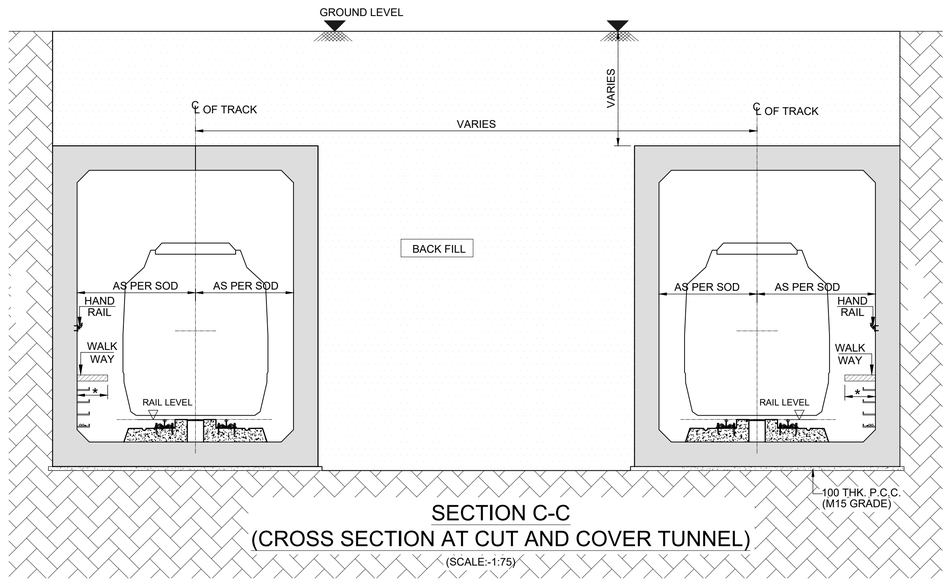
** NO SEPARATION WALL SHALL BE PROVIDED BETWEEN TWO TRACKS IN THIS ZONE.



SECTION A-A
UNDER GROUND RAMP
(SCALE 1:75)



SECTION B-B
(CROSS SECTION AT CUT AND COVER TUNNEL)
(SCALE:-1:75)



SECTION C-C
(CROSS SECTION AT CUT AND COVER TUNNEL)
(SCALE:-1:75)

TENDER DRAWING

जारी किये गए चित्रांकन
ISSUED DRAWINGS

दिनांक DATE	संशोधन REV.	DESCRIPTION	विकृत DRAWN	जांच CHECKED	सत्यापित APPROVED
12.07.23	R1	INITIAL REVISION	S.K	A. GOPE	A. Sur
06.05.23	R0	INITIAL ISSUED	S.K	A. GOPE	A. Sur

चित्रांकन संदर्भ
REFERENCE DRAWINGS

क्रमांक S.NO.	चित्रांकन संख्या DRAWING NO.	विवरण DESCRIPTION

NOTICE OF NO OBJECTIONS' FROM EMPLOYER'S REPRESENTATIVE.

GENERAL CONSULTANTS (DMRC)		JMRC
Dy.HODs	HODs	
Dy.CE/CRE/JP	PD/JP	
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डी० डी० सी० प्राधिकृत हस्ताक्षरकर्ता
Authorised Signatory for DDC.

CLIENT:- JAIPUR METRO RAIL CORPORATION LTD.

GENERAL CONSULTANT:- DELHI METRO RAIL CORPORATION LTD.

DDC:-
Ayesa India Private Limited
D 99, 3rd Floor, Sector 2, Noida -201301,Gautam Budh Nagar, Uttar Pradesh
Tel.: +(91) 120 490 8800, Email: dcdd05@ayesa.com

PROJECT:-"Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar (excluding) to Transport Nagar dead end of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, Water supply, Sanitary Installations and Drainage Works at Jaipur"

स्टेशन :
STATION NAME : UNDERGROUND CUT & COVER TUNNEL & RAMP

चित्रांकन शीर्षक :
DRAWING TITLE: OPEN RAMP, CUT & COVER GENERAL ARRANGEMENT

दिनांक	संशोधन	चित्रात्मक पैमाना	स्थिति	
DATE : 12.07.23	REV : R1	GRAPHICAL SCALE: AS SHOWN	STATUS : TENDER	
चित्रांकन संख्या DRAWING NUMBER: CCV-JMRC-1C-STR-TD-14003			पृष्ठ संख्या SHEET NO: 1 OF 2	SHEET SIZE: A1

संरचना STRUCTURE

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यह डिजाइन/ड्राइंग/डेटा जयपुर मेट्रो रेल कॉर्पोरेशन लिमिटेड की संपत्ति है।
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CHAPTER 1 GENERAL

1.0 INTRODUCTION

The work for conducting "**Geo-technical Investigation work for Extension of underground and elevated section E-W Corridor from Badi Chouper to Transport Nagar (2.85Km) Phase-1C and Mansarovar to Ajmer Road (Chauraha) (1.35 km) Phase-1D" of Jaipur Metro Rail Corporation at Jaipur**" was awarded to **CEG Test House & Research Centre Pvt. Ltd.** (CEGTH) by M/s **Jaipur Metro Rail Corporation Ltd.** vide work order no. FN:7 (C-430)/JMRC/ Phase-1C&1D/Geo/2023/02 Dated 04.04.2023**.**

The objective of this detailed geotechnical investigation work is to assess the nature and strength characteristics of the sub strata and to evaluate the soil / Rock core parameters required for design of suitable foundations for various structures.

Field work including drilling of boreholes, conducting various other field tests and collection of soil samples was carried out in the presence of Engineer in charge. Laboratory tests were conducted on selected soil samples to determine the design parameters, conforming to relevant specifications and as per guidelines received from the client.

This report includes the detailed Methodology of Investigation, collection of soil samples, field test results, laboratory test results and analysis of results based on soil / rock core samples collected from the locations of 23 boreholes carried out at underground section for metro project.

2.0 DETAILS OF SITE & GENERAL GEOLOGICAL HISTORY

The location of proposed site is situated in between Jhotwara and Bagru block of district Jaipur in the state of Rajasthan. As per IS 1893, the site falls under seismic zone II (Seismic intensity – Low), which corresponds to a Modified Mercalli Intensity of VI. In seismic design, Zone factor Z of 0.10 is recommended for Zone-II.

From Field Investigation study, it was observed that strata is in cohesionless in nature. The strata observed at site is generally of medium dense to dense below EGL which becomes very dense as the depth increases.

Local Geology

The generalized geological sequence as observed in the field can be summarized as under:

Jaipur district is located in the eastern part of Rajasthan. It is bounded in the north by Sikar district, in the east by Alwar and Dausa districts, in the south by Tonk districts and in the west by Ajmer and Nagaur districts. It stretches between 26° 26' 08.11" to 27° 51' 52.11" north latitude and 74° 54'

Jaipur Metro Rail Corporation Director (Project) JAIPUR

- Atterberg's Limits
  - (a) Liquid limit
  - (b) Plastic limit
  - (c) Plastic Index
- Specific gravity
- Bulk and dry densities
- Consolidation tests
- Triaxial tests
- Direct shear test
- Chemical tests on soil samples

- **<u>On rock samples</u>**
  - Moisture content, porosity & Density
  - Specific gravity
  - Unconfined compression test (both at saturated and in-situ water content)
  - Point load strength index
- Submitting draft report including all field records and laboratory test results, graphs etc. all complete as per specification.

4.1 FIELD INVESTIGATION

For geotechnical investigation work, drilling rig was installed at the specified borehole location along with the required men & machineries for conducting the requisite field work. The location of borehole is shown vide location plan attached under **Appendix - A1.** The details of borehole locations are shown here in below:-

Table 1.1: Details of Borehole Locations

S. No.	Chainage (km)/Structure	BH No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)	
					E	N
1	Underground section	BH-01	Not Encountered	40	582249.000	2978146.000
2		BH-02			582353.000	2978119.000
3		BH-03			582463.000	2978080.000
4		BH-04			582567.000	2978046.000
5		BH-05			582676.000	2978047.000
6		BH-06			582788.000	2978022.000
7		BH-07			583035.000	2977962.000

Jaipur Metro Rail Corporation Limited
Director (Project)
JAIPUR

8		BH-08			583134.000	2977927.000
9		BH-09			583240.000	2977907.000
10		BH-10			583335.000	2977897.000
11		BH-11			583426.000	2977864.000
12		BH-12			583532.000	2977857.000
13		BH-13			583655.000	2977804.000
14		BH-14			583776.000	2977804.000
15		BH-15			583871.000	2977775.000
16		BH-16			583966.000	2977752.000
17		BH-17			584034.000	2977720.000
18		BH-18			584169.000	2977715.000
19		BH-19			584252.000	2977669.000
20		RJST-01			582888.000	2978033.000
21		RJST-02			582863.000	2977984.000
22		RJST-03			582916.000	2977951.000
23		RJST-04			582933.000	2978009.000

4.2 FIELD INVESTIGATION IN SOIL STRATA

Following practices were followed at site:

- The locations of 23 boreholes, were marked on the ground as per the layout given by the Engineer in charge. These locations are shown in **Appendix-A1** attached subsequently.
- In soils, boreholes of 150mm dia. were drilled as per the standard procedure laid in IS: 1892 as per specifications
- Boreholes were properly cleaned before taking any sample in soil.
- Standard Penetration Tests & collection of undisturbed / disturbed soil samples were conducted at the locations of various boreholes as per the specifications and at specified depths.

The detailed procedure adopted for conducting various field tests are described in the following paragraphs:

4.2.1 Standard Penetration Test

The Standard Penetration Test was conducted in boreholes at regular interval in depth as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows 'N'. Standard split spoon sampler was attached to an 'A' rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as 'N' value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective bore logs.

SPT 'N' values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

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Director (Project)
JAIPUR

COREBOX PHOTOGRAPHS

UNDERGROUND_BH-18

Jaipur Metro Rail Corporation
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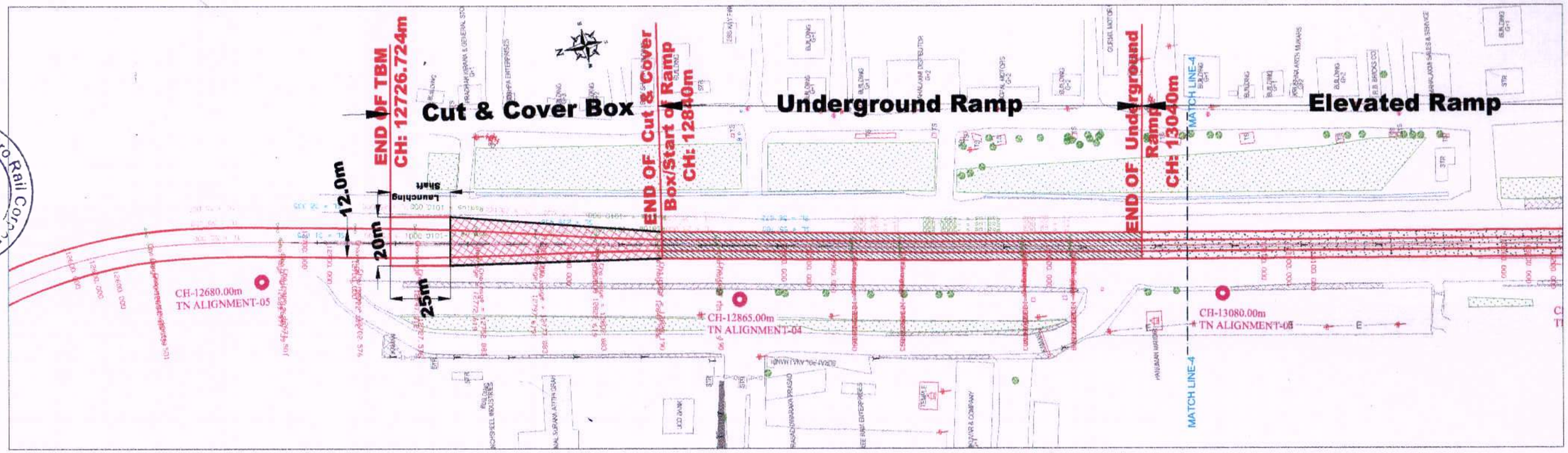
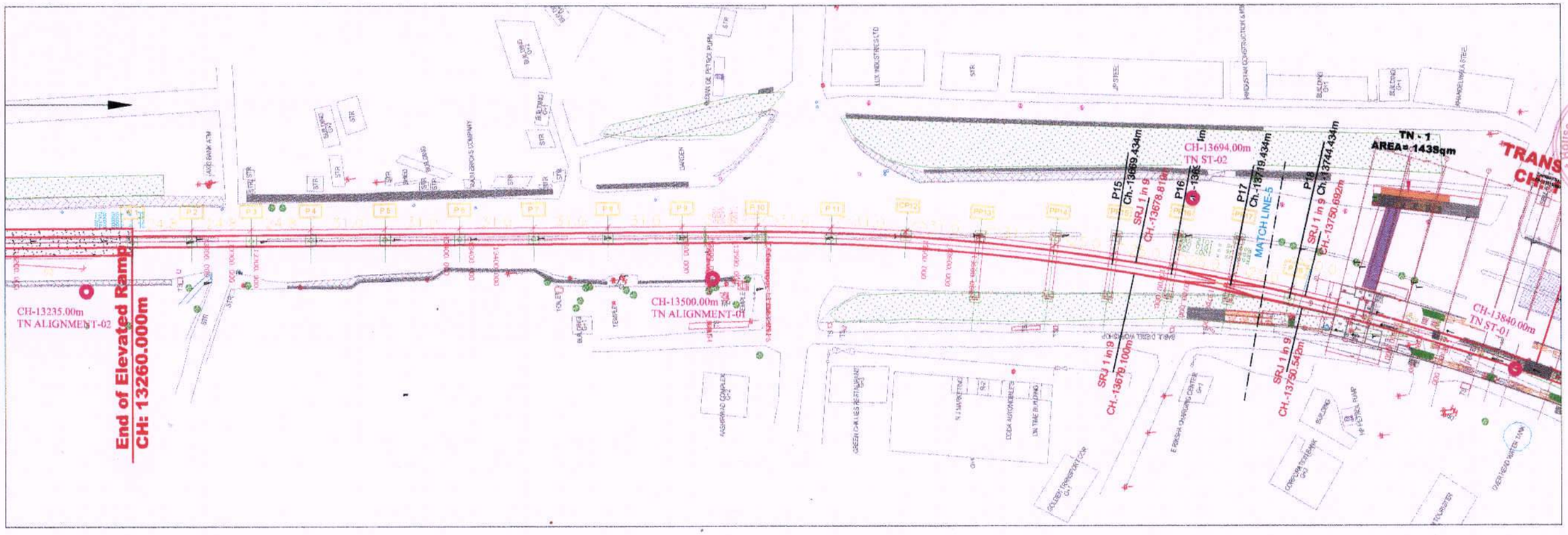
JAIPUR

GALTA GATE

ELEVATED SETION

TRANSPORT NAGAR





Jaipur Metro Rail Corporation Limited JAIPUR Director (Project)

CEG Test House and Research Centre Pvt. Ltd. Jaipur

	FIG:- BOREHOLE LOCATION PLAN	NAME OF WORK: "GEO-TECHNICAL INVESTIGATION WORK FOR EXTENSION OF E-W CORRIDOR FROM BADI CHOUPER TO TRANSPORT NAGAR (2.85KM) PHASE -1C AND MANSAROVAR TO AJMER ROAD (CHAURAHA) (1.35KM) PHASE-1D OF JAIPUR METRO RAIL CORPORATION AT JAIPUR."	CONTRACTOR :- CEG TEST HOUSE AND RESEARCH CENTER PVT LTD.

Geotechnical Investigation Report

Elevated Section (Galta Gate to Transport Nagar)

SR NO. : 837_23-24

GEO-TECHNICAL INVESTIGATION WORK FOR EXTENSION OF UNDERGROUND AND ELEVATED SECTION E-W CORRIDOR FROM BADI CHOUPER TO TRANSPORT NAGAR (2.85KM) PHASE-1C AND MANSAROVAR TO AJMER ROAD (CHAURAHA) (1.35 KM) PHASE-1D OF JAIPUR METRO RAIL CORPORATION AT JAIPUR IN THE STATE OF RAJASTHAN

CLIENT

M/s. JAIPUR METRO RAIL CORPORATION LTD.

PROGRAMME

APRIL - 2023

SR. No.	Report No.	Revision No.	Date
837_23-24	CEGTH/JMRCL/SR-837/2023-24/374_(07 BHs)	01	30.06.2023
837_23-24	CEGTH/JMRCL/SR-837/2023-24/195_(07 BHs)	00	05.06.2023

CEGTH
CEG TEST HOUSE
AND RESEARCH CENTRE PVT. LTD

B-11(G), Malviya Industrial Area, Jaipur-302017
Tel. : 91-141-4046599, Fax : 91-141-2751806
E-mail : info@cegtesthouse.com., www.cegtesthouse.com

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

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Nehal Jain

General Manager-Geotechnical

Tamoghna Dasgupta

Geotechnical Manager

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

CEGTH/JMRCL/SR-837/2023-24/374 Date: - 30.06.2023

To,

Jaipur Metro Rail Corporation Ltd.,
1st Floor, Administrative Building Wing-A,
Bhrigu Path, Mansarovar Metro Depot,
Jaipur - 302020
Tel. No. 0141-2822781
E Mail - dp@jaipurmetrorail.in

Subject :- Geo-technical Investigation work for Extension of underground and elevated section E-W Corridor from Badi Chouper to Transport Nagar (2.85Km) Phase-1C and Mansarovar to Ajmer Road (Chauraha) (1.35 km) Phase-1D of JAIPUR METRO RAIL CORPORATION at Jaipur

Dear Sir,

We are pleased to submit this report of 07 boreholes for elevated section (Galta Gate to Transport Nagar) for the proposed project.

The accompanying report presents field and laboratory test results, interpretation of test results as required for design and construction of foundations.

Should there be any clarifications regarding the contents please contact us at your most convenient time.

We value the opportunity to participate in this project and look forward a pleasant association on future projects.

Very truly yours,
CEG Test House & Research Centre Pvt. Ltd.

Prepared By:-

Nehal Jain
General Manager - Geotechnical
Authorized Signatory

Tamoghna Dasgupta
Geotechnical Manager

Technical Advisor

Dr. Sarvesh Chandra
(Geotechnical Expert)
Former Professor, IIT Kanpur

SR. No.	Report Ref. No.	Revision No.	Date
837_23-24	CEGTH/JMRCL/SR-837/2023-24/374_(07 BHs)	01	30.06.2023
837_23-24	CEGTH/JMRCL/SR-837/2023-24/194_(07 BHs)	00	05.06.2023

Director (Project) JAIPUR

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Director (Project) JAIPUR

Jaipur Metro Rail Corporation Director (Project) JAIPUR

CHAPTER 1 GENERAL

1.0 INTRODUCTION

The work for conducting "**Geo-technical Investigation work for Extension of underground and elevated section E-W Corridor from Badi Chouper to Transport Nagar (2.85Km) Phase-1C and Mansarovar to Ajmer Road (Chauraha) (1.35 km) Phase-1D" of JAIPUR METRO RAIL CORPORATION at Jaipur**" was awarded to **CEG Test House & Research Centre Pvt. Ltd.** (CEGTH) by M/s **Jaipur Metro Rail Corporation Ltd.** vide work order no. FN:7(C-430)/JMRC/Phase-1C&1D/Geo/2023/02 Dated 04.04.2023**.**

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Jaipur Metro Rail Corporation Director (Project) JAIPUR

52.59'' to 76º17' 34.36'' east longitude covering an approximate area of 11,136 sq kms. The district is drained by several rivers viz., Banganga, Banas, Sabi and Shekhawati rivers and streams like: Bandi, Mashi, Dhund, Morel, Mendha, Gumti ka Nala, Madhobini, Sota etc.

Geologic succession of Jaipur district is quite wide ranging in terms of age and rocks from Archean to Recent age are present in the area. Most of the north eastern part of the district is covered by younger and older alluvium which is predominantly sandy and clayey in nature. In some parts of western Jaipur eolian sand is also present as a thin cover above the alluvium sediments. Some parts in the northeastern region also show presence of Delhi Super Group quartzites, schists, phyllites and marbles. Most of the southern half of the district is occupied by Gneisses and schists of Bhilwara Super Group.

Table: Geologic succession

Super Group	Group	Formation
-	Recent to sub-recent	Sand, Clay, Clay Kankar etc.
Post Delhi		Granite, Pegmatite, amphobolite (intrusive)
Delhi	Ajabgarh	Schists, Phyllites, Marble and Quartzite
	Alwar	Quartzite, Conglomerate and Schists
	Raialo	Dolomitic marble and Quartzite
Bhilwara	-	Gneisses, Schists and Migmatites

The proposed site is placed in alluvial plain (sandy) which is flat to gentle undulating plain formed due to fluvial activity, mainly consists of gravels, sand, silt and clay with unconsolidated material of varying lithology, predominantly sand along river.

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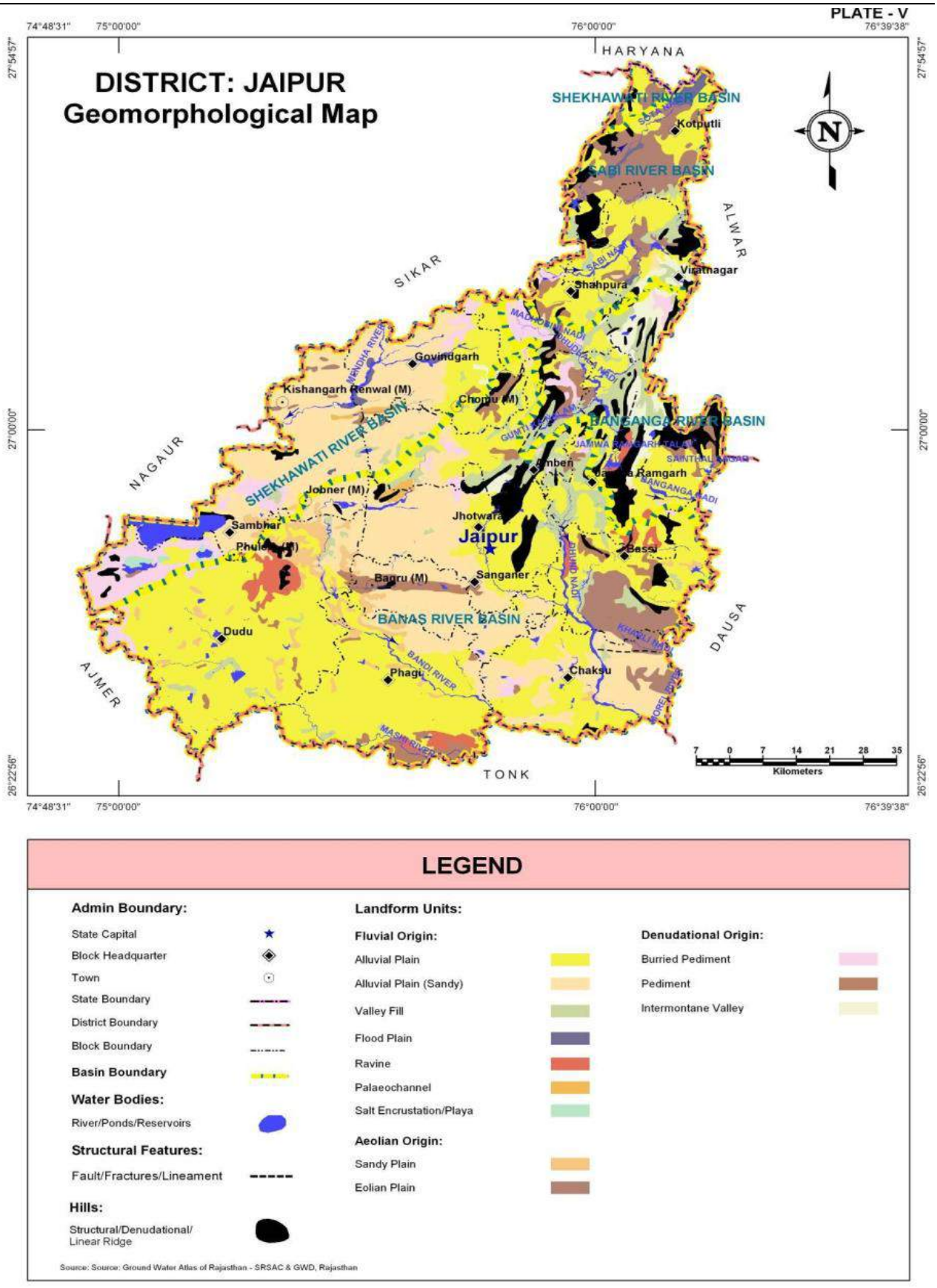

Fig 1 Geomorphological Map of Jaipur

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CLIMATIC CONDITION

Jaipur district has a semi-arid climate. There are three distinct seasons in a year. The winter season encompassing four months from November to February are mild and pleasant, with average temperatures in the 15^{o}-18^{o} C range and low humidity. December and January are the coldest months when temperature varies between 5^{o}C and 10^{o}C. There are however, occasional cold waves that lead to significant reduction of temperatures. March is a pleasant transition month to summer. The summer months of April to June record average daily temperature of around 35^{o}C. May and June are the hottest months in Jaipur district. Temperature reaches up to 48^{o}C in these months. Most of the annual rainfall is received in the monsoon months between June (end of June) and September.

3.0 SCOPE OF WORK

The stipulated scope of work involved carrying out the following operations:-

- Mobilization & Demobilization of drilling rig and all other required equipment, tool & tackles for carrying out investigation work on-land investigation.
- Shifting from one structure to other structure and set up to rigs and manpower along with other tools.
- Drilling of 150 mm dia boreholes in all type of soil/ rock up to required depth below existing ground surface and conducting standard penetration test at 1.5 meter interval on every change of strata as per IS-2131-1981 including collection of disturbed/undisturbed soil samples at every 1.5m interval and recording depth of ground water table, conducting the lab tests analyzing the test results including determination of SBC & penetration of report.
- Wherever refusal strata with characteristics of rock is encountered before achieving the required depth, boreholes as above are to be further extended up to required depth in all types of rock using hydraulic feed rotary drill and triple tube core barrel with diamond bit including collection of core samples.
- Carrying out the following Laboratory tests on the selected Soil samples in order to establish their engineering characteristics :
- **<u>On soil samples</u>**
    - Moisture content
    - Grain size analysis
        (a) Sieve Analysis
        (b) Hydrometer Analysis

- Atterberg's Limits
  - (a) Liquid limit
  - (b) Plastic limit
  - (c) Plastic Index
- Specific gravity
- Bulk and dry densities
- Consolidation tests
- Triaxial tests
- Direct shear test
- Chemical tests on soil samples

- **<u>On rock samples</u>**
  - Moisture content, porosity & Density
  - Specific gravity
  - Unconfined compression test (both at saturated and in-situ water content)
  - Point load strength index
- Submitting draft report including all field records and laboratory test results, graphs etc. all complete as per specification.

4.0 FIELD INVESTIGATION

For geotechnical investigation work, drilling rig was installed at the specified borehole location along with the required men & machineries for conducting the requisite field work. The location of borehole is shown vide location plan attached under **Appendix - A1.** The details of borehole locations are shown here in below:-

Table 1.1: Details of Borehole Locations

S. No.	Chainage (km)/Structure	BH No.	Depth of Water Table below EGL (m)	Depth of Borehole below EGL (m)	Co-ordinates (m)	
					E	N
1	Elevated Section	TNST-01	Not Encountered	40	583984.000	2976349.000
2		TN Alignment-01		40	584086.000	2976670.000
3		TNST-02		40	584079.000	2976467.000
4		TN Alignment-05		40	584247.000	2977483.000
5		TN Alignment-02		40	584132.000	2976927.000
6		TN Alignment-03		40	584164.000	2977091.000
7		TN Alignment-04		40	584201.000	2977289.000

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4.1 FIELD INVESTIGATION IN SOIL STRATA

Following practices were followed at site:

- The locations of 07 boreholes, were marked on the ground as per the layout given by the Engineer in charge. These locations are shown in **Appendix-A1** attached subsequently.
- In soils, boreholes of 150mm dia. were drilled as per the standard procedure laid in IS: 1892 as per specifications
- Boreholes were properly cleaned before taking any sample in soil.
- Standard Penetration Tests & collection of undisturbed / disturbed soil samples were conducted at the locations of various boreholes as per the specifications and at specified depths.
- The detailed procedure adopted for conducting various field tests is given here in below.

The detailed procedure adopted for conducting various field tests are described in the following paragraphs:

4.1.1 Standard Penetration Test

The Standard Penetration Test was conducted in boreholes at regular interval in depth as per IS 2131. The test was carried out using the standard split spoon sampler to measure the number of blows 'N'. Standard split spoon sampler was attached to an 'A' rod. It was driven from borehole bottom to a distance of 45 cm using a standard hammer of 63.5 kg falling freely from a height of 75 cm to the required depth. While driving, the number of blows required to penetrate every 15 cm are recorded. The total number of blows required for the last 30 cm is taken as 'N' value at that particular depth of the borehole. Wherever the total penetration was less than 45cm, the no. of blows & the depth penetrated is recorded in the respective bore logs.

SPT 'N' values were correlated with relative density of non-cohesive stratum and with consistency of cohesive stratum as given below:-

Table 1.2: Soil compactness as per SPT N values
(cl. 9.7, table 9.3 & 9.4, page 330_text book of V.N.S. Murthy)

Correlation for Clay / Plastic silt		Correlation for Sand / Non-Plastic silt	
Consistency	**SPT 'N' Value**	**Compactness**	**SPT 'N' Value**
Very Soft	0 - 2	Very Loose	0 - 4
Soft	2 - 4	Loose	4 - 10
Medium	4 - 8	Medium	10 - 30
Stiff	8 - 15	Dense	30 - 50
Very Stiff	15 - 30	Very Dense	> 50
Hard	> 30		

The field SPT N values were corrected as per the guidelines given in IS: 2131 as follows:

(a) For overburden: - The N value for cohesion less soil is corrected with the help of fig. 1 given in IS-2131.

(b) Due to dilatancy :- Wherever N values observed below water table in fine sand, silty sand or silt was greater than 15, then corrected N values were corrected as under:

$$N' = 15 + \tfrac{1}{2}(N-15)$$

4.1.2 Undisturbed Sampling (Soil) in boreholes

Undisturbed soil samples were collected using MS tubes of required size and length with Area ratio as per clause 4.1.1 (c) of IS: 1892 (latest) fitted to an adopter with ball and socket arrangement. Before taking any sample, sampling tube was properly greased. Immediately after taking on undisturbed sample in a tube, the adopter head was removed along with the disturbed material. The visible ends of the sample were trimmed off any wet disturbed soil. The ends were coated alternately with four layers of just molten wax. More molten wax was added to give a total thickness of min. 25 mm. The samples were carefully labeled and transported to the laboratory for testing. Undisturbed samples wherever slipped during lifting were duly marked in the field logs as well as in the soil profile.

4.1.3 Disturbed Soil sampling in boreholes

Disturbed soil samples were collected at regular interval & at every identifiable change of strata. Samples were immediately sealed, labeled and carefully transported to the laboratory for testing.

4.1.4 IN-SITU PERMEABILITY TEST

(A) CONSTANT HEAD METHOD

Introduction:

In-situ permeability test shall be conducted to determine the water percolation capacity of overburden soil. This test shall be performed inside the bore hole at specified depths or in each layer or as per the directions of the Engineer. The type of test shall be either pump in or pump-out test depending on the sub soil and ground water conditions.

Constant Head Method:

This test shall be conducted in bore holes where soil has a high permeability; water shall be allowed in to the bore hold through a metering system ensuring gravity flow at constant head so as to maintain a steady water level in the bore hole. A reference mark shall be made a convenient level which can be easily seen on the casing pipe to note down the fluctuations of water level. The fluctuations shall be counteracted by varying the quantity of water flowing in to the bore hole. The

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elevation of water shall be observed at every 5 minute interval. When three consecutive readings show constant value, the necessary observations such as flow rate, elevation of water surface above test depth, diameter of casing pipe, etc. shall be made and recorded as per the proforma recommended in IS: 5529,Part-I.

The test was repeated till Constant records of water level was achieved.

The result of in-situ field permeability tests are given below:

(B) Falling Head Method

In-situ permeability test using Falling Head method were conducted to determine the water percolation capacity of overburden soil. This test was performed inside the bore hole at specified depths or in each layer or as per the directions of the Engineer.

The coefficient of permeability was evaluated on the basis of Darcy's law which states that the rate of flow through a porous media is proportional to the hydraulic gradient.

In this method the water level in the test hole was allowed to fall and the equivalent permeability is computed from the data of rate of fall of the water level.

For conducting the test, a borehole upto the level of the test depth was drilled. Then the BH was cleaned and casing of 150mm dia. was inserted above the test depth and fill the borehole with water up to the top of the casing and record the rate of fall of water.

The permeability of soil overburden by falling head method is obtained by using the following expression:

$$K = (d^2/8L) \log_e [(L/r)(\log_e(h_1/h_2)/(t_2-t_1)]$$

where,

K = coefficient of permeability

d = diameter of intake pipe

L = length of test zone

h_1 = head of water at time t_1

h_2 = head of water at time t_2

r = radius of hole.

The fall in the water level was recorded at regular intervals as mentioned in IS: 5529, Part-I.

Table 1.3 (B): In-situ Soil Permeability Test

Sr. No.	BH No	Depth of test section below EGL (m)	Test Section Length (m)	Coefficient of permeability k (cm/s)
1	TN STN 01	20.25 - 21.00	0.75	2.34×10^{-4}
2		30.25 - 31.00	0.75	2.74×10^{-4}

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3	TN STN 02	12.00 - 12.75	0.75	2.59×10^{-4}
4		20.00 - 20.75	0.75	2.77×10^{-4}

Note: The results of field permeability tests are shown vide **Appendix – A4**.

4.1.5 FIELD INVESTIGATION IN ROCK STRATA

Drilling was done by rotary core drilling method using Double tube core barrels as per the guidelines of IS: 6926-1196, because of its ability in retaining higher quality of rock samples. A core barrel and Nx sized bits were used for drilling and recovering rock cores. Recovered rock cores were numbered serially and preserved in good quality sturdy wooden core boxes as specified in IS: 4078-1980. Rock core recovery and Rock Quality Designation (RQD) were computed for every run length. Water was used as the drilling fluid. The ratio of total length of rock pieces collected to length drilled, expressed as percentage and known as core recovery was recorded. To obtain RQD (Rock Quality Designation), only those pieces of rock which were 10 cm and longer were measured for the total length. The above length divided by length drilled, expressed as percentage, was recorded as RQD. The Core Recovery and RQD value were assigned based on Standard procedure given in IS: 11315 (Part 11).

Thus

(a) Core recovery in % = (Length of Core / Length of run) x 100

(b) RQD in % = (Length of core in pieces of 100mm and above / Length of run) x100

Rock classification in terms of weathering, state of fractures & strength was carried out in the following manner as tabulated below:-

Table 1.2: Scale of Weathering Grades of Rock Mass [cl. 3.6.2.2 of IS: 4464]

Terms	Description	Grade
Fresh	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.	I
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker externally that in its fresh condition.	II
Moderately Weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discolored rock is present either as a continuous framework or as core stones.	III
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as core stones.	IV
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	V

Terms	Description	Grade
Residual Soil	All rock material is converted to soil. The mass structure and material fabric are destroyed. There is a large change in volume, but the soil has not been significantly transported.	VI

As per IS 4464 it should be understood that all grades of weathering may not be seen in a given rock mass and that in some cases a particular grade may be present to a very small extent. Distribution of the various weathering grades of rock material in the rock mass may be decided related to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

Rock classification based on their physical condition and Unconfined Compressive Strength based on Clause 8.2 and Table – 2 of IRC: 78-2014 as follows:-

Table 1.3: Classification of Rocks (IRC-78)

Rock Type	Description	Unconfined Compressive Strength (UCS) in MPa
Extremely Strong	Cannot be scratched with knife or sharp pick. Breaking of specimen could be done by sledge hammer only.	> 200
Very Strong	Cannot be scratched with knife or sharp pick. Breaking of specimens requires several hard blows of geologists' pick.	100 to 200
Strong	Can be scratched with knife or pick with difficulty. Hard blow of hammer required to detach hand specimen.	50 to 100
Moderately Strong	Can be scratched with knife or pick, 6mm deep gouges or grooves can be made by hand blow of geologists' pick. Hand specimen can be detached by moderate blow.	12.5 to 50
Moderately weak	Can be grooved or gouged 1.5mm deep by firm pressure on knife or pick point. Can be broken into pieces or chips of about 2.5mm maximum size by hard blows of the geologists' pick.	5 to 12.5
Weak	Can be grooved or gouged easily with knife or pick point. Can be break down in chips to pieces several cm's in size by moderate blows of pick point. Small thin pieces can be broken by finger pressure.	1.25 to 5
Very Weak	Can be carved with knife. Can be broken easily with point of pick. Pieces 25mm or more in thickness can be broken by finger pressure. Can be scratched easily by finger nail.	< 1.25

Relation between RQD and In-situ Rock Quality

Rock quality is further measured by frequency of natural joints in rock mass. RQD is used to define state of fractures or massiveness of rock. Following table defines the quality of rock mass as per

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Clause 5, IS: 11315 (Part 11)-1985:-

Table 1.4: Core Quality

Rock Type	RQD (%)
Excellent	90 - 100
Good	75 - 90
Fair	50 - 75
Poor	25 - 50
Very Poor	< 25

5.0 LABORATORY INVESTIGATION

5.1 LABORATORY TESTS ON SOIL SAMPLES

The details of various test conducted on selected undisturbed/disturbed soil samples are given below:

Description of Test	Standard Code Applicable	Undisturbed Soil Samples	Disturbed Soil / SPT Samples
Sieve Analysis / Hydrometer	IS: 2720 (Part – 4)	√	√
• Liquid Limit • Plastic Limit	IS: 2720 (Part – 5) IS: 2720 (Part – 5)	√	√
Natural Moisture Content / Bulk / Dry density	IS : 2720 (Part – 2)	√	-
Specific Gravity	IS : 2720 (Part – 3)	√	√
Direct Shear Test	IS : 2720 (Part – 13)	√	√
Triaxial shear test	IS : 2720 (Part – 11)	-	-
Consolidation Test	IS : 2720 (Part – 15)	-	-
Chemical Analysis of Soil Samples	IS : 2720 (Part – 26, 27)	√	√

- The results of various laboratory tests conducted on selected soil samples are shown vide **Appendix – B.**

The detailed procedure adopted for conducting various laboratory tests is described in the following paragraphs:

5.1.1 Grain Size Analysis (IS: 2720- Part-4)

Wet sieve analysis:

For determination of particle sizes finer than 75 micron, wet sieve analysis test was conducted. For this test, oven dried sample of known quantity was taken in a container and soaked with dispersing agent. The soaked soil sample was washed thoroughly over 75 micron IS sieve until the water passing sieve was substantially clean.

Fraction retained on 75 micron IS sieve was carefully collected in a container without any loss in material and placed into oven for drying.

Dry sieve analysis:

For this test, the oven dried soil sample after wet sieving was sieved through the set of IS sieves 20 mm, 10 mm, 4.75 mm, 2.0 mm, 425 micron and 75micron. The amounts of soil retained on each sieve were noted down. The % retained, cumulative % retained and % passing were computed accordingly. Wherever the soil sample % passing 75 micron sieve was significant, Hydrometer method was used to find the percentage of silt and clay fraction.

Grain size analysis for the fraction passing 75 micron IS Sieve (Hydrometer method)

Calibration of Hydrometer

Hydrometer was calibrated to determine a relationship (an equation) between the effective depth H_R and corresponding hydrometer reading R_h (obtained during test).

50 to 100 gm of soil sample passing through 75 micron IS Sieve was taken. It was mixed with 100 ml of sodium hexametaphosphate solution and the mixture was warmed for about 10 minutes. It was then transferred to the cup of the mechanical mixer and the soil suspension was stirred for 15 minutes. The soil suspension was transferred into 1000 ml measuring cylinder and distilled water was added to make 1000ml solution. This solution was mixed vigorously. The measuring cylinder was then allowed to stand and the stopwatch was started. Hydrometer was immersed in the solution and reading were taken after half, one, two and four minutes. The hydrometer was then removed slowly and kept in distilled water at the same temperature as the soil suspension. Readings were taken after the periods of 8, 15 and 30 minutes, and one, two and four hours. Hydrometer was removed, rinsed and placed in the distilled water after each reading. After 4 hours reading was taken once or twice within 24 hours. Finally a reading was taken at the end of 24 hours. The temperature of the suspension was observed and recorded.

Calculations

Diameter of the particles (D):

$$D = \sqrt{\frac{30\mu}{980(G-1)}} \times \sqrt{\frac{H_R}{t}} = M\sqrt{\frac{H_R}{t}}$$

Where,

D = diameter of particle in suspension, in mm;

μ = co-efficient of viscosity of water at the temperature of the suspension at the time of taking the hydrometer reading, in poise;

G = specific gravity of the soil fraction used in the sedimentations analysis;

H_R = effective depth corresponding to R_n, in cm.

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t = time elapsed between the beginning of sedimentation and taking of hydrometer reading in minutes

$M = \sqrt{\frac{30\mu}{980(G-1)}}$ = a constant factor for given values of μ and G at the temperature of the suspension.

Percentage finer than diameter D:

The percentage by mass (w) of particles smaller than corresponding equivalent particle diameters (D) was calculated from the formula:

$$w = \frac{100G_s}{W_b(G_s - 1)} \times R_h$$

Where

w = percentage finer

G_s = specific gravity of soil particle

W_b = weight of soil

R_h = Hydrometer reading

5.1.2 Liquid Limit (IS: 2720- Part-5)

By Cone Penetrometer Method

The 'Cone Penetrometer Apparatus' is a variant of the fall-cone and consists of a cone with a smooth polished surface and angle of 30° ± 1/2°. The weight of the cone, together with its associated shaft is 80g ± 0.5g. A support assembly with an automatic cone release mechanism and cone height adjustment mechanism used to hold the cone vertically. The angle and weight of the cone were calibrated at regular intervals, and the sharpness of the cone tip was checked daily.

Distilled water was added and thoroughly mixed with the soil sample to produce a homogeneous paste. The paste was then placed in a cup with a diameter of at least 55mm and a depth of at least 40mm. The surface of the soil was smoothed off level and parallel to the base. The support assembly was used to position the tip of the cone so that it was just touching the top surface of the soil, and the automatic tripping mechanism was released. The cone was allowed to penetrate into the soil for a period of 5 (± 1) s, then the cone was locked off to stop further movement and the penetration was recorded. The cup was refilled and the test was repeated. The two recorded penetrations need to be within 0.5mm of each other, otherwise a third test is performed. when the three test vary by more than 1mm the test was repeated.

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Further tests were conducted, at varying water contents, in order to produce a series of cone penetrations (usually 4) in the range 15mm to 25mm. The resulting cone penetrations were plotted verses the water content of the test specimens. The Liquid Limit (W_L) was read off the graph, being the water content at which the line of best fit through the test points crosses 20mm penetration.

5.1.3 Plastic Limit (IS: 2720-Part-5)

For this test, soil sample was prepared in the same way as for liquid limit test. A ball of soil sample weighed about 5 gm was formed. The ball was rolled between the fingers of one hand and the glass plate with pressure sufficient to reduce the mass into a thread of about 3 mm in 5 to 10 complete forward and back movements. When a diameter of 3 mm was reached, soil was again remolded into a ball. The process of rolling and remolding was repeated until the thread started just crumbing at a diameter of 3 mm. The crumbled thread was immediately transferred to an airtight container for determination of its moisture content by oven drying method.

This water content has been termed as plastic limit. (W_P)

5.1.4 Plasticity Index (IS: 2720-Part-5)

The plasticity index Ip was given by

$I_p=W_L-W_P$ (in percent)

5.1.5 Direct Shear Test (IS:2720-Part-13):

For this test shear box test apparatus was used. The prepared specimen from remolded/undisturbed sample was placed carefully in the box. The plain grid was kept on top of the specimen with its directions at right angles to the direction of shear. The upper porous stone was placed on the grid and loading pad on the stone. The box with specimen was gently placed in the container (water jacket). The specimen was submerged with water. The container was mounted with the shear box and the specimen inside, on the shearing machine. The upper part of the box was so adjusted that it touched the proving ring. The jack was brought forward to bear up against the box container. The proving ring dial gauge was set to read zero.

The steel ball was placed in the recess of the loading pad. The loading yoke was set in contact with the steel ball on the loading pad. Vertical displacement dial gauge to read zero in contact with the top of the yoke. The normal load was applied and any change in thickness of specimen was recorded. Shear displacement dial gauge was also set to read zero. The locking screw was now removed and two parts of the shear box were separated by advancing the spacing screws.

The specimen was sheared at constant rate of strain. The readings of the proving ring dial gauge were noted down every 15 seconds for the first one-minute and then every 30 seconds thereafter. The reading of change in the thickness dial gauge and shear displacement dial gauge were also recorded at the same time interval. The test was continued until the specimen fails. The specimen

was assumed to fail when the proving ring dial gauge started receding or at shear displacement of approximately 15% of the length took place.

The soil was removed from the box and test was repeated on the identical specimen under increased normal load.

5.1.6 Triaxial Shear Test_UUT (IS: 2720-Part-11)

For this test, Triaxial Shear Test apparatus was used. The plain disc was placed on the pedestal of the triaxial cell. The specimen was placed centrally on the disc. A correct size rubber membrane was fitted inside the stretcher with ends of membrane folded over those of the stretcher. Vacuum was applied to stretch the membrane to the inside surface of the stretcher which was carefully slipped around the specimen kept on the pedestal. The vacuum on the membrane was released. Its bottom part was rolled down into the pedestal. plain disc was placed on the top of the specimen and then loading pad was placed. The top part of membrane was rolled on to the loading pad. Then the stretcher was removed and ends were sealed with 'O' rings. With the properly sealed specimen placed centrally on the pedestal, the cell was assembled, keeping the loading piston initially clear of the loading pad of the specimen, the assembly was placed in the loading frame.

For unconsolidated undrained test, the bottom drainage value (BDV) and top drainage value (TDV) of cell, was closed and air release valve (ARV) was opened. The cell was filled with water through the cell water value CWV. ARV was closed when water begins to escape through it. The cell pressure was raised to the desired value and kept constant till the end of the test.

When the cell pressure was applied, the load piston rises upward, the loading machine was operated at the anticipated rate to bring the load piston slightly above the loading pad of the specimen and the load measuring dial gauge on proving ring was set to zero.

The piston was brought just in contact with loading pad by hand operation of the machine. The axial compression dial gauge was mounted and set to read zero.

The axial loading was started at 1.25 mm/min rate of strain. Simultaneous readings on the load and compression dial gauges were noted down. The test was continued until a recession of the axial load is observed or 20% of strain.

After failure, the specimen was unloaded by reversing the loading machine, cell pressure was reduced and cell water was drained out through BRV. The cell was dismantled and the specimen was taken out, rubber membrane was removed and weight of the failed sample and its water content was determined. The test was repeated on two more identical specimens with increasing cell pressure.

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5.2 LABORATORY TESTS ON ROCK CORE SAMPLES

Rock samples recovered from various depths of strata were tested for the following properties:

Table 1.6: Laboratory Tests for Rocks

Description of Test	Specifications
Preparation of rock specimen	IS : 9179
Specific gravity, porosity and water absorption	IS : 13030
Unconfined Compressive Strength (UCS)	IS : 9143
Modulus of Elasticity	IS: 9221
Point Load Index (PLI)	IS : 8764

- The results of various laboratory tests conducted on selected rock core samples are shown vide **Appendix – B.**

The detailed procedure adopted for conducting various laboratory tests is described in the following paragraphs:

5.2.1 Preparation of Rock Specimen (IS: 9179)

The core cut-off machine was used for cross cutting of rock core. Rock core was clamped in a vee-block slotted to permit passage of wheel. Core was supported on both sides of the cut to avoid spalling. Edge grinding was done using lathe. Sample was held directly in the chuck and rotated and the grinding wheel was passed against it.

5.2.2 Water Absorption (WA) & Specific Gravity (SG) (IS: 13030)

Following procedure was adopted to determine water absorption and specific gravity of rock samples.

Approximately 500g of rock sample was thoroughly washed to remove finer particles and dust and then immersed in distilled water for a period of 24 ± ½ hours. Mass of the basket submerged in the immersion bath was noted down. Sample was transferred under water to the basket in the immersion bath. Saturated submerged mass of the basket plus sample was noted. Massof the clean dry sample container and lid was noted. Sample was removed from the immersion bath and surface dried. Mass of the saturated surface dry sample plus container was noted. Sample and the container with lid was oven dried. Dried mass was noted.

5.2.3 Unconfined Compressive Strength (UCS) (IS: 9143)

For the determination of UCS of rock core, length to diameter ratio of the cylindrical specimen was kept between 2.0 to 3.0. The specimen ends were made flat. The specimen was kept on the lower disc of compression testing machine. The axis of the specimen was carefully aligned with the center of the thrust of the spherical seat. Load on the specimen was applied continuously at a constant stress rate such that failure takes place in about 5 to 15 minutes of loading. The maximum load on the specimen was recorded. The unconfined compressive strength of the specimen was calculated

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by dividing the max load carried by the specimen during the test by the average original cross-sectional area.

5.2.4 Point Load Index (PLI) (IS:8764)

The diameter 'D' of the specimen measured in 'mm'. The core specimen was tested after soaking them. There are two methods to determine Point Load Index on rock cores.

a) Diametral Test

Core specimens with length/diameter ratio greater than 1.0 were used for diametral testing. The specimen was inserted in the test machine and the platens were closed to make contact along a core diameter, ensured the distance between contact point and the nearest free end was at least 0.50 times the core diameter.

Load was applied to the specimen such that failure occurs within 10-60s and the failure load 'P' is recorded.

b) Axial Test

Core specimens with length/diameter ratio of 0.3 to 1.0 are suitable for axial testing. The specimen was inserted in the test machine and the platens closed to make contact along a line perpendicular to the core end faces.

Load was then applied to the specimen such that failure occurs within 10-60s and the failure load 'P' was recorded.

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CHAPTER 2 TEST RESULTS AND INTERPRETATION

6.0 STRATIFICATION

From the study of the borehole log of 07 BHs, it is revealed that the sub strata:-

At the location of BH-TNST-01

a) From existing ground level to 3.00m depth, strata consist of filled up soil.

b) From 3.00m to termination depth, strata consist of coarse grained soil i.e. Silty sand (SM).

At the location of BH-TNST-02

a) From existing ground level to 3.00m depth, strata consist of filled up soil.

b) From 3.00m to 27.50m depth, strata consist of coarse grained soil i.e. Silty sand (SM).

c) From depth 27.50m to termination depth, strata consist of rocky strata i.e. Highly to completely weathered, medium grained, Sandstone/Quartzite.

At the location of BH-TN Alignment-01

a) From existing ground level to 3.00m depths, strata consist of filled up soil.

b) From depth 3.00m to 30.00m depth, strata consist of coarse grained soil i.e. Silty sand (SM)

c) From depth 30.00m to termination depth, strata consist of rocky strata i.e. Highly weathered, very poor, medium grained Quartzite.

At the location of BH-TN-Alignment-02

a) From existing ground level to 3.00m depths, strata consist of filled up soil.

b) From depth 3.00m to 7.50m depth, strata consist of rocky strata i.e. Highly to completely weathered, medium grained, Sandstone/ Quartzite

c) From depth 7.50m to 21.00m depth, strata consists of coarse grained soil i.e. Silty sand (SM).

d) From 21.00m to 24.00m depth, strata consist of coarse grained soil i.e. Clayey sand (SC)

e) From 24.00m to termination depth, strata consist of coarse grained soil i.e. Silty sand (SM)

At the location of BH-TN Alignment-03

a) From existing ground level to 3.00m depth, strata consist of filled up soil.

b) From 3.00m to 39.00m depth, strata consist of coarse grained soil i.e. Silty sand (SM)

c) From depth 39.00m to termination depth, strata consist of coarse grained soil i.e. Clayey Silty Sand (SM-SC)

At the location of BH-TN Alignment-04

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a) From existing ground level to 3.00m depth, strata consist of filled up soil.

b) From depth 3.00m to termination depth, strata consist of coarse grained soil i.e. Silty Sand (SM)

At the location of BH-TN Alignment-05

a) From Existing ground level to 3.00m depth, strata consist of filled up soil.

b) From 3.00m to 24.00m depth, strata consist of coarse grained soil i.e. Silty sand (SM)

c) From 24.00m to 28.50m depth, strata consist of coarse grained soil i.e. Clayey sand (SC)

d) From depth 28.50m to termination depth, strata consist of coarse grained soil i.e. Silty Sand (SM)

6.1 GROUND WATER TABLE DEPTH

Water table is not met in the boreholes during investigation. However, for the analysis the water table has been considered to rise up to EGL.

6.2 RESULTS OF CHEMICAL ANALYSIS

Results of chemical analysis of soil samples (as per **Appendix – B2**) indicates that the soil sample falls under Class I for sulphates and chlorides concentration (As per IS 456-2000 and CIRIA Sp. Publication No. 31). The results are summarized here in below :-

Summary of chemical analysis of soil samples

Chemical Property	Findings	Remarks (Required limits as per IS 456-200)
pH	8.14 to 8.24	> 6.0
Sulphate as SO_4^{2-} (%)	0.0021 to 0.0029 (%)	< 0.2% (Class I)
Chlorides as Cl^- (%)	0.0031 to 0.0038 (%)	No limit specified in IS 456. However, a limit of 0.20% specified for class I in CIRIA Sp. Publication No. 31)

6.3 COMPUTATION OF LIQUEFACTION POTENTIAL

Liquefaction is the sudden loss of shear strength of the sub soil strata due to earthquake-induced vibration under saturated conditions.

Assessment of liquefaction potential of foundation strata is made by simplified approach proposed as per IS: 1893 (Part-1)-2016, from the SPT data and peak ground acceleration likely to occur at the site. In this method, cyclic shear stress likely to be induced in the foundation strata by Design Basis Earthquake (DBE) is first evaluated.

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Next threshold cyclic shear stress, which is good enough to cause liquefaction, is determined from SPT data and the empirical relations. Finally, comparison of these two stresses is used in the estimation of liquefaction susceptibility of the foundation strata.

Unsaturated soils are not subjected to liquefaction because vibratory forces from earthquakes do not cause any increase in pore water pressure in such soils.

The area of site from Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road (Chauraha) in the State of Rajasthan falls in seismic zone – II of India as per IS: 1893. Further as per the provisions of IS: 1893 in soil deposits consisting of submerged loose sands & soils falling under classification of SP with standard penetration N value less than 15, the shaking caused by earthquake ground motion may cause liquefaction or excessive total and differential settlements.
For the analysis of liquefaction potential, following constant parameters are considered:

EQ Zone	II
Earthquake Magnitude (Mw)	6.0
Peak Horizontal Ground Acceleration (amax /g)	0.10

For the cohesion less strata encountered in the borehole at site, the IS: 1893 (Part-1)-2016 is referred for the analysis of Liquefaction Potential and for the cohesive strata, RDSO BS-118 is referred.

As per IITK RDSO Guidelines- Appendix – (G) "Simplified Procedure for Evaluation of Liquefaction Potential (Clause 13.3):

a. Cohesive soils should be considered liquefiable if wl≤ 37 %, Ip≤ 12 % and wn>0.80 wl is the liquid limit, where Ip is the Plasticity Index.

b. Liquefaction susceptibility of soils should be considered marginal if wl ≤ 47 %, Ip≤ 20 % and wn≥ 0.85 wl, where Ip is the Plasticity Index.

c. Cohesive soils should be considered non-liquefiable if wl>47 % or Ip>20 % or wn<0.85 wl, where Ip is the Plasticity Index.

As Ground water table was not encountered at the location of boreholes below EGL during investigation, it may rise up in rains/ rainy seasons. Therefore, for the liquefaction analysis of foundation, the water table has been considered to rise up to EGL. Further as per cl. C above liquefaction depth is given below:-

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Table 2.1: Results of Liquefaction Analysis

S.No.	Ch. (km)/ Structure	BH No.	Water table depth met during field work (m)	Water table depth considered for analysis (m)	Liquefiable Depth below EGL (m)
1	Elevated Section	TNST-01	Not Encountered	0	Non Liquefiable
2		TNST-02	Not Encountered	0	Non Liquefiable
3		TN Alignment-01	Not Encountered	0	Non Liquefiable
4		TN Alignment-02	Not Encountered	0	Non Liquefiable
5		TN Alignment-03	Not Encountered	0	Non Liquefiable
6		TN Alignment-04	Not Encountered	0	Non Liquefiable
7		TN Alignment-05	Not Encountered	0	Non Liquefiable

Sample calculation for computation of liquefaction potential vide attached **Appendix - C1**

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CHAPTER 3 TYPE AND DEPTH OF FOUNDATION WITH ANALYSIS

7.0 TYPE & DEPTH OF FOUNDATION:

Based on the nature & strength characteristics of the substrata, requirement of the project and discussions held with client, the following type of foundation have been analyzed as given below:

Chainage/Structure (km)	BH No.	Type of foundation	Depth of Foundation Below EGL (m)	Size of Foundation (m)
Elevated section	TN Alignement-02, TN Alignment-03	Open Foundation	3	3 x 4 & 4 x 5
			4	
			5	

Chainage/ Structure (km)	BH No.	Type of foundation	Size of Foundation / Dia. of Pile (m)
Elevated section	TNST-01, TNST-02, TN Alignment-01, TN Alignment-02, TN Alignment-03, TN Alignment-04, TN Alignment-05	Pile foundation	1.00
			1.20

The details of foundation analysis are given in the subsequent paragraph.

7.1 ANALYSIS OF FOUNDATION

7.1.1 From Shear Failure Criteria

Net Safe Bearing capacity from Shear Failure consideration has been computed in accordance with IS: 6403-1981, which is based on, modified Terzaghi's classical approach. The weighted average of shear strength parameters for various strata upto depth equal to 0.5*B*Tan (45+Ø/2) (where B = Width of the Foundation, Ø = Angle of internal friction) is used in the analysis. A factor of safety of 2.5 to estimate the net safe bearing capacity from ultimate net bearing capacity.

For soils, containing both coarse grained (gravels & sands) and fine grained (clays), c and Φ are used to determine the soil strength. In case of predominantly fine grained soils, c and Φ are determined by the Triaxial Compression test as per IS: 2720 pt XI. For predominantly coarse grained soils, c and Φ are determined by Direct Shear test as per IS: 2720 pt XIII. These c and Φ values were used for determining the SBC of soil as per shear failure criteria.

The ultimate net bearing capacity in case of general shear failure is given by following expression,

$$q_d = c\, N_c\, s_c\, d_c\, i_c + q\,(N_q - 1)\, s_q\, d_q\, i_q + (1/2)\, B\, \gamma\, N_\gamma\, s_\gamma\, d_\gamma\, i_\gamma\, W'$$

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The ultimate net bearing capacity in case of local shear failure is given by following expression,

$q'_d = (2/3)\, c\, N'_c\, s_c\, d_c\, i_c + q\,(N'_q-1)\, s_q\, d_q\, i_q + (1/2)\, B\, \gamma\, N'_\gamma\, s_\gamma\, d_\gamma\, i_\gamma\, W'$

Where,

$d_c = 1+ 0.2\,(D_f/B)*SQRT(N_\phi)$

$d_q = d_\gamma = 1$ for $\phi < 10^o$

$d_q = d_\gamma = 1 + 0.1\,(D_f/B)*SQRT(N_\phi)$ for $\phi > 10^o$

$N_\phi = \tan^2(\pi/4 + \phi/2)$

ϕ' for local shear failure = $\tan^{-1}(0.67 \tan\phi)$

The following soil parameter was assumed for calculations:

Chainage/Structure (km)	BH No.	Size of foundation (m)	Depth of foundation below EGL (m)	Cohesion 'C'(kg/cm2)	Angle of internal friction(ϕ)(Deg.)
Elevated Section	TN Alignment-02	3 x 4	3	0	32
			4	0	31
			5	0	31
	TN Alignment-03		3	0	32
			4	0	32
			5	0	32
	TN Alignment-02	4 x 5	3	0	31
			4	0	31
			5	0	31
	TN Alignment-03		3	0	32
			4	0	32
			5	0	32

7.1.2 From Settlement Failure Criteria

Allowable Bearing Pressure from Settlement Failure consideration has been computed in accordance with IS: 8009 (Part-I). The magnitude of settlement, when foundation loads are applied, depends upon the compressibility of the underlying strata and rigidity of the substructure.

The total permissible settlement in cohesion-less soil is estimated using clause **9.2.3.2** as per IS: 8009 (Part-I).

$Si = (q\, B\, (1-\mu^2)/E)*I$

Where,

q = Pressure, kg/cm^2

E = Modulus of Soil (Kg/Cm^2) &

E=600(N+6)+2000 (N≤15)

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E=600(N+6) (N>15)

(Reference: "Foundation Analysis and Design" by J.E.Bowles)

I = Influence Factor…….....Reference: Fig.11 IS:8009(Part I)

Further the immediate settlements in cohesionless soil are estimated using the elastic theory considering the effect of a rigid stratum underlying the foundation soils (Reference: "Foundation Analysis and Design" by J.E.Bowles) and for consolidation settlement in cohesive soil the following equation has been used:

$S_t = \Delta P\, M_v\, H$

Where,

M_v = Coefficient of volume compressibility, cm^2/kg

ΔP = Pressure increment, kg/cm^2

H = Thickness of layers

Coefficient of Volume Compressibility derived from SPT N-Value

(After Stroud and Butler, 1975)

Plasticity Index (%)	Conversion Factor (f_2)	m_v (10^{-3} kPa^{-1}) based on N-Value: $m_v = 1/(f_2N)$				
		N=10	N=20	N=30	N=40	N=50
10	800	0.12	0.06	0.04	0.03	0.02
20	525	0.19	0.09	0.06	0.05	0.04
30	475	0.21	0.10	0.07	0.05	0.04
40	450	0.22	0.11	0.07	0.06	0.04

$Mv = 1/(f_2 N_{corr.})$

Where f_2 = factor based on $N_{corr.}$ Value & plasticity index of soil

$N_{corr.}$ = corrected SPT 'N' value

For the analysis of foundation the total permissible settlement has been considered as 50mm for open foundation and 75mm for raft foundation.

Zone of influence below foundation has been considered up to 1.5 times the width of the foundation.

Lower of the two values obtained from settlement and shear criteria is used in arriving at allowable bearing capacity of the soil.

Sample calculations for computation of allowable bearing capacity of sub-strata for open foundations resting on soil are attached vide **Appendix C-1.**

(A) Safe Load Carrying Capacity of Normal Bored Cast In-Situ RCC Pile In Soil

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The safe Load Carrying Capacity of normal bored cast in-situ RCC pile is determined in compression, uplift as per **IRC: 78-2014 Appendix-5 (Clause 709.3.1)** and lateral as per **IS: 2911 (Part-1/Sec-2): 2010**. The axial capacity of a pile depends upon the soil skin friction along the shaft and end bearing at it's tip.

Thus Axial load = Skin Friction + End-bearing

a) For piles in granular soils (using the static formula)

$$\mathbf{Q_u = (0.5*D*\gamma*N_\gamma + P_D*N_q)*A_p + (\Sigma K_i*P_{Di}*\tan\delta_i)*A_{si}}$$

Where,

Q_u = Ultimate load capacity of pile in KN

D = Dia. of pile shaft in m

γ = Effective unit weight of the soil at pile tip in kN/m^3

N_γ & N_q = Bearing capacity factors depending upon the angle of internal friction Φ at pile tip

P_D = Effective overburden pressure at pile tip in kN/m^2 limited to 15 times diameter of pile

Σ = Summation for layers (1 to n) in which pile is installed and which contribute to (+ve) skin friction

K_i = Coefficient of earth pressure applicable for the i^{th} layer

P_{Di} = effective overburden pressure for the i^{th} layer in kN/m^2 limited to 15 times diameter of pile

δ_i = angle of wall friction between pile and soil for i^{th} layer, and

A_{si} = surface area of pile shaft in the i^{th} layer in m^2

b) For piles in cohesive soils (using the static formula)

$$\mathbf{Q_u = cp*Nc*A_p + \Sigma\alpha_i*c_i*A_{si}}$$

Where,

Q_u = Ultimate load capacity of pile in KN

A_p = cross-sectional area of pile tip in m^2

N_c = bearing capacity factor (= 9)

Σ = Summation for layers (1 to n) in which pile is installed and which contribute to (+ve) skin friction

α_i = adhesion factor for the i^{th} layer depending on the consistency of soil

c_i = average cohesion for i^{th} layer in kN/m^2

A_{si} = surface area for pile shaft in the i^{th} layer in m^2

c) For computation of safe load carrying capacity of pile in lateral, the following equation has been used:

Fixed Head Condition

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$$Q = (12 * E * I * Y) / (L_1 + L_f)^3$$

Where,

Q = Lateral Load (in kg)

Y = Permissible lateral deflection taken as 5mm

E = Modulus of Elasticity of concrete

I = Moment of Inertia of the pile cross-section

L_1 = Length of pile above cut-off level

L_f = Length of fixity

The effective length of the pile has been considered below the cut-off level taken as 2.0 m below the EGL. Normal Bored cast in-situ RCC piles having stem diameter equal to 1.00 m & 1.20 m. For the analysis of the pile foundations the soil parameters used for computation of safe load carrying capacity of pile is tabulated below:-

Table 3.1: Design Soil Parameter

Chainage (KM)	BH Ref.	Layer depth below EGL (m)		Thickness of strata (m)	Strata description	SPT 'N'		Bulk Density (gm/cc)	Cohesion (C) (kg/cm2)	Angle of internal Friction (Φ) (°)
		From	To			Observed	Corrected			
Elevated Section	TNST-01	0.0	7.0	7.0	Silty Sand	48	51	1.79	0	31
		7.0	10.0	3.0	Silty Sand	65	57	1.80	0	32
		10.0	13.5	3.5	Silty Sand	64	49	1.80	0	32
		13.5	16.5	3.0	Silty Sand	72	50	1.80	0	32
		16.5	21.0	4.5	Silty Sand	96	57	1.82	0	32
		21.0	25.5	4.5	Silty Sand	94	50	1.83	0	32
		25.5	30.0	4.5	Silty Sand	98	46	1.84	0	32
		30.0	34.5	4.5	Silty Sand	98	44	1.84	0	32
		34.5	37.5	3.0	Silty Sand	100	-	1.88	0	33
		37.5	40.0	2.5	Silty Sand	100	-	1.88	0	33
	TNST-02	0.0	7.0	7.0	Silty Sand	24	25	1.71	0	30
		7.0	7.5	0.5	Silty Sand	24	-	1.75	0	31
		7.5	13.0	5.5	Silty Sand	50	41	1.80	0	32
		13.0	16.5	3.5	Silty Sand	70	48	1.80	0	32
		16.5	24.0	7.5	Silty Sand	86	50	1.81	0	32
		24.0	28.5	4.5	Silty Sand	99	50	1.83	0	32
		28.5	40.0	11.5	Silty Sand	98	44	1.84	0	34
	TN Align ment-2	0.0	7.0	7.0	Silty Sand	27	29	1.74	0	30
		7.0	10.0	3.0	Silty Sand	43	37	1.79	0	31

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		10.0	13.0	3.0	Silty Sand	56	43	1.81	0	31
		13.0	18.0	5.0	Silty Sand	69	46	1.81	0	32
		18.0	24.0	6.0	Silty Sand	83	47	1.82	0	32
		24.0	28.0	4.0	Silty Sand	95	47	1.82	0	32
		28.0	31.5	3.5	Silty Sand	100	-	1.86	0	34
		31.5	40.0	8.5	Silty Sand	100	-	1.84	0	34
	TN Alignment-02	0.0	7.0	7.0	Silty Sand	48	51	1.79	0	32
		7.0	7.5	0.5	Silty Sand	35	28	1.80	0	32
		7.5	13.0	5.5	Silty Sand	35	28	1.76	0	31
		13.0	16.5	3.5	Silty Sand	54	37	1.78	0	31
		16.5	21.0	4.5	Silty Sand	81	43	1.85	0	33
		21.0	24.0	3.0	Clayey Sand	66	36	1.85	0.11	29
		24.0	31.5	7.5	Silty Sand	93	33	1.86	0	31
		31.5	37.5	6.0	Silty Sand	100	-	1.87	0	33
		37.5	40.0	2.5	Silty Sand	100	-	1.87	0	33
	TN Alignment-03	0.0	7.0	7.0	Silty Sand	46	48	1.74	0	31
		7.0	10.5	3.5	Silty Sand	65	24	1.77	0	32
		10.5	16.5	6.0	Silty Sand	43	31	1.73	0	31
		16.5	22.5	6.0	Silty Sand	72	43	1.80	0	31
		22.5	27.0	4.5	Silty Sand	97	50	1.85	0	33
		27.0	31.5	4.5	Silty Sand	100	-	1.85	0	33
		31.5	36.0	4.5	Silty Sand	100	-	1.86	0	33
		36.0	40.0	4.0	Silty Sand	100	-	1.93	0.07	31
	TN Alignment-04	0.0	7.0	7.0	Silty Sand	33	36	1.76	0	29
		7.0	10.0	3.0	Silty Sand	43	38	1.77	0	30
		10.0	13.0	3.0	Silty Sand	59	45	1.77	0	30
		13.0	16.0	3.0	Silty Sand	55	38	1.78	0	31
		16.0	19.0	3.0	Silty Sand	65	41	1.80	0	31
		19.0	24.0	5.0	Silty Sand	78	44	1.80	0	31
		24.0	30.0	6.0	Silty Sand	92	44	1.81	0	31
		30.0	34.5	4.5	Silty Sand	100	-	1.84	0	33
		34.5	40.0	5.5	Silty Sand	100	-	1.84	0	33
	TN Alignment-05	0.0	7.0	7.0	Silty Sand	15	16	1.66	0	29
		7.0	10.0	3.0	Silty Sand	31	27	1.71	0	29
		10.0	15.0	5.0	Silty Sand	49	37	1.79	0	31
		15.0	21.0	6.0	Silty Sand	61	38	1.79	0	31
		21.0	24.0	3.0	Silty Sand	81	44	1.79	0	32
		24.0	28.5	4.5	Clayey Sand	46	23	1.81	0.07	28
		28.5	36.0	7.5	Silty Sand	100	-	1.84	0	33
		36.0	40.0	4.0	Silty Sand	100	-	1.85	0	33

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The sample calculation for computation of safe load carrying capacity of normal bored cast-in-situ RCC pile in compression & uplift are attached vide **Appendix C2.**

The sample calculation for computation of safe load carrying capacity of normal bored cast-in-situ RCC pile in lateral are attached vide **Appendix C3.**

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CHAPTER 4 ANALYSIS OF FOUNDATION AND RECOMMENDATIONS

8.0 FOUNDATION RECOMMENDATIONS

- Based on the nature & strength characteristics of the substrata and requirement of the project, open foundations & pile foundations have been analysed mentioned in below Table 4.1 & 4.2.
- Based on design parameters and sample calculations attached, recommended allowable bearing capacities are tabulated as follows:-

Table 4.1 : Recommended Net Allowable Bearing Capacity

Chainage (km)/Structure	BH` No.	Type of Foundation	Depth of Foundation below EGL (m)	Foundation Size (m)	Net Safe Bearing Capacity from Shear Failure (t/m^2)	Allowable Bearing Pressure from settlement failure (t/m^2)	Recommended Allowable Bearing Capacity (t/m^2)
Elevated Section	TN Alignment-02	Open Foundation	3	3 x 4	29.1	134.3	29.1
			4		34.5	161.6	34.5
			5		41.1	201.0	41.1
	TN Alignment-03		3		28.1	93.6	28.1
			4		40.7	105.1	40.7
			5		46.4	111.0	46.4
	TN Alignment-02		3	4 x 5	29.7	103.1	29.7
			4		35.1	124.7	35.1
			5		41.4	162.6	41.4
	TN Alignment-03		3		30.6	66.6	30.6
			4		39.8	71.3	39.8
			5		43.7	83.7	43.7

Table 4.2: Safe Load Carrying Capacity of normal bored cast in-situ RCC Pile in Soil

Sl. No.	Structure	BH. No.	Dia of piles (m)	Cut-off level below EGL (m)	Length of piles below cut-off (m)	Safe load carrying capacity (T)		
						In compression	In uplift	Lateral
1	Elevated Section	TNST 01	1	2	24	435	214	66
					26	472	240	
					28	509	265	

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					30	546	290	
					32	583	316	
					34	621	342	
			1.2		24	622	279	107
					26	676	316	
					28	729	353	
					30	783	390	
					32	836	427	
					34	892	465	
2		TNST-02	1	2	24	418	207	51
					26	454	232	
					28	492	258	
					30	591	284	
					32	629	310	
					34	668	337	
			1.2		24	599	270	82
					26	651	306	
					28	706	344	
					30	868	382	
					32	924	421	
					34	981	459	
3		TN Alignment-01	1	2	24	423	209	51
					26	459	234	
					28	560	260	
					30	599	287	
					32	638	314	
					34	677	340	
			1.2		24	606	272	82.5
					26	659	309	
					28	716	348	
					30	880	386	
					32	937	425	
					34	994	464	
4		TN Alignment-02	1	2	24	399	208	47
					26	434	232	
					28	469	257	
					30	505	281	
					32	594	307	
					34	632	333	
			1.2		24	511	271	76
					26	617	307	
					28	668	342	
					30	720	378	

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					32	866	416	
					34	922	454	
5		TN Alignment-03	1	2	24	434	202	57
					26	470	227	
					28	506	252	
					30	543	277	
					32	531	302	
					34	568	327	
			1.2		24	633	265	91
					26	686	302	
					28	739	338	
					30	792	375	
					32	761	411	
					34	814	448	
6		TN Alignment-04	1	2	24	386	202	56
					26	421	226	
					28	455	250	
					30	543	275	
					32	580	301	
					34	618	326	
			1.2		24	547	263	90.5
					26	597	298	
					28	646	333	
					30	700	370	
					32	843	407	
					34	897	444	
7		TN Alignment-05	1	2	24	324	192	38
					26	354	214	
					28	388	237	
					30	514	262	
					32	549	287	
					34	585	311	
			1.2		24	446	252	62
					26	489	283	
					28	539	317	
					30	749	353	
					32	801	389	
					34	853	425	

***NOTE*:-**

1. *Permissible lateral deflection has been taken as 1.0% of Pile dia. at Max. of cut-off level/ liquefaction depth.*

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2. *The self-weight of the pile has been taken into account while computing the Safe Load Carrying Capacity of Pile in uplift only and not considered for vertical load capacity in compression.*
3. *The safe load carrying capacity of piles have been worked out on the basis of IRC 78-2014 as per provisions / assumptions provided therein & are only an assessment based on characteristics of the sub-strata obtained at the locations of the above BHs. The safe load carrying capacities as tabulated above will further depend substantially on the piling technique adopted and equipment used for making the piles in the field. However, for the final designs & constructions, the safe/allowable load carrying capacities of these piles should be taken by conducting actual initial load tests on these piles by casting them in the respective areas.*
4. *While erecting normal bored cast in-situ pile, utmost care should be taken while flushing/cleaning the bottom of pile particularly prior to start of pouring of concrete so as o rest the pile in virgin soil only for obtaining full point bearing as while computing safe load carrying capacity of pile no bottom softening during erection of pile has been considered.*
5. *Further the pile should have necessary structural strength to transmit / sustain the design load.*

All The above recommendations are based on the field and laboratory tests conducted on selected soil/ rock core samples and our experience in this regard. If the actual substrata conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations.

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Abbreviations

BH	Borehole
EGL	Existing Ground Level
GWT	Ground Water Table
IS	Indian Standards
SPT	Standard Penetration Test
UDS	Un-disturbed Soil
UDS*	UDS not recovered
DS	Disturbed Soil
R.L.	Reduced Level
m	Metre
%	Percentage
mg /l	Milligram per litre
mg /kg	Milligram per kilogram
DST	Direct shear test on UDS sample
DST+	Direct shear test on remoulded sample

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APPENDIX – A (FIELD DATA RESULTS)

Appendix No.	ITEMS
A-1	LOCATION PLAN
A-2	FIELD BOREHOLE LOG
A-3	FIELD PERMEABILITY TEST RESULTS
A-4	COREBOX PHOTOGRAPH

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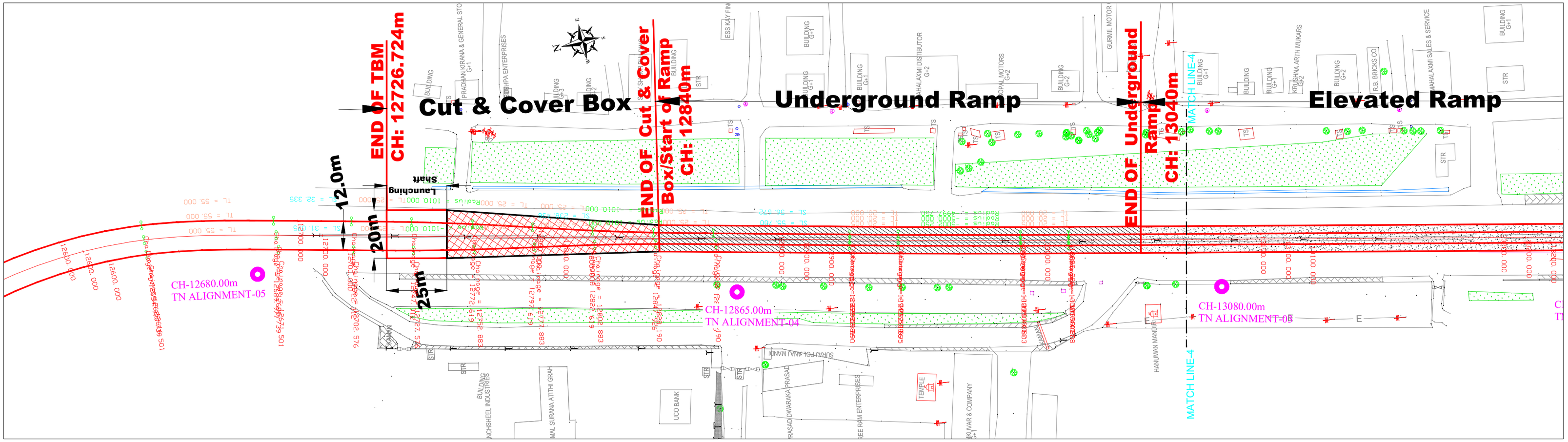
GALTA GATE

ELEVATED SETION

TRANSPORT NAGAR



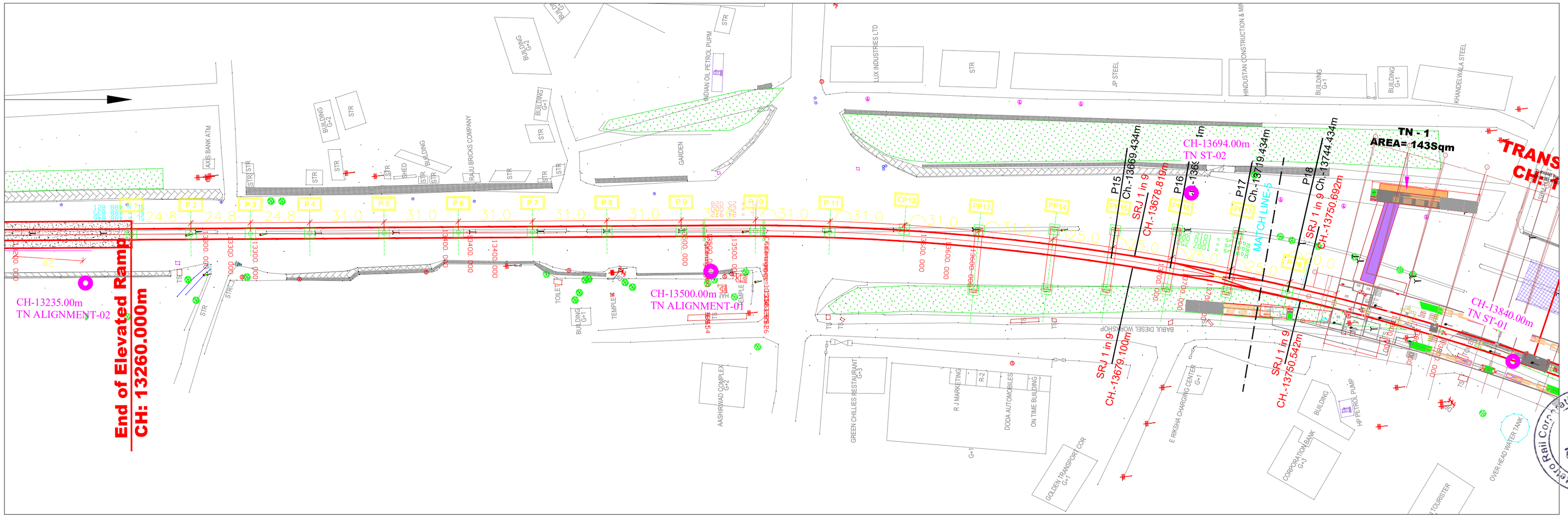


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	FIG:- BOREHOLE LOCATION PLAN	NAME OF WORK: "GEO-TECHNICAL INVESTIGATION WORK FOR EXTENSION OF E-W CORRIDOR FROM BADI CHOUPER TO TRANSPORT NAGAR (2.85KM) PHASE -1C AND MANSAROVAR TO AJMER ROAD (CHAURAHA) (1.35KM) PHASE-1D OF JAIPUR METRO RAIL CORPORATION AT JAIPUR."	CONTRACTOR :- CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD.

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Transport Nagar	*Northing :*2976349 m	*Easting :*583984 m
Reduced Level (m):(+)469.925	BH. No. :TNST-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*21-04-2023	*Date of Completion :*26-04-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS					0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
0.5										
1.0										
1.5				Filled up soil	FILL					
2.0										
2.5										
3.0	3	SPT-1	31							
3.5										
4.0	4	UDS-1								
4.5	4.5	SPT-2	40							
5.0										
5.5										
6.0	6	SPT-3	74							
6.5				Dense to very dense, brownish, silty sand	SM					
7.0	7	UDS-2								
7.5	7.5	SPT-4	71							
8.0										
8.5										
9.0	9	SPT-5	59							
9.5										
10.0	10	UDS-3								

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Transport Nagar	*Northing :*2976349 m	*Easting :*583984 m
Reduced Level (m):(+)469.925	BH. No. :TNST-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*21-04-2023	*Date of Completion :*26-04-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-6	62							
11.0										
11.5										
12.0	12	SPT-7	66							
12.5										
13.0	13	UDS*								
13.5	13.5	SPT-8	72							
14.0										
14.5										
15.0	15	SPT-9	71	Dense to very dense, brownish, silty sand	SM					
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-10	89							
17.0										
17.5										
18.0	18	SPT-11	100							
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-12	98							
20.0										

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Transport Nagar	*Northing :*2976349 m	*Easting :*583984 m
Reduced Level (m):(+)469.925	BH. No. :TNST-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*21-04-2023	*Date of Completion :*26-04-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
20.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
20.5										
21.0	21	SPT-13	95							
21.5										
22.0	22	UDS*								
22.5	22.5	SPT-14	98							
23.0										
23.5										
24.0	24	SPT-15	90							
24.5										
25.0	25	UDS*		Dense to very dense, brownish, silty sand	SM					
25.5	25.5	SPT-16	98							
26.0										
26.5										
27.0	27	SPT-17	96							
27.5										
28.0	28	UDS*								
28.5	28.5	SPT-18	99							
29.0										
29.5										
30.0	30	SPT-19	95							

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Transport Nagar	*Northing :*2976349 m	*Easting :*583984 m
Reduced Level (m):(+)469.925	BH. No. :TNST-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*21-04-2023	*Date of Completion :*26-04-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
30.0										
30.5				Dense to very dense, brownish, silty sand	SM					
31.0	31	UDS*								
31.5	31.5	SPT-20	100							
32.0										
32.5										
33.0	33	SPT-21	100							
33.5										
34.0	34	UDS*								
34.5	34.5	SPT-22	100							
35.0										
35.5				Very dense, brownish, silty sand	SM					
36.0	36	SPT-23	100							
36.5										
37.0	37	UDS*								
37.5	37.5	SPT-24	100							
38.0										
38.5										
39.0	39	SPT-25	100							
39.5										
40.0	40	SPT-26	100							

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near red light police booth	*Northing :*2976670 m	*Easting :*584086 m
Reduced Level (m):(+)467.024	BH. No. :TN Alignment-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*25-04-2023	*Date of Completion :*02-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS					0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
0.5										
1.0										
1.5				Filled up soil	FILL					
2.0										
2.5										
3.0	3	SPT-1	18							
3.5										
4.0	4	UDS-1								
4.5	4.5	SPT-2	29							
5.0										
5.5										
6.0	6	SPT-3	35							
6.5				Dense, brownish, Silty sand	SM					
7.0	7	UDS-2								
7.5	7.5	SPT-4	38							
8.0										
8.5										
9.0	9	SPT-5	47							
9.5										
10.0	10	UDS-3								

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near red light police booth	*Northing :*2976670 m	*Easting :*584086 m
Reduced Level (m):(+)467.024	BH. No. :TN Alignment-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*25-04-2023	*Date of Completion :*02-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-6	55							
11.0										
11.5										
12.0	12	SPT-7	57							
12.5										
13.0	13	UDS-4								
13.5	13.5	SPT-8	63							
14.0										
14.5										
15.0	15	SPT-9	68	Dense, brownish, Silty sand	SM					
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-10	75							
17.0										
17.5										
18.0	18	SPT-11	76							
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-12	80							
20.0										

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near red light police booth	*Northing :*2976670 m	*Easting :*584086 m
Reduced Level (m):(+)467.024	BH. No. :TN Alignment-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*25-04-2023	*Date of Completion :*02-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
20.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
20.5										
21.0	21	SPT-13	88							
21.5										
22.0	22	UDS*								
22.5	22.5	SPT-14	89							
23.0										
23.5										
24.0	24	SPT-15	92	Dense, brownish, Silty sand	SM					
24.5										
25.0	25	UDS*								
25.5	25.5	SPT-16	96							
26.0										
26.5										
27.0	27	SPT-17	97							
27.5										
28.0	28	UDS*								
28.5	28.5	SPT-18	100							
29.0				Hard, brownish, Clayey silt with low plasticity	SM					
29.5										
30.0	30	SPT-19	100							

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near red light police booth	*Northing :*2976670 m	*Easting :*584086 m
Reduced Level (m):(+)467.024	BH. No. :TN Alignment-01	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*25-04-2023	*Date of Completion :*02-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
30.0	30.02	RC-1								
31.5	31.5	RC-2					6.66	0		
33.0	33	RC-3					8	0		
34.5	34.5	RC-4					5.33	0		
35.0				Highly weathered, very poor, brownish, medium grained Quartzite	GRADE-V					
36.0	36	RC-5					7.33	0		
37.5	37.5	RC-6					10.33	0		
39.0	39	RC-7					10	8.66		
40.0	40							0		

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*In front of Khandelwal stoel shop	*Northing :*2976467 m	*Easting :*584079 m
Reduced Level (m):(+)469.254	BH. No. :TNST-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*28-04-2023	*Date of Completion :*03-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS		Filled up soil	FILL		0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
3.0	3	SPT-1	16							
4.0	4	UDS-1		Medium dense, brownish, Silty sand	SM					
4.5	4.5	SPT-2	26							
6.0	6	SPT-3	30							
7.0	7	UDS-2								
7.5	7.5	SPT-4	41							
9.0	9	SPT-5	54	Dense, brownish, Silty sand	SM					
10.0	10	UDS-3								

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*In front of Khandelwal stoel shop	*Northing :*2976467 m	*Easting :*584079 m
Reduced Level (m):(+)469.254	BH. No. :TNST-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*28-04-2023	*Date of Completion :*03-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
10.0										
10.5	10.5	SPT-6	53							
11.0										
11.5										
12.0	12	SPT-7	52							
12.5										
13.0	13	UDS-4		Dense, brownish, Silty sand	SM					
13.5	13.5	SPT-8	68							
14.0										
14.5										
15.0	15	SPT-9	72							
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-10	79							
17.0										
17.5										
18.0	18	SPT-11	82	Very dense, brownish, Silty sand	SM					
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-12	87							
20.0										

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*In front of Khandelwal stoel shop	*Northing :*2976467 m	*Easting :*584079 m
Reduced Level (m):(+)469.254	BH. No. :TNST-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*28-04-2023	*Date of Completion :*03-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
20.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
20.5										
21.0	21	SPT-13	92							
21.5										
22.0	22	UDS*								
22.5	22.5	SPT-14	89							
23.0										
23.5				Very dense, brownish, Silty sand	SM					
24.0	24	SPT-15	98							
24.5										
25.0	25	UDS*								
25.5	25.5	SPT-16	99							
26.0										
26.5										
27.0	27	SPT-17	100							
	27.23	RC-1								
27.5										
28.0										
28.5	28.5	RC-2		Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V		4.33	0		
29.0										
29.5										
30.0	30	RC-3					33	0		

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*In front of Khandelwal stoel shop	*Northing :*2976467 m	*Easting :*584079 m
Reduced Level (m):(+)469.254	BH. No. :TNST-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*28-04-2023	*Date of Completion :*03-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
30.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
30.5				Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V					
31.0										
31.5	31.5	RC-4					6.66	0		
32.0										
32.5										
33.0	33	RC-5		Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-IV		11.66	0		
33.5										
34.0										
34.5	34.5	RC-6					20	18.66		
35.0										
35.5										
36.0	36	RC-7					10.66	0		
36.5				Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V					
37.0										
37.5	37.5	RC-8					5.33	0		
38.0	38			Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-IV		16	0		
38.5										
39.0										
39.5										
40.0										

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UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Jain temple	*Northing :*2977483 m	*Easting :*584247 m
Reduced Level (m):(+)464.947	BH. No. :TN Alignment-05	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*12-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS		Filled up soil	FILL		0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
3.0	3	SPT-1	8							
4.0	4	UDS-1		Medium dense, brownish, Silty sand	SM					
4.5	4.5	SPT-2	16							
6.0	6	SPT-3	20							
7.0	7	UDS-2								
7.5	7.5	SPT-4	28							
9.0	9	SPT-5	33							
10.0	10	UDS-3								

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Jain temple	*Northing :*2977483 m	*Easting :*584247 m
Reduced Level (m):(+)464.947	BH. No. :TN Alignment-05	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*12-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0				Medium dense, brownish, Silty sand	SM		0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-6	44							
11.0										
11.5										
12.0	12	SPT-7	54							
12.5										
13.0	13	UDS*								
13.5	13.5	SPT-8	48							
14.0										
14.5										
15.0	15	SPT-9	52	Dense, brownish, Silty sand	SM					
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-10	56							
17.0										
17.5										
18.0	18	SPT-11	64							
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-12	73							
20.0										

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Jain temple	*Northing :*2977483 m	*Easting :*584247 m
Reduced Level (m):(+)464.947	BH. No. :TN Alignment-05	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*12-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
20.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
20.5										
21.0	21	SPT-13	77							
21.5										
22.0	22	UDS*		Dense, brownish, Silty sand	SM					
22.5	22.5	SPT-14	84							
23.0										
23.5										
24.0	24	SPT-15	30							
24.5										
25.0	25	UDS*								
25.5	25.5	SPT-16	46							
26.0				Medium dense to dense, brownish, Clayey sand	SC					
26.5										
27.0	27	SPT-17	93							
27.5										
28.0	28	UDS*								
28.5	28.5	SPT-18	100							
29.0				Very dense, brownish, silty sand	SM					
29.5										
30.0	30	SPT-19	100							

Jaipur Metro Rail Corporation Ltd. Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Jain temple	*Northing :*2977483 m	*Easting :*584247 m
Reduced Level (m):(+)464.947	BH. No. :TN Alignment-05	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*12-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
30.0										
30.5										
31.0	31	UDS*								
31.5	31.5	SPT-20	100							
32.0										
32.5										
33.0	33	SPT-21	100							
33.5										
34.0	34	UDS*								
34.5	34.5	SPT-22	100							
35.0				Very dense, brownish, Silty sand	SM					
35.5										
36.0	36	SPT-23	100							
36.5										
37.0	37	UDS*								
37.5	37.5	SPT-24	100							
38.0										
38.5										
39.0	39	SPT-25	100							
39.5										
40.0	40	SPT-26	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Traffic police chauki (RAC headqu	*Northing :*2976927 m	*Easting :*584132 m
Reduced Level (m):(+)463.950	BH. No. :TN Alignment-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*05-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS					0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
0.5										
1.0										
1.5				Filled up soil	FILL					
2.0										
2.5										
3.0	3	SPT-1	100							
	3.02	RC-1		Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V					
3.5										
4.0										
4.5	4.5	RC-2		Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V		6.75	0		
5.0										
5.5										
6.0	6	WS-1					8.66	0		
6.5				Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V					
7.0										
7.5	7.5	SPT-2	30							
8.0										
8.5										
9.0	9	SPT-3	35	Medium dense to dense, brownish, Silty sand	SM					
9.5										
10.0	10	UDS*								

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Traffic police chauki (RAC headqu	*Northing :*2976927 m	*Easting :*584132 m
Reduced Level (m):(+)463.950	BH. No. :TN Alignment-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*05-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-4	37							
11.0										
11.5										
12.0	12	SPT-5	38							
12.5										
13.0	13	UDS-1								
13.5	13.5	SPT-6	45							
14.0										
14.5										
15.0	15	SPT-7	63	Medium dense to dense, brownish, Silty sand	SM					
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-8	100							
17.0										
17.5										
18.0	18	SPT-9	77							
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-10	67							
20.0										

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Traffic police chauki (RAC headqu	*Northing :*2976927 m	*Easting :*584132 m
Reduced Level (m):(+)463.950	BH. No. :TN Alignment-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*05-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
20.0										
20.5				Medium dense to dense, brownish, Silty sand	SM					
21.0	21	SPT-11	68							
21.5										
22.0	22	UDS-2								
22.5	22.5	SPT-12	63	Dense, brownish, Clayey sand	SC					
23.0										
23.5										
24.0	24	SPT-13	64							
24.5										
25.0	25	UDS-3								
25.5	25.5	SPT-14	100							
26.0										
26.5										
27.0	27	SPT-15	100	Very dense, brownish, Silty sand	SM					
27.5										
28.0										
28.5	28.5	SPT-16	100							
29.0										
29.5										
30.0	30	SPT-17	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Traffic police chauki (RAC headqu	*Northing :*2976927 m	*Easting :*584132 m
Reduced Level (m):(+)463.950	BH. No. :TN Alignment-02	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*05-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
30.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
30.5										
31.0	31	UDS*								
31.5	31.5	SPT-18	100							
32.0										
32.5										
33.0	33	SPT-19	100							
33.5										
34.0	34	UDS*								
34.5	34.5	SPT-20	100							
35.0				Very dense, brownish, Silty sand	SM					
35.5										
36.0	36	SPT-21	100							
36.5										
37.0	37	UDS*								
37.5	37.5	SPT-22	100							
38.0										
38.5										
39.0	39	SPT-23	100							
39.5										
40.0	40	SPT-24	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Hanuman Temple	*Northing :*2977091 m	*Easting :*584164 m
Reduced Level (m):(+)463.910	BH. No. :TN Alignment-03	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*07-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS					0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
0.5										
1.0										
1.5				Filled up soil	FILL					
2.0										
2.5										
3.0	3	SPT-1	29							
3.5										
4.0	4	UDS-1								
4.5	4.5	SPT-2	35							
5.0										
5.5										
6.0	6	SPT-3	73							
6.5				Dense, brownish, Silty sand	SM					
7.0	7	UDS-2								
7.5	7.5	SPT-4	100							
8.0										
8.5										
9.0	9	SPT-5	29							
9.5										
10.0	10	UDS*								

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Hanuman Temple	*Northing :*2977091 m	*Easting :*584164 m
Reduced Level (m):(+)463.910	BH. No. :TN Alignment-03	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*07-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-6	33							
11.0										
11.5										
12.0	12	SPT-7	40							
12.5										
13.0	13	UDS*								
13.5	13.5	SPT-8	45							
14.0										
14.5										
15.0	15	SPT-9	52	Dense, brownish, Silty sand	SM					
15.5										
16.0	16	UDS*								
16.5	16.5	SPT-10	62							
17.0										
17.5										
18.0	18	SPT-11	71							
18.5										
19.0	19	UDS*								
19.5	19.5	SPT-12	74							
20.0										

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Hanuman Temple	*Northing :*2977091 m	*Easting :*584164 m
Reduced Level (m):(+)463.910	BH. No. :TN Alignment-03	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*07-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
20.0										
20.5										
21.0	21	SPT-13	82							
21.5										
22.0	22	UDS*		Dense, brownish, Silty sand	SM					
22.5	22.5	SPT-14	91							
23.0										
23.5										
24.0	24	SPT-15	99							
24.5										
25.0	25	UDS*								
25.5	25.5	SPT-16	100							
26.0										
26.5										
27.0	27	SPT-17	100	Very dense, brownish, Silty sand	SM					
27.5										
28.0	28	UDS*								
28.5	28.5	SPT-18	100							
29.0										
29.5										
30.0	30	SPT-19	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Hanuman Temple	*Northing :*2977091 m	*Easting :*584164 m
Reduced Level (m):(+)463.910	BH. No. :TN Alignment-03	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*150 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*07-05-2023	*Date of Completion :*09-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
30.0										
30.5										
31.0	31	UDS*								
31.5	31.5	SPT-20	100							
32.0										
32.5										
33.0	33	SPT-21	100							
33.5										
34.0	34	UDS*								
34.5	34.5	SPT-22	100	Very dense, brownish, Silty sand	SM					
35.0										
35.5										
36.0	36	SPT-23	100							
36.5										
37.0	37	UDS*								
37.5	37.5	SPT-24	100							
38.0										
38.5										
39.0	39	SPT-25	100							
39.5				Very dense, brownish, Clayey, Silty sand	SM-SC					
40.0	40	SPT-26	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Krishi Mandi	*Northing :*2977289 m	*Easting :*584201 m
Reduced Level (m):(+)464.859	BH. No. :TN Alignment-04	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*15-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
0.0		DS		Filled up soil	FILL		0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
3.0	3	SPT-1	36							
4.0	4	UDS-1		Dense, brownish, Silty sand	SM					
4.5	4.5	SPT-2	23							
6.0	6	SPT-3	40							
7.0	7	UDS-2								
7.5	7.5	SPT-4	44							
9.0	9	SPT-5	42							
10.0	10	UDS-3								

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Krishi Mandi	*Northing :*2977289 m	*Easting :*584201 m
Reduced Level (m):(+)464.859	BH. No. :TN Alignment-04	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*15-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
10.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
10.5	10.5	SPT-6	57							
11.0										
11.5										
12.0	12	SPT-7	60							
12.5										
13.0	13	UDS-4								
13.5	13.5	SPT-8	51							
14.0										
14.5										
15.0	15	SPT-9	58	Dense, brownish, Silty sand	SM					
15.5										
16.0	16	UDS-5								
16.5	16.5	SPT-10	62							
17.0										
17.5										
18.0	18	SPT-11	67							
18.5										
19.0	19	UDS-6								
19.5	19.5	SPT-12	74							
20.0										

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Krishi Mandi	*Northing :*2977289 m	*Easting :*584201 m
Reduced Level (m):(+)464.859	BH. No. :TN Alignment-04	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*15-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%)	RQD (%)	(Depth v/s SPT N Value)	Special Observations
20.0							0 25 50 75 100	0 25 50 75 100	0 10 20 30 40 50 60 70 80 90 100	
20.5										
21.0	21	SPT-13	78							
21.5										
22.0	22	UDS*								
22.5	22.5	SPT-14	82							
23.0										
23.5										
24.0	24	SPT-15	86							
24.5										
25.0	25	UDS*		Dense, brownish, Silty sand	SM					
25.5	25.5	SPT-16	92							
26.0										
26.5										
27.0	27	SPT-17	92							
27.5										
28.0	28	UDS*								
28.5	28.5	SPT-18	96							
29.0										
29.5										
30.0	30	SPT-19	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

FIELD BOREHOLE LOG

*Project Name :*Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.		*Client :*JMRCL
*BH Location/Chainage :*Near Krishi Mandi	*Northing :*2977289 m	*Easting :*584201 m
Reduced Level (m):(+)464.859	BH. No. :TN Alignment-04	*BH Depth (m):*40
Proposed/Existing Structure :	*Water Table (m):*Not Encountered	*Inclination :* Vertical
*Boring type :*Shell & Auger	*Dia. of Boring :*151 mm	*Depth of Casing (m) :*Not Used
*Date of Start :*11-05-2023	*Date of Completion :*15-05-2023	

Depth (m)	Sample & In-SituTest Depth (m)	Sample Type	SPT N Value	Strata Description	IS Classification	Graphic Log	Core Recovery (%) 0 25 50 75 100	RQD (%) 0 25 50 75 100	(Depth v/s SPT N Value) 0 10 20 30 40 50 60 70 80 90 100	Special Observations
30.0										
30.5										
31.0	31	UDS*								
31.5	31.5	SPT-20	100							
32.0										
32.5										
33.0	33	SPT-21	100							
33.5										
34.0	34	UDS*								
34.5	34.5	SPT-22	100							
35.0				Very dense, brownish, Silty sand	SM					
35.5										
36.0	36	SPT-23	100							
36.5										
37.0	37	UDS*								
37.5	37.5	SPT-24	100							
38.0										
38.5										
39.0	39	SPT-25	100							
39.5										
40.0	40	SPT-26	100							

Jaipur Metro Rail Corporation Director (Project) JAIPUR

UDS*-UDS not recovered

SUB SOIL PROFILE DIAGRAM - ELEVATED SECTION

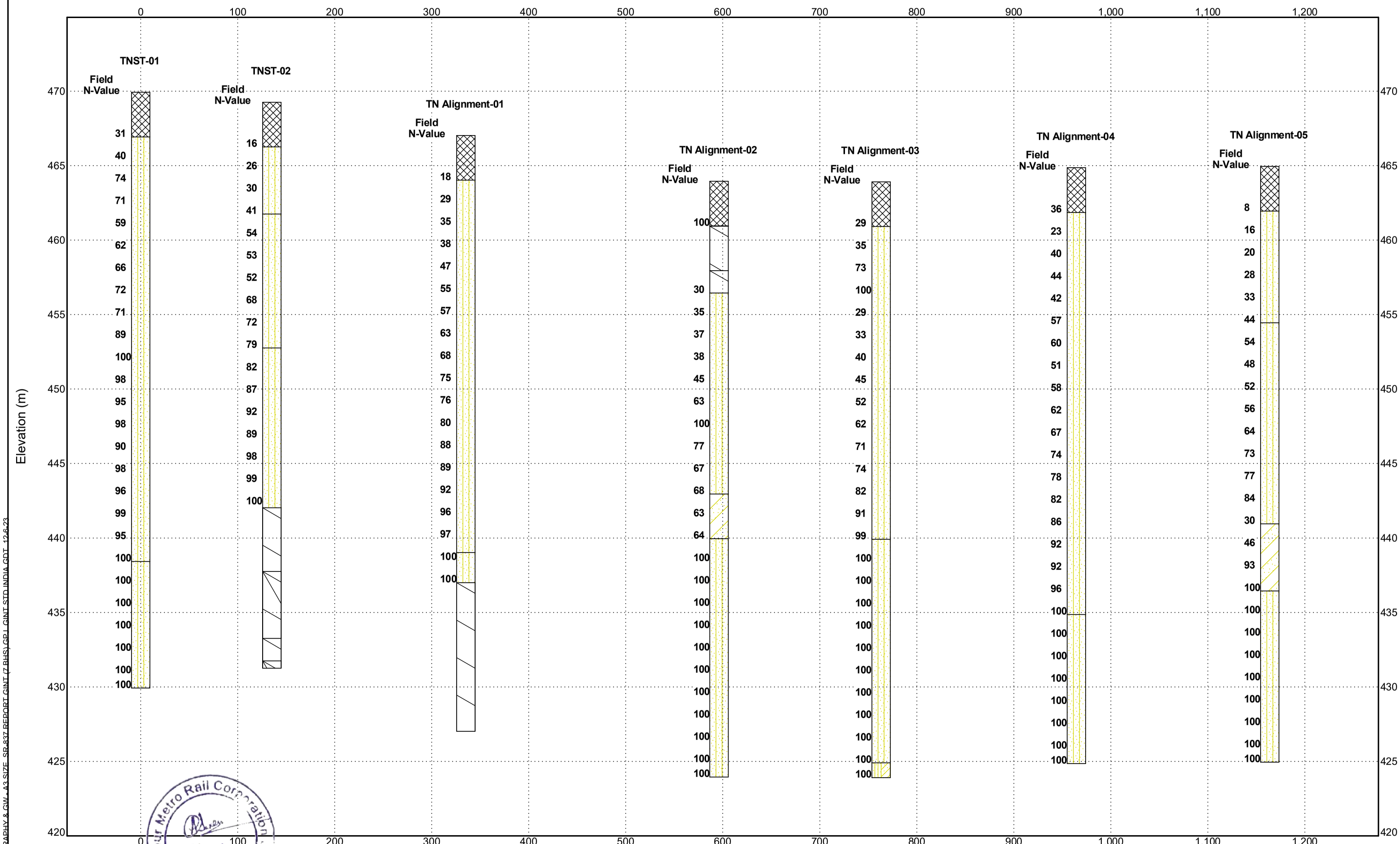
FILL | SM | GRADE-V
GRADE-IV | SC | SM-SC

CLIENT JMRCL

PROJECT NAME Badi Chouper to Transport Nagar and Mansarovar to Ajmer Road of JMRC at Jaipur.

PROJECT NUMBER SR-837_23-24

PROJECT LOCATION Jaipur



Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

STRATIGRAPHY & GW - A3 SIZE_SR-837 REPORT GINT (7 BUS) GPJ GINT STD INDIA GDT 12-6-23

Coefficient of Permeability by falling Head Method as per IS: 5529 Part-1

Borehole No.:-	**TN STN-01**		
Depth From:-	**30.25 m**	**Depth To:-**	**31.00 m**
Diameter of Intake pipe (d)	**150.0 mm**	**Co-ordinates:- (m)**	**E: 583984.000, N: 2976349.000**
Length of test section (L)	**0.75 m**		
Water level at time $t_0 = H_0$	**2.44 m**		

Coefficient of Permeability, $K = (d^2/8L)\ln[(L/r)(\ln(h_1/h_2)/((t_2-t_1)]$

Where, d = diameter of intake pipe
L = length of test zone
h_1 = head of water at time t_1
h_2 = head of water at time t_2
r = radius of hole

$d^2/8L$	=	3.7500E-03	
ln (L/r)	=	2.303	
ln (h_2/h_1)	=	0.419	
t_2-t_1	=	22	
k	=	1.65E-04	**2.74E-04 cm/sec**

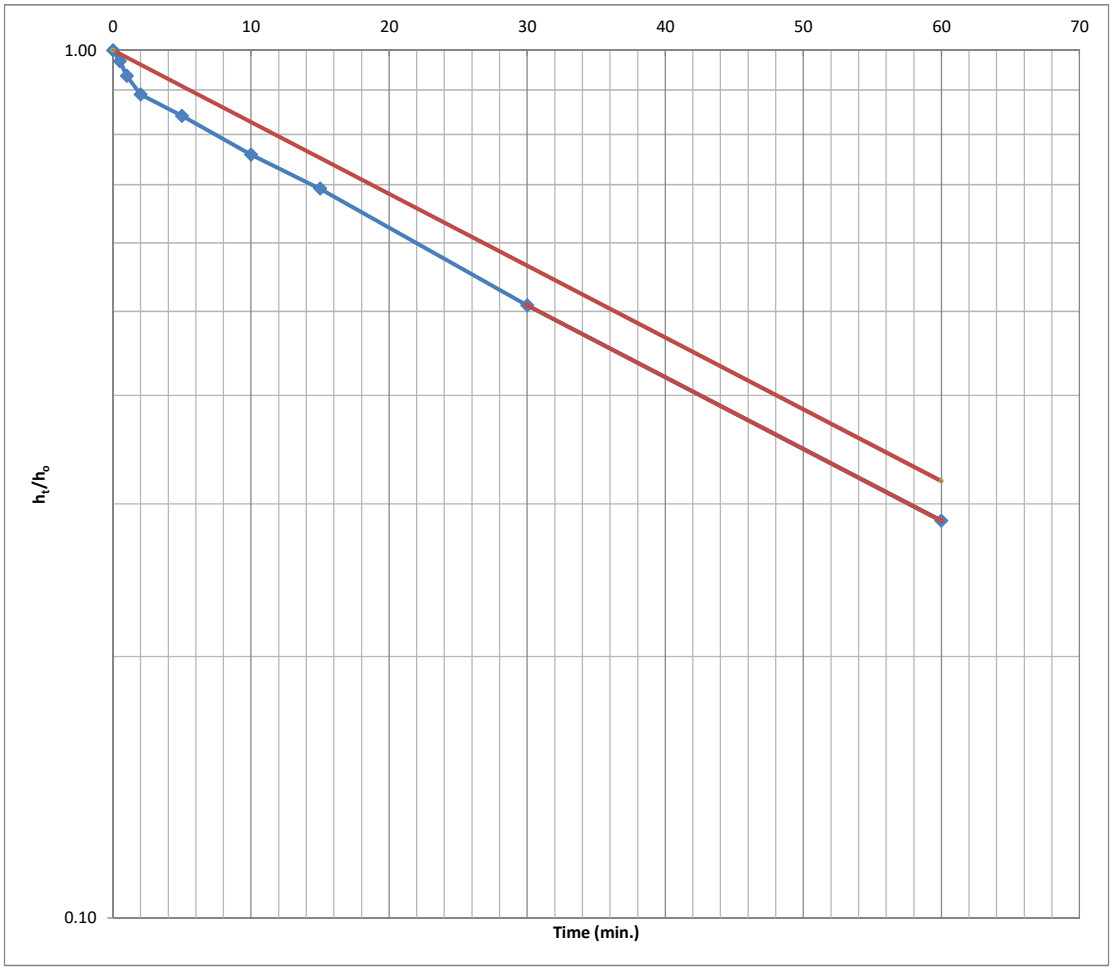
Calculations:

S.No.	Time (t) in min	H = Water level in the intake pipe at time (t) in metre	Height of Water Level (m) at time t, $H_1 = H_0-H$	H_t / H_0	From Graph	
1	0	0.00	2.44	1.00	h_1/h_o	1
2	0.5	0.07	2.37	0.97	h_2/h_o	0.66
3	1	0.16	2.28	0.93	t_1	0
4	2	0.27	2.17	0.89	t_2	22
5	5	0.39	2.05	0.84		
6	10	0.59	1.85	0.76		
7	15	0.75	1.69	0.69		
8	30	1.20	1.24	0.51		
9	60	1.74	0.70	0.29		

Assumption:

1. The soil stratum is homogeneous and the permeability of soil is equal in all directions, and
2. The soil straum in which the intake point is placed is of infinite thickness and that artesian condition prevail.

Jaipur Metro Rail Corporation Director (Project) JAIPUR



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JAIPUR

Coefficient of Permeability by falling Head Method as per IS: 5529 Part-1

Borehole No.:-	**TN STN-01**		
Depth From:-	**20.25 m**	**Depth To:-**	**21.00 m**
Diameter of Intake pipe (d)	**150.0 mm**	**Co-ordinates:- (m)**	**E: 583984.000, N: 2976349.000**
Length of test section (L)	**0.75 m**		
Water level at time $t_0 = H_0$	**2.54 m**		

Coefficient of Permeability, $K = (d^2/8L)\ln[(L/r)(\ln(h_1/h_2)/((t_2-t_1)]$

Where, d = diameter of intake pipe
L = length of test zone
h_1 = head of water at time t_1
h_2 = head of water at time t_2
r = radius of hole

$d^2/8L$	=	3.7500E-03	
ln (L/r)	=	2.303	
ln (h_2/h_1)	=	0.357	
t_2-t_1	=	22	
k	=	1.40E-04	**2.34E-04 cm/sec**

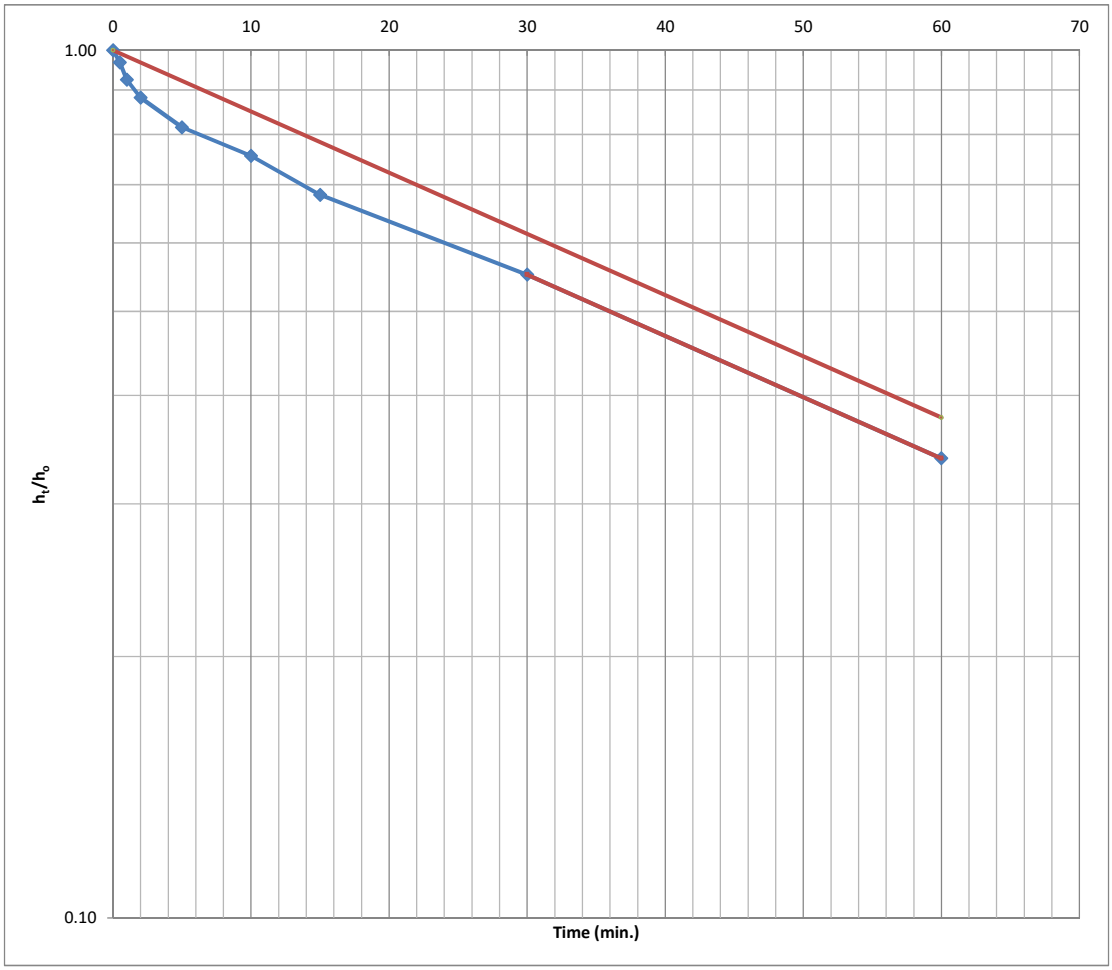
Calculations:

S.No.	Time (t) in min	H = Water level in the intake pipe at time (t) in metre	Height of Water Level (m) at time t, $H_1 = H_0-H$	H_t / H_0	From Graph	
1	0	0.00	2.54	1.00	h_1/h_o	1
2	0.5	0.08	2.46	0.97	h_2/h_o	0.70
3	1	0.19	2.35	0.93	t_1	0
4	2	0.30	2.24	0.88	t_2	22
5	5	0.47	2.07	0.81		
6	10	0.62	1.92	0.76		
7	15	0.81	1.73	0.68		
8	30	1.14	1.40	0.55		
9	60	1.68	0.86	0.34		

Assumption:

1. The soil stratum is homogeneous and the permeability of soil is equal in all directions, and
2. The soil straum in which the intake point is placed is of infinite thickness and that artesian condition prevail.

Jaipur Metro Rail Corporation Director (Project) JAIPUR



Jaipur Metro Rail Corporation
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JAIPUR

Coefficient of Permeability by falling Head Method as per IS: 5529 Part-1

Borehole No.:-	**TN STN-02**		
Depth From:-	**12.00 m**	**Depth To:-**	**12.75 m**
Diameter of Intake pipe (d)	**150.0 mm**	**Co-ordinates:- (m)**	**E: 584079.000, N: 2976467.000**
Length of test section (L)	**0.75 m**		
Water level at time $t_0 = H_0$	**2.73 m**		

Coefficient of Permeability, $K = (d^2/8L)\ln[(L/r)(\ln(h_1/h_2)/((t_2-t_1)]$

Where, d = diameter of intake pipe
L = length of test zone
h_1 = head of water at time t_1
h_2 = head of water at time t_2
r = radius of hole

$d^2/8L$	=	3.7500E-03	
ln (L/r)	=	2.303	
ln (h_2/h_1)	=	0.395	
t_2-t_1	=	22	
k	=	1.55E-04	**2.59E-04 cm/sec**

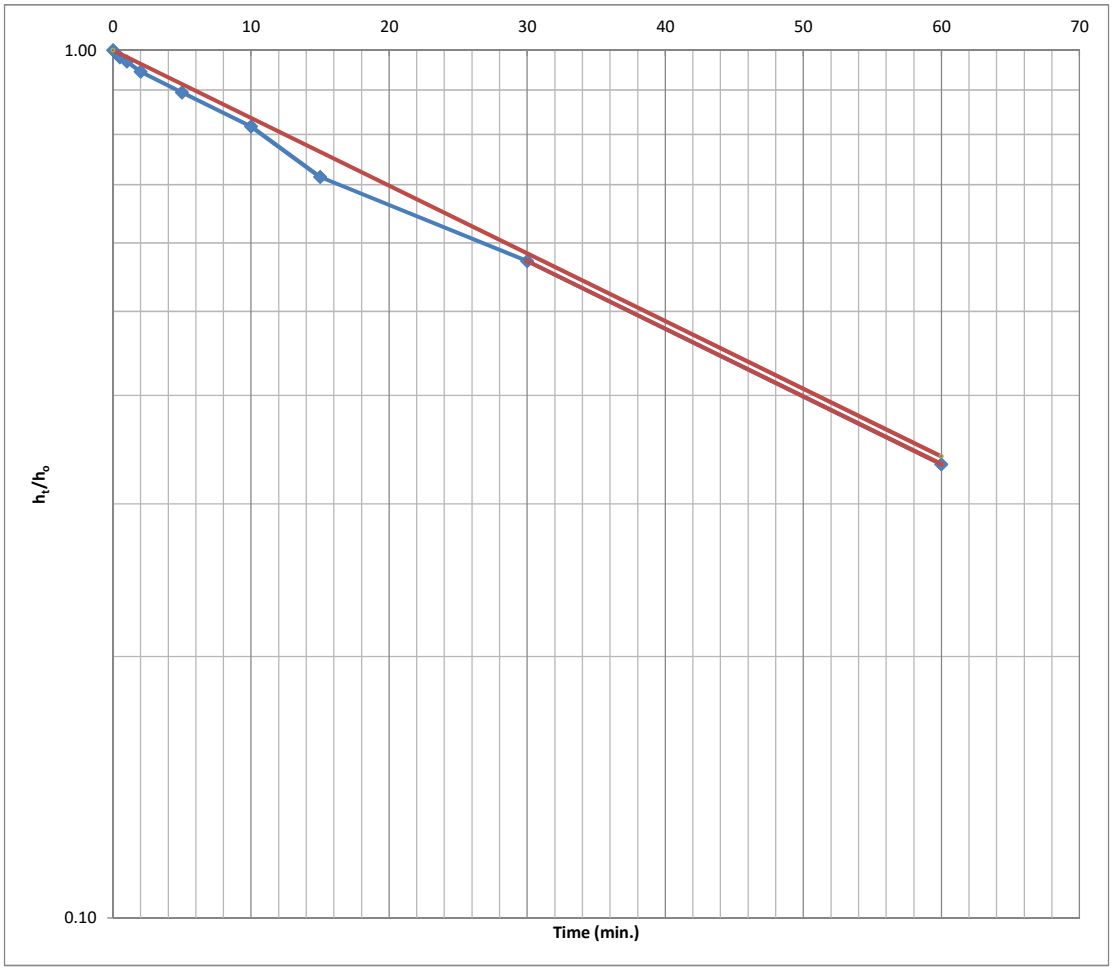
Calculations:

S.No.	Time (t) in min	H = Water level in the intake pipe at time (t) in metre	Height of Water Level (m) at time t, $H_1 = H_0-H$	H_t / H_0	From Graph	
1	0	0.00	2.73	1.00	h_1/h_o	1
2	0.5	0.05	2.68	0.98	h_2/h_o	0.67
3	1	0.08	2.65	0.97	t_1	0
4	2	0.15	2.58	0.95	t_2	22
5	5	0.29	2.44	0.89		
6	10	0.50	2.23	0.82		
7	15	0.78	1.95	0.71		
8	30	1.17	1.56	0.57		
9	60	1.82	0.91	0.33		

Assumption:

1. The soil stratum is homogeneous and the permeability of soil is equal in all directions, and
2. The soil straum in which the intake point is placed is of infinite thickness and that artesian condition prevail.

Jaipur Metro Rail Corporation Director (Project) JAIPUR



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Coefficient of Permeability by falling Head Method as per IS: 5529 Part-1

Borehole No.:-	**TN STN-02**		
Depth From:-	**20.00 m**	**Depth To:-**	**20.75 m**
Diameter of Intake pipe (d)	**150.0 mm**	**Co-ordinates:- (m)**	**E: 584079.000, N: 2976467.000**
Length of test section (L)	**0.75 m**		
Water level at time $t_0 = H_0$	**2.90 m**		

Coefficient of Permeability, $K = (d^2/8L)\ln[(L/r)(\ln(h_1/h_2)/((t_2-t_1)]$

Where, d = diameter of intake pipe
L = length of test zone
h_1 = head of water at time t_1
h_2 = head of water at time t_2
r = radius of hole

$d^2/8L$	=	3.7500E-03	
ln (L/r)	=	2.303	
ln (h_2/h_1)	=	0.423	
t_2-t_1	=	22	
k	=	1.66E-04	**2.77E-04 cm/sec**

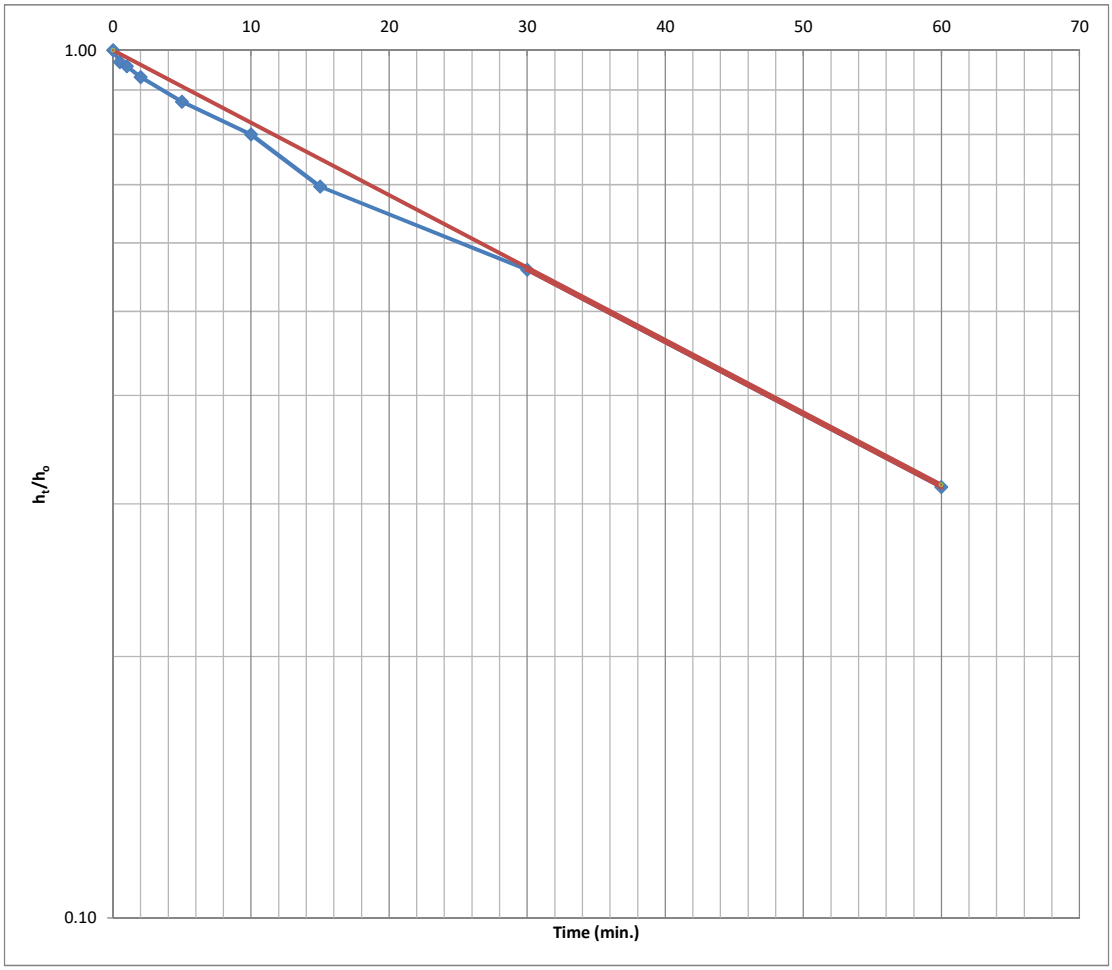
Calculations:

S.No.	Time (t) in min	H = Water level in the intake pipe at time (t) in metre	Height of Water Level (m) at time t, $H_1 = H_0-H$	H_t / H_0	From Graph	
1	0	0.00	2.90	1.00	h_1/h_o	1
2	0.5	0.09	2.81	0.97	h_2/h_o	0.66
3	1	0.12	2.78	0.96	t_1	0
4	2	0.20	2.70	0.93	t_2	22
5	5	0.37	2.53	0.87		
6	10	0.58	2.32	0.80		
7	15	0.88	2.02	0.70		
8	30	1.28	1.62	0.56		
9	60	1.99	0.91	0.31		

Assumption:

1. The soil stratum is homogeneous and the permeability of soil is equal in all directions, and
2. The soil straum in which the intake point is placed is of infinite thickness and that artesian condition prevail.

Jaipur Metro Rail Corporation Director (Project) JAIPUR



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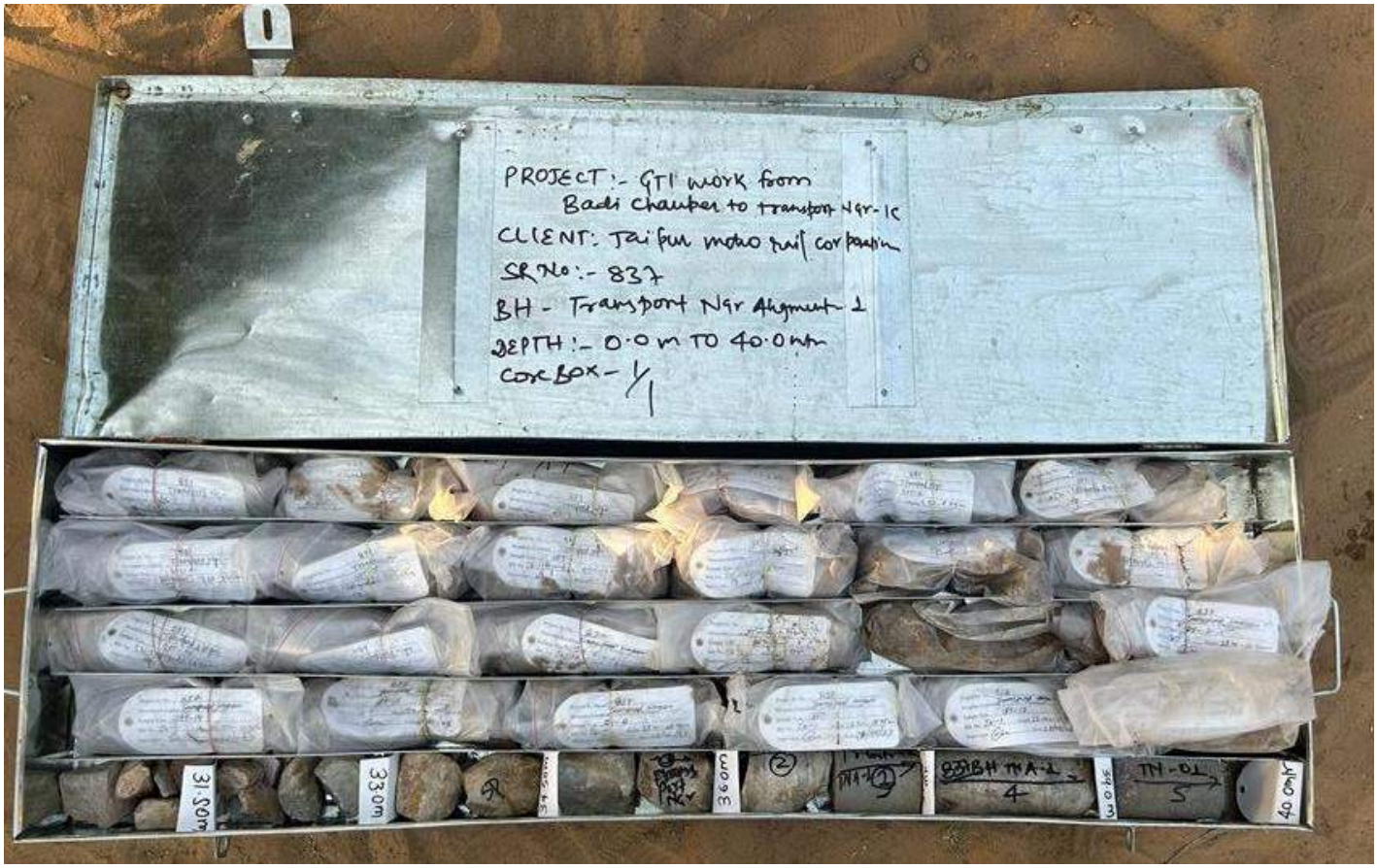
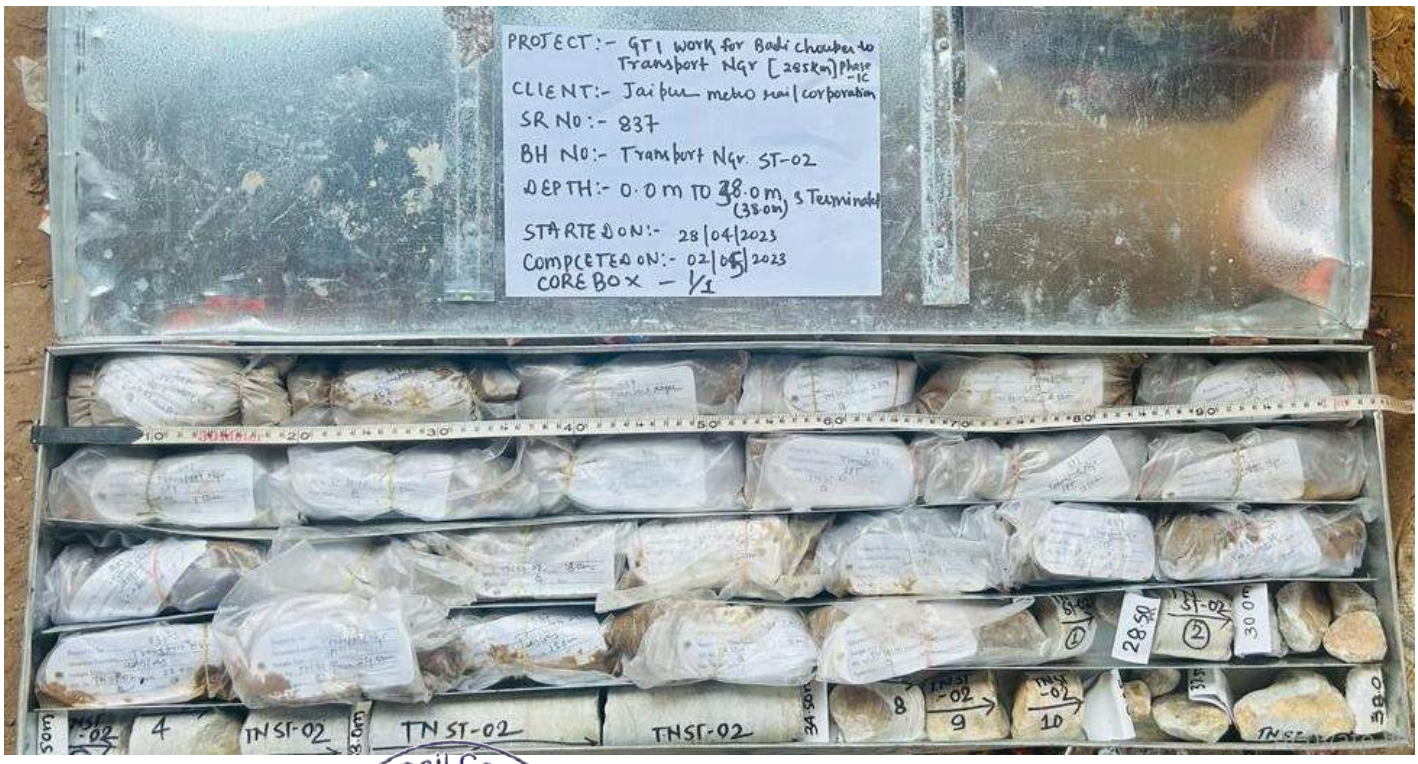
JAIPUR

COREBOX PHOTOGRAPHS



ELEVATED_BH-TN Alignment-01



ELEVATED_BH-TNST-02

Jaipur Metro Rail Corporation
Director
(Project)
JAIPUR

APPENDIX – B (LAB TEST RESULTS)

Appendix No.	ITEMS
B-1	SOIL CHARACTERISTICS SHEETS
B-2	GSD CURVE
B-3	RESULTS OF CHEMICAL ANALYSIS OF SOIL SAMPLE
B-4	SHEAR CURVE

Jaipur Metro Rail Corporation Director (Project) JAIPUR

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		21-04-2023	to	26-04-2023	Transport Nagar in front of water head tank	TNST-01	Not Encountered	40.00 m	583984.000 m	2976349.000 m	+469.925	SR-837_22-23

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %				Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit					Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																				
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	31	37		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	18	64	13	3	2	0	-	Nil	NP	-	1.79	8.90	1.64	2.62	DST	0.00	31	-	-	-	-	-	-	-	-	-
SPT-2	4.50	40	43		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	74	72		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	16	68	11	4	1	0	-	Nil	NP	-	1.80	9.20	1.65	2.62	DST	0.00	32	-	-	-	-	-	-	-	-	-
SPT-4	7.50	71	64		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	59	50		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	10.00	-	-		SM		0	16	72	9	2	1	0	-	Nil	NP	-	1.80	9.25	1.65	2.62	DST	0.00	32	-	-	-	-	-	-	-	-	-
SPT-6	10.50	62	49	Dense to very dense, brownish, silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	12.00	66	49		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	13.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	13.50	72	51		SM		0	17	70	6	5	2	0	-	Nil	NP	-	1.80	9.30	1.65	2.62	DST+	0.00	32	-	-	-	-	-	-	-	-	-
SPT-9	15.00	71	48		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	16.50	89	57		SM		0	18	66	12	4	0	0	-	Nil	NP	-	1.82	9.55	1.66	2.62	DST+	0.00	32	-	-	-	-	-	-	-	-	-
SPT-11	18.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

Jaipur Metro Rail Corporation Director (Project) JAIPUR
CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
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Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %				Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit					Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																				
SPT-12	19.50	98	57	Dense to very dense, brownish, silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	95	53		SM		0	20	71	4	2	3	0	-	Nil	NP	-	1.83	10.15	1.66	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	98	52		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	24.00	90	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	98	48		SM		0	14	76	3	5	2	0	-	Nil	NP	-	1.84	10.55	1.66	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-	-
SPT-17	27.00	96	45		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	28.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	28.50	99	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-19	30.00	95	44		SM		0	22	75	2	1	0	0	-	Nil	NP	-	1.83	10.45	1.66	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-	-
UDS*	31.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-20	31.50	>100	-	Very dense, brownish, silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-21	33.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	34.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-22	34.50	>100	-		SM		0	18	78	3	1	0	0	-	Nil	NP	-	1.88	11.25	1.69	2.63	DST+	0.00	33	-	-	-	-	-	-	-	-	-
SPT-23	36.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	37.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		21-04-2023	to	26-04-2023	Transport Nagar in front of water head tank	TNST-01	Not Encountered	40.00 m	583984.000 m	2976349.000 m	+469.925	SR-837_22-23

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %				Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit					Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																				
SPT-24	37.50	>100	-	Very dense, brownish, silty sand	SM		0	16	80	2	1	1	0	-	Nil	NP	-	1.88	11.30	1.69	2.63	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-25	39.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-26	40.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Director (Project) JAIPUR

Abbreviations:-
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CEGTH
CEG TEST HOUSE
AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		28-04-2023	to	03-05-2024	In front of Khandelwal stoel shop	BH-TNST-02	Not Encountered	38.00 m	584079.000 m	2976467.000 m	+469.254	SR-837_23-24

Sample No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	16	19	Medium dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	29	65	2	3	1	0	-	Nil	NP	-	1.71	8.90	1.57	2.63	DST	0.00	30	-	-	-	-	-	-	-	-
SPT-2	4.50	26	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	30	29		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	25	69	3	2	1	0	-	Nil	NP	-	1.75	9.23	1.60	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-4	7.50	41	37		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	54	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	10.00	-	-		SM		0	22	71	4	3	0	0	-	Nil	NP	-	1.80	9.46	1.64	2.63	DST	0.00	32	-	-	-	-	-	-	-	-
SPT-6	10.50	53	42		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	12.00	52	39	Dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	13.00	-	-		SM		0	31	62	5	1	1	0	-	Nil	NP	-	1.80	9.57	1.64	2.63	DST	0.00	32	-	-	-	-	-	-	-	-
SPT-8	13.50	68	48		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	15.00	72	48		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	16.50	79	51		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	18.00	82	50		SM		0	30	63	4	2	1	0	-	Nil	NP	-	1.81	9.67	1.65	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-
UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		28-04-2023	to	03-05-2024	In front of Khandelwal stoel shop	BH-TNST-02	Not Encountered	38.00 m	584079.000 m	2976467.000 m	+469.254	SR-837_23-24

Sample No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
SPT-12	19.50	87	51	Very dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	92	51		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	89	48		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	24.00	98	50		SM		0	14	70	8	7	1	0	-	Nil	NP	-	1.83	10.10	1.66	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	99	49		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	27.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RC-1	27.23	-	-	Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	GRADE-V		C. R. = 4.33 %		R.Q.D. = 0 %		-		-	-		-	-		-	-		-	-	-		-						
RC-2	28.50	-	-		GRADE-V		C. R. = 4.33 %		R.Q.D. = 0 %		-		-	-		-	-		-	-		-	-	-		-						
RC-3	30.00	-	-		GRADE-V		C. R. = 6.66 %		R.Q.D. = 0 %		-		-	-		-	-		-	-		-	-	-		-						
RC-4	31.50	-	-		GRADE-IV		C. R. = 11.66 %		R.Q.D. = 0 %		Sp.Gr. = 2.66		W.A. = 1.23 %	-		Porosity = 3.27 %	-		-	-		-	-	-		-						
RC-5	33.00	-	-		GRADE-IV		C. R. = 20 %		R.Q.D. = 18.66 %		Sp.Gr. = 2.67		W.A. = 1.27 %	-		Porosity = 3.39 %	-		-	-		-	-	P.L.I. = 117.01 (t/m²)								
RC-6	34.50	-	-		GRADE-IV		C. R. = 10.66 %		R.Q.D. = 0 %		-		-	-		-	-		-	-		-	-	-		-						
RC-7	36.00	-	-		GRADE-V		C. R. = 5.33 %		R.Q.D. = 0 %		-		-	-		-	-		-	-		-	-	-		-						
RC-8	37.50	-	-		GRADE-IV		C. R. = 16 %		R.Q.D. = 0 %		Sp.Gr. = 2.67		W.A. = 1.28 %	-		Porosity = 3.42 %	-		-	-		-	-	-		-						

Abbreviations:-
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Jaipur Metro Rail Corporation Director (Project) JAIPUR

CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		25-04-2023	to	02-05-2023	Near red light police booth	BH-TN Alignment-01	Not Encountered	40.00 m	584086.000 m	2976670.000 m	+467.024	SR-837_23-24

Sample Type	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	18	22		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	26	70	2	1	1	0	-	Nil	NP	-	1.74	9.87	1.58	2.63	DST	0.00	30	-	-	-	-	-	-	-	-
SPT-2	4.50	29	31		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	35	34		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	24	72	2	1	1	0	-	Nil	NP	-	1.79	9.91	1.63	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-4	7.50	38	34		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	47	40		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	10.00	-	-		SM		0	26	68	3	2	1	0	-	Nil	NP	-	1.81	10.11	1.64	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-6	10.50	55	43		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	12.00	57	42		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	13.00	-	-		SM		0	23	69	4	2	2	0	-	Nil	NP	-	1.81	10.19	1.64	2.63	DST	0.00	32	-	-	-	-	-	-	-	-
SPT-8	13.50	63	44		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	15.00	68	46	Medium dense to dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	16.50	75	48		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	18.00	76	46		SM		0	23	71	3	2	1	0	-	Nil	NP	-	1.82	10.78	1.64	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	25-04-2023 to 02-05-2023	Chainage/Location	Near red light police booth	B.H. No.	BH-TN Alignment-01	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584086.000 m, 2976670.000 m	R.L.	+467.024	Ref. Code	SR-837_23-24

Sample	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand: Fine	Sand: Medium	Sand: Coarse	Gravel: Fine	Gravel: Coarse	Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-12	19.50	80	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	88	49		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	89	47		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	24.00	92	47		SM		0	24	62	8	5	1	0	-	Nil	NP	-	1.82	10.17	1.65	2.64	DST+	0.00	32	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	96	47		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	27.00	97	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	28.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	28.50	>100	-	Very dense, brownish, Silty sand	SM		0	26	63	5	5	1	0	-	Nil	NP	-	1.86	10.11	1.69	2.63	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-19	30.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RC-1	30.02	-	-	Highly weathered, very poor, brownish, medium grained Quartzite	GRADE-V		C. R. = 6.66 %		R.Q.D. = 0 %		-		-		-		-		-		-		-		-		-		-		-	
RC-2	31.50	-	-		GRADE-V		C. R. = 8 %		R.Q.D. = 0 %		-		-		-		-		-		-		-		-		-		-	
RC-3	33.00	-	-		GRADE-V		C. R. = 5.33 %		R.Q.D. = 0 %		-		-		-		-		-		-		-		-		-		-	
RC-4	34.50	-	-		GRADE-V		C. R. = 7.33 %		R.Q.D. = 0 %		-		-		-		-		-		-		-		-		-		-	
RC-5	36.00	-	-		GRADE-IV		C. R. = 10.33 %		R.Q.D. = 0 %		Sp.Gr. = 2.65		W.A. = 1.56 %		-		Porosity = 4.13 %		-		-		-		-		-		-	
RC-6	37.50	-	-		GRADE-V		C. R. = 10 %		R.Q.D. = 8.66 %		Sp.Gr. = 2.66		W.A. = 1.47 %		-		Porosity = 3.91 %		-		-		-		-		-		P.L.I. = 115.67 (t/m²)	
RC-7	39.00	-	-		GRADE-V		C. R. = 9 %		R.Q.D. = 0 %		-		-		-		-		-		-		-		-		-		-	

Abbreviations:-
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CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	05-05-2023 to 09-05-2023	Chainage/Location	Near Traffic police chauki (RAC headquarter)	B.H. No.	BH-TN Alignment-02	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584132.000 m, 2976927.000 m	R.L.	+463.950	Ref. Code	SR-837_22-23

	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand: Fine	Sand: Medium	Sand: Coarse	Gravel: Fine	Gravel: Coarse	Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	>100	-	Highly to completely weathered, whitish to brownish, medium grained Sandstone/Quartzite	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RC-1	3.02	-	-		GRADE-V		C. R. = 6.75 %		R.Q.D. = 0 %		-		-		-		-		-			-		-			-				
RC-2	4.50	-	-		GRADE-V		C. R. = 8.66 %		R.Q.D. = 0 %		-		-		-		-		-			-		-			-				
WS-1	6.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-2	7.50	30	27	Medium dense to dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	9.00	35	29		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.76	9.55	1.61	2.63	DST+	0.00	31	-	-	-	-	-	-	-	-
UDS*	10.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-4	10.50	37	29		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	12.00	38	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	13.00	-	-		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.78	9.65	1.62	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-6	13.50	45	32		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	15.00	63	42		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	16.50	>100	-		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.85	9.85	1.68	2.63	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-9	18.00	77	47		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Director (Project) JAIPUR

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	05-05-2023 to 09-05-2023	Chainage/Location	Near Traffic police chauki (RAC headquarter)	B.H. No.	BH-TN Alignment-02	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584132.000 m, 2976927.000 m	R.L.	+463.950	Ref. Code	SR-837_22-23

							Grain Size Distribution % wt retained							Atterberg Limits %								Shear Strength						Consolidation Parameters				
									Sand			Gravel																					
	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)	Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
SPT-10	19.50	67	39		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	21.00	68	38		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	22.00	-	-	Dense, brownish, Clayey sand	SC		14	29	18	26	10	3	0	33	21	12	-	1.85	12.76	1.64	2.65	DST	0.11	29	-	-	-	-	-	-	-	-	-
SPT-12	22.50	63	34		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	24.00	64	33		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	25.00	-	-		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.86	10.16	1.69	2.64	DST+	0.00	31	-	-	-	-	-	-	-	-
SPT-14	25.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	27.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	28.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	30.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	31.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	31.50	>100	-		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.87	10.45	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-19	33.00	>100	-	Very dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	34.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-20	34.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-21	36.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	37.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-22	37.50	>100	-		SM		0	26	69	2	2	1	0	-	Nil	NP	-	1.87	10.90	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-23	39.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-24	40.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Ltd. JAIPUR Director (Project)

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CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	07-05-2023 to 09-05-2023	Chainage/Location	Near Hanuman Temple	B.H. No.	BH-TN Alignment-03	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584164.000 m, 2977091.000 m	R.L.	+463.910	Ref. Code	SR-837_23-24

Sample No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand: Fine	Sand: Medium	Sand: Coarse	Gravel: Fine	Gravel: Coarse	Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	29	35		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	21	72	3	3	1	0	-	Nil	NP	-	1.74	9.17	1.59	2.62	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-2	4.50	35	38		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	73	71		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	17	73	4	5	1	0	-	Nil	NP	-	1.77	9.29	1.62	2.62	DST	0.00	32	-	-	-	-	-	-	-	-
SPT-4	7.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	29	24		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	10.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-6	10.50	33	26		SM		0	16	78	4	1	1	0	-	Nil	NP	-	1.73	9.44	1.58	2.62	DST+	0.00	31	-	-	-	-	-	-	-	-
SPT-7	12.00	40	30		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	13.00	-	-	Dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	13.50	45	32		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	15.00	52	35		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	16.50	62	40		SM		0	25	70	3	2	0	0	-	Nil	NP	-	1.80	9.46	1.64	2.63	DST+	0.00	31	-	-	-	-	-	-	-	-
SPT-11	18.00	71	44		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Ltd. JAIPUR Director (Project)

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UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-12	19.50	74	43		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	82	46		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	91	49		SM		0	17	71	6	6	0	0	-	Nil	NP	-	1.80	9.57	1.64	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-
SPT-15	24.00	99	51		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	27.00	>100	-		SM		0	21	67	5	5	2	0	-	Nil	NP	-	1.85	9.66	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
UDS*	28.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	28.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-19	30.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	31.00	-	-	Very dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-20	31.50	>100	-		SM		0	22	68	5	4	1	0	-	Nil	NP	-	1.86	9.78	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-21	33.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	34.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-22	34.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-23	36.00	>100	-		SM		0	22	65	8	3	2	0	-	Nil	NP	-	1.87	9.86	1.70	2.63	DST+	0.00	33	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		07-05-2023	to	09-05-2023	Near Hanuman Temple	BH-TN Alignment-03	Not Encountered	40.00 m	584164.000 m	2977091.000 m	+463.910	SR-837_23-24

Sample No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters					
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																				
UDS*	37.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-24	37.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-25	39.00	>100	-	Very dense, brownish, Clayey silty sand	SM-SC		5	30	55	6	3	1	0	29	22	7	-	1.93	13.34	1.70	2.65	DST+	0.07	31	-	-	-	-	-	-	-	-	-
SPT-26	40.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Ltd. JAIPUR Director (Project)

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Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEGTH
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AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	11-05-2023 to 15-05-2023	Chainage/Location	Near Krishi Mandi	B.H. No.	TN-04	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584201.000 m, 2977289.000 m	R.L.	+464.859	Ref. Code	SR-837_22-23

Sample No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand: Fine	Sand: Medium	Sand: Coarse	Gravel: Fine	Gravel: Coarse	Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	36	43		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	15	60	19	6	0	0	-	Nil	NP	-	1.76	8.69	1.62	2.62	DST	0.00	29	-	-	-	-	-	-	-	-
SPT-2	4.50	23	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	40	39		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	16	61	15	8	0	0	-	Nil	NP	-	1.77	8.71	1.63	2.62	DST	0.00	30	-	-	-	-	-	-	-	-
SPT-4	7.50	44	40		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	42	35		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	10.00	-	-		SM		0	18	66	11	5	0	0	-	Nil	NP	-	1.77	8.72	1.63	2.63	DST	0.00	30	-	-	-	-	-	-	-	-
SPT-6	10.50	57	45		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	12.00	60	45		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-4	13.00	-	-		SM		0	18	68	7	7	0	0	-	Nil	NP	-	1.78	8.73	1.64	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-8	13.50	51	36		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	15.00	58	39		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-5	16.00	-	-	Dense, brownish, Silty sand	SM		0	18	70	10	2	0	0	-	Nil	NP	-	1.80	8.81	1.65	2.63	DST	0.00	31	-	-	-	-	-	-	-	-
SPT-10	16.50	62	40		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	18.00	67	41		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-6	19.00	-	-		SM		0	16	71	11	2	0	0	-	Nil	NP	-	1.80	8.82	1.65	2.63	DST	0.00	31	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Director (Project) JAIPUR

Abbreviations:-
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CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	11-05-2023 to 15-05-2023	Chainage/Location	Near Krishi Mandi	B.H. No.	TN-04	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584201.000 m, 2977289.000 m	R.L.	+464.859	Ref. Code	SR-837_22-23

Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
						Clay	Silt	Sand: Fine	Sand: Medium	Sand: Coarse	Gravel: Fine	Gravel: Coarse	Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)					Void Ratio (e_0)	Pressure (kg/cm^2)	$C_v \times 10^{-4}$ (cm^2/Sec)	$M_v \times 10^{-2}$ (cm^2/Kg)	Compression Index (C_c)
SPT-12	19.50	74	43		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	78	44		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	82	44		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	24.00	86	44		SM	0	19	73	4	4	0	0	-	Nil	NP	-	1.81	8.85	1.66	2.64	DST+	0.00	31	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	92	45		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-17	27.00	92	44		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	28.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	28.50	96	44		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-19	30.00	>100	-		SM	0	13	75	11	1	0	0	-	Nil	NP	-	1.84	8.86	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
UDS*	31.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-20	31.50	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-21	33.00	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	34.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-22	34.50	>100	-	Very dense, brownish, Silty sand	SM	0	13	75	9	3	0	0	-	Nil	NP	-	1.84	9.12	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-
SPT-23	36.00	>100	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	37.00	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		11-05-2023	to	15-05-2023	Near Krishi Mandi	TN-04	Not Encountered	40.00 m	584201.000 m	2977289.000 m	+464.859	SR-837_22-23

Bore Hole No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	C_v x 10^{-4} (cm^2/Sec)	M_v x 10^{-2} (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
SPT-24	37.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-25	39.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-26	40.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Jaipur Metro Rail Corporation Director (Project) JAIPUR

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Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEGTH
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SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	11-05-2023 to 12-05-2023	Chainage/Location	Near Jain temple	B.H. No.	BH-TN Alignment-05	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584247.000 m, 2977483.000 m	R.L.	+464.947	Ref. Code	SR-837_22-23

B.H. No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %			Shrinkage Limit	Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index						Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	$C_v \times 10^{-4}$ (cm^2/Sec)	$M_v \times 10^{-2}$ (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
DS	0.00	-	-	Filled up soil	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-1	3.00	8	10	Medium dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-1	4.00	-	-		SM		0	15	58	20	7	0	0	-	Nil	NP	-	1.66	8.55	1.53	2.62	DST	0.00	29	-	-	-	-	-	-	-	-
SPT-2	4.50	16	17		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-3	6.00	20	20		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-2	7.00	-	-		SM		0	31	61	6	1	1	0	-	Nil	NP	-	1.71	8.89	1.57	2.62	DST	0.00	29	-	-	-	-	-	-	-	-
SPT-4	7.50	28	25		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-5	9.00	33	28		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS-3	10.00	-	-		SM		0	28	65	4	3	0	0	-	Nil	NP	-	1.76	9.18	1.61	2.63	DST	0.00	30	-	-	-	-	-	-	-	-
SPT-6	10.50	44	35	Dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-7	12.00	54	41		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	13.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-8	13.50	48	34		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-9	15.00	52	35		SM		0	27	57	15	1	0	0	-	Nil	NP	-	1.79	9.56	1.63	2.63	DST+	0.00	31	-	-	-	-	-	-	-	-
UDS*	16.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-10	16.50	56	36		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-11	18.00	64	39		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	19.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring	11-05-2023 to 12-05-2023	Chainage/Location	Near Jain temple	B.H. No.	BH-TN Alignment-05	Depth of Water Table	Not Encountered	Termination Depth	40.00 m	Cordinates (E,N)	584247.000 m, 2977483.000 m	R.L.	+464.947	Ref. Code	SR-837_22-23

	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %				Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit					Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	$C_v \times 10^{-4}$ (cm^2/Sec)	$M_v \times 10^{-2}$ (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																				
SPT-12	19.50	73	43		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-13	21.00	77	43		SM		0	27	65	4	3	1	0	-	Nil	NP	-	1.79	8.88	1.64	2.63	DST+	0.00	32	-	-	-	-	-	-	-	-	-
UDS*	22.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-14	22.50	84	45		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-15	24.00	30	16		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	25.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-16	25.50	46	23	Medium dense to dense, brownish, Clayey sand	SC		13	31	19	26	8	3	0	35	22	13	-	1.81	13.33	1.60	2.65	DST	0.07	28	-	-	-	-	-	-	-	-	-
SPT-17	27.00	93	44		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	28.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-18	28.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-19	30.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	31.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-20	31.50	>100	-		SM		0	23	70	3	3	1	0	-	Nil	NP	-	1.84	9.25	1.68	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-	-
SPT-21	33.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UDS*	34.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-22	34.50	>100	-	Very dense, brownish, Silty sand	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-23	36.00	>100	-		SM		0	23	68	4	4	1	0	-	Nil	NP	-	1.85	9.67	1.69	2.64	DST+	0.00	33	-	-	-	-	-	-	-	-	-
UDS*	37.00	-	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

Jaipur Metro Rail Corporation Director (Project) JAIPUR

CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

SOIL CHARACTERISTICS

Project	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."	Date of Boring			Chainage/Location	B.H. No.	Depth of Water Table	Termination Depth	Cordinates (E,N)		R.L.	Ref. Code
		11-05-2023	to	12-05-2023	Near Jain temple	BH-TN Alignment-05	Not Encountered	40.00 m	584247.000 m	2977483.000 m	+464.947	SR-837_22-23

Borehole No.	Depth from G.L. (m)	Observed SPT Value (N)	Corrected SPT Value (N_c)	Soil Description	IS Classification	IS Symbol	Grain Size Distribution % wt retained							Atterberg Limits %				Bulk Density (g/cm^3)	Natural Moisture Content (%)	Dry Density (g/cm^3)	Specific Gravity	Shear Strength			Free Swell Index (%)	Swelling Pressure (kg/cm^2)	Permeability (cm/sec)	Consolidation Parameters				
							Clay	Silt	Sand			Gravel		Liquid Limit	Plastic Limit	Plasticity Index	Shrinkage Limit					Type of Test	Cohesion C (kg/cm^2)	Angle of Friction (φ°)				Void Ratio (e_0)	Pressure (kg/cm^2)	$C_v \times 10^{-4}$ (cm^2/Sec)	$M_v \times 10^{-2}$ (cm^2/Kg)	Compression Index (C_c)
									Fine	Medium	Coarse	Fine	Coarse																			
SPT-24	37.50	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-25	39.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPT-26	40.00	>100	-		-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

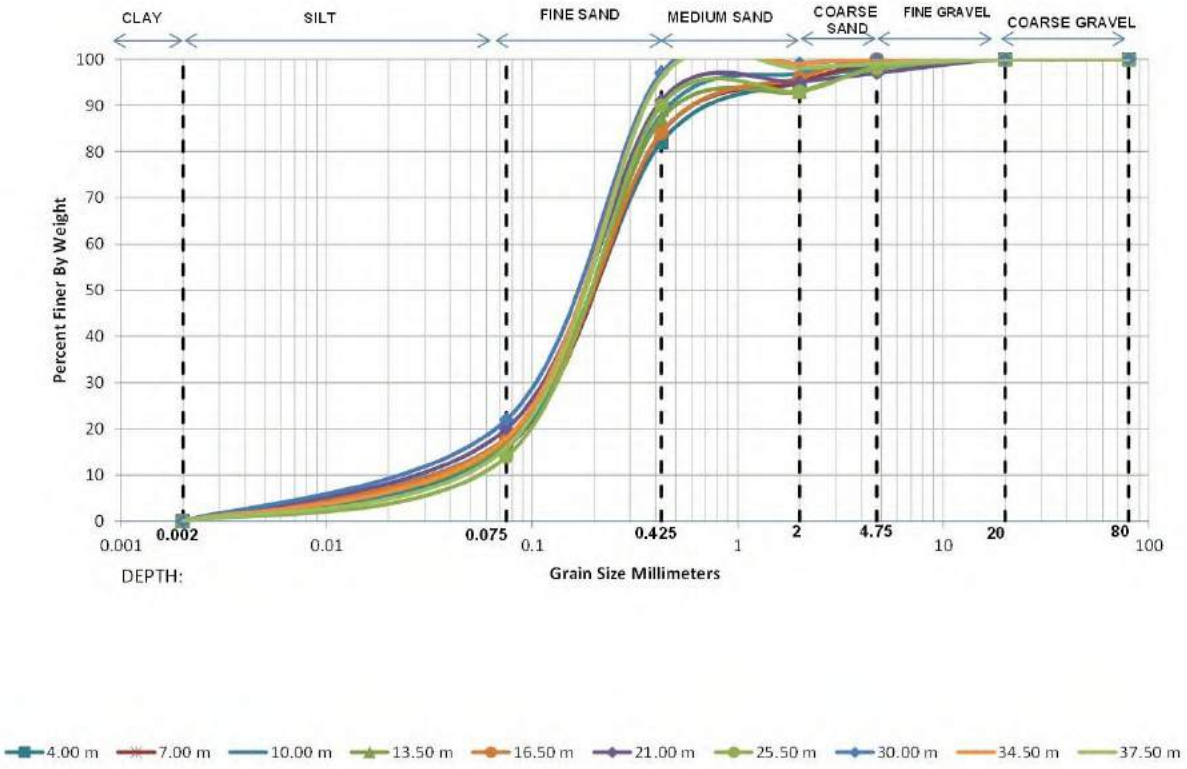
Jaipur Metro Rail Corporation Ltd. JAIPUR Director (Project)

Abbreviations:-
DS-Disturbed Sample, SPT-Standard Penetration Test, UDS-Undisturbed Sample, UDS*-UDS not recovered, DST-Direct Shear Test, UUT-Unconsolidated Undrained Triaxial Shear Test, DST+ - Direct Shear Test on Remoulded Sample, UUT+ - Unconsolidated Undrained Tri-axial Test on Remoulded Sample.

CEGTH
CEG TEST HOUSE
AND RESEARCH CENTRE PVT LTD

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Transport Nagar in front of water head tank
B.H. No.	TN-01

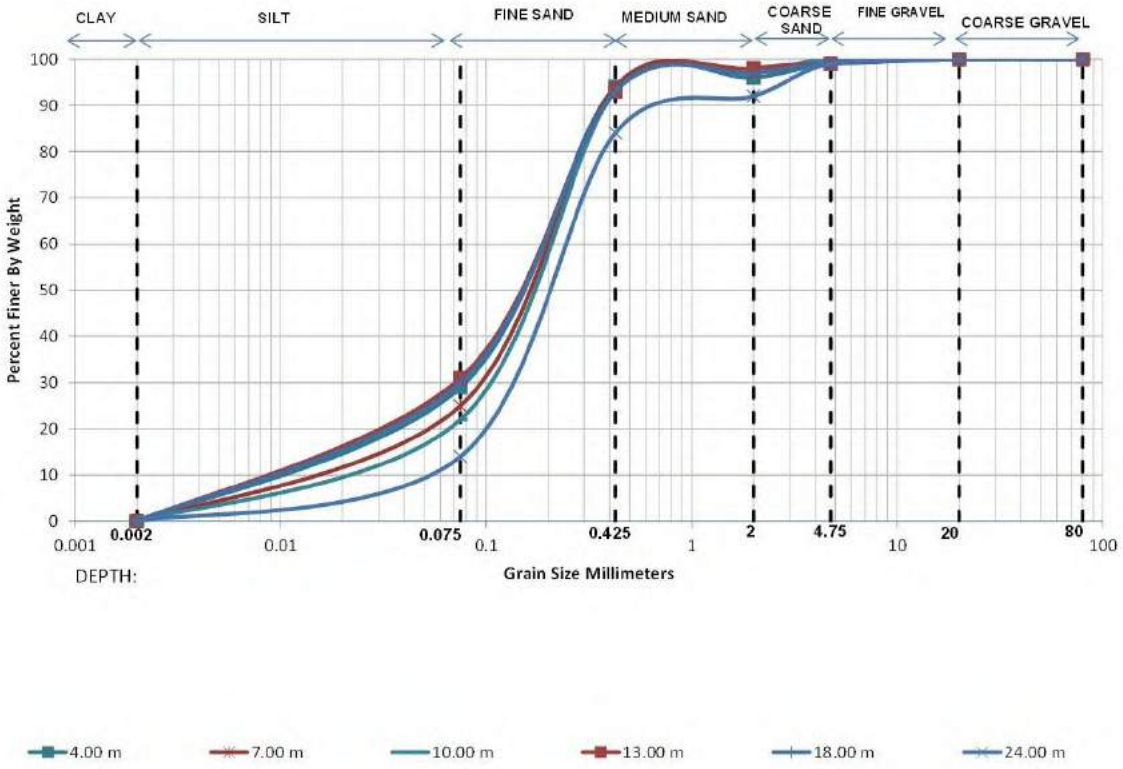


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
4.00 m	0.00	18.00	64.00	13.00	3.00	2.00	0.00	0.0331	0.1251	0.2533	7.66	1.87
7.00 m	0.00	16.00	68.00	11.00	4.00	1.00	0.00	0.0406	0.1334	0.2516	6.20	1.74
10.00 m	0.00	16.00	72.00	9.00	2.00	1.00	0.00	0.0409	0.1316	0.2398	5.87	1.77
13.50 m	0.00	17.00	70.00	6.00	5.00	2.00	0.00	0.0369	0.1273	0.2385	6.47	1.84
16.50 m	0.00	18.00	66.00	12.00	4.00	0.00	0.00	0.0332	0.1242	0.2463	7.42	1.89
21.00 m	0.00	20.00	71.00	4.00	2.00	3.00	0.00	0.0280	0.1131	0.2193	7.83	2.08
25.50 m	0.00	14.00	76.00	3.00	5.00	2.00	0.00	0.0505	0.1395	0.2392	4.73	1.61
30.00 m	0.00	22.00	75.00	2.00	1.00	0.00	0.00	0.0239	0.1038	0.2012	8.41	2.24
34.50 m	0.00	18.00	78.00	3.00	1.00	0.00	0.00	0.0340	0.1200	0.2154	6.33	1.96
37.50 m	0.00	16.00	80.00	2.00	1.00	1.00	0.00	0.0414	0.1284	0.2212	5.34	1.80

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	In front of Khandelwal stoel shop
B.H. No.	BH-TNST-02

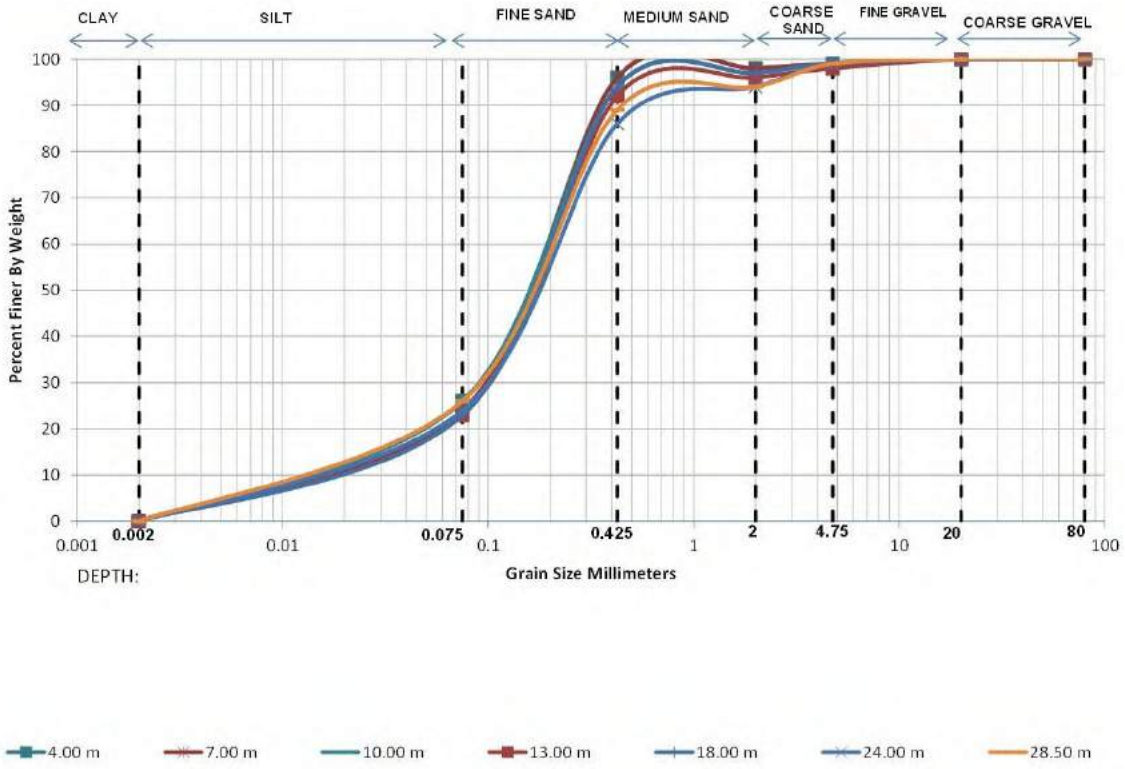


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
4.00 m	0.00	29.00	65.00	2.00	3.00	1.00	0.00	0.0143	0.0784	0.1843	12.88	2.33
7.00 m	0.00	25.00	69.00	3.00	2.00	1.00	0.00	0.0188	0.0928	0.1974	10.50	2.32
10.00 m	0.00	22.00	71.00	4.00	3.00	0.00	0.00	0.0237	0.1045	0.2090	8.82	2.21
13.00 m	0.00	31.00	62.00	5.00	1.00	1.00	0.00	0.0126	0.0717	0.1803	14.28	2.26
18.00 m	0.00	30.00	63.00	4.00	2.00	1.00	0.00	0.0134	0.0750	0.1834	13.68	2.29
24.00 m	0.00	14.00	70.00	8.00	7.00	1.00	0.00	0.0501	0.1426	0.2563	5.12	1.58

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Near red light police booth
B.H. No.	BH-TN Alignment-01

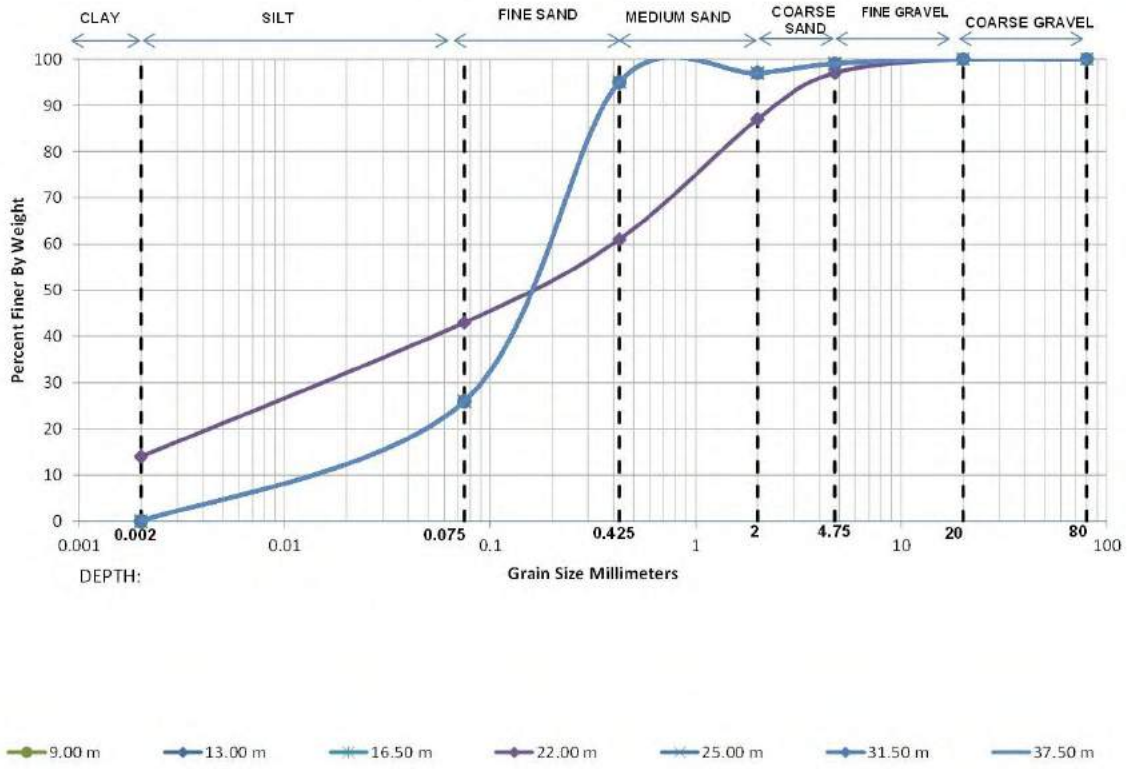


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
4.00 m	0.00	26.00	70.00	2.00	1.00	1.00	0.00	0.0176	0.0889	0.1904	10.83	2.36
7.00 m	0.00	24.00	72.00	2.00	1.00	1.00	0.00	0.0204	0.0963	0.1967	9.66	2.32
10.00 m	0.00	26.00	68.00	3.00	2.00	1.00	0.00	0.0175	0.0891	0.1942	11.11	2.34
13.00 m	0.00	23.00	69.00	4.00	2.00	2.00	0.00	0.0218	0.1008	0.2079	9.54	2.24
18.00 m	0.00	23.00	71.00	3.00	2.00	1.00	0.00	0.0219	0.1004	0.2037	9.30	2.26
24.00 m	0.00	24.00	62.00	8.00	5.00	1.00	0.00	0.0199	0.0978	0.2208	11.12	2.18
28.50 m	0.00	26.00	63.00	5.00	5.00	1.00	0.00	0.0173	0.0895	0.2054	11.90	2.26

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Near Traffic police chauki (RAC headquarter)
B.H. No.	BH-TN Alignment-02

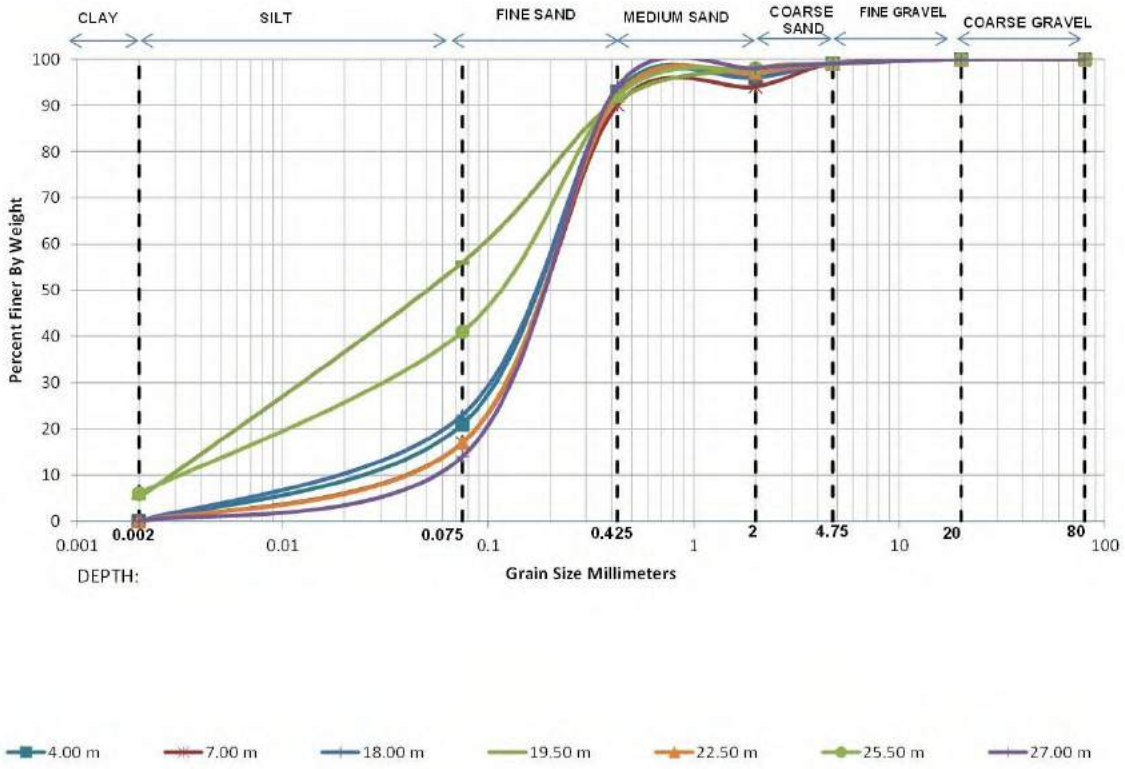


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
9.00 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35
13.00 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35
16.50 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35
22.00 m	14.00	29.00	18.00	26.00	10.00	3.00	0.00	-	0.0274	0.3959	-	-
25.00 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35
31.50 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35
37.50 m	0.00	26.00	69.00	2.00	2.00	1.00	0.00	0.0175	0.0890	0.1922	10.96	2.35

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Near Hanuman Temple
B.H. No.	BH-TN Alignment-03

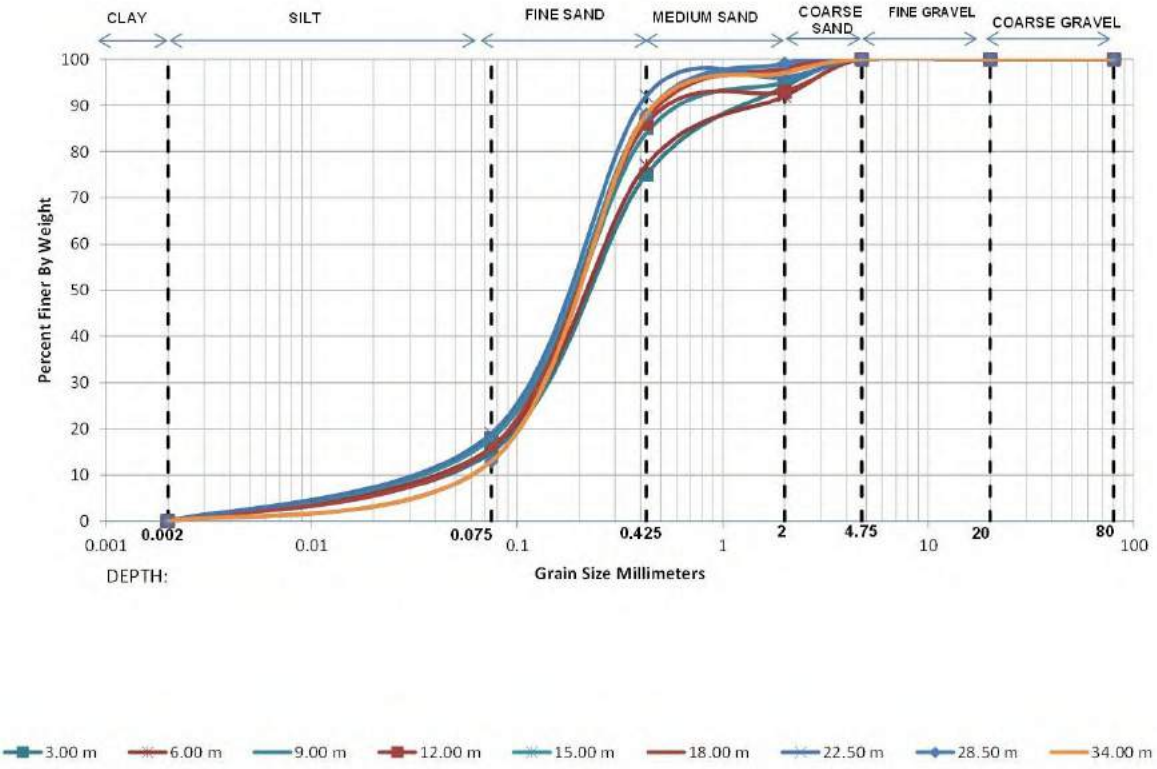


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
4.00 m	0.00	21.00	72.00	3.00	3.00	1.00	0.00	0.0258	0.1085	0.2118	8.21	2.16
7.00 m	0.00	17.00	73.00	4.00	5.00	1.00	0.00	0.0371	0.1261	0.2305	6.22	1.86
10.50 m	0.00	16.00	78.00	4.00	1.00	1.00	0.00	0.0413	0.1291	0.2253	5.46	1.79
16.50 m	0.00	25.00	70.00	3.00	2.00	0.00	0.00	0.0188	0.0927	0.1956	10.38	2.33
22.50 m	0.00	17.00	71.00	6.00	6.00	0.00	0.00	0.0369	0.1269	0.2359	6.39	1.85
27.00 m	0.00	21.00	67.00	5.00	5.00	2.00	0.00	0.0255	0.1096	0.2236	8.78	2.11
31.50 m	0.00	22.00	68.00	5.00	4.00	1.00	0.00	0.0235	0.1051	0.2157	9.17	2.18
36.00 m	0.00	22.00	65.00	8.00	3.00	2.00	0.00	0.0234	0.1058	0.2242	9.60	2.14
39.00 m	5.00	30.00	55.00	6.00	3.00	1.00	0.00	0.0073	0.0578	0.1754	23.87	2.60

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Near Krishi Mandi
B.H. No.	TN-04

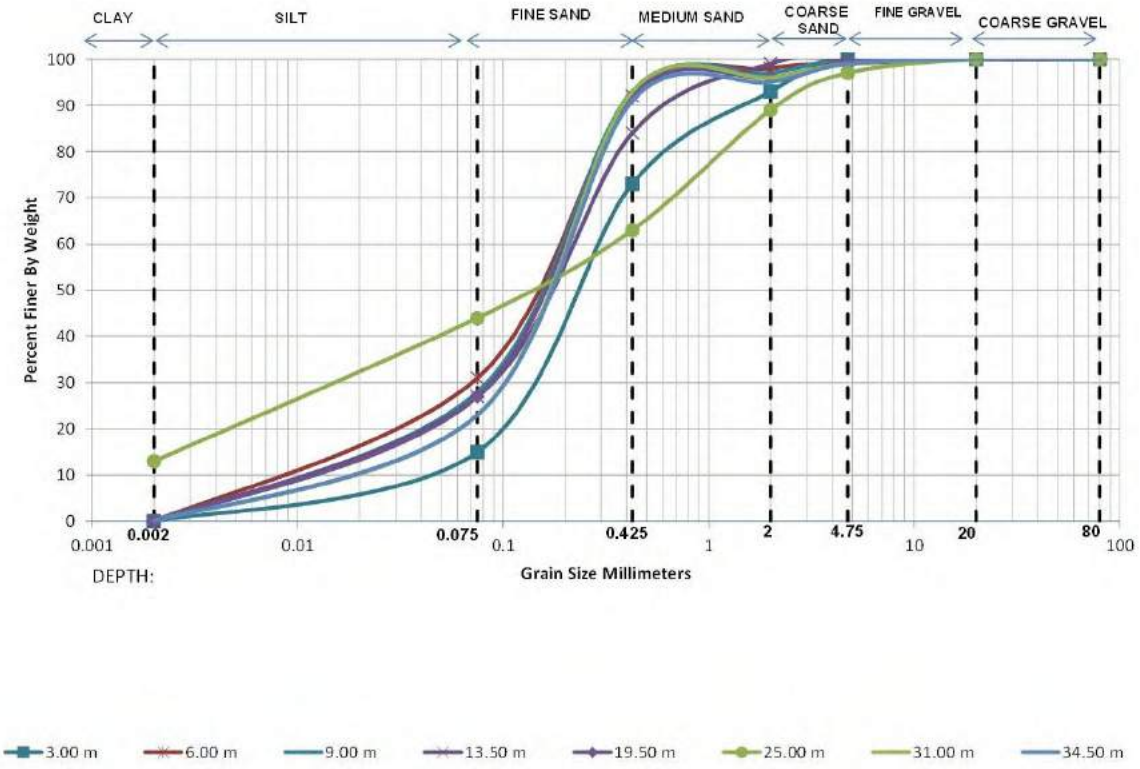


Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
3.00 m	0.00	15.00	60.00	19.00	6.00	0.00	0.00	0.0443	0.1438	0.2933	6.62	1.59
6.00 m	0.00	16.00	61.00	15.00	8.00	0.00	0.00	0.0400	0.1372	0.2797	7.00	1.68
9.00 m	0.00	18.00	66.00	11.00	5.00	0.00	0.00	0.0332	0.1242	0.2459	7.41	1.89
12.00 m	0.00	18.00	68.00	7.00	7.00	0.00	0.00	0.0334	0.1232	0.2387	7.15	1.91
15.00 m	0.00	18.00	70.00	10.00	2.00	0.00	0.00	0.0335	0.1227	0.2342	6.99	1.92
18.00 m	0.00	16.00	71.00	11.00	2.00	0.00	0.00	0.0408	0.1321	0.2430	5.96	1.76
22.50 m	0.00	19.00	73.00	4.00	4.00	0.00	0.00	0.0307	0.1170	0.2202	7.16	2.02
28.50 m	0.00	13.00	75.00	11.00	1.00	0.00	0.00	0.0561	0.1457	0.2491	4.44	1.52
34.00 m	0.00	13.00	75.00	9.00	3.00	0.00	0.00	0.0561	0.1455	0.2485	4.43	1.52

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

GRAIN SIZE DISTRIBUTION CURVES

Project Name	"Geo-technical Investigation work for Extension of E-W corridor from Badi Chouper to Transport Nagar (2.85km) Phase -1C and Mansarovar to Ajmer Road (Chauraha) (1.35km) Phase-1D of Jaipur Metro Rail Corporation at Jaipur."
Location/Chainage	Near Jain temple
B.H. No.	BH-TN Alignment-05



Depth	Grain Size Distribution % wt retained							D10	D30	D60	Cu	Cc
	Clay	Silt	Sand			Gravel						
			Fine	Medium	Coarse	Fine	Coarse					
3.00 m	0.00	15.00	58.00	20.00	7.00	0.00	0.00	0.0441	0.1453	0.3046	6.91	1.57
6.00 m	0.00	31.00	61.00	6.00	1.00	1.00	0.00	0.0126	0.0716	0.1825	14.50	2.23
9.00 m	0.00	28.00	65.00	4.00	3.00	0.00	0.00	0.0152	0.0819	0.1900	12.48	2.32
13.50 m	0.00	27.00	57.00	15.00	1.00	0.00	0.00	0.0159	0.0862	0.2197	13.85	2.13
19.50 m	0.00	27.00	65.00	4.00	3.00	1.00	0.00	0.0162	0.0856	0.1952	12.03	2.31
25.00 m	13.00	31.00	19.00	26.00	8.00	3.00	0.00	-	0.0272	0.3431	-	-
31.00 m	0.00	23.00	70.00	3.00	3.00	1.00	0.00	0.0219	0.1006	0.2056	9.41	2.25
34.50 m	0.00	23.00	68.00	4.00	4.00	1.00	0.00	0.0217	0.1009	0.2100	9.66	2.23

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APPENDIX B-3

RESULTS OF CHEMICAL ANALYSIS OF SOIL SAMPLES

S. No	BH No.	Depth (m)	pH	Chlorides (Cl^-)		Sulphate (SO_4)	
				(mg/kg)	(%)	(mg/kg)	(%)
1	TNST-01	3.00	8.14	34.74	0.0035	20.57	0.0021
2	TN Alignment-04	4.50	8.24	31.27	0.0031	24.69	0.0025
3	TN Alignment-05	3.00	8.21	38.22	0.0038	28.81	0.0029

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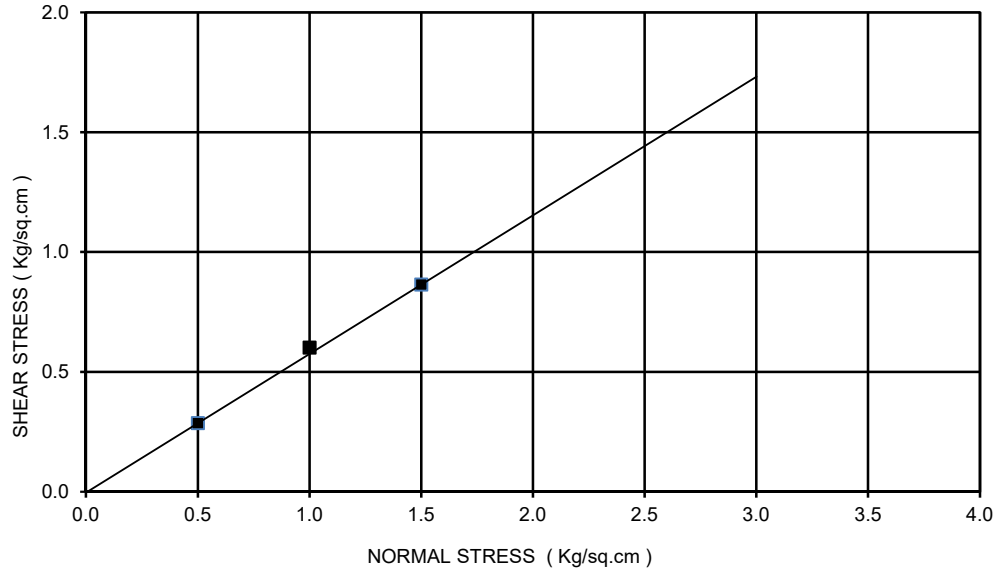
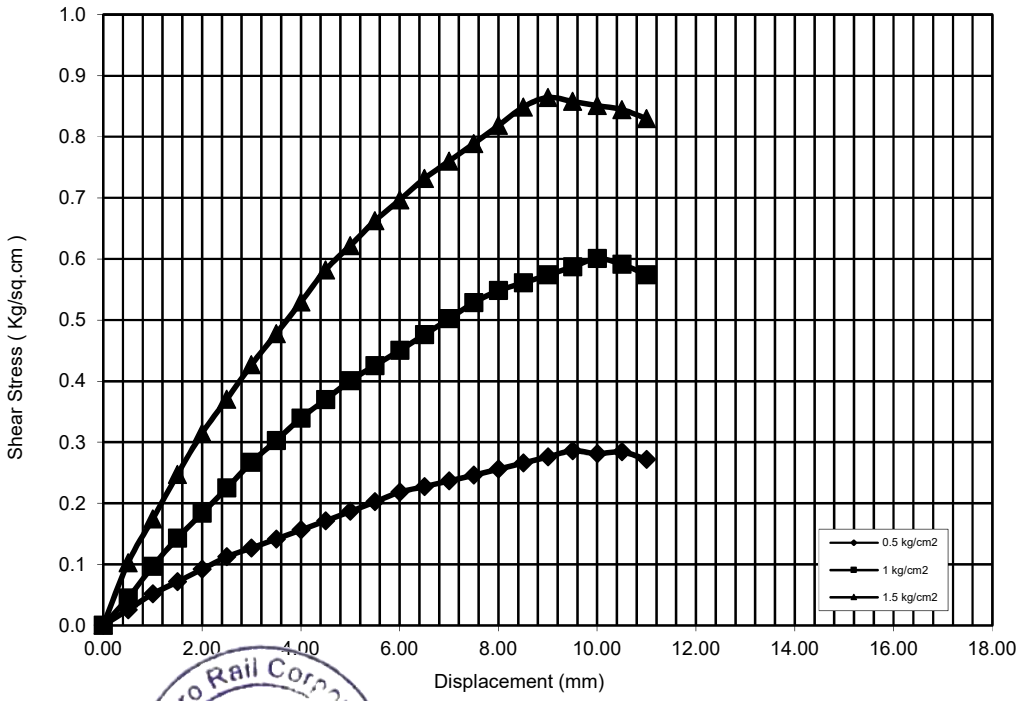
BORE HOLE NO: BH-TN Alignment-01

SAMPLE NO.: UDS-1
DEPTH: 4.00 m
COHESION(C)= 0.00 kg/sq.cm
ANGLE OF FRICTION(Phi): 30 deg
TYPE OF THE TEST: DST





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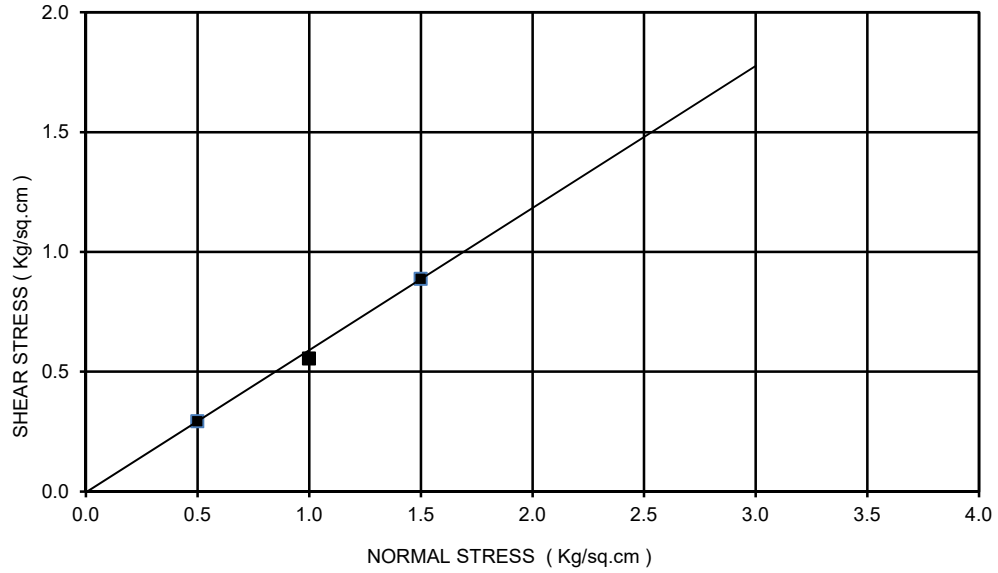
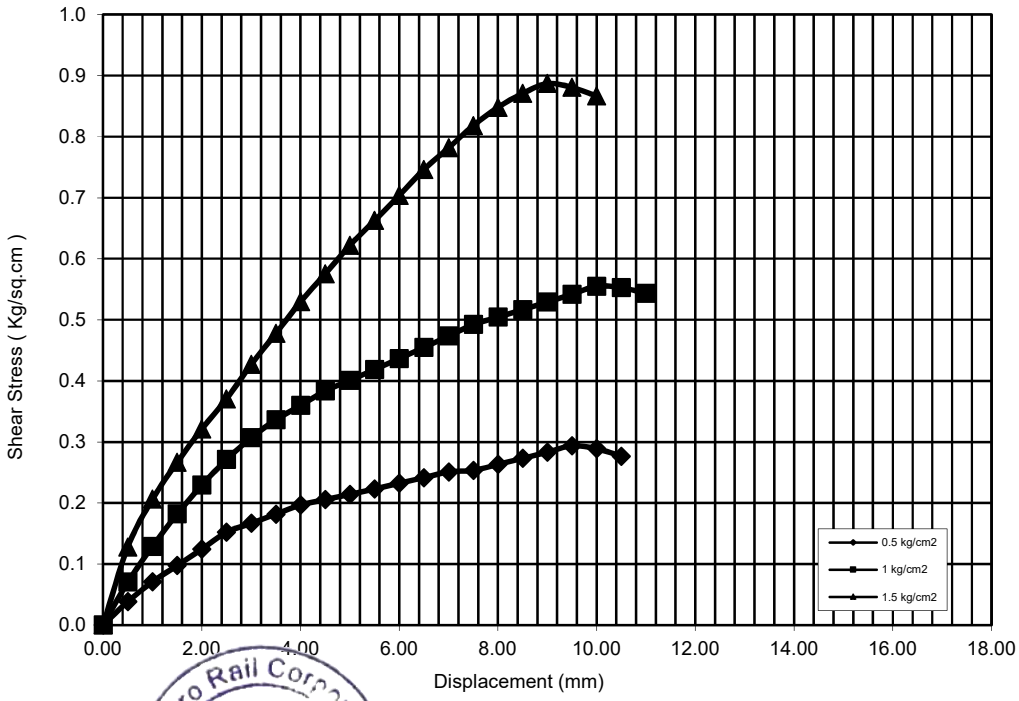
BORE HOLE NO: BH-TN Alignment-01

SAMPLE NO.: UDS-3
DEPTH: 10.00 m
COHESION(C)= 0.00 kg/sq.cm
ANGLE OF FRICTION(Phi): 31 deg
TYPE OF THE TEST: DST





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APPENDIX – C
(ANALYSIS & RECOMENDATION)

Appendix No.	ITEMS
C-1	CALCULATION FOR COMPUTATION OF LIQUEFACTION POTENTIAL
C-2	SAMPLE CALCULATION FOR COMPUTATION OF ALLOWABLE BEARING CAPACITY OF SUB-STRATA FOR SHALLOW FOUNDATION RESTING ON SOIL
C-3	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN COMPRESSION & UPLIFT
C-4	SAMPLE CALCULATION FOR COMPUTATION OF SAFE LOAD CARRYING CAPACITY OF NORMAL BORED CAST-IN-SITU RCC PILE IN LATERAL

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Liquefaction Analysis as per IS:1893 & RDSO BS-118

Structure	Elevated Section	BH No.:-	TNST-01	Liquefiable upto=	NL	Water Table depth considered for analysis (m):-	0.00

Depth Below G.L. (z) in m	Observed SPT Value	Saturated Density (t/m^3)	Submerged Density (t/m^3)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Moisture Content @ 100% saturation	Strata Type	Liquefaction Check for Cohesive Strata	Fine Content (%)	Stress Reduction Coefficient (rd)	Total Overburden Press (σ_v), t/m^2	Effective Overburden (σ'_v), t/m^2	Critical Stress Ratio (CSR)	C_{HT}	C_{HW}	C_{SS}	C_{RL}	C_{BD}	C_{60}	Stress Normalization Factor(C_N)	SPT Corrected $(N1)_{60}$	α	β	$(N1)_{60CS}$	$CRR_{M=7.5}$	K_M	Kα	Kσ	CRR_{Mw}	FOS	Conclusion
3.00	31	2.01	1.01					Cohesionless		18	0.977	6.04	3.04	0.126	0.75	0.986	1.00	0.80	1.05	0.621	1.70	32.7	3.23	1.07	38.14	NA	1.77	1	1.00	NA	>1	Non Liquefiable
4.50	40	2.01	1.01					Cohesionless		18	0.966	9.06	4.56	0.125	0.75	0.986	1.00	0.85	1.05	0.660	1.47	38.7	3.23	1.07	44.48	NA	1.77	1	1.00	NA	>1	Non Liquefiable
6.00	54	2.01	1.01					Cohesionless		18	0.954	12.08	6.08	0.123	0.75	0.986	1.00	0.95	1.05	0.738	1.27	69.3	3.23	1.07	77.09	NA	1.77	1	1.00	NA	>1	Non Liquefiable
7.50	47	2.02	1.02					Cohesionless		16	0.943	15.11	7.61	0.122	0.75	0.986	1.00	0.95	1.05	0.738	1.14	59.4	2.77	1.05	65.42	NA	1.77	1	1.00	NA	>1	Non Liquefiable
9.00	59	2.02	1.02					Cohesionless		16	0.931	18.14	9.14	0.120	0.75	0.986	1.00	0.95	1.05	0.738	1.04	45.1	2.77	1.05	50.27	NA	1.77	1	1.00	NA	>1	Non Liquefiable
10.50	62	2.02	1.02					Cohesionless		16	0.894	21.17	10.67	0.115	0.75	0.986	1.00	1.00	1.05	0.776	0.96	46.1	2.77	1.05	51.40	NA	1.77	1	1.00	NA	>1	Non Liquefiable
12.00	66	2.02	1.02					Cohesionless		16	0.854	24.20	12.20	0.110	0.75	0.986	1.00	1.00	1.05	0.776	0.90	45.9	2.77	1.05	51.18	NA	1.77	1	1.00	NA	>1	Non Liquefiable
13.50	72	2.02	1.02					Cohesionless		17	0.814	27.23	13.73	0.105	0.75	0.986	1.00	1.00	1.05	0.776	0.84	47.2	3.01	1.06	53.08	NA	1.77	1	1.00	NA	>1	Non Liquefiable

Jaipur Metro Rail Corporation Ltd. Director (Project) JAIPUR

CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

Calculation of SBC for shallow foundations as per IS : 6403 - 1981

INPUT DATA

	Elevated
	BH-TNAL-02

Type of footing

1	Continuous Strip		
2	Rectangular	***Rectangular***	**2**
3	Square		
4	Circular		

Angle of internal friction (ϕ^{o})	31.42
Cohesion (c in t/m^2)	0.00
Void ratio (e), $e = (G.\gamma_w/\gamma_d)-1$	0.63
Direction of load with vertical (^{o})	0.00
Density of foundation soil (t/m^3) γ_{bulk}	1.79
Depth of water table(m)	0.00
Factor of safety	2.50

S.no.	Depth (m) of footing (D_f) below EGL	Width (m)	Length (m)
1	3.00	4.00	5.00
		0.00	0.00
		0.00	0.00
		0.00	0.00
		0.00	0.00

SHEAR FAILURE CRITERIA

Assumptions and formula used in calculation as per IS:6403-1981 are given below -

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q_d = c\,N_c\,s_c\,d_c\,i_c + q\,(N_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q'_d = (2/3)\,c\,N'_c\,s_c\,d_c\,i_c + q\,(N'_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N'_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

Where,

$d_c = 1 + 0.2\,(D_f/B)*SQRT(N_\phi)$

$d_q = d_\gamma = 1$ for $\phi < 10^{o}$ (from IS 6403 : 1981, page No. 9)

$d_q = d_\gamma = 1 + 0.1\,(D_f/B)*SQRT(N_\phi)$ for $\phi > 10^{o}$

$N_\phi = \tan^2(\pi/4 + \phi/2)$

ϕ' is friction angle for local shear failure = $\tan^{-1}(0.67\tan\phi)$

OUTPUT

The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)

ϕ	31.42	ϕ'	22.26
N_c	33.81	N'_c	17.17
N_q	21.65	N'_q	8.03
N_γ	27.67	N'_γ	7.39

Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)

S.no.	Width(m)	Length (m)	S_c	S_q	S_γ
1	4.00	5.00	1.16	1.16	0.68
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			

Depth factors : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	dc	d_q	d_γ
1	3.00	4.00	1.27	1.13	1.13
		0.00			
		0.00			
		0.00			
		0.00			

Inclination factors : (from IS 6403 : 1981, page No. 9)

$i_c = (1-\alpha / 90)^2$	$i_q = (1-\alpha / 90)^2$	$i_\gamma = (1-\alpha / \phi)^2$
1.00	1.00	1.00

Water table factor : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	Z_w/B	W'
1	3.00	4.00	-0.75	0.50
		0.00		
		0.00		
		0.00		
		0.00		

Safe Bearing Capacity

S.no.	Depth(m)	Width(m)	Length (m)	SBC in (t/m^2)		
				General shear	Local shear	Recommended
1	3.00	4.00	5.00	41.16	12.89	29.71
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

Jaipur Metro Rail Corporation Ltd.
Director (Project)
JAIPUR

Calculation of SBC for shallow foundations as per IS : 6403 - 1981

INPUT DATA

	Elevated
	BH-TNAL-02

Type of footing

1	Continuous Strip		
2	Rectangular	***Rectangular***	**2**
3	Square		
4	Circular		

Angle of internal friction (ϕ^{o})	31.14
Cohesion (c in t/m^2)	0.00
Void ratio (e), $e = (G.\gamma_w/\gamma_d)-1$	0.63
Direction of load with vertical (^{o})	0.00
Density of foundation soil (t/m^3) γ_{bulk}	1.77
Depth of water table(m)	0.00
Factor of safety	2.50

S.no.	Depth (m) of footing (D_f) below EGL	Width (m)	Length (m)
1	4.00	4.00	5.00
		0.00	0.00
		0.00	0.00
		0.00	0.00
		0.00	0.00

SHEAR FAILURE CRITERIA

Assumptions and formula used in calculation as per IS:6403-1981 are given below -

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q_d = c\,N_c\,s_c\,d_c\,i_c + q\,(N_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q'_d = (2/3)\,c\,N'_c\,s_c\,d_c\,i_c + q\,(N'_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N'_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

Where,

$d_c = 1 + 0.2\,(D_f/B)*SQRT(N_\phi)$

$d_q = d_\gamma = 1$ for $\phi < 10^{o}$

$d_q = d_\gamma = 1 + 0.1\,(D_f/B)*SQRT(N_\phi)$ for $\phi > 10^{o}$

(from IS 6403 : 1981, page No. 9)

$N_\phi = \tan^2(\pi/4 + \phi/2)$

ϕ' is friction angle for local shear failure = $\tan^{-1}(0.67\tan\phi)$

OUTPUT

The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)

ϕ	31.14	ϕ'	22.04
N_c	33.04	N'_c	16.92
N_q	20.96	N'_q	7.85
N_γ	26.54	N'_γ	7.17

Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)

S.no.	Width(m)	Length (m)	S_c	S_q	S_γ
1	4.00	5.00	1.16	1.16	0.68
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			

Depth factors : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	dc	d_q	d_γ
1	4.00	4.00	1.35	1.18	1.18
		0.00			
		0.00			
		0.00			
		0.00			

Inclination factors : (from IS 6403 : 1981, page No. 9)

$i_c = (1-\alpha / 90)^2$	$i_q = (1-\alpha / 90)^2$	$i_\gamma = (1-\alpha / \phi)^2$
1.00	1.00	1.00

Water table factor : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	Z_w/B	W'
1	4.00	4.00	-1.00	0.50
		0.00		
		0.00		
		0.00		
		0.00		

Safe Bearing Capacity

S.no.	Depth(m)	Width(m)	Length (m)	SBC in (t/m^2)		
				General shear	Local shear	Recommended
1	4.00	4.00	5.00	48.82	15.65	35.11
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

Jaipur Metro Rail Corporation Ltd.
Director (Project)
JAIPUR

Calculation of SBC for shallow foundations as per IS : 6403 - 1981

INPUT DATA

	Elevated
	BH-TNAL-02

Type of footing

1	Continuous Strip		
2	Rectangular	***Rectangular***	**2**
3	Square		
4	Circular		

Angle of internal friction (ϕ^{o})	31.00
Cohesion (c in t/m^2)	0.00
Void ratio (e), $e = (G.\gamma_w/\gamma_d)-1$	0.63
Direction of load with vertical (^{o})	0.00
Density of foundation soil (t/m^3) γ_{bulk}	1.76
Depth of water table(m)	0.00
Factor of safety	2.50

S.no.	Depth (m) of footing (D_f) below EGL	Width (m)	Length (m)
1	5.00	4.00	5.00
		0.00	0.00
		0.00	0.00
		0.00	0.00
		0.00	0.00

SHEAR FAILURE CRITERIA

Assumptions and formula used in calculation as per IS:6403-1981 are given below -

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

The ultimate net bearing capacity in case of general shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q_d = c\,N_c\,s_c\,d_c\,i_c + q\,(N_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

The ultimate net bearing capacity in case of local shear failure is given by (from IS 6403 : 1981, page No. 8)

$$q'_d = (2/3)\,c\,N'_c\,s_c\,d_c\,i_c + q\,(N'_q-1)\,s_q\,d_q\,i_q + (1/2)\,B\,\gamma\,N'_\gamma\,s_\gamma\,d_\gamma\,i_\gamma\,W'$$

Where,

$d_c = 1 + 0.2\,(D_f/B)*SQRT(N_\phi)$

$d_q = d_\gamma = 1$ for $\phi < 10^{o}$ (from IS 6403 : 1981, page No. 9)

$d_q = d_\gamma = 1 + 0.1\,(D_f/B)*SQRT(N_\phi)$ for $\phi > 10^{o}$

$N_\phi = \tan^2(\pi/4 + \phi/2)$

ϕ' is friction angle for local shear failure = $\tan^{-1}(0.67\tan\phi)$

OUTPUT

The computer aided results for shear failure criteria are tabulated below. The results are interpolated values of bearing capacity obtained from general and local shear failure criteria.

Jaipur Metro Rail Corporation
Director (Project)
JAIPUR

Bearing capacity factors : (from IS 6403 : 1981, page No. 8, Table No. 1)

ϕ	31.00	ϕ'	21.93
N_c	32.67	N'_c	16.80
N_q	20.63	N'_q	7.76
N_γ	25.99	N'_γ	7.06

Shape factors : (from IS 6403 : 1981, page No. 8, Table No. 2)

S.no.	Width(m)	Length (m)	S_c	S_q	S_γ
1	4.00	5.00	1.16	1.16	0.68
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			
	0.00	0.00			

Depth factors : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	dc	d_q	d_γ
1	5.00	4.00	1.44	1.22	1.22
		0.00			
		0.00			
		0.00			
		0.00			

Inclination factors : (from IS 6403 : 1981, page No. 9)

$i_c = (1-\alpha / 90)^2$	$i_q = (1-\alpha / 90)^2$	$i_\gamma = (1-\alpha / \phi)^2$
1.00	1.00	1.00

Water table factor : (from IS 6403 : 1981, page No. 9)

S.no.	Depth(m)	Width(m)	Z_w/B	W'
1	5.00	4.00	-1.25	0.50
		0.00		
		0.00		
		0.00		
		0.00		

Safe Bearing Capacity

S.no.	Depth(m)	Width(m)	Length (m)	SBC in (t/m^2)		
				General shear	Local shear	Recommended
1	5.00	4.00	5.00	57.69	18.77	41.44
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			
		0.00	0.00			

NOTE: The type of failure used for bearing capacity analysis depends upon the value of void ratio (see IS 6403 : 1981, Page No. 9, Table No. 3).

Jaipur Metro Rail Corporation Ltd.
Director (Project)
JAIPUR

SETTLEMENT CALCULATION AS PER 8009 Part-1 1976																	Elevated				
Layer	Depth below FGL (m)	From (m)	To (m)	Layer Thickness	Stress at Foundation level (Kg/Cm2)	Length (m)	Breadth (m)	Height of layer(m)	Dispersed Length (m)	Dispersed Breadth (m)	Stress Increment at mid Depth (kg/Cm2)	Average N-Value	Mvc (Cm^2/Kg)	Consolidation Settlement (mm)	Corrected Consolidation Settlement (mm)	Modulus of Soil (Kg/Cm^2)	Elastic Settlement Si (mm)	Total Settlement (mm)	Depth Factor	Rigidity Factor	Corrected Total Settlement (mm)
Layer 1		3.00	7.50	4.50				4.50	5.00	4.000	10.311	50				356	86.1896	86.19			
Layer 2		7.50	9.00	1.50				1.50	9.500	8.500	2.554	34				260	7.6574	7.66			
	3.00				10.31	5.00	4.00												0.799	1.00	75.00
Layer 1		4.00	7.50	3.50				3.50	5.00	4.000	12.474	50				356	81.9488	81.95			
Layer 2		7.50	10.00	2.50				2.50	8.500	7.500	3.914	34				260	18.4914	18.49			
	4.00				12.47	5.00	4.00												0.747	1.00	75.00
Layer 1		5.00	7.50	2.50				2.50	5.00	4.000	16.260	50				356	64.4251	64.43			
Layer 2		7.50	11.00	3.50				3.50	7.500	6.500	6.671	34				260	45.3675	45.37			
	5.00				16.26	5.00	4.00												0.683	1.00	75.00

Jaipur Metro Rail Corporation
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NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 24.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	26.00	0.00	32	1.50	0.30	0.84	50	1.56	1.56	0.83	0.00	32	9	29.50	30.21	314.29	7857.14	23.02	371.87
																				717.74	371.87

Jaipur Metro Rail Corporation Director (Projects) JAIPUR

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Qu,comp.= qs + Qp

Qa,comp.= (717.74 + 371.87) / 2.5

Qa,comp.= 435.84 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 717.74 / 3 + 47.12

Qa,uplift = 214.60 T

Say **Qa,comp.= 435.00 T** **Qa,uplift = 214.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 26.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	28.00	0.00	32	1.50	0.30	0.84	250	1.56	1.56	0.84	0.00	32	9	29.50	30.21	314.29	7857.14	115.09	371.94
																				809.81	371.94

Jaipur Metro Rail Corporation JAIPUR Director (Project)

Qu,comp.= qs + Qp

Qa,comp.= (809.81 + 371.94) / 2.5

Qa,comp.= 472.70 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 809.81 / 3 + 51.05

Qa,uplift = 240.01 T

Say **Qa,comp.= 472.00 T** **Qa,uplift = 240.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 28.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.56	1.56	0.84	0.00	32	9	29.50	30.21	314.29	7857.14	207.16	371.94
																				901.88	371.94

Qu,comp.= qs + Qp

Qa,comp.= (901.88 + 371.94) / 2.5

Qa,comp.= 509.53 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 901.88 / 3 + 54.98

Qa,uplift = 265.42 T

Say **Qa,comp.= 509.00 T** **Qa,uplift = 265.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation Director (Project) JAIPUR

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 30.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.56								314.29		207.16	
1.00		30.00	32.00	0.00	32	1.50	0.30	0.84	200	1.56	1.56	0.84	0.00	32	9	29.50	30.21	314.29	7857.14	92.07	372.00
																				993.95	372.00

Jaipur Metro Rail Corporation Director (Project) JAIPUR

Qu,comp.= qs + Qp

Qa,comp.= (993.95 + 372) / 2.5

Qa,comp.= 546.38 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 993.95 / 3 + 58.9

Qa,uplift = 290.83 T

Say **Qa,comp.= 546.00 T** **Qa,uplift = 290.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 32.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.56								314.29		207.16	
1.00		30.00	34.00	0.00	32	1.50	0.30	0.84	400	1.56	1.56	0.84	0.00	32	9	29.50	30.21	314.29	7857.14	184.14	372.00
																				1086.02	372.00

Qu,comp.= qs + Qp

Qa,comp.= (1086.02 + 372) / 2.5

Qa,comp.= 583.21 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1086.02 / 3 + 62.83

Qa,uplift = 316.24 T

Say **Qa,comp.= 583.00 T** **Qa,uplift = 316.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation Director (Project) JAIPUR

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 34.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.00 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.00	2.00	0.00	2.00					0.60	200	0.06											
1.00		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								314.29		44.85	
1.00		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								314.29		55.99	
1.00		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								314.29		92.22	
1.00		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								314.29		102.12	
1.00		16.50	20.00	0.00	32	1.50	0.30	0.82	350	1.42								314.29		146.35	
1.00		20.00	21.00	0.00	32	1.50	0.30	0.82	100	1.56								314.29		46.04	
1.00		21.00	25.50	0.00	32	1.50	0.30	0.83	450	1.56								314.29		207.16	
1.00		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.56								314.29		207.16	
1.00		30.00	34.50	0.00	32	1.50	0.30	0.84	450	1.56								314.29		207.16	
1.00		34.50	36.00	0.00	33	1.50	0.30	0.88	150	1.56	1.56	0.84	0.00	32	9	29.50	30.21	314.29	7857.14	71.77	372.00
																				1180.80	372.00

Qu,comp.= qs + Qp

Qa,comp.= (1180.8 + 372) / 2.5

Qa,comp.= 621.12 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1180.8 / 3 + 66.76

Qa,uplift = 342.28 T

Say **Qa,comp.= 621.00 T** **Qa,uplift = 342.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation Director (Project) JAIPUR

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 24.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	26.00	0.00	32	1.50	0.30	0.84	50	1.89	1.89	0.83	0.00	32	9	29.50	30.21	377.14	11314.29	33.46	648.59
																				907.97	648.59

Jaipur Metro Rail Corporation Director (Projects) JAIPUR

Qu,comp.= qs + Qp

Qa,comp.= (907.97 + 648.59) / 2.5

Qa,comp.= 622.63 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 907.97 / 3 + 67.86

Qa,uplift = 279.72 T

Say **Qa,comp.= 622.00 T** **Qa,uplift = 279.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 26.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	28.00	0.00	32	1.50	0.30	0.84	250	1.89	1.89	0.84	0.00	32	9	29.50	30.21	377.14	11314.29	167.32	648.73
																				1041.83	648.73

Qu,comp.= qs + Qp

Qa,comp.= (1041.83 + 648.73) / 2.5

Qa,comp.= 676.22 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1041.83 / 3 + 73.51

Qa,uplift = 316.61 T

Say **Qa,comp.= 676.00 T** **Qa,uplift = 316.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation Director (Projects) JAIPUR

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 28.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.89	1.89	0.84	0.00	32	9	29.50	30.21	377.14	11314.29	301.18	648.73
																				1175.68	648.73

Qu,comp.= qs + Qp

Qa,comp.= (1175.68 + 648.73) / 2.5

Qa,comp.= 729.77 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1175.68 / 3 + 79.17

Qa,uplift = 353.49 T

Say **Qa,comp.= 729.00 T** **Qa,uplift = 353.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation Director (Project) JAIPUR

CEGTH CEG TEST HOUSE AND RESEARCH CENTRE PVT LTD

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 30.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.89								377.14		301.18	
1.20		30.00	32.00	0.00	32	1.50	0.30	0.84	200	1.89	1.89	0.84	0.00	32	9	29.50	30.21	377.14	11314.29	133.86	648.73
																				1309.54	648.73

Jaipur Metro Rail Corporation Director (Project) JAIPUR

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Qu,comp.= qs + Qp

Qa,comp.= (1309.54 + 648.73) / 2.5

Qa,comp.= 783.31 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1309.54 / 3 + 84.82

Qa,uplift = 390.38 T

Say **Qa,comp.= 783.00 T** **Qa,uplift = 390.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 32.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.89								377.14		301.18	
1.20		30.00	34.00	0.00	32	1.50	0.30	0.84	400	1.89	1.89	0.84	0.00	32	9	29.50	30.21	377.14	11314.29	267.71	648.83
																				1443.40	648.83

Qu,comp.= qs + Qp

Qa,comp.= (1443.4 + 648.83) / 2.5

Qa,comp.= 836.89 T

Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,uplift = 0.7 x 1443.4 / 3 + 90.48

Qa,uplift = 427.27 T

Say **Qa,comp.= 836.00 T** **Qa,uplift = 427.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation JAIPUR Director (Project)

NAME OF PROJECT:- "Extension of UG & Elevated section E-W corridor of JMRCL at Jaipur"

Length of Pile below cut of level = 34.00 m **Bore Hole No =** BH-TN-01 **Ch. (KM)** Elevated **Dia of pile =** 1.20 m **Cut-off Level =** 2.00 m below EGL

Restricting PD to 20D **Water Table depth considered for analysis =** 0.00 m **Scour Depth =** 0.00 m **Liquefaction Depth =** 0.00 m

Dia. of Pile	Cut-off Depth	Soil layers		Properties of layers/for Skin Friction							For End Bearing										
		from	to	c	Ø	k	α	γeff	ΔL	pd (s.f)	Pd (e.b)	γeff	c	Ø	Nc	Nq	Ny	As/cm	Ap	qs	Qp
(m)	(m)	(m)	(m)	kg/cm^2	deg			gm/cc	cm	kg/cm^2	kg/cm^2	gm/cc	kg/cm^2	deg				cm^2	cm^2	t	t
1.20	2.00	0.00	2.00					0.60	200	0.06											
1.20		2.00	7.00	0.00	31	1.50	0.30	0.79	500	0.32								377.14		53.82	
1.20		7.00	10.00	0.00	32	1.50	0.30	0.80	300	0.63								377.14		67.19	
1.20		10.00	13.50	0.00	32	1.50	0.30	0.80	350	0.89								377.14		110.66	
1.20		13.50	16.50	0.00	32	1.50	0.30	0.80	300	1.15								377.14		122.54	
1.20		16.50	21.00	0.00	32	1.50	0.30	0.82	450	1.46								377.14		232.31	
1.20		21.00	24.00	0.00	32	1.50	0.30	0.83	300	1.77								377.14		187.60	
1.20		24.00	25.50	0.00	32	1.50	0.30	0.83	150	1.89								377.14		100.39	
1.20		25.50	30.00	0.00	32	1.50	0.30	0.84	450	1.89								377.14		301.18	
1.20		30.00	34.50	0.00	32	1.50	0.30	0.84	450	1.89								377.14		301.18	
1.20		34.50	36.00	0.00	33	1.50	0.30	0.88	150	1.89	1.89	0.84	0.00	32	9	29.50	30.21	377.14	11314.29	104.33	648.83
																				1581.19	648.83

Qu,comp.= qs + Qp Qu,uplift = 0.7 x Safe Frictional Resistance + Weight of Pile

Qa,comp.= (1581.19 + 648.83) / 2.5 Qa,uplift = 0.7 x 1581.19 / 3 + 96.13

Qa,comp.= 892.01 T Qa,uplift = 465.08 T

Say **Qa,comp.= 892.00 T** **Qa,uplift = 465.00 T**

*FOS for Vertical Capacity of pile in compression = 2.5

**FOS for Uplift Capacity of pile = 3.0

***Density of Concrete for Weight of Pile = 2.5t/m^3

Jaipur Metro Rail Corporation JAIPUR Director (Project)

Lateral Load capacity of Pile

BH-BH-TN-01
Ch. (KM): Elevated

Type of Strata = Sandy

Le = Embedded Length of Pile in Meter = 32.000 m **Fck = 35.0 N/mm^2** **D = 100 cm**

Bed level	**0.0 m**
Pile cap bottom level	**-2.0 m**
Scour Depth	**0.0 m**

E = Young's Modulus of Pile (Kg/cm^2) = $5000\sqrt{F_{ck}}$ N/mm^2 = 295803.99 Kg/cm^2

I = Moment of Inertia (cm^2) = $\pi xD^4/64$ = 4908738.5 cm^4

K_1 = Constant for Sandy / Normally Consolidated Clay (Kg/cm^3) = **0.705**

T, Relative stiffness factor in Sand $T = \sqrt[5]{\frac{EI}{K_1}}$ = **290.3** cm

For Long Pile If $L_e > 4T$

L1 = = **0.000** cm

$\frac{L_1}{T}$ = 0.00

For Fixed Head Pile

$\frac{L_f}{T}$ = **2.20** From Fig. 4

Lf = 639.03 cm

Equivalent length of cantilever L= $L1+L_F$: 0.00 + 639.03265 = **639.03** cm

Y = Pile Head Deflection (Cm) = $\frac{Q(L_1 + L_F)^3}{12\ EI}$ (for fixed Head pile)

Q = Lateral Load in Kg

Lateral Load For Pile Head Deflection .5 cm Q = 33385.36 Kg

= **33.39 T**

Safe Lateral resistance of Pile = Lateral resistance corresponding to deflection 1.0% of Pile Diameter at scour level 1.0 cm

= **66.77 T**

Say 66 T

Jaipur Metro Rail Corporation Director (Project) JAIPUR

Lateral Load capacity of Pile

BH-BH-TN-01
Ch. (KM): Elevated

Type of Strata = Sandy

Le = Embedded Length of Pile in Meter = 32.000 m **Fck = 35.0 N/mm^2** **D = 120 cm**

Bed level	**0.0 m**
Pile cap bottom level	**-2.0 m**
Scour Depth	**0.0 m**

E = Young's Modulus of Pile (Kg/cm^2) = $5000\sqrt{F_{ck}}$ N/mm^2 = 295803.99 Kg/cm^2

I = Moment of Inertia (cm^2) = $\pi xD^4/64$ = 10178760.2 cm^4

K_1 = Constant for Sandy / Normally Consolidated Clay (Kg/cm^3) = **0.705**

T, Relative stiffness factor in Sand $T = \sqrt[5]{\frac{EI}{K_1}}$ = **335.9** cm

For Long Pile If $L_e > 4T$

L1 = = **0.000** cm

$\frac{L_1}{T}$ = 0.00

For Fixed Head Pile

$\frac{L_f}{T}$ = **2.20** From Fig. 4

Lf = 739.38 cm

Equivalent length of cantilever L= $L1+L_F$: 0.00 + 739.38059 = **739.38** cm

Y = Pile Head Deflection (Cm) = $\frac{Q(L_1 + L_F)^3}{12\ EI}$ (for fixed Head pile)

Q = Lateral Load in Kg

Lateral Load For Pile Head Deflection .5 cm Q = 44693.67 Kg

= **44.69 T**

Safe Lateral resistance of Pile = Lateral resistance corresponding to deflection 1.0% of Pile Diameter at scour level 1.2 cm

= **107.26 T**

Say 107 T

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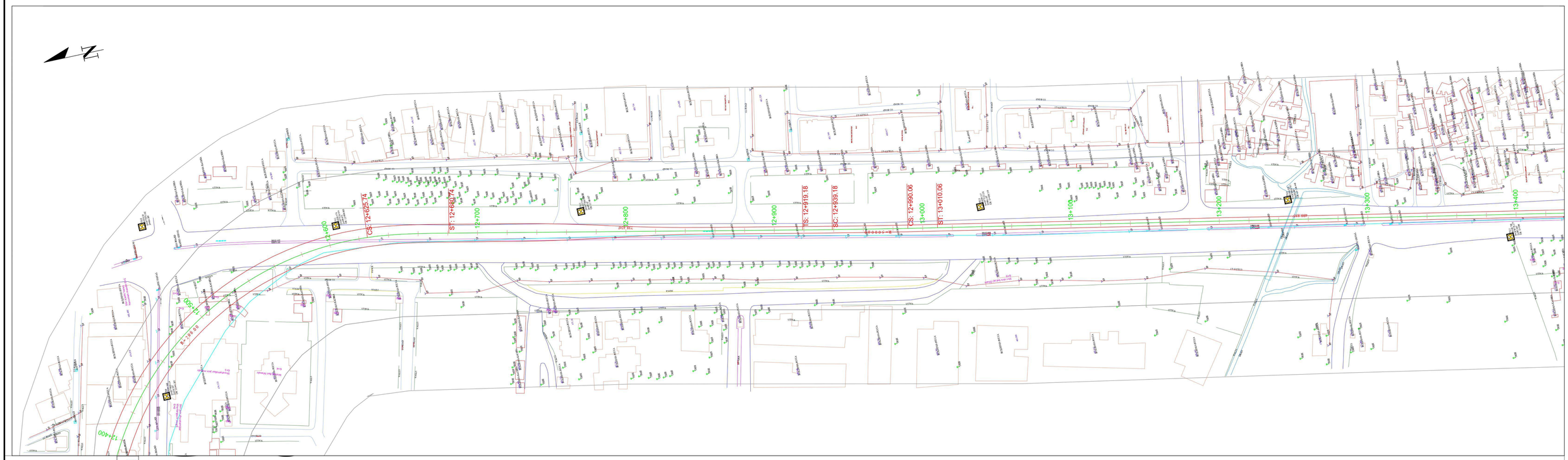

Chainage (m)	12+380 12+400 12+420 12+440 12+460 12+480 12+500 12+520 12+540 12+560 12+580 12+600 12+620 12+640 12+660 12+680 12+700 12+720 12+740 12+760 12+780 12+800 12+820 12+840 12+860 12+880 12+900 12+920 12+940 12+960 12+980 13+000 13+020 13+040 13+060 13+080 13+100 13+120 13+140 13+160 13+180 13+200 13+220 13+240 13+260 13+280 13+300 13+320 13+340 13+360 13+380 13+400 13+420
Rail Level (m)	445.783 446.196 446.608 447.020 447.433 447.845 448.258 448.670 449.082 449.495 449.907 450.319 450.732 451.144 451.557 451.969 452.381 452.797 453.382 454.138 454.897 455.655 456.414 457.172 457.931 458.690 459.448 460.207 460.966 461.724 462.483 463.241 464.000 464.759 465.517 466.276 467.034 467.793 468.552 469.310 470.069 470.828 471.586 472.345 473.103 473.862 474.621 475.379 476.138 476.897 477.655 478.414
Ground Level (m)	456.707 458.234 458.888 459.435 459.923 460.808 464.029 464.108 463.545 464.000 464.441 464.746 464.950 465.090 465.178 465.399 465.458 465.635 465.855 465.977 465.929 465.804 465.527 465.398 465.430 465.258 465.163 465.868 464.996 464.817 464.612 464.604 464.096 464.283 464.255 464.222 464.198 464.177 464.222 464.250 464.292 464.250 464.306 464.397 464.604 464.745 465.041 465.259 465.502 465.813 466.104 466.310
Cut	10.92 12.04 12.28 12.41 12.49 12.96 15.77 15.44 14.46 14.51 14.53 14.43 14.22 13.95 13.62 13.34 13.08 12.84 12.47 11.84 11.03 10.15 9.11 8.23 7.50 6.57 5.71 4.86 4.03 3.09 2.13 1.36 0.50
Fill	0.48 1.26 2.05 2.84 3.62 4.33 5.06 5.78 6.58 7.28 7.95 8.50 9.12 9.58 10.12 10.64 11.08 11.55 12.10
Vertical Geometry	

NOTE:

1. ALL DIMENSIONS ARE IN METER, EXCEPT OTHERWISE STATED.
2. CLEARANCE IN CURVE PORTION OF ALIGNMENT IS AS PER DYNAMIC PROFILE OF SOD OF METRO RAILWAY AND IT IS NOT INFRINGING THE STRUCTURE OF TUNNEL HENCE THE DIMENSION IS SAFE FOR RUNNING THE TRAIN.

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SCALE:

HORIZONTAL: 1:1000
VERTICAL: 1:250

LEGEND

50MT-BUFFERED-BOUNDARY	DIVIDER
100MT-BUFFERED-BOUNDARY	DRAIN
BUILDING-KACHHA	GROUND-CONTROL-POINT
BUILDING-PUCCA	LAMP-POLE
CARRIAGEWAY-PAVEDSHOULDER	PARKING
CC-ROAD	RETAINING-WALL
TREE	UTILITY-LT
UTILITY-EP	WALLS
UTILITY-ESB	WELL

JAIPUR METRO

JAIPUR METRO RAIL CORPORATION

SIGNATURE		Jaipur Metro Rail Corporation Director (Project) JAIPUR			
NAME & DESIGNATION					

GarudaUAV A TRENTAR COMPANY

GARUDAUAV SOFT SOLUTIONS PVT. LTD.

SIGNATURE		GarudaUAV Soft Solutions Pvt. Ltd.			
NAME & DESIGNATION	Mr. Govind Verma Sr. Operation Manager				

PROJECT NAME:	EXTENSION OF E-W CORRIDOR FROM BADI CHAUPAR TO TRANSPORT NAGAR (PHASE 1C)
DRAWING TITLE:	PLAN AND PROFILE KM: 12+400 - KM: 13+420
DRAWING NO :	JMRC-BICP-TPN-00-DWG

SHEET.	DATE	PAPER SIZE
3	10-JUN-2023	A0

Reply to Bidders Queries received upto 11.07.2023 (12:00 Hrs)

Name of Work: Contract ICB No.JP/EW/1C (Underground) /03: "Design and Construction of Twin Tunnel by Shield TBM, Underground Station (Ramganj Chaupar), Cut and Cover Tunnel Box and Underground Ramp from Badi Chaupar dead end Ch:10387.860 to Underground ramp end Ch:13040 of Jaipur Metro Phase-1C including Entry Exit Structures, Architectural finishing, water supply, Sanitary Installations and Drainage Works at Jaipur, Rajasthan, India."

S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
1	**Vol 2,** GCC, **Clause 1.8, Employer's use of Contractor's Document**, Pg 11	The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable, transferable, non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them.	Bidder seeks deletion of non- terminable, transferable, non- exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them"	Not agreed
2	**Vol 2**, GCC**, Clause 2.2, Access to and Possession of the Site**, Pg 12	If the Contractor suffers delay from failure on the part of the Employer to grant right of access to, or possession of the Site, the Contractor shall give notice to the Engineer in a period of 28 days of such occurrence. After receipt of such notice, the Engineer shall proceed to determine any extension of time to which the Contractor is entitled and shall notify the Contractor accordingly. For any such delay in handing over of site, Contractors will be entitled to only reasonable extension of time and no monetary claims, whatsoever shall be paid or entertained on this account	Bidder seeks that if the contractor's performance of the work is delayed due to non-availability of access to site, then the contractor shall not only be entitled to Extension of time but also cost.	Not agreed
3	**Vol 2**, GCC**, Clause 2.4, Assignment by the Employer,** Pg, 12	The Employer shall be fully entitled without the consent of the Contractor, to assign the benefit of the part thereof and any interest therein or thereunder to any third Party.	Bidder seeks deletion of the following "without the consent of the contractor"	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
4	**Vol 2**, GCC**, Clause 4.23, Unforeseeable Physical Conditions,**	If, during the execution of the Works, the Contractor shall encounter physical conditions, which, in his opinion, could not have been reasonably foreseen by an experienced Contractor, the Contractor shall forthwith give written notice thereof to the Engineer and if, in the opinion of the Engineer, such conditions could not have been reasonably foreseen by an experienced Contractor, then the Engineer may certify and the Employer may pay reasonable additional cost to which the Contractor shall have been put by reason of such conditions in the following cases: a) for complying with any instruction which the Engineer may issue to the Contractor in connection therewith, and b) for any proper and reasonable measures approved by the Engineer which the Contractor may take in the absence of specific instructions from the Engineer, as a result of such conditions or obstructions being encountered. The decision of the Engineer as to the additional cost shall be final and binding	Bidder seeks that "Compensation Amount has to be mutually agreed upon". The decision of the Engineer as to the additional cost shall not be final and binding	Not agreed
5	**Vol 2,** GCC**, Clause 5.8 Intellectual Property Rights and Royalties,** Pg 31	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, 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 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.	Bidder seeks that Contractor shall not grant to the Employer a non-exclusive 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.	Not agreed
6	**Vol 2,** GCC**, Clause 7.5 Testing,** Pg 36	The Engineer shall give the Contractor not less than 24 hours' notice of his intention to attend the tests.	The bidder seeks that instead of 24hrs, reasonable time should be allowed	Not agreed

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Director (Project)
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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
7	**Vol 2**, GCC**, Clause 7.10.2, Cost of uncovering the work already covered up,** Pg 37	The Contractor shall uncover any part or parts of the Works, or make openings in or through the same, as the Engineer may from time to time direct, and shall reinstate and make good such part or parts, to the satisfaction of the Engineer. If any such part or parts have been covered up, or put out of view after compliance with the requirement of Sub-clause 7.11.4 and the Works are found to be executed in accordance with the Contract, the expenses of uncovering, making openings in or through, reinstating and making good the same, shall be borne by the Employer, but if the Works are found to be defective, costs shall be borne by the Contractor. In case after completion of a part of the Work, the part of Work is not fully consistent with the Employer's Requirements and there is no way to change the same, in that case, the same (provided it has no implication on safety and operation) shall be accepted only at a Contractor's deemed variation at lower negotiated price. The decision of the Engineer in this regard shall be final and binding on the Contractor.	Bidder seeks deletion of the following "The decision of the Engineer in this regard shall be final and binding on the Contractor"	Not agreed
8	**Vol 2,** GCC, **Clause 8.3, Delay,** Pg 39	Failure or delay by the Employer or the Engineer, to hand over to the Contractor the Site necessary for execution of Works, or any part of the Works, or to give necessary notice to commence the Works, or to provide necessary Drawings or instructions or clarifications or to supply any material, Plant or Machinery, which under the Contract, is the responsibility of the Employer, shall in no way affect or vitiate the Contract or alter the character thereof; or entitle the Contractor to damages or compensation thereof but in any such case, the Engineer shall extend the time period for the completion of the Contract, as in his opinion is/are reasonable.	Bidder seeks that in case of delay by the Employer or the Engineer to hand over the site necessary for execution of works, the contractor shall be entitled to extension of time and Cost.	Not agreed
9	**Vol 2**, GCC**, Clause 8.4.1, Extension of time for completion,** Pg 39	However, the Contractor shall not be entitled to any extension of time where the instructions or acts of the Employer or the Engineer are necessitated by or "Inclement Weather Condition" intended to cure any default of or breach of Contract by the Contractor or where any delay is due to "Inclement Weather Condition"	Bidder seeks that Contractor shall be entitled to extension of time due to Inclement Weather Condition"	As per the tender conditions
10	**Vol 2,** GCC**, Clause 8.5, Liquidated Damages for Delay**, Pg 41	The decision of the Engineer as to the Liquidated Damages payable by the Contractor under this Clause shall be final and binding.	Bidder seeks deletion of this clause	Not agreed

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Director (Project)
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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
11	**Vol 2,** GCC**, Clause 10.3 Extension of Contract Period,** Pg 43	The Contract Period shall be extended by a period, after the Works are taken over, during which the Works or any Section or item of Plant, Rolling Stock, cannot be used, for the purposes for which they are intended, by reason of a defect or damage.	Bidder seeks that the actual Period of Extension must be clearly defined. It cannot be for an infinite period.	No change in bidding conditions.
12	**Vol 2,** GCC, **Clause 10.5, Removal of Defective Work**, Pg 44	If the defect or damage is such that it cannot be remedied expeditiously on the Site and if the Employer gives consent, the Contractor may, remove from the Site for the purposes of repair any part of the Works, which is defective or damaged. This consent may require the Contractor to increase the amount of Performance Security by the full replacement cost of these items or to provide other appropriate Security acceptable to the Employer	Bidder seeks that Employer may not increase the amount of the Performance Security by the full replacement cost of the defective or damaged Plant if such damage or defect is not attributable to the Bidder.	Not agreed
13	**Vol 2,** GCC, **Clause 10.11, Emergency Defect Rectification**, Pg 45	If any defect or damage, is one requiring immediate attention from safety, environmental or operational viewpoint, the Engineer has the authority to proceed with rectification in any manner suitable and deduct such sums from the Contract Price.	Bidder seeks that if defect or damage is not caused by the Contractor, the Engineer may not deduct sum from the Contract Price.	Not agreed
14	**Vol 2,** GCC, **Clause 13.3.1, Notice of Termination by the Contractor,** Pg 56	The Contractor may give notice requiring the Employer to remedy the default within 28 days after receipt of the notice. If the Employer fails to remedy the default or fails to propose steps reasonably acceptable to the Contractor to do so and in that case, the Contractor may terminate the Contract after issue of 14 days' notice to the Employer with a copy to the Engineer. In this case, the Contractor shall be compensated as per Sub clause 13.3.4. The Engineer's decision on the certified amount payable on this account shall be final and binding.	Bidder seeks deletion of this clause **"**The Engineer's decision on the certified amount payable on this account shall be final and binding."	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
15	**Vol 2,** GCC, **Clause 13.3.5, Payment on Termination,** Pg 57	In case termination/foreclosure of the Contract under whatsoever circumstances, any remaining Tools, Plants, Equipment's and surplus materials of Employer with Contractor will be returned to the Employer in good condition at Employer's depot at Contractor's cost. In case of the failure of the Contractor to do so, the Employer will be entitled to recover their cost from the Contractor from the amount becoming due to the Contractor or from any other money due in any other Contracts**. The decision of the Engineer of the amount to be recovered will be final and full credit at rates initially charged to the Contractor shall be allowed for such materials.** Similarly, the Employer shall be entitled to recover the cost of the unreturned material, Plant, Equipment and Tools from theContractor where such material has been supplied free of cost or on lease basis to the Contractor as stipulated in the Conditions of Contract.	Bidder seeks that, the Amount to be recovered from the Employer shall be decided by the Contractor and seeks deletion of the clause "The decision of the Engineer of the amount to be recovered will be final and full credit at rates initially charged to the Contractor shall be allowed for such materials".	Not agreed
16	**Vol 2,** GCC, **Clause 14.1, Indemnity,** Pg 58	**Risk and Responsibility** 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. The decision of the Engineer as to compensation claimed shall be final and binding.	Bidder seeks that, "The Decision of the Engineer as to compensation claimed shall not be final and Binding."	Not agreed
17	**Vol 2,** GCC**, Clause 16.6, Resumption of Work,** Pg 62	The obligations under the Contract shall be resumed as soon as practicable after the event has come to an end or ceased to exist. In case of doubt or dispute, whether a particular occurrence should be considered an "event" as defined under this Clause, the decision of the Engineer shall be final and binding.	Bidder seeks that the decision of the Engineer shall not be final and binding.	Not agreed
18	**Vol 2,** GCC**, Clause 17.6, Conciliation,** Pg 63	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.	Bidder seeks that "the Conciliator shall be appointed mutually"	Not agreed
19	**Vol 2,** GCC**, Clause 17.7, Conciliation Procedure,** Pg 63	There will be no objection if Conciliator so nominated is a serving employee of JMRC who would be Deputy HOD level officer and above.	Bidder seeks deletion of this clause.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
20	**Vol 2,** GCC**, Clause 17.9.2, Procedure for Appointment of Arbitrators,** Pg 64	Procedure for Appointment of Arbitrators: **In case of Sole Arbitrator:** Within 60 days from the day when a written and valid demand for Arbitration is received by MD,JMRC, the Employer will forward a panel of 03 names to the Contractor. The Contractor shall have to choose one Arbitrator from the panel of three, to be appointed as Sole Arbitrator within 30 days of dispatch of the request by the Employer. In case the Contractor fails to choose one Arbitrator within 30 days of dispatch of the request of the Employer then MD,JMRC shall appoint any one Arbitrator from the panel of 03 Arbitrators, as sole Arbitrator.	Bidder seeks that the arbitrators will be appointed mutually by the parties without any reference to the panel of arbitrators suggested by the Employer.	Not agreed
21	**Vol 2,** GCC**, Clause 17.9.2, Procedure for Appointment of Arbitrators,** Pg 65	Procedure for Appointment of Arbitrators: **In case of Three Arbitrator: a)** Within 60 days from the day when a written and valid demand for Arbitration is received by MD,JMRC, the Employer will forward a panel of 5 names to the Contractor. The Contractor will then give his consent for any one name out of the panel to be appointed as one of the Arbitrators within 30 days of dispatch of the request by the Employer. b) Employer will decide the second Arbitrator. MD,JMRC shall appoint the two Arbitrators, including the name of one Arbitrator for whom consent was given by the Contractor, within 30 days from the receipt of the consent for one name of the Arbitrator from the Contractor. In case the Contractor fails to give his consent within 30 days of dispatch of the request of the Employer then MD,JMRC shall nominate both the Arbitrators from the panel. C) The third Arbitrator shall be chosen by the two Arbitrators so appointed by the Parties out of the panel of 05 Arbitrators provided to Contractor or from the larger panel of Arbitrators to be provided to them by Employer at the request of two appointed Arbitrators (if so desired by them) and who shall act as Presiding Arbitrator. In case of failure of the two appointed Arbitrators to reach upon consensus within a period of 30 days from their appointment date, then, upon the request of either or both Parties, the Presiding Arbitrator shall be appointed by the Managing Director, JMRC.	Bidder seeks that the arbitrators will be appointed mutually by the parties without any reference to the panel of arbitrators suggested by the Employer. There shall be three arbitrators and each party shall nominate one arbitrator and the two appointed arbitrator shall appoint the presiding arbitrator.	Not agreed
22	**Vol 2,** GCC**, Appendix C, Clause 1(c) (d) Contractor Warranty,** Pg 74	(C) The Contractor will replace free of cost to the Employer any defect or failure of equipment provided in the Works for a period of 36 months from the date of Taking Over of the last Section of the Works. (D) The Contractor agrees that any design modification be required to any section or component due to any defect; the period of 36 months shall re- commence from the date when the modified part is commissioned into service, and such modification shall be carried out free of cost to the Employer in all sub- systems and systems for all sections.	Bidder seeks that the replacement period for defect or failure of equipment for a period of 36 months at free cost is exorbitant. Bidder seeks that the Design Modification for any defect shall be made at free of cost and maintenance for a period of 36 months is exorbitant.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
23	**Vol 2,** GCC**, Appendix C, Clause 3 Contractor Warranty,** Pg 75	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, the Contractor 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 or the Mass Rapid Transport System.	Bidder seeks that Contractor shall not grant to the Employer a non-exclusive 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.	Not agreed
24	**Vol 2,** SCC, **Clause 17.9 Arbitration**, Pg 18	**Arbitration** **Sub-Clause 17.9.2 (i)** In case of Sole Arbitration: Within 60 days from the day when a written and valid demand for arbitration is received by Director Projects, JMRC on behalf of MD, JMRC, the Employer will forward a panel of 03 names to the Contractor. **Sub-Clause 17.9.2(ii)(a)** Within 60 days from the day when a written and valid demand for arbitration is received by Director Projects, JMRC on behalf of MD, JMRC, the Employer will forward a panel of 05 names to the Contractor.	Bidder seeks that any dispute arising from the contract shall be referred to arbitration and the arbitrators will be appointed mutually by the parties without any reference to the panel of arbitrators suggested by the Employer. In case of Sole Arbitrator, the Arbitrator shall be appointed mutually between the Parties. In case of Arbitration with three Arbitrators: Each Party shall appoint one Arbitrator and the two appointed arbitrator shall appoint the presiding arbitrator.	Not agreed
25	Vol.-3/ Employer's Requirements/Functional	2.8 Construction Depot and Dumping Yard	Kindly provide the dimensions and topography of casting yard land for layout planning	35000 sqm casting yard area shall be provided within lead of 45km. Please refer SN-21 of Addendum/Corrigendum No-01
26	Vol.-3/ Employer's Requirements/	Appendix 2A Works Areas	Kindly provide the work area drawing at Station & Ramp Location	Please refer Appendix 2A of Employer Requirement
27	Vol.-3/ Employer's Requirements/	Appendix 2B Contract Key Dates and Completion Date	Kindly modify the start of TBM Initial Drive KD-6 to 45w & KD -7 to 51w since date provide currently is difficult to construct shaft & procure TBM's in short span	Will be as per the tender conditions
28	Tender Drawings		Kindly provide CAD file of the Tender drawing for ease of working	Not agreed
29	Tender Drawings		Kindly confirm whether contractor can adopt segmental tunnel lining as universal ring	Bidder may propose his own structure. It shall be approved by Engineer.

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
30	**Volume-4/ODS/Clause-4.1/32**	Outline Design Specification.	Train crush load data not available in tender document. Please clarify.	Please refer cl. 4.3.3 D of ODS for cut & cover of Tender documents
31	**Volume-4/ODS/Clause-4.1/32**	Outline Design Specification.	Appendix for Ridership data not available in tender document. Please clarify.	As per loading pattern given in ODS, ridership data is not required for design purpose
32	**Volume-5/Bid drawing**	Drawing number – JMRC-STN-RGC-TED-ARP-11001.	All entries - area is only available but permanent land take boundary is not available in tender drawings. Please clarify.	Permanent land is marked with hatch and RGC (Required Ground Coverage) is mentioned on the site level drawing (JMRC-STN-RGC-TED-ARP-11001)
33	**Volume-3/Bid Document/Employers requirement- Appendix**	Employers' requirement- Appendix	Space matrix for Underground station not available in tender document. Please clarify.	Room areas have been shown in layout plans in Tender Drawings .
34	**Volume-5/Bid drawing**	Drawing number – JMRC-STN-RGC-TED-ARP-13001.	Only OTE is showing in the cross section. UPE-Under platform extract is not shown in drawings. Please clarify	Tender Condition Prevails
35	**Volume-5/Bid drawing**	Drawing number – JMRC-STN-RGC-TED-ARP-11001.	All entries are open to sky in Badi Chaupar Metro station; can we consider the same for Ramganj Chaupar. Please clarify.	All entries are planned open to sky as station site is in the Heritage zone.
36	**Volume-5/Bid drawing**	Drawing number – JMRC-STN-RGC-TED-ARP-13001.	Platform screen door is not shown in section, can we consider there is not PSD in platform Level. Please clarify.	PSD are not considered.
37	**Volume-5/Bid drawing**	Drawing number – JMRC-STN-RGC-TED-ARP-13002.	In the section drawing below concourse false ceiling a line is indicated, please clarify if it is smoke down stand.	Yes it is
38	**Volume-4/ODS/Clause-4.1/32**	Outline Design Specification.	Since it is a Design and construction. Standards for Station architectural works (queuing length, passenger handling, Emergency Evacuation from Public Areas, Platform design standards, Concourse design standard, Escalator, stairs, lift design standards etc.) is not available in the tender document. Please clarify.	Please refer Vol. V. No change in bidding condition

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
39	**Volume-3/Employer's Requirements/Functional/Clause – 2.1/Page 18**	Restoration of Heritage Kund as per direction of the employer	Kindly, share the detail drawings of Ramganj Chaupar Intersection fountain details & Heritage Kund for the purpose of planning and costing for reinstatement.	Bidder may visit site
40	**Volume-3/Employer's Requirements/Functional/Clause – 8/Page 27**	Entrances and all other points of access to the underground stations and tunnels shall be adequately protected against flooding. Levels shall be maintained considering HFL in that area. The critical parameters for this proposed and other design purposes shall be either Highest Flood Level (HFL) or Ground Level (G.L) whichever is higher in that area.	Kindly, share the HFL data for considering the same in fixing the height of podium level for Existing ground level.	Please refer CGWB website
41	**Volume-5/Bid drawing**	Tunnel Alignment Layout	The tunnel alignment is passing below the existing building at chainage 11+680 to 12+726m approx. Kindly, provide the foundation details of the existing building along the alignment & influence zone of tunnel.	Refer cl. 2.3 of Employer Requirement (detailed building condition survey is in the scope of contractor)
42	**Volume-3/Employer's Requirement/Functional/Clause- 2.1 Scope under Lump Sum Price (Schedule A):/Page 15**	Demolition/dismantling of any existing structures (below & above ground level), roads, footpath, RCC drain or any type of drain, kerb stone, pavers, central verge, boundary wall, grill, gate, railing, fencing, signage's, underground tanks, any overhead &underground utilities, street lighting, transformer, signaling system, bus shelters, public/private/religious structures and any other services etc. required for the work and disposal of same as directed by Engineer. bidder must visit the site and ascertain actual magnitude of quantum of work involved for road, footpath, RCC Drain or any type of drain, kerb stone, pavers, overhead & underground utilities, central verge, boundary wall, signage's, grill, gate railing, fencing, bus shelters, existing structures (below & above ground level) and any other services, etc., and nothing shall be payable on this account. Retrieved materials obtained from demolition/dismantling shall be property of the contractor.	The details of work area boundary and number of buildings to be demolished are required. Please provide.	please refer volume V and VII and also refer cl. 2.3 of Employer Requirement along with bidder may visit the site
43	**Volume-3/Employer's Requirements/ Construction/Clause – 8. DAMAGE AND INTERFERENCE/Page 47**	The alignment is passing near the heritage/protected monuments. The contractor shall ensure to protect these monuments during the construction of work.	Kindly, share the details of all the Heritage/monument buildings in the proposed alignment and the number of buildings to be protected during construction activity.	All the Heritage/monument buildings in the proposed alignment shall be protected and also bidder may visit site

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
44	**Volume-5/Bid drawing**	Drawing No. GEN-JMRC-1C-ALG-TD-002-A1 (2 OF 4)	As per the General Arrangement drawings for Underground stretch it is mentioned that 2 Nos. of Entry Structures are "FUTURE ENTRY STRUCTURES". Kindly, clarify whether these Entry/Exit structures are in scope of current tender or not.	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-002-R1
45	Volume III - Employer Requirement	The alignment is passing near the heritage/protected monuments	Kindly provide the details of heritage structures present all along the alignment.	Bidder may visit the site
46	Volume-V	GEN-JMRC-1C-ALG-TD-001, General Arrangement Drawing for Under Ground Stretch (Sheet 1 of 4)	Kindly provide the design drawing / as built drawing of the existing shaft at the start chainage of Phase-1C.	There is no existing shaft, Bidder may propose his own proposal . It shall be approved by Engineer.
47	Volume V	GEN-JMRC-1C-ALG-TD-002 to 004, General Arrangement Drawing for Under Ground Stretch (Sheet 2 to 4)	Beyond Chainage 11+560 towards ramp, existing ground levels details are missing. Kindly provide.	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-002-R1, GEN-JMRC-1C-ALG-TD-003-R1 and GEN-JMRC-1C-ALG-TD-004-R1
48	Volume V	GEN-JMRC-1C-ALG-TD-002, General Arrangement Drawing for Under Ground Stretch (Sheet 2 of 4)	Proposed Ancillary building near Ramgunj Chaupar Station, is located at existing structure location. Kindly provide the structure details.	Refer cl. 2.3 of Employer Requirement (detailed building condition survey is in the scope of contractor). Bidder may also visit the site
49	Volume-V	GEN-JMRC-1C-ALG-TD-002 to 004, General Arrangement Drawing for Under Ground Stretch (Sheet 2 of 4)	Kindly provide the ROW details for Station, Shaft, Cut & Cover and Underground ramp.	Shall be as per existing rules of Local Authority
50	Volume V	CCV-JMRC-1C-STR-TD-14003, Open Ramp, Cut & Cover General Arrangement	Section B-B (roof slab with fill) indicated for the section in underground ramp, which shall be at the end of C&C cover. Please clarify.	Please refer revised drawing no. CCV-JMRC-1C-STR-TD-14003-R1
51	Volume V	Drawing number GEN-JMRC-1C-ALG-TD-001, Page Number 04 of 06	It is not mentioned whether the vertical Alignment details provided is with respect to UP Line or DN Line. Kindly provide the alignment details with respect to both UP Line, DN Line.	general aranagement drawing is related to alignment detail
52	Volume V	Drawing number GEN-JMRC-1C-ALG-TD-004, Sheet Number 04 of 04	It is seen that the curve between Chainage 12+345 to 12+660 has a radius of only 210 m, which seems to be critical, and radius is lesser than common metros alignment radius. Kindly suggest alternatives if possible.	the radius of curve is for alignment which is as per SOD.

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
53	Volume V	Drawing number GEN-JMRC-1C-ALG-TD-004, Sheet Number 04 of 04	The launching shaft details are given in the drawing. But there is no mention of retrieval shaft. Kindly provide details regarding how and where the TBMs are to be retrieved.	Retrieval of TBM shall be as per construction proposal from contractor and approved by Engineer
54	Volume V	Drawing number GEN-JMRC-1C-ALG-TD-004, Sheet Number 04 of 04	Kindly provide the width of cut and cover and underground ramp portions.	The width of cut and cover and underground ramp portion shall be as per the requirement of SOD and minimum width of walkway
55	Volume V	JMRC-STN-RGC-TED-ARP-11005	Is there any structure connection between utility gallery and entry / exit RGC-2. Kindly clarify.	The connection is not necessary, to be provided as per detailed design.
56	Volume-V; Volume-VII	GEN-JMRC-1C-ALG-TD-001 to 004, General Arrangement Drawing for Under Ground Stretch (Sheet 1 to 4); Topographical Survey Report, JMRC-BICP-TPN-00-DWG, Plan and Profile	The ground levels mentioned in the alignment drawings and the topographical survey for the respective chainage do not match. Kindly clarify which reduced levels should be followed.	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-001-R1, GEN-JMRC-1C-ALG-TD-002-R1, GEN-JMRC-1C-ALG-TD-003-R1 and GEN-JMRC-1C-ALG-TD-004-R1
57	Volume-VII	Geotechnical Investigation Report	Kindly provide any geotechnical investigation data for chainage 12+490 to 13+040, if available.	Please refer Addendum/ Corrigendum No 01
58	Volume-VII	Topographical Survey Report, JMRC-BICP-TPN-00-DWG, Plan and Profile	The topography survey report for chainage 12+440 to 13+040 is missing. Kindly provide the same if available.	Please refer Addendum/ Corrigendum No 01
59	Volume-VII	Topographical Survey Report, JMRC-BICP-TPN-00-DWG, Plan and Profile	Kindly provide the dilapidation report for buildings beneath which the tunnel alignment is crossing.	Refer cl. 2.3 of Employer Requirement (detailed building condition survey is in the scope of contractor)
60	Volume VII	Geotechnical report	Employer shall provide rock core pictures (if any available) from the sub soil investigation carried out.	Please refer Addendum/ Corrigendum No 01 for Rock Core Picture.
61	Volume VII	Geotechnical report	In case of rocks, UCS/Point load index values are not provided. Kindly provide if available.	Due to poor quality and minimal core recovery, UCS/ Point Load test were not required on the rock samples as per the codal guidelines.
62	General	-	Kindly provide the Key plan for the project alignment	kindly refer GAD is available in Vol. V bidding document

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
63	General	-	Kindly provide the location details of cross passages and number of cross passages along the tunnel with and without sump.	Follow NBC-2016 for number of cross passages, Exact location will be as per site conditions.
64	General	-	Kindly provide the centre-to-centre distance between the tunnels.	minimum center to center distance of bored tunnel shall be two times the outer diameter of Tunnel
65	General	-	It is seen that along the either side of the alignment, there are many densely spaced buildings. Furthermore, for a small stretch, the tunnel path will pass under these buildings. Hence kindly provide the foundation details of these existing buildings.	Refer cl. 2.3 of Employer Requirement (detailed building condition survey is in the scope of contractor) and bidder may also visit the site
66	General	-	Please provide building survey details along the alignment.	Refer cl. 2.3 of Employer Requirement (detailed building condition survey is in the scope of contractor) and bidder may also visit the site
67	General	-	Kindly provide Design Basis Report for Bored tunnel and cut and cover tunnels.	bidder may refer to Chapter 4 & Chapter 5 of ODS.
68	ITB - C18 Bid fee/ bid document cost - Page 14	(1) In case of open competitive bidding, two-stage bidding, rate contract, electronic reverse auction, bid security shall be 2% or as specified by the State Government of the estimated value of subject matter of	We request employer for clarification on the no. of stages in bidding as It was mentioned single Stage on Bid document cover.	It is single stage 2 envelope bidding process
69	GCC - Clause 1.5 Definition and Interpretation - Page 10	1.5 Priority of Documents a) The Contract Agreement; b) The Letter of Acceptance; c) Pre and Post bid proceeds d) Form of Bid e) BOQ/Payment schedule f) NIB g) ITB h) The Outline Design Specifications (Design Criteria) and Outline Construction Specifications; or any other specification i) Drawings j) The Employer's Requirements k) The Special Conditions of Contract; l) The General Conditions of Contract; m) The Contractor's Proposal; and n) Any other document forming part of the Contract.	We request employer to shift Contractor's Proposal next to LOA.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
70	GCC - Clause 1.10 Definition and Interpretation - Page 12	1.10 Compliance with Statutes, Regulations and Laws The Contractor shall be bound to give all notices required by statute, regulations or bye-laws, as aforesaid and to pay all fees and bills payable in respect thereof. The Contractor will arrange necessary clearances and approvals before the Work is taken up.	We request employer to provide the list of approvals to be procured by the Contractor and request the employer to provide necessary assistance for acquiring such approvals.	Will be dealt as per tender condition
71	GCC - Clause 2.2 - Page 12	2.2 The Employer shall grant the Contractor right of access to, and / or possession of, the Site progressively for the completion of Works. Such right and possession may not be exclusive to the Contractor. If the Contractor suffers delay from failure on the part of the Employer to grant right of access to, or possession of the Site, the Contractor shall give notice to the Engineer in a period of 28 days of such occurrence. After receipt of such notice, the Engineer shall proceed to determine any extension of time to which the Contractor is entitled and shall notify the Contractor accordingly. For any such delay in handing over of site, Contractors will be entitled to only reasonable extension of time and no monetary claims, whatsoever shall be paid or entertained on this account.	We request employer to 1) Request to provide timelines for Access to site. 2) Request to provide the status of % of land acquired and the sequence of handing over of land. Along with EOT, kindly provide the Prolongation cost.	Will be dealt as per tender condition
72	GCC - Clause 4.2 - Page 16	(4) Enhanced performance security for variation: If the original contract price increased either by due to contractor's or due to employer's variation, the 10 % amount shall be deducted from the each running bill equal to amount of variation of the original contract price.	We request employer to provide refund details of Enhanced performance security.	Please refer cl. 4.2.3 of GCC
73	GCC - Clause 4.12 - Page 22	4.12 Rights of way and Facilities The Employer will acquire and provide land for Permanent Works and right of way (within JMRC's land) for access thereto over routes established by the Contractor. The Contractor shall bear all cost and charges for special or temporary rights of way which he may require including those for access to the Site.	We request employer. i) To provide the date of right of way To get clarification regarding the % of land acquired.	Will be dealt as per tender condition

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
74	GCC - Clause 4.23 Page 25	If, during the execution of the Works, the Contractor shall encounter physical conditions, which, in his opinion, could not have been reasonably foreseen by an experienced Contractor, the Contractor shall forthwith give written notice thereof to the Engineer and if, in the opinion of the Engineer, such conditions could not have been reasonably foreseen by an experienced Contractor, then the Engineer may certify and the Employer may pay reasonable additional cost […]	We request employer to include reasonable EOT upon inspection of the site condition.	Please refer clause 8.4.1 (g) of GCC
75	GCC - Clause 8.1 Page 39	8.1 […] The Contractor shall not commence the construction, manufacture or installation of the Works or of any part of the Works unless and until the Engineer has endorsed the relevant Working Drawings in accordance with the Employer's Requirements.	We request employer for Timelines for Engineer approvals.	Will be dealt as per tender condition
76	GCC - Clause 8.4.2 Page 40	8.4.2 The Contractor shall not be entitled to an extension of time by reason of any delay to any activity in carrying out of the Works unless in the opinion of the Engineer such delay results in or may be expected to result in a delay to completion of the Works, or achievement of any Stage by the relevant Key Date. Whether or not the Contractor fails to achieve any Milestone by reason of any delay shall not by itself be material to the Contractor's entitlement to an extension of time.	We request employer for EOT for delay not attributable to the Contractor.	Will be dealt as per tender condition
77	GCC - 8.5 Page 40	8.5 Liquidated damages for Delay Time is the essence of the Contract. Appendix-1 to the Form of Bid shall include in respect of the Works and in respect of any Stage, a percentage of the total Contract value which will be recoverable from the Contractor as Liquidated Damages for delay in completion of the Works or in achievement of a stage by a particular Key Date. […]	We request employer for refund of LD after achieving subsequent milestones.	Will be dealt as per tender condition

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
78	GCC - Clause 8. 5 Page 40	8.5 Liquidated damages for Delay […] The aforesaid Liquidated Damages do not, however, include the sums payable by the Employer to Designated Contractors on account of delay caused by the Contractor to Designated Contractors. Such sums shall be recoverable from the Contractor in addition to any Liquidated Damages payable under this clause, the total ceiling limit of which is 15% of the Contract value including Liquidated Damages levied under the provision of Appendix 1 to the Form of Bid.	We request employer to delete this "Such sums shall be recoverable from the Contractor in addition to any Liquidated Damages payable under this clause, the total ceiling limit of which is 15% of the Contract value including Liquidated Damages levied under the provision of Appendix 1 to the Form of Bid"	Will be dealt as per tender condition
79	GCC - Clause10.1 - Page 43 Completion of Outstanding Work and Remedying Defects	10.1 Completion of Outstanding Work and Remedying Defects […] Provided that, if any part of the Works or sub- systems or component of that part has been replaced, renewed or repaired except minor repair, the "Defects Liability Period" in respect of that part or sub-system or components of that part shall start from the date such replacement, renewal or repair has been completed to the satisfaction of the Engineer.	We request employer to confirm that replacement or repairs shall be performed only until Defect liability period.	As per tender condition
80	GCC - Clause10.9 - Page 44 Performance certificate	10.9 Performance Certificate […] Contractor would continue to remain liable to the Employer for any cost, loss, damage or compensation which arises from hidden or latent defect in the work executed by the Contractor under the Contract, even if such hidden and latent defects arise after the expiry of Defect Liability period or grant of Performance Certificate by the Employer[…]	We request employer to provide the duration of latent defect period.	As per tender conditions
81	GCC -Clause 10.10 Page 44 Unfulfilled Obligations	10.10 Unfulfilled Obligations After the Performance Certificate has been issued, the Contractor and the Employer shall remain liable for the fulfilment of any obligation, which remains unperformed at that lime.	We request employer to correct the word "lime" to "time"	Please refer Addendum/ Corrigendum No 01
82	GCC - Clause 11.6 - Page 49 Payment of Interim and Final	11.6 Payment of Interim and Final After preliminary scrutiny and certification by the Engineer, payment of 80% of the certified interim amount shall be made by the Employer within 15 working days as far as possible. […] The balance 20% shall be paid within 28 working days as far as possible, from the date of the preliminary certification of the bill by the Engineer.	We request employer for interest in case of delayed payment.	As per tender conditions

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
83	GCC - Clause 12.1 Variations - Page 53	12.1 (4) e) An amount of 20% of items B.(i) a), b), c) and d) above to allow for Contractor's overheads including water/electricity charges and labour cess etc., profits and corporate taxes etc. No such percentage shall be applicable to the estimated cost of Materials supplied free of cost to the Contractor.	We request employer. i) request clarification for sub clause B(i) because such clause doesn't exist. It is presumed that GST is applicable over and above.	(i) Please refer SN 20 of Addendum/ Corrigendum No 01 (ii) Yes, GST is over and above. However, while deriving the rates of such items the base rate of individual component shall be taken exclusive of GST.
84	GCC- Clause 13.2.1 Conditions leading to Termination of Contract - Page 54	13.2.1 The Employer shall be entitled to terminate the Contract if the Contractor or any one of its constituents, (g) fails to adhere to the agreed programme of work by margin of 10% of the stipulated 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; or	We request employer for clarification weather such 10% will be calculated for individual Key dates or after the project completion period.	Individual Key Dates
85	GCC- Clause- 17.7 Conciliation Procedure Page 63	17.7 Conciliation Procedure […] There will be no objection if Conciliator so nominated is a serving employee of JMRC who would be Deputy HOD level officer and above.[…]	We request employer to delete this Clause and request to nominate retired employee of JMRC.	Not agreed
86	SCC - 4.9 Site Data - Page 04	[…] The Bidder should satisfy himself with the data furnished and make his own investigations, if required, for submitting his offer. Any change in design or construction methodology later during execution on account of change will be borne by the Contractor. […]	We request employer that Provided such changes made by Employer, the Contractor can be eligible for payment.	Not agreed (The bidder has mentioned PCC in place of SCC)
87	SCC - 5.3 Submission of Documents - Page 10	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.	We request employer to confirm the review period as 21 days as mentioned in Clause 5.3 GCC.	As per the tender conditions (The bidder has mentioned PCC in place of SCC)

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
88	SCC - 11.1.3 Price variation - Page 13	V = Vl + Vs + Vc + Vf + Vm V = Total adjustment on account of all factors Vl = Adjustment on account of labour component Vs = Adjustment on account of Steel component Vc = Adjustment on account of Cement component Vf = Adjustment on account of Fuel/Lubricant component Vm = Adjustment on account of Machinery and Equipment	We request employer i) request for clarification that the Steel component includes both Structural steel and Rebar. Request to provide Adjustment for Aggregates also.	Please refer cl. 20 of SCC where Cost Coefficient of Steel is mentioned. For adjustment of aggregated not agreed (The bidder has mentioned PCC in place of SCC)
89	SCC - 11.1.3 Price variation - Page 16	(iv) Price Variation during Extended Period of Completion 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 8.4.1 of GCC, the price adjustment for the period of extension under Sub-Clause 8.4.3 of GCC 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 8.4.1 of GCC as the case may be. • In case the indices fall below the indices applicable to a bill made on the last date of the original completion period or the extended period under Sub- Clauses 8.4.1 of GCC, then the lower indices will be adopted for Price Adjustment for the period of extension under Clause 8.4.3 of GCC	We request employer to consider and pay price variation even during the extended period of completion.	As per tender condition (The bidder has mentioned PCC in place of SCC)
90	SHE - 20.6 Installation of CCTV Cameras - Page 49	20.6 Storage back-up of minimum 15 days to be ensured at all times, failing which penalty shall be imposed.	We request employer for details regarding Penalty.	refer SHE cl. 56
91	Employer requirements - General - 11 (iv)Construction Interface - Page 8	The preparation of appropriate traffic diversion scheme for the work and its approval from the respective authorities/agencies shall be in the scope of the contractor.	We request employer to provide necessary assistance for procuring such approvals.	Employer assistance shall be provided as per tender condition

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
92	Employer requirements - General - TREES - Page 48	The felling of trees is governed by the Rajasthan Forest Department. The Contractor is not permitted to cut any trees without the permission of the Employer. The Employer has assessed the number of trees existing within the right-of-way and will arrange permission from Forest Department cutting back or removal of trees which are deemed to be affected by the right of way (i.e., within the limits of permanent works) construction works. Contractor shall facilitate/liaison with the respective department. The trees requiring to be felled, will be removed from ground level up by the Contractor prior to commencement of the works. The Contractor will not be permitted to cut or remove any further trees. […] The payment of tree cutting, removal, transportation required in this item shall be paid extra in Schedule 'B'.	Please make a note of it. And request for EOT in case of delay In obtaining permissions.	Will be dealt as per tender condition
93	Employer requirements - General - Appendix 12 Utilities - Page 145	The Contractor shall take into consideration time taken for utility diversions into overall programme for the contract. However the efforts shall be made to avoid shifting/disturbance of any utility and try to work by supporting the same but the required services being provided by these utilities shall be maintained at all the times at the cost of the contractor.	We request employer for necessary Cost and time compensation in case of Uncharted utilities.	Will be dealt as per tender condition
94	FORM OF BID – APPENDIX-1 [REQUIREMENTS UNDER GENERAL CONDITIONS OF CONTRACT] Page 6	Amount of Performance Security - 10% of the Contract Price in types and proportions of currencies in which the contract price is payable.	We request employer to reduce performance security requirement to 3-5% of the contract price.	Not agreed
95	FORM OF BID – APPENDIX-1 [REQUIREMENTS UNDER GENERAL CONDITIONS OF CONTRACT] Page 6	Liquidated Damages - (ii) The maximum limit of Liquidated Damages shall be 10% of the total Contract Value.	We request employer to reduce LD Cap to 5% of contract Value	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
96	Instruction to Bidders – C12.1 Staffing Schedule and Related Details Pg 33 + Annexure-3 [As per clause C12.1] MINIMUM ORGANISATION STRUCTURE REQUIRED Pg 56 of 132 + Undertaking Pg 58 of 132 + Undertaking Pg 61 of 132	C12.1 The Bidder shall submit with his Bid (Appendix-7 of Form of Bid) a staffing schedule containing the names, qualifications, professional experience and corporate affiliation of all proposed management personnel (above the level of shift supervisor) and specialists for this work. **INSTRUCTIONS TO BIDDERS** **Annexure-3 [As per clause C12.1]** **MINIMUM ORGANISATION STRUCTURE REQUIRED** The figures indicated below are the minimum number of Project-Personnel required which are to be deployed as per the minimum level of supervision. The qualification/ experience of such Project personnel is given under Annexure-4.	As this is the tendering stage and as bidder is already required to provide multiple undertakings for the provision of project-personnel with the required qualifications and experience during execution after award, we request employer to ask for Resumes/CVs of only the Key-Staff Mentioned in the Annexure-3 of ITB at page 56 of 132 of the pdf file “Vol1NIB_ITB_FOBE-proc” at the tendering stage.	Not agreed

S.No.	Designation of Project Personnel	Minimum no. of Project-Personnel required	Penalty on Non-Deployment per month per person
	Key Staff		
1.	Project Manager (Team Leader)	1	Rs. 5 lakh/month for Expatriates* &Rs 3.00 lakhs for Local expert
2.	Deputy Project Manager (Tunnels & Underground station)	2	Rs 2.00 lakhs/month
3.	Deputy Project Manager (Casting Yard)	1	Rs 2.00 lakhs/month
4.	Interface Manager	1	Rs 2.00 lakhs/month
5.	Planning Engineer	1	Rs 2.00 lakhs/month
6.	Structural/Design Engineer	1	Rs 2.00 lakhs/month
7.	Quality Assurance Engineer	1	Rs 2.00 lakhs/month
8.	Chief Safety Manager	As per Conditions of contract on Safety & Health and Environment **	As per Conditions contract on Safety Health an Environment

UNDERTAKING:

i) We confirm to deploy project-personnel required to achieve the progress of work as per t Programme agreed by the Engineer in terms of Sub-Clause 4.13 of GCC.

ii) We confirm to deploy minimum manpower as per Safety & Health and Environment Org provided in Conditions of Contract on Safety & Health and Environment. We also confirm t manpower over and above the minimum manpower stated above, if the work requiresso.

SIGNATURE OF AUTHORIZEDSIGN

ON BEHALF OF

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
		UNDERTAKING: i) We confirm to deploy project-personnel as per the above-mentioned minimun qualification & experience. ii) We confirm to deploy manpower requirement of Safety & Health and Environmer Organization as required under Conditions of Contract on Safety & Health an Environment. **SIGNATURE OF AUTHORIZEDSIGNATOR** **ON BEHALF OF BIDDE**		
97 FORM OF BID-APPENDIX 18 FINANCIAL DATA Pg 30		**FORM OF BID–APPENDIX 18** **FINANCIALDATA (FINANCIAL STANDING)** Applicant's legal name.....Date..... JV/Consortium Member's legal name..... Page.....of.....Pages Each Applicant or member of a JV must fill in this form CONTRACT ICB No: JP/EW/1C(Underground)/03Vol-1/FOB 30	The item no. 11 "Gross Annual" seems incomplete. We request employer to clarify on the parameter required.	It is Gross Annual Turn over

S.N.	Description	Financial Data for Latest Last 5 Years (Indian Rupees)				
		Year 2018-19	Year 2019-20	Year 2020-21	Year 2021-22	Year 2022-23
1.	Total Assets					
2.	Current Assets					
3.	Total External Liabilities					
4.	Current Liabilities					
5.	Annual Profits Before Taxes					
6.	Annual Profits After Taxes					
7.	Net Worth [=1- 3]					
8.	Working Capital [=2- 4]					
9.	Return on Equity					
10.	Annual turnover (from construction work)					
11.	Gross Annual					

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
98	**Clause 2.2 of GCC** Access to and Possession of the Site	The Employer shall grant the Contractor right of access to, and / or possession of, the Site progressively for the completion of Works. Such right and possession may not be exclusive to the Contractor.	Please specify the timelines within which the site shall be handed over.	Will be dealt as per tender condition
99	Vol.-3/ Employer's Requirements/Functional 11. URBAN PLANNING FUNCTIONAL REQUIREMENTS	The Station Site Plans are based on the urban planning design carried out by the Employer and specific land acquisition plans have been submitted to the concerned govt. authority and to the concerned land owning agencies of Govt. of India/Rajasthan Govt., for approval.	Please provide the status of land acquisition for the project.	For main station building land acquisition is not required. However, aquisition of land for ancillary building etc is under process.
100	Cl. 1.4 of Vol.-3/ Employer's Requirements/Functional	The Contractor shall be responsible for obtaining all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies in the design and construction of the Works.	JMRCL being Government Authority is in better position to take approval from Public/Government/Local/Statutory or any agencies. Bidder request Employer to obtain all necessary approvals from the relevant Public/Government/Local/Statutory or any agencies for effective progress of work and avoid delays.	Will be dealt as per tender condition
101	Cl. 2.8 2.8 CONSTRUCTION DEPOT & DUMPING AREA Vol.-3/ Employer's Requirements/Functional	For casting yard, batching plant and other activities a plot of land of approx. 20,000Sqmapprox.will be made available by JMRC on as is where is basis within 25 Km from the work site free of cost. .	Please provide the tentative location of Casting Yard.	Please refer SN-21 of Addendum/ Corrigendum No 01

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
102	Clause 8.5 of GCC	Time is the essence of the Contract. Appendix-1 to the Form of Bid shall include in respect of the Works and in respect of any Stage, a percentage of the total Contract value which will be recoverable from the Contractor as Liquidated Damages for delay in completion of the Works or in achievement of a stage by a particular Key Date. The total amount of Liquidated Damages in respect of the Works in all stages shall, however, not exceed the limit of Liquidated Damages stated in the Appendix to the Form of Bid. The aforesaid Liquidated Damages do not, however, include the sums payable by the Employer to Designated Contractors on account of delay caused by the Contractor to Designated Contractors. Such sums shall be recoverable from the Contractor in addition to any Liquidated Damages payable under this clause, the total ceiling limit of which is 15% of the Contract value including Liquidated Damages levied under the provision of Appendix 1 to the Form of Bid.	Bidder request the Employer to reimburse the LD levied towards a key date if the subsequent key date/completion of works is achieved timely.	Will be dealt as per tender condition
103	Cl. 11.2.1 (Mobilisation Advance) of GCC	In respect of works costing more than Rs. 50.00 Crore (Rs. Fifty Crore) only the JMRC will, if provided in bidding document and requested by the Contractor to make mobilization advance, payment to the Contractor (**at 9% per annum interest compounded annually basis**) to assist in defraying the initial expenses that necessarilybe incurred by the Contractor for mobilization. The total of such advance payments and the number & timing of instalments is stated here under-	Bidder request Employer to provide Interest Free Mobilization Advance.	Not agreed
104	Cl. 11.2.2 (Advance against Plant and Machinery) of GCC	Deleted	Bidder request Employer to provide interest free advance against Plant and Machinery of 5% of Contract Price.	Not agreed
105	FORM OF BID – APPENDIX-1 i. Amount of Performance Security	10% of the Contract Price in types and proportions of currencies in which the contract price is payable. 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 Security shall be adjusted in accordance with clause 4.2 of GCC.	Bidder request Employer to reduce the amount of Performance Security to 3% of Contract Price as per the standard practice in construction industry.	Not agreed
106	Clause 11.1.4 (Change in Taxes/Duty) of SCC		Bidder understands that there are no changes in the SCC and the Clause 11.1.4 of GCC is applicable. Please confirm.	Yes, understanding is correct

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
107	Bonus		In the event the Project Completion Date occurs prior to the Scheduled Completion Date, the Contractor shall be entitled to receive a payment of bonus being a standard practice in the construction industry. Bidder request Authority to introduce bonus clause in the contract agreement.	Not agreed
108	Submission Date	General	We request you to provide minimum 4 weeks of time for bid submission after final release of pre- bid clarifications and addendums if any.	Please refer SN-01 of Addendum/ Corrigendum No 01
109	GCC Cl. No. 4.2.4 Page No. 17 of GCC Gaurantees & Warranties	Within 30 days of the date of Letter of Acceptance of the Bid, the Contractor shall submit to the Employer: (i) 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. (ii) 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. (iii) A warrantee in the approved format from the Contractor.	Generally the **Parent Company guarantee & undertakings is mandatory for the bidders who draw technical and financial credentials of the parent company and such guarantees are not required for the agencies who are bidding on their own individual credentials**. **The Bidder is participating in the bid process based on its own individual capacity (both financial & technical) and hence Parent Company guarantee & undertakings are not required.** Kindly confirm. You may kindly note that such requirements are never asked for, in tenders of other metros and Govt departments.	Firm's understanding is correct and will be as per GCC.
110	GCC Cl. No. 11.2 Page No. 46 of GCC Mobilization / Advance payment and Interest on advance	In respect of works costing more than Rs. 50.00 Crore (Rs. Fifty Crore) only the JMRC will, if provided in bidding document and requested by the Contractor to make mobilization advance, payment to the Contractor **(at 9% per annum interest compounded annually basis**) to assist in defraying the initial expenses that necessarily be incurred by the Contractor for mobilization.	The interest cost will be part of bidder's estimate, will increase the quoted price. We request you to amend the clause as follows. The Authority shall make an ***Interest free mobilisation advance*** , to ease the project cash flow. Also, Interest free advances are adopted by various metro rail clients.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
111	Employer's Requirements/ Functional Cl. No. 2.8 Page 24 Construction Depot & Dumping area	For casting yard, batching plant and other activities a plot of land of approx. **20,000 Sqm approx**.will be made available by JMRC on as is where is basis **within 25 Km from the work site** free of cost.	Bidder requests to provide a plot of land of ***atleast. 60,000 sqm*** for the casting yard and batching plant setup ***within 20 km from the work site.*** It is also requested to provide exact ***location of Work area marked in Google Map*** for ready reference. Also, please provide the handing over schedule of work area.	Please refer SN-21 of Addendum/ Corrigendum No 01
112	NIB Cl. 1.1.2 Page No. 3 Bid Security	Amount of Bid Security: **INR 14.34 Crores** (In favour of Jaipur Metro Rail Corporation Limited, payable at Jaipur , Rajasthan)	The amount of bid security as given in the reference tender clause amounts to ***2% of the approximate cost of work which is unusual.*** Bidder requests to reduce the same to ***1% of the project cost*** i.e. ***INR 7.17 crores***	Not agreed
113	GCC Cl. 8.5 & FOB Appendix 1 & Employer's Requirements Appendix 2B	Liquidated Damage for not achieving the key dates - 0.01% of the fixed lump sum price quoted in schedule “A” per week of delay for the key date.	Bidder requests to issue an amendment stating ***"Delay Damages levied will be refunded if the other key dates or overall completion date is adhered to".*** Kindly consider the same.	Will be delat as per tender condition.
114	GCC Cl. 4.2 Performance Security Amount	The amount of performance security shall be five percent, or as may be specified in the bidding documents, of the amount of supply order in case of procurement of goods and services and **ten percent of the amount of work order in case of procurement of works.**	Bidder requests to consider the performance security as ***five percent of the amount of work order in case of procurement of works.***	Not agreed
115	Volume 4 Part 1 Clause 4.3.12 Groundwater	Loads due to water pressure shall be calculated using a unit weight of 10 kN/m3 The Ground water table (Base value) shall be considered as maximum (in terms of RL) of Ground water table from a) data published by Central Ground Water board (CGWB), (b) Ground water table reported in Geotechnical report provided by JMRC in tender documents, (c) Ground water table reported in Geotechnical report provided by Design & Build contractor. The design Ground water table shall be taken as 4.0m higher than the Base value for evaluation of effects for design purposes during service stage.	Please provide data published by Central Ground Water Board.	Please refer CGWB website

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
116	Volume 4 Part 1 Cl. No. 4.3.6 Seismic Loads Annexure 7 Load Combination	a) Load Combinations for ODE (Operating Design Earthquake) PGA for ODE: 0.075g b) Load Combinations for MDE (Maximum Design Earthquake): PGA for MDE: 0.15g	ODE & MDE value in the seismic loads and in combination is different. Kindly confirm which to follow.	Please refer Page no. 81AR1 to 90R1 of ODS
117	Volume 4 Part 1 Cl. No. 4.3.15 One Strut Failure	The temporary structures shall be checked for the effects of a 'One-Strut failure' condition. A condition of Single Strut failing at any location when all strut and Wallers are installed, shall be evaluated in Ultimate limit state condition with Load factor of 1.05	1. Incase of splayed strut, is the failure considered for whole strut or the single splay. It is not possible to design the waler if the whole strut including splayed strut is considered as failure. Kindly clarify. 2. Also, does one strut failure system applies for anchor/bolts system also?	1. Yes, condition to be checked for both the cases i.e failure of Splay and failure of complete strut. 2. Yes

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
118	Volume 4 Part 1 Cl. no. 4.3.2 Note-9	Live Load surcharge shall be minimum as 20 kN/m2 at ground level (fill depth greater than 1.3m) or from actual load dispersion in case it gets higher than 20 kN/m2 for the areas under roads etc.	As per Cl. 4.3.11 Live Load surcharge shall be considered as 24kPa for areas under road. There is discrepancy between Cl. 4.3.2 note-9 and Cl. 4.3.11. Please confirm which loading to be followed.	24kPa to be considered.
119	Employer's Requirements Appendix 2B Contract Key Dates & Completion Dates	KD-06 Start of initial drive TBM 1 - 35 weeks (8.1 months) KD-07 Start of initial drive TBM 2 - 45 weeks (10.4 months) KD-08 Completion of tunnel incl. Cross passages & 1st stage of track bed concrete - 90 weeks (20.7 months)	KD 06 & KD 07 - It is impossible for any TBM manufacturer to deliver the TBMs in such a short duration. They usually take minimum 12 months for the delivery of TBMs at EX work after the purchase order is placed. Delivery to EX work - 12 months Delivery to site - 1.5 months Assembly of TBM - 1.5 months Total months - **15.0 months** **Also, there is discrepancy in the Project duration which is 40 months and the final Key Date which is 36.8 months.** Keeping in view of the above, we have proposed revised Key dates in Annexure-1. Please accept the same.	Not agreed for extension of KD06, KD07 and Annexure-1. Final KD23 & KD24 are self explanatory.
120	Volume V Drawings General	-	CAD files of the drawings shall be provided. This is required for technically sound and financially competitive bidding.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
121	Volume III ER - Functional 2.1 Scope under Lump Sump Price (Sch A)	(ii) Design and Construction of one underground station viz Ramganj Chaupar by Top down Cut & Cover method along with entry/exit structures and associated structures such as ancillary buildings, Utilities galleries, AC plants room, ASS rooms, TVF rooms, system rooms and all other rooms, shafts, pump houses, water tanks, diesel generator set room or enclosure, sumps etc. as shown in the bid drawings provided with bid documents. The layout/length of Utility Gallery connecting ancillary building(which is proposed inside the vacant area of Ramganj Chaupar police station compound)with Station Structure shown in the bid Drawings Is indicative, Contractor is required to submit its proposal indicating layout/design of this utility gallery during actual execution stage for approval of The Employer and the cost of constructing the same will be considered to be included in quoted Lump Sum Price.	Since the Architectural design is not in scope of the Contractor, the Contractor shall propose the layout for the utility gallery considering structural and construction feasibility only for Client's approval.	Will be dealt as per tender condition
122	Volume III ER - Functional 2.1 Scope under Lump Sump Price (Sch A)	-	All Architectural and MEP drawings will be provided by the DDC appointed by the Client.	Will be dealt as per tender condition
123	Volume III ER - Functional 8. Operational Requirements		Since Architectural and MEP drawings will be provided by Client, the provisions of this clause do not apply to the Contractor.	Will be dealt as per tender condition

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
124	Volume III ER - Functional 8. Operational Requirements	(v) In the design and construction of the Works, the Contractor shall, as a fundamental objective and as a priority, ensure that passengers, staff and the public will, throughout the operational period of the Jaipur MRTS, and within the confines thereof, be provided with safe environment as is reasonably possible. The Contractor's attention is drawn to Clause 13 of this Employer's Requirements . Functional, concerning the role of the Commissioner of Metro Railway Safety (CMRS). (vi) The design of the works shall be such that the Forecast Passenger Flows can be met without congestion occurring and without risk to the safety of passengers or metro employees including during any emergencies. Exits and passages, in particular. should be suitably designed and provided. (vii) Escalator pits shall be designed to enable drainage by gravity flow system. However, where length of the drainage is exceptionally long, the pumping system may be considered subject to approval of Engineer. Installation of pumps is not in the scope of th is contract.	Since Architectural and MEP drawings will be provided by Client, the provisions of this clause do not apply to the Contractor.	Will be dealt as per tender condition
125	Volume III ER - Functional 9. Functional Requirements of Pumping Installations	**9. FUNCTIONAL REQUIREMENTS OF PUMPING INSTALLATIONS** (i) Water pump installations shall be designed for unmanned operation, controlled through liquid level controllers, capable of pumping the requisite amount of waler lo the ulili□ or lo the ground I over head tanks. (ii) The pumping installation shall withstand the corrosive effects of normal waler supply, seepage waler and sewage and serve for !he anticipated life of !he equipment. The discharge velocity for sewage I seepage pumping shall not be less than 0.751/sec. (iii) The pipe line size should be such Iha! !he velocity head does not exceed !he normal static head except for the fire pump which is governed by separate criteria. The valve controls and regulating mechanisms shall be designed for automatic operation.	Since Architectural and MEP drawings will be provided by Client, the provisions of this clause do not apply to the Contractor.	Will be dealt as per tender condition
126	General		It is requested to the Employer to provide details of existng Badi Chaupar UG station including tunnel details towards the start of the alignment.	Please refer Bid Drawing No GEN-JMRC-1C-ALG-TD-001
127	Volume-V Alignment GAD	GEN-JMRC-1C-ALG-TD-002/003/004	No Ground Level is mentioned from CH:11580 to CH:12700. Please provide the same	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-002-R1, GEN-JMRC-1C-ALG-TD-003-R1 and GEN-JMRC-1C-ALG-TD-004-R1
128	Volume-V Alignment GAD	GEN-JMRC-1C-ALG-TD-001/002/003/004	The drawings are not clearly visible. Better quality PDF requested	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-001-R1, GEN-JMRC-1C-ALG-TD-002-R1, GEN-JMRC-1C-ALG-TD-003-R1 and GEN-JMRC-1C-ALG-TD-004-R1
129	Volume-V Alignment GAD	GEN-JMRC-1C-ALG-TD-001/002/003/004	Please provide .kmz of alignment for a better understanding of the area	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
130	Volume-V General	General	Please provide the acad version of the drawings	Not agreed
131	Volume-VII Topo Survey Report	JMRC-BICP-TPN-00-DWG, Sheet 1 & 2	Ground Level mentioned in L-section is not matching with Alignment GAD provided in Volume-5. In some places, Rail Level also not matching. Please issue the correct Alignment GAD based on Topo Survey Drawings	Please refer revised drawing no. GEN-JMRC-1C-ALG-TD-001-R1, GEN-JMRC-1C-ALG-TD-002-R1, GEN-JMRC-1C-ALG-TD-003-R1 and GEN-JMRC-1C-ALG-TD-004-R1
132	General	General	Please provide Utility drawings for Station, Tunnel and C&C stretch	please refer Vol. VII
133	General	General	Please mention, if there are any Historical Structure, Structures of special interest, Railway Crossings, Flyover, Underpass, Foot over Bridge, or Water bodies falling inside the influence zone	Bidder may visit the site
134	Volume-V Instrumentation Drawings	INT-JMRC-1C-STR-TD-15001/15002/15003/15004	Please confirm, Contractor understood those drawings are for reference/tender purposes only and the Contractor will produce his own drawings during detailed design and there is no requirement to follow those tender drawings blindly	Will be dealt as per tender and site condition
135	Volume-IV ODS/OCS, Appendix-18, SOD	Schedule of Dimension, SOD	Please provide the latest SOD	attached SOD is latest.however any update / revision in SOD is issued by Ministry of Railways/RDSO/JMRC etc shall also be applicable.
136	Volume-III ER, Appendix-15	Real Time Monitoring	Please provide a scheme/guidelines for real-time monitoring	Tender condition prevails.
137	Volume IV, 4 ODS for Cut & Cover Clause 4.3.12	Ground Water	Please provide the CGWB data of the groundwater table	please refer CGWB website

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
138	Volume-IV :5 ODS for Bored Tunnel, Clause 5.3	Tunnel Lining Segment	Instrumentation and monitoring to demonstrate the performance of the installed linings". Contractor seeking clarification, if they need to install any instrumented segment. Please provide guidelines	Scheme for Instrumentation and Monitoring of Tunnel Lining segment shall be approved by the Engineer.
139	Volume-IV :5 ODS for Bored Tunnel, Clause 6.5.2	Load Factor and Combinations	Load factors of 1.5 applied to ground & water load in the combination of 2. DL+EQ seems to be on the higher side. Please check.	No change in bidding conditions.
140	Volume IV, 5 ODS for Bored Tunnel, Clause 2.7.18	Cross Passage	For the allowable crack width for the NATM tunnel, reference shall be made to IS-456, please confirm.	Confirmed
141	Volume IV, 5 ODS for Geotechnical Works	Tunnel Profile Construction Methods	Change in the spacing between the tunnels determined by numerical analysis may change the horizontal alignment.	the alignment is fixed however, if any changes are proposed because of design requirement during construction phase same may be approved by Engineer.
142	Volume IV, 6 ODS for Geotechnical Works, Clause 2.3	Other Ground- Investigation Methods	Full-Scale groundwater pumping tests shall be performed only in case the water is encountered in the borehole. In the Geotechnical investigation data available, no groundwater is encountered up to the drill depth in any of the boreholes.	No change in bidding conditions.
143	Volume IV, 6 ODS for Geotechnical Works, Clause 3.1	(a) Tunnel Seismic Prediction (TSP) & (b) Geo-Electrical Real-Time Ground Prediction while TBM Boring:	These tests to predict the geological condition ahead of the cutter head shall be performed depending on the site constraint and requirement. Please modify the clause.	Not agreed
144	Volume V, Section S.14 OCS for Civil Works, Clause 14.5.3, Sub Clause 15.5.3.3	Final Tunnel Support (NATM Tunnel Support)	Please specify the minimum grade of concrete for the permanent lining of the NATM Tunnel.	M35
145	Volume V, Drawings TUN-JMRC-1C-STR-TD-14002	Details of TBM segment Lining	Can a universal segment ring arrangement be considered? Please confirm.	Yes however, Bidder may propose his own structure. It shall be approved by Engineer.

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
146	1.1.3.1 Eligible Applicants: vii. Page 8	LEAD PARTNER / NON-SUBSTANTIAL PARTNERS / CHANGE IN JV / CONSORTIUM a. Lead partner must be a substantial partner in the JV / Consortium i.e it should have a minimum of 26% participation in the JV / Consortium. Each substantial partner in case of JV / Consortium shall have experience of executing at least one “similar work” of value of minimum 40% of NIB value in last 07 years.	We request the Authority to review the eligibility requirement as mentioned herein and amends the eligibility criteria of each substantial partners as requested below:- Lead partner must be a substantial partner in the JV / Consortium i.e it should have a minimum of 26% participation in the JV / Consortium. Each substantial partner in case of JV / Consortium shall have experience of executing at least one work (Any Civil Infrastructure work) of value of minimum 40% of NIB value in last 07 years. Please do the needful as requested above.	Not agreed
147	1.1.3.2 Minimum Eligibility Criteria: Page 11 - 12 of 20	A. Work Experience: The Bidders will be qualified only if they have successfully completed similar work(s) during last seven years ending last day of the month previous to the month of Bid submission as given below: i. At least one “similar work”* of value of INR 573.78crore or more. OR ii. Two “similar works”*each of value of INR 358.62 crore or more. OR iii. Three “similar works”*each of value of INR 286.89 crore or more. *The “Similar works” for this contract shall be either A1 or A2. A1. “Tunneling work in urban environment by Shield TBM with finished internal diameter of minimum 5.0 mtr, along with or without underground station(s) (which may/may not include architectural finishing/E&M work) ”. Additional Work Experience: Experience of having completed Tunneling work(s) in urban environment of minimum 02 KM Tunnel length put together from maximum of 03 Works by Shield TBM (in case of twin	We request the Authority that in JV, any member of JV shall be allowed to meet the 100 % Technical Eligibility criteria as mentioned herein.	Not agreed

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
		"A. Work Experience: The Bidders will be qualified only if they have successfully completed similar work(s) during last seven years ending last day of the month previous to the month of Bid submission as given below: i. At least one “similar work”* of value of INR 573.78crore or more. OR ii. Two “similar works”*each of value of INR 358.62 crore or more. OR iii. Three “similar works”*each of value of INR 286.89 crore or more.		
		*The “Similar works” for this contract shall be either A1 or A2. A1. “Tunneling work in urban environment by Shield TBM with finished internal diameter of minimum 5.0 mtr, along with or without underground station(s) (which may/may not include architectural finishing/E&M work) ”. Additional Work Experience: Experience of having completed Tunneling work(s) in urban environment of minimum 02 KM Tunnel length put together from maximum of 03 Works by Shield TBM (in case of twin tunnel, each tunnel shall be counted as a separate Tunnel for calculation of length of tunnel finished internal dia of minimum 5.0 mtr diameter either in Works under A above or any 03 Works irrespective of value of Works. AND		

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
		Experience of having completed at least one work of underground station either in Works under A above or any Work irrespective of value of Work (which may/may not include architectural finishing/E&M Works). OR A2. “ A1. “Tunneling work in urban environment by Shield TBM with finished internal diameter of minimum 5.0 mtr, along with or without underground station(s) (which may/may not include architectural finishing/E&M work) ”. Additional Work Experience: Experience of having completed Tunneling work(s) in urban environment of minimum 02 KM Tunnel length put together from maximum of 03 Works by Shield TBM (in case of twin tunnel, each tunnel shall be counted as a separate Tunnel for calculation of length of tunnel"		
148	General	Due Date Extension	We are keenly interested to participate in the above bid, but looking into the clarity required for participation in bid as requested above and looking into the size and complexity of project, we request the Authority to please provide 4 weeks’ time for submission of bid from the date of pre bid reply received from your end for submitting a comprehensive bid.	Please refer SN-01 of Addendum/ Corrigendum No 01

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
149	1.1.3.1, VII (a) of NIB, Volume-1 Eligible Applicants	Each substantial partner in case of JV/Consortiu m shall have experience of executing at least one “similar work” of value of minimum 40% of NIB value in last 07 years.	We presume that, in case of JV/Consortium, any member of the JV/Consortium can meet the said minimum technical criteria and all consortium members combinedly meet the entire PQ criteria. As the similar type of projects are rare and limited in our country, a very small number of entities will have the said criteria. For the departments such as CMRL (Chennai Metro Rail Limited) and UPMRC (Uttar Pradesh Metro Rail Corporation), It is predominantly stated as, the required criteria can be met by any one member or collectively in case of JV/Consortium. In view of the above we request you to change the condition i.e., each substantial partner in case of JV/Consortium shall have experience of Executing at least one similar work. And allow the JV/Consortium with collective accomplishment of PQ. So that, financially sound companies can also be partnered with technically skilled companies for participating in the tender, resulting in witnessing a competitive bidding for the said project	Not agreed
150	Clause 1.1.3.1, vii, b	"Each non-substantial partner should have a minimum of 20% participation in the JV/Consortium. Partners having less than 26% participation will be termed as non-substantial partner, and their financial soundness shall not be considered for the evaluation of JV/Consortium. In the Bid for Civil work, a Joint Venture / Consortium to qualify, each of its non-substantial partners must have experience of executing at least one civil work of minimum 20% of NIB value in the last 07 years. The Bidder shall submit details of the above works in the Performa of Appendix-17 & 17A of FOB as per Notes to Clause 1.1.3.2.A of NIB	1. We seek clarification on the term "Civil Work" mentioned in Clause 1.1.3.1, vii, b. According to our understanding, firms with experience in Civil Works such as Road Work, Highway Work, Flyover Work, Bridge Work, etc., would be eligible. Could you confirm if our understanding is correct? 2. Additionally, we would like clarification on whether the completion of a Road Project would be considered qualifying experience under Clause 1.1.3.1, vii, b.	1. Civil Work is defined under volume 4 part 1 of Outline construction specifications for Phase1C & 1D of Civil Works. 2. Yes
151	General		. We also request clarification on whether the contracting authority approves subcontracting for this project. As we currently lack experience in Tunnel work, we are exploring the possibility of partnering with another contractor. Kindly inform us if the authority allows subcontracting and specify the percentage of work that can be approved for subcontracting	for partnering Bidder may refer to NIB Clause vii and for subconrtracting Bidder may refer to GCC Clause 4.5 & SCC Clause 4

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S.No	Reference Volume/ Clause/ Page no of tender documents	Reference to tender document clause	Queries	Engineer's Reply
152	NIB Clause 1.1.3.1 vii	a. Lead partner must be a substantial partner in the JV / Consortium i.e it should have a minimum of 26% participation in the JV / Consortium. Each substantial partner in case of JV / Consortium shall have experience of executing at least one “similar work” of value of minimum 40% of NIB value in last 07 years.	The above criteria is not alliowing enthusiastic bidders like us to participate in tendering for the subject project and hence limiting the competiiton. We request you to modify the criteria similar to other metro organozations like Chennai metro, MMRDA.	Not agreed
153	NIB Clause 1.1.3.1 vii	Work experience of only substantial partner (partner with share of more than 26% or more in JV/Consortium) shall be considered for the evaluation of JV/Consortium	We request to delete this clause	Not agreed

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