



MINUTES OF PRE-BID MEETING.

BID IDENTIFICATION NO.:	AEGCL/MD/TECH-1219/Thermal-Assam/2026/ BID Dated 23.08.2026
NIT No.:	AEGCL/MD/TECH-1219/Thermal-Assam/2026/ NIT Dated 23.08.2026
Name of the Work	"Implementation of Transmission Infrastructure to evacuate 3200MW thermal power from upcoming Generating Station at Chapar" Part I: Turnkey construction of 400kV Chapar-I-Rangia Double Circuit Quad Moose Transmission Line with Associated 400kV bays and Reactor Works. Part II: Turnkey Construction of 400/220kV Agia Substation with associated 400kV Chapar-II-Agia Transmission Line, including Bay Extension and Reactor Works
Funding Agency	Internal Source of AEGCL
Date of Pre-Bid Meeting	16/09/2026
Venue of Pre-Bid Meeting	Conference Room O/o the MD, AEGCL, 1 st Floor, Bijulee Bhawan, Paltan Bazar, Guwahati-01

OPENING REMARKS:

Smt. Jayashree Devi, CGM (PP&D), AEGCL extended a warm welcome to all the prospective bidders and introduced his team.

Sri Arunav Gogoi, GM (N-EAP), AEGCL briefed on Tender of
"Implementation of Transmission Infrastructure to evacuate 3200MW thermal power from upcoming Generating Station at Chapar"

Part I: Turnkey construction of 400kV Chapar-I-Rangia Double Circuit Quad Moose Transmission Line with Associated 400kV bays and Reactor Works.

Part II: Turnkey Construction of 400/220kV Agia Substation with associated 400kV Chapar-II-Agia Transmission Line, including Bay Extension and Reactor Works.



It was assured to the prospective bidders that comprehensive reply/clarifications shall be prepared and uploaded in the AEGCL site as well as e-tender portal in response to their raised queries on the bid document.

NAMES OF THOSE PRESENT (Attendance Sheet enclosed herewith):

1. FROM EMPLOYER:

1. Smt. Jayashree Devi, CGM (PP&D), AEGCL
2. Sri Pranab Kumar Sarma, CGM(F&A), AEGCL
3. Sri Arunav Gogoi, GM (N-EAP), AEGCL
4. Sri Rituparna Khargharia, GM(P&D), AEGCL
5. Sri David Bathari GM(Civil), AEGCL
6. Sri Himangshu Raj Gogoi, DGM(P&D), AEGCL
7. Md Feisal Hussain Hasmi, DGM(EAP), AEGCL
8. Sri Rupjyoti Sarma, DGM (N-EAP), AEGCL
9. Sri Dipayan Chanda, AGM(EAP), AEGCL
10. Sri Kushal Chayengia, AGM(EAP), AEGCL
11. Sri Prantik Pran Saikia, AGM(P&D), AEGCL
12. Sri Neelkamal Sarma, DM(P&D), AEGCL
13. Smt. Pallavi Borthakur, DM(NEAP), AEGCL
14. Smt. Madhusmita Choudhury, DM(Civil), AEGCL
15. Smt. Bidisha Taye, DM(Civil), AEGCL
16. Sri Bijendra Prasad, AM(F&A), AEGCL

2. FROM PROSPECTIVE BIDDERS:

A. BIDDERS/O&M THAT WERE PRESENT AT THE PRE BID MEETING.

1. M/s Larsen & Toubro Limited
2. M/s Kalpataru Projects International Ltd.
3. M/s Hyosung

MEMBERS OF THE COST COMMITTEE/PRE-BID COMMITTEE OF THE BID:

1. Smt. Jayashree Devi, CGM (PP&D), AEGCL
2. Sri Pranab Kumar Sarma, CGM(F&A), AEGCL



3. Sri Arunav Gogoi, GM (N-EAP), AEGCL
4. Sri Rituparna Khargharia, GM(P&D), AEGCL
5. Sri David Bathari GM(Civil), AEGCL
6. Sri Himangshu Raj Gogoi, DGM(P&D), AEGCL
7. Md Feisal Hussain Hasmi, DGM(EAP), AEGCL
8. Sri Bikram Bordoloi, DGM, (BD&T), AEGCL
9. Sri Rupjyoti Sarma, DGM (N-EAP), AEGCL
10. Sri Dipayan Chanda, AGM(EAP), AEGCL
11. Sri Kushal Chayengia, AGM(EAP), AEGCL
12. Sri Prantik Pran Saikia, AGM(P&D), AEGCL
13. Sri Neelkamal Sarma, DM(P&D), AEGCL

The queries submitted by the prospective bidders were discussed by the COST COMMITTEE/PRE-BID COMMITTEE MEMBERS and the Members that were present at the Pre-Bid Meeting and observations made are as follow in **Table-1**

Table -1

Name of Work : Implementation of transmission infrastructure to evacuate 3200 MW thermal power from upcoming generation station at Chapar

Serial Number	Clause No./Drawing No./Description	Query	Reply
1	Bid Volume 1 — Source of fund	Request you to kindly share details regarding source of fund i.e. AEGCL own funding or any external funding.	Internal Source of AEGCL
2	Bid Volume 1 — Appendix 1 Terms of Payment Supply	Referring to terms of payment of AEGCL for subject package for Supply portion is : i. Progressive Payment: 75% of Total supply invoice value. ii. Remaining 25%:- a. 15% of completion of 50% total erection work, b. 5% on completion and 5% on Operational acceptance certificates. We request to amend payments terms as mentioned below :- i. Interest free Advance 10% in Supply Portion, ii. Interest free Engineering Advance 10%, iii. Progressive 55% of total supply invoice value, iv. Remaining 25%:- a. 15% of completion of 50% total erection work, b. 5% on completion and 5% on Operational acceptance certificates. Please consider.	As per Bid and corrigendum issued
3	Bid Volume 1 — Appendix 1 Terms of Payment Installation	Referring to terms of payment of AEGCL for subject package for Installation portion is : i. Progressive Payment: 90% against of invoice for foundation, erection and civil works. ii. Remaining 10%:- 5% on completion and 5% on Operational acceptance certificates. We request to amend payments terms as mentioned below :- i. Interest free Advance 10% of Installation Portion, ii. Progressive Payment: 80% against of invoice for foundation, erection and civil works. iii. Remaining 10%:- 5% on completion and 5% on Operational acceptance certificates.	As per BID
4	Bid Volume 1 — Appendix 1 Terms of Payment	In payment terms it is mentioned "Subject to availability of fund". Request you to please clarify the same.	Fund Available
5	Bid Volume 1 — Price Adjustment	As per bid document, Price adjustment is not applicable as it is fixed term contract. We like to draw your attention on current market fluctuation due to West Asia crisis. Due to this, prices of Copper, CRGO, Aluminium in internation market is volatile. Therefore, we request you to kindly accept PV as per IEEMA for Power Transformer, Conductor, CVT, EHV and Power - Control Cables, Station Transformer, WT BPL, LA, Metal based items and Installation (Erection and Civil).	As per Corrigendum Issued
6	Bid Volume 1 — Stamp Paper	Request you to kindly confirm stamp paper duty required for preparation of EMD. Also, we assume, EMD can be issued from any National bank. Please confirm.	As per BID
7	Bid Volume 1 — Undertakings	As per bid documents, bidder required to submit undertaking on stamp paper of Rs 100 notarized. We request you to kindly allow bidders to submit undertaking on Letter head in tender stage. Further, bidder shall submit undertaking on stamp paper after award of contract by successful bidder. Please consider.	As per BID
8	Bid Volume 1 — Sec-4, Evaluation and Qualification Criteria, 4.2.1 (b) Experience in Key Activities	A. The tenderer must have the experience of design, install, test and commission of the following listed equipment's which are in successful operation for at least one year within last seven year as on the date of original bid submission. Kindly confirm, Design for Power Transformer is in Transformer OEM scope. EPC having experience of Supply, Erection, testing and commissioning is acceptable.	For OEM related items, design in OEM Scope.
9	Bid Volume 1 — Sec-4, Evaluation and Qualification Criteria, 4.2.1 (c) Manufacturers/Subcontractor	In said clause, for GIS OEM, certain testing laboratories are mentioned. We request you to kindly include XIHARI testing lab also in this list or kindly mention TTR from IEC or equivalent from others lab not mentioned in this list is also acceptable. Please consider.	As per BID
10	Bid Volume 1 — Sec-4, Evaluation and Qualification Criteria, 4.2.1 (c) Manufacturers/Subcontractor	FOR GIS, V. The Tenderer shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period. No GIS OEM is accepting to this clause. Therefore, we request you to kindly remove this performance guarantee requirement. Please consider.	As per Bid and Corrigendum Issued

11	Bid Volume 1 — Section-III, BDS, ITB 2.13.3, Undertaking by the contractor to supply spare parts for a period of 10 years.	As per AEGCL requirement, bidder need to submit an "Undertaking for supply of spare parts for a period of 10 years" and we have shared the same with our vendors and GIS OEM for their confirmation. In response to this undertaking, vendors and GIS OEM are regretting to confirm this requirement. Therefore, we request you to kindly remove this undertaking for successful participation.	As per BID
12	General — General	Please confirm Seismic zone. Also, please share creepage and RTV requirement for said tender.	Refer Bid Volume - II
13	General — General	For any Statutory clearances and permission required for tree cutting, forest clearance, shutdown permission shall be arranged by AEGCL. Reimbursement for the same shall be done by AEGCL directly. EPC shall provide necessary support only. Kindly confirm.	As per Bid and Corrigendum Issued
14	BOQ_84456 SL no. 3 — Site Preparation and Earth filling with Compaction	Request you to please provide the existing contour drawing or FGL for the new GIS substation.	To be prepared by TKC during detailed engineering
15	BOQ_84456 SL no. 2 — Site clearance	During the site visit, it was observed that a considerable number of large trees exist within the proposed GIS substation area. Kindly clarify whether the cutting, uprooting, disposal, and removal of these trees, including obtaining any statutory permissions required from the concerned authorities, are within the scope of the bidder or shall be arranged by the owner.	Permission will be arranged by AEGCL, Remaining scope under site clearance
16	BOQ_84456 SL no. 5.01 — 400 KV GIS building (PEB) along with GIS bay foundations complete on pile foundation	Since the soil investigation report for the proposed GIS substation is not available in the tender documents, it is difficult to estimate the pile foundation quantities accurately. Therefore, kindly provide the estimated pile quantity in running meters (RMT) or furnish the detailed pile foundation drawings/design criteria to enable proper estimation and submission of a competitive bid.	Soil investigation report will be provided. Design to be prepared as per soil investigation report
17	BOQ_84456 SL no. 6 — Construction of 500 MVA Power Transformer foundation with Burnt Oil Pit on pile foundation.	Since the soil investigation report for the proposed GIS substation is not available in the tender documents, it is difficult to estimate the pile foundation quantities accurately. Therefore, kindly provide the estimated pile quantity in running meters (RMT) or furnish the detailed pile foundation drawings/design criteria to enable proper estimation and submission of a competitive bid.	Soil investigation report will be provided. Design to be prepared as per soil investigation report
18	BOQ_84456 SL no. 7 — Construction of 80 MVAR Bus Reactor foundation with Burnt Oil Pit on pile foundation.	Since the soil investigation report for the proposed GIS substation is not available in the tender documents, it is difficult to estimate the pile foundation quantities accurately. Therefore, kindly provide the estimated pile quantity in running meters (RMT) or furnish the detailed pile foundation drawings/design criteria to enable proper estimation and submission of a competitive bid.	Soil investigation report will be provided. Design to be prepared as per soil investigation report
19	New Item — Rail cum road foundation.	Request you to include a separate BOQ line item for the foundation of the rail-cum-road arrangement. In case pile foundations are envisaged/recommended for the rail-cum-road foundation, kindly provide the relevant reference drawings and design details to enable accurate estimation.	Refer to revised BOQ and Soil Investigation report provided
20	New Item — Bus duct foundation.	Request you to include a separate BOQ line item for the foundation of the bus duct. In case pile foundations are envisaged/recommended for the bus duct foundation, kindly provide the relevant reference drawings and design details to enable accurate estimation.	Refer to revised BOQ
21	Technical — Existing Equipments Make and Model.	We request you to please provide details of existing equipment make and model for CRP, PLCC FOTE at Rangia Station.	CRP and PLCC make is Hitachi. FOTE is Tejas.
22	General — General	We request AEGCL to clearly mention bidder scope regarding dismantling and site clearing work for estimation purposes.	As per Bid and BoQ
23	General — General	Kindly confirm, permission for shutdown (existing and remote end if any) related activities shall be done by AEGCL only. Bidder shall provide necessary support only	Confirm
24	General — Approved vendor list	Request you to please provide approved AEGCL vendor list. Also, please confirm, Powergrid approved vendors are also acceptable.	AEGCL do not have a Vendor List. PGCIL approved vendor list may be referred.
25	General — Approved vendor list	Request you to please provide approved AEGCL vendor list. Also, please confirm, Powergrid approved vendors are also acceptable.	AEGCL do not have a Vendor List. PGCIL approved vendor list may be referred.
26	General — Dismantling Work	Referring to BOQ 84456 for substation portion, there is no dismantling related work is envisaged. Please confirm.	AS PER BOQ and BID
27	Bid Vol-I, SECTION VIII Special Conditions of Contract — Cl 26 Applicable rate for liquidated damages shall not exceed: ½% (half percent) per week. Maximum deduction for liquidated damages: 10 (ten) percent of contract price	We would like to bring to your kind notice many utilities including PGCIL, have modified the said clause to read as " Applicable rate for liquidated damages shall not exceed: .05% per day. Maximum deduction for liquidated damages: 5 (Five) percent of contract price". We propose to modify applicable rate of Liquidated Damages accordingly. Kindly confirm.	AS PER BID

28	Taxes and Duties	We understand that BOCW cess @ 1% is applicable on construction portion only. Please confirm	As per Prevailing Laws
29	Bid Vol-1 — Cl 2.7 Right of Way for Transmission Lines:	As per the tender documents we have noted that any right of way that may be required for execution of transmission line shall be arranged by the Contractor in favour of AEGCL. The scope also includes Identification and demarcation of defense, airport areas and forest land, and plotting, but not limited to, preparation of proposals with necessary drawings/schedules is the responsibility of the Contractor. Even, Access roads to the work site shall be arranged by the contractor at his cost. All necessary compensation in this respect shall be borne by the Contractor. We have further noted that AEGCL will make statutory payment and charges only. AEGCL shall not be responsible for arranging access roads/RoW for transport of material from road side to worksites. For zirat compensation on account of crop damage, plantation damage, tree cutting etc the assessment shall be done jointly by the contractor and AEGCL officials in coordination with the district/revenue officials. In this regard, we wish to bring to your kind attention that, in transmission projects executed by PGCIL as well as various State Transmission Utilities, the responsibility for arranging the Right of Way, including the associated payments/compensation, is generally retained within the scope of the Employer/Utility. This approach also helps in addressing the various issues and complexities that arise during RoW acquisition, particularly in respect of landowners, statutory authorities, compensation assessment, forest/defence/airport areas and local access. Considering the above, we request AEGCL to kindly review the present provision and consider keeping the responsibility for arranging the required RoW, Forest Clearance and other required clearance including associated payments/compensation, within the Employer's scope. Similarly, the responsibility for arranging access roads required for transportation of materials and execution of the works may also kindly be considered under AEGCL's scope, wherever such access involves land acquisition or permissions from landowners/statutory authorities. Such an arrangement would facilitate smoother execution of the project, minimize potential disputes with landowners and other stakeholders, and avoid delays arising from RoW and access-related issues, which are largely dependent on factors beyond the Contractor's direct control. We therefore request AEGCL to kindly consider the above and suitably amend/clarify the tender provisions so that the responsibility for RoW, associated compensation and access-related statutory/landowner issues is appropriately allocated to the Employer.	As per Bid and Corrigendum Issued
30	BOQ_84456 Items under Sr No. 1 of PRICE SCHEDULE 5: Supply_line_400kV Chapar - Agia & PRICE SCHEDULE 8: Supply_line_400kV Chapar - Rangia	Tower wise supply quantities are given in the Price Schedule for both the lines. However, bifurcation of MS / HT and Boltnuts is missing in the given quantities. We request you to kindly provide the quantities of MS, HT and Bolt nuts to enable us to quote.	To be provided during detailed engineering
31	BOQ_84456 Items under Sr No. 18 of PRICE SCHEDULE 7: ETC_line_400kV Chapar - Agia & PRICE SCHEDULE 10: ETC_line_400kV Chapar - Rangia	As per the BoQ, bidder has to quoted for Concreting of foundation including all Labour, materials, equipment, excavation shuttering, head loading, back filling etc complete for handling, transportation, batching, mixing, placing, levelling, curing etc complete inclusive of cost of cement and reinforcement steel. Also provide 300 mm thick boulder soiling below foundation. However, we have noted that quantities of M20, M10, Rebar is inadvertently missing in the BoQ. We request you to kindly provide the bifurcation of M20, M10, Rebar quantities to enable us to quote.	To be provided during detailed engineering. Boulder soling as per BOQ
32	BOQ_84456 Items under Sr No. 21 of PRICE SCHEDULE 10: ETC_line_400kV Chapar - Rangia Items under Sr No. 26.1 of PRICE SCHEDULE 7: ETC_line_400kV Chapar - Agia	We have noted Pile Foundation is in scope of this line. We understand that the Pile Design is in Employer's scope. We also request you to kindly detailed BoQ of Pile Foundation Activities. Please also provide Soil investigation of locations where the work is to be carried out.	To be provided during detailed engineering
33	BOQ_84456 Items under Sr No. 28 of PRICE SCHEDULE 7: ETC_line_400kV Chapar - Agia Construction of Well foundation for Special Suspension Tower	We have noted that well foundation is in scope of this line. We understand that well foundation design is in AEGCL scope. Please provide the location where Well foundation works are to be carried out. Please also provide Soil investigation of locations where the work is to be carried out.	Under scope of TKC. Please refer BID and revised BoQ

34	BOQ_84456 Items under Sr No. 27 of PRICE SCHEDULE 7: ETC_line_400kV Chapar - Agia Design and construction of tower — 27.1 Design of D/C special suspension tower for river crossing with Quad ACSR MOOSE conductor, 48 F (steel tube design) OPGW and sheild wire (7/3.66 mm) alongwith well foundation for D/C special suspension tower for river crossing including geotechnical investigation, hydrological and hydraulic study of the river, determination of HFL and vetting for complete job alongwith Design of D/C Anchor tower with Quad ACSR MOOSE conductor and 48 F (steel tube design) OPGW and sheild wire (7/3.66 mm) alongwith foundation for D/C Anchor tower (Design and vetting) 27.2 Construction of foundation for D/C Anchor tower as per design	We understand that for items covered under Sr No. 27.1, we need to quoted for Design of special suspension tower, Design of well foundation and vetting of design. Futher please also clarify below mentioned points. 1. Design vetting will be done by AEGCL only. Please confirm 2. Please provide preliminary soil investigation reports based on maximum flood level, the water current, scour depth, soil parameters etc. of the particular location(s). Moreover, we understand that for items under Sr No. 27.2, we need to quote rates for Concreting of foundation including all Labour, materials, equipment, excavation shuttering, head loading, back filling etc complete for handling, transportation, batching, mixing, placing, levelling, curing etc complete inclusive of cost of cement and reinforcement steel on per tower basis	Please refer revised BoQ and BID. All will be inclusive of quoted rate.
35	BOQ_84456 Items under Sr No. 26.1 of PRICE SCHEDULE 7: ETC_line_400kV Chapar - Agia Construction of Well foundation for Special Suspension Tower	We understand that bidder has to quote as per quantities mentioned in the BoQ, moreover we understand that well foundation design is in AEGCL scope.	Under the scope of TKC. Please refer revised BoQ.
36	BOQ_84456 PRICE SCHEDULE 10: ETC_line_400kV Chapar - Rangia — Sr No. 22 Design of D/C Line Gantry with foundation for Quad ACSR MOOSE conductor and 48 F (steel tube design) OPGW and sheild wire (7/3.66 mm)	As per price schedule, Foundation design for Gantry structure is required however foundation loads for the same is not given in the specification. Please furnish the same.	Under the design scope of TKC.
37	BOQ_84456 - TL portion — Anti Fog Disc Insulator Stack Disc insulator suitable for Quad ACSR Moose 400 KV TL-210 KN Disc insulator suitable for Quad ACSR Moose (400 KV TL)-320 KN INSULATOR (31mm /kV) Disc insulator suitable for Quad ACSR Moose 400 KV TL-210 KN Disc insulator suitable for Quad ACSR Moose (400 KV TL)-160 KN	As per the BOQ, bidders are required to supply Disc Insulators of 160 kN, 210 kN, and 320 kN ratings. However, for 400 kV D/C Quad lines, 120 kN and 160 kN insulators are normally envisaged. Further, as per the “Principal Parameters of the Disc Insulators” specified in Volume II, Pages 917 & 918, the insulator ratings mentioned in the BOQ (160 kN / 210 kN / 320 kN) do not appear in the corresponding table. It is therefore requested that the Employer kindly provide/confirm the detailed technical specifications and applicable requirements for the Disc Insulators to be supplied under the scope of the BOQ.	As per revised BoQ

38	BOQ_84456 - TL portion — Anti Fog Disc Insulator Stack Disc insulator suitable for Quad ACSR Moose 400 KV TL-210 KN Disc insulator suitable for Quad ACSR Moose (400 KV TL)-320 KN INSULATOR (31mm /kV) Disc insulator suitable for Quad ACSR Moose 400 KV TL-210 KN Disc insulator suitable for Quad ACSR Moose (400 KV TL)-160 KN	Further, it may please be noted that several utilities, including Power Grid, have adopted Polymer (Silicone Rubber Composite) Long Rod Insulators in their tenders as an alternative to conventional Disc Insulators. Composite Long Rod insulators offer potential advantages in terms of weight, handling, installation, and overall cost-effectiveness, while meeting the required electrical and mechanical performance criteria. In view of the above, we request the Employer to kindly consider modifying the BOQ and relevant technical specifications to permit bidders to quote suitable technically compliant alternatives, including Polymeric (Silicone Rubber Composite) Insulators, in lieu of conventional Disc Insulators, subject to compliance with the specified electrical, mechanical, environmental, and performance requirements. This provision would enable bidders to offer technically suitable and cost-effective solutions while maintaining the required reliability and performance of the transmission line.	As per revised BoQ
39	BOQ_84456 - TL portion — Hardware fittings suitable for Quad ACSR Moose Conductor-Double Tension String 160X4 kN &	As per the BoQ 320 KN Insulator to be supplied, whereas in Hardware description it is mentioned as 160*4 kN. Kindly confirm. Moreover, In Quad lines Quad Tension String is envisaged, whereas as per description it is mentioned as Double Tension String. Please confirm.	As per revised BoQ
40	BOQ_84456 - TL portion — POWER CONDUCTOR ACCESSORIES	We have noted that the line to be constructed is 400 kV D/C Quad line. However, the items in Power Conductor Accessories does not have the required items like Quad Spacer Damper. We request you to kindly revise the BoQ.	As per revised BoQ
41	BOQ_84456 - TL portion — Supply - Schedule - 48 Fibre (DWSM) OPGW fibre optic cable (Steel tube) & ETC Schedule - Stringing of 96 Fibre (DWSM)OPGW Fibre Optic cable including transportation and distribution of OPGW and accessories to site and laying, stringing, tensioning , clamping, jointing , complete including all fittings and accessories not specifically mentioned elsewhere per route Km of line alongwith Installation of Hardware set for above 96 Fibre OPGW Fibre Optic cabling including all cable fittings & accessories like suspension assembly, tension assembly, dead end tension assembly at line terminations, tension double end set for splice location, vibration dampers, earthing clamps, down lead clamps, in-line splice enclosures etc.	As per the Supply BoQ 48 fibre OPGW is to be supplied, whereas as per ETC BoQ stringing of 96 Fibre given. WE request you kindly amend the BOQ accordingly.	As per revised BoQ
42	Vol-I -Section - III - Bid Data Sheets — BDS (ITB 2.37.1) a period of 3 (Three) years from the date of its signing.	Contract shall be for As the handing over of encumbrance free land is the primary requirement for the construction of substation, we request that the project commencement date be considered from providing access to and handing over of the encumbrance free land for the substation completion period. Please confirm.	As per Bid. For Substation, the land is emcumbance free land. Site Clearance under the Scope of Contractor.
43	Vol-I -Section - VIII - Special Conditions of Contract (SCC) — SCC Clause No 11 Price shall be firm.	The Contract Considering the prevailing geopolitical uncertainty in the middle east & Europe and amidst fluctuating market dynamics, the commodity prices have reached multi-year highs, especially Copper, Steel & Aluminium. Hence, to deal with such fluctuation, we request that the price variation be permitted for Transformer, Reactor, CB, ITR, LA, Cables, Conductors, Steel Structures and Installation works incl Civil as per IEEMA formula and indices without any ceiling which is followed by other utilities also. Request your acceptance.	As per Bid and Corrigendum Issued

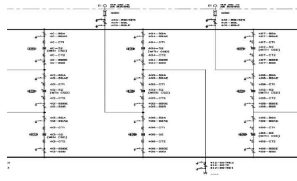
44	Vol-I -Section - IX - Contract Forms — APPENDIX 1:TERMS AND PROCEDURES OF PAYMENT (A) Terms of Payment Schedule No. 1 & 2 - Plant and Mandatory Spare Parts Supplied from Abroad and Within the Employer's Country respectively. In respect of plant and mandatory spare supplied from abroad and within the Employer's country, the following payments shall be made: A. Progressive payments for supply items: 1. Within 60 (sixty) days from the date of submission of the invoice against supply, not more than 75% (seventy percent) payment of the total supply invoice value would be made, on receipt and acceptance of materials in full and good conditions (subject to availability of fund). However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Remaining 25% (Twenty Five percent), retention amount of that item would be released subject to fulfillment of the following conditions – (a) 15% supply amount would be paid on completion of 50% of the total erection works of that particular item (b) within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount 5% would be paid upon issue of the Completion Certificate and balance 5% upon issue of the Operational Acceptance Certificate as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority.	Considering the green energy corridor, all the customers are providing advance payments for securing the deliveries considering the huge volume of commodity involvement in the major items like Transformers, reactors, GIS, AIS Equipments and conductors. Considering the same we request the below amendment which in line with PGCIL and other utilities. (A) Terms of Payment Schedule No. 1 & 2 - Plant and Mandatory Spare Parts Supplied from Abroad and Within the Employer's Country respectively. In respect of plant and mandatory spare supplied from abroad and within the Employer's country, the following payments shall be made: A. Advance Payment (Interest Free) 10% of the Contract Value shall be paid as an initial advance within Thirty (30) days from the date of LOI against submission of following supporting documents: (a) Proforma Invoice (b) Acceptance of LOI (c) ABG of equivalent amount. B. Progressive payments for supply items: 1. Within 30 (thirty) days from the date of submission of the invoice against supply, not more than 80% (eighty percent) payment of the total supply invoice value would be made, on receipt and acceptance of materials in full and good conditions (subject to availability of fund). However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Remaining 10% (Ten percent), retention amount of that item would be released subject to fulfillment of the following conditions – (a) within 30 (thirty) days after receipt of invoice out of remaining 10% of the supply amount 5% would be paid upon issue of the Completion Certificate and balance 5% upon issue of the Operational Acceptance Certificate as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority. Request your acceptance.	As per Bid and Corrigendum Issued
45	Vol-I -Section - IX - Contract Forms — APPENDIX 1:TERMS AND PROCEDURES OF PAYMENT In respect of installation services, the following payments shall be made: A. Progressive payments for Erection Works: 1. Within 60 (sixty) days from the date of submission of invoice against foundation, erection & civil works, not more than 90% (ninety percent) of the total verified invoice would be made. However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Within 60 (sixty) days after receipt of invoice out of remaining 10% of the supply amount 5% would be paid upon issue of the Completion Certificate and balance 5% upon issue of the Operational Acceptance Certificate as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority. In the event that the Employer fails to make any payment on its respective due date, the Employer shall not pay any interest to the Contractor.	Kindly amend the Service Payment Terms as below, In respect of installation services, the following payments shall be made: A. Advance Payment (Interest Free) 10% of the Contract Value (excluding Freight and Transit Insurance Charges and GST) shall be paid as an initial advance within Thirty (30) days from the date of LOI against submission of following supporting documents: (a) Proforma Invoice (b) Acceptance of LOI (c) ABG of equivalent amount. B. Progressive payments for Erection Works: 1. Within 30 (thirty) days from the date of submission of invoice against foundation, erection & civil works, not more than 80% (eighty percent) of the total verified invoice would be made. However, GST amount on invoice would be paid 100% or as per Govt. Rules. 2. Within 30 (thirty) days after receipt of invoice out of remaining 10% of the supply amount 5% would be paid upon issue of the Completion Certificate and balance 5% upon issue of the Operational Acceptance Certificate as per clause 25, 26 & 27 of GCC, which should be certified by the Project Authority. Request your acceptance.	As per Bid and Corrigendum Issued
46	Vol-I -Section - IX - Contract Forms — APPENDIX 1:TERMS AND PROCEDURES OF PAYMENT In the event that the Employer fails to make any payment on its respective due date, the Employer shall not pay any interest to the Contractor.	In line with prevailing terms of payment in majority of PSUs / power utilities, please include the provision of payment of interest on delayed payment by the employer beyond 30 days from the date of Invoice certification.	As per Bid
47	General — - Source of Fund	Please provide the source of fund for this project	Internal Source of AEGCL
48	Vol-I -Section - VIII - Special Conditions of Contract (SCC) — SCC Clause No 26.22 0.5% for each week to maximum of 10% of the contract Price	Kindly amend the clause as below, The tenderer should note that the completion time allowed for carrying out the work should be strictly observed. Any delay that may take place in achieving Completion of the works beyond Contractual Time of Completion in the Contract shall be subject to Liquidated Damages (LD), and not by way of penalty, at the rate of 0.5% for each week or part thereof, of the value of unexecuted works. The aggregate amount of such liquidated damages shall in no event exceed 5% of the value of unexecuted works (inclusive of GST).	As per Bid
49	Vol-I -Section - VI - General Conditions of Contract (GCC) Vol-II: Information to Bidders (ITB) — Clause -10.2 & 10.3 / Clause 2.7 I GCC ROW, Statutory Approvals including forest and tree cuttings are in AEGCL scope. As per BID VOL-II ITB ROW, Statutory Approvals including forest and tree cuttings are in Contractor scope.	GCC Clause 10.2 & 10.3 and ITB Clause 2.7 of Bid Vol-II appear to be contradictory regarding the responsibility for ROW clearance and statutory approvals. Considering GCC provisions, ROW clearance, statutory approvals, forest clearance and tree cutting permissions are in the scope of AEGCL in line with state / central utilities. Please confirm.	As per Bid and Corrigendum Issued
50	Vol-I -Section - II - INSTRUCTIONS TO BIDDERS (ITB) Vol-II: Chapter 2: Information to Bidders (ITB) — - Two ITB's available in the tender	We observe that two different versions of the Instructions to Bidders (ITB) are provided in the Tender Documents. Kindly clarify which version of the ITB shall be considered and followed for the purpose of bid preparation and submission.	One is Instructions to Bidder and other is Information to Bidder.

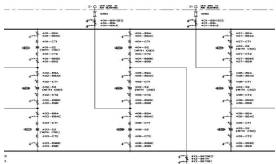
51	Vol-I -Section - VII - General Conditions of Contract (GCC) — SCC Clause No 25.3 and (d) any minor items mentioned in GCC Subclause 24.7 hereof relevant to the Facilities or that part thereof have been completed.	and (d) any minor items mentioned in GCC Subclause 24.7 hereof relevant to the Facilities or that part thereof have been completed. Since DLP is in bidder scope, minor punch points will be attended during the DLP. Request to delete the above clause.	As per BID
52	Vol-I -Section - VIII - Special Conditions of Contract (SCC) — Clause -27.10.b The Tenderer shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years to cover the extended defect liability period	We request AEGCL to kindly remove the 20% additional performance guarantee for GIS equipment.	As per Bid and Corrigendum Issued
53	Vol-I -Section - III - Bid Data Sheets — Clause No ITB 2.11.1 (xv) iv. Undertaking between the GIS Manufacturer and authorised agents in India to provide service facility as per clause V of 4.2.1(c) (Subcontractor- GIS) of section IV (Evaluation and Qualification requirement)	We presume that the undertaking is required from manufacturer of GIS during detail engineering. Kindly confirm.	As per Bid
54	Vol-I -Section - VIII - Special Conditions of Contract (SCC) — SCC Clause No 7.3 The Contractor agrees to supply spare parts for a period of years: Ten (10) Years. An undertaking to the effect that the spare parts shall be made available to AEGCL by the contractor for a period of ten (10) years should be furnished by the contractor. The undertaking shall be under ought by the contractor executed through non-judicial stamp paper of Rs. 100/- or above to be notarized in India. The Contractor shall carry sufficient inventories to ensure an ex-stock supply of consumable spares for the Plant. Other spare parts and components shall be supplied as promptly as possible, but at the most within 6 months of placing the order. In addition, in the event of termination of the production of spare parts, advance notification will be made to the Employer of the pending termination, with sufficient time to permit the Employer to procure the needed requirement. Following such termination, the Contractor will furnish to the extent possible and at no cost to the Employer the blueprints, drawings and specifications of the spare parts, if requested.	Please confirm the said clause is applicable only for Transformers, Reactors & GIS Equipment	Confirm
55	Volume-I, Section VII - General Conditions Of Contract (GCC) — GCC Clause No 41 SUSPENSION OF WORK BY CONTRACTOR ON EMPLOYERS DEFAULT'S	We request the inclusion of a provision granting the Contractor the right to suspend the Works if: (a) the Employer has failed to pay the Contractor any sum due under the Contract within the specified period, has failed to approve any invoice or supporting documents without just cause pursuant to the Payment terms to the Contract Agreement, or commits a substantial breach of the Contract, the Contractor may give a notice to the Employer that requires payment of such sum, requires approval of such invoice or supporting documents, or specifies the breach and requires the Employer to remedy the same, as the case may be. If the Employer fails to pay such sum together with such interest, fails to approve such invoice or supporting documents or give its reasons for withholding such approval, or fails to remedy the breach or take steps to remedy the breach within 14 days after receipt of the Contractor's notice; or (b) the Contractor is unable to carry out any of its obligations under the Contract for any reason attributable to the Employer, including but not limited to the Employer's failure to provide possession of or access to the Site or other areas in accordance with contract , or failure to obtain any governmental permit necessary for the execution and/or completion of the Facilities, then the Contractor may by 14 days' notice to the Employer suspend performance of all or any of its obligations under the Contract, or reduce the rate of progress If the Contractor's performance of its obligations is suspended, or the rate of progress is reduced , then the Time for Completion shall be extended and any and all additional costs or expenses incurred by the Contractor as a result of such suspension or reduction shall be paid by the Employer to the Contractor in addition to the Contract Price, except in the case of suspension order or reduction in the rate of progress by reason of the Contractor's default or breach of the Contract.	As per BID
56	Volume-I, Section VII - General Conditions of Contract (GCC) — GCC Clause No 14 BOCW	We understand that BOCW is applicable only on the Erection contract value. Please confirm. Also, please indicate the % of BOCW.	As per prevailing Laws
57	General Order of Precedence	In case of contradictions among BOQ, scope of works & technical specifications, kindly confirm the order of precedence.	Refer BoQ

58	Vol-I -Section - II - Instructions to Bidders (ITB) — Clause No 2.2Bid Security: Guarantee	EMD Bank	Please provide the Bank details for SFMS confirmation	Enclosed with Pre-Bid MoM
59	General		In case of discrepancy between Technical Specification, BOQ and Bid Purpose Drawings, kindly confirm the order of precedence to be followed.	Refer BoQ
60	BoQ1 -Sr. No.-1: Isolators and accessories as per specification.		As per the reference clause, 220kV HDB isolator with 1 ES = 6 sets 220kV HDB isolator without ES = 4 sets However as per the SLD & Layout, 220kV HDB isolator with 1 ES = 1 set 220kV HDB isolator with 1 ES (Tandem) = 1 set 220kV HDB isolator without ES = 8 sets Kindly confirm the actual requirement.	As per BoQ
61	BoQ1, Sl. No. 2.01		The reference clause specifies 7 sets of double tension strings, whereas the actual requirement for 2 lines is only 6 sets. We understand the additional 1 set is intended as a spare. Kindly confirm.	As per BoQ
62	BoQ1, Sl. No. 2.02 & Agia 400 kV & 220 kV Switchyard Section		A) The reference clause specifies 7 sets of double suspension string, whereas the actual requirement for 2 lines is only 6 sets. We understand the additional 1 set is intended as a spare. Kindly confirm. B) Additionally, the reference drawing does not indicate any suspension insulator. We are therefore proceeding as per the BOQ. Kindly confirm.	As per BoQ
63	BoQ1, Sl. No. 2.03		The reference clause specifies 7 sets of double tension strings, whereas the actual requirement for 2 lines is only 6 sets. We understand the additional 1 set is intended as a spare. Kindly confirm.	As per BoQ
64	BoQ1 -Sr. No.-2: & Agia 400 kV & 220 kV Sw.yard Section		As per the reference clause, 220kV, 2x120kN double suspension string suitable for Twin ACSR Moose conductor = 43 sets 220kV, 2x160kN double tension string suitable for Twin ACSR Moose conductor = 43 sets 220kV, 4x160kN double tension string suitable for Quad ACSR Moose conductor = 37 sets However as per the Layout, 220kV, 2x120kN double suspension string suitable for Twin ACSR Moose conductor = 36 sets +1 spare = 37 sets 220kV, 2x160kN double tension string suitable for Twin ACSR Moose conductor = 36 sets +1 spare = 37 sets 220kV, 4x160kN double tension string suitable for Quad ACSR Moose conductor = 42 sets +1 spare = 43 sets Kindly confirm the actual requirement.	As per BoQ
65	Vol-II, Ch-2 Scope of Works, Station Auxiliary SLD, BOQ Station Transformer Item		Technical Specification specifies 2 x 1000 kVA Station Transformers, whereas the Auxiliary SLD and BOQ indicate 2 x 630 kVA Station Service Transformers. Kindly confirm the rating to be considered.	As per BoQ
66	BoQ1 - Sr. No. 13.01 & BoQ11 - Sr. No. 9.01		We are not considering any PIR or CSD for 400kV line bay. Kindly confirm.	As per revised BoQ
67	Aux SLD - Sub DB requirement		Please confirm wheather a spearate Sub DB is required for 220KV voltage level in switch yard kiosk	During Detailed Engineering
68	FOTE - Requirement		BOQ says 2 nos SDH panel for new station and 4 nos DTPC for the existing Rangia station. We understand that Rangia station do have the SDH panel we need to integrate our line DTPC to that. Those 2 new SDH panel will be installed in Agia station itself.	SDH panel available in Rangia Substation. Out of two SDH panel, one to be installed at Agia and other in Chapor
69	PLCC CHAPTER 2: INFORMATION TO BIDDERS(ITB)		PLCC BOQ says 8 LMU . PLCC in Agia and Ragia need to be installed . And the equipments for chaper station we just need to supply as loose item	During Project Implementation
70	Chapter 29 - PLCC/Communication		Kindly clarify whether PLCC system shall be used for Teleprotection only or Teleprotection + Speech communication or Teleprotection + Speech + Data communication.	Teleprotection + Speech + Data communication
71	Vol-II, Scope of Works - Rangia GIS Extension		Kindly provide existing GIS OEM make, model at Rangia New (Tampur).	Hyosung
72	Vol-II, Scope of Works - Rangia GIS Extension		Kindly provide existing GIS Single Line Diagram, General Arrangement Drawing and Gas Compartmentalization drawings to facilitate extension engineering.	During Detailed Engineering
73	General input		Kindly provide following existing drawings for the proposed extension area. 1) Existing GIS building Earthmat layout 2) Existing GIS building , Relay panle room and AHU room cable trench layout 3) Existing control building layout 4) Existing Lightning Protection (DSLPL) Layout of GIS buildings 5) Existing GIS hall illumination layout 6) Visual monitoring system (VMS) layout of GIS building	During Detailed Engineering
74	Cable trench Details		Kindly confirm whether cable trench is available up to the location of the extension scope.	During Detailed Engineering
75	Auxiliaries		Kindly confirm whether existing 220V and 48V battery & battery charger are sized by considering future extension of bays under presents scope.	Existing Battery and Charger are sufficient for all future extensions.

76	Chapter 15 - SAS	Kindly provide existing SAS architecture at Rangia New (Tampur) including Gateway make, HMI platform, Ethernet Switch architecture, existing licences and available spare capacity.	During detail engineering. Gateway make is Hitachi.
77	Chapter 14 - Protection	Kindly provide make, model, arrangement and available spare capacity of existing Busbar Protection System.	During detail engineering. Busbar panel make is Hitachi. Spare present for all future extensions.
78	Chapter 29 - Communication	Kindly provide existing SDH / FOTE make, model, communication architecture and spare interface availability at Rangia New (Tampur).	During detail engineering. Existing FOTE make is Tejas.
79	Existing VMS	We have not included any CCTV supply or integration with the existing VMS in our scope. Please confirm.	As per BoQ
80	Existing Station Integration	Any hardware/software upgrade required in existing SAS, Gateway, HMI, Networking or Busbar Protection System for integration of new bays at station level shall be treated as extra scope	No upgradation required. Only integration as per BoQ.
81	BoQ11, Sl. No. 1.01	The reference clause specifies 7 sets of double tension strings, whereas the actual requirement for 2 lines is only 6 sets. We understand the additional 1 set is intended as a spare. Kindly confirm.	As per BoQ
82	BoQ11, Sl. No. 1.02 and RANGIA TAMPUR SS CHAPAR LINE BAY LAYOUT AND SECTION 31-08-26-Model	A) The reference clause specifies 7 sets of double suspension string, whereas the actual requirement for 2 lines is only 6 sets. We understand the additional 1 set is intended as a spare. Kindly confirm. B) Additionally, the reference drawing does not indicate any suspension insulator. We are therefore proceeding as per the BOQ. Kindly confirm.	As per BoQ
83	General - Auxiliary Supply	We understand that the existing ACDB and DCDB have sufficient spare feeders to accommodate the current scope of work. Kindly confirm the same and provide the locations of the existing ACDB and DCDB.	Spare feeder available for current scope. Location shall be shared during detail engineerin
84	Existing Earthing	We understand that the main earth mat (40mm dia MS rod) is already available for the proposed extension bay. Kindly confirm. If yes, please also confirm the existing earth mat spacing.	Earthing equipment included in BoQ. Earthing shall be done wherever necessary.
85	BOQ_ Sheet BOQ 5, 6, 8 and 9 S.No.1 — Supply of type tested towers	We understand that employer had existing type tested Tower and gantry design. The required basic input like sag-tension, Tower spotting data, GA drawings, shop drawings and Bill of Materials (BOM) shall be provided by the Client for construction and erection purposes. Kindly Confirm.	Confirm
86	"BID VOL-2 TL Portion / Clause-1.1.4 / Page no. -25/134" "BOQ / BOQ-7" — As per BID VOL-2 TL Portion / Clause-1.1.4 / Page no. -25/134 mentioned as "NUMBER OF CONDUCTOR PER PHASE -2 " whereas as in the BOQ7 specified as NUMBER OF CONDUCTOR PER PHASE - Quad	Please confirm the Number of conductors per phase fro both lines	Both TLs shall have quad moose conductor i.e., 4 conductors per phase
87	"BID VOL-2 TL Portion / Clause-38.1.8.0 / Page no. -16/134" — as per IS-802-2015, Part 1, sec 1	Please confirm loads on tower need to be considered as per latest addendum of IS:802-2015, Part 1/Sec 1.	Confirmed
88	"BID VOL-2 TL Portion / Clause-38.1.5.0 / Page no. -15/134" — Slenderness ratio for members shall be computed in accordance with Clause 10 of IS: 802. The limiting values of L/R shall be as follows: (a) Leg members, G.W. peak and cross arm lower member: 150 (b) Bracings: 150 (c) Redundant members and those carrying nominal stress: 250 (d) Tension member: 400	Please confirm Slenderness ratio limit need to be considered as per latest addendum of IS:802.	As per latest code
89	"BID VOL-2 TL Portion / Clause-40.4.4 / Page no. -51/134" — The special foundations like pile foundations if required shall also be designed by the Owner based on detailed soil investigation report. The working drawing of these foundations shall be provided by the Employer to the Contractor during execution stage based on requirements.	We understand that Pile foundation design is done by client. The detailed pile foundation design, including design calculations, geotechnical evaluation requirements, and issued-for-construction drawings, shall be provided during the execution stage by the Client. The Contractor's responsibility shall be limited to the construction of the pile foundations in accordance with the approved drawings and specifications provided. Please Confirm.	During Detailed Engineering
90	"BOQ / BOQ-6 / 18" — Insulator	As per BOQ requirement only Disc Type of insulator needs to be used, please confirm.	Confirmed

91	BOQ / BOQ-7_5.No 26.1 & BOQ-10_5.No 20 — Providing, driving with hydraulic piling rigs with power unit and installing driven cast-in-situ reinforced cement concrete piles of grade M25 including the cost of reinforcement steel, cost of boring with temporary guide casting bentonite solution (length of the pile for payment shall be measured from the Ground Level). The pile top should be chipped off to remove laitance concrete above cut off level 0.75m from the top of the pile (no additional payment shall be done for laitance concrete and its removal). The unit rate should include excavation, dewatering, socketing, anchoring (if required), backfilling, form work for placing plain or reinforced cement concrete, supply & providing MS liner of 8 mm thick (length of the liner shall be as per geotechnical report) in piles from the Ground Level, necessary labour, materials, plants, tools and tackles and mobilization of piling rig including preparation of work space, approach road, dewatering, arrangement of electricity, jungle clearing, earth filling and making all arrangement for completion of the work and construction and supply of all materials & labours of temporary island/platform to facilitate the construction of foundation including platform for storage of construction materials such as stone chips, sand, cement, steel reinforcement bar, mixture machines, tools & plants all foundation materials keeping & mixing. (Payment will be made as per actual length of the piles executed and rate shall be inclusive of integrity test on each pile)	1. The effort, productivity, equipment selection, and drilling methodology for pile installation vary significantly depending on the encountered strata, such as soil, soft rock, and hard rock. Since the current BOQ provides a single item for pile drilling irrespective of geological conditions, we request you to provide separate BOQ items for drilling in soil, soft rock, and hard rock to facilitate fair valuation of the actual work executed. 2. Pile reinforcement requirements are highly location-specific and depend on several factors, including soil parameters, tower type, loading conditions, and scour depth. As a result, the reinforcement quantity can vary substantially from one location to another and cannot be accurately correlated with the pile length BOQ item. Therefore, we request you to exclude reinforcement from this pile foundation item and provide a separate BOQ item for supply, fabrication, and placement of reinforcement steel for piles, with payment based on actual measured quantity in tonnage (MT).	During Detailed Engineering. Any changes encountered during detailed engineering or during execution of work will be amended as required.
92	BOQ / BOQ-7_5.No 27.1 — Design of D/C special suspension tower for river crossing with Quad ACSR MOOSE conductor, 48 F (steel tube design) OPGW and shield wire (7/3.66 mm) alongwith well foundation for D/C special suspension tower for river crossing including geotechnical investigation, hydrological and hydraulic study of the river, determination of HFL and vetting for complete job alongwith Design of D/C Anchor tower with Quad ACSR MOOSE conductor and 48 F (steel tube design) OPGW and shield wire (7/3.66 mm) alongwith foundation for D/C Anchor tower (Design and vetting)	Please confirm whether AACSR Moose conductor can be adopted for the river crossing locations in lieu of the specified ACSR Moose conductor. The higher tensile strength and improved strength-to-weight ratio of AACSR conductor may result in reduced conductor sag, thereby enabling optimization of tower heights and associated foundation requirements.	As per revised BoQ
93	Bramaputra River crossing Special Suspension tower and Anchor Tower — Expected ruling span, wind span and weight span considered for Brahmaputra crossing special towers.	Design details are extracted based on the tower schedule provided. Please confirm the design spans to be considered for the following transmission line towers: River Crossing Tower Wind Span: 1000 m Weight Span: 1000 m Anchor Tower Wind Span: 400 m Weight Span: +600 m / -300 m	Shall be in the scope of TKC and shall be finalized during detailed engineering
94	River crossing BOQ — Bramaputra River crossing Special Suspension tower and Anchor Tower	Request to arrange separate BOQ for River crossing towers accessories, hardware fittings, Insulator, OPGW & Earth wire.	As per BoQ
95	Bramaputra River crossing Special Suspension tower and Anchor Tower	For foundation design requirements, construction methodology, and associated risks for the river crossing section, we request you to provide the following information for the Brahmaputra River crossing: Hydraulic study/report indicating: Design scour depth High Flood Level (HFL) Low Water Level Design discharge/flow rate Flow velocity Navigation requirements River regime and morphological data, if available Geotechnical investigation reports, borehole logs, and foundation details of the existing towers located within or adjacent to the proposed crossing corridor. The above information is required for tender-stage evaluation of foundation construction methodology, temporary works, construction risks, and cost assessment.	Under the scope of TKC.
96	"BOQ / BOQ-7 / 29.6" — Special Suspension tower - Well Foundation	As per BOQ, 14m circular well is provided, as per that we understood well foundation diameter need to consider 14m only.	The design of well foundation is under EPC's scope
97	General — River works and temporary facilities	The provision of floating platforms, barges, temporary access roads, construction islands, and other temporary works required for river crossing execution shall be under separate BOQ item.	The quoted rates for the items mentioned in BOQ for well foundation job shall include all incidental and miscellaneous charges.

98	4.2.1 ©- I Manufacturers/Subcontractor page 32 of 149 — The manufacturer should have designed, supplied, erected, tested and commissioned on supply cum erection basis at least 3 (three) nos. GIS installations of 400kV or above voltage level in India during last 7(seven) years having minimum 5 (five) nos. complete GIS Bays and which should be under satisfactory operation for at least 1 (one) year as on the originally schedule date of tender opening (Certificate of original customer to be submitted).	As GIS OEM responsibility is Supply+ Supervision hence we request you to kindly amend this clause accordingly. (This amendment already made in Rangia pkg & the copy of same we have encloed for your kind reference. REQUEST FOR AMENDMENT - The manufacturer should have designed, supplied, erected, tested and commissioned on supply cum supervision (erection, testing and commissioning) at least 3 (three) nos. GIS installations of 400kV or above voltage level in India during last 7(seven) years having minimum 5 (five) nos. complete GIS Bays and which should be under satisfactory operation for at least 1 (one) year as on the originally schedule date of tender opening (Certificate of original customer to be submitted).	Accepted																		
99	4.2.1 ©- V Manufacturers/Subcontractor page 33 of 149 — The Tenderer shall furnish performance guarantee for an amount of 20% of the ex-works cost of GIS equipment(s) for a period of five (5) years after completion of the defect liability period.	Being the product is established from long hence we rquest you to kindly remove this clause.	As per Corrigendum Issued																		
100	BOQ_84456 — - — Spare part requirement	We would like to inform that Spare part requirement is not mentioned in BPS. In case it is required request you to please share the list as part of BPS/BOQ.	As per BoQ																		
101	BOQ_84456 — SR.NO 15 — Testing & Maintenance Equipment	We understood that Testing & Maintenance Equipment as mentioned under Sr. No. 15 of the BOQ is to be supplied. Further, testing & maintenance equipment list as mentioned under Sr. No. 16.14 of TS (Chapter 16) is not required for this project. Kindly confirm.	As per BoQ																		
102	BOQ_84456 — - — Bus Bar rating <table><tr><td>8.03</td><td>3- Ø 400kV, 5000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - Bus bar Module each enclosed in bus bar enclosures running along the length of the switchgear to interconnect each of the circuit breaker bay modules in One and Half breaker configuration as per technical specification alongwith Adapter Module for integration of the new bays with the existing GIS alongwith Extension module with all necessary arrangements for future extension of the GIS in One & Half Breaker</td><td>Item#BOCode3</td><td>2.00</td><td>Set</td><td>0.00</td></tr></table>	8.03	3- Ø 400kV, 5000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - Bus bar Module each enclosed in bus bar enclosures running along the length of the switchgear to interconnect each of the circuit breaker bay modules in One and Half breaker configuration as per technical specification alongwith Adapter Module for integration of the new bays with the existing GIS alongwith Extension module with all necessary arrangements for future extension of the GIS in One & Half Breaker	Item#BOCode3	2.00	Set	0.00	Please note that the bus bar rating for the Rangia extension will be considered as per the existing GIS bus 4000A. Kindly confirm.	As per revised BoQ												
8.03	3- Ø 400kV, 5000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - Bus bar Module each enclosed in bus bar enclosures running along the length of the switchgear to interconnect each of the circuit breaker bay modules in One and Half breaker configuration as per technical specification alongwith Adapter Module for integration of the new bays with the existing GIS alongwith Extension module with all necessary arrangements for future extension of the GIS in One & Half Breaker	Item#BOCode3	2.00	Set	0.00																
103	BOQ_84457 — - — CSD <table><tr><td>9</td><td>400 kV GIS Equipment (As per specification)</td><td>Item#B</td><td>2.00</td><td>Set</td><td></td></tr><tr><td>9.01</td><td>3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module as per technical specification</td><td>Item#BOCode1</td><td>1.00</td><td>Set</td><td></td></tr><tr><td>9.02</td><td>3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module with CSD as per technical specification</td><td>Item#BOCode2</td><td>1.00</td><td>Set</td><td></td></tr></table>	9	400 kV GIS Equipment (As per specification)	Item#B	2.00	Set		9.01	3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module as per technical specification	Item#BOCode1	1.00	Set		9.02	3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module with CSD as per technical specification	Item#BOCode2	1.00	Set		Please note that the CSD for the line bay is not mentioned. However mention for the TIE bay. Kindly confirm the scope of supply Kindly confirm.	As per revised BoQ
9	400 kV GIS Equipment (As per specification)	Item#B	2.00	Set																	
9.01	3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module as per technical specification	Item#BOCode1	1.00	Set																	
9.02	3- Ø 400 kV, 4000 A, 63 kA-3 sec. metal enclosed SF6 Gas Insulated Switchgear - One bay Module with CSD as per technical specification	Item#BOCode2	1.00	Set																	
104	Agia 400kV SLD revised 31-08-26-Model — - — BUS VT 	Please note that in the received SLD, a Bus CVT is indicated. However, as per the standard GIS design, an Inductive Voltage Transformer (IVT) shall be provided for the GIS scope. CVT has not been considered. Kindly review and confirm.	Accepted																		
105	Agia 400kV SLD revised 31-08-26-Model — - — Star shown in Tie bay 	Please note that a star (*) mark is indicated for the CT and CB in the Tie Bay in the received SLD. However, the scope and requirement corresponding to this indication are not clear. Kindly clarify the scope and requirement for the CT and CB marked with (*). Kindly review and confirm.	Refer Chapter 2 " Information to Bidders" of Volume-II																		

106	Agia 400kV SLD revised 31-08-26-Model — — CT VT data 	Please note that, as per the received BOQ and SLD, the CT data is not mentioned for both substations for RANGIA EXTN. We will consider the data as per the existing GIS data. Also, for Agia substation, under SoW (Cl 2.6) only CT ratio and Class is mentioned, without other CT parameters. So we will consider parameters as per CT feasibility. Below ratio we will consider Line feeder bay module-3000-2000-1000/1A, (0.25-PX-PX-PX-PX PX) ICT bay module-2000-1000-500A/1, (0.25-PX-PX-PX-PX PX) 6-core Bus Reactor Bay-2000-1000-500/1A, (0.25-PX-PX-PX-PX PX) 6-core Tie Bay module- 4000-3000-2000-1000/1A, (0.25-PX-PX PX-PX-PX) 6-core The GIS OEM shall submit the detailed CT and VT parameters in the SLD. The GIS OEM can comply only with the specified parameters, subject to design feasibility. Any changes to the specified parameters shall be subject to design feasibility and may have cost implications, if applicable. Kindly confirm.	Refer Chapter 2 "Information to Bidders" of Volume-II
107	TECHNICAL SPECIFICATION FOR GIS — C.I 16.4.8 Page no 291/939 — Elbow double mitered elbows shall be used with bus duct depending on mechanical stress. Single or	The GIS OEM has a standard Design which type tested and supplied to numerous projects, including AEGCL. Also, the elbow design is casted type. Hence, the same type-tested design shall elbow shall be used for this project. Please accept as per the type-tested design.	As per Type Tested Design
108	TECHNICAL SPECIFICATION FOR GIS — C.I 16.4.14 Page no 293/939 — Stroboscopic Stroboscopic port shall also be provided.	Please note that the We will provide the Boroscope against this Model FLIR VS80. if there is any specification then kindly provide the same. Kindly confirm.	During Detailed Engineering
109	TECHNICAL SPECIFICATION FOR GIS — C.I 16.4.48 Page no 299/939 — UHF Sensor adequacy of number of sensors and their location shall be verified at site as per recommendations of above CIGRE Document No. 654. In case during site testing, additional UHF sensors are required, the same shall also be supplied & installed to complete the technical requirement. However	The UHF sensor location and quantities are determined during the detail engineering stage. And UHF PD test will be done at the factory. Since the sensor is already technically verified during the design and testing stages, there is not need for additional sensors at site. Kindly accept the same.	During Detailed Engineering
110	TECHNICAL SPECIFICATION FOR GIS — C.I 16.4.4.49 9) Page no 300/939 — GIB manufacturer as per their design shall preferably use maximum three standard straight horizontal outdoor bus duct lengths for entire GIS installation to optimize the spare requirement. GIS	We would like to inform you that, the GIB layout is governed by many factors such as site condition, Gas to Air Bushing location, GIS OEM design, clearances etc. Hence keeping the GIB types to three is not possible. We shall use least number of types as possible for GIB layout. we cannot apply using of maximum three standard straight horizontal outdoor bus duct lengths, but we will try to reduce and optimize the GIB type during the detail engineering stage Kindly accept the same.	During Detailed Engineering
111	TECHNICAL SPECIFICATION FOR GIS — C.I 16.5.15 Page no 300/939 — PIR requirement Pre insertion resister: 400 kV circuit breakers for line bay (as per the provisions of bid proposal sheet) shall be provided with single step pre insertion closing resistors (wherever the requirement of PIR is explicitly specified so) to limit the switching surges to a value of less than 2.3 p.u for 400kV.	Please note that, as per the received BOQ and SLD, the PIR requirement is not mentioned; the same shall not be considered in the GIS scope. Also, CSD is considered for the transformer bay & Tie bay module as mentioned in the BOQ for the AGIA substation. & for the TIE bay with CSD for the RANGIA substation. Kindly confirm.	As per BoQ
112	TECHNICAL SPECIFICATION FOR GIS — C.I 16.4.4.52 XXV) Page no 302/939 — Additional CB Data Additional CB data to be furnished during detailed engineering : a) Design data on capabilities of circuit breakers in terms of time and number of operations at duties ranging from 100 % fault currents to load currents of the lowest possible value without requiring any maintenance or checks. b) Curves supported by test data indicating the opening time under close open operation with combined variation of trip coil voltage and hydraulic pressure. c) Contact Travel: Operating mechanism operating shaft travel and contact overlap of Circuit Breaker to be provided xxv.	Please note that the CB is type-tested and type test report will submit during detail engineering no need of additional data. Kindly accept.	As per Type Tested Design
113	TECHNICAL SPECIFICATION FOR GIS — C.I 16.5.1.22.2.1 Page no 319/939 — IP 55 degree of protection of enclosure of LCC shall be IP55 Minimum The mechanism shall be housed in a dust proof cabinet and shall have IP: 55 degree of protection.	We would like to inform you that, As per the received documentation we understand that the present scope GIS will be placed in inside GIS hall. The indoor GIS won't be subject to harsh environmental conditions thus we request you to kindly consider IP 44 Rating for OM box and IP 42 for LCC. Kindly accept the same,.	As per BID

114	TECHNICAL SPECIFICATION FOR GIS — C.I 16.5.1.14.2.19 Page no 310/939 — Endurance Class DS mechanical endurance class shall be M2 as per IEC for 400kV, 220 kV and 132kV disconnectors. Electrical endurance class shall be E2.	The	The disconnecter has mechanical endurance class of M2 and electrical endurance class is not applicable. Kindly accept the same.	As per Type Tested Design
115	TECHNICAL SPECIFICATION FOR GIS — C.I 16.5.1.15.10 Page no 311/939 — Endurance Class ES safety grounding switches shall conform to the requirements of IEC- 62271- 102 and shall have electrical endurance class: E2 & shall have mechanical endurance class M2 for 400 kV/220/132 kV voltage level..	The	We would like to inform you that, Our Maintenance earthing switch is type test for electrical endurance class of E0 as per IEC 62271-102. Kindly accept the same.	As per Type Tested Design
116	TECHNICAL SPECIFICATION FOR GIS — C.I 16.5.1.13 Page no 312/939 — Endurance Class HE5 These shall confirm to class F and electrical endurance class E2 and mechanical endurance class M2.	These shall	We would like to inform you that our fast-acting earthing switch is type-tested for Class B electrical endurance class E1 & mechanical endurance class M1 as per IEC 62271-102. Kindly accept the same.	As per Type Tested Design
117	TECHNICAL SPECIFICATION FOR GIS — C.I 16.7.6 Page no 326/939 — - of such a design review shall at least include the following: 24. Proper Interfacing of High voltage test bushing. 25. TEV calculation for proper designing of insulators and bushings. 26. Ferro Resonance test report for GIS VT 27. Calculation of thermal expansion due to temperature rise in GIS.	The scope	The GIS offered is fully type tested and is compliant with the IEC requirements, hence additional calculations and design review is not envisaged.	During Detailed Engineering
118	General — - — Welded Enclosure		We Would like to inform you that, some of our component such as CB, Main bus, GIB shall be applied with welded enclosure. It was type tested as per IEC for welded enclosure, hence re type test is not envisaged. Kindly accept the type tested design.	As per Type Tested Design
119	General — - — Shutdown		During extension of GIS, either one busbar or both the busbar need to take shutdown depending on the existing GIS gas single line diagram. Kindly confirm the same.	During Project Implementation
120	General — - — GIB length inside GIS hall		We proposed the SLD, Layout based on inputs received from Client. In case there is any change in client input (Column position, Orientation & Bay Sequence etc.) may affect the GIB length inside the building, during detail engineering the additional differential price due to this change shall be chargeable basis. Along with that, Exact GIB route is not known additional costs may be requested if the number of bending increases in future detailed design. Kindly accept the same.	As per BoQ
121	General — - — GD monitoring		for the online gas pressure monitoring, please accept the following points of our proposed system. 1) Hyosung will only supply transducers (i.e., hybrid gas density monitor), and its connections will be extended till the LCC panel, where provision for further integration will be provided. 2) hybrid GDs will have analog output (6.5-20mA). 3) The scope of supply, installation, and integration of transducers with SCADA/SAS/HMI panel will be part of EPC contractor's scope. Kindly accept the same.	Accepted
122	Bid Volume-II, Site Visit		As per site visit it was noticed that area of proposed 400 KV switchyard is down compared to the adjacent NH and existing 220 KV switchyard. Request you to please share the FGL of the proposed 400 KV switchyard.	During Detailed Engineering
123	Bid Volume-II, Site Clearance including necessary excavation		As per site visit it was noticed that there are plenty numbers of staff quarters and unused part of Transformers and oil drums present at site. We understand same to be dismantled or removed for construction of proposed 400 KV switchyard. Please clarify whether the dismantled items to be handed over to AEGCL or to be disposed as scrap by the contractor.	As per BID and BoQ. All serviceable materials to be handed over to AEGCL and unserviceable materials to be disposed off.
124	Bid Volume-II, Site Visit		As per site visit we have noticed that there is an existing fencing available between the existing 220 KV switchyard and proposed 400 KV switchyard and the same has been shown in the proposed master plan also. Please clarify whether the same to be dismantled or not.	Any dismantling required will be inclusive in site clearance
125	Bid Volume-II, Site Visit		Please share the soil test report of proposed 400 KV switchyard.	Uploaded with Pre Bid MoM
126	Bid Volume-II, Pile foundation		As per civil technical specification steel liner to be used for pile foundation. Please clarify whether temporary liner or permanent liner to be used. Also please clarify the length of the steel liner.	During Detailed Engineering
127	Bid Volume-II, Pile foundation		Please share specific pile foundation drawings for building and transformers.	In the design scope of EPC
128	BoQ, Rail cum road for Transformer and Reactor		Request you to please add one line item for rail cum road of Transformer and Reactor.	Please refer revised BoQ
129	BOQ SI No. 10.01, Water Supply Work		The item description of the SI No. is hidden and cannot be visible. Request you to please share the editable version of the BOQ for our reference only.	E-Tender Portal Guidelines
130	BOQ SI No. 12, Cable Trench and Culvert		Request you to please share the drawing of culverts	In the design scope of EPC

131	BOQ SI No. 12.12, Sump Pit with Electric Pump Set	Request you to please share the drawing of sump pit	In the design scope of EPC
132	BOQ SI No. 13, Main and switchyard gate	Request you to please share the drawing of main and switchyard gate.	During Detailed Engineering
133	Bid Volume-II, Site Visit	Please share the soil test report of existing 400 KV switchyard at Rangia.	Uploaded with Pre Bid Queries
134	Bid Volume-II, Site Visit	Please share the following drawings of existing 400 KV switchyard at Rangia required for estimation i. Existing layout plan ii. Existing earthing layout. iii. Existing cable trench layout. iv. Existing busduct layout. v. Existing indoor panel arrangement layout. vi. Existing DSLP drawing.	During Detailed Engineering
135	Bid Volume-II, Site Visit	As per site visit we understand that yard PCC and gravel spreading to be done for outdoor switchyard. Same is not appearing the BOQ. Request you to please add one separate line item for Yard PCC and gravel spreading.	As per Revised BoQ
136	Bid Volume-II, Site Visit	As per site visit we understand that spare feeders in existing ACDB and DCDB are already available for the present scope of work. Please confirm.	Spare Feeders available in existing ACDB and DCDB
137	Bid Volume-II, Site Visit	As per site visit we understand existing GIS is of Hyosung make. Request you to please share the following drawings for estimation purpose: i. GIS plan and section drawing ii. GTP iii. Gas SLD iv. Bus duct drawing v. SF6 to air bushing drawing vi. Earthing drawing of GIS vii. Indoor cable trench drawing	During Detailed Engineering
138	Bid Volume-II, Site Visit	As per site visit we understand existing CRP & SAS is of Hitachi make. Request you to please share the following drawings for estimation purpose: i. Panel wise detail drawing ii. Scheme iii. SAS Architecture	During Detailed Engineering
139	Payment Terms, Supply of Goods Portion	Interest Free Advance: Ten percent (10%) of the Ex-works price component of Main Equipment/Materials (including Mandatory Spares) shall be paid as an interest free initial advance after signing the Contract Agreement and on submission of: (a) Proforma invoice(s), (b) Advance Payment Security for 100% (one hundred percent) of the amount of Advance, (c) Performance Securities in line with GCC & sec and (d) Detailed PERT Network/Bar chart and its approval by the Employer. Interest free Engineering Advance: Further advance of ten percent (10%) of the Ex-works price component of Main Equipment/Materials (including Mandatory Spares) shall be paid as an interest-free interim advance on: a) Approval of all designs, drawings & guaranteed technical particulars as identified in Technical Specifications, Volume-II of the Bidding Documents. b) Approval of all quality plans and sub-vendor list. c) Approval of type test reports in case type tests are not required to be repeated. d) Detailed invoice e) Submission of an unconditional & irrevocable Payment Security in favour of the Employer for 100% (one hundred percent) of the amount of Interim Engineering Advance as per Bidding Documents.	As per Bid and Corrigendum Issued

140	Payment Terms, Supply of Goods Portion	Progressive Payment: Fifty percent (50%) of the Ex-Works price component of Main Equipment/Materials (including Mandatory Spares) shall be paid progressively on submission of documents indicated hereinunder: (a) Evidence of despatch (Consignment Note - (R/R or L/R)) along with Ewaybill wherever applicable]] (b) Contractor's GST invoice, claim & packing list identifying contents of each shipment. (c) Marine Cargo Policy/Transit Insurance policy/certificate along with premium paid certificates / receipts (d) Manufacturer's/Contractor's guarantee certificate of Quality. (e) Material Inspection Clearance Certificate (MICC) for despatch issued by the Employer's representative and the Contractor's factory inspection report. (f) Test certificate (g) Submission of CPGs, if any, as per Technical Specifications (h) Submission of (i) Authorization certificate issued by domestic manufacturer for selling Domestically Manufactured Iron & Steel Products, if applicable; and (ii) Affidavit of Self certification regarding Domestic Value Addition in Iron & Steel Products; in line with GCC. Twenty Percent (20%) of the Ex-works price of Main Equipment/ materials (excluding Mandatory Spares) shall be paid on receipt and storage at site and on physical verification and furnishing of necessary certificate by Employer's representative. However, for Mandatory Spares, balance thirty Percent (30%) payment of the Ex-works price component shall be released on receipt & storage of the same at site, physical verification and taking over by the Employer's representative.	As per Bid and Corrigendum Issued
141	Payment Terms, Supply of Goods Portion	Final Payment Balance 10% (Ten Percent) of the Ex-works price component of Main Equipment/Materials (excluding Mandatory Spares) shall be paid as per the following: a) 5% (Five Percent) on Successful completion of erection, testing and commissioning of individual bays. b) 5% (Five Percent) on proof of submission of required number of reproducibles, O&M Manuals, approved drawings, data sheets, test report, pamphlets and manuals of mandatory spares, maintenance & testing equipment and on successful completion of erection, testing and commissioning of all bays and issuance of Taking Over Certificate.	As per Bid and Corrigendum Issued
142	Payment Terms, Supply of Services Portion	Inland Transportation, In-transit insurance, Loading & unloading Charges Inland transportation and In-transit insurance charges shall be paid to the Contractor on pro-rata basis, as per the unit rates indicated in the Contract Agreement, after receipt of materials/items at site and on presentation of the Bill of supply or any other documents prescribed under GST Law along with supporting documents by the Contractor. However, these charges will be subject to a limitation that the aggregate of all invoices does not exceed the total amount indicated in the Contract Agreement. It is the Employer's understanding that as per extant provisions, on the charges for supply of services related to Inland transportation, In-transit insurance, loading and unloading by the Contractor to the Employer, GST is not payable. The Contractor is, however, advised to check the position from their own sources. If payable, the same shall be to the Contractor's account and Employer shall not reimburse any GST on this account.	As per Bid and Corrigendum Issued

143	Payment Terms, Supply of Goods Portion	1.3 Supply of Services Portion: Price Component for Installation (including Civil Works) A. Interest Free Advance Ten percent (10%): A.1 1st Instalment: 5% (five percent) of the total Installation price component shall be paid as an interest free advance on submission of (a) Proforma invoice(s), (b) Establishment of Contractor's site offices for preparatory to mobilisation for Installation establishment, (c) Advance Payment Security for [(100% (one hundred percent) of the amount of Advance) Plus {amount of GST reimbursable on Advance as per the Proforma invoice}] in line with GCC and (d) Performance Securities in line with GCC & SCC. A.2 2nd InstalmentAA^: 5% (five percent) of the total Installation price component shall be paid as an interest free advance subject to time-based recovery on submission of (a) Proforma invoice(s), (b) On start of equipment erection, (c) Advance Payment Security for [(100% (one hundred percent) of the amount of Advance) Plus {amount of GST reimbursable on Advance as per the Proforma invoice}] in line with GCC, (d) A declaration by the Contractor stating that 1st Installation (5%) of advance has been utilized against the mobilization works for the subject contract.	As per Bid and Corrigendum Issued
144	Payment Terms, Supply of Goods Portion	Progressive Payment Seventy percent (70%) shall be paid on completion the each of the items of Erection activity and on successful completion of quality check point involved in Installation, submission of Erection all Risk/Contractor All Risk insurance policy/certificate, Workmen Compensation policy/certificate along with premium paid certificates/receipts, submission of the details of items, components, raw materials, services etc. and on submission of GST invoice. Ten Percent (10%) of Price Component for Installation shall be paid bay-wise on physical construction of individual bay including liquidation of defects/deficiencies on the Sub-station bay and certification of the same by Employer's representative and on submission of GST invoice.	As per Bid and Corrigendum Issued
145	Payment Terms, Supply of Goods Portion	Final Payment Final Ten Percent (10%) payment shall be made as follow: 5% (Five Percent) of the Installation price component shall be paid on commissioning of individual bay and complete supply of Mandatory spares. Balance 5% (Five Percent) of the Installation price component shall be paid on commissioning of all bays and issuance of Taking Over Certificate.	As per Bid and Corrigendum Issued
146	Payment Terms- Transmission Line Portion	Payment Term - Transmission Line Portion Supply of Goods Portion A. Interest Free Advance: Ten percent (10%) of the total Ex-works price component of Tower/ Tower Parts (including Bolts & Nuts) and all other materials shall be paid as an interest free initial advance after signing the Contract Agreement and on submission of: (a) Proforma invoice(s), (b) Advance Payment Security for 100% (one hundred percent) of the amount of Advance (c) Performance Securities in line with GCC & SCC and (d) Detailed PERT Network/Bar chart and its approval by the Employer.	As per Bid and Corrigendum Issued

147	Payment Terms- Transmission Line Portion	Progressive Payment Sixty percent (60%) of the Ex-Works price component for Tower/ Tower Parts (including Bolts & Nuts) excluding all other materials shall be paid on successful completion of inspection and testing of the materials/items and on submission of documents indicated hereinunder: Evidence of dispatch (Consignment Note (R/R or L/R) along with E-waybill (wherever applicable)) Contractor's GST invoice, claim & packing list identifying contents of each shipment. Marine Cargo Policy/Transit Insurance policy/certificate along with premium paid certificates/receipts Manufacturer's/Contractor's guarantee certificate of Quality.Material Inspection Clearance Certificate (MICC) for despatch issued by the Employer's representative and the Contractor's factory inspection report. Test certificate Submission of Authorization certificate issued by domestic manufacturer for selling Domestically Manufactured Iron & Steel Products, if applicable. The payment of fabricated tower parts/towers shall, however, be made on completed tower basis on certification by the Employer. Eighty percent (80%) of the Ex-works price component of all items, excluding that of tower parts/tower including Bolts & Nuts, shall be paid on dispatch of the same and on submission of the documents indicated under Clause 1.1 (B) (B.1) above. Twenty percent (20%) of the Ex-works price component for the tower parts/tower (including Bolts & Nuts) excluding all other materials shall be paid on completion of erection of complete tower and furnishing of necessary certificate by Employer's representative.	As per Bid and Corrigendum Issued
148	Payment Terms- Transmission Line Portion	Final Payment The balance ten percent (10%) of the Ex-works price component for Tower/ Tower Parts (including Bolts & Nuts)/ Pole Structures excluding all other materials shall be paid on quarterly basis on erection and liquidation of defects/deficiencies of corresponding erected towers/ Pole Structures on prorata basis and on submission of an unconditional & irrevocable Bank Guarantee/ Insurance Surety Bond for amount paid so that Bank Guarantee available with the Employer is of cumulative value of amount paid on this account, initially valid till scheduled date of completion of testing & commissioning of the transmission line and its taking over by the Employer and shall be extended from time to time till the actual date of successful completion of testing & commissioning of line and its taking over by the Employer. The balance 10% (ten percent) of the Ex-works price component of all the other materials other than Tower/ Tower Parts/ Pole Structures (including Bolts & Nuts) shall be paid pro-rata on receipt of Items at site and on submission of invoice supported by the Material Acceptance Certificate issued by the Employer's representative.	As per Bid and Corrigendum Issued
149	Payment Terms- Transmission Line Portion	Inland Transportation, In-transit insurance, Loading & unloading Charges Inland transportation and In-transit insurance charges shall be paid to the Contractor on pro-rata basis, as per the unit rates indicated in the Contract Agreement, after receipt of materials/items at site and on presentation of the Bill of supply or any other documents prescribed under GST Law along with supporting documents by the Contractor.1.2	As per Bid and Corrigendum Issued
150	Payment Terms- Transmission Line Portion	Supply of Services Portion: Price Component for Installation (including Civil Works) A. Survey Payment for survey shall be paid on pro-rata basis on completion of survey and approval of the same by the Employer.	As per Bid and Corrigendum Issued

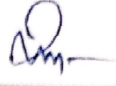
151	Payment Terms- Transmission Line Portion	Establishment of Contractor's site offices for preparatory to mobilization for Installation establishment, Interest Free Advance Ten percent (10%): 1 Installment: 5% (five percent) of the total Installation price component (excluding the price component for survey) shall be paid as an interest free advance on submission of: Advance Payment Security for [{100% (one hundred percent) of the amount of Advance} Plus {amount of GST reimbursable on Advance}] in line with GCC and Performance Securities in line with GCC & SCC 2nd Installment of 05% (Five percent): 5% (five percent) of the total Installation price component (excluding the price component for survey) shall be paid as an interest free advance on commencement of stringing activities & certification of the same by Project Manager and on submission of: Proforma invoice(s), Advance Payment Security for [100% (one hundred percent)] of the amount of Advance Plus {amount of GST reimbursable on Advance}] in line with GCC and Performance Securities in line with GCC & SCC A declaration by the contractor stating that 1st Installment (5%) of advance has been utilized against the mobilization works for the subject contract.	As per Bid and Corrigendum Issued
152	Payment Terms- Transmission Line Portion	Progressive Payment Sixty Eight percent (70%) shall be paid on completion of the each of the items of Erection activity and on successful completion of quality check point involved in Installation and certification by Employer's representative and on submission of GST invoice. Ten percent (10%) of total Installation price component shall be paid in three equal parts, each on physical construction of 1/3rd of the Transmission Line section including liquidation of defects/deficiencies on the line section and certification of the same by Employer's representative and on submission of GST invoice. Final Payment 5% (five percent) of the erection price component shall be paid after successful commissioning of the transmission line. 5% (five percent) of the erection price component shall be paid after issuance of Taking Over Certificate.	As per Bid and Corrigendum Issued
153	Method of Payment	Payment Procedure Method of Payment The Employer shall make payments promptly within thirty (30) days of submission of an invoice/claim by the Contractor, complete in all respects and supported by the requisite documents and fulfilment of stipulated conditions, if any. Delayed Payment In the event that the Employer fails to make any payment on its respective due date, the Employer shall pay interest to the Contractor. Interest rate shall be one-year MCLR (One Year Tenor Rate p.a.) published by State Bank of India prevailing as on the date.	As per Bid and Corrigendum Issued

Pre Bid meeting of the Tender for Implementation of transmission infrastructure to evacuate 3200 MW thermal power from
upcoming generation station at Chapar
Date: 16.09.2026

	Name of the Executive/Officer	Designation	Signature
1	Sayantan Nandi	AGM - Project Execution (KPIL)	
2	Satyabrata Dash	Hyosung Sr. Mgr - KM	
3	Somnath Kundu	Manager (BD)	
4	Nitul Talukdar	Branch Manager Guraahati - L&T	
5			
6	Mukamal Sarma	DM (P&D), AEGCL	
7	Prantik Sainia	AGM (RD), AEGCL	
8	Rituparna Khaybar	GM (PRO), AEGCL	
9	Jayashree Devi	CCM (PP&D)	
10	Pranab Kr Sarma	CM (FEA)	
11	F.H. HASHMI	DM (CAP)	
12	Darip Bhatnari	GM (L)	
13	Himangshu Raygupta	DCM (PED)	
14	Dipayan Chandra	AGM - I (BAP)	
15	Kushal Chatterjee	AGM (NBAP)	

Pre Bid meeting of the Tender for Implementation of transmission infrastructure to evacuate 3200 MW thermal power from
upcoming generation station at Chapar

Date:16.09.2026

	Name of the Executive/Officer	Designation	Signature
16	Rupjyoti Sarma	DGM(NEMP)	
17			
18			
19			
20	PALLABI BORTHAKUR	DM, NE AP	
21	Madhusmita Choudhury	DM (C)	
22	Bidisha Taye	DM (C)	
23	Bisendra Prasad	AM(FBA)	
24			
25			
26			
27			
28			
29			
30			

Price Adjustment / Price Variation

(Refer Corrigendum III)

1. Applicability

Prices payable to the Contractor under the Contract shall be subject to price adjustment during the contractual delivery period to reflect changes in the cost of specified material components.

Price variation (PV) shall be applicable only to the following Plant and Equipment supplied under the Contract:

- a) Power Transformers with OLTC and oil only, excluding accessories such as bushings, clamps, connectors, relays, etc.; *Item no. 16.01 of BoQ1*
- b) Reactors and oil only, excluding accessories such as bushings, clamps, connectors, relays, etc.; *Item No. 17.01 of BoQ1*
- c) Cables, both PVC and XLPE; *Item No. 21, 22 of BoQ1, Item No. 11, 12 of BoQ11*
- d) Tower Structures; *Item No. 1 of BoQ5, Item No. 1 of BoQ8,*
- e) Conductors. *Item No. 3.02, 3.03 of BoQ1, Item No; 7.1 and 7.2 in BoQ5, Item No. 7 of BoQ8, Item No. 2.01 of BoQ11*

2. Basis of Price Variation

Price Variation shall be calculated in accordance with the applicable **IEEMA Price Variation Formula** and the monthly indices published by IEEMA.

The applicable IEEMA circulars and price indices shall be used for determining the relevant indices for Price Variation. The IEEMA circulars are available at <https://ieema.org/about-ieema/services/pv-clauses-prices-indices/>

Base Date and Applicable Date

The **Base Date** for the purpose of Price Variation shall be the date corresponding to the applicable indices prevailing **30 days prior to the date of Bid Opening**.

The **Applicable Date** shall be the date corresponding to the applicable indices prevailing **60 days prior to the date of Final Inspection or the date of the Joint Measurement Sheet, as applicable**.

3. Period of Applicability

Price Variation shall be applicable only during the **contractual delivery period**.

No positive Price Variation shall be payable for any period of delay attributable to the Contractor. However, where there is a decrease in the applicable prices/indices during such Contractor-attributable delay period, the corresponding negative Price Variation shall be applicable and recoverable by AEGCL.

In no case, positive Price Variation will be allowed beyond the **original contractual delivery/closing date**.

4. Non-Publication of Indices

In the event that an applicable IEEMA index for a particular month has not been published, the latest index published immediately prior to that month shall be considered for the purpose of calculating Price Variation.

5. Positive and Negative Price Variation

Where the calculated Price Variation is **positive**, the admissible amount shall be payable by AEGCL to the Contractor, subject to the maximum ceiling specified below.

Where the calculated Price Variation is **negative**, the corresponding amount shall be recovered by AEGCL from the Contractor.

6. Ceiling on Positive Price Variation

Positive Price Variation shall be allowed up to a maximum of **10% of the quoted rate of the respective eligible item**.

No ceiling shall apply to negative Price Variation.

7. Components Not Eligible for Price Variation

No Price Variation shall be payable on the following:

- a) Freight and Insurance components of FOR Destination prices;
- b) Installation and Services;
- c) Freight and Insurance;
- d) Civil Construction works;
- e) Civil Supplies except items mentioned above ;
- f) Any item or component not specifically identified as eligible for Price

Variation under this Contract; and

g) The portion of the Contract price paid to the Contractor as **advance payment**.

8. Submission of Price Variation Bills

The Contractor shall submit Price Variation bills, whether **positive or negative**, along with the relevant supporting documents for verification and payment/recovery.

The documents shall include, as applicable:

- a) Relevant IEEMA circulars and published indices;
- b) Price Variation calculation sheet;
- c) Sheet generated through the **IEEMA Online PV Calculator**; and
- d) Any other supporting documents required to substantiate the Price Variation claim.

9. Discontinuation of IEEMA Online PV Calculator

In the event that IEEMA discontinues the IEEMA Online PV Calculator, the Contractor shall submit the Price Variation calculation along with duly notarized copies of the relevant IEEMA circulars, applicable indices, calculation sheets, and other supporting documents along with the respective invoice.

10. Currency

All quoted rates and Price Variation calculations under the Contract shall be in **Indian Rupees (INR)**.

11. General

Price Variation shall be calculated strictly in accordance with the applicable IEEMA Price Variation Formula, the relevant IEEMA monthly indices, and the provisions of this Contract. No Price Variation shall be admissible for any item, component, period, or circumstance not specifically covered under these provisions.

ASSAM ELECTRICITY GRID CORPORATION LIMITED



**Geo Technical Investigation Report for
up gradation of Existing 220/132kV Agia
Grid Substation to 400/220kV Grid
Substation for Evacuation of Power from
3200 MW Chapar Thermal Power Plant.**

SUBMITTED BY:



**P.K.DUTTA & CO.
'SAI TOWER' BLOCK-A 1ST FLOOR,
NAIHATI, WEST BWNAL-743165**

Bandiliga
**Junior Manager (C)
Design & Project
AEGCL, Kahilpara, Ghy-19**

[Signature]
**Asstt. General Manager (C)
Design & Project
AEGCL, Kahilpara, Ghy-19**

[Signature]
**Asstt. General Manager (C)
Design & Project
AEGCL, Kahilpara, Ghy-19**

Client: Assam Electricity Grid Corporation Limited

Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

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A) BY BORING METHOD

A.1.0 INTRODUCTION:

The Geo Technical Investigation Report for up gradation of existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant has been awarded to P K Dutta & Co. Naihati, WB by Assam Electricity Grid Corporation Limited. Field Soil Exploration of bore holes, conducting of Plate Load Tests, California bearing Ratio and Proctor density test have been completed during 03.08.2026 to 15.08.2026.

The objective of this soil investigation consisting of borings including, execution of Plate Load Tests, California Bearing Ratio and Proctor Density test, collection of undisturbed & disturbed soil samples, conducting relevant laboratory tests, to study the soil stratifications, characteristics and engineering properties and suggesting safe approach to design and construction of foundation of proposed structure.

A.2.0 FIELD INVESTIGATION:

A.2.1 GENERAL:

For the design of the foundation for the proposed structure to be constructed at the site, this geotechnical investigation was done. In field work, the type of sub-soil profile and their characterization have been revealed. Laboratory testing and Plate Load Tests actually helps in determining relevant geotechnical properties of the sub-surface deposits leading to finalization of foundation depths and type of the structures and the bearing capacity with particular reference to the sub-surface types and their strength parameters and settlement potentials at the site.



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Schedule of boreholes in tabulated form is given below:

Bore Hole No.	Terminating Depth (m)	GPS		Date of Commencement	Date of Completion
		LONGITUDE	LATITUDE		
BH-1	15.00	90°33'53.8"	26°05'46.1"	08.08.2026	09.08.2026
BH-2	15.00	90°33'55.4"	26°05'46.2"	09.08.2026	10.08.2026
BH-3	15.00	90°33'56.4"	26°05'47.7"	15.08.2026	15.08.2026
BH-4	15.00	90°33'58.2"	26°05'50.4"	13.08.2026	14.08.2026
BH-5	15.00	90°33'54.8"	26°05'44.5"	10.08.2026	11.08.2026
BH-6	15.00	90°33'57.9"	26°05'45.3"	11.08.2026	12.08.2026
BH-7	15.00	90°33'59.7"	26°05'47.0"	12.08.2026	13.08.2026
BH-8	15.00	90°33'59.2"	26°05'43.8"	07.08.2026	08.08.2026
BH-9	15.00	90°34'01.2"	26°05'45.9"	05.08.2026	06.08.2026
BH-10	15.00	90°34'01.5"	26°05'48.8"	06.08.2026	07.08.2026
BH-11	15.00	90°34'06.8"	26°05'46.1"	04.08.2026	05.08.2026
BH-12	15.00	90°34'06.7"	26°05'48.1"	03.08.2026	03.08.2026

Submitted By **P K Dutta & Co.**

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A.2.2 BORING/SAMPLING:

Of the different types of explorations, borings are the most practical and relatively correct method of obtaining sub-surface information. 12 (twelve) nos. bore holes of 150 mm diameter were sunk as per specifications and IS: 1892 and were extended up to specified depth 15.00m each for visualizing the stratification of soil. Casings as required were used to retain the borehole. Boring was carried out by Shell and Augur followed by Wash boring method in soil.

The details of these bore holes including field tests of Standard Penetration tests and also collection of disturbed and undisturbed soil samples are given in Bore Logs enclosed. Disturbed & SPT representative samples of sub-surface deposits were collected from bore holes, labeled depth wise and placed in polythene bags. Reference Numbers and depth of these samples are shown in Bore Log Data Sheets.

For proper evaluation of engineering properties of in-situ soils, including shear parameters and consolidation characteristics, representative undisturbed soil samples were collected at intervals along the boreholes, whenever clayey silt/silty clay or silty fine sand with clay binders were encountered.

Disturbed representative soil samples were collected during progress of boring, from shell and also from split-spoon sampler of Standard Penetration Tests conducted at different depth in boreholes. Such soil sample contains all the constituent materials of the respective stratum. Depth and details of the sample are shown in the borehole logs (Annexure).

A.2.3 STANDARD PENETRATION TEST (SPT):

The standard penetration tests were conducted as per IS 2131-1981. The split spoon sampler, connected with a string of drill rods, was lowered into the bottom of the bore hole. The sampler was driven into the soil stratum up to a maximum depth of 450mm. by making use of 63.5 kg. Weight falling freely from a height of 750mm on to an anvil fixed on the top of drill rod. The number of blows required to penetrate each of the successive 150mm. depths was counted to produce a total penetration of 450mm. To avoid seating errors, the blows required for the first 150mm. of penetration was not taken into account. Those required to increase the penetration from 150mm. to 450mm. constituted the N-number. On completion of the test, the sampler was lifted to the ground, opened, and the specimen of the soil sample was stored in polythene bags with the proper identification mark. N-value is noted in borehole log data sheets against the corresponding depth.

Followings are the corrections on SPT values in cohesion-less soil:

1. Due to overburden: N value for cohesion-less soil shall be corrected for overburden as per Fig. 1 of IS: 2131 (N').
2. Due to Dilatancy: The values corrected for overburden shall be corrected for dilatancy if the stratum consists of fine sand and silt below water table for values of N' greater than 15, as under (N''): $N'' = 15 + 0.5 \cdot (N' - 15)$

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Typical calculation for N value correction:

BH No.-1: 10.00m to 10.45m. Field N = 24. Water table: 3.35

Effective OVP at the average depth: = 1.21 Kg/cm^2 .

From Fig 1. of IS: 2131, correction factor = 0.94

So corrected SPT value for overburden, $N' = 0.94 \times 24 = 22.56$

Dilatancy(N'') = $15 + 0.5(22.56 - 15) = 18.78$

Corrected SPT value = 19

Same calculation will be valid for other N values in sandy layer. All the correction in detail is presented in a tabular form below.

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.35				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-1	3.00	2.45	2.73	11	0.42	0.53	0.42	1.25	13.75	—	14
	5.00	5.45	5.23	13	0.60	0.62	0.60	1.12	14.56	—	15
	5.00	5.45	5.23	8	0.00	0.70	0.70	1.04	8.32	—	8
	7.00	7.45	7.23	7	1.35	0.06	0.06	1.01	7.07	—	7
	10.00	10.45	10.23	24	1.01	1.22	1.22	0.94	22.56	18.78	19
	12.00	12.45	12.23	32	2.29	1.40	1.40	0.87	27.84	23.82	23
	13.50	13.95	13.73	38	2.57	1.53	1.53	0.84	31.92	25.46	23
	15.00	15.45	15.23	47	2.85	1.66	1.66	0.82	38.54	26.77	27

AVG. BULK DENSITY (gm/cc)		1.86	WATER TABLE (M)				2.70				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-2	3.00	2.45	2.73	10	0.41	0.46	0.41	1.26	12.60	—	13
	5.00	5.45	5.23	12	0.60	0.55	0.55	1.16	13.92	—	14
	5.00	5.45	5.23	9	0.07	0.72	0.72	1.05	9.45	—	9
	7.00	7.45	7.23	8	1.34	0.09	0.09	1.02	8.56	—	8
	10.00	10.45	10.23	23	1.90	1.15	1.15	0.91	21.85	18.43	18
	12.00	12.45	12.23	29	2.27	1.32	1.32	0.88	26.58	20.55	21
	13.50	13.95	13.73	36	2.55	1.45	1.45	0.86	30.96	22.98	23
	15.00	15.45	15.23	43	2.83	1.58	1.58	0.82	35.24	25.13	25

AVG. BULK DENSITY (gm/cc)		1.88	WATER TABLE (M)				3.00				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-3	3.00	2.45	2.73	11	0.42	0.48	0.42	1.25	13.75	—	14
	5.00	5.45	5.23	9	0.67	0.56	0.56	1.15	10.35	—	10
	5.00	5.45	5.23	8	0.00	0.74	0.74	1.04	8.32	—	8
	7.00	7.45	7.23	9	1.36	0.02	0.02	1.02	9.18	—	9
	10.00	10.45	10.23	16	1.92	1.18	1.18	0.94	15.04	13.03	15
	12.00	12.45	12.23	18	2.30	1.36	1.36	0.89	16.68	15.51	16
	13.50	13.95	13.73	23	2.54	1.49	1.49	0.85	19.53	17.28	17
	15.00	15.45	15.23	25	2.86	1.62	1.62	0.82	23.50	17.73	18

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AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.88				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OWP (kg/cm^2)		EFFECTIVE OWP (kg/cm^2)	OWP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DRAINAGE	
BH-4	3.00	2.45	2.23	13	0.43	0.57	0.43	1.25	16.25	15.63	16
	5.00	5.45	5.23	15	0.60	0.66	0.60	1.12	16.20	15.90	16
	5.00	5.45	5.23	8	0.00	0.00	0.00	1.01	8.34	-	8
	7.00	7.45	7.23	13	1.35	1.03	1.03	1.00	13.00	-	13
	10.00	10.45	10.23	20	1.81	1.77	1.77	1.00	20.00	17.50	18
	17.00	17.45	17.23	23	2.29	1.44	1.44	0.86	15.28	17.28	17
	19.50	19.95	19.73	21	2.57	1.57	1.57	0.83	22.41	18.71	19
	21.00	25.45	23.23	32	2.85	1.40	1.40	0.81	25.50	20.46	20

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				2.70				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OWP (kg/cm^2)		EFFECTIVE OWP (kg/cm^2)	OWP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DRAINAGE	
BH-5	3.00	2.45	2.23	14	0.43	0.46	0.43	1.25	17.50	16.25	16
	5.00	5.45	5.23	13	0.60	0.55	0.55	1.16	15.08	15.04	15
	5.00	5.45	5.23	9	0.00	0.23	0.23	1.05	9.45	-	9
	7.00	7.45	7.23	10	1.35	0.00	0.00	1.07	10.00	-	10
	10.00	10.45	10.23	24	1.81	1.36	1.36	0.91	22.80	18.90	19
	17.00	17.45	17.23	26	2.29	1.33	1.33	0.90	23.40	19.28	19
	19.50	19.95	19.73	30	2.57	1.46	1.46	0.86	32.68	23.84	24
	21.00	25.45	23.23	47	2.85	1.59	1.59	0.87	38.54	26.77	27

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.26				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OWP (kg/cm^2)		EFFECTIVE OWP (kg/cm^2)	OWP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DRAINAGE	
BH-6	3.00	2.45	2.23	14	0.43	0.53	0.43	1.25	17.50	16.25	16
	5.00	5.45	5.23	12	0.60	0.60	0.60	1.12	15.44	-	13
	5.00	5.45	5.23	8	0.00	0.77	0.77	1.04	8.50	-	8
	7.00	7.45	7.23	13	1.35	0.96	0.95	1.01	12.12	-	12
	10.00	10.45	10.23	22	1.81	1.73	1.73	0.94	20.68	17.84	18
	17.00	17.45	17.23	25	2.29	1.38	1.38	0.88	22.80	18.58	19
	19.50	19.95	19.73	28	2.57	1.51	1.51	0.85	24.65	19.83	20
	21.00	25.45	23.23	34	2.85	1.64	1.64	0.82	27.88	21.44	21

AVG. BULK DENSITY (gm/cc)		1.88	WATER TABLE (M)				3.46				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OWP (kg/cm^2)		EFFECTIVE OWP (kg/cm^2)	OWP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DRAINAGE	
BH-7	3.00	2.45	2.23	14	0.43	0.54	0.43	1.25	17.50	16.25	16
	5.00	5.45	5.23	16	0.63	0.67	0.63	1.12	17.92	16.46	16
	5.00	5.45	5.23	9	0.00	0.30	0.00	1.04	9.36	-	9
	7.00	7.45	7.23	14	1.36	0.98	0.98	1.00	14.80	-	14
	10.00	10.45	10.23	23	1.92	1.24	1.24	0.93	19.53	17.27	17
	17.00	17.45	17.23	24	2.30	1.42	1.42	0.87	20.88	17.98	18
	19.50	19.95	19.73	36	2.58	1.55	1.55	0.83	21.58	18.28	18
	21.00	25.45	23.23	30	2.86	1.68	1.68	0.81	24.30	19.65	20

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AVG. BULK DENSITY (gm/cc)		1.86	WATER TABLE (M)				3.63				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DETERMINCY	
BH-8	3.00	2.45	2.23	12	0.41	0.56	0.41	1.26	15.32	15.06	15
	5.00	3.45	3.23	11	0.60	0.66	0.60	1.12	12.32	—	12
	5.00	3.45	3.23	9	0.97	0.81	0.81	1.04	9.36	—	9
	7.00	2.45	2.23	13	1.34	0.99	0.99	1.00	13.00	—	13
	10.00	10.45	10.23	24	1.90	1.24	1.24	0.93	22.32	18.64	19
	12.00	12.45	12.23	30	2.27	1.42	1.42	0.87	26.56	22.56	21
	13.50	13.95	13.73	33	2.55	1.55	1.55	0.83	27.78	21.28	21
	15.00	15.45	15.23	37	2.83	1.67	1.67	0.82	30.14	22.67	23

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.46				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DETERMINCY	
BH-9	3.00	2.45	2.23	11	0.42	0.51	0.42	1.25	16.75	16.58	17
	5.00	3.45	3.23	12	0.60	0.62	0.60	1.12	13.44	—	13
	5.00	3.45	3.23	8	0.98	0.79	0.79	1.04	8.32	—	8
	7.00	2.45	2.23	13	1.35	0.97	0.97	1.01	13.11	—	13
	10.00	10.45	10.23	24	1.91	1.23	1.23	0.93	22.32	18.64	19
	12.00	12.45	12.23	25	2.29	1.40	1.40	0.87	26.09	22.51	18
	13.50	13.95	13.73	26	2.57	1.53	1.53	0.84	27.00	18.00	18
	15.00	15.45	15.23	27	2.85	1.66	1.66	0.82	27.34	18.57	19

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.68				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DETERMINCY	
BH-10	3.00	2.45	2.23	11	0.42	0.50	0.42	1.25	13.75	—	14
	5.00	3.45	3.23	12	0.60	0.66	0.60	1.12	13.44	—	13
	5.00	3.45	3.23	8	0.98	0.81	0.81	1.04	8.32	—	8
	7.00	2.45	2.23	7	1.35	0.99	0.99	1.01	7.03	—	7
	10.00	10.45	10.23	22	1.91	1.25	1.25	0.93	20.46	17.73	18
	12.00	12.45	12.23	26	2.29	1.42	1.42	0.87	24.36	19.66	20
	13.50	13.95	13.73	30	2.57	1.55	1.55	0.84	25.28	20.18	20
	15.00	15.45	15.23	34	2.85	1.68	1.68	0.82	27.88	21.44	21

AVG. BULK DENSITY (gm/cc)		1.87	WATER TABLE (M)				3.58				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (kg/cm^2)		EFFECTIVE OVP (kg/cm^2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DETERMINCY	
BH-11	3.00	2.45	2.23	12	0.42	0.54	0.42	1.25	15.00	15.00	15
	5.00	3.45	3.23	14	0.60	0.63	0.60	1.12	15.68	15.54	15
	5.00	3.45	3.23	10	0.98	0.80	0.80	1.04	10.40	—	10
	7.00	2.45	2.23	13	1.35	0.98	0.98	1.01	13.13	—	13
	10.00	10.45	10.23	25	1.91	1.24	1.24	0.93	23.25	19.15	19
	12.00	12.45	12.23	29	2.29	1.45	1.45	0.87	25.23	20.12	20
	13.50	13.95	13.73	31	2.57	1.54	1.54	0.84	26.88	20.94	21
	15.00	15.45	15.23	40	2.85	1.67	1.67	0.82	27.80	21.90	24

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AVG. BULK DENSITY (gm/cc)		1.86	WATER TABLE (M)				3.60				
BH NO.	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE DWP (kg/cm ²)		EFFECTIVE DWP (kg/cm ²)	DWP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DRILLAGE	
BH-12	3.00	2.45	2.73	12	0.41	0.35	0.41	1.26	15.32	15.06	15
	5.00	3.45	3.23	10	0.60	0.46	0.60	1.12	11.20	—	11
	5.00	3.45	3.23	11	0.67	0.61	0.61	1.04	11.44	—	11
	7.00	7.45	7.23	7	1.34	0.90	0.90	1.00	7.00	—	7
	10.00	10.45	10.23	12	1.90	1.34	0.90	1.01	12.32	—	12
	12.00	12.45	12.23	17	2.27	1.41	1.41	0.87	14.79	—	15
	13.50	13.95	13.73	19	2.55	1.54	1.54	0.83	15.77	15.59	15
	15.00	15.45	15.23	24	2.83	1.67	1.67	0.80	21.12	19.06	18

A.2.4 MEASUREMENT OF WATER TABLE:

Depth of level of water was noted when struck in. This is termed as depth of observed water table below existing ground level (EGL). Depth of ground water table (GWT) below EGL after 24 hours of removal of casing was also noted and shown in the profile. Ground water table was not encountered at any Borehole or Trail Pit. However ground water table is considered at ground level for design purpose.

BH No.	Depth (m)	Depth of GWT below EGL (m)	Commenced on	Completed on
BH-1	15.00	3.35	08.08.2026	09.08.2026
BH-2	15.00	2.70	09.08.2026	10.08.2026
BH-3	15.00	2.80	15.08.2026	15.08.2026
BH-4	15.00	3.80	13.08.2026	14.08.2026
BH-5	15.00	2.70	10.08.2026	11.08.2026
BH-6	15.00	3.20	11.08.2026	12.08.2026
BH-7	15.00	3.40	12.08.2026	13.08.2026
BH-8	15.00	3.65	07.08.2026	08.08.2026
BH-9	15.00	3.40	05.08.2026	06.08.2026
BH-10	15.00	3.60	06.08.2026	07.08.2026
BH-11	15.00	3.50	04.08.2026	05.08.2026
BH-12	15.00	3.60	03.08.2026	03.08.2026

Note: GWT=Ground Water Table, EGL=Existing Ground Level

A.2.5 ROTARY CORE DRILLING:

Conventional diamond core drilling equipment was used for drilling vertical holes up to specified depth at each location. Rotary core drilling in rock was carried out according to IS 1892-1979. This drilling technique was regarded as the most satisfactory method of assessing the character of rock formations, which lie at depth below the ground surface. Specimens of rock in the form of cylindrical cores were recovered from the drill hole by means of a core barrel. Double barrel technique was adopted according to field condition. The core barrel was provided at its lower end with a detachable shoe or core bit, which is of diamond. All rotary core bits were of NX (75mm) size.

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A.3.0 LABORATORY TESTING:

For proper identification and classification of the sub-surface and for deriving adequate information regarding its relevant physical and geotechnical properties at the site under investigation, the following laboratory tests were conducted on the soil and rock samples collected from the bore holes:

For Soil Samples:

1. Grain size analysis (Sieve as well as Hydrometer).
2. Liquid Limit & Plastic Limit.
3. Natural Moisture Content.
4. Specific Gravity.
5. Bulk & Dry Density.
6. Triaxial Shear Test (UU)
7. Unconfined Compressive Test (UC)
8. Direct Shear Test (DS)
9. Consolidation Test (**Oedometer test or a One-dimensional compression test.**)
10. Proctor Density
11. CBR
12. Free Swell Index
13. Relative Density
14. Chemical Analysis

For Water Samples:

1. Chemical Analysis

The above mentioned laboratory tests were done following the testing procedure given in the relevant parts of IS: 2720 and other relevant IS codes. Results of all tests are furnished in Annexure of this report.

A.4.0 SUBSOIL PROFILE & ENGINEERING PROPERTIES:

4.1. BH-1:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey clayey sand mixed with kankars & gravels.” Depth of this layer is 0.50m. No SPT & UDS value is encountered in this layer. This layer is laying after EGL and continues up to 0.50m.

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.” Depth of this layer is 4.50m. Average Field “N” value of this layer is 12. This layer is laying after 0.50m and continues up to 5.00m.

Physical properties			Liquid limit	%	47.00	Shear strength		
Gravel	%	4	Plastic limit	%	25.00	Type of Test		
Sand	%	8	PI		22.00	UC		
Silt	%	39	Bulk density	g/cc	1.88	C	kg/cm ²	0.39
Clay	%	49	Dry density	g/cc	1.44	Ø	°	0
Classification			NMC	%	30.50	Consolidation		
IS Classification		CI	Sp. Gr.		2.68	M _v	m ² /t	0.0039
			Free swell Index	%	40.00			

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff, brownish grey, sandy clay.” Depth of this layer is 2.00m. Field “N” value of this layer is 8. This layer is laying after 5.00m and continues up to 7.00m.

Physical properties			Liquid limit	%	34.00	Shear strength		
Gravel	%	0	Plastic limit	%	19.00	Type of Test		
Sand	%	23	PI		15.00	(Triaxial Shear Test)		
Silt	%	35	Bulk density	g/cc	1.86	C	kg/cm ²	0.22
Clay	%	42	Dry density	g/cc	1.54	Ø	°	5
Classification			NMC	%	21.00	Consolidation		
IS Classification		CL	Sp. Gr.		2.63	M _v	m ² /t	0.0021

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STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 16. This layer is laying after 7.00m and continues up to 12.00m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	60	PI		NP	(Direct-Shear Test)		
Silt	%	31	Bulk density	g/cc	1.86	C	kg/cm ²	0.00
Clay	%	9	Dry density	g/cc	1.63	Ø	°	22
Classification			NMC	%	14.40	Consolidation		
IS Classification	SM		Sp. Gr.		2.64	M _v	m ² /t	-----

STRATUM-V:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 3.00m. Average Field “N” value of this layer is 39. This layer is laying after 12.00m and continues up to its termination depth (15.00m).

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	68	PI		NP	DS (Direct-Shear Test)		
Silt	%	29	Bulk density	g/cc	1.87	C	kg/cm ²	0.00
Clay	%	3	Dry density	g/cc	-	Ø	°	29
Classification			NMC	%	-	Consolidation		
IS Classification	SM		Sp. Gr.		2.65	M _v	m ² /t	-----

4.2. BH-2:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 11. This layer is laying after EGL and continues up to 5.00m.

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Physical properties			Liquid limit	%	44.25	Shear strength		
Gravel	%	4	Plastic limit	%	18.25	Type of Test		
Sand	%	10	PI		26.00	UC		
Silt	%	37	Bulk density	g/cc	1.87	C	kg/cm ²	0.37
Clay	%	49	Dry density	g/cc	1.43	Ø	°	0
Classification			NMC	%	30.83	Consolidation		
IS Classification		CI	Sp. Gr.		2.69	M _v	m ² /t	0.0038
			Free swell Index	%	39.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish grey sandy clay.” Depth of this layer is 2.00m. Field “N” value of this layer is 9. This layer is laying after 5.00m and continues up to 7.00m.

Physical properties			Liquid limit	%	35.50	Shear strength		
Gravel	%	0	Plastic limit	%	21.00	Type of Test		
Sand	%	27	PI		14.50	UU (Triaxial Shear Test)		
Silt	%	30	Bulk density	g/cc	1.85	C	kg/cm ²	0.25
Clay	%	43	Dry density	g/cc	1.55	Ø	°	4
Classification			NMC	%	19.00	Consolidation		
IS Classification		CI	Sp. Gr.		2.65	M _v	m ² /t	0.0022

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 16. This layer is laying after 7.00m and continues up to 12.00m.

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	68	PI		NP	DS (Direct-Shear Test)		
Silt	%	27	Bulk density	g/cc	1.85	C	kg/cm ²	0.00
Clay	%	5	Dry density	g/cc	1.63	Ø	°	24
Classification			NMC	%	13.50	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	-----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 3.00m. Average Field “N” value of this layer is 36. This layer is laying after 12.00m and continues up to its termination depth (15.00m).

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	72	PI		NP	DS (Direct-Shear Test)		
Silt	%	26	Bulk density	g/cc	1.86	C	kg/cm ²	0.00
Clay	%	2	Dry density	g/cc	-	Ø	°	31
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	-----

4.3. BH-3:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.” Depth of this layer is 4.50m. Average Field “N” value of this layer is 10. This layer is laying after EGL and continues up to 4.50m.

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Physical properties			Liquid limit	%	40.00	Shear strength		
Gravel	%	4	Plastic limit	%	18.50	Type of Test		
Sand	%	9	PI		21.50	UC		
Silt	%	39	Bulk density	g/cc	1.90	C	kg/cm ²	0.34
Clay	%	48	Dry density	g/cc	1.45	Ø	°	0
Classification			NMC	%	31.06	Consolidation		
IS Classification		CI	Sp. Gr.		2.70	M _v	m ² /t	0.0038
			Free Swell Index	%	32.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff, brownish grey, sandy clay with kankars.” Depth of this layer is 2.50m. Field “N” value of this layer is 8. This layer is laying after 4.50m and continues up to 7.00m.

Physical properties			Liquid limit	%	33.00	Shear strength		
Gravel	%	2	Plastic limit	%	18.00	Type of Test		
Sand	%	25	PI		15.00	UU (Triaxial-Shear Test)		
Silt	%	32	Bulk density	g/cc	1.85	C	kg/cm ²	0.20
Clay	%	41	Dry density	g/cc	1.59	Ø	°	6
Classification			NMC	%	16.65	Consolidation		
IS Classification		CL	Sp. Gr.		2.64	M _v	m ² /t	0.0020

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 8.00m. Average Field “N” value of this layer is 18. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

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Physical properties		
Gravel	%	0
Sand	%	68
Silt	%	26
Clay	%	6
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.87
Dry density	g/cc	1.67
NMC	%	12.00
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0.00
Ø	°	27
Consolidation		
M _v	m ² /t	-----

4.4. BH-4:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.” Depth of this layer is 4.50m. Average Field “N” value of this layer is 14. This layer is laying after EGL and continues up to 4.50m.

Physical properties		
Gravel	%	2
Sand	%	6
Silt	%	38
Clay	%	54
Classification		
IS Classification	CI	

Liquid limit	%	47.75
Plastic limit	%	20.00
PI		27.75
Bulk density	g/cc	1.91
Dry density	g/cc	1.49
NMC	%	27.87
Sp. Gr.		2.69
Free swell index	%	43.00

Shear strength		
Type of Test		
UC		
C	kg/cm ²	0.44
Ø	°	0
Consolidation		
M _v	m ² /t	0.0040

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff, brownish grey, sandy clay with kankars.” Depth of this layer is 1.50m. Field “N” value of this layer is 8. This layer is laying after 4.50m and continues up to 6.00m.

Physical properties		
Gravel	%	3
Sand	%	23
Silt	%	34
Clay	%	40
Classification		
IS Classification	CL	

Liquid limit	%	33.00
Plastic limit	%	19.00
PI		14.00
Bulk density	g/cc	1.84
Dry density	g/cc	-
NMC	%	-
Sp. Gr.		2.63

Shear strength		
Type of Test		
UU (Triaxial-Shear Test)		
C	kg/cm ²	0.21
Ø	°	5
Consolidation		
M _v	m ² /t	0.0018

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose light brownish grey silty fine sand with mica.” Depth of this layer is 1.00m. No SPT value is encountered in this layer. This layer is laying after 6.00m and continues up to 7.00m.

Physical properties		
Gravel	%	0
Sand	%	65
Silt	%	28
Clay	%	7
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.84
Dry density	g/cc	1.61
NMC	%	14.50
Sp. Gr.		2.65

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0.00
Ø	°	25
Consolidation		
M _v	m ² /t	-----

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STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium, brownish grey silty sand with mica.” Depth of this layer is 8.00m. Average Field “N” value of this layer is 23. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	0
Sand	%	73
Silt	%	22
Clay	%	5
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.86
Dry density	g/cc	1.68
NMC	%	11.00
Sp. Gr.		2.65

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0.00
Ø	°	32
Consolidation		
M _v	m ² /t	-----

4.5. BH-5:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 14. This layer is laying after EGL and continues up to 5.00m.

Physical properties		
Gravel	%	3
Sand	%	10
Silt	%	38
Clay	%	49
Classification		
IS Classification	CI	

Liquid limit	%	44.75
Plastic limit	%	19.50
PI		25.25
Bulk density	g/cc	1.89
Dry density	g/cc	1.44
NMC	%	31.44
Sp. Gr.		2.70
Free swell Index	%	37.00

Shear strength		
Type of Test		
UC		
C	kg/cm ²	0.40
Ø	°	0
Consolidation		
M _v	m ² /t	0.0039

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish grey sandy clay.” Depth of this layer is 2.00m. Field “N” value of this layer is 9. This layer is laying after 5.00m and continues up to 7.00m.

Physical properties			Liquid limit	%	33.50	Shear strength		
Gravel	%	0	Plastic limit	%	18.50	Type of Test		
Sand	%	24	PI		15.00	UU (Triaxial-Shear Test)		
Silt	%	36	Bulk density	g/cc	1.85	C	kg/cm ²	0.24
Clay	%	40	Dry density	g/cc	1.53	Ø	°	4
Classification			NMC	%	21.00	Consolidation		
IS Classification		CL	Sp. Gr.		2.64	M _v	m ² /t	0.0018

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 6.50m. Average Field “N” value of this layer is 20. This layer is laying after 7.00m and continues up to 13.50m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	69	PI		NP	DS (Direct-Shear Test)		
Silt	%	24	Bulk density	g/cc	1.84	C	kg/cm ²	0.00
Clay	%	7	Dry density	g/cc	1.61	Ø	°	25
Classification			NMC	%	14.00	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	-----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Dense, brownish grey silty sand with mica.” Depth of this layer is 1.50m. Average Field “N” value of this layer is 43. This layer is laying after 13.50m and continues up to its termination depth (15.00m).

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	72	PI		NP	DS (Direct-Shear Test)		
Silt	%	24	Bulk density	g/cc	1.87	C	kg/cm ²	0.00
Clay	%	4	Dry density	g/cc	-	Ø	°	33
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.66	M _v	m ² /t	-----

4.6. BH-6:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 13. This layer is laying after EGL and continues up to 5.00m.

Physical properties			Liquid limit	%	47.25	Shear strength		
Gravel	%	3	Plastic limit	%	22.50	Type of Test		
Sand	%	7	PI		24.75	UC		
Silt	%	38	Bulk density	g/cc	1.90	C	kg/cm ²	0.40
Clay	%	52	Dry density	g/cc	1.47	Ø	°	0
Classification			NMC	%	28.75	Consolidation		
IS Classification		CI	Sp. Gr.		2.69	M _v	m ² /t	0.0037
			Free Swell Index	%	41.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff brownish to reddish grey sandy clay with kankars.” Depth of this layer is 2.00m. Field “N” value of this layer is 8. This layer is laying after 5.00m and continues up to 7.00m.

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Physical properties			Liquid limit	%	35.50	Shear strength		
Gravel	%	2	Plastic limit	%	21.00	Type of Test		
Sand	%	22	PI		14.50	UU (Triaxial-Shear Test)		
Silt	%	31	Bulk density	g/cc	1.86	C	kg/cm ²	0.20
Clay	%	45	Dry density	g/cc	1.55	Ø	°	6
Classification			NMC	%	20.00	Consolidation		
IS Classification		CI	Sp. Gr.		2.65	M _v	m ² /t	0.0024

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 6.50m. Average Field “N” value of this layer is 20. This layer is laying after 7.00m and continues up to 13.50m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	62	PI		NP	DS (Direct-Shear Test)		
Silt	%	31	Bulk density	g/cc	1.84	C	kg/cm ²	0.00
Clay	%	7	Dry density	g/cc	1.62	Ø	°	26
Classification			NMC	%	13.50	Consolidation		
IS Classification		SM	Sp. Gr.		2.63	M _v	m ² /t	----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 1.50m. Average Field “N” value of this layer is 32. This layer is laying after 13.50m and continues up to its termination depth (15.00m).

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	71	PI		NP	DS (Direct-Shear Test)		
Silt	%	27	Bulk density	g/cc	1.86	C	kg/cm ²	0.00
Clay	%	2	Dry density	g/cc	-	Ø	°	31
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	-----

4.7. BH-7:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 15. This layer is laying after EGL and continues up to 5.00m.

Physical properties			Liquid limit	%	47.00	Shear strength		
Gravel	%	3	Plastic limit	%	19.50	Type of Test		
Sand	%	6	PI		27.50	UC		
Silt	%	37	Bulk density	g/cc	1.92	C	kg/cm ²	0.43
Clay	%	54	Dry density	g/cc	1.45	Ø	°	0
Classification			NMC	%	32.17	Consolidation		
IS Classification		CI	Sp. Gr.		2.70	M _v	m ² /t	0.0041
			Free Swell Index	%	41.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff, brownish grey, sandy clay with kankars.” Depth of this layer is 1.00m. Average Field “N” value of this layer is 9. This layer is laying after 5.00m and continues up to 6.00m.

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Physical properties			Liquid limit	%	34.00	Shear strength		
Gravel	%	2	Plastic limit	%	20.50	Type of Test		
Sand	%	23	PI		13.50	UU (Triaxial-Shear Test)		
Silt	%	35	Bulk density	g/cc	1.84	C	kg/cm ²	0.23
Clay	%	40	Dry density	g/cc	-	Ø	°	4
Classification			NMC	%	-	Consolidation		
IS Classification		CL	Sp. Gr.		2.65	M _v	m ² /t	0.0019

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose light, brownish grey silty fine sand with mica.” Depth of this layer is 1.00m. No SPT is encountered in this layer. This layer is laying after 6.00m and continues up to 7.00m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	66	PI		NP	DS (Direct-Shear Test)		
Silt	%	27	Bulk density	g/cc	1.85	C	kg/cm ²	0.00
Clay	%	7	Dry density	g/cc	1.61	Ø	°	26
Classification			NMC	%	15.00	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium, brownish grey silty sand with mica.” Depth of this layer is 8.00m. Average Field “N” value of this layer is 23. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	72	PI		NP	DS (Direct-Shear Test)		
Silt	%	22	Bulk density	g/cc	1.87	C	kg/cm ²	0.00
Clay	%	6	Dry density	g/cc	1.65	Ø	°	31
Classification			NMC	%	13.00	Consolidation		
IS Classification		SM	Sp. Gr.		2.66	M _v	m ² /t	-----

4.8. BH-8:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay with sand & kankars.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 11. This layer is laying after EGL and continues up to 6.00m.

Physical properties			Liquid limit	%	46.33	Shear strength		
Gravel	%	2	Plastic limit	%	23.50	Type of Test		
Sand	%	11	PI		22.83	UC		
Silt	%	35	Bulk density	g/cc	1.89	C	kg/cm ²	0.37
Clay	%	52	Dry density	g/cc	1.46	Ø	°	0
Classification			NMC	%	29.16	Consolidation		
IS Classification		CI	Sp. Gr.		2.69	M _v	m ² /t	0.0038
			Free Swell Index	%	39.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose, light brownish grey silty fine sand with mica.” Depth of this layer is 1.00m. No SPT value is encountered in this layer. This layer is laying after 6.00m and continues up to 7.00m.

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	61	PI		NP	DS (Direct-Shear Test)		
Silt	%	32	Bulk density	g/cc	1.83	C	kg/cm ²	0.00
Clay	%	7	Dry density	g/cc	1.47	Ø	°	23
Classification			NMC	%	24.50	Consolidation		
IS Classification		SM	Sp. Gr.		2.63	M _v	m ² /t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium, brownish grey silty sand with mica.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 19. This layer is laying after 7.00m and continues up to 12.00m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	68	PI		NP	DS (Direct-Shear Test)		
Silt	%	28	Bulk density	g/cc	1.84	C	kg/cm ²	0.00
Clay	%	4	Dry density	g/cc	-	Ø	°	27
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 3.00m. Average Field “N” value of this layer is 33. This layer is laying after 12.00m and continues up to its termination depth (15.00m).

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	73	PI		NP	DS (Direct-Shear Test)		
Silt	%	24	Bulk density	g/cc	1.86	C	kg/cm ²	0.00
Clay	%	3	Dry density	g/cc	-	Ø	°	33
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.67	M _v	m ² /t	----

4.9. BH-9:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay with sand.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 12. This layer is laying after EGL and continues up to 6.00m.

Physical properties			Liquid limit	%	46.50	Shear strength		
Gravel	%	0	Plastic limit	%	18.25	Type of Test		
Sand	%	9	PI		28.25	UC		
Silt	%	40	Bulk density	g/cc	1.89	C	kg/cm ²	0.33
Clay	%	51	Dry density	g/cc	1.43	Ø	°	0
Classification			NMC	%	32.50	Consolidation		
IS Classification		CI	Sp. Gr.		2.69	M _v	m ² /t	0.0037
			Free Swell Index	%	39.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 9.00m. Average Field “N” value of this layer is 22. This layer is laying after 6.00m and continues up to its termination depth (15.00m).

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Physical properties		
Gravel	%	0
Sand	%	66
Silt	%	27
Clay	%	7
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.84
Dry density	g/cc	1.47
NMC	%	25.25
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	26
Consolidation		
M _v	m ² /t	-----

4.10. BH-10:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with sand.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 10. This layer is laying after EGL and continues up to 6.00m.

Physical properties		
Gravel	%	0
Sand	%	13
Silt	%	36
Clay	%	51
Classification		
IS Classification	CI	

Liquid limit	%	46.00
Plastic limit	%	17.00
PI		29.00
Bulk density	g/cc	1.89
Dry density	g/cc	1.45
NMC	%	30.50
Sp. Gr.		2.68
Free Swell Index	%	40.00

Shear strength		
Type of Test		
UC		
C	kg/cm ²	0.36
Ø	°	0
Consolidation		
M _v	m ² /t	0.0038

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose to medium, brownish grey silty sand with mica.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 15. This layer is laying after 6.00m and continues up to 12.00m.

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	66	PI		NP	DS (Direct-Shear Test)		
Silt	%	29	Bulk density	g/cc	1.85	C	kg/cm ²	0
Clay	%	5	Dry density	g/cc	1.48	Ø	°	25
Classification			NMC	%	24.50	Consolidation		
IS Classification		SM	Sp. Gr.		2.63	M _v	m ² /t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 3.00m. Average Field “N” value of this layer is 31. This layer is laying after 12.00m and continues up to its termination depth (15.00m).

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	72	PI		NP	DS (Direct-Shear Test)		
Silt	%	24	Bulk density	g/cc	1.87	C	kg/cm ²	0
Clay	%	4	Dry density	g/cc	-	Ø	°	29
Classification			NMC	%	-	Consolidation		
IS Classification		SM	Sp. Gr.		2.65	M _v	m ² /t	-----

4.11. BH-11:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 12. This layer is laying after EGL and continues up to 6.00m.

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Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

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Physical properties			Liquid limit	%	48.25	Shear strength		
Gravel	%	0	Plastic limit	%	20.50	Type of Test		
Sand	%	8	PI		27.75	UC		
Silt	%	25	Bulk density	g/cc	1.90	C	kg/cm ²	0.36
Clay	%	67	Dry density	g/cc	1.45	Ø	°	0
Classification			NMC	%	31.25	Consolidation		
IS Classification		CI	Sp. Gr.		2.68	M _v	m ² /t	0.0041
			Free Swell Index	%	40.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose, light brownish grey silty fine sand with mica.” Depth of this layer is 1.00m. No SPT value is encountered in this layer. This layer is laying after 6.00m and continues up to 7.00m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	66	PI		NP	DS (Direct-Shear Test)		
Silt	%	29	Bulk density	g/cc	1.82	C	kg/cm ²	0
Clay	%	5	Dry density	g/cc	1.46	Ø	°	25
Classification			NMC	%	25.00	Consolidation		
IS Classification		SM	Sp. Gr.		2.64	M _v	m ² /t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium, brownish grey silty sand with mica.” Depth of this layer is 5.00m. Average Field “N” value of this layer is 19. This layer is laying after 7.00m and continues up to 12.00m.

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Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	69	PI		NP	DS (Direct-Shear Test)		
Silt	%	27	Bulk density	g/cc	1.85	C	kg/cm ²	0
Clay	%	4	Dry density	g/cc	1.52	Ø	°	27
Classification			NMC	%	21.50	Consolidation		
IS Classification	SM		Sp. Gr.		2.65	M _v	m ² /t	-----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium to dense, brownish grey silty sand with mica.” Depth of this layer is 3.00m. Average Field “N” value of this layer is 34. This layer is laying after 12.00m and continues up to its termination depth (15.00m).

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	73	PI		NP	DS (Direct-Shear Test)		
Silt	%	25	Bulk density	g/cc	1.86	C	kg/cm ²	0
Clay	%	2	Dry density	g/cc	-	Ø	°	30
Classification			NMC	%	-	Consolidation		
IS Classification	SM		Sp. Gr.		2.65	M _v	m ² /t	-----

4.12. BH-12:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This layer consists of “Stiff consistency, brownish grey silty clay with kankars & traces of sand.” Depth of this layer is 6.00m. Average Field “N” value of this layer is 11. This layer is laying after EGL and continues up to 6.00m.

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Physical properties			Liquid limit	%	46.75	Shear strength		
Gravel	%	0	Plastic limit	%	18.50	Type of Test		
Sand	%	11	PI		28.25	UC		
Silt	%	24	Bulk density	g/cc	1.89	C	kg/cm ²	0.34
Clay	%	65	Dry density	g/cc	1.45	Ø	°	0
Classification			NMC	%	30.50	Consolidation		
IS Classification		CI	Sp. Gr.		2.70	M _v	m ² /t	0.0039
			Free Swell Index	%	41.00			

STRATUM-II:-

The properties of the layer are as follows:

Description:

This layer consists of “Loose, light brownish, grey silty fine sand with mica.” Depth of this layer is 4.00m. Field “N” value of this layer is 7. This layer is laying after 6.00m and continues up to 10.00m.

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	0	Plastic limit	%	NP	Type of Test		
Sand	%	69	PI		NP	DS (Direct-Shear Test)		
Silt	%	28	Bulk density	g/cc	1.85	C	kg/cm ²	0
Clay	%	3	Dry density	g/cc	1.48	Ø	°	25
Classification			NMC	%	24.50	Consolidation		
IS Classification		SM	Sp. Gr.		2.64	M _v	m ² /t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This layer consists of “Medium, brownish grey silty sand with mica” Depth of this layer is 5.00m. Average Field “N” value of this layer is 18. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

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Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from
3200 MW Chapar Thermal Power Plant

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<i>Physical properties</i>		
Gravel	%	0
Sand	%	73
Silt	%	25
Clay	%	2
<i>Classification</i>		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.86
Dry density	g/cc	-
NMC	%	-
Sp. Gr.		2.65

<i>Shear strength</i>		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	28
<i>Consolidation</i>		
M _v	m ² /t	-----

5.0 CHOICE OF FOUNDATION:

In view of the above sub-soil conditions in mind and the type of structure both the aspects regarding allowable bearing capacity for shallow foundation and deep foundation have been discussed in the following paragraphs. Designer can choose the requirement depending upon the loading & geometry of the structure envisaged.

5.0.1 SHALLOW FOUNDATION:

5.1. SAMPLE CALCULATION

5.1.1 BH-1:-

Stratum-II:

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 3.00 m.

The founding depth is falling in Stratum-II.

DETERMINATION OF BEARING CAPACITY:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m)

Bearing Capacity as per IS 6403:1981 considering 3.00m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 3.9 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.88 - 1 = 0.88 \text{ t/m}^3$

For, $\phi = 0^\circ$, Bearing Capacity factors, $N_c = 5.14$, $N_q = 1.00$, $N_\gamma = 0.00$,

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

$s_c = 1.30$

d_q & d_γ = Depth correction. Here, $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.20$

i_q & i_γ = Inclination Factor. = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3, and B.C Punmia Pg-660]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 3.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.d_c.s_c.i_c + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [3.9 * 5.14 * 1.20 * 1.30 * 1.00 + 0.88 * 3 * (1.00 - 1) * 1.20 * 1.00 * 1.00 + 0.5 * 1.88 * \\ &3 * 0.00 * 0.8 * 1.00 * 1.00 * 0.5] \\ &= 10.42 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

Settlement, $S = H \times mv \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = $1.5 B = 1.5 \times 3.0 = 4.50$ m

mv = Co-efficient of Volume Change = 0.0039 sqm/t

Note – For Δp , As per IS:8009 (Part-I) – 1976, we take 2:1 Stress Distribution method,

Δp = Increment of stress = $(3 \times 3 \times 10.42) / \{(3+2.25)^2\} = 3.40$ t/ Sqm

Therefore,

$S = 4.5 \times 0.0039 \times 3.40 \times 1000 = 59.71$ mm

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 6.98 t/sqm

Stratum-III:

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 6.00 m.

The founding depth is falling in Stratum-III.

DETERMINATION OF BEARING CAPACITY:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m)

Bearing Capacity as per IS 6403:1981 considering 6.00m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma' D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 2.2 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.86 - 1 = 0.86$ t/m³

For, $\phi = 3^\circ$, Bearing Capacity factors, $N_c = 5.90$, $N_q = 1.31$, $N_\gamma = 0.24$, [**Considering Local Shear Failure**]

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

$s_c = 1.30$

d_q & d_γ = Depth correction. Here, $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.42$

i_q & i_γ = Inclination Factor. = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3, and B.C Punmia Pg-660]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 4.00 metre

B = 3.00 metre

Hence:

$$q_d = 1/F [C.N_c.d_c.s_c.i_c + \gamma' D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

$$\begin{aligned} &= 1/(3) [2.2 \times 5.90 \times 1.42 \times 1.30 \times 1.00 + 0.86 \times 6 \times (1.31 - 1) \times 1.20 \times 1.00 \times 1.00 + 0.5 \times 1.86 \times \\ &3 \times 0.24 \times 0.8 \times 1.00 \times 1.00 \times 0.5] \\ &= 8.72 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

Settlement, $S = H \times m_v \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = 1.5 B = 1.5X3.0 = 4.50 m

m_v = Co-efficient of Volume Change = 0.0021 sqm/t

Note – For Δp , As per IS:8009 (Part-I) – 1976, we take 2:1 Stress Distribution method,

Δp = Increment of stress = $(3 \times 3 \times 8.72) / \{(3+2.25)^2\} = 2.85 \text{ t/ Sqm}$

Therefore,

$S = 4.5 \times 0.0021 \times 2.85 \times 1000 = 26.92 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 8.72 t/sqm

Stratum-IV:

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 7.00 m.

The founding depth is falling in Stratum-IV.

DETERMINATION OF BEARING CAPACITY:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m)

Bearing Capacity as per IS 6403:1981 considering 7.00m depth of foundation

$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.86 - 1 = 0.86 \text{ t/m}^3$

For, $\phi = 15^\circ$, Bearing Capacity factors, $N_c = 10.98$, $N_q = 3.94$, $N_\gamma = 2.65$, [**Considering Local Shear Failure**]

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

$s_c = 1.30$

d_q & d_γ = Depth correction. Here, $d_q = 1.30$ and $d_\gamma = 1.30$

$d_c = 1.61$

i_q & i_γ = Inclination Factor. = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3, and B.C Punmia Pg-660]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 4.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.d_c.s_c.i_c + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 \times 10.98 \times 1.61 \times 1.30 \times 1.00 + 0.86 \times 7 \times (3.94 - 1) \times 1.20 \times 1.00 \times 1.30 + 0.5 \times 1.86 \times \\ &\quad 3 \times 2.65 \times 0.8 \times 1.30 \times 1.00 \times 0.5] \\ &= 10.48 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for average ' N' ' = 16 is 19.10 mm

Hence, for 10.48 t/sqm pressure the settlement will be = $19.10 \times 10.48 / 10 = 20.02 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 10.48 t/sqm

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.88	1.88	1.88	1.88
C	3.9	3.9	3.9	3.9
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0039	0.0039	0.0039	0.0039
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.88	0.88	0.88	0.88
C.N _c .s _c .d _c .i _c	31.27	28.67	27.88	27.36
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	31.27	28.67	27.88	27.36
SBC	10.42	9.56	9.29	9.12
Recommended SBC for sattlement of 40mm	10.42	9.56	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	19.9	36.52	53.24	69.68
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.40	3.12	3.03	2.98
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.88	1.88	1.88	1.88
C	3.9	3.9	3.9	3.9
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
m_v	0.0039	0.0039	0.0039	0.0039
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.88	0.88	0.88	0.88
C.N_c.s_c.d_c.i_c	36.48	31.27	29.45	28.67
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	36.48	31.27	29.45	28.67
SBC	12.16	10.42	9.82	9.56
Recommended SBC for sattlement of 40mm	12.16	10.42	6.98	5.23
For Settlement				
of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	23.23	39.81	56.27	73.05
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.97	3.40	3.21	3.12
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.88	1.88	1.88	1.88
C	3.9	3.9	3.9	3.9
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
S_c	1.3	1.3	1.3	1.3
D_c	1.6	1.3	1.2	1.15
S_q	1.2	1.2	1.2	1.2
D_q=D_y	1	1	1	1
D_q=D_y	1.3	1.15	1.1	1.08
S_y	0.8	0.8	0.8	0.8
D_q=D_y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (y')	0.88	0.88	0.88	0.88
C.N_c. s_c.d_c.i_c	41.7	33.88	31.27	29.97
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	41.7	33.88	31.27	29.97
SBC	13.9	11.29	10.42	9.99
Recommended SBC for sattlement of 40mm	13.9	10.47	6.98	5.24
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	26.55	43.13	59.71	76.33
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.54	3.69	3.40	3.26
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.88	1.88	1.88	1.88
C	3.9	3.9	3.9	3.9
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
D_c	1.8	1.4	1.27	1.2
S_q	1.2	1.2	1.2	1.2
D_q=D_y	1	1	1	1
D_q=D_y	1.4	1.2	1.13	1.1
S_y	0.8	0.8	0.8	0.8
D_q=D_y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (y')	0.88	0.88	0.88	0.88
C.N_c. s_c.d_c.i_c	46.91	36.48	33.1	31.27
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	46.91	36.48	33.1	31.27
SBC	15.64	12.16	11.03	10.42
Recommended SBC for sattlement of 40mm	15.64	10.47	6.98	5.23
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	29.88	46.46	63.21	79.62
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.11	3.97	3.60	3.40
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =5m)					
Depth (D)	5	5	5	5	
Width (B)	1	2	3	4	
Bulk Dencit (y)	1.86	1.86	1.86	1.86	Design
C	2.2	2.2	2.2	2.2	General shear failure
Ø	3	3	3	3	Local shear failure
W'	0.5	0.5	0.5	0.5	
FOS	3	3	3	3	
N Value	0	0	0	0	
m _v	0.0021	0.0021	0.0021	0.0021	
N _c	5.9	5.9	5.9	5.9	
N _q	1.31	1.31	1.31	1.31	
N _y	0.24	0.24	0.24	0.24	
S _c	1.3	1.3	1.3	1.3	
D _c	2.05	1.53	1.35	1.26	
S _q	1.2	1.2	1.2	1.2	
D _q =D _y	1	1	1	1	
D _q =D _y	1.53	1.26	1.18	1.13	
S _y	0.8	0.8	0.8	0.8	
D _q =D _y	1	1	1	1	
Tan(45+Ø /2)	1.05	1.05	1.05	1.05	
i _c , i _q & i _y	1	1	1	1	
Submarged Dencit (y')	0.86	0.86	0.86	0.86	
C.N _c s _c .d _c .i _c	34.59	25.82	22.78	21.26	
γ'D.(N _q -1).s _q .d _q .i _q	1.6	1.6	1.6	1.6	
0.5. γ.B.N _y .s _y .d _y .i _y W'	0.09	0.18	0.27	0.36	
NBC	36.28	27.6	24.65	23.22	
SBC	12.09	9.2	8.22	7.74	
Recommended SBC for sattlement of 40mm	12.09	9.20	8.22	7.74	
For Settlement					
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	0	0	0	0	
Settlement (S)	12.44	18.93	25.36	31.84	
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.95	3.00	2.68	2.53	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.86	1.86	1.86	1.86		
C	2.2	2.2	2.2	2.2		
Ø	3	3	3	3	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	5
FOS	3	3	3	3	Local shear failure	3
N Value	0	0	0	0		
m _v	0.0021	0.0021	0.0021	0.0021		
Nc	5.9	5.9	5.9	5.9		
Nq	1.31	1.31	1.31	1.31		
Ny	0.24	0.24	0.24	0.24		
Sc	1.3	1.3	1.3	1.3		
Dc	2.26	1.63	1.42	1.32		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.63	1.32	1.21	1.16		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.86	0.86	0.86	0.86		
C.N _c .s _c .d _c .i _c	38.14	27.5	23.96	22.27		
γ'D.(Nq-1).s _q .d _q .i _q	1.92	1.92	1.92	1.92		
0.5. γ.B.Nγ.s _y .d _y .i _y W'	0.09	0.18	0.27	0.36		
NBC	40.15	29.6	26.15	24.55		
SBC	13.38	9.87	8.72	8.18		
Recommended SBC for sattlement of 40mm	13.38	9.87	8.72	8.18		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	0	0	0	0		
Settlement (S)	13.76	20.3	26.91	33.65		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.37	3.22	2.85	2.67		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-1) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.86	1.86	1.86	1.86		
C	0	0	0	0		
Ø	15	15	15	15	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	22
FOS	3	3	3	3	Local shear failure	15
N Value	16	16	16	16		
Nc	10.98	10.98	10.98	10.98		
Nq	3.94	3.94	3.94	3.94		
Ny	2.65	2.65	2.65	2.65		
Sc	1.3	1.3	1.3	1.3		
Dc	2.82	1.91	1.61	1.46		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.91	1.46	1.3	1.23		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.91	1.46	1.3	1.23		
Tan(45+Ø /2)	1.3	1.3	1.3	1.3		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.86	0.86	0.86	0.86		
C.Nc.s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	40.57	31.01	27.61	26.12		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ . W'	1.88	2.88	3.84	4.85		
NBC	42.45	33.89	31.45	30.97		
SBC	14.15	11.3	10.48	10.32		
Recommended SBC for sattlement of 40mm	14.15	11.30	10.48	10.32		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	17.6	18.2	19.1	20.8		
Settlement (S)	24.9	20.57	20.02	21.47		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.62	3.69	3.42	3.37		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-01								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	31.27	36.48	41.7	46.91	36.28	40.15	42.45
SBC	1 x 1	10.42	12.16	13.9	15.64	12.09	13.38	14.15
BC for sattlement of 40mm	1 x 1	10.42	12.16	13.9	15.64	12.09	13.38	14.15
Settlement (S)	1 x 1	19.9	23.23	26.55	29.88	12.44	13.76	24.9
NBC	2 x 2	28.67	31.27	33.88	36.48	27.6	29.6	33.89
SBC	2 x 2	9.56	10.42	11.29	12.16	9.2	9.87	11.3
BC for sattlement of 40mm	2 x 2	9.56	10.42	10.47	10.47	9.20	9.87	11.30
Settlement (S)	2 x 2	36.52	39.81	43.13	46.46	18.93	20.3	20.57
NBC	3 x 3	27.88	29.45	31.27	33.1	24.65	26.15	31.45
SBC	3 x 3	9.29	9.82	10.42	11.03	8.22	8.72	10.48
BC for sattlement of 40mm	3 x 3	6.98	6.98	6.98	6.98	8.22	8.72	10.48
Settlement (S)	3 x 3	53.24	56.27	59.71	63.21	25.36	26.91	20.02
NBC	4 x 4	27.36	28.67	29.97	31.27	23.22	24.55	30.97
SBC	4 x 4	9.12	9.56	9.99	10.42	7.74	8.18	10.32
BC for sattlement of 40mm	4 x 4	5.24	5.23	5.24	5.23	7.74	8.18	10.32
Settlement (S)	4 x 4	69.68	73.05	76.33	79.62	31.84	33.65	21.47

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.87	1.87	1.87	1.87
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
S _c	1.3	1.3	1.3	1.3
D _c	1.2	1.1	1.07	1.05
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.1	1.05	1.03	1.03
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.87	0.87	0.87	0.87
C.N _c .s _c .d _c .i _c	29.67	27.2	26.45	25.96
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W ³	0	0	0	0
NBC	29.67	27.2	26.45	25.96
SBC	9.89	9.07	8.82	8.65
Recommended SBC for sattlement of 40mm	9.89	9.07	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	18.41	33.76	49.25	64.4
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.23	2.96	2.88	2.82
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.87	1.87	1.87	1.87
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
S _c	1.3	1.3	1.3	1.3
D _c	1.4	1.2	1.13	1.1
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.2	1.1	1.07	1.05
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.87	0.87	0.87	0.87
C.N _c .s _c .d _c .i _c	34.61	29.67	27.94	27.2
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.N _y .s _y .d _y .i _y W'	0	0	0	0
NBC	34.61	29.67	27.94	27.2
SBC	11.54	9.89	9.31	9.07
Recommended SBC for sattlement of 40mm	11.54	9.89	7.16	5.37
For Settlement				
of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	21.48	36.82	51.98	67.53
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.77	3.23	3.04	2.96
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.87	1.87	1.87	1.87
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.87	0.87	0.87	0.87
C.N_c.s_c.d_c.i_c	39.56	32.14	29.67	28.43
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	39.56	32.14	29.67	28.43
SBC	13.19	10.71	9.89	9.48
Recommended SBC for sattlement of 40mm	13.19	10.71	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	24.55	39.87	55.22	70.58
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.31	3.50	3.23	3.10
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.87	1.87	1.87	1.87
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.87	0.87	0.87	0.87
C.N_c.s_c.d_c.i_c	44.5	34.61	31.4	29.67
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	44.5	34.61	31.4	29.67
SBC	14.83	11.54	10.47	9.89
Recommended SBC for sattlement of 40mm	14.83	10.74	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	17	17	17	17
Settlement (S)	27.6	42.96	58.46	73.63
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.84	3.77	3.42	3.23
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =5m)						
Depth (D)	5	5	5	5		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	2.5	2.5	2.5	2.5	Design	Φ
Ø	3	3	3	3	General shear failure	4
W'	0.5	0.5	0.5	0.5	Local shear failure	3
FOS	3	3	3	3		
N Value	0	0	0	0		
m _v	0.0022	0.0022	0.0022	0.0022		
Nc	5.9	5.9	5.9	5.9		
Nq	1.31	1.31	1.31	1.31		
Ny	0.24	0.24	0.24	0.24		
Sc	1.3	1.3	1.3	1.3		
Dc	2.05	1.53	1.35	1.26		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.53	1.26	1.18	1.13		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	39.31	29.34	25.89	24.16		
γ'D.(Nq-1).s _q .d _q .i _q	1.58	1.58	1.58	1.58		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.09	0.18	0.27	0.36		
NBC	40.98	31.1	27.74	26.1		
SBC	13.66	10.37	9.25	8.7		
Recommended SBC for sattlement of 40mm	13.66	10.37	9.25	8.7		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	14.72	22.35	29.9	37.5		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.46	3.39	3.02	2.84		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	2.5	2.5	2.5	2.5		
Ø	3	3	3	3	Design	Ø
W'	0.5	0.5	0.5	0.5	General shear failure	4
FOS	3	3	3	3	Local shear failure	3
N Value	0	0	0	0		
m _v	0.0022	0.0022	0.0022	0.0022		
Nc	5.9	5.9	5.9	5.9		
Nq	1.31	1.31	1.31	1.31		
Ny	0.24	0.24	0.24	0.24		
Sc	1.3	1.3	1.3	1.3		
Dc	2.26	1.63	1.42	1.32		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.63	1.32	1.21	1.16		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	43.34	31.26	27.23	25.31		
γ'D.(Nq-1).s _q .d _q .i _q	1.9	1.9	1.9	1.9		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.09	0.18	0.27	0.36		
NBC	45.33	33.34	29.4	27.57		
SBC	15.11	11.11	9.8	9.19		
Recommended SBC for settlement of 40mm	15.11	11.11	9.80	9.19		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	16.28	23.94	31.68	39.61		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.93	3.63	3.20	3.00		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-2) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	0	0	0	0		
Ø	16	16	16	16	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	24
FOS	3	3	3	3	Local shear failure	16
N Value	16	16	16	16		
Nc	11.63	11.63	11.63	11.63		
Nq	4.34	4.34	4.34	4.34		
Ny	3.06	3.06	3.06	3.06		
Sc	1.3	1.3	1.3	1.3		
Dc	2.86	1.93	1.62	1.47		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.93	1.47	1.31	1.23		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.93	1.47	1.31	1.23		
Tan(45+Ø /2)	1.33	1.33	1.33	1.33		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	46.03	35.06	31.24	29.33		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.19	3.33	4.45	5.57		
NBC	48.22	38.39	35.69	34.9		
SBC	16.07	12.8	11.9	11.63		
Recommended SBC for settlement of 40mm	16.07	12.80	11.90	11.63		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	17.6	18.2	19.1	20.8		
Settlement (S)	28.28	23.3	22.73	24.19		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.25	4.18	3.89	3.80		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-02								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	29.67	34.61	39.56	44.5	40.98	45.33	48.22
SBC	1 x 1	9.89	11.54	13.19	14.83	13.66	15.11	16.07
BC for sattlement of 40mm	1 x 1	9.89	11.54	13.19	14.83	13.66	15.11	16.07
Settlement (S)	1 x 1	18.41	21.48	24.55	27.6	14.72	16.28	28.28
NBC	2 x 2	27.2	29.67	32.14	34.61	31.1	33.34	38.39
SBC	2 x 2	9.07	9.89	10.71	11.54	10.37	11.11	12.8
BC for sattlement of 40mm	2 x 2	9.07	9.89	10.71	10.74488	10.37	11.11	12.80
Settlement (S)	2 x 2	33.76	36.82	39.87	42.96	22.35	23.94	23.3
NBC	3 x 3	26.45	27.94	29.67	31.4	27.74	29.4	35.69
SBC	3 x 3	8.82	9.31	9.89	10.47	9.25	9.8	11.9
BC for sattlement of 40mm	3 x 3	7.16	7.16	7.16	7.16	9.25	9.80	11.90
Settlement (S)	3 x 3	49.25	51.98	55.22	58.46	29.9	31.68	22.73
NBC	4 x 4	25.96	27.2	28.43	29.67	26.1	27.57	34.9
SBC	4 x 4	8.65	9.07	9.48	9.89	8.7	9.19	11.63
BC for sattlement of 40mm	4 x 4	5.37	5.37	5.37	5.37	8.70	9.19	11.63
Settlement (S)	4 x 4	64.4	67.53	70.58	73.63	37.5	39.61	24.19

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N _c .s _c .d _c .i _c	27.26	24.99	24.31	23.85
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	27.26	24.99	24.31	23.85
SBC	9.09	8.33	8.1	7.95
Recommended SBC for sattlement of 40mm	9.09	8.33	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	16.92	31.01	45.23	59.19
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	2.97	2.72	2.64	2.60
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N _c .s _c .d _c .i _c	31.81	27.26	25.67	24.99
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	31.81	27.26	25.67	24.99
SBC	10.6	9.09	8.56	8.33
Recommended SBC for sattlement of 40mm	10.6	9.09	7.16	5.37
For Settlement				
of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	19.73	33.84	47.8	62.02
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.46	2.97	2.80	2.72
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N _c .s _c .d _c .i _c	36.35	29.53	27.26	26.13
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	36.35	29.53	27.26	26.13
SBC	12.12	9.84	9.09	8.71
Recommended SBC for sattlement of 40mm	12.12	9.84	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	22.56	36.63	50.76	64.85
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.96	3.21	2.97	2.84
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	40.89	31.81	28.85	27.26
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	40.89	31.81	28.85	27.26
SBC	13.63	10.6	9.62	9.09
Recommended SBC for sattlement of 40mm	13.63	10.60	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	25.37	39.46	53.71	67.67
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.45	3.46	3.14	2.97
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =5m)					
Depth (D)	5	5	5	5	
Width (B)	1	2	3	4	
Bulk Dencit (y)	1.85	1.85	1.85	1.85	
C	2	2	2	2	
Ø	4	4	4	4	Design
W'	0.5	0.5	0.5	0.5	General shear failu
FOS	3	3	3	3	Local shear failure
N Value	0	0	0	0	
m _v	0.002	0.002	0.002	0.002	
Nc	6.19	6.19	6.19	6.19	
Nq	1.43	1.43	1.43	1.43	
Ny	0.34	0.34	0.34	0.34	
Sc	1.3	1.3	1.3	1.3	
Dc	2.07	1.54	1.36	1.27	
Sq	1.2	1.2	1.2	1.2	
Dq=Dy	1	1	1	1	
Dq=Dy	1.54	1.27	1.18	1.13	
Sy	0.8	0.8	0.8	0.8	
Dq=Dy	1	1	1	1	
Tan(45+Ø /2)	1.07	1.07	1.07	1.07	
ic, iq & iy	1	1	1	1	
Submarged Dencit (y')	0.85	0.85	0.85	0.85	
C.N _c .s _c .d _c .i _c	33.31	24.78	21.89	20.44	
γ'D.(Nq-1).s _q .d _q .i _q	2.19	2.19	2.19	2.19	
0.5. γ.B.Nγ.sγ.dγ.iγ W'	0.13	0.25	0.38	0.5	
NBC	35.63	27.22	24.46	23.13	
SBC	11.88	9.07	8.15	7.71	
Recommended SBC for sattlement of 40mm	11.88	9.07	8.15	7.71	
For Settlement					
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	0	0	0	0	
Settlement (S)	11.64	17.77	23.95	30.21	
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.88	2.96	2.66	2.52	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =6m)						
Depth (D)	6	6	6	6	Design	Φ
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85	General shear failure	6
C	2	2	2	2		
Ø	4	4	4	4	Local shear failure	4
W'	0.5	0.5	0.5	0.5		
FOS	3	3	3	3		
N Value	0	0	0	0		
m _v	0.002	0.002	0.002	0.002		
N _c	6.19	6.19	6.19	6.19		
N _q	1.43	1.43	1.43	1.43		
N _y	0.34	0.34	0.34	0.34		
S _c	1.3	1.3	1.3	1.3		
D _c	2.28	1.64	1.43	1.32		
S _q	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.64	1.32	1.21	1.16		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1	1	1	1		
Tan(45+Ø /2)	1.07	1.07	1.07	1.07		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	36.69	26.39	23.01	21.24		
γ'D _c (N _q -1).s _q .d _q .i _q	2.63	2.63	2.63	2.63		
0.5. γ.B.N _y .s _y .d _y .i _y .W'	0.13	0.25	0.38	0.5		
NBC	39.45	29.27	26.02	24.37		
SBC	13.15	9.76	8.67	8.12		
Recommended SBC for settlement of 40mm	13.15	9.76	8.67	8.12		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	12.88	19.12	25.48	31.82		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.29	3.19	2.83	2.65		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-3) (Depth =7m)					
Depth (D)	7	7	7	7	
Width (B)	1	2	3	4	
Bulk Dencit (y)	1.87	1.87	1.87	1.87	
C	0	0	0	0	Design
Ø	18	18	18	18	General shear failure
W'	0.5	0.5	0.5	0.5	Local shear failure
FOS	3	3	3	3	
N Value	18	18	18	18	
Nc	13.1	13.1	13.1	13.1	
Nq	5.26	5.26	5.26	5.26	
Ny	4.07	4.07	4.07	4.07	
Sc	1.3	1.3	1.3	1.3	
Dc	2.93	1.97	1.64	1.48	
Sq	1.2	1.2	1.2	1.2	
Dq=Dy	1	1	1	1	
Dq=Dy	1.97	1.48	1.32	1.24	
Sy	0.8	0.8	0.8	0.8	
Dq=Dy	1.97	1.48	1.32	1.24	
Tan(45+Ø /2)	1.38	1.38	1.38	1.38	
ic, iq & iy	1	1	1	1	
Submarged Dencit (y')	0.87	0.87	0.87	0.87	
C.N _c .s _c .d _c .i _c	0	0	0	0	
γ'D _c (Nq-1).s _q .d _q .i _q	61.33	46.08	41.09	38.6	
0.5. γ.B.Nγ.s _γ .d _γ .i _γ .W'	3	4.51	6.03	7.55	
NBC	64.33	50.59	47.12	46.15	
SBC	21.44	16.86	15.71	15.38	
Recommended SBC for settlement of 40mm	21.44	16.86	15.71	15.38	
For Settlement					
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	15.5	16.6	17.3	18.4	
Settlement (S)	33.23	27.99	27.18	28.3	
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	7.00	5.51	5.13	5.02	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

SBC & Settlement Summary of BH-03								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	27.26	31.81	36.35	40.89	35.63	39.45	64.33
SBC	1 x 1	9.09	10.6	12.12	13.63	11.88	13.15	21.44
BC for settlement of 40mm	1 x 1	9.09	10.6	12.12	13.63	11.88	13.15	21.44
Settlement (S)	1 x 1	16.92	19.73	22.56	25.37	11.64	12.88	33.23
NBC	2 x 2	24.99	27.26	29.53	31.81	27.22	29.27	50.59
SBC	2 x 2	8.33	9.09	9.84	10.6	9.07	9.76	16.86
BC for settlement of 40mm	2 x 2	8.33	9.09	9.84	10.6	9.07	9.76	16.86
Settlement (S)	2 x 2	31.01	33.84	36.63	39.46	17.77	19.12	27.99
NBC	3 x 3	24.31	25.67	27.26	28.85	24.46	26.02	47.12
SBC	3 x 3	8.1	8.56	9.09	9.62	8.15	8.67	15.71
BC for settlement of 40mm	3 x 3	7.16	7.16	7.16	7.16	8.15	8.67	15.71
Settlement (S)	3 x 3	45.23	47.8	50.76	53.71	23.95	25.48	27.18
NBC	4 x 4	23.85	24.99	26.13	27.26	23.13	24.37	46.15
SBC	4 x 4	7.95	8.33	8.71	9.09	7.71	8.12	15.38
BC for settlement of 40mm	4 x 4	5.37	5.37	5.37	5.37	7.71	8.12	15.38
Settlement (S)	4 x 4	59.19	62.02	64.85	67.67	30.21	31.82	28.3

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.91	1.91	1.91	1.91
C	4.4	4.4	4.4	4.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.004	0.004	0.004	0.004
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.91	0.91	0.91	0.91
C.N _c .s _c .d _c .i _c	35.28	32.34	31.46	30.87
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	35.28	32.34	31.46	30.87
SBC	11.76	10.78	10.49	10.29
Recommended SBC for sattlement of 40mm	11.76	10.20833	6.81	5.10
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	23.04	42.24	61.66	80.64
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.84	3.52	3.43	3.36
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.91	1.91	1.91	1.91
C	4.4	4.4	4.4	4.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.004	0.004	0.004	0.004
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.91	0.91	0.91	0.91
C.N_c.s_c.d_c.i_c	41.16	35.28	33.22	32.34
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	41.16	35.28	33.22	32.34
SBC	13.72	11.76	11.07	10.78
Recommended SBC for sattlement of 40mm	13.72	10.20833	6.81	5.10
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	26.88	46.08	65.06	84.48
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.48	3.84	3.61	3.52
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.91	1.91	1.91	1.91
C	4.4	4.4	4.4	4.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.004	0.004	0.004	0.004
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
S _c	1.3	1.3	1.3	1.3
D _c	1.6	1.3	1.2	1.15
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.3	1.15	1.1	1.08
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.91	0.91	0.91	0.91
C.N _c .S _c .d _c .i _c	47.04	38.22	35.28	33.81
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	47.04	38.22	35.28	33.81
SBC	15.68	12.74	11.76	11.27
Recommended SBC for sattlement of 40mm	15.68	10.20833	6.81	5.10
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	30.72	49.92	69.12	88.32
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.12	4.16	3.84	3.68
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.91	1.91	1.91	1.91
C	4.4	4.4	4.4	4.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.004	0.004	0.004	0.004
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.91	0.91	0.91	0.91
C.N_c.s_c.d_c.i_c	52.92	41.16	37.34	35.28
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	52.92	41.16	37.34	35.28
SBC	17.64	13.72	12.45	11.76
Recommended SBC for sattlement of 40mm	17.64	10.21	6.81	5.10
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	34.56	53.76	73.18	92.16
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.76	4.48	4.07	3.84
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =5m)					
Depth (D)	5	5	5	5	
Width (B)	1	2	3	4	
Bulk Dencit (y)	1.84	1.84	1.84	1.84	
C	2.1	2.1	2.1	2.1	Design
Ø	3	3	3	3	General shear failure
W'	0.5	0.5	0.5	0.5	Local shear failure
FOS	3	3	3	3	
N Value	0	0	0	0	
m _v	0.0018	0.0018	0.0018	0.0018	
Nc	5.9	5.9	5.9	5.9	
Nq	1.31	1.31	1.31	1.31	
Ny	0.24	0.24	0.24	0.24	
Sc	1.3	1.3	1.3	1.3	
Dc	2.05	1.53	1.35	1.26	
Sq	1.2	1.2	1.2	1.2	
Dq=Dy	1	1	1	1	
Dq=Dy	1.53	1.26	1.18	1.13	
Sy	0.8	0.8	0.8	0.8	
Dq=Dy	1	1	1	1	
Tan(45+Ø /2)	1.05	1.05	1.05	1.05	
ic, iq & iy	1	1	1	1	
Submarged Dencit (y')	0.84	0.84	0.84	0.84	
C.N _c .s _c .d _c .i _c	33.02	24.64	21.74	20.29	
γ'D.(Nq-1).s _q .d _q .i _q	1.56	1.56	1.56	1.56	
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.09	0.18	0.26	0.35	
NBC	34.67	26.38	23.56	22.2	
SBC	11.56	8.79	7.85	7.4	
Recommended SBC for sattlement of 40mm	11.56	8.79	7.85	7.4	
For Settlement					
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0	
Settlement (S)	10.19	15.5	20.76	26.1	
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.77	2.87	2.56	2.42	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =6m)					
Depth (D)	6	6	6	6	
Width (B)	1	2	3	4	
Bulk Dencit (y)	1.84	1.84	1.84	1.84	
C	0	0	0	0	Design
Ø	17	17	17	17	General shear failure
W'	0.5	0.5	0.5	0.5	Local shear failure
FOS	3	3	3	3	
N Value	13	13	13	13	
m _v	0	0	0	0	
Nc	12.34	12.34	12.34	12.34	
Nq	4.77	4.77	4.77	4.77	
Ny	3.53	3.53	3.53	3.53	
Sc	1.3	1.3	1.3	1.3	
Dc	2.62	1.81	1.54	1.41	
Sq	1.2	1.2	1.2	1.2	
Dq=Dy	1	1	1	1	
Dq=Dy	1.81	1.41	1.27	1.2	
Sy	0.8	0.8	0.8	0.8	
Dq=Dy	1.81	1.41	1.27	1.2	
Tan(45+Ø/2)	1.35	1.35	1.35	1.35	
ic, iq & iy	1	1	1	1	
Submarged Dencit (y')	0.84	0.84	0.84	0.84	
C.N _c .s _c .d _c .i _c	0	0	0	0	
γ'D.(Nq-1).s _q .d _q .i _q	41.27	32.15	28.96	27.36	
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.35	3.66	4.95	6.24	
NBC	43.62	35.81	33.91	33.6	
SBC	14.54	11.94	11.3	11.2	
Recommended SBC for sattlement of 40mm	14.54	11.94	11.30	11.20	
For Settlement					
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	23	24.2	26.8	28.8	
Settlement (S)	33.44	28.89	30.28	32.26	
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.75	3.90	3.69	3.66	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

Bearing Capacity as per IS 6403:1981 (BH-4) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.86	1.86	1.86	1.86		
C	0	0	0	0		
Ø	32	32	32	32	Design	Ø
W'	0.5	0.5	0.5	0.5	General shear failure	32
FOS	3	3	3	3		
N Value	23	23	23	23		
m _v	0	0	0	0		
N _c	35.49	35.49	35.49	35.49		
N _q	23.18	23.18	23.18	23.18		
N _y	30.22	30.22	30.22	30.22		
Sc	1.3	1.3	1.3	1.3		
Dc	3.52	2.26	1.84	1.63		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	2.26	1.63	1.42	1.32		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	2.26	1.63	1.42	1.32		
Tan(45+Ø /2)	1.8	1.8	1.8	1.8		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.86	0.86	0.86	0.86		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	362.12	261.17	227.52	211.5		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	25.41	36.65	47.89	59.36		
NBC	387.53	297.82	275.41	270.86		
SBC	129.18	99.27	91.8	90.29		
Recommended SBC for sattlement of 40mm	34.19	33.33	29.85	28.17		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	11.7	12	13.4	14.2		
Settlement (S)	151.14	119.12	123.01	128.21		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	42.18	32.41	29.98	29.48		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-04								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	35.28	41.16	47.04	52.92	34.67	43.62	387.53
SBC	1 x 1	11.76	13.72	15.68	17.64	11.56	14.54	129.18
BC for settlement of 40mm	1 x 1	11.76	13.72	15.68	17.64	11.56	14.54	34.19
Settlement (S)	1 x 1	23.04	26.88	30.72	34.56	10.19	33.44	151.14
NBC	2 x 2	32.34	35.28	38.22	41.16	26.38	35.81	297.82
SBC	2 x 2	10.78	11.76	12.74	13.72	8.79	11.94	99.27
BC for settlement of 40mm	2 x 2	10.21	10.20833	10.20833	10.20833	8.79	11.94	33.33
Settlement (S)	2 x 2	42.24	46.08	49.92	53.76	15.5	28.89	119.12
NBC	3 x 3	31.46	33.22	35.28	37.34	23.56	33.91	275.41
SBC	3 x 3	10.49	11.07	11.76	12.45	7.85	11.3	91.8
BC for settlement of 40mm	3 x 3	6.81	6.81	6.81	6.81	7.85	11.30	29.85
Settlement (S)	3 x 3	61.66	65.06	69.12	73.18	20.76	30.28	123.01
NBC	4 x 4	30.87	32.34	33.81	35.28	22.2	33.6	270.86
SBC	4 x 4	10.29	10.78	11.27	11.76	7.4	11.2	90.29
BC for settlement of 40mm	4 x 4	5.10	5.10	5.10	5.10	7.40	11.20	28.17
Settlement (S)	4 x 4	80.64	84.48	88.32	92.16	26.1	32.26	128.21

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0039	0.0039	0.0039	0.0039
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	32.07	29.4	28.6	28.06
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	32.07	29.4	28.6	28.06
SBC	10.69	9.8	9.53	9.35
Recommended SBC for sattlement of 40mm	10.69	9.8	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	20.42	37.44	54.61	71.44
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.49	3.20	3.11	3.05
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0039	0.0039	0.0039	0.0039
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	37.42	32.07	30.2	29.4
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	37.42	32.07	30.2	29.4
SBC	12.47	10.69	10.07	9.8
Recommended SBC for sattlement of 40mm	12.47	10.47013	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	23.82	40.84	57.71	74.88
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.07	3.49	3.29	3.20
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	42.76	34.75	32.07	30.74
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	42.76	34.75	32.07	30.74
SBC	14.25	11.58	10.69	10.25
Recommended SBC for sattlement of 40mm	14.25	10.47016	6.98	5.23
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	27.22	44.24	61.26	78.32
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.65	3.78	3.49	3.35
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	48.11	37.42	33.94	32.07
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	48.11	37.42	33.94	32.07
SBC	16.04	12.47	11.31	10.69
Recommended SBC for sattlement of 40mm	16.04	10.47	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	30.64	47.64	64.81	81.68
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.24	4.07	3.69	3.49
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =5m)						
Depth (D)	5	5	5	5		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	2.4	2.4	2.4	2.4		
Ø	3	3	3	3	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	4
FOS	3	3	3	3	Local shear failure	3
N Value	0	0	0	0		
m _v	0.0018	0.0018	0.0018	0.0018		
N _c	5.9	5.9	5.9	5.9		
N _q	1.31	1.31	1.31	1.31		
N _y	0.24	0.24	0.24	0.24		
Sc	1.3	1.3	1.3	1.3		
Dc	2.05	1.53	1.35	1.26		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.53	1.26	1.18	1.13		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	37.74	28.16	24.85	23.19		
γ'D.(Nq-1).s _q .d _q .i _q	1.58	1.58	1.58	1.58		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.09	0.18	0.27	0.36		
NBC	39.41	29.92	26.7	25.13		
SBC	13.14	9.97	8.9	8.38		
Recommended SBC for sattlement of 40mm	13.14	9.97	8.90	8.38		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	11.58	17.58	23.54	29.55		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.29	3.26	2.91	2.74		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-5) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	2.4	2.4	2.4	2.4		
Ø	3	3	3	3	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	4
FOS	3	3	3	3	Local shear failure	3
N Value	0	0	0	0		
m _v	0.0018	0.0018	0.0018	0.0018		
N _c	5.9	5.9	5.9	5.9		
N _q	1.31	1.31	1.31	1.31		
N _y	0.24	0.24	0.24	0.24		
S _c	1.3	1.3	1.3	1.3		
D _c	2.26	1.63	1.42	1.32		
S _q	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.63	1.32	1.21	1.16		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	41.6	30.01	26.14	24.3		
γ'D.(N _q -1).s _q .d _q .i _q	1.9	1.9	1.9	1.9		
0.5. γ.B.N _y .s _y .d _y .i _y .W'	0.09	0.18	0.27	0.36		
NBC	43.59	32.09	28.31	26.56		
SBC	14.53	10.7	9.44	8.85		
Recommended SBC for settlement of 40mm	14.53	10.70	9.44	8.85		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	12.81	18.87	24.97	31.21		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.74	3.49	3.08	2.89		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981		(BH-5) (Depth =7m)				
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (γ)	1.84	1.84	1.84	1.84		
C	0	0	0	0		
Ø	17	17	17	17	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	25
FOS	3	3	3	3	Local shear failure	17
N Value	20	20	20	20		
m _v	0	0	0	0		
N _c	12.34	12.34	12.34	12.34		
N _q	4.77	4.77	4.77	4.77		
N _y	3.53	3.53	3.53	3.53		
S _c	1.3	1.3	1.3	1.3		
D _c	2.89	1.95	1.63	1.47		
S _q	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.95	1.47	1.32	1.24		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1.95	1.47	1.32	1.24		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (γ')	0.84	0.84	0.84	0.84		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(N _q -1).s _q .d _q .i _q	51.87	39.1	35.11	32.99		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ .W'	2.53	3.82	5.14	6.44		
NBC	54.4	42.92	40.25	39.43		
SBC	18.13	14.31	13.42	13.14		
Recommended SBC for settlement of 40mm	18.13	14.31	13.42	13.14		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	14.7	15.4	16.5	17.6		
Settlement (S)	26.65	22.04	22.14	23.13		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.92	4.67	4.38	4.29		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-05								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	32.07	37.42	42.76	48.11	39.41	43.59	54.4
SBC	1 x 1	10.69	12.47	14.25	16.04	13.14	14.53	18.13
BC for sattlement of 40mm	1 x 1	10.69	12.47	14.25	16.04	13.14	14.53	18.13
Settlement (S)	1 x 1	20.42	23.82	27.22	30.64	11.58	12.81	26.65
NBC	2 x 2	29.4	32.07	34.75	37.42	29.92	32.09	42.92
SBC	2 x 2	9.8	10.69	11.58	12.47	9.97	10.7	14.31
BC for sattlement of 40mm	2 x 2	9.80	10.47	10.47	10.47	9.97	10.70	14.31
Settlement (S)	2 x 2	37.44	40.84	44.24	47.64	17.58	18.87	22.04
NBC	3 x 3	28.6	30.2	32.07	33.94	26.7	28.31	40.25
SBC	3 x 3	9.53	10.07	10.69	11.31	8.9	9.44	13.42
BC for sattlement of 40mm	3 x 3	6.98	6.98	6.98	6.98	8.90	9.44	13.42
Settlement (S)	3 x 3	54.61	57.71	61.26	64.81	23.54	24.97	22.14
NBC	4 x 4	28.06	29.4	30.74	32.07	25.13	26.56	39.43
SBC	4 x 4	9.35	9.8	10.25	10.69	8.38	8.85	13.14
BC for sattlement of 40mm	4 x 4	5.24	5.24	5.23	5.24	8.38	8.85	13.14
Settlement (S)	4 x 4	71.44	74.88	78.32	81.68	29.55	31.21	23.13

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	32.07	29.4	28.6	28.06
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_y.d_y.i_y W'	0	0	0	0
NBC	32.07	29.4	28.6	28.06
SBC	10.69	9.8	9.53	9.35
Recommended SBC for sattlement of 40mm	10.69	9.8	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	19.37	35.52	51.81	67.78
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.49	3.20	3.11	3.05
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N _c .s _c .d _c .i _c	37.42	32.07	30.2	29.4
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	37.42	32.07	30.2	29.4
SBC	12.47	10.69	10.07	9.8
Recommended SBC for sattlement of 40mm	12.47	10.69	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	22.6	38.75	54.75	71.04
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.07	3.49	3.29	3.20
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	42.76	34.75	32.07	30.74
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	42.76	34.75	32.07	30.74
SBC	14.25	11.58	10.69	10.25
Recommended SBC for sattlement of 40mm	14.25	11.03645	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	25.82	41.97	58.12	74.3
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.65	3.78	3.49	3.35
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.9	1.9	1.9	1.9
C	4	4	4	4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	48.11	37.42	33.94	32.07
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	48.11	37.42	33.94	32.07
SBC	16.04	12.47	11.31	10.69
Recommended SBC for sattlement of 40mm	16.04	11.04	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	29.07	45.2	61.49	77.49
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.24	4.07	3.69	3.49
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =5m)						
Depth (D)	5	5	5	5		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.86	1.86	1.86	1.86		
C	2	2	2	2		
Ø	4	4	4	4	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	6
FOS	3	3	3	3	Local shear failure	4
N Value	0	0	0	0		
m _v	0.0024	0.0024	0.0024	0.0024		
N _c	6.19	6.19	6.19	6.19		
N _q	1.43	1.43	1.43	1.43		
N _y	0.34	0.34	0.34	0.34		
Sc	1.3	1.3	1.3	1.3		
Dc	2.07	1.54	1.36	1.27		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.54	1.27	1.18	1.13		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø/2)	1.07	1.07	1.07	1.07		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.86	0.86	0.86	0.86		
C.N _c .s _c .d _c .i _c	33.31	24.78	21.89	20.44		
γ'D.(Nq-1).s _q .d _q .i _q	2.22	2.22	2.22	2.22		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.13	0.25	0.38	0.51		
NBC	35.66	27.25	24.49	23.17		
SBC	11.89	9.08	8.16	7.72		
Recommended SBC for sattlement of 40mm	11.89	9.08	8.16	7.72		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	50	32	27	25		
Settlement (S)	13.98	21.35	28.78	36.3		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.88	2.96	2.66	2.52		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.86	1.86	1.86	1.86		
C	2	2	2	2	Design	Φ
Ø	4	4	4	4	General shear failure	6
W'	0.5	0.5	0.5	0.5	Local shear failure	4
FOS	3	3	3	3		
N Value	0	0	0	0		
m _v	0.0024	0.0024	0.0024	0.0024		
N _c	6.19	6.19	6.19	6.19		
N _q	1.43	1.43	1.43	1.43		
N _y	0.34	0.34	0.34	0.34		
Sc	1.3	1.3	1.3	1.3		
Dc	2.28	1.64	1.43	1.32		
Sq	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.64	1.32	1.21	1.16		
Sy	0.8	0.8	0.8	0.8		
D _q =D _y	1	1	1	1		
Tan(45+Ø /2)	1.07	1.07	1.07	1.07		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.86	0.86	0.86	0.86		
C.N _c .s _c .d _c .i _c	36.69	26.39	23.01	21.24		
γ'D.(N _q -1).s _q .d _q .i _q	2.66	2.66	2.66	2.66		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0.13	0.25	0.38	0.51		
NBC	39.48	29.3	26.05	24.41		
SBC	13.16	9.77	8.68	8.14		
Recommended SBC for sattlement of 40mm	13.16	9.77	8.68	8.14		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0		
Settlement (S)	15.47	22.97	30.61	38.27		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.30	3.19	2.83	2.66		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-6) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.84	1.84	1.84	1.84		
C	0	0	0	0	Design	Φ
Ø	17	17	17	17	General shear failure	26
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	20	20	20	20		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.89	1.95	1.63	1.47		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.95	1.47	1.32	1.24		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.95	1.47	1.32	1.24		
Tan(45+Ø/2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.84	0.84	0.84	0.84		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	51.87	39.1	35.11	32.99		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.53	3.82	5.14	6.44		
NBC	54.4	42.92	40.25	39.43		
SBC	18.13	14.31	13.42	13.14		
Recommended SBC for sattlement of 40mm	18.13	14.31	13.42	13.14		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	14.7	15.4	16.5	17.6		
Settlement (S)	26.65	22.04	22.14	23.13		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.92	4.67	4.38	4.29		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-06								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	32.07	37.42	42.76	48.11	35.66	39.48	54.4
SBC	1 x 1	10.69	12.47	14.25	16.04	11.89	13.16	18.13
BC for settlement of 40mm	1 x 1	10.69	12.47	14.25	16.04	11.89	13.16	18.13
Settlement (S)	1 x 1	19.37	22.6	25.82	29.07	13.98	15.47	26.65
NBC	2 x 2	29.4	32.07	34.75	37.42	27.25	29.3	42.92
SBC	2 x 2	9.8	10.69	11.58	12.47	9.08	9.77	14.31
BC for settlement of 40mm	2 x 2	9.80	10.69	11.03645	11.0354	9.08	9.77	14.31
Settlement (S)	2 x 2	35.52	38.75	41.97	45.2	21.35	22.97	22.04
NBC	3 x 3	28.6	30.2	32.07	33.94	24.49	26.05	40.25
SBC	3 x 3	9.53	10.07	10.69	11.31	8.16	8.68	13.42
BC for settlement of 40mm	3 x 3	7.36	7.36	7.36	7.36	8.16	8.68	13.42
Settlement (S)	3 x 3	51.81	54.75	58.12	61.49	28.78	30.61	22.14
NBC	4 x 4	28.06	29.4	30.74	32.07	23.17	24.41	39.43
SBC	4 x 4	9.35	9.8	10.25	10.69	7.72	8.14	13.14
BC for settlement of 40mm	4 x 4	5.52	5.52	5.52	5.52	7.72	8.14	13.14
Settlement (S)	4 x 4	67.78	71.04	74.3	77.49	36.3	38.27	23.13

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.92	1.92	1.92	1.92
C	4.3	4.3	4.3	4.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0041	0.0041	0.0041	0.0041
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.2	1.1	1.07	1.05
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.1	1.05	1.03	1.03
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.92	0.92	0.92	0.92
C.N _c .s _c .d _c .i _c	34.48	31.61	30.74	30.17
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W ³	0	0	0	0
NBC	34.48	31.61	30.74	30.17
SBC	11.49	10.54	10.25	10.06
Recommended SBC for sattlement of 40mm	11.49	9.959839	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	23.07	42.33	61.75	80.81
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.75	3.44	3.35	3.28
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.92	1.92	1.92	1.92
C	4.3	4.3	4.3	4.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.92	0.92	0.92	0.92
C.N_c.s_c.d_c.i_c	40.23	34.48	32.47	31.61
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	40.23	34.48	32.47	31.61
SBC	13.41	11.49	10.82	10.54
Recommended SBC for sattlement of 40mm	13.41	9.95883	6.64	4.98
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	26.93	46.15	65.18	84.66
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.38	3.75	3.53	3.44
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.92	1.92	1.92	1.92
C	4.3	4.3	4.3	4.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.92	0.92	0.92	0.92
C.N_c.s_c.d_c.i_c	45.97	37.35	34.48	33.04
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	45.97	37.35	34.48	33.04
SBC	15.32	12.45	11.49	11.01
Recommended SBC for sattlement of 40mm	15.32	9.96	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	30.77	50	69.22	88.44
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.00	4.07	3.75	3.60
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.92	1.92	1.92	1.92
C	4.3	4.3	4.3	4.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.92	0.92	0.92	0.92
C.N_c.s_c.d_c.i_c	51.72	40.23	36.49	34.48
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	51.72	40.23	36.49	34.48
SBC	17.24	13.41	12.16	11.49
Recommended SBC for sattlement of 40mm	17.24	9.96	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	34.62	53.86	73.26	92.3
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.63	4.38	3.97	3.75
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =5m)						
Depth (D)	5	5	5	5		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.84	1.84	1.84	1.84		
C	2.3	2.3	2.3	2.3	Design	Φ
Ø	3	3	3	3	General shear failure	4
W'	0.5	0.5	0.5	0.5	Local shear failure	3
FOS	3	3	3	3		
N Value	0	0	0	0		
m _v	0.0019	0.0019	0.0019	0.0019		
N _c	5.9	5.9	5.9	5.9		
N _q	1.31	1.31	1.31	1.31		
N _y	0.24	0.24	0.24	0.24		
Sc	1.3	1.3	1.3	1.3		
Dc	2.05	1.53	1.35	1.26		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.53	1.26	1.18	1.13		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1	1	1	1		
Tan(45+Ø /2)	1.05	1.05	1.05	1.05		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.84	0.84	0.84	0.84		
C.N _c .s _c .d _c .i _c	36.16	26.99	23.82	22.23		
γ'D.(Nq-1).s _q .d _q .i _q	1.56	1.56	1.56	1.56		
0.5. γ.B.N _y .s _y .d _y .i _y W'	0.09	0.18	0.26	0.35		
NBC	37.81	28.73	25.64	24.14		
SBC	12.6	9.58	8.55	8.05		
Recommended SBC for sattlement of 40mm	12.60	9.58	8.55	8.05		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976						
Settlement (S)	11.73	17.83	23.87	29.97		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.11	3.13	2.79	2.63		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =6m)					Design	Φ
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4	General shear failure	26
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	0	0	0	0	Local shear failure	17
Ø	17	17	17	17		
W'	0.5	0.5	0.5	0.5		
FOS	3	3	3	3		
N Value	14	14	14	14		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.62	1.81	1.54	1.41		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.81	1.41	1.27	1.2		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.81	1.41	1.27	1.2		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	41.76	32.53	29.3	27.69		
0.5. γ.B.Nγ.s _y .d _y .i _y W'	2.36	3.68	4.98	6.27		
NBC	44.12	36.21	34.28	33.96		
SBC	14.71	12.07	11.43	11.32		
Recommended SBC for sattlement of 40mm	14.71	12.07	11.43	11.32		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	20.5	21.6	23.4	25.4		
Settlement (S)	30.16	26.07	26.75	28.75		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.80	3.94	3.73	3.70		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-7) (Depth =7m)					Design	Φ
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4	General shear failure	31
Bulk Dencit (y)	1.87	1.87	1.87	1.87		
C	0	0	0	0		
Ø	31	31	31	31		
W'	0.5	0.5	0.5	0.5		
FOS	3	3	3	3		
N Value	23	23	23	23		
m _v	0	0	0	0		
Nc	32.67	32.67	32.67	32.67		
Nq	20.63	20.63	20.63	20.63		
Ny	25.99	25.99	25.99	25.99		
Sc	1.3	1.3	1.3	1.3		
Dc	3.48	2.24	1.83	1.62		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	2.24	1.62	1.41	1.31		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	2.24	1.62	1.41	1.31		
Tan(45+Ø /2)	1.77	1.77	1.77	1.77		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.87	0.87	0.87	0.87		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	253.92	232.4	202.27	187.93		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	21.77	31.49	41.12	50.93		
NBC	275.69	263.89	243.39	238.86		
SBC	91.9	87.96	81.13	79.62		
Recommended SBC for sattlement of 40mm	34.19	33.33	29.85	28.17		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	11.7	12	13.4	14.2		
Settlement (S)	107.52	105.55	108.71	113.06		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	30.01	28.72	26.49	26.00		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-07								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	34.48	40.23	45.97	51.72	37.81	44.12	275.69
SBC	1 x 1	11.49	13.41	15.32	17.24	12.6	14.71	91.9
BC for sattlement of 40mm	1 x 1	11.49	13.41	15.32	17.24	12.60	14.71	34.19
Settlement (S)	1 x 1	23.07	26.93	30.77	34.62	11.73	30.16	107.52
NBC	2 x 2	31.61	34.48	37.35	40.23	28.73	36.21	263.89
SBC	2 x 2	10.54	11.49	12.45	13.41	9.58	12.07	87.96
BC for sattlement of 40mm	2 x 2	9.96	9.95883	9.96	9.959153	9.58	12.07	33.33
Settlement (S)	2 x 2	42.33	46.15	50	53.86	17.83	26.07	105.55
NBC	3 x 3	30.74	32.47	34.48	36.49	25.64	34.28	243.39
SBC	3 x 3	10.25	10.82	11.49	12.16	8.55	11.43	81.13
BC for sattlement of 40mm	3 x 3	6.64	6.64	6.64	6.64	8.55	11.43	29.85
Settlement (S)	3 x 3	61.75	65.18	69.22	73.26	23.87	26.75	108.71
NBC	4 x 4	30.17	31.61	33.04	34.48	24.14	33.96	238.86
SBC	4 x 4	10.06	10.54	11.01	11.49	8.05	11.32	79.62
BC for sattlement of 40mm	4 x 4	4.98	4.98	4.98	4.98	8.05	11.32	28.17
Settlement (S)	4 x 4	80.81	84.66	88.44	92.3	29.97	28.75	113.06

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
S _c	1.3	1.3	1.3	1.3
D _c	1.2	1.1	1.07	1.05
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.1	1.05	1.03	1.03
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	29.67	27.2	26.45	25.96
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W ³	0	0	0	0
NBC	29.67	27.2	26.45	25.96
SBC	9.89	9.07	8.82	8.65
Recommended SBC for sattlement of 40mm	9.89	9.07	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	18.41	33.76	49.25	64.4
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.23	2.96	2.88	2.82
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	34.61	29.67	27.94	27.2
γ'D.(Nq-1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	0	0	0	0
NBC	34.61	29.67	27.94	27.2
SBC	11.54	9.89	9.31	9.07
Recommended SBC for sattlement of 40mm	11.54	9.89	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	21.48	36.82	51.98	67.53
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.77	3.23	3.04	2.96
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	39.56	32.14	29.67	28.43
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	39.56	32.14	29.67	28.43
SBC	13.19	10.71	9.89	9.48
Recommended SBC for sattlement of 40mm	13.19	10.71	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	24.55	39.87	55.22	70.58
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.31	3.50	3.23	3.10
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	44.5	34.61	31.4	29.67
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	44.5	34.61	31.4	29.67
SBC	14.83	11.54	10.47	9.89
Recommended SBC for sattlement of 40mm	14.83	10.74	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	27.6	42.96	58.46	73.63
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.84	3.77	3.42	3.23
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =5m)				
Depth (D)	5	5	5	5
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.7	3.7	3.7	3.7
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	2	1.5	1.33	1.25
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.5	1.25	1.17	1.13
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	49.45	37.09	32.88	30.9
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	49.45	37.09	32.88	30.9
SBC	16.48	12.36	10.96	10.3
Recommended SBC for sattlement of 40mm	16.48	10.75	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976				
Settlement (S)	30.67	46.01	61.2	76.68
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.38	4.04	3.58	3.36
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.83	1.83	1.83	1.83		
C	0	0	0	0		
Ø	15	15	15	15	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	23
FOS	3	3	3	3	Local shear failure	15
N Value	13	13	13	13		
m _v	0	0	0	0		
Nc	10.98	10.98	10.98	10.98		
Nq	3.94	3.94	3.94	3.94		
Ny	2.65	2.65	2.65	2.65		
Sc	1.3	1.3	1.3	1.3		
Dc	2.56	1.78	1.52	1.39		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.78	1.39	1.26	1.2		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.78	1.39	1.26	1.2		
Tan(45+Ø /2)	1.3	1.3	1.3	1.3		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.83	0.83	0.83	0.83		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	31.27	24.42	22.14	21.08		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ .W'	1.73	2.7	3.67	4.66		
NBC	33	27.12	25.81	25.74		
SBC	11	9.04	8.6	8.58		
Recommended SBC for sattlement of 40mm	11.00	9.04	8.60	8.58		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	23.4	24.2	26.8	28.8		
Settlement (S)	25.74	21.88	23.05	24.71		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.59	2.95	2.81	2.80		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-8) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.84	1.84	1.84	1.84		
C	0	0	0	0		
Ø	18	18	18	18	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	27
FOS	3	3	3	3	Local shear failure	18
N Value	19	19	19	19		
m _v	0	0	0	0		
N _c	13.1	13.1	13.1	13.1		
N _q	5.26	5.26	5.26	5.26		
N _y	4.07	4.07	4.07	4.07		
Sc	1.3	1.3	1.3	1.3		
Dc	2.93	1.97	1.64	1.48		
Sq	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.97	1.48	1.32	1.24		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1.97	1.48	1.32	1.24		
Tan(45+Ø/2)	1.38	1.38	1.38	1.38		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.84	0.84	0.84	0.84		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(N _q -1).s _q .d _q .i _q	59.22	44.49	39.68	37.27		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.95	4.43	5.93	7.43		
NBC	62.17	48.92	45.61	44.7		
SBC	20.72	16.31	15.2	14.9		
Recommended SBC for sattlement of 40mm	20.72	16.31	15.20	14.90		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	14.7	15.8	16.4	17.2		
Settlement (S)	30.46	25.77	24.93	25.63		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	6.77	5.33	4.96	4.87		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-08								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	29.67	34.61	39.56	44.5	49.45	33	62.17
SBC	1 x 1	9.89	11.54	13.19	14.83	16.48	11	20.72
BC for settlement of 40mm	1 x 1	9.89	11.54	13.19	14.83	16.48	11.00	20.72
Settlement (S)	1 x 1	18.41	21.48	24.55	27.6	30.67	25.74	30.46
NBC	2 x 2	27.2	29.67	32.14	34.61	37.09	27.12	48.92
SBC	2 x 2	9.07	9.89	10.71	11.54	12.36	9.04	16.31
BC for settlement of 40mm	2 x 2	9.07	9.89	10.71	10.74	10.75	9.04	16.31
Settlement (S)	2 x 2	33.76	36.82	39.87	42.96	46.01	21.88	25.77
NBC	3 x 3	26.45	27.94	29.67	31.4	32.88	25.81	45.61
SBC	3 x 3	8.82	9.31	9.89	10.47	10.96	8.6	15.2
BC for settlement of 40mm	3 x 3	7.16	7.16	7.16	7.16	7.16	8.60	15.20
Settlement (S)	3 x 3	49.25	51.98	55.22	58.46	61.2	23.05	24.93
NBC	4 x 4	25.96	27.2	28.43	29.67	30.9	25.74	44.7
SBC	4 x 4	8.65	9.07	9.48	9.89	10.3	8.58	14.9
BC for settlement of 40mm	4 x 4	5.37	5.37	5.37	5.37	5.37	8.58	14.90
Settlement (S)	4 x 4	64.4	67.53	70.58	73.63	76.68	24.71	25.63

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.3	3.3	3.3	3.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0037	0.0037	0.0037	0.0037
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
D _c	1.2	1.1	1.07	1.05
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.1	1.05	1.03	1.03
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	26.46	24.26	23.59	23.15
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W ³	0	0	0	0
NBC	26.46	24.26	23.59	23.15
SBC	8.82	8.09	7.86	7.72
Recommended SBC for sattlement of 40mm	8.82	8.09	7.36	5.52
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	15.98	29.32	42.73	55.96
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	2.88	2.64	2.57	2.52
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.3	3.3	3.3	3.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	30.87	26.46	24.92	24.26
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	30.87	26.46	24.92	24.26
SBC	10.29	8.82	8.31	8.09
Recommended SBC for sattlement of 40mm	10.29	8.82	7.36	5.52
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	18.65	31.97	45.18	58.64
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.36	2.88	2.71	2.64
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.3	3.3	3.3	3.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	35.28	28.67	26.46	25.36
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	35.28	28.67	26.46	25.36
SBC	11.76	9.56	8.82	8.45
Recommended SBC for sattlement of 40mm	11.76	9.56	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	21.31	34.65	47.95	61.25
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.84	3.12	2.88	2.76
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.3	3.3	3.3	3.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	39.69	30.87	28	26.46
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	39.69	30.87	28	26.46
SBC	13.23	10.29	9.33	8.82
Recommended SBC for sattlement of 40mm	13.23	10.29	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	23.98	37.3	50.72	63.94
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.32	3.36	3.05	2.88
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =5m)				
Depth (D)	5	5	5	5
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.3	3.3	3.3	3.3
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0037	0.0037	0.0037	0.0037
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	2	1.5	1.33	1.25
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.5	1.25	1.17	1.13
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	44.1	33.08	29.33	27.56
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	44.1	33.08	29.33	27.56
SBC	14.7	11.03	9.78	9.19
Recommended SBC for sattlement of 40mm	14.70	11.03	7.36	5.52
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976				
Settlement (S)	26.64	39.98	53.17	66.62
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.80	3.60	3.19	3.00
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.84	1.84	1.84	1.84		
C	0	0	0	0	Design	Φ
Ø	17	17	17	17	General shear failure	26
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	22	22	22	22		
m _v	0	0	0	0		
N _c	12.34	12.34	12.34	12.34		
N _q	4.77	4.77	4.77	4.77		
N _y	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.62	1.81	1.54	1.41		
Sq	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.81	1.41	1.27	1.2		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1.81	1.41	1.27	1.2		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (y')	0.84	0.84	0.84	0.84		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(N _q -1).s _q .d _q .i _q	41.27	32.15	28.96	27.36		
0.5. γ.B.Nγ.sγ.dγ.iγ W'	2.35	3.66	4.95	6.24		
NBC	43.62	35.81	33.91	33.6		
SBC	14.54	11.94	11.3	11.2		
Recommended SBC for sattlement of 40mm	14.54	11.94	11.30	11.20		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	12.5	13	14.1	14.8		
Settlement (S)	18.18	15.52	15.93	16.58		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.75	3.90	3.69	3.66		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-9) (Depth =7m)					
Depth (D)	7	7	7	7	
Width (B)	1	2	3	4	
Bulk Dencit (γ)	1.84	1.84	1.84	1.84	
C	0	0	0	0	Design
ϕ	17	17	17	17	General shear failure
W'	0.5	0.5	0.5	0.5	Local shear failure
FOS	3	3	3	3	
N Value	16	16	16	16	
m_v	0	0	0	0	
Nc	12.34	12.34	12.34	12.34	
Nq	4.77	4.77	4.77	4.77	
Ny	3.53	3.53	3.53	3.53	
Sc	1.3	1.3	1.3	1.3	
Dc	2.89	1.95	1.63	1.47	
Sq	1.2	1.2	1.2	1.2	
Dq=Dy	1	1	1	1	
Dq=Dy	1.95	1.47	1.32	1.24	
Sy	0.8	0.8	0.8	0.8	
Dq=Dy	1.95	1.47	1.32	1.24	
Tan(45+ ϕ /2)	1.35	1.35	1.35	1.35	
i_c, i_q & i_y	1	1	1	1	
Submarged Dencit (γ')	0.84	0.84	0.84	0.84	
C.N _c .s _c .d _c .i _c	0	0	0	0	
$\gamma'D.(Nq-1).s_q.d_q.i_q$	51.87	39.1	35.11	32.99	
0.5. $\gamma.B.N\gamma.s_\gamma.d_\gamma.i_\gamma W'$	2.53	3.82	5.14	6.44	
NBC	54.4	42.92	40.25	39.43	
SBC	18.13	14.31	13.42	13.14	
sattlement of 40mm	18.13	14.31	13.42	13.14	
For Settlement					
per Fig 9 of IS 8009 (Part-	12.5	13	14.1	14.8	
Settlement (S)	22.66	18.6	18.92	19.45	
$\Delta P = (SBC \times \text{Footing})$	5.92	4.67	4.38	4.29	
H (1.5 x B)	1500	3000	4500	6000	
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3	

SBC & Settlement Summary of BH-09								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	26.46	30.87	35.28	39.69	44.1	43.62	54.4
SBC	1 x 1	8.82	10.29	11.76	13.23	14.7	14.54	18.13
BC for sattlement of 40mm	1 x 1	8.82	10.29	11.76	13.23	14.70	14.54	18.13
Settlement (S)	1 x 1	15.98	18.65	21.31	23.98	26.64	18.18	22.66
NBC	2 x 2	24.26	26.46	28.67	30.87	33.08	35.81	42.92
SBC	2 x 2	8.09	8.82	9.56	10.29	11.03	11.94	14.31
BC for sattlement of 40mm	2 x 2	8.09	8.82	9.56	10.29	11.03	11.94	14.31
Settlement (S)	2 x 2	29.32	31.97	34.65	37.3	39.98	15.52	18.6
NBC	3 x 3	23.59	24.92	26.46	28	29.33	33.91	40.25
SBC	3 x 3	7.86	8.31	8.82	9.33	9.78	11.3	13.42
BC for sattlement of 40mm	3 x 3	7.36	7.36	7.36	7.36	7.36	11.30	13.42
Settlement (S)	3 x 3	42.73	45.18	47.95	50.72	53.17	15.93	18.92
NBC	4 x 4	23.15	24.26	25.36	26.46	27.56	33.6	39.43
SBC	4 x 4	7.72	8.09	8.45	8.82	9.19	11.2	13.14
BC for sattlement of 40mm	4 x 4	5.52	5.52	5.52	5.52	5.52	11.20	13.14
Settlement (S)	4 x 4	55.96	58.64	61.25	63.94	66.62	16.58	19.45

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0038	0.0038	0.0038	0.0038
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
D _c	1.2	1.1	1.07	1.05
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.1	1.05	1.03	1.03
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N _c .s _c .d _c .i _c	28.87	26.46	25.74	25.26
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W ³	0	0	0	0
NBC	28.87	26.46	25.74	25.26
SBC	9.62	8.82	8.58	8.42
Recommended SBC for sattlement of 40mm	9.62	8.82	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	17.9	32.83	47.91	62.69
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.14	2.88	2.80	2.75
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	33.68	28.87	27.18	26.46
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	33.68	28.87	27.18	26.46
SBC	11.23	9.62	9.06	8.82
Recommended SBC for sattlement of 40mm	11.23	9.62	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	20.9	35.81	50.59	65.66
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.67	3.14	2.96	2.88
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	38.49	31.27	28.87	27.66
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	38.49	31.27	28.87	27.66
SBC	12.83	10.42	9.62	9.22
Recommended SBC for sattlement of 40mm	12.83	10.42	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	23.88	38.79	53.71	68.64
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.19	3.40	3.14	3.01
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	43.3	33.68	30.55	28.87
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	43.3	33.68	30.55	28.87
SBC	14.43	11.23	10.18	9.62
Recommended SBC for sattlement of 40mm	14.43	10.75	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	26.86	41.8	56.84	71.62
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.71	3.67	3.32	3.14
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =5m)				
Depth (D)	5	5	5	5
Width (B)	1	2	3	4
Bulk Dencit (y)	1.89	1.89	1.89	1.89
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0038	0.0038	0.0038	0.0038
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	2	1.5	1.33	1.25
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.5	1.25	1.17	1.13
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (y')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	48.11	36.08	31.99	30.07
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ W'	0	0	0	0
NBC	48.11	36.08	31.99	30.07
SBC	16.04	12.03	10.66	10.02
Recommended SBC for sattlement of 40mm	16.04	10.75	7.16	5.37
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976				
Settlement (S)	29.85	44.78	59.52	74.6
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.24	3.93	3.48	3.27
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =6m)						
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (γ)	1.85	1.85	1.85	1.85		
C	0	0	0	0	Design	Φ
ϕ	17	17	17	17	General shear failure	25
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	15	15	15	15		
m_v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.62	1.81	1.54	1.41		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.81	1.41	1.27	1.2		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.81	1.41	1.27	1.2		
Tan(45+ ϕ /2)	1.35	1.35	1.35	1.35		
i_c, i_q & i_y	1	1	1	1		
Submarged Dencit (γ')	0.85	0.85	0.85	0.85		
C.N _c . s _c .d _c .i _c	0	0	0	0		
$\gamma'D.(Nq-1).s_q.d_q.i_q$	41.76	32.53	29.3	27.69		
0.5. $\gamma.B.N\gamma.s_\gamma.d_\gamma.i_\gamma W'$	2.36	3.68	4.98	6.27		
NBC	44.12	36.21	34.28	33.96		
SBC	14.71	12.07	11.43	11.32		
Recommended SBC for sattlement of 40mm	14.71	12.07	11.43	11.32		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	18.1	19	20	22		
Settlement (S)	26.63	22.93	22.86	24.9		
$\Delta P = (SBC \times \text{Footing Size}) / (\text{width of Foundation} + \text{Layer Depth})^2 =$	4.80	3.94	3.73	3.70		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-10) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	0	0	0	0	Design	Φ
Ø	17	17	17	17	General shear failure	25
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	15	15	15	15		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.89	1.95	1.63	1.47		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.95	1.47	1.32	1.24		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.95	1.47	1.32	1.24		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	52.49	39.57	35.53	33.38		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.55	3.84	5.17	6.48		
NBC	55.04	43.41	40.7	39.86		
SBC	18.35	14.47	13.57	13.29		
Recommended SBC for sattlement of 40mm	18.35	14.47	13.57	13.29		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part- I) 1976	18.1	19	20	22		
Settlement (S)	33.21	27.49	27.14	29.24		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.99	4.72	4.43	4.34		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-10								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	28.87	33.68	38.49	43.3	48.11	44.12	55.04
SBC	1 x 1	9.62	11.23	12.83	14.43	16.04	14.71	18.35
BC for sattlement of 40mm	1 x 1	9.62	11.23	12.83	14.43	16.04	14.71	18.35
Settlement (S)	1 x 1	17.9	20.9	23.88	26.86	29.85	26.63	33.21
NBC	2 x 2	26.46	28.87	31.27	33.68	36.08	36.21	43.41
SBC	2 x 2	8.82	9.62	10.42	11.23	12.03	12.07	14.47
BC for sattlement of 40mm	2 x 2	8.82	9.62	10.42	10.75	10.75	12.07	14.47
Settlement (S)	2 x 2	32.83	35.81	38.79	41.8	44.78	22.93	27.49
NBC	3 x 3	25.74	27.18	28.87	30.55	31.99	34.28	40.7
SBC	3 x 3	8.58	9.06	9.62	10.18	10.66	11.43	13.57
BC for sattlement of 40mm	3 x 3	7.16	7.16	7.16	7.16	7.16	11.43	13.57
Settlement (S)	3 x 3	47.91	50.59	53.71	56.84	59.52	22.86	27.14
NBC	4 x 4	25.26	26.46	27.66	28.87	30.07	33.96	39.86
SBC	4 x 4	8.42	8.82	9.22	9.62	10.02	11.32	13.29
BC for sattlement of 40mm	4 x 4	5.37	5.37	5.37	5.37	5.37	11.32	13.29
Settlement (S)	4 x 4	62.69	65.66	68.64	71.62	74.6	24.9	29.24

Bearing Capacity as per IS 6403:1981		(BH-11) (Depth =1m)		
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.9	1.9	1.9	1.9
C	3.6	3.6	3.6	3.6
∅	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m _v	0.0041	0.0041	0.0041	0.0041
N _c	5.14	5.14	5.14	5.14
N _q	1	1	1	1
N _y	0	0	0	0
S _c	1.3	1.3	1.3	1.3
D _c	1.2	1.1	1.07	1.05
S _q	1.2	1.2	1.2	1.2
D _q =D _y	1	1	1	1
D _q =D _y	1.1	1.05	1.03	1.03
S _y	0.8	0.8	0.8	0.8
D _q =D _y	1	1	1	1
Tan(45+∅ /2)	1	1	1	1
i _c , i _q & i _y	1	1	1	1
Submarged Dencit (γ')	0.9	0.9	0.9	0.9
C.N _c .s _c .d _c .i _c	28.87	26.46	25.74	25.26
γ'D.(N _q -1).s _q .d _q .i _q	0	0	0	0
0.5. γ.B.N _y .s _y .d _y .i _y .W'	0	0	0	0
NBC	28.87	26.46	25.74	25.26
SBC	9.62	8.82	8.58	8.42
Recommended SBC for sattlement of 40mm	9.62	8.82	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	19.32	35.42	51.69	67.63
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.14	2.88	2.80	2.75
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-11) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.9	1.9	1.9	1.9
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
S_c	1.3	1.3	1.3	1.3
D_c	1.4	1.2	1.13	1.1
S_q	1.2	1.2	1.2	1.2
D_q=D_y	1	1	1	1
D_q=D_y	1.2	1.1	1.07	1.05
S_y	0.8	0.8	0.8	0.8
D_q=D_y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submerged Dencit (γ')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	33.68	28.87	27.18	26.46
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.N_y.s_y.d_y.i_y W'	0	0	0	0
NBC	33.68	28.87	27.18	26.46
SBC	11.23	9.62	9.06	8.82
Recommended SBC for sattlement of 40mm	11.23	9.62	6.64	4.98
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	22.55	38.64	54.58	70.85
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.67	3.14	2.96	2.88
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-11) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.9	1.9	1.9	1.9
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (γ')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	38.49	31.27	28.87	27.66
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ. W'	0	0	0	0
NBC	38.49	31.27	28.87	27.66
SBC	12.83	10.42	9.62	9.22
Recommended SBC for sattlement of 40mm	12.83	9.959379	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	25.76	41.85	57.96	74.06
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.19	3.40	3.14	3.01
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-11) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.9	1.9	1.9	1.9
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (γ')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	43.3	33.68	30.55	28.87
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.sγ.dγ.iγ W'	0	0	0	0
NBC	43.3	33.68	30.55	28.87
SBC	14.43	11.23	10.18	9.62
Recommended SBC for sattlement of 40mm	14.43	9.96	6.64	4.98
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	28.98	45.1	61.33	77.27
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.71	3.67	3.32	3.14
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-11) (Depth =5m)				
Depth (D)	5	5	5	5
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.9	1.9	1.9	1.9
C	3.6	3.6	3.6	3.6
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0041	0.0041	0.0041	0.0041
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	2	1.5	1.33	1.25
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.5	1.25	1.17	1.13
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (γ')	0.9	0.9	0.9	0.9
C.N_c.s_c.d_c.i_c	48.11	36.08	31.99	30.07
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ. W'	0	0	0	0
NBC	48.11	36.08	31.99	30.07
SBC	16.04	12.03	10.66	10.02
Recommended SBC for sattlement of 40mm	16.04	9.96	6.64	4.98
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976				
Settlement (S)	32.21	48.32	64.22	80.49
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.24	3.93	3.48	3.27
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981		(BH-11) (Depth =6m)				
Depth (D)	6	6	6	6		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.82	1.82	1.82	1.82		
C	0	0	0	0	Design	Φ
Ø	17	17	17	17	General shear failure	25
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	13	13	13	13		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.62	1.81	1.54	1.41		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.81	1.41	1.27	1.2		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.81	1.41	1.27	1.2		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.82	0.82	0.82	0.82		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	40.29	31.38	28.27	26.71		
0.5. γ.B.N _γ .s _γ .d _γ .i _γ W'	2.33	3.62	4.9	6.17		
NBC	42.62	35	33.17	32.88		
SBC	14.21	11.67	11.06	10.96		
Recommended SBC for settlement of 40mm	14.21	11.67	11.06	10.96		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	23.4	24.2	26.8	28.8		
Settlement (S)	33.25	28.24	29.64	31.56		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.64	3.81	3.61	3.58		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-11) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (γ)	1.85	1.85	1.85	1.85		
C	0	0	0	0		
Ø	18	18	18	18	Design	Φ
W'	0.5	0.5	0.5	0.5	General shear failure	27
FOS	3	3	3	3	Local shear failure	18
N Value	19	19	19	19		
m _v	0	0	0	0		
N _c	13.1	13.1	13.1	13.1		
N _q	5.26	5.26	5.26	5.26		
N _y	4.07	4.07	4.07	4.07		
Sc	1.3	1.3	1.3	1.3		
D _c	2.93	1.97	1.64	1.48		
S _q	1.2	1.2	1.2	1.2		
D _q =D _y	1	1	1	1		
D _q =D _y	1.97	1.48	1.32	1.24		
S _y	0.8	0.8	0.8	0.8		
D _q =D _y	1.97	1.48	1.32	1.24		
Tan(45+Ø /2)	1.38	1.38	1.38	1.38		
i _c , i _q & i _y	1	1	1	1		
Submarged Dencit (γ')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(N _q -1).s _q .d _q .i _q	59.92	45.02	40.15	37.72		
0.5. γ.B.Nγ.sγ.dγ.iγ W'	2.97	4.46	5.96	7.47		
NBC	62.89	49.48	46.11	45.19		
SBC	20.96	16.49	15.37	15.06		
Recommended SBC for sattlement of 40mm	20.96	16.49	15.37	15.06		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	14.7	15.8	16.4	17.2		
Settlement (S)	30.81	26.05	25.21	25.9		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	6.84	5.38	5.02	4.92		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-11								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	28.87	33.68	38.49	43.3	48.11	42.62	62.89
SBC	1 x 1	9.62	11.23	12.83	14.43	16.04	14.21	20.96
BC for sattlement of 40mm	1 x 1	9.62	11.23	12.83	14.43	16.04	14.21	20.96
Settlement (S)	1 x 1	19.32	22.55	25.76	28.98	32.21	33.25	30.81
NBC	2 x 2	26.46	28.87	31.27	33.68	36.08	35	49.48
SBC	2 x 2	8.82	9.62	10.42	11.23	12.03	11.67	16.49
BC for sattlement of 40mm	2 x 2	8.82	9.62	9.959379	9.96	9.96	11.67	16.49
Settlement (S)	2 x 2	35.42	38.64	41.85	45.1	48.32	28.24	26.05
NBC	3 x 3	25.74	27.18	28.87	30.55	31.99	33.17	46.11
SBC	3 x 3	8.58	9.06	9.62	10.18	10.66	11.06	15.37
BC for sattlement of 40mm	3 x 3	6.64	6.64	6.64	6.64	6.64	11.06	15.37
Settlement (S)	3 x 3	51.69	54.58	57.96	61.33	64.22	29.64	25.21
NBC	4 x 4	25.26	26.46	27.66	28.87	30.07	32.88	45.19
SBC	4 x 4	8.42	8.82	9.22	9.62	10.02	10.96	15.06
BC for sattlement of 40mm	4 x 4	4.98	4.98	4.98	4.98	4.98	10.96	15.06
Settlement (S)	4 x 4	67.63	70.85	74.06	77.27	80.49	31.56	25.9

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =1m)				
Depth (D)	1	1	1	1
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.89	1.89	1.89	1.89
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
S_c	1.3	1.3	1.3	1.3
D_c	1.2	1.1	1.07	1.05
S_q	1.2	1.2	1.2	1.2
D_q=D_y	1	1	1	1
D_q=D_y	1.1	1.05	1.03	1.03
S_y	0.8	0.8	0.8	0.8
D_q=D_y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (γ')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	27.26	24.99	24.31	23.85
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.N_y.s_y.d_y.i_y.W'	0	0	0	0
NBC	27.26	24.99	24.31	23.85
SBC	9.09	8.33	8.1	7.95
Recommended SBC for sattlement of 40mm	9.09	8.33	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	17.36	31.82	46.42	60.74
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	2.97	2.72	2.64	2.60
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =2m)				
Depth (D)	2	2	2	2
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.89	1.89	1.89	1.89
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
Nc	5.14	5.14	5.14	5.14
Nq	1	1	1	1
Ny	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.4	1.2	1.13	1.1
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.2	1.1	1.07	1.05
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (γ')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	31.81	27.26	25.67	24.99
γ'D.(Nq-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ. W'	0	0	0	0
NBC	31.81	27.26	25.67	24.99
SBC	10.6	9.09	8.56	8.33
Recommended SBC for sattlement of 40mm	10.6	9.09	6.98	5.23
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976		0	0	0
Settlement (S)	20.25	34.73	49.05	63.65
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.46	2.97	2.80	2.72
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =3m)				
Depth (D)	3	3	3	3
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.89	1.89	1.89	1.89
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.6	1.3	1.2	1.15
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.3	1.15	1.1	1.08
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (γ')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	36.35	29.53	27.26	26.13
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.Nγ.s_γ.d_γ.i_γ. W'	0	0	0	0
NBC	36.35	29.53	27.26	26.13
SBC	12.12	9.84	9.09	8.71
Recommended SBC for sattlement of 40mm	12.12	9.84	6.98	5.24
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	23.15	37.59	52.09	66.55
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	3.96	3.21	2.97	2.84
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =4m)				
Depth (D)	4	4	4	4
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.89	1.89	1.89	1.89
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
Sc	1.3	1.3	1.3	1.3
Dc	1.8	1.4	1.27	1.2
Sq	1.2	1.2	1.2	1.2
Dq=Dy	1	1	1	1
Dq=Dy	1.4	1.2	1.13	1.1
Sy	0.8	0.8	0.8	0.8
Dq=Dy	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
ic, iq & iy	1	1	1	1
Submarged Dencit (γ')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	40.89	31.81	28.85	27.26
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.N_y.s_y.d_y.i_y W'	0	0	0	0
NBC	40.89	31.81	28.85	27.26
SBC	13.63	10.6	9.62	9.09
Recommended SBC for sattlement of 40mm	13.63	10.47	6.98	5.23
For Settlement				
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	0	0	0	0
Settlement (S)	26.04	40.5	55.13	69.46
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.45	3.46	3.14	2.97
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =5m)				
Depth (D)	5	5	5	5
Width (B)	1	2	3	4
Bulk Dencit (γ)	1.89	1.89	1.89	1.89
C	3.4	3.4	3.4	3.4
Ø	0	0	0	0
W'	0.5	0.5	0.5	0.5
FOS	3	3	3	3
N Value	0	0	0	0
m_v	0.0039	0.0039	0.0039	0.0039
N_c	5.14	5.14	5.14	5.14
N_q	1	1	1	1
N_y	0	0	0	0
S_c	1.3	1.3	1.3	1.3
D_c	2	1.5	1.33	1.25
S_q	1.2	1.2	1.2	1.2
D_q=D_y	1	1	1	1
D_q=D_y	1.5	1.25	1.17	1.13
S_y	0.8	0.8	0.8	0.8
D_q=D_y	1	1	1	1
Tan(45+Ø /2)	1	1	1	1
i_c, i_q & i_y	1	1	1	1
Submarged Dencit (γ')	0.89	0.89	0.89	0.89
C.N_c.s_c.d_c.i_c	45.44	34.08	30.22	28.4
γ'D.(N_q-1).s_q.d_q.i_q	0	0	0	0
0.5. γ.B.N_y.s_y.d_y.i_y W'	0	0	0	0
NBC	45.44	34.08	30.22	28.4
SBC	15.15	11.36	10.07	9.47
Recommended SBC for sattlement of 40mm	15.15	10.47	6.98	5.23
For Settlement				
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976				
Settlement (S)	28.94	43.4	57.71	72.36
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.95	3.71	3.29	3.09
H (1.5 x B)	1500	3000	4500	6000
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =6m)						
Depth (D)	6	6	6	6	Design	Φ
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	0	0	0	0	General shear failure	25
Ø	17	17	17	17	Local shear failure	17
W'	0.5	0.5	0.5	0.5		
FOS	3	3	3	3		
N Value	7	7	7	7		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.62	1.81	1.54	1.41		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.81	1.41	1.27	1.2		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.81	1.41	1.27	1.2		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	41.76	32.53	29.3	27.69		
0.5. γ.B.Nγ.s _γ .d _γ .i _γ W'	2.36	3.68	4.98	6.27		
NBC	44.12	36.21	34.28	33.96		
SBC	14.71	12.07	11.43	11.32		
Recommended SBC for settlement of 40mm	6.90	6.45	6.15	5.88		
For Settlement						
Settlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	58	62	65	68		
Settlement (S)	85.32	74.83	74.3	76.98		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	4.80	3.94	3.73	3.70		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

Bearing Capacity as per IS 6403:1981 (BH-12) (Depth =7m)						
Depth (D)	7	7	7	7		
Width (B)	1	2	3	4		
Bulk Dencit (y)	1.85	1.85	1.85	1.85		
C	0	0	0	0	Design	Φ
Ø	17	17	17	17	General shear failure	25
W'	0.5	0.5	0.5	0.5	Local shear failure	17
FOS	3	3	3	3		
N Value	7	7	7	7		
m _v	0	0	0	0		
Nc	12.34	12.34	12.34	12.34		
Nq	4.77	4.77	4.77	4.77		
Ny	3.53	3.53	3.53	3.53		
Sc	1.3	1.3	1.3	1.3		
Dc	2.89	1.95	1.63	1.47		
Sq	1.2	1.2	1.2	1.2		
Dq=Dy	1	1	1	1		
Dq=Dy	1.95	1.47	1.32	1.24		
Sy	0.8	0.8	0.8	0.8		
Dq=Dy	1.95	1.47	1.32	1.24		
Tan(45+Ø /2)	1.35	1.35	1.35	1.35		
ic, iq & iy	1	1	1	1		
Submarged Dencit (y')	0.85	0.85	0.85	0.85		
C.N _c .s _c .d _c .i _c	0	0	0	0		
γ'D.(Nq-1).s _q .d _q .i _q	52.49	39.57	35.53	33.38		
0.5. γ.B.Nγ.s _y .d _y .i _y W'	2.55	3.84	5.17	6.48		
NBC	55.04	43.41	40.7	39.86		
SBC	18.35	14.47	13.57	13.29		
Recommended SBC for sattlement of 40mm	6.90	6.45	6.15	5.88		
For Settlement						
Sattlement Factor (As per Fig 9 of IS 8009 (Part-I) 1976	58	62	65	68		
Settlement (S)	106.43	89.71	88.21	90.37		
ΔP = (SBC x Footing Size)/(width of Foundation +Layer Depth)^2 =	5.99	4.72	4.43	4.34		
H (1.5 x B)	1500	3000	4500	6000		
Layer Depth = (1.5 x B)/2	0.75	1.5	2.25	3		

SBC & Settlement Summary of BH-12								
Depth (D)		1	2	3	4	5	6	7
Footing Size								
NBC	1 x 1	27.26	31.81	36.35	40.89	45.44	44.12	55.04
SBC	1 x 1	9.09	10.6	12.12	13.63	15.15	14.71	18.35
BC for sattlement of 40mm	1 x 1	9.09	10.6	12.12	13.63	15.15	6.90	6.90
Settlement (S)	1 x 1	17.36	20.25	23.15	26.04	28.94	85.32	106.43
NBC	2 x 2	24.99	27.26	29.53	31.81	34.08	36.21	43.41
SBC	2 x 2	8.33	9.09	9.84	10.6	11.36	12.07	14.47
BC for sattlement of 40mm	2 x 2	8.33	9.09	9.84	10.47	10.47	6.45	6.45
Settlement (S)	2 x 2	31.82	34.73	37.59	40.5	43.4	74.83	89.71
NBC	3 x 3	24.31	25.67	27.26	28.85	30.22	34.28	40.7
SBC	3 x 3	8.1	8.56	9.09	9.62	10.07	11.43	13.57
BC for sattlement of 40mm	3 x 3	6.98	6.98	6.98	6.98	6.98	6.15	6.15
Settlement (S)	3 x 3	46.42	49.05	52.09	55.13	57.71	74.3	88.21
NBC	4 x 4	23.85	24.99	26.13	27.26	28.4	33.96	39.86
SBC	4 x 4	7.95	8.33	8.71	9.09	9.47	11.32	13.29
BC for sattlement of 40mm	4 x 4	5.24	5.23	5.24	5.23	5.23	5.88	5.88
Settlement (S)	4 x 4	60.74	63.65	66.55	69.46	72.36	76.98	90.37

5.2 USE OF PILE FOUNDATION:

Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies; ease of construction and less sound pollution.

While calculating the pile capacity, let us assume that,

- a) Cut off level is at 2.0 m
- b) Pile capacities shall be ascertained by approved method (IS 2911 (Part 1/Sec 2):2010).
- c) Assumed Grade of Concrete = M25
- d) Diameter of pile used = 300mm.

Sample Calculation of Safe Vertical Pile Capacity around Agia Grid Substation, [BH-1] : [As per IS 2911 (Part 1/Sec 2) : 2010]

Pile embedment depth = 14 m.

Diameter of pile = 300 mm.

Sample vertical pile capacity has been estimated considering average layer stratification as per Soil Profile Clause 4.0 in the Report

Design Strength Parameters:

STRATUM-I

[Note: As, Recommended Cut-off 2m length falls within this layer, also No SPT & UDS value is encountered in this stratum, Hence the stratum is ignored.

STRATUM-II

Considering the lab result and subsoil condition,

Use design $c = 3.9 \text{ t/m}^2$ and $\Phi = 0^\circ$.

Submerged Density=0.88

Also use, $\alpha = 1.0$ (As $C = 3.9 \text{ t/m}^2$)

Length of Shaft = 3.00 m

STRATUM-III

Considering the lab result and subsoil condition,

Use design $c = 2.2 \text{ t/m}^2$ and $\Phi = 5^\circ$.

Submerged Density=0.86

Also use, $\alpha = 1.0$ (As $C = 2.2 \text{ t/m}^2$)

Length of shaft= 2.00 m

STRATUM-IV

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 22^\circ$.

Submerged Density=0.86

Also use, $K_i = 1$ (As $\Phi = 22^\circ$.)

Length of shaft= 5.00 m

STRATUM-V

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 29^\circ$.

Submerged Density=0.87

Also use, $K_i = 1$ (As $\Phi = 29^\circ$.)

Length of shaft= 2.00 m

The ultimate vertical pile capacity of bored cast in situ RCC pile in soil may be estimated using the formula as given below:

$$Q_u = (A_p \times N_c \times c_p) + \sum [K_i \times P_{Di} \times \tan \delta_i \times A_{si}] + \sum [\alpha_i \times c_i \times A_{si}]$$

where, Q_u = Ultimate vertical load carrying capacity of RCC bored pile,
 A_p = Cross sectional area of pile tip. $= \pi/4 \times (D)^2$
 D = Diameter of pile.
 P_D = Effective overburden pressure at pile tip.
 N_q = Bearing capacity factor for bored pile depending on Φ .
 N_c = Bearing capacity factor, may be taken as 9.
 c_p = Average cohesion at pile tip.
 K_i = Co-efficient of earth pressure in i^{th} layer.
 P_{Di} = Mean effective overburden pressure of i^{th} layer.
 δ_i = Angle of wall friction between pile and soil for the i^{th} layer.
 A_{si} = Surface area of pile shaft in i^{th} layer $= \pi \times D \times L_i$
 L_i = Length of pile in respective stratum,
 Φ = Angle of internal friction of soil.
 α_i = Adhesion factor for the i^{th} layer.
 c_i = Average cohesion for the i^{th} layer.

Calculation of Safe Skin Frictional Resistance:

Stratum-I: (Layer 0 m depth to -0.50 m depth)

(Note: Pile embedded 14 m and cut out level 2.0m below the existing G.L)

As the Cut-off, length is 2m from the existing ground level, Layer-II doesn't have influence in the frictional resistance of the soil. Hence, it is ignored.

Stratum-II: (Layer 2.00 m depth to 5.00 m depth)

$$\alpha_i = 1.00$$

Effective thickness = 3.00 m.

$$C_{us} = 3.9 \text{ t/m}^2$$

$$A_s = \pi \times 0.3 \times 3.00 = 2.83 \text{ m}^2.$$

Where, $D = 0.3 \text{ m}$. and Shaft length = 3.00m.

$$\text{Ultimate Skin Frictional Resistance} = (1.0 \times 3.9 \times 2.83) = 11.02 \text{ t}$$

$$\text{Permissible skin friction resistance} = 11.02/3 = 3.67 \text{ t}$$

Stratum-III: (Layer 5.00 m depth to 7.00 m depth)

$$\alpha_i = 1.00,$$

Effective thickness = 2.00 m.

$$C_{us} = 2.2 \text{ t/m}^2, \phi = 5^\circ$$

$$A_s = \pi \times 0.3 \times 2.00 = 1.88 \text{ m}^2.$$

Where, $D = 0.3 \text{ m}$. and Shaft length = 2.00m.

$$\text{Ultimate Skin Frictional Resistance} = (1.0 \times 2.2 \times 1.88) = 4.14 \text{ t}$$

$$\text{Permissible skin friction resistance} = 4.14/3 = 1.38 \text{ t}$$

Stratum-IV: (Layer 7.00 m depth to 12.00 m depth)

$$K_i = 1$$

$$\phi = 22^\circ$$

$$\text{Effective thickness} = 5.00 \text{ m}$$

$$A_s = \pi \times 0.3 \times 5.00 = 4.71 \text{ m}^2$$

$$P_{di} = (3.0 \times 0.88 + 2.0 \times 0.86 + 0.5 \times 5.00 \times 0.86) = 6.51 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1 \times 6.51 \times \tan 22^\circ) \times 4.71 = 12.39 \text{ t}$$

$$\text{Permissible skin friction resistance} = 12.39/3 = 4.13 \text{ t}$$

Stratum-V: (Layer 12.00 m depth to 14.00 m depth)

$$K_i = 1$$

$$\phi = 29^\circ$$

$$\text{Effective thickness} = 2.00 \text{ m}$$

$$A_s = \pi \times 0.3 \times 2.00 = 1.884 \text{ m}^2$$

$$P_{di} = (3.0 \times 0.88 + 2.0 \times 0.86 + 5.00 \times 0.86 + 0.5 \times 2.0 \times 0.87) = 9.53 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1 \times 9.53 \times \tan 29^\circ) \times 1.884 = 9.95 \text{ t}$$

$$\text{Permissible skin friction resistance} = 9.95/3 = 3.32 \text{ t}$$

Calculation of Safe End Bearing Resistance:

$$A_p = 3.14 \times (0.3)^2/4 = 0.071 \text{ m}^2$$

$$\phi = \text{Angle of internal friction at the base of the pile} = 29^\circ$$

$$N_c = \text{Bearing capacity factor taken as 9}$$

$$D = \text{Dia of pile} = 0.3 \text{ meter}$$

$$F_s = \text{Factor of safety taken 3}$$

$$N_\gamma = \text{Bearing Capacity Factors} = 19.34$$

$$N_q = \text{Bearing Capacity Factors} = 18.00$$

$$P_d = \text{Effective overburden pressure at Pile tip (Restricted to } 15D = (15 \times 0.3) \text{ m} = 4.50 \text{ m}$$

$$\text{Hence, } P_d = (0.88 \times 3.0 + 0.86 \times 1.5) \text{ t/m}^2 = 3.93 \text{ t/m}^2$$

$$\begin{aligned} \text{Ultimate End Bearing Resistance} &= 0.071 \times (0.5 \times 0.3 \times 0.87 \times 19.34) + (3.93 \times 18.00) \text{ t/m}^2 \\ &= 5.20 \text{ t/m}^2 \end{aligned}$$

$$\text{Safe End Bearing Resistance} = 5.20/3 \text{ t/m}^2 = 1.73 \text{ t/m}^2$$

$$\begin{aligned} \text{Safe vertical capacity of Pile} &= (1.73 + 3.67 + 1.38 + 4.13 + 3.32) \text{ t} \\ &= 14.23 \text{ t} \end{aligned}$$

Recommended vertical capacity of the Pile = 12 t

Calculation of Uplift capacity of pile:

$$\begin{aligned} \text{Uplift capacity of pile} &= (3.67 + 1.38 + 4.13 + 3.32)/2 \text{ t} \\ &= 6.25 \text{ t} \end{aligned}$$

$$\text{Self weight of the pile } (W_p) = A_p \times L \times \gamma$$

$$= 0.071 \times 12 \times 25 = 21.3 \text{ KN (excluding cut off 2 m, } \gamma = 25 \text{ kN/m}^3 \text{ as per IS 456)}$$

$$= 2.17 \text{ t}$$

$$\text{So, as per IS 2911 (Part 1 / Sec 2): 2010, Clause 6.3.2}$$

$$\text{Safe Uplift Capacity of pile} = (6.25 + 2.17) = 8.42 \text{ t}$$

Recommended uplift capacity of the Pile = 7 t

BH-01					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V	
Shaft Length	2	5	7	12	
	5	7	12	14	
	3	2	5	2	
C Value	3.9	2.2	0	0	
Φ Value	0	5	22	29	
α	1	1	0	0	
Ki	0	0	1	1	
Dia of Pile	0.25	0.25	0.25	0.25	
Bulk Dencity (Submarged)	0.88	0.86	0.86	0.87	
Tan Value (TAN Φ)	0.000	0.087	0.404	0.554	
Pdmean	1.32	3.5	6.51	9.53	
As ($\pi \times \text{dia} \times \text{tickness}$)	2.355	1.57	3.925	1.57	
Ultimate Skin Frictional Resistance (For C Value)	9.1845	3.454	0	0	
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	10.32	8.29	
Permissable skin friction Resistance (t)	3.0615	1.15	3.44	2.76	
Uplift capacity of Pile	5.21				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.285	Cosidering 15*D (15*0.25 = 3.75)			
N_y	19.34				
N_q	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	3.00	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.00	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	11.42				
Uplift capacity of Pile	5.21				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	6.71				

BH-01					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V	
Shaft Length	2	5	7	12	
	5	7	12	14	
	3	2	5	2	
C Value	3.9	2.2	0	0	
Φ Value	0	5	22	29	
α	1	1	0	0	
Ki	0	0	1	1	
Dia of Pile	0.3	0.3	0.3	0.3	
Bulk Dencity (Submarged)	0.88	0.86	0.86	0.87	
Tan Value (TAN Φ)	0.000	0.087	0.404	0.554	
Pdmean	1.32	3.5	6.51	9.53	
As ($\pi \times \text{dia} \times \text{tickness}$)	2.826	1.884	4.71	1.884	
Ultimate Skin Frictional Resistance (For C Value)	11.0214	4.1448	0	0	
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	12.39	9.95	
Permissable skin friction Resistance (t)	3.6738	1.38	4.13	3.32	
Uplift capacity of Pile	6.25				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	3.93	Cosidering 15*D (15*0.30 = 4.5)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	5.18	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Pressure	1.73	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	14.23				
Uplift capacity of Pile	6.25				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.41				

BH-01					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V	
Shaft Length	2	5	7	12	
	5	7	12	14	
	3	2	5	2	
C Value	3.9	2.2	0	0	
Φ Value	0	5	22	29	
α	1	1	0	0	
Ki	0	0	1	1	
Dia of Pile	0.4	0.4	0.4	0.4	
Bulk Dencity (Submarged)	0.88	0.86	0.86	0.87	
Tan Value (TAN Φ)	0.000	0.087	0.404	0.554	
Pdmean	1.32	3.5	6.51	9.53	
As (π x dia x tickness)	3.768	2.512	6.28	2.512	
Ultimate Skin Frictional Resistance (For C Value)	14.6952	5.5264	0	0	
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	16.52	13.27	
Permissable skin friction Resistance (t)	4.8984	1.84	5.51	4.42	
Uplift capacity of Pile	8.33				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P_D	5.22	Cosidering 15*D (15*0.40 = 6)			
N_y	19.34				
N_q	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	12.22	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Presssure	4.07	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	20.74				
Uplift capacity of Pile	8.33				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.18				

BH-01					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V	
Shaft Length	2	5	7	12	
	5	7	12	14	
	3	2	5	2	
C Value	3.9	2.2	0	0	
Φ Value	0	5	22	29	
α	1	1	0	0	
Ki	0	0	1	1	
Dia of Pile	0.5	0.5	0.5	0.5	
Bulk Dencity (Submarged)	0.88	0.86	0.86	0.87	
Tan Value (TAN Φ)	0.000	0.087	0.404	0.554	
Pdmean	1.32	3.5	6.51	9.53	
As ($\pi \times \text{dia} \times \text{tickness}$)	4.71	3.14	7.85	3.14	
Ultimate Skin Frictional Resistance (For C Value)	18.369	6.908	0	0	
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	20.65	16.59	
Permissable skin friction Resistance (t)	6.123	2.30	6.88	5.53	
Uplift capacity of Pile	10.42				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	6.51	Cosidering 15*D (15*0.50 = 7.5)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	23.82	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	7.94	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	28.78				
Uplift capacity of Pile	10.42				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	16.42				

BH-01					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V	
Shaft Length	2	5	7	12	
	5	7	12	14	
	3	2	5	2	
C Value	3.9	2.2	0	0	
Φ Value	0	5	22	29	
α	1	1	0	0	
Ki	0	0	1	1	
Dia of Pile	0.6	0.6	0.6	0.6	
Bulk Dencity (Submarged)	0.88	0.86	0.86	0.87	
Tan Value (TAN Φ)	0.000	0.087	0.404	0.554	
Pdmean	1.32	3.5	6.51	9.53	
As ($\pi \times \text{dia} \times \text{tickness}$)	5.652	3.768	9.42	3.768	
Ultimate Skin Frictional Resistance (For C Value)	22.0428	8.2896	0	0	
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	24.78	19.90	
Permissable skin friction Resistance (t)	7.3476	2.76	8.26	6.63	
Uplift capacity of Pile	12.50				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.8	Cosidering 15*D (15*0.60 = 9.0)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	41.10	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	13.70	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	38.71				
Uplift capacity of Pile	12.50				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.14				

BH-01					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	11.42	14.23	20.74	28.78	38.71
Safe Uplift capacity of Pile	6.71	8.41	12.18	16.42	21.14

BH-02					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	12	14
	5	7	12	14	14
	3	2	5	2	0
C Value	3.7	2.5	0	0	
Φ Value	0	4	24	31	
α	1	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.87	0.85	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.070	0.445	0.601	0.000
Pdmean	1.305	3.46	6.435	9.42	10.28
As (π x dia x tickness)	2.355	1.57	3.925	1.57	0
Ultimate Skin Frictional Resistance (For C Value)	8.7135	3.925	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	11.25	9.78	0.00
Permissable skin friction Resistance (t)	2.9045	1.31	3.75	3.26	0.00
Uplift capacity of Pile	5.61				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	4.31	Cosidering 20*D (20*0.25 = 5)			
N_y	25.99				
N_q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	5.21	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.74	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	12.96				
Uplift capacity of Pile	5.61				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m ³ as per IS 456)			
Safe Uplift capacity of Pile	7.11				

BH-02					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	12	14
	5	7	12	14	14
	3	2	5	2	0
C Value	3.7	2.5	0	0	
Φ Value	0	4	24	31	
α	1	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.87	0.85	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.070	0.445	0.601	0.000
Pdmean	1.305	3.46	6.435	9.42	10.28
As (π x dia x tickness)	2.826	1.884	4.71	1.884	0
Ultimate Skin Frictional Resistance (For C Value)	10.4562	4.71	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	13.49	11.73	0.00
Permissable skin friction Resistance (t)	3.4854	1.57	4.50	3.91	0.00
Uplift capacity of Pile	6.73				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	5.16	Cosidering 20*D (20*0.30 = 6)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	8.99	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	3.00	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	16.46				
Uplift capacity of Pile	6.73				
Self Weight of Pile	2.16	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	8.89				

BH-02					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	12	14
	5	7	12	14	14
	3	2	5	2	0
C Value	3.7	2.5	0	0	
Φ Value	0	4	24	31	
α	1	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.87	0.85	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.070	0.445	0.601	0.000
Pdmean	1.305	3.46	6.435	9.42	10.28
As (π x dia x tickness)	3.768	2.512	6.28	2.512	0
Ultimate Skin Frictional Resistance (For C Value)	13.9416	6.28	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	17.99	15.64	0.00
Permissable skin friction Resistance (t)	4.6472	2.09	6.00	5.21	0.00
Uplift capacity of Pile	8.98				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	6.86	Cosidering 20*D (20*0.40 = 8)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	21.24	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	7.08	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	25.03				
Uplift capacity of Pile	8.98				
Self Weight of Pile	3.84	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	12.82				

BH-02					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	12	14
	5	7	12	14	14
	3	2	5	2	0
C Value	3.7	2.5	0	0	
Φ Value	0	4	24	31	
α	1	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.87	0.85	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.070	0.445	0.601	0.000
Pdmean	1.305	3.46	6.435	9.42	10.28
As (π x dia x tickness)	4.71	3.14	7.85	3.14	0
Ultimate Skin Frictional Resistance (For C Value)	17.427	7.85	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	22.49	19.55	0.00
Permissable skin friction Resistance (t)	5.809	2.62	7.50	6.52	0.00
Uplift capacity of Pile	11.22				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	8.56	Cosidering 20*D (20*0.50 = 10)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	41.41	$A_p(1/2 \cdot D \cdot Y \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	13.80	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	36.24				
Uplift capacity of Pile	11.22				
Self Weight of Pile	6.00	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	17.22				

BH-02					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	12	14
	5	7	12	14	14
	3	2	5	2	0
C Value	3.7	2.5	0	0	
Φ Value	0	4	24	31	
α	1	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.87	0.85	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.070	0.445	0.601	0.000
Pdmean	1.305	3.46	6.435	9.42	10.28
As ($\pi \times \text{dia} \times \text{tickness}$)	5.652	3.768	9.42	3.768	0
Ultimate Skin Frictional Resistance (For C Value)	20.9124	9.42	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	26.99	23.46	0.00
Permissable skin friction Resistance (t)	6.9708	3.14	9.00	7.82	0.00
Uplift capacity of Pile	13.46				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	10.28	Cosidering 20*D (20*0.60 = 12)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	71.62	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	23.87	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	50.80				
Uplift capacity of Pile	13.46				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	22.11				

BH-02					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	12.96	16.46	25.03	36.24	50.80
Safe Uplift capacity of Pile	7.11	8.89	12.82	17.22	22.11

BH-03					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	7	14	14
	4.5	7	14	14	14
	2.5	2.5	7	0	0
C Value	3.4	2	0	0	
Φ Value	0	6	27	0	
α	1	1	0	0	
Ki	0	0	1	0	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.9	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.105	0.510	0.000	0.000
Pdmean	1.125	3.3125	7.42	10.465	10.465
As ($\pi \times \text{dia} \times \text{tickness}$)	1.9625	1.9625	5.495	0	0
Ultimate Skin Frictional Resistance (For C Value)	6.6725	3.925	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	20.77	0.00	0.00
Permissable skin friction Resistance (t)	2.22	1.31	6.92	0.00	0.00
Uplift capacity of Pile	5.23				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.31	Cosidering 15*D (15*0.25 = 3.75)			
N_y	14.47				
N_q	14	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	2.35	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	0.78	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	11.24				
Uplift capacity of Pile	5.23				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	6.73				

BH-03					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	7	14	14
	4.5	7	14	14	14
	2.5	2.5	7	0	0
C Value	3.4	2	0	0	
Φ Value	0	6	27	0	
α	1	1	0	0	
Ki	0	0	1	0	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.9	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.105	0.510	0.000	0.000
Pdmean	1.125	3.3125	7.42	10.465	10.465
As (π x dia x tickness)	2.355	2.355	6.594	0	0
Ultimate Skin Frictional Resistance (For C Value)	8.007	4.71	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	24.93	0.00	0.00
Permissable skin friction Resistance (t)	2.669	1.57	8.31	0.00	0.00
Uplift capacity of Pile	6.27				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P_D	3.95	Cosidering 15*D (15*0.30 = 4.5)			
N_y	14.47				
N_q	14	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	4.04	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	1.35	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	13.90				
Uplift capacity of Pile	6.27				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.44				

BH-03					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	7	14	14
	4.5	7	14	14	14
	2.5	2.5	7	0	0
C Value	3.4	2	0	0	
Φ Value	0	6	27	0	
α	1	1	0	0	
Ki	0	0	1	0	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.9	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.105	0.510	0.000	0.000
Pdmean	1.125	3.3125	7.42	10.465	10.465
As (π x dia x tickness)	3.14	3.14	8.792	0	0
Ultimate Skin Frictional Resistance (For C Value)	10.676	6.28	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	33.24	0.00	0.00
Permissable skin friction Resistance (t)	3.558666667	2.09	11.08	0.00	0.00
Uplift capacity of Pile	8.37				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P_D	5.245	Cosidering 15*D (15*0.40 = 6)			
N_y	14.47				
N_q	14	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	9.54	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	3.18	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	19.91				
Uplift capacity of Pile	8.37				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.21				

BH-03					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	7	14	14
	4.5	7	14	14	14
	2.5	2.5	7	0	0
C Value	3.4	2	0	0	
Φ Value	0	6	27	0	
α	1	1	0	0	
Ki	0	0	1	0	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.9	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.105	0.510	0.000	0.000
Pdmean	1.125	3.3125	7.42	10.465	10.465
As (π x dia x tickness)	3.925	3.925	10.99	0	0
Ultimate Skin Frictional Resistance (For C Value)	13.345	7.85	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	41.55	0.00	0.00
Permissable skin friction Resistance (t)	4.448333333	2.62	13.85	0.00	0.00
Uplift capacity of Pile	10.46				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	6.55	Cosidering 15*D (15*0.50 = 7.5)			
N_y	14.47				
N_q	14	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	18.61	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	6.20	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	27.12				
Uplift capacity of Pile	10.46				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	16.46				

BH-03					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	7	14	14
	4.5	7	14	14	14
	2.5	2.5	7	0	0
C Value	3.4	2	0	0	
Φ Value	0	6	27	0	
α	1	1	0	0	
Ki	0	0	1	0	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.9	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.105	0.510	0.000	0.000
Pdmean	1.125	3.3125	7.42	10.465	10.465
As ($\pi \times \text{dia} \times \text{tickness}$)	4.71	4.71	13.188	0	0
Ultimate Skin Frictional Resistance (For C Value)	16.014	9.42	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	49.86	0.00	0.00
Permissable skin friction Resistance (t)	5.338	3.14	16.62	0.00	0.00
Uplift capacity of Pile	12.55				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.855	Cosidering 15*D (15*0.60 = 9)			
Ny	14.47				
Nq	14	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	32.14	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	10.71	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	35.81				
Uplift capacity of Pile	12.55				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.19				

BH-03					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	11.24	13.90	19.91	27.12	35.81
Safe Uplift capacity of Pile	6.73	8.44	12.21	16.46	21.19

BH-04					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	6	7	14
	4.5	6	7	14	14
	2.5	1.5	1	7	0
C Value	4.4	2.1	0	0	
Φ Value	0	5	25	32	
α	0.9	1	0	0	
Ki	0	0	1	1.15	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.91	0.84	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.087	0.466	0.625	0.000
Pdmean	1.1375	2.905	3.955	7.385	10.395
As (π x dia x tickness)	1.9625	1.1775	0.785	5.495	0
Ultimate Skin Frictional Resistance (For C Value)	7.7715	2.47275	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	1.45	29.16	0.00
Permissable skin friction Resistance (t)	2.59	0.82	0.48	9.72	0.00
Uplift capacity of Pile	6.81				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_d	4.38	Cosidering 20*D (20*0.25 = 5)			
N_y	30.22				
N_q	28	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	6.17	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	2.06	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	15.67				
Uplift capacity of Pile	6.81				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	8.31				

BH-04					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	6	7	14
	4.5	6	7	14	14
	2.5	1.5	1	7	0
C Value	4.4	2.1	0	0	
Φ Value	0	5	25	32	
α	0.9	1	0	0	
Ki	0	0	1	1.15	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.91	0.84	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.087	0.466	0.625	0.000
Pdmean	1.1375	2.905	3.955	7.385	10.395
As ($\pi \times \text{dia} \times \text{tickness}$)	2.355	1.413	0.942	6.594	0
Ultimate Skin Frictional Resistance (For C Value)	9.3258	2.9673	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	1.74	34.99	0.00
Permissable skin friction Resistance (t)	3.1086	0.99	0.58	11.66	0.00
Uplift capacity of Pile	8.17				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P_D	5.235	Cosidering 20*D (20*0.30 = 6)			
N_y	30.22				
N_q	28	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	10.63	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Presssure	3.54	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	19.89				
Uplift capacity of Pile	8.17				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	10.33				

BH-04					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	6	7	14
	4.5	6	7	14	14
	2.5	1.5	1	7	0
C Value	4.4	2.1	0	0	
Φ Value	0	5	25	32	
α	0.9	1	0	0	
Ki	0	0	1	1.15	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.91	0.84	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.087	0.466	0.625	0.000
Pdmean	1.1375	2.905	3.955	7.385	10.395
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	1.884	1.256	8.792	0
Ultimate Skin Frictional Resistance (For C Value)	12.4344	3.9564	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	2.32	46.66	0.00
Permissable skin friction Resistance (t)	4.1448	1.32	0.77	15.55	0.00
Uplift capacity of Pile	10.89				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P_D	6.955	Cosidering 20*D (20*0.40 = 8)			
N_y	30.22				
N_q	28	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	25.11	$A_p(1/2 \cdot D \cdot Y \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	8.37	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	30.16				
Uplift capacity of Pile	10.89				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	14.74				

BH-04					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	6	7	14
	4.5	6	7	14	14
	2.5	1.5	1	7	0
C Value	4.4	2.1	0	0	
Φ Value	0	5	25	32	
α	0.9	1	0	0	
Ki	0	0	1	1.15	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.91	0.84	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.087	0.466	0.625	0.000
Pdmean	1.1375	2.905	3.955	7.385	10.395
As ($\pi \times \text{dia} \times \text{tickness}$)	3.925	2.355	1.57	10.99	0
Ultimate Skin Frictional Resistance (For C Value)	15.543	4.9455	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	2.90	58.32	0.00
Permissable skin friction Resistance (t)	5.181	1.65	0.97	19.44	0.00
Uplift capacity of Pile	13.62				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	8.675	Cosidering 20*D (20*0.50 =10)			
Ny	30.22				
Nq	28	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	48.94	$Ap(1/2*D*Y*Ny +Pd*Nq)$			
Safe End Bearing Pressure	16.31	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	43.55				
Uplift capacity of Pile	13.62				
Self Weight of Pile	6.00	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	19.62				

BH-04					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	4.5	6	7	14
	4.5	6	7	14	14
	2.5	1.5	1	7	0
C Value	4.4	2.1	0	0	
Φ Value	0	5	25	32	
α	0.9	1	0	0	
Ki	0	0	1	1.15	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.91	0.84	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.087	0.466	0.625	0.000
Pdmean	1.1375	2.905	3.955	7.385	10.395
As ($\pi \times \text{dia} \times \text{tickness}$)	4.71	2.826	1.884	13.188	0
Ultimate Skin Frictional Resistance (For C Value)	18.6516	5.9346	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	3.47	69.99	0.00
Permissable skin friction Resistance (t)	6.2172	1.98	1.16	23.33	0.00
Uplift capacity of Pile	16.34				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P_D	10.395	Cosidering 20*D (20*0.60 = 12)			
Ny	30.22				
Nq	28	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	84.46	$A_p(1/2 \cdot D \cdot Y \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	28.15	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	60.83				
Uplift capacity of Pile	16.34				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	24.98				

BH-04					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	15.67	19.89	30.16	43.55	60.83
Safe Uplift capacity of Pile	8.31	10.33	14.74	19.62	24.98

BH-05					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2.4	0	0	
Φ Value	0	4	25	33	
α	0.9	1	0	0	
Ki	0	0	1	1.2	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.89	0.85	0.84	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.466	0.649	0.000
Pdmean	1.335	3.52	7.1	10.0475	10.265
As ($\pi \times \text{dia} \times \text{tickness}$)	2.355	1.57	5.1025	0.3925	0
Ultimate Skin Frictional Resistance (For C Value)	8.478	3.768	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	16.89	3.07	0.00
Permissable skin friction Resistance (t)	2.83	1.26	5.63	1.02	0.00
Uplift capacity of Pile	5.37				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	4.37	Cosidering 20*D (20*0.25 = 5)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	7.48	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	2.49	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	13.23				
Uplift capacity of Pile	5.37				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	6.87				

BH-05					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2.4	0	0	
Φ Value	0	4	25	33	
α	0.9	1	0	0	
Ki	0	0	1	1.2	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.89	0.85	0.84	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.466	0.649	0.000
Pdmean	1.335	3.52	7.1	10.0475	10.265
As (π x dia x tickness)	2.826	1.884	6.123	0.471	0
Ultimate Skin Frictional Resistance (For C Value)	10.1736	4.5216	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	20.27	3.69	0.00
Permissable skin friction Resistance (t)	3.3912	1.51	6.76	1.23	0.00
Uplift capacity of Pile	6.44				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P_D	5.21	Cosidering 20*D (20*0.30 = 6)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	12.84	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	4.28	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	17.16				
Uplift capacity of Pile	6.44				
Self Weight of Pile	2.16	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	8.60				

BH-05					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2.4	0	0	
Φ Value	0	4	25	33	
α	0.9	1	0	0	
Ki	0	0	1	1.2	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.89	0.85	0.84	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.466	0.649	0.000
Pdmean	1.335	3.52	7.1	10.0475	10.265
As (π x dia x tickness)	3.768	2.512	8.164	0.628	0
Ultimate Skin Frictional Resistance (For C Value)	13.5648	6.0288	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	27.03	4.92	0.00
Permissable skin friction Resistance (t)	4.5216	2.01	9.01	1.64	0.00
Uplift capacity of Pile	8.59				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	6.89	Cosidering 20*D (20*0.40 = 8)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	30.19	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	10.06	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	27.24				
Uplift capacity of Pile	8.59				
Self Weight of Pile	3.84	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	12.43				

BH-05					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2.4	0	0	
Φ Value	0	4	25	33	
α	0.9	1	0	0	
Ki	0	0	1	1.2	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.89	0.85	0.84	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.466	0.649	0.000
Pdmean	1.335	3.52	7.1	10.0475	10.265
As (π x dia x tickness)	4.71	3.14	10.205	0.785	0
Ultimate Skin Frictional Resistance (For C Value)	16.956	7.536	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	33.79	6.15	0.00
Permissable skin friction Resistance (t)	5.652	2.51	11.26	2.05	0.00
Uplift capacity of Pile	10.74				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	8.57	Cosidering 20*D (20*0.50 =10)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	58.69	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	19.56	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	41.04				
Uplift capacity of Pile	10.74				
Self Weight of Pile	6.00	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	16.74				

BH-05					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2.4	0	0	
Φ Value	0	4	25	33	
α	0.9	1	0	0	
Ki	0	0	1	1.2	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.89	0.85	0.84	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.466	0.649	0.000
Pdmean	1.335	3.52	7.1	10.0475	10.265
As (π x dia x tickness)	5.652	3.768	12.246	0.942	0
Ultimate Skin Frictional Resistance (For C Value)	20.3472	9.0432	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	40.54	7.38	0.00
Permissable skin friction Resistance (t)	6.7824	3.01	13.51	2.46	0.00
Uplift capacity of Pile	12.89				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P_D	10.265	Cosidering 20*D (20*0.60 = 12)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	101.23	$Ap(1/2*D*Y*Ny + Pd*Nq)$			
Safe End Bearing Pressure	33.74	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	59.51				
Uplift capacity of Pile	12.89				
Self Weight of Pile	8.64	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	21.53				

BH-05					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	13.23	17.16	27.24	41.04	59.51
Safe Uplift capacity of Pile	6.87	8.60	12.43	16.74	21.53

BH-06					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2	0	0	
Φ Value	0	6	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.9	0.86	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.105	0.488	0.601	0.000
Pdmean	1.35	3.56	7.15	10.095	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	2.355	1.57	5.1025	0.3925	0
Ultimate Skin Frictional Resistance (For C Value)	8.478	3.14	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	17.79	2.62	0.00
Permissable skin friction Resistance (t)	2.83	1.05	5.93	0.87	0.00
Uplift capacity of Pile	5.34				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	4.42	Cosidering 20*D (20*0.25 = 5)			
N_y	25.99				
N_q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	5.34	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.78	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	12.46				
Uplift capacity of Pile	5.34				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m ³ as per IS 456)			
Safe Uplift capacity of Pile	6.84				

BH-06					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2	0	0	
Φ Value	0	6	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.9	0.86	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.105	0.488	0.601	0.000
Pdmean	1.35	3.56	7.15	10.095	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	2.826	1.884	6.123	0.471	0
Ultimate Skin Frictional Resistance (For C Value)	10.1736	3.768	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	21.35	3.14	0.00
Permissable skin friction Resistance (t)	3.3912	1.26	7.12	1.05	0.00
Uplift capacity of Pile	6.41				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	5.26	Cosidering 20*D (20*0.30 = 6)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	9.16	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Pressure	3.05	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	15.86				
Uplift capacity of Pile	6.41				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.57				

BH-06					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2	0	0	
Φ Value	0	6	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.9	0.86	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.105	0.488	0.601	0.000
Pdmean	1.35	3.56	7.15	10.095	10.31
As (π x dia x tickness)	3.768	2.512	8.164	0.628	0
Ultimate Skin Frictional Resistance (For C Value)	13.5648	5.024	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	28.47	4.19	0.00
Permissable skin friction Resistance (t)	4.5216	1.67	9.49	1.40	0.00
Uplift capacity of Pile	8.54				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	6.94	Cosidering 20*D (20*0.40 = 8)			
N _y	25.99				
N _q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	21.48	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	7.16	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	24.24				
Uplift capacity of Pile	8.54				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.38				

BH-06					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2	0	0	
Φ Value	0	6	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.9	0.86	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.105	0.488	0.601	0.000
Pdmean	1.35	3.56	7.15	10.095	10.31
As (π x dia x tickness)	4.71	3.14	10.205	0.785	0
Ultimate Skin Frictional Resistance (For C Value)	16.956	6.28	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	35.59	5.24	0.00
Permissable skin friction Resistance (t)	5.652	2.09	11.86	1.75	0.00
Uplift capacity of Pile	10.68				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	8.62	Cosidering 20*D (20*0.50 =10)			
N _y	25.99				
N _q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	41.70	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Pressure	13.90	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	35.25				
Uplift capacity of Pile	10.68				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	16.68				

BH-06					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	7	13.5	14
	5	7	13.5	14	14
	3	2	6.5	0.5	0
C Value	4	2	0	0	
Φ Value	0	6	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.9	0.86	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.105	0.488	0.601	0.000
Pdmean	1.35	3.56	7.15	10.095	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	5.652	3.768	12.246	0.942	0
Ultimate Skin Frictional Resistance (For C Value)	20.3472	7.536	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	42.71	6.29	0.00
Permissable skin friction Resistance (t)	6.7824	2.51	14.24	2.10	0.00
Uplift capacity of Pile	12.81				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	10.31	Cosidering 20*D (20*0.60 = 12)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	71.82	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Presssure	23.94	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	49.57				
Uplift capacity of Pile	12.81				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.45				

BH-06					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	12.46	15.86	24.24	35.25	49.57
Safe Uplift capacity of Pile	6.84	8.57	12.38	16.68	21.45

BH-07					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	6	7	14
	5	6	7	14	14
	3	1	1	7	0
C Value	4.3	2.3	0	0	
Φ Value	0	4	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.92	0.84	0.85	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.488	0.601	0.000
Pdmean	1.38	3.18	4.025	7.495	10.54
As (π x dia x tickness)	2.355	0.785	0.785	5.495	0
Ultimate Skin Frictional Resistance (For C Value)	9.11385	1.8055	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	1.54	27.22	0.00
Permissable skin friction Resistance (t)	3.04	0.60	0.51	9.07	0.00
Uplift capacity of Pile	6.61				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	4.45	Cosidering 20*D (20*0.25 = 5)			
N_y	25.99				
N_q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	5.38	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.79	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	15.02				
Uplift capacity of Pile	6.61				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	8.11				

BH-07					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	6	7	14
	5	6	7	14	14
	3	1	1	7	0
C Value	4.3	2.3	0	0	
Φ Value	0	4	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.92	0.84	0.85	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.488	0.601	0.000
Pdmean	1.38	3.18	4.025	7.495	10.54
As ($\pi \times \text{dia} \times \text{tickness}$)	2.826	0.942	0.942	6.594	0
Ultimate Skin Frictional Resistance (For C Value)	10.93662	2.1666	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	1.85	32.67	0.00
Permissable skin friction Resistance (t)	3.64554	0.72	0.62	10.89	0.00
Uplift capacity of Pile	7.94				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	5.32	Cosidering 20*D (20*0.30 = 6)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	9.26	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Pressure	3.09	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	18.96				
Uplift capacity of Pile	7.94				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	10.10				

BH-07					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	6	7	14
	5	6	7	14	14
	3	1	1	7	0
C Value	4.3	2.3	0	0	
Φ Value	0	4	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.92	0.84	0.85	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.488	0.601	0.000
Pdmean	1.38	3.18	4.025	7.495	10.54
As (π x dia x tickness)	3.768	1.256	1.256	8.792	0
Ultimate Skin Frictional Resistance (For C Value)	14.58216	2.8888	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	2.47	43.55	0.00
Permissable skin friction Resistance (t)	4.86072	0.96	0.82	14.52	0.00
Uplift capacity of Pile	10.58				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P_D	7.06	Cosidering 20*D (20*0.40 = 8)			
N_y	25.99				
N_q	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	21.85	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	7.28	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	28.45				
Uplift capacity of Pile	10.58				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	14.42				

BH-07					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	6	7	14
	5	6	7	14	14
	3	1	1	7	0
C Value	4.3	2.3	0	0	
Φ Value	0	4	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.92	0.84	0.85	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.488	0.601	0.000
Pdmean	1.38	3.18	4.025	7.495	10.54
As ($\pi \times \text{dia} \times \text{tickness}$)	4.71	1.57	1.57	10.99	0
Ultimate Skin Frictional Resistance (For C Value)	18.2277	3.611	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	3.08	54.44	0.00
Permissable skin friction Resistance (t)	6.0759	1.20	1.03	18.15	0.00
Uplift capacity of Pile	13.23				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	8.8	Cosidering 20*D (20*0.50 =10)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	42.56	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	14.19	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	40.64				
Uplift capacity of Pile	13.23				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	19.23				

BH-07					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	5	6	7	14
	5	6	7	14	14
	3	1	1	7	0
C Value	4.3	2.3	0	0	
Φ Value	0	4	26	31	
α	0.9	1	0	0	
Ki	0	0	1	1.1	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.92	0.84	0.85	0.87	
Tan Value (TAN Φ)	0.000	0.070	0.488	0.601	0.000
Pdmean	1.38	3.18	4.025	7.495	10.54
As (π x dia x tickness)	5.652	1.884	1.884	13.188	0
Ultimate Skin Frictional Resistance (For C Value)	21.87324	4.3332	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	0.00	3.70	65.33	0.00
Permissable skin friction Resistance (t)	7.29108	1.44	1.23	21.78	0.00
Uplift capacity of Pile	15.87				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	10.54	Cosidering 20*D (20*0.60 = 12)			
Ny	25.99				
Nq	24	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	73.40	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	24.47	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	56.21				
Uplift capacity of Pile	15.87				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	24.51				

BH-07					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	15.02	18.96	28.45	40.64	56.21
Safe Uplift capacity of Pile	8.11	10.10	14.42	19.23	24.51

BH-08					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.7	0	0	0	
Φ Value	0	23	27	33	
α	1	0	0	0	
Ki	0	1	1	1.2	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.89	0.83	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.424	0.510	0.649	0.000
Pdmean	1.78	3.975	6.49	9.45	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	0.785	3.925	1.57	0
Ultimate Skin Frictional Resistance (For C Value)	11.618	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	1.32	12.98	11.56	0.00
Permissable skin friction Resistance (t)	3.87	0.44	4.33	3.85	0.00
Uplift capacity of Pile	6.25				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	4.39	Cosidering 20*D (20*0.25 = 5)			
N_y	35.19				
N_q	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	7.51	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	2.50	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	15.00				
Uplift capacity of Pile	6.25				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	7.75				

BH-08					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.7	0	0	0	
Φ Value	0	23	27	33	
α	1	0	0	0	
Ki	0	1	1	1.2	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.89	0.83	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.424	0.510	0.649	0.000
Pdmean	1.78	3.975	6.49	9.45	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	3.768	0.942	4.71	1.884	0
Ultimate Skin Frictional Resistance (For C Value)	13.9416	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	1.59	15.58	13.87	0.00
Permissable skin friction Resistance (t)	4.6472	0.53	5.19	4.62	0.00
Uplift capacity of Pile	7.50				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	5.23	Cosidering 20*D (20*0.30 = 6)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	12.88	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	4.29	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	19.29				
Uplift capacity of Pile	7.50				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	9.66				

BH-08					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.7	0	0	0	
Φ Value	0	23	27	33	
α	1	0	0	0	
Ki	0	1	1	1.2	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.89	0.83	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.424	0.510	0.649	0.000
Pdmean	1.78	3.975	6.49	9.45	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	5.024	1.256	6.28	2.512	0
Ultimate Skin Frictional Resistance (For C Value)	18.5888	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	2.12	20.77	18.50	0.00
Permissable skin friction Resistance (t)	6.196266667	0.71	6.92	6.17	0.00
Uplift capacity of Pile	10.00				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	6.91	Cosidering 20*D (20*0.40 = 8)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	30.27	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Pressure	10.09	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	30.08				
Uplift capacity of Pile	10.00				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	13.84				

BH-08					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.7	0	0	0	
Φ Value	0	23	27	33	
α	1	0	0	0	
Ki	0	1	1	1.2	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.89	0.83	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.424	0.510	0.649	0.000
Pdmean	1.78	3.975	6.49	9.45	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	6.28	1.57	7.85	3.14	0
Ultimate Skin Frictional Resistance (For C Value)	23.236	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	2.65	25.96	23.12	0.00
Permissable skin friction Resistance (t)	7.745333333	0.88	8.65	7.71	0.00
Uplift capacity of Pile	12.49				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	8.59	Cosidering 20*D (20*0.50 =10)			
Ny	35.19				
Nq	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	58.80	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	19.60	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	44.59				
Uplift capacity of Pile	12.49				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	18.50				

BH-08					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.7	0	0	0	
Φ Value	0	23	27	33	
α	1	0	0	0	
Ki	0	1	1	1.2	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.89	0.83	0.84	0.86	
Tan Value (TAN Φ)	0.000	0.424	0.510	0.649	0.000
Pdmean	1.78	3.975	6.49	9.45	10.31
As ($\pi \times \text{dia} \times \text{tickness}$)	7.536	1.884	9.42	3.768	0
Ultimate Skin Frictional Resistance (For C Value)	27.8832	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	3.18	31.15	27.75	0.00
Permissable skin friction Resistance (t)	9.2944	1.06	10.38	9.25	0.00
Uplift capacity of Pile	14.99				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	10.31	Cosidering 20*D (20*0.60 = 12)			
N _y	35.19				
N _q	34	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	101.63	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Pressure	33.88	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	63.86				
Uplift capacity of Pile	14.99				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	23.64				

BH-08					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	15.00	19.29	30.08	44.59	63.86
Safe Uplift capacity of Pile	7.75	9.66	13.84	18.50	23.64

BH-09					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	14	14	14
	6	14	14	14	14
	4	8	0	0	0
C Value	3.3	0	0	0	
Φ Value	0	26	0	0	
α	1	0	0	0	
Ki	0	1	0	0	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.89	0.84	0	0	
Tan Value (TAN Φ)	0.000	0.488	0.000	0.000	0.000
Pdmean	1.78	6.92	10.28	10.28	10.28
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	6.28	0	0	0
Ultimate Skin Frictional Resistance (For C Value)	10.362	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	21.20	0.00	0.00	0.00
Permissable skin friction Resistance (t)	3.45	7.07	0.00	0.00	0.00
Uplift capacity of Pile	5.26				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.34	Cosidering 15*D (15*0.25 = 3.75)			
N_y	12.54				
N_q	12	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.84				
Ultimate Unit End Bearing Resistance	2.03	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	0.68	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	11.20				
Uplift capacity of Pile	5.26				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	6.76				

BH-09					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	14	14	14
	6	14	14	14	14
	4	8	0	0	0
C Value	3.3	0	0	0	
Φ Value	0	26	0	0	
α	1	0	0	0	
Ki	0	1	0	0	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.89	0.84	0	0	
Tan Value (TAN Φ)	0.000	0.488	0.000	0.000	0.000
Pdmean	1.78	6.92	10.28	10.28	10.28
As ($\pi \times \text{dia} \times \text{tickness}$)	3.768	7.536	0	0	0
Ultimate Skin Frictional Resistance (For C Value)	12.4344	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	25.43	0.00	0.00	0.00
Permissable skin friction Resistance (t)	4.1448	8.48	0.00	0.00	0.00
Uplift capacity of Pile	6.31				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	3.98	Cosidering 15*D (15*0.30 = 4.5)			
N _y	12.54				
N _q	12	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.84				
Ultimate Unit End Bearing Resistance	3.49	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Pressure	1.16	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	13.79				
Uplift capacity of Pile	6.31				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.47				

BH-09					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	14	14	14
	6	14	14	14	14
	4	8	0	0	0
C Value	3.3	0	0	0	
Φ Value	0	26	0	0	
α	1	0	0	0	
Ki	0	1	0	0	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.89	0.84	0	0	
Tan Value (TAN Φ)	0.000	0.488	0.000	0.000	0.000
Pdmean	1.78	6.92	10.28	10.28	10.28
As ($\pi \times \text{dia} \times \text{tickness}$)	5.024	10.048	0	0	0
Ultimate Skin Frictional Resistance (For C Value)	16.5792	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	33.91	0.00	0.00	0.00
Permissable skin friction Resistance (t)	5.5264	11.30	0.00	0.00	0.00
Uplift capacity of Pile	8.42				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	5.24	Cosidering 15*D (15*0.40 = 6)			
Ny	12.54				
Nq	12	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.84				
Ultimate Unit End Bearing Resistance	8.16	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	2.72	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	19.55				
Uplift capacity of Pile	8.42				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.26				

BH-09					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	14	14	14
	6	14	14	14	14
	4	8	0	0	0
C Value	3.3	0	0	0	
Φ Value	0	26	0	0	
α	1	0	0	0	
Ki	0	1	0	0	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.89	0.84	0	0	
Tan Value (TAN Φ)	0.000	0.488	0.000	0.000	0.000
Pdmean	1.78	6.92	10.28	10.28	10.28
As (π x dia x tickness)	6.28	12.56	0	0	0
Ultimate Skin Frictional Resistance (For C Value)	20.724	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	42.39	0.00	0.00	0.00
Permissable skin friction Resistance (t)	6.908	14.13	0.00	0.00	0.00
Uplift capacity of Pile	10.52				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	6.5	Cosidering 15*D (15*0.50 =7.5)			
N_y	12.54				
N_q	12	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.84				
Ultimate Unit End Bearing Resistance	15.82	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Pressure	5.27	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	26.31				
Uplift capacity of Pile	10.52				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	16.52				

BH-09					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	14	14	14
	6	14	14	14	14
	4	8	0	0	0
C Value	3.3	0	0	0	
Φ Value	0	26	0	0	
α	1	0	0	0	
Ki	0	1	0	0	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.89	0.84	0	0	
Tan Value (TAN Φ)	0.000	0.488	0.000	0.000	0.000
Pdmean	1.78	6.92	10.28	10.28	10.28
As ($\pi \times \text{dia} \times \text{tickness}$)	7.536	15.072	0	0	0
Ultimate Skin Frictional Resistance (For C Value)	24.8688	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	50.87	0.00	0.00	0.00
Permissable skin friction Resistance (t)	8.2896	16.96	0.00	0.00	0.00
Uplift capacity of Pile	12.62				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.76	Cosidering 15*D (15*0.60 = 9)			
Ny	12.54				
Nq	12	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.84				
Ultimate Unit End Bearing Resistance	27.21	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Pressure	9.07	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	34.32				
Uplift capacity of Pile	12.62				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.27				

BH-09					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	11.20	13.79	19.55	26.31	34.32
Safe Uplift capacity of Pile	6.76	8.47	12.26	16.52	21.27

BH-10					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	12	14	14
	6	12	14	14	14
	4	6	2	0	0
C Value	3.6	0	0	0	
Φ Value	0	25	29	0	
α	1	0	0	0	
Ki	0	1	1	0	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.89	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.466	0.554	0.000	0.000
Pdmean	1.78	6.11	9.53	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	4.71	1.57	0	0
Ultimate Skin Frictional Resistance (For C Value)	11.304	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	13.42	8.29	0.00	0.00
Permissable skin friction Resistance (t)	3.77	4.47	2.76	0.00	0.00
Uplift capacity of Pile	5.50				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.34	Cosidering 15*D (15*0.25 = 3.75)			
N_y	19.34				
N_q	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	3.05	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.02	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	12.02				
Uplift capacity of Pile	5.50				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	7.00				

BH-10					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	12	14	14
	6	12	14	14	14
	4	6	2	0	0
C Value	3.6	0	0	0	
Φ Value	0	25	29	0	
α	1	0	0	0	
Ki	0	1	1	0	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.89	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.466	0.554	0.000	0.000
Pdmean	1.78	6.11	9.53	10.4	10.4
As (π x dia x tickness)	3.768	5.652	1.884	0	0
Ultimate Skin Frictional Resistance (For C Value)	13.5648	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	16.10	9.95	0.00	0.00
Permissable skin friction Resistance (t)	4.5216	5.37	3.32	0.00	0.00
Uplift capacity of Pile	6.60				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P_D	3.985	Cosidering 15*D (15*0.30 = 4.5)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	5.25	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	1.75	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	14.96				
Uplift capacity of Pile	6.60				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.76				

BH-10					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	12	14	14
	6	12	14	14	14
	4	6	2	0	0
C Value	3.6	0	0	0	
Φ Value	0	25	29	0	
α	1	0	0	0	
Ki	0	1	1	0	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.89	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.466	0.554	0.000	0.000
Pdmean	1.78	6.11	9.53	10.4	10.4
As (π x dia x tickness)	5.024	7.536	2.512	0	0
Ultimate Skin Frictional Resistance (For C Value)	18.0864	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	21.47	13.27	0.00	0.00
Permissable skin friction Resistance (t)	6.0288	7.16	4.42	0.00	0.00
Uplift capacity of Pile	8.80				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P_D	5.26	Cosidering 15*D (15*0.40 = 6)			
N_y	19.34				
N_q	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	12.31	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Presssure	4.10	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	21.71				
Uplift capacity of Pile	8.80				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.65				

BH-10					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	12	14	14
	6	12	14	14	14
	4	6	2	0	0
C Value	3.6	0	0	0	
Φ Value	0	25	29	0	
α	1	0	0	0	
Ki	0	1	1	0	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.89	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.466	0.554	0.000	0.000
Pdmean	1.78	6.11	9.53	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	6.28	9.42	3.14	0	0
Ultimate Skin Frictional Resistance (For C Value)	22.608	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	26.84	16.59	0.00	0.00
Permissable skin friction Resistance (t)	7.536	8.95	5.53	0.00	0.00
Uplift capacity of Pile	11.01				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	6.535	Cosidering 15*D (15*0.50 =7.5)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	23.91	$Ap(1/2*D*\gamma*Ny + Pd*Nq)$			
Safe End Bearing Presssure	7.97	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	29.98				
Uplift capacity of Pile	11.01				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	17.01				

BH-10					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	12	14	14
	6	12	14	14	14
	4	6	2	0	0
C Value	3.6	0	0	0	
Φ Value	0	25	29	0	
α	1	0	0	0	
Ki	0	1	1	0	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.89	0.85	0.87	0	
Tan Value (TAN Φ)	0.000	0.466	0.554	0.000	0.000
Pdmean	1.78	6.11	9.53	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	7.536	11.304	3.768	0	0
Ultimate Skin Frictional Resistance (For C Value)	27.1296	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	32.21	19.90	0.00	0.00
Permissable skin friction Resistance (t)	9.0432	10.74	6.63	0.00	0.00
Uplift capacity of Pile	13.21				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.81	Cosidering 15*D (15*0.60 = 9)			
Ny	19.34				
Nq	18	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.87				
Ultimate Unit End Bearing Resistance	41.15	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	13.72	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	40.13				
Uplift capacity of Pile	13.21				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.85				

BH-10					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	12.02	14.96	21.71	29.98	40.13
Safe Uplift capacity of Pile	7.00	8.76	12.65	17.01	21.85

BH-11					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.6	0	0	0	
Φ Value	0	25	27	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.9	0.82	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.510	0.577	0.000
Pdmean	1.8	4.01	6.545	9.53	10.39
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	0.785	3.925	1.57	0
Ultimate Skin Frictional Resistance (For C Value)	11.304	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	1.47	13.09	8.64	0.00
Permissable skin friction Resistance (t)	3.77	0.49	4.36	2.88	0.00
Uplift capacity of Pile	5.75				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.38	Cosidering 15*D (15*0.25 = 3.75)			
N_y	22.4				
N_q	20	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	3.43	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	1.14	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	12.64				
Uplift capacity of Pile	5.75				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	7.25				

BH-11					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.6	0	0	0	
Φ Value	0	25	27	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.9	0.82	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.510	0.577	0.000
Pdmean	1.8	4.01	6.545	9.53	10.39
As ($\pi \times \text{dia} \times \text{tickness}$)	3.768	0.942	4.71	1.884	0
Ultimate Skin Frictional Resistance (For C Value)	13.5648	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	1.76	15.71	10.37	0.00
Permissable skin friction Resistance (t)	4.5216	0.59	5.24	3.46	0.00
Uplift capacity of Pile	6.90				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	4.01	Cosidering 15*D (15*0.30 = 4.5)			
Ny	22.4				
Nq	20	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	5.87	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	1.96	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	15.76				
Uplift capacity of Pile	6.90				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	9.06				

BH-11					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.6	0	0	0	
Φ Value	0	25	27	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.9	0.82	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.510	0.577	0.000
Pdmean	1.8	4.01	6.545	9.53	10.39
As ($\pi \times \text{dia} \times \text{tickness}$)	5.024	1.256	6.28	2.512	0
Ultimate Skin Frictional Resistance (For C Value)	18.0864	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	2.35	20.94	13.82	0.00
Permissable skin friction Resistance (t)	6.0288	0.78	6.98	4.61	0.00
Uplift capacity of Pile	9.20				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	5.27	Cosidering 15*D (15*0.40 = 6)			
N _y	22.4				
N _q	20	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	13.72	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + Pd \cdot N_q)$			
Safe End Bearing Pressure	4.57	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	22.97				
Uplift capacity of Pile	9.20				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	13.04				

BH-11					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.6	0	0	0	
Φ Value	0	25	27	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.9	0.82	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.510	0.577	0.000
Pdmean	1.8	4.01	6.545	9.53	10.39
As (π x dia x tickness)	6.28	1.57	7.85	3.14	0
Ultimate Skin Frictional Resistance (For C Value)	22.608	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	2.94	26.18	17.28	0.00
Permissable skin friction Resistance (t)	7.536	0.98	8.73	5.76	0.00
Uplift capacity of Pile	11.50				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P_D	6.545	Cosidering 15*D (15*0.50 =7.5)			
N_y	22.4				
N_q	20	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	26.63	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	8.88	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	31.88				
Uplift capacity of Pile	11.50				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	17.50				

BH-11					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	7	12	14
	6	7	12	14	14
	4	1	5	2	0
C Value	3.6	0	0	0	
Φ Value	0	25	27	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.9	0.82	0.85	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.510	0.577	0.000
Pdmean	1.8	4.01	6.545	9.53	10.39
As ($\pi \times \text{dia} \times \text{tickness}$)	7.536	1.884	9.42	3.768	0
Ultimate Skin Frictional Resistance (For C Value)	27.1296	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	3.52	31.41	20.73	0.00
Permissable skin friction Resistance (t)	9.0432	1.17	10.47	6.91	0.00
Uplift capacity of Pile	13.80				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.82	Cosidering 15*D (15*0.60 = 9)			
N _y	22.4				
N _q	20	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	45.83	$A_p(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	15.28	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	42.88				
Uplift capacity of Pile	13.80				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	22.44				

BH-11					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	12.64	15.76	22.97	31.88	42.88
Safe Uplift capacity of Pile	7.25	9.06	13.04	17.50	22.44

BH-12					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	10	14	14
	6	10	14	14	14
	4	4	4	0	0
C Value	3.4	0	0	0	
Φ Value	0	25	28	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.25	0.25	0.25	0.25	0.25
Bulk Dencity (Submarged)	0.89	0.85	0.86	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.532	0.577	0.000
Pdmean	1.78	5.26	8.68	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	3.14	3.14	3.14	0	0
Ultimate Skin Frictional Resistance (For C Value)	10.676	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	7.70	14.49	0.00	0.00
Permissable skin friction Resistance (t)	3.56	2.57	4.83	0.00	0.00
Uplift capacity of Pile	5.48				
Calculation of Safe End Bearing Resistance:					
Ap	0.049	$(\pi \times (\text{dia})^2)/4$			
P_D	3.34	Cosidering 15*D (15*0.25 = 3.75)			
N_y	16.72				
N_q	16	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	2.71	$Ap(1/2*D*Y*N_y + Pd*N_q)$			
Safe End Bearing Pressure	0.90	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	11.86				
Uplift capacity of Pile	5.48				
Self Weight of Pile	1.50	excluding cut off 2 m, Y=25kN/m3 as per IS 456)			
Safe Uplift capacity of Pile	6.98				

BH-12					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	10	14	14
	6	10	14	14	14
	4	4	4	0	0
C Value	3.4	0	0	0	
Φ Value	0	25	28	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.3	0.3	0.3	0.3	0.3
Bulk Dencity (Submarged)	0.89	0.85	0.86	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.532	0.577	0.000
Pdmean	1.78	5.26	8.68	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	3.768	3.768	3.768	0	0
Ultimate Skin Frictional Resistance (For C Value)	12.8112	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	9.24	17.39	0.00	0.00
Permissable skin friction Resistance (t)	4.2704	3.08	5.80	0.00	0.00
Uplift capacity of Pile	6.57				
Calculation of Safe End Bearing Resistance:					
Ap	0.071	$(\pi \times (\text{dia})^2)/4$			
P _D	3.985	Cosidering 15*D (15*0.30 = 4.5)			
Ny	16.72				
Nq	16	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	4.66	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Pressure	1.55	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	14.70				
Uplift capacity of Pile	6.57				
Self Weight of Pile	2.16	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	8.73				

BH-12					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	10	14	14
	6	10	14	14	14
	4	4	4	0	0
C Value	3.4	0	0	0	
Φ Value	0	25	28	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.4	0.4	0.4	0.4	0.4
Bulk Dencity (Submarged)	0.89	0.85	0.86	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.532	0.577	0.000
Pdmean	1.78	5.26	8.68	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	5.024	5.024	5.024	0	0
Ultimate Skin Frictional Resistance (For C Value)	17.0816	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	12.32	23.19	0.00	0.00
Permissable skin friction Resistance (t)	5.693866667	4.11	7.73	0.00	0.00
Uplift capacity of Pile	8.77				
Calculation of Safe End Bearing Resistance:					
Ap	0.126	$(\pi \times (\text{dia})^2)/4$			
P _D	5.26	Cosidering 15*D (15*0.40 = 6)			
N _y	16.72				
N _q	16	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	10.93	$Ap(1/2 \cdot D \cdot \gamma \cdot N_y + P_d \cdot N_q)$			
Safe End Bearing Pressure	3.64	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	21.17				
Uplift capacity of Pile	8.77				
Self Weight of Pile	3.84	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	12.61				

BH-12					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	10	14	14
	6	10	14	14	14
	4	4	4	0	0
C Value	3.4	0	0	0	
Φ Value	0	25	28	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.5	0.5	0.5	0.5	0.5
Bulk Dencity (Submarged)	0.89	0.85	0.86	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.532	0.577	0.000
Pdmean	1.78	5.26	8.68	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	6.28	6.28	6.28	0	0
Ultimate Skin Frictional Resistance (For C Value)	21.352	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	15.40	28.98	0.00	0.00
Permissable skin friction Resistance (t)	7.117333333	5.13	9.66	0.00	0.00
Uplift capacity of Pile	10.96				
Calculation of Safe End Bearing Resistance:					
Ap	0.196	$(\pi \times (\text{dia})^2)/4$			
P _D	6.535	Cosidering 15*D (15*0.50 =7.5)			
Ny	16.72				
Nq	16	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	21.23	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	7.08	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	28.99				
Uplift capacity of Pile	10.96				
Self Weight of Pile	6.00	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	16.96				

BH-12					
Depth of Pile (14 m including 2 m Cut off length)					
	STRATUM-I	STRATUM-II	STRATUM-III	STRATUM-IV	STRATUM-V
Shaft Length	2	6	10	14	14
	6	10	14	14	14
	4	4	4	0	0
C Value	3.4	0	0	0	
Φ Value	0	25	28	30	
α	1	0	0	0	
Ki	0	1	1	1	
Dia of Pile	0.6	0.6	0.6	0.6	0.6
Bulk Dencity (Submarged)	0.89	0.85	0.86	0.86	
Tan Value (TAN Φ)	0.000	0.466	0.532	0.577	0.000
Pdmean	1.78	5.26	8.68	10.4	10.4
As ($\pi \times \text{dia} \times \text{tickness}$)	7.536	7.536	7.536	0	0
Ultimate Skin Frictional Resistance (For C Value)	25.6224	0	0	0	0
Ultimate Skin Frictional Resistance (For Φ Value)	0	18.48	34.78	0.00	0.00
Permissable skin friction Resistance (t)	8.5408	6.16	11.59	0.00	0.00
Uplift capacity of Pile	13.15				
Calculation of Safe End Bearing Resistance:					
Ap	0.283	$(\pi \times (\text{dia})^2)/4$			
P _D	7.82	Cosidering 15*D (15*0.60 = 9)			
Ny	16.72				
Nq	16	Fig. 1 of IS 2911 (Part 1/Sec 2): 2010]			
Bulk Dencity (Submarged)	0.86				
Ultimate Unit End Bearing Resistance	36.58	$Ap(1/2 \cdot D \cdot \gamma \cdot Ny + Pd \cdot Nq)$			
Safe End Bearing Presssure	12.19	(Ultimate Unit End Bearing Resistance /3)			
Safe vertical capacity of Pile	38.49				
Uplift capacity of Pile	13.15				
Self Weight of Pile	8.64	excluding cut off 2 m, $\gamma=25\text{kN/m}^3$ as per IS 456)			
Safe Uplift capacity of Pile	21.79				

BH-12					
Depth of Pile (14 m including 2 m Cut off length)	Dia 250mm	Dia 300mm	Dia 400mm	Dia 500mm	Dia 600mm
Safe vertical capacity of Pile	11.86	14.70	21.17	28.99	38.49
Safe Uplift capacity of Pile	6.98	8.73	12.61	16.96	21.79

Calculation of Lateral-Load Carrying Capacity and Moment-Resisting Capacity: [BH-1]

Diameter of Pile= 300 mm

Refer to IS 2911 (Part-1/Section-2): 2010 Annex-c (Clause 6.5.2 page-14)

Stiffness Factor $T = (EI/\eta h)^{1/5}$ m (For pile in sand and normally loaded clay)

Here $E_c = 5000 \times 25$ ($f_{ck} = 25$) = 25000000 kN/ Sqm

$$I = \pi \times 0.3^4 / 64 = 0.0004 \text{ m}^4$$

Taking, $\eta h = 1100$ kN/m³ (from Table-3 of IS2911 (Part-1/Section-2) for Avg. Field N-value of 12 in Stratum-II, considering Layer-I as zone of influence and ground condition considered as submerged)

Therefore, $T = 1.55$ m [Note: As, $L > 4T$ i.e. Long Pile, Calculation has been proceed with equivalent cantilever approach]

Here, $e = 0$ m (Considering, pile will be fully embedded) and

$$e/T = 0;$$

Refer to figure-4 of Annex C of IS2911 (Part-1/Section-2) (Fixed head piles in sands and normally consolidated clays, $L_f/T = 2.2$

Therefore, $L_f = 2.2 \times 1.55 = 3.41$ m and hence, $e + Z_f = 0 + 3.41 = 3.41$ m

Permissible deflection of 300mm dia. Pile = 3 mm (considering 1% of Pile dia)

For Fixed Head Pile

Refer to Clause c- 4.2 of IS 2911 $y = HX(e + Z_f)^3 / 12 EI$

Here, $y = 3$ mm or 0.003m

or $H = 8.99$ kN= 0.899 ton

Moment $MF =$ (Refer to Clause C-4.3 of IS 2911) = $Hx(e + Z_f)/2$

$$MF = 0.899 \times 3.41 / 2 = 1.53 \text{ t-M}$$

Reduction Factor, $m = 0.82$ [Ref. to Is 2911-part1-sec2, cl.C-4.3, 5B]

Hence, Actual Maximum moment, $MA = 1.26$ ton-m

Refer to figure-4 of Annex C of IS2911 (Part-1/Section-2) (Free head piles in sands and normally consolidated clays, $L_f/T = 1.9$

Therefore, $L_f = 1.9 \times 1.55 = 2.95$ m and hence, $e + Z_f = 0 + 2.95 = 2.95$ m

Permissible deflection of 300mm dia. Pile = 3 mm (considering 1% of Pile dia)

For Free Head Pile

Refer to Clause c- 4.2 of IS 2911 $y = HX(e + Z_f)^3 / 3 EI$

Here, $y = 3$ mm or 0.003m

or $H = 3.49$ kN= 0.349 ton

Moment $MF =$ (Refer to Clause C-4.3 of IS 2911) = $Hx(e + Z_f)$

$$MF = 0.349 \times 2.95 = 1.029 \text{ t-M}$$

Reduction Factor, $m = 0.4$ [Ref. to Is 2911-part1-sec2, cl.C-4.3, 5A]

Hence, Actual Maximum moment, $MA = 0.412$ t-M

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-1	250	0.568	0.220	0.697	0.228
	300	0.899	0.349	1.263	0.412
	400	1.922	0.746	3.411	1.116
	500	3.400	1.319	7.183	2.348
	600	5.452	2.116	13.317	4.352

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-2	250	0.537	0.208	0.664	0.22
	300	0.849	0.330	1.214	0.396
	400	1.814	0.704	3.28	1.072
	500	3.212	1.246	6.913	2.26
	600	5.148	1.998	12.817	4.192

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-3	250	0.598	0.232	0.722	0.236
	300	0.947	0.368	1.304	0.428
	400	2.024	0.786	3.534	1.156
	500	3.583	1.390	7.437	2.432
	600	5.745	2.230	13.784	4.508

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-4	250	0.628	0.244	0.738	0.244
	300	0.994	0.386	1.345	0.44
	400	2.124	0.824	3.649	1.192
	500	3.758	1.458	7.675	2.512
	600	6.028	2.339	14.235	4.656

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-5	250	0.684	0.266	0.787	0.256
	300	1.083	0.420	1.427	0.468
	400	2.314	0.898	3.862	1.264
	500	4.096	1.589	8.134	2.66
	600	6.567	2.548	15.072	4.928

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-6	250	0.656	0.255	0.763	0.252
	300	1.039	0.403	1.386	0.452
	400	2.221	0.861	3.756	1.228
	500	3.928	1.525	7.905	2.588
	600	6.300	2.445	14.662	4.796

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-7	250	0.763	0.296	0.845	0.276
	300	1.208	0.469	1.533	0.504
	400	2.582	1.002	4.157	1.36
	500	4.569	1.774	8.749	2.86
	600	7.328	2.844	16.211	5.304

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-8	250	1.078	0.419	1.066	0.348
	300	1.707	0.663	1.935	0.632
	400	3.645	1.415	5.232	1.708
	500	6.450	2.504	11.004	3.6
	600	10.345	4.051	20.402	6.672

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-9	250	1.233	0.478	1.164	0.38
	300	1.952	0.757	2.116	0.692
	400	4.168	1.617	5.715	1.868
	500	7.376	2.863	12.038	3.936
	600	11.828	4.592	22.312	7.296

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-10	250	1.036	0.403	1.033	0.34
	300	1.642	0.637	1.886	0.616
	400	3.508	1.361	5.092	1.664
	500	6.205	2.408	10.726	3.508
	600	9.956	3.862	19.893	6.504

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-11	250	1.340	0.520	1.23	0.4
	300	2.121	0.824	2.239	0.732
	400	4.532	1.760	6.043	1.976
	500	8.023	3.114	12.726	4.164
	600	12.864	4.992	23.6	7.716

Location	Pile Diameter (mm)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment- resisting Capacity, (t-m)	
		Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-12	250	1.195	0.464	1.14	0.372
	300	1.891	0.734	2.066	0.676
	400	4.044	1.568	5.601	1.832
	500	7.152	2.775	11.792	3.856
	600	11.472	4.453	21.861	7.148

P.K.Dutta & Co. 6No. Bijoy Nagar, Nallhati(W.B)

Plate Load Test:-

Project: <u>400/220/132 KV D/G. Garia Sub-Station</u>	Dial Gauge: <u>0.01/25mm</u>
Site: _____	
Date: <u>18-03-2024</u>	Jack Arm Area: <u>107.82 cm²</u>

Pressure Gauge reading:-

Time	Time elapsed	Dial Gauge reading			Avg. reading	Settlement	Total Settlement
		Dp-1	Dp-2	Dp-3			
Initial reading :- 10 kg/cm ²							
7.30 H.		0.00	0.00	0.00			
10.15 AM	1 min	16	12	13			
10.17 ~	2 min	18	13	15			
10.19 ~	4 min	21	17	18			
10.21 ~	6 min	26	20	22			
10.24 ~	9 min	31	25	29			
10.31 ~	16 min	33	26	30			
10.40 ~	23 min	37	30	39			
10.51 ~	26 min	39	33	44			
11.15 ~	60 min	42	35	49			
					Total		
Pressure Gauge reading :- 20 kg/cm ²							
11.16 AM	1 min	76	82	87			
	2 min	82	89	91			
	4 min	90	96	98			
	6 min	96	104	112			
	9 min	107	116	126			
	16 min	130	126	134			
	23 min	138	130	139			
	26 min	139	133	142			
	60 min	142	135	145			
					Total		
Pressure Gauge reading :- 40 kg/cm ²							
12.16 AM	1 min	366	356	380			
	2 min	378	385	396			
	4 min	396	392	415			
	6 min	402	399	460			
	9 min	417	395	468			
	16 min	426	419	488			
	23 min	433	425	492			
	26 min	437	426	494			
	60 min	440	438	500			
					Total		
Pressure Gauge reading :- 60 kg/cm ²							
1.16 AM	1 min	890	862	856			
	2 min	897	874	868			
	4 min	922	902	907			
	6 min	928	935	936			
	9 min	933	942	931			
	16 min	948	954	936			
	23 min	950	960	940			
	26 min	948	959	940			
	60 min	948	959	940			
					Total		

Signature of Site In-Charge

[Signature]
(P.K. Dutta S Co.)

Signature of Engineer In-Charge

[Signature]
Junior Manager (Civil)
Mirza T & T Circle
AEGCL Mirza

P.K.Dutta & Co. 6No. Bijoy Nagar, Naihati(W.B)

Plate Load Test:- 400/220/132kV Agia Garia Sub Station

Project :	400/220/132kV Agia Garia Sub Station	Dial Gauge :	0.01 mm
Site :		Jack Arm Area :	105.82 cm ²
Date :-	18-08-2024		

Pressure Gauge reading:-

Time	Time elapsed	Dial Gauge reading			Avp reading	Settlement	Total Settlement
		Dg-1	Dg-2	Dg-3			
Initial reading :-							
		Rebounded					
40kg/cm ²		948	959	940			
	1 min	946	958	940			
2.20kPa	2 min	944	956	937			
	4 min	944	954	936			
	6 min	944	954	933			
	9 min	944	954	932			
	16 min	944	954	932			
	25 min	944	954	932			
	36 min	944	954	932			
	60 min	943	952	931			
					Total		
Pressure Gauge reading :-							
2.20kPa		20kN/cm ²					
	1 min	945	950	930			
	2 min	943	950	930			
	4 min	943	949	929			
	6 min	941	949	929			
	9 min	941	947	928			
	16 min	940	946	927			
	25 min	940	946	927			
	36 min	940	946	927			
	60 min	940	946	927			
					Total		
Pressure Gauge reading :-							
	1 min						
	2 min						
	4 min						
	6 min						
	9 min						
	16 min						
	25 min						
	36 min						
	60 min						
					Total		
Pressure Gauge reading :-							
	1 min						
	2 min						
	4 min						
	6 min						
	9 min						
	16 min						
	25 min						
	36 min						
	60 min						
					Total		

Signature of Site In-Charge

(P.K.Dutta & Co.)

Signature of Engineer In-Charge

(M) P.K.Dutta
 Junior Manager (Civil)
 Mirza T & T Circle
 AEGCL, Mirza

Client: Assam Electricity Grid Corporation Limited.

Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

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B) PLATE LOAD TEST

B.1.0 INTRODUCTION:

Assam Electricity Grid Corporation Limited, has entrusted us to carry out 1 (one) Nos. Plate Load Test for proposed Sub-Station Complex at Assam. The main objective of this investigation is to estimate the Ultimate Bearing Capacity of the soil. This report consists of details of field tests performed and the result of the tests.

B.2.0 METHOD :

A test plate having size 300 mm X 300 mm was used as a model of prototype foundation. The plate was placed at proposed foundation level and subject to incremental loading. Settlement of each increment of load was measured and Load Vs Settlement Curve plotted. The Bearing Capacity and Settlement of proposed shallow foundation were determined with the help of Load Vs. Settlement Curve for the test plate. The test conducted as per IS 1888:1982.

Procedure:

1. Rough Mild Steel plate 300mmX 300 mm square in shape was used in this test. The proposed foundation area was excavated upto 1500 mm depth. The test plate was seated at the centre over a fine sand layer of about 5 mm.
2. The Kentledge was constructed by preparing loading platform with ISMB and wooden platform. Sack of gravel, sand and clay were placed over that platform to obtain a total load of about 4.5 tons.
3. Load was applied on the plate by hydraulic jack of 50 ton capacity by reaction obtained from Kentledge. Pressure on the jack was recorded from a calibrated pressure gauge placed between the jack and hydraulic pump.
4. A seating load of 70 g/sqm was first applied and released after sometimes. Loads were applied on the test plate in increment of $1/5^{\text{th}}$ of total estimated safe load.
5. At each load increment settlement recordings were recorded at a time interval of 1 minute, 2 minutes, 4 minutes, 6 minutes, 9 minutes, 16 minutes, 25 minutes, 36 minutes and 1 hour by means of displacement with dial gauge having least count of 0.01 mm. The settlements were recorded with reference to the datum bar.
6. After noting settlement recordings of 1 hour and when the settlement dropped to a value less than 0.02mm/ minute the next increment of load was applied

The load Vs settlement curve for the test plate were plotted from obtained test data

B.3.0 CALCULATIONS

B.3.1 Bearing Capacity

From Load Intensity vs Settlement Curve:-

Ultimate Bearing capacity = 2.60 Kg/cm^2

Size of plate = 0.3 m X 0.3 m

Ultimate Bearing capacity = $2.60 \text{ Kg/cm}^2 = 28.89 \text{ Mt/Sqm}$

Safe Bearing Capacity = $28.89/3 = 9.63 \text{ Mt/Sqm}$

Client: Assam Electricity Grid Corporation Limited.

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Therefore, Safe Bearing Capacity of **9.63 Mt/Sqm** is recommended at a depth of **1.5 M** depth with **Factor of Safety = 3.0**

B.3.2 Settlement Analysis

Refer to IS 8009 (Part-I) 1976 (Reaffirmed 1993 and 1998) in Amendment No-1, May 1981 in clause no. 9.1.3.

$$S_t = S_p * \left[\frac{B * (B_p + 0.3)}{B_p * (B + 0.3)} \right]^2$$

Where:

S_t = Settlement of footing in mm

S_p = Settlement of plate in mm = 2.65 mm for load intensity 2.6 Kg/cm² (from graph)

B = Width of footing in metre = 3.0 m

B_p = Width of plate in metre = 0.30 m

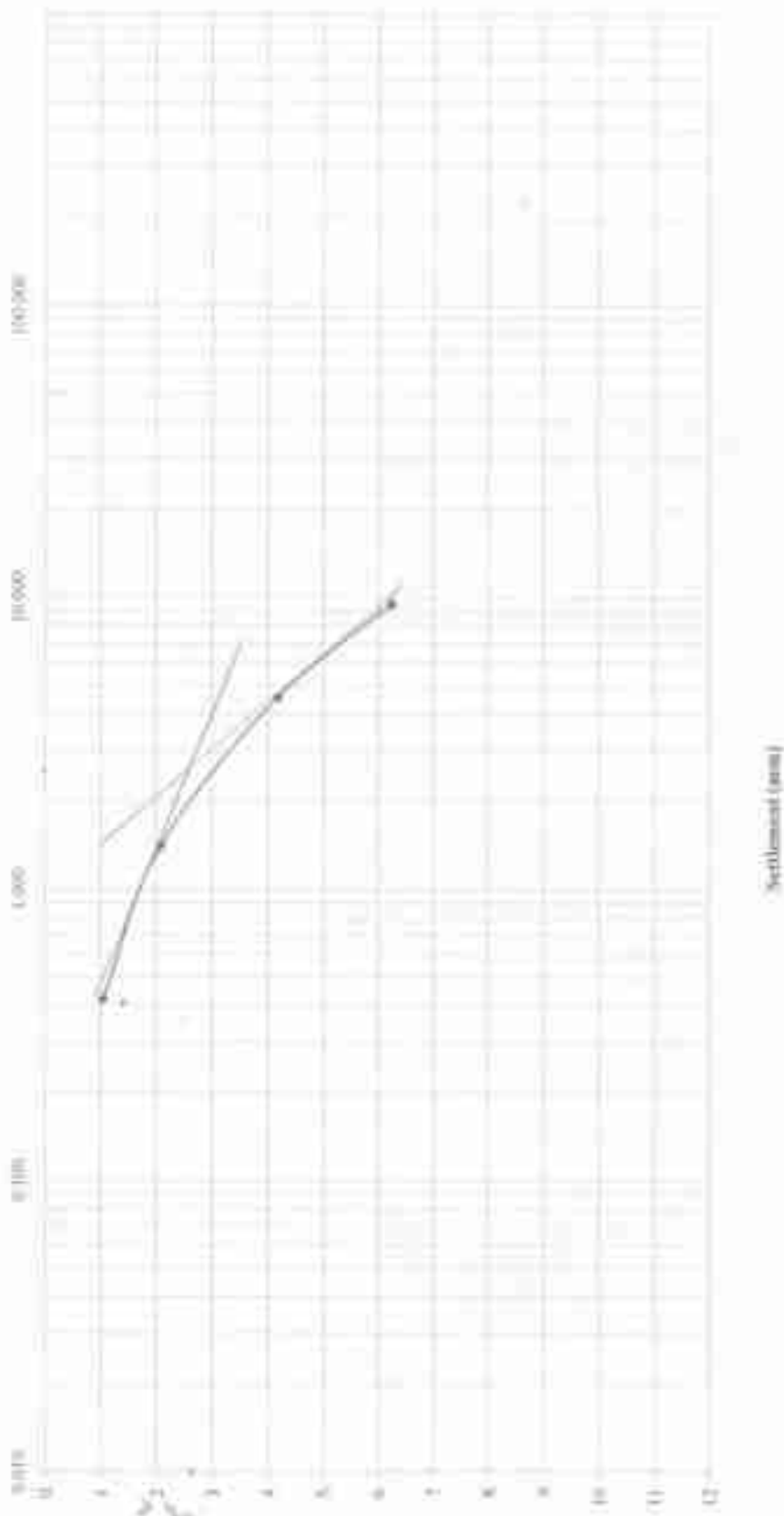
(Considering size of footing 3.0m X 3.0 m)

Hence:

$$\begin{aligned} S_t &= 2.65 * \left[\frac{3.0 * (0.30 + 0.3)}{0.30 * (3.0 + 0.3)} \right]^2 \\ &= 2.65 * 3.305 \text{ mm} \\ &= 8.76 \text{ mm hence within Permissible limit} \end{aligned}$$

Settlement = 2.65 mm
 Load = 2.60 t/cm²

2.65 mm



Client: Assam Electricity Grid Corporation Limited.

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C) CALIFORNIA BEARING RATIO

The California Bearing Ratio test, and penetration test conducted for evaluation of the strength of sub-grade and bases for structures, was carried out by collecting undisturbed/ remoulded soil specimens according to IS 2720(Part-16):1987 from two different locations within the substation area for laboratory test and finding out CBR value

California bearing ratio is the ratio of force per unit area required to penetrate in to a soil mass with a circular plunger of 50mm diameter at the rate of 1.25mm / min.

The table given below the standard loads adopted for a standard material with 100% CBR value for various penetrations.

Percentage of plunger(mm)	Standard Load(Kg)
2.5	1370
5.0	2055
7.5	2630
10.0	3180
12.5	3600

CBR Test Apparatus:

CBR Test Apparatus Consisting of Loading machine with capacity of at least 5000 kg and equipped with a movable head or base which enables Plunger of 50 mm dia. to penetrate into the specimen at a rate of 1.25 mm/ minute.



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Calculation

$$\text{C.B.R.} = (\text{PT/PS}) \times 100$$

Where, PT = Corrected test load corresponding to the chosen penetration from the load penetration curve.

PS = Standard load for the same penetration taken from the table above.

Penetration	Proving Reading	Standard Load(Kg)	Tested Load (Kg)	CBR Value (%)	Average CBR value (%)
0.00	0				2.21
0.50	3				
1.00	6				
1.50	9				
2.00	11				
2.50	14	1370	31.72	2.32	
3.00	16				
4.00	18				
5.00	19	2055	43.05	2.10	
7.50	23	2630	52.12		
10.00	28	3180	63.45		
12.50	35	3600	79.31		

D) STANDARD PROCTOR COMPACTION TEST

The Proctor density test is standard IS: 2720(Part-8)-1983 lays down the determination of relation between the water content and the dry density of soils.

The soil is compacted into the mould to a certain amount of equal layers, each receiving a number of blows from 2.6 Kg weighted hammer at a 31 cm height. The process is then repeated for various moisture contents and dry densities are determined for each. The graphical relationship is then plotted to establish the compaction curve.

- a) Optimum Moisture Content = 26.04 %
- b) Maximum Dry Density = 1.56 gm/cc

E) RELATIVE DENSITY TEST

Dia. of Mould = 15cm

Height of Mould = 16.60cm

Volume of Mould = 2931.98 cm³

Specific Gravity = 2.65

Wt of Mould = 10.420Kg

Wt. of Mould + loose Soil = 14.363Kg

Wt of loose Soil = 3.943Kg = 3943Gm

Wt of compacted Soil = 4.620Kg = 4620Gm

Wt. of Mould + compacted Soil = 15.040Kg

$\gamma_{d \max} = (15040 - 10420) / 2931.98 = \mathbf{1.58 \text{ gm/cc}}$

$\gamma_{d \min} = (14363 - 10420) / 2931.98 = \mathbf{1.34 \text{ gm/cc}}$

$e_{\max} = (2.65 \times 1000) / 1.34 = \mathbf{1977.61}$

$e_{\min} = (2.65 \times 1000) / 1.58 = \mathbf{1677.21}$

Bulk density = 1.86 gm/cc

Water Content = 27.33

Dry density = $1.86 / (1 + 27.33/100) = 1.46 \text{ gm/cc}$

$e = (2.65 \times 1000) / 1.46 = \mathbf{1815}$

$e_{\max} - e$

Relative Density = -----x 100

$e_{\max} - e_{\min}$

$= [(1977.61 - 1815) / (1977.61 - 1677.21)] \times 100$

Relative Density = 54.09%

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F) CHEMICAL TESTS

Chemical tests were performed on soil and water samples for determining the pH value, Sulphate, Chloride content etc. The results are given in a tabular form below:

F.1 Chemical Test on Water Sample

Bore Hole No- BH-5

At depth –2.70m

Physical Test Findings:

1. Colour-Colourless

2.Odour-Agreeable

Chemical Test Findings:

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS: 3025(Part11):1983 Reaffirmed 2012		6.23
2	conductivity at 25 ⁰ C	IS: 3025(Part14):2013 Reaffirmed 2006	μS/cm	218
3	Chloride as CL	IS:3025(Part-32):1988 Reaffirmed 2009	mg/l	29
4	Nitrate as NO ₃	IS:3025(Part-34):1988 Reaffirmed 2009	mg/l	<1
5	Turbidity	IS:3025(Part-10):1984 Reaffirmed 2012	NTU	87.60
6	Organic matter	IS:3025(Part-47):1994	mg/l	181.0

Minimum detection limit: (i) Nitrate: 1.0mg/l

Bore Hole No- BH-6

At depth –3.20m

Physical Test Findings:

1. Colour-Colourless

2.Odour-Agreeable

Chemical Test Findings:

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS: 3025(Part11):1983 Reaffirmed 2012		6.31
2	conductivity at 25 ⁰ C	IS: 3025(Part14):2013 Reaffirmed 2006	μS/cm	215
3	Chloride as CL	IS:3025(Part-32):1988 Reaffirmed 2009	mg/l	34
4	Nitrate as NO ₃	IS:3025(Part-34):1988 Reaffirmed 2009	mg/l	<1
5	Turbidity	IS:3025(Part-10):1984 Reaffirmed 2012	NTU	92.20
6	Organic matter	IS:3025(Part-47):1994	mg/l	186.0

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Minimum detection limit: (i) Nitrate: 1.0mg/l

F.2 Chemical Test on Soil Sample

Bore Hole No- BH-05

At depth –1.00-1.45m

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS:2720(Part-26):1987		2.54
2	Organic Matter(OM)	IS:2720(Part-22):1972	%	0.25
3	Calcium carbonate (cacO ₃)	IS:2720(Part-23):1976	%	17.05
4	Sulphate(SO ₃)	IS:2720(Part-27):1977	mg/kg	5.59
5	Sulphate(SO ₄)	IS:2720(Part-27):1977	mg/kg	8.60
6	Chloride	IS:3025(Part-32):1988	%	0.019
7	Salinity as Conductivity	IS:14767-2000	ms	1.54
8	Nitrate	SOP No: RVB/SOP/05/25 As per ICAR 2011 (Department of Agriculture & cooperation , Ministry of Agriculture, Govt. of India)	mg/kg	0.63

Bore Hole No- BH-06

At depth –4.00-4.45m

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS:2720(Part-26):1987		2.68
2	Organic Matter(OM)	IS:2720(Part-22):1972	%	0.33
3	Calcium carbonate (cacO ₃)	IS:2720(Part-23):1976	%	19.11
4	Sulphate(SO ₃)	IS:2720(Part-27):1977	mg/kg	5.81
5	Sulphate(SO ₄)	IS:2720(Part-27):1977	mg/kg	8.73
6	Chloride	IS:3025(Part-32):1988	%	0.023
7	Salinity as Conductivity	IS:14767-2000	ms	1.64
8	Nitrate	SOP No: RVB/SOP/05/25 As per ICAR 2011 (Department of Agriculture & cooperation , Ministry of Agriculture, Govt. of India)	mg/kg	0.53

Submitted By **P K Dutta & Co.**

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Chemical test was carried out on a soil and water samples to determine the pH value, Sulphate and Chloride. It is seen that the values are within permissible limits (as per IS: 456-2000) and so no special cement will be required for foundation concrete. **Either Ordinary Portland cement or Portland slag cement or Portland Pozzolana cement can be used for concreting.**

G): CONCLUSION & RECOMANDATION

From engineering properties of the deposit following recommendations for foundation are suggested:

- a) Based on the field tests and the foregoing discussion the following are summarized:
- b) The subsoil is characterized by silty clay with sand & kankars in first layer, second layer characterized sandy clay & third layer silty fine sand with mica continues up to terminating depth of maximum boreholes.
- c) The present report deals with the geotechnical investigation findings at the location and the discussion on the aspects regarding allowable bearing capacity of open foundations. However, the Foundation Designer may modulate the type of foundations and other values regarding foundation geometry and soil design parameter to meet any specific design criteria.
- d) Water level observations were made during the progress of boring. The depths at which ground water was encountered, was recorded in the respective borelog sheet as standing water level. Standing water level was measured after 24 hours of removal of casing. It was noticed that the ground water level was found within a depth of 2.70 m to 3.80 m below EGL.
- e) Precaution in all respect should be taken for nearby existing structures, if any. The final decision regarding the foundation will depend on the judgment of the engineer concerned.
- f) Any unsuitable expansive/decomposed if encountered should be replaced.
- g) The foundation spacing should be chosen in such a way that there should not be any overlap of pressure bulb of 2 adjacent footings.
- h) Concentration of chlorides, sulphates & pH value are under limit as per IS Code specification. So no special cement will be required for foundation concrete.
- i) Pile Capacity shall be considered for Foundation design as per nearest bore hole data

Prepared By P.K. Dutta & Co.

Checked & approved by

Signature
Soil Investigator
Corporation Ltd

Pranaya Dutta
PRANAYA DUTTA
B. Tech (Civil)
Sr. Geotechnical Engineer

Signature
Assam Electricity Grid



Banindilaya

Submitted By P.K. Dutta & Co.

Junior Manager (C)
Design & Project
AEGCL, Kahilipara, Ghy-19

Asst. General Manager (C)
Design & Project
AEGCL, Kahilipara, Ghy-19

Genl. Mgr.
O/o The MD, Paltan
Paltan

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ANNEXURE

FIELD BORE LOG DATA

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant								BORE LOG DATA SHEET			
Bore Hole No. :- BH-1				Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples		Nos			
Land Type :- Agia S/S Land				Northing :-		26°05'46.1"									
Commenced on:- 08.08.2026				Easting :-		90°33'53.8"		SPT	8	Undisturbed (U)		4			
Completed on:- 09.08.2026				Termination Depth (m):-15.00 M				Cone	-	Distubed (D)		6			
Water Level :- 3.35 M								Vane	-	Core (C)		-			
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks	
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)					
0.00					Stiff consistency, brownish to reddish grey clayey sand mixed with kankars & gravels.		0.50	D	1	0.50	----				
0.50															
0.50					Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.		4.50	D	2	1.00	----				
								U	1	1.00	1.45				
								D	3	1.50	----				
	2	4	7	11				S	1	2.00	2.45				
	5	6	7	13				S	2	3.00	3.45				
								U	2	4.00	4.45				
5.00								D	4	4.50	----				
5.00	3	4	4	8	Stiff, brownish grey, sandy clay.		2.00	S	3	5.00	5.45				
								U	3	6.00	6.45				
7.00								D	5	6.50	----				
7.00	3	3	4	7	Loose to medium, brownish grey silty sand with mica.		5.00	S	4	7.00	7.45				
								U	4	8.00	8.45				
								D	6	8.50	----				
12.00	7	10	14	24				S	5	10.00	10.45				
12.00	9	14	18	32	Medium to dense, brownish grey silty sand with mica.		3.00	S	6	12.00	12.45				
	11	16	22	38				S	7	13.50	13.95				
15.00	14	20	27	47				S	8	15.00	15.45				
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE'		" D " - 'DISTURBED SAMPLE'		" W " - 'WATER SAMPLE'		" BGL " - 'BELOW GROUND LEVEL'					

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Bore Hole No. :-					BH-2		Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples		Nos		
Land Type :-					Agia S/S Land		Northing :-		26°05'46.2"									
Commenced on:-					09.08.2026		Easting :-		90°33'55.4"			SPT	8	Undisturbed (U)		4		
Completed on:-					10.08.2026		Termination Depth (m):-15.00 M					Cone	-	Distubed (D)		6		
Water Level :- 2.70 M					Vane	-						Core (C)		-				
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks				
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)								
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.			D	1	0.50	----							
				D				2	1.00	----								
				U				1	1.00	1.45								
				D				3	1.50	----								
	2	4	6	10				S	1	2.00	2.45							
	5	6	6	12				S	2	3.00	3.45							
								U	2	4.00	4.45							
5.00						5.00	D	4	4.50	----								
5.00	4	4	5	9	Stiff consistency, brownish grey sandy clay.		2.00	S	3	5.00	5.45							
				U				3	6.00	6.45								
7.00					D			5	6.50	----								
7.00	3	4	4	8	Loose to medium, brownish grey silty sand with mica.			S	4	7.00	7.45							
				U				4	8.00	8.45								
				D				6	8.50	----								
12.00	7	10	13	23			5.00	S	5	10.00	10.45							
12.00	8	13	16	29	Medium to dense, brownish grey silty sand with mica.			S	6	12.00	12.45							
	10	15	21	36				S	7	13.50	13.95							
15.00	13	19	24	43				3.00	S	8	15.00				15.45			
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE '			" D " - 'DISTURBED SAMPLE '		" W " - 'WATER SAMPLE '				" BGL " - 'BELOW GROUND LEVEL '					

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Bore Hole No. :-				BH-3		Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples		Nos			
Land Type :-				Agia S/S Land		Northing :-		26°05'47.7"									
Commenced on:-				15.08.2026		Easting :-		90°33'56.4"				SPT	8	Undisturbed (U)		4	
Completed on:-				15.08.2026		Termination Depth (m):-15.00 M				Cone	-	Distubed (D)		6			
Water Level :- 2.80 M				Vane	-					Core (C)		-					
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)							
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.			D	1	0.50	----						
								D	2	1.00	----						
								U	1	1.00	1.45						
								D	3	1.50	----						
	3	5	6	11				S	1	2.00	2.45						
	3	4	5	9				S	2	3.00	3.45						
								U	2	4.00	4.45						
4.50							4.50	D	4	4.50	----						
4.50	3	4	4	8	Stiff, brownish grey, sandy clay with kankars.			S	3	5.00	5.45						
								U	3	6.00	6.45						
7.00							2.50	D	5	6.50	----						
7.00	3	4	5	9	Loose to medium, brownish grey silty sand with mica.			S	4	7.00	7.45						
								U	4	8.00	8.45						
								D	6	8.50	----						
	4	6	10	16				S	5	10.00	10.45						
	5	8	10	18				S	6	12.00	12.45						
	7	10	13	23				S	7	13.50	13.95						
	8	10	15	25				S	8	15.00	15.45						
15.00							8.00										
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE '		" D " - 'DISTURBED SAMPLE '		" W " - 'WATER SAMPLE '		" BGL " - 'BELOW GROUND LEVEL '							

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.							BORE LOG DATA SHEET			
Bore Hole No. :- BH-4					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples	Nos	
Land Type :- Agia S/S Land					Northing :-		26°05'50.4"							
Commenced on:- 13.08.2026					Easting :-		90°33'58.2"			SPT	8	Undisturbed (U)	4	
Completed on:- 14.08.2026					Termination Depth (m):-15.00 M					Cone	-	Distubed (D)	6	
Water Level :- 3.80 M										Vane	-	Core (C)	-	
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)`	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)				
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.		4.50	D	1	0.50	----			
				D				2	1.00	----				
				U				1	1.00	1.45				
				D				3	1.50	----				
	4	5	8	13				S	1	2.00	2.45			
	3	7	8	15				S	2	3.00	3.45			
								U	2	4.00	4.45			
4.50							D	4	4.50	----				
4.50					Stiff, brownish grey, sandy clay with kankars.		1.50							
	3	4	4	8				S	3	5.00	5.45			
6.00														
6.00					Loose light brownish grey silty fine sand with mica.		1.00	U	3	6.00	6.45			
7.00								D	5	6.50	----			
7.00	4	6	7	13	Medium, brownish grey silty sand with mica.		8.00	S	4	7.00	7.45			
								U	4	8.00	8.45			
								D	6	8.50	----			
	6	8	12	20				S	5	10.00	10.45			
	6	10	13	23				S	6	12.00	12.45			
	8	13	14	27				S	7	13.50	13.95			
	10	14	18	32				S	8	15.00	15.45			
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE'		" D " - 'DISTURBED SAMPLE'		" W " - 'WATER SAMPLE'		" BGL " - 'BELOW GROUND LEVEL'				

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.								BORE LOG DATA SHEET			
Bore Hole No. :- BH-5					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples	Nos		
Land Type :- Agia S/S Land					Northing :-		26°05'44.5"								
Commenced on:- 10.08.2026					Easting :-		90°33'54.8"			SPT	8	Undisturbed (U)	4		
Completed on:- 11.08.2026					Termination Depth (m):-15.00 M					Cone	-	Distubed (D)	6		
Water Level :- 2.70 M										Vane	-	Core (C)	-		
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks	
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)					
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.			D	1	0.50	----				
				D				2	1.00	----					
				U				1	1.00	1.45					
				D				3	1.50	----					
	5	6	8	14				S	1	2.00	2.45				
	4	6	7	13				S	2	3.00	3.45				
								U	2	4.00	4.45				
5.00						5.00	D	4	4.50	----					
5.00	3	4	5	9	Stiff consistency, brownish grey sandy clay.		2.00	S	3	5.00	5.45				
				U				3	6.00	6.45					
7.00					D			5	6.50	----					
7.00	4	4	6	10	Loose to medium, brownish grey silty sand with mica.			S	4	7.00	7.45				
				U				4	8.00	8.45					
				D				6	8.50	----					
	6	10	14	24				S	5	10.00	10.45				
13.50	7	11	15	26				6.50	S	6	12.00				12.45
13.50	10	16	22	38	Dense, brownish grey silty sand with mica.		1.50	S	7	13.50	13.95				
15.00	14	19	28	47				S	8	15.00	15.45				
" S " - ' SPT '		" C " - ' CORE '		" U " - ' UNDISTURBED SAMPLE '		" D " - ' DISTURBED SAMPLE '			" W " - ' WATER SAMPLE '		" BGL " - ' BELOW GROUND LEVEL '				

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.							BORE LOG DATA SHEET			
Bore Hole No. :- BH-6				Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples		Nos		
Land Type :- Agia S/S Land				Northing :-		26°05'45.3"								
Commenced on:- 11.08.2026				Easting :-		90°33'57.9"		SPT	8	Undisturbed (U)		4		
Completed on:- 12.08.2026				Termination Depth (m):-15.00 M				Cone	-	Distubed (D)		6		
Water Level :- 3.20 M								Vane	-	Core (C)		-		
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)				
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.			D	1	0.50	----			
				D				2	1.00	----				
				U				1	1.00	1.45				
				D				3	1.50	----				
	4	6	8	14				S	1	2.00	2.45			
	5	5	7	12				S	2	3.00	3.45			
								U	2	4.00	4.45			
5.00						5.00	D	4	4.50	----				
5.00	3	3	5	8	Stiff brownish to reddish grey sandy clay with kankars.			S	3	5.00	5.45			
								U	3	6.00	6.45			
	7.00							D	5	6.50	----			
7.00	5	5	7	12	Loose to medium, brownish grey silty sand with mica.			S	4	7.00	7.45			
								U	4	8.00	8.45			
								D	6	8.50	----			
	6	10	12	22				S	5	10.00	10.45			
13.50	6	10	15	25			6.50	S	6	12.00	12.45			
13.50	8	12	17	29	Medium to dense, brownish grey silty sand with mica.			S	7	13.50	13.95			
15.00	10	14	20	34				S	8	15.00	15.45			
" S " - ' SPT '		" C " - ' CORE '		" U " - ' UNDISTURBED SAMPLE '		" D " - ' DISTURBED SAMPLE '		" W " - ' WATER SAMPLE '		" BGL " - ' BELOW GROUND LEVEL '				

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										BORE LOG DATA SHEET			
Bore Hole No. :- BH-7					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests		Nos		Samples		Nos	
Land Type :- Agia S/S Land					Northing :-		26°05'47.0"										
Commenced on:- 12.08.2026					Easting :-		90°33'59.7"					SPT		8		Undisturbed (U) 4	
Completed on:- 13.08.2026					Termination Depth (m):-15.00 M					Cone		-		Distubed (D)		6	
Water Level :- 3.40M										Vane		-		Core (C)		-	
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)							
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.			D	1	0.50	----						
								D	2	1.00	----						
								U	1	1.00	1.45						
								D	3	1.50	----						
	5	7	7	14				S	1	2.00	2.45						
	5	7	9	16				S	2	3.00	3.45						
								U	2	4.00	4.45						
								D	4	4.50	----						
5.00							5.00	D	4	4.50	----						
5.00					Stiff, brownish grey, sandy clay with kankars.				S	3	5.00	5.45					
	3	4	5	9													
6.00							1.00										
6.00					Loose light, brownish grey silty fine sand with mica.			U	3	6.00	6.45						
7.00							1.00		D	5	6.50	----					
7.00	4	6	8	14	Medium, brownish grey silty sand with mica.				S	4	7.00	7.45					
									U	4	8.00	8.45					
									D	6	8.50	----					
	5	9	12	21					S	5	10.00	10.45					
	7	10	14	24					S	6	12.00	12.45					
	9	11	15	26					S	7	13.50	13.95					
	10	14	16	30					S	8	15.00	15.45					
15.00							8.00										
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE'			" D " - 'DISTURBED SAMPLE'			" W " - 'WATER SAMPLE'			" BGL " - 'BELOW GROUND LEVEL'				

M/s P.K.Dutta & Co.					Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant						BORE LOG DATA SHEET				
Bore Hole No. :- BH-8					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples	Nos		
Land Type :- Agia S/S Land					Northing :-		26°05'43.8"								
Commenced on:- 07.08.2026					Easting :-		90°33'59.2"			SPT	8	Undisturbed (U)	4		
Completed on:- 08.08.2026					Termination Depth (m):-15.00 M					Cone	-	Distubed (D)	6		
Water Level :- 3.65 M										Vane	-	Core (C)	-		
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks	
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)					
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.		6.00	D	1	0.50	----				
				D				2	1.00	----					
				U				1	1.00	1.45					
				D				3	1.50	----					
	3	5	7	12				S	1	2.00	2.45				
	3	5	6	11				S	2	3.00	3.45				
								U	2	4.00	4.45				
								D	4	4.50	----				
6.00	4	4	5	9	S		3	5.00	5.45						
6.00					Loose, light brownish grey silty fine sand with mica.		1.00	U	3	6.00	6.45				
7.00								D	5	6.50	----				
7.00	4	6	7	13	Medium, brownish grey silty sand with mica.		5.00	S	4	7.00	7.45				
								U	4	8.00	8.45				
								D	6	8.50	----				
12.00	6	10	14	24	S			5	10.00	10.45					
12.00	8	12	18	30	Medium to dense, brownish grey silty sand with mica.			3.00	S	6	12.00	12.45			
	8	14	19	33					S	7	13.50	13.95			
	15.00	8	16	21			37		S	8	15.00	15.45			
" S " - ' SPT '		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE '		" D " - 'DISTURBED SAMPLE '			" W " - 'WATER SAMPLE '		" BGL " - 'BELOW GROUND LEVEL '				

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.							BORE LOG DATA SHEET			
Bore Hole No. :- BH-9					Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples	Nos		
Land Type :- Agia S/S Land					Northing :-		26°05'45.9"							
Commenced on:- 05.08.2026					Easting :-		90°34'01.2"		SPT	8	Undisturbed (U)	4		
Completed on:- 06.08.2026					Termination Depth (m):-15.00 M				Cone	-	Distubed (D)	6		
Water Level :- 3.40 M									Vane	-	Core (C)	-		
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)				
0.00					Stiff consistency, brownish to reddish grey silty clay with sand.			D	1	0.50	----			
								D	2	1.00	----			
								U	1	1.00	1.45			
								D	3	1.50	----			
	4	6	9	15				S	1	2.00	2.45			
	3	5	7	12				S	2	3.00	3.45			
								U	2	4.00	4.45			
								D	4	4.50	----			
6.00	3	3	5	8		6.00	S	3	5.00	5.45				
6.00					Loose to medium, brownish grey silty sand with mica.			U	3	6.00	6.45			
								D	5	6.50	----			
	4	5	6	11				S	4	7.00	7.45			
								U	4	8.00	8.45			
								D	6	8.50	----			
	8	11	13	24				S	5	10.00	10.45			
	8	10	13	23				S	6	12.00	12.45			
	7	12	13	25				S	7	13.50	13.95			
15.00	7	11	16	27		9.00	S	8	15.00	15.45				
" S " - ' SPT '		" C " - ' CORE '		" U " - ' UNDISTURBED SAMPLE '		" D " - ' DISTURBED SAMPLE '		" W " - ' WATER SAMPLE '		" BGL " - ' BELOW GROUND LEVEL '				

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										BORE LOG DATA SHEET			
Bore Hole No. :- BH-10					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples		Nos			
Land Type :- Agia S/S Land					Northing :-		26°05'48.8"										
Commenced on:- 06.08.2026					Easting :-		90°34'01.5"			SPT	8	Undisturbed (U)		4			
Completed on:- 07.08.2026					Termination Depth (m):-15.00 M					Cone	-	Distubed (D)		6			
Water Level :- 3.60 M										Vane	-	Core (C)		-			
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)							
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with sand.			D	1	0.50	----						
								D	2	1.00	----						
								U	1	1.00	1.45						
								D	3	1.50	----						
	3	4	7	11				S	1	2.00	2.45						
	3	5	7	12				S	2	3.00	3.45						
								U	2	4.00	4.45						
								D	4	4.50	----						
	6.00	3	3	5				8	S	3	5.00				5.45		
	6.00								Loose to medium, brownish grey silty sand with mica.		6.00				U	3	6.00
					D	5	6.50	----									
3		3	4	7	S	4	7.00	7.45									
					U	4	8.00	8.45									
					D	6	8.50	----									
12.00		6	10	12	22	S	5	10.00				10.45					
12.00	10	13	15	28	Medium to dense, brownish grey silty sand with mica.		3.00	S	6	12.00	12.45						
	10	14	16	30				S	7	13.50	13.95						
	15.00	12	16	18				34	S	8	15.00				15.45		
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE '		" D " - 'DISTURBED SAMPLE '		" W " - 'WATER SAMPLE '		" BGL " - 'BELOW GROUND LEVEL '							

M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										BORE LOG DATA SHEET			
Bore Hole No. :- BH-11					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples		Nos			
Land Type :- Agia S/S Land					Northing :-		26°05'46.1"										
Commenced on:- 04.08.2026					Easting :-		90°34'06.8"			SPT	8	Undisturbed (U)		4			
Completed on:- 05.08.2026					Termination Depth (m):-15.00 M					Cone	-	Distubed (D)		6			
Water Level :- 3.50 M										Vane	-	Core (C)		-			
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)							
0.00					Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.			D	1	0.50	----						
				D				2	1.00	----							
				U				1	1.00	1.45							
				D				3	1.50	----							
	4	5	7	12				S	1	2.00	2.45						
	4	7	7	14				S	2	3.00	3.45						
								U	2	4.00	4.45						
								D	4	4.50	----						
6.00	3	5	5	10		6.00	S	3	5.00	5.45							
6.00					Loose, light brownish, grey silty fine sand with mica.		1.00	U	3	6.00	6.45						
7.00								D	5	6.50	----						
7.00	4	5	8	13	Medium, brownish grey silty sand with mica.			S	4	7.00	7.45						
								U	4	8.00	8.45						
								D	6	8.50	----						
12.00	5	9	16	25		5.00	S	5	10.00	10.45							
12.00	10	12	17	29	Medium to dense, brownish grey silty sand with mica.			S	6	12.00	12.45						
	11	14	18	32				S	7	13.50	13.95						
	13	17	23	40				S	8	15.00	15.45						
15.00						3.00											
" S " - 'SPT'		" C " - 'CORE'		" U " - 'UNDISTURBED SAMPLE '		" D " - 'DISTURBED SAMPLE '			" W " - 'WATER SAMPLE '			" BGL " - 'BELOW GROUND LEVEL '					

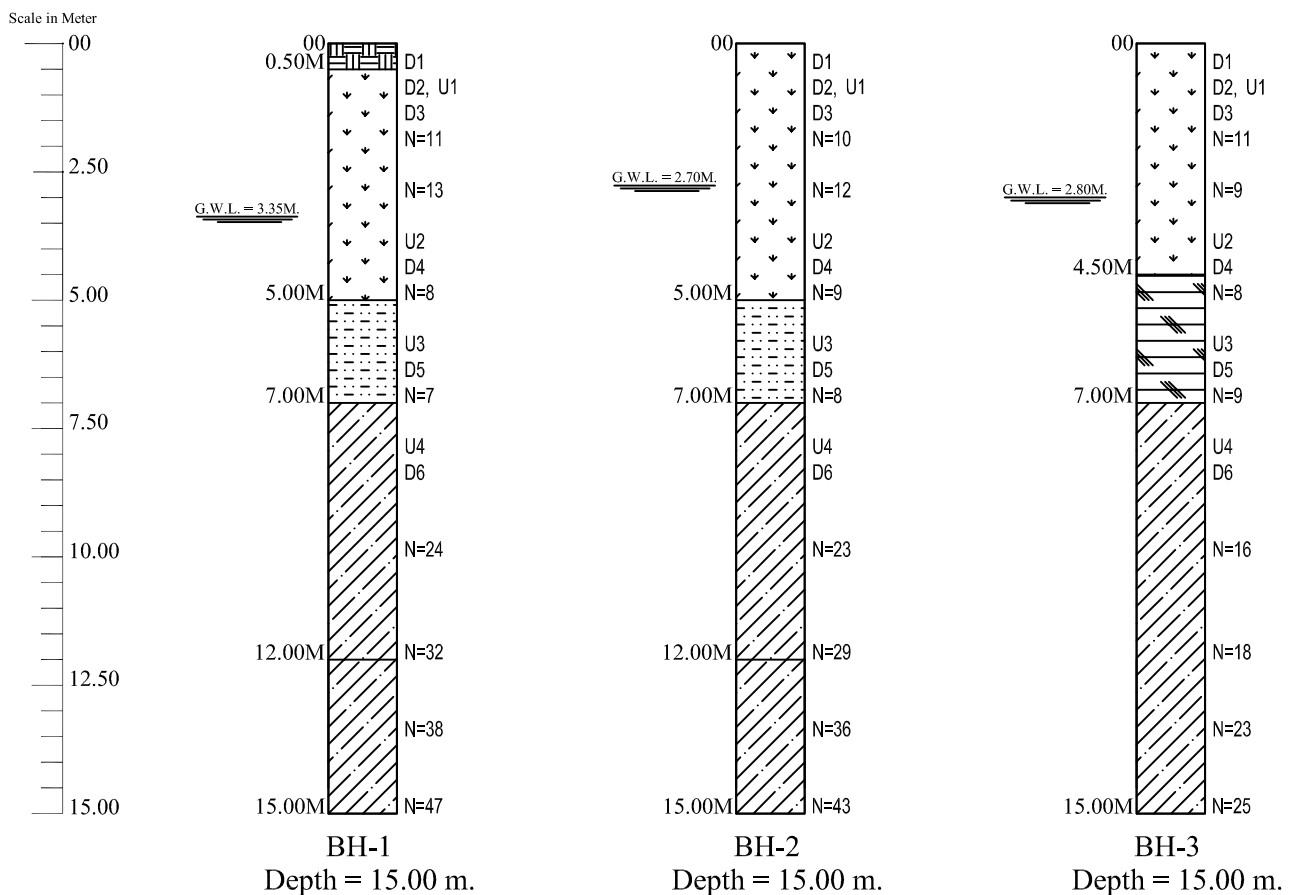
M/s P.K.Dutta & Co.				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.							BORE LOG DATA SHEET				
Bore Hole No. :-				BH-12				Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples	Nos
Land Type :-				Agia S/S Land				Northing :-		26°05'48.1"					
Commenced on:-				03.08.2026				Easting :-		90°34'06.7"		SPT	8	Undisturbed (U)	3
Completed on:-				03.08.2026				Termination Depth (m):-15.00 M				Cone	-	Distubed (D)	6
Water Level :- 3.60 M												Vane	-	Core (C)	-
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks	
	15 cm	15 cm	15 cm					Type	No.	Depth (m.)					
0.00					Stiff consistency, brownish grey silty clay with kankars & traces of sand.			D	1	0.50	----				
								D	2	1.00	----				
								U	1	1.00	1.45				
								D	3	1.50	----				
	5	6	6	12				S	1	2.00	2.45				
	3	5	5	10				S	2	3.00	3.45				
								U	2	4.00	4.45				
6.00					Loose, light brownish, grey silty fine sand with mica.			D	4	4.50	----				
	4	5	6	11				S	3	5.00	5.45				
6.00					Loose, light brownish, grey silty fine sand with mica.			U	3	6.00	6.45				
								D	5	6.50	----				
	3	3	4	7				S	4	7.00	7.45				
								U	4	8.00	8.45				
10.00							4.00	D	6	8.50	----				
10.00	4	5	7	12	Medium, brownish grey silty sand with mica.			S	5	10.00	10.45				
	4	7	10	17				S	6	12.00	12.45				
	5	8	11	19				S	7	13.50	13.95				
	6	9	15	24				S	8	15.00	15.45				
" S " - ' SPT '		" C " - ' CORE '		" U " - ' UNDISTURBED SAMPLE '		" D " - ' DISTURBED SAMPLE '		" W " - ' WATER SAMPLE '			" BGL " - ' BELOW GROUND LEVEL '				

SUBSOIL PROFILE

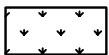
CLIENT:-ASSAM ELECTRICITY GRID CORPORATION LIMITED.

PROJECT:- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

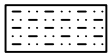
Generalised Subsoil Profile



- Clayey sand mixed with kankars & gravels.



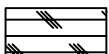
- Silty clay with kankars & traces of sand. / Silty clay mixed with sand & kankars.



- Sandy clay.



- Silty fine sand with mica. / Silty sand with mica.



- Sandy clay with kankars.

NOTE:

- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) C <No.> (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.

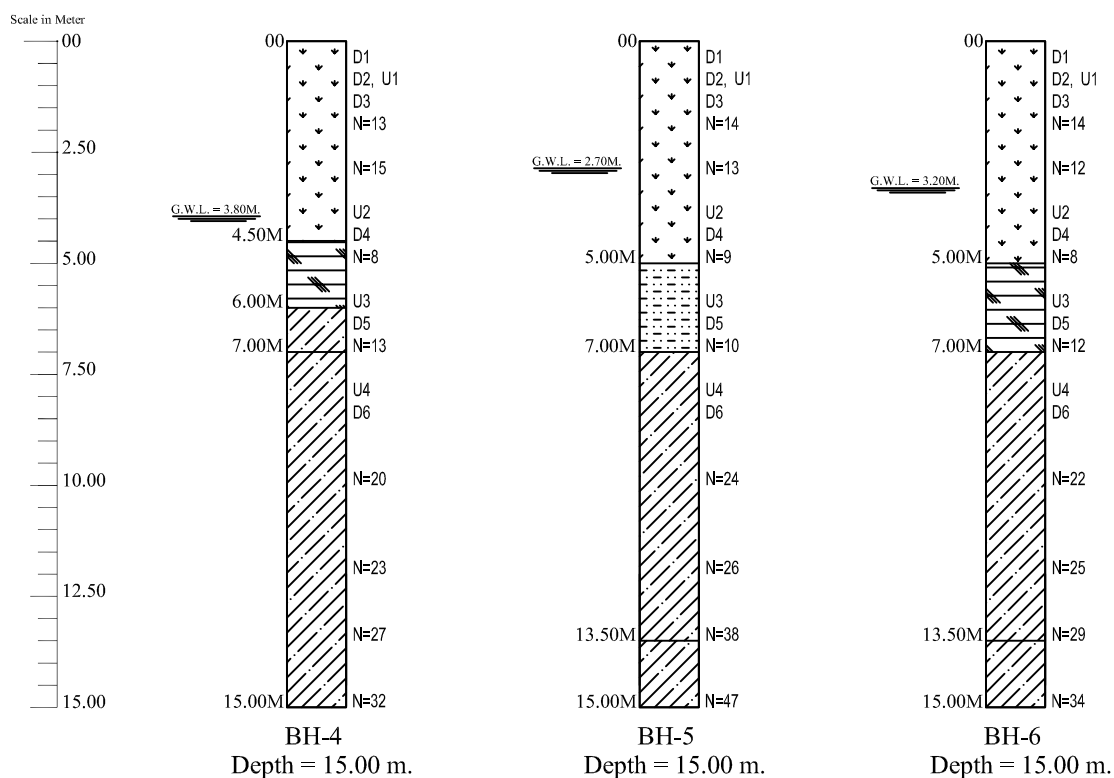
M/s P.K.DUTTA & CO.

Generalised Subsoil Profile

CLIENT:-ASSAM ELECTRICITY GRID CORPORATION LIMITED.

PROJECT:- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

Generalised Subsoil Profile



NOTE:

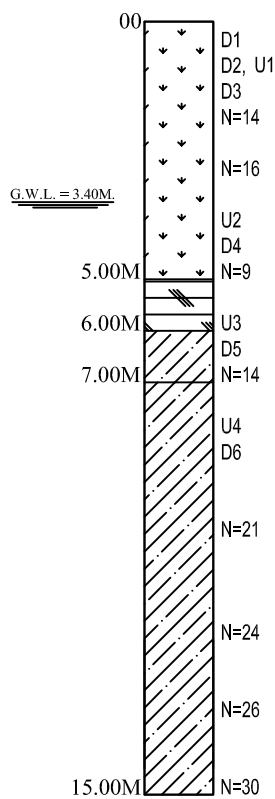
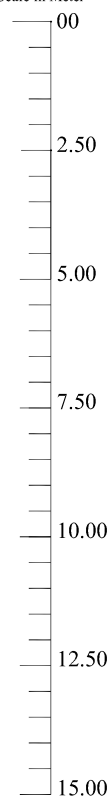
- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) C <No.> (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.

CLIENT:-ASSAM ELECTRICITY GRID CORPORATION LIMITED.

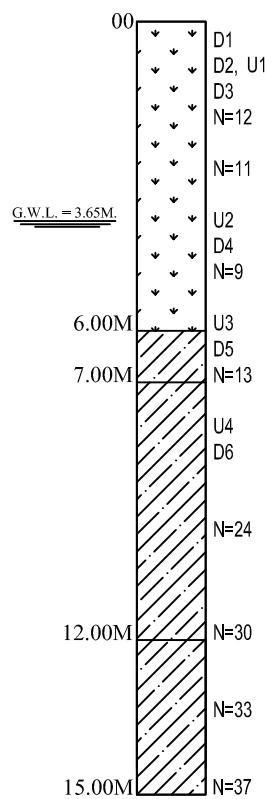
PROJECT:- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

Generalised Subsoil Profile

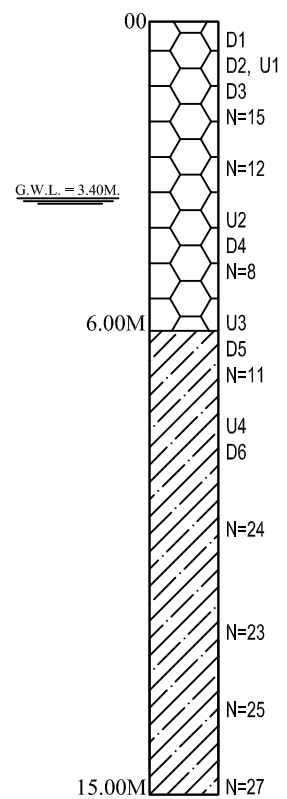
Scale in Meter



BH-7
Depth = 15.00 m.



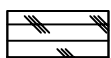
BH-8
Depth = 15.00 m.



BH-9
Depth = 15.00 m.



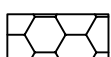
— Silty clay with kankars & traces of sand. / Silty clay mixed with sand & kankars.



— Sandy clay with kankars.



— Silty fine sand with mica. / Silty sand with mica.



— Silty clay mixed with sand.

NOTE:

- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) $C < N_{60}$ (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.

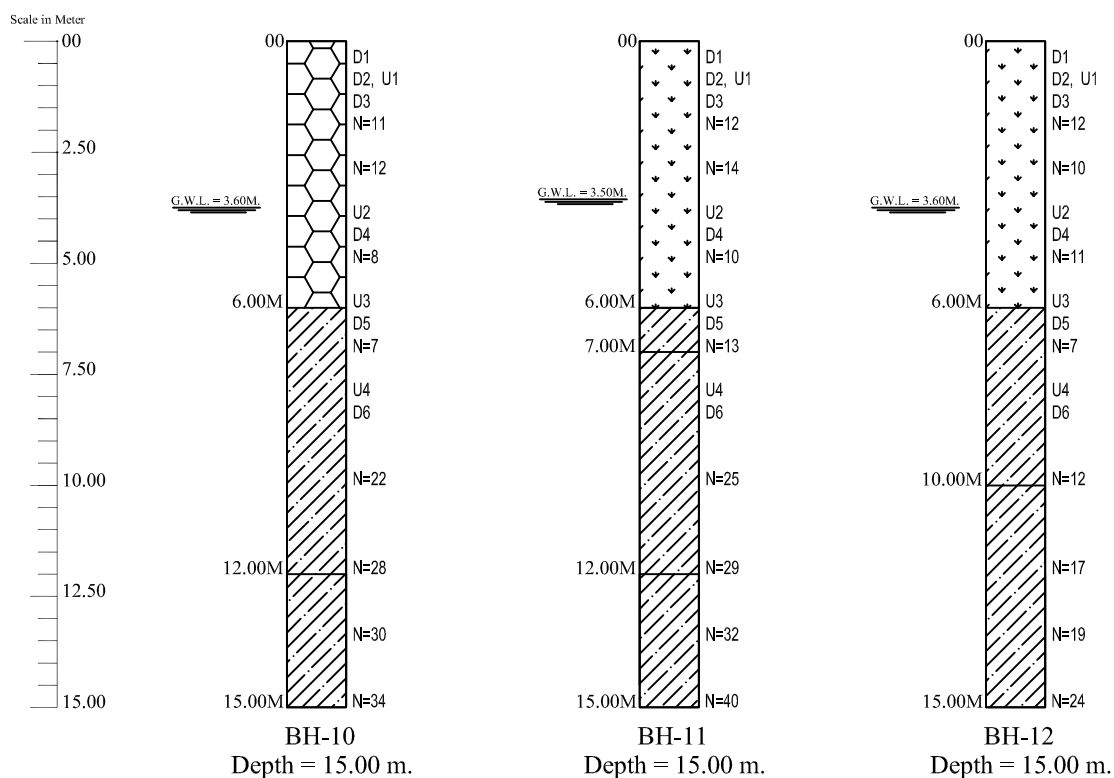
M/s P.K.DUTTA & CO.

Generalised Subsoil Profile

CLIENT:-ASSAM ELECTRICITY GRID CORPORATION LIMITED.

PROJECT:- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

Generalised Subsoil Profile



- Silty clay mixed with sand.



- Silty fine sand with mica./ Silty sand with mica.

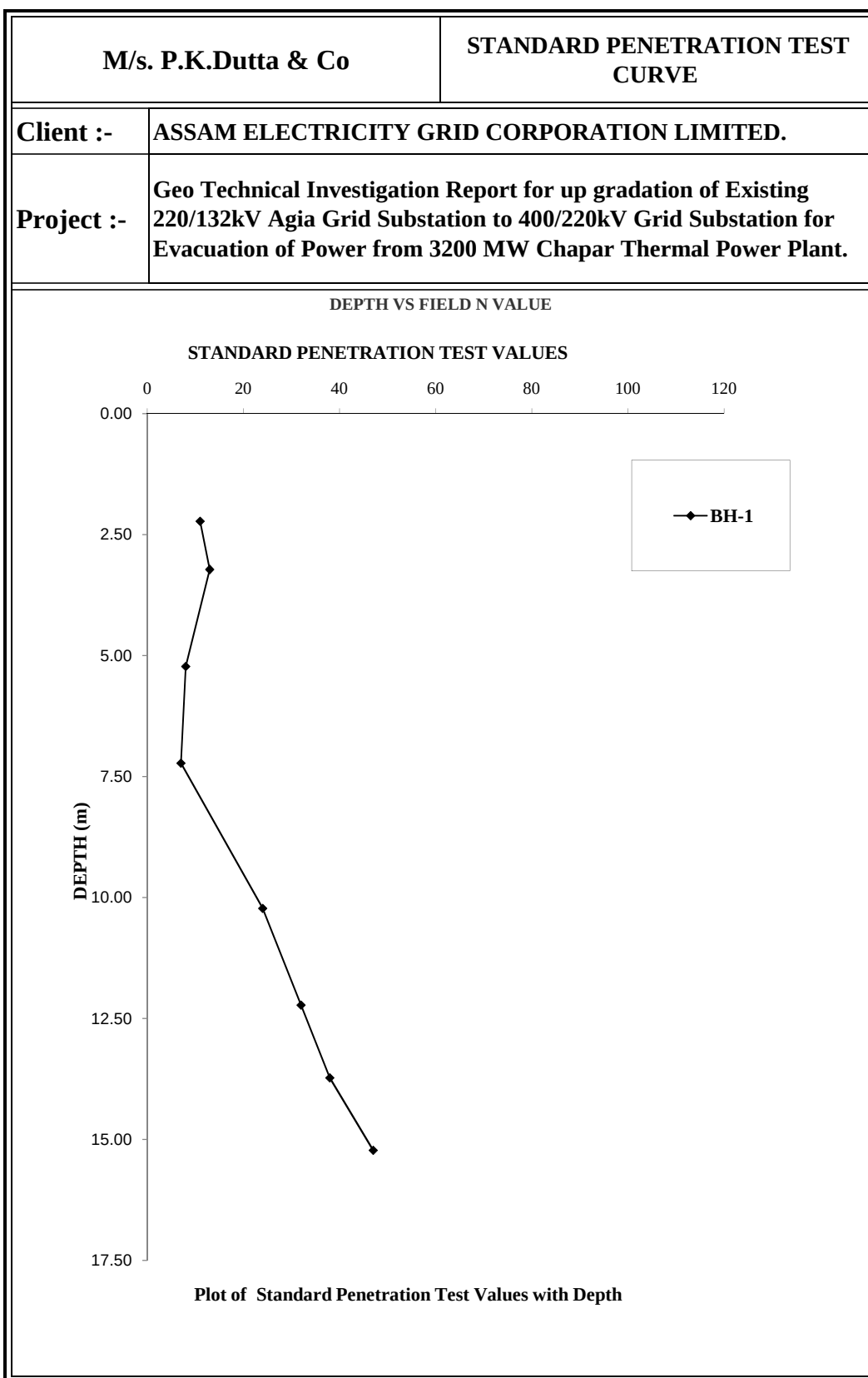


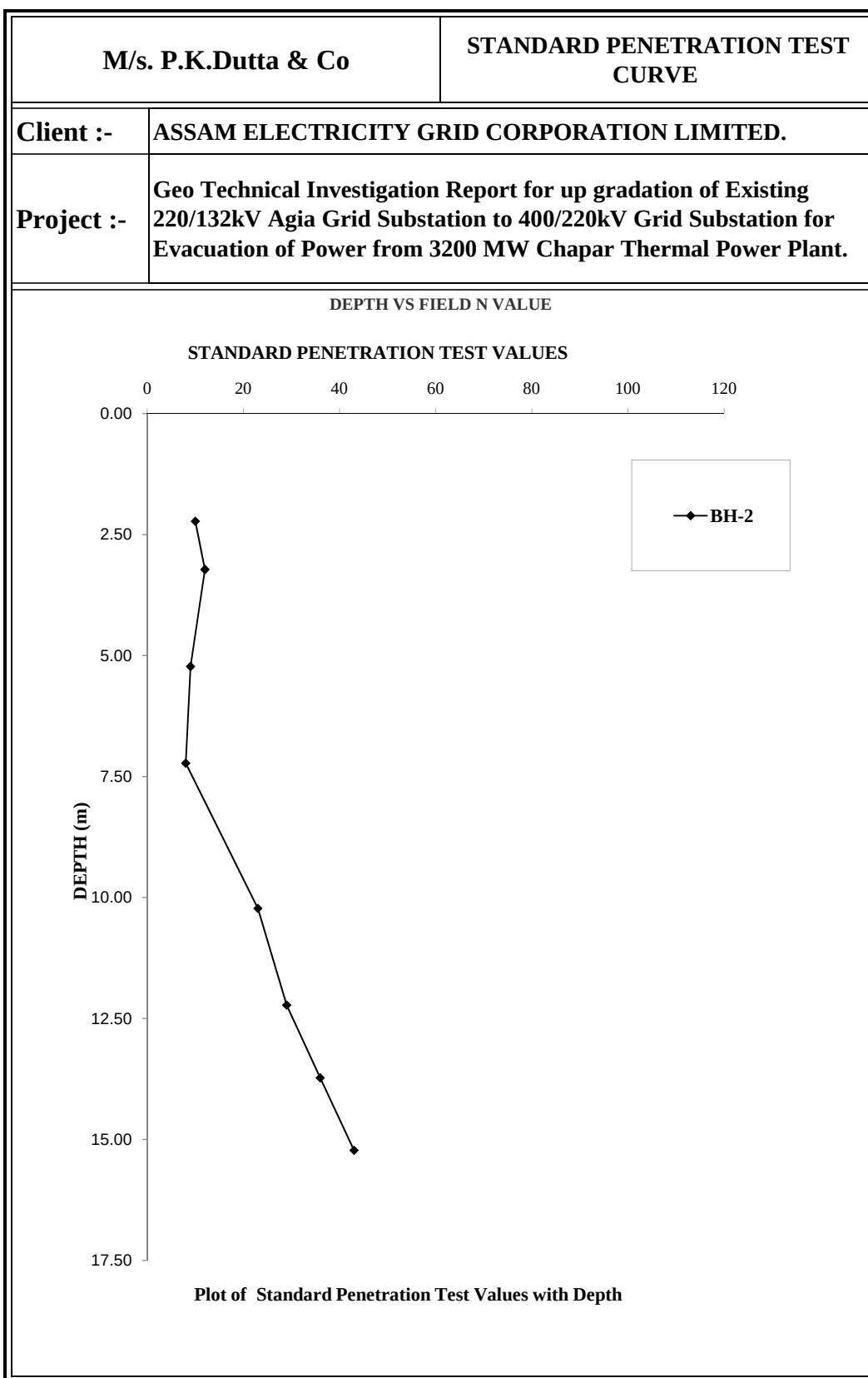
- Silty clay with kankars & traces of sand. / Silty clay mixed with sand & kankars.

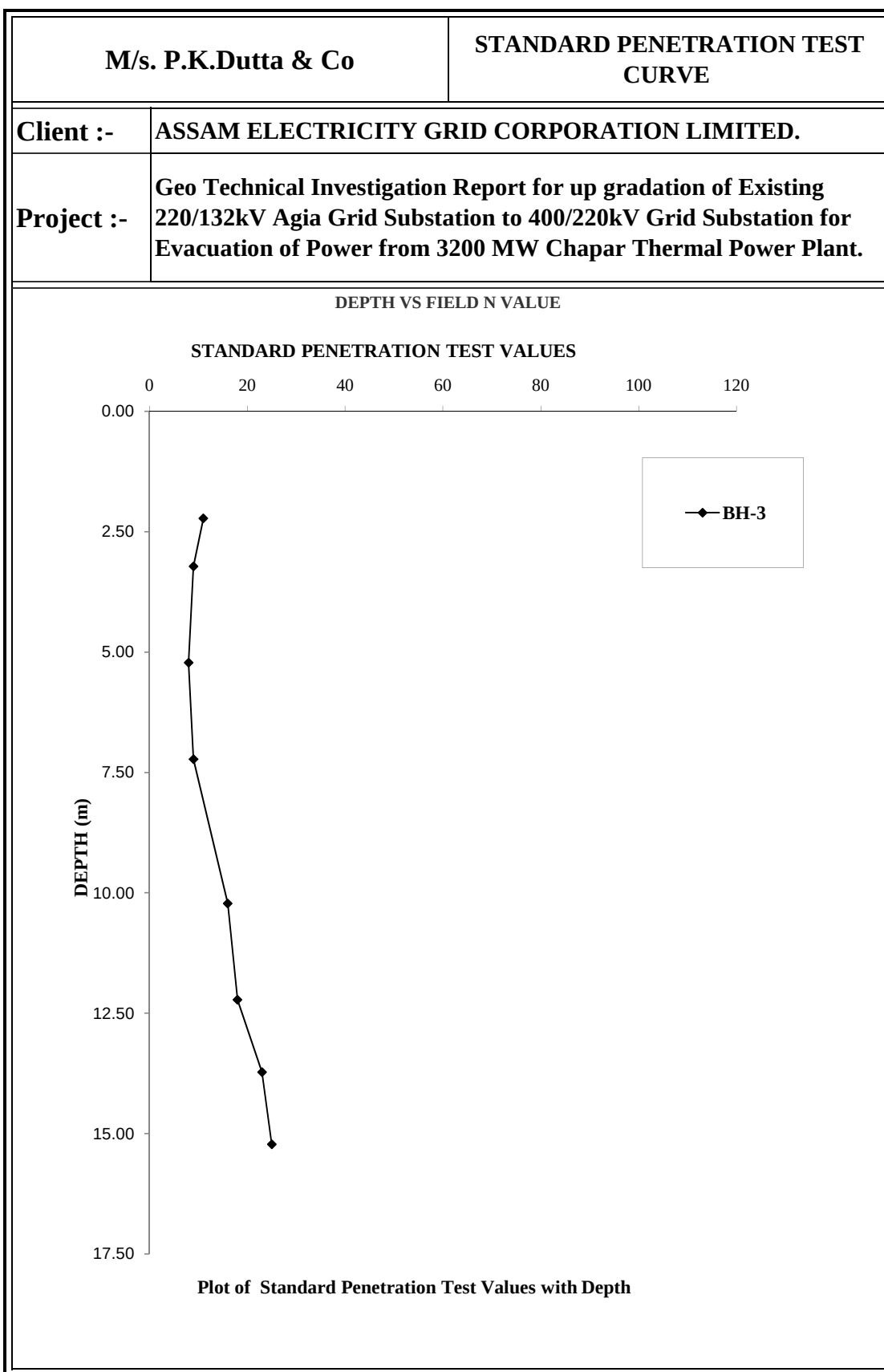
NOTE:

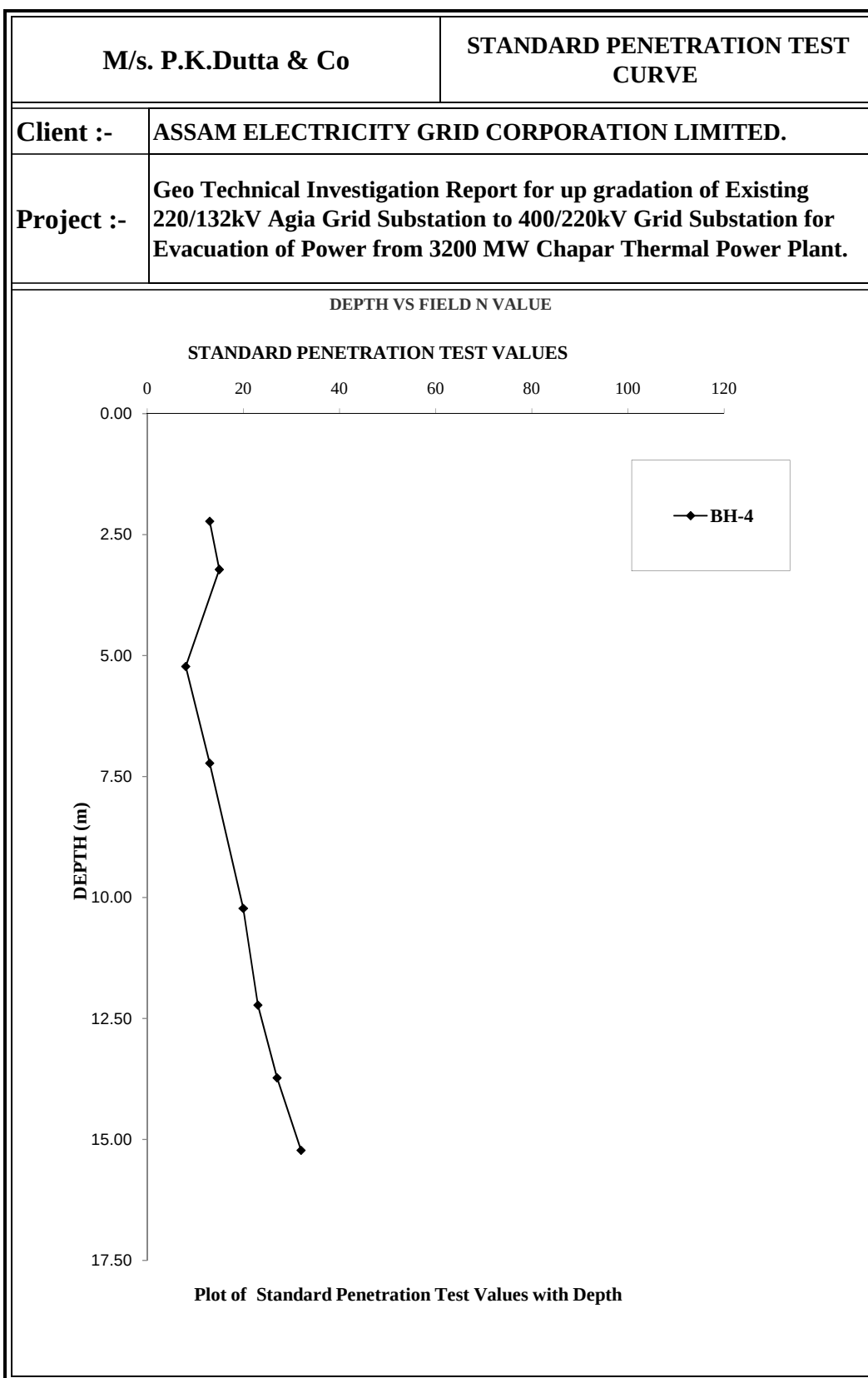
- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) C <No.> (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.

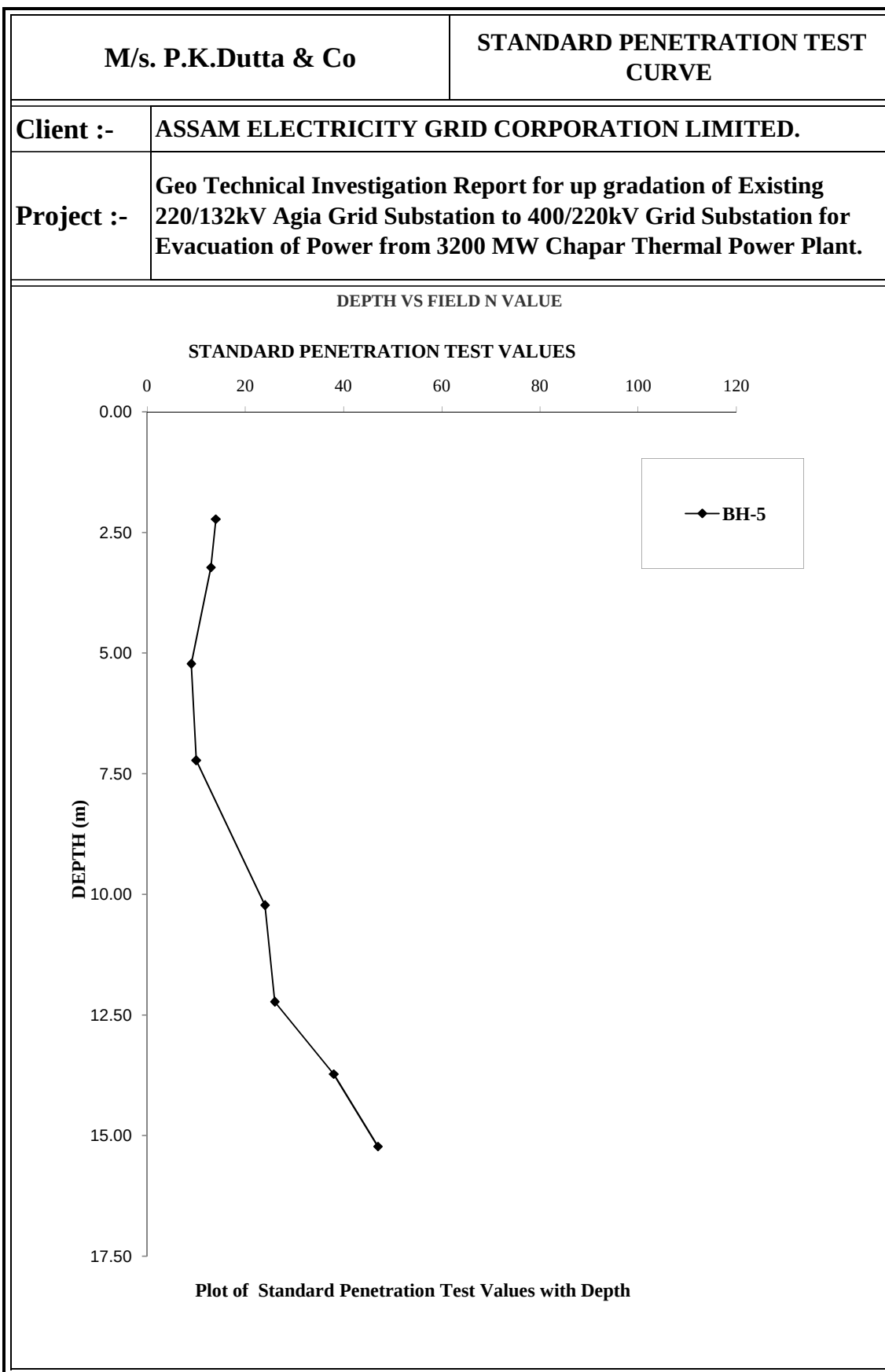
PLOT OF SPT VALUES WITH DEPTH

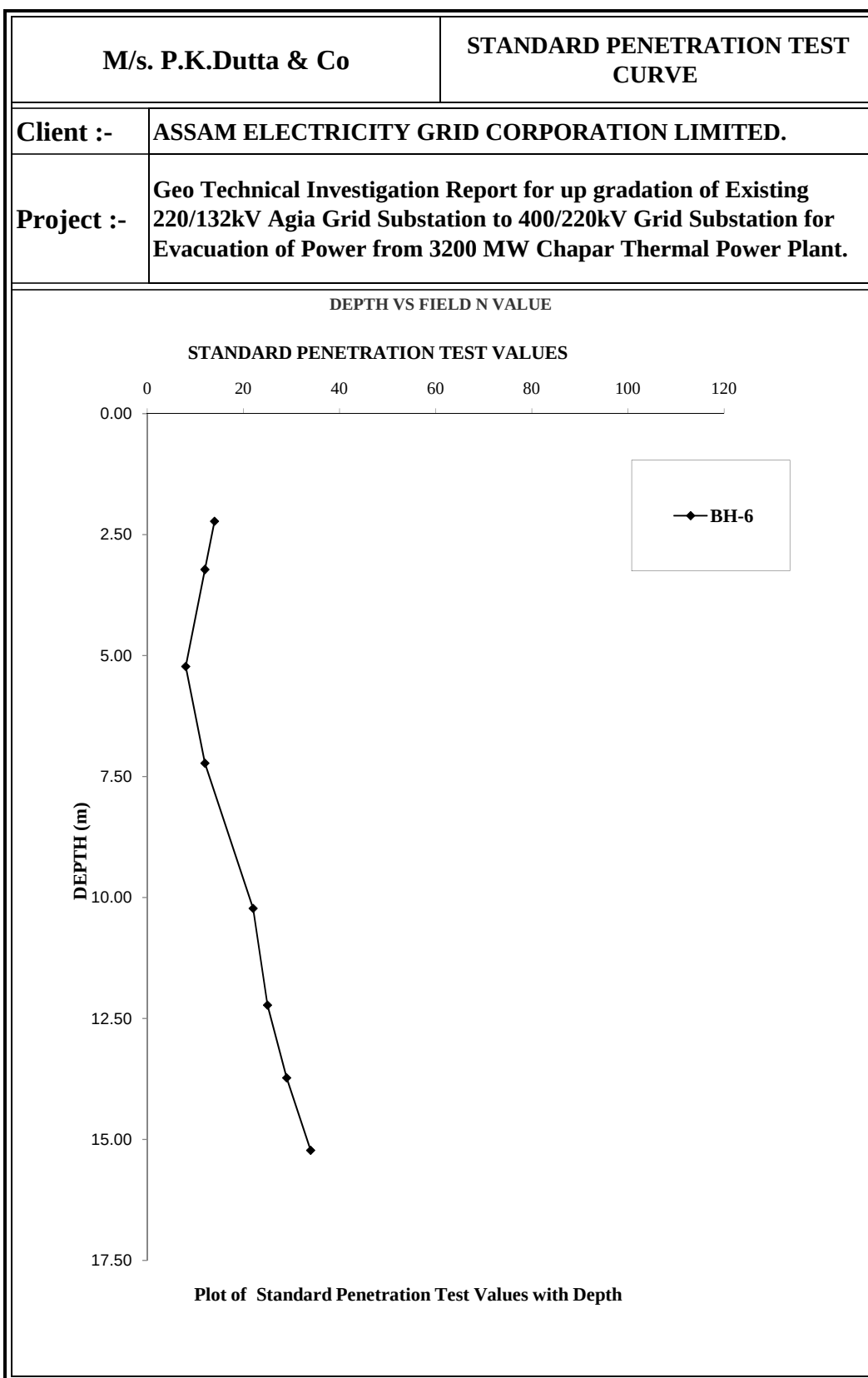


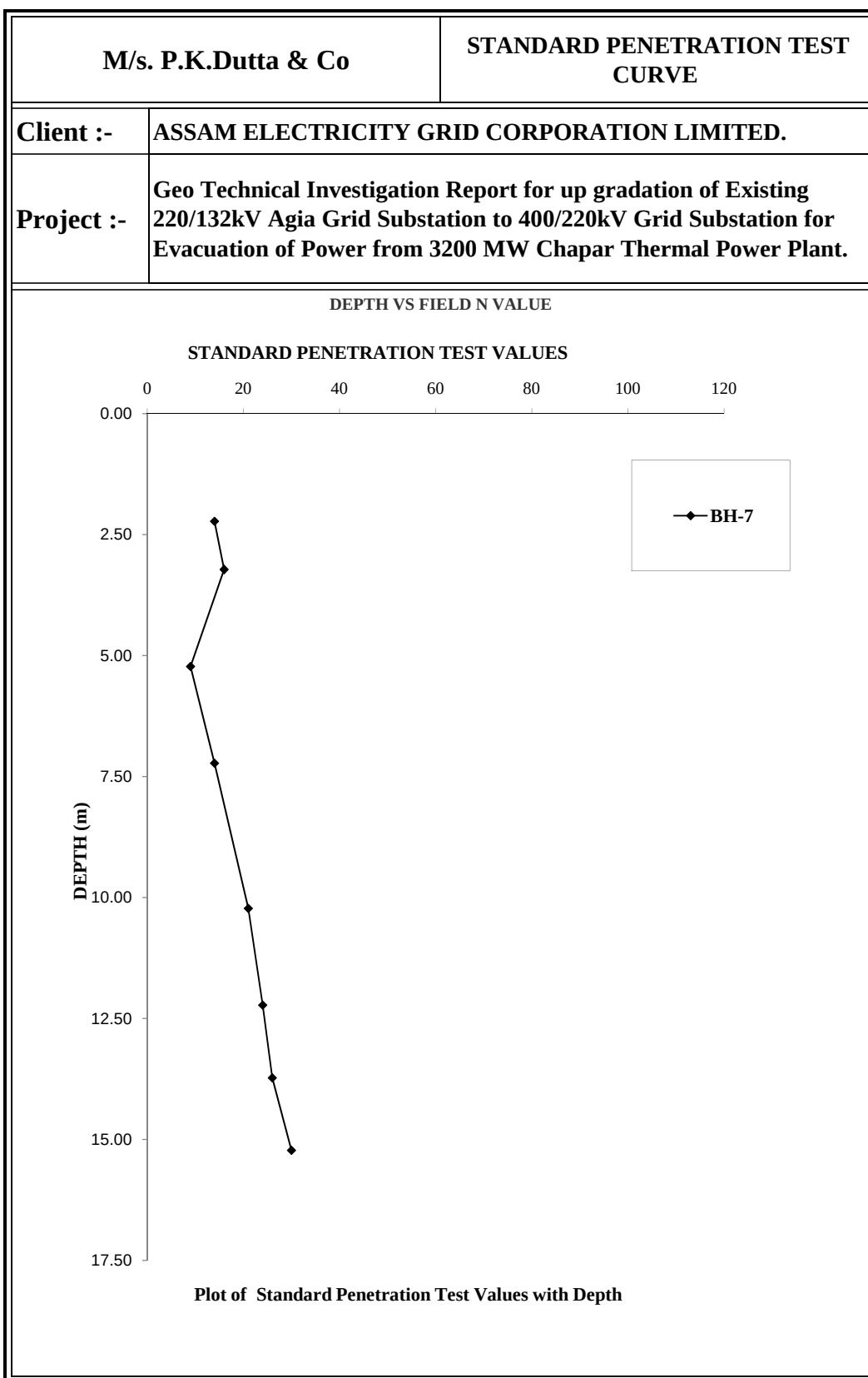


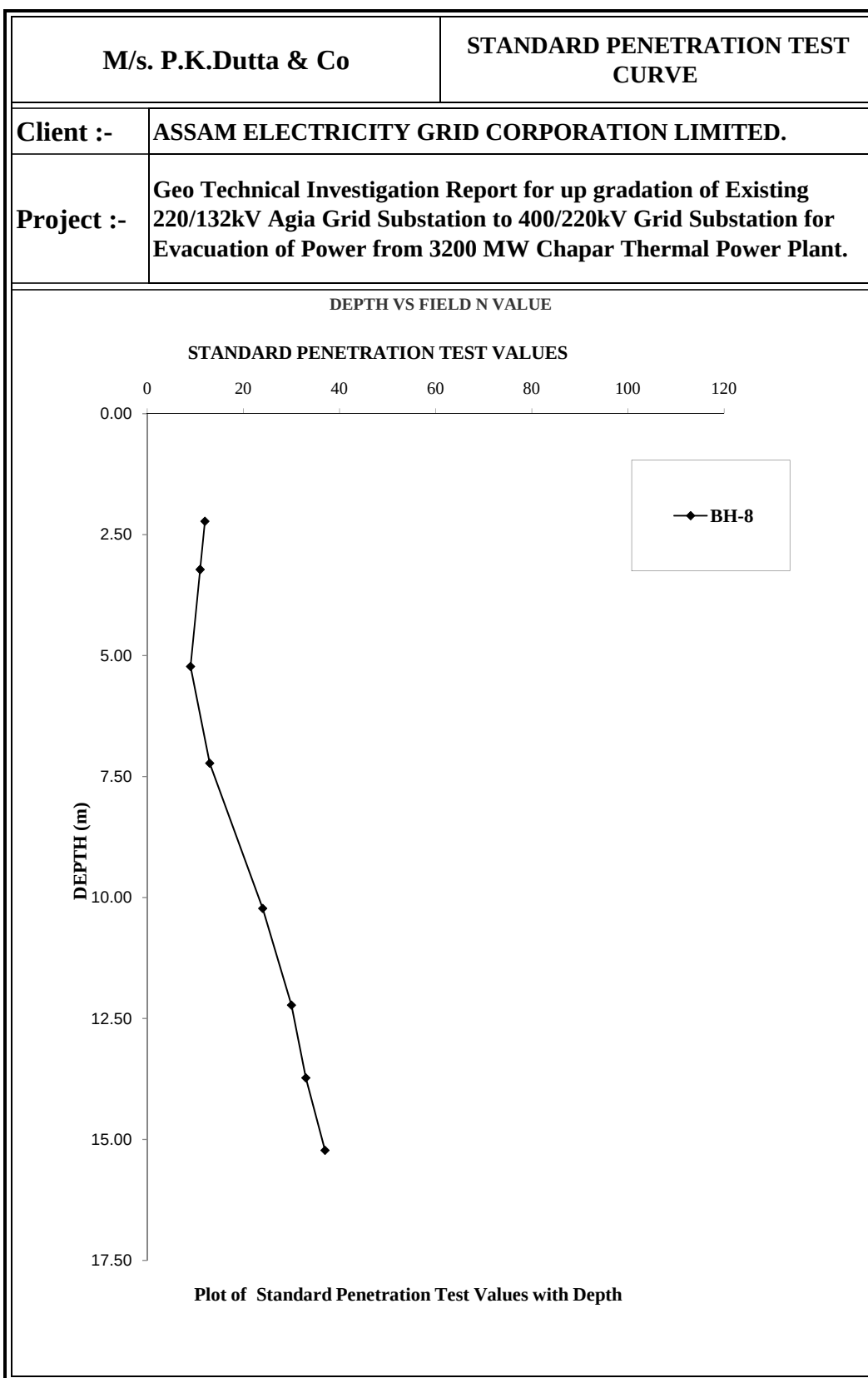


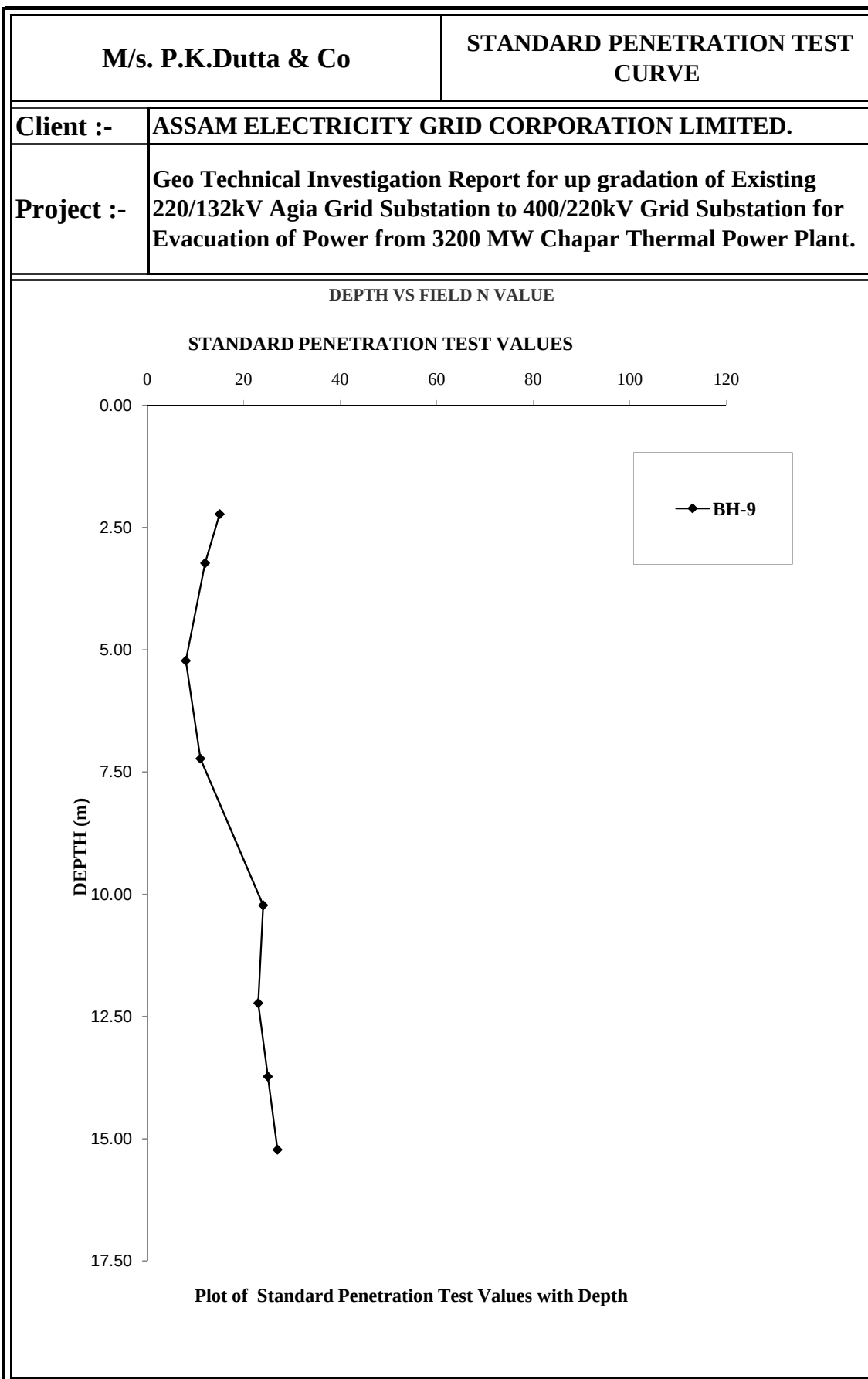


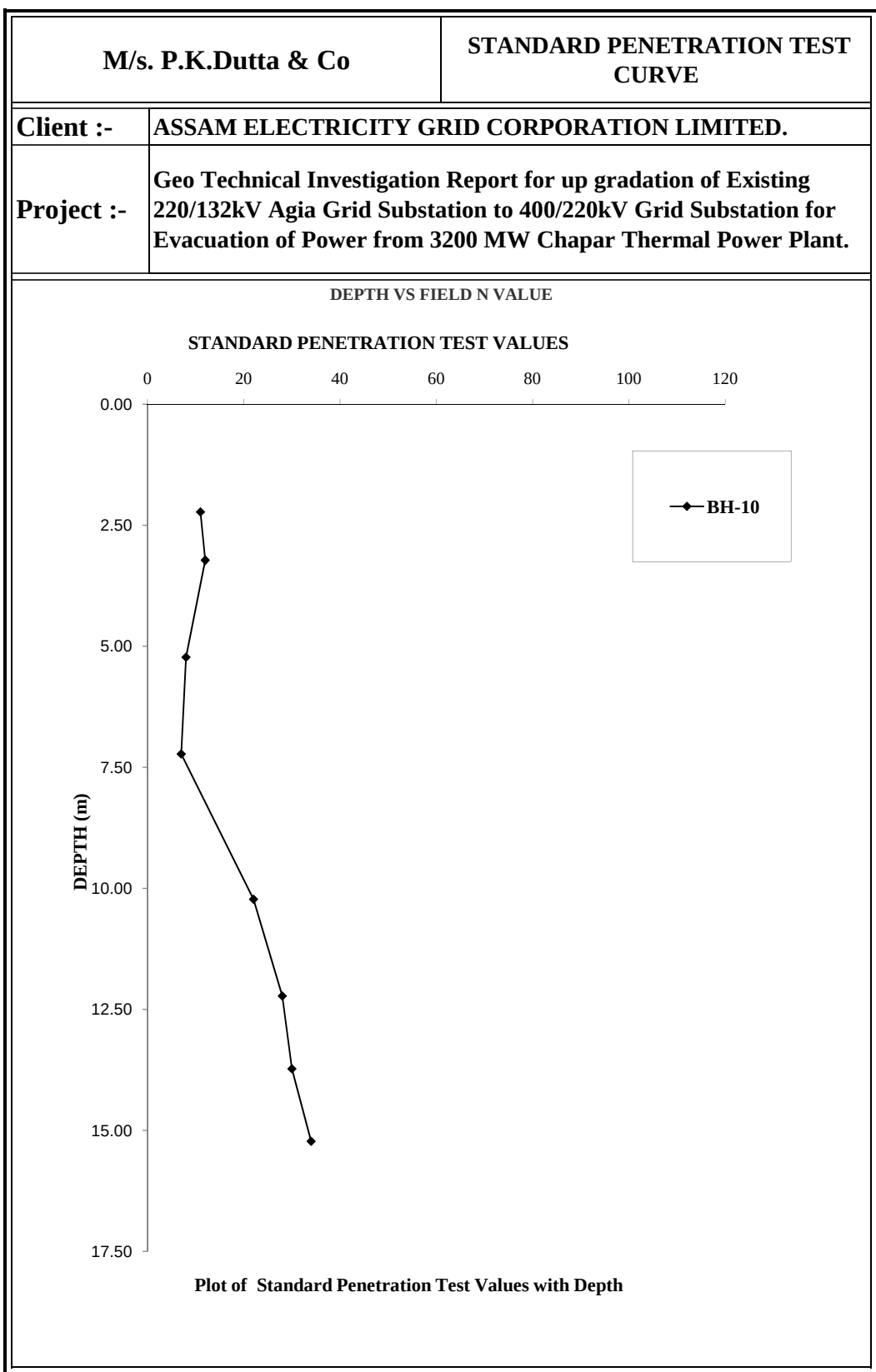


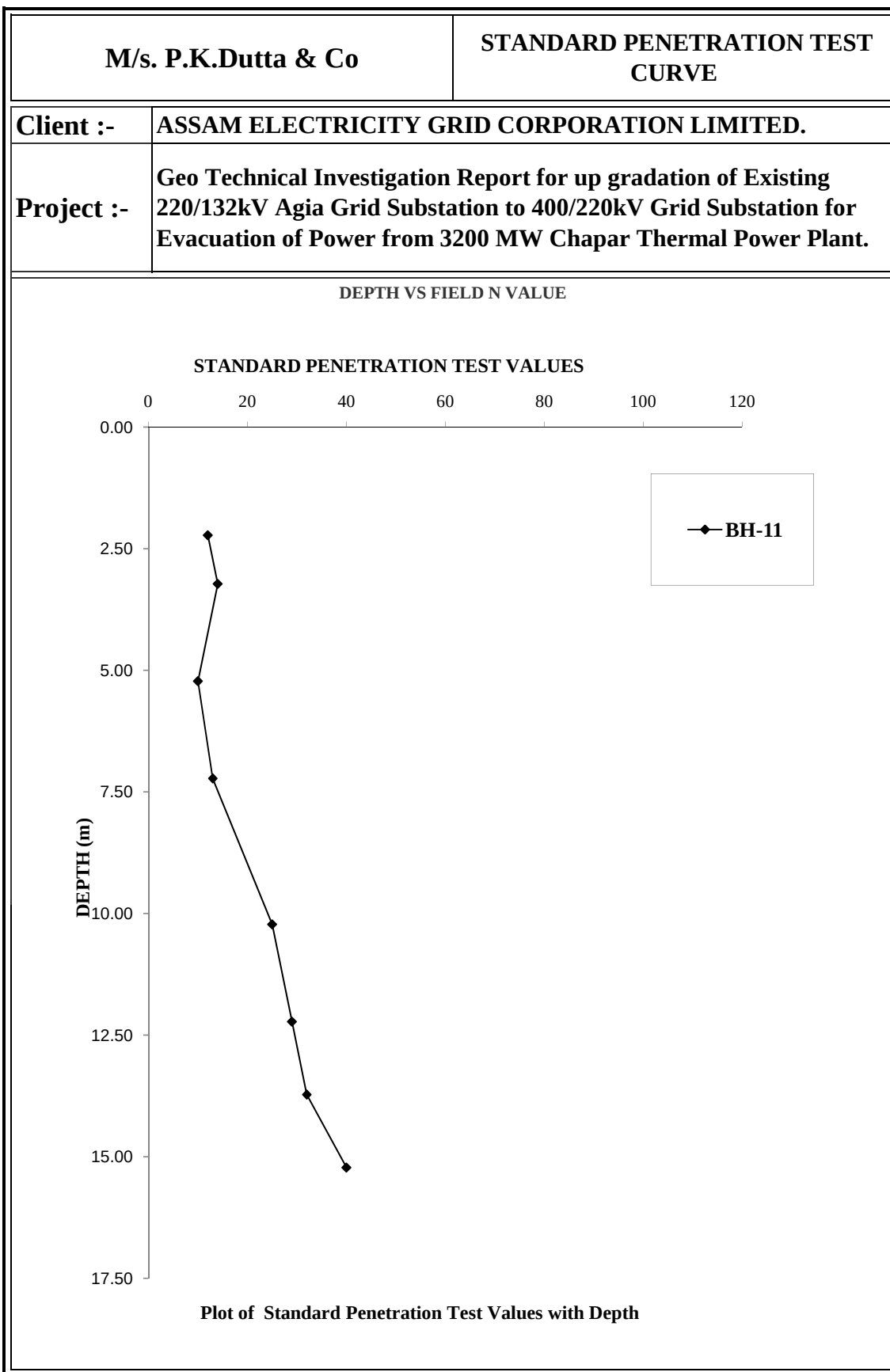


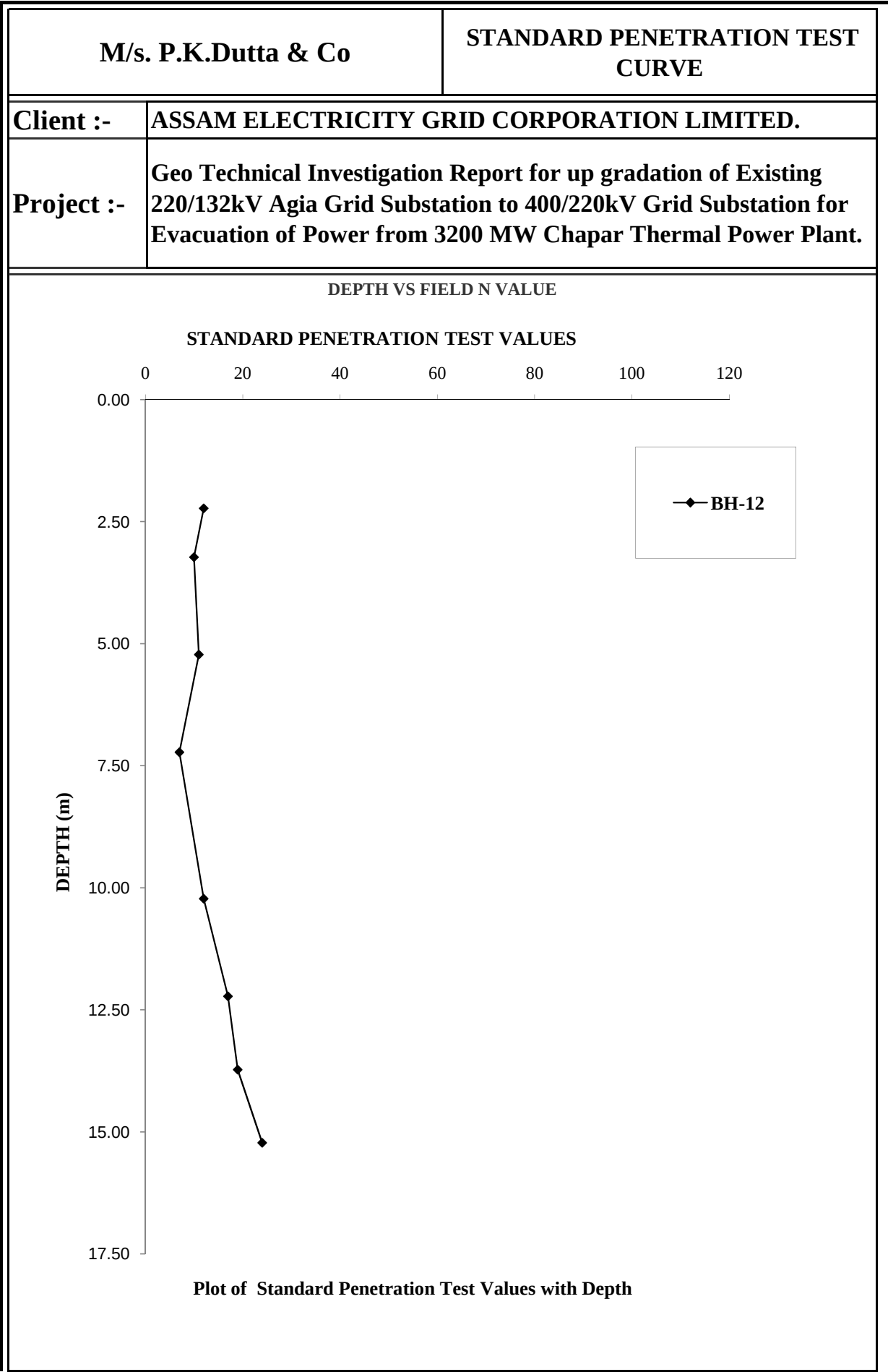












LABORATORY TEST RESULTS OF SOIL

Client: Assam Electricity Grid Corporation Limited.

PROJECT: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No	Sample Number	Depth (m)	Sample Description	Bulk Density	Dry Density	Sp. Gravity	Nat. Moisture	Mv	Shear Strength (kg/cm ²)		Type of Test	Atter. Limits			IS Classification	Free swell	Grain Size				Test Method
									Cohesion	Friction		LL	PL	PI			Gravel	Sand	Silt	Clay	
				gms/cc	gms/cc		%	t/sqm	kg/sqcm	Deg.		%	%	%			%	%	%	%	
BH-1	U1	1.00	Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.	1.86	1.43	2.67	30.00	0.0038	0.38	0.00	UC	46.00	26.00	20.00	CI	39	5.00	7.00	40.00	48.00	*See the Note
	U2	4.00		1.89	1.44	2.68	31.00	0.0039	0.40	0.00	UC	48.00	24.00	24.00	CI	41	3.00	9.00	37.00	51.00	*See the Note
	U3	6.00	Stiff, brownish grey, sandy clay	1.86	1.54	2.63	21.00	0.0021	0.22	5.00	UU	34.00	19.00	15.00	CL	-----	0.00	23.00	35.00	42.00	*See the Note
	U4	8.00	Loose to medium, brownish grey silty sand with mica.	1.86	1.63	2.64	14.40	-----	0.00	22.00	DS	NP	NP	NP	SM	-----	0.00	60.00	31.00	9.00	*See the Note
	*S7	13.50	Medium to dense, brownish grey silty sand with mica.	1.87	-----	2.65	-----	-----	0.00	29.00	DS	NP	NP	NP	SM	-----	0.00	68.00	29.00	3.00	*See the Note
BH-2	U1	1.00	Stiff consistency, brownish to reddish grey silty clay mixed with sand & kankars.	1.86	1.44	2.68	29.00	0.0037	0.35	0.00	UC	42.50	17.00	25.50	CI	38	5.00	9.00	38.00	48.00	*See the Note
	U2	4.00		1.88	1.42	2.69	32.65	0.0039	0.38	0.00	UC	46.00	19.50	26.50	CI	39	4.00	10.00	36.00	50.00	*See the Note
	U3	6.00	Stiff consistency, brownish grey sandy clay	1.85	1.55	2.65	19.00	0.0022	0.25	4.00	UU	35.50	21.00	14.50	CL	-----	0.00	27.00	30.00	43.00	*See the Note
	U4	8.00	Loose to medium, brownish grey silty sand with mica.	1.85	1.63	2.65	13.50	-----	0.00	24.00	DS	NP	NP	NP	SM	-----	0.00	68.00	27.00	5.00	*See the Note
	*S7	13.50	Medium to dense, brownish grey silty sand with mica.	1.86	-----	2.65	-----	-----	0.00	31.00	DS	NP	NP	NP	SM	-----	0.00	72.00	26.00	2.00	*See the Note
BH-3	U1	1.00	Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.	1.89	1.45	2.69	30.11	0.0037	0.33	0.00	UC	39.00	18.00	21.00	CI	31	4.00	8.00	40.00	48.00	*See the Note
	U2	4.00		1.91	1.45	2.71	32.00	0.0038	0.35	0.00	UC	41.00	19.00	22.00	CI	33	3.00	10.00	38.00	49.00	*See the Note
	U3	6.00	Stiff, brownish grey, sandy clay with kankars.	1.85	1.59	2.64	16.65	0.0020	0.20	6.00	UU	33.00	18.00	15.00	CL	-----	2.00	25.00	32.00	41.00	*See the Note
	U4	8.00	Loose to medium, brownish grey silty sand with mica.	1.87	1.67	2.64	12.00	-----	0.00	27.00	DS	NP	NP	NP	SM	-----	0.00	68.00	26.00	6.00	*See the Note
BH-4	U1	1.00	Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.	1.90	1.51	2.68	26.00	0.0039	0.43	0.00	UC	47.00	19.50	27.50	CI	41	2.00	5.00	40.00	53.00	*See the Note
	U2	4.00		1.92	1.48	2.70	29.73	0.0040	0.44	0.00	UC	48.50	20.50	28.00	CI	44	1.00	7.00	36.00	56.00	*See the Note
	*S3	5.00	Stiff, brownish grey, sandy clay with kankars.	1.84	-----	2.63	-----	0.002	0.21	5.00	UU	33.00	19.00	14.00	CL	-----	3.00	23.00	34.00	40.00	*See the Note
	U3	6.00	Loose Light brownish grey silty fine sand with mica.	1.84	1.61	2.65	14.50	-----	0.00	25.00	DS	NP	NP	NP	SM	-----	0.00	65.00	28.00	7.00	*See the Note
	U4	8.00	Medium, brownish grey silty sand with mica.	1.86	1.68	2.65	11.00	-----	0.00	32.00	DS	NP	NP	NP	SM	-----	0.00	73.00	22.00	5.00	*See the Note

Unconfined Compressive Strength Test: IS 2720 (Part 10) Plastic Limit: IS 2720 (Part 5) Consolidation Test: IS 2720 (Part 15) Liquid limit: IS 2720 (Part 5) Specific Gravity: IS 2720 (Part 3)

Grain Size Analysis: IS 2720 (Part 4) Direct Shear Test (DS) : IS 2720 (Part 13) Triaxial Test (UU): IS 2720 (Part 11) Natural Moisture Content: IS 2720 (Part 2) *-Remould Sample

Client: Assam Electricity Grid Corporation Limited.

PROJECT: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No	Sample Number	Depth (m)	Sample Description	Bulk Density	Dry Density	Sp. Gravity	Nat. Moisture	Mv	Shear Strength (kg/cm^2)		Type of Test	Atter. Limits			IS Classification	Free swell	Grain Size				Test Method
									Cohesion	Friction		LL	PL	PI			Gravel	Sand	Silt	Clay	
				gms/cc	gms/cc		%	t/sqm	kg/sqcm	Deg.		%	%	%			%	%	%	%	
BH-5	U1	1.00	Stiff consistency brownish to reddish grey silty clay with sand & kankars	1.88	1.44	2.69	30.50	0.0038	0.39	0.00	UC	43.00	19.00	24.00	CI	36	4.00	10.00	39.00	47.00	*See the Note
	U2	4.00		1.90	1.44	2.71	32.37	0.0040	0.41	0.00	UC	46.50	20.00	26.50	CI	37	3.00	9.00	37.00	51.00	*See the Note
	U3	6.00	Stiff consistency, brownish grey sandy clay.	1.85	1.53	2.64	21.00	0.002	0.24	4.00	UU	33.50	18.50	15.00	CL	-----	0.00	24.00	36.00	40.00	*See the Note
	U4	8.00	Loose to medium, brownish grey silty sand with mica.	1.84	1.61	2.65	14.00	-----	0.00	25.00	DS	NP	NP	NP	SM	-----	0.00	69.00	24.00	7.00	*See the Note
	*S7	13.50	Dense, brownish grey silty sand with mica.	1.87	-----	2.66	-----	-----	0.00	33.00	DS	NP	NP	NP	SM	-----	0.00	72.00	24.00	4.00	*See the Note
BH-6	U1	1.00	Stiff consistency brownish to reddish grey silty clay mixed with kankars & sand	1.89	1.47	2.68	28.50	0.0036	0.39	0.00	UC	46.50	22.00	24.50	CI	40	3.00	6.00	41.00	50.00	*See the Note
	U2	4.00		1.90	1.47	2.70	29.00	0.0037	0.41	0.00	UC	48.00	23.00	25.00	CI	41	3.00	8.00	36.00	53.00	*See the Note
	U3	6.00	Stiff brownish to reddish grey sandy clay with kankars.	1.86	1.55	2.65	20.00	0.002	0.20	6.00	UU	35.50	21.00	14.50	CL	-----	2.00	22.00	31.00	45.00	*See the Note
	U4	8.00	Loose to medium, brownish grey silty sand with mica.	1.84	1.62	2.63	13.50	-----	0.00	26.00	DS	NP	NP	NP	SM	-----	0.00	62.00	31.00	7.00	*See the Note
	*S7	13.50	Medium to dense brownish grey silty sand with mica.	1.86	-----	2.65	-----	-----	0.00	31.00	DS	NP	NP	NP	SM	-----	0.00	71.00	27.00	2.00	*See the Note
BH-7	U1	1.00	Stiff consistency, brownish to reddish grey silty clay mixed with kankars & sand.	1.91	1.45	2.69	31.33	0.0040	0.42	0.00	UC	46.00	19.00	27.00	CI	39	3.00	6.00	39.00	52.00	*See the Note
	U2	4.00		1.92	1.44	2.71	33.00	0.0041	0.43	0.00	UC	48.00	20.00	28.00	CI	42	2.00	7.00	35.00	56.00	*See the Note
	*S3	5.00	Stiff, brownish grey, sandy clay with kankars.	1.84	-----	2.65	-----	0.002	0.23	4.00	UU	34.00	20.50	13.50	CL	-----	2.00	23.00	35.00	40.00	*See the Note
	U3	6.00	Loose light, brownish grey silty fine sand with mica.	1.85	1.61	2.65	15.00	-----	0.00	26.00	DS	NP	NP	NP	SM	-----	0.00	66.00	27.00	7.00	*See the Note
	U4	8.00	Medium, brownish grey silty sand with mica.	1.87	1.65	2.66	13.00	-----	0.00	31.00	DS	NP	NP	NP	SM	-----	0.00	72.00	22.00	6.00	*See the Note
BH-8	U1	1.00	Stiff consistency, brownish to reddish, grey silty clay mixed with sand & kankars	1.88	1.46	2.68	28.75	0.0037	0.36	0.00	UC	45.65	23.00	22.65	CI	38	2.00	12.00	35.00	51.00	*See the Note
	U2	4.00		1.90	1.47	2.70	29.56	0.0039	0.38	0.00	UC	47.00	24.00	23.00	CI	40	2.00	9.00	36.00	53.00	*See the Note
	U3	6.00	Loose, light brownish grey silty fine sand with mica.	1.83	1.47	2.63	24.50	-----	0.00	23.00	DS	NP	NP	NP	SM	-----	0.00	61.00	32.00	7.00	*See the Note
	U4	8.00	Medium, brownish grey silty sand with mica.	1.84	-----	2.65	-----	-----	0.00	27.00	DS	NP	NP	NP	SM	-----	0.00	68.00	28.00	4.00	*See the Note
	*S7	13.50	Medium to dense, brownish grey silty sand with mica.	1.86	-----	2.67	-----	-----	0.00	33.00	DS	NP	NP	NP	SM	-----	0.00	73.00	24.00	3.00	*See the Note

Unconfined Compressive Strength Test: IS 2720 (Part 10) Plastic Limit: IS 2720 (Part 5) Consolidation Test: IS 2720 (Part 15) Liquid limit: IS 2720 (Part 5) Specific Gravity: IS 2720 (Part 3)

Grain Size Analysis: IS 2720 (Part 4) Direct Shear Test (DS) : IS 2720 (Part 13) Triaxial Test (UU): IS 2720 (Part 11) Natural Moisture Content: IS 2720 (Part 2) *-Remould Sample

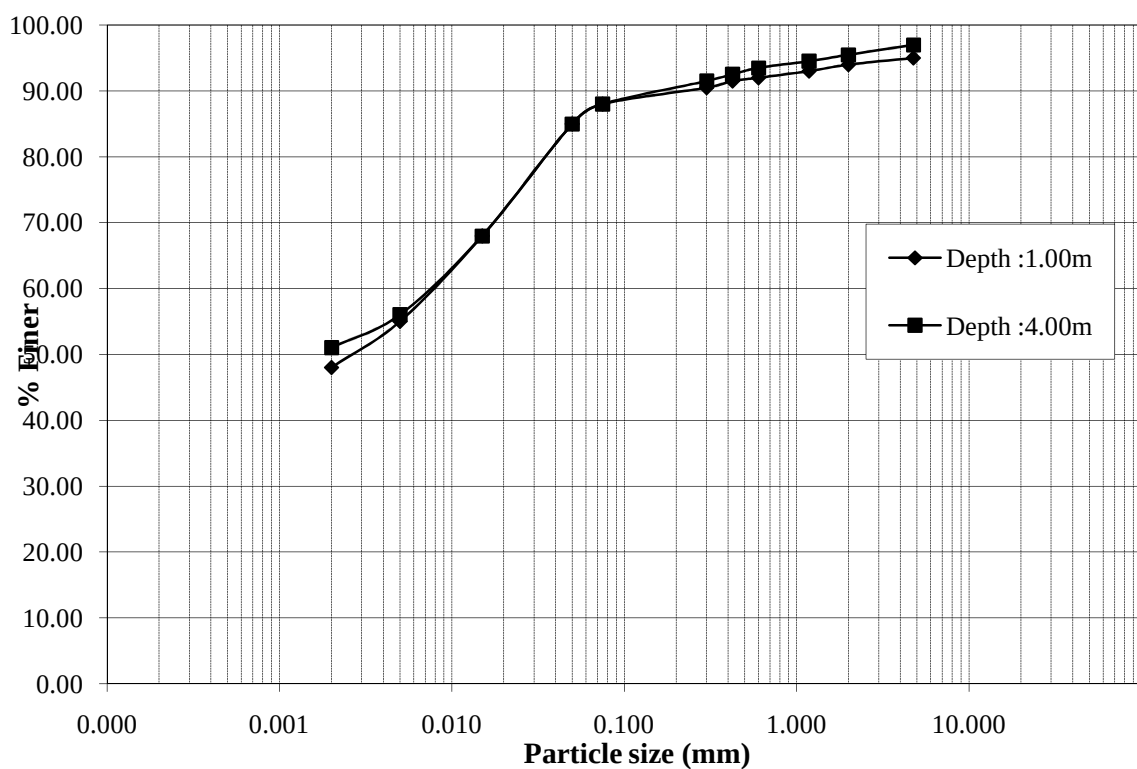
Client: Assam Electricity Grid Corporation Limited.

PROJECT: Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No	Sample Number	Depth (m)	Sample Description	Bulk Density	Dry Density	Sp. Gravity	Nat. Moisture	Mv	Shear Strength (kg/cm ²)		Type of Test	Atter. Limits			IS Classification	Free swell	Grain Size				Test Method
									Cohesion	Friction		LL	PL	PI			Gravel	Sand	Silt	Clay	
				gms/cc	gms/cc		%	t/sqm	kg/sqcm	Deg.		%	%	%			%	%	%	%	
BH-9	U1	1.00	Stiff consistency brownish to reddish grey silty clay with sand.	1.88	1.42	2.69	32.00	0.0036	0.32	0.00	UC	46.00	18.50	27.50	CI	39	0.00	10.00	38.00	52.00	*See the Note
	U2	4.00		1.90	1.43	2.69	33.00	0.0038	0.34	0.00	UC	47.00	18.00	29.00	CI	38	0.00	9.00	41.00	50.00	*See the Note
	U3	6.00	Loose to medium brownish grey silty sand with mica.	1.83	1.48	2.64	24.00	-----	0.00	25.00	DS	NP	NP	NP	SM	-----	0.00	65.00	28.00	7.00	*See the Note
	U4	8.00		1.85	1.46	2.64	26.50	-----	0.00	26.00	DS	NP	NP	NP	SM	-----	0.00	68.00	26.00	6.00	*See the Note
BH-10	U1	1.00	Stiff consistency brownish to reddish grey silty clay mixed with sand.	1.88	1.45	2.68	30.00	0.0037	0.35	0.00	UC	45.00	17.00	28.00	CI	40	0.00	12.00	35.00	53.00	*See the Note
	U2	4.00		1.90	1.45	2.68	31.00	0.0039	0.36	0.00	UC	47.00	17.00	30.00	CI	39	0.00	14.00	36.00	50.00	*See the Note
	U3	6.00	Loose to medium brownish grey silty sand with mica.	1.83	1.48	2.63	24.00	-----	0.00	24.00	DS	NP	NP	NP	SM	-----	0.00	64.00	30.00	6.00	*See the Note
	U4	8.00		1.86	1.49	2.63	25.00	-----	0.00	26.00	DS	NP	NP	NP	SM	-----	0.00	68.00	28.00	4.00	*See the Note
	*S6	12.00	Medium to dense brownish grey silty sand with mica.	1.87	-----	2.65	-----	-----	0.00	29.00	DS	NP	NP	NP	SM	-----	0.00	72.00	24.00	4.00	*See the Note
BH-11	U1	1.00	Stiff consistency brownish to reddish grey silty clay mixed with sand & kankars.	1.89	1.44	2.68	31.00	0.0040	0.35	0.00	UC	47.50	20.00	27.50	CI	39	0.00	7.00	24.00	69.00	*See the Note
	U2	4.00		1.91	1.45	2.68	31.50	0.0041	0.37	0.00	UC	49.00	21.00	28.00	CI	41	0.00	8.00	26.00	66.00	*See the Note
	U3	6.00	Loose light brownish grey silty fine sand with mica.	1.82	1.46	2.64	25.00	-----	0.00	25.00	DS	NP	NP	NP	SM	-----	0.00	66.00	29.00	5.00	*See the Note
	U4	8.00	Medium brownish grey silty sand with mica.	1.85	1.52	2.65	21.50	-----	0.00	27.00	DS	NP	NP	NP	SM	-----	0.00	69.00	27.00	4.00	*See the Note
	*S7	13.50	Medium to dense brownish grey silty sand with mica.	1.86	-----	2.65	-----	-----	0.00	30.00	DS	NP	NP	NP	SM	-----	0.00	73.00	25.00	2.00	*See the Note
BH-12	U1	1.00	Stiff consistency brownish grey silty clay with kankars & traces of sand.	1.88	1.45	2.69	30.00	0.0038	0.33	0.00	UC	46.00	18.00	28.00	CI	40	0.00	10.00	23.00	67.00	*See the Note
	U2	4.00		1.89	1.44	2.70	31.00	0.0040	0.34	0.00	UC	47.50	19.00	28.50	CI	41	0.00	12.00	24.00	64.00	*See the Note
	U3	6.00	Loose light brownish grey silty fine sand with mica.	1.84	1.48	2.63	24.00	-----	0.00	24.00	DS	NP	NP	NP	SM	-----	0.00	69.00	28.00	3.00	*See the Note
	U4	8.00		1.85	1.48	2.65	25.00	-----	0.00	25.00	DS	NP	NP	NP	SM	-----	0.00	70.00	27.00	3.00	*See the Note
	*S6	12.00	Medium brownish grey silty sand with mica.	1.86	-----	2.65	-----	-----	0.00	28.00	DS	NP	NP	NP	SM	-----	0.00	73.00	25.00	2.00	*See the Note

**Unconfined Compressive Strength Test:IS 2720 (Part 10) Plastic Limit:IS 2720 (Part 5) Consolidation Test:IS 2720 (Part 15) Liquid limit:IS 2720 (Part 5) Specific Gravity: IS 2720 (Part 3)
Grain Size Analysis:IS 2720 (Part 4) Direct Shear Test (DS) : IS 2720 (Part 13) Triaxial Test (UU): IS 2720 (Part 11) Natural Moisture Content: IS 2720 (Part 2) *-Remould Sample**

GRAIN SIZE DISTRIBUTION CURVES

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-1**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-1, U-1, 1.00m	48.00	40.00	7.00	5.00
BH-1, U-2, 4.00m	51.00	37.00	9.00	3.00

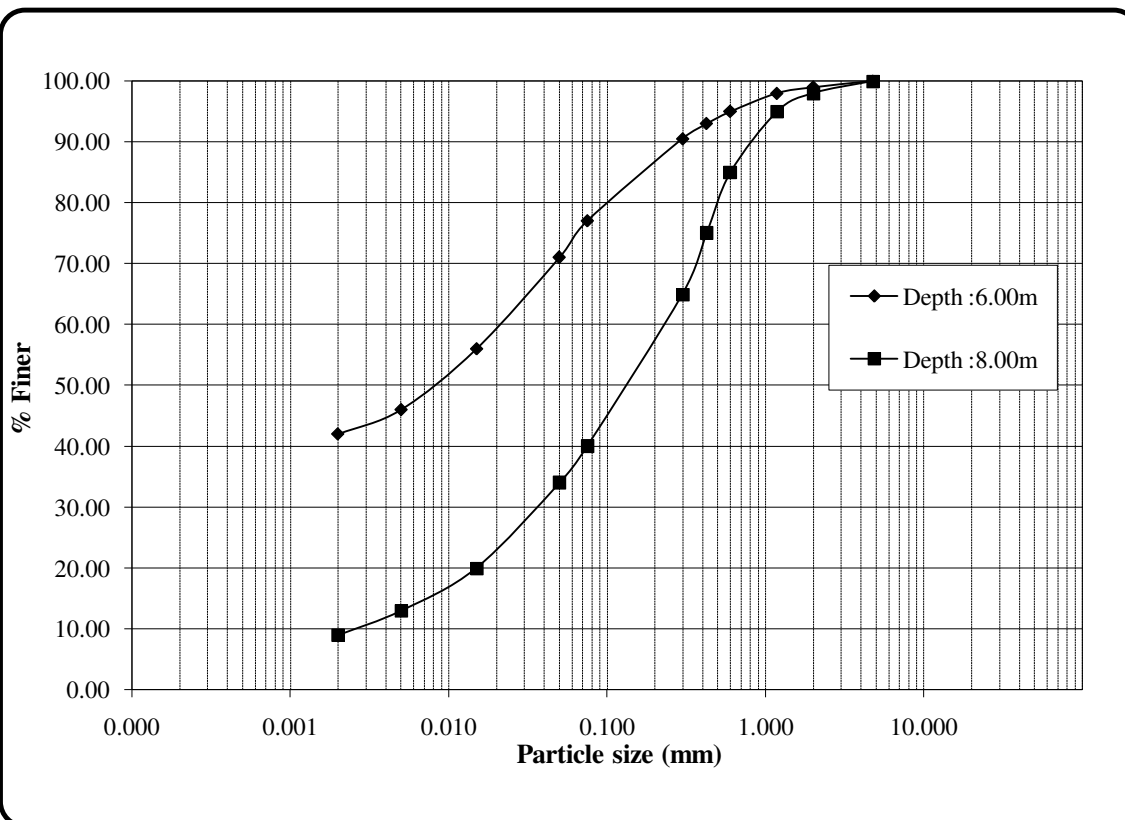
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-1



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-1, U-3, 6.00m	42.00	35.00	23.00	0.00
BH-1, U-4, 8.00m	9.00	31.00	60.00	0.00

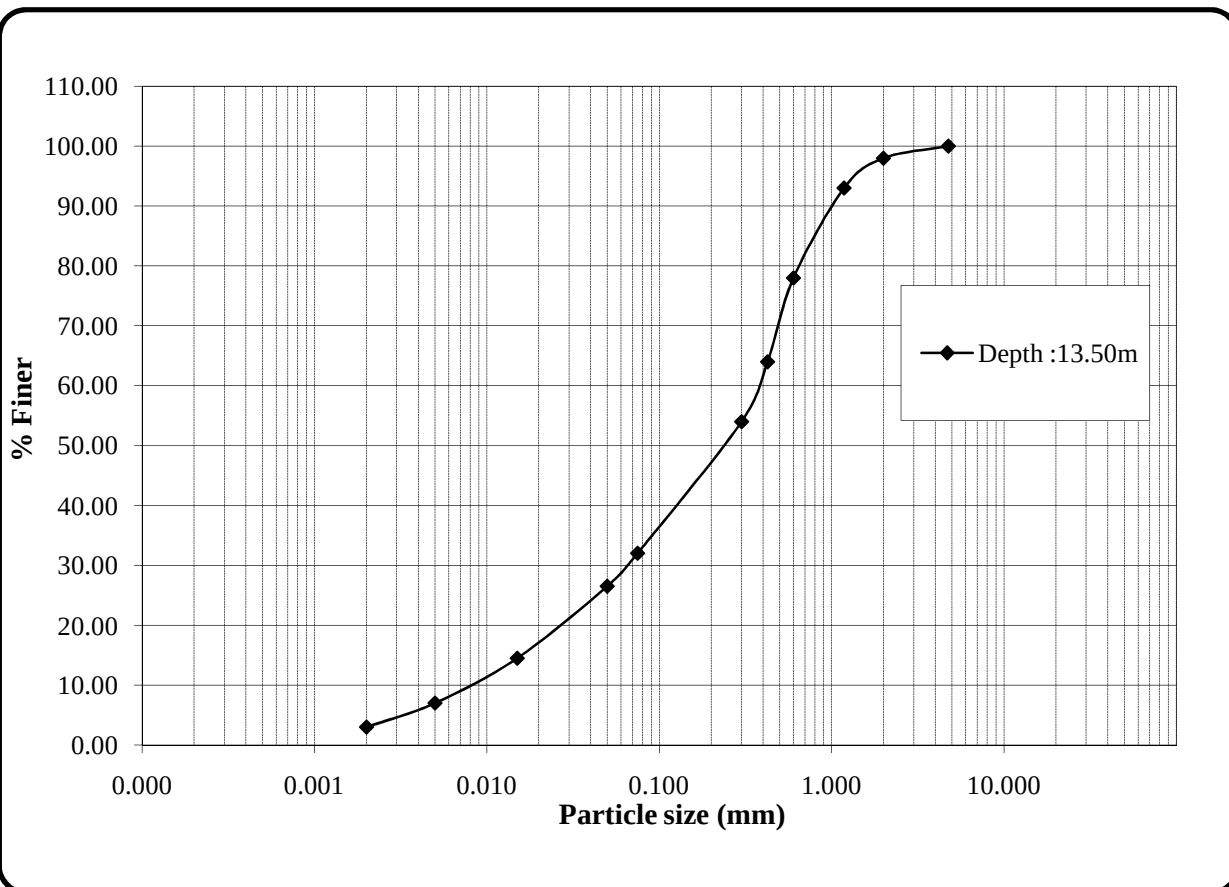
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

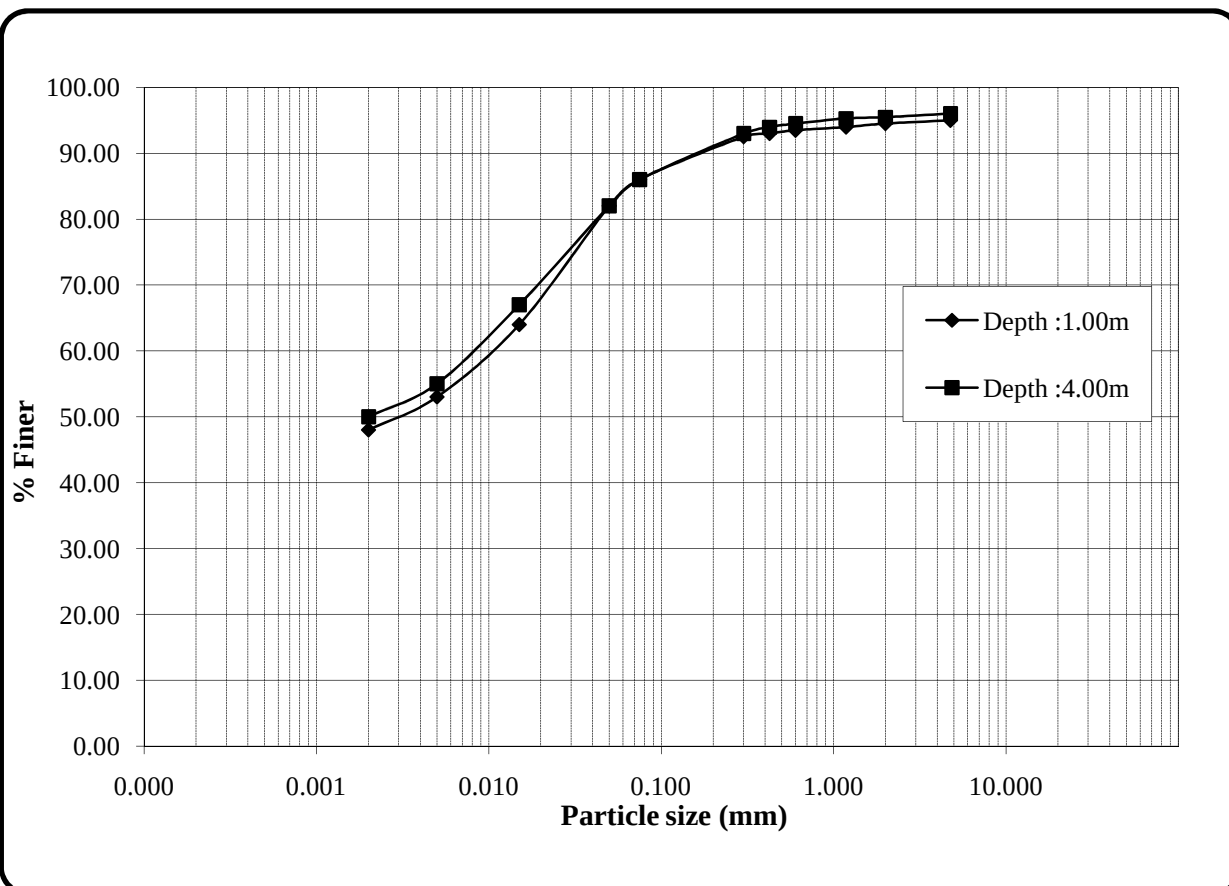
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia
Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200
MW Chapar Thermal Power Plant

Bore Hole No. BH-1



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-1, S-7, 13.50m	3.00	29.00	68.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-2**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-2, U-1, 1.00m	48.00	38.00	9.00	5.00
BH-2, U-2, 4.00m	50.00	36.00	10.00	4.00

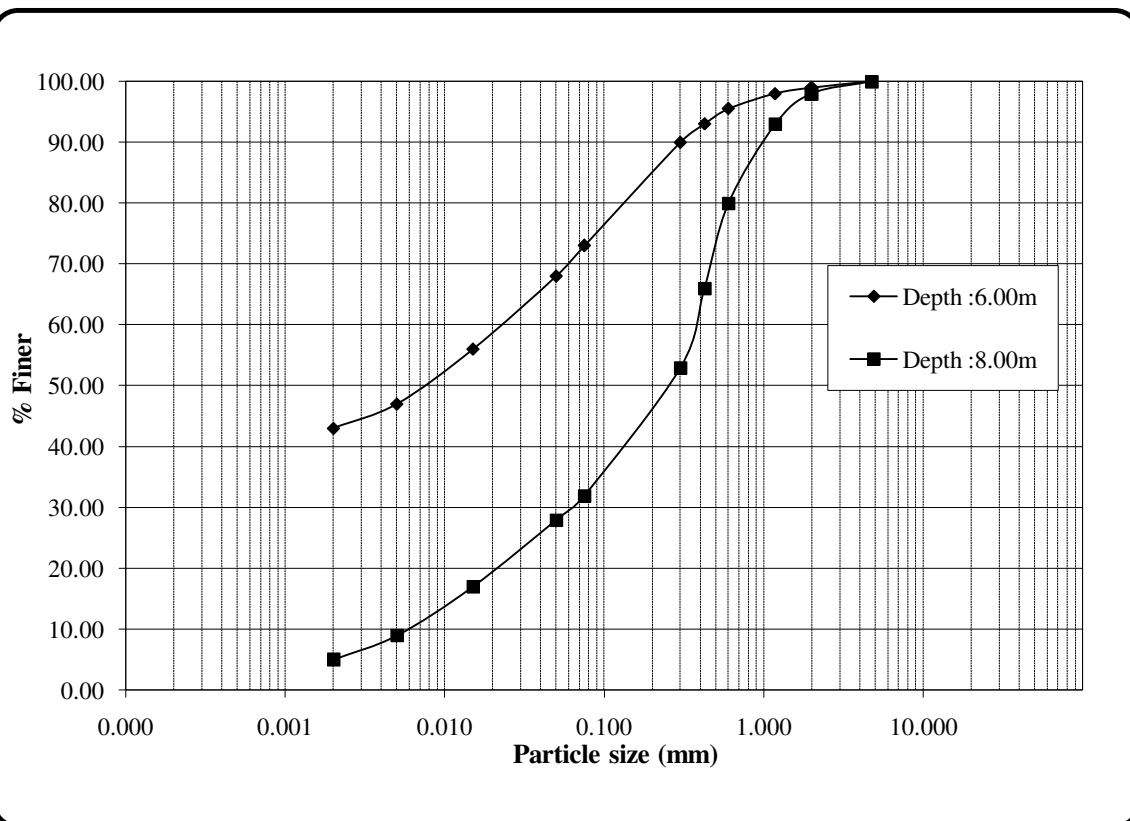
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-2



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-2, U-3, 6.00m	43.00	30.00	27.00	0.00
BH-2, U-4, 8.00m	5.00	27.00	68.00	0.00

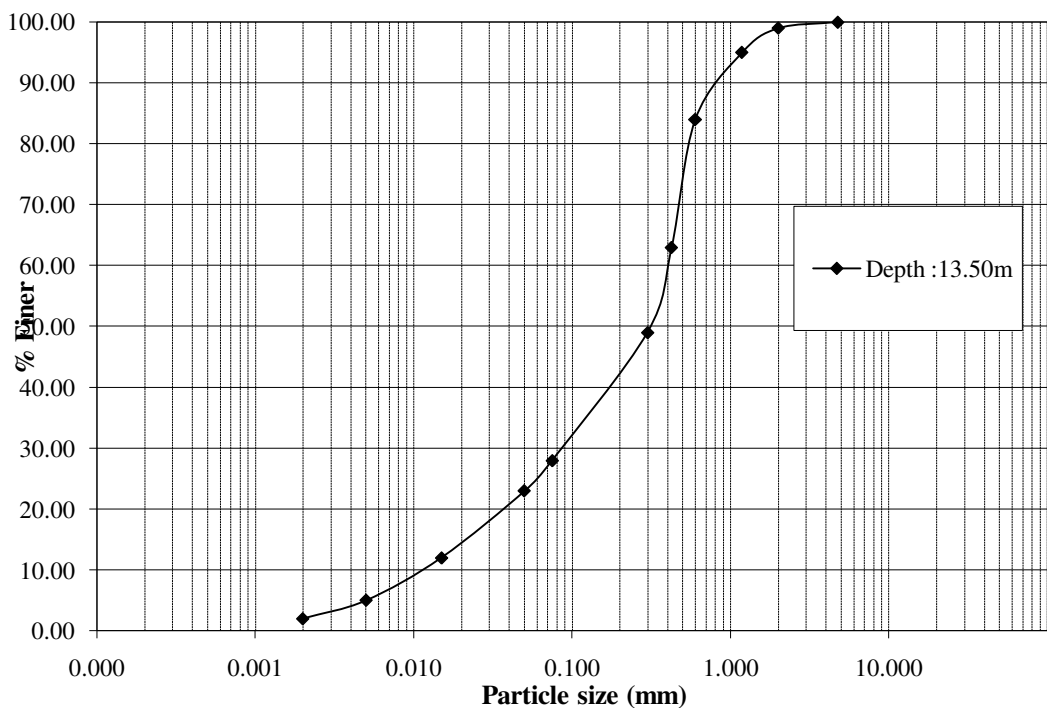
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

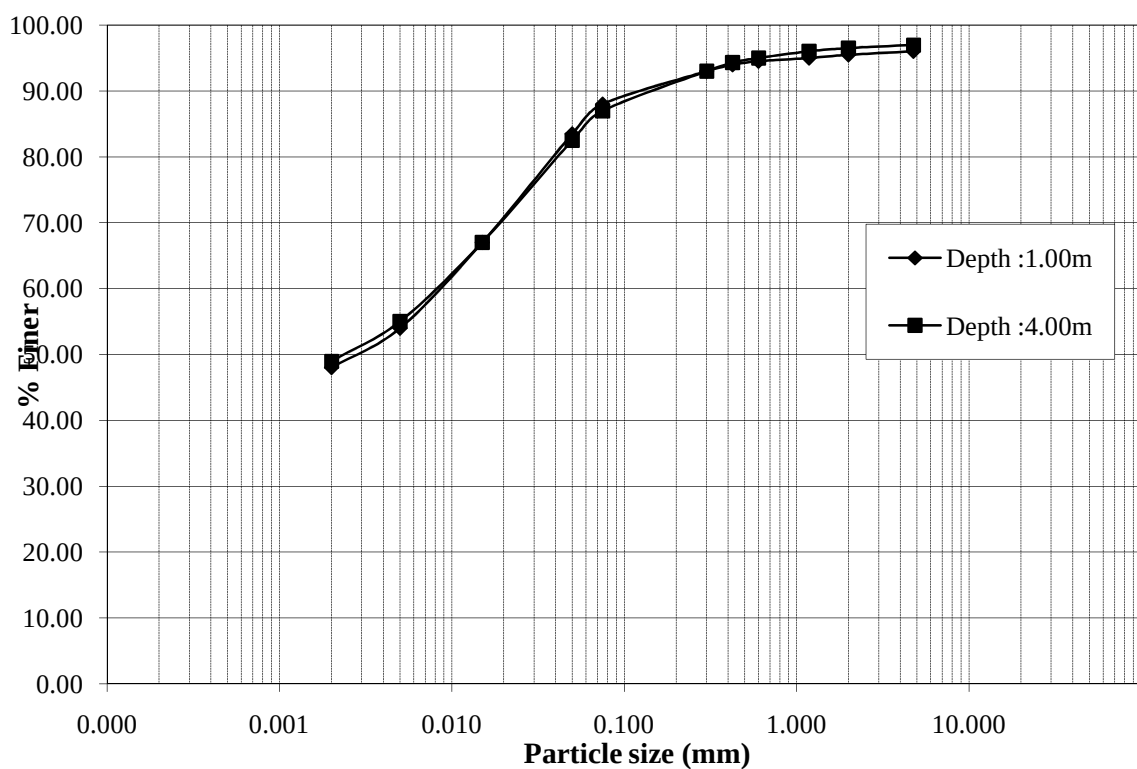
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-2



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-2, S-7,13.50m	2.00	26.00	72.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-3**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-3, U-1, 1.00m	48.00	40.00	8.00	4.00
BH-3, U-2, 4.00m	49.00	38.00	10.00	3.00

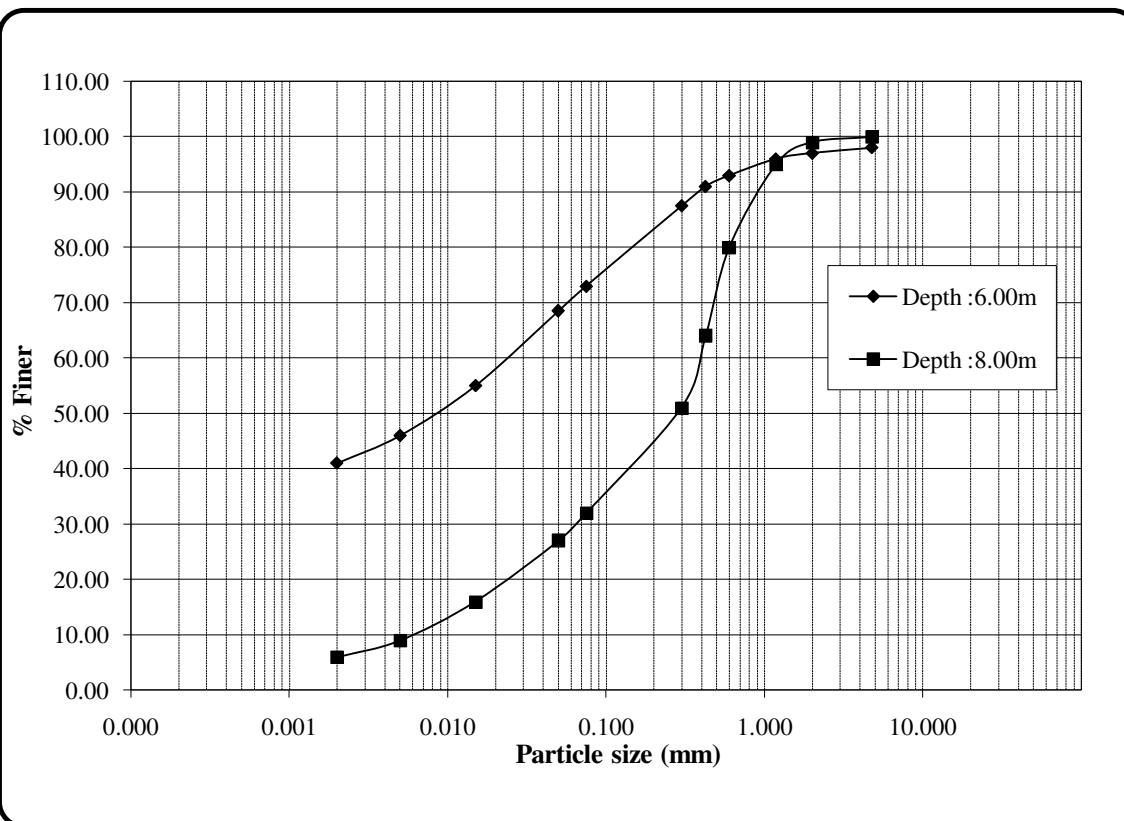
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

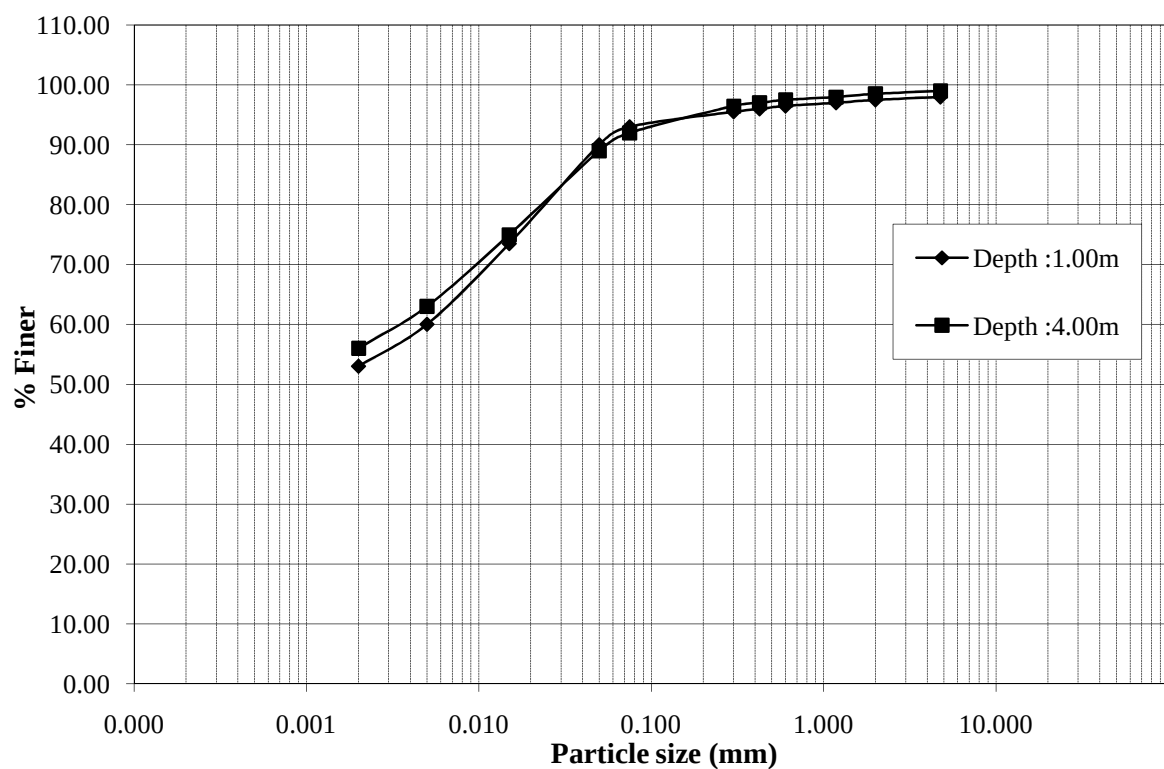
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-3



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-3, U-3, 6.00m	41.00	32.00	25.00	2.00
BH-3, U-4, 8.00m	6.00	26.00	68.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-4**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-4, U-1, 1.00m	53.00	40.00	5.00	2.00
BH-4, U-2, 4.00m	56.00	36.00	7.00	1.00

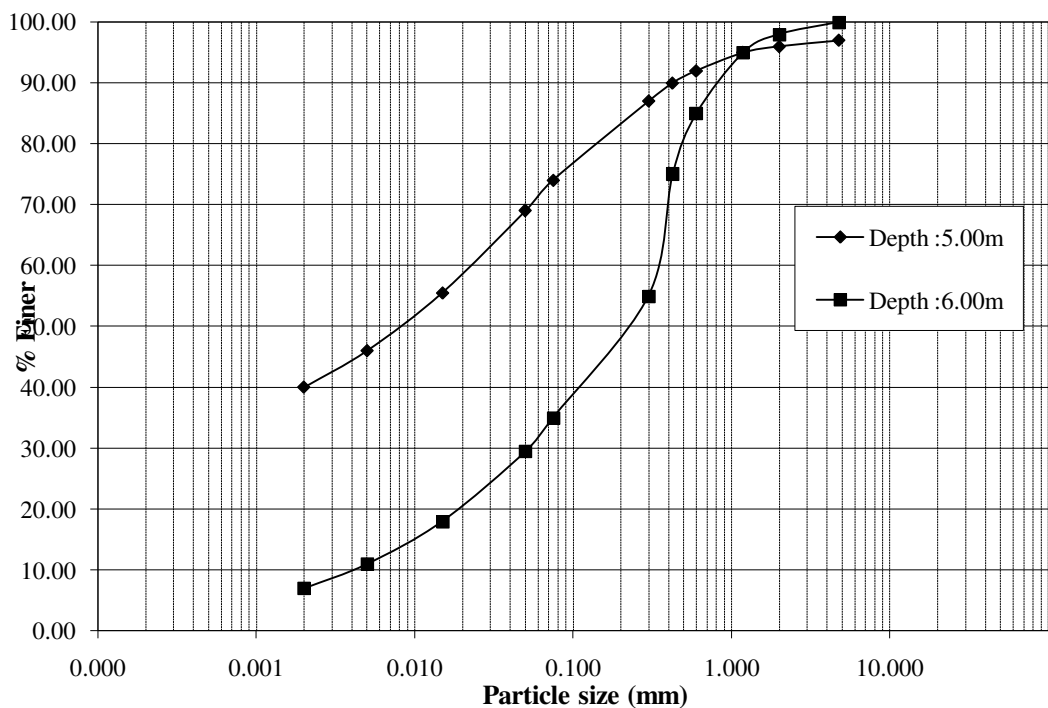
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-4



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-4, S-3, 5.00m	40.00	34.00	23.00	3.00
BH-4, U-3, 6.00m	7.00	28.00	65.00	0.00

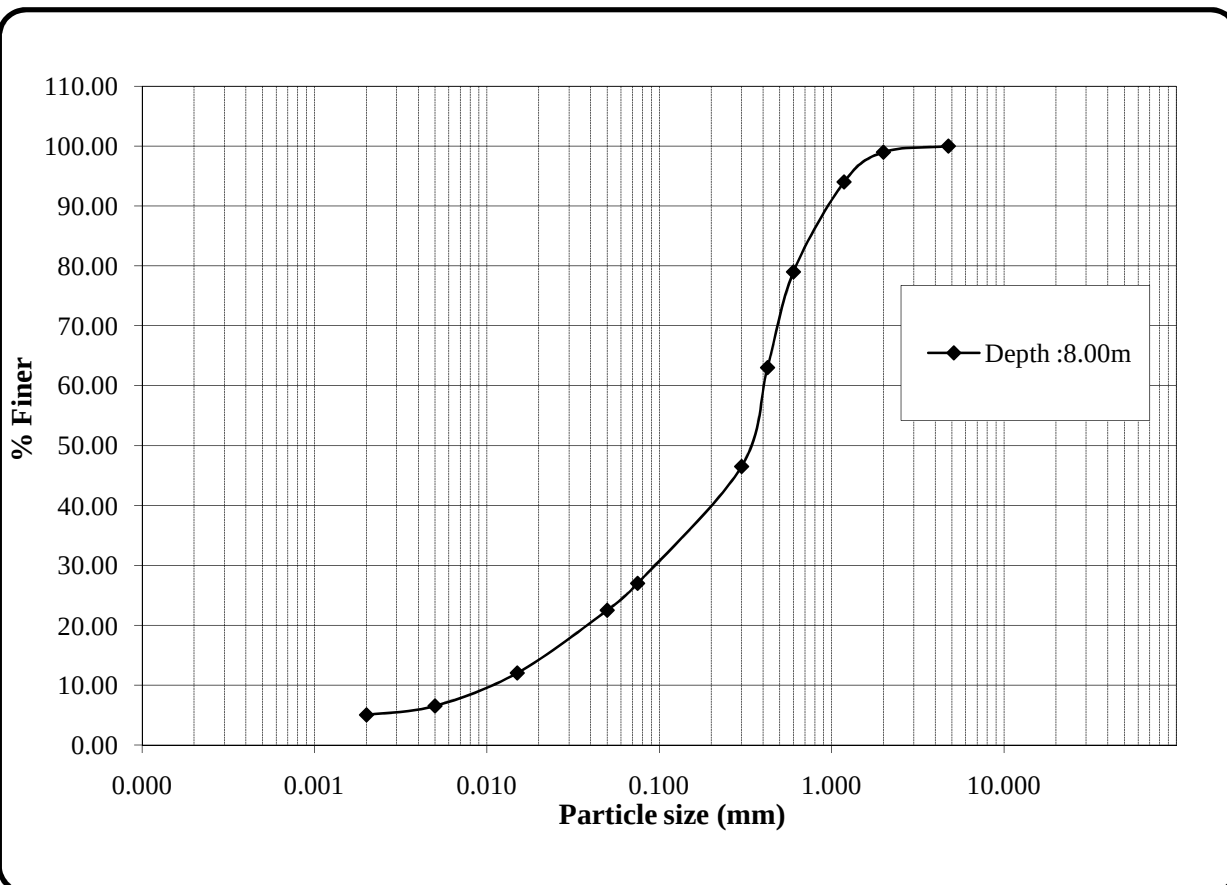
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

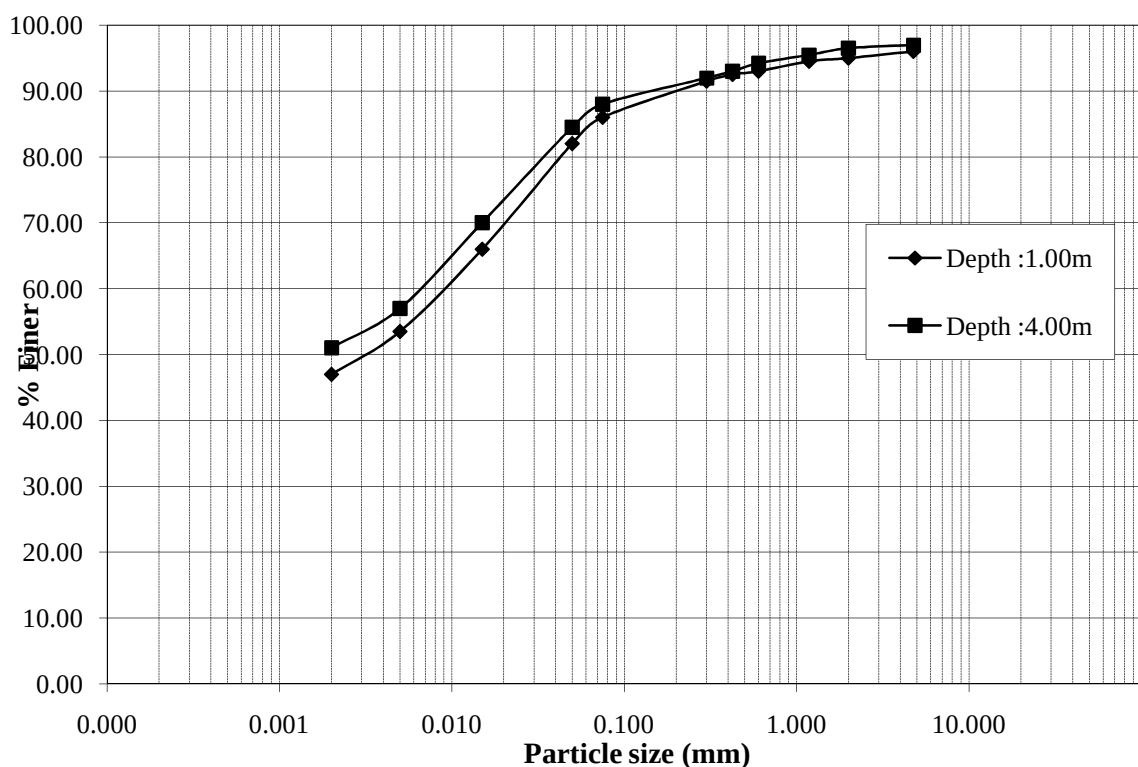
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-4



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-4, U4, 8.00m	5.00	22.00	73.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-5**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-5, U-1, 1.00m	47.00	39.00	10.00	4.00
BH-5, U-2, 4.00m	51.00	37.00	9.00	3.00

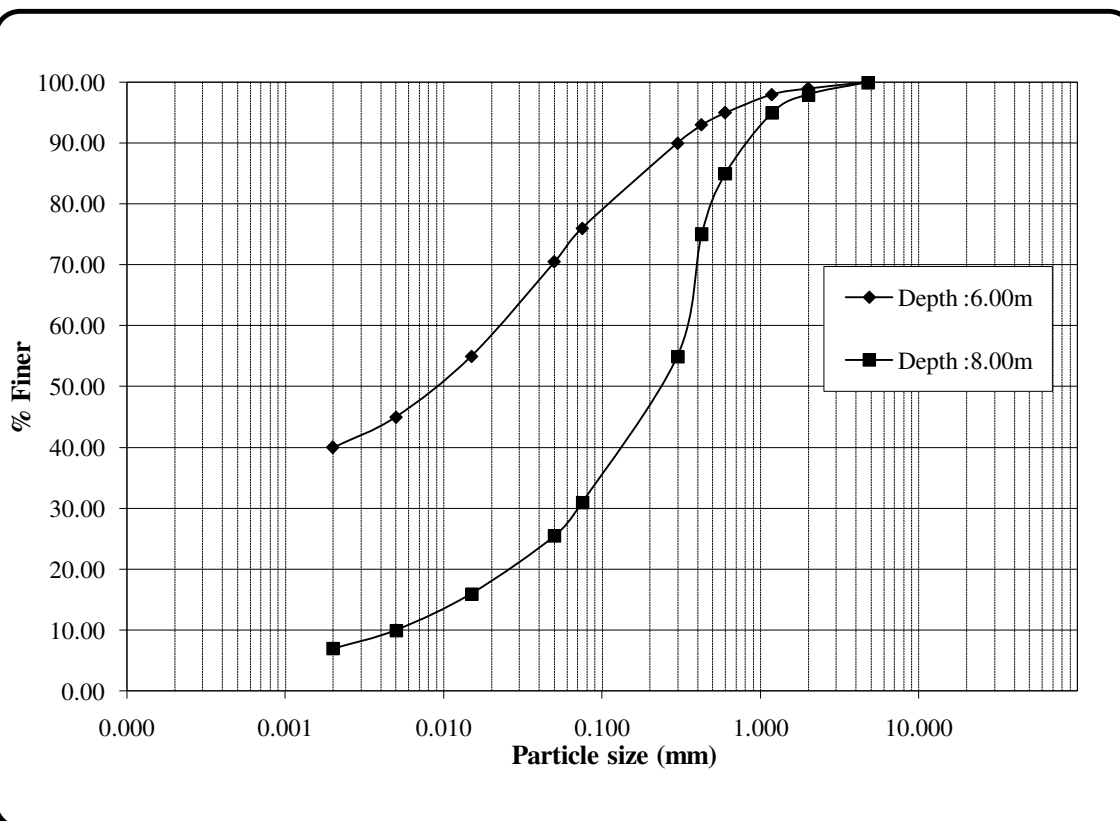
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-5



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-5, U-3, 6.00m	40.00	36.00	24.00	0.00
BH-5, U-4, 8.00m	7.00	24.00	69.00	0.00

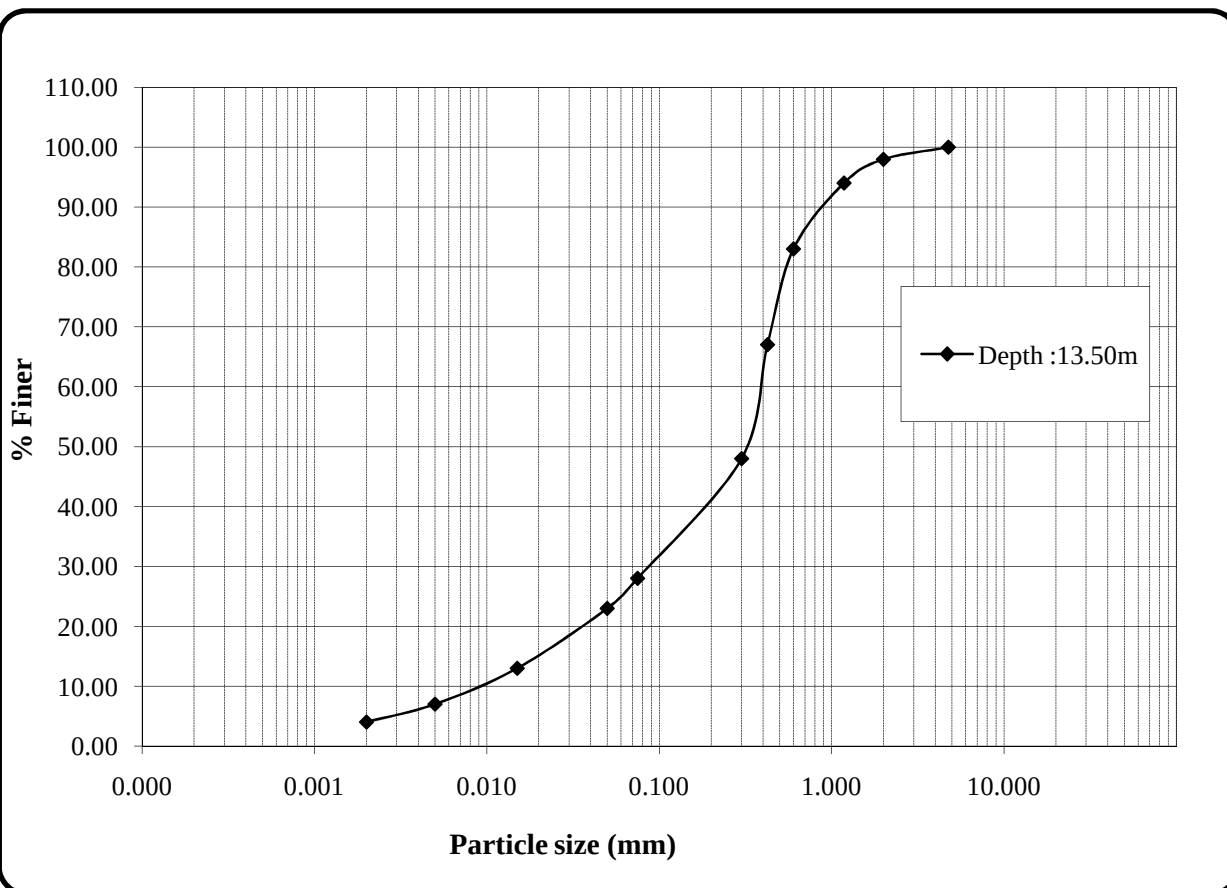
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

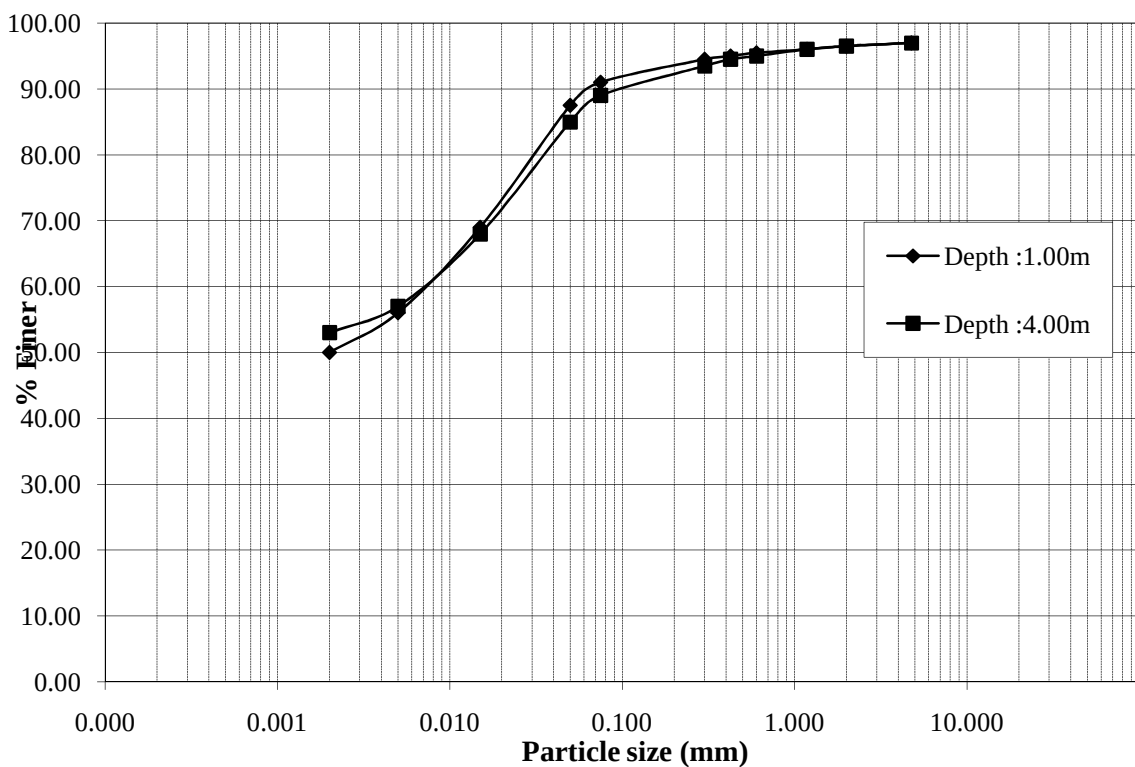
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia
Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200
MW Chapar Thermal Power Plant

Bore Hole No. BH-5



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-5, S7, 13.50m	4.00	24.00	72.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-6**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-6, U-1, 1.00m	50.00	41.00	6.00	3.00
BH-6, U-2, 4.00m	53.00	36.00	8.00	3.00

M/s. P.K.Dutta & Co.

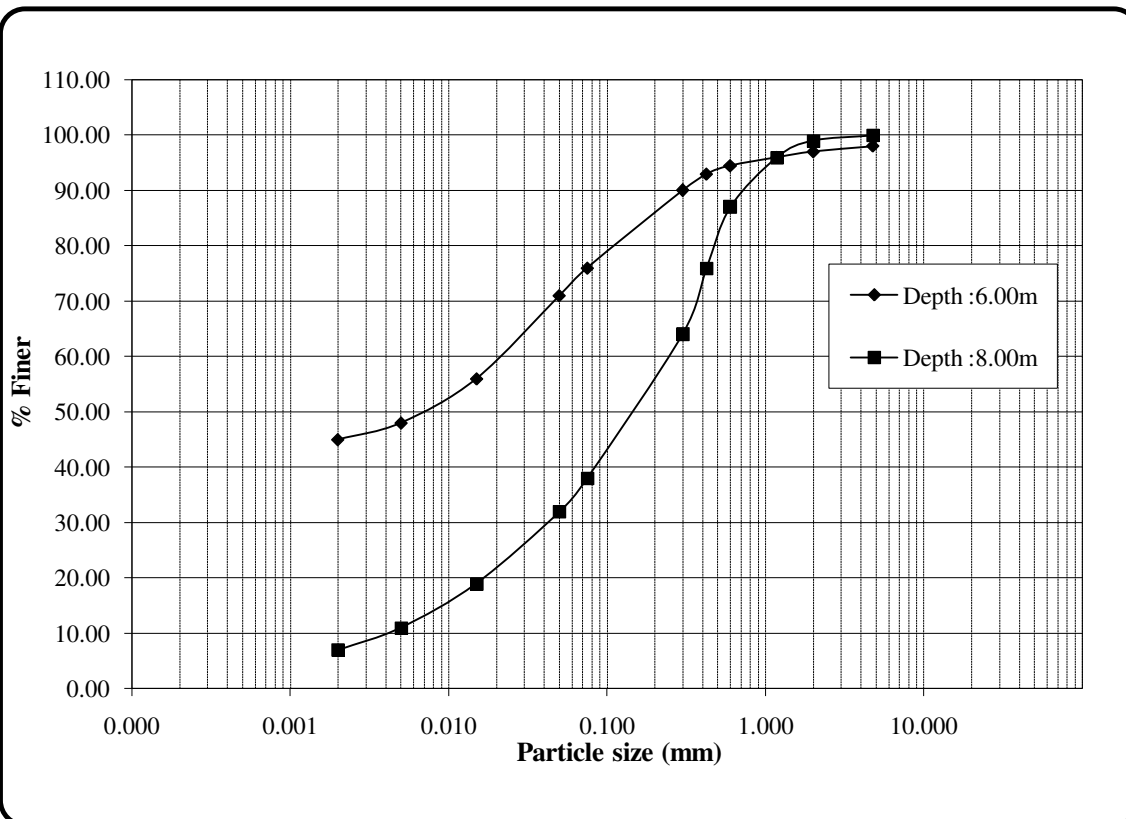
**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :-

Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-6



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-6, U-3, 6.00m	45.00	31.00	22.00	2.00
BH-6, U-4, 8.00m	7.00	31.00	62.00	0.00

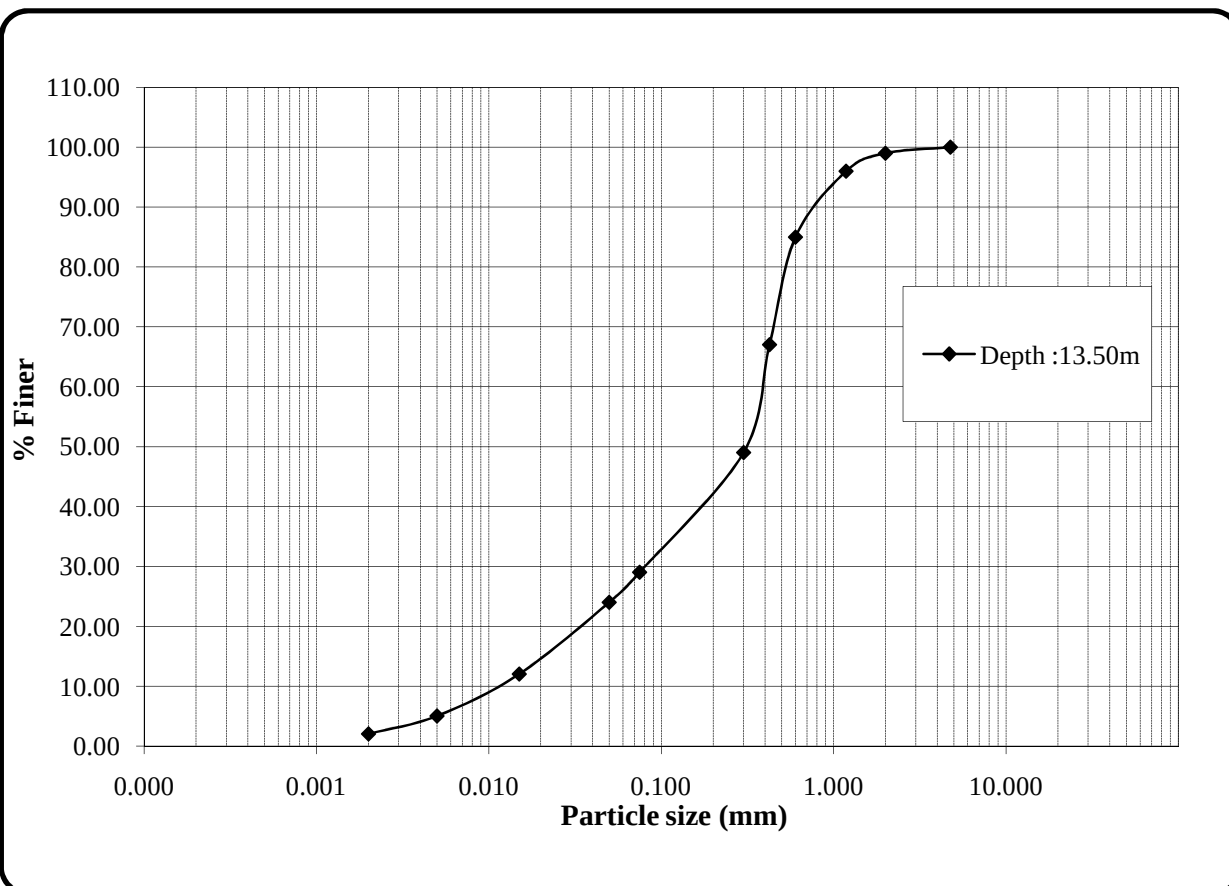
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

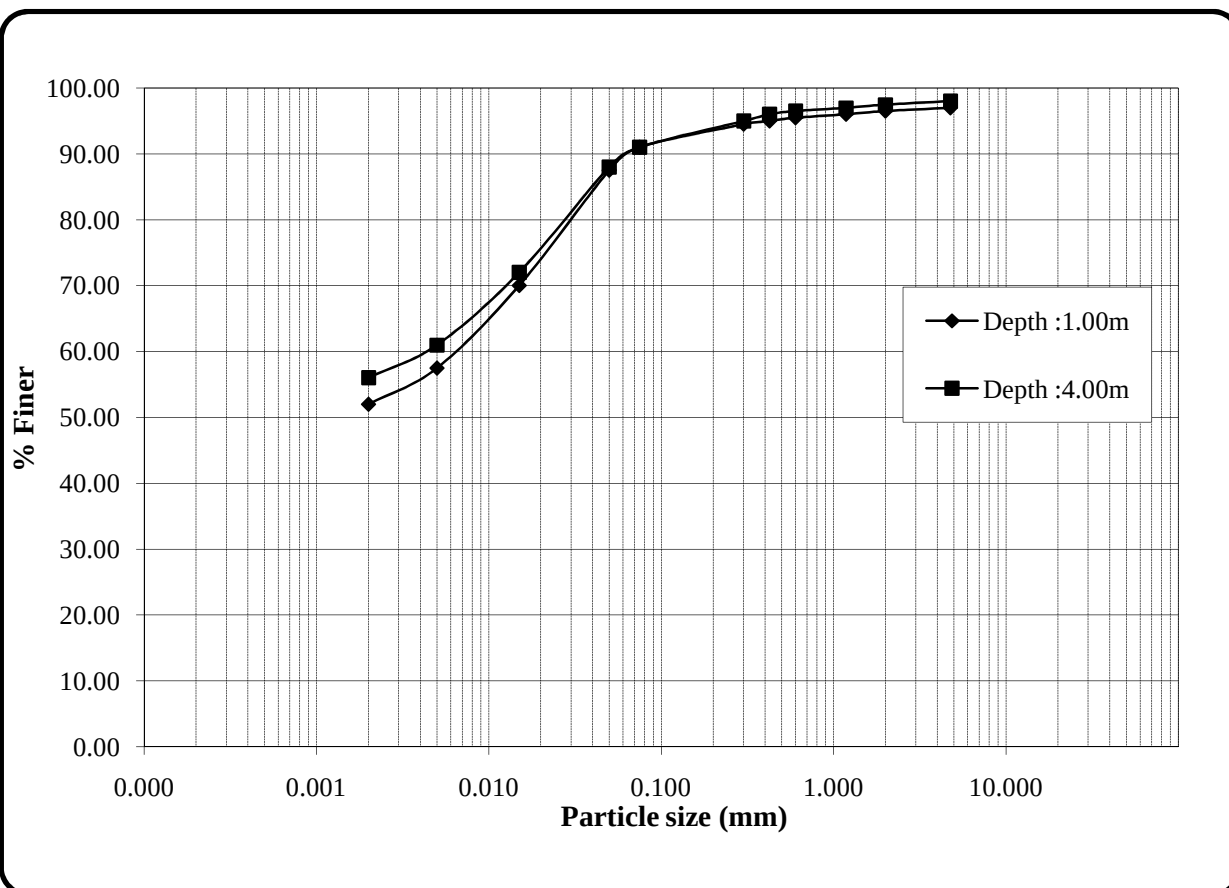
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-6



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-6, S7, 13.50m	2.00	27.00	71.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-7**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-7, U-1, 1.00m	52.00	39.00	6.00	3.00
BH-7, U-2, 4.00m	56.00	35.00	7.00	2.00

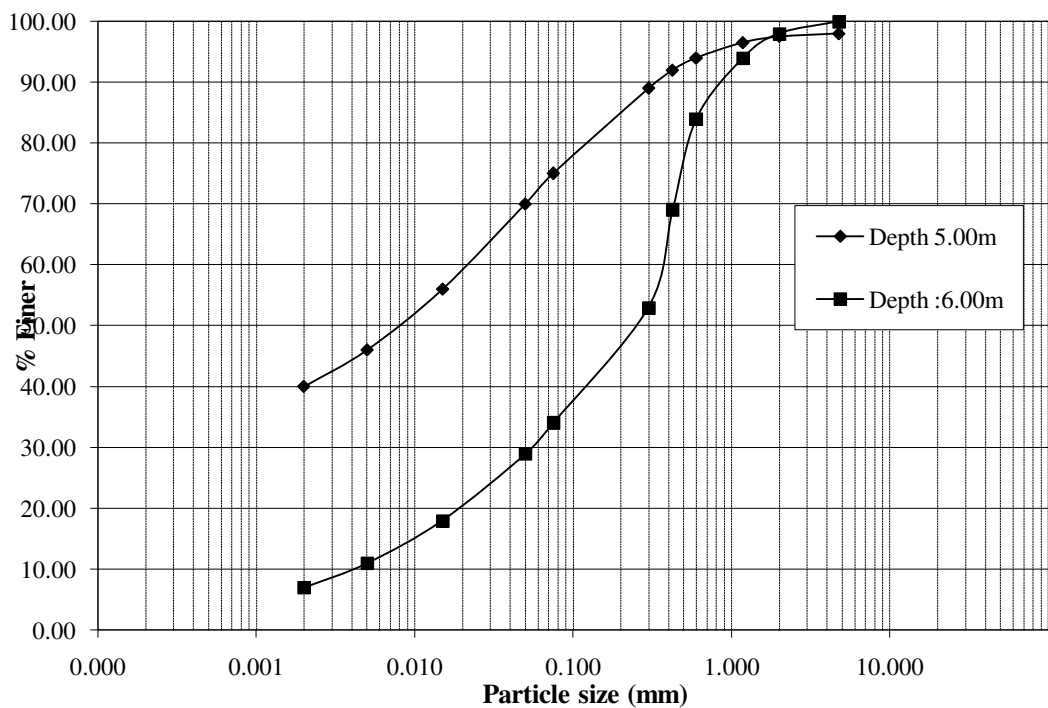
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-7



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-7, S-3, 5.00m	40.00	35.00	23.00	2.00
BH-7, U-3, 6.00m	7.00	27.00	66.00	0.00

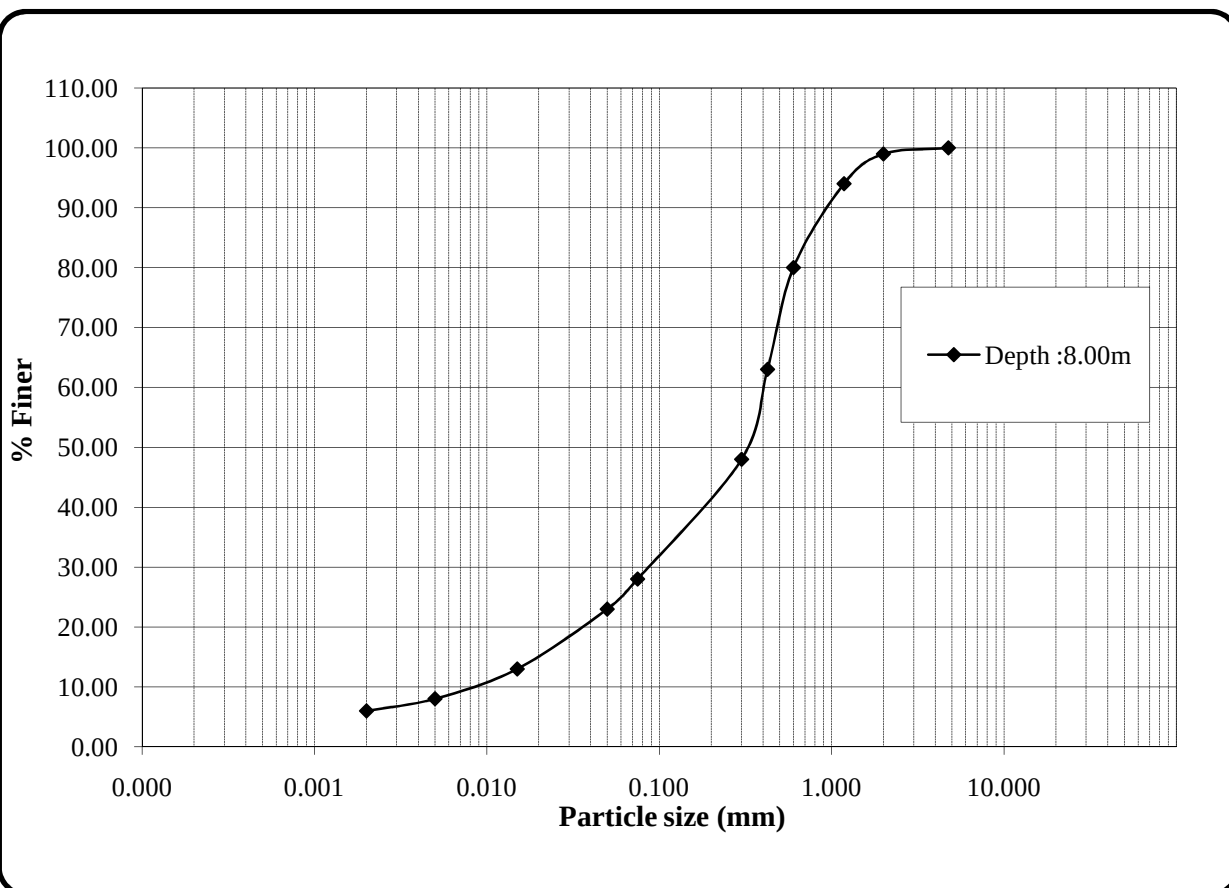
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

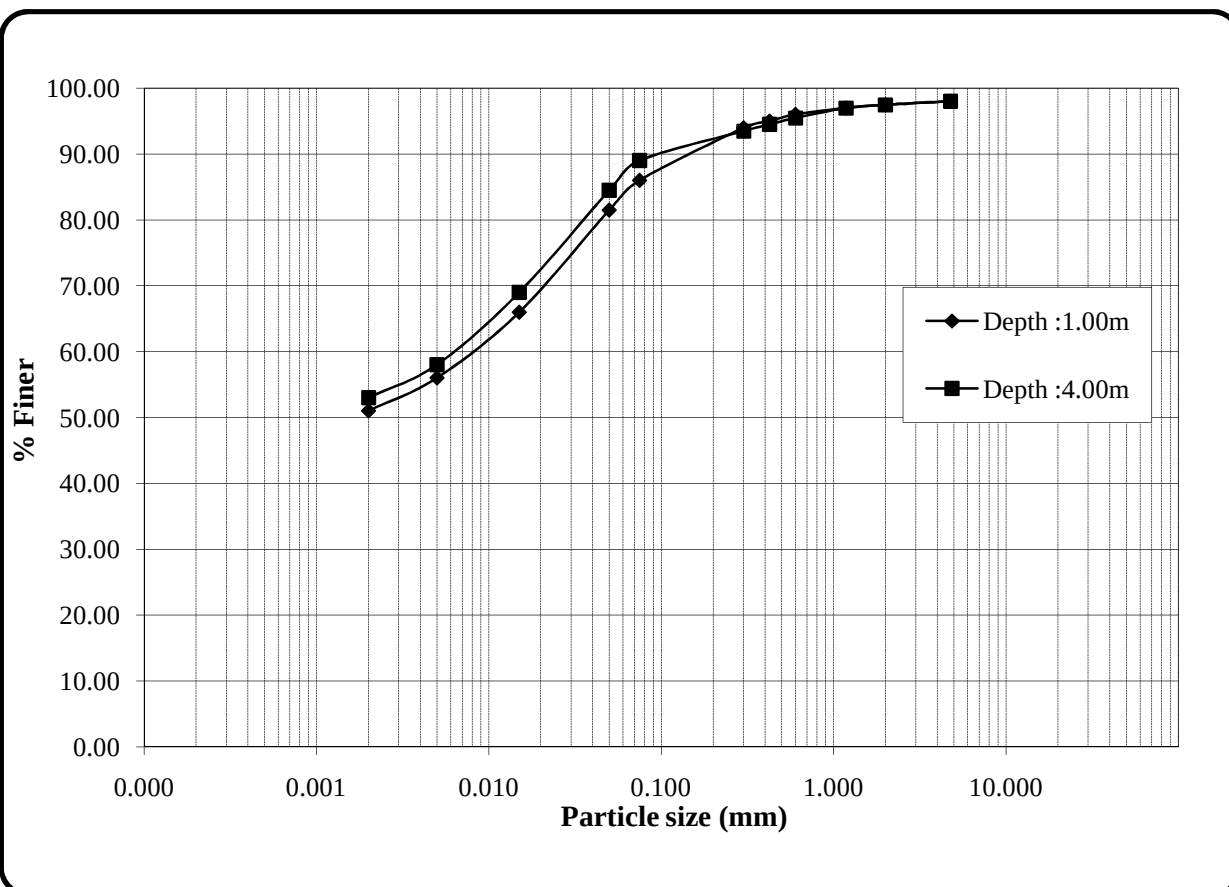
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-7



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-7, U4, 8.00m	6.00	22.00	72.00	0.00

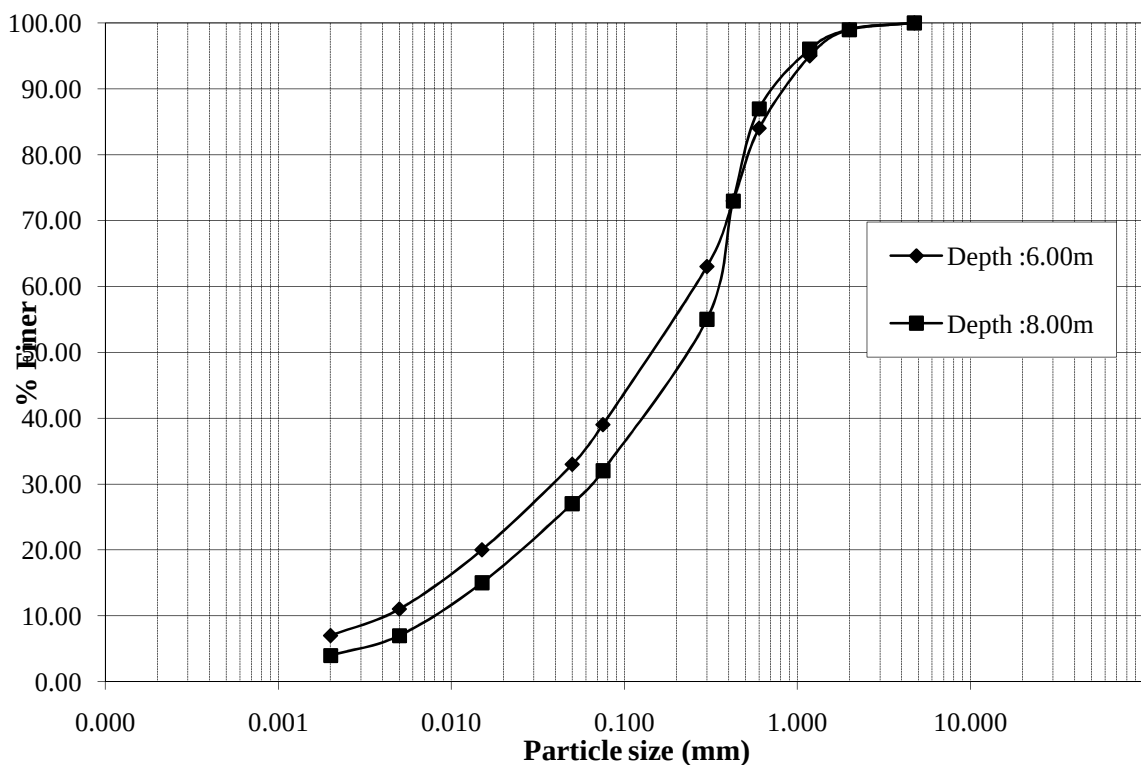
Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-8**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-8, U-1, 1.00m	51.00	35.00	12.00	2.00
BH-8, U-2, 4.00m	53.00	36.00	9.00	2.00

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-8



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-8, U-3, 6.00m	7.00	32.00	61.00	0.00
BH-8, U-4, 8.00m	4.00	28.00	68.00	0.00

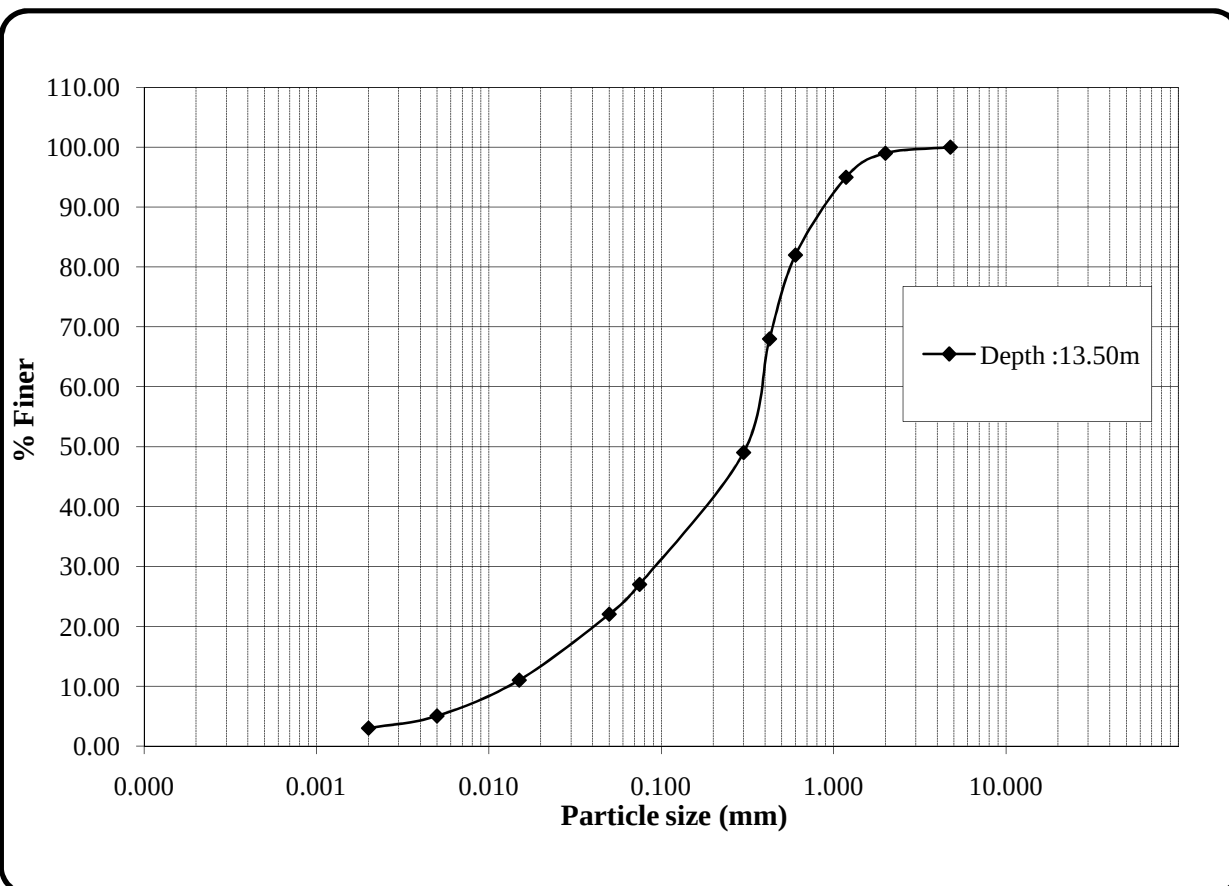
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

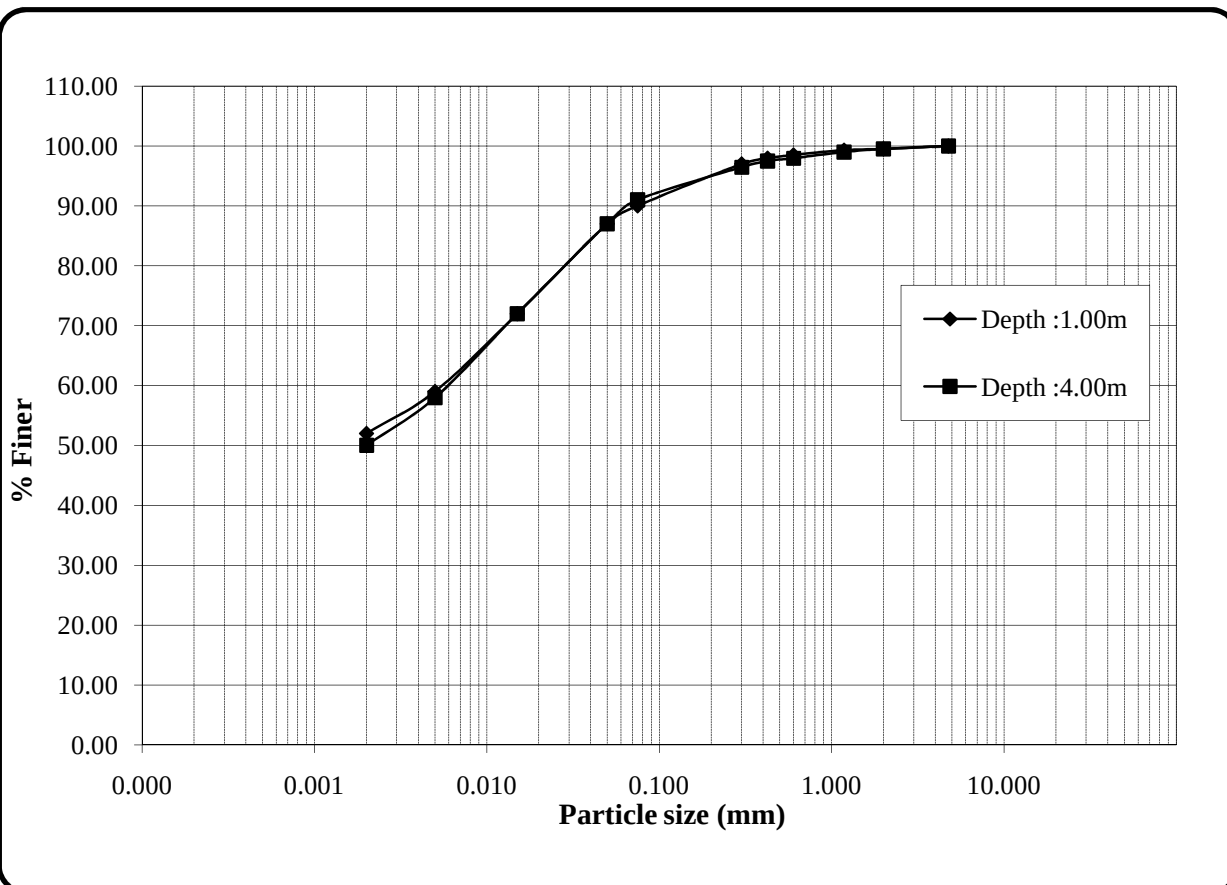
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-8



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-8, S7, 13.50m	3.00	24.00	73.00	0.00

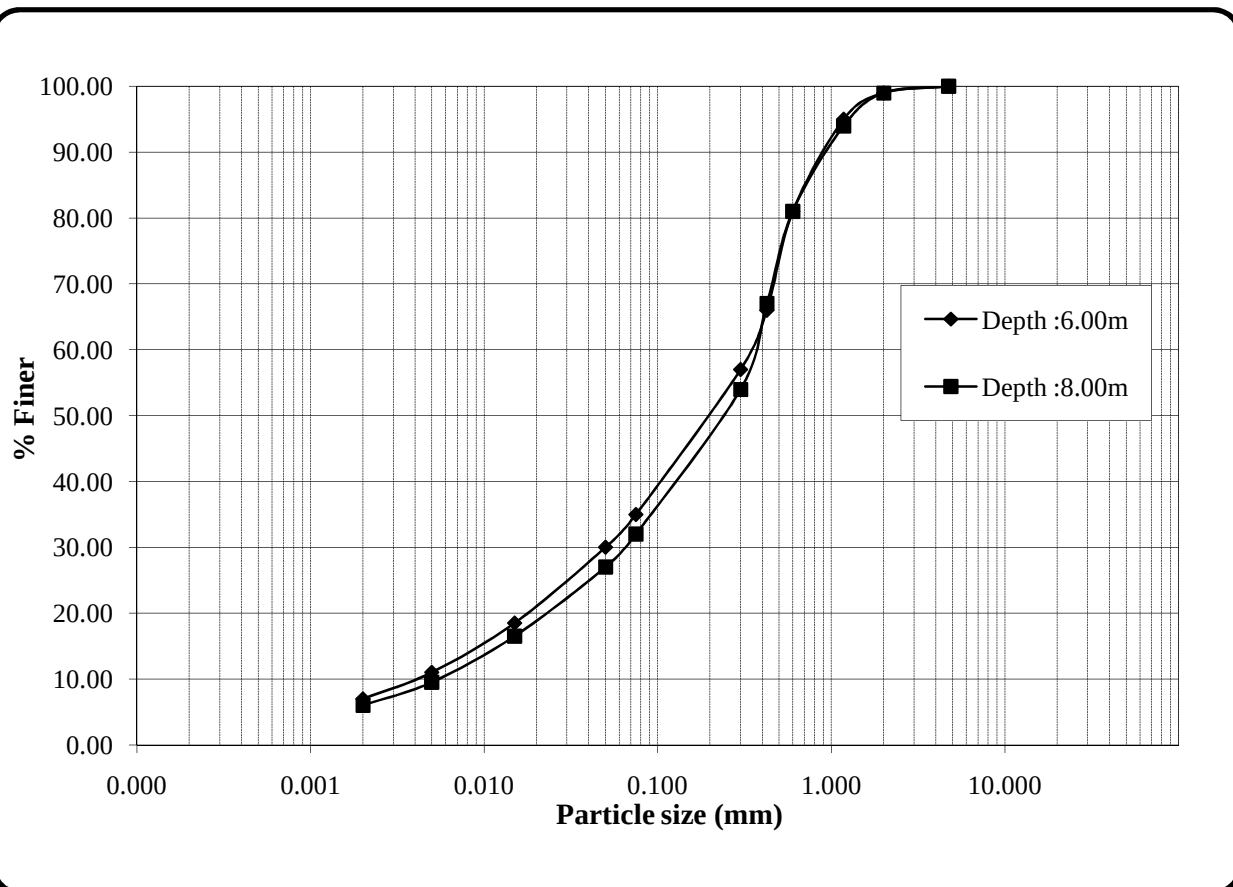
Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-9**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-9, U-1, 1.00m	52.00	38.00	10.00	0.00
BH-9, U-2, 4.00m	50.00	41.00	9.00	0.00

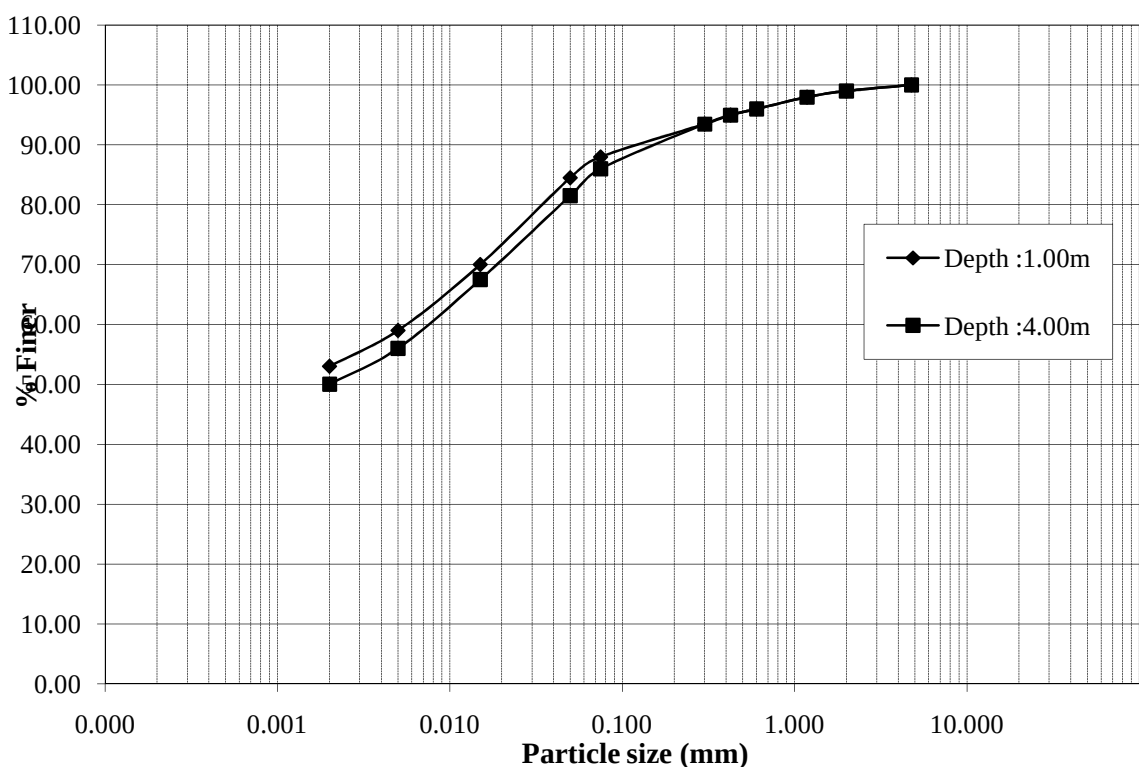
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

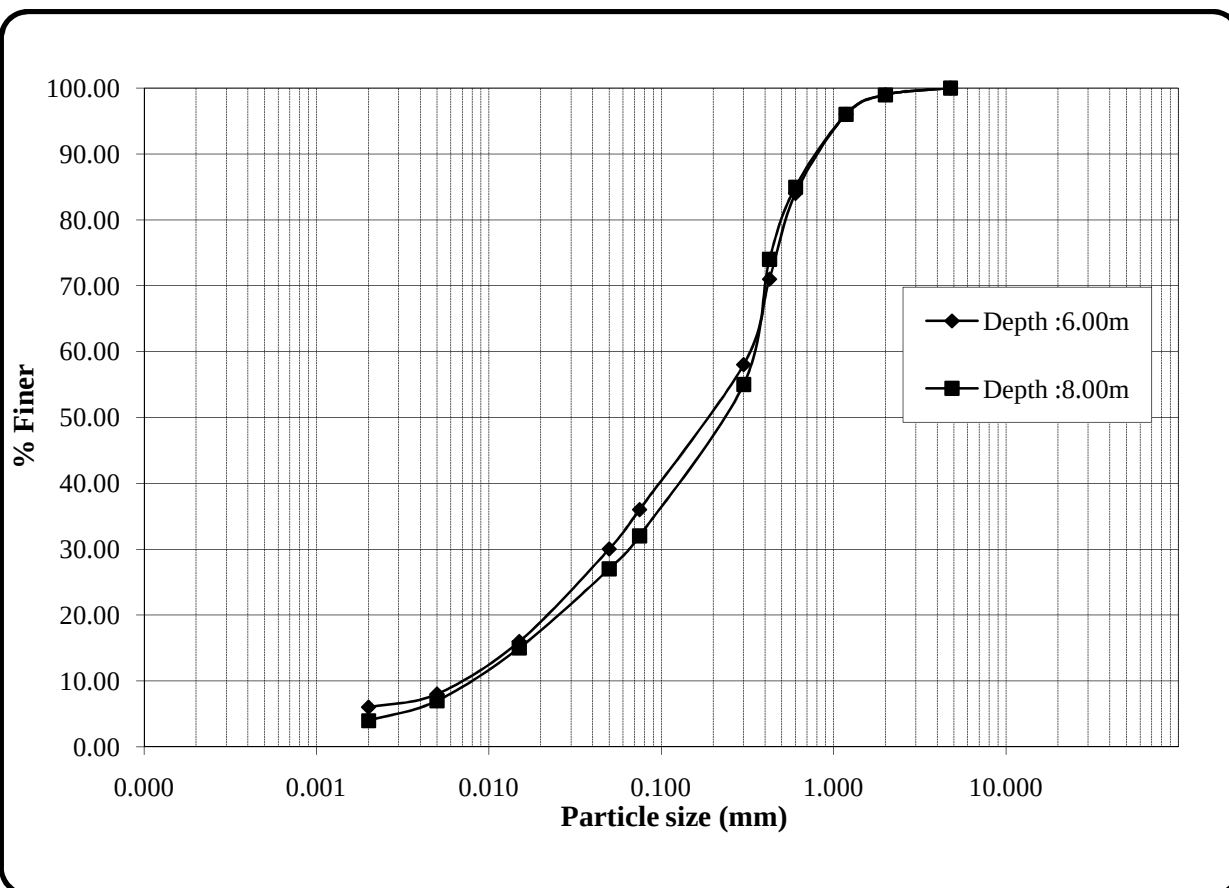
Bore Hole No. BH-9



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-9, U-3, 6.00m	7.00	28.00	65.00	0.00
BH-9, U-4, 8.00m	6.00	26.00	68.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-10**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-10, U-1, 1.00m	53.00	35.00	12.00	0.00
BH-10, U-2, 4.00m	50.00	36.00	14.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-10**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-10, U-3, 6.00m	6.00	30.00	64.00	0.00
BH-10, U-4, 8.00m	4.00	28.00	68.00	0.00

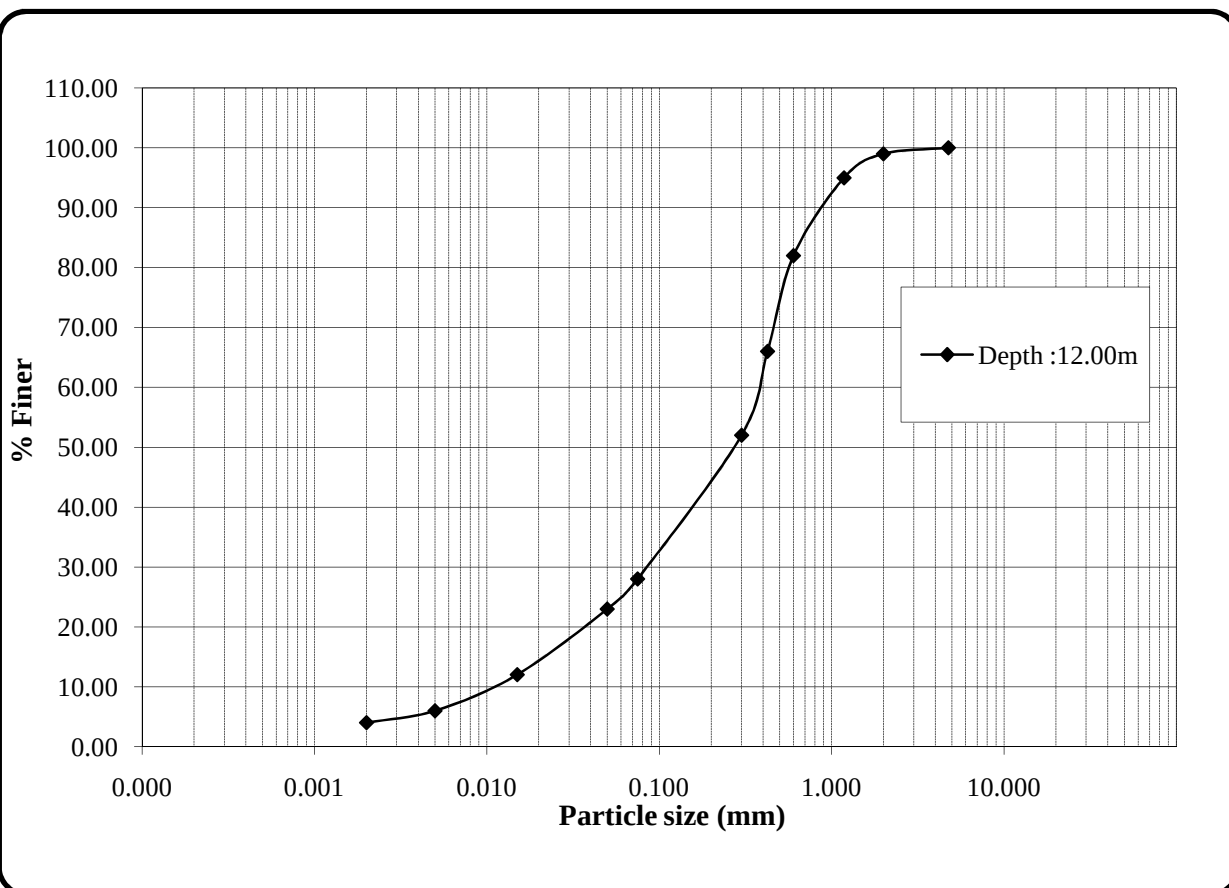
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

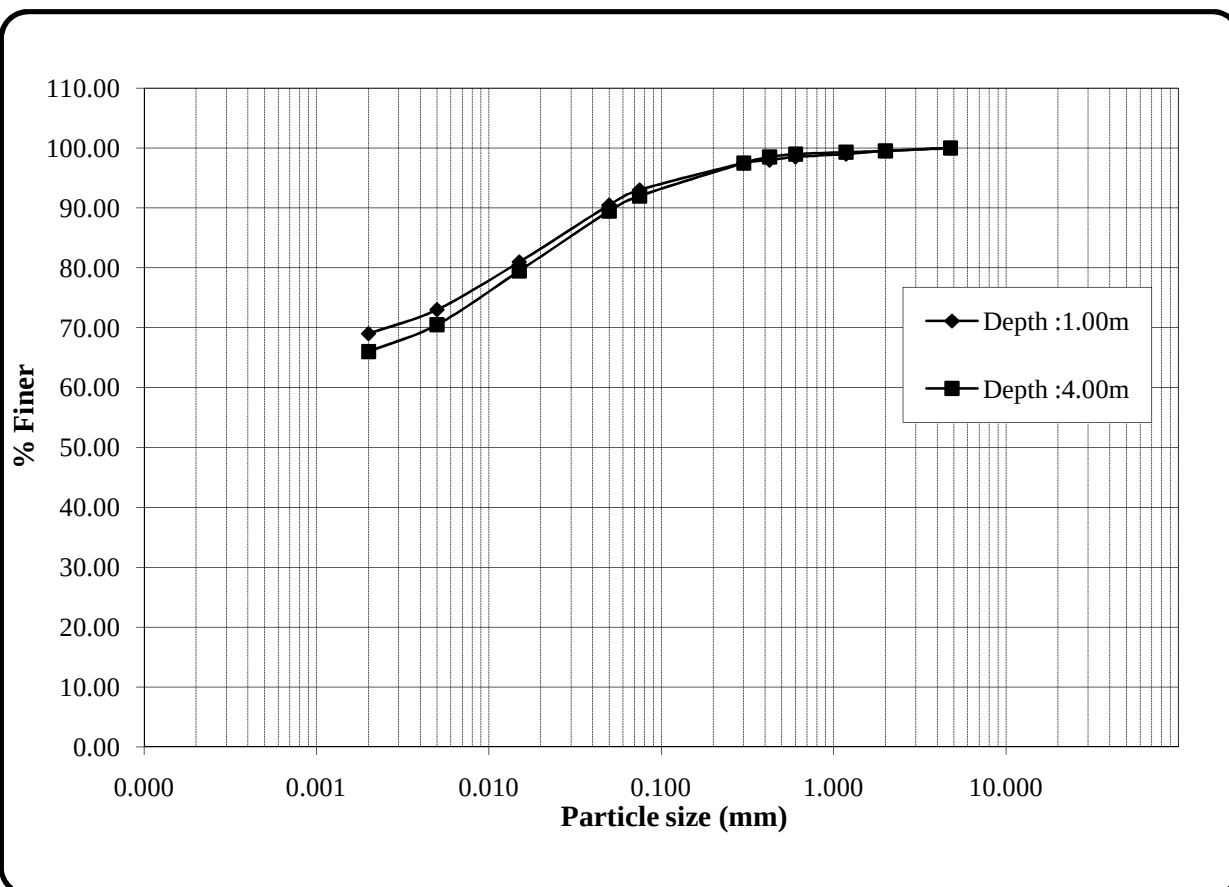
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

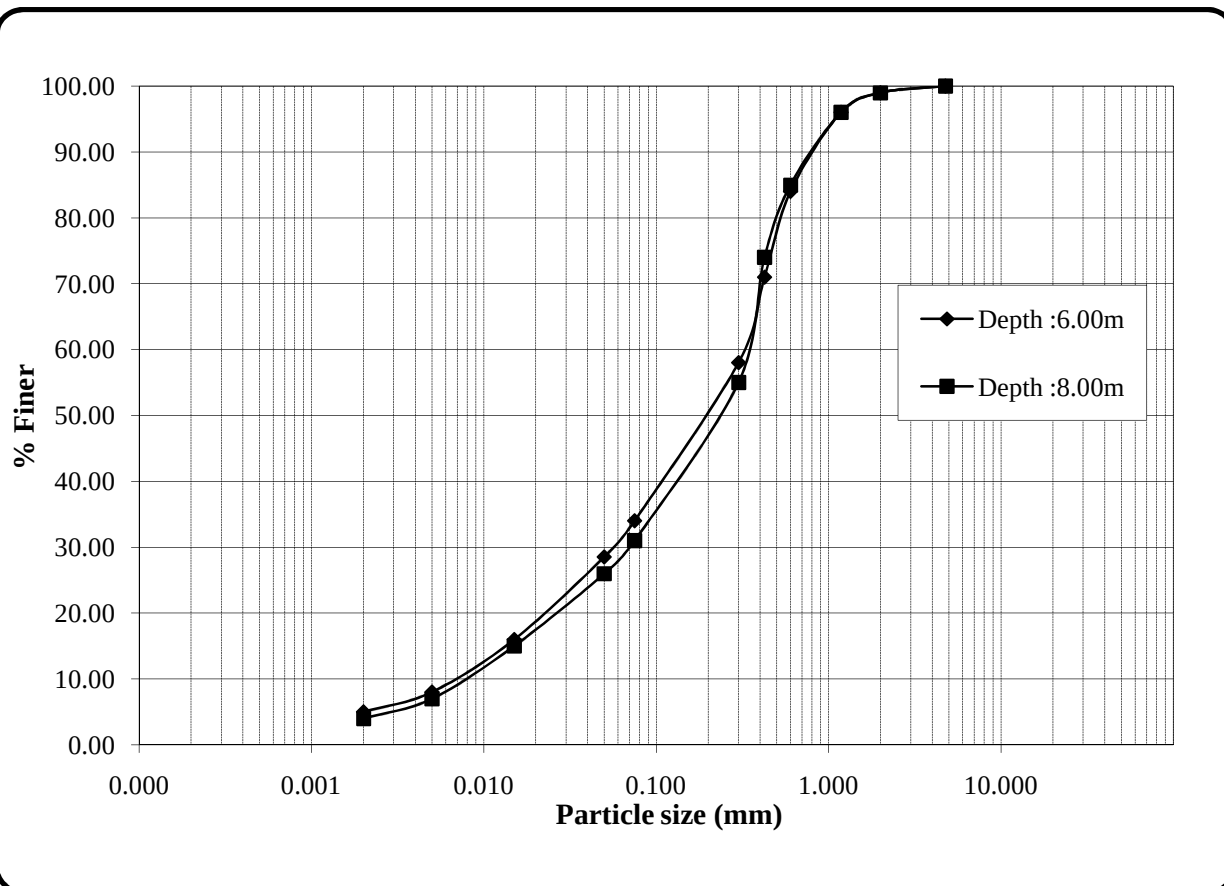
Bore Hole No. BH-10



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-10, S-6, 12.00m	4.00	24.00	72.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-11**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-11, U-1, 1.00m	69.00	24.00	7.00	0.00
BH-11, U-2, 4.00m	66.00	26.00	8.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-11**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-11, U-3, 6.00m	5.00	29.00	66.00	0.00
BH-11, U-4, 8.00m	4.00	27.00	69.00	0.00

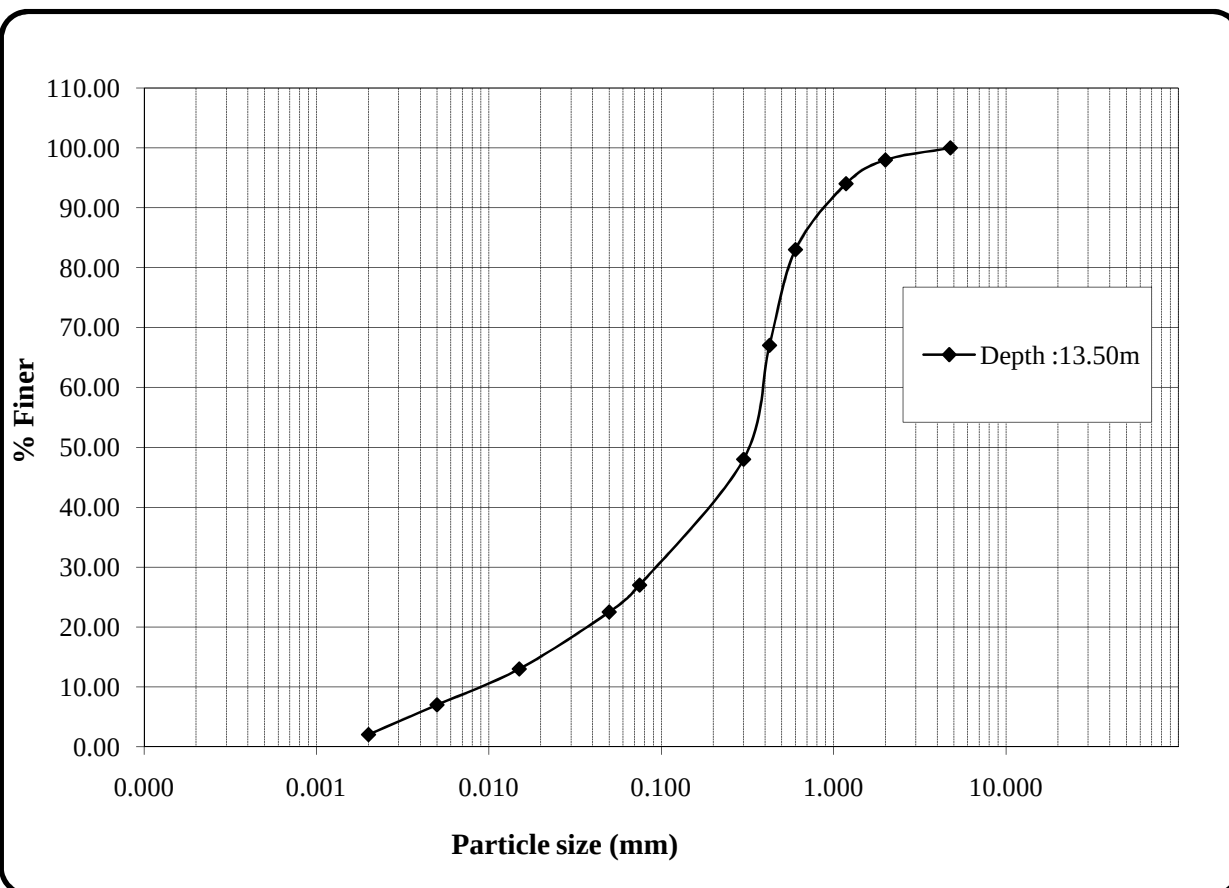
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

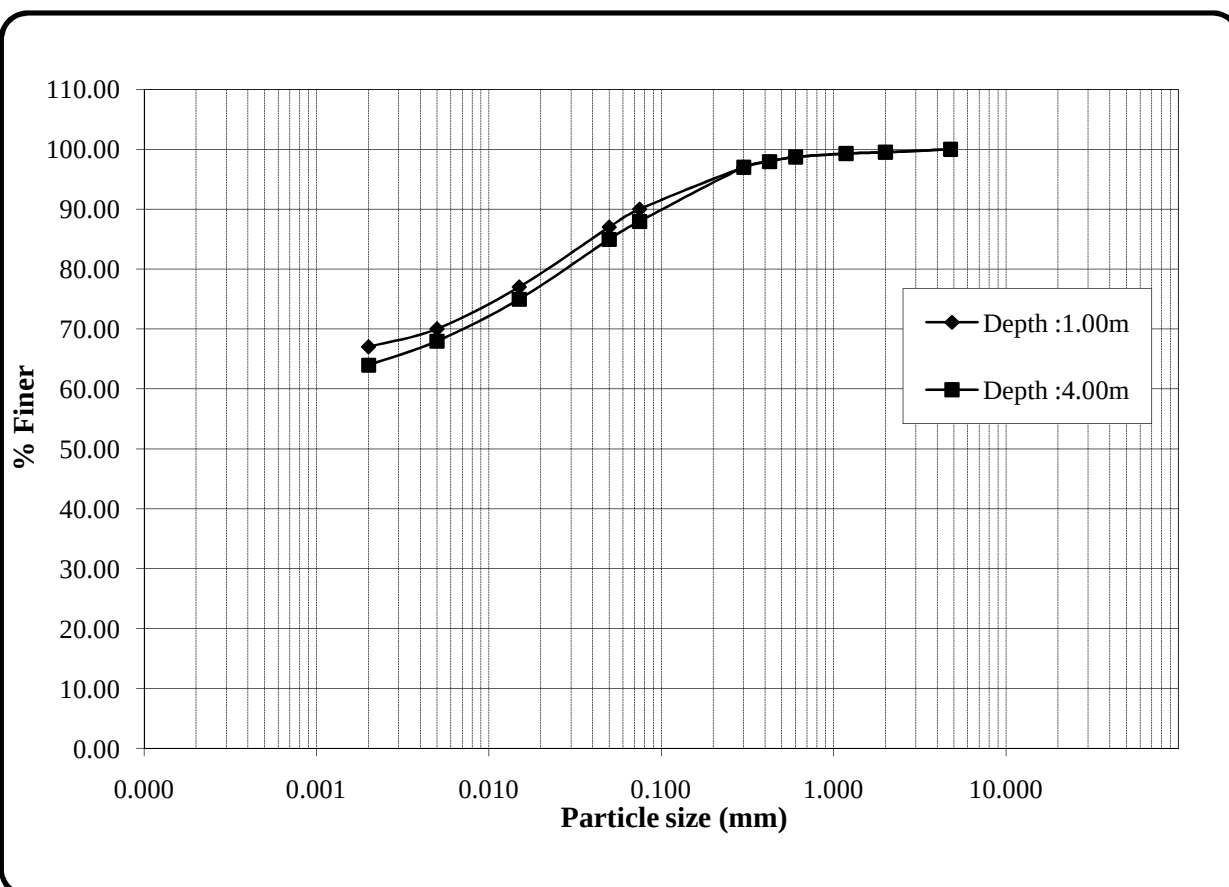
Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-11



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-11, S7, 13.50m	2.00	25.00	73.00	0.00

Client :- Assam Electricity Grid Corporation Limited**Project :-** Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant**Bore Hole No. BH-12**

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-12, U-1, 1.00m	67.00	23.00	10.00	0.00
BH-12, U-2, 4.00m	64.00	24.00	12.00	0.00

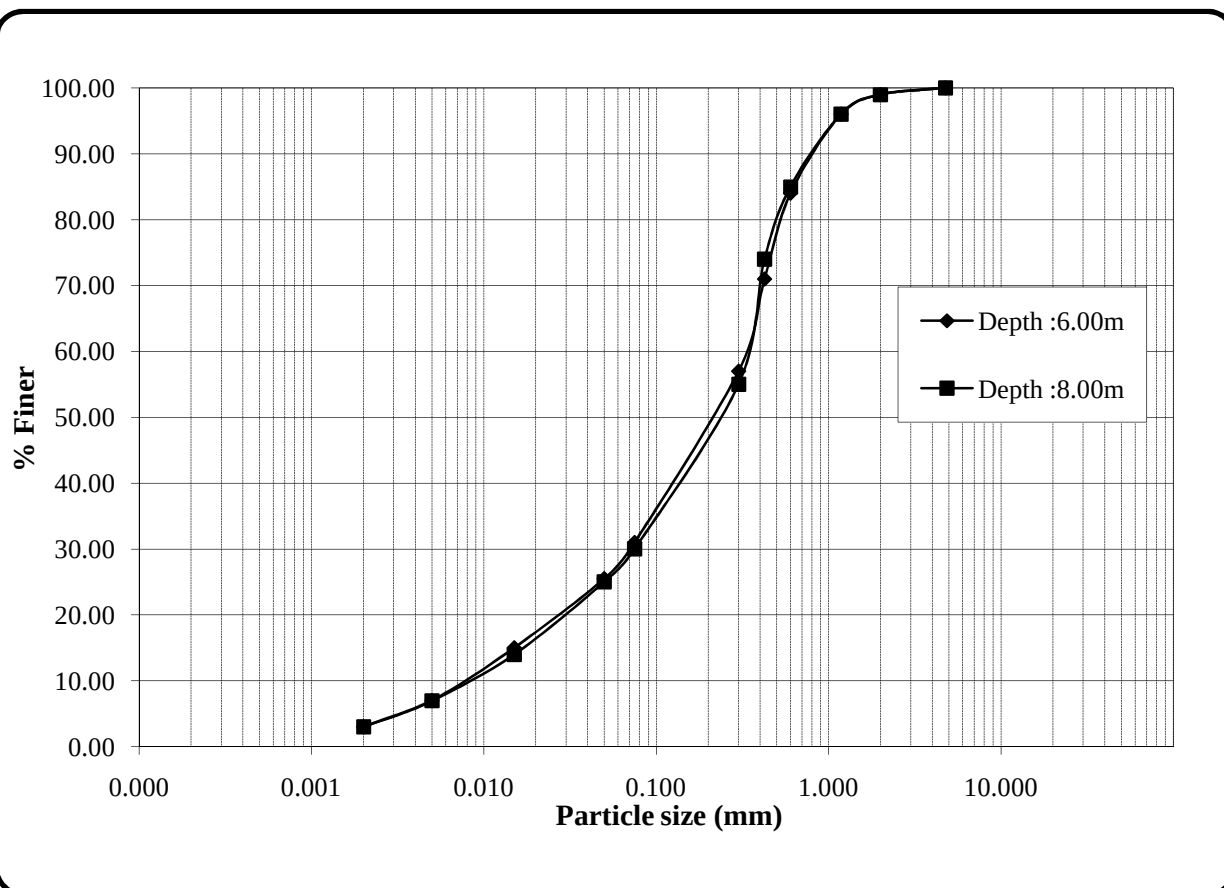
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-12



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-12, U-3, 6.00m	3.00	28.00	69.00	0.00
BH-12, U-4, 8.00m	3.00	27.00	70.00	0.00

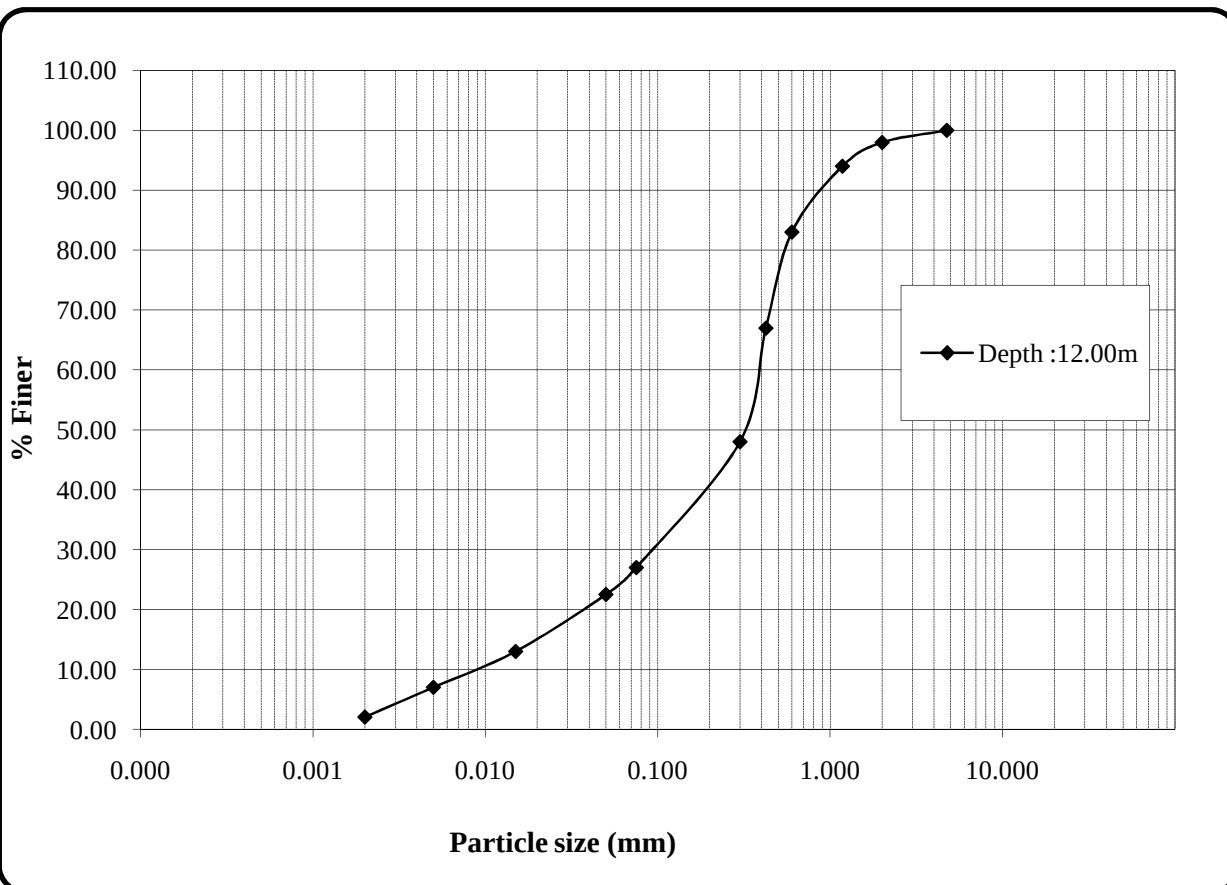
M/s. P.K.Dutta & Co.

**GRAIN SIZE DISTRIBUTION
CURVE**

Client :- Assam Electricity Grid Corporation Limited

Project :- Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant

Bore Hole No. BH-12

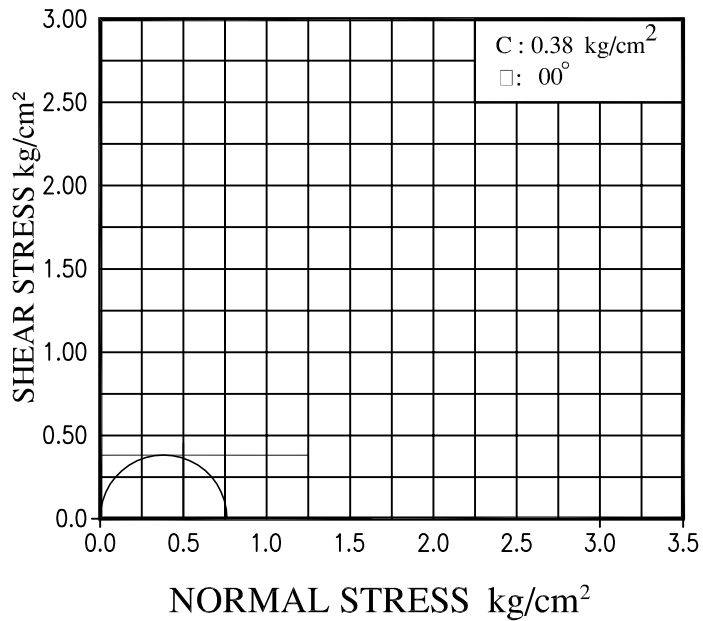
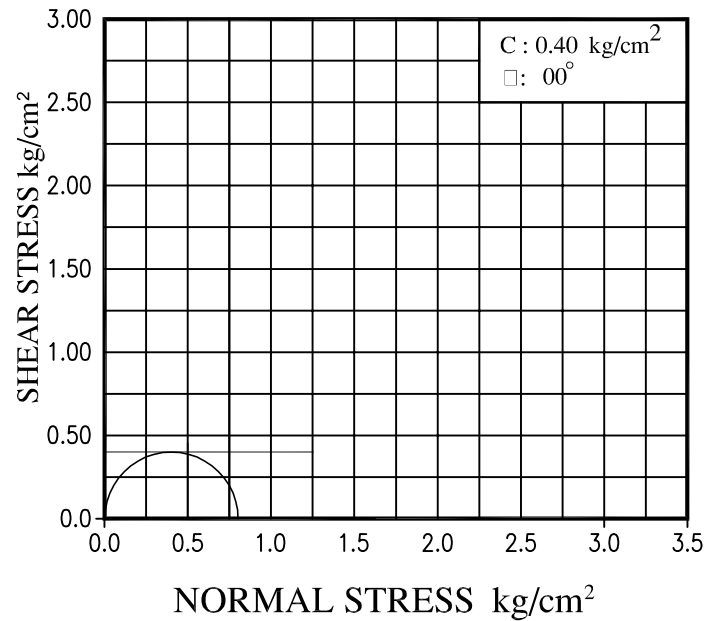
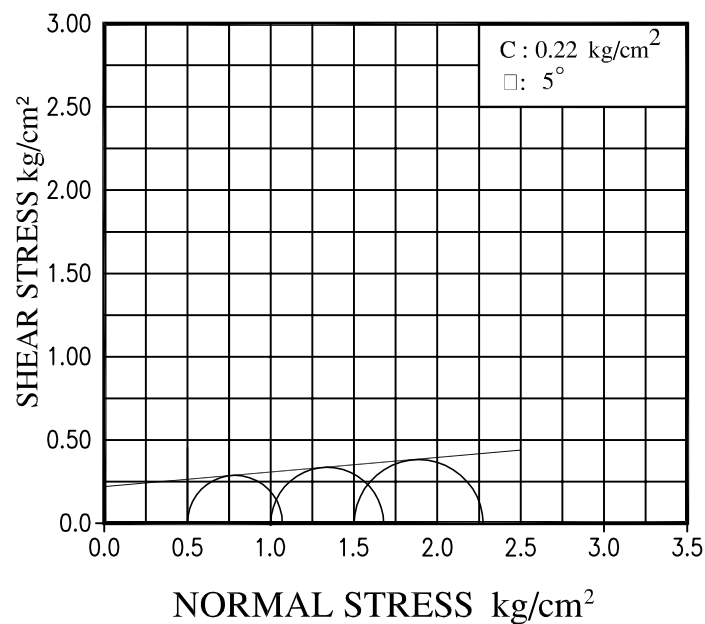


Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
BH-12, S6, 12.00m	2.00	25.00	73.00	0.00

SHEAR TEST CURVES

Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-1
DEPTH :- 1.00 mBH-1
DEPTH :- 4.00 mBH-1
DEPTH :- 6.00 m

M/s P.K.Dutta & Co.

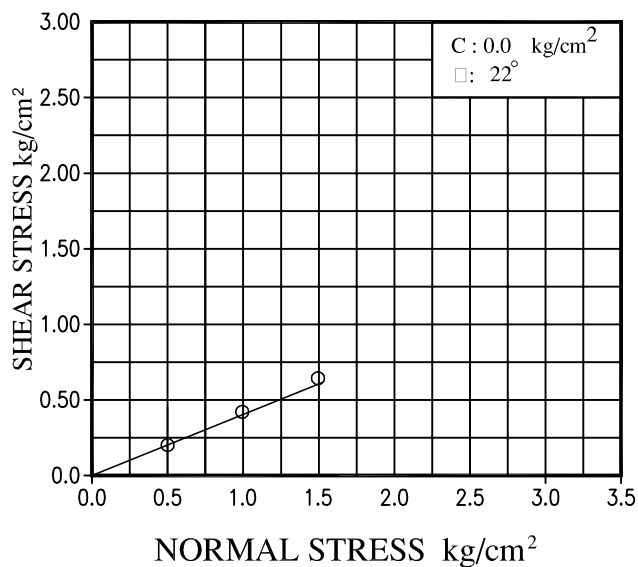
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

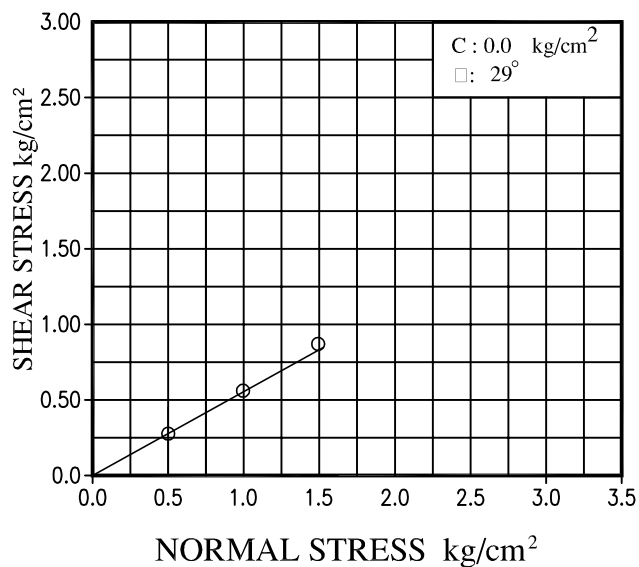
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-1
DEPTH :- 8.00 m

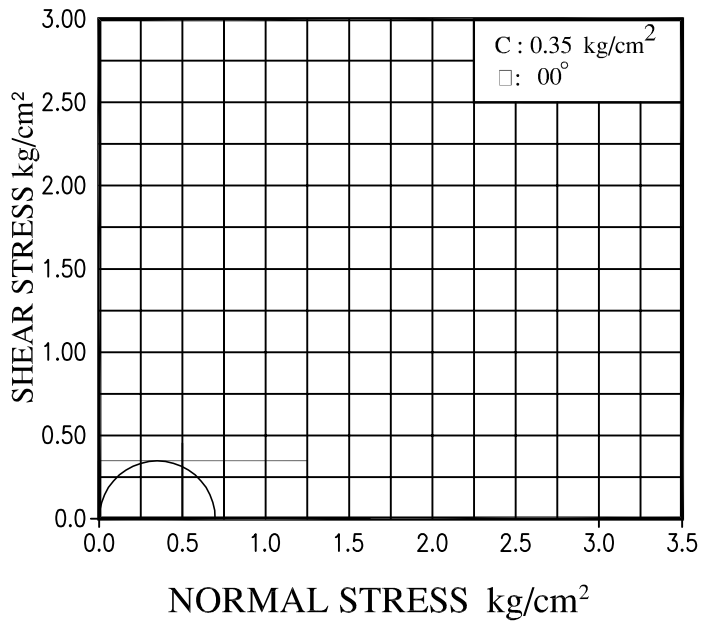
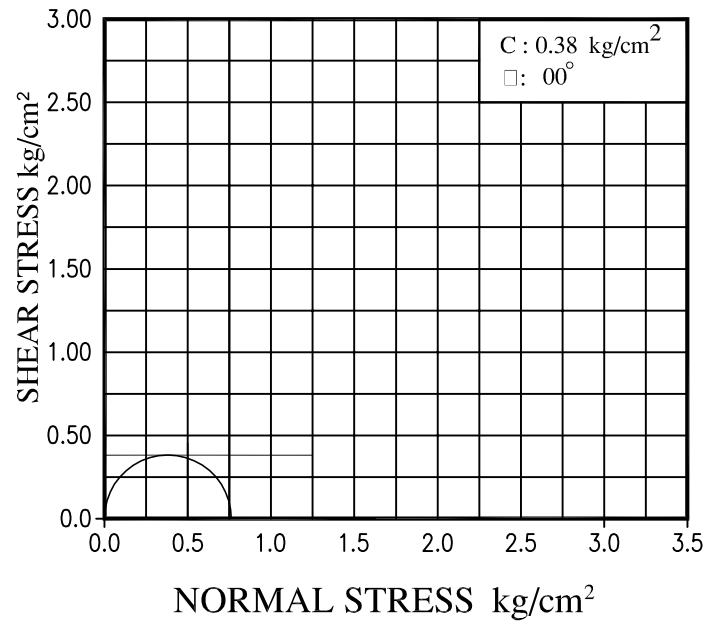
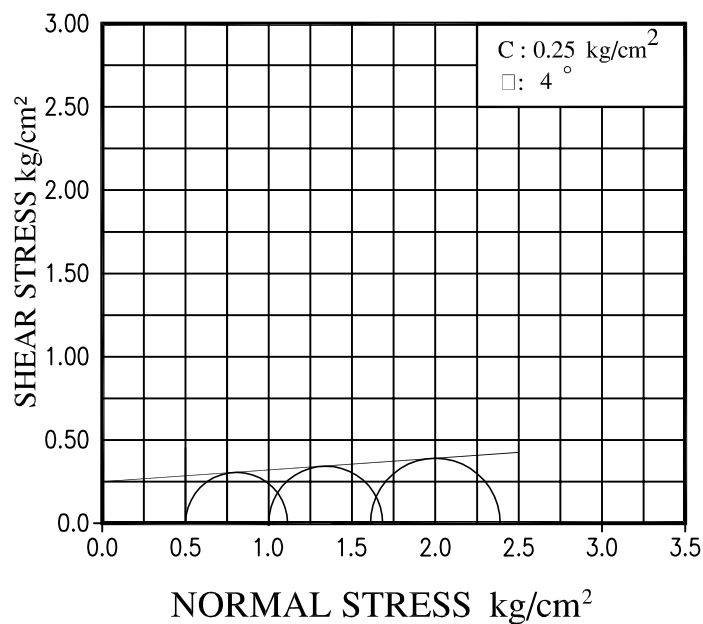


BH-1
DEPTH :- 13.50 m



Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-2
DEPTH :- 1.00 mBH-2
DEPTH :- 4.00 mBH-2
DEPTH :- 6.00 m

M/s P.K.Dutta & Co.

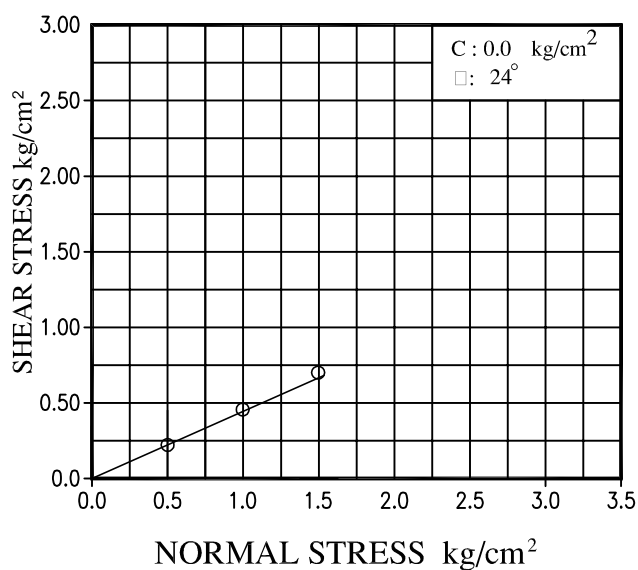
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

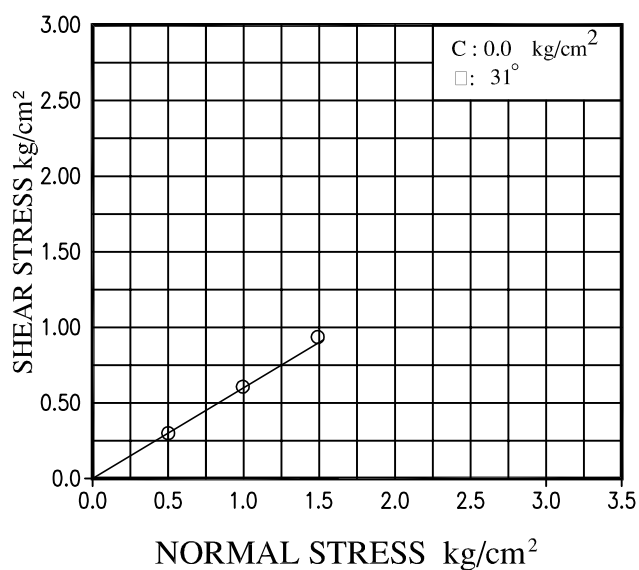
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-2
DEPTH :- 8.00 m

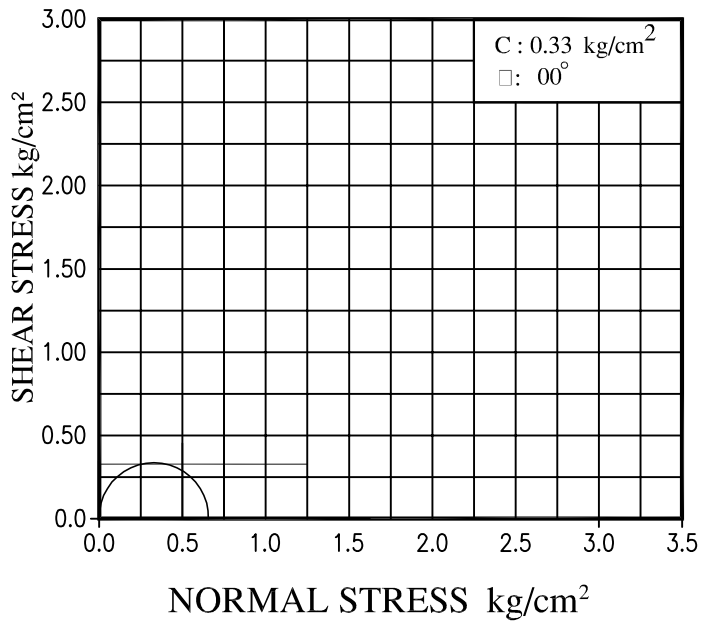
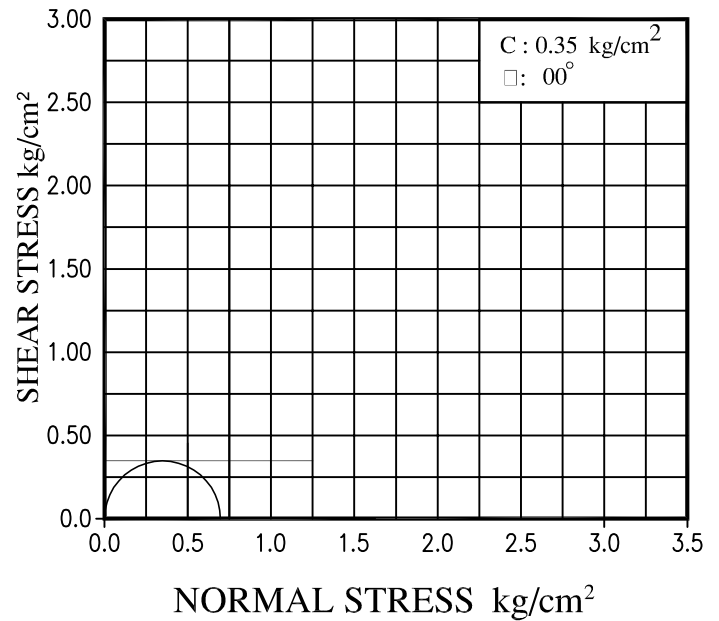
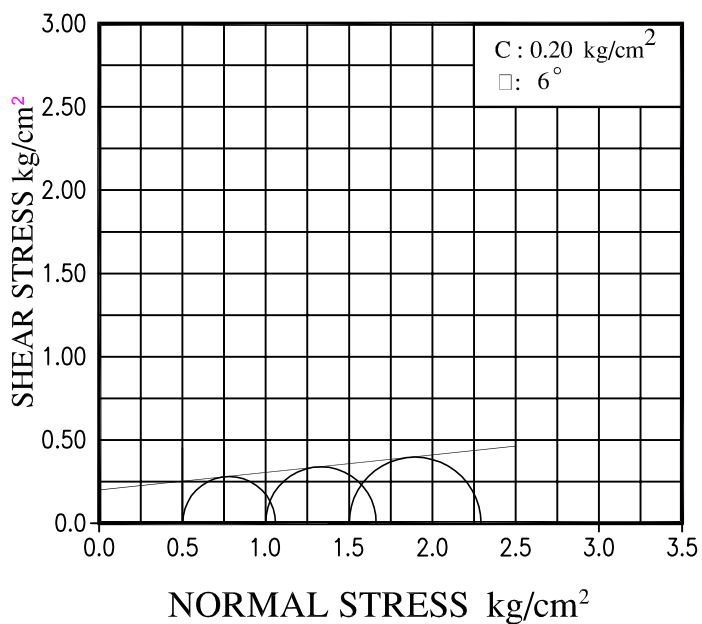
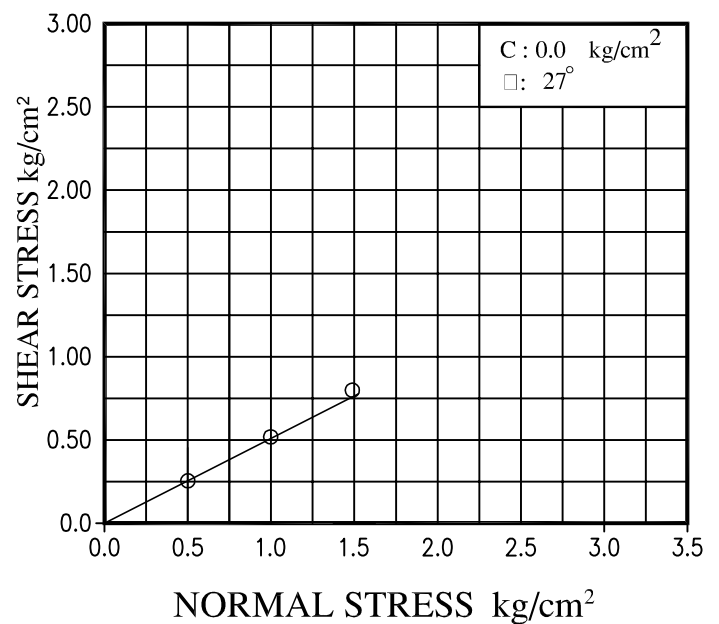


BH-2
DEPTH :- 13.50 m



Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-3
DEPTH :- 1.00 mBH-3
DEPTH :- 4.00 mBH-3
DEPTH :- 6.00 mBH-3
DEPTH :- 8.00 m

M/s P.K.Dutta & Co.

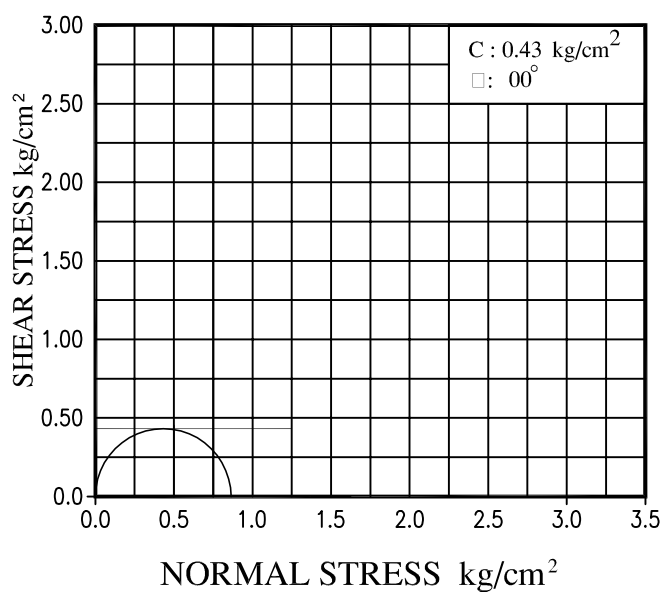
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

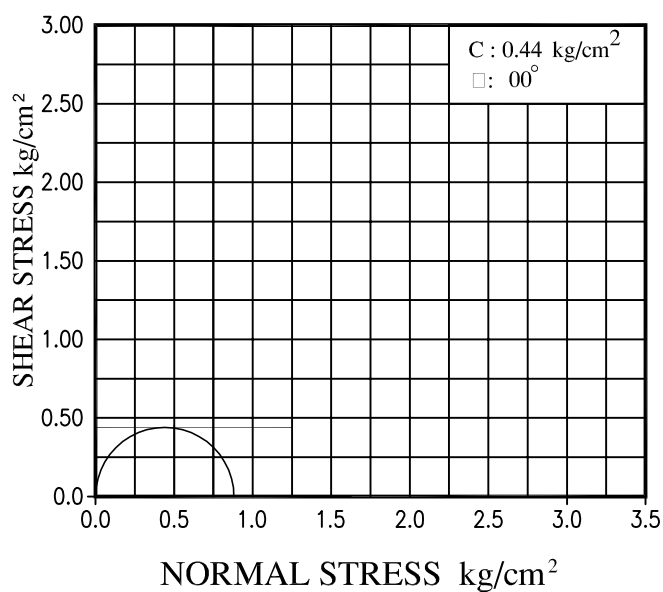
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

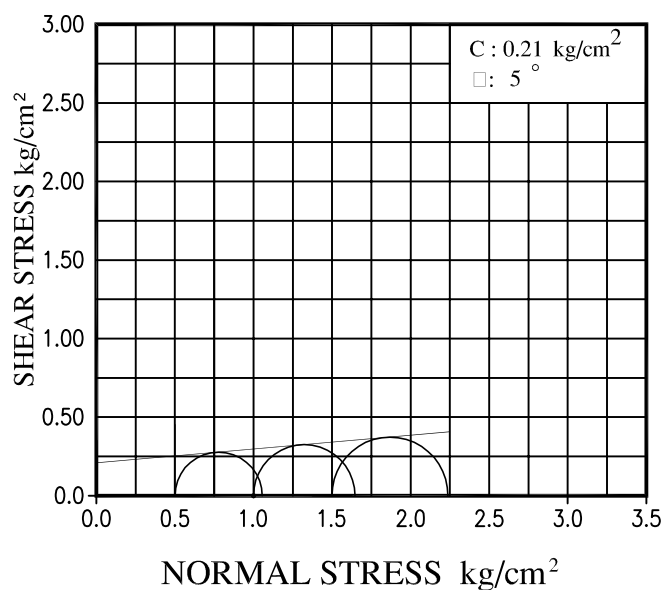
BH-4
DEPTH :- 1.00 m



BH-4
DEPTH :- 4.00 m



BH-4
DEPTH :- 5.00 m



M/s P.K.Dutta & Co.

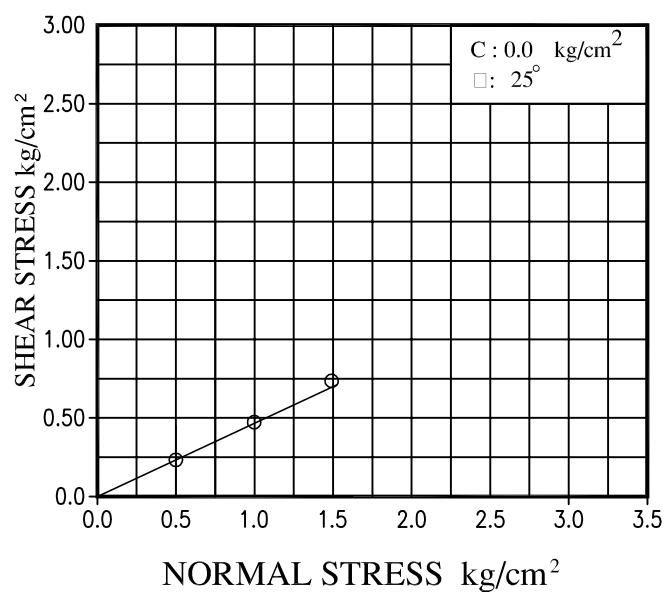
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

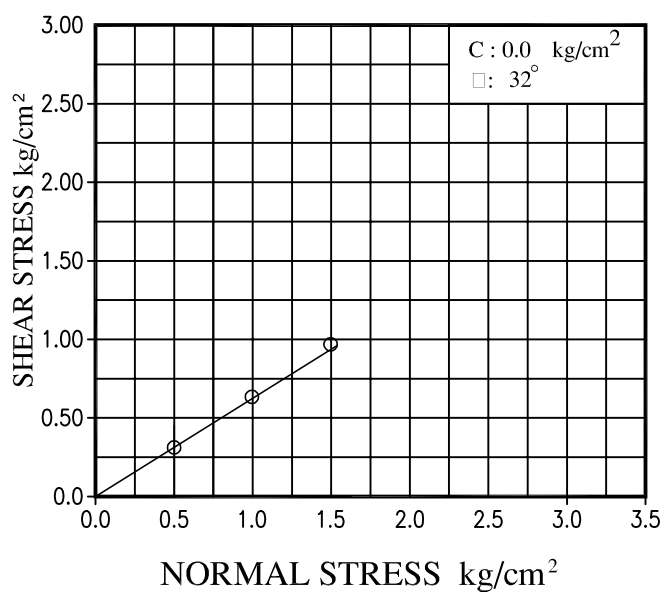
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-4
DEPTH :- 6.00 m

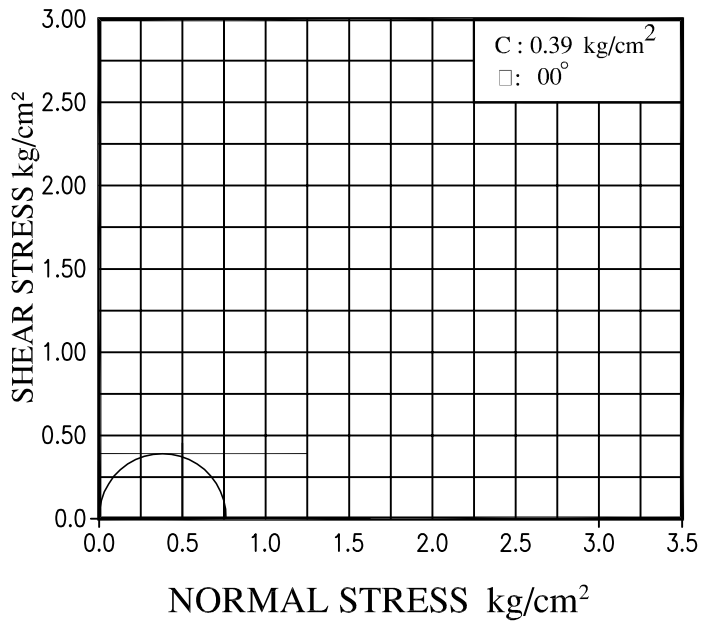
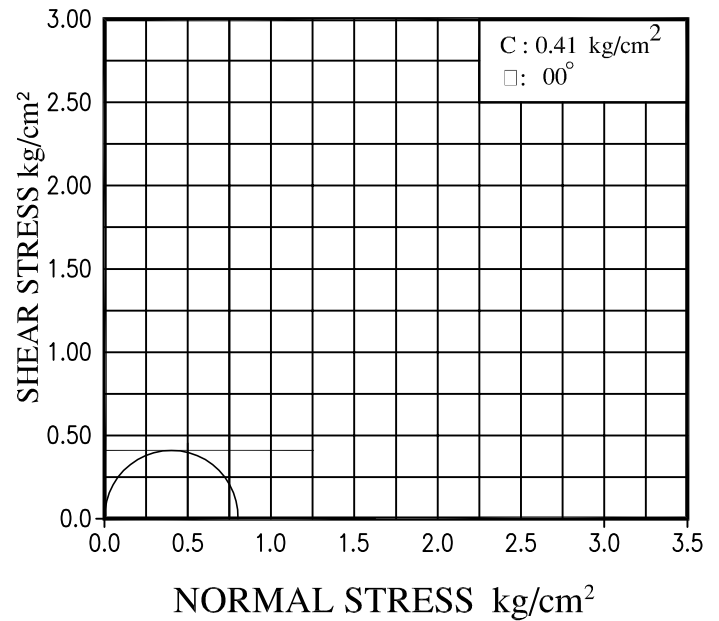
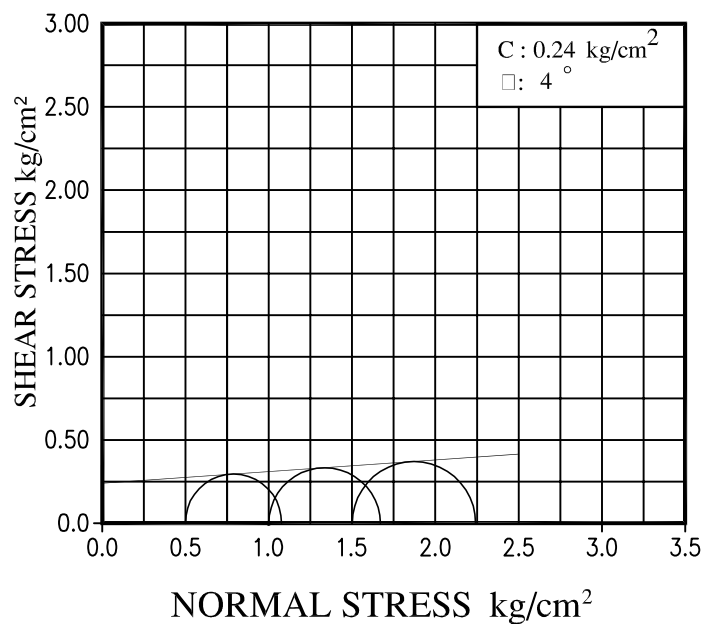


BH-4
DEPTH :- 8.00 m



Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-5
DEPTH :- 1.00 mBH-5
DEPTH :- 4.00 mBH-5
DEPTH :- 6.00 m

M/s P.K.Dutta & Co.

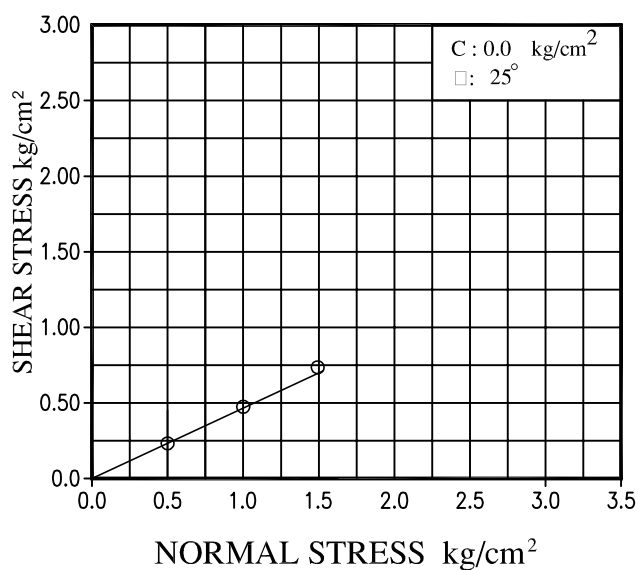
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

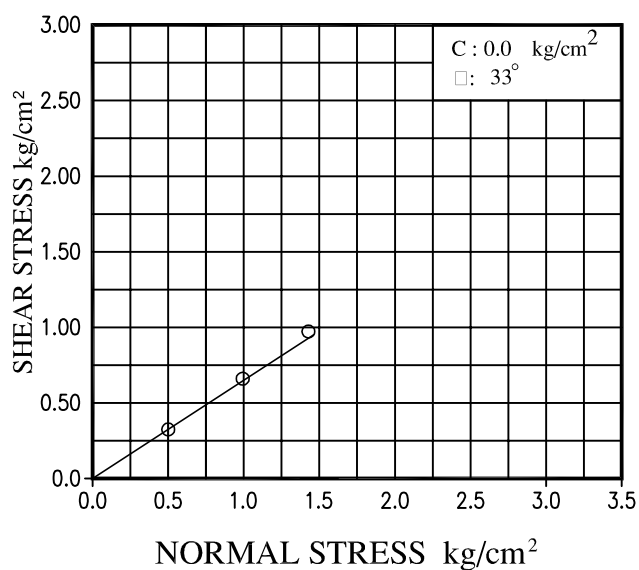
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-5
DEPTH :- 8.00 m

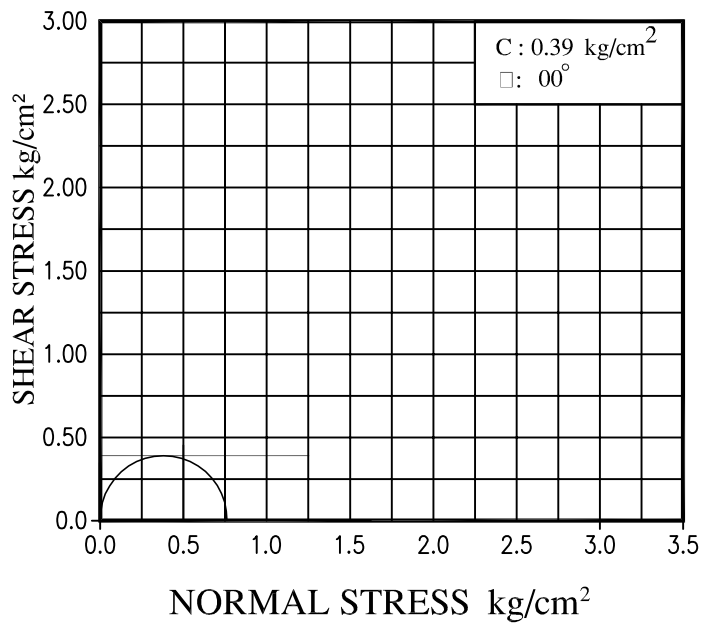
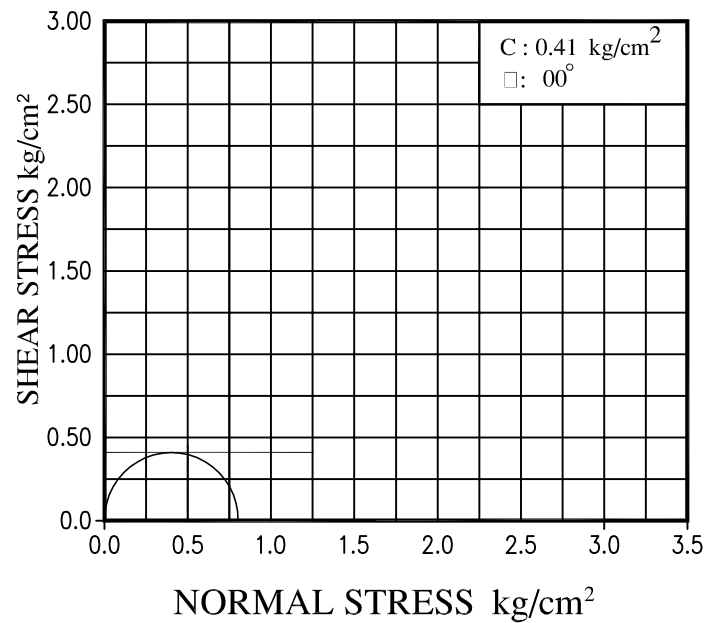
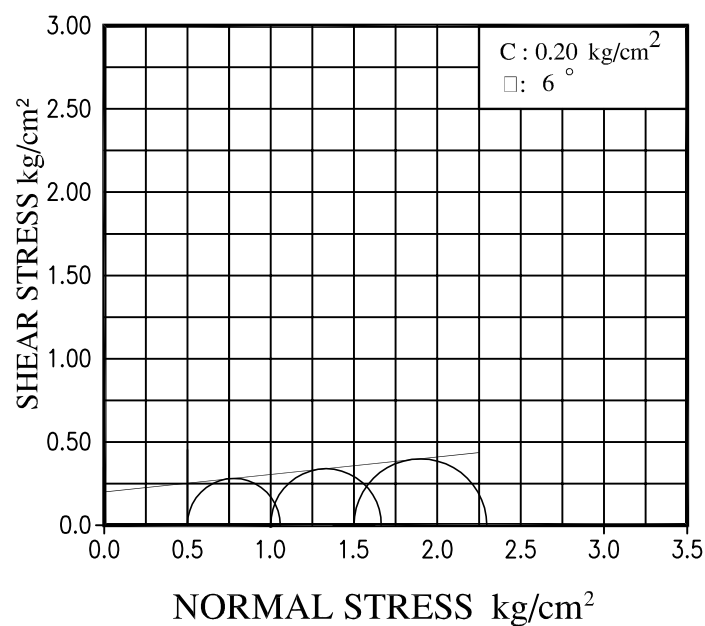


BH-5
DEPTH :- 13.50 m



Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-6
DEPTH :- 1.00 mBH-6
DEPTH :- 4.00 mBH-6
DEPTH :- 6.00 m

M/s P.K.Dutta & Co.

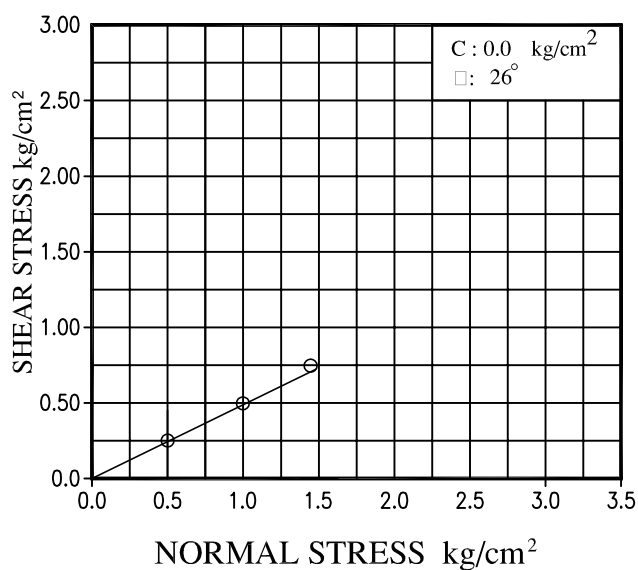
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

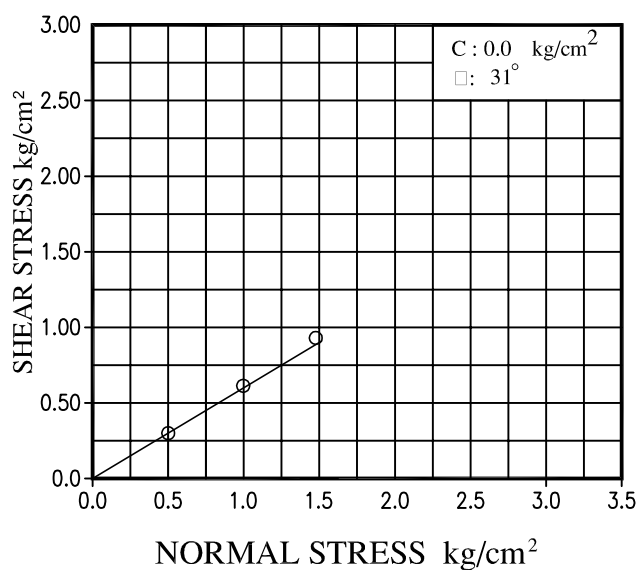
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-6
DEPTH :- 8.00 m

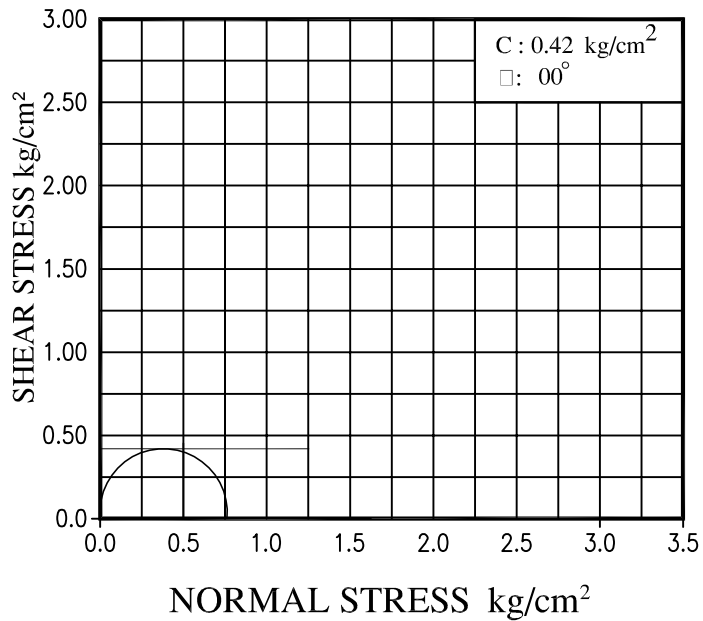
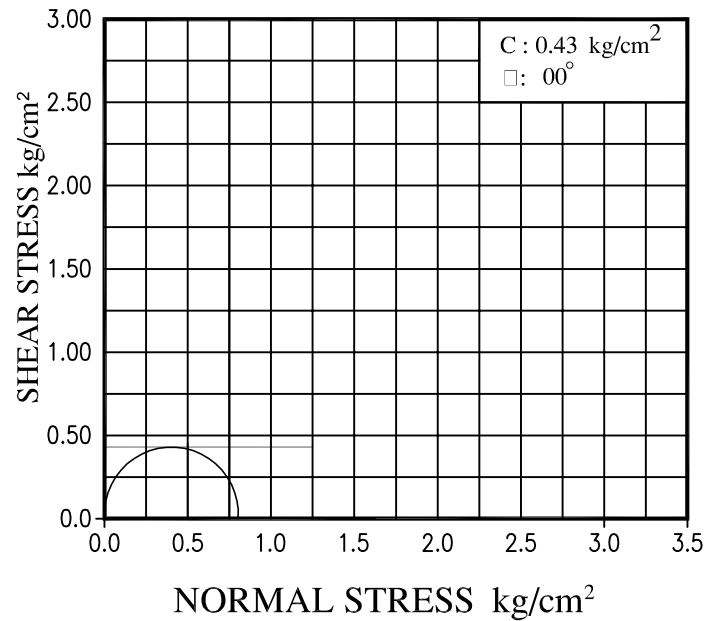
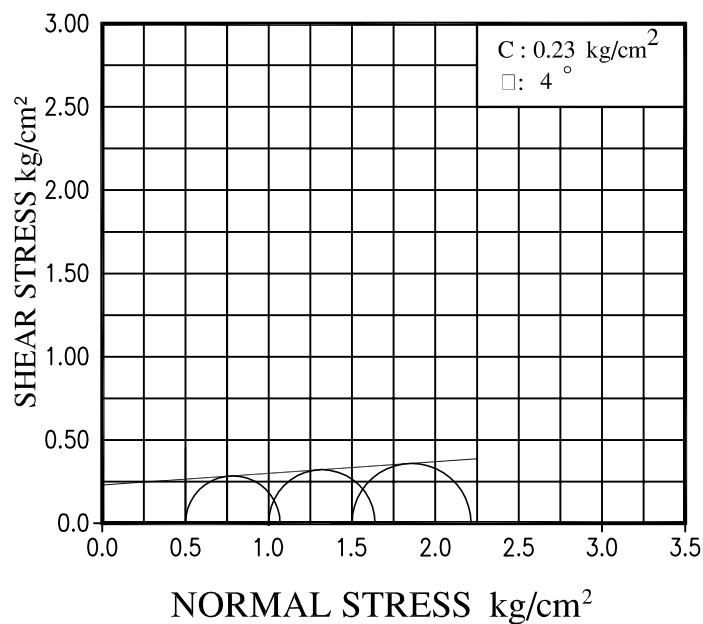


BH-6
DEPTH :- 13.50 m



Client : Assam Electricity Grid Corporation Limited

Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVEBH-7
DEPTH :- 1.00 mBH-7
DEPTH :- 4.00 mBH-7
DEPTH :- 5.00 m

M/s P.K.Dutta & Co.

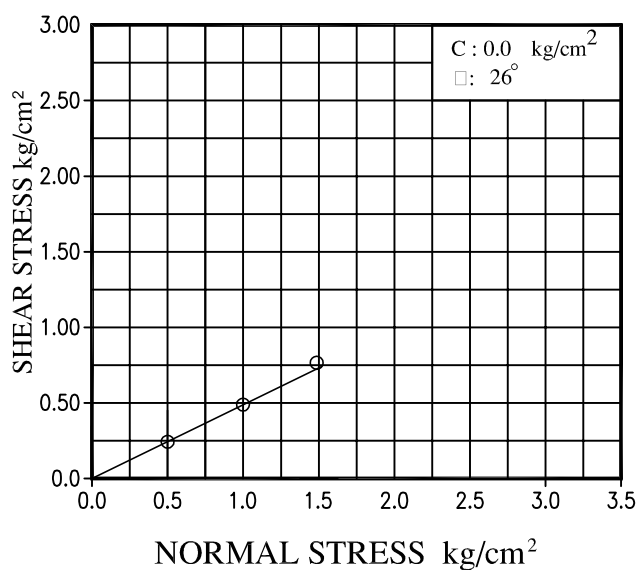
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

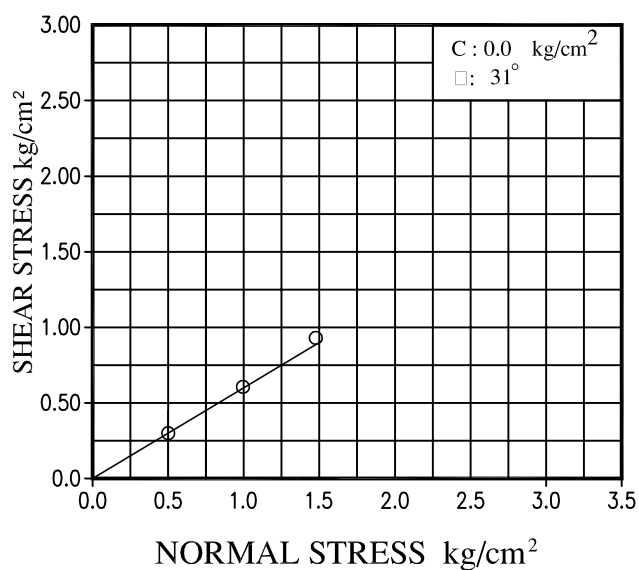
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-7
DEPTH :- 6.00 m



BH-7
DEPTH :- 8.00 m



M/s P.K.Dutta & Co.

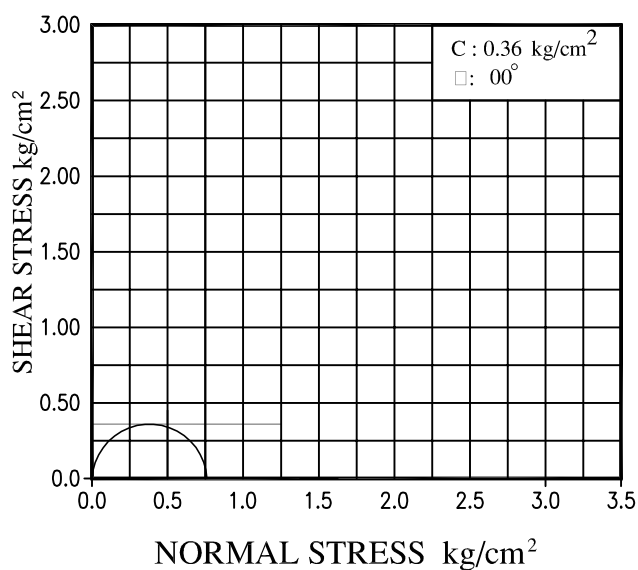
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

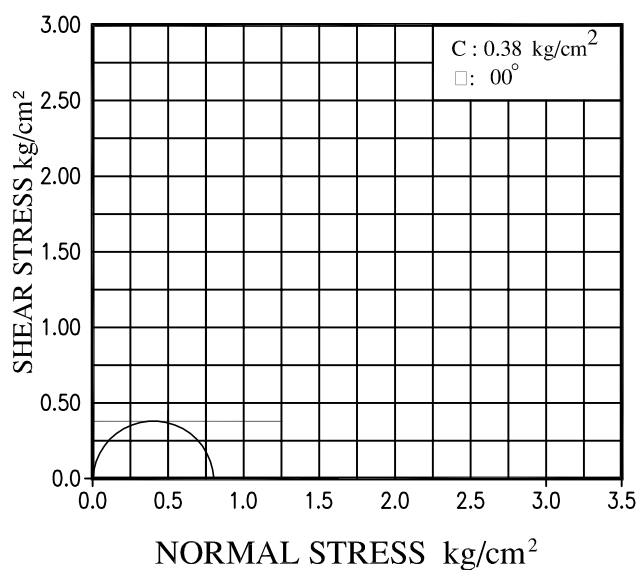
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

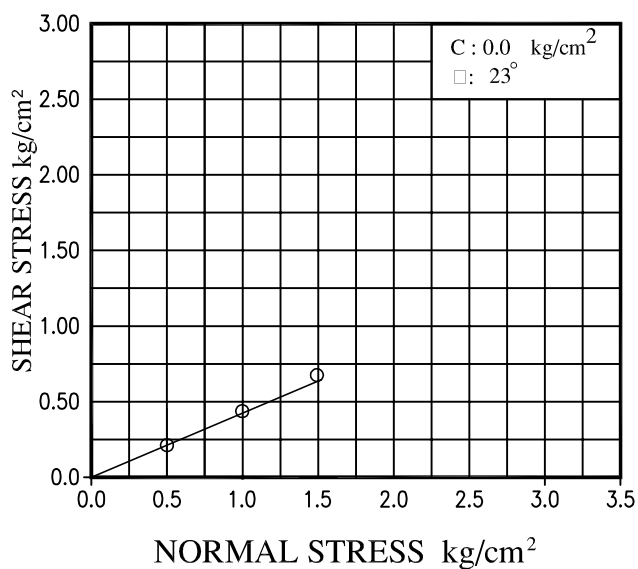
BH-8
DEPTH :- 1.00 m



BH-8
DEPTH :- 4.00 m



BH-8
DEPTH :- 6.00 m



M/s P.K.Dutta & Co.

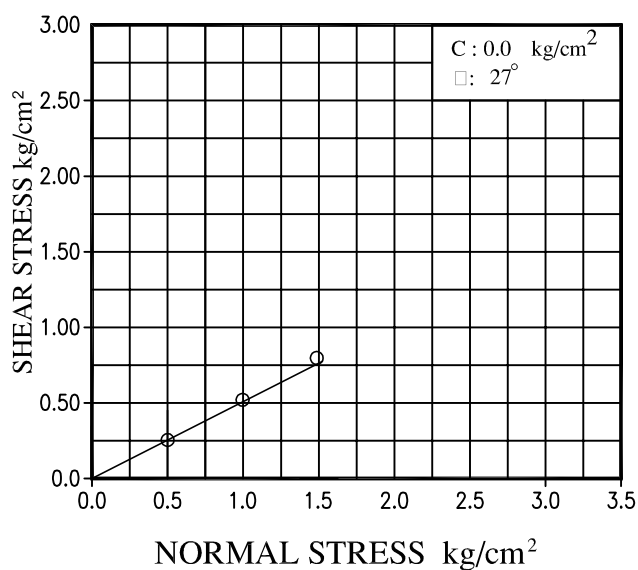
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

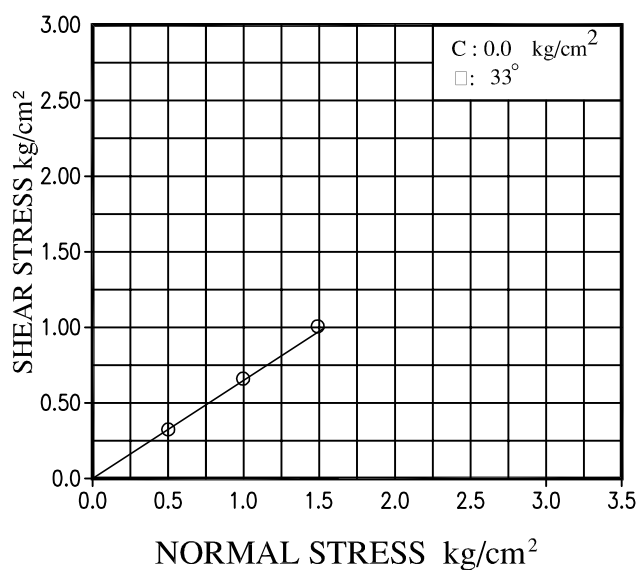
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-8
DEPTH :- 8.00 m



BH-8
DEPTH :- 13.50 m



M/s P.K.Dutta & Co.

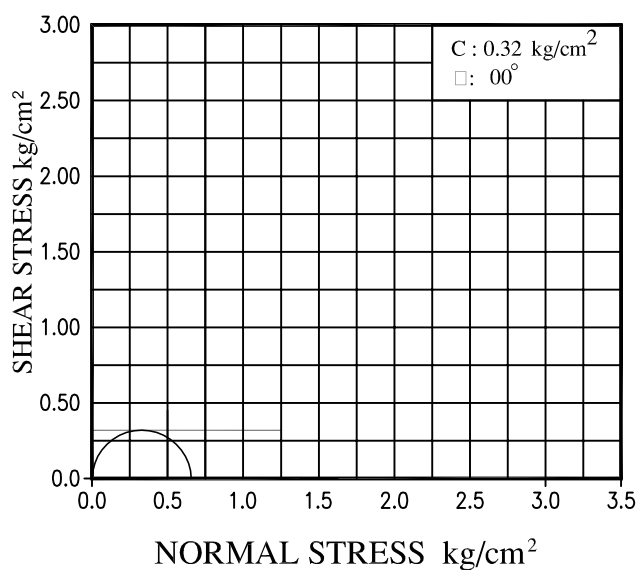
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

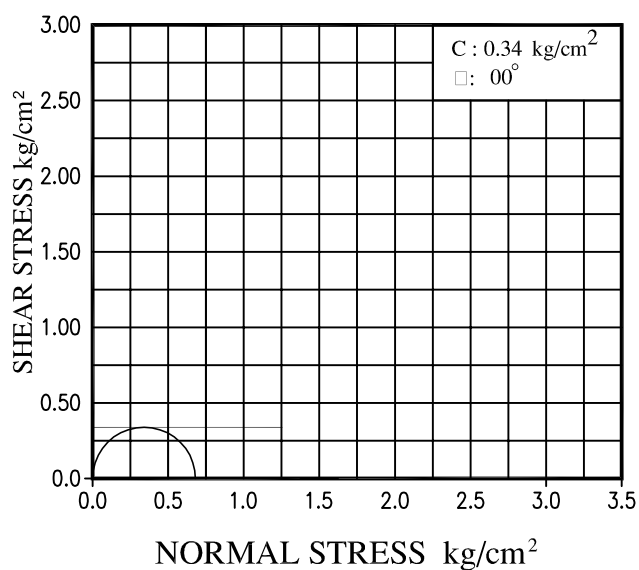
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

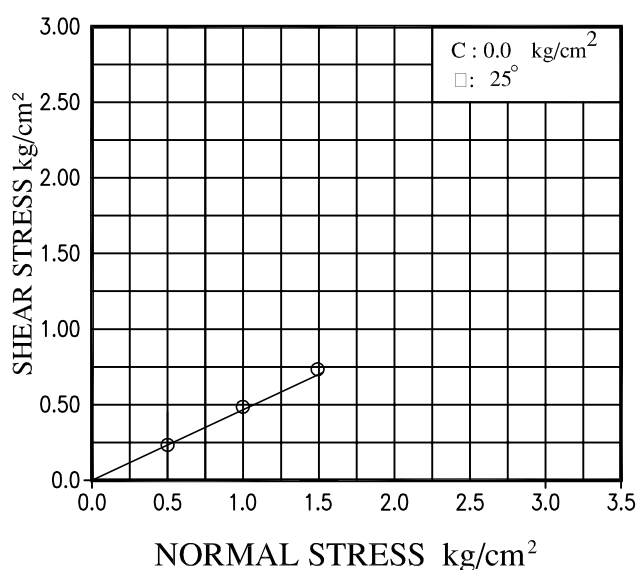
BH-9
DEPTH :- 1.00 m



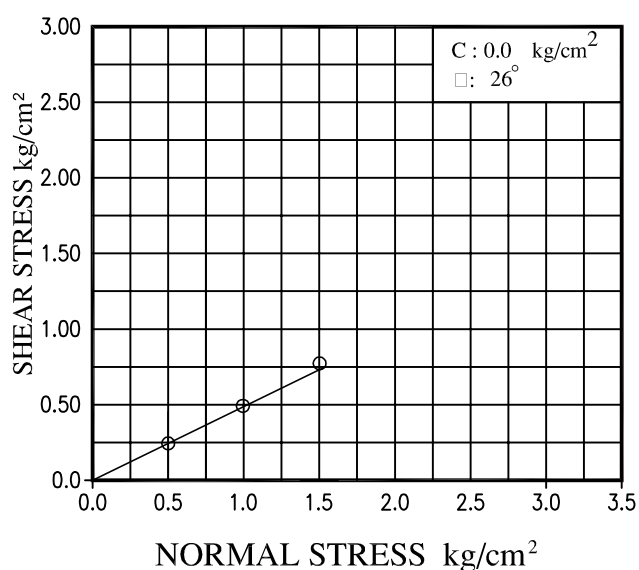
BH-9
DEPTH :- 4.00 m



BH-9
DEPTH :- 6.00 m



BH-9
DEPTH :- 8.00 m



M/s P.K.Dutta & Co.

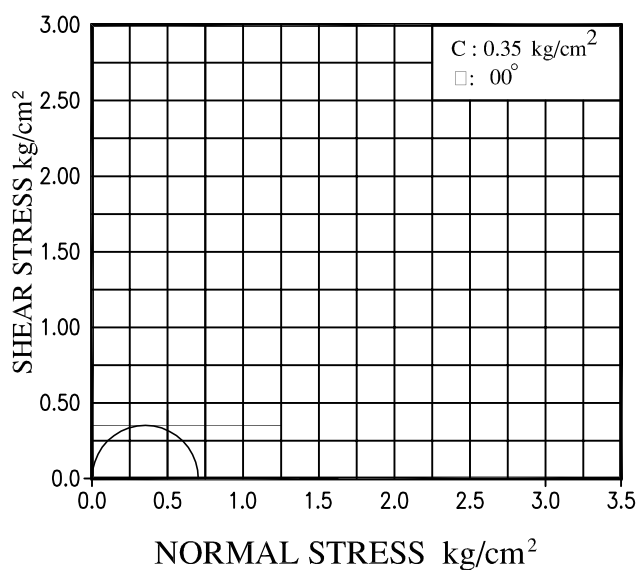
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

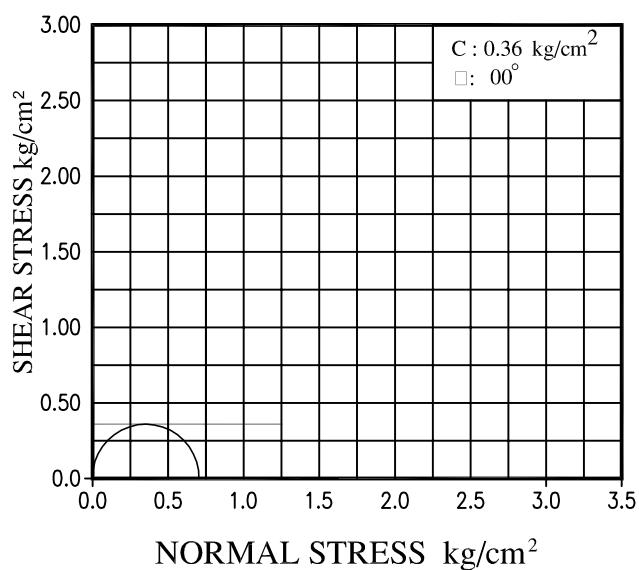
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

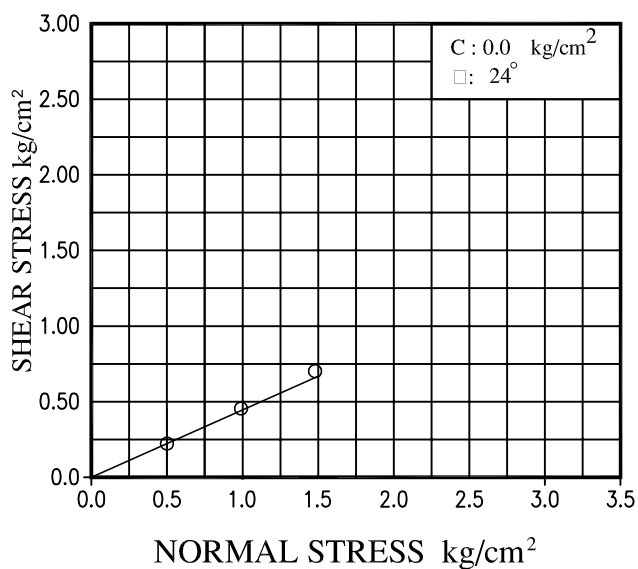
BH-10
DEPTH :- 1.00 m



BH-10
DEPTH :- 4.00 m



BH-10
DEPTH :- 6.00 m



M/s P.K.Dutta & Co.

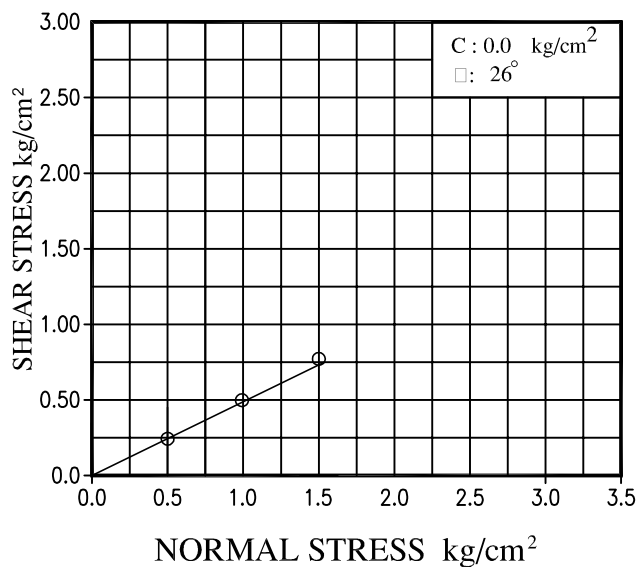
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

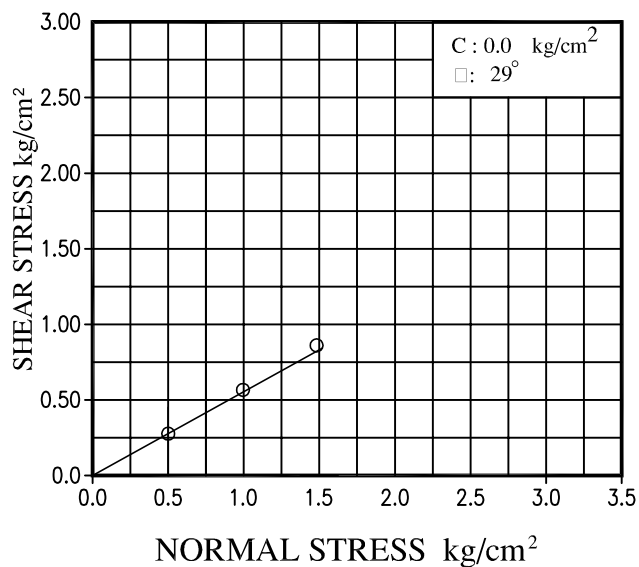
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-10
DEPTH :- 8.00 m



BH-10
DEPTH :- 12.00 m



M/s P.K.Dutta & Co.

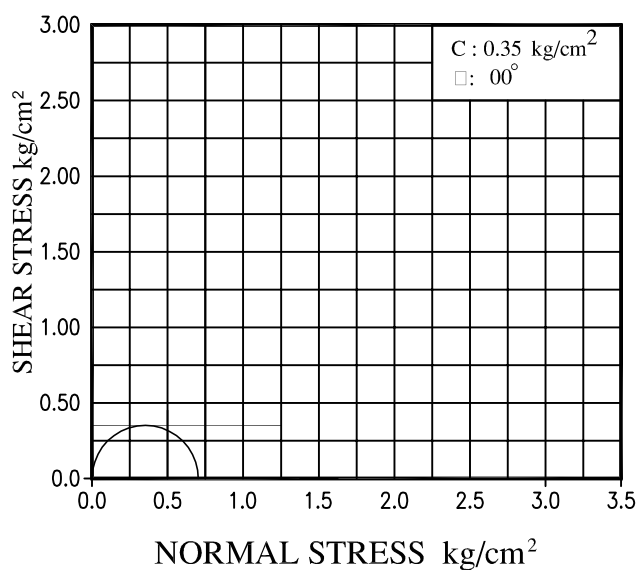
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

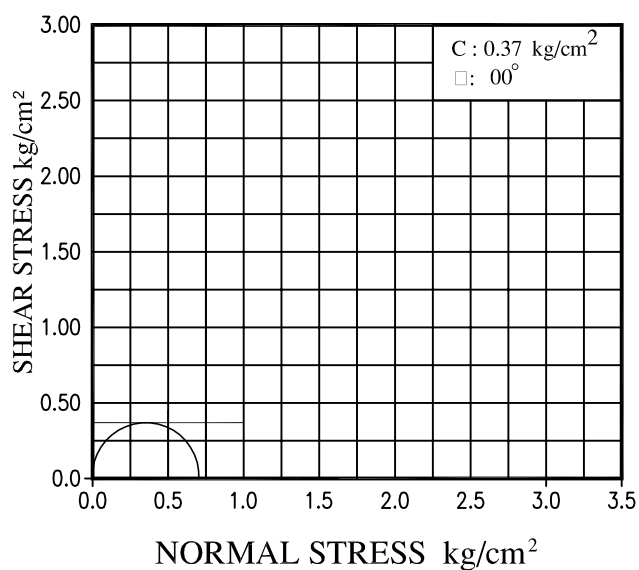
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

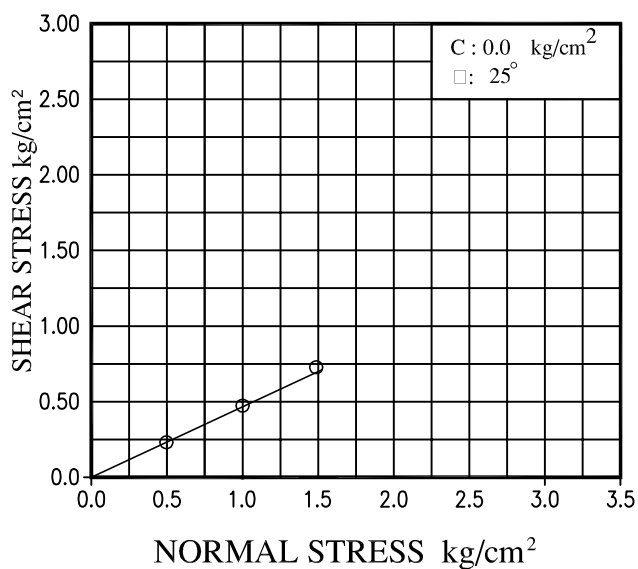
BH-11
DEPTH :- 1.00 m



BH-11
DEPTH :- 4.00 m



BH-11
DEPTH :- 6.00 m



M/s P.K.Dutta & Co.

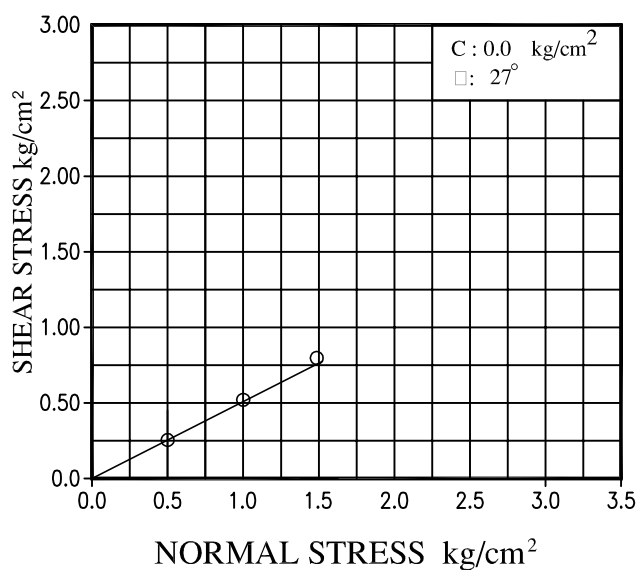
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

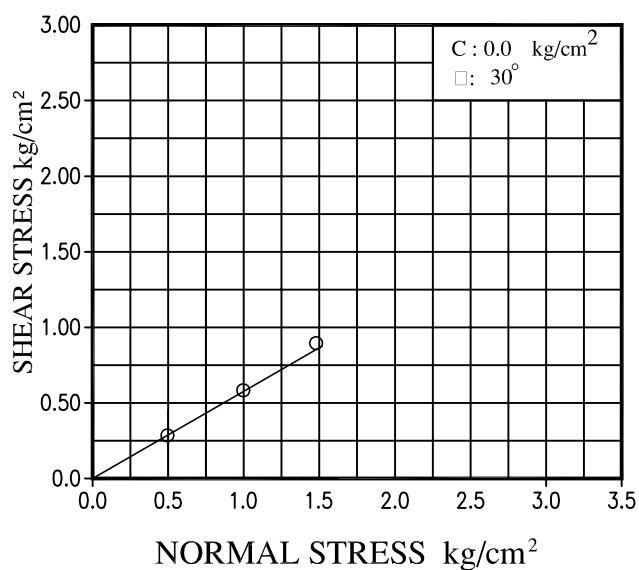
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-11
DEPTH :- 8.00 m



BH-11
DEPTH :- 13.50 m



M/s P.K.Dutta & Co.

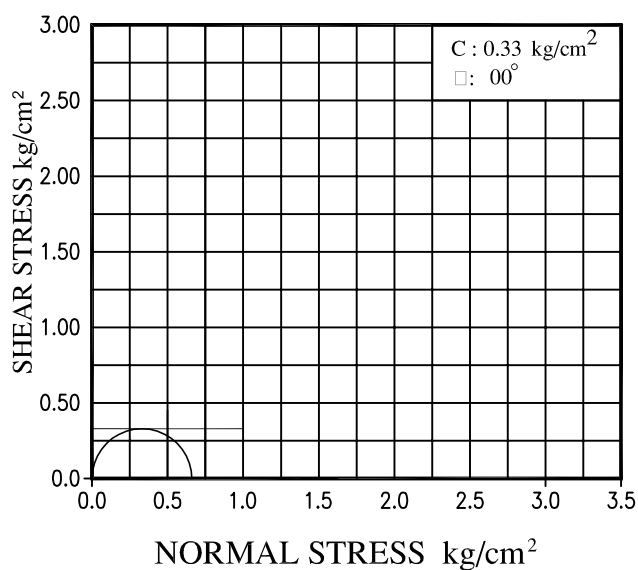
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

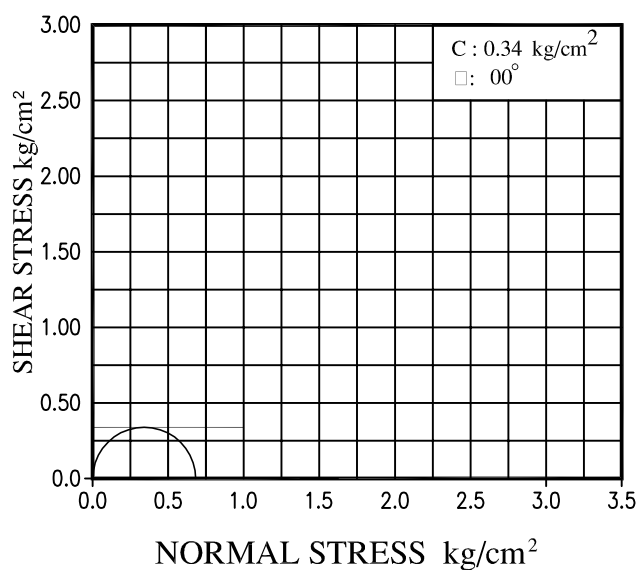
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

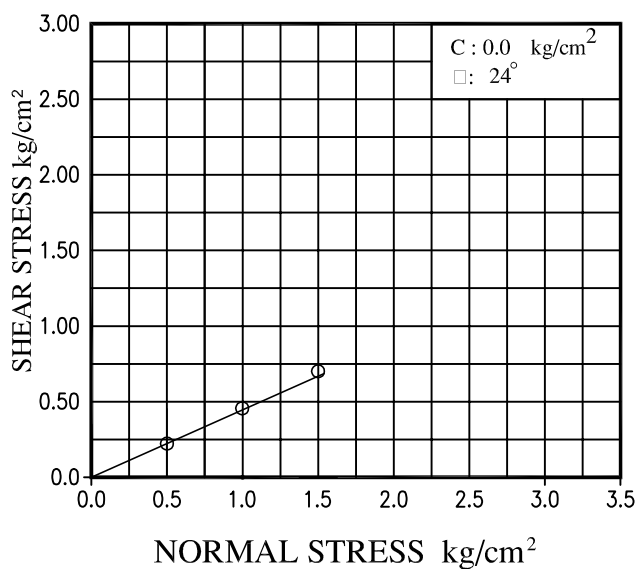
BH-12
DEPTH :- 1.00 m



BH-12
DEPTH :- 4.00 m



BH-12
DEPTH :- 6.00 m



M/s P.K.Dutta & Co.

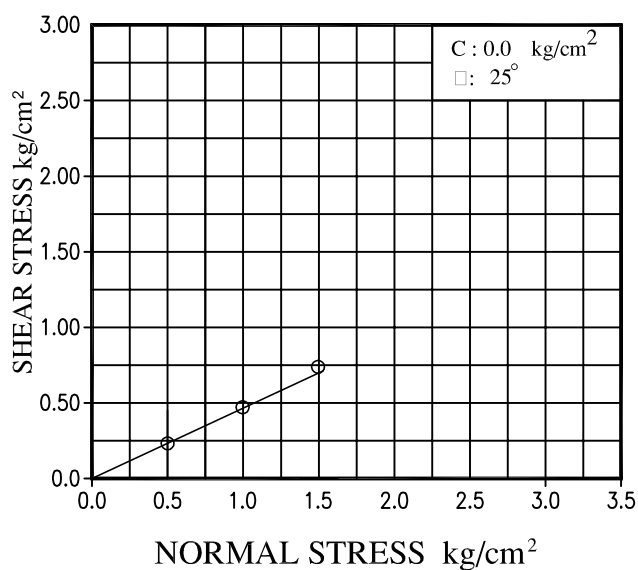
SHEAR TESTS CURVES

Client : Assam Electricity Grid Corporation Limited

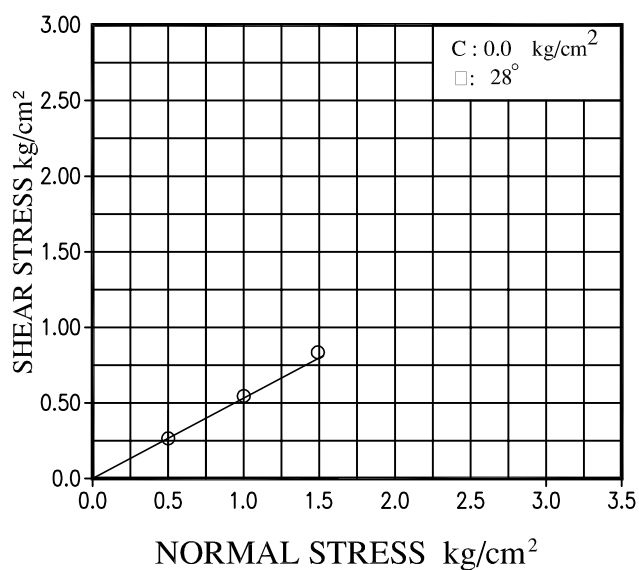
Site / Project :-Geo Technical Investigation Report for up gradation of Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.

SHEAR CURVE

BH-12
DEPTH :- 8.00 m



BH-12
DEPTH :- 12.00 m



RESISTIVITY REPORT

ERT Report for Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.ERT Report for 400/220/132kV Grid Substatio at Rangia										
ER-1 (E= 90°33'57.2" , N= 26°05'45.7")										
Soil Type : Agia S/S Land, Tempareture: 27°C - 34°C										
Sl. No.	Location No.	Direction	Electrode Space (a)	Depth of Electrode(b)	Resistance (Ω)	Resistivity Value(Ω/m)	Land Type	Date	Time	Remarks
1	ER-1	N	2	0.2	6.49	82.92	Agia grid Sub Station	19.08.2026	10:00AM - 10:30 AM	
		S	2	0.2	5.86	74.87				
		E	2	0.2	2.46	31.43				
		W	2	0.2	2.44	31.17				
		NE	2	0.2	5.4	68.99				
		SE	2	0.2	5.07	64.78				
		NW	2	0.2	4.96	63.37				
		SW	2	0.2	5.38	68.74				
2	ER-1	N	5	0.2	2.54	79.98		19.08.2026	10:40AM - 11:10 AM	
		S	5	0.2	2.69	84.7				
		E	5	0.2	2.42	76.2				
		W	5	0.2	2.49	78.4				
		NE	5	0.2	2.36	74.31				
		SE	5	0.2	2.28	71.79				
		NW	5	0.2	2.24	70.53				
		SW	5	0.2	2.32	73.05				
3	ER-1	N	10	0.2	0.98	61.59		19.08.2026	11:20AM - 11:50 AM	
		S	10	0.2	0.96	60.33				
		E	10	0.2	0.88	55.3				
		W	10	0.2	0.89	55.93				
		NE	10	0.2	1.12	70.39				
		SE	10	0.2	0.91	57.19				
		NW	10	0.2	0.94	59.07				
		SW	10	0.2	1.1	69.13				
4	ER-1	N	15	0.2	0.54	50.88		19.08.2026	12:00PM - 1;30 PM	
		S	15	0.2	0.56	52.77				
		E	15	0.2	0.6	56.54				
		W	15	0.2	0.58	54.65				
		NE	15	0.2	0.66	62.19				
		SE	15	0.2	0.44	41.46				
		NW	15	0.2	0.49	46.17				
		SW	15	0.2	0.65	61.25				
5	ER-1	N	25	0.2	0.29	45.54		19.08.2026	1:40PM - 1:10 PM	
		S	25	0.2	0.33	51.82				
		E	25	0.2	0.27	42.39				
		W	25	0.2	0.25	39.25				
		NE	25	0.2	0.24	37.68				
		SE	25	0.2	0.28	43.96				
		NW	25	0.2	0.27	42.39				
		SW	25	0.2	0.26	40.82				
6	ER-1	N	50	0.2	0.12	37.68		19.08.2026	1:20PM - 1:50 PM	
		S	50	0.2	0.14	43.96				
		E	50	0.2	0.11	34.54				
		W	50	0.2	0.16	50.24				
		NE	50	0.2	0.09	28.26				
		SE	50	0.2	0.13	40.82				
		NW	50	0.2	0.15	47.1				
		SW	50	0.2	0.10	31.4				
						55.58				

ERT Report for Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										
ER-2 (E= 90°33'56.0" , N= 26°05'47.2")										
Soil Type : Agia S/S Land, Tempareture: 27°C - 34°C										
Sl. No.	Location No.	Direction	Electrode Space (a)	Depth of Electrode(b)	Resistance (Ω)	Resistivity Value(Ω/m)	Land Type	Date	Time	Remarks
1	ER-2	N	2	0.2	6.46	82.54	Agia grid Sub Station	14.08.2026	9:00AM - 9:30 AM	
		S	2	0.2	5.73	73.21				
		E	2	0.2	2.39	30.54				
		W	2	0.2	2.56	32.71				
		NE	2	0.2	5.59	71.42				
		SE	2	0.2	1.17	14.95				
		NW	2	0.2	1.32	16.86				
		SW	2	0.2	4.77	60.94				
2	ER-2	N	5	0.2	2.86	90.05		14.08.2026	9:40AM - 10:10 AM	
		S	5	0.2	1.95	61.4				
		E	5	0.2	1.41	44.4				
		W	5	0.2	1.86	58.57				
		NE	5	0.2	2.42	76.2				
		SE	5	0.2	0.96	30.23				
		NW	5	0.2	0.88	27.71				
		SW	5	0.2	0.92	28.97				
3	ER-2	N	10	0.2	0.97	60.96		14.08.2026	10:20AM - 10:50 AM	
		S	10	0.2	0.89	55.93				
		E	10	0.2	0.76	47.76				
		W	10	0.2	0.82	51.53				
		NE	10	0.2	0.84	52.79				
		SE	10	0.2	0.62	38.96				
		NW	10	0.2	0.77	48.39				
		SW	10	0.2	0.69	43.36				
4	ER-2	N	15	0.2	0.5	47.11		14.08.2026	11:00AM - 11:30 AM	
		S	15	0.2	0.64	60.31				
		E	15	0.2	0.58	54.65				
		W	15	0.2	0.63	59.36				
		NE	15	0.2	0.46	43.35				
		SE	15	0.2	0.46	43.35				
		NW	15	0.2	0.44	41.46				
		SW	15	0.2	0.52	49				
5	ER-2	N	25	0.2	0.34	53.39		14.08.2026	11:40AM - 12:10 PM	
		S	25	0.2	0.29	45.54				
		E	25	0.2	0.23	36.11				
		W	25	0.2	0.26	40.82				
		NE	25	0.2	0.3	47.11				
		SE	25	0.2	0.28	43.96				
		NW	25	0.2	0.32	50.25				
		SW	25	0.2	0.29	45.54				
6	ER-2	N	50	0.2	0.06	18.84		14.08.2026	12:20PM - 12:50 PM	
		S	50	0.2	0.07	21.98				
		E	50	0.2	0.04	12.56				
		W	50	0.2	0.06	18.84				
		NE	50	0.2	0.05	15.7				
		SE	50	0.2	0.07	21.98				
		NW	50	0.2	0.09	28.26				
		SW	50	0.2	0.06	18.84				
						44.14				

ERT Report for Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										
ER-3 (E= 90°33'53.9" , N= 26°05'46.7")										
Soil Type : Agia S/S Land, Temperature: 27°C - 34°C										
Sl. No.	Location No.	Direction	Electrode Space (a)	Depth of Electrode(b)	Resistance (Ω)	Resistivity Value(Ω/m)	Land Type	Date	Time	Remarks
1	ER-3	N	2	0.2	3.46	44.21	Agia grid Sub Station	16.08.2026	9:00AM - 9:30 AM	
		S	2	0.2	2.79	35.65				
		E	2	0.2	6.19	79.09				
		W	2	0.2	5.76	73.59				
		NE	2	0.2	4.32	55.19				
		SE	2	0.2	3.70	47.27				
		NW	2	0.2	2.89	36.92				
		SW	2	0.2	5.76	73.59				
2	ER-3	N	5	0.2	2.22	69.9		16.08.2026	9:40AM - 10:10 AM	
		S	5	0.2	2.19	68.96				
		E	5	0.2	2.67	84.07				
		W	5	0.2	2.44	76.83				
		NE	5	0.2	1.82	57.31				
		SE	5	0.2	2.02	63.61				
		NW	5	0.2	2.19	68.96				
		SW	5	0.2	1.84	57.94				
3	ER-3	N	10	0.2	0.78	49.02		16.08.2026	10:20AM - 10:50 AM	
		S	10	0.2	0.67	42.11				
		E	10	0.2	0.98	61.59				
		W	10	0.2	0.76	47.76				
		NE	10	0.2	0.64	40.22				
		SE	10	0.2	0.57	35.82				
		NW	10	0.2	0.46	28.91				
		SW	10	0.2	0.44	27.65				
4	ER-3	N	15	0.2	0.27	25.44		16.08.2026	11:00AM - 11:30 AM	
		S	15	0.2	0.26	24.5				
		E	15	0.2	0.29	27.33				
		W	15	0.2	0.36	33.92				
		NE	15	0.2	0.21	19.79				
		SE	15	0.2	0.19	17.9				
		NW	15	0.2	0.25	23.56				
		SW	15	0.2	0.28	26.38				
5	ER-3	N	25	0.2	0.16	25.12		16.08.2026	11:40AM - 12:10 PM	
		S	25	0.2	0.19	29.83				
		E	25	0.2	0.25	39.25				
		W	25	0.2	0.26	40.82				
		NE	25	0.2	0.19	29.83				
		SE	25	0.2	0.17	26.69				
		NW	25	0.2	0.22	34.54				
		SW	25	0.2	0.23	36.11				
6	ER-3	N	50	0.2	-			16.08.2026	12:20PM - 12:50 PM	
		S	50	0.2	0.05	15.7				
		E	50	0.2	0.09	28.26				
		W	50	0.2	-					
		NE	50	0.2	-					
		SE	50	0.2	0.08	25.12				
		NW	50	0.2	-					
		SW	50	0.2	0.07	21.98				
						42.69				

ERT Report for Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										
ER-4 (E= 90°34'00.1" , N= 26°05'44.5")										
Soil Type : Agia S/S Land, Temperature: 27°C - 34°C										
Sl. No.	Location No.	Direction	Electrode Space (a)	Depth of Electrode(b)	Resistance (Ω)	Resistivity Value(Ω/m)	Land Type	Date	Time	Remarks
1	ER-4	N	2	0.2	1.23	15.71	Agia grid Sub Station	14.08.2026	1:00PM-1:30PM	
		S	2	0.2	1.26	16.1				
		E	2	0.2	1.3	16.61				
		W	2	0.2	1.39	17.76				
		NE	2	0.2	1.87	23.89				
		SE	2	0.2	1.77	22.61				
		NW	2	0.2	1.68	21.46				
		SW	2	0.2	1.73	22.1				
2	ER-4	N	5	0.2	0.59	18.58		14.08.2026	1:40PM-2:10PM	
		S	5	0.2	0.62	19.52				
		E	5	0.2	0.67	21.1				
		W	5	0.2	0.66	20.78				
		NE	5	0.2	0.93	29.28				
		SE	5	0.2	0.86	27.08				
		NW	5	0.2	0.89	28.02				
		SW	5	0.2	0.94	29.6				
3	ER-4	N	10	0.2	0.21	13.2		14.08.2026	2:20PM-2:50PM	
		S	10	0.2	0.25	15.71				
		E	10	0.2	0.24	15.08				
		W	10	0.2	0.27	16.97				
		NE	10	0.2	0.34	21.37				
		SE	10	0.2	0.23	14.45				
		NW	10	0.2	0.29	18.22				
		SW	10	0.2	0.26	16.34				
4	ER-4	N	15	0.2	0.13	12.25		14.08.2026	3:00PM-3:30PM	
		S	15	0.2	0.19	17.9				
		E	15	0.2	0.17	16.02				
		W	15	0.2	0.16	15.08				
		NE	15	0.2	0.22	20.73				
		SE	15	0.2	0.16	15.08				
		NW	15	0.2	0.18	16.96				
		SW	15	0.2	0.17	16.02				
5	ER-4	N	25	0.2	0.05	7.85		14.08.2026	3:40PM-4:10PM	
		S	25	0.2	0.06	9.42				
		E	25	0.2	0.08	12.56				
		W	25	0.2	0.1	15.7				
		NE	25	0.2	0.12	18.84				
		SE	25	0.2	0.13	20.41				
		NW	25	0.2	0.09	14.13				
		SW	25	0.2	0.11	17.27				
6	ER-4	N	50	0.2	0.05	15.7		14.08.2026	4:20PM-4:50PM	
		S	50	0.2	0.08	25.12				
		E	50	0.2	0.07	21.98				
		W	50	0.2	0.07	21.98				
		NE	50	0.2	0.06	18.84				
		SE	50	0.2	0.08	25.12				
		NW	50	0.2	0.09	28.26				
		SW	50	0.2	0.11	34.54				
						19.15				

ERT Report for Existing 220/132kV Agia Grid Substation to 400/220kV Grid Substation for Evacuation of Power from 3200 MW Chapar Thermal Power Plant.										
ER-5 (E= 90°34'01.3" , N= 26°05'47.6")										
Soil Type : Agia S/S Land, Tempareture: 27°C - 34°C										
Sl. No.	Location No.	Direction	Electrode Space (a)	Depth of Electrode(b)	Resistance (Ω)	Resistivity Value(Ω/m)	Land Type	Date	Time	Remarks
1	ER-5	N	2	0.2	4.12	52.64	Agia grid Sub Station	16.08.2026	1:00PM-1:30PM	
		S	2	0.2	3.88	49.57				
		E	2	0.2	3.69	47.14				
		W	2	0.2	3.76	48.04				
		NE	2	0.2	2.87	36.67				
		SE	2	0.2	2.88	36.8				
		NW	2	0.2	3.26	41.65				
		SW	2	0.2	3.79	48.42				
2	ER-5	N	5	0.2	1.88	59.2		16.08.2026	1:40PM-2:10PM	
		S	5	0.2	1.79	56.36				
		E	5	0.2	2.16	68.01				
		W	5	0.2	2.17	68.33				
		NE	5	0.2	1.92	60.46				
		SE	5	0.2	1.87	58.88				
		NW	5	0.2	1.69	53.21				
		SW	5	0.2	1.78	56.05				
3	ER-5	N	10	0.2	1.46	91.75		16.08.2026	2:20PM-2:50PM	
		S	10	0.2	1.39	87.35				
		E	10	0.2	1.64	103.06				
		W	10	0.2	1.57	98.66				
		NE	10	0.2	1.56	98.04				
		SE	10	0.2	1.39	87.35				
		NW	10	0.2	1.33	83.58				
		SW	10	0.2	1.42	89.24				
4	ER-5	N	15	0.2	0.67	63.13		16.08.2026	3:00PM-3:30PM	
		S	15	0.2	0.74	69.73				
		E	15	0.2	0.71	66.9				
		W	15	0.2	0.69	65.02				
		NE	15	0.2	0.58	54.65				
		SE	15	0.2	0.66	62.19				
		NW	15	0.2	0.67	63.13				
		SW	15	0.2	0.62	58.42				
5	ER-5	N	25	0.2	0.21	32.97		16.08.2026	3:40PM-4:10PM	
		S	25	0.2	0.19	29.83				
		E	25	0.2	0.26	40.82				
		W	25	0.2	0.24	37.68				
		NE	25	0.2	0.27	42.39				
		SE	25	0.2	0.22	34.54				
		NW	25	0.2	0.19	29.83				
		SW	25	0.2	0.23	36.11				
6	ER-5	N	50	0.2	0.14	43.96		16.08.2026	4:20PM-4:50PM	
		S	50	0.2	0.13	40.82				
		E	50	0.2	0.10	31.4				
		W	50	0.2	0.12	37.68				
		NE	50	0.2	0.09	28.26				
		SE	50	0.2	0.11	34.54				
		NW	50	0.2	0.07	21.98				
		SW	50	0.2	0.08	25.12				
						54.82				

SIGN FIELD DATA SHEET

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-circulation</i>	JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub Station.</i>
	CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-1 (SL. NO. 6)</i>
Commenced On:- <i>08-08-2026</i>	RL:- <i>6PS</i>
Completed On:- <i>09-08-2026</i>	Ground Water:- <i>3.85 (M)</i> <i>N - 26°05'46.1"</i> <i>E - 90°33'53.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey clayey Sand mixed with Kankar & gravel.	0.00	0.50		DS- 0.50					
				DS- 1.00					
Stiff Consistency, brownish to Reddish grey Silty clay mixed with Sand & Kankar.	0.50			UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	2, 4, 7 = 11			
				SPT- 3.00	3.45	5, 6, 7 = 13			
				UDS- 4.00	4.45				
				DS- 4.50					
Stiff, brownish grey, Sandy clay	5.00	5.00		SPT- 5.00	5.45	3, 4, 4 = 8			
				UDS- 6.00	6.45				
		7.00		DS- 6.50					

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(24/08/2026)
JM (Civil)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>prop. 400/220/132 KV Agia Gasd Sub-Station</i>
	CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/Ø	Depth In Mtr:- <i>15.0(M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-1</i> <i>(SL. NO. 6)</i>
Commenced On:- <i>08-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>09-08-2026</i>	Ground Water:- <i>3.35(M)</i> <i>N - 26°05'46.1"</i> <i>E - 90°33'53.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N-Value	COLLECTION OF ROCK SAMPLES.	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Loose to Medium, brownish grey Silty Sand with mica.	7.00			SPT-	7.00	7.45	8, 3, 4 = 7		
				UDS-	8.00	8.45			
				DS-	8.50				
				SPT-	10.00	10.45	7, 10, 14 = 24		
				SPT-	12.00	12.45	9, 14, 18 = 32		
				SPT-	13.50	13.95	11, 16, 22 = 38		
				SPT-	15.00	15.45	14, 20, 27 = 47		
Medium to Dense, brownish grey Silty Sand with mica.	12.00	12.00							
		15.45							

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
Jm (Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub-Station.</i>
	CLIENT:- <i>AEBCL</i>
Dia Of Hole : 150mm/NX	Depth In Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-2</i> <i>(SL. No. 7)</i>
Commenced On:- <i>09-08-2026</i>	RL:- <i>(GPS)</i>
Completed On:- <i>10-08-2026</i>	Ground Water:- <i>2.70 (M)</i> <i>N - 26°05'46.2"</i>
	<i>E - 90°33'55.4"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey Silty clay mixed with Sand & Konkors.	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	3, 4, 6 = 10			
				SPT- 3.00	3.45	5, 6, 6 = 12			
				UDS- 4.00	4.45				
				DS- 4.50					
Stiff Consistency, brownish grey Sandy clay	5.00	5.00		SPT- 5.00	5.45	4, 4, 5 = 9			
				UDS- 6.00	6.45				
				DS- 6.50					
	7.00	7.00		SPT- 7.00	7.45	3, 4, 4 = 8			

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
Jm (GWD)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No, Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring: <i>Pugor & Mud Circulation</i>	JOB Name: <i>100kV/132kV Ngia Grid Sub Station</i>
	CLIENT: <i>AEGL</i>
Dia Of Hole: 150mm/100	Depth in Mtr: <i>15.0 (N)</i> <i>Ngia S/S Land</i>
	Location No: <i>BH-2</i> <i>(SL. No. 7)</i>
Commenced On: <i>09-08-2026</i>	RL: <i>(G.P.S)</i>
Completed On: <i>10-08-2026</i>	Ground Water: <i>2-70 (N)</i> <i>N - 26°05'46.2"</i>
	<i>E - 90°33'55.9"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Loose to Medium, brownish grey Silty Sand with mica.	7.00			UPS	8.00	8.45			
				DS	8.50				
				SPT	10.00	10.45	7, 10, 13 = 23		
		12.00		SPT	12.00	12.45	8, 13, 16 = 29		
Medium to Dense, brownish grey Silty Sand with mica.	12.00			SPT	13.50	13.95	10, 15, 21 = 36		
		15.45		SPT	15.00	15.45	13, 19, 24 = 43		

Signature of Site in-Charge

(P.K. Dutta SCA)

Signature of Engineer in-Charge

(P.K. Dutta SCA)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Ruger & Mud-circulation</i>	JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEGL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land</i>
	Location No :- <i>BH-3</i> <i>(SL. NO. 12)</i>
Commenced On:- <i>15-08-2026</i>	RL:- <i>6PS</i>
Completed On:- <i>15-08-2026</i>	Ground Water:- <i>2.80 (M)</i> <i>N - 26°05'47.7"</i> <i>E - 90°33'56.4"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey silty clay mixed with Kanchar & Sand	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	3, 5, 6 = 11			
				SPT- 3.00	3.45	3, 4, 5 = 9			
				UDS- 4.00	4.45				
Stiff, brownish grey, Sandy clay with Kanchar.	4.50	4.50		DS- 4.50					
				SPT- 5.00	5.45	3, 4, 4 = 8			
				UDS- 6.00	6.45				
				DS- 6.50					
		7.00		SPT- 7.00	7.45	3, 4, 5 = 9			

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
Jm (Civil)

P.K.DUTTA & CO. SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165									
Type of Boring:- <i>Auger & Mud-circulation</i>			JOB Name:- <i>Prop. 400/220/132KV Agia Grid Sub-Station</i> CLIENT:- <i>AEGCL</i>						
Dia Of Hole : 150mm/NX			Depth in Mtr:- <i>15.0 (H)</i> <i>Agia S/S Land.</i> Location No :- <i>BH-3</i> <i>(SL NO. 12)</i>						
Commenced On:- <i>15-08-2026</i>			RL:- <i>GPS</i> <i>N - 26°05'47.7"</i>						
Completed On:- <i>15-08-2026</i>			Ground Water:- <i>2.80 (H)</i> <i>E - 90°33'56.4"</i>						
D= Disturbed Sample, U= Undisturbed Sample, P=S,P,T									
DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
<i>Loose to Medium, brownish grey Silty Sand with mica.</i>	<i>7.00</i>	<i>15.45</i>	<i>UPS</i> <i>UPS - 8.00</i> <i>PS - 8.50</i> <i>SPT - 10.00</i> <i>SPT - 12.00</i> <i>SPT - 13.50</i> <i>SPT - 15.00</i>	<i>8.45</i> <i>8.50</i> <i>10.45</i> <i>12.45</i> <i>13.95</i> <i>15.45</i>	 <i>4, 6, 10 = 16</i> <i>5, 8, 10 = 18</i> <i>7, 10, 13 = 23</i> <i>8, 10, 15 = 25</i>				

Signature of Site In-Charge.

[Signature]
 (P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
 Date *28/08/26*
 JTM (Civil)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub-Station</i> CLIENT:- <i>AECL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land</i> Location No:- <i>BH-4 (SL. NO. 11)</i>
Commenced On:- <i>13-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>14-08-2026</i>	Ground Water:- <i>3.80 (M)</i> <i>N - 26°05'50.4°</i> <i>E - 90°38'58.2°</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey Silty clay mixed with Kankar & Sand.	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	4, 5, 8 = 13			
				SPT- 3.00	3.45	3, 7, 8 = 15			
				UDS- 4.00	4.45				
Stiff, brownish grey, Sandy clay with Kankar.	4.50	4.50		DS- 4.50					
				SPT- 5.00	5.45	3, 4, 4 = 8			
				UDS- 6.00	6.45				
Loose Light brownish grey Silty fine Sand with mica.	6.00	6.00		DS- 6.50					
				SPT- 7.00	7.45	4, 6, 7 = 13			
		7.00							

Signature of Site In-Charge,

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

Prop. 400/220/132KV
JM (Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Pug & Mud-Circulation</i>	JOB Name:- <i>PROP 400/220/132KV Agia Grid Sub-Station</i> CLIENT:- <i>AEBCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0(M)</i> <i>Agia S/S Land.</i> Location No :- <i>BH-4</i> <i>(SL. NO. 11)</i>
Commenced On:- <i>13-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>14-08-2026</i>	Ground Water:- <i>3.80(M)</i> <i>N - 26°05'50.4"</i> <i>E - 90°33'58.2"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES		N- Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	RQD (%)	
					From				To
Medium, brownish grey Silty Sand with mica.	7.00	15.45		UPS- 8.00	8.45				
				DS- 8.50					
				SPT- 10.00	10.45	6, 8, 12 = 20			
				SPT- 12.00	12.45	6, 10, 13 = 23			
				SPT- 13.50	13.95	8, 13, 14 = 27			
				SPT- 15.00	15.45	10, 14, 18 = 32			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(P.K. Dutta & Co.)

P.K.DUTTA & CO.

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>prop. 400/220/132 KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEBCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-5</i> <i>(SL. No. 8)</i>
Commenced On:- <i>10-08-2026</i>	RL:- <i>(GPS)</i>
Completed On:- <i>11-08-2026</i>	Ground Water:- <i>2.70 (M)</i> <i>N - 26°05'44.5"</i> <i>E - 90°33'54.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey Silty clay mixed with Sand & Konkan.	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	5, 6, 8 = 14			
				SPT- 3.00	3.45	4, 6, 7 = 13			
				UDS- 4.00	4.45				
				DS- 4.50					
Stiff Consistency, brownish grey sandy clay	5.00	5.00		SPT- 5.00	5.45	3, 4, 5 = 9			
				UDS- 6.00	6.45				
				DS- 6.50					
	7.00	7.00		SPT- 7.00	7.45	4, 4, 6 = 10			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(P.K. Dutta & Co.)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PG5 (N) W.B Pin-743165

Type of Boring:- <i>Ruger & Mud-Circulation</i>	JOB Name:- <i>Prop. 400/220/132KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEGL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-5</i> <i>(SL. No. 8)</i>
Commenced On:- <i>10-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>11-08-2026</i>	Ground Water:- <i>2.70 (M)</i> <i>N - 26°05'44.5"</i> <i>E - 90°33'54.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Loose to Medium, brownish grey Silty Sand with mica.	7.00			UDS- 8.00	8.45				
				DS- 8.50					
				SPT- 10.00	10.45	6, 10, 14 = 24			
				SPT- 12.00	12.45	7, 11, 15 = 26			
		13.50		SPT- 13.50	13.95	10, 16, 22 = 38			
Dense, brownish grey Silty Sand with mica.	13.50			SPT- 15.00	15.45	14, 19, 28 = 47			
		15.45							

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

3M (Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>Prop. 400/220/132kv Agia Grid Sub-Station</i>
	CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0(M)</i> <i>Agia S/S Land</i>
	Location No :- <i>BH-6</i> <i>(SL. No. 9)</i>
Commenced On:- <i>11-08-2026</i>	RL:- <i>APS</i>
Completed On:- <i>12-08-2026</i>	Ground Water:- <i>3.20(M)</i> <i>N- 26°05'45.3"</i> <i>E- 90°33'57.9"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish grey Silty clay mixed with KanKar & Sand.	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	4, 6, 8 = 14			
				SPT- 3.00	3.45	5, 5, 7 = 12			
				UDS- 4.00	4.45				
				DS- 4.50					
Stiff brownish to Reddish grey Sandy clay with KanKar.	5.00	5.00		SPT- 5.00	5.45	3, 3, 5 = 8			
				UDS- 6.00	6.45				
				DS- 6.50					
		7.00		SPT- 7.00	7.45	5, 5, 7 = 12			

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
24/08/26
JM (Unit)

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>Prop 400/220/132KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land</i>
	Location No > <i>BH-6</i> <i>(SL. NO. 9)</i>
Commenced On:- <i>12-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>12-08-2026</i>	Ground Water:- <i>N - 26°05'45.3"</i> <i>E - 90°33'57.9"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Loose to Medium, brownish grey Silty Sand with mica.	7.00			UDS- 8.00	8.45				
				DS- 8.50					
				SPT- 10.00	10.45	6, 10, 12 = 22			
				SPT- 12.00	12.45	6, 10, 15 = 25			
		13.50		SPT- 13.50	13.95	8, 12, 17 = 29			
Medium to Dense, brownish grey Silty Sand with mica.	13.50			SPT- 15.00	15.45	10, 14, 20 = 34			
		15.45							

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
24/08/26
JM(civil)

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijohnagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- Auger & Mud-circulation

JOB Name:- Prop. 400/220/132KV Agia Anid Sub-Station
CLIENT:- DEBEL

Dia Of Hole : 150mm/NX

Depth in Mtr:- 15.0 (M) Rgr 5/5 Land
Location No:- BH-7 (SL. No. 10)

Commenced On: 12-08-2024

RL:- GPS
N - 26°05'47.0"
Ground Water:- 3.40(M) E - 90°33'59.7"

Completed On:- 18-08-2026

Ground Water:- 3.40/M

$$E = 94^{\circ}23'59.7''$$

D= Disturbed Sample, U= Undisturbed Sample, P=S,P,T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistencey , brownish to Reddish grey Silty clay mixed with Kankar & Sand.	0.00			DS-	0.50				
				DS-	1.00				
				UDS-	1.00	1.45			
				DS-	1.50				
				SPT-	2.00	2.45	5, 7, 7 = 14		
				SPT-	3.00	3.45	5, 7, 9 = 16		
Stiff, brownish grey, Sandy clay with Kankar.	5.00	5.00		UDS-	4.00	4.45			
				DS-	4.50				
				SPT-	5.00	5.45	3, 4, 5 = 9		
Loose Light, brownish grey Silty fine Sand with mica.	6.00	6.00		UDS-	6.00	6.45			
				DS-	6.50				
				SPT-	7.00	7.45	4, 6, 8 = 14		
		7.00							

Signature of Site In-Charge:

Sec
(P.K. Gupta 86)

Signature of Engineer In- Charge

Signature of Engineer In
Charge
20/04/23
JTM (Civil)

P.K.DUTTA & CO. SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165									
Type of Boring:- <i>Auger & Mud-Circulation</i>			JOB Name:- <i>Prop. 400/220/132 KV Agia, Grid Sub Station</i> CLIENT:- <i>AERCL</i>						
Dia Of Hole : 150mm/NX			Depth in Mtr:- <i>15.0 (H)</i> <i>Agia S/S Land</i> Location No :- <i>BH-7</i> <i>(SL No. 10)</i>						
Commenced On:- <i>12-08-2026</i>			RL:- <i>GPS</i> <i>N - 26°05'47.0"</i>						
Completed On:- <i>13-08-2026</i>			Ground Water:- <i>3.40 (H)</i> <i>E - 90°33'59.7"</i>						
D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T									
DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
<i>Medium, broatnish grey Silty Sand with mica.</i>	<i>7.00</i>	<i>15.45</i>							
			<i>SPT-</i>	<i>7.00</i>	<i>7.45</i>	<i>4, 6, 8 = 14</i>			
			<i>URS-</i>	<i>8.00</i>	<i>8.45</i>				
			<i>DS-</i>	<i>8.50</i>					
			<i>SPT-</i>	<i>10.00</i>	<i>10.45</i>	<i>5, 9, 12 = 21</i>			
			<i>SPT-</i>	<i>12.00</i>	<i>12.45</i>	<i>7, 10, 14 = 23</i>			
			<i>SPT-</i>	<i>13.50</i>	<i>13.95</i>	<i>9, 11, 15 = 26</i>			
			<i>SPT-</i>	<i>15.00</i>	<i>15.45</i>	<i>10, 14, 16 = 30</i>			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(P.K. Dutta & Co.)

P.K.DUTTA & CO.

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- *Auger & Mud-Circulation*

JOB Name:- *Prop. 400/220/132KV Agia Grid Sub-Station*
CLIENT:- *AE&CL*

Dia Of Hole : 150mm/NX

Depth in Mtr:- *15.0(M)* *Agia S/S Land.*
Location No :- *BH-8 (SL.No.5)*

Commenced On:- *07-08-2026*

RL:-

GPS

Completed On:- *08-08-2026*

Ground Water:- *3.65(M)*

N - 26°05'43.8°
E - 90°33'59.2°

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to Reddish, grey Silty clay mixed with sand & Konkar.	0.00			DS- 0.50					
				DS- 1.00					
				UDS- 1.00	1.45				
				DS- 1.50					
				SPT- 2.00	2.45	3, 5, 7 = 12			
				SPT- 3.00	3.45	3, 5, 6 = 11			
				UDS- 4.00	4.45				
				DS- 4.50					
				SPT- 5.00	5.45	4, 4, 5 = 9			
				UDS- 6.00	6.45				
				DS- 6.50					
Loose, Light brownish grey Silty Fine Sand with mica.	6.00	6.00		SPT- 7.00	7.45	4, 6, 7 = 13			
		7.00							

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(Jm Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>Prop. 400/220/132KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEGL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land.</i>
	Location No :- <i>BH-8 (SL.No.5)</i>
Commenced On:- <i>07-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>08-08-2026</i>	Ground Water:- <i>3.65 (M)</i> <i>N - 26°05'43.8"</i> <i>E - 90°33'59.2"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES.	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Medium, brownish grey silty sand with mica.	7.00			UDS- 8.00	8.45				
				DS- 8.50					
				SPT- 10.00	10.45	6, 10, 14 = 24			
		12.00		SPT- 12.00	12.45	8, 12, 18 = 30			
Medium to dense, brownish grey silty sand with mica.	12.00			SPT- 13.50	13.95	8, 14, 19 = 33			
		15.45		SPT- 15.00	15.45	8, 16, 21 = 37			

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
20/08/26
JTM (Civil)

P.K.DUTTA & CO.									
SAI TOWER , BLOCK – A, 1 st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165									
Type of Boring:- <i>Auger & Mud-Circulation</i>			JOB Name:- <i>Prop. 400/220/132KV Agia Conkr Sub Station</i>						
			CLIENT:- <i>REGCL</i>						
Dia Of Hole : 150mm/NX			Depth in Mtr:- <i>15.0 (M) Agia S/S Land</i>						
			Location No:- <i>BH-9 (SL. No. 3)</i>						
Commenced On:- <i>05-08-2026</i>			RL:- <i>GPS</i>						
Completed On:- <i>06-08-2026</i>			Ground Water:- <i>3.40 (M)</i>						
			<i>N - 26°05'45.9°</i> <i>E - 90°34'01.2°</i>						
D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T									
DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
<i>Stiff Consistency, brownish to Reddish grey Silty clay with Sand</i>	0.00			<i>DS-</i>	<i>0.50</i>				
				<i>DS-</i>	<i>1.00</i>				
				<i>UDS-</i>	<i>1.00</i>	<i>1.45</i>			
				<i>DS-</i>	<i>1.50</i>				
				<i>SPT-</i>	<i>2.00</i>	<i>2.45</i>	<i>4, 6, 9 = 15</i>		
				<i>SPT-</i>	<i>3.00</i>	<i>3.45</i>	<i>3, 5, 7 = 12</i>		
				<i>UDS-</i>	<i>4.00</i>	<i>4.45</i>			
				<i>DS-</i>	<i>4.50</i>				
				<i>SPT-</i>	<i>5.00</i>	<i>5.45</i>	<i>3, 3, 5 = 8</i>		
				<i>UDS-</i>	<i>6.00</i>	<i>6.45</i>			
				<i>DS-</i>	<i>6.50</i>				
				<i>SPT-</i>	<i>7.00</i>	<i>7.45</i>	<i>4, 5, 6 = 11</i>		
				<i>UDS-</i>	<i>8.00</i>	<i>8.45</i>			
				<i>DS-</i>	<i>8.50</i>				
				<i>Loose to Medium, brownish grey Silty Sand with mica.</i>	6.00	6.00			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(J.M. (Civil))

P.K.DUTTA & CO.

SAI TOWER , BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-circulation</i>	JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub-Station</i>
	CLIENT:- <i>AEBCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M) Agia S/S Land.</i>
	Location No:- <i>BH-9 (SL. NO. 3)</i>
Commenced On:- <i>05-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>06-08-2026</i>	Ground Water:- <i>3.40 (M)</i>
	<i>N - 26°05'45.9"</i>
	<i>E - 90°34'01.2"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Loose to Medium, brownish grey Silty Sand with mica.		15.45		SPT- 10.00	10.45	8, 11, 13 = 24			
				SPT- 12.00	12.45	8, 10, 13 = 23			
				SPT- 13.50	13.95	7, 12, 13 = 25			
				SPT- 15.00	15.45	7, 11, 16 = 27			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(P.K. Dutta & Co.)
24/08/26
24M (Civil)

P.K.DUTTA & CO.										
SAI TOWER , BLOCK – A, 1 st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165										
Type of Boring:- <i>Pug & Mud - Circulation</i>			JOB Name:- <i>prop. 400/220/132KV Agia Grid Sub Station.</i>							
Dia Of Hole : 150mm/NX			CLIENT:- <i>AEGCL</i>							
Depth in Mtr:- <i>15.0 (M)</i>			Location No:- <i>BH-10 (SL. NO. 4)</i>							
Commenced On:- <i>06-08-2026</i>			RL:- <i>GP5</i>							
Completed On:- <i>07-08-2026</i>			Ground Water:- <i>3.60 (M)</i> <i>N - 26°05'48.8"</i> <i>E - 90°34'01.5"</i>							
D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T										
DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth			TCR (%)	RQD (%)	
					From	To				
<i>Stiff Consistency, brownish to Reddish grey Silty clay mixed with Sand.</i>	0.00			DS-	0.50					
				DS-	1.00					
				UDS-	1.00	1.45				
				DS-	1.50					
				SPT-	2.00	2.45	3, 4, 7 = 11			
				SPT-	3.00	3.45	3, 5, 7 = 12			
				UDS-	4.00	4.45				
				DS-	4.50					
				SPT-	5.00	5.45	3, 3, 5 = 8			
				UDS-	6.00	6.45				
				DS-	6.50					
				SPT-	7.00	7.45	3, 3, 4 = 7			
				UDS-	8.00	8.45				
				PS-	8.50					
				<i>Loose to Medium, brownish grey Silty Sand with mica.</i>	6.00	6.00				

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(Jm Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation</i>	JOB Name:- <i>prop 400/220/132KV Agia Grid Sub Station</i> CLIENT:- <i>AEBCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0(M) Agia S/S Land.</i> Location No :- <i>BH-10 (SL.NO.4)</i>
Commenced On:- <i>06-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>07-08-2026</i>	Ground Water:- <i>3.60(M)</i> <i>N-26°05'48.8"</i> <i>E-90°34'01.5"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES		N- Value	COLLECTION OF ROCK SAMPLES.		
	From	To		Type	Depth		TCR (%)	RQD (%)	
					From				To
Loose to Medium, brownish grey Silty Sand with mica.		12.00		SPT-	10.00	10.45	6, 10, 12 = 22		
				SPT-	12.00	12.45	10, 13, 15 = 28		
Medium to Dense, brownish grey Silty Sand with mica.	12.00			SPT-	13.50	13.95	10, 14, 16 = 30		
		15.45		SPT-	15.00	15.45	12, 16, 18 = 34		

Signature of Site In-Charge.

[Signature]
(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

[Signature]
24/08/26
JM Civil

P.K.DUTTA & CO.

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-circulation</i>	JOB Name:- <i>Prop. 400/220/132kv Agia Grid Substation</i> CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (M)</i> <i>Agia S/S Land</i> Location No :- <i>BH-11 (SL.NO.2)</i>
Commenced On:- <i>04-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>05-08-2026</i>	Ground Water:- <i>3.50 (M)</i> <i>N - 26°05'46.1"</i> <i>E - 90°34'06.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff Consistency, brownish to reddish grey Silty clay mixed with sand & Kankar.	0.00			DS-	0.50				
				DS-	1.00				
				UDS-	1.00	1.45			
				DS-	1.50				
				SPT-	2.00	2.45	4, 5, 7 = 12		
				SPT-	3.00	3.45	4, 7, 7 = 14		
				UDS-	4.00	4.45			
				DS-	4.50				
				SPT-	5.00	5.45	3, 5, 5 = 10		
Loose, Light brownish grey Silty Fine Sand with mica.	6.00	6.00		UDS-	6.00	6.45			
				DS-	6.50				
				SPT-	7.00	7.45	4, 5, 8 = 13		
Medium, brownish grey Silty Sand with mica.	7.00	7.00		UDS-	8.00	8.45			
				DS-	8.50				

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

20/08/26 Jm (Civil)

P.K.DUTTA & CO.

SAI TOWER , BLOCK – A, 1st FLOOR, 6No. Bijoy nagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-circulation</i>	JOB Name:- <i>Prop. 400/220/132KV Agir Grid Sub-Station.</i>
	CLIENT:- <i>AEGL</i>
Dia Of Hole : 150mm/NX	Depth In Mtr:- <i>15.0 (M)</i>
	Location No :- <i>BH-11 (SL.No. 2)</i>
Commenced On:- <i>04-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>05-08-2026</i>	Ground Water:- <i>3.50 (M)</i>
	<i>N - 26°05'46.1"</i>
	<i>E - 90°34'06.8"</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Medium, brownish grey Silty Sand with mica.		12.00		SPT- 10.00	10.45	5, 9, 16 = 25			
				SPT 12.00	12.45	10, 12, 17 = 29			
Medium to Dense, brownish grey Silty Sand with mica.	12.00			SPT- 13.50	13.95	11, 14, 18 = 32			
		15.45		SPT- 15.00	15.45	13, 17, 23 = 40			

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In- Charge.

(P.K. Dutta & Co.)
Jm (Print)

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring:- <i>Auger & Mud-Circulation.</i>	JOB Name:- <i>Prop. 400/220/132 KV Agia Grid Substation.</i>
	CLIENT:- <i>AEGCL</i>
Dia Of Hole : 150mm/NX	Depth in Mtr:- <i>15.0 (H)</i> <i>Agia S/S Land</i>
	Location No :- <i>BH-12 (SI.No.1)</i>
Commenced On:- <i>03-08-2026</i>	RL:- <i>GPS</i>
Completed On:- <i>03-08-2026</i>	Ground Water:- <i>3.60 (H)</i> <i>N-26°05'48.1°</i> <i>E-90°34'06.7°</i>

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
Stiff. Consistency, brownish grey Silty Clay with Konkars & traces of sand.	0.00			DS-	0.50				
				DS-	1.00				
				UDS-	1.00	1.45			
				DS-	1.50				
				SPT-	2.00	2.45	5, 6, 6 = 12		
				SPT-	3.00	3.45	8, 5, 5 = 10		
				UDS-	4.00	4.45			
				DS-	4.50				
				SPT-	5.00	5.45	4, 5, 6 = 11		
				UDS-	6.00	6.45			
Loose, Light brownish, grey Silty fine sand with mica	6.00	6.00		DS-	6.50				
				SPT-	7.00	7.45	3, 3, 4 = 7		
				UDS-	8.00	8.45			
				DS-	8.50				
				SPT-	10.00	10.45	4, 5, 7 = 12		

Signature of Site In-Charge.

(P.K. Dutta & Co.)

Signature of Engineer In-Charge.

(P.K. Dutta & Co.)
JM (Civil)

P.K.DUTTA & CO.									
SAI TOWER , BLOCK – A, 1 st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165									
Type of Boring:- <i>Ruger & Mud-Circulation</i>			JOB Name:- <i>Prop. 400/220/132 Agia Grid Substation</i>						
			CLIENT:- <i>AE & CL</i>						
Dia Of Hole : 150mm/NX			Depth in Mtr:- <i>15.0(M)</i> <i>Agia S/S Land.</i>						
			Location No :- <i>BH-12 (SL.No.1)</i>						
Commenced On:- <i>03-08-2026</i>			RL:- <i>GPS</i>						
Completed On:- <i>03-08-2026</i>			Ground Water:- <i>3.60 (M)</i> <i>N- 26°05'48.1"</i> <i>E- 90°34'06.7"</i>						
D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T									
DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES			N- Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth			TCR (%)	RQD (%)
					From	To			
<i>Medium, brownish grey Silty Sand with mica.</i>	10.00			SPT-	12.00	12.45	4, 7, 10 = 17		
				SPT-	13.50	13.95	5, 8, 11 = 19		
				SPT-	15.00	15.45	6, 9, 15 = 24		
		15.45							

Signature of Site in-Charge.

(P.K. Dutta & Co.)

Signature of Engineer in-Charge.

(20/08/2026)
JM (Civil)

FIELD PHOTOGRAPH



PLT TEST



BH-1



BH-2



BH-3



BH-4



BH-5



BH-6



BH-7



BH-8



BH-9



BH-10



BH-11



BH-12

ASSAM ELECTRICITY GRID CORPORATION LIMITED



Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

: CONTRACTOR :
Shyama Power (India) Limited



: GEOTECHNICAL INVESTIGATION CONDUCTED BY :

P.K.DUTTA & CO.
SAI TOWER, Block-A, 1st Floor
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Checked by Jai Prasad	Checked by Jai Prasad	Checked by Jai Prasad	Checked by AGN (D&P)	Approved by AGN (D&P)

Submitted by :



Sign:
Date:

Client: Assam Electricity Grid Corporation Limited

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

1

A BY BORING METHOD

A.1.0 INTRODUCTION:

The Soil Investigation and laboratory tests for the proposed project for construction of 400/220/132/33 KV Grid Substation at Rangia has been awarded to Shyama power (India) Limited, Gurgaon, Haryana by Assam Electricity Grid Corporation Limited. Field Soil Exploration of bore holes , conducting of Plate Load Tests, California bearing Ratio and Proctor density test have been completed during 10.05.2024 to 29.05.2024.

The objective of this soil investigation consisting of borings including conducting in-situ tests, execution of Plate Load Tests ,California Bearing Ratio and Proctor Density test, collection of undisturbed & disturbed soil samples, conducting relevant laboratory tests, to study the soil stratifications, characteristics and engineering properties and suggesting safe approach to design and construction of foundation of proposed structure.

A.2.0 FIELD INVESTIGATION:

A.2.1 GENERAL:

For the design of the foundation for the proposed structure to be constructed at the site, this geotechnical investigation was done. In field work, the type of sub-soil profile and their characterization have been revealed. Laboratory testing and Plate Load Tests actually helps in determining relevant geotechnical properties of the sub-surface deposits leading to finalization of foundation depths and type of the structures and the bearing capacity with particular reference to the sub-surface types and their strength parameters and settlement potentials at the site.



Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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Schedule of boreholes in tabulated form is given below:

Bore Hole No.	Terminating Depth (m)	GPS		Date of Commencement	Date of Completion
		LONGITUDE	LATITUDE		
BH-1	15.00	91°36'23.9"	26°38'28.6"	11.05.2024	12.05.2024
BH-2	15.00	91°36'25.2"	26°38'26.9"	10.05.2024	11.05.2024
BH-3	15.00	91°36'28.2"	26°38'26.5"	13.05.2024	16.05.2024
BH-4	15.00	91°36'26.3"	26°38'28.9"	16.05.2024	18.05.2024
BH-5	15.00	91°36'28.9"	26°38'29.8"	18.05.2024	20.05.2024
BH-6	15.00	91°36'25.2"	26°38'32.4"	27.05.2024	29.05.2024
BH-7	15.00	91°36'28.5"	26°38'32.7"	20.05.2024	22.05.2024
BH-8	15.00	91°36'25.5"	26°38'36.9"	22.05.2024	24.05.2024
BH-9	15.00	91°36'24.5"	26°38'33.3"	25.05.2024	27.05.2024

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3

A.2.2 BORING/SAMPLING:

Of the different types of explorations, borings are the most practical and relatively correct method of obtaining sub-surface information. 9 (Nine) nos. bore holes of 150 mm diameter were sunk as per specifications and IS: 1892 and were extended up to specified depth 15.00m each for visualizing the stratification of soil. Casings as required were used to retain the borehole. Boring was carried out by Shell and Augur followed by Wash boring method in soil.

The details of these bore holes including field tests of Standard Penetration tests and also collection of disturbed and undisturbed soil samples are given in Bore Logs enclosed. Disturbed & SPT representative samples of sub-surface deposits were collected from bore holes, labeled depth wise and placed in polythene bags. Reference Numbers and depth of these samples are shown in Bore Log Data Sheets.

For proper evaluation of engineering properties of in-situ soils, including shear parameters and consolidation characteristics, representative undisturbed soil samples were collected at intervals along the boreholes, whenever clayey silt/silty clay or silty fine sand with clay binders were encountered.

Disturbed representative soil samples were collected during progress of boring, from shell and also from split-spoon sampler of Standard Penetration Tests conducted at different depth in boreholes. Such soil sample contains all the constituent materials of the respective stratum. Depth and details of the sample are shown in the borehole logs (Annexure).

A.2.3 STANDARD PENETRATION TEST (SPT):

The standard penetration tests were conducted as per IS 2131-1981. The split spoon sampler, connected with a string of drill rods, was lowered into the bottom of the bore hole. The sampler was driven into the soil stratum up to a maximum depth of 450mm. by making use of 63.5 kg. Weight falling freely from a height of 750mm on to an anvil fixed on the top of drill rod. The number of blows required to penetrate each of the successive 150mm. depths was counted to produce a total penetration of 450mm. To avoid seating errors, the blows required for the first 150mm. of penetration was not taken into account. Those required to increase the penetration from 150mm. to 450mm. constituted the N-number. On completion of the test, the sampler was lifted to the ground, opened, and the specimen of the soil sample was stored in polythene bags with the proper identification mark. N-value is noted in borehole log data sheets against the corresponding depth.

Followings are the corrections on SPT values in cohesion-less soil:

1. Due to overburden: N value for cohesion-less soil shall be corrected for overburden as per Fig. 1 of IS: 2131 (N').
2. Due to Dilatancy: The values corrected for overburden shall be corrected for dilatancy if the stratum consists of fine sand and silt below water table for values of N' greater than 15, as under (N''): $N'' = 15 + 0.5 \cdot (N' - 15)$



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Typical calculation for N value correction:

BH:-. Depth: 5.00m to 5.45m. Field N = 25. Water table: 2.00 m below EGL.

From Fig 1. of IS: 2131, correction factor = 1.10

So corrected SPT value for overburden, $N' = 1.10 \times 25 = 27.50$.

Corrected SPT value for dilatancy, $N'' = 15 + \{0.5 \times (27.50 - 15)\} = 21.25$.

Same calculation will be valid for other N values in sandy layer. All the correction in detail is presented in a tabular form below.

BULK DENSITY		1.86	WATER TABLE				2				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-1	2.00	2.45	2.23	6	0.41	0.39	0.39	1.77	7.62		8
	3.00	3.45	3.23	11	0.60	0.48	0.48	1.21	13.31		13
	5.00	5.45	5.23	25	0.97	0.65	0.65	1.09	27.25	21.13	21
	7.00	7.45	7.23	54	1.34	0.82	0.82	1.04	56.16	35.58	36
	10.00	10.45	10.23	76	1.90	1.08	1.08	0.97	73.72	44.36	44
	13.00	13.25	13.13	100	2.44	1.33	1.33	0.9	90.00	52.50	53

BULK DENSITY		1.85	WATER TABLE				1.7				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR.	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH 2	2.00	2.45	2.23	13	0.41	0.36	0.36	1.28	16.64	15.82	16
	3.00	3.45	3.23	5	0.60	0.44	0.44	1.24	6.2		6
	5.00	5.45	5.23	42	0.97	0.61	0.61	1.11	46.62	30.81	31
	7.00	7.45	7.23	45	1.34	0.78	0.78	1.04	46.8	30.90	31
	10.00	10.45	10.23	56	1.89	1.04	1.04	0.99	55.44	35.22	35
	13.00	13.30	13.15	100	2.43	1.25	1.29	0.91	91.00	53.00	53

BULK DENSITY		1.86	WATER TABLE				1.7				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-3	2.00	2.45	2.23	6	0.41	0.36	0.35	1.28	7.68		8
	3.00	3.45	3.23	10	0.60	0.45	0.45	1.23	12.3		12
	5.00	5.45	5.23	26	0.97	0.62	0.62	1.11	28.96	21.93	22
	7.00	7.45	7.23	48	1.34	0.79	0.79	1.04	49.92	32.46	32
	10.00	10.45	10.23	70	1.90	1.05	1.05	0.98	68.6	41.80	42
	13.00	13.30	13.15	100	2.45	1.30	1.30	0.91	91.00	53.00	53

Submitted By Shyama Power (I) Limited.



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BULK DENSITY		1.84	WATER TABLE				2.3				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-4	2.00	2.45	2.23	4	0.41	0.42	0.41	1.25	5		5
	3.00	3.45	3.23	19	0.59	0.50	0.50	1.2	22.8	18.90	19
	5.00	5.45	5.23	30	0.96	0.67	0.67	1.08	22.40	23.70	24
	7.00	7.45	7.23	42	1.33	0.84	0.84	1.03	43.76	29.13	29
	10.00	10.45	10.23	72	1.88	1.09	1.09	0.97	69.84	42.42	42
	13.00	13.25	13.13	100	2.42	1.33	1.33	0.9	90.00	52.50	53

BULK DENSITY		1.82	WATER TABLE				2.1				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-5	2.00	2.45	2.23	8	0.40	0.39	0.39	1.27	10.16		10
	3.00	3.45	3.23	14	0.59	0.47	0.47	1.22	17.08	16.04	16
	5.00	5.45	5.23	28	0.95	0.64	0.64	1.1	30.80	22.90	23
	7.00	7.45	7.23	47	1.31	0.80	0.80	1.04	48.88	31.91	32
	10.00	10.45	10.23	73	1.86	1.05	1.05	0.90	71.54	43.27	43
	13.00	13.30	13.15	100	2.39	1.29	1.29	0.9	90.00	52.50	53

BULK DENSITY		1.85	WATER TABLE				1.5				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-6	2.00	2.45	2.23	6	0.41	0.34	0.34	1.3	7.8		8
	3.00	3.45	3.23	15	0.60	0.42	0.42	1.24	12.4	-	12
	5.00	5.45	5.23	23	0.97	0.59	0.59	1.13	23.99	20.50	20
	7.00	7.45	7.23	58	1.31	0.76	0.76	1.04	60.32	37.66	38
	10.00	10.45	10.23	75	1.89	1.02	1.02	0.99	74.25	44.69	45
	13.00	13.25	13.13	130	2.43	1.27	1.27	0.92	92.00	59.50	54

BULK DENSITY		1.84	WATER TABLE				2.25				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m2)		EFFECTIVE OVP (t/m2)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-7	2.00	2.45	2.23	4	0.41	0.41	0.41	1.25	5	-	5
	3.00	3.45	3.23	10	0.59	0.50	0.50	1.2	12	-	12
	5.00	5.45	5.23	23	0.96	0.66	0.66	1.08	24.84	19.92	20
	7.00	7.45	7.23	41	1.33	0.83	0.83	1.03	45.32	30.16	30
	10.00	10.45	10.23	85	1.88	1.08	1.08	0.97	83.42	49.21	49
	13.00	13.25	13.13	100	2.42	1.33	1.33	0.9	90.00	52.50	53

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari GSS (Package G)"

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BULK DENSITY		1.87	WATER TABLE				1.5				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m ²)		EFFECTIVE OVP (t/m ²)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-8	2.00	2.45	2.23	6	0.42	0.35	0.35	1.29	7.74		8
	3.00	3.45	3.23	9	0.60	0.44	0.44	1.24	11.15		11
	5.00	5.45	5.23	30	0.98	0.61	0.61	1.11	39.30	24.15	24
	7.00	7.45	7.23	51	1.35	0.79	0.79	1.04	53.04	34.02	34
	10.00	10.45	10.23	80	1.91	1.05	1.05	0.98	78.4	46.70	47
	13.00	13.25	13.13	100	2.45	1.30	1.30	0.91	92.00	59.00	53

BULK DENSITY		1.83	WATER TABLE				1.5				
STRATUM	START DEPTH (m)	END DEPTH (m)	AVG. DEPTH (m)	FIELD N VALUE	EFFECTIVE OVP (t/m ²)		EFFECTIVE OVP (t/m ²)	OVP CORR. FACTOR	CORRECTION		CORRECTED N
					ABOVE WT	BELOW WT			OVERBURDEN	DILATANCY	
BH-9	2.00	2.45	2.23	6	0.41	0.34	0.34	1.3	7.8	-	8
	3.00	3.45	3.23	14	0.59	0.43	0.43	1.24	17.36	16.18	16
	5.00	5.45	5.23	25	0.96	0.59	0.59	1.13	28.75	21.63	22
	7.00	7.45	7.23	54	1.37	0.76	0.76	1.04	56.16	35.38	36
	10.00	10.45	10.23	72	1.87	1.01	1.01	1	72	43.50	44
	13.00	13.25	13.13	100	2.40	1.25	1.25	0.93	93.00	54.00	54

A.2.4 MEASUREMENT OF WATER LEVEL:

Depth of level of water was noted when struck in. This is termed as depth of observed water level below existing ground level (EGL). Depth of standing water level (SWL) below EGL after 24 hours of removal of casing was also noted and shown in the profile. Standing water level was not encountered at any Borehole or Trail Pit. However ground water level is considered at ground level for design purpose.

BH No.	Depth (m)	Depth of SWL below EGL (m)	Commenced on	Completed on
BH-1	15.00	2.00	11.05.2024	12.05.2024
BH-2	15.00	1.70	10.05.2024	11.05.2024
BH-3	15.00	1.70	13.05.2024	16.05.2024
BH-4	15.00	2.30	16.05.2024	18.05.2024
BH-5	15.00	2.10	18.05.2024	20.05.2024
BH-6	15.00	1.50	27.05.2024	29.05.2024
BH-7	15.00	2.25	20.05.2024	22.05.2024
BH-8	15.00	1.60	22.05.2024	24.05.2024
BH-9	15.00	1.60	25.05.2024	27.05.2024

Note: SWL=Standing Water Level, EGL=Existing Ground Level

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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A.2.5 ROTARY CORE DRILLING:

Conventional diamond core drilling equipment was used for drilling vertical holes up to specified depth at each location. Rotary core drilling in rock was carried out according to IS 1892-1979. This drilling technique was regarded as the most satisfactory method of assessing the character of rock formations, which lie at depth below the ground surface. Specimens of rock in the form of cylindrical cores were recovered from the drill hole by means of a core barrel. Double barrel technique was adopted according to field condition. The core barrel was provided at its lower end with a detachable shoe or core bit, which is of diamond. All rotary core bits were of NX (75mm) size.

A.3.0 LABORATORY TESTING:

For proper identification and classification of the sub-surface and for deriving adequate information regarding its relevant physical and geotechnical properties at the site under investigation, the following laboratory tests were conducted on the soil and rock samples collected from the bore holes:

For Soil Samples:

1. Grain size analysis (Sieve as well as Hydrometer).
2. Liquid Limit & Plastic Limit.
3. Natural Moisture Content.
4. Specific Gravity.
5. Bulk & Dry Density.
6. Triaxial Shear Test
7. Direct Shear Test (DS).
8. Chemical Analysis
9. Proctor Density
10. CBR

For Water Samples:

1. Chemical Analysis

The above mentioned laboratory tests were done following the testing procedure given in the relevant parts of IS: 2720 and other relevant IS codes. Results of all tests are furnished in Annexure of this report.



Client: Assam Electricity Grid Corporation Limited.

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A.4.0 SUBSOIL PROFILE:

A.4.0 SUBSOIL PROFILE & ENGINEERING PROPERTIES:

4.1. BH-1:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Firm to stiff brownish to dark black grey silty clay/clayey silt with kankars. Depth of this layer is 4.50m. Average Field "N" value of this layer is 9. This layer is laying after EGL and continues up to 4.50m.

Physical properties		
Gravel	%	0
Sand	%	6
Silt	%	56
Clay	%	28
Classification		
IS Classification	ML	

Liquid limit	%	34.60
Plastic limit	%	20.43
PI		14.17
Bulk density	g/cc	1.88
Dry density	g/cc	1.43
NMC	%	31.14
Sp. Gr.		2.67

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm	0.30
Ø	°	6
Consolidation		
M _v	m/t	0.0023

STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of dense dark grey / bluish grey silty sand with mica. Depth of this layer is 2.50m. Average Field "N" value of this layer is 25. This layer is laying after 4.50m and continues up to 7.00m.

Physical properties		
Gravel	%	3
Sand	%	75
Silt	%	20
Clay	%	2
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.80
Dry density	g/cc	1.38
NMC	%	30.00
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm	0
Ø	°	28
Consolidation		
M _v	m/t	-----



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey bluish grey silty medium to coarse sand with mica. Depth of this layer is 8.00m. Average Field "N" value of this layer is 77. This layer is laying after 7.00m and continues up to its termination depth (15.00m)

Physical properties		
Gravel	%	4
Sand	%	86
Silt	%	9
Clay	%	1
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.87
Dry density	g/cc	1.42
NMC	%	32.00
Sp. Gr.		2.67

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	34
Consolidation		
M _v	m/t	-----

4.2. BH-2:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Stiff deep brownish to dark bluish grey silty clay / clayey silt with mica. Depth of this layer is 5.00m. Average Field "N" value of this layer is 9. This layer is laying after EGL and continues up to 5.00m.

Physical properties		
Gravel	%	0
Sand	%	8
Silt	%	66
Clay	%	26
Classification		
IS Classification		ML

Liquid limit	%	33.99
Plastic limit	%	19.55
PI		14.44
Bulk density	g/cc	1.90
Dry density	g/cc	1.44
NMC	%	31.25
Sp. Gr.		2.66

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.32
Ø	°	7
Consolidation		
M _v	m/t	0.0022

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari GSS (Package G)"

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of dense dark grey to bluish grey silty fine sand to medium sand with mica. Depth of this layer is 5.00m. Average Field "N" value of this layer is 44. This layer is laying after 5.00m and continues up to 10.00m.

Physical properties		
Gravel	%	4
Sand	%	70
Silt	%	22
Clay	%	4
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.82
Dry density	g/cc	1.42
NMC	%	28.00
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	32
Consolidation		
M _v	m / t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey to light grey medium to coarse sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 78. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	10
Sand	%	74
Silt	%	15
Clay	%	1
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.80
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.65

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	37
Consolidation		
M _v	m / t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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4.3. BH-3:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Firm to stiff deep brownish to dark bluish grey silty clay / clayey silt with mica. Depth of this layer is 4.50m. Average Field "N" value of this layer is 8. This layer is laying after EGL and continues up to 4.50m.

Physical properties		
Gravel	%	0
Sand	%	7
Silt	%	66
Clay	%	27
Classification		
IS Classification	ML	

Liquid limit	%	33.56
Plastic limit	%	19.35
PI		14.21
Bulk density	g/cc	1.91
Dry density	g/cc	1.48
NMC	%	29.06
Sp. Gr.		2.67

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.31
Ø	°	6
Consolidation		
M _v	m/t	0.0025

STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense to dense dark grey to bluish grey silty fine to medium sand with mica. Depth of this layer is 5.50m. Average Field "N" value of this layer is 37. This layer is laying after 4.50m and continues up to 10.00m.

Physical properties		
Gravel	%	2
Sand	%	84
Silt	%	10
Clay	%	4
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.80
Dry density	g/cc	1.43
NMC	%	26.25
Sp. Gr.		2.63

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	31
Consolidation		
M _v	m/t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey to light grey medium to coarse sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 85. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	7
Sand	%	87
Silt	%	5
Clay	%	1
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.83
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.67

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	35
Consolidation		
M _v	m ² /t	-----

4.4. BH-4:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Soft deep brownish grey silty clay / clayey silt with mica. Depth of this layer is 3.00m. Average Field "N" value of this layer is 4. This layer is laying after EGL and continues up to 3.00m.

Physical properties		
Gravel	%	0
Sand	%	5
Silt	%	80
Clay	%	15
Classification		
IS Classification		ML

Liquid limit	%	33.40
Plastic limit	%	19.70
PI		13.70
Bulk density	g/cc	1.90
Dry density	g/cc	1.50
NMC	%	26.54
Sp. Gr.		2.66

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.22
Ø	°	5
Consolidation		
M _v	m ² /t	0.0020

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense to dense dark grey silty fine to medium sand with mica. Depth of this layer is 7.00m. Average Field "N" value of this layer is 30. This layer is laying after 3.00m and continues up to 10.00m.

Physical properties		
Gravel	%	4
Sand	%	76
Silt	%	18
Clay	%	2
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.82
Dry density	g/cc	1.42
NMC	%	27.55
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	33
Consolidation		
M _v	m/t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey medium to coarse sand with mica. Depth of this layer is 5.00m. Average Field "N" value of this layer is 86. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	7
Sand	%	88
Silt	%	5
Clay	%	0
Classification		
IS Classification		SP

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.82
Dry density	g/cc	1.48
NMC	%	-----
Sp. Gr.		2.68

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	37
Consolidation		
M _v	m/t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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4.5. BH-5:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Medium stiff to stiff dark brownish grey silty clay / clayey silt with mica. Depth of this layer is 3.00m. Average Field "N" value of this layer is 8. This layer is laying after EGL and continues up to 3.00m.

Physical properties			Liquid limit			Shear strength		
Gravel	%	0	Plastic limit	%	20.56	Type of Test		
Sand	%	10	PI		14.65	UU (Triaxial Test)		
Silt	%	70	Bulk density	g/cc	1.87	C	kg/cm ²	0.24
Clay	%	20	Dry density	g/cc	1.47	Ø	°	7
Classification			NMC	%	27.45	Consolidation		
IS Classification	ML		Sp. Gr.		2.66	M _v	m ³ /t	0.0021

STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense to dense dark grey silty fine to medium sand with mica. Depth of this layer is 2.00m. Average Field "N" value of this layer is 14. This layer is laying after 3.00m and continues up to 5.00m.

Physical properties			Liquid limit			Shear strength		
Gravel	%	3	Plastic limit	%	NP	Type of Test		
Sand	%	87	PI		NP	DS (Direct-Shear Test)		
Silt	%	5	Bulk density	g/cc	1.77	C	kg/cm ²	0
Clay	%	5	Dry density	g/cc	1.47	Ø	°	32
Classification			NMC	%	20.65	Consolidation		
IS Classification	SM		Sp. Gr.		2.64	M _v	m ³ /t	-----



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of dense dark grey silty fine to medium sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 38. This layer is laying after 5.00m and continues up to 10.00m.

Physical properties		
Gravel	%	5
Sand	%	91
Silt	%	3
Clay	%	1
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.81
Dry density	g/cc	1.48
NMC	%	22.35
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	35
Consolidation		
M _v	m / t	-----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey medium to coarse sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 87. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	6
Sand	%	94
Silt	%	0
Clay	%	0
Classification		
IS Classification		SP

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.83
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.63

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	38
Consolidation		
M _v	m / t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package (i))"

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4.6. BH-6:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Medium stiff dark brownish grey silty clay / clayey silt with mica. Depth of this layer is 3.50m. Average Field "N" value of this layer is 8. This layer is laying after T.G.T. and continues up to 3.50m.

Physical properties		
Gravel	%	0
Sand	%	9
Silt	%	68
Clay	%	23
Classification		
IS Classification	ML	

Liquid limit	%	34.85
Plastic limit	%	20.35
PI		14.50
Bulk density	g/cc	1.90
Dry density	g/cc	1.45
NMC	%	31.21
Sp. Gr.		2.67

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.30
Ø	°	6
Consolidation		
M _v	m/t	0.0022

STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense dark grey silty fine to medium sand with mica. Depth of this layer is 3.50m. Average Field "N" value of this layer is 23. This layer is laying after 3.50m and continues up to 7.00m.

Physical properties		
Gravel	%	5
Sand	%	83
Silt	%	7
Clay	%	5
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.84
Dry density	g/cc	1.44
NMC	%	27.83
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	32
Consolidation		
M _v	m/t	---

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey medium to coarses sand with mica & gravels. Depth of this layer is 8.00m. Average Field "N" value of this layer is 78. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

Physical properties			Liquid limit	%	NP	Shear strength		
Gravel	%	10	Plastic limit	%	NP	Type of Test		
Sand	%	90	PI		NP	DS (Direct-Shear Test)		
Silt	%	0	Bulk density	g/cc	1.82	C	kg/cm ²	0
Clay	%	0	Dry density	g/cc	-----	Ø	°	36
Classification			NMC	%	-----	Consolidation		
IS Classification	SP		Sp. Gr.		2.65	M _v	m / t	-----

4.7. BH-7:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Soft to firm deep brownish grey clay / clayey silt with mica. Depth of this layer is 3.00m. Average Field "N" value of this layer is 4. This layer is laying after FGL and continues up to 3.00m.

Physical properties			Liquid limit	%	34.00	Shear strength		
Gravel	%	9	Plastic limit	%	19.00	Type of Test		
Sand	%	69	PI		15.00	UU (Triaxial Test)		
Silt	%	22	Bulk density	g/cc	1.88	C	kg/cm ²	0.22
Clay	%	20	Dry density	g/cc	1.50	Ø	°	5
Classification			NMC	%	25.23	Consolidation		
IS Classification	ML		Sp. Gr.		2.66	M _v	m / t	0.0018

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense dark grey silty fine to medium sand with mica. Depth of this layer is 2.00m. Average Field "N" value of this layer is 10. This layer is laying after 3.00m and continues up to 5.00m.

Physical properties		
Gravel	%	0
Sand	%	85
Silt	%	10
Clay	%	5
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.80
Dry density	g/cc	1.52
NMC	%	18.20
Sp. Gr.		2.63

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	34
Consolidation		
M _v	m/t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Dense dark grey silty fine to medium sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 34. This layer is laying after 5.00m and continues up to 10.00m.

Physical properties		
Gravel	%	8
Sand	%	91
Silt	%	1
Clay	%	0
Classification		
IS Classification		SP

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.82
Dry density	g/cc	1.53
NMC	%	19.00
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	37
Consolidation		
M _v	m/t	-----



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-IV:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey medium to coarse sand with mica & gravels. Depth of this layer is 5.00m. Average Field "N" value of this layer is 93. This layer is laying after 10.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	9
Sand	%	91
Silt	%	0
Clay	%	0
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.85
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.67

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	40
Consolidation		
M _v	m/t	-----

4.8. BII-8:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Medium stiff to stiff dark brownish grey to dark grey silty clay / clayey silt with mica. Depth of this layer is 5.00m. Average Field "N" value of this layer is 8. This layer is laying after EGL and continues up to 5.00m.

Physical properties		
Gravel	%	0
Sand	%	9
Silt	%	64
Clay	%	27
Classification		
IS Classification		ML

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.90
Dry density	g/cc	1.46
NMC	%	29.90
Sp. Gr.		2.68

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.31
Ø	°	6
Consolidation		
M _v	m/t	0.0023



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense dark silty fine to medium sand with mica. Depth of this layer is 2.00m. Average Field "N" value of this layer is 30. This layer is laying after 5.00m and continues up to 7.00m.

Physical properties		
Gravel	%	7
Sand	%	83
Silt	%	8
Clay	%	2
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.83
Dry density	g/cc	1.51
NMC	%	21.56
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	30
Consolidation		
M _v	m/t	-----

STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey medium to coarse sand with gravels & mica. Depth of this layer is 8.00m. Average Field "N" value of this layer is 77. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	9
Sand	%	91
Silt	%	0
Clay	%	0
Classification		
IS Classification	SP	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.85
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.65

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	35
Consolidation		
M _v	m/t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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4.9. BH-9:

STRATUM-I:-

The properties of the layer are as follows:

Description:

This later consists of Medium stiff brownish grey to dark grey silty clay / clayey silt with mica. Depth of this layer is 3.00m. Average Field "N" value of this layer is 6. This layer is laying after EGL and continues up to 3.00m.

Physical properties		
Gravel	%	0
Sand	%	10
Silt	%	68
Clay	%	22
Classification		
IS Classification	ML	

Liquid limit	%	33.27
Plastic limit	%	21.00
PI		12.27
Bulk density	g/cc	1.90
Dry density	g/cc	1.47
NMC	%	29.25
Sp. Gr.		2.67

Shear strength		
Type of Test		
UU (Triaxial Test)		
C	kg/cm ²	0.30
Ø	°	4
Consolidation		
M _v	m / t	0.0022

STRATUM-II:-

The properties of the layer are as follows:

Description:

This later consists of Medium dense dark grey silty fine to medium sand with mica. Depth of this layer is 2.00m. Average Field "N" value of this layer is 14. This layer is laying after 3.00m and continues up to 5.00m.

Physical properties		
Gravel	%	4
Sand	%	80
Silt	%	10
Clay	%	6
Classification		
IS Classification	SM	

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.78
Dry density	g/cc	1.49
NMC	%	19.65
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	31
Consolidation		
M _v	m ² /t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)"

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STRATUM-III:-

The properties of the layer are as follows:

Description:

This later consists of Dense dark grey silty fine to medium sand with mica & gravels. Depth of this layer is 2.00m. Average Field "N" value of this layer is 25. This layer is laying after 5.00m and continues up to 7.00m.

Physical properties		
Gravel	%	7
Sand	%	84
Silt	%	6
Clay	%	3
Classification		
IS Classification		SM

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.81
Dry density	g/cc	1.51
NMC	%	20.15
Sp. Gr.		2.64

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	34
Consolidation		
M _v	m/t	-----

STRATUM-IV:-

The properties of the layer are as follows:

Description:

This later consists of Very dense dark grey silty medium to coarse sand with mica & gravels. Depth of this layer is 8.00m. Average Field "N" value of this layer is 75. This layer is laying after 7.00m and continues up to its termination depth (15.00m).

Physical properties		
Gravel	%	11
Sand	%	89
Silt	%	0
Clay	%	0
Classification		
IS Classification		SP

Liquid limit	%	NP
Plastic limit	%	NP
PI		NP
Bulk density	g/cc	1.83
Dry density	g/cc	-----
NMC	%	-----
Sp. Gr.		2.66

Shear strength		
Type of Test		
DS (Direct-Shear Test)		
C	kg/cm ²	0
Ø	°	36
Consolidation		
M _v	m/t	-----

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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A5.0: Sample Calculations

[Note: As per borelog BH-1, BH-6 & BH-8 are almost similar in nature. So, sample calculation of BH-1 is incorporated & bearing capacity of other boreholes are shown in table format below]

BH-1

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 3.00 m.

The founding depth is falling in Stratum-1.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-I:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0mX3.0m) (Depth 3.00m)

Bearing Capacity as per IS 6403:1981 considering 3.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 3.0 t/sqm

γ = Submerged density = $(\gamma-1) = 1.88-1 = 0.88$ t/m³

N_q = Bearing capacity factor, for $\phi = 4^\circ$ [Considering Local Shear Failure], $N_q = 1.43$

N_γ = Bearing capacity factor, for $\phi = 4^\circ$ [Considering Local Shear Failure], $N_\gamma = 0.34$

$N_c = 6.19$

s_q & s_γ = Shape correction, $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction, Here $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.21$

i_q & i_γ = Inclination Factor, $= (1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 3.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [3*6.19*1.3*1.21*1 + 0.88*3*(1.43-1)*1.2*1.00*1.0 + 0.5*1.88* \\ &3*0.34*0.8*1.00*1.0*0.5] \\ &= 10.32 \text{ T/Sqm} \end{aligned}$$

Client: Assam Electricity Grid Corporation Limited.

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24

Settlement Analysis of Shallow Foundation

Settlement, $S = H \times mv \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = $1.5 B = 1.5 \times 3.0 = 4.50$ m

mv = Co-efficient of Volume Change = $0.023 \text{ sqcm/Kg} = 0.0023 \text{ sqm/t}$

Δp = Increment of stress = $(3 \times 3 \times 10.32) / \{(3 - 2.25)^2\} = 3.37 \text{ t/sqm}$

Therefore

$S = 4.5 \times 0.0023 \times 3.37 \times 1000 = 34.88 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 10.32 t/sqm

Assumed foundation size = $3.00 \text{ m} \times 3.00 \text{ m}$

Depth of foundation = 5.00 m .

The founding depth is falling in Stratum-II.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-II:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width $3.0 \text{ m} \times 3.0 \text{ m}$) (Depth 5.00 m)

Bearing Capacity as per IS 6403:1981 considering 5.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.80 - 1 = 0.80 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 28^\circ$, $N_q = 14.72$

N_γ = Bearing capacity factor, for $\phi = 28^\circ$, $N_\gamma = 16.72$

$N_c = 25.80$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.28$ and $d_\gamma = 1.28$

$d_c = 1.55$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 5.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 \times 25.80 \times 1.3 \times 1.55 \times 1 + 0.80 \times 5 \times (14.72 - 1) \times 1.2 \times 1.28 \times 1.0 + 0.5 \times 1.80 \times \\ &\quad 3 \times 16.72 \times 0.8 \times 1.28 \times 1.0 \times 0.5] \\ &= 35.80 \text{ T/Sqm} \end{aligned}$$

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

25

Settlement Analysis of Shallow Foundation

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N'= 21 is 15.5 mm

Hence, for 35.80 t/sqm pressure the settlement will be – $15.5 \times 35.80 / 10 = 55.49 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 25.81 t/sqm

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 7.00 m.

The founding depth is falling in Stratum-III.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-III:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m) (Depth 7.00m)

Bearing Capacity as per IS 6403:1981 considering 7.00 m depth of foundation

$$q_d = 1/F [C.N_c s_c d_c i_c + \gamma' D.(N_q + 1).s_q d_q i_q + 0.5. \gamma.B.N_\gamma s_\gamma d_\gamma i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.87 - 1 = 0.87 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 34^\circ$, $N_q = 29.44$

N_γ = Bearing capacity factor, for $\phi = 34^\circ$, $N_\gamma = 41.06$

$N_c = 42.16$

s_q & s_γ = Shape correction, $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.44$ and $d_\gamma = 1.44$

$d_c = 1.88$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 7.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c s_c d_c i_c + \gamma' D.(N_q + 1).s_q d_q i_q + 0.5. \gamma.B.N_\gamma s_\gamma d_\gamma i_\gamma W'] \\ &= 1/3 [0 \times 42.16 \times 1.3 \times 1.44 \times 1 + 0.87 \times 7 \times (29.44 + 1) \times 1.2 \times 1.44 \times 1.0 + 0.5 \times 1.87 \times 3 \times 41.06 \times 0.8 \times 1.44 \times 1.0 \times 0.5] \\ &= 121.88 \text{ T/Sqm} \end{aligned}$$



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Settlement Analysis of Shallow Foundation

According to IS 8009 (Part I): 1976 clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N'= 36 is 7.5 mm

Hence, for 121.88 t/sqm pressure the settlement will be = $7.5 \times 121.88 / 10 = 91.41 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 53.33t/sqm

[Note: As per borelog BH-2, BH-3 & BH-4 are almost similar in nature. So, sample calculation of BH-2 is incorporated & bearing capacity of other boreholes are shown in table format below]

BH-2

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 3.00 m.

The founding depth is falling in Stratum-I.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-I:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m) (Depth 3.00m)

Bearing Capacity as per IS 6403:1981 considering 3.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d - Allowable Bearing Capacity

C - Cohesion = 3.2 t/sqm

γ' - Submerged density - $(\gamma - 1) = 1.90 - 1 = 0.90 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 7^\circ$ [Considering Local Shear Failure], $N_q = 1.88$

N_γ = Bearing capacity factor, for $\phi = 7^\circ$ [Considering Local Shear Failure], $N_\gamma = 0.71$

$N_c = 7.16$

s_q & s_γ - Shape correction, $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ - Depth correction. Here $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.23$

i_q & i_γ - Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' - Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 3.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [3.2*7.16*1.3*1.23*1 + 0.90*3*(1.88-1)*1.2*1.00*1.0 + 0.5*1.90* \\ &3*0.71*0.8*1.00*1.0*0.5] \\ &= 13.43 \text{ T/Sqm} \end{aligned}$$

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Settlement Analysis of Shallow Foundation

Settlement, $S = H \times mv \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = $1.5 B = 1.5 \times 3.0 = 4.50$ m

mv = Co-efficient of Volume Change = $0.022 \text{ sqcm/Kg} = 0.0022 \text{ sqm/t}$

Δp = Increment of stress = $(3 \times 3 \times 13.43) / \{(3 + 2.25)^2\} = 4.39 \text{ t/Sqm}$

Therefore

$S = 4.5 \times 0.0022 \times 4.39 \times 1000 = 43.41 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 12.38t/sqm

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 5.00 m.

The founding depth is falling in Stratum-II.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-II:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0m X 3.0m) (Depth 5.00m)

Bearing Capacity as per IS 6403:1981 considering 5.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_q + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.82 - 1 = 0.82 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 32^\circ$, $N_q = 23.18$

N_γ = Bearing capacity factor, for $\phi = 32^\circ$, $N_\gamma = 30.22$

$N_c = 35.49$

s_q & s_γ = Shape correction, $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.30$ and $d_\gamma = 1.30$

$d_c = 1.60$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 5.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_q + \gamma' D.(N_q - 1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 \times 35.49 \times 1.3 \times 1.60 \times 1 + 0.82 \times 5 \times (23.18 - 1) \times 1.2 \times 1.30 \times 1.0 + 0.5 \times 1.82 \times \\ &\quad 3 \times 30.22 \times 0.8 \times 1.30 \times 1.0 \times 0.5] \\ &= 61.59 \text{ T/Sqm} \end{aligned}$$

Submitted By **Shyama Power (I) Limited.**



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

28

Settlement Analysis of Shallow Foundation

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N'= 31 is 8.5 mm

Hence, for 61.59 t/sqm pressure the settlement will be = $8.5 \times 61.59 / 10 = 52.35 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 47.06 t/sqm

[Note: As per borelog, BH-5 & BH-7 are almost similar in nature. So, sample calculation of BH-5 is incorporated & bearing capacity of other boreholes are shown in table format below]

BH-5

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 1.00 m.

The founding depth is falling in Stratum-I.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-I:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0mX3.0m) (Depth 1.00m)

Bearing Capacity as per IS 6403:1981 considering 1.00 m depth of foundation

$$q_d = 1/F [C.N_c s_c d_c i_c + \gamma' D (N_q - 1) s_q d_q i_q + 0.5 \gamma B N_\gamma s_\gamma d_\gamma i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 2.4 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.87 - 1 = 0.87 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 7^\circ$ [Considering Local Shear Failure], $N_q = 1.88$

N_γ = Bearing capacity factor, for $\phi = 7^\circ$ [Considering Local Shear Failure], $N_\gamma = 0.71$

$N_c = 7.16$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.08$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 1.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c s_c d_c i_c + \gamma' D (N_q - 1) s_q d_q i_q + 0.5 \gamma B N_\gamma s_\gamma d_\gamma i_\gamma W'] \\ &= 1/(3) [2.4 * 7.16 * 1.3 * 1.08 * 1 + 0.87 * 1 * (1.88 - 1) * 1.2 * 1.00 * 1.0 + 0.5 * 1.87 * \\ &3 * 0.71 * 0.8 * 1.00 * 1.0 * 0.5] \\ &= 8.62 \text{ T/Sqm} \end{aligned}$$



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

29

Settlement Analysis of Shallow Foundation

Settlement, $S = H \times mv \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = $1.5 B = 1.5 \times 3.0 = 4.50$ m

mv = Co-efficient of Volume Change = $0.021 \text{ sqcm/Kg} = 0.0021 \text{ sqm/t}$

Δp = Increment of stress = $(3 \times 3 \times 8.62) / (3 + 2.25)^2 = 2.81 \text{ t/Sqm}$

Therefore

$S = 4.5 \times 0.0021 \times 2.81 \times 1000 = 26.60 \text{ mm}$

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 8.62t/sqm

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 3.00 m.

The founding depth is falling in Stratum-II.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-II:

As per Indian Standard IS 6403: 1981

(For Square Footing (Width 3.0mX3.0m) (Depth 3.00m)

Bearing Capacity as per IS 6403:1981 considering 3.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.77 - 1 = 0.77 \text{ t/m}^3$

N_q = Bearing capacity factor, for $\phi = 32^\circ$, $N_q = 23.18$

N_γ = Bearing capacity factor, for $\phi = 32^\circ$, $N_\gamma = 30.22$

$N_c = 35.49$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_s & d_γ = Depth correction. Here $d_q = 1.18$ and $d_\gamma = 1.18$

$d_c = 1.36$

i_q & i_γ = Inclination Factor, $= (1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 3.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 \times 35.49 \times 1.3 \times 1.36 \times 1 + 0.77 \times 3 \times (23.18 - 1) \times 1.2 \times 1.18 \times 1.0 + 0.5 \times 1.77 \times \\ &\quad 3 \times 30.22 \times 0.8 \times 1.18 \times 1.0 \times 0.5] \\ &= 36.81 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari GSS (Package C)

30

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N'= 16 is 19 mm

Hence, for 36.81 t/sqm pressure the settlement will be = $19 \times 36.81 / 10 = 69.94 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 21.05t/sqm

Assumed foundation size – 3.00 m x 3.00 m

Depth of foundation = 5.00 m.

The founding depth is falling in Stratum-III.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-III:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m) (Depth 5.00m)

Bearing Capacity as per IS 6403:1981 considering 5.00 m depth of foundation

$$q_d = 1/F [C.N_c s_c d_c i_c + \gamma' D (N_q - 1) s_q d_q i_q + 0.5 \gamma B N_\gamma s_\gamma d_\gamma i_\gamma W']$$

Where:

q_d – Allowable Bearing Capacity

C – Cohesion = 0.00 t/sqm

γ' – Submerged density = $(\gamma - 1) = 1.81 - 1 = 0.81 \text{ t/m}^3$

N_q – Bearing capacity factor, for $\phi = 35^\circ$, $N_q = 33.30$

N_γ – Bearing capacity factor, for $\phi = 35^\circ$, $N_\gamma = 48.03$

$N_c = 46.12$

s_q & s_γ – Shape correction, $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ – Depth correction. Here $d_q = 1.32$ and $d_\gamma = 1.32$

$d_c = 1.64$

i_q & i_γ – Inclination Factor – $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' – Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F – Factor of safety, considering 3

D – 5.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c s_c d_c i_c + \gamma' D (N_q - 1) s_q d_q i_q + 0.5 \gamma B N_\gamma s_\gamma d_\gamma i_\gamma W'] \\ &= 1/(3) [0 + 46.12 * 1.3 * 1.64 * 1 + 0.81 * 5 * (33.30 - 1) * 1.2 * 1.32 * 1.0 + 0.5 * 1.81 * \\ &\quad 3 * 48.03 * 0.8 * 1.32 * 1.0 * 0.5] \\ &= 92.02 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N'= 29 is 9.2 mm

Hence, for 92.02t/sqm pressure the settlement will be = $9.2 \times 92.02 / 10 = 84.66 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 43.48t/sqm



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari GSS (Package G)

31

BH-9

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 1.00 m.

The founding depth is falling in Stratum-I.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-I:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0mX3.0m) (Depth 1.00m)

Bearing Capacity as per IS 6403:1981 considering 1.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 3.0 t/sqm

γ' = Submerged density = $(\gamma-1) = 1.90-1 = 0.90$ t/m³

N_q = Bearing capacity factor, for $\phi = 4^\circ$ [Considering Local Shear Failure], $N_q = 1.43$

N_γ = Bearing capacity factor, for $\phi = 4^\circ$ [Considering Local Shear Failure], $N_\gamma = 0.34$

$N_c = 6.19$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.00$ and $d_\gamma = 1.00$

$d_c = 1.07$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 1.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [3*6.19*1.3*1.07*1 + 0.90*1*(1.43-1)*1.2*1.00*1.0 + 0.5*1.90* \\ &\quad 3*0.34*0.8*1.00*1.0*0.5] \\ &= 8.89 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

Settlement, $S = H \times mv \times \Delta p$.

Here,

S = Anticipated Settlement

H = Height of strata = $1.5 B = 1.5 \times 3.0 = 4.50$ m

mv = Co-efficient of Volume Change = 0.022 sqcm/Kg = 0.0022sqm/t

Δp = Increment of stress = $(3*3*8.89)/\{(3+2.25)^2\} = 2.90$ t/ Sqm

Therefore

$S = 4.5 \times 0.0021 \times 2.90 \times 1000 = 28.74$ mm

The permissible settlement is 40 mm

Hence the allowable bearing capacity of Shallow foundation is 8.89t/sqm



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

32

Assumed foundation size – 3.00 m x 3.00 m

Depth of foundation = 3.00 m.

The founding depth is falling in Stratum-II.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-II:

As per Indian Standard IS 6403: 1981

(For Square Footing)(Width 3.0mX3.0m) (Depth 3.00m)

Bearing Capacity as per IS 6403:1981 considering 3.00 m depth of foundation

$$q_a = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_a = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density – $(\gamma-1) = 1.78-1 = 0.78$ t/m³

N_q = Bearing capacity factor, for $\phi = 31^\circ$ [Considering Local Shear Failure], $N_q = 20.63$

N_γ = Bearing capacity factor, for $\phi = 31^\circ$ [Considering Local Shear Failure], $N_\gamma = 25.99$

$N_c = 32.67$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.18$ and $d_\gamma = 1.18$

$d_c = 1.35$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 3.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_a &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 \times 32.67 \times 1.3 \times 1.35 \times 1 + 0.78 \times 3 \times (20.63-1) \times 1.2 \times 1.18 \times 1.0 + 0.5 \times 1.78 \times \\ &\quad 3 \times 25.99 \times 0.8 \times 1.18 \times 1.0 \times 0.5] \\ &= 32.60 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

According to IS 8009 (Part I): 1976 clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N' = 16 is 19mm

Hence, for 32.60 t/sqm pressure the settlement will be = $19 \times 32.60 / 10 = 61.94 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 21.05 t/sqm

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 5.00 m.

The founding depth is falling in Stratum-III.

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-III:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0m X 3.0m) (Depth 5.00m)

Bearing Capacity as per IS 6403:1981 considering 5.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W']$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma-1) = 1.81-1 = 0.81$ t/m³

N_q = Bearing capacity factor, for $\phi = 34^\circ$, $N_q = 29.44$

N_γ = Bearing capacity factor, for $\phi = 34^\circ$, $N_\gamma = 41.06$

$N_c = 42.16$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.31$ and $d_\gamma = 1.31$

$i_c = 1.63$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) = (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cl's- 5.1.2.3]

W' = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 5.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W'] \\ &= 1/(3) [0 * 42.16 * 1.3 * 1.63 * 1 * 0.81 * 5 * (29.44 - 1) * 1.2 * 1.31 * 1.0 + 0.5 * 1.81 * 3 * 41.06 * 0.8 * 1.31 * 1.0 * 0.5] \\ &= 79.83 \text{ t/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

According to **IS 8009 (Part I): 1976** clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected ' N ' = 22 is 12.5 mm

Hence, for 79.83t/sqm pressure the settlement will be = $12.5 \times 79.83/10 = 99.79 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 32.00t/sqm

Assumed foundation size = 3.00 m x 3.00 m

Depth of foundation = 7.00 m.

The founding depth is falling in Stratum-IV.

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:

Stratum-IV:

As per Indian Standard IS 6403: 1981

(For Square Footing) (Width 3.0mX3.0m) (Depth 7.00m)

Bearing Capacity as per IS 6403:1981 considering 7.00 m depth of foundation

$$q_d = 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W^*]$$

Where:

q_d = Allowable Bearing Capacity

C = Cohesion = 0.00 t/sqm

γ' = Submerged density = $(\gamma - 1) = 1.83 - 1 = 0.83$ t/m³

N_q = Bearing capacity factor, for $\phi = 36^\circ$, $N_q = 37.75$

N_γ = Bearing capacity factor, for $\phi = 36^\circ$, $N_\gamma = 56.31$

$N_c = 50.59$

s_q & s_γ = Shape correction. $s_q = 1.20$ and $s_\gamma = 0.80$

d_q & d_γ = Depth correction. Here $d_q = 1.46$ and $d_\gamma = 1.46$

$d_c = 1.91$

i_q & i_γ = Inclination Factor = $(1 - \alpha/90) - (1 - 0/90) = 1$ (α = inclination of the load to the vertical, in degree); $\alpha = 0$, [refer : IS 6403-1981, Cls- 5.1.2.3]

W^* = Water table correction = 0.5 (Considering fully submerged condition for design purpose)

F = Factor of safety, considering 3

D = 7.00 metre

B = 3.00 metre

Hence:

$$\begin{aligned} q_d &= 1/F [C.N_c.s_c.d_c.i_c + \gamma'D.(N_q-1).s_q.d_q.i_q + 0.5. \gamma.B.N_\gamma.s_\gamma.d_\gamma.i_\gamma W^*] \\ &= 1/(3) [0 * 50.59 * 1.3 * 1.91 * 1 + 0.83 * 7 * (37.75 - 1) * 1.2 * 1.46 * 1.0 + 0.5 * 1.83 * \\ &\quad 3 * 56.31 * 0.8 * 1.46 * 1.0 * 0.5] \\ &= 154.78 \text{ T/Sqm} \end{aligned}$$

Settlement Analysis of Shallow Foundation

According to IS 8009 (Part I): 1976 clause 9.4.1, settlement of footing of granular soil for a pressure of 10 Mt/Sqm for corrected 'N' = 36 is 7.3 mm

Hence, for 154.78 t/sqm pressure the settlement will be = $7.3 \times 154.78 / 10 = 112.99 \text{ mm}$

The permissible settlement is 40 mm.

Hence the allowable bearing capacity of Shallow foundation is 54.79 t/sqm

Client: Assam Electricity Grid Corporation Limited.

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5.1 Summary of SBC:

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-1	1.00 m	1.0mX1.0m	9.93	11.19	9.93
		2.0mX2.0m	9.17	20.66	9.17
		3.0mX3.0m	8.89	30.04	8.89
		4.0mX4.0m	8.77	39.52	8.77
	2.00 m	1.0mX1.0m	11.85	13.35	11.85
		2.0mX2.0m	10.13	22.82	10.13
		3.0mX3.0m	9.6	32.44	9.60
		4.0mX4.0m	9.41	42.4	8.88
	3.00 m	1.0mX1.0m	13.69	15.42	13.69
		2.0mX2.0m	11.16	25.14	11.16
		3.0mX3.0m	10.32	34.88	10.32
		4.0mX4.0m	9.96	44.88	8.88
	4.00 m	1.0mX1.0m	15.62	17.6	15.62
		2.0mX2.0m	12.2	27.49	12.20
		3.0mX3.0m	11.11	37.55	11.11
		4.0mX4.0m	10.51	47.36	8.88
	5.00 m	1.0mX1.0m	43.85	67.97	25.81
		2.0mX2.0m	36.87	57.15	25.81
		3.0mX3.0m	35.8	55.49	25.81
		4.0mX4.0m	36.27	56.22	25.81
	6.00 m	1.0mX1.0m	56.7	85.05	26.67
		2.0mX2.0m	45.53	68.3	26.66
		3.0mX3.0m	43.04	64.56	26.67
		4.0mX4.0m	42.96	64.44	26.67
	7.00 m	1.0mX1.0m	172.61	124.28	55.56
		2.0mX2.0m	132	95.04	55.56
		3.0mX3.0m	121.88	87.75	55.56
		4.0mX4.0m	119.38	85.95	55.56

Chief Expert
PT Feedback Infra
Indonesia

Checked by JMC, D&P	Checked by AMC, D&P	Checked by DMC, D&P	Checked by AGM, D&P	Approved by DGM, C
Submitted by Shyama Power (I) Limited.				



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

36

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS -3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-2	1.00 m	1.0mX1.0m	12.62	13.6	12.62
		2.0mX2.0m	11.52	24.83	11.52
		3.0mX3.0m	11.31	36.56	11.31
		4.0mX4.0m	11.2	48.27	9.28
	2.00 m	1.0mX1.0m	15.12	16.29	15.12
		2.0mX2.0m	13.03	28.08	13.03
		3.0mX3.0m	12.32	39.83	12.32
		4.0mX4.0m	12.01	51.77	9.28
	3.00 m	1.0mX1.0m	17.72	19.09	17.72
		2.0mX2.0m	14.43	31.1	14.43
		3.0mX3.0m	13.43	43.41	12.38
		4.0mX4.0m	12.93	55.73	9.28
	4.00 m	1.0mX1.0m	20.22	21.79	20.22
		2.0mX2.0m	15.84	34.14	15.84
		3.0mX3.0m	14.44	46.68	12.37
		4.0mX4.0m	13.84	59.65	9.28
	5.00 m	1.0mX1.0m	76.08	64.67	47.06
		2.0mX2.0m	63.38	53.87	47.06
		3.0mX3.0m	61.59	52.35	47.06
		4.0mX4.0m	62.78	53.36	47.06
	6.00 m	1.0mX1.0m	98.42	83.66	47.06
		2.0mX2.0m	78.51	66.73	47.06
		3.0mX3.0m	74.32	63.17	47.06
		4.0mX4.0m	74.06	62.95	47.06
	7.00 m	1.0mX1.0m	123.38	104.87	47.06
		2.0mX2.0m	94.96	80.72	47.06
		3.0mX3.0m	87.93	74.74	47.06
		4.0mX4.0m	86.58	73.59	47.06

 Expert PT Feedback Infra Indonesia	 Checked by J. D&P	 Checked by AM(C), D&P	 Checked by DM(C), D&P	 Checked by AGM(C), D&P	 Approved by DGM(C)

Submitted by Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

37

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-3	1.00 m	1.0mX1.0m	11.5	14.08	11.50
		2.0mX2.0m	10.56	25.86	10.56
		3.0mX3.0m	10.27	37.73	10.27
		4.0mX4.0m	10.25	50.2	8.17
	2.00 m	1.0mX1.0m	13.77	16.86	13.77
		2.0mX2.0m	11.83	28.97	11.83
		3.0mX3.0m	11.26	41.36	10.89
		4.0mX4.0m	10.97	53.73	8.17
	3.00 m	1.0mX1.0m	16.14	19.76	16.14
		2.0mX2.0m	13.1	32.08	13.10
		3.0mX3.0m	12.16	44.67	10.89
		4.0mX4.0m	11.78	57.7	8.17
	4.00 m	1.0mX1.0m	18.41	22.54	18.41
		2.0mX2.0m	14.37	35.19	14.37
		3.0mX3.0m	13.16	48.34	10.89
		4.0mX4.0m	12.5	61.22	8.17
	5.00 m	1.0mX1.0m	65.25	75.04	34.78
		2.0mX2.0m	54.21	62.34	34.78
		3.0mX3.0m	52.99	60.94	34.78
		4.0mX4.0m	53.54	61.57	34.78
	6.00 m	1.0mX1.0m	84.06	96.67	34.78
		2.0mX2.0m	67.21	77.29	34.78
		3.0mX3.0m	63.51	73.04	34.78
		4.0mX4.0m	63.71	73.27	34.78
	7.00 m	1.0mX1.0m	105.48	121.3	34.78
		2.0mX2.0m	81.34	93.54	34.78
		3.0mX3.0m	75.19	86.47	34.78
		4.0mX4.0m	73.95	85.04	34.78

Civil Expert
PT Feedback Infra
Indore

Checked by JM/C, D&P	Checked by AM/C, D&P	Checked by DM/C, D&P	Checked by AGM/C D&P	Approved by DGM/C
Submitted By Shyama Power (I) Limited.				



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

38

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BII-4	1.00 m	1.0mX1.0m	7.81	7.65	7.81
		2.0mX2.0m	7.19	14.09	7.19
		3.0mX3.0m	7	20.57	7.00
		4.0mX4.0m	6.93	27.15	6.93
	2.00 m	1.0mX1.0m	9.38	9.19	9.38
		2.0mX2.0m	8.07	15.81	8.07
		3.0mX3.0m	7.7	22.63	7.70
		4.0mX4.0m	7.5	29.39	7.50
	3.00 m	1.0mX1.0m	44.88	56.1	32.00
		2.0mX2.0m	42.53	53.16	32.00
		3.0mX3.0m	44.25	55.31	32.00
		4.0mX4.0m	47.61	59.51	32.00
	4.00 m	1.0mX1.0m	64.71	80.89	32.00
		2.0mX2.0m	56.8	71	32.00
		3.0mX3.0m	57.16	71.45	32.00
		4.0mX4.0m	59	73.75	32.00
	5.00 m	1.0mX1.0m	87.2	109	32.00
		2.0mX2.0m	72.54	90.68	32.00
		3.0mX3.0m	70.68	88.35	32.00
		4.0mX4.0m	71.62	89.53	32.00
	6.00 m	1.0mX1.0m	112.66	140.83	32.00
		2.0mX2.0m	89.77	112.21	32.00
		3.0mX3.0m	85.2	106.5	32.00
		4.0mX4.0m	85.06	106.33	32.00
	7.00 m	1.0mX1.0m	141.7	177.13	32.00
		2.0mX2.0m	108.48	135.6	32.00
		3.0mX3.0m	100.69	125.86	32.00
		4.0mX4.0m	98.58	123.23	32.00


 Civil Expert
 PT Feedback Inf
 Indonesia

				
Checked by AMCI, D&P	Checked by AMCI, D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DGM(C)

Submitted By: Shyam Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

39

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-5	1.00 m	1.0mX1.0m	9.56	9.83	9.56
		2.0mX2.0m	8.75	18	8.75
		3.0mX3.0m	8.62	26.6	8.62
		4.0mX4.0m	8.55	35.18	8.55
	2.00 m	1.0mX1.0m	11.5	11.83	11.50
		2.0mX2.0m	9.95	20.47	9.95
		3.0mX3.0m	9.44	29.13	9.44
		4.0mX4.0m	9.23	37.97	9.23
	3.00 m	1.0mX1.0m	37.05	70.4	21.05
		2.0mX2.0m	35.08	66.65	21.05
		3.0mX3.0m	36.81	69.94	21.05
		4.0mX4.0m	39.62	75.28	21.05
	4.00 m	1.0mX1.0m	53.13	100.95	21.05
		2.0mX2.0m	46.86	89.03	21.05
		3.0mX3.0m	47.15	89.59	21.05
		4.0mX4.0m	49.07	93.23	21.05
	5.00 m	1.0mX1.0m	113.92	113.92	40.00
		2.0mX2.0m	94.6	94.6	40.00
		3.0mX3.0m	92.02	92.02	40.00
		4.0mX4.0m	93.63	93.63	40.00
	6.00 m	1.0mX1.0m	147.46	147.46	40.00
		2.0mX2.0m	117.52	117.52	40.00
		3.0mX3.0m	110.65	110.65	40.00
		4.0mX4.0m	110.91	110.91	40.00
	7.00 m	1.0mX1.0m	184.98	184.98	40.00
		2.0mX2.0m	141.69	141.69	40.00
		3.0mX3.0m	131.43	131.43	40.00
		4.0mX4.0m	129.23	129.23	40.00


 Civil Expert
 PT Ferret Infra
 Indonesia

				
Checked by	Checked by	Checked by	Checked by	Approved by
AM(C), DSP	AM(C), DSP	DM(C), DSP	AM(C), DSP	DM(C)
Submitted by Shyam Power (I) Limited.				



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

40

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-6	1.00 m	1.0mX1.0m	11.13	11.99	11.13
		2.0mX2.0m	10.23	22.05	10.23
		3.0mX3.0m	9.95	32.16	9.95
		4.0mX4.0m	9.93	42.8	9.28
	2.00 m	1.0mX1.0m	13.34	14.37	13.34
		2.0mX2.0m	11.46	24.7	11.46
		3.0mX3.0m	10.92	35.3	10.92
		4.0mX4.0m	10.64	45.86	9.28
	3.00 m	1.0mX1.0m	15.63	16.84	15.63
		2.0mX2.0m	12.69	27.35	12.69
		3.0mX3.0m	11.79	38.11	11.79
		4.0mX4.0m	11.42	49.22	9.28
	4.00 m	1.0mX1.0m	57.65	89.36	25.81
		2.0mX2.0m	50.62	78.46	25.81
		3.0mX3.0m	50.75	78.66	25.81
		4.0mX4.0m	52.67	81.64	25.81
	5.00 m	1.0mX1.0m	77.84	120.65	25.81
		2.0mX2.0m	64.78	100.41	25.81
		3.0mX3.0m	62.9	97.5	25.81
		4.0mX4.0m	64.07	99.31	25.81
	6.00 m	1.0mX1.0m	100.72	156.12	25.81
		2.0mX2.0m	80.28	124.43	25.81
		3.0mX3.0m	75.94	117.71	25.81
		4.0mX4.0m	75.62	117.21	25.81
	7.00 m	1.0mX1.0m	216.17	151.32	57.14
		2.0mX2.0m	165.69	115.98	57.14
		3.0mX3.0m	153.12	107.18	57.14
		4.0mX4.0m	149.69	104.78	57.14

Civil Expert
PT Feedback Indonesia

Checked by JAP	Checked by AMC	Checked by DAP	Checked by DAP	Approved by DGMIC
ma Power (I) Limited				



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV. 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (1/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-7	1.00 m	1.0mX1.0m	7.8	6.88	7.80
		2.0mX2.0m	7.18	12.66	7.18
		3.0mX3.0m	6.99	18.49	6.99
		4.0mX4.0m	6.92	24.4	6.92
	2.00 m	1.0mX1.0m	9.37	8.26	9.37
		2.0mX2.0m	8.06	14.21	8.06
		3.0mX3.0m	7.69	20.34	7.69
		4.0mX4.0m	7.49	26.41	7.49
	3.00 m	1.0mX1.0m	50.28	160.9	12.50
		2.0mX2.0m	47.56	152.19	12.50
		3.0mX3.0m	50.08	160.26	12.50
		4.0mX4.0m	53.59	171.49	12.50
	4.00 m	1.0mX1.0m	72.33	231.46	12.50
		2.0mX2.0m	63.84	204.29	12.50
		3.0mX3.0m	63.98	204.74	12.50
		4.0mX4.0m	66.77	213.66	12.50
	5.00 m	1.0mX1.0m	154.33	185.2	33.33
		2.0mX2.0m	127.22	152.66	33.33
		3.0mX3.0m	124.41	149.29	33.33
		4.0mX4.0m	126.09	151.31	33.33
	6.00 m	1.0mX1.0m	200.07	240.08	33.33
		2.0mX2.0m	157.7	189.24	33.33
		3.0mX3.0m	149.23	179.08	33.33
		4.0mX4.0m	149.01	178.81	33.33
	7.00 m	1.0mX1.0m	251.31	301.57	33.33
		2.0mX2.0m	190.93	229.12	33.33
		3.0mX3.0m	176.9	212.28	33.33
		4.0mX4.0m	173.3	207.96	33.33

Civil Expert
PT Feed Back
Indonesia

Checked by JMC/D&P	Checked by AMC/D&P	Checked by DMC/D&P	Checked by AGM/D&P	Approved by DMC/D&P



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

42

BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS =3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-8	1.00 m	1.0mX1.0m	11.49	12.94	11.49
		2.0mX2.0m	10.56	23.79	10.56
		3.0mX3.0m	10.27	34.71	10.27
		4.0mX4.0m	10.25	46.19	8.88
	2.00 m	1.0mX1.0m	13.77	15.51	13.77
		2.0mX2.0m	11.82	26.63	11.82
		3.0mX3.0m	11.26	38.05	11.26
		4.0mX4.0m	10.96	49.39	8.88
	3.00 m	1.0mX1.0m	16.13	18.17	16.13
		2.0mX2.0m	13.09	29.49	13.09
		3.0mX3.0m	12.15	41.06	11.84
		4.0mX4.0m	11.77	53.04	8.88
	4.00 m	1.0mX1.0m	18.4	20.73	18.40
		2.0mX2.0m	14.35	32.33	14.35
		3.0mX3.0m	13.15	44.44	11.84
		4.0mX4.0m	12.49	56.28	8.88
	5.00 m	1.0mX1.0m	59.12	73.9	32.00
		2.0mX2.0m	49.12	61.4	32.00
		3.0mX3.0m	47.84	59.8	32.00
		4.0mX4.0m	48.58	60.73	32.00
	6.00 m	1.0mX1.0m	76.28	95.35	32.00
		2.0mX2.0m	60.99	76.24	32.00
		3.0mX3.0m	57.86	72.33	32.00
		4.0mX4.0m	57.45	71.81	32.00
	7.00 m	1.0mX1.0m	193.75	151.13	51.28
		2.0mX2.0m	148.17	115.57	51.28
		3.0mX3.0m	137.23	107.04	51.28
		4.0mX4.0m	134.76	105.11	51.28

Checked by JMC/DSP	Checked by AMIC/DSP	Checked by DMIC/DSP	Checked by ADMIC/DSP	Approved by OGMIC
Submitted By Shyama Power (I) Limited.				



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BH-NO	Depth of footing considering for bearing capacity calculation	Size of footing considering for bearing capacity calculation	Bearing Capacity (T/Sqm) As per IS 6403:1981 and Settlement analysis as per IS 8009-1976		
			Based on shear failure criteria with FOS -3.00	Anticipated settlement (mm)	Recommended Bearing capacity with total settlement of 40 mm
BH-9	1.00 m	1.0mX1.0m	9.93	10.7	9.93
		2.0mX2.0m	9.17	19.76	9.17
		3.0mX3.0m	8.89	28.74	8.89
		4.0mX4.0m	8.78	37.84	8.78
	2.00 m	1.0mX1.0m	11.86	12.78	11.86
		2.0mX2.0m	10.13	21.83	10.13
		3.0mX3.0m	9.61	31.07	9.61
		4.0mX4.0m	9.42	40.6	9.28
	3.00 m	1.0mX1.0m	32.83	64.02	20.51
		2.0mX2.0m	31.17	60.78	20.51
		3.0mX3.0m	32.6	63.57	20.51
		4.0mX4.0m	34.7	67.67	20.51
	4.00 m	1.0mX1.0m	47.17	91.98	20.51
		2.0mX2.0m	41.4	80.73	20.51
		3.0mX3.0m	41.85	81.61	20.51
		4.0mX4.0m	43.46	84.75	20.51
	5.00 m	1.0mX1.0m	98.99	143.54	27.59
		2.0mX2.0m	82.29	119.32	27.59
		3.0mX3.0m	79.83	115.75	27.59
		4.0mX4.0m	81.7	118.47	27.59
	6.00 m	1.0mX1.0m	128.32	186.06	27.59
		2.0mX2.0m	101.7	147.47	27.59
		3.0mX3.0m	96.81	140.37	27.59
		4.0mX4.0m	96.13	139.39	27.59
	7.00 m	1.0mX1.0m	218.69	159.64	54.80
		2.0mX2.0m	167.56	122.32	54.79
		3.0mX3.0m	154.78	112.99	54.79
		4.0mX4.0m	151.27	110.47	54.79

Civil Expert
PT Feedback
Indonesia

Checked by JSM/D&P	Checked by JSM/D&P	Checked by JSM/D&P	Checked by JSM/D&P	Approved by JSM/D&P
Submitted By Shyama Power (I) Limited.				



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B) PLATE LOAD TEST

B.1.0 INTRODUCTION:

Assam Electricity Grid Corporation Limited, has entrusted us to carry out 1 (one) nos Plate Load Test for proposed Sub-Station Complex at Assam. The main objective of this investigation is to estimate the Ultimate Bearing Capacity of the soil. This report consists of details of field tests performed and the result of the tests.



B.2.0 METHOD :

A test plate having size 300 mm X 300 mm was used as a model of prototype foundation. The plate was placed at proposed foundation level and subject to incremental loading. Settlement of each increment of load was measured and Load Vs Settlement Curve plotted. The Bearing Capacity and Settlement of proposed shallow foundation were determined with the help of Load Vs. Settlement Curve for the test plate. The test conducted as per IS 1888:1982.

Procedure:

1. Rough Mild Steel plate 300mmX 300 mm square in shape was used in this test. The proposed foundation area was excavated upto 1500 mm depth. The test plate was seated at the centre over a fine sand layer of about 5 mm.
2. The Kentledge was constructed by preparing loading platform with ISMB and wooden platform. Sack of gravel, sand and clay were placed over that platform to obtain a total load of about 4.5 tons.
3. Load was applied on the plate by hydraulic jack of 50 ton capacity by reaction obtained from Kentledge. Pressure on the jack was recorded from a calibrated pressure gauge placed between the jack and hydraulic pump.
4. A seating load of 70 g/sqm was first applied and released after sometimes. Loads were applied on the test plate in increment of $1/5^{th}$ of total estimated safe load.
5. At each load increment settlement recordings were recorded at a time interval of 1 minute, 2.5 minutes, 4 minutes, 6.25 minutes, 9 minutes, 16 minutes, 25 minutes, 36 minutes and 1 hour by means of displacement with dial gauge having least count of 0.01 mm. The settlements were recorded with reference to the datum bar.

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6. After noting settlement recordings of 1 hour and when the settlement dropped to a value less than 0.02mm/ minute the next increment of load was applied

The load Vs settlement curve for the test plate were plotted from obtained test data

B.3.0 CALCULATIONS

B.3.1 Bearing Capacity

From Load Intensity vs Settlement Curve:-

Ultimate Bearing capacity = 1.95 Kg/cm²

Size of plate = 0.3 m X 0.3 m

Ultimate Bearing capacity = 1.95 Kg/cm² = 19.50 Mt/Sqm

Safe Bearing Capacity = 19.50/3 = 6.50 Mt/Sqm

Therefore, Safe Bearing Capacity of 6.50 Mt/Sqm is recommended at a depth of 1.5 M depth with Factor of Safety = 3.0

B.3.2 Settlement Analysis

Refer to IS 8009 (Part-I) 1976 (Reaffirmed 1993 and 1998) in Amendment No-1, May 1981 in clause no. 9.1.3.

$$S_f = S_p * \left[\frac{B * (B_p + 0.3)}{B_p * (B + 0.3)} \right]^2$$

Where:

S_f = Settlement of footing in mm

S_p = Settlement of plate in mm = 7.80 mm for load intensity 2.15 Kg/cm² (from graph)

B = Width of footing in metre = 3.0 m

B_p = Width of plate in metre = 0.30 m

(Considering size of footing 3.0m X 3.0 m)

Hence:

$$S_f = 6.99 * \left[\frac{3.0 * (0.30 + 0.3)}{0.30 * (3.0 + 0.3)} \right]^2$$

$$= 6.99 * (1.818)^2 \text{ mm}$$

$$= 23.10 \text{ mm hence within Permissible limit}$$



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Graph showing Load Intensity (Kg/cm²) versus Time (min) for a 1000g weight. The curve shows an initial linear increase followed by a plateau. A tangent line is drawn at the start of the curve.

Time (min)	Load Intensity (Kg/cm²)
0	0
1	1.5
2	3.0
3	4.5
4	5.5
5	6.0
6	6.0
7	6.0
8	6.0
9	6.0
10	6.0



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C) CALIFORNIA BEARING RATIO

The California Bearing Ratio test, and penetration test conducted for evaluation of the strength of sub-grade and bases for structures, was carried out by collecting undisturbed/ remoulded soil specimens according to IS 2720(Part-16):1987 from two different locations within the substation area for laboratory test and finding out CBR value

California bearing ratio is the ratio of force per unit area required to penetrate in to a soil mass with a circular plunger of 50mm diameter at the rate of 1.25mm / min.

The table given below the standard loads adopted for a standard material with 100% CBR value for various penetrations.

Percentage of plunger(mm)	Standard Load(Kg)
2.5	1370
5.0	2055
7.5	2630
10.0	3180
12.5	3600

CBR Test Apparatus:

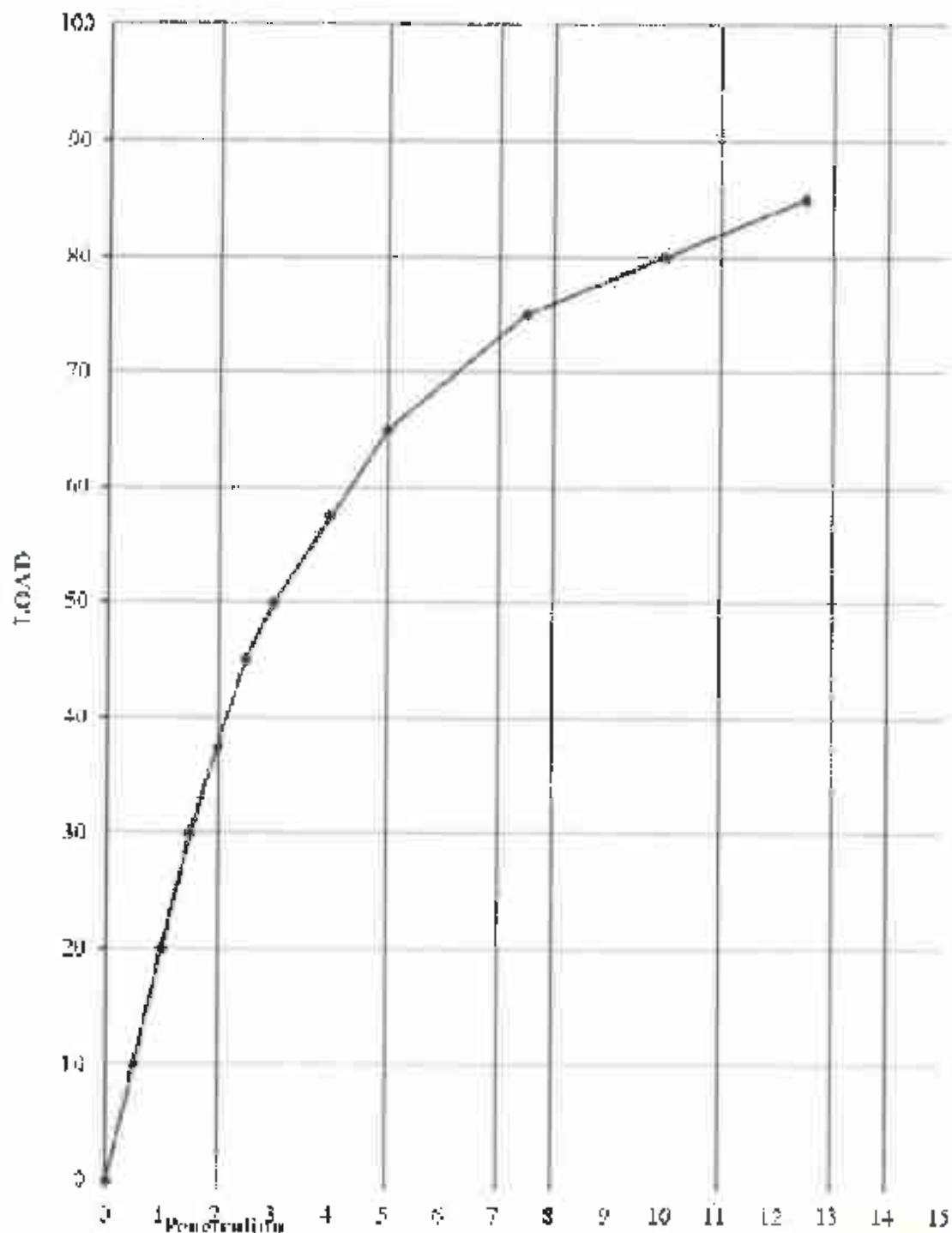
CBR Test Apparatus Consisting of Loading machine with capacity of at least 5000 kg and equipped with a movable head or base which enables Plunger of 50 mm dia. to penetrate into the specimen at a rate of 1.25 mm/ minute.



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Calculation

$$\text{C.B.R.} = (\text{PT/PS}) \times 100$$

Where, PT = Corrected test load corresponding to the chosen penetration from the load penetration curve.

PS = Standard load for the same penetration taken from the table above.

Penetration	Proving Reading	Standard Load(Kg)	Tested Load (Kg)	CBR Value (%)	Average CBR value (%)
0.00	0		0		3.29
0.50	4		10		
1.00	8		20		
1.50	12		30		
2.00	15		37.5		
2.50	18	1370	45	3.29	
3.00	20		50		
4.00	23		57.5		
5.00	26	2055	65	3.16	
7.50	30	2630	75		
10.00	32	3180	80		
12.50	34	3600	85		

D) STANDARD PROCTOR COMPACTION TEST

The Proctor density test is standard IS: 2720(Part-8)-1983 lays down the determination of relation between the water content and the dry density of soils.

The soil is compacted into the mould to a certain amount of equal layers, each receiving a number of blows from 2.6 Kg weighted hammer at a 31 cm height. The process is then repeated for various moisture contents and dry densities are determined for each. The graphical relationship is then plotted to establish the compaction curve.

- a) Optimum Moisture Content – 27.50 %
- b) Maximum Dry Density = 1.59 gm/cc



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E) DYNAMIC CONE PENITRATION TEST:

Apparatus required for DCP test:

- A cone (Size 65mm)
- Driving rods
- Driving head
- Hoisting equipment
- A hammer (made up of mild steel or cast-iron with a base plate of mild steel weighing 65kg.

Procedure:

1. The initial reading on the dynamic cone penetrometer is recorded.
2. Then, the dynamic cone penetrometer is kept with the cone resting vertically on the ground where the test is to be carried out.
3. Now, the cone is driven into the soil by the freefall of hammer of 750 mm each time.
4. Then the number of blow of every 100mm penetration is recorded.
5. This process is repeated until when the cone does not reach the required depth.

Advantages of Dynamic Cone Penetration Test:

- This test does not need a borehole.
- This test can be performed quickly so that it covers a large area making it economical.

Disadvantages:

- This test cannot be performed on cohesive soils or very loose cohesionless soil.
- It is not possible to determine the mechanical properties of soil by this test if the soil is at a great depth and friction along the extension rod is significant.

Factors affecting DCP test

There is a various factor which affects this test such as:

- Alignment of DCP rods
- Damaged cone tip
- Depth of testing
- The apex angle of the cone
- Hammer weight
- Freefall height of hammer
- Moisture content
- Material composition
- Intensity of compaction

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Field Observation Sheet for Dynamic Cone Penetration Test					
Depth (M)	Number of Blows	Remarks	Depth (M)	Number of Blows	Remarks
0.30	4		7.80	80	
0.60	2		8.10	86	
0.90	7		8.40	83	
1.20	3		8.70	65	
1.50	5		9.00	69	
1.80	4		9.30	75	
2.10	8		9.60	79	
2.40	8		9.90	88	
2.70	17		10.20	82	
3.00	15		10.50	87	
3.30	14		10.80	89	
3.60	13		11.10	88	
3.90	17		11.40	99	
4.20	39		11.70	108	Rebound
4.50	38		12.00		
4.80	28		12.30		
5.10	38		12.60		
5.40	38		12.90		
5.70	39		13.20		
6.00	48		13.50		
6.30	53		13.80		
6.60	77		14.10		
6.90	73		14.40		
7.20	91		14.70		
7.50	90		15.00		

Note: As per specification Depth termination depth is 15.00m from Natural ground level.
But here we observed rebound at depth 11.70m hence we terminated the same at 11.70m

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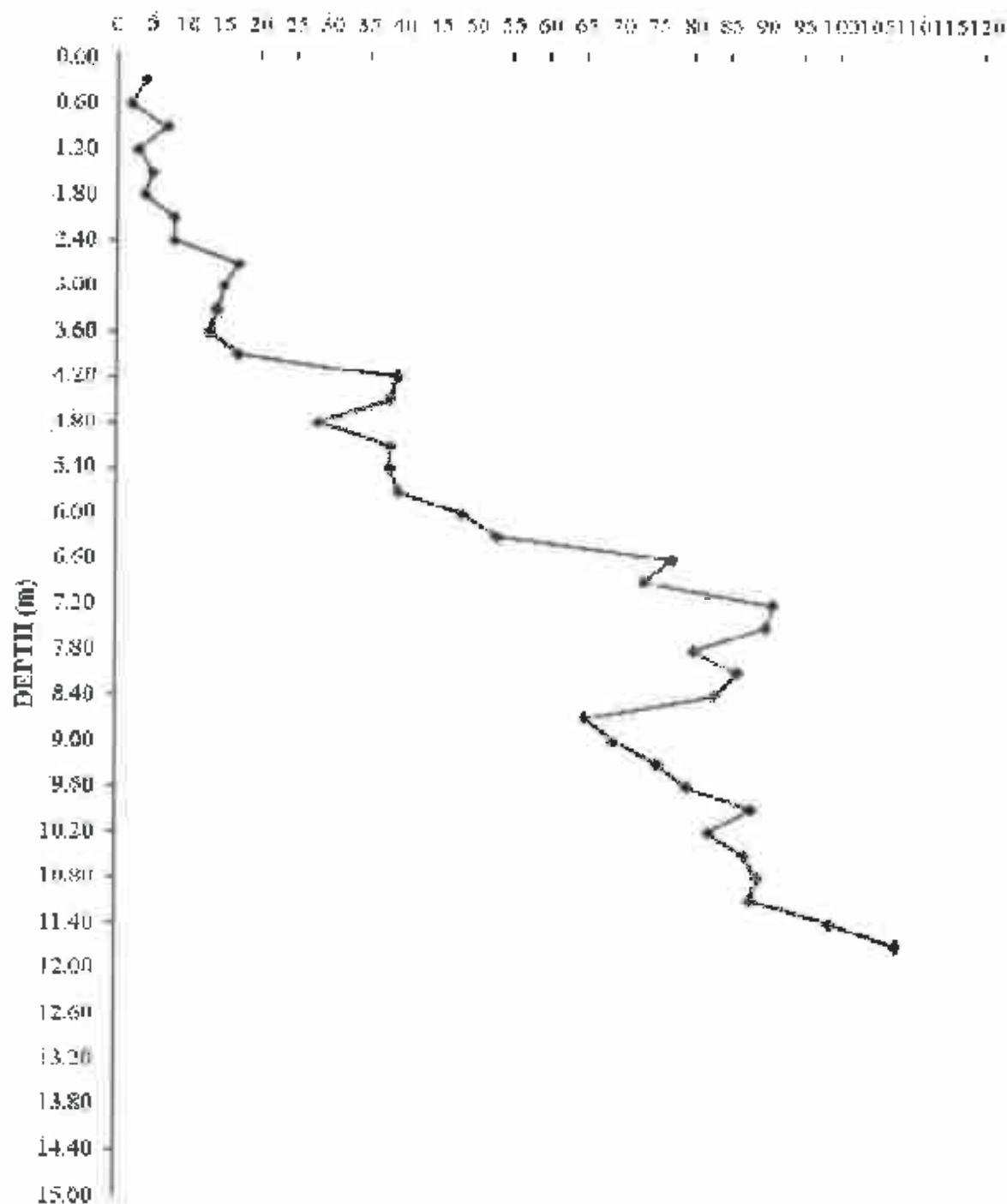


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STANDARD PENETRATION TEST VALUES



Plot of Standard Penetration Test Values with Depth

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F) CHEMICAL TESTS

Chemical tests were performed on soil and water samples for determining the p_H value, Sulphate, Chloride content etc. The results are given in a tabular form below:

F.1 Chemical Test on Water Sample

Bore Hole No- BH-04

At depth 2.30m

Physical Test Findings:

1. Colour-Colourless

2. Odour-Agreable

Chemical Test Findings:

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS: 3025(Part11):1983 Reaffirmed 2012		6.20
2	conductivity at 25°C	IS: 3025(Part14):2013 Reaffirmed 2006	μS/cm	230
3	Chloride as CL	IS:3025(Part-32):1988 Reaffirmed 2009	mg/l	31
4	Nitrate as NO ₃	IS:3025(Part-34):1988 Reaffirmed 2009	mg/l	<1
5	Turbidity	IS:3025(Part-10):1984 Reaffirmed 2012	NTU	89.50
6	Organic matter	IS:3025(Part-47):1994	mg/l	180.0

Minimum detection limit: (i) Nitrate: 1.0mg/l

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Bore Hole No- BH-06

At depth -1.50m

Physical Test Findings:

1. Colour-Colourless

2.Odour-Agreeable

Chemical Test Findings:

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS: 3025(Part11):1983 Reaffirmed 2012		6.35
2	conductivity at 25°C	IS: 3025(Part14):2013 Reaffirmed 2006	µS/cm	210
3	Chloride as CL	IS:3025(Part-32):1988 Reaffirmed 2009	mg/l	35
4	Nitrate as NO ₃	IS:3025(Part-34):1988 Reaffirmed 2009	mg/l	<1
5	Turbidity	IS:3025(Part-10):1984 Reaffirmed 2012	NTU	90.20
6	Organic matter	IS:3025(Part-47):1994	mg/l	190.0

Minimum detection limit: (i) Nitrate: 1.0mg/l

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F.2 Chemical Test on Soil Sample

Bore Hole No- BH-01

At depth 1.00-1.45m

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS:2720(Part-26):1987		2.60
2	Organic Matter(OM)	IS:2720(Part-22):1972	%	0.27
3	Calcium carbonate (CaCO ₃)	IS:2720(Part-23):1976	%	18.05
4	Sulphate(SO ₃)	IS:2720(Part-27):1977	mg/kg	5.70
5	Sulphate(SO ₄)	IS:2720(Part-27):1977	mg/kg	8.65
6	Chloride	IS:3025(Part-32):1988	%	0.020
7	Salinity as Conductivity	IS:14767-2000	ms	1.55
8	Nitrate	SOP No: RVB/SOP/05/25 As per ICAR 2011 (Department of Agriculture & cooperation , Ministry of Agriculture, Govt. of India)	mg/kg	0.65

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Bore Hole No- BH-06

At depth -4.00-4.45m

SL NO	Test Parameters	Test Method	Unit	Result
1	pH value	IS:2720(Part-26):1987		2.69
2	Organic Matter(OM)	IS:2720(Part-22):1972	%	9.33
3	Calcium carbonate (CaCO ₃)	IS:2720(Part-23):1976	%	19.15
4	Sulphate(SO ₃)	IS:2720(Part-27):1977	mg/kg	5.75
5	Sulphate(SO ₄)	IS:2720(Part-27):1977	mg/kg	8.95
6	Chloride	IS:3025(Part-32):1988	%	0.025
7	Salinity as Conductivity	IS:14767-2000	ms	1.68
8	Nitrate	SOP No: RVB/SOP/05/25 As per ICAR 2011 (Department of Agriculture & co-operation , Ministry of Agriculture, Govt. of India)	mg/kg	0.55

Chemical test was carried out on a soil and water samples to determine the pH value, Sulphate and Chloride. It is seen that the values are within permissible limits (as per IS: 456-2000) and so no special cement will be required for foundation concrete. **Either Ordinary Portland cement or Portland slag cement or Portland Pozzolana cement can be used for concreting.**

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G) USE OF PILE FOUNDATION:

Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies; ease of construction and less sound pollution.

While calculating the pile capacity, let us assume that,

- a) Cut off level is at 2.0 m
- b) Pile capacities shall be ascertained by approved method (IS 2911 (Part 1/Sec 2):2010).
- c) Assumed Grade of Concrete – M25
- d) Diameter of pile used – 300mm.

Sample Calculation of Safe Vertical Pile Capacity around BH-1[As per IS 2911 (Part 1/Sec 2) : 2010]

Pile embedment depth = 14 m.

Diameter of pile = 300 mm.

Sample vertical pile capacity has been estimated considering average layer stratification as per Sub- Soil Profile Clause 4.1 in the Report

Design Strength Parameters:

STRATUM-I

Considering the lab result and subsoil condition,

Use design $c = 3.0 \text{ t/m}^2$ and $\Phi = 6^\circ$.

Submerged Density=0.88

Also use, $\alpha = 1.0$ (As $C = 3.0 \text{ t/m}^2$)

Length of shaft– 2.50 m(As Cut off length = 2.5m)

STRATUM-II

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 28^\circ$.

Submerged Density–0.80

Also use, $K_i = 1.0$ (As $\Phi = 28^\circ$)

Length of shaft= 2.50 m

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STRATUM-III

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 34^\circ$.

Submerged Density=0.87

Also use, $K_i = 1.2$ (As $\Phi = 34^\circ$.)

Length of shaft= 7.00 m

The ultimate vertical pile capacity of bored cast in situ RCC pile in soil may be estimated using the formula as given below:

$$Q_u = [K_i \times P_{Di} \times \tan \delta_i \times A_{si}] / F_s + C_{u1} \times N_c \times \pi \times D^2 / 4 F_s + \alpha \times C_{u2} \times \pi \times D \times L / F_s$$

Note :-

$K_i \times P_{Di} \times \tan \delta_i \times A_{si}$ is the skin frictional resistance to stratum-II (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-1 page 10 of IS 2911 (Part-1/sec-2): 2010 (Granular Soil)

$C_{u1} \times N_c \times \pi \times D^2 / 4 F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

$\alpha \times C_{u2} \times \pi \times D \times L / F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

where, Q_u = Ultimate vertical load carrying capacity of RCC bored pile,

K_i = Co-efficient of earth pressure in i^{th} layer.

P_{Di} = Mean effective overburden pressure of i^{th} layer.

δ_i = Angle of wall friction between pile and soil for the i^{th} layer.

A_{si} = Surface area of pile shaft in i^{th} layer = $\pi \times D \times L$.

C_{u1} = Shear strength of rock below the base of pile

N_c = Bearing capacity factor taken as 9

D = Dia of pile in meter

F_s = Factor safety taken 3

$\alpha = 0.9$ (recommended value)

C_{u2} = Average shear strength of rock in the socketed length pile

L = Length of pile in respective stratum,



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Calculation of Safe Skin Frictional Resistance:

Stratum-I: (Layer 0 m depth to -4.50 m depth)

(Note Pile embedded 14 m and cut out level 2.0m below the existing G.L)

$$\alpha_i = 1.0$$

Effective thickness = 2.5 m.

Cus = 3.0 t/m^2 , (Avg. value has been taken for calculation)

$$A_s = \pi \times 0.3 \times 2.5 = 2.36 \text{ m}^2$$

Where, D = 0.3 m. and Shell length = 2.5m.

$$\text{Ultimate Skin Frictional Resistance} = (1.0 \times 3.0 \times 2.36) = 7.07 \text{ t}$$

$$\text{Permissible skin friction resistance} = 7.07/3 = 2.36 \text{ t}$$

Stratum-II : (Layer -4.50 m depth to -7.00 m depth)

$$K_i = 1.0$$

$$\phi = 28^\circ$$

Effective thickness = 2.5 m

$$A_s = \pi \times 0.3 \times 2.5 = 2.36 \text{ m}^2$$

$$P_{di} = (0.88 \times 2.5 - 0.5 \times 0.8 \times 2.5) = 3.20 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1.0 \times 3.20 \times \tan 28^\circ) \times 2.36 = 4.01 \text{ t}$$

$$\text{Permissible skin friction resistance} = 4.01/3 = 1.34 \text{ t}$$

Stratum-III : (Layer -7.00 m depth to -14.00 m depth)

$$K_i = 1.2$$

$$\phi = 34^\circ$$

Effective thickness = 7.00 m

$$A_s = \pi \times 0.3 \times 7 = 6.59 \text{ m}^2$$

$$P_{di} = (2.5 \times 0.88 + 2.5 \times 0.8 + 0.5 \times 7 \times 0.87) = 7.23 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1.2 \times 7.23 \times \tan 34^\circ) \times 6.59 = 38.67 \text{ t}$$

$$\text{Permissible skin friction resistance} = 38.67/3 = 12.89 \text{ t}$$

Calculation of Safe End Bearing Resistance:

$$A_p = 3.14 \times (0.3)^2/4 = 0.071 \text{ m}^2$$

ϕ = Angle of internal friction at the base of the pile = 34°

N_c = Bearing capacity factor taken as 9

D = Dia of pile = 0.3 meter

F_s = Factor of safety taken 3

Submitted By **Shyama Power (I) Limited.**



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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$N_f = \text{Bearing Capacity Factors} = 41.06$

$N_q = \text{Bearing Capacity Factors} = 46.00$

$P_d = \text{Effective overburden pressure at Pile tip (Restricted to } 20D - (20 \times 0.3) \text{ m} = 6.00 \text{ m}$

Hence, $P_d = (0.88 \times 2.5 + 0.8 \times 2.5 + 0.87 \times 1) \text{ t/m}^2 = 5.07 \text{ t/m}^2$

Ultimate End Bearing Resistance $= 0.071 \times (0.5 \times 0.3 \times 0.87 \times 41.06 + 5.05 \times 46.00) \text{ t/m}^2 = 16.86 \text{ t/m}^2$

Safe End Bearing Resistance $= 16.86/3 \text{ t/m}^2 = 5.62 \text{ t/m}^2$

Safe vertical capacity of Pile $= (5.62 + 12.89 + 1.34 + 2.36) \text{ t} = 22.20 \text{ t}$

Recommended vertical capacity of the Pile = 22 t

Calculation of Uplift capacity of pile:

Safe uplift capacity of pile $= 8.29$

Recommended uplift capacity of pile = 8 t

Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies; ease of construction and less sound pollution.

While calculating the pile capacity, let us assume that,

- Cut off level is at 2.0 m
- Pile capacities shall be ascertained by approved method (IS 2911 (Part 1/Sec 2):2010).
- Assumed Grade of Concrete = M25
- Diameter of pile used = 500mm.

Sample Calculation of Safe Vertical Pile Capacity around BH-1 (As per IS 2911 (Part 1/Sec 2) : 2010)

Pile embedment depth = 14 m.

Diameter of pile = 500 mm.

Sample vertical pile capacity has been estimated considering average layer stratification as per Sub- Soil Profile Clause 4.1 in the Report

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Design Strength Parameters:

STRATUM-I

Considering the lab result and subsoil condition,

Use design $c = 3.0 \text{ t/m}^2$ and $\Phi = 6^\circ$.

Submerged Density=0.88

Also use, $\alpha = 1.0$ (As $C = 3.0 \text{ t/m}^2$)

Length of shaft= 2.50 m (As Cut off length = 2.5m)

STRATUM-II

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 28^\circ$.

Submerged Density=0.80

Also use, $K_i = 1.0$ (As $\Phi = 28^\circ$)

Length of shaft= 2.50 m

STRATUM-III

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 34^\circ$.

Submerged Density=0.87

Also use, $K_i = 1.2$ (As $\Phi = 34^\circ$)

Length of shaft= 7.00 m

The ultimate vertical pile capacity of bored cast in situ RCC pile in soil may be estimated using the formula as given below:

$$Q_u = [K_i \times P_{Di} \times \tan \delta_i \times A_{si}] / F_s + C_{u1} \times N_{u1} \times \pi \times D^2 / 4 F_s + \alpha \times C_{u2} \times \pi \times D \times L / F_s$$

Note :-

$K_i \times P_{Di} \times \tan \delta_i \times A_{si}$ is the skin frictional resistance to stratum-II (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-1 page 10 of IS 2911 (Part-1/sec-2): 2010 (Granular Soil)

$C_{u1} \times N_{u1} \times \pi \times B^2 / 4 F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

$\alpha \times C_{u2} \times \pi \times B \times L / F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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where, Q_u = Ultimate vertical load carrying capacity of RCC bored pile,

K_i = Co-efficient of earth pressure in i^{th} layer,

P_{Di} = Mean effective overburden pressure of i^{th} layer,

δ_i = Angle of wall friction between pile and soil for the i^{th} layer.

A_{si} = Surface area of pile shaft in i^{th} layer = $\pi \times D \times L$

C_u = Shear strength of rock below the base of pile

N_c = Bearing capacity factor taken as 9

D = Dia of pile in meter

F_s = Factor safety taken 3

$\alpha = 0.9$ (recommended value)

C_{m2} = Average shear strength of rock in the socketed length pile

L = Length of pile in respective stratum,

Calculation of Safe Skin Frictional Resistance:

Stratum-I: (Layer 0 m depth to -4.50 m depth)

(Note Pile embedded 14 m and cut out level 2.0m below the existing G.L)

$\alpha_i = 1.0$

Effective thickness = 2.5 m.

$C_{us} = 3.0 \text{ t/m}^2$. (Avg. value has been taken for calculation)

$A_s = \pi \times 0.5 \times 2.5 = 3.93 \text{ m}^2$.

Where, $D = 0.5 \text{ m}$. and Shaft length = 2.5m.

Ultimate Skin Frictional Resistance = $(1.0 \times 3.0 \times 3.93) = 11.78 \text{ t}$

Permissible skin friction resistance = $11.78/3 = 3.93 \text{ t}$

Stratum-II : (Layer -4.50 m depth to -7.00 m depth)

$K_i = 1.0$

$\phi = 28^\circ$

Effective thickness = 2.5 m

$A_s = \pi \times 0.5 \times 2.5 = 3.93 \text{ m}^2$

$P_{di} = (0.88 \times 2.5 + 0.5 \times 0.8 \times 2.5) = 3.20 \text{ t/m}^2$

Ultimate Skin Frictional Resistance = $(1.0 \times 3.20 \times \tan 28^\circ) \times 3.93 = 6.68 \text{ t}$

Permissible skin friction resistance = $6.68/3 = 2.23 \text{ t}$

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Stratum-III : (Layer -7.00 m depth to -14.00 m depth)

$K_i = 1.2$

$\phi = 34^\circ$

Effective thickness = 7.00 m

$A_s = \pi \times 0.5 \times 7 = 10.99 \text{ m}^2$

$P_d = (2.5 \times 0.88 + 2.5 \times 0.8 + 0.5 \times 7 \times 0.87) = 7.25 \text{ t/m}^2$

Ultimate Skin Frictional Resistance = $(1.2 \times 7.25 \times \tan 34^\circ) \times 10.99 = 64.45 \text{ t}$

Permissible skin friction resistance = $64.45/3 = 21.48 \text{ t}$

Calculation of Safe End Bearing Resistance:

$A_p = 3.14 \times (0.5)^2/4 = 0.196 \text{ m}^2$

$\phi =$ Angle of internal friction at the base of the pile = 34°

$N_c =$ Bearing capacity factor taken as 9

$D =$ Dia of pile = 0.5 meter

$F_s =$ Factor of safety taken 3

$N_\gamma =$ Bearing Capacity Factors = 41.06

$N_q =$ Bearing Capacity Factors = 46.00

$P_d =$ Effective overburden pressure at Pile tip (Restricted to $20D = (20 \times 0.5) \text{ m} = 10.00 \text{ m}$

Hence, $P_d = (0.88 \times 2.5 + 0.8 \times 2.5 + 0.87 \times 5) \text{ t/m}^2 = 8.55 \text{ t/m}^2$

Ultimate End Bearing Resistance = $0.196 \times (0.5 \times 0.5 \times 0.87 \times 41.06 + 5.05 \times 46.00) \text{ t/m}^2 = 78.94 \text{ t/m}^2$

Safe End Bearing Resistance = $78.94/3 \text{ t/m}^2 = 26.31 \text{ t/m}^2$

Safe vertical capacity of Pile = $(26.31 + 21.48 + 2.23 + 3.93) \text{ t} = 53.95 \text{ t}$

Recommended vertical capacity of the Pile = 53 t

Calculation of Uplift capacity of pile:

Safe uplift capacity of pile = 13.82

Recommended uplift capacity of pile = 13 t



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies; ease of construction and less sound pollution.

While calculating the pile capacity, let us assume that,

- Cut off level is at 2.0 m
- Pile capacities shall be ascertained by approved method (IS 2911 (Part 1/Sec 2):2010).
- Assumed Grade of Concrete = M25
- Diameter of pile used = 400mm.

Sample Calculation of Safe Vertical Pile Capacity around BH-7/As per IS 2911 (Part 1/Sec 2) : 2010]

Pile embedment depth = 14 m.

Diameter of pile = 400 mm.

Sample vertical pile capacity has been estimated considering average layer stratification as per Sub- Soil Profile Clause 4.1 in the Report

Design Strength Parameters:

STRATUM-I

Considering the lab result and subsoil condition,

Use design $c = 2.2 \text{ t/m}^2$ and $\Phi = 5^\circ$.

Submerged Density = 0.88gm/cc

Also use, $\alpha = 1.0$ (As $C = 2.2 \text{ t/m}^2$)

Length of shaft = 1.00 m (As Cut off length = 2m)

STRATUM-II

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 34^\circ$.

Submerged Density = 0.80gm/cc

Also use, $K_i = 1.2$ (As $\Phi = 34^\circ$)

Length of shaft = 2.00 m



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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STRATUM-III

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 37^\circ$.

Submerged Density = 0.82gm/cc

Also use, $K_i = 1.4$ (As $\Phi = 37^\circ$.)

Length of shaft= 5.00 m

STRATUM-IV

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 40^\circ$.

Submerged Density = 0.85gm/cc

Also use, $K_i = 1.5$ (As $\Phi = 40^\circ$.)

Length of shaft= 4.00 m

The ultimate vertical pile capacity of bored cast in situ RCC pile in soil may be estimated using the formula as given below:

$$Q_u = [K_i \times P_{Di} \times \tan \delta_i \times A_{si}] / F_s + C_{u1} \times N_c \times \pi \times D^2 / 4 F_s + \alpha \times C_{u2} \times \pi \times D \times L / F_s$$

Note :-

$K_i \times P_{Di} \times \tan \delta_i \times A_{si}$ is the skin frictional resistance to stratum-II (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-1 page 10 of IS 2911 (Part-1/sec-2): 2010 (Granular Soil)

$C_{u1} \times N_c \times \pi \times D^2 / 4 F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

$\alpha \times C_{u2} \times \pi \times D \times L / F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

where, Q_u = Ultimate vertical load carrying capacity of RCC bored pile,

K_i = Co-efficient of earth pressure in i^{th} layer.

P_{Di} = Mean effective overburden pressure of i^{th} layer.

δ_i = Angle of wall friction between pile and soil for the i^{th} layer.

A_{si} = Surface area of pile shaft in i^{th} layer = $\pi \times D \times L$

C_{u1} = Shear strength of rock below the base of pile

N_c = Bearing capacity factor taken as 9

D = Dia of pile in meter

F_s = Factor safety taken 3

$\alpha = 0.9$ (recommended value)

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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C_{u2} = Average shear strength of rock in the socketed length pile

L = Length of pile in respective stratum,

Calculation of Safe Skin Frictional Resistance:

Stratum-I: (Layer 2 m depth to -3.00 m depth)

$\alpha_i = 1.0$

Effective thickness = 1 m.

$C_{us} = 2.2 \text{ t/m}^2$.

$A_s = \pi \times 0.4 \times 1 = 1.26 \text{ m}^2$.

Where, $D = 0.4 \text{ m}$. and Shaft length = 1.0m.

Ultimate Skin Frictional Resistance = $(1.0 \times 2.2 \times 1.26) = 2.76 \text{ t}$

Permissible skin friction resistance = $2.76/3 = 0.92 \text{ t}$

Stratum-II : (Layer -3.00 m depth to -5.00 m depth)

$K_i = 1.2$

$\phi = 34^\circ$

Effective thickness = 2.00 m

$A_s = \pi \times 0.4 \times 2.0 = 2.51 \text{ m}^2$

$P_{di} = (0.88 \times 1.0 + 0.5 \times 0.80 \times 2.0) = 1.68 \text{ t/m}^2$

Ultimate Skin Frictional Resistance = $(1.2 \times 1.68 \times \tan 34^\circ) \times 2.51 = 3.42 \text{ t}$.

Permissible skin friction resistance = $3.42/3 = 1.14 \text{ t}$

Stratum-III : (Layer -5.00 m depth to -10.00 m depth)

$K_i = 1.4$

$\phi = 37^\circ$

Effective thickness = 5.00 m

$A_s = \pi \times 0.4 \times 5 = 6.28 \text{ m}^2$

$P_{di} = (1.0 \times 0.88 + 2.0 \times 0.80 + 0.5 \times 5.0 \times 0.82) = 4.53 \text{ t/m}^2$

Ultimate Skin Frictional Resistance = $(1.4 \times 4.53 \times \tan 37^\circ) \times 6.28 = 30.01 \text{ t}$.

Permissible skin friction resistance = $30.01/3 = 10.00 \text{ t}$



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Stratum-IV : (Layer -10.00 m depth to -14.00 m depth)

$$K_i = 1.5$$

$$\phi = 40^\circ$$

Effective thickness = 4.00 m

$$A_s = \pi \times 0.4 \times 4 = 5.02 \text{ m}^2$$

$$P_{di} = (1.0 \times 0.88 - 2.0 \times 0.80 + 5.0 \times 0.82 + 0.5 \times 4 \times 0.85) = 8.28 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1.5 \times 8.28 \times \tan 40^\circ) \times 5.02 = 52.36 \text{ t}$$

$$\text{Permissible skin friction resistance} = 52.36/3 = 17.45 \text{ t}$$

Pile terminates at this layer.

Calculation of Safe End Bearing Resistance:

$$A_p = 3.14 \times (0.4)^2/4 = 0.126 \text{ m}^2$$

ϕ = Angle of internal friction at the base of the pile = 40°

N_c = Bearing capacity factor taken as 9

D = Dia of pile = 0.4 meter

F_s = Factor of safety taken 3

N_{γ} = Bearing Capacity Factors = 109.41

N_q = Bearing Capacity Factors = 110

P_d = Effective overburden pressure at Pile tip (Restricted to 20D) = $(20 \times 0.4) \text{ m} = 8.00 \text{ m}$

$$\text{Hence, } P_d = (1.0 \times 0.88 - 2.0 \times 0.80 + 5.0 \times 0.82) \text{ t/m}^2 = 6.58 \text{ t/m}^2$$

$$\begin{array}{ccccccc} \text{Ultimate} & & \text{End} & & \text{Bearing} & & \text{Resistance} \\ 0.126 \times (0.5 \times 0.4 \times 0.85 \times 109.41 - 6.58 \times 110) \text{ t/m}^2 & = & 93.16 \text{ t/m}^2 & & & & \end{array}$$

$$\text{Safe End Bearing Resistance} = 93.16/3 \text{ t/m}^2 = 31.05 \text{ t/m}^2$$

Safe vertical capacity of Pile = $(31.05 + 0.92 + 1.14 + 10.00 + 17.45) \text{ t} = 60.57 \text{ t}$

Recommended vertical capacity of the Pile = 60 t

Calculation of Uplift capacity of pile:

Safe uplift capacity of pile = 14.76 t

Recommended uplift capacity of pile = 14.0 t

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies; ease of construction and less sound pollution.

While calculating the pile capacity, let us assume that,

- Cut off level is at 2.0 m
- Pile capacities shall be ascertained by approved method (IS 2911 (Part 1/Sec 2):2010).
- Assumed Grade of Concrete = M25
- Diameter of pile used = 600mm.

Sample Calculation of Safe Vertical Pile Capacity around BH-7(As per IS 2911 (Part 1/Sec 2) : 2010)

Pile embedment depth = 14 m.

Diameter of pile = 600 mm.

Sample vertical pile capacity has been estimated considering average layer stratification as per Sub- Soil Profile Clause 4.1 in the Report

Design Strength Parameters:

STRATUM-I

Considering the lab result and subsoil condition,

Use design $c = 2.2 \text{ t/m}^2$ and $\Phi = 5^\circ$.

Submerged Density = 0.88gm/cc

Also use, $\alpha = 1.0$ (As $C = 2.2 \text{ t/m}^2$)

Length of shaft = 1.00 m (As Cut off length = 2m)

STRATUM-II

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 34^\circ$.

Submerged Density = 0.80gm/cc

Also use, $K_i = 1.2$ (As $\Phi = 34^\circ$)

Length of shaft = 2.00 m

Submitted By Shyama Power (I) Limited.



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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STRATUM-III

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 37^\circ$,

Submerged Density = 0.82 gm/cc

Also use, $K_i = 1.4$ (As $\Phi = 37^\circ$.)

Length of shaft = 5.00 m

STRATUM-IV

Considering the lab result and subsoil condition,

Use design $c = 0 \text{ t/m}^2$ and $\Phi = 40^\circ$,

Submerged Density = 0.85 gm/cc

Also use, $K_i = 1.5$ (As $\Phi = 40^\circ$.)

Length of shaft = 4.00 m

The ultimate vertical pile capacity of bored cast in situ RCC pile in soil may be estimated using the formula as given below:

$$Q_u = [K_i \times P_{Di} \times \tan \delta_i \times A_{si}] / F_s + C_{u1} \times N_c \times \pi \times D^2 / 4 F_s + \alpha \times C_{u2} \times \pi \times D \times L / F_s$$

Note :-

$K_i \times P_{Di} \times \tan \delta_i \times A_{si}$ is the skin frictional resistance to stratum-II (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-1 page 10 of IS 2911 (Part-1/sec-2): 2010 (Granular Soil)

$C_{u1} \times N_c \times \pi \times B^2 / 4 F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)

$\alpha \times C_{u2} \times \pi \times B \times L / F_s$ is end bearing of Stratum-III (Ref. Cl 6.3.1.1 , and 6.3.2 Annex-B-8 page 13 of IS 2911 (Part-1/sec-2): 2010 (Pile in soft/ weathered rock)



Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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where, Q_u = Ultimate vertical load carrying capacity of RCC bored pile,

K_i = Co-efficient of earth pressure in i^{th} layer.

P_{Di} = Mean effective overburden pressure of i^{th} layer.

δ_i = Angle of wall friction between pile and soil for the i^{th} layer.

A_{si} = Surface area of pile shaft in i^{th} layer = $\pi \times D \times L$

C_{u1} = Shear strength of rock below the base of pile

N_c = Bearing capacity factor taken as 9

D = Dia of pile in meter

F_s = Factor safety taken 3

$\alpha = 0.9$ (recommended value)

C_{u2} = Average shear strength of rock in the socketed length pile

L = Length of pile in respective stratum,

Calculation of Safe Skin Frictional Resistance:

Stratum-I: (Layer 2 m depth to -3.00 m depth)

$\alpha_i = 1.0$

Effective thickness = 1 m.

$C_{us} = 2.2 \text{ t/m}^2$.

$A_s = \pi \times 0.6 \times 1 = 1.88 \text{ m}^2$.

Where, $D = 0.6 \text{ m}$. and Shaft length = 1.0m.

Ultimate Skin Frictional Resistance = $(1.0 \times 2.2 \times 1.88) = 4.14 \text{ t}$

Permissible skin friction resistance = $4.14/3 = 1.38 \text{ t}$

Stratum-II : (Layer -3.00 m depth to -5.00 m depth)

$K_i = 1.2$

$\phi = 34^\circ$

Effective thickness = 2.00 m

$A_s = \pi \times 0.6 \times 2.0 = 3.77 \text{ m}^2$

$P_{di} = (0.88 \times 1.0) + (0.5 \times 0.80 \times 2.0) = 1.68 \text{ t/m}^2$

Ultimate Skin Frictional Resistance = $(1.2 \times 1.68 \times \tan 34^\circ) \times 3.77 = 5.12 \text{ t}$.

Permissible skin friction resistance = $5.12/3 = 1.71 \text{ t}$



Client: Assam Electricity Grid Corporation Limited,

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Stratum-III : (Layer -5.00 m depth to -10.00 m depth)

$$K_i = 1.4$$

$$\phi = 37^\circ$$

$$\text{Effective thickness} = 5.00 \text{ m}$$

$$A_s = \pi \times 0.6 \times 5 = 9.42 \text{ m}^2$$

$$P_{di} = (1.0 \times 0.88 + 2.0 \times 0.80 + 0.5 \times 5.0 \times 0.82) = 4.53 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1.4 \times 4.53 \times \tan 37^\circ) \times 9.42 = 45.02 \text{ t.}$$

$$\text{Permissible skin friction resistance} = 45.02/3 = 15.01 \text{ t}$$

Stratum-IV : (Layer -10.00 m depth to -14.00 m depth)

$$K_i = 1.5$$

$$\phi = 40^\circ$$

$$\text{Effective thickness} = 4.00 \text{ m}$$

$$A_s = \pi \times 0.6 \times 4 = 7.54 \text{ m}^2$$

$$P_{di} = (1.0 \times 0.88 + 2.0 \times 0.80 + 5.0 \times 0.82 + 0.5 \times 4 \times 0.85) = 8.28 \text{ t/m}^2$$

$$\text{Ultimate Skin Frictional Resistance} = (1.5 \times 8.28 \times \tan 40^\circ) \times 7.54 = 78.54 \text{ t.}$$

$$\text{Permissible skin friction resistance} = 78.54/3 = 26.18 \text{ t}$$

Pile terminates at this layer.

Calculation of Safe End Bearing Resistance:

$$A_p = 3.14 \times (0.6)^2/4 = 0.283 \text{ m}^2$$

$$\phi = \text{Angle of internal friction at the base of the pile} = 40^\circ$$

$$N_c = \text{Bearing capacity factor taken as 9}$$

$$D = \text{Dia of pile} = 0.6 \text{ meter}$$

$$F_s = \text{Factor of safety taken 3}$$

$$N_y = \text{Bearing Capacity Factors} = 109.41$$

$$N_q = \text{Bearing Capacity Factors} = 110$$



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P_d = Effective overburden pressure at Pile tip (Restricted to $20D = (20 \times 0.6) \text{ m} = 12.00 \text{ m}$

Hence, $P_d = (1.0 \times 0.88 + 2.0 \times 0.80 + 5.0 \times 0.82 + 4 \times 0.85) \text{ t/m}^2 = 9.98 \text{ t/m}^2$

Ultimate End Bearing Resistance =
 $0.283 \times (0.5 \times 0.6 \times 0.85 \times 109.41 + 9.98 \times 110) \text{ t/m}^2 = 317.84 \text{ t/m}^2$

Safe End Bearing Resistance = $317.84/3 \text{ t/m}^2 = 105.95 \text{ t/m}^2$

Safe vertical capacity of Pile = $(105.95 + 1.38 + 1.71 + 15.01 + 26.18) \text{ t} = 150.22 \text{ t}$

Recommended vertical capacity of the Pile = 150t

Calculation of Uplift capacity of pile:

Safe uplift capacity of pile = 22.14t

Recommended uplift capacity of pile = 22 t

Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-1	250	14	17	6.0	3.485	0.65	2.8	0.46
	300	14	22	8.0	5.6	0.98	4.273	0.82
	400	14	39	11.0	8.76	2.21	9.303	2.29
	500	14	53	13.0	21.129	3.951	24.26	4.89
	600	14	78	16.0	33.94	6.34	45.10	9.09

Checked by Jyoti, D&P	Checked by AM(C), D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DGM(C)

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Submitted By Shyama Power (I) Limited.

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package-G)

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Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-2	250	14	20	7.0	3.291	0.615	2.213	0.446
	300	14	27	9.0	5.28	0.98	4.11	0.82
	400	14	45	12.0	11.17	2.08	10.93	2.20
	500	14	70	15.0	19.95	3.73	23.36	4.71
	600	14	105	18.0	32.05	6.00	43.42	8.75

Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-3	250	14	17	6.0	3.48	0.65	2.29	0.46
	300	14	22	8.0	6.00	1.047	4.27	0.86
	400	14	35	11.0	11.82	2.21	11.36	2.29
	500	14	54	13.0	21.12	3.95	24.26	4.89
	600	14	79	16.0	33.94	6.34	45.10	9.09

				
Checked by JM(C), D&P	Checked by AM(C), D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DGM(C)

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Submitted By **Shyama Power (I) Limited.**

Client: Assam Electricity Grid Corporation Limited.

Project: Geotechnical Investigation of "Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

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Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-4	250	14	19	7.0	1.9	0.35	1.53	0.3
	300	14	25	8.0	3.051	0.57	2.85	0.57
	400	14	42	11.0	6.44	1.20	7.58	1.52
	500	14	67	14.0	11.51	2.15	16.19	3.26
	600	14	101	17.0	18.49	3.45	30.09	6.06

Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-5	250	14	21	7.0	1.096	0.20	1.063	0.21
	300	14	29	9.0	1.76	0.32	1.97	0.39
	400	14	50	12.0	3.72	0.69	5.25	1.05
	500	14	80	15.0	6.64	1.243	11.22	2.26
	600	14	122	18.0	10.67	2.00	20.86	4.20

				
Checked by J. S. D&P	Checked by AM(C), D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DCM(C)

Chief Expert
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Submitted By Shyama Power (I) Limited.

Client: Assam Electricity Grid Corporation Limited.

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Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-6	250	14	19	7.0	1.598	0.3	1.367	0.27
	300	14	24	9.0	2.56	0.48	2.54	0.51
	400	14	39	12.0	5.42	1.01	6.75	1.36
	500	14	59	15.0	9.69	1.81	14.43	2.91
	600	14	86	18.0	15.56	2.911	26.82	5.4

Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-7	250	14	26	9.0	1.012	0.189	1.008	0.20
	300	14	32	11.0	1.625	0.3	1.874	0.38
	400	14	60	14.0	3.43	0.642	4.98	1.00
	500	14	97	18.0	6.134	1.147	8.7	2.145
	600	14	150	22.0	9.853	1.843	19.78	3.98

				
Checked by JMG, D&P	Checked by AM(C), D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DGM(C)

Submitted By Shyama Power (I) Limited.




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Client: Assam Electricity Grid Corporation Limited.

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Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-8	250	14	19	7.0	3.09	0.57	2.12	0.42
	300	14	25	9.0	4.96	0.92	3.94	0.79
	400	14	40	12.0	10.48	1.96	10.48	2.11
	500	14	60	15.0	18.73	3.5	22.39	2.51
	600	14	88	18.0	30.09	5.627	41.63	8.393

Location	Pile Diameter (mm)	Pile Embedment Depth below existing Ground level with Cut-out level -2.0 M (m)	Recommended Vertical Pile Capacity (t)	Recommended Uplift Pile Capacity (t)	Recommended Lateral Load Carrying Capacity, (t)		Recommended Moment-resisting Capacity, (t-m)	
					Fixed-head Pile	Free-head Pile	Fixed-head Pile	Free-head Pile
BH-9	250	14	18	7.0	1.176	0.22	1.11	0.22
	300	14	23	8.0	1.89	0.35	2.07	0.41
	400	14	37	11.0	4.00	0.74	5.5	1.11
	500	14	57	14.0	7.13	1.33	11.76	2.37
	600	14	83	17.0	11.45	2.14	21.86	4.40

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<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>	<i>[Signature]</i>
Checked by JMC(C), D&P	Checked by AM(C), D&P	Checked by DM(C), D&P	Checked by AGM(C), D&P	Approved by DGM(C)

Submitted By Shyama Power (I) Limited.



n2ah.

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H) CONCLUSION AND RECOMMENDATION :

From engineering properties of the deposit following recommendations for foundation are suggested:

- a) Based on the field tests and the foregoing discussion the following are summarized:
- b) The subsoil is characterized by clayey silt in first layer & fine sand continues up to terminating depth of all the boreholes.
- c) The present report deals with the geotechnical investigation findings at the location and the discussion on the aspects regarding allowable bearing capacity of open foundations. However, the Foundation Designer may modulate the type of foundations and other values regarding foundation geometry and soil design parameter to meet any specific design criteria.
- d) Water level observations were made during the progress of boring. The depths at which ground water was encountered, was recorded in the respective borclog sheet as standing water level. Standing water level was measured after 24 hours of removal of casing. It was noticed that the standing water level was found within a depth of 1.50 m to 2.30 m below EGL.
- e) Precaution in all respect should be taken for nearby existing structures, if any. The final decision regarding the foundation will depend on the judgment of the engineer concerned.
- f) Any unsuitable expansive/decomposed if encountered should be replaced.
- g) The foundation spacing should be chosen in such a way that there should not be any overlap of pressure bulb of 2 adjacent footings.
- h) Determination of recommended allowable bearing capacity has been discussed in the section 5.1 (Summary of SBC) for Shallow Foundation & section G for Pile Foundation.

Submitted By Shyama Power (I) Limited.

 Checked by AS (SAP)	 Checked by AS (SAP)	 Checked by AS (SAP)	 Checked by AS (SAP)	 Approved by AS (SAP)
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- i) Concentration of chlorides, sulphates & pH value are under limit as per IS Code specification. So no special cement will be required for foundation concrete.
- j) Pile Capacity shall be considered for Foundation design as per nearest bore hole data

Prepared By

Checked & approved by

Signature
Soil Investigator

Signature
Assam Electricity Grid
Corporation Ltd

P.K. Dutta & Co.

Pranaya Dutta
PRANAYA DUTTA
B. Tech (Civil)
Sr. Geotechnical Engineer

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Checked by JM (DSP)	Checked by AM (DSP)	Checked by CM (DSP)	Checked by AM (DSP)	Approved by DCM (G)

Submitted By **Shyama Power (I) Limited.**



ANNEXURE

FIELD BORE LOG DATA

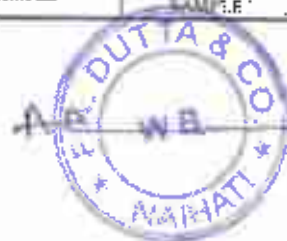
Shyama Power (India) Limited					Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)										BORE LOG DATA SHEET		
Bore Hole No. :- BH-1					Borehole Diameter :- 150 mm Drill Hole:- NX					Field Tests	Nos	Samples		Nos			
Land Type :- Paddy Land					Northing :-		26°38'28.6"			SPT	7	Undisturbed (U)		4			
Commenced on:- 11.05.2024					Easting :-		91°36'23.9"			Cone	-	Disturbed (D)		11			
Completed on:- 12.05.2024					R.L. Value :-					Vane	-	Core (C)		-			
Water Level :- 2.00 M					Termination Depth (m):-15.00 M												
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES			Core Recovery (%)	R.Q.D. (%)	Remarks				
	15	15	15					Type	No.	Depth (m.)							
0.00					Firm to stiff brownish to dark black grey silty clay / clayey silt with kankars.			D	1	0.50	----						
								U	1	1.00	1.45						
								D	2	1.50	----						
	2	3	3	6				S	1	2.00	2.45						
								D	3	2.50	----						
	3	5	6	11				S	2	3.00	3.45						
4.50							4.50	D	4	3.50	----						
								U	2	4.00	4.45						
								D	5	4.50	----						
4.50	7	10	15	25	Dense dark grey / bluish grey silty sand with mica.			S	3	5.00	5.45						
				D				6	5.50	----							
				U				3	6.00	6.45							
7.00							2.50	D	7	6.50	----						
7.00	17	25	29	54				S	4	7.00	7.45						
								U	4	8.00	8.45						
					D	8	8.50	----									
	23	30	46	76	S	5	10.00	10.45									
					U	5	11.00	11.45									
					D	9	11.50	----									
					D	10	12.00	----									
	46, 59 >100				S	6	13.00	13.30									
15.00							8.00	D	11	13.50	----						
								S	7	15.00	15.30						
	48,60 For 5cm>100																
* S * - 'SPT'		* C * - 'CORE'		* U * - 'UNDISTURBED SAMPLE'		* D * - 'DISTURBED SAMPLE'		* W * - 'WATER LEVEL'		* BGL * - 'BELOW GROUND LEVEL'							



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Bore Hole No. :- BH-2				Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests		Nos		Samples		Nos			
Land Type :- Paddy Land				Northing :-		26°38'26.9"											
Commenced on:- 10.05.2024				Easting :-		91°36'25.2"				SPT		7		Undisturbed (U)		3	
Completed on:- 11.05.2024				R.L. Value :-						Cone		-		Disturbed (D)		10	
Water Level :- 1.70 M				Termination Depth (m):-15.00 M				Vane		-		Core (C)		.			
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15	15	15					Type	No.	Depth (m.)							
0.00					Stiff deep brownish to dark bluish grey silty clay / clayey silt with mica.			D	1	0.50	----						
								D	2	1.00	----						
	4	6	7	13				S	1	1.50	1.95						
								D	3	2.00	----						
								U	1	2.50	2.95						
								D	4	3.00	----						
	2	2	3	5				S	2	3.00	3.45						
							D	5	3.50	----							
							U	2	4.00	4.45							
5.00							5.00	D	6	4.50	----						
5.00	15	19	23	42	Dense dark grey to bluish grey silty fine sand to medium sand with mica.			S	3	5.00	5.45						
								U	3	6.00	6.45						
								D	7	6.50	----						
	19	21	24	45				S	4	7.00	7.45						
								U	4	8.00	8.25						
10.00							5.00	D	8	8.50	----						
10.00	12	29	33	56	Very dense dark grey to light grey medium to coarse sand with mica & gravels.			S	5	10.00	10.45				Rebound		
								D	7	11.00	----						
								U	5	11.00	11.25						
								D	8	11.50	----						
								D	9	12.00	----						
	45, 60 >100							S	6	13.00	13.30						
								D	10	13.50	----						
15.00	49,57 For 7cm>>100						5.00	S	10	14.00	15.30						
"S" - 'SPT'		"C" - 'CORE'		"U" - 'UNDISTURBED SAMPLE'		"D" - 'DISTURBED'		"W" - 'WATER LEVEL'		"BGL" - 'BELOW GROUND LEVEL'							



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Bore Hole No. :- BH-3		Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples	Nos				
Land Type :- Paddy Land		Northing :- 26°38'26.5"											
Commenced on:- 13.05.2024		Easting :- 91°36'28.2"		SPT	7	Undisturbed (U)		3					
Completed on:- 16.05.2024		R.L. Value :-		Cone	-	Distubed (D)		10					
Water Level :- 1.70 M		Termination Depth (m):-15.00 M				Vane	-	Core (C)	-				
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES		Core Recovery (%)	R.Q.D. (%)	Remarks	
	15	15	15					Type	No.				Depth (m.)
0.00					Firm to stiff deep brownish to dark bluish grey silty clay / clayey silt with mica.		4.50	D	1	0.50	----		
				U				1	1.00	1.45			
				D				2	1.50	----			
	2	3	3	6				S	1	2.00	2.45		
	3	4	6	10				S	2	3.00	3.45		
								U	2	4.00	4.45		
4.50								D	3	4.50	----		
4.50	8	16	10	26	Medium dense to dense dark grey to bluish grey silty fine to medium sand with mica.		5.50	S	3	5.00	5.45		Rebound
				U				3	6.00	6.45			
				D				4	6.50	----			
	18	18	30	43				S	4	7.00	7.45		
								U	4	8.00	8.25		
								D	5	8.50	----		
10.00								D	6	9.00	----		
10.00	20	31	39	70	Very dense dark grey to light grey medium to coarse sand with mica & gravels.		5.00	S	5	10.00	10.45		Rebound
				D				7	11.00	----			
				U				5	11.00	11.20			
				D				8	11.50	----			
				D				9	12.00	----			
	46, 58 > 100			S				6	13.00	13.50			
				D				10	13.50	----			
15.00	48, 60 For 10cm >100							S	7	15.00	15.25		
"S" - SPT		"C" - CORE		"U" - UNDISTURBED SAMPLE		"D" - DISTURBED SAMPLE		"W" - WATER SAMPLE		"BOL" - BELOW PROBING LEVEL			



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Bore Hole No. :-		BH-4		Borehole Diameter :- 150 mm		Drill Hole:- NX.		Field Tests	Nos	Samples	Nos			
Land Type :-		Paddy Land		Northing :-		26°38'28.9"								
Commenced on:-		16.05.2024		Easting :-		91°36'26.3"		SPT	7	Undisturbed (U)	3			
Completed on:-		18.05.2024		R.L. Value :-				Cone	-	Disturbed (D)	10			
Water Level :- 2.30 M				Termination Depth (m):-15.00 M				Vane	-	Core (C)	-			
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES			Core Recovery (%)	R.Q.D. (%)	Remarks	
	15	15	15					Type	No.	Depth (m.)				
0.00					Soft deep brownish grey silty clay / clayey silt with mica.		3.00	D	1	0.50	----			
								U	1	1.00	1.45			
								D	2	1.50	----			
3.00	2	2	2	4				S	1	2.00	2.45			
3.00	5	8	11	19	Medium dense to dense dark grey silty fine to medium sand with mica.		7.00	S	2	3.00	3.45			
								U	2	4.00	4.45			
								D	3	4.50	----			
	10	13	17	30				S	3	5.00	5.45			
								U	3	6.00	6.45			
								D	4	6.50	----			
	16	20	22	42				S	4	7.00	7.45			
					U	4		8.00	8.45			Slip		
					D	5		8.50	----					
10.00						D		6	9.00	----				
10.00	21	30	42	72	Very dense dark grey medium to coarse sand with mica.			S	5	10.00	10.45			
								D	7	11.00	----			
								U	5	11.00	11.45			Slip
								D	8	11.50	----			
								D	9	12.00	----			
	38, 55 > 100							S	6	13.00	13.25			
								D	10	13.50	----			
15.00	40, 53 > 100				S			7	15.00	15.20				
"S" - 'SPT'		"C" - 'CORE'		"U" - 'UNDISTURBED SAMPLE'			"D" - 'DISTURBED SAMPLE'		"W" - 'WATER SAMPLE'		"BGL" - 'BELOW GROUND LEVEL'			

"S" - 'SPT'

"C" - 'CORE'

"U" - 'UNDISTURBED SAMPLE'

"D" - 'DISTURBED SAMPLE'

"W" - 'WATER SAMPLE'

"BGL" - 'BELOW GROUND LEVEL'



Shyama Power (India) Limited				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction Of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA And 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated Transmission Lines With Bay Extension Works At Existing 132/33 KV Nalbari GSS.(Package G)										BORE LOG DATA SHEET					
Bore Hole No. :- BH-5				Borehole Diameter :- 150 mm				Drill Hole:- NX.				Field Tests		Nos		Samples		Nos	
Land Type :- Paddy Land				Northing :-		26°38'29.8"													
Commenced on:- 18.05.2024				Easting :-		91°36'28.9"				SPT		7		Undisturbed (U)		3			
Completed on:- 20.05.2024				R.L. Value :-						Conc		-		Disturbed (D)		10			
Water Level :- 2.10 M				Termination Depth (m):-15.00 M				Vane		-		Core (C)		-					
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks					
	15	15	15					Type	No.	Depth (m.)									
0.00					Medium stiff to stiff dark brownish grey silty clay / clayey silt with mica.		3.00	D	1	0.50	----								
				U				1	1.00	1.45									
				D				2	1.50	----									
3.00	2	3	5	8				S	1	2.00	2.45								
3.00	5	6	8	14	Medium dense to dense dark grey silty fine to medium sand with mica.		2.00	S	2	3.00	3.45								
				U				2	4.00	4.45									
5.00								D	3	4.50	----								
5.00	7	11	17	28	Dense dark grey silty fine to medium sand with mica & gravels.		5.00	S	3	5.00	5.45								
				U				3	6.00	6.45									
				D				4	6.50	----									
	19	22	25	47				S	4	7.00	7.45								
								U	4	8.00	8.45				Slip				
								D	5	8.50	----								
10.00								D	6	9.00	----								
10.00	24	33	40	73	Very dense dark grey medium to coarse sand with mica & gravels.		5.00	S	5	10.00	10.45								
				D				7	11.00	----									
				U				5	11.00	11.45				Slip					
				D				8	11.50	----									
				D				9	12.00	----									
	43 , 59 > 100							S	6	13.00	13.30								
								D	10	13.50	----								
15.00	48 , 52 > 100								S	7	15.00	15.25							
"S" - SPT		"C" - CORE		"U" - UNDISTURBED SAMPLE		"D" - DISTURBED SAMPLE		"W" - WATER		"BCL" - BELOW GROUND LEVEL									



Shyama Power (India) Limited					Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction Of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA And 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated Transmission Lines With Bay Extension Works At Existing 132/33 KV Nalbari GSS (Package G)										BORE LOG DATA SHEET		
Bore Hole No. :- BH-6					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples		Nos			
Land Type :- Paddy Land					Northing :-		26°38'32.4"			SPT	7	Undisturbed (U)		3			
Commenced on:- 27.05.2024					Easting :-		91°36'25.2"			Cone	-	Distubed (D)		10			
Completed on:- 29.05.2024					R.L. Value :-					Vane	-	Core (C)		-			
Water Level :- 1.50 M					Termination Depth (m):-15.00 M						-						
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES			Core Recovery (%)	R.Q.D. (%)	Remarks				
	15	15	15					Type	No.	Depth (m.)							
0.00					Medium stiff dark brownish grey silty clay / clayey silt with mica.			D	1	0.50	----						
				U				1	1.00	1.45							
				D				2	1.50	----							
	2	3	3	6				S	1	2.00	2.45						
3.50	3	4	6	10				S	2	3.00	3.45						
3.50					Medium dense dark grey silty fine to medium sand with mica.		3.50	U	2	4.00	4.45						
				D				3	4.50	----							
	5	9	14	23				S	3	5.00	5.45						
				U				3	6.00	6.45							
7.00								D	4	6.50	----						
7.00	12	27	31	58	Very dense dark grey medium to coarses sand with mica & gravels.			S	4	7.00	7.45						
				U				4	8.00	8.45			Slip				
				D				5	8.50	----							
				D				6	9.00	----							
	19	30	45	75				S	5	10.00	10.45						
				D				7	11.00	----							
				U				5	11.00	11.45			Slip				
				D				8	11.50	----							
				D				9	12.00	----							
	47, 55 1'or 10cm > 100							S	6	13.00	13.25						
								D	10	13.50	----						
15.00	53, 50 For 5cm > 100							8.00	S	7	15.00	15.20					
"S" - SPT		"C" - CORE		"U" - UNDISTURBED SAMPLE				"D" - DISTURBED SAMPLE		"W" - WATER SAMPLE		"BGL" - "BELOW GROUND LEVEL"					



Shyama Power (India) Limited				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction Of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA And 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated Transmission Lines With Bay Extension Works At Existing 132/33 KV Nalbari GSS (Package C)										BORE LOG DATA SHEET		
Bore Hole No. :- BH-7				Borehole Diameter :- 150 mm Drill Hole:- NX.				Field Tests	Nos	Samples		Nos				
Land Type :- Paddy Land				Northing :-		26°38'32.7"		SPT	7	Undisturbed (U)		3				
Commenced on:- 20.05.2024				Easting :-		91°36'28.5"		Cone	-	Disturbed (D)		10				
Completed on:- 22.05.2024				R.L. Value :-				Vane	-	Core (C)		-				
Water Level :- 2.25 M				Termination Depth (m):-15.00 M												
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks		
	15	15	15					Type	No.	Depth (m.)						
0.00					Soft to firm deep brownish grey clay / clayey silt with mica.		3.00	D	1	0.50	---					
				U				1	1.00	1.45						
				D				2	1.50	---						
3.00	2	2	2	4				S	1	2.00	2.45					
3.00	4	4	6	10	Medium dense dark grey silty fine to medium sand with mica.		2.00	S	2	3.00	3.45					
				U				2	4.00	4.45						
				D				3	4.50	---						
5.00								S	3	5.00	5.45					
								U	3	6.00	6.45					
								D	4	6.50	---					
	12	19	25	44				S	4	7.00	7.45					
								U	4	8.00	8.45				Slip	
								D	5	8.50	---					
10.00							5.00	D	6	9.00	---					
10.00	24	39	47	86	Very dense dark grey medium to coarse sand with mica & gravels.		5.00	S	5	10.00	10.45					
				D				7	11.00	---						
				U				5	11.00	11.45						
				D				8	11.50	---						
				D				9	12.00	---						
				S				6	13.00	13.25						
				D				10	13.50	---						
15.00	54	50	For 5cm > 100				5.00	S	7	15.00	15.20					
"S" - 'SPT'		'C' - 'CORE'		'U' - 'UNDISTURBED SAMPLE'		'D' - 'DISTURBED SAMPLE'		'W' - 'WATER SAMPLE'		'BOL' - 'BELOW GROUND LEVEL'						



Shyama Power (India) Limited				Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction Of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA And 132/33 KV GHS At Rangia (Kumarikata) Along With The Associated Transmission Lines With Bay Extension Works At Existing 132/33 KV Nalbari GSS (Package G)										BORE LOG DATA SHEET			
Bore Hole No. :- BH-8				Borehole Diameter :- 150 mm				Drill Hole:- NX.				Field Tests	Nos	Samples	Nos		
Land Type :- Paddy Land				Northing :-		26°38'36.9"											
Commenced on:- 22.05.2024				Easting :-		91°36'25.5"		SPT	7	Undisturbed (U)		3					
Completed on:- 24.05.2024				R.L. Value :-				Cone	-	Disrubed (D)		10					
Water Level :- 1.60 M				Termination Depth (m):-15.00 M				Vane	-	Core (C)		-					
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D (%)	Remarks			
	15	15	15					Type	No.	Depth (m.)							
0.00					Medium stiff to stiff dark brownish grey to dark grey silty clay / clayey silt with mica.		5.00	D	1	0.50	----						
				U				1	1.00	1.45							
				D				2	1.50	----							
	2	3	3	6				S	1	2.00	2.45						
	4	4	5	9				S	2	3.00	3.45						
				U				2	4.00	4.45							
5.00							D	3	4.50	----							
5.00	8	12	18	30	Medium dense dark silty fine to medium sand with mica.		2.00	S	3	5.00	5.45						
				U				3	6.00	6.45							
7.00							D	4	6.50	----							
7.00	14	23	28	51	Very dense dark grey medium to coarse sand with gravels & mica.		8.00	S	4	7.00	7.45			Slip			
								U	4	8.00	8.45						
								D	5	8.50	----						
								D	6	9.00	----						
	22	36	44	80				S	5	10.00	10.45			Slip			
								D	7	11.00	----						
								U	5	11.00	11.45						
								D	8	11.50	----						
								D	9	12.00	----						
	48 , 56 For 10cm > 100							S	6	13.00	13.25						
								D	10	13.50	----						
15.00	55 , 53 For 5cm > 100						S	7	15.00	15.20							
"S" - "SPT"		"C" - "CORE"		"U" - "UNDISTURBED SAMPLES"		"D" - "DISTURBED SAMPLES"		"W" - "WATER SAMPLE"		"BCL" - "BLOW GROUND LEVEL"							



Shyama Power (India) Limited					Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED. Project: Construction Of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA And 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated Transmission Lines With Bay Extension Works At Existing 132/33 KV Nalbari GSS (Package G)										BORE LOG DATA SHEET		
Bore Hole No. :- BH-9					Borehole Diameter :- 150 mm Drill Hole:- NX.					Field Tests	Nos	Samples		Nos			
Land Type :- Paddy Land					Northing :-		26°38'33.3"			SPT	7	Undisturbed (U)		3			
Commenced on:- 25.05.2024					Easting :-		91°36'24.5"					Disturbed (D)		10			
Completed on:- 27.05.2024					R.L. Value :-					Cone	-	Core (C)		-			
Water Level :- 1.60 M					Termination Depth (m):-15.00 M					Vane	-						
DEPTH (m.)	Penetration			N value	STRATA DESCRIPTION	Symbol	Thickness (m)	SAMPLES				Core Recovery (%)	R.Q.D. (%)	Remarks			
	15	15	15					Type	No.	Depth (m.)							
0.00					Medium stiff brownish grey to dark grey silty clay / clayey silt with mica.		3.00	D	1	0.50	----						
				U				1	1.00	1.45							
				D				2	1.50	----							
3.00	2	3	3	6				S	1	2.00	2.45						
3.00	5	6	8	14	Medium dense dark grey silty fine to medium sand with mica.		2.00	S	2	3.00	3.45						
				U				2	4.00	4.45							
5.00								D	3	4.50	----						
5.00	5	9	16	25	Dense dark grey silty fine to medium sand with mica & gravels.		2.00	S	3	5.00	5.45						
				U				3	6.00	6.45							
7.00								D	4	6.50	----						
7.00	15	23	31	54	Very dense dark grey silty medium to coarse sand with mica & gravels.			S	4	7.00	7.45				Slip		
				U				4	8.00	8.45							
				D				5	8.50	----							
				D				6	9.00	----							
	24	33	39	72				S	5	10.00	10.45				Slip		
				D				7	11.00	----							
				U				5	11.00	11.45							
				D				8	11.50	----							
				D				9	12.00	----							
	44 , 56 For 10cm > 100							S	6	13.00	13.25						
								D	10	13.50	----						
15.00	52 , 50 For 5cm > 100							S	7	15.00	15.20						
"S" - "SPT"		"C" - "CORE"		"U" - "UNDISTURBED SAMPLE"				"D" - "DISTURBED SAMPLE"		"W" - "WATER SAMPLES"		"BGL" - "BELOW GROUND LEVEL"					

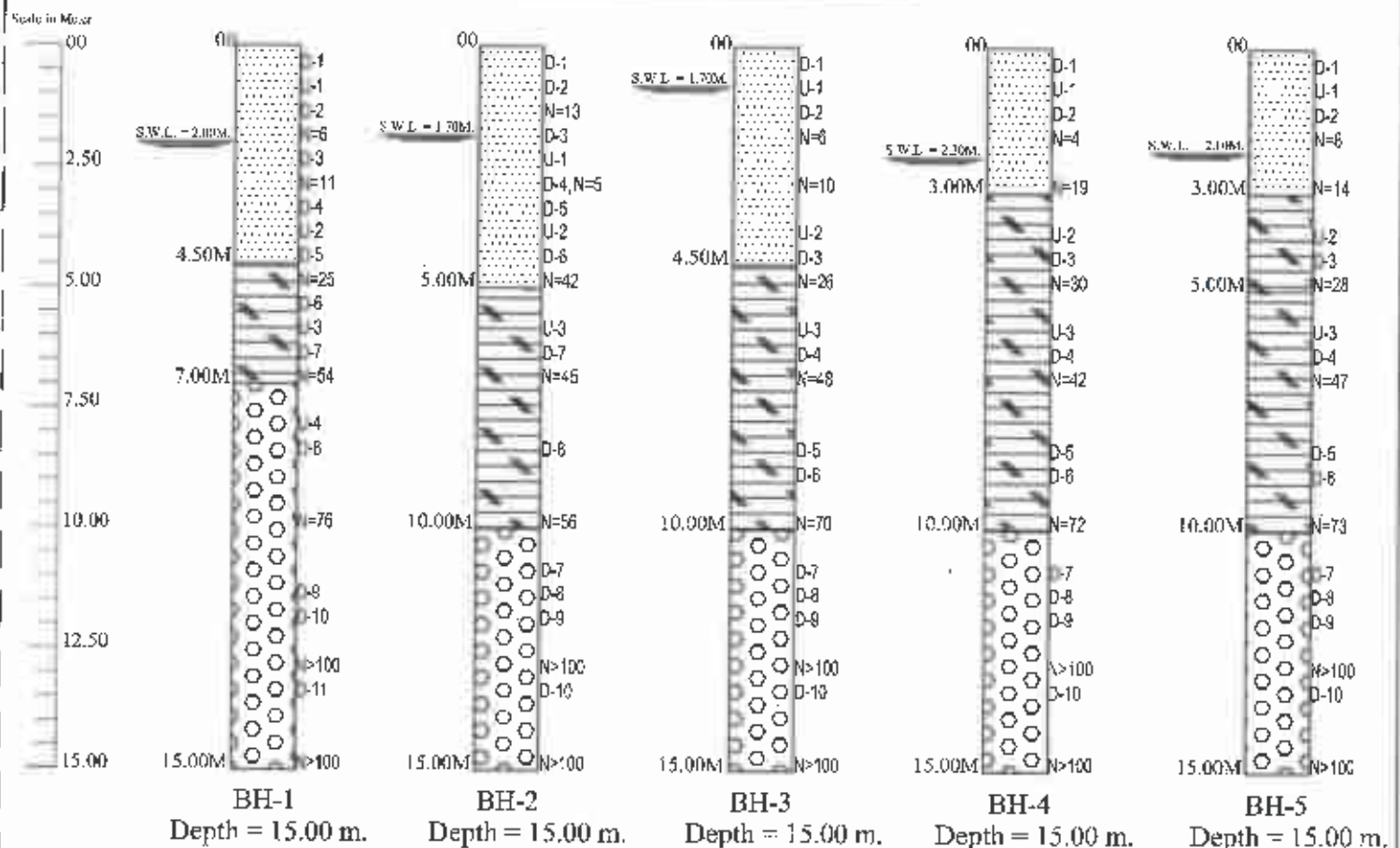


SUBSOIL PROFILE

CLIENT:- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

PROJECT:- Construction Of 400/220 KV, 2X500 MVA, 220/132 KV, 2X160 MVA & 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated TL With Bay Extension Works At Existing 132/33 KV Nalbari GSS (Package G)

Generalised Subsoil Profile



- Silty clay / clayey silt with mica & kankars.

- Silty fine sand to medium sand with mica & gravels.

- Medium to coarse sand with mica & gravels.



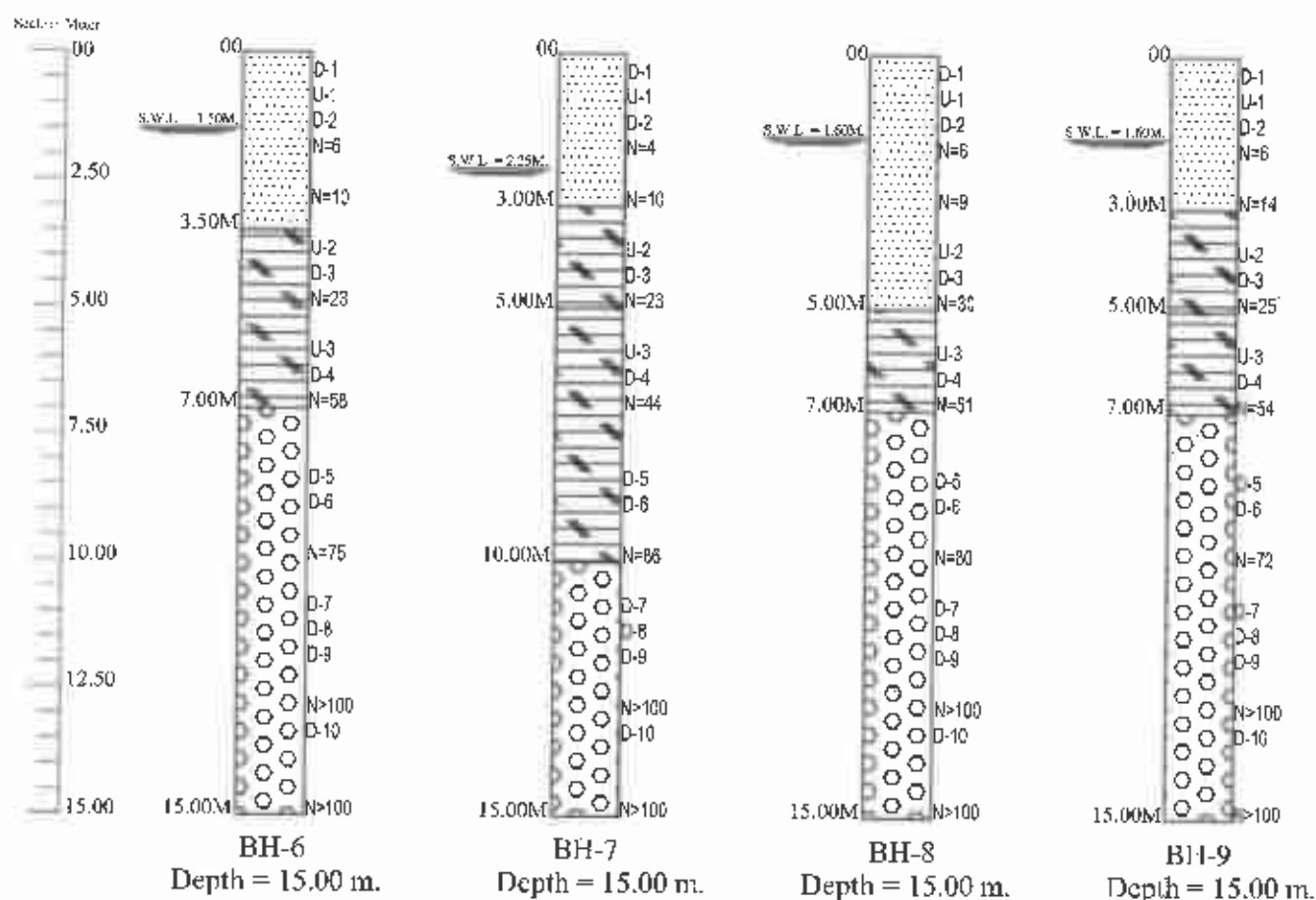
NOTE:

- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) "C" <No.> (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.

CLIENT:- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

PROJECT:- Construction Of 400/220 KV, 2X500 MVA, 220/132 KV, 2X160 MVA & 132/33 KV GIS At Rangia (Kumarikata) Along With The Associated TL With Bay Extension Works At Existing 132/33 KV Nalhari GSS (Package G)

Generalised Subsoil Profile



-  - Silty clay / clayey silt with mica.
-  - Silty fine to medium sand with mica.
-  - Medium to coarser sand with gravel & mica.

NOTE:

- 1) "N" means Standard Penetration Test value.
- 2) "U" means Undisturbed Soil Sample.
- 3) "C <No.>" (TCR/RQD).
- 4) "C" means Core.
- 5) "TCR" means Total Core Recovery.
- 6) "RQD" means Rock Quality Designation.
- 7) "SWL" means Standing water Level.
- 8) Thickness of each stratum is shown in left side of each borehole.



LABORATORY TEST RESULTS OF SOIL

CLIMATE ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project Name: Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Ramga (Kamailaka) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nabari GSS (Package G)

Bore Hole	Sample Number	Depth (m)	Sample Description	Bulk Density g/cc	Dry Density g/cc	Sp. Gravity	Nat. Moisture %	Mo. Index, %	Shear Strength (kg/cm ²)			Atter. Limits			IS Classification	Grain Size			Test Method
									Cohesion kg/cm ²	Friction Deg.	Type of Test	LL %	PL %	PT %		Gravel %	Sand %	Silt %	
BH-1	U1	1.00	Firm to stiff brownish to dark black grey silty clay / clayey silt with mica.	1.86	1.45	2.65	28.00	0.0024	0.28	5.00	UU	34.11	20.00	14.11	ML	0.00	5.00	63.00	*See the Note
	U2	4.00		1.89	1.41	2.68	34.28	0.0021	0.31	7.00	UU	35.09	20.85	14.24	ML	0.00	7.00	65.00	*See the Note
BH-1	U3	6.00	Dense dark grey / bluish grey silty sand with mica.	1.80	1.38	2.66	30.00	—	0.00	28.00	DS	NP	NP	NP	SM	3.00	75.00	20.00	*See the Note
BH-1	U4	8.00	Very dense dark grey bluish grey silty medium to coarse sand with mica.	1.87	1.42	2.67	32.00	—	0.00	34.00	DS	NP	NP	NP	SM	4.00	86.00	9.00	*See the Note
BH-2	U1	2.50	Stiff deep brownish to dark bluish grey silty clay / clayey silt with mica.	1.88	1.43	2.65	30.00	0.0019	0.30	6.00	UU	33.08	19.25	13.83	ML	0.00	7.00	71.00	*See the Note
	U2	4.00		1.91	1.44	2.67	32.50	0.0024	0.33	8.00	UU	34.89	19.85	15.04	ML	0.00	11.00	62.00	*See the Note
BH-2	U3	6.00	Dense dark grey to bluish grey silty fine sand to medium sand with mica.	1.82	1.42	2.66	28.00	—	—	32.00	DS	NP	NP	NP	SM	4.00	70.00	22.00	*See the Note
BH-2	S5	10.00	Very dense dark grey to light grey medium to coarse sand with mica & gravels.	1.80	—	2.65	—	—	—	37.00	DS	NP	NP	NP	SM	10.00	74.00	15.00	*See the Note
BH-3	U1	1.00	Firm to stiff deep brownish to dark bluish grey silty clay / clayey silt with mica.	1.89	1.51	2.65	25.33	0.0023	0.30	6.00	UU	33.11	19.04	14.07	ML	0.00	8.00	67.00	*See the Note
	U2	4.00		1.92	1.45	2.68	32.79	0.0026	0.32	5.00	UU	34.00	19.65	14.35	ML	0.00	7.00	65.00	*See the Note
BH-3	U3	6.00	Medium dense to dense dark grey to bluish grey silty fine to medium sand with mica.	1.80	1.43	2.63	26.25	—	0.00	31.00	DS	NP	NP	NP	SM	2.00	84.00	10.00	*See the Note
BH-3	S5	10.00	Very dense dark grey to light grey medium to coarse sand with mica & gravels.	1.83	—	2.67	—	—	0.00	35.00	DS	NP	NP	NP	SM	3.00	87.00	5.00	*See the Note
BH-4	U1	1.00	Soft deep brownish grey silty clay / clayey silt with mica.	1.90	1.50	2.66	26.54	0.0020	0.22	5.00	UU	33.40	19.70	13.70	ML	0.00	5.00	80.00	*See the Note
BH-4	U2	4.00	Medium dense to dense dark grey silty fine to medium sand with mica.	1.80	1.42	2.65	27.00	—	0.00	32.00	DS	NP	NP	NP	SM	2.00	74.00	21.00	*See the Note
	U3	6.00		1.83	1.45	2.66	28.10	—	0.00	34.00	DS	NP	NP	NP	SM	5.00	78.00	15.00	*See the Note
BH-4	S5	10.00	Very dense dark grey medium to coarse sand with mica.	1.82	—	2.86	—	—	0.00	37.00	DS	NP	NP	NP	SP	7.00	88.00	5.00	*See the Note

*Note: Test Methods

Specific Gravity: IS 2720 (Part 3), Grain Size Analysis: IS 2710 (Part 4)

Plastic Limit: IS 2730 (Part 3)

Consolidation Test: IS 2736 (Part 3)

Liquid Limit: IS 2720 (Part 5)

Triaxial Test (UU): IS 2720 (Part 1)

Natural Moisture Content: IS 2720 (Part 2)



Client: ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project Name: Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/23 KV (MS in Rangai (Kamarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/23 KV Nahuni GSS (Package G)

Bore Hole	Sample Number	Depth (m)	Sample Description	Bulk Density		Dry Density	Sp. Gravity	Nat. Moisture	M _v	Proc. Swell Index	Shear Strength (kg/cm ²)			Atter. Limits			IS Classification	Grain Size				Test Method
				gm/cc	gm/cc			%	sqm/kg		Cohesion kg/cm ²	Friction Deg.	Type of Test	CL %	PL %	PT %		Gravel %	Sand %	Silt %	Clay %	
BH-5	U1	1.00	Medium stiff to stiff dark brownish grey silty clay / clayey silt with mica.	1.87	1.47	1.47	2.66	27.45	0.0071	2.89	0.24	7.00	UU	35.21	20.56	14.65	ML	0.00	10.00	70.00	20.00	*See the Note
BH-5	U2	4.00	Medium dense to dense dark grey silty fine to medium sand with mica.	1.77	1.47	1.47	2.64	20.65	---	---	0.00	32.00	DS	NP	NP	NP	SM	3.00	87.00	5.00	5.00	*See the Note
BH-5	U3	6.00	Dense dark grey silty fine to medium sand with mica & gravels.	1.81	1.48	1.48	2.66	22.35	---	---	0.00	35.00	DS	NP	NP	NP	SM	5.00	91.00	3.00	1.00	*See the Note
BH-5	S5	10.00	Very dense dark grey medium to coarse sand with mica & gravels.	1.83	---	---	2.63	---	---	---	0.00	38.00	DS	NP	NP	NP	SP	6.00	94.00	0.00	0.00	*See the Note
BH-6	U1	1.00	Medium stiff dark brownish grey silty clay / clayey silt with mica.	1.90	1.45	1.45	2.67	31.21	0.0022	2.66	0.30	6.00	UU	34.85	20.35	14.50	ML	0.00	9.00	68.00	23.00	*See the Note
BH-6	U2	4.00	Medium dense dark grey silty fine to medium sand with mica.	1.83	1.43	1.43	2.63	27.65	---	---	0.00	30.00	DS	NP	NP	NP	SM	4.00	81.00	8.00	7.00	*See the Note
	U3	6.00	Very dense dark grey medium to coarse sand with mica & gravels.	1.85	1.45	1.45	2.64	28.60	---	---	0.00	34.00	DS	NP	NP	NP	SM	7.00	85.00	3.00	3.00	*See the Note
BH-6	S5	10.00	Soft to firm deep brownish grey clay / clayey silt with mica.	1.82	---	---	2.65	---	---	---	0.00	36.00	DS	NP	NP	NP	SP	10	90.00	0.00	0.00	*See the Note
BH-7	U1	1.00	Medium dense dark grey silty fine to medium sand with mica.	1.88	1.50	1.50	2.66	25.25	0.0018	5.65	0.22	5.00	UU	34.00	19.00	15.00	ML	6.00	9.00	69.00	22.00	*See the Note
BH-7	U2	4.00	Medium dense dark grey silty fine to medium sand with mica.	1.80	1.52	1.52	2.63	18.20	---	---	0.00	34.00	DS	NP	NP	NP	SM	0.00	85.00	10.00	5.00	*See the Note
BH-7	U3	6.00	Dense dark grey silty fine to medium sand with mica & gravels.	1.82	1.53	1.53	2.66	19.00	---	---	0.00	37.00	DS	NP	NP	NP	SP	8.00	91.00	1.00	0.00	*See the Note
BH-7	S5	10.00	Very dense dark grey medium to coarse sand with mica & gravels.	1.85	-	-	2.67	---	---	---	0.00	40.00	DS	NP	NP	NP	SM	9.00	91.00	0.00	0.00	*See the Note

*Note: Test Methods

Plastic Limit: IS 2720 (Part 5)

Consolidation Test: IS 2720 (Part 13)

Liquid Limit: IS 2720 (Part 5)

Specific Gravity: IS 2720

Grain Size Analysis: IS 2720 (Part 4)

Triaxial Test (UU): IS 2720 (Part 11)

Natural Moisture Content: IS 2720 (Part 2)



Client ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project Name/Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kamarkhata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nahbari GSS (Package G)

Bore Hole	Sample Number	Depth (m)	Sample Description	Bulk Density g/cm ³	Dry Density g/cm ³	Sp. Gravity	Nat. Moisture %	Mo. w/cm ² kg	Free Swell- Index	Shear Strength (kg/cm ²)			Atter. Limits			IS Classification	Grain Size				Test Method
										Cohesion kg/sqcm	Friction Deg.	Type of Test	LL %	PL %	PI %		Gravel %	Sand %	Silt %	Clay %	
BH-3	U1	1.00	Medium stiff to stiff dark brownish grey to dark grey silty clay / clayey silt with mica.	1.88	1.46	2.68	29.00	0.0021	2.78	0.29	4.00	UU	31.56	18.54	13.02	ML	0.00	5.00	67.00	28.00	*See the Note
	U2	4.00		1.92	1.47	2.68	30.79	0.0025	2.86	0.33	7.00	UU	35.00	21.22	13.78	ML	0.00	12.00	61.00	27.00	
BH-3	U3	6.00	Medium dense dark silty fine to medium sand with mica.	1.83	1.51	2.64	21.56	---	---	0.00	30.00	DS	NP	NP	NP	SM	7.00	83.00	8.00	2.00	*See the Note
BH-3	S4	7.00	Very dense dark grey medium to coarse sand with gravels & mica.	1.85	---	2.65	---	---	---	0.00	35.00	DS	NP	NP	NP	SP	9.00	91.00	0.00	0.00	*See the Note
BH-9	U1	1.00	Medium stiff brownish grey to dark grey silty clay / clayey silt with mica.	1.90	1.47	2.67	29.25	0.0022	2.50	0.30	4.00	UU	33.27	21.00	12.27	ML	0.00	10.00	68.00	22.00	*See the Note
	U2	4.00	Medium dense dark grey silty fine to medium sand with mica.	1.78	1.49	2.64	19.65	---	---	0.00	31.00	DS	NP	NP	NP	SM	4.00	80.00	16.00	6.00	*See the Note
BH-9	U3	6.00	Dense dark grey silty fine to medium sand with mica & gravels.	1.81	1.51	2.64	20.15	---	---	0.00	34.00	DS	NP	NP	NP	SM	7.00	84.00	6.00	3.00	*See the Note
BH-9	S5	10.00	Very dense dark grey silty medium to coarse sand with mica & gravels.	1.83	---	2.66	---	---	---	0.00	36.00	DS	NP	NP	NP	SP	11.00	89.00	0.00	0.00	*See the Note

*Note: Test Methods

Specific Gravity: IS 2720 (Part 3).

Grain Size Analysis: IS 2720 (Part 4)

Plastic Limits: IS 2720 (Part 5)

Consolidation Test: IS 2720 (Part 15)

Liquid Limit: IS 2720 (Part 5)

Triaxial Test (UU): IS 2720 (Part 11)

Natural Moisture Content: IS 2720 (Part 2)



PLOT OF SPT VAUES WITH DEPTH

Shyama Power (India) Limited

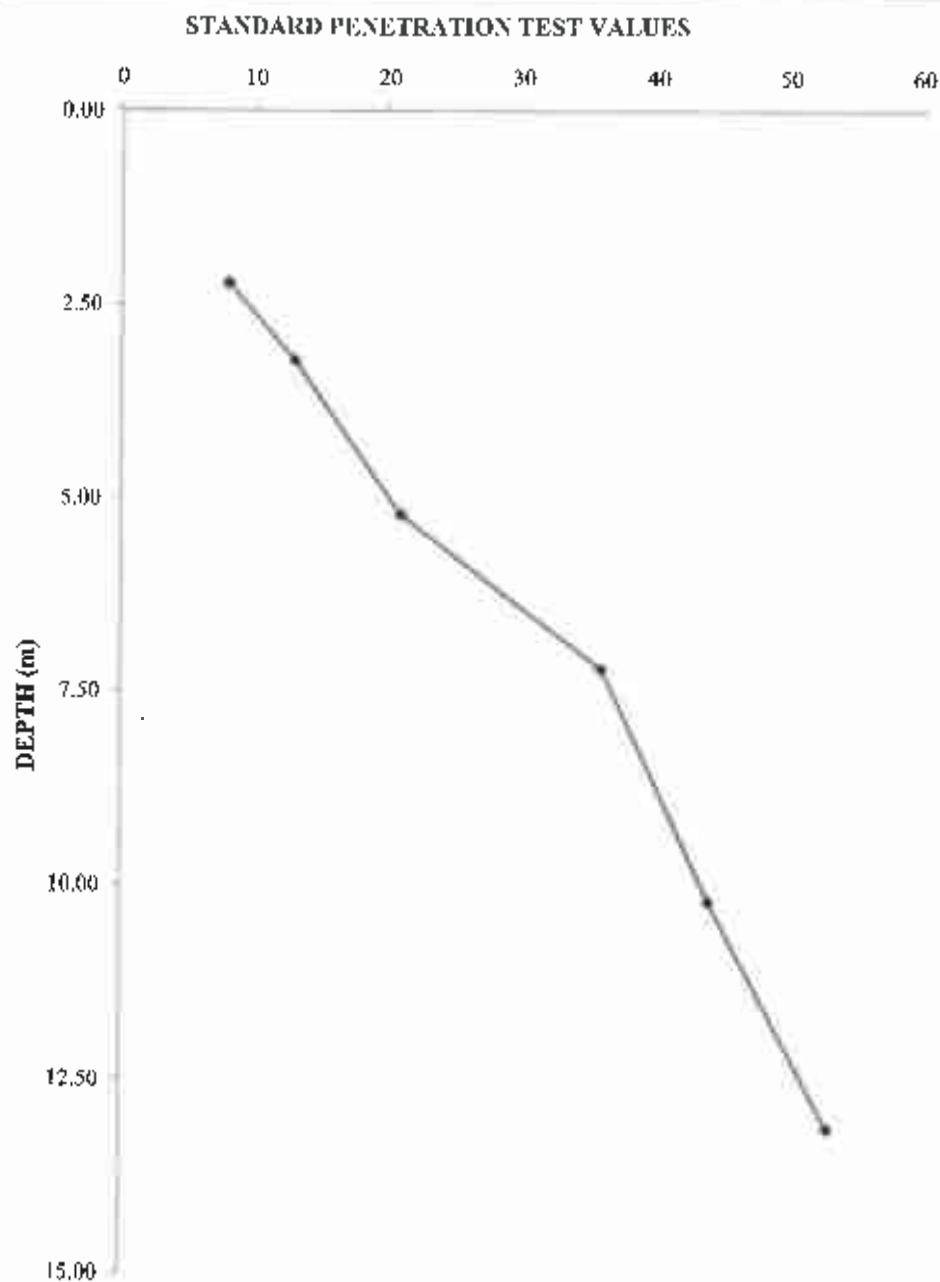
**STANDARD PENETRATION TEST
CURVE**

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :-

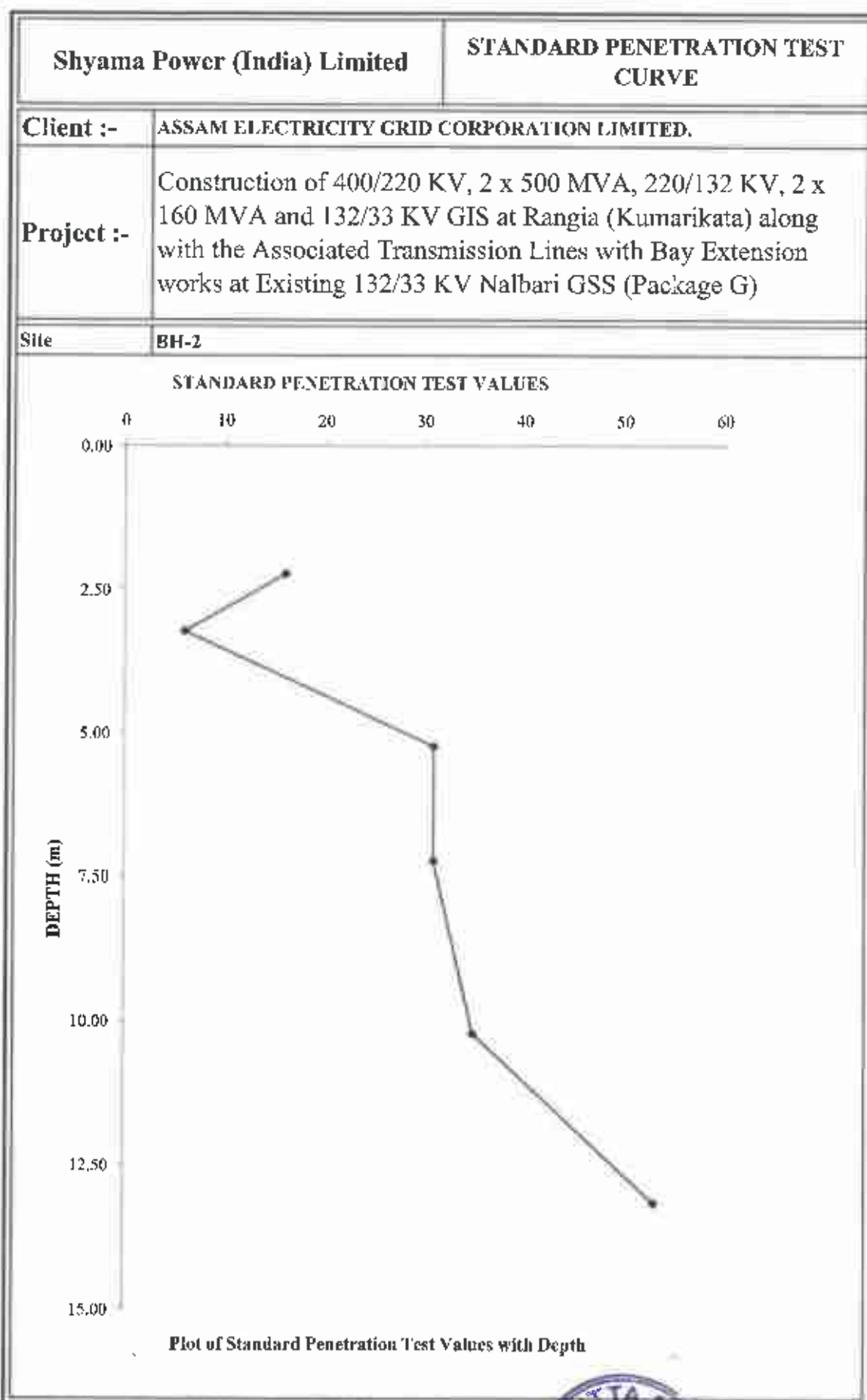
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Site BII-1



Plot of Standard Penetration Test Values with Depth





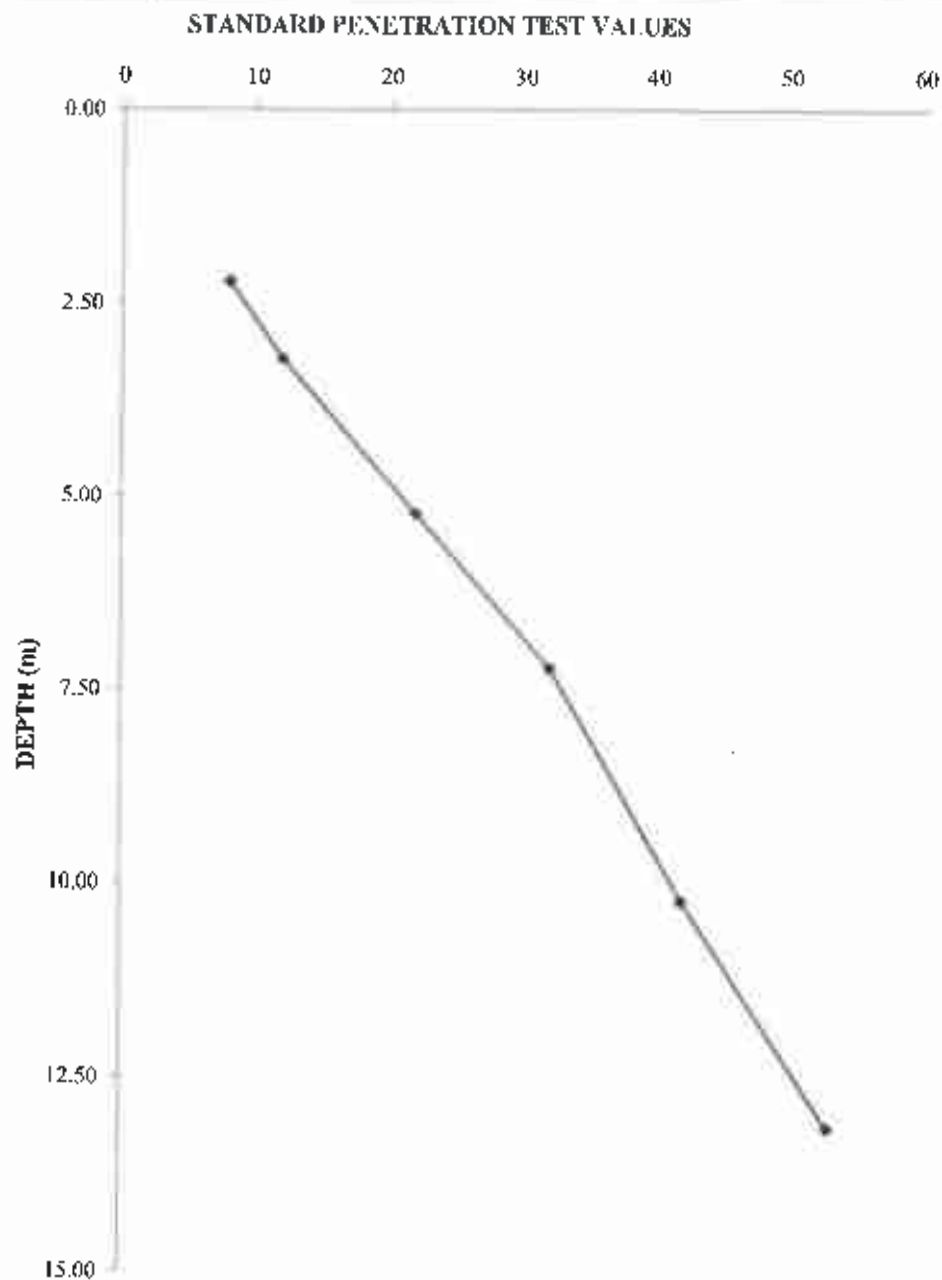
Shyama Power (India) Limited

**STANDARD PENETRATION TEST
CURVE**

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

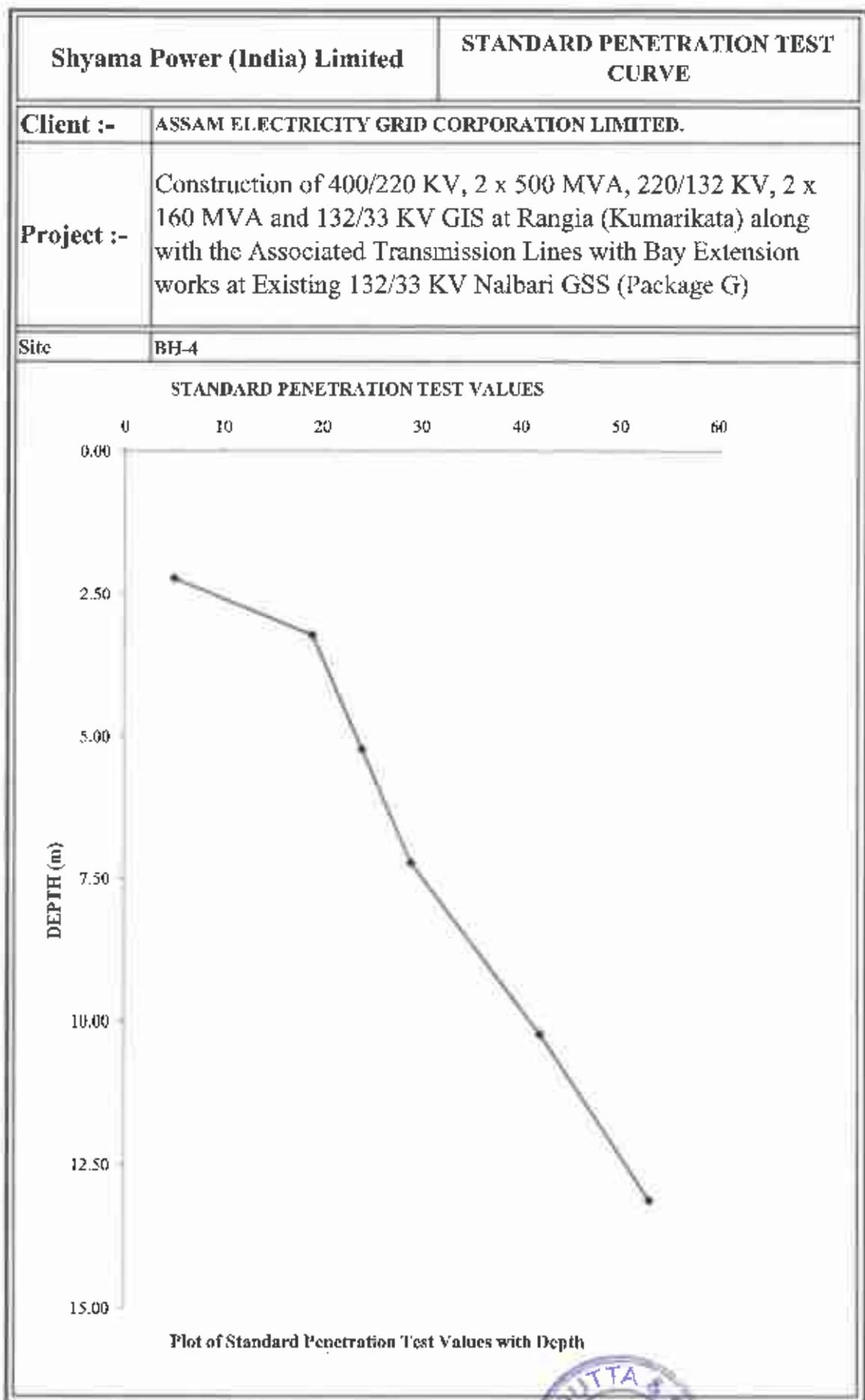
Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

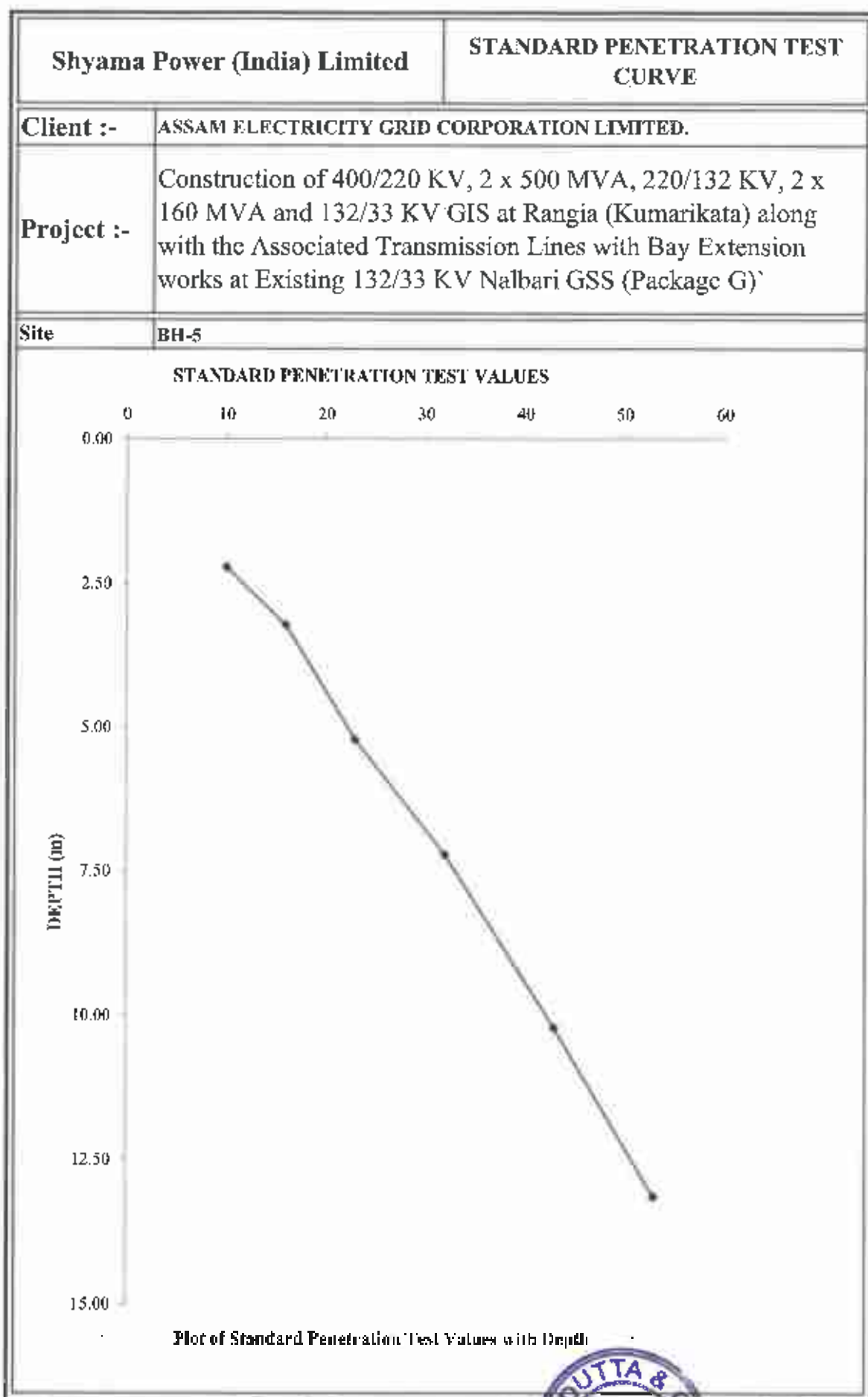
Site BII-3



Plot of Standard Penetration Test Values with Depth







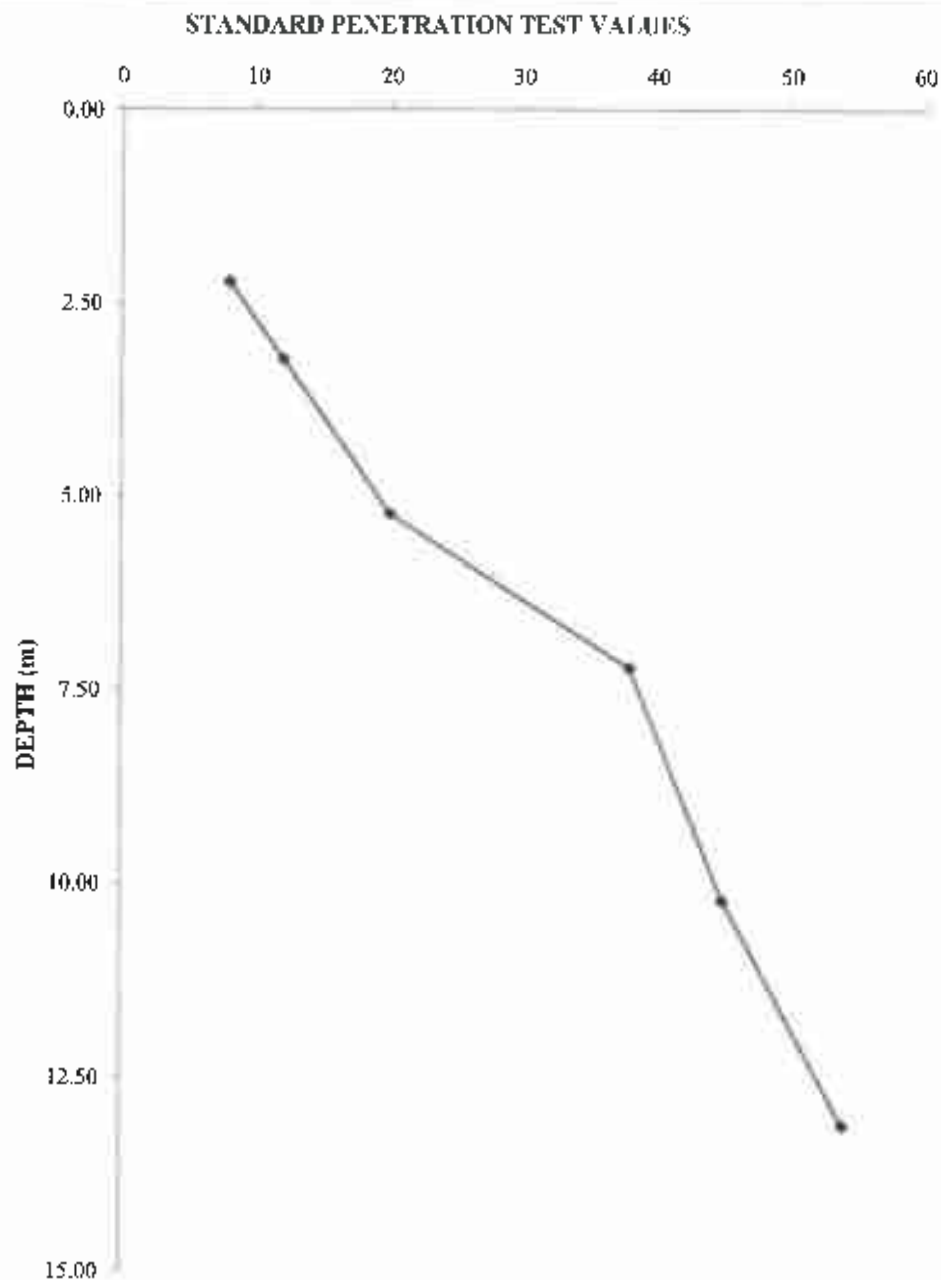
Shyama Power (India) Limited

**STANDARD PENETRATION TEST
CURVE**

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

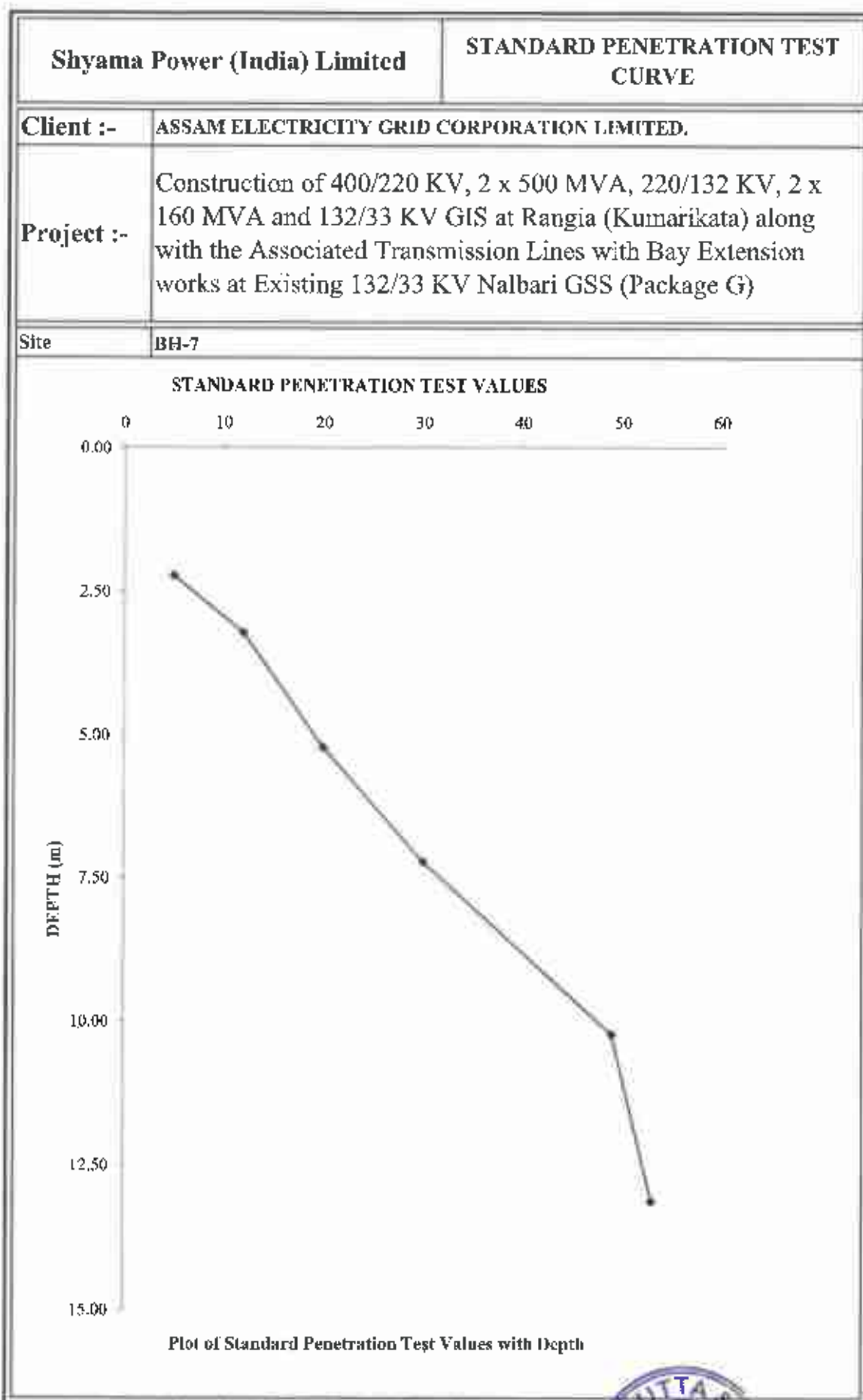
Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

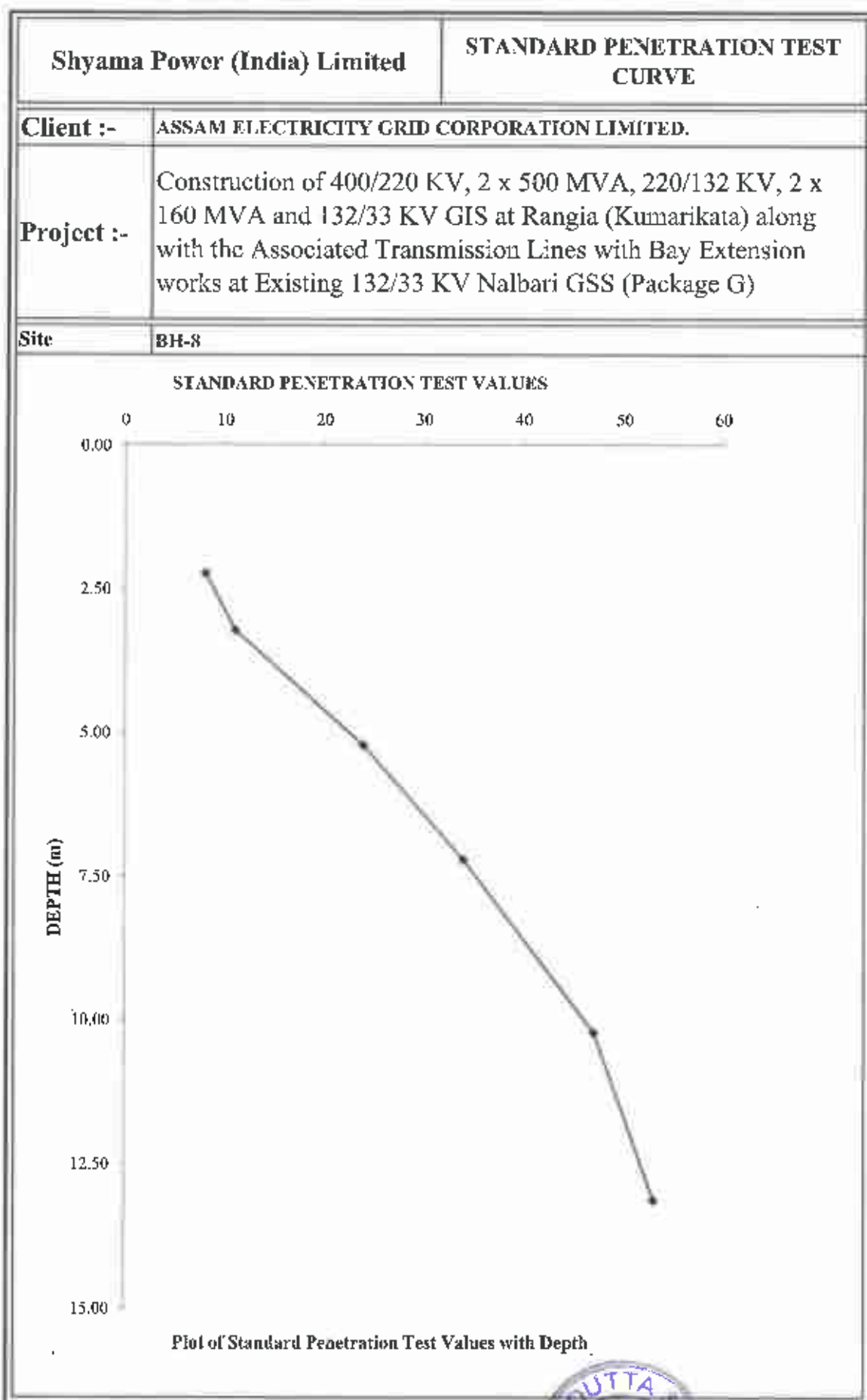
Site BH-6



Plot of Standard Penetration Test Values with Depth







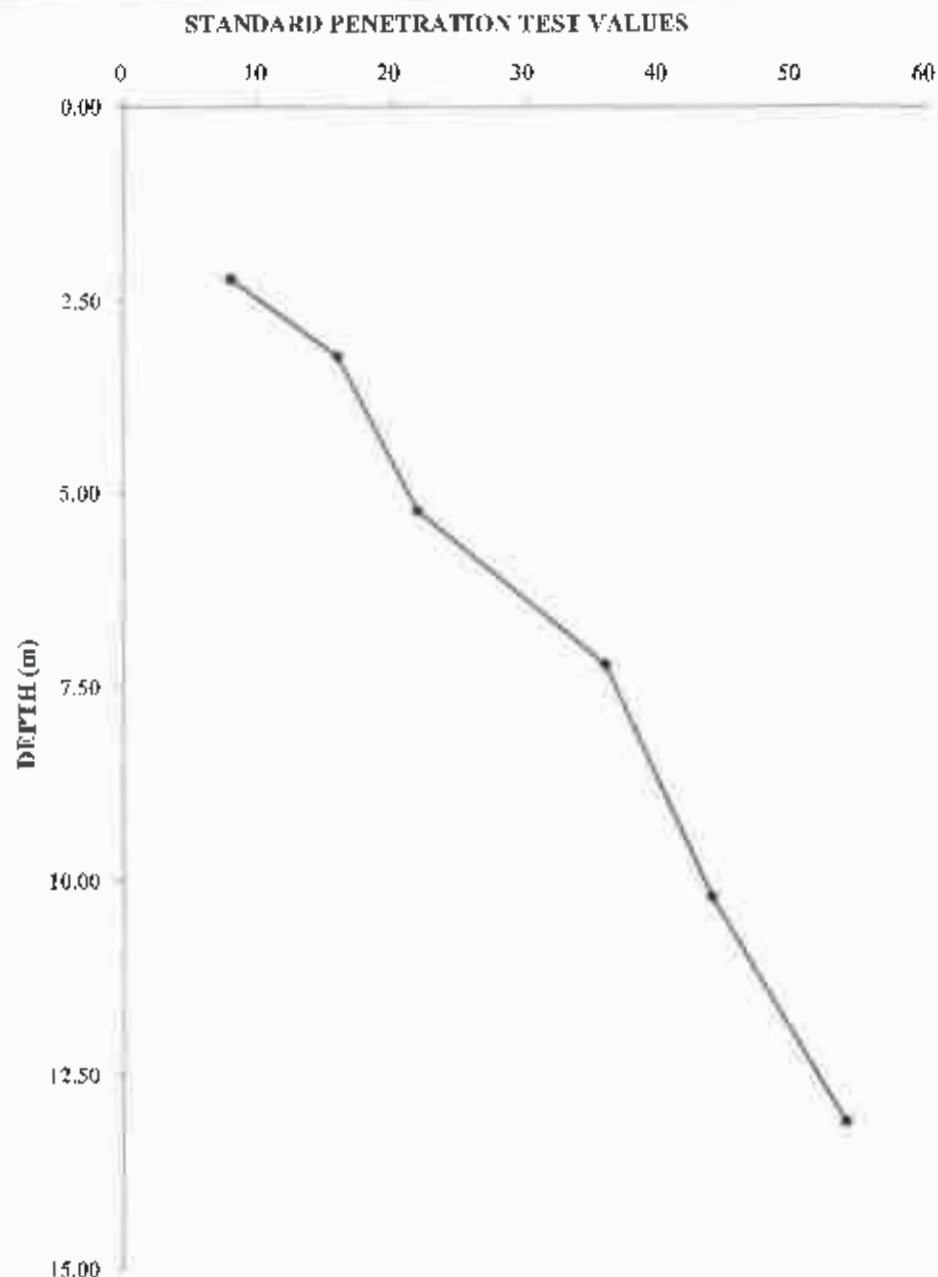
Shyama Power (India) Limited

**STANDARD PENETRATION TEST
CURVE**

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Site BH-9



Plot of Standard Penetration Test Values with Depth



SHEAR TEST CURVES

Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

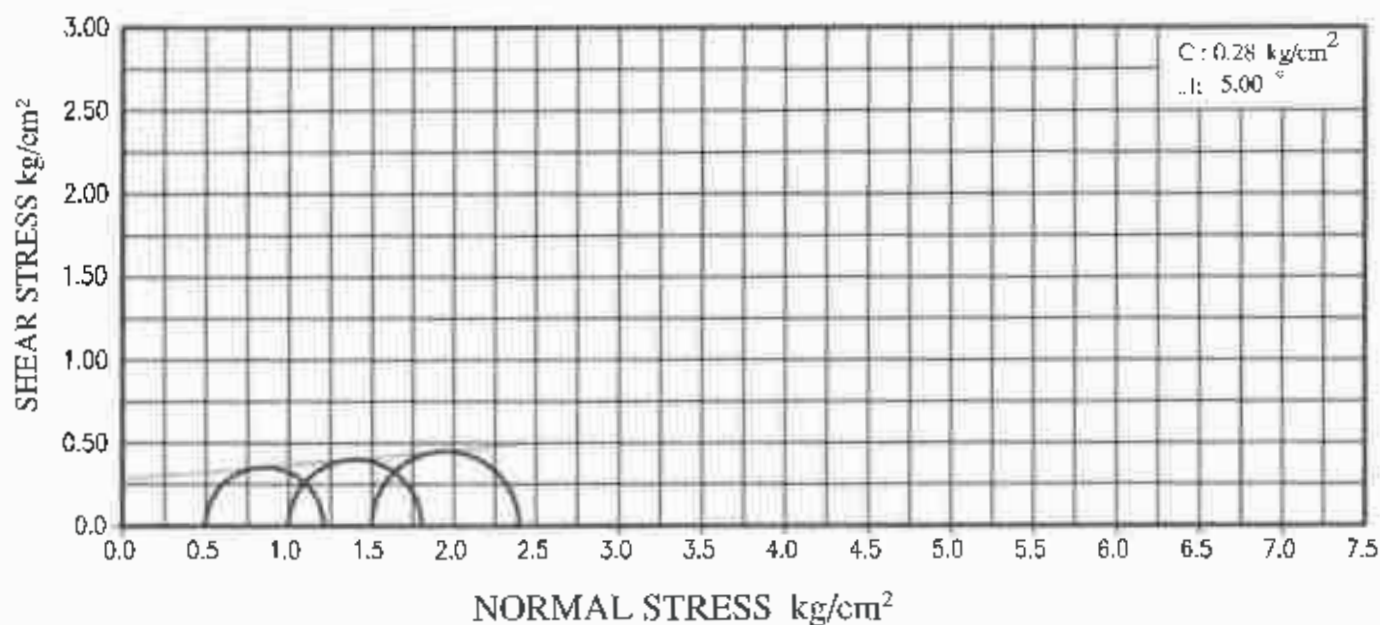
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 1

SAMPLE NO. - U1

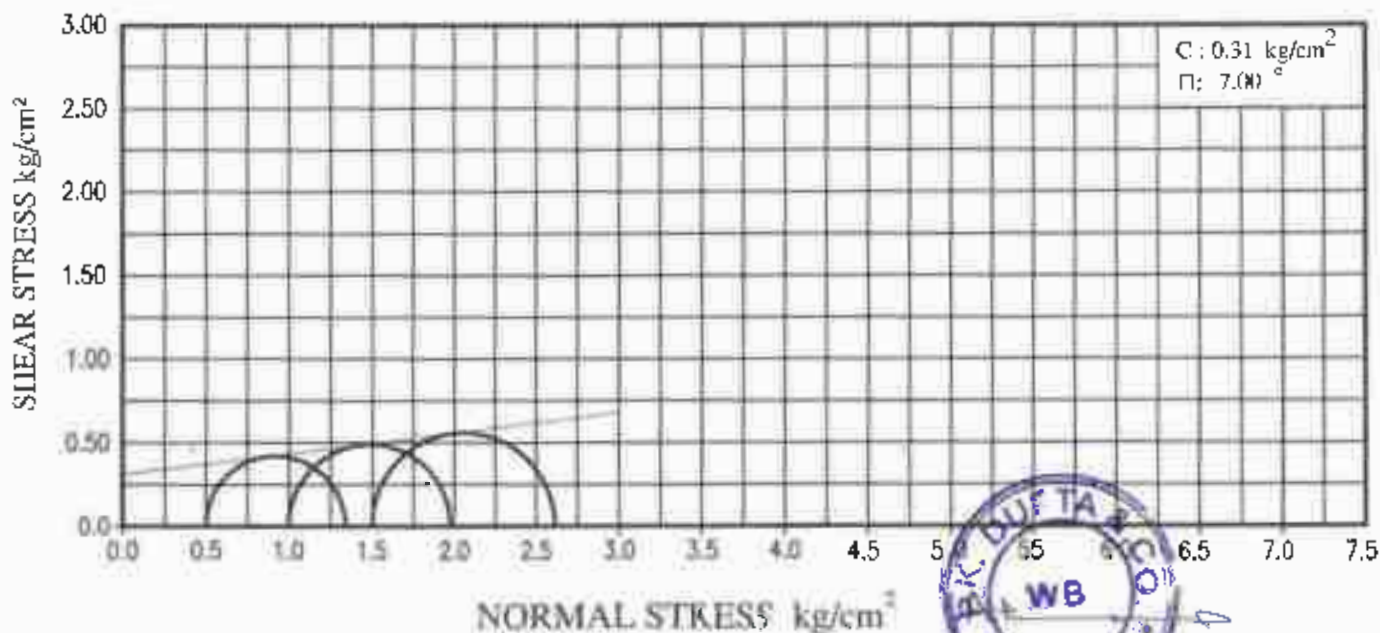
DEPTH :- 1.00 m

TRI-AXIAL SHEAR TEST CURVE

BH NO. 1

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

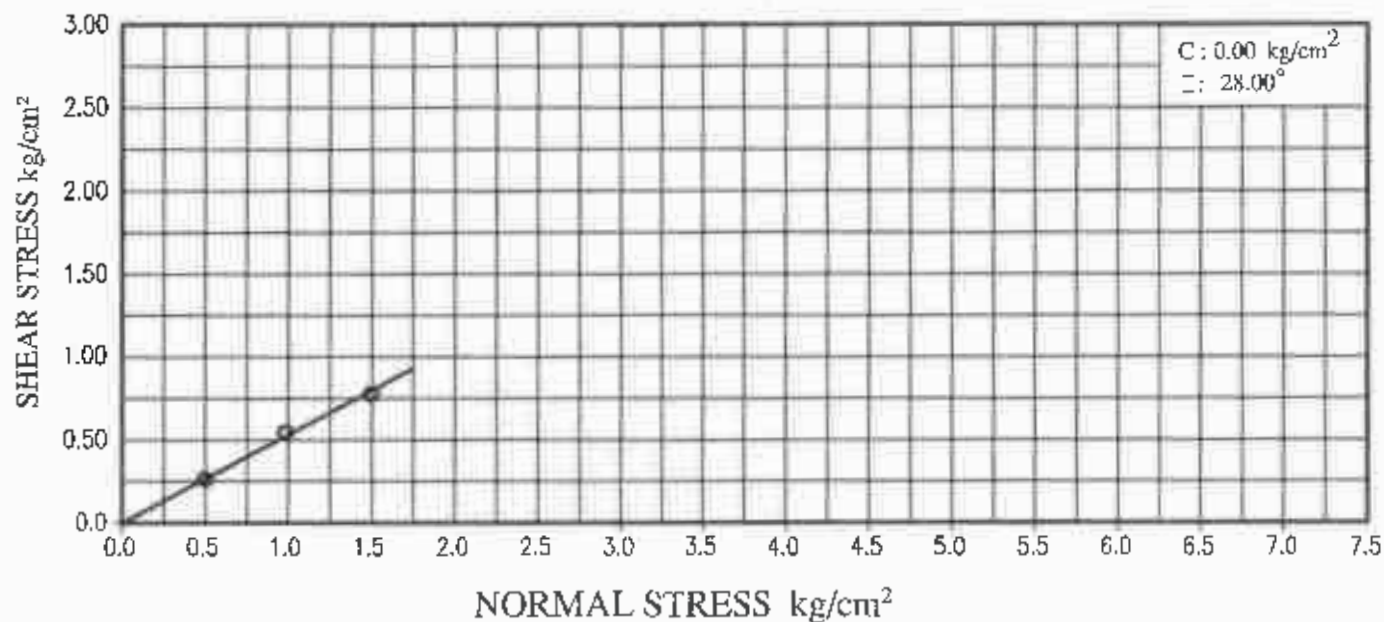
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumari) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 1

SAMPLE NO. - U3

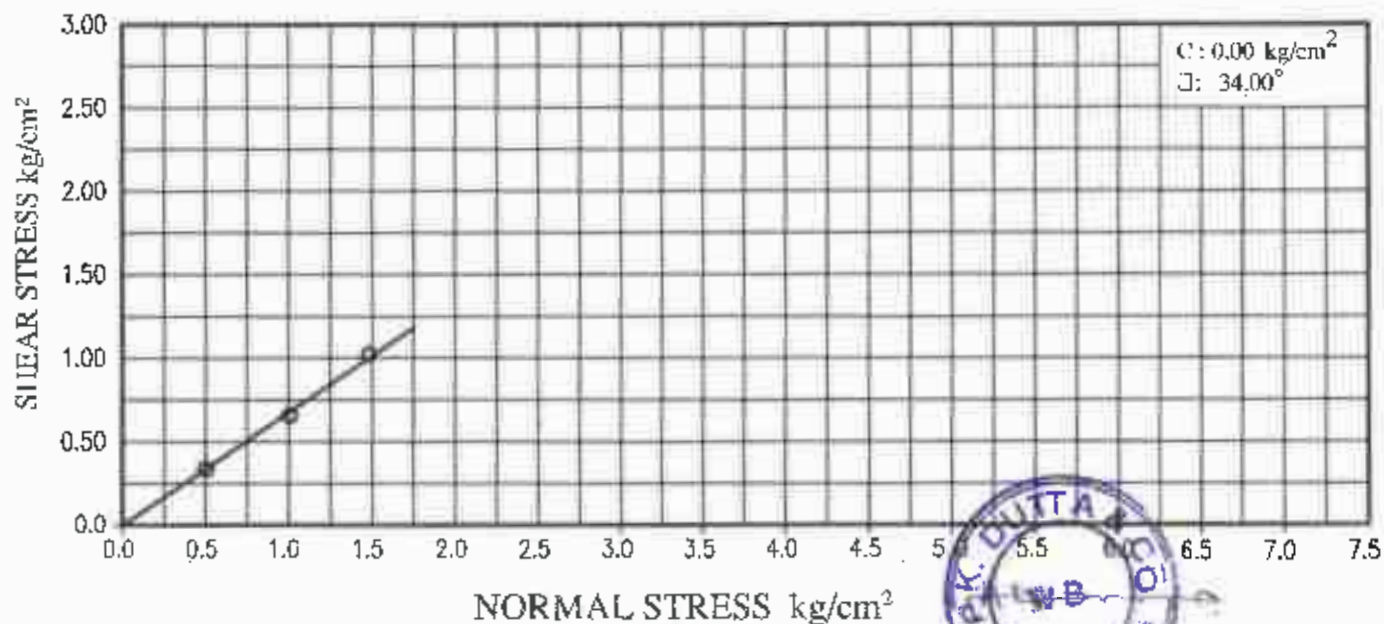
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 1

SAMPLE NO. - U4

DEPTH :- 8.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

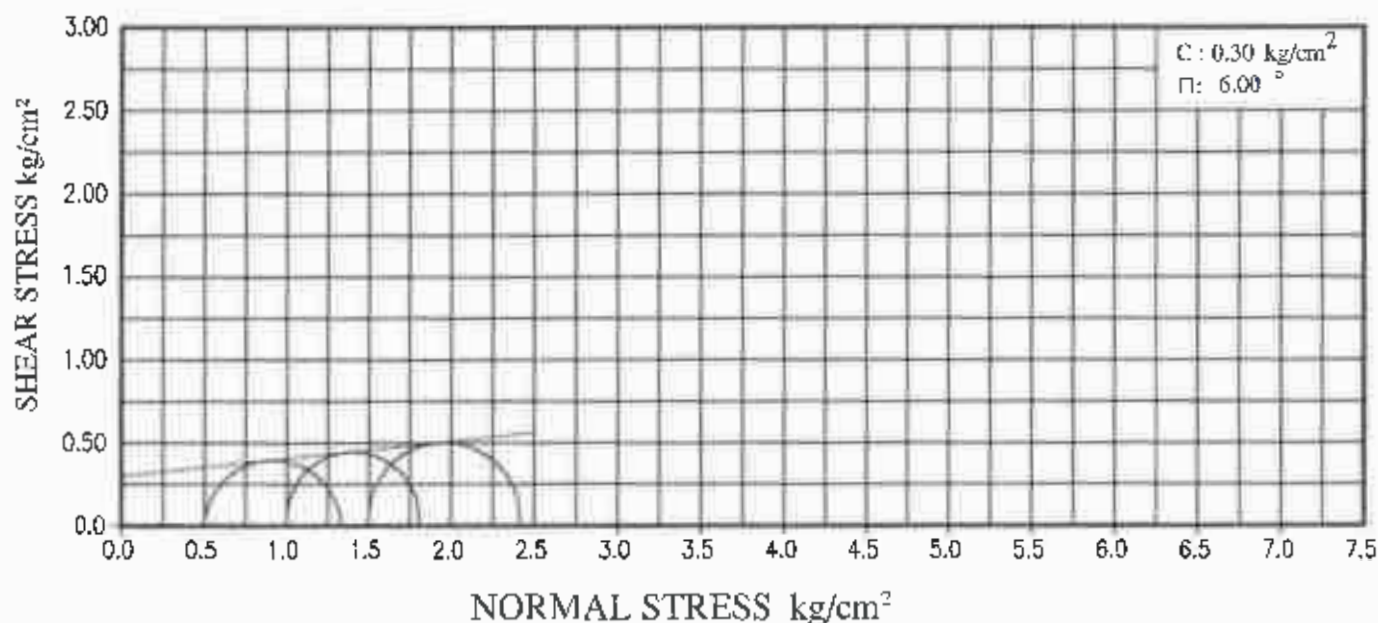
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 2

SAMPLE NO. - U1

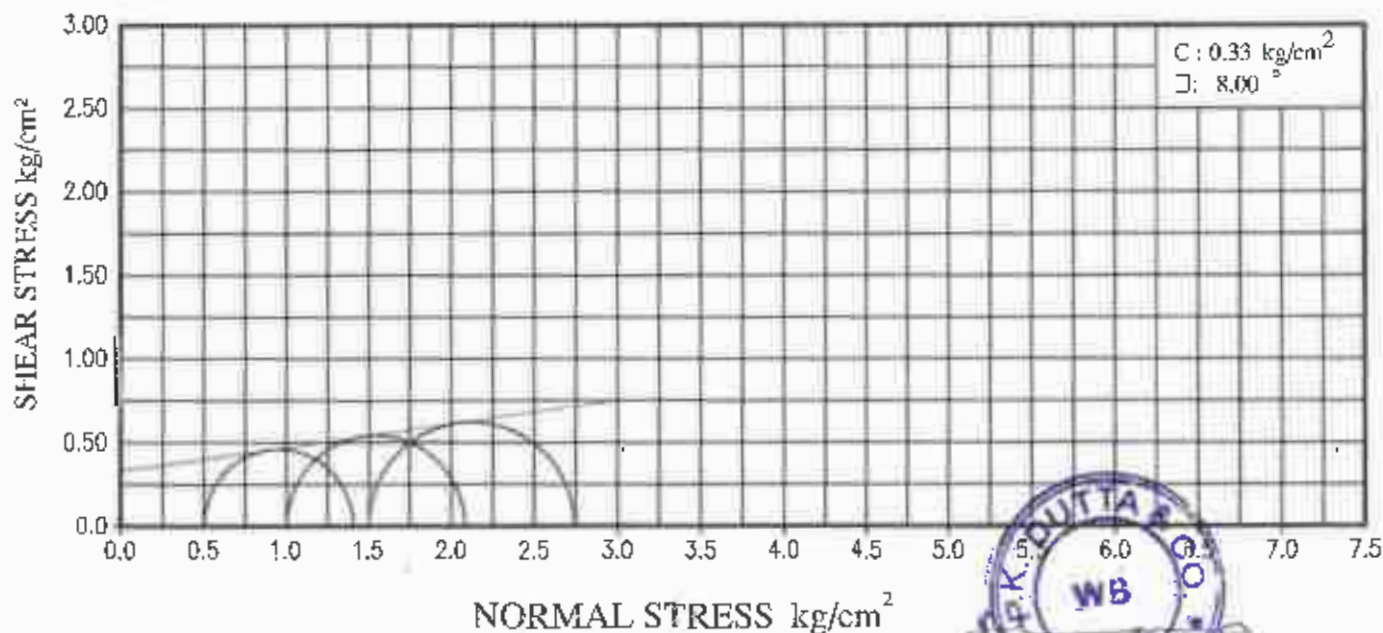
DEPTH :- 2.50 m

TRI-AXIAL SHEAR TEST CURVE

BH NO. 2

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

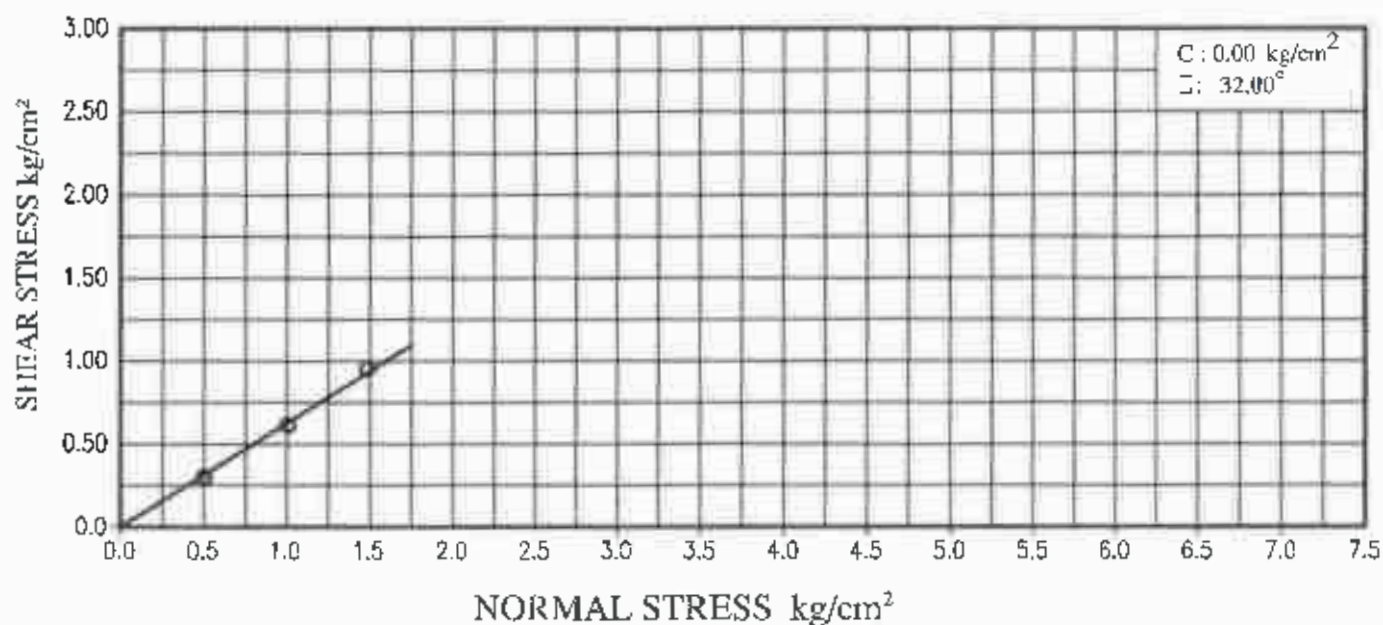
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 2

SAMPLE NO. - U3

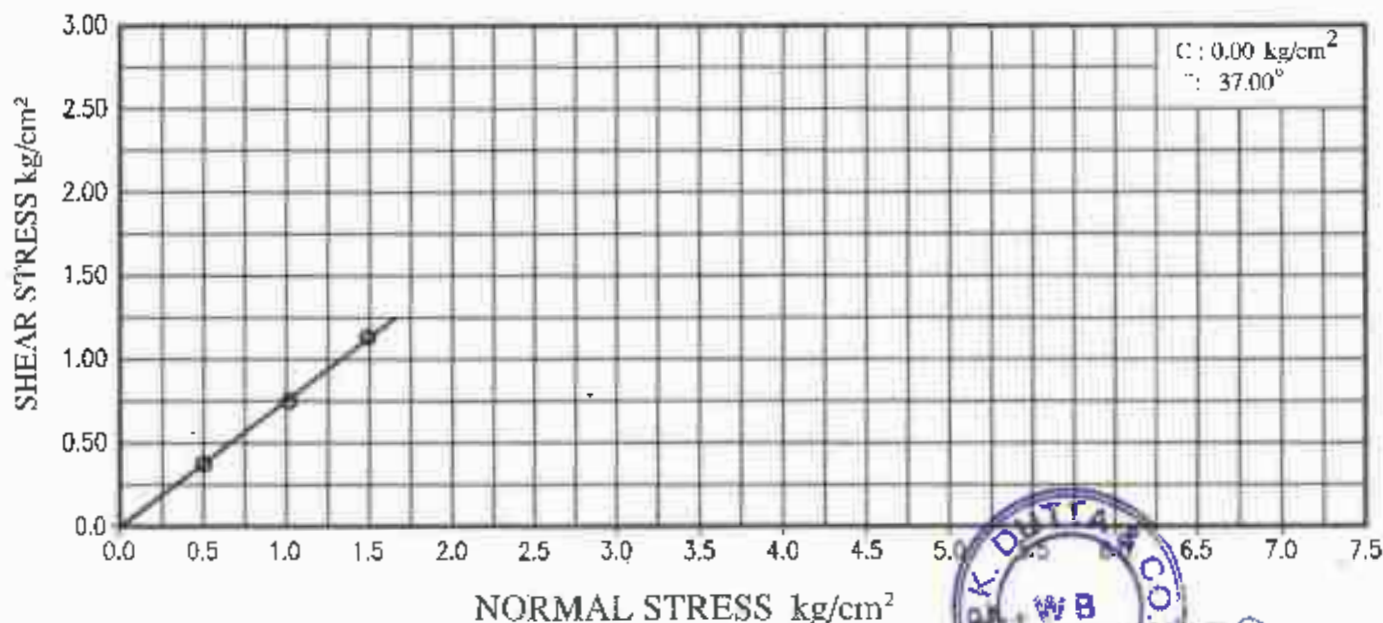
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 2

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

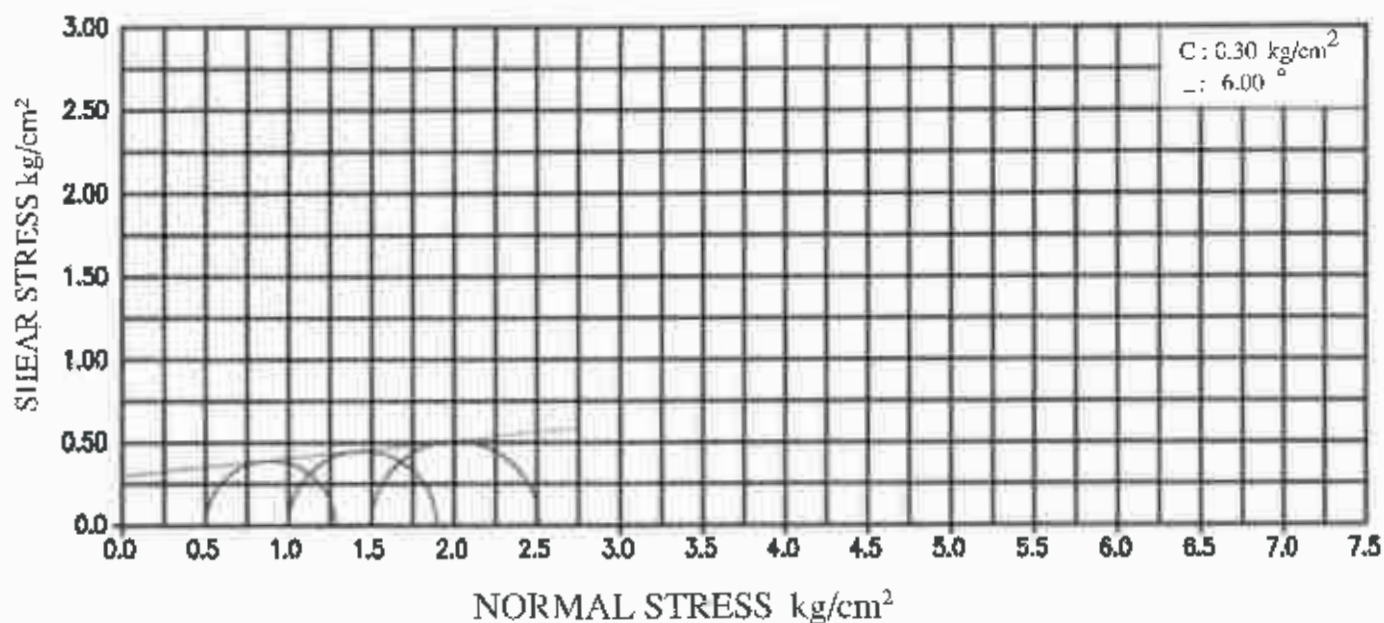
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 3

SAMPLE NO. - U1

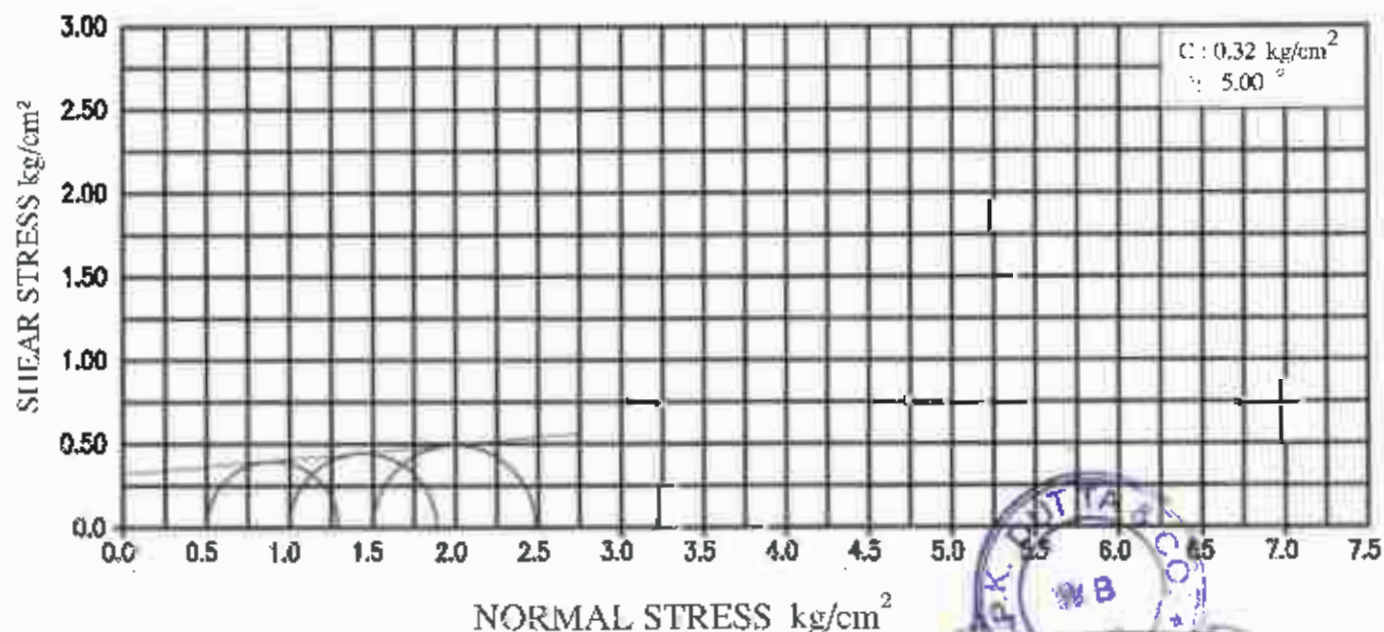
DEPTH :- 1.00 m

TRI-AXIAL SHEAR TEST CURVE

BH NO. 3

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

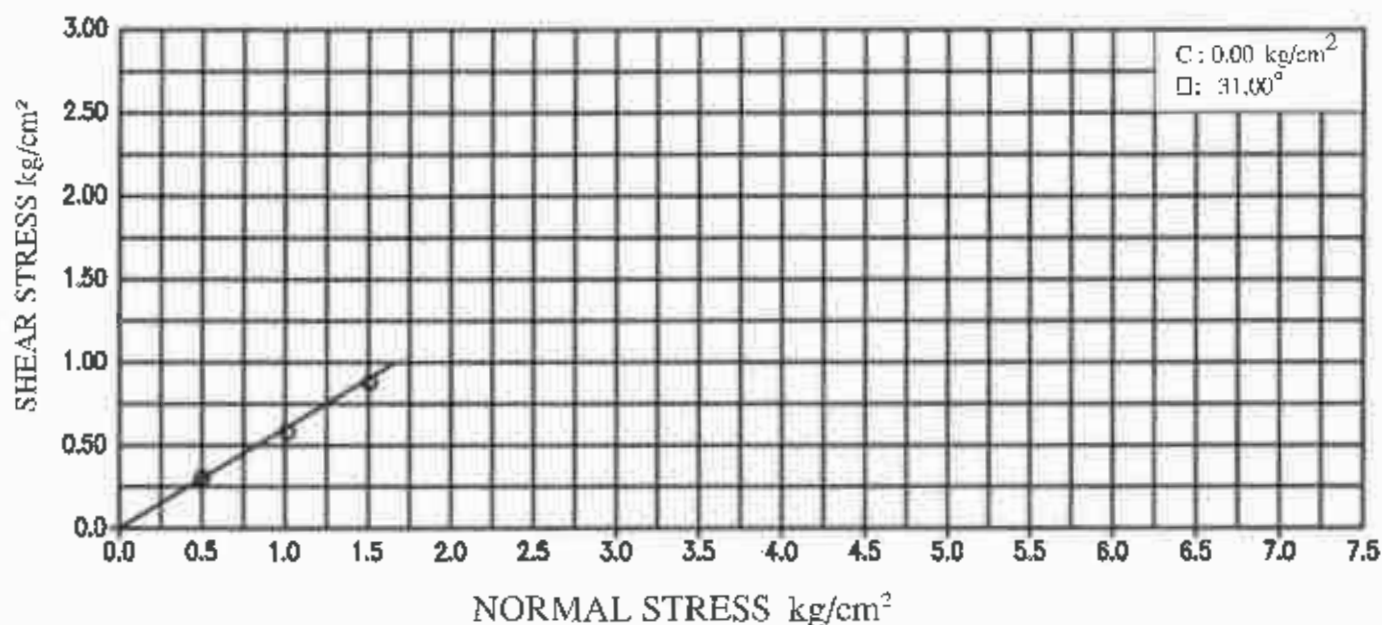
Construction of 400/230 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangta (Kamrang Gata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 3

SAMPLE NO. - U3

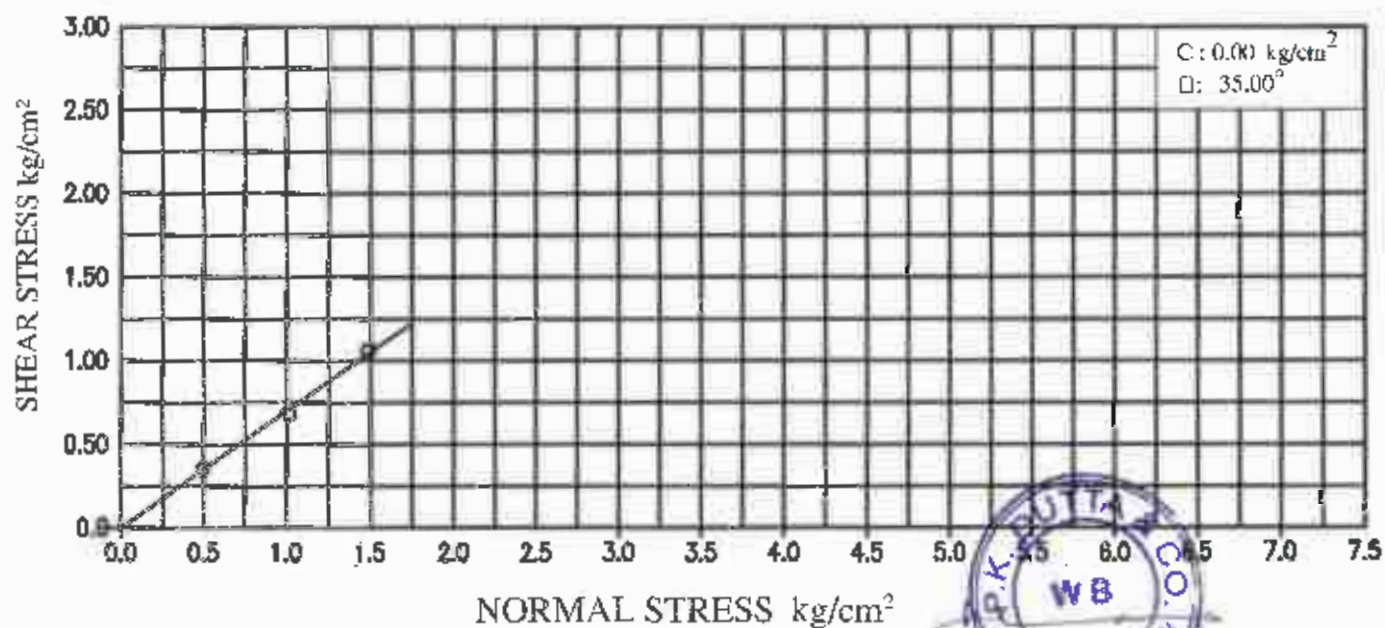
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 3

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

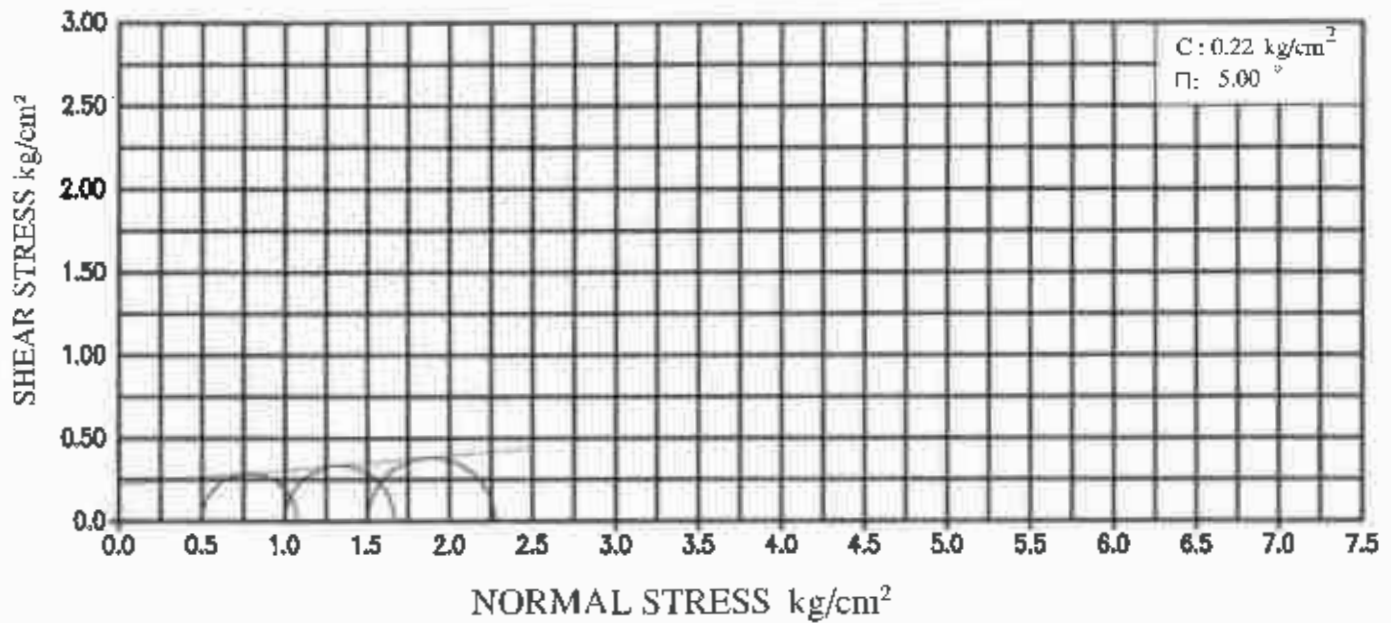
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 4

SAMPLE NO. - U1

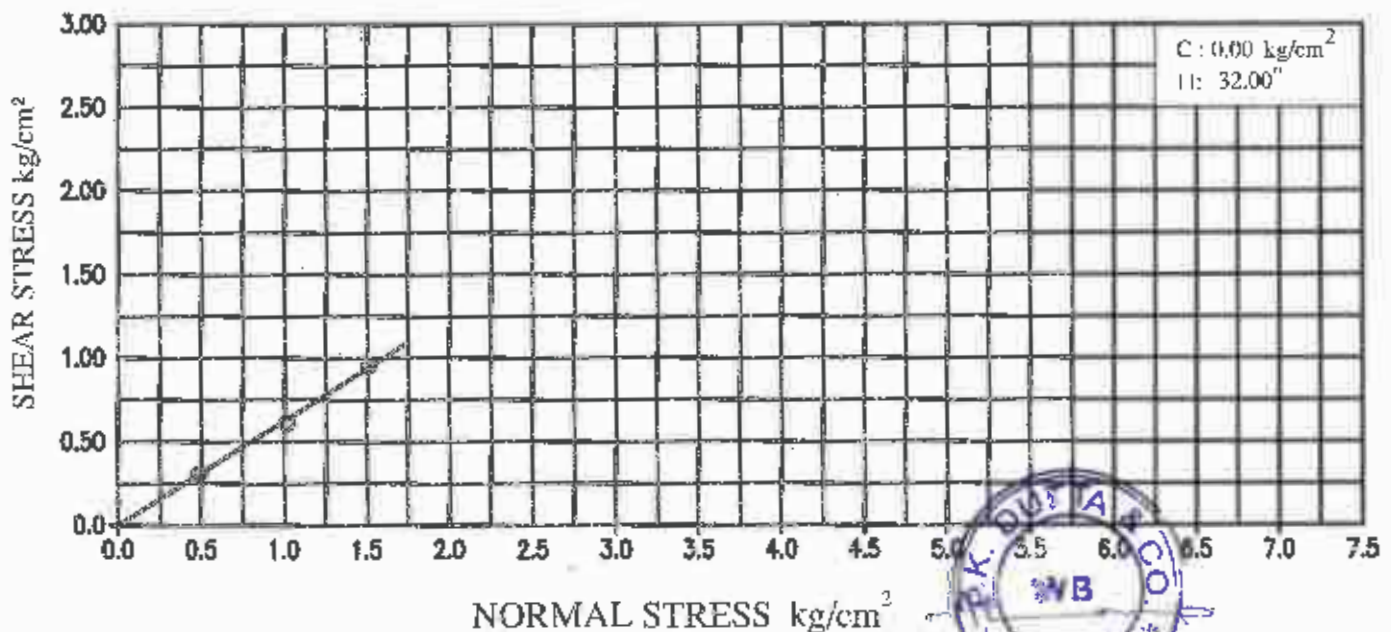
DEPTH :- 1.00 m

DIRECT SHEAR TEST CURVE

BH NO. 4

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

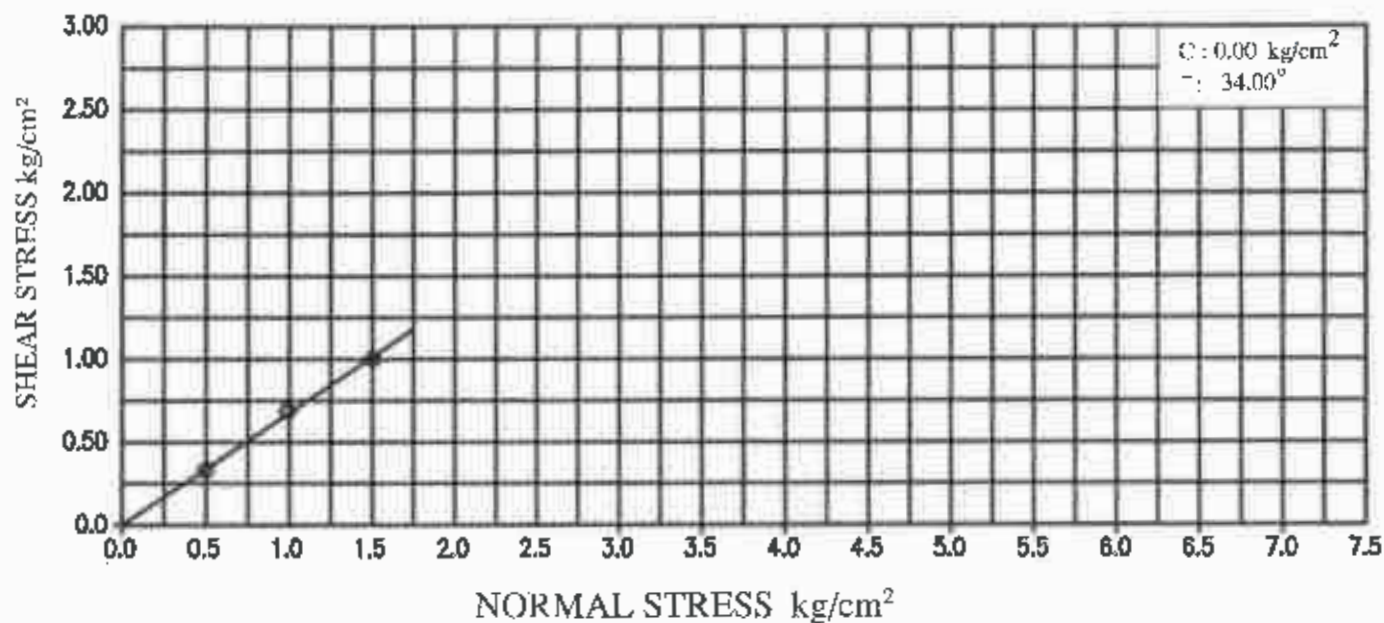
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 4

SAMPLE NO. - U3

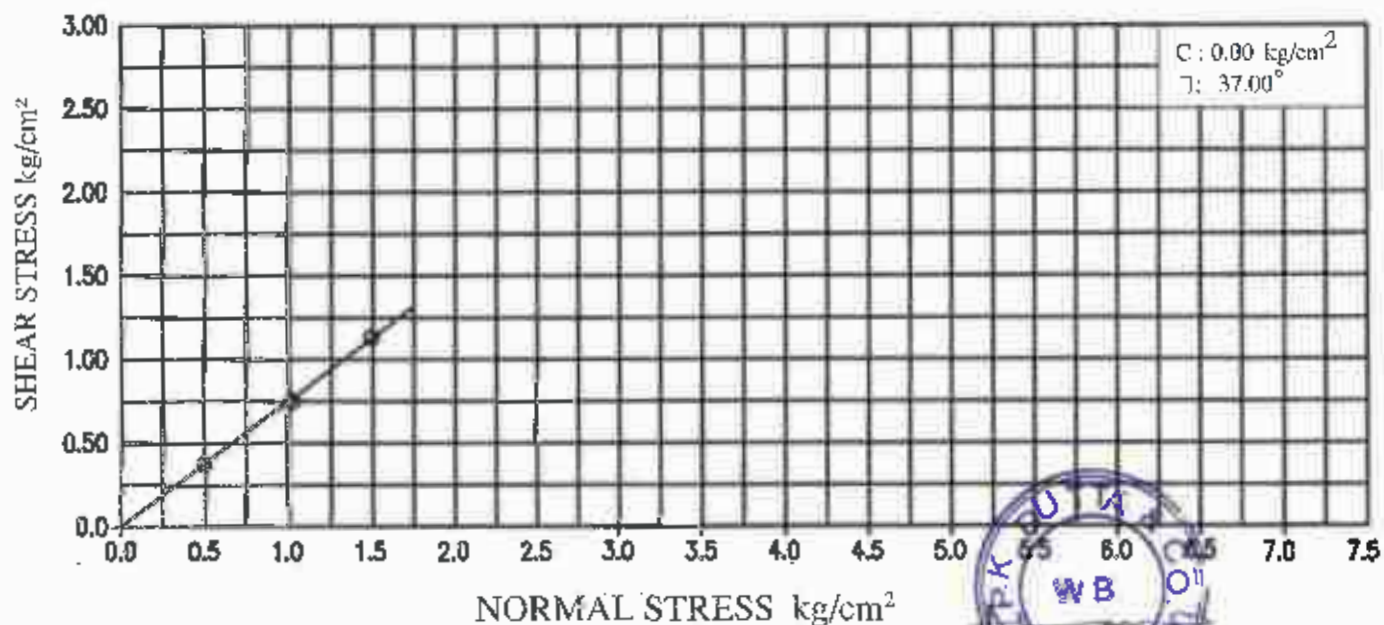
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 4

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

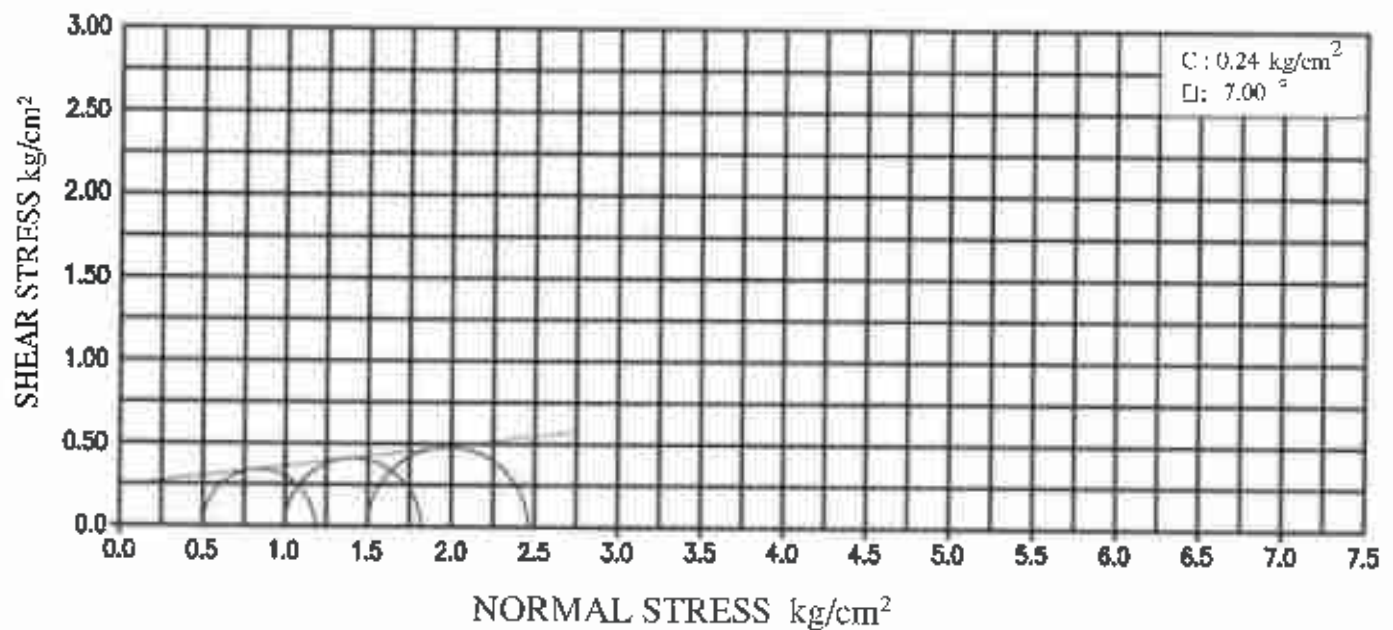
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 5

SAMPLE NO. - U1

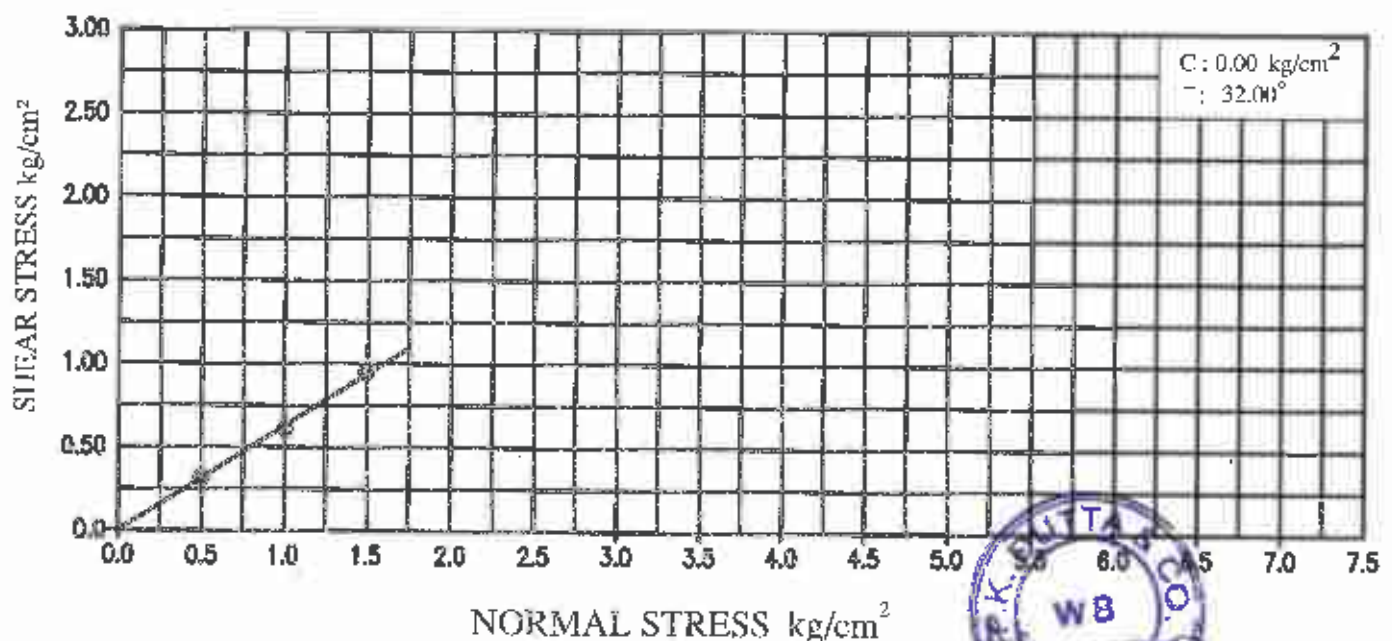
DEPTH :- 1.00 m

DIRECT SHEAR TEST CURVE

BH NO. 5

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

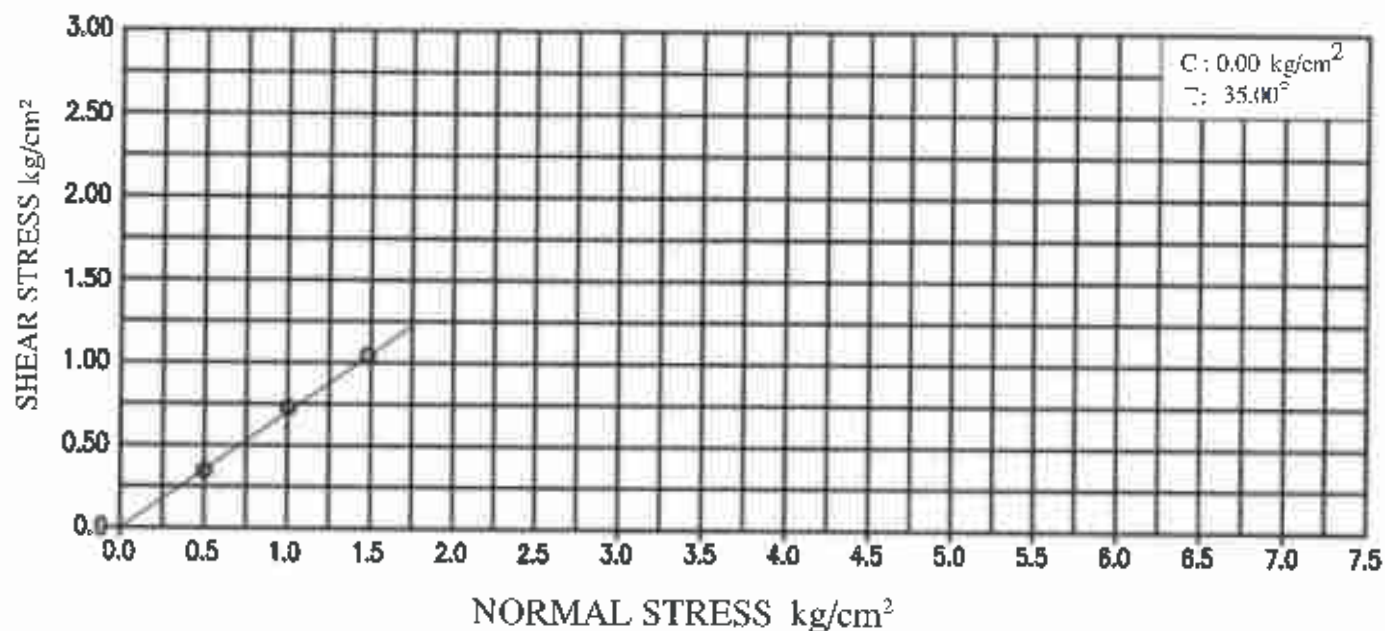
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Raigia (Kamarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 5

SAMPLE NO. - U3

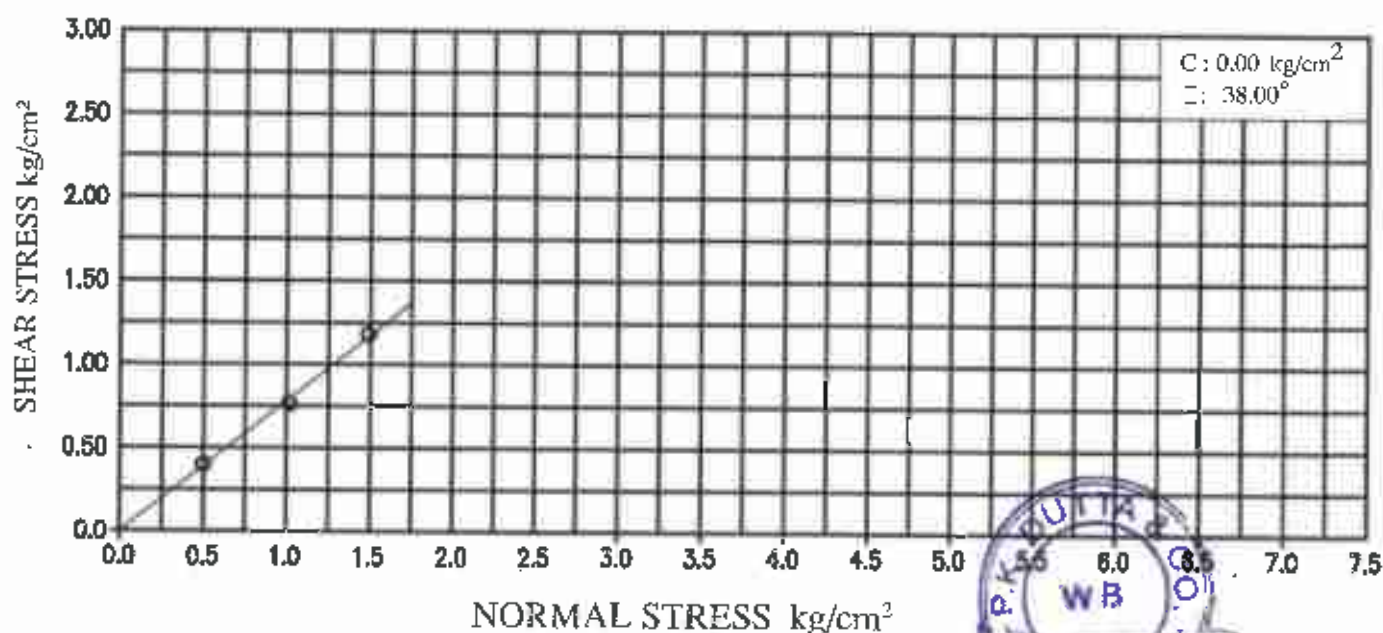
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 5

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

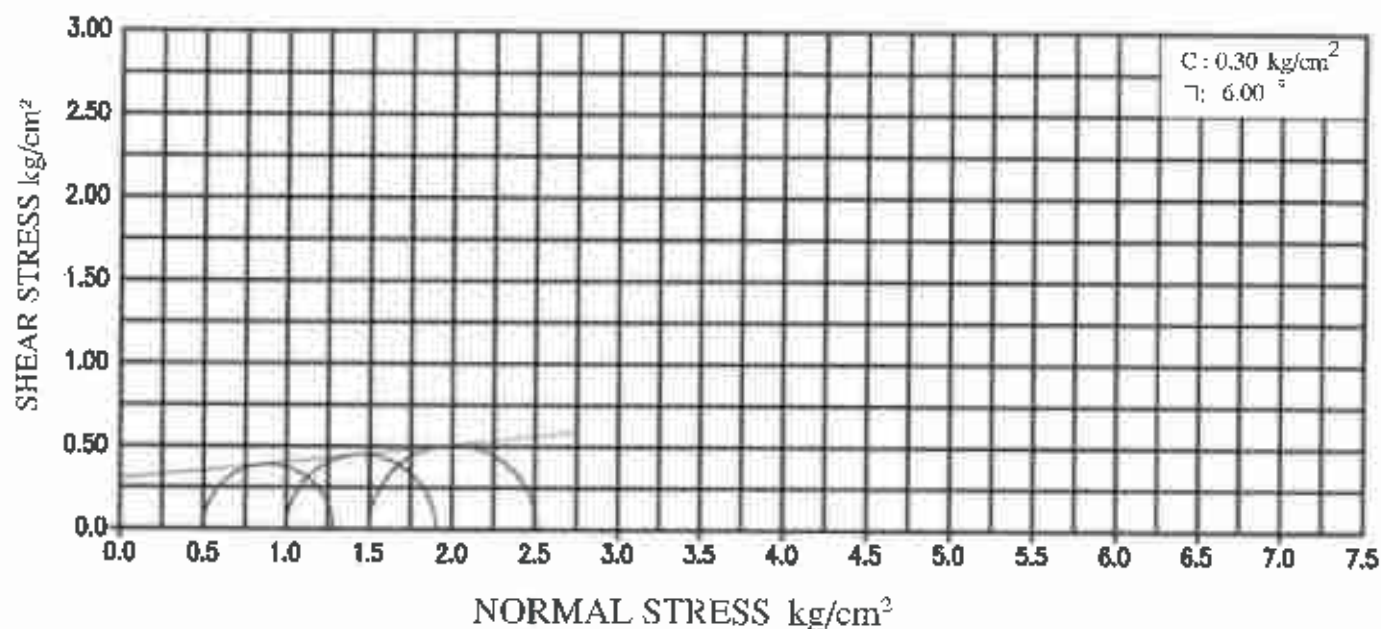
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 6

SAMPLE NO. - U1

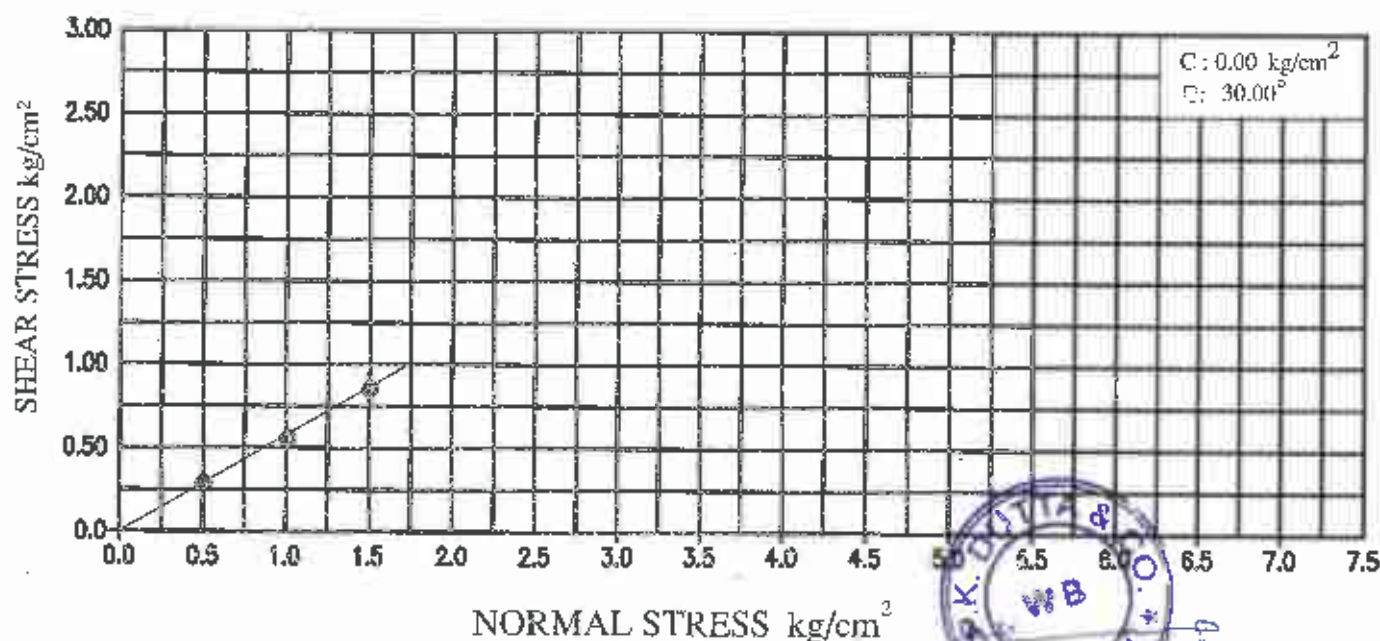
DEPTH :- 1.00 m

DIRECT SHEAR TEST CURVE

BH NO. 6

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

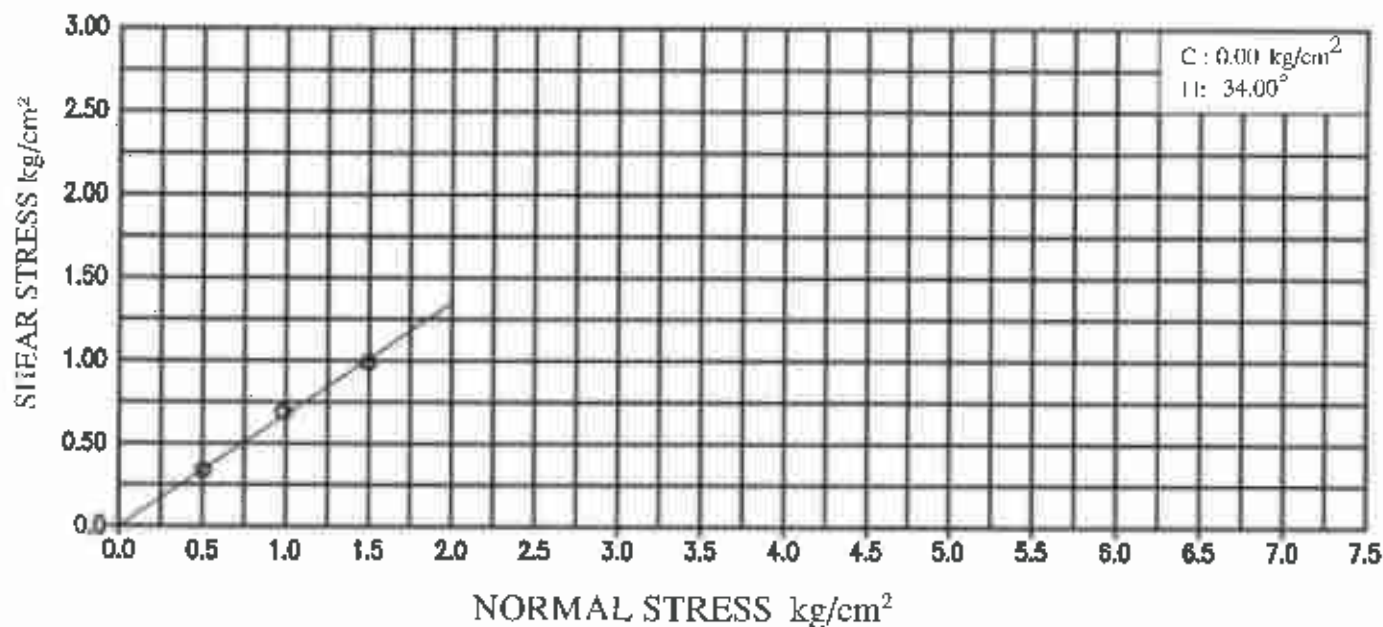
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 6

SAMPLE NO. - U3

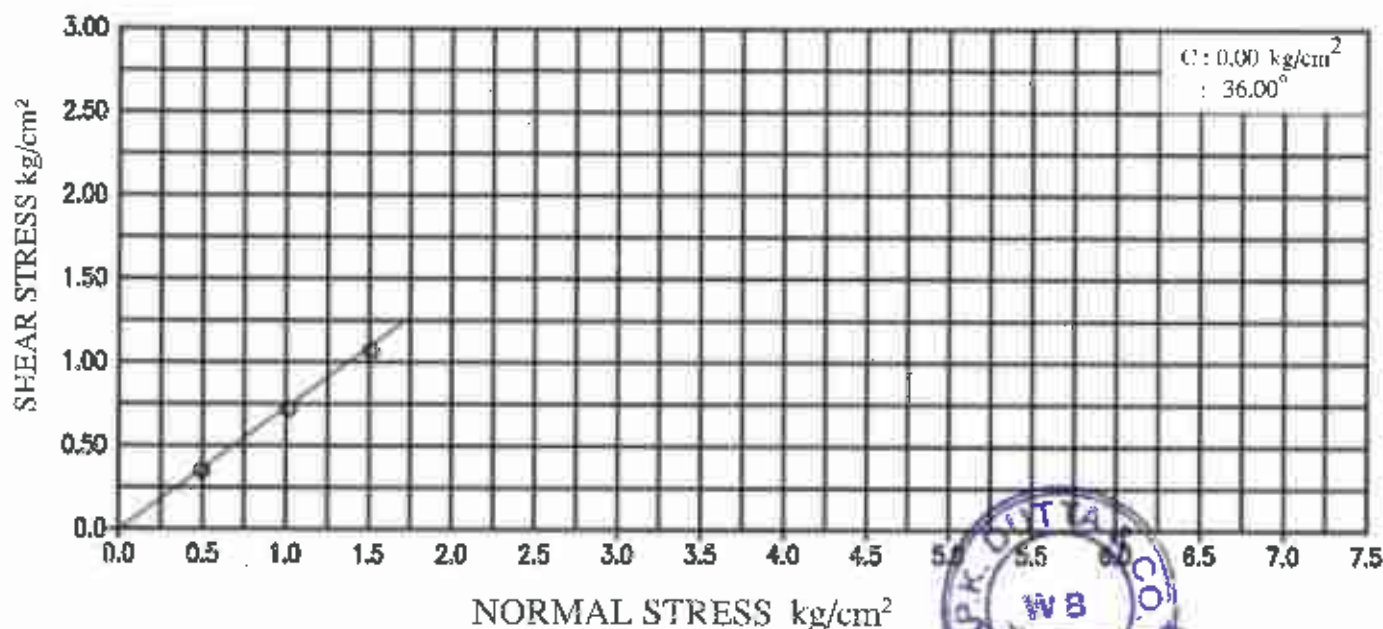
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 6

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

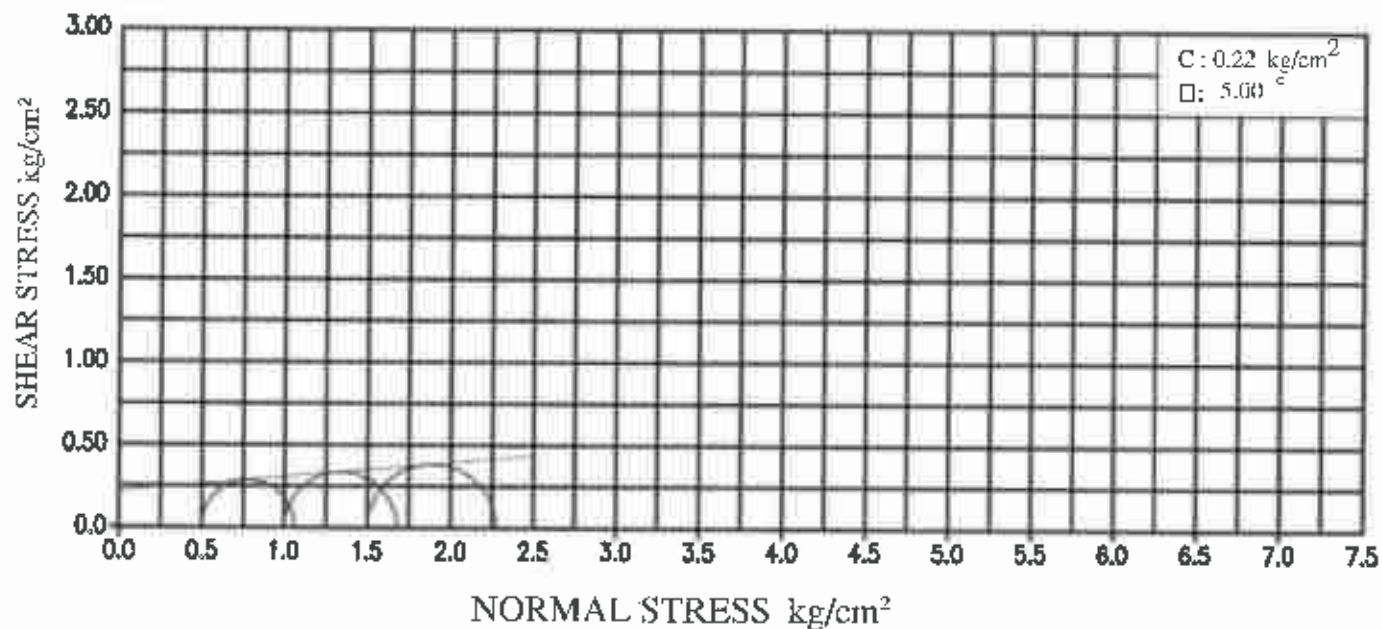
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumariata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 7

SAMPLE NO. - U1

DEPTH :- 1.00 m

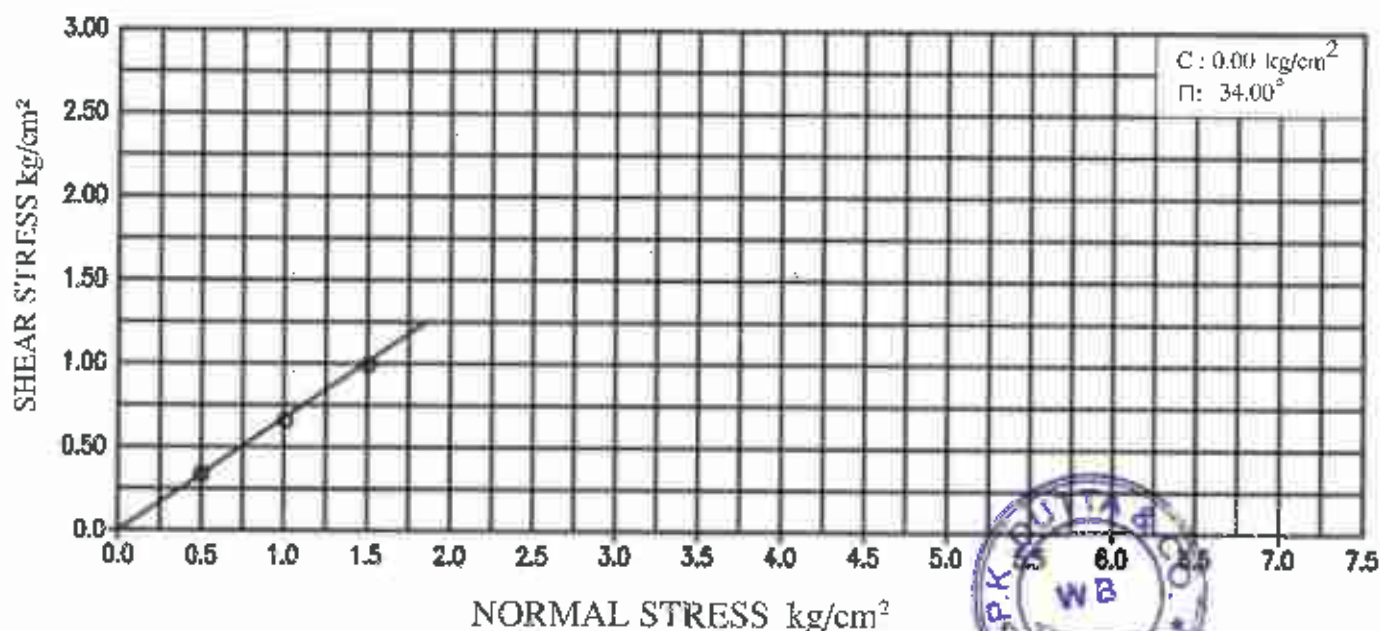


DIRECT SHEAR TEST CURVE

BH NO. 7

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

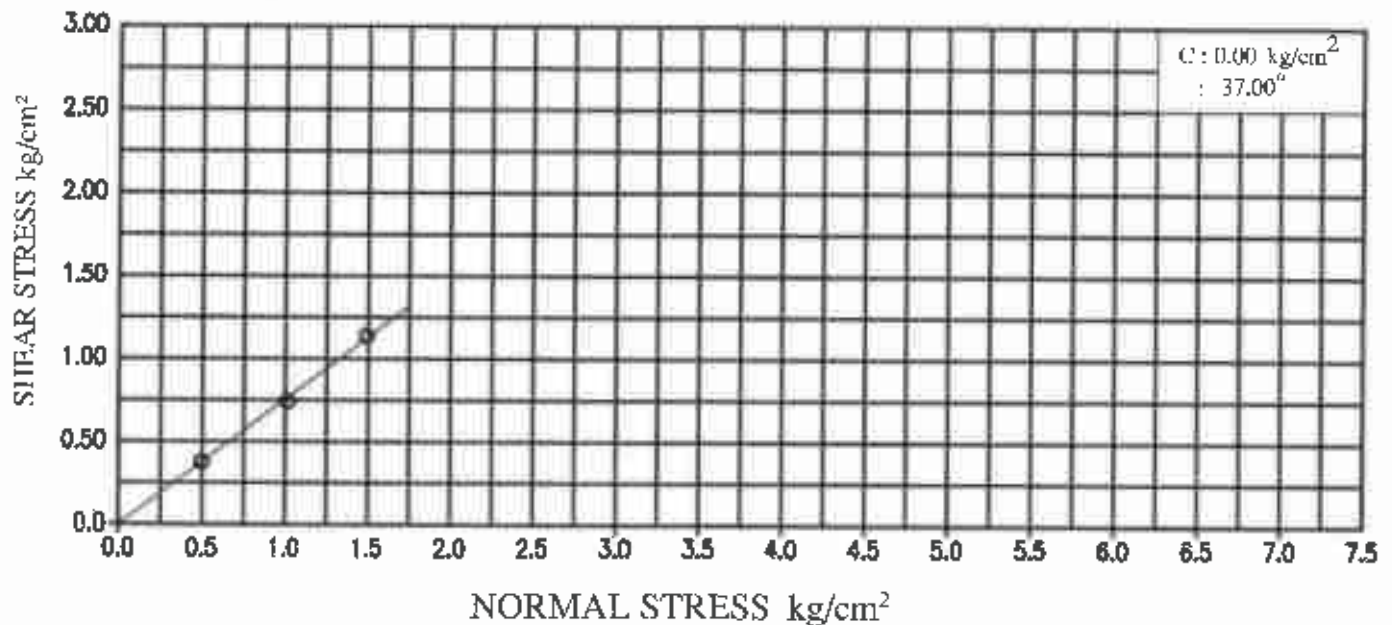
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumariata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 7

SAMPLE NO. - U3

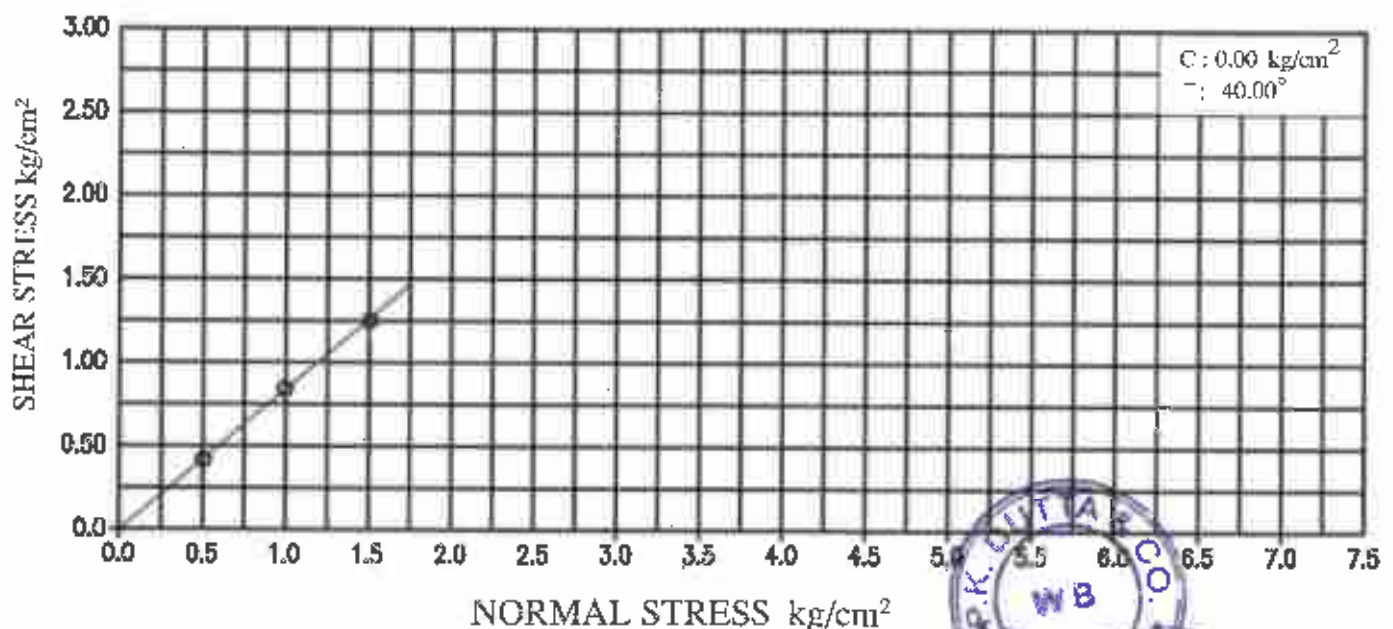
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 7

SAMPLE NO. - S5

DEPTH :- 10.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

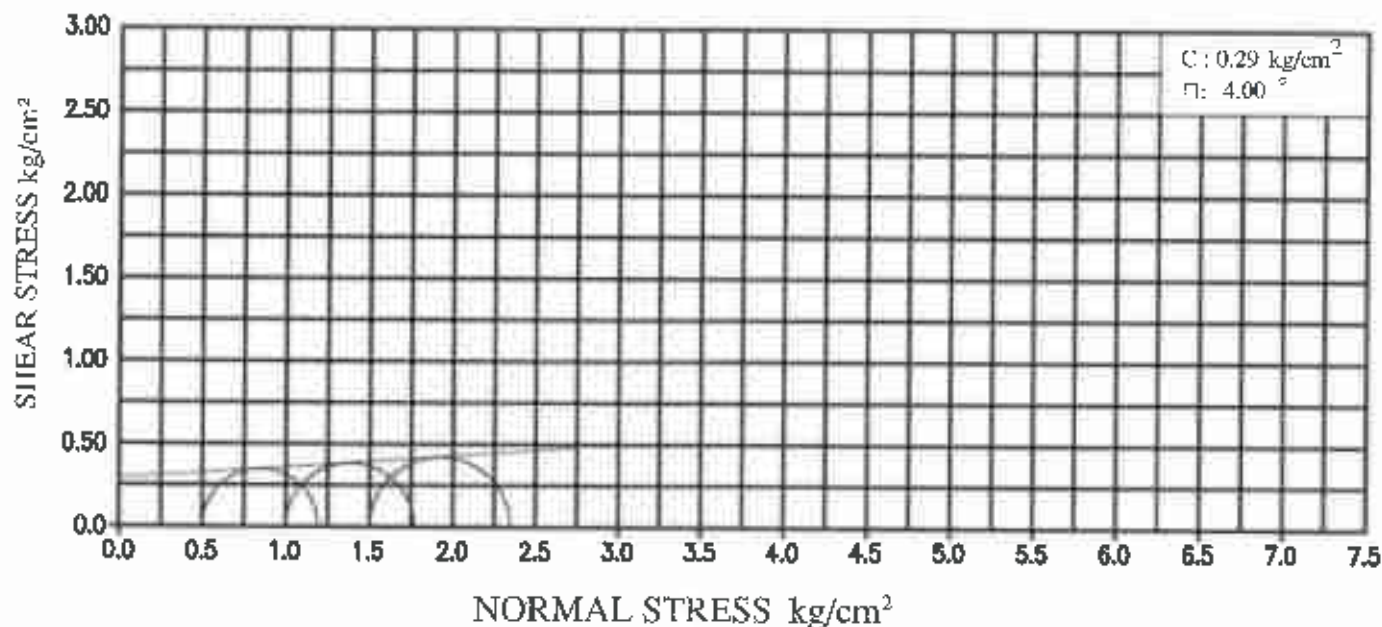
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 8

SAMPLE NO. - U1

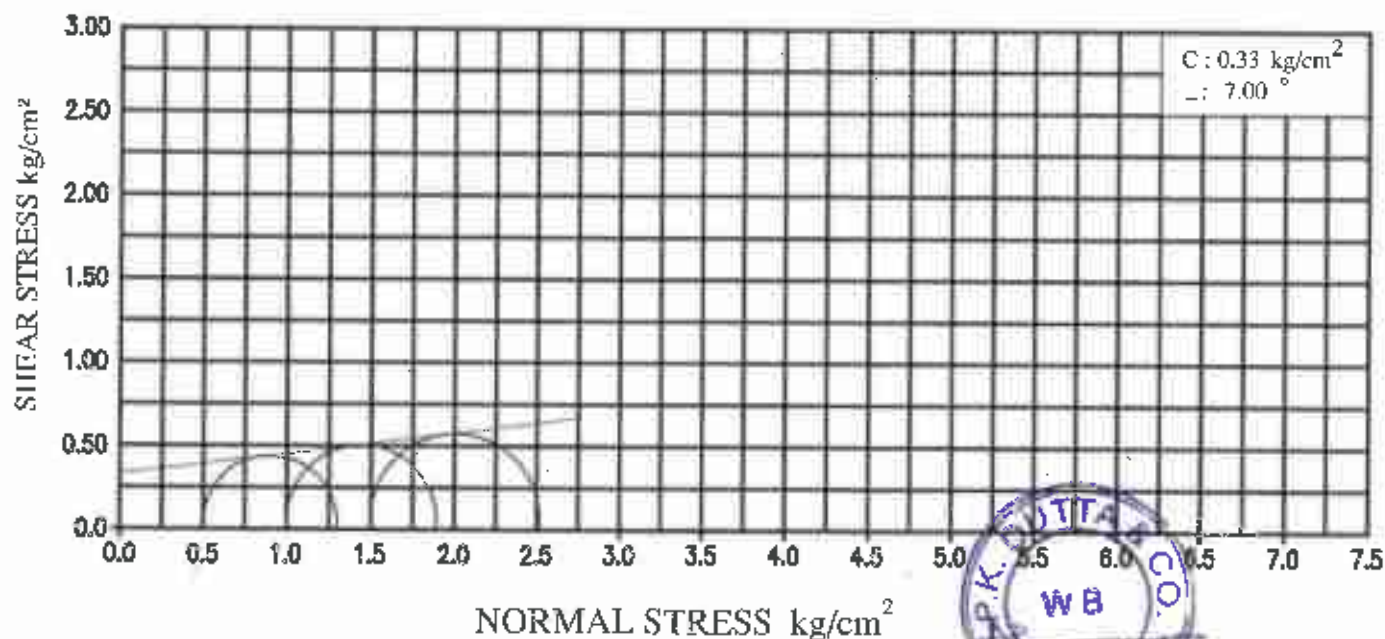
DEPTH :- 1.00 m

TRI-AXIAL SHEAR TEST CURVE

BH NO. 8

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

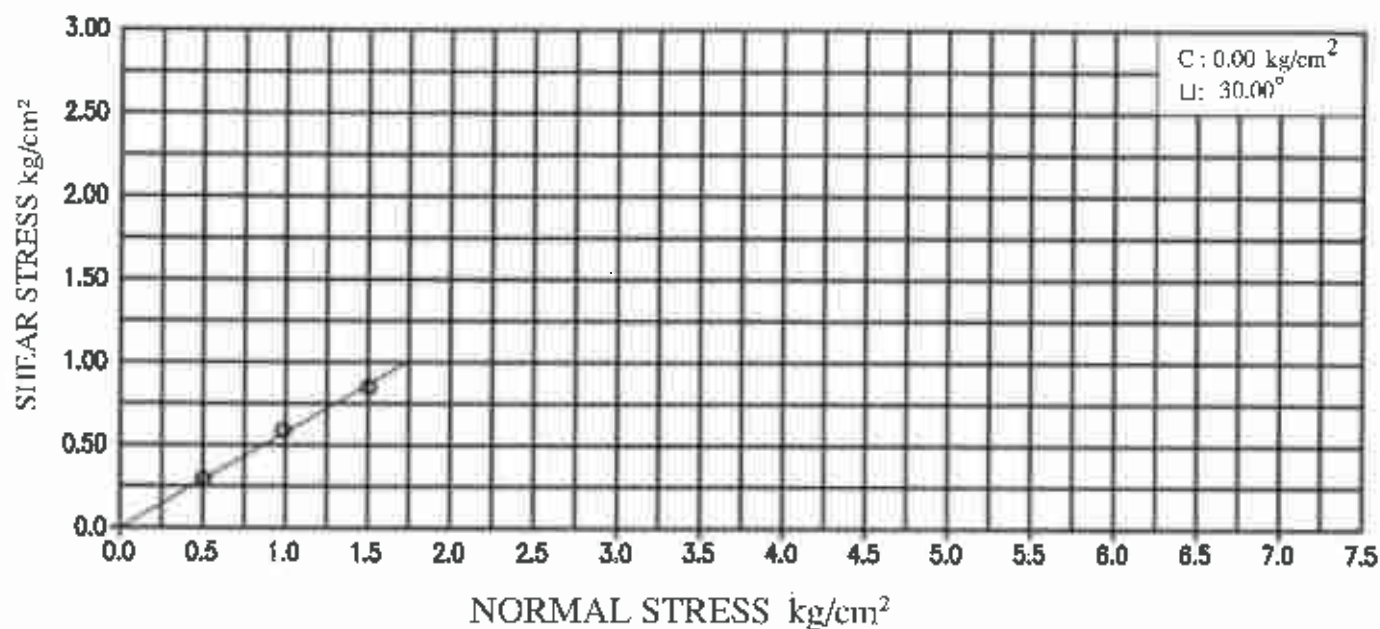
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 8

SAMPLE NO. - U3

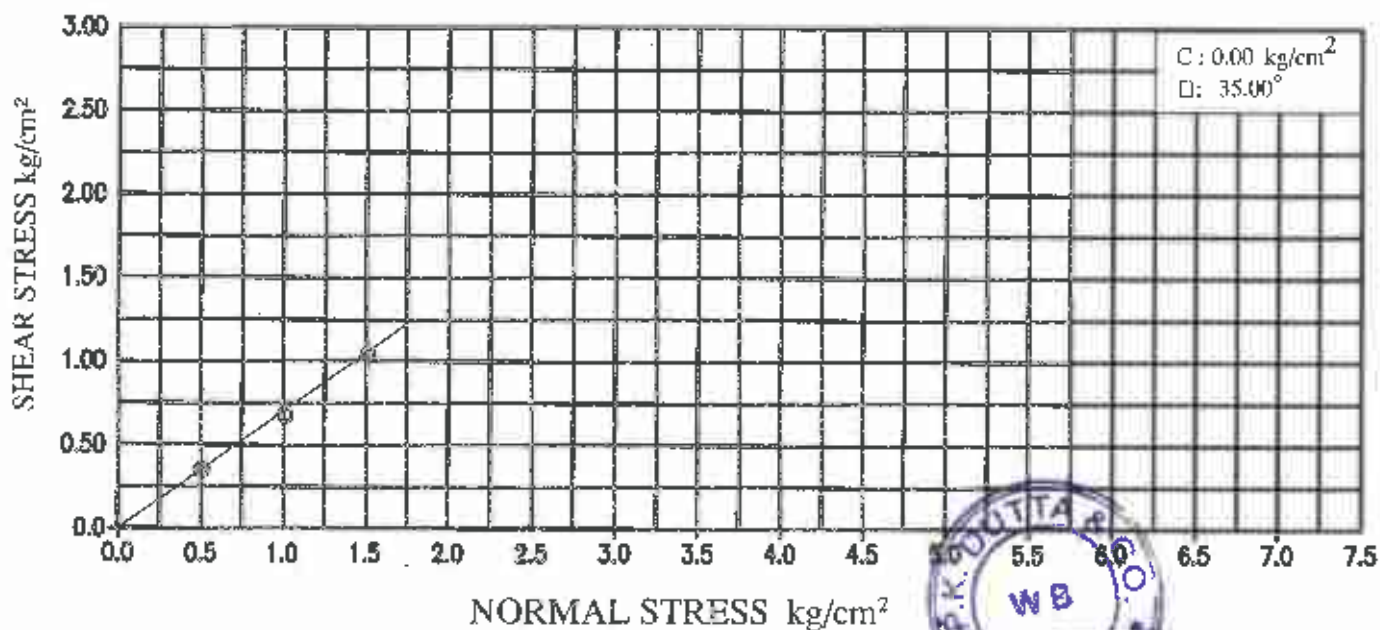
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

BH NO. 8

SAMPLE NO. - S4

DEPTH :- 7.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

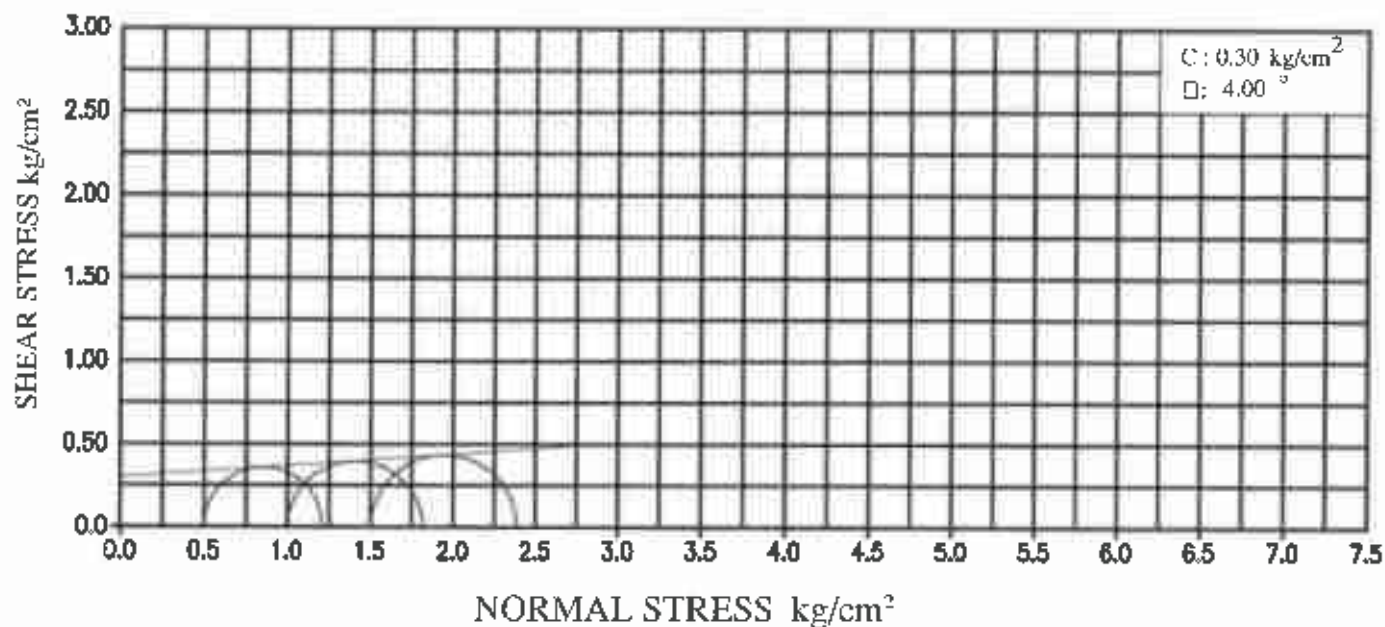
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

TRI-AXIAL SHEAR TEST CURVE

BH NO. 9

SAMPLE NO. - U1

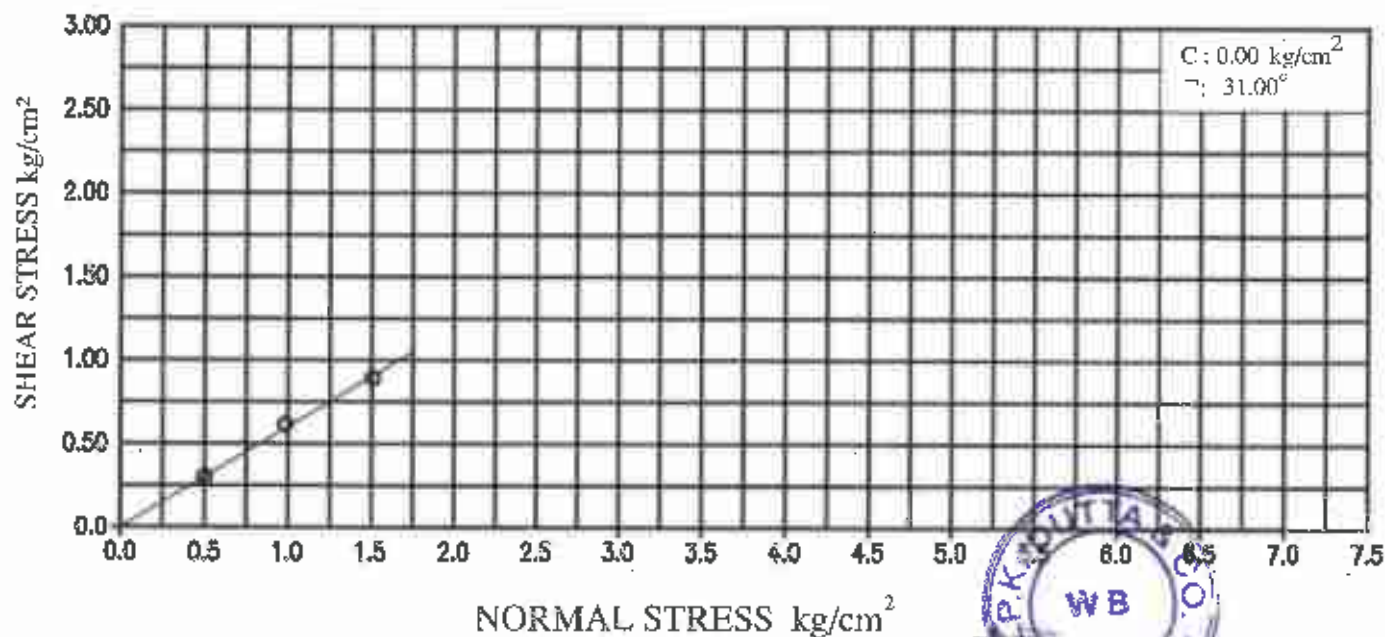
DEPTH :- 1.00 m

DIRECT SHEAR TEST CURVE

BH NO. 9

SAMPLE NO. - U2

DEPTH :- 4.00 m



Client : ASSAM ELECTRICITY GRID CORPORATION LIMITED.

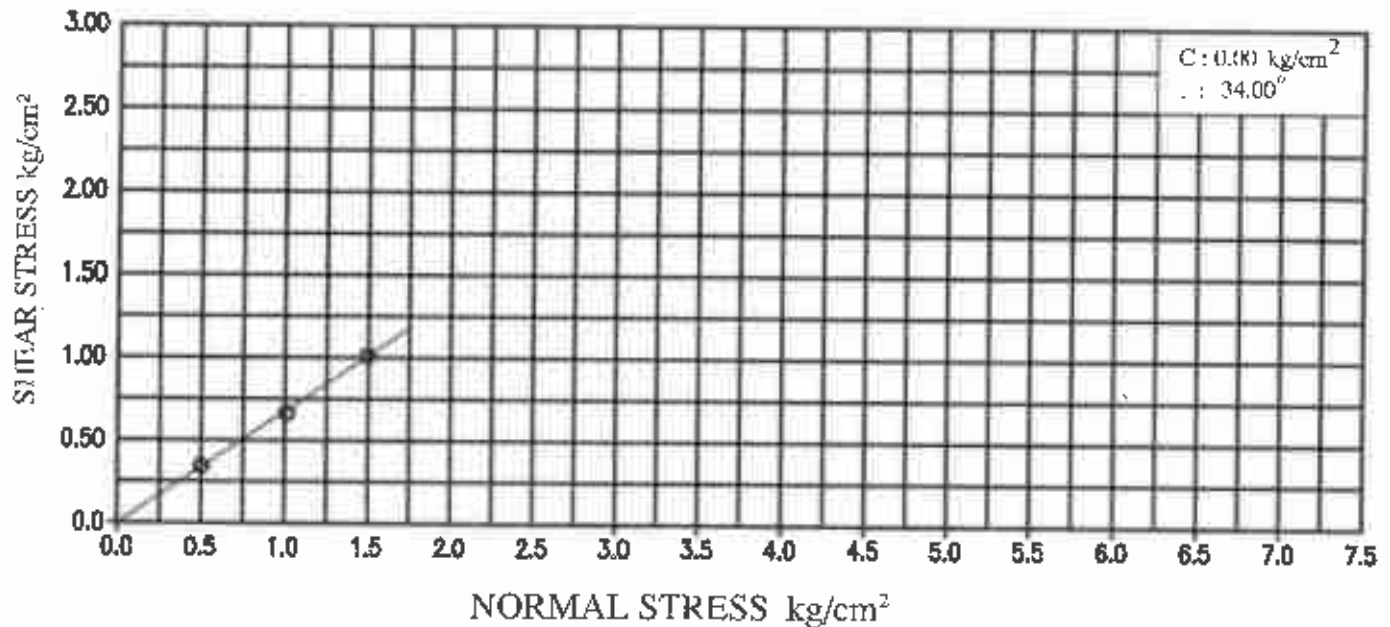
Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

DIRECT SHEAR TEST CURVE

BH NO. 9

SAMPLE NO. - U3

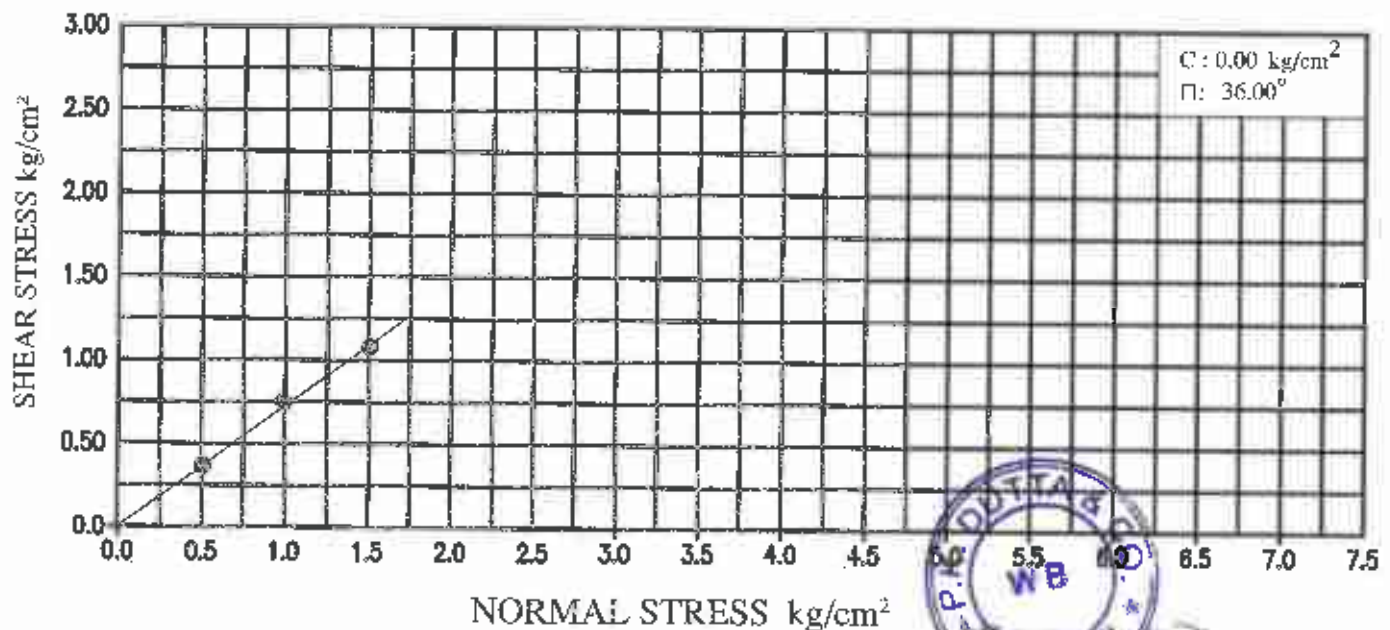
DEPTH :- 6.00 m

DIRECT SHEAR TEST CURVE

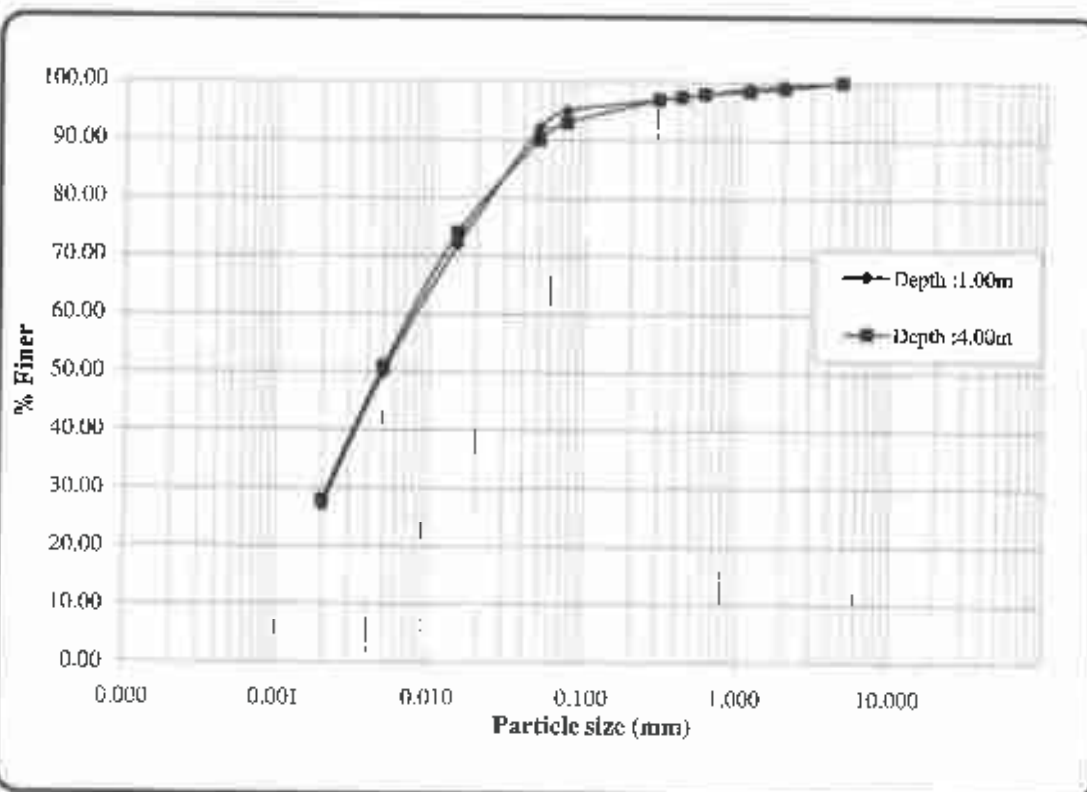
BH NO. 9

SAMPLE NO. - S5

DEPTH :- 10.00 m



GRAIN SIZE DISTRIBUTION CURVES

Shyama Power(India) Limited**GRAIN SIZE DISTRIBUTION
CURVE****Client :-** ASSAM ELECTRICITY GRID CORPORATION LIMITED.**Project :-** Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarkata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)**Bore Hole No.** BH-1

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	27.00	68.00	5.00	0.00
U2-4.00M	28.00	65.00	7.00	0.00



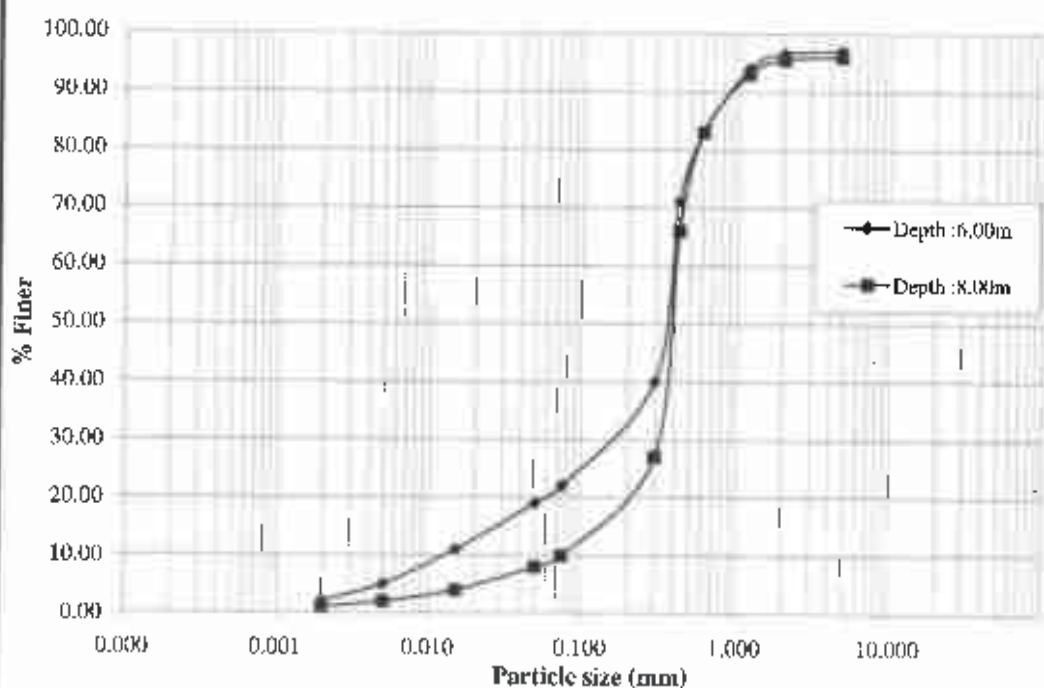
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

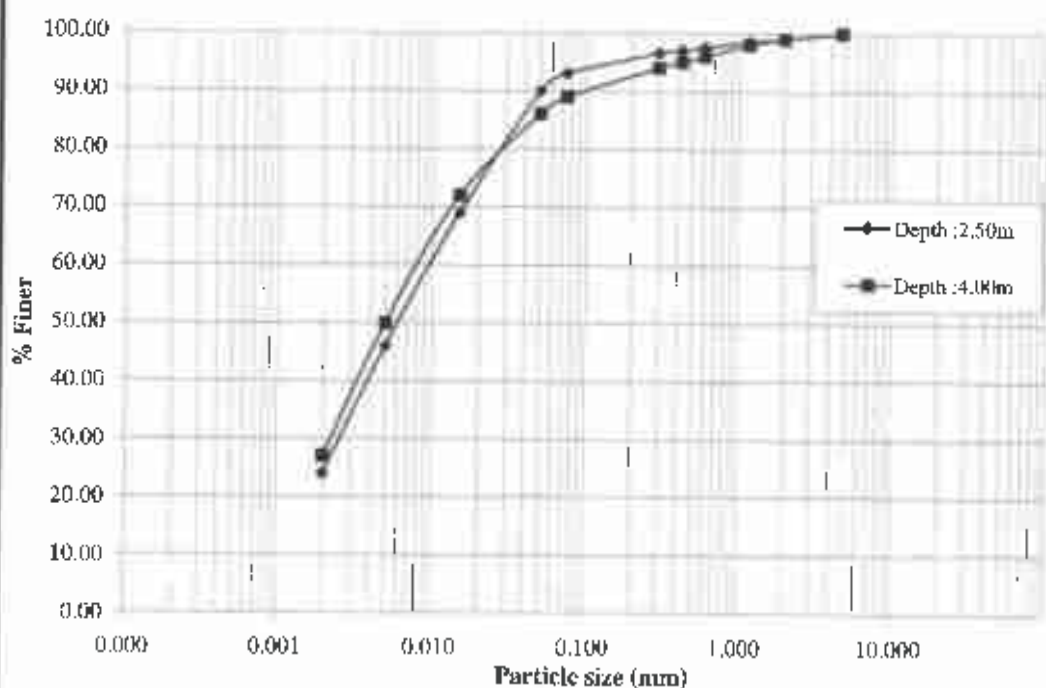
Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Ray Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. B11-1



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	2.00	20.00	75.00	3.00
U4-8.00M	1.00	9.00	86.00	4.00



Shyama Power(India) Limited**GRAIN SIZE DISTRIBUTION CURVE****Client :-** ASSAM ELECTRICITY GRID CORPORATION LIMITED.**Project :-** Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari CSS (Package G)**Bore Hole No.** B11-2

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-2.50M	24.00	69.00	7.00	0.00
U2-4.00M	27.00	62.00	11.00	0.00



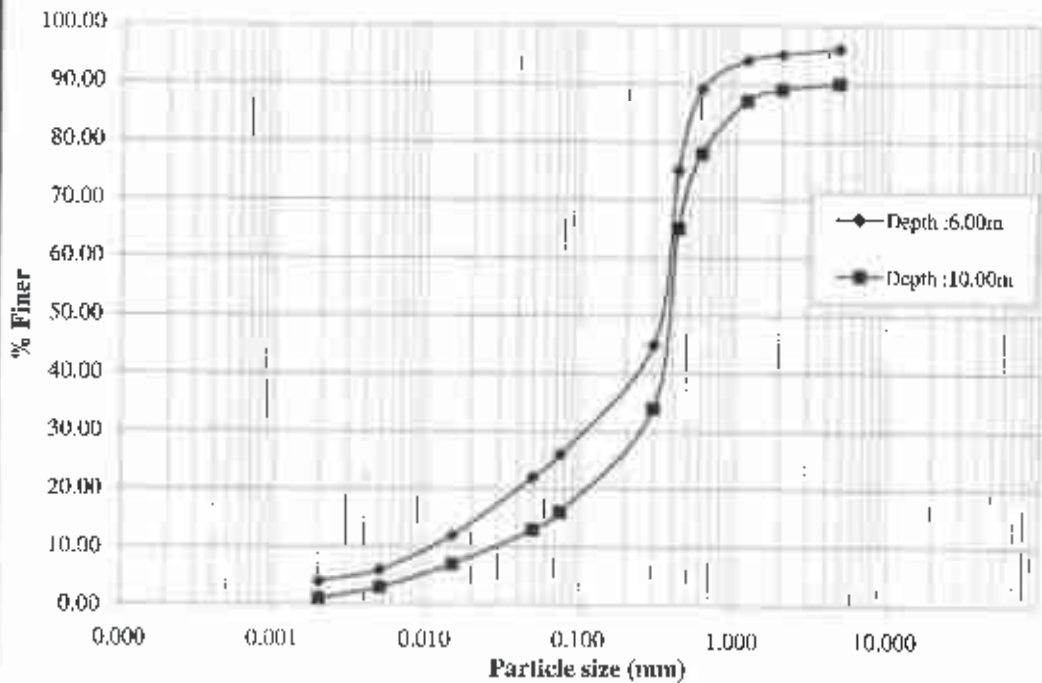
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

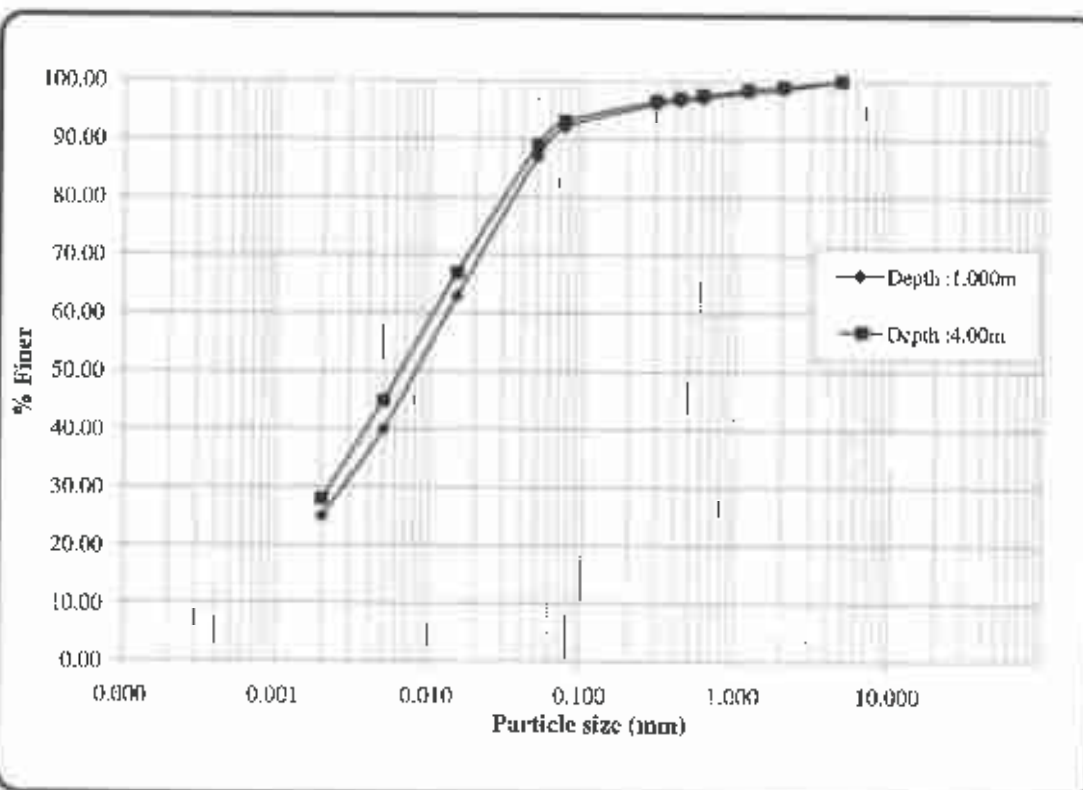
Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-2



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	4.00	22.00	70.00	4.00
S5-10.00M	1.00	15.00	74.00	10.00



Shyama Power(India) Limited**GRAIN SIZE DISTRIBUTION CURVE****Client :-** ASSAM ELECTRICITY GRID CORPORATION LIMITED.**Project :-** Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)**Bore Hole No.** BH-3

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	25.00	67.00	8.00	0.00
U2-4.00M	28.00	65.00	7.00	0.00



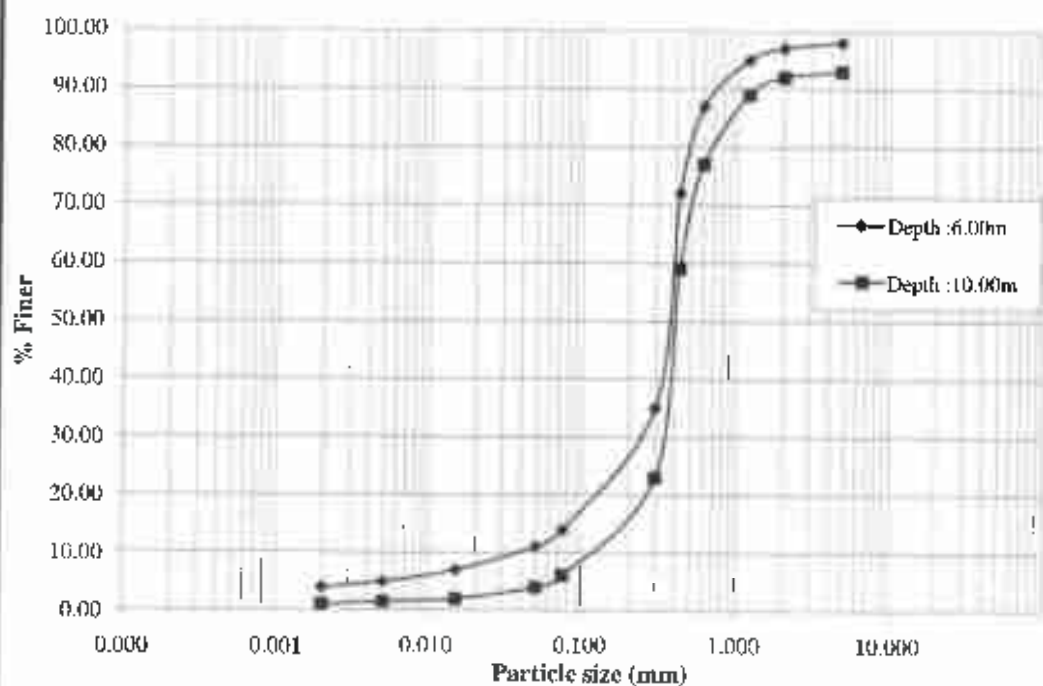
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-3



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	4.00	10.00	84.00	2.00
SS-10.00M	1.00	5.00	87.00	7.00



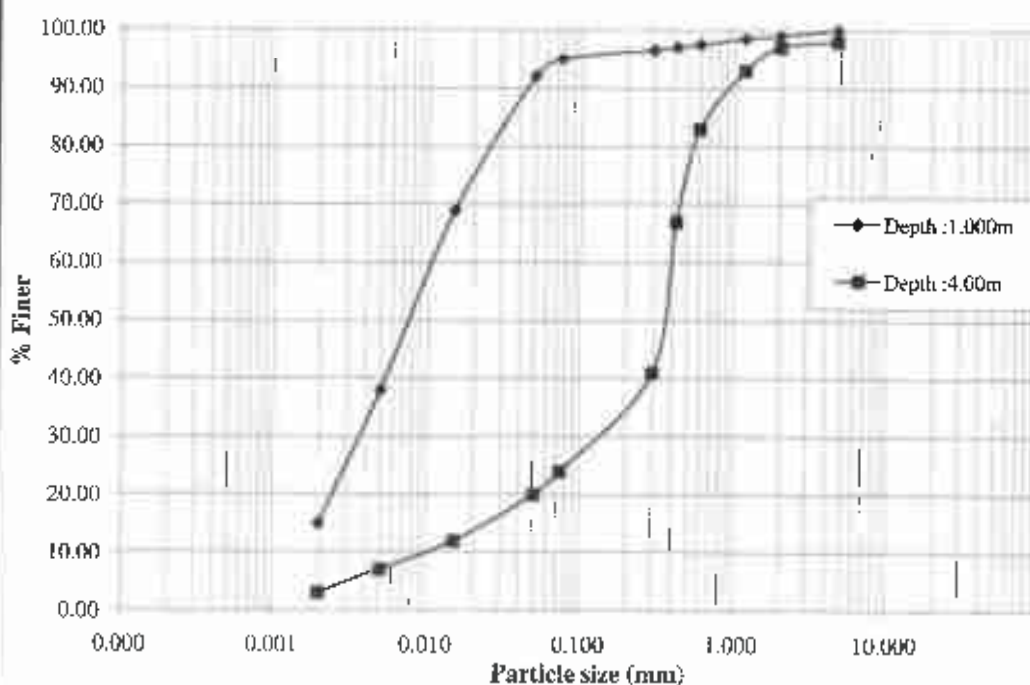
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-4



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	15.00	80.00	5.00	0.00
U2-4.00M	3.00	21.00	74.00	2.00



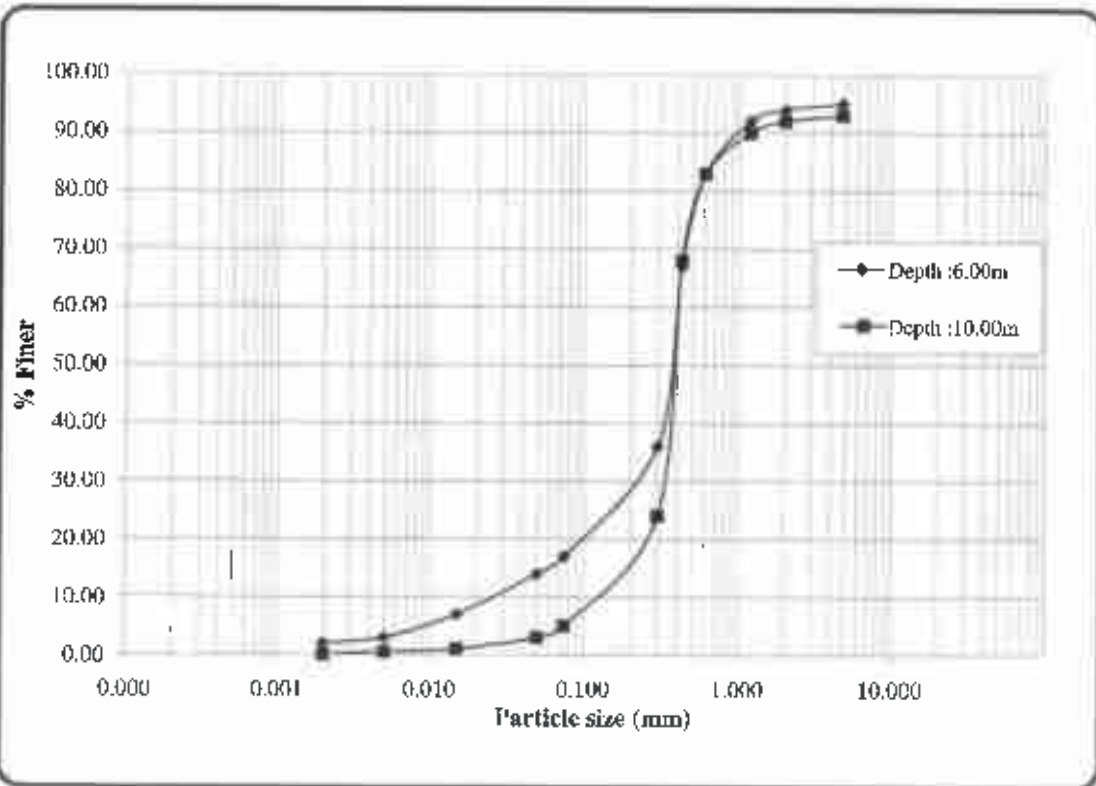
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GHS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalhari GSS (Package G)

Bore Hole No. BH-4



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	2.00	15.00	78.00	5.00
S5-10.00M	0.00	5.00	88.00	7.00



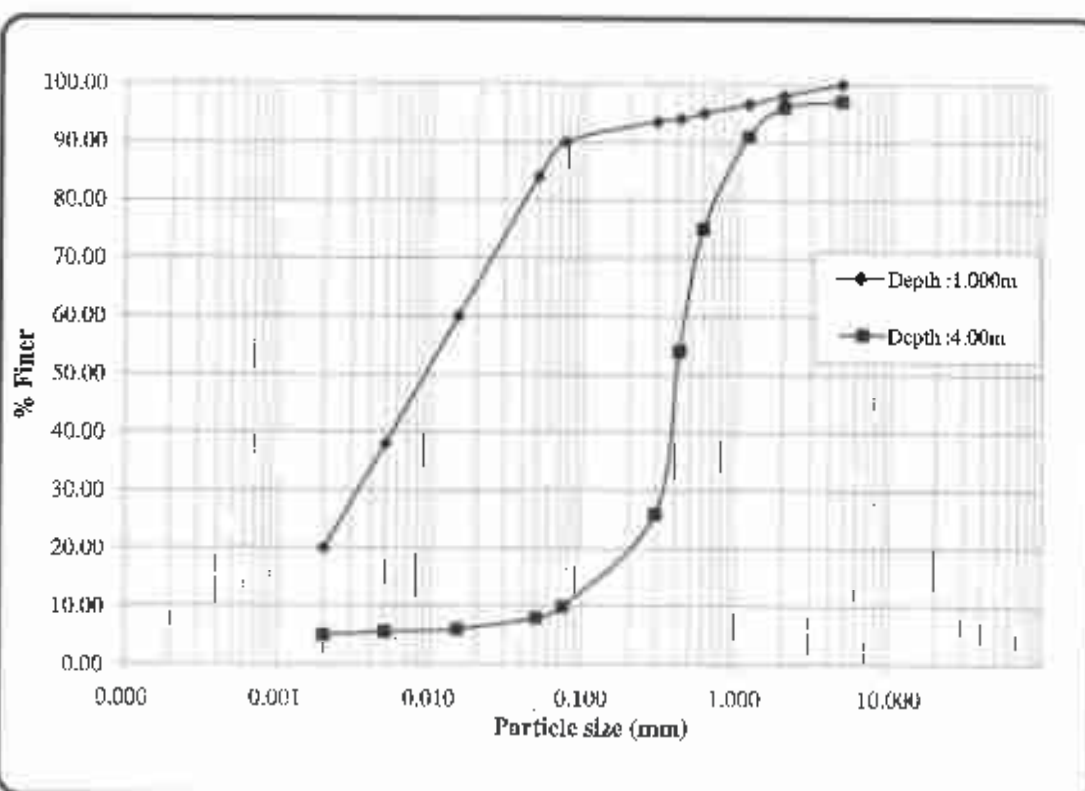
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari CSS (Package G)

Bore Hole No. BH-5



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	20.00	70.00	10.00	0.00
U2-4.00M	5.00	5.00	87.00	3.00



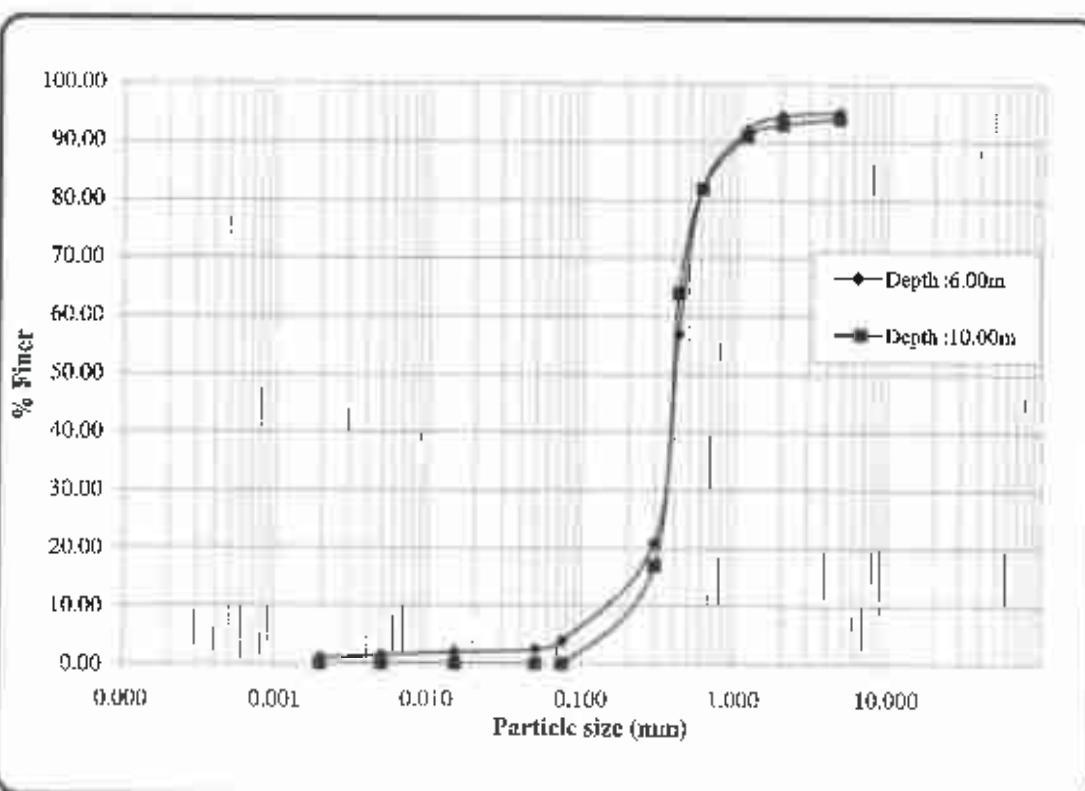
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-5



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	1.00	3.00	91.00	5.00
S5-10.00M	0.00	0.00	94.00	6.00



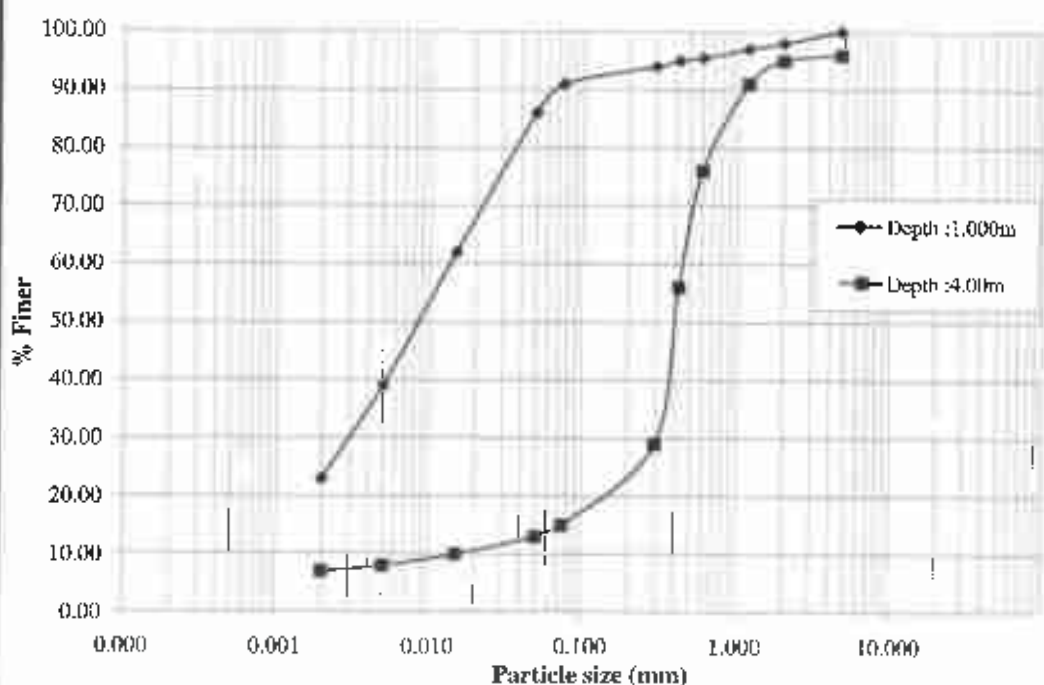
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS. (Package G)

Bore Hole No. BH-6



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	23.00	68.00	9.00	0.00
U2-4.00M	7.00	8.00	81.00	4.00



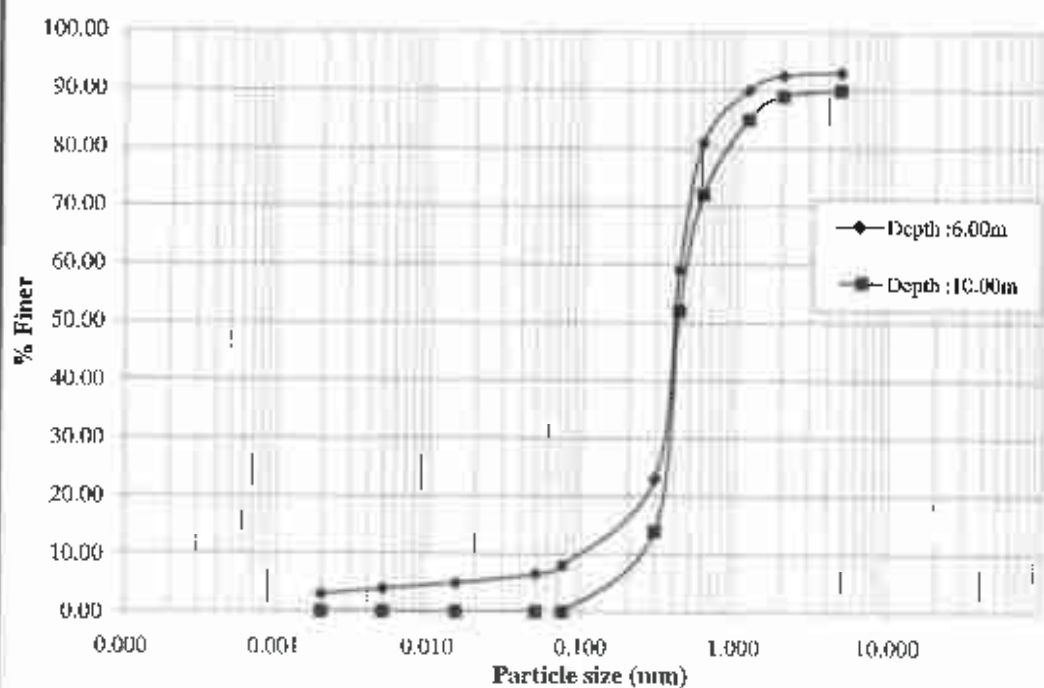
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-6



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	3.00	5.00	85.00	7.00
SS-10.00M	0.00	0.00	90.00	10.00



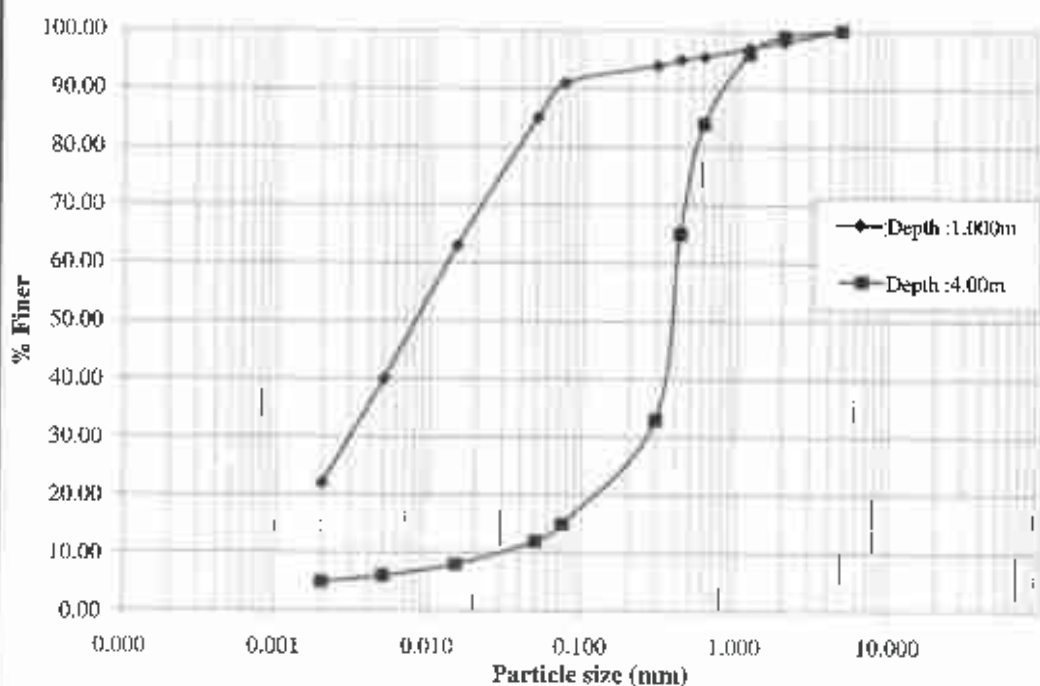
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-7



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	22.00	69.00	9.00	0.00
U2-4.00M	5.00	10.00	85.00	0.00



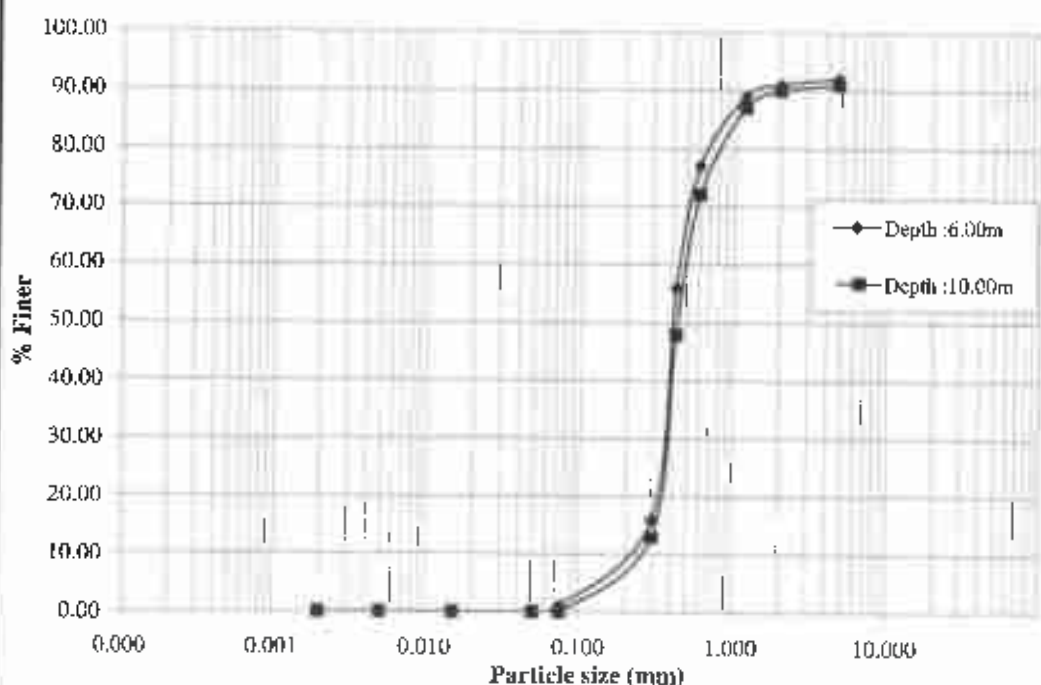
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

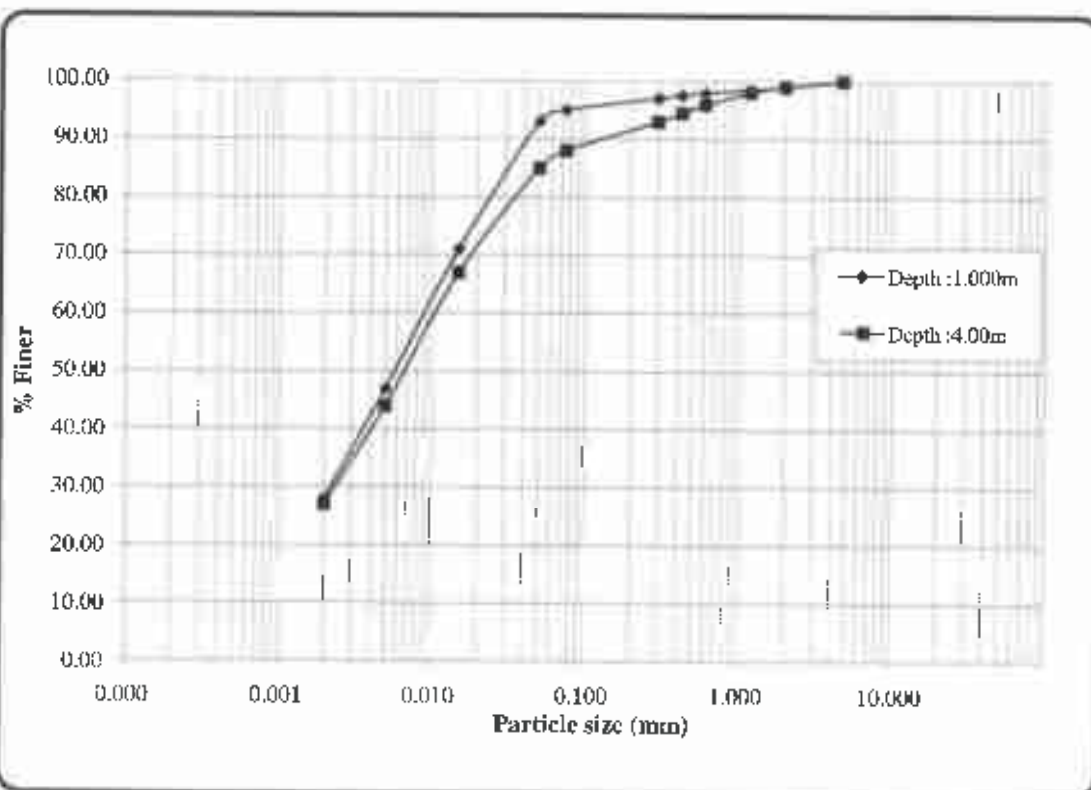
Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-7



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	0.00	1.00	91.00	8.00
SS-10.00M	0.00	0.00	91.00	9.00



Shyama Power(India) Limited**GRAIN SIZE DISTRIBUTION CURVE****Client :-** ASSAM ELECTRICITY GRID CORPORATION LIMITED.**Project :-** Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikuta) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)**Bore Hole No.** BII-8

Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	28.00	67.00	5.00	0.00
U2-4.00M	27.00	61.00	12.00	0.00



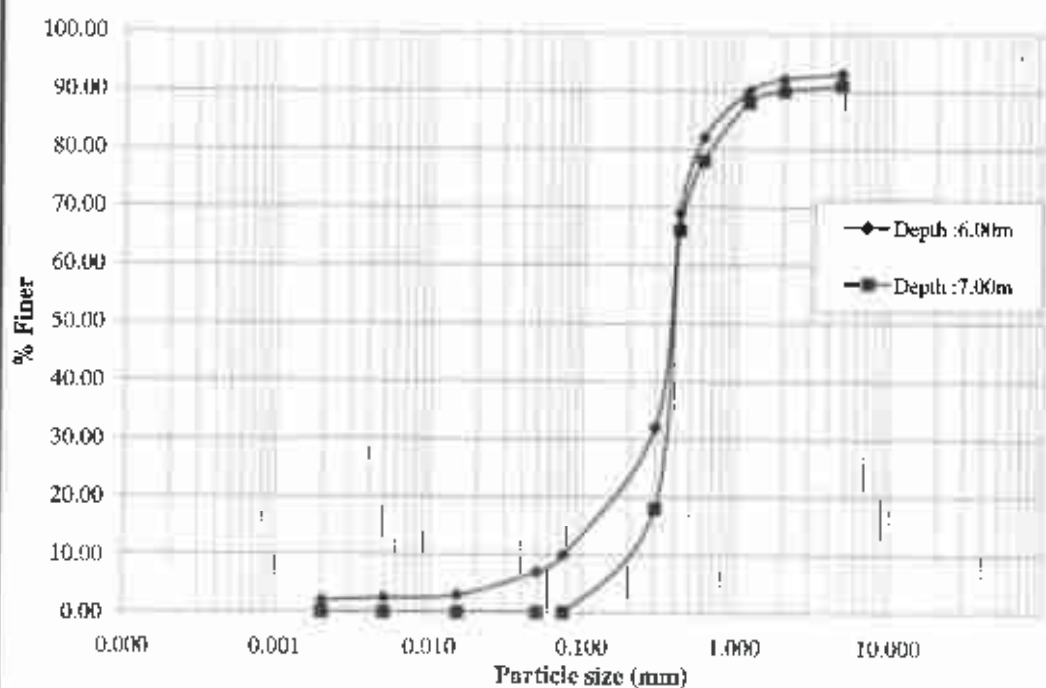
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BII-8



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	2.00	8.00	83.00	7.00
S4-7.00M	0.00	0.00	91.00	9.00



Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

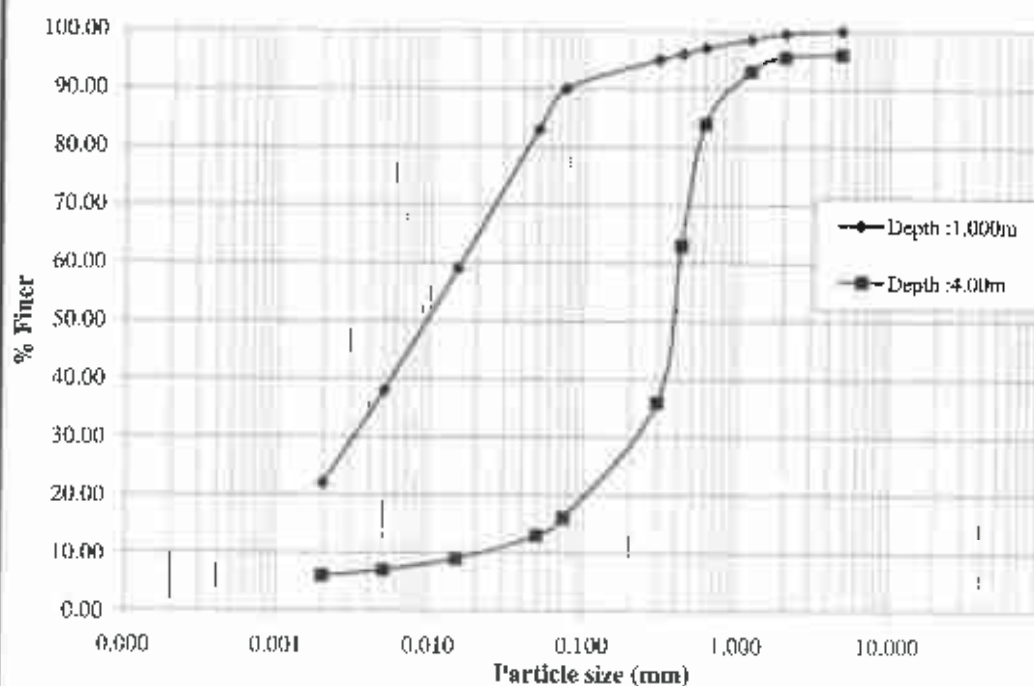
Client :-

Project :-

Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No.

BH-9



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U1-1.00M	22.00	68.00	10.00	0.00
U2-4.00M	6.00	10.00	80.00	4.00



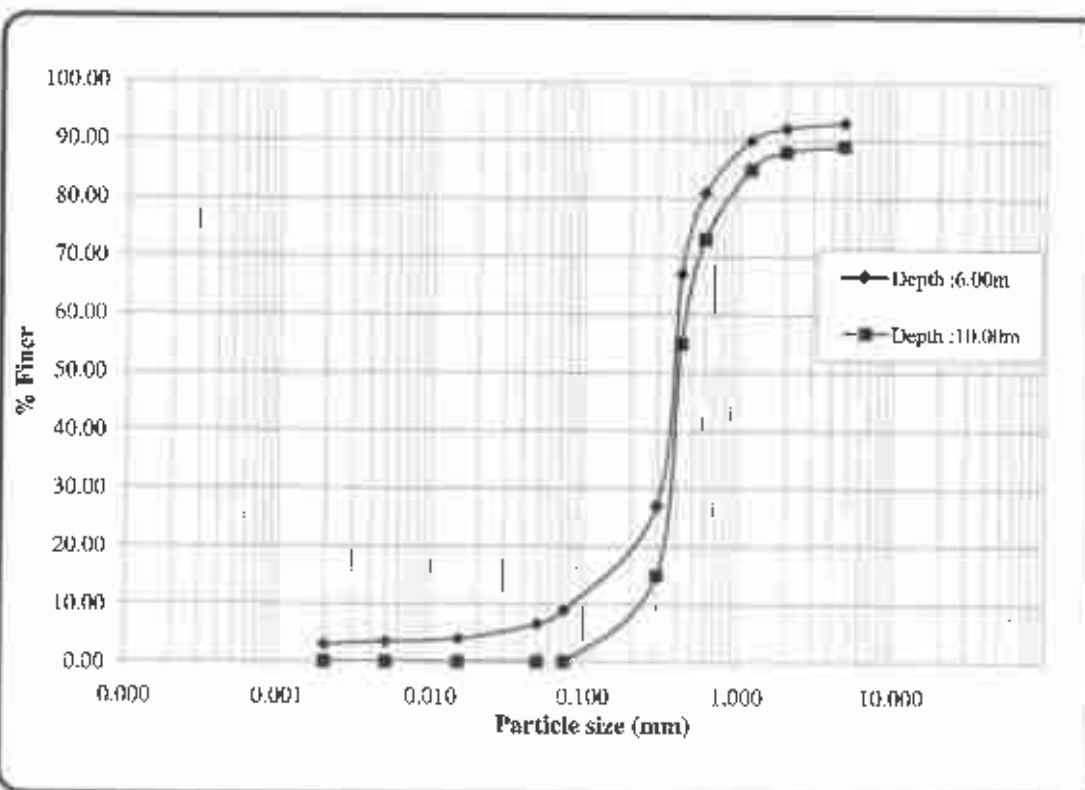
Shyama Power(India) Limited

GRAIN SIZE DISTRIBUTION CURVE

Client :- ASSAM ELECTRICITY GRID CORPORATION LIMITED.

Project :- Construction of 400/220 KV, 2 x 500 MVA, 220/132 KV, 2 x 160 MVA and 132/33 KV GIS at Rangia (Kumarikata) along with the Associated Transmission Lines with Bay Extension works at Existing 132/33 KV Nalbari GSS (Package G)

Bore Hole No. BH-9



Grain Size (mm)	<0.002	0.002-0.075	0.075-4.75	>4.75
Sample No.	Clay (%)	Silt (%)	Sand (%)	Gravel (%)
U3-6.00M	3.00	6.00	84.00	7.00
S5-10.00M	0.00	0.00	89.00	11.00



SIGN FIELD DATA SHEET

P.K.DUTTA & CO.

SAT TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS(N) W.B Pin-743165

Type of Boring: Auger Boring JOB Name: 400/220/122 KV, S/S.

CLIENT: REGAL, Rangpur, Assam

Dia. Of Hole: 150mm/NX

Depth in Metre: 15.0 (M)

Location No: GH-01

Commenced On: 11-05-2024

RL:-

Completed On: 12-05-2024

Ground Water: 2.00 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(M)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth		TCR (%)	ROD (%)
From to slight brownish to dark brown grey silty clayey clayey silt with kaolinite.	0.00			DS-1	0.20			
				UDS-1	1.00	1.45		
				PS-2	1.50			
				SPT-1	2.20	2.45	23.3	6
				DS-3	2.50			
				UDS-2	3.40	3.45	25.6	11
				DS-4	3.50			
				UDS-2	4.20	4.45		
Dense dark grey silty sand with mica	4.50	4.50	4.50	DS-5	4.60			
				SPT-2	5.00	6.45	7.10	15.25
				DS-6	5.50			
				UDS-3	6.00	6.45		
				DS-7	6.50			
Very dense dark grey blue clayey silty medium to coarse sand with mica.	7.00	7.00	2.50	SPT-3	7.00	7.45	17.25	29.51
				UDS-4	8.00	8.45		
				DS-8	8.50			
				SPT-5	10.00	10.45	23.30	46.76
				UDS-5	11.00	11.45		
				DS-9	11.50			

Signature of Site In-Charge

Signature of Engineer In-Charge

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No, Bijnagar, Naihati, 24 PGS (N) W.B Pin-743165

Type of Boring: Auger Drilling JOB Name: 2107208122 km: 5/5

CLIENT: AGCL - Rangia - A 33 am

Dia of Hole: 150mm/IN

Depth in MLC: 15.00 (m)

Location No: BH-01

Commenced On: 11-05-2024

RL:

Completed On: 12-05-2024

Ground Water: 2.00 (m)

D=Disturbed Sample, U=Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness (m)	COLLECTION OF SOIL SAMPLES			COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth	N-Value	TCR	RQD
very dense coarse, bluish grey medium to coarse sand with trace.				DS-10	12.00			
				SPT-6	13.00	13.30	42.37	71.00
				DS-11	13.50			
		15.00		SPG-7	15.00	15.20	98.60	100.00
							60.50	75.00
							Returned	Yes

Signature of Site In-Charge.

16.5.2024

Signature of Engineer In-Charge.



P.K.DUTTA & CO.

SATOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naitani, 24PGS (N) W.B-Pin-743165

Type of Boring: Auger Boring JOB Name: 400 / 22 of 132 Kw, S/S,

CLIENT: AECCL, Rangia, Assam.

Dia Of Hole: 150mm/NX

Depth in Mtr: 15.00 (4)

Location No: BAF-02

Commenced On: 10-05-2024 BL:

Completed On: 11-05-2024 Ground Water: 1.70 (4)

D: Disturbed Sample, U: Undisturbed Sample, P+S.F.T

DESCRIPTION	DEPTH (M)		Thickness (Mtr)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth		TCR (%)	RQP (%)
Stiff, damp brownish mica to dark blue clayey silty claystone with mica				DS-1	0.50			
				DS-2	1.00			
				SPT-1	1.50	1.95	46.7	1.13
				DS-3	2.00			
				DS-4	2.50	2.95		
				DS-4	3.00			
Dense brown clayey to bluish clayey fine sandstone, sand, with mica				SPT-2	3.00	2.45	29.3	0.5
				DS-5	3.50			
				DS-1	4.00	4.45		
				DS-6	4.50			
	5.00	5.00	5.00	SPT-3	5.00	5.45	18.19	23.82
				DS-3	6.00	6.45		
				DS-7	6.50			
				SPT-4	7.00	7.45	19.21	24.45
				DS-4	8.00	8.25	26.00	
		10.00	5.00		DS-8	8.50		
				SPT-5	10.00	10.45	17.23	33.56

Signature of Site In-Charge.



Signature of Engineer in Charge.

P.K.DUTTA & CO.

SAT TOWER, BLOCK - A, 1st FLOOR, 6No. Bipinagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Drilling- Augure Drilling JOB Name:- 400/220/192.00, 515
CLIENT:- AEGCL, Rangia, Assam

Dia Of Hole : 150mm/ØX Depth In Mtr:- 15.00 (m)
Location No:- BH-02

Commenced On:- 10-05-2024 RL:
Completed On:- 11-05-2024 Ground Water:- 1.70 (m)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(M)	COLLECTION OF SOIL SAMPLES		COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth	N-Value	TCR (%)	RQD (%)
very dense clayey to light grey medium to coarse sand w/ sh. and some gravel.		10.00		BSF	11.00			
				US 5	11.00	11.25	Robinson	
				BS 16	11.30			
				PS 19	12.00			
				SPT 6	13.00	13.00	45, 60 > 100	
				PS 10	13.50		Robinson	
		12.00		SPT 7	15.00	15.00	49, 57 > 100	
							Robinson	

Signature of Site In-Charge.

Signature of Engineer In Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No. Bijoynagar, Naihati, 24 PGS (N) W.B Pin-743165

Type of Boring- *Augure / Drilling* JOB Name- *430/220/135, W.S.S.*

CLIENT- *REGOL, Ramgiri, Nabam*

Dia Of Hole: 150mm/NX

Depth in Mtr- *15.00 (M)*

Location No:- *13A.N0.03*

Commenced On: *13.03.2024* R/L:-

Completed On: *13.05.2024* Ground Water: *1.70 (M)*

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH (M)		COLLECTION OF SOIL SAMPLES			COLLECTION OF ROCK SAMPLES	
	From	To	Type	Depth	N-Value	TCR (%)	RQD (%)
<i>From top to 4.50 m depth Brownish to dark blueish grey silty clay / clayey silt with mica.</i>			DS-1	0.20			
			DS-1	1.00	1.45		
			DS-1	1.50			
			SPT	2.00	2.45	2.5, 3.6	
			SPT	3.10	3.45	3.4, 6.10	
			UDS	4.00	4.45		
<i>Medium brown to beige clayey to silty clayey silt fine to medium sandy with mica.</i>	4.50	4.50	DS-3	4.50			
			SPT	5.00	5.00	8, 16, 10, 2.6	
			UDS	6.00	6.45		
			DS-4	6.50			
			SPT	7.10	7.45	18, 18, 30, 48	
			UDS	8.00	8.25	Rebound	
			DS-5	8.50			
			DS-6	9.00			
	10.00	5.50	SPT	10.00	10.45	20, 31, 39, 70	

Signature of Site In-Charge.

for S.P.T



Signature of Engineer in Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No. Bijoynagar, Mahati, 24PGS (N) W.B Pin-743165

Type of Boring: Augur boring

JOB Name: 400/220/132 kV, SIS

CLIENT: ABGCL, Rangia, Assam.

Dia Of Hole: 150mm/NX

Depth in Mtrs: 15.00 (M)

Location No: B11-00-03

Commenced On: 13-05-2024

RL:-

Completed On: 16-05-2024

Ground Water: 1.70 (M)

D- Disturbed Sample, U- Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(M)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	RQD (%)	
					From				To
Very dense auger to light gray medium to coarse sand with mica & gravel		10.00		DS-7	11.00				
				DS-8	11.20	11.20	Rebound		
				DS-8	11.50				
				DS-9	12.00				
				SPT-6	13.00	13.30	46.58	7100	
				DS-10	13.50				
		15.00		SPT-7	15.00	15.25	48.60	7100	

Signature of Site In-Charge.

Signature of Engineer In-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, ENo. Bijoynagar, Naihati, 24PG5 (N) W.B Pin-743165

Type of Boring: Augure/Boring

JOB Name: 2007220132KV/S/S

CLIENT: AEGOL, Rangia, Assam.

Dia Of Hole : 150mm/NX

Depth in Mtr:- 15.00 (M)

Location No :- BH- NO-04

Commenced On:- 16-05-2024

RL:-

Completed On:- 18-05-2024

Ground Water:- 2.30 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH (M)		Thickness (Mtr)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	ROD (%)	
					From				To
Soft to medium brownish grey silty clay / clayey silt with mica	0.00			DS-1	0.50				
				UDS-1	1.40	1.15			
				DS-2	1.50				
				SPT-1	2.40	2.25	22	24	
Hard to medium dense to dense medium grey silty fine to medium sand with mica	3.00	3.00	3.00	SPT-2	3.40	3.45	5.8	11-13	
				UDS-2	4.00	4.45			
				DS-3	4.00				
				SPT-3	5.00	5.45	10.13	17-20	
				UDS-3	6.00	6.45			
				DS-4	6.00				
				SPT-4	7.00	7.45	16.20	27-42	
				UDS-4	8.00	8.45			
				DS-5	8.50				
				DS-6	9.00				
	10.00	7.00		SPT-5	10.00	10.45	21.30	42-52	

Signature of Site in-Charge.

[Handwritten Signature]



Signature of Engineer in-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring: Auger Boring JOB Name: 400/220/132 KW S/S
 CLIENT: AEGCL, Rangia, Assam

Dia Of Hole: 150mm/NX Depth in Soil: 15.00 (M)
 Location No: 24/NO-04

Commenced On: 16-05-2024 RL:-
 Completed On: 18-05-2024 Ground Water: 2.30 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(M)	COLLECTION OF SOIL SAMPLES			COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		N-Value	RCR (%)	RCD (%)
					From	To			
Wet clayey sandstone with some coarse sand and small pebbles		10.20							
				22.87	11.00				
				22.87	11.00	11.95	22.87		
				22.87	11.50				
				22.87	12.00				
				22.87	13.00	13.95	22.87		
		15.00		22.87	13.50				

Signature of Site In-Charge.

15/5/2024



Signature of Engineer In-Charge.

P.K.DUTTA & CO.

SAITOWER, BLOCK - A, 1ST FLOOR, GNo. 8/Joynagar, Nalhati, 24PGS (N) W.B Pin-743165

Type of Boring: Augure sounding

JOB Name: 400/220/132KV, S-15

CLIENT: AEGCL, Rangian Assam

Dia Of Hole : 150mm/114

Depth in Metre: 15.00 CM

Location No: BH. No. 05

Commenced On: 18.05.2024

RL:

Completed On: 20.05.2024

Ground Water: 2.10 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		In Ch. (M)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	ROD (%)	
					From				To
Medium silty to clayey dark brownish grey silty clay with mica.	0.00			DS-1	0.50				
				U.S-1	1.00	1.45			
				DS-2	1.50				
				SPT-1	2.00	2.45	2.5=8		
Medium dense to dense brown grey silty fine to medium sand with mica.	3.00	3.00	3.00	SPT-2	3.50	3.15	5.6=14		
				U.S-2	4.00	4.45			
				DS-3	4.50				
Dense dark grey silty fine to medium sand with mica & gravel.	5.00	5.00	2.00	SPT-3	5.00	5.45	7.1, 17=28		
				U.S-3	6.00	6.45			
				DS-4	6.50				
				SPT-4	7.00	7.45	13, 27, 25=47		
				U.S-4	8.00	8.45	SUP		
				DS-5	8.50				
				DS-6	9.00				
Very dense dark grey medium to coarse sand with mica & gravel.	10.00	10.00	5.00	SPT-5	10.00	10.45	21, 32, 40=73		

Signature of Site In-Charge

Signature of Engineer in-Charge

SAI TOWER, BLOCK - A, 1ST FLOOR, 6 No. Bijoynagar, Naihati, 24 PGS (N) W.B Pin-743165

Type of Boring: AUGURE (Drilling) JOB Name: 450/220 MS Q-KN 2/5

CLIENT: Atul, Rangia, Assam.

Dia Of Hole : 150mm/NX

Depth in fms: 1500 (24)

Location No. 2- 24-20-05

Commenced On: 18.05.2024 RI:

Completed On: 20-05-2024 Ground Water: 2.45 (M)

D=Disturbed Sample, U=Undisturbed Sample, #=S.P.T

Signature of Site in Charge.

Signature of Engineer-in-Charge.

P.K.DUTTA & CO.

SAT TOWER, BLOCK - A, 1st FLOOR, 6 No. Bijoynagar, Naitati, 24PG5 (N) W.B Pin-743165

Type of Boring: Auger & Drilling

Job Name:- 900/220/132 kv. S/S

CLIENT:- AERCL

Dia Of Hole: 158mm/6X

Depth in Mtr:- 15.0 (M)

Location No:- BH-06

Commenced On:- 27-05-2024

RL:-

Completed On:- 29-05-2024

Ground Water:- 1.50 (M)

D= Disturbed Sample, U= Undisturbed Sample, P= S.P.T

DESCRIPTION	DEPTH (M)		Thickness (M)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth		TCR (%)	ROD (%)
					From	To		
Medium stiff, dark brownish grey Silty clay / clayey silt with mica.	0.00			DC-01	0.50			
				UAS-1	1.00	1.45		
				DS-2	2.50			
				SPT-1	7.00	7.45	2, 3, 3 = 6	
				SPT-2	8.00	8.45	3, 4, 6 = 10	
Medium Dense dark grey Silty fine to medium sand with mica.	3.50	3.50		UAS-2	4.00	4.45		
				DS-3	4.50			
				SPT-3	5.00	5.45	5, 9, 14 = 23	
				UAS-3	6.00	6.45		
				DS-4	6.50			
Very Dense dark grey medium to coarse sand with mica & gravel.	7.00	7.00		SPT-4	7.00	7.45	12, 27, 31 = 58	
				UAS-4	8.00	8.45	cliff	
				DS-5	8.50			
				DS-C	9.00			
				SPT-5	10.00	10.45	19, 30, 45 = 75	

Signature of Site In-Charge.

25.5.2024



Signature of Engineer in-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 5th, Bijoynagar, Naihat, 24PGS (N) W.B. Pin-743165

Type of Boring: Auger & Casing

JOB Name: 401/221/132KV S/S

CLIENT: AEGCL

Dia. of Hole: 150mm/NX

Depth in Mtr: 15.0 (N)

Location No: BH-06

Commenced On: 27-05-2024

RL:

Completed On: 29-05-2024

Ground Water: 1.50 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.I

DESCRIPTION	DEPTH(M)		Thickness(Mtr)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth		TCR (%)	RQR (%)
Very dense dark grey medium to bedded sand with mica & gravels.				AS-7	11.00			
				US-5	11.00 - 11.45	SLP		
				DS-8	11.50			
				DS-9	12.00			
				SPT-6	13.00 - 13.25	47, 55 for 10cm	>100	
				DS-10	13.50			
		15.00		SPT-7	15.00 - 15.20	53, 50 for 5cm	>100	

Signature of Site in-Charge.

Signature of Engineer in-Charge.



Signature of Engineer in-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No. Bijoynagar, Naihati, 24PG5 (N) W.B Pin-743165

Type of Boring: Auger / well

OB Name: 200/220/132 KV S/S

CLIENT: ASSCL, Rangia, Assam

Dia Of Hole: 150mm/NX

Depth in Mtr: 15.00 (M)

Location No: B-10-07

Commenced On: 20-05-2024

At:

Completed On: 22-05-2024

Ground Water: 2-25 (M)

D=Disturbed Sample, U=Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH(M)		Thickness(m)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES	
	From	To		Type	Depth		RCR (%)	RQP (%)
Sap 1 (a) 12m from surface Brownish grey silty clayey layer with mica	0-00			DS-1	0-00			
				UDS-1	1-00	1-45		
				DS-2	1-50			
				SPT-1	2-00	2-45	22.2	4
Medium dense dark grey silty fine to medium sand with mica	3-00	3-00	3-00	SPT-2	3-00	3-45	14.5	10
				UDS-2	4-00	4-45		
				DS-3	4-50			
Some of dark grey silty fine to medium sand with mica in clasts	5-00	5-00	2-00	SPT-3	5-00	5-45	11.12	23
				UDS-3	6-00	6-45		
				DS-4	6-50			
				SPT-4	7-00	7-45	12.19	25.45
				UDS-4	8-00	8-45	SWF	
				DS-5	8-50			
				DS-6	9-00			
	10-00	5-00		SPT-5	10-00	10-45	24.39	47.36

Signature of Site In-Charge

Signature of Engineer In-Charge

SAI TOWER, BLOCK - A, 1ST FLOOR, 6A No. Bijoynagar, Naitatl, 24PGS (N) W.B Pin-743165

Type of Boring: Augure (Drilling)

JOE Name: 1107220132.M. 815

CLIENT: ARGEL, Ramon, MRS.

Dia of Hole : ± 50 micron / NK

Depth in Mtr: 12500 (M)

Location No. 1- 24-10-57

Commenced On: 20-08-2024 RE:-

Completed On:- 22-05-2024, Ground Water:- 2.25 CM)

D = Disturbed Sample, U = Undisturbed Sample, p = S.P.T.

D= Disturbed Sample, U= Undisturbed Sample, P= Photo									
DESCRIPTION	DEPTH (ft)		Thickness (in)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TER (%)	ROD (%)	
									From
very fine sand to coarse sand with mica and gravel	10.00	10.50							
				10.8.7	11.00				
				10.8.8	11.00	11.45	11.00		
				10.5.2	11.50				
				10.3.4	12.00				
				SPT. 6	12.00	13.05	17.55	7.00	
			10.3.10	13.50					
				15.00	6.57	15.00	15.20	54.50	7.00

Signal fire, of Site in Change.

Signature of Engineer In-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK-A, 1st FLOOR, GNo. Bhoynagar, Naihati, 24PGS (N) W.B Pin-743165

Type of Boring: Auger Boring JOB Name: 400/225/132KV, S-15

CLIENT: ARCEL - (Rangia, 12.5 km)

Dia Of Hole : 150mm/NX.

Depth in Meter: 15.50m

Location No: EX-100-08

Commenced On: 22-03-2024

RL:-

Completed On: 24-05-2024

Ground Water: 1.60 (M)

D= Disturbed Sample; U= Undisturbed Sample, Per P.T

DESCRIPTION	DEPTH (M)		Thickness (M)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	RQD (%)	
					From				To
Medium stiff to stiff dark brownish grey to black grey silty clay part of silt with mica.	0.00			OS-1	0.50				
				US-1	1.00	1.45			
				OS-2	1.50				
				SPT-1	2.00	2.45	2.3, 3.8		
				SPT-2	3.00	3.45	4.75 = 19		
				US-2	4.00	4.45			
				OS-3	4.50				
Medium to hard clay silty brown to medium brown with mica.	5.00	5.00	5.00	SPT-3	5.00	5.45	8, 12, 18 = 30		
				US-3	6.00	6.45			
				OS-4	6.50				
Very dense to extremely dense medium to coarse sand with gravel at various.	7.00	7.00	2.50	SPT-4	7.00	7.45	12, 13, 28 = 51		
				US-4	8.00	8.45	5.45		
				OS-5	8.50				
				US-6	9.00				
				SPT-5	10.00	10.45	22, 30, 44 = 80		
				OS-6	11.00				
				US-7	11.00	11.45	5.45		

Signature of Site In-Charge.

Signature of Engineer In-Charge.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No. Bhojnagar, Naitati, 24 PG 5 (N) W.B Pin-743165

Type of Boring: Auger Boring - JOB Name: 400/220/132KV, EIS

CLIENT: At. G. R. S. Rangia, Assam.

Dia. Of Hole = 150mm/No.

Dispatch in March 1956 (M)

Location No :- 72-QN-3-28

Commenced On: 02-08-2014

R1:-

Completed On: 24-05-2021

Ground Water:- 1:60 (Fol)

D = Disturbed Sample, U = Undisturbed sample, P = S, P, T

DESCRIPTION	DEPTH(M)		Thickness(Mm)	COLLECTION OF SOIL SAMPLES		COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth	N-Value	TCR	ROD
Very dense to very medium to coarse sand with rills or streaks				SP-8	11.50			
				SP-9	12.10			
				SP-6	12.00	13.20	28.56	7100
				SP-10	12.50			
		15.00		SP-7	15.00	15.20	55.53	7100

Signature of Site Co-Chair:

Signature of Engineer In-Charge.

P.K.DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6 No. Bijoynagar, Nathati, 24 PGS (N) W.B Pin-743165

Type of Boring: *Augurboring* JOB Name: *403/520/13220/2/5*

CLIENT: *REC. CL., Rangia, (Assam).*

Dia Of Hole: 150mm/NX

Depth in Meter: 15.00 (M)

Location No: *24-103-09*

Commenced On: 25-05-2024

RE:

Completed On: 27-05-2024

Ground Water: 1.60 (M)

D = Disturbed Sample, U = Undisturbed Sample, P = S.P.T

DESCRIPTION	DEPTH (M)		Thickness (m)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TER (%)	REID (%)	
					From				To
Medium to silty Brown to grey to medium grey silty clay (clay of silt with mica)	0.00			DS-1	0.30				
				UDS-1	0.90	1.45			
				DS-2	1.50				
				SPT-1	2.00	2.45	2,3,2,6		
Medium to coarse sand grey silty fine to medium sand with mica	3.00	5.00	2.00	DS-2	3.45	3.95	5,6,8,14		
				UDS-2	4.30	4.45			
				DS-3	4.50				
Coarse to medium grey silty fine to medium sand with mica & gravel	5.00	7.50	2.50	SPT-2	5.00	5.45	5,7,16,25		
				UDS-3	6.00	6.45			
				DS-4	6.50				
Coarse to medium grey silty medium to coarse sand with mica & gravel	7.50	10.00	2.50	SPT-3	7.00	7.45	15,23,31,54		
				UDS-4	8.00	8.15	slip		
				DS-5	8.50				
				DS-6	9.00				
				SPT-4	10.00	10.45	24,33,39,72		

M.
Signature of Site In-Charge.

Abir
27.5.2024



Signature of Engineer in-Charge.

P.K. DUTTA & CO.

SAI TOWER, BLOCK - A, 1st FLOOR, 6No. Bijoynagar, Melhati, 24PGS (N) W.B. Pin-743165

Type of Boring: Augur Boring JOB Name: 100-12201120-24PGS
CLIENT: B.E.C. Co., Rangpur, Assam,

Dia Of Hole: 150mm/Ø Dia Depth In Mtrs: 15.00 (M)
Location No: B.N. NO-09

Commenced On: 25-05-2024 RL:-

Completed On: 27-05-2024 Ground Water: 1.60 (M)

D= Disturbed Sample, U= Undisturbed Sample, P=S.P.T

DESCRIPTION	DEPTH (M)		Thickness (m)	COLLECTION OF SOIL SAMPLES		N-Value	COLLECTION OF ROCK SAMPLES		
	From	To		Type	Depth		TCR (%)	RQD (%)	
					From				To
Very coarse sand to silty medium to coarse sand with mica & gravels.				DS-7	11.00				
				DS-5	11.25	11.25	Ship		
				DS-8	11.50				
				DS-4	12.00				
				SPT-6	12.00	12.25	156 >100		
				DS-10	12.50		1000cm		
		12.50		SPT-7	12.50	12.75	52 >100		
							1000cm		

Signature of Site In-Charge.

Signature of Engineer In-Charge.

P.K.DUTTA & CO. Naihati, West Bengal.

TEST FORMAT

[illegible]

Signature of Site In-Charge.

Signature of Engineer-in-Charge.

Field Observation Sheet for Dynamic Cone Penetration Test			
Depth	Depth of Penetration	No. of Blows	NEER
	3100	5	
	3200	5	
3.300	3300	4	
	3400	5	
	3500	4	
3.600	3600	4	
	3700	6	
	3800	5	
3.900	3900	6	
	4000	10	
	4100	15	
4.200	4200	14	
	4300	13	
	4400	13	
4.500	4500	12	
	4600	8	
	4700	7	
4.800	4800	13	
	4900	14	
	5000	12	
5.100	5100	12	
	5200	11	
	5300	13	
5.400	5400	14	
	5500	13	
	5600	14	
5.700	5700	12	
	5800	16	
	5900	15	
6.000	6000	17	

平

10/1/2004

Field Observation Sheet for Dynamic Cone Penetration Test

Depth	Depth of Penetration	No. of Blows	NCAR
	6100	15	
	6200	18	
6.300	6300	20	
	6400	17	
	6500	34	
6.600	6600	26	
	6700	26	
	6800	26	
6.900	6900	21	
	7000	30	
	7100	30	
7.200	7200	31	
	7300	31	
	7400	32	
7.500	7500	27	
	7600	26	
	7700	28	
7.800	7800	26	
	7900	29	
	8000	27	
8.100	8100	30	
	8200	30	
	8300	26	
8.400	8400	27	
	8500	24	
	8600	22	
8.700	8700	19	
	8800	25	
	8900	21	
9.000	9000	23	

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Field Observation Sheet for Dynamic Cone Penetration Test			
Depth	Depth of Penetration	No. of Blows	MPa
	9100	27	
	9200	29	
9.300	9300	26	
	9400	30	
	9500	32	
9.600	9600	28	
	9700	31	
	9800	32	
9.900	9900	26	
	10000	24	
	10100	28	
10.200	10200	30	
	10300	28	
	10400	29	
10.500	10500	30	
	10600	29	
	10700	30	
10.800	10800	30	
	10900	28	
	11000	29	
11.100	11100	31	
	11200	32	
	11300	33	
11.400	11400	34	
	11500	34	
	11600	36	
11.700	11700	38	

SP

20.9.2011

P.K. Dutta & Co, 6 No. Bijoy Nagar, Naihati (W.B)

Plate Load Test:-

Site: Plot 400/220/172- S/C of Rangia
 Date: 25-05-2024

Dial Gauge: 0.01-25mm
 Jack Arm
 Area: 100.02 cm²

Pressure Gauge reading:-

Time	Time elapsed	Dial Gauge reading			Avg. reading	Settlement	Total Settlement
		Dg-1	Dg-2	Dg-3			

Initial reading:-

Time	Dg-1	Dg-2	Dg-3
10 kg/cm ²	0	0	0
1 min	80	80	82
2 min	85	88	90
4 min	100	98	99
6 min	110	107	109
9 min	115	108	110
16 min	120	110	112
25 min	128	115	118
36 min	135	120	122
60 min	150	133	137

Total

Pressure Gauge reading: 15 kg/cm²

Time	Dg-1	Dg-2	Dg-3
1 min	150	132	133
2 min	340	280	282
4 min	350	300	299
6 min	359	320	303
9 min	368	329	320
16 min	374	334	327
25 min	388	340	355
36 min	410	393	386
60 min	435	416	420

Total

Pressure Gauge reading: 20 kg/cm²

Time	Dg-1	Dg-2	Dg-3
1 min	445	436	420
2 min	570	553	528
4 min	577	562	537
6 min	592	575	548
9 min	610	588	562
16 min	627	616	596
25 min	680	665	650
36 min	755	748	730
60 min	782	762	748

Total

Pressure Gauge reading: 30 kg/cm²

Time	Dg-1	Dg-2	Dg-3
1 min	782	762	748
2 min	1017	982	960
4 min	1035	1013	990
6 min	1055	1030	1013
9 min	1082	1070	1056
16 min	1148	1140	1129
25 min	1170	1158	1163
36 min	1165	1156	1160
60 min	1162	1150	1150

Total

Signature of Site In-Charge

Signature of Engineer In-Charge

P.K. Dutta & Co. ENO. Bijoy Nagar, Naihati (W.B)

Plate Load Test:

Site: *Eno. 400/220/1124v 8/1 of Region*
 Date: *25-03-2024*

Dial Gauge: 0.01-25mm
 Jack Arm Area: 100.82 cm²

Pressure Gauge reading:

Time	Time elapsed	Dia. Gauge reading			Avg. reading	Settlement	Total Settlement
		Dg-1	Dg-2	Dg-3			
Initial reading :-		2.0 kg/cm ² Release					
	1 min	1155	1138	1130			
	2 min	1158	1137	1128			
	4 min	1152	1136	1128			
	6 min	1150	1133	1126			
	9 min	1150	1133	1126			
	11 min	1149	1131	1125			
	25 min	1149	1130	1121			
	36 min	1148	1120	1120			
	60 min	1146	1127	1119			
Pressure Gauge reading :- 08					Total		
	1 min	1146	1127	1119			
	2 min	1140	1120	1117			
	4 min	1139	1122	1117			
	6 min	1137	1121	1115			
	9 min	1137	1120	1114			
	15 min	1137	1120	1114			
	25 min	1135	1119	1112			
	36 min	1134	1119	1112			
	60 min	1130	1115	1110			
Pressure Gauge reading :-					Total		
	1 min						
	2 min						
	4 min						
	6 min						
	9 min						
	15 min						
	25 min						
	36 min						
	60 min						
Pressure Gauge reading :-					Total		
	1 min						
	2 min						
	4 min						
	6 min						
	9 min						
	15 min						
	25 min						
	36 min						
	60 min						
					Total		

Signature of Site in-Charge

Signature of Engineer in-Charge

FIELD PHOTOGRAPH











LOCATION MAP RANGIA SS

PROP. 132 KV NAIHATI

SH. BOUNDARY
PILLAR

PROP. RANGIA SS BOUNDARY

SH. TO (TAMULPUR NAGRIHUL ROAD)

TO TAMILPUR

SH. BOUNDARY

400KV DC BALIARAKA TO
GONDALAKHULI LINE

IN-201
(DAM)

BH-8
N:294771.6648
E:361360.9281

BR
N:2947558

B7
N:2947657

D6
N:2947513

D5
N:2947613
E:3613714

DIL-7
N:2947586.078
E:361442.5392

CBR-1
N:2947549.274
E:361318.678

BH-6
N:2947536.792
E:361351.1895

DCTP-1
N:2947501.926
E:361386.3159

BH-4
N:2947478.004
E:361390.1445

TP-1
N:2947475
E:361383

DIL-1
N:2947459.676
E:361371.9298

PLT-1
N:2947408.851
E:361402.7329

BH-2
N:2947408.57
E:361349.51

BIL-5
N:2947485.788
E:361450.7683

BH-3
N:2947393.553
E:361430.5941

R1
N:2947343
E:361247

B2
N:2947335
E:361247

B3
N:2947331
E:361400

B4
N:2947321

