

SCHEDULE FOR CONCRETE RCC AND REINFORCEMENT STEEL					
4 X 270 MW BHADRADRI TPS					
PRE TREATMENT PLANT					
Sl.No	DESCRIPTION OF EQUIPMENT / ITEM				
1	2				
	Description	QTY		Unit	
1.0	Total Quantity of all Concrete RCC works required for entire Pretreatment plant (except Chemical house & Centrifuge Building)			CuM	
2.0	Total Quantity of all Reinforcement steel required for entire Pretreatment plant (except Chemical house & Centrifuge Building)			MT	
Notes :-					
1. Bidders Total price shall be determined after adding cost of Concrete & reinforcement Steel at following rates in his total quoted prices. a) Concrete RCC – Rs. 7000 per cum b) Reinforcement steel – Rs. 55000 per MT					

Dear Sir,

We have reviewed Specification and request you to clarify following points at earliest.

- i) Specification calls for HRSCC unit with rise rate restricted to 2.5 M/hr. It also states provision of minimum 4 Nos of Flocculator Agitator vide spec. Cl. No 6.8 and 6.9 (Page 165).

**Bidder to follow
tender specification**

We request you to review Spec. as HRSCC type unit has one Propeller unit placed at centre. For very large units, exceeding 40M dia and 20M Flocc. Zone dia Clear Water Design provides 2 additional Flocculators to improve flocculation activities. In present case dia being less than 40M, additional Flocculators are not required.

The bridge could be fixed or periphery driven type as per design of supplier.

Clear Water has supplied to BHEL periphery driven type HRSCC units at Korba (East), Koderma, Kothagudam TPP etc.

NTPC spec. also permits either type units.

- ii) Centrifuge (Cl. 12 Page 167)

**Bidder to follow
tender specification**

To feed thickened sludge to centrifuge screw pumps are required but no provision has been specified in Data Sheet. However such provision has been indicated in P & I Drawing. For clarity please clarify requirement.

- iii) Please define nature of works covered under "Minor Civil Works".

**Bidder to refer cl. 5.0 (d) page no. 9
of technical specification**

Thanking you.

Yours faithfully,

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION	BHEL REPLY
COMMERCIAL QUERIES:							
GENERAL	-	-	-	-	Kindly confirm whether separate orders are issued for Supply & Service Part.	For bidder's confirmation	Yes
GENERAL	-	-	-	-	Kindly confirm whether Road permits & Way bills for materials purchased outside Telangana shall be provided by BHEL.	For bidder's confirmation	Yes
GENERAL	-	-	-	-	Whether Service Tax applicable on Services part would be paid extra . Also kindly inform where the Service tax amount on Service Part to be indicated in the Price Bid Format.	For bidder's confirmation	Please refer SCC & GCC and Follow price format
GENERAL	-	-	-	-	Form C shall be issued by BHEL on Quarterly basis before the end of subsequent Quarter.	For bidder's confirmation	Please refer SCC and GCC
GENERAL	-	-	-	-	Kindly provide us BHEL VAT registration number for Telangana.	For bidder's confirmation	Shall be provided after PO
GENERAL	-	-	-	-	For Imports purchases kindly let us know whether BHEL would sign High Sea Sales agreement and also to provide applicable certificate , Import & Export registration codes.	For bidder's confirmation	No as the import of item (if any), import formalities and other import related activities are in contractor scope
GENERAL	-	-	-	-	Kindly confirm Insurance coverage during transit, storage, erection & commissioning is under the scope of BHEL and hence Insurance premium costs would not be in the Scope of Contractor.	For bidder's confirmation	Kindly refer to GCC
GENERAL	-	-	-	-	Any concessions / Benefits /Exemptions on Taxes & Duties would be available for this job.	For bidder's confirmation	Please refer SCC and GCC
GENERAL	-	-	-	-	If single order is issued for the Price Schedule , BHEL shall countersign in the Purchase Order.	For bidder's confirmation	Separate POs shall be placed for Supply, Services and Mandatory Spares
GENERAL	-	-	-	-	Please confirm all Civil works is not envisaged in this contract.	For bidder's confirmation	Bidder to follow technical specification.
GENERAL	-	-	-	-	Kindly inform us whether Service Tax (Reverse Charge) applicable on freight would be reimbursed or it should be loaded in the Price Bid.	For bidder's confirmation	Freight inclusive of service tax to be quoted, refer price format
GENERAL	-	-	-	-	If two separate orders are issued for Supply & Services, TDS under telangana VAT would not be applicable. For supply part Tax invoice would be submitted and for Service Part , Service Tax invoice would be submitted. Hence Running Bills would not be submitted.	For bidder's confirmation	Please refer SCC and GCC
GENERAL	-	-	-	-	Please confirm VAT registration under Telangana would not be required for the Contractor since Supply invoice would be submitted using Tamil Nadu VAT / CST registration since all the materials would be purchased outside the state of telangana	For bidder's confirmation	That is in vendor scope and hence check with your tax authorities
GENERAL	-	-	-	-	Whether the Billing Schedule of the order be jointly signed by Owner and Contractor for the contract price.	For bidder's confirmation	Shall be finalised after PO

GENERAL	-	-	-	-	Kindly indicate us whether Octroi and Entry Tax are applicable in the state of Telangana. If applicable whether same would be reimbursed by BHEL.	For bidder's confirmation	Please refer SCC
GENERAL	-	-	-	-	Please confirm if Any increase in the rates of tax on implementation of GST, any Change in law & Change in rates of tax on a subsequent date after the submission of bid and on issuance of work order would be to BHEL account. Such additional taxes would be reimbursed by BHEL.	For bidder's confirmation	Please refer SCC and GCC
PROCESS QUERIES:							
Technical Specification for Pre Treatment Plant	SPECIFICATION NO.PE-TS-411-158A-A00 1 / Section-IA,Rev-00	17.0.d)	18/531	If the total quantity of reinforcement steel and concrete during contract execution is found to be more than the quantities quoted at tender stage, the additional cost for excess quantity of reinforcement steel and concrete shall be deducted from the bidder's payments as per the rates specified in the NIT. No benefit will be given to Bidder, in case of reduction in actual quantity of reinforcement steel and concrete with respect to the quantities quoted in bid evaluation.	Please clarify where the civil steel and cement quantity are to be quoted as there is no provision in Price Bid.	For bidder's confirmation	Format attached. Bidder to submit the duly filled in format along with offer.
Technical Specification for Pre Treatment Plant	SPECIFICATION NO.PE-TS-411-158A-A00 1 / SECTION-IA	16.0	169/531	One no. Pressure Sand Filter for potable water system along with instrumentation, valves, fittings, piping etc. as per flow diagram of pre-treatment plant	Please confirm us the inlet parameter of the potable water which is the feed to the PSF.	To know the inlet water parameter to PSF	PSF shall be located outside Chemical house. Bidder to terminate the pipe as per TP given in tender specification. Capacity of PSF shall be 25 m3/hr instead of 10 m3/hr. Outlet pressure of potable water transfer pump 5.1 kg/cm2 however PSF to be design for minimum 8 kg/cm2
Technical Specification for Pre Treatment Plant	SPECIFICATION NO.PE-TS-411-158A-A00 1 / SECTION-IA	16.16.1,9.7.2	170/531,168/531	Type-Centrifugal Twin Lobe Type	Please confirm the type of blower as only twin lobe blower is used for sludge sump and filters and centrifugal types are not used.	For bidder's confirmation	Bidder to follow technical specification.
Technical Specification for Pre Treatment Plant	SPECIFICATION NO.PE-TS-411-158A-A00 11	Plot plan	183/531	Plot plan	Please clarify the location of the Chlorination plant, Filtered water overhead tank and chemical house.	For bidder's confirmation	Location of PTP already indicated in the plot plan. Bidder also to refer terminal point given in section IA of tender specification.
General	-	-	-	-	Please confirm whether piping from Filter Water OHT to Chlorination plant is in the scope of Bidder. If so, please provide us the distance.	For bidder's confirmation	Bidder to follow technical specification.

General	-	-	-	-	Please confirm the location of Potable Water plant filter in the plot plan.	For bidder's confirmation	PSF shall be located outside Chemical house.
ELECTRICAL QUERIES:							
PE-TS-411-158A-A001	1.ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR(FOR EPC PROJECTS) 2.ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR (FOR EPC PROJECTS)		186/531 189/531	PACKAGES : DM/ PTP/ CHLORINATION/ ETP/ CWTP/STP PACKAGE: PRE-TREATMENT PLANT	The two scope matrix are contradictory.Kindly confirm which specification has to be followed	For bidder's confirmation	Bidder to note that page no. 184 to 186 Electrical scope between BHEL and vendor (For EPC projects) shall be folowed for complete PT plant however page no. 187 Standard Electrical scope between BHEL and vendor (For EPC projects) shall be followed for electric hoist only applicable for PT plant.
PE-DM-411-145-1900	PLC configuration PTP System		197/531	Back Up Panel & Control Desk,RIO panel	The Bidder has understood that there is no requirement of Back Up Panel or Control Desk or RIO panel as it is not shown in the PLC Configuration (PE-DM-411-145-1900) . Kindly confirm.	For bidder's confirmation	Bidder to follow technical specification.
PE-TS-411-145-I	Control & Instrumentation		445/531	CABLE BOQ	The Bidder has understood that the 'Cable BOQ' is not in the scope of Bidder and same will not be quoted. Kindly confirm	For bidder's confirmation	Scope of cable shall be as per Electrical scope between BHEL and vendor. The referred table of Cable BOQ is given for information of applicable cable types for this project.
CIVIL QUERIES:							
GENERAL					Please provide us the soil report for quoting the cement and steel quantity.	For bidder's confirmation	Enclosed as Annexure A.
GENERAL					Please provide us the civil technical specification for quoting the cement and steel quantity.	For bidder's confirmation	Civil specification included in tender specification is sufficient for qouting cement and steel qty.

CLIENT - BHEL BHADRADRI
PROJECT- 4 X 270MW BHADRADRI THERMAL POWER PLANT
PLANT- PRE-TREATMENT

VOLUME	SECTION	CLAUSE NO	PAGE NO	SPECIFICATION	CLARIFICATION	BHEL REPLY
TECHNICAL						
IIB	IA	14	14 of 531	Control philosophy	Motor operated sluice gate is not part of our scope. Please confirm.	Bidder to follow tender specification.
IIB	IA	15	16 of 531	Vertical pump self lubrication.	Pumps for clear water application shall be self-lubricating type but the pumps for handling effluent containing solid particle shall be external lubricating type. Please confirm.	Bidder to note that the provision for external lubrication arrangement as required for the pumps handling effluents containing solid particles shall be in the scope of bidder.
IIB	IA	6	167 of 531	Data sheet for Pretreatment plant - HRSCC	Please confirm the net output capacity of clarifier since there is variation in flowrate as per the datasheet, technical guarantees (pg No 114 - 531) & as per Plant water system P&ID.	Net output of each clarifier shall be 1950 m3/hr
IIB	IA	6	167 of 531	Data sheet for Pretreatment plant - HRSCC	Please specify whether there is any restriction based on retention time in clarification zone? If yes, please specify the retention time in clarification zone.	Bidder to note that the minimum retention time for flocculation zone shall be 30 minutes and for clarification zone shall be 60 minutes.
IIB	IA	PE-DG-411-158-A001	179 of 531	Flow diagram for PT	Please confirm whether Clariflocculator is to be offered as per flow diagram OR HRSCC is need to be offerd as per Technical data sheets.	Bidder to follow tender specification.
IIB	IA	PE-DG-411-158-A001	179 of 531	Flow diagram for PT	We envisage to feed thickened sludge directly to centrifuge unit via centrifuge feed pump hence, avoiding thickened sludge sump. Please confirm.	Bidder to follow tender specification.
IIB	IA		181 of 531	Plant water system P&ID	As per the P&ID all the civil, electro- mechanical works of the clarified water stoarge tank is excluded from our scope except DM supply pumps. Please confirm.	Bidder to follow tender specification.
IIB	IA		182 of 531	Clarified water pump house drawing	1 No. portable stool cum ladder for access to top bearing of motor is & puddles ,handrailing requirement for clarified water storage tank is not part of our scope. Please confirm.	Bidder to follow tender specification.
IIB	X	2.00.00	220 of 531	Codes & Standard	IS: 1710 standard resembles to Vertical turbine pumps & not for centrifugal type. Hence, vertical centrifugal pumps shall be selected as HI standard. Please confirm.	Biddet to follow relevant standard.

IIB	X	4	243 of 531	Design,Manufacture, Fabrication Erection	The MOC of piping for river, Clarified, Filterd water shall confirm to Mild steel/carbon steel. Please confirm.	Bidder to note that MOC of pipe under different services shall be as per clause number 4.03.00, page number 241 to 243 of tender specification.
					The MOC of piping for instrument air shall be SS 316 Sch10. Please confirm.	Bidder to note that MOC of pipe under different services shall be as per clause number 4.03.00, page number 241 to 243 of tender specification.
					The MOC of piping for chemicals Like alum,Poly & lime shall confirm to CPVC Sch 80 / CSRL with ball valve as per tender specified MOC. Please confirm.	Bidder to note that MOC of pipe under different services shall be as per clause number 4.03.00, page number 241 to 243 of tender specification.
ELECTRICAL & INSTRUMENTATION						
IIB	IB		184 & 187	SPECIFIC REQ OF ELECTRICAL	As per tender we have reviewed two different scope matrix for PT.We have considered final scope matrix as per electrical scope between BHEL and WTP bidder ref pg 184. Please confirm the same.	Bidder to note that page no. 184 to 186 Electrical scope between BHEL and vendor (For EPC projects) shall be folowed for complete PT plant however page no. 187 Standard Electrical scope between BHEL and vendor (For EPC projects) shall be followed for electric hoist only applicable for PT plant.
IIB	D		327	PLC DATA SHEET-REMOTE I/O PANEL	We don't envisage any requirement of separete RIO panel for this package.	Bidder to follow tender specification.
IIB	D	3.4.1	319 & 327	No of channel per card	As per tender there is some ambiguity in channel density.At present we have considered AI/AO- 8 channel density. Please review.	Bidder to follow tender specification.
IIB	D		326 & 196	LVS	At present we have not considered any LVS other that OWS & EWS and Laptop as per data sheet & PLC configuration.	Bidder to follow tender specification.
IIB	ANNEX-VI	PLC-vi	132	MANDATORY SPARES-PLC- Electric pnumatic converters	We have not considered the same which are not applicable.	Bidder to follow tender specification.
IIB		3.9.1	321 & 196	UPS BACK UP TIME	Please confirm the UPS back up time for estimation purpose.	2X60 min power back up.

IIB	D		89	Vendor list for PLC	We request you to please provide vendor list for relevant PT package .	Bidder to follow tender specification.
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**4X 270 MW BHADRADI THERMAL POWER PROJECT
TECHNICAL SPECIFICATION FOR PRETREATMENT PLANT
(Specification No PE-TS-411-158-A001)**

**TECHNICAL PREBID QUERIES
(SCHEDULE OF PREBID CLARIFICATION)**

S. NO.	VOLUME	SECTION	CLAUSE NO	PAGE NO	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION	BHEL Reply
1	II-B II-B	I-A II-A	2.0, Iviii. 1.0, 7.0	7 199	Hydraulics of the complete pretreatment plant shall be designed to take an occasional overloading of 20% over the design flow	Clarification required : We are considering this 20% design margin to relate to relating to design of piping, launders , hydraulic levels etc only. However, wish to know whether this design margin should apply also to the sizing of equipment, including pumps and tanks	If all equipment and tanks are designed applying this margin, the unit sizes will have to be increased	Bidder to follow technical specification.
2	II-B II-B	I-A I-A	2.0, Iv 5.0, i)	7 9	Broad Scope of supply - Monitoring Gadgets , instruments and equipment required for commissioning&maintenance (Till PG test and Plant Handover) Monitoring gadgets, instruments and equipment required for maintenance (Till PG and Plant Handover)	Clarification required : What are the specific types of monitoring gadgets , instruments and equipment referred to, and their functionality.	Depending on the type of gadgets instruments and equipment required, procurement will be considered	Bidder to follow technical specification.
3	II-B	I-A	6.0, b)	9	Terminal Point - Service water and Instrument Air	Clarification required : Please specify the gauge pressure and line size of service water and instrument air at the inlet terminal point	Pipeline size/type , instruments type etc, selected will depend on these design values	Service water connection 50 NB and 25 NB Instrument air supply at 5 to 7 kg/cm2 (g) shall be provided by BHEL at terminal point.
4	II-B II-B	I-A I-A	Clause 6.0, c) P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0	9 177	Terminal Point - Potable Water for PSF 10 from PT plant chemical house at flow of 10m3/hr at a pressure of 10Kg/cm2	Clarification required : Does the potable water flow and pressure refer to the feed to the feed to the PSF feed flow . The terminal point (TP) location is 10 m from the Chemical house. What is the distance of TP to the PSF and proposed tentative location of PSF with respect to chemical house . Is the indicated pressure value expressed as gauge or absolute pressure . Elevation of Filtered Water Overhead tank over FGL	This will help detrmine PSF t and outlet line length and pressure spec required.	PSF shall be located outside Chemical house. Bideer to terminate the pipe as per TP given in tender specification. Capacity of PSF shall be 25 m3/hr instead of 10 m3/hr. Outlet pressure of potable water transfer pump 5.1 kg/cm2 however PSF to be design for minimum 8 kg/cm2
5	II-B II-B II-B II-B	I-A I-A I-A I-A	6.0, c) Data sheet16.2 ID For Plant Water System Plant - Drg No PE-DG-411-172-N001 R-0 P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0	9 167 179 177	Terminal Point - Potable Water for PSF 10 from PT plant chemical house at flow of 10m3/hr at a pressure of 10kg/cm2 PSF Design flow (Net output) : 10M3/hr for plant potable water as per PSF data sheet . PSF Inlet 8M3/hr and 20 m3/hr (Filling Rate) , PSF Feed Pump is Potable Water Pump capacity is 25M3/hr as per Plant Water System P&ID .	Clarification required : What is the distance of PSF inlet Terminal point from the PSF. What is PSF inlet flow of 8 m3/hr and 20 m3/hr ,and why does this not match with PSF design net output capacity of 10m3/hr. Kindly clarify. Kindly also indicate the total designflow out from PSF to the potable water tanks and design water flow from the overhead to the raw water chlorination plant .	The discrepancy in the flow data needs to be clarified to enable determination the design basis of the PSF and the overhead filterwater tank.	Refer BHEL reply for sl. No. 4.0 above.
6	II-B	I-A	P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0	177	Potable water chlorination point is indicated in the inlet of the PSF unit	Clarification required : Should the potable chlorination point be located at the outlet of the PSF in the inlet line to the potable water storage tank	This would reduce the chlorine consumption, as with the present configuration, the feed to the overhead filtered water tank is also being chlorinated. Further , the dilution water for chemical preparation will have residual chlorine levels, which can affect the chemical preparation	Location of chlorine dosing point shall be decided during detailed engineering.
7	II-B	I-A	P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0	177	Dotted lines indicated at PSF outlet	Clarification required : What do these dotted lines represent? Kindly provide complete legend sheet , including ffor instrumentation and piping	Clarity required	Bidder to refer note-10 of P&ID.

8	II-B II-B	I-A II-A	P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0 Clause 1.5,ii)	177 201	As per P&ID the overflow line from the Overhead Filter Water tank is indicated as taken to the Clarifier Sludge Sump. Further, as per the Chemical House Overflow and Drain Disposal System in section II-A, "Overflow from water overhead tank shall be led to the inlet channel of the clarifiers "	We suggest that the overflow from the Overflow Filter Water tank be taken to the Clarified Water Storage Tank . Kindly confirm	This would avoid unnecessary dilution of the clarifier underflow sludge and avoid hydraulic overloading of the clarifier units .	Overflow line shall be led to clarified water storage tank.
9	II-B II-B	I-A I-A	Annexure III, Clause I,1,a) Annexure VIII Raw Water Analysis	112 144	As per Annexure III-"Effluent quality at the outlet of the clarifiers shall be guaranteed for the following: Iron content : less than 0.3 mg/l " As per Annexure VIII, the Raw Water Analysis the iron content is indicated as traces.	It is assumed that the raw water iron level , which is indicated as in traces will be less than 0.3 mg/l . Kindly confirm	As the inlet raw water iron content is less than the desired treated clarified water iron content of 0.3 mg/l , then treatment for iron removal is not required in the plant	Noted.
10	II-B	I-A	Annexure VIII Clarified Water Analysis	144	Clarified Water Analysis Note - The other parameters I clarified water shall be remaining unchanged as present in Raw Water	If chemicals , lime and alum are dosed, then the chemical composition of the treated clarified water is expected to differ from that of the raw water for parameters such as Ca, Mg, hardness, sulfate, TDS , hardness etc	Components of the dosed chemicals get added to the water, changing the chemical composition and TDS levels	Note indicated in Annexure VII "Note: The other parameters in Clarified water shall be remaining unchanged as present in Raw Water" stands deleted.
11	II-B	I-A	P& ID For Pretreatment Plant - Drg No PE-DG-411-158-A001 R-0	177	The filtered water from the overhead tank is taken to the Raw Water Chlorination Plant	Kindly indicated the design water flow rate to the Raw Water Chlorination Plant	Value is required to size the overhead tank and the PSF	Flow to RW chlorination plant shall be 10 m3/hr.
12	II-B	II-A	Clause 1.3 xiii)	201	Sludge removal design shall consist of central sludge area with rotating pickets and backflush arrangement for proper control of sludge accumulation at the bottom.	Kindly explain the backflush arrangement indicated	Clarity required	Bidder to follow technical specification.
13	II-B	I-A	Clause 12.3	167	Lining material of scraper : Tiles	Kindly further clarify the required MOC of the tiles and necessity of the the same	Clarity required	Bidder to follow technical specification.

**TELANGANA STATE POWER
GENERATION CORPORATION LIMITED
(TSGENCO)**

4X270 MW BHADRADRI TPS

**GEOTECHNICAL INVESTIGATION REPORT-
BOP AREA**

DOCUMENT NO. PE-DC-411-602-C001

VOLUME - 8



**BHARAT HEAVY ELECTRICALS LIMITED
PROJECT ENGINEERING MANAGEMENT
NOIDA-201301**



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**GEOTECHNICAL INVESTIGATION REPORT
FOR THE PROPOSED (4 X 270 MW)
BHADRADRI THERMAL POWER PROJECT**

**VOLUME - 8
FOR BOP AREA**

Customer :

**Telengana State Power Generation
Corporation
(TS GENCO)**

EPC Contractor :

**Bharat Heavy Electricals Limited
(BHEL)**

Job No. : **G(H) 1658(8)**

Date : 27.08.15

**GEOTECHNICAL INVESTIGATION REPORT FOR THE
PROPOSED (4 X 270 MW) BHADRADRI THERMAL POWER
PROJECT TELENGANA
VOLUME - 8
FOR BOP AREA**

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GEOTECHNICAL INVESTIGATION REPORT FOR (4 X 270 MW)
BHADRADRI THERMAL POWER PROJECT TELENGANA
PREAMBLE

Telangana State Power Generation Corporation (TS GENCO) has proposed to install 4 x 270 MW Bhadradi Thermal Power Project in Manuguru, District Khammam, Telangana State and the job was awarded to M/s Bharat Heavy Electrical Limited. To design the foundation system of Plant structures/ buildings, a detailed geotechnical investigation was required to be conducted. M/s Bharat Heavy Electrical Limited, in turn awarded the job to M/s Nagadi Consultants Pvt. Ltd. To obtain adequate information regarding the subsoil/rock conditions, for the design of the substructures for the proposed structures of the Power Plant, a detailed geotechnical investigation programme has been undertaken at the site of the proposed plant for which a geotechnical investigation report has been prepared.

The scope of work comprises of sinking 136 nos. boreholes. The scope also included 10 nos. plate load tests, 10 nos. cyclic plate load tests, 47 nos. electrical resistivity tests, 20 nos. dynamic cone penetration tests, 20 nos. trial pits, 32 nos. field permeability tests, 8 nos. pressure meter tests and 12 cross hole shear tests.

This geotechnical investigation report has been prepared in 12 Volumes which are as follows:

- Volume - 1 Geotechnical investigation report for Chimney Area
- Volume - 2 Geotechnical investigation report for ESP Area
- Volume - 3 Geotechnical investigation report for Mill and Boiler Area
- Volume - 4 Geotechnical investigation report for Power House and Transformer Yard Area
- Volume - 5 Geotechnical investigation report for ID Fan Area
- Volume - 6 Geotechnical investigation report for Switchyard Area
- Volume - 7 Geotechnical investigation report for Cooling Tower Area
- Volume - 8 Geotechnical investigation report for BOP Area
- Volume - 9 Geotechnical investigation report for CHP/ AHP Area
- Volume - 10 Geotechnical investigation report for Electrical Resistivity Area
- Volume - 11 Geotechnical investigation report for Permeability and CBR Test Area
- Volume - 12 Geotechnical investigation report for PMT & CHST Tests

This is Volume - 8 of the report pertaining to the BOP Area



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Job No. : **G(H) 1658(8)**

Sheet No. : **1 of 117**

**GEOTECHNICAL INVESTIGATION REPORT FOR
POWER HOUSE AND TRANSFORMER YARD AREA
(4 X 270 MW) BHADRADRI THERMAL POWER PROJECT
TELENGANA**

1.0 INTRODUCTION

1.1 This volume - 8 of Geotechnical investigation report pertains to the investigations carried out for BOP Area of the Thermal Power Project.

2.0 PROJECT DETAILS

2.1 Site Location

2.1.1 The site of the proposed Thermal Power Plant is located near Ramanujavaram Village adjacent to Burgampadu Etunagaram Road.

2.1.2 The site is located at a distance of about 20 km from Manuguru Railway Station.

2.2 Site Topography

2.2.1 The site had earlier been used for agriculture and at the time of commencement of the investigations, standing crops were observed in some portions of the site. A few nallahs were observed to be passing through the site which apparently were used to provide irrigation water to the fields for crop cultivation/agriculture.

2.2.2 The Godavari river was observed to flow in a North-South direction to the east of the site at a distance of about 2km from the main plant area.

2.3 Geology of the Site

2.3.1 The geology of the site has been assessed based on the published detailed geological studies carried out by Geological Survey of India (GSI).

2.3.2 The rocks encountered at the site belong to the Gondwana Supergroup of an older Triassic age. More specifically, the rocks belong to the Kamthi formation which primarily consists of red and grey argillaceous sandstones, conglomerates and shales. These are overlain by the Maleri formation to the North.

2.3.3 The Kamthi formation extends along the Wardha -Godavaru valley which includes areas in Maharashtra and Telengana.



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2.3.4 The rock encountered at the present site is shale in a weathered condition. The rock is generally reddish brown in colour with occasional grey and white colours also encountered. The bedding planes of the shale rock encountered at the present site are generally horizontal.

2.4 Seismic Zone

2.4.1 The present site is located in the Seismic Zone III which is the zone of medium seismicity, as per the seismic zoning map of India given in BIS code IS:1893 (Part1)-2002.

3.0 OBJECT OF GEOTECHNICAL INVESTIGATION

3.1 For designing the foundation system of the proposed structures, the following data are required :

- a) Type of foundation
- b) Depth below the ground level at which the foundation system is to be laid.
- c) Allowable bearing pressure at the foundation level.

3.2 To determine the above factors, the following information shall be required:

- a) The subsoil profile indicating thickness of the various soil/rock strata, to a depth within the influence zone below the foundations
- b) Engineering properties of the soil/rock strata at various levels
- c) Physical characteristics of the soil/rock strata
- d) Variation of strength of soil/rock strata with depth

3.3 For evaluating the above parameters, field investigations and laboratory investigations on the soil/rock samples collected during the field investigations, have been carried out.

3.4 The results from these investigations have been analysed to provide the recommendations for the design of foundations.

4.0 SCOPE OF WORK

4.1 The scope of work comprises of sinking 22 nos. boreholes down to a maximum depth of 15m below the existing ground level, conducting 8 nos. dynamic cone penetration tests down to depth of refusal/ rock strata, conducting 4 nos. Trial Pits.

5.0 FIELD INVESTIGATIONS

5.1.1 Field investigations had commenced from 6th January 2015 and have been completed.

5.1.2 A geotechnical investigation layout showing test locations is attached in the report as reference in fig. 1.



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5.2 Boreholes

- 5.2.1 All the boreholes had been conducted down to the stipulated depths.
- 5.2.2 All the boreholes of 150mm diameter had been progressed by Augering down to the refusal depths i.e. depths at which the boreholes could not be progressed by this method.
- 5.2.3 Drilling in rock/ refusal strata had been carried out in all the boreholes, to get adequate information regarding the rock strata encountered.
- 5.2.4 Drilling in rock / refusal strata had been carried out beyond the depths of refusal strata down to a maximum depth of 15m below the existing ground level, by rotary drilling machine using bits of Nx size.
- 5.2.5 The entire investigation carried out is presented in Twelve (12) Volumes as listed below:
- Volume - 1 Geotechnical investigation report for Chimney Area
 - Volume - 2 Geotechnical investigation report for ESP Area
 - Volume - 3 Geotechnical investigation report for Mill And Boiler Area
 - Volume - 4 Geotechnical investigation report for Power House and Transformer Yard Area
 - Volume - 5 Geotechnical investigation report for ID Fan Area
 - Volume - 6 Geotechnical investigation report for Switchyard Area
 - Volume - 7 Geotechnical investigation report for Cooling Tower Area
 - Volume - 8 Geotechnical investigation report for BOP Area
 - Volume - 9 Geotechnical investigation report for CHP/ AHP Area
 - Volume - 10 Geotechnical investigation report for Electrical Resistivity Tests
 - Volume - 11 Geotechnical investigation report for Permeability and CBR Tests
 - Volume - 12 Geotechnical investigation report for PMT & CHST Tests

This report is Volume - 8, which presents field and laboratory test results of Boreholes, BH-75, BH-76, BH-100, BH-102, BH-103, BH-78, BH-101, BH-113, BH-114, BH-115, BH-116, BH-77, BH-88, BH-89, BH-90, BH-117, BH-118, BH-119, BH-120, BH-124, BH-125 and BH-127, conducted down to a maximum depth of 15m below the existing ground level, conducting dynamic cone penetration tests (DCPT), DCPT-2, DCPT-3, DCPT-4, DCPT-5, DCPT-6, DCPT-7, DCPT-16 and DCPT-18 and conducting Trial Pits, TP-2, TP-5, TP-17 and TP-18.



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5.2.6 The structures for BOP Area are as follows :

- a) CW - PH, Chlorination & Treatment Plant, Fuel Oil and Compressor building Area and PT Pant, DM Plant, Clarified PH& tank, Chemical lab and DH PH & Tank area
- b) ETP Area and Admin, Canteen and Fire Station building Area
- c) Fuel Oil Unloading and pressurising pump house and trench and Raw Water Reservoir Area

5.2.7 Termination depths and depth at which the refusal/ rock strata had been encountered in different boreholes are being given hereunder.

Location	BH No.	Termination	Top of the	Existing Ground	Boreholes Coordinates (m)	
		Depth (m) below EGL	Rock below EGL (m)		North	East
	BH 75	15	9.5	R.L. (+)71.29	1992938	471831
CH-PH	BH 76	15	6	R.L. (+)70.94	1992955	471868
Chlorination	BH 100	15	8	R.L. (+)68.15	1993427	471885
& Treatment	BH 102	15	6.5	R.L. (+)68.40	1993434	471839
	BH 103	15	6.5	R.L. (+)68.41	1993466	471841
Fuel Oil &	BH 78	15	6.5	R.L. (+)68.25	1993454	471973
Comp. Bldg	BH 101	15	6.5	R.L. (+)67.76	1993454	472055
PT Plant, DM	BH 113	15	6.5	R.L. (+)67.50	1993630	472214
Plant,						
Clarified PH	BH 114	15	5	R.L. (+)66.53	1993516	472221
& tank,						
Chemical Lab	BH 115	15	6.5	R.L. (+)67.10	1993633	472316
& DH PH &	BH 116	15	5	R.L. (+)66.40	1993506	472286
Tank Area						
ETP Area	BH 77	15	5	R.L. (+)71.57	1992923	471975
Admin	BH 88	15	6.5	R.L. (+)72.45	1992859	472126
Canteen &	BH 89	15	5	R.L. (+)73.30	1992806	472119
Fire Stn.						
Bldg.	BH 90	15	5	R.L. (+)72.40	1992905	472131



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Location	BH No.	Termination	Top of the	Existing Ground	Boreholes Coordinates (m)	
		Depth (m) below EGL	Rock below EGL (m)		North	East
Fuel Oil unloading and Pressurising pump House and Trench	BH 117	15	N.E.	R.L.(+) 65.96	1993610	472505
	BH 118	15	N.E.	R.L.(+) 67.08	1993553	472877
	BH 119	10	N.E.	R.L.(+) 67.01	1993643	472829
Raw Water	BH 120	10	N.E.	R.L. (+)67.35	1993800	472864
Reservoir	BH 124	15	N.E.	R.L. (+)67.12	1993776	473029
	BH 125	10	N.E.	R.L. (+)67.02	1993634	472988
	BH 127	15	N.E.	R.L. (+)69.97	1993440	473054

N.E. : not encountered

EGL : Existing Ground level

- 5.2.8 In the soil strata, Standard Penetration Tests (SPT) had been conducted at specified intervals. Disturbed soil samples recovered from split spoon samplers had been retained for identification purposes.
- 5.2.9 Undisturbed soil samples had been recovered at specified intervals, by thin walled tube samplers conforming to IS : 2132. These tubes had an area ratio of less than 10%.
- 5.2.10 The diameter of undisturbed soil samples was 100mm and the length was 450mm.
- 5.2.11 The ends of sample tubes had been sealed by wax to prevent loss / ingress of moisture. Disturbed soil samples had been enclosed in polythene bags.
- 5.2.12 In the rock strata, the rock core samples, where recovered from the boreholes had been preserved in the core boxes with proper marking on each sample and the borelogs had been maintained appropriately.
- 5.2.13 Soil / rock samples had been transported to the laboratory for testing purposes.
- 5.2.14 Ground water table had not been encountered in any of the boreholes.



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5.3 Dynamic Cone Penetration Test

- 5.3.1 The stipulated scope of work consists of conducting dynamic cone penetration tests with circulation of bentonite slurry at seven locations.
- 5.3.2 Dynamic cone penetration tests (DCPT2, DCPT3, DCPT4, DCPT5, DCPT6, DCPT7, DCPT16 and DCPT18) had been conducted down to the refusal strata below the existing ground level.
- 5.3.3 The reduced level and the coordinates of dynamic cone penetration tests are as follows

DCPT No.	Existing Ground Level (m)	DCPT Coordinates (m)	
		North	East
2	R.L.(+) 67.18	1993676	472316
3	R.L.(+) 67.40	1993579	472214
4	R.L.(+) 67.38	1993515	472198
5	R.L.(+) 64.40	1993400	472625
6	R.L.(+) 67.58	1993487	472072
7	R.L.(+) 69.11	1993493	471885
16	R.L.(+) 71.46	1992889	471867
18	R.L.(+) 71.34	1992945	471956

EGL : Existing Ground level

- 5.3.4 This test involved driving into the soil of a steel cone having a diameter of 65mm and an apex angle of 60 degrees attached to rods of lesser diameter with arrangement for the drilling mud to flow through the cone, by giving blows from a 65 kg hammer falling freely through a height of 75 cm. The drilling mud is forced under pressure through the pipe and cone. The mud solution coming out of the cone rises above along the drill rod eliminating thereby the frictional resistance offered by the soil for penetration. The number of blows required for every 30cm penetration had been recorded. Such a continuous record had been maintained down to the termination depth of the test.



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5.4 Trial Pits

5.4.1 Trial pits, TP-2, TP-17 and TP-18 had been excavated down to 4m depth whereas TP-5 had been excavated down to 3m depth below the existing ground level.

5.4.2 The reduced level and the coordinates of trial pits are as follows :

TP No.	Existing	TP Coordinates (m)	
	Ground Level (m)	North	East
2	R.L.(+) 65.22	1993272	472129
5	R.L.(+) 66.93	1993437	473079
17	R.L.(+) 71.28	1992918	471900
18	R.L.(+) 71.25	1992977	471683

EGL : Existing Ground level

6.0 LABORATORY INVESTIGATIONS

6.1 Tests on Soil and Rock Samples from Boreholes

6.1.1 The soil samples brought to the laboratory had been subjected to various tests to determine the following properties :

- Type and gradation of soil
- Atterberg limits
- Density and water content
- Shear strength parameters
- Free swell index
- Swell Pressure
- Consolidation Test

6.1.2 As the rock cores, where recovered, are in a very soft and friable state, tests to determine the physical and engineering properties of the rock cores could not be satisfactorily carried out.

7.0 RESULTS & ANALYSIS

7.1 Presentation of Results

7.1.1 As specified, the results of the borehole investigations and of the laboratory investigations conducted on the soil samples collected from the boreholes, have been presented in the form of tables.



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7.1.2 The tables indicate the following:

- Standard penetration test values at various depths
- Soil description identifying the type of soil
- Grain size analysis indicating composition of subsoil
- Atterberg Limits
- Natural density and water content
- Triaxial test results
- Swell test results

7.2 Soil/Rock Profile

7.2.1 A perusal of the data presented in the tables indicates the presence of the following two soil/rock strata at the site :

- Stratum - I : Silty clay with occasional gravel
- Stratum - II : Yellowish brown to reddish brown weathered shale

7.2.2 The minimum, maximum and average depths down to which the Stratum-I (i.e. Soil Strata) has been encountered are as follows :

Borehole Nos.	Depth (m) of Soil Strata		
	below EGL		
	Minimum	Maximum	Average
BH88, BH89, BH90, BH75, BH76, BH77	5	9.5	7.25
BH78, BH100, BH101, BH102, BH103	6.5	8	7.25
BH113, BH114, BH115, BH116	5	6.5	5.75
BH117, BH118, BH119, BH120, BH124, BH125, BH127	-	-	-

7.3 Soil Composition

7.3.1 The grain size distributions of the soil samples at various depths have been presented in the form of grain size analysis curves.



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7.3.2 The variations in the grain size distributions at different levels are being given hereunder

Depth(m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	0 - 28	4 - 49	19 - 47	16 - 55
3	0 - 61	9 - 34	18 - 48	18 - 56
5	0 - 14	12 - 39	26 - 45	22 - 51
8	0 - 9	3 - 27	33 - 44	32 - 58
9.5	0 - 5	8 - 23	38 - 41	36 - 48
11	0 - 7	4 - 28	36 - 41	35 - 54
15	0	20	36	44

The above results indicate that :

- The soil generally comprises of grain size fractions from clay to silt to sand as well as gravel.
- Large variations are observed in the percentages of each grain size fraction (i.e. clay, silt, sand and gravel) thus indicating a very heterogenous grain size distribution of the soil throughout the site.
- The percentage of clay has been observed to increase with depth.

7.4 Natural Density and Water Content

7.4.1 The variations in the natural bulk densities, water contents and dry densities of the subsoil at different depths are as given here under.

Depth (m)	Bulk Density (g/cm ³)	Water Content (%)	Dry Density (g/cm ³)
2	1.65 - 2.03	4.87 - 35.10	1.40 - 1.88
4	1.84 - 2.13	13.23 - 33.63	1.56 - 1.74
6.5	1.88 - 2.11	19.7 - 34.1	1.46 - 1.66

The above results indicate the following :

- The subsoil is generally stiff / very stiff to hard silty clay down to the depths of the refusal strata.



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- b) Large variations are observed in the in-situ dry densities of the soil throughout the area of the site thus indicating significant heterogeneity in the in-situ density state of the soil.

7.5 Atterberg Limits

- 7.5.1 The Atterberg limits indicate that the soil is predominantly medium to high plastic with occasional layers of low plastic soils in between.
- 7.5.2 In the medium plastic to high plastic soil where encountered, the liquid limit varies from about 30% to 92% while the plastic limit varies from about 20% to about 48% with the Plasticity index varying from about 10 to 44.

7.6 Standard Penetration Tests Values (N-values)

- 7.6.1 The observed Standard Penetration Test values (N-values) vary between 13 and 82 in soil strata and generally in excess of 100 in case of rock strata.
- 7.6.2 These test results indicate that the silty clay subsoil is generally stiff / very stiff to hard down to the depths of the refusal strata.

7.7 Rock Conditions

- 7.7.1 The rock strata consists of Shale in a highly to moderately weathered condition down to the maximum depth investigated i.e. 15m below the existing ground level.
- 7.7.2 The colour of the shale varies from reddish to greyish.
- 7.7.3 Core recoveries in weathered Shale strata is generally nil. However, at some depths in some of the boreholes core recovery of upto 73% has been recorded.
- 7.7.4 RQD values in the weathered Shale strata is generally nil.

7.8 Compiled Soil And Rock Profile

- 7.8.1 An overview of the results of the geotechnical investigations and their analysis has been presented in the form of compiled soil and rock profile.
- 7.8.2 The above figures show the various strata encountered and their thicknesses in each of the boreholes and also gives the soil / rock composition and the observed N-values at various depths as also the core recoveries and RQD in the rock strata.



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7.9 Free Swell Index Tests

7.9.1 As significant percentages of clay have been observed in the subsoil in all the boreholes, free swell index tests have been conducted on selected soil samples at different depths and different boreholes to assess the swelling characteristics of the subsoil.

7.9.2 The results of the free swell index tests show that the subsoil has shown free swelling index varying between about 15% to 180%.

7.10 Swell Pressure Tests

7.10.1 Swell pressure tests have been conducted on selected soil samples at different depths and different boreholes to assess the level of swelling pressures generated in the subsoil.

7.10.2 The results of the swell pressure tests show that the subsoil shows swell pressures varying between about 0.13 kg/cm² to over 1.78 kg/cm².

7.11 Consolidation Tests

7.11.1 Consolidation tests have been conducted on undisturbed soil samples from various depths from different boreholes to determine the consolidation properties of the soil. The consolidation properties of the clayey soil are needed for determining the probable settlements of foundations resting on this type of soil.

7.11.2 The results of these tests have been presented in the form of plots of void ratio 'e' versus normal axial stress 'p' in sheet nos.

7.11.3 The coefficient of compressibility 'a_v' is then determined as the slope of the straight line portion of the above plot.

7.11.4 The void ratio 'e', coefficient of compressibility 'a_v' and coefficient of volume compressibility 'm_v' as determined for the tests conducted are given in the table below:

BH No.	Depth (m)	e ₀	a _v (cm ² /kg)	m _v (cm ² /kg)
BH 75	4	0.517	0.017	0.0112
BH 88	4	0.565	0.022	0.014
BH 124	6.5	0.526	0.032	0.0209



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7.11.5 The results of the consolidation tests are considered for determining the settlement of shallow foundations.

7.12 Chemical Analysis

7.12.1 The results of the chemical analysis conducted on soil samples collected from the boreholes for determining the presence of any harmful salts which can have adverse effects on construction are as follows :

Borehole No./ Depth (m)	pH value	Chloride Content (ppm)	Sulphate Content (ppm) SO ₄	Carbonate Content (ppm)	Nitrate Content (ppm)	Sulphate Content (ppm) SO ₃	Organic matter (ppm)	Alkali metals (ppm)
BH75/3	6.5	27	50	15	5	38	30	71
BH103/3	6.5	54	42	13	6	32	12	62
BH115/5	7	43	48	12	4	36	25	69
BH118/5	6.5	48	52	14	4	41	32	65
BH124/3	6.5	52	46	15	5	37	20	52

7.13 Dynamic Cone Penetration Tests

7.13.1 The results of these tests have been presented in the form of plots of number of blows per 30cm penetration vs depth.

7.13.2 These results which primarily indicate the variation in the hardness/stiffness with depth of the subsoil show close conformity with the standard penetration test values (N-values) and also show that there is no significant variation in the hardness/stiffness conditions of the subsoil at the locations of these tests in reference to those observed at nearby borehole locations.

7.14 Trial Pits (TP2, TP5 , TP17 & TP18)

7.14.1 During the excavations of trial pits the substrata had been observed to be comprising of Brownish grey to Reddish Silty clay down to the depth excavated except for Trial Pit, TP18 wherein the subsoil strata consists of Brownish silty sand beyond a depth of about 3m down to the depth excavated.



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7.14.2 Grain size distribution, water content density, atterberg limits and swelling properties of the subsoil at various levels of the trial pits have been presented in laboratory test results.

8.0 DESIGN CRITERIA

8.1 The parameters required for the design of the foundation system for the proposed structures are:

- a) Type of foundation to be adopted
- b) Depth at which the foundations have to be laid
- c) Allowable bearing pressure on the soil/rock at the foundation level

8.2 On the basis of the analysis of the results of the investigations, the required design parameters have been arrived at as given in the following sections.

8.2.1 The type of foundation depends upon the following :

- a) Subsoil/rock conditions
- b) Type of structure
- c) Configuration of loading points
- d) Loading intensities on the foundations

8.2.2 The proposed structures are of BOP Area. Considering this, medium heavy to heavy loads can be anticipated on the foundations.

8.2.3 The results of the investigations have indicated that the rock strata in the form of weathered Shale has been encountered at depths varying between about 5m and 9.5m below the existing ground level except for at the location of Raw Water Reservoir area wherein rock strata has not been encountered down to the maximum depth investigated i.e. 15m below the existing ground level.

8.2.4 Hence, the proposed structures can be supported on open foundations resting on the soil/rock strata, depending upon the requirement.

9.0 RECOMMENDATIONS

9.1 Considering the subsoil/rock conditions and the proposed structure at the present site, shallow / open foundations can be adopted for the BOP Area.

9.2 Ground water table had not been encountered in any of the boreholes.



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9.3 The recommended net safe bearing capacity values for different widths of foundations at various depths are presented below.

Location	Reference Boreholes	FGL. R.L.(+)m	Founding Strata	Depth (m) of Foundation below FGL	Net Safe Bearing Capacity (t/m ²)
Admin, Canteen, Fire Stn. Bldg. CW-PH, Chlorination and Treatment, ETP Area	BH88, BH89, BH90, BH75, BH76, BH77	71.00	Soil	2	15
			Soil	3	20
			Soil	4	30
			Soil	5	35
			Rock	6	45
Fuel Oil & Compressor building, CW-PH Chlorination and Treatment	BH78, BH100, BH101, BH102, BH103	69.00	Soil	2	15
			Soil	3	18
			Soil	4	20
			Soil	5	35
PT Pant, DM Plant, Clarified PH & Tank, Chemical Lab, DHPH & Tank Area	BH113, BH114, BH115, BH116	67.00	Soil	3	25
			Soil	4	30

F.G.L. : Finished Ground Level

Remarks / Notes

- In case any loose pockets are observed at the proposed founding level, the same shall be excavated out and filled up with PCC upto the founding level.
- Foundations resting in rock strata shall be embedded 0.3m into the rock strata.

9.4 The soil at site down to about 2m depth below the natural ground level is generally high swelling soil. This soil shall not be used for filling and backfilling purposes. However, below 2m depth, low to medium swelling soil available at site, on confirmation by conducting suitable laboratory tests, can be used for filling/ backfilling purposes.

9.5 The modulus of subgrade reaction (K-value) can be obtained as dividing net safe bearing capacity by corresponding settlement.



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9.6 Chemical tests were carried out on a few soil samples so as to detect the pH value, Sulphate and Chloride contents. The values are on the safe side as they are well within the acceptable limits. Accordingly, either Ordinary Portland cement or Portland slag cement or Portland Pozzolana cement can be used for the purpose.

10.0 Appendices

10.1.1 The typical calculation of allowable bearing pressure has been shown in Appendix - A of this report.

10.1.2 A list of IS Codes referred for providing the recommendations and that which might be required to implement the same is also enclosed in this report in Appendix - B.

10.2 Special Note

If any loose pockets and/or soil strata are observed at the proposed foundation level, the same shall be removed and filled with lean concrete. Foundations can subsequently be placed over such a prepared surface.

11.0 LIMITATIONS

This Geotechnical investigation has been carried out at locations in the site chosen by the client so as to represent the entire site. The recommendations provided in this report are hence valid only for these test locations.

Dr. N. Santosh Rao

Technical Director

For Nagadi Consultants Pvt. Ltd.,

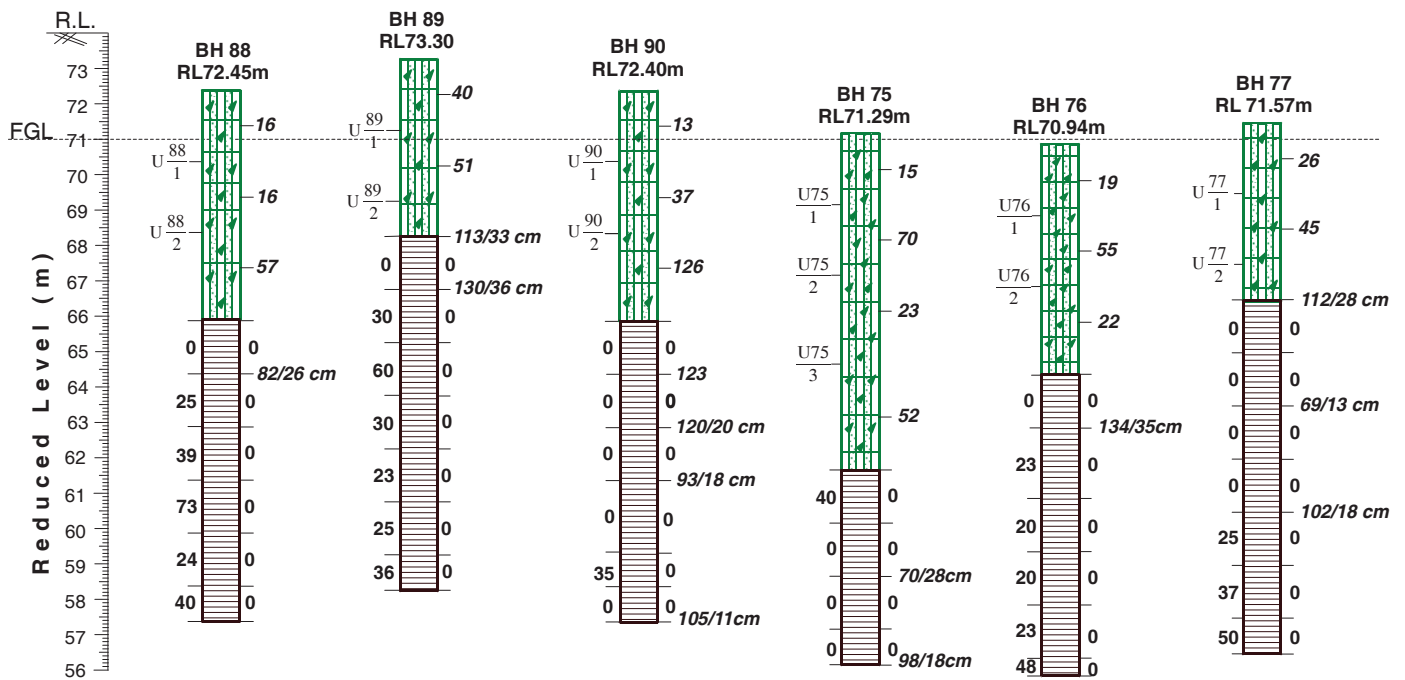


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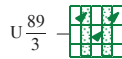
LEGEND



Silty Clay



Core Recovery



Undisturbed Sample No 3 in Borehole BH 89



Soft Weathered Rock (Shale)



0 RQD



13 N Value (Observed)



105/ 11 cm N-value : No. of Blows / Penetration

COMPILED SOIL & ROCK PROFILE BOP Area

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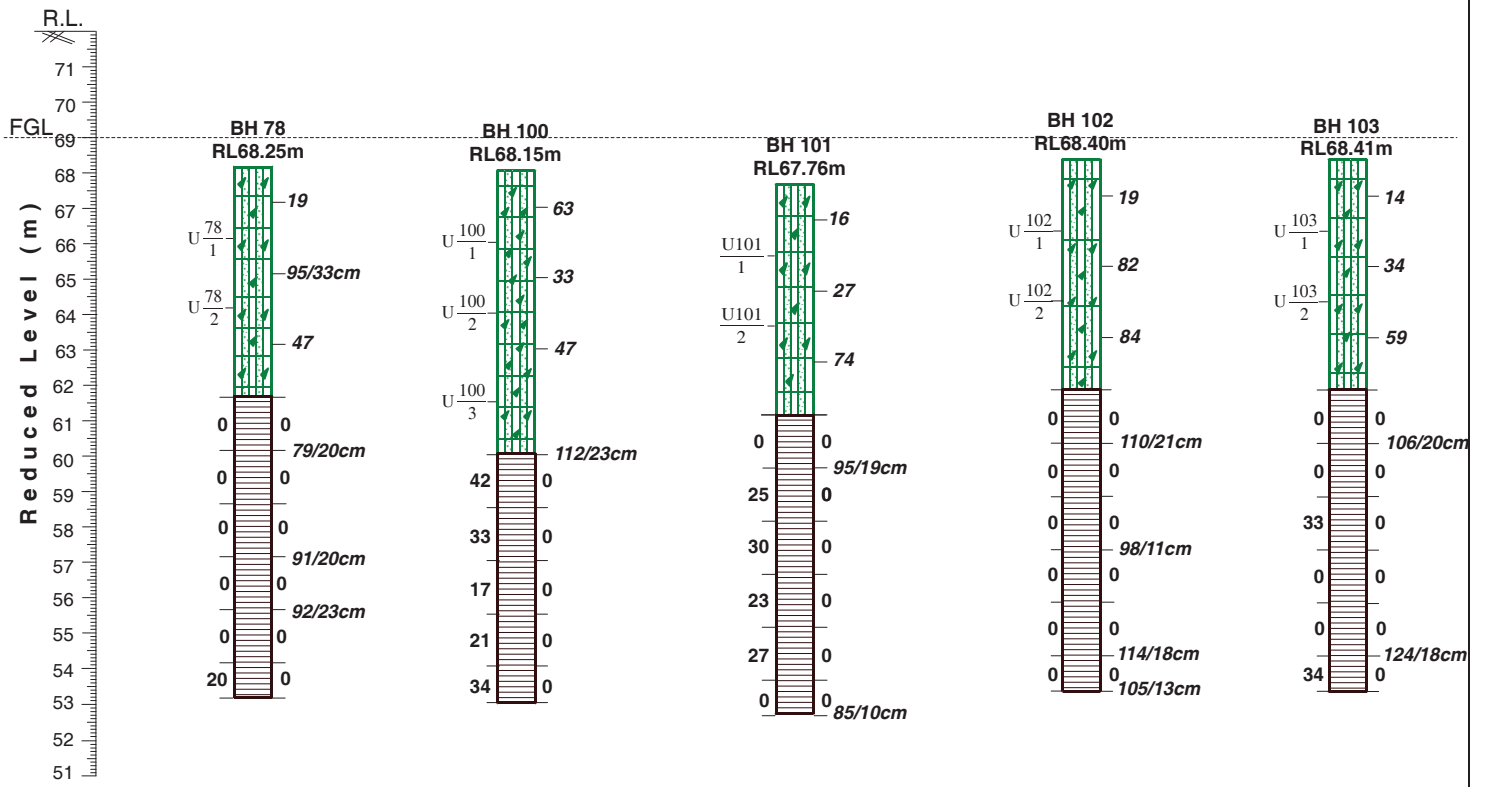


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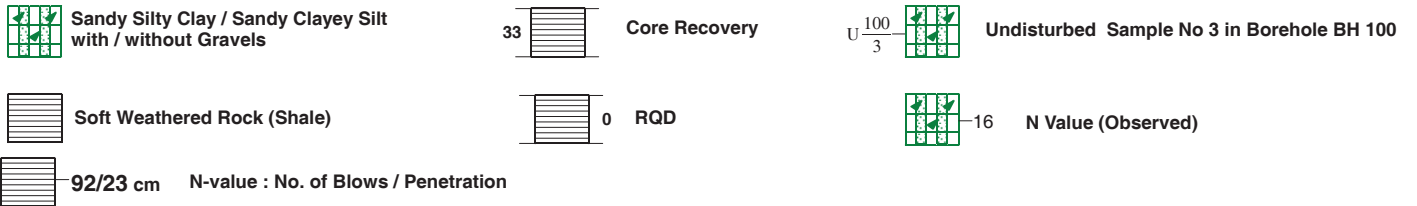
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LEGEND



COMPILED SOIL & ROCK PROFILE BOP Area

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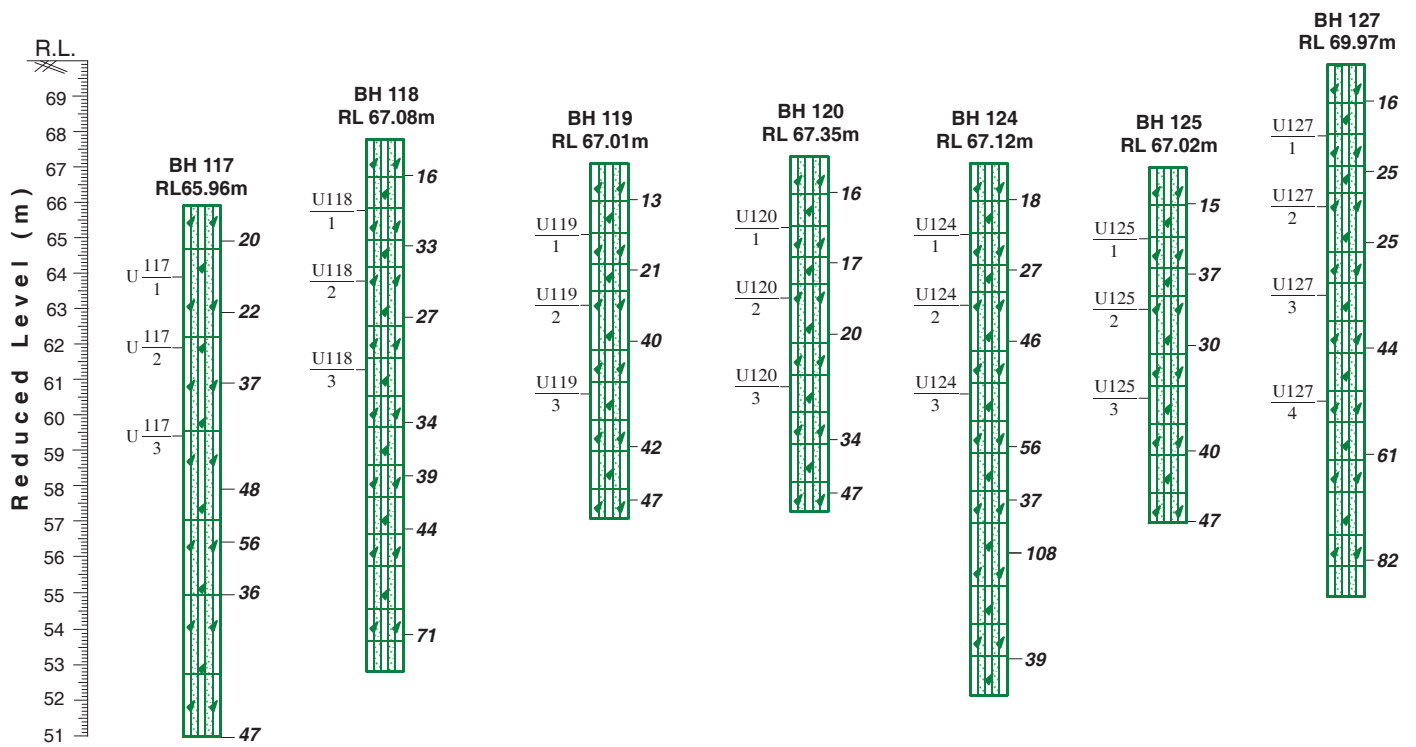


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LEGEND



Sandy Silty Clay / Sandy Clayey Silt
with / without Gravels

U120/3



Undisturbed Sample No 3 in Borehole BH 120



15 N Value (Observed)

COMPILED SOIL & ROCK PROFILE

Raw Water Reservoir Area

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**Reference Boreholes BH88, BH89, BH90, BH75,
BH76 & BH77**

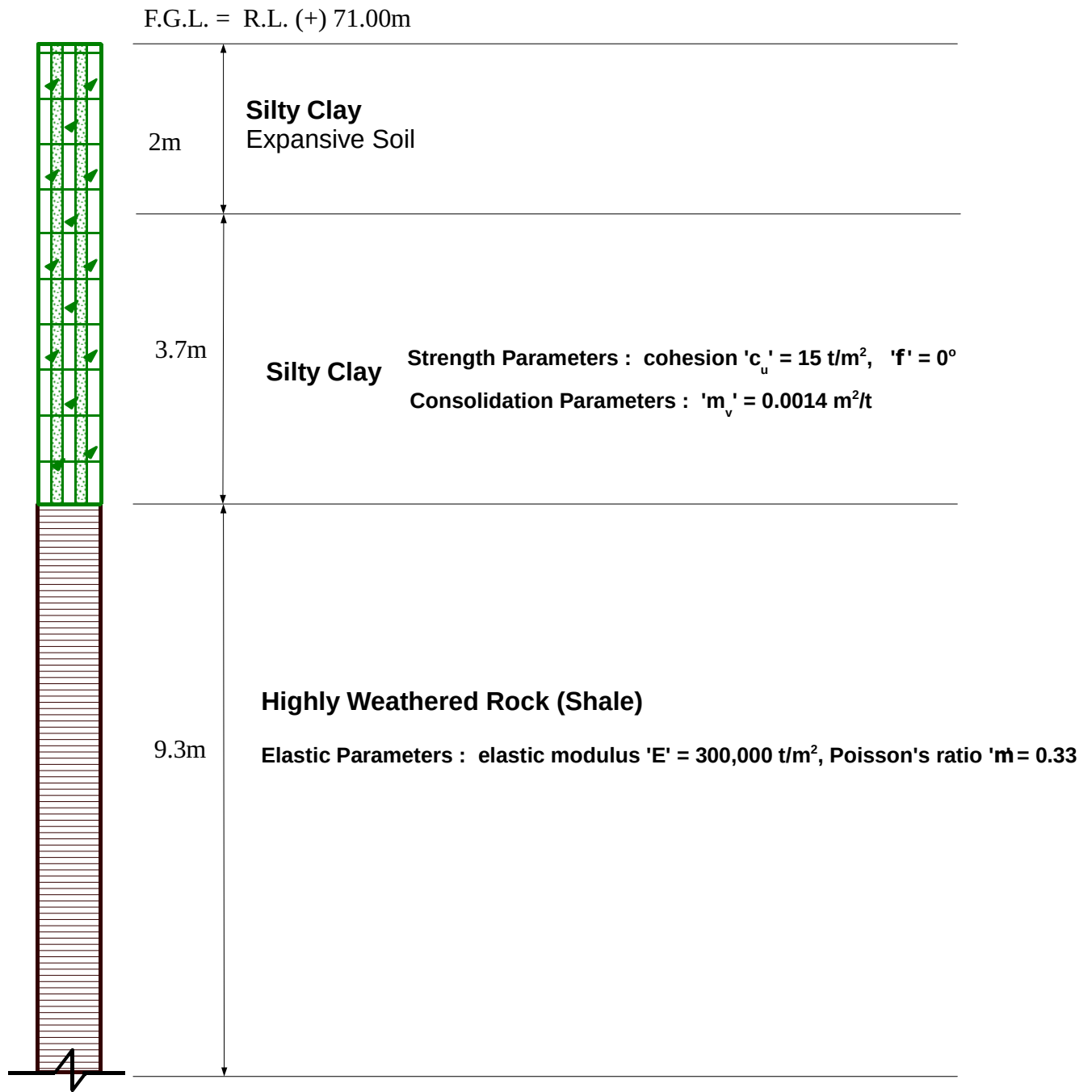


Fig. 2a : Design Profile

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Reference Boreholes BH78, BH100, BH101, BH102 & BH103

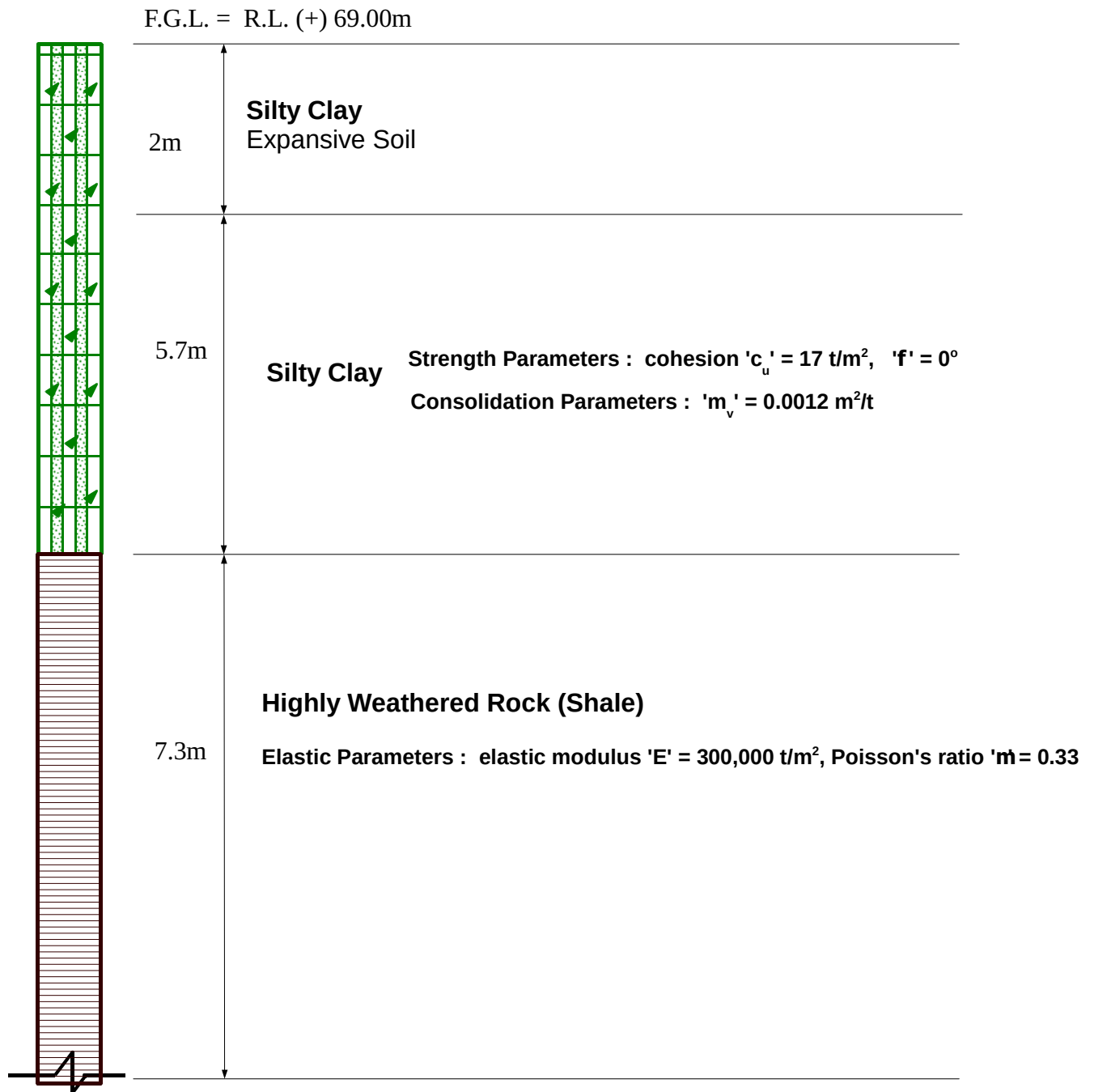


Fig. 2b : Design Profile

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Reference Boreholes BH113, BH114, BH115 & BH116

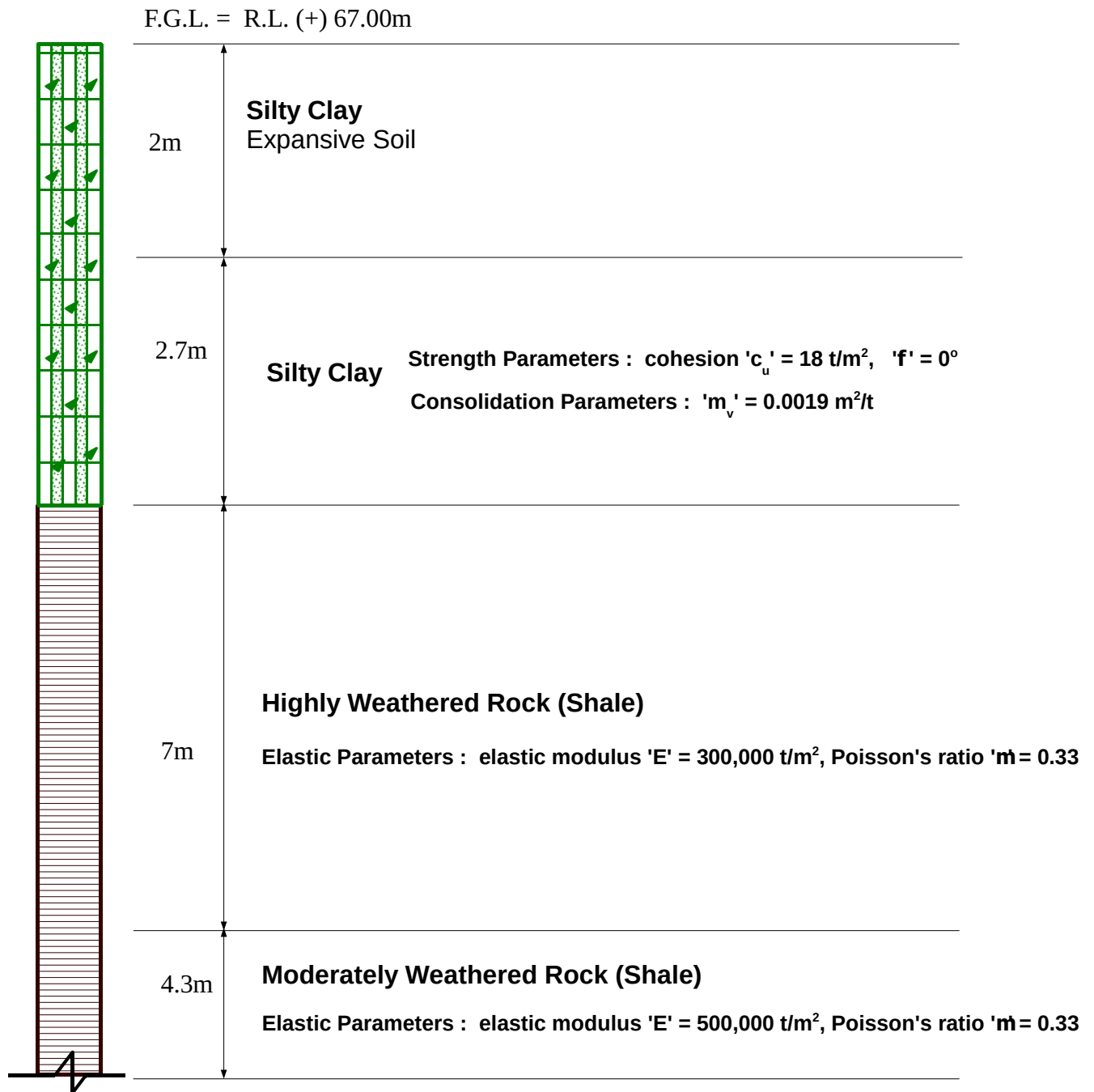


Fig. 2c : Design Profile

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ANALYSIS FOR SAFE BEARING CAPACITY

A.1 METHODOLOGY

- A.1.1 The safe bearing capacities for foundations resting on both soil strata as well as weathered rock strata are determined based on the lower of the values determined from the shear failure criterion and the settlement criterion.
- A.1.2 As the soil strata generally consists of Silty Clay, to calculate the safe bearing capacity from the shear failure criterion, the undrained shear strength parameters of cohesion ' c_u ' and angle of shearing resistance ' ϕ_u ' are considered. For the weathered rock strata, to calculate the safe bearing capacity from the shear failure criterion, the weathered rock strata is considered as very dense sand and accordingly the appropriate value of the angle of shearing resistance ' ϕ ' is adopted.
- A.1.3 For the Silty Clay soil strata, the safe bearing capacity from the settlement criterion is calculated based on the consolidation properties of the clayey soil namely the coefficient of volume compressibility ' m_v '.
- A.1.4 For the weathered rock strata, to calculate the safe bearing capacity from the settlement criterion, the calculation of settlement of foundations can be carried out by use of elastic theory considering the weathered rock mass as an elastic half space with certain elastic modulus E and Poisson's ratio ' μ '.
- A.1.5 The settlement of foundations resting on an elastic space are generally determined by the equation given by Timoshenko & Goodier. The influence factors considered in the equation given by Timoshenko & Goodier, are determined by equations given by Steinbrenner.

A.2 DATA

A.2.1 Depth of Foundation

Foundations can be placed at different levels at locations of the boreholes for different structures as given below :

Location	Depths of Foundations Below FGL (m)	
	In Soil Strata	In Weathered Rock
BH88, BH89, BH90, BH75, BH76, BH77	2, 3, 4, 5	6
BH78, BH100, BH101, BH102, BH103	2, 3, 4, 5	-
BH113, BH114, BH115, BH116	3, 4	-

FGL : Finished Ground Level

A.2.2 Soil Properties

The soil properties considered for the calculations of the safe bearing capacities are shown in the respective design profiles adopted for each of the units.

A.2.3 Weathered Rock Properties

The typical minimum value of the elastic modulus of the weathered rock encountered at the present site which is Shale is around 300,000t/m² as given in the book titled Foundation Design by J.E. Bowles.

The Poisson's ratio ' μ ' is typically in the range of about 0.3 to 0.4 for weathered Shale and considering the rock conditions encountered at the present site, the Poisson's ratio is taken as $\mu = 0.33$.

A.2.4 Allowable Settlement

The allowable settlement of foundations resting on Silty Clay soil strata is considered as 25mm only. This is because at higher total settlements, the differential settlements can become significant owing to the varying nature of soil as well as varying depth to rock (i.e. varying thickness of soil below the foundations).

The allowable settlement of foundations resting on weathered rock strata is considered as 12mm as per the provisions given in BIS codes IS:12070-1987 & IS:13063-1991.

A.2.5 Design Profile

The design profiles considered for each of the unit, are shown in the figs. 2a to 2c.

A.3 CALCULATION OF SAFE BEARING CAPACITY IN SILTY CLAY SOIL FROM SHEAR CRITERION

A.3.1 The ultimate bearing capacity of the foundation is determined using the following equation as given in BIS code IS:6403-1981.



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$$q_d = c_u \cdot N_c \cdot s_c \cdot d_c \cdot i_c$$

Where c_u = undrained cohesion of the Silty Clay soil

N_c	=	bearing capacity factor	=	5.14 (for $\phi_u = 0$)
s_c	=	shape factor	=	1 (for Strip footing)
d_c	=	depth factor	=	$1 + 0.2 D_f/B$
i_c	=	inclination factor	=	1 (for inclination $\alpha = 0^\circ$)
D_f	=	depth of foundation		
B	=	width of foundation		

A.3.2 Considering a factor of safety of 2.5, the safe bearing capacities for foundations resting at different depths at the locations of boreholes are given below.

Reference Boreholes	Depth (m) of Foundation below FGL	Safe Bearing Capacity (t/m ²)
	2	33
BH88, BH89, BH90, BH75, BH76, BH77	3	35
	4	36
	5	37
	2	38
BH78, BH100, BH101, BH102, BH103	3	39
	4	41
	5	42
	3	41
BH113, BH114, BH115, BH116	4	43

A.4 CALCULATION OF SAFE BEARING CAPACITY IN SILTY CLAY SOIL FROM SETTLEMENT CRITERION

A.4.1 The safe bearing capacity of foundations resting on Silty Clay soil strata is determined using the consolidation properties of the clayey soil as given below

$$q_s = \frac{s}{\Delta p \cdot m_v \cdot H}$$



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Where Δp = increase in pressure at the middle of the soil layer due to the bearing pressure on the foundation

m_v = coefficient of volume compressibility

H = thickness of the compressible soil layer

A.4.2 The increase in pressure Δp at the middle of the soil layer is determined by the simplified method of determining the stress distribution below the foundation by considering a two dimensional spread of load in the soil at an angle of 1H : 2V.

A.4.3 For example, for a width of foundation 'B' of 3m and thickness of compressible soil layer below the foundation 'H' of 2m, the increase in pressure Δp at the middle of the soil layer will be $0.75t/m^2$ for a unit pressure on the foundation 'p' of $1t/m^2$.

Considering a coefficient of volume compressibility ' m_v ' of $0.0010 m^2/t$, the safe bearing capacity on the foundation works out to be $17t/m^2$.

A.4.4 Further, foundation widths greater than 6m are typically considered as raft foundations and the settlements of such foundations are lower on account of the rigidity of the foundation and hence, the calculated settlements have to be reduced by use of a reduction factor for rigidity of 0.8 as given in the relevant provisions of BIS code IS:8009(Part1) - 1976.

A.5 CALCULATION OF SAFE BEARING CAPACITY IN WEATHERED ROCK FROM SHEAR CRITERION

A.5.1 The ultimate bearing capacity of the foundation is determined using the following equation as given in BIS code IS:6403-1981.

$$q_d = q \cdot (N_q - 1) \cdot s_q \cdot d_q \cdot i_q + \frac{1}{2} \gamma \cdot B \cdot N_\gamma \cdot s_\gamma \cdot d_\gamma \cdot i_\gamma \cdot W'$$

Where q = effective surcharge at the foundation level

N_q, N_γ = bearing capacity factors

s_q, s_γ = shape factors

d_q, d_γ = depth factors

i_q, i_γ = inclination factors

γ = unit weight of soil/weathered rock = $2t/m^3$

B = width of foundation

W' = water table correction factor



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A.5.2 Considering the weathered rock as dense sand, the angle of shearing resistance ' ϕ ' can be taken as 40° .

A.5.3 Accordingly, the bearing capacity factors for general shear failure conditions will be :

$$N_q = 64.20$$

$$N_\gamma = 109.41$$

A.5.4 As the foundation is not subjected to any inclined loads, the inclination factors will be equal to 1.

A.5.5 As the foundations can either be continuous strip or square in shape, the shape factors corresponding to the continuous strip are adopted as they are generally lower.

$$s_q = s_\gamma = 1.0$$

A.5.6 Considering the depth of foundation as an average of about 6m, and the width of foundation as 6m, the depth factors work out to be :

$$d_q, d_\gamma = 1.21$$

A.5.7 Although ground water table has not been encountered, to be on the safer side, the water table correction factor is considered as $W' = 0.5$.

A.5.8 The effective surcharge at the foundation level calculated by considering the unit weight of the soil $= 2t/m^3$, works out to be $= 12t/m^2$.

A.5.9 Accordingly, the ultimate bearing capacity works out to be :

$$q_d = 984 t/m^2$$

A.5.10 Applying a factor of safety of 2.5, the safe bearing capacity from shear criterion works out to be :

$$q_s = 393 t/m^2$$

A.6 CALCULATION OF SAFE BEARING CAPACITY IN WEATHERED ROCK FROM SETTLEMENT CRITERION

A.6.1 The settlement of foundations resting on weathered rock strata is calculated based on the equation given by Timoshenko & Goodier as given below :

$$s = q \cdot B \cdot \frac{1 - \mu^2}{E} \left(I_1 + \frac{1 - 2\mu}{1 - \mu} I_2 \right) \cdot I_F$$



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The above equation simplified by Steinbrenner is given below :

$$s = q \cdot B' \cdot \frac{1 - \mu^2}{E} \cdot m \cdot I_s \cdot I_F$$

Where q = loading intensity on the foundation

B' = Least lateral dimension of the contributing loaded area

m = factor which is 4 at footing centre

I_s = influence factor for loaded area

I_F = influence factor for depth of foundation
The calculation of settlement of foundation is done considering the following data:

q = bearing pressure on foundation

= 45t/m²

E = 3,00,000 t/m²

μ = 0.33

The influence factors ' I_s ' & ' I_F ' are determined considering the thickness of compressible weathered rock strata, the depth of foundation and the widths of foundations.

Considering the depth of foundation of 7m and width of foundation of 6m and thickness of highly weathered rock strata of 4m, the influence factors are determined to be :

I_s = 0.2386

I_F = 0.6382

Accordingly, the settlement of foundation works out to be :

s = 0.24mm

As the proposed foundation will be a rigid foundation, the above calculated settlement has to be reduced by use of a reduction factor for rigidity of 0.8 as given in the relevant provisions of BIS code IS:8009(Part1) - 1976.

Accordingly, the final calculated settlement of the foundation works out to be :

s = 0.8 x 0.24 ≈ 0.2mm

As the above calculated settlements of the foundation are less than the allowable settlement of 12mm, the net safe bearing capacity of 45 t/m² can be safely adopted for the foundations resting on weathered rock strata.



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LIST OF IS CODES

Field Investigation

1. IS : 1892 - 1979 : Code of practice for sub surface investigations for foundations
2. IS : 2131 - 1981 : Method of Standard Penetration Tests for soils (First revision)
3. IS : 2132 - 1986 : Code of practice for thin walled tube sampling of soils (Second revision)
4. IS : 11315 - 1985 (Part 11) : Method for the quantitative descriptions of discontinuities in rock masses
5. IS : 11315 - 1995 (Part 12) : Quantitative description of discontinuities in rock mass methods.

Laboratory Tests

1. IS : 2720 - 1983 (Part 1) : Methods of test for soils: Preparation of dry soil samples for various tests (Second revision)
2. IS : 2720 - 1980 (Part 2) : Method of test for soils: Determination of water content (Second revision) Amendment 1
3. IS : 2720 - 1980 (Part 3/sec 1) : Method of Test for Soils : Determination of Specific Gravity : Fine Grained Soils. (First Revision)
4. IS : 2720 - 1980 (Part 3/Sec 2) : Method of test for soils : Determination of Specific Gravity : Fine, Medium & Coarse grained soils. (First revision).
5. IS : 2720 - 1985 (Part 4) : Method of test for soils : Grain size analysis (Second revision)
6. IS : 2720 - 1985 (Part 5) : Method of test for soils : Determination of liquid and plastic limit (Second revision)
7. IS : 2720 (Part 10) - 1973 : Method of test for soils : Determination of shear strength parameters using Triaxial apparatus



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8. IS: 4078 - 1980 : Code of practice for indexing and storage of drill cores (First Revision)
9. IS: 5529 (Part1) - 1985 : Code of practice for in-situ permeability tests.
10. IS : 9143 : 1976 : Method for the determination of unconfined compressive strength of rock materials.
11. IS : 13030 : 1991 : Method of test for laboratory determination of water content, porosity, density and related properties of rock material.

Foundation Construction

1. IS : 1904 - 1986 : Code of practice for design and construction of foundation in soils: General requirements (Third revision)
2. IS : 1904 - 1986 : Code of practice for design and construction of foundation in soils: General requirements (Third revision)
3. IS : 6403 - 1981 : Code of practice for determination of bearing capacity of shallow foundations : First revision (Amendment 1)
4. IS : 8009 - 1976 (Part 1) : Code of practice for calculation of settlements of foundations : Shallow foundations subject to symmetrical static vertical loads (Amendment 2)
5. IS: 12070 - 1987 : Code of practice for design and construction of shallow foundations on rocks
6. IS : 13063 : 1991 : Code of practice for structural safety of buildings on shallow foundations on Rocks



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Job No. **G(H) 1658(8)**

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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 75		
		Location: CW-PH, Chlorination & Treatment			Red. Lev. (m): 71.29		Term. Depth (m): 15		
		B.H. Coord. : 1992938N, 471831E					Water Table (m): nil		
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description		
From	To								
0.0	9.5 10.5 11.0 12.5 15.0		SPT	(2, 5, 10) 15			Brownish Silty Clay with Gravels		
1.0							Brownish Silty Clay with Gravels		
2.0							Brownish Silty Clay with Gravels		
3.0			SPT	(14, 23, 47) 70			Brownish Silty Clay with Gravels		
4.0							UDS	Yellowish Brown Silty Sandy Clay with Gravels	
5.0			SPT	(7, 10, 13) 23			Reddish Brown Highly Weathered Rock (Shale)		
6.5			UDS	Red Highly Weathered Rock (Shale)					
8.0			SPT	(14, 23, 29) 52			0	0	Red Highly Weathered Rock (Shale)
9.5			UDS	0			0	Red Highly Weathered Rock (Shale)	
10.5			0	0			Red Highly Weathered Rock (Shale)		
11.0			0	0			Red Highly Weathered Rock (Shale)		
12.5			SPT	70/28 cm			0	0	Red Highly Weathered Rock (Shale)
15.0			SPT	98/18 cm			0	0	Red Highly Weathered Rock (Shale)

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 76	
		Location: CW-PH, Chlorination & Treatment			Red. Lev. (m): 70.94		Term. Depth (m): 15	
		B.H. Coord. : 1992955 N, 471868E					Water Table (m): nil	
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description	
From	To							
0.0							Dark Brown Clay Silt with Gravels	
1.0			SPT	(3, 6, 13) 19			Dark Brown Clay Silt with Gravels	
2.0			UDS				Dark Brown Clay Silt with Gravels	
3.0			SPT	(13, 21, 34) 55			Brown Clay Silt with Gravels	
4.0			UDS				Yellowish Brown Clay Silt with Gravels	
4.5		20					Brown Clay Silt	
5.0		-	SPT	(9, 12, 12) 22			Reddish Brown Clay Silt with Gravels	
6.0		75					Red Highly Weathered Rock (Shale)	
6.5		-	UDS		0	0	Red Highly Weathered Rock (Shale)	
7.5		60			0	0	Red Highly Weathered Rock (Shale)	
8.0	10.0	75	SPT	134/35cm	23	0	Red Moderately Weathered Rock (Shale)	
10.0	11.5	100			20	0	Red Moderately Weathered Rock (Shale)	
11.5	13.0	120			20	0	Red Moderately Weathered Rock (Shale)	
13.0	14.5	80			23	0	Red Moderately Weathered Rock (Shale)	
14.5	15.0	40			48	0	Red Moderately Weathered Rock (Shale)	

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 100
		Location: CW-PH, Chlorination & Treatment			Red. Lev. (m): 68.15		Term. Depth (m): 15
		B.H. Coord. : 1993427N, 471885E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brownish Grey Clay Silt with Gravels
1.0			SPT	(9, 24, 39) 63			Whitish Brown Clay Silt with Gravels
2.0			UDS				Whitish / Brownish Yellow Sandy Clay Silt with Gravels
3.0			SPT	(9, 12, 21) 33			Red Clay Silt
3.5		40					Red Sandy Clay Silt with Gravels
4.0		50	UDS				Red Sandy Clay Silt
5.0		-	SPT	(12, 18, 29) 47			Red Sandy Clay Silt with Gravels
6.0		55					Red Sandy Clay Silt with Gravels
6.5		-	UDS				Red Sandy Clay Silt with Gravels
7.0	8.0	50			0	0	Red Highly Weathered Rock (Shale)
8.0	9.5	65	SPT	112/23 cm	42	0	Red Moderately Weathered Rock (Shale)
9.5	11.0	70			33	0	Greyish / Red Moderately Weathered Rock (Shale)
11.0	12.5	60			17	0	Red Moderately Weathered Rock (Shale)
12.5	14.0	65			21	0	Red Moderately Weathered Rock (Shale)
14.0	15.0	45			34	0	Red Moderately Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No. : 102
		Location: CW-PH, Chlorination & Treatment			Red. Lev. (m): 68.40		Term. Depth (m): 15
		B.H. Coord. : 1993434N, 471839E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brownish Grey Clay Silt
1.0			SPT	(6, 7, 12) 19			Yellowish Brown Clay Silt with Gravels
2.0			UDS				Reddish / Yellowish Brown Clay Silt with Gravels
3.0	3.5		SPT	(36, 37, 45) 82	0	0	Greyish / Brownish Red Highly Weathered Rock (Shale)
3.5	4.0	40			0	0	Brownish Red Highly Weathered Rock (Shale)
4.0	4.5	-	UDS		0	0	Brownish Red Highly Weathered Rock (Shale)
4.5	5.0	55			0	0	Red Highly Weathered Rock (Shale)
5.0	6.0	-	SPT	(31, 41, 43) 84	0	0	Red Highly Weathered Rock (Shale)
6.0	6.5	75			0	0	Red Highly Weathered Rock (Shale)
6.5	7.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
7.5	8.0	90			0	0	Red Highly Weathered Rock (Shale)
8.0	9.0	-	SPT	110/21cm	0	0	Red Highly Weathered Rock (Shale)
9.0	9.5	100			0	0	Red Highly Weathered Rock (Shale)
9.5	10.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
10.5	11.0	95			0	0	Red Highly Weathered Rock (Shale)
11.0	12.0	-	SPT	98/11 cm	0	0	Red Highly Weathered Rock (Shale)
12.0	13.0	110			0	0	Red Highly Weathered Rock (Shale)
13.0	14.0	120			0	0	Red Highly Weathered Rock (Shale)
14.0	15.0	85	SPT	114/18 cm	0	0	Red Highly Weathered Rock (Shale)
15.0		-	SPT	105/13 cm	0	0	Red Highly Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 103
		Location: CW-PH, Chlorination & Treatment			Red. Lev. (m): 68.41		Term. Depth (m): 15
		B.H. Coord. : 1993466N, 471841E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brownish Grey Clay Silt With Gravels
1.0			SPT	(3, 5, 9) 14			Dark Brownish Grey Clay Silt With Gravels
2.0			UDS				Reddish / Yellowish Brown Sandy Clay Silt With Gravels
3.0			SPT	(8, 15, 19) 34			Red Clay Silt with Gravels
3.5		40					Brownish Red Sandy Clay Silt with Gravels
4.0		-	UDS				Brownish Red Sandy Clay Silt with Gravels
4.5		45					Brownish Red Sandy Clay Silt with Gravels
5.0	6.0	-	SPT	(13, 23, 36) 59	0	0	Greyish Red Highly Weathered Rock (Shale)
6.0	6.5	65			0	0	Red Highly Weathered Rock (Shale)
6.5	7.0	-	UDS		0	0	Red Highly Weathered Rock (Shale)
7.0	8.0	70			0	0	Red Highly Weathered Rock (Shale)
8.0	9.0	-	SPT	106/20cm	0	0	Red Highly Weathered Rock (Shale)
9.0	9.5	65			0	0	Red Highly Weathered Rock (Shale)
9.5	11.0	80	SPT	N >100	33	0	Red Moderately Weathered Rock (Shale)
11.0	13.0	-			0	0	Red Highly Weathered Rock (Shale)
13.0	14.0	140			0	0	Red Highly Weathered Rock (Shale)
14.0	15.0	50	SPT	124/18cm	34	0	Red Moderately Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 78
		Location: Fuel oil and Compressor Building Area			Red. Lev. (m): 68.25		Term. Depth (m): 15
		B.H. Coord. : 1993630N, 472214 E					Water Table (m): Nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0	6.5 8.0 9.5 11.0 12.5 14.0 15.0		SPT	(6, 8, 11) 19			Dark Brown Silt with Clay
1.0							Dark Brown Silt Clay with Gravels
2.0							Brown Silt Clay with Gravels
3.0			SPT	(27, 48, 20/3 cm) 95/33 cm	0	0	Brownish Grey Highly Weathered Rock (Shale)
4.0			UDS		0	0	Brownish Highly Weathered Rock (Shale) with Boulder Pieces
5.0			SPT	(13, 23, 24) 47	0	0	Red Highly Weathered Rock (Shale)
6.5			UDS		0	0	Red Highly Weathered Rock (Shale)
8.0			SPT	79/20cm	0	0	Greyish Red Highly Weathered Rock (Shale)
9.5			UDS		0	0	Greyish Red Highly Weathered Rock (Shale)
11.0			SPT	91/20 cm	0	0	Red Highly Weathered Rock (Shale)
12.5			SPT	92/23 cm	0	0	Red Highly Weathered Rock (Shale)
14.0					20	0	Red Moderately Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 101
		Location: Fuel oil and Compressor Building Area			Red. Lev. (m): 67.76		Term. Depth (m): 15
		B.H. Coord. : 1993454N, 472055E					Water Table (m): Nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brown Clay Silt
1.0			SPT	(5, 7, 9) 16			Dark Brown Clay Silt with Gravels
1.5		20					Yellowish Brown Clay Silt
2.0		-	UDS				Yellowish Brown Clay Silt
2.5		25					Yellowish Brown Clay Silt
3.0		-	SPT	(6, 11, 16) 27	0	0	Yellowish Brown Clay Silt with Gravels
4.0		32	UDS		0	0	Red Brown Clay Silt
5.0	6.0	-	SPT	(16, 30, 44) 74	0	0	Red Highly Weathered Rock (Shale)
6.0	6.5	80			0	0	Red Highly Weathered Rock (Shale)
6.5	7.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
7.5	8.0	95			0	0	Red Highly Weathered Rock (Shale)
8.0	9.5	100	SPT	95/19 cm	25	0	Greyish Red Moderately Weathered Rock (Shale)
9.5	11.0	110			30	0	Red Moderately Weathered Rock (Shale)
11.0	12.5	120			23	0	Red Moderately Weathered Rock (Shale)
12.5	14.0	130			27	0	Red Highly Weathered Rock (Shale)
14.0	15.0	-			0	0	Red Highly Weathered Rock (Shale)
15.0			SPT	85	0	0	Red Highly Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 113		
		Location: PT pant, DM Plant, Clarified PH & Tank, Chemical Lab and DH PH & Tank Area			Red. Lev. (m): 67.50		Term. Depth (m): 15		
		B.H. Coord. : 1993630N, 472214 E					Water Table (m): Nil		
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description		
From	To								
0.0			SPT	(4, 6, 10) 16			Dark Brown Silt with Clay		
1.0							Dark Brown Silt Clay with Gravels		
2.0							Greyish Red Silt Clay with Gravels		
3.0			4.0	SPT	(3, 53, 80/8 cm) 136	0	0	Red Highly Weathered Rock (Shale)	
4.0			5.0	UDS		0	0	Red Highly Weathered Rock (Shale)	
5.0			6.5	SPT	(17, 34, 53) 87	0	0	Red Highly Weathered Rock (Shale)	
6.5			8.0	UDS		0	0	Red Highly Weathered Rock (Shale)	
8.0			9.5	SPT	90/10cm	0	0	Red Highly Weathered Rock (Shale)	
9.5			11.0	UDS		29	0	Red Moderately Weathered Rock (Shale)	
11.0			12.5			10	0	Red Moderately Weathered Rock (Shale)	
12.5			14.0			0	0	Red Highly Weathered Rock (Shale)	
14.0			15.0			27	0	Red Moderately Weathered Rock (Shale)	



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 114	
		Location: PT pant, DM Plant, Clarified PH & Tank, Chemical Lab and DH PH & Tank Area			Red. Lev. (m): 66.53		Term. Depth (m): 15	
		B.H. Coord. : 1993516 N, 472221 E					Water Table (m): Nil	
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description	
From	To							
0.0							Dark Brown Clay Silt with Gravels	
1.0			SPT	(5, 7, 9) 16			Dark Brown Clay Silt with Gravels	
2.0			UDS				Reddish Brown Clay Silt with Gravels	
2.5		25					Reddish Brown Clay Silt with Gravels	
3.0		-	SPT	(20, 26, 42) 67	0	0	Red Highly Weathered Rock (Shale)	
3.5		30			0	0	Red Highly Weathered Rock (Shale)	
4.0		-	UDS		0	0	Red Highly Weathered Rock (Shale)	
4.5		35			0	0	Red Highly Weathered Rock (Shale)	
5.0		6.0	-	SPT	(15, 37, 84/5 cm) 121	0	0	Red Highly Weathered Rock (Shale)
6.0		6.5	80		0	0	Red Highly Weathered Rock (Shale)	
6.5		7.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
7.5		8.0	90		0	0	Red Highly Weathered Rock (Shale)	
8.0		9.5	100	SPT	(10, 47, 57/3cm) 104	25	0	Red Moderately Weathered Rock (Shale)
9.5		11.0	115	UDS		34	0	Red Moderately Weathered Rock (Shale)
11.0		12.5	120			46	0	Red Moderately Weathered Rock (Shale)
12.5	14.0	125			21	0	Red Moderately Weathered Rock (Shale)	
14.0	15.0	-			0	0	Red Highly Weathered Rock (Shale)	
15.0		-	SPT	(70/7cm) 70	0	0	Red Highly Weathered Rock (Shale)	



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 115	
		Location:PT pant, DM Plant, Clarified PH & Tank, Chemical Lab and DH PH & Tank Area			Red. Lev. (m): 67.10		Term. Depth (m): 15	
		B.H. Coord. : 1993633 N, 472316 E					Water Table (m): Nil	
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description	
From	To							
0.0							Dark Brown Clay Silt with Gravels	
1.0			SPT	(6, 13, 19) 32			Dark Brown Clay Silt with Gravels	
2.0			UDS				Reddish Brown Silt Clay with Gravels	
3.0			SPT	(11, 12, 17) 29	0	0	Red Highly Weathered Rock (Shale)	
4.0			UDS		0	0	Red Highly Weathered Rock (Shale)	
4.5		28			0	0	Brownish Clay Silt	
5.0		-	SPT	(7, 9, 14) 23	0	0	Red Highly Weathered Rock (Shale)	
6.0		90			0	0	Red Highly Weathered Rock (Shale)	
6.5		7.5	-	UDS	0	0	Red Highly Weathered Rock (Shale)	
7.5		8.0	95		0	0	Red Highly Weathered Rock (Shale)	
8.0		9.0	-	SPT	(36, 62, 73/5cm) 135	0	0	Red Highly Weathered Rock (Shale)
9.0		9.5	-		0	0	Red Highly Weathered Rock (Shale)	
9.5		11.0	140	UDS	27	0	Red Moderately Weathered Rock (Shale)	
11.0		12.5	130		29	0	Red Moderately Weathered Rock (Shale)	
12.5		14.0	-		-	0	Red Highly Weathered Rock (Shale)	
14.0	15.0	60		35	0	Red Moderately Weathered Rock (Shale)		



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 116	
		Location: PT pant, DM Plant, Clarified PH & Tank, Chemical Lab and DH PH & Tank Area			Red. Lev. (m): 66.40		Term. Depth (m): 15	
		B.H. Coord. : 1993506 N, 472286 E					Water Table (m): Nil	
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description	
From	To							
0.0							Brown Clay Silt with Gravels	
1.0			SPT	(4, 7, 8) 15			Brown Clay Silt with Gravels	
2.0			UDS				Yellowish Brown Clay Silt with Gravels	
3.0			SPT	(20, 29, 40) 69			Yellowish Brown Clay Silt with Gravels	
4.0			UDS				Yellowish Brown Clay Silt with Gravels	
4.5							Brown Clay Silt with Gravels	
5.0	6.5	85	SPT	90/34 cm	0	0	Brown Highly Weathered Rock (Shale)	
6.5	8.0	90			0	0	Brown Highly Weathered Rock (Shale)	
8.0	9.5	100	SPT	93/25cm	0	0	Brownish Red Highly Weathered Rock (Shale)	
9.5	11.0	105			0	0	Brownish Red Weathered Rock (Shale)	
11.0	12.5	-	SPT	77/18 cm	0	0	Red Highly weathered Rock (Shale)	
12.5	14.0	110			0	0	Red Highly weathered Rock (Shale)	
14.0	15.0	90	SPT	60/10 cm	0	0	Red Highly weathered Rock (Shale)	

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 77
		Location: ETP Area			Red. Lev. (m): 71.57		Term. Depth (m): 15
		B.H. Coord. : 199293N, 471975E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brownish Clay Silt
1.0			SPT	(2, 8, 18)			Dark Brownish Clay Silt with Gravels
2.0			UDS	26			Dark Brownish Clay Silt with Gravels
2.5		20					Brown Sandy Clay Silt with Gravels
3.0	3.5	-	SPT	(10, 17, 28)	0	0	Red Highly Weathered Rock (Shale)
3.5	4.0	25		45	0	0	Red Highly Weathered Rock (Shale)
4.0	4.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
4.5	5.0	30			0	0	Red Highly Weathered Rock (Shale)
5.0	6.0	-	SPT	112/28cm	0	0	Red Highly Weathered Rock (Shale)
6.0	6.5	55			0	0	Red Highly Weathered Rock (Shale)
6.5	7.5	-	UDS		0	0	Red Highly Weathered Rock (Shale)
7.5	8.0	70			0	0	Red Highly Weathered Rock (Shale)
8.0	9.0	-	SPT	69/13 cm	0	0	Red Highly Weathered Rock (Shale)
9.0	9.5	80			0	0	Red Highly Weathered Rock (Shale)
9.5	10.5	-	UDS		0	0	Greyish Red Highly Weathered Rock (Shale)
10.5	11.0	100			0	0	Red Highly Weathered Rock (Shale)
11.0	12.5	85	SPT	102/18 cm	25	0	Greyish Red Moderately Weathered Rock (Shale)
12.5	14.0	90			37	0	Greyish Red Moderately Weathered Rock (Shale)
14.0	15.0	55			50	0	Greyish Red Moderately Weathered Rock (Shale)



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 88
		Location: Admin, Canteen and Fire Station Building Area			Red. Lev. (m): 72.45		Term. Depth (m): 15
		B.H. Coord. : 1992806N, 472119E					Water Table (m): Nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Brownish Clay Silt with Gravels
1.0			SPT	(4, 7, 9) 16			Brownish Clay Silt with Gravels
2.0			UDS				Yellowish Red Clay Silt with Gravels
3.0			SPT	(3, 7, 9) 16			Yellowish Red Clay Silt with Gravels
3.5		40					Yellowish Red Clay Silt with Gravels
4.0	4.5	-	UDS				Red Highly Weathered Rock (Shale)
4.5	5.0	15					Red Highly Weathered Rock (Shale)
5.0	6.5	-	SPT	(13, 24, 33) 57			Red Highly Weathered Rock (Shale)
6.5	7.5	-	UDS				Red Highly Weathered Rock (Shale)
7.5	8.0	60					Red Highly Weathered Rock (Shale)
8.0	9.5	75	SPT	82/26 cm	25	0	Greyish Red Moderately Weathered Rock (Shale)
9.5	11.0	135			39	0	Greyish Red Moderately Weathered Rock (Shale)
11.0	12.5	115			73	0	Greyish Red Moderately Weathered Rock (Shale)
12.5	14.0	85			24	0	Greyish Red Moderately Weathered Rock (Shale)
14.0	15.0	90			40	0	Greyish Red Moderately Weathered Rock (Shale)

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 89	
		Location: Admin, Canteen and Fire Station Building Area			Red. Lev. (m): 73.30		Term. Depth (m): 15	
		B.H. Coord. :					Water Table (m): nil	
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description	
From	To							
0.0							Brown Clay Silt with Gravels	
1.0			SPT	(11, 12, 28)			Yellow Clay Silt with Gravels	
2.0			UDS	40			Yellow Clay Silt with Gravels	
3.0			SPT	(10, 20, 31)			Brownish Red Clay Silt with Gravels	
4.0			UDS	51			Reddish Grey Clay Silt with Gravels	
4.5		20					Reddish Grey Highly Weathered Rock (Shale)	
5.0	6.0	-	SPT	113/33 cm			Reddish Grey Highly Weathered Rock (Shale)	
6.0	6.5	100					Reddish Grey Highly Weathered Rock (Shale)	
6.5	8.0	65	SPT	130/36 cm	30	0	Reddish Grey Moderately Weathered Rock (Shale)	
8.0	9.5	50			60	0	Reddish / Greyish / Yellowish Brown Moderately Weathered Rock (Shale)	
9.5	11.0	65			30	0	Yellowish / Brownish Whitish Grey Moderately Weathered Rock (Shale)	
11.0	12.5	90			23	0	Reddish Grey Moderately Weathered Rock (Shale)	
12.5	14.0	80			25	0	Reddish Grey Moderately Weathered Rock (Shale)	
14.0	15.0	90			36	0	Reddish Grey Moderately Weathered Rock (Shale)	

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 90
		Location: Admin, Canteen and Fire Station Building Area			Red. Lev. (m): 72.40		Term. Depth (m): 15
		B.H. Coord. : 1992905N, 473121E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brown Clay Silt with Gravels
1.0			SPT	(2, 4, 9)			Dark Brown Clay Silt with Gravels
2.0			UDS	13			Brown Clay Silt with Gravels
3.0			SPT	(7, 13, 24)			Red Clay Silt with Gravels
3.5		40		37			Red Clay Silt with Gravels
4.0		-	UDS				Red Clay Silt with Gravels
4.5		50					Red Clay Silt with Gravels
5.0		-	SPT	(19, 51, 75)			Red Clay Silt with Gravels
6.0		60	UDS		0	0	Red Highly Weathered Rock (Shale)
6.5	7.5	-			0	0	Red Highly Weathered Rock (Shale)
7.5	8.0	65			0	0	Red Highly Weathered Rock (Shale)
8.0	9.0	-	SPT	134/5cm	0	0	Red Highly Weathered Rock (Shale)
9.0	9.5	70			0	0	Red Highly Weathered Rock (Shale)
9.5	10.5	-	SPT	120/5 cm	0	0	Red Highly Weathered Rock (Shale)
10.5	11.0	80			0	0	Greyish Red Highly Weathered Rock (Shale)
11.0	12.0	-	SPT	93/3 cm	0	0	Red Highly Weathered Rock (Shale)
12.0	13.0	90			0	0	Red Highly Weathered Rock (Shale)
13.0	14.0	100			35	0	Red Moderately Weathered Rock (Shale)
14.0	15.0	-			0	0	Red Highly Weathered Rock (Shale)
15.0		-	SPT	105/4cm	0	0	Red Highly Weathered Rock (Shale)

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 117
		Location: Fuel Oil Unloading & Pressurising Pump House & Trench			Red. Lev. (m): 65.96		Term. Depth (m): 15
		B.H. Coord. : 1993325N, 471956E					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Yellowish Brown Clay Silt with Gravels
1.0			SPT	(7, 9, 11) 20			Yellowish Brown Clay Silt with Gravels
2.0			UDS				Brown Clay Silt with Gravels
3.0			SPT	(7, 9, 13) 22			Brown Clay Silt with Gravels
4.0		55	UDS				Brown Clay Silt with Gravels
5.0		-	SPT	(6, 15, 22) 37			Brown Clay Silt with Gravels
6.0		70					Brown Clay Silt with Gravels
6.5		-	UDS				Brown Clay Silt with Gravels
7.5		80					Brown Clay Silt with Gravels
8.0		-	SPT	(14, 20, 28) 48			Brown Clay Silt with Gravels
9.0		85					Brown Clay Silt with Gravels
9.5		-	UDS				Brown Clay Silt with Gravels
10.5		90					Brown Clay Silt with Gravels
11.0		-	SPT	(8, 15, 21) 36			Brown Clay Silt with Gravels
12.0		80					Brown Clay Silt with Gravels
13.0		85					Brown Clay Silt with Gravels
14.0		55					Brown Clay Silt with Gravels
15.0		-	SPT	(10, 19, 28) 47			Brown Clay Silt with Gravels



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 118
		Location: Raw Water Reservoir Area			Red. Lev. (m): 67.08		Term. Depth (m): 15
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Brownish Clayey Silt
1.0			SPT	(3, 7, 9)			Brownish Clayey Silty
2.0			UDS	16			
3.0			SPT	(7, 13, 20)			Brownish Red Clayey Silt with Gravels
4.0			UDS	33			Brownish Red Clayey Silt with Gravels
5.0			SPT	(7, 12, 15)			Brown Clayey Silt with Gravels
6.5			UDS	27			Brownish Red Clayey Silt with Gravels
8.0			SPT	(7, 14, 20)			Brownish Grey Clayey Silt
9.5			SPT	(8, 15, 24)			Black Clayey Silt with Gravels
11.0			SPT	(10, 14, 32)			Black Clayey Silt with Gravels
14.0			SPT	(13, 32, 69)			Brown Clayey Silt
15.0				44			Brown Sandy Clayey Silt
				71			Brown Sandy Clayey Silt



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 119
		Location: Raw Water Reservoir Area			Red. Lev. (m): 67.01		Term. Depth (m): 10
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Brown Clayey Silt
1.0			SPT	(3, 5, 8) 13			Brown Clayey Silt
2.0			UDS				Yellowish Brown Clayey Silt
3.0			SPT	(5, 8, 13) 21			Brownish Red Clayey Silt
4.0			UDS				Brownish Red Clayey Silt
5.0							Brownish Red Clayey Silt
6.5			SPT	(6, 13, 27) 40			Black Silty Clay
7.0							Black Silty Clay
8.0			SPT	(9, 16, 26) 42			Black Silty Clay
9.5			SPT	(12, 19, 28) 47			Black Clayey Silty with Gravels
10.0							Black Clayey Silty with Gravels

Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 120
		Location: Raw Water Reservoir Area		Red. Lev. (m): 67.35			Term. Depth (m): 10
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Brown Clayey Silt
1.0			SPT	(3, 7, 9) 16			Brown Clayey Silt
2.0			UDS				Brown Clayey Silt
3.0			SPT	(4, 7, 10) 17			Brownish Red Clayey Silt
4.0							Brownish Red Clayey Silt
5.0			SPT	(7, 9, 11) 20			Brown Clayey Silt
6.5			UDS				Brown Clayey Silt with Gravels
7.0							Brown Clayey Silt
8.0			SPT	(8, 12, 22) 34			Brown Clayey Silt
9.0							Brown Clayey Silt
10.0			SPT	(11, 19, 28) 47			Brown Clayey Silt



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No. : 124
		Location: Raw Water Reservoir Area			Red. Lev. (m): 67.12		Term. Depth (m): 15
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brown Clayey Silt
1.0			SPT	(7, 8, 10) 18			Brown Clayey Silt with Gravels
2.0			UDS				Brown Clayey Silt with Gravels
3.0			SPT	(8, 11, 16) 27			Brown Clayey Silt with Gravels
4.0			UDS				Brown Clayey Silt with Gravels
5.0			SPT	(15, 19, 27) 46			Brownish Red Clayey Silt
6.5			UDS				Brown Silty Clay with Gravels
8.0			SPT	(10, 26, 30) 56			Black Clayey Silt with Gravels
9.5			SPT	(11, 14, 23) 37			Black Clayey Silt with Gravels
11.0			SPT	108			Pinkish Brown Sand
14.0			SPT	(11, 19, 29) 39			Brownish Sandy Clayey Silt
15.0							Brownish Sandy Clayey Silt



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 125
		Location: Raw Water Reservoir Area			Red. Lev. (m): 67.02		Term. Depth (m): 10
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Brown Clayey Silt
1.0			SPT	(3, 5, 10) 15			Brown Clayey Silt
2.0			UDS				Brownish Red Clayey Silt with Gravels
3.0			SPT	(6, 15, 22) 37			Brownish Red Clayey Silt with Gravels
4.0			UDS				Brownish Red Clayey Silt
5.0			SPT	(6, 10, 20) 30			Brownish Red Clayey Silt
6.5			UDS				Brown Silty Clay with Gravels
8.0			SPT	(9, 15, 25) 40			Black Clayey Silt
10.0			SPT	(11, 19, 28) 47			Black Clayey Silt



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Field Borelog		Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana					B.H.No.: 127
		Location: Raw Water Reservoir Area			Red. Lev. (m): 69.97		Term. Depth (m): 15
		B.H. Coord. :					Water Table (m): nil
Drill Run (m)		Drilling Time (min)	Sample Type	N-Value	Core Recovery (%)	RQD (%)	Strata Description
From	To						
0.0							Dark Brown Clayey Silt
1.0		SPT	(5, 7, 9) 16			Brown Clayey Silt	
2.0		UDS				Brownish Red Clayey	
3.0		SPT	(7, 10, 15) 25			Brownish Red Clayey	
4.0		UDS				Brownish Red Clayey	
5.0		SPT	(7, 9, 16) 25			Brownish Red Clayey	
6.5		UDS				Brown Clayey Silt with Gravels	
8.0		SPT	(9, 17, 27) 44			Black Clayey Silt with Gravels	
9.5		UDS				Brown Clayey Silt with Gravels	
11.0		SPT	(14, 27, 34) 61			Black Clayey Silt	
14.0		SPT	(11, 19, 52) 82			Pinkish Brown Sand	
15.0						Brown sand	



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Field Log for Trial Pit	Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana		PLT/T.P.No.: 2
	Location: BOP AREA	Red. Lev. (m): 65.22	Term. Depth (m): 4
	T.P. Coord. : 1994076N, 473179E		Water Table (m): nil
Depth (m)	Sample Type	Strata Description	
0.0			
1.0	UDS	Brownish Silty Clay	
2.0	UDS	Reddish Silty Clay	
3.0	UDS	Reddish Silty Clay with Gravel	
4.0	UDS	Reddish Silty Clay with Gravel	

Field Log for Trial Pit	Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana		PLT/T.P.No.: 5
	Location: BOP Area	Red. Lev. (m): 66.93	Term. Depth (m): 3
	T.P. Coord. : 1993553N, 473057E		Water Table (m): nil
Depth (m)	Sample Type	Strata Description	
- 0.0			
1.0	UDS	Brownish Silty Clay with Gravels	
2.0	UDS	Brownish grey Silty Clay with Gravels	
3.0	UDS	Brownish grey Silty Clay with Gravels	



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Field Log for Trial Pit	Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana		PLT/T.P.No.: 17
	Location: BOP Area	Red. Lev. (m): 71.28	Term. Depth (m): 4
	T.P. Coord. : 1992889N, 471867E		Water Table (m): nil
Depth (m)	Sample Type	Strata Description	
- 0.0			
1.0	UDS	Brownish grey Silty Clay with gravels	
2.0	UDS	Brownish grey Silty Clay with gravels	
3.0	UDS	Brownish grey Silty Clay with gravels	
4.0	UDS	Red Silty Clay with gravels	

Field Log for Trial Pit	Project: 4 x 270MW Thermal Power Plant at Manuguru, Telangana		PLT/TP.No.: 18
	Location: BOP Area	Red. Lev. (m): 71.25	Term. Depth (m): 4
	T.P. Coord. : 1992977N, 471683E		Water Table (m): nil
Depth (m)	Sample Type	Strata Description	
0.0			
1.0	UDS	Brownish Silty Clay with Gravels	
2.0	UDS	Brownish Silty Clay with Gravels	
3.0	UDS	Brownish Silty Clay with Gravels	
4.0	UDS	Brownish Silty Sand	

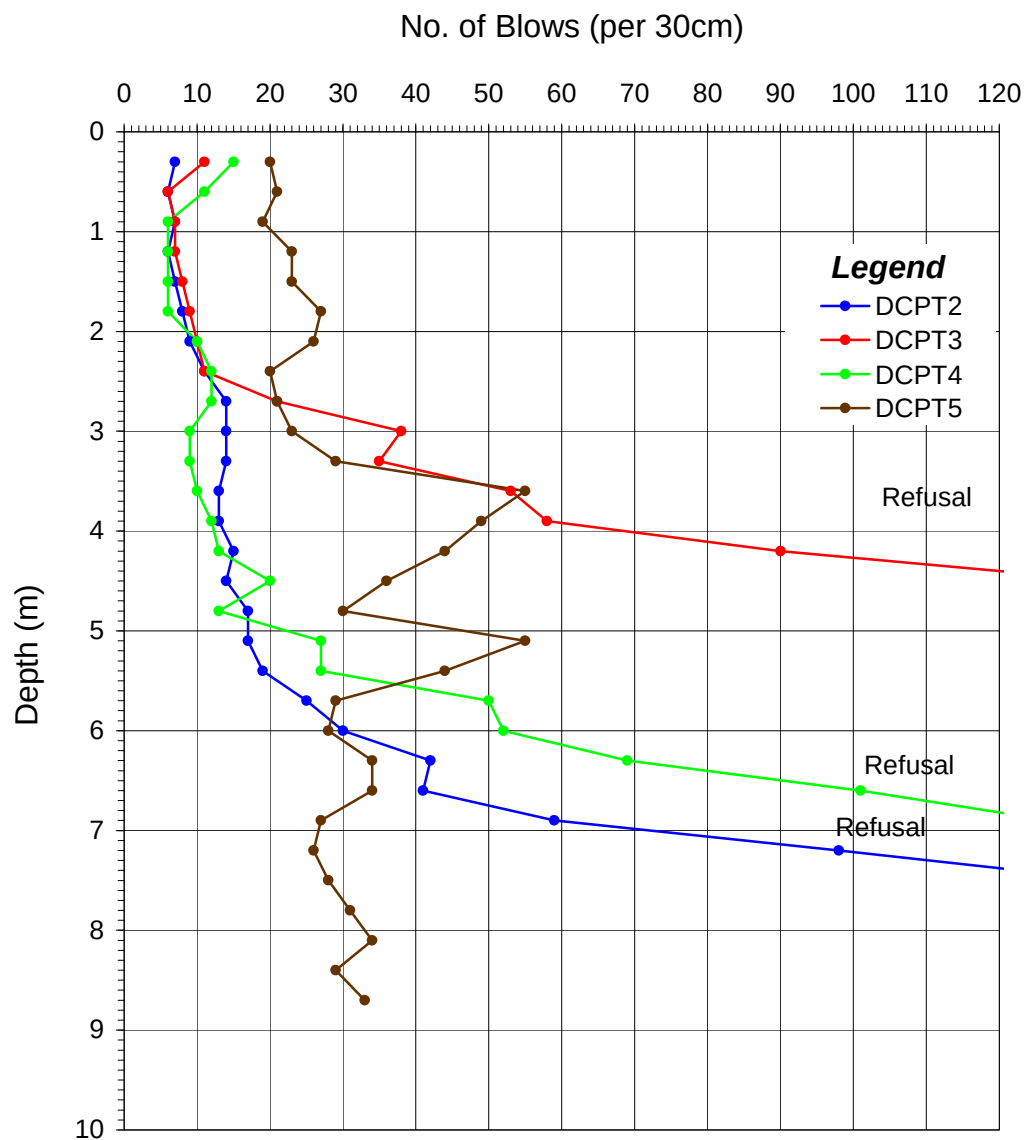


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Dynamic Cone Penetration Test Curves



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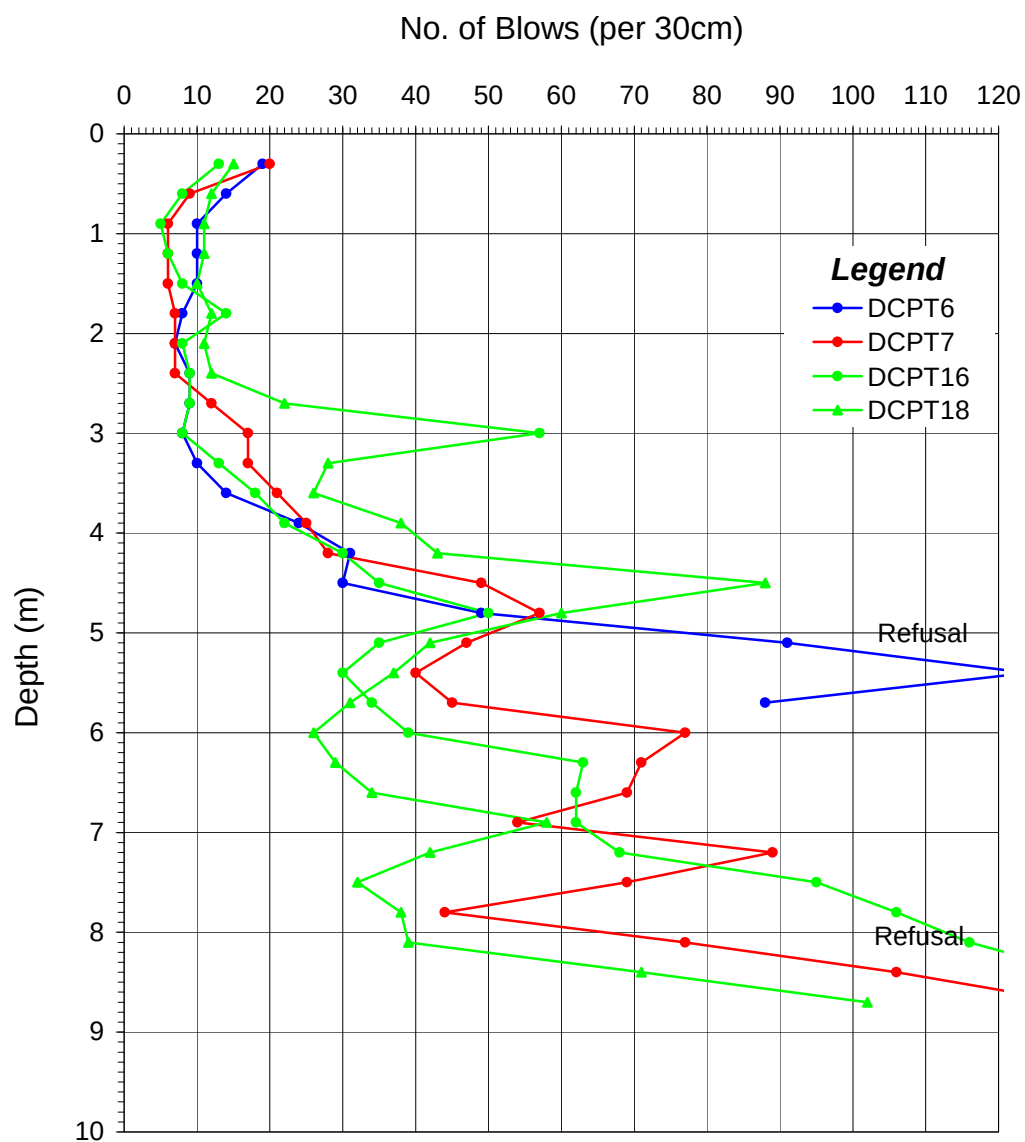
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Dynamic Cone Penetration Test Curves



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Section of Trial Pit TP 2

Project : **Geotechnical Investigation for (4x270MW)
Bhadradi Thermal Power Plant Project,
Manuguru, Khammam District, Telangana**



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Section of Trial Pit TP 5

Project : **Geotechnical Investigation for (4x270MW)**
Bhadradri Thermal Power Plant Project,
Manuguru, Khammam District, Telangana

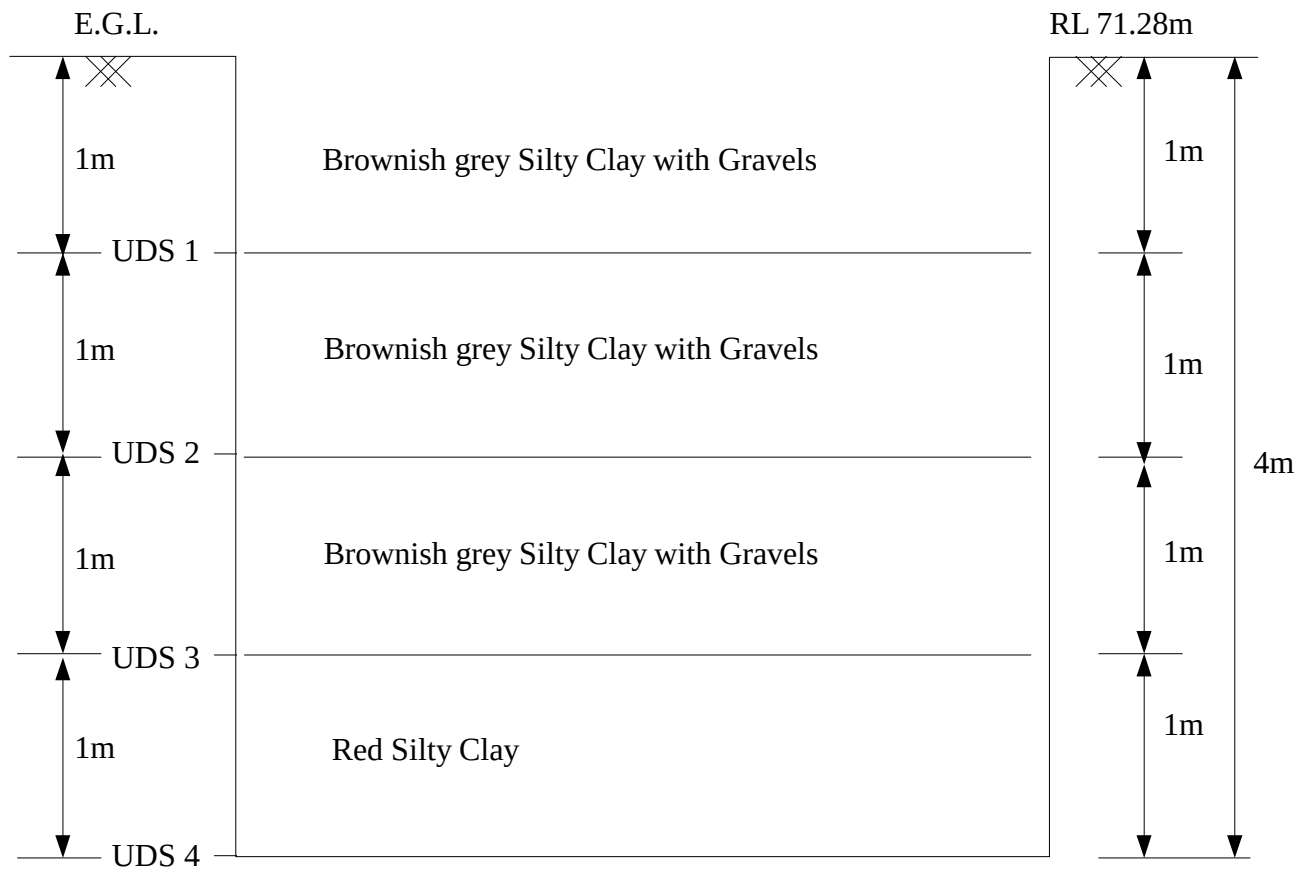


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Job No. :G(H) 1658 (8)

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Section of Trial Pit TP 17

Project : **Geotechnical Investigation for (4x270MW)
Bhadradi Thermal Power Plant Project,
Manuguru, Khammam District, Telangana**



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Job No. :G(H) 1658 (8)

Sheet No. : 63 of 117



Section of Trial Pit TP 18

Project : **Geotechnical Investigation for (4x270MW)
Bhadradi Thermal Power Plant Project,
Manuguru, Khammam District, Telangana**

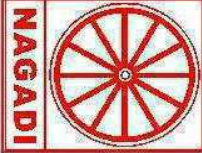


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Job No. : G(H)1658(8)
Sheet No. : 65 of 117

CW - PH, CHLORINATION & TREATMENT

Results of Field and Laboratory Tests

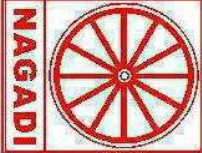
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C'ₑ	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)				
75	1.0	SPT	2	5	10	15				0	52	26	22	40	22	18		CI																	
75	2.0	UDS					1.96	1.69	15.6											CD	0.18	24													
75	3.0	SPT	14	23	47	70				0	27	35	38	46	24	22		CI		2.5															
75	4.0	UDS					2.00	1.63	22.4								8.9			UCC	1.65						0.35	70							
75	5.0	SPT	7	10	13	23				3	12	39	46	56	26	30		CH		2.6															
75	6.5	UDS					2.11	1.66	26.9																		1.25	135							

Type of Sample

- DS Disturbed Soil Sample
- UDS Undisturbed Soil Sample
- RMS Remoulded Soil Sample
- WS Water Sample

Type of Strength Tests

- UCC Unconfined Compression Test
- VST Vane Shear Test
- Tuu Unconsolidated undrained triaxial test
- Tcu Consolidated Undrained triaxial test with pore pressure
- Tcd Consolidated drained triaxial test



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Sheet No. 66 of 117

CW - PH, CHLORINATION & TREATMENT

Results of Field and Laboratory Tests

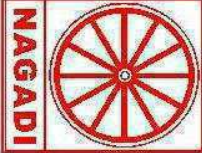
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)	Optimum Moisture Cont. (%)				
76	1.0	SPT	3	6	13	19				0	29	37	34	42	24	18		CI		2.54																
76	2.0	UDS					2.03	1.58	28.2											CD	0.20	23						0.26	25							
76	3.0	SPT	13	21	34	55				10	33	30	27	38	22	16		CI		2.55																
76	4.0	UDS					1.98	1.63	20.8											UU	1.30	25														
76	5.0	SPT	9	12	12	24																														

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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CW - PH, CHLORINATION & TREATMENT

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm			DENSIT Y (g/cm³)	WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
								GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)	Optimum Moisture Cont. (%)				
100	1.0	SPT	9	24	39	63			28	37	19	16	L	P			SM																	
100	2.0	UDS					1.80	1.71	5.08																									
100	3.0	SPT	9	12	21	33			24	28	30	18	30	20	10		CL	2.56																
100	4.0	UDS					2.13	1.74	22.26						7.5			UCC	0.98							0.19	35							
100	5.0	SPT	12	18	29	47			0	44	34	22	32	21	11		CL																	
100	6.5	UDS					1.90	1.59	19.7																		20							

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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CW - PH, CHLORINATION & TREATMENT

Results of Field and Laboratory Tests

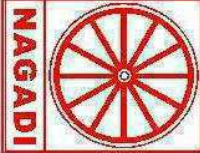
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Blows 15cm				DENSITY Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS	
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'Cc'	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)					Optimum Moisture Cont. (%)
102	1.0	SPT	6	7	12	19				2	24	36	38	44	24	20		CI		2.54																
102	2.0						1.78	1.54	15.1										CD	0.31	20						20									
102	3.0	SPT	36	37	45	82				46	34	20	0	L	P		SM																			
102	4.0																																			
102	5.0	SPT	31	41	43	84				5	30	32	33	40	23	17		CL		2.56																

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
TuU Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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CW - PH, CHLORINATION & TREATMENT

Results of Field and Laboratory Tests

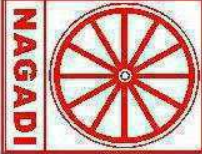
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C'ₑ	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)	Optimum Moisture Cont. (%)				
103	1.0	SPT	3	5	9	14				5	47	27	21	32	20	12		CL		2.54																
103	2.0	UDS					1.97	1.88	4.87										UU	1.30	16															
103	3.0	SPT	8	15	19	34				10	29	33	28	38	22	16		CI		2.57																
103	4.0	UDS					1.95	1.56	25.17																	0.13	15									
103	5.0	SPT	12	23	36	59				6	19	35	40	52	26	26		CH																		

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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FUEL OIL & COMPRESSOR BUILDING AREA

Results of Field and Laboratory Tests

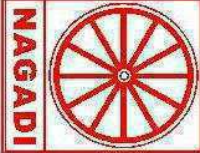
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm³/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
78	1.0	SPT	6	8	11	19				0	49	28	23	38	22	16		CI		2.54															
78	2.0	UDS					1.91	1.56	22.1										CD	0.24	23							26							
78	3.0	SPT	27	48	20	95				61	21	18	0	L	P			SM																	
78	4.0	UDS					1.95	1.64	18.95																		0.16	40							
78	5.0	SPT	13	23	24	47				0	30	34	36	40	23	17		CI																	

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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FUEL OIL & COMPRESSOR BUILDING AREA

Results of Field and Laboratory Tests

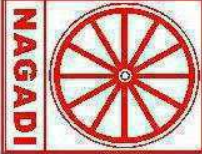
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST		CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)				
101	1.0	SPT	5	7	9	16				2	18	35	45	56	26	30		CH		2.53														
101	2.0	UDS					1.97	1.57	25.34								8.5										1.13	125						
101	3.0	SPT	6	11	16	27				2	20	36	42	52	25	27		CH		2.54														
101	4.0	UDS					2.02	1.64	22.56											UCC	1.2							80						
101	5.0	SPT	16	30	44	74				14	33	26	27	40	23	17		CI																

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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PT pant, DM plant, Clarified PH & tank, Chemical lab and DH PH & tank area

Results of Field and Laboratory Tests

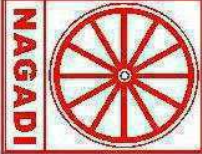
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm			DENSIT Y (g/cm³)	WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST		CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS		
								GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'Cc'	Co. of Vol. Comp. 'mv' (cm³/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)					Max. Dry Dendity (g/cm³)	Optimum Moisture Cont. (%)
113	1.0	SPT	4	6	10	16			0	26	35	39	48	24	24		CI	2.55																
113	2.0	UDS					1.90	1.59	19.60																	65								
113	3.0	SPT	3	53	80	133			11	9	34	46	58	27	31		CH																	
113	4.0	UDS					2.00	1.61	24.56																	0.67	70							
113	5.0	SPT	17	34	53	87				0	33	33	34	44	24	20		CI																

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
TuU Unconsolidated undrained triaxial test
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Sheet No. : 73 of 117

PT pant, DM plant, Clarified PH & tank, Chemical lab and DH PH & tank area

Results of Field and Laboratory Tests

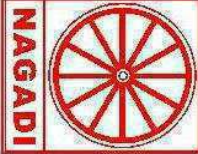
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'Cc'	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
114	1.0	SPT	5	7	9	16				6	25	31	38	50	25	25		CH	2.53																
114	2.0	UDS					1.76	1.58	11.11								9.2		UCC	1.67							0.69	75							
114	3.0	SPT	20	26	42	68				4	21	42	33	44	24	20		CI																	
114	4.0	UDS					1.84	1.62	13.23																										

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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Job No. : G(H)1658(8)
Sheet No. : 74 of 117

PT pant, DM plant, Clarified PH & tank, Chemical lab and DH PH & tank area

Results of Field and Laboratory Tests

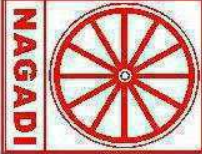
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Blows 15cm				DENSIT Y (g/cm ³)	WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
									GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION	Type	Cohesion 'c' (kg/cm ²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e ₀ '	Preconsolid. Press. 'P _c ' (kg/cm ²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm ² /kg)	Co. of Consolid. 'Cv' (cm ² /min)	Swelling Pressure (kg/cm ²)	Free Swell Index (%)	Max. Dry Dendity (g/cm ³)	Optimum Moisture Cont. (%)			
115	1.0	SPT	6	13	19	32			0	21	37	42	50	25	25		CH		2.54														
115	2.0	UDS					1.90	1.57	20.72										CD	0.31	20						1.13	115					
115	3.0	SPT	11	12	17	29			8	13	34	45	54	26	28		CH																
115	4.0	UDS					1.95	1.67	16.46										UU	1.15	19							95					
115	5.0	SPT	7	9	14	23			2	39	27	32	46	24	22		CI		2.55														

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
TuU Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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Sheet No. : 75 of 117

PT pant, DM plant, Clarified PH & tank, Chemical lab and DH PH & tank area

Results of Field and Laboratory Tests

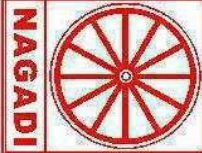
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C'c	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
116	1.0	SPT	4	7	8	15				0	4	41	55	82	45	37		CH		2.53															
116	2.0	UDS					1.99	1.58	25.38										CD	0.35	16						1.59	170							
116	3.0	SPT	20	29	40	69				0	9	40	51	76	42	34		CH		2.54															
116	4.5	UDS					2.03	1.62	24.74										UU	1.81	16							85							
116	5.0	SPT	26	36	28	90				4	21	36	39	50	25	25		CH																	

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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ETP AREA

Results of Field and Laboratory Tests

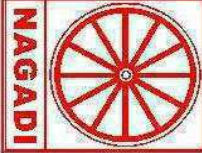
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm³/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)				
77	1.0	SPT	2	8	18	26				2	31	32	35	46	24	22		CI		2.55															
77	2.0	UDS					1.65	1.55	6.39								8.4				CD	0.32	21					0.89	85						
77	3.0	SPT	10	17	28	45				13	12	34	41	52	25	27		CH		2.56															
77	4.0	UDS					1.92	1.64	17.32																			60							

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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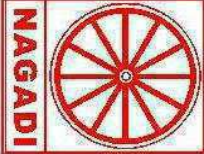
ADMIN, CANTEN AND FIRE STATION BUILDING AREA

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm					DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST						
								BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)					Optimum Moisture Cont. (%)
88	1.0	SPT	4	7	9	16					2	32	34	32	44	24	20		CI		2.55																
88	2.0	UDS					1.88	1.64	14.84													UCC	1.63					0.71	60								
88	3.0	SPT	3	7	9	16					12	27	28	33	46	24	22		CI		2.56																
88	4.0	UDS					2.02	1.69	19.87																				70								
88	5.0	SPT	13	24	33	57					0	24	36	40	54	26	28		CH																		

Type of Sample
DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests
UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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ADMIN, CANTEN AND FIRE STATION BUILDING AREA

Results of Field and Laboratory Tests

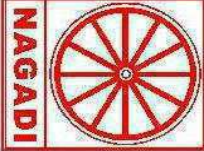
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
89	1.0	SPT	11	12	28	40				4	18	37	41	56	25	31		CH		2.53															
89	2.0	UDS					2.01	1.69	18.44								9.2				UU	1.10	2					0.95	90						
89	3.0	SPT	10	20	31	51				3	25	38	34	44	23	21		CI																	
89	4.0	UDS					1.95	1.57	24.24																				55						

Type of Sample

- DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

- UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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ADMIN, CANTEN AND FIRE STATION BUILDING AREA

Results of Field and Laboratory Tests

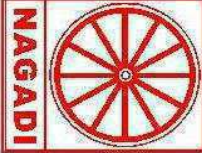
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e' _o	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C' _c	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
90	1.0	SPT	2	4	9	13				0	28	37	35	45	24	21		CI		2.56															
90	2.0	UDS					1.90	1.62	17.41												UCC	1.44					0.67	75							
90	3.0	SPT	7	13	24	37				0	23	35	42	52	25	27		CH		2.54															
90	4.0	UDS					2.06	1.62	27.16																										

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



FUEL OIL UNLOADING AND PRESSURISING PUMP HOUSE AND TRENCH AREA

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'Cc'	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
117	1.0	SPT	7	9	11	20				0	23	43	34	44	24	20		CI	2.54																
117	2.0	UDS					2.02	1.65	22.3										CD	0.25	24						0.59	65							
117	3.0	SPT	7	9	13	22				0	87	13	0	L	P			SM																	
117	4.0	UDS					1.97	1.54	27.1							8.3																			
117	5.0	SPT	6	15	22	37				0	7	45	48	62	28	34		CH	2.55																
117	6.5	UDS					1.88	1.49	26.4										UU	1.32	24						1.21	115							

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test

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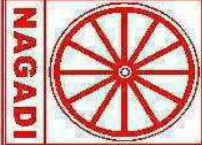
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FUEL OIL UNLOADING AND PRESSURISING PUMP HOUSE AND TRENCH AREA

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm			DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
						BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C'c	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)				
117	8.0	SPT	14	20	28	48			4	20	44	32	44	24	20		CI																	
117	9.5	SPT	11	20	36	56			0	23	41	36	46	24	22		CI	2.55									85							
117	11.0	SPT	8	15	21	36			0	28	37	35	46	25	21		CI																	
117	15.0	SPT	10	19	28	47			0	20	36	44	56	25	31		CH										90							

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test

RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

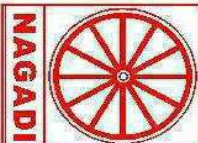
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
118	1.0	SPT	3	7	9	16				0	5	39	56	88	46	42		CH																	
118	2.0	UDS					1.96	1.45	35.1											CD	0.37	16					1.58	160							
118	3.0	SPT	7	13	20	33				0	5	42	53	76	42	34		CH		2.54															
118	4.0	UDS					2.20	1.73	26.9																										
118	5.0	SPT	7	12	15	27				2	7	41	50	78	43	35		CH		2.53															
118	6.5	UDS					1.95	1.46	33.9								8.6			UCC	1.67							1.37	145						

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST		CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)				
118	8.0	SPT	7	14	20	34				3	9	42	46	72	39	33		CH	2.54																
118	9.5	SPT	8	15	24	39				5	8	39	48	74	40	34		CH									120								
118	11.0	SPT	10	14	30	44				0	10	36	54	84	44	40		CH																	
118	14.0	SPT	13	32	69	101				0	18	39	43	68	38	30		CH	2.55								135								

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSITY (g/cm ³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		STRENGTH TEST	CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS				
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm ²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e' ₀	Preconsolid. Press. 'P _c ' (kg/cm ²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm ² /kg)	Co. of Consolid. 'Cv' (cm ² /min)					Swelling Pressure (kg/cm ²)	Free Swell Index (%)	Max. Dry Dendity (g/cm ³)	Optimum Moisture Cont. (%)
119	1.0	SPT	3	5	8	13				7	5	41	47	76	44	32		CH		2.55																
119	2.0	UDS					1.84	1.42	29.4											UCC	1.58							1.23	125							
119	3.0	SPT	5	8	13	21				7	6	41	46	78	45	33		CH																		
119	4.0	UDS					2.05	1.60	28.4																			1.34	140							
119	5.0	SPT	6	13	27	40				7	7	41	45	72	40	32		CH		2.53	UU	1.20	23													

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test

RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

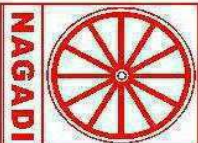
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm ³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		STRENGTH TEST		CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION	Type	Cohesion 'c' (kg/cm ²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm ²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm ² /kg)	Co. of Consolid. 'Cv' (cm ² /min)	Swelling Pressure (kg/cm ²)	Free Swell Index (%)	Max. Dry Dendity (g/cm ³)	Optimum Moisture Cont. (%)		
119	6.5	UDS					1.95	1.54	26.9																			90					
119	8.0	SPT	9	16	26	42				0	27	41	32	46	24	22		CI															
119	9.5	SPT	12	19	28	47				0	19	38	43	51	25	26		CH		2.53													

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

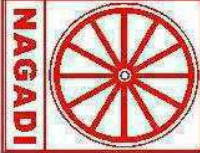
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)	Optimum Moisture Cont. (%)				
120	1.0	SPT	3	7	9	16				0	17	37	46	68	37	31		CH		2.54																
120	2.0	UDS					1.92	1.46	31.26								7.8			CD	0.34	20						1.42	130							
120	3.0	SPT	4	7	10	17				0	5	43	52	76	40	36		CH																		
120	4.0	UDS					2.10	1.57	33.63																		1.68	170								
120	5.0	SPT	7	9	11	20				0	5	45	50	80	40	40		CH		2.56																

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

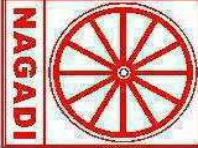
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL			STRENGTH TEST	CONSOLIDATION TEST				SWELL TEST		CT TEST						
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION			Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'ₒ	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Idex 'C'ₑ	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)					Swelling Pressure (kg/cm²)
120	6.5	UDS					2.00	1.53	30.80																									
120	8.0	SPT	8	12	22	34				2	9	41	48	78	42	36		CH																
120	10.0	SPT	11	19	28	47				0	11	39	50	76	40	36		CH																

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
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 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

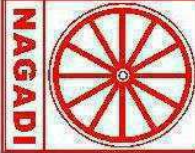
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Blows 15cm				DENSITY Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'Cc'	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
124	1.0	SPT	7	8	10	18				0	3	40	57	92	48	44		CH		2.53															
124	2.0	UDS					1.97	1.53	28.44												UU	0.88	19						1.78	180					
124	3.0	SPT	8	11	16	27				0	7	37	56	86	45	41		CH																	
124	4.0	UDS					2.16	1.65	30.91								7.8				2.54	UCC	1.73							1.15	120				
124	5.0	SPT	15	19	27	46				2	21	45	32	46	24	20		CI																	

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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Results of Field and Laboratory Tests

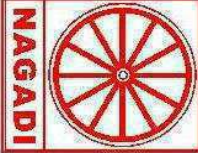
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL			STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST					
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C'c	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
124	6.5	UDS					1.97	1.51	30.37											CD	0.36	21						1.32	135						
124	8.0	SPT	10	26	30	56				9	6	40	45	70	37	33		CH																	
124	9.5	SPT	11	14	23	37				4	10	39	47	72	38	34		CH																	
124	11.0	SPT	21	31	67	98				0	74	26	0	L	P			SM																	
124	14.0	SPT	11	17	29	46				0	85	15	0	L	P			SM																	

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

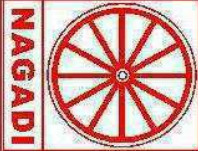
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
125	1.0	SPT	3	5	10	15				0	8	47	45	78	42	36		CH		2.54															
125	2.0	UDS					1.92	1.52	26.64								7.6										0.92	110							
125	3.0	SPT	6	15	22	37				2	8	45	45	73	38	35		CH																	
125	4.0	UDS					2.16	1.65	30.9										UCC	1.37															
125	5.0	SPT	6	10	20	30				0	10	40	50	80	41	39		CH		2.56															

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
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 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

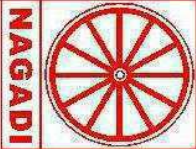
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST		CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)				
125	6.5	UDS					1.95	1.47	34.1																									
125	8.0	SPT	9	15	25	40				0	3	39	58	86	45	41	CH										1.58	160						
125	10.0	SPT	11	19	28	47				0	10	39	51	82	42	40	CH																	

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
Tuu Unconsolidated undrained triaxial test
Tcu Consolidated Undrained triaxial test with pore pressure
Tcd Consolidated drained triaxial test



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Job No. 1658(8)

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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

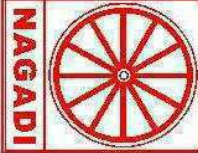
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)	WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS	
									GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)					Optimum Moisture Cont. (%)
127	1.0	SPT	5	7	9	16				0	9	37	54	85	45	40		CH		2.53															
127	2.0	UDS					1.76	1.40	25.66											UU	1.55	19						1.42	150						
127	3.0	SPT	7	10	15	25				8	12	40	40	74	40	34		CH																	
127	4.0	UDS					2.14	1.65	29.6											2.55															
127	5.0	SPT	7	9	16	25				0	6	43	51	78	42	36		CH																	

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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RAW WATER RESERVOIR AREA

Results of Field and Laboratory Tests

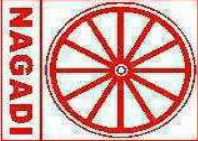
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSIT Y (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e'₀	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Idex 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)				
127	6.5	UDS					2.01	1.52	32.4																										
127	8.0	SPT	9	17	27	44				0	5	42	53	82	42	40		CH																	
127	9.5	UDS					2.07	1.54	34.3											UCC	1.82														
127	11.0	SPT	14	27	34	61				7	4	41	48	72	40	32		CH																	
127	14.0	SPT	30	52		82				0	72	28	0	L	P		SM																		

Type of Sample

DS Disturbed Soil Sample
 UDS Undisturbed Soil Sample
 RMS Remoulded Soil Sample
 WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
 VST Vane Shear Test
 Tuu Unconsolidated undrained triaxial test
 Tcu Consolidated Undrained triaxial test with pore pressure
 Tcd Consolidated drained triaxial test



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PLT/ TRIAL PIT

Results of Field and Laboratory Tests

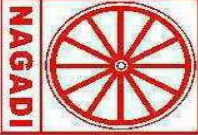
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS			SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage Limit	IS CLASSIFICATION		DESCRIPTION	Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'Pc' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)				
2	1.0	U					1.84	1.45	26.70	0	33	30	37	48	26	22		CI																
2	2.0	U					1.94	1.43	35.20	0	7	41	52	75	44	31		CH	2.57								1.21	130						
2	3.0	U					1.95	1.49	30.82	6	14	38	42	52	28	24		CH																
2	4.0	U					1.84	1.52	21.60	0	36	29	35	46	25	21		CI									70							

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
RMS Remoulded Soil Sample
WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
VST Vane Shear Test
UU Unconsolidated undrained triaxial test
CD Consolidated drained triaxial test



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PLT/ TRIAL PIT

Results of Field and Laboratory Tests

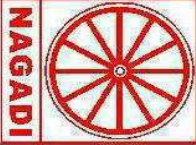
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	Value) Blows 15cm			DENSITY (g/cm ³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST		CONSOLIDATION TEST					SWELL TEST		CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
						BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage Limit	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm ²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e ₀ '	Preconsolid. Press. 'P _c ' (kg/cm ²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm ² /kg)	Co. of Consolid. 'Cv' (cm ² /min)	Swelling Pressure (kg/cm ²)	Free Swell Index (%)	Max. Dry Dendity (g/cm ³)	Optimum Moisture Cont. (%)			
5	1.0	U				1.89	1.43	31.50	0	6	42	52	68	37	31		CH		2.54									1.32	125					
5	2.0	U				1.90	1.46	30.40	0	7	44	49	55	30	25		CH											80						
5	3.0	U				1.79	1.36	31.50	16	13	36	35	48	26	22		CI																	

Type of Sample

DS Disturbed Soil Sample
UDS Undisturbed Soil Sample
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WS Water Sample

Type of Strength Tests

UCC Unconfined Compression Test
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PLT/ TRIAL PIT

Results of Field and Laboratory Tests

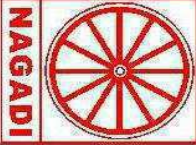
BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm				DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST					SWELL TEST		COMPA CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
							BULK	DRY		GRAVEL	SAND	SILT	CLAY	Liquid	Plastic	Plasticity Index	Shrinkage Limit	IS CLASSIFICATION	DESCRIPTION		Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)	Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Idex 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Density (g/cm³)	Optimum Moisture Cont. (%)				
17	1.0	U					1.75	1.52	15.40	0	40	28	32	46	23	23		CI	2.56									0.37	55							
17	2.0	U					1.85	1.49	23.80	20	35	23	22	38	22	16		CI																		
17	3.0	U					1.95	1.56	24.70	9	39	25	27	40	22	18		CI																		
17	4.0	U					1.82	1.52	19.40	0	17	36	47	65	28	37		CH										0.65	90							

Type of Sample

- DS Disturbed Soil Sample
- UDS Undisturbed Soil Sample
- RMS Remoulded Soil Sample
- WS Water Sample

Type of Strength Tests

- UCC Unconfined Compression Test
- VST Vane Shear Test
- UU Unconsolidated undrained triaxial test
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PLT/ TRIAL PIT

Results of Field and Laboratory Tests

BOREHOLE / TRIAL PIT NO.	DEPTH (m)	TYPE OF SAMPLE	SPT (N Value) Blows 15cm			DENSITY (g/cm³)		WATER CONTENT (%)	PARTICLE SIZE (%)				ATTERBERG'S LIMITS				SOIL		SPECIFIC GRAVITY	STRENGTH TEST			CONSOLIDATION TEST				SWELL TEST		COMPA CT TEST		CALIFORNIA BEARING RATIO (%)	RELATIVE DENSITY	PERMEABILITY (m/hr)	REMARKS
			BULK	DRY	GRAVEL	SAND	SILT		CLAY	Liquid	Plastic	Plasticity Index	Shrinkage Limit	IS CLASSIFICATION	DESCRIPTION	Type	Cohesion 'c' (kg/cm²)	Angle of Shearing Res. 'Φ' (deg)		Initial Void Ratio 'e _o '	Preconsolid. Press. 'P _c ' (kg/cm²)	Compression Index 'C _c '	Co. of Vol. Comp. 'mv' (cm²/kg)	Co. of Consolid. 'Cv' (cm²/min)	Swelling Pressure (kg/cm²)	Free Swell Index (%)	Max. Dry Dendity (g/cm³)	Optimum Moisture Cont. (%)						
18	1.0	U				1.79	1.52	17.82	0	35	32	33	48	24	24		CI	2.53								45								
18	2.0	U				2.01	1.59	26.41	0	31	32	37	46	24	22		CI																	
18	3.0	U				2.05	1.67	22.63	2	38	28	32	42	22	20		CI									0.40	35							
18	4.0	U				2.05	1.71	19.74	47	40	13	0	L	P			SM																	

Type of Sample

- DS Disturbed Soil Sample
- UDS Undisturbed Soil Sample
- RMS Remoulded Soil Sample
- WS Water Sample

Type of Strength Tests

- UCC Unconfined Compression Test
- VST Vane Shear Test
- UU Unconsolidated undrained triaxial test
- CD Consolidated drained triaxial test

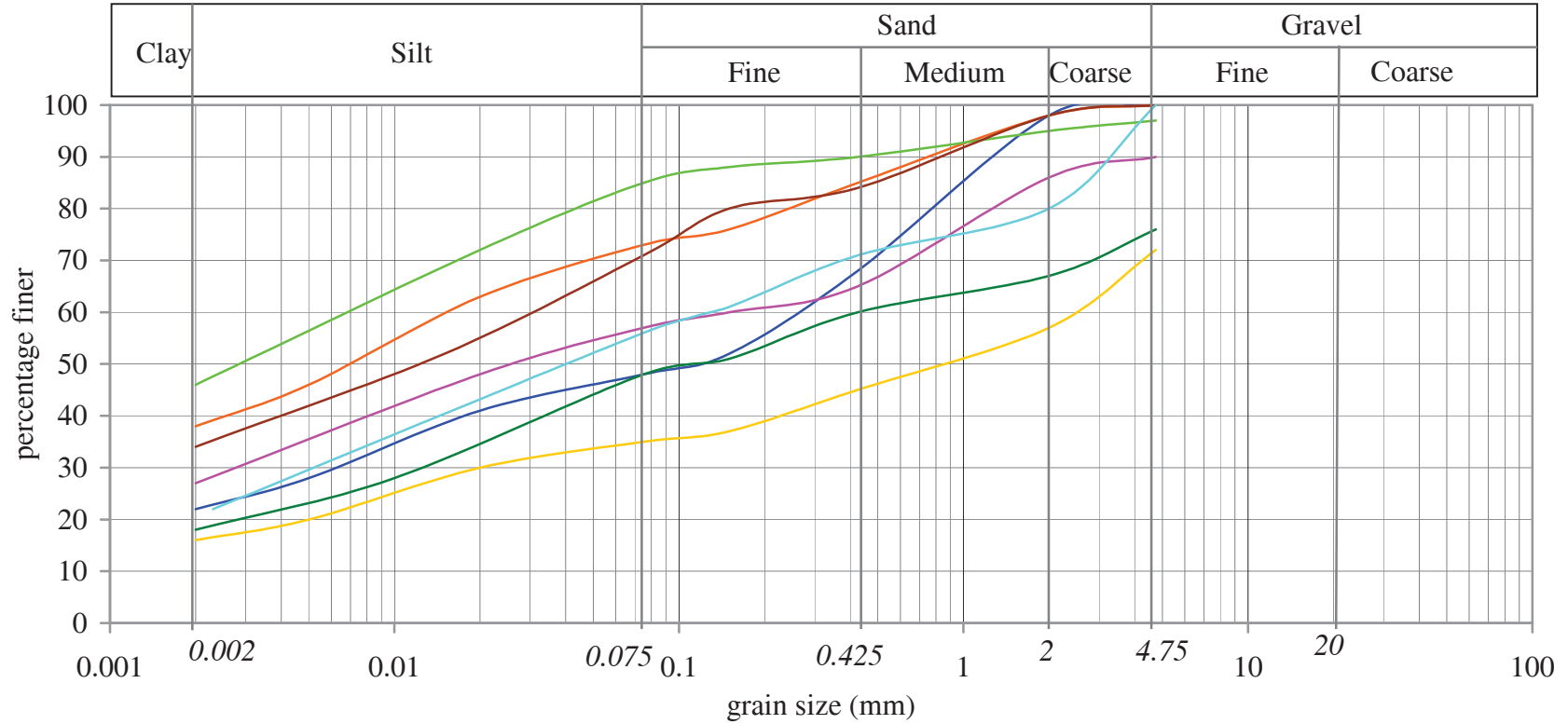


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 Sheet No. : **98 of 117**



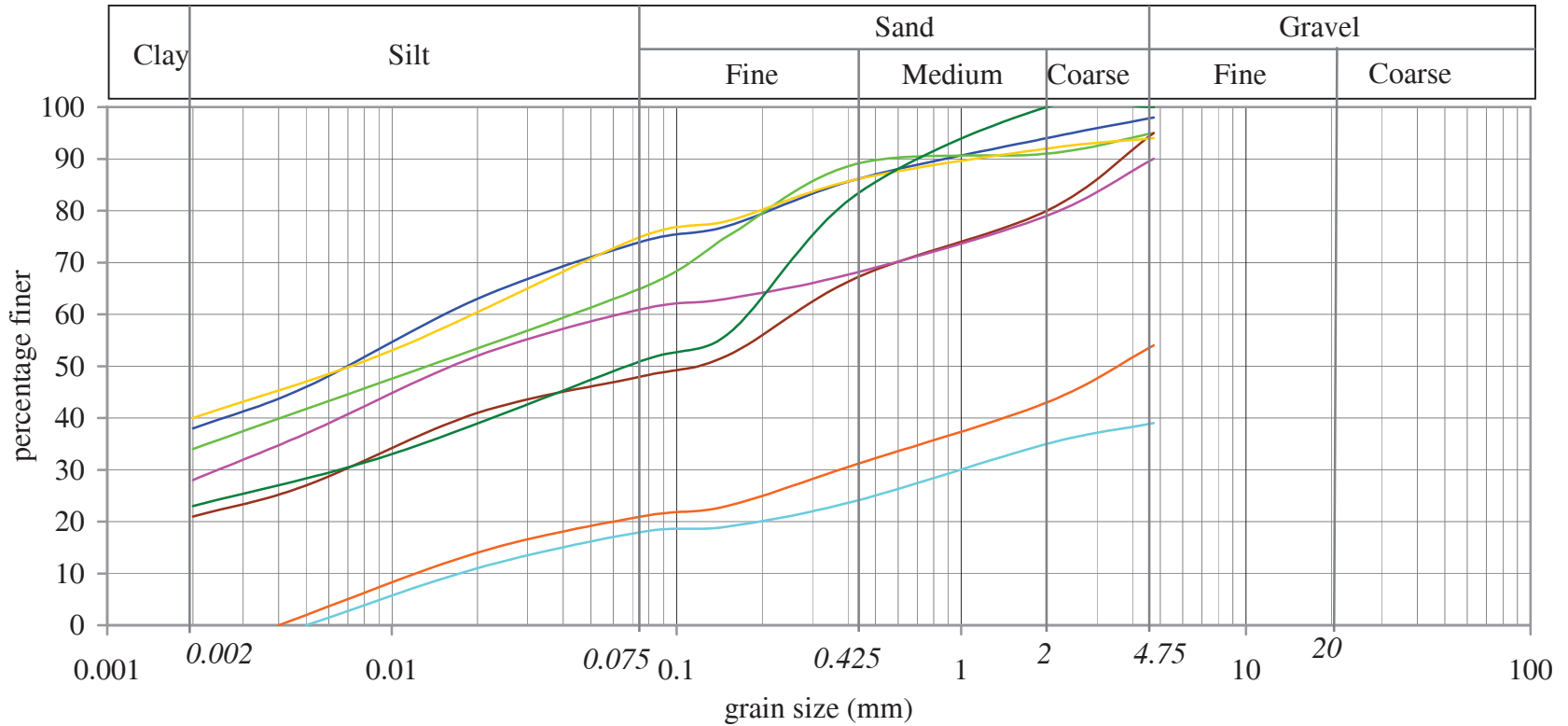


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Sheet No. :



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
	102	1	Sandy silty clay with gravel	2	24	36	38	0.016	-	-
	102	3	Silty sand with gravel	46	33	21	0	-	0.012	-
	102	5	Sandy silty clay with gravel	5	30	31	34	0.04	-	-
	103	1	Clayey silty sand with gravel	5	47	27	21	0.26	-	-
	103	3	Clayey sandy silt with gravel	10	29	33	28	0.06	-	-
	103	5	Sandy silty clay with gravel	6	19	35	40	0.02	-	-
	78	1	Clayey silty sand	0	49	28	23	0.18	-	-
	78	3	Sand with silt and gravel	61	21	18	0	-	0.018	-

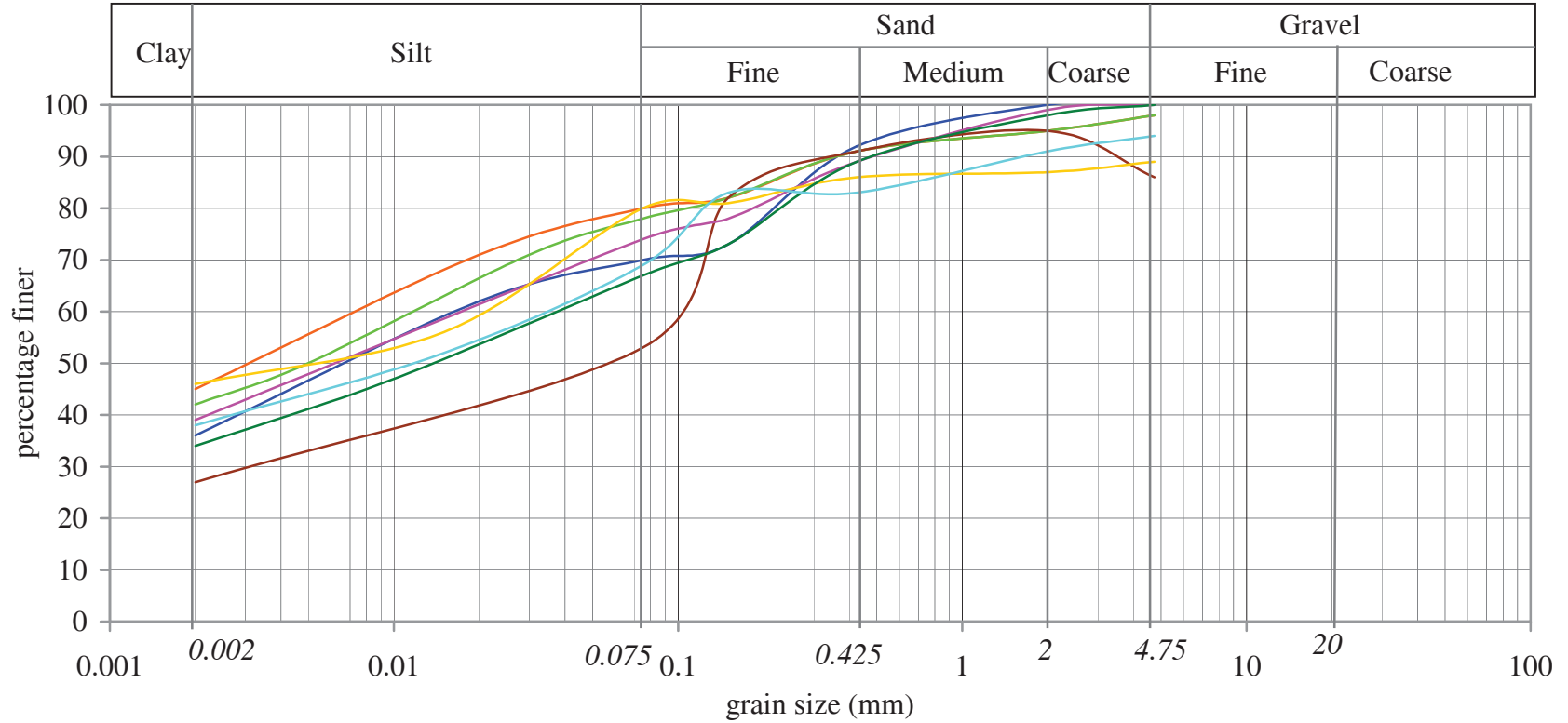


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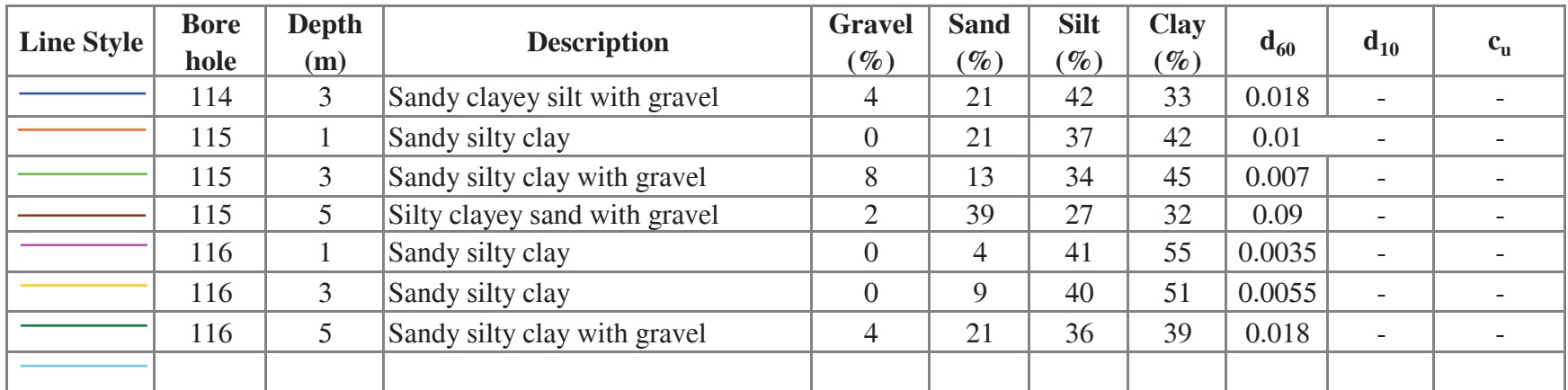
Job No. : **G(H)1658(8)**
 Sheet No. : **100 of 117**



Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
—	78	5	Sandy silty clay	0	30	34	36	0.018	-	-
—	101	1	Sandy silty clay with gravel	2	18	35	45	0.007	-	-
—	101	3	Sandy silty clay with gravel	2	20	36	42	0.012	-	-
—	101	5	Silty clayey sand with gravel	14	33	26	27	0.11	-	-
—	113	1	Sandy silty clay	0	26	35	39	0.018	-	-
—	113	3	Sandy silty clay with gravel	11	9	34	46	0.021	-	-
—	113	5	Sandy silty clay	0	33	33	34	0.038	-	-
—	114	1	Sandy silty clay with gravel	6	25	31	38	0.037	-	-



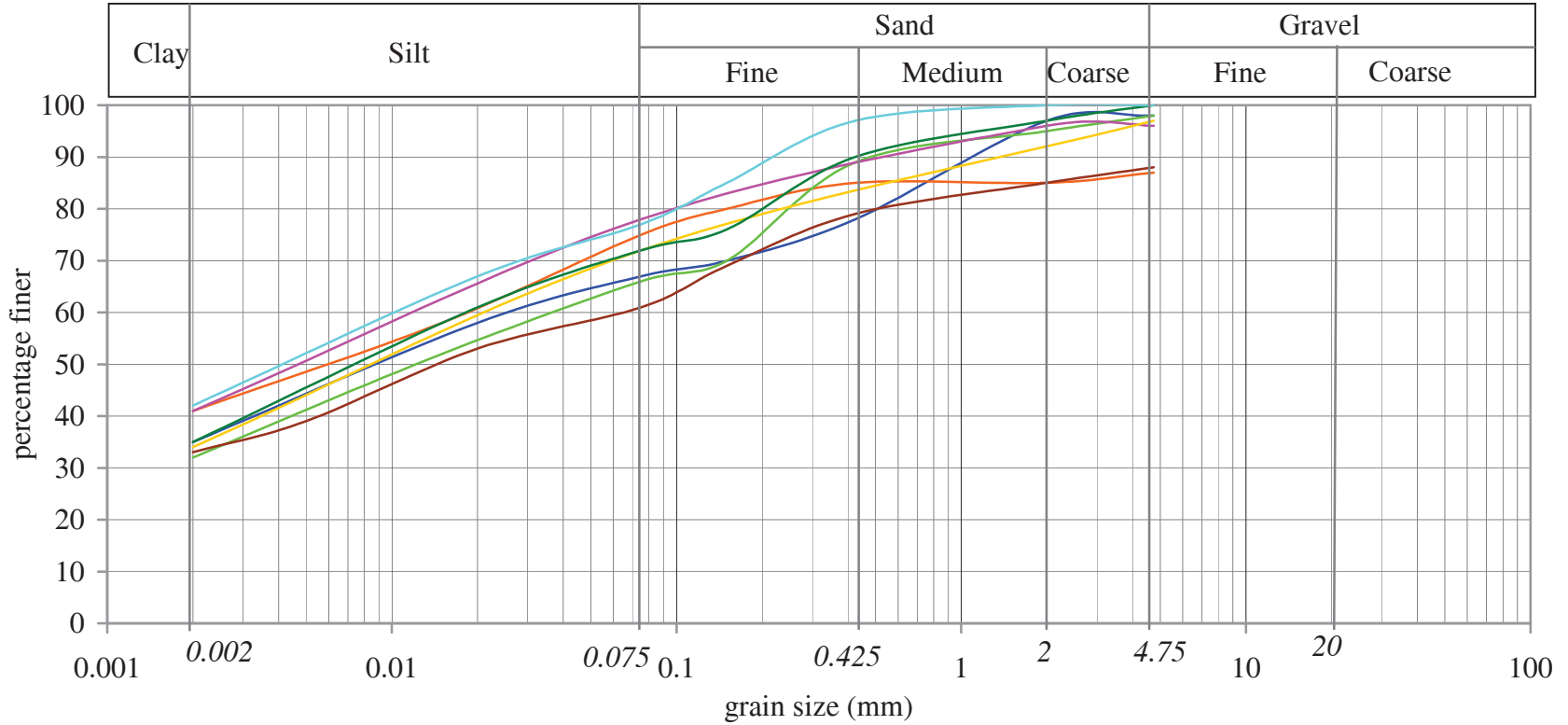
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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d_{60}	d_{10}	c_u
—	77	1	Sandy silty clay with gravel	2	31	32	35	0.025	-	-
—	77	3	Sandy silty clay with gravel	13	12	34	41	0.012	-	-
—	88	1	Sandy clayey silt with gravel	2	32	34	32	0.01	-	-
—	88	3	Sandy silty clay with gravel	12	27	28	33	0.07	-	-
—	89	1	Sandy silty clay with gravel	4	18	37	41	0.012	-	-
—	89	3	Sandy clayey silt with gravel	3	25	38	34	0.02	-	-
—	90	1	Sandy clayey silt	0	28	37	35	0.038	-	-
—	90	3	Sandy silty clay	0	23	35	42	0.009	-	-

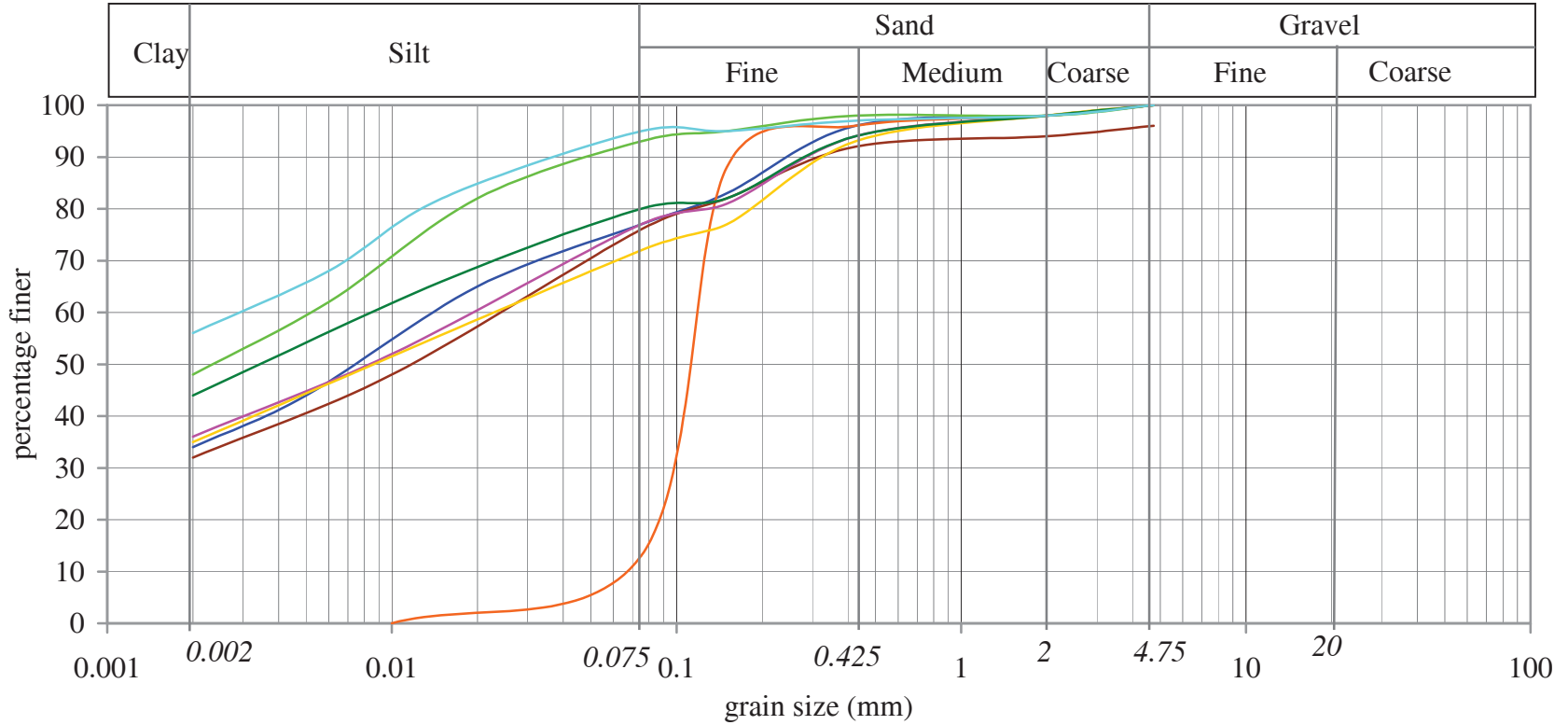


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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
—	117	1	Sandy silty clay	0	23	43	34	0.015	-	-
—	117	3	Sand with silt	0	87	13	0	0.13	0.065	2.0
—	117	5	Sandy silty clay	0	7	45	48	0.005	-	-
—	117	8	Sandy clayey silt with gravel	4	20	44	32	0.034	-	-
—	117	9.5	Sandy clayey silt	0	23	41	36	0.019	-	-
—	117	11	Sandy clayey silt	0	28	37	35	0.02	-	-
—	117	14	Sandy silty clay	0	20	36	44	0.0085	-	-
—	118	1	Sandy silty clay	0	5	39	56	0.003	-	-

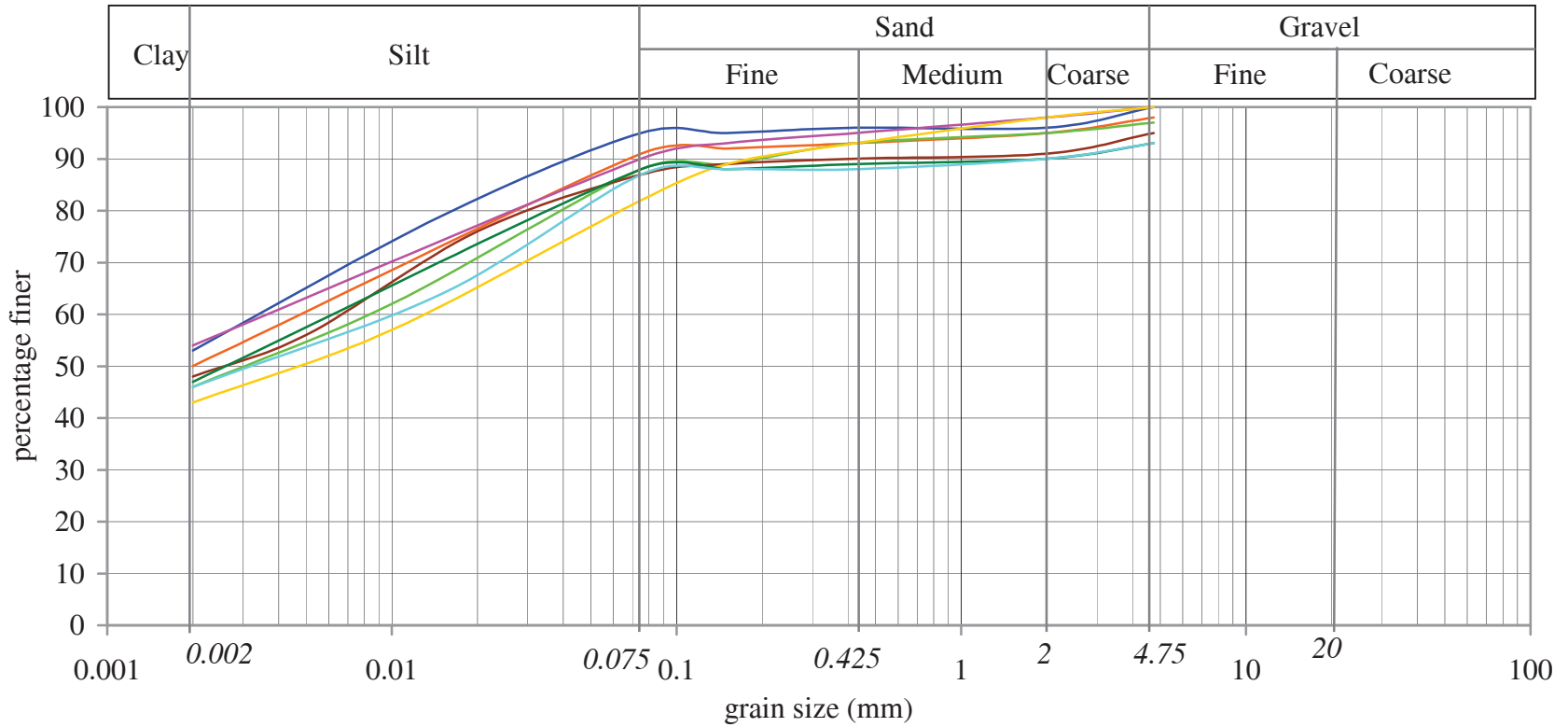


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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
	118	3	Sandy silty clay	0	5	42	53	0.0035	-	-
	118	5	Sandy silty clay with gravel	2	7	41	50	0.005	-	-
	118	8	Sandy silty clay with gravel	3	9	42	46	0.009	-	-
	118	9.5	Sandy silty clay with gravel	5	8	39	48	0.007	-	-
	118	11	Sandy silty clay	0	10	36	54	0.0038	-	-
	118	14	Sandy silty clay	0	18	39	43	0.013	-	-
	119	1	Sandy silty clay with gravel	7	5	41	47	0.0065	-	-
	119	3	Sandy silty clay with gravel	7	6	41	46	0.01	-	-

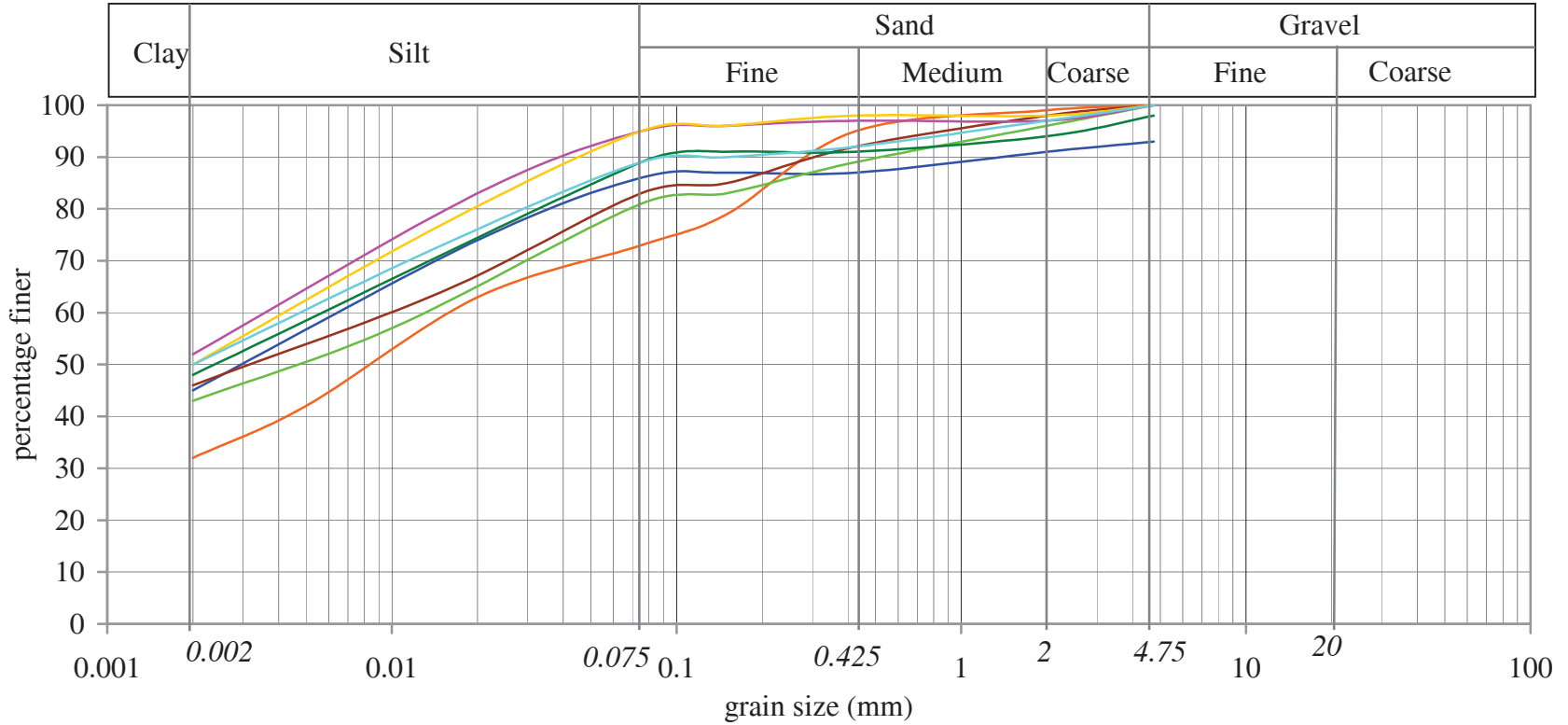


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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
	119	5	Sandy silty clay with gravel	7	7	41	45	0.0065	-	-
	119	8	Sandy clayey silt	0	27	41	32	0.0038	-	-
	119	9.5	Sandy silty clay	0	19	38	43	0.012	-	-
	120	1	Sandy silty clay	0	17	37	46	0.011	-	-
	120	3	Sandy silty clay	0	5	43	52	0.0038	-	-
	120	5	Sandy silty clay	0	5	45	50	0.012	-	-
	120	8	Sandy silty clay with gravel	2	9	41	48	0.007	-	-
	120	10	Sandy silty clay	0	11	39	50	0.006	-	-

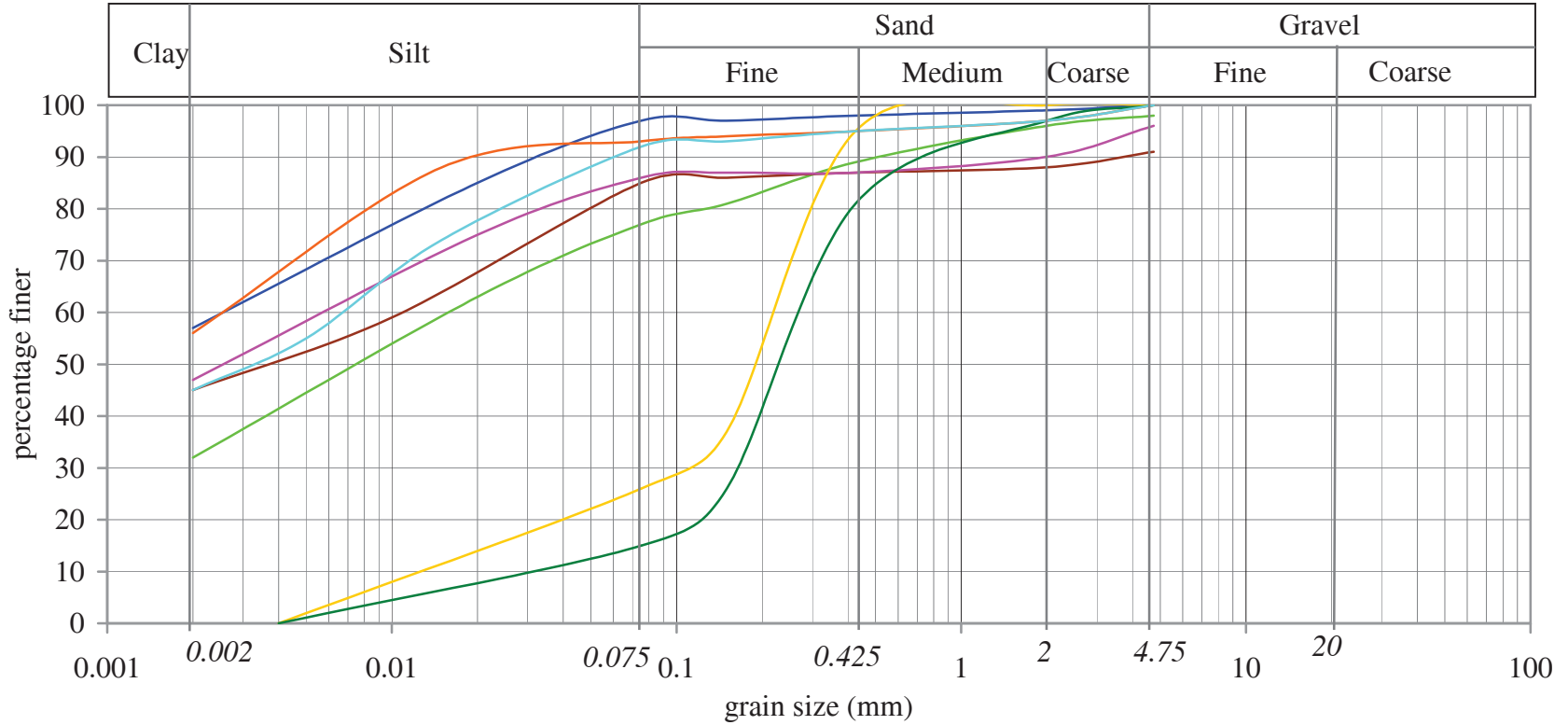


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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
—	124	1	Sandy silty clay	0	3	40	57	0.0028	-	-
—	124	3	Sandy silty clay	0	7	37	56	0.0028	-	-
—	124	5	Sandy clayey silt with gravel	2	21	45	32	0.017	-	-
—	124	8	Sandy silty clay with gravel	9	6	40	45	0.012	-	-
—	124	9	Sandy silty clay with gravel	4	10	39	47	0.006	-	-
—	124	11	Silty sand	0	74	26	0	0.22	0.013	16.9
—	124	14	Sand with silt	0	85	15	0	0.28	0.04	7.0
—	125	1	Sandy clayey silt	0	8	47	45	0.0065	-	-

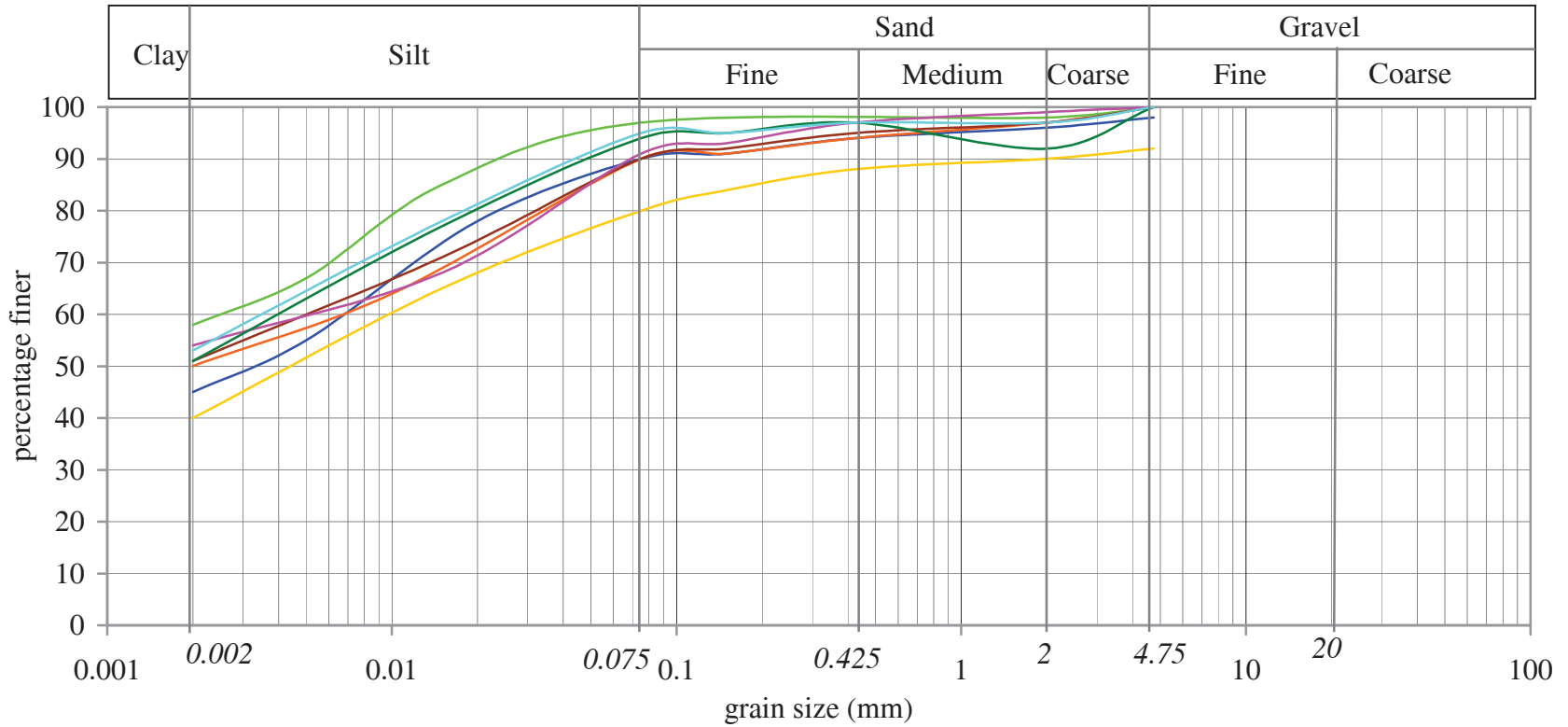


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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
	125	3	Sandy clayey silt	2	8	45	45	0.007	-	-
	125	5	Sandy silty clay	0	10	40	50	0.007	-	-
	125	8	Sandy silty clay	0	3	39	58	0.0035	-	-
	125	10	Sandy silty clay	0	10	39	51	0.005	-	-
	127	1	Sandy silty clay	0	9	37	54	0.005	-	-
	127	3	Sandy clayey silt with gravel	8	12	40	40	0.01	-	-
	127	5	Sandy silty clay	0	6	43	51	0.004	-	-
	127	8	Sandy silty clay	0	5	42	53	0.0035	-	-

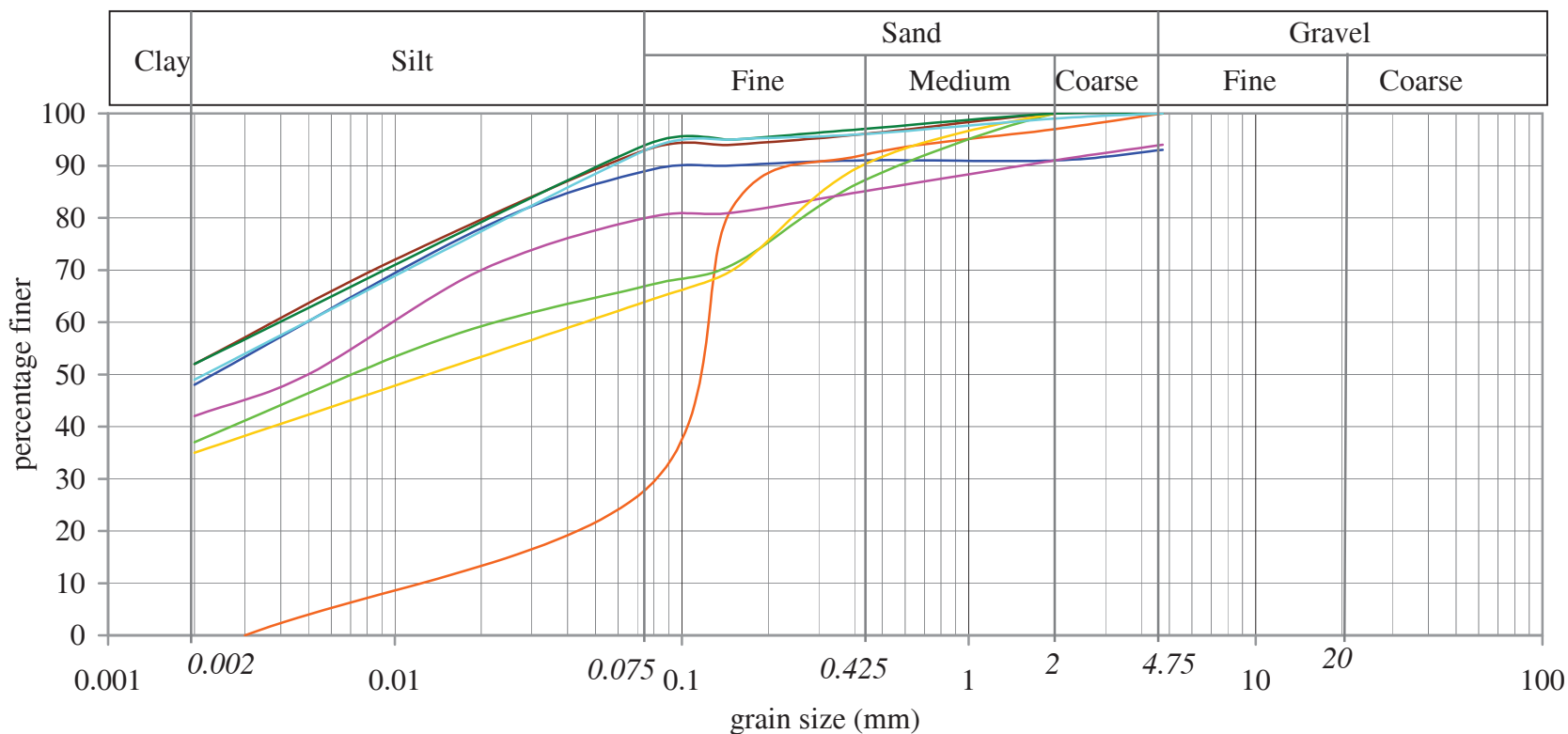


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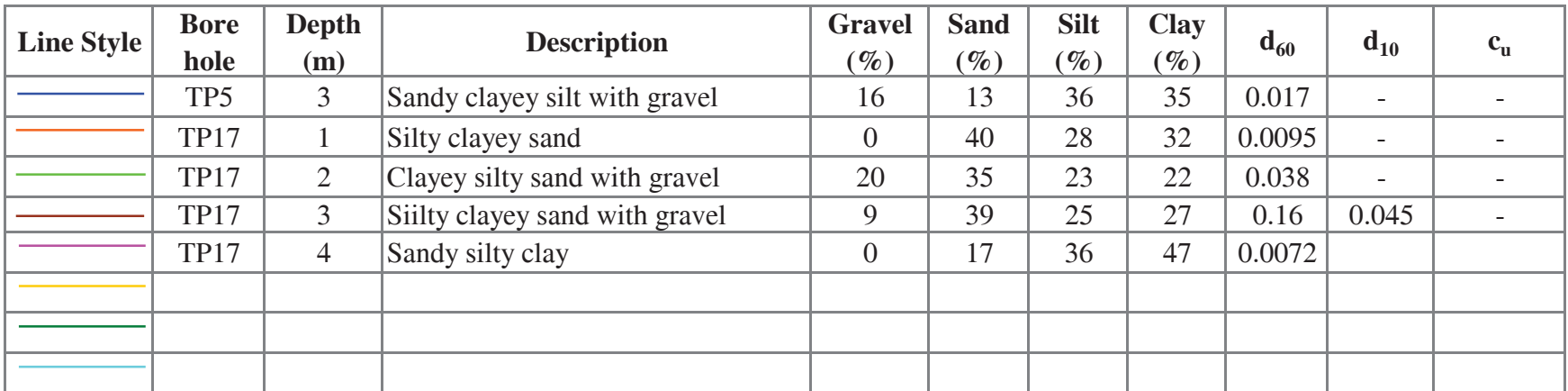
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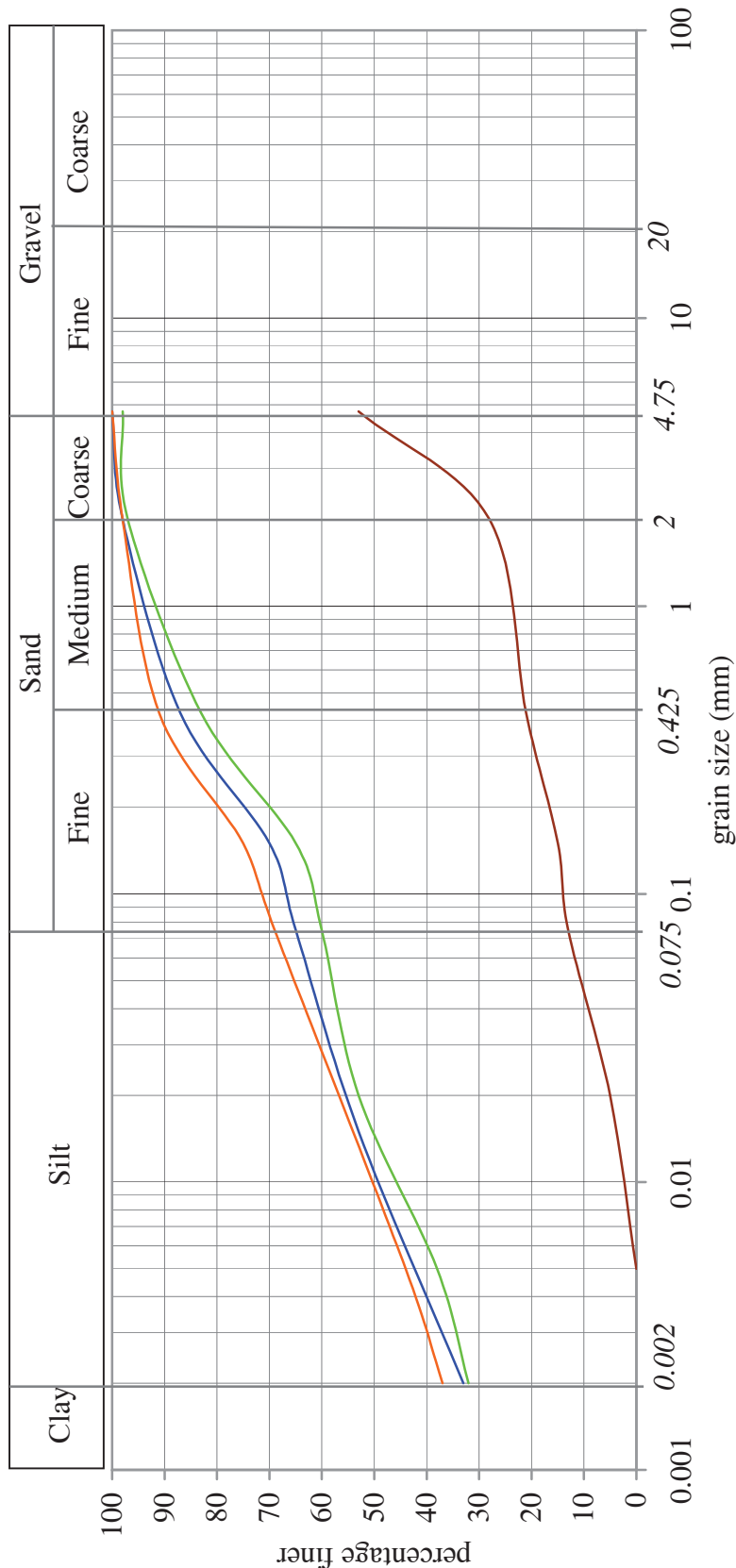


Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
—	127	11	Sandy silty clay with gravel	7	4	41	48	0.004	-	-
—	127	14	Silty sand	0	72	28	0	0.13	0.012	-
—	TP2	1	Silty sandy clay	0	33	30	37	0.02	-	-
—	TP2	2	Sandy silty clay	0	7	41	52	0.004	-	-
—	TP2	3	Sandy silty clay with gravel	6	14	38	42	0.01	-	-
—	TP2	4	Silty clayey sand	0	36	29	35	0.046	-	-
—	TP5	1	Sandy silty clay	0	6	42	52	0.004	-	-
—	TP5	2	Sandy silty clay	0	7	44	49	0.005	-	-



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Line Style	Bore hole	Depth (m)	Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	d ₆₀	d ₁₀	c _u
—	TP18	1	Silty sandy clay	0	35	32	33	0.038	-	-
—	TP18	2	Sandy silty clay	0	31	32	37	0.03	-	-
—	TP18	3	Silty sandy clay with gravel	2	38	28	32	0.075	-	-
—	TP18	4	Sand with silt and gravel	47	40	13	0	-	0.045	-
—										
—										
—										
—										

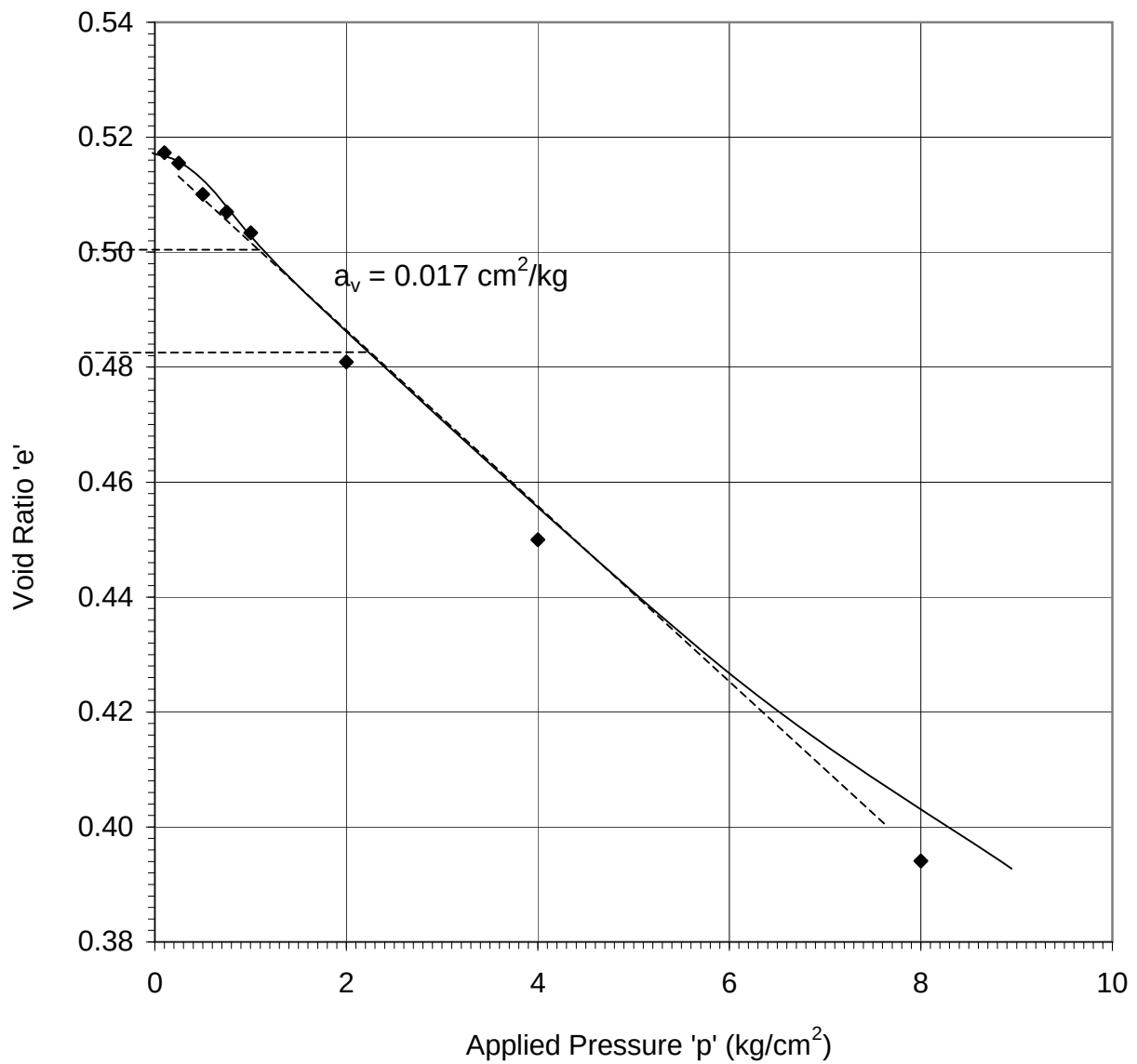


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Soil Sample Details

Borehole - BH75
 Depth - 4m
 Soil Type - Sandy silty clay

Consolidation Test - 1



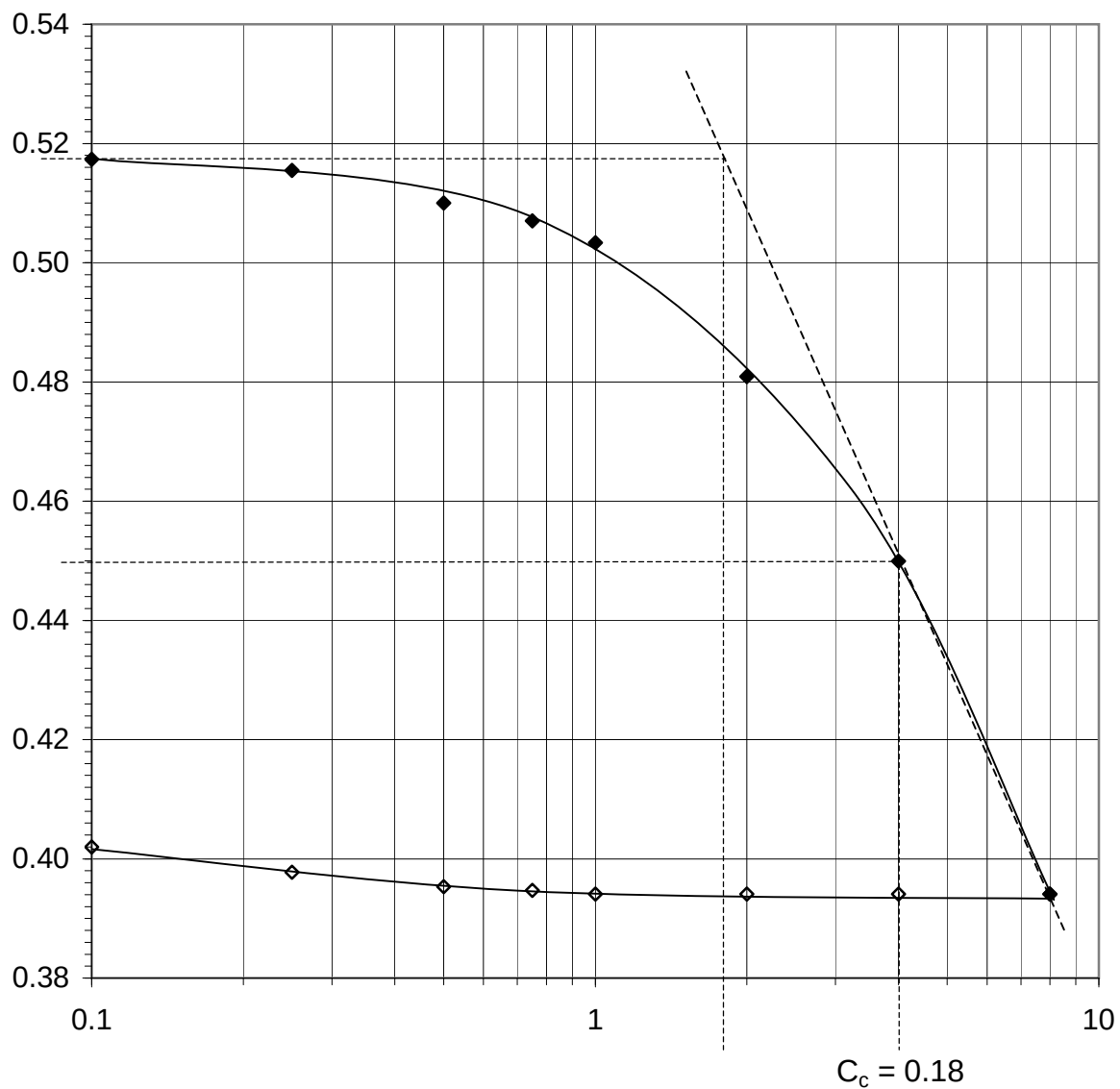
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Soil Sample Details

Borehole - BH75
 Depth - 4m
 Soil Type - Sandy silty clay

Consolidation Test - I

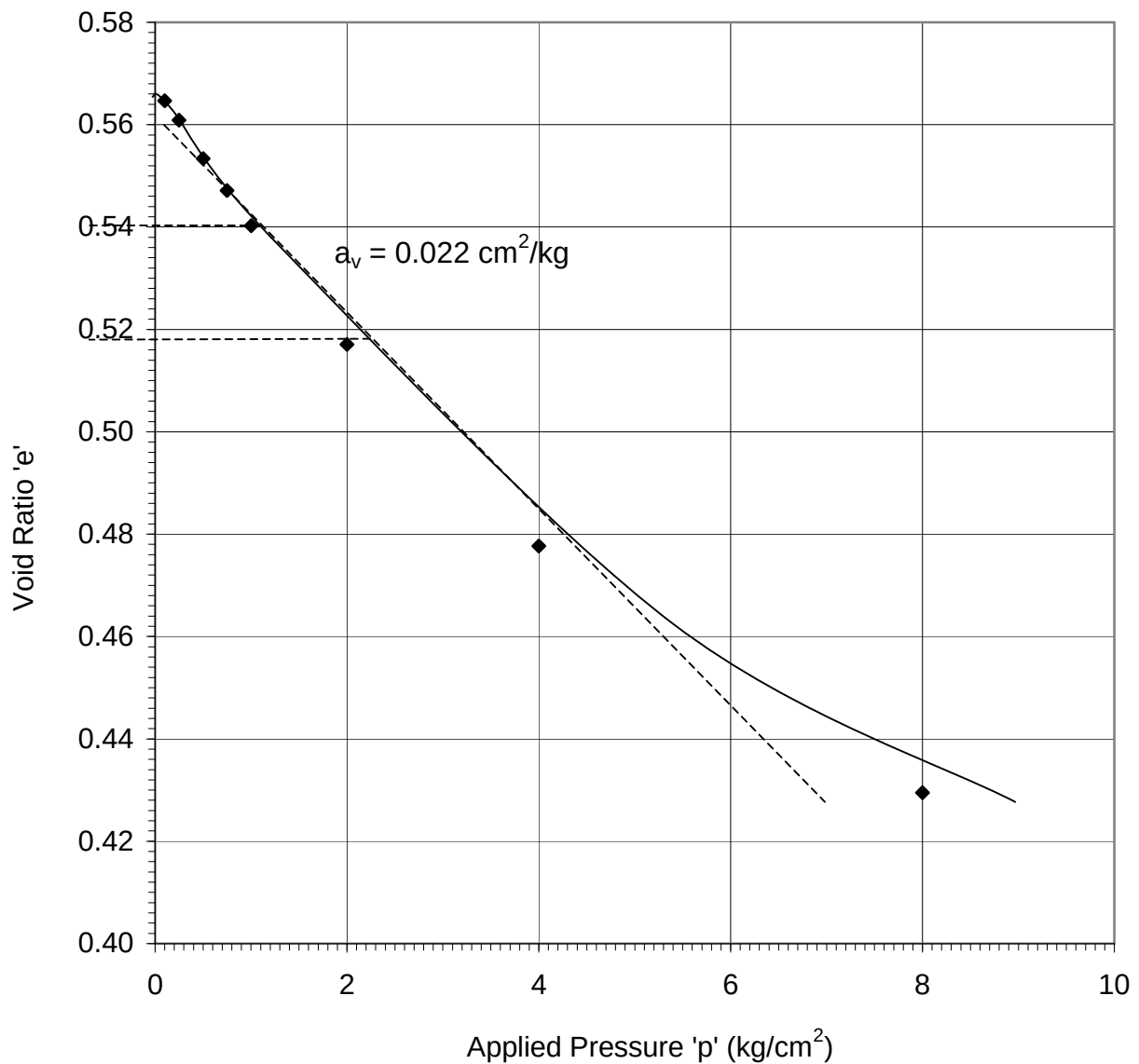


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Soil Sample Details

Borehole - BH88
 Depth - 4m
 Soil Type - Sandy silty clay

Consolidation Test - 2



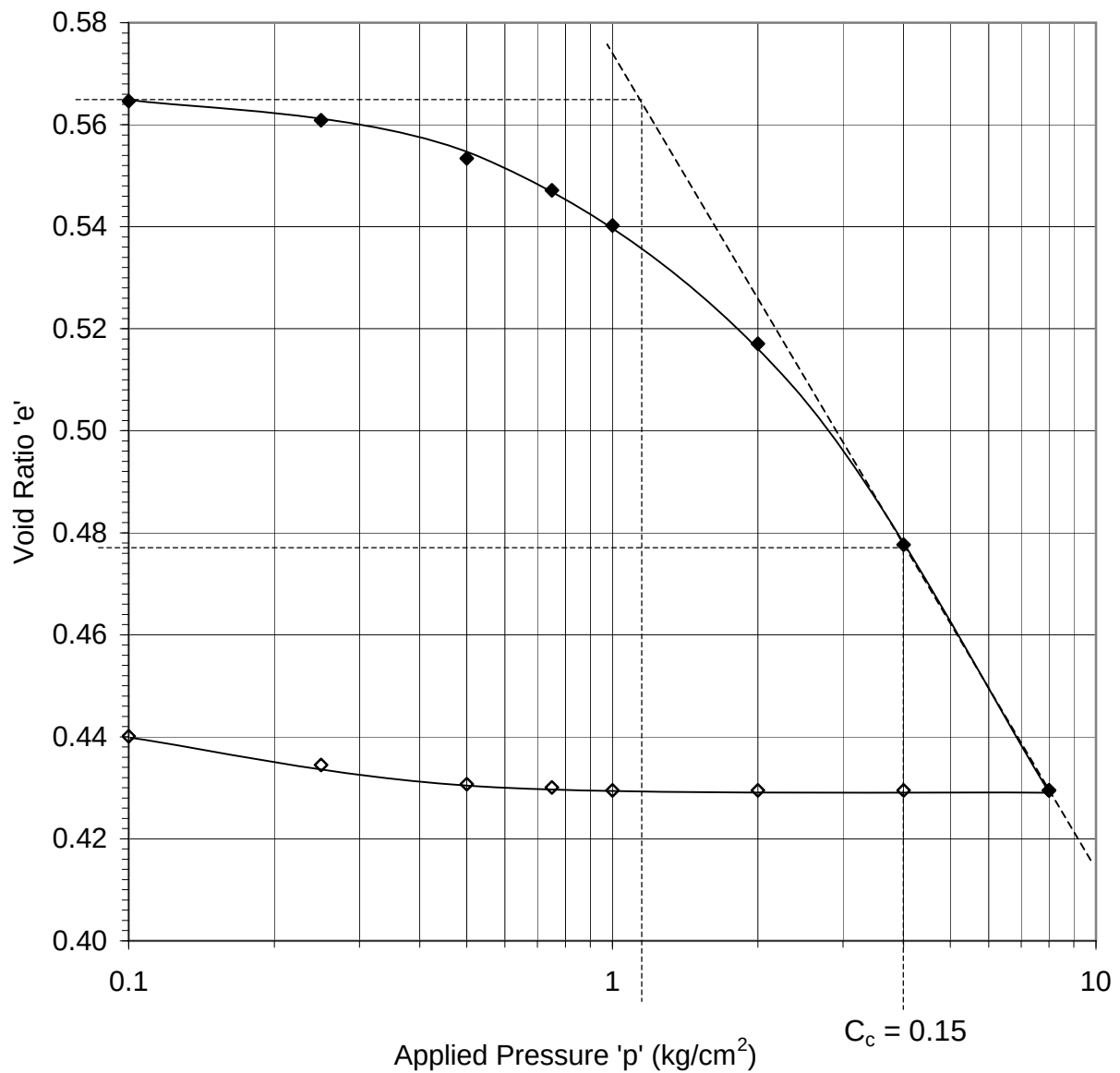
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Soil Sample Details

Borehole - BH88
 Depth - 4m
 Soil Type - Sandy silty clay

Consolidation Test - 2

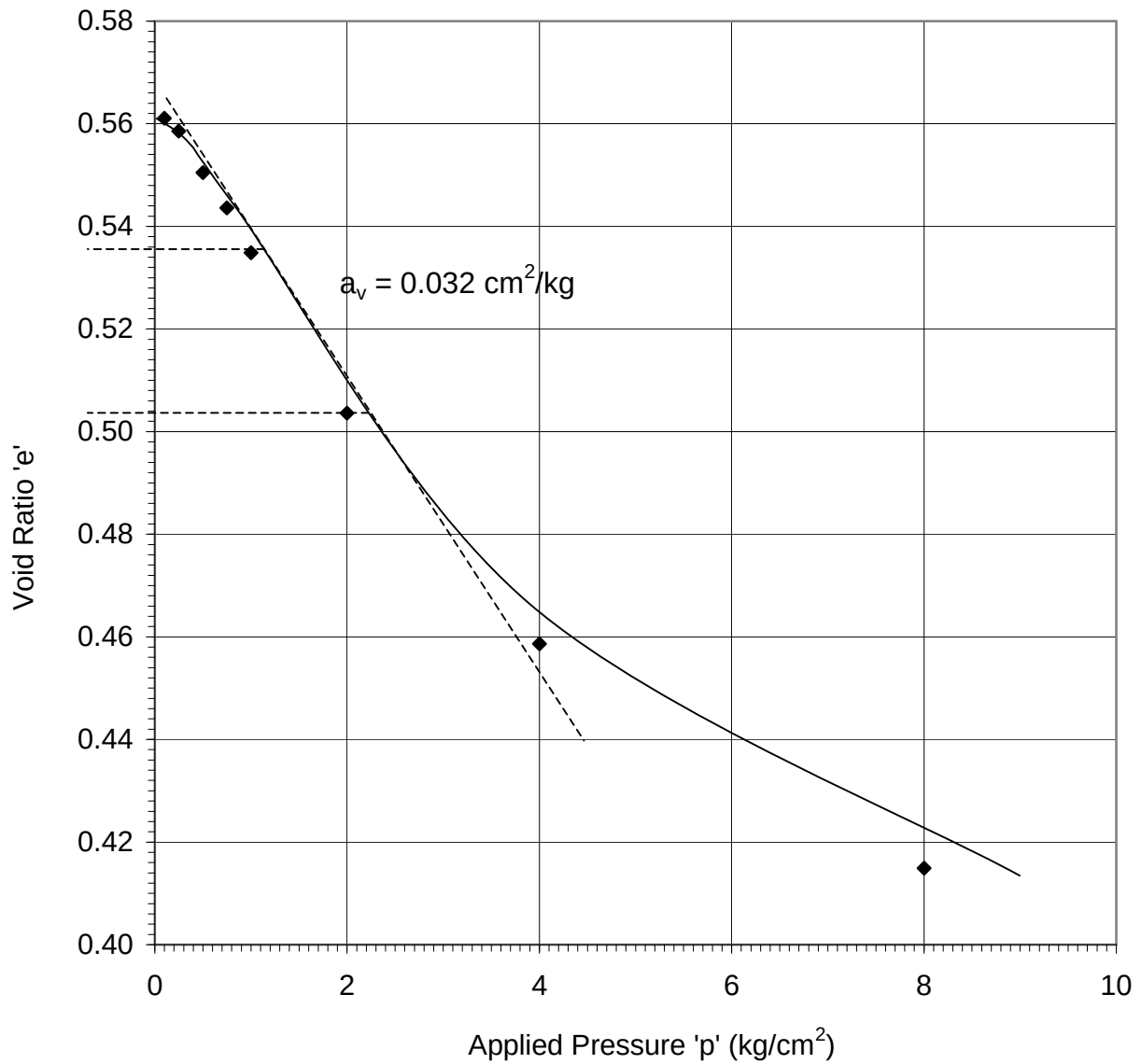


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Soil Sample Details

Borehole - BH124
 Depth - 6.5m
 Soil Type - Sandy silty clay

Consolidation Test - 3

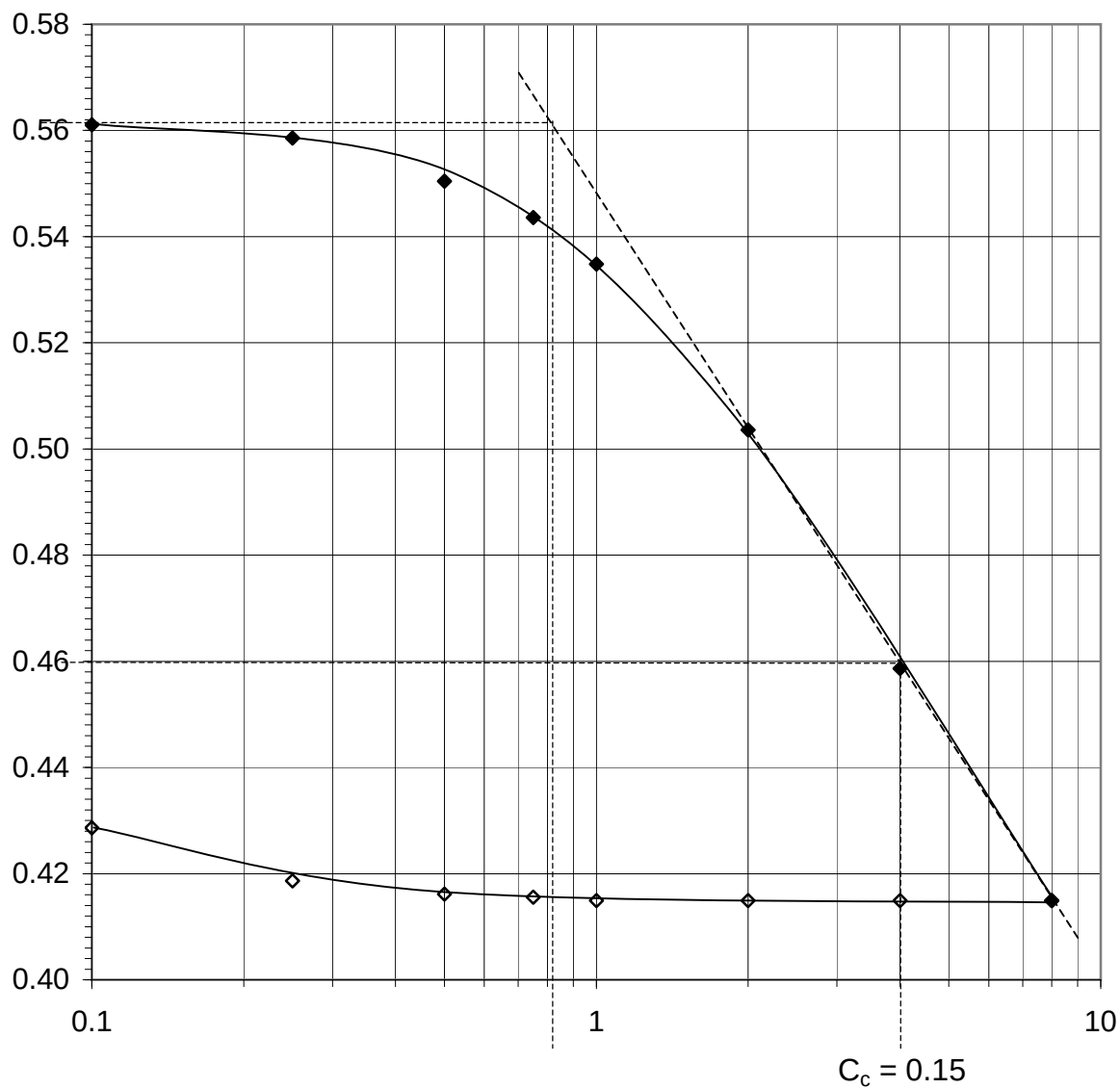


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Soil Sample Details

Borehole - BH124
 Depth - 6.5m
 Soil Type - Sandy silty clay

Consolidation Test - 3



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PHOTOGRAPH SHOWING WORK UNDER PROGRESS



PHOTOGRAPH SHOWING CORE PIECES IN CORE BOX



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