

Ref: BHE/PW/PUR/ MOFG-CVL-CHIMENY/PKG-A (U-01):2179/PKG-B (U-02):2180/Corg-01

Date: 16/09/2019

To,

ALL BIDDERS,

Sub: Corrigendum-01: Issuance of Clarifications and Extension of Tender submission due date.

Package- A (Unit#01): Construction of 150M height RCC Single Flue Chimney complete in all respect including pile & pilecap works, fabrication & erection of steel flue cans, installation of Borosilicate Glass Block Lining on Inner Surface of Steel Flue CAN, erection of shop fabricated structural platforms, installation of electrical items in conformity with the approved layout etc to complete the chimney in all respect as per TCC for Unit#01 Chimney at **2x500 MW NTPC Mauda Stage-I FGD Package.**

and

Package- B (Unit#02): Construction of 150M height RCC Single Flue Chimney complete in all respect including pile & pilecap works, fabrication & erection of steel flue cans, installation of Borosilicate Glass Block Lining on Inner Surface of Steel Flue CAN, erection of shop fabricated structural platforms, installation of electrical items in conformity with the approved layout etc to complete the chimney in all respect as per TCC for Unit#02 Chimney at **2x500 MW NTPC Mauda Stage-I FGD Package.**

01	Package-A (Unit#01)	BHE/PW/PUR/ MOFG-CVL-CHIMENY/PKG-A (U-01):2179
02	Package-B (Unit#02)	BHE/PW/PUR/ MOFG-CVL-CHIMENY/PKG-B (U-02):2180

References: -

- E-Tender Specification Nos: BHE/PW/PUR/ MOFG-CVL-CHIMENY/PKG-A (U-01):2179/PKG-B (U-02):2180

Bidders kindly to take note of the following:

AA) ISSUE OF CLARIFICATIONS AGAINST THE QUERIES:

Sl No	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
1	Clause 15 of Important Information of NIT	The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side). The quoted rates for individual items shall remain firm irrespective of any variations in the individual quantities. No compensation becomes payable in case the variation of the final executed contract value is within the limit of Minus (-) 30% of awarded contract value.	The quantities given in the contract are tentative and may change to any extent (both in plus side and minus side). The quoted rates for individual items shall remain firm irrespective of any variations in the individual quantities. No compensation becomes payable in case the variation of the final executed contract value is within the limit of Minus (-) 15% of awarded contract value."	Tender Condition shall prevail.

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Sl No	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
2	Clause 2.0.3 of Chapter – II of Vol-IA-TCC	Installation of Borosilicate Glass Lining inside MS Flue CANS, including surface preparation, application of primer (supply included in the scope of contractor),	Installation of Borosilicate Glass Lining inside MS Flue CANS, including surface preparation, application of primer (shall be Supplied by BHEL as Free of Cost Items as it is a special item.	BOQ item B26 shall be amended as below: Installation of closed cell borosilicate glass block lining system at all elevations, on ground or in erected position, with minimum 38 mm thick borosilicate glass block, adhesive membrane having a minimum thickness of 3 mm and primer including blast cleaning of internal surface of steel flue liner to near white metal surface finish conforming to Sa 2 ½ finish as per ISO 8501-1, in supervision, and as directed by and satisfaction of borosilicate glass block manufacturer, testing, ten years full replacement guarantee including getting approval of design/drawings and installation procedure from BHEL/NTPC etc all complete as per specification, drawings and as directed by the Engineer-in-charge including cost of skilled labour, material, tools & tackles, equipments etc all complete. Installation of borosilicate lining shall be done under controlled temperature and humidity conditions, as mentioned in specification, including providing all equipments required to create controlled temperature & humidity conditions inside chimney during installation, hot air blow cleaning of internal surface

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Sl No	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
				before application etc. all complete. (Borosilicate Glass Blocks, Primer, Adhesive and onsite supervision of borosilicate glass block supplier shall be provided by BHEL Free of Cost) Clause 2.0.3 of Chapter-II of Vol-IA-TCC is amended as under: Installation of Borosilicate Glass Lining inside MS Flue CANS, including surface preparation, application of primer, adhesive etc. as per the technical specifications and approved erection procedure under the expert supervision of Borosilicate Glass Lining manufacturer /supplier.
3	Clause 2.0.4.2 of Chapter – II of Vol-IA-TCC			Clause 2.0.4.2 of Chapter - II of Vol-IA-TCC is amended as under: Borosilicate Glass Lining Materials, Adhesive (suitable fixing materials), primer (for application of borosilicate glass lining) and Expert Supervision of Manufacturer shall be provided by BHEL as Free of Cost Items.
4	Clause 2.8.9 of Chapter – II of Vol-IA-TCC	The charges only for the actual energy consumed by the contractor shall be recovered based on prevalent rate of DISCOM.	Provide the current electricity charges.	Tender condition shall prevail. Bidder to visit site and may gather further information from site.

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Sl No	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
5	Clause 2.11 of Chapter – II of Vol-IA TCC	Reconciliation of Material issued by BHEL (free of cost)	Provide the Allowable wastage for Borosilicate Glass Block lining work, as Borosilicate Glass Block, Adhesive membrane shall be free of cost supply by BHEL.	Additional Clause No. 2.21 has been added in the Chapter-II of Vol-IA-TCC. Please refer attached <u>Annexure-A</u> to this corrigendum for further details.
6	General	-	Soil report	Available Geotechnical Investigation report (BHEL Doc No: PE-DC-444-602-C001 Rev 03) is attached herewith as <u>Annexure-B</u> for tender purpose only and it may undergo changes during later stage.
7	General	-	Design load on piles	Please refer Geotechnical Investigation report (BHEL Doc No: PE-DC-444-602-C001 Rev 03) is attached herewith as <u>Annexure-B</u> .
8	General	-	Has an additional test piles to be driven or is the test to be performed on working piles.	Test on piles shall be carried out as per BOQ and technical specifications.
9	General	-	No drawing of chimney is available. Kindly arrange to provide us the G.A drawing for the same	Available General arrangement drg is enclosed (Drg. No: PE-DG-444-620-C101, Rev 0) as <u>Annexure-C</u> , however, it may undergo changes during execution.
10	General	-	As per "Annexure-1 to Technical Amendment No-2_Civil" (Volume-IE Tech Spec Part 1 of 3), data for Borelog (23,81,82,106,107,109) are provided. Please confirm the bore-log related to Chimney	Please refer Geotechnical Investigation report (BHEL Doc No: PE-DC-444-602-C001 Rev 03) is attached herewith as <u>Annexure-B</u> .
11	General	-	As per Page 12 of 53 of "Annexure-1 to Technical Amendment No-2_Civil" (Volume-IE Tech Spec Part 1 of 3), pile diameter is mentioned as 600 mm	Refer geotechnical investigation report and project information part of specification (SUB SECTION II PROJECT INFORMATION PAGE 19 & 20 OF 32).

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Sl No	Reference clause of Tender Document	Existing provision	Bidder's query	BHEL's clarification
			dia with Minimum length 27 m and Cut off Level 3 m below F.G.L, whereas as per BOQ, item no A2504(d), pile diameter is mentioned as 900 mm diameter with 11m length below Cut off level. This is contradictory. Please clarify the correct cut off level, minimum length of pile below cut off level and the safe load capacity.	
12	General		As per NIT & Vol-IA-Tech-Bid-2179-2180, completion time of Chimney (including piling works) is 13 months. Please note that minimum 20 months is required for completion	Tender conditions shall prevail.

BB) Extension of Last Date for Tender Submission:

The last date for submission of Tender has been re-scheduled to **24/09/2019, 15.00 hrs.**

Technical Bid shall be opened on 24/09/2019 at 16.00 hrs.

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All other Terms and conditions of the Tender Specification shall remain unaltered unless expressly amended by BHEL in writing. Bidders are requested to submit as a part of their offer, a copy of this corrigendum duly Digitally countersigned by the authorized signatory as a token of Bidder's unqualified acceptance of this corrigendum.

BIDDERS MAY PLEASE NOTE THAT SUBJECT TENDER IS E-TENDER AND THE OFFER IS TO BE SUBMITTED ONLY IN E-PROCUREMENT PORTAL→ www.bhel.abcpurchase.com

BIDDERS WHO HAVE ALREADY SUBMITTED THEIR OFFERS PRIOR TO ISSUANCE OF THIS CORRIGENDUM IN E-TENDER PORTAL ARE REQUIRED TO RE-SUBMIT THEIR OFFER AFTER TAKING COGNIZANCE OF THIS CORRIGENDUM.

Thanking you,
Yours faithfully,

AGM (Purchase)

Enclosure:

- 1) **Annexure-A:** Application of Borosilicate Glass block (02 Pages)
- 2) **Annexure-B:** BHEL DOCUMENT NO. PE-DC-444-602-C001 Rev-03 (348 Pages)
- 3) **Annexure-C:** Drg. No: PE-DG-444-620-C101, Rev 0 (02 Pages)

2.21 Application of Borosilicate Glass block**2.21.1 ISSUE OF MATERIALS**

- 2.21.1.1 **ISSUE OF BOROSILICATE GLASS BLOCK (Free Issue item)** Borosilicate Glass block shall be issued as received vide challan of the transporter in sqm worked out by multiplication of block sizes by no of block.
- 2.21.1.2 **ADHESIVES / MEMBRANCE (Free Issue item)** Shall be issued in Kg/Litre as received in drum.
- 2.21.1.3 **PRIMER PAINT (Free Issue item)** Shall be issued in Litre as received in drum.
- 2.21.1.4 The contractor shall satisfy himself of the quality and quantity of the materials at the time of taking delivery from BHEL stores. No claims whatsoever will be entertained by BHEL because of quality or quantity after contractor takes the materials from BHEL stores.

2.21.2 RETURN OF MATERIALS

- 2.21.2.1 **BOROSILICATE GLASS BLOCK**
All unused Borosilicate blocks shall be taken back by BHEL in sqm worked out by multiplication of block sizes by no. of block.
- 2.1 **ADHESIVES / MEMBRANCE**
All unused untampered adhesive / membrane drum shall be taken back by BHEL in Kg as received during issue. Open drum / partially used drum shall not be taken back.
- 2.2 **PRIMER PAINT**
All unused untampered drum containing paint shall be taken back by BHEL in litre as received during issue. Open drum / partially used drum shall not be taken back.

1. CONSUMPTION AND WASTAGE**3.1 BOROSILICATE GLASS BLOCK**

- 3.1.1 Consumption shall be calculated based on actual required of no. of block /sqm or supplier recommendation whichever is less.
- 3.1.2 Allowable wastage: One and half percent (+1.5%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 1.5% shall be recovered at penal rate. Basis of recovery shall be as follows:

SR no	Borosilicate Glass Block consumption	Basis of issue & penal recovery
B-1	Theoretical consumption (without considering any wastage or loss).	Free
B-2	Actual consumption being Limited to one and half percent (+1.5%) of aforesaid theoretical consumption towards allowable wastage.	Free
B-3	Actual consumption beyond one and half percent (+1.5 %) of above (B-1).	Penal rate

3.2 ADHESIVES / MEMBRANCE

- 3.2.1 Actual consumption of adhesive / membrane per sqm or supplier recommendation whichever is less.

- 3.2.2 Allowable wastage: Three percent (+3%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 3% shall be recovered at penal rate. Basis of recovery shall be as follows:

SR no	Adhesives / Membrane Consumption	Basis of issue & penal recovery
C-1	Theoretical consumption (without considering any wastage or loss).	Free
C-2	Actual consumption being Limited to three percent (+3%) of aforesaid theoretical consumption towards allowable wastage.	Free
C-3	Actual consumption beyond three (+3 %) of above (B-1).	Penal rate

3.3 PRIMER PAINT

- 3.3.1 Actual consumption of paint per sqm or supplier recommendation whichever is less.
- 3.3.2 Allowable wastage: Three percent (+3%) of theoretical consumption unless specified otherwise in the technical specification. Consumption beyond 3% shall be recovered at penal rate. Basis of recovery shall be as follows:

SR no	Adhesives / Membrane Consumption	Basis of issue & penal recovery
P-1	Theoretical consumption (without considering any wastage or loss).	Free
P-2	Actual consumption being Limited to three percent (+3%) of aforesaid theoretical consumption towards allowable wastage.	Free
P-3	Actual consumption beyond three (+3 %) of above (B-1).	Penal rate

2. RECONCILIATION OF BHEL ISSUED MATERIALS

- 4.1 At the time of submission of bills, the contractor shall properly account for the material Issued to him as specified herein to the satisfaction of BHEL certifying that the balance materials are available with contractor's custody at site.
- 4.2 If it is noticed by BHEL that the wastage is high and calls recovery at the penal rate, then BHEL will proceed for recovery for the excess wastage as per penal recovery rates as specified.

3. RECOVERY OF MATERIAL

- 5.1 If wastage exceeds the specified limit, the recovery of excess wastage shall be made from monthly RA bill at the penal rate stipulated below.
- 5.2 PENAL RATE OF MATERIALS

Item	Panel rate
BOROSILICATE GLASS BLOCK	Rs 28000 / Sqm
ADHESIVES / MEMBRANCE	Rs. 2500 / Kg
PRIMER PAINT	Rs. 300 / Litre

NTPC LIMITED
FLUE GAS DESULPHURISATION (FGD) SYSTEM
MAUDA STPP, STAGE-I (2X500MW)



GEOTECHNICAL INVESTIGATION REPORT

BHEL DOCUMENT NO. PE-DC-444-602-C001

NTPC DOCUMENT NO. 9561-109-PEM-PVC-U-148

(REVISION R03)



Furnish recommendation
for 600mm and 760mm
dia pile also

BHARAT HEAVY ELECTRICALS LIMITED
NEW DELHI



BHARAT HEAVY ELECTRICALS LIMITED

REPORT ON GEOTECHNICAL INVESTIGATION WORK OF FGD PACKAGE AREA AT 2X500 MW NTPC MOUDA STPP STAGE-I, FGD PROJECT, MAHARASHTRA



Submitted To
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345, Kingsway,
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CETEST
Engineering Consultants

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PROJECT: 2x500 MW MAUDA TPS STAGE-I FGD OWNER: NTPC Ltd. COMPLIANCE REPORT Comments On Geotechnical Investigation Report, Rev 02 BHEL DOCUMENT NO. PE-DC-444-602-C001 NTPC DOCUMENT NO. 9561-109-PEM-PVC-U-148						
SI No.	NTPC COMMENTS	BHEL Reply	NTPC COMMENTS dated 16.07.2019	BHEL Reply dated 19.07.2019	NTPC COMMENTS dated 07.08.2019	BHEL Reply dated 07.08.2019
1	Page no. 42 to 45/97 Eu value is very high	The basis of "E" calculation is presented in Annexure-1.	-	Point closed		
2	Page no. 46 to 48/97 Mention NGL from Topographical survey in place of FGL for all structures	The NGLs of all the bore holes are rechecked with reference to the spot levels and contours as per Topographical survey conducted at site. It is confirmed that NGLs of various structures are higher than respective FGLs. Accordingly, depth of foundation is considered from FGL. Topographical Survey drg superimposed on Geotechnical Investigation Layout is enclosed for reference.	For NGL, refer annexure-III and topographical survey provided in the technical spec	BHEL explained during meeting on 17.07.2019 that NGL should be referred based on the topographical survey and geotechnical investigation report carried out at site. However NTPC insisted to consider NGL as per the survey which was carried out earlier by NTPC. It is once again reiterated that BHEL will follow latest survey drawing and geotechnical investigation report for consideration of NGL.	Revise as per technical specification	Report revised as per the discussion during meeting.
3	Page no. 46/97 1.1m filled-up shall be considered as surcharge in wet stack-1	The NGL of BH-6 & 7 is RL 270.94 m and FGL is RL 271 m. Accordingly, there is no fill and hence no additional surcharge is considered in calculation.				
4	Page no. 46 to 48/97 2.4m filled-up shall be considered as surcharge in wet stack-2	The NGL of BH-11 & 12 is RL 271 m and FGL is RL 271 m. Accordingly, there is no fill and hence no additional surcharge is considered in calculation.				
5	Page no. 46 to 48/97 Consider filled up soil as surcharge in design in calculation of Net	As NGL of bore holes are higher than respective FGLs. Hence no additional surcharge is considered in calculation.				
6	Page no. 50,51, 55 & 56/97 For Layer -IV, consider $\phi=36$ degree and $K_0 = 1.3$ in place of 40 degree and 1.50	Considering the bore log data and lab test results, the sub strata for Layer-IV is completely weathered rock. For analysis, this strata is considered as dense soil with SPT N value > 100 and accordingly $\phi=40$ degree and $K_0 = 1.5$ has been considered as per IS 6403 Fig 1 and IS 2911 Part-1 Sec 2. Moreover, refer enclosed reference (as Annexure-2) from Bowles book regarding ϕ value for weathered rock.	phi shall be 36 degree, refer "Pile design and construction practice" by M.J.Tomlinson and "Geotechnical Investigation Methods" by Hunt	Pile capacity in vertical compression is revised as per clause B-8 of IS 2911 part-1 section-2.	Furnish pile capacity for 600mm and 760 mm dia pile for structures other than chimney	Kindly note that, the absorber, RC oxidation blower building and booster fan are also in the chimney area. Considering the space restriction to accommodate these facilities along with chimney, site constraints and substrata conditions, in order to minimise the size of pile cap of each structure, high capacity piles are required as in chimney foundation. Hence BHEL proposes 900mm/1000mm diameter pile for above mentioned building/structures also.
7	Page no. 53 & 54/97 Furnish pile capacity for 600 & 760mm dia pile as mentioned in Technical spec.	Please refer MOM between NTPC and BHEL dated 04.06.19 at Mouda site, accordingly 900 mm/1000 mm dia piles are considered in place of 600mm/760 mm dia piles.	Furnish pile capacity for 600mm and 760 mm dia pile	Please refer MOM between NTPC and BHEL dated 04.06.19 at Mouda site, accordingly 900 mm/1000 mm dia piles are considered in place of 600mm/760 mm dia piles.		
8	Page no. 53 & 54/97 Revise length as per comments marked above	Please refer our reply as per point no. 6 above.				
9	Page no. 57 & 59/97 Backfilling shall be done as per technical spec	Noted. As per Free swell index and swell pressure test results, the top soil is having medium swelling characteristics. Hence tests shall be conducted on existing soil for suitability of the same as backfilling material during foundation construction.	No comments from NTPC	Point closed		
10	Page no. A147/A247 Free Swelling Index is very high. Backfilling shall be done as per Annexure III(f) in Tech. Spec.	Noted. As per Free swell index and swell pressure test results, the top soil is having medium swelling characteristics. Hence tests shall be conducted on existing soil for suitability of the same as backfilling material during foundation construction.	No comments from NTPC	Point closed		

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REPORT ON
GEOTECHNICAL INVESTIGATION WORK OF
FGD PACKAGE AREA AT 2X500 MW NTPC MOUDA
STPP STAGE-I, FGD PROJECT, MAHARASHTRA

1. INTRODUCTION

M/s. NTPC has proposed the construction of FGD package area at 2 x 500 MW NTPC Mouda STPP Stage-I, FGD Project at Maharashtra and the job was awarded to **M/s. Bharat Heavy Electricals Limited**. For designing of Foundation Structures coming under this project, it was necessary to conduct a Detailed Geotechnical Investigation Work and **M/s Bharat Heavy Electricals Limited**, in turn awarded the job to **M/s. C. E. Testing Company Pvt. Ltd., Kolkata**.

The scope of the work comprises of sinking 35 nos. Boreholes, 6 nos. Trial Pits (TP), 2 nos. Plate Load Tests (PLT), 3 nos. Cyclic Plate Load Tests (CPLT), 2 nos. Dynamic Cone Penetration Tests (DCPT), 2 nos. Field Permeability Tests (FPT) and 7 nos. Electrical Resistivity Tests (ERT).

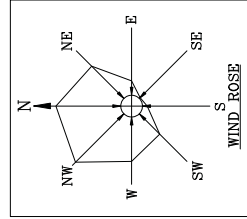
The boreholes of 150 mm diameter were advanced by Shell and Auger method in soil. In rock, rotary core drilling of "NX" size was adopted. The scope also included conducting Standard Penetration Tests, collecting disturbed samples at regular intervals for identification and logging purposes, collecting undisturbed tube samples at suitable intervals or at change of strata whichever is earlier and testing these in the laboratory.

Based on the above, this report presents the Bore Logs, Soil Profile, laboratory and field Test Results. On the basis of field tests and laboratory test results and their analysis thereof, the most suitable type of foundation is suggested.

The subsoil is characterised by medium to stiff silty clay / clayey silt followed by very stiff to hard silty clay / clayey silt layer. After that dense to very dense silty sand with clay binder is observed. Then, weathered rock layer is struck and that continues upto the terminating depth of all the boreholes.

Considering the nature of the subsoil as revealed from field tests, most suitable type of foundation is recommended. However, this is discussed in details later.

BORE HOLE (BH/IBH)			DEPTH (M)
MARKING	CO-ORDINATES		
BH-1	5947 E 5743 N	30	
BH-2	5947 E 5625 N	30	
BH-3	5998 E 5670 N	30	
BH-4	6021 E 5706 N	30	
BH-5	6063 E 5680 N	25	
BH-6	6090 E 5588 N	30	
BH-7	6106 E 5604 N	35	
BH-8	6102 E 5627 N	30	
BH-9	6079 E 5725 N	25	
BH-10	6094 E 5759 N	30	
BH-11	6092 E 5781 N	35	
BH-12	6109 E 5796 N	30	
BH-13	6230.321 E 5669.562 N	25	
BH-14	6246.980 E 5676.948 N	25	
BH-15	6275.075 E 5698.030 N	25	
BH-16	6231 E 5626 N	30	
BH-17	6317 E 5692 N	25	
BH-18	6245.698 E 5484.384 N	25	
BH-19	6273 E 5480 N	25	
BH-20	5983.500 E 5729.500 N	25	
BH-21	6041 E 5724 N	25	
BH-22	6085 E 5649 N	25	
BH-23	6116 E 5765 N	25	
BH-24	6251 E 5712 N	25	
BH-25	6318 E 5727 N	25	
BH-26	6274 E 5500 N	25	
IBH-1	6255 E 5210 N	25	
IBH-2	6270 E 5236 N	35	
IBH-3	6266 E 5276 N	25	
IBH-4	6260 E 5355 N	25	
IBH-5	6252 E 5394 N	35	
IBH-6	6273 E 5417 N	35	
IBH-7	6265 E 5446 N	35	
IBH-8	6271 E 5732 N	35	
IBH-9	6271 E 5786 N	35	



NOTES:-

1. ALL DIMENSIONS ARE IN METERS UNLESS NOTED OTHERWISE.
2. BORE HOLE SHALL BE DRILLED UPTO THE DEPTH INDICATED AGAINST EACH BORE HOLE OR UPTO 5M IN ROCK WITH CONTINUOUS ROD >25% WHICH-EVER IS EARLIER.
3. BACKFILLING OF BORE HOLES AND PITS SHALL BE AS PER SPECIFICATION AND AS DIRECTED BY THE ENGINEER-IN-CHARGE.
4. STARTING DEPTH OF STANDARD PENETRATION TEST (SPT) SHALL BE 1M BELOW GROUND LEVEL. SPT SHALL BE CONDUCTED AT EVERY 1M INTERVAL ALTERNATE TO COLLECTION OF UNDISTURBED SAMPLE (UDS) UPTO 10M DEPTH BELOW GROUND LEVEL AND AT EVERY 1.5M INTERVAL ALTERNATE TO COLLECTION OF UDS BEYOND 10M DEPTH.
5. STARTING DEPTH OF COLLECTION OF UDS SHALL BE 2M BELOW GROUND LEVEL AND UDS SHALL BE COLLECTED AT 1M INTERVAL ALTERNATE TO CONDUCTING SPT UPTO 10M DEPTH BELOW GROUND LEVEL AND AT EVERY 1.5M INTERVAL ALTERNATE TO CONDUCTING SPT BEYOND 10M DEPTH.
6. PUMP IN TYPE FIELD PERMEABILITY TEST SHALL BE CARRIED OUT IN BH-2, BH-8 & IBH-7 AT 1M, 3M, 5M, 8M & 12M BELOW LEVEL.
7. ELECTRICAL RESISTIVITY TEST SHALL BE CARRIED OUT BY WENNER'S METHOD.
8. GROUND WATER SAMPLE SHALL BE COLLECTED FROM BH-2, BH-5, BH-10, BH-13, BH-14, BH-16, BH-19, IBH-2, IBH-5, & IBH-6.
9. PLATE LOAD TEST SHALL BE CONDUCTED IN TP-2 & TP-4 AT 3M DEPTH BELOW GROUND LEVEL.
10. CYCLIC PLATE LOAD TEST SHALL BE CONDUCTED IN TP-1, TP-3 & ITP-1 AT 3M DEPTH BELOW GROUND LEVEL.
11. GEOTECHNICAL INVESTIGATION SHALL BE CARRIED OUT AS PER SPECIFICATION.
12. DO NOT SCALE THIS DRAWING.

REFERENCE DRAWINGS:-

1. NTPC DRG. NO. 9561/9575-999-POC-F-001, TITLED "GENERAL LAYOUT PLAN".

GEOTECHNICAL INVESTIGATION LEGEND:

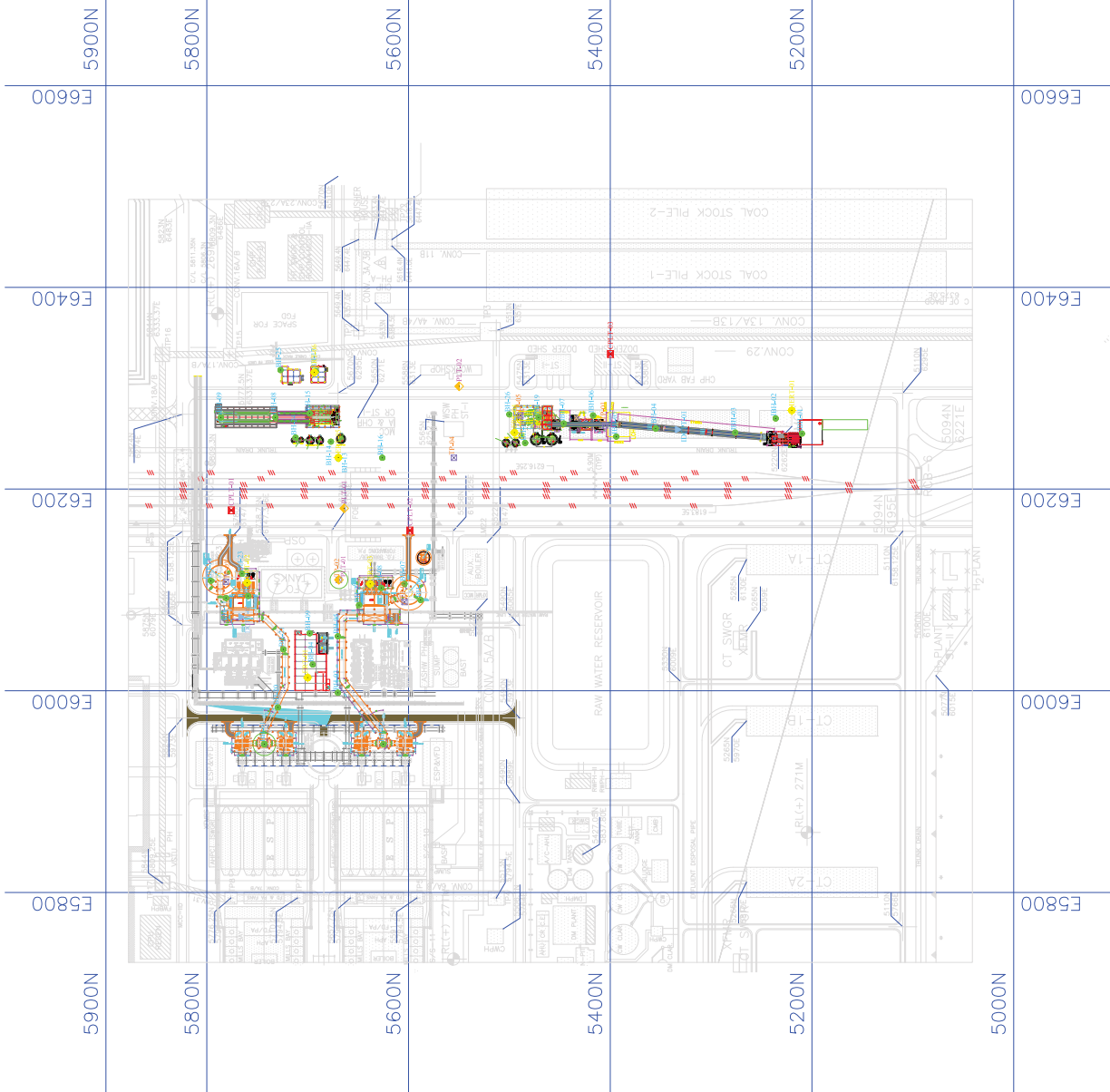
1. BOREHOLE (BH / IBH)
2. TRIAL PIT (TP / ITP)
3. ELECTRICAL RESISTIVITY TEST (ERT / IERT)
6. DYNAMIC CONE PENETRATION TEST (DCPT/IDCPT)

ELECTRICAL RESISTIVITY TEST (ERT/IERT)

MARKING	CO-ORDINATES
ERT-1	6013 E 5700 N
ERT-2	6107.184 E 5760.041 N
ERT-3	6106 E 5638 N
ERT-4	6256 E 5495 N
ERT-5	6231.186 E 5669.562 N
ERT-6	6315.655 E 5693.406 N
IERT-1	6278 E 5220 N

DYNAMIC CONE PENETRATION TEST (DCPT/IDCPT)

MARKING	CO-ORDINATES
DCPT-1	6073.300 E 5763 N
IDCPT-1	6259 E 5330 N



Annexure-B

NTPC DRG. No. 9561-108-PEM-PVC-B-005	
PROJECT MAUDA SUPER THERMAL POWER PROJECT	
STAGE-I (23500MW)	
NTPC Limited	
Bharat Heavy Electricals Ltd	
PROJECT ENGINEERING MANAGEMENT	
444	
AS BUILT DRAWING	
DATE 20.02.2019	
BY 20.02.2019	
CHECKED 20.02.2019	
APPROVED 20.02.2019	
TITLE GEOTECHNICAL INVESTIGATION LAYOUT FOR POC AREA	
SCALE 1:1	
SHEET 1 OF 1	
FORM SIZE A4	

2. FIELD INVESTIGATION

2.01. GENERAL:

In an attempt for finalisation in the design of foundation for these proposed structures to be constructed at this site, Geotechnical Investigation was envisaged. The entire Investigation programme had been divided mainly into two parts, I) Field works & II) Laboratory tests.

- I) Field works unfold the sub-surface deposit types and their characteristics and
- II) Laboratory tests part would help determining the relevant physical and geotechnical properties of the sub-surface deposits leading to finalisation of foundation depths of the structures and the bearing capacity with particular reference to the sub-surface types and their strength parameters and settlement potentials at the site.

A list of the bore holes with the location, ground level, standing water level etc. are presented in a tabular form below:-

Name of Structure	Bore Hole No.	Co-ordinate, (M)			Terminating Depth (M)	Standing Water Level (M)
		Easting	Northing	R.L.		
Booster Fan	BH-01	5947.000	5743.000	271.187	30.00	1.58
	BH-02	5947.000	5625.000	271.156	30.00	1.55
Duct	BH-03	5998.000	5670.000	271.500	30.00	1.70
FGD Control Room	BH-04	6026.000	5695.000	271.396	30.00	1.40
Pipe Rack	BH-05	6054.000	5670.000	271.064	25.00	1.70
Stack Unit 1	BH-06	6090.000	5588.000	270.996	30.10	1.50
	BH-07	6106.000	5604.000	271.113	35.08	1.50
Absorber / Oxidation Blower 1	BH-08	6102.000	5627.000	271.009	30.13	1.40
FGD Control Room	BH-09	6057.000	5698.000	271.223	25.00	1.90
Absorber / Oxidation Blower 2	BH-10	6094.000	5759.000	270.757	30.06	1.65
Stack Unit 2	BH-11	6092.000	5781.000	270.839	35.00	1.30
	BH-12	6109.000	5796.000	270.911	30.00	1.30
Pipe Rack Near Railway Track	BH-13	6230.321	5669.562	269.020	25.00	0.60
Gypsum Dewatering Building	BH-14	6246.980	5676.948	269.554	25.00	1.30
	BH-15	6275.075	5698.030	270.861	25.00	1.40
Pipe Rack	BH-16	6231.000	5626.000	269.454	30.00	0.60
FGD DMCW / ACW Pump House	BH-17	6317.000	5692.000	270.178	25.06	1.44
Pipe Rack & Lime Storage Slurry Tank	BH-18	6245.698	5484.384	269.384	25.05	0.65
Ballmill	BH-19	6271.000	5471.000	269.600	25.00	0.60
Duct	BH-20	5983.500	5729.500	271.103	25.00	1.55
	BH-21	6041.000	5724.000	271.366	25.00	1.50
Absorber / Oxidation Blower 1	BH-22	6085.000	5649.000	271.237	30.24	1.70
Absorber / Oxidation Blower 2	BH-23	6116.000	5765.000	270.907	30.07	1.90
Cake Wash Tank	BH-24	6251.000	5712.000	270.950	25.20	1.60

Name of Structure	Bore Hole No.	Co-ordinate, (M)			Terminating Depth (M)	Standing Water Level (M)
		Eastings	Northing	R.L.		
FGD Comp. House	BH-25	6318.000	5727.000	270.184	25.00	1.50
Ballmill	BH-26	6274.000	5500.000	269.126	25.00	0.40
Truck Unloading Area	IBH-01	6255.00	5210.00	269.397	25.10	0.70
Lime Stone MCC Room	IBH-02	6270.00	5236.00	268.990	35.00	0.95
Limestone Conveyor	IBH-03	6256.00	5276.00	269.276	25.33	0.60
	IBH-04	6260.00	5355.00	269.130	25.00	0.40
Crusher House	IBH-05	6252.00	5394.00	269.359	35.40	0.80
	IBH-06	6273.00	5417.00	269.311	35.10	0.45
Silo	IBH-07	6265.00	5446.00	269.601	30.45	0.40
Gypsum Shed	IBH-08	6271.00	5732.00	270.578	35.00	1.30
	IBH-09	6271.00	5786.00	269.782	35.00	1.10

2.02. BORING IN SOIL:

Boring was carried out by Shell and Auger method to sink nominal 150mm diameter bore holes to depths envisaged by using a mechanical winch. Undisturbed soil samples were collected at suitable intervals or at change of strata whichever is earlier by open drive sampling method since it was intended to ascertain the sub-soil characteristics.

2.03. SAMPLING:

Nominal 100 mm diameter undisturbed samples were recovered. The sampling equipment used consists of a two-tier assembly of sample tubes 450 mm in length fitted at its lower end. The sampling assembly was driven by means of a jarring link to its full length or as far down as was found practicable. As the soil is very stiff to hard and contains sand mixtures / calcareous nodules, cutting shoe was used with a area ratio < 20%. After withdrawal the ends of the tubes were sealed with wax and capped before onward transmission to the laboratory. At close intervals in depth disturbed samples were collected for identification and logging purpose. These were tagged and packed in polythene packets and transported to the laboratory.

2.04. STANDARD PENETRATION TESTS:

Standard Penetration Tests were conducted in the bore holes at intervals of 2.0M depth (at the upper reaches due to collection of UDS) or 1m depth (at the lower reaches when no UDS could be collected) or at change of strata whichever is earlier using a split spoon sampler. The split spoon sampler used is of a Standard design having an outer diameter of 50.8 mm and inner diameter of 35 mm, driven with a monkey weighing 63.5 kgs, falling freely through 75cms. A record of the number of blows required to penetrate every 15cms to a maximum depth of 45cms was made. The first 15cm of drive are considered to be seating drive and

are neglected. The total blows required for second & third 15cm of penetration is counted and termed as penetration resistance "N". On completion of a test, the split spoon sampler was opened and soil specimens were preserved in polythene bags for logging purpose.

All the boreholes were sunk with winch. However, raising of hammer for SP Tests were done manually. Hence there will not be any inertia loss and the efficiency of hammer blows should be considered as 100%.

2.05. MEASUREMENT OF WATER TABLE:

Standing water level after 24 hours of removal of casing was also noted and shown in the profile.

2.06. ROTARY CORE DRILLING IN ROCK:

This drilling technique is regarded as the most satisfactory method of assessing the character of rock formations, which lie at depth below the ground surface. Specimens of rock in the form of cylindrical cores are recovered from the drill holes by means of a core barrel. Double barrel technique is adopted according to field condition. The core barrel is provided at its lower end with a detachable shoe or core bit, which is of diamond. All rotary core bits were of NX (73mm) size.

2.07. TRIAL PITS:

6 nos. Trial Pits were excavated for physical verification of subsoil with depth. The co-ordinate and ground level of the Trial Pit locations are presented below.

Trial Pit No.	Co-ordinate (M)		E.G.L. (M)	Depth (M)	Standing Water Level (M)
	Easting	Northing			
TP-01	6108.000	5781.000	270.740	3.00	Not found
TP-02	6110.000	5669.000	271.273	3.00	Not found
TP-03	6088.000	5604.000	270.975	3.00	2.90
TP-04	6231.000	5555.000	269.660	3.00	Not found
TP-05	6273.000	5489.000	269.342	3.00	Not found
ITP-01	6263.000	5405.000	269.236	3.00	Not found

2.08. PLATE LOAD TESTS:

Total five (5) sets of Plate Load Tests were conducted **using a 600mm square plate** (two nos. tests are of routine type & rest three nos. are of cyclic type). Tests are continued upto a maximum desired loading intensity or specified plate settlement which ever is earlier. The load is applied through a hydraulic jack. The reaction for applying the load on the plate is

obtained by a loading platform with sandbags. After applying the load increments, settlement records are made at intervals of 1, 2.25, 4, 6.25, 9, 16, 25, 60 & 90 minutes and thereafter at an interval of an hour. Next increment of load was applied only when the rate of plate settlement reduced to 0.02 mm per minute.

In case of CPLT, when the rate of plate settlement reduced to 0.02 mm per minute, the final reading of the dial gauges is recorded. The applied load is then released and the plate allowed to rebound. When no further rebound occurs or the rate of rebound becomes negligible, the readings of the dial gauges are again noted. The load then is increased gradually till its magnitude acquires a value equal to the proposed next higher stage of loading which is to be maintained constantly and the final dial gauge readings are noted as earlier. The entire load is then reduced to zero and final dial gauge readings recorded when the rate of rebound becomes negligible.

The coordinate, ground level and depth of test locations are given below.

PLT No.	Type of Tests	Plate size (mm x mm)	Co-ordinates (M)		Ground Level (M)	Depth (M)
			Easting	Northing		
PLT-01	Routine Type	600 x 600	6110	5669	271.273	3.00
PLT-02	Routine Type	600 x 600	6231	5555	269.660	3.00
CPLT-01	Cyclic Type	600 x 600	6108	5781	270.740	3.00
CPLT-02	Cyclic Type	600 x 600	6088	5604	270.975	3.00
CPLT-03	Cyclic Type	600 x 600	6263	5405	269.236	3.00

2.09. DYNAMIC CONE PENETRATION TESTS:

Total two (2 nos.) Dynamic Cone Penetration Tests were conducted at the following locations. The co-ordinates, ground level and depth of test at each DCPT locations are presented below. The DCPT values vs. depth plots are presented in Appendix

DCPT No.	Co-ordinate (M)		E.G.L. (M)	Depth (M)	
	Easting	Northing		Starting depth	Ending Depth
DCPT-01	6073.300	5763.000	270.898	0.00	6.30
IDCPT-01	6259.000	5330.000	269.182	0.00	5.10

2.10. FIELD PERMEABILITY TESTS:

Field Permeability Tests were conducted in three (3 nos.) borehole locations using falling head method as per IS: 5529 (Part 1). The test locations, type of test and depth of test are presented below.

Test Locations	Co-ordinates (M)		E.G.L. (M)	Type of Test	Depth of Test (M)
	Easting	Northing			
BH-02	5947	5625	271.156	Falling Head	0.80 – 1.50
				Falling Head	2.80 – 3.50
				Falling Head	4.80 – 5.40
				Falling Head	7.80 – 8.40
				Falling Head	11.80 – 12.50
BH-08	6102	5627	271.009	Falling Head	0.80 – 1.50
				Falling Head	2.70 – 3.40
				Falling Head	4.80 – 5.50
				Falling Head	7.70 – 8.40
				Falling Head	11.65 – 12.35
IBH-07	6265	5446	269.601	Falling Head	0.70 – 1.40
				Falling Head	2.80 – 3.50
				Falling Head	4.80 – 5.50
				Falling Head	7.80 – 8.50
				Falling Head	11.80 – 12.50

2.11. ELECTRICAL RESISTIVITY TESTS:

Seven (7) nos. Electrical Resistivity Tests were carried out at the following locations. The test procedure and results are presented in Section 8.

ERT	Co-ordinate (M)		E.G.L. (M)
	Easting	Northing	
ERT-01	6013.000	5700.000	271.444
ERT-02	6107.184	5760.041	270.805
ERT-03	6106.000	5638.000	271.180
ERT-04	6256.000	5495.000	269.419
ERT-05	6231.186	5669.562	269.037
ERT-06	6315.655	5693.406	270.271
IERT-01	6278.000	5220.000	269.102

3. LABORATORY TESTING

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

On Soil Samples:

1. Grain size analysis (Sieve as well as Hydrometer).
2. Determination of Liquid Limit, Plastic Limit and Shrinkage Limit.
3. Determination of Natural Moisture Content.
4. Determination of Specific Gravity.
5. Determination of Bulk & Dry Unit Weight.
6. Strength determination by Triaxial Unconsolidated Undrained Test (UU).
7. Strength Determination of Unconfined Compression Test on "UDS" (UNCONFD).
8. Strength Determination of Unconfined Compression Test on REMOULDED samples.
9. One-dimensional Consolidation Test for determining settlement potentiality.
10. Determination of Free Swelling Index & Swelling Pressure.
11. Conducting Standard Proctor Compaction Test to determine Optimum Moisture Content (OMC) and Maximum Dry Density (MDD).
12. Conducting CBR test (soaked & unsoaked) on sample prepared at 95% of MDD.
13. Chemical tests on soil and water samples to determine pH value, Sulphate, Chloride content etc.

On Rock Samples:

1. Determination of Bulk Density, Water Content, Specific Gravity & Porosity of Rock.
2. Determination of Unconfined Compressive Strength of Rock samples (Saturated & In-situ State)
3. Determination of Point Load Strength Index.
4. Determination of Slake Durability Index of Rock.
5. Determination of Hardness, Soundness and Deformability both at saturated and in-situ water content.

Laboratory test results are presented in a tabular form in the Appendix. The results are self explanatory excepting that of consolidation tests. The compressibility for a pressure range has been separated into 2 components through the compression ratio. As a first step dial gauge reading is plotted against square root of time and by extrapolation dial reading at zero time, is obtained. The compression ratio is given as

$$r = (d_i - d_s) / (d_i - d_f), \text{ where}$$

d_i = Initial reading of dial before load application

d_s = Dial reading corresponding to theoretical zero time

d_f = Final dial reading after 24 hrs.

Now we write $m_{vc} = (1 - r) \times m_v$

All the tests were conducted as per relevant Indian Standard Specifications.

4. SUBSOIL CONDITION, STRATIFICATION AND PROPERTIES

4.1. SUB-SOIL CONDITION:

The boring records showing the various soils met with are enclosed in the Appendix. These are prepared from field logs after proper modifications in the light of the laboratory test results and observation of disturbed and penetrometer soil samples. The results of the Standard Penetration Tests are given as 'N' values in these boring records. The sub-soil profiles (as obtained from field and Laboratory test results) across the bore holes are shown under Figs. 2.01 to 2.13 giving description, consistency and colour of each strata. The "N" values are shown in the profiles as well as presented in the borelogs. The laboratory test results and the back up sheets are also presented there.

4.2. SUB-SOIL STRATIFICATION:

The subsoil is characterised by medium to stiff silty clay / clayey silt followed by very stiff to hard silty clay / clayey silt layer. After that dense to very dense silty sand with clay binder is observed. Then, weathered rock layer is struck and that continues upto the terminating depth of all the boreholes. The description of each layer is presented below.

4.2.1. STRATUM - I:

The soil in this layer is characterized by medium to stiff, yellowish grey to brownish grey / deep grey, silty clay / clayey silt with sand mixture. Kankar & moorum have been observed in this layer. Routine laboratory tests conducted on the "UDS" and "SPT" samples that could be collected from this layer show the following average properties.

Bulk Density, gms/cc	1.95	Specific gravity	2.65
Dry Density, gms/cc	1.56	Void Ratio	0.699
Natural Water Content %	25	Liquid limit %	55
TRSH-UU:		Plastic Limit %	19
Cohesion kg/sqcm	0.63	Shrinkage Limit %	09
Friction angle °	4°	GRAIN SIZE	
Unconfined cohesion, kg/sqcm	0.62	Gravel %	01
Remoulded cohesion, kg/sqcm	0.49	Sand %	20
SENSITIVITY, S_t	1.26	Silt %	54
		Clay %	25



FIG. 2.01 : GENERALISED SOIL PROFILE

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Annexure-B

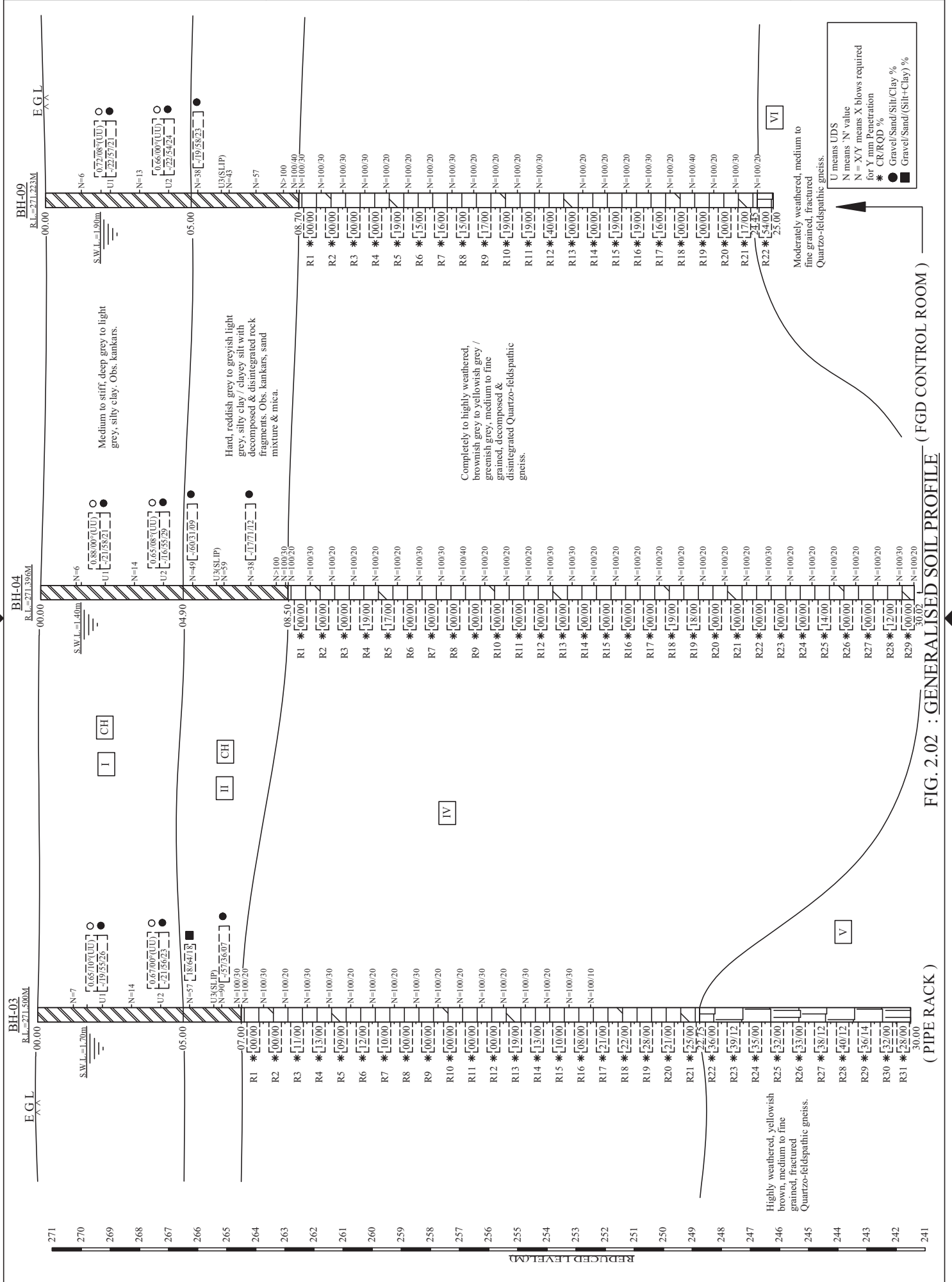
CETEST

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Created by : T.SAHA

Created on : 08/05/2019

Sheet No:





Sheet No:



Job No : 4287

Created by : T.SAHA

Created on : 26/04/2019

Sheet No:

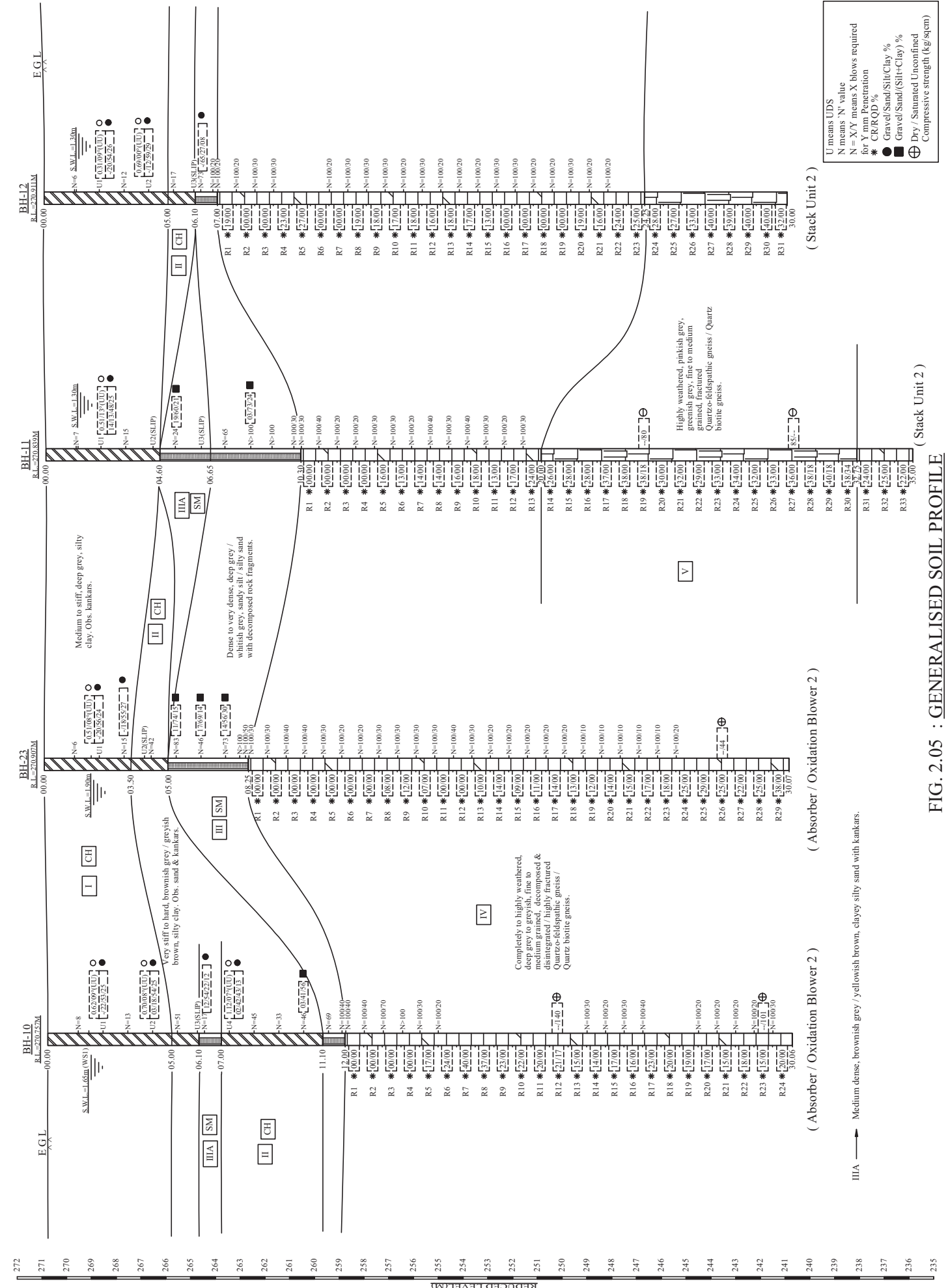


FIG. 2.05 : GENERALISED SOIL PROFILE

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Sheet No:



Sheet No:



(Pipe Rack & Lime Storage Slurry Tank)

III A ———▶ Medium dense, clayey sandy silt. Obs. kankars.

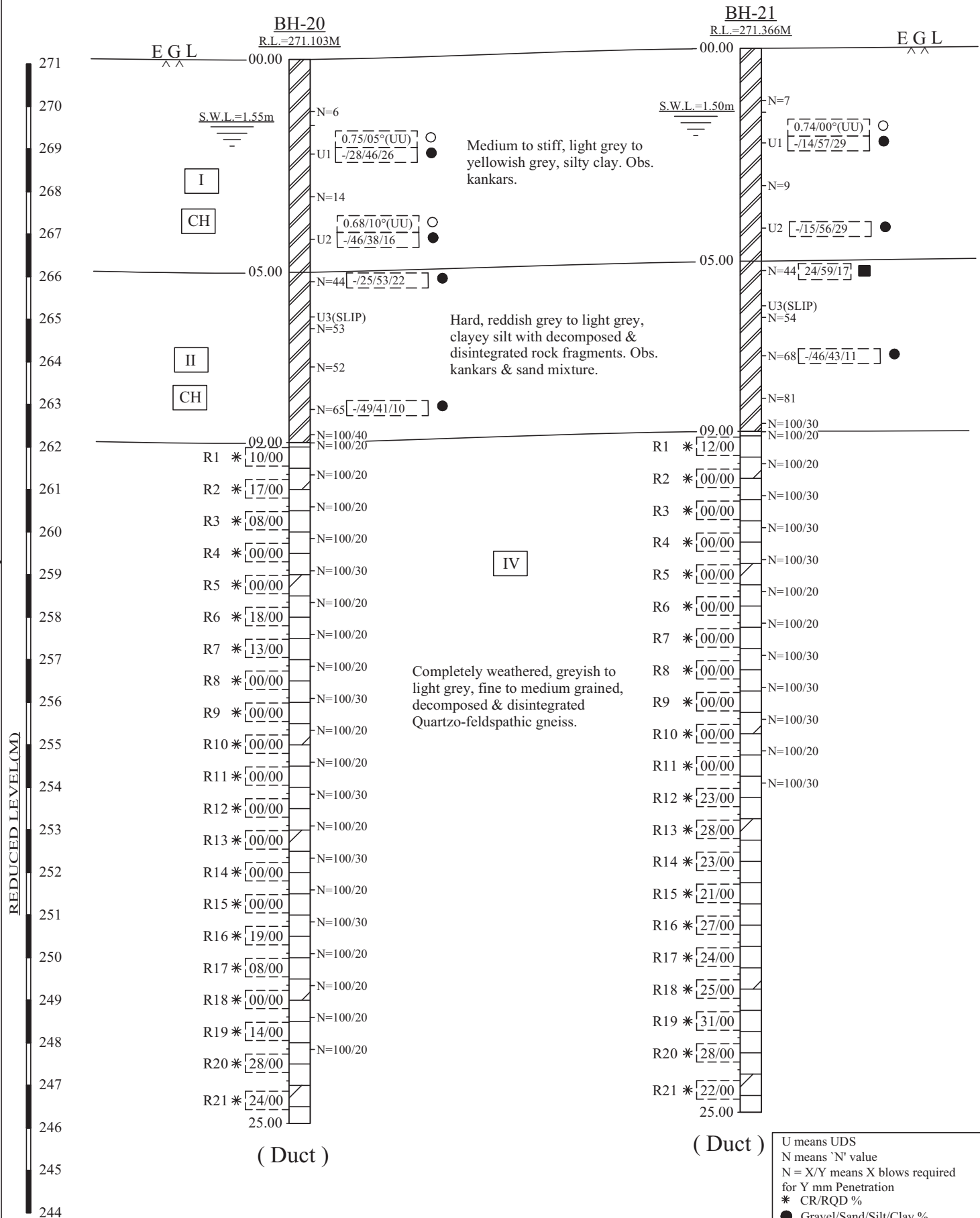


FIG. 2.09 : GENERALISED SOIL PROFILE

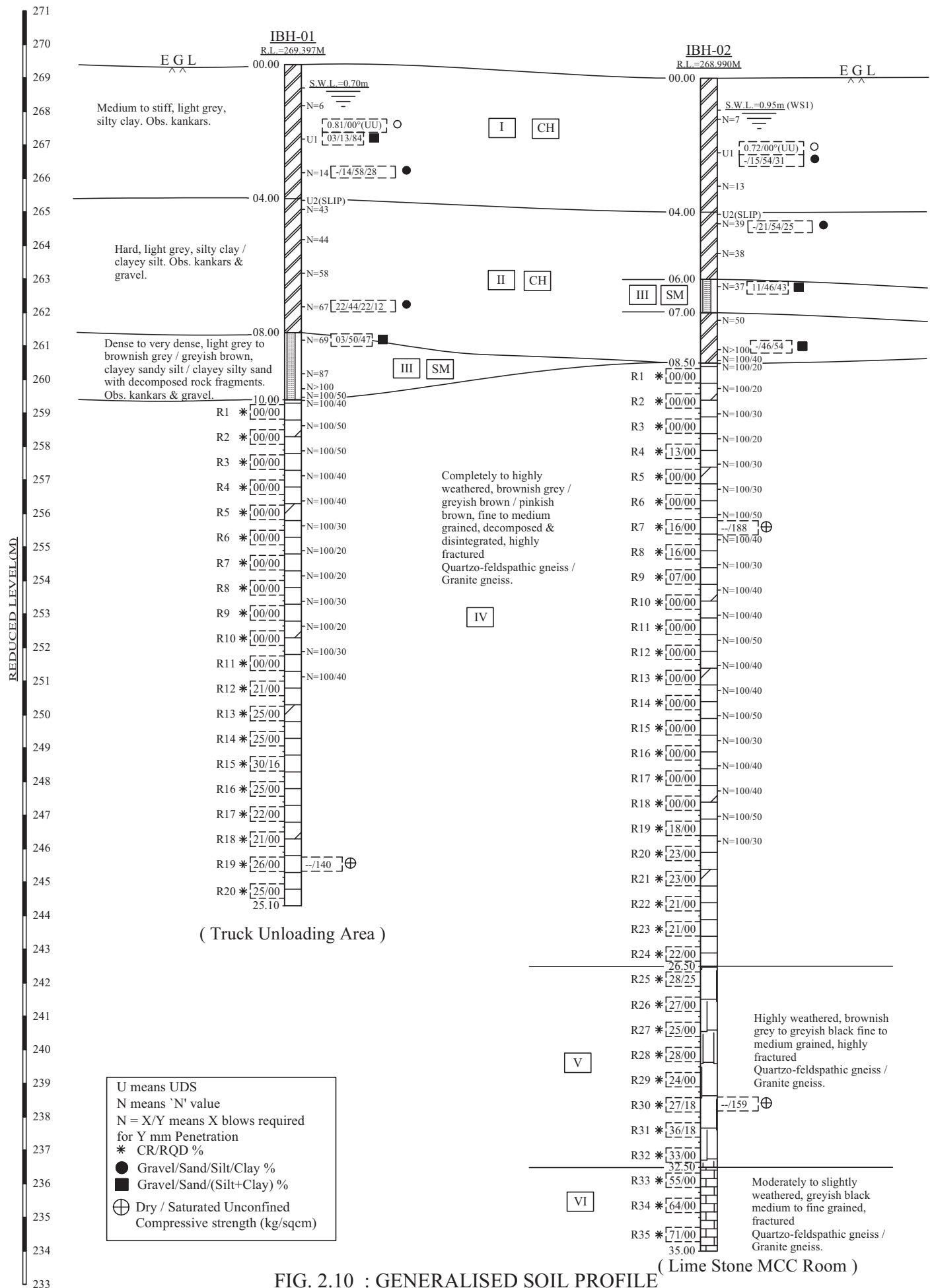
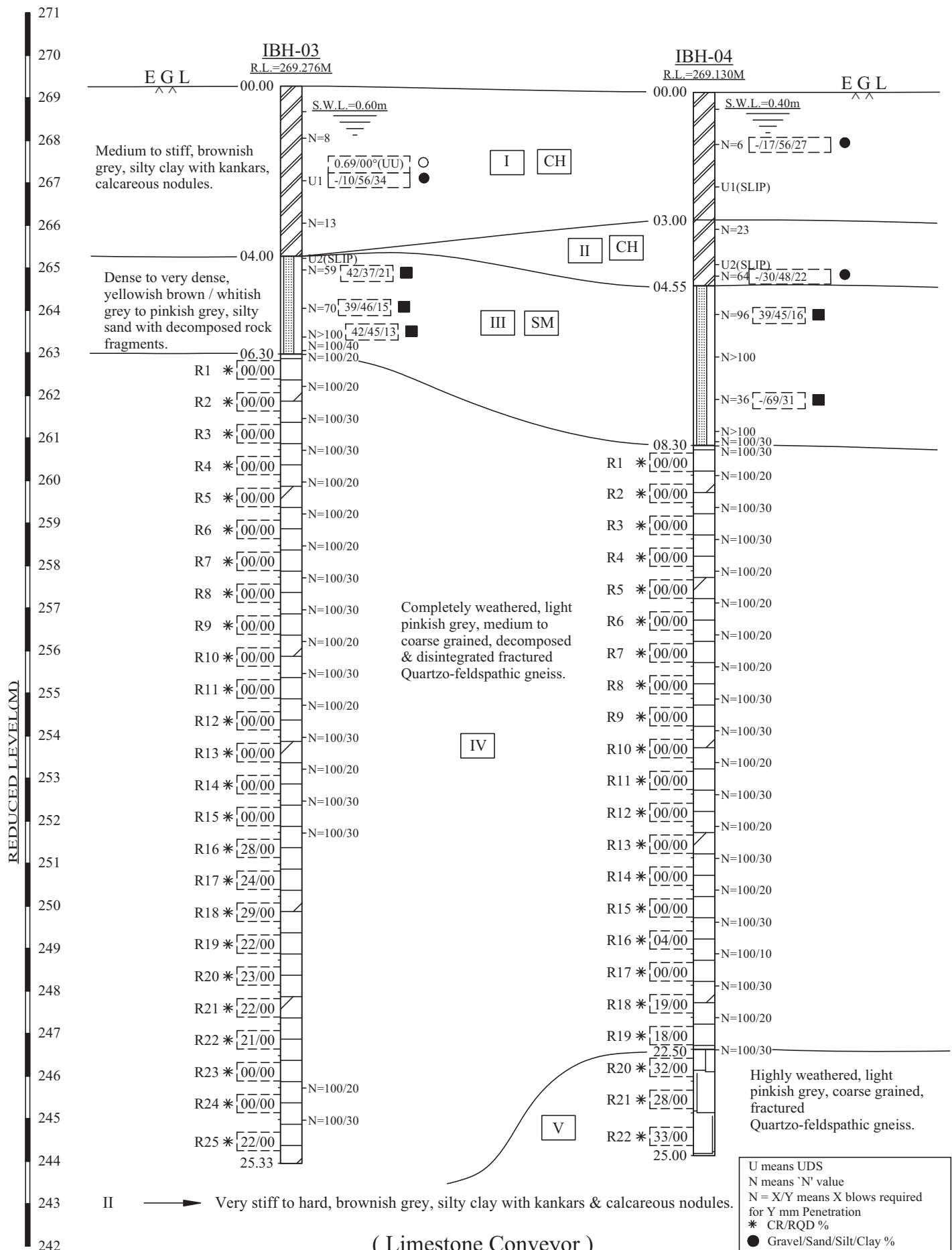


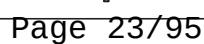
FIG. 2.10 : GENERALISED SOIL PROFILE



(Limestone Conveyor)
FIG. 2.11 : GENERALISED SOIL PROFILE

Sheet No:





4.2.2. STRATUM - II:

The soil in this layer consists of very stiff to hard, brownish grey to reddish grey / greyish brown, silty clay / clayey silt with sand mixture. Decomposed rock fragments, moorum & kankar, calcareous nodules have been observed in this layer. Routine laboratory tests conducted on the "UDS" and "SPT" samples that could be collected from this layer show the following average properties.

Bulk Density, gms/cc	1.98	Specific gravity	2.66
Dry Density, gms/cc	1.64	Void Ratio	0.633
Natural Water Content %	21	Liquid limit %	57
TRSH-UU:		Plastic Limit %	20
Cohesion kg/sqcm	0.99	Shrinkage Limit %	11
Friction angle °	7°	GRAIN SIZE	
Unconfined cohesion, kg/sqcm	1.14	Gravel %	03
Remoulded cohesion, kg/sqcm	0.77	Sand %	33
SENSITIVITY, S_t	1.48	Silt %	47
		Clay %	17

4.2.3. STRATUM - III:

This is sand layer and it consists of dense to very dense, deep grey to brownish grey / whitish grey, silty sand with clay binder & decomposed rock fragments. Kankar & gravel have been observed in this layer. No UDS could be collected from this layer. However, grain size analysis of some "SPT" samples shows the following average properties.

Specific gravity	2.77
GRAIN SIZE	
Gravel %	11
Sand %	63
(Silt+Clay) %	26

4.2.4. STRATUM - IIIA:

This is also sand layer and present only around BH-10, 11, 24 & 26 locations. The soil in this layer consists of medium dense, brownish grey / yellowish brown, silty sand with clay binder & kankar. The average properties of this layer obtained from routine laboratory tests on the few "SPT" samples collected from this layer are presented below.

Specific gravity	2.66
GRAIN SIZE	
Gravel %	10
Sand %	58
(Silt+Clay) %	32

4.2.5. STRATUM - IV:

This is a rock layer and this layer consists of completely to highly weathered, brownish grey to yellowish grey / reddish brown, fine to medium grained, decomposed and disintegrated / highly fractured Granite gneiss / Quattzo-feldspathic gneiss / Quartz biotite gneiss / Talc schist. The following tests were carried out on the rock samples viz.

1. Unconfined Compressive Strength determination of the rock samples as collected from the field (i.e. insitu condition).
2. Unconfined Compressive Strength determination of the rock samples after 24 hours full submergence and thereafter air drying before testing (i.e. saturated condition).
3. Determination of Point Load Strength Index.

The average properties of this layer as revealed from the routine laboratory test are as follows.

Bulk Density, gms/cc	2.409	UCS (in-situ), kg/sqcm	72 *
Dry Density, gms/cc	2.354	UCS (saturated), kg/sqcm	168 **
Water Content %	2.336	Point Load Strength Index, kg/sqcm	6.87
Specific Gravity	2.573	Slake Durability Index (%)	63.89
Porosity %	7.015	Soundness (% Loss)	21.59

* - based on 4 nos. samples, ** - based on 8 nos. samples

4.2.6. STRATUM - V:

This rock layer consists of highly to moderately weathered, brownish grey to greenish grey yellowish brown, fine to medium / coarse grained, moderately fractured Granite gneiss / Quattzo-feldspathic gneiss / Quartz biotite gneiss / Talc schist.

The average properties of this layer as revealed from the routine laboratory test are as follows.

Bulk Density, gms/cc	2.491	UCS (in-situ), kg/sqcm	46 #
Dry Density, gms/cc	2.471	UCS (saturated), kg/sqcm	282 ##
Water Content %	0.809	Point Load Strength Index, kg/sqcm	11.03
Specific Gravity	2.644	Slake Durability Index (%)	50.49
Porosity %	3.369	Soundness (% Loss)	20.47

- based on 3 nos. samples, ## - based on 4 nos. samples

4.2.7. STRATUM - VI:

This is also a rock layer and present around few boreholes (i.e. BH-09, IBH-02, 05, 06, 07) consists of moderately to slightly weathered, pinkish / greyish black, fine to medium grained, highly fractured Granite gneiss / Quattzo-feldspathic gneiss / Quartz biotite gneiss / Talc schist.

The average properties of this layer as revealed from the routine laboratory test are as follows.

Bulk Density, gms/cc	2.666	UCS (dry), kg/sqcm	--
Dry Density, gms/cc	2.660	UCS (saturated), kg/sqcm	345
Water Absorption %	0.226	Point Load Strength Index, kg/sqcm	--
Specific Gravity	2.620	Slake Durability Index (%)	--
Porosity %	1.018	Soundness (% Loss)	13.62

4.3. GRAPHICAL PRESENTATION:

The detailed Laboratory Test Results in tabular form are given in the Appendix. The back up sheets are also presented there as given in below:

1. *Strength envelopes from Triaxial Tests.*
2. *Standard Proctor Compaction Curves.*
3. *CBR Curves.*
4. *e-log p curves from consolidation tests.*
5. *Grain size distribution curves for sieve and hydrometer tests.*

The consolidation test results are analysed by numerical methods and only the final output in a tabular form is given. The m_{vc} indicates the time dependent component of m_v and c_v is the co-efficient of consolidation.

5. DISCUSSION

5.01. PLATE LOAD TEST:

Five nos. (5). Plate Load Tests were conducted in the site (2 nos. are of routine type & the rest 3 nos. are of cyclic type) at specified depths using 600mm square plate Load (vs.) settlement plots is made to calculate Allowable Bearing Capacity, Young's modulus. The calculations are presented below separately.

DETERMINATION OF SAFE BEARING CAPACITY:

PLT – 02:

B_f = Width of footing = 2m (say), B_p = Size of test plate = 0.60m

S_f = Limiting Settlement of footing = 25mm and S_p = Settlement of test plate.

Now As per IS : 1888, in case of clayey soil, we can write $(S_p / S_f) = (B_p / B_f)$

Hence, $S_p = 7.50\text{mm}$

From load-settlement curve, safe load = 12.00 t/sqm

Based on the above data, the safe bearing capacity value for different footing size is presented below.

Test Location	Depth (M)	Recommended Safe Bearing Capacity, T/M ²			
		Foundation width = 1m	Foundation width = 2m	Foundation width = 3m	Foundation width = 4m
		S= 25mm	S= 25mm	S= 25mm	S= 25mm
PLT-01	3.00	26	13	10	8
PLT-02	3.00	16	12	9	7

Where S = limiting settlement

SUBGRADE MODULUS:

Subgrade Modulus is obtained from Plate Load Tests as $K = P/S$. Where P = Plate Load corresponding to settlement S under working load. The final results values are presented in a tabular form below.

Test No.	Depth (M)	Subgrade Modulus for Plate as per IS 9214, Kg/cm ³	Subgrade Modulus for Plate, correcting as per IS 9214, Kg/cm ³
PLT-01	3.00	1.92	1.50
PLT-02	3.00	1.60	1.25

The Subgrade modulus value is inversely proportional to the square root of the foundation area up to a base area of 10 sqm and then remains constant. The calculated subgrade modulus values for different foundation areas are presented afterwards in Page No.33 / 97.

PLATE LOAD TEST NO.01

Commenced on: 07/05/2019
 Completed on: 08/05/2019
 Pit size: 3.00mX3.00mX3.00m(depth)
 Load on pr. guage/divn. = 5Kg/sq.cm
 Load on jack/divn. = 0.8252te
 Plate size: 0.600mX0.600m
 Load on plate/divn. = 2.29te/sq.m.

Test Type: Routine PLT

Co-ordinates:
 E = 6110.000M.
 N = 5669.000M.
 RL = 271.273M.

S.W.L. = Not found.

EGL-0.80m:- Brownish grey, silty clay with traces of calcareous nodules & kankars.
 0.80-1.50m:- Deep grey, silty clay with kankars & sand mixture.
 1.50-1.65m:- Reddish brown, silty sand with kankars & moorum.
 1.65-3.00m:- Deep grey, silty clay with traces of kankars.

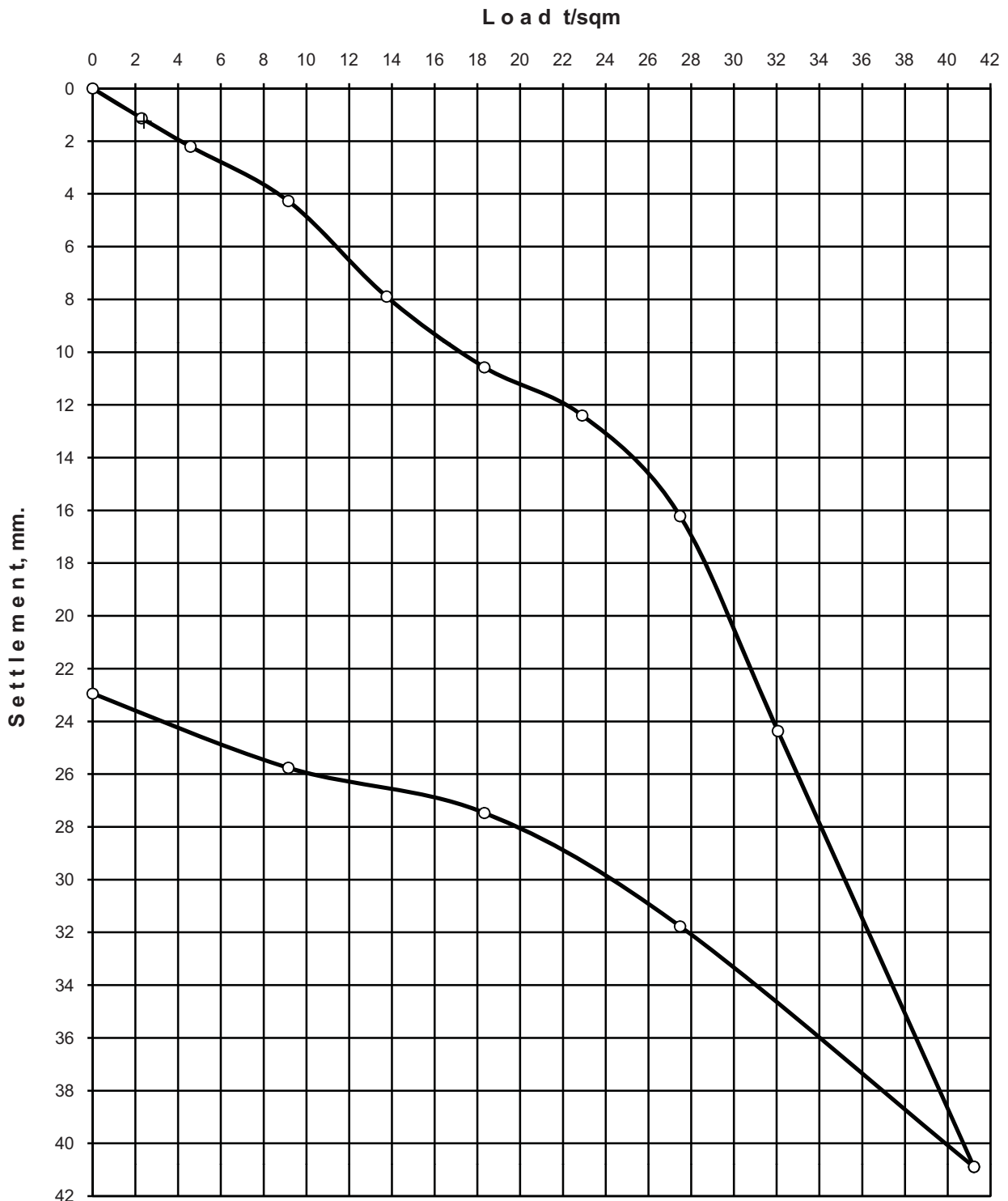


FIG. 3.1 LOAD VS SETTLEMENT GRAPH FOR PLT-01

PLATE LOAD TEST NO.02

Commenced on: 30/04/2019
 Completed on: 30/04/2019
 Pit size: 3.00mX3.00mX3.00m(depth)
 Load on pr. guage/divn. = 5Kg/sq.cm
 Load on jack/divn. = 0.8252te
 Plate size: 0.600mX0.600m
 Load on plate/divn. = 2.29te/sq.m.
Test Type: Routine PLT

Co-ordinates:
 E = 6231.000M.
 N = 5555.000M.
 RL = 269.660M.

S.W.L. = 2.90M.

EGL-0.20m:- Light grey, silty clay with rock pieces & sand mixture.
 0.20-2.20m:- Deep grey, silty clay.
 2.20-3.00m:- Yellowish grey, clayey silt. Obs. sand mixture.

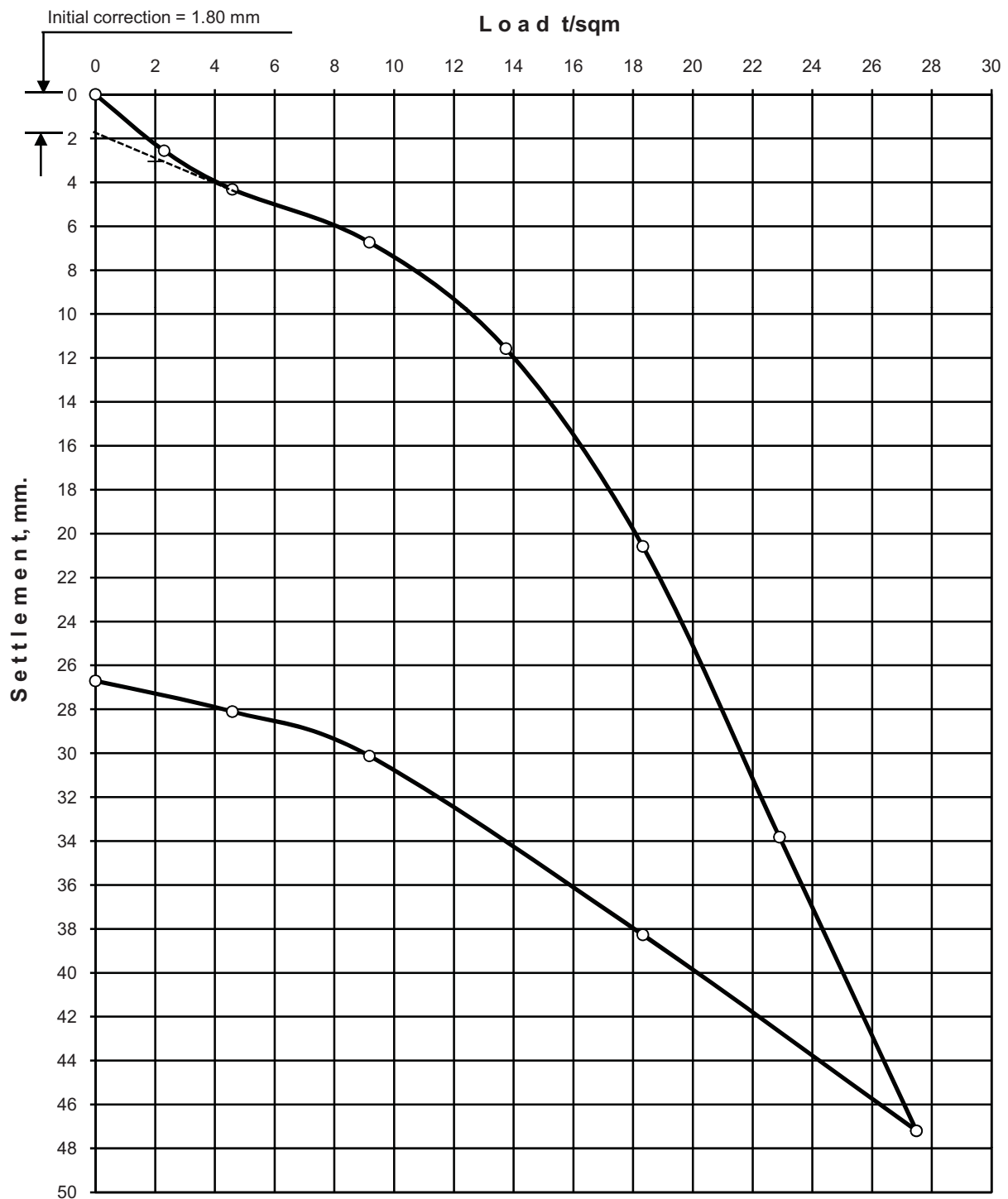


FIG. 3.2 LOAD VS SETTLEMENT GRAPH FOR PLT-02

CYCLIC PLATE LOAD TEST NO.01

Commenced on:08/05/2019
 Completed on:09/05/2019
 Pit size: 3.00mX3.00mX3.00m(depth)
 Load on pr.guage/divn.=5Kg/sq.cm
 Load on jack/divn. = 0.8252te
 Plate size: 0.600mX0.600m
 Load on plate/divn.=2.29te/sq.m.
Test Type: Cyclic PLT

Co-ordinates:
 N = 5781.000M.
 E = 6108.000M.
 RL = 270.740M.

S.W.L.= Not Found.

EGL-0.80m:- Brownish grey, silty clay with traces of kankars. Obs. calcareous nodules.
 0.80-3.30m:- Deep grey, silty clay with traces of kankars.

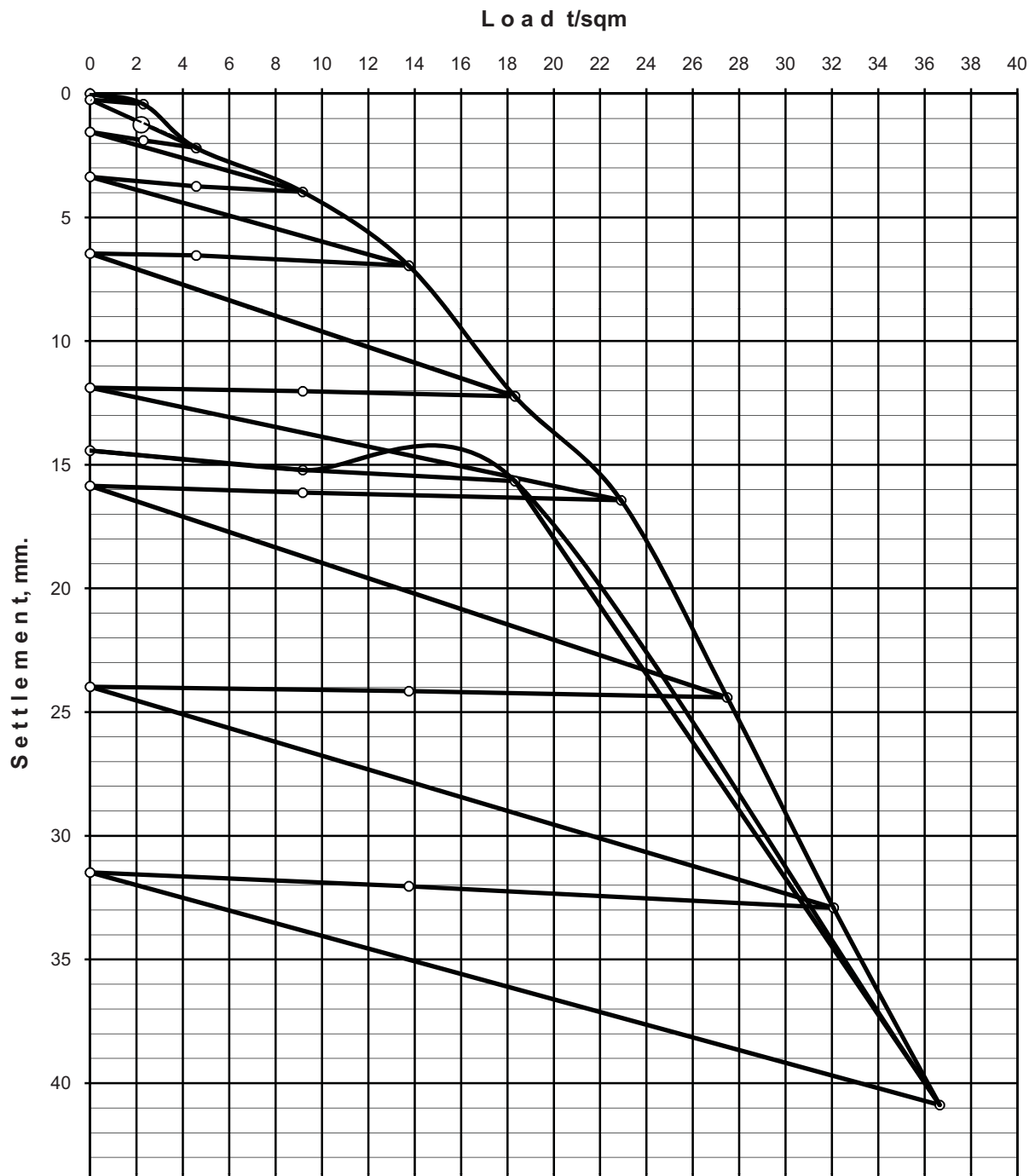


FIG. 3.3 LOAD VS SETTLEMENT GRAPH FOR CPLT-01

CYCLIC PLATE LOAD TEST NO.02

Commenced on:05/05/2019
 Completed on:06/05/2019
 Pit size: 3.00mX3.00mX3.00m(depth)
 Load on pr.guage/divn.=5Kg/sq.cm
 Load on jack/divn. = 0.8252te
 Plate size: 0.600mX0.600m
 Load on plate/divn.=2.29te/sq.m.
Test Type: Cyclic PLT

Co-ordinates:
 N = 5604.000M.
 E = 6088.000M.
 RL = 270.975M.

S.W.L.=2.85m.

EGL-0.70m:- Brownish grey, silty clay with traces of kankars. Obs. calcareous nodules.
 0.70-2.20m:- Deep grey, silty clay with traces of kankars.
 2.20 - 3.00m:- Light yellowish grey, silty clay with traces of kankars.

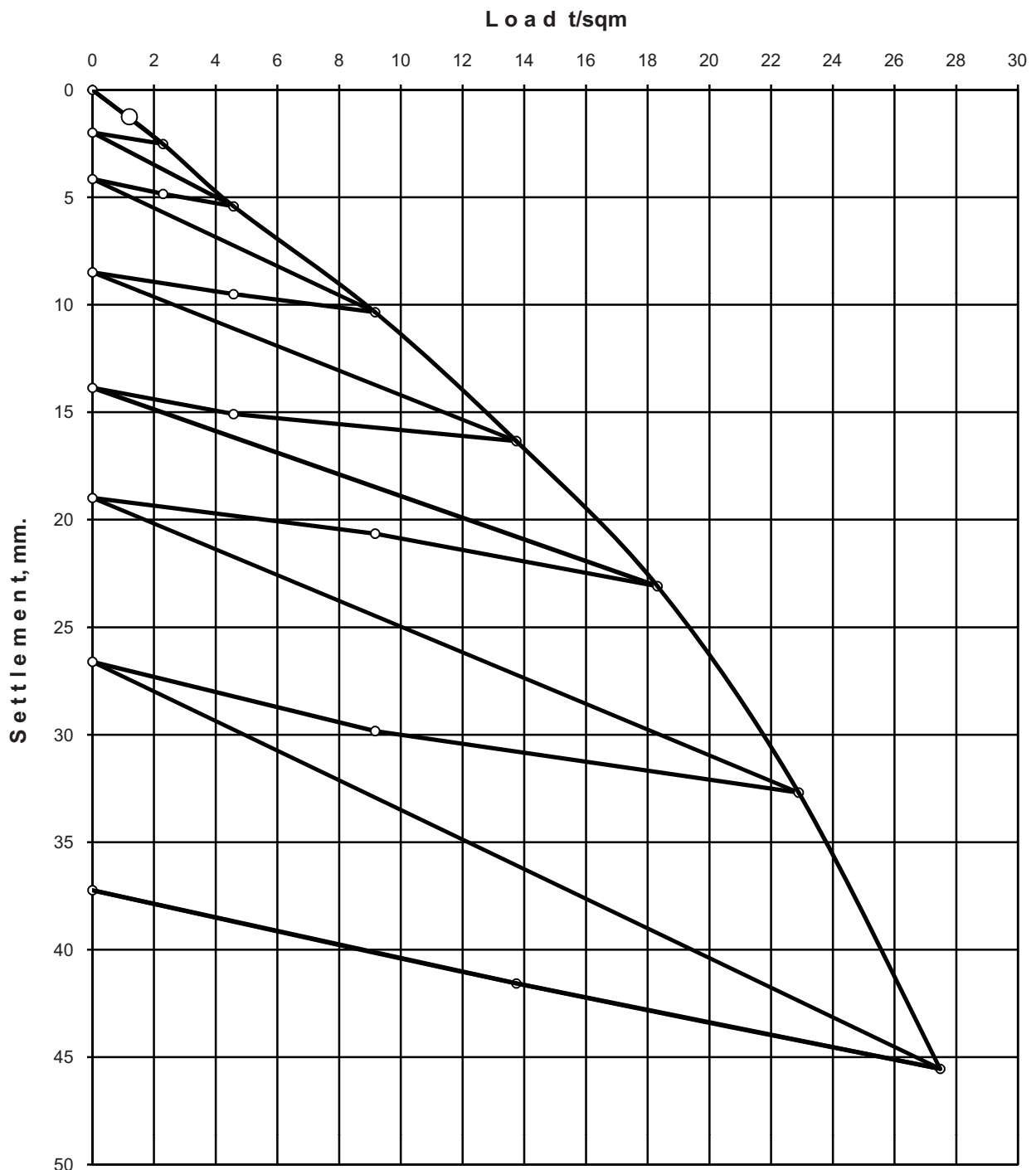


FIG. 3.4 LOAD VS SETTLEMENT GRAPH FOR CPLT-02

CYCLIC PLATE LOAD TEST NO.03

Commenced on:03/05/2019
 Completed on:04/05/2019
 Pit size: 3.00mX3.00mX3.00m(depth)
 Load on pr.guage/divn.=5Kg/sq.cm
 Load on jack/divn. = 0.82527te
 Plate size: 0.600mX0.600m
 Load on plate/divn.=2.29te/sq.m.
Test Type: Cyclic PLT

Co-ordinates:
 N = 5405.000M.
 E = 6263.000M.
 RL = 269.236M.

S.W.L.= 2.85M.

EGL-0.40m:- Light grey, clayey silt rock pieces & sand mixture.
 0.40-2.00m:- Deep grey, silty clay.
 2.00 - 3.00m:- Yellowish grey, clayey silt. Obs. sand mixture.

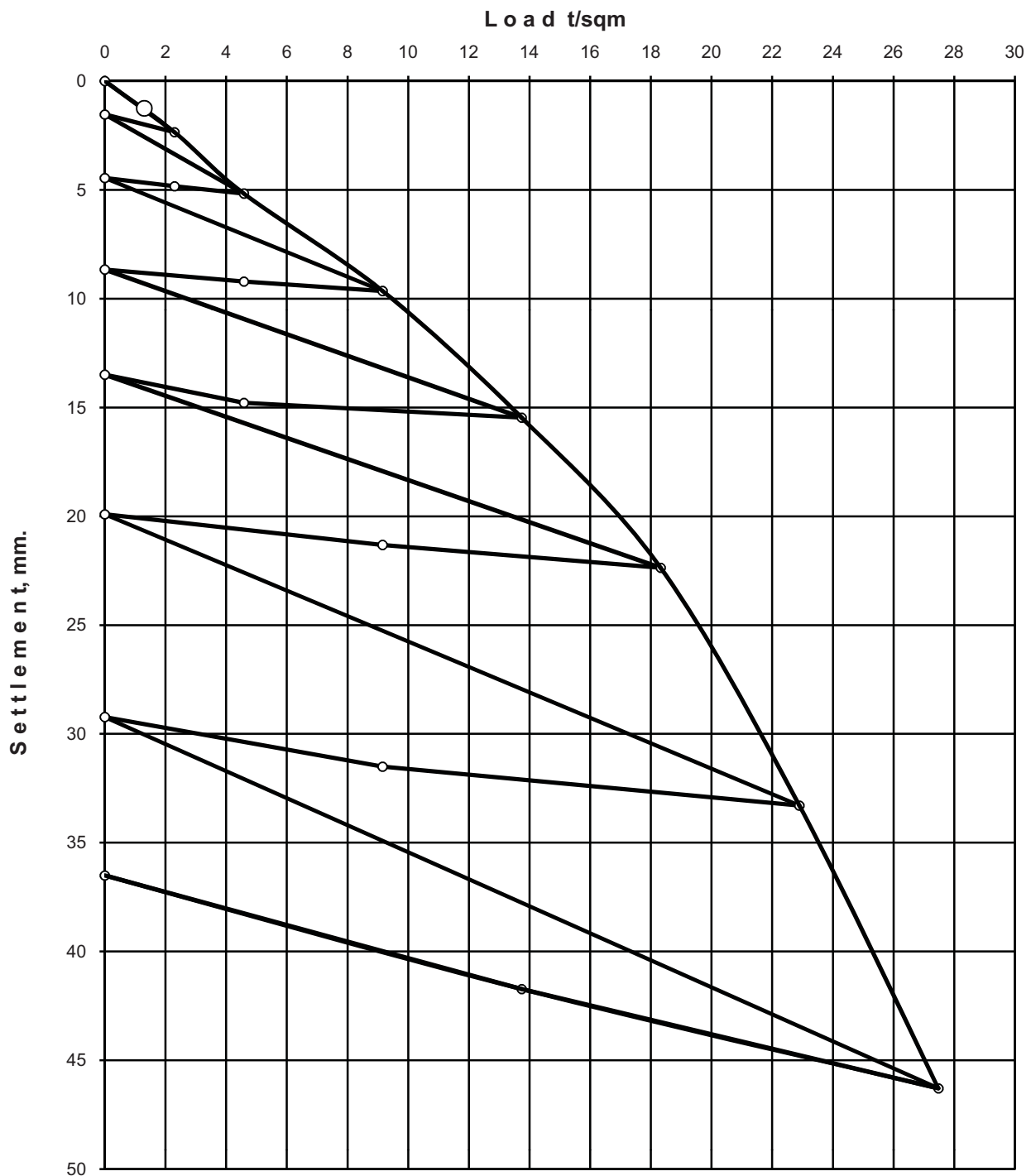


FIG. 3.5 LOAD VS SETTLEMENT GRAPH FOR CPLT-03

Test No.	Depth (M)	Subgrade Modulus, (kg/cucm)			
		Foundation Area = 1 sqm	Foundation Area = 4 sqm	Foundation Area = 5 sqm	Foundation Area = 10 sqm or above
PLT-01	3.00	0.90	0.45	0.40	0.28
PLT-02	3.00	0.75	0.38	0.34	0.24

Sample Calculation of Subgrade Modulus for foundation area 4 Sq.m for PLT-02

For Plate

Safe Load, corresponding to 1.25mm settlement = 2.40 t/sqm

Subgrade Modulus for Plate, $K = P/S = 2.40/1.25 = 1.92 \text{ Kg/cm}^3$

Applying correction for plate bending, as per Clause 5.1.3 & Fig.5 of IS:9214, corrected Subgrade Modulus = 1.92 Kg/cm^3

Since the test was conducted on 600mm square plate (i.e. smaller than 75cm dia.), corrected Subgrade Modulus as per Clause 5.1.1 & Fig.3 of IS: 9214 = $1.92 / 1.28 = 1.50 \text{ Kg/cm}^3$

For Foundation

Corrected Subgrade Modulus of plate = 1.50 Kg/cm^3

Area of plate = $60 \times 60 \text{ sq.cm} = 0.60 \times 0.60 \text{ sq.m}$

Area of footing = 4 sq.m

Subgrade Modulus of foundation = $1.50 \times \sqrt{(0.6 \times 0.6)/4} \text{ Kg/cm}^3 = 0.45 \text{ Kg/cm}^3$

ELASTIC COMPRESSION:

For Cyclic Plate Load Tests, after application of each load increment and full stabilisation of plate settlement, the applied load was reduced to zero and the settlement records were noted till full stabilisation. Thereafter, the next load increment was applied.

The elastic rebounds at these load intensities are calculated from the field data and are graphically presented in graph (Ref. fig. no. 3.06 – 3.08). The coefficient of elastic uniform compression, C_u is obtained as $C_u = P / S_e \text{ (kg/cucm)}$.

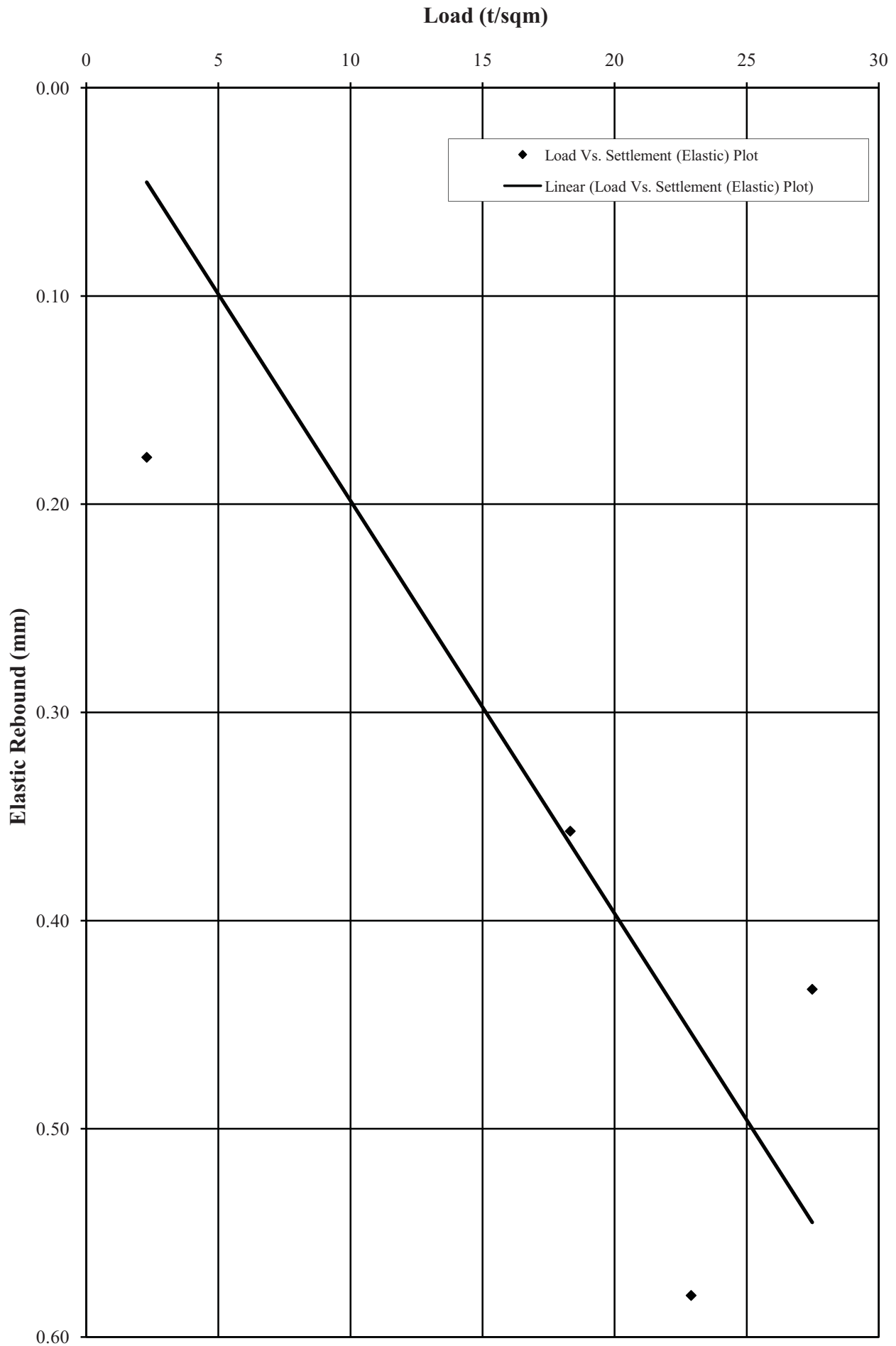
CPLT- 1:

From the load vs elastic rebound plot, the slope of the trend line = $C_u = (20-10)/(0.395-0.20) = 51.28 \text{ kg/cucm}$

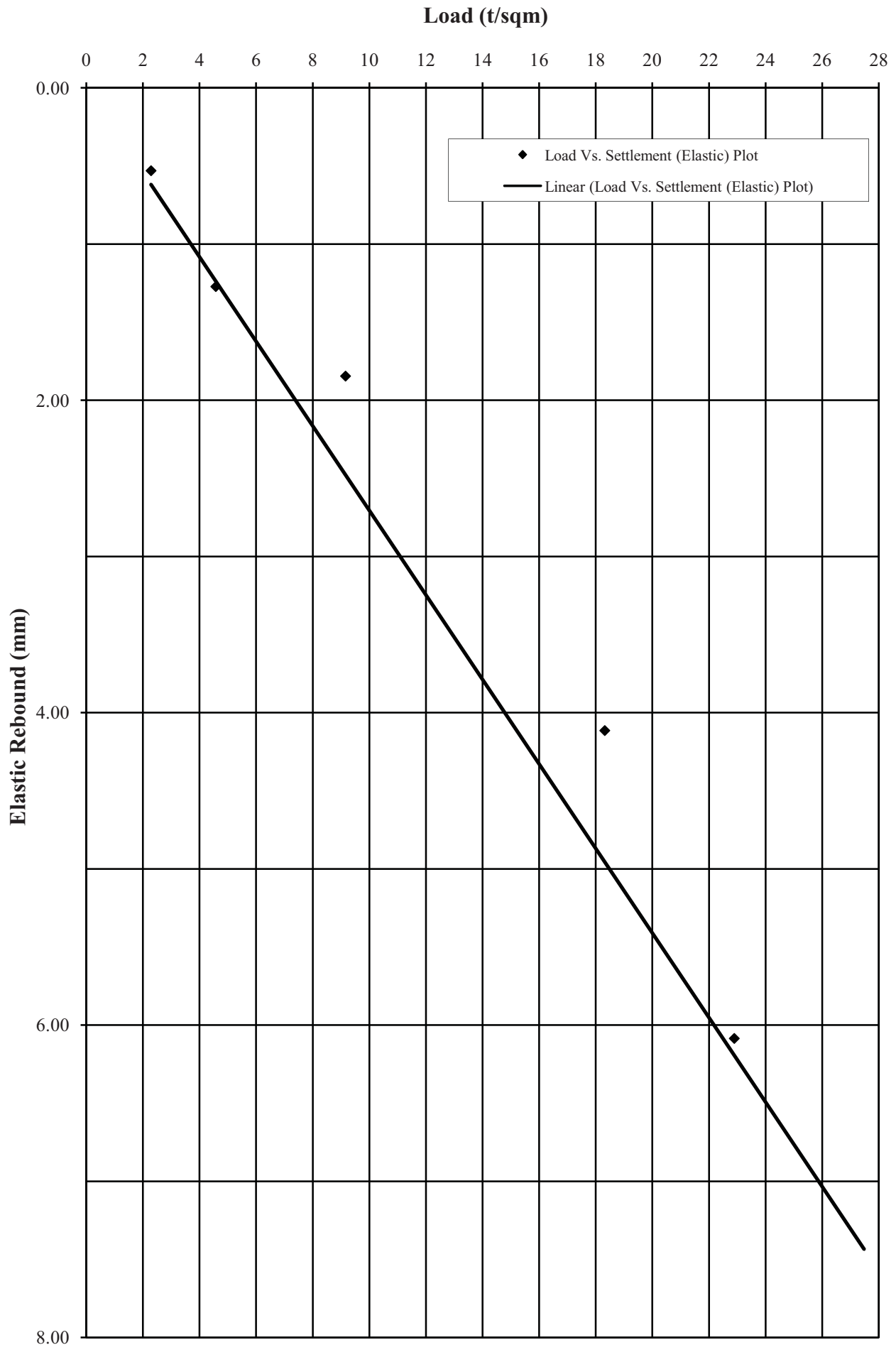
Now, for a foundation size of 10 sqm (3m x 3.33m, say), the corresponding value will be,

$$C_{u10\text{sqm}} = 51.28 \times \sqrt{[(0.600 \times 0.600) / 10]} = 9.73 \text{ kg/cucm}$$

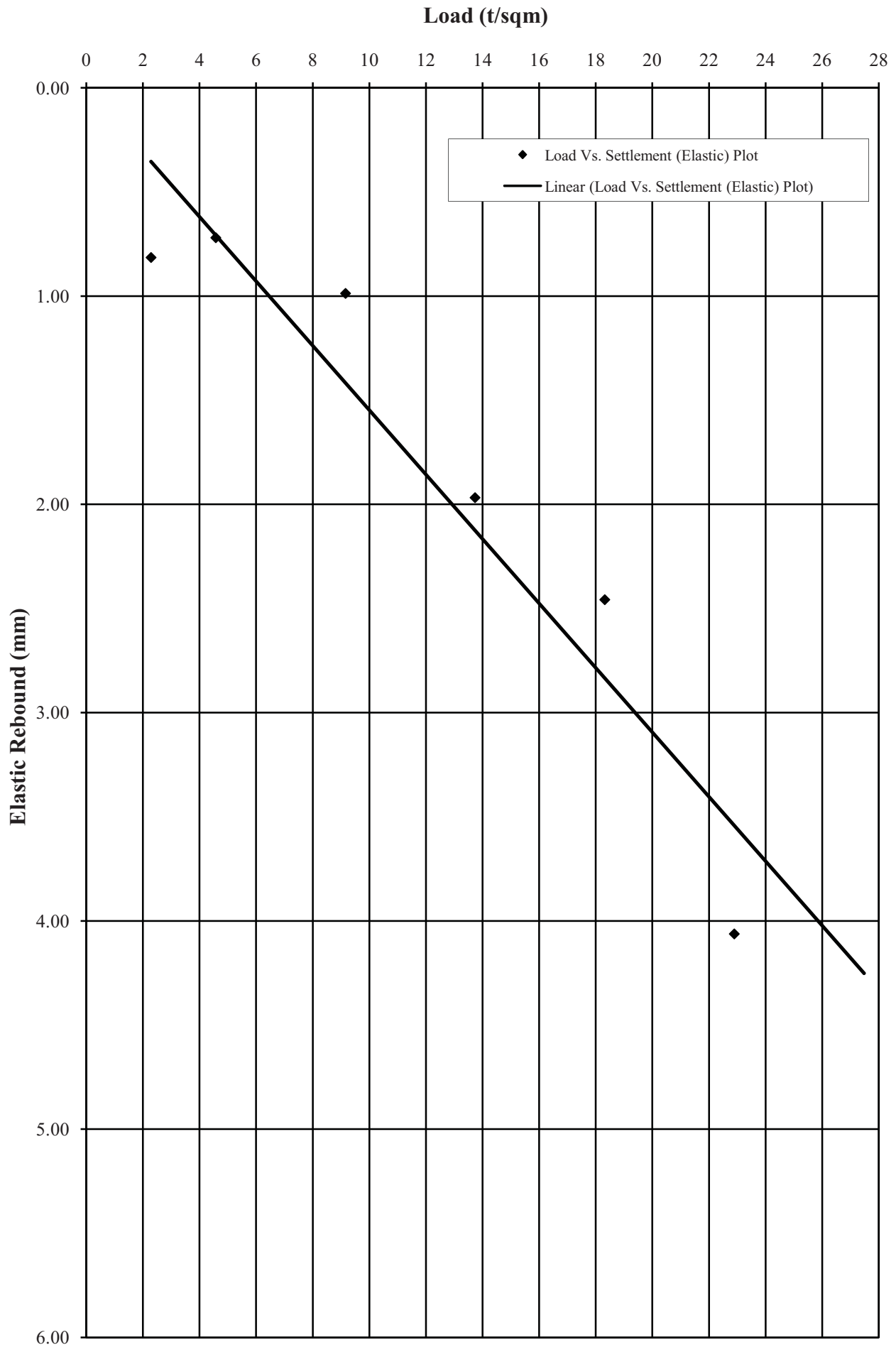
Test No.	Depth (M)	$C_u \text{ (kg/cucm)}$	$C_u \text{ (10sqm fdn.size) (kg/cucm)}$
CPLT-01	3.00	51.28	9.73
CPLT-02	3.00	3.72	0.71
CPLT-03	3.00	6.41	1.22

**Fig. 3.6. Load vs. Elastic Rebound Plot (CPLT-01)**

as per IS 5249 : 1992, Pg - 6

**Fig. 3.7. Load vs. Elastic Rebound Plot (CPT-02)**

as per IS 5249 : 1992, Pg - 6



5.02. CHOICE OF FOUNDATION AND FOUNDING LEVEL:

Considering the nature of the subsoil and the type of structures to be constructed at the present site, it is suggested to go for open foundation. The determination of bearing capacity is presented below.

5.03. DETERMINATION OF BEARING CAPACITY (Around Stack Unit-1):

Let us place the foundation at 6.50m below FGL i.e. 6.496m below EGL (where, FGL = 271 M).

Founding level falls inside Stratum -III.

This layer consists of dense to very dense silty sand.

Average corrected $N = 46$

Considering the above, use $C = 0$ kg/sqcm & $\Phi = 34^\circ$ for bearing capacity calculation.

EVALUATION OF STRENGTH AND DEFORMATION PARAMETERS:**For Stratum III**

Design corrected "N" in this layer = 46

Treating the sand as normally consolidated sand, $E_s = 5(N+15) = 305$ kg/sqcm

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 883$ kg/sqcm

[Ref. to "Foundation Analysis and Design, fifth Edition, by Joseph E. Bowles, P-316, Table 5-6]

Thus average $E_s = 594$ kg/sqcm

Use $E_s = 590$ kg/sqcm

Use $G = 1.00$ & $\mu = 0.25$

For Stratum IV

After that rock layer was encountered. Settlement of rock may be neglected. However, to be in the conservative side, use a lowest probable Young's modulus, E_s for layer IV = 1000 kg/sqcm.

[Refer to "Soil Mechanics and Foundation Engineering" 4th Edition by Prof. V. N. S. Murthy, pp – 271]

CALCULATION OF NET SAFE BEARING CAPACITY:

The Net Ultimate Bearing Capacity is given as:

$$q_{nu} = C.N_c.S_c.D_c + q.N_q.S_q.D_q + 0.5\gamma.B.N_\gamma.S_\gamma.D_\gamma - q$$

Where,

N_c , N_q and N_γ are bearing capacity factors,

S_c , S_q and S_γ are shape factors,

D_c , D_q and D_γ are depth factors,

And

C = Cohesion

q = Overburden pressure,

B = Width of foundation,

γ = Effective density below foundation.

For 35m Dia. Circular Footing Placed at 6.50m below FGL**Considering general shear failure**

Cohesion, $C = 0.00$ t/sqm

Using $\phi = 36$ degree, the bearing capacity factors are:

$$N_c = 50.59$$

$$N_q = 37.75$$

$$N_\gamma = 56.31$$

Use,

Depth of Foundation = $D_f = 6.5$ M below FGL (i.e. 6.496m below EGL)

Diameter of Foundation = $B = 35$ M

Overburden Pressure = $q = 6.500$ (Depth) $\times$ 0.90 (Submerged density) = 5.85 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.30 \quad S_q = 1.20 \quad S_\gamma = 0.60$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.07 \quad D_q = 1.04 \quad D_\gamma = 1.04$$

Computed Net Ultimate Bearing Capacity = 820.36 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 328.15 t/sqm

Considering Local Shear Failure

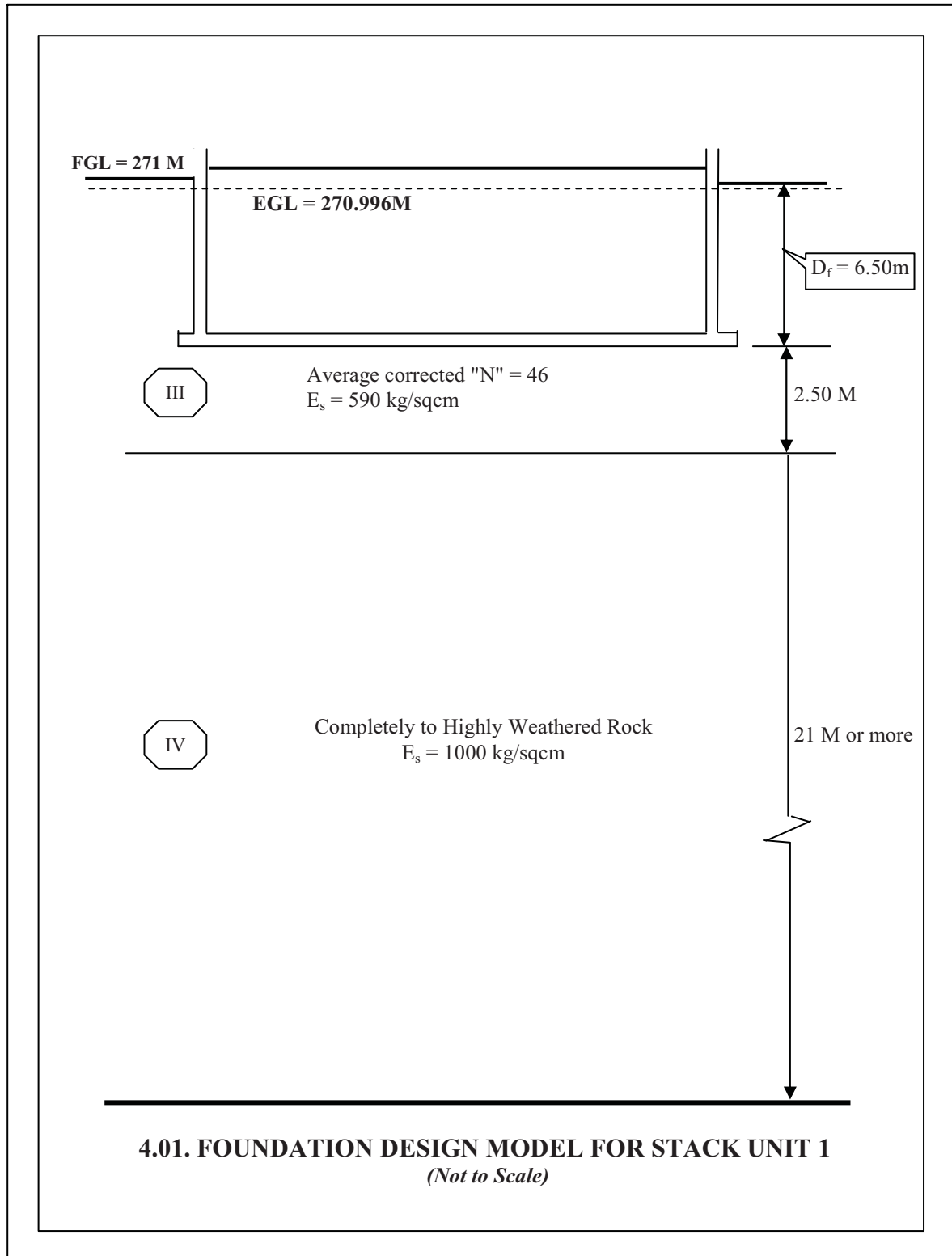
$$\Phi = 28^\circ, \Phi' = \tan^{-1} (2/3 \times \tan 28^\circ) = 19^\circ$$

Computed Net Ultimate Bearing Capacity = 81.30 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 32.52 t/sqm

Therefore, interpolated SBC for Φ of $34^\circ = [32.52 + \{(34-28) / (36-28)\} \times (328.15-32.52)] = 254.24$ t/sqm.

The above bearing capacity should be checked against settlement criteria.



SETTLEMENT CALCULATION

Dia of chimney = 35m, so, size of equivalent square = 31.02m

A) General Data:

Width of foundation =	31.02	m
Length of foundation =	31.02	m
Depth of foundation =	6.50	m below FGL
Net Base Pressure =	6.5	kg/sqcm

B) Subsoil Properties:**Layer - III**

Young's Modulus =	590	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	6.50	m
End of Stratum =	9.00	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Layer - IV

Young's Modulus =	1000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	9.00	m
End of Stratum =	53.03	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

C) Calculation of Immediate Settlement:*Settlement at center*

$M = L' / B' =$	1.000	
$N = H / B' =$	0.161	
$I_1 =$	0.006	
$I_2 =$	0.035	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.029	
Immediate settlement $S_i =$	1.843	cm
$[q_o \times B \times (1 - \mu^2) \times m \times I_s] / E_s$		

Settlement at corner

$M = L' / B' =$	1.00	
$N = H / B' =$	0.081	
$I_1 =$	0.001456	
$I_2 =$	0.018690	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.014	
Immediate settlement $S_i =$	0.446	cm

Average S_i for Stratum III = 11.44 mm

Total immediate settlement = 98.67 mm

So, Total Settlement = 98.67 mm

Fox's Depth correction Factor = 0.950

Applying Rigidity correction Factor : 0.80

Corrected total settlement = 75.00 mm

Settlement at center

$M = L' / B' =$	1.000	
$N = H / B' =$	2.627	
$I_1 =$	0.339	
$I_2 =$	0.053	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.375	
Immediate settlement $S_i =$	13.103	cm
$[q_o \times B \times (1 - \mu^2) \times m \times I_s] / E_s$		

Settlement at corner

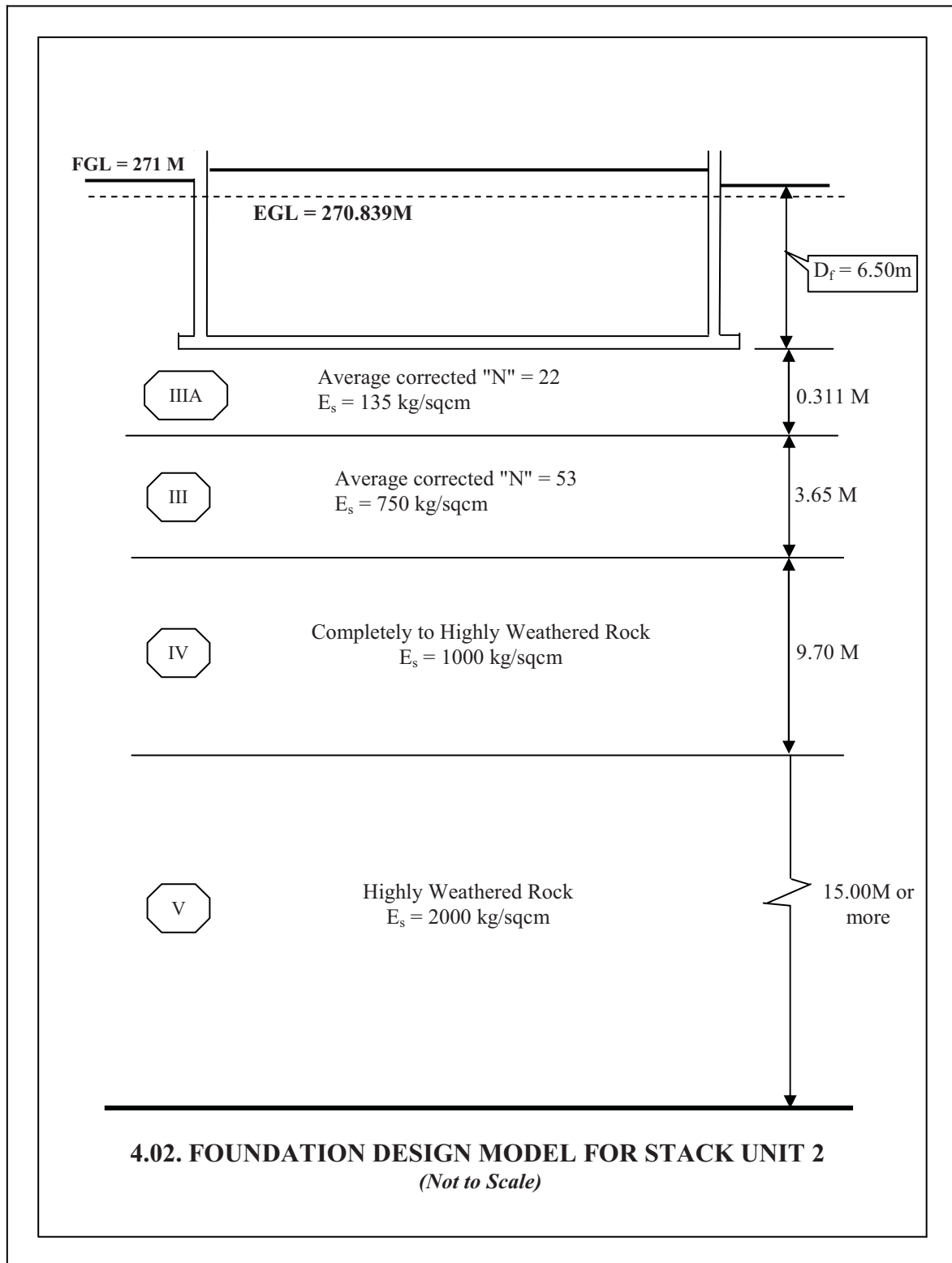
$M = L' / B' =$	1.00	
$N = H / B' =$	1.314	
$I_1 =$	0.196	
$I_2 =$	0.079	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.248	
Immediate settlement $S_i =$	4.342	cm

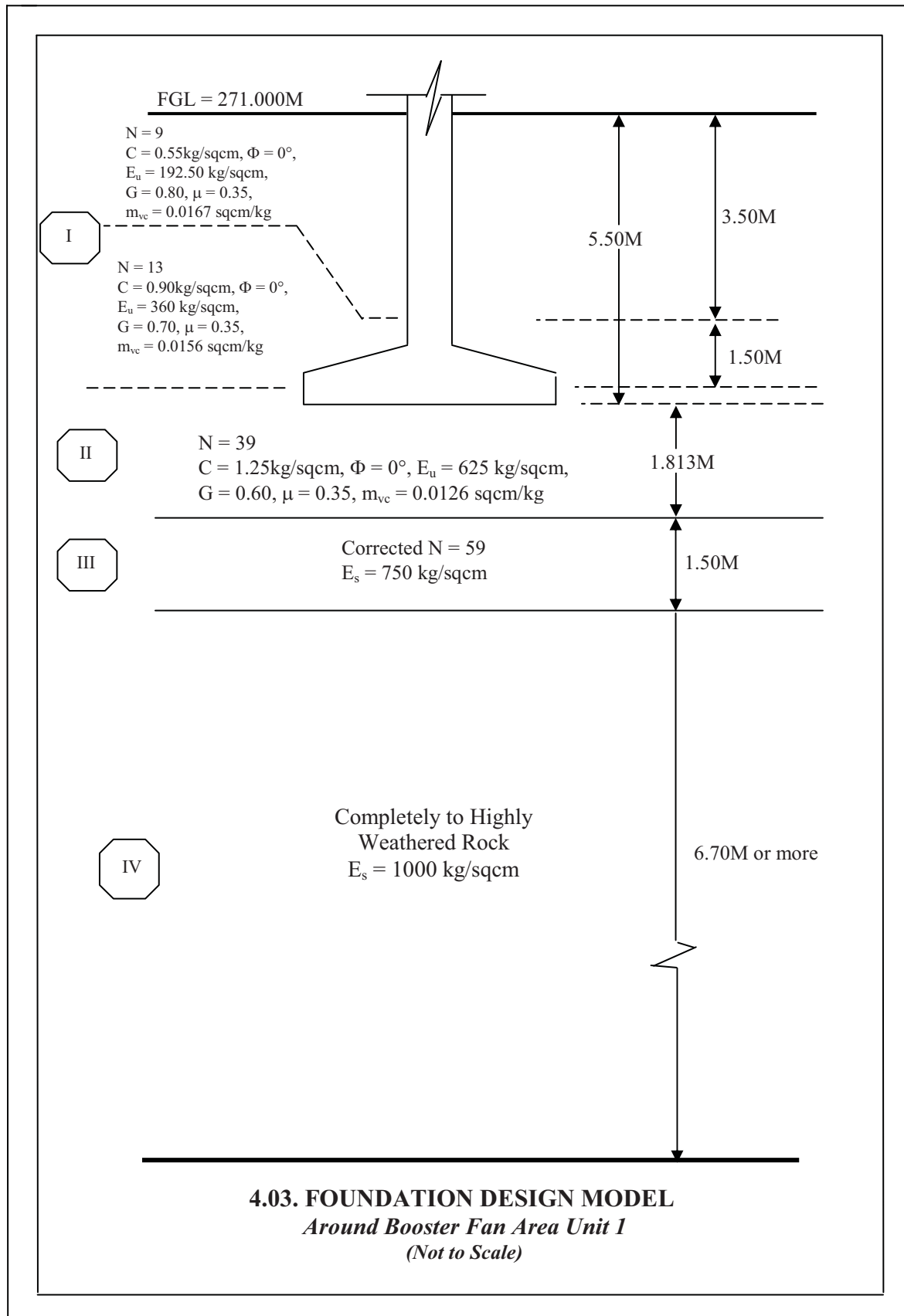
Average S_i for Stratum IV = 87.22 mm

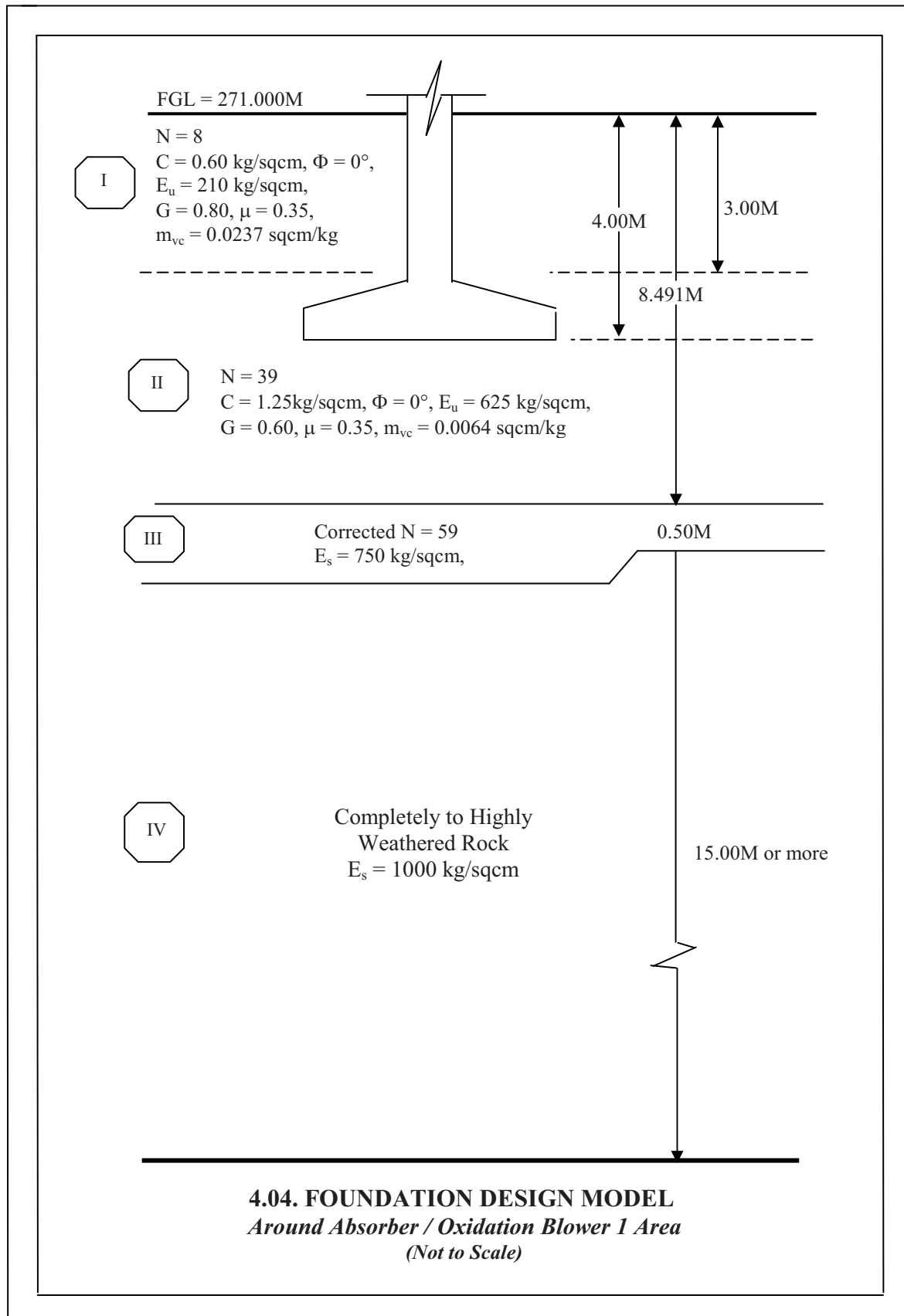
(for both the layer)

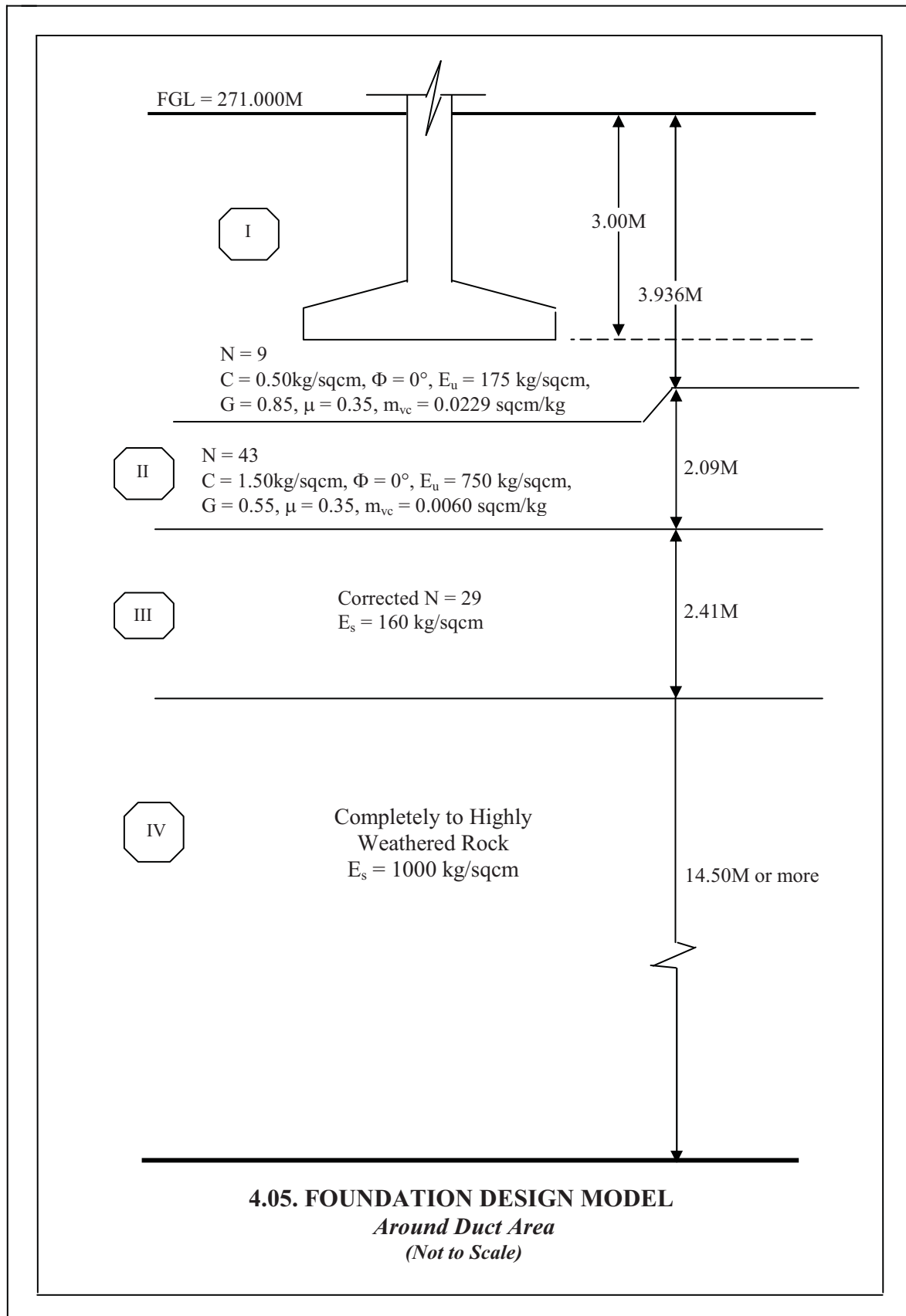
The calculated settlement is well within permissible limit. However, let us restrict the bearing capacity to 50 t/sqm for 6.50m below FGL.

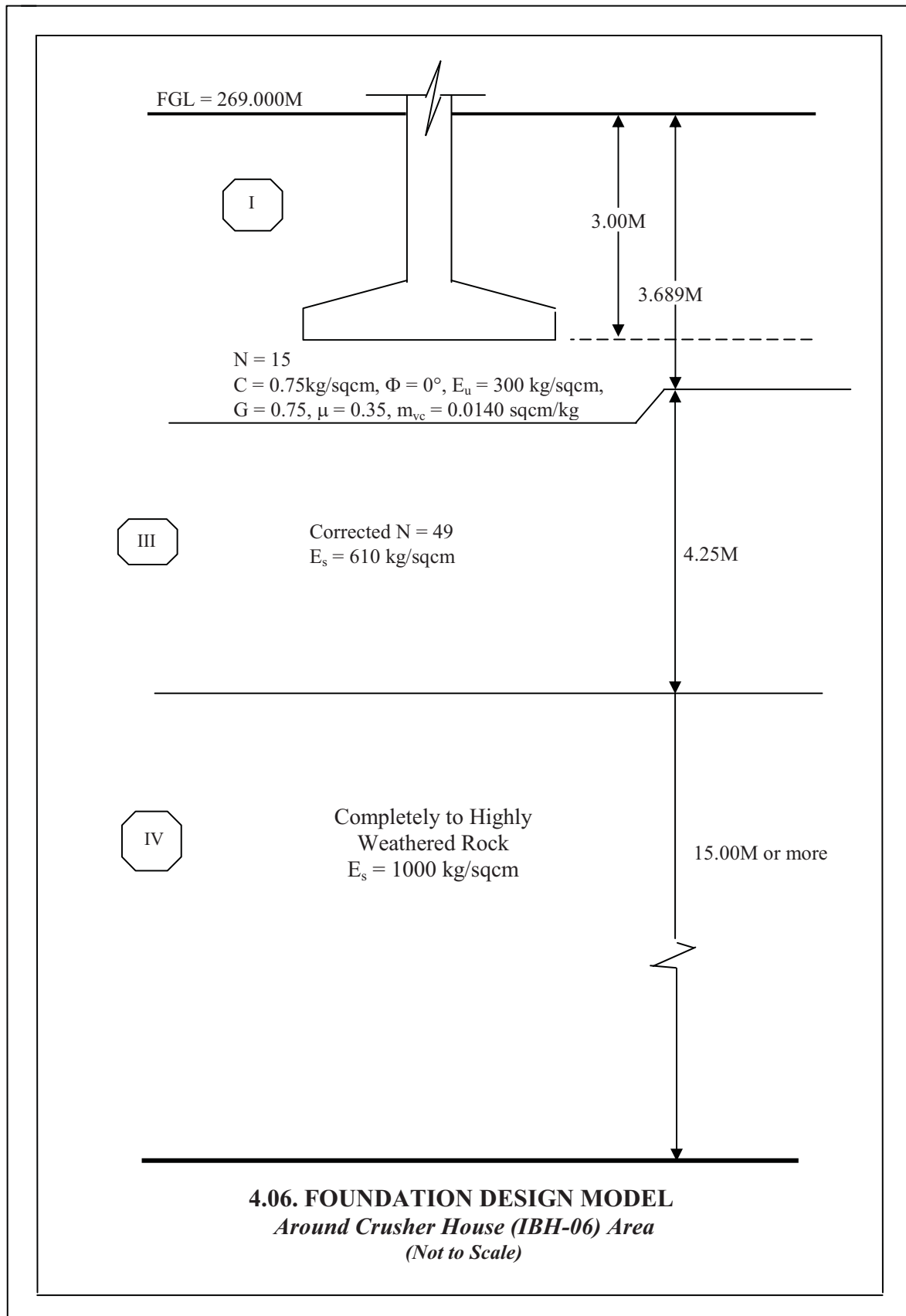
Based on the above, the structure wise recommended bearing capacity values have been presented in Sec. 5.04.











5.04. RECOMMENDATION:

Foundation Location	NGL in RL (M)	FGL in RL (M)	Depth of fill (m)	D _f below FGL (m)	Width of Foundation, B (m)	NSBC (t/sqm)	Recommended NABC (t/sqm)			NABC (t/sqm) as per soil condition		
							S = 25 (mm)	S = 40 (mm)	S = 75 (mm)	S = 25 (mm)	S = 40 (mm)	S = 75 (mm)
Booster Fan Unit-2 (BH-01)	270.000	271.000	1.00	3.00	1≤B≤3	14.18	7	8	--	10	14	--
					3<B<6	13.52	7	8	--	8	12	--
					B≥6	13.02	--	--	8	--	--	13
				4.00	1≤B≤3	15.05	10	12	--	15	15	--
					3<B<6	14.05	10	12	--	14	14	--
					B≥6	13.31	--	--	13	9	12	13
				4.50	1≤B≤3	15.48	15	15	--	15	15	--
					3<B<6	14.32	14	14	--	14	14	--
					B≥6	13.45	12	13	13	12	13	13
				5.00	1≤B≤3	25.95	16	25	--	16	25	--
					3<B<6	23.78	12	18	--	12	18	--
					B≥6	22.15	10	16	22	10	16	22
Booster Fan Unit-1 (BH-02)	271.000	271.000	-	2.00	1≤B≤3	14.18	7	8	--	10	14	--
					3<B<6	13.52	7	8	--	8	12	--
					B≥6	13.02	--	--	8	--	--	13
				3.00	1≤B≤3	15.05	10	12	--	12	15	--
					3<B<6	14.05	10	12	--	10	14	--
					B≥6	13.31	--	--	13	9	12	13
				3.50	1≤B≤3	15.48	15	15	--	15	15	--
					3<B<6	14.32	11	14	--	11	14	--
					B≥6	13.45	10	13	13	10	13	13
				4.00	1≤B≤3	25.95	16	25	--	16	25	--
					3<B<6	23.78	12	18	--	12	18	--
					B≥6	22.15	10	16	22	10	16	22
Duct & Pipe Rack (BH-03 & 05)	270.000	271.000	1.00	3.00	1≤B≤3	12.90	7	8	--	10	12	--
					3<B<6	12.30	7	8	--	9	12	--
					B≥6	11.84	--	--	8	--	--	11
				4.00	1≤B≤3	13.69	10	12	--	12	13	--
					3<B<6	12.78	10	12	--	11	12	--
					B≥6	12.11	--	--	12	--	--	12
				4.50	1≤B≤3	14.09	14	14	--	14	14	--
					3<B<6	13.03	13	13	--	13	13	--
					B≥6	12.24	--	--	12	--	--	12
FGD Control Room (BH-04 & 09)	270.000	271.000	1.00	3.00	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				4.00	1≤B≤3	15.05	10	12	--	15	15	--
					3<B<6	14.05	10	12	--	14	14	--
					B≥6	13.31	--	--	13	--	--	13
				4.50	1≤B≤3	18.27	18	18	--	18	18	--
					3<B<6	16.90	16	16	--	16	16	--
					B≥6	15.87	--	--	15	--	--	15
				5.00	1≤B≤3	43.15	40	40	--	40	40	--
					3<B<6	39.53	35	39	--	35	39	--
					B≥6	36.81	--	--	36	--	--	36
Wet Stack Unit 1 (BH-06 & 07)	270.000	271.000	1	5.50	35 m dia	55	with increase in depth bearing capacity decreasing			40	50	35
				6.50	35 m dia	254				35	50	40
Aux. absorbant tank (BH-07)	270.000	271.000	1	3.00	1≤B≤3	23.16	7	8	--	18	23	--
					3<B<6	22.07	7	8	--	16	22	--
					B≥6	21.26	--	--	8	--	--	21
				4.00	1≤B≤3	39.49	10	12	--	22	35	--
					3<B<6	36.87	10	12	--	20	32	--
					B≥6	34.90	--	--	14	--	--	34
				4.50	1≤B≤3	40.60	40	40	--	40	40	--
					3<B<6	37.54	32	37	--	32	37	--
					B≥6	35.24	--	--	35	--	--	35

from Boussines q equation its coming 35 and 40t/m² for depth 5.5m and 6.5m

Foundation Location	NGL in RL (M)	FGL in RL (M)	Depth of fill (m)	D _f below FGL (m)	Width of Foundation, B (m)	NSBC (t/sqm)	Recommended NABC (t/sqm)			NABC (t/sqm) as per soil condition		
							S = 25 (mm)	S = 40 (mm)	S = 75 (mm)	S = 25 (mm)	S = 40 (mm)	S = 75 (mm)
Absorber / Oxidation Blower Unit-1 (BH-08 & 22)	270.500	271.000	0.50	2.50	1≤B≤3	14.18	7	8	--	10	14	--
					3<B<6	13.52	7	8	--	8	13	--
					B≥6	13.02	--	--	8	--	--	13
				3.50	1≤B≤3	16.41	10	12	--	12	16	--
					3<B<6	15.32	10	12	--	10	15	--
					B≥6	14.50	--	--	14	--	--	14
				4.00	1≤B≤3	35.02	32	35	--	32	35	--
					3<B<6	32.38	22	32	--	22	32	--
					B≥6	30.40	--	--	30	--	--	30
Absorber / Oxidation Blower Unit-2 (BH-10 & 23)	269.00	271.000	2.00	4.00	1≤B≤3	18.03	7	8	--	8	12	--
					3<B<6	17.18	7	8	--	5	8	--
					B≥6	16.55	--	--	8	--	--	15
				5.00	1≤B≤3	19.12	10	12	--	10	16	--
					3<B<6	17.85	7	11	--	7	11	--
					B≥6	16.90	--	--	14	--	--	16
				6.50	1≤B≤3	42.83	32	40	--	32	40	--
					3<B<6	38.89	28	38	--	28	38	--
					B≥6	35.94	--	--	35	--	--	35
Stack Unit 2 (BH-11 & 12)	268.800	271.000	2.20	6.50	Upto 6	75.29	40	40	--	40	40	--
					35m dia	143.38	--	40	50	--	40	50
Pipe Rack near Railway Track (BH-13)	269.000	269.000	0.00	2.00	1≤B≤3	12.90	6	8	--	6	10	--
					3<B<6	12.30	5	8	--	5	8	--
					B≥6	11.84	--	--	8	--	--	11
				3.00	1≤B≤3	13.69	8	12	--	8	12	--
					3<B<6	12.78	6	9	--	6	9	--
					B≥6	12.11	--	--	12	--	--	12
				4.00	1≤B≤3	27.38	16	25	--	16	25	--
					3<B<6	25.09	10	16	--	10	16	--
					B≥6	23.37	--	14	23	--	14	23
Gypsum Dewatering Building (BH-14 & 15)	268.500	269.000	0.50	2.50	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				3.50	1≤B≤3	29.99	10	12	--	20	29	--
					3<B<6	27.99	10	12	--	18	27	--
					B≥6	26.50	--	--	14	--	--	26
				4.50	1≤B≤3	31.68	29	30	--	29	30	--
					3<B<6	29.03	20	29	--	20	29	--
					B≥6	27.03	--	--	27	--	--	27
Pipe Rack (BH-16)	268.500	269.000	0.50	2.50	1≤B≤3	19.31	7	8	--	14	19	--
					3<B<6	18.41	7	8	--	11	18	--
					B≥6	17.73	--	--	8	--	--	17
				3.50	1≤B≤3	20.48	10	12	--	16	20	--
					3<B<6	19.12	10	12	--	14	19	--
					B≥6	18.10	--	--	14	--	--	18
				4.50	1≤B≤3	21.65	19	21	--	19	21	--
					3<B<6	19.84	14	19	--	14	19	--
					B≥6	18.48	--	--	18	--	--	18
FGD DMCW / ACW Pump House (BH-17)	268.000	269.000	1.00	3.00	1≤B≤3	19.31	7	8	--	16	19	--
					3<B<6	18.41	7	8	--	13	18	--
					B≥6	17.73	--	--	8	--	--	17
				4.00	1≤B≤3	20.48	10	12	--	18	20	--
					3<B<6	19.12	10	12	--	15	19	--
					B≥6	18.78	--	--	14	--	--	18
				4.50	1≤B≤3	70.72	40	40	--	40	40	--
					3<B<6	76.24	40	40	--	40	40	--
					B≥6	86.41	--	--	40	--	--	40
Pipe Rack (BH-18)	268.300	269.000	0.70	2.70	1≤B≤3	33.42	7	8	--	25	30	--
					3<B<6	31.85	7	8	--	22	31	--
					B≥6	30.67	--	--	8	--	--	30
				3.70	1≤B≤3	35.42	10	12	--	30	35	--
					3<B<6	33.06	10	12	--	25	33	--
					B≥6	31.30	--	--	14	--	--	31
				4.20	1≤B≤3	36.42	36	36	--	36	36	--
					3<B<6	33.67	30	32	--	30	32	--
					B≥6	31.61	--	--	30	--	--	30
				4.70	1≤B≤3	37.42	37	37	--	37	37	--
					3<B<6	34.28	34	34	--	34	34	--
					B≥6	31.92	--	17	31	--	17	31

Foundation Location	NGL in RL (M)	FGL in RL (M)	Depth of fill (m)	D _f below FGL (m)	Width of Foundation, B (m)	NSBC (t/sqm)	Recommended NABC (t/sqm)			NABC (t/sqm) as per soil condition		
							S = 25 (mm)	S = 40 (mm)	S = 75 (mm)	S = 25 (mm)	S = 40 (mm)	S = 75 (mm)
Ballmill & Lime storage slurry tank (BH-19 & 26)	268.000 267.5	269.000	1.00	3.00	1≤B≤3	14.18	7	8	--	7	11.2	--
					3<B<6	13.52	6	8	--	6	9.6	--
					B≥6	13.02	--	--	8	4	6.4	12
				4.00	1≤B≤3	15.05	8	12	--	8	12	--
					3<B<6	14.05	6	9	--	6	9	--
					B≥6	13.31	6	10	13	6	10	13
				5.00	1≤B≤3	15.91	12	15	--	12	15	--
					3<B<6	14.59	10	14	--	10	14	--
					B≥6	13.59	9	13	13	9	13	13
				6.00	1≤B≤3	16.78	16	16	--	16	16	--
					3<B<6	15.12	15	15	--	15	15	--
					B≥6	13.88	13	13	13	13	13	13
Duct (BH-20 & 21)	269.500	271.000	1.50	3.50	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				4.50	1≤B≤3	15.05	10	12	--	14	15	--
					3<B<6	14.05	10	12	--	12	14	--
					B≥6	13.31	--	--	14	--	--	13
				5.00	1≤B≤3	18.27	18	18	--	18	18	--
					3<B<6	16.90	16	16	--	16	16	--
					B≥6	15.87	--	9	15	--	9	15
Tank near Gypsum Dewatering building (BH-24)	268.500	269.000	0.50	2.50	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				3.50	1≤B≤3	15.05	10	12	--	14	15	--
					3<B<6	14.05	10	12	--	12	14	--
					B≥6	13.31	--	--	13	--	--	13
				4.00	1≤B≤3	18.27	18	18	--	18	18	--
					3<B<6	16.90	16	16	--	16	16	--
					B≥6	15.87	--	9	15	--	9	15
FGD Comp. House (BH-25)	268.000	269.000	1.00	3.00	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				4.00	1≤B≤3	40.85	10	12	--	25	40	--
					3<B<6	38.13	10	12	--	20	32	--
					B≥6	36.10	--	--	14	--	--	32
				5.00	1≤B≤3	43.15	40	40	--	40	40	--
					3<B<6	39.53	39	39	--	39	39	--
					B≥6	36.81	--	--	36	--	--	36
IBH-1, 3 & 4 Lime stone conveyor & truck unloading area	270.500	269.000	-	2.00	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				3.00	1≤B≤3	15.05	10	12	--	14	15	--
					3<B<6	14.05	10	12	--	12	14	--
					B≥6	13.31	--	--	13	--	--	13
				4.00	1≤B≤3	43.15	40	40	--	40	40	--
					3<B<6	39.53	39	39	--	39	39	--
					B≥6	36.81	--	--	36	--	--	36
IBH-7 Lime stone conveyor	268.000	269.000	1.00	2.00	1≤B≤3	18.03	7	8	--	14	18	--
					3<B<6	17.18	7	8	--	12	17	--
					B≥6	16.55	--	--	8	--	--	16
				3.00	1≤B≤3	19.12	10	12	--	16	19	--
					3<B<6	17.85	10	12	--	14	17	--
					B≥6	16.90	--	--	14	--	--	16
				4.00	1≤B≤3	43.15	40	40	--	40	40	--
					3<B<6	39.53	39	39	--	39	39	--
					B≥6	36.81	--	--	36	--	--	36
Lime Stone MCC Room (IBH-02)	270.000	269.000	-	2.00	1≤B≤3	18.03	7	8	--	16	18	--
					3<B<6	17.18	7	8	--	14	17	--
					B≥6	16.55	--	--	8	--	--	16
				3.00	1≤B≤3	19.12	10	12	--	18	19	--
					3<B<6	17.85	10	12	--	16	17	--
					B≥6	16.90	--	--	14	--	--	16
				4.00	1≤B≤3	20.21	20	20	--	20	20	--
					3<B<6	18.52	18	18	--	18	18	--
					B≥6	17.26	--	--	17	--	--	17

Annexure-B

Foundation Location	NGL in RL (M)	FGL in RL (M)	Depth of fill (m)	D _f below FGL (m)	Width of Foundation, B (m)	NSBC (t/sqm)	Recommended NABC (t/sqm)			NABC (t/sqm) as per soil condition		
							S = 25 (mm)	S = 40 (mm)	S = 75 (mm)	S = 25 (mm)	S = 40 (mm)	S = 75 (mm)
Crusher House (IBH-5 & 6)	269.000	269.000	-	2.00	1≤B≤3	14.18	7	8	--	12	14	--
					3<B<6	13.52	7	8	--	10	13	--
					B≥6	13.02	--	--	8	--	--	13
				3.00	1≤B≤3	15.05	10	12	--	14	15	--
					3<B<6	14.05	10	12	--	12	14	--
					B≥6	13.31	--	--	13	--	--	13
				4.50	1≤B≤3	91.04	40	40	--	40	40	--
					3<B<6	93.44	40	40	--	40	40	--
					B≥6	102.10	--	--	40	--	--	40
Gypsum Shed (IBH-08 & 09)	268.200	269.000	0.80	2.80	1≤B≤3	12.90	7	8	--	10	12	--
					3<B<6	12.30	7	8	--	8	12	--
					B≥6	11.84	--	--	8	--	--	11
				3.80	1≤B≤3	13.69	10	12	--	12	13	--
					3<B<6	12.78	10	12	--	10	12	--
					B≥6	12.11	--	--	12	--	--	12
				4.80	1≤B≤3	28.82	28	28	--	28	28	--
					3<B<6	26.40	20	26	--	20	26	--
					B≥6	24.59	--	--	24	--	--	24

Note:

1. NSBC = Net Safe Bearing Capacity, NABC = Net Allowable Bearing Capacity, EGL = Existing Ground Level & S = Limiting Settlement
2. L/B ratio = 2 is considered for SBC calculation
3. In case any loose pocket is observed at the founding level, then the same should be excavated out and filled up with PCC.

5.05. DEEP FOUNDATION:

Alternative to shallow foundation, for higher capacity deep foundation in form of R.C. Bored pile can be used around Chimney, Absorber & Pipe Rack area. Bored Cast-in-Situ piles are preferred due to typical geological formation, availability of construction agencies, ease of construction and less sound pollution.

While determining the pile capacity, the following considerations are made.

- a) Assume grade of concrete = M30
- b) Diameter of pile used = 900 and 1000mm

With reference to the above, following pile capacity calculations are presented below.

5.5.1. VERTICAL PILE CAPACITY COMPRESSION

Let us assume length of pile = 12m below cut-off for 900mm dia pile and 12.50m below cut-off for 1000mm dia pile.

As per IS 2911(Part 1/Sec 2): 2010, the allowable load on the pile,

$$Q_a = c_{u1}N_c (\pi B^2/4F_s) + \alpha c_{u2} (\pi BL/F_s)$$

Where,

C_{u1} = Shear strength of rock below the base of the pile, in kN/m^2

N_c = Bearing capacity factor taken as 9

F_s = Factor of safety usually taken as 3

α = 0.9 (recommended value)

C_{u2} = Average shear strength of rock in the socketed length of pile, in kN/m^2

B = Minimum width of pile shaft (diameter in case of circular piles), in m

L = socket length of pile, in m

Considering socket length, $L = 3.76\text{m}$ for 900mm dia pile and 4.00m for 1000mm dia pile

D = diameter of pile in m = 900mm = 0.90m

Use design $C_{u1} = 700 \text{ kN/m}^2 = 70\text{t/m}^2$ and design $C_{u2} = 700 \text{ kN/m}^2 = 70\text{t/m}^2$ Therefore, $Q_a =$

$$c_{u1}N_c (\pi B^2/4F_s) + \alpha c_{u2} (\pi BL/F_s)$$

$$= [70 \times 9 \times (3.14 \times 0.9^2)/(4 \times 3) + 0.90 \times 70 \times (3.14 \times 0.90 \times 3.76) / 3] \text{ t}$$

$$= (133.528 + 223.254) \text{ t} = 356.782 \text{ t}$$

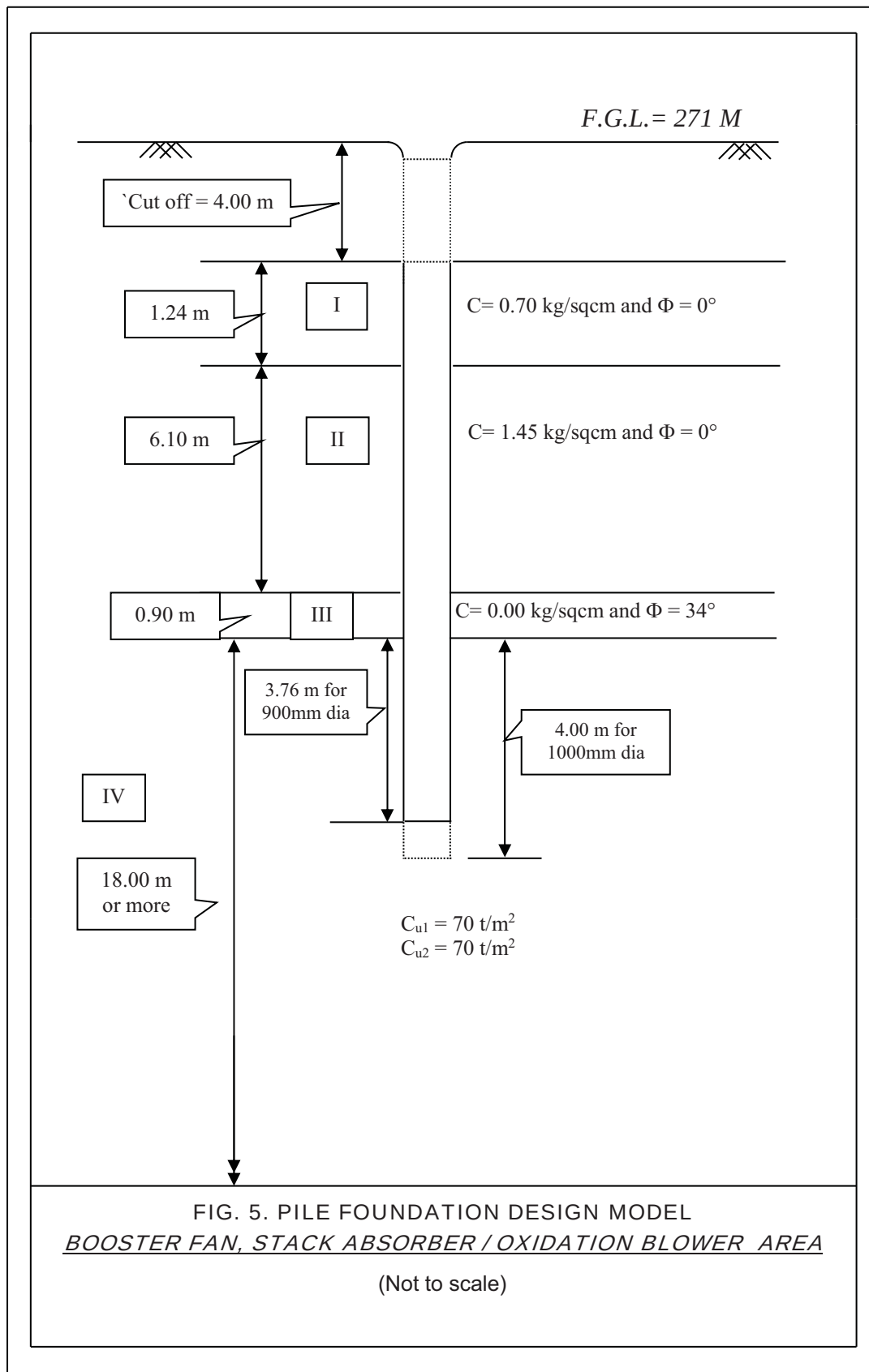
So, recommended pile capacity = 350 t for 900mm dia pile

Similarly, for 1000mm dia pile, calculated pile capacity = 428.83t

So, recommended pile capacity = 425 t for 1000mm dia pile.

Neglecting end bearing, safe uplift capacity = 223.25T for 900mm dia pile. So, recommended uplift capacity = 220T

Neglecting end bearing, safe uplift capacity = 263.89T for 1000mm dia pile. So, recommended uplift capacity = 250T



5.5.2. HORIZONTAL PILE CAPACITY:

Use design $C = 1.00 \text{ kg/sqcm}$ for lateral pile capacity calculation (cut-off = 4m below FGL).

Refer to IS : 2911 (Part I/Sec 2) - 2010, Appendix - C

Modulus of Subgrade reaction, $k_1 = 3.60 \text{ kg/cucm}$ corresponding to Cohesion = 1.00 kg/sqcm

Now, $K = (k_1/1.5) \times (30/D)$ which is coming as 0.80 kg/cucm [D = Pile dia in cm]

Stiffness factor, $R = [EI/KD]^{1/4}$

Now, $I = 3.22 \times 10^6 \text{ cm}^4$ [for 900mm dia pile]

$E = 5000 \times (f_{ck})^{0.5} = 5000 \times (30)^{0.5} = 27386 \text{ N/sqmm} = 2.74 \times 10^5 \text{ kg/sqcm}$

Hence, $R = 332.69 \text{ cm}$

From Graph (Fig.4), $L_f = 1.95 \times R = 648.74 \text{ cm}$ [Assuming Fixed Head Piles in OC Clay]

Pile Head deflection, $Y = H \times L_f^3 / 12EI = 0.2580\text{mm}$ for 1T load

So, for 5mm horizontal deflection, $H = 19.38T$, say 19T

5.5.3. RECOMMENDED PILE CAPACITY:

With reference to the above, the recommended pile capacity values are presented below.

For Cut-off level = 4.00* m below FGL

Borehole Location	Dia. of Pile (mm)	Pile Shaft Length below Cut-off (M)	Recommended Pile Capacity (T)		
			Vertical	Uplift	Lateral
Booster Fan (BH-01 & 02), Stack Unit-1 (BH-06 & 07), Stack Unit-2 (BH-11 & 12), Absorber / Oxidation Blower 1(BH-08 & 22), Absorber / Oxidation Blower 2(BH-10 & 23)	900	12.00	350	220	19.0
	1000	12.50	425	250	21.5

* For piles with cut off level 2m and 3m below FGL, the pile tip level shall be maintained at RL (+) 255.000m. However lateral capacity shall be 16 MT and 17 MT for pile cut off level 2m and 3m below FGL respectively for 900mm dia meter piles.

Furnish recommendation for 600mm and 760mm dia pile also

5.06. SWELLING CHARACTERISTICS:

The swelling pressure and Free Swell Index tests were performed on a few samples and the test results are presented at the end of the Appendix. The average swelling pressure and Free Swell Index as found from the tests are 0.74kg/sqcm and 51.54% respectively.

5.07. FIELD PERMEABILITY TEST RESULTS:

Field permeability test was conducted at different depths by falling head method and the test results are presented below. Sample calculations are also enclosed at the end of the Appendix.

Test Locations	Type of Test	Depth of Test (M)	Permeability (cm/sec)
BH-02	Falling Head	0.80 – 1.50	2.818×10^{-6}
	Falling Head	2.80 – 3.50	5.222×10^{-6}
	Falling Head	4.80 – 5.40	7.725×10^{-6}
	Falling Head	7.80 – 8.40	5.630×10^{-6}
	Falling Head	11.80 – 12.50	8.588×10^{-5}
BH-08	Falling Head	0.80 – 1.50	9.617×10^{-6}
	Falling Head	2.70 – 3.40	5.206×10^{-6}
	Falling Head	4.80 – 5.50	1.875×10^{-6}
	Falling Head	7.70 – 8.40	4.973×10^{-6}
	Falling Head	11.65 – 12.35	2.818×10^{-6}
IBH-07	Falling Head	0.70 – 1.40	1.723×10^{-5}
	Falling Head	2.80 – 3.50	9.122×10^{-6}
	Falling Head	4.80 – 5.50	6.677×10^{-6}
	Falling Head	7.80 – 8.50	6.171×10^{-6}
	Falling Head	11.80 – 12.50	5.216×10^{-6}

5.08. STANDARD PROCTOR COMPACTION & CBR TEST:

Standard Proctor Compaction tests were carried out in the laboratory to determine the Optimum Moisture Content (OMC) and Maximum Dry Density (MDD). Thereafter, CBR (4 days soaked) tests were carried out on the samples prepared at 95% of MDD. The test results and graphs are presented in the Appendix.

5.09. CHEMICAL TESTS:

Chemical tests were performed on few soil and water samples for determining the pH value, Sulphate, Chloride content etc.

CHEMICAL TEST RESULTS ON SOIL SAMPLES:-

BH/Sample No.	Depth (m)	pH value	Sulphate as SO ₃ (%)	Chloride as Cl (%)	Organic Matter (%)	Carbonate as CO ₃ (%)
01 / UDS01	2.10	7.44	B.D.L.*	0.0060	0.5107	2.76
05 / UDS01	2.00	7.50	B.D.L.*	0.0080	0.6656	2.52
07 / UDS01	2.00	7.45	B.D.L.*	0.0060	1.1940	1.80
11 / UDS01	2.00	7.50	B.D.L.*	0.0040	0.4538	2.28
18 / UDS01	2.00	7.46	B.D.L.*	0.0050	0.2429	2.52
20 / UDS01	2.00	7.46	B.D.L.*	0.0090	0.8954	3.24
22 / UDS01	2.00	7.30	B.D.L.*	0.0160	0.4865	4.20
26 / UDS01	2.00	7.62	B.D.L.*	0.0060	0.3320	3.00
IBH03/UDS01	2.00	7.48	B.D.L.*	0.0060	0.9508	2.76
IBH06/UDS01	2.00	7.66	B.D.L.*	0.0050	0.1546	2.04

CHEMICAL TEST RESULTS ON WATER SAMPLES:-

BH/Sample No.	Depth (M)	pH value	Sulphate as (mg/litre)	Chloride as (mg/litre)	Organic Matter (mg/litre)
02	1.55	7.20	120	112	11.70
06	1.50	6.60	180	92	11.70
10	1.65	6.65	120	82	9.75
13	0.60	6.70	120	56	9.75
14	1.30	7.02	180	82	7.80
16	0.60	6.80	120	62	11.70
19	0.60	6.90	120	56	7.80
IBH-02	0.95	6.84	360	160	9.75
IBH-05	0.80	6.89	360	170	9.75
IBH-08	1.30	6.87	300	112	7.80

Note: * - B.D.L. = Below Detection Limit (i.e. below 0.050%)

It is seen that the values are on a safer side and so no special cement will be required for foundation concrete. **Either Ordinary Portland cement or Portland slag cement or Portland Pozzolana cement can be used for the purpose.**

5.10. SUITABILITY OF EXISTING SOIL FOR FILLING AND BACK-FILLING:

The subsoil at the site is inorganic in nature & consists of silty clay (CH type soil) with sand having medium swelling properties (varies from 23.81% to 75%). The swelling pressure also varies from 0.01 kg/sqcm to 2.00 kg/sqcm. Hence the soil shall be tested as per specification before it is used as filling & backfilling material.

5.11. SUITABILITY OF SOIL FOR CONSTRUCTION OF ROADS & PAVEMENT:

In the laboratory, standard proctor compaction tests were performed, using samples collected at a depth varying from 1.00-3.00m below ground level. The MDD ranges between 1.569 gm/cc to 1.692 gm/cc.

Laboratory CBR tests were performed on remoulded soil samples (compacted at 95% of MDD) under soaked (4days soaking) and unsoaked condition. The CBR values are in the range of 1% to 3% for soaked condition and 3% to 8% for unsoaked condition.

5.12. LIQUEFACTION ANALYSIS:

As per H. B. Seed and I.M. Idriss (1982) a clayey soil is said to be non-liquefiable if any one of the following three criteria is satisfied.

- a) the soil contains fine grained soils with clay contents greater than 15%,
- b) liquid limit greater than 35% or
- c) moisture content less than 90% of the liquid limit.

Based on the above criteria, it is seen that the medium to stiff, silty clay / clayey silt layer (layer-I) at the present site is non-liquefiable as the above three criteria are satisfied; viz. the clay content (25%) is greater than 15%, the liquid limit (55%) is greater than 35% and the moisture content (25%) is less than 90% of the liquid limit.

Similarly, it is also seen that the very stiff to hard, clayey silt layer (layer-II) is also non-liquefiable as the above three criteria are satisfied; viz. the clay content (17%) is greater than 15%, liquid limit (57%) is greater than 35% and the moisture content (21%) is less than 90% of the liquid limit.

A medium dense silty sand (layer IIIA) layer appears, the subsoil may liquefy due to earthquake.

The liquefaction potential of sandy soil is evaluated as per provision laid down in "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils" by Dr. Gonzalo

Castro et al. published in “*Journal of Geotechnical and Geoenvironmental Engineering*”, October’ 2001 [recently adopted in IS 1893 (part 1): 2016]

Based on the SPT values in boreholes, the liquefaction resistance of all the boreholes were evaluated for zone – II as per IS:1893 Part I and presented in separate sheets.

Maximum earthquake intensity considered as 6.0 with MSF = 1.77

The ratio of $CRR/CSR \leq 1.0$ indicates that the soil is prone to liquefaction whereas $CRR/CSR > 1.0$ or corrected $N_1 > 30$ indicates the soil is non liquefiable.

Based on the above, the liquefaction resistance of the subsoil is determined and presented below.

	Zone	II	Earthquake magnitude =				6.00	Bulk density =					a_{max}/g	0.10	MSF	1.77	Hammer	63.5	kg	Drop	762	mm				
Borehole Location	Avg Depth	Field N	Total OVP (t/sqm)	Effective OVP (t/sqm)	CN	C _{HT}	C _{HW}	C _{BD}	C _{SS}	C _{RL}	N ₆₀	(N ₁) ₆₀	FC	α	β	(N ₁) _{60CS}	r _d	CSR	CRR _{7.5}	CRR	Relative density	f	K _σ	FOS		
BH-10	6.33	17	12.333	6.008	1.29	0.75	1.00	1.05	1.10	0.95	13.99	18.0	34	4.93	1.19	26.4	0.95	0.127	0.32	0.57	45.50	0.77	1.00	4.490		
BH-11	5.23	24	10.095	4.870	1.43	0.75	1.00	1.05	1.10	0.85	17.67	25.3	21	3.78	1.09	31.3	Non - Liquefiable									
BH-24	8.83	15	10.095	4.870	1.43	0.75	1.00	1.05	1.10	0.95	12.34	17.7	32	4.83	1.17	25.5	0.93	0.126	0.30	0.54	42.50	0.79	1.00	4.268		
BH-26	5.73	27	11.130	5.405	1.36	0.75	1.00	1.05	1.10	0.85	19.88	27.0	40	5.00	1.20	37.4	Non - Liquefiable									
1) C _N = Correction for Overburden pressure limited to 1.70																										
$C_N = \frac{P_a}{\sigma_v}$			P _a = 1 Atmospheric pressure = 10t/sqm σ = Vertical effective stress at the depth of SPT										Fine content means particles smaller than 75 micron For Fine Content<5, α = 0 and β = 1 For(Fine Content>5 AND <35), α = EXP((1.76-(190/FC))) and β = (0.99+(FC ^{-1.5} /1000)) For Fine Content>35, α = 5 and β = 1.20													
2) C _d = Correction for Level of energy delivered by SPT hammer = 1.00.																										
3) C _b = Correction for Borehole Diameter = 1.05 for 150mm borehole dia.																										
4) C _s = Correction for SPT sampler use = 1.10 for sampler without liner.																										
5) C _{sl} = Correction for short length of drill rod.																										
Rod length(m)	C _{sl}		Rod length(m)	C _{sl}																						
<3	0.75		6-<10	0.95																						
3-<4	0.80		10-30	1.00																						
4-<6	0.85																									
(N1) = N.C _N C _d C _b C _s C _{sl}																										
FOS against Liquefaction = (CRR _{7.5} /CSR).MSF For calculation of CSR & CRR, water level is considered at ground level.																										

After that a dense to very dense (layer III) sand layer appears. So, the soil is non-liquefiable.

So, the subsoil at the proposed site is non-liquefiable.

6. SUMMARY & RECOMMENDATIONS

Based on the field and laboratory tests and the foregoing discussion the following are summarised.

1. The subsoil is characterised by medium to stiff silty clay / clayey silt followed by very stiff to hard silty clay / clayey silt layer. After that dense to very dense silty sand with clay binder is observed. Then, weathered rock layer is struck and that continues upto the terminating depth of all the boreholes.
2. Five nos. (5) Plate Load Tests were conducted around plant area (2 nos. are of routine type & rest 3 nos. are of cyclic type). The safe load & corresponding plate settlement, subgrade modulus & settlement for foundation and the dynamic properties using the elastic rebound as we obtain from CPLT-01 to 03 have been discussed in the Section 5.1.
3. **Use of Open Foundation:** The recommended bearing capacity values at different depth of foundation are presented in Section 5.04.
4. **Use of Pile Foundation:** Alternatively, deep foundation in form of pile can be used. Bored cast in-situ piles are preferred due to typical geological formation, availability of construction agencies, ease of construction and less sound pollution. The recommended pile capacity values are presented in Section 5.5.3.
5. The discussion on swelling characteristics is given in Section 5.06.
6. Chemical tests were carried out on a few soil and water samples so as to detect the **pH value, Sulphate, Chloride etc.** It is seen that the values are on a safe side. So, any cement can be used for foundation concrete. **Either Ordinary Portland cement or Portland slag cement or Portland Pozzolana cement can be used for the purpose.**
7. The suitability of existing soil for filling and back-filling is given in Section 5.10.
8. The suitability of soil for construction of roads & pavement is discussed in Section 5.11.
9. Geological logging of the rock samples for the zone of investigation is presented in Section -7.

10. 7 (Seven) nos. ERT were performed at the site and the test results are discussed and presented in Section -8.

For C. E. Testing Company Private Limited,

Prepared By

Checked By

Approved By

(S. SARKAR)

(S. NATH)

(DR. M. NAYAK)

7. GEOLOGICAL LOGGING

1. GEOLOGY

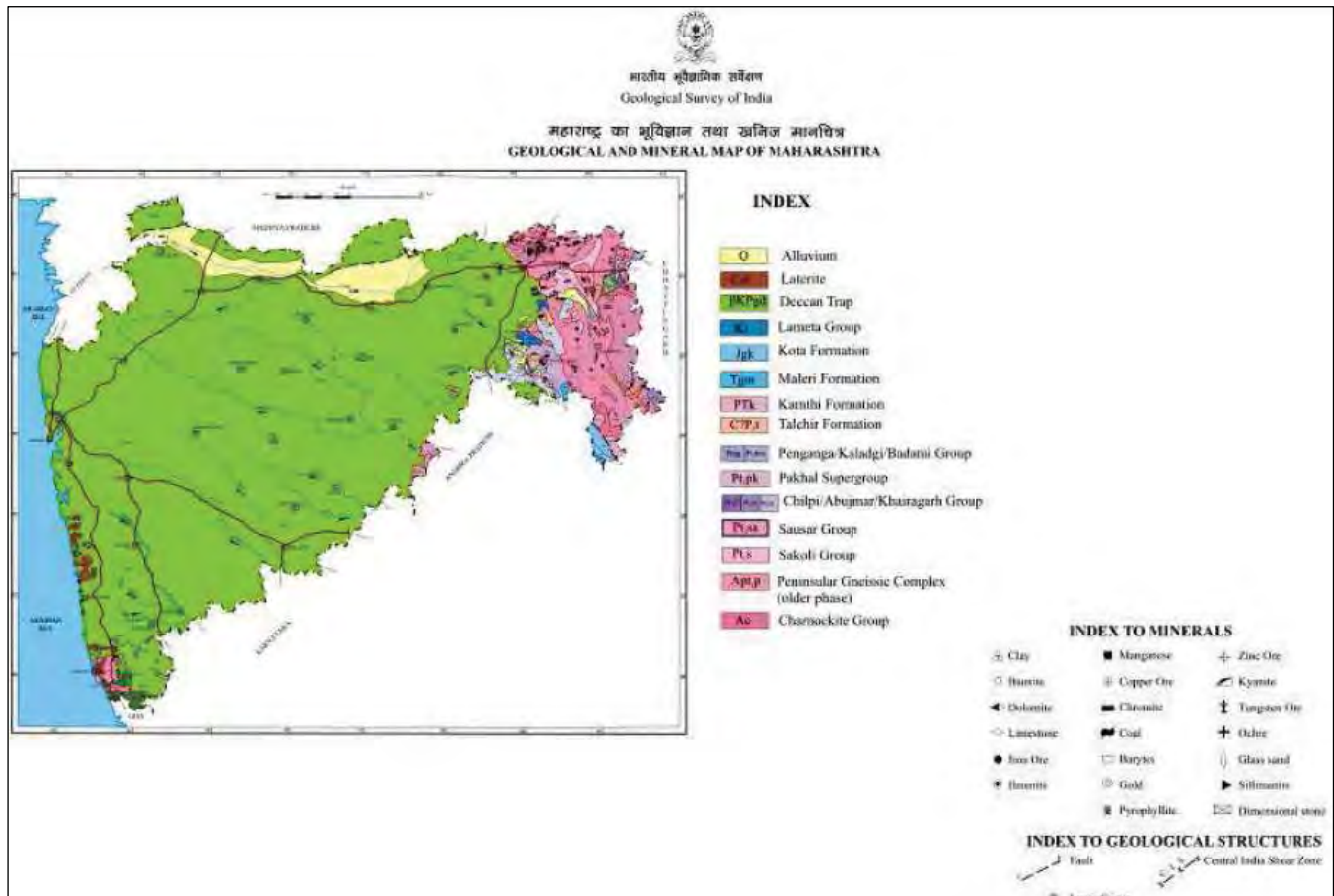
1.1. INTRODUCTION:

The Geo-technical investigation work has been carried out for FGD at 2x500MW NTPC Mouda STPP, Stage-I, Maharashtra, located at Mouda of Nagpur district, the study area is about 40km east of Nagpur city. The site is well connected by metalled road which ultimately connected the major road of the state. Nearest railway station is Chacher, 8 km from the site. Geologically the area belongs to the granite gneissic complex. Geo-morphologically the area is more or less plain land with shallow highs and lows. Most part of the area is barren with scatteredly distributed seasonal bushes and various types of forest tree. The entire area is covered with soil of variable thickness. For better understanding the sub-surface conditions, the investigation works have been carried out both by Boring (in soil by Shell and Auger) followed by core drilling (in case of rock by Rotary Diamond Drilling) methods.

For construction of different structures for the said project, detailed knowledge regarding the subsurface conditions of soil and rock strata is required. For the purpose the area is explored by boring followed by drilling. Total 35 numbers of boring followed by core drilling have been carried out to understand the details sub-surface conditions.

1.2. REGIONAL GEOLOGY:

Maharashtra exhibits a spectrum of stratigraphic sequences of rocks ranging from Archaean to Quaternary. The oldest Archaean gneisses, variously designated as Amgaon Gneiss, Bengpal Gneiss, Tirodi Gneiss and Peninsular Gneiss are well exposed in different parts of the state. The Archaean gneissic complex is unconformably overlain by the metamorphosed volcano-sedimentary rocks of Sakoli Group and banded ferruginous quartzite, metapelites, quartzites of Archaean to Palaeoproterozoic age. The 3000 m thick unfossiliferous platform cover sediments exposed along Godavari valley is classified into Pakhal, Penganga and Sullavai groups. Basic and ultrabasic rocks exposed in Sindhudurg District are considered to be an extension of the Chitradurga Group of rocks of Karnataka and Goa. The Palaeoproterozoic acid volcanics and volcanoclastics of Nandgaon Group exposed in the easternmost Gondia and Gadchiroli districts, is intruded by Dongargarh Granite (2500 m.y). Khairagarh Group of rocks of Palaeo to Mesoproterozoic age, and comprising bimodal volcano-sedimentaries, unconformably overly the Dongargarh Granite. The rocks of Sausar Group occur in Nagpur and Bhandara districts and are exposed in a 75km wide and 210 km long belt extending into Madhya Pradesh.



1.3. THE STUDY AREA:

The study area belongs to the Archean granite gneiss complex, occupying eastern part of the Maharashtra. The geology and rock types of the area have been established mainly depends on the rocks encountered by drilling.

Based on the field and laboratory data, and the various boreholes drilled over the area of interest, the general stratigraphy has been interpreted to consist predominantly of Quartzo-feldspathic gneiss, quartz-biotite-gneiss and granite gneiss with thick overburden. The subsurface strata mainly consist of genetically related gneissic rocks. The gneissic rocks obtained throughout the investigations is brownish grey to dark grey colour and highly fractured at least upper 15m-20m depth from the surface. The gneissic rock was observed in different stages of weathering, ranges from complete to highly-weathered, followed by moderately weathered. The fracture planes in the gneisses are usually planar and stain, and majority are discolored due to weathering. Thick overburden consisting of medium to stiff

silty clay / clayey silt followed by very stiff to hard silty clay / clayey silt layer. After that dense to very dense silty sand with clay binder is observed. Then, weathered rock layer is struck and that continues upto the terminating depth of all the boreholes.

It is shown that the rocks encountered in the studied area are genetically related. The geology of the area is represented by the country rocks of gneiss and schist, which are one of the major rock types of the area. The gneissic complex of the area is characterised high grade metamorphism as a result rocks are highly foliated, fissile. During drilling most abundant rock encountered is quartzo-feldspathic gneiss represent by quartz-biotite gneiss and granite gneiss.

1.3.1. Encountered Rock Types:

Banded gneisses: One of the frequent rock types of the area is the banded gneiss (Quartz-feldspathic gneiss, Quartz-biotite gneiss). The alternate bands are rich in felsic components and mafic components. The bands rich in felsic minerals are greyish to grayish pink colored and the bands rich in mafic minerals are darker than the felsic bands. It is dominantly medium grained rock of subrounded grains. Grains are interlocked and compacted. The banded gneisses preferably split along or parallel to the low angle gneissosity of the rock (dip of the gneissosity is 20°-35°). The rock is moderately soft to hard and very weak to moderately strong with medium to slightly high specific gravity and has low porosity. The upper part of the rock is highly fractured as a result effect of weathering become prominent and the rock mostly disintegrated into rock fragments and or retain rounded pebbles and gravels as remnants. Depending on the weathering intensity the light grey to light pinkish body color of the rock has great effect and the color change to yellowish brown to greyish brown. It has been observed that the rock is very prone to weathering and decomposes into disintegrated rock particles all through the studied area. Such disintegrated weathered rock struck by drilling from very near the surface / from surface and continues at a depth of as high as about 30m from the ground level. In general three sets of fracture are observed of which the horizontal fracture are more dominant than the inclined and vertical fractures / joints. Throughout the depth of investigation rock quality is very poor to poor. Core recovery and RQD % are also low in most of the bore holes is due to presence of random, closely spaced fractured and variation of the grain sizes and prolonged weathering affects along the weak sheared plains and joints. Most of the joints / fractures are continuous. It is noted that the horizontal fractured surfaces are discontinuous, non-planar and rough. Whereas vertical to sub-vertical and inclined open fractured surfaces are mostly planar, relatively smooth to smooth and stain within the weathering depth. In general core recovery and RQD is also

very low at the upper reaches. The strength property of the rock reduced greatly with the depth.

Granite gneiss: Depending on the intensity of weathering the body color of the rock as a whole varies from brownish grey at the weathering end and light pinkish grey for the fresh variety of rock. The rock is dominantly medium to coarse grained with white spots of plagioclase. Grains are equigranular and are interlocked. With parallel arrangement of the mafic mineral, the rocks impart foliated gneissose structure and become extreme fissile in nature and easily weathered. In general the rock is hard, densely packed and moderately strong to strong across the foliation (at fresh end). Depending on weathering the rock becomes moderately compacted and the strength parameters reduced a great extent. Under the soil cover the gneiss is complete to highly weathered and the core recovery is low to very low. However, core recovery and RQD are both improved with depths. Due to distinct foliation plains, the rocks are easily split along such weak plains. The open surfaces are dominantly planar, smooth and altered to clean depending on intensity of weathering. Talc schist rarely found in few boreholes.

BH- 01

(00.00 – 09.00)m:

Overburden soil.

(09.00 – 30.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard to moderately soft and weak rock. Complete core loss occurred at (09.00-21.00)m, (25.50-28.50)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 02

(00.00 – 08.80)m:

Overburden soil.

(08.80 – 30.00)m:

Rock Description: Highly weathered, dark grey and light grey bands with yellowish alteration, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard and weak rock.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm with few 100-200mm pieces at places.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass

broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 03

(00.00 – 07.00)m:

Overburden soil.

(07.00 – 30.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patch and yellowish alteration, medium grains are loosely to moderately compacted and indistinctly foliated **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred at depths of 7.00-8.50 m and 12.25-16.00 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. **Description of Core:** Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 04

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 30.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patch and yellowish alteration, medium grains are loosely to moderately compacted and indistinctly foliated **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred throughout the depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (i. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. **Description of Core:** Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to

huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 05

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 25.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patch and yellowish alteration, medium grains are loosely to moderately compacted and indistinctly foliated **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred at (08.50-10.00)m, (16.0-18.25)m, (19.00-22.00)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 06

(00.00 – 08.60)m:

Overburden soil.

(08.60 – 30.10)m:

Rock Description: Completely to highly weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss**.

Rock Properties: Hard and moderately strong rock.

Complete core loss occurred at 8.60-16.85 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, rough and deeply altered. Foliation parallel fracture surfaces are apparently smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous

framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 07

(00.00 – 09.05)m:

Overburden soil.

(09.05 – 35.08)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium to coarse grains are moderately compacted and foliated (25°-35°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at 9.05-24.00 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 08

(00.00 – 09.00)m:

Overburden soil.

(09.00 – 30.13)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium to coarse grains are moderately compacted and foliated (20°-25°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at 9.00-18.75 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 09

(00.00 – 08.70)m:

Overburden soil.

(08.70 – 25.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard to moderately soft and weak to very weak rock.

Complete core loss occurred at (08.70-11.70)m, (17.70-19.20)m, (21.45-23.70)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 10

(00.00 – 12.00)m:

Overburden soil.

(12.00 – 30.08)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartz-biotite gneiss**, with extensive mica observed along the foliation surfaces.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred at 12.00-15.00 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 11

(00.00 – 10.30)m:

Overburden soil.

(10.30 – 35.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are loosely to moderately compacted and foliated (30°-35°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at 10.30-13.25 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 12

(00.00 – 07.00)m:

Overburden soil.

(07.00 – 30.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patch and yellowish alteration, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard to moderately soft and weak to very weak rock.

Complete core loss occurred at depths of 7.75-9.25 m, 10.75-12.25m and 18.25-21.25 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 13

(00.00 – 10.00)m:

Overburden soil.

(10.00 – 25.08)m:

Rock Description: Highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**, with pockets of highly weathered, pinkish grey, coarse grained, hard and moderately strong Granite gneiss observed at (10.00-11.50)m, (18.25-19.75)m depth.

Rock Properties: Moderately hard and weak rock.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 14

(00.00 – 08.00)m:

Overburden soil.

(08.00 – 25.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patches, medium grains are loosely to moderately compacted and indistinctly foliated **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred at (08.75-13.25)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (i. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 15

(00.00 – 06.50)m:

Overburden soil.

(06.50 – 25.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at (6.50-14.00)m, (14.75-15.50)m, (19.25-21.50) depths.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened

and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 16

(00.00 – 08.65)m:

Overburden soil.

(08.65 – 30.00)m:

(08.65 – 15.25)m:

Rock Description: Completely to highly weathered, light greenish grey, very fine grains are loosely compacted and indistinctly foliated **Talc schist.**

Rock Properties: Soft and very weak rock.

(15.25 – 30.00)m:

Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (30°-40°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at (10.15-13.75)m, (15.25-17.50), (18.25-24.25)m, (25.00-27.25)m, (28.00-30.00)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 17

(00.00 – 08.20)m:

Overburden soil.

(08.20 – 25.06)m:

Rock Description: Completely (upto 12.00m) followed by highly weathered, light grey with yellowish patches/ alteration, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard to moderately soft and weak to very weak rock.

Complete core loss occurred at depth of 8.20-12.00 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 18

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 25.05)m:

(08.50 – 15.25)m:

Rock Description: Highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (30°-40°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

(15.25 – 25.00)m:

Highly weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss**.

Rock Properties: Hard and moderately strong rock.

Complete core loss occurred at (10.75-13.75)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 19

(00.00 – 07.30)m:

Overburden soil.

(07.30 – 25.00)m:

Rock Description: Completely weathered, medium grained and brownish grey, disintegrated and decomposed rock particles, with remnants of highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (25°-30°)

Quartzo-feldspathic gneiss at (10.20-11.80)m, (23.80-25.00)m depth.

Rock Properties: Moderately hard and weak rock.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal fractures/ joints observed. Open fracture surfaces are non-planar, smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 20

(00.00 – 09.00)m:

Overburden soil.

(09.00 – 25.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (20°-30°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard to moderately soft and weak rock.

Complete core loss occurred at (11.25-12.75)m, (14.25-20.25)m, (21.75-22.50)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 21

(00.00 – 09.00)m:

Overburden soil.

(09.00 – 25.00)m:

Rock Description: Completely to highly weathered, brownish grey

with dark patches/ alteration, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard to moderately soft and weak to very weak rock.

Complete core loss occurred at depth of 9.75-17.25m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 22

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 30.24)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (30°-40°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at depths of (8.50-16.50) m and (16.75-20.50) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal fractures/ joints observed. Open fracture surfaces are non-planar, smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 23

(00.00 – 08.25)m:

Overburden soil.

(08.25 – 30.07)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with dark brown patches, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartz-biotite gneiss**, with extensive mica observed along the foliation surfaces.

Rock Properties: Moderately soft and very weak rock.

Complete core loss occurred at depths of (8.25-13.50) m and (15.75-17.25) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 24

(00.00 – 09.50)m:

Overburden soil.

(09.50 – 25.20)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (25°-35°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at depth of (10.25-13.25) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal fractures/ joints observed. Open fracture surfaces are non-planar, smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed

and removed by drill water during drilling operation.

BH- 25

(00.00 – 08.10)m:

Overburden soil.

(08.10 – 25.00)m:

Rock Description: Completely (up to 12.50m) to highly weathered, light grey with brown patch and pink shades, medium grains are loosely to moderately compacted and foliated (20°-30°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard to moderately soft and weak rock. Complete core loss occurred at (08.10-12.50) m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

BH- 26

(00.00 – 08.00)m:

Overburden soil.

(08.00 – 25.00)m:

(11.00 – 15.50)m:

Rock Description: Highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (30°-40°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard and weak rock.

(15.50 – 25.00)m:

Highly weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss**.

Rock Properties: Hard and moderately strong rock.

Complete core loss occurred at (8.00-11.00) m and (14.75-15.50)m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 01

(00.00 – 10.00)m:

Overburden soil.

(10.00 – 25.10)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (30°-40°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at (10.00-18.25) m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 02

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 35.00)m:

Rock Description: Completely to highly weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss**.

Rock Properties: Hard and moderately strong rock.

Complete core loss occurred at depths of (8.50-10.75) m, (11.50-13.00) m and (15.25-22.00) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered.

Description of Core: Recovered core occurs as discontinuous

framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 03

(00.00 – 06.30)m:

Overburden soil.

(06.30 – 25.33)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (30°-35°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at (6.30-17.55) m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 04

(00.00 – 08.30)m:

Overburden soil.

(08.30 – 25.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (30°-35°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at depths of (8.30-19.50) m and (20.25-21.00) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal fractures/ joints observed. Open fracture surfaces are non-planar, smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous

framework. Cores are mostly in lengths of 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 05

(00.00 – 08.50)m:

Overburden soil.

(08.50 – 35.40)m:

Rock Description: Completely to highly weathered (up to 32.50m) followed by moderately weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss**.

Rock Properties: Hard and moderately strong to strong rock.

Complete core loss occurred at (8.50-16.75) m and (21.25-23.50) m depth.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework (up to 32.50m) followed by continuous framework. Cores are mostly in lengths of <30 and 30-100mm, with rare 100-200mm pieces at 33.25-34.00m depth.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to moderately weathered and complete to modest amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 06

(00.00 – 08.25)m:

Overburden soil.

(08.25 – 35.10)m:

(08.25 – 28.50)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (30°-30°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at depth of (10.50-20.25) m.

(28.50 – 35.10)m:

Highly (up to 33.00m) to moderately weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss.**

Rock Properties: Hard and moderately strong to strong rock.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework (up to 33.00m) followed by continuous framework. Cores are mostly in lengths of <30 and 30-100mm, with rare 100-200mm pieces at 32.25-34.50m depth.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to moderately weathered and complete to modest amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 07

(00.00 – 08.70)m:

Overburden soil.

(08.70 – 30.45)m:

(08.70 – 19.20)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands, medium grains are loosely to moderately compacted and foliated (30°-30°) **Quartzo-feldspathic gneiss.**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at (8.70-10.20) m and (10.95-13.95) m depth.

(19.20 – 30.45)m:

Highly (up to 25.20m) to moderately weathered, pinkish grey, medium to coarse grains are densely compacted and indistinctly foliated **Granite gneiss.**

Rock Properties: Hard and moderately strong to strong rock.

Structural Condition: Very closely to closely spaced (>15 to 15-8 nos./m up to 29.70m), followed by medium spaced (8-5 nos/m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework (up to 25.20m) followed by continuous framework. Cores are mostly in lengths of <30 and 30-100mm, with few 100-200mm pieces at 25.20-30.45m depth.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to moderately weathered and complete to modest amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 08

(00.00 – 07.00)m:

Overburden soil.

(07.00 – 35.00)m:

Rock Description: Completely to highly weathered, dark grey and light grey bands with brownish patch, medium grains are moderately compacted and foliated (25°-35°) **Quartzo-feldspathic gneiss**

Rock Properties: Moderately hard and weak rock.

Complete core loss occurred at depth of (7.00-31.75) m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 1 set of fractures/ joints (foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and deeply altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

IBH- 09

(00.00 – 07.00)m:

Overburden soil.

(07.00 – 35.00)m:

Rock Description: Completely to highly weathered, brownish grey with dark patches/ alteration, medium grains are loosely to moderately compacted and foliated (25°-30°) **Quartzo-feldspathic gneiss**.

Rock Properties: Moderately hard to moderately soft and weak to very weak rock.

Complete core loss occurred at depths of 9.25-21.25 m and 25.75-27.25 m.

Structural Condition: Very closely spaced (>15 nos./m) fractures. Dominantly horizontal with 2 set of fractures/ joints (i. almost vertical, ii. foliation parallel). Open fracture surfaces are non-planar, smooth and deeply altered. Foliation parallel fracture surfaces are smooth and

altered. Vertical fracture surfaces are slightly rough and altered.

Description of Core: Recovered core occurs as discontinuous framework. Cores are mostly in lengths of <30 and 30-100mm.

Rock Mass Structure: The rock mass is of very poor quality.

Partial drill water loss has been noticed for the entire depth.

The formation rock is complete to highly weathered and complete to huge amount of the rock mass is disintegrated and removed. It is due to prolonged weathering, intensely fractured, loosely compacted and weak nature of the rock. Highly jointed and foliated nature facilitated weathering within the rock mass and subsequently the rock mass broken down into smaller pieces. Once the rock has been weakened and broken up by weathering, such loose rock mass is easily crushed and removed by drill water during drilling operation.

For C. E. Testing Company private Limited,

(S. Paramanik, Geologist)

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STP.**CETEST****Job No. : 4287****Sheet No.**

8. ELECTRICAL RESISTIVITY TEST

REPORT ON ELECTRICAL RESISTIVITY TEST (ERT) FGD PACKAGE AREA AT 2X500 MW NTPC MOUDA STPP STAGE-I, FGD PROJECT, MAHARASHTRA

INTRODUCTION:

Electrical Resistivity Test was carried out for the proposed 2x500 MW at FGD package area at NTPC Mouda STPP Stage-I, Maharashtra on 26.03.2019 & 27.03.2019 using resistivity meter (model DDR2, Gensensors) and following Indian standard Code: IS- 3043 at seven (7) locations.

METHODOLOGY:

The Soil Resistivity Survey is a method to find out the Electrical Resistivity (Specific Resistance) of a medium. It is the resistance offered by a unit cube of a particular medium (so called strata below the ground level) when a unit current passes perpendicular to the surface of a cross-sectional area A. The relation is given by Ohm's Law is –

$$\rho = R \times \frac{A}{L} \quad \text{ohm} \times \frac{\text{m}^2}{\text{m}} = \text{ohm} - \text{m} \text{ where}$$

ρ = Resistivity, R = resistance offered by the medium of length L and Cross-sectional area A.

In electrical resistivity survey a known current I (direct current or low frequency alternating current) is sent into the ground through a pair of current electrodes A & B and the potential difference (ΔV) created in the medium is measured between another pair of electrodes M & N. The resistivity of the formation is then given.....

$$\rho = K \frac{\Delta V}{I}$$

by $\rho = K \frac{\Delta V}{I}$ where ρ is the apparent resistivity, K is the geometric factor.

I

In the Earth Resistivity Test, the Wenner configuration was followed. In this configuration two potential electrodes M & N are placed in a line with the current electrodes A & B, all four

being situated equidistance from one to another and disposed symmetrically with respect to a central point such that $AM=MN=NB=s$. The outer two electrodes A & B were used for sending current (I) and inner two M & N were used for measuring the potential differences (ΔV). The distance between each consecutive electrode (s) was kept constant and was progressively increased to reach the depth at which resistivity information are wanted. Suitable electrode spacing determines the conductivity of the top soil as well as the various subsurface layers occurring in the area under study. At each location, with respect to centre point, measurements were carried out in four mutually perpendicular direction namely N-S, E-W, NE-SW and NW-SE and in each direction eight different electrode spacing viz.: $s = 0.50\text{m}, 1.0\text{m}, 2.0\text{m}, 3.0\text{m}, 4.0\text{m}, 5.0\text{m}, 8.0\text{m}$ and 10.0m were used to know the nature of change of resistivity.

The apparent resistivity was determined by the formula –

$$\rho = 6.28 s \frac{\Delta V}{I} \text{ where 's' is the distance between the two consecutive}$$

Electrodes and $\frac{\Delta V}{I}$ is R which is the observed resistance for measuring resistivity.

The mean value of the resistivity estimated was taken as the representative one.

The depth of investigation in an isotropic and homogeneous formation can be approximated to the distance between the consecutive two electrodes (s).

It may be indicated here that in case of highly resistive formations, current penetrates much deeper into the earth than when the subsurface formations are conducting. Further, in the present investigation only apparent resistivity is measured which may be taken (as a first approximation) as the weighted average of the true resistivity of the subsurface formations in which current lines flow.

GEOLOGY:

Two type of semi consolidated formations i.e. Lameta and Gondwana occur in the district. They along with the unconsolidated Alluvial formation form the soft rock aquifers occurring in the district.

- (i) Lameta beds – Lameta beds, found to the north of the district in a small patch are compact, clayey and poor in permeability.

- (ii) Gondwana Sediments – Gondwana formation, occupying a total area of about 470 sq.km, occurs in the northern part of the Nagpur city extending from Kamptee to Saoner, and an isolated patch also occurs near of Sathnaori. Among the Gondwanas, the Barakars and Kamthis generally consist of medium to coarse-grained friable sandstone.

APPARENT RESISTIVITY VALUES**ERT No. 01**

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	98.627	98.470	98.627	98.470	98.549
2	1.0	34.242	34.556	34.870	34.556	34.556
3	2.0	18.408	18.409	18.534	18.346	18.424
4	3.0	18.660	18.754	18.566	18.660	18.660
5	4.0	14.827	14.953	15.455	15.079	15.079
6	5.0	12.408	13.037	12.251	12.723	12.605
7	8.0	14.074	14.576	15.079	14.576	14.576
8	10.0	12.251	12.565	12.880	12.566	12.566

Mean Resistivity at ERT-01 is 28.127 Ohm - m.

ERT No. 02

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	13.694	13.694	13.663	13.694	13.686
2	1.0	13.634	13.602	13.571	13.727	13.634
3	2.0	8.670	8.921	8.733	8.796	8.780
4	3.0	7.256	7.351	7.445	7.633	7.421
5	4.0	7.539	7.162	7.790	7.413	7.476
6	5.0	8.324	8.482	8.796	8.796	8.600
7	8.0	11.058	11.309	11.309	11.309	11.246
8	10.0	10.995	10.681	10.366	11.309	10.838

Mean Resistivity at ERT-02 is 10.210 Ohm - m.

ERT No. 03

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	10.223	10.239	10.208	10.192	10.216
2	1.0	4.303	4.335	4.366	4.366	4.343
3	2.0	6.659	6.785	6.848	6.785	6.769
4	3.0	7.727	7.728	7.633	7.633	7.680
5	4.0	8.419	8.418	8.293	8.418	8.387
6	5.0	7.853	7.696	8.167	8.324	8.010
7	8.0	9.550	10.053	9.801	10.053	9.864
8	10.0	9.738	10.366	10.681	11.623	10.602

Mean Resistivity at ERT-03 is 8.234 Ohm - m.

ERT No. 04

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	7.710	7.695	7.695	7.695	7.699
2	1.0	13.382	13.602	13.508	13.508	13.500
3	2.0	6.345	6.696	6.785	6.596	6.606
4	3.0	6.220	6.408	6.691	6.219	6.385
5	4.0	6.534	6.659	6.534	6.785	6.628
6	5.0	7.068	7.225	7.696	7.696	7.421
7	8.0	9.047	9.047	9.801	9.550	9.361
8	10.0	8.167	7.853	9.110	7.539	8.167

Mean Resistivity at ERT-04 is 8.221 Ohm - m.

ERT No. 05

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	7.867	7.852	7.867	7.836	7.856
2	1.0	8.733	8.796	8.796	8.796	8.780
3	2.0	6.659	3.423	6.785	6.785	5.913
4	3.0	7.727	7.539	7.539	7.727	7.633
5	4.0	8.418	8.544	8.795	8.167	8.481
6	5.0	9.267	9.895	9.895	9.581	9.660
7	8.0	8.796	9.801	10.806	11.309	10.178
8	10.0	8.167	9.424	10.366	9.738	9.424

Mean Resistivity at ERT-05 is 8.49 Ohm - m.

ERT No. 06

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	20.636	20.635	20.683	20.667	20.655
2	1.0	13.728	13.633	13.885	13.885	13.783
3	2.0	7.539	7.727	7.727	7.664	7.664
4	3.0	5.560	5.843	5.560	5.748	5.678
5	4.0	6.910	7.664	7.036	7.288	7.225
6	5.0	6.597	6.911	6.911	7.225	6.911
7	8.0	8.545	9.550	9.298	10.053	9.362
8	10.0	7.853	9.110	8.168	8.481	8.403

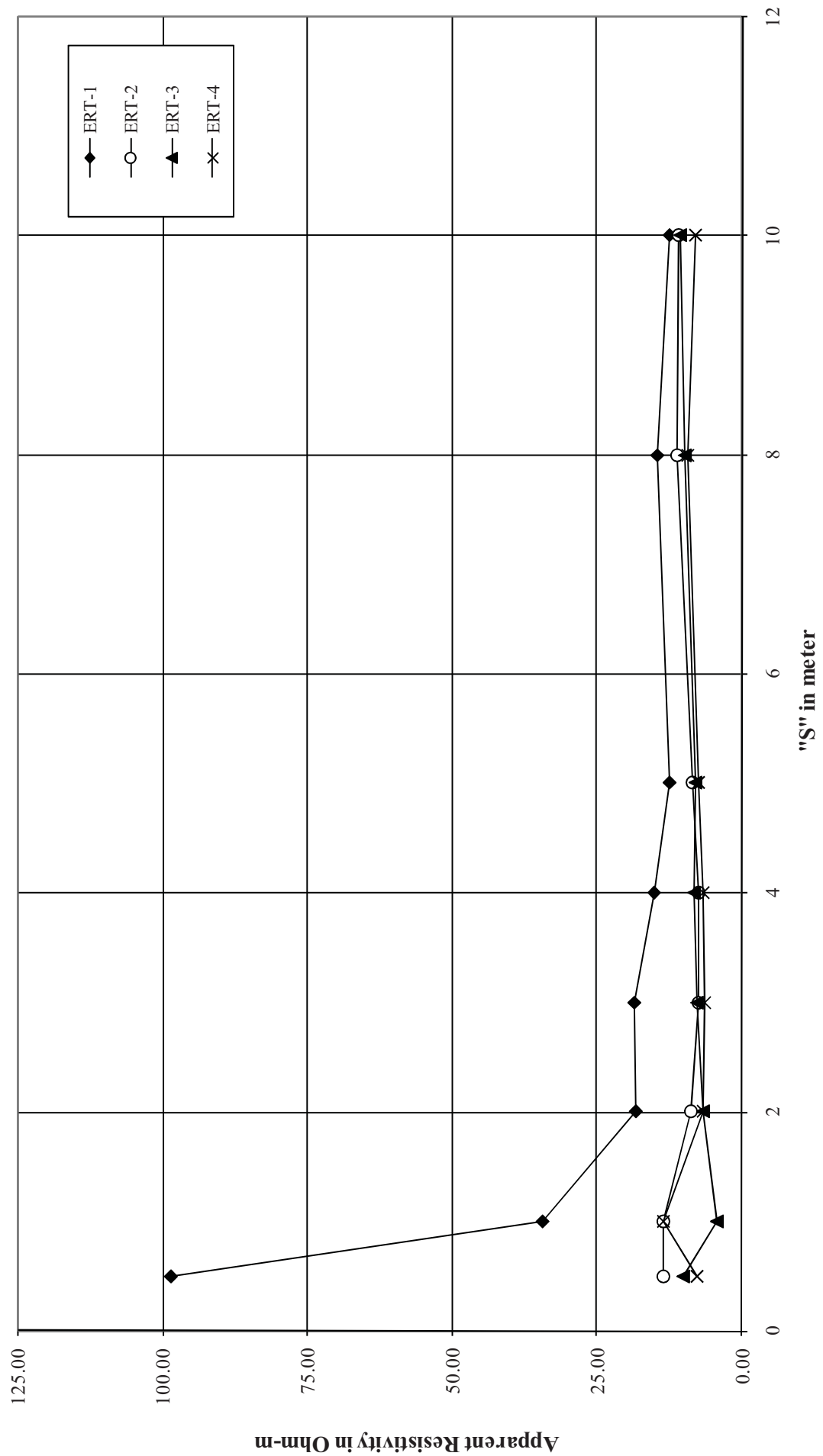
Mean Resistivity at ERT-06 is 9.96 Ohm - m.

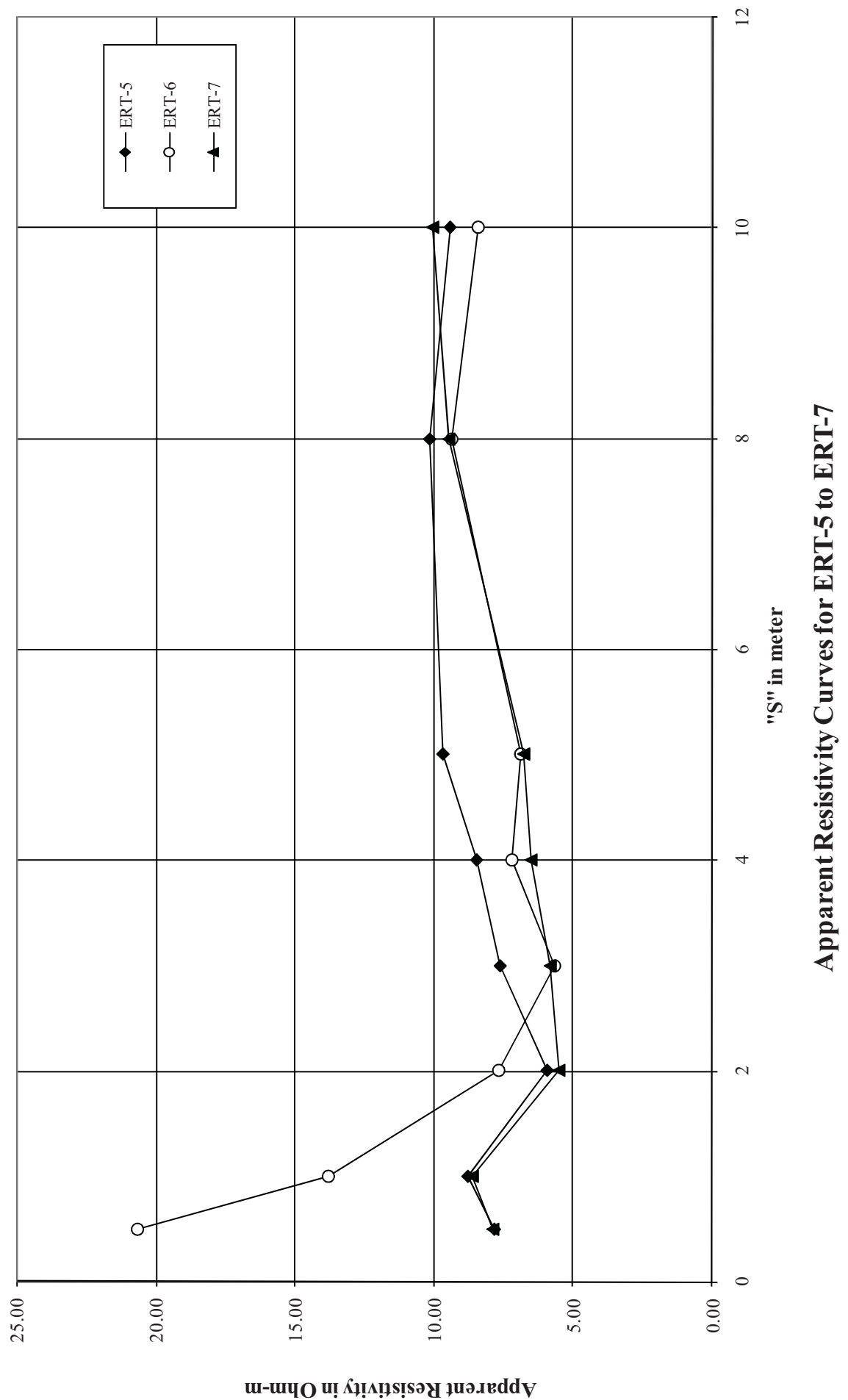
ERT No. 07

SI No.	S (M)	Apparent Electrical Resistivity (Ohm-m)				Mean
		(N - S)	(E - W)	(NE - SW)	(NW - SE)	
1	0.5	7.852	7.867	7.867	7.899	7.871
2	1.0	8.842	8.575	8.575	8.575	8.642
3	2.0	5.403	5.529	5.340	5.717	5.497
4	3.0	5.842	6.031	5.843	5.654	5.843
5	4.0	6.283	6.659	6.659	6.408	6.502
6	5.0	6.440	7.068	6.911	6.754	6.793
7	8.0	9.047	9.298	9.550	10.053	9.487
8	10.0	9.424	10.052	10.052	10.680	10.052

Mean Resistivity at ERT-07 is 7.586 Ohm - m.

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STP.**CETEST****Job No. : 4287****Sheet No.****APPARENT RESISTIVITY CURVES**





APPENDICES**SUBJECT****SHEET NUMBER****PART I: ALL FIELD TESTS RESULTS**

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 Penetration Tests
 Field Density Test Results
 Field Permeability Test Results

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 Swelling Test Results
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Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP**Job No. : 4287****Sheet No.****PART I: ALL FIELD TESTS RESULTS**

BORE LOG DATA SHEET

BORE HOLE NO.BH-1

Co-ordinates E=5947.000
N=5743.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/04/2019
Penetrometer (SPT)	33	Undisturbed (UDS)	3	Completion Date : 29/04/2019
Cone (Pc)		Penetrometer (SPT)	33	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	21	Level Of Ground : 271.187 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.58 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
Top layer consist of RCC.									
0.00m 0.30m								DS-1	0.50
Very stiff, reddish brown, silty clay with moorum.		1	1	2	4	16	5	SPT-1	1.00-1.45
1.50m								UDS-1	2.10-2.55
Stiff, yellowish grey, silty clay with sand mixture.		2	2	3	3	13	4	SPT-2	3.05-3.50
4.00m								UDS-2	4.15-4.60
Hard, brownish grey, silty clay with traces of kankars.		4	9	9	10	45	14	SPT-3	5.00-5.45
								*UDS-3	6.10-6.18
		5	10	11	11	46	12	SPT-4	6.70-7.15
7.50m								SPT-5	7.70-7.90
Very dense, light pinkish grey, silty sand with decomposed rock fragments.		18	34	48		>100			
						5.0 cm Pentn.		SPT-6	8.70-8.76
9.00m		100				Refusal			
Completely weathered, dark grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100				6.0 cm Pentn.		*SPT-7	9.00-9.03
						3.0 cm Pentn.		R1	CR=NIL
						Refusal		DS-2	RQD=NIL
		100				2.0 cm Pentn.		*SPT-8	9.75-9.77
						NX. drilling from 9.00m to 30.00m		R2	CR=NIL
10.50m									9.75

BORE LOG DATA SHEET

BORE HOLE NO.BH-1

Co-ordinates E=5947.000
N=5743.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/04/2019
Penetrometer (SPT)	33	Undisturbed (UDS)	3	Completion Date : 29/04/2019
Cone (Pc)		Penetrometer (SPT)	33	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	21	Level Of Ground : 271.187 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.58 m.

DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH	DIVN=7.5CM		Ref. No	Depth (m)
10.50m Completely weathered, dark grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss. 21.00m		100	Refusal		*SPT-9	10.50-10.53
		3.0	cm Pentn.		R3 DS-4	CR=NIL RQD=NIL
		100	Refusal		*SPT-10	11.25-11.28
		3.0	cm Pentn.		R4 DS-5	CR=NIL RQD=NIL
		100	Refusal		*SPT-11	12.00-12.03
		3.0	cm Pentn.		R5 DS-6	CR=NIL RQD=NIL
		100	Refusal		*SPT-12	12.75-12.77
		2.0	cm Pentn.		R6 DS-7	CR=NIL RQD=NIL
		100	Refusal		*SPT-13	13.50-13.54
		4.0	cm Pentn.		R7 DS-8	CR=NIL RQD=NIL
		100	Refusal		*SPT-14	14.25-14.28
		3.0	cm Pentn.		R8 DS-9	CR=NIL RQD=NIL
		100	Refusal		*SPT-15	15.00-15.02
		2.0	cm Pentn.		R9 DS-10	CR=NIL RQD=NIL
		100	Refusal		*SPT-16	15.75-15.77
		2.0	cm Pentn.		R10 DS-11	CR=NIL RQD=NIL
		100	Refusal		*SPT-17	16.50-16.52
		2.0	cm Pentn.		R11 DS-12	CR=NIL RQD=NIL
		100	Refusal		*SPT-18	17.25-17.28
		3.0	cm Pentn.		R12 DS-13	CR=NIL RQD=NIL
		100	Refusal		*SPT-19	18.00-18.04
		4.0	cm Pentn.		R13 DS-14	CR=NIL RQD=NIL
		100	Refusal		*SPT-20	18.75-18.77
		2.0	cm Pentn.		R14 DS-15	CR=NIL RQD=NIL
		100	Refusal		*SPT-21	19.50-19.52
		2.0	cm Pentn.		R15 DS-16	CR=NIL RQD=NIL
		100	Refusal		*SPT-22	20.25-20.27
		2.0	cm Pentn.		R16 DS-17	CR=NIL RQD=NIL
						21.00

BORE LOG DATA SHEET

BORE HOLE NO.BH-1

Co-ordinates E=5947.000
N=5743.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/04/2019
Penetrometer (SPT)	33	Undisturbed (UDS)	3	Completion Date : 29/04/2019
Cone (Pc)		Penetrometer (SPT)	33	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	21	Level Of Ground : 271.187 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.58 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES			
		EACH DIVN=7.5CM				Ref. No	Depth (m)		
21.00m Completely weathered, dark grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100	Refusal			*SPT-23	21.00-21.03		
		3.0	cm Pentn.			R17	CR=12% RQD=NIL		
		100	Refusal			*SPT-24	21.75-21.78		21.75
		3.0	cm Pentn.			R18	CR=12% RQD=NIL		
		100	Refusal			*SPT-25	22.50-22.52		22.50
		2.0	cm Pentn.			R19	CR=16% RQD=NIL		
Completely weathered, reddish brown, fine grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal			*SPT-26	23.25-23.29	23.25	
		4.0	cm Pentn.			R20	CR=14% RQD=NIL		
		100	Refusal			*SPT-27	24.00-24.02	24.00	
		2.0	cm Pentn.			R21	CR=18% RQD=NIL		
		100	Refusal			*SPT-28	24.75-24.77	24.75	
		2.0	cm Pentn.			R22	CR=18% RQD=NIL		
25.50m Completely weathered, dark grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100	Refusal			*SPT-29	25.50-25.53	25.50	
		3.0	cm Pentn.			R23	CR=NIL RQD=NIL		
		100	Refusal			DS-18 *SPT-30	26.25-26.28	26.25	
		3.0	cm Pentn.			R24	CR=NIL RQD=NIL		
		100	Refusal			DS-19 *SPT-31	27.00-27.03	27.00	
		3.0	cm Pentn.			R25	CR=NIL RQD=NIL		
28.50m Highly weathered, reddish brown, fine grained, fractured Quartzo-feldspathic-gneiss.		100	Refusal			DS-20 *SPT-32	27.75-27.79	27.75	
		4.0	cm Pentn.			R26	CR=NIL RQD=NIL		
		100	Refusal			DS-21 *SPT-33	28.50-28.52	28.50	
		2.0	cm Pentn.			R27	CR=34% RQD=NIL		
							29.25		
						R28	CR=38% RQD=NIL		
30.00m						30.00			
N.B. - '*' means sample could not be recovered.									

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-2

Co-ordinates E=5947.000
N=5625.000

Field Test	Nos	Samples	Nos	Commencement Date : 27/04/2019
Penetrometer (SPT)	7	Undisturbed (UDS)	3	Completion Date : 02/05/2019
Cone (Pc)		Penetrometer (SPT)	7	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	1	Level Of Ground : 271.156 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 1.55 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m Top layer consist of RCC.									
0.40m Medium, reddish brown to grey, silty clay with moorum & sand mixture.		1	1	1	2	$\frac{6}{1}$	2	DS-1	0.60
1.50m								SPT-1	0.80-1.25
1.50m Hard, reddish brown, silty clay with kankars, moorum & traces of calcareous nodules.								WS-1	1.55
3.50m								*UDS-1	2.25-2.35
3.50m		5	14	8	8	$\frac{47}{15}$	16	SPT-2	2.80-3.25
5.50m Very stiff, brownish grey, silty clay with traces of sand mixture.								UDS-2	4.00-4.45
5.50m		3	3	4	5	$\frac{19}{5}$	5	SPT-3	4.80-5.25
8.80m Very desne, light pinkish grey, silty sand with decomposed rock fragments.						≥ 100		*UDS-3	6.10-6.18
8.80m		12	28	37	23	1.5 cm Pentn.		SPT-4	6.70-6.94
10.50m Highly weathered, yellowish grey, medium grained, fractured Quartzo-feldspathic-gneiss.						≥ 100		SPT-5	7.80-8.00
10.50m		20	28	52		5.0 cm Pentn.		*SPT-6	8.70-8.74
		100				Refusal		*SPT-7	8.80-8.83
		100				4.0 cm Pentn.		R1	CR=32% RQD=NIL
						3.0 cm Pentn.		R2	CR=21% RQD=NIL
						NX. drilling from 8.80m to 30.00m			8.80 ↓ 9.50 ↓ 10.25

BORE LOG DATA SHEET

BORE HOLE NO.BH-2

Co-ordinates E=5947.000
N=5625.000

Field Test	Nos	Samples	Nos	Commencement Date : 27/04/2019
Penetrometer (SPT)	7	Undisturbed (UDS)	3	Completion Date : 02/05/2019
Cone (Pc)		Penetrometer (SPT)	7	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	1	Level Of Ground : 271.156 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 1.55 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
Highly to moderately weathered, greenish grey, to brownish grey, medium grained, moderately fractured Quartzo-feldspathic-gneiss								R17	CR=40% RQD=NIL
								R18	CR=44% RQD=NIL
								R19	CR=54% RQD=NIL
								R20	CR=45% RQD=NIL
Moderately to highly weathered, light yellowish brown to greenish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.								R21	CR=37% RQD=NIL
								R22	CR=36% RQD=14%
								R23	CR=32% RQD=NIL
								R24	CR=32% RQD=NIL
Highly weathered, light yellowish brown, fine to medium grained, moderately fractured Quartzo-feldspathic-gneiss.								R25	CR=36% RQD=14%
								R26	CR=30% RQD=14%
								R27	CR=40% RQD=NIL
Highly weathered, light pinkish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.								R28	CR=40% RQD=14%

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-3

Co-ordinates E=5998.000
N=5670.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/04/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	3	Completion Date : 20/04/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	8	Level Of Ground : 271.500 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, light grey to deep grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	2	$\frac{7}{2}$	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	3	3	4	$\frac{14}{3}$	4	SPT-2	3.00-3.45
5.00m									
								UDS-2	4.00-4.45
		7	11	13	14	$\frac{57}{15}$	15	SPT-3	5.00-5.45
								*UDS-3	6.00-6.10
7.00m								SPT-4	6.10-6.55
		11	16	18	20	$\frac{90}{24}$	28		
		100	3.0	cm	Pentn.	Refusal		*SPT-5	6.90-6.93
		100	Refusal					*SPT-6	7.00-7.02 7.00
Completely weathered, brownish grey to yellowish brown, medium to fine grained, completely decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.								R1	CR=NIL RQD=NIL
								DS-2	
								*SPT-7	7.75-7.78 7.75
								R2	CR=NIL RQD=NIL
								DS-3	
								*SPT-8	8.50-8.52 8.50
								R3	CR=11% RQD=NIL
								*SPT-9	9.25-9.28 9.25
								R4	CR=13% RQD=NIL
								*SPT-10	10.00-10.03 10.00
10.50m								R5	CR=09% RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-3

Co-ordinates E=5998.000
N=5670.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/04/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	3	Completion Date : 20/04/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	8	Level Of Ground : 271.500 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
10.50m		Refusal					
		2.0 cm Pentn.				*SPT-11	10.75-10.77 10.75
						R6	CR=12% RQD=NIL
		Refusal				*SPT-12	11.50-11.52 11.50
		2.0 cm Pentn.				R7	CR=10% RQD=NIL
		Refusal				*SPT-13	12.25-12.27 12.25
		2.0 cm Pentn.				R8	CR=NIL RQD=NIL
		Refusal				DS-4	
		3.0 cm Pentn.				*SPT-14	13.00-13.03 13.00
		Refusal				R9	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-5	
		Refusal				SPT-15	13.75-13.77 13.75
		2.0 cm Pentn.				R10	CR=NIL RQD=NIL
		Refusal				DS-6	
		2.0 cm Pentn.				*SPT-16	14.50-14.52 14.50
		Refusal				R11	CR=NIL RQD=NIL
		3.0 cm Pentn.				DS-7	
		Refusal				*SPT-17	15.25-15.28 15.25
		2.0 cm Pentn.				R12	CR=NIL RQD=NIL
		Refusal				DS-8	
		2.0 cm Pentn.				*SPT-18	16.00-16.02 16.00
		Refusal				R13	CR=19% RQD=NIL
		3.0 cm Pentn.				*SPT-19	16.75-16.78 16.75
		Refusal				R14	CR=13% RQD=NIL
		2.0 cm Pentn.				*SPT-20	17.50-17.52 17.50
		Refusal				R15	CR=10% RQD=NIL
		3.0 cm Pentn.				*SPT-21	18.25-18.28 18.25
		Refusal				R16	CR=08% RQD=NIL
19.00m		1.0 cm Pentn.				*SPT-22	19.00-19.01 19.00
		Refusal				R17	CR=21% RQD=NIL
							19.75
						R18	CR=22% RQD=NIL
							20.50
21.00m						R19	CR=28% RQD=NIL

Completely weathered, brownish grey to yellowish brown, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.

Highly weathered, yellowish brown, medium to fine grained, fractured Quartzo-feldspathic-gneiss.

BORE LOG DATA SHEET

BORE HOLE NO.BH-3

Co-ordinates E=5998.000
N=5670.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/04/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	3	Completion Date : 20/04/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	8	Level Of Ground : 271.500 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
21.00m Highly weathered, yellowish brown, medium to fine grained, fractured Quartzo-feldspathic-gneiss.								R20	21.25 CR=21% RQD=NIL
								R21	22.00 CR=25% RQD=NIL
22.75m								R22	22.75 CR=36% RQD=NIL
								R23	23.50 CR=39% RQD=12%
								R24	24.25 CR=35% RQD=NIL
								R25	25.00 CR=32% RQD=NIL
								R26	25.75 CR=33% RQD=NIL
Highly weathered, yellowish brown, medium to fine grained, fractured Quartzo-feldspathic-gneiss.								R27	26.50 CR=38% RQD=12%
								R28	27.25 CR=40% RQD=12%
								R29	28.00 CR=36% RQD=14%
								R30	28.75 CR=32% RQD=NIL
								R31	29.50 CR=28% RQD=NIL
30.00m									30.00
N.B. - '*' means sample could not be recovered.									

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B **CETEST**

Job No : 4287 Created by : T.SAHA Created on : 06/05/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-4

Co-ordinates E=6026.000
N=5695.000

Field Test	Nos	Samples	Nos	Commencement Date : 23/04/2019
Penetrometer (SPT)	37	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	37	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	24	Level Of Ground : 271.396 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, deep grey to light grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	6	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	3	3	3	14	4	SPT-2	3.00-3.45
4.90m									
		6	10	12	12	49	14	SPT-3	5.00-5.45
		5	9	12	16	59	15	*UDS-3	6.00-6.08
		4	7	9	9	38	10	SPT-4	6.08-6.53
8.50m									
		12	16	52		>100		SPT-5	7.00-7.45
		100	5.0	cm	Pentn.			SPT-6	8.00-8.20
		100	3.0	cm	Refusal			*SPT-7	8.40-8.43
10.50m									
		100	2.0	cm	Pentn.			*SPT-8	8.50-8.52 8.50
								R1	CR=NIL
		100	3.0	cm	Pentn.			DS-2	RQD=NIL
		100	3.0	cm	Pentn.			*SPT-9	9.25-9.28 9.25
								R2	CR=NIL
		100	2.0	cm	Pentn.			DS-3	RQD=NIL
								*SPT-10	10.00-10.02 10.00
								R3	CR=NIL
									RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-4

Co-ordinates E=6026.000
N=5695.000

Field Test	Nos	Samples	Nos	Commencement Date : 23/04/2019
Penetrometer (SPT)	37	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	37	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	24	Level Of Ground : 271.396 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
10.50m  Completely weathered, brownish grey to yellowish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.						Refusal	DS-4 *SPT-11 10.75-10.77 10.75
					2.0 cm Pentn.	R4	CR=19% RQD=NIL
						Refusal	*SPT-12 11.50-11.52 11.50
					2.0 cm Pentn.	R5	CR=17% RQD=NIL
						Refusal	*SPT-13 12.25-12.27 12.25
					2.0 cm Pentn.	R6	CR=NIL RQD=NIL
						Refusal	DS-5 *SPT-14 13.00-13.03 13.00
					3.0 cm Pentn.	R7	CR=NIL RQD=NIL
						Refusal	DS-6 *SPT-15 13.75-13.78 13.75
					3.0 cm Pentn.	R8	CR=NIL RQD=NIL
						Refusal	DS-7 *SPT-16 14.50-14.54 14.50
					4.0 cm Pentn.	R9	CR=NIL RQD=NIL
						Refusal	DS-8 *SPT-17 15.25-15.27 15.25
					2.0 cm Pentn.	R10	CR=NIL RQD=NIL
						Refusal	DS-9 *SPT-18 16.00-16.02 16.00
					2.0 cm Pentn.	R11	CR=NIL RQD=NIL
						Refusal	DS-10 *SPT-19 16.75-16.77 16.75
					2.0 cm Pentn.	R12	CR=NIL RQD=NIL
						Refusal	DS-11 *SPT-20 17.50-17.53 17.50
					3.0 cm Pentn.	R13	CR=NIL RQD=NIL
						Refusal	DS-12 *SPT-21 18.25-18.28 18.25
					3.0 cm Pentn.	R14	CR=NIL RQD=NIL
						Refusal	DS-13 *SPT-22 19.00-19.02 19.00
					2.0 cm Pentn.	R15	CR=NIL RQD=NIL
						Refusal	DS-14 *SPT-23 19.75-19.77 19.75
					2.0 cm Pentn.	R16	CR=NIL RQD=NIL
						Refusal	DS-15 *SPT-24 20.50-20.52 20.50
					2.0 cm Pentn.	R17	CR=NIL RQD=NIL
21.00m							

BORE LOG DATA SHEET

BORE HOLE NO.BH-4

Co-ordinates E=6026.000
N=5695.000

Field Test	Nos	Samples	Nos	Commencement Date : 23/04/2019
Penetrometer (SPT)	37	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	37	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	24	Level Of Ground : 271.396 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
21.00m Completely weathered, brownish grey to yellowish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		Refusal				DS-16	21.25-21.27 21.25
		2.0 cm Pentn.				*SPT-25	
		Refusal				R18	CR=19% RQD=NIL
		2.0 cm Pentn.				*SPT-26	22.00-22.02 22.00
		Refusal				R19	CR=18% RQD=NIL
		2.0 cm Pentn.				*SPT-27	22.75-22.77 22.75
		Refusal				R20	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-17	23.50-23.52 23.50
		Refusal				*SPT-28	
		2.0 cm Pentn.				R21	CR=NIL RQD=NIL
23.50m Completely weathered, pinkish grey to light grey, medium to fine grained decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		Refusal				DS-18	24.25-24.27 24.25
		2.0 cm Pentn.				*SPT-29	
		Refusal				R22	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-19	25.00-25.03 25.00
		Refusal				*SPT-30	
		3.0 cm Pentn.				R23	CR=NIL RQD=NIL
		Refusal				DS-20	25.75-25.77 25.75
		2.0 cm Pentn.				*SPT-31	
		Refusal				R24	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-21	26.50-26.52 26.50
		Refusal				*SPT-32	
		2.0 cm Pentn.				R25	CR=14% RQD=NIL
		Refusal				*SPT-33	27.25-27.27 27.25
		2.0 cm Pentn.				R26	CR=NIL RQD=NIL
		Refusal				DS-22	28.00-28.02 28.00
		2.0 cm Pentn.				*SPT-34	
		Refusal				R27	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-23	28.75-28.77 28.75
		Refusal				*SPT-35	
		2.0 cm Pentn.				R28	CR=12% RQD=NIL
		Refusal				*SPT-36	29.50-29.53 29.50
		3.0 cm Pentn.				R29	CR=NIL RQD=NIL
		Refusal				DS-24	30.00-30.02 30.00
		2.0 cm Pentn.				*SPT-37	

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-5

Co-ordinates E=6054.000 N=5670.000

Field Test	Nos	Samples	Nos	Commencement Date : 25/04/2019
Penetrometer (SPT)	21	Undisturbed (UDS)	3	Completion Date : 27/04/2019
Cone (Pc)		Penetrometer (SPT)	21	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	10	Level Of Ground : 271.064 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, light grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	6	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
4.00m									
		2	2	3	3	13	4	SPT-2	3.00-3.45
								*UDS-2	4.00-4.08
Hard, yellowish grey to greenish light grey, clayey silt / silty clay with decomposed & disintegrated rock fragments. Obs. kankar, sand mixture, mica & calcareous nodules.		4	9	9	12	44	12	SPT-3	4.08-4.53
		5	6	8	8	42	15	SPT-4	5.00-5.45
6.09m									
		5	5	9	10	42	13	*UDS-3	6.00-6.09
								SPT-5	6.09-6.54
Dense to very dense, light grey, silty sand with dark grey fragments.		6	8	8	10	40	11	SPT-6	7.00-7.45
		18	28	54		>100		SPT-7	8.00-8.20
8.50m									
								*SPT-8	8.40-8.44

BORE LOG DATA SHEET

BORE HOLE NO.BH-5

Co-ordinates E=6054.000 N=5670.000

Field Test	Nos	Samples	Nos	Commencement Date : 25/04/2019
Penetrometer (SPT)	21	Undisturbed (UDS)	3	Completion Date : 27/04/2019
Cone (Pc)		Penetrometer (SPT)	21	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	10	Level Of Ground : 271.064 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.70 m.

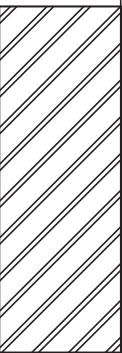
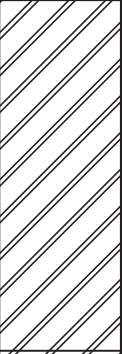
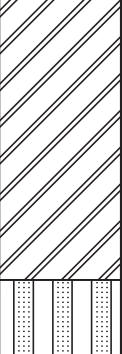
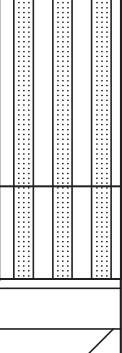
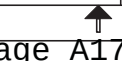
DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH DIVN=7.5CM			Ref. No	Depth (m)
Completely weathered, light grey to greenish brown, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.	8.50m	100	Refusal		*SPT-9	8.50-8.53 8.50
			3.0 cm Pentn.		R1	CR=NIL RQD=NIL
		100	Refusal		DS-2	
			3.0 cm Pentn.		*SPT-10	9.25-9.28 9.25
			Refusal		R2	CR=NIL RQD=NIL
		100	Refusal		DS-3	
			4.0 cm Pentn.		*SPT-11	10.00-10.04 10.00
			Refusal		R3	CR=19% RQD=NIL
		100	Refusal		*SPT-12	10.75-10.77 10.75
			2.0 cm Pentn.		R4	CR=14% RQD=NIL
Highly weathered, greenish brown to greyish brown, medium to fine grained, fractured Quartzo-feldspathic-gneiss.	11.50m	100	Refusal		*SPT-13	11.50-11.52 11.50
			2.0 cm Pentn.		R5	CR=22% RQD=NIL
			NX. drilling from 8.50m to 25.00m			
					R6	CR=25% RQD=NIL
						12.25
					R7	CR=27% RQD=NIL
						13.00
					R8	CR=28% RQD=NIL
						13.75
					R9	CR=21% RQD=NIL
Completely weathered, light grey to pinkish brown, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.	16.00m					14.50
					R10	CR=24% RQD=NIL
						15.25
					R11	CR=NIL RQD=NIL
	17.00m	100	Refusal		DS-4	
			3.0 cm Pentn.		*SPT-14	16.75-16.78 16.75

BORE LOG DATA SHEET

BORE HOLE NO.BH-6

Co-ordinates E=6090.000 N=5588.000

Field Test	Nos	Samples	Nos	Commencement Date : 02/04/2019
Penetrometer (SPT)	23	Undisturbed (UDS)	2	Completion Date : 05/04/2019
Cone (Pc)		Penetrometer (SPT)	23	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	11	Level Of Ground : 270.996 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m Medium / stiff, deep grey, silty clay. Obs. kankars.		1	1	1	2	8	3	DS-1	0.50
						2		SPT-1	1.00-1.45
								WS-1	1.50
2.00m								UDS-1	2.00-2.45
Very stiff to hard, brownish grey, silty clay with moorum & gravel. Obs. kankars.		2	3	4	5	21	7	SPT-2	3.00-3.45
						48		*UDS-2	4.00-4.10
4.50m		7	8	8	11	19	10	SPT-3	4.10-4.55
Hard, brownish grey, clayey silt with kankars & gravel.		4	5	8	7	38	14	SPT-4	5.10-5.55
						48		SPT-5	6.10-6.55
6.10m		5	5	9	12	13	14		
Dense to very dense, brownish grey, silty sand with decomposed rock fragments.		7	8	12	13	61	21	SPT-6	7.10-7.55
						>100		SPT-7	8.10-8.36
8.00m		16	29	35	65	3.5 cm	Pentr.	*SPT-8	8.50-8.54
Very dense, greyish brown, sandy silt / silty sand with decomposed rock fragments. Obs. kankars.		100				4.0 cm	Pentr.	*SPT-9	8.60-8.63
8.60m		100				3.0 cm	Pentr.	R1	
Completely weathered, brownish, grey fine to medium grained, decomposed and disintegrated Granite gneiss.						Refusal		DS-2	
						4.0 cm	Pentr.	*SPT-10	9.35-9.39
						Refusal		R2	
						3.0 cm	Pentr.	DS-3	
						Refusal		*SPT-11	10.10-10.13
10.50m						NX. drilling from 8.60m to 10.10m		R3	
									CR=NIL RQD=NIL
									9.35
									10.10
									CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-7

Co-ordinates E=6106.000
N=5604.000

Field Test	Nos	Samples	Nos	Commencement Date : 31/03/2019
Penetrometer (SPT)	45	Undisturbed (UDS)	2	Completion Date : 02/04/2019
Cone (Pc)		Penetrometer (SPT)	45	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	21	Level Of Ground : 271.113 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium, blackish grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	7	3	SPT-1	1.00-1.45
2.00m								UDS-1	2.00-2.45
Hard, brownish grey, silty clay with moorum & traces of black spot. Obs. kankars.						17		SPT-2	3.00-3.45
		1	3	2	4	5	6		
						49		*UDS-2	4.00-4.09
		4	7	8	10	13	18	SPT-3	4.09-4.54
5.45m						41		SPT-4	5.00-5.45
Dense to very dense, brownish grey, sandy silt with clay binder & gravel.		4	6	7	9	12	13		
						46		SPT-5	6.00-6.45
		5	7	7	10	14	15		
						58		SPT-6	7.00-7.45
		4	6	9	11	17	21		
						>100		SPT-7	8.00-8.45
8.00m		14	18	20	28	30	34		
Very dense, greyish white, sandy silt with decomposed rock fragments. Obs. gravel & kankars.						>100		SPT-8	8.80-8.90
		40	60	2.5	cm	Pentr.		*SPT-9	8.95-8.99
		100		4.0	cm	Pentr.		*SPT-10	9.05-9.08
9.05m		100				Refusal			9.05
Completely weathered, brownish grey, fine to medium grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.						3.0	cm	Pentr.	
								R1	CR=NIL
								DS-2	RQD=NIL
		100						*SPT-11	9.75-9.78
						3.0	cm	Pentr.	
								R2	CR=NIL
								DS-3	RQD=NIL
		100						*SPT-12	10.50-10.52
						2.0	cm	Pentr.	
								R3	CR=NIL
								DS-4	RQD=NIL
		100						*SPT-13	11.25-11.27
						2.0	cm	Pentr.	
								R4	CR=NIL
								DS-5	RQD=NIL
12.00m									12.00
									12.00

BORE LOG DATA SHEET

BORE HOLE NO.BH-7

Co-ordinates E=6106.000
N=5604.000

Field Test	Nos	Samples	Nos	Commencement Date : 31/03/2019
Penetrometer (SPT)	45	Undisturbed (UDS)	2	Completion Date : 02/04/2019
Cone (Pc)		Penetrometer (SPT)	45	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	21	Level Of Ground : 271.113 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH	DIVN=7.5CM		Ref. No	Depth (m)
Completely weathered, brownish grey, fine to medium grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100	Refusal		*SPT-30	24.00-24.01
		1.0	cm Pentn.		R21	CR=10% RQD=NIL
		100	Refusal		*SPT-31	24.75-24.76
		1.0	cm Pentn.		R22	CR=09% RQD=NIL
		100	Refusal		*SPT-32	25.50-25.51
		1.0	cm Pentn.		R23	CR=14% RQD=NIL
		100	Refusal		*SPT-33	26.25-26.27
		2.0	cm Pentn.		R24	CR=17% RQD=NIL
		100	Refusal		*SPT-34	27.00-27.03
		3.0	cm Pentn.		R25	CR=12% RQD=NIL
Completely weathered, brownish grey to deep grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal		*SPT-35	27.75-27.77
		2.0	cm Pentn.		R26	CR=13% RQD=NIL
		100	Refusal		*SPT-36	28.50-28.52
		2.0	cm Pentn.		R27	CR=16% RQD=NIL
		100	Refusal		*SPT-37	29.25-29.26
		1.0	cm Pentn.		R28	CR=14% RQD=NIL
		100	Refusal		*SPT-38	30.00-30.01
		1.0	cm Pentn.		R29	CR=12% RQD=NIL
		100	Refusal		*SPT-39	30.75-30.76
		1.0	cm Pentn.		R30	CR=18% RQD=NIL
		100	Refusal		*SPT-40	31.50-31.51
		1.0	cm Pentn.		R31	CR=15% RQD=NIL
		100	Refusal		*SPT-41	32.25-32.26
		1.0	cm Pentn.		R32	CR=17% RQD=NIL
		100	Refusal		*SPT-42	33.00-33.01
		1.0	cm Pentn.		R33	CR=13% RQD=NIL
		100	Refusal		*SPT-43	33.75-33.76
		1.0	cm Pentn.		R34	CR=12% RQD=NIL
		100	Refusal		*SPT-44	34.50-34.51
		1.0	cm Pentn.		R35	CR=15% RQD=NIL
		100	Refusal		*SPT-45	35.08-35.09
		1.0	cm Pentn.			

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-8

Co-ordinates E=6102.000
N=5627.000

Field Test	Nos	Samples	Nos	Commencement Date : 28/03/2019
Penetrometer (SPT)	30	Undisturbed (UDS)	2	Completion Date : 30/03/2019
Cone (Pc)		Penetrometer (SPT)	30	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	14	Level Of Ground : 271.009 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Stiff, deep grey, silty clay. Obs. kankars & gravel.								DS-1	0.50
		1	1	1	2	<u>8</u>	3	SPT-1	0.80-1.25
						<u>2</u>		UDS-1	1.80-2.25
2.80m									
Very stiff to hard, brownish grey, silty clay with high percentage of moorum.		1	2	2	4	<u>16</u>	5	SPT-2	2.80-3.25
						<u>43</u>		*UDS-2	3.80-3.90
		5	5	5	10	<u>12</u>	16	SPT-3	3.90-4.35
4.90m									
Hard, yellowish brown, clayey silt with sand mixture, kankars & gravel.		4	4	5	7	<u>32</u>	9	SPT-4	4.90-5.35
						<u>44</u>		SPT-5	5.90-6.35
		4	6	7	10	<u>12</u>	15	SPT-6	6.80-7.25
						<u>60</u>		SPT-7	7.75-8.20
		5	6	11	13	<u>16</u>	20	SPT-8	8.60-8.78
8.50m									
Very desne, brownish grey, sandy silt with decomposed rock fragments.		28	37	58		<u>66</u>		SPT-9	8.90-8.94
						<u>>100</u>		*SPT-10	9.00-9.03
		100	100					R1	CR=NIL RQD=NIL
9.00m									
								DS-2	9.75-9.79
								*SPT-11	CR=NIL RQD=NIL
								R2	
								DS-3	10.50
10.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-8

Co-ordinates E=6102.000
N=5627.000

Field Test	Nos	Samples	Nos	Commencement Date : 28/03/2019
Penetrometer (SPT)	30	Undisturbed (UDS)	2	Completion Date : 30/03/2019
Cone (Pc)		Penetrometer (SPT)	30	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	14	Level Of Ground : 271.009 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
21.00m Completely weathered, pinkish grey to yellowish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal			*SPT-26	21.00-21.01
		1.0	cm Pentn.			R17	CR=15% RQD=NIL
		100	Refusal			*SPT-27	21.75-21.77
		2.0	cm Pentn.			R18	CR=12% RQD=NIL
		100	Refusal			*SPT-28	22.50-22.51
		1.0	cm Pentn.			R19	CR=18% RQD=NIL
		100	Refusal			*SPT-29	23.25-23.26
		1.0	cm Pentn.			R20	CR=16% RQD=NIL
		100	Refusal			*SPT-30	24.00-24.02
		2.0	cm Pentn.			R21	CR=21% RQD=NIL
24.00m Highly weathered, brownish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal			R22	CR=28% RQD=19%
24.75m Highly weathered, brownish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.						R23	CR=33% RQD=NIL
						R24	CR=35% RQD=NIL
						R25	CR=22% RQD=NIL
27.00m Highly weathered, brownish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.						R26	CR=24% RQD=NIL
						R27	CR=25% RQD=NIL
						R28	CR=22% RQD=NIL
30.13m							

N.B. - '*' means sample could not be recovered.

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B CETEST

Job No : 4287 Created by : T.SAHA Created on : 06/05/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-9

Co-ordinates E=6057.000 N=5698.000

Field Test	Nos	Samples	Nos	Commencement Date : 28/04/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	3	Completion Date : 30/04/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 271.223 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, light grey, silty clay. Obs. kankar.								DS-1	0.50
		1	1	1	1	6	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	2	3	13	4	SPT-2	3.00-3.45
5.00m								UDS-2	4.00-4.45
		1	3	7	9	38	11	SPT-3	5.00-5.45
		4	6	9	11	43	11	*UDS-3	6.00-6.08
								SPT-4	6.08-6.53
Hard, reddish grey to light grey, silty clay / clayey silt with decomposed & disintegrated rock fragments. Obs. kankars, sand mixture & mica.		8	11	13	13	57	15	SPT-5	7.00-7.45
		10	18	20	24	100	28	SPT-6	8.00-8.35
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-9

Co-ordinates E=6057.000
N=5698.000

Field Test	Nos	Samples	Nos	Commencement Date : 28/04/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	3	Completion Date : 30/04/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 271.223 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE		SAMPLES	
		EACH	DIVN=7.5CM	Ref. No	Depth (m)
Hard, reddish grey to light grey, silty clay / clayey silt with decomposed & disintegrated rock fragments. Obs. kankars, sand mixture & mica.	8.50m	100	4.0 cm Pentn.	*SPT-7	8.60-8.64
	8.70m	100	Refusal	*SPT-8	8.70-8.73
			3.0 cm Pentn.	R1	CR=NIL RQD=NIL
			Refusal	DS-2	
		100	Refusal	*SPT-9	9.45-9.48
			3.0 cm Pentn.	R2	CR=NIL RQD=NIL
			Refusal	DS-3	
		100	3.0 cm Pentn.	*SPT-10	10.20-10.23
			Refusal	R3	CR=NIL RQD=NIL
		100	3.0 cm Pentn.	DS-4	
Completely weathered, brownish grey to greenish grey, coarse to medium grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	3.0 cm Pentn.	*SPT-11	10.95-10.98
			Refusal	R4	CR=NIL RQD=NIL
		100	2.0 cm Pentn.	DS-5	
			Refusal	*SPT-12	11.70-11.72
			2.0 cm Pentn.	R5	CR=19% RQD=NIL
		100	2.0 cm Pentn.	*SPT-13	12.45-12.47
			Refusal	R6	CR=15% RQD=NIL
		100	2.0 cm Pentn.	*SPT-14	13.20-13.22
			Refusal	R7	CR=16% RQD=NIL
		100	3.0 cm Pentn.	*SPT-15	13.95-13.98
			Refusal	R8	CR=15% RQD=NIL
		100	2.0 cm Pentn.	*SPT-16	14.70-14.72
			Refusal	R9	CR=17% RQD=NIL
		100	2.0 cm Pentn.	*SPT-17	15.45-15.47
			Refusal	R10	CR=19% RQD=NIL
		100	2.0 cm Pentn.	SPT-18	16.20-16.22
			Refusal	R11	CR=19% RQD=NIL
	16.95m	100	3.0 cm Pentn.	*SPT-19	16.95-16.98
	17.00m				

BORE LOG DATA SHEET

BORE HOLE NO.BH-9

Co-ordinates E=6057.000
N=5698.000

Field Test	Nos	Samples	Nos	Commencement Date : 28/04/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	3	Completion Date : 30/04/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 271.223 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
17.00m Highly weathered, greenish grey, medium to fine grained, fractured, Quartzo-feldspathic-gneiss.							R12	CR=40% RQD=NIL
17.70m							R13	CR=NIL RQD=NIL
							DS-6 SPT-20	18.45-18.47
							R14	CR=NIL RQD=NIL
							DS-7 *SPT-21	19.20-19.22
							R15	CR=19% RQD=NIL
							*SPT-22	19.95-19.97
							R16	CR=19% RQD=NIL
							SPT-23	20.70-20.73
							R17	CR=16% RQD=NIL
							*SPT-24	21.45-21.47
							R18	CR=NIL RQD=NIL
							DS-8 *SPT-25	22.20-22.24
							R19	CR=NIL RQD=NIL
							DS-9 *SPT-26	22.95-22.97
							R20	CR=NIL RQD=NIL
							DS-10 *SPT-27	23.70-23.73
							R21	CR=17% RQD=NIL
							*SPT-28	24.45-24.47
24.45m Moderately weathered, medium to fine grained, fractured Quartzo-feldspathic-gneiss.							R22	CR=54% RQD=NIL
25.00m								

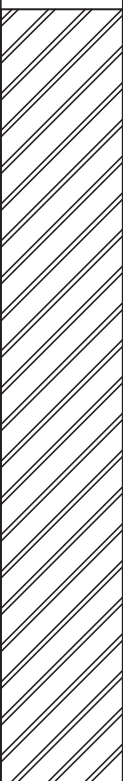
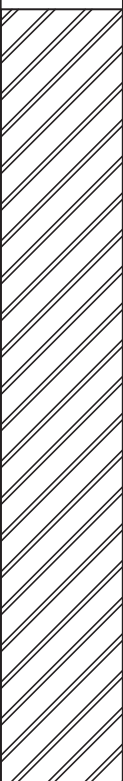
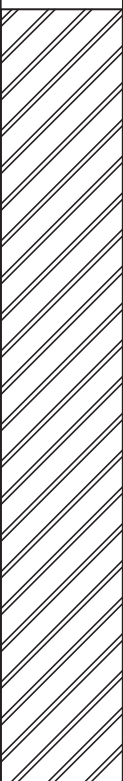
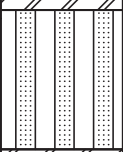
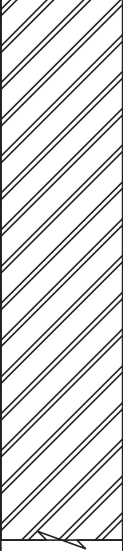
N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-10

Co-ordinates E=6094.000
N=5759.000

Field Test	Nos	Samples	Nos	Commencement Date : 08/04/2019
Penetrometer (SPT)	24	Undisturbed (UDS)	4	Completion Date : 10/04/2019
Cone (Pc)		Penetrometer (SPT)	24	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.757 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 1.65 m.

DESCRIPTION	SYMBOL	N-VALUE							SAMPLES		
		EACH DIVN=7.5CM							Ref. No	Depth (m)	
0.00m										DS-1	0.50
Stiff, deep grey, silty clay. Obs. kankars.		1	1	1	2	<u>8</u>	3			SPT-1	1.00-1.45
										WS-1	1.65
										UDS-1	2.00-2.45
		1	2	2	3	<u>13</u>	4			SPT-2	3.00-3.45
										UDS-2	4.00-4.45
5.00m		4	6	11	10	<u>51</u>	17			SPT-3	5.00-5.45
Hard, greyish brown, silty clay with high percentage of moorum & kankars.											
6.10m		4	4	4	4	<u>17</u>	5			*UDS-3	6.00-6.07
Medium dense, brownish grey, clayey silty sand with kankars. Obs. black patches.										SPT-4	6.10-6.55
7.00m										UDS-4	7.10-7.55
Hard, whitish grey, clayey silt with decomposed rock fragments and mica.		5	7	8	11	<u>45</u>	13			SPT-5	8.10-8.55
		12	13	10	8	<u>33</u>	6	9		SPT-6	9.10-9.55
10.50m		5	7	9	10	<u>46</u>	12	15		SPT-7	10.10-10.55

BORE LOG DATA SHEET

BORE HOLE NO.BH-10

Co-ordinates E=6094.000
N=5759.000

Field Test	Nos	Samples	Nos	Commencement Date : 08/04/2019
Penetrometer (SPT)	24	Undisturbed (UDS)	4	Completion Date : 10/04/2019
Cone (Pc)		Penetrometer (SPT)	24	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.757 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 1.65 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
10.50m Hard, whitish grey, clayey silt with decomposed rock fragments and mica.									
11.10m		9	9	12	15	19	23	SPT-8	11.10-11.55
Very dense, whitish grey, sandy silt / silty sand with mica.									
12.00m		100		4.0	cm	Pentr.		*SPT-9	11.85-11.89
		100		4.0	cm	Pentr.		*SPT-10	12.00-12.04 12.00
								R1	CR=NIL RQD=NIL
		100		4.0	cm	Pentr.		DS-2	
								*SPT-11	12.75-12.79 12.75
								R2	CR=NIL RQD=NIL
Completely weathered, deep grey, medium grained, decomposed & disintegrated Quartz biotite gneiss.		100		4.0	cm	Pentr.		DS-3	
								SPT-12	13.50-13.57 13.50
								R3	CR=NIL RQD=NIL
		100		7.0	cm	Pentr.		DS-4	
								SPT-13	14.25-14.39 14.25
		40	100	6.5	cm	Pentr.		R4	CR=NIL RQD=NIL
								DS-5	
15.00m		100		3.0	cm	Pentr.		*SPT-14	15.00-15.03 15.00
								R5	CR=17% RQD=NIL
		100		2.0	cm	Pentr.		*SPT-15	15.75-15.77 15.75
								R6	CR=24% RQD=NIL
									16.50
								R7	CR=40% RQD=NIL
									17.25
Highly weathered, greyish to deep grey with light grey, medium to coarse grained, highly fractured Quartz biotite gneiss.								R8	CR=37% RQD=NIL
									18.00
								R9	CR=23% RQD=NIL
									18.75
								R10	CR=22% RQD=NIL
									19.50
19.50m								R11	CR=20% RQD=NIL
									20.25
Completely weathered, deep grey with light grey, fine grained, highly fractured Quartz biotite gneiss.								R12	CR=21% RQD=17%
21.00m									21.00

NX. drilling from 12.00m to 30.06m

BORE LOG DATA SHEET

BORE HOLE NO.BH-11

Co-ordinates E=6098.000
N=5781.000

Field Test	Nos	Samples	Nos	Commencement Date : 11/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	3	Completion Date : 13/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.839 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, deep grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	2	$\frac{7}{2}$	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	3	3	3	$\frac{15}{4}$	5	SPT-2	3.00-3.45
4.60m									
Medium dense, yellowish brown, silty sand with moorum & kankars.		3	4	4	5	$\frac{24}{7}$	8	SPT-3	5.00-5.45
								*UDS-3	6.05-6.50
6.65m									
Very dense, whitish grey, silty sand with decomposed rock fragments.		7	14	14	16	$\frac{65}{17}$	18	SPT-4	7.00-7.45
		8	23	32	46	$\frac{50}{4.0}$	cm Pentr.	SPT-5	8.10-8.44
		13	35	48	52	$\frac{52}{2.5}$	cm Pentr.	SPT-6	9.00-9.25
		100				Refusal	3.0 cm Pentr.	*SPT-7	10.00-10.03
10.30m		100				Refusal	3.0 cm Pentr.	*SPT-8	10.30-10.33 10.30
Completely weathered, grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.						Refusal	4.0 cm Pentr.	R1 DS-2	CR=NIL RQD=NIL
		100				Refusal	4.0 cm Pentr.	*SPT-9	11.00-11.04 11.00
						NX. drilling from 10.30m to 35.00m		R2 DS-3	CR=NIL RQD=NIL
		100				Refusal	2.0 cm Pentr.	*SPT-10	11.75-11.77 11.75
12.00m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-11

Co-ordinates E=6098.000
N=5781.000

Field Test	Nos	Samples	Nos	Commencement Date : 11/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	3	Completion Date : 13/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.839 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
12.00m Completely weathered, grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.						R3 DS-4 *SPT-11	CR=NIL RQD=NIL 12.50-12.52 12.50
13.25m						R4 DS-5 *SPT-12	CR=NIL RQD=NIL 13.25-13.28 13.25
14.00m						R5 *SPT-13	CR=16% RQD=NIL 14.00-14.03 14.00
14.75m						R6 *SPT-14	CR=13% RQD=NIL 14.75-14.77 14.75
15.50m						R7 *SPT-15	CR=14% RQD=NIL 15.50-15.54 15.50
16.25m						R8 *SPT-16	CR=14% RQD=NIL 16.25-16.28 16.25
17.00m						R9 *SPT-17	CR=16% RQD=NIL 17.00-17.04 17.00
17.75m						R10 *SPT-18	CR=18% RQD=NIL 17.75-17.78 17.75
18.50m						R11 *SPT-19	CR=13% RQD=NIL 18.50-18.52 18.50
19.25m						R12 *SPT-20	CR=17% RQD=NIL 19.25-19.28 19.25
20.00m						R13	CR=24% RQD=NIL 20.00-20.00 20.00
20.75m						R14	CR=26% RQD=NIL 20.75-20.75 20.75
21.50m						R15	CR=28% RQD=NIL 21.50-21.50 21.50
22.25m						R16	CR=28% RQD=NIL 22.25-22.25 22.25
23.00m						R17	CR=37% RQD=NIL 23.00-23.00 23.00
23.75m						R18	CR=38% RQD=NIL 23.75-23.75 23.75
24.00m							

BORE LOG DATA SHEET

BORE HOLE NO.BH-11

Co-ordinates E=6098.000
N=5781.000

Field Test	Nos	Samples	Nos	Commencement Date : 11/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	3	Completion Date : 13/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.839 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
24.00m Highly weathered, light pinkish grey, medium grained, fractured Quartzo-feldspathic-gneiss.								R19	CR=38% RQD=18% 24.50
								R20	CR=30% RQD=NIL 25.25
								R21	CR=32% RQD=NIL 26.00
								R22	CR=29% RQD=NIL 26.75
								R23	CR=33% RQD=NIL 27.50
								R24	CR=34% RQD=NIL 28.25
								R25	CR=32% RQD=NIL 29.00
								R26	CR=33% RQD=NIL 29.75
								R27	CR=36% RQD=NIL 30.50
								R28	CR=38% RQD=18% 31.25
29.75m Highly weathered, greenish grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.								R29	CR=40% RQD=18% 32.00
								R30	CR=38% RQD=34% 32.75
								R31	CR=24% RQD=NIL 33.50
32.75m Highly weathered, blackish grey, fine grained to medium grained, fractured Quartzo-feldspathic-gneiss.								R32	CR=25% RQD=NIL 34.25
								R33	CR=22% RQD=NIL 35.00
35.00m N.B. - '*' means sample could not be recovered.									

BORE LOG DATA SHEET

BORE HOLE NO.BH-12

Co-ordinates E=6109.000
N=5796.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/04/2019
Penetrometer (SPT)	25	Undisturbed (UDS)	3	Completion Date : 19/04/2019
Cone (Pc)		Penetrometer (SPT)	25	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 270.911 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, deep grey to light grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	6	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	1	3	12	4	SPT-2	3.00-3.45
Very stiff, reddish grey, clayey silt to silty clay with decomposed & disintegrated rock fragments. Obs. kankars & black patches.									
								UDS-2	4.00-4.45
		3	3	3	4	17	6	SPT-3	5.00-5.45
								*UDS-3	6.00-6.10
Very dense, clayey silty sand with kankars & moorum.									
		8	11	13	16	22	22	SPT-4	6.10-6.55
								*SPT-5	6.80-6.82
		100			2.0 cm	Refusal		*SPT-6	7.00-7.02
Completely weathered, greyish to brownish grey, fine to medium grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.									
		100			2.0 cm	Pentn.		R1	CR=19% RQD=NIL
								*SPT-7	7.75-7.77
		100			2.0 cm	Pentn.		R2	CR=NIL RQD=NIL
Highly weathered, brownish grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.									
		100			3.0 cm	Pentn.		*SPT-8	8.50-8.53
								R3	CR=NIL RQD=NIL
		100			3.0 cm	Pentn.		*SPT-9	9.25-9.28
								R4	CR=23% RQD=NIL
								R5	CR=27% RQD=NIL
10.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-12

Co-ordinates E=6109.000
N=5796.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/04/2019
Penetrometer (SPT)	25	Undisturbed (UDS)	3	Completion Date : 19/04/2019
Cone (Pc)		Penetrometer (SPT)	25	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 270.911 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Highly weathered, brownish grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.							10.75
						R6 DS-4 *SPT-10	11.50-11.52
						R7 DS-5 *SPT-11	12.25-12.28
						R8 *SPT-12	13.00-13.03
						R9 *SPT-13	13.75-13.78
						R10 *SPT-14	14.50-14.52
						R11 *SPT-15	15.25-15.28
						R12 *SPT-16	16.00-16.02
						R13 *SPT-17	16.75-16.77
						R14 *SPT-18	17.50-17.52
						R15 *SPT-19	18.25-18.28
						R16 DS-6 *SPT-20	19.00-19.03
						R17 DS-7 *SPT-21	19.75-19.77
						R18 DS-8 *SPT-22	20.50-20.52
						R19	
Completely weathered, brownish to light grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.							21.00

BORE LOG DATA SHEET

BORE HOLE NO.BH-13

Co-ordinates E=6230.321 N=5669.562

Field Test	Nos	Samples	Nos	Commencement Date : 10/04/2019
Penetrometer (SPT)	25	Undisturbed (UDS)	4	Completion Date : 12/04/2019
Cone (Pc)		Penetrometer (SPT)	25	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 269.020 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

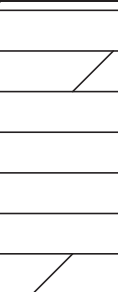
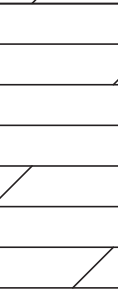
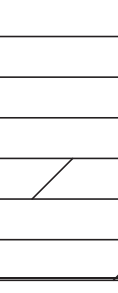
DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN=7.5CM							Ref. No	Depth (m)
0.00m										
Medium, deep grey, silty clay. Obs. kankars.		1	1	1	1	6	2		DS-1 WS-1	0.50 0.60
									SPT-1	1.00-1.45
									*UDS-1	2.00-2.45
3.00m		5	5	8	14	58	20		SPT-2	3.00-3.45
Very dense, reddish grey, silty sand. Obs. kankar & gravel.									UDS-2	4.00-4.45
4.00m		2	2	3	3	20	9		SPT-3	5.00-5.45
Very stiff, light grey, silty clay. Obs. kankars.									*UDS-3	6.00-6.10
6.00m		4	4	8	9	41	11	13	SPT-4	6.10-6.55
Very stiff to hard, yellowish grey, clayey silt. Obs. kankars, gravel & sand mixture.		3	4	4	7	29	8	10	SPT-5	7.00-7.45
									*UDS-4	8.00-8.45
8.50m										

BORE LOG DATA SHEET

BORE HOLE NO.BH-13

Co-ordinates E=6230.321
N=5669.562

Field Test	Nos	Samples	Nos	Commencement Date : 10/04/2019
Penetrometer (SPT)	25	Undisturbed (UDS)	4	Completion Date : 12/04/2019
Cone (Pc)		Penetrometer (SPT)	25	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 269.020 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
8.50m Very stiff to hard, yellowish grey, clayey silt. Obs. kankars, gravel & sand mixture.		2	2	4	7	24	7	SPT-6	9.00-9.45
10.00m Completely weathered, pinkish grey to brownish grey, medium to fine grained, fractured Granite gneiss.		100	4.0	cm	Refusal	Pentn.		*SPT-7	9.80-9.84
		100	3.0	cm	Refusal	Pentn.		*SPT-8	10.00-10.03 10.00
			NX. drilling from 10.00m to 25.00m						
		100	2.0	cm	Refusal	Pentn.		R1	CR=18% RQD=NIL
			2.0	cm	Refusal	Pentn.		*SPT-9	10.75-10.77 10.75
			2.0	cm	Refusal	Pentn.		R2	CR=19% RQD=NIL
11.50m Completely weathered, pinkish grey to brownish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		100	2.0	cm	Refusal	Pentn.		*SPT-10	11.50-11.52 11.50
			3.0	cm	Refusal	Pentn.		R3	CR=18% RQD=NIL
		100	2.0	cm	Refusal	Pentn.		*SPT-11	12.25-12.28 12.25
			2.0	cm	Refusal	Pentn.		R4	CR=17% RQD=NIL
		100	2.0	cm	Refusal	Pentn.		*SPT-12	13.00-13.02 13.00
			2.0	cm	Refusal	Pentn.		R5	CR=15% RQD=NIL
		100	2.0	cm	Refusal	Pentn.		*SPT-13	13.75-13.77 13.75
			2.0	cm	Refusal	Pentn.		R6	CR=16% RQD=NIL
14.50m Completely weathered, pinkish grey to yellowish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	3.0	cm	Refusal	Pentn.		*SPT-14	14.50-14.53 14.50
			2.0	cm	Refusal	Pentn.		R7	CR=NIL RQD=NIL
		100	2.0	cm	Refusal	Pentn.		DS-2 *SPT-15	15.25-15.27 15.25
			3.0	cm	Refusal	Pentn.		R8	CR=NIL RQD=NIL
		100	3.0	cm	Refusal	Pentn.		DS-3 *SPT-16	16.00-16.03 16.00
			3.0	cm	Refusal	Pentn.		R9	CR=NIL RQD=NIL
17.00m		100	3.0	cm	Refusal	Pentn.		DS-4 *SPT-17	16.75-16.78 16.75

BORE LOG DATA SHEET

BORE HOLE NO.BH-13

Co-ordinates E=6230.321
N=5669.562

Field Test	Nos	Samples	Nos	Commencement Date : 10/04/2019
Penetrometer (SPT)	25	Undisturbed (UDS)	4	Completion Date : 12/04/2019
Cone (Pc)		Penetrometer (SPT)	25	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	9	Level Of Ground : 269.020 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
17.00m Completely weathered, pinkish grey to yellowish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.							R10 DS-5 *SPT-18	CR=NIL RQD=NIL 17.50-17.52 17.50
18.25m Completely weathered, pinkish grey, medium to fine grained, fractured Granite gneiss.							R11 DS-6 *SPT-19	CR=NIL RQD=NIL 18.25-18.27 18.25
19.75m Completely weathered, pinkish grey to yellowish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.							R12 DS-7 *SPT-20	CR=19% RQD=NIL 19.00-19.01 19.00
							R13 DS-8 *SPT-21	CR=18% RQD=NIL 19.75-19.77 19.75
							R14 DS-9 *SPT-22	CR=NIL RQD=NIL 20.50-20.52 20.50
							R15 DS-10 *SPT-23	CR=NIL RQD=NIL 21.25-21.27 21.25
							R16 DS-11 *SPT-24	CR=NIL RQD=NIL 22.00-22.02 22.00
							R17 DS-12 *SPT-25	CR=13% RQD=NIL 22.75-22.77 22.75
							R18 DS-13 *SPT-26	CR=24% RQD=NIL 23.50-23.52 23.50
23.50m Highly to moderately weathered, yellowish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.							R19 DS-14 *SPT-27	CR=26% RQD=NIL 24.25-24.27 24.25
25.00m N.B. - '*' means sample could not be recovered.							R20 DS-15 *SPT-28	CR=48% RQD=NIL 25.00-25.02 25.00

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda										Aspire-B		CETEST	
Job No : 4287			Created by : T.SAHA			Created on : 19/04/2019			Sheet No:				
BORE LOG DATA SHEET					BORE HOLE NO.BH-14				Co-ordinates			E=6246.980 N=5676.948	
Field Test		Nos	Samples		Nos	Commencement Date : 13/04/2019							
Penetrometer (SPT)		27	Undisturbed (UDS)		3	Completion Date : 17/04/2019							
Cone (Pc)			Penetrometer (SPT)		27	Bore Hole Diameter : 150 mm./ N.X							
Vane (V)			Disturbed (DS)		7	Level Of Ground : 269.554 M.							
			Water Sample (WS)		1	Water Struck At : Standing Water Level : 1.30 m.							
DESCRIPTION					SYMBOL	N-VALUE				SAMPLES			
						EACH DIVN=7.5CM				Ref. No	Depth (m)		
Completely weathered, brownish grey, medium grained to fine grained, fractured Quartzo-feldspathic-gneiss.					8.50m								
					8.75m								
Completely weathered, brownish light grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.					100	Refusal				*SPT-7	8.75-8.77	8.75	
						2.0 cm Pentn.				R2	CR=NIL RQD=NIL		
					100	Refusal				DS-2 *SPT-8	9.50-9.52	9.50	
						2.0 cm Pentn.				R3	CR=NIL RQD=NIL		
					100	Refusal				DS-3 *SPT-9	10.25-10.27	10.25	
						2.0 cm Pentn.				R4	CR=NIL RQD=NIL		
					100	Refusal				DS-4 *SPT-10	11.00-11.03	11.00	
						3.0 cm Pentn.				R5	CR=NIL RQD=NIL		
					100	Refusal				DS-5 *SPT-11	11.75-11.78	11.75	
						3.0 cm Pentn.				R6	CR=NIL RQD=NIL		
Completely weathered, light greenish grey, medium grained, highly fractured Quartzo-feldspathic-gneiss.					100	Refusal				DS-6 *SPT-12	12.50-12.52	12.50	
						2.0 cm Pentn.				R7	CR=NIL RQD=NIL		
					100	Refusal				DS-7 *SPT-13	13.25-13.27	13.25	
						2.0 cm Pentn.				R8	CR=17% RQD=NIL		
Completely weathered, whitish grey, fine grained, highly fractured Quartzo-feldspathic-gneiss.					100	Refusal				*SPT-14	14.00-14.02	14.00	
						2.0 cm Pentn.				R9	CR=18% RQD=NIL		
					100	Refusal				*SPT-15	14.75-14.78	14.75	
						3.0 cm Pentn.				R10	CR=12% RQD=NIL		
Completely weathered, light greenish grey to light brownish grey, medium grained, fractured Quartzo-feldspathic-gneiss.					100	Refusal				*SPT-16	15.50-15.52	15.50	
						2.0 cm Pentn.				R11	CR=16% RQD=NIL		
					100	Refusal				*SPT-17	16.25-16.28	16.25	
						3.0 cm Pentn.				R12	CR=13% RQD=NIL		
					17.00m						17.00		

BORE LOG DATA SHEET

BORE HOLE NO.BH-14

Co-ordinates E=6246.980
N=5676.948

Field Test	Nos	Samples	Nos	Commencement Date : 13/04/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	3	Completion Date : 17/04/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	7	Level Of Ground : 269.554 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
17.00m Completely weathered, light greenish grey to light brownish grey, medium grained, fractured Quartzo-feldspathic-gneiss.		100	3.0	Refusal	cm Pentn.	*SPT-18	17.00-17.03
						R13	CR=14% RQD=NIL
		100	2.0	Refusal	cm Pentn.	*SPT-19	17.75-17.77
						R14	CR=16% RQD=NIL
		100	4.0	Refusal	cm Pentn.	*SPT-20	18.50-18.54
						R15	CR=17% RQD=NIL
		100	3.0	Refusal	cm Pentn.	*SPT-21	19.25-19.28
						R16	CR=18% RQD=NIL
		100	2.0	Refusal	cm Pentn.	*SPT-22	20.00-20.02
						R17	CR=17% RQD=NIL
22.25m Completely to highly weathered, light blackish grey, medium grained, highly fractured Quartzo-feldspathic-gneiss.		100	3.0	Refusal	cm Pentn.	*SPT-23	20.75-20.78
						R18	CR=18% RQD=NIL
		100	2.0	Refusal	cm Pentn.	*SPT-24	21.50-21.52
						R19	CR=20% RQD=NIL
		100	4.0	Refusal	cm Pentn.	*SPT-25	23.00-23.04
						R20	CR=17% RQD=NIL
		100	3.0	Refusal	cm Pentn.	*SPT-26	23.75-23.78
						R21	CR=17% RQD=NIL
		100	3.0	Refusal	cm Pentn.	*SPT-27	24.50-24.53
						R22	CR=18% RQD=NIL
25.00m N.B. - '*' means sample could not be recovered.		100	3.0	Refusal	cm Pentn.	R23	CR=24% RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-15

Co-ordinates E=6275.075
N=5698.030

Field Test	Nos	Samples	Nos	Commencement Date : 02/04/2019
Penetrometer (SPT)	23	Undisturbed (UDS)	2	Completion Date : 05/04/2019
Cone (Pc)		Penetrometer (SPT)	23	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 270.861 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.40 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
8.50m <							

BORE HOLE NO.BH-15

Co-ordinates	E=6275.075 N=5698.030

Penetrometer (SPT)	23	Undisturbed (UDS)	2
Cone (Pc)		Penetrometer (SPT)	23
		Disturbed (DS)	15
Vane (V)		Water Sample (WS)	0

Depth (m)	Remarks	Core Log	Core ID	CR (%)	RQD (%)	DS	SPT	Interval (m)	Depth (m)
17.00	Highly weathered, yellowish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		R15	25%	NIL				17.75
			R16	29%	NIL				18.50
			R17	27%	NIL				19.25
19.25			R18	NIL	NIL	DS-13	*SPT-20	20.00-20.03	20.00
Completely weathered, yellowish grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		Refusal							
			R19	NIL	NIL	DS-14	*SPT-21	20.75-20.78	20.75
			R20	NIL	NIL				
	21.50		R21	16%	NIL	DS-15	*SPT-22	21.50-21.52	21.50
Completely to highly weathered, light grey to whitish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		Refusal							
			R22	25%	NIL				
			R23	37%	NIL				
	23.00		R24	27%	NIL				
Highly weathered, light grey to whitish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.			R25	28%	NIL				
	25.00								25.00

N.B. — '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-16

Co-ordinates E=6231.000
N=5626.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	3	Completion Date : 09/04/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	23	Level Of Ground : 269.454 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, brownish grey, silty clay with sand mixture.								DS-1 WS-1	0.50 0.60
		1	1	1	2	$\frac{7}{2}$	2	SPT-1	1.00-1.45
								*UDS-1	2.00-2.45
		1	1	1	2	$\frac{9}{2}$	4	SPT-2	3.00-3.45
5.45m								UDS-2	4.00-4.45
		2	2	3	3	$\frac{15}{4}$	5	SPT-3	5.00-5.45
								*UDS-3	5.60-5.70
		4	5	7	8	$\frac{31}{8}$	8	SPT-4	6.00-6.45
Very stiff to hard, yellowish grey to light grey, silty clay with fully decomposed rock fragments.									
		3	4	4	6	$\frac{26}{7}$	9	SPT-5	7.00-7.45
		4	6	6	7	$\frac{34}{9}$	12	SPT-6	8.00-8.45
		100				Refusal		*SPT-7	8.55-8.57
8.50m		100				Refusal		*SPT-8	8.65-8.68
Completely to highly weathered, light grey, fine grained, decomposed & disintegrated / fractured Talc Schist								R1	CR=30% RQD=NIL
								R2	CR=21% RQD=NIL
								R3	CR=NIL RQD=NIL
10.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-16

Co-ordinates E=6231.000
N=5626.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	3	Completion Date : 09/04/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	23	Level Of Ground : 269.454 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Completely weathered, pinkish grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss		Refusal				DS-13	21.00m
		4.0 cm Pentn.				*SPT-20	21.25-21.29 21.25
		Refusal				R18	CR=NIL RQD=NIL
		2.0 cm Pentn.				DS-14	22.00-22.02 22.00
		Refusal				*SPT-21	CR=NIL RQD=NIL
		2.0 cm Pentn.				R19	22.75-22.77 22.75
		Refusal				DS-15	CR=NIL RQD=NIL
		2.0 cm Pentn.				*SPT-22	CR=NIL RQD=NIL
		Refusal				R20	23.50-23.52 23.50
		2.0 cm Pentn.				DS-16	CR=NIL RQD=NIL
		Refusal				*SPT-23	CR=NIL RQD=NIL
		3.0 cm Pentn.				R21	24.25-24.28 24.25
		Refusal				DS-17	CR=19% RQD=NIL
		2.0 cm Pentn.				*SPT-24	CR=NIL RQD=NIL
		Refusal				R22	25.00-25.02 25.00
		2.0 cm Pentn.				*SPT-25	CR=NIL RQD=NIL
		Refusal				R23	25.75-25.78 25.75
		3.0 cm Pentn.				DS-18	CR=NIL RQD=NIL
		Refusal				*SPT-26	CR=NIL RQD=NIL
		3.0 cm Pentn.				R24	26.50-26.53 26.50
		Refusal				DS-19	CR=NIL RQD=NIL
		3.0 cm Pentn.				*SPT-27	CR=NIL RQD=NIL
		Refusal				R25	27.25-27.29 27.25
		4.0 cm Pentn.				DS-20	CR=11% RQD=NIL
		Refusal				*SPT-28	CR=NIL RQD=NIL
		2.0 cm Pentn.				R26	28.00-28.02 28.00
		Refusal				*SPT-29	CR=NIL RQD=NIL
		2.0 cm Pentn.				R27	28.75-28.77 28.75
		Refusal				DS-21	CR=NIL RQD=NIL
		3.0 cm Pentn.				*SPT-30	CR=NIL RQD=NIL
		Refusal				R28	29.50-29.53 29.50
		3.0 cm Pentn.				DS-22	CR=NIL RQD=NIL
		Refusal				*SPT-31	CR=NIL RQD=NIL
		3.0 cm Pentn.				R29	30.00-30.03 30.00
		Refusal				DS-23	
		3.0 cm Pentn.				*SPT-32	

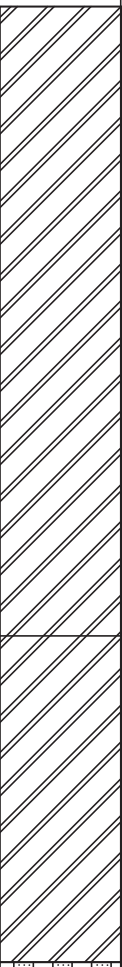
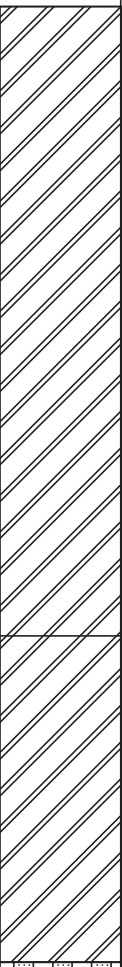
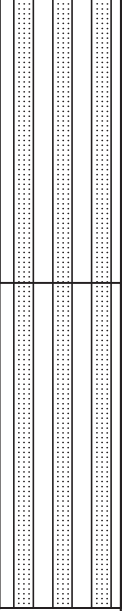
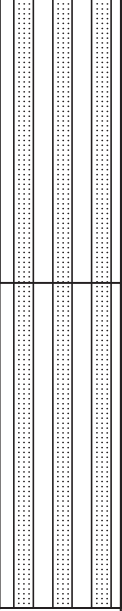
N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-17

Co-ordinates E=6317.000 N=5692.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 22/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 270.178 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.44 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
								DS-1	0.50
		1	1	1	2	$\frac{7}{2}$	2	SPT-1	1.00-1.45
Medium, deep grey, silty clay with kankars.									
								UDS-1	2.10-2.55
3.05m		2	2	2	4	$\frac{16}{4}$	6	SPT-2	3.05-3.50
								UDS-2	4.20-4.65
Very stiff, deep grey, silty clay with kankars.									
5.00m		14	16	18	22	$\frac{98}{26}$	32	SPT-3	5.10-5.55
		6	6	8	8	$\frac{39}{9}$	14	SPT-4	6.00-6.45
Dense to very dense, brownish grey to light brownish grey, silty sand with fully decomposed rock fragments. Obs. gravel & kankars.									
6.50m		25	39	41	55	$\frac{100}{3.5}$	Pentn.	SPT-5	7.10-7.36
Very dense, whitish grey, silty sand with fully decomposed rock fragments. Obs. gravel.									
8.20m		100	3.0	cm	Refusal		Pentn.	*SPT-6	8.00-8.03
		100	4.0	cm	Refusal		Pentn.	*SPT-7	8.20-8.24
									8.20
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-17

Co-ordinates E=6317.000
N=5692.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 22/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 270.178 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.44 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Completely weathered, light grey, medium grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss	8.50m	NX. drilling from 8.20m to 25.06m				R1	CR=NIL RQD=NIL
		Refusal				DS-2 *SPT-8	9.00-9.02 9.00
		2.0 cm Pentn.				R2	CR=NIL RQD=NIL
		Refusal				DS-3 *SPT-9	9.75-9.78 9.75
		3.0 cm Pentn.				R3	CR=NIL RQD=NIL
		Refusal				DS-4 *SPT-10	10.50-10.53 10.50
		3.0 cm Pentn.				R4	CR=NIL RQD=NIL
		Refusal				DS-5 *SPT-11	11.25-11.27 11.25
		2.0 cm Pentn.				R5	CR=NIL RQD=NIL
		Refusal				DS-6 *SPT-12	12.00-12.02 12.00
Completely to highly weathered, whitish grey to light yellowish grey, fine to medium grained, highly fractured Quartzo-feldspathic-gneiss	12.00m	2.0 cm Pentn.				R6	CR=16% RQD=NIL
		Refusal				*SPT-13	12.75-12.79 12.75
		4.0 cm Pentn.				R7	CR=17% RQD=NIL
		Refusal				*SPT-14	13.50-13.52 13.50
		2.0 cm Pentn.				R8	CR=18% RQD=NIL
		Refusal				*SPT-15	14.25-14.28 14.25
		3.0 cm Pentn.				R9	CR=17% RQD=NIL
		Refusal				*SPT-16	15.00-15.03 15.00
		3.0 cm Pentn.				R10	CR=21% RQD=NIL
							15.75
						R11	CR=30% RQD=NIL
							16.50
	17.00m					R12	CR=28% RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-17

Co-ordinates E=6317.000
N=5692.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/04/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 22/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 270.178 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.44 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
Completely to highly weathered, whitish grey to light yellowish grey, fine to medium grained, highly fractured Quartzo-feldspathic-gneiss	17.00m							
	17.25m							
							R13	CR=18% RQD=NIL
							*SPT-17	18.00-18.03 18.00
							R14	CR=18% RQD=NIL
							*SPT-18	18.75-18.78 18.75
							R15	CR=16% RQD=NIL
							*SPT-19	19.50-19.54 19.50
							R16	CR=16% RQD=NIL
							*SPT-20	20.25-20.28 20.25
Completely to highly weathered, light yellowish grey to light brownish grey, medium grained, fractured Quartzo-feldspathic-gneiss.							R17	CR=20% RQD=14%
							R18	CR=21% RQD=14%
							R19	CR=25% RQD=NIL
							R20	CR=24% RQD=NIL
							R21	CR=29% RQD=14%
Highly weathered, light pinkish grey, fine grained, fractured Quartzo-feldspathic-gneiss							R22	CR=26% RQD=NIL
							R23	CR=32% RQD=18%
N.B. - '*' means sample could not be recovered.	25.06m							

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B **CETEST**

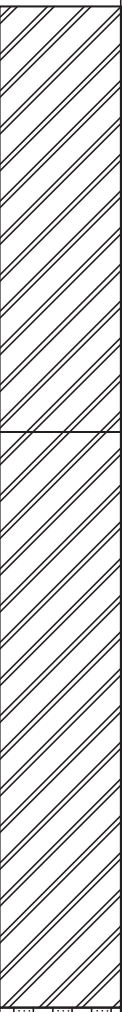
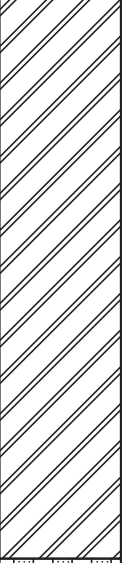
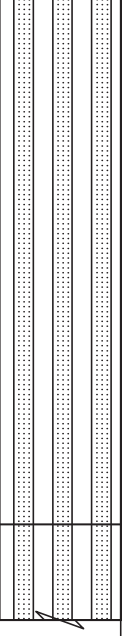
Job No : 4287 Created by : T.SAHA Created on : 12/04/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-18

Co-ordinates E=6245.698
N=5484.384

Field Test	Nos	Samples	Nos	Commencement Date : 31/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 05/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 269.384 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.65 m.

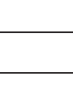
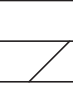
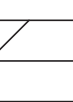
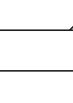
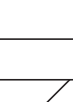
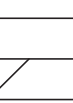
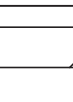
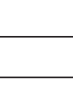
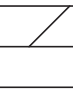
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m								DS-1	0.50
Stiff, brownish grey, silty clay with kankars & sand mixture.		1	1	2	3	<u>13</u>	4	SPT-1	1.00-1.45
2.00m								UDS-1	2.00-2.45
		4	6	6	7	<u>28</u>	8	SPT-2	3.00-3.45
Very stiff to hard, brownish grey, silty clay with kankars & sand mixture.								*UDS-2	4.00-4.10
		4	6	8	12	<u>51</u>	17	SPT-3	4.10-4.55
5.45m		6	6	7	10	<u>49</u>	18	SPT-4	5.00-5.45
		4	6	9	11	<u>53</u>	20	SPT-5	6.00-6.45
Very dense, brownish grey, clayey silty sand. Obs. gravel & kankars.								SPT-6	7.00-7.45
		4	6	9	14	<u>53</u>	16		
8.00m		19	30	52		<u>>100</u>		SPT-7	8.00-8.20
Very dense, brownish grey, silty sand with decomposed rock fragments.		100				5.0 cm Pentn.		*SPT-8	8.40-8.44
8.50m						4.0 cm Pentn.			

BORE LOG DATA SHEET

BORE HOLE NO.BH-18

Co-ordinates E=6245.698
N=5484.384

Field Test	Nos	Samples	Nos	Commencement Date : 31/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 05/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm. / N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 269.384 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.65 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Very dense, brownish grey, silty sand with decomposed rock fragments.		100	Refusal	3.0 cm Pentr.		*SPT-9	8.50-8.53 8.50
Highly weathered, brownish grey, medium grained, highly fracture Quartzo-feldspathic-gneiss		100	Refusal	3.0 cm Pentr.		R1	CR=21% RQD=NIL
		100	Refusal	3.0 cm Pentr.		R2	CR=23% RQD=NIL
		100	Refusal	3.0 cm Pentr.		R3	CR=25% RQD=NIL
		100	Refusal	3.0 cm Pentr.		R4	CR=NIL RQD=NIL
Completely weathered, light pinkish grey, coarse grained, decomposed / disintegrated Quartzo-feldspathic-gneiss		100	Refusal	3.0 cm Pentr.		DS-2	
		100	Refusal	3.0 cm Pentr.		*SPT-10	11.50-11.53 11.50
		100	Refusal	3.0 cm Pentr.		R5	CR=NIL RQD=NIL
		100	Refusal	3.0 cm Pentr.		DS-3	
Completely weathered, light pinkish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal	3.0 cm Pentr.		*SPT-11	12.25-12.28 12.25
		100	Refusal	2.0 cm Pentr.		R6	CR=NIL RQD=NIL
		100	Refusal	2.0 cm Pentr.		DS-4	
		100	Refusal	2.0 cm Pentr.		*SPT-12	13.00-13.02 13.00
Completely weathered, light pinkish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		100	Refusal	2.0 cm Pentr.		R7	CR=NIL RQD=NIL
		100	Refusal	2.0 cm Pentr.		DS-5	
		100	Refusal	2.0 cm Pentr.		*SPT-13	13.75-13.77 13.75
		100	Refusal	2.0 cm Pentr.		R8	CR=16% RQD=NIL
Completely to highly weathered, light pinkish grey, medium to coarse grained, highly fractured Granite gneiss.		100	Refusal	2.0 cm Pentr.		*SPT-14	14.50-14.52 14.50
		100	Refusal	2.0 cm Pentr.		R9	CR=15% RQD=NIL
		100	Refusal	2.0 cm Pentr.		*SPT-15	15.25-15.27 15.25
		100	Refusal	2.0 cm Pentr.		R10	CR=13% RQD=NIL
		100	Refusal	2.0 cm Pentr.		*SPT-16	16.00-16.02 16.00
		100	Refusal	2.0 cm Pentr.		R11	CR=25% RQD=NIL
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			
		100	Refusal	2.0 cm Pentr.			

BORE LOG DATA SHEET

BORE HOLE NO.BH-18

Co-ordinates E=6245.698
N=5484.384

Field Test	Nos	Samples	Nos	Commencement Date : 31/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	2	Completion Date : 05/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 269.384 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.65 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
Highly weathered, light pinkish grey, medium to coarse grained, highly fractured Granite gneiss.							R12	CR=32% RQD=NIL
								17.50
							R13	CR=33% RQD=NIL
								18.25
							R14	CR=22% RQD=NIL
								19.00
Highly to moderately weathered, light pinkish grey, medium to coarse grained, highly fractured Granite gneiss.							R15	CR=23% RQD=NIL
								19.75
							R16	CR=28% RQD=NIL
								20.50
Completely weathered, light pinkish grey, coarse to medium grained, highly fractured Granite gneiss.							R17	CR=36% RQD=NIL
								21.25
							R18	CR=43% RQD=NIL
								22.00
							R19	CR=13% RQD=NIL
								22.75
							*SPT-17	22.75-22.77 22.75
							R20	CR=12% RQD=NIL
								23.50
							*SPT-18	23.50-23.53 23.50
N.B. - '*' means sample could not be recovered.							R21	CR=11% RQD=NIL
								24.25
							*SPT-19	24.25-24.27 24.25
							R22	CR=08% RQD=NIL
								25.05
							*SPT-20	25.05-25.07 25.05

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B **CETEST**

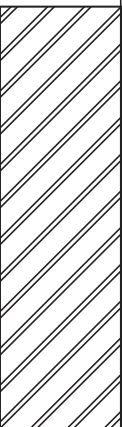
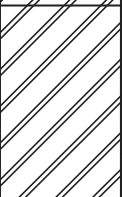
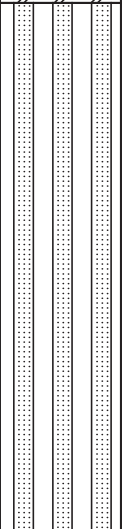
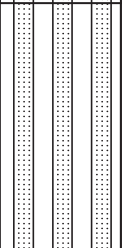
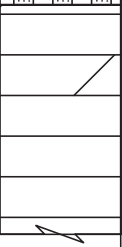
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BORE LOG DATA SHEET

BORE HOLE NO.BH-19

Co-ordinates E=6271.000
N=5471.000

Field Test	Nos	Samples	Nos	Commencement Date : 20/03/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	2	Completion Date : 24/03/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	20	Level Of Ground : 269.600 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m Medium, brownish grey, silty clay. Obs. kankars.		1	1	1	1	6	2	DS-1 WS-1	0.50 0.60
2.00m Very stiff, brownish grey, silty clay with calcareous nodules.		3	3	4	4	25	10	SPT-1	1.00-1.45
3.45m Dense, brownish grey, clayey silty sand. Obs. kankars.		4	5	7	9	43	15	UDS-1	2.00-2.45
6.00m Very dense, light grey, silty sand with decomposed rock fragments. Obs. mica.		4	6	8	11	49	17	SPT-2	3.00-3.45
7.30m Completely weathered, pinkish brown, medium to coarse grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		7	13	16	16	77	26	*UDS-2	4.00-4.10
8.50m		16	32	52	>100	Refusal		SPT-3	4.10-4.55
		100	5.0 cm	Pentr.				SPT-4	5.00-5.45
		100	4.0 cm	Pentr.				SPT-5	6.00-6.45
		100	2.0 cm	Pentr.				SPT-6	6.80-7.00
			NX. drilling from 7.30m to 25.00m	Refusal				*SPT-7	7.20-7.24
								*SPT-8	7.30-7.32 7.30
								R1	CR=NIL RQD=NIL
								DS-2	
								*SPT-9	8.05-8.07 8.05
								R2	CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-19

Co-ordinates E=6271.000
N=5471.000

Field Test	Nos	Samples	Nos	Commencement Date : 20/03/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	2	Completion Date : 24/03/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	20	Level Of Ground : 269.600 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
17.00m Completely weathered, pinkish brown, medium to coarse grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	Refusal			DS-11 *SPT-21	17.05-17.07 17.05
		2.0	cm Pentn.			R14	CR=NIL RQD=NIL
		100	Refusal			DS-12 *SPT-22	17.80-17.82 17.80
		2.0	cm Pentn.			R15	CR=NIL RQD=NIL
		100	Refusal			DS-13 *SPT-23	18.55-18.58 18.55
		3.0	cm Pentn.			R16	CR=NIL RQD=NIL
		100	Refusal			DS-14 *SPT-24	19.30-19.32 19.30
		2.0	cm Pentn.			R17	CR=NIL RQD=NIL
		100	Refusal			DS-15 *SPT-25	20.05-20.07 20.05
		2.0	cm Pentn.			R18	CR=NIL RQD=NIL
18.55m Completely weathered, pinkish brown, fine to medium grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100	Refusal			DS-16 *SPT-26	20.80-20.83 20.80
		3.0	cm Pentn.			R19	CR=NIL RQD=NIL
		100	Refusal			DS-17 *SPT-27	21.55-21.57 21.55
		2.0	cm Pentn.			R20	CR=NIL RQD=NIL
		100	Refusal			DS-18 *SPT-28	22.30-22.32 22.30
		2.0	cm Pentn.			R21	CR=NIL RQD=NIL
		100	Refusal			DS-19 *SPT-29	23.05-23.07 23.05
		2.0	cm Pentn.			R22	CR=NIL RQD=NIL
		100	Refusal			DS-20 *SPT-30	23.80-23.83 23.80
		3.0	cm Pentn.			R23	CR=16% RQD=NIL
23.80m Highly weathered, pinkish brown, fine to medium grained, fractured Quartzo-feldspathic-gneiss.		100	Refusal			*SPT-31	24.55-24.57 24.55
		2.0	cm Pentn.			R24	CR=18% RQD=NIL
25.00m N.B. - '*' means sample could not be recovered.		100	Refusal			*SPT-32	25.00-25.02 25.00
		2.0	cm Pentn.				

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B **CETEST**

Job No : 4287 Created by : T.SAHA Created on : 06/05/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-20

Co-ordinates E=5983.500
N=5729.500

Field Test	Nos	Samples	Nos	Commencement Date : 22/04/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	13	Level Of Ground : 271.103 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.55 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
								DS-1	0.50
		1	1	1	1	$\frac{6}{2}$	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	3	3	3	$\frac{14}{4}$	4	SPT-2	3.00-3.45
								UDS-2	4.00-4.45
5.00m		5	9	10	11	$\frac{44}{10}$	13	SPT-3	5.00-5.45
		5	8	10	13	$\frac{53}{15}$	15	*UDS-3	6.00-6.10
								SPT-4	6.10-6.55
		8	8	11	13	$\frac{52}{14}$	14	SPT-5	7.00-7.45
		10	12	15	16	$\frac{65}{16}$	18	SPT-6	8.00-8.45
8.50m									

Medium to stiff, light grey to yellowish grey, silty clay. Obs. kankars.

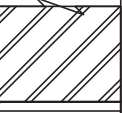
Hard, reddish grey to light grey, clayey silt with decomposed & disintegrated rock fragments. Obs. kankars & sand mixture.

BORE LOG DATA SHEET

BORE HOLE NO.BH-20

Co-ordinates E=5983.500
N=5729.500

Field Test	Nos	Samples	Nos	Commencement Date : 22/04/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	13	Level Of Ground : 271.103 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.55 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Hard, reddish grey to light grey, clayey silt with decomposed & disintegrated rock fragments. Obs. kankars & sand mixture.		100	4.0	cm	Pentn.	*SPT-7	8.80-8.84
		100	Refusal			*SPT-8	9.00-9.02 9.00
Completely weathered, greyish to light grey, fine to medium grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.			2.0	cm	Pentn.	R1	CR=10% RQD=NIL
			NX. drilling from 9.00m to 25.00m				
			Refusal				
		100	2.0	cm	Pentn.	*SPT-9	9.75-9.77 9.75
						R2	CR=17% RQD=NIL
			Refusal				
		100	2.0	cm	Pentn.	*SPT-10	10.50-10.52 10.50
						R3	CR=08% RQD=NIL
			Refusal				
		100	2.0	cm	Pentn.	*SPT-11	11.25-11.27 11.25
						R4	CR=NIL RQD=NIL
			Refusal			DS-2	
		100	3.0	cm	Pentn.	*SPT-12	12.00-12.03 12.00
						R5	CR=NIL RQD=NIL
			Refusal			DS-3	
		100	2.0	cm	Pentn.	*SPT-13	12.75-12.77 12.75
						R6	CR=18% RQD=NIL
			Refusal				
		100	2.0	cm	Pentn.	*SPT-14	13.50-13.52 13.50
						R7	CR=13% RQD=NIL
			Refusal				
		100	2.0	cm	Pentn.	*SPT-15	14.25-14.27 14.25
						R8	CR=NIL RQD=NIL
			Refusal			DS-4	
		100	3.0	cm	Pentn.	*SPT-16	15.00-15.03 15.00
						R9	CR=NIL RQD=NIL
			Refusal			DS-5	
		100	2.0	cm	Pentn.	*SPT-17	15.75-15.77 15.75
						R10	CR=NIL RQD=NIL
			Refusal			DS-6	
		100	2.0	cm	Pentn.	*SPT-18	16.50-16.52 16.50
						R11	CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.BH-20

Co-ordinates E=5983.500
N=5729.500

Field Test	Nos	Samples	Nos	Commencement Date : 22/04/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	3	Completion Date : 24/04/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	13	Level Of Ground : 271.103 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.55 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES		
		EACH DIVN=7.5CM				Ref. No	Depth (m)	
17.00m <								

BORE LOG DATA SHEET

BORE HOLE NO.BH-21

Co-ordinates E=6041.000 N=5724.000

Field Test	Nos	Samples	Nos	Commencement Date : 20/04/2019
Penetrometer (SPT)	19	Undisturbed (UDS)	3	Completion Date : 22/04/2019
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	11	Level Of Ground : 271.366 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.50 m.

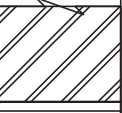
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, deep grey, to light grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	2	$\frac{7}{2}$	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		1	2	2	2	$\frac{9}{2}$	3	SPT-2	3.00-3.45
5.00m								UDS-2	4.00-4.45
		8	14	9	10	$\frac{44}{12}$	13	SPT-3	5.00-5.45
		8	12	10	13	$\frac{54}{15}$	16	*UDS-3	6.00-6.10
		8	11	12	15	$\frac{68}{20}$	21	SPT-4	6.10-6.55
Hard, reddish to yellowish grey, clayey silt to silty clay with decomposed & disintegrated rock fragments. Obs. kankar & sand mixture.		8	11	12	15	$\frac{68}{20}$	21	SPT-5	7.00-7.45
		12	15	18	18	$\frac{81}{21}$	24	SPT-6	8.00-8.45
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-21

Co-ordinates E=6041.000
N=5724.000

Field Test	Nos	Samples	Nos	Commencement Date : 20/04/2019
Penetrometer (SPT)	19	Undisturbed (UDS)	3	Completion Date : 22/04/2019
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	11	Level Of Ground : 271.366 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
Hard, reddish to yellowish grey, clayey silt to silty clay with decomposed & disintegrated rock fragments. Obs. 9.00m kankar & sand mixture.		100	3.0	cm	Pentr.	*SPT-7	8.80-8.83
		100	Refusal			*SPT-8	9.00-9.02 9.00
			2.0	cm	Pentr.	R1	CR=12% RQD=NIL
			NX. drilling from 9.00m to 25.00m				
		100	Refusal			*SPT-9	9.75-9.77 9.75
			2.0	cm	Pentr.	R2	CR=NIL RQD=NIL
		100	Refusal			DS-2 *SPT-10	10.50-10.53 10.50
			3.0	cm	Pentr.	R3	CR=NIL RQD=NIL
		100	Refusal			DS-3 *SPT-11	11.25-11.28 11.25
			3.0	cm	Pentr.	R4	CR=NIL RQD=NIL
Completely weathered, light grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	Refusal			DS-4 *SPT-12	12.00-12.03 12.00
			3.0	cm	Pentr.	R5	CR=NIL RQD=NIL
		100	Refusal			DS-5 *SPT-13	12.75-12.77 12.75
			2.0	cm	Pentr.	R6	CR=NIL RQD=NIL
		100	Refusal			DS-6 *SPT-14	13.50-13.52 13.50
			2.0	cm	Pentr.	R7	CR=NIL RQD=NIL
		100	Refusal			DS-7 *SPT-15	14.25-14.28 14.25
			3.0	cm	Pentr.	R8	CR=NIL RQD=NIL
		100	Refusal			DS-8 *SPT-16	15.00-15.03 15.00
			3.0	cm	Pentr.	R9	CR=NIL RQD=NIL
		100	Refusal			DS-9 *SPT-17	15.75-15.78 15.75
			3.0	cm	Pentr.	R10	CR=NIL RQD=NIL
		100	Refusal			DS-10 *SPT-18	16.50-16.52 16.50
			2.0	cm	Pentr.	R11	CR=NIL RQD=NIL
		17.00m					

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda

Job No : 4287

Created by : T.SAHA

Created on : 25/04/2019

Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-21

Co-ordinates

E=6041.000
N=5724.000

Field Test

Nos

Samples

Nos

Commencement Date : 20/04/2019

Completion Date : 22/04/2019

Bore Hole Diameter : 150 mm./ N.X

Level Of Ground : 271.366 M.

Water Struck At :

Standing Water Level : 1.50 m.

Penetrometer (SPT)

19

Undisturbed (UDS)

3

Cone (Pc)

Penetrometer (SPT)

19

Disturbed (DS)

11

Vane (V)

Water Sample (WS)

0

DESCRIPTION

SYMBOL

N-VALUE

EACH DIVN=7.5CM

SAMPLES

Ref. No

Depth (m)

Completely weathered, light grey, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.

17.00m

17.25m

Refusal

100

3.0 cm Pentn.

DS-11

*SPT-19

17.25-17.28

17.25

CR=23%

RQD=NIL

18.00

CR=28%

RQD=NIL

18.75

CR=23%

RQD=NIL

19.50

CR=21%

RQD=NIL

20.25

CR=27%

RQD=NIL

21.00

CR=24%

RQD=NIL

21.75

CR=25%

RQD=NIL

22.50

CR=31%

RQD=NIL

23.25

CR=28%

RQD=NIL

24.00

CR=22%

RQD=NIL

25.00

Highly weathered, brownish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.

25.00m

N.B. - '*' means sample could not be recovered.

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BH-21/Sheet-3

BORE LOG DATA SHEET

BORE HOLE NO.BH-22

Co-ordinates E=6085.000 N=5649.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 271.237 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Stiff, brownish grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	2	8	3	SPT-1	1.00-1.45
						2		UDS-1	2.00-2.45
3.05m									
Very stiff to hard, brownish grey, silty clay with high percentage of moorum.		2	3	4	4	20	7	SPT-2	3.05-3.50
						54		*UDS-2	4.00-4.08
		3	5	6	9	18	21	SPT-3	4.10-4.55
5.00m									
Dense to very dense, deep grey, sandy silt with clay binder.		4	6	7	8	38	13	SPT-4	5.00-5.45
						64		SPT-5	6.00-6.45
		4	8	10	14	17	23	SPT-6	7.00-7.45
8.00m									
Very dense, deep grey, sandy silt. Obs. decomposed rock fragments.		12	28	37	56	>100		SPT-7	8.00-8.26
						3.5 cm Pentn.		*SPT-8	8.35-8.40
		100				Refusal		*SPT-9	8.50-8.53
8.50m									
		100				5.0 cm Pentn.		R1	CR=NIL
						3.0 cm Pentn.		DS-2	RQD=NIL
						Refusal		*SPT-10	9.25-9.29
								R2	CR=NIL
						4.0 cm Pentn.		DS-3	RQD=NIL
						Refusal		*SPT-11	10.00-10.02
						2.0 cm Pentn.		R3	CR=NIL
10.50m									
						NX. drilling from 8.50m to 30.24m			

BORE LOG DATA SHEET

BORE HOLE NO.BH-22

Co-ordinates E=6085.000
N=5649.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 271.237 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
10.50m						Refusal	
		100				DS-4 *SPT-12	10.75-10.78 10.75
			3.0	cm	Pentn.	R4	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-5 *SPT-13	11.50-11.54 11.50
			4.0	cm	Pentn.	R5	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-6 *SPT-14	12.25-12.30 12.25
			5.0	cm	Pentn.	R6	CR=NIL RQD=NIL
		100				Refusal	
Completely weathered, brpownish grey, fine to medium grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100				DS-7 *SPT-15	13.00-13.04 13.00
			4.0	cm	Pentn.	R7	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-8 *SPT-16	13.75-13.78 13.75
			3.0	cm	Pentn.	R8	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-9 *SPT-17	14.50-14.52 14.50
			2.0	cm	Pentn.	R9	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-10 *SPT-18	15.25-15.28 15.25
			3.0	cm	Pentn.	R10	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-11 *SPT-19	16.00-16.04 16.00
Highly weathered, brownish grey, fine to medium grained, fractured Quartzo-feldspathic -gneiss.			4.0	cm	Pentn.	R11	CR=25% RQD=NIL
16.00m		100				Refusal	
16.75m		100				DS-12 *SPT-20	17.50-17.52 17.50
			2.0	cm	Pentn.	R12	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-13 *SPT-21	18.25-18.28 18.25
			3.0	cm	Pentn.	R13	CR=NIL RQD=NIL
		100				Refusal	
Completely weathered, brownish grey, fine to medium grained decomposed & disintegrated Quartzo-feldspathic-gneiss.		100				DS-14 *SPT-22	19.00-19.03 19.00
			3.0	cm	Pentn.	R14	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-15 *SPT-23	19.75-19.79 19.75
			4.0	cm	Pentn.	R15	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-16 *SPT-24	20.50-20.52 20.50
20.50m			2.0	cm	Pentn.	R16	CR=NIL RQD=NIL
		100				Refusal	
		100				DS-17	CR=16% RQD=NIL
21.00m		100				Refusal	

BORE LOG DATA SHEET

BORE HOLE NO.BH-22

Co-ordinates E=6085.000
N=5649.000

Field Test	Nos	Samples	Nos	Commencement Date : 26/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 271.237 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.70 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
21.00m								
Completely weathered, brownish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss		100					*SPT-25	21.25-21.26 21.25
			1.0	cm	Pentn.		R18	CR=18% RQD=NIL
								
		100					*SPT-26	22.00-22.02 22.00
Highly weathered, brownish grey to deep grey, coarse to medium grained, highly fractured Quartzo-feldspathic-gneiss			2.0	cm	Pentn.		R19	CR=18% RQD=NIL
								
		100					*SPT-27	22.75-22.76 22.75
			1.0	cm	Pentn.		R20	CR=17% RQD=NIL
23.50m								
Highly weathered, brownish grey to deep grey, coarse to medium grained, highly fractured Quartzo-feldspathic-gneiss		100					*SPT-28	23.50-23.51 23.50
			1.0	cm	Pentn.		R21	CR=25% RQD=NIL
								
							R22	CR=35% RQD=NIL
24.25m								
Highly weathered, brownish grey to deep grey, coarse to medium grained, highly fractured Quartzo-feldspathic-gneiss								24.25
								25.00
							R23	CR=38% RQD=NIL
								25.75
							R24	CR=29% RQD=NIL
								26.50
							R25	CR=27% RQD=NIL
								27.25
28.00m							R26	CR=26% RQD=NIL
Highly weathered, brownish grey to deep grey, coarse to medium grained, highly fractured Quartzo-feldspathic-gneiss								28.00
							R27	CR=23% RQD=NIL
								28.75
							R28	CR=23% RQD=NIL
30.24m								29.50
							R29	CR=22% RQD=NIL
								30.24

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-23

Co-ordinates E=6116.000
N=5765.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	2	Completion Date : 07/04/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	10	Level Of Ground : 270.907 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.90 m.

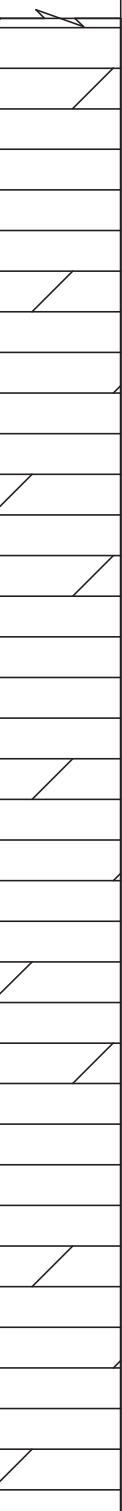
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, deep grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	6 2	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	3	3	15 4	5	SPT-2	3.00-3.45
3.50m									
Hard, brownish grey, silty clay. Obs. sand mixture & kankars.		2	3	4	8	42 12	18	*UDS-2	4.00-4.09
								SPT-3	4.09-4.54
5.00m									
Very dense, brownish grey, silty sand with gravel.		4	6	10	19	83 25	29	SPT-4	5.10-5.55
		3	8	11	12	46 10	13	SPT-5	6.10-6.55
7.00m									
Very dense, deep grey, sandy silt / silty sand with decomposed rock fragments.		8	14	16	17	73 19	21	SPT-6	7.10-7.55
		10	28	75	>100			SPT-7	7.80-7.98
8.25m									
Completely weathered, deep grey, fine to medium grained, decomposed & disintegrated / fractured Quartz-biotite-gneiss.									
10.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-23

Co-ordinates E=6116.000
N=5765.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	2	Completion Date : 07/04/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	10	Level Of Ground : 270.907 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
10.50m  Completely weathered, deep grey, fine to medium grained, decomposed & disintegrated / fractured Quartz-biotite-gneiss.	100	Refusal				*SPT-12	10.50-10.54
		4.0 cm Pentn.				R4	CR=NIL RQD=NIL
	100	Refusal				DS-5	
		3.0 cm Pentn.				*SPT-13	11.25-11.28 11.25
		Refusal				R5	CR=NIL RQD=NIL
	100	Refusal				DS-6	
		2.0 cm Pentn.				*SPT-14	12.00-12.02 12.00
		Refusal				R6	CR=NIL RQD=NIL
	100	Refusal				DS-7	
		2.0 cm Pentn.				*SPT-15	12.75-12.77 12.75
		Refusal				R7	CR=NIL RQD=NIL
	100	Refusal				DS-8	
		3.0 cm Pentn.				*SPT-16	13.50-13.53 13.50
		Refusal				R8	CR=08% RQD=NIL
	100	Refusal				*SPT-17	14.25-14.28 14.25
		3.0 cm Pentn.				R9	CR=12% RQD=NIL
	100	Refusal				*SPT-18	15.00-15.03 15.00
		3.0 cm Pentn.				R10	CR=07% RQD=NIL
	100	Refusal				*SPT-19	15.75-15.78 15.75
		3.0 cm Pentn.				R11	CR=NIL RQD=NIL
	100	Refusal				DS-9	
		4.0 cm Pentn.				*SPT-20	16.50-16.54 16.50
		Refusal				R12	CR=NIL RQD=NIL
	100	Refusal				DS-10	
		3.0 cm Pentn.				*SPT-21	17.25-17.28 17.25
		Refusal				R13	CR=10% RQD=NIL
	100	Refusal				*SPT-22	18.00-18.02 18.00
		2.0 cm Pentn.				R14	CR=14% RQD=NIL
	100	Refusal				*SPT-23	18.75-18.77 18.75
		2.0 cm Pentn.				R15	CR=09% RQD=NIL
	100	Refusal				*SPT-24	19.50-19.52 19.50
		2.0 cm Pentn.				R16	CR=11% RQD=NIL
	100	Refusal				*SPT-25	20.25-20.27 20.25
		2.0 cm Pentn.				R17	CR=14% RQD=NIL
20.25m	100	Refusal					
21.00m							21.00

BORE LOG DATA SHEET

BORE HOLE NO.BH-23

Co-ordinates E=6116.000
N=5765.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	32	Undisturbed (UDS)	2	Completion Date : 07/04/2019
Cone (Pc)		Penetrometer (SPT)	32	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	10	Level Of Ground : 270.907 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.90 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES		
		EACH DIVN=7.5CM				Ref. No	Depth (m)	
21.00m		100	Refusal			*SPT-26	21.00-21.02	
			2.0 cm Pentn.			R18	CR=13% RQD=NIL	
		100	Refusal			*SPT-27	21.75-21.76	
			1.0 cm Pentn.			R19	CR=12% RQD=NIL	
		100	Refusal			*SPT-28	22.50-22.51	
			1.0 cm Pentn.			R20	CR=14% RQD=NIL	
		100	Refusal			*SPT-29	23.25-23.26	
			1.0 cm Pentn.			R21	CR=15% RQD=NIL	
		100	Refusal			*SPT-30	24.00-24.01	
			1.0 cm Pentn.			R22	CR=17% RQD=NIL	
Completely weathered, deep grey to greyish coarse to medium grained, highly fractured Quartz-biotite-gneiss.		100	Refusal			*SPT-31	24.75-24.76	
			1.0 cm Pentn.			R23	CR=18% RQD=NIL	
		100	Refusal			*SPT-32	25.50-25.52	
			2.0 cm Pentn.			R24	CR=25% RQD=NIL	
						R25	CR=29% RQD=NIL	
						R26	CR=25% RQD=NIL	
						R27	CR=22% RQD=NIL	
						R28	CR=25% RQD=NIL	
						R29	CR=38% RQD=NIL	
25.50m								
Highly weathered, greyish to blackish grey, coarse to medium grained, highly fractured Quartz-biotite-gneiss.								
30.07m								
N.B. — ‘*’ means sample could not be recovered.								

N.B. - '*' means sample could not be recovered.

Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda Astexure-B **CETEST**

Job No : 4287 Created by : T.SAHA Created on : 12/04/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.BH-24

Co-ordinates E=6251.000
N=5712.000

Field Test	Nos	Samples	Nos	Commencement Date : 29/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	4	Completion Date : 02/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.950 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.60 m.

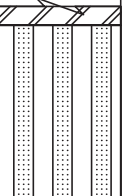
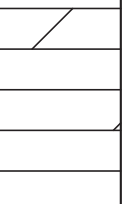
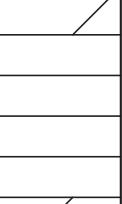
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium, brownish grey, silty clay. Obs. kankars.		1	1	1	1	$\frac{6}{2}$	2	DS-1	0.50
								SPT-1	1.00-1.45
2.00m									
								UDS-1	2.00-2.45
		1	1	2	2	$\frac{9}{3}$	2	SPT-2	3.00-3.45
Stiff, light grey, silty clay. Obs. kankar & black patches.								UDS-2	4.00-4.45
		2	2	3	3	$\frac{14}{4}$	4	SPT-3	5.00-5.45
6.00m									
								UDS-3	6.00-6.45
		2	3	4	6	$\frac{30}{9}$	11	SPT-4	7.00-7.45
Very stiff, reddish grey, clayey silt / silty clay. Obs. kankar & gravel.									
								*UDS-4	8.00-8.45
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-24

Co-ordinates E=6251.000
N=5712.000

Field Test	Nos	Samples	Nos	Commencement Date : 29/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	4	Completion Date : 02/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.950 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.60 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
Very stiff, reddish grey, clayey silt / silty clay. Obs. kankar & gravel.		2	3	3	3	15	SPT-5	8.60-9.05
Medium dense, yellowish brown, sandy silt. Obs. kankars & clay binder.		100	4.0	Refusal	cm	Pentn.	*SPT-6	9.30-9.34
		100	Refusal	Refusal	Refusal	Refusal	*SPT-7	9.50-9.53 9.50
			3.0	cm	Pentn.	NX. drilling from 9.50m to 25.20m	R1	CR=18% RQD=NIL
		100	2.0	cm	Pentn.	Refusal	*SPT-8	10.25-10.27 10.25
			Refusal	Refusal	Refusal	Refusal	R2	CR=NIL RQD=NIL
Completely weathered, yellowish brown to brownish grey, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	3.0	cm	Pentn.	Refusal	DS-2 *SPT-9	11.00-11.03 11.00
			Refusal	Refusal	Refusal	Refusal	R3	CR=NIL RQD=NIL
		100	2.0	cm	Pentn.	Refusal	DS-3 *SPT-10	11.75-11.77 11.75
			Refusal	Refusal	Refusal	Refusal	R4	CR=NIL RQD=NIL
		100	2.0	cm	Pentn.	Refusal	DS-4 *SPT-11	12.50-12.52 12.50
			Refusal	Refusal	Refusal	Refusal	R5	CR=NIL RQD=NIL
		100	2.0	cm	Pentn.	Refusal	DS-5 *SPT-12	13.25-13.27 13.25
			Refusal	Refusal	Refusal	Refusal	R6	CR=12% RQD=NIL
		100	1.0	cm	Pentn.	Refusal	*SPT-13	14.00-14.01 14.00
			Refusal	Refusal	Refusal	Refusal	R7	CR=18% RQD=NIL
		100	2.0	cm	Pentn.	Refusal	*SPT-14	14.75-14.77 14.75
			Refusal	Refusal	Refusal	Refusal	R8	CR=18% RQD=NIL
Completely weathered, pinkish grey to light grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.		100	2.0	cm	Pentn.	Refusal	*SPT-15	15.50-15.52 15.50
			Refusal	Refusal	Refusal	Refusal	R9	CR=13% RQD=NIL
		100	2.0	cm	Pentn.	Refusal	*SPT-16	16.25-16.27 16.25
			Refusal	Refusal	Refusal	Refusal	R10	CR=17% RQD=NIL
		100	2.0	cm	Pentn.	Refusal		17.00

BORE LOG DATA SHEET

BORE HOLE NO.BH-24

Co-ordinates E=6251.000
N=5712.000

Field Test	Nos	Samples	Nos	Commencement Date : 29/03/2019
Penetrometer (SPT)	20	Undisturbed (UDS)	4	Completion Date : 02/04/2019
Cone (Pc)		Penetrometer (SPT)	20	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	5	Level Of Ground : 270.950 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.60 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
17.00m Completely weathered, pinkish grey to light grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.		100	Refusal				*SPT-17	17.00-17.03
		3.0	cm	Pentn.			R11	CR=18% RQD=NIL
		100	Refusal				*SPT-18	17.75-17.78 17.75
		3.0	cm	Pentn.			R12	CR=17% RQD=NIL
Completely weathered, light grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.		100	Refusal				*SPT-19	18.50-18.52 18.50
		2.0	cm	Pentn.			R13	CR=19% RQD=NIL
		100	Refusal				*SPT-20	19.25-19.28 19.25
19.25m		3.0	cm	Pentn.			R14	CR=32% RQD=NIL
							R15	CR=39% RQD=26%
							R16	CR=32% RQD=NIL
							R17	CR=36% RQD=NIL
							R18	CR=32% RQD=NIL
							R19	CR=28% RQD=NIL
							R20	CR=27% RQD=NIL
							R21	CR=25% RQD=NIL
25.20m N.B. - '*' means sample could not be recovered.								25.20

BORE LOG DATA SHEET

BORE HOLE NO.BH-25

Co-ordinates E=6318.000
N=5727.000

Field Test	Nos	Samples	Nos	Commencement Date : 22/04/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	2	Completion Date : 25/04/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	7	Level Of Ground : 270.184 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.50 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
17.00m		100	Refusal			*SPT-17	17.00-17.02
		2.0	cm Pentn.			R13	CR=15% RQD=NIL
Completely weathered, light pinkish grey, medium to fine grained, highly fractured Quartzo-feldspathic-gneiss		100	Refusal			*SPT-18	17.75-17.78 17.75
		3.0	cm Pentn.			R14	CR=15% RQD=NIL
18.50m		100	Refusal			*SPT-19	18.50-18.52 18.50
		2.0	cm Pentn.			R15	CR=14% RQD=NIL
		100	Refusal			*SPT-20	19.25-19.28 19.25
		3.0	cm Pentn.			R16	CR=12% RQD=NIL
Completely weathered, yellowish grey, fine grained, highly fractured Quartzo-feldspathic-gneiss		100	Refusal			SPT-21	20.00-20.03 20.00
		3.0	cm Pentn.			R17	CR=14% RQD=NIL
		100	Refusal			*SPT-22	20.75-20.77 20.75
		2.0	cm Pentn.			R18	CR=15% RQD=NIL
21.50m		100	Refusal			*SPT-23	21.50-21.52 21.50
Completely weathered, blackish grey, fine grained, fractured Quartzo-feldspathic-gneiss		2.0	cm Pentn.			R19	CR=14% RQD=NIL
		100	Refusal			*SPT-24	22.25-22.27 22.25
22.25m		2.0	cm Pentn.			R20	CR=15% RQD=NIL
		100	Refusal			*SPT-25	23.00-23.03 23.00
Completely to highly weathered, whitish grey to yellowish grey, fine grained, fractured Quartzo-feldspathic-gneiss		3.0	cm Pentn.			R21	CR=15% RQD=NIL
		100	Refusal			*SPT-26	23.75-23.79 23.75
		4.0	cm Pentn.			R22	CR=17% RQD=NIL
24.50m		100	Refusal			*SPT-27	24.50-24.53 24.50
Moderately weathered, whitish grey to yellowish grey, fine grained, fractured Quartzo-feldspathic-gneiss.		3.0	cm Pentn.			R23	CR=46% RQD=NIL
25.00m							25.00

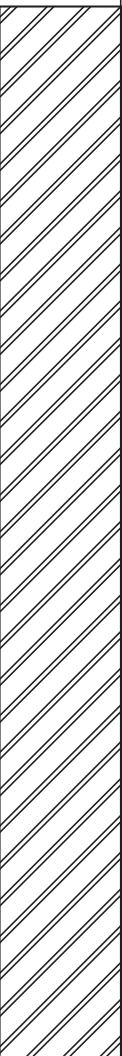
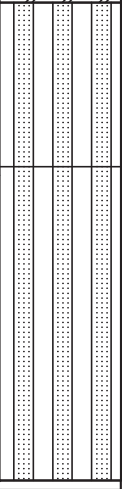
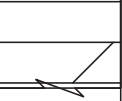
N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.BH-26

Co-ordinates E=6274.000
N=5500.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	16	Undisturbed (UDS)	3	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	16	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 269.126 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
								DS-1	0.50
		1	1	1	1	5	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	2	2	10	3	SPT-2	3.00-3.45
								*UDS-2	4.00-4.45
		3	2	2	1	7	2	SPT-3	4.60-5.05
5.50m		5	4	5	6	27	8	SPT-4	5.50-5.95
								*UDS-3	6.00-6.12
6.12m		6	7	10	11	44	12	SPT-5	6.12-6.57
		12	15	13	18	77	25	SPT-6	7.00-7.45
		36	64			>100		SPT-7	7.60-7.70
						2.5 cm Pentn.			
						Refusal			
		100				4.0 cm Pentn.		*SPT-8	7.90-7.94
8.00m		100				Refusal		*SPT-9	8.00-8.03 8.00
						3.0 cm Pentn.			
						NX. drilling from 8.00m to 25.00m		R1	CR=NIL RQD=NIL
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO.BH-26

Co-ordinates E=6274.000
N=5500.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	16	Undisturbed (UDS)	3	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	16	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 269.126 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
8.50m		100	Refusal			DS-2 *SPT-10	8.75
		2.0	cm	Pentr.		R2	CR=NIL RQD=NIL
		100	Refusal			DS-3 *SPT-11	9.50
		2.0	cm	Pentr.		R3	CR=NIL RQD=NIL
Completely weathered, brownish grey to yellowish brown, medium to fine grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	Refusal			DS-4 *SPT-12	10.25
		3.0	cm	Pentr.		R4	CR=NIL RQD=NIL
		100	Refusal			DS-5 *SPT-13	11.00
		2.0	cm	Pentr.		R5	CR=17% RQD=NIL
11.75m		100	Refusal			*SPT-14	11.75
Completely weathered, blackish, medium to fine grained, fractured Quartzo-feldspathic-gneiss		2.0	cm	Pentr.		R6	CR=18% RQD=NIL
12.50m		100	Refusal			*SPT-15	12.50
Highly weathered, yellowish brown, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		2.0	cm	Pentr.		R7	CR=28% RQD=NIL
						R8	CR=37% RQD=NIL
						R9	CR=31% RQD=NIL
14.75m			Refusal			DS-6 *SPT-16	14.75
Completely weathered, light grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100				R10	CR=NIL RQD=NIL
15.50m		2.0	cm	Pentr.		R11	CR=21% RQD=NIL
Highly weathered, pinkish grey, medium to fine grained, fractured Granite gneiss.						R12	CR=33% RQD=NIL
16.25m							16.25
Highly weathered, pinkish grey, medium to fine grained, fractured Granite gneiss.							17.00
17.00m							

BORE LOG DATA SHEET

BORE HOLE NO.BH-26

Co-ordinates E=6274.000
N=5500.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	16	Undisturbed (UDS)	3	Completion Date : 28/03/2019
Cone (Pc)		Penetrometer (SPT)	16	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	6	Level Of Ground : 269.126 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
17.00m Highly weathered, pinkish grey, medium to fine grained, fractured Granite gneiss.								R13	CR=32% RQD=NIL
17.75m								R14	CR=40% RQD=NIL
								R15	CR=39% RQD=13%
								R16	CR=32% RQD=NIL
								R17	CR=24% RQD=NIL
								R18	CR=39% RQD=NIL
Highly weathered, blackish grey to pinkish grey, medium to fine grained, fractured Granite gneiss.								R19	CR=28% RQD=NIL
								R20	CR=28% RQD=NIL
								R21	CR=27% RQD=NIL
								R22	CR=31% RQD=NIL
								R23	CR=34% RQD=NIL
25.00m									

N.B. — '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.IBH-01

Co-ordinates E=6255.000 N=5210.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	2	Completion Date : 26/03/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	12	Level Of Ground : 269.397 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.70 m.

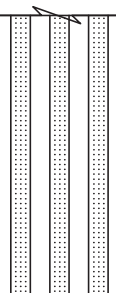
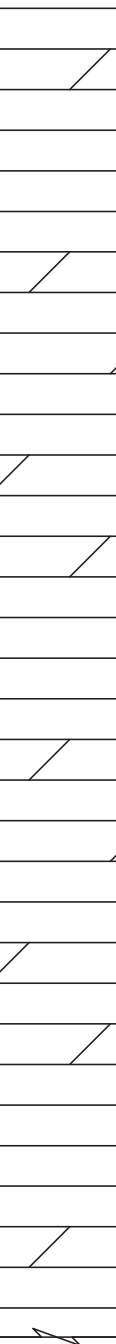
DESCRIPTION	SYMBOL	N-VALUE							SAMPLES	
		EACH DIVN=7.5CM							Ref. No	Depth (m)
0.00m										
Medium to stiff, brownish grey, silty clay. Obs. kankars.									DS-1	0.50
		1	1	1	1	6	2		SPT-1	1.00-1.45
									UDS-1	2.00-2.45
Hard, light grey, clayey silt / silty clay. Obs. kankars & gravel.		1	2	2	3	14	4	5	SPT-2	3.00-3.45
		2	4	8	11	43	10	14	*UDS-2	4.00-4.10
									SPT-3	4.10-4.55
Hard, reddish brown, clayey silt with kankars & traces of gravel.		3	6	7	10	44	11	16	SPT-4	5.00-5.45
		4	5	8	12	58	16	22	SPT-5	6.00-6.45
Very dense, greyish brown, clayey sandy silt with decomposed rock fragments. Obs. kankars.		6	8	11	13	67	18	25	SPT-6	7.00-7.45
		7	9	12	13	69	18	26	SPT-7	8.00-8.45
8.50m										

BORE LOG DATA SHEET

BORE HOLE NO. IBH-01

Co-ordinates E=6255.000
N=5210.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	2	Completion Date : 26/03/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	12	Level Of Ground : 269.397 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.70 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES				
		EACH DIVN=7.5CM					Ref. No	Depth (m)			
Very dense, greyish brown, clayey sandy silt with decomposed rock fragments. Obs. kankars.		8.50m	7	10	14	18	25	30	SPT-8	9.00-9.45	
Completely weathered, dark grey, medium grained, decomposed and disintegrated Quartzo-feldspathic -gneiss.		10.00m	15	28	37	52	2.5 cm Pentn. Refusal			SPT-9	9.55-9.80
			100	5.0	cm Pentn. Refusal			*SPT-10	9.90-9.95		
			100	Refusal				*SPT-11	10.00-10.04 10.00		
			100	4.0	cm Pentn. NX. drilling from 10.00m to 25.10m			R1	CR=NIL RQD=NIL		
			100	Refusal				DS-2			
			100	5.0	cm Pentn.			*SPT-12	10.75-10.80 10.75		
			100	Refusal				R2	CR=NIL RQD=NIL		
			100	5.0	cm Pentn.			DS-3			
			100	Refusal				*SPT-13	11.50-11.55 11.50		
			100	5.0	cm Pentn.			R3	CR=NIL RQD=NIL		
			100	Refusal				DS-4			
			100	4.0	cm Pentn.			*SPT-14	12.25-12.29 12.25		
			100	Refusal				R4	CR=NIL RQD=NIL		
			100	4.0	cm Pentn.			DS-5			
			100	4.0	cm Pentn.			*SPT-15	13.00-13.04 13.00		
			100	Refusal				R5	CR=NIL RQD=NIL		
			100	3.0	cm Pentn.			DS-6			
			100	Refusal				*SPT-16	13.75-13.78 13.75		
			100	2.0	cm Pentn.			R6	CR=NIL RQD=NIL		
			100	Refusal				DS-7			
	100	2.0	cm Pentn.			*SPT-17	14.50-14.52 14.50				
	100	Refusal				R7	CR=NIL RQD=NIL				
	100	2.0	cm Pentn.			DS-8					
	100	2.0	cm Pentn.			*SPT-18	15.25-15.27 15.25				
	100	Refusal				R8	CR=NIL RQD=NIL				
	100	3.0	cm Pentn.			DS-9					
	100	Refusal				*SPT-19	16.00-16.03 16.00				
	100	2.0	cm Pentn.			R9	CR=NIL RQD=NIL				
	100	Refusal				DS-10					
	100	2.0	cm Pentn.			*SPT-20	16.75-16.77 16.75				
	17.00m										

Job No : 4287 Created by : T.SAHA Created on : 12/04/2019 Sheet No:

BORE LOG DATA SHEET

BORE HOLE NO.IBH-01

Co-ordinates E=6255.000
N=5210.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	22	Undisturbed (UDS)	2	Completion Date : 26/03/2019
Cone (Pc)		Penetrometer (SPT)	22	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	12	Level Of Ground : 269.397 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.70 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
17.00m Completely weathered, dark grey, medium grained, decomposed and disintegrated Quartzo-feldspathic -gneiss.								R10 DS-11 *SPT-21	CR=NIL RQD=NIL 17.50-17.53 17.50
		100	3.0	cm	Pertn.			R11 DS-12 *SPT-22	CR=NIL RQD=NIL 18.25-18.29 18.25
18.25m		100	4.0	cm	Pertn.			R12	CR=21% RQD=NIL 19.00
								R13	CR=25% RQD=NIL 19.75
								R14	CR=25% RQD=NIL 20.50
								R15	CR=30% RQD=16% 21.25
								R16	CR=25% RQD=NIL 22.00
								R17	CR=22% RQD=NIL 22.75
								R18	CR=21% RQD=NIL 23.50
								R19	CR=26% RQD=NIL 24.25
								R20	CR=25% RQD=NIL 25.10
25.10m N.B. - '*' means sample could not be recovered.									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-02

Co-ordinates E=6270.000
N=5236.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 23/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 268.990 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 0.95 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, light grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	2	2	2	WS-1 SPT-1	0.95 1.00-1.45
								UDS-1	2.00-2.45
		2	2	3	3	3	4	SPT-2	3.00-3.45
4.00m									
Hard, light grey, silty clay / clayey silt. Obs. kankars & gravel.		3	5	8	9	7	15	*UDS-2 SPT-3	4.00-4.12 4.12-4.57
		6	7	8	10	10	10	SPT-4	5.00-5.45
6.00m									
Dense, light grey to brownish grey, clayey sandy silt with decomposed rock fragments. Obs. kankars & gravel.		5	7	7	9	11	10	SPT-5	6.00-6.45
		5	5	5	8	15	22	SPT-6	7.00-7.45
7.00m									
Hard, brownish grey, clayey silt with sand mixture.		18	30	52				SPT-7	8.00-8.20
		100		5.0 cm	Pentn.			*SPT-8	8.40-8.44
		100		4.0 cm	Pentn.			*SPT-9	8.50-8.52
8.50m									
Completely weathered, pinkish brown, medium to coarse grained, decomposed & disintegrated Granite gneiss.		100		2.0 cm	Pentn.			R1 DS-2	CR=NIL RQD=NIL
		100		2.0 cm	Pentn.			*SPT-10	9.25-9.27
		100		2.0 cm	Pentn.			R2 DS-3	CR=NIL RQD=NIL
		100		3.0 cm	Pentn.			*SPT-11	10.00-10.03
10.75m									
Highly weathered, pinkish brown, fine to medium grained highly fractured Granite gneiss.		100		2.0 cm	Pentn.			R3 DS-4	CR=NIL RQD=NIL
		100		2.0 cm	Pentn.			*SPT-12	10.75-10.77
11.50m									
		100		3.0 cm	Pentn.			R4 *SPT-13	CR=13% RQD=NIL
								R5	CR=NIL RQD=NIL
12.00m									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-02

Co-ordinates E=6270.000
N=5236.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 23/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 268.990 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.95 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
12.00m Completely weathered, pinkish brown, medium to fine grained, decomposed & disintegrated Granite gneiss.		100	Refusal			DS-5 *SPT-14	12.25-12.28 12.25
		3.0	cm Pentn.			R6 DS-6 *SPT-15	CR=NIL RQD=NIL 13.00-13.05 13.00
13.00m Completely to highly weathered, pinkish brown, fine to medium grained, fractured Granite gneiss.		100	Refusal			R7 *SPT-16	CR=16% RQD=NIL 13.75-13.79 13.75
		4.0	cm Pentn.			R8 *SPT-17	CR=16% RQD=NIL 14.50-14.53 14.50
		3.0	cm Pentn.			R9 *SPT-18	CR=07% RQD=NIL 15.25-15.29 15.25
15.25m Completely weathered, pinkish brown, fine to medium grained, decomposed & disintegrated Granite gneiss.		100	Refusal			R10 DS-7 *SPT-19	CR=NIL RQD=NIL 16.00-16.04 16.00
		4.0	cm Pentn.			R11 DS-8 *SPT-20	CR=NIL RQD=NIL 16.75-16.80 16.75
		5.0	cm Pentn.			R12 DS-9 *SPT-21	CR=NIL RQD=NIL 17.50-17.54 17.50
		4.0	cm Pentn.			R13 DS-10 *SPT-22	CR=NIL RQD=NIL 18.25-18.29 18.25
		4.0	cm Pentn.			R14 DS-11 *SPT-23	CR=NIL RQD=NIL 19.00-19.05 19.00
		5.0	cm Pentn.			R15 DS-12 *SPT-24	CR=NIL RQD=NIL 19.75-19.78 19.75
		3.0	cm Pentn.			R16 DS-13 *SPT-25	CR=NIL RQD=NIL 20.50-20.54 20.50
		4.0	cm Pentn.			R17 DS-14 *SPT-26	CR=NIL RQD=NIL 21.25-21.29 21.25
		4.0	cm Pentn.			R18 DS-15 *SPT-27	CR=NIL RQD=NIL 22.00-22.05 22.00
		5.0	cm Pentn.			R19 *SPT-28	CR=18% RQD=NIL 22.75-22.78 22.75
22.75m Highly weathered, pinkish brown to brownish grey, fine to medium grained, highly fractured Granite gneiss.		100	Refusal			R20	CR=23% RQD=NIL 23.50
24.00m						R21	CR=23% RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO. IBH-02

Co-ordinates E=6270.000
N=5236.000

Field Test	Nos	Samples	Nos	Commencement Date : 18/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 23/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 268.990 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.95 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
24.00m Highly weathered, pinkish brown to brownish grey, fine to medium grained, highly fractured Granite gneiss.								R22	24.25
								R23	25.00
								R24	25.75
								R25	26.50
								R26	27.25
								R27	28.00
								R28	28.75
								R29	29.50
								R30	30.25
								R31	31.00
30.25m Highly weathered, brownish grey to greyish black, fine to medium grained, highly fractured Granite gneiss.								R32	31.75
								R33	32.50
								R34	33.25
32.50m Moderately to slightly weathered, greyish black medium to fine grained, fractured Granite gneiss.								R35	34.00
35.00m N.B. - '*' means sample could not be recovered.									35.00

BORE LOG DATA SHEET

BORE HOLE NO.IBH-03

Co-ordinates E=6256.000 N=5276.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/03/2019
Penetrometer (SPT)	24	Undisturbed (UDS)	2	Completion Date : 24/03/2019
Cone (Pc)		Penetrometer (SPT)	24	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	18	Level Of Ground : 269.276 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Stiff, brownish grey, silty clay with kankars.								DS-1	0.50
		1	1	1	2	8	3	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	3	3	13	4	SPT-2	3.00-3.45
								*UDS-2	4.00-4.10
4.00m		6	10	12	14	59	17	SPT-3	4.10-4.55
Very dense, yellowish brown, silty sand with gravel, kankars & decomposed rock fragments.		10	12	14	16	70	24	SPT-4	5.00-5.45
5.80m		18	33	51		>100		SPT-5	5.80-6.00
Very dense, yellowish brown, clayey sandy silt with kankars & gravel. Obs. decomposed rock fragments.									
6.30m									
Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.									
8.50m									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-03

Co-ordinates E=6256.000
N=5276.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/03/2019
Penetrometer (SPT)	24	Undisturbed (UDS)	2	Completion Date : 24/03/2019
Cone (Pc)		Penetrometer (SPT)	24	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	18	Level Of Ground : 269.276 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH DIVN=7.5CM			Ref. No	Depth (m)
8.50m Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.	100	Refusal	DS-4	*SPT-10	8.55-8.58	8.55
		3.0 cm Pentr.	R4		CR=NIL RQD=NIL	
	100	Refusal	DS-5	*SPT-11	9.30-9.32	9.30
		2.0 cm Pentr.	R5		CR=NIL RQD=NIL	
	100	Refusal	DS-6	*SPT-12	10.05-10.07	10.05
		2.0 cm Pentr.	R6		CR=NIL RQD=NIL	
	100	Refusal	DS-7	*SPT-13	10.80-10.82	10.80
		2.0 cm Pentr.	R7		CR=NIL RQD=NIL	
	100	Refusal	DS-8	*SPT-14	11.55-11.58	11.55
		3.0 cm Pentr.	R8		CR=NIL RQD=NIL	
	100	Refusal	DS-9	*SPT-15	12.30-12.33	12.30
		3.0 cm Pentr.	R9		CR=NIL RQD=NIL	
	100	Refusal	DS-10	*SPT-16	13.05-13.07	13.05
		2.0 cm Pentr.	R10		CR=NIL RQD=NIL	
	100	Refusal	DS-11	*SPT-17	13.80-13.83	13.80
		3.0 cm Pentr.	R11		CR=NIL RQD=NIL	
	100	Refusal	DS-12	*SPT-18	14.55-14.57	14.55
		2.0 cm Pentr.	R12		CR=NIL RQD=NIL	
	100	Refusal	DS-13	*SPT-19	15.30-15.33	15.30
		3.0 cm Pentr.	R13		CR=NIL RQD=NIL	
	100	Refusal	DS-14	*SPT-20	16.05-16.07	16.05
		2.0 cm Pentr.	R14		CR=NIL RQD=NIL	
	100	Refusal	DS-15	*SPT-21	16.80-16.83	16.80
		3.0 cm Pentr.				
17.00m						

BORE LOG DATA SHEET

BORE HOLE NO. IBH-03

Co-ordinates E=6256.000
N=5276.000

Field Test	Nos	Samples	Nos	Commencement Date : 17/03/2019
Penetrometer (SPT)	24	Undisturbed (UDS)	2	Completion Date : 24/03/2019
Cone (Pc)		Penetrometer (SPT)	24	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	18	Level Of Ground : 269.276 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.60 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
17.00m Completely weathered, light pinkish grey, coarse grained, decomposed and disintegrated Quartzo-feldspathic-gneiss. 17.55m								R15 DS-16 *SPT-22	CR=NIL RQD=NIL 17.55-17.58 17.55
								R16	CR=28% RQD=NIL 18.30
								R17	CR=24% RQD=NIL 19.05
								R18	CR=29% RQD=NIL 19.80
								R19	CR=22% RQD=NIL 20.55
								R20	CR=23% RQD=NIL 21.30
								R21	CR=22% RQD=NIL 22.05
								R22	CR=21% RQD=NIL 22.80
22.80m Highly weathered, light pinkish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.								R23 DS-17 *SPT-23	CR=NIL RQD=NIL 23.55-23.57 23.55
								R24	CR=NIL RQD=NIL 24.30
								R25	CR=22% RQD=NIL 25.33
25.33m Completely to highly weathered, light pinkish grey, medium to coarse grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.									
N.B. - '*' means sample could not be recovered.									

BORE LOG DATA SHEET

BORE HOLE NO.IBH-04

Co-ordinates E=6260.000 N=5355.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 17/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 269.130 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium, brownish grey, silty clay with calcareous nodules & kankars.								DS-1	0.50
		1	1	1	1	6	2	SPT-1	1.00-1.45
						23	7		
3.00m									
		3	4	4	6	6	7	SPT-2	3.00-3.45
						64			
4.55m									
		6	12	14	16	16	18	SPT-3	4.10-4.55
						96			
Very dense, yellowish brown, silty sand with gravel & kankars. Obs. decomposed rock fragments.									
		9	18	20	22	24	30	SPT-4	5.00-5.45
						>100			
7.00m									
		6	16	18	24	30	33	SPT-5	6.00-6.45
						36			
Dense to very dense, whitish grey to pinkish grey, silty sand with decomposed rock fragments.									
		4	5	6	8	10	12	SPT-6	7.00-7.45
						>100			
8.30m									
		10	29	40	45	50		SPT-7	7.80-8.15
						5.0 cm Pentn.			
8.50m									
		100				Refusal		*SPT-8	8.20-8.23
						3.0 cm Pentn.			
		100				Refusal		*SPT-9	8.30-8.33 8.30
						3.0 cm Pentn.			

BORE LOG DATA SHEET

BORE HOLE NO. IBH-04

Co-ordinates E=6260.000
N=5355.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 17/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 269.130 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.40 m.

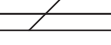
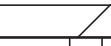
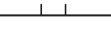
DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH DIVN=7.5CM			Ref. No	Depth (m)
8.50m Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss. 17.00m		NX. drilling from 8.30m to 25.00m			R1	CR=NIL RQD=NIL
		Refusal			DS-2 *SPT-10	9.00-9.02 9.00
		2.0 cm Pentn.			R2	CR=NIL RQD=NIL
		Refusal			DS-3 *SPT-11	9.75-9.78 9.75
		3.0 cm Pentn.			R3	CR=NIL RQD=NIL
		Refusal			DS-4 *SPT-12	10.50-10.53 10.50
		3.0 cm Pentn.			R4	CR=NIL RQD=NIL
		Refusal			DS-5 *SPT-13	11.25-11.27 11.25
		2.0 cm Pentn.			R5	CR=NIL RQD=NIL
		Refusal			DS-6 *SPT-14	12.00-12.02 12.00
		2.0 cm Pentn.			R6	CR=NIL RQD=NIL
		Refusal			DS-7 *SPT-15	12.75-12.77 12.75
		2.0 cm Pentn.			R7	CR=NIL RQD=NIL
		Refusal			DS-8 *SPT-16	13.50-13.52 13.50
		2.0 cm Pentn.			R8	CR=NIL RQD=NIL
		Refusal			DS-9 *SPT-17	14.25-14.28 14.25
		3.0 cm Pentn.			R9	CR=NIL RQD=NIL
		Refusal			DS-10 *SPT-18	15.00-15.03 15.00
		3.0 cm Pentn.			R10	CR=NIL RQD=NIL
		Refusal			DS-11 *SPT-19	15.75-15.77 15.75
		2.0 cm Pentn.			R11	CR=NIL RQD=NIL
		Refusal			DS-12 *SPT-20	16.50-16.53 16.50
		3.0 cm Pentn.			R12	CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO. IBH-04

Co-ordinates E=6260.000
N=5355.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	28	Undisturbed (UDS)	2	Completion Date : 17/03/2019
Cone (Pc)		Penetrometer (SPT)	28	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	16	Level Of Ground : 269.130 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE					SAMPLES	
		EACH DIVN=7.5CM					Ref. No	Depth (m)
17.00m Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.		100	2.0	cm	Pentn.	Refusal	DS-13 *SPT-21	17.25-17.27 17.25
							R13	CR=NIL RQD=NIL
							DS-14 *SPT-22	18.00-18.03 18.00
							R14	CR=NIL RQD=NIL
							DS-15 *SPT-23	18.75-18.77 18.75
							R15	CR=NIL RQD=NIL
							DS-16 *SPT-24	19.50-19.53 19.50
							R16	CR=04% RQD=NIL
							*SPT-25	20.25-20.26 20.25
							R17	CR=NIL RQD=NIL
21.00m Highly weathered, light pinkish grey, coarse grained, fractured Quartzo-feldspathic-gneiss.		100	3.0	cm	Pentn.	Refusal	*SPT-26	21.00-21.03 21.00
							R18	CR=19% RQD=NIL
							*SPT-27	21.75-21.77 21.75
22.50m Highly weathered, light pinkish grey, coarse grained, fractured Quartzo-feldspathic-gneiss.		100	3.0	cm	Pentn.	Refusal	*SPT-28	22.50-22.53 22.50
							R20	CR=32% RQD=NIL
							R21	CR=28% RQD=NIL
							R22	CR=33% RQD=NIL
25.00m N.B. - '*' means sample could not be recovered.								

BORE LOG DATA SHEET

BORE HOLE NO. IBH-05

Co-ordinates E=6252.000
N=5394.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	29	Undisturbed (UDS)	2	Completion Date : 20/03/2019
Cone (Pc)		Penetrometer (SPT)	29	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 269.359 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.80 m.

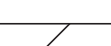
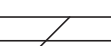
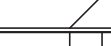
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, light grey, silty clay. Obs. kankars.								DS-1	0.50
								WS-1	0.80
								SPT-1	1.00-1.45
3.45m									
Hard, light grey to yellowish grey, clayey silt. Obs. kankars & gravel.								UDS-1	2.00-2.45
								SPT-2	3.00-3.45
								*UDS-2	4.00-4.10
								SPT-3	4.10-4.55
5.00m									
Very dense, yellowish brown, clayey sandy silt with decomposed rock fragments. Obs. kankars & gravel.								SPT-4	5.00-5.45
								SPT-5	6.00-6.45
								SPT-6	7.00-7.45
								SPT-7	8.00-8.20
								*SPT-8	8.40-8.43
8.50m								*SPT-9	8.50-8.52 8.50
Completely weathered, brownish grey, medium to coarse grained, decomposed & disintegrated Granite gneiss.								R1	CR=NIL RQD=NIL
								DS-2	
								*SPT-10	9.25-9.28 9.25
								R2	CR=NIL RQD=NIL
								DS-3	
								*SPT-11	10.00-10.03 10.00
								R3	CR=NIL RQD=NIL
								DS-4	
								*SPT-12	10.75-10.77 10.75
								R4	CR=NIL RQD=NIL
								DS-5	
								*SPT-13	11.50-11.52 11.50
								R5	CR=NIL RQD=NIL
12.00m									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-05

Co-ordinates E=6252.000
N=5394.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	29	Undisturbed (UDS)	2	Completion Date : 20/03/2019
Cone (Pc)		Penetrometer (SPT)	29	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 269.359 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 0.80 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
12.00m Completely weathered, brownish grey, medium to coarse grained, decomposed & disintegrated Granite gneiss.		100	2.0	cm	Pentn.	Refusal	DS-6 *SPT-14 12.25-12.27 12.25
						Refusal	R6 DS-7 *SPT-15 13.00-13.03 13.00
						Refusal	R7 DS-8 *SPT-16 13.75-13.77 13.75
						Refusal	R8 DS-9 *SPT-17 14.50-14.53 14.50
						Refusal	R9 DS-10 *SPT-18 15.25-15.27 15.25
						Refusal	R10 DS-11 *SPT-19 16.00-16.02 16.00
						Refusal	R11 DS-12 *SPT-20 16.75-16.77 16.75
						Refusal	R12 CR=11% RQD=NIL
						Refusal	*SPT-21 17.50-17.52 17.50
						Refusal	R13 CR=16% RQD=NIL
16.75m Highly weathered, pinkish grey, medium grained, fractured Granite gneiss.		100	2.0	cm	Pentn.	Refusal	*SPT-22 18.25-18.26 18.25
						Refusal	R14 CR=11% RQD=NIL
						Refusal	*SPT-23 19.00-19.02 19.00
						Refusal	R15 CR=19% RQD=NIL
						Refusal	*SPT-24 19.75-19.77 19.75
						Refusal	R16 CR=14% RQD=NIL
						Refusal	*SPT-25 20.50-20.52 20.50
						Refusal	R17 CR=16% RQD=NIL
						Refusal	*SPT-26 21.25-21.27 21.25
						Refusal	R18 CR=NIL RQD=NIL
21.25m Completely weathered, greyish brown, medium to coarse grained, decomposed & disintegrated Granite gneiss.		100	3.0	cm	Pentn.	Refusal	DS-13 SPT-27 22.00-22.03 22.00
						Refusal	R19 CR=NIL RQD=NIL
						Refusal	DS-14 *SPT-28 22.75-22.77 22.75
						Refusal	R20 CR=NIL RQD=NIL
						Refusal	DS-15 *SPT-29 23.50-23.52 23.50
						Refusal	R21 CR=31% RQD=NIL
						Refusal	
						Refusal	
						Refusal	
						Refusal	
23.50m Highly weathered, brownish grey to pinkish grey, medium to fine grained, fractured Granite gneiss. 24.00m		100	2.0	cm	Pentn.		

BORE LOG DATA SHEET

BORE HOLE NO. IBH-05

Co-ordinates E=6252.000
N=5394.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	29	Undisturbed (UDS)	2	Completion Date : 20/03/2019
Cone (Pc)		Penetrometer (SPT)	29	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	15	Level Of Ground : 269.359 M.
		Water Sample (WS)	1	Water Struck At : Standing Water Level : 0.80 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
24.00m Highly weathered, brownish grey to pinkish grey, medium to fine grained, fractured Granite gneiss.								R22	CR=32% RQD=NIL 24.25
								R23	CR=31% RQD=NIL 25.00
								R24	CR=35% RQD=NIL 25.75
								R25	CR=37% RQD=13% 26.50
								R26	CR=32% RQD=NIL 27.25
								R27	CR=37% RQD=NIL 28.00
								R28	CR=38% RQD=NIL 28.75
								R29	CR=40% RQD=NIL 29.50
								R30	CR=36% RQD=NIL 30.25
								R31	CR=37% RQD=NIL 31.00
								R32	CR=32% RQD=NIL 31.75
32.50m Slightly weathered, pinkish grey, medium to fine grained, fractured Granite gneiss.								R33	CR=70% RQD=NIL 32.50
								R34	CR=68% RQD=25% 33.25
								R35	CR=79% RQD=NIL 34.00
								R36	CR=61% RQD=NIL 34.75
35.40m N.B. — '*' means sample could not be recovered.									35.40

BORE LOG DATA SHEET

BORE HOLE NO. IBH-06

Co-ordinates E=6273.000 N=5417.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	2	Completion Date : 18/03/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	14	Level Of Ground : 269.311 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.45 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium, brownish grey, silty clay. Obs. traces of kankars.								DS-1	0.50
		1	1	1	1	5	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
3.00m									
Stiff, greyish brown, silty clay / clayey silt. Obs. black patches.		2	3	3	3	15	4	SPT-2	3.00-3.45
4.00m									
Dense to very dense, greyish brown, sandy silt with decomposed rock fragments & clay binder.		10	8	11	16	60	15	*UDS-2	4.00-4.10
								SPT-3	4.10-4.55
		9	10	14	19	78	21	SPT-4	5.10-5.55
		5	6	6	10	47	13	SPT-5	6.10-6.55
		11	16	21	25	>100	32	SPT-6	7.10-7.55
		34	50			>100		SPT-7	8.00-8.13
8.25m		100				5.5 cm Pentn. Refusal		*SPT-8	8.25-8.29
Completely to highly weathered, brownish grey, medium grained, fractured Quartzo-feldspathic-gneiss.						4.0 cm Pentn. NX. drilling from 8.25m to 35.10m		R1	CR=14% RQD=NIL
		100				Refusal		*SPT-9	9.00-9.04
						4.0 cm Pentn. Refusal		R2	CR=10% RQD=NIL
		100				Refusal		*SPT-10	9.75-9.78
10.50m						3.0 cm Pentn. Refusal		R3	CR=06% RQD=NIL
Completely weathered, brownish grey, medium grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100				5.0 cm Pentn. Refusal		*SPT-11	10.50-10.55
								R4	CR=NIL RQD=NIL
		100				2.0 cm Pentn.		*SPT-12	11.25-11.27
12.00m								R5	CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO. IBH-06

Co-ordinates E=6273.000
N=5417.000

Field Test	Nos	Samples	Nos	Commencement Date : 13/03/2019
Penetrometer (SPT)	27	Undisturbed (UDS)	2	Completion Date : 18/03/2019
Cone (Pc)		Penetrometer (SPT)	27	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	14	Level Of Ground : 269.311 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.45 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
24.00m Highly weathered, yellowish to reddish grey, coarse grained, highly fractured Quartzo-feldspathic-gneiss.								R22	CR=21% RQD=NIL 24.75
								R23	CR=28% RQD=NIL 25.50
								R24	CR=28% RQD=15% 26.25
								R25	CR=25% RQD=NIL 27.00
								R26	CR=25% RQD=NIL 27.75
								R27	CR=22% RQD=NIL 28.50
								R28	CR=24% RQD=NIL 29.25
28.50m Highly weathered, yellowish to reddish grey, coarse grained, highly fractured Granite gneiss.								R29	CR=25% RQD=NIL 30.00
								R30	CR=22% RQD=NIL 30.75
								R31	CR=21% RQD=NIL 31.50
31.50m Highly to moderately weathered, brownish grey to greyish black, medium grained, highly fractured Granite gneiss.								R32	CR=38% RQD=NIL 32.25
								R33	CR=42% RQD=17% 33.00
								R34	CR=44% RQD=14% 33.75
								R35	CR=65% RQD=13% 34.50
33.75m Slightly weathered, greyish black, medium grained, highly fractured Granite gneiss.								R36	CR=64% RQD=NIL 35.10
35.10m									

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO. IBH-07

Co-ordinates E=6265.000
N=5446.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	19	Undisturbed (UDS)	3	Completion Date : 30/03/2019
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	7	Level Of Ground : 269.601 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.40 m.

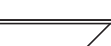
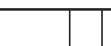
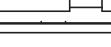
DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Stiff, brownish grey, silty clay with kankars.								DS-1	0.50
		1	1	1	2	$\frac{9}{3}$	3	SPT-1	0.80-1.25
								UDS-1	2.00-2.45
Hard, yellowish brown, silty clay with gravel & kankars.									
		1	1	2	3	$\frac{13}{4}$	4	SPT-2	2.80-3.25
								UDS-2	4.00-4.45
Dense to very dense, yellowish brown, sandy silt. Obs. clay binder.									
		6	8	10	14	$\frac{56}{16}$	16	SPT-3	4.80-5.25
								*UDS-3	6.00-6.10
Very dense, brownish grey, silty sand with decomposed rock fragments.									
		6	9	9	12	$\frac{45}{11}$	13	SPT-4	6.10-6.55
Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated / fractured Quartzo-feldspathic-gneiss.									
		6	8	10	13	$\frac{53}{15}$	15	SPT-5	7.00-7.45
		10	12	14	18	$\frac{86}{22}$	32	SPT-6	7.80-8.25
8.30m									
8.70m									
10.50m									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-07

Co-ordinates E=6265.000
N=5446.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	19	Undisturbed (UDS)	3	Completion Date : 30/03/2019
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	7	Level Of Ground : 269.601 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE			SAMPLES	
		EACH DIVN=7.5CM			Ref. No	Depth (m)
10.50m Completely weathered, light pinkish grey, coarse grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		Refusal			*SPT-11	10.95-10.97 10.95
		2.0 cm Pentr.			R4	CR=NIL RQD=NIL
		Refusal			DS-4	
		2.0 cm Pentr.			*SPT-12	11.70-11.72 11.70
		Refusal			R5	CR=NIL RQD=NIL
		2.0 cm Pentr.			DS-5	
		Refusal			*SPT-13	12.45-12.47 12.45
13.95m Completely to highly weathered, brownish grey, medium grained, fractured Quartzo-feldspathic-gneiss.		Refusal			R6	CR=NIL RQD=NIL
		2.0 cm Pentr.			DS-6	
		3.0 cm Pentr.			*SPT-14	13.20-13.23 13.20
		Refusal			R7	CR=NIL RQD=NIL
		2.0 cm Pentr.			DS-7	
		Refusal			*SPT-15	13.95-13.97 13.95
		2.0 cm Pentr.			R8	CR=06% RQD=NIL
16.20m Highly weathered, brownish grey, medium to coarse grained, highly fractured Quartzo-feldspathic-gneiss.		Refusal			*SPT-16	14.70-14.72 14.70
		2.0 cm Pentr.			R9	CR=10% RQD=NIL
		Refusal			*SPT-17	15.45-15.46 15.45
		1.0 cm Pentr.			R10	CR=23% RQD=NIL
						16.20
					R11	CR=28% RQD=NIL
						16.95
19.20m Completely to highly weathered, brownish grey, coarse to medium grained, highly fractured Granite gneiss.					R12	CR=31% RQD=12%
						17.70
					R13	CR=28% RQD=16%
						18.45
					R14	CR=33% RQD=15%
						19.20
					R15	CR=15% RQD=NIL
21.00m		Refusal			*SPT-18	19.95-19.97 19.95
		2.0 cm Pentr.			R16	CR=14% RQD=NIL
		Refusal			*SPT-19	20.70-20.72 20.70
		2.0 cm Pentr.			R17	CR=21% RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO. IBH-07

Co-ordinates E=6265.000
N=5446.000

Field Test	Nos	Samples	Nos	Commencement Date : 24/03/2019
Penetrometer (SPT)	19	Undisturbed (UDS)	3	Completion Date : 30/03/2019
Cone (Pc)		Penetrometer (SPT)	19	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	7	Level Of Ground : 269.601 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 0.40 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
21.00m Completely to highly weathered, brownish grey, coarse to medium grained, highly fractured Granite gneiss.								R18	21.45 CR=22% RQD=NIL
22.95m Highly weathered, light pinkish grey, medium grained, highly fractured Granite gneiss.								R19	22.20 CR=36% RQD=28%
24.45m Moderately weathered, light pinkish grey, medium grained, moderately fractured Granite gneiss.								R20	22.95 CR=24% RQD=NIL
27.45m Moderately to slightly weathered, light pinkish grey, medium grained, moderately fractured Granite gneiss.								R21	23.70 CR=22% RQD=NIL
30.45m								R22	24.45 CR=26% RQD=NIL
								R23	25.20 CR=44% RQD=28%
								R24	25.95 CR=48% RQD=32%
								R25	26.70 CR=50% RQD=29%
								R26	27.45 CR=56% RQD=39%
								R27	28.20 CR=50% RQD=48%
								R28	28.95 CR=48% RQD=32%
								R29	29.70 CR=74% RQD=60%
									30.45

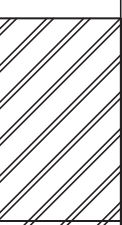
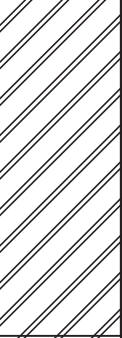
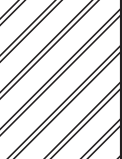
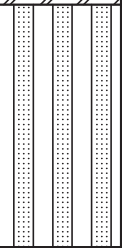
N.B. — '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO.IBH-08

Co-ordinates E=6271.000
N=5732.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	39	Undisturbed (UDS)	3	Completion Date : 11/04/2019
Cone (Pc)		Penetrometer (SPT)	39	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	33	Level Of Ground : 270.578 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m Medium, brownish grey, silty clay. Obs. kankars.		1	1	2	1	6	1	2	DS-1 0.50 SPT-1 1.00-1.45
1.50m Stiff, light grey, clayey silt / silty clay. Obs. kankars.		2	2	2	3	9	2	2	WS-1 1.30 UDS-1 2.00-2.45 SPT-2 3.00-3.45
4.00m Hard, light grey to reddish grey, clayey silt. Obs. gravel & kankars.		5	7	9	13	50	15	13	*UDS-2 4.00-4.10 SPT-3 4.10-4.55
5.00m Dense to very dense, brownish grey, silty sand with decomposed rock fragments. Obs. gravel & kankars.		4	6	7	11	41	10	13	SPT-4 5.00-5.45
7.00m Completely weathered, pinkish grey to brownish grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		8	12	19	26	>100	35		*UDS-3 6.00-6.10 SPT-5 6.10-6.45
		100	4.0	cm	Pentn.	Refusal			*SPT-6 6.80-6.84
		100	3.0	cm	Pentn.	Refusal			*SPT-7 7.00-7.03 7.00
		100	3.0	cm	Pentn.	Refusal			R1 CR=NIL DS-2 RQD=NIL
		100	3.0	cm	Pentn.	Refusal			*SPT-8 7.75-7.78 7.75
		100	2.0	cm	Pentn.	Refusal			R2 CR=NIL DS-3 RQD=NIL
		100	2.0	cm	Pentn.	Refusal			*SPT-9 8.50-8.52 8.50
		100	2.0	cm	Pentn.	Refusal			R3 CR=NIL DS-4 RQD=NIL
		100	3.0	cm	Pentn.	Refusal			*SPT-10 9.25-9.27 9.25
		100	2.0	cm	Pentn.	Refusal			R4 CR=NIL DS-5 RQD=NIL
		100	2.0	cm	Pentn.	Refusal			*SPT-11 10.00-10.03 10.00
		100	2.0	cm	Pentn.	Refusal			R5 CR=NIL DS-6 RQD=NIL
		100	2.0	cm	Pentn.	Refusal			*SPT-12 10.75-10.77 10.75
		100	2.0	cm	Pentn.	Refusal			R6 CR=NIL DS-7 RQD=NIL
		100	2.0	cm	Pentn.	Refusal			*SPT-13 11.50-11.52 11.50
12.00m NX. drilling from 7.00m to 35.00m									R7 CR=NIL RQD=NIL

BORE LOG DATA SHEET

BORE HOLE NO.IBH-08

Co-ordinates E=6271.000
N=5732.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	39	Undisturbed (UDS)	3	Completion Date : 11/04/2019
Cone (Pc)		Penetrometer (SPT)	39	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	33	Level Of Ground : 270.578 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE		SAMPLES	
		EACH	DIVN=7.5CM	Ref. No	Depth (m)
12.00m Completely weathered, pinkish grey to brownish grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		100	Refusal	DS-8 *SPT-14	12.25-12.27 12.25
				R8 DS-9	CR=NIL RQD=NIL
				*SPT-15	13.00-13.03 13.00
				R9 DS-10	CR=NIL RQD=NIL
				*SPT-16	13.75-13.77 13.75
				R10 DS-11	CR=NIL RQD=NIL
				*SPT-17	14.50-14.53 14.50
				R11 DS-12	CR=NIL RQD=NIL
				*SPT-18	15.25-15.27 15.25
				R12 DS-13	CR=NIL RQD=NIL
				*SPT-19	16.00-16.02 16.00
				R13 DS-14	CR=NIL RQD=NIL
				*SPT-20	16.75-16.78 16.75
				R14 DS-15	CR=NIL RQD=NIL
				*SPT-21	17.50-17.53 17.50
				R15 DS-16	CR=NIL RQD=NIL
				*SPT-22	18.25-18.28 18.25
				R16 DS-17	CR=NIL RQD=NIL
				*SPT-23	19.00-19.02 19.00
				R17 DS-18	CR=NIL RQD=NIL
				*SPT-24	19.75-19.77 19.75
				R18 DS-19	CR=NIL RQD=NIL
				*SPT-25	20.50-20.53 20.50
				R19 DS-20	CR=NIL RQD=NIL
				*SPT-26	21.25-21.27 21.25
				R20 DS-21	CR=NIL RQD=NIL
				*SPT-27	22.00-22.03 22.00
				R21 DS-22	CR=NIL RQD=NIL
				*SPT-28	22.75-22.78 22.75
				R22 DS-23	CR=NIL RQD=NIL
				*SPT-29	23.50-23.53 23.50
				R23	CR=NIL RQD=NIL
24.00m					

BORE LOG DATA SHEET

BORE HOLE NO.IBH-08

Co-ordinates E=6271.000
N=5732.000

Field Test	Nos	Samples	Nos	Commencement Date : 06/04/2019
Penetrometer (SPT)	39	Undisturbed (UDS)	3	Completion Date : 11/04/2019
Cone (Pc)		Penetrometer (SPT)	39	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	33	Level Of Ground : 270.578 M.
		Water Sample (WS)	1	Water Struck At :
				Standing Water Level : 1.30 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
24.00m		Refusal				DS-24 *SPT-30	24.25-24.28 24.25
Completely weathered, pinkish grey to brownish grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		3.0 cm Pentn.				R24 DS-25 *SPT-31	CR=NIL RQD=NIL 25.00-25.04 25.00
		Refusal				R25 DS-26 *SPT-32	CR=NIL RQD=NIL 25.75-25.78 25.75
		4.0 cm Pentn.				R26 DS-27 *SPT-33	CR=NIL RQD=NIL 26.50-26.54 26.50
		Refusal				R27	CR=24% RQD=NIL 27.25
26.50m		4.0 cm Pentn.				R28 DS-28 *SPT-34	CR=NIL RQD=NIL 28.00-28.04 28.00
Highly weathered, pinkish grey, medium to fine grained, fractured, Quartzo-feldspathic-gneiss.		Refusal				R29 DS-29 *SPT-35	CR=NIL RQD=NIL 28.75-28.78 28.75
		3.0 cm Pentn.				R30 DS-30 *SPT-36	CR=NIL RQD=NIL 29.50-29.53 29.50
		Refusal				R31 DS-31 *SPT-37	CR=NIL RQD=NIL 30.25-30.29 30.25
		4.0 cm Pentn.				R32 DS-32 *SPT-38	CR=NIL RQD=NIL 31.00-31.03 31.00
27.25m		3.0 cm Pentn.				R33 DS-33 *SPT-39	CR=NIL RQD=NIL 31.75-31.78 31.75
Completely weathered, pinkish grey to brownish grey, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.		Refusal				R34	CR=23% RQD=NIL 32.50
		3.0 cm Pentn.				R35	CR=21% RQD=NIL 33.25
		Refusal				R36	CR=23% RQD=NIL 34.00
		3.0 cm Pentn.				R37	CR=21% RQD=NIL 35.00
31.75m		3.0 cm Pentn.					
Highly weathered, brownish grey, fine to medium grained, fractured Quartzo-feldspathic-gneiss.							
35.00m							

N.B. - '*' means sample could not be recovered.

BORE LOG DATA SHEET

BORE HOLE NO. IBH-09

Co-ordinates E=6271.000
N=5786.000

Field Test	Nos	Samples	Nos	Commencement Date : 12/04/2019
Penetrometer (SPT)	35	Undisturbed (UDS)	3	Completion Date : 14/04/2019
Cone (Pc)		Penetrometer (SPT)	35	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	19	Level Of Ground : 269.782 M.
		Water Sample (WS)	0	Water Struck At :
				Standing Water Level : 1.10 m.

DESCRIPTION	SYMBOL	N-VALUE						SAMPLES	
		EACH DIVN=7.5CM						Ref. No	Depth (m)
0.00m									
Medium to stiff, yellowish grey, silty clay. Obs. kankars.								DS-1	0.50
		1	1	1	1	<u>6</u>	2	SPT-1	1.00-1.45
								UDS-1	2.00-2.45
		2	2	2	3	<u>12</u>	4	SPT-2	3.00-3.45
4.00m									
Very stiff, yellowish grey to light grey, clayey silt. Obs. kankars & gravel.								*UDS-2	4.00-4.45
		3	4	4	5	<u>22</u>	6	SPT-3	5.00-5.45
								*UDS-3	6.00-6.45
		100				Refusal		*SPT-4	6.80-6.84
7.00m		100				Refusal		*SPT-5	7.00-7.02
Highly weathered, light grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.								R1	CR=21% RQD=NIL
								R2	CR=31% RQD=NIL
								R3	CR=22% RQD=NIL
								R4	CR=NIL RQD=NIL
9.25m								DS-2	
Completely weathered, pinkish brown, medium to fine grained, decomposed & disintegrated Quartzo-feldspathic-gneiss.								*SPT-6	10.00-10.03
								R5	CR=NIL RQD=NIL
								DS-3	
								*SPT-7	10.75-10.78
								R6	CR=NIL RQD=NIL
								DS-4	
								*SPT-8	11.50-11.52
								R7	CR=NIL RQD=NIL
12.00m									

BORE LOG DATA SHEET

BORE HOLE NO. IBH-09

Co-ordinates E=6271.000
N=5786.000

Field Test	Nos	Samples	Nos	Commencement Date : 12/04/2019
Penetrometer (SPT)	35	Undisturbed (UDS)	3	Completion Date : 14/04/2019
Cone (Pc)		Penetrometer (SPT)	35	Bore Hole Diameter : 150 mm./ N.X
Vane (V)		Disturbed (DS)	19	Level Of Ground : 269.782 M.
		Water Sample (WS)	0	Water Struck At : Standing Water Level : 1.10 m.

DESCRIPTION	SYMBOL	N-VALUE				SAMPLES	
		EACH DIVN=7.5CM				Ref. No	Depth (m)
24.00m Completely weathered, light grey, medium to fine grained decomposed and disintegrated / fractured Quartzo-feldspathic-gneiss.		100	2.0	cm	Pentr.	*SPT-25	24.25-24.27 24.25
						R24	CR=18% RQD=NIL
						*SPT-26	25.00-25.02 25.00
						R25	CR=15% RQD=NIL
						*SPT-27	25.75-25.77 25.75
						R26	CR=NIL RQD=NIL
						DS-18	
						*SPT-28	26.50-26.54 26.50
						R27	CR=NIL RQD=NIL
						DS-19	
27.25m Completely to highly weathered, brownish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		100	3.0	cm	Pentr.	*SPT-29	27.25-27.28 27.25
						R28	CR=12% RQD=NIL
						*SPT-30	28.00-28.02 28.00
						R29	CR=13% RQD=NIL
						*SPT-31	28.75-28.77 28.75
						R30	CR=19% RQD=NIL
						*SPT-32	29.50-29.52 29.50
						R31	CR=16% RQD=NIL
						*SPT-33	30.25-30.27 30.25
						R32	CR=14% RQD=NIL
32.50m Highly to moderately weathered, brownish grey, medium to fine grained, fractured Quartzo-feldspathic-gneiss.		100	2.0	cm	Pentr.	*SPT-34	31.00-31.02 31.00
						R33	CR=17% RQD=NIL
						*SPT-35	31.75-31.77 31.75
						R34	CR=21% RQD=NIL
						R35	CR=32% RQD=NIL
35.00m		100	2.0	cm	Pentr.	R36	CR=54% RQD=NIL
						R37	CR=41% RQD=NIL

N.B. - '*' means sample could not be recovered.



Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 08/05/2019

Sheet No:

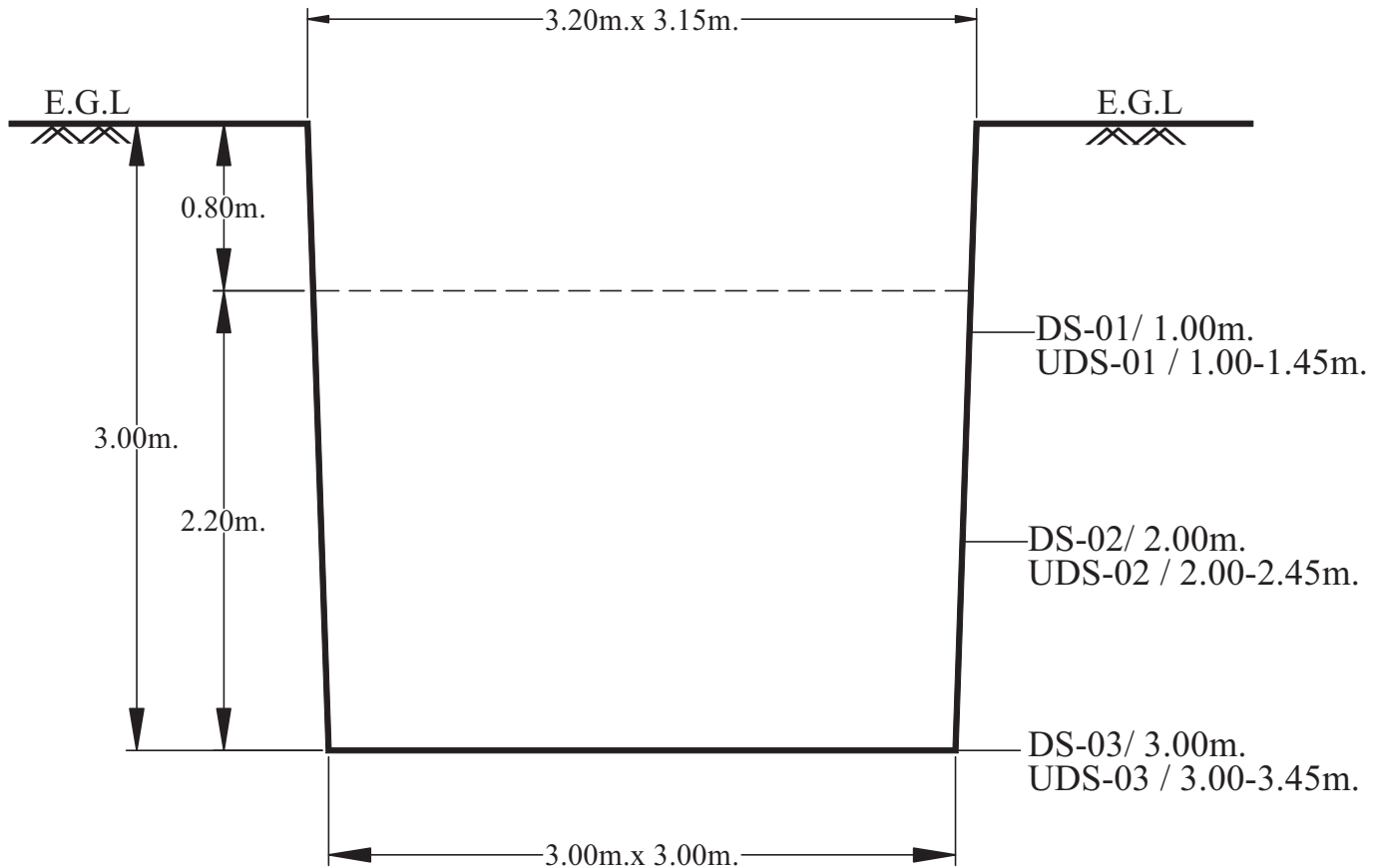
Co-ordinates(M):

N =5781.000

E =6108.000

RL =270.740 M

SWL = Not Found



EGL-0.80m:- Brownish grey, silty clay with traces of kankars. Obs. calcareous nodules.
0.80 - 3.00m:-Deep grey, silty clay with traces of kankars.

Note :-

DS means Disturbed Sample
UDS means Undisturbed Sample
All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR TP -01 & CPLT-01





Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 08/05/2019

Sheet No:

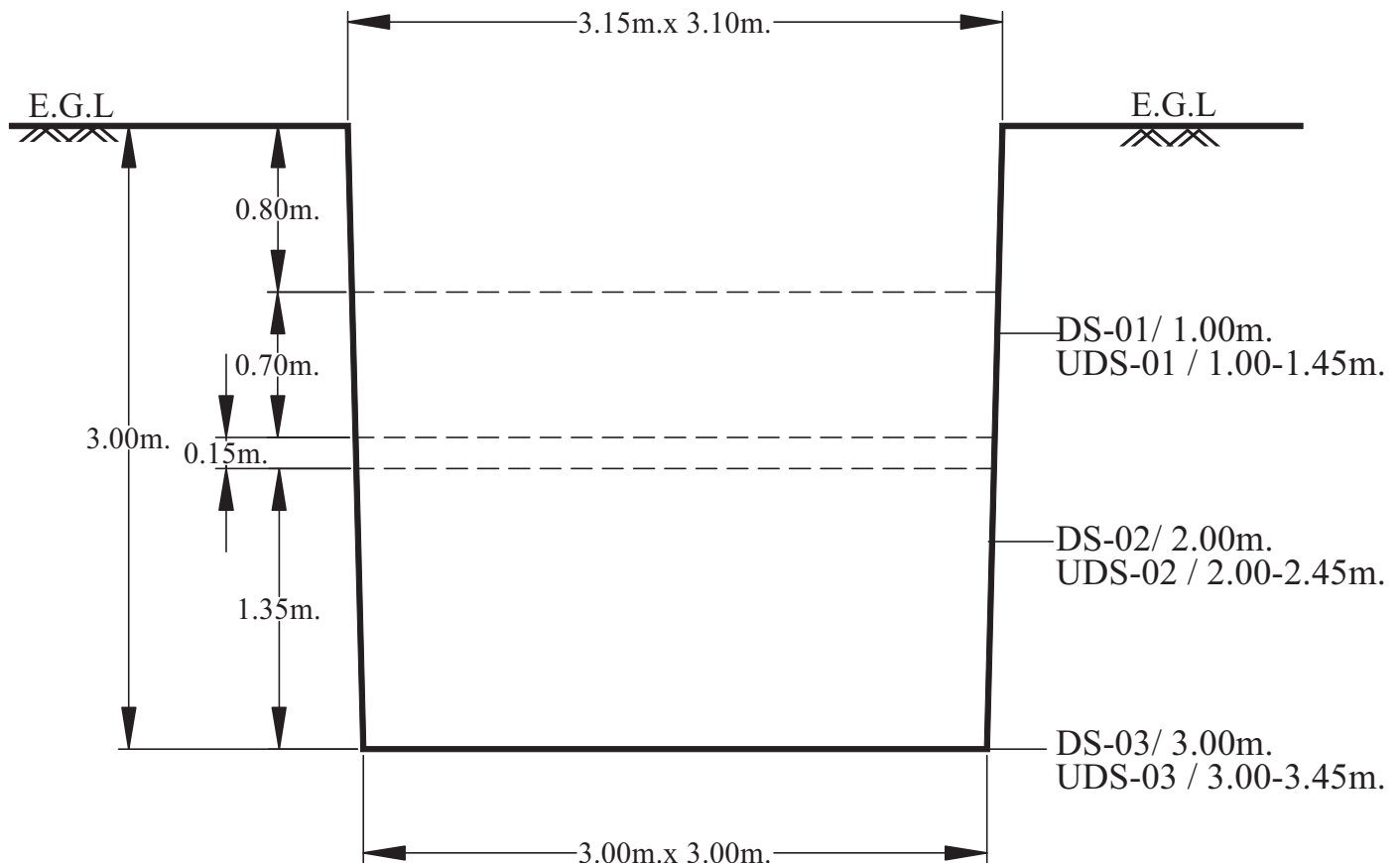
Co-ordinates(M):

N =5669.000

E =6108.000

RL =271.273 M

SWL = Not Found



EGL-0.80m:- Brownish grey, silty clay with traces of calcareous nodules & kankars.

0.80 - 1.50m:-Deep grey, silty clay with kankars & sand mixture.

1.50 - 1.65m:-Reddish brown, silty sand with kankars & moorum.

1.65 - 3.00m:-Deep grey, silty clay with traces of kankars.

Note :-

DS means Disturbed Sample

UDS means Undisturbed Sample

All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR TP -02 & PLT-01





Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 08/05/2019

Sheet No:

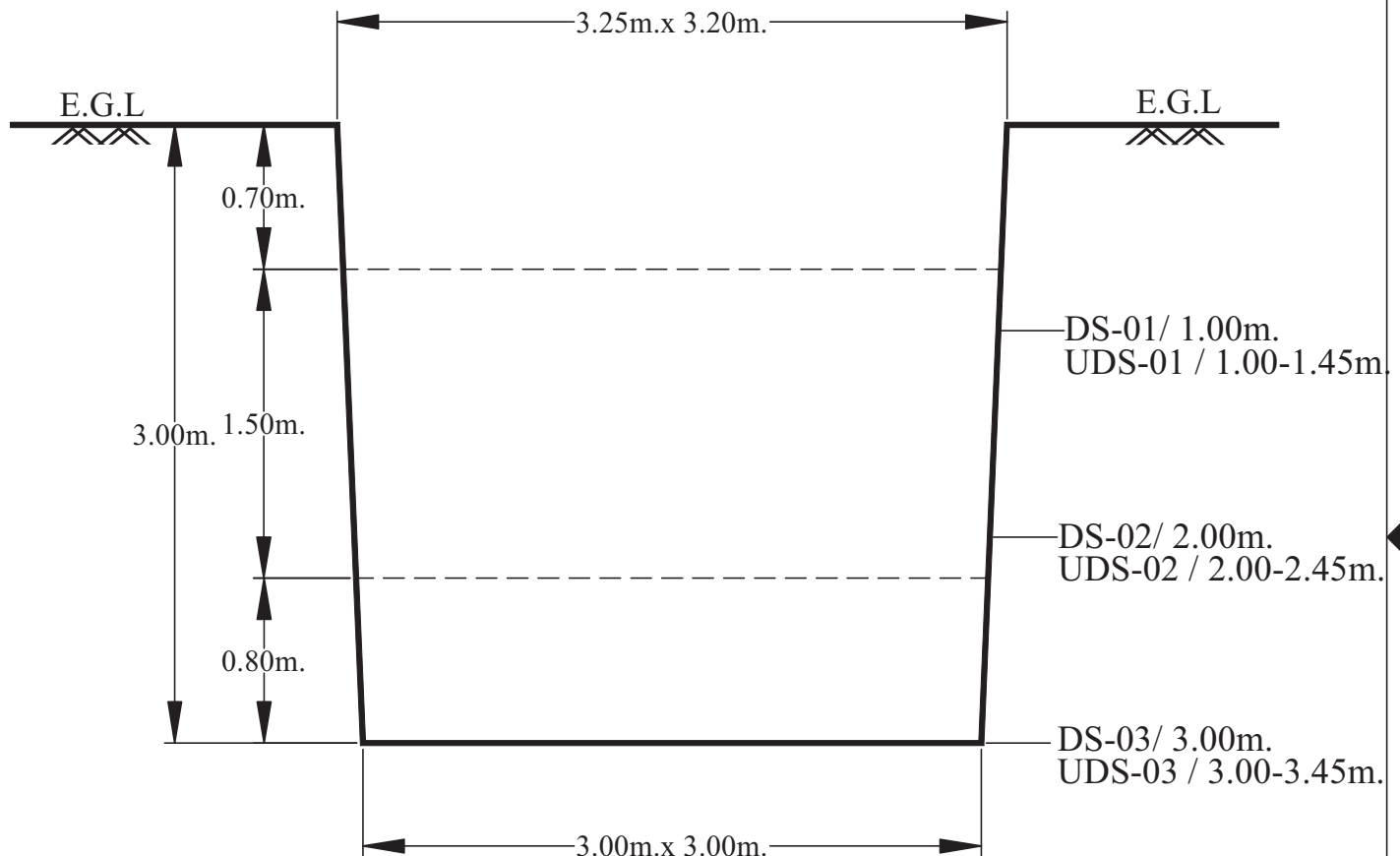
Co-ordinates(M):

N =5604.000

E =6088.000

RL =270.975 M

SWL = 2.90M



EGL-0.70m:- Brownish grey, silty clay with traces of kankars. Obs. calcareous nodules.

0.70 - 2.20m:-Deep grey, silty clay with traces of kankars.

2.20 - 3.00m:-Light yellowish grey, silty clay with traces of kankars.

Note :-

DS means Disturbed Sample

UDS means Undisturbed Sample

All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR TP -03 & CPLT-02





Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 29/04/2019

Sheet No:

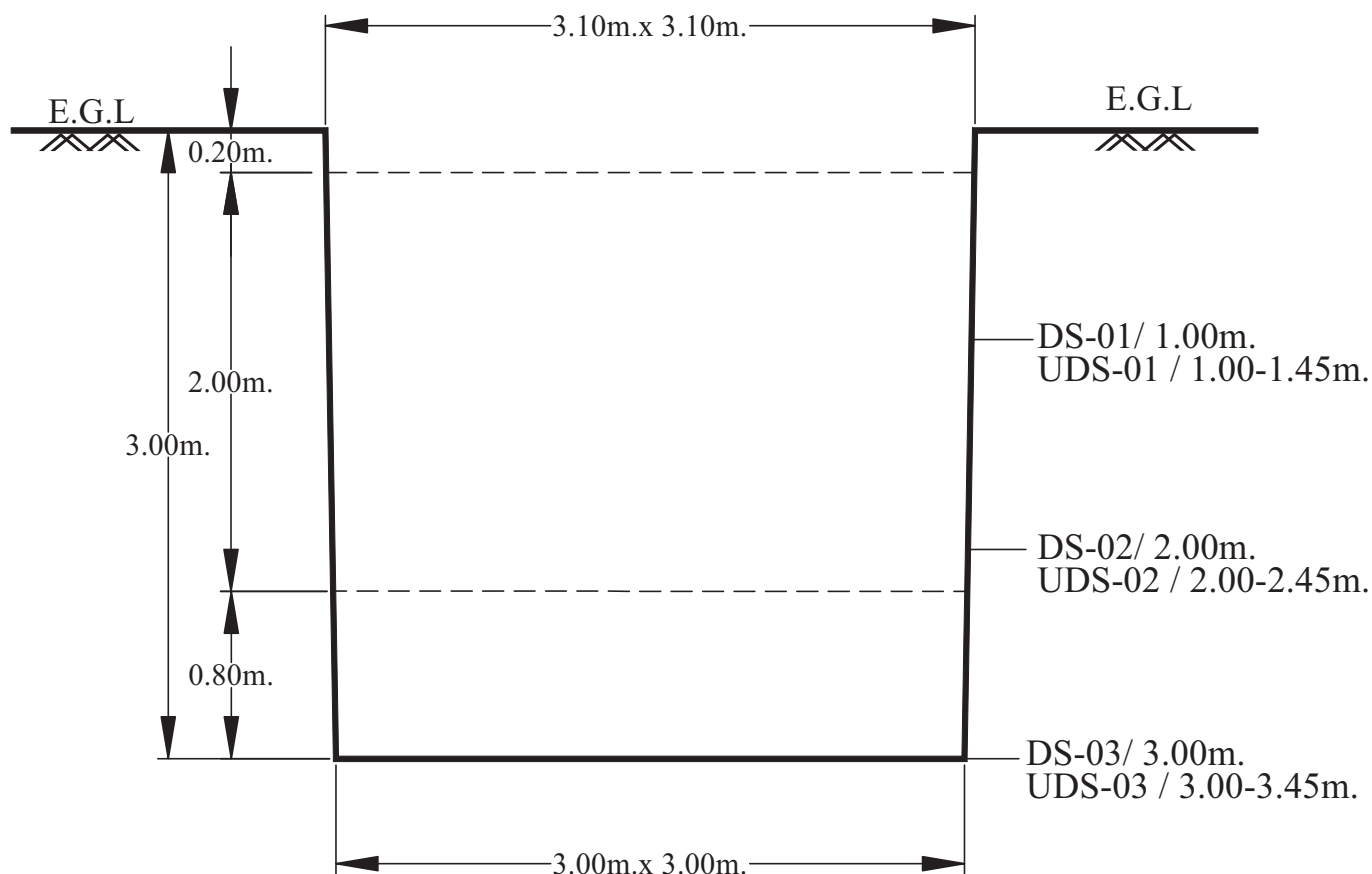
Co-ordinates(M):

N =5555.000

E =6231.000

RL =269.660 M

SWL = Not Found



EGL-0.20m:- Light grey, silty clay with rock pieces & sand mixture.

0.20 - 2.20m:-Deep grey, silty clay.

2.20 - 3.00m:-Yellowish grey, clayey silt. Obs. sand mixture.

Note :-

DS means Disturbed Sample

UDS means Undisturbed Sample

All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR TP -04 & PLT-02





Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 29/04/2019

Sheet No:

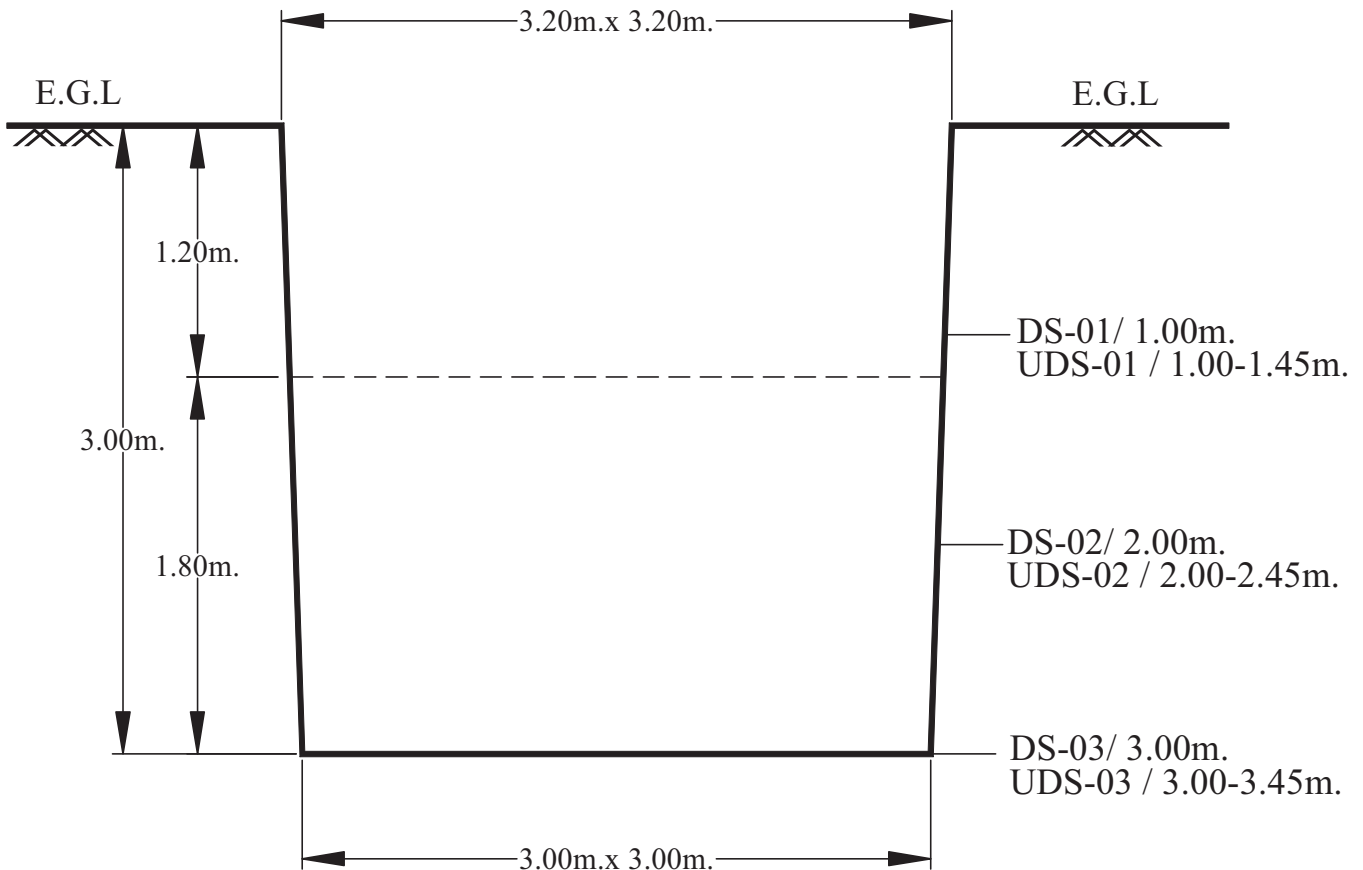
Co-ordinates(M):

N =5489.000

E =6273.000

RL =269.342 M

SWL = 2.85M



EGL-1.20m:- Brownish grey, silty clay. Obs. kankar, calcareous nodules.

1.20 - 3.00m:- Yellowish grey, silty clay. Obs. kankars.

Note :-

DS means Disturbed Sample

UDS means Undisturbed Sample

All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR TP -05



Project : Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Job No : 4287

Created by : T.SAHA

Created on : 29/04/2019

Sheet No:

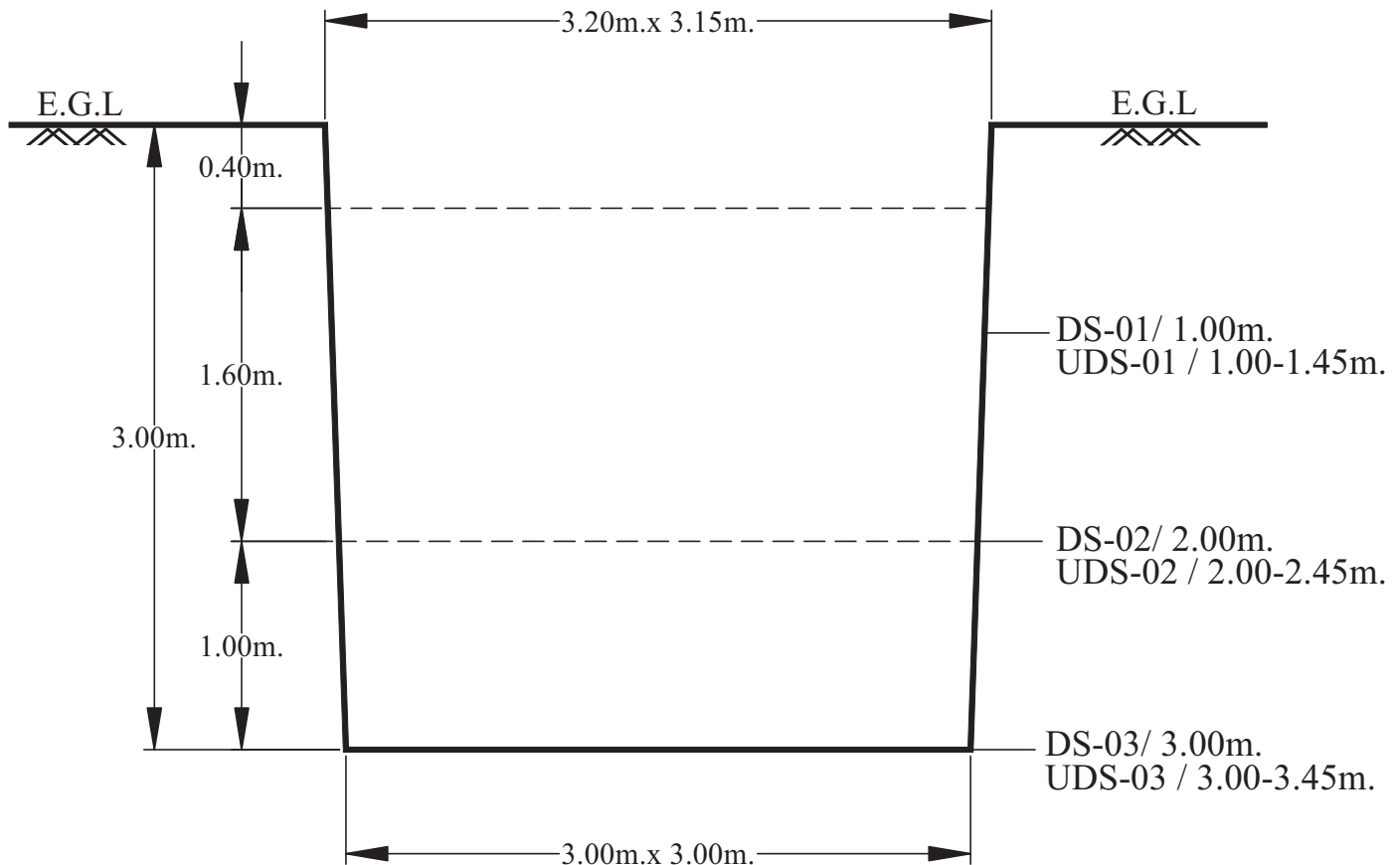
Co-ordinates(M):

N =5405.000

E =6263.000

RL =269.236 M

SWL = 2.90M



EGL-0.40m:- Light grey, clayey silt with rock pieces & sand mixture.

0.40 - 2.00m:-Deep grey, silty clay.

2.00 - 3.00m:-Yellowish grey, clayey silt. Obs. sand mixture.

Note :-

DS means Disturbed Sample

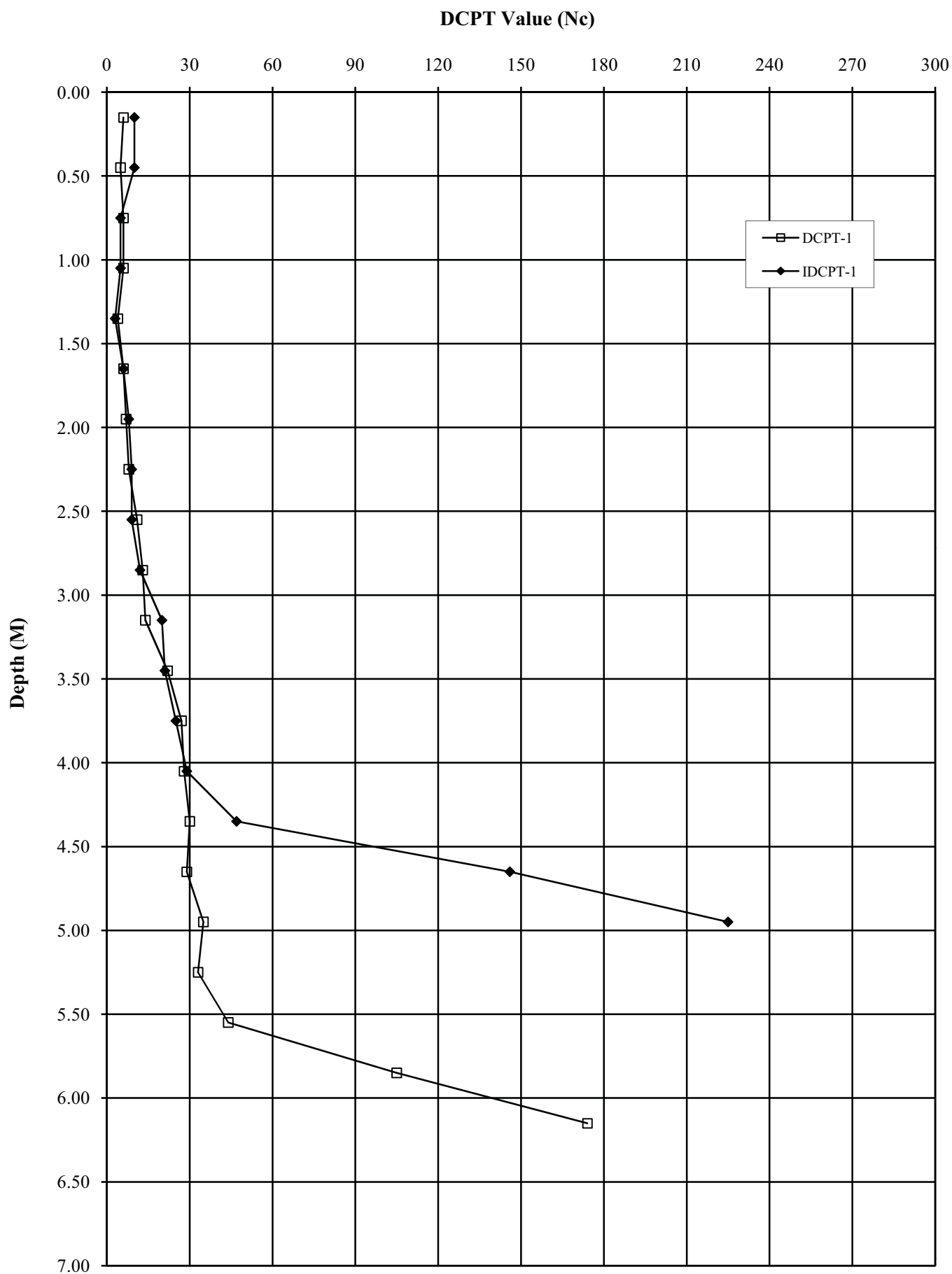
UDS means Undisturbed Sample

All Dimensions are in Metre Unless Noted Otherwise

PIT LOG FOR ITP -01 & CPLT-03

DYNAMIC CONE PENETRATION TEST RESULTS

DCPT No.	Co-Ordinates		R.L. of Ground (M)	Starting Depth (M)	Ending Depth (M)	Average Depth (M)	Nc	Value
	Easting	Northinng						
DCPT-1	6073.300	5763.000	270.898	0.00	0.30	0.15	6	
				0.30	0.60	0.45	5	
				0.60	0.90	0.75	6	
				0.90	1.20	1.05	6	
				1.20	1.50	1.35	4	
				1.50	1.80	1.65	6	
				1.80	2.10	1.95	7	
				2.10	2.40	2.25	8	
				2.40	2.70	2.55	11	
				2.70	3.00	2.85	13	
				3.00	3.30	3.15	14	
				3.30	3.60	3.45	22	
				3.60	3.90	3.75	27	
				3.90	4.20	4.05	28	
				4.20	4.50	4.35	30	
				4.50	4.80	4.65	29	
				4.80	5.10	4.95	35	
				5.10	5.40	5.25	33	
				5.40	5.70	5.55	44	
				5.70	6.00	5.85	105	
				6.00	6.30	6.15	174	
IDCPT-1	6259.000	5330.000	269.182	0.00	0.30	0.15	10	
				0.30	0.60	0.45	10	
				0.60	0.90	0.75	5	
				0.90	1.20	1.05	5	
				1.20	1.50	1.35	3	
				1.50	1.80	1.65	6	
				1.80	2.10	1.95	8	
				2.10	2.40	2.25	9	
				2.40	2.70	2.55	9	
				2.70	3.00	2.85	12	
				3.00	3.30	3.15	20	
				3.30	3.60	3.45	21	
				3.60	3.90	3.75	25	
				3.90	4.20	4.05	29	
				4.20	4.50	4.35	47	
				4.50	4.80	4.65	146	
				4.80	5.10	4.95	225	



DCPT Value (Nc) vs. Depth Plot

Summarised Field Density Test Results

Test Location	Depth of Test (M)	Avg. Field Bulk Density (gm/cc)	Avg. Field Dry Density (gm/cc)	Moisture Content (%)
TP-01	1.00	1.460	1.290	13
	2.00	1.630	1.420	15
	3.00	1.530	1.300	18
TP-02	1.00	1.540	1.380	12
	2.00	1.680	1.460	15
	3.00	1.580	1.350	17
TP-03	1.00	1.710	1.540	11
	2.00	1.590	1.400	14
	3.00	1.800	1.520	18
TP-04	1.00	1.370	1.220	12
	2.00	1.820	1.580	15
	3.00	1.800	1.530	18
TP-05	1.00	1.640	1.450	13
	2.00	2.090	1.810	16
	3.00	2.240	1.900	18
ITP-01	1.00	1.840	1.630	13
	2.00	1.650	1.430	15
	3.00	1.710	1.450	18

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP



Job No. : 4287

Sheet No.

FIELD PERMEABILITY TEST RESULTS

Field permeability test was conducted at different depths by falling head method and the test results are presented below.

Test Locations	Type of Test	Depth of Test (M)	Permeability (cm/sec)
BH-02	Falling Head	0.80 – 1.50	2.818×10^{-6}
	Falling Head	2.80 – 3.50	5.222×10^{-6}
	Falling Head	4.80 – 5.40	7.725×10^{-6}
	Falling Head	7.80 – 8.40	5.630×10^{-6}
	Falling Head	11.80 – 12.50	8.588×10^{-5}
BH-08	Falling Head	0.80 – 1.50	9.617×10^{-6}
	Falling Head	2.70 – 3.40	5.206×10^{-6}
	Falling Head	4.80 – 5.50	1.875×10^{-6}
	Falling Head	7.70 – 8.40	4.973×10^{-6}
	Falling Head	11.65 – 12.35	2.818×10^{-6}
IBH-07	Falling Head	0.70 – 1.40	1.723×10^{-5}
	Falling Head	2.80 – 3.50	9.122×10^{-6}
	Falling Head	4.80 – 5.50	6.677×10^{-6}
	Falling Head	7.80 – 8.50	6.171×10^{-6}
	Falling Head	11.80 – 12.50	5.216×10^{-6}

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP**Job No. : 4287****Sheet No.**

PART II: LABORATORY TEST RESULTS



C. E. Testing Company Pvt. Ltd.

(AN NABL ACCREDITED TESTING LABORATORY AS PER ISO/IEC 17025)
Sardarpara, Brahmapur, Kolkata-700 096, Tel: (033) 2410 5085/9813
E-mail: cetest.lab@gmail.com • Web: www.cetestindia.com
CIN: U74920WB1988PTC045778



Format No: CET/FM/42

TEST REPORT

TEST REPORT NO : 4287 DATE: 18/06/2019

ULR: TC684019000000073P

Name and Address of Customer: M/s. Bharat Heavy Electricals Limited
345, Shreemohini Complex, 345 Kingsway
Nagpur - 440001

Customer Reference No : 4287

Customer Reference Date : 15/04/2019

Date of Sample Received at Lab : 19/04/2019

Date of Starting of Test : 19/04/2019

Date of Completion of Test : 16/05/2019

Sample ID Nos : 4287/BH-01/UDS-01 to 4287/ITP-01/DS-02

Please refer the page no. A119 of A247 to A148 of A247 of the Report for the following:

1. Sample Description
2. Test methods used
3. Test results

Further to note that the test parameters are mentioned at the header of test result table.

- * The report related to the particular sample(s) tested under stated condition.
- * All tests are based as per IS/ASTM specifications
- * Any discrepancy in this report should be brought to the notice within 15 (fifteen) days from the date of certificate
- * Full/Partial use of this test results could not be done without the written permission of authorized signatory.

Head Office: 124-A, N.S.C Bose Road, Kolkata-700092
Project Office: Agartala • Patna • Ranchi • Hyderabad



Job No. : 4287

Sheet No.

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc						Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
BH01	UDS01	2.10	Brownish grey silty clay with traces of calcareous nodules, black spots.	1.94	1.56	2.63	25 S	0.713	TRSH-UU	0.52	5	16	60	16		CH		15	59	26	*See the note			
										3.0	0.894													
										2.0	0.774													
										1.0	0.684													
										UNCONF	0.63	0												
										0.0	0.582													
										0.0	0.632													
										0.0	0.664													
										REMOULD	0.49	0												
										0.0	0.452													
BH01																								
BH01	UDS02	4.15	Brownish grey silty clay with traces of calcareous nodules.	1.97	1.59	2.62	26 S		TRSH-UU	1.25	8	18	55	18		CH		20	54	26	Do			
										3.0	1.923													
										2.0	1.761													
										1.0	1.600													
										UNCONF	0.65	0												
										0.0	0.652													
										0.0	0.652													
										0.0	0.652													
										REMOULD	0.46	0												
										0.0	0.461													
BH01																								
BH02	SPT04	6.70	Greyish brown silty clay with rusty spots & kankar.			2.63												16	59	25	Do			
BH02	SPT05	7.70	Brownish grey silty sand with decomposed rock fragments.													SM	4	71	25 (Silt+Clay)		Do			
BH02	SPT02	2.80	Brownish grey silty clay with calcareous nodules, kankar, moorum & decomposed rock fragments.																		Do			
BH02	UDS02	4.00	Brownish grey silty clay with decomposed rock fragments.	1.97	1.64	2.68	24 S	0.783	TRSH-UU	1.15	0		57	19	15	CH		35	45	20	Do			
										3.0	1.169													
										2.0	1.146													
										1.0	1.141													
										UNCONF	0.95	0												
										0.0	0.932													
									0.0	0.946														
									0.0	0.874														

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
										REMOULD 0.0	0.731	0												
										0.0	0.752													
										0.0	0.792													
BH02	SPT05	7.80	Brownish grey silty sand with decomposed rock fragments.														SM	8	71	21 (Silt+Clay)		Do		
BH03	UDS01	2.00	Deep brownish grey silty clay with traces of calcareous nodules.	2.03	1.74	2.63	17 S 17 T			TRSH-UU 3.0	1.405	0.65	10	48	18		CI	19	55	26		Do		
										2.0	1.195													
										1.0	0.985													
										UNCONF 0.0	0.71	0												
										0.0	1.009													
										0.0	0.602													
										0.0	0.511													
										REMOULD 0.0	0.797	0.56	0											
										0.0	0.471													
										0.0	0.439													
BH03	UDS02	4.00	Brownish grey silty clay with calcareous nodules.	2.01	1.67	2.62	19 S 20 T			TRSH-UU 3.0	0.689	0.67	0	54	16		CH	21	56	23		Do		
										2.0	0.668													
										1.0	0.646													
										UNCONF 0.0	0.63	0												
										0.0	1.653													
										0.0	1.592													
										0.0	1.653													
										REMOULD 0.0	0.347	0.35	0											
										0.0	0.345													
										0.0	0.347													
BH03	SPT03	5.00	Brownish grey silty clay with moorum & kankar.															18	64	18 (Silt+Clay)		Do		
BH03	SPT04	6.10	Yellowish grey clayey silt with sand mixture.				2.67												57	36	7	Do		
BH04	UDS01	2.00	Brownish grey silty clay with calcareous nodules.	1.98	1.60	2.62	24 S 24 T 25 C		0.655	TRSH-UU 3.0	0.969	0.88	0	54	27		CH	21	58	21		Do		
										2.0	0.872													
										1.0	0.802													

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Sheet No.

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size			Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %	
									UNCONF	0.75	0										
									0.0	0.794											
									0.0	0.660											
									0.0	0.794											
									REMOULD	0.55	0										
									0.0	0.591											
									0.0	0.479											
									0.0	0.591											
BH04	UDS02	4.00	Brownish grey silty clay with calcareous nodules.	2.00	1.56	2.61	31 S 28 T		TRSH-UU	0.65	8	56	18		CH		16	55	29	Do	
									3.0	1.233											
									2.0	1.071											
									1.0	0.909											
									UNCONF	0.51	0										
									0.0	0.528											
									0.0	0.515											
									0.0	0.487											
									REMOULD	0.42	0										
									0.0	0.438											
									0.0	0.427											
									0.0	0.395											
BH04	SPT03	5.00	Deep grey silty clay with decomposed rock fragments & kankar.			2.73											60	31	9	Do	
BH04	SPT05	7.00	Brownish grey clayey silt with traces of sand mixture & decomposed rock fragments.			2.67											17	71	12	Do	
BH05	UDS01	2.00	Brownish grey silty clay with traces of kankar.	1.80	1.31	2.62	35 S 37 T		TRSH-UU	0.13	0	54	20		CH		19	57	24	Do	
									3.0	0.151											
									2.0	0.117											
									1.0	0.114											
									UNCONF	0.12	0										
									0.0	0.144											
									0.0	0.106											
									0.0	0.095											
									REMOULD	0.07	0										
									0.0	0.086											
									0.0	0.061											
									0.0	0.048											
BH05	SPT03	4.08	Brownish grey silty clay with gravel pieces & calcareous nodules.													29	48	23 (Silt+Clay)		Do	

Bore Hole	Sample Number	Depth	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	Clay %	
BH05	SPT05	6.09	Light grey silty sand with decomposed rock fragments.												SM	2	80	18 (Silt+Clay)	Do		
BH05	SPT07	8.00	Light grey silty sand with decomposed rock fragments.												SM		63	37 (Silt+Clay)	Do		
BH06	SPT01	1.00	Brownish grey clayey silt with traces of sand mixture & kankars.			2.60											19	50	31	Do	
BH06	UDS01	2.00	Brownish grey silty clay with black spots and traces of kankars	1.99	1.62	2.63	24 S 23 T 28 C	0.758	TRSH-UU 3.0 2.0 1.0 UNCONF	0.92 1.372 1.255 1.138 0.828	0.92	6	61	20	9	CH	19	52	29	Do	
											0.83	0									
										0.0	0.978										
										0.0	0.677										
										0.0	0.828										
										REMOULD	0.70	0									
										0.0	0.847										
										0.0	0.554										
										0.0	0.707										
BH06	SPT02	3.00	Brownish grey silty clay with traces of calcareous nodules.										55	18	CH					Do	
BH06	SPT04	5.10	Yellowish brown silty clay										72	28	CH					Do	
BH06	SPT06	7.10	Brownish grey silty sand with decomposed rock fragments.												SM	5	73	22 (Silt+Clay)	Do		
BH06	SPT07	8.10	Brownish grey silty sand with decomposed rock fragments												SM	7	79	14 (Silt+Clay)	Do		
BH07	SPT01	1.00	Brownish grey, silty clay / clayey silt.										55	20	CH					Do	
BH07	UDS01	2.00	Greyish brown silty clay with traces of calcareous nodules .	2.02	1.63	2.69	23 S 24 T 22 C	0.636	TRSH-UU 3.0 2.0 1.0	1.170 1.075 0.979	0.81	5	53	20	9	CH	15	64	21	Do	

Job No. : 4287

Sheet No.

Bore Hole	Sample Number	Depth	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
										UNCONF	0.75	0											
										0.0	0.662												
										0.0	0.846												
										0.0	0.740												
										REMOULD	0.58	0											
										0.0	0.521												
										0.0	0.668												
										0.0	0.563												
BH07	SPT02	3.00	Brownish grey clayey silt with sand mixture and silt stone.				2.66											29	59	12	Do		
BH07	SPT03	4.09	Brownish grey clayey silt with sand mixture and kankars.				2.65											58	28	14	Do		
BH07	SPT04	5.00	Brownish grey silty clay with sand & decomposed rock fragments.															43	57	(Silt+Clay)	Do		
BH07	SPT05	6.00	Brownish grey clayey silty sand with decomposed rock fragments.															55	45	(Silt+Clay)	Do		
BH07	SPT07	8.00	Whitish grey silty sand with decomposed rock fragments.															2	68	30	(Silt+Clay)	Do	
BH08	SPT01	0.80	Brownish grey silty clay with traces of kankar.										56	20							Do		
BH08	UDS01	1.80	Brownish grey silty clay with kankars.					32 S					53	17	8						Do		
BH08	SPT03	3.90	Brownish grey silty clay with kankar.										51	17							Do		
BH08	SPT04	4.90	Brownish grey clayey silt with sand mixture.															26	74	(Silt+Clay)	Do		

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	Clay %	
BH08	SPT07	7.75	Brownish grey clayey silt with sand mixture & decomposed rock fragments.														45	54 (Silt+Clay)	Do		
BH08	SPT08	8.60	Brownish grey silty sand with decomposed rock fragments												SM		70	30 (Silt+Clay)	Do		
BH09	UDS01	2.00	Deep brownish grey silty clay with traces of kankar.	1.97	1.61	2.62	23 S 22 T		TRSH-UU 3.0 2.0 1.0 UNCONFD 0.0 0.0 0.0 REMOULD 0.0 0.0 0.0	1.313 1.152 0.990	0.72	8	51	18	CH		22	57	21	Do	
BH09	UDS02	4.00	Brownish grey silty clay with traces of calcareous nodules.	1.92	1.50	2.64	24 S 28 T 24 C	0.672	TRSH-UU 3.0 2.0 1.0 UNCONFD 0.0 0.0 0.0 REMOULD 0.0 0.0 0.0	0.678 0.662 0.641	0.66	0	55	16	CH		22	54	24	Do	
BH09	SPT03	5.00	Brownish grey silty clay with decomposed rock fragments			2.63											19	58	23	Do	
BH09	SPT05	7.00	Brownish grey clayey silt with traces of decomposed rock fragments.										42	21	CI					Do	
BH10	SPT01	1.00	Brownish grey, silty clay with traces of calcareous nodules.										52	16	CH					Do	

Bore Hole	Sample Number	Depth	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
BH10	UDS01	2.00	Brownish grey silty clay with calcareous nodules	1.98	1.64	2.63	22 S			TRSH-UU	0.62	9	55	20		CH	22	53	25	Do		
							21 T			3.0	1.282											
										2.0	1.097											
										1.0	0.911											
										UNCONF	0.86	0										
										0.0	1.079											
										0.0	0.635											
										0.0	0.872											
										REMOULD	0.64	0										
										0.0	0.846											
										0.0	0.455											
										0.0	0.607											
BH10	UDS02	4.00	Brownish grey silty clay / clayey silt.	1.92	1.51	2.73	29 S			TRSH-UU	0.70	8	56	20	10	CH	3	18	54	25	Do	
							27 T			3.0	1.290											
										2.0	1.129											
										1.0	0.967											
BH10	SPT03	5.00	Yellowish brown, clayey silt / silty clay with traces of kankar.													CH					Do	
BH10	SPT04	6.07	Brownish grey clayey silty sand with kankars & gravel pcs.			2.66										SM	12	54	22	12	Do	
BH10	UDS04	7.10	Brownish grey silty clay with decomposed rock fragments.	1.95	1.67	2.71	19 S	0.600		TRSH-UU	1.12	7	48	17	13	CI	2	42	43	13	Do	
							17 T			3.0	1.682											
							20 C			2.0	1.543											
										1.0	1.405											
										UNCONF	0.91	0										
										0.0	0.918											
										0.0	0.951											
										0.0	0.870											
										REMOULD	0.72	0										
										0.0	0.708											
										0.0	0.769											
										0.0	0.667											
BH10	SPT07	10.10	Brownish grey clayey silt with decomposed rock fragments.														3	41	56 (Silt+Clay)		Do	
BH11	UDS01	2.00	Deep brownish grey silty clay with traces of calcareous nodules and kankars.	2.04	1.71	2.69	22 S	0.618		TRSH-UU	0.51	13	56	19	8	CH	14	13	48	25	Do	
							20 T			3.0	1.512											
							20 C			2.0	1.222											
									1.0	0.931												

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
									UNCONF	0.61	0												
									0.0	0.765													
									0.0	0.531													
									0.0	0.546													
									REMOULD	0.57	0												
									0.0	0.703													
									0.0	0.474													
									0.0	0.518													
BH11	SPT03	5.00	Brownish grey silty sand with gravel pcs.													SM	19	60	21 (Silt+Clay)	Do			
BH11	SPT05	8.10	Brownish grey silty sand with decomposed rock fragments													SM	3	73	24 (Silt+Clay)	Do			
BH12	UDS01	2.00	Brownish grey silty clay with calcareous nodules & kankar.	1.97	1.58	2.60	24 S 25 T		TRSH-UU	0.31	9	53	19			CH		20	54	26	Do		
									3.0	0.913													
									2.0	0.725													
									1.0	0.543													
									UNCONF	0.44	0												
									0.0	0.632													
									0.0	0.469													
									0.0	0.228													
									REMOULD	0.35	0												
									0.0	0.527													
									0.0	0.344													
									0.0	0.174													
BH12	UDS02	4.00	Brownish grey silty clay with traces of calcareous nodules, kankar.	1.93	1.53	2.61	29 S 26 T		TRSH-UU	0.69	0	56	19	8		CH	12	59	29	Do			
									3.0	0.757													
									2.0	0.675													
									1.0	0.634													
									UNCONF	0.61	0												
									0.0	0.607													
									0.0	0.607													
									0.0	0.607													
									REMOULD	0.45	0												
									0.0	0.452													
									0.0	0.452													
									0.0	0.452													
BH12	SPT04	6.10	Brownish grey clayey silty sand with moorum & kankar.			2.80										SM	65	27	8	Do			

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Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
BH14	SPT02	3.00	Brownish grey silty clay with traces of kankars.										55	19							Do		
BH14	SPT03	5.00	Brownish grey clayey silt with sand mixture.			2.66												29	48	23	Do		
BH14	SPT04	7.00	Brownish grey clayey silt with traces of sand mixture.															21	79 (Silt+Clay)		Do		
BH15	UDS01	2.00	Brownish grey silty clay with kankars and traces of calcareous nodules.	1.86	1.54	2.70	21 S 21 T		TRSH-UU 3.0 0.769 2.0 0.732 1.0 0.709 UNCONFD	0.74	0	59	21	14			26	51	23		Do		
									0.0 0.749 0.0 0.773 0.0 0.773		0												
									REMOULD 0.0 0.548 0.0 0.569 0.0 0.569	0.56	0												
BH15	SPT02	3.00	Deep brownish grey, silty clay with traces of sand mixture & calcareous nodules.									50	17								Do		
BH16	SPT01	1.00	Brownish grey, silty clay.									59	20								Do		
BH16	SPT02	3.00	Brownish grey clayey silt with sand mixture & calcareous nodules.			2.62											32	45	23		Do		
BH16	UDS02	4.00	Brownish grey silty clay with traces of calcareous nodules & kankars.	2.01	1.65	2.63	23 S 22 T		TRSH-UU 3.0 1.257 2.0 1.091 1.0 1.066 UNCONFD	0.86	5	57	16				31	46	23		Do		
									0.0 0.634 0.0 0.677 0.0 0.650	0.65	0												

Bore Hole	Sample Number	Depth	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
										REMOULD		0.56	0									
										0.0	0.538											
										0.0	0.564											
										0.0	0.564											
BH16	SPT04	6.00	Brownish grey silty clay .											75	30		CH				Do	
BH16	SPT06	8.00	Brownish grey clayey silt with sand mixture & decomposed rock fragments			2.60												39	49	12	Do	
BH17	UDS01	2.10	Brownish grey silty clay with traces of calcareous nodules.	2.01	1.66	2.65	22 S 21 T			TRSH-UU		0.51	9	53	18		CH	28	51	21	Do	
										3.0	1.153											
										2.0	0.968											
										1.0	0.783											
										UNCONF		0.42	0									
										0.0	0.438											
										0.0	0.427											
										0.0	0.395											
										REMOULD		0.38	0									
										0.0	0.398											
										0.0	0.388											
										0.0	0.354											
BH17	UDS02	4.20	Brownish grey silty clay with decomposed rock fragments.	2.08	1.88	2.66	10 S 10 T 11 C	0.390		TRSH-UU		0.78	5	55	20		CH	19	58	17	6	Do
										3.0	1.138											
										2.0	1.042											
										1.0	0.947											
										UNCONF		0.65	0									
										0.0	0.668											
										0.0	0.652											
										0.0	0.630											
										REMOULD		0.58	0									
										0.0	0.598											
										0.0	0.583											
										0.0	0.559											
BH17	SPT03	5.10	Brownish grey silty sand with gravel pieces.													SM	40	42	18 (Silt+Clay)		Do	
BH17	SPT05	7.10	Whitish grey silty sand with decomposed rock fragments.													SM-SP		93	7 (Silt+Clay)		Do	

Bore Hole	Sample Number	Depth	Sample Description	Bulk		Dry Dens.	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
BH18	SPT01	1.00	Brownish grey silty clay.										57	20		CH					Do		
BH18	UDS01	2.00	Brownish grey silty clay with calcareous nodules and kankars.	1.95	1.63	2.69	22 S 20 T			TRSH-UU 3.0 2.0 1.0 UNCONF	1.432 1.337 1.241 1.17	1.05	5	59	15	8	CH	22	17	39	22	Do	
BH18	SPT02	3.00	Brownish grey clayey silt with sand mixture, decomposed rock fragments & kankars.			2.65												22	48	26	4	Do	
BH18	SPT03	4.10	Brownish grey clayey silt with sand mixture & decomposed rock fragments.																47	53 (Silt+Clay)		Do	
BH18	SPT07	8.00	Brownish grey clayey silty sand with decomposed rock fragments.														SM		64	36 (Silt+Clay)		Do	
BH19	SPT01	1.00	Brownish grey silty clay with traces of kankars.																				
BH19	UDS01	2.00	Brownish grey silty clay with calcareous nodules.	1.91	1.61	2.67	17 S 18 T 20 C	0.574		TRSH-UU 3.0 2.0 1.0 UNCONF	1.727 1.517 1.307 1.05	0.92	10	51	17	10	CH		27	47	26	Do	
															</								

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
BH19	SPT02	3.00	Brownish grey silty clay with sand & decomposed rock fragments.																	51	49 (Silt+Clay)		Do	
BH19	SPT03	4.10	Brownish grey clayey silt with sand mixture & decomposed rock fragments.																	57	43 (Silt+Clay)		Do	
BH19	SPT06	6.80	Brownish grey silty sand with decomposed rock fragments																					
BH20	UDS01	2.00	Brownish grey clayey silt / silty clay with traces of calcareous nodules.	1.86	1.55	2.62	16 S 20 T			TRSH-UU	0.75	5	48	17						28	46	26	Do	
										3.0 2.0 1.0	1.105 1.009 0.914													
										UNCONF	0.51	0												
										0.0 0.0 0.0	0.608 0.452 0.471													
										REMOULD	0.40	0												
										0.0 0.0 0.0	0.474 0.353 0.362													
BH20	UDS02	4.00	Brownish grey silty clay with calcareous nodules & sand mixture.	1.98	1.38	2.62	20 S 18 T			TRSH-UU	0.68	10	48	16	8					46	38	16	Do	
										3.0 2.0 1.0	1.441 1.231 1.021													
										UNCONF	0.40	0												
										0.0 0.0 0.0	0.686 0.511 0.000													
										REMOULD	0.30	0												
										0.0 0.0 0.0	0.529 0.382 0.000													
BH20	SPT03	5.00	Brownish grey clayey silt with sand mixture, kankar & decomposed rock fragments.			2.60													25	53	22	Do		
BH20	SPT04	6.10	Brownish grey clayey silt with decomposed rock fragments.										41	21								Do		

Bore Hole	Sample Number	Depth	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
BH20	SPT06	8.00	Brownish grey clayey silt with sand mixture & decomposed rock fragments.			2.61												49	41	10	Do	
BH21	UDS01	2.00	Deep brownish grey silty clay with traces of calcareous nodules.	1.99	1.60	2.61	24 S 24 T 25 C	0.678	TRSH-UU 3.0 2.0 1.0	0.777 0.721 0.713	0.74	0	51	19		CH		14	57	29	Do	
									UNCONF		0.65	0										
									0.0	0.651												
									0.0	0.651												
									0.0	0.651												
									REMOULD		0.51	0										
									0.0	0.511												
									0.0	0.511												
									0.0	0.511												
BH21	UDS02	4.00	Brownish grey silty clay with traces of calcareous nodules & kankar.			2.61	50 S						54	16	5	CH		15	56	29	Do	
BH21	SPT03	5.00	Yellowish grey silty clay with decomposed rock fragments													SM	24	59	17 (Silt+Clay)		Do	
BH21	SPT05	7.00	Brownish grey clayey silt with sand mixture & decomposed rock fragments.			2.68												46	43	11	Do	
BH22	SPT01	1.00	Brownish grey, silty clay with calcareous nodules.										51	17		CH					Do	
BH22	UDS01	2.00	Deep brownish grey silty clay with calcareous nodules and kankars.	1.96	1.58	2.68	24 S 24 T		TRSH-UU 3.0 2.0 1.0	1.210 1.048 0.886	0.63	8	53	17	9	CH		18	54	28	Do	
									UNCONF		0.75	0										
									0.0	0.742												
									0.0	0.750												
									0.0	0.759												
									REMOULD		0.68	0										
									0.0	0.669												
									0.0	0.677												
									0.0	0.686												

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	Clay %	
BH22	SPT02	3.05	Brownish grey silty clay with traces of calcareous nodules.										56	19		CH				Do	
BH22	SPT03	4.10	Brownish grey clayey moorum, kankar & sand mixture.			2.67											18	53	26	3	Do
BH22	SPT04	5.00	Brownish grey silty sand with decomposed rock fragments													SM	4	61	35 (Silt+Clay)		Do
BH22	SPT07	8.00	Brownish grey silty sand with decomposed rock fragments.													SM	3	70	27 (Silt+Clay)		Do
BH23	SPT01	1.00	Brownish grey, silty clay.										55	18		CH					Do
BH23	UDS01	2.00	Brownish grey silty clay with traces of calcareous nodules	1.95	1.58	2.65	24 S 23 T		TRSH-UU	0.51	8	54	20	13	CH		20	56	24		Do
									3.0	1.092											
									2.0	0.854											
									1.0	0.775											
									UNCONF	0.75	0										
									0.0	0.747											
									0.0	0.578											
									0.0	0.916											
									REMOULD	0.59	0										
BH23	SPT02	3.00	Brownish grey clayey silt with traces of sand mixture & kankars.			2.63											18	55	27		Do
	SPT04	5.10	Brownish grey silty sand.												SM	11	74	15 (Silt+Clay)		Do	
BH23	SPT05	6.10	Brownish grey silty sand with traces of gravel pcs.												SM	17	69	14 (Silt+Clay)		Do	
BH23	SPT06	7.10	Brownish grey silty sand with decomposed rock fragments												SM	14	56	30 (Silt+Clay)		Do	

Bore Hole	Sample Number	Depth	Sample Description	Bulk		Dry Dens.	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
BH24	UDS01	2.00	Brownish grey silty clay with calcareous nodules and kankars.	1.94	1.61	2.65	20 S 20 T	20 S 20 T			TRSH-UU 3.0 2.0	1.378 1.026	0.55	11	58	20	13		21	55	24	Do	
											1.0	0.936	0										
											UNCONFD		0.47	0									
											0.0	0.713											
											0.0	0.351											
											0.0	0.351											
											REMOULD		0.37	0									
											0.0	0.604											
											0.0	0.246											
											0.0	0.246											
BH24	SPT02	3.00	Brownish grey, silty clay with kankar & calcareous nodules.											50	19						Do		
BH24	UDS02	4.00	Brownish grey silty clay with kankars and traces of calcareous nodules.	1.87	1.46	2.63	22 S 28 T	22 S 28 T			TRSH-UU 3.0 2.0	1.138 1.042	0.78	5	54	19	8		27	68	5	Do	
											1.0	0.947											
											UNCONFD		0.81	0									
											0.0	0.999											
											0.0	0.870											
											0.0	0.554											
											REMOULD		0.61	0									
											0.0	0.796											
											0.0	0.670											
											0.0	0.375											
BH24	SPT03	5.00	Brownish grey clayey silt with sand mixture & calcareous nodules.			2.69												20	49	31	Do		
BH24	UDS03	6.00	Brownish grey silty clay with calcareous nodules and kankars	1.91	1.60	2.66	21 S 19 T 25 C	21 S 19 T 25 C	0.744		TRSH-UU 3.0 2.0	1.611 1.422	0.90	9	53	21	16		30	65	5	Do	
											1.0	1.243											
											UNCONFD		1.45	0									
											0.0	1.680											
											0.0	1.496											
											0.0	1.175											
											REMOULD		1.16	0									
											0.0	1.339											
											0.0	1.236											
											0.0	0.898											

Bore Hole	Sample Number	Depth	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	Clay %	
BH24	SPT04	7.00	Reddish brown clayey moorum with sand mixture & kankars.													26	43	31 (Silt+Clay)	Do		
BH25	UDS01	2.15	Brownish grey silty clay with traces of calcareous nodules.	1.92	1.50	2.64	29 S 28 T 28 C	0.738	TRSH-UU 3.0 2.0 1.0 UNCONFD	0.378 0.314 0.263	0.32	0	47	17	CI		21	57	22	Do	
BH25	SPT03	5.00	Brownish grey silty clay with moorum, kankar & decomposed rock fragments.													17	63	20 (Silt+Clay)	Do		
BH25	SPT04	6.10	Yellowish brown silty clay with traces of kankar.										69	21	CH					Do	
BH25	SPT05	7.00	Brownish grey silty sand with decomposed rock fragments.																		
																11	57	32 (Silt+Clay)	Do		
BH26	SPT01	1.00	Brownish grey clayey moorum & kankar.			2.66											31	46	23	Do	
BH26	UDS01	2.00	Brownish grey silty clay with traces of kankars.	1.98	1.58	2.70	25 S 25 T		TRSH-UU 3.0 2.0 1.0 UNCONFD	0.657 0.613 0.603	0.62	0	56	18	8	CH	2	21	54	23	Do

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				Atter. Limits			IS Classification	Grain Size				Test Method
									Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	Clay %	
IBH26	SPT03	4.60	Brownish grey silty clay .										53	18		CH				Do	
IBH26	SPT04	5.50	Brownish grey silty sand with decomposed rock fragments.													SM		60 40 (Silt+Clay)		Do	
IBH26	SPT07	7.60	Brownish grey silty sand with decomposed rock fragments.													SM		58 37 (Silt+Clay)		Do	
IBH01	SPT01	1.00	Brownish grey, silty clay.										59	19		CH				Do	
IBH01	UDS01	2.00	Brownish grey silty clay with traces of kankars and calcareous nodules.	1.96	1.55	2.74	29 S	0.738	TRSH-UU	0.81	0		57	19	8	CH	3	13 84 (Silt+Clay)		Do	
								26 T		3.0	0.846										
								26 C		2.0	0.835										
										1.0	0.752										
										UNCONF	0.75	0									
										0.0	0.722										
									0.0	0.776											
									0.0	0.736											
									REMOULD	0.67	0										
									0.0	0.607											
									0.0	0.691											
									0.0	0.716											
IBH01	SPT02	3.00	Brownish grey clayey silt with traces of sand mixture.			2.73											14	58	28	Do	
IBH01	SPT03	4.10	Brownish grey silty clay with traces of kankars.										55	18		CH				Do	
IBH01	SPT06	7.00	Brownish grey clayey silt with decomposed rock fragments			2.74											22	44	22	12	Do
IBH01	SPT07	8.00	Brownish grey clayey silty sand with decomposed rock fragments													SM	3	50 47 (Silt+Clay)		Do	

[illegible]

Bore Hole	Sample Number	Depth M	Sample Description	Bulk Dens. gms/cc	Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results				After Limits			IS Classification	Grain Size			Test Method
									Pc/sqcm kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %		Gravl %	Sand %	Silt %	
IBH03	SPT02	3.00	Brownish grey silty clay with traces of kankars.										57	18		CH				Do
IBH03	SPT03	4.10	Brownish grey silty sand with decomposed rock fragments & kankars.													SM	42	37	21 (Silt+Clay)	Do
IBH03	SPT04	5.00	Brownish grey silty sand with decomposed rock fragments.													SM	39	46	15 (Silt+Clay)	Do
IBH03	SPT05	5.80	Brownish grey silty sand with decomposed rock fragments													SM	42	45	13 (Silt+Clay)	Do
IBH04	SPT01	1.00	Brownish grey clayey silt with traces of sand mixture & kankars.			2.66											17	56	27	Do
IBH04	SPT02	3.00	Brownish grey silty clay with traces of kankars.										56	19		CH				Do
IBH04	SPT03	4.10	Brownish grey clayey silt with sand mixture & calcareous nodules.			2.61											30	48	22	Do
IBH04	SPT04	5.00	Brownish grey silty sand with rock pieces													SM	39	45	16 (Silt+Clay)	Do
IBH04	SPT06	7.00	Brownish grey silty sand with decomposed rock fragments														69	31 (Silt+Clay)		Do
IBH05	SPT01	1.00	Brownish grey, silty clay.										62	19		CH				Do
IBH05	UDS01	2.00	Brownish grey silty clay with traces of calcareous nodules and kankars	2.04	1.71	2.62	19 S 19 T 23 C	0.603	TRSH-UU 3.0 2.0 1.0 UNCONF	0.886 0.833 0.752	0.82	0	58	20	9	CH	18	53	29	Do
									0.0	0.972	0.74	0								
									0.0	0.486										
									0.0	0.754										

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Sheet No.

Bore Hole	Sample Number	Depth	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
				Dens. gms/cc						Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
										REMOULD		0.63	0										
										0.0	0.660												
										0.0	0.604												
										0.0	0.663												
IBH05	SPT03	4.10	Yellowish brown silty clay with traces of calcareous nodules & kankar.											46	16		CI					Do	
IBH05	SPT04	5.00	Brownish grey silty sand with traces of clay binder & kankar.				2.73										SM		69	24	7	Do	
IBH05	SPT05	6.00	Brownish grey silty sand with decomposed rock fragments														SM		58	42 (Silt+Clay)		Do	
IBH06	SPT01	1.00	Brownish grey, silty clay.											56	19		CH					Do	
IBH06	UDS01	2.00	Brownish grey silty clay with traces of kankars and calcareous nodules.	2.02	1.66	2.71		22 S 22 T		TRSH-UU		0.70	0	55	18	8	CH	3	22	54	21	Do	
										3.0	0.723												
										2.0	0.706												
										1.0	0.671												
										UNCONF		1.03	0										
										0.0	1.206												
										0.0	0.890												
										0.0	0.979												
										REMOULD		0.86	0										
										0.0	1.006												
										0.0	0.685												
										0.0	0.878												
IBH06	SPT03	4.10	Brownish grey silty sand with decomposed rock fragments														SM	36	46	18 (Silt+Clay)		Do	
IBH06	SPT06	7.10	Whitish grey silty sand with decomposed rock fragments														SM		66	34 (Silt+Clay)		Do	
IBH07	SPT01	0.80	Brownish grey clayey silt with sand mixture & kankar.				2.66											36	42	22		Do	

Bore Hole	Sample Number	Depth M	Sample Description	Bulk		Dry Dens. gms/cc	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits				IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %	Sand %		Silt %	Clay %			
IBH07	UDS01	2.00	Brownish grey silty clay with traces of calcareous nodules and kankars	1.94	1.58	2.64	24 S	0.666	TRSH-UU	0.68	9	58	21	9	CH	15	57	28	Do					
						3.0	1.353																	
						2.0	1.167																	
						1.0	0.982																	
						UNCONFD	0.77	0																
						0.0	0.963																	
						0.0	0.513																	
						0.0	0.833																	
						REMOULD	0.55	0																
						0.0	0.758																	
IBH07																								
IBH07	SPT02	2.80	Brownish grey silty clay with traces of calcareous nodules.									57	20		CH				Do					
IBH07	UDS02	4.00	Brownish grey silty clay with calcareous nodules and kankars.	2.04	1.73	2.71	19 S	0.579	TRSH-UU	1.50	10	50	16		CH	28	47	25	Do					
							18 T			3.0	2.418													
							21 C			2.0	2.208													
										1.0	1.998													
										UNCONFD	1.19	0												
										0.0	1.160													
										0.0	1.237													
										0.0	1.180													
										REMOULD	0.98	0												
										0.0	0.932													
IBH07																								
IBH07	SPT03	4.80	Brownish grey silty clay .																Do					
IBH07	SPT04	6.10	Brownish grey silty sand with decomposed rock fragments												SM	71	29 (Silt+Clay)	Do						
IBH07	SPT06	7.80	Brownish grey silty sand with decomposed rock fragments												SM	13	65	22 (Silt+Clay)	Do					
IBH08	UDS01	2.00	Brownish grey silty clay with calcareous nodules	1.91	1.53	2.66	26 S	0.756	TRSH-UU	0.64	0	56	19	10	CH	19	52	29	Do					
							25 T			3.0	0.708													
							28 C			2.0	0.616													
										1.0	0.593													

Bore Hole	Sample Number	Depth	Sample Description	Bulk		Dry	Spec. Grav.	Nat. Mois. %	Void Ratio	Strength Test Results					Atter. Limits			IS Classification	Grain Size				Test Method
				Dens. gms/cc	Dens. gms/cc					Pc/Pn kg/sqcm	Shear kg/sqcm	Cohesn kg/sqcm	Frictn Deg.	LL %	PL %	SL %	Gravl %		Sand %	Silt %	Clay %		
										UNCONF	0.55	0											
										0.0	0.536												
										0.0	0.546												
										0.0	0.560												
										REMOULD	0.46	0											
										0.0	0.446												
										0.0	0.459												
										0.0	0.472												
IBH08	SPT02	3.00	Brownish grey, silty clay.										57	20		CH					Do		
IBH08	SPT03	4.10	Brownish grey clayey silt with traces of sand mixture & kankars.			2.63												19	50	31	Do		
IBH08	SPT04	5.00	Reddish brown silty sand with moorum													SM	19	61	20 (Silt+Clay)		Do		
IBH08	SPT05	6.10	Brownish grey silty sand with gravel pcs & decomposed rock fragments.													SM	21	54	25 (Silt+Clay)		Do		
IBH09	UDS01	2.00	Brownish grey silty clay with traces of kankar.	1.81	1.32	2.63	35 S	0.848	TRSH-UU	0.15	0		49	18		CI		20	53	27	Do		
							36 T		3.0	0.206													
							32 C		2.0	0.179													
									1.0	0.077													
IBH09	SPT03	5.00	Brownish grey clayey silt with sand mixture & kankar			2.63												19	58	23	Do		

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive Strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	
			Bulk	Dry				In-situ	Saturated						In-situ	Saturated
1	17	21.00-21.75	2.1014	2.0808	0.990	2.413	2.426	--	--	--	--	--	Moderately Soft	--	--	--
1	27	28.50-29.25	2.3688	2.3471	0.924	1.212	2.747	--	--	--	2.80	80.35	--	--	--	--
2	4	11.00-11.75	2.2071	2.1758	1.442	8.800	2.386	--	--	--	--	--	--	--	--	--
2	8	14.00-14.75	2.245	2.058	9.086	14.357	2.574	--	--	--	1.89	--	--	--	--	--
2	16	20.00-20.75	2.4436	2.3293	4.906	10.127	2.700	--	--	--	4.00	--	--	--	--	--
2	18	21.50-22.25	--	--	--	--	--	--	--	--	--	--	18.34	--	--	--
3	18	19.75-20.50	2.3161	2.183	6.095	13.512	2.554	--	--	--	1.06	--	--	--	--	--
3	29	28.00-28.75	2.4666	2.4315	1.443	8.216	2.649	--	--	--	0.99	37.79	Moderately Soft	--	--	--
4	4	10.75-11.50	2.1347	2.0432	4.478	12.383	2.332	--	--	--	--	--	--	--	--	--
4	25	26.50-27.25	2.4024	2.3907	0.487	6.473	2.556	--	--	--	--	--	--	--	--	--
5	4	10.75-11.50	2.646	2.4694	7.151	15.374	2.812	--	--	--	4.85	--	--	--	--	--
5	8	13.75-14.50	2.1586	2.0265	6.520	14.300	2.365	--	--	--	--	--	--	--	--	--
5	10	15.25-16.00	--	--	--	--	--	--	--	--	--	--	23.410	--	--	--
7	21	24.00-24.75	2.367	2.354	0.524	3.422	2.627	--	580	--	--	--	Moderately Hard	--	--	--
7	31	31.50-32.25	2.537	2.445	3.763	5.683	2.642	--	--	--	0.94	--	--	--	--	--
9	7	13.20-13.95	2.003	1.872	6.998	15.814	2.224	--	--	--	--	--	--	--	--	--
9	12	16.95-17.70	2.315	2.129	8.736	13.524	2.526	--	--	--	--	--	--	--	--	--
10	7	16.50-17.25	--	--	--	--	--	--	--	--	--	18.02	--	--	--	--
10	12	20.25-21.00	2.409	2.380	1.221	3.614	2.625	--	140	--	--	--	--	--	--	--
10	17	24.00-24.75	--	--	--	--	--	--	--	--	--	--	19.62	--	--	--

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive Strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	
			Bulk	Dry				In-situ	Saturated						In-situ	Saturated
10	23	28.50-29.25	2.315	2.211	4.704	10.905	2.651	--	101	--	--	--	--	--	--	--
11	12	18.50-19.25	--	--	--	--	--	--	--	--	--	87.52	--	--	--	--
11	19	23.75-24.50	2.614	2.602	0.486	3.191	2.688	--	80	--	--	--	Moderately Hard	--	--	5653
11	27	29.75-30.50	2.461	2.460	0.042	1.884	2.657	85	--	--	--	--	--	--	7777	--
12	8	12.25-13.00	2.2676	2.2167	2.297	6.493	2.371	--	--	--	0.82	24.51	--	--	--	--
12	30	28.75-29.50	2.4945	2.485	0.383	3.070	2.564	--	--	--	9.32	--	--	--	--	--
13	5	13.00-13.75	2.236	2.091	6.934	14.975	2.640	88	--	--	--	--	--	--	--	--
13	12	18.25-19.00	2.490	2.486	0.153	0.836	2.507	--	--	--	7.64	--	--	--	--	--
13	13	17.70-18.45	--	--	--	--	--	--	--	--	--	24.19	--	--	--	--
13	19	23.50-24.25	--	--	--	--	--	--	--	--	--	36.09	--	--	--	--
14	9	14.00-14.75	2.5224	2.5181	0.169	1.573	2.558	--	--	--	--	--	--	--	--	--
14	16	19.25-20.00	2.2766	2.2059	3.204	8.301	2.406	--	--	--	5.26	--	--	--	--	--
14	22	23.75-24.50	2.5877	2.584	0.142	0.367	2.594	--	--	--	--	--	--	--	--	--
15	17	18.25-19.00	2.351	2.197	7.010	14.392	2.637	--	--	--	1.05	--	--	--	--	--
15	25	24.50-25.00	2.576	2.567	0.356	2.799	2.641	--	--	--	12.08	--	21.17	--	--	--
16	9	14.50-15.25	2.232	2.179	2.395	3.349	2.647	101	--	--	--	--	--	Soft	--	--
17	7	12.75-13.50	2.5945	2.5897	0.185	2.307	2.651	--	--	--	--	--	--	--	--	--
17	23	24.50-25.06	2.6842	2.68	0.159	0.658	2.698	--	--	--	36.39	--	--	--	--	--
18	11	16.00-16.75	2.583	2.579	0.156	0.757	2.599	--	--	--	23.64	--	--	Hard	--	--
18	18	21.25-22.00	2.539	2.517	0.859	4.847	2.646	--	--	--	3.16	--	--	--	--	--
20	16	20.25-21.00	2.5488	2.5251	0.936	5.850	2.682	--	--	--	--	--	--	--	--	--

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive Strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	
			Bulk	Dry				In-situ	Saturated						In-situ	Saturated
20	20	23.25-24.00	2.3499	2.3251	1.067	14.560	2.721	--	--	--	--	--	--	--	--	--
21	13	18.00-18.75	2.4313	2.4227	0.352	6.168	2.582	--	--	--	--	--	--	--	--	--
21	20	23.25-24.00	2.4822	2.4748	0.299	2.911	2.549	--	--	--	3.77	--	--	--	--	--
22	11	16.00-16.75	2.451	2.432	0.793	9.277	2.681	--	--	--	0.97	--	--	--	--	--
22	21	23.50-24.25	2.488	2.474	0.552	4.452	2.589	--	--	--	9.16	--	--	--	--	--
22	23	25.00-25.75	--	--	--	--	--	--	--	--	--	--	24.62	--	--	--
23	9	14.25-15.00	2.230	2.156	3.432	7.613	2.519	--	--	--	1.60	--	Moderately Soft	--	--	3960
23	22	24.00-24.75	--	--	--	--	--	--	--	--	--	88.95	--	--	--	--
23	26	27.00-27.75	2.537	2.521	0.629	5.155	2.658	--	44	--	--	--	--	--	--	--
24	1	9.50-10.50	2.387	2.310	3.333	8.315	2.612	--	--	--	1.21	--	--	--	2127	--
24	15	20.00-20.75	2.230	2.220	0.456	0.794	2.682	28	--	--	--	--	--	--	--	--
24	18	22.25-23.00	--	--	--	--	--	--	--	--	--	--	18.44	--	--	--
25	8	13.25-14.00	2.5258	2.5203	0.220	1.973	2.571	--	--	--	27.45	97.14	--	--	--	--
25	14	17.75-18.50	2.515	2.5078	0.287	3.020	2.586	--	--	--	--	--	--	--	--	--
26	8	13.25-14.00	--	--	--	--	--	--	--	--	--	3.66	--	--	--	--
26	15	18.50-19.25	2.493	2.484	0.354	0.554	2.799	24	--	--	--	--	--	--	3050	--
26	20	22.25-23.00	2.623	2.619	0.126	0.939	2.644	--	--	--	27.71	--	Hard	--	--	--
IBH-01	15	20.50-21.25	--	--	--	--	--	--	--	--	--	58.68	--	--	--	--
IBH-01	19	23.50-24.25	2.521	2.490	1.246	4.985	2.615	--	140	--	--	--	--	--	--	--
IBH-02	7	13.00-13.75	2.416	2.289	5.548	9.875	2.604	--	188	--	--	--	--	--	--	--
IBH-02	19	22.00-22.75	--	--	--	--	--	--	--	--	--	94.35	Hard	--	--	--

Job No. : 4287

Sheet No.

LABORATORY ROCK TEST RESULTS

BH No.	Run No.	Depth (M)	Density (gm/cc)		Water Content (%)	Porosity %	Specific Gravity	Unconfined Compressive Strength (kg/sqcm)		Coefficient of softening	Point Load Strength Index (kg/sqcm)	Slake Durability Index (%)	Hardness (based on Mohs' Scale)	Soundness* (% Loss)	E (Kg/sqcm)	
			Bulk	Dry				In-situ	Saturated						In-situ	Saturated
IBH-02	30	30.25-31.00	2.612	2.604	0.323	1.901	2.654	--	159	--	--	--	--	--	--	12051
IBH-02	33	32.50-33.25	--	--	--	--	--	--	--	--	--	--	--	13.62	--	--
IBH-03	22	22.05-22.80	2.441	2.432	0.353	7.649	2.621	--	--	--	0.92	--	--	--	--	--
IBH-04	20	22.50-23.25	2.520	2.506	0.566	4.454	2.623	--	--	--	3.61	--	--	--	--	--
IBH-04	22	24.00-25.00	2.512	2.493	0.768	6.268	2.659	--	--	--	1.78	--	--	--	--	--
IBH-05	13	17.50-18.25	2.645	2.641	0.133	0.744	2.661	--	--	--	19.11	--	--	--	--	--
IBH-05	24	26.50-27.25	--	--	--	--	--	--	--	--	--	94.58	Hard	--	--	--
IBH-05	34	33.25-34.00	2.666	2.660	0.200	1.018	2.620	--	345	--	--	--	--	--	--	13341
IBH-06	18	21.00-21.75	2.411	2.406	0.194	1.881	2.453	--	--	--	19.44	--	--	--	--	--
IBH-06	24	25.60-26.35	2.507	2.503	0.144	0.745	2.522	89	--	--	2.65	--	--	15.55	6050	21080
IBH-06	33	32.25-33.00	2.605	2.601	0.155	1.263	2.634	--	307	--	--	--	--	--	--	--
IBH-07	19	22.20-22.95	2.364	2.211	6.920	12.625	2.614	11	--	--	--	--	--	--	1685	--
IBH-07	24	25.95-26.70	2.664	2.661	0.095	0.495	2.674	--	581	--	31.65	--	Hard	--	--	32573
IBH-08	21	24.75-25.50	2.514	2.503	0.438	3.484	2.613	--	63	--	--	--	--	--	--	5823
IBH-08	27	26.50-27.25	--	--	--	--	--	--	--	--	--	81.65	--	21.73	--	--
IBH-08	34	31.75-32.50	2.468	2.463	0.217	2.787	2.631	--	88	--	--	--	--	--	--	--
IBH-09	2	7.75-8.50	2.3465	2.2921	2.372	7.188	2.470	--	--	--	--	--	--	--	--	--
IBH-09	24	24.25-25.00	2.5305	2.5037	1.068	7.172	2.697	--	--	--	0.94	--	--	--	--	--
IBH-09	36	33.25-34.00	2.4068	2.3923	0.603	4.671	2.510	--	--	--	1.83	--	24.72	--	--	--

SWELLING TEST RESULTS

Bore Hole No.	Sample No.	Depth (M)	Description	Free Swell Index, (%)	Swelling Pressure, (kg/sqcm)	PI (%)	Test Methods
BH-01	UDS-01	2.10	Brownish grey silty clay with traces of kankar.	50.00	0.71	44	*See the note Do
BH-02	UDS-02	4.00	Yellowish grey silty clay with sand mixture & traces of calcareous nodules.	34.88	0.33	38	
BH-04	UDS-01	2.00	Deep grey silty clay with traces of kankars.	52.63	0.12	27	Do
BH-06	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	50.00	0.46	41	Do
BH-07	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	42.50	0.88	33	Do
BH-08	UDS-01	1.80	Brownish grey silty clay with kankars.	53.85	--	36	Do
BH-09	UDS-01	2.00	Brownish grey silty clay with traces of kankar.	50.00	1.00	33	Do
BH-10	UDS-04	7.10	Brownish grey silty clay with traces of calcareous nodules.	23.81	0.86	31	Do
BH-11	UDS-01	2.00	Brownish grey silty clay with calcareous nodules.	53.85	2.00	37	Do
BH-12	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	46.34	0.44	34	Do
BH-13	UDS-02	4.00	Brownish grey silty clay with traces of calcareous nodules.	60.00	1.80	36	Do
BH-14	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	71.79	1.00	40	Do
BH-15	UDS-01	2.00	Brownish grey silty clay with kankars and traces of calcareous nodules.	75.00	--	38	Do
BH-16	UDS-02	4.00	Brownish grey silty clay with traces of calcareous nodules & kankars.	40.00	--	41	Do
BH-17	UDS-02	4.20	Brownish grey clayey silt with sand mixture & rock pieces.	33.33	0.48	35	Do
BH-18	UDS-01	2.00	Brownish grey silty clay with calcareous nodules and kankars.	45.00	--	44	Do
BH-19	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	50.00	1.55	34	Do
BH-20	UDS-02	4.00	Brownish grey silty clay with kankar & calcareous nodules.	35.00	0.24	32	Do
BH-21	UDS-01	2.00	Brownish grey silty clay with traces of kankar.	48.72	0.48	32	Do
BH-22	UDS-01	2.00	Deep brownish grey silty clay with calcareous nodules and kankars.	66.67	--	36	Do
BH-23	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	52.50	--	34	Do
BH-24	UDS-03	6.00	Brownish grey silty clay with traces of sand mixture.	63.64	0.56	32	Do
BH-25	UDS-01	2.15	Brownish grey silty clay with traces of calcareous nodules.	53.85	0.35	30	Do
BH-26	UDS-01	2.00	Brownish grey silty clay with traces of kankars.	62.50	--	38	Do
IBH-01	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	50.00	1.00	38	Do
IBH-02	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules and kankars	50.00	--	42	Do

SWELLING TEST RESULTS

Bore Hole No.	Sample No.	Depth (M)	Description	Free Swell Index, (%)	Swelling Pressure, (kg/sqcm)	PI (%)	Test Methods
IBH-03	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	67.50	0.88	39	Do
IBH-05	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	60.00	1.00	38	Do
IBH-06	UDS-01	2.00	Brownish grey silty clay with traces of kankars and calcareous nodules.	60.00	--	37	Do
IBH-07	UDS-01	2.00	Brownish grey silty clay with calcareous nodules.	--	0.14	37	Do
IBH-07	UDS-02	4.00	Brownish grey silty clay with calcareous nodules.	41.07	1.00	34	Do
IBH-08	UDS-01	2.00	Brownish grey silty clay with traces of calcareous nodules.	50.00	0.45	37	Do
IBH-09	UDS-01	2.00	Brownish grey silty clay with traces of sand mixture.	55.00	0.01	31	Do

SUMMERISED LABORATORY COMPACTION & CBR TEST RESULTS

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP

Annexure-B

Job No. : 4287

Sheet No.

SL No	Test No.	Sample No	Depth (M)	Description	Standard Proctor Compaction Test			Soaked CBR		Recommended Soaked CBR (%)	UnSoaked CBR		Recommended UnSoaked CBR (%)	Test Method
					OMC (%)	MDD (gm/cc)		2.50mm Pentn	5.00mm Pentn		2.50mm Pentn	5.00mm Pentn		
1	TP01	DS01	1.00	Brownish grey silty clay with traces of calcareous nodules.	18.00	1.607		2.02	1.60	2	--	--	--	*See the Note
2	TP01	DS02	2.00	Deep grey silty clay with traces of calcareous nodules.	18.24	1.611		--	--	--	8.21	6.90	8	Do
3	TP02	DS02	2.00	Deep brownish grey silty clay with traces of calcareous nodules.	19.20	1.692		--	--	--	9.47	7.44	9	Do
4	TP02	DS03	3.00	Deep grey silty clay with traces of calcareous nodules.	18.57	1.579		1.44	1.32	1	--	--	--	Do
5	TP03	DS01	1.00	Deep grey silty clay with traces of calcareous nodules.	17.22	1.577		--	--	--	3.63	3.35	3	Do
6	TP03	DS03	3.00	Deep grey silty clay with traces of calcareous nodules.	17.50	1.569		--	--	--	4.03	3.91	4	Do
7	TP04	DS01	1.00	Deep grey silty clay with traces of calcareous nodules.	19.04	1.602		2.43	2.01	2	--	--	--	Do
8	TP04	DS02	2.00	Brownish grey silty clay with traces of calcareous nodules.	18.35	1.577		--	--	--	--	--	--	Do
9	TP05	DS02	2.00	Brownish grey silty clay with traces of calcareous nodules.	19.88	1.595		--	--	--	--	--	--	Do
10	TP05	DS03	3.00	Deep grey silty clay with traces of calcareous nodules.	20.15	1.578		2.09	1.81	2	--	--	--	Do
11	ITP01	DS01	1.00	Brownish grey silty clay with traces of calcareous nodules.	21.40	1.597		--	--	--	5.70	4.82	5	Do
12	ITP01	DS02	2.00	Deep grey silty clay with traces of calcareous nodules.	21.00	1.606		3.66	2.88	3	--	--	--	Do

*Note: Test Methods

Bulk Density & Dry Density: Ref. CET/SOP/01, Issue No. 01-(Page 27 & 39 of 40)

Natural Moisture Content: IS 2720 (Part 2)

Specific Gravity: IS 2720 (Part 3).

Grain size analysis: IS 2720 (Part 4)

Liquid Limit & Plastic Limit: IS 2720 (Part 5)

Shrinkage Limit: IS 2720 (Part 6)

Standard Proctor Compaction Test (Light Compaction): IS 2720 (Part 7)

California Bearing Ratio (CBR) Test: IS 2720 (Part 16)

Free Swell Index: IS 2720 (Part 40)

Point Load Index: IS 8764.

Water Content, Bulk & Dry Density and Porosity: IS 13030

Shake Durability Index : IS 10050.

Unconfined Compressive Strength: IS 9143.

C.E. Testing Company Pvt. Ltd.

Prepared By

Checked & Approved By

(I. Chowdhury)

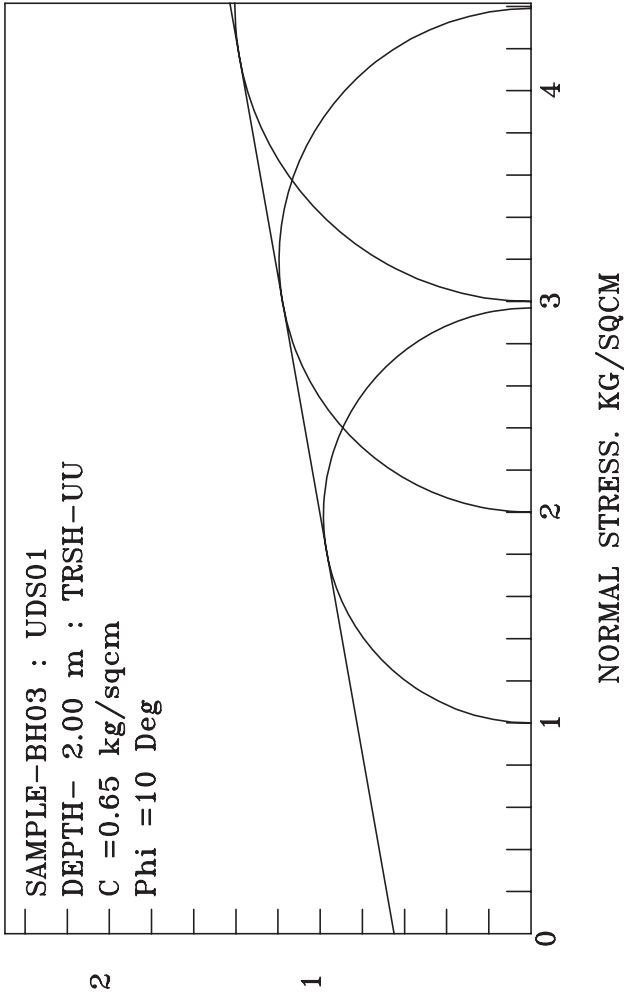
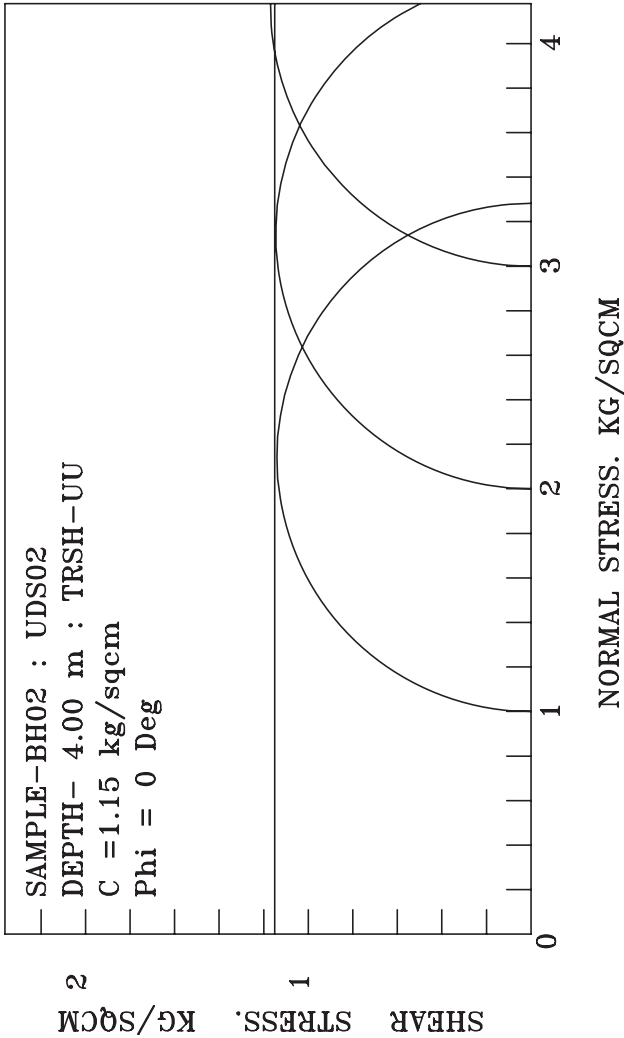
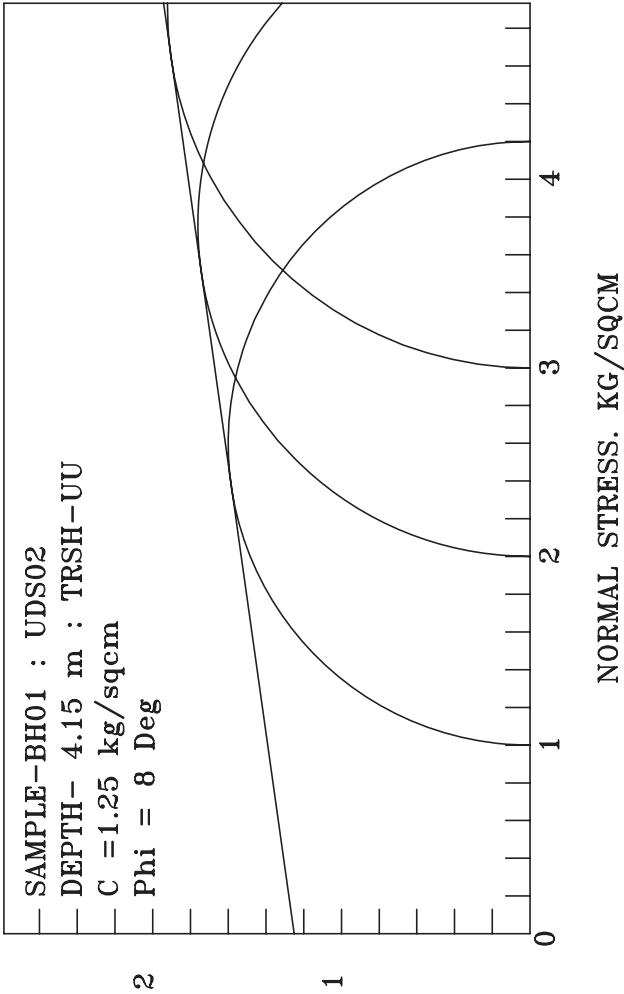
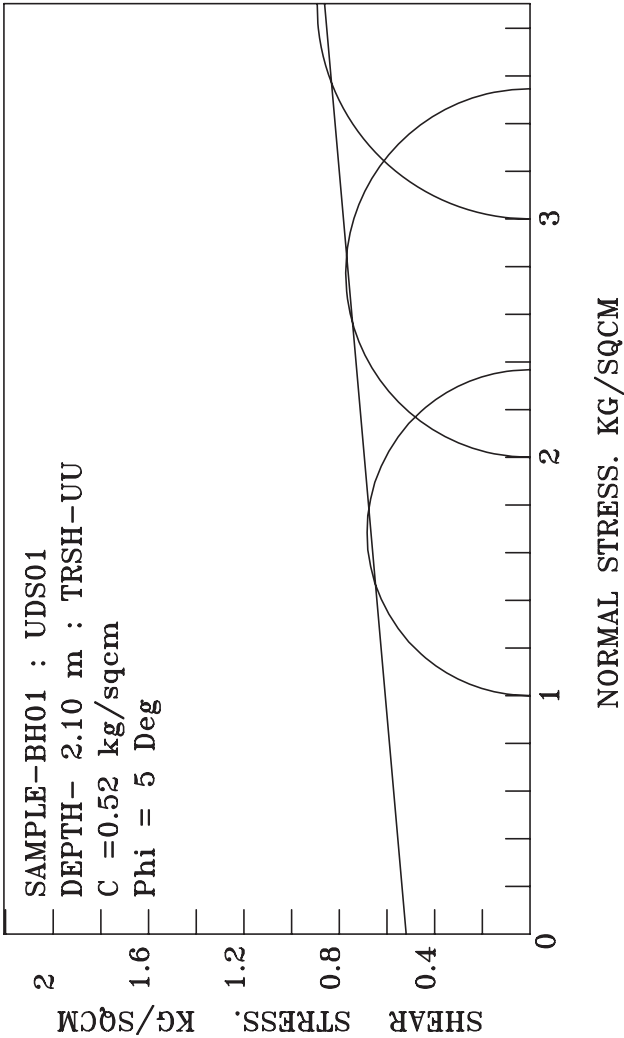
Deputy Technical Manager

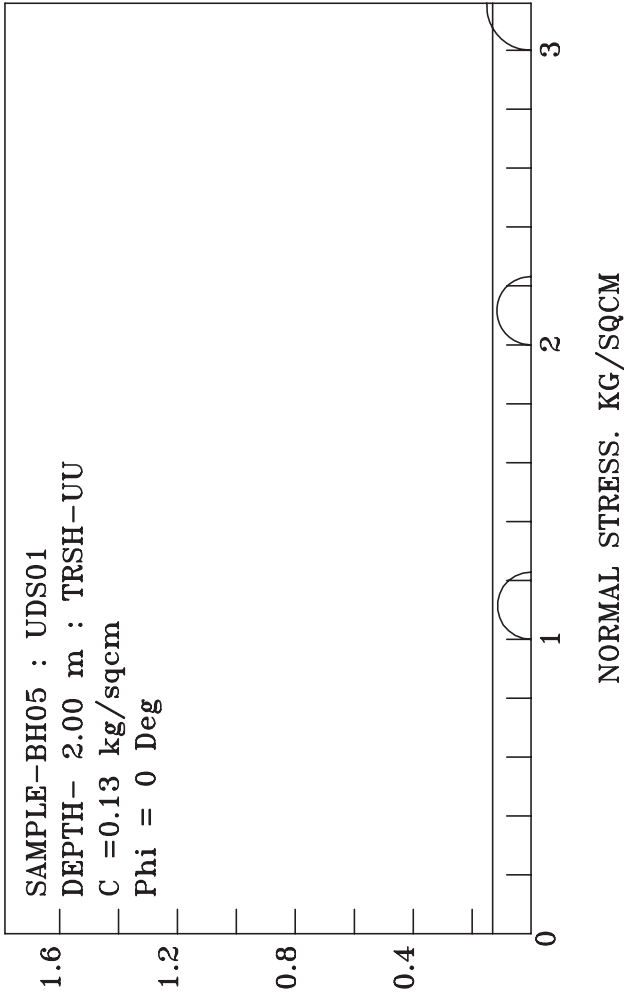
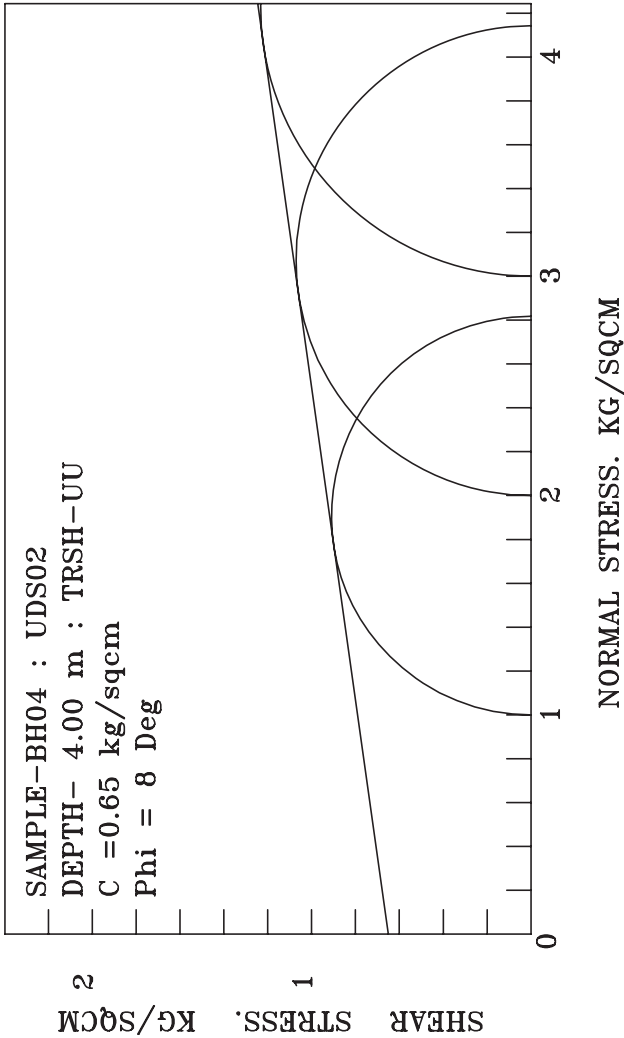
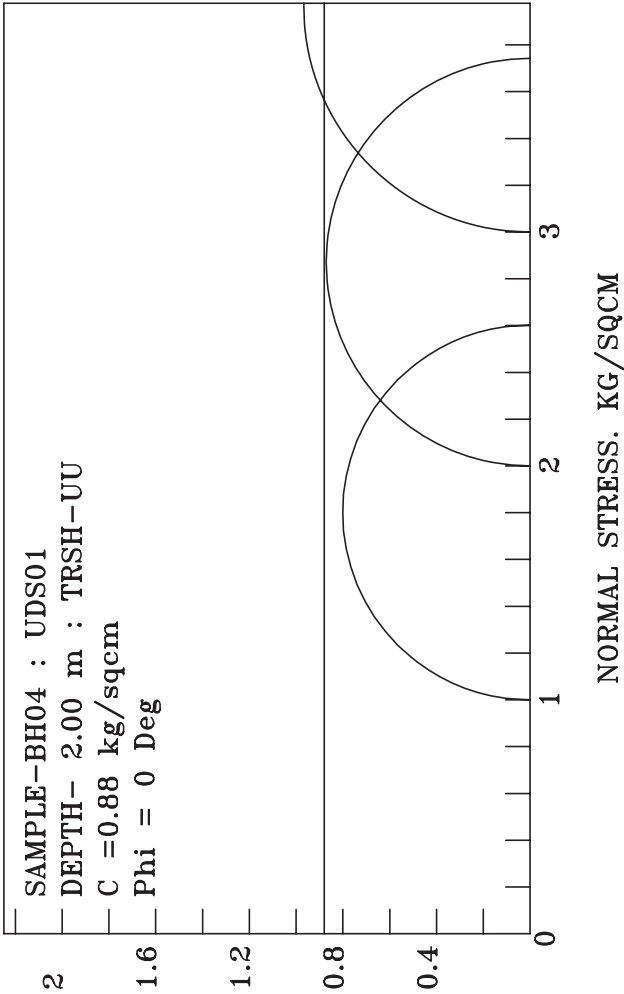
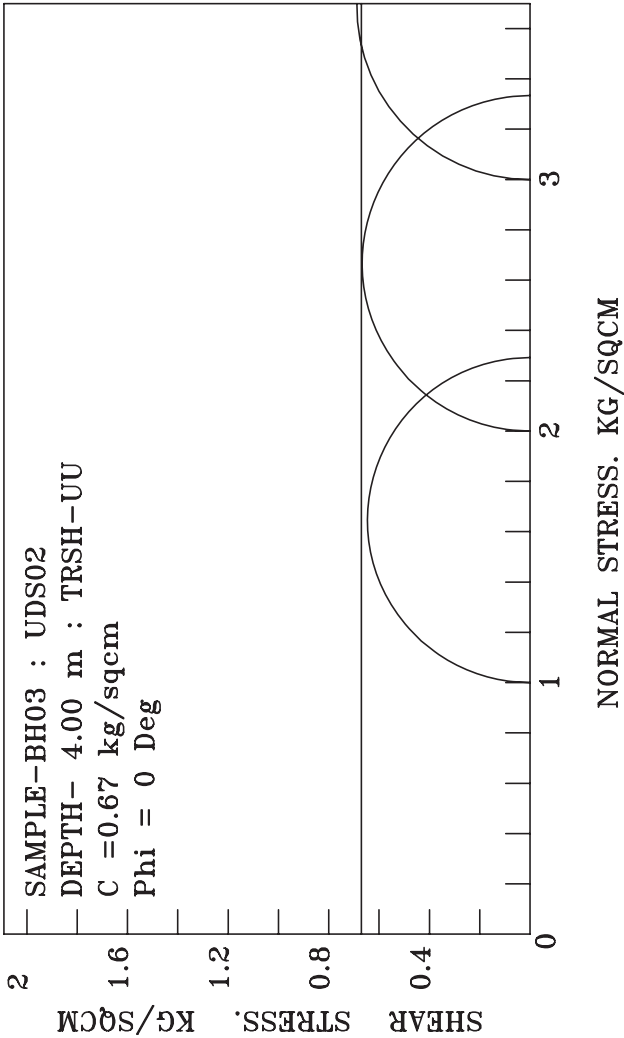
Sudip Nath

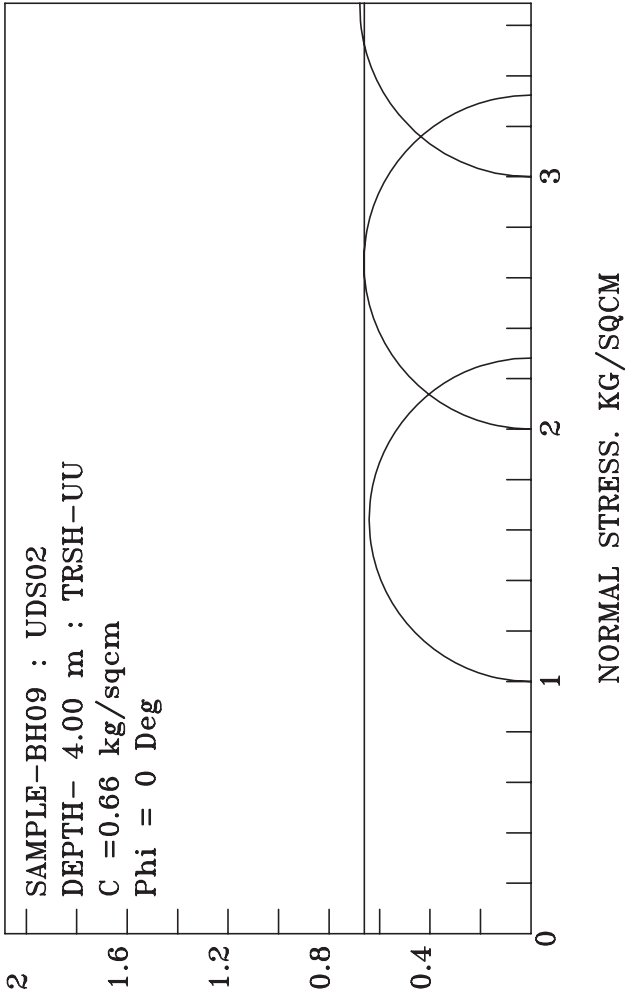
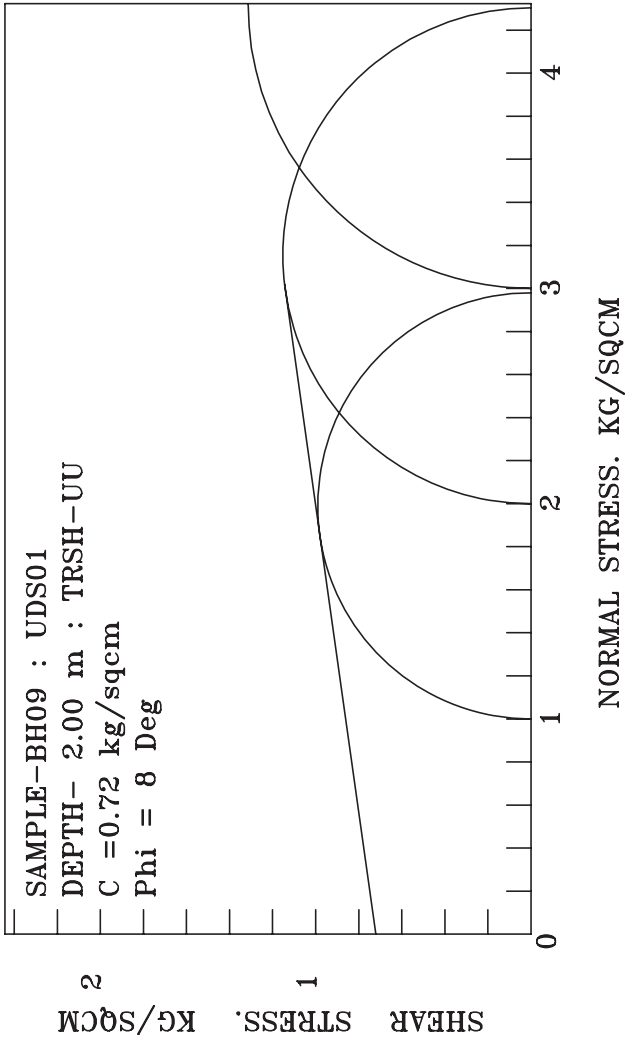
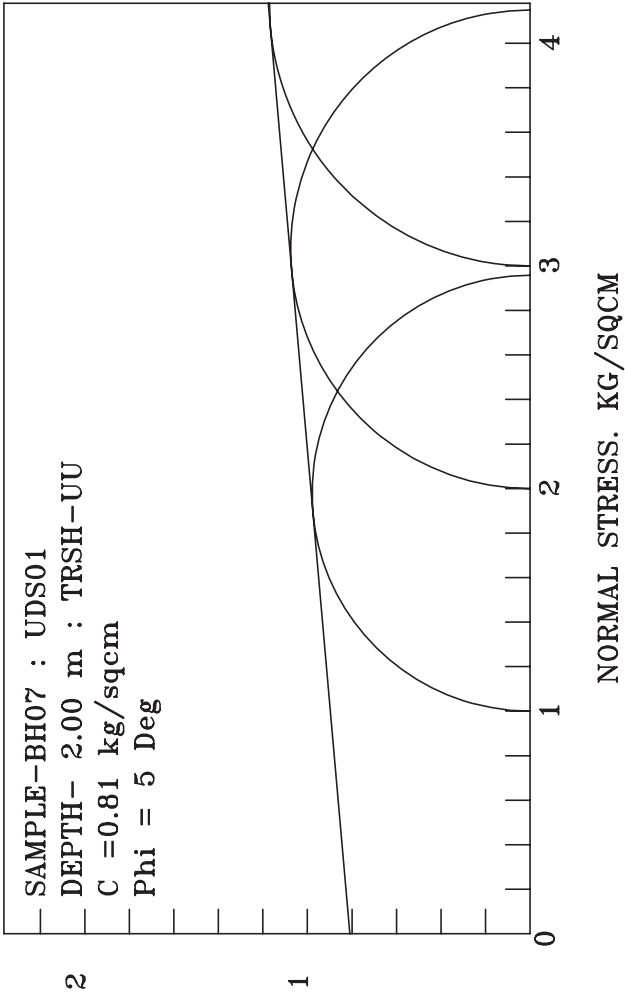
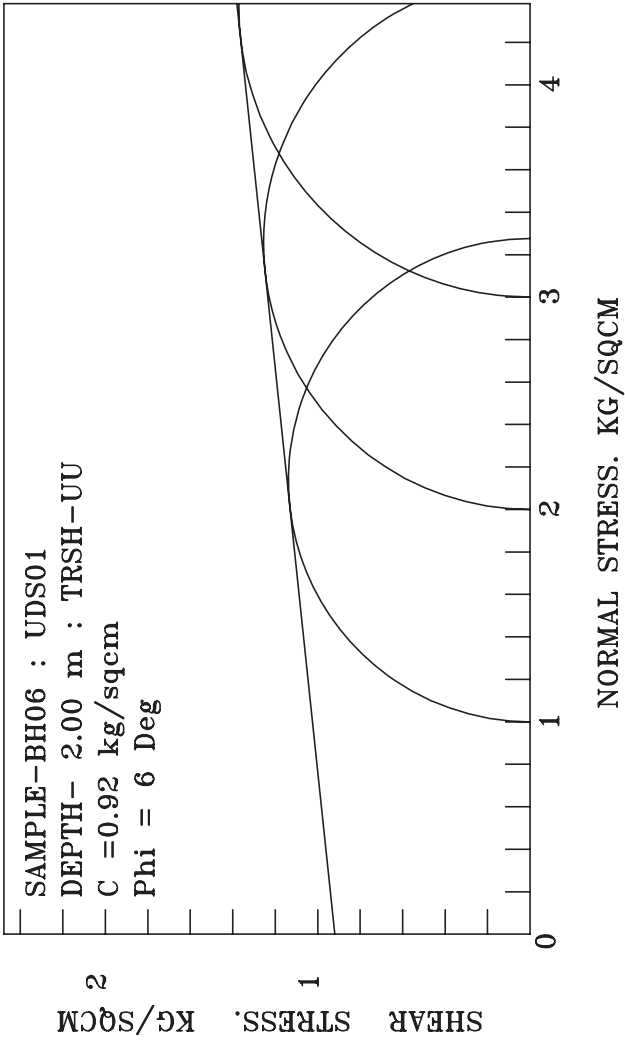
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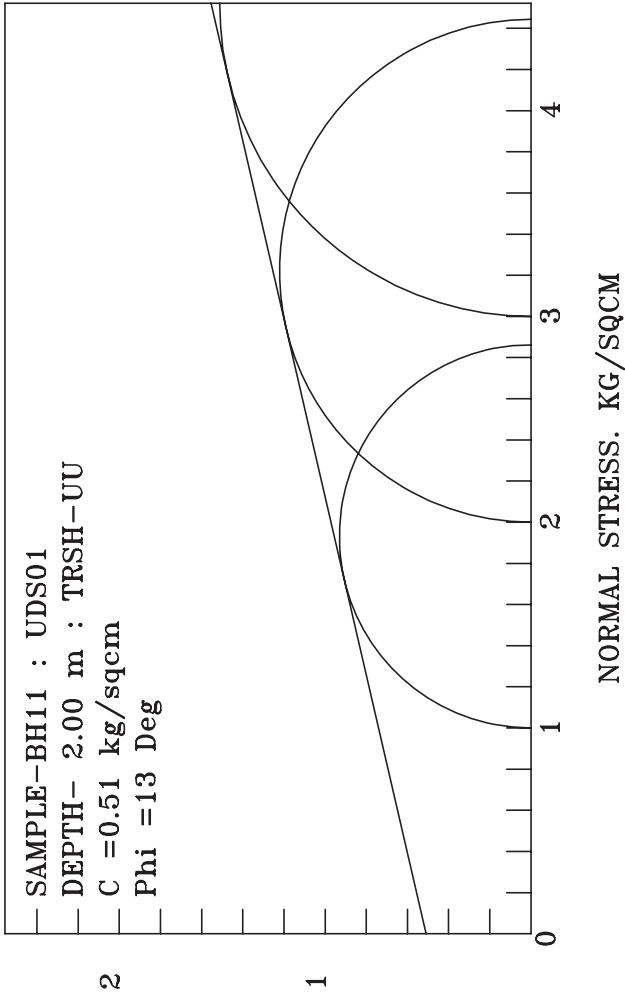
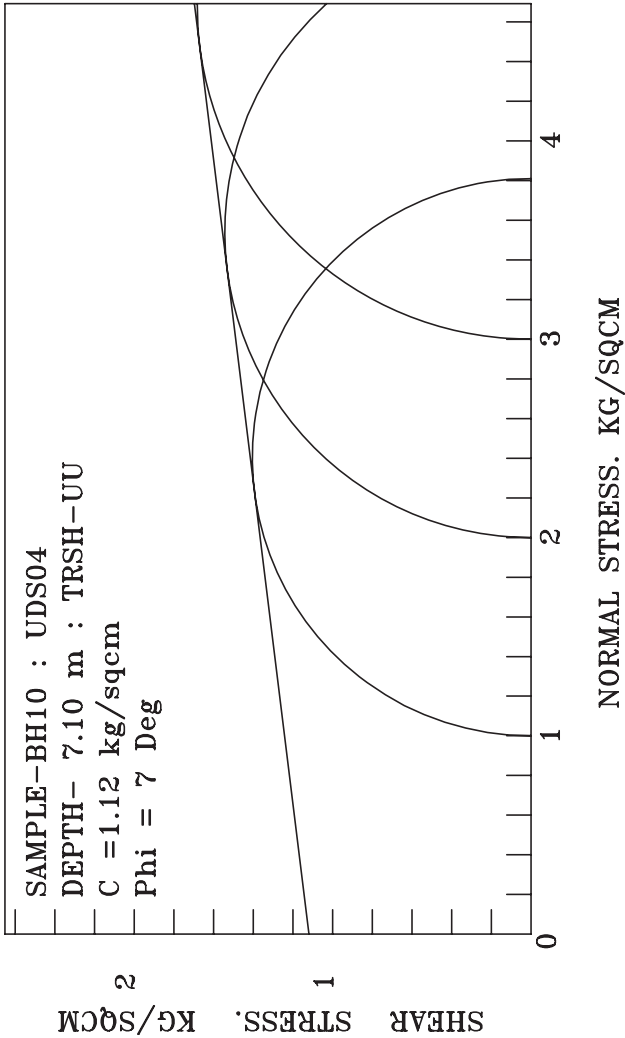
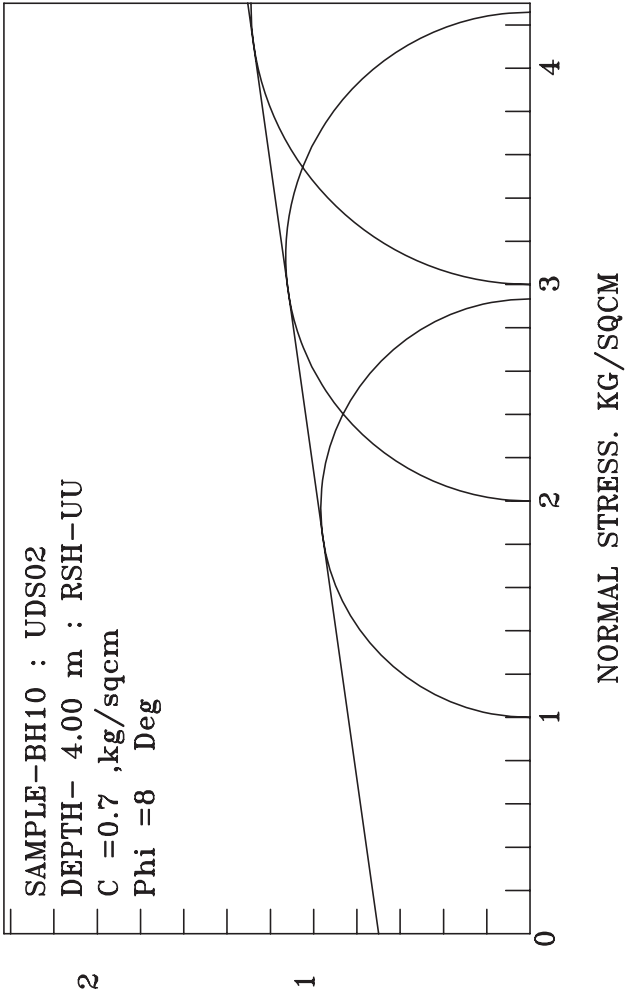
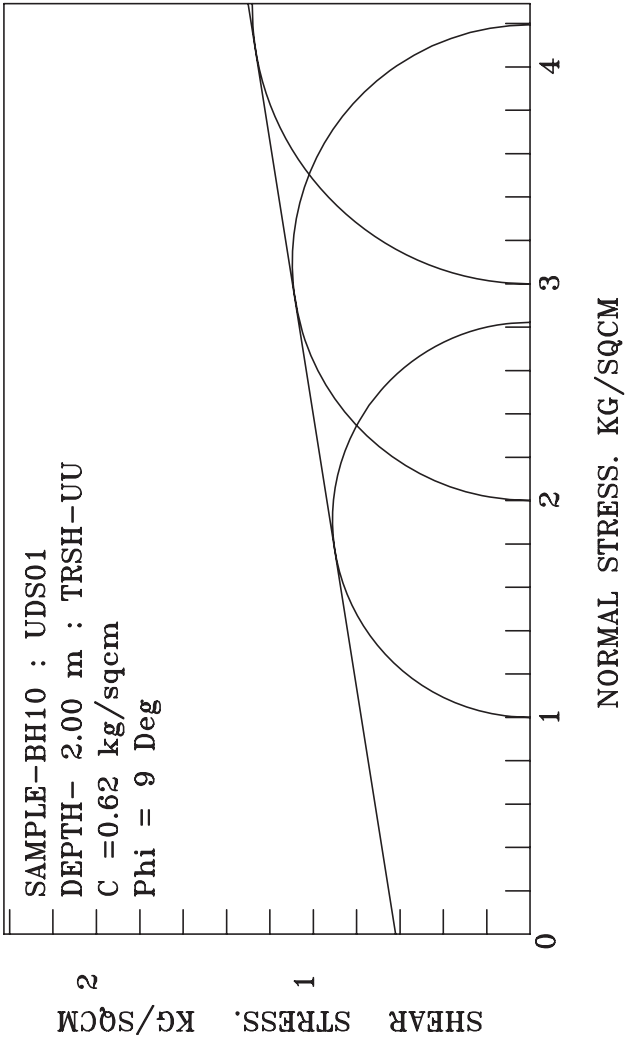
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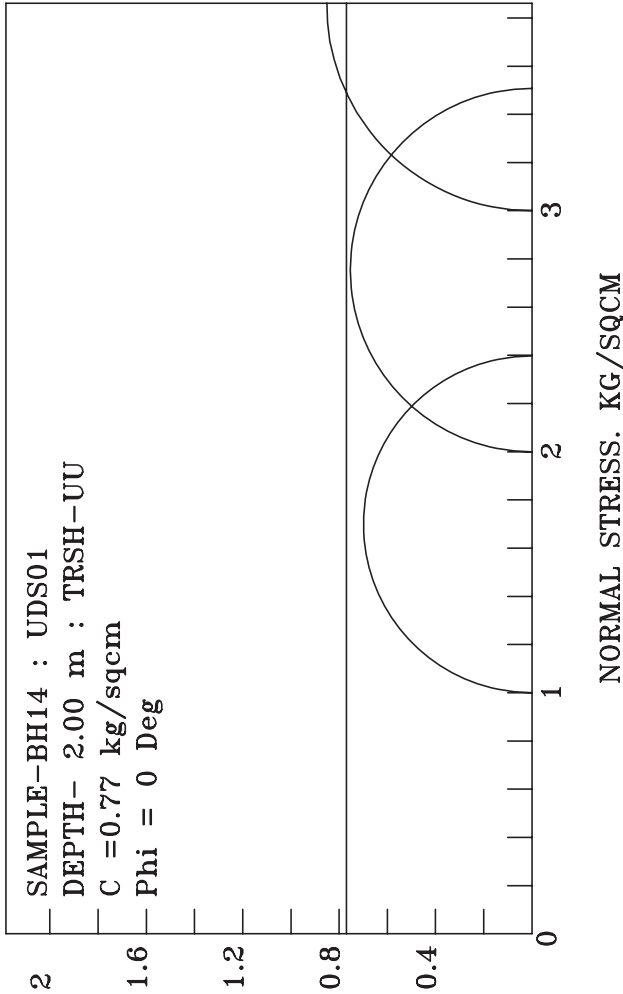
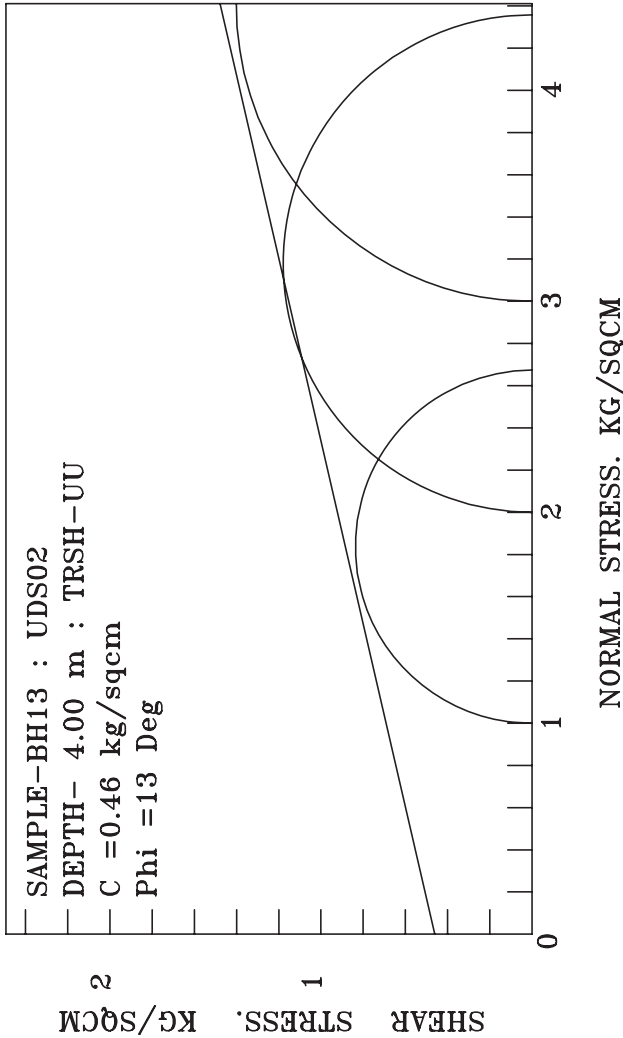
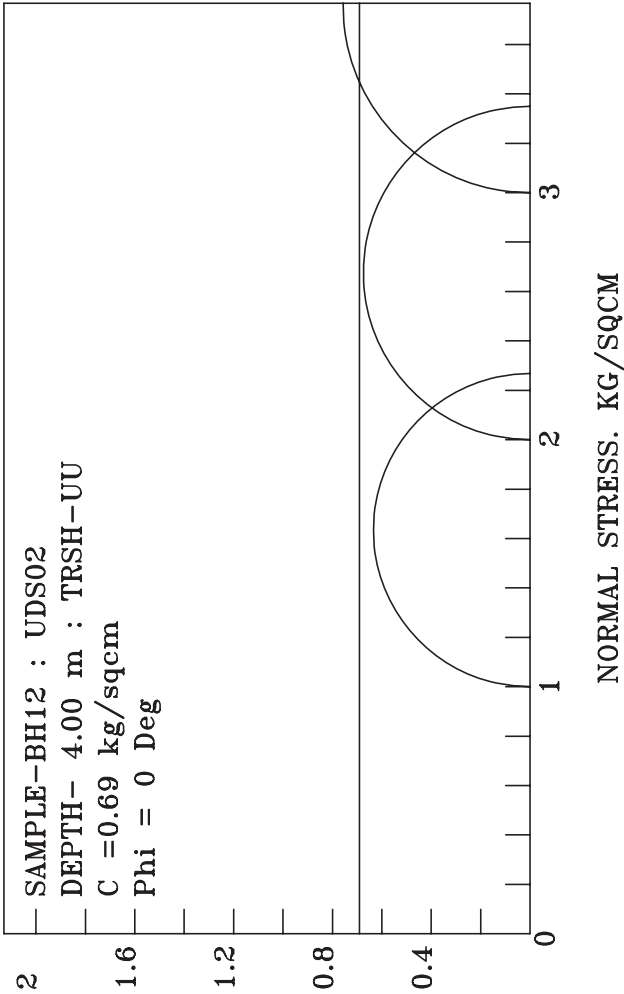
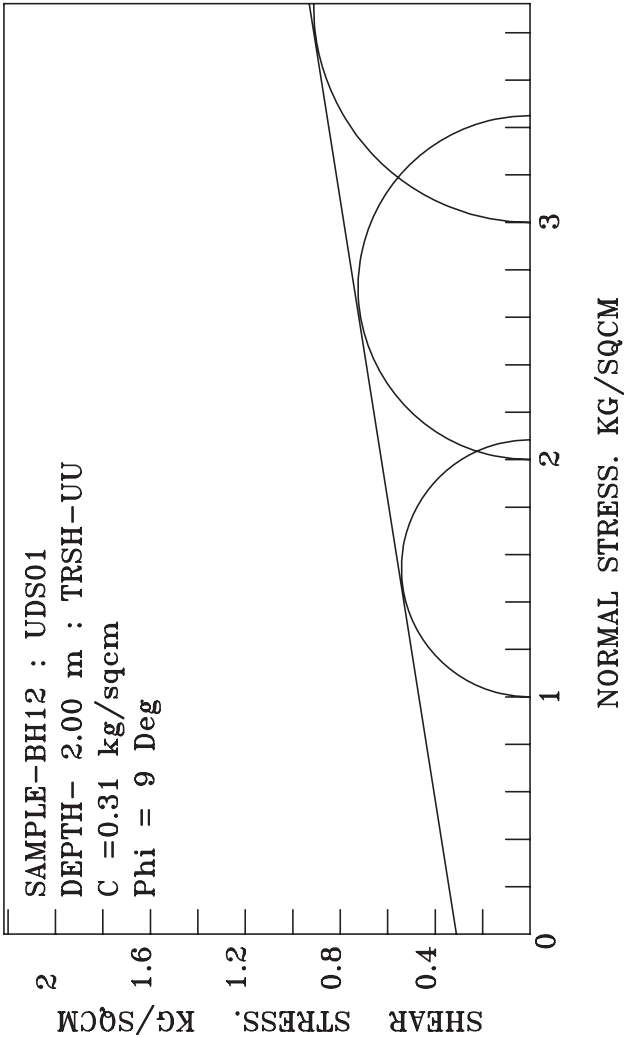
PART III: CHARTS & GRAPHS











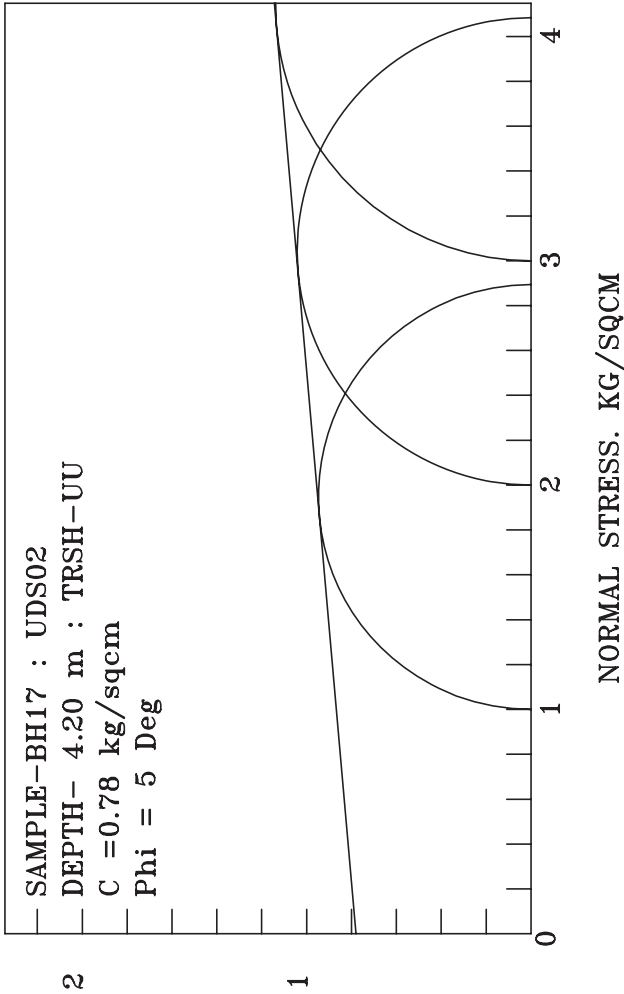
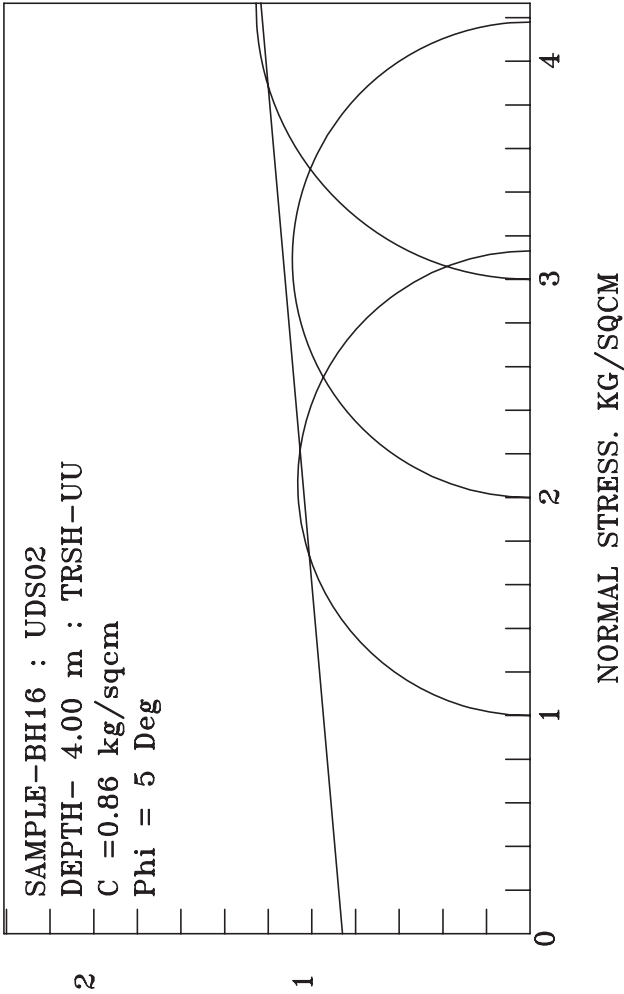
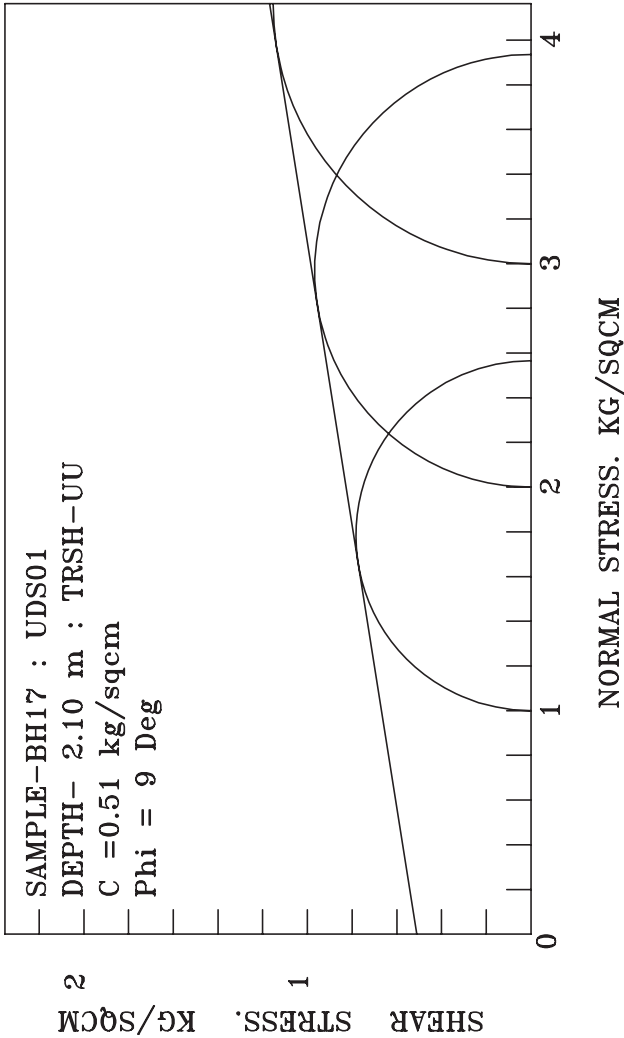
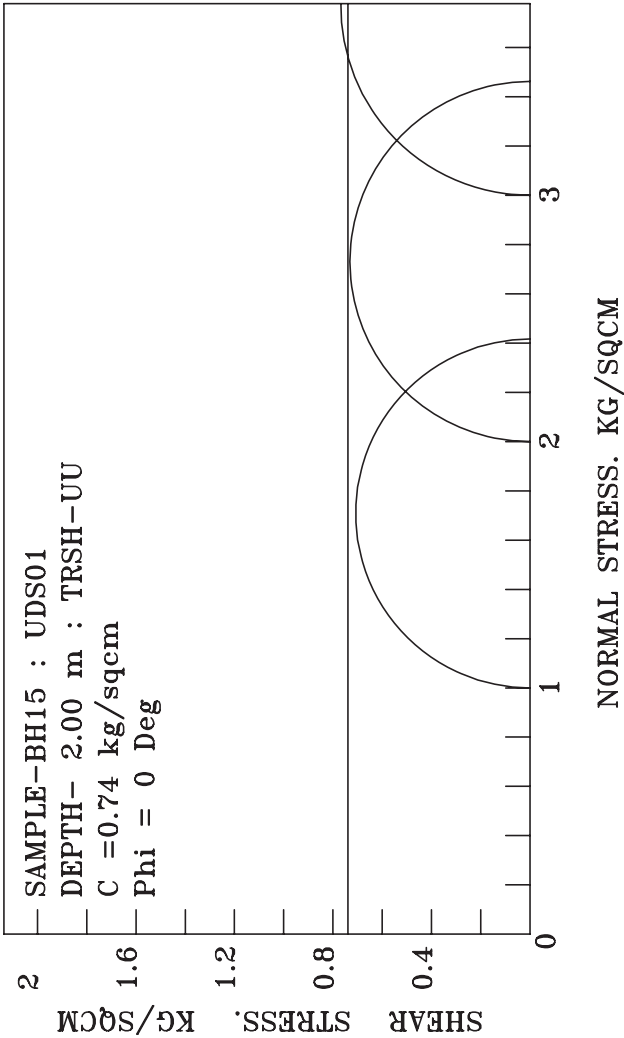
Job No :4287

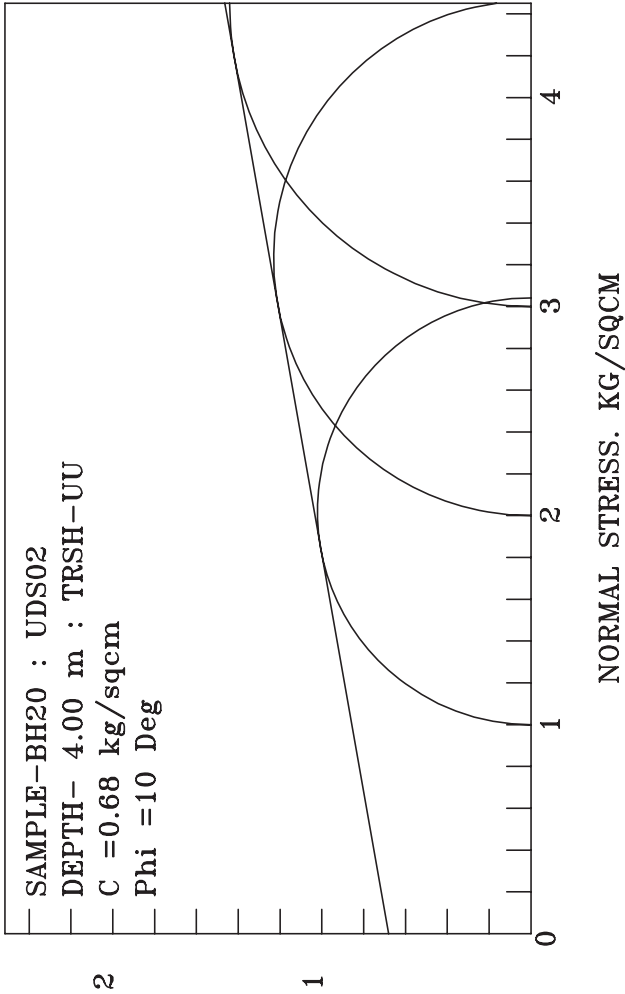
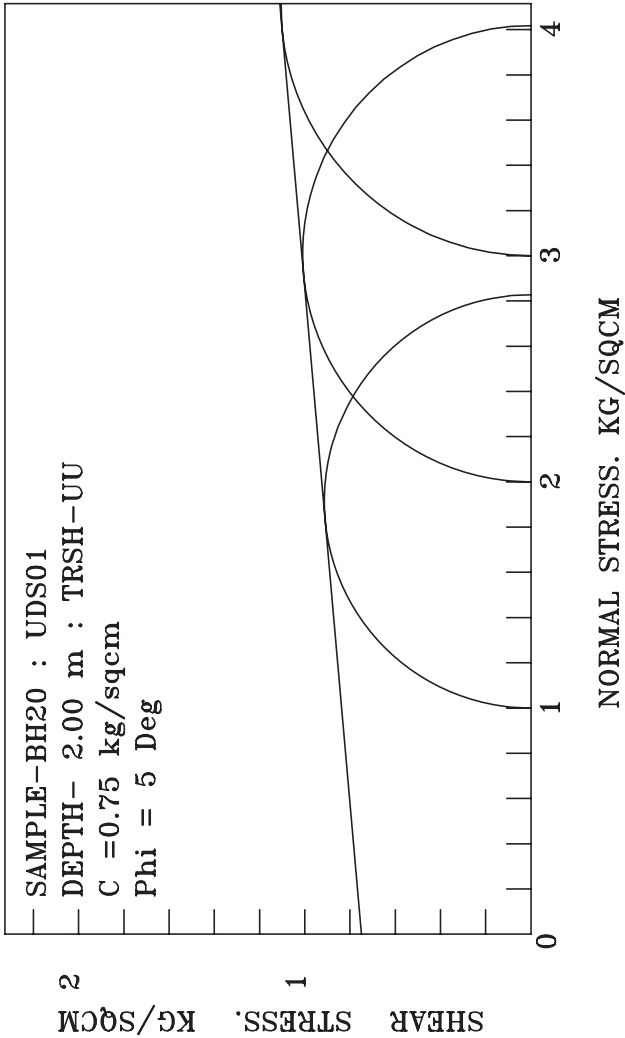
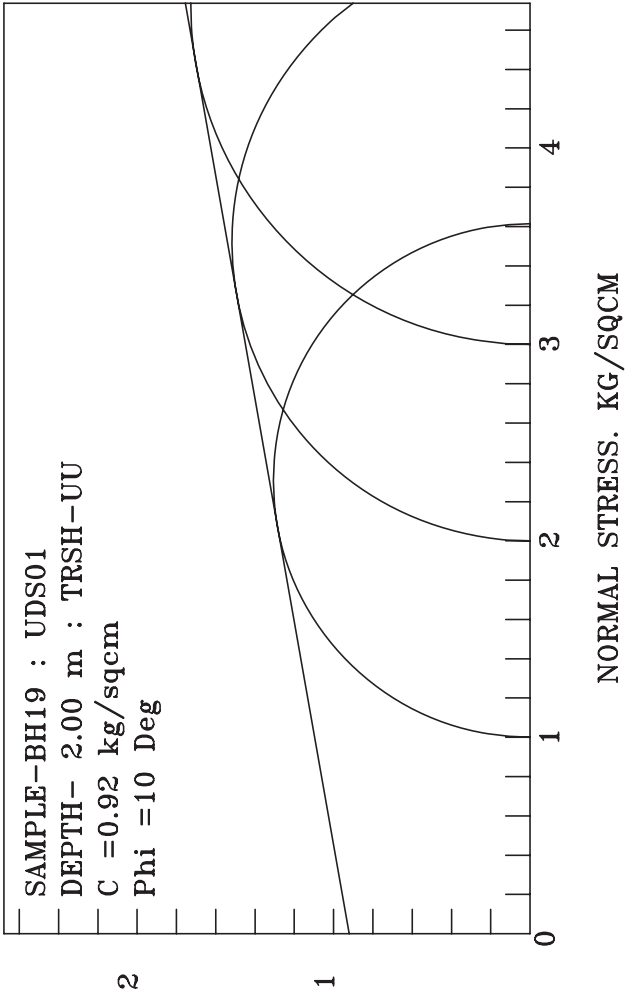
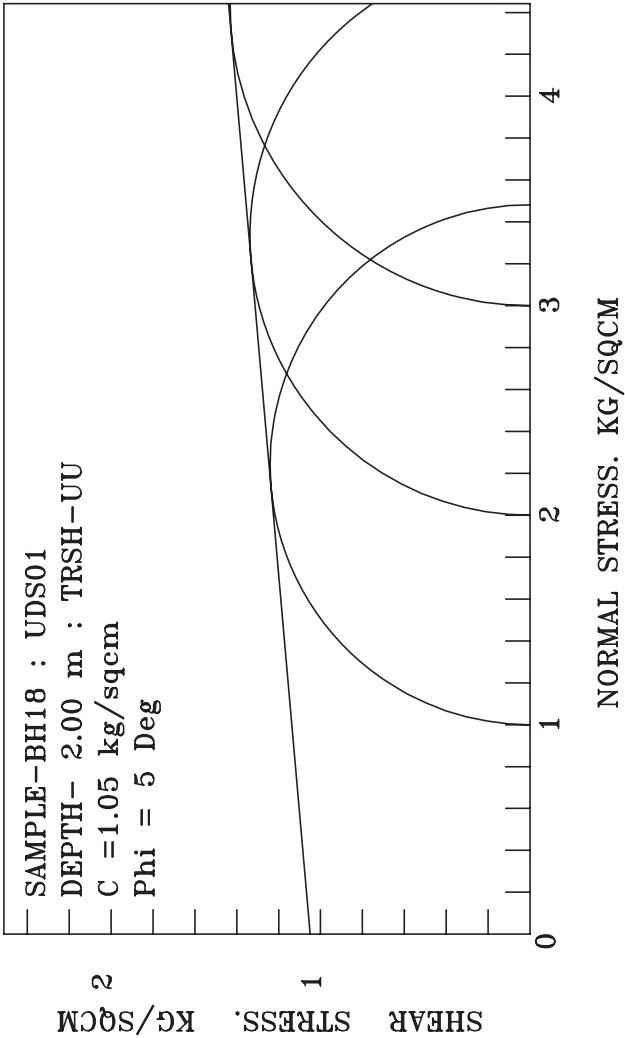
Created by : Srabanti

Created on :

Annexure-B

Sheet No:





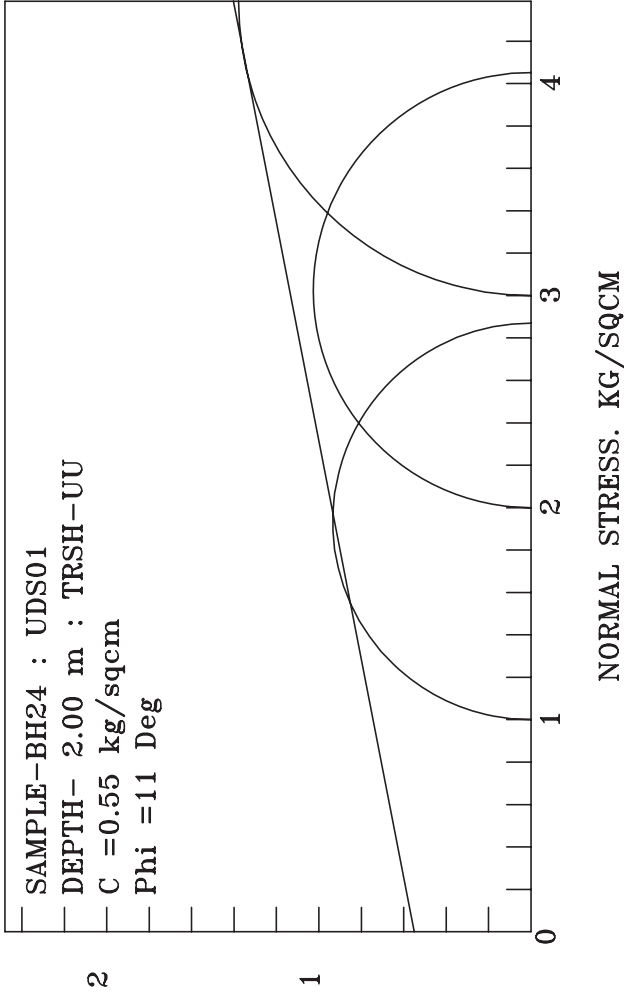
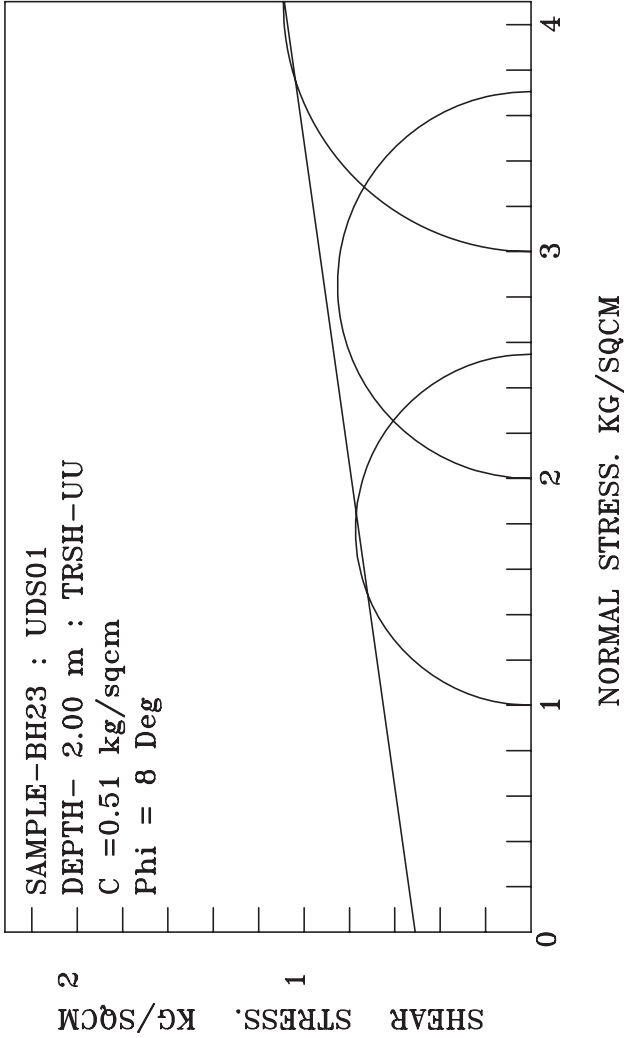
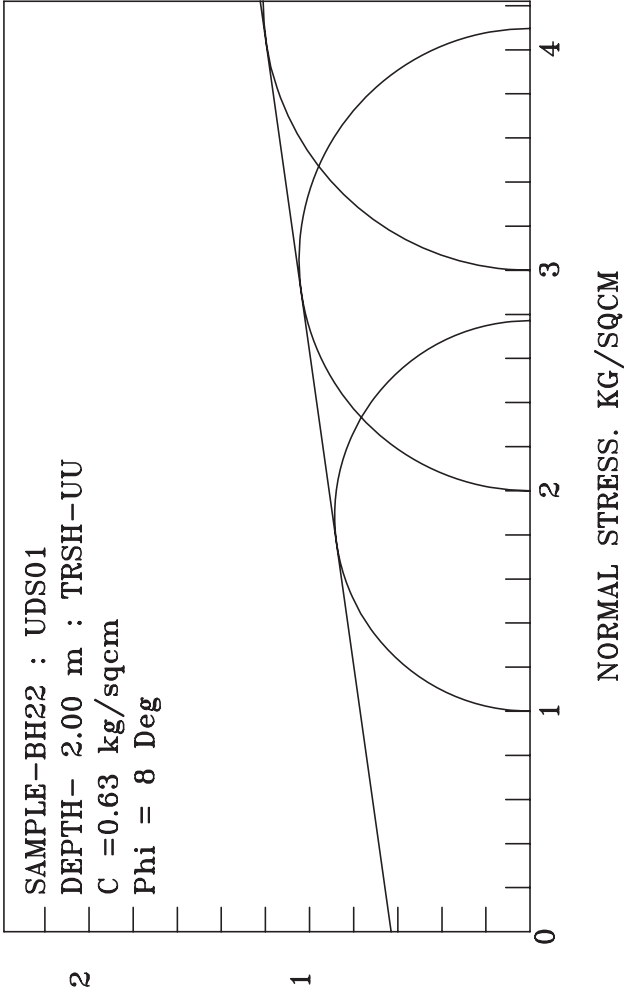
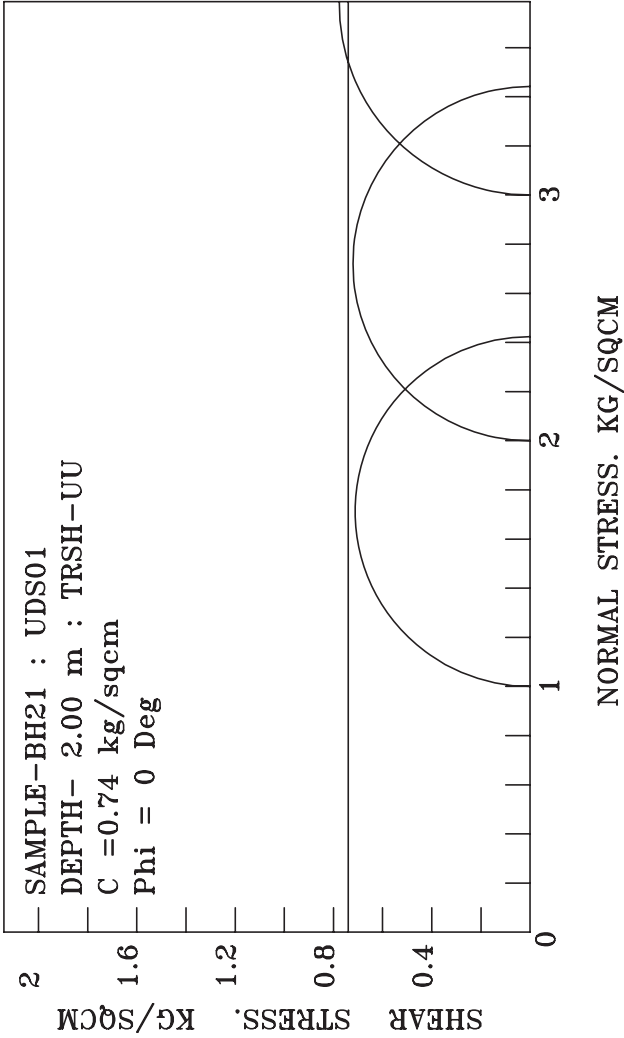
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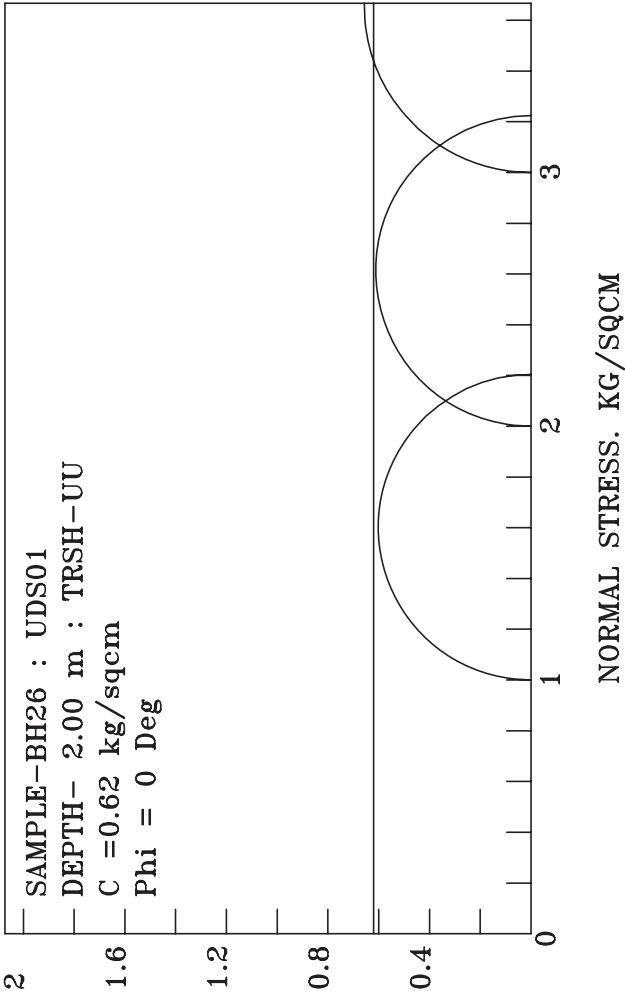
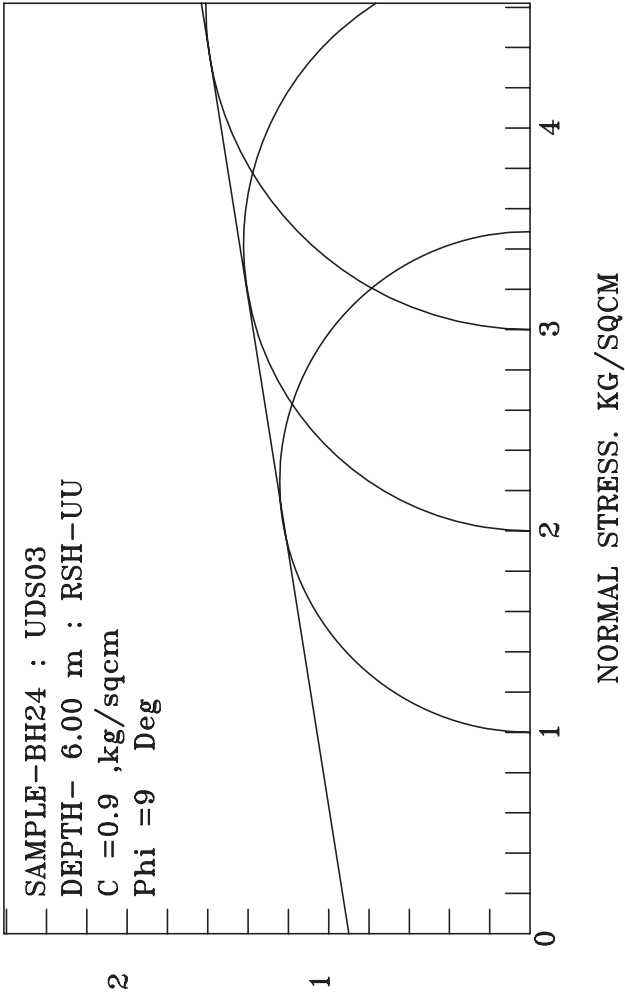
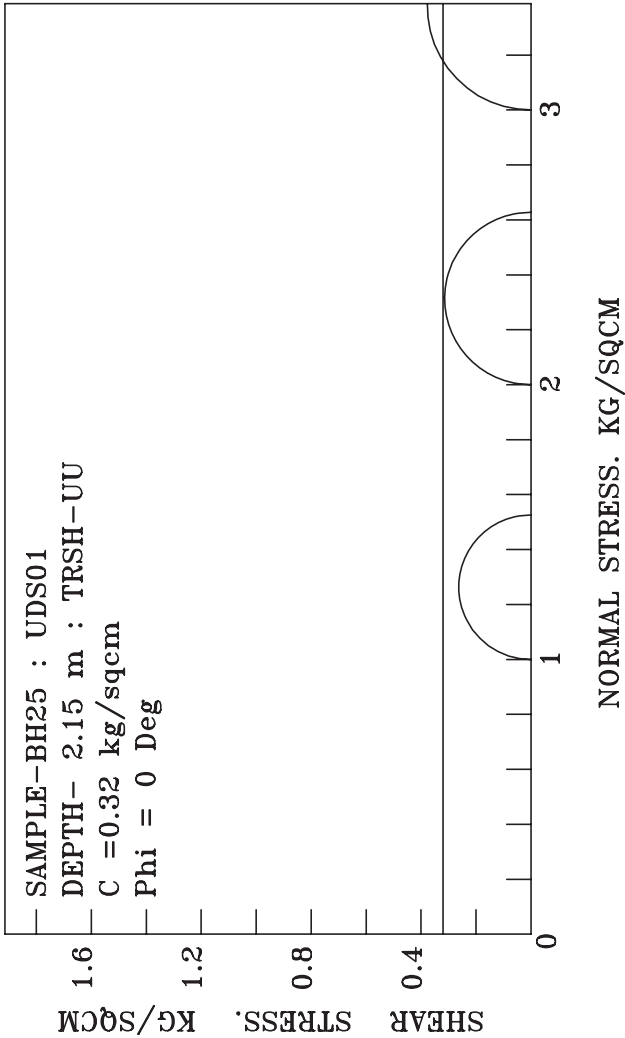
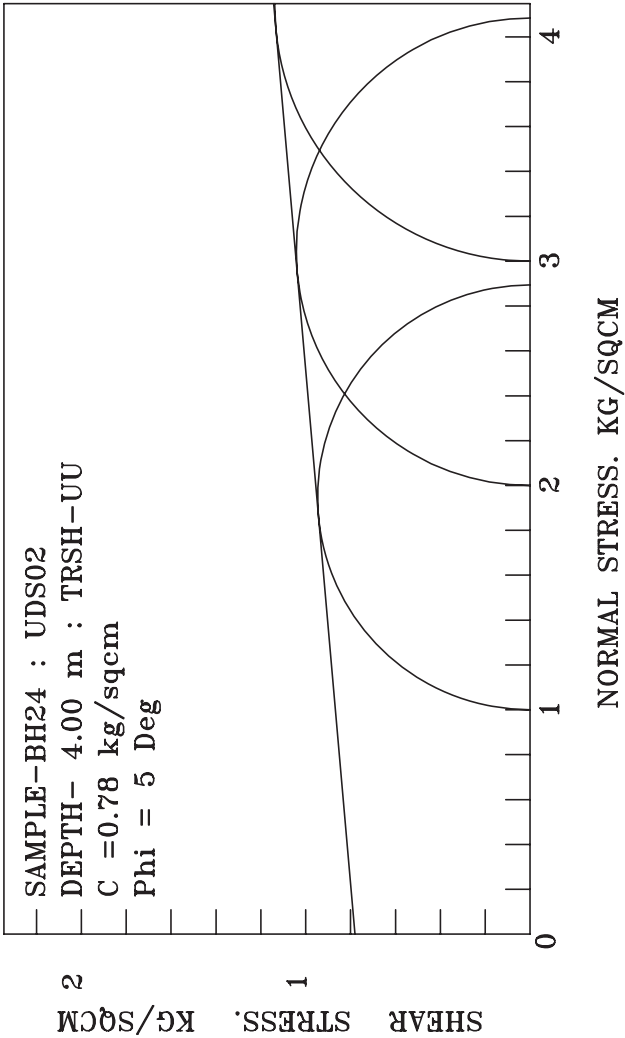
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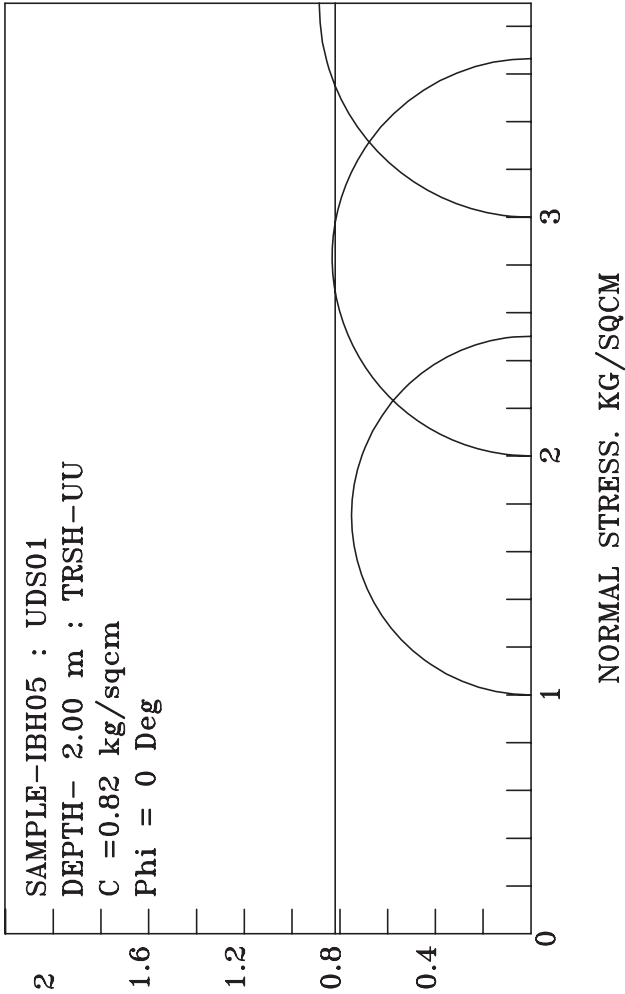
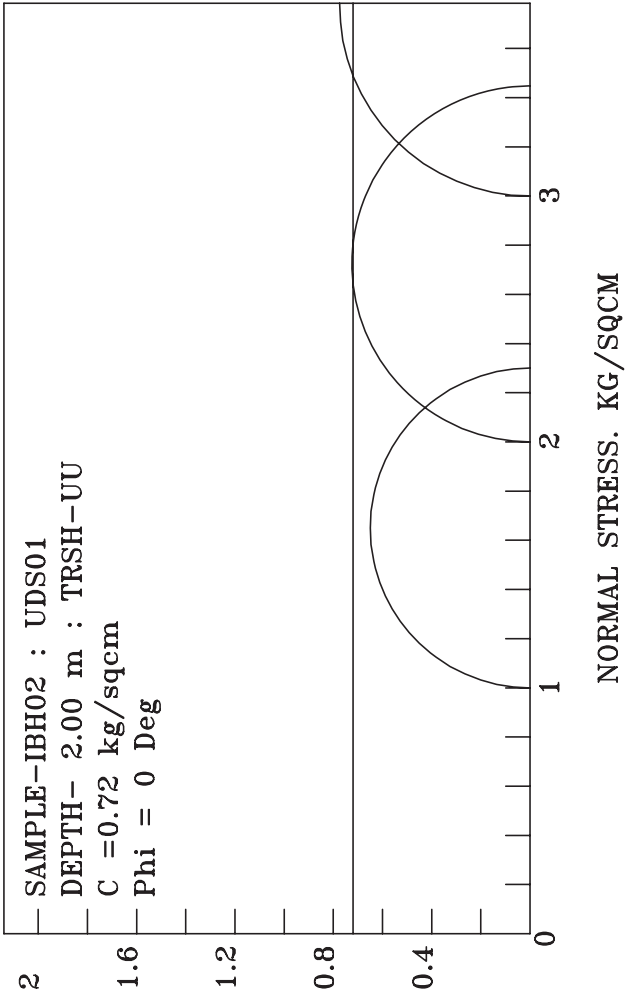
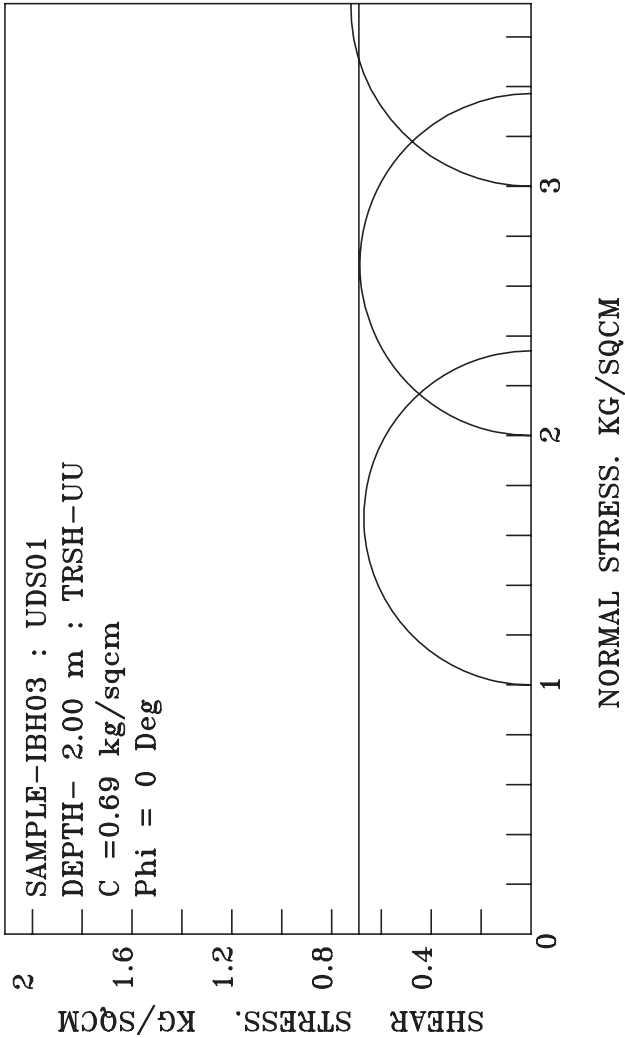
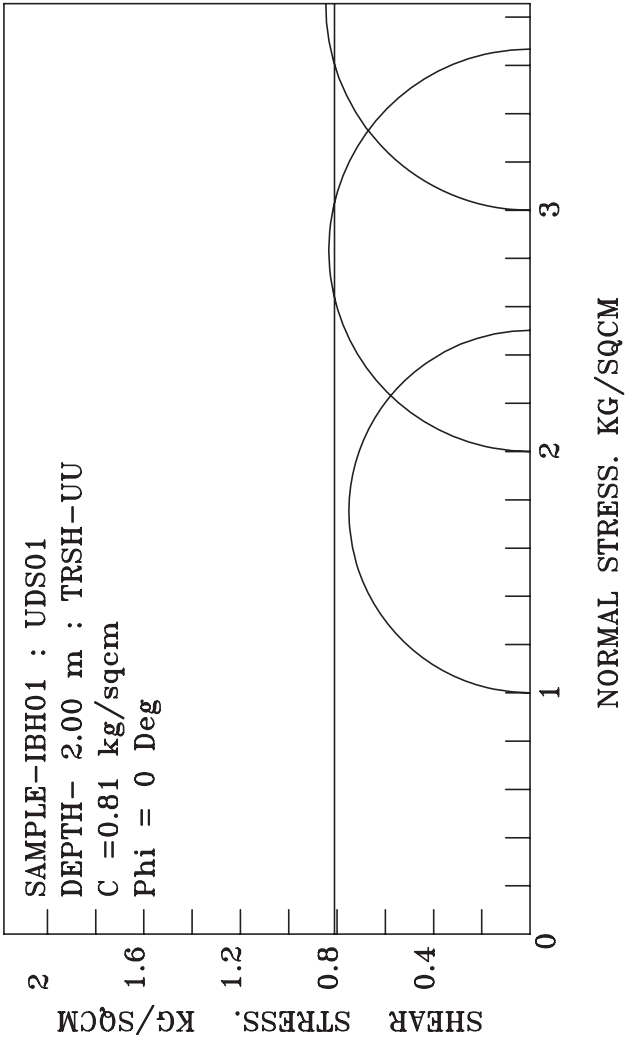
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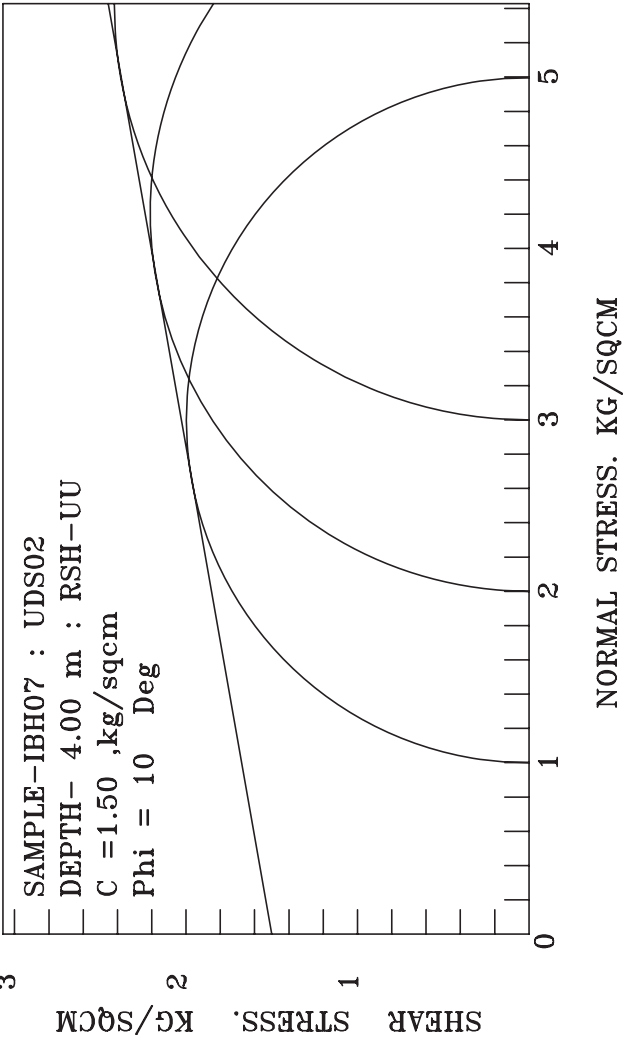
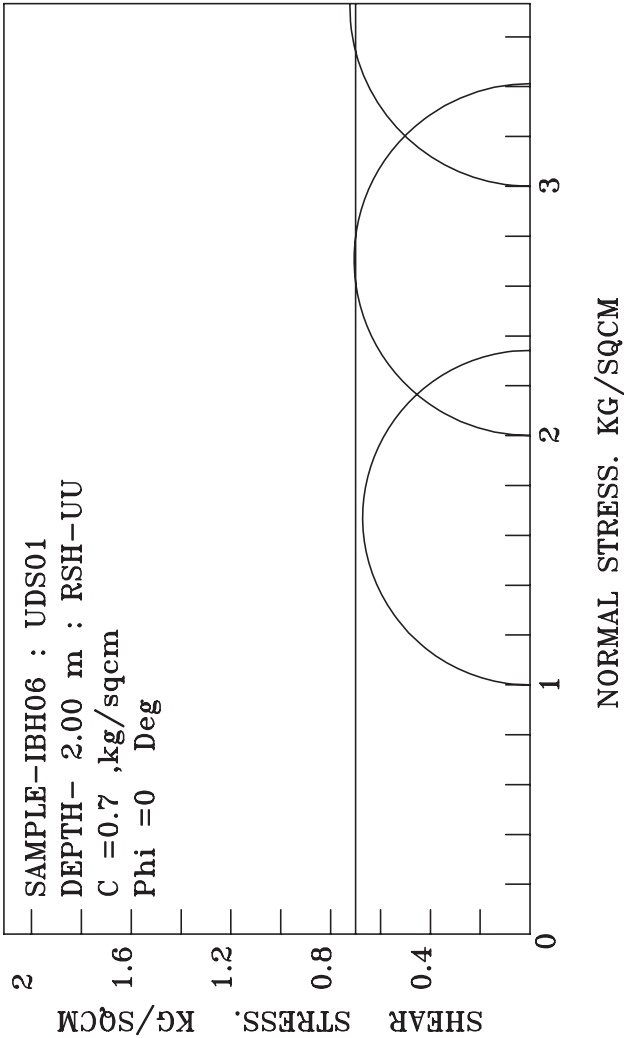
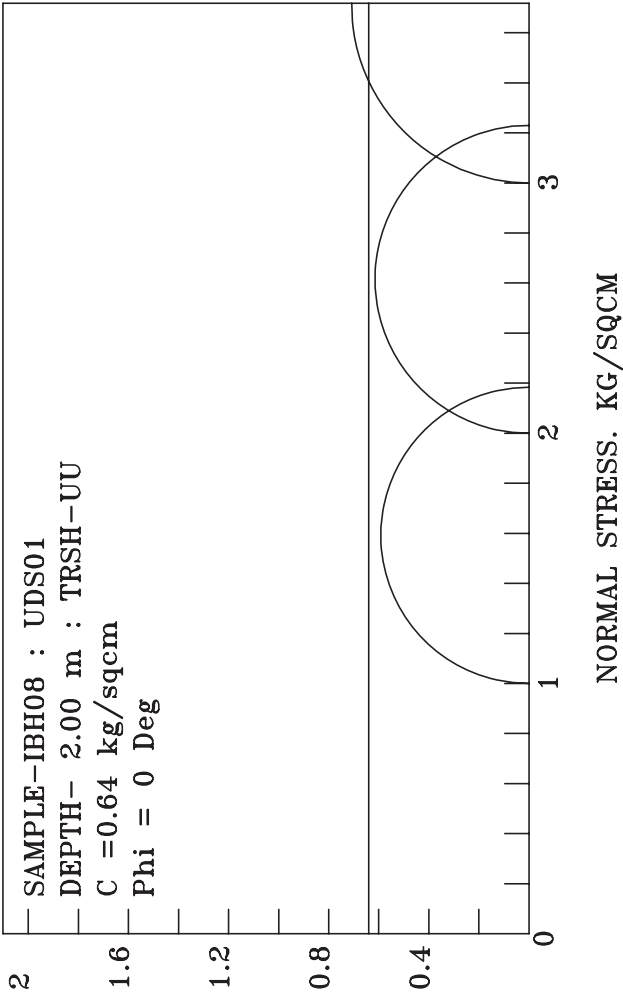
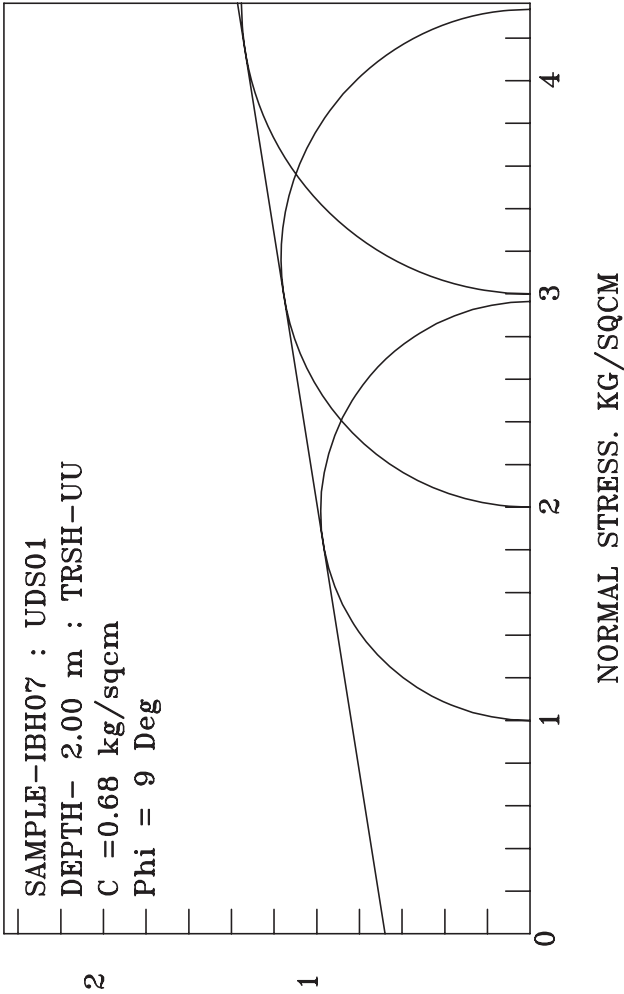
Annexure-B

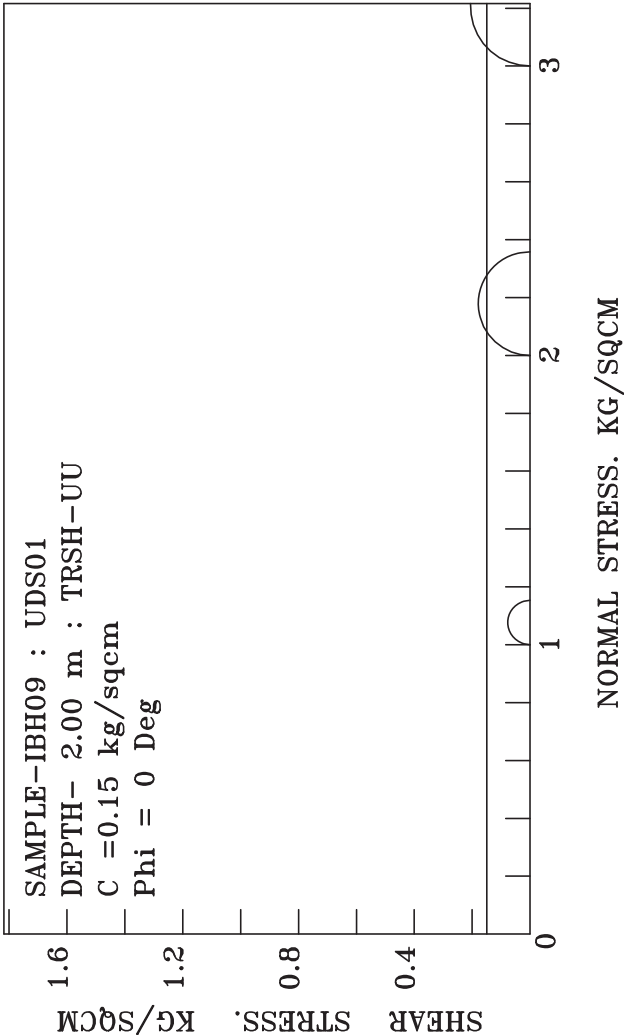
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CONSOLIDATION TEST RESULTS

Sample Number: BH-01/UDS-01

Depth : 2.1-2.55 meters

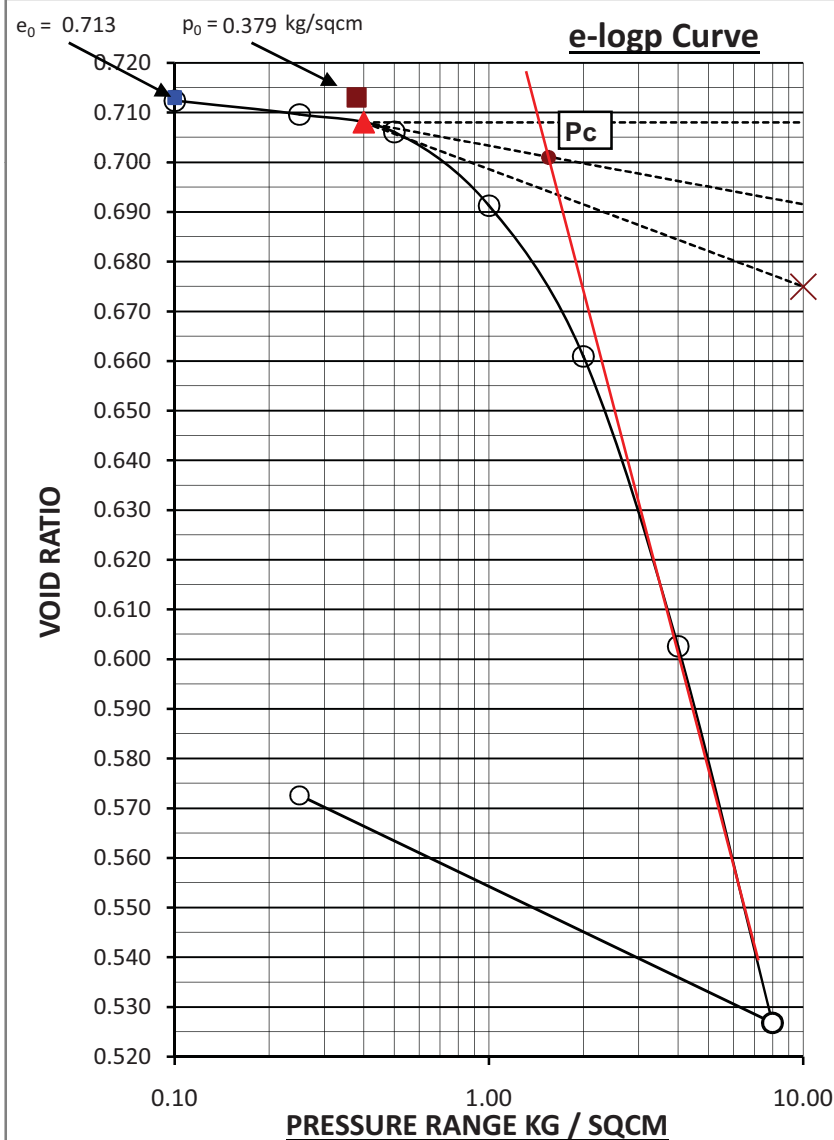
Description : Brownish grey silty clay, with traces of kankars.

Water content: Initial=26.3%

Final =23.8%

Initial Void Ratio =0.713

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.712	0.0060				
0.10 - 0.25	16	0.710	0.0107	10.00	0.0096	124.4	6.765
0.25 - 0.50	21	0.706	0.0084	14.80	0.0072	142.3	5.872
0.50 - 1.00	86	0.691	0.0173	25.58	0.0129	166.1	4.922
1.00 - 2.00	177	0.661	0.0179	22.03	0.0140	149.6	5.176
2.00 - 4.00	340	0.603	0.0176	26.18	0.0130	198.9	3.483
4.00 - 8.00	442	0.527	0.0118	15.84	0.0100	186.3	3.103
8.00 - 0.25	267	0.573	0.0039				



$$C_c = 0.2518$$

$$C_r = 0.0304$$

$$P_0 = 0.379 \text{ kg/sqcm}$$

$$P_c = 1.550 \text{ kg/sqcm}$$

$$\text{OCR} = 4.091$$

CONSOLIDATION TEST RESULTS

Sample Number: BH-02/UDS-02

Depth : 4-4.45 meters

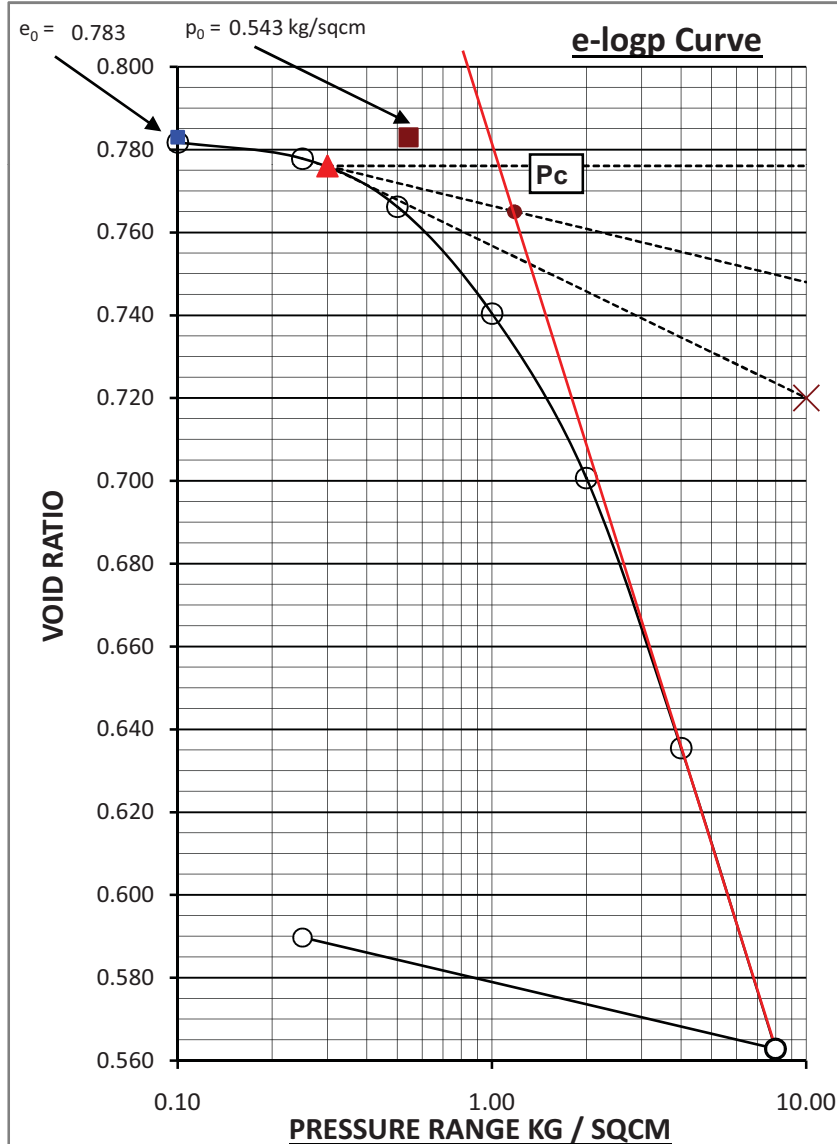
Description : Yellowish grey silty clay, with sand mixture and rock pieces.

Water content: Initial=28%

Final =23.2%

Initial Void Ratio =0.783

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.782	0.0060				
0.10 - 0.25	22	0.778	0.0147	27.27	0.0107	75.3	11.215
0.25 - 0.50	65	0.766	0.0260	26.90	0.0190	98.3	8.438
0.50 - 1.00	145	0.740	0.0292	31.72	0.0200	105.5	7.532
1.00 - 2.00	223	0.701	0.0228	19.28	0.0184	140.0	5.252
2.00 - 4.00	366	0.636	0.0192	20.49	0.0152	166.2	3.882
4.00 - 8.00	408	0.563	0.0111	15.93	0.0093	164.2	3.263
8.00 - 0.25	151	0.590	0.0022				



$$C_c = 0.2414$$

$$C_r = 0.0179$$

$$P_0 = 0.543 \text{ kg/sqcm}$$

$$P_c = 1.180 \text{ kg/sqcm}$$

$$\text{OCR} = 2.173$$

Job No. 4287

Sheet No.

CONSOLIDATION TEST RESULTS

Sample Number: BH-04/UDS-01

Depth : 2-2.45 meters

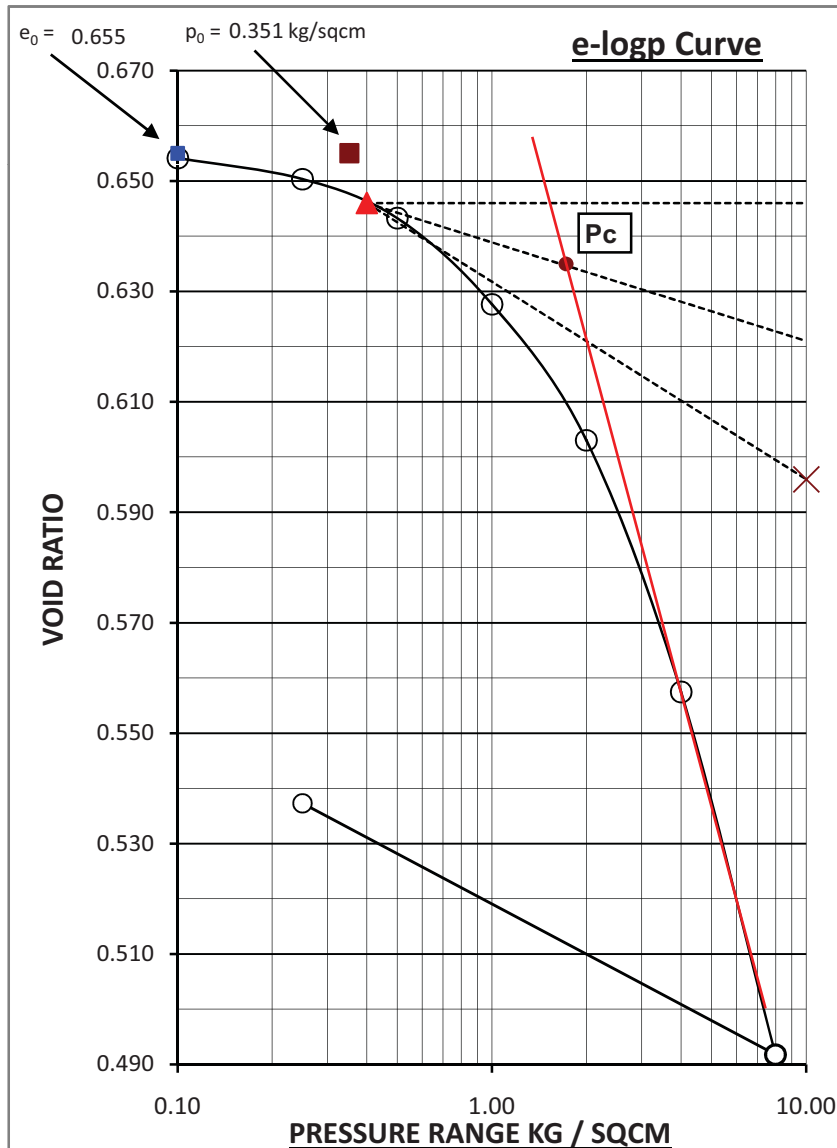
Description : Deep grey silty clay with traces of kankars.

Water content: Initial=24.6%

Final =21.8%

Initial Void Ratio =0.655

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.654	0.0050				
0.10 - 0.25	23	0.650	0.0153	47.83	0.0080	133.4	6.328
0.25 - 0.50	43	0.643	0.0172	25.58	0.0128	151.7	5.491
0.50 - 1.00	94	0.628	0.0189	23.40	0.0145	351.4	2.305
1.00 - 2.00	149	0.603	0.0151	21.48	0.0119	151.7	5.078
2.00 - 4.00	276	0.557	0.0142	24.64	0.0107	179.6	3.916
4.00 - 8.00	397	0.492	0.0105	19.14	0.0085	115.1	5.239
8.00 - 0.25	275	0.537	0.0039				



$$C_c = 0.2180$$

$$C_r = 0.0302$$

$$P_0 = 0.351 \text{ kg/sqcm}$$

$$P_c = 1.720 \text{ kg/sqcm}$$

$$OCR = 4.895$$

CONSOLIDATION TEST RESULTS

Sample Number: BH-06/UDS-01

Depth : 2-2.45 meters

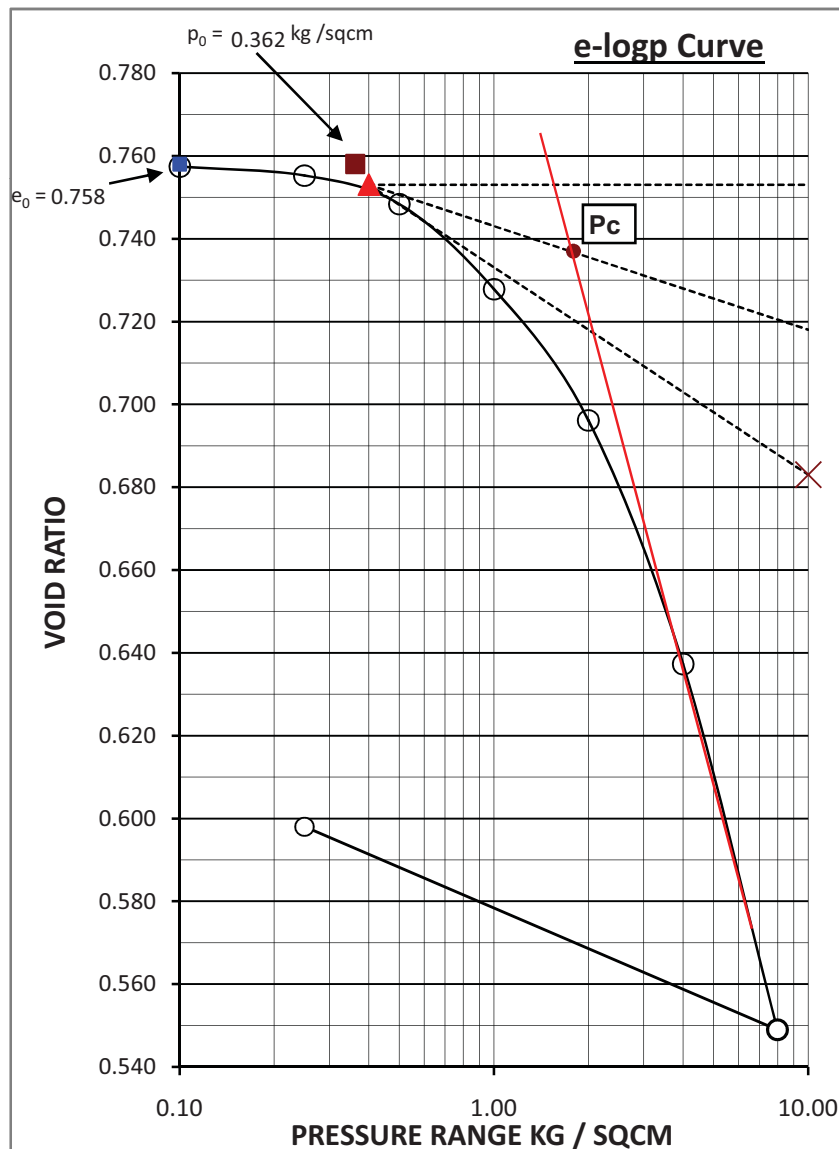
Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=28.5%

Final =24%

Initial Void Ratio =0.758

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.757	0.0050				
0.10 - 0.25	12	0.755	0.0080	50.00	0.0040	182.1	4.633
0.25 - 0.50	39	0.748	0.0156	35.90	0.0100	261.3	3.196
0.50 - 1.00	117	0.728	0.0235	22.22	0.0183	298.4	2.711
1.00 - 2.00	180	0.696	0.0183	22.78	0.0142	293.0	2.595
2.00 - 4.00	335	0.637	0.0174	21.19	0.0137	242.4	2.805
4.00 - 8.00	502	0.549	0.0135	12.35	0.0118	202.6	2.758
8.00 - 0.25	279	0.598	0.0041				



$$C_c = 0.2933$$

$$C_r = 0.0326$$

$$P_0 = 0.362 \text{ kg/sqcm}$$

$$P_c = 1.790 \text{ kg/sqcm}$$

$$\text{OCR} = 4.944$$

CONSOLIDATION TEST RESULTS

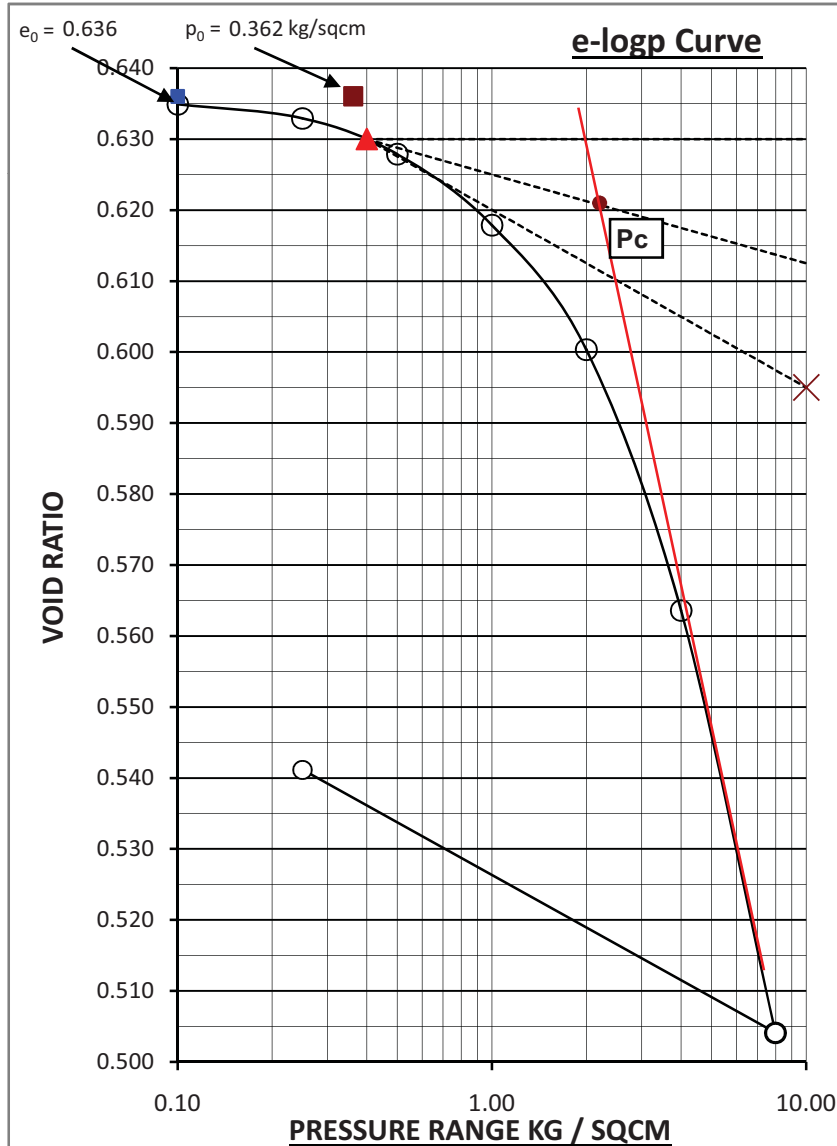
Sample Number: BH-07/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of calcareous nodules

Water content: Initial=22.2% Final =21.4% Initial Void Ratio =0.636

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.635	0.0050				
0.10 - 0.25	12	0.633	0.0080	33.33	0.0053	106.6	7.890
0.25 - 0.50	31	0.628	0.0124	45.16	0.0068	267.1	3.121
0.50 - 1.00	61	0.618	0.0123	16.39	0.0103	151.7	5.395
1.00 - 2.00	107	0.600	0.0108	15.40	0.0092	102.6	7.706
2.00 - 4.00	224	0.564	0.0115	28.13	0.0082	145.6	5.064
4.00 - 8.00	363	0.504	0.0095	20.11	0.0076	249.7	2.593
8.00 - 0.25	226	0.541	0.0032				



$$C_c = 0.1976$$

$$C_r = 0.0246$$

$$P_0 = 0.362 \text{ kg/sqcm}$$

$$P_c = 2.200 \text{ kg/sqcm}$$

$$\text{OCR} = 6.077$$

Job No. 4287

Sheet No.

CONSOLIDATION TEST RESULTS

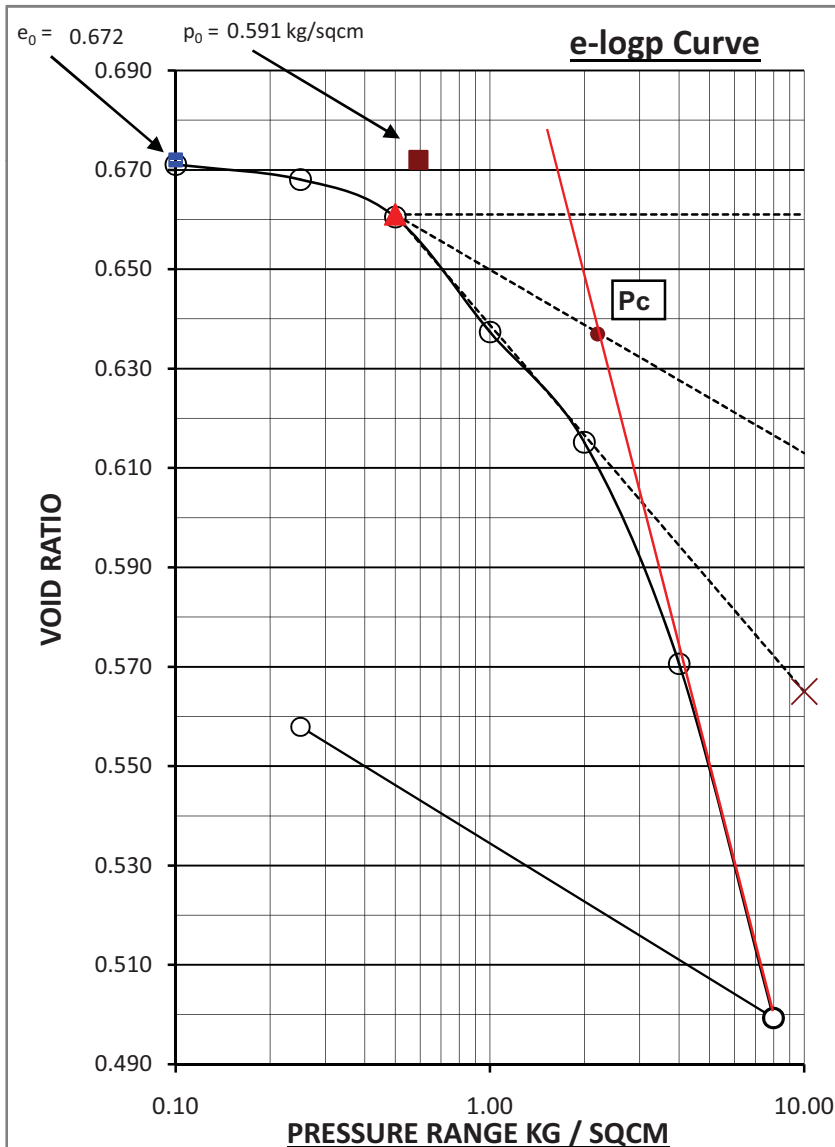
Sample Number: BH-09/UDS-02

Depth : 4-4.45 meters

Description : Brownish grey silty clay with traces of clay.

Water content: Initial=24.3% Final =23.3% Initial Void Ratio =0.672

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	7	0.671	0.0070				
0.10 - 0.25	18	0.668	0.0120	38.89	0.0073	193.6	4.347
0.25 - 0.50	45	0.660	0.0181	33.33	0.0120	295.7	2.810
0.50 - 1.00	138	0.637	0.0278	53.62	0.0129	237.6	3.369
1.00 - 2.00	133	0.615	0.0136	21.80	0.0106	130.1	5.815
2.00 - 4.00	266	0.571	0.0138	30.83	0.0095	221.2	3.137
4.00 - 8.00	426	0.499	0.0113	29.34	0.0080	216.6	2.732
8.00 - 0.25	350	0.558	0.0050				



$$C_c = 0.2368$$

$$C_r = 0.0389$$

$$P_0 = 0.591 \text{ kg/sqcm}$$

$$P_c = 2.200 \text{ kg/sqcm}$$

$$\text{OCR} = 3.720$$

Job No. 4287

Sheet No.

CONSOLIDATION TEST RESULTS

Sample Number: BH-10/UDS-04

Depth : 7.1-7.55 meters

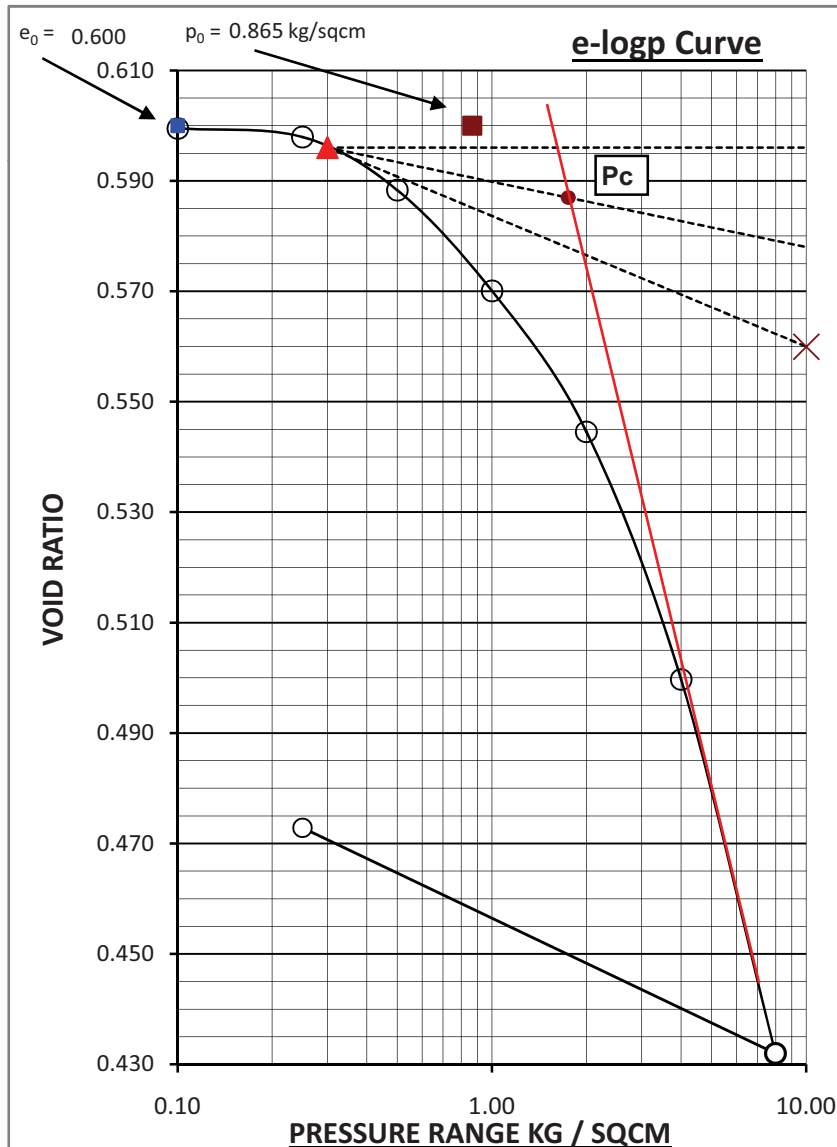
Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=19.9%

Final =18.2%

Initial Void Ratio =0.6

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.600	0.0060				
0.10 - 0.25	10	0.598	0.0067	10.00	0.0060	82.1	10.261
0.25 - 0.50	60	0.588	0.0241	31.67	0.0164	153.6	5.410
0.50 - 1.00	114	0.570	0.0230	34.60	0.0150	112.6	7.122
1.00 - 2.00	159	0.545	0.0162	38.30	0.0100	214.3	3.535
2.00 - 4.00	280	0.500	0.0145	35.71	0.0093	163.4	4.217
4.00 - 8.00	423	0.432	0.0113	20.09	0.0090	163.4	3.585
8.00 - 0.25	255	0.473	0.0037				



$$C_c = 0.2251$$

$$C_r = 0.0271$$

$$P_0 = 0.865 \text{ kg/sqcm}$$

$$P_c = 1.750 \text{ kg/sqcm}$$

$$\text{OCR} = 2.023$$

CONSOLIDATION TEST RESULTS

Sample Number: BH-11/UDS-01

Depth : 2-2.45 meters

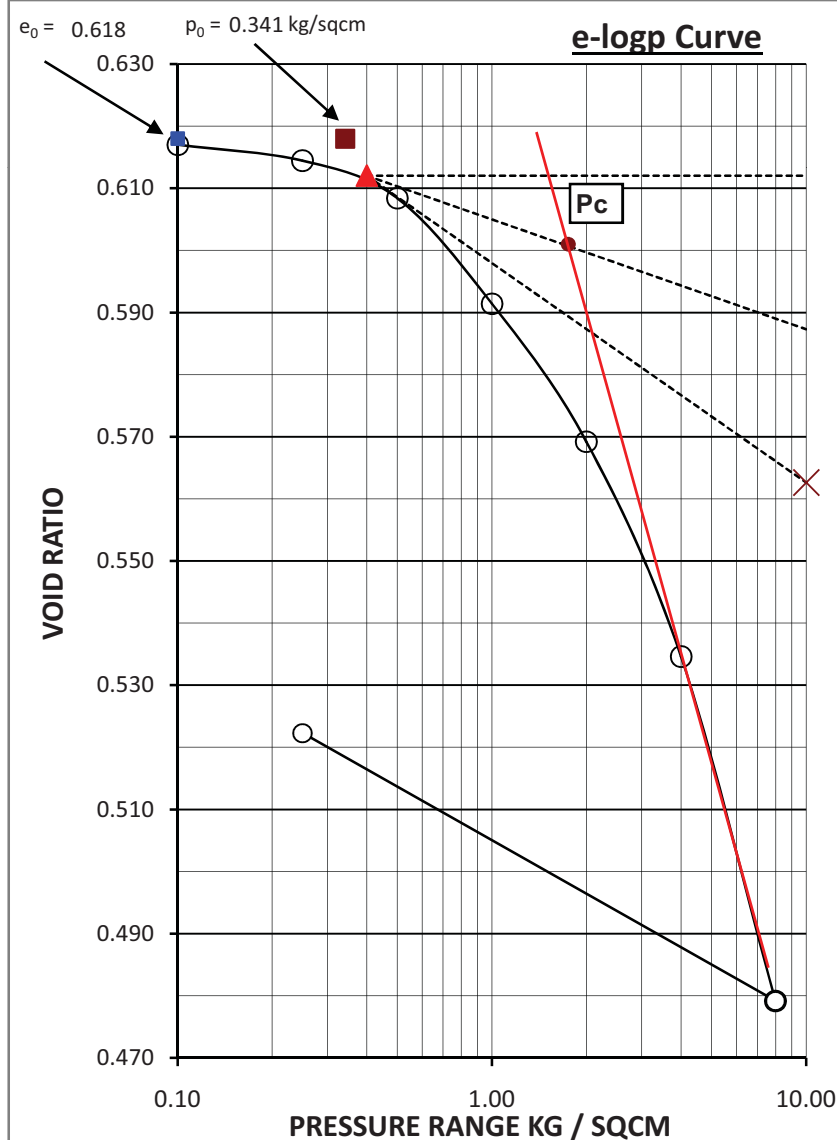
Description : Brownish grey silt clay with calcareous nodules.

Water content: Initial=20.5%

Final =22.8%

Initial Void Ratio =0.618

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.617	0.0050				
0.10 - 0.25	16	0.614	0.0107	18.75	0.0087	102.6	8.207
0.25 - 0.50	37	0.608	0.0148	18.92	0.0120	185.9	4.483
0.50 - 1.00	105	0.591	0.0211	30.48	0.0147	119.3	6.786
1.00 - 2.00	137	0.569	0.0139	33.58	0.0093	259.6	2.966
2.00 - 4.00	214	0.535	0.0110	25.23	0.0083	107.7	6.629
4.00 - 8.00	342	0.479	0.0090	23.39	0.0069	160.4	3.929
8.00 - 0.25	266	0.522	0.0038				



$$C_c = 0.1840$$

$$C_r = 0.0286$$

$$P_0 = 0.341 \text{ kg/sqcm}$$

$$P_c = 1.750 \text{ kg/sqcm}$$

$$\text{OCR} = 5.126$$

CONSOLIDATION TEST RESULTS

Sample Number: BH-13/UDS-02

Depth : 4-4.45 meters

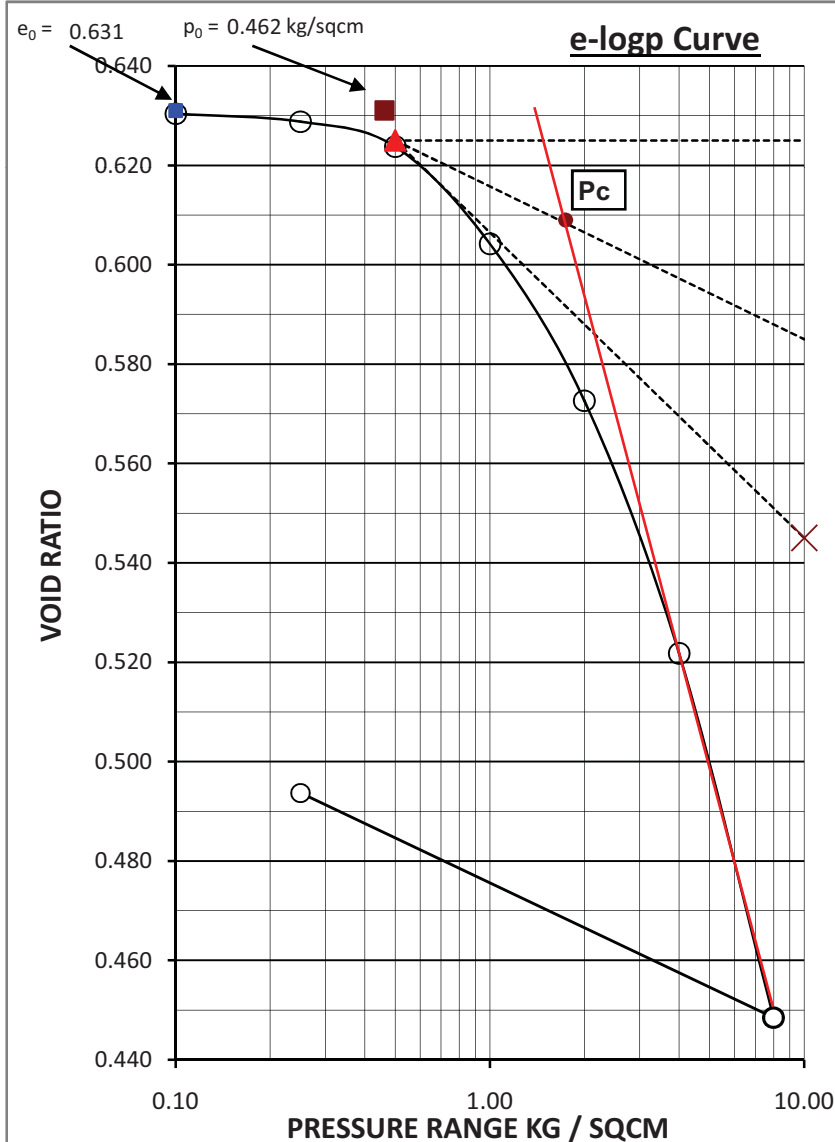
Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=19.6%

Final =21.1%

Initial Void Ratio =0.631

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.630	0.0050				
0.10 - 0.25	10	0.629	0.0067	20.00	0.0053	102.1	8.270
0.25 - 0.50	31	0.624	0.0124	35.48	0.0080	259.6	3.226
0.50 - 1.00	120	0.604	0.0241	41.67	0.0141	190.1	4.272
1.00 - 2.00	193	0.573	0.0196	31.09	0.0135	554.5	1.373
2.00 - 4.00	312	0.522	0.0162	40.06	0.0097	622.1	1.096
4.00 - 8.00	449	0.449	0.0120	26.06	0.0089	685.5	0.833
8.00 - 0.25	277	0.494	0.0040				



$$C_c = 0.2433$$

$$C_r = 0.0300$$

$$P_0 = 0.462 \text{ kg/sqcm}$$

$$P_c = 1.740 \text{ kg/sqcm}$$

$$\text{OCR} = 3.766$$

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Sheet No.

CONSOLIDATION TEST RESULTS

Sample Number: BH-14/UDS-01

Depth : 2-2.45 meters

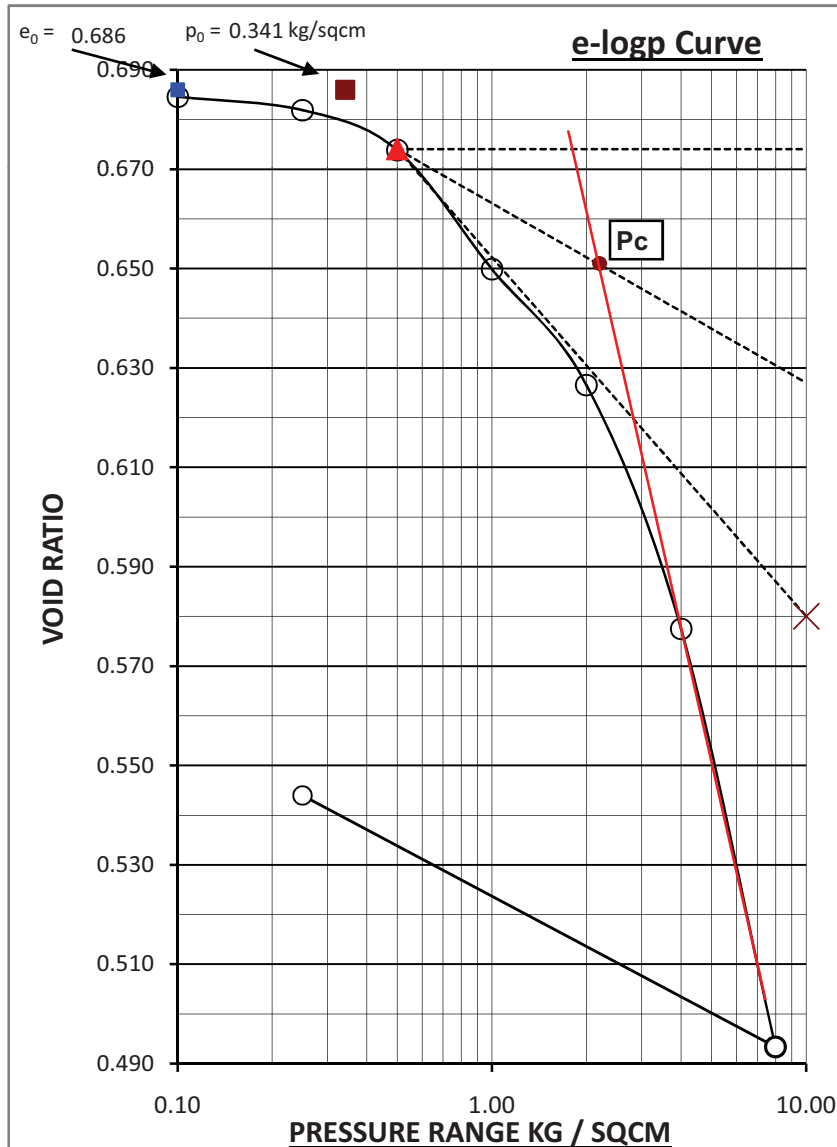
Description : Brownish grey silty clay with traces of calcareous nodules

Water content: Initial=25.3%

Final =23.7%

Initial Void Ratio =0.686

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.685	0.0060				
0.10 - 0.25	16	0.682	0.0107	31.25	0.0073	396.3	2.125
0.25 - 0.50	48	0.674	0.0193	39.58	0.0116	163.4	5.090
0.50 - 1.00	142	0.650	0.0286	47.89	0.0149	157.5	5.080
1.00 - 2.00	138	0.627	0.0141	23.91	0.0107	173.4	4.351
2.00 - 4.00	291	0.577	0.0151	29.90	0.0106	399.4	1.721
4.00 - 8.00	499	0.493	0.0133	21.04	0.0105	497.7	1.149
8.00 - 0.25	300	0.544	0.0044				



$$C_c = 0.2796$$

$$C_r = 0.0336$$

$$P_0 = 0.341 \text{ kg/sqcm}$$

$$P_c = 2.200 \text{ kg/sqcm}$$

$$\text{OCR} = 6.445$$

CONSOLIDATION TEST RESULTS

Sample Number: BH-17/UDS-02

Depth : 4.2-4.65 meters

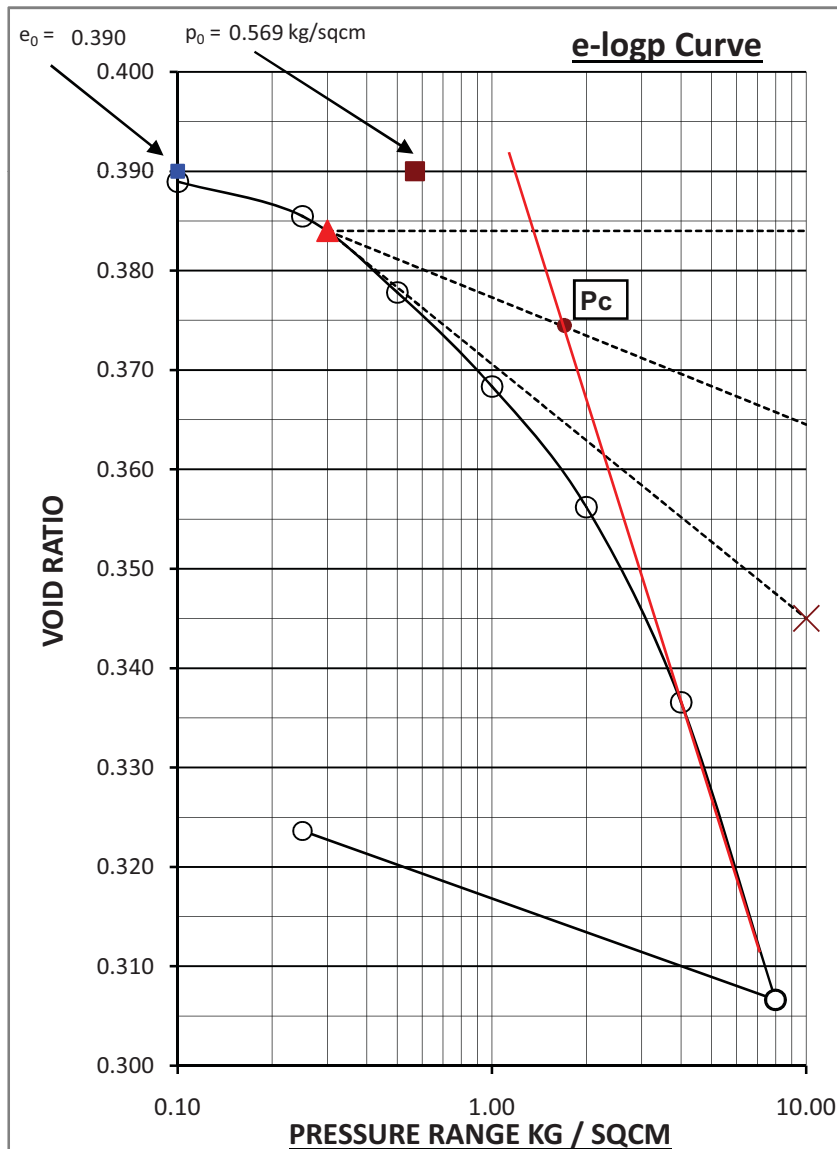
Description : Brownish grey clayey silt with sand mixture and rock pieces.

Water content: Initial=10.8%

Final =12.8%

Initial Void Ratio =0.39

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	9	0.389	0.0090				
0.10 - 0.25	25	0.385	0.0167	40.00	0.0100	115.9	7.225
0.25 - 0.50	55	0.378	0.0221	41.82	0.0129	155.5	5.299
0.50 - 1.00	68	0.368	0.0137	33.82	0.0091	190.1	4.227
1.00 - 2.00	87	0.356	0.0089	36.78	0.0056	126.2	6.169
2.00 - 4.00	141	0.337	0.0072	58.87	0.0030	159.4	4.652
4.00 - 8.00	215	0.307	0.0056	57.21	0.0024	142.3	4.823
8.00 - 0.25	122	0.324	0.0017				



$$C_c = 0.0995$$

$$C_r = 0.0113$$

$$P_0 = 0.569 \text{ kg/sqcm}$$

$$P_c = 1.700 \text{ kg/sqcm}$$

$$\text{OCR} = 2.990$$

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CONSOLIDATION TEST RESULTS

Sample Number: BH-19/UDS-01

Depth : 2-2.45 meters

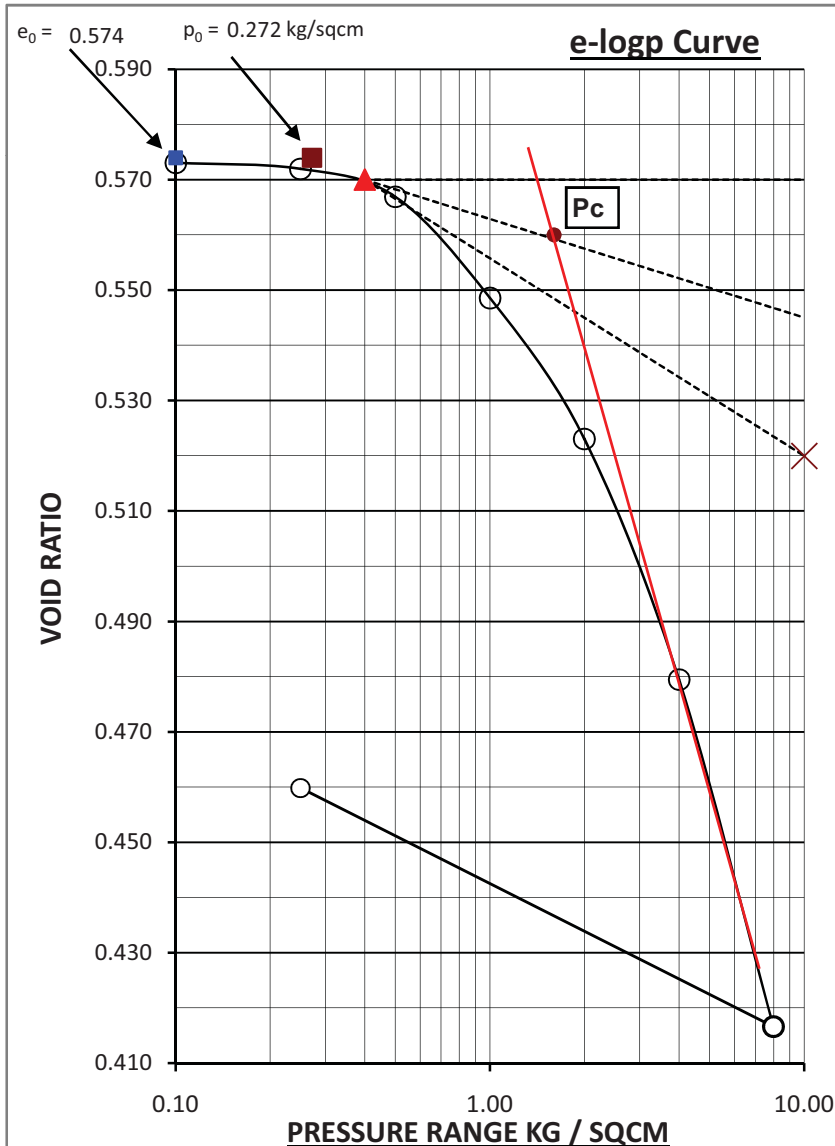
Description : Brownish grey sity clay with traces of calcareous nodules.

Water content: Initial=19.7%

Final =19.7%

Initial Void Ratio =0.574

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	3	0.573	0.0030				
0.10 - 0.25	7	0.572	0.0047	14.29	0.0040	287.8	2.942
0.25 - 0.50	32	0.567	0.0128	12.50	0.0112	351.4	2.391
0.50 - 1.00	117	0.549	0.0235	22.22	0.0183	262.1	3.110
1.00 - 2.00	162	0.523	0.0165	27.16	0.0120	248.3	3.098
2.00 - 4.00	277	0.479	0.0143	30.32	0.0100	106.1	6.596
4.00 - 8.00	400	0.417	0.0106	21.50	0.0083	157.5	3.808
8.00 - 0.25	275	0.460	0.0039				



$$C_c = 0.2090$$

$$C_r = 0.0287$$

$$P_0 = 0.272 \text{ kg/sqcm}$$

$$P_c = 1.600 \text{ kg/sqcm}$$

$$\text{OCR} = 5.881$$

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CONSOLIDATION TEST RESULTS

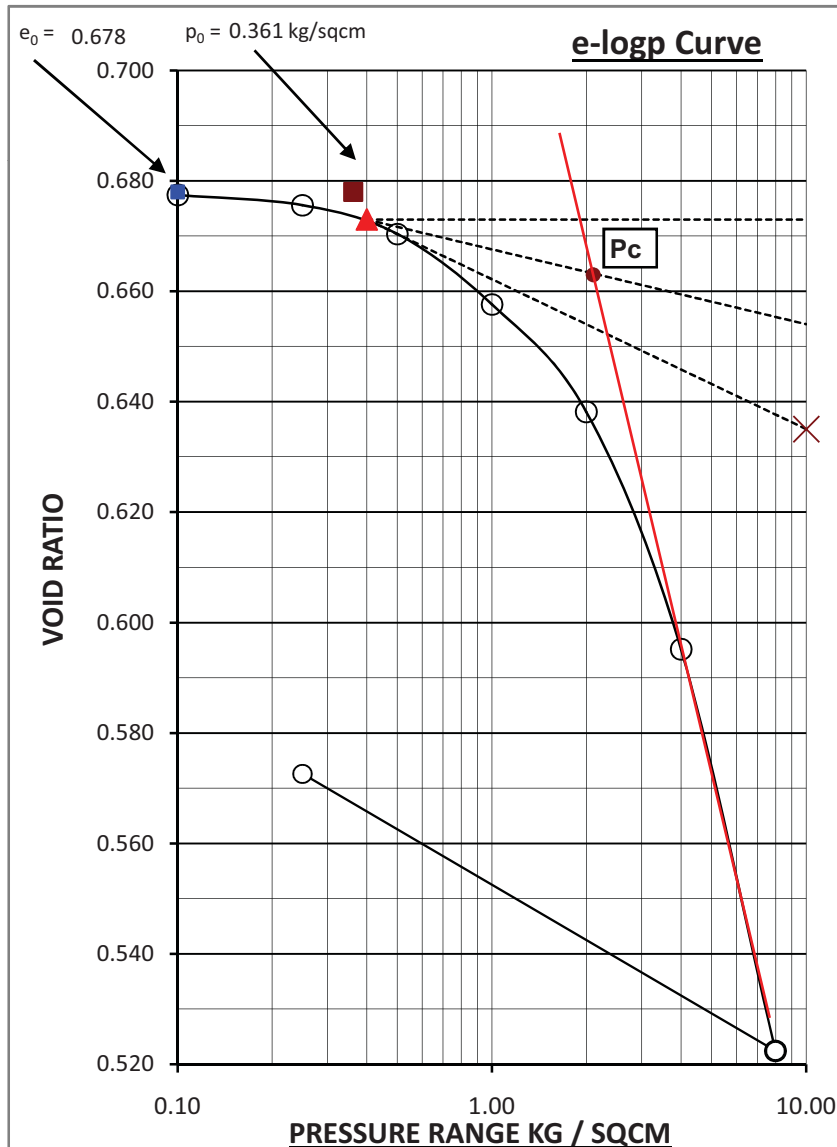
Sample Number: BH-21/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of kankars.

Water content: Initial=25.2% Final =23.7% Initial Void Ratio =0.678

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	4	0.677	0.0040				
0.10 - 0.25	11	0.676	0.0073	27.27	0.0053	104.0	8.112
0.25 - 0.50	31	0.670	0.0124	29.03	0.0088	146.0	5.729
0.50 - 1.00	76	0.658	0.0153	23.68	0.0117	181.7	4.507
1.00 - 2.00	116	0.638	0.0118	23.28	0.0090	173.3	4.541
2.00 - 4.00	256	0.595	0.0131	21.88	0.0103	184.1	3.951
4.00 - 8.00	433	0.522	0.0114	16.86	0.0095	156.7	3.977
8.00 - 0.25	299	0.573	0.0043				



$$C_c = 0.2415$$

$$C_r = 0.0334$$

$$P_0 = 0.361 \text{ kg/sqcm}$$

$$P_c = 2.100 \text{ kg/sqcm}$$

$$\text{OCR} = 5.811$$

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CONSOLIDATION TEST RESULTS

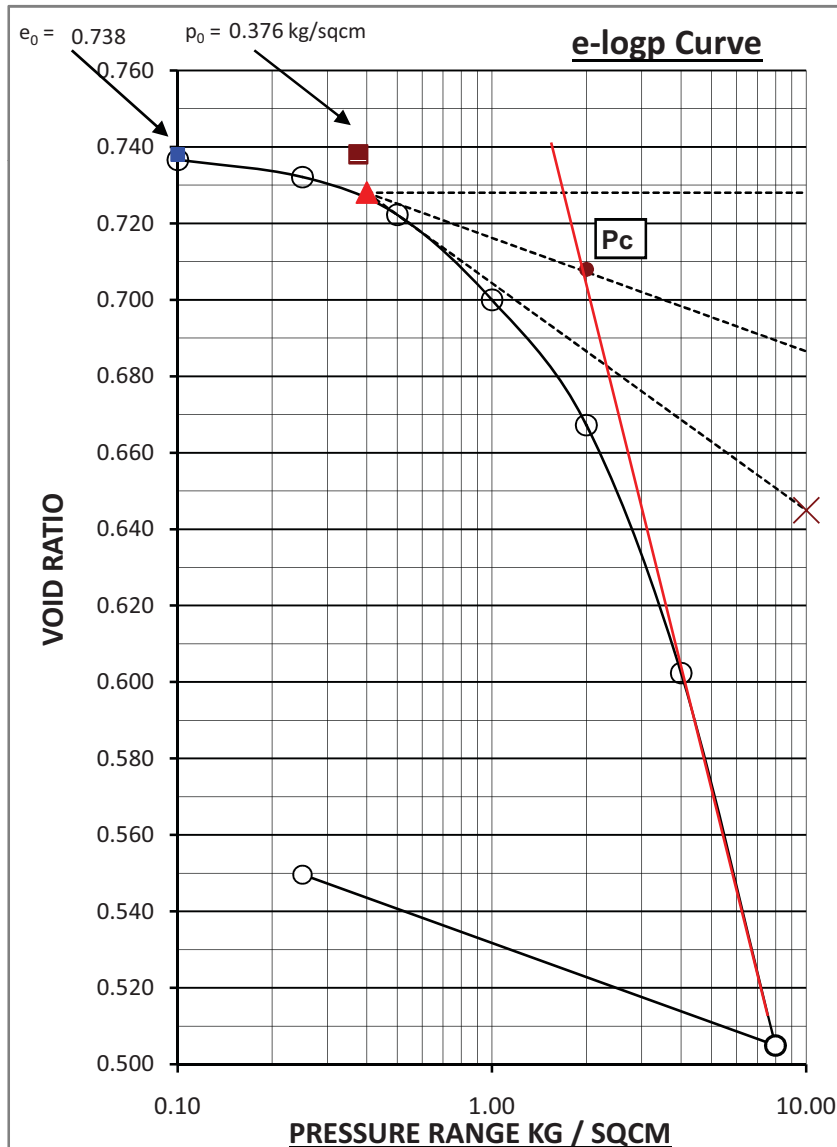
Sample Number: BH-25/UDS-01

Depth : 2.15-2.6 meters

Description : Brownish grey silty clay, with traces of calcareous nodules.

Water content: Initial=27.7% Final =23.8% Initial Void Ratio =0.738

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.737	0.0060				
0.10 - 0.25	26	0.732	0.0174	46.15	0.0093	452.4	1.857
0.25 - 0.50	57	0.722	0.0229	33.33	0.0153	424.5	1.946
0.50 - 1.00	128	0.700	0.0259	31.25	0.0178	200.9	3.959
1.00 - 2.00	188	0.667	0.0192	23.40	0.0147	418.2	1.780
2.00 - 4.00	373	0.602	0.0195	28.95	0.0138	389.5	1.689
4.00 - 8.00	560	0.505	0.0152	12.50	0.0133	194.0	2.711
8.00 - 0.25	257	0.550	0.0038				



$$C_c = 0.3235$$

$$C_r = 0.0297$$

$$P_0 = 0.376 \text{ kg/sqcm}$$

$$P_c = 2.000 \text{ kg/sqcm}$$

$$OCR = 5.324$$

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CONSOLIDATION TEST RESULTS

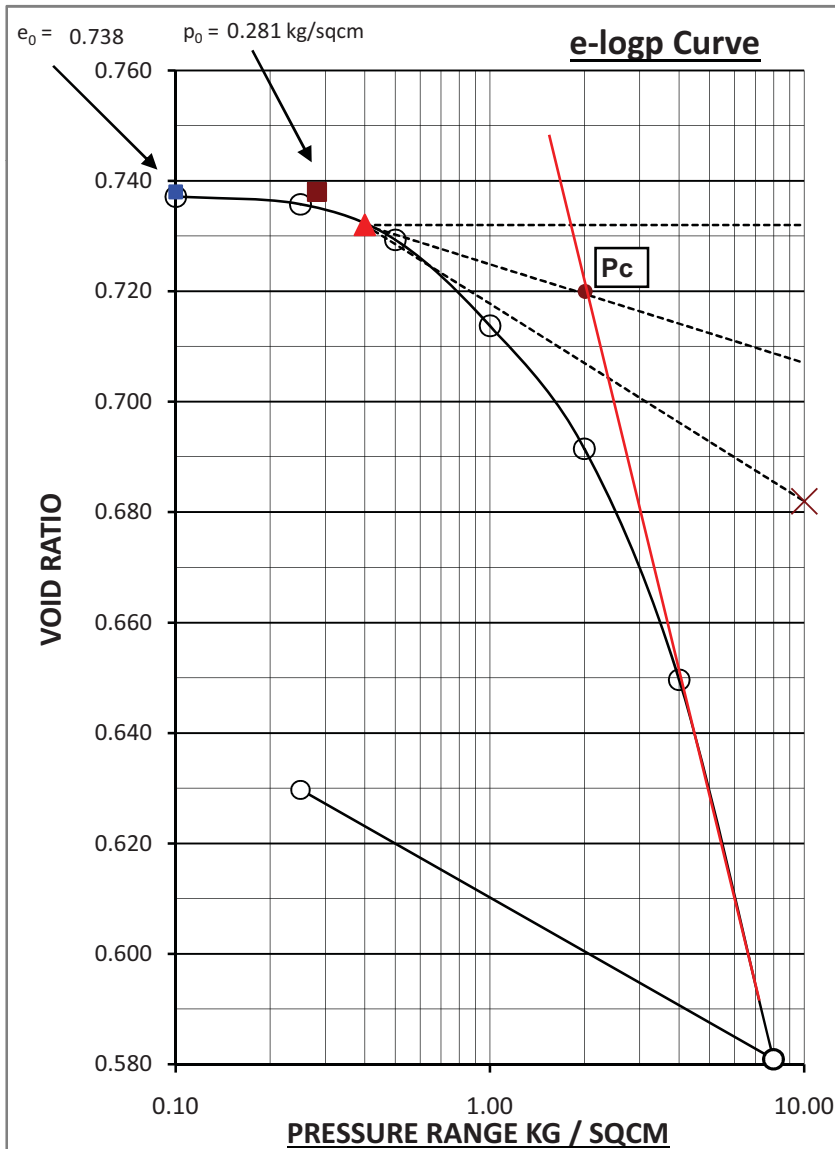
Sample Number: IBH-01/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=25.5% Final =23.8% Initial Void Ratio =0.738

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	4	0.737	0.0040				
0.10 - 0.25	8	0.736	0.0053	12.50	0.0047	98.3	8.618
0.25 - 0.50	37	0.729	0.0148	29.73	0.0104	188.0	4.466
0.50 - 1.00	90	0.714	0.0181	23.33	0.0139	190.1	4.304
1.00 - 2.00	128	0.692	0.0130	26.56	0.0095	103.7	7.544
2.00 - 4.00	241	0.650	0.0124	25.31	0.0092	140.5	5.150
4.00 - 8.00	396	0.581	0.0104	15.40	0.0088	130.3	4.812
8.00 - 0.25	281	0.630	0.0040				



$$C_c = 0.2284$$

$$C_r = 0.0324$$

$$P_0 = 0.281 \text{ kg/sqcm}$$

$$P_c = 2.010 \text{ kg/sqcm}$$

$$\text{OCR} = 7.143$$

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CONSOLIDATION TEST RESULTS

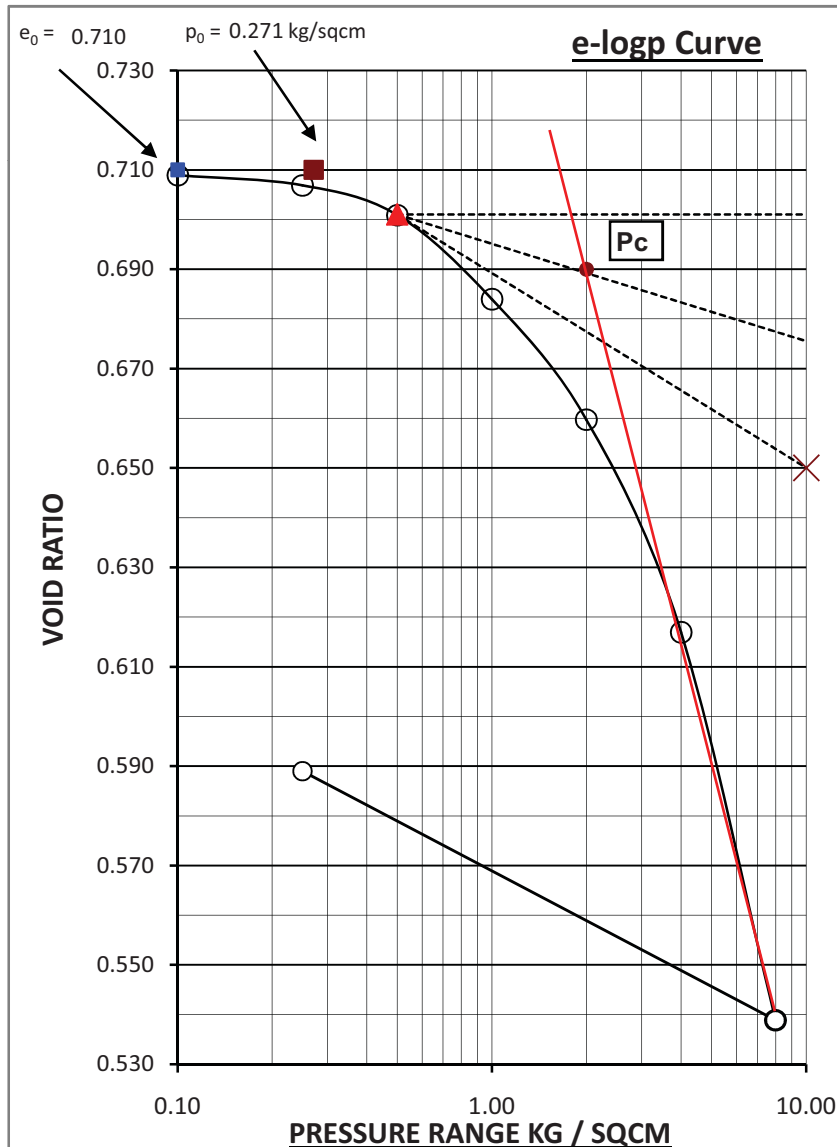
Sample Number: IBH-03/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=24.3% Final =22.8% Initial Void Ratio =0.71

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	4	0.709	0.0040				
0.10 - 0.25	12	0.707	0.0080	16.67	0.0067	72.6	11.573
0.25 - 0.50	35	0.701	0.0141	37.14	0.0088	118.2	7.041
0.50 - 1.00	99	0.684	0.0200	34.34	0.0131	142.3	5.692
1.00 - 2.00	141	0.660	0.0144	31.21	0.0099	375.0	2.055
2.00 - 4.00	250	0.617	0.0129	28.40	0.0092	185.9	3.813
4.00 - 8.00	455	0.539	0.0121	18.68	0.0098	232.9	2.592
8.00 - 0.25	292	0.589	0.0042				



$$C_c = 0.2591$$

$$C_r = 0.0333$$

$$P_0 = 0.271 \text{ kg/sqcm}$$

$$P_c = 2.000 \text{ kg/sqcm}$$

$$\text{OCR} = 7.370$$

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CONSOLIDATION TEST RESULTS

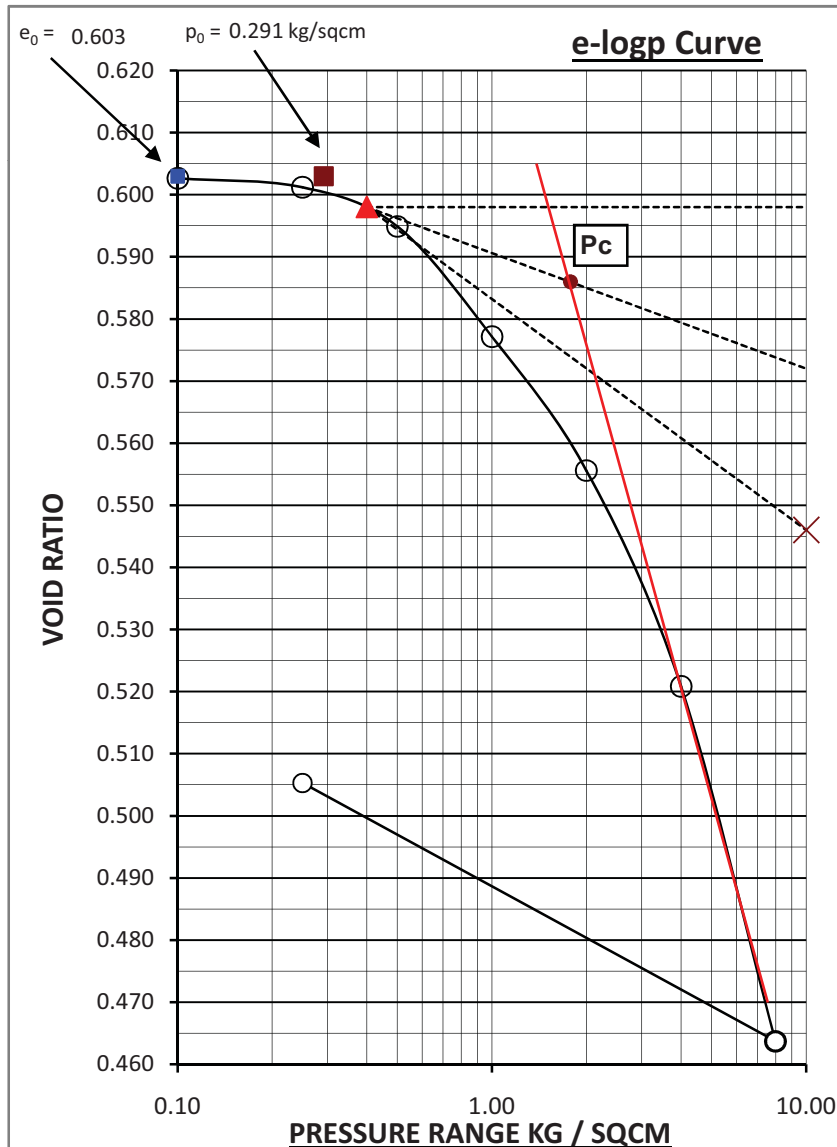
Sample Number: IBH-05/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of calcareous nodules.

Water content: Initial=22.8% Final =22.5% Initial Void Ratio =0.603

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.603	0.0050				
0.10 - 0.25	9	0.601	0.0060	33.33	0.0040	101.4	8.327
0.25 - 0.50	39	0.595	0.0156	23.08	0.0120	169.2	4.942
0.50 - 1.00	111	0.577	0.0223	29.73	0.0157	157.5	5.152
1.00 - 2.00	134	0.556	0.0136	24.63	0.0103	372.0	2.073
2.00 - 4.00	217	0.521	0.0112	22.58	0.0087	153.6	4.657
4.00 - 8.00	356	0.464	0.0094	18.54	0.0076	135.0	4.658
8.00 - 0.25	259	0.505	0.0037				



$$C_c = 0.1897$$

$$C_r = 0.0276$$

$$P_0 = 0.291 \text{ kg/sqcm}$$

$$P_c = 1.780 \text{ kg/sqcm}$$

$$\text{OCR} = 6.109$$

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CONSOLIDATION TEST RESULTS

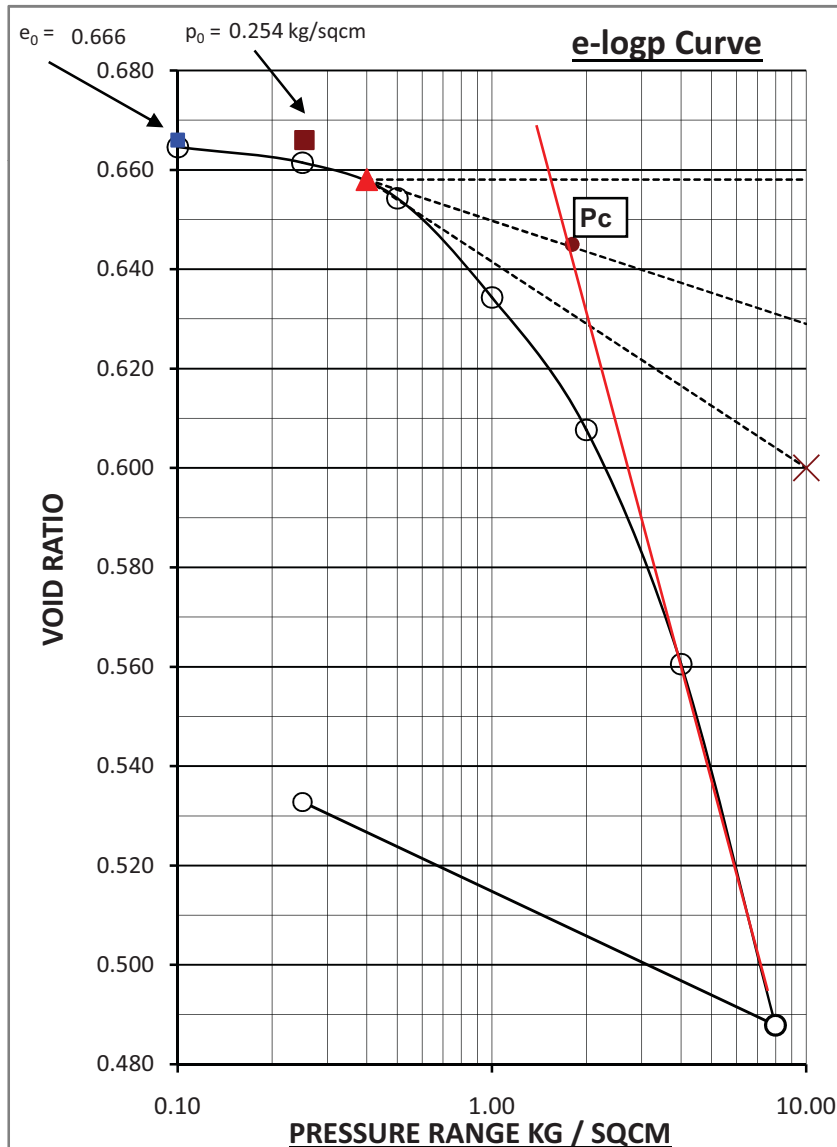
Sample Number: IBH-07/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with calcareous nodules.

Water content: Initial=25.1% Final =22.2% Initial Void Ratio =0.666

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	8	0.665	0.0080				
0.10 - 0.25	19	0.661	0.0127	47.37	0.0067	372.6	2.264
0.25 - 0.50	43	0.654	0.0172	37.21	0.0108	424.5	1.962
0.50 - 1.00	120	0.634	0.0241	35.80	0.0155	515.1	1.564
1.00 - 2.00	160	0.608	0.0163	18.75	0.0132	566.2	1.343
2.00 - 4.00	283	0.561	0.0147	18.73	0.0119	504.6	1.369
4.00 - 8.00	437	0.488	0.0117	18.08	0.0095	448.2	1.305
8.00 - 0.25	270	0.533	0.0039				



$$C_c = 0.2416$$

$$C_r = 0.0299$$

$$P_0 = 0.254 \text{ kg/sqcm}$$

$$P_c = 1.800 \text{ kg/sqcm}$$

$$OCR = 7.098$$

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Sheet No.

CONSOLIDATION TEST RESULTS

Sample Number: IBH-07/UDS-02

Depth : 4-4.45 meters

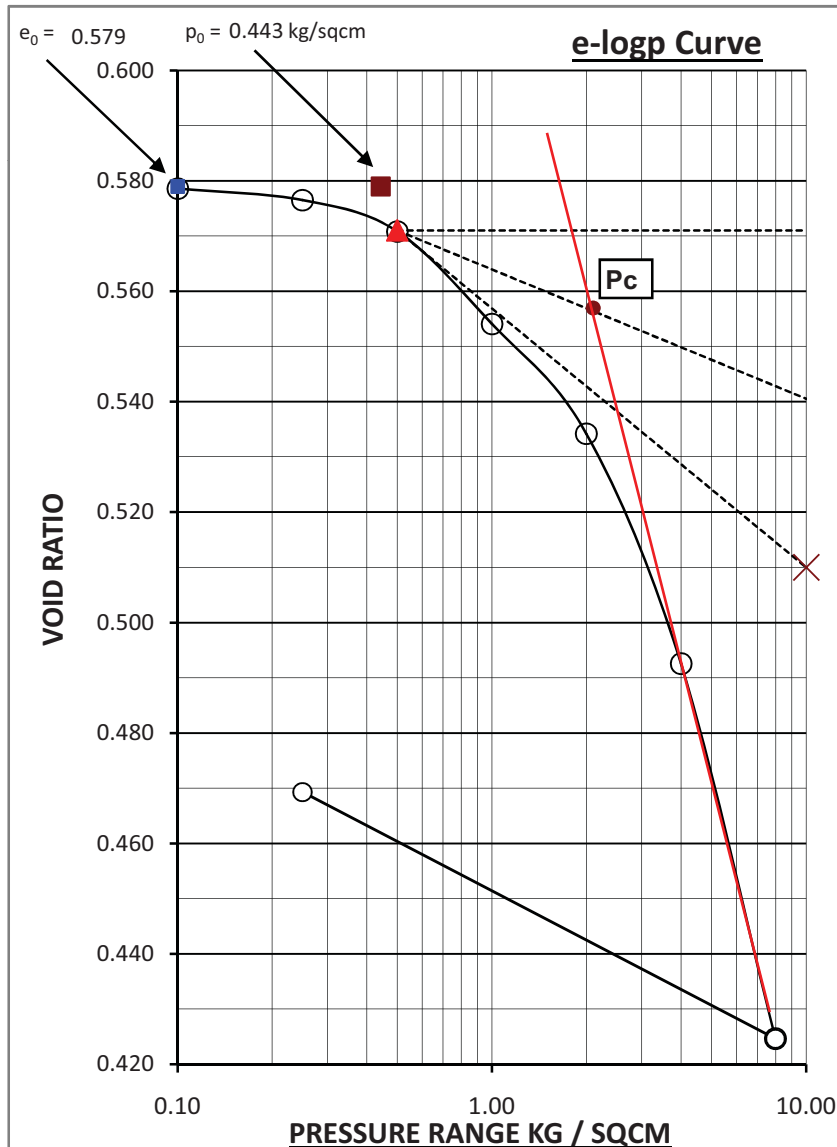
Description : Brownish grey silty clay with calcareous nodules.

Water content: Initial=20.8%

Final =19.3%

Initial Void Ratio =0.579

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	5	0.579	0.0050				
0.10 - 0.25	13	0.577	0.0087	15.38	0.0073	396.3	2.131
0.25 - 0.50	36	0.571	0.0144	30.56	0.0100	540.0	1.548
0.50 - 1.00	106	0.554	0.0213	41.51	0.0125	773.3	1.051
1.00 - 2.00	126	0.534	0.0128	22.22	0.0100	237.6	3.259
2.00 - 4.00	264	0.493	0.0136	26.89	0.0099	622.1	1.145
4.00 - 8.00	430	0.425	0.0114	21.86	0.0089	610.6	0.997
8.00 - 0.25	283	0.469	0.0040				



$$C_c = 0.2256$$

$$C_r = 0.0297$$

$$P_0 = 0.443 \text{ kg/sqcm}$$

$$P_c = 2.100 \text{ kg/sqcm}$$

$$OCR = 4.744$$

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CONSOLIDATION TEST RESULTS

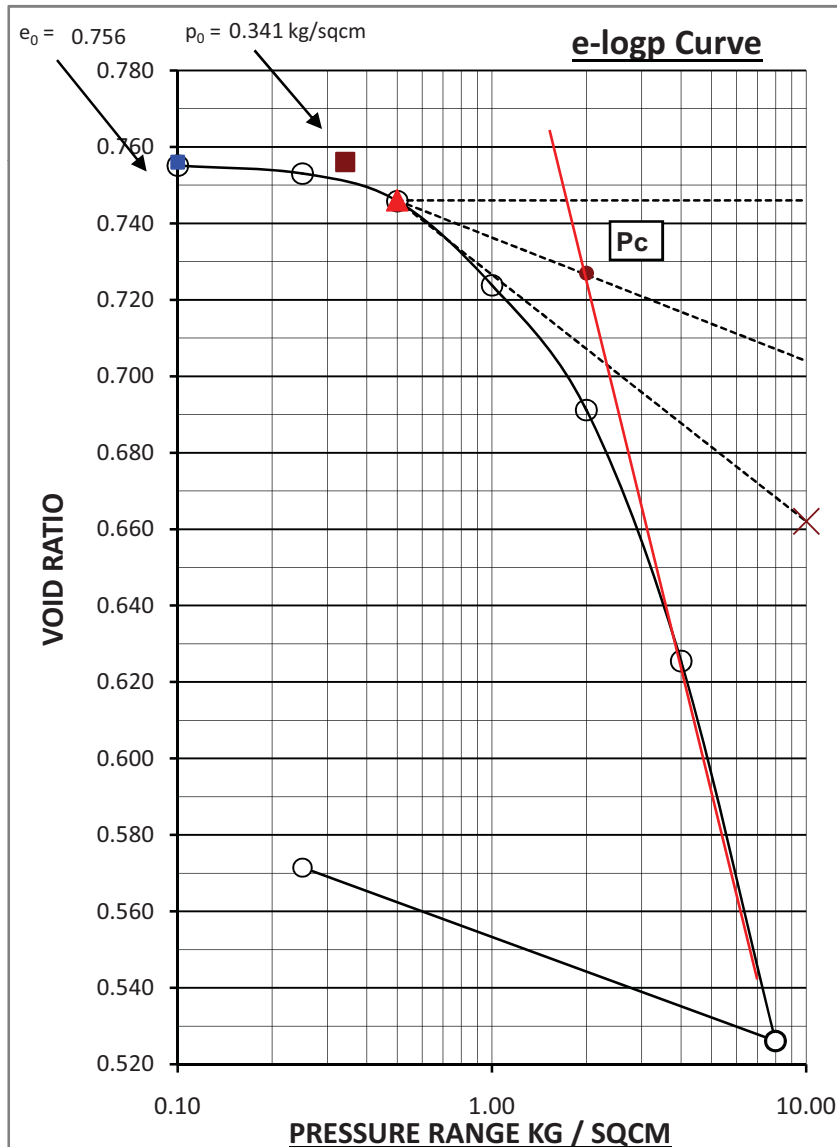
Sample Number: IBH-08/UDS-01

Depth :2-2.45 meters

Description :Brownish grey silty clay with traces of calcareous nodules

Water content:Initial=28.1% Final =23.5% Initial Void Ratio =0.756

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	6	0.755	0.0060				
0.10 - 0.25	12	0.753	0.0080	33.33	0.0053	393.8	2.140
0.25 - 0.50	41	0.746	0.0164	34.15	0.0108	565.5	1.475
0.50 - 1.00	125	0.724	0.0252	26.00	0.0186	205.4	3.926
1.00 - 2.00	186	0.691	0.0190	19.35	0.0153	290.4	2.602
2.00 - 4.00	374	0.625	0.0194	27.27	0.0141	369.0	1.812
4.00 - 8.00	565	0.526	0.0153	16.81	0.0127	418.2	1.279
8.00 - 0.25	258	0.571	0.0038				



$$C_c = 0.3298$$

$$C_r = 0.0301$$

$$P_0 = 0.341 \text{ kg/sqcm}$$

$$P_c = 2.000 \text{ kg/sqcm}$$

$$\text{OCR} = 5.859$$

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CONSOLIDATION TEST RESULTS

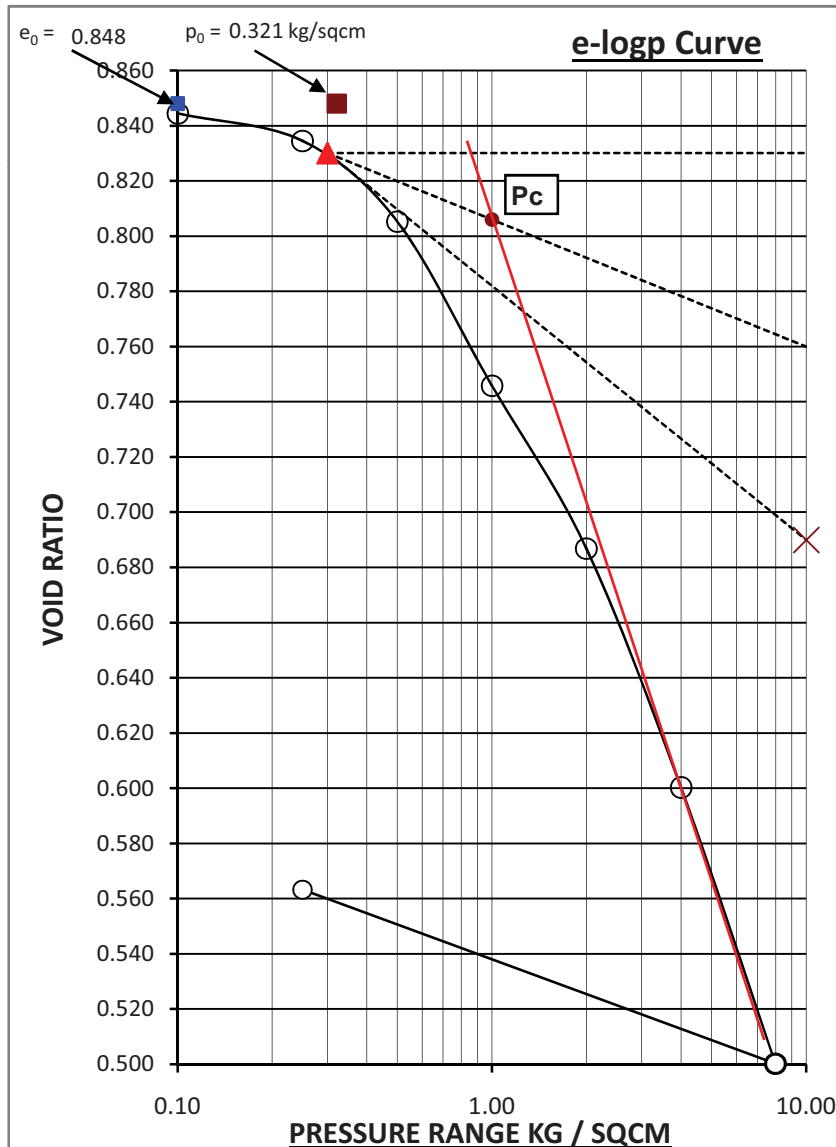
Sample Number: IBH-09/UDS-01

Depth : 2-2.45 meters

Description : Brownish grey silty clay with traces of sand mixture.

Water content: Initial=31.8% Final =23.4% Initial Void Ratio =0.848

P1-P2 Kg/Sqcm	Dial Change	Void Ratio	Mv Sqcm/kg	Comprn %	Mvc sqcm/kg	T90 Sec	1000.Cv sqcm/sec
0.00 - 0.10	20	0.844	0.0200				
0.10 - 0.25	54	0.835	0.0361	22.22	0.0281	126.7	6.570
0.25 - 0.50	158	0.805	0.0637	23.90	0.0484	160.0	4.983
0.50 - 1.00	322	0.746	0.0659	24.90	0.0495	165.3	4.356
1.00 - 2.00	319	0.687	0.0338	19.10	0.0273	164.0	3.802
2.00 - 4.00	469	0.600	0.0257	12.37	0.0225	152.1	3.381
4.00 - 8.00	541	0.500	0.0156	10.35	0.0140	130.2	2.991
8.00 - 0.25	341	0.563	0.0054				



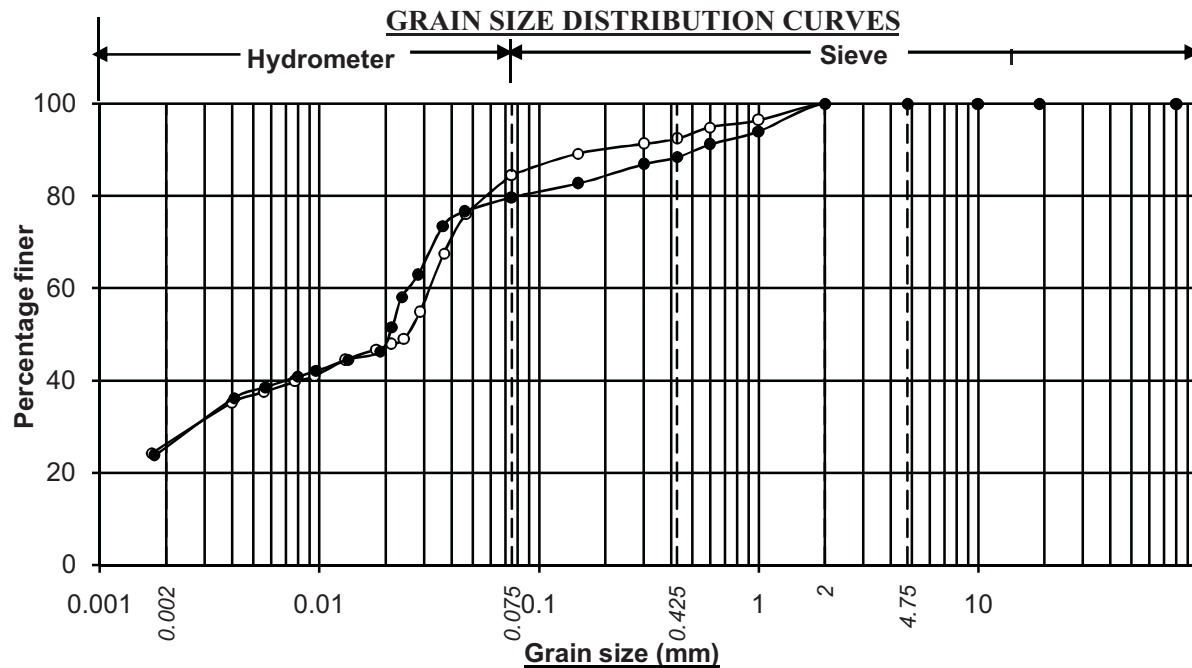
$$C_c = 0.3321$$

$$C_r = 0.0419$$

$$P_0 = 0.321 \text{ kg/sqcm}$$

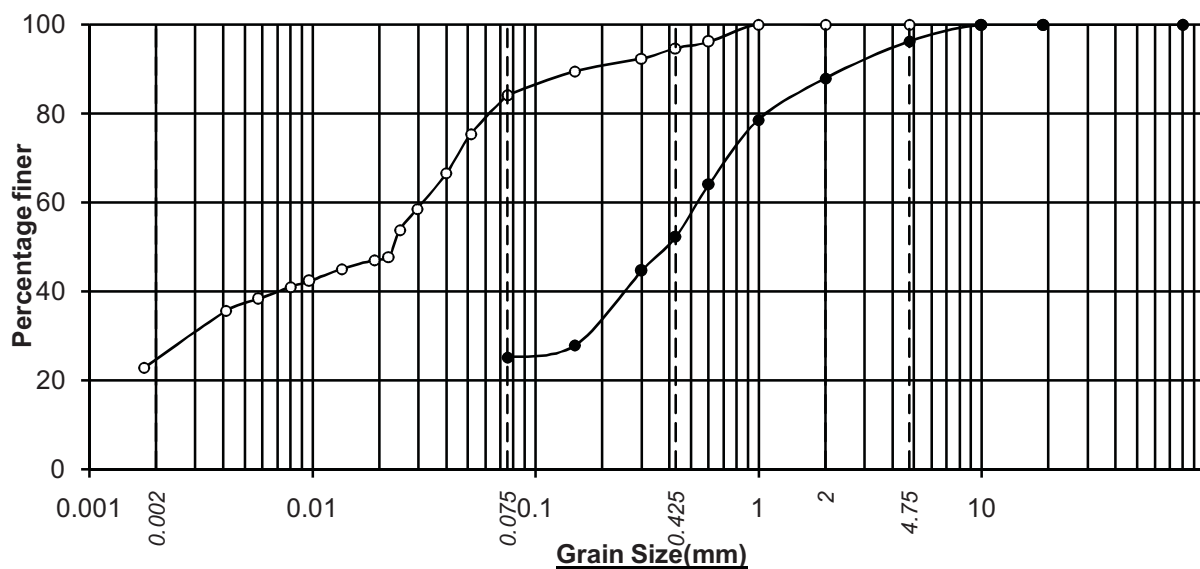
$$P_c = 1.000 \text{ kg/sqcm}$$

$$\text{OCR} = 3.112$$



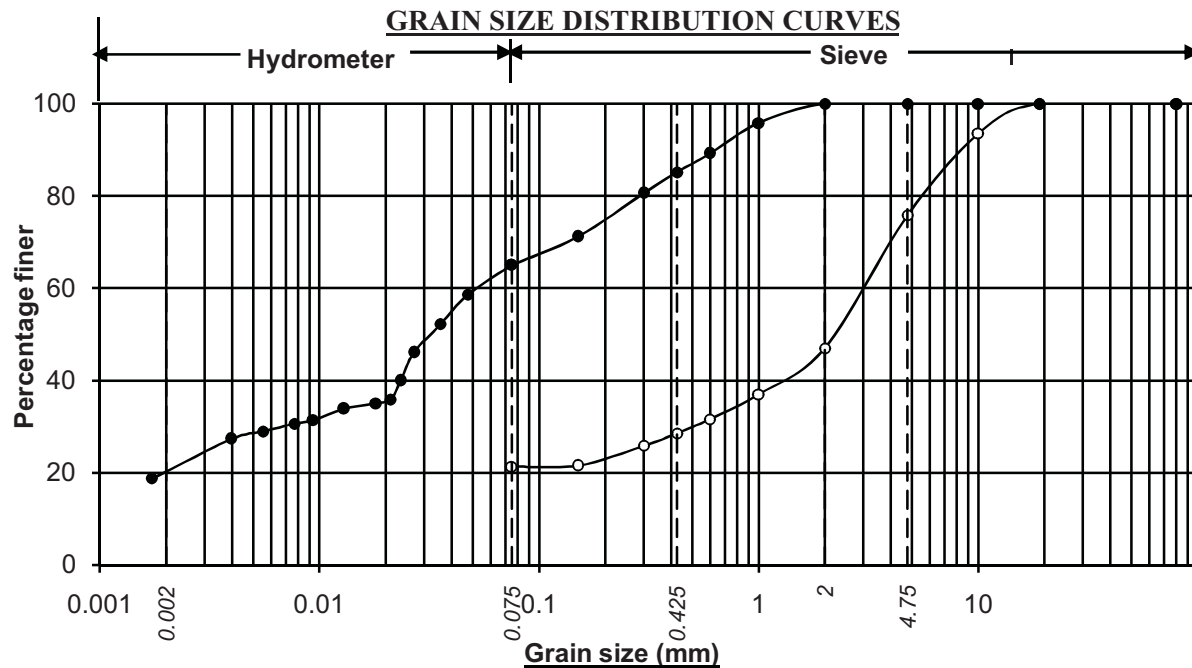
—○— BH-01,UDS-01, 2.10M —●— BH-01,UDS-02, 4.15M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-01,UDS-01, 2.10M	26.2	58.4	7.8	7.6	0.0	15.4		0.0
BH-01,UDS-02, 4.15M	25.5	54.2	8.7	11.6	0.0	20.3		0.0



—○— BH-01,SPT-04, 6.70M —●— BH-01,SPT-05, 7.70M

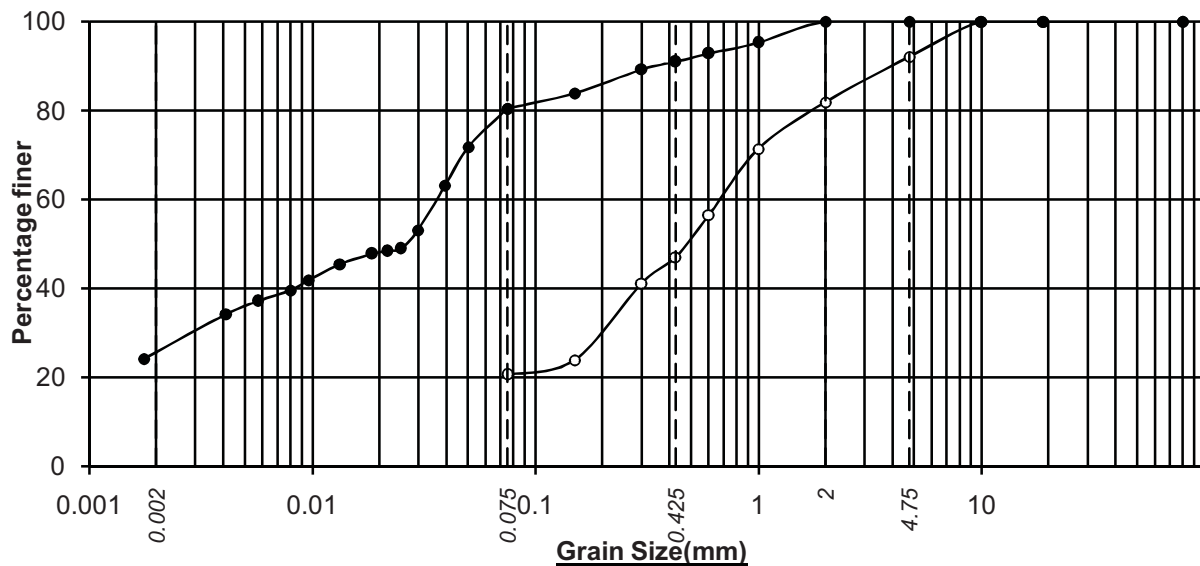
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-01,SPT-04, 6.70M	24.8	59.4	10.5	5.3	0.0	15.8		0.0
BH-01,SPT-05, 7.70M		25.2	27.2	35.5	8.4	71.1		3.7



—○— BH-02,SPT-02, 2.80M

—●— BH-02,UDS-02, 4.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-02,SPT-02, 2.80M		21.3	7.2	18.5	28.8	54.5		24.2
BH-02,UDS-02, 4.00M	20.3	44.8	20.0	14.9	0.0	34.9		0.0



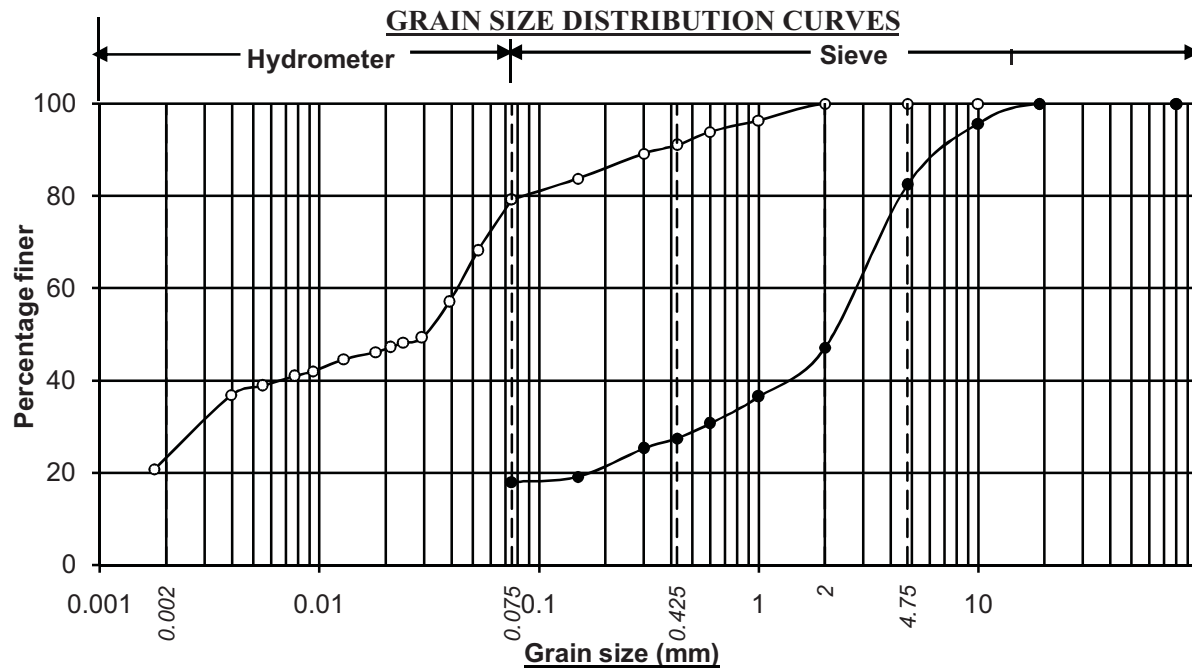
—○— BH-02,SPT-05, 7.80M

—●— BH-03,UDS-01, 2.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-02,SPT-05, 7.80M		20.7	26.3	34.8	10.2	71.3		8.0
BH-03,UDS-01, 2.00M	25.7	54.7	10.6	9.0	0.0	19.6		0.0

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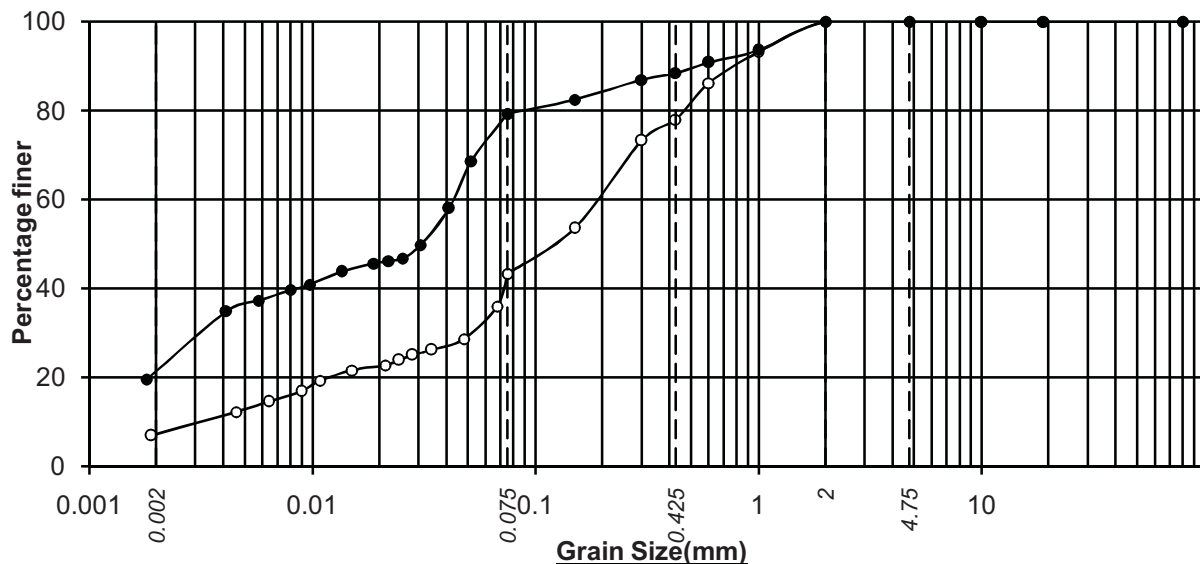
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—○— BH-03,UDS-02, 4.00M

—●— BH-03,SPT-03, 5.00M

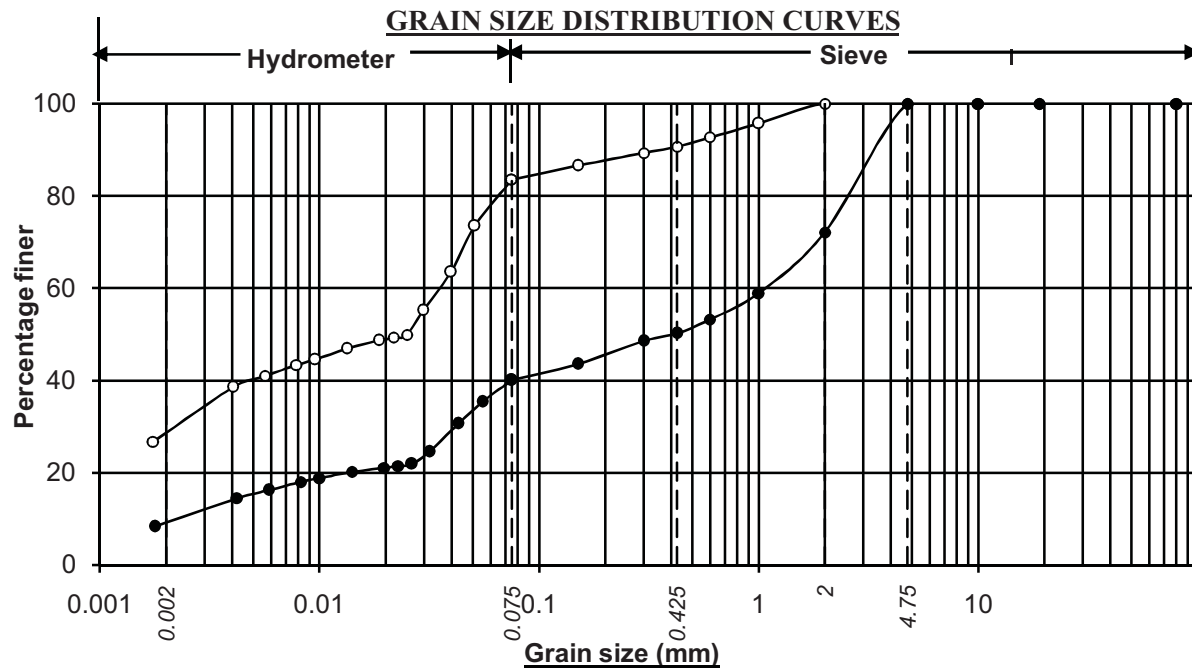
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-03,UDS-02, 4.00M	23.2	56.1	11.7	9.0	0.0	20.7		0.0
BH-03,SPT-03, 5.00M		18.0	9.5	19.6	35.3	64.4		17.6



—○— BH-03,SPT-04, 6.10M

—●— BH-04,UDS-01, 2.00M

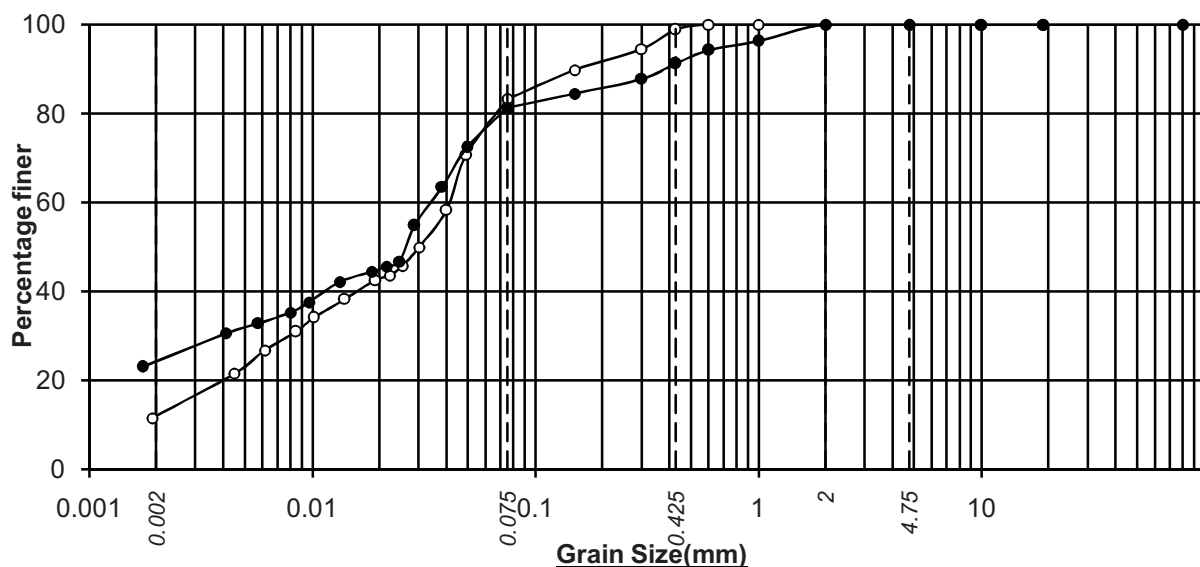
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-03,SPT-04, 6.10M	7.3	36.0	34.7	22.0	0.0	56.7		0.0
BH-04,UDS-01, 2.00M	21.4	57.9	9.1	11.6	0.0	20.7		0.0



—○— BH-04,UDS-02, 4.00M

—●— BH-04,SPT-03, 5.00M

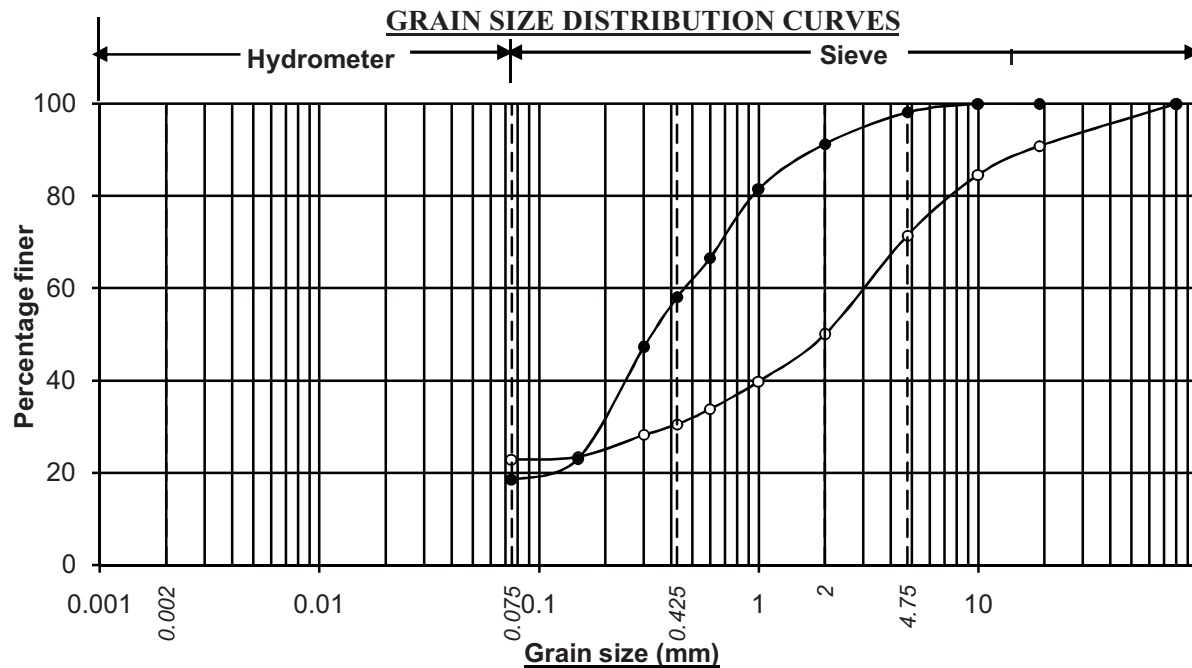
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-04,UDS-02, 4.00M	28.6	55.0	7.1	9.3	0.0	16.4		0.0
BH-04,SPT-03, 5.00M	9.1	31.0	10.1	21.9	27.9	59.9		0.0



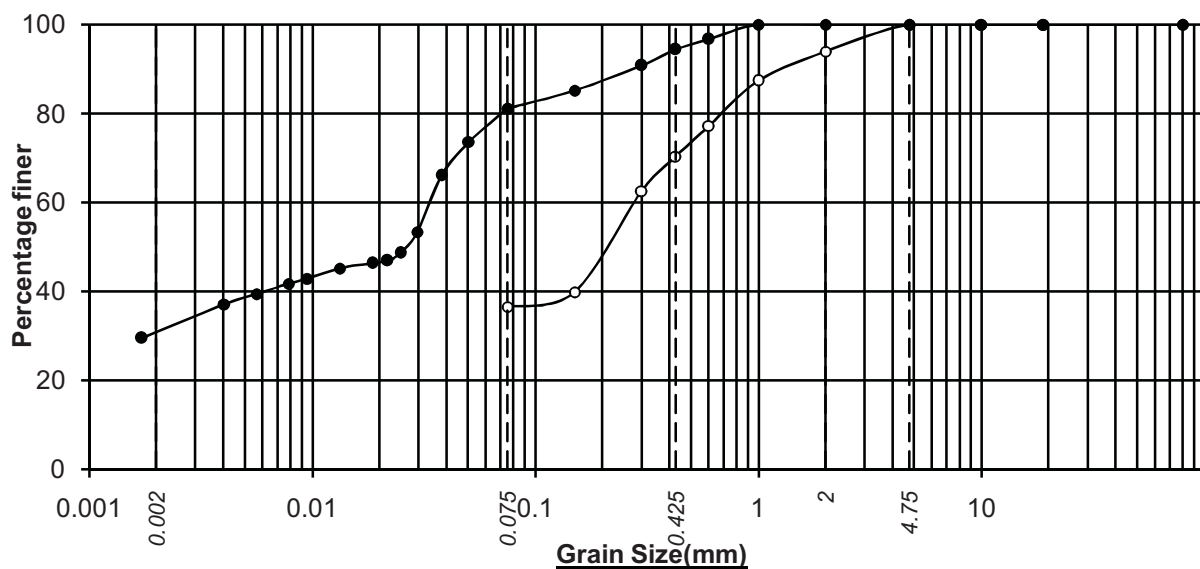
—○— BH-04,SPT-05, 7.00M

—●— BH-05,UDS-01, 2.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-04,SPT-05, 7.00M	12.0	71.2	15.7	1.1	0.0	16.8		0.0
BH-05,UDS-01, 2.00M	24.3	57.0	10.0	8.7	0.0	18.7		0.0



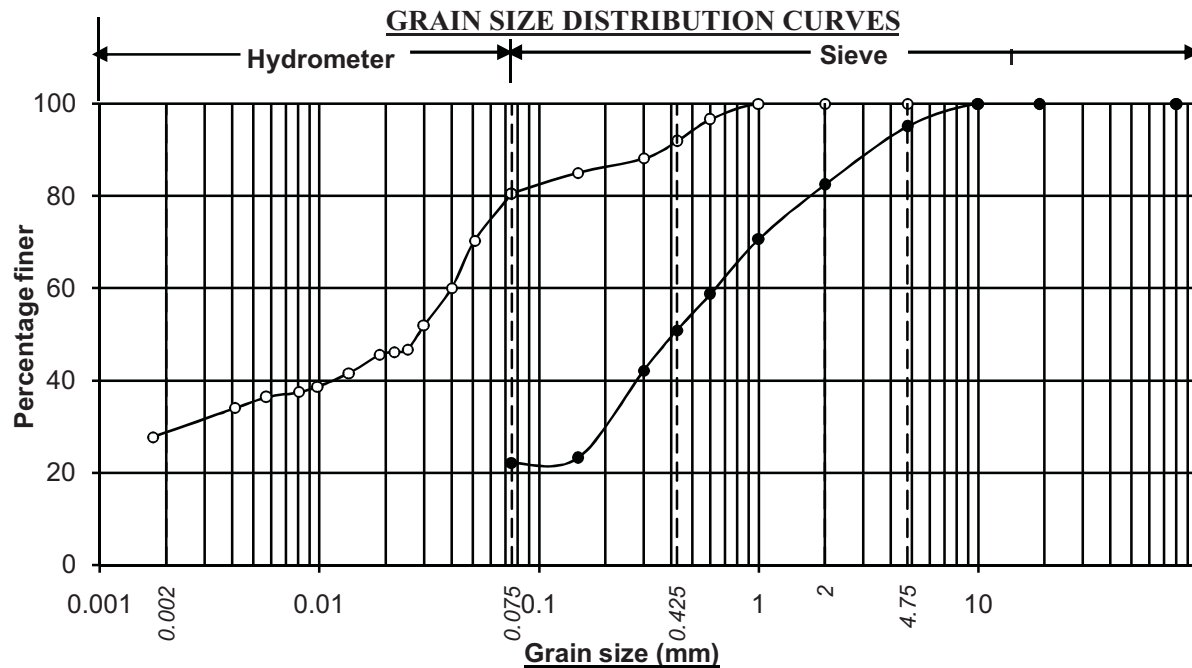
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-05, SPT-03, 4.08M		22.9	7.6	19.5	21.4	48.5		28.6
BH-05, SPT-05, 6.09M		18.5	39.5	33.2	6.9	79.6		1.9



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-05, SPT-07, 8.00M		36.6	33.7	23.6	6.1	63.4		0.0
BH-06, SPT-01, 1.00M	30.9	50.3	13.2	5.6	0.0	18.8		0.0

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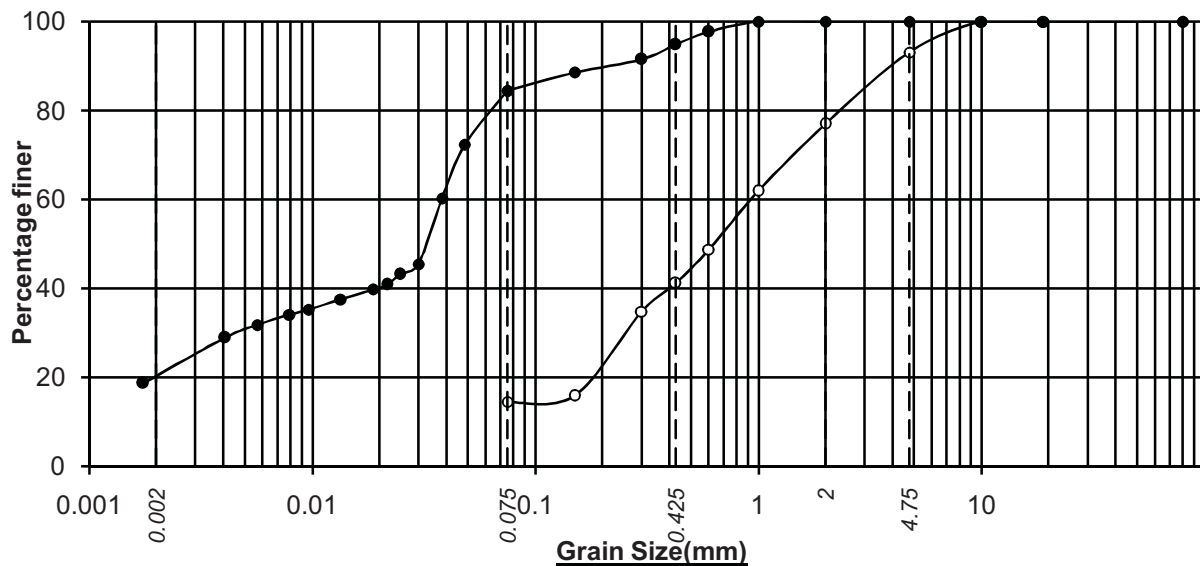
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—○— BH-06,UDS-01, 2.00M

—●— BH-06,SPT-06, 7.10M

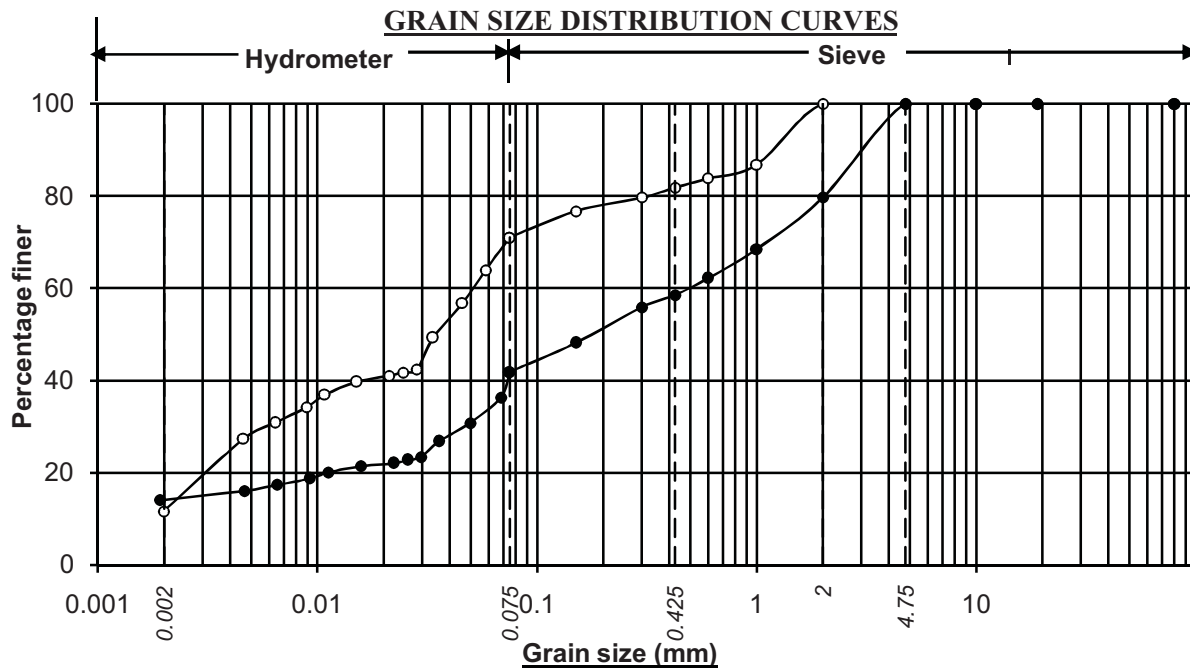
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-06,UDS-01, 2.00M	28.7	51.9	11.3	8.1	0.0	19.4		0.0
BH-06,SPT-06, 7.10M		22.1	28.7	31.6	12.7	73.0		4.9



—○— BH-06,SPT-07, 8.10M

—●— BH-07,UDS-01, 2.00M

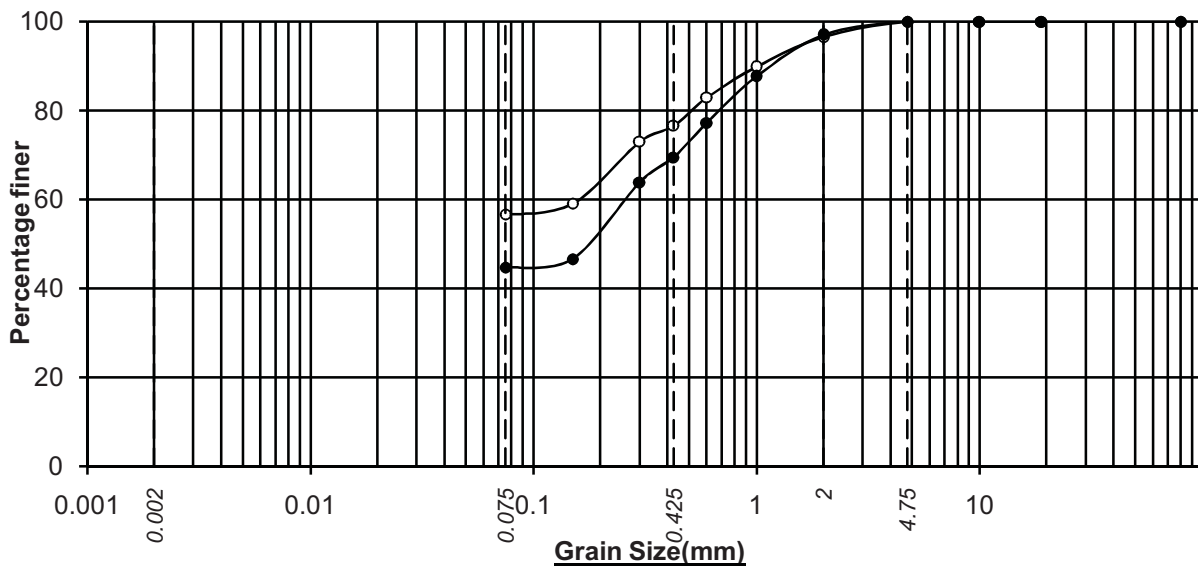
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-06,SPT-07, 8.10M		14.5	26.8	35.8	16.0	78.6		6.9
BH-07,UDS-01, 2.00M	20.4	64.0	10.5	5.1	0.0	15.6		0.0



—○— BH-07, SPT-02, 3.00M

—●— BH-07, SPT-03, 4.09M

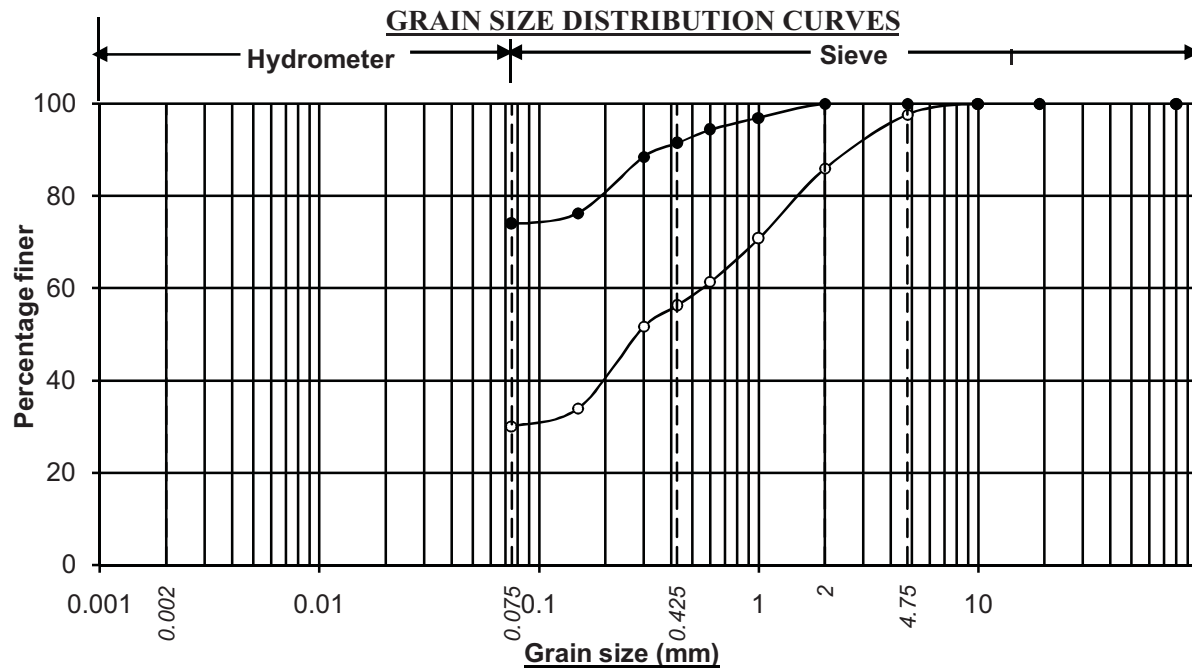
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-07, SPT-02, 3.00M	11.6	59.4	10.8	18.2	0.0	29.0		0.0
BH-07, SPT-03, 4.09M	14.1	27.7	16.7	21.2	20.3	58.2		0.0



—○— BH-07, SPT-04, 5.00M

—●— BH-07, SPT-05, 6.00M

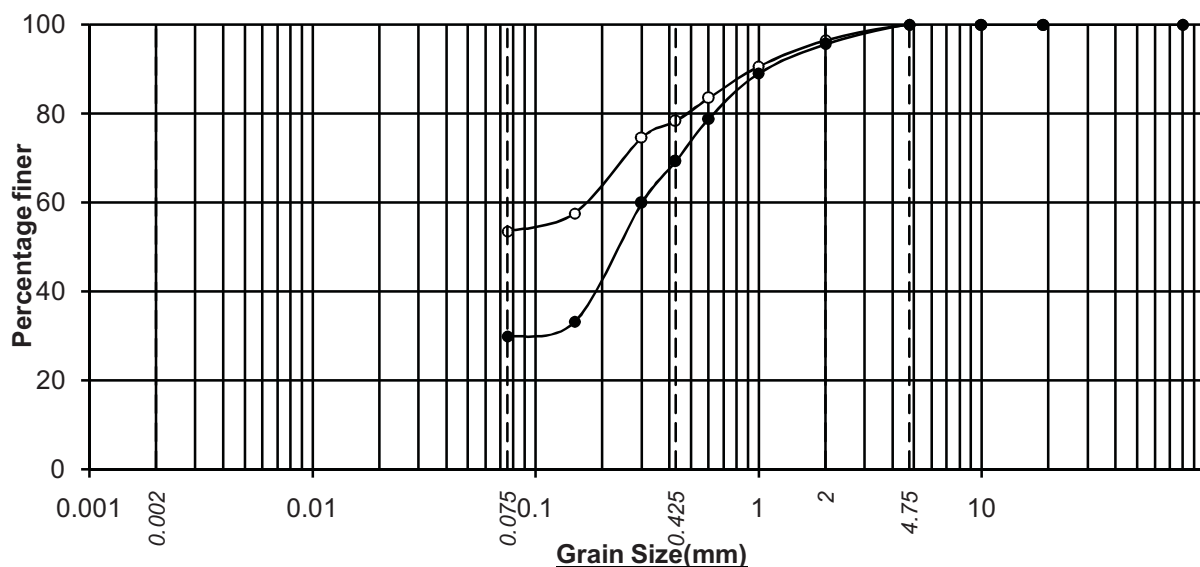
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-07, SPT-04, 5.00M		56.6	20.0	19.9	3.5	43.4		0.0
BH-07, SPT-05, 6.00M		44.7	24.8	27.5	3.0	55.3		0.0



—○— BH-07, SPT-07, 8.00M

—●— BH-08, SPT-04, 4.90M

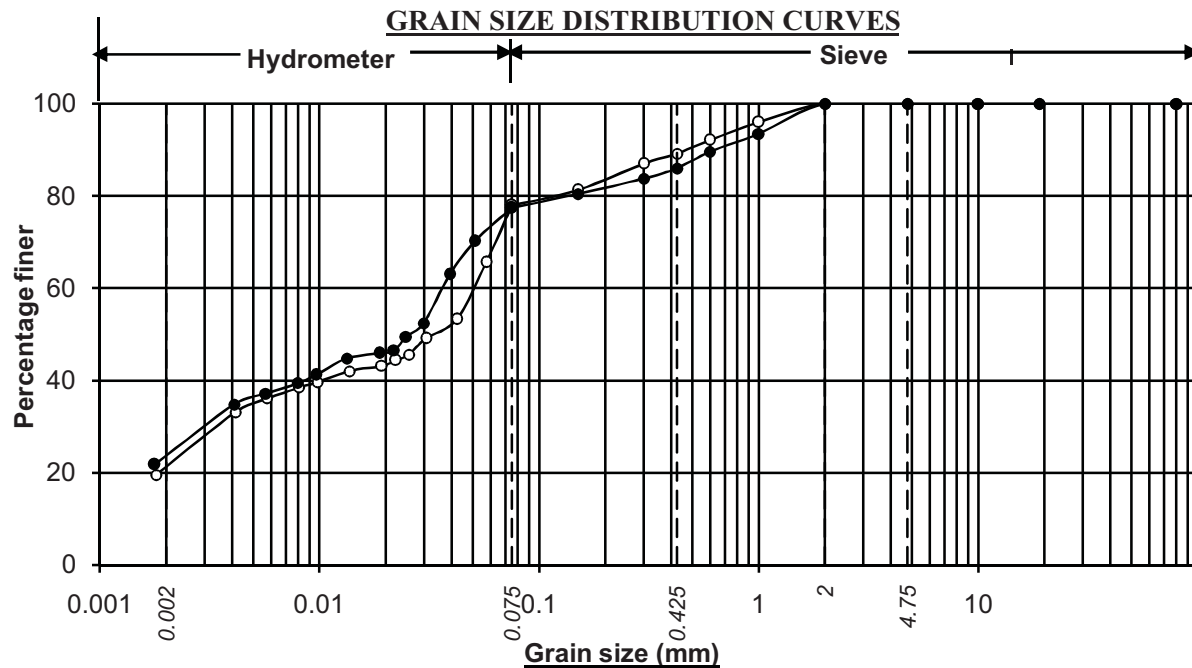
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-07, SPT-07, 8.00M		30.1	26.1	29.7	11.7	67.5		2.4
BH-08, SPT-04, 4.90M		74.0	17.4	8.6	0.0	26.0		0.0



—○— BH-08, SPT-07, 7.75M

—●— BH-08, SPT-08, 8.60M

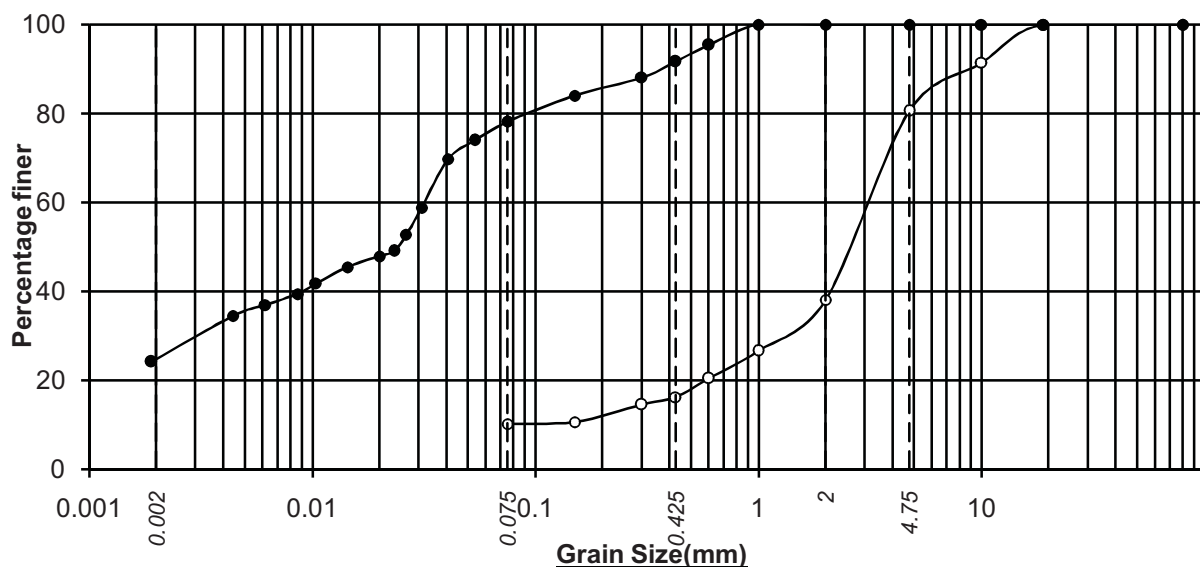
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-08, SPT-07, 7.75M		53.5	24.9	18.1	3.5	46.5		0.0
BH-08, SPT-08, 8.60M		29.9	39.3	26.4	4.4	70.1		0.0



—○— BH-09,UDS-01, 2.00M

—●— BH-09,UDS-02, 4.00M

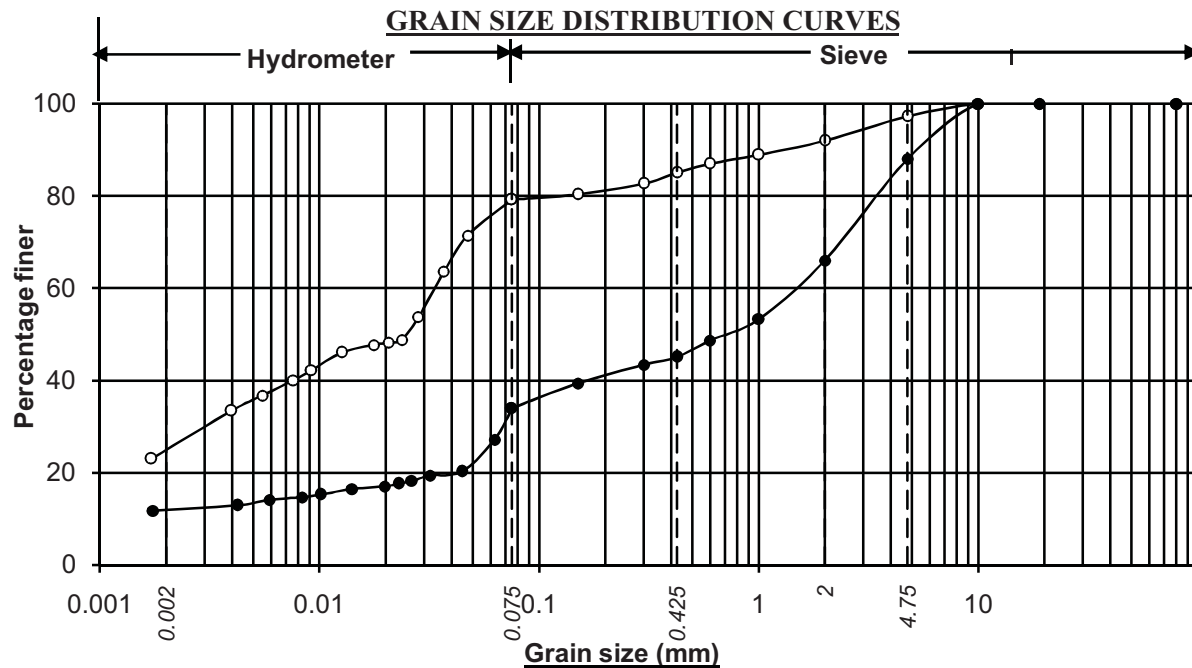
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-09,UDS-01, 2.00M	21.2	56.8	11.1	10.9	0.0	22.0		0.0
BH-09,UDS-02, 4.00M	23.6	53.8	8.6	14.0	0.0	22.6		0.0



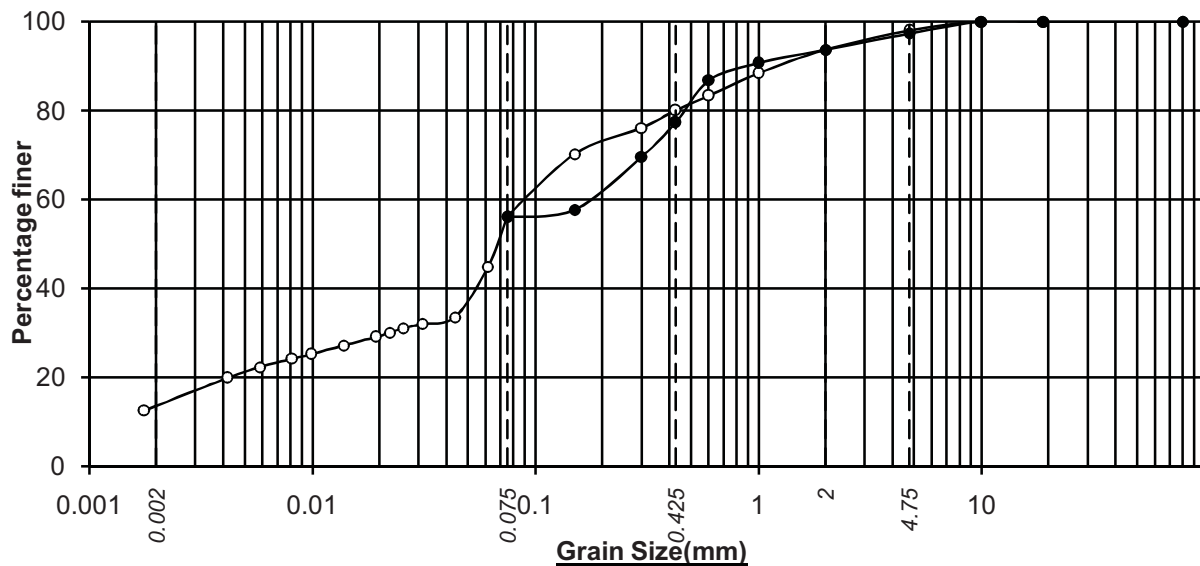
—○— BH-09,SPT-03, 5.00M

—●— BH-10,UDS-01, 2.00M

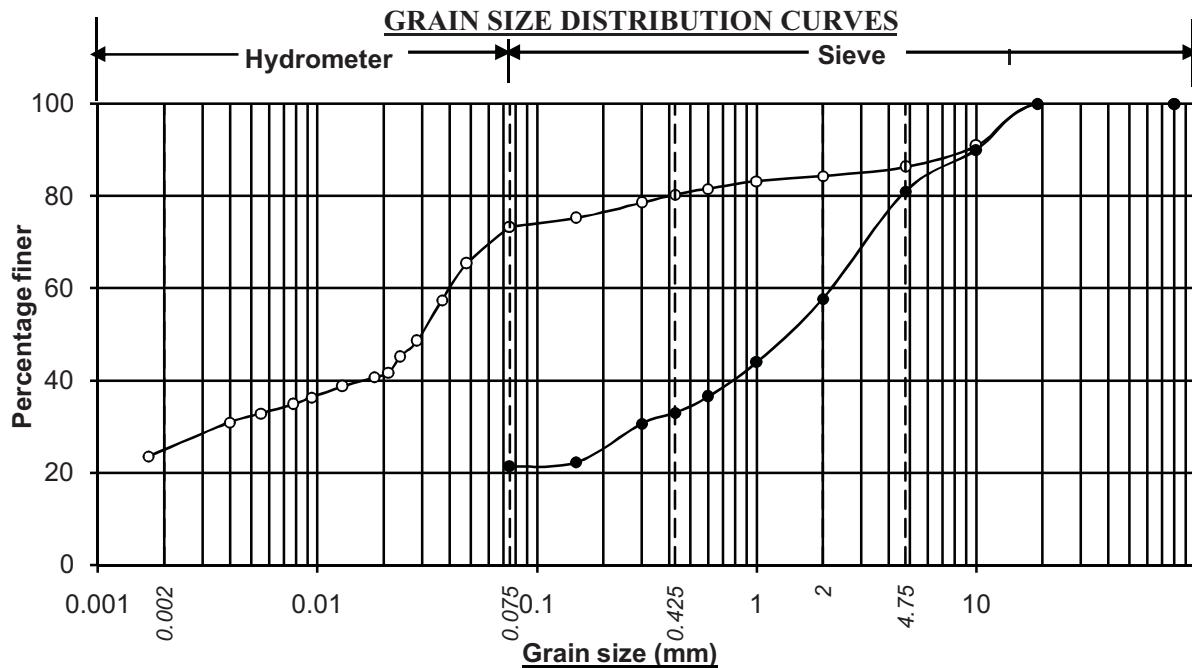
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-09,SPT-03, 5.00M		10.3	6.0	21.8	42.5	70.3		19.4
BH-10,UDS-01, 2.00M	24.9	53.4	13.4	8.3	0.0	21.7		0.0



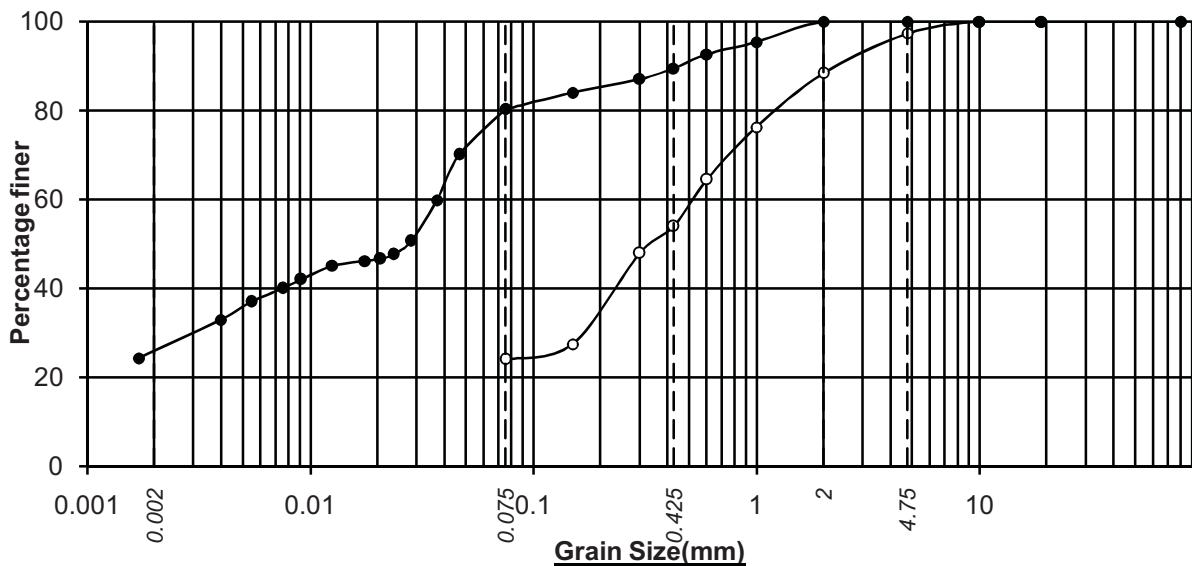
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-10,UDS-02, 4.00M	24.9	54.3	5.9	6.9	5.3	18.1		2.7
BH-10,SPT-04, 6.07M	11.9	22.1	11.1	20.9	22.0	54.0		12.0



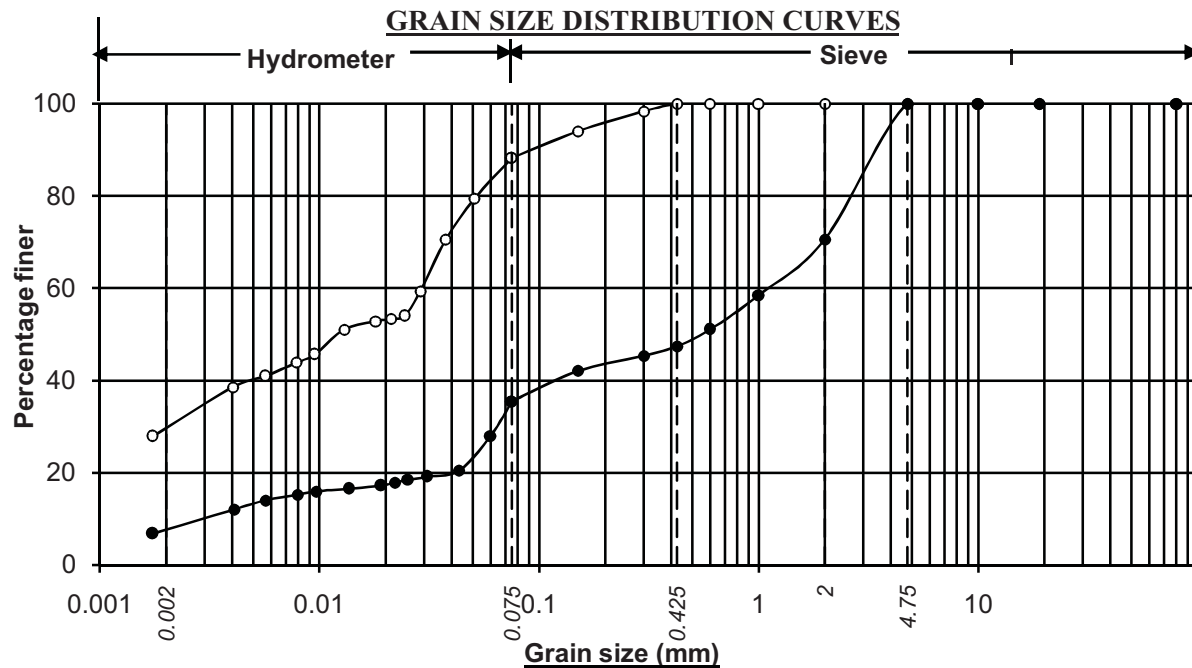
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-10,UDS-04, 7.10M	13.7	42.6	23.7	13.6	4.4	41.7		2.0
BH-10,SPT-07, 10.10M		56.1	21.2	16.3	3.7	41.2		2.7



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-11,UDS-01, 2.00M	24.9	48.4	6.9	4.1	2.0	13.0		13.7
BH-11,SPT-03, 5.00M		21.5	11.5	24.7	23.3	59.5		19.0



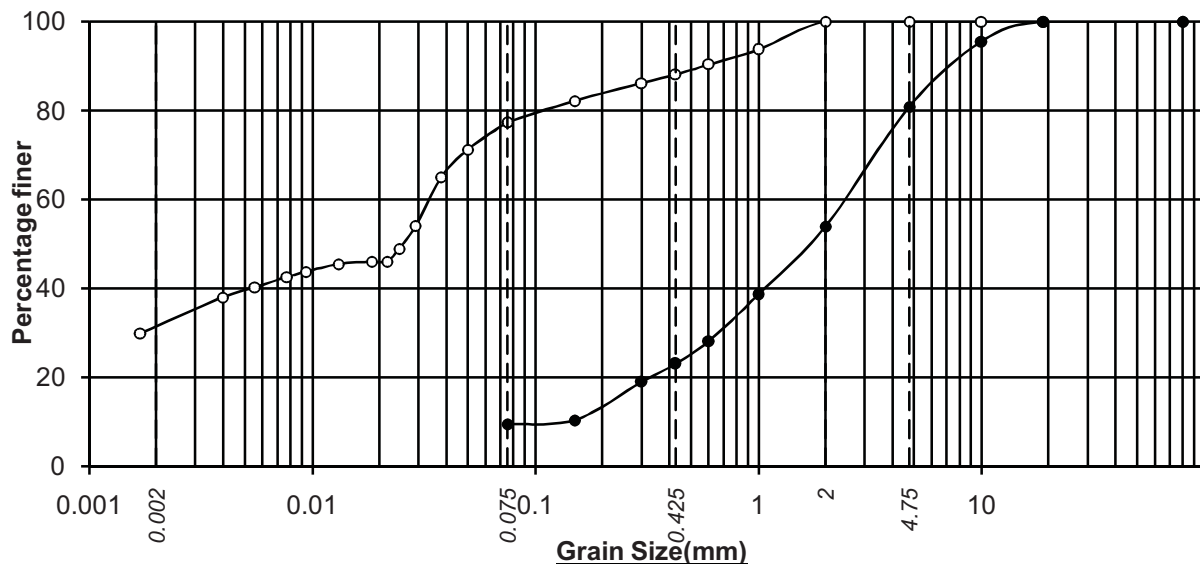
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-11,SPT-05, 8.10M		24.1	29.8	34.4	9.0	73.2		2.7
BH-12,UDS-01, 2.00M	26.0	54.4	9.1	10.5	0.0	19.6		0.0



—○— BH-12,UDS-02, 4.00M

—●— BH-12,SPT-04, 6.10M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-12,UDS-02, 4.00M	29.6	58.6	11.8	0.0	0.0	11.8		0.0
BH-12,SPT-04, 6.10M	7.7	27.8	11.9	23.2	29.4	64.5		0.0



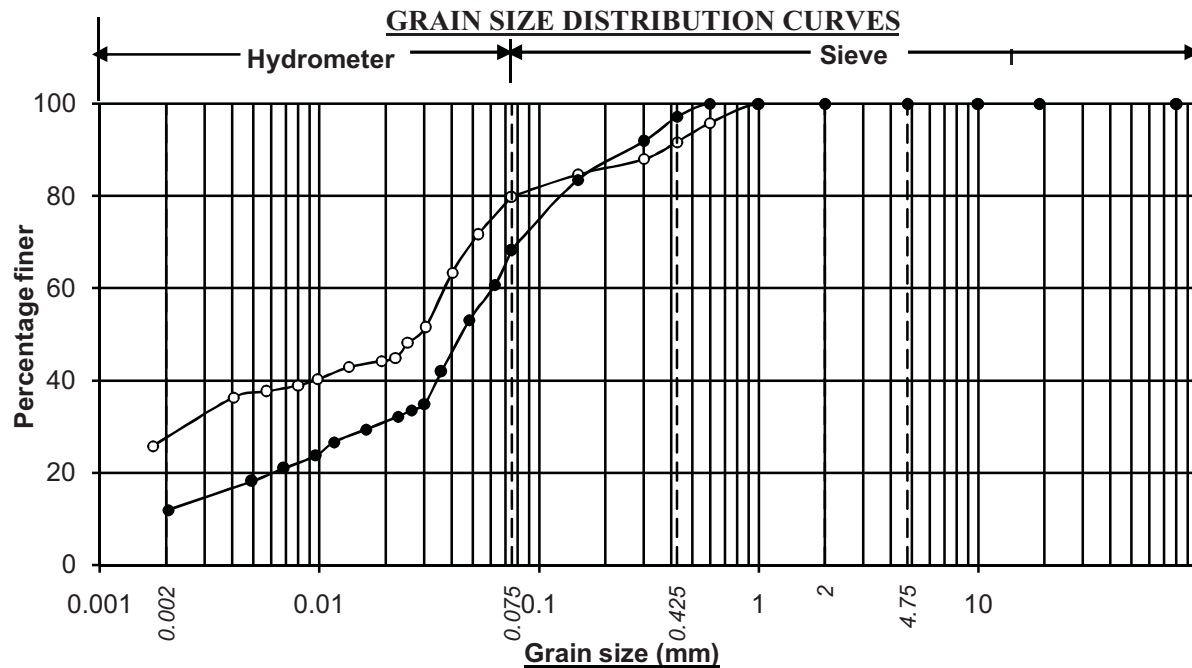
—○— BH-13,SPT-01, 1.00M

—●— BH-13,SPT-02, 3.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-13,SPT-01, 1.00M	31.5	46.0	10.6	11.9	0.0	22.5		0.0
BH-13,SPT-02, 3.00M		9.5	13.6	30.9	26.9	71.4		19.1

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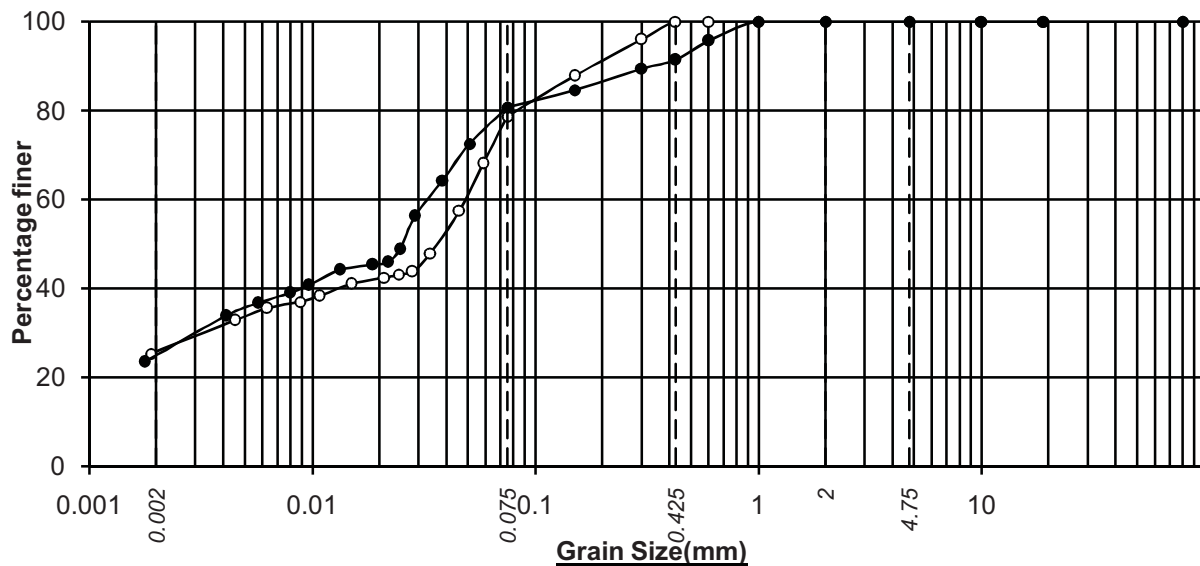
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—○— BH-13,UDS-02, 4.00M

—●— BH-13,SPT-04, 6.10M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-13,UDS-02, 4.00M	27.4	52.4	11.9	8.3	0.0	20.2		0.0
BH-13,SPT-04, 6.10M	11.7	56.6	28.9	2.8	0.0	31.7		0.0



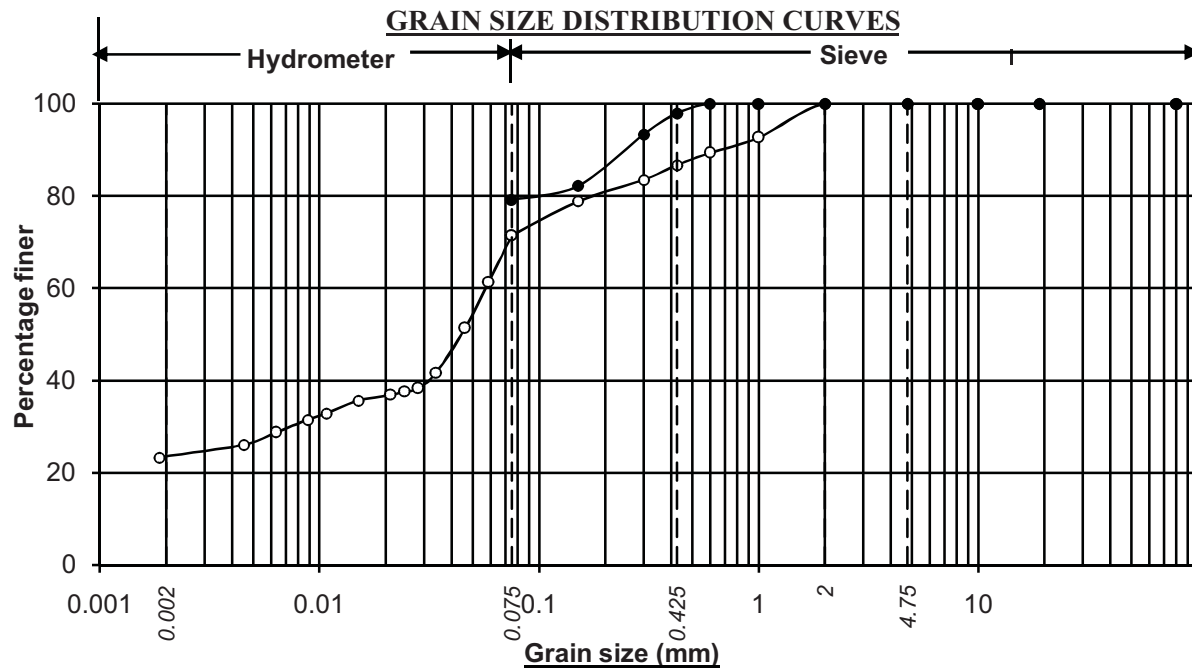
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—●— BH-14,UDS-01, 2.00M

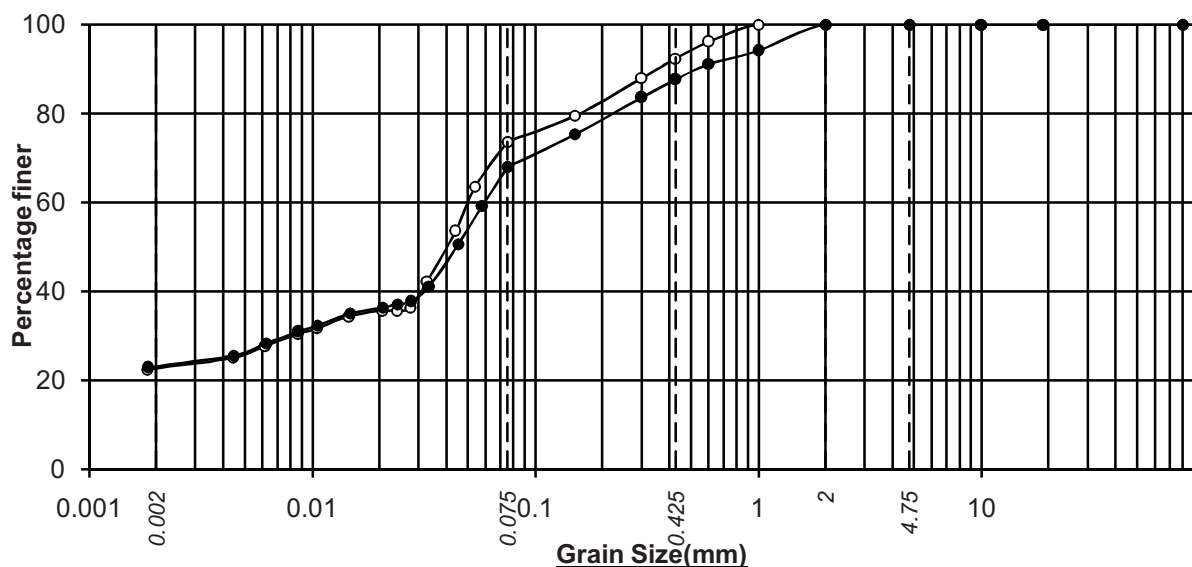
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-14,SPT-01, 1.00M	25.8	52.9	21.3	0.0	0.0	21.3		0.0
BH-14,UDS-01, 2.00M	25.1	55.7	10.6	8.6	0.0	19.2		0.0

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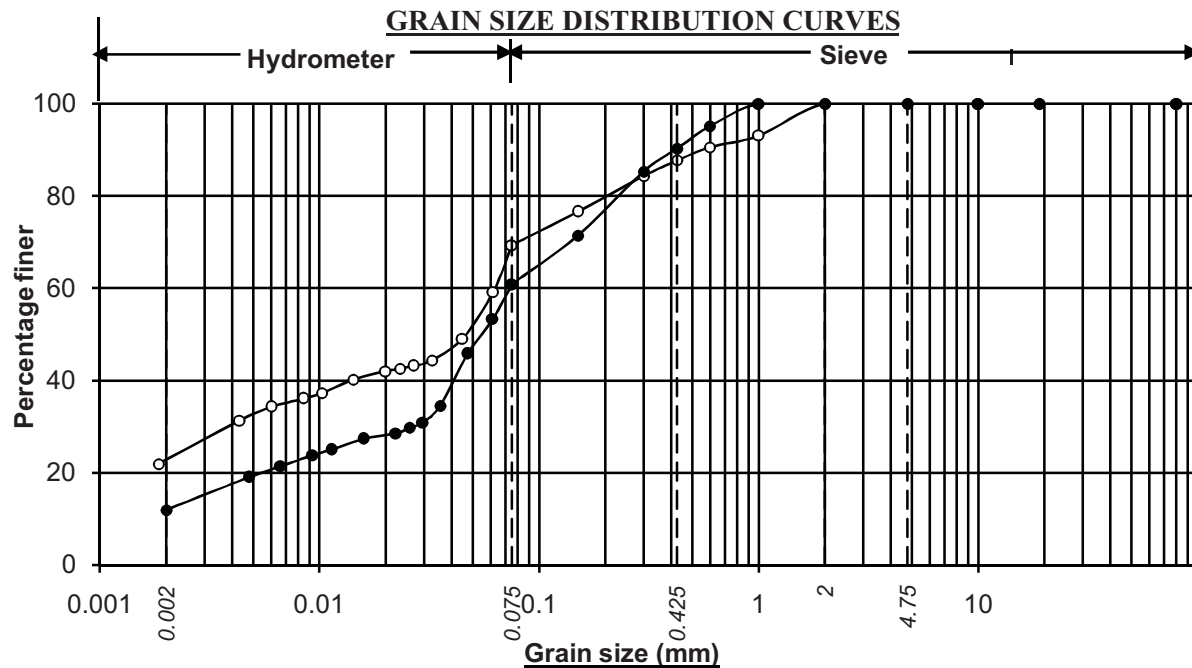
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Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-14,SPT-03, 5.00M	23.5	48.0	15.2	13.3	0.0	28.5		0.0
BH-14,SPT-04, 7.00M		79.2	18.7	2.1	0.0	20.8		0.0



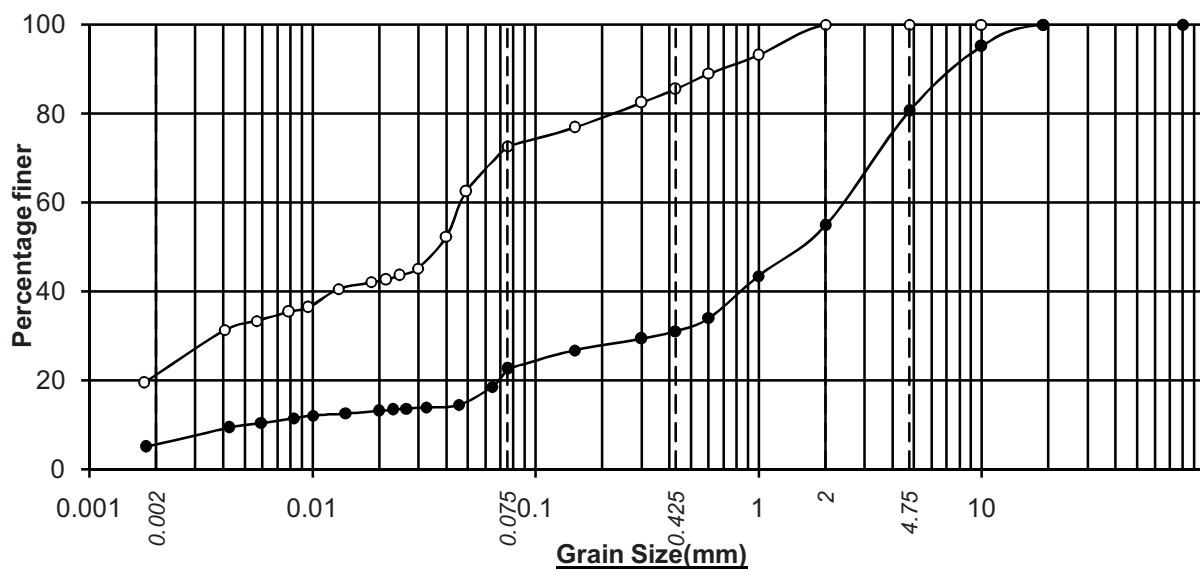
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-15,UDS-01, 2.00M	22.8	50.9	18.6	7.7	0.0	26.3		0.0
BH-16,SPT-02, 3.00M	23.2	44.8	19.7	12.3	0.0	32.0		0.0



—○— BH-16,UDS-02, 4.00M

—●— BH-16,SPT-06, 8.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-16,UDS-02, 4.00M	22.7	46.6	18.4	12.3	0.0	30.7		0.0
BH-16,SPT-06, 8.00M	11.8	49.0	29.5	9.7	0.0	39.2		0.0



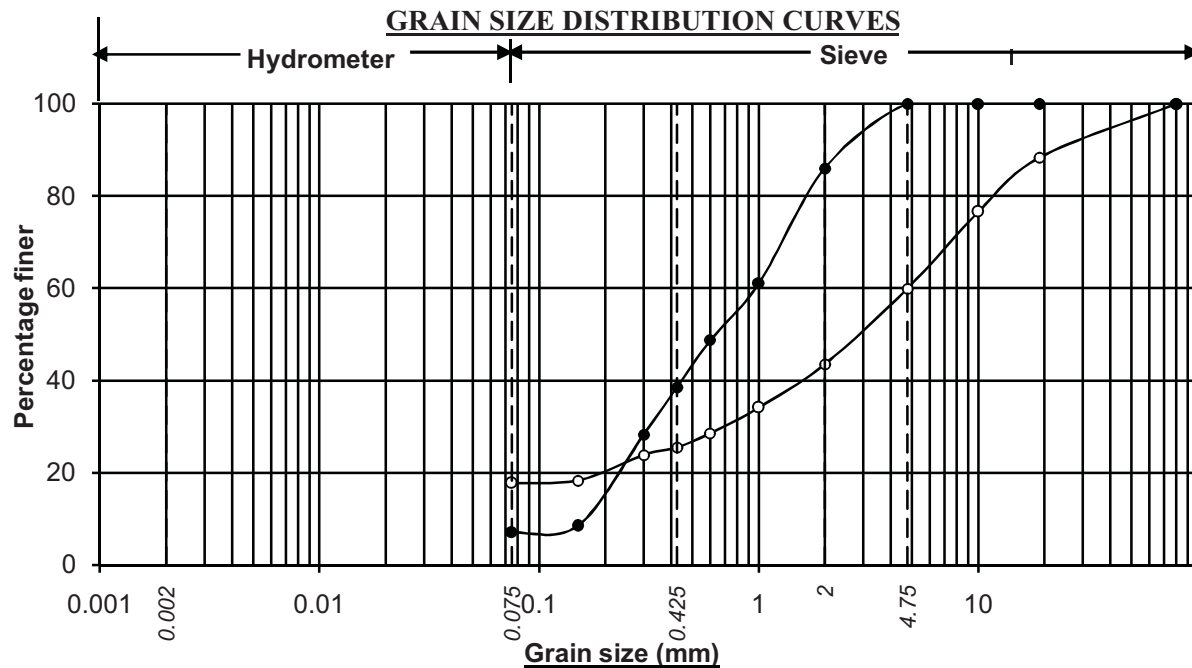
—○— BH-17,UDS-01, 2.10M

—●— BH-17,UDS-02, 4.20M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-17,UDS-01, 2.10M	21.3	51.3	12.9	14.5	0.0	27.4		0.0
BH-17,UDS-02, 4.20M	5.7	17.0	8.4	23.8	25.7	57.9	2.077	19.4

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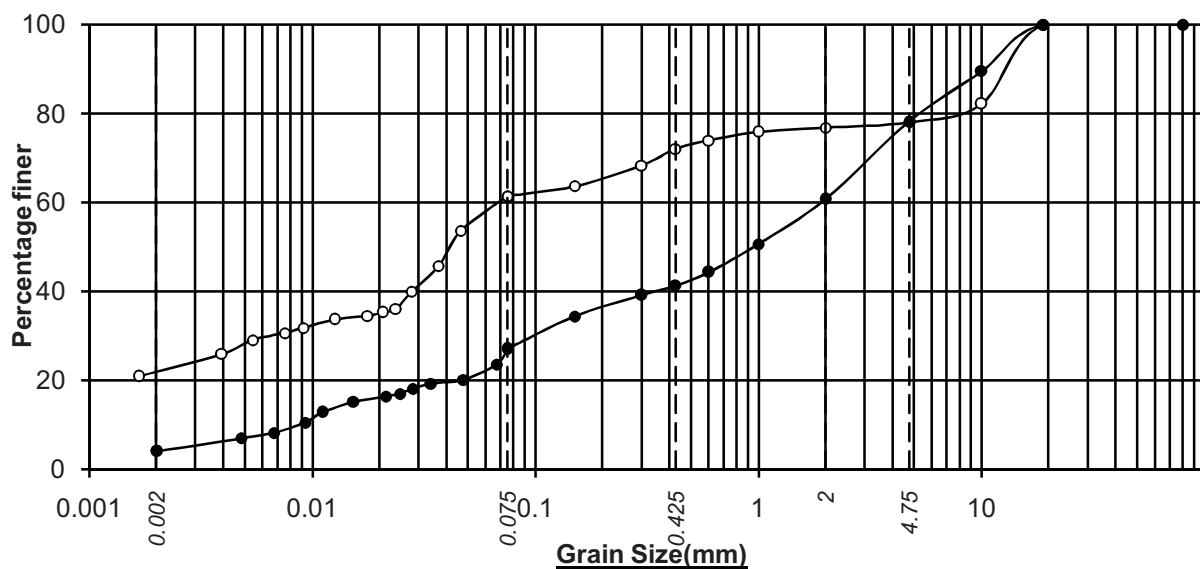
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—○— BH-17, SPT-03, 5.10M

—●— BH-17, SPT-05, 7.10M

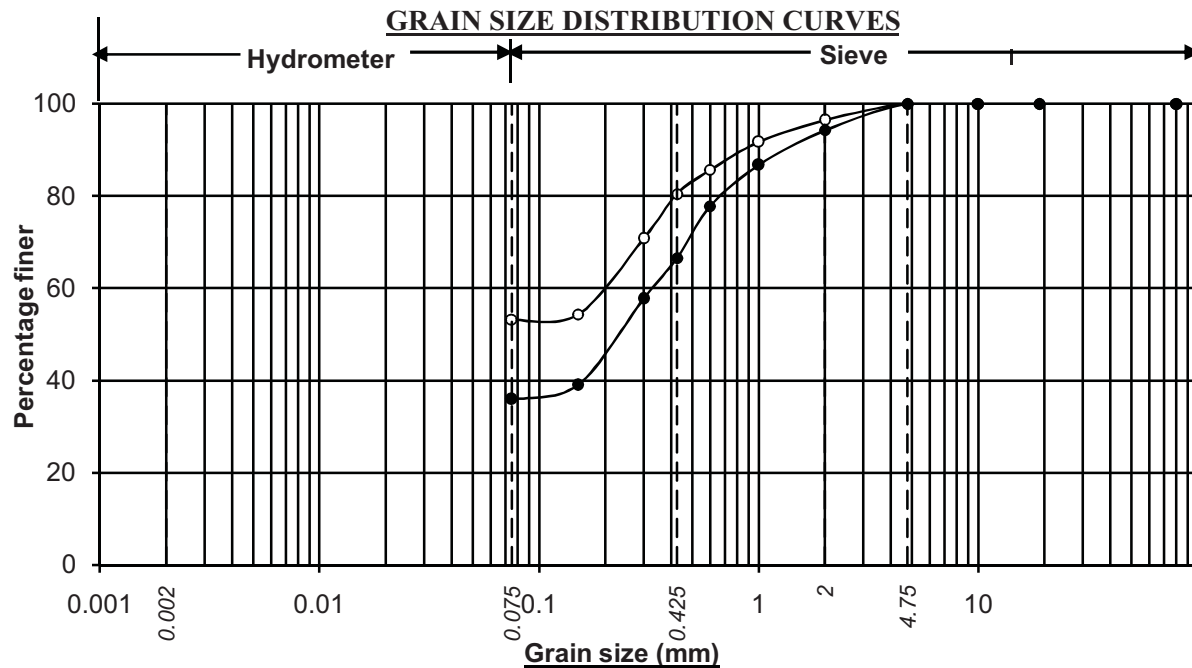
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-17, SPT-03, 5.10M		17.7	7.8	18.0	16.4	42.2		40.1
BH-17, SPT-05, 7.10M		7.1	31.4	47.4	14.1	92.9		0.0



—○— BH-18, UDS-01, 2.00M

—●— BH-18, SPT-02, 3.00M

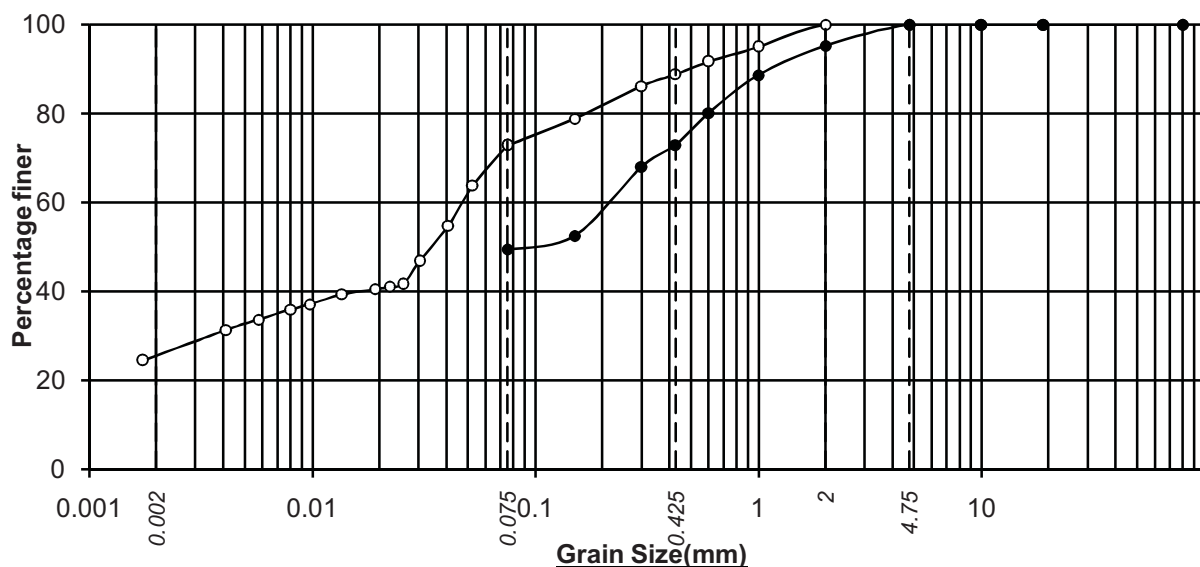
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-18, UDS-01, 2.00M	22.0	39.4	10.6	4.8	1.2	16.6		22.0
BH-18, SPT-02, 3.00M	4.1	23.0	14.3	19.4	17.5	51.2		21.7



—○— BH-18,SPT-03, 4.10M

—●— BH-18,SPT-07, 8.00M

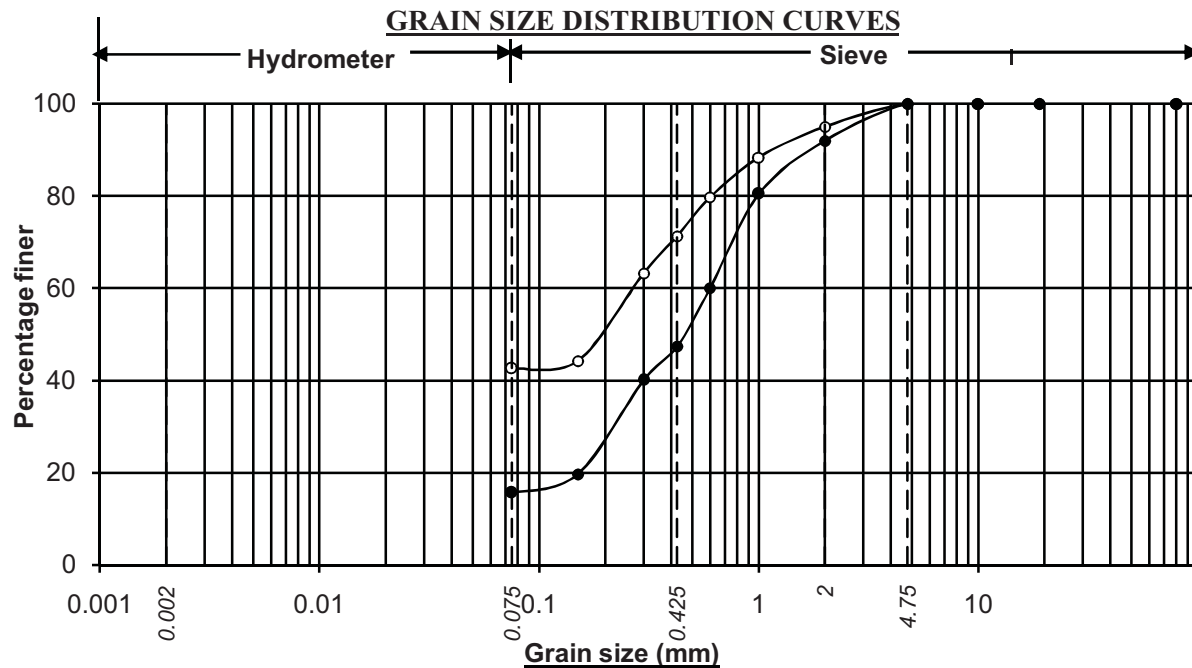
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-18,SPT-03, 4.10M		53.2	27.2	16.0	3.6	46.8		0.0
BH-18,SPT-07, 8.00M		35.9	30.7	27.7	5.7	64.1		0.0



—○— BH-19,UDS-01, 2.00M

—●— BH-19,SPT-02, 3.00M

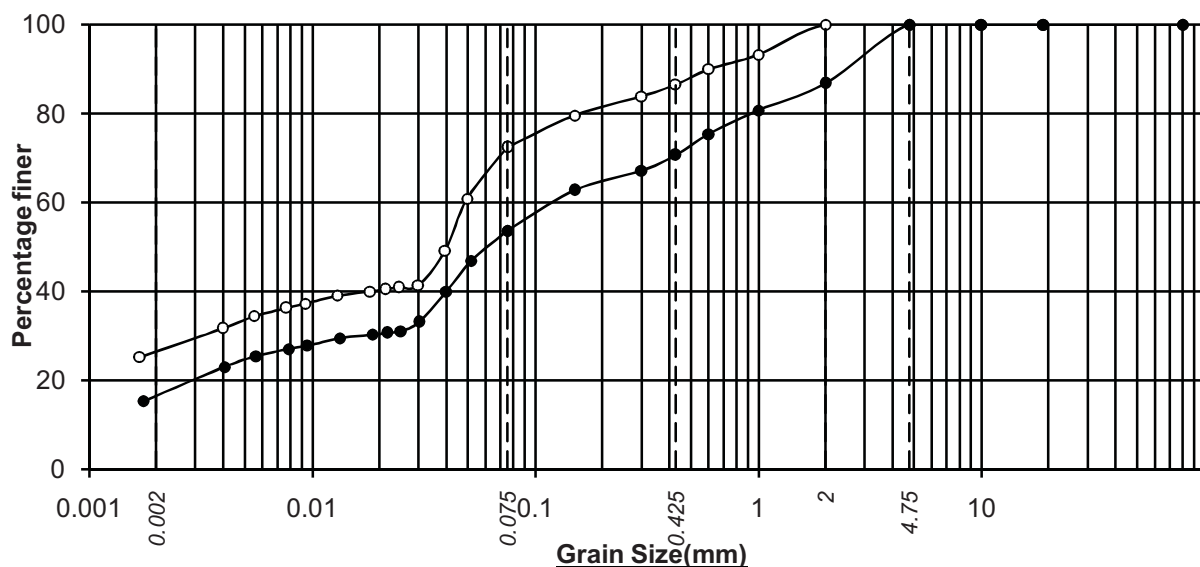
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-19,UDS-01, 2.00M	25.6	47.2	16.1	11.1	0.0	27.2		0.0
BH-19,SPT-02, 3.00M		49.5	23.4	22.3	4.8	50.5		0.0



—○— BH-19,SPT-03, 4.10M

—●— BH-19,SPT-06, 6.80M

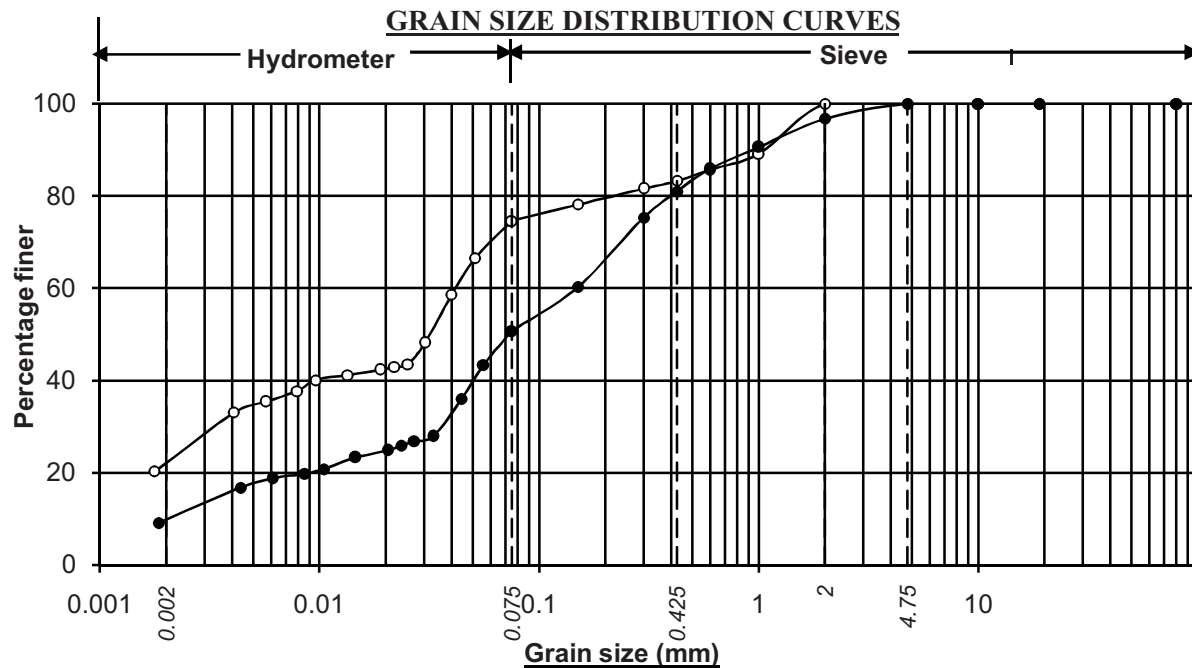
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-19,SPT-03, 4.10M		42.6	28.7	23.7	5.0	57.4		0.0
BH-19,SPT-06, 6.80M		15.7	31.6	44.6	8.1	84.3		0.0



—○— BH-20,UDS-01, 2.00M

—●— BH-20,UDS-02, 4.00M

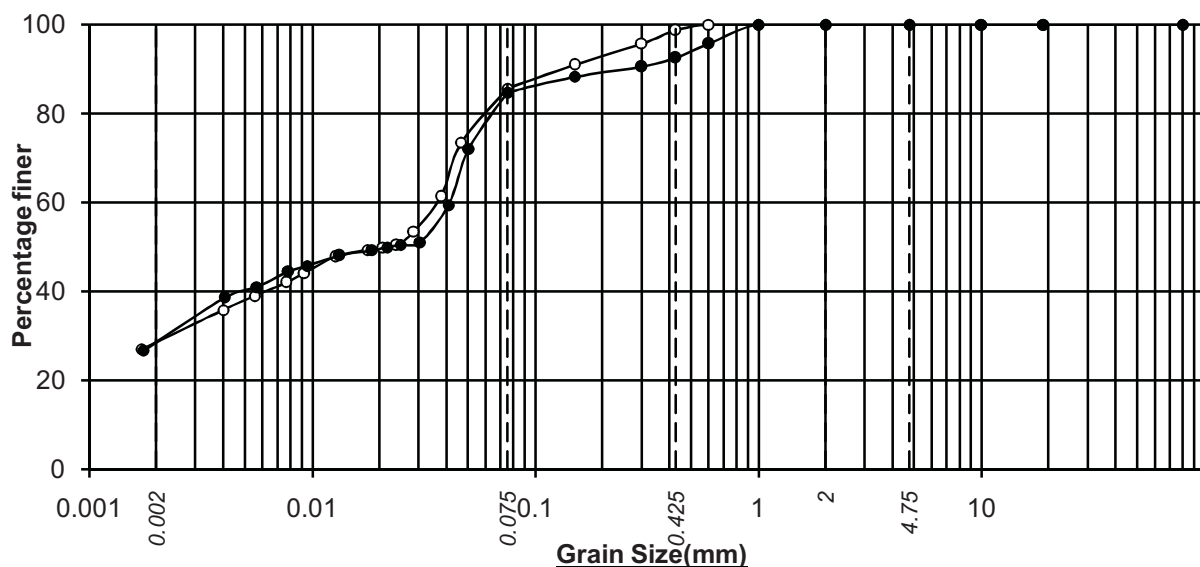
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-20,UDS-01, 2.00M	26.6	45.9	14.1	13.4	0.0	27.5		0.0
BH-20,UDS-02, 4.00M	16.6	37.1	17.0	16.1	13.2	46.3		0.0



—○— BH-20, SPT-03, 5.00M

—●— BH-20, SPT-06, 8.00M

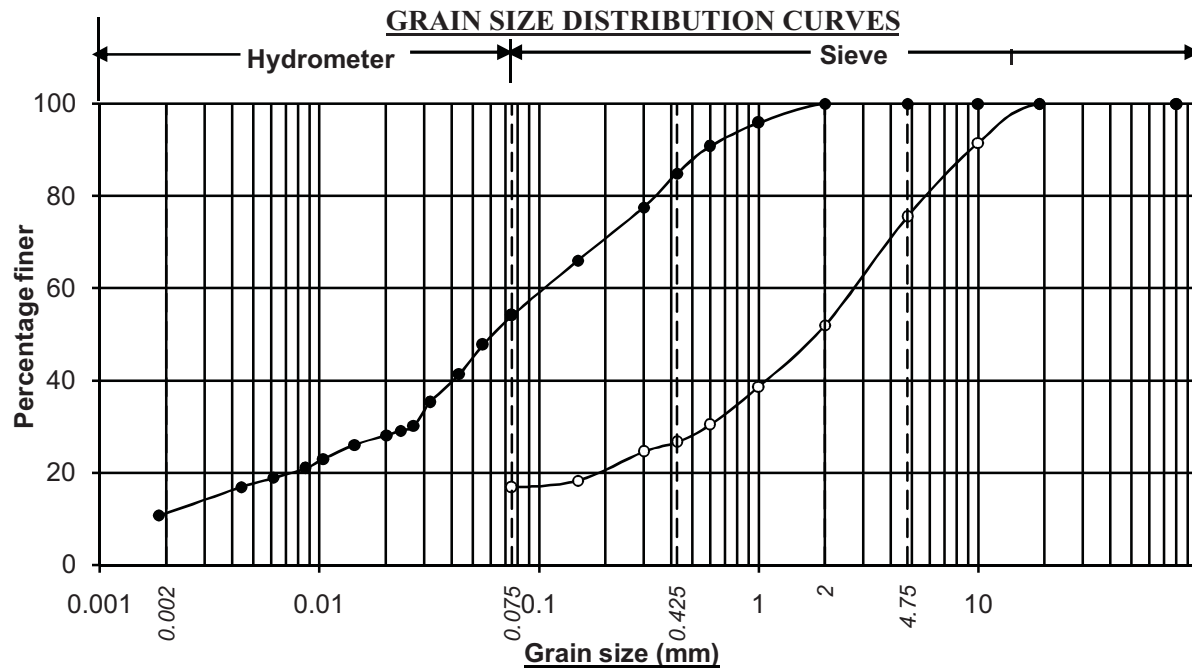
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-20, SPT-03, 5.00M	22.1	52.4	8.8	16.7	0.0	25.5		0.0
BH-20, SPT-06, 8.00M	9.8	41.0	30.1	15.8	3.3	49.2		0.0



—○— BH-21, UDS-01, 2.00M

—●— BH-21, UDS-02, 4.00M

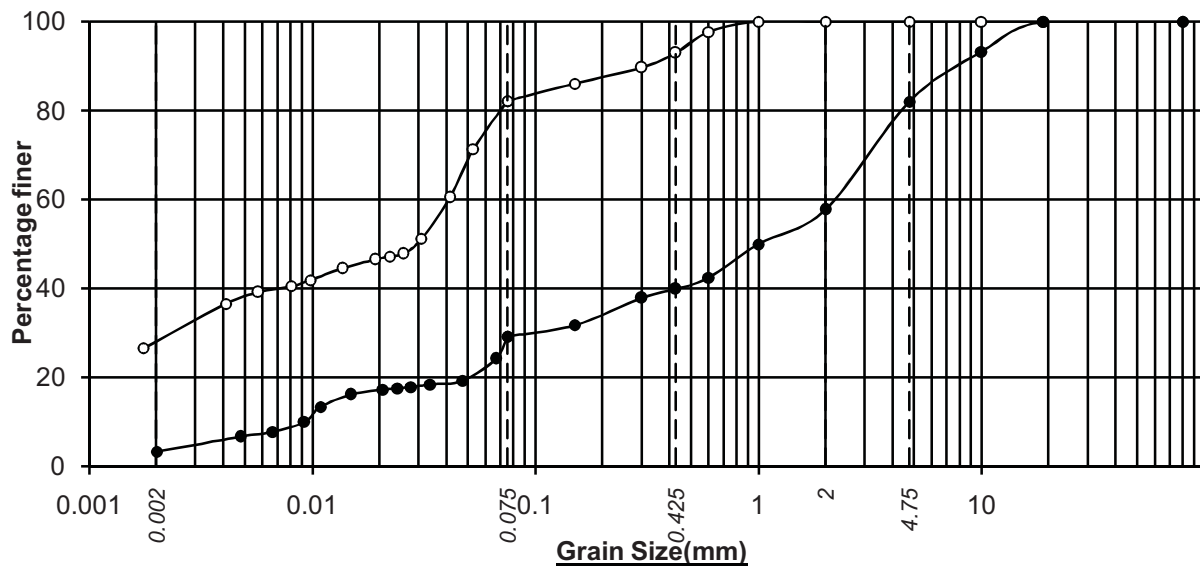
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-21, UDS-01, 2.00M	28.6	57.0	13.1	1.3	0.0	14.4		0.0
BH-21, UDS-02, 4.00M	28.6	56.1	7.9	7.4	0.0	15.3		0.0



—○— BH-21, SPT-03, 5.00M

—●— BH-21, SPT-05, 7.00M

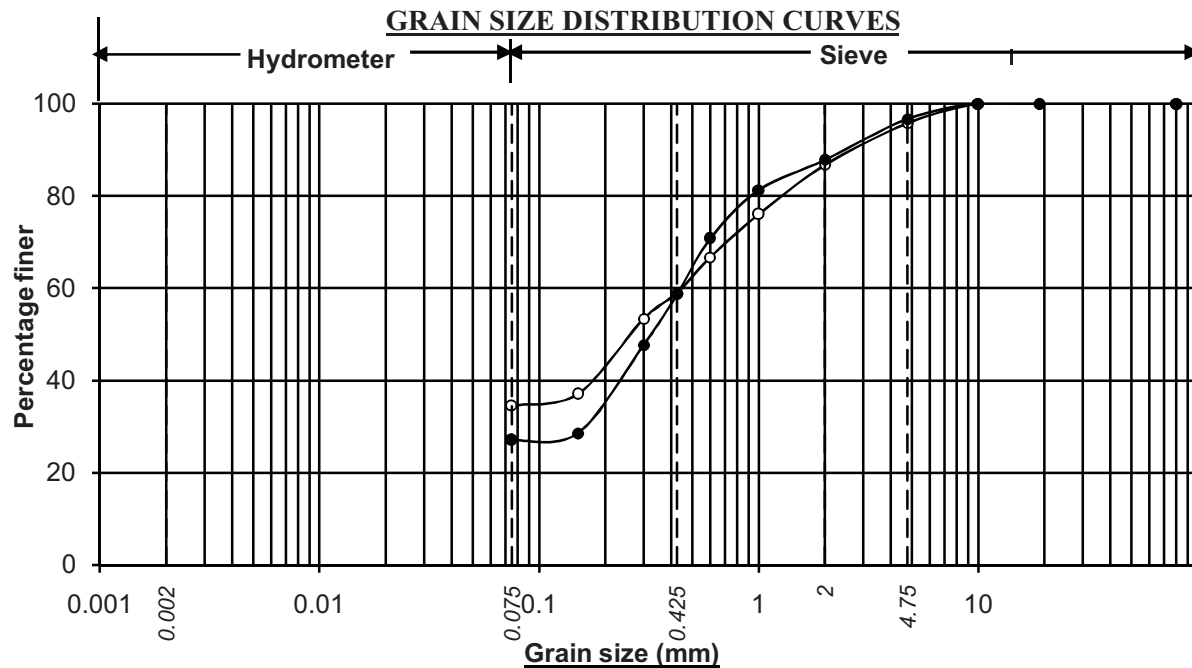
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-21, SPT-03, 5.00M		16.8	9.9	25.3	23.5	58.7		24.5
BH-21, SPT-05, 7.00M	11.2	42.9	30.8	15.1	0.0	45.9		0.0



—○— BH-22, UDS-01, 2.00M

—●— BH-22, SPT-03, 4.10M

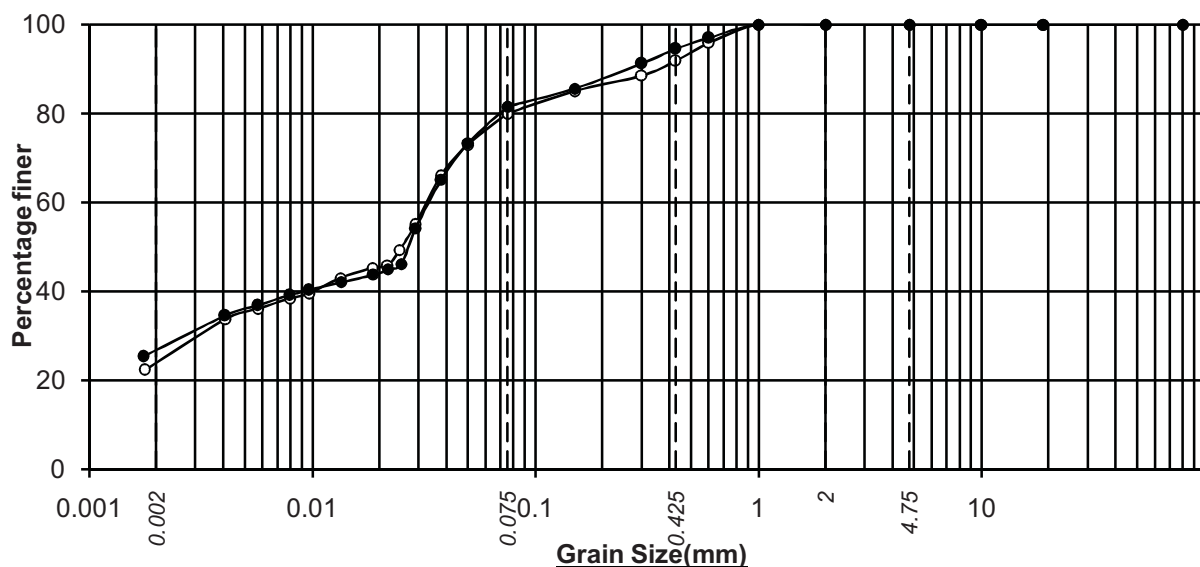
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-22, UDS-01, 2.00M	28.1	54.0	10.9	7.0	0.0	17.9		0.0
BH-22, SPT-03, 4.10M	3.3	25.9	10.7	17.8	24.3	52.8		18.0



—○— BH-22,SPT-04, 5.00M

—●— BH-22,SPT-07, 8.00M

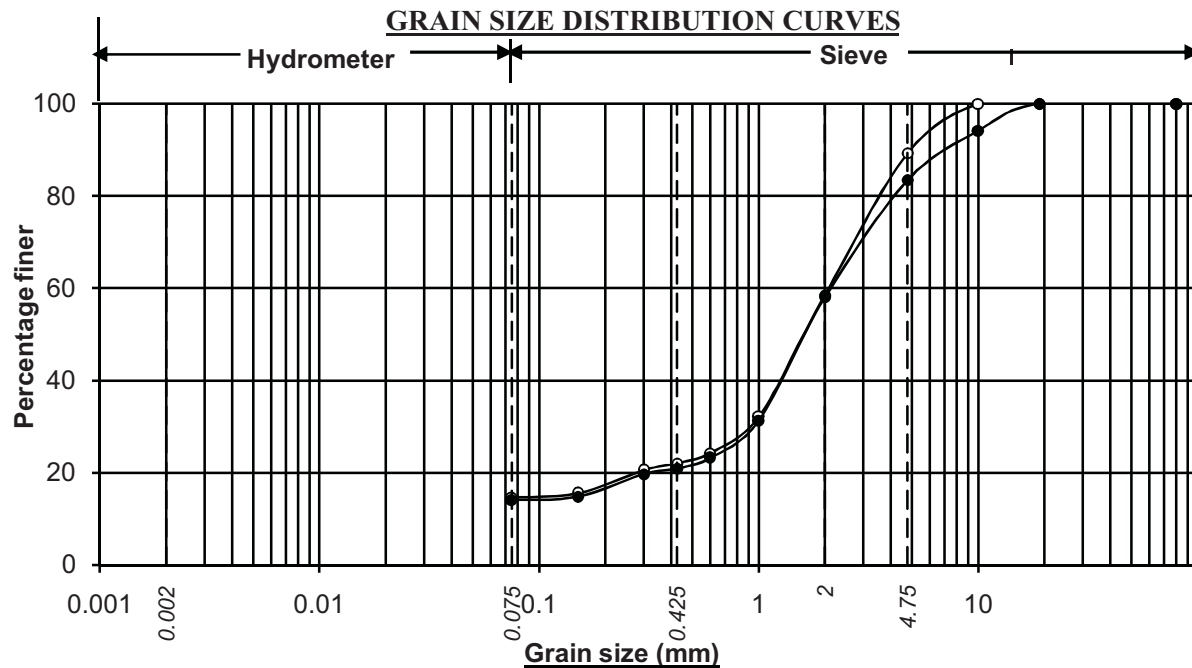
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-22,SPT-04, 5.00M		34.6	24.3	27.8	9.0	61.1		4.3
BH-22,SPT-07, 8.00M		27.0	31.8	29.1	8.8	69.7		3.3



—○— BH-23,UDS-01, 2.00M

—●— BH-23,SPT-02, 3.00M

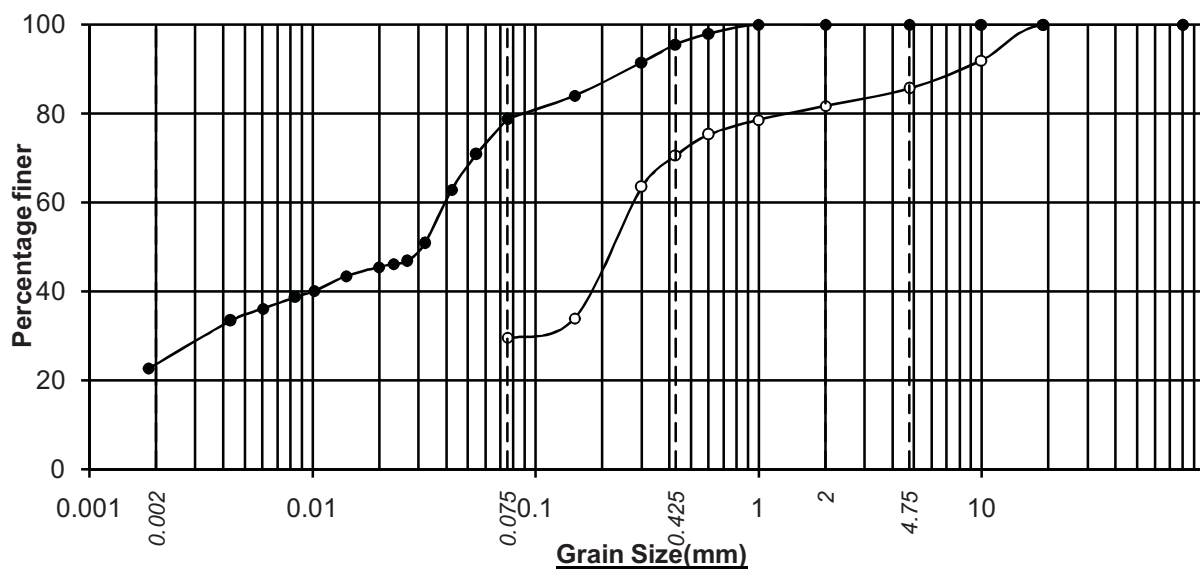
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-23,UDS-01, 2.00M	24.0	56.0	11.9	8.1	0.0	20.0		0.0
BH-23,SPT-02, 3.00M	26.8	54.7	13.1	5.4	0.0	18.5		0.0



—○— BH-23,SPT-04, 5.10M

—●— BH-23,SPT-05, 6.10M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-23,SPT-04, 5.10M		14.7	7.3	36.5	30.8	74.6		10.7
BH-23,SPT-05, 6.10M		14.1	6.8	37.1	25.4	69.3		16.6



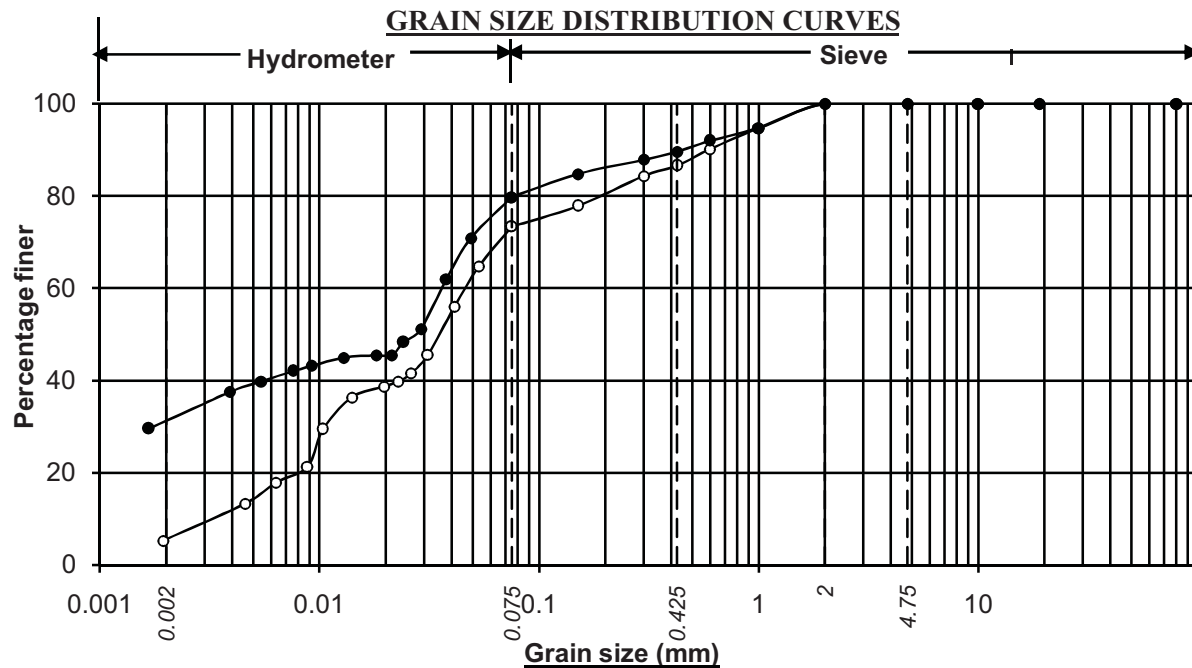
—○— BH-23,SPT-06, 7.10M

—●— BH-24,UDS-01, 2.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-23,SPT-06, 7.10M		29.6	40.9	11.1	4.0	56.0		14.4
BH-24,UDS-01, 2.00M	23.7	55.1	16.7	4.5	0.0	21.2		0.0

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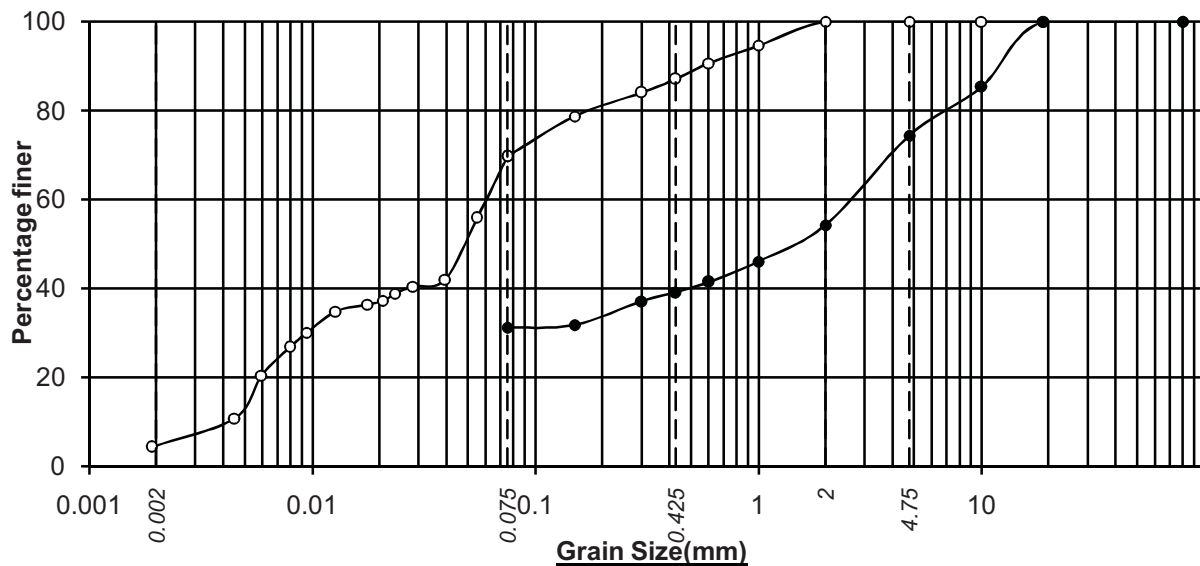
Job No.
4287



—○— BH-24,UDS-02, 4.00M

—●— BH-24,SPT-03, 5.00M

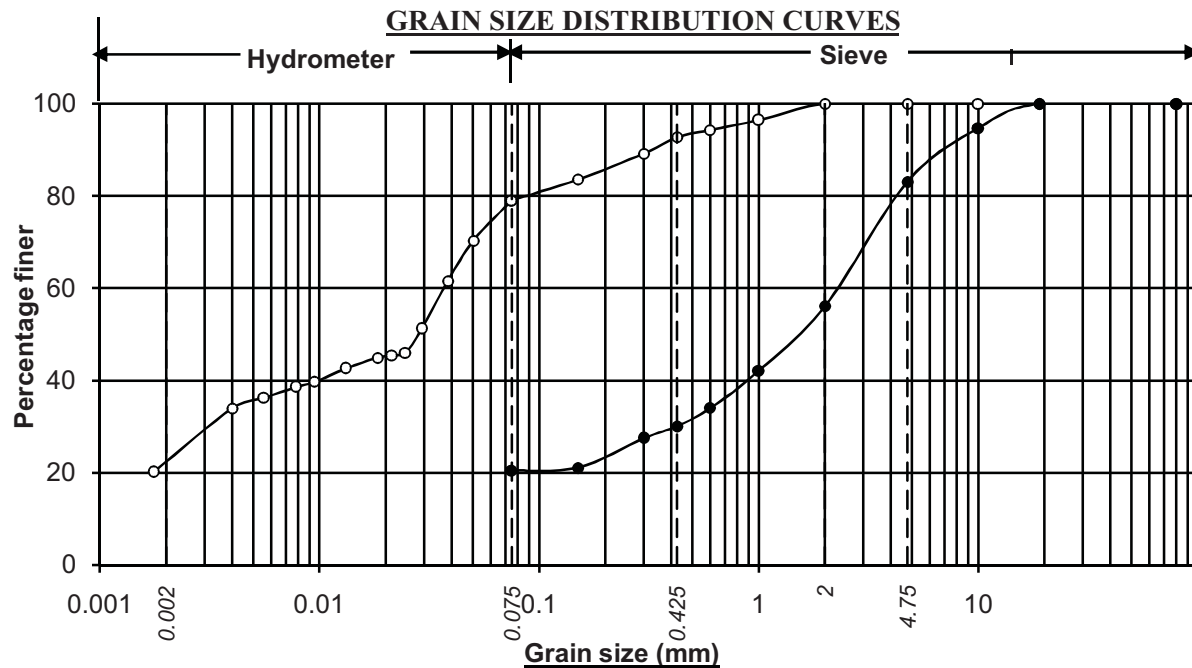
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-24,UDS-02, 4.00M	5.5	68.0	13.1	13.4	0.0	26.5		0.0
BH-24,SPT-03, 5.00M	31.2	48.5	9.9	10.4	0.0	20.3		0.0



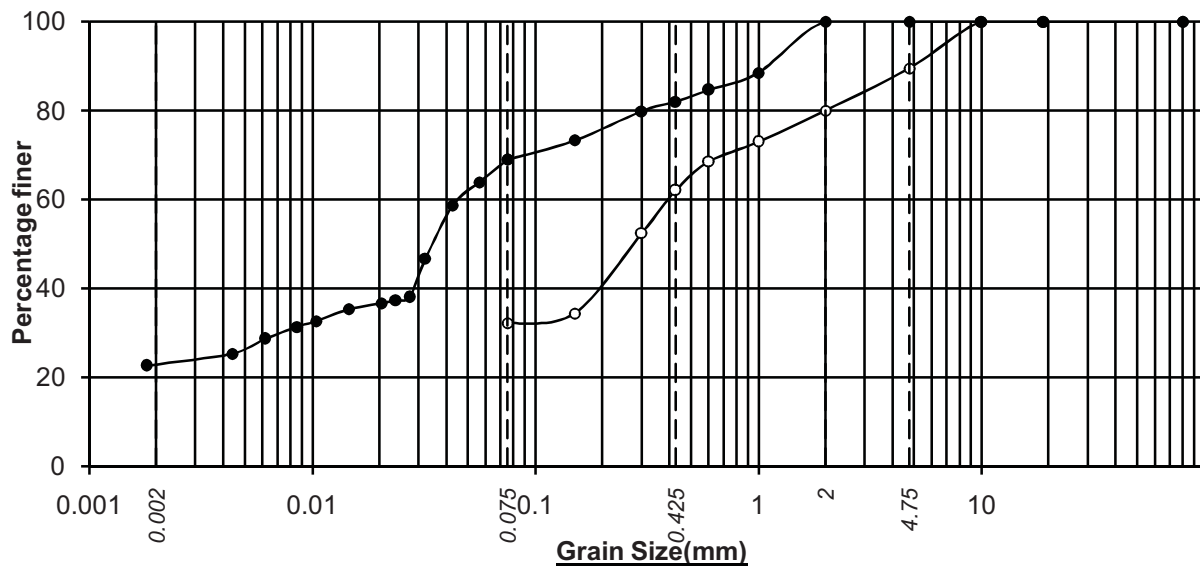
—○— BH-24,UDS-03, 6.00M

—●— BH-24,SPT-04, 7.00M

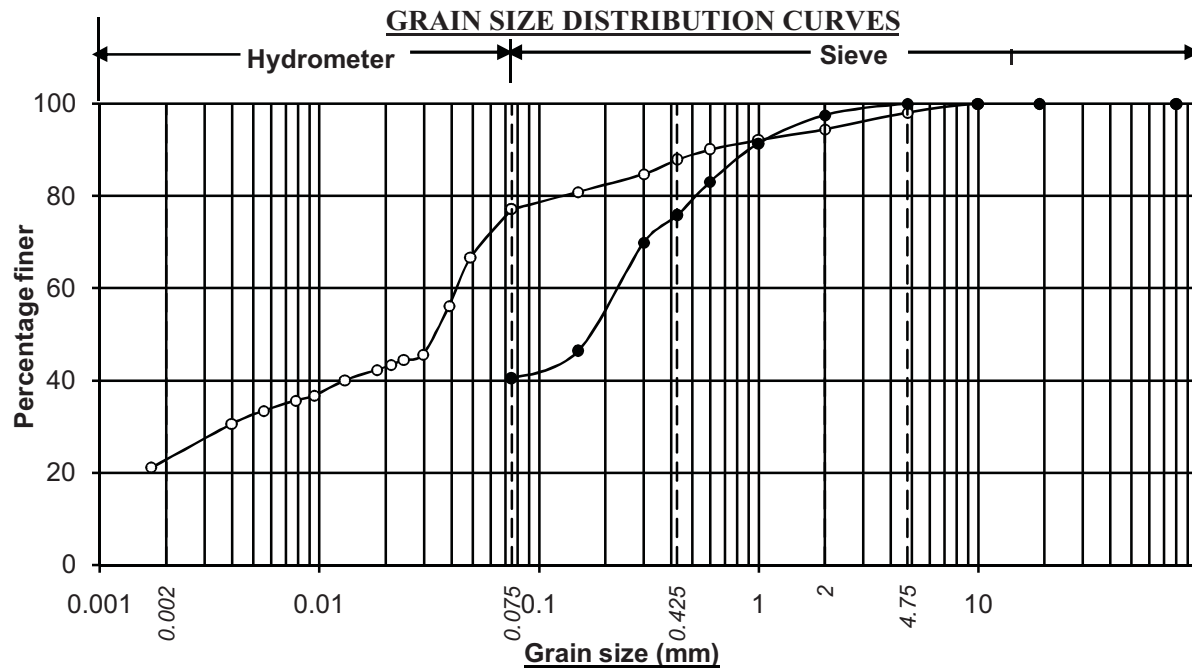
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-24,UDS-03, 6.00M	4.7	65.0	17.4	12.9	0.0	30.3		0.0
BH-24,SPT-04, 7.00M		31.2	8.0	15.1	20.1	43.2		25.6



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-25,UDS-01, 2.15M	22.3	56.7	13.7	7.3	0.0	21.0		0.0
BH-25,SPT-03, 5.00M		20.4	9.7	26.0	27.0	62.7		16.9



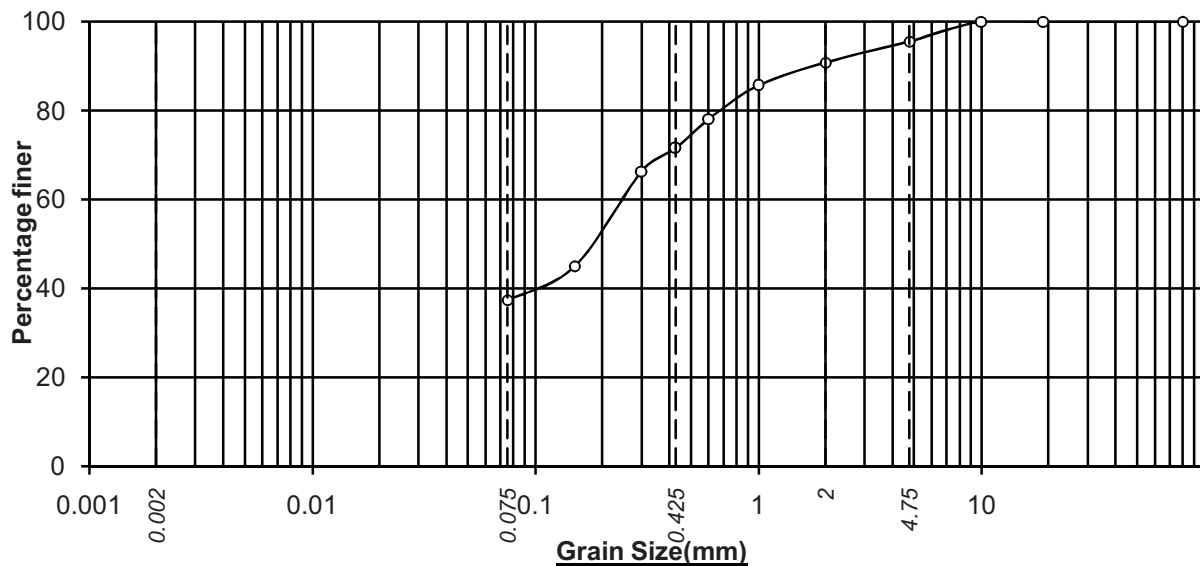
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-25,SPT-05, 7.00M		32.2	29.9	17.9	9.5	57.3		10.5
BH-26,SPT-01, 1.00M	23.0	46.0	13.0	18.0	0.0	31.0		0.0



—○— BH-26,UDS-01, 2.00M

—●— BH-26,SPT-04, 5.50M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-26,UDS-01, 2.00M	22.8	54.3	10.7	6.6	3.6	20.9		2.0
BH-26,SPT-04, 5.50M		40.4	35.3	21.8	2.5	59.6		0.0



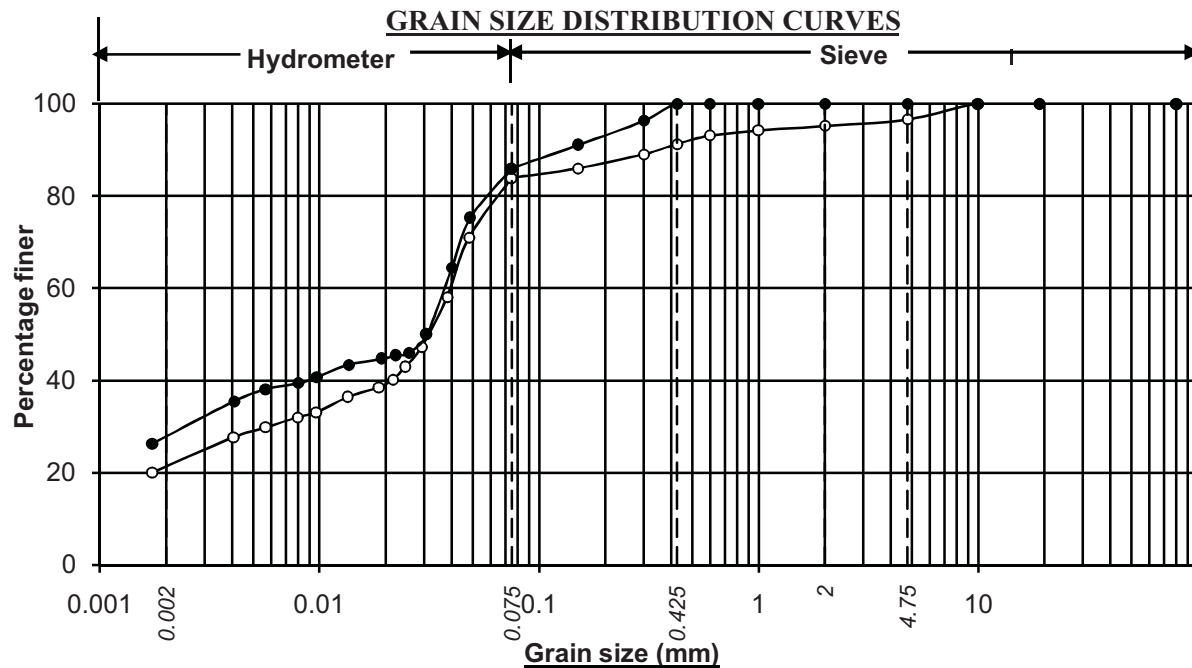
—○— BH-26,SPT-07, 7.60M

—●— #N/A

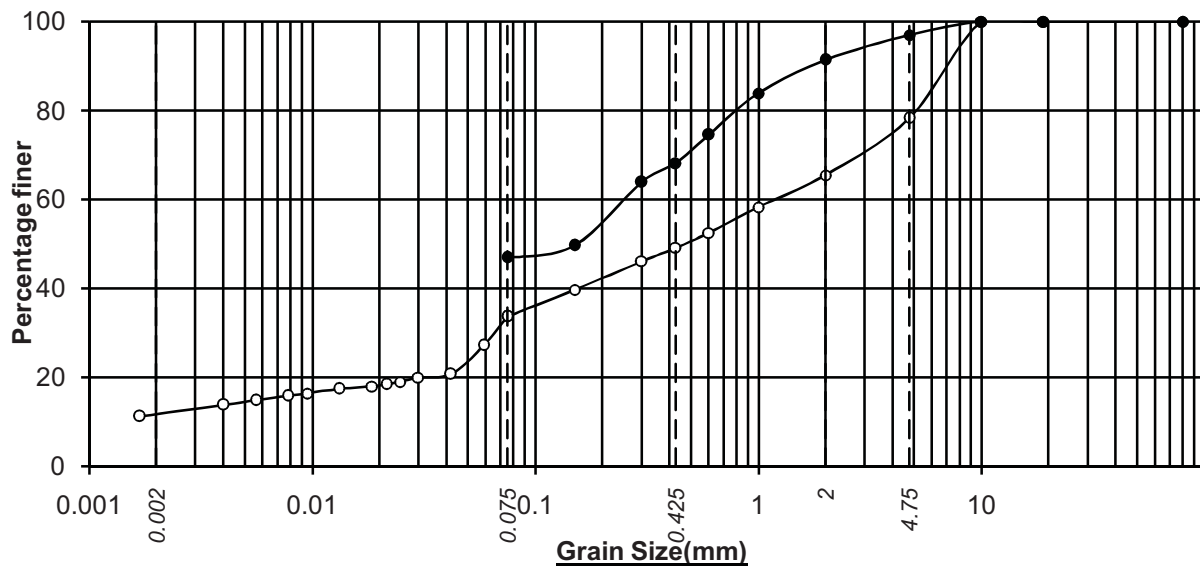
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
BH-26,SPT-07, 7.60M		37.4	34.2	19.2	4.8	58.2		4.4

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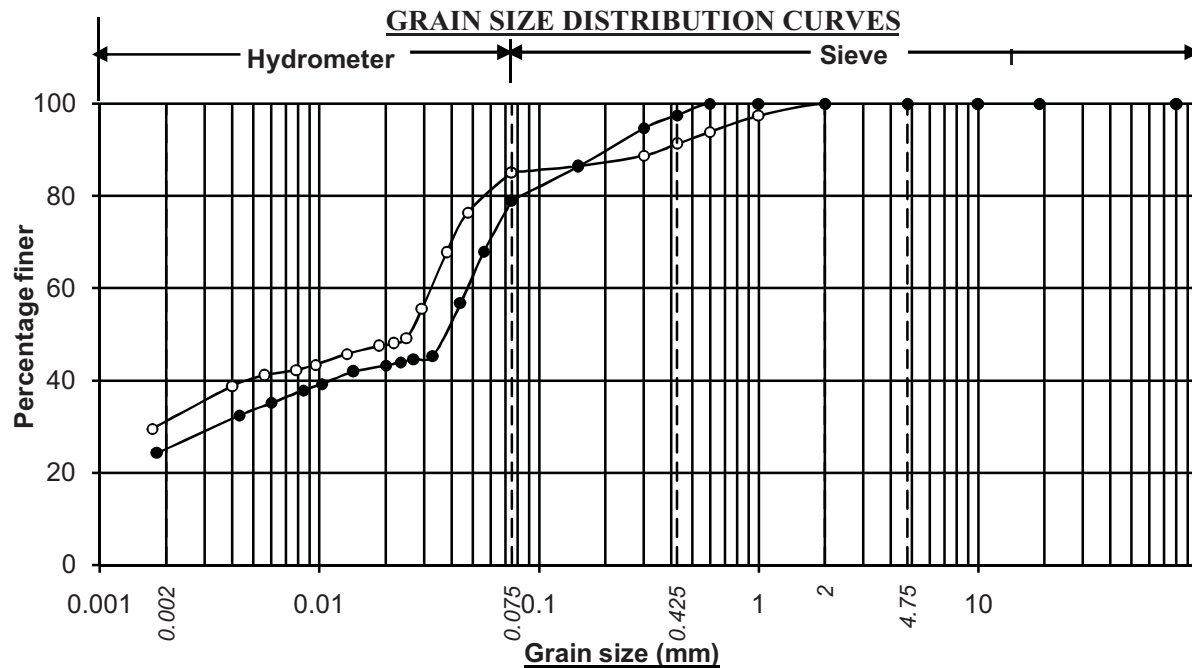
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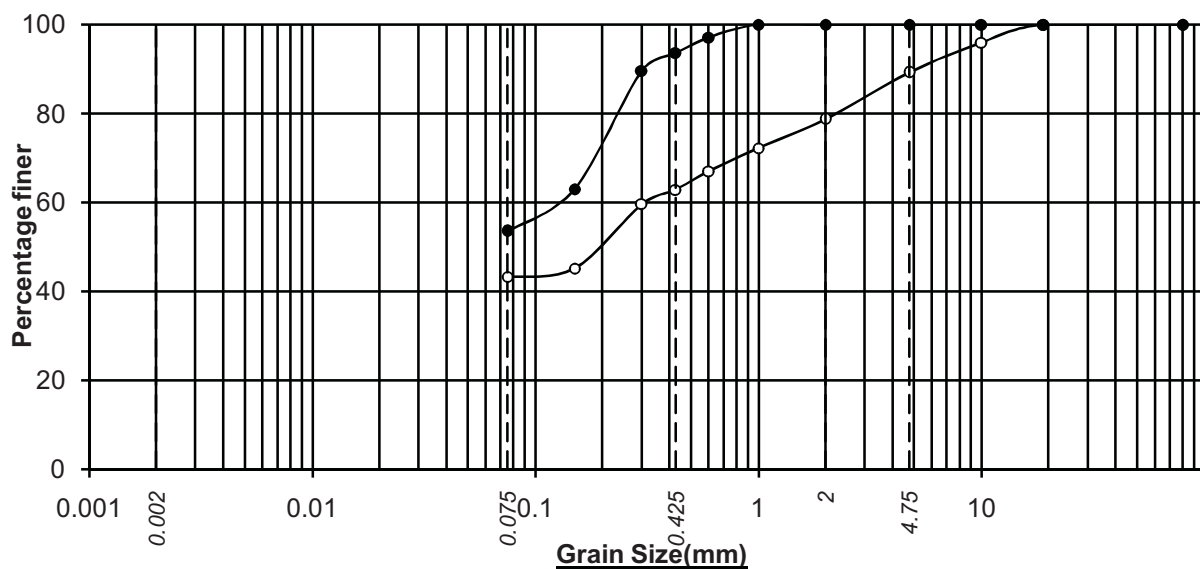
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-01,UDS-01, 2.00M	21.3	62.6	7.3	4.0	1.4	12.7		3.4
IBH-01,SPT-02, 3.00M	27.8	58.2	14.0	0.0	0.0	14.0		0.0



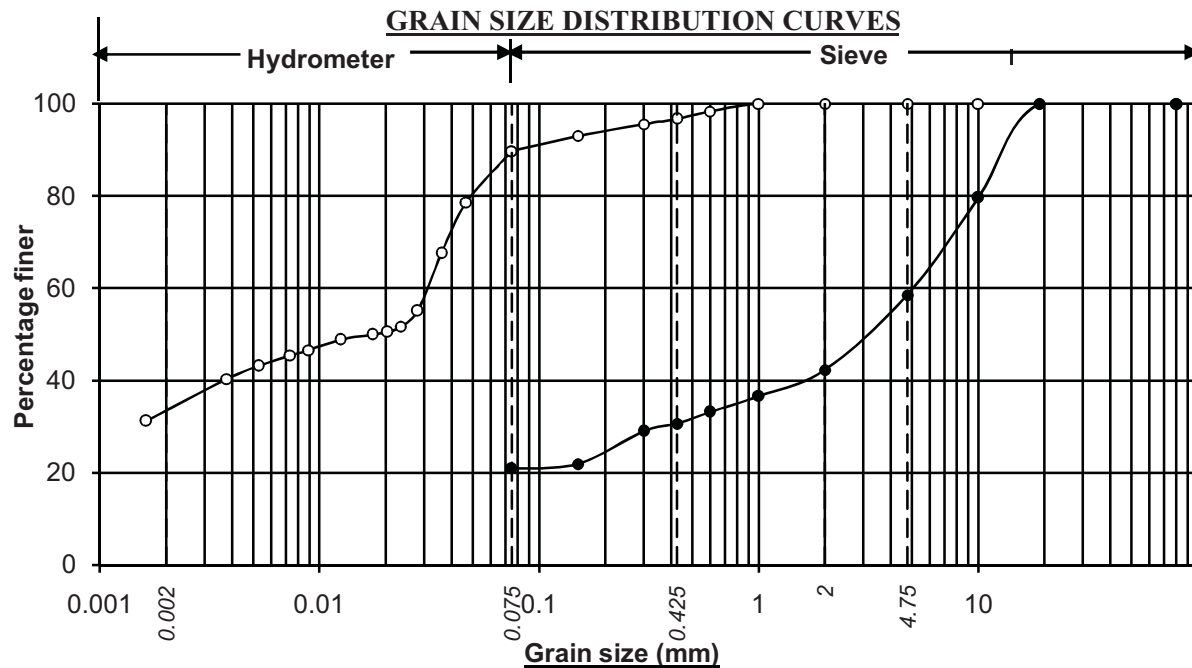
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-01,SPT-06, 7.00M	11.8	21.9	15.4	16.3	12.9	44.6		21.7
IBH-01,SPT-07, 8.00M		47.0	21.1	23.2	5.6	49.9		3.1



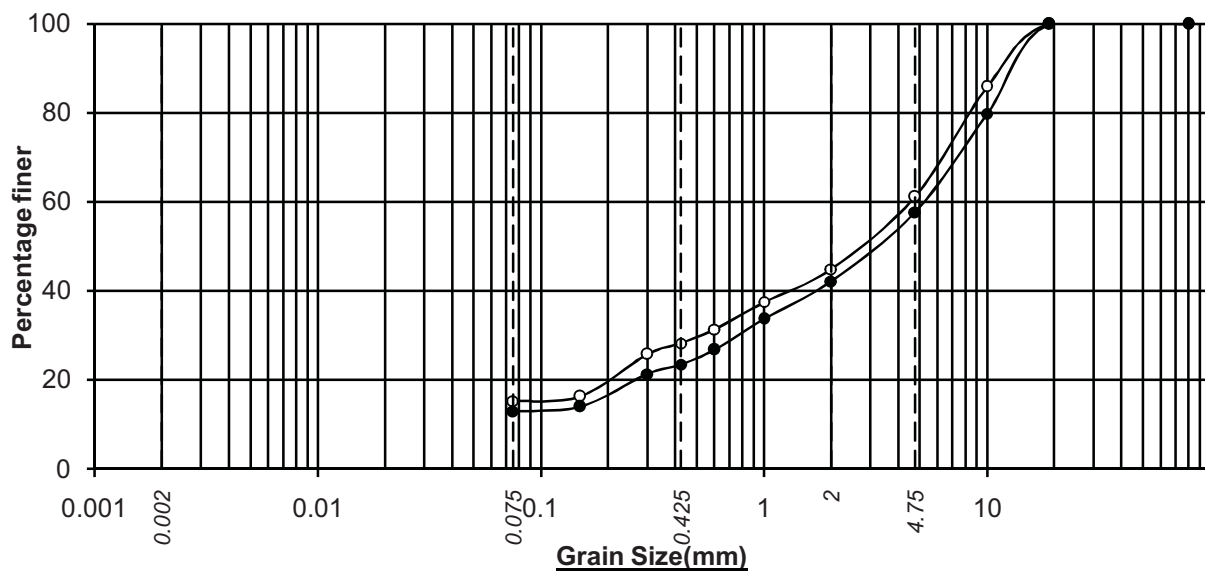
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-02,UDS-01, 2.00M	31.1	54.1	6.1	8.7	0.0	14.8		0.0
IBH-02,SPT-03, 4.12M	25.2	53.8	18.5	2.5	0.0	21.0		0.0



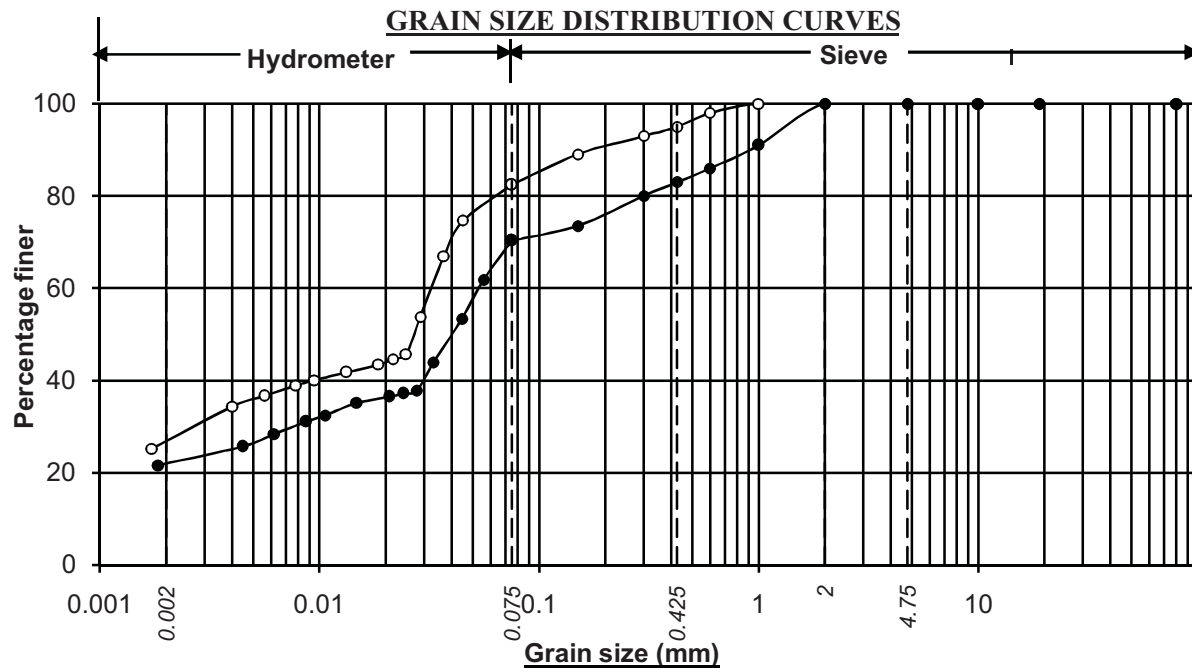
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-02,SPT-05, 6.00M		43.3	19.5	15.9	10.5	45.9		10.8
IBH-02,SPT-07, 8.00M		53.6	40.0	6.4	0.0	46.4		0.0



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-03,UDS-01, 2.00M	33.4	56.3	7.0	3.3	0.0	10.3		0.0
IBH-03,SPT-03, 4.10M		21.0	9.6	11.7	16.2	37.5		41.5



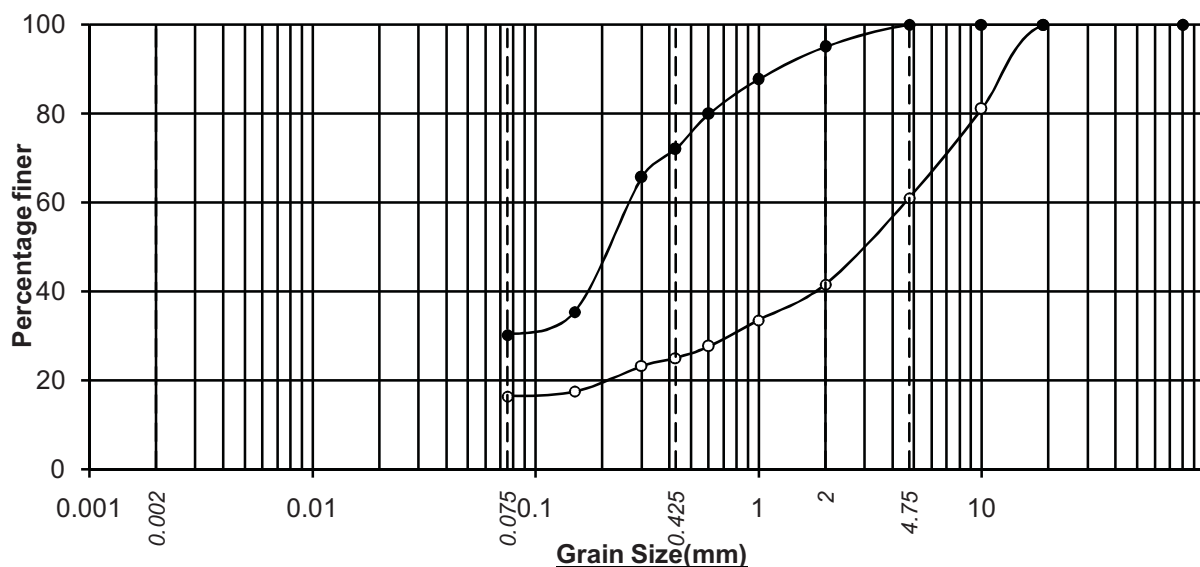
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-03,SPT-04, 5.00M		15.3	13.0	16.6	16.3	45.9		38.8
IBH-03,SPT-05, 5.80M		12.9	10.5	18.7	15.5	44.7		42.4



—○— IBH-04,SPT-01, 1.00M

—●— IBH-04,SPT-03, 4.10M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-04,SPT-01, 1.00M	26.7	55.7	12.6	5.0	0.0	17.6		0.0
IBH-04,SPT-03, 4.10M	22.0	48.3	12.7	17.0	0.0	29.7		0.0



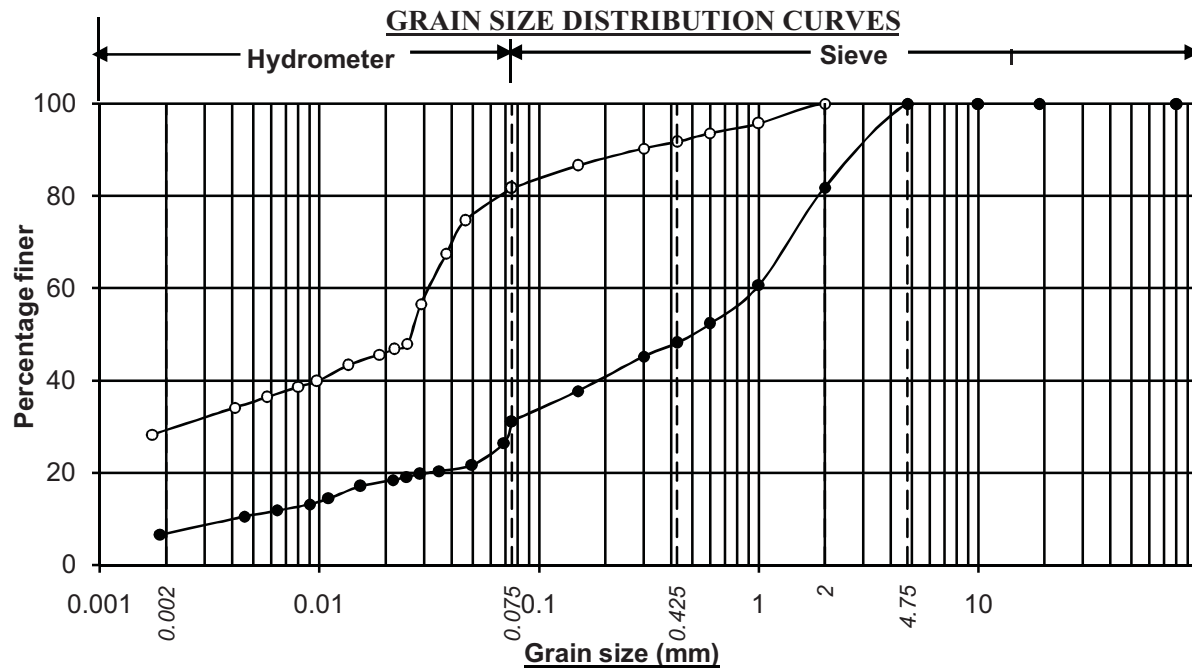
—○— IBH-04,SPT-04, 5.00M

—●— IBH-04,SPT-06, 7.00M

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-04,SPT-04, 5.00M		16.4	8.7	16.5	19.4	44.6		39.0
IBH-04,SPT-06, 7.00M		30.3	41.7	23.0	5.0	69.7		0.0

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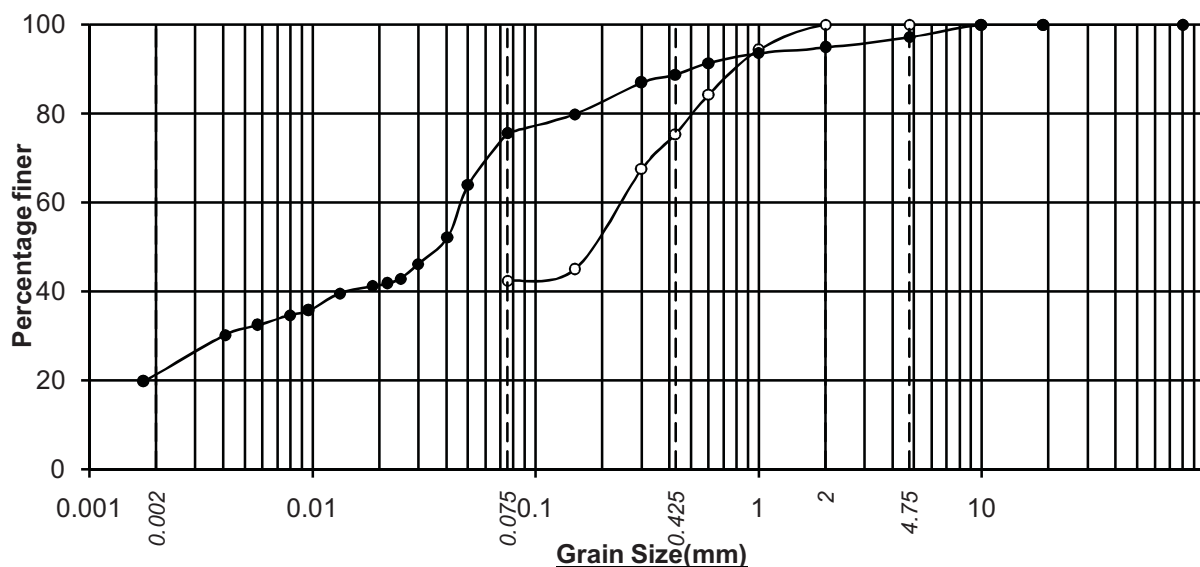
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—○— IBH-05,UDS-01, 2.00M

—●— IBH-05,SPT-04, 5.00M

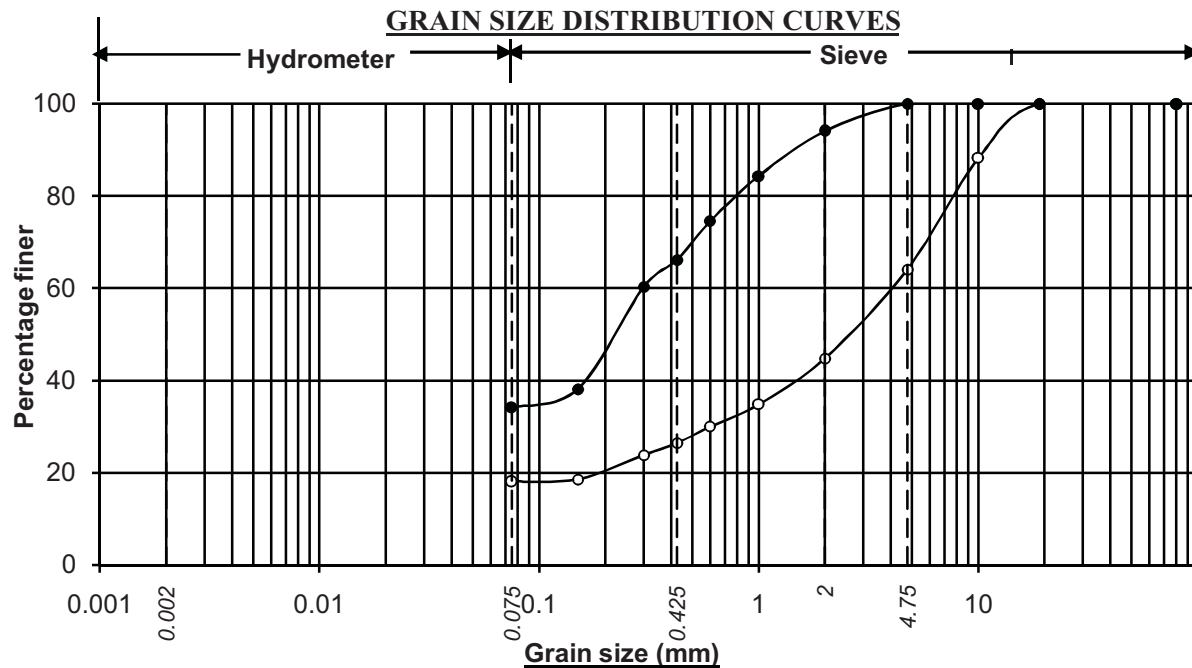
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-05,UDS-01, 2.00M	29.2	52.5	10.0	8.3	0.0	18.3		0.0
IBH-05,SPT-04, 5.00M	6.8	24.3	17.0	33.7	18.2	68.9		0.0



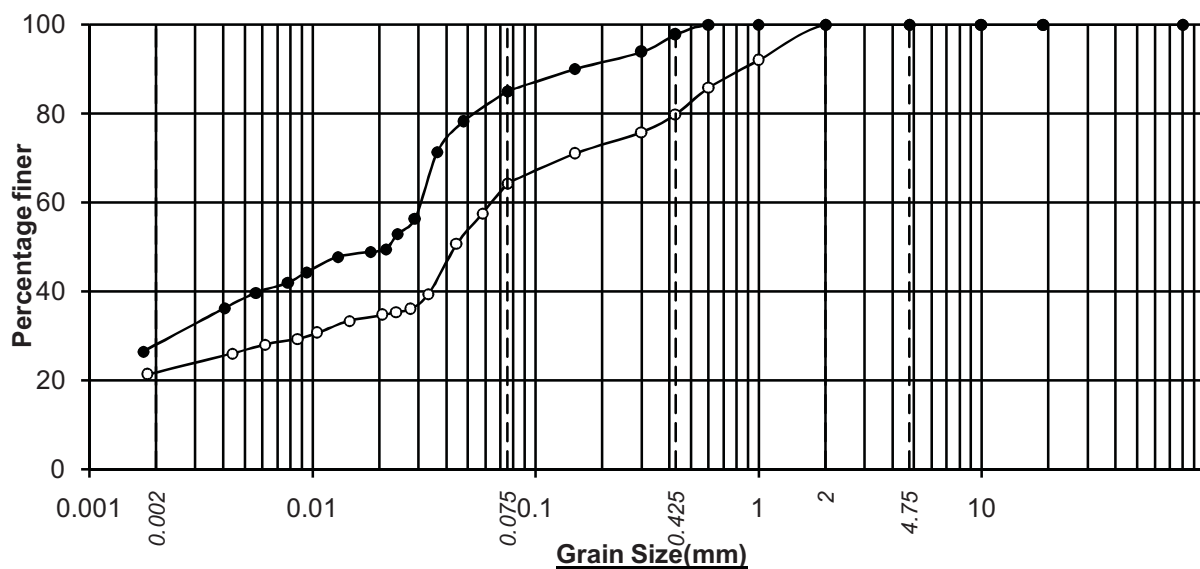
—○— IBH-05,SPT-05, 6.00M

—●— IBH-06,UDS-01, 2.00M

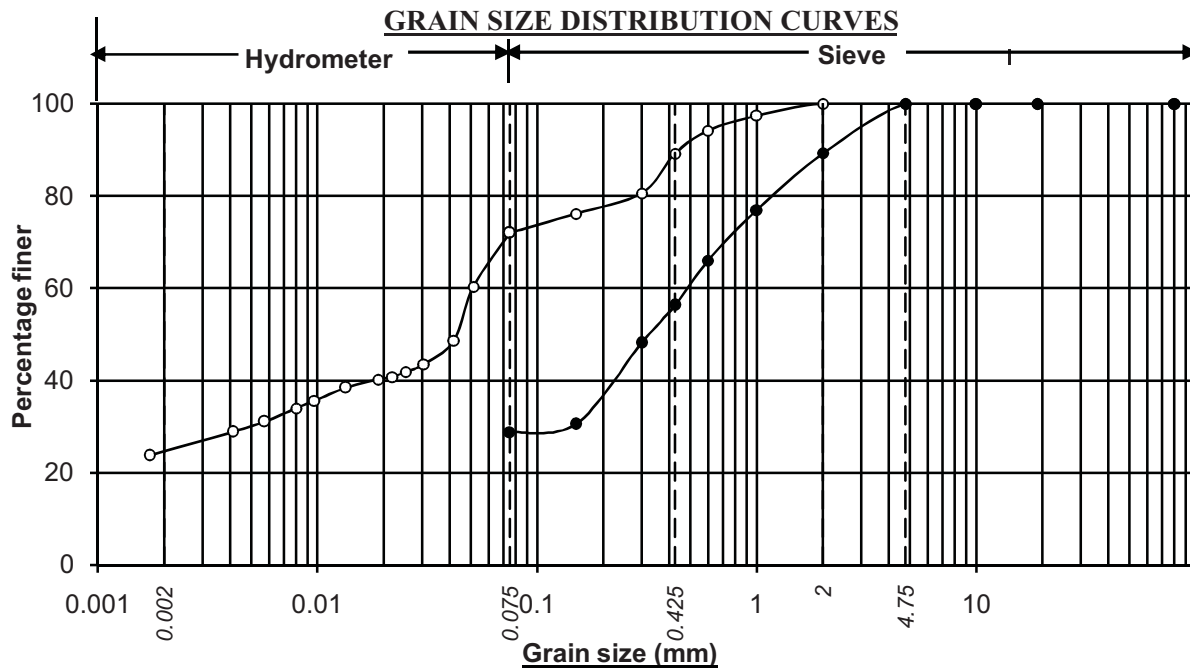
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-05,SPT-05, 6.00M		42.5	32.9	24.6	0.0	57.5		0.0
IBH-06,UDS-01, 2.00M	21.4	54.3	13.0	6.1	2.4	21.5		2.8



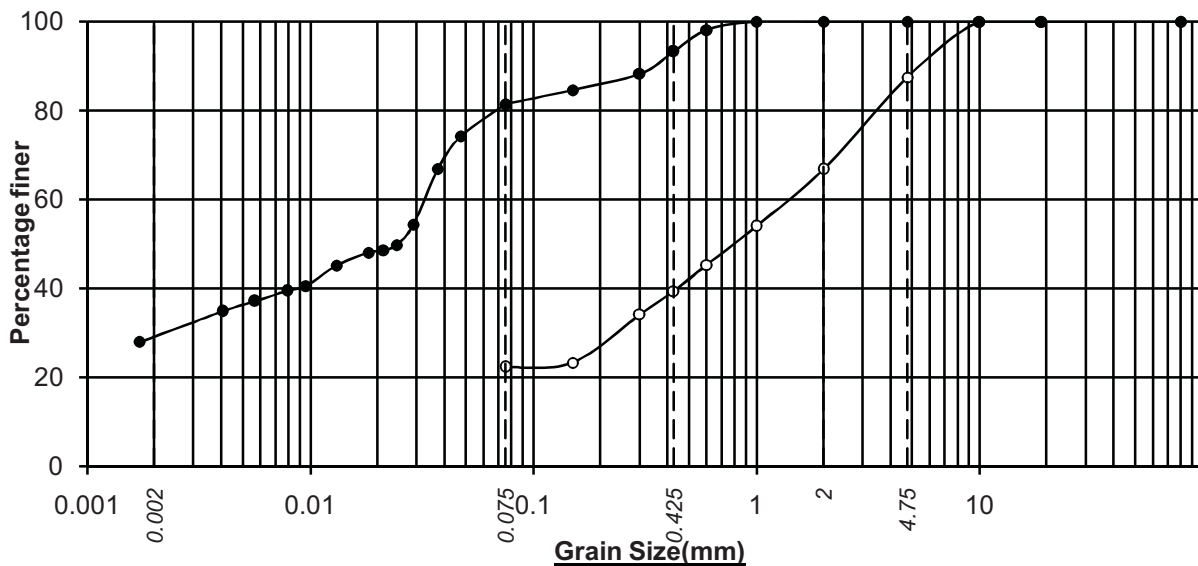
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-06,SPT-03, 4.10M		18.1	8.4	18.3	19.3	46.0		35.9
IBH-06,SPT-06, 7.10M		34.2	31.9	27.9	6.0	65.8		0.0



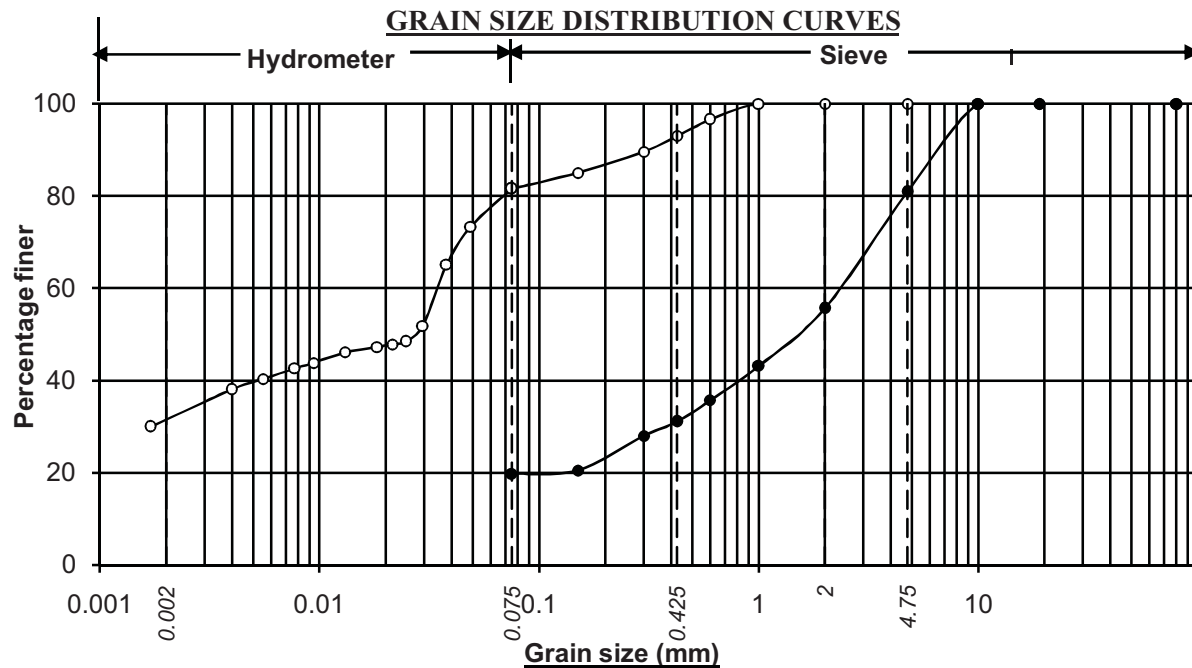
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-07,SPT-01, 0.8M	21.9	42.5	15.4	20.2	0.0	35.6		0.0
IBH-07,UDS-01, 2.00M	28.0	57.0	12.7	2.3	0.0	15.0		0.0



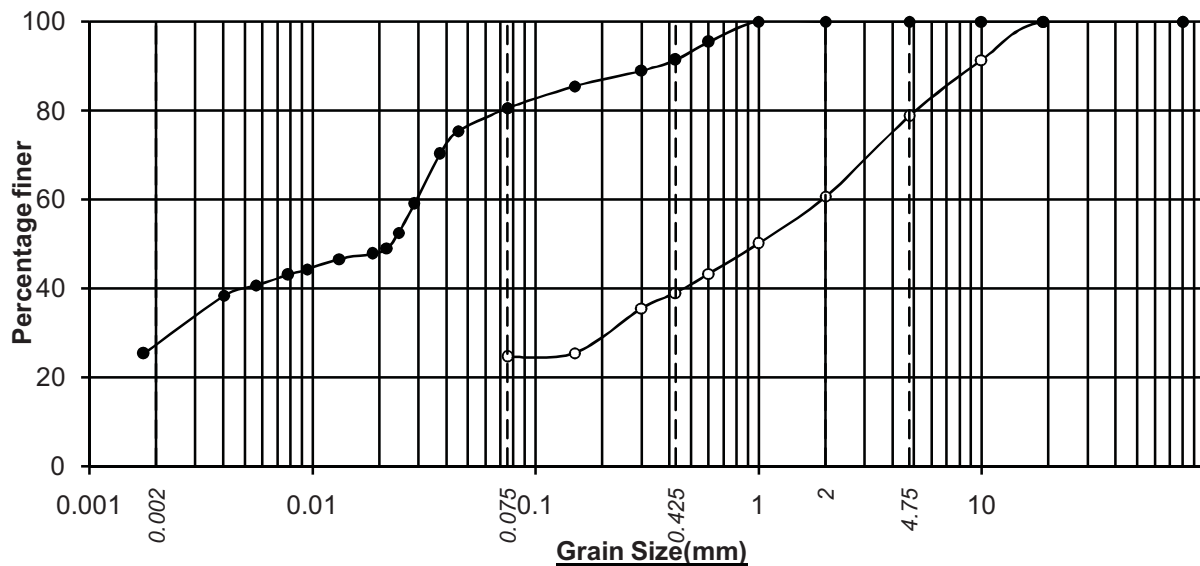
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-07, UDS-02, 4.00M	24.6	47.4	17.1	10.9	0.0	28.0		0.0
IBH-07, SPT-04, 6.10M		28.8	27.6	32.9	10.7	71.2		0.0



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-07, SPT-06, 7.8M		22.4	17.0	27.4	20.7	65.1		12.5
IBH-08, UDS-01, 2.00M	29.2	52.2	11.9	6.7	0.0	18.6		0.0



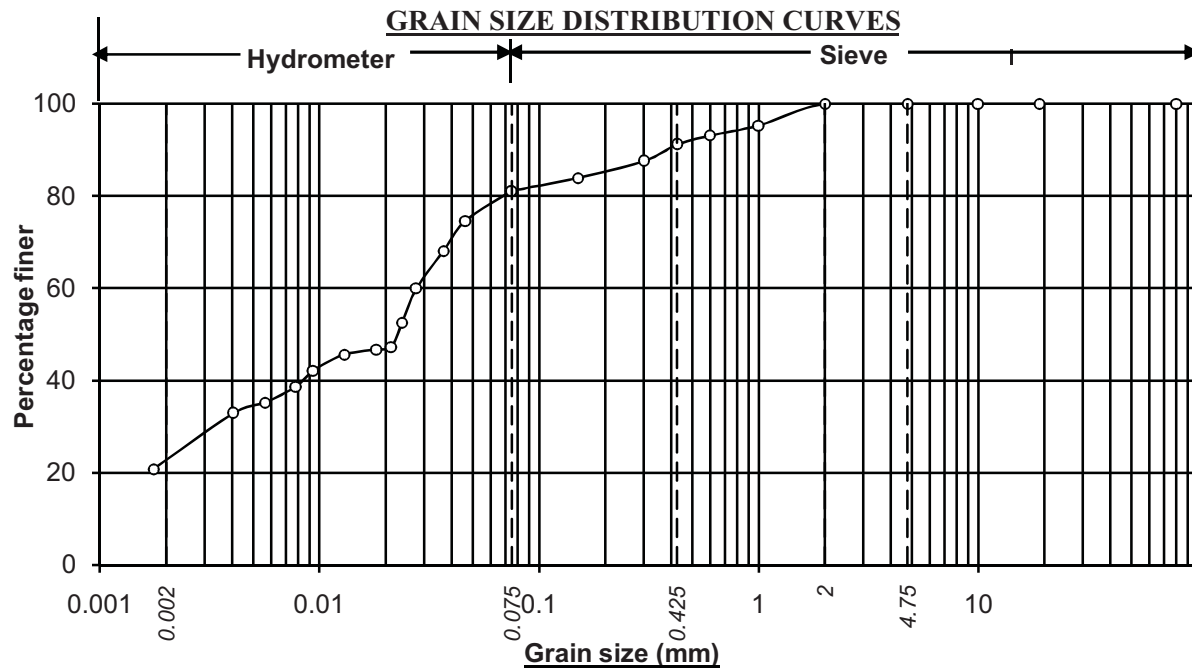
Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-08,SPT-03, 4.10M	31.5	50.1	11.4	7.0	0.0	18.4		0.0
IBH-08,SPT-04, 5.00M		19.8	11.2	24.6	25.3	61.1		19.1



Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-08,SPT-05, 6.10M		24.7	14.3	21.7	18.1	54.1		21.2
IBH-09,UDS-01, 2.00M	27.4	53.1	10.9	8.6	0.0	19.5		0.0

Project:- Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.

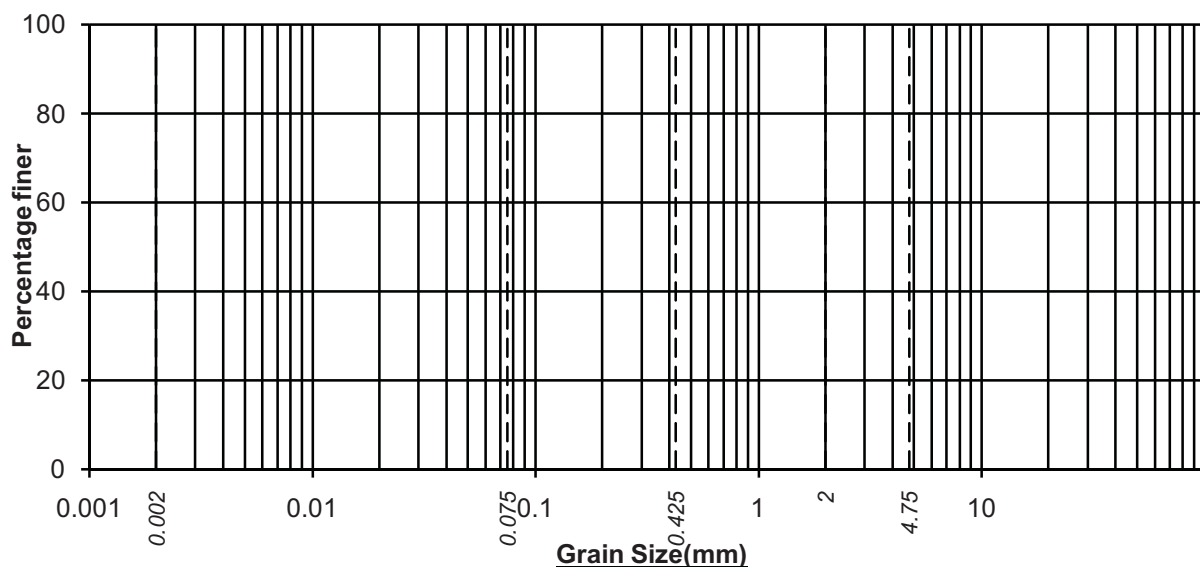
Job No.
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—○— IBH-09, SPT-03, 5.00M

—●— #N/A

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)
IBH-09, SPT-03, 5.00M	22.7	58.5	9.9	8.9	0.0	18.8		0.0



—○— #N/A

—●— #N/A

Grain size (mm)	<0.002	0.002-0.075	0.075-0.425	0.425-2.00	2.0-4.75	Total sand	Weighted mean dia (mm)	>4.75
Sample No.	Clay (%)	Silt (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)			Gravel (%)

Project:- Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.

Job No.
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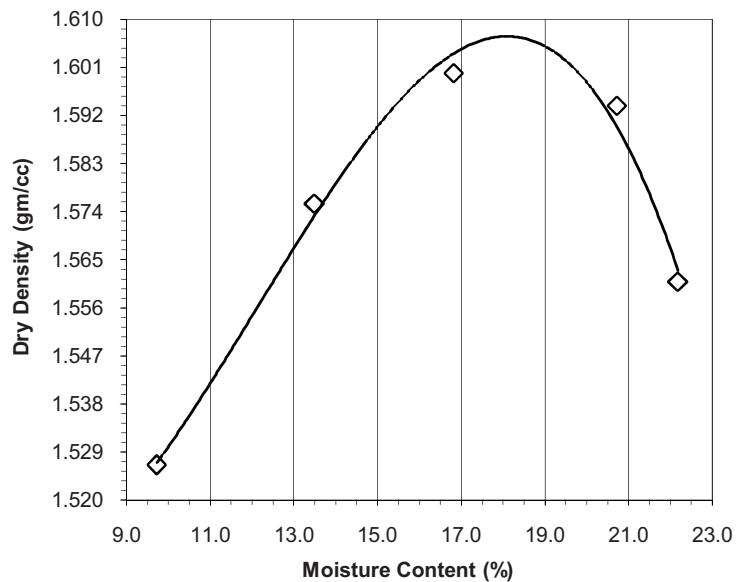
C.B.R. & PROCTOR TEST RESULTS.

TP01 / DS01

Depth = 1.00m

Maximum Dry Density : 1.607 gm/cc
Optimum Moisture Content: 18.00 %

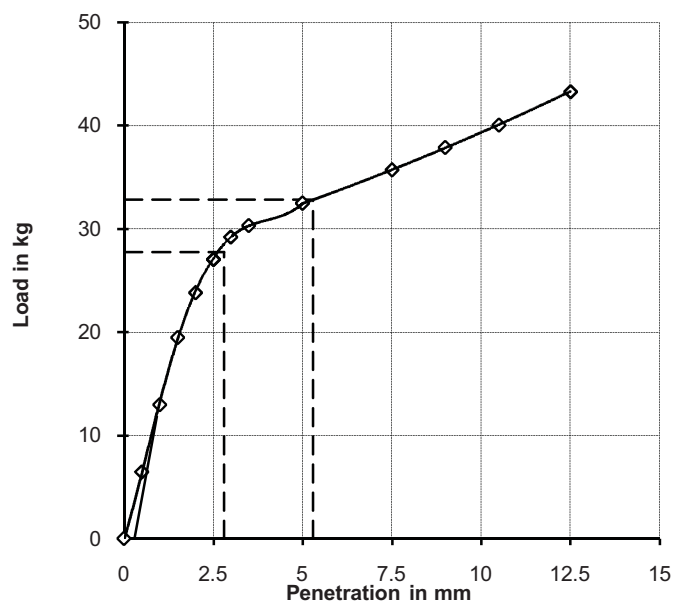
O.M.C. GRAPH



TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	2.02
5.0	1.60

CBR GRAPH

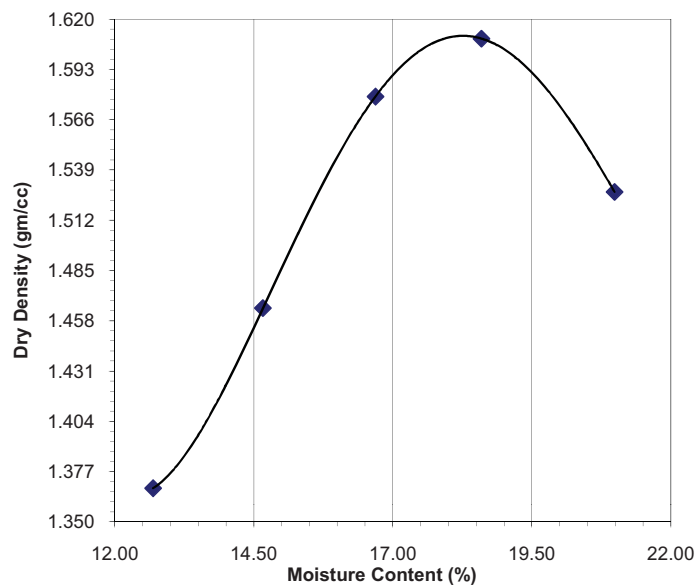


C.B.R. & PROCTOR TEST RESULTS.

TP01 / DS02

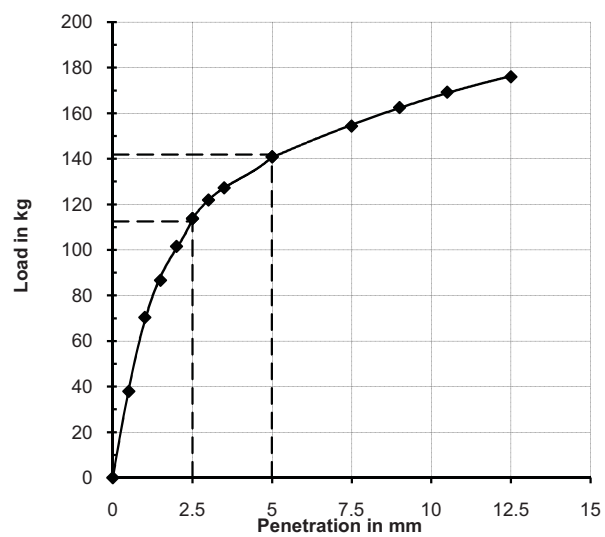
Depth = 2.00m

Maximum Dry Density : 1.611 gm/cc
Optimum Moisture Content: 18.24 %

O.M.C. GRAPH

TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	8.21
5.0	6.90

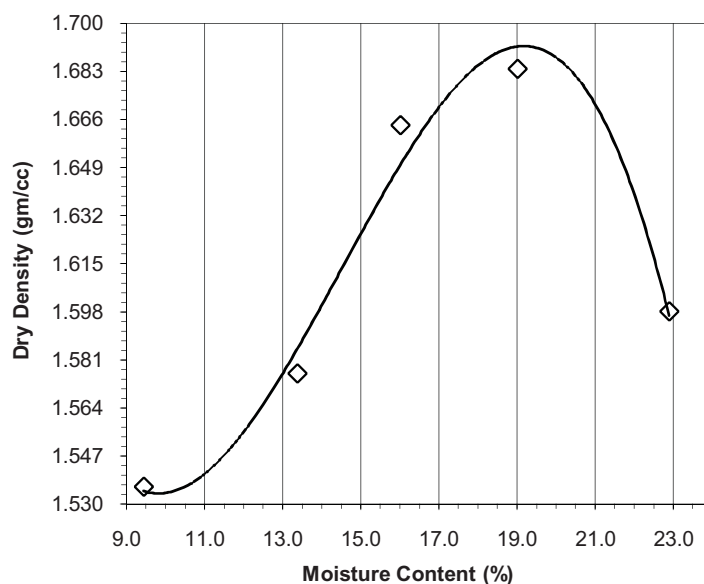
CBR GRAPH

C.B.R. & PROCTOR TEST RESULTS.

TP02 / DS02

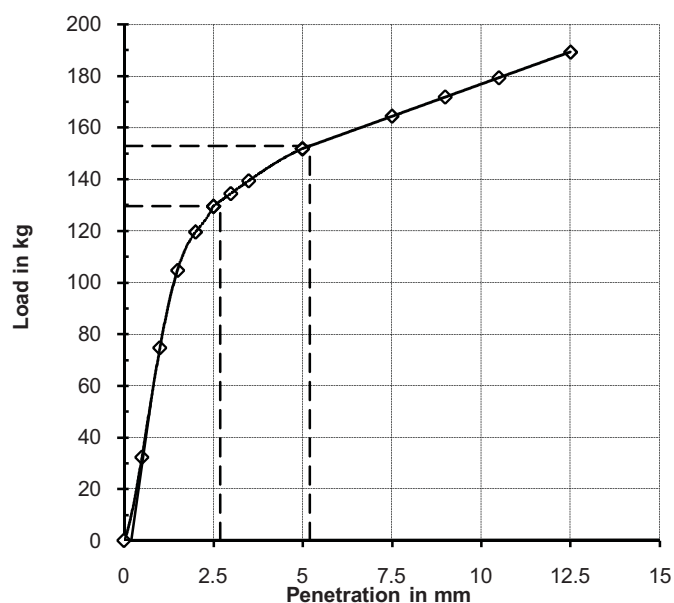
Depth = 2.00m

Maximum Dry Density : 1.692 gm/cc
Optimum Moisture Content: 19.20 %

O.M.C. GRAPH

TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	9.47
5.0	7.44

CBR GRAPH

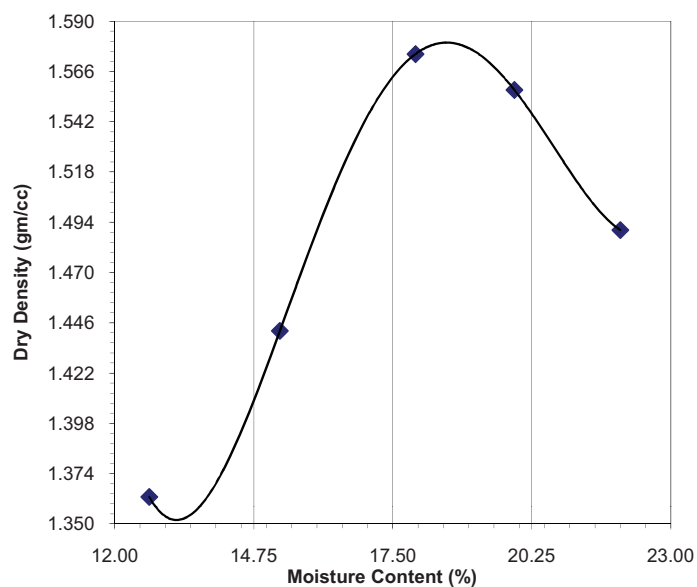
C.B.R. & PROCTOR TEST RESULTS.

TP02 / DS03

Depth = 3.00m

Maximum Dry Density : 1.579 gm/cc
Optimum Moisture Content: 18.57 %

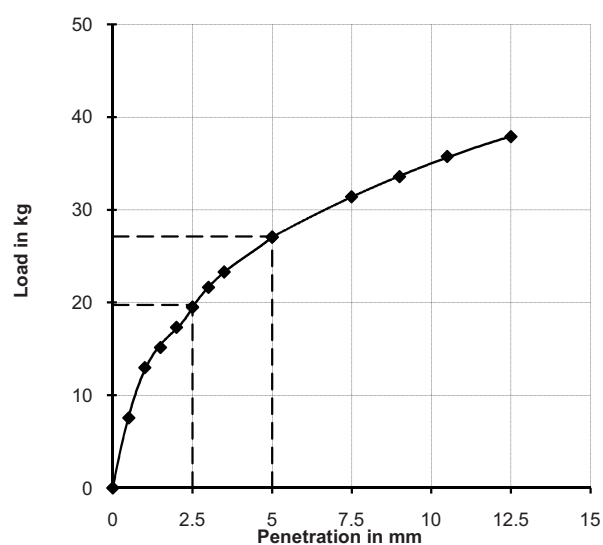
O.M.C. GRAPH



TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	1.44
5.0	1.32

CBR GRAPH



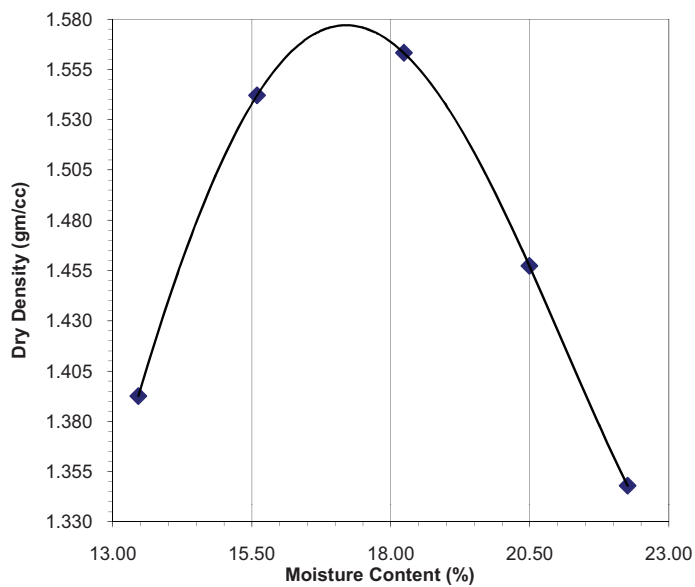
C.B.R. & PROCTOR TEST RESULTS.

TP03 / DS01

Depth = 1.00m

Maximum Dry Density : 1.577 gm/cc
Optimum Moisture Content: 17.22 %

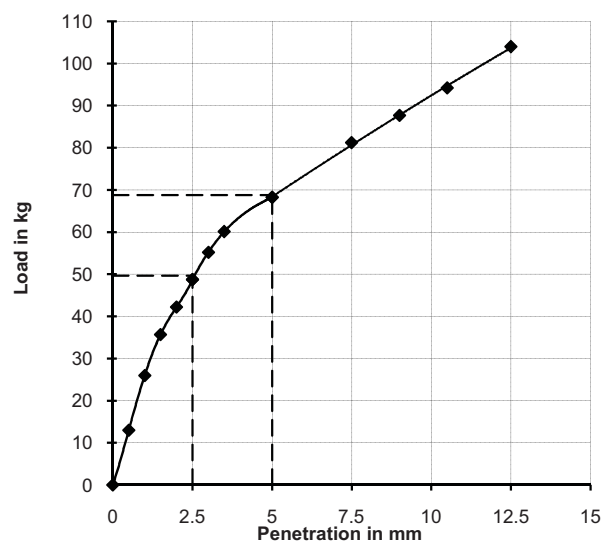
O.M.C. GRAPH



TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	3.63
5.0	3.35

CBR GRAPH

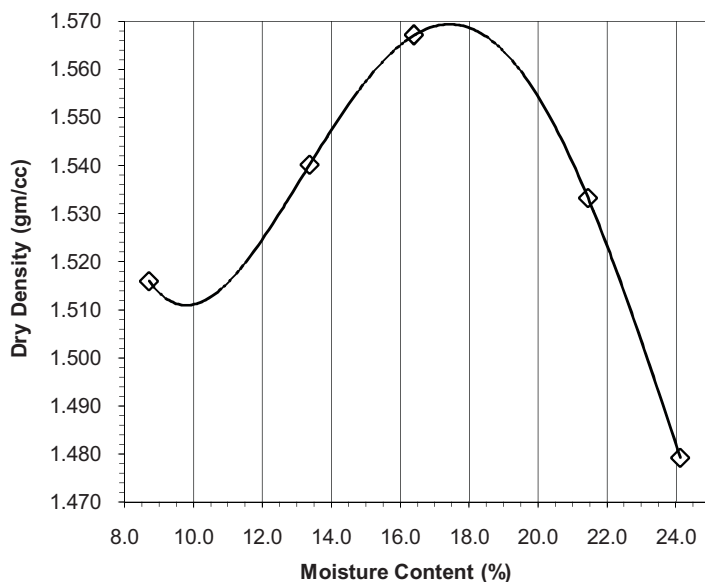


C.B.R. & PROCTOR TEST RESULTS.

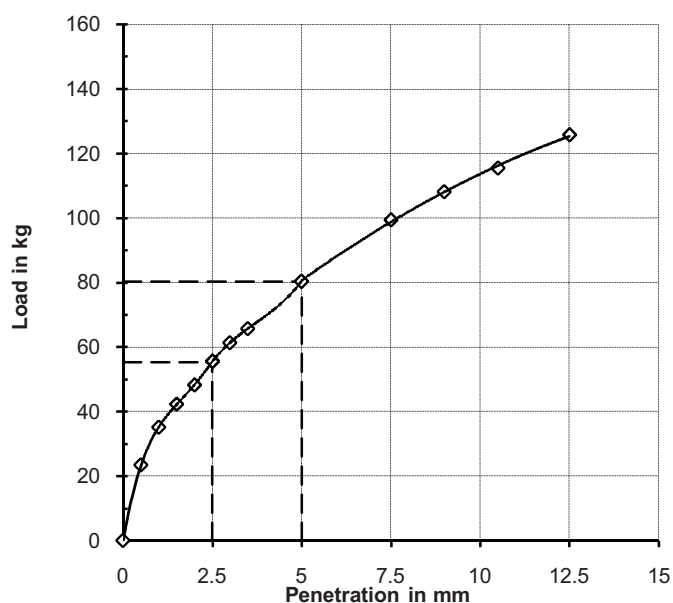
TP03 / DS03

Depth = 3.00m

Maximum Dry Density : 1.569 gm/cc
Optimum Moisture Content: 17.50 %

O.M.C. GRAPH**TYPE :- SOAKED**

Penetration (mm)	CBR (%)
2.5	4.03
5.0	3.91

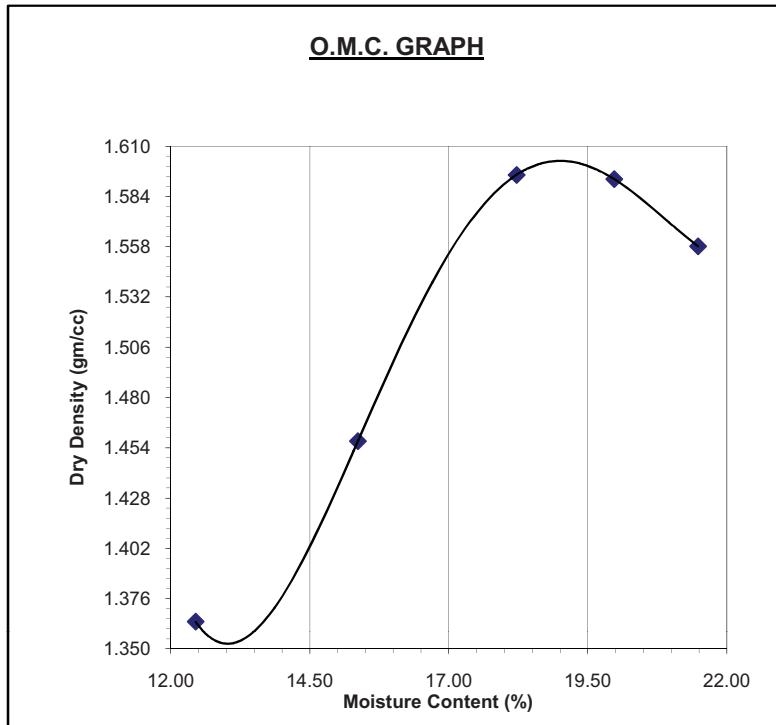
CBR GRAPH

C.B.R. & PROCTOR TEST RESULTS.

TP04 / DS01

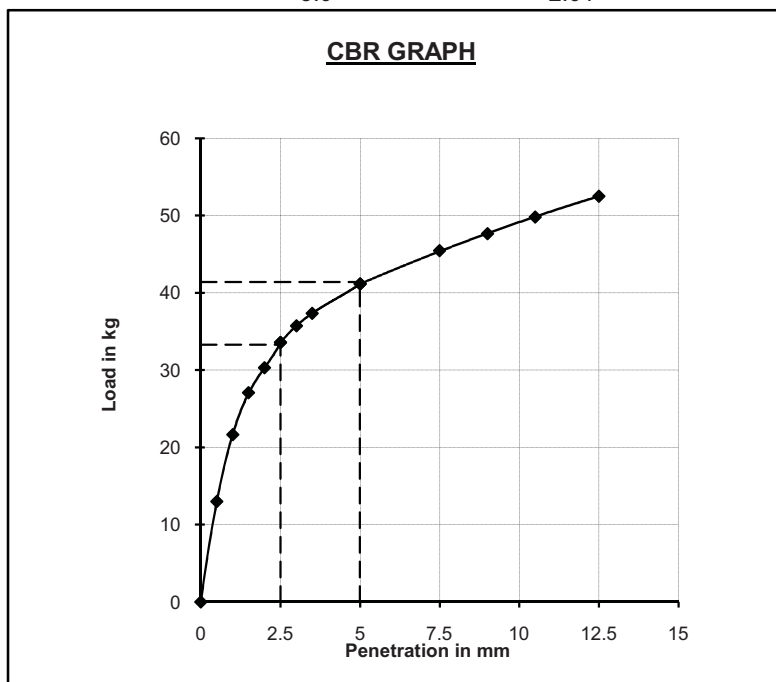
Depth = 1.00m

Maximum Dry Density : 1.602 gm/cc
Optimum Moisture Content: 19.04 %



TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	2.43
5.0	2.01

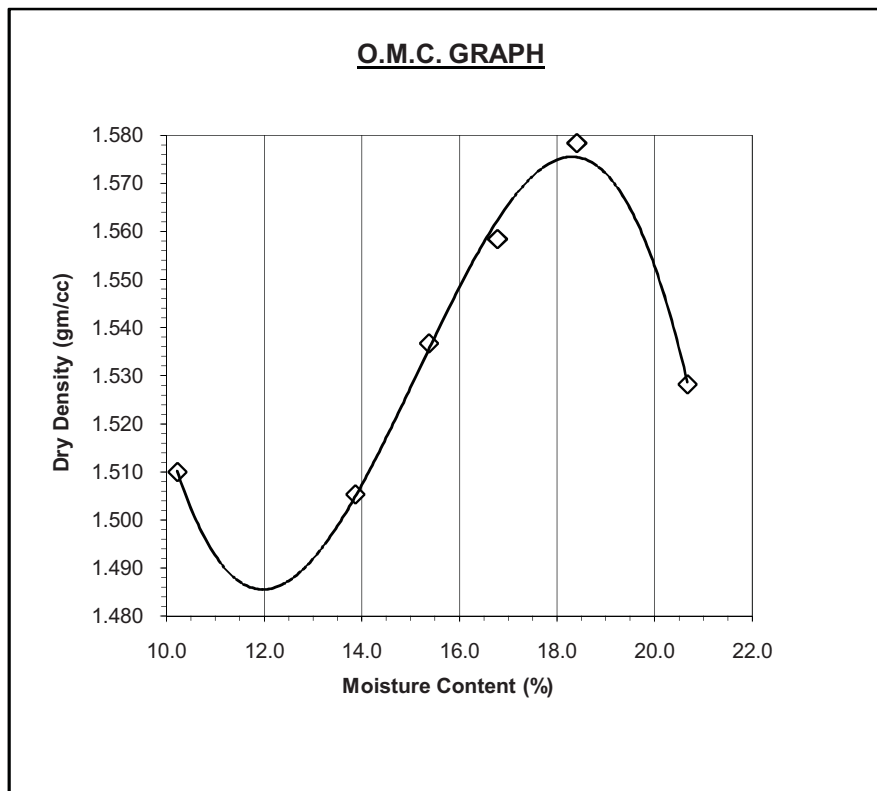


PROCTOR TEST RESULTS.

TP04 / DS02

Depth = 2.00m

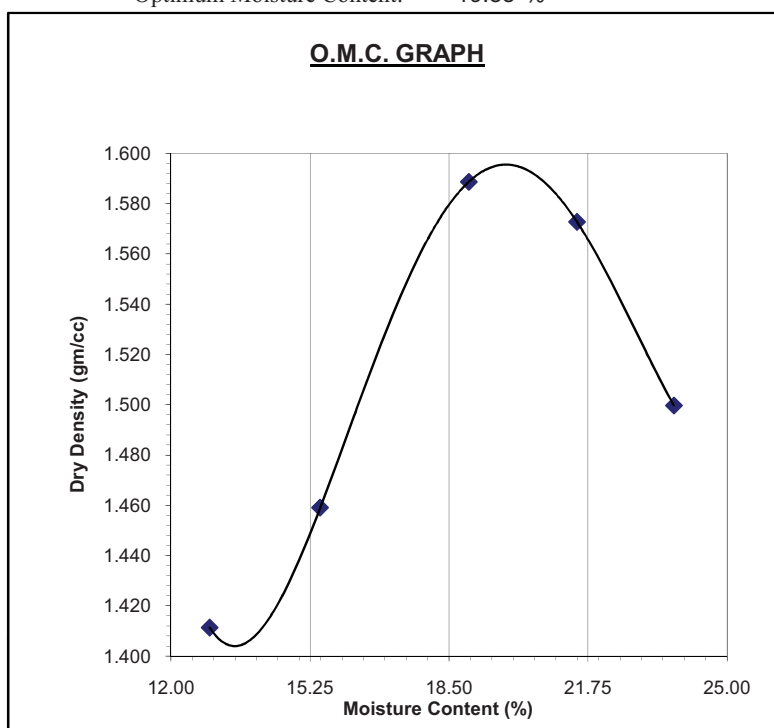
Maximum Dry Density : 1.577 gm/cc
Optimum Moisture Content: 18.35 %

**PROCTOR TEST RESULTS.**

TP05 / DS02

Depth = 2.00m

Maximum Dry Density : 1.595 gm/cc
Optimum Moisture Content: 19.88 %

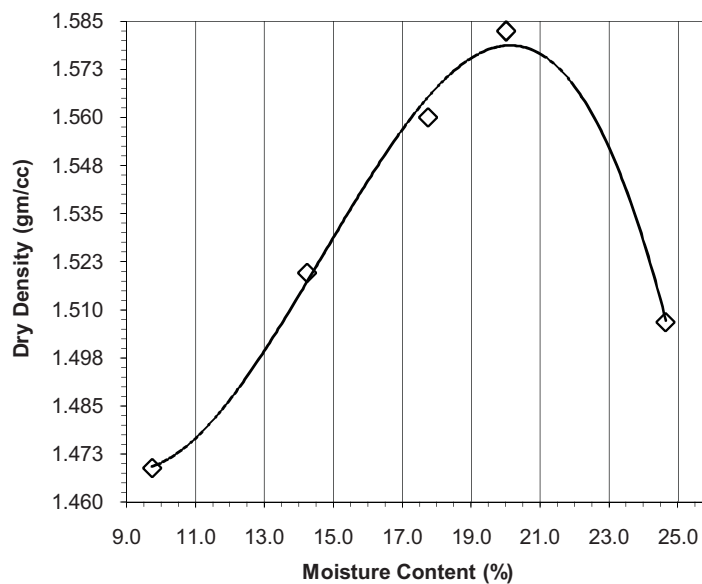


C.B.R. & PROCTOR TEST RESULTS.

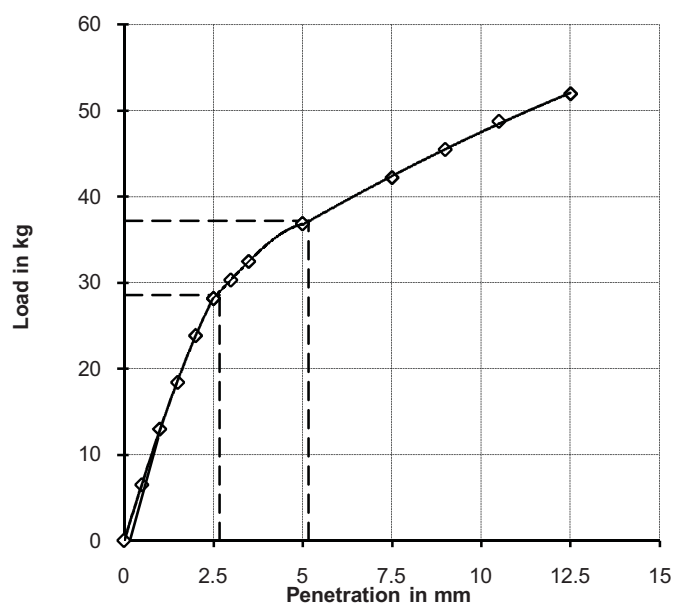
TP05 / DS03

Depth = 3.00m

Maximum Dry Density : 1.578 gm/cc
Optimum Moisture Content: 20.15 %

O.M.C. GRAPH**TYPE :- SOAKED**

Penetration (mm)	CBR (%)
2.5	2.09
5.0	1.81

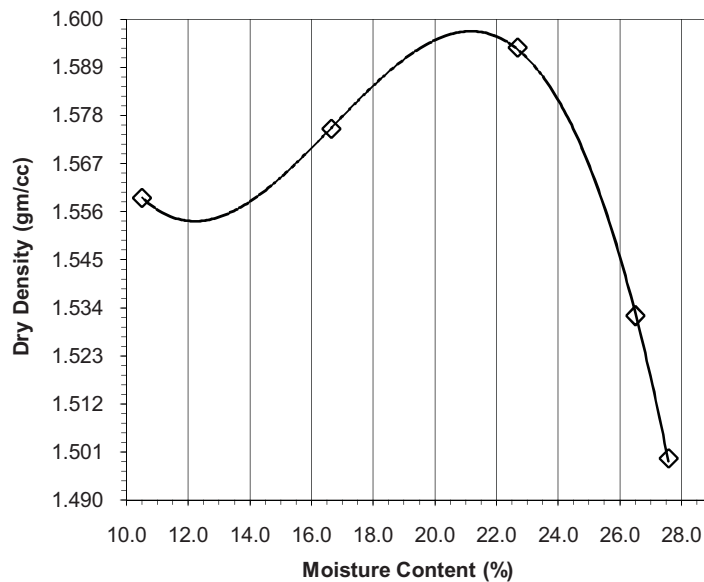
CBR GRAPH

C.B.R. & PROCTOR TEST RESULTS.

ITP01 / DS01

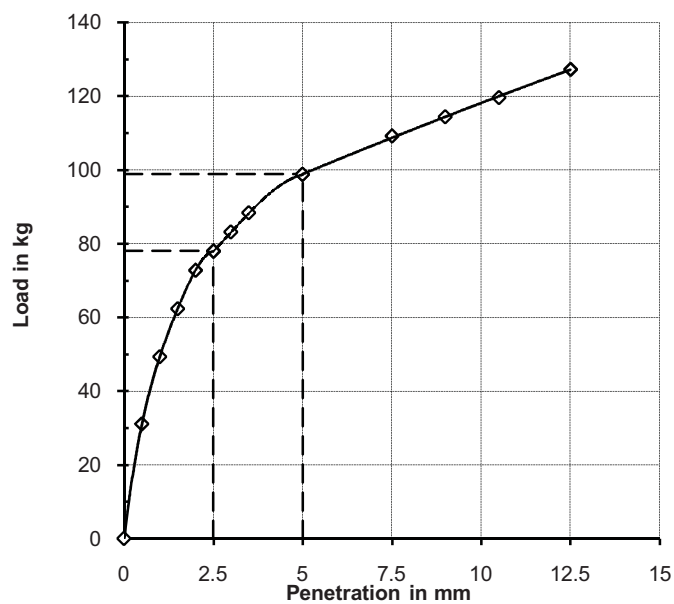
Depth = 1.00m

Maximum Dry Density : 1.597 gm/cc
Optimum Moisture Content: 21.40 %

O.M.C. GRAPH

TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	5.70
5.0	4.82

CBR GRAPH

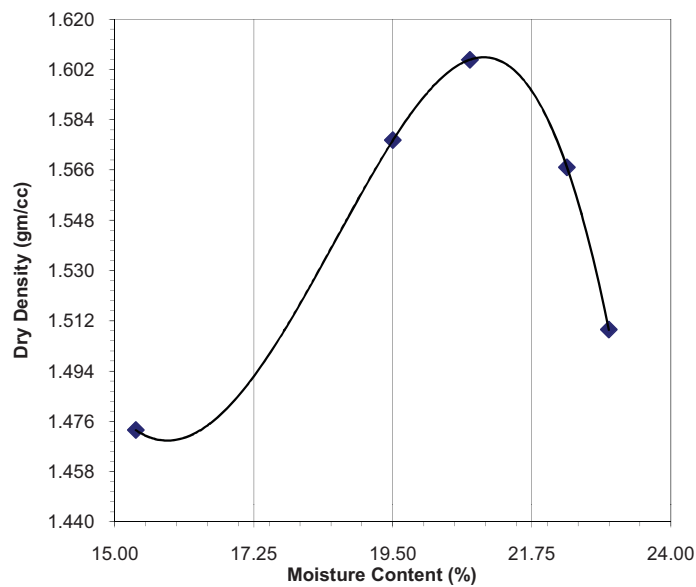
C.B.R. & PROCTOR TEST RESULTS.

ITP01 / DS02

Depth = 2.00m

Maximum Dry Density : 1.606 gm/cc
Optimum Moisture Content: 21.00 %

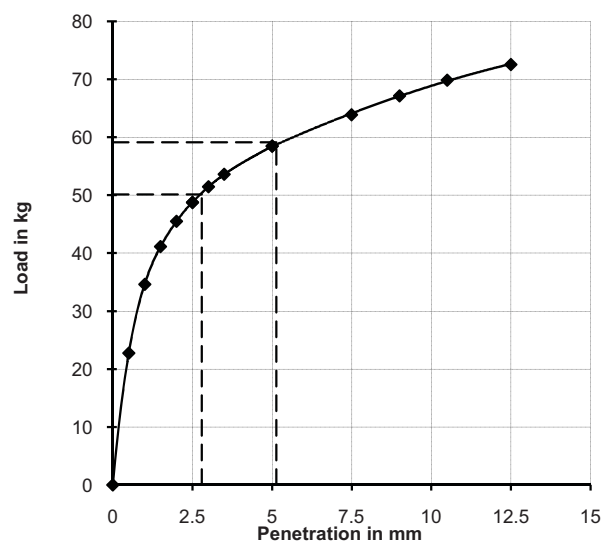
O.M.C. GRAPH



TYPE :- SOAKED

Penetration (mm)	CBR (%)
2.5	3.66
5.0	2.88

CBR GRAPH



PART IV: SAMPLE CALCULATION

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

Foundation around Stack Unit 2 Area, Depth of foundation = 6.50m below FGL (FGL= 271.000M)

The founding level falls inside medium dense sand layer i.e layer IIIA.

The Average field "N" = 24

After correction for Overburden Pressure and Dilatancy, Final Corrected "N" = 22

So, use $C = 0$ kg/sqcm & $\Phi = 31^\circ$

Assume size of foundation = 35m dia

So, equivalent width of foundation = 31.02m

Considering general shear failure

Cohesion, $C = 0.00$ t/sqm

Using $\phi = 36$ degree, the bearing capacity factors are:

$$N_c = 50.59$$

$$N_q = 37.75$$

$$N_\gamma = 56.31$$

Use,

Depth of Foundation = $D_f = 6.50$ M below FGL (i.e. 6.257m below EGL)

Diameter of Foundation = $B = 35$ M

Overburden Pressure = $q = 6.500$ (Depth) $\times 0.90$ (Submerged density) = 5.85 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.30 \quad S_q = 1.20 \quad S_\gamma = 0.60$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.07 \quad D_q = 1.04 \quad D_\gamma = 1.04$$

Computed Net Ultimate Bearing Capacity = 820.36 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 328.15 t/sqm

Considering Local Shear Failure

$$\Phi = 28^\circ, \Phi' = \tan^{-1} (2/3 \times \tan 28^\circ) = 19^\circ$$

Computed Net Ultimate Bearing Capacity = 81.30 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 32.52 t/sqm

Therefore, interpolated SBC for Φ of $31^\circ = [32.52 + \{(31-28) / (36-28)\} \times (328.15-32.52)] = 143.38$ t/sqm.

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters**Stratum IIIA**

Design corrected "N" in this layer = 22

Treating the sand as silty sand, $E_s = 3(N+6) = 84$ kg/sqcm

Treating the sand as normally consolidated sand, $E_s = 5(N+15) = 185$ kg/sqcm

So, use $E_s = 135$ kg/sqcm, $G = 1.00$ & $\mu = 0.25$

Stratum III

Design corrected "N" in this layer = 53

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 956.50$ kg/sqcm

However, let us restrict the E_s value to 750 kg/sqcm, $G = 1.00$ & $\mu = 0.25$

Stratum IV & V

Use Young's modulus for layer IV & V = 1000 kg/sqcm & 2000 kg/sqcm respectively.

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



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Sheet No.

SETTLEMENT CALCULATION

A) General Data:

Width of foundation =	31.02	m
Length of foundation =	31.02	m
Depth of foundation =	6.50	m below FGL
Net Base Pressure =	10.0	kg/sqcm

B) Subsoil Properties:**Layer - IIIA**

Young's Modulus =	135	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	6.50	m
End of Stratum =	6.81	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Layer - III

Young's Modulus =	750	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	6.81	m
End of Stratum =	10.46	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

C) Calculation of Immediate Settlement:*Settlement at center*

$M = L' / B' =$	1.000	
$N = H / B' =$	0.020	
$I_1 =$	0.000	
$I_2 =$	0.005	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.003	
Immediate settlement $S_i =$	1.453	cm
$[q_o \times B' \times (1 - \mu^2) \times m \times I_s] / E_s$		

Settlement at corner

$M = L' / B' =$	1.00	
$N = H / B' =$	0.010	
$I_1 =$	0.000023	
$I_2 =$	0.002484	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.002	
Immediate settlement $S_i =$	0.362	cm

Average S_i for Layer - IIIA 9.07 mm*Settlement at center*

$M = L' / B' =$	1.000	
$N = H / B' =$	0.233	
$I_1 =$	0.012	
$I_2 =$	0.046	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.0427	
Immediate settlement $S_i =$	3.2773	cm
$[q_o \times B' \times (1 - \mu^2) \times m \times I_s] / E_s$		

Settlement at corner

$M = L' / B' =$	1.00	
$N = H / B' =$	0.116	
$I_1 =$	0.003	
$I_2 =$	0.026	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.0204	
Immediate settlement $S_i =$	0.7839	cm

Average S_i for Layer - III = 20.306 mm

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



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Layer - IV

Young's Modulus =	1000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	10.46	m
End of Stratum =	20.161	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Layer - V

Young's Modulus =	2000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	20.161	m
End of Stratum =	52.5	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Settlement at center

$M = L' / B' =$	1.000	
$N = H / B' =$	0.555	
$I_1 =$	0.058	
$I_2 =$	0.077	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.110	
Immediate settlement $S_i =$	5.649	cm
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$		

Settlement at center

$M = L' / B' =$	1.000	
$N = H / B' =$	1.448	
$I_1 =$	0.216	
$I_2 =$	0.076	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.267	
Immediate settlement $S_i =$	5.388	cm
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$		

Settlement at corner

$M = L' / B' =$	1.000	
$N = H / B' =$	0.277	
$I_1 =$	0.017	
$I_2 =$	0.053	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.052	
Immediate settlement $S_i =$	1.329	cm

Settlement at corner

$M = L' / B' =$	1.000	
$N = H / B' =$	0.724	
$I_1 =$	0.090	
$I_2 =$	0.082	
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.145	
Immediate settlement $S_i =$	1.460	cm

Average S_i for Layer - IV = 34.89 mmAverage S_i for Layer - V = 34.24 mm

Total immediate settlement = 98.51 mm

(for all the four layers)

So, Total Settlement = 98.51 mm

Fox's Depth correction Factor = 0.95

Applying Rigidity correction Factor : 0.80

Corrected total settlement = 74.88 mm

The calculated settlement is well within permissible limit. However, let us restrict the bearing capacity to 50 t/sqm for 6.50m below FGL.

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

Foundation around Booster Fan (Unit 1) Area, Depth of foundation = 5.50m below FGL (FGL= 271.000M)

The founding level falls inside hard clay layer i.e layer II.

Average $N = 39$, corresponding cohesion from N value = 1.30 kg/sqcm & $\Phi = 0^\circ$

From laboratory TRSH-UU test results, average $C = 1.20 \text{ kg/sqcm}$ & $\Phi = 4^\circ$

Thus average $C = 1.25 \text{ kg/sqcm}$ & $\Phi = 2^\circ$

So use $C = 1.25 \text{ kg/sqcm}$ & $\Phi = 0^\circ$

Assume size of foundation = $5\text{m} \times 10\text{m}$

Cohesion, $C = 12.50 \text{ t/sqm}$

Using $\phi = 0$ degree, the bearing capacity factors are:

$$N_c = 5.14$$

$$N_q = 1.00$$

$$N_\gamma = 0.00$$

Use,

Depth of Foundation = $D_f = 5.5 \text{ M}$ (Below Finished Ground level)

Width of Foundation = $B = 5 \text{ M}$

Length of Foundation = $L = 10 \text{ M}$

Overburden Pressure = $q = 5.500 \text{ (Depth)} \times 0.90 \text{ (Submerged density)} = 4.95 \text{ t/sqm}$ (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.10 \quad S_q = 1.10 \quad S_\gamma = 0.80$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.22 \quad D_q = 1.00 \quad D_\gamma = 1.00$$

Computed Net Ultimate Bearing Capacity = 86.79 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 34.72 t/sqm

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters

Stratum II

Total soil modulus, $E_s = 4.4 \times N = 171.60 \text{ kg/sqcm}$

Undrained Young's modulus, $E_u = K \times C = 500 \times 1.25 = 625 \text{ kg/sqcm}$

Again, $1/E_s = 1/E_u + 1/E_d$ giving drained young's modulus, $E_d = 236.55 \text{ kg/sqcm}$

Now, we have, $E_d = E_u/3 = 208.33 \text{ kg/sqcm}$

Considering the above, let us use $E_d = 220 \text{ kg/sqcm}$

From E_d , $m_{vc} = 1/G \cdot E_d = 0.0076 \text{ sqcm/kg}$ [Geological Factor, $G = 0.60$ & $\mu = 0.35$]

Again from SPT "N", $m_{vc} = 1/5N = 0.0051 \text{ sqcm/kg}$

Now, let us consider the m_{vc} value for the pressure range between 0.50 to 2.00 kg/sqcm

Sample No.	0.50 – 1.00kg/sqcm	1.00 - 2.00kg/sqcm
BH-02/UDS-02	0.0200	0.0184
Weighted average m_{vc} over the pressure range	0.0189	

Giving more weightage to the laboratory test results,

Use $m_{vc} = [2 \times 0.0189 + 1 \times 0.0076 + 1 \times 0.0051]/4 = 0.0126 \text{ sqcm/kg}$

Stratum III

Design corrected "N" in this layer = 59

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 1019.50 \text{ kg/sqcm}$

However, let us restrict the E_s value to 750 kg/sqcm

Use $G = 1.00$ & $\mu = 0.25$

Stratum IV

Use Young's modulus for layer IV = 1000 kg/sqcm

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

SETTLEMENT CALCULATION

Settlement Analysis

A) General Data:

Width of foundation =	5.0	m
Length of foundation =	10.0	m
Depth of foundation =	5.5	m
Net Base Pressure =	2.3	kg/sqcm

B) Subsoil Properties:

Layer - II

Young's Modulus =	625	kg/sqcm
Poisson Ratio, μ =	0.35	
Top of Stratum =	5.50	m
End of Stratum =	7.31	m
Geological factor, G =	0.60	
m_{vc} =	0.0126	sqcm/kg

Layer - III

Young's Modulus =	750	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	7.31	m
End of Stratum =	8.81	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Layer - IV

Young's Modulus =	1000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	8.81	m
End of Stratum =	15.50	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

C) Calculation of Immediate Settlement:

Settlement at center

$M = L' / B' =$	2.000
$N = H / B' =$	0.725
$I_1 =$	0.076
$I_2 =$	0.100
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.122
Immediate settlement $S_i =$	0.394 cm
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.734
$N = H / B' =$	0.440
$I_1 =$	0.033
$I_2 =$	0.076
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.084
Immediate settlement $S_i =$	0.204 cm
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.601
$N = H / B' =$	1.609
$I_1 =$	0.236
$I_2 =$	0.098
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.301
Immediate settlement $S_i =$	0.488 cm
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at corner

$M = L' / B' =$	2.00
$N = H / B' =$	0.363
$I_1 =$	0.022046
$I_2 =$	0.068161
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.054
Immediate settlement $S_i =$	0.086 cm

Settlement at corner

$M = L' / B' =$	1.73
$N = H / B' =$	0.220
$I_1 =$	0.009
$I_2 =$	0.046
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.040
Immediate settlement $S_i =$	0.048 cm

Settlement at corner

$M = L' / B' =$	1.601
$N = H / B' =$	0.804
$I_1 =$	0.094
$I_2 =$	0.099
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.160
Immediate settlement $S_i =$	0.129 cm

Average S_i for Stratum II =	2.40 mm
Total immediate settlement =	6.75 mm

Average S_i for Stratum III =	1.26 mm
(for all the three layers)	

Average S_i for Stratum IV =	3.09 mm

D) Calculation of Consolidation Settlement:

Strata	From (M)	To (M)	Thickness (M)	Mid depth (M)	ΔP (kg/sqcm)	m_{vc} sqcm/kg	G	S_c (cm)
Layer - II	5.50	6.41	0.91	0.45	2.02	0.0126	0.60	1.38
	6.41	7.31	0.91	1.36	1.59	0.0126	0.60	1.09

Hence, Total Consolidation Settlement = 24.73 mm

So, Total Settlement =	31.48 mm
Fox's Depth correction Factor =	0.77
Corrected total settlement =	24.34 mm

So, use a net allowable bearing capacity of 23t/sqm for depth of foundation of 5.50m below FGL with a limiting settlement of 25mm.

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

Foundation around Absorber / Oxidation Blower 1 Area, Depth of foundation = 4.00m below FGL (FGL= 271.000M)

NGL = 270.500M, FGL = 271.000M, So depth of fill = (271-270.50) = 0.50m

Depth of foundation = 4.00m below FGL i.e. 3.50m below NGL.

The founding level falls inside hard clay layer i.e layer II.

Average N = 39, corresponding cohesion from N value = 1.30 kg/sqcm & $\Phi = 0^\circ$

So use C = 1.25 kg/sqcm & $\Phi = 0^\circ$

Assume size of foundation = 10m x 20m

Cohesion, C = 12.50 t/sqm

Using $\phi = 0$ degree, the bearing capacity factors are:

$$N_c = 5.14$$

$$N_q = 1.00$$

$$N_\gamma = 0.00$$

Use,

Depth of Foundation = $D_f = 3.5$ M (Below Natural Ground level)

Width of Foundation = B = 10 M

Length of Foundation = L = 20 M

Overburden Pressure = $q = 3.500$ (Depth) x 0.90 (Submerged density) = 3.15 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.10 \quad S_q = 1.10 \quad S_\gamma = 0.80$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.07 \quad D_q = 1.00 \quad D_\gamma = 1.00$$

Computed Net Ultimate Bearing Capacity = 76.00 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 30.40 t/sqm

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters

Stratum II

Total soil modulus, $E_s = 4.4 \times N = 171.60$ kg/sqcm

Undrained Young's modulus, $E_u = K \times C = 500 \times 1.25 = 625$ kg/sqcm

Again, $1/E_s = 1/E_u + 1/E_d$ giving drained young's modulus, $E_d = 236.55$ kg/sqcm

Now, we have, $E_d = E_u/3 = 208.33$ kg/sqcm

Considering the above, let us use $E_d = 220$ kg/sqcm

From E_d , $m_{vc} = 1/G.E_d = 0.0076$ sqcm/kg [Geological Factor, $G = 0.60$ & $\mu = 0.35$]

Again from SPT "N", $m_{vc} = 1/5N = 0.0051$ sqcm/kg

Thus average $m_{vc} = [1 \times 0.0076 + 1 \times 0.0051]/2 = 0.0064$ sqcm/kg

Stratum III

Design corrected "N" in this layer = 59

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 1019.50$ kg/sqcm

However, let us restrict the E_s value to 750 kg/sqcm

Use $G = 1.00$ & $\mu = 0.25$

Stratum IV

Use Young's modulus for layer IV = 1000 kg/sqcm

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

SETTLEMENT CALCULATION

Settlement Analysis

A) General Data:

Width of foundation =	10.0	m
Length of foundation =	20.0	m
Depth of foundation =	4.0	m below FGL
Net Base Pressure =	3.0	kg/sqcm

B) Subsoil Properties:

Layer - II

Young's Modulus =	625	kg/sqcm
Poisson Ratio, μ =	0.35	
Top of Stratum =	4.00	m
End of Stratum =	8.491	m
Geological factor, G =	0.60	
m_{vc} =	0.0064	sqcm/kg

Layer - III

Young's Modulus =	750	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	8.49	m
End of Stratum =	8.99	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

Layer - IV

Young's Modulus =	1000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	8.99	m
End of Stratum =	24.00	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

C) Calculation of Immediate Settlement:

Settlement at center

$M = L' / B' =$	2.000
$N = H / B' =$	0.898
$I_1 =$	0.107
$I_2 =$	0.107
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.156
Immediate settlement $S_i =$	1.312 cm
$[q_o \times B \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.690
$N = H / B' =$	0.069
$I_1 =$	0.001
$I_2 =$	0.016
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.012
Immediate settlement $S_i =$	0.072 cm
$[q_o \times B \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.667
$N = H / B' =$	2.002
$I_1 =$	0.292
$I_2 =$	0.092
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.354
Immediate settlement $S_i =$	1.593 cm
$[q_o \times B \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at corner

$M = L' / B' =$	2.00
$N = H / B' =$	0.449
$I_1 =$	0.032838
$I_2 =$	0.078445
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.069
Immediate settlement $S_i =$	0.291 cm

Settlement at corner

$M = L' / B' =$	1.69
$N = H / B' =$	0.035
$I_1 =$	0.000
$I_2 =$	0.008
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.006
Immediate settlement $S_i =$	0.018 cm

Settlement at corner

$M = L' / B' =$	1.667
$N = H / B' =$	1.001
$I_1 =$	0.129
$I_2 =$	0.104
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.199
Immediate settlement $S_i =$	0.447 cm

Average S_i for Stratum II = 8.02 mm

Total immediate settlement = 18.66 mm

Average S_i for Stratum III = 0.45 mm

(for all the three layers)

Average S_i for Stratum IV = 10.20 mm

D) Calculation of Consolidation Settlement:

Strata	From (M)	To (M)	Thickness (M)	Mid depth (M)	ΔP (kg/sqcm)	m_{vc} sqcm/kg	G	S_c (cm)
Layer - II	4.00	6.25	2.25	1.12	2.55	0.0064	0.60	2.20
	6.25	8.49	2.25	3.37	1.92	0.0064	0.60	1.66
Hence, Total Consolidation Settlement =								38.58 mm

So, Total Settlement = 57.25 mm

Fox's Depth correction Factor = 0.92

Applying Rigidity correction Factor : 0.80

Corrected total settlement = 42.32 mm

So, use a net allowable bearing capacity of 30t/sqm for depth of foundation of 4.00m below FGL with a limiting settlement of 75mm.

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

Foundation around Crusher House Area, Depth of foundation = 4.50m below FGL (FGL= 269.000M)

NGL = 269.000M, FGL = 269.000M

Depth of foundation = 4.50m below FGL / NGL.

The founding level falls inside dense to very dense sand layer i.e layer III.

The Average field "N" = 71

After correction for Overburden Pressure and Dilatancy, Final Corrected "N" = 49

So, use $C = 0$ kg/sqcm & $\Phi = 34^\circ$

Assume size of foundation = 5m x 10m

Considering general shear failure

Cohesion, $C = 0.00$ t/sqm

Using $\phi = 36$ degree, the bearing capacity factors are:

$$N_c = 50.59$$

$$N_q = 37.75$$

$$N_\gamma = 56.31$$

Use,

Depth of Foundation = $D_f = 4.5$ M below FGL (i.e. 4.811m below EGL)

Width of Foundation = $B = 5$ M

Length of Foundation = $L = 10$ M

Overburden Pressure = $q = 4.500$ (Depth) x 0.90 (Submerged density) = 4.05 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.10 \quad S_q = 1.10 \quad S_\gamma = 0.80$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.35 \quad D_q = 1.18 \quad D_\gamma = 1.18$$

Computed Net Ultimate Bearing Capacity = 313.11 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 125.24 t/sqm

Considering Local Shear Failure

$$\Phi = 28^\circ, \Phi' = \tan^{-1} (2/3 \times \tan 28^\circ) = 19^\circ$$

Computed Net Ultimate Bearing Capacity = 34.53 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 13.81 t/sqm

Therefore, interpolated SBC for Φ of $34^\circ = [13.81 + \{(34-28) / (36-28)\} \times (125.24-13.81)] = 97.39$ t/sqm.

Similarly, for 4m x 8m interpolated SBC for Φ of $34^\circ = 93.44$ t/sqm

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters

Stratum III

Design corrected "N" in this layer = 49

Treating the sand as normally consolidated sand, $E_s = 5(N+15) = 320$ kg/sqcm

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 914.50$ kg/sqcm

Thus average $E_s = 617$ kg/sqcm

So, use $E_s = 610$ kg/sqcm, $G = 1.00$ & $\mu = 0.25$

Stratum IV

Use Young's modulus for layer IV = 1000 kg/sqcm respectively.

Job No. : 4287

Sheet No.

Settlement Analysis			
A) General Data:			
Width of foundation =	5.0	m	
Length of foundation =	10.0	m	
Depth of foundation =	4.50	m below FGL	
Net Base Pressure =	8.0	kg/sqcm	
B) Subsoil Properties:			
Layer - III			
Young's Modulus =	610	kg/sqcm	
Poisson Ratio, μ =	0.25		
Top of Stratum =	4.50	m	
End of Stratum =	7.94	m	
Geological factor, G =	1.00		
m_{vc} =	0.0000	sqcm/kg	
Layer - IV			
Young's Modulus =	1000	kg/sqcm	
Poisson Ratio, μ =	0.25		
Top of Stratum =	7.94	m	
End of Stratum =	14.50	m	
Geological factor, G =	1.00		
m_{vc} =	0.0000	sqcm/kg	
C) Calculation of Immediate Settlement:			
<i>Settlement at center</i>			
$M = L' / B' =$	2.000		
$N = H / B' =$	1.376		
$I_1 =$	0.192		
$I_2 =$	0.111		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.266		
Immediate settlement $S_i =$	3.269	cm	
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$			
<i>Settlement at corner</i>			
$M = L' / B' =$	2.00		
$N = H / B' =$	0.688		
$I_1 =$	0.069532		
$I_2 =$	0.097786		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.135		
Immediate settlement $S_i =$	0.828	cm	
Average S_i for Stratum III=	20.48	mm	
Total immediate settlement =	30.82	mm	
So, Total Settlement =	30.82	mm	
Fox's Depth correction Factor =	0.808		
Corrected total settlement =	24.90	mm	
<i>Settlement at center</i>			
$M = L' / B' =$	1.592		
$N = H / B' =$	1.555		
$I_1 =$	0.228		
$I_2 =$	0.098		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.293		
Immediate settlement $S_i =$	1.637	cm	
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$			
<i>Settlement at corner</i>			
$M = L' / B' =$	1.59		
$N = H / B' =$	0.777		
$I_1 =$	0.089		
$I_2 =$	0.098		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.154		
Immediate settlement $S_i =$	0.430	cm	
Average S_i for Stratum IV=	10.34	mm	
(for both the layer)			

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Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

Foundation around Booster Fan (Unit 2) Area, Depth of foundation = 4.00m below FGL (FGL= 271.000M)

NGL = 270.000M, FGL = 271.000M, So Depth of Fill = (271.00-270.00) = 1.00m

Depth of foundation = 4.00m below FGL i.e. 3.00m below NGL.

The founding level falls inside hard clay layer. Since the depth of embedment is very small inside layer II, to be in the conservative side we considered properties of layer I to determine bearing capacity.

Design N = 13,

Use C = 0.55 kg/sqcm & $\Phi = 0^\circ$

Assume size of foundation = 5m x 10m

Cohesion, C = 5.50 t/sqm

Using $\phi = 0$ degree, the bearing capacity factors are:

$$N_c = 5.14$$

$$N_q = 1.00$$

$$N_\gamma = 0.00$$

Use,

Depth of Foundation = $D_f = 3$ M (Below Natural Ground level)

Width of Foundation = $B = 5$ M

Length of Foundation = $L = 10$ M

Overburden Pressure = $q = 3.000$ (Depth) x 0.90 (Submerged density) = 2.70 t/sqm (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.10 \quad S_q = 1.10 \quad S_\gamma = 0.80$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.12 \quad D_q = 1.00 \quad D_\gamma = 1.00$$

Computed Net Ultimate Bearing Capacity = 35.13 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 14.05 t/sqm

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters

Stratum II

Average N = 45

Use C = 1.45 kg/sqcm & $\Phi = 0^\circ$

Total soil modulus, $E_s = 4.4 \times N = 198$ kg/sqcm

Undrained Young's modulus, $E_u = K \times C = 500 \times 1.45 = 725$ kg/sqcm

Again, $1/E_s = 1/E_u + 1/E_d$ giving drained young's modulus, $E_d = 272.39$ kg/sqcm

Now, we have, $E_d = E_u/3 = 241.67$ kg/sqcm

Considering the above, let us use $E_d = 250$ kg/sqcm

From E_d , $m_{vc} = 1/G.E_d = 0.0067$ sqcm/kg [Geological Factor, $G = 0.60$ & $\mu = 0.35$]

Again from SPT "N", $m_{vc} = 1/5N = 0.0044$ sqcm/kg

Thus average $m_{vc} = [0.0067 + 0.0044]/2 = 0.0056$ sqcm/kg

Stratum III

Design corrected "N" in this layer = 59

Treating the sand as over consolidated sand, $E_s = 400 + 10.5N = 1019.50$ kg/sqcm

However, let us restrict the E_s value to 750 kg/sqcm

Use $G = 1.00$ & $\mu = 0.25$

Stratum IV

Use Young's modulus for layer IV = 1000 kg/sqcm

Project: Geotech. Inv. Work of FGD Package Area at 2x500 MW NTPC Mouda STPP.



Job No. : 4287

Sheet No.

SETTLEMENT CALCULATION

Settlement Analysis											
A) General Data:											
Width of foundation =	5.00	m									
Length of foundation =	10.00	m									
Depth of foundation =	4.0	m below FGL									
Net Base Pressure =	1.4	kg/sqcm									
B) Subsoil Properties:											
Layer - II				Layer - III				Layer - IV			
Young's Modulus =	725	kg/sqcm		Young's Modulus =	750	kg/sqcm		Young's Modulus =	1000	kg/sqcm	
Poisson Ratio, μ =	0.35			Poisson Ratio, μ =	0.25			Poisson Ratio, μ =	0.25		
Top of Stratum =	4.00	m		Top of Stratum =	7.31	m		Top of Stratum =	8.81	m	
End of Stratum =	7.31	m		End of Stratum =	8.81	m		End of Stratum =	14.00	m	
Geological factor, G =	0.60			Geological factor, G =	1.00			Geological factor, G =	1.00		
m_{vc} =	0.0056	sqcm/kg		m_{vc} =	0.0000	sqcm/kg		m_{vc} =	0.0000	sqcm/kg	
C) Calculation of Immediate Settlement:											
<i>Settlement at center</i>				<i>Settlement at center</i>				<i>Settlement at center</i>			
$M = L' / B' =$	2.000			$M = L' / B' =$	1.601			$M = L' / B' =$	1.510		
$N = H / B' =$	1.325			$N = H / B' =$	0.361			$N = H / B' =$	1.057		
$I_1 =$	0.183			$I_1 =$	0.023			$I_1 =$	0.142		
$I_2 =$	0.111			$I_2 =$	0.067			$I_2 =$	0.101		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.235		$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.068		$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.209	
Immediate settlement $S_i =$		0.397 cm		Immediate settlement $S_i =$		0.089 cm		Immediate settlement $S_i =$		0.186 cm	
$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$				$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$				$[q_o \times B' \times (1-\mu^2) \times m \times I_s] / E_s$			
<i>Settlement at corner</i>				<i>Settlement at corner</i>				<i>Settlement at corner</i>			
$M = L' / B' =$	2.00			$M = L' / B' =$	1.60			$M = L' / B' =$	1.510		
$N = H / B' =$	0.663			$N = H / B' =$	0.180			$N = H / B' =$	0.529		
$I_1 =$	0.065306			$I_1 =$	0.006			$I_1 =$	0.047		
$I_2 =$	0.096277			$I_2 =$	0.039			$I_2 =$	0.083		
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.110		$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.032		$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$		0.102	
Immediate settlement $S_i =$		0.093 cm		Immediate settlement $S_i =$		0.021 cm		Immediate settlement $S_i =$		0.045 cm	
Average S_i for Stratum II=	2.45	mm		Average S_i for Stratum III=	0.55	mm		Average S_i for Stratum IV=	1.16	mm	
Total immediate settlement =		4.16 mm		(for all the three layers)							
So, Total Settlement =		14.50 mm									
Fox's Depth correction Factor =		0.83									
Corrected total settlement =		12.01 mm									

So a net allowable bearing capacity of 14t/sqm can be used for depth of foundation of 4.00m below FGL with a limiting settlement of 25mm.

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Foundation around FGD Control Room Area, Depth of foundation = 4.00m below FGL (FGL= 271.000M)

NGL = 270.000M, FGL = 271.000M, So Depth of Fill = (271.00-270.00) = 1.00m

Depth of foundation = 4.00m below FGL i.e. 3.00m below NGL.

The founding level falls inside medium to stiff clay layer. i.e Layer I,

Average $N = 10$,

Use $C = 0.55 \text{ kg/sqcm}$ & $\Phi = 0^\circ$

Assume size of foundation = 5m x 10m

Cohesion, $C = 5.50 \text{ t/sqm}$

Using $\phi = 0$ degree, the bearing capacity factors are:

$$N_c = 5.14$$

$$N_q = 1.00$$

$$N_\gamma = 0.00$$

Use,

Depth of Foundation = $D_f = 3 \text{ M}$ (Below Natural Ground level)

Width of Foundation = $B = 5 \text{ M}$

Length of Foundation = $L = 10 \text{ M}$

Overburden Pressure = $q = 3.000 \text{ (Depth)} \times 0.90 \text{ (Submerged density)} = 2.70 \text{ t/sqm}$ (Assuming the ground water table is flushing with the ground level)

The Shape factors are [IS:6403 - 1981]

$$S_c = 1.10 \quad S_q = 1.10 \quad S_\gamma = 0.80$$

The Depth factors are [IS:6403 - 1981]

$$D_c = 1.12 \quad D_q = 1.00 \quad D_\gamma = 1.00$$

Computed Net Ultimate Bearing Capacity = 35.13 t/sqm

Using a factor of safety of 2.5, Net Safe Bearing Capacity = 14.05 t/sqm

The above bearing capacity should be checked against settlement criteria. This is shown below.

Determination of Deformation Parameters

Stratum I

Total soil modulus, $E_s = 4.4 \times N = 44 \text{ kg/sqcm}$

Undrained Young's modulus, $E_u = K \times C = 350 \times 0.55 = 192.50 \text{ kg/sqcm}$

Again, $1/E_s = 1/E_u + 1/E_d$ giving drained young's modulus, $E_d = 57.04 \text{ kg/sqcm}$

Now, we have, $E_d = E_u/3 = 64.17 \text{ kg/sqcm}$

Considering the above, let us use $E_d = 60 \text{ kg/sqcm}$

From E_d , $m_{vc} = 1/G.E_d = 0.0208 \text{ sqcm/kg}$ [Geological Factor, $G = 0.80$ & $\mu = 0.35$]

Again from SPT "N", $m_{vc} = 1/5N = 0.0200 \text{ sqcm/kg}$

Now, let us consider the m_{vc} value for the pressure range between 0.50 to 2.00 kg/sqcm

Sample No.	0.50 – 1.00kg/sqcm	1.00 - 2.00kg/sqcm
BH-04/UDS-01	0.0145	0.0119
BH-09/UDS-02	0.0129	0.0106
Weighted average m_{vc} over the pressure range	0.0121	

Giving more weightage to the laboratory test results,

Use $m_{vc} = [2 \times 0.0121 + 1 \times 0.0208 + 1 \times 0.0200]/4 = 0.0162 \text{ sqcm/kg}$

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Stratum II

Average N = 54

Use C = 1.50 kg/sqcm & $\Phi = 0^\circ$ Total soil modulus, $E_s = 4.4 \times N = 237.60$ kg/sqcmUndrained Young's modulus, $E_u = K \times C = 500 \times 1.50 = 750$ kg/sqcmAgain, $1/E_s = 1/E_u + 1/E_d$ giving drained young's modulus, $E_d = 347.78$ kg/sqcmNow, we have, $E_d = E_u/3 = 250$ kg/sqcmConsidering the above, let us use $E_d = 290$ kg/sqcmFrom E_d , $m_{vc} = 1/G \cdot E_d = 0.0063$ sqcm/kg [Geological Factor, $G = 0.55$ & $\mu = 0.35$]Again from SPT "N", $m_{vc} = 1/5N = 0.0037$ sqcm/kgThus average $m_{vc} = [0.0063 + 0.0037]/2 = 0.0050$ sqcm/kg**Stratum IV**

Use Young's modulus for layer IV = 1000 kg/sqcm

Settlement Analysis**A) General Data:**

Width of foundation =	5.00	m
Length of foundation =	10.00	m
Depth of foundation =	4.0	m
Net Base Pressure =	1.4	kg/sqcm

B) Subsoil Properties:**Layer - I**

Young's Modulus =	192.5	kg/sqcm
Poisson Ratio, μ =	0.35	
Top of Stratum =	4.00	m
End of Stratum =	4.60	m
Geological factor, G =	0.80	
m_{vc} =	0.0162	sqcm/kg

Layer - II

Young's Modulus =	750	kg/sqcm
Poisson Ratio, μ =	0.35	
Top of Stratum =	4.60	m
End of Stratum =	8.30	m
Geological factor, G =	0.55	
m_{vc} =	0.0050	sqcm/kg

Layer - IV

Young's Modulus =	1000	kg/sqcm
Poisson Ratio, μ =	0.25	
Top of Stratum =	8.30	m
End of Stratum =	14.00	m
Geological factor, G =	1.00	
m_{vc} =	0.0000	sqcm/kg

C) Calculation of Immediate Settlement:**Settlement at center**

$M = L' / B' =$	2.000
$N = H / B' =$	0.242
$I_1 =$	0.010
$I_2 =$	0.050
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.033
Immediate settlement $S_i =$	0.212 cm
$[q_0 \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.892
$N = H / B' =$	1.320
$I_1 =$	0.184
$I_2 =$	0.109
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.234
Immediate settlement $S_i =$	0.362 cm
$[q_0 \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at center

$M = L' / B' =$	1.537
$N = H / B' =$	1.224
$I_1 =$	0.172
$I_2 =$	0.101
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.240
Immediate settlement $S_i =$	0.220 cm
$[q_0 \times B' \times (1-\mu^2) \times m \times I_s] / E_s$	

Settlement at corner

$M = L' / B' =$	2.00
$N = H / B' =$	0.121
$I_1 =$	0.002579
$I_2 =$	0.027615
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.015
Immediate settlement $S_i =$	0.049 cm

Settlement at corner

$M = L' / B' =$	1.89
$N = H / B' =$	0.660
$I_1 =$	0.066
$I_2 =$	0.095
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.110
Immediate settlement $S_i =$	0.085 cm

Settlement at corner

$M = L' / B' =$	1.537
$N = H / B' =$	0.612
$I_1 =$	0.061
$I_2 =$	0.089
$I_s = I_1 + \{(1-2\mu) / (1-\mu)\} I_2 =$	0.120
Immediate settlement $S_i =$	0.055 cm

Average S_i for Stratum I=	1.31 mm
Total immediate settlement =	4.91 mm
So, Total Settlement =	22.87 mm
Fox's Depth correction Factor =	0.83
Corrected total settlement =	18.94 mm

Average S_i for Stratum II=	2.23 mm
(for all the three layers)	

Average S_i for Stratum IV=	1.38 mm

So a net allowable bearing capacity of 14t/sqm can be used for depth of foundation of 4.00m below FGL with a limiting settlement of 25mm.

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IN-SITU PERMEABILITY TEST IN OVERBURDEN (FALLING HEAD METHOD)

Test location BH-08
 Ground elevation 271.009M Static water level 1.40m below G.L.
 Diameter of hole (2R) 174.0mm Ht. of casing from GL 0.20m
 Inner diameter of casing/ intake pipe (d) 150.0mm
 Depth tested 0.80m to 1.50m
 Length of test section (L) 0.70m

Data sheet

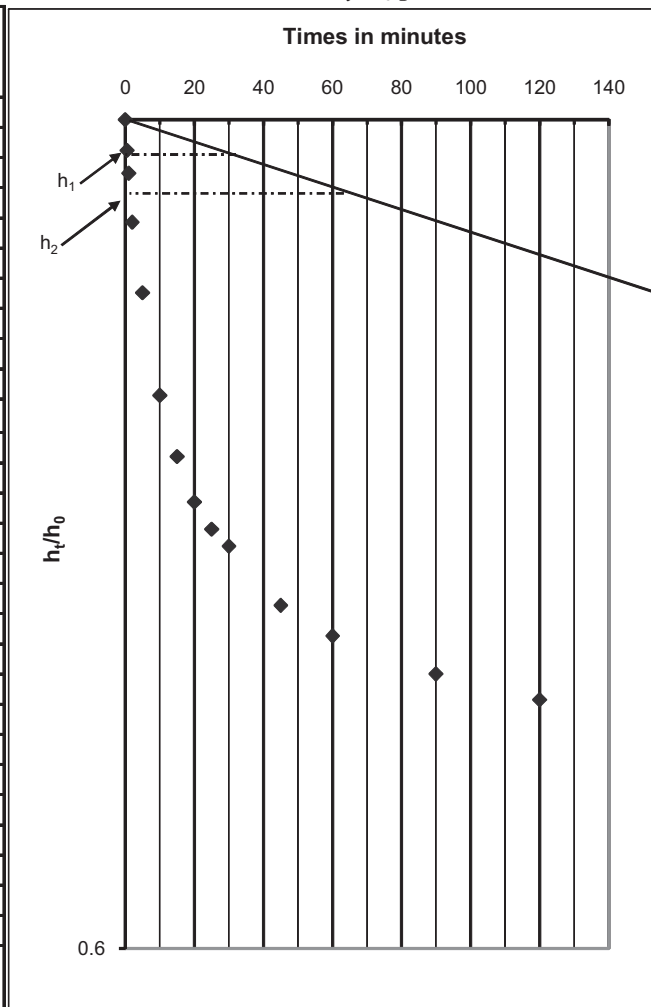
Time interval (minute)	Water level in intake pipe (cm)	h_t (cm)	h_t/h_0
0	0.00	160.000	1.0000
0.5	3.00	157.000	0.9813
1	5.20	154.800	0.9675
2	9.80	150.200	0.9388
5	16.20	143.800	0.8988
10	25.00	135.000	0.8438
15	30.00	130.000	0.8125
20	33.60	126.400	0.7900
25	35.70	124.300	0.7769
30	37.00	123.000	0.7688
45	41.40	118.600	0.7413
60	43.60	116.400	0.7275
90	46.30	113.700	0.7106
120	48.10	111.900	0.6994

From the above Graph, We have

$h_1 \rightarrow$	0.978	$t_1 \rightarrow$	30 min
$h_2 \rightarrow$	0.958	$t_2 \rightarrow$	60 min

$$K = \frac{d^2}{8L} \log_e \frac{L}{R} \frac{\log_e (h_1 / h_2)}{t_2 - t_1} \rightarrow 9.617E-06 \text{ cm/sec}$$

Legend: h_1 = head of water in the intake pipe at time t_1 above static water level,
 h_2 = head of water in the intake pipe at time t_2 above static water level;
 h_0 = depth of static water level at time t_0 ,
 h_t = head of water in the intake pipe at any time t

Time vs. h_t/h_0 plot

PART V: PHOTOGRAPHS

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Core box



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DCPT



