INTERIM GEOTECHNICAL INVESTIGATION REPORT

FOR

PROPOSED SAMSUNG PLANT

AT PLOT NO. – B-1, PHASE – II, SECTOR – 81,

NOIDA, UTTAR PARDESH

SUBMITTED TO

M/S EIE ENGINEERING INDIA PRIVATE LIMITED

H-79, L.G.L. Kalkaji,
New Delhi - 110019

PROJECT NO- 1632

DECEMBER- 2016

BY

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INTERIM REPORT ON
GEOTECHNICAL INVESTIGATION
FOR
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AT PLOT NO. – B-1, PHASE – II, SECTOR – 81,
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NOIDA, UTTAR PARDESH

1.0 INTRODUCTION:

1.1 This interim report presented herein deals with the field and laboratory investigations carried out by us to access the nature of sub-strata and to evaluate the soil parameters required for design of rehabilitation work at proposed Samsung Plant at Plot No. – B1, Phase – II, Sector – 81, Noida, Uttar Pradesh.

1.2 Client's help is gratefully acknowledged in providing borehole locations, close supervision and checking during boring, sampling, various testing operations and cooperation and guidance during preparation of report.

1.3 The work of Geotechnical Investigation was awarded to **M/s Sai Geotechnical Engineers Pvt. Ltd.**, 22, Indraprastha Apartment, 826, Shalimar Garden Ext-1, Sahibabad, Ghaziabad (U.P.) by **M/s EIE Engineering India Pvt. Ltd.**

1.4 This interim report is based upon the results of field and laboratory tests conducted on selected soil samples collected from one bore hole.

2.0 DETAILS OF SITE :

2.1 The details of the site & various test locations for the proposed project are shown in the figure. The proposed Project site is located at Plot No. – B1, Phase – II, Sector – 81, Noida, Uttar Pradesh.

3.0 SCOPE OF WORK:

The scope of work provided to us for this project was limited to the following:-

3.1 Mobilizing necessary plant, equipments and personnel to the project site, setting up the equipment, shifting of the equipment from one test location to another location, carrying out the field investigations on land and demobilization on completion of work.

3.2 Making 150 mm nominal diameter bore holes at various locations in all types of soil using suitable approved method of boring at the specified locations to be given at site by the Engineer-in-Charge up to desired depth or refusal whichever occurs earlier. Refusal shall mean when SPT field 'N' value reaches 100 for 30 cm or less penetration of SPT sampler.

3.2.1 Conducting standard penetration tests in the bore holes at 1.50/1.0m interval in depth & at every change of strata, whichever is earlier as per specifications / instructions of Engineer-in-Charge.

3.2.2 Collecting undisturbed soil samples from bore holes at 3.00 m interval in depth or at every change of strata, whichever is earlier as per specifications.

3.2.4 Collecting disturbed soil samples from bore holes at regular interval and at every identifiable change of strata to supplement the boring records.

3.2.5 Recording the depth of ground water table in all the bore holes if observed up to the depth of exploration during boring work as per specifications & withdrawing the casing pipe.

3.2.6 Conducting soil resistivity tests at ground level by Wenner's four electrode method as per IS: 3043 & relevant IS codes.

3.2.6 Conducting the following laboratory tests on selected disturbed / undisturbed soil samples collected from various bore holes / test locations :-

(a) Liquid Limit & Plastic Limit.
(b) Sieve Analysis
(c) Hydrometer Analysis.
(d) Tri-axial Shear Test (UUT).
(e) Direct Shear Test.
(f) Consolidation Test.
(g) Bulk & Dry Density.
(h) Natural Moisture Contents.
(i) Specific Gravity.
(j) Unconfined Compression Test

3.2 Preparation and submission of report in three copies.

4.0 FIELD INVESTIGATIONS:

4.1 Necessary plant, equipment and personnel for conducting the requisite field work were mobilized to the site. These were shifted from one test location to another location during execution of the field work and demobilized on satisfactory completion of the entire field work.

4.2 One bore hole carried out was first marked on the ground surface as per the layout given to us by the Engineer-in-Charge.

4.3 Bore hole was bored at this site using shell and auger and sand bailor method as per IS: 1892-1979. Casing as required was used to retain the bore hole.

4.3.1 Standard penetration tests were conducted in the above bore holes at every 1.50/1.00m interval & at change of strata as per specifications / instructions of Engineer-in-Charge. The bores were cleaned up to the desired depths. Standard split spoon sampler attached to lower end of 'A' drill rods was driven in the bore holes by means of standard hammer of 63.5 Kg. falling freely from a height of 75 cm. The sampler was driven 45 cm as per specifications & the numbers of blows required for each 15 cm penetration were recorded. The numbers of blows for the first 15 cm penetration were not taken into account. This was considered as seating drive. The numbers of blows for next 30 cm penetration were designated as SPT 'N' value. Wherever the total penetration was less than 45 cm, the number of blows & the depth penetrated is incorporated in respective bore logs. Disturbed soil samples obtained from standard split spoon sampler for all the above standard penetration tests were collected in polythene bags of suitable size. These samples were properly sealed, labelled, recorded and carefully transported to the laboratory for testing.

4.3.2 Undisturbed soil samples were collected from the bore holes at every 3.00 m interval in depth & at change of strata as per sampling specifications, in thin walled sampling tubes of 100 mm dia and 450 mm length fitted to an adopter with ball and socket arrangement. These sampling tubes after retrieval from the bore holes were properly waxed and sealed at both ends. These were carefully labeled and transported to the laboratory for testing. Undisturbed soil samples wherever slipped during lifting, were duly marked in the field bore logs as well as in the soil profile.

4.3.3 Disturbed soil samples were also collected from the bore holes at suitable depths/intervals to supplement the boring records. These samples were collected in polythene bags of suitable size. These samples were properly sealed, labeled, recorded & carefully transported to the laboratory for testing.

4.3.4 The ground water table was encountered in bore hole at 13.40m depth during the boring activity.

4.3.5 **Summary of bore hole:**

Borehole No	Depth of Soil (m)	Water table (m)
BH – 1	32.50	13.40

5.0 LABORATORY INVESTIGATIONS:

5.1 The following laboratory tests were conducted on selected soil samples recovered from various bore hole / test locations: -

(a) Liquid Limit & Plastic Limit.

(b) Sieve Analysis.

(c) Hydrometer Analysis.

(d) Tri-axial Shear Test (UUT).

(e) Direct Shear Test.

(f) Consolidation Test.

(g) Bulk & Dry Density.

(h) Natural Moisture Contents.

(i) Specific Gravity.

(j) Unconfined Compression Test

All the above laboratory tests were carried out as per relevant Indian Standards. All the soil samples were identified and classified as per IS: 1498-1970.

6.0 FINDING OF GEOTECHNICAL INVESTIGATION:

The study of bore logs/results of laboratory and other field tests as above from ground level reveal that:-

6.1 A**t the locations of BH-1**

The sub-soil strata: -

From existing ground surface to 2.50m depth consist of brownish clayey silt of low plasticity (CL), SPT field 'N' value is 3 showing very soft consistency of the strata.

From 2.50m to 8.50m depth consist of grayish fine sand (SP-SM), SPT field 'N' values ranges from 21 to 26 showing medium dense compactness of the strata.

From 8.50m to 15.00m depth consist of grayish clayey silt of medium plasticity (CI), SPT field 'N' values ranges from 09 to 18 showing stiff to very stiff consistency of the strata.

From 15.00m to 23.50m depth consist of grayish silty sand (SM), SPT field 'N' values ranges from 28 to 60 showing medium dense to very dense compactness of the strata.

From 23.50m to 32.50m depth consist of grayish fine sand (SM), SPT field 'N' values ranges from 64 to 95 showing very dense compactness of the strata.

The depth wise observed & corrected SPT values of subsoil strata are given in Soil Profile of respective bore holes.

7.0 TYPE AND DEPTH OF FOUNDATIONS:

Based upon the results of field investigations, laboratory test results, & further discussions held with the client, the following type of foundations have been analyzed herein below : -

- Pile Foundation
- Open Foundation

❖ PILE FOUNDATION:

Pile foundation is a feasible foundation scheme that may be designed where the loadings are heavy/medium, upper strata are loose/soft or filled up, and depth of water table is less. The pile load bearing capacity is calculated in accordance with IS: 2911(Part-I/Section -2) – 2010.

Piles in cohesion less soil

The ultimate bearing capacity of pile in homogeneous sand may be represented by the following formula:

$$Q_u = A_P (0.5 D_\gamma N_\gamma + P_D N_q) + \sum_{i=1}^{D} K P_{Di} \tan\delta A_{si}$$

Where
- A_P = Cross sectional area of pile toe in sq cm
- D = stem diameter in cm
- γ = effective unit weight of soil at pile toe in kg/sq cm
- P_D = effective overburden pressure at pile toe in kg/sq cm
- $N\gamma$, Nq = Bearing capacity factors
- A_{si} = Surface area of pile stem in sq cm
- K = Coefficient of Earth pressure
- d = Angle of wall friction between pile and soil

Piles in cohesive soil

The ultimate bearing capacity of pile in homogeneous sand may be represented by the following formula:

$Q_u = A_P \times N_c \times C_p + \alpha \times c \times A_s$

Where,

A_P = Cross Sectional Area of Pile Toe
N_c = Bearing Capacity factor usually Taken as 9.0
C_p = Average Undrained Cohesion at Pile Tip
α = Reduction factor = 0.5 for Bored Piles in stiff Clay
c = Average undrained cohesion along embedded length of pile
A_s = Surface area of pile Shaft.

- **OPEN SHALLOW FOUNDATIONS**:

The allowable bearing capacity of sub-soil strata for Open foundation has been computed from shear and settlement failure considerations.

Allowable Bearing Capacity

The net intensity of loading which the foundation will carry without undergoing settlement in excess of the permissible value for the structure under consideration but not exceeding net safe bearing capacity.

Net Safe Bearing Capacity from Shear consideration

For Clayey Soil ($\phi = 0$)

The values are computed from unconfined compressive strength UCS, using the following equation;

qd = C Nc Sc dc - Refer IS:6403, Clause 5.3

Where

qd = Net Ultimate bearing capacity

A factor of safety of 2.5 is used.
Considering $\phi = 0$, Nc = 5.14
Thus the equation is simplified as

$q_{(Net\ safe)}$ = 1 / 2.5 x C x 5.14 Sc dc
= 2.056 C Sc dc

For C - ϕ Soils

Refer IS: 6403 – 1981, Clause 5.1

General Shear Failure

$q_d = C N_c Sc\ dc + \gamma D (N_q - 1) S_q d_q + 0.5 \gamma B N\gamma S\gamma d\gamma W'$

Local Shear Failure

$q_{d'} = 2/3C N'_c Sc\ dc + \gamma D (N'_q - 1) S_q d_q + 0.5 \gamma B N\gamma' S\gamma d\gamma W'$

Where

qd and qd' are net ultimate bearing capacity for general and local shear failure

Net safe bearing capacity = 1 / 2.5 x Net ultimate bearing capacity

Bearing capacity factor shall be determined for ϕ for general shear failure and $\phi' = \tan^{-1}(0.67 \tan\phi)$ for local shear failure.

Shape and depth factors shall be determined as per IS: 6403-1981.

For cohesion less soil with e_o value less than 0.55, values are computed for General shear failure, for e_o values between 0. 55 to 0.75 the values are computed by linear interpolation between local and general shear failure, and for eo value greater than 0.75 the values are computed for local shear failure.

For footing resting on multilayer deposit, Bowls recommends that the ultimate bearing capacity of footing be determined using average values of cohesion, C_{av} and angle of shearing resistance, ϕ_{av}. The average values are computed over a depth H below the base of footing,

Where

H = 0.5 B tan (45 + ϕ/2)

Safe Bearing pressure from settlement Consideration.

For normal consolidated clay

Sf = Sc + Si
Sc = λ Soed
Si = $pB(1-\mu^2)$ I /E; will be negligible
μ = poission's ratio,
Soed = $\Sigma(h_I C_c /(1 + e_0)) \log_{10} ((\Delta p' + p_0') / p_0'))$
(Reference: clause 9.2.2.2 IS 8009 (Part I))

Where;

h_I = thickness of soil layer (m)
C_c = Compression index
e_0 = Initial void ratio
p_0' = effective overburden pressure (t/sq.m)
$\Delta p'$ = net increase in pressure at centre of cohesive soil layer

For pre compressed clays

S_1 = Sc (for fully saturated clays)
Sc = λ Soed; λ is taken from table – 1, IS: 8009 (Part – 1), 0.7
Soed = $\Sigma m_v h_I \Delta p$

(Reference: clause 9.2.2.3 IS 8009 (Part I))

Where;

h_I = thickness of soil layer (m)
m_v = Coefficient of volume compression
Δp = net increase in pressure at center of cohesive soil layer

If clays are lightly over consolidated, then the above method may be adopted but if the clay is heavily over consolidated, it may not be necessary to compute the settlement.

If the soil deposits consist of several regular soil layers in the influence zone, the settlement of each layer below the foundation shall be computed and summed to obtain the total settlement.

The settlement contribution by non cohesive / partially cohesive soil layer shall be estimated by the methods in clause 9.1, IS: 8009 (Part I); De Beer Marten method shall be used.

De Beer and Martens' Procedure

S_2 = $(2.303 / C_i) \log_{10} ((\Delta p + p_0') / p_0'))h_i$
h_I = thickness of soil layer (m)
C_i = a constant of compressibility = $3/2 (C_{kd} / p_0')$
C_{kd} = average static cone resistance
p_0' = effective overburden pressure (t/sq.m)
Δp = net increase in pressure at centre of non cohesive/ partially cohesive soil layer
Total settlement = $S_1 + S_2$

For purely non-cohesive soils

Settlement shall be determined for unit pressure for a specified width of footing based on Corrected SPT values between the level of base of footing and the depth equal to 1.5 to 2.0 times the width of footing. Corrections shall be applied as applicable. Refer; IS: 8009 (Part-1).

Recommended Foundations

Considering the expansive strata, type of proposed structures, expected loads and after discussion with client, following type of foundation can be recommended;

1) Open Isolated/Raft Footing

Type of Foundation	Depth, m	Size of Footing, m
Isolated	2.50 to 3.00	2.0 x 2.0 3.0 x 3.0

8.0 RECOMMENDATIONS

- Depending on the field and laboratory observations of subsoil strata, test results and the type of structures proposed at site, the types of foundations, depths and net safe bearing capacities recommended for design purposes are given in the following table. The net SBC/API in the following table are the lower of the values obtained from shear failure criterion as per IS: 6403 and settlement failure criterion as per IS: 8009, Part-I.

  Type of Foundation: Isolated footing

For Permissible settlement = 50.0 mm

Depth of Foundation (m)	Size of Foundation (m)	Net Safe Bearing Capacity (t/m^2)		
		Shear	Settlement (50mm)	Recommended
2.50	2.0 x 2.0	29.30	28.20	28.00
	3.0 x 3.0	29.60	23.40	23.00
3.00	2.0 x 2.0	35.50	29.40	29.00
	3.0 x 3.0	35.10	24.30	24.00

Notes:

- The ground water was encountered in the bore holes at the time of boring activities at site and for design purpose water table was considered at foundation depth.
- This recommendation is based on only one bore hole, final recommendation may change based on the results of other surrounding bore holes.

9.0 CLOSURE

We appreciate the opportunity given to us to submit this report. This presented report is based on observations and tests on samples collected from the boreholes as decided by the client. In case any difference is noticed in the field subsoil strata and reported subsoil strata during excavation please contact us before proceeding with further construction.

For SAI GEOTECHNICAL ENGINEERS PVT. LTD.

NAVIN BIHARI JOHARI
MANAGING DIRECTOR

BOREHOLE NO. : 1 **SHEET NO :** 11

Project : Soil Investigations work for proposed Samsung Plant at Sector -81, Noida, Uttar Pradesh

REDUCED LEVEL OF B/HOLE : 100.000 m

DATE STARTED : 29/11/2016
DATE COMPLETED : 01/12/2016

FIELD TEST RESULTS | LABORATORY TEST RESULTS

ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	DEPTH OF SAMPLE BELOW REFERENCE LEVEL	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE / L.W.L	SPT TEST RESULTS					DIA. OF CASING USED (MM)	SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (t / cum.)	DRY DENSITY (t/cum)	MOISTURE CONTENT (%)	SPECIFIC GRAVITY	SHEAR STRENGTH CHARACTERISTICS		Voide ratio (e_o)	Compression (C_c)
						DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N, VALUE (Recorded)	N, VALUE (Corrected)					GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)								Cohesion, C, (Kg/sqcm.)	Angle of friction (Degrees)		
100.00	0.0	DS	0.00	1		0.00 - 0.45					150		Brownish Clayey silt of low plasticity **(CL)**		0	7	80	13											
99.00	1.0	SPT	1.50	1		1.50 - 1.95	3	30	3	4									33	21	12								
98.00	2.0	UDS	2.50	1		2.50 - 2.95								DST	0	91	9	0	N	P	-	1.68	1.56	7.6	2.62	0.00	31	0.679	
97.00	3.0	SPT	3.00	2		3.00 - 3.45	21	30	21	29																			
96.00	4.0	SPT	4.50	3		4.50 - 4.95	26	30	26	28			Grayish fine sand **(SP-SM)**																
95.00	5.0	UDS*	5.50	2		5.50 - 5.95								DST					N	P	-	1.76	1.62	8.9	2.63				
94.00	6.0	SPT	6.00	4		6.00 - 6.45	23	30	23	22					0	92	8	0											
93.00	7.0	SPT	7.50	5		7.50 - 7.95	21	30	21	19																			
92.00	8.0	UDS*	8.50	3		8.50 - 8.95								UUT	0	9	74	17	41	24	17	1.73	1.49	16.2	2.69	0.53	9		
91.00	9.0	SPT	9.00	6	14.30 m	9.00 - 9.45	9	30	9	9																			
90.00	10.0	SPT	10.50	7		10.50 - 10.95	15	30	15	15																			
89.00	11.0	UDS	11.50	4		11.50 - 11.95							Grayish clayey silt of medium plasticity **(CI)**	UUT	0	12	69	19				1.84	1.55	18.9	2.69			0.735	0.133
88.00	12.0	SPT	12.00	8		12.00 - 12.45	17	30	17	17																			
87.00	13.0	SPT	13.50	9		13.50 - 13.95	18	30	18	18																			
86.00	14.0	UDS	14.50	5		14.50 - 14.95													38	23	15	1.94	1.59	21.7		0.90	6		
85.00	15.0	SPT	15.00	10		15.00 - 15.45	28	30	28	17																			
84.00	16.0	SPT	16.50	11		16.50 - 16.95	38	30	38	20					5	84	11	0	N	P	-								
83.00	17.0	UDS	17.50	6		17.50 - 17.95							Grayish Silty Sand **(SM)**	DST+											2.63	0.00	33		
82.00	18.0	SPT	18.00	12		18.00 - 18.45	46	30	46	22																			
80.00	19.0																												

NOTE : 1. CLASSIFICATION OF SOIL AS PER IS : 1498

2. ABBREVATION USED : DS = DISTURBED SAMPLE UDS = UNDISTURBED SAMPLE UU = UNCONSOLIDATED UNDRAINED DST = DIRECT SHEAR TEST

BORE LOG CHART AND DATA SHEET

BOREHOLE NO. : 1 **SHEET NO :** 12

Project : Soil Investigations work for proposed Samsung Plant at Sector -81, Noida, Uttar Pradesh **DATE STARTED : 29/11/2016**

REDUCED LEVEL OF B/HOLE : 100.00 m **DATE COMPLETED : 01/12/2016**

FIELD TEST RESULTS | LABORATORY TEST RESULTS

ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	DEPTH OF SAMPLE BELOW REFERENCE LEVEL	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE / L.W.L	SPT TEST RESULTS					DIA. OF CASING USED (MM)	SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)		BULK DENSITY (t / cum.)	DRY DENSITY (t/cum)	MOISTURE CONTENT (%)	SPECIFIC GRAVITY	SHEAR STRENGTH CHARACTERISTICS		Voide ratio (e_o)	Compression (C_c)
						DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N. VALUE (Recorded)	N. VALUE (Corrected)					GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)								Cohesion, C_c (t/sqm.)	Angle of friction (Degrees)		
80.00	19.0																												
80.00	20.0	SPT	19.50	13		19.50 - 19.95	54	30	54	24					0	80	20	0	N	P	-								
79.50	20.5	UDS	20.50	7		20.50 - 20.95							Grayish Silty Sand **(SM)**												2.63				
79.00	21.0	SPT	21.00	14		21.00 - 21.45	58	30	58	25					0	84	16	0	N	P	-								
78.00	22.0	SPT	22.50	15		22.50 - 22.95	60	30	60	25																			
77.00	23.0	UDS	23.50	8		23.50 - 23.95								DST+	5	84	11	0	N	P	-	1.99	1.68	18.2	2.62	0.00	35		
76.00	24.0	SPT	24.00	16		24.00 - 24.45	64	30	64	26																			
75.00	25.0	SPT	25.50	17	14.30 m	25.50 - 25.95	68	30	68	27	150																		
74.00	26.0	UDS	26.50	9		26.50 - 26.95									12	79	9	0	N	P	-				2.62				
73.00	27.0	SPT	27.00	18		27.00 - 27.45	77	30	77	29			Grayish fine sand **(SP-SM)**																
72.00	28.0	SPT	28.50	19		28.50 - 28.95	82	30	82	30				DST+												0.00	36		
71.00	29.0	UDS	29.50	10		29.50 - 29.95									8	82	10	0	N	P	-				2.60				
70.00	30.0	SPT	30.00	20		30.00 - 30.45	87	30	87	31																			
67.50	32.5	SPT	32.50	21		32.50 - 32.95	95	30	95	32																			

NOTE : 1. CLASSIFICATION OF SOIL AS PER IS : 1498

2. ABBREVATION USED : DS = DISTURBED SAMPLE UDS = UNDISTURBED SAMPLE UU = UNCONSOLIDATED UNDRAINED DST = DIRECT SHEAR TEST

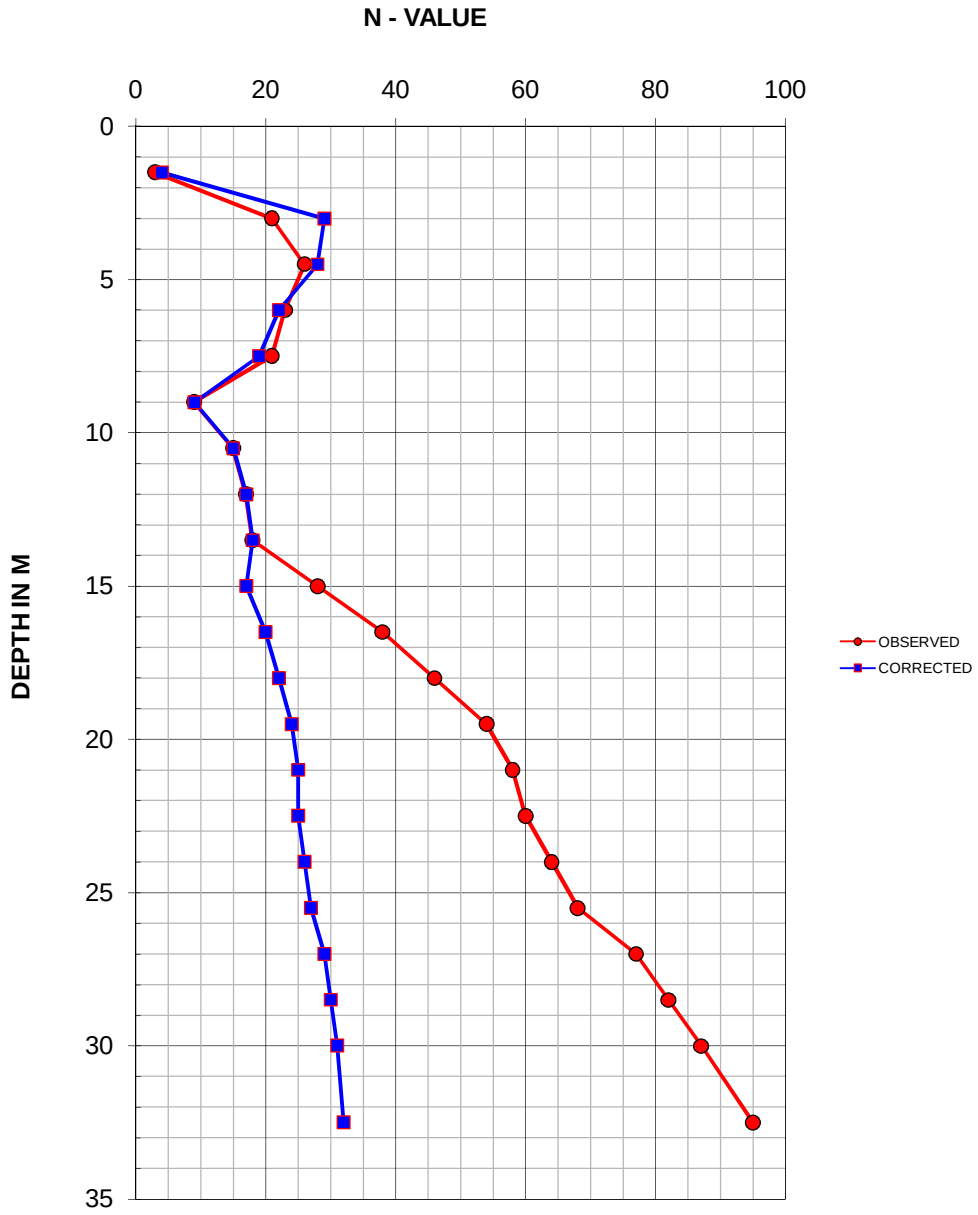
BORE LOG CHART AND DATA SHEET

SAI GEOTECHNICAL ENGINEERS PVT. LTD

Project : Soil Investigations work for proposed Samsung Plant at Sector - 81, Noida, Uttar Pradesh

STANDARD PENETRATION TEST CURVES

BOREHOLE NO. : 1



BEARING CAPACITY CALCULATION SHEETS

BEARING CAPACITY ANALYSIS FOR SHALLOW FOUNDATIONS

LAYERED SOILS Analysis as per IS 6403-1981

Project : **Soil Investigation work for Proposed Samsung Plant at Plot No. - B1, Phase - II, Sector - 81, Noida, Uttar Pradesh**

The bearing capacity equation is as follows :

$$q_{net\ safe} = (1/FS)\{c_{equi}Nc\zeta_c d_c + q(N_q - 1)\zeta_q d_q + 0.5B\gamma N_\gamma \zeta_\gamma d_\gamma R_w\}$$

where:

$q_{net\ safe}$ = safe net bearing capacity

c_{equi} = equivalent cohesion intercept

q = overburden pressure

B = Foundation width

γ = Bulk density of soil below founding level

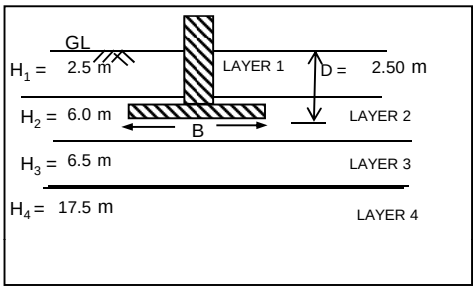
N_c, N_q, N_γ = bearing capacity factors, which are a function of ϕ_{equi}, equivalent ϕ

R_w = Water table correction factor

d_c, d_q, d_γ = Depth factors

FS = Factor of safety

ζ_c, ζ_q, ζ_γ = Shape factors



Layer No.	Depth, m From	Depth, m To	c t/m²	ϕ deg.	γ t/m³
1	0.0	2.5			1.50
2	2.5	8.5	0.0	31	1.68
3	8.5	15.0	5.3	9	1.73
4	15.0	32.5	0.0	35	1.94

Reference : Foundation Analysis and Design by J.E.Bowles, fifth edition (1995)

$$H_{equi} = 0.5\,B\tan(45 + \phi_{equi}/2) = H_1 + H_2 + H_3 + \ldots$$

$$\tan\phi_{equi} = \frac{H_1\tan\phi_1 + H_2\tan\phi_2 + H_3\tan\phi_3 + \ldots}{H_{equi}}$$

$$c_{equi} = \frac{c_1 H_1 + c_2 H_2 + c_3 H_3 + \ldots}{H_{equi}}$$

where

H_{equi} = Effective Depth of influence of foundation of width B

ϕ_{equi} = Equivalent angle of internal friction

c_{equi} = Equivalent cohesion intercept

Width of Foundation	B	=	2.0 m
Length of Foundation	L	=	2.0 m
Type of Foundation		=	Square
RL of Borehole level		=	100.00 m
RL of proposed Foundation level		=	97.50 m
Depth of foundation	D_f	=	2.50 m

Equivalent Shear Parameters

ϕ_{equi} = 31.00 °

c_{equi} = 0.00 t/m²

DESIGN PARAMETERS

ϕ_{Design} = 31.0 °

c_{Design} = 0.00 t/m²

Bearing capacity Calculation (Ref. IS 6403 : 1981)

Width of Foundation	B	=	2.0	m
Length of Foundation	L	=	2.0	m
RL of existing ground level		=	100.0	m
RL of proposed Foundation level		=	97.5	m
Depth of foundation	D_f	=	2.50	m
Design Depth of GWT from ground level	d_w	=	2.50	m
Inclination of the footing	α	=	0	deg.
Unit weight of soil	$\gamma_{\beta\upsilon\lambda\kappa}$	=	1.68	t/m^3
Unit weight of water	γ_w	=	1.0	t/m^3
Effective overburden pressure	$\gamma'.D_f$	=	3.75	t/m^2
Cohesion	C	=	0.00	t/m^2
Angle of internal friction	ϕ_{des}	=	31.0	deg
Void Ratio		=	0.679	

Failure Mode **INTERMEDIATE**

Bearing Capacity Calculations

Local Shear Failure

Mobilised cohesion	c'	=	0.000	t/m^2
Mobilised angle of internal friction	ϕ'	=	21.83	deg

Bearing Capacity Factors	*Shape Factors*	*Depth Factors*	*Inclination Factors*	*Water table correction*
Nc = 16.69	Sc = 1.30	dc = 1.37	i_c = 1.00	dw = 2.50 m
Nq = 7.69	Sq = 1.20	dq = 1.22	i_q = 1.00	Df+B = 4.5 m
Nγ = 6.960	Sγ = 0.80	dγ = 1.22	i_γ = 1.00	W' = 0.5

dw = depth of water table

Ultimate bearing capacity $q_u = C.N_c\, s_c d_c i_c + q(N_{q-1}) s_q d_q i_q + 0.5\, \gamma_{sat}.B\, N_g\, s_\gamma\, d_\gamma\, i_\gamma\, W`$

q_u = 42.5 t/m^2

Factor of safety FOS = 2.5 as per IS 1904-1986

Safe bearing capacity (q_u/FOS) q_{slocal} = **16.98** t/m^2

General Shear Failure

Mobilised cohesion	c'	=	0	t/m^2
Mobilised angle of internal friction	ϕ'	=	31.00	deg

Bearing Capacity Factors	*Shape Factors*	*Depth Factors*	*Inclination Factors*	*Water table correction*
Nc = 32.67	Sc = 1.30	dc = 1.44	i_c = 1.00	Df+B = 4.5 m
Nq = 20.63	Sq = 1.20	dq = 1.22	i_q = 1.00	dw = 2.50 m
Ng = 25.99	Sg = 0.80	dg = 1.22	i_γ = 1.00	W' = 0.5

dw = depth of water table

Ultimate bearing capacity $q_u = C.N_c\, s_c d_c i_c + q(N_{q-1}) s_q d_q i_q + 0.5\, \gamma_{sat}.B\, N_g\, s_\gamma\, d_\gamma\, i_\gamma\, W`$

q_u = 129 t/m^2

Factor of safety FOS = 2.5 as per IS 1904-1986

Safe bearing capacity (q_u/FOS) $q_{sgeneral}$ = **51.7** t/m^2

c) Interpoplation

after interploating for the actual failure case from the above general and local failure modes,

q_s = **29.30** t/m^2

Settlement Failure Consideration

Allowable Settlement Consideration	=	50.0 mm
Load Intensity assumed at Foundation depth	=	10.0 t/m^2
Depth of Footing	=	2.5 m
Width of Footing	=	2.0 m
Length of Footing	=	2.0 m
Depth of Influence zone below Foundation depth	=	3.0 m

Layer No	Depth		Layer Thickness	Effective Layer Thickness	Type of strata	Corr. Av. SPT N Value
	From	to				
1	2.5	8.5	6.0	3.00	Coarse Grained	20
2	8.5	15.0	6.5	0.00	Fine Grained	14
3	15.0	32.5	17.5	0.00	Coarse Grained	17

Layer - 1

The Settlement of coarse grained strata layers comprising of Silty Sand layers within Influence zone were computed by using the Chart of Settlement Vs SPT N value as per IS: 8009 Part -I.

Thickness of Layer = 3.0
Average SPT 'N' value = 20

Settlement under 10 t/m^2 : 12.85 mm From Figure 9 of IS:8009 Part -I

Hence total settlement = 12.85 mm

Water Correction Factor = 0.50

Rigidity Correction Factor = 1.00

Corrected Settlement = 25.69 mm

Layer - 2

The Settlement of fine grained strata layers comprising of clayey silt/Sandy Silt layers within Influence zone were computed by using thethe following equation as per IS:8009, Part - I :

$S = m_v \times \Delta p \times H$

Where,

m_v = Coeffcient of volume compressibilty (cm^2/kg) = 0.0172 cm^2/kg

Δp = Effective Pressure (kg/cm^2) = 1.60 t/m^2

H = Thickness of Layer (cm) = 0 cm

Settlement = 0.00 mm

Layer - 3

The Settlement of coarse grained strata layers comprising of Silty Sand layers within Influence zone were computed by using the Chart of Settlement Vs SPT N value as per IS: 8009 Part -I.

Thickness of Layer =	0.0		
Average SPT 'N' value =	17		
Settlement under 10 t/ m^2 :	15.60	mm	From Figure 9 of IS:8009 Part -I
Hence total settlement =	15.60	mm	
Water Correction Factor =	0.50		
Rigidity Correction Factor =	1.00		
Corrected Settlement =	0.00	mm	

Rigity Factor =	1	
Depth Factor =	0.690	
Total settlement =	25.69	mm
Corrected Settlement =	17.73	mm
Permissible settlement =	50.0	mm

Net allowable Bearing pressure for permissible settlement

= 28.20 t/m^2

GEOTECHNICAL INVESTIGATION REPORT FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

SUBMITTED TO

EIE ENGINEERING INDIA PVT. LTD.

H-79, L.G.F KALKAJI, NEW DELHI

REPORT NO. 16083 ON DATED 22.12.2016

SUBMITTED BY

UV GLOBAL GEO SOLUTIONS PVT. LTD.

GEOTECHNICAL CONSULTANTS & LAND SURVEYORS

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TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This soil investigation work, whose results are being presented herewith, has been carried out for the Proposed Samsung Plant at Noida, U.P. The Proposed structure may consist of with/without single basement.

The Total scope of investigation included to drill 15 nos. of boreholes to 30.0-40.0m depth. This report presents the recommendations for 6 nos. of boreholes (BH-2, BH-7, BH-17, BH-21, BH-23 & BH-31). BH-23 was drilled from 3.5m depth below NGL.

1.2 PURPOSE OF INVESTIGATION

The purpose of this study are to investigate the stratigraphy at the site and to develop geotechnical recommendations for foundation design and construction. To achieve these purposes, the following study was conducted at the site.

(a) Drilling 6 boreholes (BH-2 to 40.0m, BH-7 to 30.0m, BH-17 to 36.0m, BH-21 to 30.0m, BH-23 to 31.5m & BH-31 to 32.0m) depth or Refusal whichever met earlier, through Soil and to collect disturbed and undisturbed soil samples.

(b) Laboratory testing for selected soil samples to determine different properties of the soils; and

(c) Analyzing all field and laboratory data in order to develop engineering recommendations for foundation design and construction.

(d) Preparation and submission of technical report.

2.0 FIELD INVESTIGATIONS CONDUCTED

Locations of Boreholes have been marked at the site as per the approved drawing provided by the client to us. These locations have been marked as BH-2, BH-7, BH-17, BH-21, BH-23 and BH-31 in this report.

2.1 BOREHOLES PROCEDURE

The boreholes were progressed to the specified depth of 30.0m-40.0m. The work was done in accordance with IS:1892-1979.

Standard Penetration Tests (SPT) were conducted in the borehole at 1.5-3.0m interval by connecting a split spoon sampler to 'A' rods and driving it by 45 cm using a 63.5 kg hammer falling freely from a height of 75 cm. The tests were done in accordance with IS:2131-1981.

The number of blows for each 15 cm of penetration was recorded. The blows required to penetrate the initial 15 cm of the split spoon for seating the sampler is ignored due to the possible presence of loose materials or cuttings from the drilling operation. The cumulative number of blows required to penetrate the balance 30 cm of the 45 cm sampling interval is termed the SPT value or the 'N' value.

Disturbed samples were collected from the split spoon after conducting SPT. The samples were preserved in transparent polythene bags. Undisturbed samples were collected by attaching a 100 mm diameter thin walled 'Shelby' tubes and driving the sampler lightly using a 63.5 kg hammer in accordance with IS:2132 .

2.2 GROUND WATER

Groundwater level in the boreholes was recorded after 24 hours after drilling was completed. It is mentioned in the borehole logs attached with the report.

3.0 LABORATORY TESTS

The following table presents the various tests conducted on Soil samples in the laboratory:

Laboratory Test	IS : Code Referred
Natural moisture content	IS : 2720 (Part-2)-1973
Grain size analysis	IS : 2720 (Part-4)-1985
Liquid & Plastic limit	IS : 2720 (Part-5)-1985
Unconsolidated Undrained Triaxial shear test	IS : 2720 (Part-11)-1993
Consolidated Drained Direct Shear Test	IS : 2720 (Part-13)-1986
Unconfined Compression Test	IS : 2720 (Part-10)-1991
Specific Gravity Test	IS : 2720 (Part-3)-1980

All test Results are being presented at Table no 1 to 6 of soil profiles & Fig. No. 7 to 55 attached in the report.

4.0 SITE CONDITIONS

4.1 SITE STRATIGRAPHY

The soils met at the site are light brown Sandy silt/Silty sand & Fine sand in alternate layers from ground surface to the final explored depth of 30.0m-40.0m.

The SPT values at site range from 5 to 15 to about 5.0m depth & from 20 to 27 to about 10.5m. Below this, SPT values range from 23 to 48 to about 15.0m depth & from 62 to Refusal(N>100) to final explored depth of 40.0m.

4.2 GROUND WATER TABLE

Groundwater was encountered to about **13.20m-13.30m** depth below ground surface during our field investigation (December, 2016). Fluctuations may occur in measured water table due to variation in rainfall and surface evaporation rates.

5.0 LIQUEFACTION ANALYSIS

As per IS 1893-2002, liquefaction is likely in Sand strata below water table for SPT values less than 15. At this site, groundwater was encountered at about 13.20m-13.30m depth below ground surface. The soils classify primarily as Sandy Silt (CL) /Fine Sand(SP-SM) below foundation level.

The SPT values at site range from 5 to 15 to about 5.0m depth & from 20 to 27 to about 10.5m. Below this, SPT values range from 23 to 48 to about 15.0m depth & from 62 to Refusal(N>100) to final explored depth of 40.0m.

On review of all soil parameters like, SPT values, Soil gradation, Depth to water table etc., we are of the opinion that the liquefaction is not likely to take place at this site.

6.0 FOUNDATION TYPE & DEPTH

Reviewing the site stratigraphy, SPT 'N' values & laboratory test results, we recommend that Isolated open spread foundation at or below 2.0m depth below the existing ground surface may be provided at the site to support the structural loads. Recommendations for Isolated foundations are provided in section 8.1 of this report.

Alternatively, Raft foundations may also be provided. We recommend a minimum foundation embedment depth of 3.5m below existing ground surface for single basement. Recommendations for Raft foundations are provided in section 8.2 of this report.

7.0 CONCEPT OF ANALYSIS FOR OPEN FOUNDATIONS

Bearing capacity analysis for Open spread foundations/Raft foundation have been done in general accordance with IS:6403-1981.For the soil conditions encountered at this site, average of local and general shear failure conditions has been used for analysis.

Settlement analysis has been performed based on the SPT values as per chart given in IS:8009 Part-I-1976. As per IS 1904-1986, the tolerable total settlement is taken as 50 mm for Isolated Open Spread foundation and 75mm for Raft foundation.

Appropriate values have been substituted into the bearing capacity equation given in IS-6403 to compute the safe net bearing capacity. The values have been checked to determine the settlement of the foundation under the safe bearing pressure. The allowable bearing pressure has been taken as the lower of the two values computed from the bearing capacity shear failure criterion as well as that computed from the tolerable settlement criterion. The same has been recommended for the design.

8.0 RECOMMENDATIONS

8.1 OPEN FOUNDATION

The following table presents our recommended values of Net allowable bearing pressure for Isolated Open Spread foundations bearing at or below 2.0m depth below the existing ground surface for 2-5 m wide foundations.

Foundation Depth below existing ground level, m	Recommended Net Allowable Bearing Pressure, T/m²
2.0	12.4
3.0	15.0
3.5	16.6
4.5	19.5

The above values include a safety factor of 2.5. Total settlement of foundation designed for the above net bearing pressure is expected to be about 50 mm. Net bearing pressure for foundations at intermediate depths may be interpolated linearly between the values given above.

8.2 RAFT FOUNDATIONS

The following table presents our recommended values of Net and Gross allowable bearing pressures and Modulus of sub grade reaction for Raft foundations (≥6 m) bearing at or below 3.5m depth below the existing ground surface for 75 mm settlement.

Foundation Depth below EGL, m	Recommended Net Allowable Bearing Pressure, T/m²	Recommended Gross Allowable Bearing Pressure, T/m²	Modulus of Sub grade reaction(*), Kg/cm³
3.5	19.5	25.1	1.1
4.5	21.4	28.6	1.2

For intermediate foundation depths, allowable bearing pressure values & Modulus of sub grade reaction values may be linearly interpolated. These values include a Safety Factor of 2.5.

Note:

As no Plate Load tests have been conducted at the site, the Modulus of Sub-grade reaction (*) values for Raft foundation given in above table are based purely on empirical formula. A suitable safety factor has been used for evaluation the same. It is recommended that these values of Modulus of Sub-grade reaction should be reconfirmed by Plate Load Tests.

9.0 BASEMENT DESIGN

The basement should be designed to resist lateral earth pressure. For design purpose, we recommend the following values of co-efficient of earth pressures for the active, passive and at rest condition.

Depth, m		k_a	k_p	k_o
From	To			
3.5	4.5	0.35	2.85	0.52

where:

k_a = Co-efficient of active earth pressure
k_p = Co-efficient of passive earth pressure
k_o = Co-efficient of earth pressure at rest

A suitable safety factor should be applied on the passive earth pressures in the design of the wall.

10.0 EXCAVATION

Temporary open cut excavation through soil to about 3.5m-4.5m depth for foundation construction may be done using side slopes of 1.0 vertical on 0.5-0.6 horizontal.

.

A 1.2-1.5m wide Berm also may provided at every 3.0m interval at the site. The excavation slopes should be monitored by the engineer to ensure stability. In case excessive sloughing or caving occurs, the slopes may be flattened further to ensure stability. In case, sufficient space is not available, sheet piles or contiguous piles may be provided at the site.

11.0 CLOSURE

We are thankful to client to provide the opportunity to perform this investigation by us. We have pleasure in submitting this report. Please contact us when we can be of further service to you.

For UV GLOBAL GEO SOLUTIONS PVT. LTD.

(PUSHPENDRA KUMAR)
DIRECTOR

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 2

WATER TABLE : 13.25m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to Medium dense light brown Sandy Silt,low plastic (CL) Loose, 0.0m to 0.5m														
SPT1	1.50 1.95	11	Medium dense, 0.5m to 3.0m	2	21	65	12	28.8	19.1	9.7	2.67						
UDS1	2.25 2.55											1.68	1.52	10.2	1,2,3 (UUT)	0.50	8^o
			(3.0m)														
SPT2	3.00 3.45	13	Medium dense light brown Silty Sand (SM)														
			(4.5m)														
SPT3	4.50 4.95	14	Medium dense light grey Fine Sand (SP-SM)														
UDS2	5.25 5.55																
SPT4	6.00 6.45	20		0	94	6	0	N.P.	N.P.		2.63						
SPT5	7.50 7.95	25															
UDS3	8.25 8.55											1.75	1.56	12.1	0.5,1.0 1.5 (DST)	0.00	33^o
			(9.0m)														
SPT6	9.00 9.45	8	Loose to Dense light brown Sandy Silt, low plastic (CL) Loose,9.0m to 10.5m														
SPT7	10.50 10.95	34	Dense, 10.5m to 11.0m														

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 2

WATER TABLE : 13.25m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)	6	33	50	11	28.5	20.1	8.4	2.67	1.80	1.59	13.4	1,2,3 (UUT)	0.85	10^o
SPT8	12.00 12.45	23	(13.5m)														
SPT9	13.50 13.95	30	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 13.5m to 18.0m														
UDS5	14.25 14.55																
SPT10	15.00 15.45	38															
UDS6	17.25 17.55																
SPT11	18.00 18.45	62	Very dense, 18.0m to 21.0m	0	92	8	0	N.P.	N.P.		2.64						
UDS7	20.25 20.55		(21.0m)									1.96	1.66	17.8	0.5,1.0 1.50 (DST)	0.00	35^o
SPT12	21.00 21.45	72	Dense to Very dense light brown Sandy Silt, low plastic (CL) Very dense, 21.0m to 24.0m														
UDS8	23.25 23.55			2	22	65	11	28.3	19.7	8.6	2.68						
SPT13	24.00 24.45	36	Dense, 24.0m to 27.0m														
UDS9	26.25 26.55		(27.0m)									2.03	1.68	20.8	1,2,3 (UUT)	1.45	9^o

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 2

WATER TABLE : 13.25m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	92	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55																
SPT15	30.00 30.45	92		0	90	10	0	N.P.	N.P.		2.64						
								N.P. : Non Plastic									
UDS11	32.25 32.55																
SPT16	33.00 33.45	90															
UDS12	35.25 35.55											2.08	1.74	19.8	0.5,1.0 1.50 (DST)	0.00	37^o
SPT17	36.00 36.45	91															
													DST:Drained Direct Shear Test				
UDS13	38.25 38.55																
SPT18	40.00 40.45	74	(40.00m)	0	92	8	0	N.P.	N.P.		2.63						

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 7

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 2

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Medium dense light brown Sandy Silt, low plastic (CL)	0	16	73	11	28.6	19.9	8.7	2.67						
SPT1	1.50 1.95	13	Medium dense light grey Fine Sand (SP-SM)														
UDS1	2.25 2.55																
SPT2	3.00 3.45	12															
SPT3	4.50 4.95	15															
UDS2	5.25 5.55											1.72	1.55	10.9	0.5,1.0 1.5 (DST)	0.00	32^o
SPT4	6.00 6.45	22		0	92	8	0	N.P.	N.P.		2.63	DST:Drained Direct Shear Test					
SPT5	7.50 7.95	23						N.P. : Non Plastic									
UDS3	8.25 8.55		(9.0m)									1.75	1.57	11.6	0.5,1.0 1.5 (DST)	0.00	33^o
SPT6	9.00 9.45	20	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	27															

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 7

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 2a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense to Dense light brown Sandy Silt, low plastic (CL) Medium dense, 9.0m to 12.0m	6	30	51	13	29.2	19.3	9.9	2.68	1.82	1.61	13.0	1,2,3 (UUT)	0.90	9^o
SPT8	12.00 12.45	45	Dense, 12.0m to 13.5m												UUT : Unconsolidated Undrained Triaxial Shear Test		
			(13.5m)														
SPT9	13.50 13.95	38	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 13.5m to 18.0m														
UDS5	14.25 14.55																
SPT10	15.00 15.45	42															
UDS6	17.25 17.55			2	94	4	0	N.P.	N.P.		2.63	1.93	1.65	16.9	0.5,1.0 1.50 (DST)	0.00	36^o
								N.P. : Non Plastic									
SPT11	18.00 18.45	81	Very dense, 18.0m to 30.0m												DST:Drained Direct Shear Test		
UDS7	20.25 20.55																
SPT12	21.00 21.45	84															
UDS8	23.25 23.55																
SPT13	24.00 24.45	90		0	94	6	0	N.P.	N.P.		2.64						
UDS9	26.25 26.55											2.01	1.70	18.4	0.5,1.0 1.50 (DST)	0.00	35^o

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 7

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 2b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	98	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55						N.P. : Non Plastic										
SPT15	30.00 30.45	99	(30.0m)	0	92	8	0	N.P.	N.P.		2.64						

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 17

WATER TABLE : 13.30m

TERMINATION DEPTH (M) 36.0m

TABLE NO. 3

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to Medium dense light brown Sandy Silt, low plastic (CL) Loose, 0.0m to 0.5m														
SPT1	1.50 1.95	10	Medium dense, 0.5m to 3.0m														
UDS1	2.25 2.55			4	18	68	10	28.3	19.9	8.4	2.66	1.66	1.50	10.5	1,2,3 (UUT)	0.50	9^o
			(3.0m)														
SPT2	3.00 3.45	11	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	17															
UDS2	5.25 5.55																
SPT4	6.00 6.45	15															
SPT5	7.50 7.95	26		8	81	11	0	N.P.	N.P.		2.64						
UDS3	8.25 8.55											1.75	1.56	12.3	0.5,1.0 1.5 (DST)	0.00	31^o
			(9.0m)														
SPT6	9.00 9.45	28	Medium dense to Dense light brown Sandy Silt, low plastic (CL) Medium dense, 9.0m to 10.5m														
SPT7	10.50 10.95	31	Dense, 10.5m to 11.0m														

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 17

WATER TABLE : 13.30m

TERMINATION DEPTH (M) 36.0m

TABLE NO. 3a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)	2	24	63	11	28.7	19.8	8.9	2.67	1.80	1.58	13.7	1,2,3 (UUT)	0.90	8^0
SPT8	12.00 12.45	23															
			(13.5m)														
SPT9	13.50 13.95	33	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 13.5m to 18.0m														
UDS5	14.25 14.55																
SPT10	15.00 15.45	48															
UDS6	17.25 17.55																
SPT11	18.00 18.45	56	Very dense, 18.0m to 21.0m	0	94	6	0	N.P.	N.P.		2.63						
UDS7	20.25 20.55											1.94	1.65	17.6	0.5,1.0 1.50 (DST)	0.00	36^0
			(21.0m)														
SPT12	21.00 21.45	32	Dense light brown Sandy Silt, low plastic (CL)														
UDS8	23.25 23.55			0	23	66	11	28.6	20.1	8.5	2.67						
			(24.0m)														
SPT13	24.00 24.45	54	Very dense light grey Fine Sand (SP-SM)														
UDS9	26.25 26.55											2.01	1.69	18.9	0.5,1.0 1.50 (DST)	0.00	35^0

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

GLOBAL	SOIL PROFILE	Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.	BH.No. 17 WATER TABLE : 13.30m	TERMINATION DEPTH (M) 36.0m	TABLE NO. 3b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	72	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55																
SPT15	30.00 30.45	Ref.															
UDS11	32.25 32.55																
SPT16	33.00 33.45	Ref.		2	89	9	0	N.P.	N.P.		2.63						
UDS12	35.25 35.55							N.P. : Non Plastic				2.07	1.73	19.8	0.5,1.0 1.50 (DST)	0.00	37^o
SPT17	36.00 36.45	Ref.	(36.00m)														

Note: The boreholes have been terminated at 36.0m depth due to Refusal criteria (N>100)

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 21

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 4

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Medium dense light brown Sandy Silt, low plastic (CL)	0	18	71	11	28.6	19.3	9.3	2.68						
			(1.5m)														
SPT1	1.50 1.95	12	Medium dense light brown Silty Sand (SM)														
UDS1	2.25 2.55											1.67	1.52	9.9	0.5,1.0 1.5 (DST)	0.00	30^o
SPT2	3.00 3.45	12										DST:Drained Direct Shear Test					
SPT3	4.50 4.95	10															
UDS2	5.25 5.55			0	74	26	0	N.P.	N.P.		2.65	N.P. : Non Plastic					
			(6.0m)														
SPT4	6.00 6.45	11	Medium dense light grey Fine Sand (SP-SM)														
SPT5	7.50 7.95	20															
UDS3	8.25 8.55											1.75	1.55	12.6	0.5,1.0 1.5 (DST)	0.00	32^o
			(9.0m)														
SPT6	9.00 9.45	22	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	26															

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 21

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 4a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	39		5	28	57	10	28.2	20.2	8.0	2.66						
SPT9	13.50 13.95	35															
UDS5	14.25 14.55											1.88	1.60	17.2	1,2,3 (UUT)	1.10	10^o
			(15.0m)														
SPT10	15.00 15.45	42	Medium dense to Dense light grey Fine Sand (SP-SM) Dense, 15.0m to 18.0m														
UDS6	17.25 17.55			0	93	7	0	N.P.	N.P.		2.63						
SPT11	18.00 18.45	12	Medium dense, 18.0m to 21.0m														
UDS7	20.25 20.55											1.95	1.65	18.1	0.5,1.0 1.50 (DST)	0.00	34^o
			(21.0m)														
SPT12	21.00 21.45	39	Dense light brown Silty Sand (SM)														
UDS8	23.25 23.55			0	80	20	0	N.P.	N.P.		2.64						
			(24.0m)														
SPT13	24.00 24.45	60	Very dense light grey Fine Sand (SP-SM)														
UDS9	26.25 26.55																

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 21

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 30.0m

TABLE NO. 4b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	69	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55											2.03	1.70	19.2	0.5,1.0 1.50 (DST)	0.00	36^o
															DST:Drained Direct Shear Test		
SPT15	30.00 30.45	51	(30.00m)	0	90	10	0	N.P.	N.P.		2.63						
								N.P. : Non Plastic									

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 23

WATER TABLE : 10.00m

TERMINATION DEPTH (M) 35.0m

TABLE NO. 5

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	3.50 4.00		Loose light brown Silty Sand (SM) (4.5m)														
SPT1	4.50 4.95	8	Loose light grey Fine Sand (SP-SM)														
UDS1	5.25 5.55		(6.0m)	0	88	12	0	N.P.	N.P.		2.64	1.65	1.50	10.2	0.5,1.0 1.5 (DST)	0.00	29^o
SPT2	6.00 6.45	9	Loose to Dense light brown Sandy Silt, low plastic (CL) Loose, 6.0m to 7.5m														
SPT3	7.50 7.95	18	Medium dense, 7.5m to 9.0m														
UDS2	8.25 8.55																
SPT4	9.00 9.45	37	Dense, 9.0m to 10.5m														
SPT5	10.50 10.95	16	Medium dense, 10.5m to 15.0m														
UDS3	11.25 11.55			4	20	66	10	28.2	20.2	8.0	2.67	1.79	1.56	14.5	1,2,3 (UUT)	0.60	9^o
SPT6	12.00 12.45	18															
SPT7	13.50 13.95	26															

N.P. : Non Plastic

DST:Drained Direct Shear Test

UUT : Unconsolidated Undrained Triaxial Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 23

WATER TABLE : 10.00m

TERMINATION DEPTH (M) 35.0m

TABLE NO. 5a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	14.25 14.55		Medium dense light brown Sandy Silt, low plastic (CL)														
			Medium dense, 10.5m to 15.0m (15.0m)														
SPT8	15.00 15.45	52	Very dense light grey Fine Sand (SP-SM)														
UDS5	17.25 17.55											1.91	1.63	16.9	0.5,1.0 1.50 (DST)	0.00	35^o
SPT9	18.00 18.45	71		0	93	7	0	N.P.	N.P.		2.63						
UDS6	20.25 20.55																
			(21.0m)														
SPT10	21.00 21.45	101	Very dense light brown Sandy Silt, low plastic (CL)														
UDS7	23.25 23.55			6	15	64	15	30.8	19.7	11.1	2.68	1.96	1.65	18.7	1,2,3 (UUT)	1.80	8^o
			(24.0m)														
SPT11	24.00 24.45	139	Very dense light grey Fine Sand (SP-SM)														
UDS8	26.25 26.55																
SPT12	27.00 27.45	157															
UDS9	29.25 29.55											2.0	1.7	18.2	0.5,1.0 1.50 (DST)	0.00	36^o
SPT13	30.00 30.45	Ref.		3	90	7	0	N.P.	N.P.		2.63						

DST:Drained Direct Shear Test

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 23

WATER TABLE : 10.00m

TERMINATION DEPTH (M) 35.0m

TABLE NO. 5b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS10	32.25 32.55		Very dense light grey Fine Sand (SP-SM)									2.06	1.74	18.5	0.5,1.0 1.50 (DST)	0.00	37^0
SPT14	33.00 33.45	Ref.															
SPT15	35.00 35.45	Ref.	(35.0m)	0	92	8	0	N.P.	N.P.		2.62						

DST:Drained Direct Shear Test

Note: The boreholes have been terminated at 35.0m depth due to Refusal criteria(N>100)

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 31

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 32.0m

TABLE NO. 6

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose light brown Sandy Silt, low plastic (CL)														
			(1.5m)														
SPT1	1.50 1.95	5	Loose light brown Silty Sand (SM)														
UDS1	2.25 2.55			0	72	28	0	N.P.	N.P.		2.65	1.64	1.48	10.8	0.5,1.0 1.5 (DST)	0.00	29^o
			(3.0m)					N.P. : Non Plastic									
SPT2	3.00 3.45	6	Loose to Dense light grey Fine Sand (SP-SM)												DST:Drained Direct Shear Test		
			Loose, 3.0m to 6.0m														
SPT3	4.50 4.95	9															
UDS2	5.25 5.55																
SPT4	6.00 6.45	24	Medium dense, 6.0m to 7.5m														
SPT5	7.50 7.95	32	Dense, 7.5m to 9.0m														
UDS3	8.25 8.55			0	94	6	0	N.P.	N.P.		2.63	1.75	1.56	11.9	0.5,1.0 1.5 (DST)	0.00	33^o
			(9.0m)														
SPT6	9.00 9.45	24	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	22															

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 31

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 32.0m

TABLE NO. 6a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	27															
SPT9	13.50 13.95	30															
UDS5	14.25 14.55		(15.0m)	3	17	67	13	29.4	18.9	10.5	2.68	1.87	1.61	16.3	1,2,3 (UUT)	0.85	8^o
SPT10	15.00 15.45	47	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 15.0m to 18.0m														
UDS6	17.25 17.55																
SPT11	18.00 18.45	55	Very dense, 18.0m to 21.0m	0	95	5	0	N.P.	N.P.		2.63						
UDS7	20.25 20.55		(21.0m)									1.94	1.65	17.7	0.5,1.0 1.50 (DST)	0.00	35^o
SPT12	21.00 21.45	60	Very dense light brown Silty Sand (SM)														
UDS8	23.25 23.55		(24.0m)														
SPT13	24.00 24.45	125	Very dense light grey Fine Sand (SP-SM)	3	88	9	0	N.P.	N.P.		2.64						
UDS9	26.25 26.55																

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 31

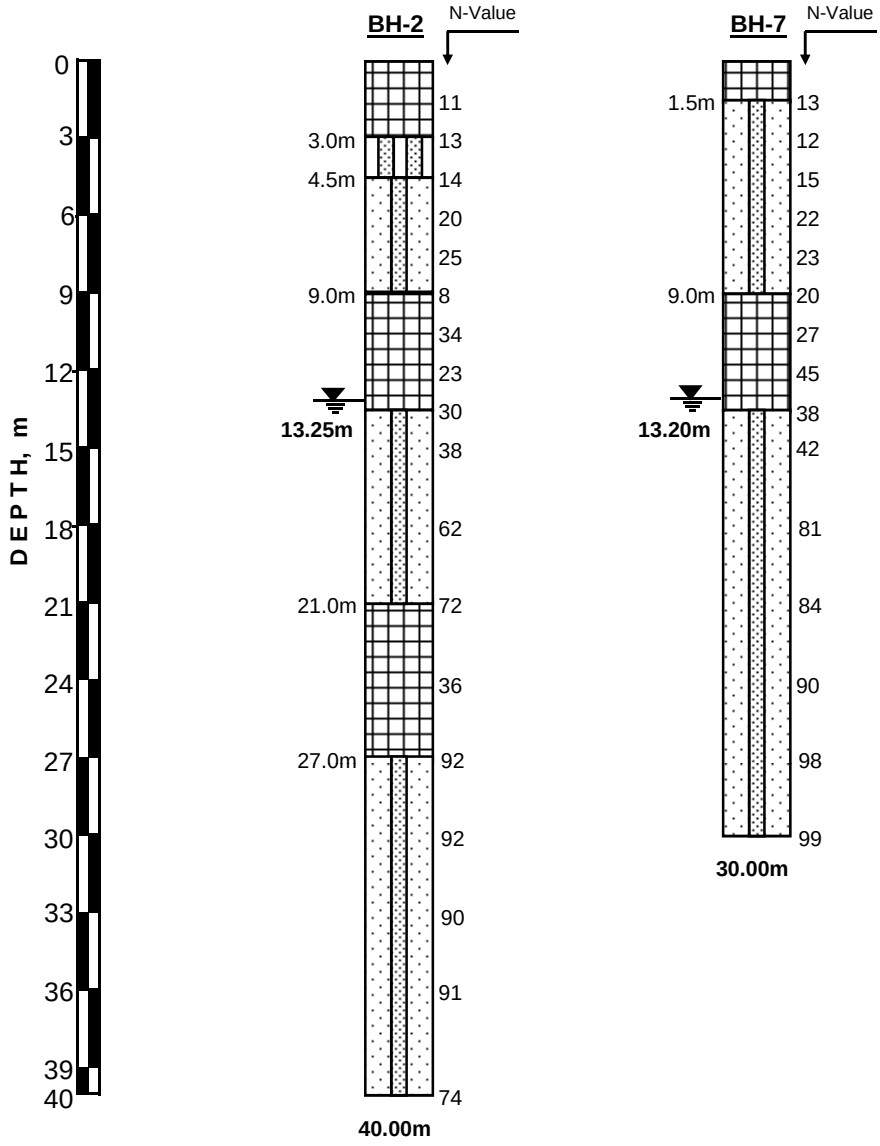
WATER TABLE : 13.20m

TERMINATION DEPTH (M) 32.0m

TABLE NO. 6b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	164	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55											2.0	1.7	18.3	0.5,1.0 1.50 (DST)	0.00	36^o
SPT15	30.00 30.45	Ref.	(30.0m)	10	53	37	0	N.P.	N.P.		2.66	DST:Drained Direct Shear Test					
			Very dense light brown Sitly Sand (SM)					N.P. : Non Plastic									
SPT16	32.00 32.45	Ref.	(32.0m)														

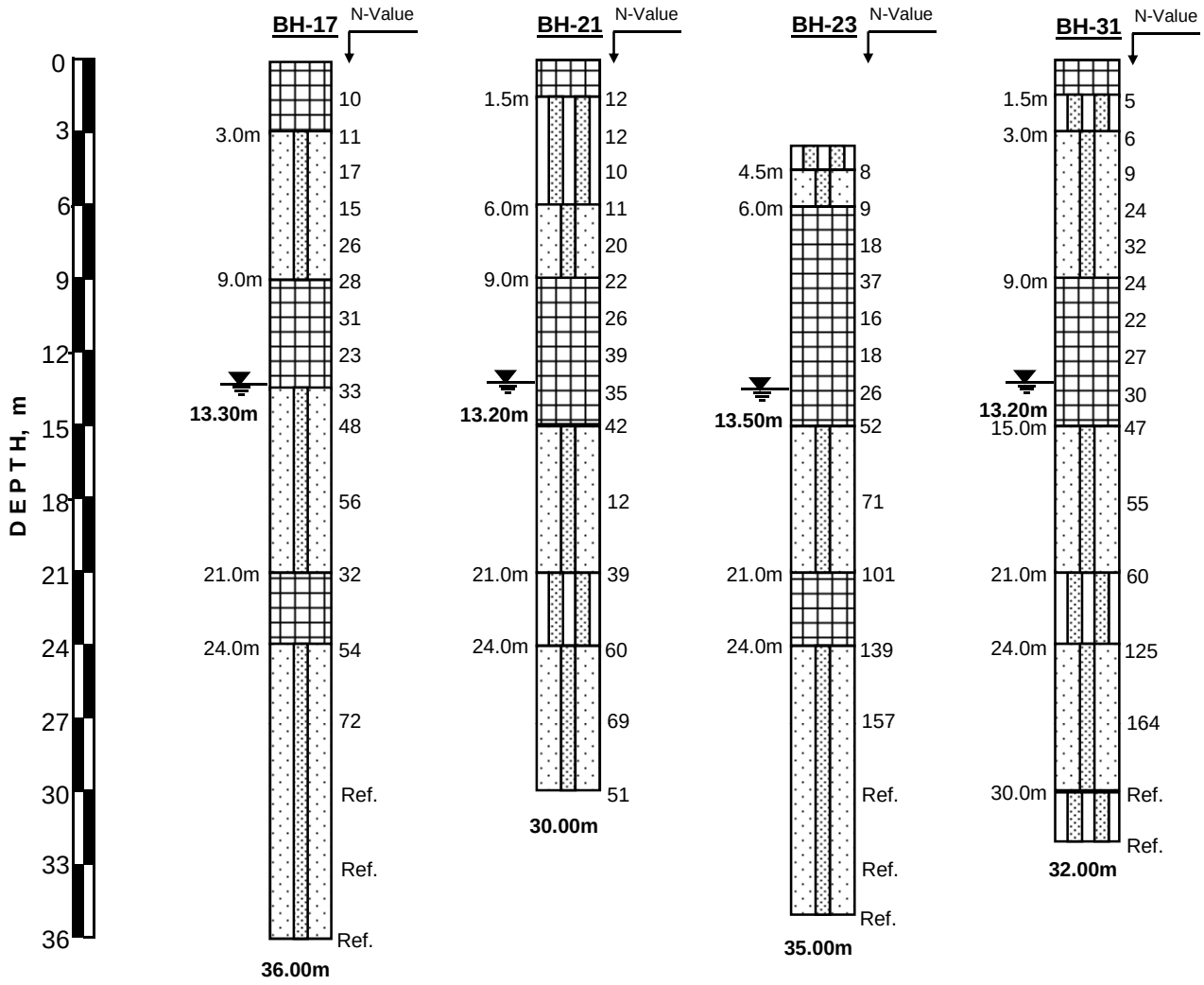
Note: The boreholes have been terminated at 32.0m depth due to Refusal criteria.



SUMMARY OF BOREHOLE PROFILE

LEGEND	
SYMBOL	DESCRIPTION
	Silty sand
	Sandy silt
	Fine sand
	Water table

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SUMMARY OF BOREHOLE PROFILE

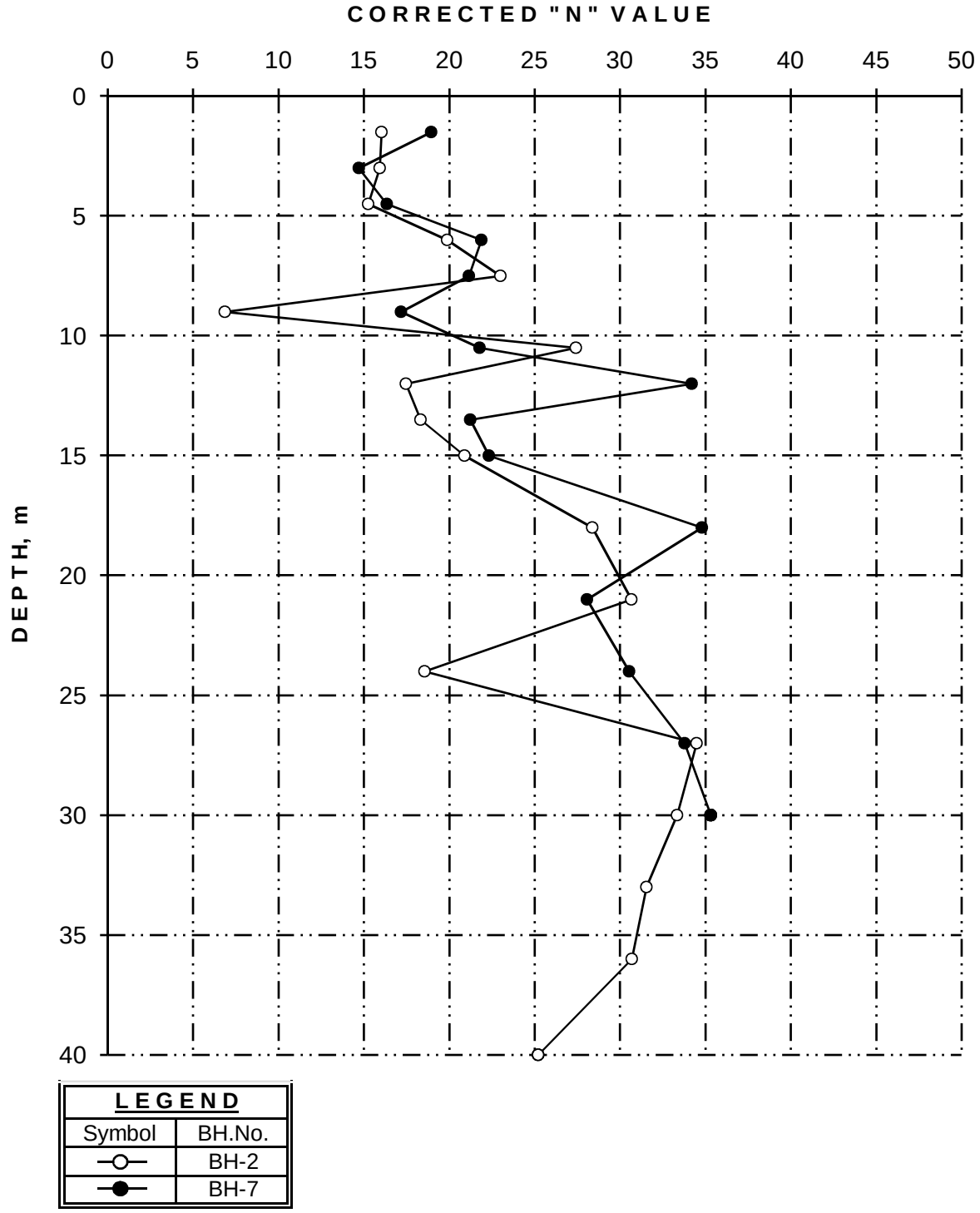
Ref. means Refusal (N>100)

LEGEND	
SYMBOL	DESCRIPTION
	Silty sand
	Sandy silt
	Fine sand
	Water table

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

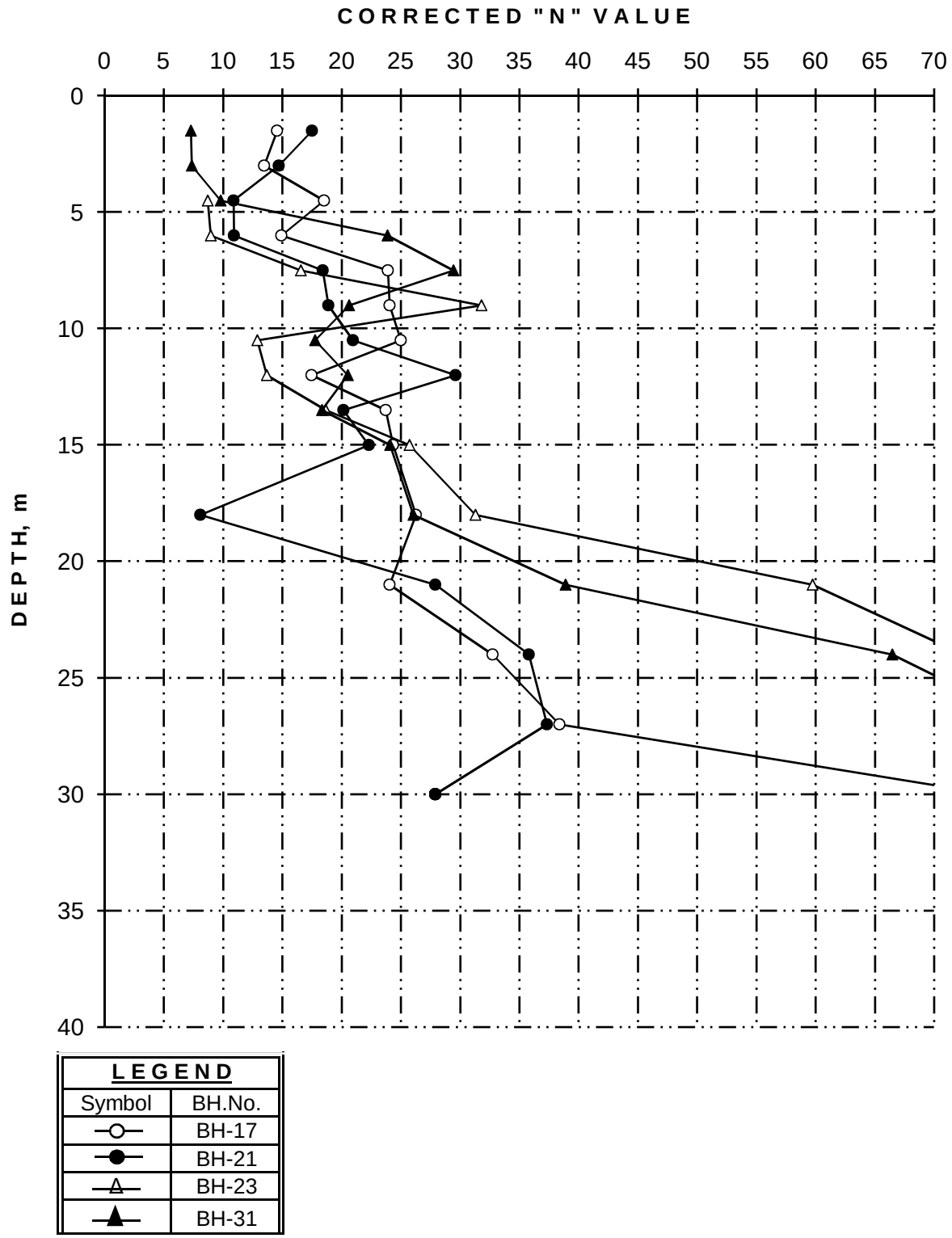
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 9

STANDARD PENETRATION TEST



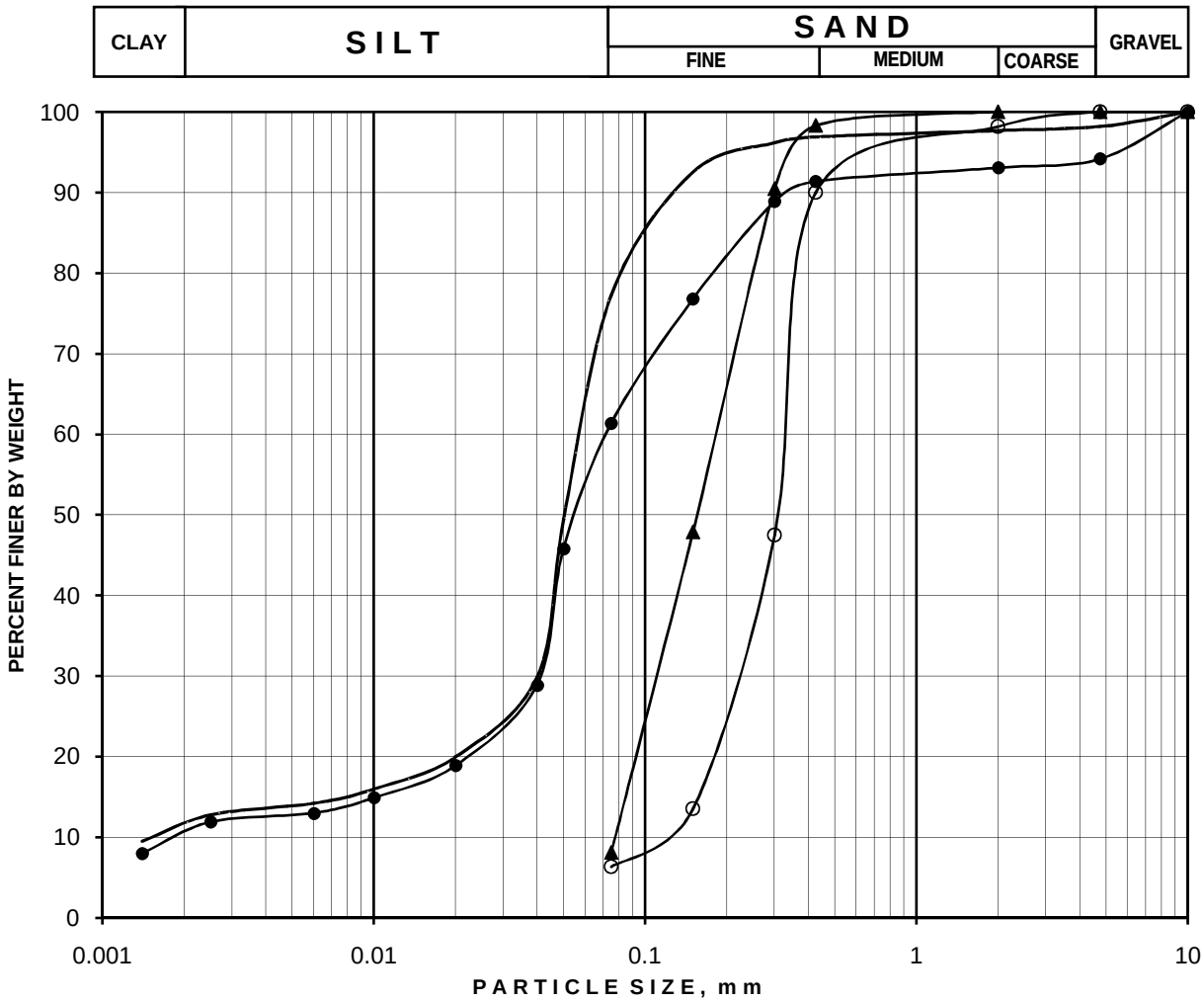
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

STANDARD PENETRATION TEST



LEGEND	
Symbol	BH.No.
—○—	BH-17
—●—	BH-21
—△—	BH-23
—▲—	BH-31

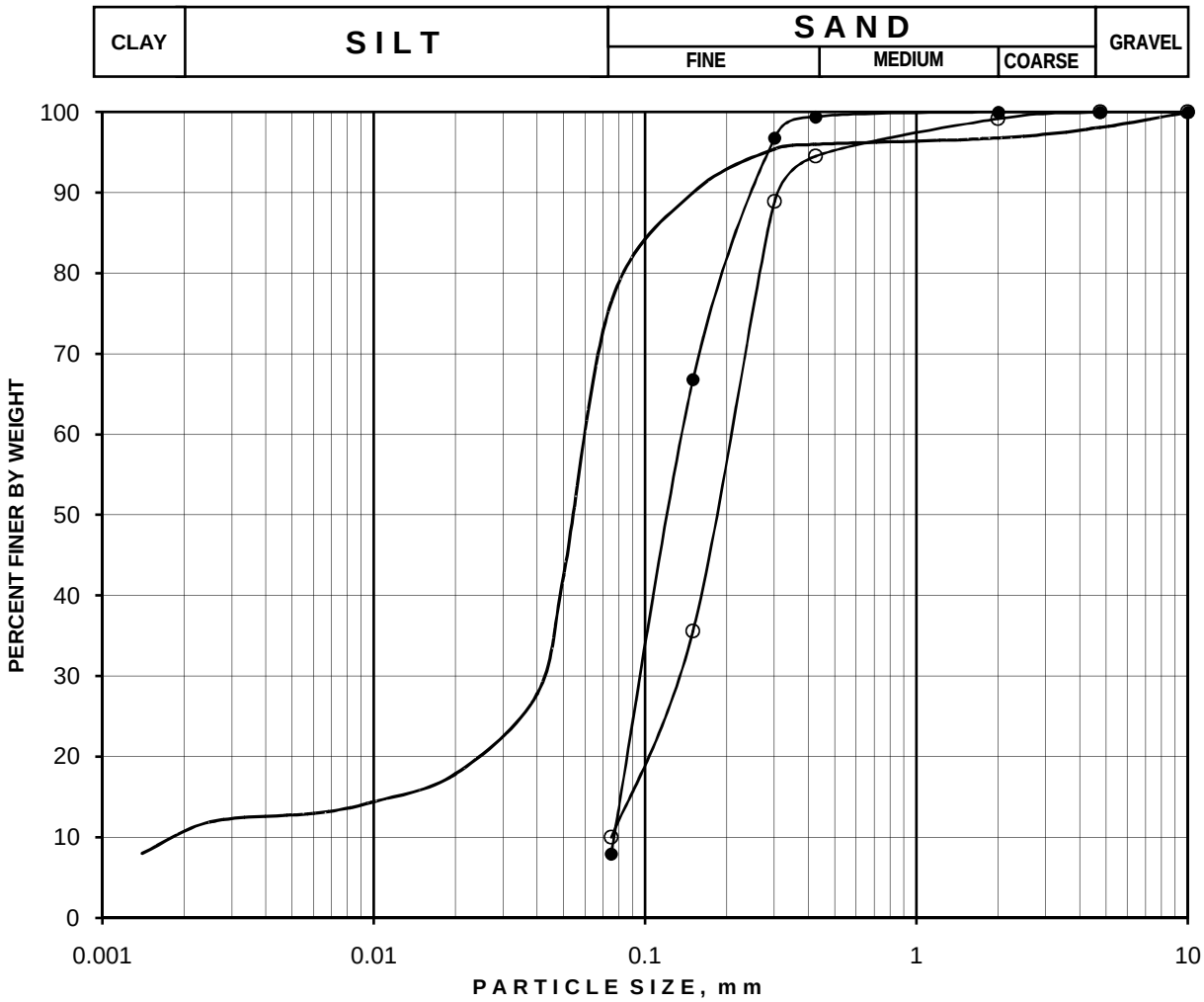
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	2/1.50	Sandy silt (CL)	2	21	65	12
	2/6.00	Fine sand (SP-SM)	0	94	6	0
	2/11.25	Sandy silt (CL)	6	33	50	11
	2/18.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

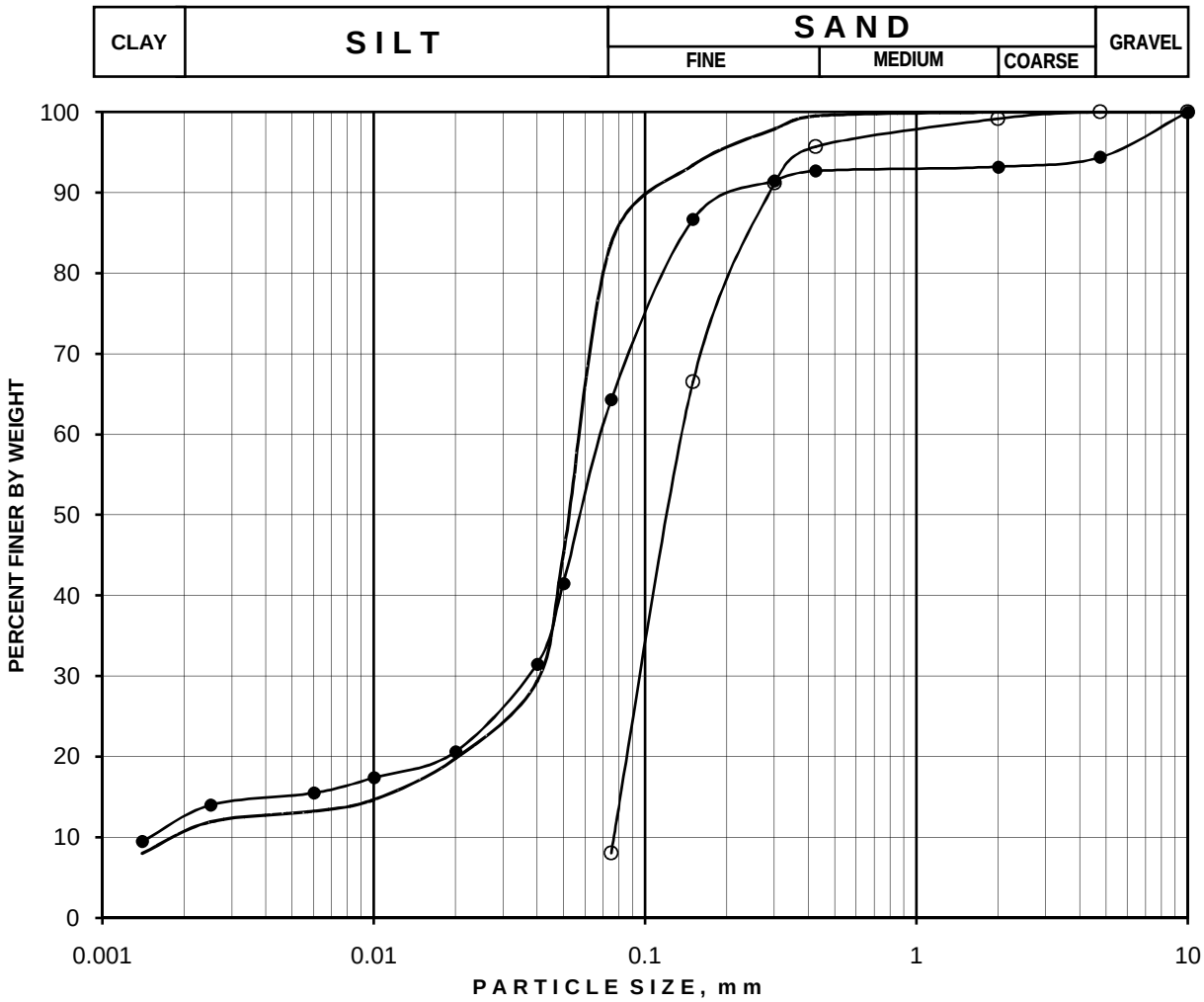
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	2/23.25	Sandy silt (CL)	2	22	65	11
	2/30.00	Fine sand (SP-SM)	0	90	10	0
	2/40.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

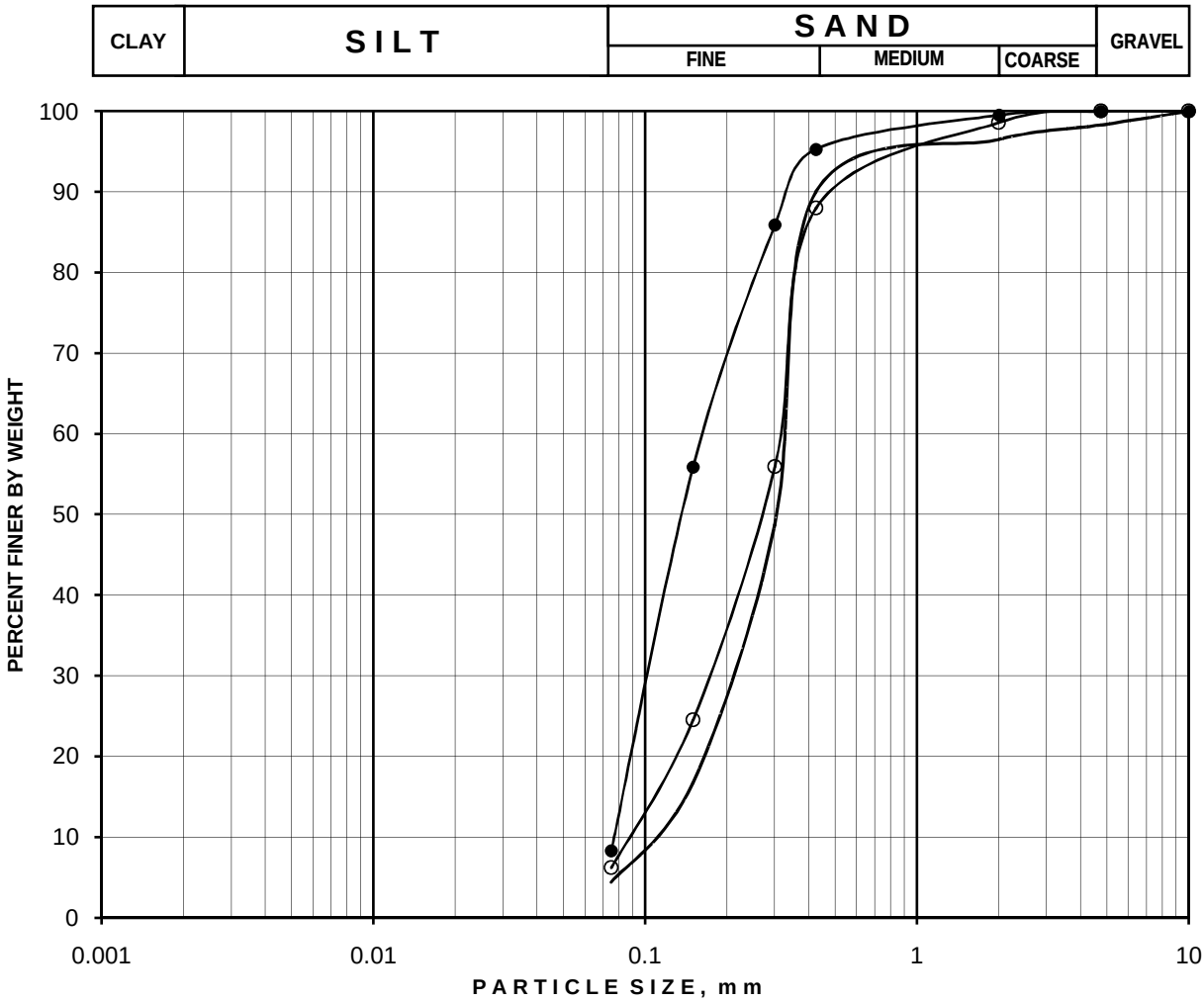
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	7/0.00	Sandy silt (CL)	0	16	73	11
	7/6.00	Fine sand (SP-SM)	0	92	8	0
	7/11.25	Sandy silt (CL)	6	30	51	13

GRAIN SIZE ANALYSIS

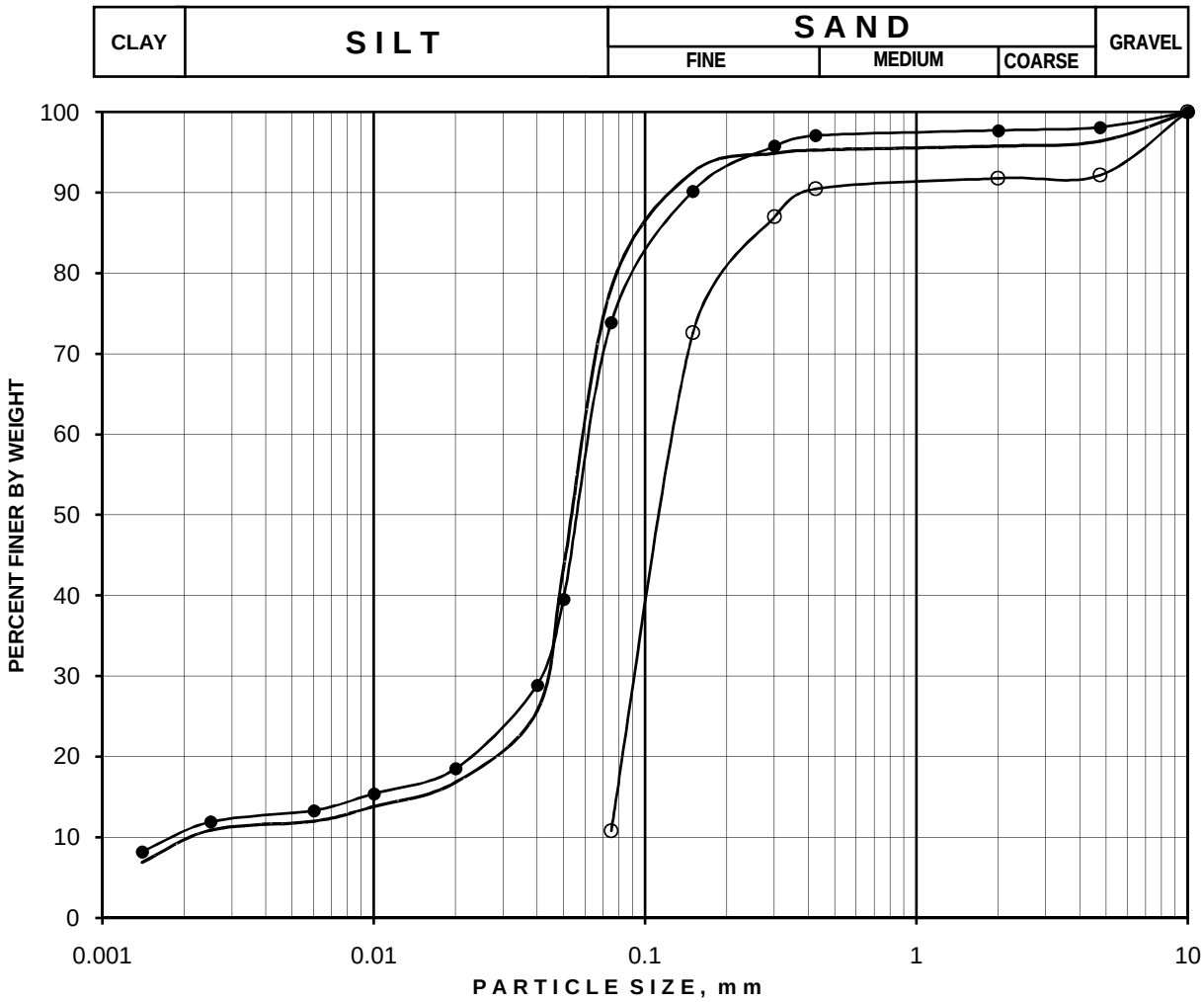
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	7/17.25	Fine sand (SP-SM)	2	94	4	0
	7/24.00	Fine sand (SP-SM)	0	94	6	0
	7/30.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

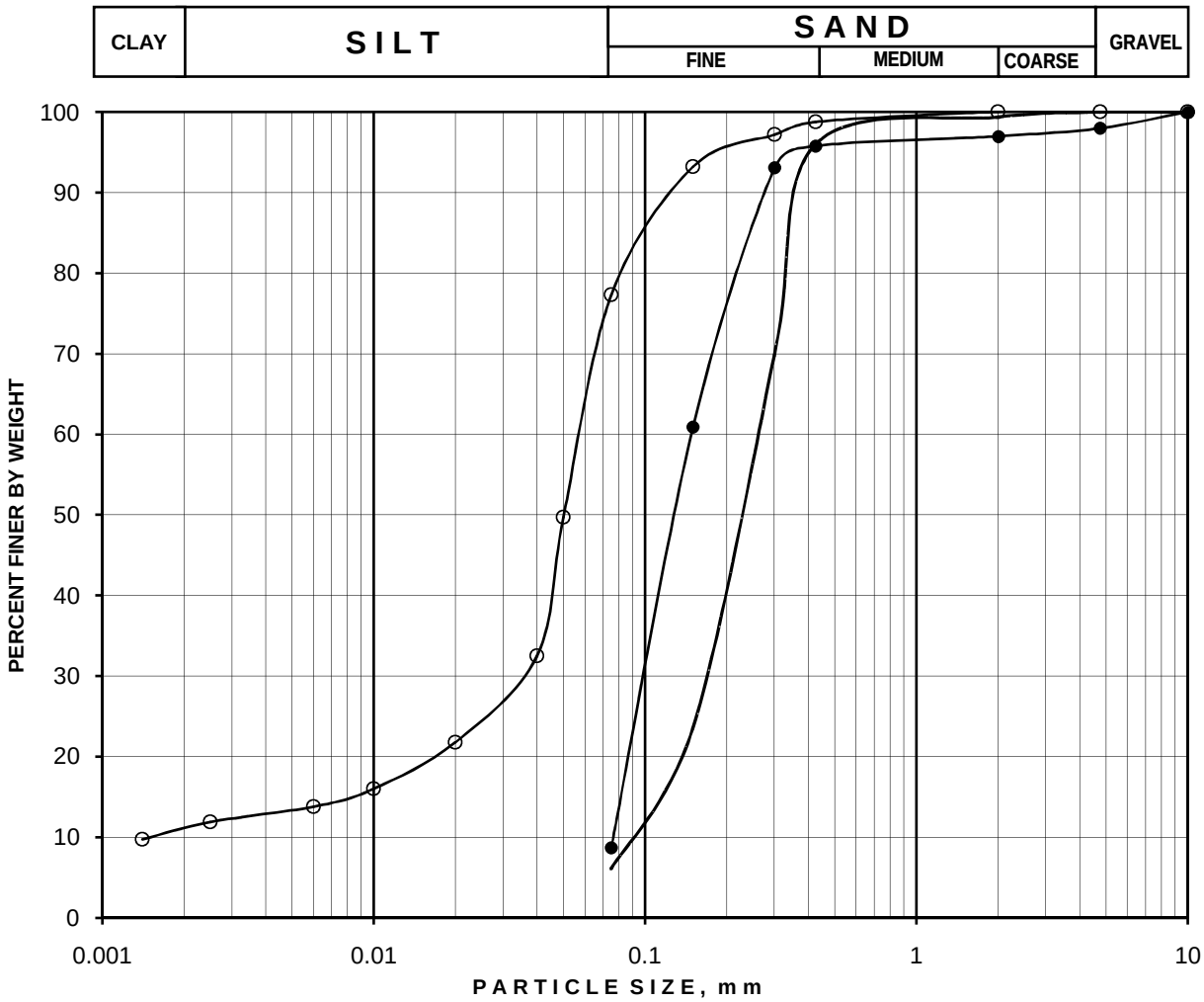
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	17/2.25	Sandy silt (CL)	4	18	68	10
	17/7.50	Fine sand (SP-SM)	8	81	11	0
	17/11.25	Sandy silt (CL)	2	24	63	11

GRAIN SIZE ANALYSIS

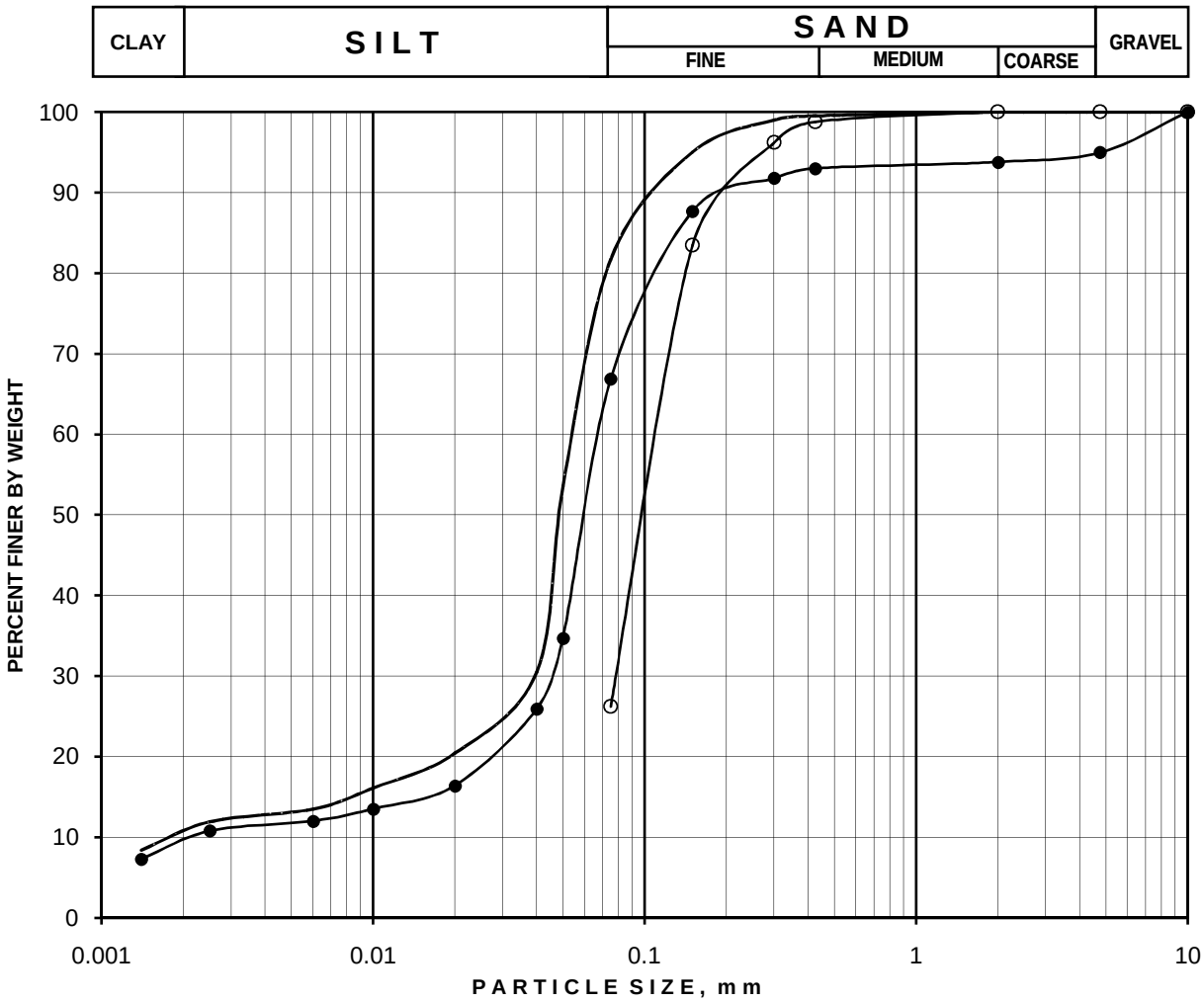
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	17/18.00	Fine sand (SP-SM)	0	94	6	0
○	17/23.25	Sandy silt (CL)	0	23	66	11
●	17/33.00	Fine sand (SP-SM)	2	89	9	0

GRAIN SIZE ANALYSIS

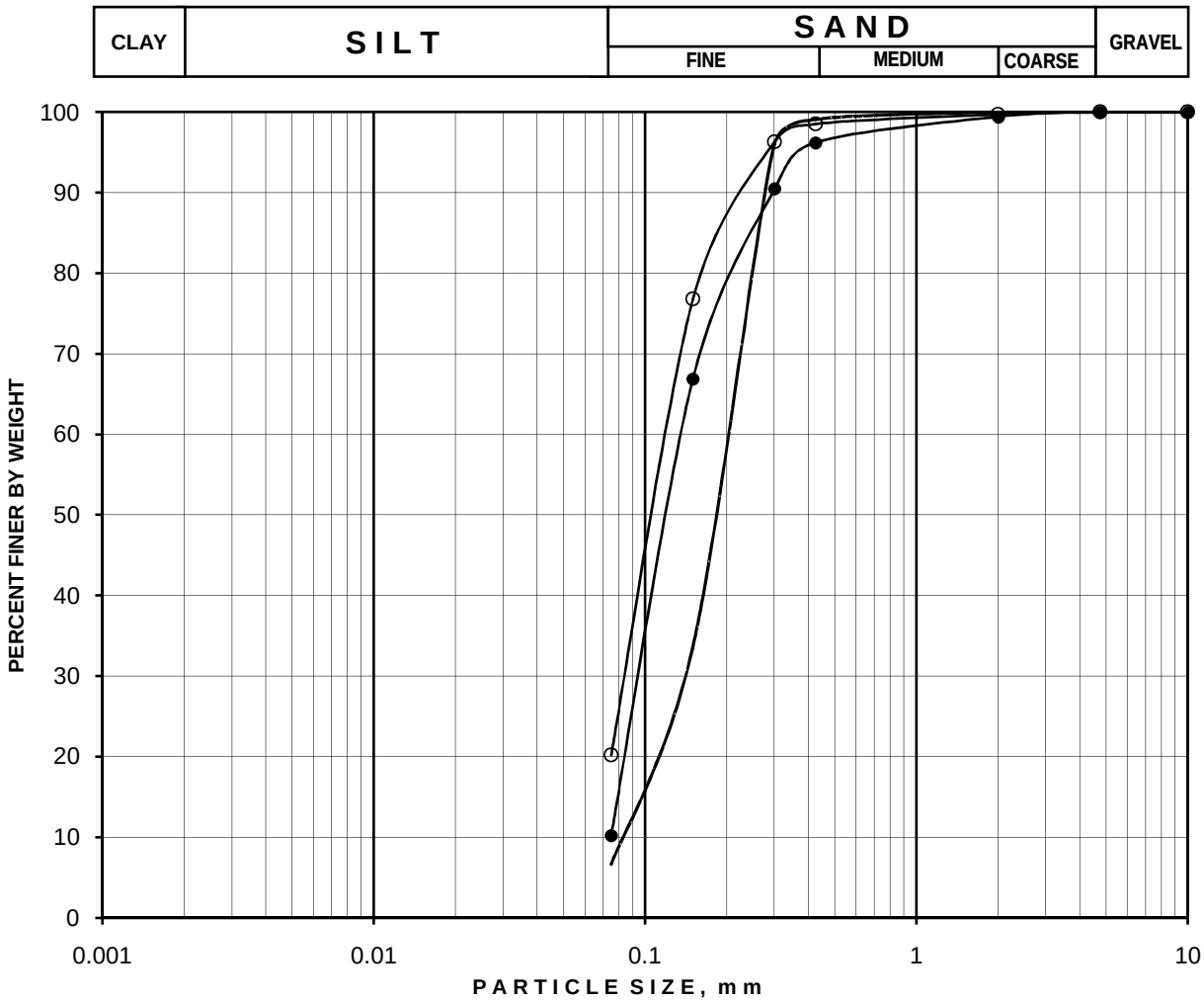
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	21/0.00	Sandy silt (CL)	0	18	71	11
	21/5.25	Silty sand (SM)	0	74	26	0
	21/12.00	Sandy silt (CL)	5	28	57	10

GRAIN SIZE ANALYSIS

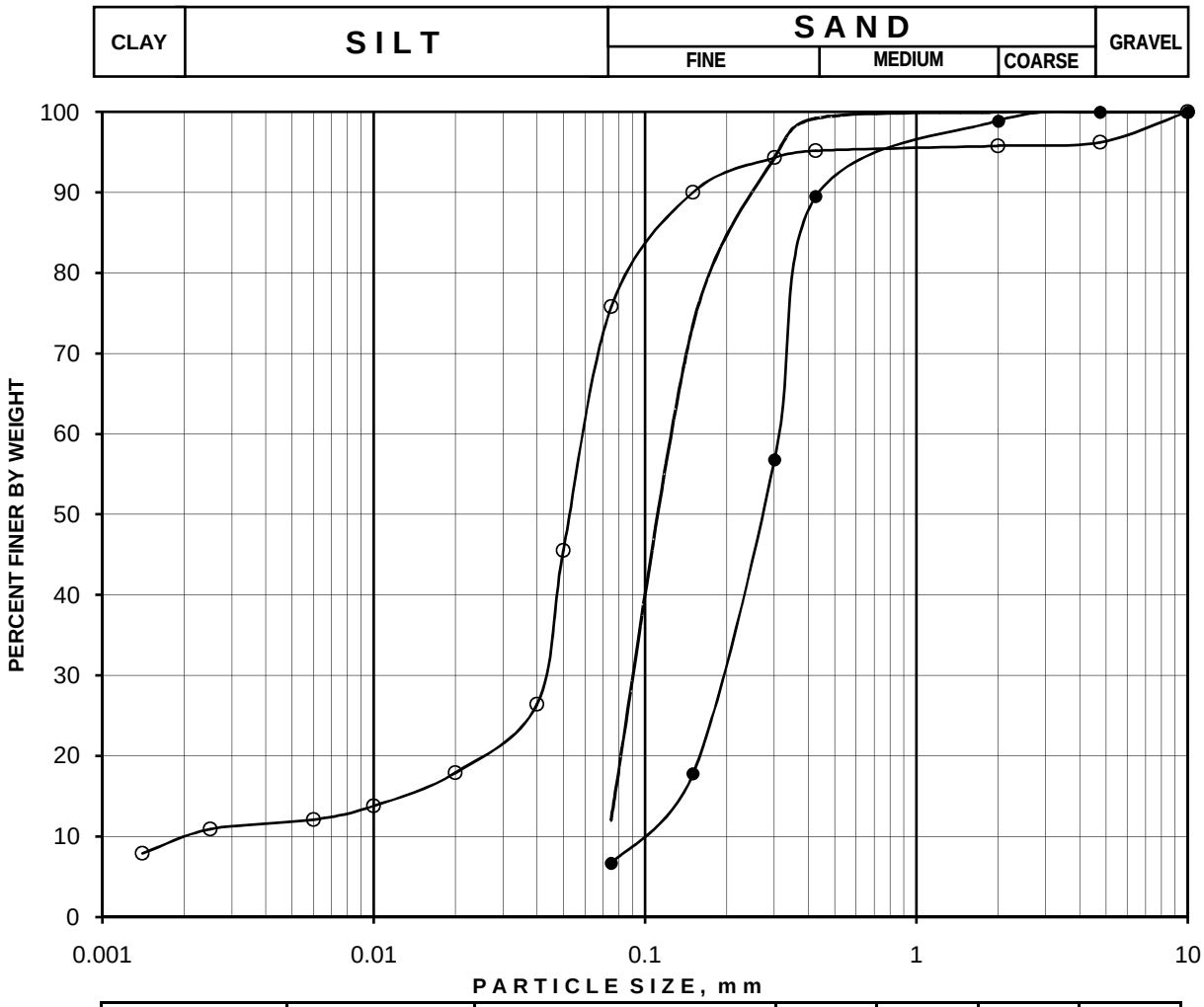
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	21/17.25	Fine sand (SP-SM)	0	93	7	0
	21/23.25	Silty sand (SM)	0	80	20	0
	21/30.00	Fine sand (SP-SM)	0	90	10	0

GRAIN SIZE ANALYSIS

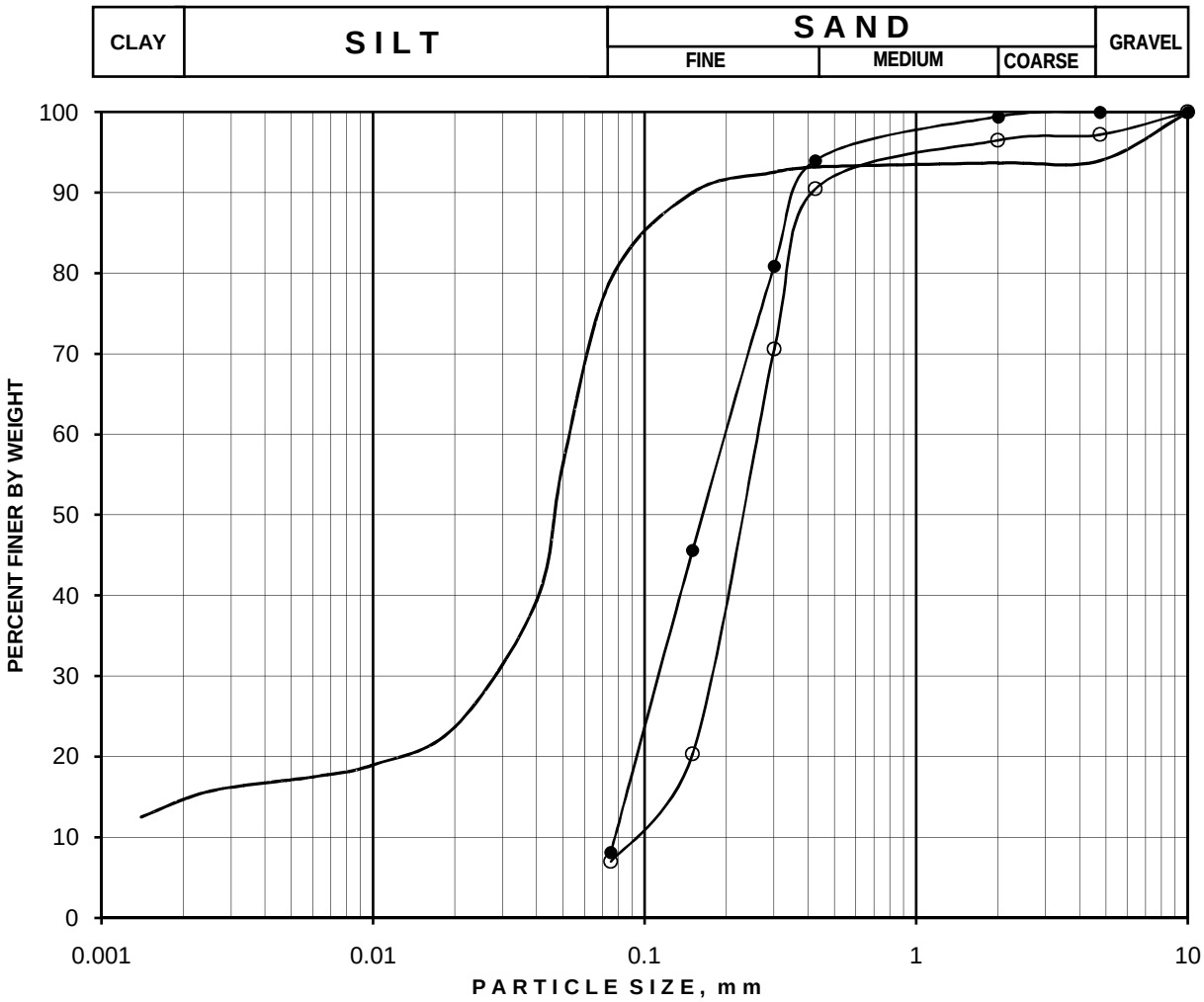
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	23/5.25	Fine sand (SP-SM)	0	88	12	0
○	23/11.25	Sandy silt (CL)	4	20	66	10
●	23/18.00	Fine sand (SP-SM)	0	93	7	0

GRAIN SIZE ANALYSIS

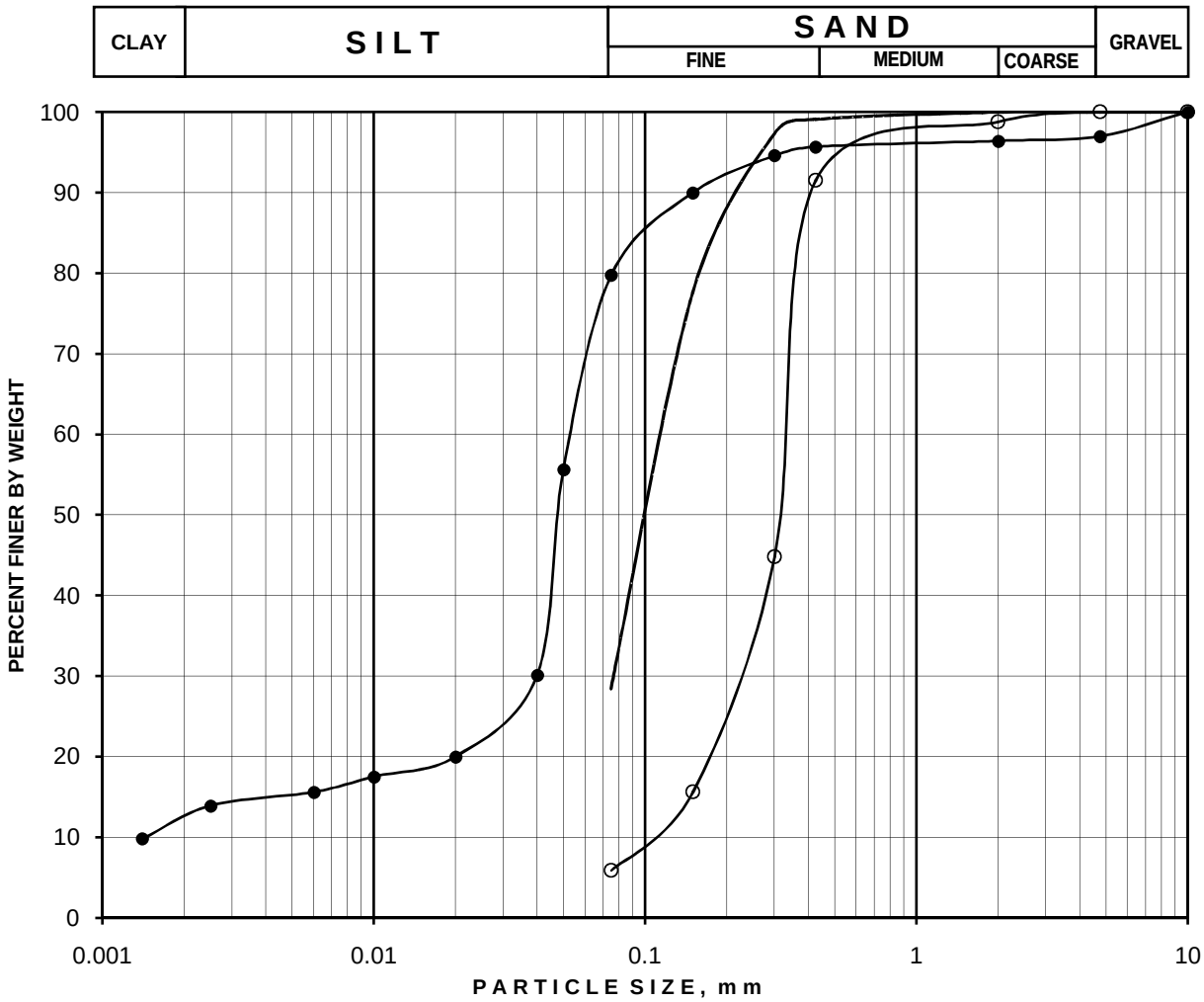
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	23/23.25	Sandy silt (CL)	6	15	64	15
	23/30.00	Fine sand (SP-SM)	3	90	7	0
	23/35.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

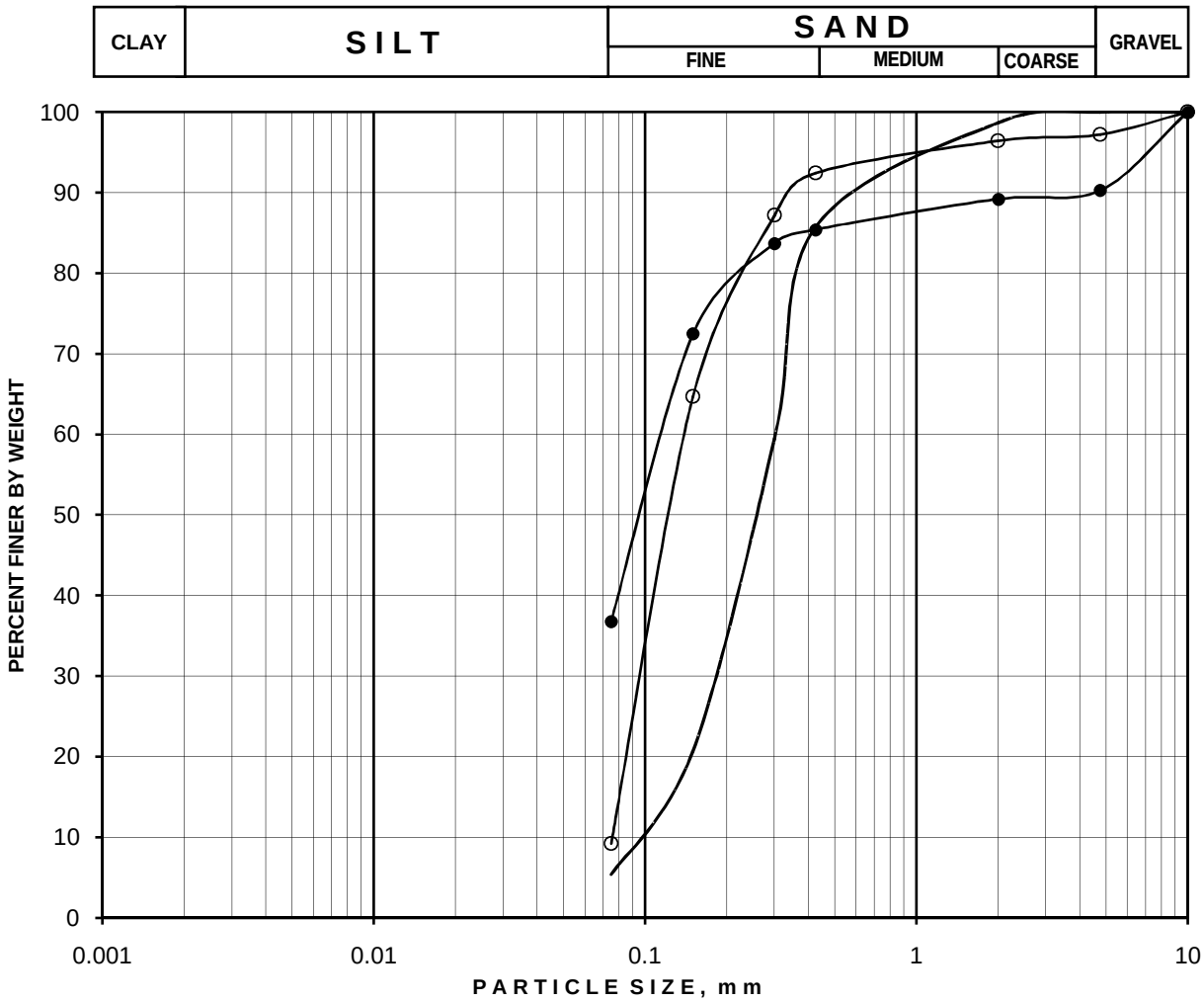
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	31/2.25	Silty sand (SM)	0	72	28	0
	31/8.25	Fine sand (SP-SM)	0	94	6	0
	31/14.25	Sandy silt (CL)	3	17	67	13

GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	31/18.00	Fine sand (SP-SM)	0	95	5	0
	31/24.00	Fine sand (SP-SM)	3	88	9	0
	31/30.00	Silty sand (SM)	10	53	37	0

GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

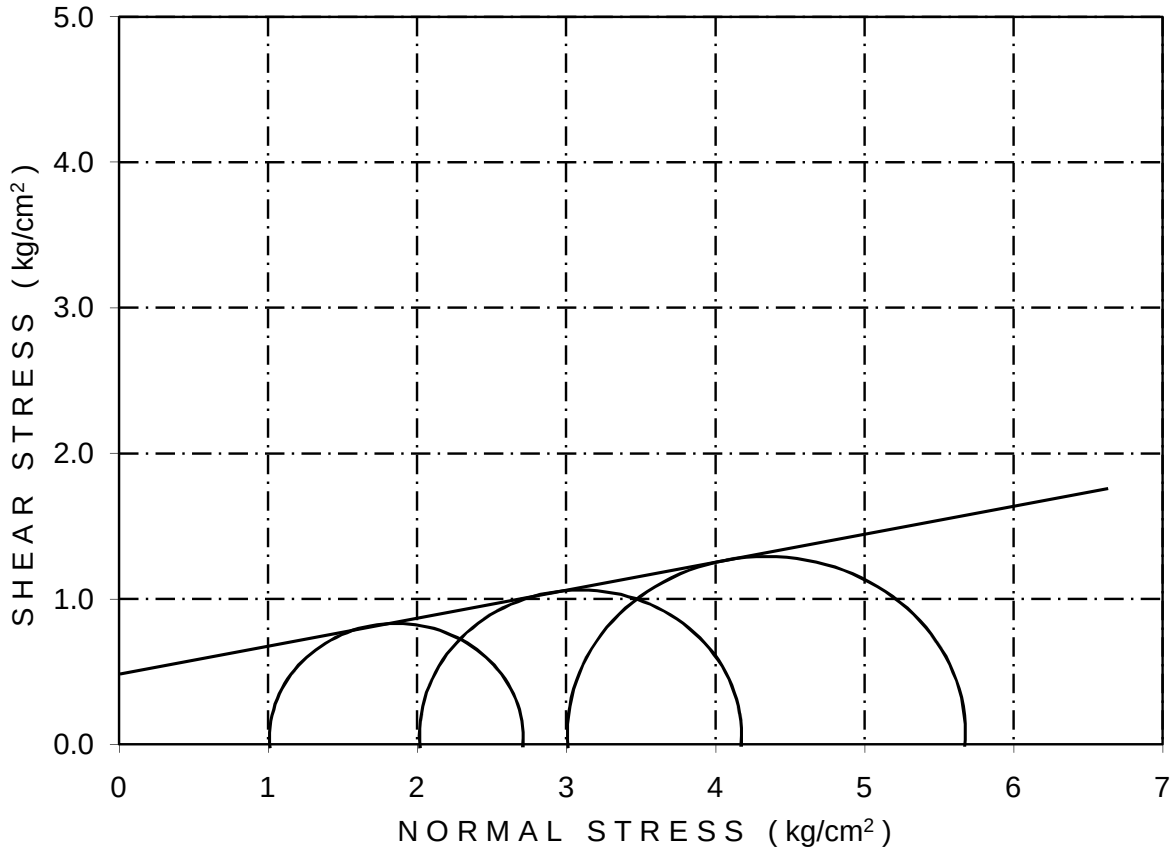
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 23

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	2
Depth	:	2.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.68	1.52	10.2

"c" Value kg/cm^2	"Ø" Value DEGREE
0.50	8



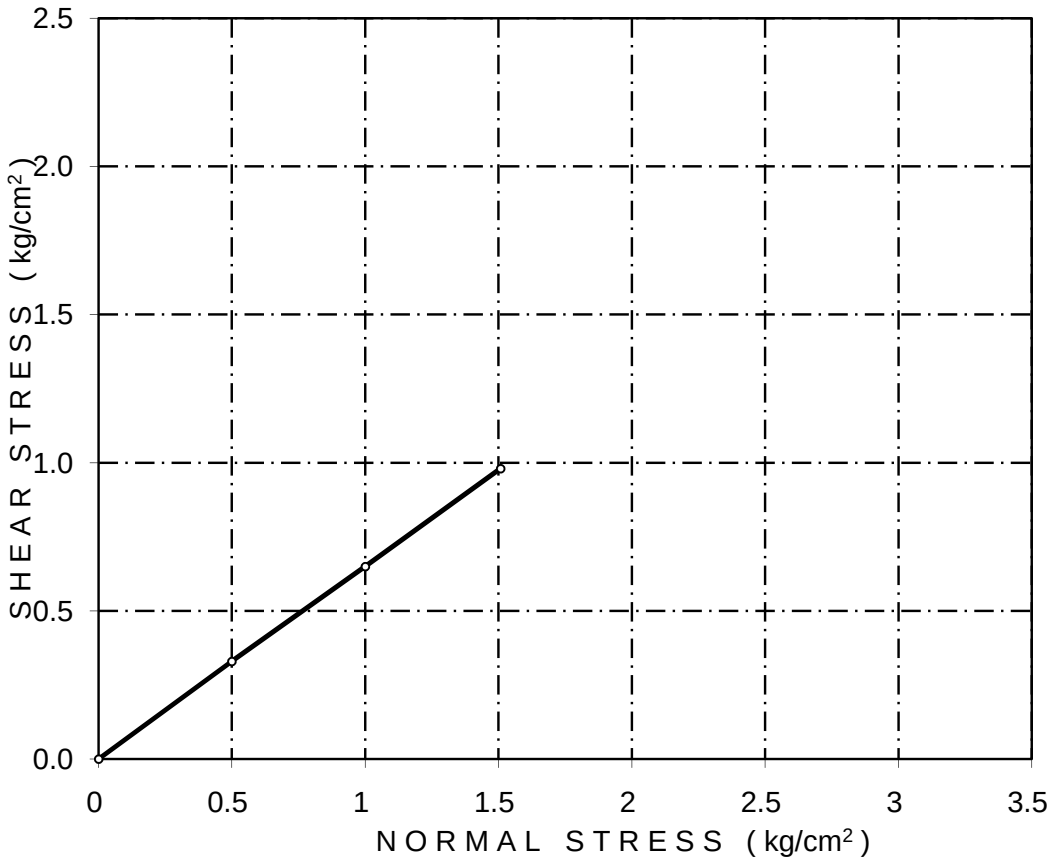
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 24

DRAINED DIRECT SHEAR TEST

Borehole No :	2
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	33



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

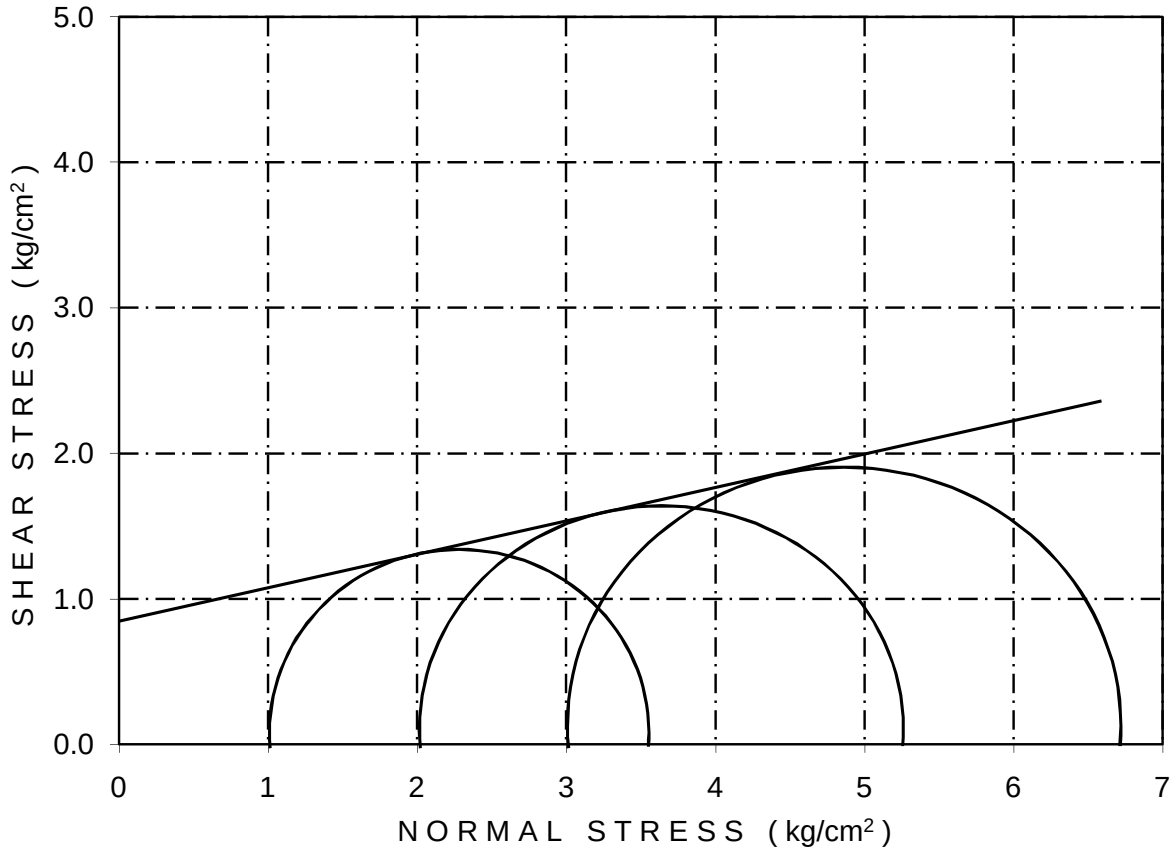
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 25

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	2
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.80	1.59	13.4

"c" Value kg/cm^2	"Ø" Value DEGREE
0.85	10



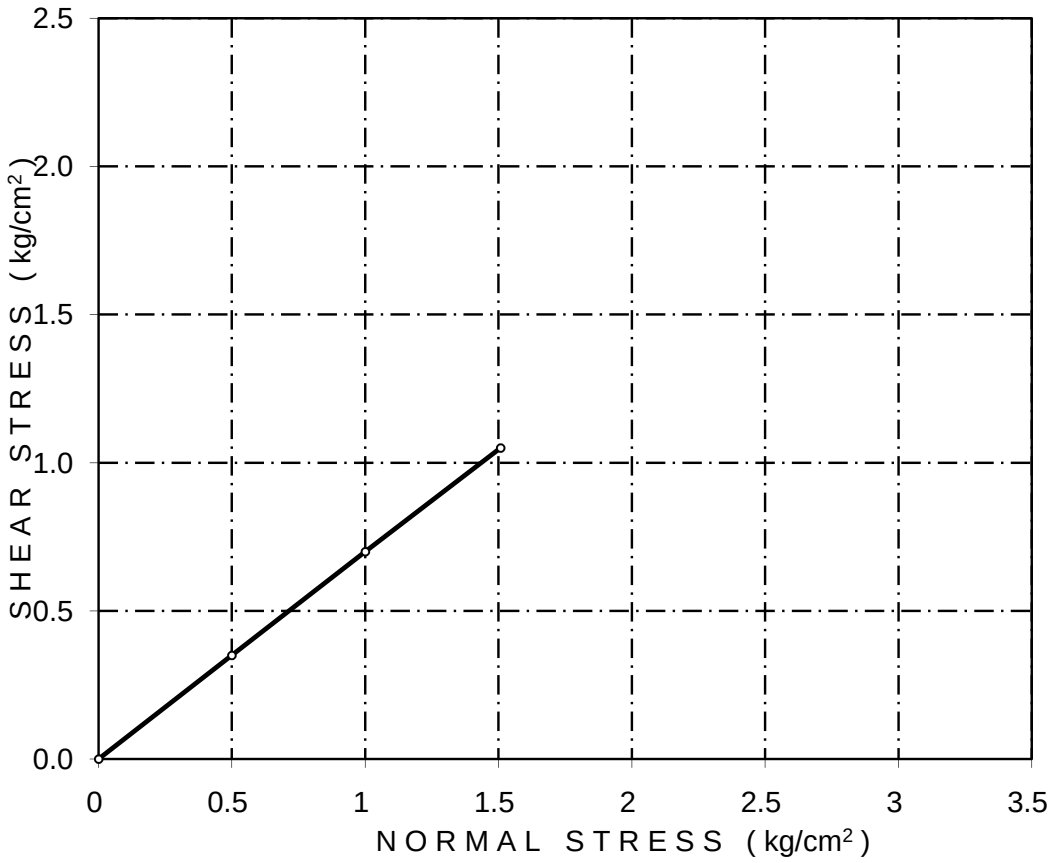
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 26

DRAINED DIRECT SHEAR TEST

Borehole No :	2
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.66	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

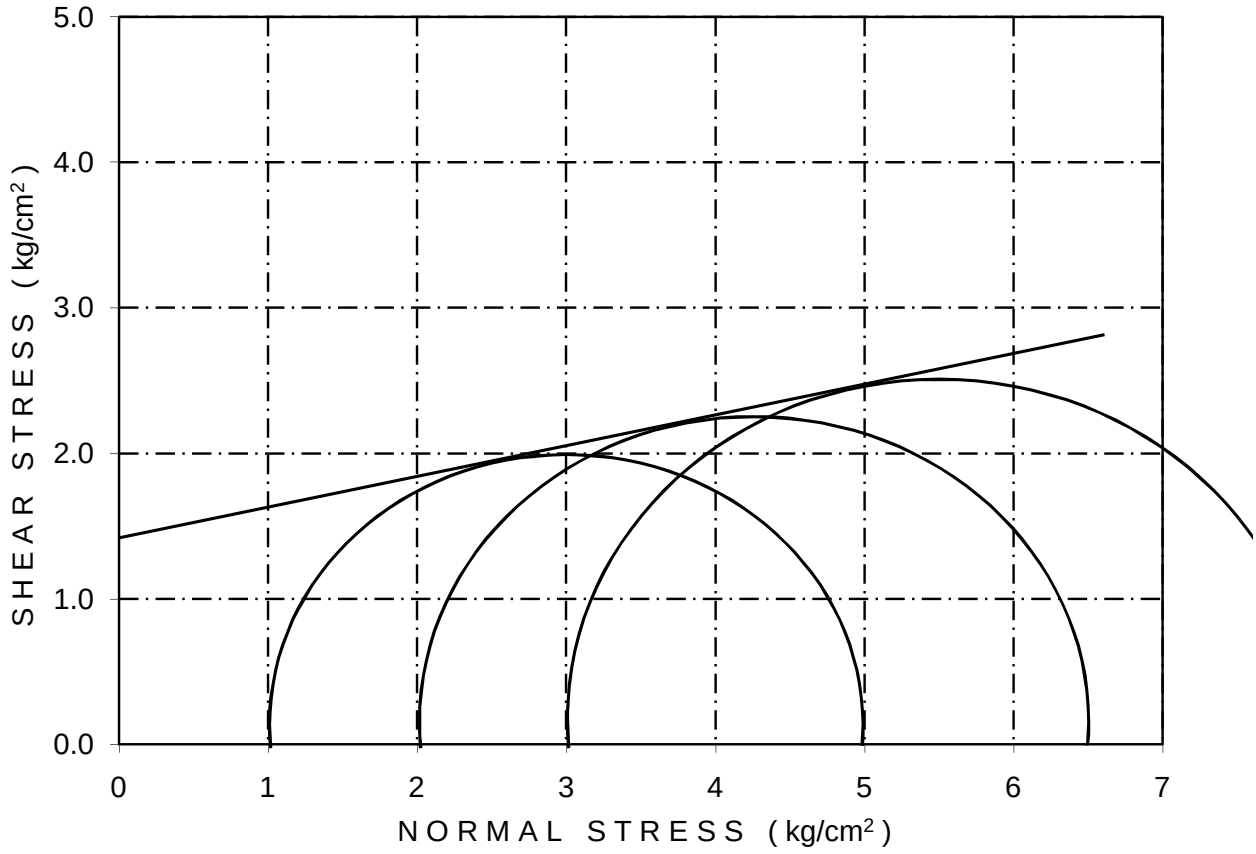
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 27

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	2
Depth	:	26.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.03	1.68	20.8

"c" Value kg/cm^2	"Ø" Value DEGREE
1.45	9



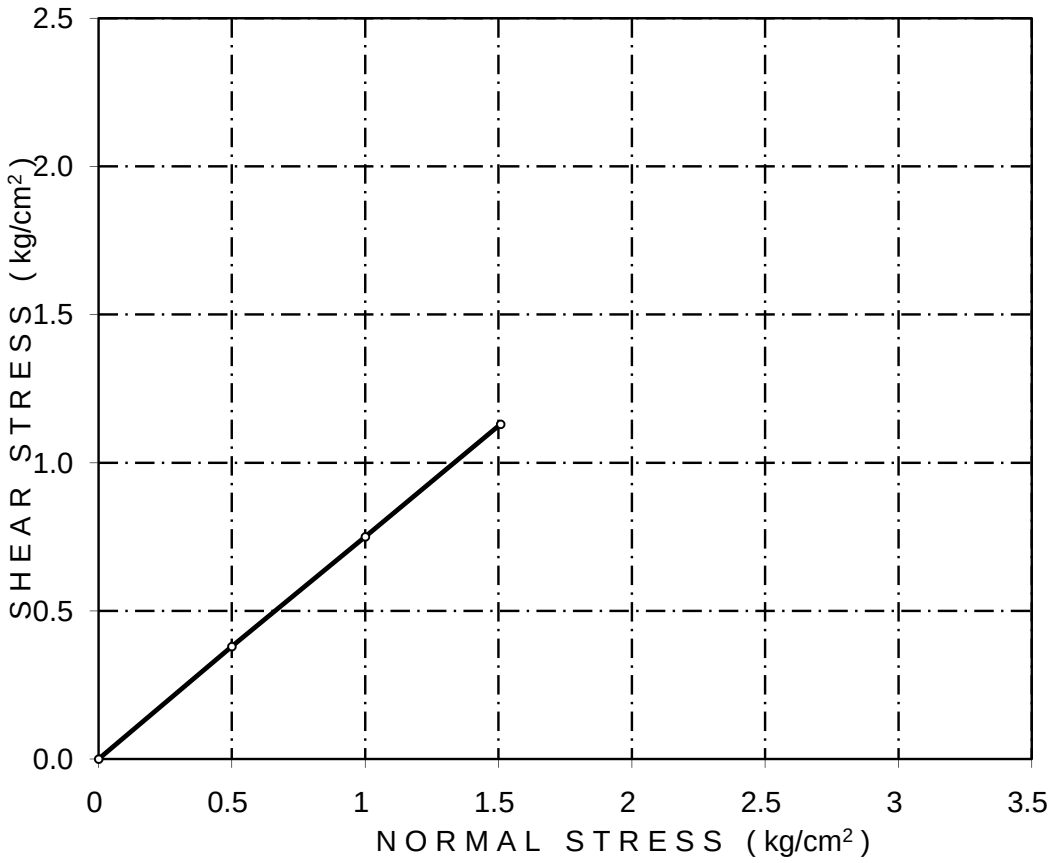
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 28

DRAINED DIRECT SHEAR TEST

Borehole No :	2
Depth :	**35.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.74	0	37



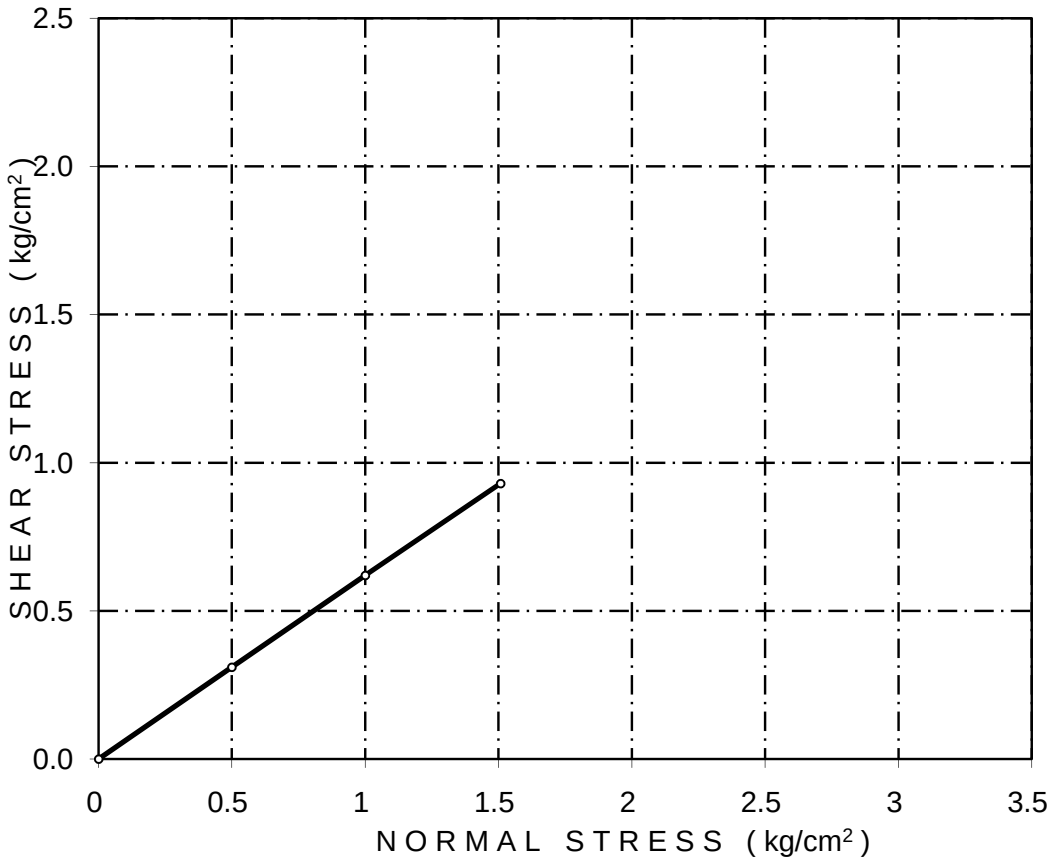
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 29

DRAINED DIRECT SHEAR TEST

Borehole No :	7
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	0	32



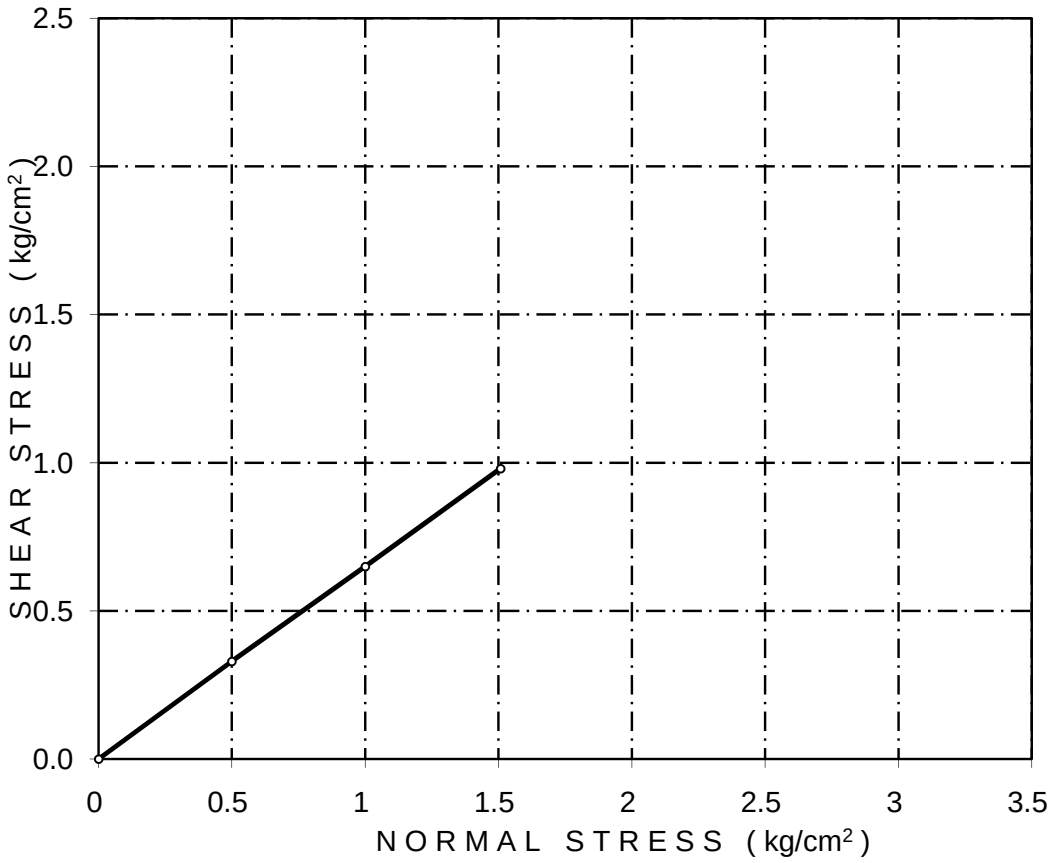
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 30

DRAINED DIRECT SHEAR TEST

Borehole No :	7
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.57	0	33



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

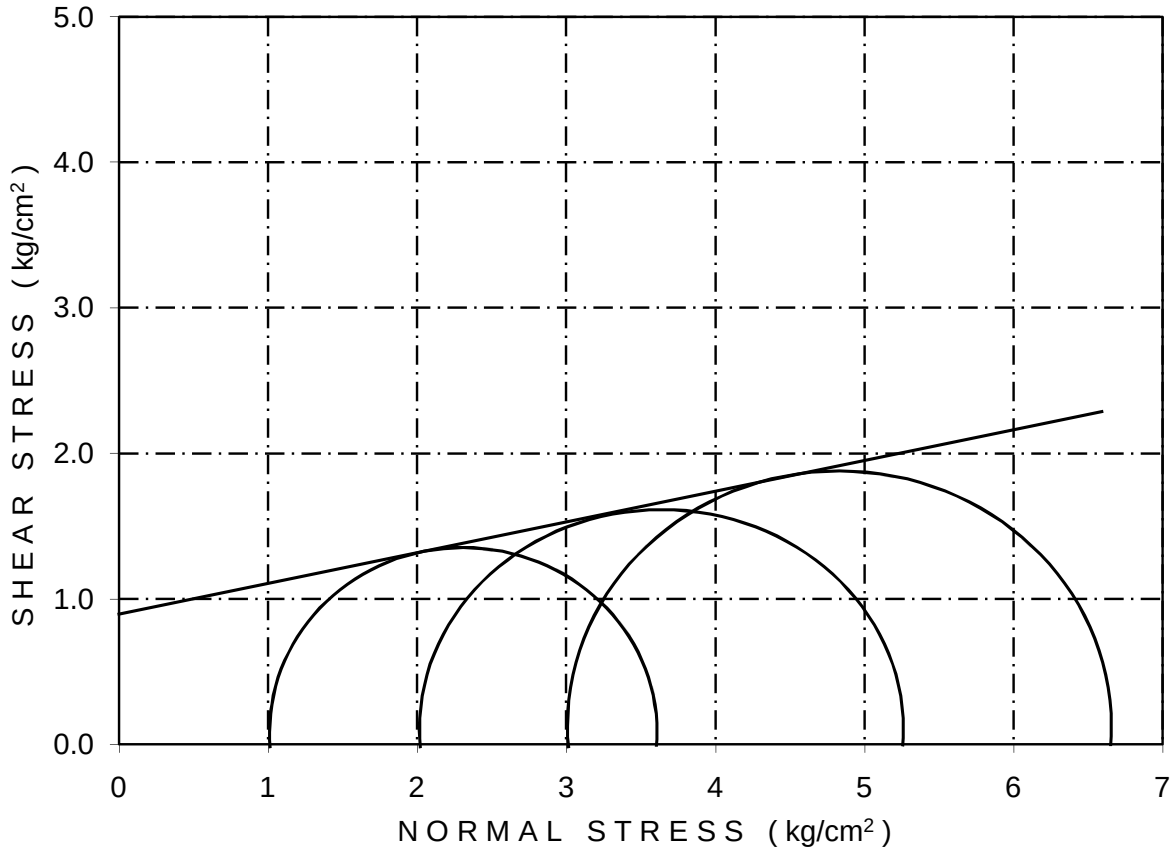
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 31

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	7
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.82	1.61	13.0

"c" Value kg/cm^2	"Ø" Value DEGREE
0.90	9



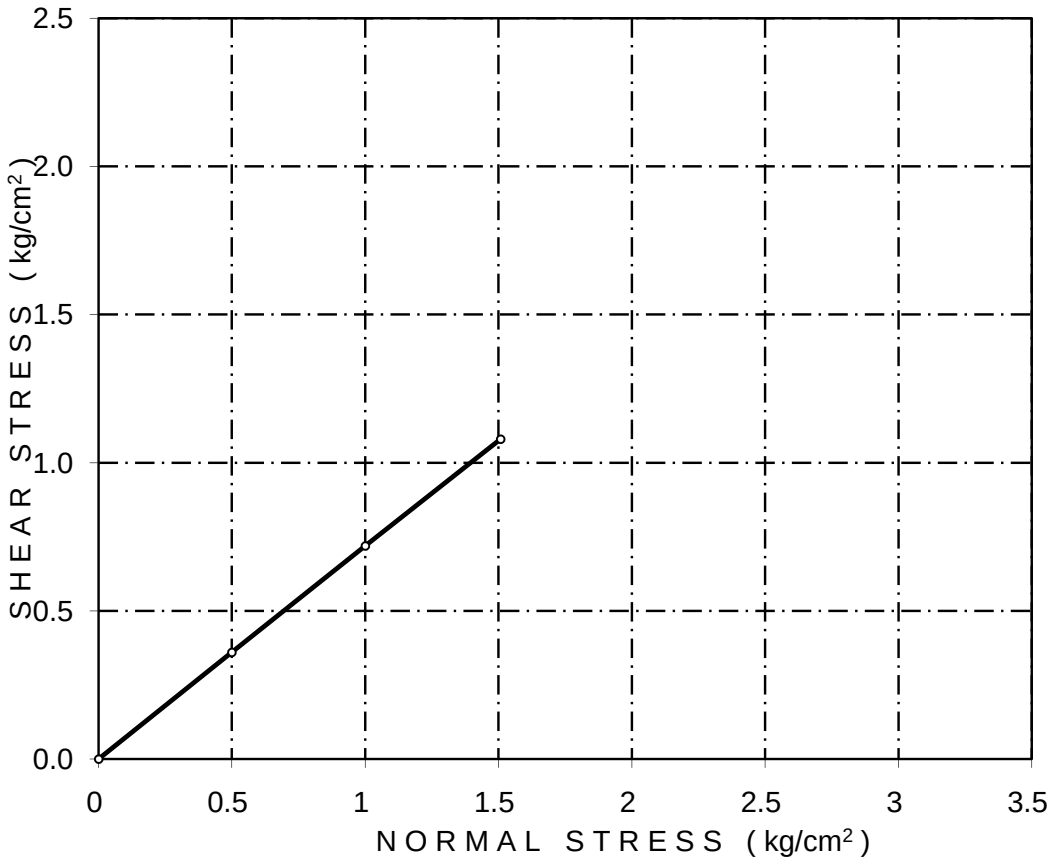
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 32

DRAINED DIRECT SHEAR TEST

Borehole No :	7
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.65	0	36



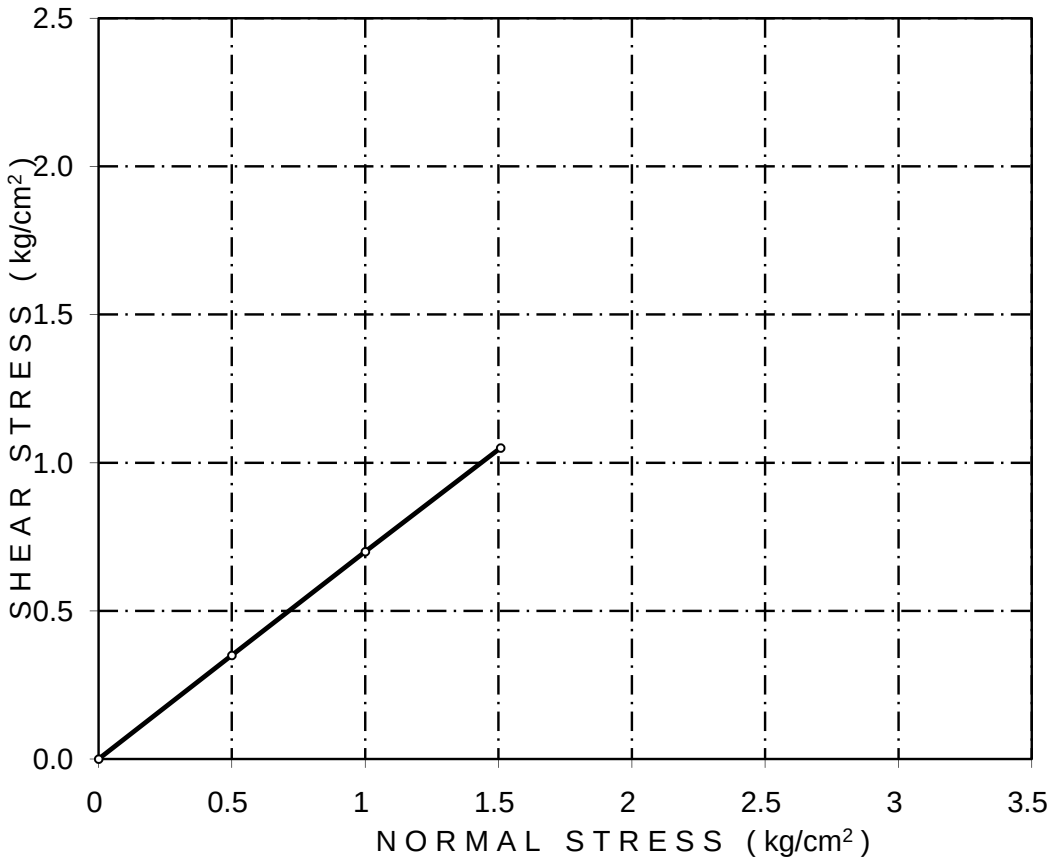
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 33

DRAINED DIRECT SHEAR TEST

Borehole No :	7
Depth :	**26.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.70	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

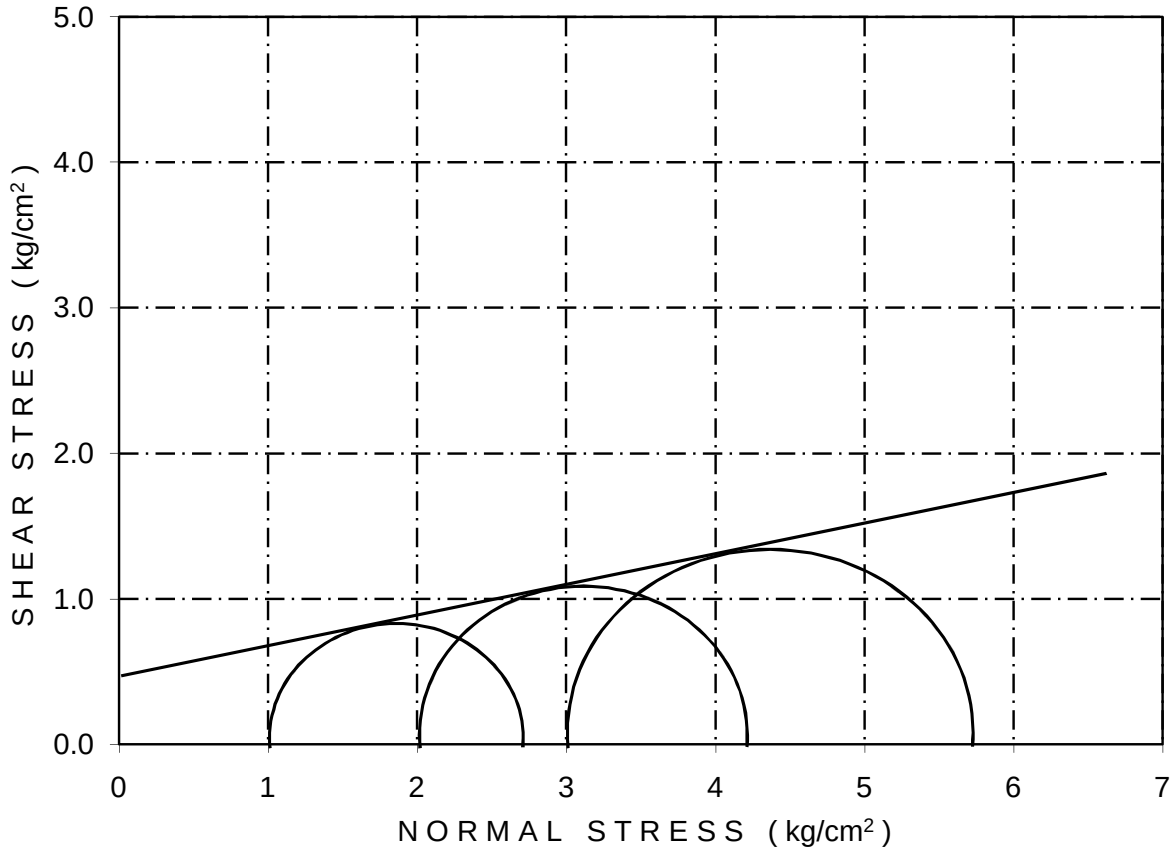
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 34

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	17
Depth	:	2.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.66	1.50	10.5

"c" Value kg/cm^2	"Ø" Value DEGREE
0.50	9



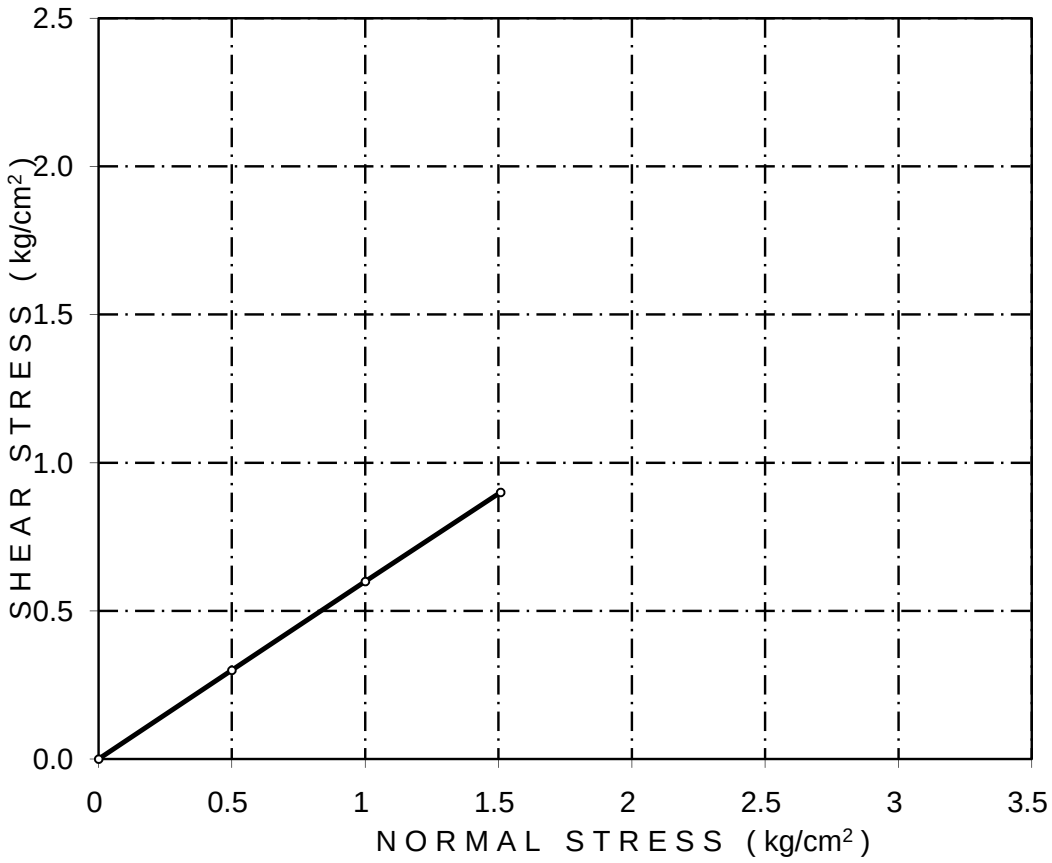
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 35

DRAINED DIRECT SHEAR TEST

Borehole No :	17
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	31



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

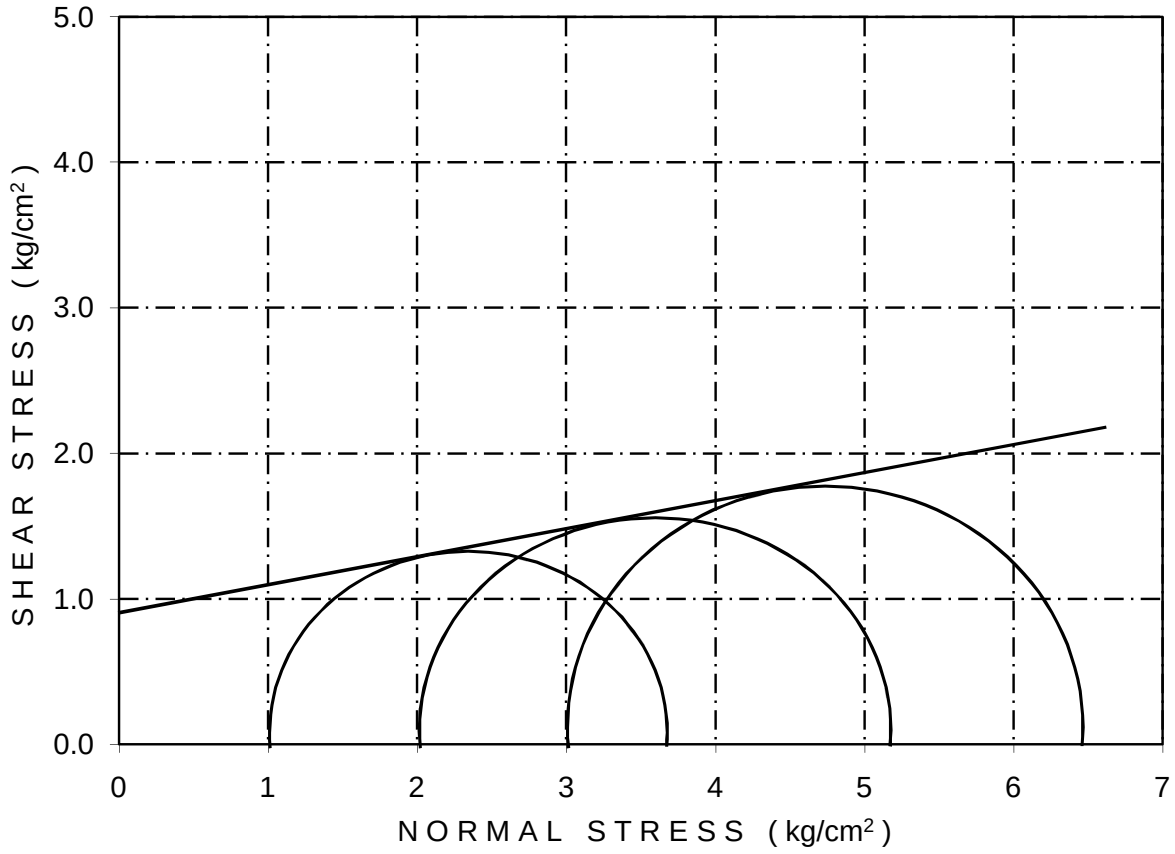
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 36

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	17
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.80	1.58	13.7

"c" Value kg/cm^2	"Ø" Value DEGREE
0.90	8



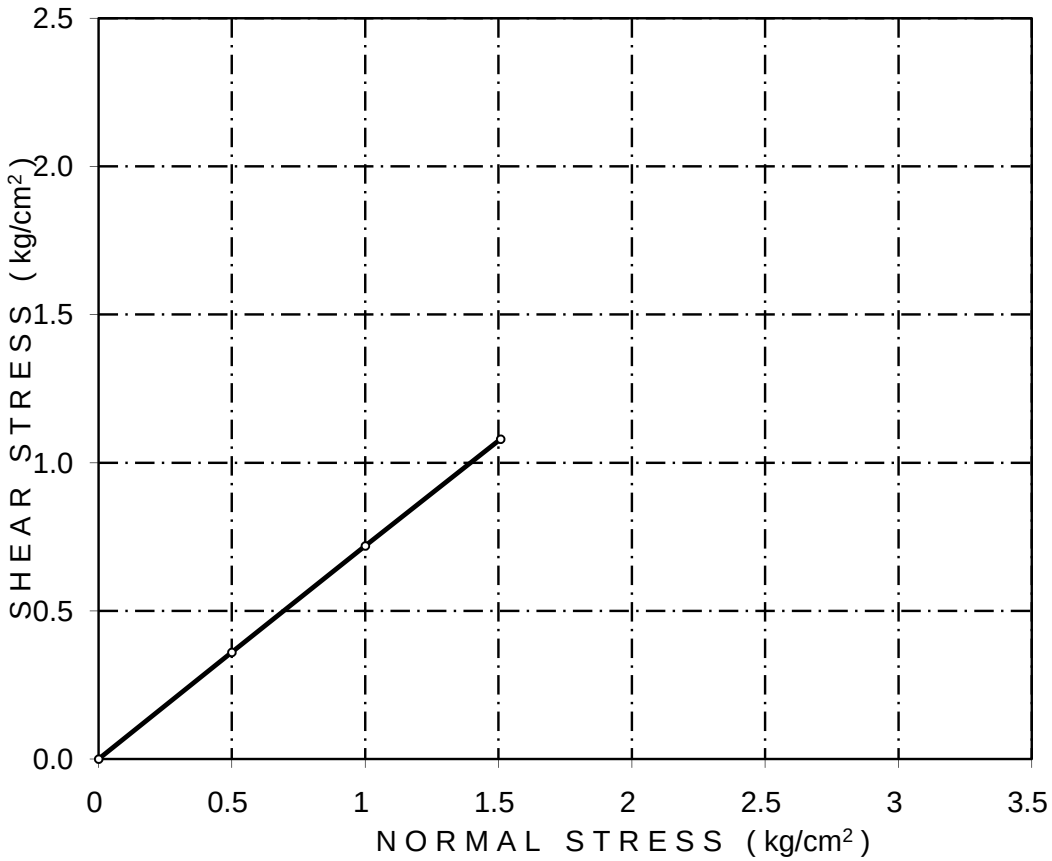
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 37

DRAINED DIRECT SHEAR TEST

Borehole No :	17
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.65	0	36



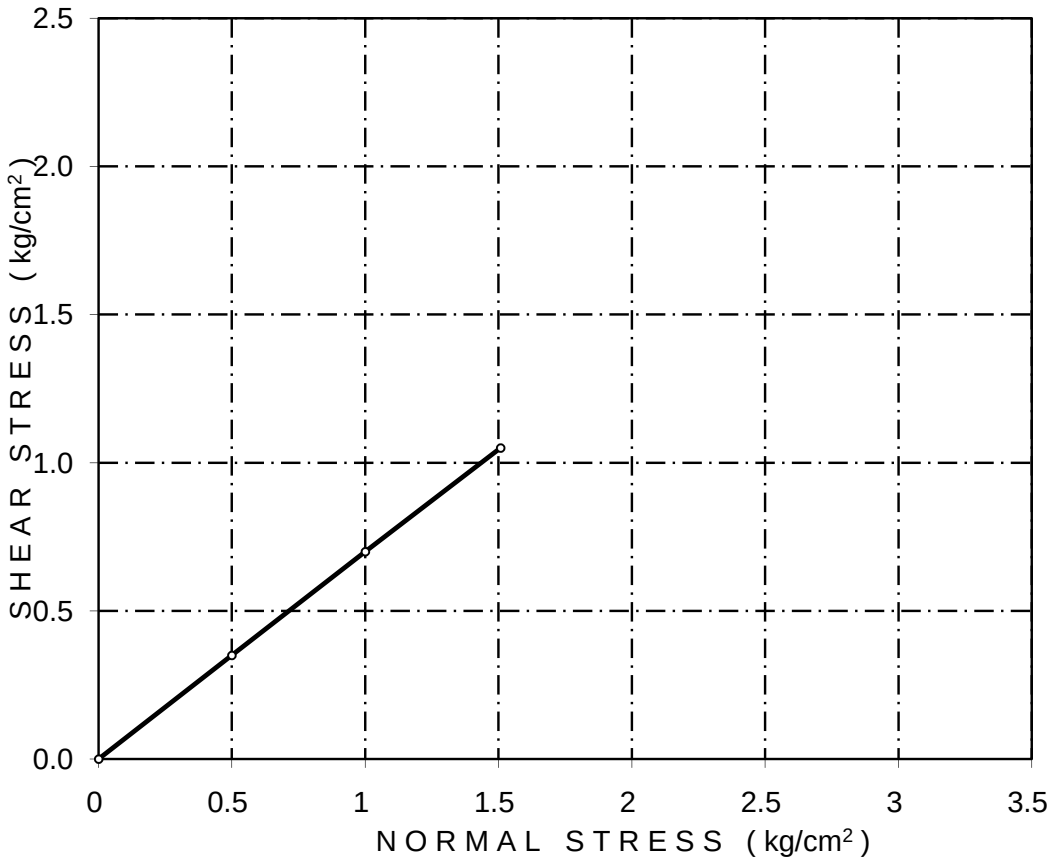
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 38

DRAINED DIRECT SHEAR TEST

Borehole No :	17
Depth :	**26.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.69	0	35



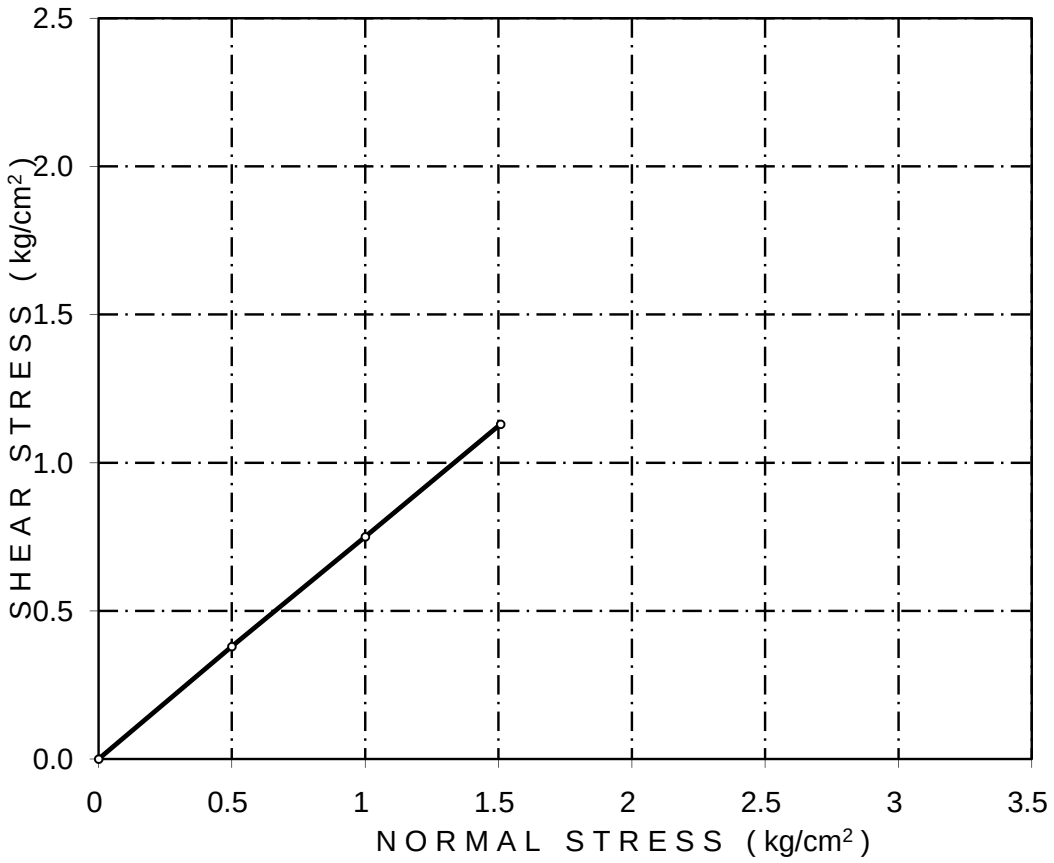
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 39

DRAINED DIRECT SHEAR TEST

Borehole No :	17
Depth :	**35.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.73	0	37



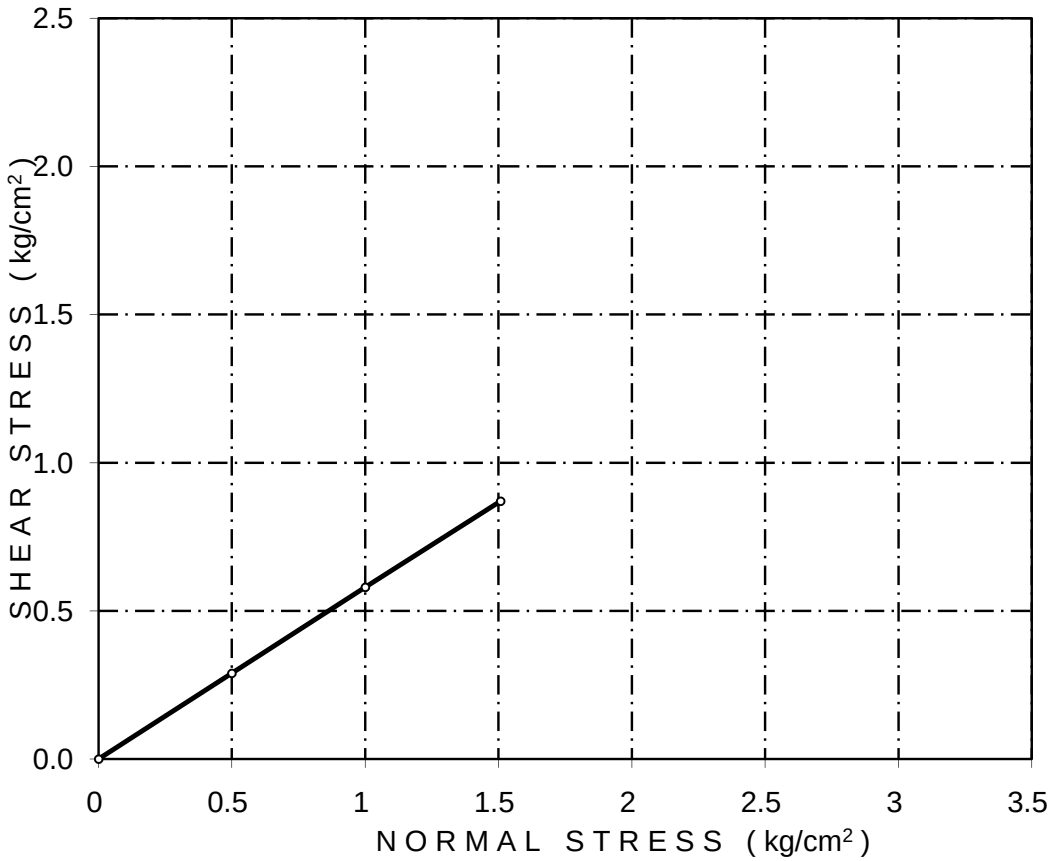
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 40

DRAINED DIRECT SHEAR TEST

Borehole No :	21
Depth :	**2.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.52	0	30



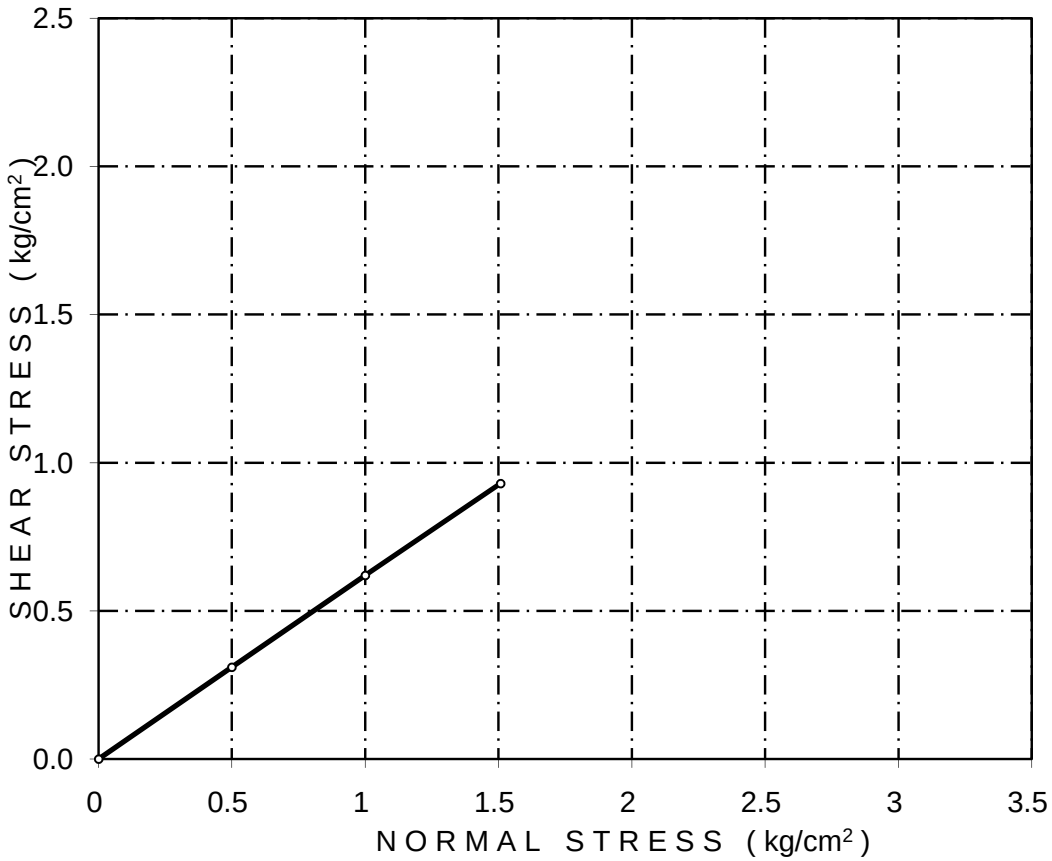
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 41

DRAINED DIRECT SHEAR TEST

Borehole No :	21
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	0	32



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

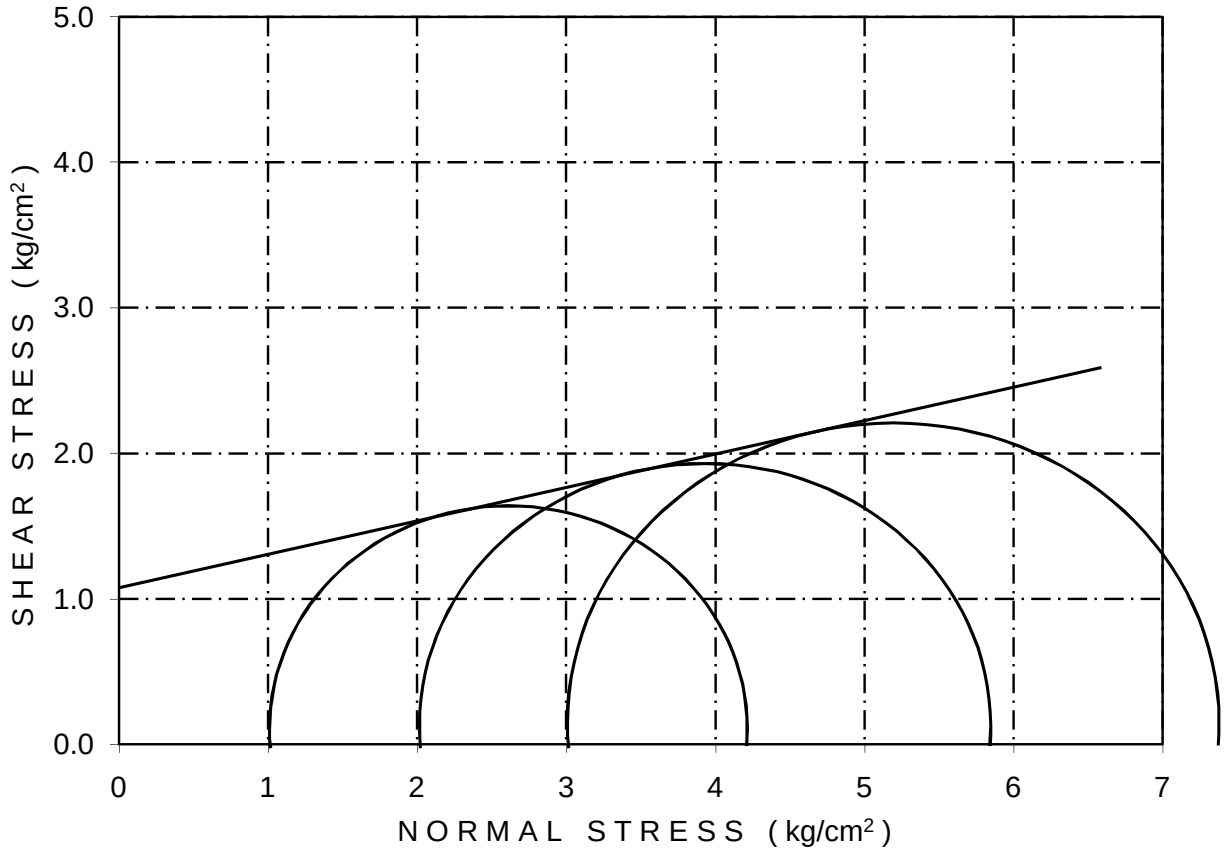
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 42

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	21
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.88	1.60	17.2

"c" Value kg/cm^2	"Ø" Value DEGREE
1.10	10



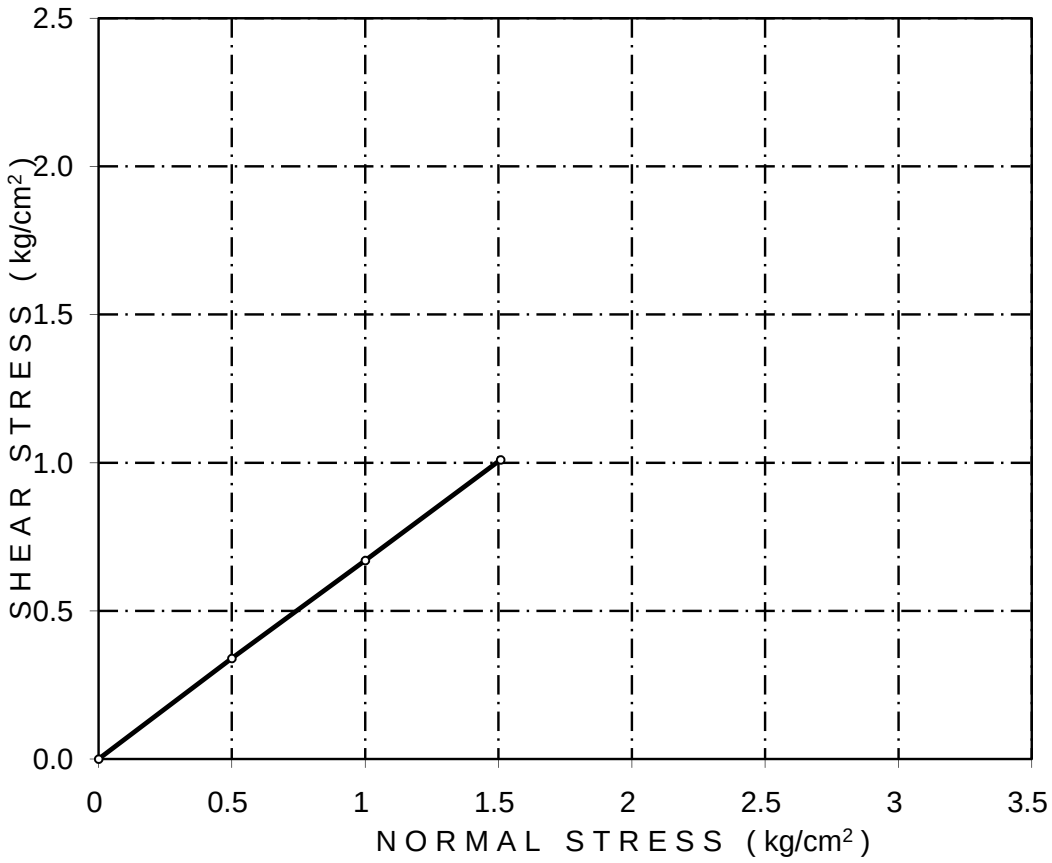
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 43

DRAINED DIRECT SHEAR TEST

Borehole No :	21
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.65	0	34



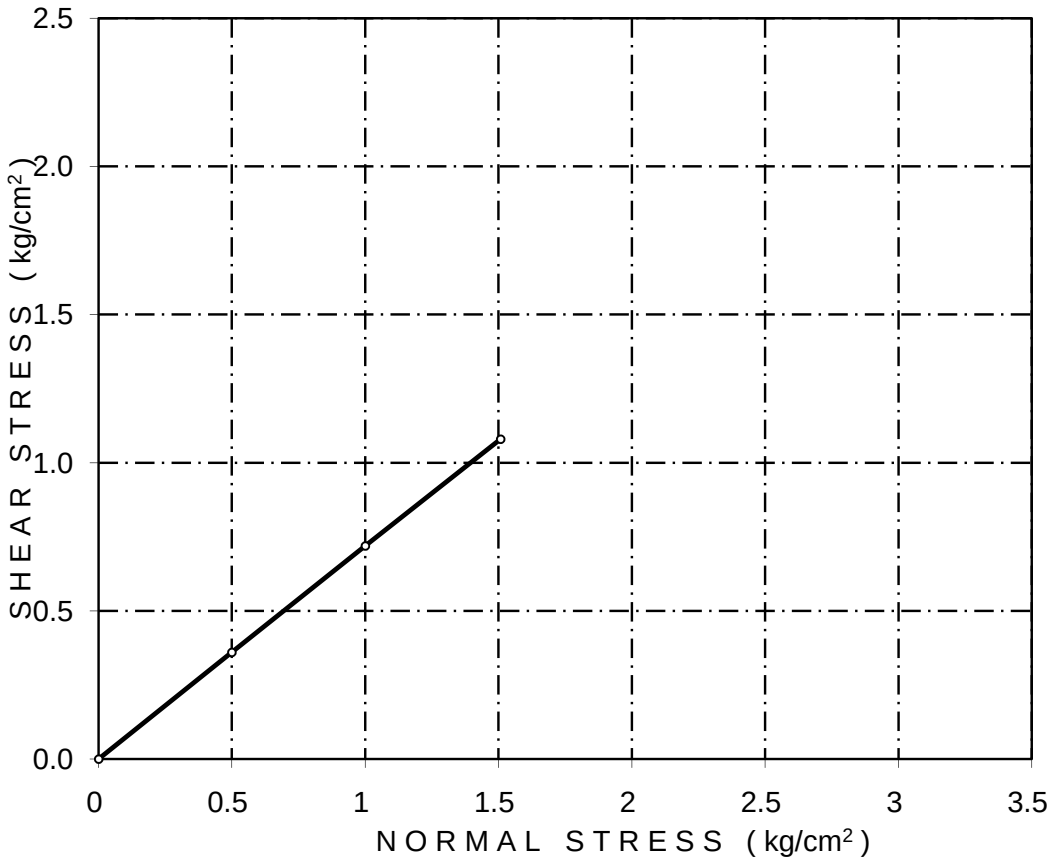
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 44

DRAINED DIRECT SHEAR TEST

Borehole No :	21
Depth :	**29.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.70	0	36



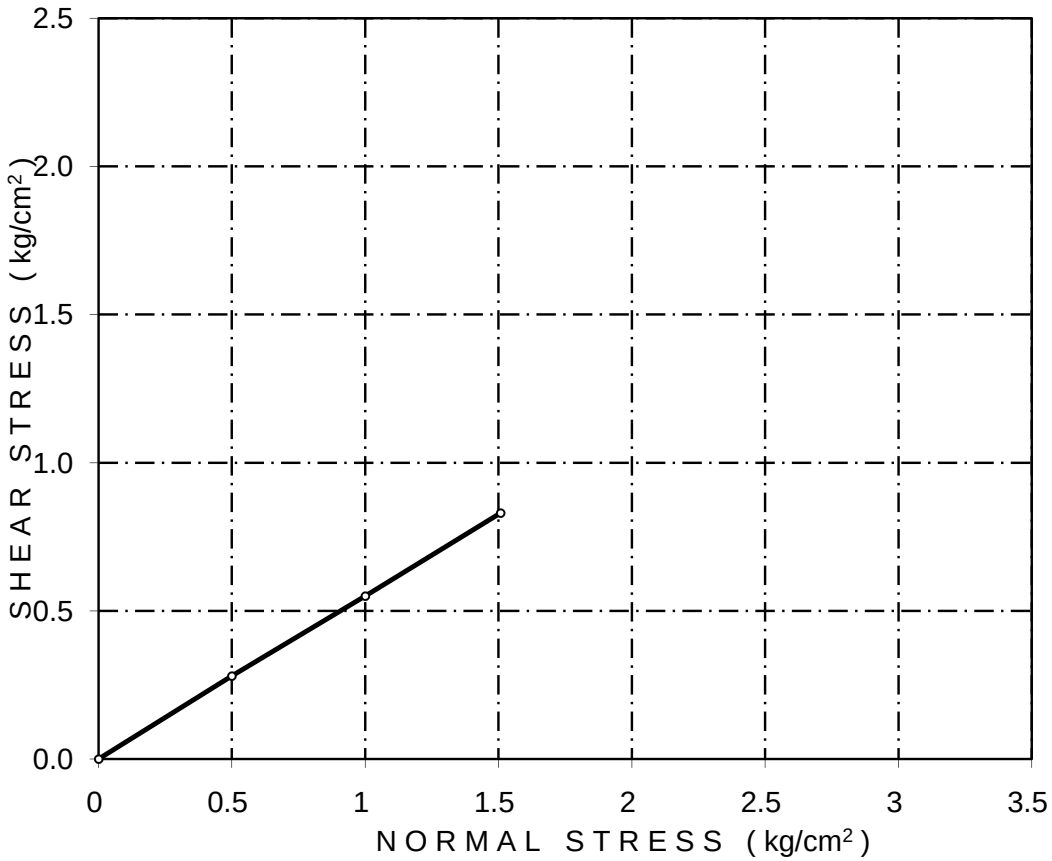
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 45

DRAINED DIRECT SHEAR TEST

Borehole No :	23
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.50	0	29



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

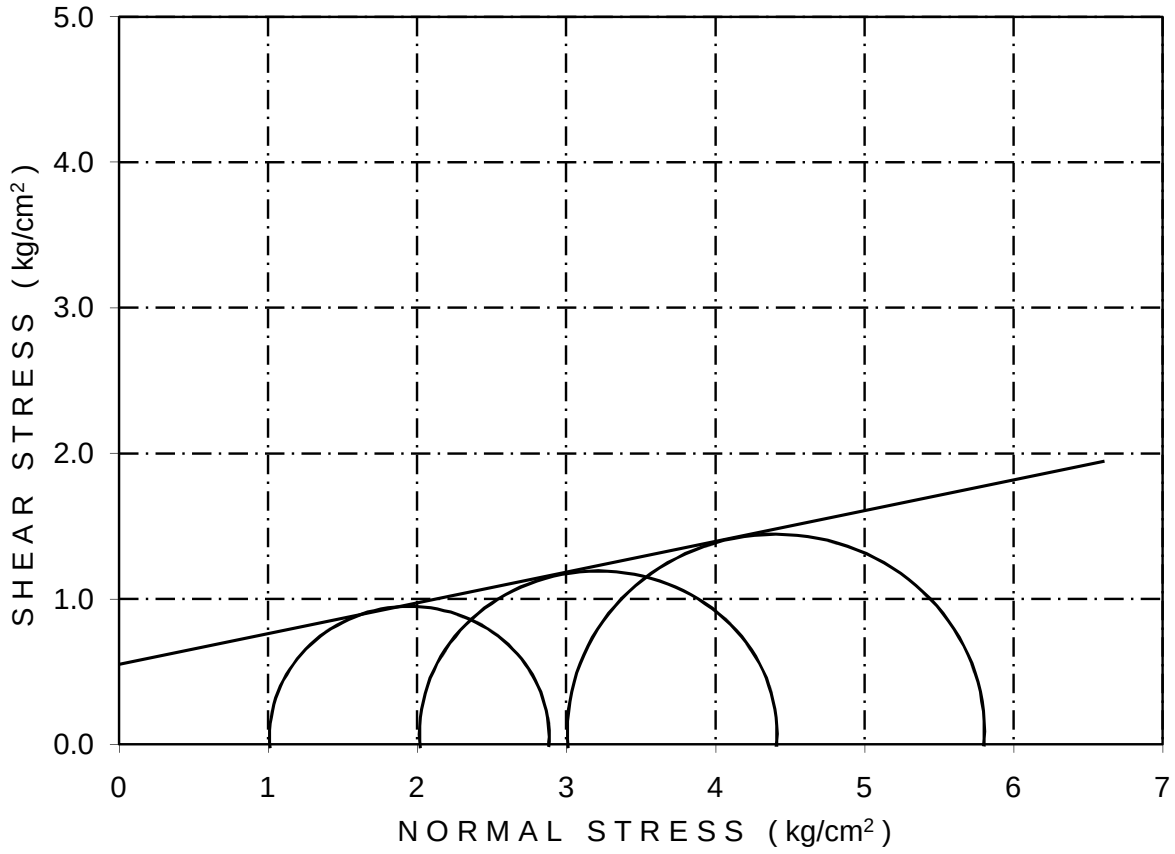
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 46

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	23
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.79	1.56	14.5

"c" Value kg/cm^2	"Ø" Value DEGREE
0.60	9



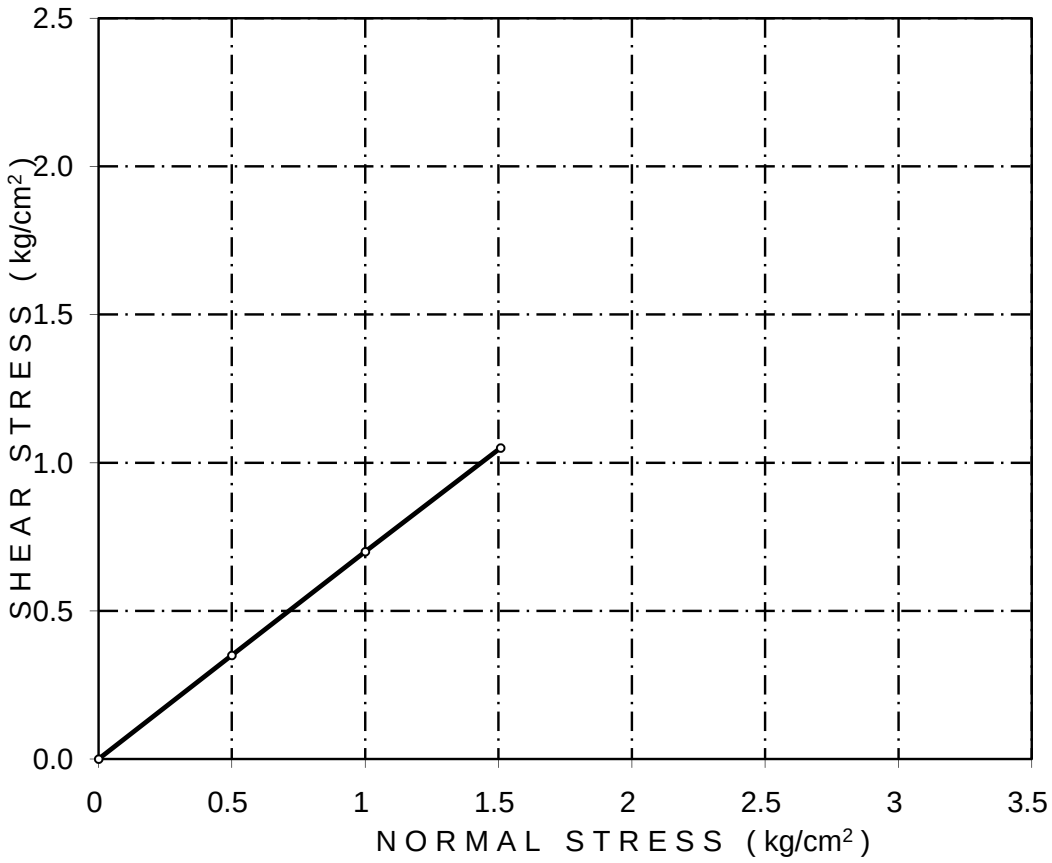
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 47

DRAINED DIRECT SHEAR TEST

Borehole No :	23
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.63	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

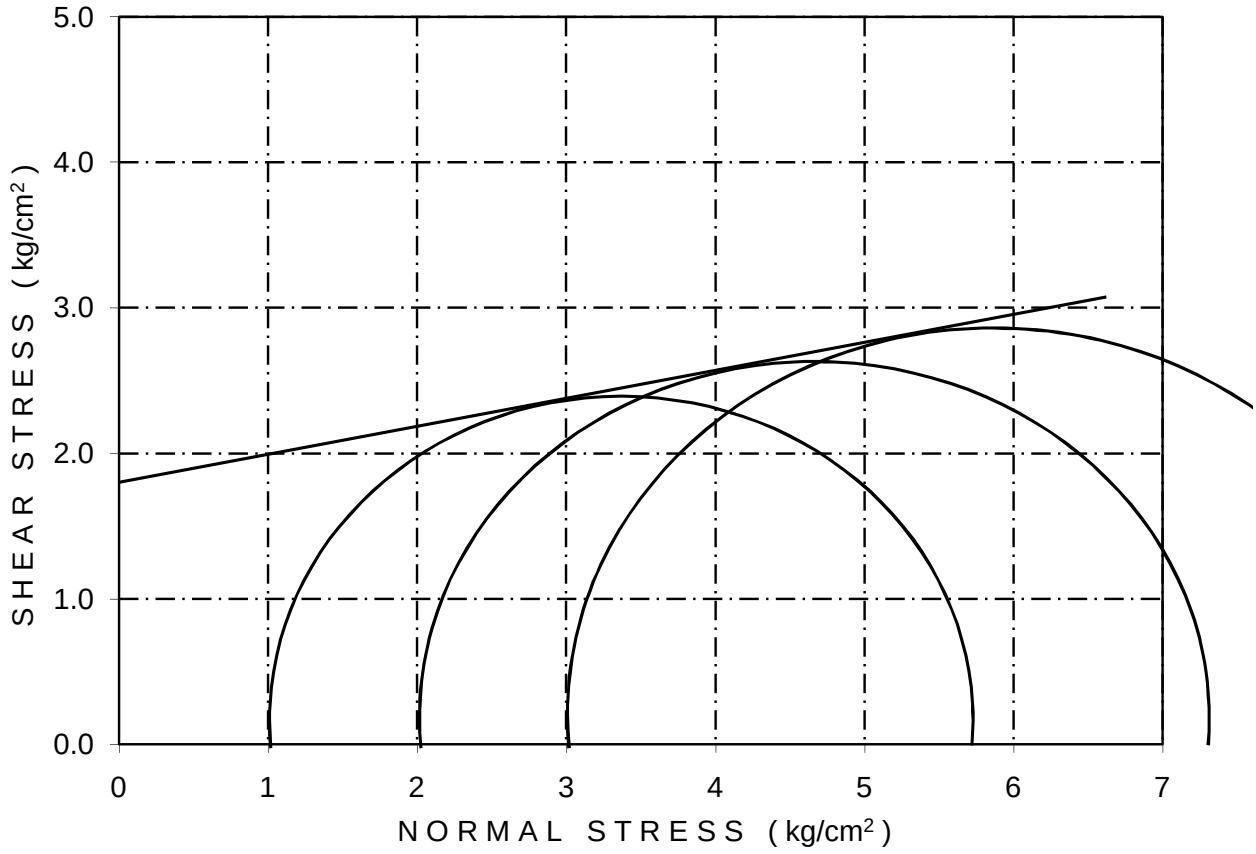
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 48

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	23
Depth	:	23.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.96	1.65	18.7

"c" Value kg/cm^2	"Ø" Value DEGREE
1.80	8



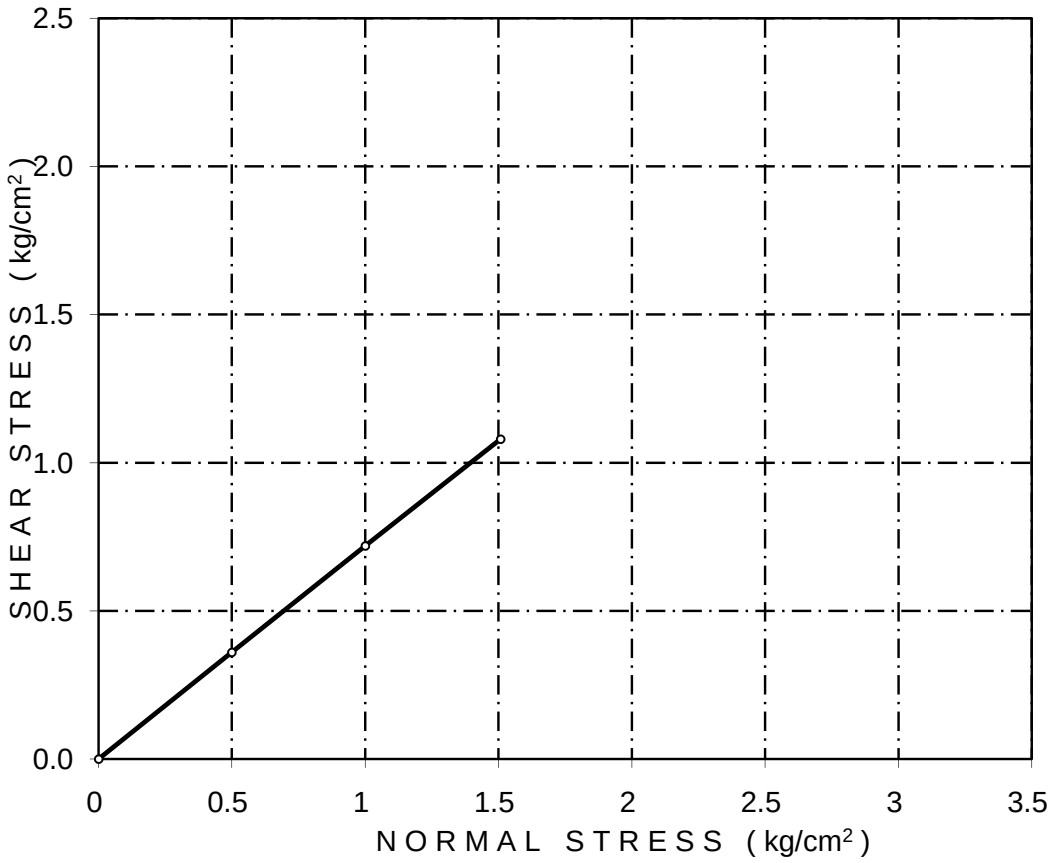
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 49

DRAINED DIRECT SHEAR TEST

Borehole No :	23
Depth :	**29.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.71	0	36



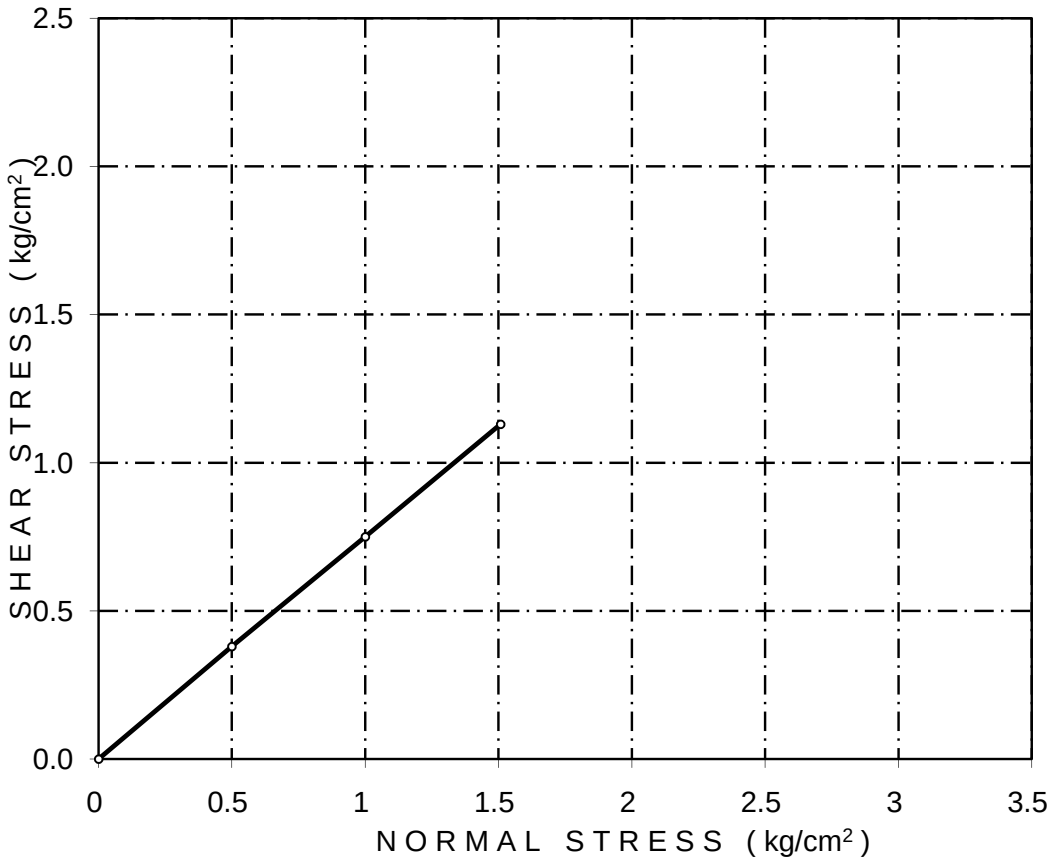
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 50

DRAINED DIRECT SHEAR TEST

Borehole No :	23
Depth :	**32.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.74	0	37



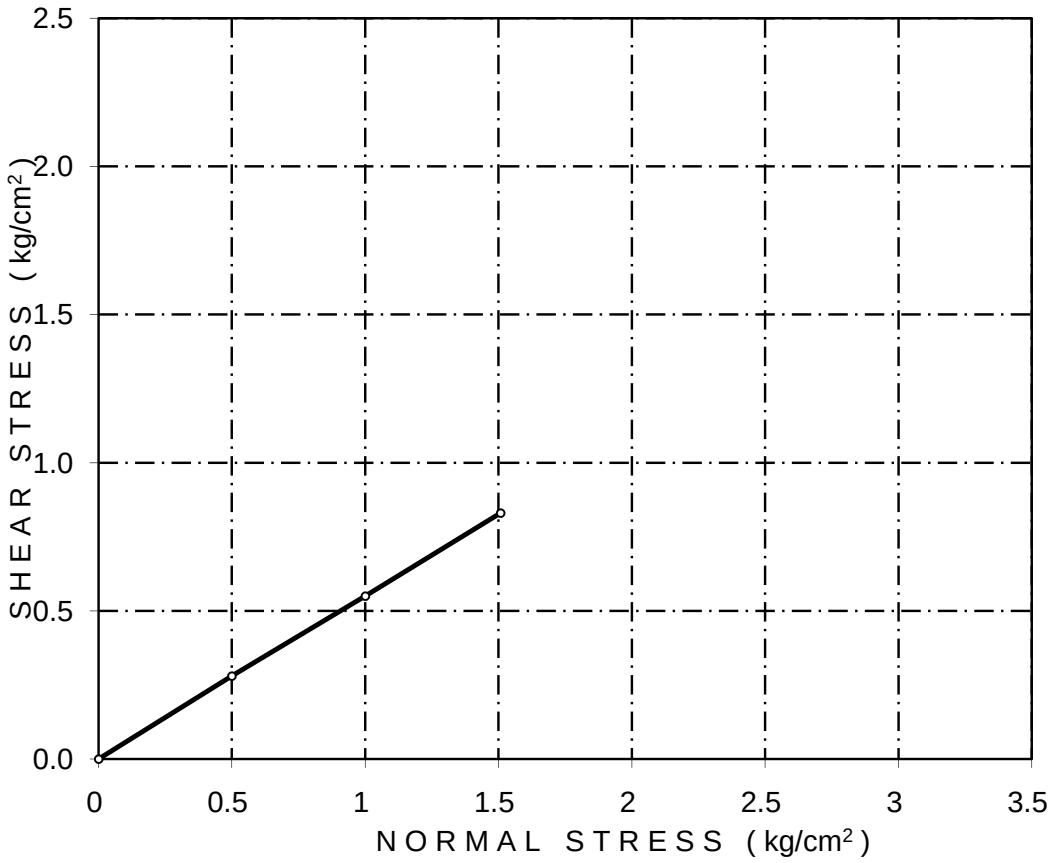
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 51

DRAINED DIRECT SHEAR TEST

Borehole No :	31
Depth :	**2.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.48	0	29



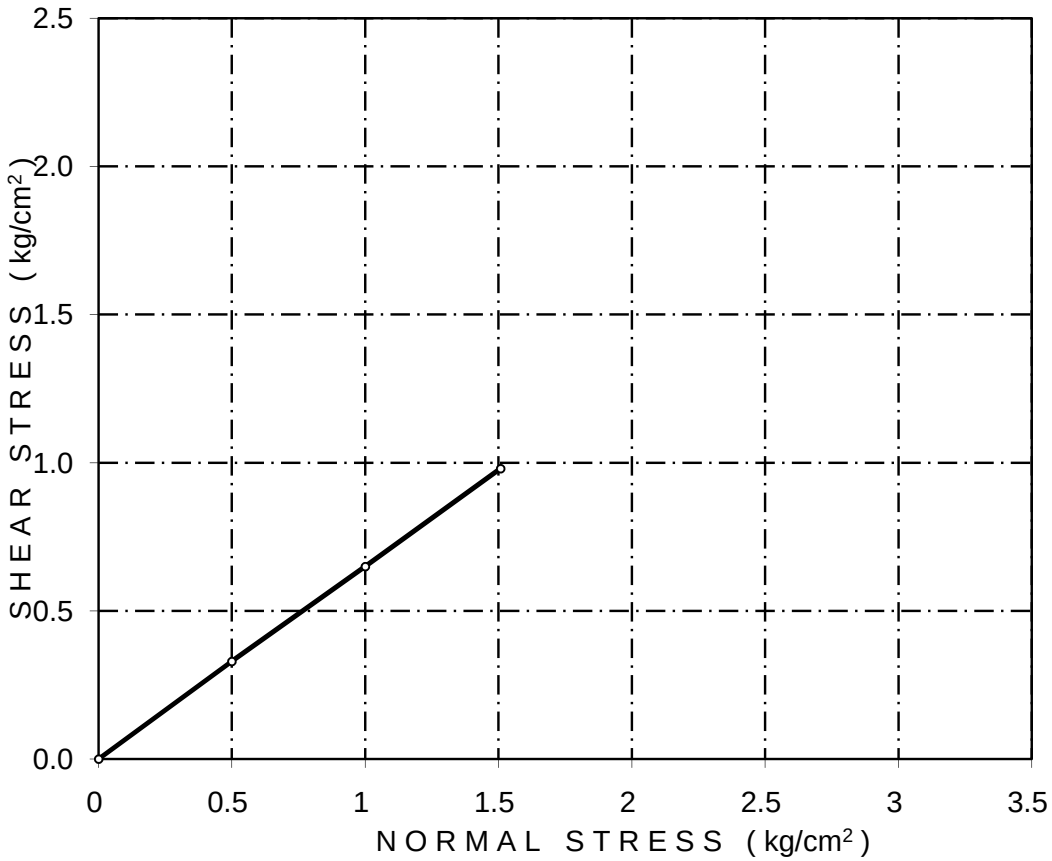
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 52

DRAINED DIRECT SHEAR TEST

Borehole No :	31
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	33



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

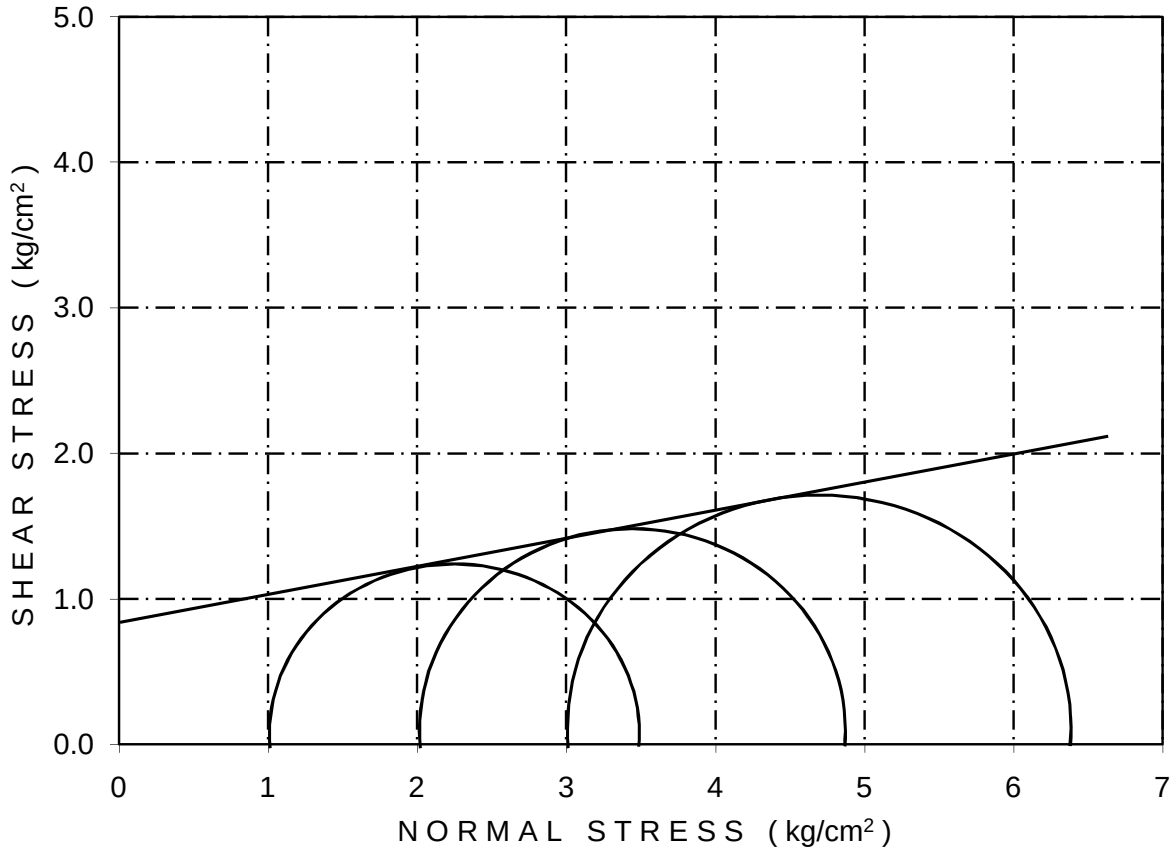
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 53

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	31
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.87	1.61	16.3

"c" Value kg/cm^2	"Ø" Value DEGREE
0.85	8



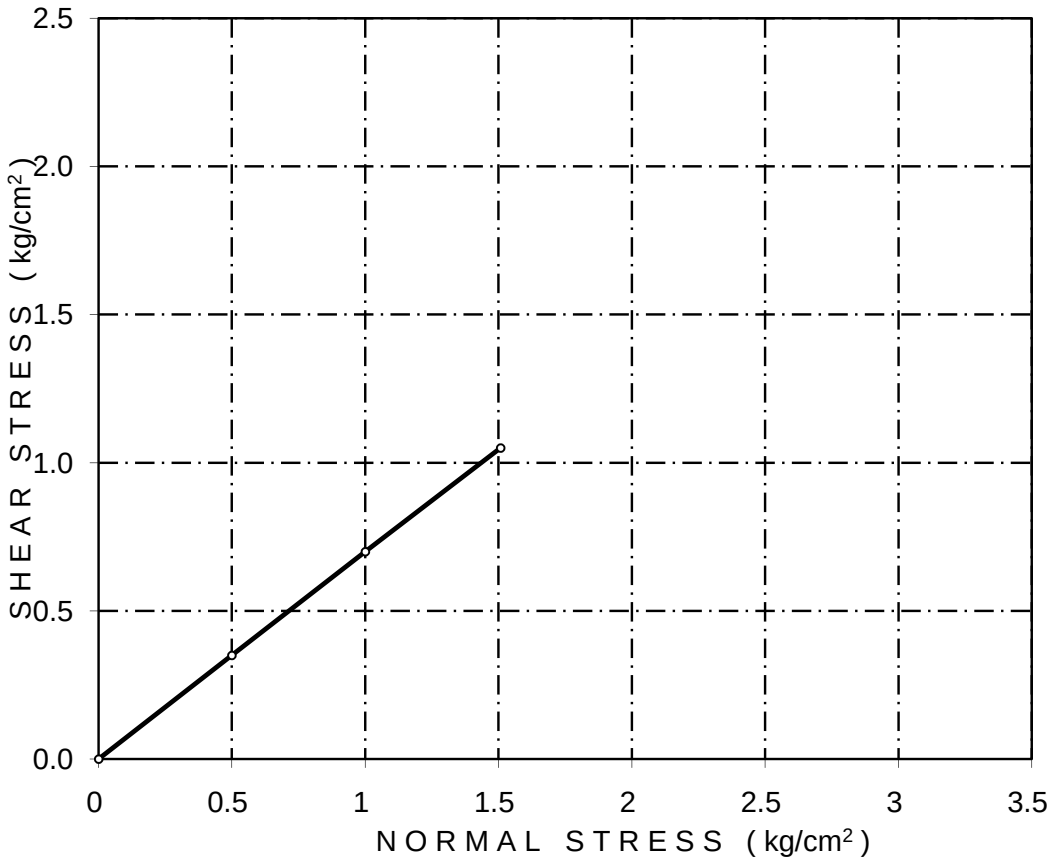
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 54

DRAINED DIRECT SHEAR TEST

Borehole No :	31
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.65	0	35



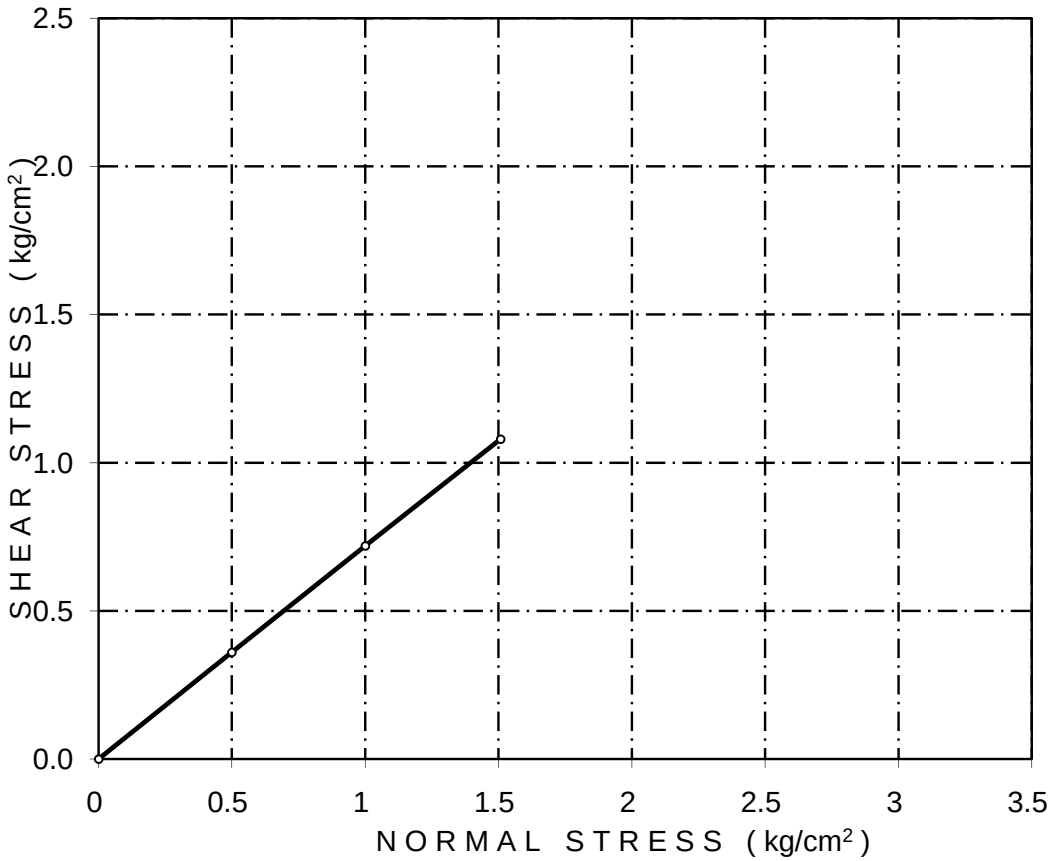
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 55

DRAINED DIRECT SHEAR TEST

Borehole No :	31
Depth :	**29.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.70	0	36



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

Project: Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BEARING CAPACITY ANALYSIS FOR SHALLOW FOUNDATIONS AS PER IS 6403-1981

The bearing capacity equation is as follows :

$$q_{net\ safe} = (1/FS)\{cNc\zeta_c d_c + q(N_q-1)\zeta_q d_q + 0.5B\gamma N_\gamma \zeta_\gamma d_\gamma R_w\}$$

where:

$q_{net\ safe}$ =	safe net bearing capacity	c =	cohesion intercept
q =	overburden pressure	B =	Foundation width
γ =	Bulk density of soil below founding level		
R_w =	Water table correction factor	FS =	Factor of safety
N_c, N_q, N_γ =	bearing capacity factors, which are a function of ϕ		
d_c, d_q, d_γ =	Depth factors		
$\zeta_c, \zeta_q, \zeta_\gamma$ =	Shape factors		

Soil parameters :

c = **5.00** T/m^2 ϕ = **8.0** degrees GENERAL SHEAR FAILURE

c' = 3.33 T/m^2 ϕ' = 5.4 degrees LOCAL SHEAR FAILURE

General Shear Failure :	N_c =	7.53	N_q =	2.06	N_γ =	0.86
Local Shear Failure :	N_c' =	6.60	N_q' =	1.62	N_γ' =	0.49

Bulk Density Profile

Depth, m From	Depth, m To	γ T/m^3
0.0	**5.0**	**1.60**
5.0	**10.0**	**1.75**
10.0	**25.0**	**1.90**

Factor of safety = **2.5** as per **IS 1904-1986**

Design Water Table depth = **10.0** m

R_w factor: Constant value(**V**) for worst condition or calculate(**C**) based on WT Depth ? : **V** Rw = **0.60**

Depth factor to be considered ? **Y**

For computation of Depth Factor, depth below GL to be ignored to account for loose soils,poorly compacted backfill above foundation, scour etc. = **1.0**

FAILURE CRITERIA **:** **AVERAGE OF LOCAL & GENERAL SHEAR FAILURE**

Foundation Dimensions		FOUN-DATION SHAPE	Depth,m	R_w	Shape Factors			Depth factors (GSF)			Depth factors (LSF)			$q_{net\ safe}$, T/m^2		Safe Net Bearing Capacity T/m^2
B, m	L, m				ζ_c	ζ_q	ζ_γ	d_c	d_q	d_γ	d_c'	$d_{q'}$	d_γ'	GSF	LSF	
3.0	**3.0**	**Square**	**2.0**	**0.60**	**1.30**	**1.20**	**0.80**	**1.08**	**1.00**	**1.00**	**1.07**	**1.00**	**1.00**	**23.1**	**13.5**	**18.3**

SETTLEMENT ANALYSIS FOR SHALLOW FOUNDATIONS AS PER IS: 8009 (Part-1)-1976, Clause 9.1.4

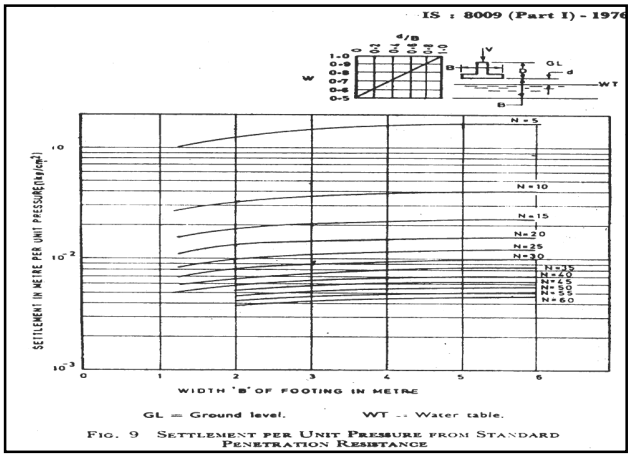


FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

Design Water Table Depth : **10.0m**

R_w factor : Calculate (**C**) based on water table depth or Fixed Value(**V**) for worst condition : **V** Rw factor for design : **0.6**

Fox's Depth Factor to be considered ? **Y**

Depth to be ignored in Depth Factor Computation for loose soils, poorly compacted backfill, scour, etc. **1.0** **m**

Tolerable Total Settlement : **50** **mm**

Foundation Width,m	Foundation Length,m	Foundation Depth,m	Shape	Design **N-value**	Settlement @ 1kg/cm^2 (as read off from graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	**Net Allowable Bearing Pressure, T/m^2**
3.0	**3.0**	**2.0**	**Square**	**12.0**	**26.5**	**0.60**	**0.91**	**1.0**	**12.4**

Lower of the two values of the above (Shear Criteria & Settlement Criteria) has been considered for the design. i.e. 12.4 T/m^2 .

GEOTECHNICAL INVESTIGATION REPORT FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

SUBMITTED TO

EIE ENGINEERING INDIA PVT. LTD.

H-79, L.G.F KALKAJI, NEW DELHI

REPORT NO. 16083-A ON DATED 11.02.2017

SUBMITTED BY

UV GLOBAL GEO SOLUTIONS PVT. LTD.

GEOTECHNICAL CONSULTANTS & LAND SURVEYORS

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

This soil investigation work, whose results are being presented herewith, has been carried out for the Proposed Samsung Plant at Noida, U.P. The Proposed structure may consist of with/without single basement.

A report containing the recommendations based on BH-2,7,17,21,23 & 31 has already been presented wide report no. 16083 on dated 22.12.2016. This report (Report No. 16083-A) presents the recommendations for 10 nos. of boreholes (BH-3, BH-4, BH-5, BH-8, BH-9, BH-10, BH-14, BH-16, BH-28 & BH-33). BH-28 was drilled from 1.5m depth below NGL.

1.2 PURPOSE OF INVESTIGATION

The purpose of this study are to investigate the stratigraphy at the site and to develop geotechnical recommendations for foundation design and construction. To achieve these purposes, the following study was conducted at the site.

(a) Drilling 10 boreholes (BH-3 to 40.0m, BH-4 to 45.0m, BH-5 to 45.0m, BH-8 to 42.0m, BH-9 to 42.0m, BH-10 to 40.0m, BH-14 to 42.0m, BH-16 to 45.0m, BH-28 to 45.0m & BH-33 to 45.0m) depth or Refusal whichever met earlier, through Soil and to collect disturbed and undisturbed soil samples.

(b) Laboratory testing for selected soil samples to determine different properties of the soils; and

(c) Analyzing all field and laboratory data in order to develop engineering recommendations for foundation design and construction.

(d) Preparation and submission of technical report.

2.0 FIELD INVESTIGATIONS CONDUCTED

Locations of Boreholes have been marked at the site as per the approved drawing provided by the client to us. These locations have been marked as BH-3, BH-4, BH-5, BH-8, BH-9, BH-10, BH-14, BH-16, BH-28 & BH-33 in this report.

2.1 BOREHOLES PROCEDURE

The boreholes were progressed to the specified depth of 40.0m-45.0m. The work was done in accordance with IS:1892-1979.

Standard Penetration Tests (SPT) were conducted in the borehole at 1.5-3.0m interval by connecting a split spoon sampler to 'A' rods and driving it by 45 cm using a 63.5 kg hammer falling freely from a height of 75 cm. The tests were done in accordance with IS:2131-1981.

The number of blows for each 15 cm of penetration was recorded. The blows required to penetrate the initial 15 cm of the split spoon for seating the sampler is ignored due to the possible presence of loose materials or cuttings from the drilling operation. The cumulative number of blows required to penetrate the balance 30 cm of the 45 cm sampling interval is termed the SPT value or the 'N' value.

Disturbed samples were collected from the split spoon after conducting SPT. The samples were preserved in transparent polythene bags. Undisturbed samples were collected by attaching a 100 mm diameter thin walled 'Shelby' tubes and driving the sampler lightly using a 63.5 kg hammer in accordance with IS:2132 .

2.2 GROUND WATER

Groundwater level in the boreholes was recorded after 24 hours after drilling was completed. It is mentioned in the borehole logs attached with the report.

3.0 LABORATORY TESTS

The following table presents the various tests conducted on Soil samples in the laboratory:

Laboratory Test	IS : Code Referred
Natural moisture content	IS : 2720 (Part-2)-1973
Grain size analysis	IS : 2720 (Part-4)-1985
Liquid & Plastic limit	IS : 2720 (Part-5)-1985
Unconsolidated Undrained Triaxial shear test	IS : 2720 (Part-11)-1993
Consolidated Drained Direct Shear Test	IS : 2720 (Part-13)-1986
Unconfined Compression Test	IS : 2720 (Part-10)-1991
Specific Gravity Test	IS : 2720 (Part-3)-1980

All test Results are being presented at Table no 1 to 10 of soil profiles & Fig. No. 11 to 97 attached in the report.

4.0 SITE CONDITIONS

4.1 SITE STRATIGRAPHY

The soils met at the site are light brown Sandy silt/Silty sand & Fine sand in alternate layers from ground surface to the final explored depth of 40.0m-45.0m.

The SPT values at site range from 7 to 19 to about 5.0m depth & from 13 to 27 to about 10.5m. Below this, SPT values range from 25 to 43 to about 15.0m depth & from 40 to Refusal(N>100) with some lower values to the final explored depth of 45.0m.

4.2 GROUND WATER TABLE

Groundwater was encountered to about **12.80-13.40m** depth below ground surface during our field investigation (December, 2016). Fluctuations may occur in measured water table due to variation in rainfall and surface evaporation rates.

5.0 LIQUEFACTION ANALYSIS

As per IS 1893-2002, liquefaction is likely in Sand strata below water table for SPT values less than 15. At this site, groundwater was encountered at about 12.80-13.40m depth below ground surface. The soils classify primarily as Sandy Silt (CL) /Fine Sand(SP-SM) below foundation level.

The SPT values at site range from 7 to 19 to about 5.0m depth & from 13 to 27 to about 10.5m. Below this, SPT values range from 25 to 43 to about 15.0m depth & from 40 to Refusal(N>100) with some lower values to the final explored depth of 45.0m.

On review of all soil parameters like, SPT values, Soil gradation, Depth to water table etc., we are of the opinion that the liquefaction is not likely to take place at this site.

6.0 FOUNDATION TYPE & DEPTH

Reviewing the site stratigraphy, SPT 'N' values & laboratory test results, we recommend the following foundation schemes at the site to support the structural loads.

(a) For lightly loaded structures, we recommend that Isolated open spread foundation at or below 2.0m depth below the existing ground surface may be provided at the site to support the structural loads. Recommendations for Isolated foundations are provided in section 8.1 of this report.

(a) Raft foundations at or below 3.5m depth below the existing ground surface. Recommendations for the same are provided in section 8.2 of this report.

(c) Bored Cast-in-situ piles may also be provided at the site to support the structural loads. 600mm, 750mm or 1000mm Diameter Piles may be used. Recommendations for Pile foundations are provided in section 8.3 of this report.

7.0 CONCEPT OF ANALYSIS

7.1 OPEN/RAFT FOUNDATIONS

Bearing capacity analysis for Open spread foundations/Raft foundation have been done in general accordance with IS:6403-1981.For the soil conditions encountered at this site, average of local and general shear failure conditions has been used for analysis.

Settlement analysis has been performed based on the SPT values as per chart given in IS:8009 Part-I-1976. As per IS 1904-1986, the tolerable total settlement is taken as 50 mm for Isolated Open Spread foundation and 75mm for Raft foundation.

Appropriate values have been substituted into the bearing capacity equation given in IS-6403 to compute the safe net bearing capacity. The values have been checked to determine the settlement of the foundation under the safe bearing pressure. The allowable bearing pressure has been taken as the lower of the two values computed from the bearing capacity shear failure criterion as well as that computed from the tolerable settlement criterion. The same has been recommended for the design.

7.2 PILE FOUNDATIONS

The axial compressive capacity for bored piles has been computed based on static analysis using c-ϕ values as interpreted from the site stratigraphy and laboratory test results.

The ultimate pile compressive capacity has been computed using the following equation as given in IS 2911 Part-I Section 2.

$$Q_{ult} = \left[\sum_{i=1}^{n} f_s A_s L_i\right] + q_u A_p$$

$$= \left[\sum_{i=1}^{n} (\alpha c_i + p_i k \tan\delta_i) A_s L_i\right] + \left[c_p N_c + q_p N_q + 0.5 D r N r\right] A_p$$

where :

Q_{ult}	=	Ultimate pile capacity
f_s	=	Unit skin friction
α	=	Adhesion factor
c_i	=	Cohesion intercept in ith layer
p_i	=	Overburden pressure at centre of ith layer
k	=	Coefficient of lateral earth pressure,
δ_i	=	Angle of friction between soil and pile (taken as equal to ϕ_i) for the ith layer
A_s	=	Surface area of pile per m length
L_i	=	Length of pile section in ith layer
c_p	=	Cohesion intercept in bearing strata
q_u	=	Unit end bearing
q_p	=	Overburden pressure in bearing strata
N_c, N_q, N_r	=	Bearing capacity factors, which are a function of ϕ in the bearing strata
A_p	=	Pile cross sectional area

The overburden pressure is assumed to become constant below depth of 15-20 times of pile diameter depending upon the diameter of the piles.

8.0 RECOMMENDATIONS

8.1 OPEN FOUNDATION

The following table presents our recommended values of Net allowable bearing pressure for Isolated Open Spread foundations bearing at or below 2.0m depth below the existing ground surface for 2-5 m wide foundations.

Foundation Depth below existing ground level, m	Recommended Net Allowable Bearing Pressure, T/m²
2.0	**12.4**
3.0	**15.0**
3.5	**16.6**
4.5	**19.5**

The above values include a safety factor of 2.5. Total settlement of foundation designed for the above net bearing pressure is expected to be about 50 mm. Net bearing pressure for foundations at intermediate depths may be interpolated linearly between the values given above.

8.2 RAFT FOUNDATIONS

The following table presents our recommended values of Net and Gross allowable bearing pressures and Modulus of sub grade reaction for Raft foundations (≥6 m) bearing at or below 3.5m depth below the existing ground surface for 75 mm settlement.

Foundation Depth below EGL, m	Recommended Net Allowable Bearing Pressure, T/m²	Recommended Gross Allowable Bearing Pressure, T/m²	Modulus of Sub grade reaction(*), Kg/cm³
3.5	16.8	22.4	1.1
4.0	18.4	24.8	1.1
4.5	20.1	27.3	1.2

For intermediate foundation depths, allowable bearing pressure values & Modulus of sub grade reaction values may be linearly interpolated. These values include a Safety Factor of 2.5.

Note:

As no Plate Load tests have been conducted at the site, the Modulus of Sub-grade reaction (*) values for Raft foundation given in above table are based purely on empirical formula. A suitable safety factor has been used for evaluation the same. It is recommended that these values of Modulus of Sub-grade reaction should be reconfirmed by Plate Load Tests.

8.3 PILE FOUNDATIONS

Bored cast-in-situ piles are a feasible foundation scheme to support structural loads. The following table presents the various parameters used for calculating pile capacities.

Depth, m		Soil Classification	c, T/m2	ϕ, degree	γ, T/m3
From	To				
0.0	3.0	Sandy Silt	5.0	7	1.66
3.0	9.0	Silty Sand/Fine Sand	0.0	29	1.75
9.0	15.0	Sandy Silt	9.0	8	1.85
15.0	21.0	Fine Sand	0.0	31	1.92
21.0	27.0	Sandy Silt	13.0	7	2.00
27.0	33.0	Fine Sand	0.0	31	2.02
33.0	40.0	Fine Sand	0.0	32	2.02

where :

c = Cohesion intercept

ϕ = Angle of internal friction between soil and pile

γ = Total unit weight

The following table presents our recommended Compressive pile capacities for 600 mm,750mm and 1000 mm diameter Bored Cast-in-situ piles with a cut off level of 2.0-2.5m depth below EGL. For pile capacity design, water table has been considered to rise upto 5.0m depth below existing ground surface for worst condition.

Pile Diameter , mm	Pile Tip Length Below COL, m	Recommended Compressive Pile capacities , Tonnes
600	20.0	122
	24.0	148
	28.0	193
	30.0	209
	32.0	231
	35.0	255
750	20.0	163
	24.0	196
	28.0	266
	30.0	287
	32.0	319
	35.0	352
1000	20.0	247
	24.0	294
	28.0	429
	30.0	463
	32.0	522
	35.0	575

The above values are based on as per IS:2911, Part-1, Section-II and include a safety factor of 2.5. Safe capacities of piles of intermediate length may be interpolated linearly between the values given above. Piles should be load tests to verify capacities as per IS:2911,Part-IV.

9.0 BASEMENT DESIGN

The basement should be designed to resist lateral earth pressure. For design purpose, we recommend the following values of co-efficient of earth pressures for the active, passive and at rest condition.

Depth, m		k_a	k_p	k_o
From	To			
3.5	4.5	0.35	2.85	0.52

where:

k_a = Co-efficient of active earth pressure
k_p = Co-efficient of passive earth pressure
k_o = Co-efficient of earth pressure at rest

A suitable safety factor should be applied on the passive earth pressures in the design of the wall.

10.0 EXCAVATION

Temporary open cut excavation through soil to about 3.5m-4.5m depth for foundation construction may be done using side slopes of 1.0 vertical on 0.5-0.6 horizontal. A 1.2-1.5m wide Berm also may provided at every 3.0m interval at the site. The excavation slopes should be monitored by the engineer to ensure stability. In case excessive sloughing or caving occurs, the slopes may be flattened further to ensure stability. In case, sufficient space is not available, sheet piles or contiguous piles may be provided at the site.

11.0 CLOSURE

We are thankful to client to provide the opportunity to perform this investigation by us. We have pleasure in submitting this report. Please contact us when we can be of further service to you.

For UV GLOBAL GEO SOLUTIONS PVT. LTD.

(PUSHPENDRA KUMAR)
DIRECTOR

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 3

WATER TABLE : 12.80m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to Medium dense light brown Silty Sand (SM) Loose, 0.0m to 0.5m														
SPT1	1.50 1.95	14	Medium dense, 0.5m to 3.0m	0	67	33	0	N.P.	N.P.		2.65						
UDS1	2.25 2.55		(3.0m)														
SPT2	3.00 3.45	18	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	19															
UDS2	5.25 5.55											1.70	1.54	10.4	0.5,1.0 1.5 (DST)	0.00	31^o
SPT4	6.00 6.45	23		0	93	7	0	N.P.	N.P.		2.63						
			(7.5m)														
SPT5	7.50 7.95	25	Medium dense light brown Silty Sand (SM)														
UDS3	8.25 8.55											1.78	1.59	11.7	0.5,1.0 1.5 (DST)	0.00	33^o
			(9.0m)														
SPT6	9.00 9.45	56	Very dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	64															

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 3

WATER TABLE : 12.80m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense to Dense light brown Sandy Silt, low plastic (CL)	2	19	67	12	28.7	19.4	9.3	2.68						
			Medium dense, 11.0m to 13.5m														
SPT8	12.00 12.45	22															
SPT9	13.50 13.95	36	Dense, 13.5m to 15.0m														
UDS5	14.25 14.55											1.90	1.63	16.5	1,2,3 (UUT)	1.10	8°
			(15.0m)														
SPT10	15.00 15.45	38	Dense to Very dense light grey Fine Sand (SP-SM)														
			Dense, 15.0m to 21.0m														
UDS6	17.25 17.55			0	95	5	0	N.P.	N.P.		2.62						
SPT11	18.00 18.45	41															
UDS7	20.25 20.55																
SPT12	21.00 21.45	57	Very dense, 21.0m to 27.0m														
UDS8	23.25 23.55											1.98	1.68	17.9	0.5,1.0 1.5 (DST)	0.00	35°
SPT13	24.00 24.45	67		3	91	9	0	N.P.	N.P.		2.63						
UDS9	26.25 26.55																

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 3

WATER TABLE : 12.80m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 1b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	48	Dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55		(30.0m)														
SPT15	30.00 30.45	55	Very dense light brown Sandy Silt, low plastic (CL)														
UDS11	32.25 32.55		(33.0m)	6	25	59	10	28.0	20.0	8.0	2.66	2.07	1.71	21.1	1,2,3 (UUT)	1.60	10^o
SPT16	33.00 33.45	81	Very dense light grey Fine Sand (SP-SM)														
UDS12	35.25 35.55																
SPT17	36.00 36.45	102															
UDS12	38.25 38.55											2.11	1.75	20.6	0.5,1.0 1.5 (DST)	0.00	37^o
SPT18	40.00 40.45	60	(40.0m)	2	90	8	0	N.P.	N.P.		2.63						

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 4

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 2

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose light brown Sandy Silt, low plastic (CL) (1.5m)	1	19	69	11	28.4	19.6	8.8	2.67						
SPT1	1.50 1.95	9	Loose to medium dense light brown Silty Sand (SM) Loose, 1.50m to 2.0m														
UDS1	2.25 2.55		Medium dense, 2.0m to 3.0m (3.0m)									1.65	1.50	10.2	0.5,1.0 1.5 (DST)	0.00	29^o
SPT2	3.00 3.45	11	Medium dense light brown Sandy Silt, low plastic (CL) (4.5m)														
SPT3	4.50 4.95	15	Loose to Medium dense light grey Fine Sand (SP-SM)														
UDS2	5.25 5.55		Medium dense, 4.5m to 7.5m														
SPT4	6.00 6.45	20															
SPT5	7.50 7.95	8	Loose, 7.5m to 8.0m	0	93	7	0	N.P.	N.P.		2.63						
			Medium dense, 8.0m to 9.0m					N.P. : Non Plastic									
UDS3	8.25 8.55		(9.0m)									1.75	1.56	11.9	0.5,1.0 1.5 (DST)	0.00	32^o
SPT6	9.00 9.45	23	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	17															

DST:Drained Direct Shear Test

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BH.No. 4

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 2a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	28															
SPT9	13.50 13.95	28															
UDS5	14.25 14.55		(15.0m)	4	15	66	15	30.9	18.9	12.0	2.69	1.89	1.61	17.1	1,2,3 (UUT)	1.20	7°
SPT10	15.00 15.45	50	Very dense light grey Fine Sand (SP-SM)														
UDS6	17.25 17.55																
SPT11	18.00 18.45	62															
UDS7	20.25 20.55																
SPT12	21.00 21.45	76		0	94	6	0	N.P.	N.P.		2.62						
UDS8	23.25 23.55											1.99	1.69	17.6	0.5,1.0 1.5 (DST)	0.00	36°
SPT13	24.00 24.45	71															
UDS9	26.25 26.55		(27.0m)														

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

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WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 2b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	68	Very dense light brown Sandy Silt, low plastic (CL)														
UDS10	29.25 29.55			3	23	63	11	28.6	19.5	8.9	2.67	2.02	1.70	18.9	1,2,3 (UUT)	1.75	9°
			(30.0m)														
SPT15	30.00 30.45	87	Very dense light grey Fine Sand (SP-SM)														
UDS11	32.25 32.55																
SPT16	33.00 33.45	94															
UDS12	35.25 35.55											2.09	1.74	19.9	0.5,1.0 1.50 (DST)	0.00	37°
SPT17	36.00 36.45	103		2	92	6	0	N.P.	N.P.		2.63						
UDS12	38.25 38.55																
			(39.0m)														
SPT18	39.00 39.45	82	Very dense light brown Sandy Silt, low plastic (CL)														
UDS13	41.25 41.55																
			(42.0m)														
SPT19	42.00 42.45	Ref.	Very dense light grey Fine Sand (SP-SM)	0	92	8	0	N.P.	N.P.		2.64						

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 4

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 2c

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS14	44.25 44.55		Very dense light grey Fine Sand (SP-SM)									2.13	1.77	20.4	0.5,1.0 1.50 (DST)	0.00	38^0
SPT20	45.00 45.45	Ref.	(45.0m)														

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 5

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 3

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose light brown Sandy Silt, low plastic (CL)	1	18	70	11	28.3	19.5	8.8	2.67						
			(1.5m)														
SPT1	1.50 1.95	7	Loose light brown Silty Sand (SM)														
UDS1	2.25 2.55																
SPT2	3.00 3.45	7															
			(4.5m)														
SPT3	4.50 4.95	9	Loose to Dense light grey Fine Sand (SP-SM)														
			Loose, 4.5m to 5.0m												0.5,1.0		
UDS2	5.25 5.55		Medium dense, 5.0m to 7.5m									1.72	1.55	10.7	1.5 (DST)	0.00	30^o
SPT4	6.00 6.45	22															
												DST:Drained Direct Shear Test					
SPT5	7.50 7.95	31	Dense, 7.5m to 9.0m														
UDS3	8.25 8.55			0	94	6	0	N.P.	N.P.		2.64						
								N.P. : Non Plastic									
			(9.0m)														
SPT6	9.00 9.45	24	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	21															

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Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 5

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 3a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)									1.80	1.58	13.8	1,2,3 (UUT)	0.80	8^o
												UUT : Unconsolidated Undrained Triaxial Shear Test					
SPT8	12.00 12.45	27		4	15	68	13	29.1	19.8	9.3	2.68						
SPT9	13.50 13.95	30															
UDS5	14.25 14.55		(15.0m)														
SPT10	15.00 15.45	47	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 15.0m to 18.0m														
UDS6	17.25 17.55											1.92	1.63	17.8	0.5,1.0 1.5 (DST)	0.00	34^o
SPT11	18.00 18.45	55	Very dense, 18.0m to 27.0m										DST:Drained Direct Shear Test				
UDS7	20.25 20.55																
SPT12	21.00 21.45	60		0	93	7	0	N.P.	N.P.		2.63						
								N.P. : Non Plastic									
UDS8	23.25 23.55																
SPT13	24.00 24.45	125															
UDS9	26.25 26.55		(27.0m)									2.01	1.70	18.1	0.5,1.0 1.5 (DST)	0.00	37^o

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 5

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 3b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	164	Very dense light brown Sandy Silt, low plastic (CL)														
UDS10	29.25 29.55			3	25	62	10	27.9	19.9	8.0	2.66	2.09	1.73	20.6	1,2,3 (UUT)	2.10	10^o
			(30.0m)														
SPT15	30.00 30.45	117	Very dense light grey Fine Sand (SP-SM)														
UDS11	32.25 32.55																
SPT16	33.00 33.45	Ref.															
UDS12	35.25 35.55																
SPT17	36.00 36.45	Ref.		2	91	7	0	N.P.	N.P.		2.63						
UDS12	38.25 38.55																
			(39.0m)														
SPT18	39.00 39.45	Ref.	Very dense light brown Sandy Silt, low plastic (CL)														
UDS13	41.25 41.55											2.2	1.75	22.7	1,2,3 (UUT)	2.30	9^o
SPT19	42.00 42.45	Ref.		2	23	64	11	28.4	19.8	8.6	2.67						

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 5

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 3c

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS14	44.25 44.55		Very dense light brown Sandy Silt, low plastic (CL)														
SPT20	45.00 45.45	Ref.	(45.0m)														

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 8

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 4

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to medium dense light brown Sandy Silt, low plastic (CL) Loose, 0.0m to 2.0m														
SPT1	1.50 1.95	7															
			Medium dense, 2.0m to 3.0m														
UDS1	2.25 2.55			0	24	66	10	28.1	20.0	8.1	2.66						
			(3.0m)														
SPT2	3.00 3.45	14	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	17															
UDS2	5.25 5.55											1.72	1.55	10.7	0.5,1.0 1.5 (DST)	0.00	30^o
SPT4	6.00 6.45	18		0	94	6	0	N.P.	N.P.		2.64						
			(7.5m)														
SPT5	7.50 7.95	15	Medium dense light brown Sandy Silt, low plastic (CL)														
UDS3	8.25 8.55																
SPT6	9.00 9.45	23															
SPT7	10.50 10.95	28															

DST:Drained Direct Shear Test

N.P. : Non Plastic

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 8

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 4a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)									1.79	1.58	13.4	1,2,3 (UUT)	0.80	8°
												UUT : Unconsolidated Undrained Triaxial Shear Test					
SPT8	12.00 12.45	26	(13.5m)	3	19	65	13	29.5	18.9	10.6	2.68						
SPT9	13.50 13.95	29	Medium dense to Very dense light grey Fine Sand (SP-SM) Medium dense, 13.5m to 15.0m														
UDS5	14.25 14.55																
SPT10	15.00 15.45	35	Dense, 15.0m to 21.0m														
UDS6	17.25 17.55											1.88	1.61	16.9	0.5,1.0 1.50 (DST)	0.00	35°
												DST:Drained Direct Shear Test					
SPT11	18.00 18.45	30															
UDS7	20.25 20.55																
SPT12	21.00 21.45	53	Very dense, 21.0m to 39.0m	0	95	5	0	N.P.	N.P.		2.62						
								N.P. : Non Plastic									
UDS8	23.25 23.55											1.96	1.66	17.8	0.5,1.0 1.50 (DST)	0.00	36°
SPT13	24.00 24.45	57															
UDS9	26.25 26.55																

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 8

WATER TABLE : 13.00m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 4b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	86	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55																
SPT15	30.00 30.45	83		0	93	7	0	N.P.	N.P.		2.63						
								N.P. : Non Plastic									
UDS11	32.25 32.55											2.02	1.71	18.1	0.5,1.0 1.50 (DST)	0.00	36^o
SPT16	33.00 33.45	68															
												DST:Drained Direct Shear Test					
UDS12	35.25 35.55																
SPT17	36.00 36.45	82															
UDS12	38.25 38.55																
			(39.0m)														
SPT18	39.00 39.45	Ref.	Very dense light brown Sandy Silt, low plastic (CL)	4	23	62	11	28.3	19.9	8.4	2.67						
												UUT : Unconsolidated Undrained Triaxial Shear Test					
UDS13	41.25 41.55											2.14	1.74	23.1	1,2,3 (UUT)	1.90	9^o
SPT19	42.00 42.45	Ref.															
			(42.0m)														

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 9

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 5

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to medium dense light brown Sandy Silt, low plastic (CL)														
SPT1	1.50 1.95	8	Loose, 0.0m to 2.0m	0	19	70	11	28.6	19.4	9.2	2.68						
UDS1	2.25 2.55		Medium dense, 2.0m to 3.0m									1.65	1.50	10.3	1,2,3 (UUT)	0.55	9^o
			(3.0m)														
SPT2	3.00 3.45	11	Loose to Medium dense light grey Fine Sand (SP-SM)														
			Medium dense, 3.0m to 4.5m														
SPT3	4.50 4.95	7	Loose, 4.5m to 5.0m														
UDS2	5.25 5.55																
SPT4	6.00 6.45	13	Medium dense, 5.0m to 7.5m														
SPT5	7.50 7.95	7	Loose, 7.5m to 8.0m														
UDS3	8.25 8.55		Medium dense, 8.0m to 9.0m	1	92	7	0	N.P.	N.P.		2.64	1.75	1.56	11.9	0.5,1.0 1.5 (DST)	0.00	32^o
			(9.0m)														
SPT6	9.00 9.45	24	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	28															

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 9

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 5a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense to Dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	31	Dense, 12.0m to 13.5m														
SPT9	13.50 13.95	15	Medium dense, 13.5m to 15.0m	3	16	66	15	30.4	18.7	11.7	2.69						
UDS5	14.25 14.55		(15.0m)									1.85	1.57	18.1	1,2,3 (UUT)	0.70	8^o
SPT10	15.00 15.45	28	Medium dense light brown Silty Sand (SM)														
UDS6	17.25 17.55		(18.0m)	2	75	23	0	N.P.	N.P.		2.65						
SPT11	18.00 18.45	40	Dense to Very dense light grey Fine Sand (SP-SM)														
			Dense, 18.0m to 21.0m												0.5,1.0 1.50 (DST)		
UDS7	20.25 20.55											1.91	1.6	17.9		0.00	34^o
SPT12	21.00 21.45	59	Very dense, 21.0m to 27.0m														
UDS8	23.25 23.55																
SPT13	24.00 24.45	70		0	95	5	0	N.P.	N.P.		2.63						
UDS9	26.25 26.55		(27.0m)														

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 9

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 5b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	81	Very dense light brown Sandy Silt, low plastic (CL)														
UDS10	29.25 29.55											2.00	1.66	20.7	1,2,3 (UUT)	1.60	9^o
			(30.0m)														
SPT15	30.00 30.45	57	Very dense light grey Fine Sand (SP-SM)														
UDS11	32.25 32.55																
SPT16	33.00 33.45	90		0	92	8	0	N.P.	N.P.		2.64						
UDS12	35.25 35.55																
SPT17	36.00 36.45	Ref.															
UDS12	38.25 38.55											2.05	1.73	18.4	0.5,1.0 1.50 (DST)	0.00	37^o
			(39.0m)														
SPT18	39.00 39.45	Ref.	Very dense light brown Sandy Silt, low plastic (CL)														
UDS13	41.25 41.55																
SPT19	42.00 42.45	Ref.		4	18	65	13	29.2	19.0	10.2	2.68						
			(42.0m)														

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 10

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 6

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Medium dense light brown Sandy Silt, low plastic (CL)														
SPT1	1.50 1.95	10															
UDS1	2.25 2.55			0	23	67	10	28.0	20.0	8.0	2.66	1.67	1.52	10.0	1,2,3 (UUT)	0.50	9^o
			(3.0m)														
SPT2	3.00 3.45	12	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	10															
UDS2	5.25 5.55																
SPT4	6.00 6.45	11															
SPT5	7.50 7.95	20		0	92	8	0	N.P.	N.P.		2.64						
UDS3	8.25 8.55											1.74	1.56	11.8	0.5,1.0 1.5 (DST)	0.00	32^o
			(9.0m)														
SPT6	9.00 9.45	21	Medium dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	25															

N.P. : Non Plastic

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 10

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 6a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	27	(13.5m)	3	18	65	14	29.5	18.9	10.6	2.67						
SPT9	13.50 13.95	29	Medium dense to Very dense light grey Fine Sand (SP-SM)														
UDS5	14.25 14.55		Medium dense, 13.5m to 15.0m														
SPT10	15.00 15.45	36	Dense, 15.0m to 18.0m														
UDS6	17.25 17.55											1.89	1.60	17.9	0.5,1.0 1.5 (DST)	0.00	34^o
SPT11	18.00 18.45	10	Medium dense, 18.0m to 21.0m														
UDS7	20.25 20.55																
SPT12	21.00 21.45	39	Dense, 21.0m to 24.0m	0	94	6	0	N.P.	N.P.		2.62						
UDS8	23.25 23.55											1.93	1.63	18.5	0.5,1.0 1.5 (DST)	0.00	35^o
SPT13	24.00 24.45	57	Very dense, 24.0m to 27.0m														
UDS9	26.25 26.55																

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 10

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 40.0m

TABLE NO. 6b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	64	Very dense light brown Sandy Silt, low plastic (CL)														
UDS10	29.25 29.55		(30.0m)	2	21	65	12	28.8	19.7	9.1	2.67	2.0	1.7	21.6	1,2,3 (UUT)	1.70	8^o
SPT15	30.00 30.45	56	Very dense light brown Silty Sand (SM)														
UDS11	32.25 32.55																
SPT16	33.00 33.45	63															
UDS12	35.25 35.55		(36.0m)														
SPT17	36.00 36.45	89	Very dense light grey Fine Sand (SP-SM)	4	91	5	0	N.P.	N.P.		2.63						
UDS12	38.25 38.55											2.08	1.74	19.5	0.5,1.0 1.5 (DST)	0.00	38^o
SPT18	40.00 40.45	Ref.	(40.0m)														

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 14

WATER TABLE : 13.40m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 7

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose light brown Sandy Silt, low plastic (CL)	0	25	65	10	28.2	20.1	8.1	2.67						
			(1.5m)														
SPT1	1.50 1.95	8	Loose to medium dense light brown Silty Sand (SM)														
			Loose, 1.5m to 2.0m												0.5,1.0		
UDS1	2.25 2.55		Medium dense, 2.0m to 3.0m									1.66	1.51	9.8	1.5 (DST)	0.00	29^o
			(3.0m)														
SPT2	3.00 3.45	10	Loose to Medium dense light grey Fine Sand (SP-SM)									DST:Drained Direct Shear Test					
SPT3	4.50 4.95	15	Medium dense, 3.0m to 7.5m														
UDS2	5.25 5.55											1.70	1.54	10.6	0.5,1.0 1.5 (DST)	0.00	31^o
SPT4	6.00 6.45	21		0	88	12	0	N.P.	N.P.		2.64						
								N.P. : Non Plastic									
SPT5	7.50 7.95	6	Loose, 7.5m to 8.0m														
UDS3	8.25 8.55		Medium dense, 8.0m to 9.0m														
			(9.0m)														
SPT6	9.00 9.45	42	Dense light brown Sandy Silt, low plastic (CL)														
SPT7	10.50 10.95	31															

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 14

WATER TABLE : 13.40m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 7a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Dense light brown Sandy Silt, low plastic (CL)														
SPT8	12.00 12.45	36															
SPT9	13.50 13.95	30															
UDS5	14.25 14.55			3	20	66	11	28.6	19.6	9.0	2.67	1.87	1.59	17.9	1,2,3 (UUT)	1.55	9^o
			(15.0m)														
SPT10	15.00 15.45	62	Very dense light brown Silty Sand (SM)														
UDS6	17.25 17.55			0	80	20	0	N.P.	N.P.		2.65						
			(18.0m)														
SPT11	18.00 18.45	62	Very dense light grey Fine Sand (SP-SM)														
UDS7	20.25 20.55											1.9	1.6	17.5	0.5,1.0 1.50 (DST)	0.00	35^o
SPT12	21.00 21.45	70															
UDS8	23.25 23.55																
SPT13	24.00 24.45	71		0	94	6	0	N.P.	N.P.		2.63						
UDS9	26.25 26.55																

UUT : Unconsolidated Undrained Triaxial Shear Test

N.P. : Non Plastic

DST:Drained Direct Shear Test

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 14

WATER TABLE : 13.40m

TERMINATION DEPTH (M) 42.0m

TABLE NO. 7b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	75	Very dense light grey Fine Sand (SP-SM)														
UDS10	29.25 29.55											2.0	1.7	18.2	0.5,1.0 1.50 (DST)	0.00	37^o
SPT15	30.00 30.45	60										DST:Drained Direct Shear Test					
UDS11	32.25 32.55																
SPT16	33.00 33.45	102		0	91	9	0	N.P.	N.P.		2.63						
								N.P. : Non Plastic									
UDS12	35.25 35.55																
			(36.0m)														
SPT17	36.00 36.45	Ref.	Very dense light brown Sandy Silt, low plastic (CL)														
UDS12	38.25 38.55											2.1	1.73	22.2	1,2,3 (UUT)	1.95	8^o
SPT18	39.00 39.45	Ref.										UUT : Unconsolidated Undrained Triaxial Shear Test					
UDS13	41.25 41.55			4	21	62	13	29.1	19.0	10.1	2.68						
SPT19	42.00 42.45	Ref.															
			(42.0m)														

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 16

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 8

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Medium dense light brown Sandy Silt, low plastic (CL)														
SPT1	1.50 1.95	11		0	20	69	11	28.4	19.5	8.9	2.67						
UDS1	2.25 2.55																
			(3.0m)														
SPT2	3.00 3.45	11	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	18															
UDS2	5.25 5.55			0	92	8	0	N.P.	N.P.		2.64	1.69	1.53	10.6	0.5,1.0 1.5 (DST)	0.00	31°
								N.P. : Non Plastic									
SPT4	6.00 6.45	15										DST:Drained Direct Shear Test					
SPT5	7.50 7.95	26															
UDS3	8.25 8.55																
			(9.0m)														
SPT6	9.00 9.45	26	Medium dense to Dense light brown Sandy Silt, low plastic (CL) Medium dense, 9.0m to 10.5m														
SPT7	10.50 10.95	31	Dense, 10.5m to 12.0m														

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 16

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 8a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense to Dense light brown Sandy Silt, low plastic (CL)									1.79	1.57	13.8	1,2,3 (UUT)	0.85	7°
SPT8	12.00 12.45	23	Medium dense, 12.0m to 13.5m														
SPT9	13.50 13.95	37	Dense, 13.5m to 15.0m														
UDS5	14.25 14.55			2	15	67	16	30.9	18.9	12.0	2.68						
			(15.0m)														
SPT10	15.00 15.45	41	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 15.0m to 18.0m														
UDS6	17.25 17.55											1.89	1.61	17.3	0.5,1.0 1.5 (DST)	0.00	35°
SPT11	18.00 18.45	54	Very dense, 18.0m to 21.0m														
UDS7	20.25 20.55			0	94	6	0	N.P.	N.P.		2.63						
SPT12	21.00 21.45	34	Dense, 21.0m to 24.0m														
UDS8	23.25 23.55											1.93	1.64	17.9	0.5,1.0 1.5 (DST)	0.00	36°
SPT13	24.00 24.45	53	Very dense, 24.0m to 27.0m														
UDS9	26.25 26.55																

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 16

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 8b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	72	Very dense light brown Sandy Silt, low plastic (CL)														
UDS10	29.25 29.55											2.05	1.68	22.1	1,2,3 (UUT)	1.85	9^o
			(30.0m)												UUT : Unconsolidated Undrained Triaxial Shear Test		
SPT15	30.00 30.45	97	Very dense light brown Silty Sand (SM)	0	75	25	0	N.P.	N.P.		2.65						
								N.P. : Non Plastic									
UDS11	32.25 32.55																
SPT16	33.00 33.45	87															
UDS12	35.25 35.55											2.08	1.72	21.2	0.5,1.0 1.50 (DST)	0.00	36^o
SPT17	36.00 36.45	83		2	71	27	0	N.P.	N.P.		2.65				DST:Drained Direct Shear Test		
UDS12	38.25 38.55																
			(39.0m)														
SPT18	39.00 39.45	109	Very dense light brown Sandy Silt, low plastic (CL)														
UDS13	41.25 41.55																
SPT19	42.00 42.45	85		4	18	64	14	30.1	19.2	10.9	2.67						

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SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 16

WATER TABLE : 12.90m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 8c

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS14	44.25 44.55		Very dense light brown Sandy Silt, low plastic (CL)									2.15	1.75	23.1	1,2,3 (UUT)	2.05	8°
SPT20	45.00 45.45	88	(45.0m)														

UUT : Unconsolidated Undrained Triaxial Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 28

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 9

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	1.50 2.00		Medium dense light brown Silty Sand (SM)														
UDS1	2.25 2.55																
SPT1	3.00 3.45	12															
SPT2	4.50 4.95	10															
UDS2	5.25 5.55			0	70	30	0	N.P.	N.P.		2.66	1.69	1.5	10.5	0.5,1.0 1.5 (DST)	0.00	29^o
SPT3	6.00 6.45	12	(7.5m)					N.P. : Non Plastic									
SPT4	7.50 7.95	11	Medium dense light grey Fine Sand (SP-SM)									DST:Drained Direct Shear Test					
UDS3	8.25 8.55		(9.0m)														
SPT5	9.00 9.45	20	Medium dense light brown Sandy Silt, low plastic (CL)	2	18	66	14	29.4	19.5	9.9	2.67						
SPT6	10.50 10.95	22										UUT : Unconsolidated Undrained Triaxial Shear Test					
UDS4	11.25 11.55		(12.0m)									1.78	1.56	14.1	1,2,3 (UUT)	0.70	8^o

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 28

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 9a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT7	12.00 12.45	26	Medium dense to Dense light brown Silty Sand (SM) Medium dense, 12.0m to 13.5m														
SPT8	13.50 13.95	38	Dense, 13.5m to 15.0m														
UDS5	14.25 14.55			0	80	20	0	N.P.	N.P.		2.65						
			(15.0m)					N.P. : Non Plastic									
SPT9	15.00 15.45	33	Medium dense to Dense light grey Fine Sand (SP-SM) Dense, 15.0m to 21.0m														
UDS6	17.25 17.55																
SPT10	18.00 18.45	40															
UDS7	20.25 20.55											1.88	1.60	17.3	0.5,1.0 1.5 (DST)	0.00	34^{o}
SPT11	21.00 21.45	25	Medium dense, 21.0m to 24.0m	0	92	8	0	N.P.	N.P.		2.63	DST:Drained Direct Shear Test					
UDS8	23.25 23.55																
SPT12	24.00 24.45	39	Dense, 24.0m to 27.0m														
UDS9	26.25 26.55																
			(27.0m)														
SPT13	27.00 27.45	60	Very dense light brown Sandy Silt, low plastic (CL)														

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 28

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 9b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS10	29.25 29.55		Very dense light brown Sandy Silt, low plastic (CL)	3	25	62	10	28.1	20.0	8.1	2.66	2.02	1.66	21.4	1,2,3 (UUT)	1.75	10^o
SPT14	30.00 30.45	69															
UDS11	32.25 32.55																
			(33.0m)														
SPT15	33.00 33.45	57	Very dense light brown Silty Sand (SM)														
UDS12	35.25 35.55											2.08	1.71	21.7	0.5,1.0 1.50 (DST)	0.00	36^o
SPT16	36.00 36.45	55		0	79	21	0	N.P.	N.P.		2.65						
UDS13	38.25 38.55																
SPT17	39.00 39.45	89															
UDS14	41.25 41.55											2.12	1.74	22.0	0.5,1.0 1.50 (DST)	0.00	37^o
			(42.0m)														
SPT18	42.00 42.45	60	Very dense light brown Sandy Silt, low plastic (CL)														
UDS15	44.25 44.55			2	17	66	15	29.7	18.2	11.5	2.68						

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 28

WATER TABLE : 13.10m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 9c

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT19	45.00 45.45	72	Very dense light brown Sandy Silt, low plastic (CL)														
SPT20	46.50 46.95	76	(46.5m)														

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 33

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 10

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
DS1	0.00 0.50		Loose to medium dense light brown Sandy Silt, low plastic (CL)														
SPT1	1.50 1.95	7	Loose, 0.0m to 2.0m	0	20	70	10	27.9	19.7	8.2	2.66						
			Medium dense, 2.0m to 3.0m														
UDS1	2.25 2.55											1.68	1.52	10.2	1,2,3 (UUT)	0.55	10°
			(3.0m)														
SPT2	3.00 3.45	10	Medium dense light grey Fine Sand (SP-SM)														
SPT3	4.50 4.95	16															
UDS2	5.25 5.55																
SPT4	6.00 6.45	16															
SPT5	7.50 7.95	28		0	94	6	0	N.P.	N.P.		2.63						
UDS3	8.25 8.55											1.74	1.55	12.3	0.5,1.0 1.5 (DST)	0.00	32°
			(9.0m)														
SPT6	9.00 9.45	23	Medium dense light brown Silty Sand (SM)														
			(10.5m)														
SPT7	10.50 10.95	17	Medium dense light brown Sandy Silt, low plastic (CL)														

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

N.P. : Non Plastic

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 33

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 10a

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS4	11.25 11.55		Medium dense light brown Sandy Silt, low plastic (CL)	2	19	67	12	28.8	19.9	8.9	2.67						
			(12.0m)														
SPT8	12.00 12.45	23	Medium dense light brown Silty Sand (SM)														
			(13.5m)														
SPT9	13.50 13.95	43	Dense to Very dense light grey Fine Sand (SP-SM) Dense, 13.5m to 24.0m														
UDS5	14.25 14.55											1.84	1.58	16.5	0.5,1.0 1.5 (DST)	0.00	33^o
SPT10	15.00 15.45	37										DST:Drained Direct Shear Test					
UDS6	17.25 17.55																
SPT11	18.00 18.45	43		0	93	7	0	N.P.	N.P.		2.63						
								N.P. : Non Plastic									
UDS7	20.25 20.55											1.91	1.62	17.8	0.5,1.0 1.5 (DST)	0.00	35^o
SPT12	21.00 21.45	48															
UDS8	23.25 23.55																
SPT13	24.00 24.45	57	Very dense, 24.0m to 27.0m														
UDS9	26.25 26.55																

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BH.No. 33

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 10b

Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis: Gravel %	Sand %	Silt %	Clay %	Atterberg Limits: Liquid %	Plastic %	Plasticity Index %	Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test: Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
SPT14	27.00 27.45	45	Dense light grey Fine Sand (SP-SM)	2	92	6	0	N.P.	N.P.		2.62						
UDS10	29.25 29.55							N.P. : Non Plastic									
SPT15	30.00 30.45	36															
UDS11	32.25 32.55																
			(33.0m)														
SPT16	33.00 33.45	75	Very dense light brown Sandy Silt, low plastic (CL)														
UDS12	35.25 35.55			3	23	61	13	29.3	20.0	9.3	2.67	2.11	1.72	22.4	1,2,3 (UUT)	1.90	8^o
SPT17	36.00 36.45	70															
UDS12	38.25 38.55																
			(39.0m)														
SPT18	39.00 39.45	94	Very dense light grey Fine Sand (SP-SM)														
UDS13	41.25 41.55											2.1	1.76	20.5	0.5,1.0 1.50 (DST)	0.00	38^o
SPT19	42.00 42.45	101		4	89	7	0	N.P.	N.P.		2.63						

UUT : Unconsolidated Undrained Triaxial Shear Test

DST:Drained Direct Shear Test

GLOBAL

SOIL PROFILE

Project : Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

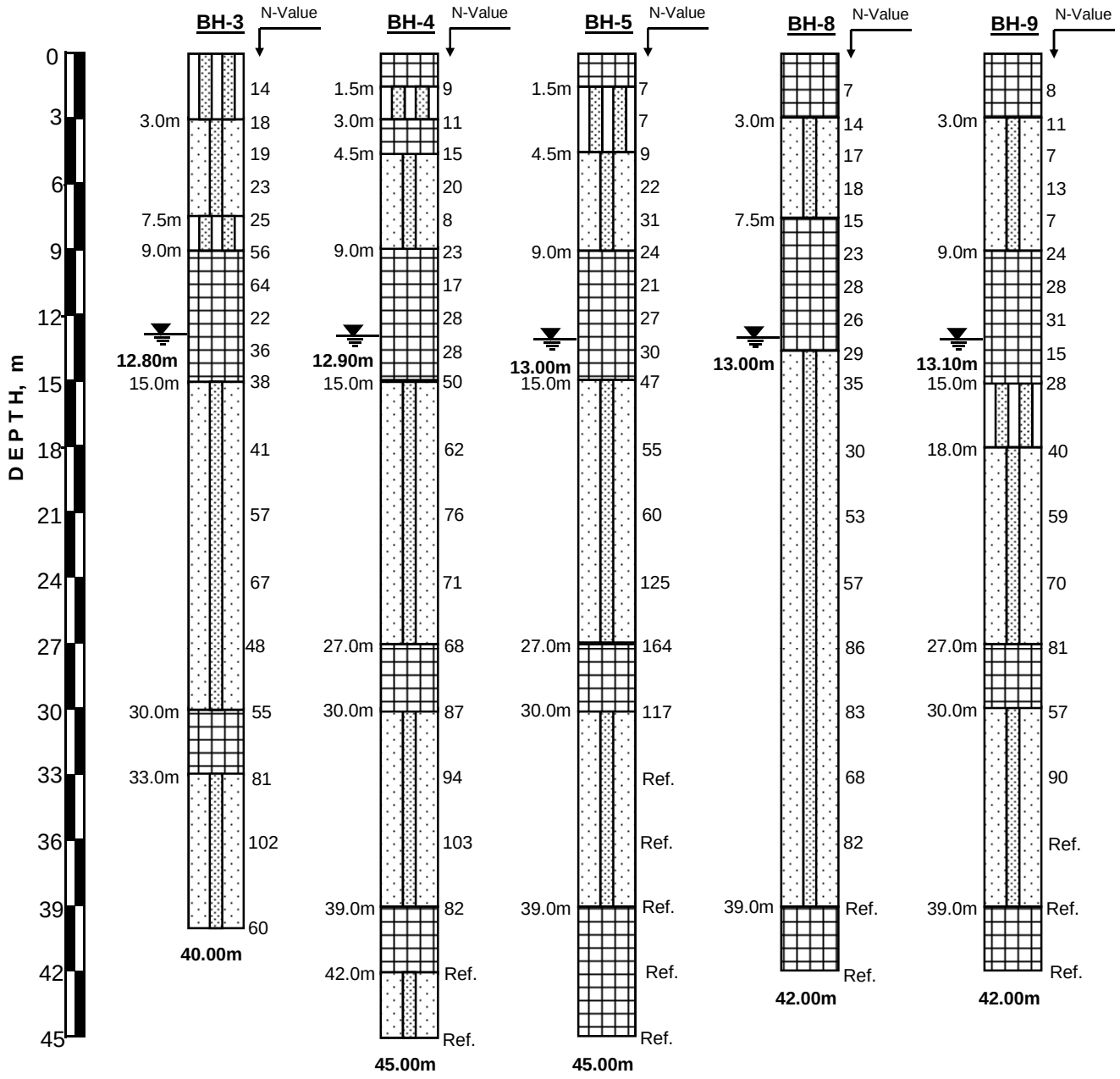
BH.No. 33

WATER TABLE : 13.20m

TERMINATION DEPTH (M) 45.0m

TABLE NO. 10c

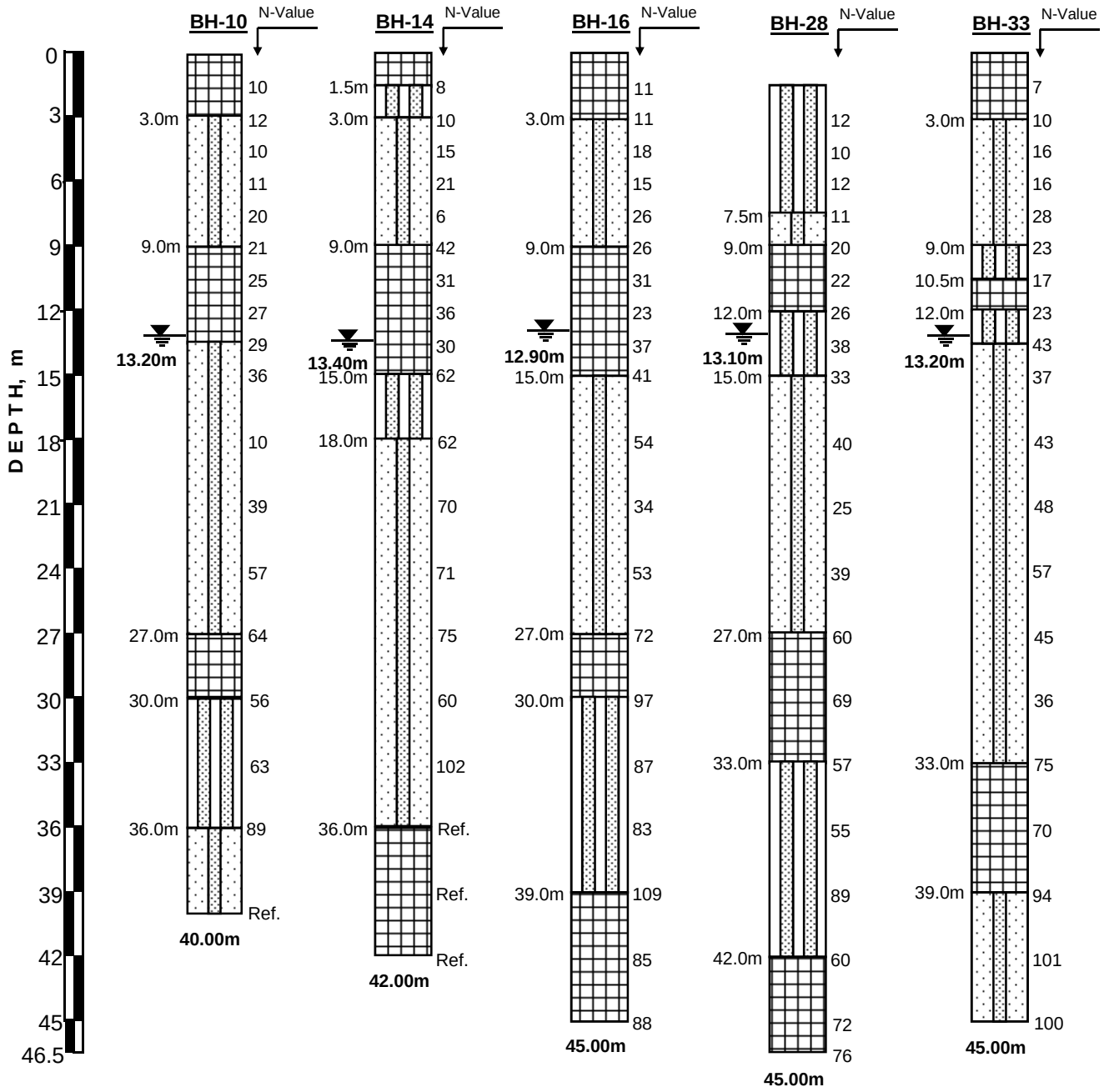
Sample type	Depth (m)	N-Value	SOIL DESCRIPTION	Grain Size Analysis				Atterberg Limits			Specific Gravity	Natural Density gms/cm^3	Dry Density gms/cm^3	Moisture Content %	Triaxial Test		
				Gravel %	Sand %	Silt %	Clay %	Liquid %	Plastic %	Plasticity Index %					Confining Pressure Kg/cm^2	Cohesion Intercept Kg/cm^2	Angle of Internal Friction
UDS14	44.25 44.55		Very dense light grey Fine Sand (SP-SM)														
SPT20	45.00 45.45	100	(45.0m)														



SUMMARY OF BOREHOLE PROFILE

LEGEND	
SYMBOL	DESCRIPTION
	Silty sand
	Sandy silt
	Fine sand
	Water table

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

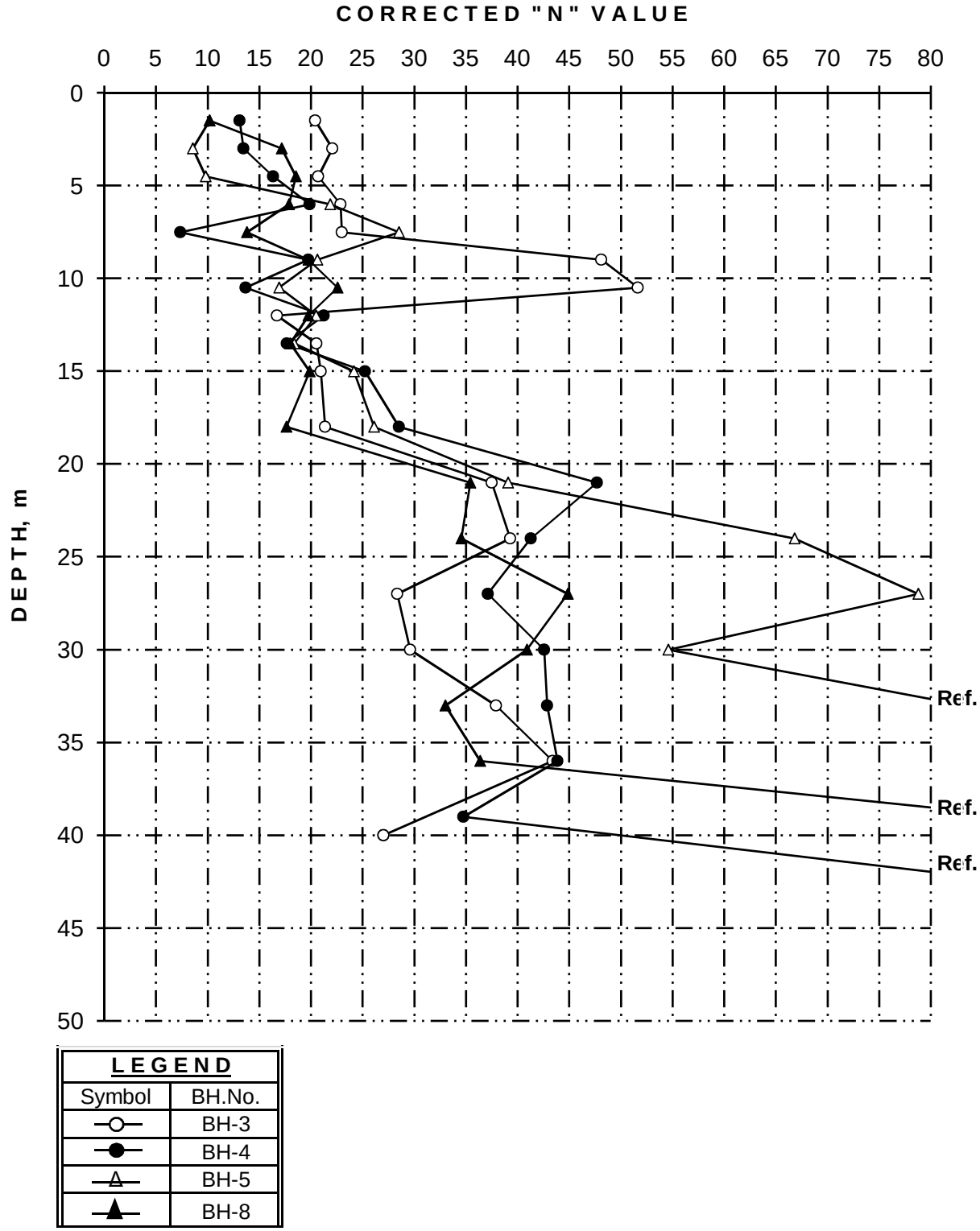


SUMMARY OF BOREHOLE PROFILE

LEGEND	
SYMBOL	DESCRIPTION
	Silty sand
	Sandy silt
	Fine sand
	Water table

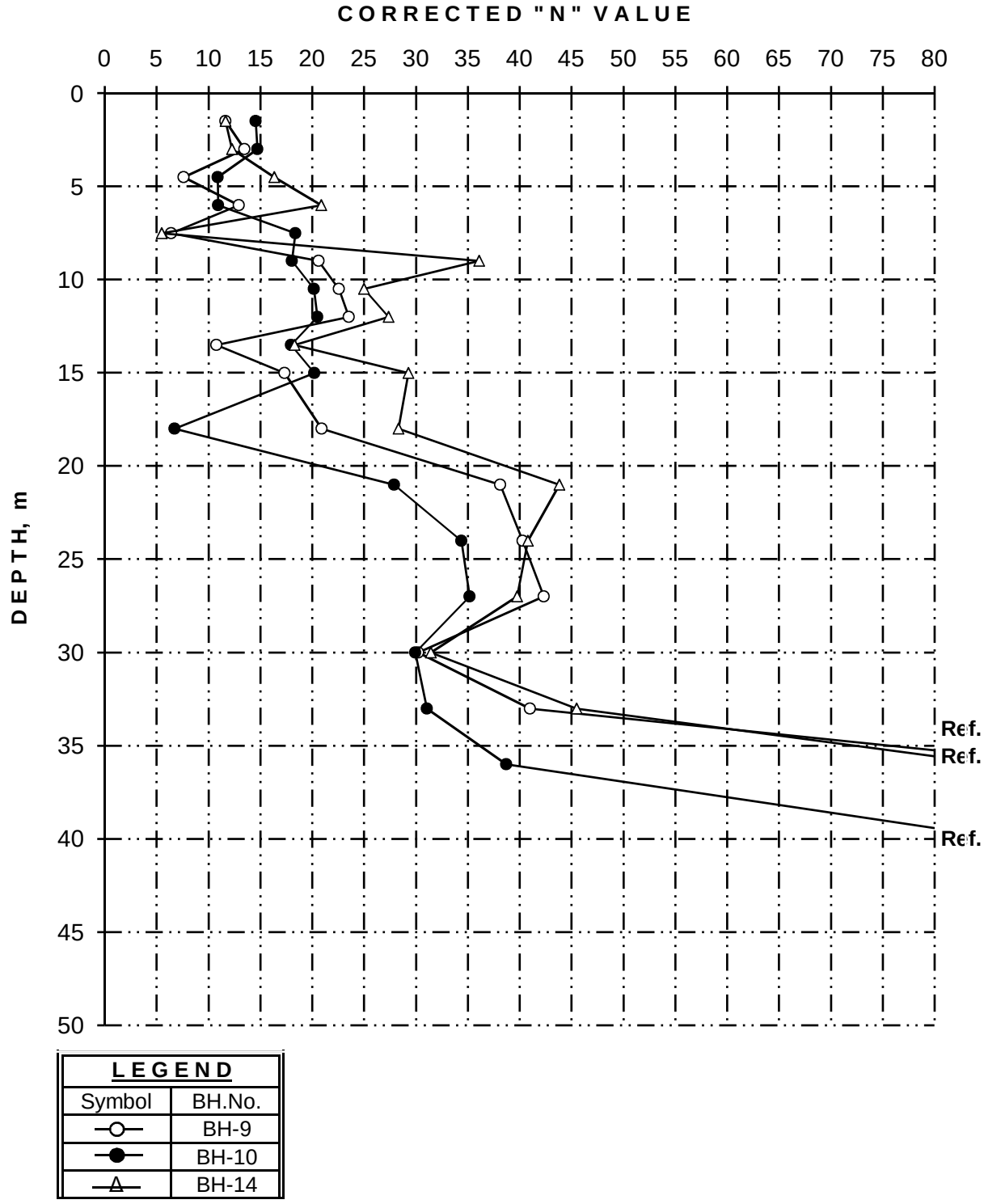
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

STANDARD PENETRATION TEST



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

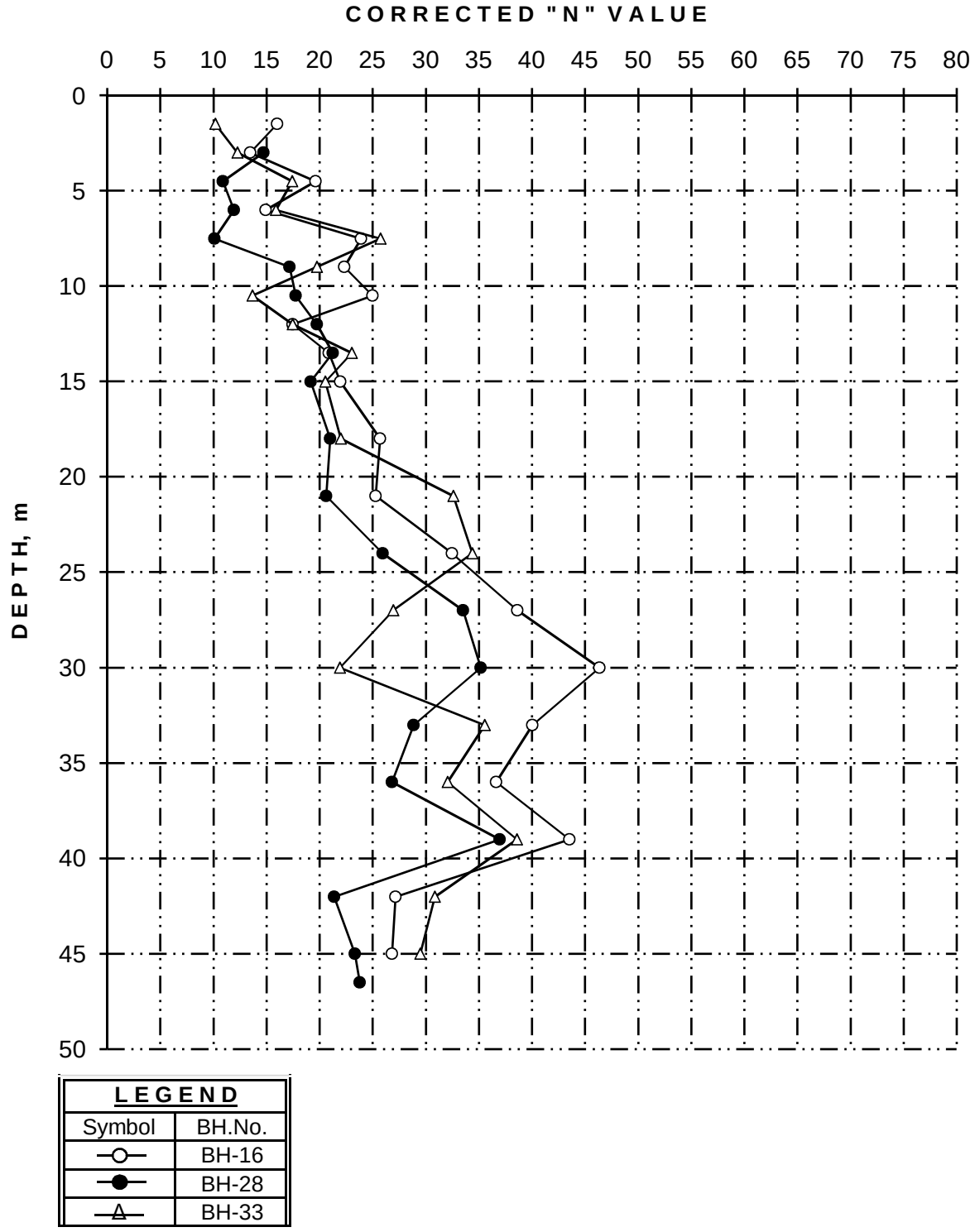
STANDARD PENETRATION TEST



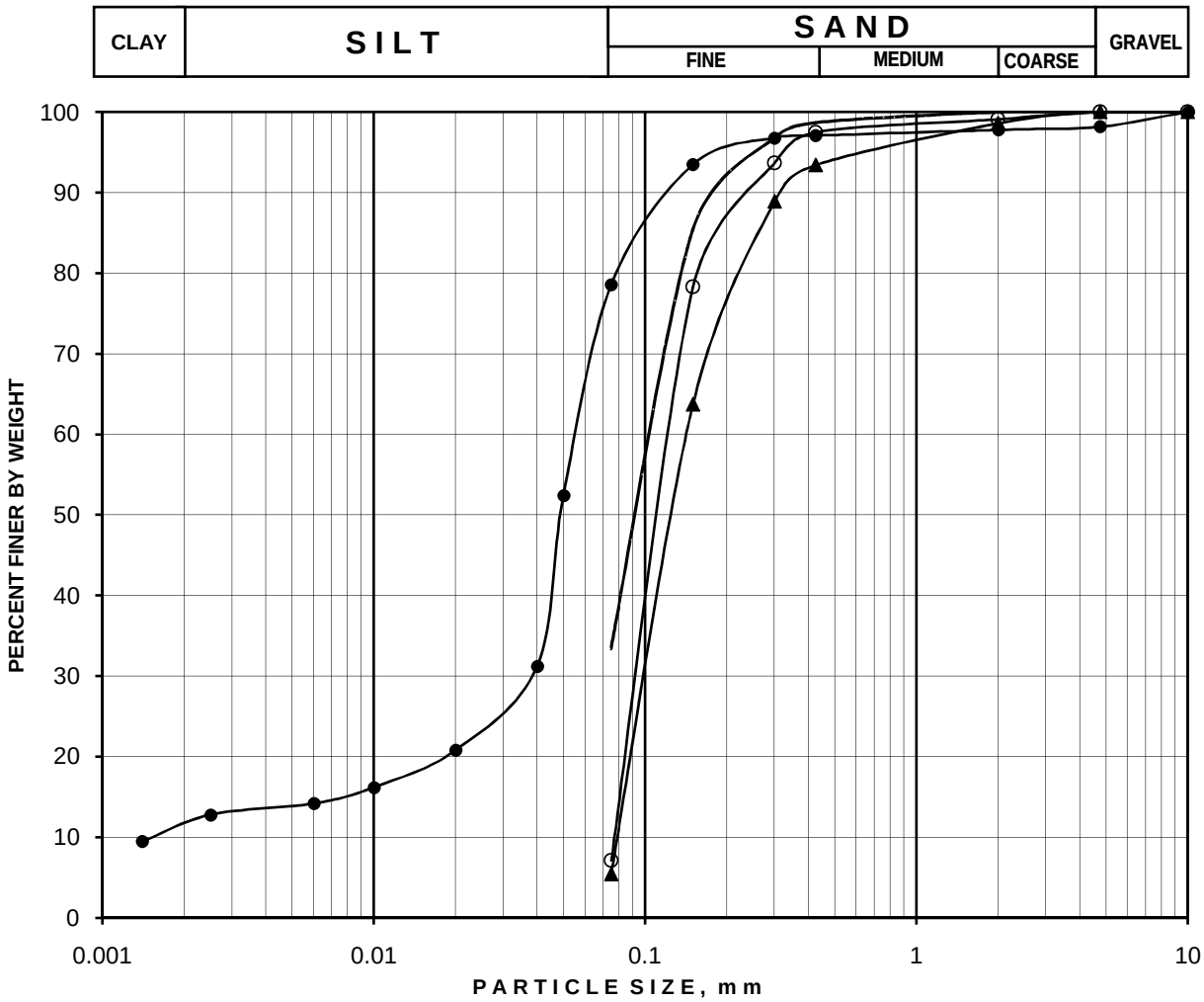
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 15

STANDARD PENETRATION TEST



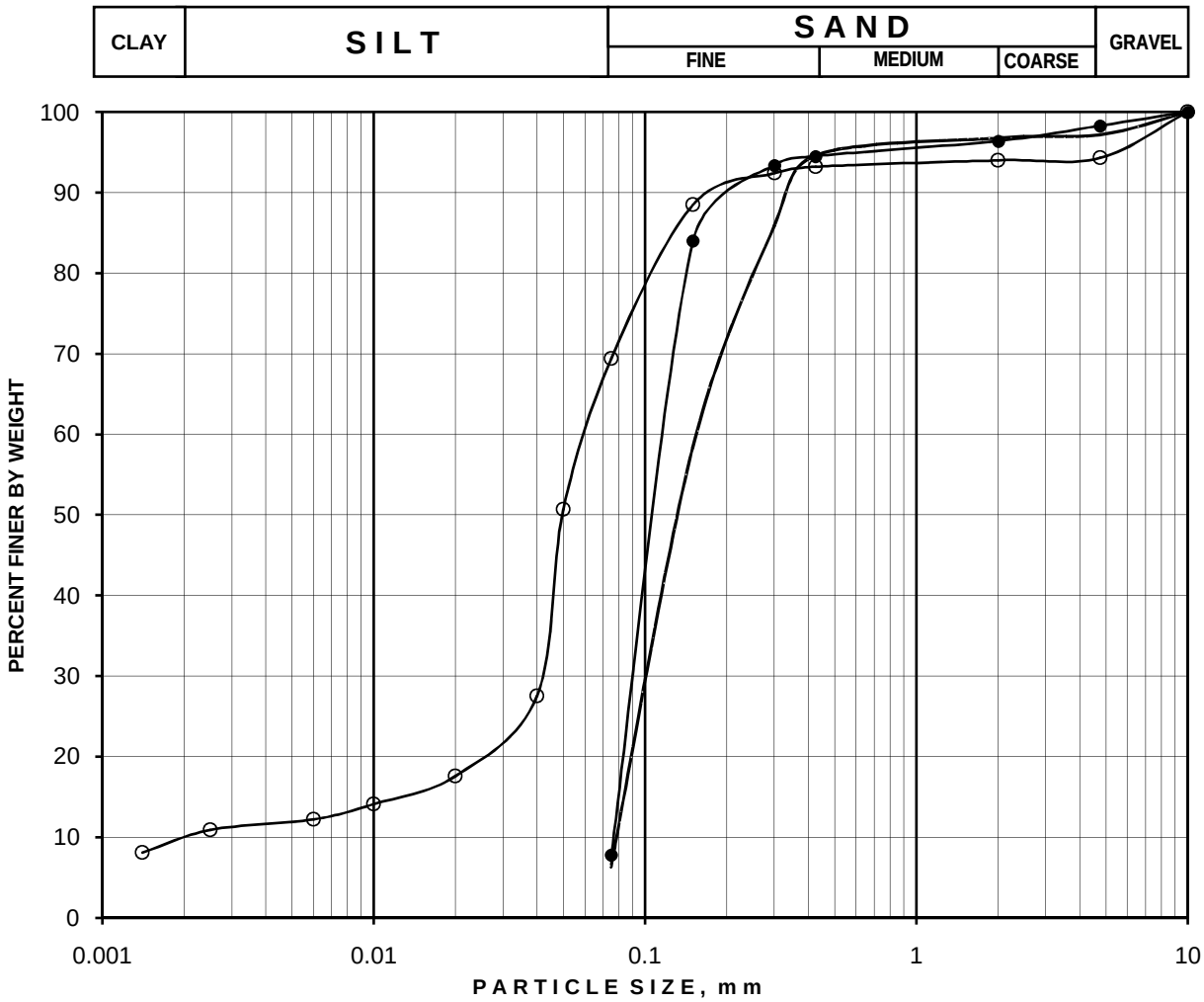
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	3/1.50	Silty sand (SM)	0	67	33	0
○	3/6.00	Fine sand (SP-SM)	0	93	7	0
●	3/11.25	Sandy silt (CL)	2	19	67	12
▲	3/17.25	Fine sand (SP-SM)	0	95	5	0

GRAIN SIZE ANALYSIS

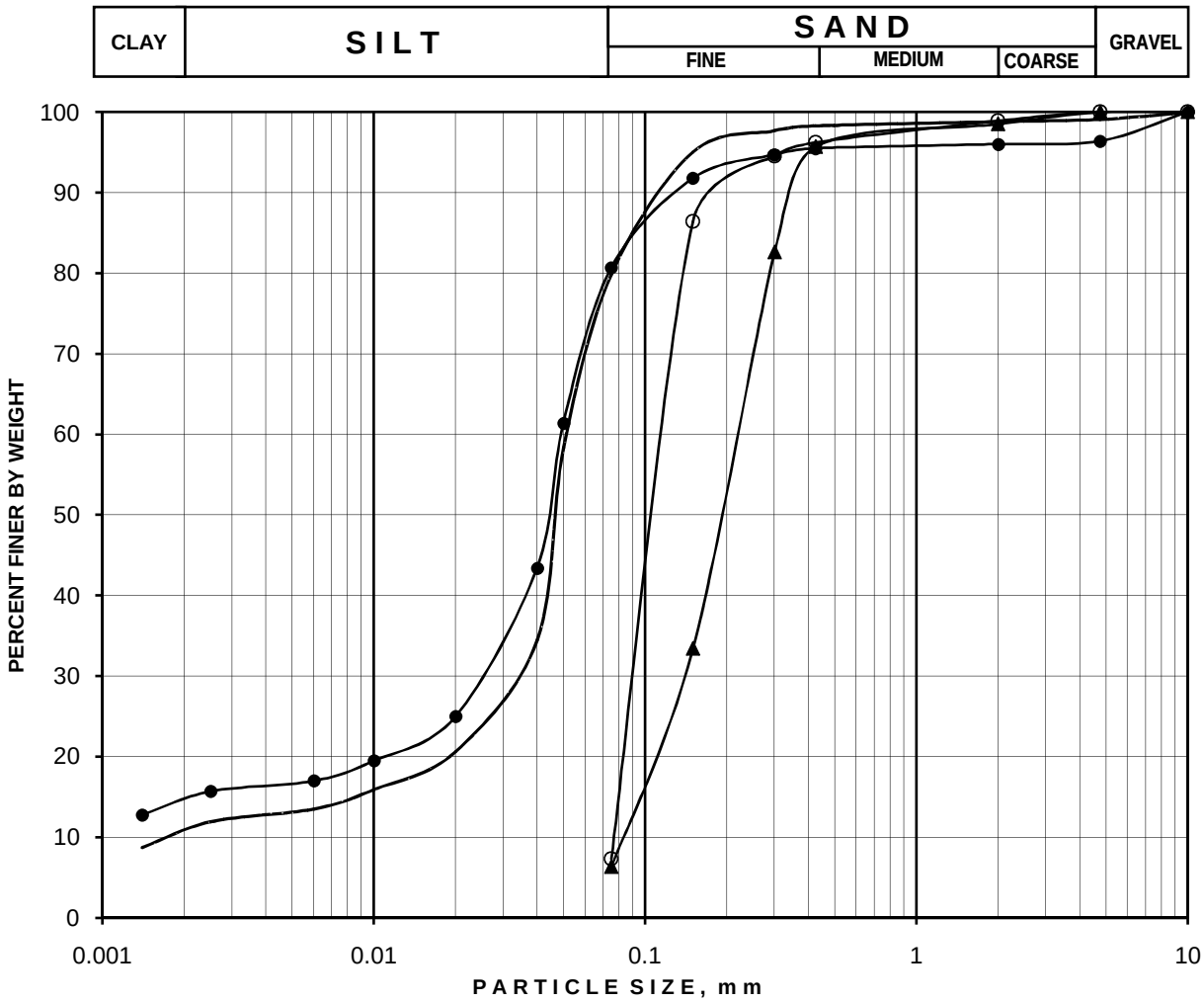
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	3/24.00	Fine sand (SP-SM)	3	91	6	0
○	3/32.25	Sandy silt (CL)	6	25	59	10
●	3/40.00	Fine sand (SP-SM)	2	90	8	0

GRAIN SIZE ANALYSIS

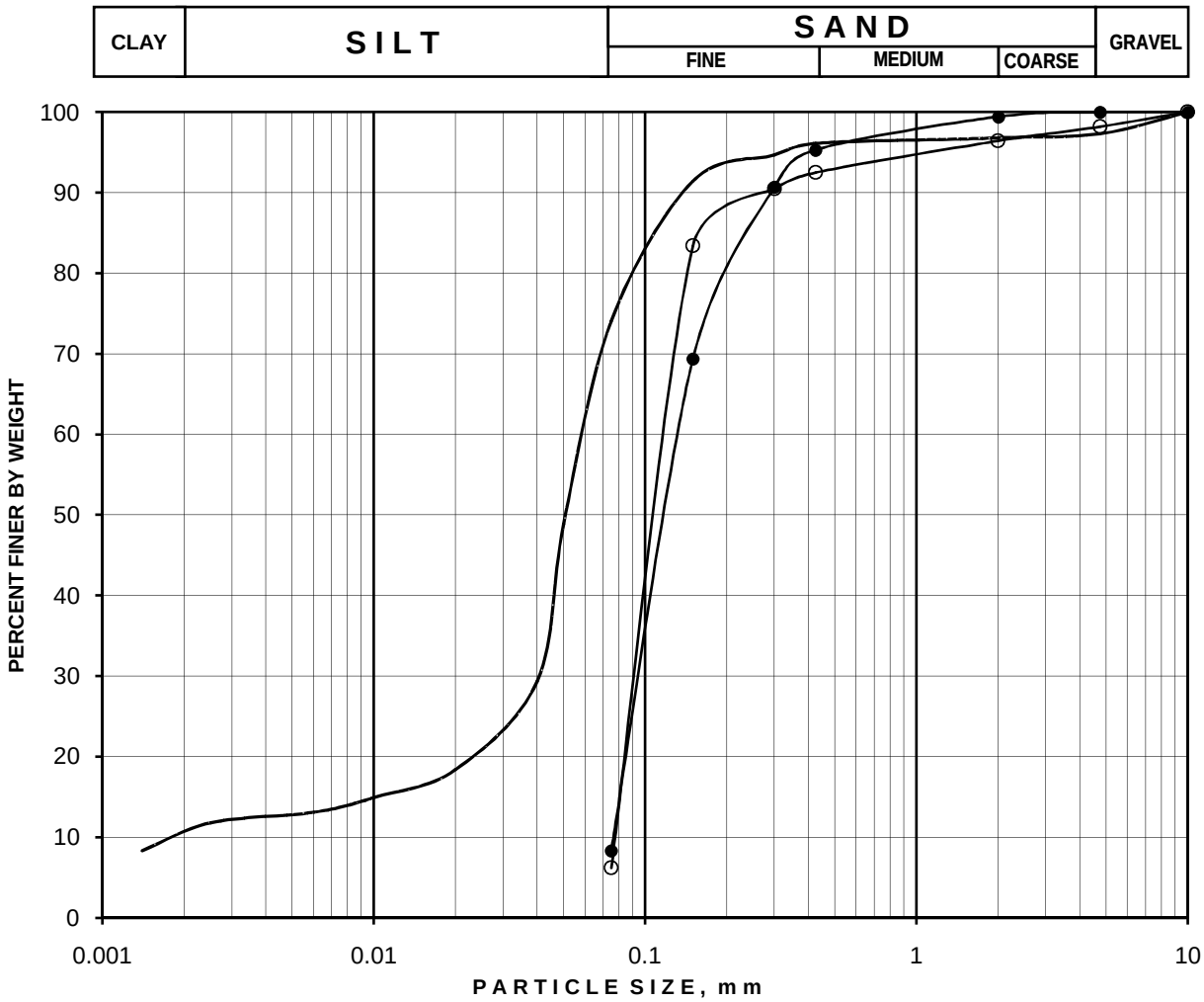
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	4/0.00	Sandy silt (CL)	1	19	69	11
○	4/7.50	Fine sand (SP-SM)	0	93	7	0
●	4/14.25	Sandy silt (CL)	4	15	66	15
▲	4/21.00	Fine sand (SP-SM)	0	94	6	0

GRAIN SIZE ANALYSIS

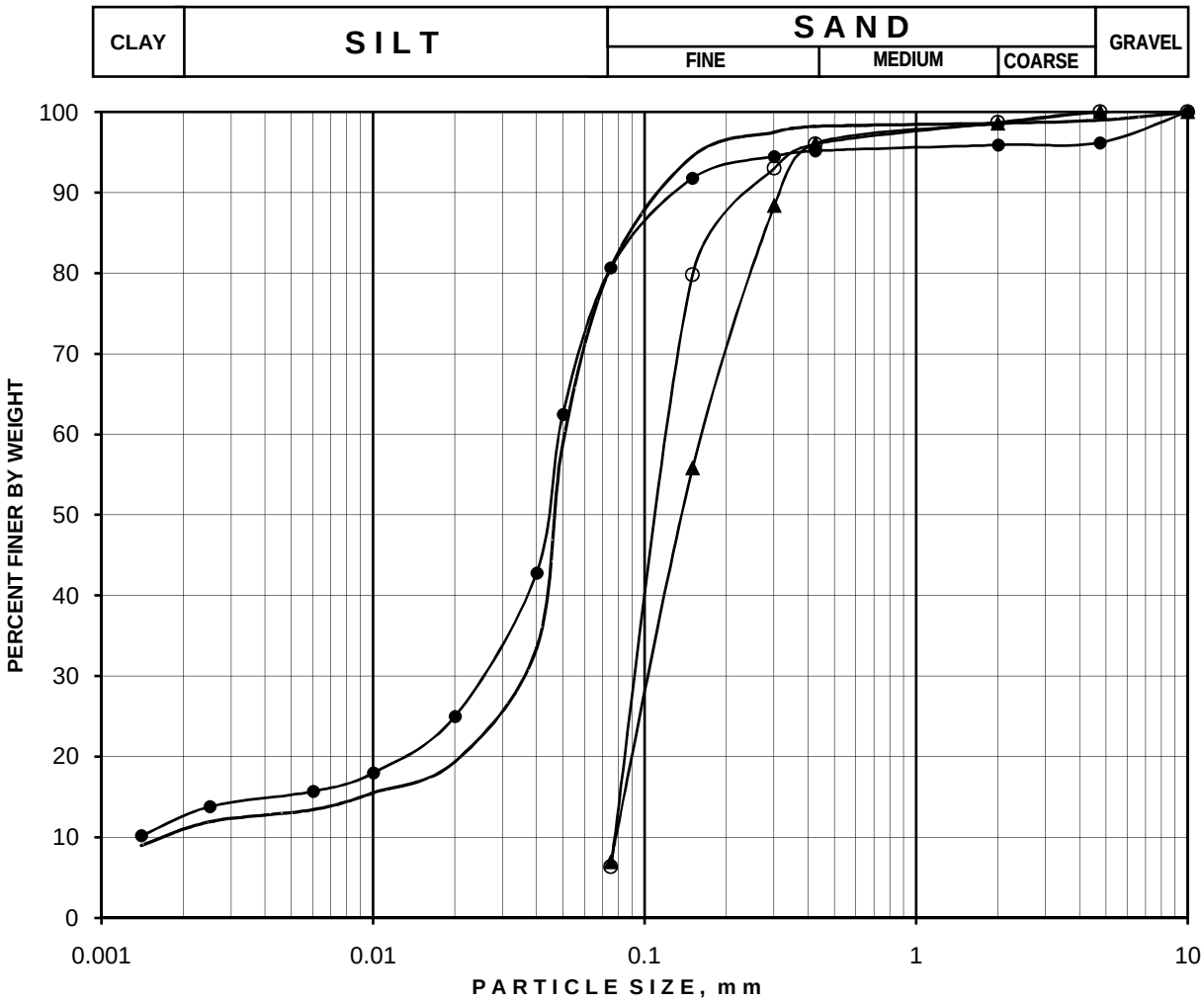
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	4/29.25	Sandy silt (CL)	3	23	63	11
	4/36.00	Fine sand (SP-SM)	2	92	6	0
	4/42.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	5/0.00	Sandy silt (CL)	1	18	70	11
○	5/8.25	Fine sand (SP-SM)	0	94	6	0
●	5/12.00	Sandy silt (CL)	4	15	68	13
▲	5/21.00	Fine sand (SP-SM)	0	93	7	0

GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	5/29.25	Sandy silt (CL)	3	25	62	10
	5/36.00	Fine sand (SP-SM)	2	91	7	0
	5/42.00	Sandy silt (CL)	2	23	64	11

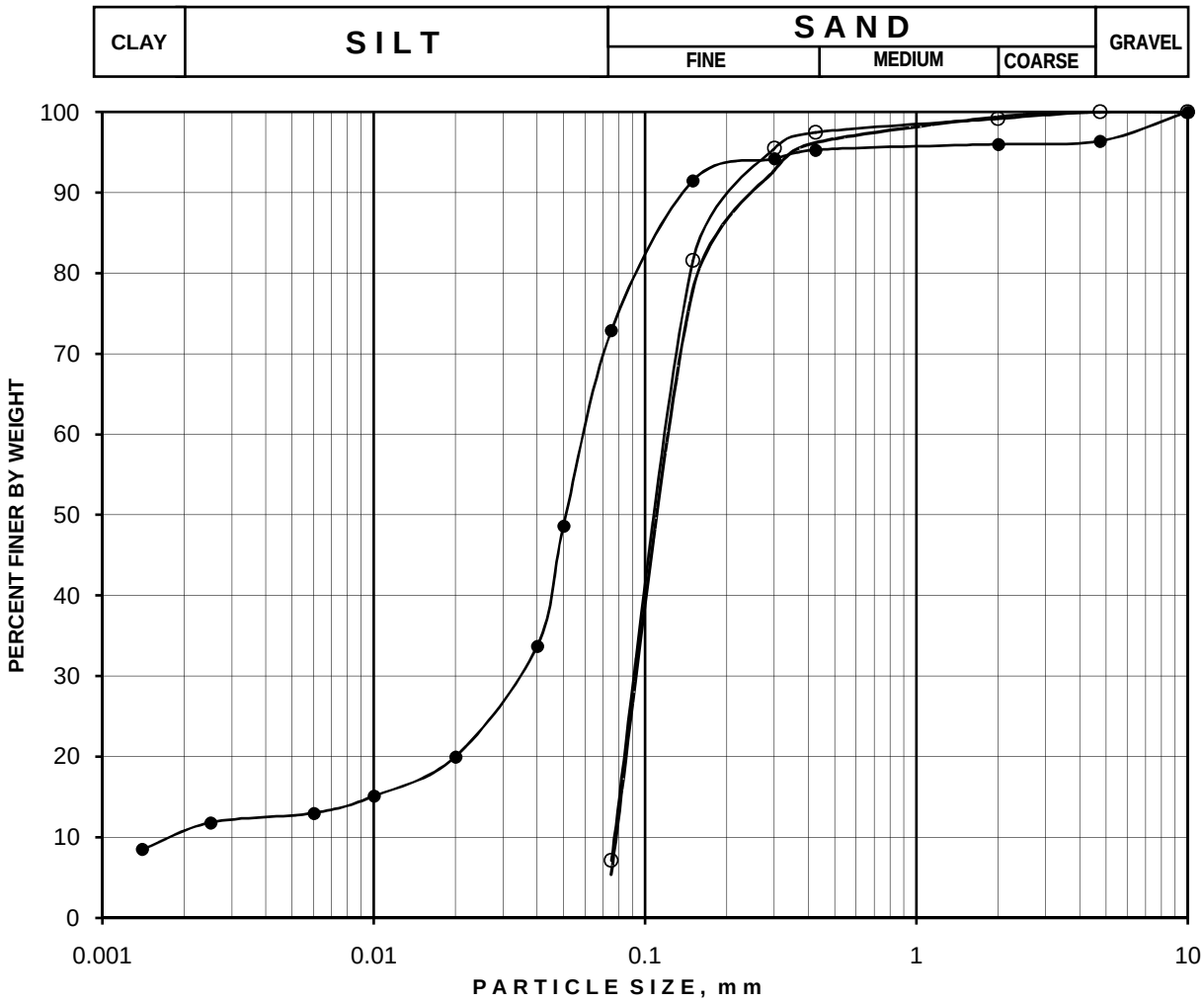
GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	8/2.25	Sandy silt (CL)	0	24	66	10
	8/6.00	Fine sand (SP-SM)	0	94	6	0
	8/12.00	Sandy silt (CL)	3	19	65	13

GRAIN SIZE ANALYSIS

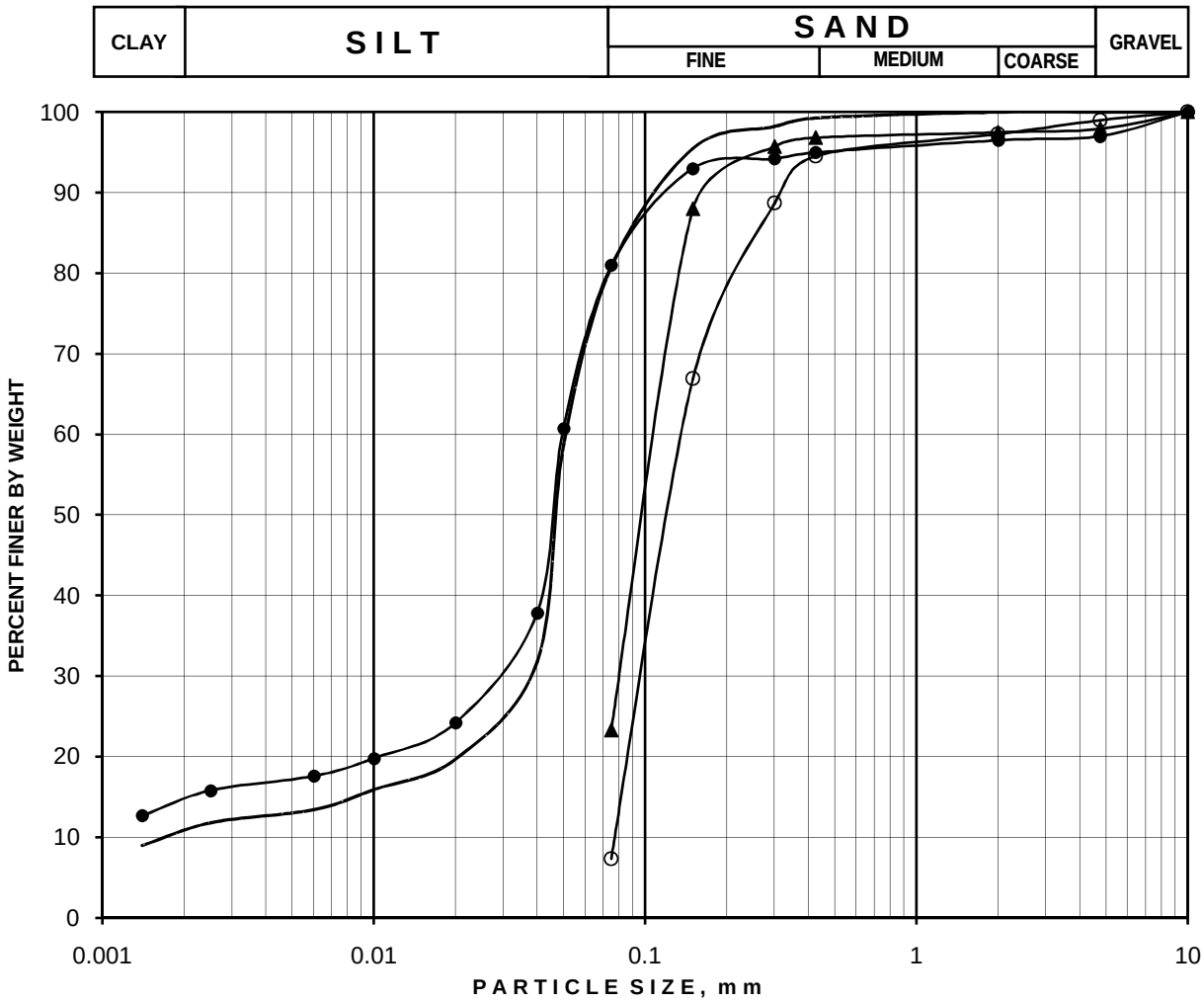
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	8/21.00	Fine sand (SP-SM)	0	95	5	0
	8/30.00	Fine sand (SP-SM)	0	93	7	0
	8/39.00	Sandy silt (CL)	4	23	62	11

GRAIN SIZE ANALYSIS

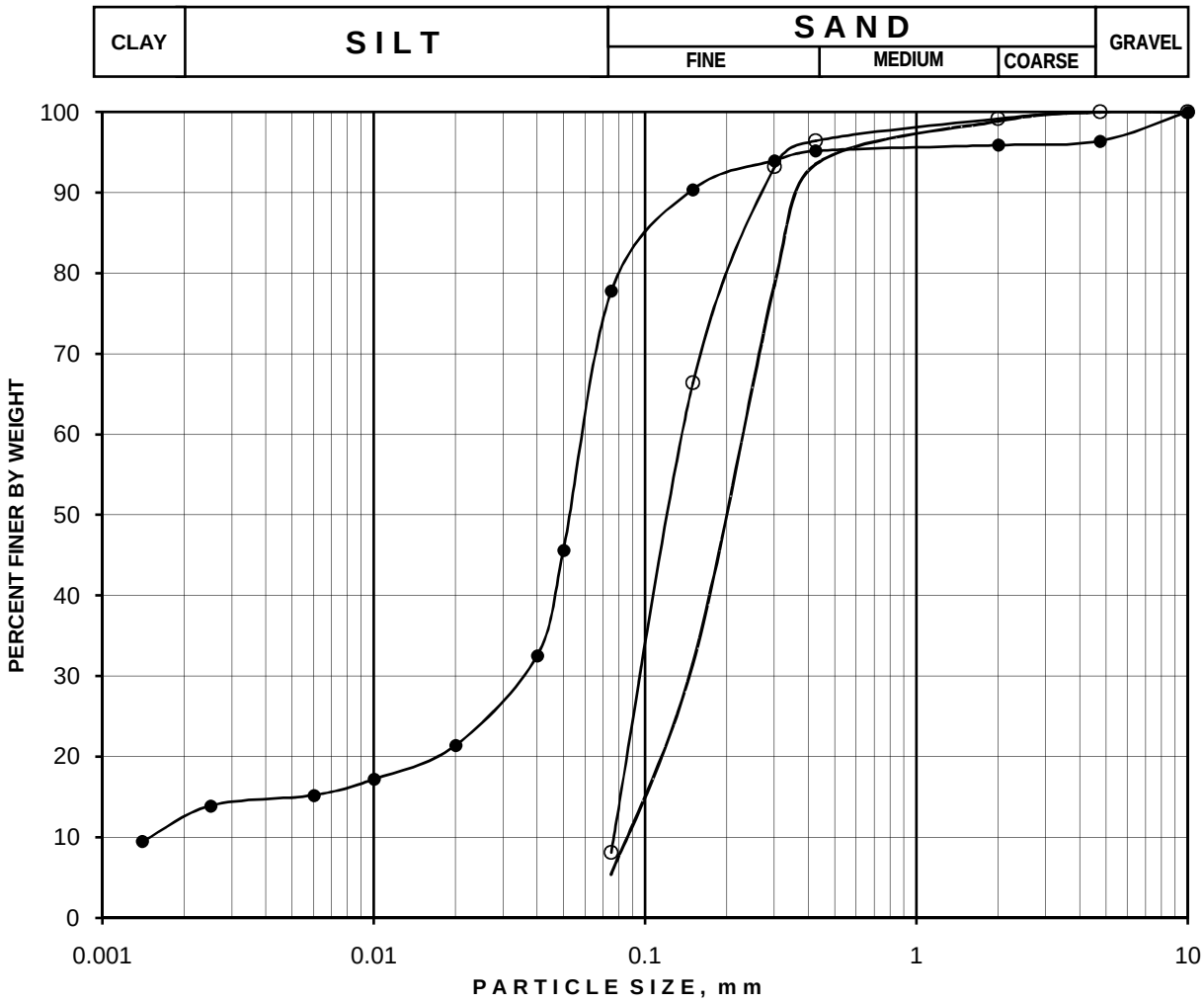
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	9/1.50	Sandy silt (CL)	0	19	70	11
○	9/8.25	Fine sand (SP-SM)	1	92	7	0
●	9/13.50	Sandy silt (CL)	3	16	66	15
▲	9/17.25	Silty sand (SM)	2	75	23	0

GRAIN SIZE ANALYSIS

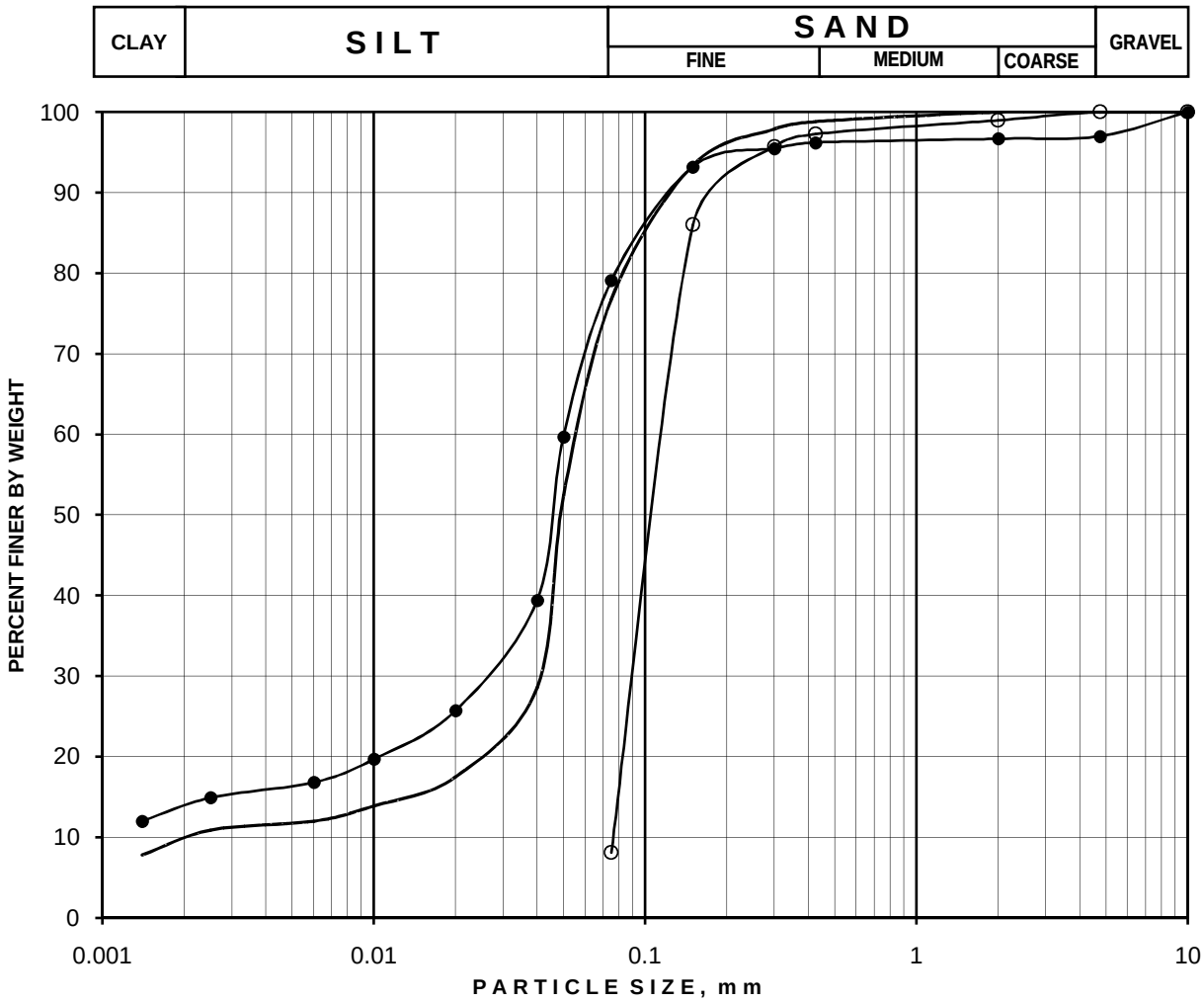
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	9/24.00	Fine sand (SP-SM)	0	95	5	0
	9/33.00	Fine sand (SP-SM)	0	92	8	0
	9/42.00	Sandy silt (CL)	4	18	65	13

GRAIN SIZE ANALYSIS

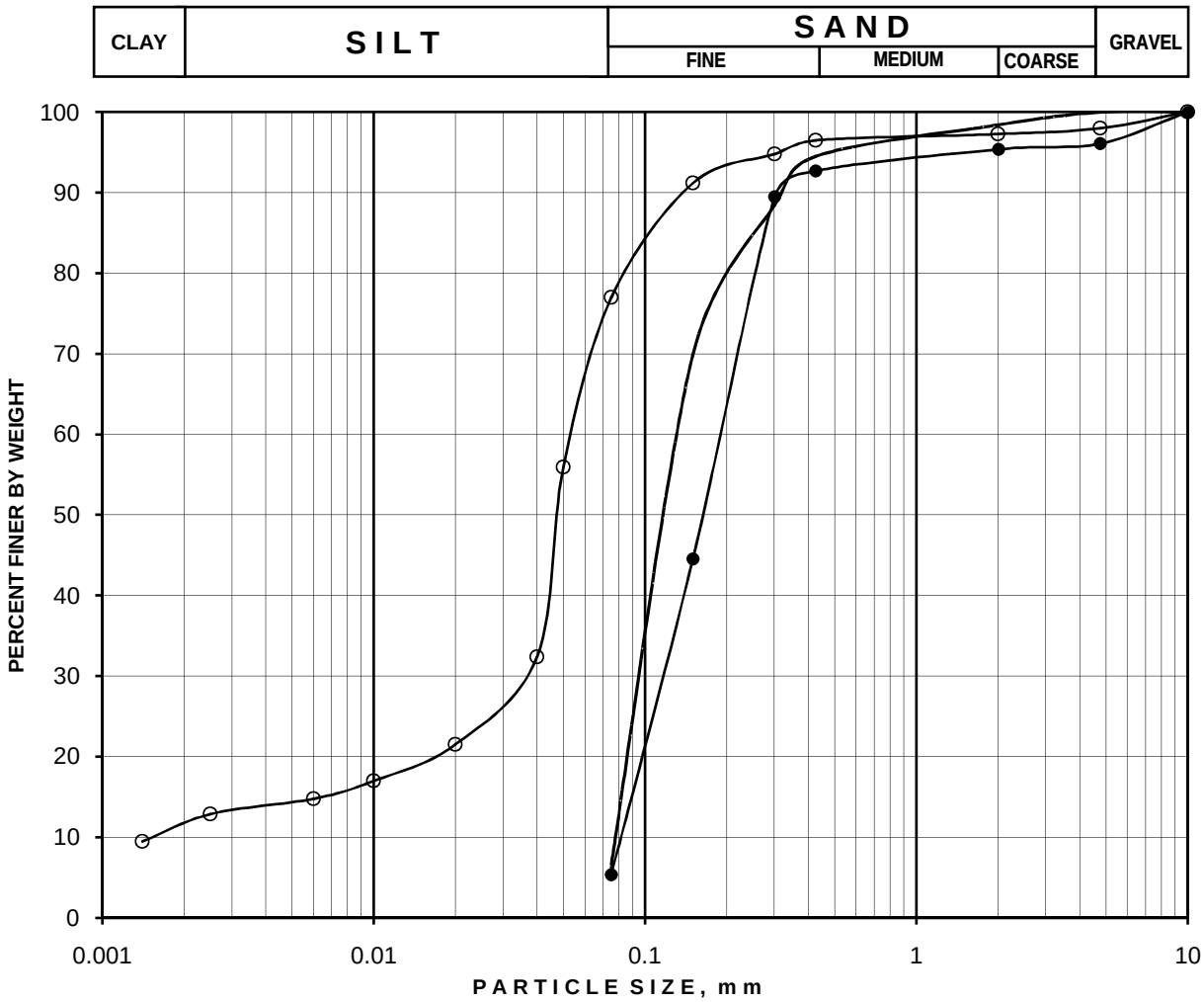
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	10/2.25	Sandy silt (CL)	0	23	67	10
	10/7.50	Fine sand (SP-SM)	0	92	8	0
	10/12.00	Sandy silt (CL)	3	18	65	14

GRAIN SIZE ANALYSIS

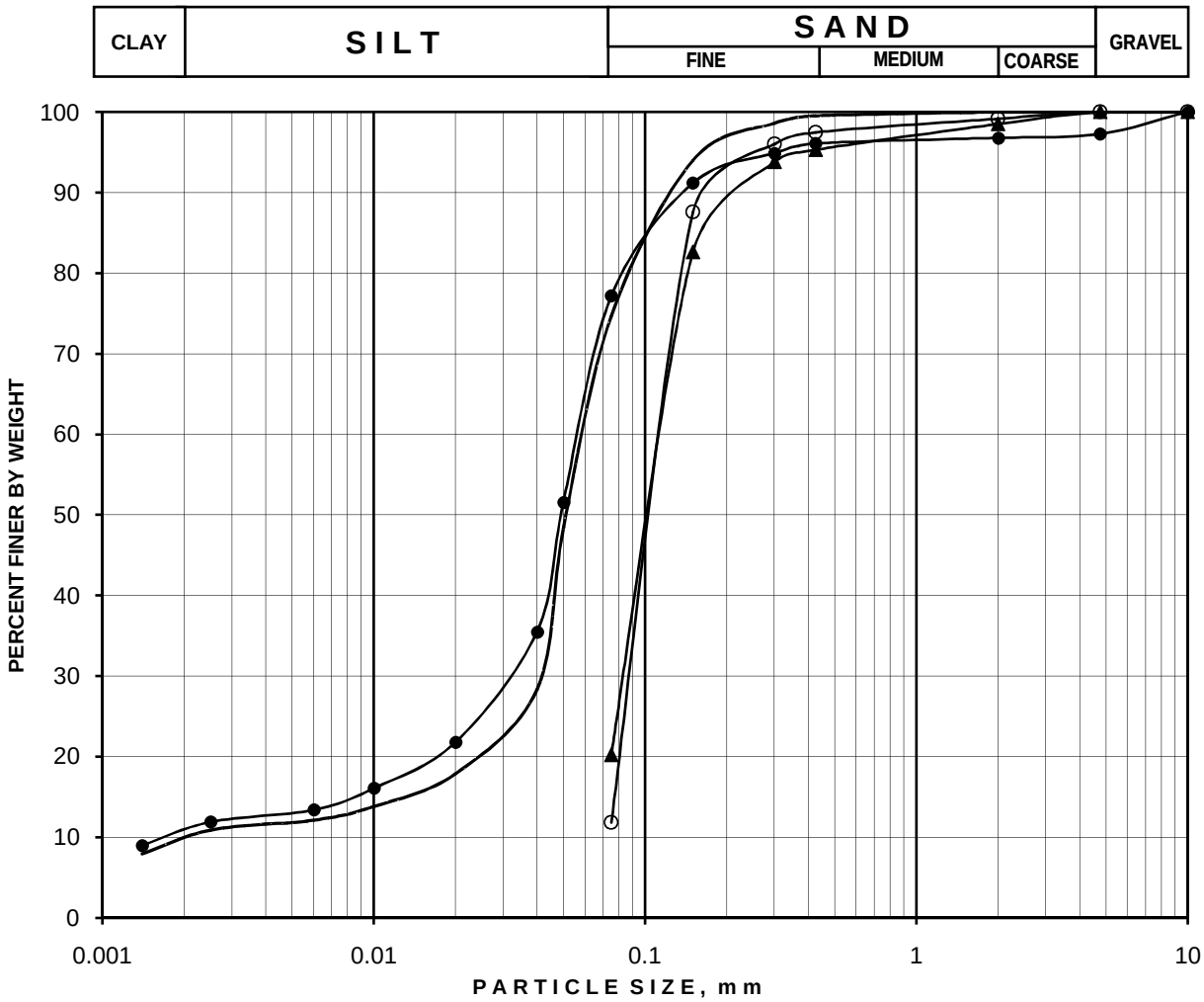
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	10/21.00	Fine sand (SP-SM)	0	94	6	0
○	10/29.25	Sandy silt (CL)	2	21	65	12
●	10/36.00	Fine sand (SP-SM)	4	91	5	0

GRAIN SIZE ANALYSIS

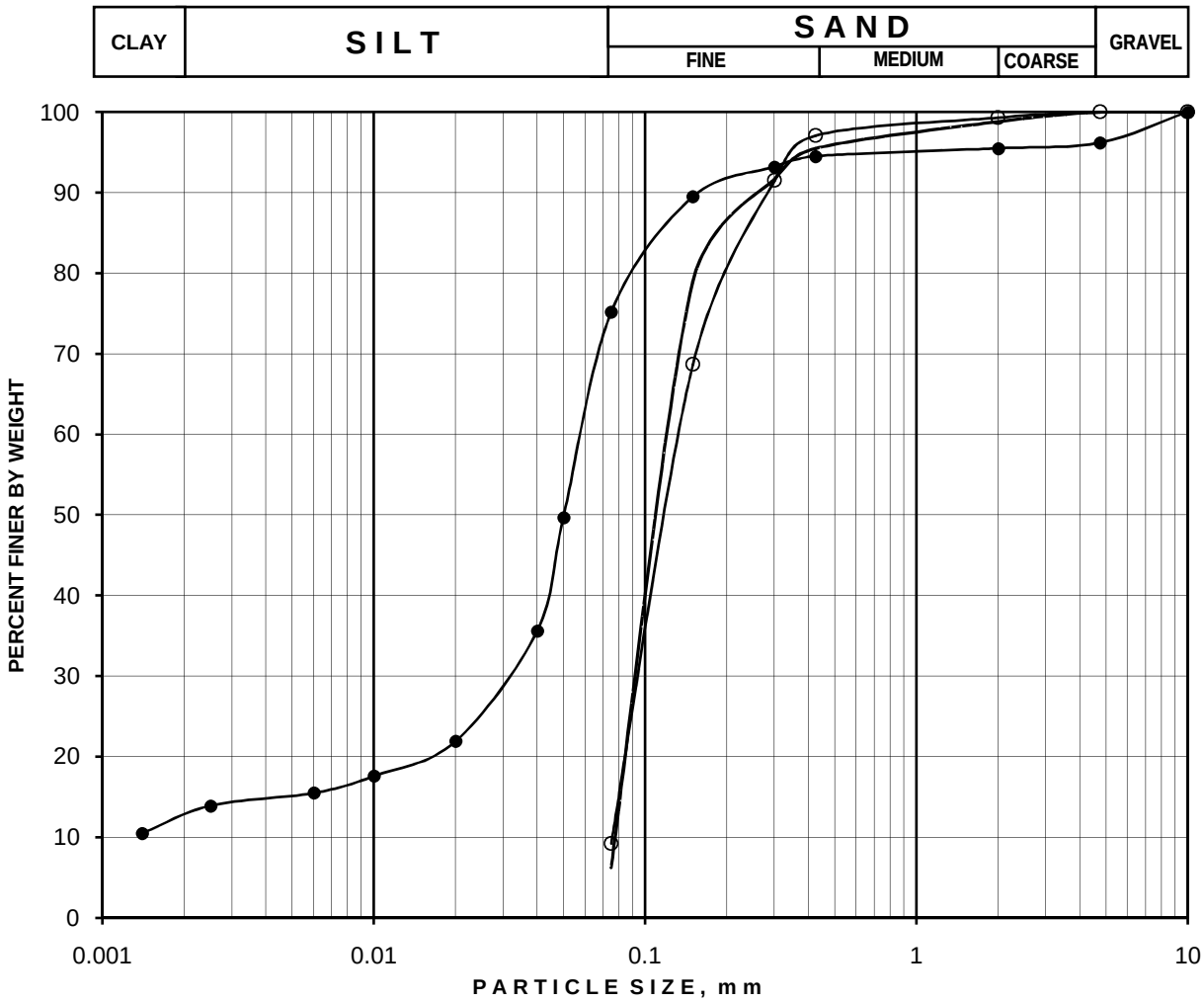
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	14/0.00	Sandy silt (CL)	0	25	65	10
○	14/6.00	Fine sand (SP-SM)	0	88	12	0
●	14/14.25	Sandy silt (CL)	3	20	66	11
▲	14/17.25	Silty sand (SM)	0	80	20	0

GRAIN SIZE ANALYSIS

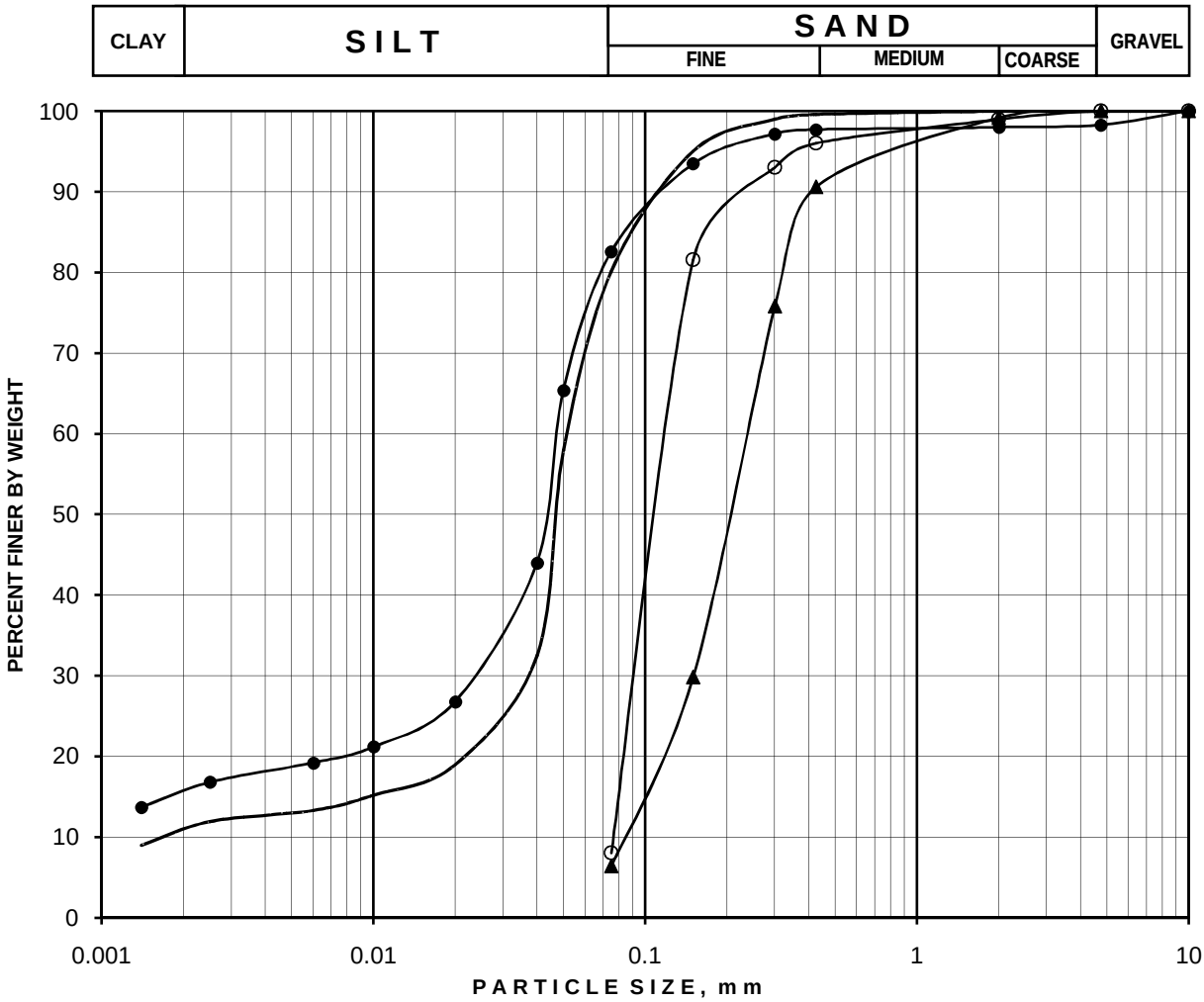
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	14/24.00	Fine sand (SP-SM)	0	94	6	0
	14/33.00	Fine sand (SP-SM)	0	91	9	0
	14/41.25	Sandy silt (CL)	4	21	62	13

GRAIN SIZE ANALYSIS

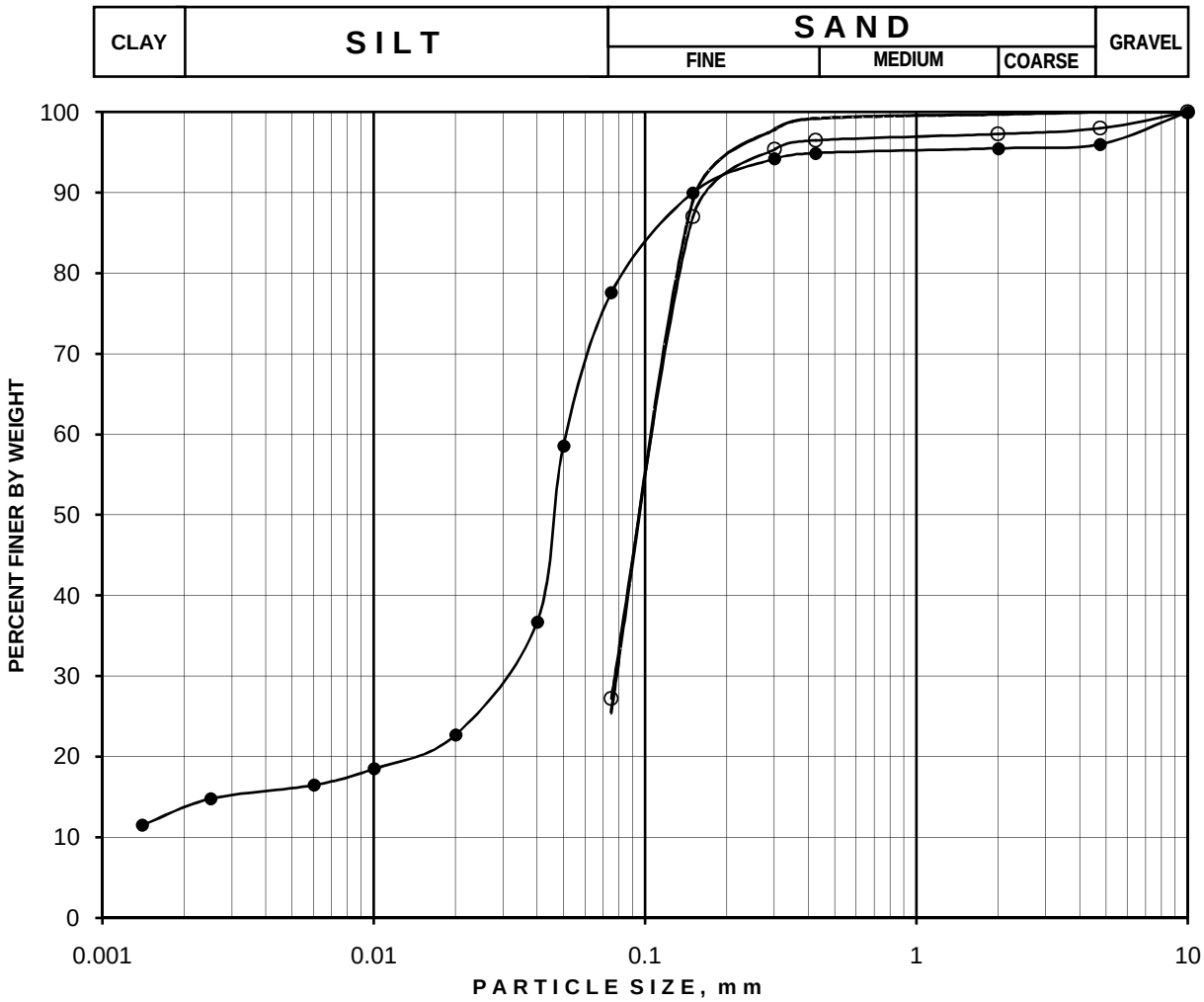
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	16/1.50	Sandy silt (CL)	0	20	69	11
○	16/5.25	Fine sand (SP-SM)	0	92	8	0
●	16/14.25	Sandy silt (CL)	2	15	67	16
▲	16/20.25	Fine sand (SP-SM)	0	94	6	0

GRAIN SIZE ANALYSIS

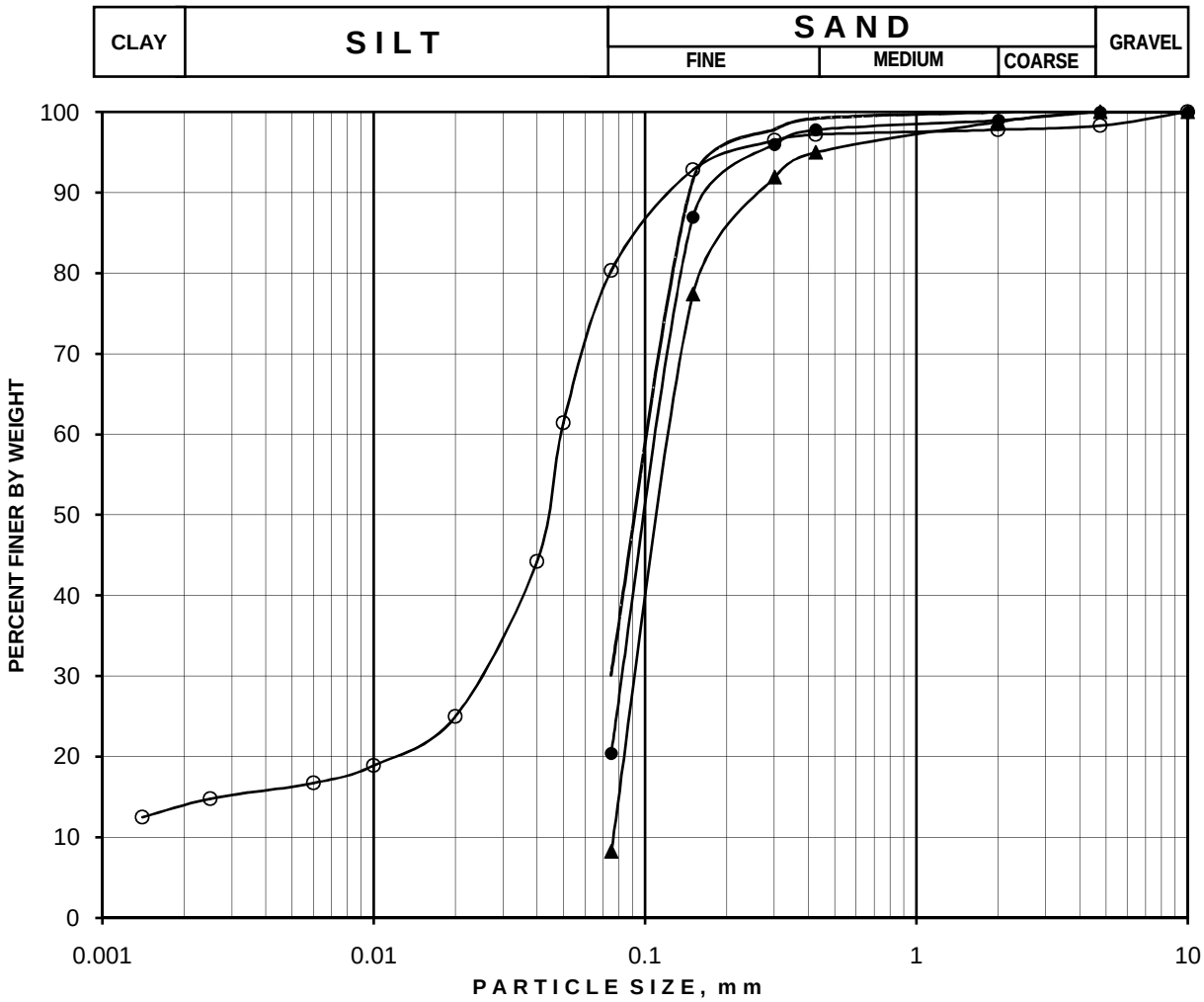
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	16/30.00	Silty sand (SM)	0	75	25	0
	16/36.00	Silty sand (SM)	2	71	27	0
	16/42.00	Sandy silt (CL)	4	18	64	14

GRAIN SIZE ANALYSIS

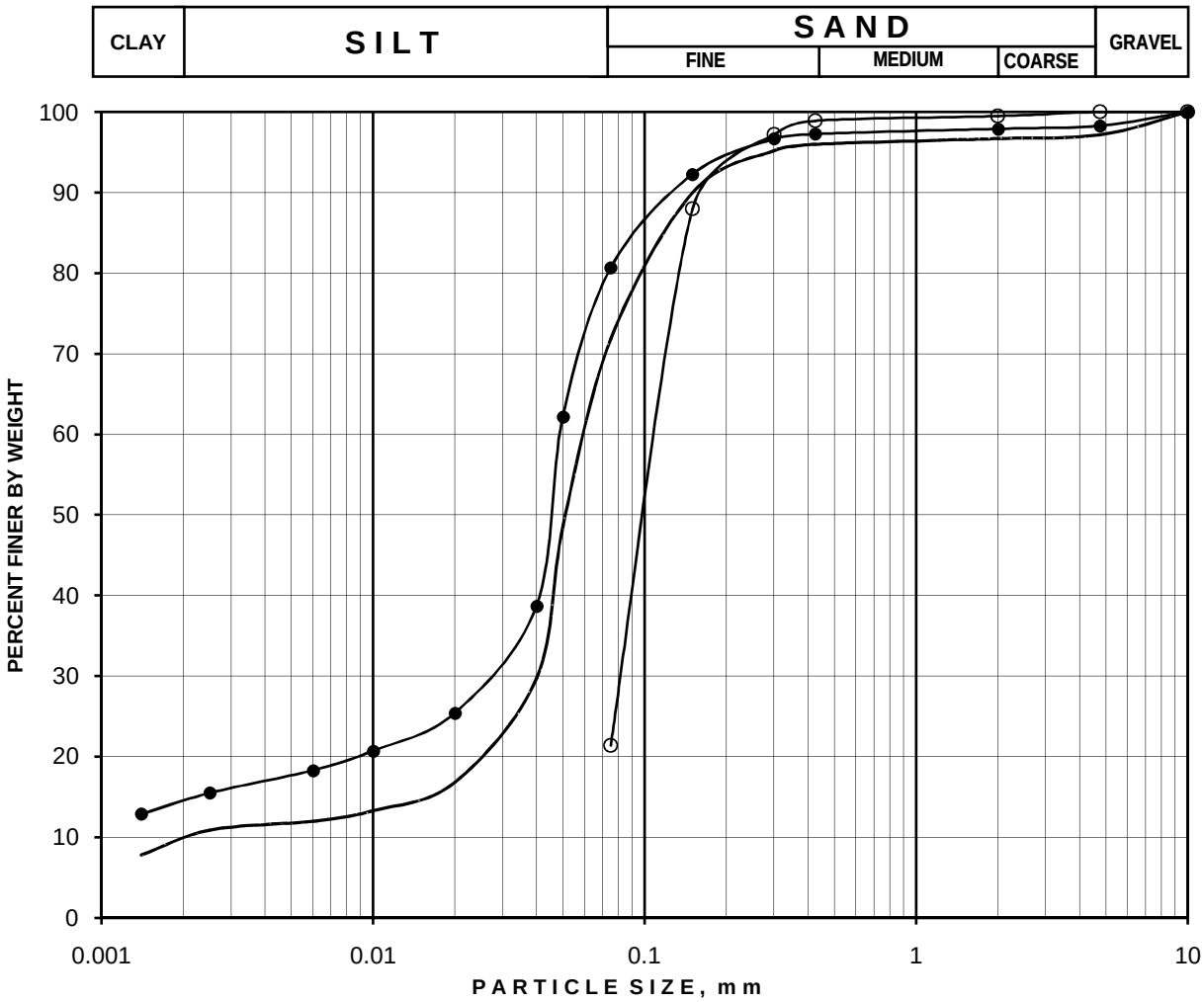
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	28/5.25	Silty sand (SM)	0	70	30	0
○	28/9.00	Sandy silt (CL)	2	18	66	14
●	28/14.25	Silty sand (SM)	0	80	20	0
▲	28/21.00	Fine sand (SP-SM)	0	92	8	0

GRAIN SIZE ANALYSIS

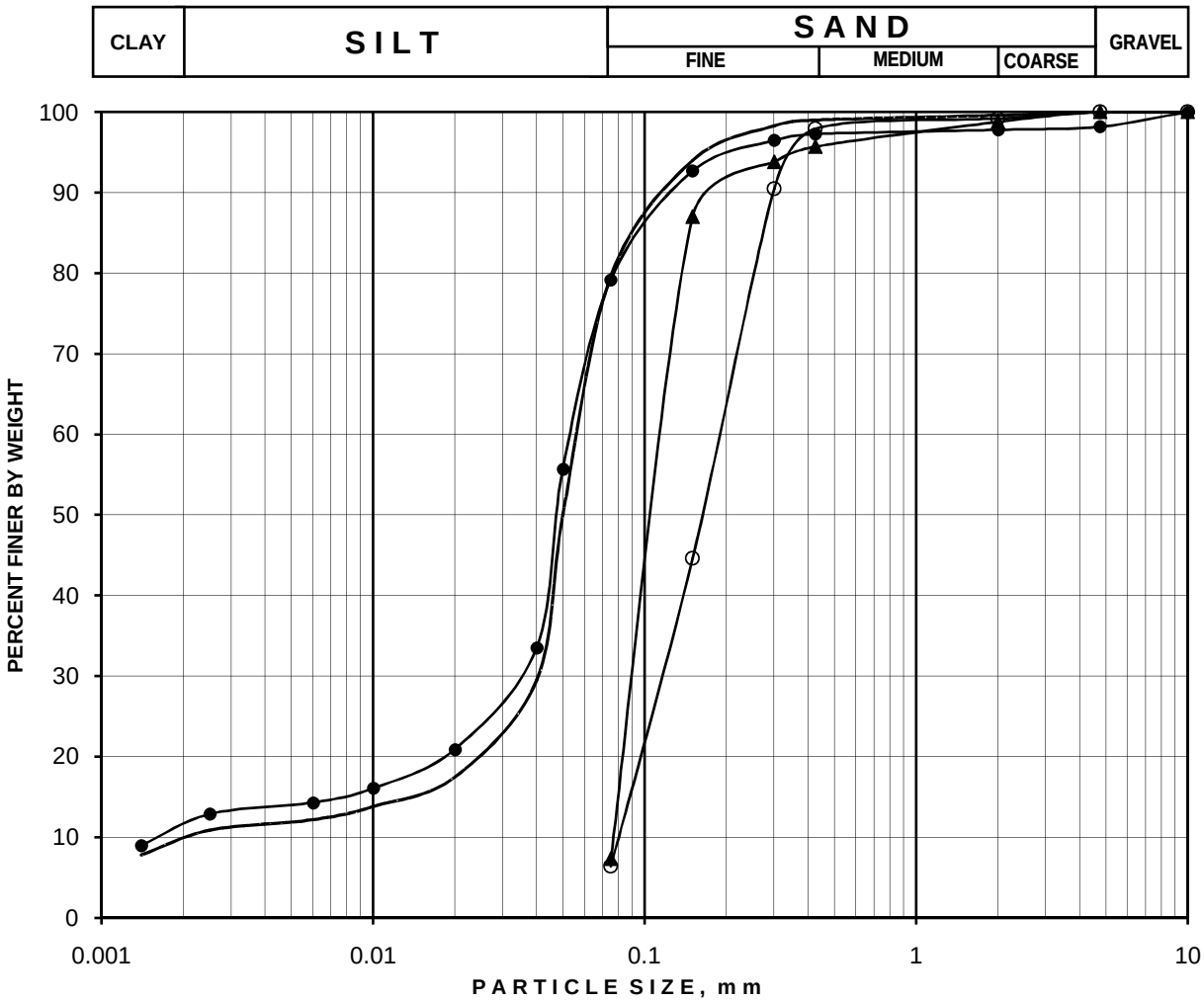
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	28/29.25	Sandy silt (CL)	3	25	62	10
	28/36.00	Silty sand (SM)	0	79	21	0
	28/44.25	Sandy silt (CL)	2	17	66	15

GRAIN SIZE ANALYSIS

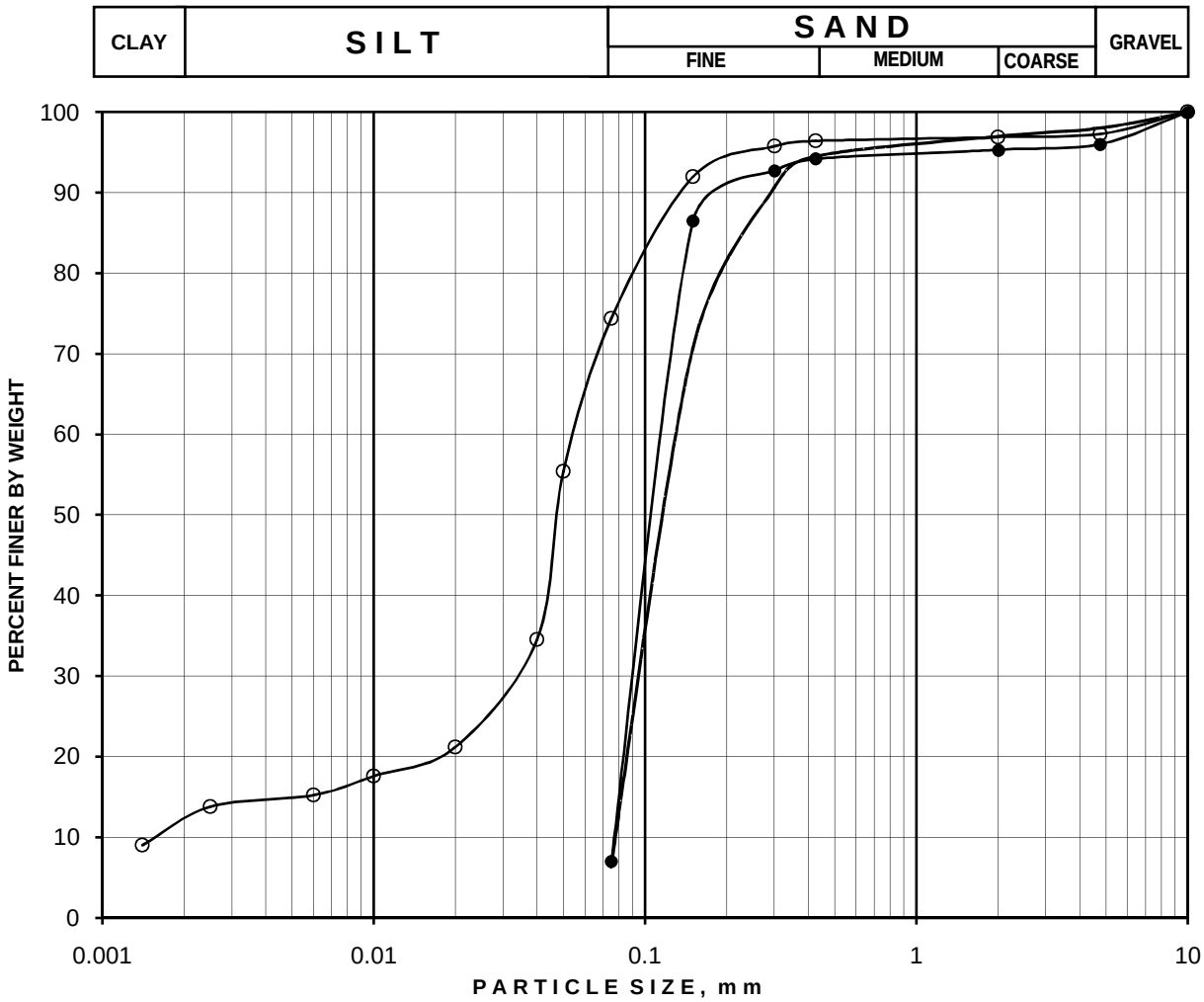
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	33/1.50	Sandy silt (CL)	0	20	70	10
○	33/7.50	Fine sand (SP-SM)	0	94	6	0
●	33/11.25	Sandy silt (CL)	2	19	67	12
▲	33/18.00	Fine sand (SP-SM)	0	93	7	0

GRAIN SIZE ANALYSIS

SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.



SYMBOL	BH.NO / DEPTH.	DESCRIPTION	GRAVEL %	SAND %	SILT %	CLAY %
	33/27.00	Fine sand (SP-SM)	2	92	6	0
○	33/35.25	Sandy silt (CL)	3	23	61	13
●	33/42.00	Fine sand (SP-SM)	4	89	7	0

GRAIN SIZE ANALYSIS

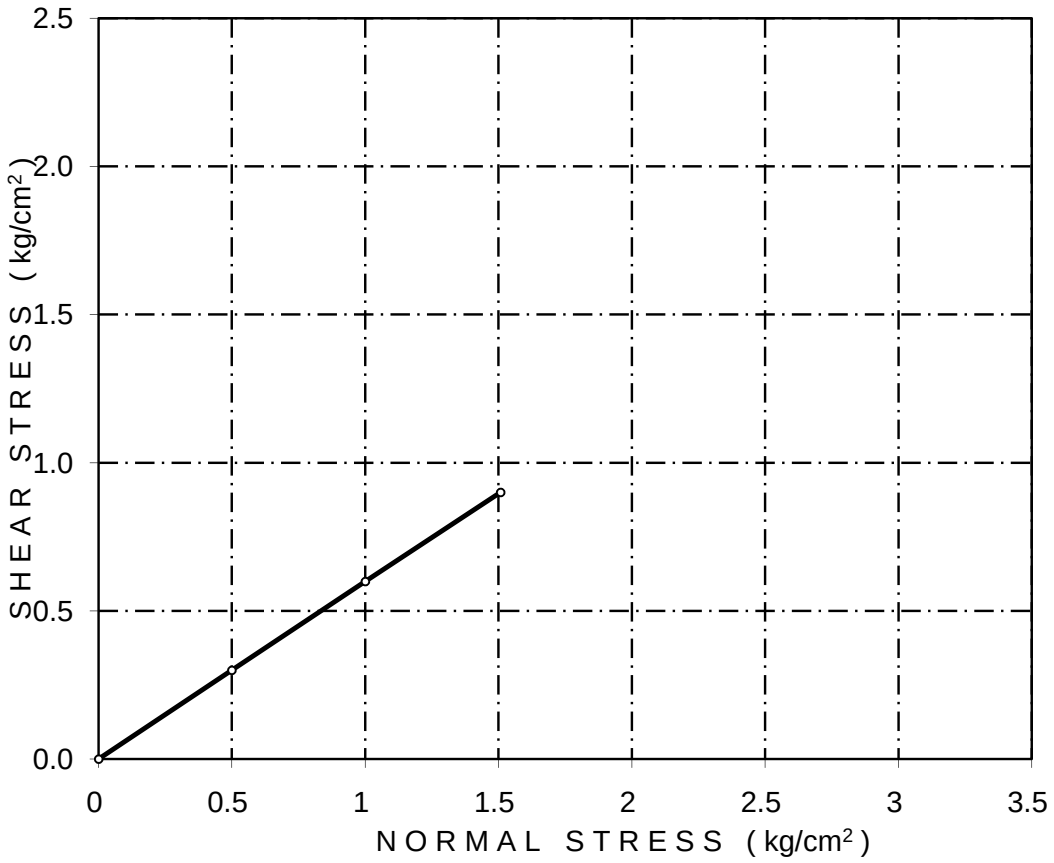
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 36

DRAINED DIRECT SHEAR TEST

Borehole No :	3
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.54	0	31



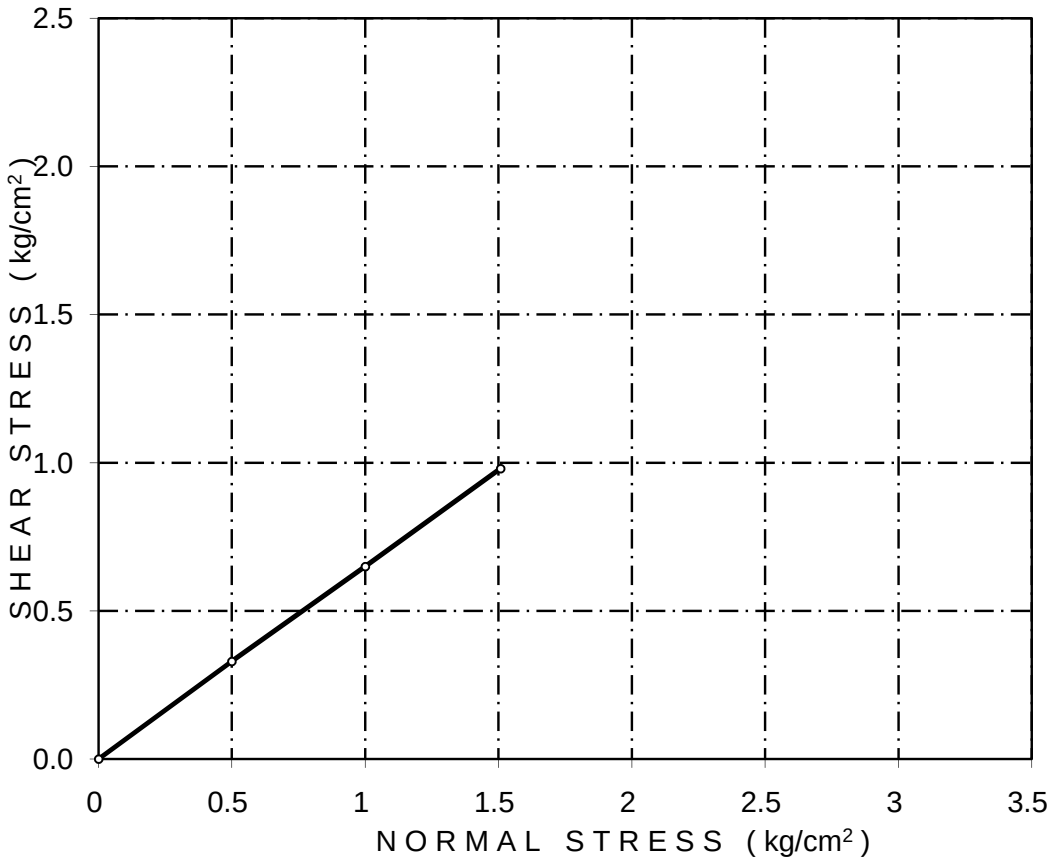
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 37

DRAINED DIRECT SHEAR TEST

Borehole No :	3
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.59	0	33



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

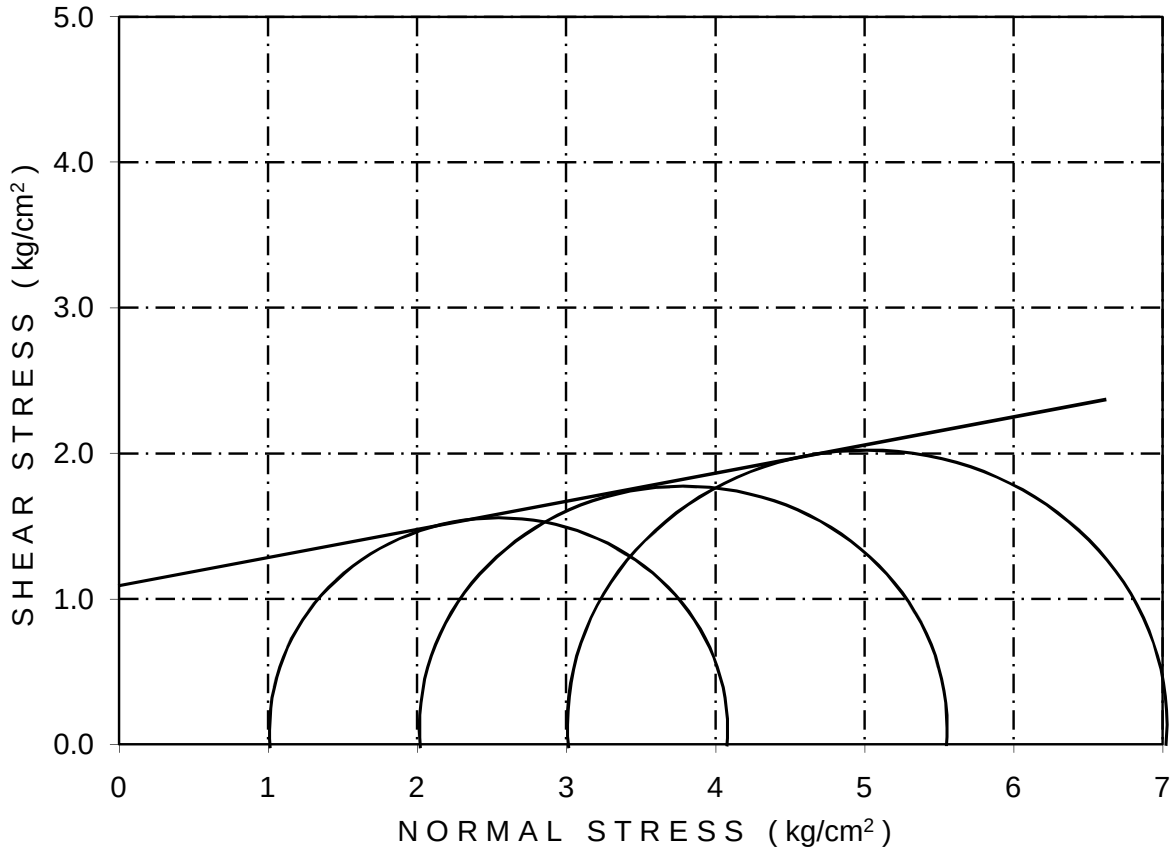
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 38

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	3
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.90	1.63	16.5

"c" Value kg/cm^2	"Ø" Value DEGREE
1.10	8



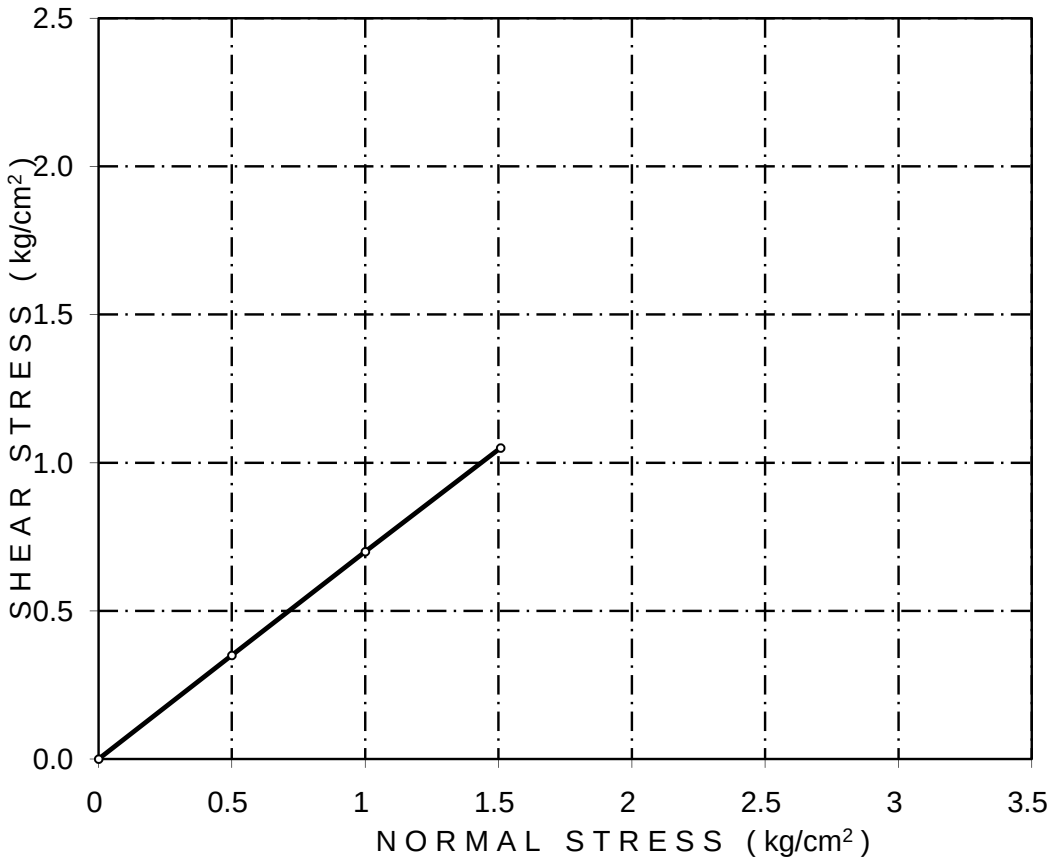
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 39

DRAINED DIRECT SHEAR TEST

Borehole No :	3
Depth :	**23.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.68	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

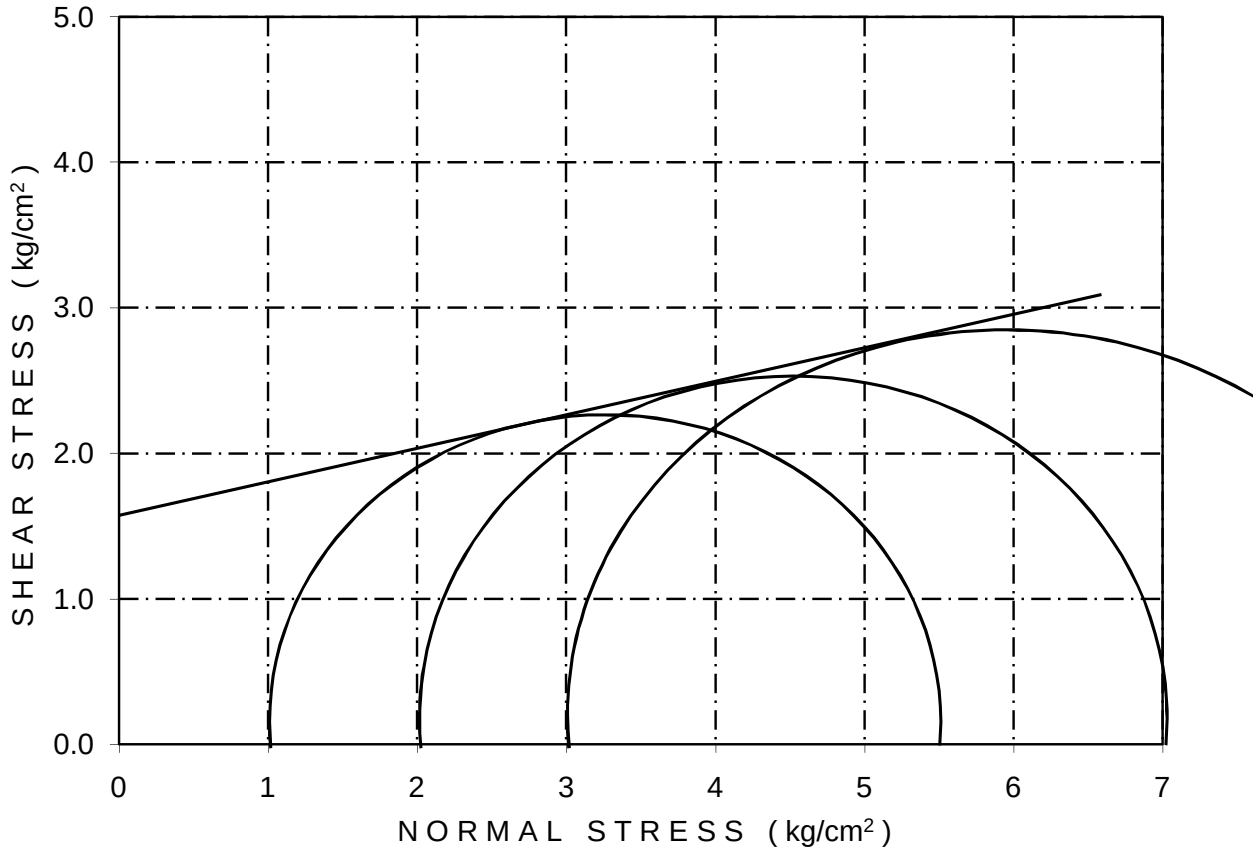
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 40

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	3
Depth	:	32.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.07	1.71	21.1

"c" Value kg/cm^2	"Ø" Value DEGREE
1.60	10



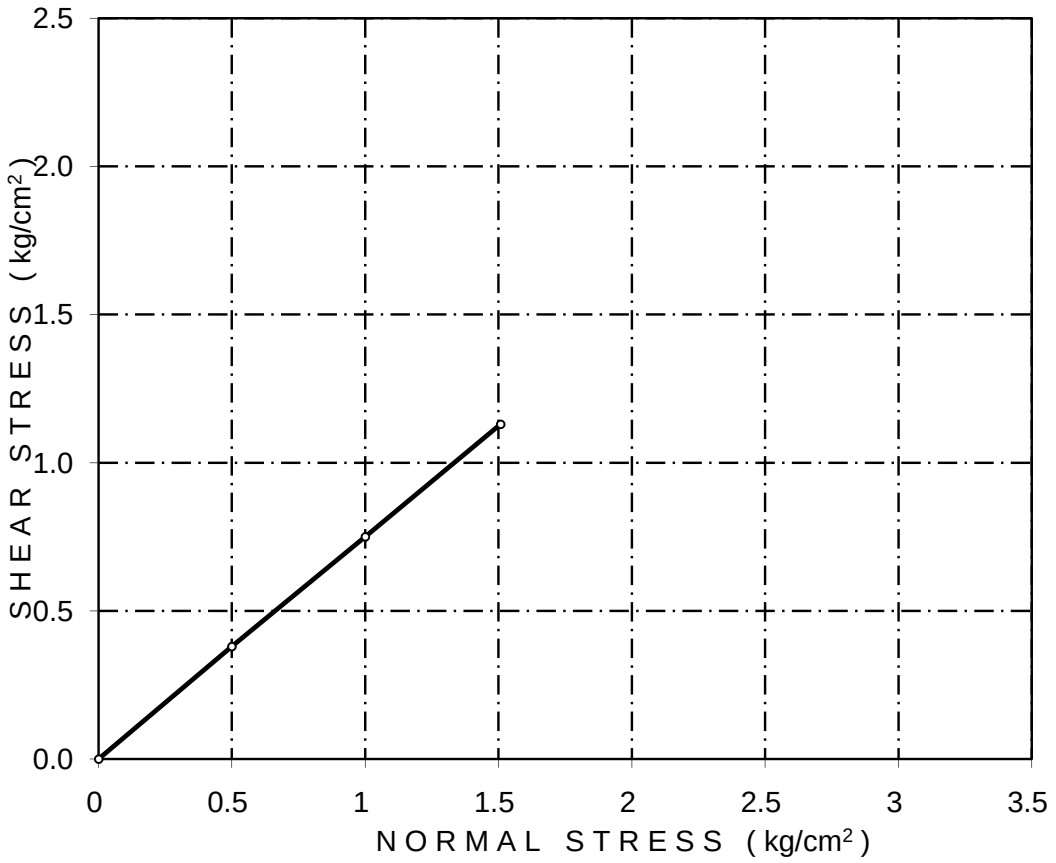
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 41

DRAINED DIRECT SHEAR TEST

Borehole No :	3
Depth :	**38.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.75	0	37



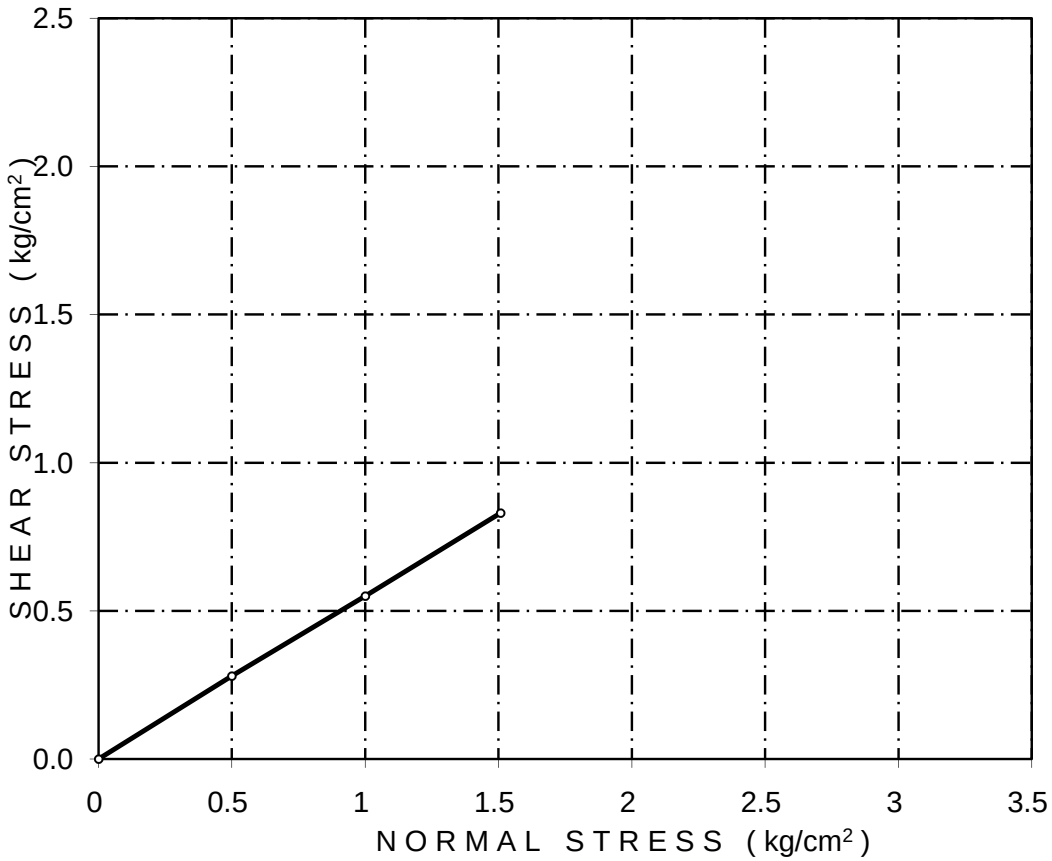
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 42

DRAINED DIRECT SHEAR TEST

Borehole No :	4
Depth :	**2.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.50	0	29



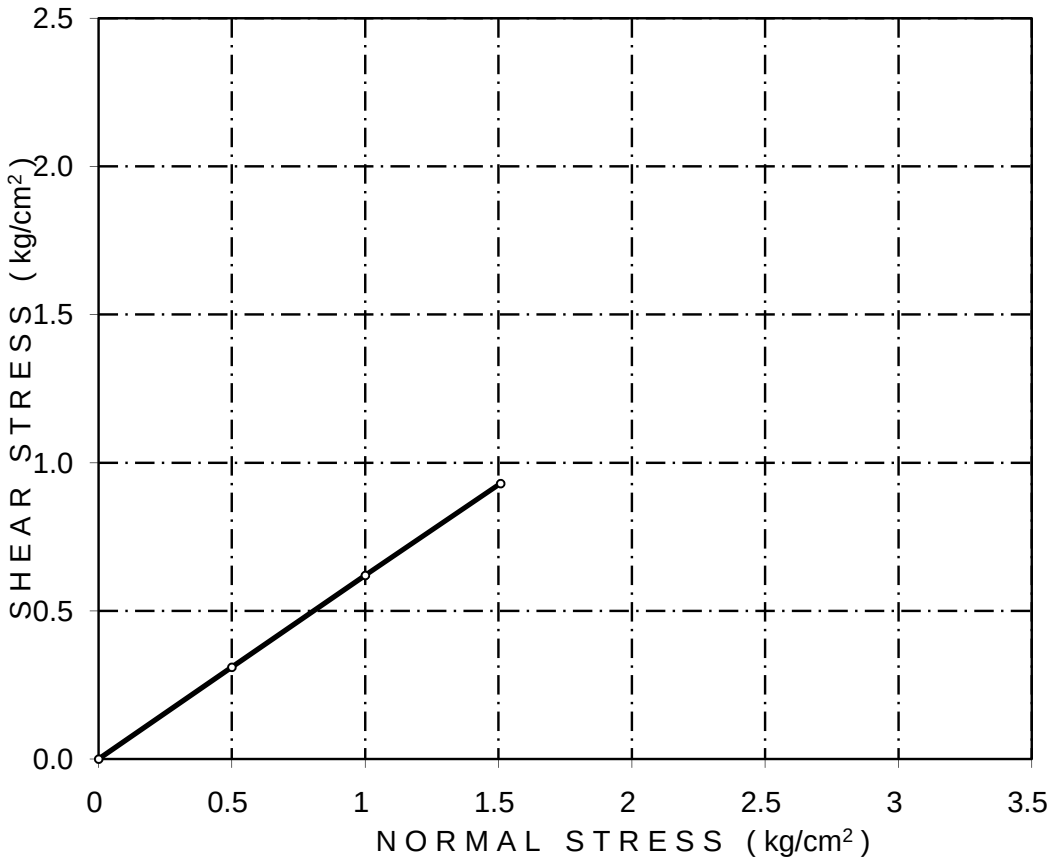
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 43

DRAINED DIRECT SHEAR TEST

Borehole No :	4
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	32



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

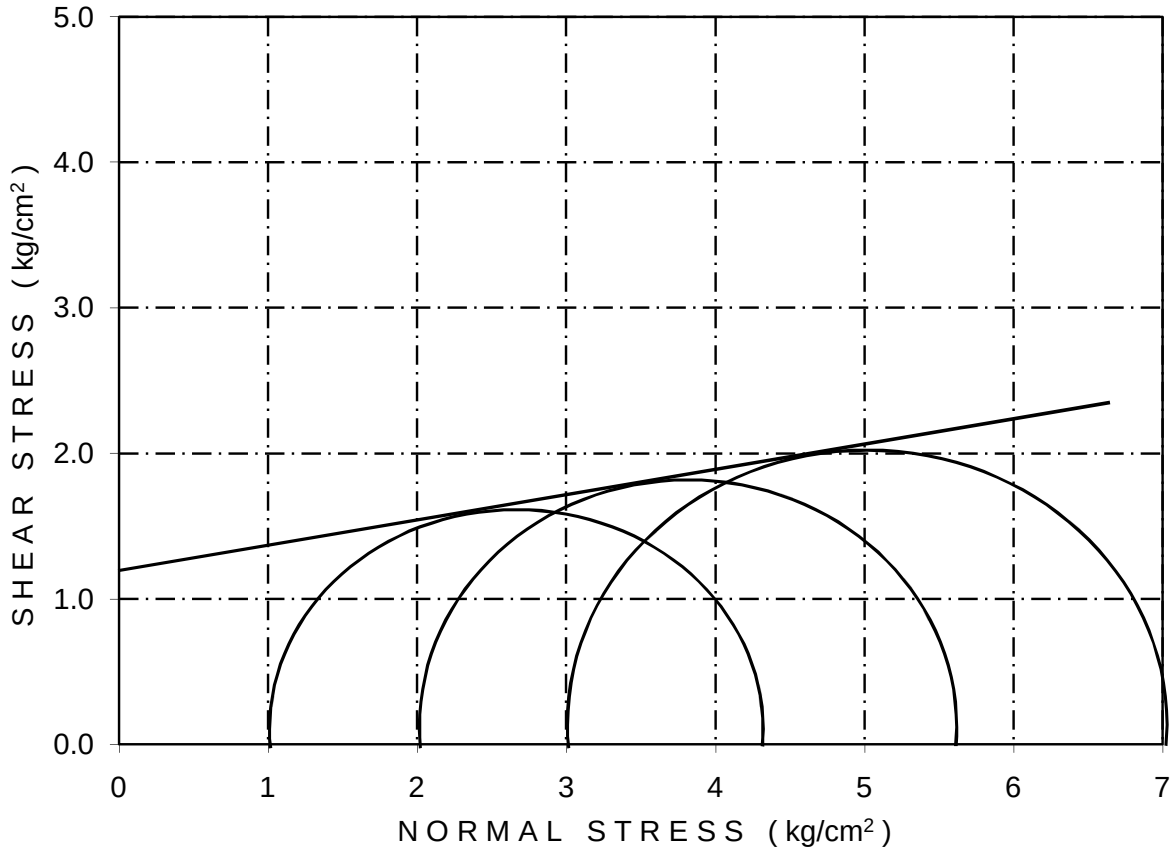
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 44

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	4
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.89	1.61	17.1

"c" Value kg/cm^2	"Ø" Value DEGREE
1.20	7



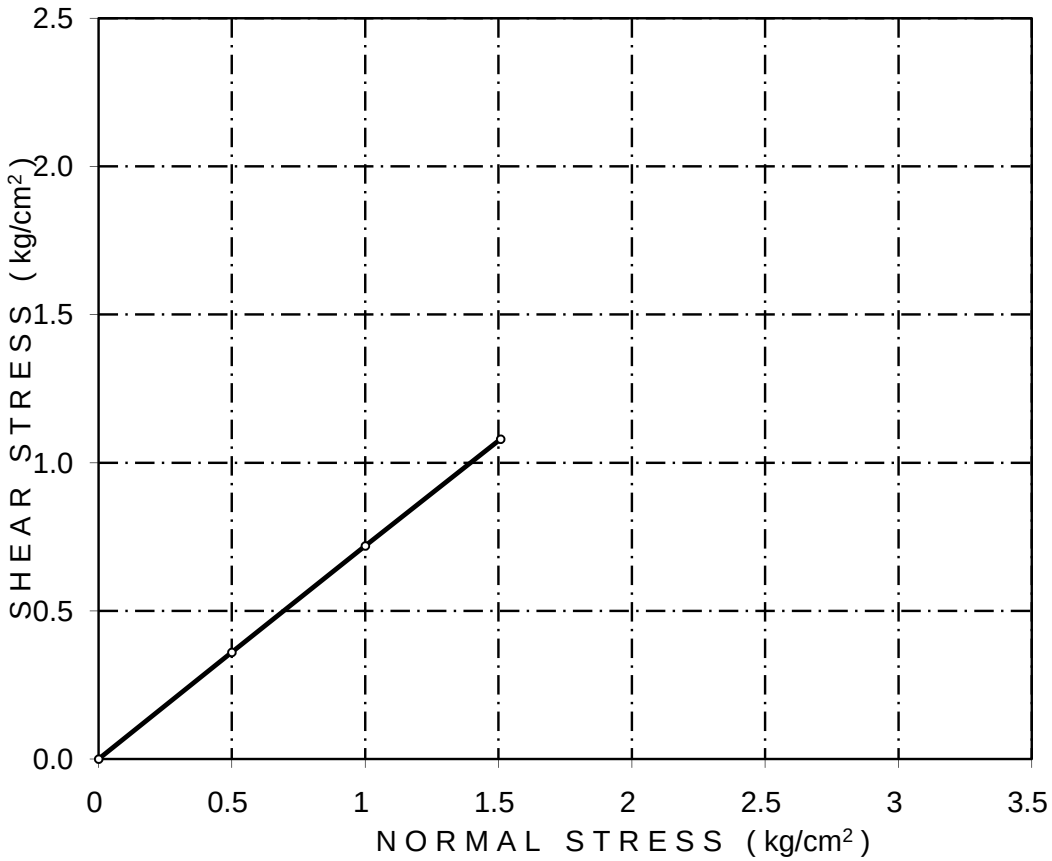
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 45

DRAINED DIRECT SHEAR TEST

Borehole No :	4
Depth :	**23.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.69	0	36



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

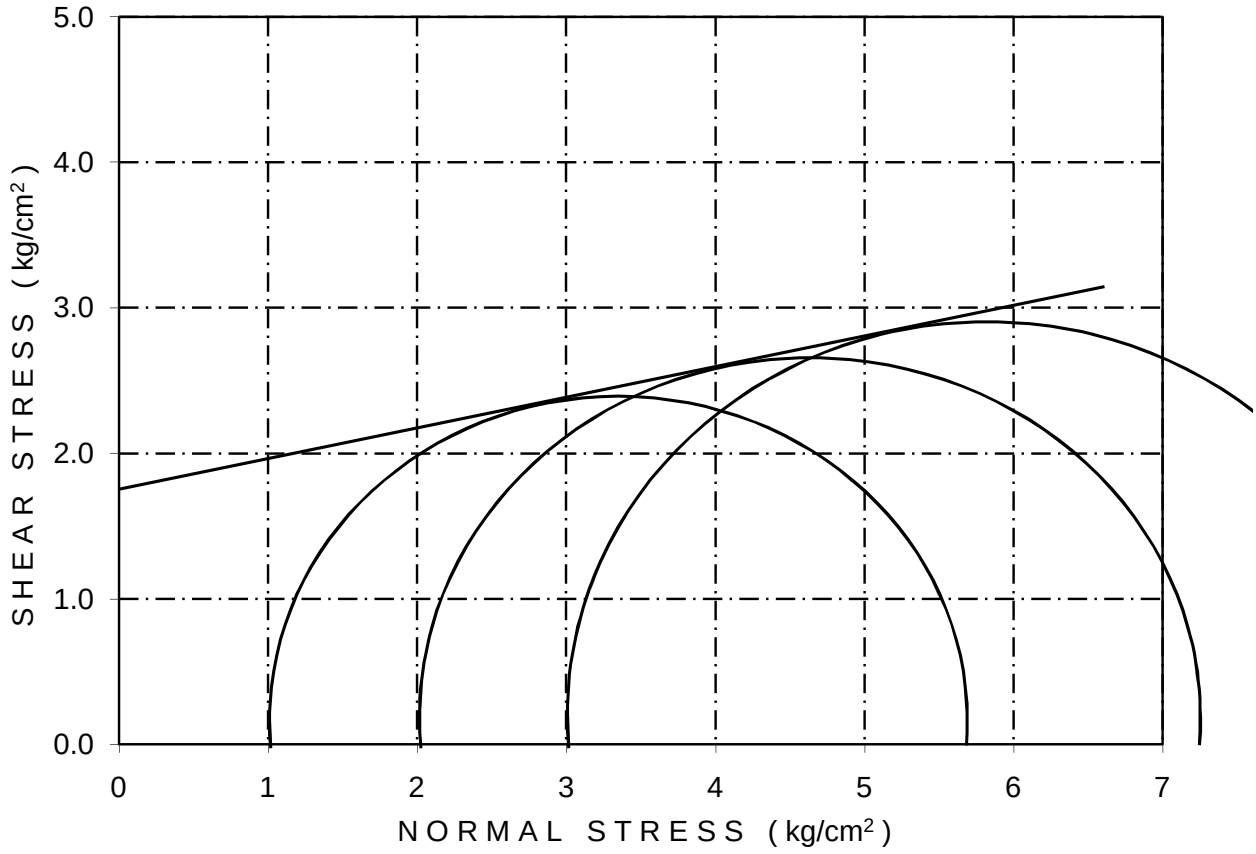
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 46

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	4
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.02	1.70	18.9

"c" Value kg/cm^2	"Ø" Value DEGREE
1.75	9



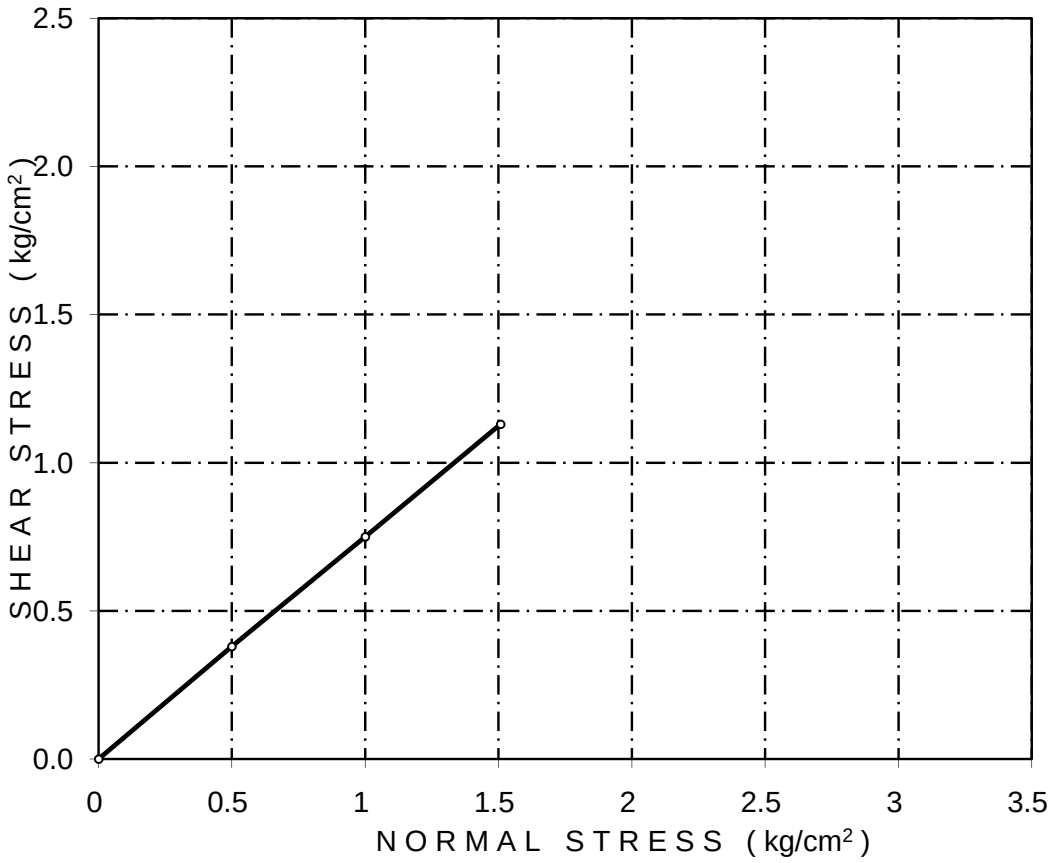
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 47

DRAINED DIRECT SHEAR TEST

Borehole No :	4
Depth :	**35.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.74	0	37



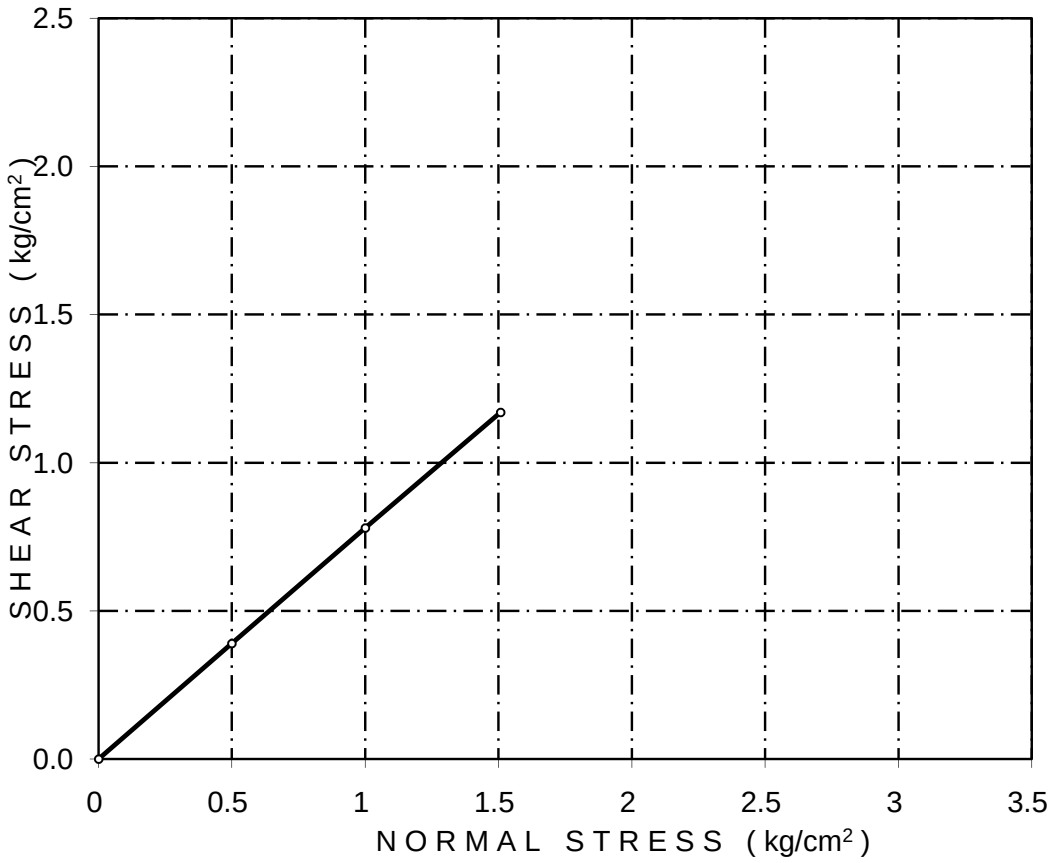
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 48

DRAINED DIRECT SHEAR TEST

Borehole No :	4
Depth :	**44.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.77	0	38



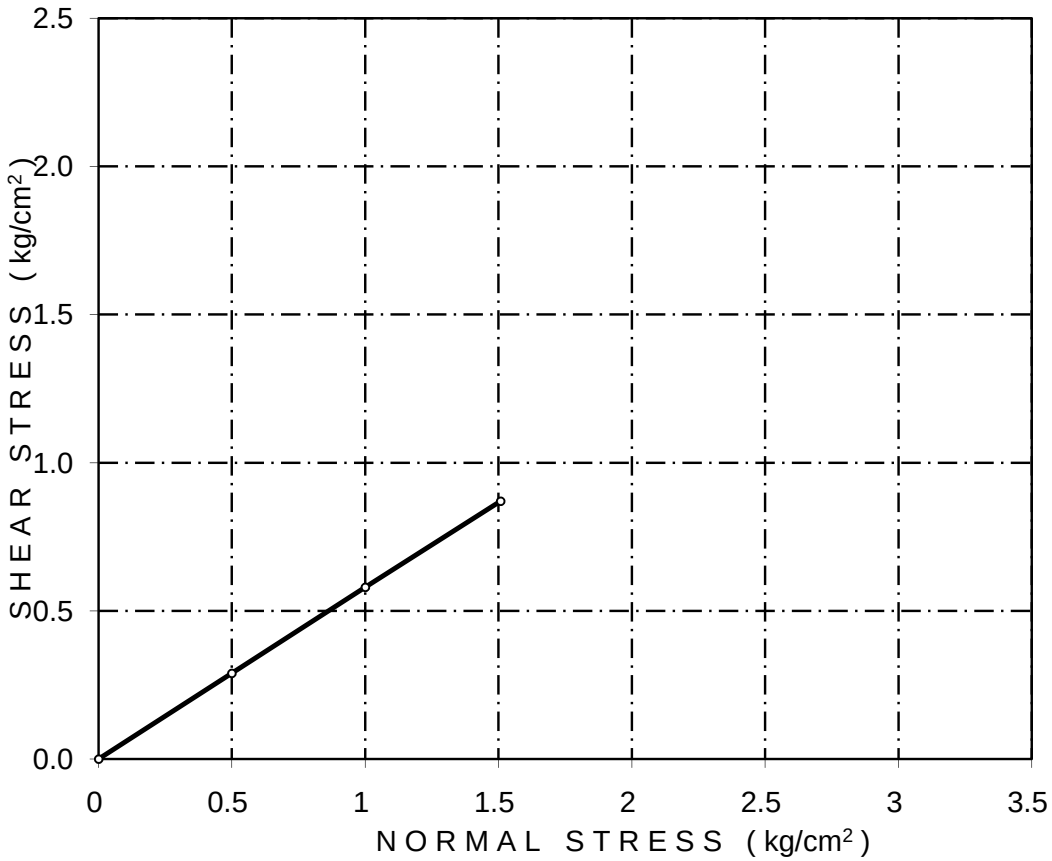
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 49

DRAINED DIRECT SHEAR TEST

Borehole No :	5
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	0	30



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

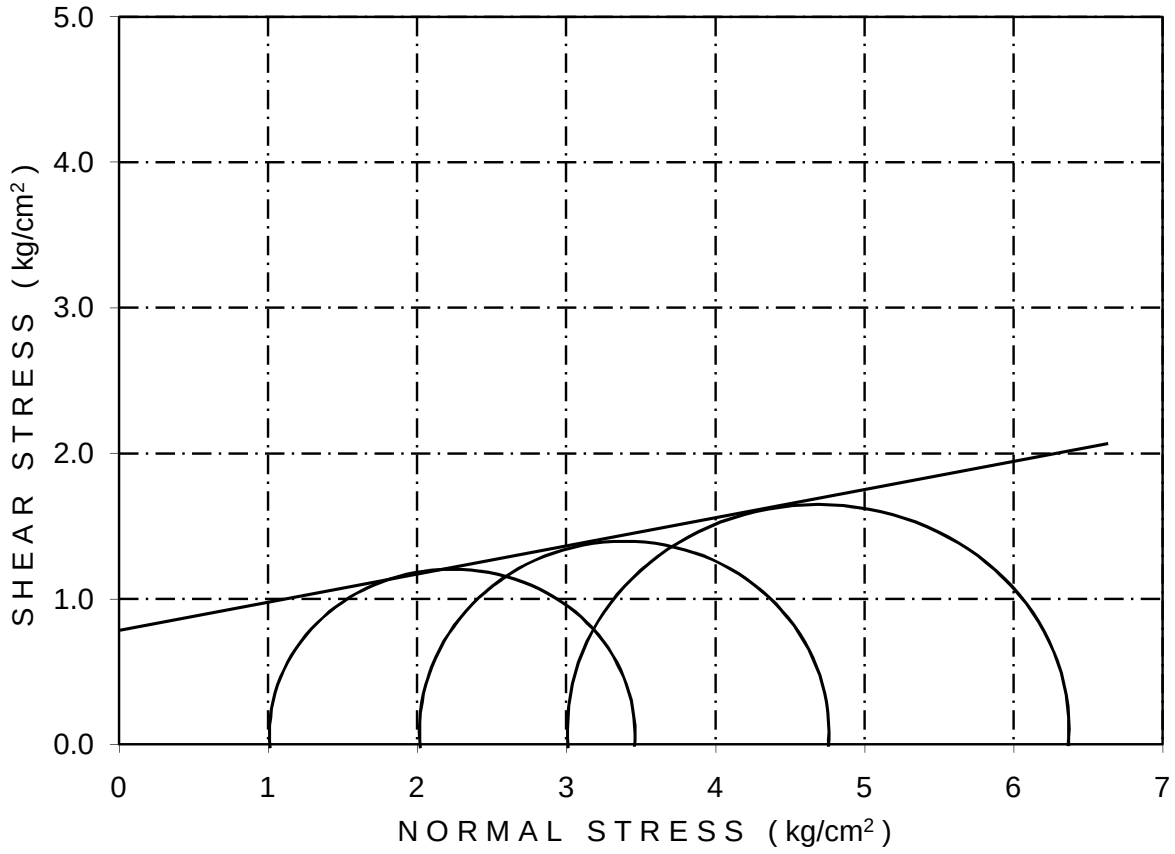
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 50

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	5
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.80	1.58	13.8

"c" Value kg/cm^2	"Ø" Value DEGREE
0.80	8



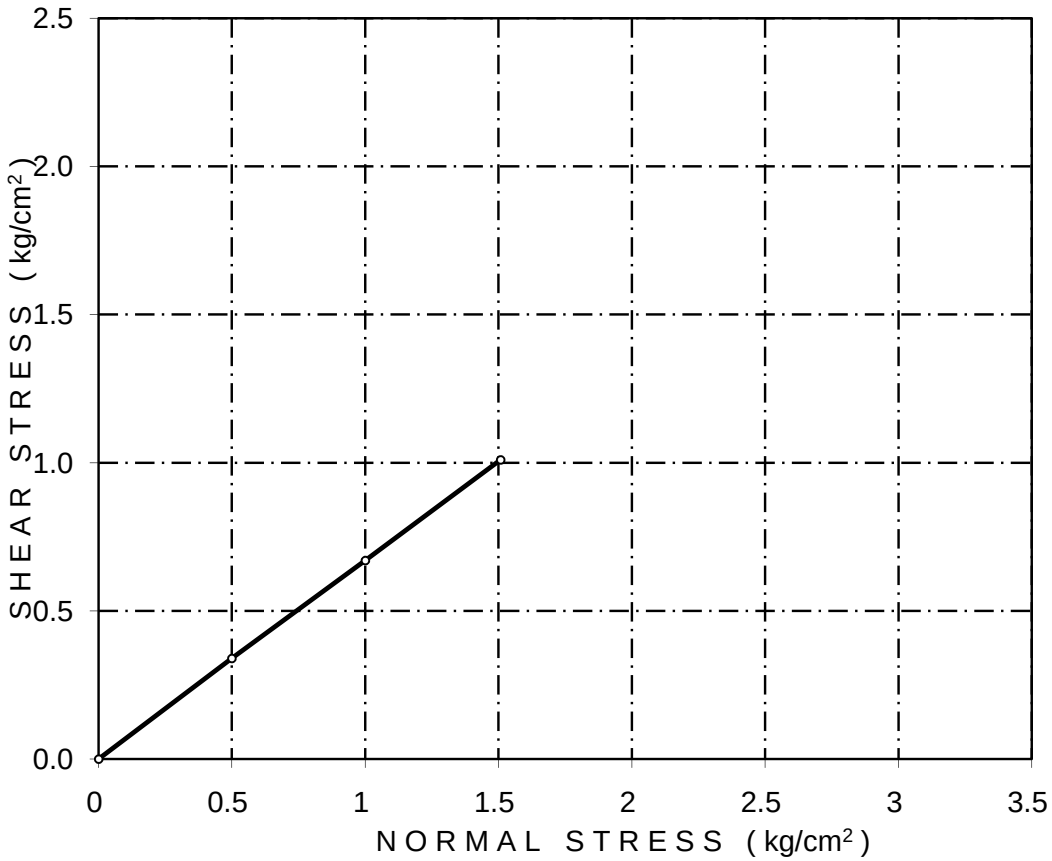
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 51

DRAINED DIRECT SHEAR TEST

Borehole No :	5
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.63	0	34



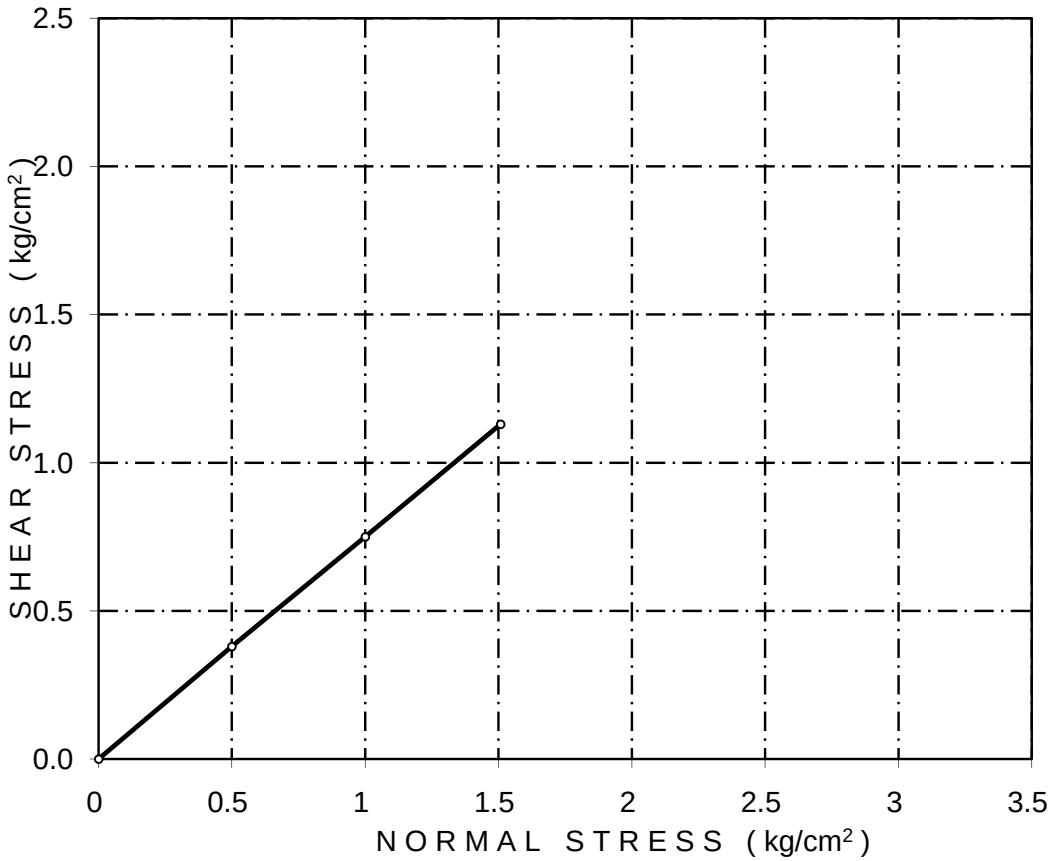
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 52

DRAINED DIRECT SHEAR TEST

Borehole No :	5
Depth :	**26.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.70	0	37



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

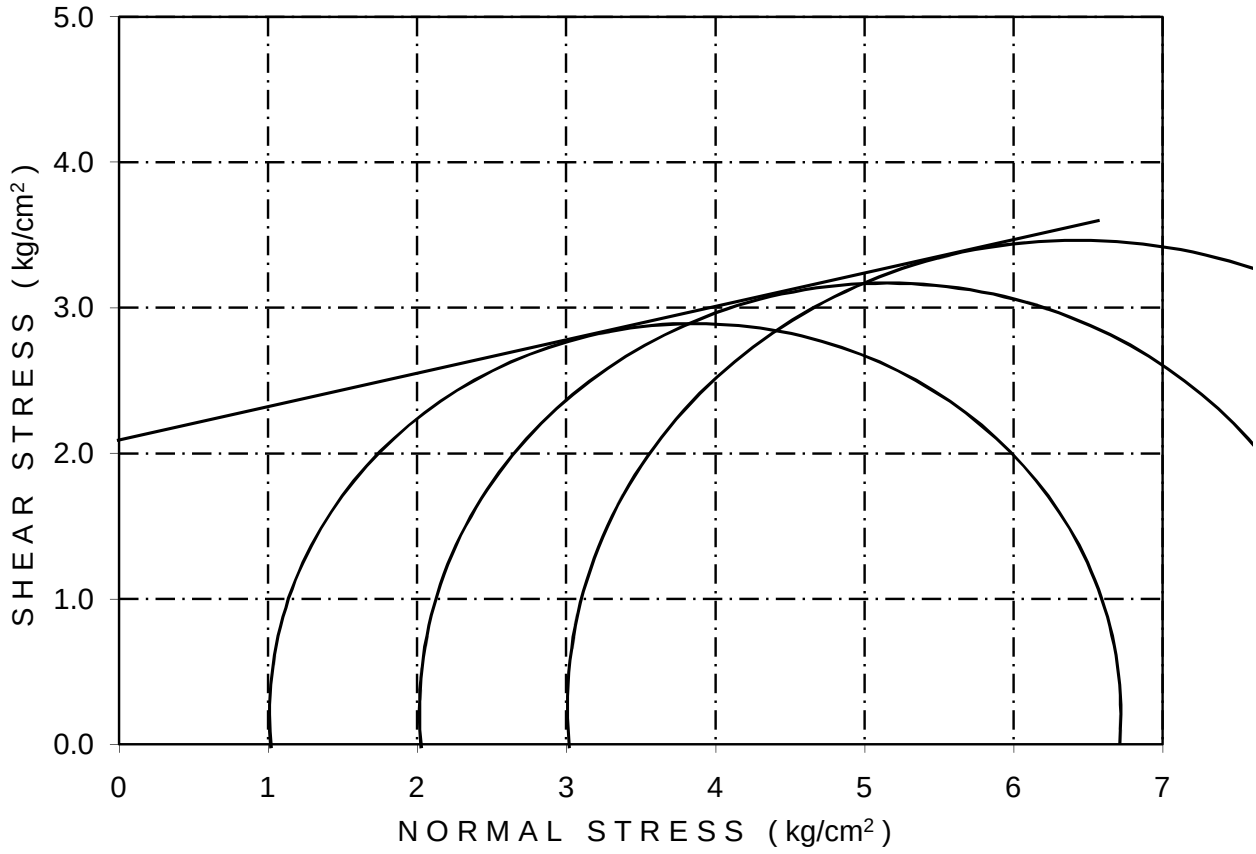
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 53

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	5
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.09	1.73	20.6

"c" Value kg/cm^2	"Ø" Value DEGREE
2.10	10



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

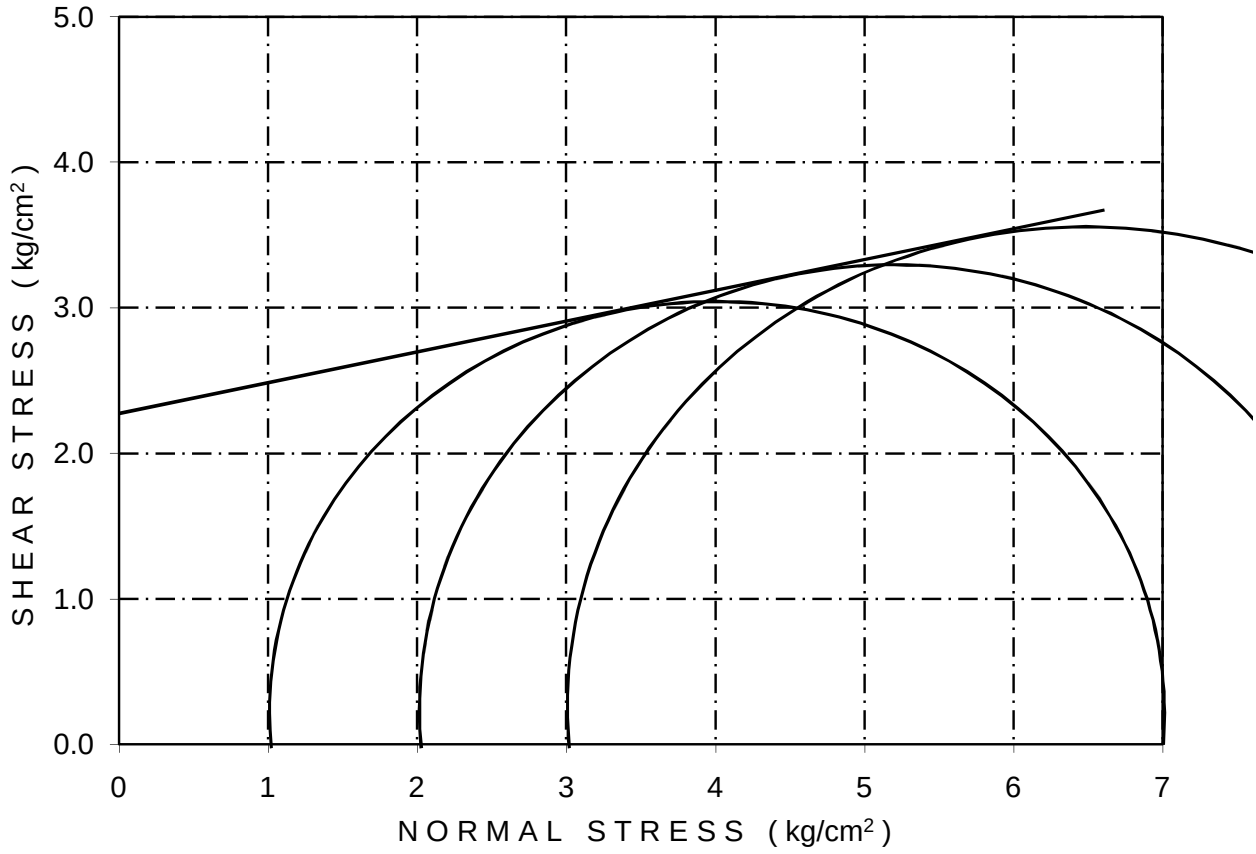
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 54

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	5
Depth	:	41.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.15	1.75	22.7

"c" Value kg/cm^2	"Ø" Value DEGREE
2.30	9



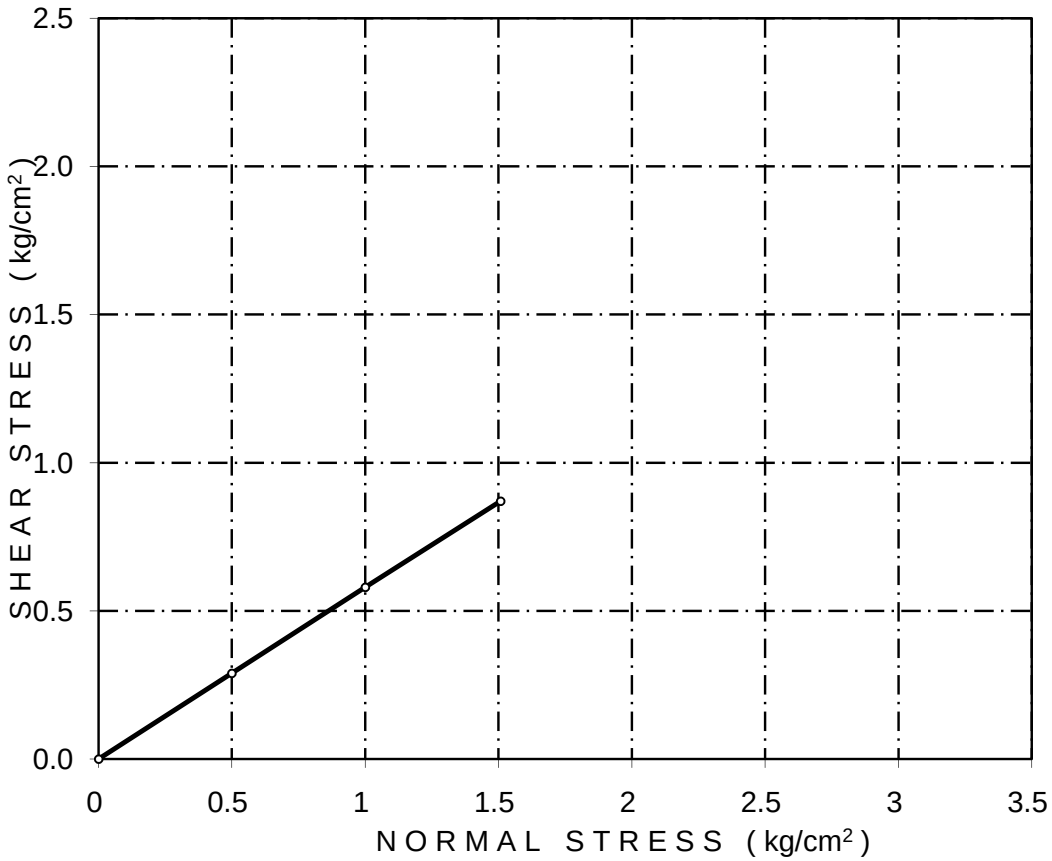
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 55

DRAINED DIRECT SHEAR TEST

Borehole No :	8
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	0	30



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

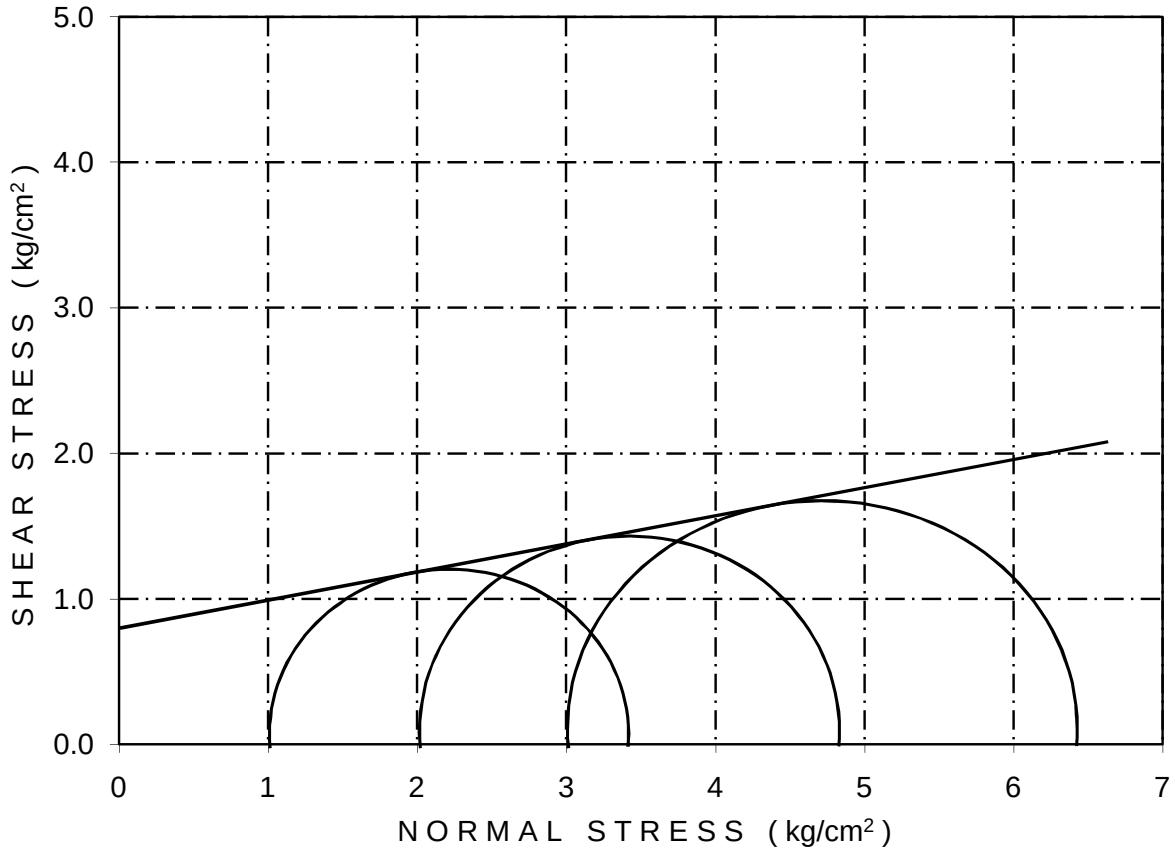
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 56

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	8
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.79	1.58	13.4

"c" Value kg/cm^2	"Ø" Value DEGREE
0.80	8



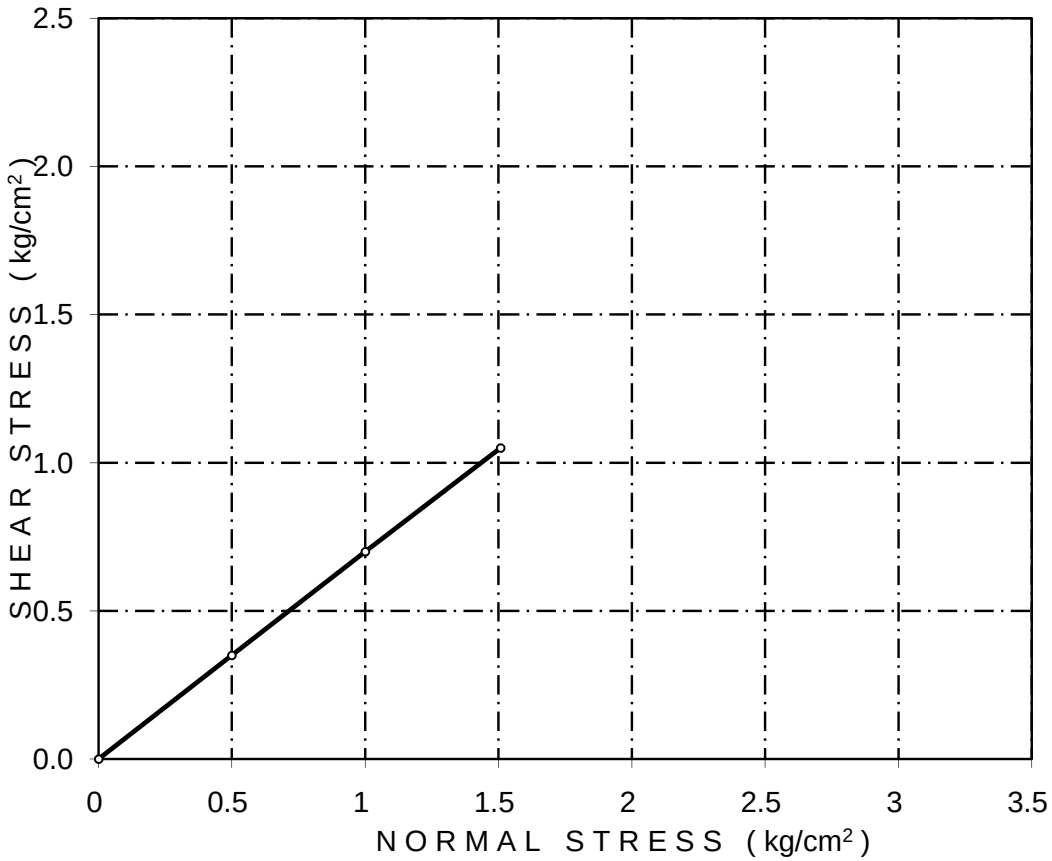
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 57

DRAINED DIRECT SHEAR TEST

Borehole No :	8
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.61	0	35



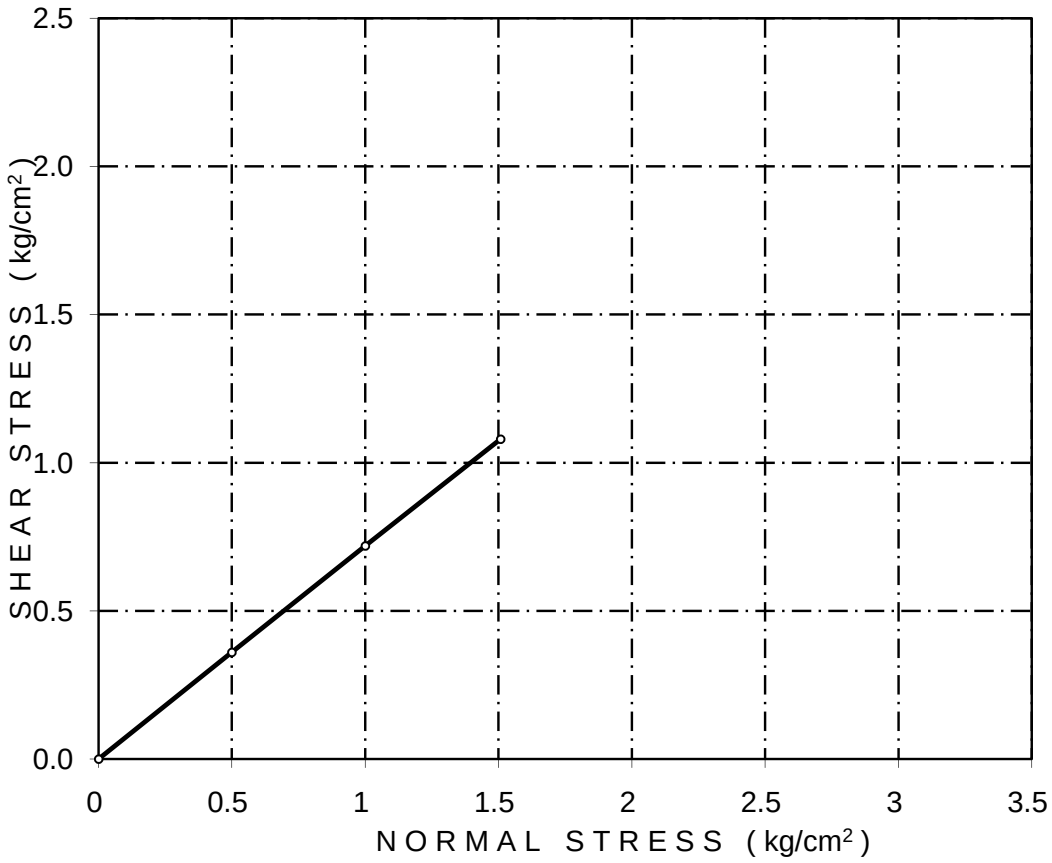
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 58

DRAINED DIRECT SHEAR TEST

Borehole No :	8
Depth :	**23.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.66	0	36



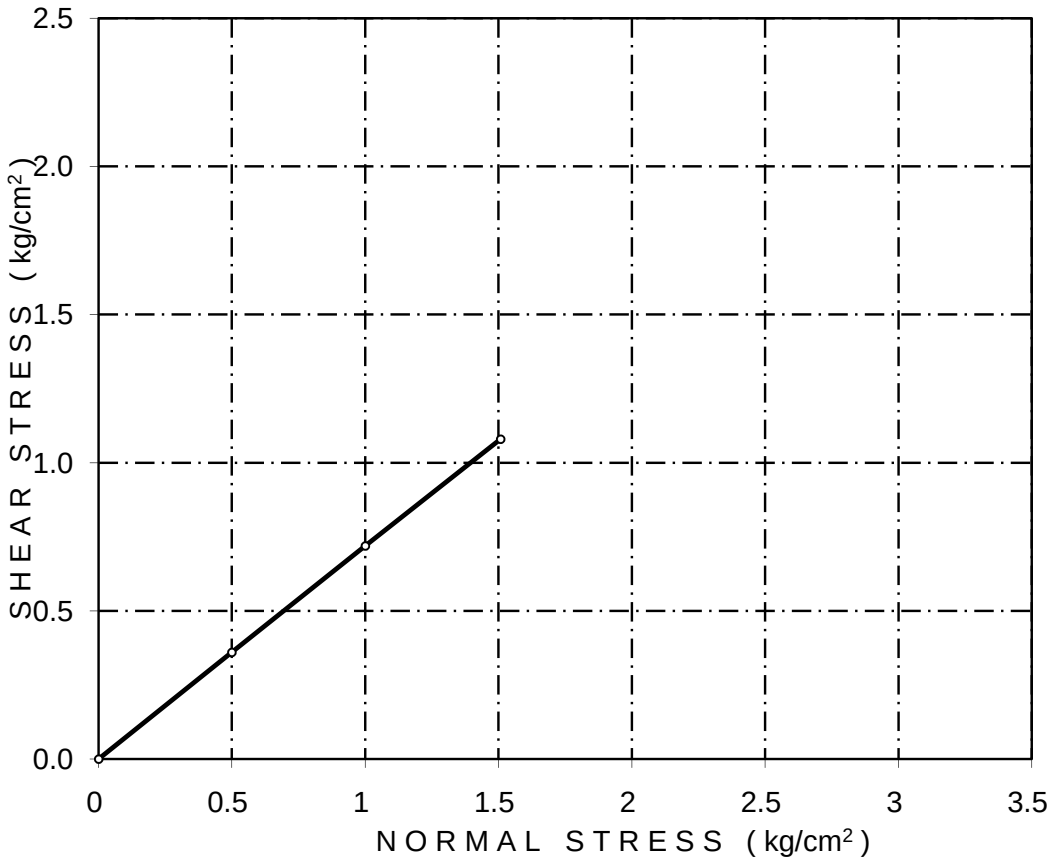
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 59

DRAINED DIRECT SHEAR TEST

Borehole No :	8
Depth :	**32.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.71	0	36



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

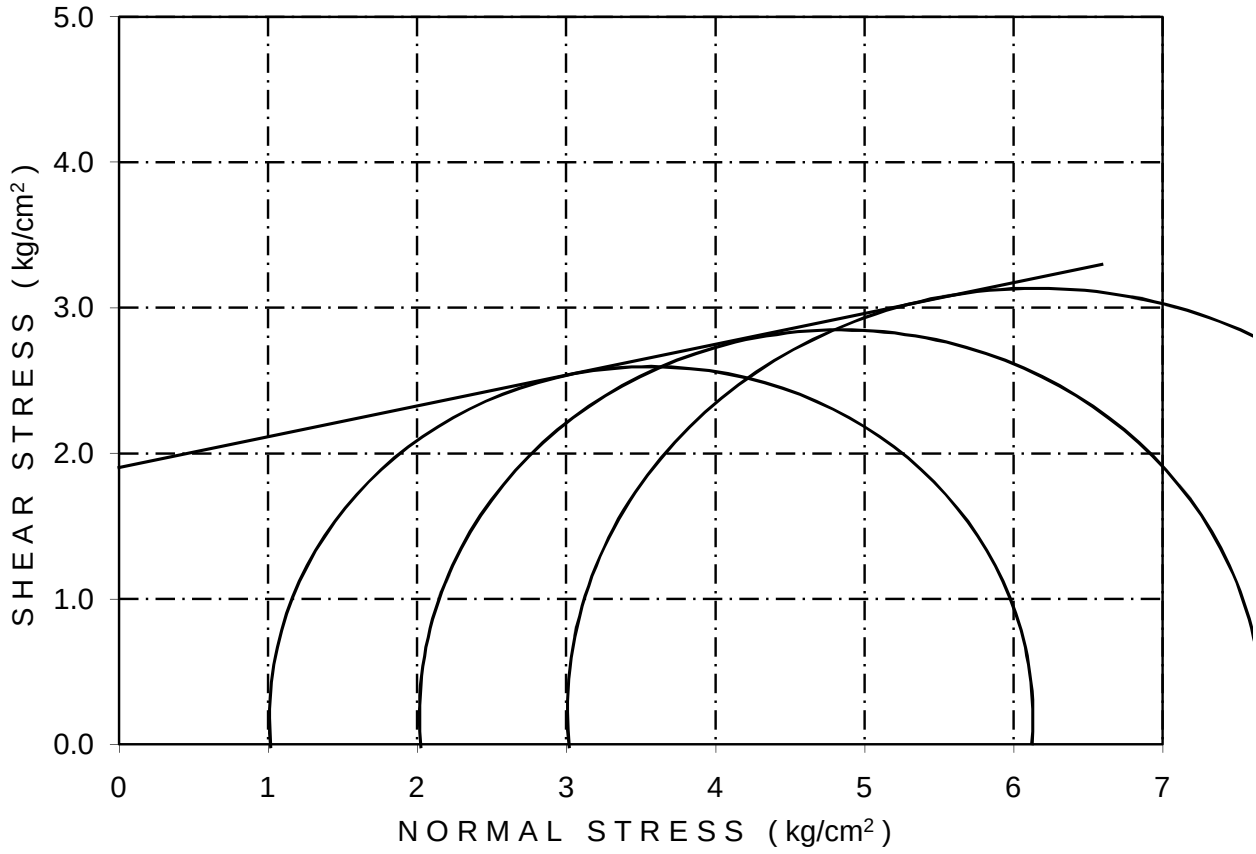
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 60

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	8
Depth	:	41.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.14	1.74	23.1

"c" Value kg/cm^2	"Ø" Value DEGREE
1.90	9



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

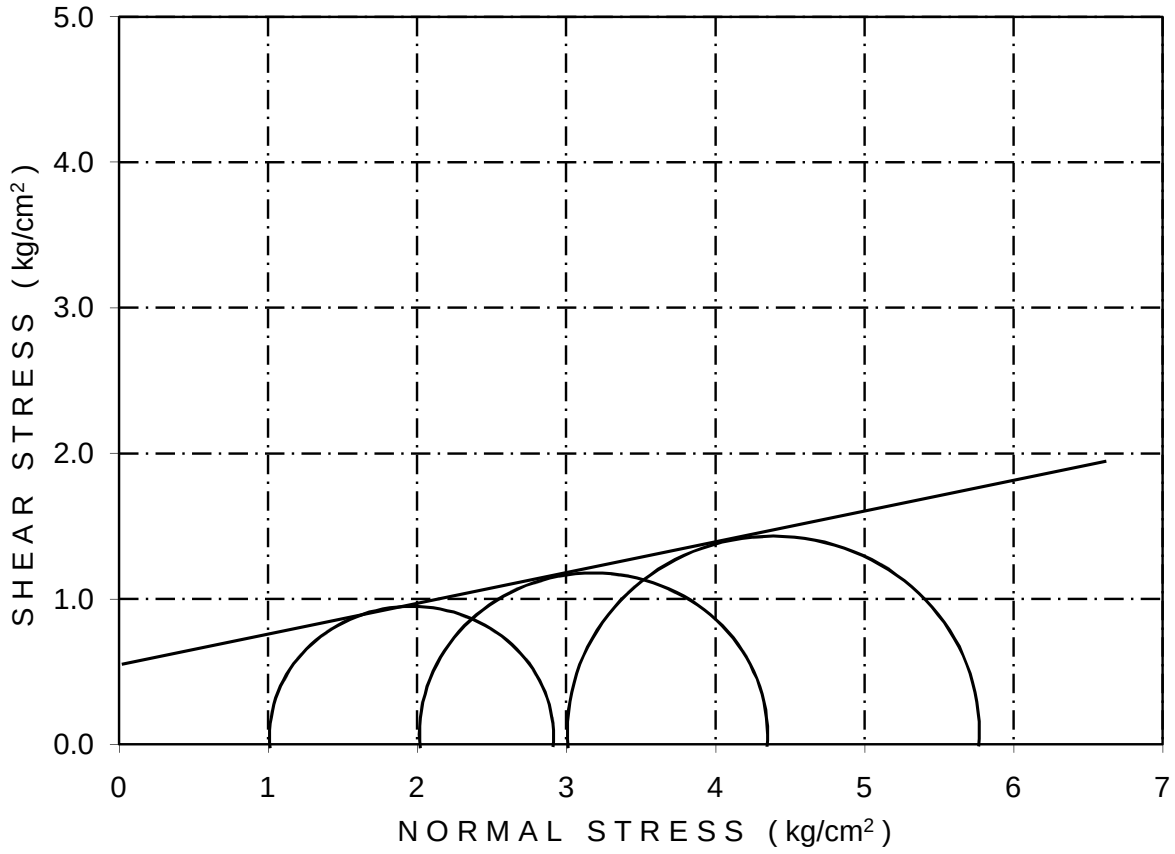
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 61

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	9
Depth	:	2.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.65	1.50	10.3

"c" Value kg/cm^2	"Ø" Value DEGREE
0.55	9



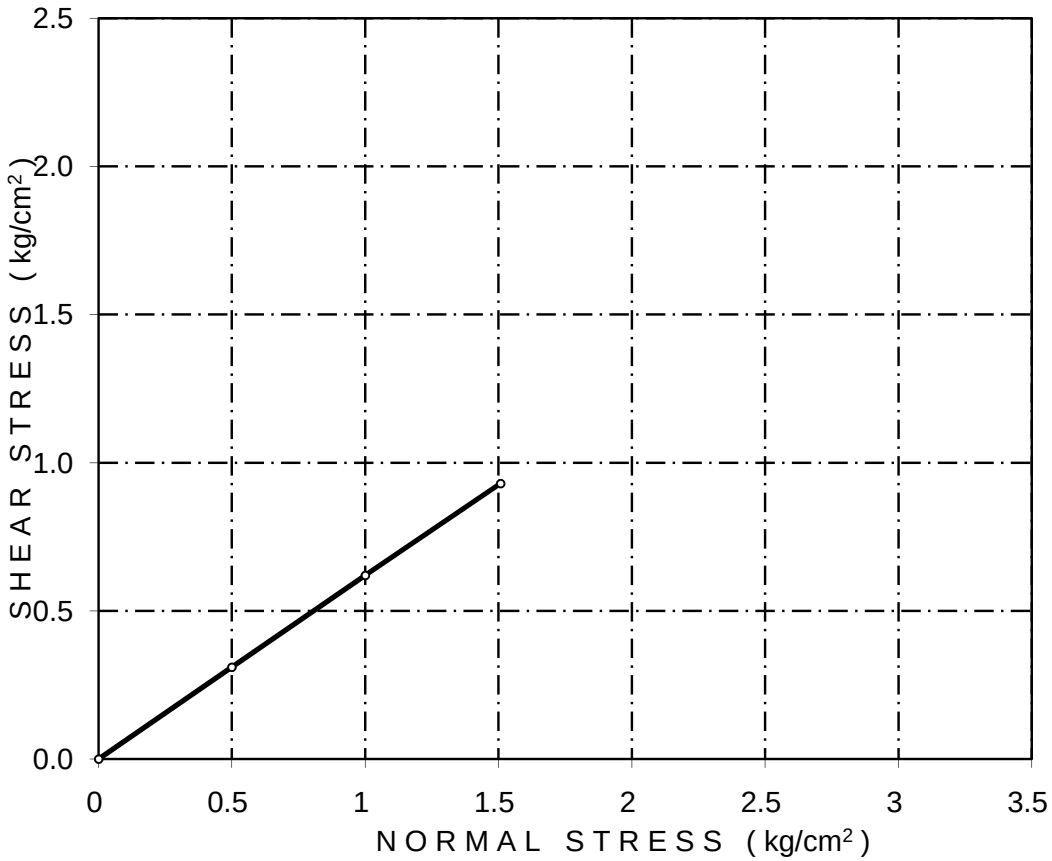
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 62

DRAINED DIRECT SHEAR TEST

Borehole No :	9
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	32



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

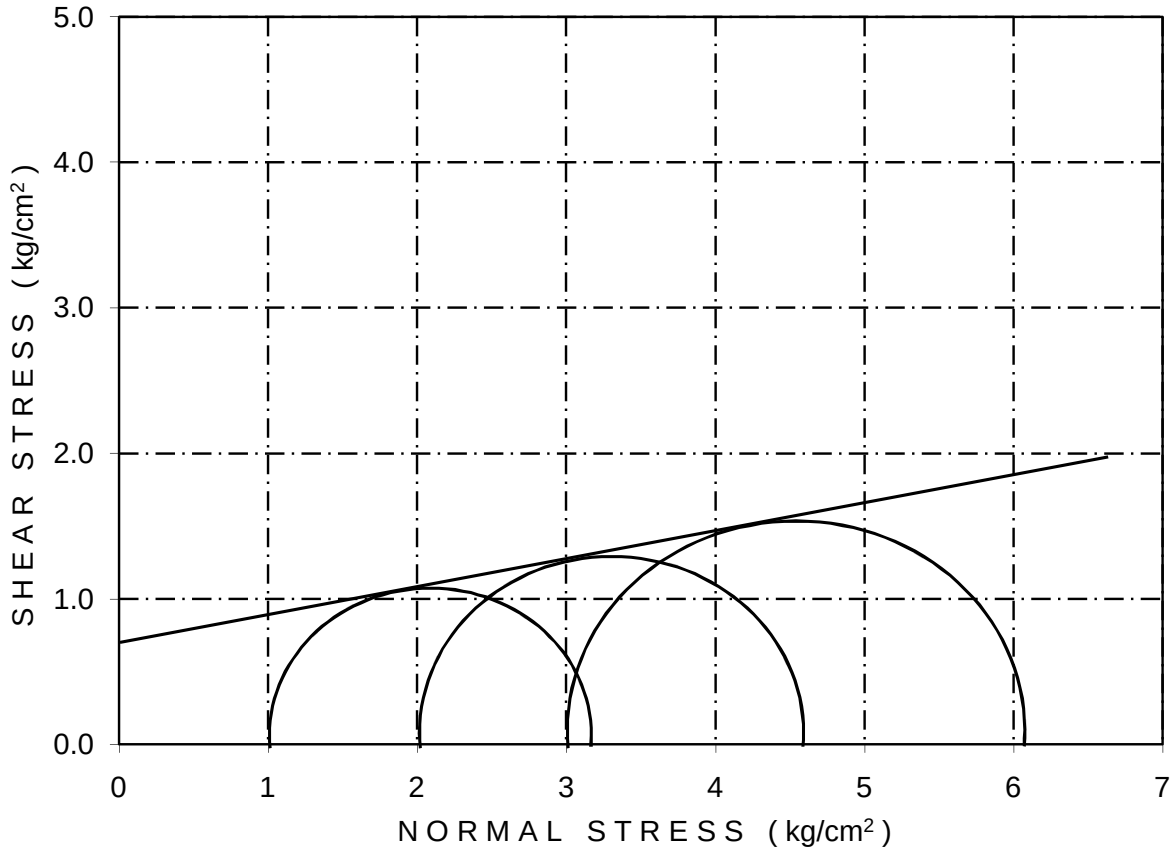
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 63

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	9
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.85	1.57	18.1

"c" Value kg/cm^2	"Ø" Value DEGREE
0.70	8



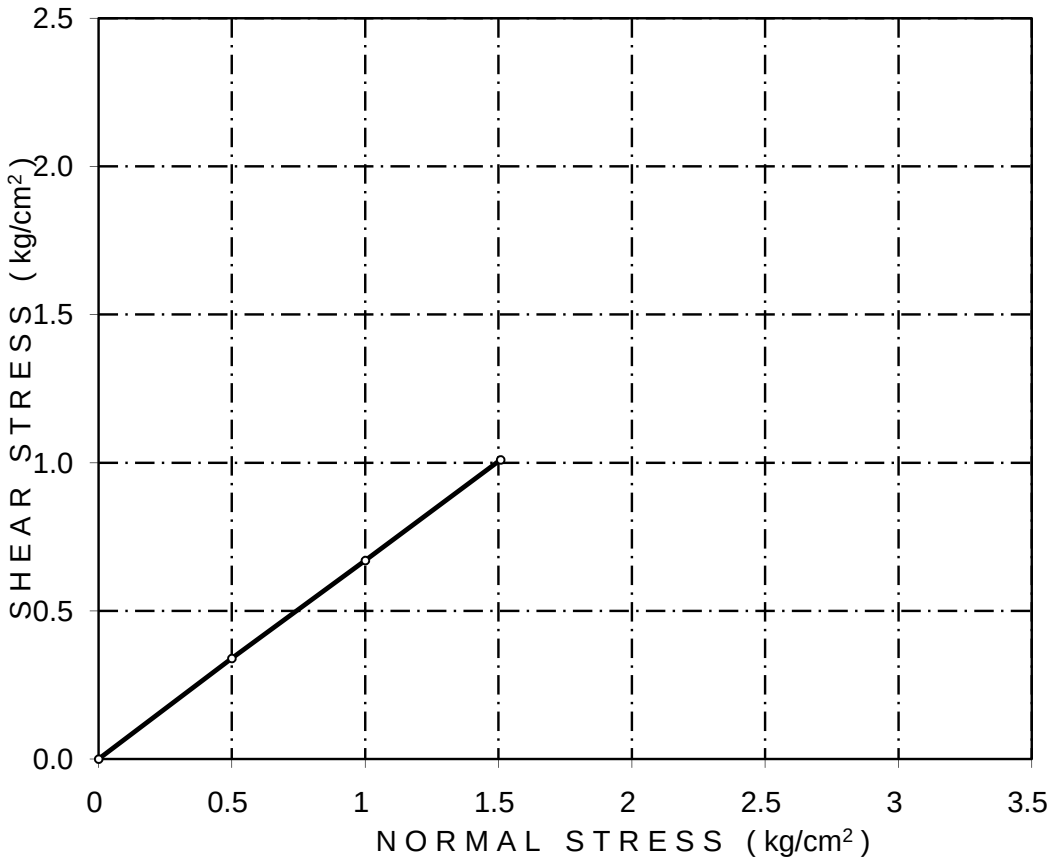
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 64

DRAINED DIRECT SHEAR TEST

Borehole No :	9
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.62	0	34



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

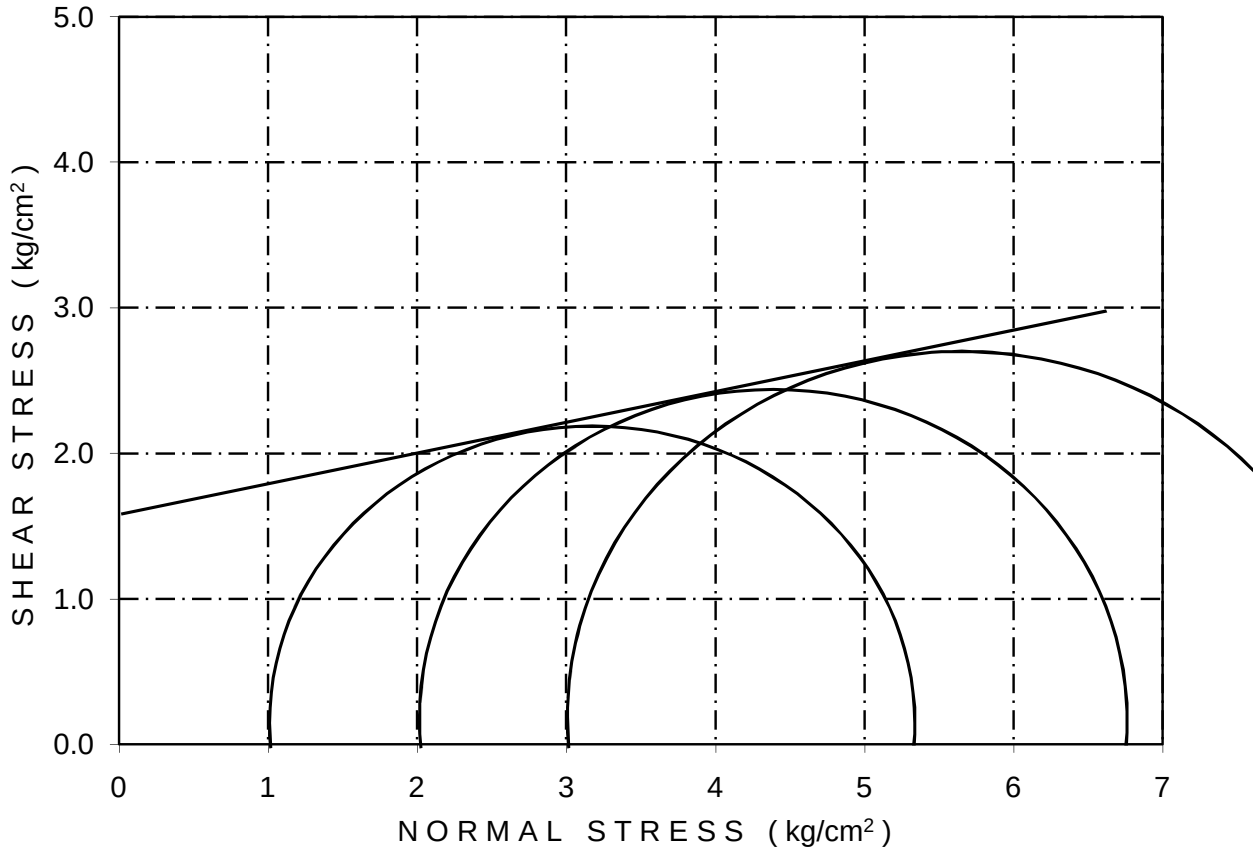
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 65

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	9
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.00	1.66	20.7

"c" Value kg/cm^2	"Ø" Value DEGREE
1.60	9



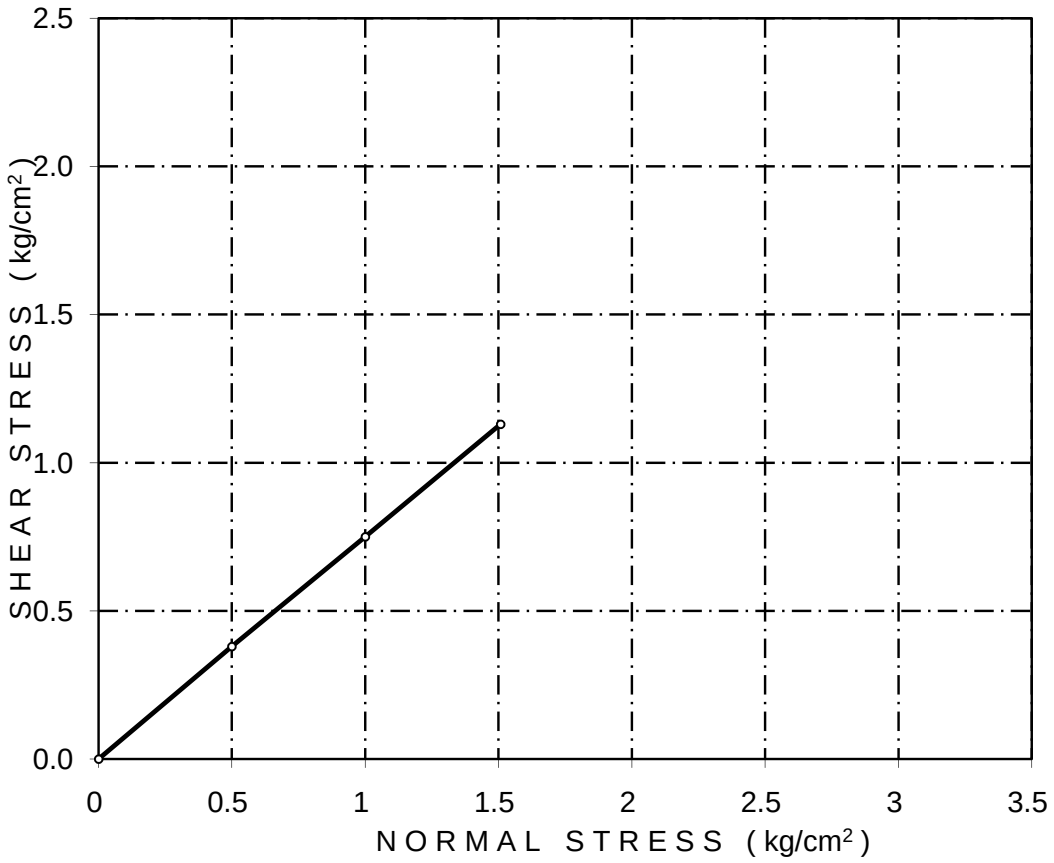
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 66

DRAINED DIRECT SHEAR TEST

Borehole No :	9
Depth :	**38.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.73	0	37



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

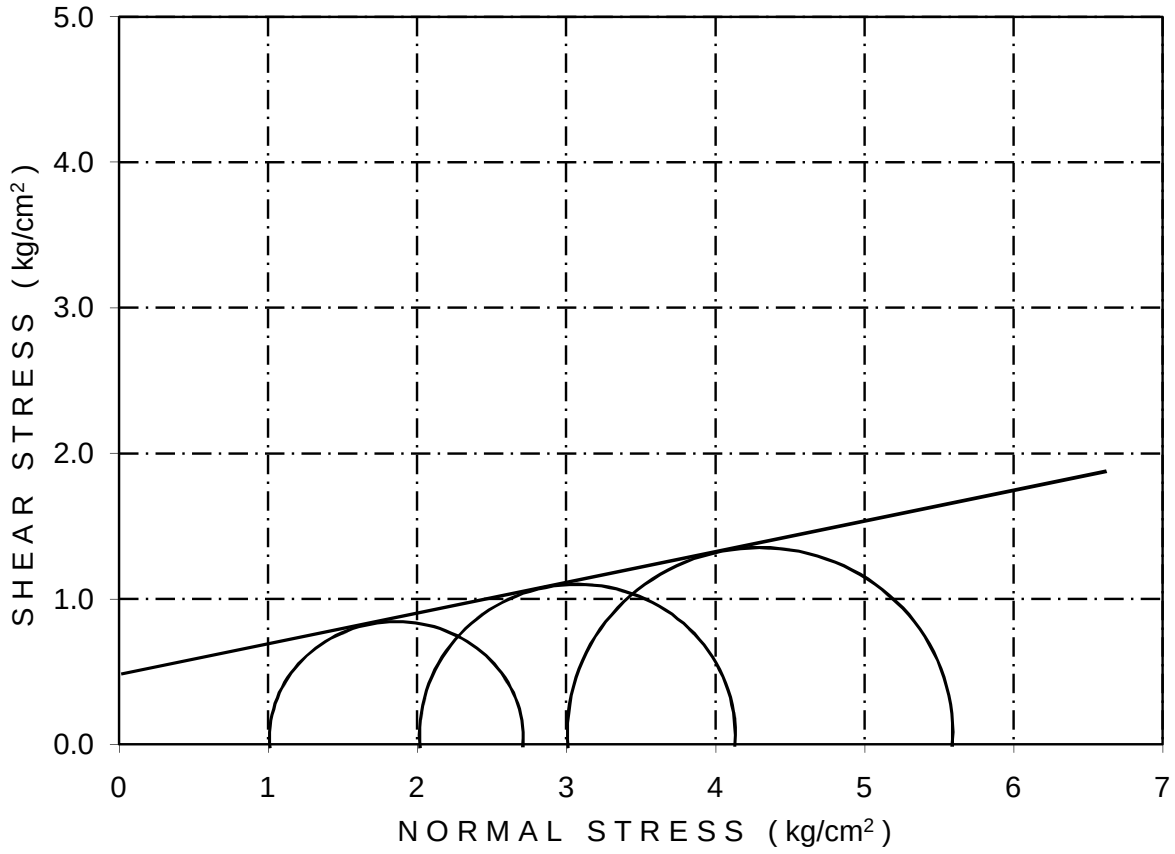
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 67

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	10
Depth	:	2.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.67	1.52	10.0

"c" Value kg/cm^2	"Ø" Value DEGREE
0.50	9



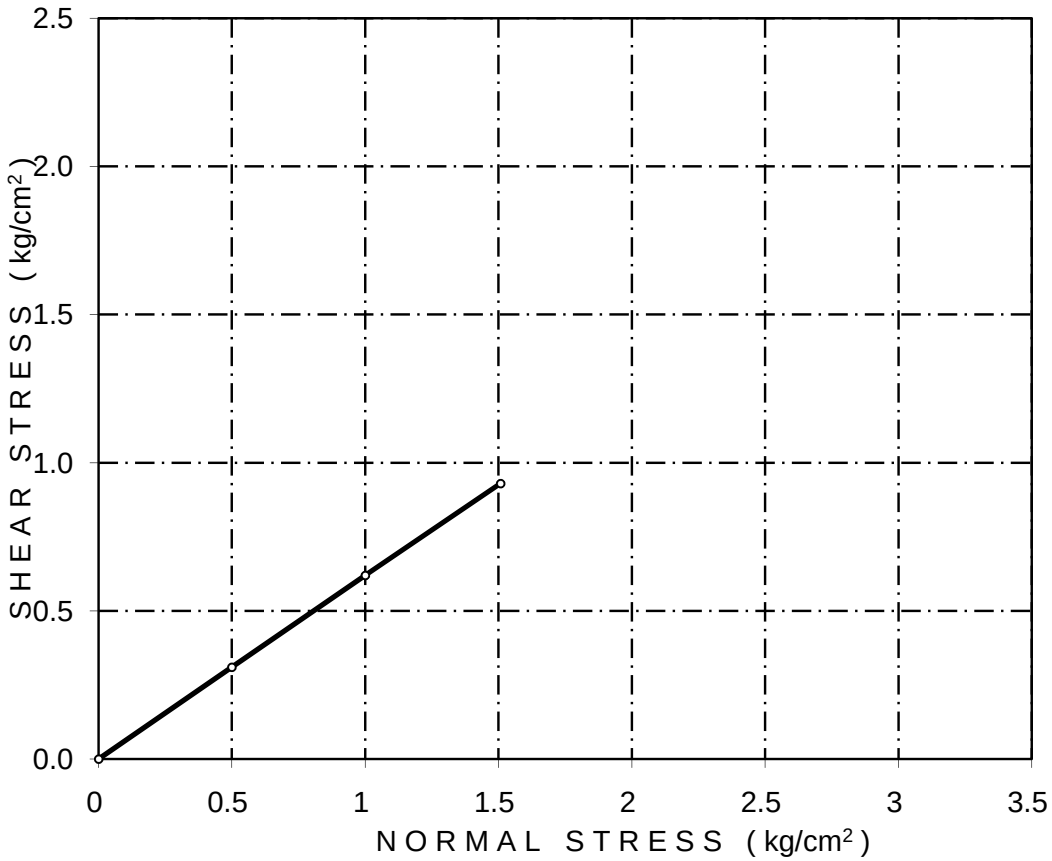
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 68

DRAINED DIRECT SHEAR TEST

Borehole No :	10
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.56	0	32



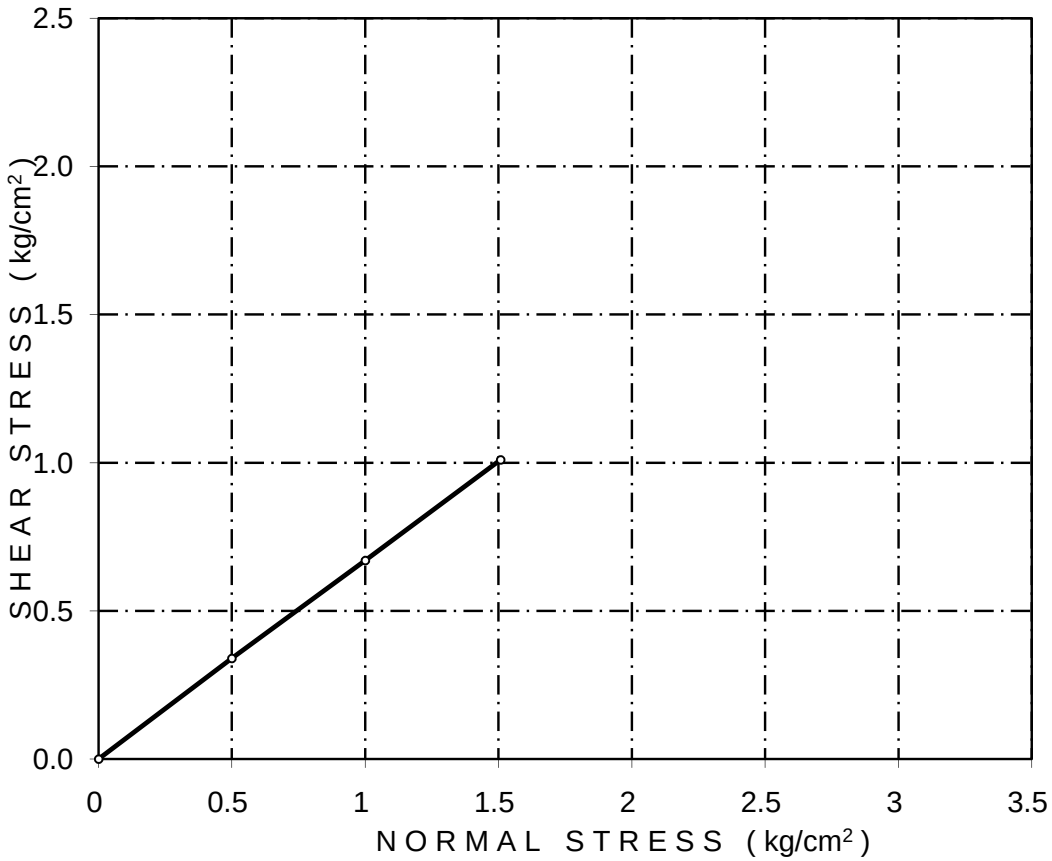
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 69

DRAINED DIRECT SHEAR TEST

Borehole No :	10
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.60	0	34



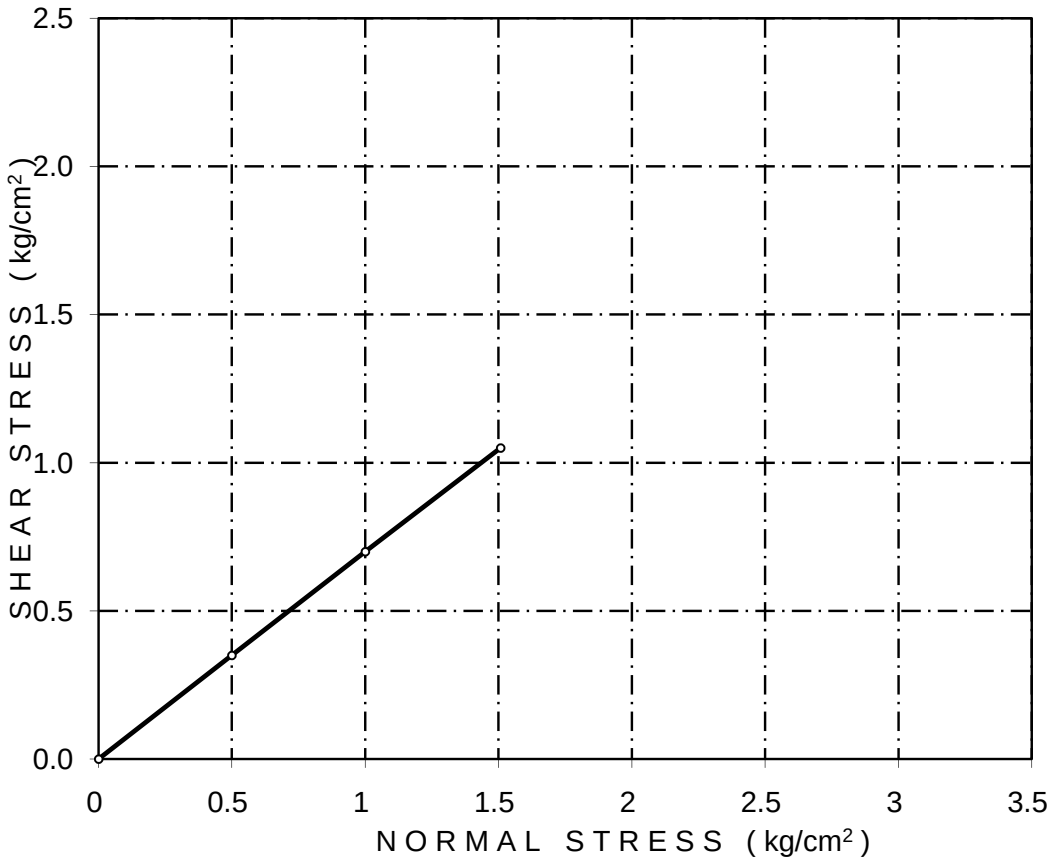
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 70

DRAINED DIRECT SHEAR TEST

Borehole No :	10
Depth :	**23.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.63	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

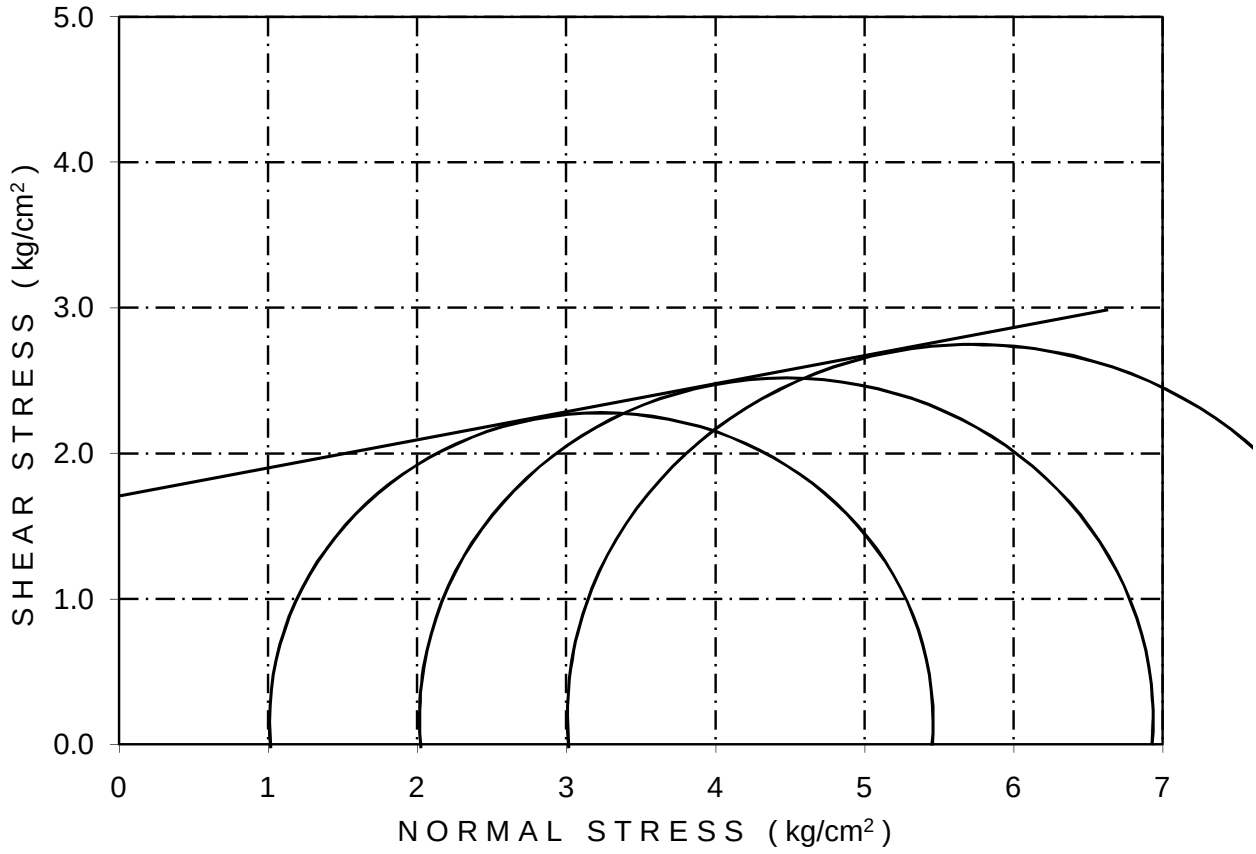
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 71

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	10
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.02	1.66	21.6

"c" Value kg/cm^2	"Ø" Value DEGREE
1.70	8



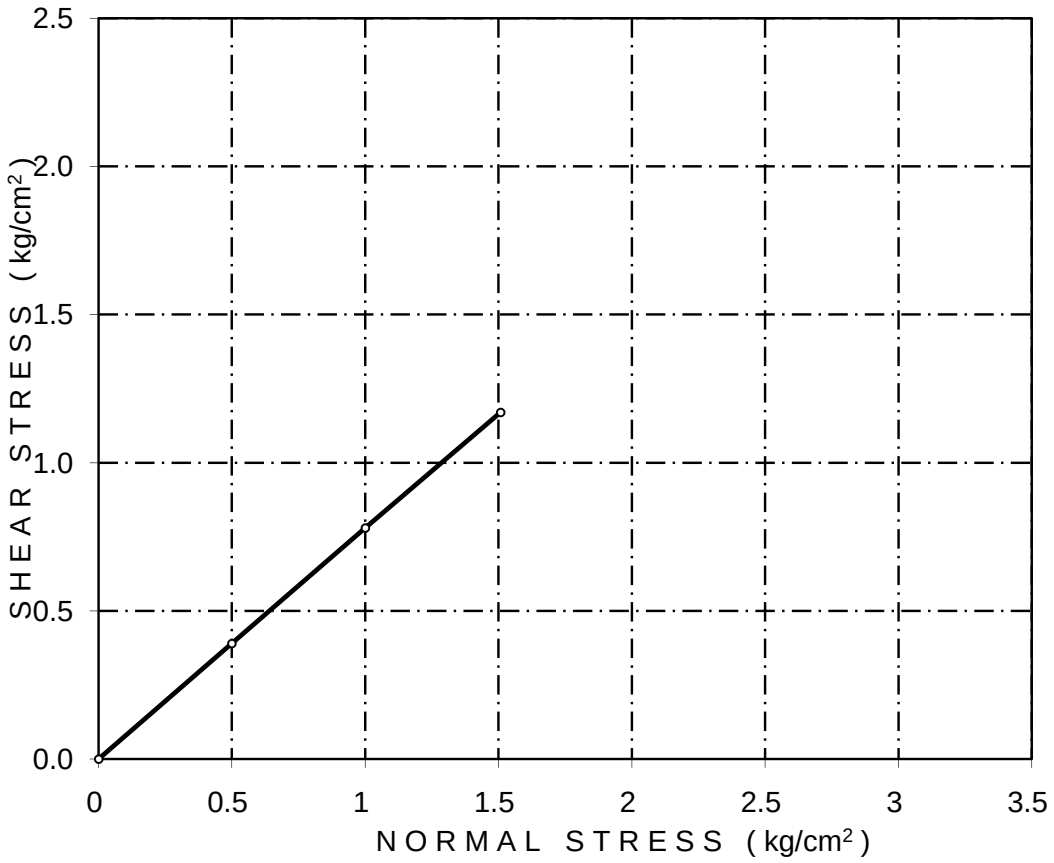
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 72

DRAINED DIRECT SHEAR TEST

Borehole No :	10
Depth :	**38.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.74	0	38



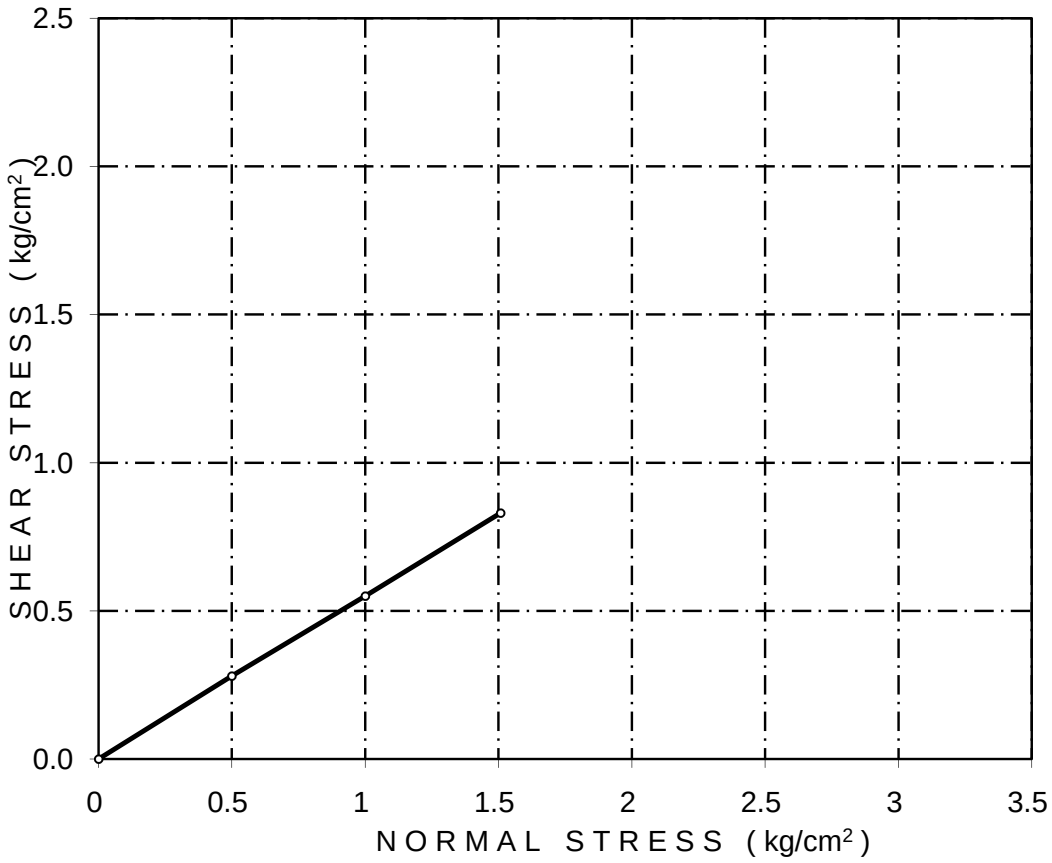
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 73

DRAINED DIRECT SHEAR TEST

Borehole No :	14
Depth :	**2.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.51	0	29



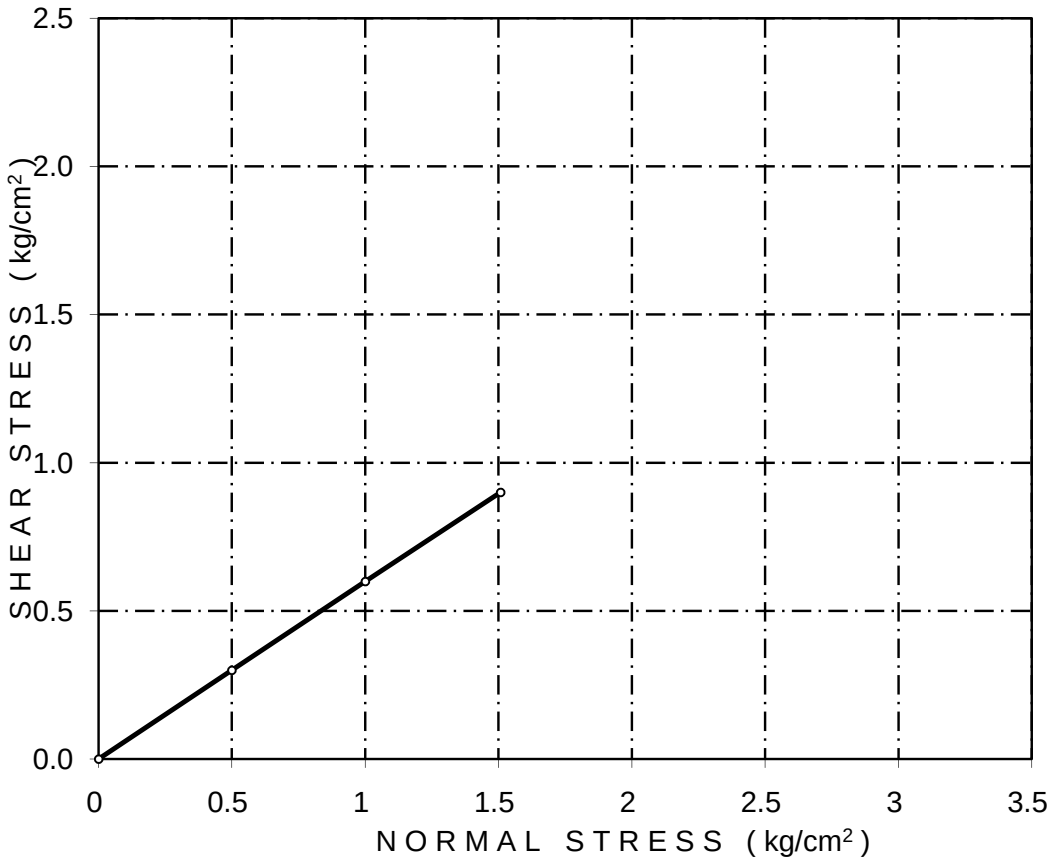
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 74

DRAINED DIRECT SHEAR TEST

Borehole No :	14
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"∅" Value DEGREE
1.54	0	31



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

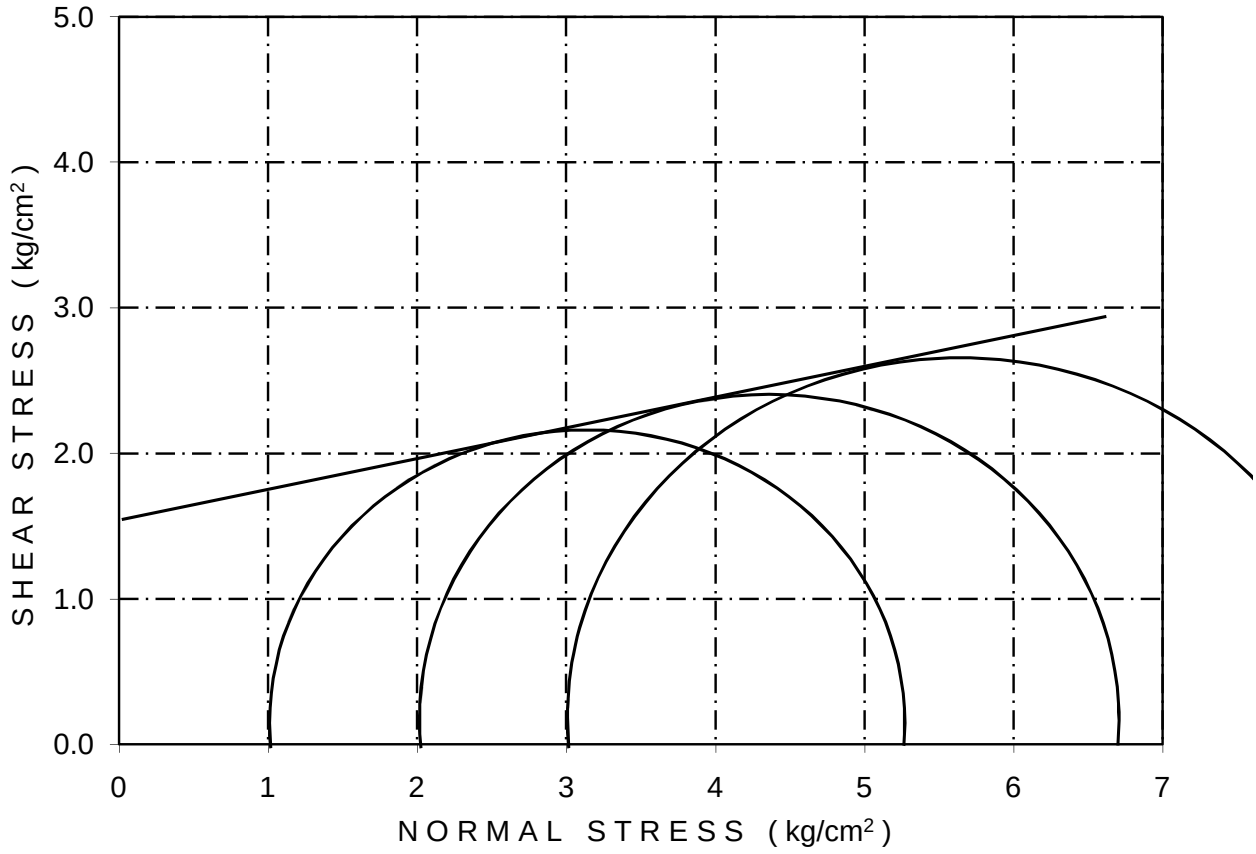
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 75

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	14
Depth	:	14.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.87	1.59	17.9

"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	9



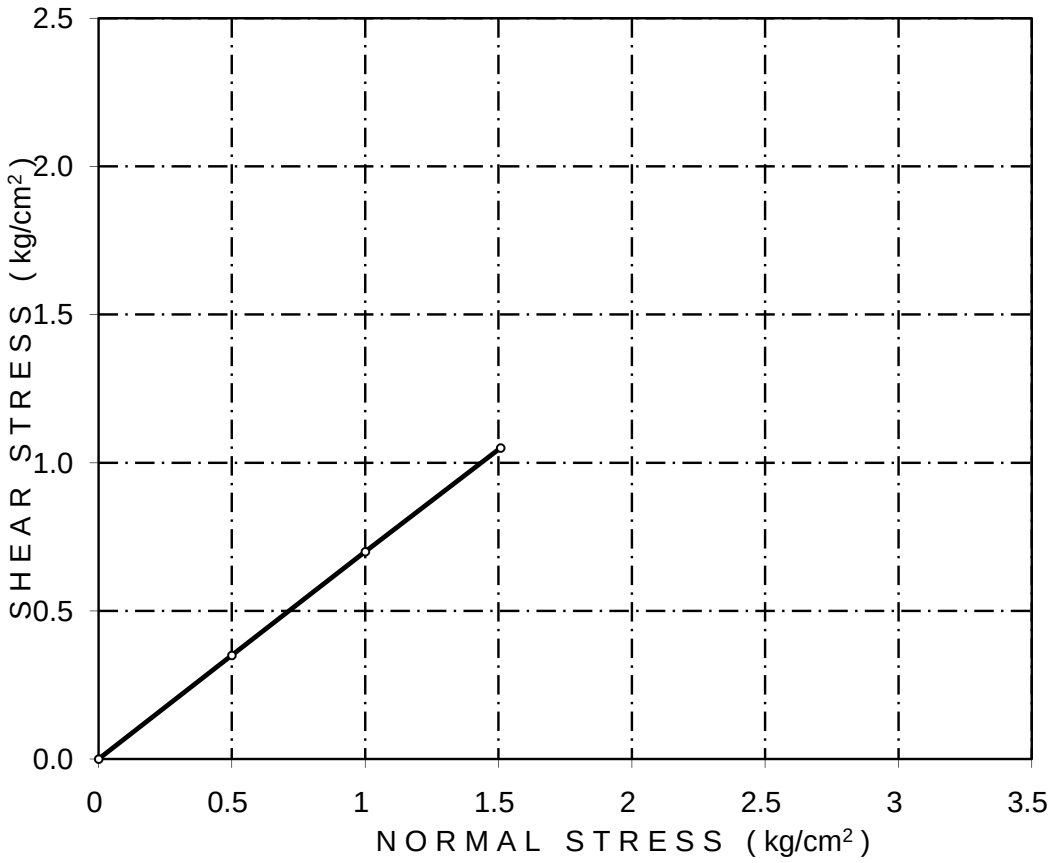
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 76

DRAINED DIRECT SHEAR TEST

Borehole No :	14
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.64	0	35



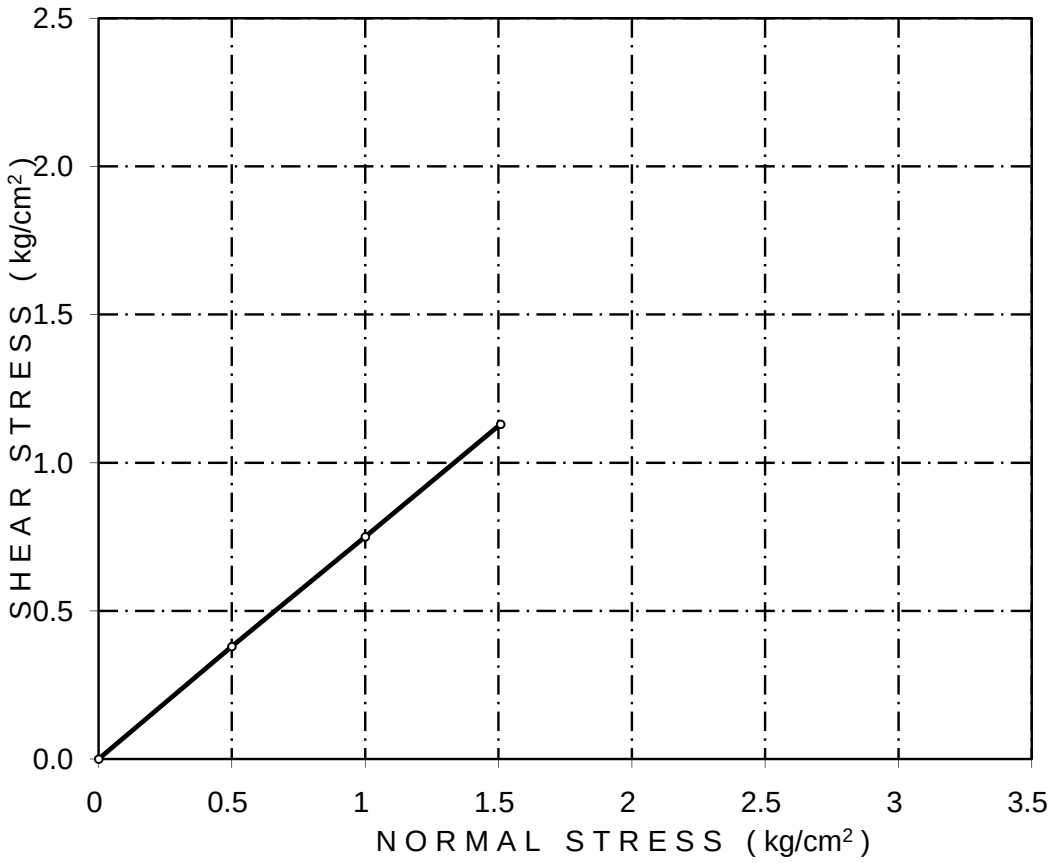
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 77

DRAINED DIRECT SHEAR TEST

Borehole No :	14
Depth :	**29.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.68	0	37



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

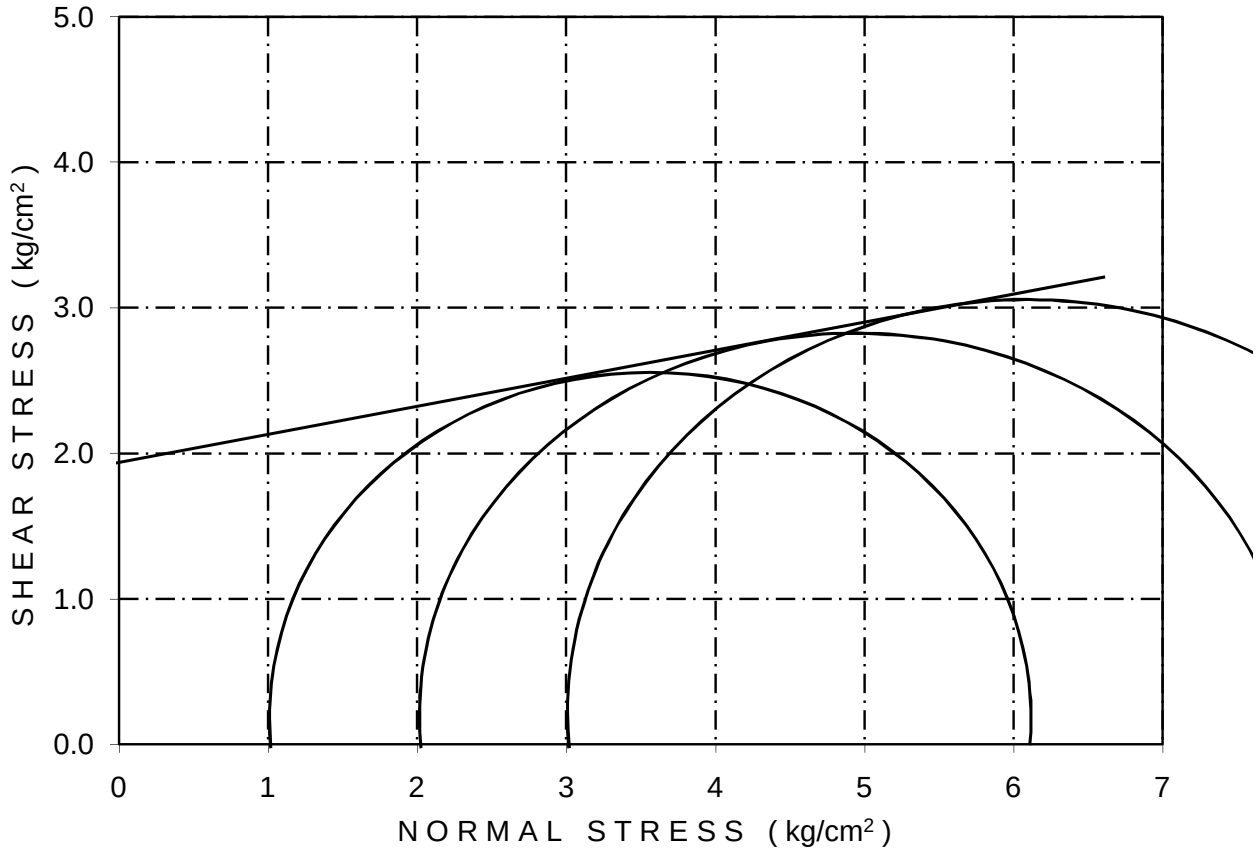
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 78

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	14
Depth	:	38.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.11	1.73	22.2

"c" Value kg/cm^2	"Ø" Value DEGREE
1.95	8



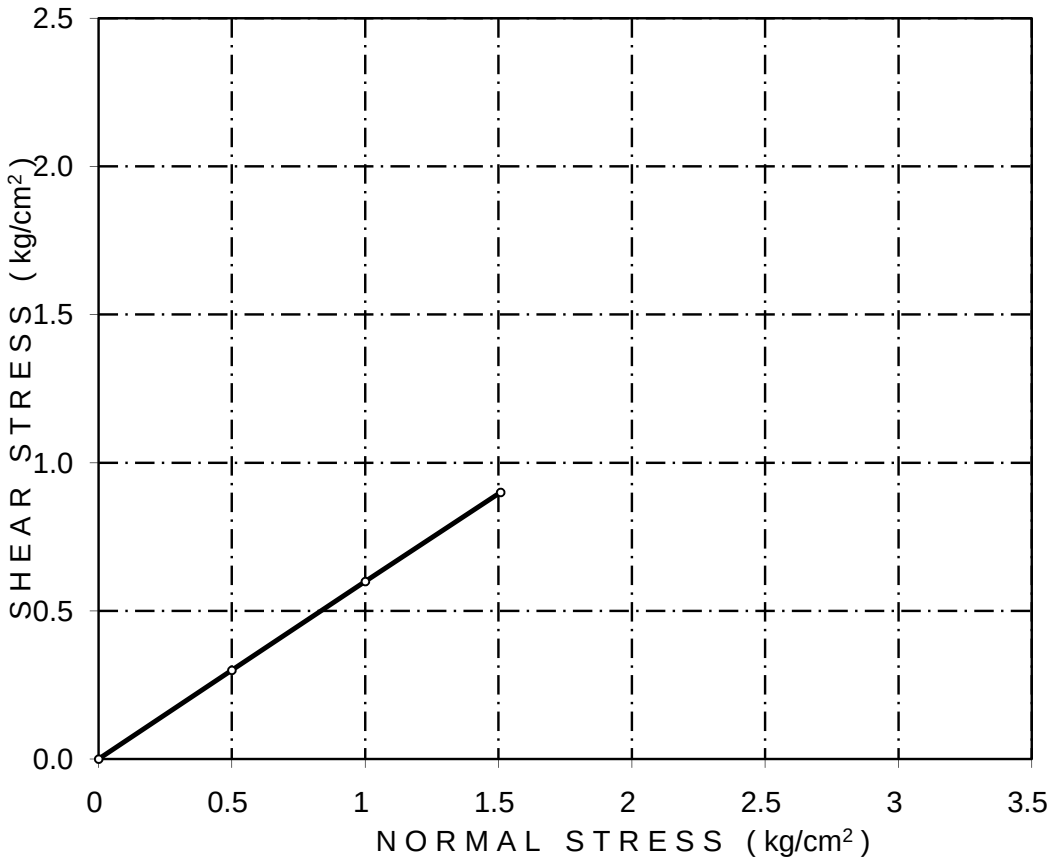
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 79

DRAINED DIRECT SHEAR TEST

Borehole No :	16
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.53	0	31



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

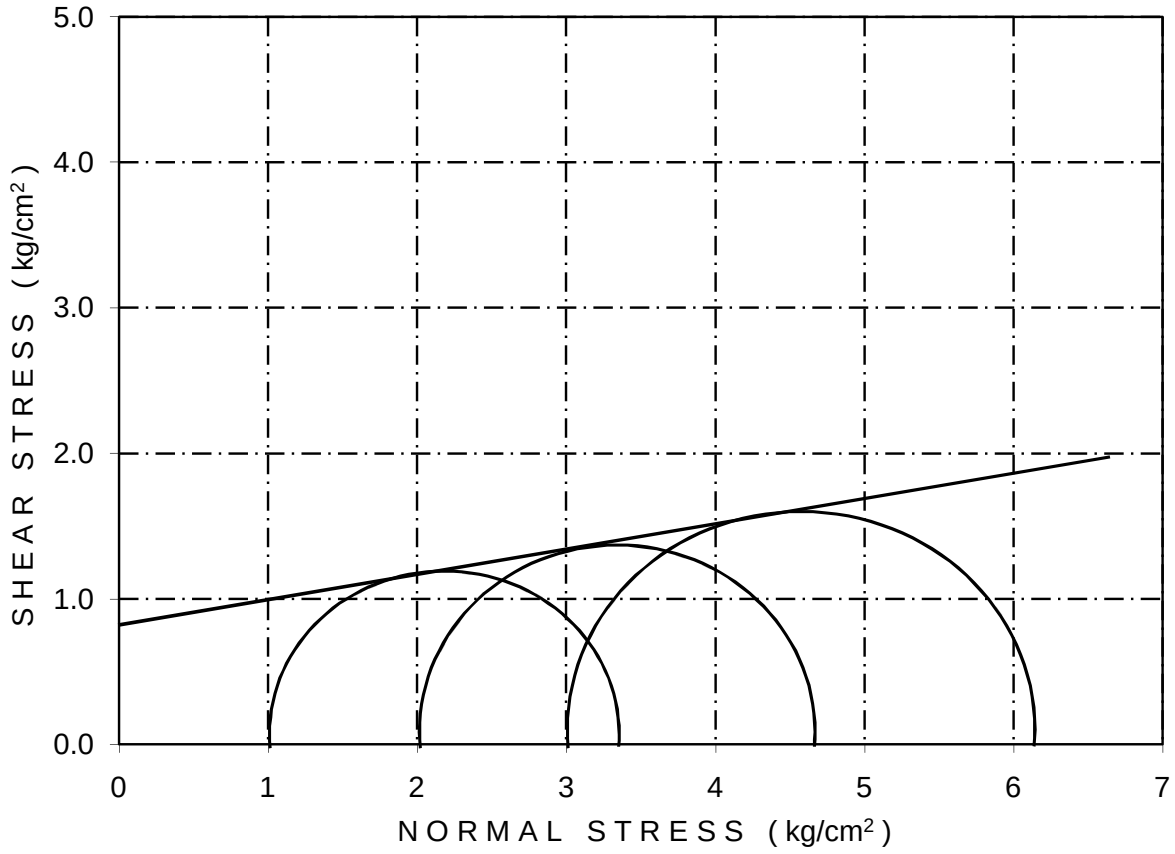
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 80

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	16
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.79	1.57	13.8

"c" Value kg/cm^2	"Ø" Value DEGREE
0.85	7



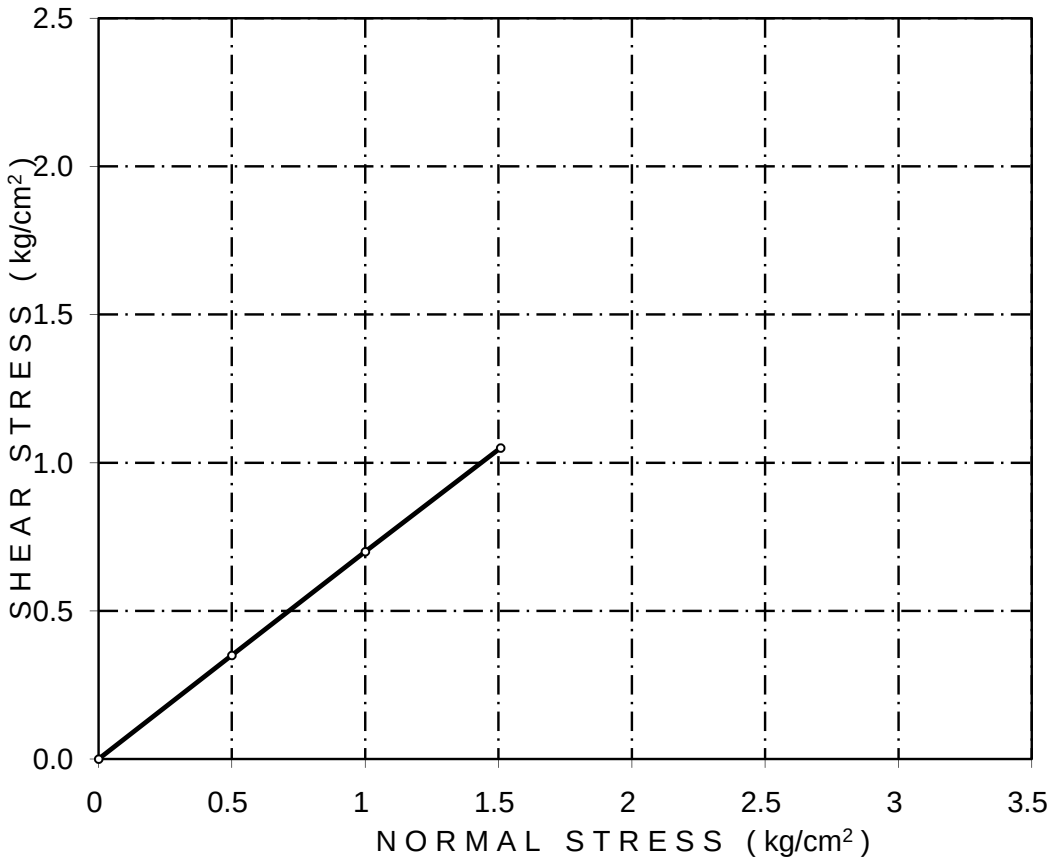
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 81

DRAINED DIRECT SHEAR TEST

Borehole No :	16
Depth :	**17.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"∅" Value DEGREE
1.61	0	35



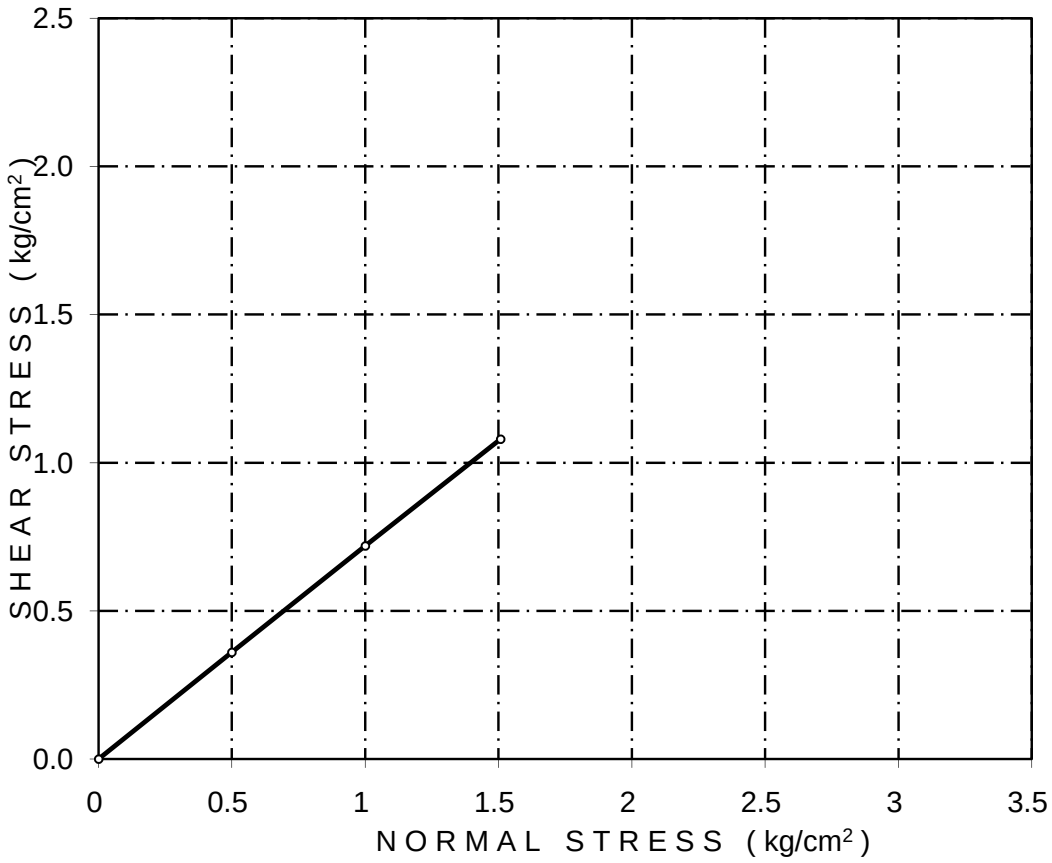
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 82

DRAINED DIRECT SHEAR TEST

Borehole No :	16
Depth :	**23.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.64	0	36



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

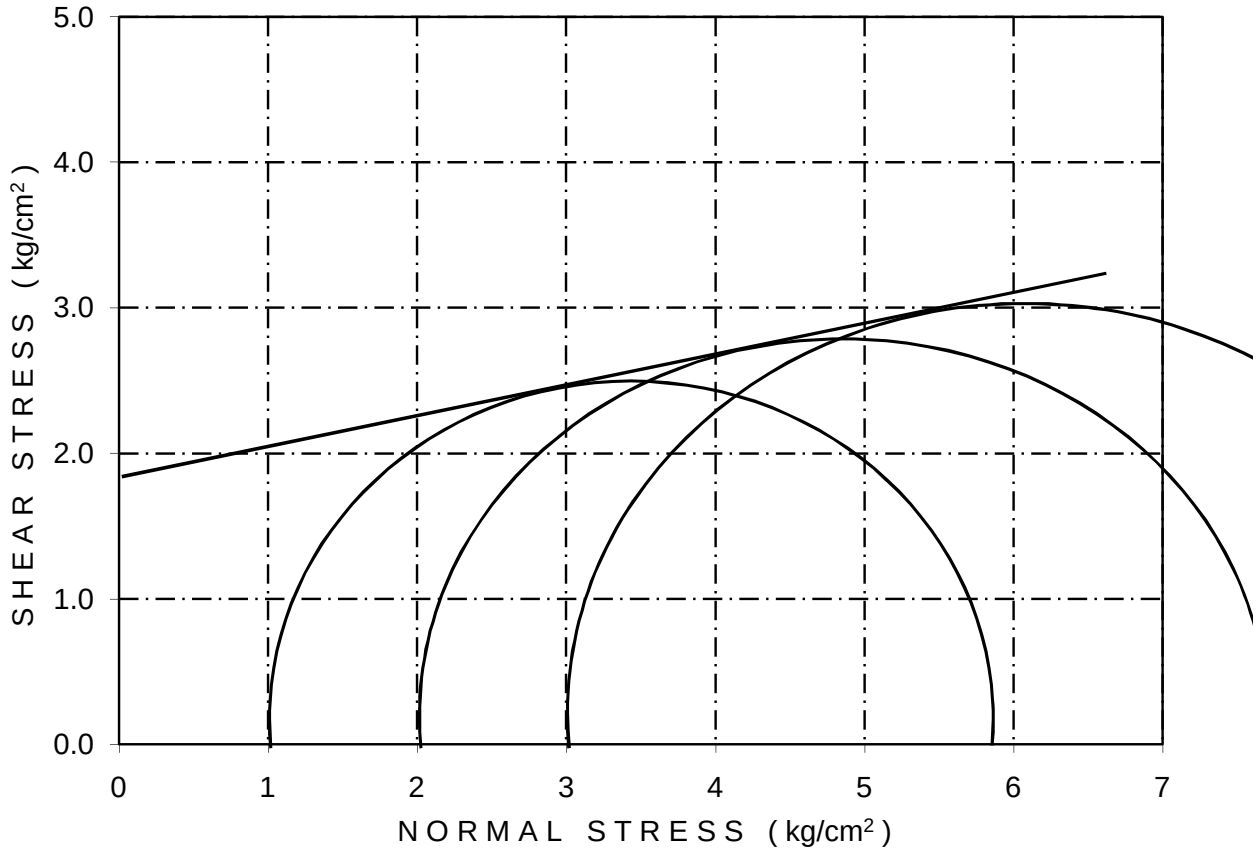
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 83

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	16
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.05	1.68	22.1

"c" Value kg/cm^2	"Ø" Value DEGREE
1.85	9



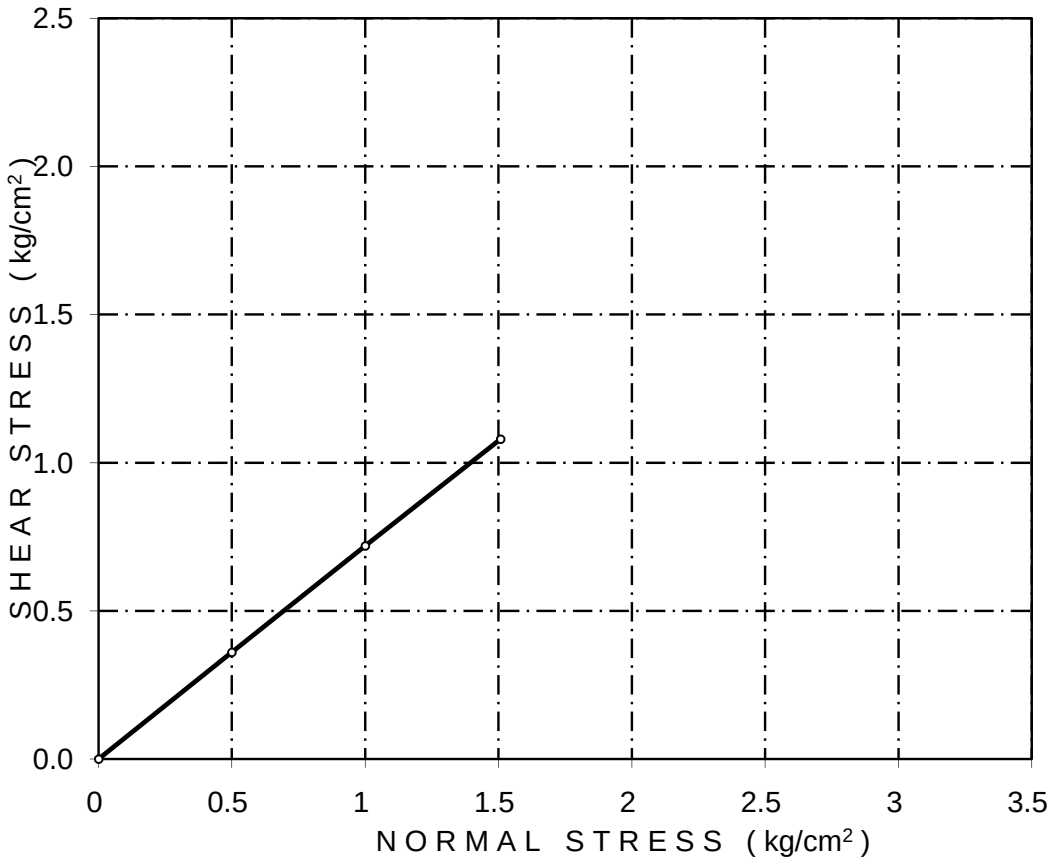
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 84

DRAINED DIRECT SHEAR TEST

Borehole No :	16
Depth :	**35.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.72	0	36



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

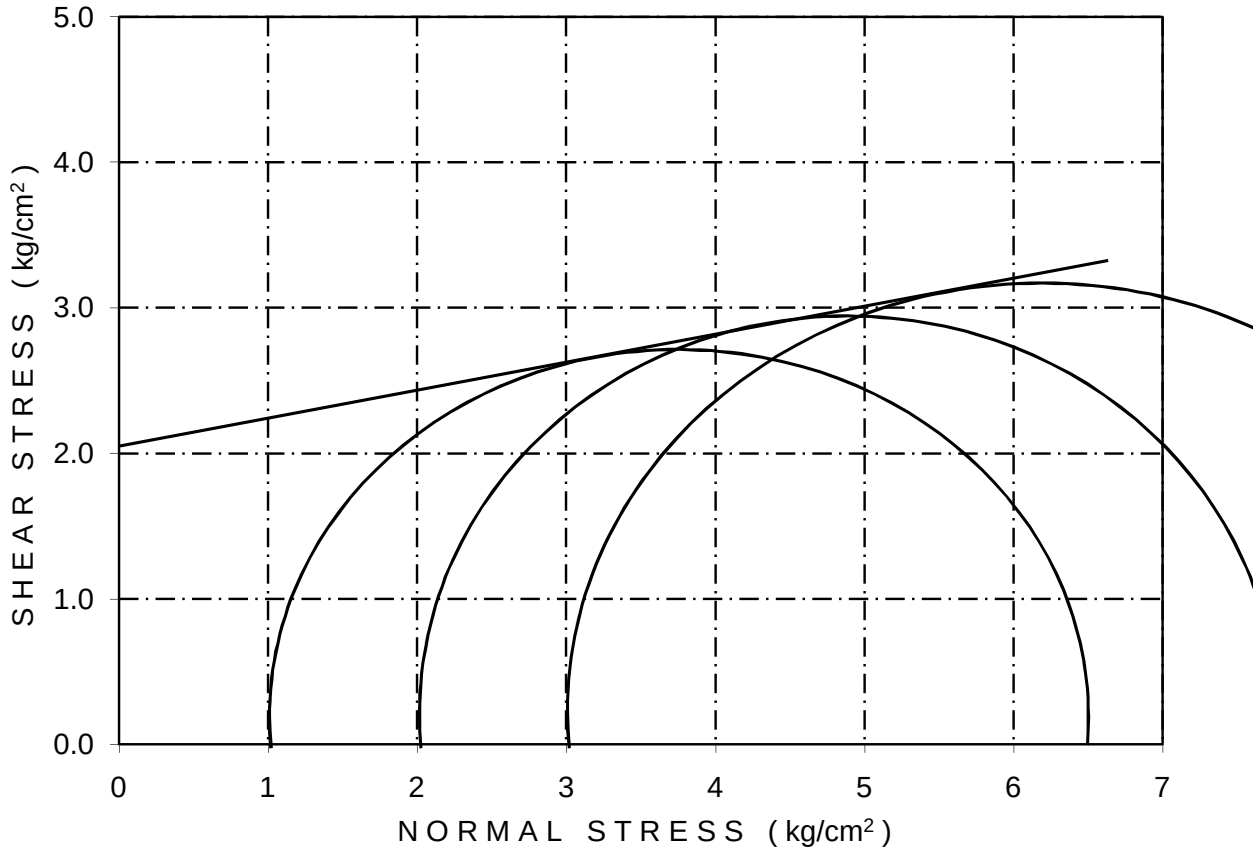
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 85

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	16
Depth	:	44.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.15	1.75	23.1

"c" Value kg/cm^2	"Ø" Value DEGREE
2.05	8



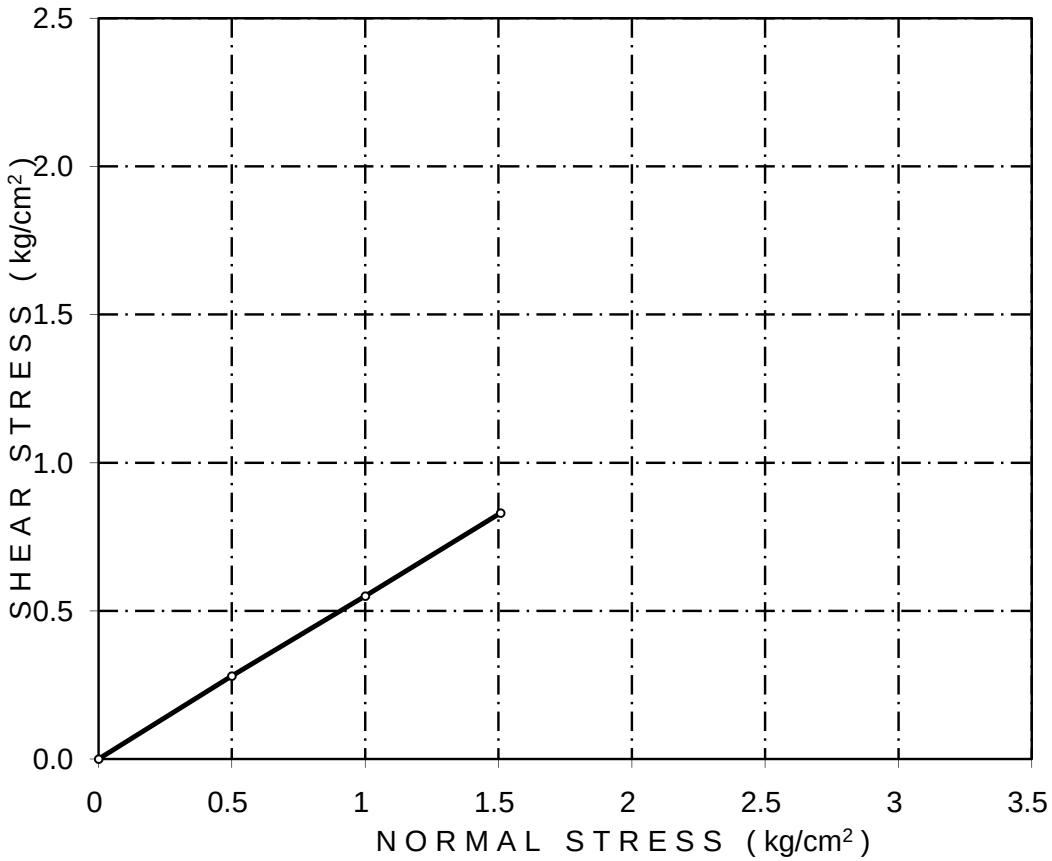
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 86

DRAINED DIRECT SHEAR TEST

Borehole No :	28
Depth :	**5.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.53	0	29



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

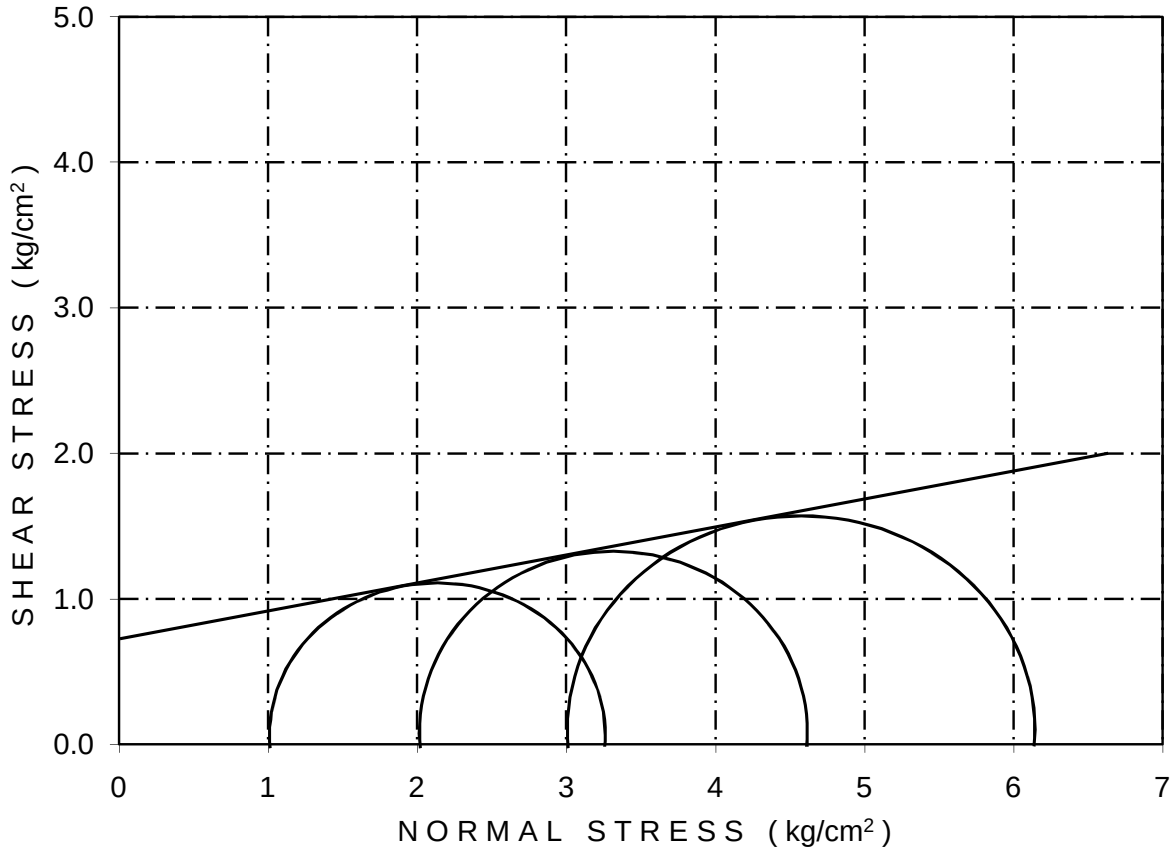
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 87

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	28
Depth	:	11.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.78	1.56	14.1

"c" Value kg/cm^2	"Ø" Value DEGREE
0.70	8



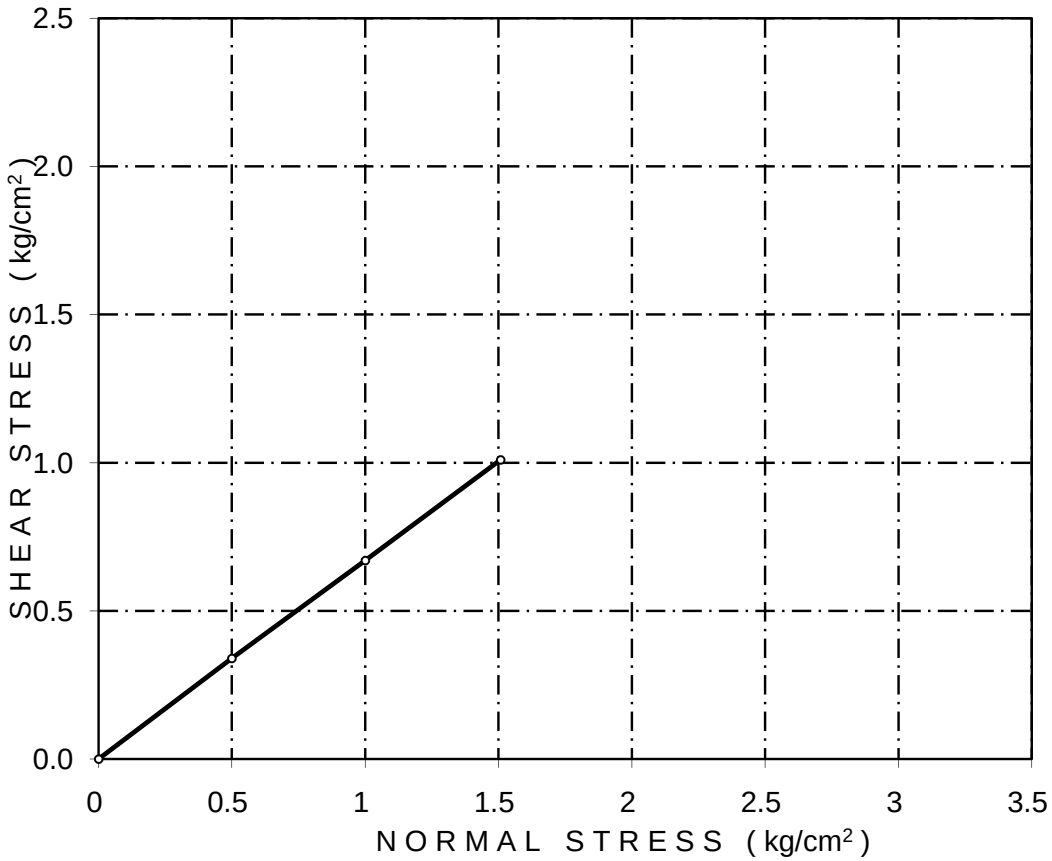
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 88

DRAINED DIRECT SHEAR TEST

Borehole No :	28
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.60	0	34



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

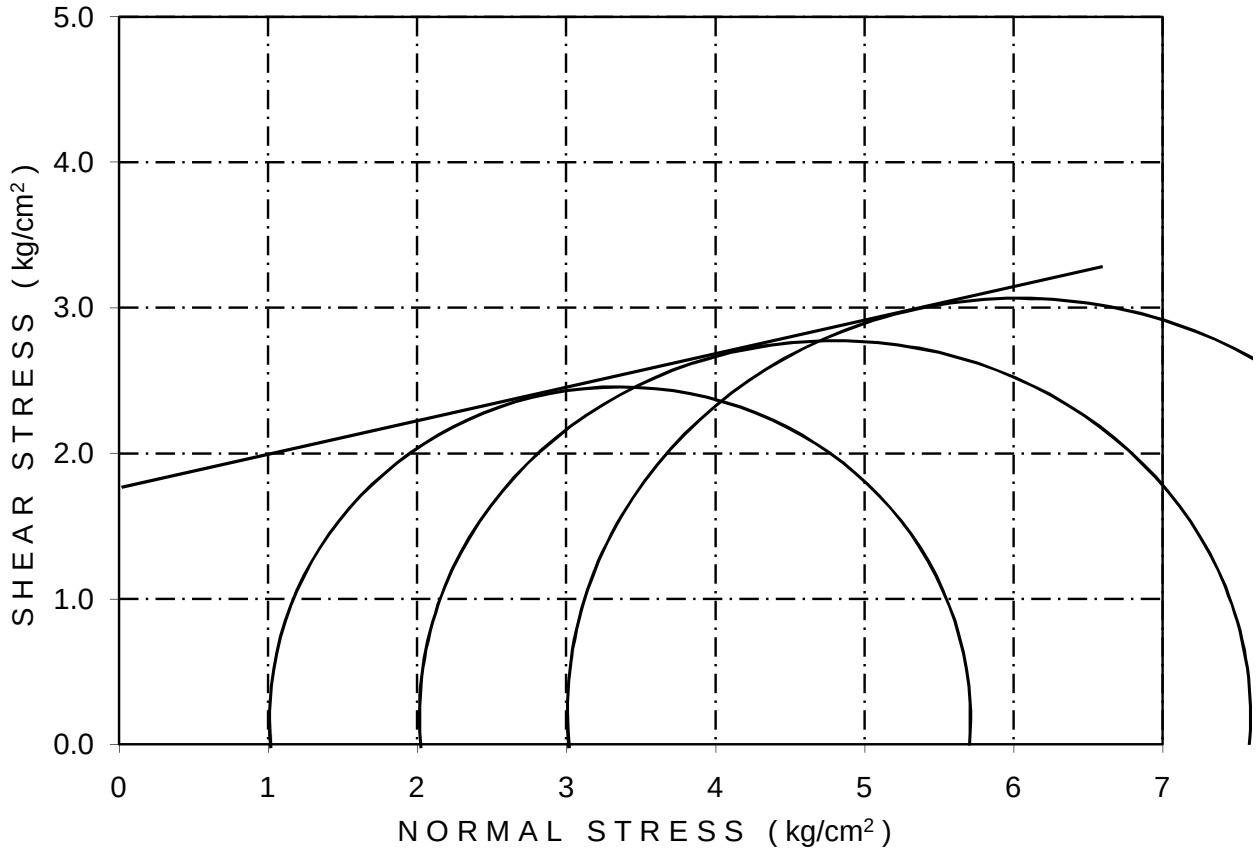
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 89

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	28
Depth	:	29.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.02	1.66	21.4

"c" Value kg/cm^2	"Ø" Value DEGREE
1.75	10



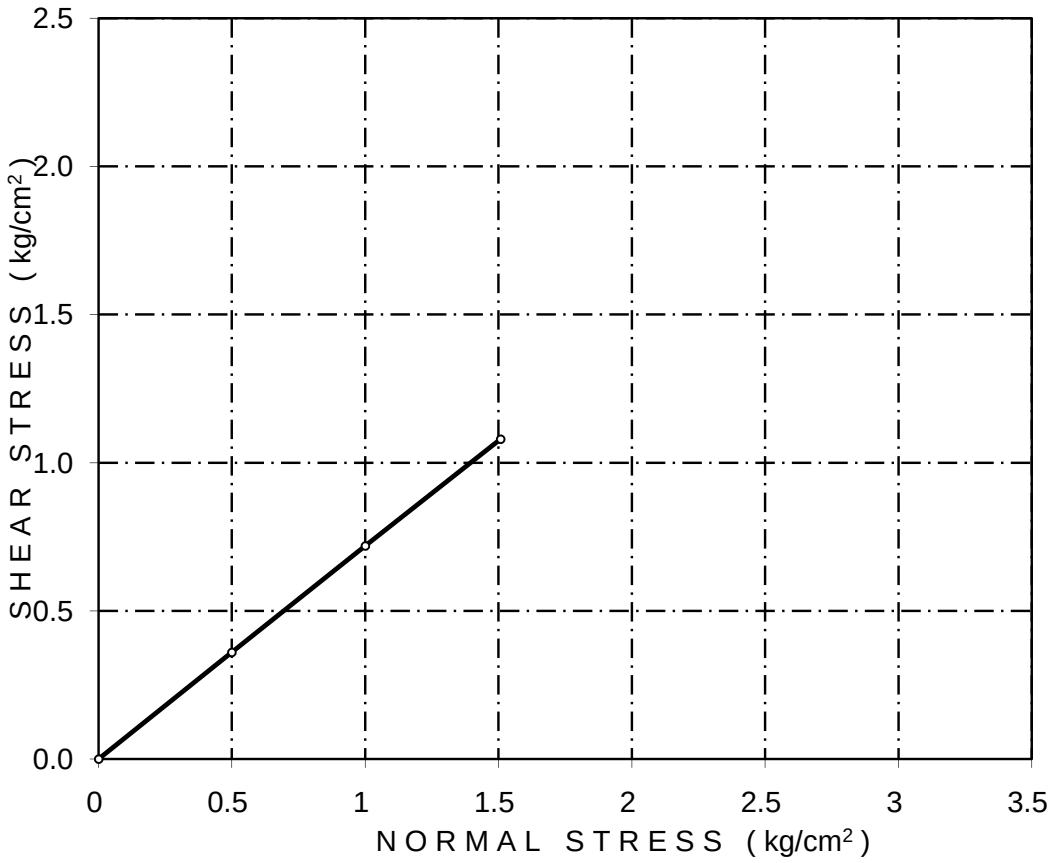
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 90

DRAINED DIRECT SHEAR TEST

Borehole No :	28
Depth :	**35.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.71	0	36



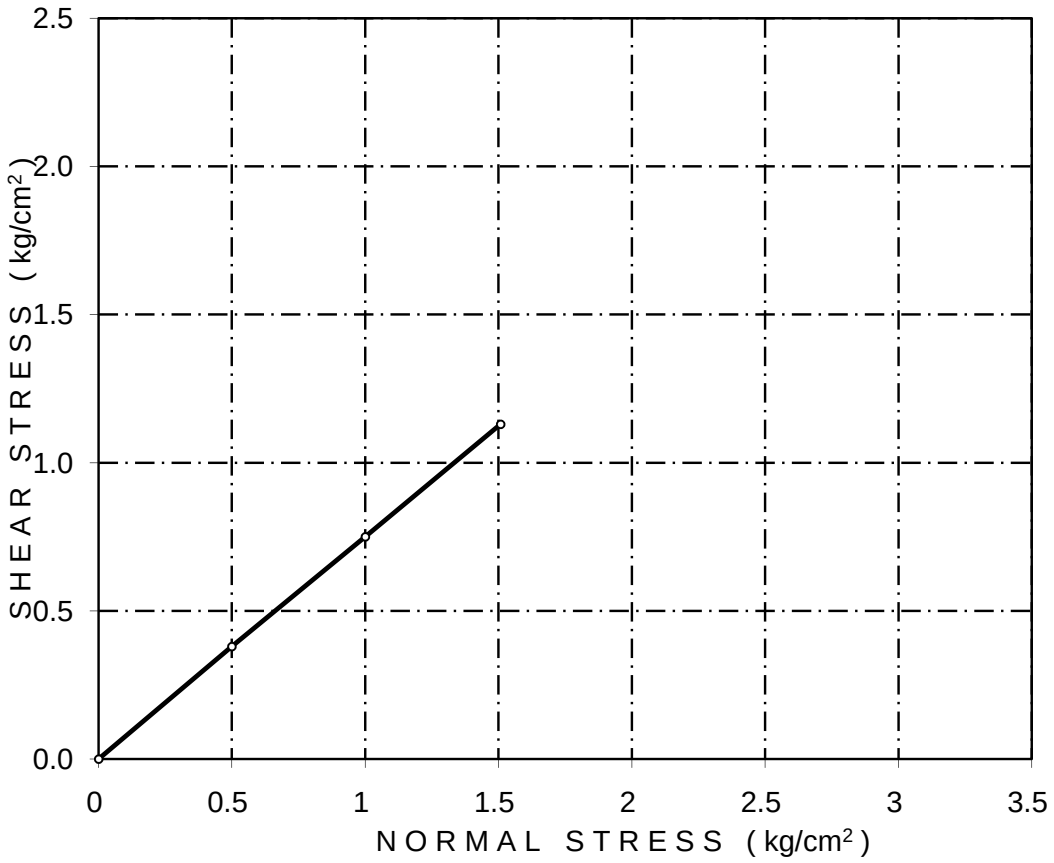
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 91

DRAINED DIRECT SHEAR TEST

Borehole No :	28
Depth :	**41.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.74	0	37



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

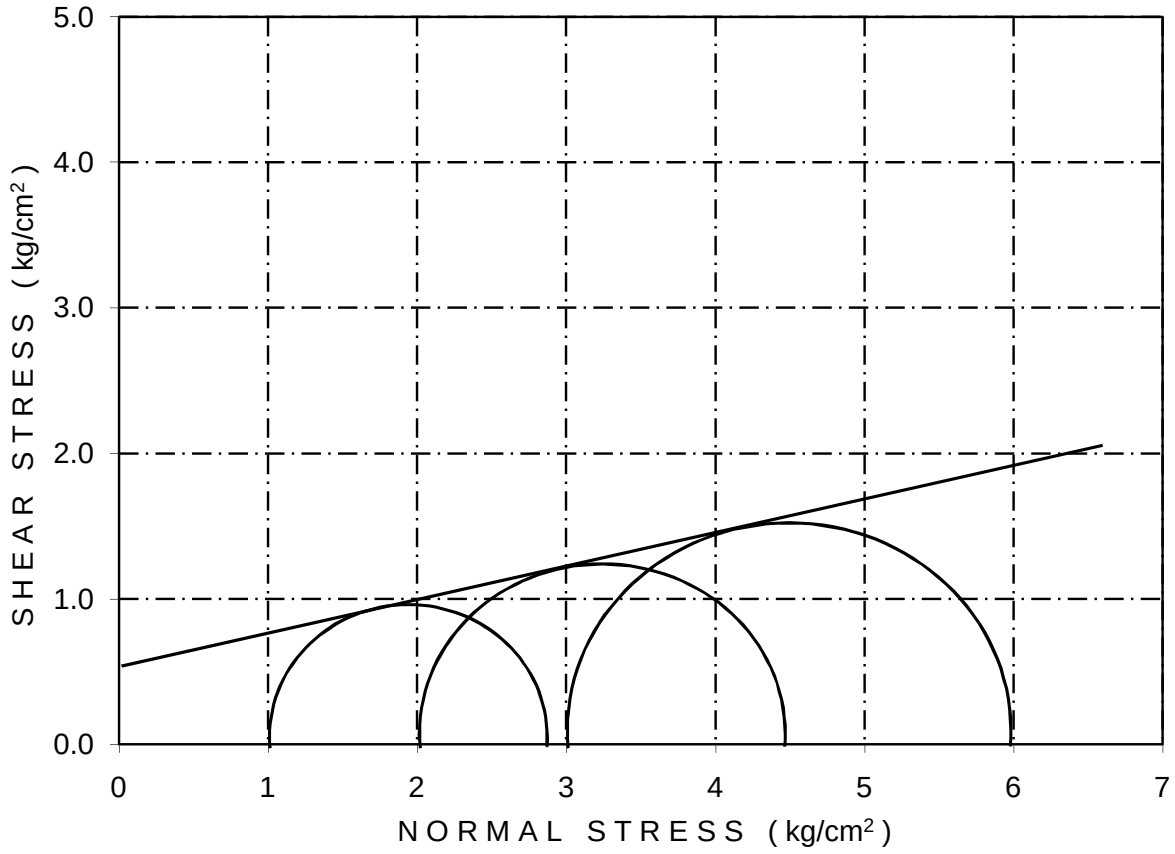
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 92

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	33
Depth	:	2.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
1.68	1.52	10.2

"c" Value kg/cm^2	"Ø" Value DEGREE
0.55	10



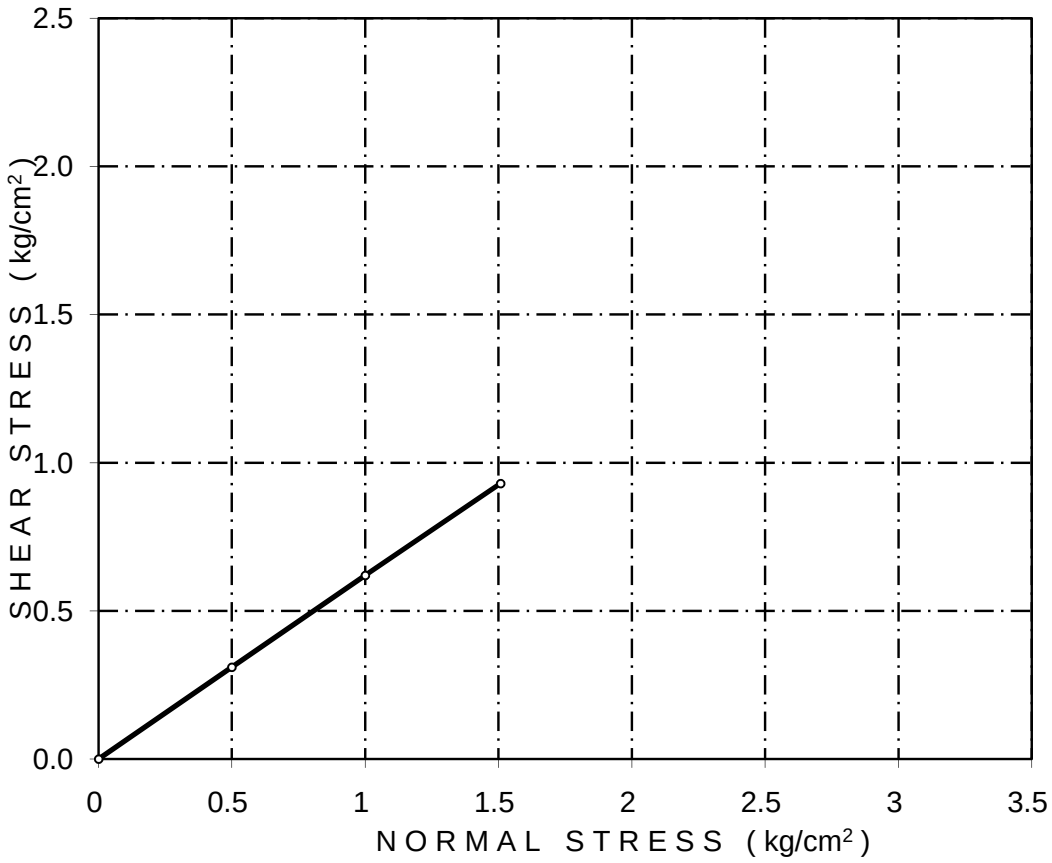
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 93

DRAINED DIRECT SHEAR TEST

Borehole No :	33
Depth :	**8.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.55	0	32



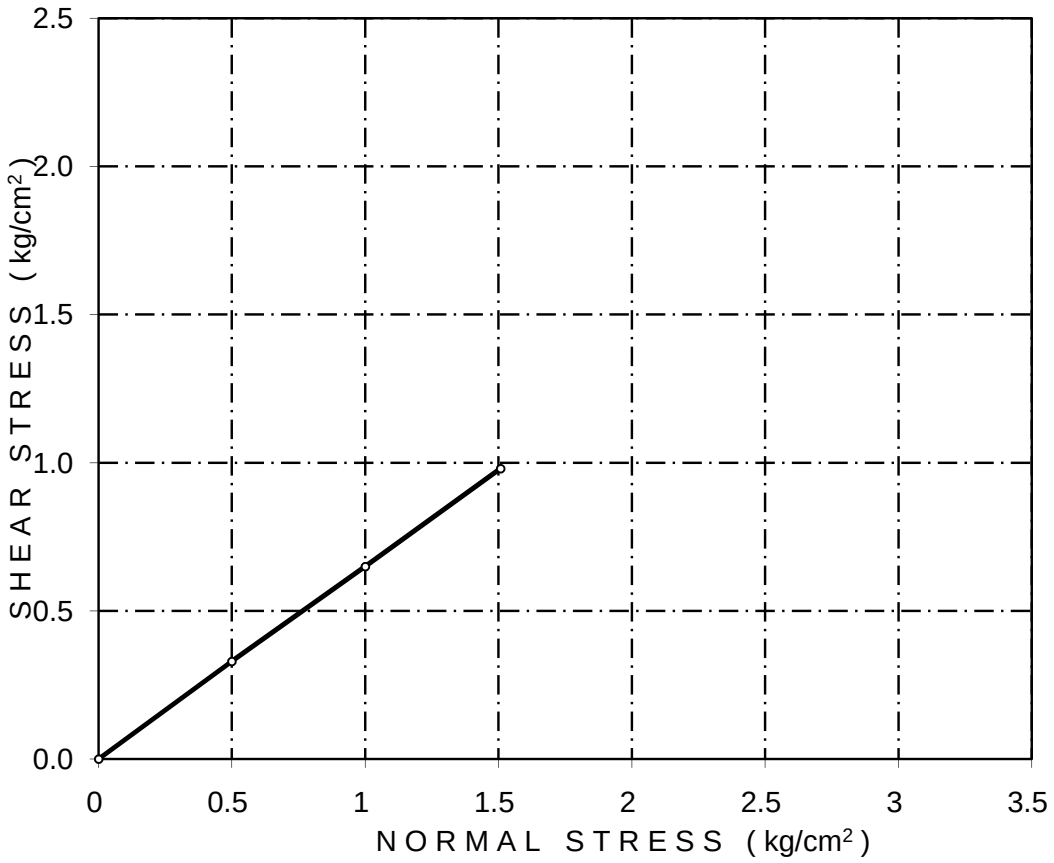
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 94

DRAINED DIRECT SHEAR TEST

Borehole No :	33
Depth :	**14.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.58	0	33



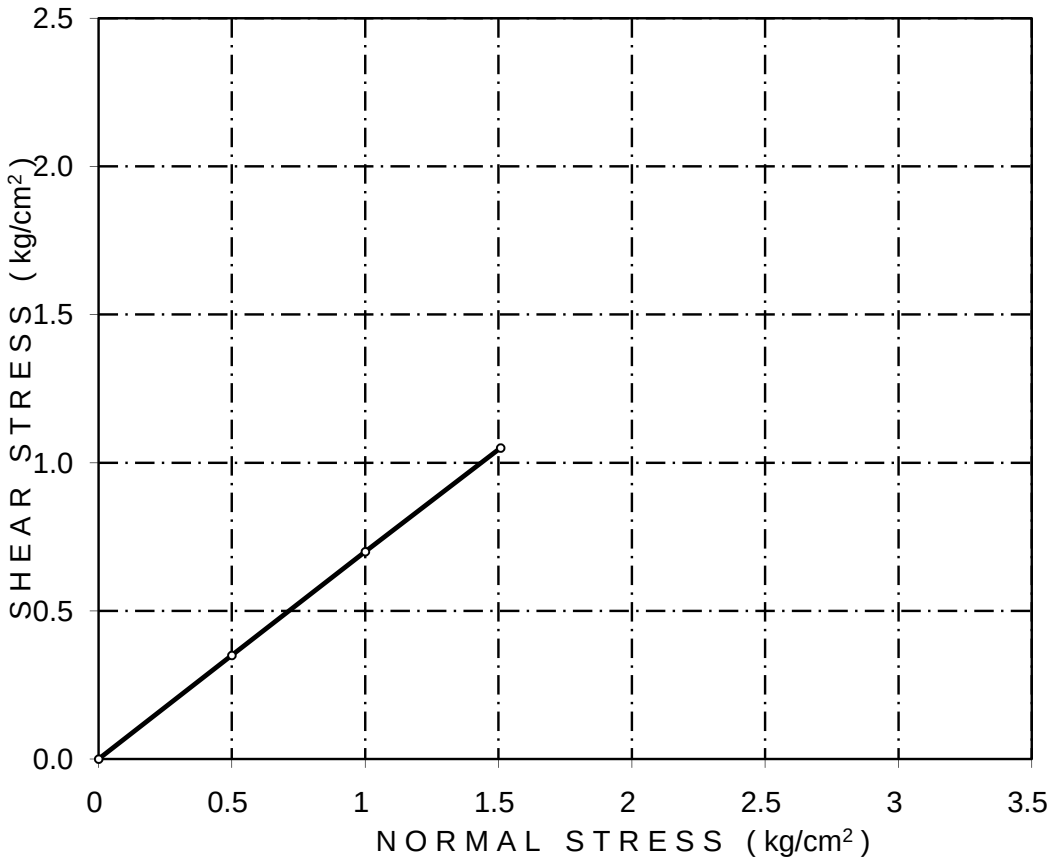
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 95

DRAINED DIRECT SHEAR TEST

Borehole No :	33
Depth :	**20.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.62	0	35



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

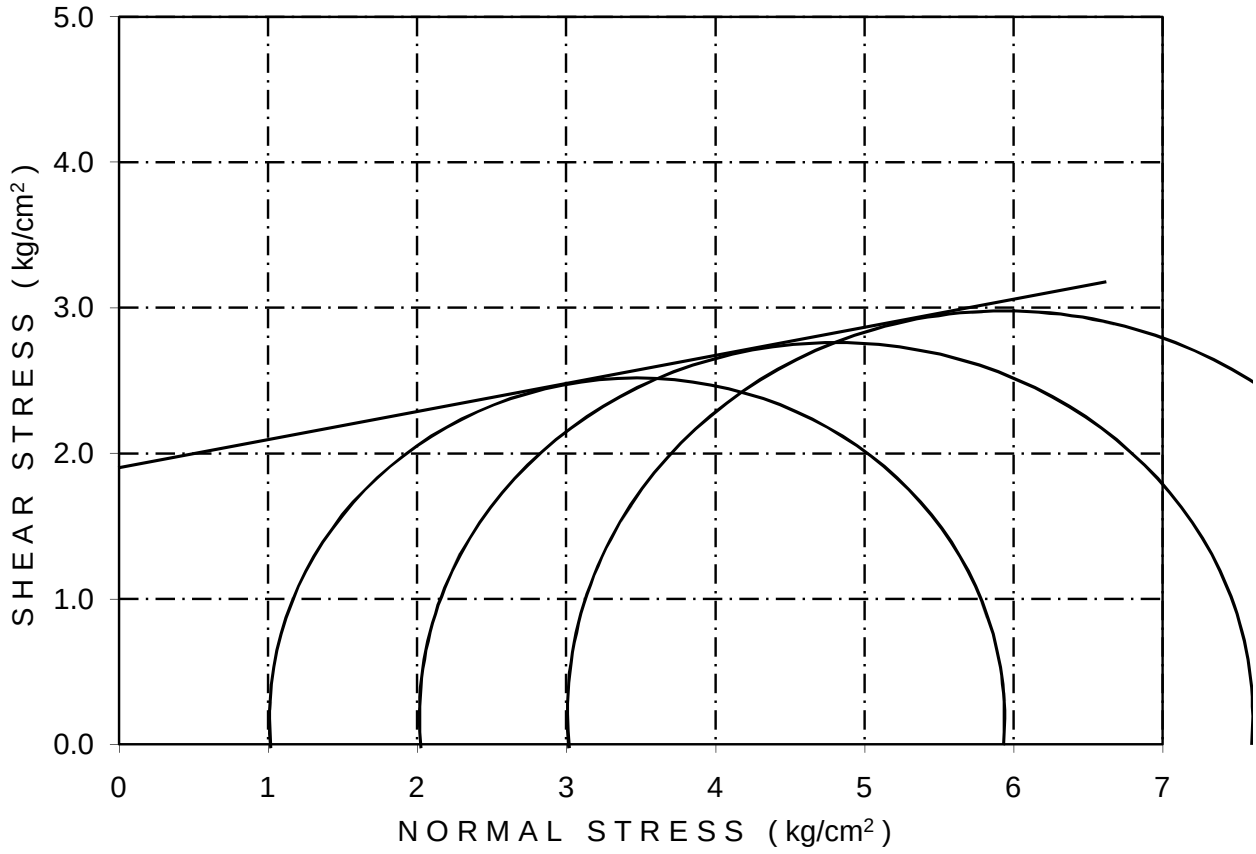
	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 96

UNCONSOLIDATED UNDRAINED TRIAXIAL TEST

Borehole No	:	33
Depth	:	35.25m

BULK DENSITY gm/cc	DRY DENSITY gm/cc	MOISTURE CONTENT %
2.11	1.72	22.4

"c" Value kg/cm^2	"Ø" Value DEGREE
1.90	8



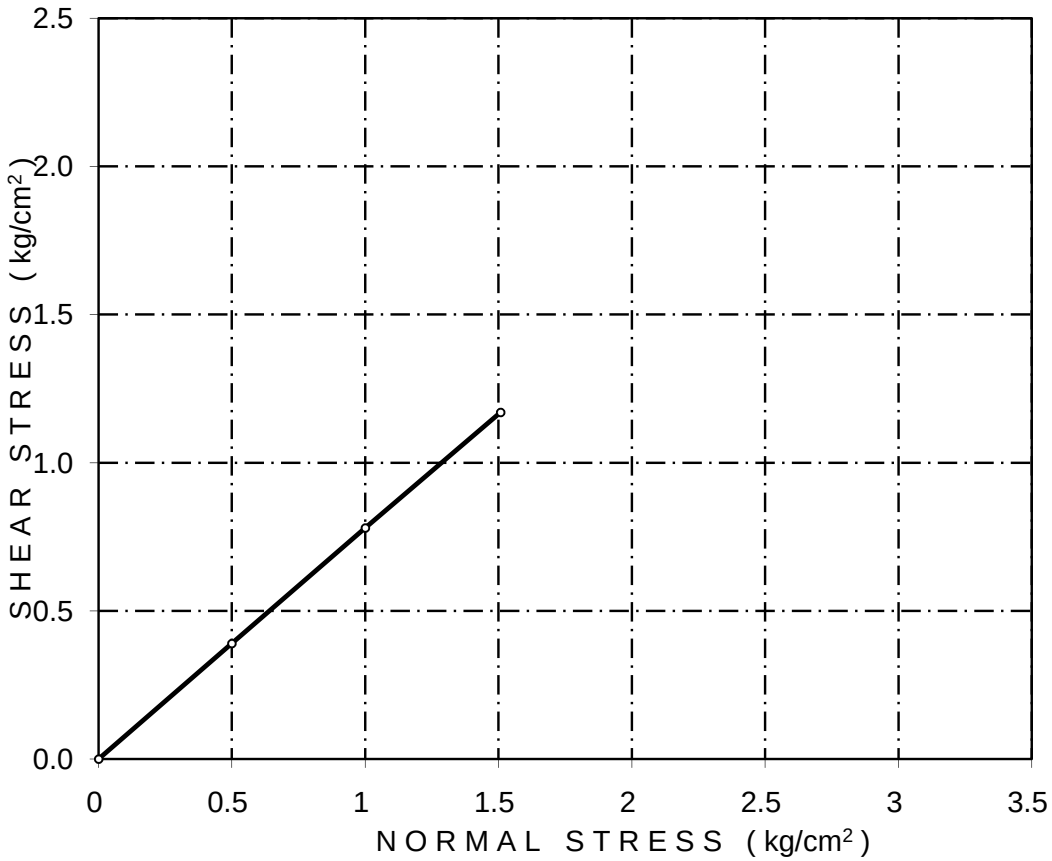
SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 97

DRAINED DIRECT SHEAR TEST

Borehole No :	33
Depth :	**41.25m**
Type of Test	**:** Drained Direct Shear Test

Dry Density gm/cc	"c" Value kg/cm^2	"Ø" Value DEGREE
1.76	0	38



SOIL INVESTIGATION WORK FOR PROPOSED SAMSUNG PLANT AT NOIDA, U.P.

Project: Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.

BEARING CAPACITY ANALYSIS FOR SHALLOW FOUNDATIONS AS PER IS 6403-1981

The bearing capacity equation is as follows :

$$q_{net\ safe} = (1/FS)\{cNc\zeta_c d_c + q(N_q-1)\zeta_q d_q + 0.5B\gamma N_\gamma \zeta_\gamma d_\gamma R_w\}$$

where:

$q_{net\ safe}$ =	safe net bearing capacity	c =	cohesion intercept
q =	overburden pressure	B =	Foundation width
γ =	Bulk density of soil below founding level		
R_w =	Water table correction factor	FS =	Factor of safety
N_c, N_q, N_γ =	bearing capacity factors, which are a function of ϕ		
d_c, d_q, d_γ =	Depth factors		
$\zeta_c, \zeta_q, \zeta_\gamma$ =	Shape factors		

Soil parameters :

c = **5.00** T/m^2 ϕ = **8.0** degrees GENERAL SHEAR FAILURE

c' = 3.33 T/m^2 ϕ' = 5.4 degrees LOCAL SHEAR FAILURE

General Shear Failure :	N_c =	7.53	N_q =	2.06	N_γ =	0.86
Local Shear Failure :	N_c' =	6.60	N_q' =	1.62	N_γ' =	0.49

Bulk Density Profile

Depth, m From	Depth, m To	γ T/m^3
0.0	**5.0**	**1.60**
5.0	**10.0**	**1.75**
10.0	**25.0**	**1.90**

Factor of safety = **2.5** as per **IS 1904-1986**

Design Water Table depth = **10.0** m

R_w factor: Constant value(**V**) for worst condition or calculate(**C**) based on WT Depth ? : **V** Rw = **0.60**

Depth factor to be considered ? **Y**

For computation of Depth Factor, depth below GL to be ignored to account for loose soils,poorly compacted backfill above foundation, scour etc. = **1.0**

FAILURE CRITERIA **:** **AVERAGE OF LOCAL & GENERAL SHEAR FAILURE**

Foundation Dimensions		FOUN-DATION SHAPE	Depth,m	R_w	Shape Factors			Depth factors (GSF)			Depth factors (LSF)			$q_{net\ safe}$, T/m^2		Safe Net Bearing Capacity T/m^2
B, m	L, m				ζ_c	ζ_q	ζ_γ	d_c	d_q	d_γ	d_c'	$d_{q'}$	d_γ'	GSF	LSF	
3.0	**3.0**	**Square**	**2.0**	**0.60**	**1.30**	**1.20**	**0.80**	**1.08**	**1.00**	**1.00**	**1.07**	**1.00**	**1.00**	**23.1**	**13.5**	**18.3**

SETTLEMENT ANALYSIS FOR SHALLOW FOUNDATIONS AS PER IS: 8009 (Part-1)-1976, Clause 9.1.4

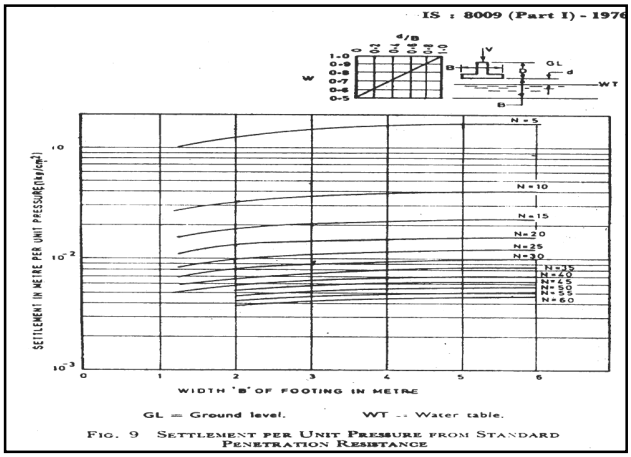


FIG. 9 SETTLEMENT PER UNIT PRESSURE FROM STANDARD PENETRATION RESISTANCE

Design Water Table Depth : **10.0m**

R_w factor : Calculate (**C**) based on water table depth or Fixed Value(**V**) for worst condition : **V** Rw factor for design : **0.6**

Fox's Depth Factor to be considered ? **Y**

Depth to be ignored in Depth Factor Computation for loose soils, poorly compacted backfill, scour, etc. **1.0** **m**

Tolerable Total Settlement : **50** **mm**

Foundation Width,m	Foundation Length,m	Foundation Depth,m	Shape	Design **N-value**	Settlement @ 1kg/cm^2 (as read off from graph), mm	R_w	Fox's Depth Factor, d_f	Rigidity Factor, d_r	**Net Allowable Bearing Pressure, T/m^2**
3.0	**3.0**	**2.0**	**Square**	**12.0**	**26.5**	**0.60**	**0.91**	**1.0**	**12.4**

Lower of the two values of the above (Shear Criteria & Settlement Criteria) has been considered for the design. i.e. 12.4 T/m^2 .

	UV GLOBAL GEO SOLUTIONS PVT. LTD. *GEOTECHNICAL CONSULTANTS*	Fig. 100

COMPUTATION OF SAFE AXIAL COMPRESSIVE PILE CAPACITY
BY STATIC ANALYSIS
Analysis in accordance with IS 2911 Part 1 Section 2-1979 Reaffirmed 1997
Project : **Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.**

Pile Type : **Bored Cast in Situ** RCC Pile Loading : Axial Compression

The safe pile capacity is computed as :

$$Q_{safe}=(1/FS)\{\Sigma_{1\ to\ n}[(\alpha c+pk\tan\delta)A_sL]+[(cN_c+pN_q+0.5D\ \gamma\ N_\gamma)A_p]\}$$

where :

Q_{safe}	=	safe axial pile capacity, Tonnes	FS	=	Factor of safety
α	=	adhesion factor	p	=	overburden pressure, T/m^2
δ	=	friction angle between soil and pile, degrees (= ϕ)	L	=	Pile segment length in selected layer
c	=	cohesion intercept, T/m^2	k	=	earth pressure coefficient
γ	=	effective density of soil, T/m^3	D	=	Pile diameter
N_c, N_q, N_γ	=	Bearing capacity factors, which are a function of ϕ	A_s	=	Pile surface area per m length
n	=	number of layers	A_p	=	Pile end bearing area

Pile Cross section : Circle Pile cut-off Level (COL) : 2.0 m
Pile Diameter ,D : 1000 **mm**
Pile Surface Area, A_s = 3.142 m^2/m length Pile cross-section Area, A_p = 0.785 m^2
Overburden Pressure to be considered below : 2.0 m
Consider overburden pressure to 15 pile diameters, i.e. 15.0 m below 2.0 m
become constant below : i.e. 17.0 m below 0.0 m
Design Water Table Depth: 5.0 m
Factor of Safety : 2.5 as per IS 1904-1986

Layer No.	Depth,m		Soil	c, T/m^2	ϕ (=δ), degrees	γ, T/m^3	k	α	N_c	N_q	N_γ
	From	To	Classification								
1	0.0	3.0	Sandy Silt	5.0	7	1.66	1.5	0.5			
2	3.0	9.0	Silty Sand/Fine Sand	0.0	29	1.75	1.5	0.5			
3	9.0	15.0	Sandy Silt	9.0	8	1.85	1.5	0.5	9.0	2.06	0.86
4	15.0	21.0	Fine Sand	0.0	31	1.92	1.5	0.5		23.93	25.99
5	21.0	27.0	Sandy Silt	13.0	7	2.00	1.5	0.5	9.0	1.88	0.71
6	27.0	33.0	Fine Sand	0.0	31	2.02	1.5	0.5		23.93	25.99
7	33.0	40.0	Fine Sand	0.0	32	2.02	1.5	0.5		28.88	30.21

Pile Capacity Calculation at following	**20.0**	**24.0**	**28.0**	**30.0**	**32.0**
Pile Length(s) below cut-off Level (m)	**35.0**				

COMPUTATION OF SAFE AXIAL COMPRESSIVE PILE CAPACITY

BY STATIC ANALYSIS

Analysis in accordance with IS 2911 Part 1 Section 2-1979 Reaffirmed 1997

Project : **Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.**

Pile Type : **Bored Cast in Situ** RCC Pile Loading : Axial Compression

Pile Dia = 1000 mm

Depth Below GL , m	Pile Length below COL, m	Layer No.	Soil Parameters			Overburden Pressure	Unit Skin Friction	Skin Friction in Layer	Cumulative Skin Friction	Unit End Bearing	Total End Bearing	Ult. Pile Capacity	Safe Pile Capacity
			c, T/m^2	ϕ (=δ), degrees	γ_{eff}, T/m^3	T/m^2	T/m^2	Tonnes	Tonnes	T/m^2	Tonnes	Tonnes	Tonnes
0.0	-												
		1	5.0										
2.0	**0.0**					0.00							
		1	5.0	7	1.66	0.83	2.65	8.3					
3.0	**1.0**					1.66			8.3				
		2	0.0	29	1.75	3.41	2.84	17.8					
5.0	**3.0**					5.16			26.1				
		2	0.0	29	0.75	6.66	5.54	69.6					
9.0	**7.0**					8.16			95.7				
		3	9.0	8	0.85	10.71	6.76	127.4					
15.0	**13.0**					13.26			223.1				
		4	0.0	31	0.92	14.18	12.78	80.3					
17.0	**15.0**					15.10			303.4				
		4	0.0	31	0.92	15.10	13.61	171.0					
21.0	**19.0**					15.10			474.4				
		5	13.0	7	1.00	15.10	9.28	29.2					
22.0	**20.0**					15.10			503.6	145.7	114.5	618.0	**247**
		5	13.0	7	1.00	15.10	9.28	116.6					
26.0	**24.0**					15.10			620.2	145.7	114.5	734.7	**294**
		5	13.0	7	1.00	15.10	9.28	29.2					
27.0	**25.0**					15.10			649.4	145.7	114.5	763.8	**306**
		6	0.0	31	1.02	15.10	13.61	128.3					
30.0	**28.0**					15.10			777.7	374.5	294.2	1071.8	**429**

COMPUTATION OF SAFE AXIAL COMPRESSIVE PILE CAPACITY

BY STATIC ANALYSIS

Analysis in accordance with IS 2911 Part 1 Section 2-1979 Reaffirmed 1997

Project : **Soil Investigation Work for Proposed Samsung Plant at Noida, U.P.**

Pile Type : **Bored Cast in Situ** RCC Pile Loading : Axial Compression

Pile Dia = 1000 mm

Depth Below GL , m	Pile Length below COL, m	Layer No.	Soil Parameters			Overburden Pressure	Unit Skin Friction	Skin Friction in Layer	Cumulative Skin Friction	Unit End Bearing	Total End Bearing	Ult. Pile Capacity	Safe Pile Capacity
			c, T/m^2	ϕ (=δ), degrees	γ_{eff}, T/m^3	*T/m^2*	*T/m^2*	*Tonnes*	*Tonnes*	*T/m^2*	*Tonnes*	*Tonnes*	*Tonnes*
30.0	**28.0**	6	0.0	31	1.02	15.10	14.15		777.7	374.5	294.2	1071.8	**429**
						15.10	13.61	85.5					
32.0	**30.0**	6	0.0	31	1.02	15.10			863.2	374.5	294.2	1157.3	**463**
						15.10	13.61	42.8					
33.0	**31.0**	7	0.0	32	1.02	15.10			905.9	374.5	294.2	1200.1	**480**
						15.10	14.15	44.5					
34.0	**32.0**	7	0.0	32	1.02	15.10			950.4	451.5	354.6	1305.0	**522**
						15.10	14.15	133.4					
37.0	**35.0**					15.10			1083.8	451.5	354.6	1438.4	**575**