

JAIPUR DEVELOPMENT AUTHORITY, JAIPUR

www.jda.urban.rajasthan.gov.in

MINUTES OF PRE-BID MEETING

Name of Work: Construction of Elevated Road at Gopalpura Bypass from Triveni Nagar ROB to Near Gujar Ki Thadi, Jaipur”.

NIT for the work “Construction of Elevated Road at Gopalpura Bypass from Triveni Nagar ROB to Near Gujar Ki Thadi, Jaipur” was issued on 11-04-2025 & with pre-bid meeting was held on 24-04-2025 at 11:00 AM in “MANTHAN” hall of JDA. The bids are uploaded on website on 11-04-2025. The last date of submitting the tender online is 14-05-2025 up to 6.00 PM. The tenders (technical bid) shall be open on 20-05-2025 at 11:00 AM in Superintending Engineer office.

Pre-bid meeting was held on 24-04-2025 in ‘MANTHAN” hall of JDA, which was attended by officers of JDA he queries raised by the bidders and their respective replies are as under:-

S. No.	Query/ Suggestion	Response/ clarifications by JDA officials in pre-bid meeting
1	GAD as well SAD drawing details for grid foundation is required. Kindly furnish the approximate depth and total numbers of piles.	GAD has been enclosed & Detailed structural drawings will be provided after approval from proof checking authority.
2	Kindly furnish the Geological investigation report along with bore log details.	Geotech report is being enclosed at Annexure-“C”

Signature valid



Digitally signed by Kailash Chand
Gupta
Designation : Executive Engineer
Date: 2025.04.28 13:32:20 IST
Reason: Approved

3	Bidder requests for the soft /hard copy of the tender drawings.	GAD has been enclosed & Detailed structural drawings will be provided after approval from proof checking authority.
4	Kindly confirm that the dismantled structure (salvage material from the structure) will be the asset of the contractor or the material has to be returned to concerned department.	If there is any serviceable material, it will be asset of the department.
5	Request to keep this 30 (thirty) days beyond the original validity period.	Not acceptable.
6	Request to review the requirement of 2 nos. Fully Automatic and Computerized Batching Plant (Two 30 Cum/hr at casing yard) due to space constrain in this location, RMC can be used as an alternative.	Not acceptable.
7	Request you to provide detailed Geological investigation report.	Geotech report is being enclosed at Annexure-“C”
8	Detailed arrangement with codal stipulation is needed for commencing load test.	GAD has been enclosed & Detailed structural drawings will be provided after approval from proof checking authority.
9	Please mention approved vendor list wherein manufacturer or make of the followings: Cement (OPC43), Reinforcement – Fe 500D, Steel Strands & Structural Steel is mentioned.	As per the decision of EIC.
10	Bidder agreed to borne all cost for labour hutment. Request employer to nominate place for labour accommodation well within the reach of site at per nearest location.	As per bid documents (Section -4, Technical specification point no. 2.4).

Signature valid

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Reason: Approved

11	Kindly issue the drawings for Architectural and Structural plan defining where the section is being taken.	GAD has been enclosed & Detailed structural drawings will be provided after approval from proof checking authority.
12	Please confirm whether JV is allowed with domestic/ International partner whose credential will be required for prequalification but need not to participate in actual execution of work and authorize the local partners to carry out the entire execution. Please also confirm whether all the partners in a JV are required to submit Bank Guarantee/Warrantee for their respective portion of works.	As per bid document.
13	A sum of Rs. 3,41,34,420.00 @2% for enlisted contractors outside the JDA and 85,33,605.00 @ 0.5% for contractors registered in JDA is forwarded herewith in the form of Cash, Bank Draft, Bankers Cheque as Earnest Money. In this regard description is further required.	As per Bid document.
14	Please explain if both Performance Guarantee & Security Deposit carry same meaning?	Yes both are the same.
15	Bidder requests the employer to modify the referred clause whereby no cash against security deposit @10% would be made from the running account bills and the contractor shall be allowed to submit the bank guarantee in lieu of cash retention prior to raising the first invoice for an amount of 5% of the contract value. Please confirm.	As per bid document.

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16	From the stipulations of the referred clauses, bidder understands that, quoted Price should include all applicable taxes like ST, CST, ED, GST, duties, royalties etc. Please confirm.	Rates are inclusive of all taxes.
17	Given the volume of work and to maintain a proper cash flow during the currency of work, the bidder requests to modify this stipulations of the clause, whereby 80% of the payment shall be released within 4 days of date of submission of bill and balance 20% within 15 days for smooth functioning of the work. Please confirm.	Not accepted.
18	The bidder request to confirm the maximum required depth of excavation from existing ground level for construction of pile caps.	As per design.
19	The bidder request to confirm the item(s) through which earth work in excavation beyond 3000mm with shoring shall get paid or there is no scope of excavation below 3000 mm. Please confirm.	There is no excavation beyond 3000mm except piles boring.
20	Please Indicate details of Dumping Area/Muck disposal area with tentative lead.	Will be identified by the bidder.
21	Please Indicate details for Construction report for casting yard, batching plant and tentative lead from site.	As per bid document (Section-4, Technical specification point no. 2.4).
22	Please provide the breakup of components of all materials, labour etc. for calculating the Price Escalation.	As per Annexure-“A”.

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	Request to change Price Escalation clause in each month instead of each quarter. Please confirm.	As per bid document.
23	We request the department to kindly reduce the performance bond from 10% of CV to 3% of CV in line with other NHAI tenders.	Not accepted.
24	We request you to kindly provide interest free Mobilization advance of 10% of CV against submission of BG of equivalent amount.	The mobilization advance can be made on the request of contractor (at 9% per annum interest compound annually basis) to assist in defraying the initial expenses that necessarily be Incurred by the contractor for mobilization as per Office order of Finance Department (GF&AR), GoR Vide No- F.3(2)FD/GF&AR/2020 dated 16.06.2022 (Annexure "B")
25	We request you to kindly provide interest free Plant advance of 5% of CV against submission of BG of equivalent amount.	The mobilization advance can be made on the request of contractor (at 9% per annum interest compound annually basis) to assist in defraying the initial expenses that necessarily be Incurred by the contractor for mobilization as per Office order of Finance Department (GF&AR), GoR Vide No- F.3(2)FD/GF&AR/2020 dated 16.06.2022 (Annexure "B")
26	We request you to kindly provide the breakup of percentage component for Labour, Material, Bitumen, Petroleum, Cement& Steel required for calculating the Price Variation.	As per Annexure-"A".

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27	We request you to kindly confirm that price variation of HT Strand shall be covered under percentage component for "Steel".	Yes, shall be covered under percentage component for Steel.
28	We understand that Cl. 3.12.2.2 of O.C.C. is also applicable along with the Financial milestones as per Cl. 2 of COC pg 77 subject to total LD not exceed 10% of the Final Bill amount. We request you to kindly provide the "key dates" of intermediate milestones as per Cl. 3.12.2.2 of O.C.C. which are missing.	Programme to be prepared by the bidder.
29	Kindly confirm whether Initial & Routine Pile load testing is in Bidder's scope of work. In case if it is in scope of work, we request you to kindly separately incorporate relevant items in BOQ. Kindly specify the number of tests, pile capacity & test load for Initial & Routine pile testing.	As per MoRTH.
30	Unit Rate of BOQ item for Supplying, fitting & placing of TMT bar reinf. including all material, labour, machinery, etc., appears to be of only prevailing market rate of Supply of rebar steel & hence very less. Please review & modify the same.	As per BOQ.
31	Unit Rate of BOQ item no. 18 for providing GI BW in place of MS appears to be very less. Unit of this BOQ item shall be "kg" instead of "MT". Please review and correct the same.	As per BOQ.

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32	We understand that TMT bar reinforcement for superstructure girders (BOQ item no. 15) shall be payable separately under item no. 11 of BOQ . Please reconfirm.	Yes, TMT bar reinforcement for superstructure girders (BOQ item no. 15) shall be payable separately under item no. 11 of BOQ.
33	We understand that Unit rate for RCC BOQ items nos. such as 25,26,53& 76 are excluding cost of TMT bar reinf. and the same shall be payable separately under relevant BOQ item no. 11,11,54 & 77 of TMT bar reinf. respectively. Please reconfirm.	Yes, Unit rate for RCC BOQ items nos. such as 25,26,53& 76 are excluding cost of TMT bar reinf. and the same shall be payable separately under relevant BOQ item no. 11,11,54 & 77 of TMT bar reinf. respectively.
34	Overall maximum width of superstructure for proposed project is 17.20 m. Kindly specify the maximum weight of precast unit required to be erected. Further, whether it is permitted to cast & erect precast Spine unit & Wing units separately i.e. Spine unit shall be erected first, followed by erection of Wing units on either side? Please confirm.	Approximately 70.0T per Segments. The entire precast unit shall be monolithic. The spine and wings shall be casted monolithic and shall not be erected in stages.
35	We request you to kindly provide the details of HT strands such as type of cable system (such as 19K15, 12T13 , etc.,)	Cable system may vary as per span length (19K13 or 19K15).
36	We understand that the minimum requirement to be deployed as per the list of Machinery & Equipment mentioned in Schedule- III is tentative & not mandatory. Hence, the Contractor can increase / decrease the same based on their methodology adopted during execution.	The requirement of machinery and equipment are in Schedule-III and is mandatory bidder has to fulfill it.

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Gupta
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	Please confirm the same.	
37	We request you to kindly provide clear/readable copy of GAD.	Enclosed Can also be received of Executive Engineer office.
38	We request the Employer to arrange all the necessary permits, licenses, clearances & approvals as required from the various Government bodies (such as railways, forest, environmental, etc.,) prior to award of work/ during execution as required. Any deposit / cost shall be borne by the Employer.	Please refer point no. 38, special condition (Schedule-H).
39	We request you to kindly provide structural drawings showing dimensional details of foundation, Substructure & Super structure.	GAD has been enclosed & Detailed structural drawings will be provided after approval from proof checking authority.
40	Kindly provide the width of ROW of Construction Zone to be handed over to the Contractor along the project alignment. Also, we request you to kindly handover encroachment/hindrance free ROW before issue of Award of Work to the Contractor.	RoW for the work is available however the construction space will be provided as per the traffic movement plan.
41	Kindly confirm the maximum width of ROW permitted to be barricaded along the alignment for construction work during the execution.	RoW for the work is available however the construction space will be provided as per the traffic movement plan.
42	Bidder requests you to furnish the geotechnical report prepared during the DPR stage for correct assessment of foundation depth /strata.	Geotech report is being enclosed at Annexure-“C”.

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43	We request Department to provide us land nearby to site for site establishment, Installation of Batching plant, Casting yard, labour camp (approx. 7-8 acres) etc. free of cost nearby the site. Kindly provide the lead/distance of the same from site.	As per bid document technical specification section-4 point no. 2.4.
44	Kindly indicate the location, lead for Dumping ground.	Will be identified by the bidder.
45	Please provide the following documents for reference: 1. CAD file of alignment (Plan & Profile) 2. KMZ file 3. Traffic diversion Plan	1 CAD file of alignment (Plan & Profile) is enclosed. 2. KMZ file Enclosed. 3. As the ROW is 48m hence no need of any separate diversion plan.
46	We request you to extend the tender submission date by atleast 02 weeks from prevailing date.	Not acceptable.
47	You have mentioned in technical criteria the bidder should have completed/executed at least one work of Elevated road/ viaduct/bridge/metro corridor/flyover by segmental construction method in last seven Financial years. We request you please consider the bidder should have completed/executed at least one work of Elevated road/Viaduct/bridge/metro corridor/ Flyover by Segmental construction or PSC Girder Work method in last Seven Financial years.	Not acceptable.

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48	The bid Security and the performance security in the surety form of BG/E-BG/Insurance bond issued by the insurer registered with the Insurance Regulator and development Authority of India (IRDA). The surety bond is also acceptable in the WCR, Government of Rajasthan, The document is enclosed for your reference. You are requested to accept the Surety Bond also.	Not acceptable.
49	Kindly provide the detailed of GAD Drawings for Detailed Quantity Estimation of the project.	GAD is enclosed with the tender document however if bidder required GAD can be got Executive Engineer office also.
50	Rates considered in the BOQ provided do not match with the Jaipur SOR 2024. Therefore, please provide the Rate analysis with the respective SOR details.	The BOQ is mainly based on RUIDP SOR 2013.
51	Kindly provide the existing utility shifting details.	The same will be provided at the time of execution.

All others conditions shall remains same.

(K.C. Gupta)
Executive Engineer -05

Signature valid

Digitally signed by Kailash Chand
Gupta
Designation : Executive Engineer
Date: 2025.04.28 13:32:20 IST
Reason: Approved

Copy to :-

1. PS to JDC, JDA, Jaipur.
2. Director (Engineering-I)/Finance, JDA, Jaipur.
3. Additional Chief Engineer-VI, JDA, Jaipur.
4. Superintending Engineer-XIX, JDA, Jaipur.

(K.C. Gupta)
Executive Engineer -05

Signature valid

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Gupta
Designation : Executive Engineer
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Jaipur Development Authority, Jaipur

<https://jda.urban.rajasthan.gov.in>

Annexure-A

Name of Work: Construction of Elevated Road at Gopalpura Bypass from Triveni Nagar ROB to Near Gujar Ki Thadi, Jaipur”.

The component factor of the G-Schedule are as below-

S. No.	Particulars	Factors %
1	Labour (P_l)	16.41%
2	Cement (P_c)	11.24%
3	Steel (P_s)	46.55%
4	Bitumen (P_b)	1.47%
5	Diesel and Petrol (POL-P)	10.95%
6	Material (P_m)	13.38%
7	Total	100.00%



राजस्थान सरकार
वित्त (सामान्य वित्तीय एवं लेखा नियम) विभाग



No. F.3 (2) FD/GF&AR/2020

Jaipur, dated: 16.06.2022

ORDER

In supersession of all previous instructions/orders issued by FD regarding Mobilization Advance, the Governor is pleased to order that the following amendment is hereby made in the Public Works Financial & Accounts Rules, Part-I :-

After the existing Rule 435, a new Rule 435A shall be added, as under :-

"Rule 435A.

1.1 Mobilization Advance: In respect of works costing more than Rs. 50.00 Crore (Rs. Fifty Crore) only the department 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 Capital work. Payment of Mobilization Advance shall be made in two equal installments, out of these first installment shall not be more than 5% of the Capital work and on compliance of the requisite conditions as stated in the bidding document, the remaining amount of 5% of Capital work shall be in second installment.

1.2 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

Handwritten signature

acceptable to the Department. 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 divisional office headquarter or in case of non-functioning of bank's branch at divisional office headquarter than at the nearest place to divisional office headquarter in Rajasthan and the Department 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 Department 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.

Guarantee

1.2.1 Release of First Installment: The Department 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 department.
- (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.

1.2.2 Release of Second Installment: After the first installment of the advance payment has been utilized as per the approved programme, substantiated by relevant documents and to the satisfaction of the Engineer-in-charge, the Contractor may then apply for the second installment after complying the conditions stated in the bid. The Department will make payment of the second installment after the Contractor has successfully fulfilled the following conditions:

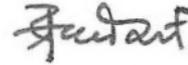
- Amint*
- (a) Actual deployment of (i) such Personnel (ii) Machinery and Equipment, as per the approved deployment schedules, if stated in bid document.
 - (b) Established the fully furnished Site Office(s), if stated in bid document.
 - (c) Established and staffed, with qualified personnel, completely equipped testing laboratory(s) at Site for quality control purposes, if stated in bid document.
 - (d) Placed confirmed orders for supply of major items of material and equipment, which is to be incorporated into the Permanent works as per the approved procurement schedule, if stated in bid document.
 - (e) Commenced construction work at the site in accordance with the approved construction program, if stated in bid document.
 - (f) The second Installment of Mobilization Advance would be released after submission of utilization certificate by contractor for the first Installment of advance released earlier.
 - (g) Requisite Bank Guarantee has been deposited.
 - (h) Any other condition mentioned in bid document in order to release second installment.

1.3 Schedule of Re-payment of Mobilization Advance: The Advance Payment shall be repaid through percentage from the running bill as under :-

- (a) deductions shall commence in the first running bill.

- (b) deductions shall be made at the rate of 15% (fifteen percent) of each running bill until such time as the advance payment has been repaid along with interest thereon; provided that the advance payment shall be completely repaid prior to the time when 75% (seventy five percent) of Payment of works or 13 months from the date of first installment of Advance, whichever is earlier."

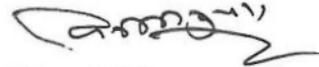
By Order,



(Sudhir Kumar Sharma)
Secretary to Government
Finance (Budget) Department

Copy forwarded for information and necessary action to:

1. Principal Secretary to H.E. Governor.
2. Principal Secretary, Hon'ble Chief Minister, Rajasthan.
3. All Special Assistants/Private Secretaries to Ministers/State Ministers.
4. Principal Accountant General (A&E/Audit) Rajasthan, Jaipur.
5. All Addl.Chief Secretaries/Principal Secretaries/Secretaries, Rajasthan.
6. Sr. Dy.Secretary to Chief Secretary, Rajasthan.
7. Principal Chief Conservator of Forests (HoFF) Rajasthan.
8. Director, Treasuries and Accounts/Inspection/Local Fund Audit, Rajasthan.
9. All Chief Engineer, PWD/WRD/PHED/RWSSMB/GWD/IGNP/CAD, Rajasthan.
10. All FA/CAO, RWSSMB/PWD/WRD/PHED/GWD/IGNP/CAD/Forest Department,Rajasthan.
11. All Treasury Officers/Sub-Treasury Officers, Rajasthan.
12. All Sections of Finance Department.
13. Technical Director, Finance Department to upload this order on FD website.
14. Guard File.



(Vimal Kumar Gupta)
Joint Secretary to Government

(PWF&AR- 89/2022)



JAIPUR DEVELOPMENT AUTHORITY

Annexure-"C"

PROJECT

Consultancy services for Preparation of DPR for Construction of Grade-separator for Traffic improvement at Riddhi Siddhi Junction, Gopalpura Bypass road, Zone-5, JDA Jaipur



GEO TECH-INVESTIGATION REPORT



THOUGHTS CONSULTANTS JAIPUR PVT. LTD. D-13,
SHANTI PATH, TILAK NAGAR, JAIPUR TEL : +91-9829055330
E MAIL : thoughts.jaipur@gmail.com

E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2



Geotechnical Investigation Report



E.T.T.L.

ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY
(AN ISO 9001:2015 CERTIFIED CO.)

NABL ACCREDITED LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2			
ULR No.: - TC127432400006031F			
Issued To:	M/s Thoughts Consultants Jaipur Pvt. Ltd.	Sample ID:	6031-2
		Date of Booking:	14.09.2024
		Date of Report:	07.10.2024
Name of Work:	Construction of Grade-separator for Traffic improvement at Riddhi Siddhi Junction, Gopalpura Bypass road, Zone-5, JDA Jaipur		
Location	Riddhi Siddhi, BH 01, BH 02, BH 03 & BH 04		
Client:	Jaipur Development Authority Zone 05		



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

C O N T E N T S

1. INTRODUCTION:.....	3
2. FIELD INVESTIGATION:.....	4
3. CLASSIFICATION CRITERIA OF ROCK MASSES:	7
4. LABORATORY INVESTIGATION:	9
5. COMPUTATION OF BEARING CAPACITY:	10
6. RECOMMENDATIONS:	12
7. STRATIGRAPHY DRAWINGS.....	17
8. FIELD TEST RESULT	21
9. LABORATORY TEST RESULT	25
10. TEST PLOTS.....	30
11. SHEAR FAILUR AND CALCULATION	34
12. SATTLEMENT FAILUR AND CALCULATION	38
13. SAMPLE CALCULATION FOR BH-01.....	39

E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

1. INTRODUCTION:

The work of conducting the detailed Geotechnical Investigation has been awarded to us who includes investigation in field, laboratory testing of bulk samples collected from the site and submission of the test report.

This report includes the detail of Methodology of investigation, collection of samples, field and laboratory test result including their interpretation/ analysis, recommendations on the properties of soils required for design of foundation and suggesting suitable type of foundation and safe allowable bearing capacity for safe and strong foundation for various structures.



Seismic Map of India

Source: National Disaster Management Authority



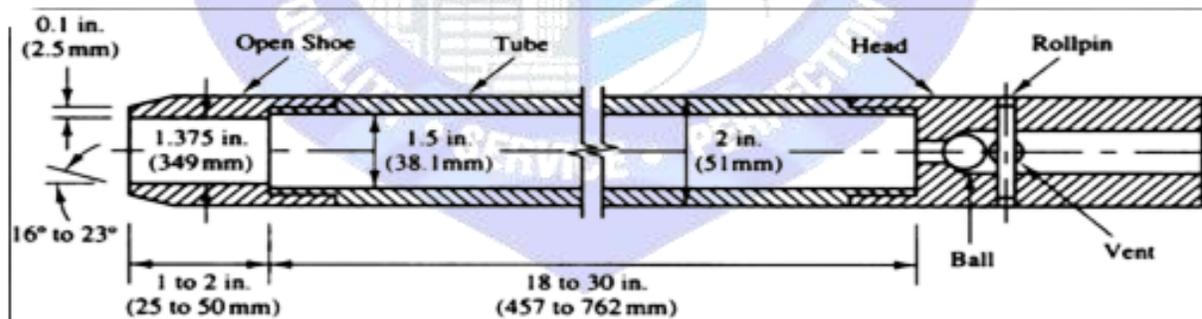
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ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

2. FIELD INVESTIGATION:

The field investigation work at the sites under consideration of this part of the report was carried out, boreholes of diameter 150 mm, the boreholes were progressed by using power driven rotary drilling machines. In disintegrated and hard rock strata boreholes were progressed using NX size (75 mm diameter) double tube barrel with diamond bit. As the core recovery was from top the rock drilling was done. Standard Penetration Tests were conducted at 1.50 meter interval up to the depth as per the procedure laid in IS: 2131-1981 in all the bore holes whereas possible. For conducting the test, the bottom of the borehole was properly cleaned and split spoon sampler was properly seated in position in the borehole. The split spoon sampler resting on the bottom of borehole was allowed to sink under its own weight; then the sampler was allowed to penetrate 15 cm with the blows of the hammer 63.50 kg weight falling free through 75 cm, thereafter the split spoon sampler was further driven by another 15 cm. For the 3rd and final drive, the sampler was further allowed to penetrate 15 cm. The number of blows required to affect each 15 cm of penetration was recorded. The first 15 cm of drive is considered to be seating drive.

Structure of SPT Sampler



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

The total blows of penetration for the second and third 15 cm of penetration is termed the penetration resistance N. The N' values are indicative of the compactness/ relative density of cohesion less soils and consistency of cohesive soils.

In case the blows count of SPT in soil (including the number of blows of seating) exceeds 100, the corresponding penetration was recorded and this particular test at that depth stopped. If the total penetration is more than the seating penetration of 15 cm, then breakup of blows count for 15 cm seating penetration and for remaining portion of penetration is also given.

SPT 'N' values are correlated with relative of non-cohesive stratum as per BS: 5930 (1999) - for sandy strata and with consistency of cohesive stratum.

CORRELATION FOR CLAY/PLASTIC SILT		CORRELATION FOR SAND/NON-PLASTIC SILT	
Consistency of clays	Penetration Value	Relative Density of sand	Penetration Value
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	3 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	5 to 8 Blows	Medium	11 to 30 Blows
Stiff	9 to 16 Blows	Dense	31 to 50 Blows
Very Stiff	17 to 32 Blows	Very Dense	Above 50
Hard	Above 32		

In this method, the sampler acts as a probe and the driving energy is supplied by the fall of the drop weight. The values of 'N' depend on the compactness or relative density of the material. In hard formations, the testing is discontinued if 'N' value is found to be more than 100. It is termed as refusal.



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'N' value depends upon degree of saturation and over burden pressure of the formation. Silty fine sand and fine sand below the water table develop pore water pressure. Depending on the in-situ void ratio which in turn affects the effective stress. This change in effective stress influences the 'N' value considerably. Soil sample obtained from standard spoon sampler for all above standard penetration tests were collected in the polythene bags of suitable size. These samples were property seal, labelled, record and carefully transported to the laboratory for testing.

Disturbed soil samples were tried to be collected at 1.50-meter interval and at significant change of stratum. Soil from cutting edge of SPT samplers and retained in split spoon sampler, used for Standard Penetration Tests was taken as disturbed samples. These samples were placed without delay in adequately sealed polythene bags. The laboratory tests were conducted on the collected soil samples and reported

2.1 Undisturbed soil samples were tried to be collected in accordance with IS: 2132-1986. Undisturbed soil samples (UDS) was obtained in 100 mm diameter MS tubes of length 450 mm at 3.00 meter interval in all the bore holes.

Undisturbed samples were collected using 75 mm dia. and 450 mm long MS tubes provided with sampler head with ball check arrangement in power operated rotary drilling for deep bore holes. Collection of Undisturbed samples in very hard cohesive soils/ dense granular soils/gravels/ cobbles/ pebbles/ boulders, refusal strata is practically not possible and such collected samples will not truly represent the undisturbed conditions.

Immediately after taking undisturbed sample in a tube, the adopter head was removed along with the disturbed material. The visible ends of the samples shall each be trimmed off any wet disturbed soil. The ends will then be coated alternately with four layers of just molten wax. More molten wax will then be added to give a total thickness of not less than 25mm. The laboratory test results have been reported

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

2.2 IF the **water table** at this site was encountered during the boring operation. Depth of water table was recorded as per IS 6935-1973. Recorded depth of water table in different bore holes are reported below.

Location	Depth of Bore (m)	Water table (m)	Coordinate	
			Northing	Easting
BH-01	40.0	Not found	NA	NA
BH-02	40.0	Not found	NA	NA
BH-03	40.0	Not found	NA	NA
BH-04	40.0	Not found	NA	NA

3. CLASSIFICATION CRITERIA OF ROCK MASSES:

Rock classification in terms of weathering and state of fractures and strength is carried out in the following manner. Tabulations given in below explain it briefly.

TERMS	DESCRIPTION	GRADE	GEOLOGIST INTERPRETATION
Fresh	No visible sign of rock material weathering; perhaps slight coloration on major discontinuity surfaces	I	CR > 91 %
Slightly Weathered	Discoloration indicates weathering of rock material and discontinuity surfaces. All the rock material may be discoloured by weathering.	II	CR between 71 % to 90 %
Moderately Weathered	Less than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a continuous framework or as core-stones.	III	CR between 51 % to 70 %
Highly Weathered	More than half of the rock material is decomposed or disintegrated to a soil. Fresh or discoloured rock is present either as a discontinuous framework or as core-stones.	IV	CR between 11 % to 50 %
Completely weathered	All rock material is decomposed and / or disintegrated to soil. The original mass structure is still largely intact.	V	CR between zero to 10 %
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	CR = Zero % But N > 50

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

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 related to the porosity of the rock material and the presence of open discontinuities of all types in the rock mass.

- 3.1 **Relation between RQD and In-situ Rock quality** is further measured by frequency of natural joints in rock mass. Rock Quality Designation (RQD) is used to define state of fractures or massiveness of rock. Following table defines the quality of rock mass.

RQD classification	RQD %
Excellent	91 to 100
Good	76 to 90
Fair	51-75
Poor	25-50
Very Poor	0-25

- 3.2 **Classification of Rock by Compressive Strength**

Rock type	Unconfined compressive strength in MPa
Extremely strong	>200
Very Strong	100 to 200
Strong	50 to 100
Moderately Strong	12.5 to 50
Moderately Weak	5 to 12.5
Weak	1.25 to 5
Very weak	<1.25

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

4. LABORATORY INVESTIGATION:

- 4.1 Field moisture contents** were determined by oven drying method as per IS 2720 (part II)-1997. The results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.2 Bulk density** of soil strata were obtained using density ring method. The results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.3 Mechanical sieve analysis** test were performed in accordance with IS 2720 (Part IV) - 1985, for the purpose of identification by grain size analysis, on coarse part of the soil
- 4.4** Samples and the results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.5 Particle size** analysis test by **hydrometer** method were performed in accordance with IS 2720 (Part IV) - 1995 on the part of soil samples obtained after the sieve analysis. The results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.6 Atterbergs limits** tests were performed in accordance with IS 2720 (part V)-1985 and results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.7 Specific gravity** tests were performed in accordance with IS 2720 (part III-sec. 1) -1980 and the results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.8 Direct shear tests** were performed as per IS 2720 (part XII)-1971, on the undisturbed soil samples obtained during the field investigation. The results have been reported in Table 1 to table 3 of Appendix A under the title “Laboratory Test Result”.
- 4.9 Point load tests** were performed as per **IS 8764:1998** on the rock samples obtained during field investigation. The results have been reported in Table 1 of under the title “Laboratory Test Result”.
- 4.10 Unconfined compressive strength tests** were performed as per **IS 9143:1979** on the rock samples obtained during field investigation. The results have been reported in Table 1 of under the title “Laboratory Test Result”.

E.T.T.L.
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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

5. COMPUTATION OF BEARING CAPACITY:

The safe allowable bearing capacity of the foundation for the proposed structure has been calculated on the shear failure criteria suggested as per IS 6403-1981 and settlement criteria as per IS: 8009 (part-I)-1976. Looking at the site condition, sub soil stratification and type of proposed structure, calculations have been done for isolated footing.

5.1 ISOLATED FOOTING:

IS: 6403-1981

(a) In case of general shear failure –

$$q_d = cN_c s_c d_c i_c + q(N_q - 1) s_q d_q i_q + 0.5 B \gamma N_\gamma S_\gamma d_\gamma i_\gamma W'$$

(b) In case of local shear failure –

$$q'_d = 0.67 c N'_c s_c d_c i_c + q(N'_q - 1) s_q d_q i_q + 0.5 B \gamma N'_\gamma S_\gamma d_\gamma i_\gamma W'$$

Where,

$N_c, N'_c, N_q, N'_q, N_\gamma, N'_\gamma$ = Bearing capacity factors

C = Unit Cohesion

B = Width of Footing

γ = Bulk Density

$$q = \gamma d$$

S_c, S_q, S_γ = Shape factors

d_c, d_q, d_γ = Depth factors

i_c, i_q, i_γ = Inclination factors

W' = Correction factor for location for location of water table

Φ = Angle of internal resistance of soil

$$\Phi' = \tan^{-1}(0.67 \tan \phi)$$

Note: - If the void ratio is less than 0.55, the shear failure is considered as General shear failure. On the other hand, if the relative density is smaller than 20% and the void ratio is greater than 0.75, the failure is local shear failure. For relative density between 20% and 70% and the void ratio 0.55 to 0.75, the bearing capacity factors are obtained by interpolation between the general shear failure and local shear failure.

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

5.2 SETTLEMENT CRITERIA:

IS : 8009 (Part I)

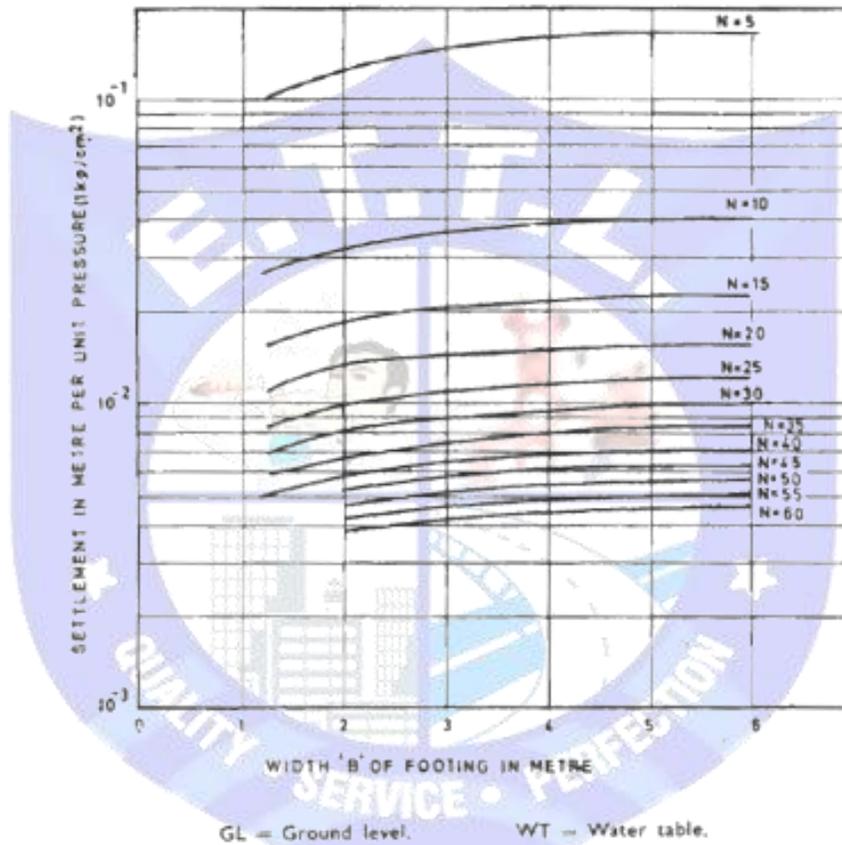
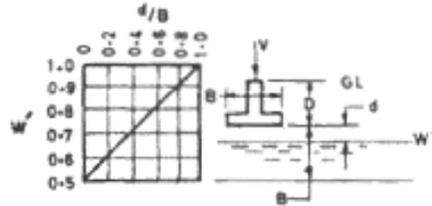


FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

6. RECOMMENDATIONS:

Keeping in mind, the field conditions, field test results, laboratory test results and IS codes of practice; the following recommendations are hereby made:

6.1 Isolated footing:

Isolated **footings** shall be provided for the foundation of the proposed structures.

The depth and corresponding safe allowable bearing capacity shall be as follows:

The field investigation and laboratory tests conducted over the soil revealed the following Conclusions:

- ❖ The soil stratum consists as per **Stratigraphy Drawings**.
- ❖ The specimen found gets disintegrated into gravels during the process of soaking core in water.
- ❖ The SPT 'N' value indicates that soil stratum is **mostly dense to hard strata**.
- ❖ Depth of ground water is encountered as per clause No.-2.2.
- ❖ Plastic index as per laboratory test result as per clause no. - 9.

BH-1

Depth of footing (m)	Type of footing	Width of foundation (M)	General Shear Failure Criteria (T / m ²)	Local Shear Failure Criteria (T / m ²)	Interpolated Value from Column 4&5 (As per IS 6403-1981) (T / m ²)	Settlement Criteria (Safe Bearing Capacity (t/m ²))	Recommended Safe Bearing Capacity (T / m ²) (Lower of columns 6 & 7 & rounded down)	Settlement (mm)
1	2	3	4	5	6	7	8	9
3.00	Isolated Footing	6.00	51.34	18.10	24.75	29.41	24.75	25
4.50		6.00	74.98	26.09	38.31	31.64	31.64	
6.00		6.00	91.19	32.13	46.90	33.78	33.78	

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

BH-2

Depth of footing (m)	Type of footing	Width of foundation (M)	General Shear Failure Criteria (T / m ²)	Local Shear Failure Criteria (T / m ²)	Interpolated Value from Column 4&5 (As per IS 6403-1981) (T / m ²)	Settlement Criteria (Safe Bearing Capacity (t/m ²))	Recommended Safe Bearing Capacity (T / m ²) (Lower of columns 6 & 7 & rounded down)	Settlement (mm)
1	2	3	4	5	6	7	8	9
3.00	Isolated Footing	6.00	57.71	19.68	23.48	37.87	23.48	25
4.50		6.00	74.53	25.93	33.22	39.68	33.22	
6.00		6.00	90.64	31.93	40.74	41.66	40.74	

BH-3

Depth of footing (m)	Type of footing	Width of foundation (M)	General Shear Failure Criteria (T / m ²)	Local Shear Failure Criteria (T / m ²)	Interpolated Value from Column 4&5 (As per IS 6403-1981) (T / m ²)	Settlement Criteria (Safe Bearing Capacity (t/m ²))	Recommended Safe Bearing Capacity (T / m ²) (Lower of columns 6 & 7 & rounded down)	Settlement (mm)
1	2	3	4	5	6	7	8	9
3.00	Isolated Footing	6.00	58.06	19.80	23.63	36.76	23.63	25
4.50		6.00	74.98	26.09	35.87	38.46	35.87	
6.00		6.00	91.19	32.13	43.94	39.68	39.68	

BH-4

Depth of footing (m)	Type of footing	Width of foundation (M)	General Shear Failure Criteria (T / m ²)	Local Shear Failure Criteria (T / m ²)	Interpolated Value from Column 4&5 (As per IS 6403-1981) (T / m ²)	Settlement Criteria (Safe Bearing Capacity (t/m ²))	Recommended Safe Bearing Capacity (T / m ²) (Lower of columns 6 & 7 & rounded down)	Settlement (mm)
1	2	3	4	5	6	7	8	9
3.00	Isolated Footing	6.00	51.34	18.10	24.75	37.31	24.75	25
4.50		6.00	75.44	26.25	38.54	38.46	38.46	
6.00		6.00	91.75	32.32	47.18	39.06	39.06	

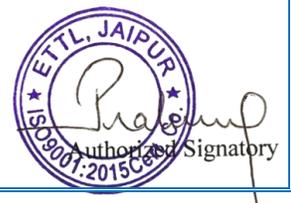
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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

Dia. of the pile (m)	Axial load carrying capacity	Lateral Load carrying capacity of pile (Tons)	Uplift Capacity (Tons)	Depth of pile
1.0	225.6	13.6	118.7	20
1.0	254.4		141.2	22
1.0	285.6		165.6	24
1.0	302.7		178.5	25
1.2	318.1	18.2	148.1	20
1.2	852.6		175.6	22
1.2	390.4		205.5	24
1.2	410.6		221.3	25

CALCULATION OF LATERAL LOAD CAPACITY

Sr. No.	Diameter, D (cm)	Mix (N/mm ²)	Young's Modulus of Pile Material, E (Kg/Sq.cm)	Young's Modulus of Subgrade Reaction, K (Kg/Sq.cm)	Moment of Inertia, I (CMS ⁴)	Stiffness Factor, T (M)	L1 / T	Depth of Fixity, L1 (cms)	(Fixed head) Lateral Load Capacity, QL (T.)
1	100.00	35	295804	0.15	4908739	395.53	2.18	862	13.602
2	120.00	35	295804	0.15	10178760	457.64	2.18	998	18.174



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

As Per IS 2911-1_sec 2 : 2010												
BH No	Minimum of Four			Depth of GWT, m	not found			No of layer	3			
Pile length, m	20			Pile Dia, m	1			Factor of Safety	2.5			
Skin Friction Resistance (Granular)					$Q_s = \sum k_i \cdot P_{di} \cdot \tan \delta \cdot A_{si}$							
End Bearing Resistance (Granular)					$Q_b = A_p(0.5 \cdot D \cdot \gamma \cdot N_\gamma + P_d \cdot N_q)$							
Layer No.	Start Depth, m	End Depth, m	Layer Thickness, m	Cohesion, C, T/m ²	Reduction Factor, α	Angle of Internal Friction $\phi = \delta$	Earth Pressure Coefficient, K	Bulk Density, of 1 layer γ_i T/m ³	Over Burden at mid depth of layer P_{di}	Q _s		
1	2.5	5.00	2.50	0	0	27	1	0.985	1.231	4.93		
2	5.0	11.5	6.50	0	0	28	1	0.985	5.66	61.50		
3	11.5	22.5	11.00	0	0	29	1	0.985	14.28	273.30		
Total Skin friction resistance Q_s , T										339.7		
Soil Parameters at Pile Tip				Cohesion, C, T/m ²		0	ϕ	29	18.4	End Bearing Resistance Q_b, T		224.3
				Q'		7.5	pd	15.0	19.34			
Ultimate Pile Carrying Capacity T			564.0	Safe Pile Carrying Capacity T						225.6		
UPLIFT LOAD CAPACITY												
Volume of Pile m ³		15.70	Unit Weight of Concrete, T/m ³			1.5	Weight of Pile, T		23.55			
Total Uplift Capacity, T		237.81	Factor of Safety			2.5	Safe Uplift Capacity, T		118.7			



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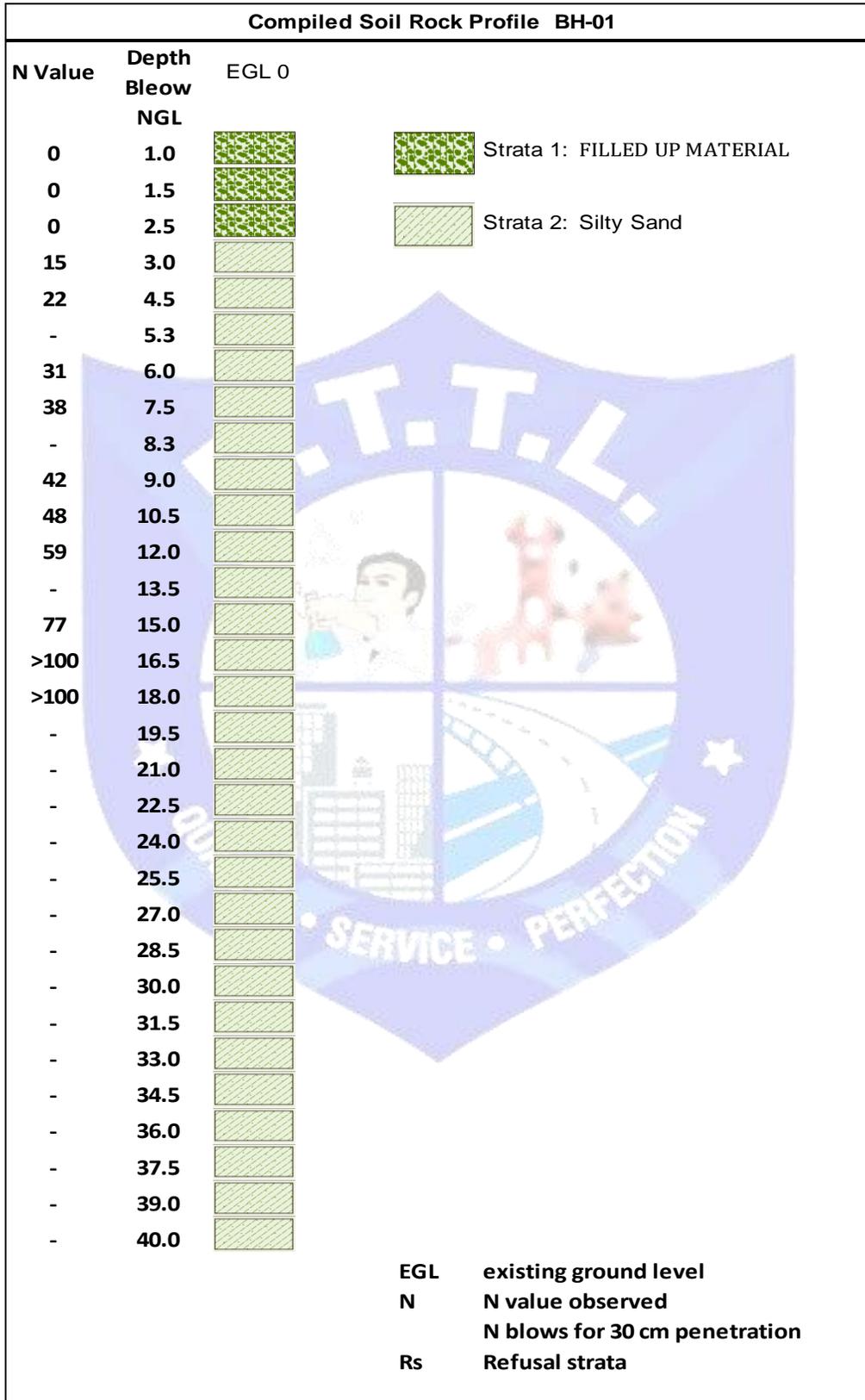
As Per IS 2911-1_sec 2 : 2010											
BH No	Minimum of Four			Depth of GWT,m	not found			No of layer	3		
Pile length, m	20			Pile Dia,m	1.2			Factor of Safety	2.5		
Skin Friction Resistance (Granular)				$Q_s = \sum k_i \cdot P_{di} \cdot \tan \delta \cdot A_{si}$							
End Bearing Resistance (Granular)				$Q_b = A_p(0.5 \cdot D \cdot \gamma \cdot N_\gamma + P_d \cdot N_q)$							
Layer No.	Start Depth, m	End Depth, m	Layer Thickness, m	Cohesion, C, T/m ²	Reduction Factor, α	Angle of Internal Friction φ = δ	Earth Pressure Coefficient, K	Bulk Density, of 1 layer γ _i T/m ³	Over Burden at mid depth of layer P _{bi}	Q _s	
1	2.5	5.00	2.50	0	0	27	1	0.985	1.231	5.91	
2	5.0	11.5	6.50	0	0	28	1	0.985	5.66	73.80	
3	11.5	22.5	11.00	0	0	29	1	0.985	14.28	327.96	
									Total Skin friction resistance Q_s , T		407.7
Soil Parameters at Pile Tip			Cohesion, C, T/m ²		0	φ	29	18.4	End Bearing Resistance Q_b, T	387.5	
			Q'		7.5	pd	18.0	19.34			
Ultimate Pile Carrying Capacity T			795.2		Safe Pile Carrying Capacity T					318.1	
UPLIFT LOAD CAPACITY											
Volume of Pile m ³		22.61		Unit Weight of Concrete, T/m ³			1.5	Weight of Pile, T			33.91
Total Uplift Capacity, T		285.37		Factor of Safety			2.5	Safe Uplift Capacity, T			148.1



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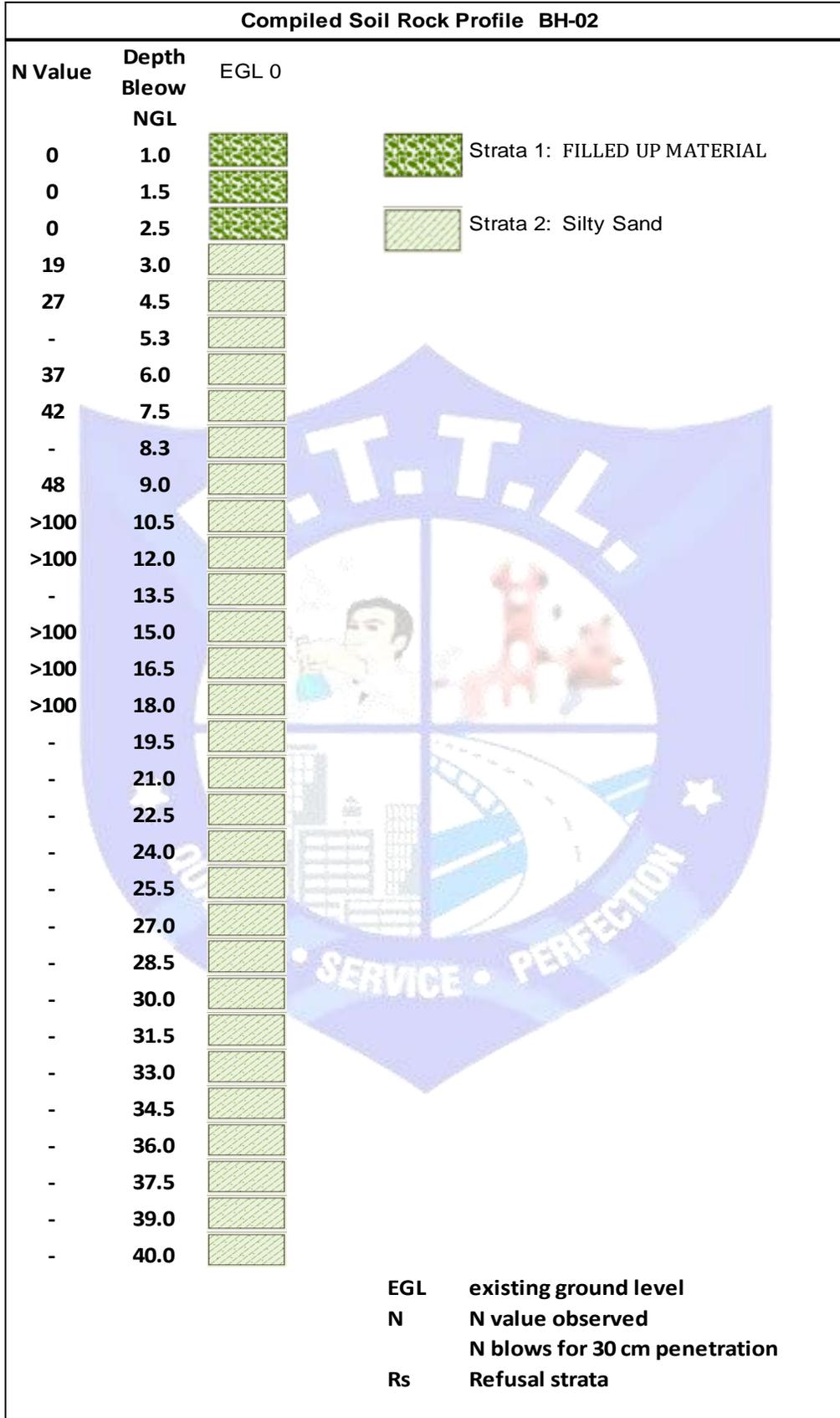
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7. STRATIGRAPHY DRAWINGS



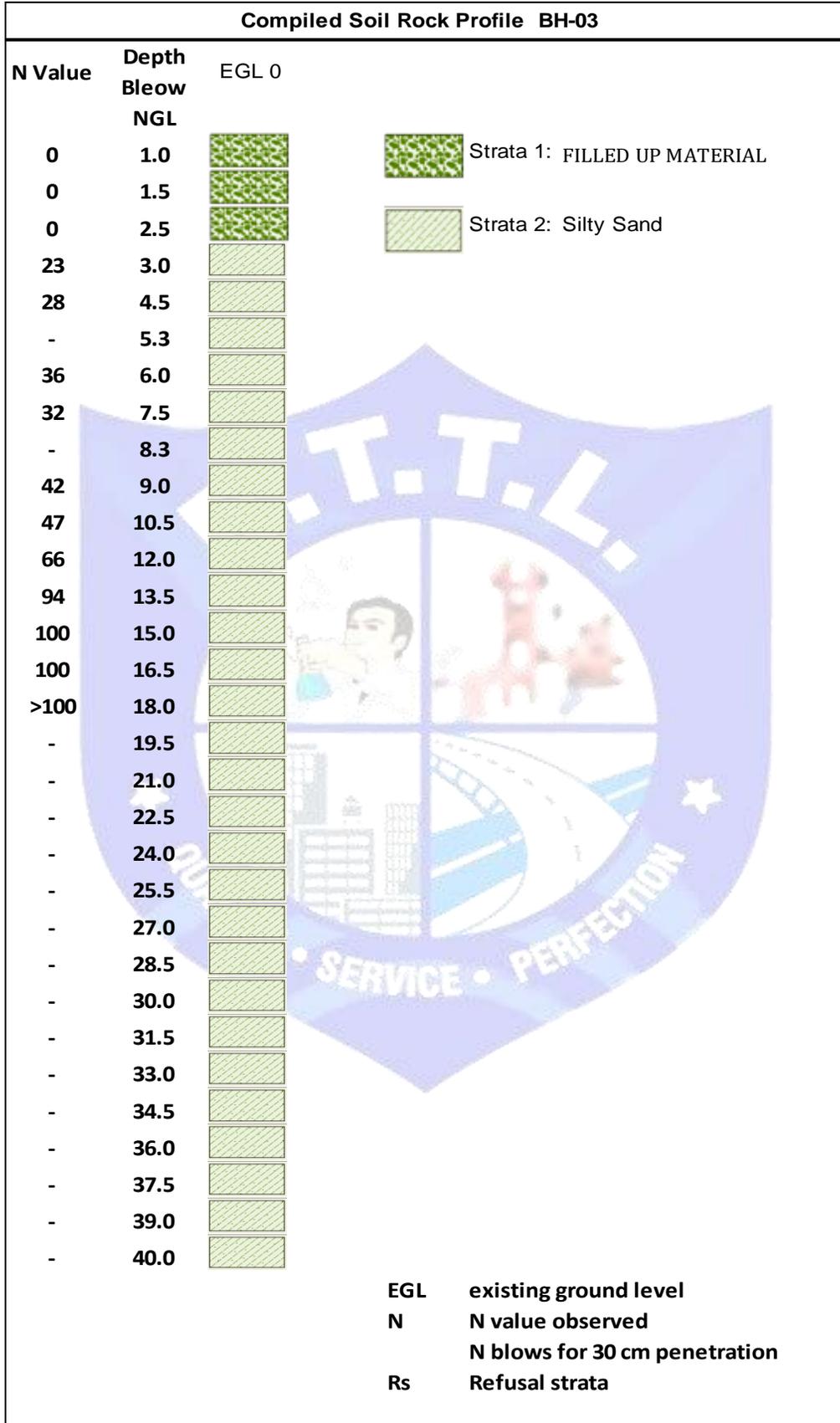
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Report No. JP/ETTL/24-25/TE-85060310914-2 L2



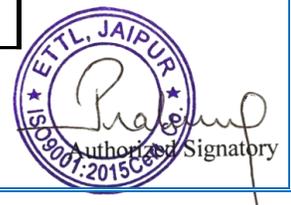
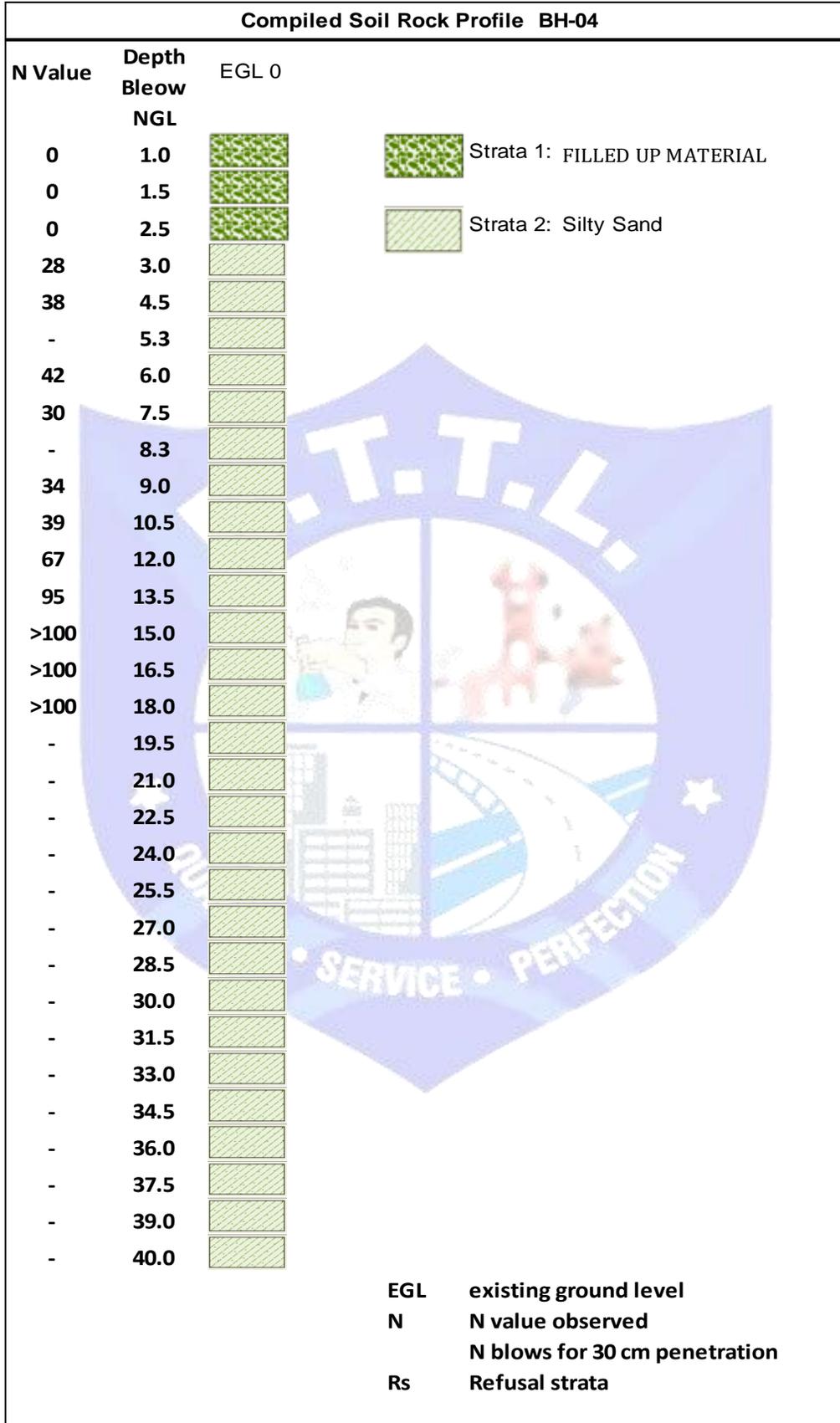
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Report No. JP/ETTL/24-25/TE-85060310914-2 L2



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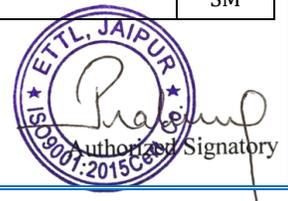


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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

8. FIELD TEST RESULT

location /Chainage: BH-01			Method of drilling: Rotary											
Diameter of Bore hole: 100 mm			Starting Date:- 26/09/2024											
FIELD TEST RESULT			Ending Date:- 26/09/2024											
Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	SPT Test Result					Description of soil	Soil Classification					
			N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT N(N2+N3)	N' (Correct N)							
1.0	DS	1	FILLED UP MATERIAL											
1.5	DS	2												
2.5	DS	3												
3.0	SPT/DS	4	4	7	8	15	19	Silty Sand	SM					
4.5	SPT	5	7	10	12	22	24	Silty Sand	SM					
5.3	UDS	6	-	-	-	-	-	Silty Sand	SM					
6.0	SPT	7	10	15	16	31	31	Silty Sand	SM					
7.5	SPT	8	13	17	21	38	35	Silty Sand	SM					
8.3	UDS	9	-	-	-	-	-	Silty Sand	SM					
9.0	SPT	10	12	19	23	42	36	Silty Sand	SM					
10.5	SPT	11	15	21	27	48	39	Silty Sand	SM					
12.0	SPT	12	20	27	32	59	45	Silty Sand	SM					
13.5	DS	13	-	-	-	-	-	Silty Sand	SM					
15.0	SPT	14	32	37	40	77	52	Silty Sand	SM					
16.5	SPT	15	40	50	-	>100	60	Silty Sand	SM					
18.0	DS	16	-	-	-	>100	60	Silty Sand	SM					
19.5	DS	17	-	-	-	-	60	Silty Sand	SM					
21.0	DS	18	-	-	-	-	-	Silty Sand	SM					
22.5	DS	19	-	-	-	-	-	Silty Sand	SM					
24.0	DS	20	-	-	-	-	-	Silty Sand	SM					
25.5	DS	21	-	-	-	-	-	Silty Sand	SM					
27.0	DS	22	-	-	-	-	-	Silty Sand	SM					
28.5	DS	23	-	-	-	-	-	Silty Sand	SM					
30.0	DS	24	-	-	-	-	-	Silty Sand	SM					
31.5	DS	25	-	-	-	-	-	Silty Sand	SM					
33.0	DS	26	-	-	-	-	-	Silty Sand	SM					
34.5	DS	27	-	-	-	-	-	Silty Sand	SM					
36.0	DS	28	-	-	-	-	-	Silty Sand	SM					
37.5	DS	29	-	-	-	-	-	Silty Sand	SM					
39.0	DS	30	-	-	-	-	-	Silty Sand	SM					
40.0	DS	31	-	-	-	-	-	Silty Sand	SM					



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

location /Chainage: BH-02			Method of drilling: Rotary									
Diameter of Bore hole: 100 mm			Starting Date:- 25/09/2024									
FIELD TEST RESULT			Ending Date:- 25/09/2024									
Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	SPT Test Result					Description of soil	Soil Classification			
			N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT N(N2+N3)	N' (Correct N)					
1.0	DS	1	FILLED UP MATERIAL									
1.5	DS	2										
2.5	DS	3										
3.0	SPT/DS	4	6	8	11	19	24	Silty Sand	SM			
4.5	SPT	5	9	13	14	27	30	Silty Sand	SM			
5.3	UDS	6	-	-	-	-	-	Silty Sand	SM			
6.0	SPT	7	11	16	21	37	37	Silty Sand	SM			
7.5	SPT	8	9	18	24	42	39	Silty Sand	SM			
8.3	UDS	9	-	-	-	-	-	Silty Sand	SM			
9.0	SPT	10	10	21	27	48	42	Silty Sand	SM			
10.5	SPT	11	46	50	-	>100	60	Silty Sand	SM			
12.0	SPT	12	49	50	-	>100	60	Silty Sand	SM			
13.5	DS	13	-	-	-	-	-	Silty Sand	SM			
15.0	SPT	14	50	-	-	>100	60	Silty Sand	SM			
16.5	SPT	15	50	-	-	>100	60	Silty Sand	SM			
18.0	DS	16	-	-	-	>100	60	Silty Sand	SM			
19.5	DS	17	-	-	-	-	60	Silty Sand	SM			
21.0	DS	18	-	-	-	-	-	Silty Sand	SM			
22.5	DS	19	-	-	-	-	-	Silty Sand	SM			
24.0	DS	20	-	-	-	-	-	Silty Sand	SM			
25.5	DS	21	-	-	-	-	-	Silty Sand	SM			
27.0	DS	22	-	-	-	-	-	Silty Sand	SM			
28.5	DS	23	-	-	-	-	-	Silty Sand	SM			
30.0	DS	24	-	-	-	-	-	Silty Sand	SM			
31.5	DS	25	-	-	-	-	-	Silty Sand	SM			
33.0	DS	26	-	-	-	-	-	Silty Sand	SM			
34.5	DS	27	-	-	-	-	-	Silty Sand	SM			
36.0	DS	28	-	-	-	-	-	Silty Sand	SM			
37.5	DS	29	-	-	-	-	-	Silty Sand	SM			
39.0	DS	30	-	-	-	-	-	Silty Sand	SM			
40.0	DS	31	-	-	-	-	-	Silty Sand	SM			



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

location /Chainage: BH-03			Method of drilling: Rotary											
Diameter of Bore hole: 100 mm			Starting Date:- 24/09/2024											
FIELD TEST RESULT			Ending Date:- 24/09/2024											
Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	SPT Test Result					Description of soil	Soil Classification					
			N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT N(N2+N3)	N' (Correct N)							
1.0	DS	1	FILLED UP MATERIAL											
1.5	DS	2												
2.5	DS	3												
3.0	SPT/DS	4	7	10	13	23	29	Silty Sand	SM					
4.5	SPT	5	10	12	16	28	31	Silty Sand	SM					
5.3	UDS	6	-	-	-	-	-	Silty Sand	SM					
6.0	SPT	7	13	17	19	36	36	Silty Sand	SM					
7.5	SPT	8	11	15	17	32	30	Silty Sand	SM					
8.3	UDS	9	-	-	-	-	-	Silty Sand	SM					
9.0	SPT	10	14	19	23	42	36	Silty Sand	SM					
10.5	SPT	11	16	21	26	47	38	Silty Sand	SM					
12.0	SPT	12	22	29	37	66	50	Silty Sand	SM					
13.5	SPT	13	27	44	50	94	68	Silty Sand	SM					
15.0	SPT	14	25	50	50	100	68	Silty Sand	SM					
16.5	SPT	15	37	50	50	100	65	Silty Sand	SM					
18.0	DS	16	-	-	-	>100	60	Silty Sand	SM					
19.5	DS	17	-	-	-	-	60	Silty Sand	SM					
21.0	DS	18	-	-	-	-	-	Silty Sand	SM					
22.5	DS	19	-	-	-	-	-	Silty Sand	SM					
24.0	DS	20	-	-	-	-	-	Silty Sand	SM					
25.5	DS	21	-	-	-	-	-	Silty Sand	SM					
27.0	DS	22	-	-	-	-	-	Silty Sand	SM					
28.5	DS	23	-	-	-	-	-	Silty Sand	SM					
30.0	DS	24	-	-	-	-	-	Silty Sand	SM					
31.5	DS	25	-	-	-	-	-	Silty Sand	SM					
33.0	DS	26	-	-	-	-	-	Silty Sand	SM					
34.5	DS	27	-	-	-	-	-	Silty Sand	SM					
36.0	DS	28	-	-	-	-	-	Silty Sand	SM					
37.5	DS	29	-	-	-	-	-	Silty Sand	SM					
39.0	DS	30	-	-	-	-	-	Silty Sand	SM					
40.0	DS	31	-	-	-	-	-	Silty Sand	SM					



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

location /Chainage: BH-04			Method of drilling: Rotary											
Diameter of Bore hole: 100 mm			Starting Date:- 23/09/2024											
FIELD TEST RESULT			Ending Date:- 23/09/2024											
Depth Below NGL (Meter)	Nature of Sample	Sample Reference No.	SPT Test Result					Description of soil	Soil Classification					
			N1 (Seating Drive)	N2 (First Drive)	N3 (Second Drive)	Observed SPT N(N2+N3)	N' (Correct N)							
1.0	DS	1	FILLED UP MATERIAL											
1.5	DS	2												
2.5	DS	3												
3.0	SPT/DS	4	8	11	17	28	35	Silty Sand	SM					
4.5	SPT	5	10	17	21	38	42	Silty Sand	SM					
5.3	UDS	6	-	-	-	-	-	Silty Sand	SM					
6.0	SPT	7	15	22	20	42	42	Silty Sand	SM					
7.5	SPT	8	16	13	17	30	28	Silty Sand	SM					
8.3	UDS	9	-	-	-	-	-	Silty Sand	SM					
9.0	SPT	10	17	15	19	34	29	Silty Sand	SM					
10.5	SPT	11	20	18	21	39	31	Silty Sand	SM					
12.0	SPT	12	24	29	38	67	51	Silty Sand	SM					
13.5	SPT	13	30	45	50	95	68	Silty Sand	SM					
15.0	SPT	14	41	50	-	>100	60	Silty Sand	SM					
16.5	SPT	15	50	50	-	>100	60	Silty Sand	SM					
18.0	DS	16	-	-	-	>100	60	Silty Sand	SM					
19.5	DS	17	-	-	-	-	60	Silty Sand	SM					
21.0	DS	18	-	-	-	-	-	Silty Sand	SM					
22.5	DS	19	-	-	-	-	-	Silty Sand	SM					
24.0	DS	20	-	-	-	-	-	Silty Sand	SM					
25.5	DS	21	-	-	-	-	-	Silty Sand	SM					
27.0	DS	22	-	-	-	-	-	Silty Sand	SM					
28.5	DS	23	-	-	-	-	-	Silty Sand	SM					
30.0	DS	24	-	-	-	-	-	Silty Sand	SM					
31.5	DS	25	-	-	-	-	-	Silty Sand	SM					
33.0	DS	26	-	-	-	-	-	Silty Sand	SM					
34.5	DS	27	-	-	-	-	-	Silty Sand	SM					
36.0	DS	28	-	-	-	-	-	Silty Sand	SM					
37.5	DS	29	-	-	-	-	-	Silty Sand	SM					
39.0	DS	30	-	-	-	-	-	Silty Sand	SM					
40.0	DS	31	-	-	-	-	-	Silty Sand	SM					



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

9. LABORATORY TEST RESULT

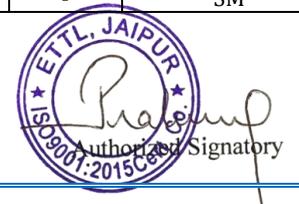
Depth of bore hole: 40.00 mtr										Water Table: Not Found								
LABORATORY TEST RESULT BH-01																		
Depth Below NGL (Meter)	Index Property				Grain Size Analysis					Grain Size Analysis by Hydrometer		Index Property			Shear Strength Parameters			Soil Classification
	Bulk Density (gm/cc)	Moisture Content (%)	Void Ratio	Specific Gravity (Gs)	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt & Clay (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Type of Test	Cohesion C (kg/cm ²)	Angle of Friction (Degree) ϕ	
1.0	FILLED UP MATERIAL																	
1.5	FILLED UP MATERIAL																	
2.5	FILLED UP MATERIAL																	
3.0	1.64	4.35	0.71	2.689	0.00	1.25	2.61	76.32	19.82	19.82	0.00	23.8	Nil	NP	DST	0.00	27	SM
4.5	1.65	4.85	0.70	2.681	0.00	0.95	3.45	74.02	21.58	21.58	0.00	-	-	-	-	-	-	SM
5.5	1.65	5.02	0.70	2.678	0.00	0.36	5.22	72.51	21.91	21.91	0.00	23.2	Nil	NP	DST	0.00	28	SM
6.0	1.66	5.32	0.69	2.669	0.00	0.52	1.24	76.32	21.92	21.92	0.00	-	-	-	-	-	-	SM
7.5	1.68	5.65	0.68	2.676	0.00	0.47	3.26	75.22	21.05	21.05	0.00	-	-	-	-	-	-	SM
8.5	1.69	5.82	0.67	2.675	0.00	0.41	2.02	78.95	18.62	18.62	0.00	23.6	Nil	NP	DST	0.00	28	SM
9.0	1.71	6.11	0.65	2.665	0.00	0.25	5.24	71.45	23.06	23.06	0.00	-	-	-	-	-	-	SM
10.5	1.71	6.42	0.65	2.651	0.00	0.65	2.06	68.32	28.97	28.97	0.00	-	-	-	-	-	-	SM
12.0	1.72	6.62	0.65	2.668	0.00	0.82	2.95	76.52	19.71	19.71	0.00	-	-	-	-	-	-	SM
13.5	1.74	6.79	0.64	2.674	0.00	0.33	3.44	71.34	24.89	24.89	0.00	22.5	Nil	NP	DST	0.00	29	SM
15.0	1.74	6.98	0.63	2.656	0.00	0.56	1.25	75.26	22.93	22.93	0.00	-	-	-	-	-	-	SM
16.5	1.75	7.12	0.63	2.663	0.00	0.92	3.64	70.02	25.42	25.42	0.00	22.1	Nil	NP	DST	0.00	29	SM
18.0	1.76	7.50	0.62	2.659	0.00	0.51	2.74	66.32	30.43	30.43	0.00	-	-	-	-	-	-	SM
19.5	1.77	7.51	0.61	2.657	0.00	0.54	1.55	76.52	21.39	21.39	0.00	-	-	-	-	-	-	SM
21.0	1.78	7.85	0.61	2.651	0.00	0.75	2.85	79.41	16.99	16.99	0.00	-	-	-	-	-	-	SM
22.5	1.79	8.11	0.60	2.647	0.32	0.25	3.02	75.25	21.16	21.16	0.00	-	-	-	-	-	-	SM
24.0	1.81	8.52	0.59	2.652	0.52	0.85	3.16	74.31	21.16	21.16	0.00	-	-	-	-	-	-	SM
25.5	1.83	8.98	0.58	2.656	0.15	1.02	3.66	71.15	24.02	24.02	0.00	-	-	-	-	-	-	SM
27.0	1.84	9.10	0.58	2.658	0.64	3.26	2.58	66.38	27.14	27.14	0.00	-	-	-	-	-	-	SM
28.5	1.86	9.24	0.56	2.651	0.85	2.51	2.94	68.52	25.18	25.18	0.00	-	-	-	-	-	-	SM
30.0	1.87	9.52	0.56	2.657	1.02	2.69	1.64	72.64	22.01	22.01	0.00	-	-	-	-	-	-	SM
31.5	1.88	9.85	0.55	2.646	1.62	2.44	2.54	79.65	13.75	13.75	0.00	-	-	-	-	-	-	SM
33.0	1.89	10.03	0.54	2.653	0.25	2.34	1.75	83.25	12.41	12.41	0.00	-	-	-	-	-	-	SM
34.5	1.90	10.52	0.54	2.652	0.85	2.02	2.31	71.14	23.68	23.68	0.00	-	-	-	-	-	-	SM
36.0	1.92	10.85	0.53	2.656	0.64	1.64	2.33	76.50	18.89	18.89	0.00	-	-	-	-	-	-	SM
37.5	1.94	11.13	0.52	2.651	0.74	3.65	3.69	65.02	26.90	26.90	0.00	-	-	-	-	-	-	SM
39.0	1.95	11.34	0.51	2.652	0.12	1.47	2.74	68.52	27.15	27.15	0.00	-	-	-	-	-	-	SM
40.0	1.96	11.54	0.51	2.650	0.52	2.55	3.64	73.16	20.13	20.13	0.00	-	-	-	-	-	-	SM



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

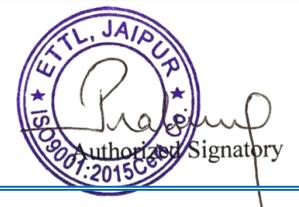
Depth of bore hole: 40.00 mtr										Water Table: Not Found								
LABORATORY TEST RESULT BH-02																		
Depth Below NGL (Meter)	Index Property				Grain Size Analysis					Grain Size Analysis by Hydrometer		Index Property			Shear Strength Parameters			Soil Classification
	Bulk Density (gm/cc)	Moisture Content (%)	Void Ratio	Specific Gravity (Gs)	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt & Clay (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Type of Test	Cohesion C (kg/cm ²)	Angle of Friction (Degree) ϕ	
1.0	FILLED UP MATERIAL																	
1.5	FILLED UP MATERIAL																	
2.5	FILLED UP MATERIAL																	
3.0	1.62	4.46	0.73	2.681	0.32	1.26	2.55	73.26	22.61	22.61	0.00	23.1	Nil	NP	DST	0.00	28	SM
4.5	1.63	4.64	0.72	2.686	0.25	2.30	2.95	78.51	15.99	15.99	0.00	-	-	-	-	-	-	SM
5.5	1.64	4.92	0.72	2.688	0.61	2.35	3.65	70.02	23.37	23.37	0.00	23.8	Nil	NP	DST	0.00	28	SM
6.0	1.64	5.22	0.72	2.679	0.25	3.15	5.14	66.52	24.94	24.94	0.00	-	-	-	-	-	-	SM
7.5	1.65	5.62	0.72	2.686	0.85	1.42	4.62	79.65	13.46	13.46	0.00	-	-	-	-	-	-	SM
8.5	1.66	5.85	0.72	2.694	0.64	0.85	2.87	71.24	24.40	24.40	0.00	23.2	Nil	NP	DST	0.00	28	SM
9.0	1.67	6.24	0.71	2.685	0.15	1.32	3.26	75.66	19.61	19.61	0.00	-	-	-	-	-	-	SM
10.5	1.68	6.52	0.70	2.676	0.45	2.01	4.21	65.25	28.08	28.08	0.00	-	-	-	-	-	-	SM
12.0	1.70	6.85	0.68	2.668	0.62	1.74	2.02	66.32	29.30	29.30	0.00	-	-	-	-	-	-	SM
13.5	1.70	7.21	0.68	2.661	0.25	2.31	3.65	73.25	20.54	20.54	0.00	22.9	Nil	NP	DST	0.00	29	SM
15.0	1.71	7.36	0.68	2.674	0.85	1.22	2.65	74.16	21.12	21.12	0.00	-	-	-	-	-	-	SM
16.5	1.72	7.62	0.67	2.665	0.64	1.63	3.47	76.52	17.74	17.74	0.00	23.1	Nil	NP	DST	0.00	29	SM
18.0	1.72	7.98	0.68	2.674	0.29	1.02	2.55	61.02	35.12	35.12	0.00	-	-	-	-	-	-	SM
19.5	1.73	8.22	0.67	2.665	0.62	1.87	2.98	65.28	29.25	29.25	0.00	-	-	-	-	-	-	SM
21.0	1.75	8.52	0.67	2.685	0.34	1.22	2.56	69.52	26.36	26.36	0.00	-	-	-	-	-	-	SM
22.5	1.77	8.79	0.64	2.671	0.52	1.56	3.41	67.46	27.05	27.05	0.00	-	-	-	-	-	-	SM
24.0	1.78	9.21	0.64	2.668	0.26	1.98	2.04	65.33	30.39	30.39	0.00	-	-	-	-	-	-	SM
25.5	1.79	9.54	0.62	2.652	0.61	1.32	2.74	63.25	32.08	32.08	0.00	-	-	-	-	-	-	SM
27.0	1.81	9.85	0.62	2.663	0.26	2.34	3.55	67.54	26.31	26.31	0.00	-	-	-	-	-	-	SM
28.5	1.82	10.42	0.61	2.654	0.95	2.06	2.58	61.24	33.17	33.17	0.00	-	-	-	-	-	-	SM
30.0	1.82	10.63	0.62	2.657	0.35	2.84	2.64	69.65	24.52	24.52	0.00	-	-	-	-	-	-	SM
31.5	1.83	10.85	0.61	2.651	0.84	2.64	1.34	75.46	19.72	19.72	0.00	-	-	-	-	-	-	SM
33.0	1.84	11.30	0.60	2.642	0.55	1.64	2.52	67.65	27.64	27.64	0.00	-	-	-	-	-	-	SM
34.5	1.85	11.65	0.60	2.650	0.28	1.75	3.02	62.51	32.44	32.44	0.00	-	-	-	-	-	-	SM
36.0	1.86	11.94	0.59	2.641	0.74	2.52	1.64	69.46	25.64	25.64	0.00	-	-	-	-	-	-	SM
37.5	1.88	12.24	0.58	2.647	0.64	1.23	1.79	73.52	22.82	22.82	0.00	-	-	-	-	-	-	SM
39.0	1.89	12.64	0.58	2.651	0.42	1.95	2.64	68.11	26.88	26.88	0.00	-	-	-	-	-	-	SM
40.0	1.91	12.74	0.56	2.646	0.87	1.24	3.22	70.02	24.65	24.65	0.00	-	-	-	-	-	-	SM



E.T.T.L.
ENGINEERING TRAINING TESTING AND CALIBRATION LABORATORY

Report No. JP/ETTL/24-25/TE-85060310914-2 L2

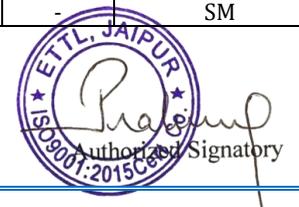
Depth of bore hole: 40.00 mtr										Water Table: Not Found								
LABORATORY TEST RESULT BH-03																		
Depth Below NGL (Meter)	Index Property				Grain Size Analysis					Grain Size Analysis by Hydrometer		Index Property			Shear Strength Parameters			Soil Classification
	Bulk Density (gm/cc)	Moisture Content (%)	Void Ratio	Specific Gravity (Gs)	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt & Clay (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Type of Test	Cohesion (kg/cm ²)	Angle of Friction (Degree)	
1.0	FILLED UP MATERIAL																	
1.5	FILLED UP MATERIAL																	
2.5	FILLED UP MATERIAL																	
3.0	1.63	4.74	0.73	2.686	0.85	1.25	3.25	70.02	24.63	24.63	0.00	23.1	Nil	NP	DST	0.00	28	SM
4.5	1.64	4.95	0.72	2.681	0.64	2.26	5.26	73.26	18.58	18.58	0.00	-	-	-	-	-	-	SM
5.3	1.65	5.02	0.71	2.694	0.24	2.31	4.51	76.51	16.43	16.43	0.00	23.4	Nil	NP	DST	0.00	28	SM
6.0	1.66	5.62	0.70	2.678	0.95	1.62	2.84	74.22	20.37	20.37	0.00	-	-	-	-	-	-	SM
7.5	1.67	5.95	0.70	2.686	0.36	2.03	3.64	78.52	15.45	15.45	0.00	-	-	-	-	-	-	SM
8.5	1.69	6.20	0.69	2.684	0.41	3.62	2.55	74.65	18.77	18.77	0.00	23.8	Nil	NP	DST	0.00	28	SM
9.0	1.69	6.53	0.69	2.678	0.25	2.15	2.80	76.25	18.55	18.55	0.00	-	-	-	-	-	-	SM
10.5	1.70	6.87	0.69	2.689	0.87	1.45	2.14	70.02	25.52	25.52	0.00	-	-	-	-	-	-	SM
12.0	1.71	7.11	0.68	2.688	0.55	2.85	4.64	65.29	26.67	26.67	0.00	-	-	-	-	-	-	SM
13.5	1.73	7.52	0.66	2.674	0.46	2.02	4.78	69.85	22.89	22.89	0.00	22.5	Nil	NP	DST	0.00	29	SM
15.0	1.73	7.85	0.66	2.669	0.32	2.84	3.62	79.65	13.57	13.57	0.00	-	-	-	-	-	-	SM
16.5	1.74	8.14	0.66	2.678	0.59	2.64	3.02	74.15	19.60	19.60	0.00	23.5	Nil	NP	DST	0.00	29	SM
18.0	1.75	8.62	0.65	2.665	0.52	2.85	1.52	76.32	18.79	18.79	0.00	-	-	-	-	-	-	SM
19.5	1.76	8.98	0.64	2.652	0.31	2.36	4.25	69.85	23.23	23.23	0.00	-	-	-	-	-	-	SM
21.0	1.77	9.14	0.63	2.651	0.25	2.41	4.84	78.50	14.00	14.00	0.00	-	-	-	-	-	-	SM
22.5	1.78	9.55	0.63	2.653	0.69	1.64	5.32	74.33	18.02	18.02	0.00	-	-	-	-	-	-	SM
24.0	1.79	9.84	0.63	2.650	0.84	2.36	3.26	78.50	15.04	15.04	0.00	-	-	-	-	-	-	SM
25.5	1.81	10.24	0.61	2.648	0.79	2.66	3.85	79.65	13.05	13.05	0.00	-	-	-	-	-	-	SM
27.0	1.82	10.69	0.61	2.652	0.66	3.21	4.65	72.02	19.46	19.46	0.00	-	-	-	-	-	-	SM
28.5	1.84	10.84	0.59	2.643	0.50	1.42	3.02	68.52	26.54	26.54	0.00	-	-	-	-	-	-	SM
30.0	1.86	11.16	0.59	2.656	0.27	2.02	4.65	67.49	25.57	25.57	0.00	-	-	-	-	-	-	SM
31.5	1.87	11.63	0.59	2.668	0.41	2.52	2.88	76.35	17.84	17.84	0.00	-	-	-	-	-	-	SM
33.0	1.88	11.89	0.59	2.664	0.36	3.26	2.69	70.03	23.66	23.66	0.00	-	-	-	-	-	-	SM
34.5	1.88	12.42	0.59	2.652	0.65	3.41	4.51	69.41	22.02	22.02	0.00	-	-	-	-	-	-	SM
36.0	1.89	12.52	0.58	2.653	0.98	2.59	2.02	67.52	26.89	26.89	0.00	-	-	-	-	-	-	SM
37.5	1.91	12.87	0.57	2.650	0.52	3.65	3.51	76.32	16.00	16.00	0.00	-	-	-	-	-	-	SM
39.0	1.92	13.32	0.56	2.644	0.25	1.47	4.16	76.50	17.62	17.62	0.00	-	-	-	-	-	-	SM
40.0	1.94	13.62	0.55	2.648	0.74	2.51	2.64	74.18	19.93	19.93	0.00	-	-	-	-	-	-	SM



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

Depth of bore hole: 40.00 mtr										Water Table: Not Found								
LABORATORY TEST RESULT BH-04																		
Depth Below NGL (Meter)	Index Property				Grain Size Analysis					Grain Size Analysis by Hydrometer		Index Property			Shear Strength Parameters			Soil Classification
	Bulk Density (gm/cc)	Moisture Content (%)	Void Ratio	Specific Gravity (Gs)	Gravel (%)	Coarse Sand (%)	Medium Sand (%)	Fine Sand (%)	Silt & Clay (%)	Silt (%)	Clay (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index (%)	Type of Test	Cohesion C (kg/cm ²)	Angle of Friction (Degree)	
1.0	FILLED UP MATERIAL																	
1.5	FILLED UP MATERIAL																	
2.5	FILLED UP MATERIAL																	
3.0	1.64	4.22	0.71	2.696	0.22	1.25	2.64	68.32	27.57	27.57	0.00	23.8	Nil	NP	DST	0.00	27	SM
4.5	1.65	4.65	0.71	2.689	0.66	1.96	3.25	69.52	24.61	24.61	0.00	-	-	-	-	-	-	SM
5.3	1.66	4.86	0.70	2.684	0.84	2.34	4.50	76.32	16.00	16.00	0.00	23.5	Nil	NP	DST	0.00	28	SM
6.0	1.67	5.05	0.69	2.679	0.46	1.25	2.65	78.52	17.12	17.12	0.00	-	-	-	-	-	-	SM
7.5	1.68	5.46	0.69	2.685	0.31	1.64	2.85	71.24	23.96	23.96	0.00	-	-	-	-	-	-	SM
8.5	1.70	5.92	0.66	2.668	0.85	2.55	3.16	75.65	17.79	17.79	0.00	23.0	Nil	NP	DST	0.00	28	SM
9.0	1.71	6.21	0.66	2.676	0.22	3.26	4.26	68.03	24.23	24.23	0.00	-	-	-	-	-	-	SM
10.5	1.72	6.46	0.66	2.679	0.65	1.45	3.95	65.32	28.63	28.63	0.00	-	-	-	-	-	-	SM
12.0	1.73	6.85	0.65	2.665	0.02	1.28	5.24	79.52	13.94	13.94	0.00	-	-	-	-	-	-	SM
13.5	1.75	7.02	0.64	2.685	0.95	1.84	4.66	71.22	21.33	21.33	0.00	22.9	Nil	NP	DST	0.00	29	SM
15.0	1.76	7.43	0.63	2.670	0.64	2.02	2.15	64.37	30.82	30.82	0.00	-	-	-	-	-	-	SM
16.5	1.77	7.79	0.63	2.675	0.35	3.26	2.87	78.50	15.02	15.02	0.00	23.4	Nil	NP	DST	0.00	29	SM
18.0	1.79	8.01	0.62	2.683	0.85	1.65	3.34	71.02	23.14	23.14	0.00	-	-	-	-	-	-	SM
19.5	1.80	8.33	0.61	2.669	0.41	0.85	1.64	62.15	34.95	34.95	0.00	-	-	-	-	-	-	SM
21.0	1.80	8.62	0.61	2.669	0.25	0.61	2.53	78.65	17.96	17.96	0.00	-	-	-	-	-	-	SM
22.5	1.81	8.98	0.61	2.679	0.74	1.29	2.02	79.64	16.31	16.31	0.00	-	-	-	-	-	-	SM
24.0	1.82	9.14	0.59	2.651	0.35	0.74	3.65	73.29	21.97	21.97	0.00	-	-	-	-	-	-	SM
25.5	1.84	9.52	0.59	2.676	0.45	2.16	2.85	79.64	14.90	14.90	0.00	-	-	-	-	-	-	SM
27.0	1.86	9.86	0.59	2.685	0.65	1.06	4.22	74.55	19.52	19.52	0.00	-	-	-	-	-	-	SM
28.5	1.87	10.04	0.58	2.677	0.25	2.47	2.17	72.51	22.60	22.60	0.00	-	-	-	-	-	-	SM
30.0	1.88	10.64	0.58	2.686	0.84	2.63	3.64	78.63	14.26	14.26	0.00	-	-	-	-	-	-	SM
31.5	1.89	10.80	0.56	2.665	0.52	3.24	2.53	71.01	22.70	22.70	0.00	-	-	-	-	-	-	SM
33.0	1.91	11.32	0.54	2.646	0.69	1.54	3.61	76.32	17.84	17.84	0.00	-	-	-	-	-	-	SM
34.5	1.92	11.52	0.54	2.653	0.51	1.67	0.84	70.02	26.96	26.96	0.00	-	-	-	-	-	-	SM
36.0	1.94	11.89	0.53	2.650	0.47	2.59	2.16	67.33	27.45	27.45	0.00	-	-	-	-	-	-	SM
37.5	1.95	12.14	0.52	2.648	0.63	2.63	4.28	65.91	26.55	26.55	0.00	-	-	-	-	-	-	SM
39.0	1.96	12.62	0.52	2.641	0.20	3.25	2.63	74.27	19.65	19.65	0.00	-	-	-	-	-	-	SM
40.0	1.97	13.02	0.52	2.648	0.26	1.45	4.21	76.32	17.76	17.76	0.00	-	-	-	-	-	-	SM

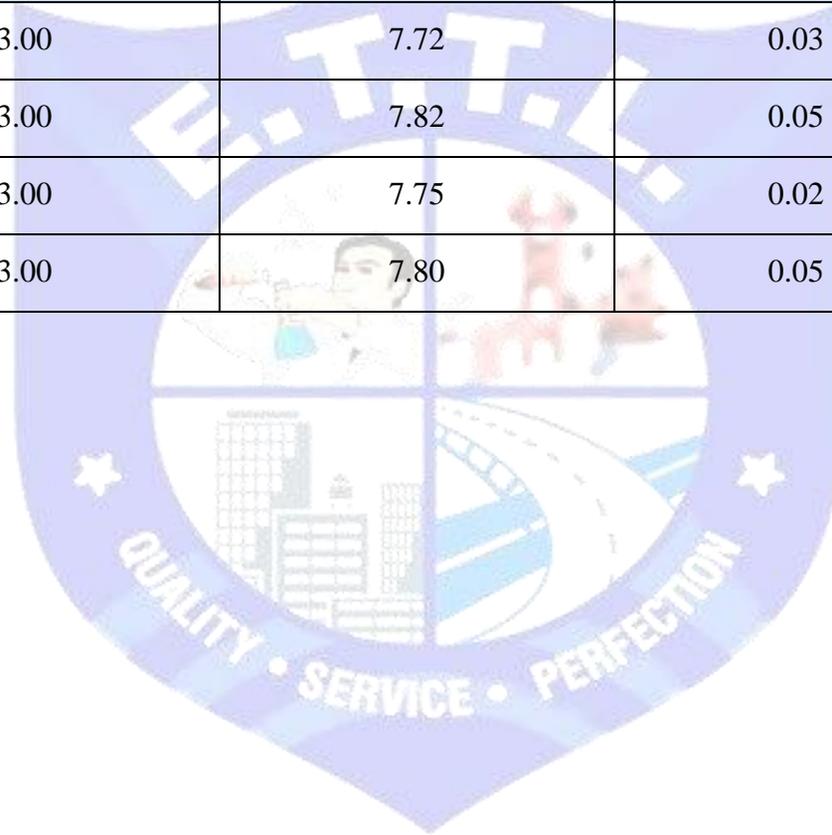


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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

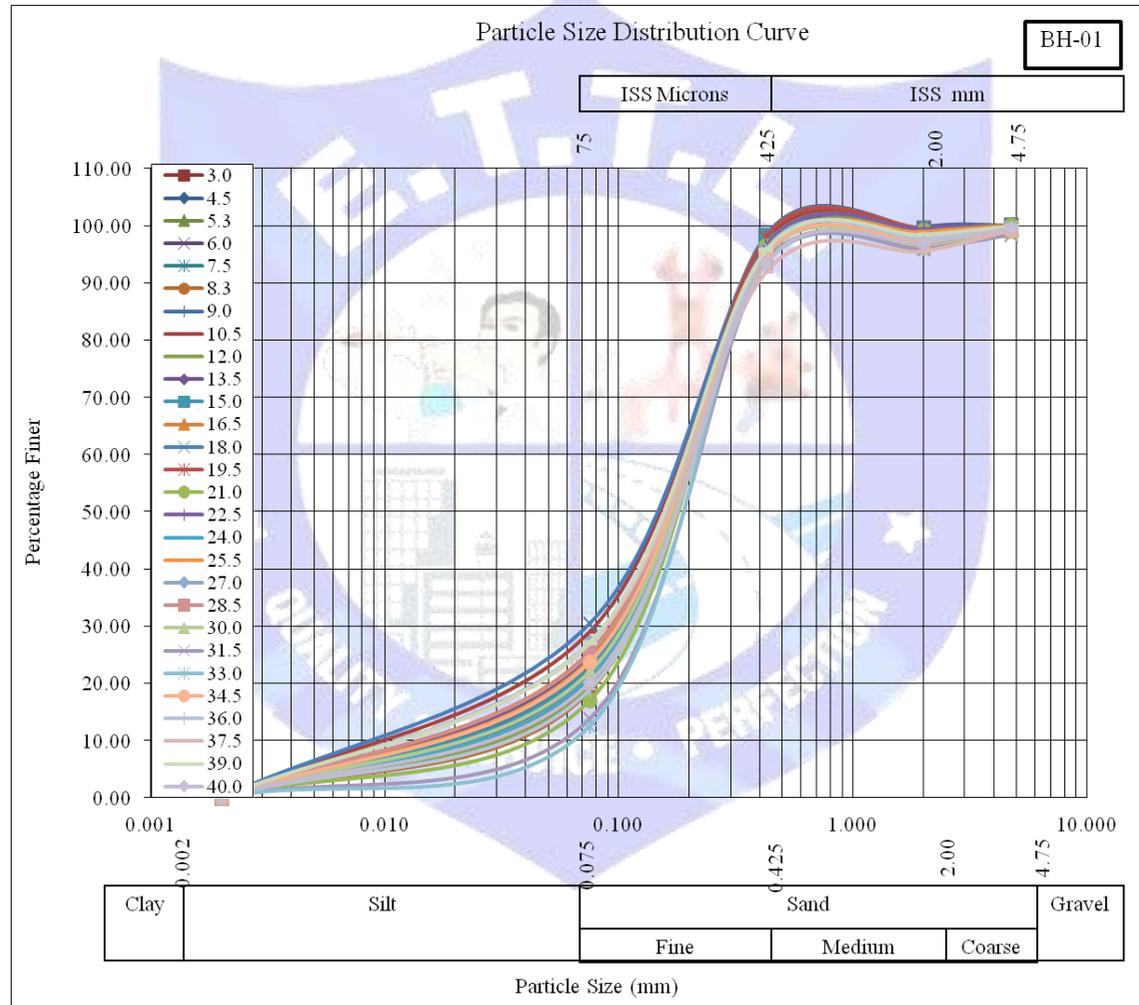
Chemical test

BH No.	Depth of Sampling (mtr)	Chemical Properties		
		pH	Sulphate so ₃ (%)	Chloride (%)
BH-01	3.00	7.72	0.03	0.004
BH-02	3.00	7.82	0.05	0.008
BH-03	3.00	7.75	0.02	0.004
BH-04	3.00	7.80	0.05	0.005



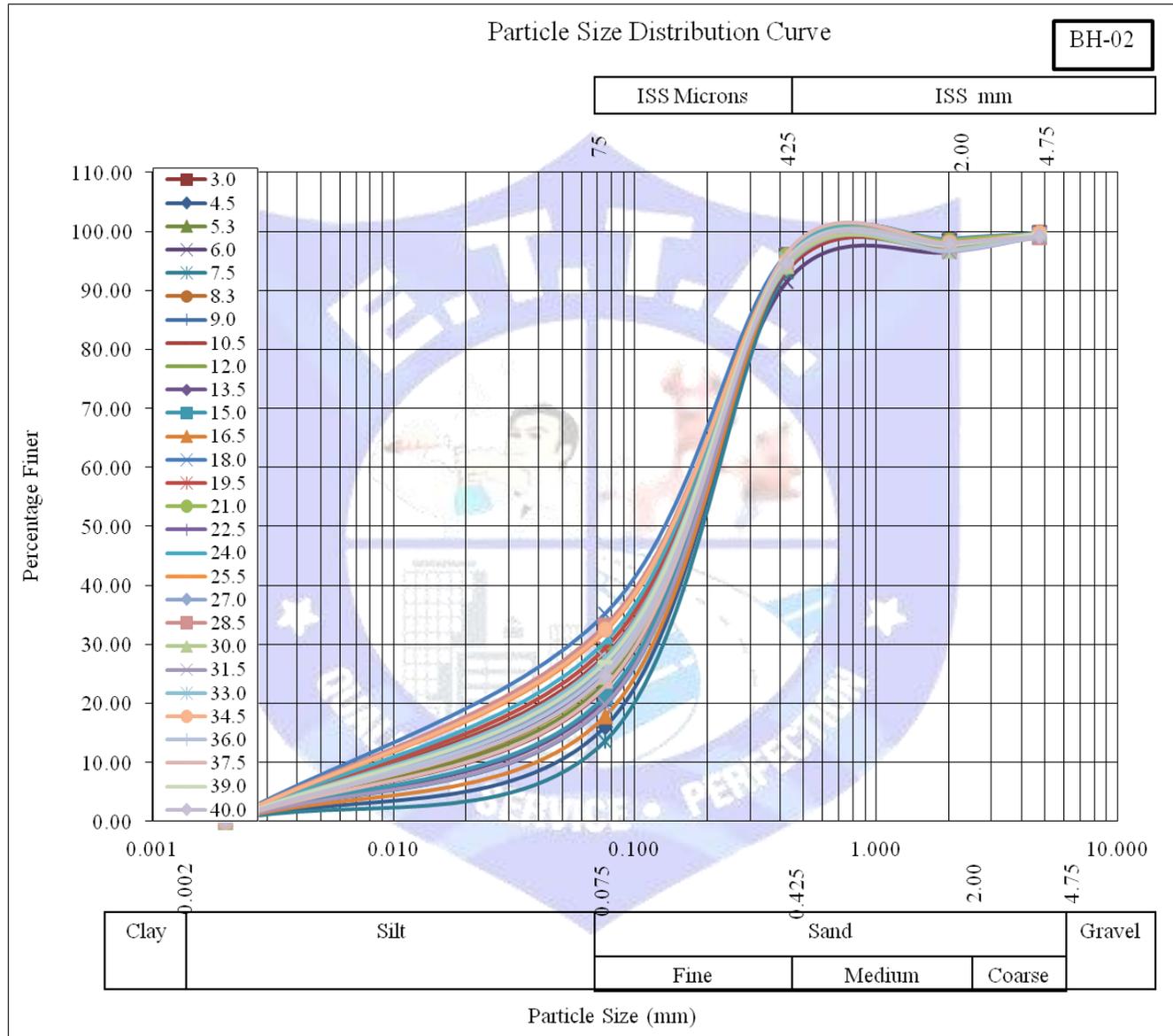
10. TEST PLOTS

Grain Size Analysis



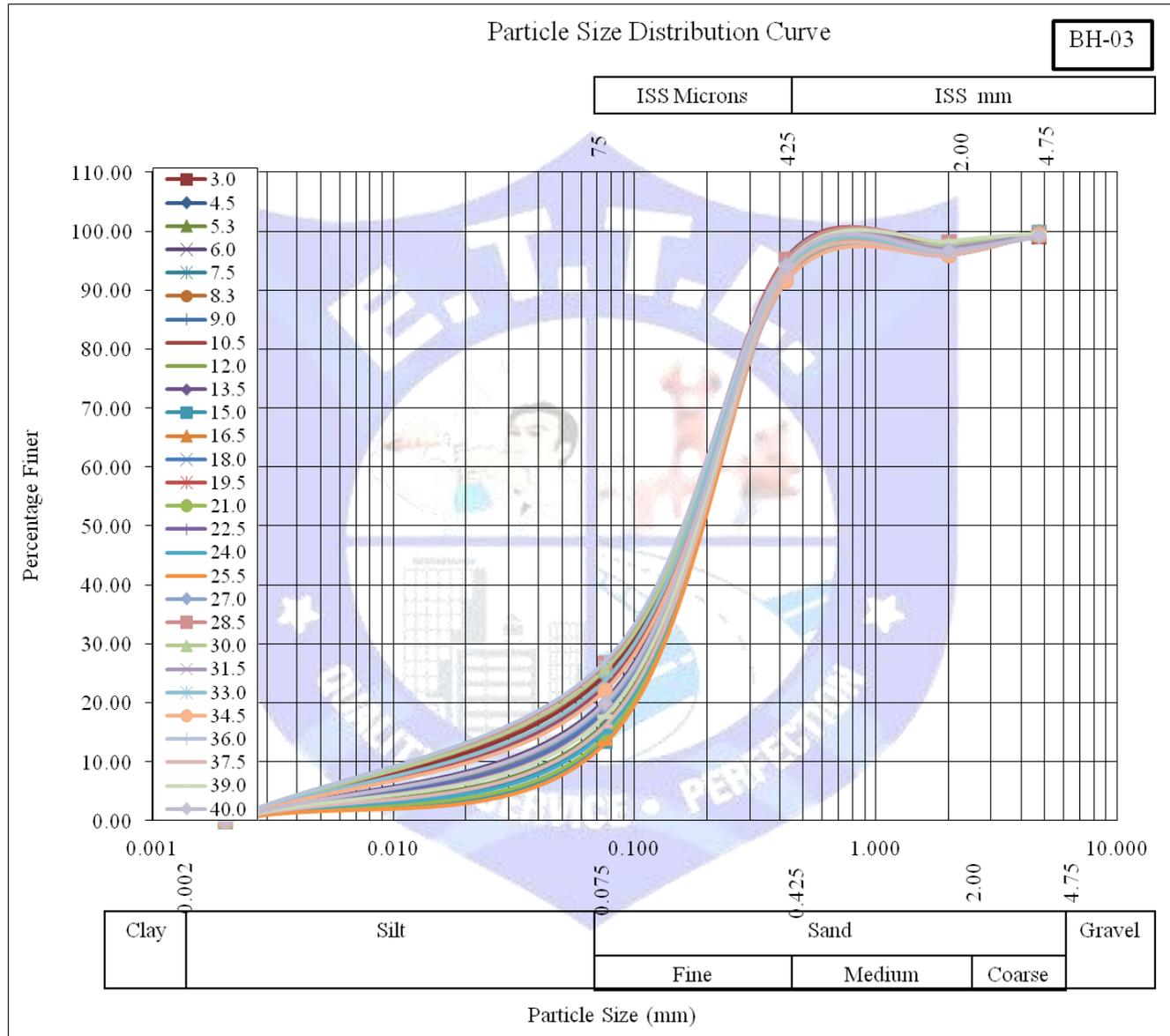
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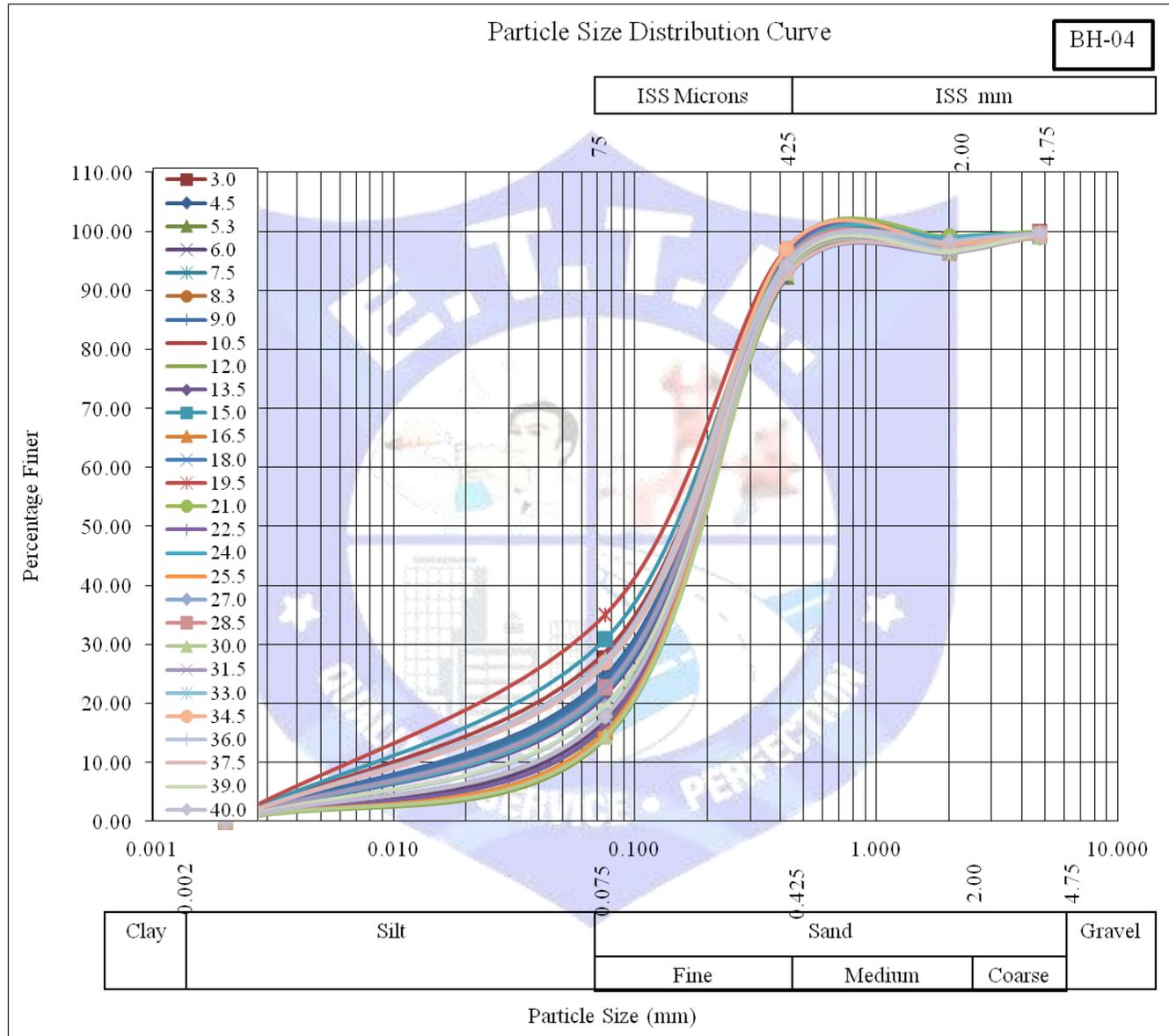
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Report No. JP/ETTL/24-25/TE-85060310914-2 L2



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

11. SHEAR FAILURE AND CALCULATION

BH-01 (Local Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [2/3 * C * N_c S_{cd} + q(N_q - 1) S_{qd} + 0.5 * B * \gamma * N_{\gamma} * W_q S_{ydy}]$; $Q_s = Q_{ns} + \gamma d$
 FS=2.50, Water Table as per Clause No.2.2.

Sr.No	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ	Φ'	N _c	N _q	N _{γ}			W _q	W _{γ}	S _c	S _q	S _y		
1	6.00	6.00	3.00	0.0	27	18.8	13.68	5.65	4.52	1.64	4.920	1.0	1.0	1.3	1.2	0.8	18.10	23.02
2	6.00	6.00	4.50	0.0	28	19.5	14.34	6.09	5.03	1.65	7.425	1.0	1.0	1.3	1.2	0.8	26.09	33.51
3	6.00	6.00	6.00	0.0	28	19.5	14.34	6.09	5.03	1.65	9.900	1.0	1.0	1.3	1.2	0.8	32.13	42.03

BH-01 (General Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [C * N_c S_{cd} + q(N_q - 1) S_{qd} + 0.5 * B * \gamma * N_{\gamma} * W_q S_{ydy}]$; $Q_s = Q_{ns} + \gamma d$
 FS=2.50, Water Table as per Clause No.2.2.

S.N O	Size of Foundation		Depth of Foundation m	Shear Parameter		Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ	N _c	N _q	N _{γ}			W _q	W _{γ}	S _c	S _q	S _y		
1	6.00	6.00	3.00	0.00	27	23.82	13.13	14.40	1.64	4.920	1.0	1.0	1.3	1.2	0.8	51.34	56.26
2	6.00	6.00	4.50	0.00	28	25.66	14.65	16.64	1.65	7.425	1.0	1.0	1.3	1.2	0.8	74.98	82.41
3	6.00	6.00	6.00	0.00	28	25.66	14.65	16.64	1.65	9.900	1.0	1.0	1.3	1.2	0.8	91.19	101.09

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

BH-02 (Local Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [2/3 * C * N_c \text{Secdcic} + q(N_q - 1)S_{qd}q_{iq} + 0.5 * B * \gamma * N_{\gamma} * W_q \text{Sydyiy}] ; Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

Sr.No	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ	Φ'	N _c	N _q	N _{γ}			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.0	28	19.5	14.34	6.09	5.03	1.62	4.860	1.0	1.0	1.3	1.2	0.8	19.68	24.54
2	6.00	6.00	4.50	0.0	28	19.5	14.34	6.09	5.03	1.64	7.380	1.0	1.0	1.3	1.2	0.8	25.93	33.31
3	6.00	6.00	6.00	0.0	28	19.5	14.34	6.09	5.03	1.64	9.840	1.0	1.0	1.3	1.2	0.8	31.93	41.77

BH-02 (General Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [C * N_c \text{Secdcic} + q(N_q - 1)S_{qd}q_{iq} + 0.5 * B * \gamma * N_{\gamma} * W_q \text{Sydyiy}] ; Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

S.NO	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ		N _c	N _q	N _{γ}			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.00	28		25.66	14.65	16.64	1.62	4.860	1.0	1.0	1.3	1.2	0.8	57.71	62.57
2	6.00	6.00	4.50	0.00	28		25.66	14.65	16.64	1.64	7.380	1.0	1.0	1.3	1.2	0.8	74.53	81.91
3	6.00	6.00	6.00	0.00	28		25.66	14.65	16.64	1.64	9.840	1.0	1.0	1.3	1.2	0.8	90.64	100.48

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

BH-03 (Local Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [2/3 * C * N_c \text{Sec} \phi + q(N_q - 1) S_q d q_i q + 0.5 * B * \gamma * N_\gamma * W_q S_y d y_i y]$; $Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

Sr.No	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ	Φ'	N _c	N _q	N _y			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.0	28	19.5	14.34	6.09	5.03	1.63	4.890	1.0	1.0	1.3	1.2	0.8	19.80	24.69
2	6.00	6.00	4.50	0.0	28	19.5	14.34	6.09	5.03	1.65	7.425	1.0	1.0	1.3	1.2	0.8	26.09	33.51
3	6.00	6.00	6.00	0.0	28	19.5	14.34	6.09	5.03	1.65	9.900	1.0	1.0	1.3	1.2	0.8	32.13	42.03

BH-03 (General Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [C * N_c \text{Sec} \phi + q(N_q - 1) S_q d q_i q + 0.5 * B * \gamma * N_\gamma * W_q S_y d y_i y]$; $Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

S.NO	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ		N _c	N _q	N _y			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.00	28		25.66	14.65	16.64	1.63	4.890	1.0	1.0	1.3	1.2	0.8	58.06	62.95
2	6.00	6.00	4.50	0.00	28		25.66	14.65	16.64	1.65	7.425	1.0	1.0	1.3	1.2	0.8	74.98	82.41
3	6.00	6.00	6.00	0.00	28		25.66	14.65	16.64	1.65	9.900	1.0	1.0	1.3	1.2	0.8	91.19	101.09

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

BH-04 (Local Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [2/3 * C * N_c \text{Secdcic} + q(N_q - 1)S_{qd}q_{iq} + 0.5 * B * \gamma * N_{\gamma} * W_q \text{Sydyiy}] ; Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

Sr.No	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ	Φ'	N _c	N _q	N _{γ}			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.0	27	18.8	13.68	5.65	4.52	1.64	4.920	1.0	1.0	1.3	1.2	0.8	18.10	23.02
2	6.00	6.00	4.50	0.0	28	19.5	14.34	6.09	5.03	1.66	7.470	1.0	1.0	1.3	1.2	0.8	26.25	33.72
3	6.00	6.00	6.00	0.0	28	19.5	14.34	6.09	5.03	1.66	9.960	1.0	1.0	1.3	1.2	0.8	32.32	42.28

BH-04 (General Shear Failure)

Calculation of Net Safe Bearing Capacity Based on Shear Parameters C- Φ
 $Q_{ns} = 1/FS [C * N_c \text{Secdcic} + q(N_q - 1)S_{qd}q_{iq} + 0.5 * B * \gamma * N_{\gamma} * W_q \text{Sydyiy}] ; Q_s = Q_{ns} + \gamma d$
FS=2.50, Water Table as per Clause No.2.2.

S.NO	Size of Foundation		Depth of Foundation m	Shear Parameter			Bearing Capacity Factors			Unit Weight (γ) (gm/cc)	Overburden q	Water Table Correction		Shape Factor			Net Safe Bearing Capacity t/m ² (Q _{ns})	Gross Safe Bearing Capacity t/m ² (Q _s)
	Length m	Width m		C (kg/cm ²)	Φ		N _c	N _q	N _{γ}			W _q	W _{γ}	Sc	S _q	S _y		
1	6.00	6.00	3.00	0.00	27		23.82	13.13	14.40	1.64	4.920	1.0	1.0	1.3	1.2	0.8	51.34	56.26
2	6.00	6.00	4.50	0.00	28		25.66	14.65	16.64	1.66	7.470	1.0	1.0	1.3	1.2	0.8	75.44	82.91
3	6.00	6.00	6.00	0.00	28		25.66	14.65	16.64	1.66	9.960	1.0	1.0	1.3	1.2	0.8	91.75	101.71

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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

12. SETTLEMENT FAILUR AND CALCULATION

BH-01

Depth(m)	width(m)	Length(m)	corrected N	Weighted average corrected 'N' value	from Figure 12 of IS:8009 part -1, depth factor	Settlement in 'm' per unit pressure (reading from graph)	Recommended allowable bearing pressure for 25 mm settlement
3.00	6.00	6.00	35	34	1.000	0.009	29.41
4.50	6.00	6.00	40	36	1.000	0.008	31.64
6.00	6.00	6.00	45	38	1.000	0.007	33.78

BH-02

Depth(m)	width(m)	Length(m)	corrected N	Weighted average corrected 'N' value	from Figure 12 of IS:8009 part -1, depth factor	Settlement in 'm' per unit pressure (reading from graph)	Recommended allowable bearing pressure for 25 mm settlement
3.00	6.00	6.00	44	43	1.000	0.007	37.87
4.50	6.00	6.00	49	45	1.000	0.006	39.68
6.00	6.00	6.00	52	47	1.000	0.006	41.66

BH-03

Depth(m)	width(m)	Length(m)	corrected N	Weighted average corrected 'N' value	from Figure 12 of IS:8009 part -1, depth factor	Settlement in 'm' per unit pressure (reading from graph)	Recommended allowable bearing pressure for 25 mm settlement
3.00	6.00	6.00	43	41	1.000	0.007	36.76
4.50	6.00	6.00	47	43	1.000	0.007	38.46
6.00	6.00	6.00	50	45	1.000	0.006	39.68

BH-04

Depth(m)	width(m)	Length(m)	corrected N	Weighted average corrected 'N' value	from Figure 12 of IS:8009 part -1, depth factor	Settlement in 'm' per unit pressure (reading from graph)	Recommended allowable bearing pressure for 25 mm settlement
3.00	6.00	6.00	43	42	1.000	0.007	37.31
4.50	6.00	6.00	46	43	1.000	0.007	38.46
6.00	6.00	6.00	48	44	1.000	0.006	39.06



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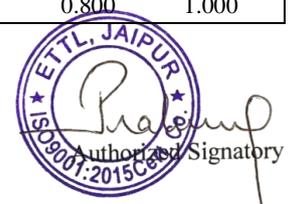
Report No. JP/ETTL/24-25/TE-85060310914-2 L2

13. SAMPLE CALCULATION FOR BH-01

SAFE BEARING CAPACITY OF SOIL - Based on IS: 6403

Shape of footing		Rectangle		
Depth of footing, D	3.00	Cohesion, C, kg/sq.cm	0.000	
Width of footing, B	6.00	Angle of Int.Friction, f	27.00	
	6.00	Specific Gravity, g	2.689	
Depth of Water Table, m	Not found	Bulk Density, Y _d , gm/cc	1.640	
Ratio d/B	0.500	Sat. Density, Y _{sat} , gm/cc	1.988	
Water Table Factor	1.00	Sub. Density, Y', gm/cc	0.988	
Effective Surcharge over EGL, m	0.00 m	Inclination Angle a	0	
Dry Density, Y _d , gm/cc	1.572 4.35	Factor of Safety	2.5	
Overburden Pressure, t/m ²	4.920	Surcharge Density Assumed, gm/cc	1.000	
Shear Zone, H = 0.5 B tan (45+φ/2)	5.41	Void Ratio, e _o = $\frac{G_x}{Y_w} - 1$	= 0.71	
		Mode of Failure =	Intermediate Shear Failure	
F' = Tan ⁻¹ (0.67 tan F)	= 18.85	Nc'' =	15.708	23.82 13.68
		Nq'' =	7.147	13.13 5.65
		Ng'' =	6.497	14.40 4.52
		Inter	General	Local
For general shear failure i.e. Void Ratio < 0.55				
qu = cNcScdcic + q(Nq-1) Sqdqiq + 0.5 BgNgSgdgig W'	= 128.34	qs =	51.34	t/m ²
For local shear failure i.e. Void Ratio > 0.75				
qu = 0.67cN'cScdcic + q(N'q-1) Sqdqiq + 0.5 BgN'gSgdgig W'	= 45.25		18.10	t/m ²
For intermediate shear failure i.e. Void Ratio < 0.55 and > 0.75				
	Void Ratio	e <= 0.55	e >= 0.75	0.55 < e < 0.75
	e	0.55	0.75	0.71
qu = Net Safe Bearing Capacity, t/m ²		51.34	18.10	24.75

Factors- Tan-1(0.67 tan F)				Factors- tan F			
d, s, i	Depth factor	Shape factor	Inclination factor	d, s, i	Depth factor	Shape factor	Inclination factor
dc, sc, ic	1.000	1.300	1.000	dc, sc, ic	1.000	1.300	1.000
dq, sq, iq	1.000	1.200	1.000	dq, sq, iq	1.000	1.200	1.000
dg, sg, ig	1.000	0.800	1.000	dg, sg, ig	1.000	0.800	1.000



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Report No. JP/ETTL/24-25/TE-85060310914-2 L2

SETTLEMENT ANALYSIS FOR SHALLOW FOUNDATIONS BASED ON N - VALUES			
Analysis as per IS:8009(Part 1)-1976 , Clause 9.1.4			
Width of footing	B =	6.00	m
Length of footing	L =	6.00	m
Depth of foundation	D _f =	3.00	m
Depth of Influence	=	9.00	m
CORRECTED 'N' VALUE=NVALUE*	N' = (0.77 log 10 20/ρ) N		(ρ= Overburden Pressure)
Weighted average 'N' value			
Calculation			
		32.7	
Weighted average corrected 'N' value	N =	32.71	
Design Depth of water table	d =	Not found	m
Water Table Correction	W'	1.00	
from Figure 12 of IS:8009 part -1, depth factor	=	1.000	
Settlement in 'm' per unit pressure (reading from graph)	=	0.0085	m/kg/sq cm
Settlement after applying water table correction for 1 unit pressure	=	0.000085	m/kN/m ²
	=1*0.0085/ (1*100)	=	
Bearing Pressure for 25 mm settlement	=25/(0.000085*1000)	=	294.1 kN/m ²
Recommended allowable bearing pressure for 25 mm settlement	=	294.1	kN/m ²
	=	29.41	t/m ²

END OF REPORT

