

GEOTECHNICAL REPORT

ISO/IEC 17025 Accredited Testing Laboratory by NABL



TC-10081

2024

ASL- 84

PROJECT: GEOTECHNICAL INVESTIGATION FOR
"ELEVATED VIADUCT (APPROX 2500 MTR) FROM KIOCL
JUNCTION TO BAIKAMPADDY SECTION OF NH-66 NEAR
MANGALORE IN THE STATE OF KARNATAKA

SUBMITTED To: M/s PARK FUTURISTICS &
ASSOCIATES SECTOR 62, NOIDA - GAUTAM BUDH
NAGAR, (UTTAR PRADESH)-201309



ARUN SOIL LAB PRIVATE LIMITED

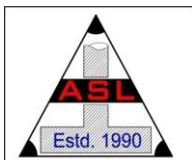
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"QUALITY CONSCIOUSNESS IS OUR CORE CONCEPT"



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Geotech Investigation Report No. **ASL 84 -2024**

ACKNOWLEDGEMENT

PROJECT: SUB SOIL INVESTIGATION FOR PROPOSED CONSTRUCTION OF "ELEVATED VIADUCT (APPROX 2500 MTR) FROM KIOCL JUNCTION TO BAIKAMPADDY SECTION OF NH-66 NEAR MANGALORE IN THE STATE OF KARNATAKA

CLIENT: - M/s PARK FUTURISTICS & ASSOCIATES

Subject: - Geotechnical Investigation Report

Dear Sir,

Arun Soil Lab Pvt. Ltd. (ASL) is pleased to submit the report carried out for the proposed site.

The investigation end up with conclusions and recommendations relevant to the findings in addition to the laboratory test results, also attached herewith.

We look forward for further co-operation if any, whenever required. For any further clarification concerning the report, please contact us at your convenience.

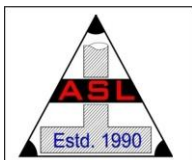
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SUB SOIL INVESTIGATION REPORT FOR “PROPOSED CONSTRUCTION OF "ELEVATED VIADUCT (APPROX 2500 MTR) FROM KIOCL JUNCTION TO BAIKAMPADDY SECTION OF NH-66 NEAR MANGALORE IN THE STATE OF KARNATAKA”

1. INTRODUCTION

The object of the investigation was to study the geo-technical properties of soil both in field and laboratory and determine safe allowable pressure for the foundation soil. In order to collect data and achieve the project objectives, studies and site Investigations were conducted. Main purpose of these studies was to obtain the relevant geotechnical design data including sub-surface profile (soil/rock interface), classification, behavior, and engineering properties, i.e., Density, strength and compressibility of sub-surface soil, groundwater table and its fluctuation, the potential occurrence of contaminated ground or groundwater that might be hazardous to the durability of construction material. The investigation was planned through boreholes/field tests (SPT), collections of disturbed / un-disturbed soil samples, collection of water samples, relevant laboratory tests.

The report includes the field investigation, laboratory testing, analysis and interpretations of the test results by Geo-technical expert with assessment and recommendations for the properties essential to the design of foundations.

2. PLANING AND DETAILS OF THE SOIL TEST REPORT

Recommendation of the suitable and economical foundation type and dimensions for bridge based on boreholes done at site to assess the penetration resistance (SPT) of soil and obtain soil samples, both disturb and undisturbed (wherever possible) for classification tests and other laboratory tests for determining index and engineering properties of soil and ground water location.

All locations & Ground levels of boreholes were given by **M/s Park Futuristics & Associates** field investigations, field tests, sampling during Feb. 2024 and laboratory testing as per relevant IS / IRC / MORTH specifications under the instructions of Contractor, Client, and Design Consultant.

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3. SUMMARY OF FIELD WORK

The field investigation work at this site was carried out from 10/02/2024 to 21/02/2024. The following investigation work was carried out 4 boreholes of diameter 150 mm were made within the proposed layout of the structure.

Bore Hole No.	Chainage	Borehole Coordinate (m)		Depth of Bore Hole	Field Work Start date	Field Completion Start date
		Easting	Northing			
1	49+600	481079	1429179	30.00	19/02/2024	21/02/2024
2	46+545	479357	1431737	25.00	13/02/2024	15/02/2024
3	46+210	479279	1431437	20.50	10/02/2024	12/02/2024
4	48+500	480363	1430105	30.00	16/02/2024	18/02/2024

4. GEOLOGICAL INFORMATION OF THE REGION



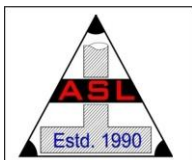
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5. REFERENCES

All field work was carried out in accordance with the latest addition of the applicable code of practice / procedures as laid down by the Bureau of Indian Standards. List of applicable codes are as below.

Field Investigation		
Sl. No.	Particular of Properties	Ref: IS Code
1.	Sub-Surface Investigation for foundation	IS 1892-2021
2.	Standard Penetration Test	IS 2131-1981
3.	Collection of Un-disturbed Sample	IS 2132-1986

Laboratory Test		
Sl. No.	Particular of Properties	Ref: IS Code
1.	Sieve Analysis / Hydrometer	IS 2720 (Part IV)
2.	Natural Moisture Content / Bulk / Dry Density	IS 2720 (Part II)
3.	Specific Gravity	IS 2720 (Part III)
4.	Liquid Limit/Plastic Limit/Plasticity Index	IS 2720 (Part V)
5.	Direct Shear Test	IS 2720 (Part XIII)
6.	Unconfined Compressive Strength test	IS 2720 (Part X)
7.	Unconsolidated Un-drained Tri-axial Test	IS 2720 (Part XI)
8.	Consolidation Test	IS 2720 (Part XV)
9.	Chemical Analysis on soil Sample / Water Sample	IS 2720 & IS 3025

Bearing Capacity		
Sl. No.	Particular of Properties	Ref: IS Code
1.	Bearing Capacity Calculation	IS 6403
2.	Settlement	IS 8009 (Part I)
3.	Maximum Permissible Settlement	IS 1904
4.	Pile Capacity Calculation	IRC 78 / IS 2911 (Part 1/Sec 2)

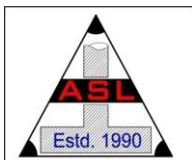
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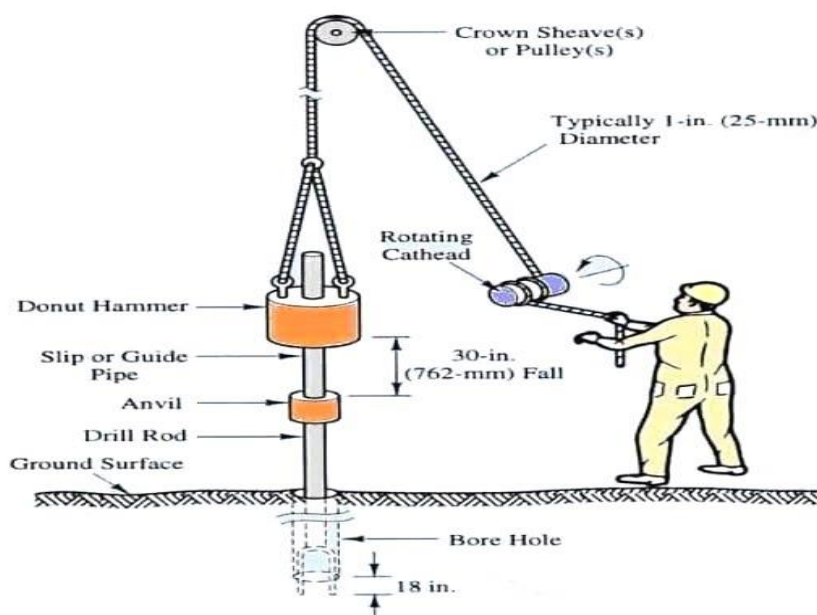


6. METHODOLOGY OF INVESTIGATION:

The investigation was planned to obtain the subsurface stratification in the proposed project site and collect soil samples for laboratory testing to determine the engineering properties such as shear strength, along with basic engineering classification of the subsurface stratum to arrive at the foundation design parameters.

Standard Penetration Test (SPT)

Conducted in the boreholes at every 1.50 m interval and change of strata as per specifications. Standard split spoon sampler attached to lower end of drill rods was driven in the boreholes by means of standard hammer of 63.50 kg falling freely from a height of 75 cm. The sampler was driven 45 cm as per specifications and number of blows required for each 15 cm penetration was recorded. The number of blows for the first 15 cm penetration was not taken into account as it is considered seating drive. The number of blows for next 30 cm penetration was 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 were collected in polythene bags of suitable size. These samples were properly sealed, labeled, recorded and carefully transported to laboratory for testing.



DIAGRAMMATIC OF SPT

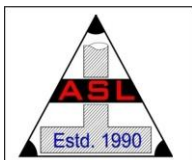
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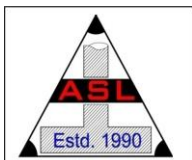
CONSISTENCY / RELATIVE DENSITY OF SOIL WITH SPT VALUES AS PER IRC: 75-2015

CORRELATION FOR CLAY/PLASTIC SILT		CORRELATION FOR SAND/NON-PLASTIC SILT	
Consistency	Penetration Value	Relative density	Penetration Value
Very Soft	0 to 2 Blows	Very loose	0 to 4 Blows
Soft	2 to 4 Blows	Loose	5 to 10 Blows
Medium Stiff	4 to 8 Blows	Medium	11 to 30 Blows
Stiff	8 to 15 Blows	Dense	31 to 50 Blows
Very Stiff	15 to 30 Blows	Very Dense	Above 50
Hard	Above 30		

7. UNDISTURBED SAMPLE (UDS):

Collected from the boreholes at every 1.50 m interval & change of strata as per sampling specifications, in thin-walled sampling tubes of 100 mm dia. and 450 mm length. These sampling tubes after retrieval from the boreholes were properly waxed and sealed at both ends. These were carefully labeled and transported to the laboratory for testing. UDS wherever slipped during lifting, were duly marked in the bore logs as well in the soil profile.





8. LABORATORY TESTS:

The following laboratory tests were conducted to determine the engineering characteristics of sub-soils:

Natural moisture contents were determined by oven drying method as per IS 2720 (Part II)-1973. The results have been reported in result sheet attached.

Dry and Bulk density of soil strata were obtained using Shelby tubes in accordance with IS 2720 (Part XXIX)-1975. The results have been reported in result sheet attached.

Particle size analysis test by **hydrometer method** were performed in accordance with IS 2720 (Part IV) - 1965 on the part of soil samples obtained after the sieve analysis. The results have been reported in result sheet attached.

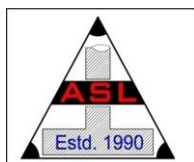
Atterberg Limits' tests were performed in accordance with IS 2720 (Part V) - 1985 and results have been reported in result sheet attached.

Specific gravity tests were performed in accordance with IS 2720 (Part III Section1) -1980 and the results have been reported in result sheet attached.

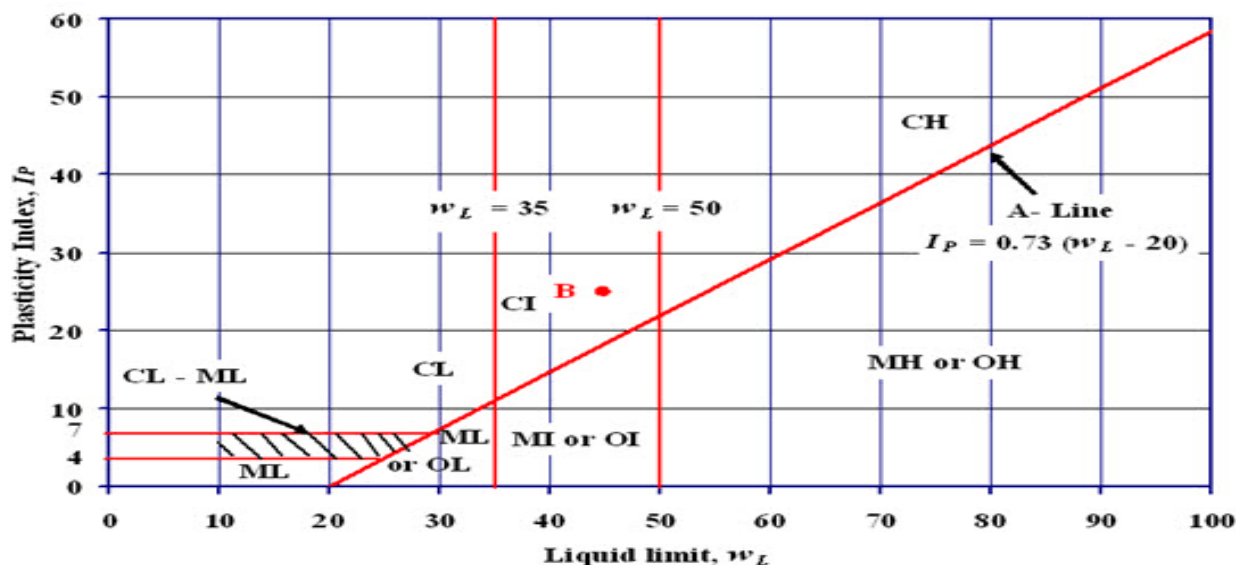
Triaxial Compression Test under Unconsolidated Un-drained (UU) condition as per IS: 2720 (Part-XI)-2011 were performed on the undisturbed soil samples obtained during the field investigation. The results have been reported in result sheet attached.

Direct shear tests were performed as per IS 2720 (Part XIII)-2015, on the undisturbed soil samples obtained during the field investigation. The results and the density of samples have been reported in result sheet attached.

Consolidation tests were performed as per IS 2720 (Part XV)-1986, on the undisturbed soil samples obtained during the field investigation. The result in the form of compression index (Cc) is reported in result sheet attached.



9. CLASSIFICATION OF SOIL



FOR COHESIVE SOIL	
Plasticity	Liquid Limit
Low Plastic	<35
Medium Plastic	35 to 50
High Plastic	>50

FOR NON-COHESIVE SOIL	
Soil Classification	% Passing on IS Sieve 0.075 mm
ML	>50
SM	13-49
SM-SP	5-12
SP	1-4

ABBREVIATIONS

<ul style="list-style-type: none"> CL - SILTY CLAY OF LOW PLASTICITY CI - SILTY CLAY OF MEDIUM PLASTICITY CH - SILTY CLAY OF HIGH PLASTICITY ML - CLAYEY SILT OF LOW PLASTICITY CL-ML - CLAYEY SILT OF LOW PLASTICITY MI - CLAYEY SILT OF MEDIUM PLASTICITY SC - CLAYEY SAND GL - GROUND LEVEL 	<ul style="list-style-type: none"> ML - SANDY SILT SM - SILTY SAND SM-SP - POORLY GRADED SAND-SILT MIXTURE SW/SP - WELL/POORLY GRADED SAND GSF - GENERAL SHEAR FAILURE LSF- LOCAL SHEAR FAILURE ISF - INTERMEDIATE SHEAR FAILURE BGL - BELOW GROUND LEVEL
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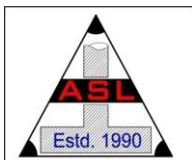
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10. SUB SURFACE CONDITION

FOR CH 49+600

The results of lab tests and bore hole log charts of bore holes indicate that the strata at the site is found to comprise of only non-cohesive soil.

The non-cohesive type soil is found to comprise of either silty sand 'SM' type soil or poorly graded sand-silt mixture belonging to 'SP' group of IS classification and having 02 to 48 percent fines.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of only coarse-grained soils (sandy soil).

S.P.T. VALUES

The S.P.T. values obtained in the respective sandy layer region present as per bore-log charts enclosed are found to range from 06 to 79 indicating 'Loose' to 'Very Dense' relative density.

The results of S.P.T. values indicate that the stratum at the Site is 'Very Dense' to 'Well' compacted.

WATER TABLE

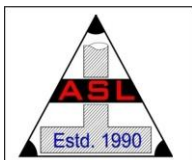
Water Table at the Site was observed at a depth of 3.00 meter below ground level on the day of soil investigation

FOR CH 46+545

The results of lab tests and bore hole log charts of bore holes indicate that the strata at the site is found to comprise of only non-cohesive soil.

The non-cohesive type soil is found to comprise of either silty sand 'SM' type soil or poorly graded sand-silt mixture belonging to 'SP' group of IS classification and having 02 to 37 percent fines.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of only coarse-grained soils (sandy soil).



S.P.T. VALUES

The S.P.T. values obtained in the respective sandy layer region present as per bore-log charts enclosed are found to range from 08 to 55 indicating 'Loose' to 'Very Dense' relative density.

The results of S.P.T. values indicate that the stratum at the Site is 'Very Dense' to 'Well' compacted.

WATER TABLE

Water Table at the Site was observed at a depth of 3.00 meter below ground level on the day of soil investigation

FOR CH 46+210

The results of lab tests and bore hole log charts of bore holes indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The cohesive type soil comprises of silty clay soil of low and medium plasticity and compressibility belonging to 'OH' and 'MH' group of IS classification and having 94 to 98 percent material finer than 75 micron.

However, the non-cohesive type soil is found to comprise of either poorly graded sand-silt mixture belonging to 'SM-SP' and 'SP' group of IS classification and having 03 to 08 percent fines.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils (clayey soil) and coarse-grained soils (sandy soil).

S.P.T. VALUES

The S.P.T. values obtained in the respective clayey layer region present as per bore-log charts enclosed are found to range from 09 to Refusal indicating 'Stiff' to 'Hard' consistency.

However, the S.P.T. values obtained in the respective sandy layer region present as per bore-log charts enclosed are found to range from 08 to 18 indicating 'Loose' to 'Medium' relative density.

The results of S.P.T. values indicate that the stratum at the Site is 'Medium' to 'Well' compacted.

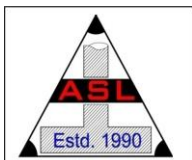
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WATER TABLE

Water Table at the Site was observed at a depth of 3.00 meter below ground level on the day of soil investigation

FOR CH 48+500

The results of lab tests and bore hole log charts of bore holes indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The cohesive type soil comprises of silty clay soil of low and medium plasticity and compressibility belonging to 'OH' group of IS classification and having 96 to 98 percent material finer than 75 micron.

However, the non-cohesive type soil is found to comprise of either silty sand 'SM' type soil or poorly graded sand-silt mixture belonging to 'SP' group of IS classification and having 01 to 18 percent fines.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils (clayey soil) and coarse-grained soils (sandy soil).

S.P.T. VALUES

The S.P.T. values obtained in the respective clayey layer region present as per bore-log charts enclosed are found to range from 06 to 08 indicating 'Medium Stiff' to 'Stiff' consistency.

However, the S.P.T. values obtained in the respective sandy layer region present as per bore-log charts enclosed are found to range from 07 to 76 indicating 'Loose' to 'Very Dense' relative density.

The results of S.P.T. values indicate that the stratum at the Site is 'Medium' to 'Well' compacted.

WATER TABLE

Water Table at the Site was observed at a depth of 3.00 meter below ground level on the day of soil investigation

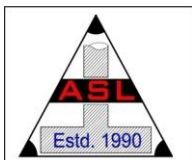
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NOTE: -

The laboratory tests results of the samples collected from the test locations and our experience in this regard. If the actual sub-soil conditions during excavation for the foundations differ from that has been reported, a reference should be made to us for suggestions.

Further, the recommendations are based on the assumptions as mentioned in the Report and the designer of the Structure should take into consideration all the factors required as per codes. The recommendations should be taken as guidelines for the designer.

Er. Anuj Verma
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ASSISTANT ENGINEER
ARUN SOIL LAB Pvt. Ltd.

Er. Anurag Kapoor
B.Tech. (Civil), M. Tech (Geotech)
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RESULT SHEET

NAME OF THE PROJECT										Geotechnical Investigation for "Elevated Viaduct (approx 2500 mtr) from KIOCL Junction to Baikampady section of NH-66near Mangalore in the state of Karnataka".																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
Client Name			M/s. Park Futuristics & Associates.							Coordinate			Easting		Depth of Water Level (m bgl)				3.00		ARUN SOIL LAB PVT. LTD.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
Bore Hole No.			BH-01							Type of Sample			Northing		Commenced on				27-Feb-2024																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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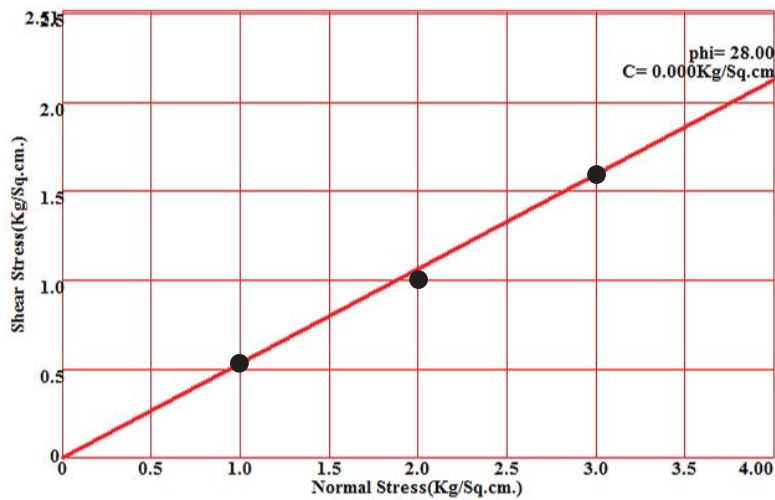
ARUN SOIL LAB PRIVATE LIMITED

RESULT SHEET

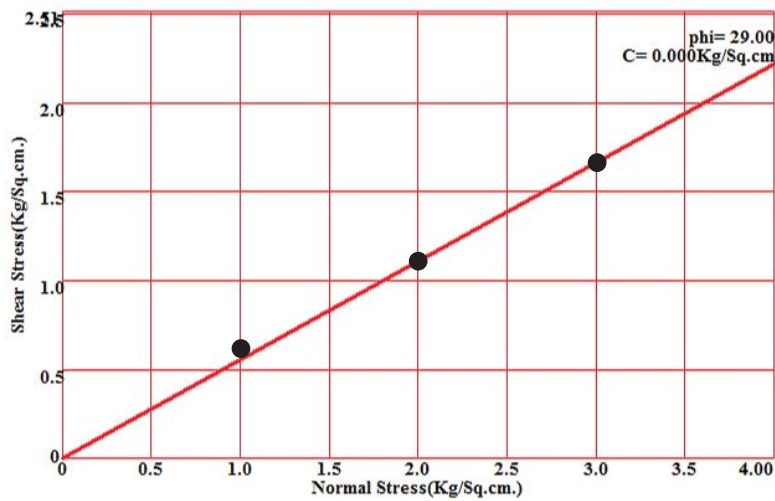
NAME OF THE PROJECT										Geotechnical Investigation for "Elevated Viaduct (approx 2500 mtr) from KIOCL Junction to Baikampaddy section of NH-66near Mangalore in the state of Karnataka".																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Depth of Bore Hole	metre	Reduced Level (Assumed)		Type of Sample	SPT Value	N	N'	SPT Value corrected due to overburden	SPT Value corrected due to dilatancy	Material Passing IS Sieve	Slit Factor	Atterberg Limits				IS group symbol	Wet Bulk Density (gm/cc)	Original Moisture %	Dry Bulk Density (gm/cc)	Specific Gravity (G)	Void Ratio (e)	Cohesion (kg/cm ²)	Angle of Internal Friction (Ø)	Compression Index (Cc)	Type of Test	Organic Matter %	Porosity %	Water Absorption %	Point Load strength Index (MPa)	Soaked (MPa)	Test Type Of Point Load	Uniaxial Compressive Strength		Rock Quality Designation	Total Core Recovery																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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RESULT SHEET

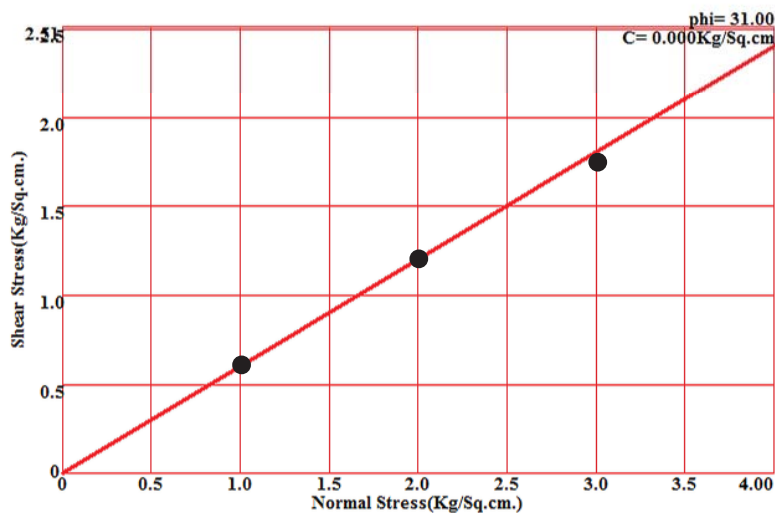
[illegible]



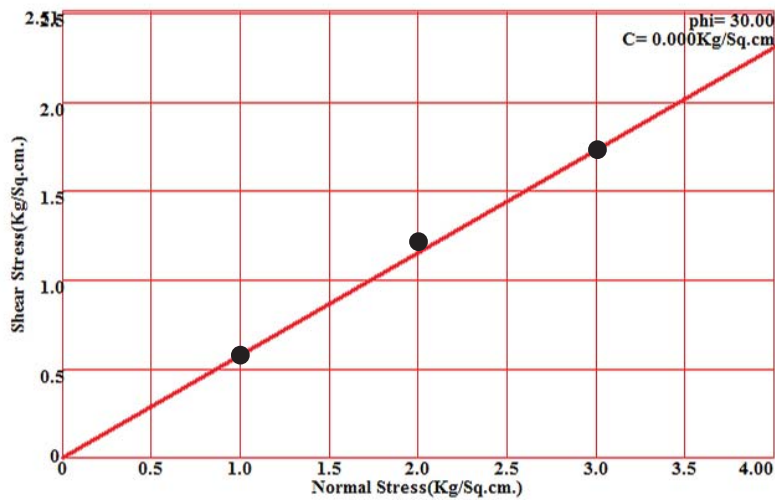
Bore Hole No.= 1
Sample No.= A-1/1
Depth= 1.000000M
Type of Test= C.D.



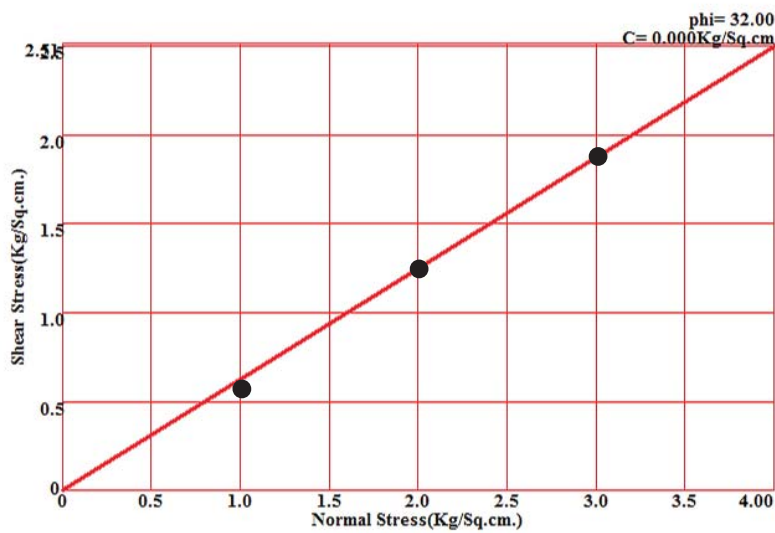
Bore Hole No.= 1
Sample No.= A-1/3
Depth= 4.000000M
Type of Test= C.D.



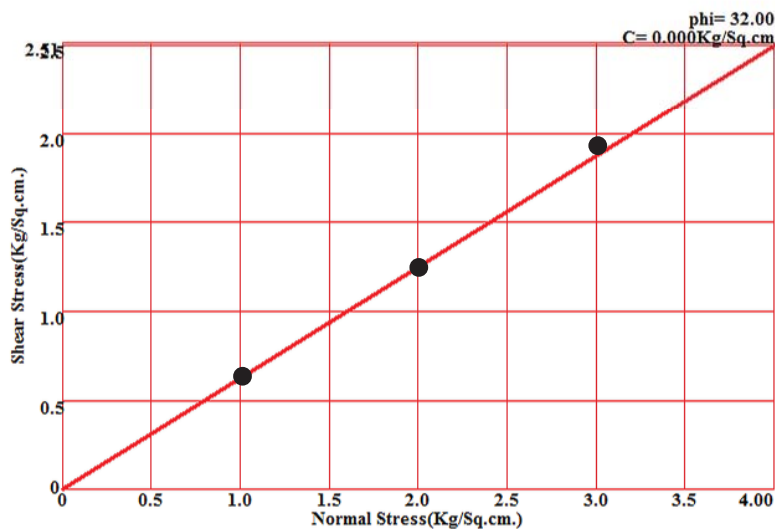
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Sample No.= A-1/5
Depth= 7.000000M
Type of Test= C.D.



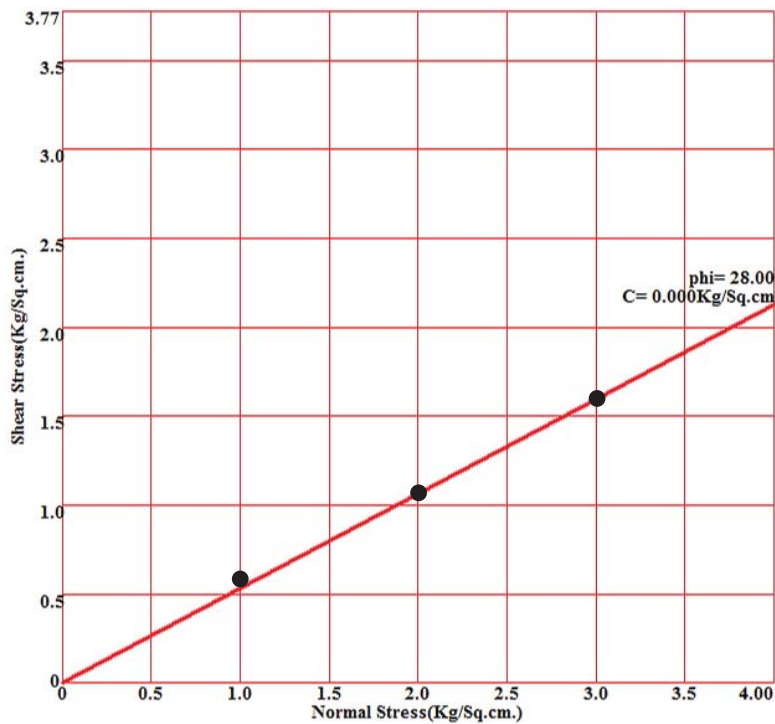
Bore Hole No.= 1
Sample No.= A-1/8
Depth= 11.500000M
Type of Test= C.D.



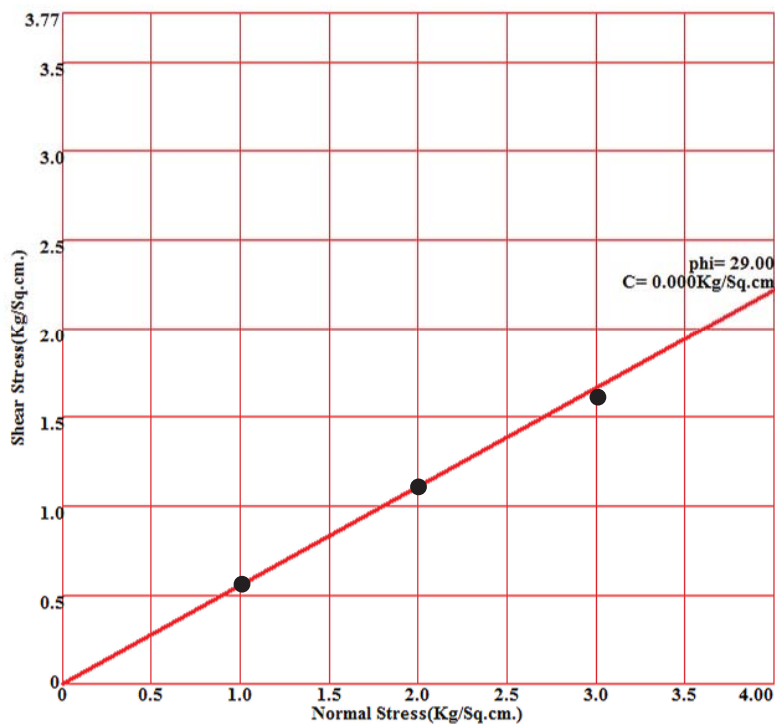
Bore Hole No.= 1
Sample No.= A-1/11
Depth= 16.000000M
Type of Test= C.D.



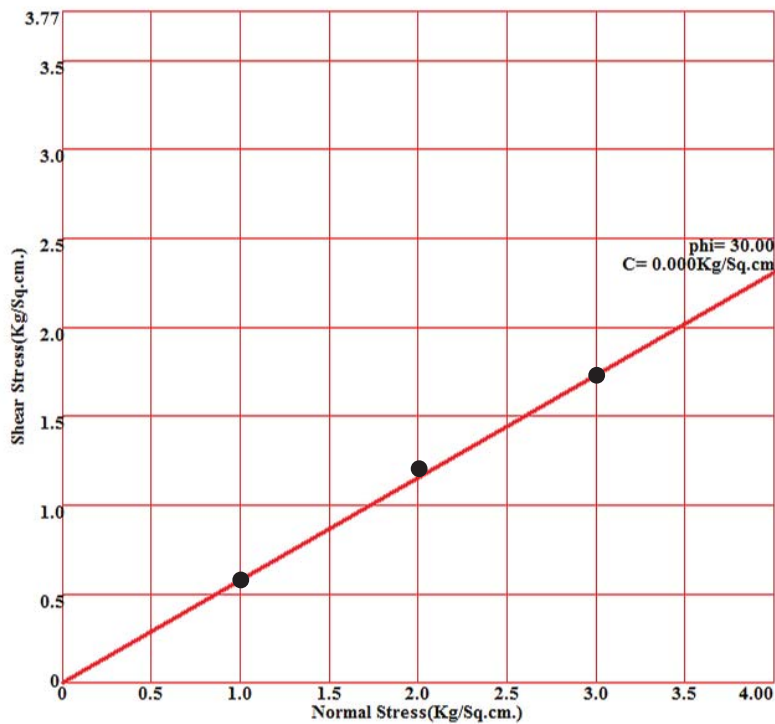
Bore Hole No.= 1
Sample No.= A-1/14
Depth= 20.500000M
Type of Test= C.D.



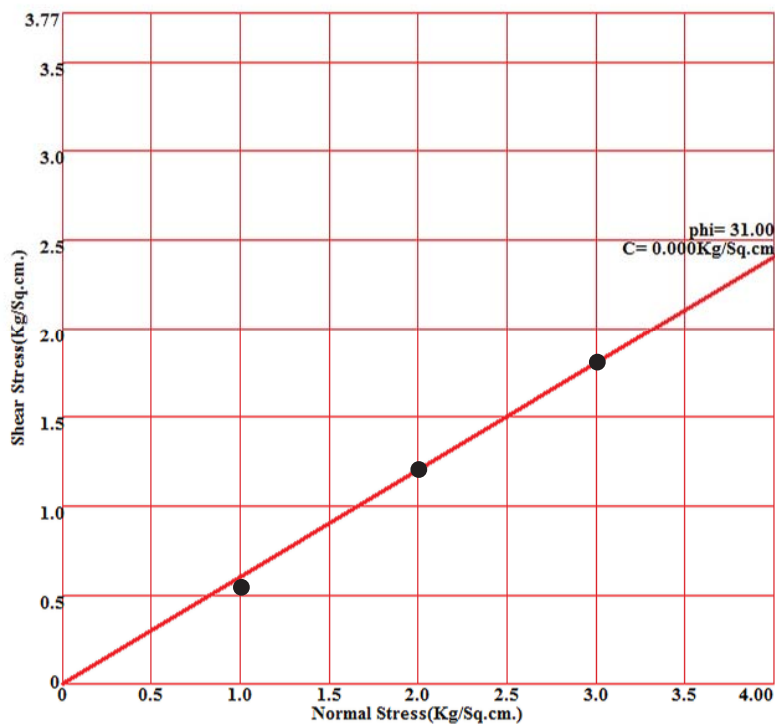
Bore Hole No.= 1
Sample No.= B-1/1
Depth= 1.000000M
Type of Test= C.D.



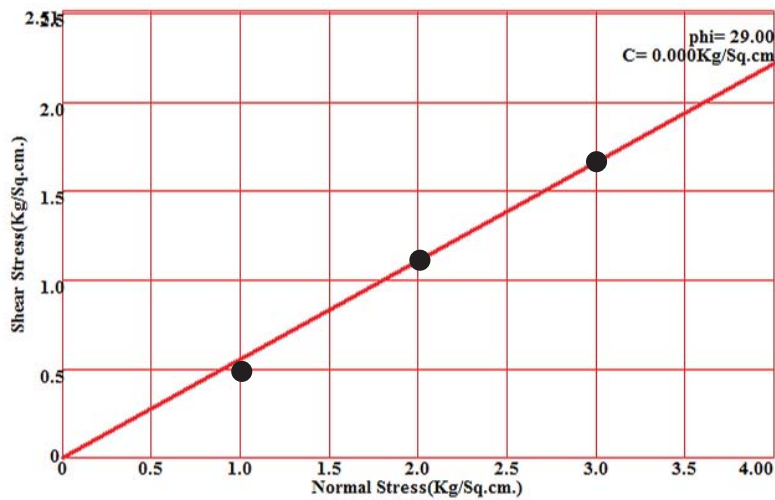
Bore Hole No.= 1
Sample No.= B-1/4
Depth= 5.500000M
Type of Test= C.D.



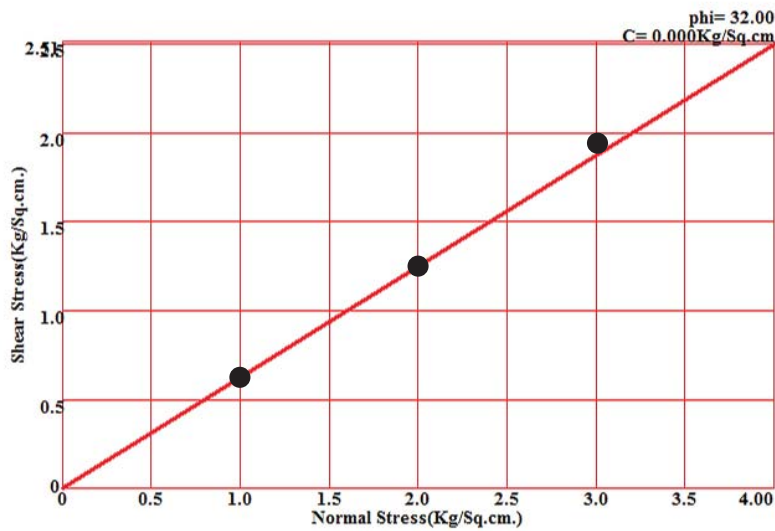
Bore Hole No.= 1
Sample No.= B-1/8
Depth= 11.500000M
Type of Test= C.D.



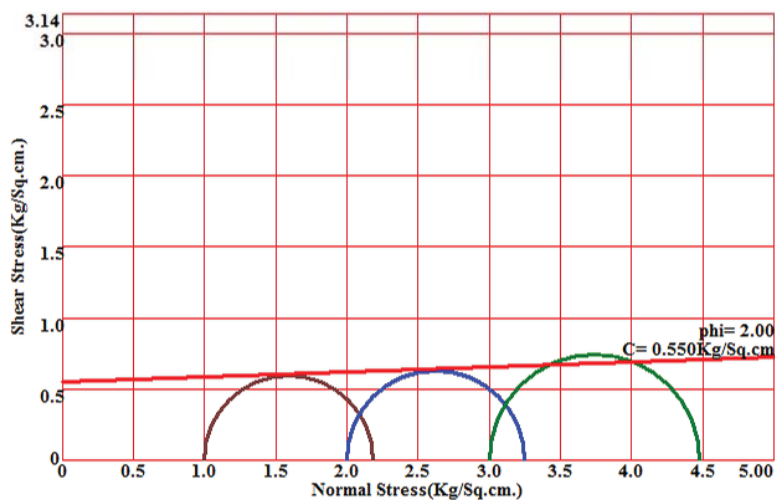
Bore Hole No.= 1
Sample No.= B-1/10
Depth= 14.500000M
Type of Test= C.D.



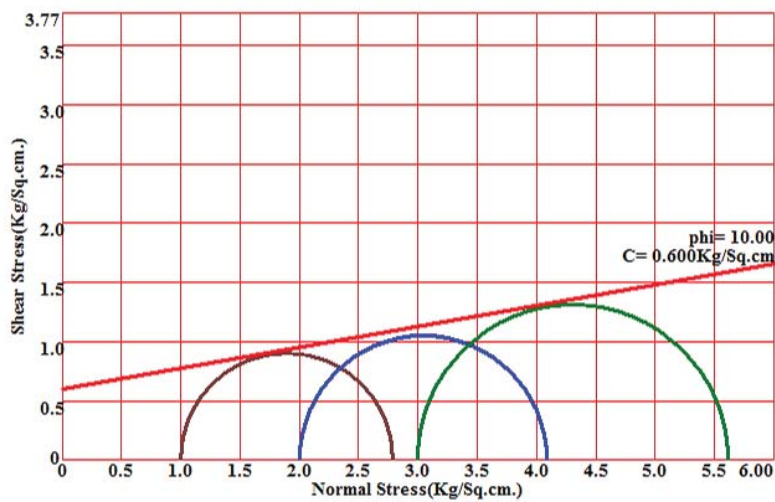
Bore Hole No.= 1
Sample No.= C-1/1
Depth= 1.000000M
Type of Test= C.D.



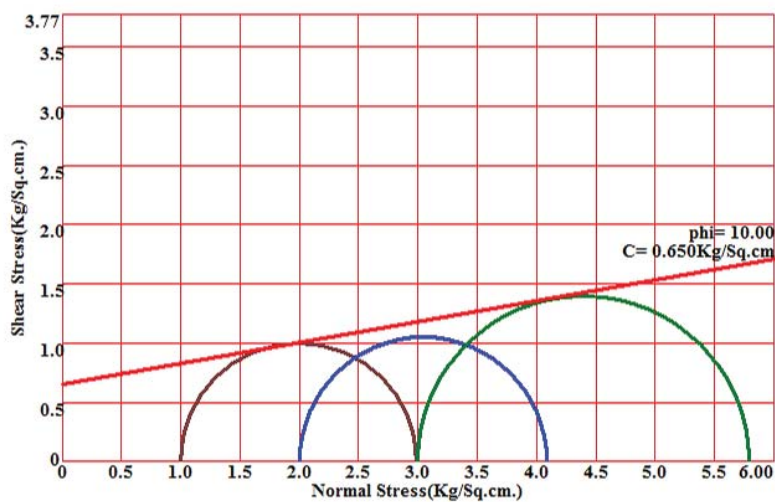
Bore Hole No.= 1
Sample No.= C-1/2
Depth= 2.500000M
Type of Test= C.D.



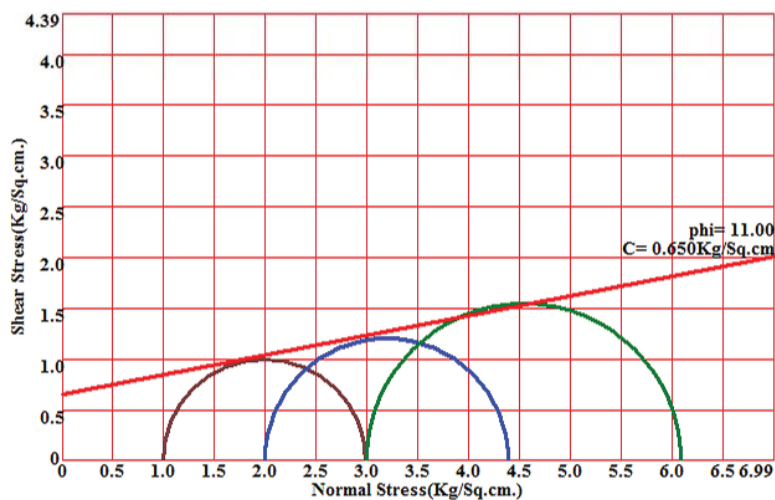
Bore Hole No.= 1
Sample No.= C-1/4
Depth= 5.500000M
Type of Test= U.U.



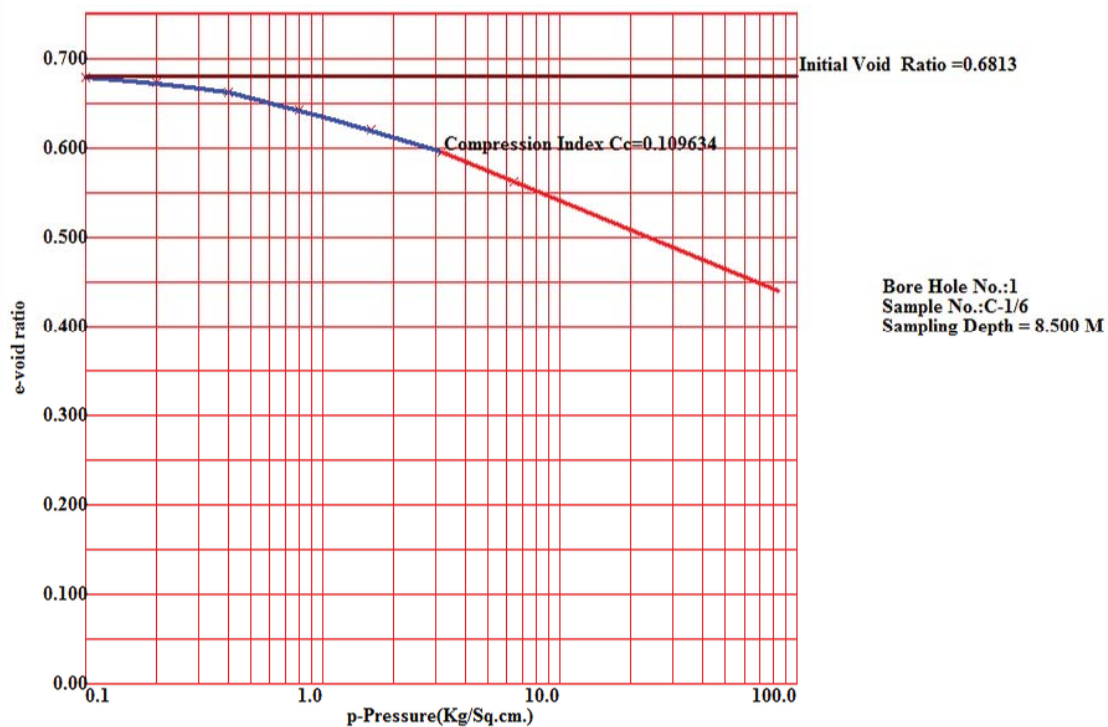
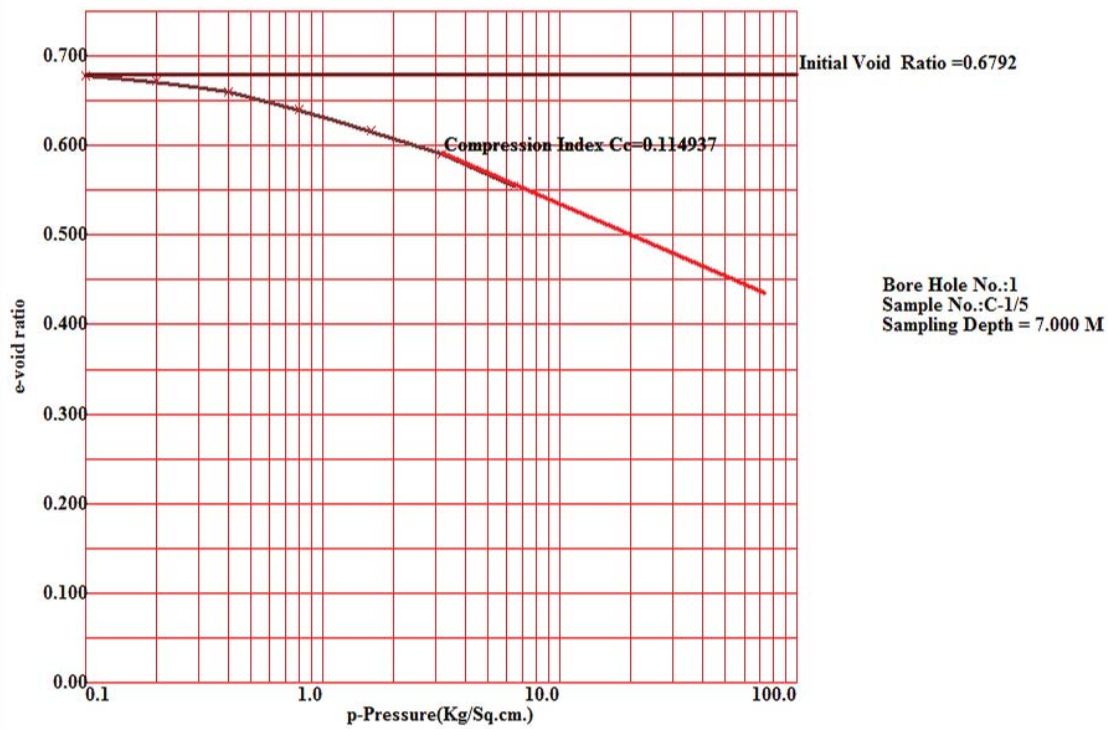
Bore Hole No.= 1
 Sample No.= C-1/5
 Depth= 7.000000M
 Type of Test= U.U.

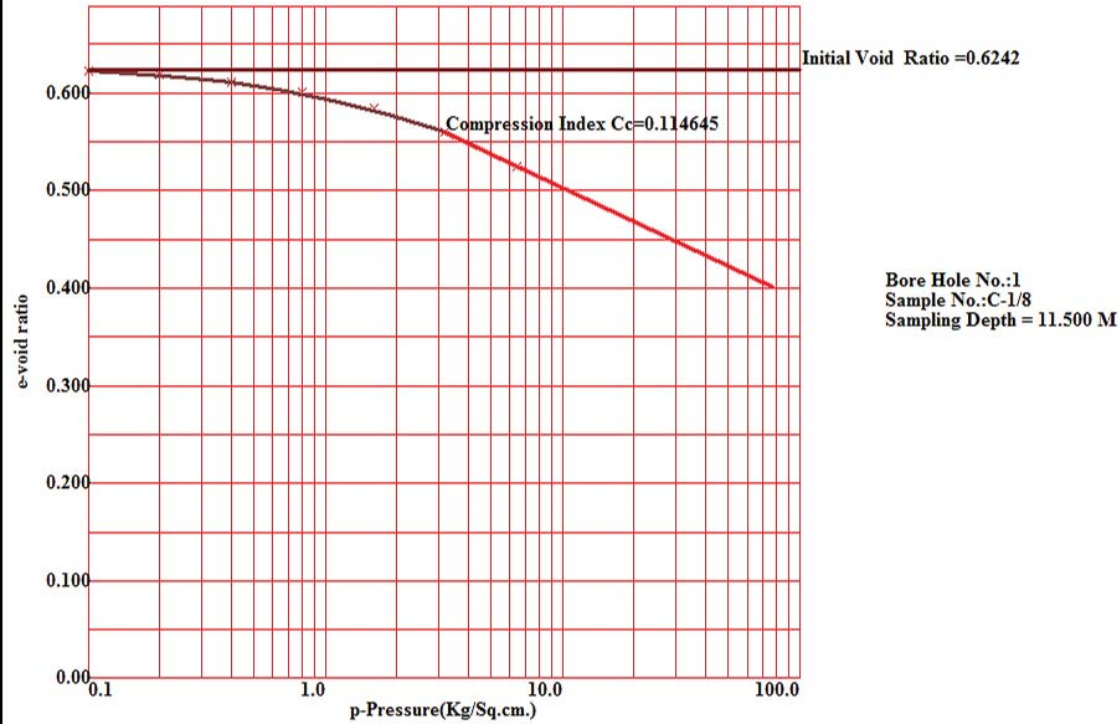


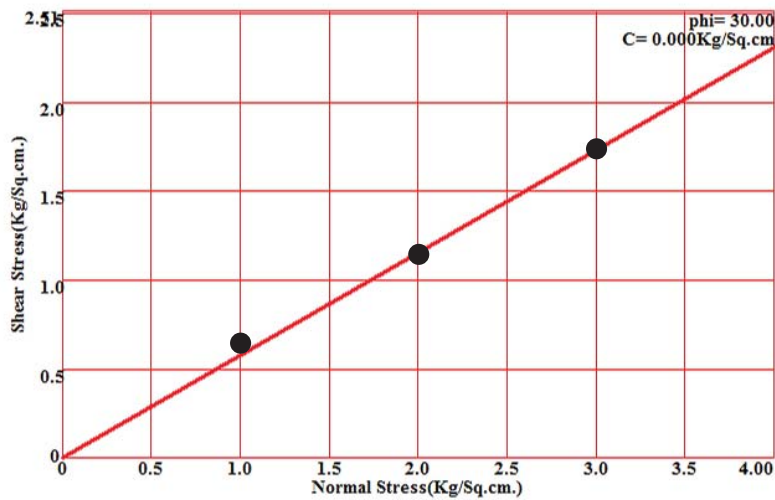
Bore Hole No.= 1
 Sample No.= C-1/6
 Depth= 8.500000M
 Type of Test= U.U.



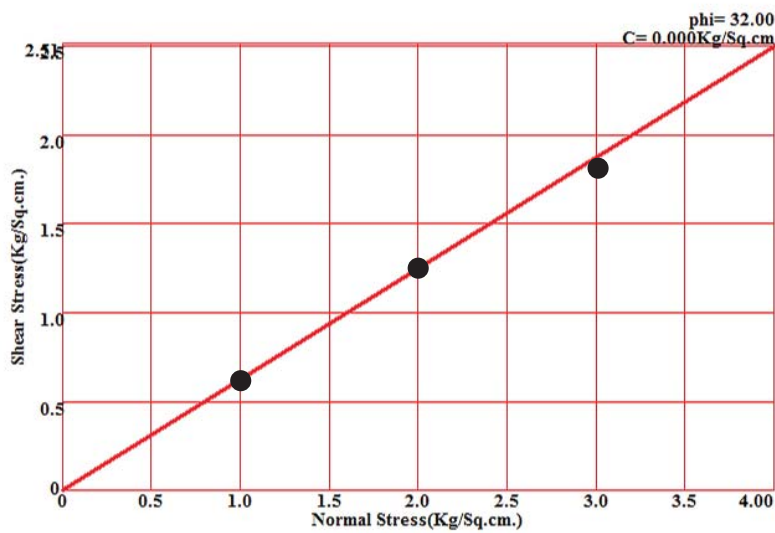
Bore Hole No.= 1
 Sample No.= C-1/8
 Depth= 11.500000M
 Type of Test= U.U.



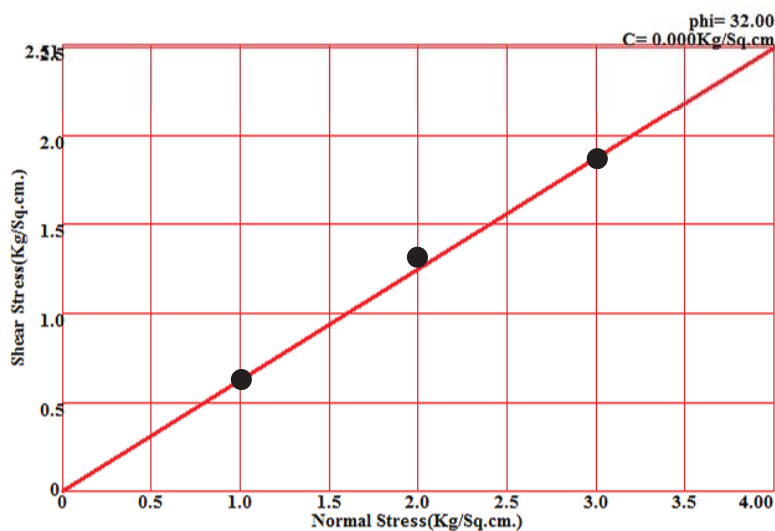




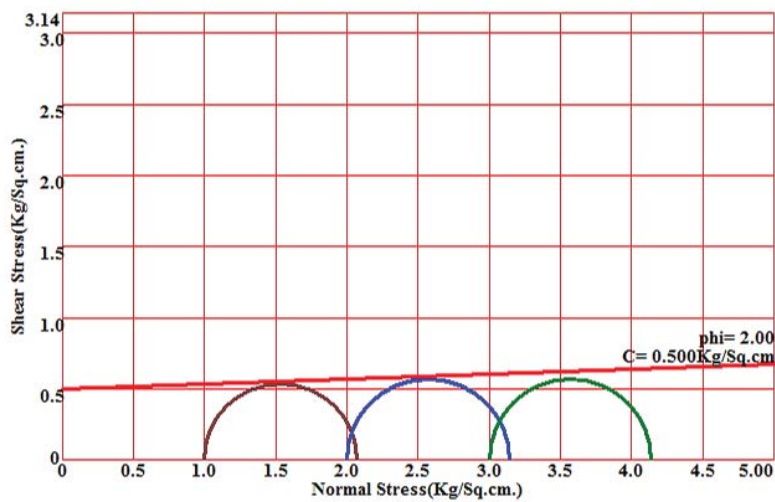
Bore Hole No.= 1
Sample No.= D-1/1
Depth= 1.000000M
Type of Test= C.D.



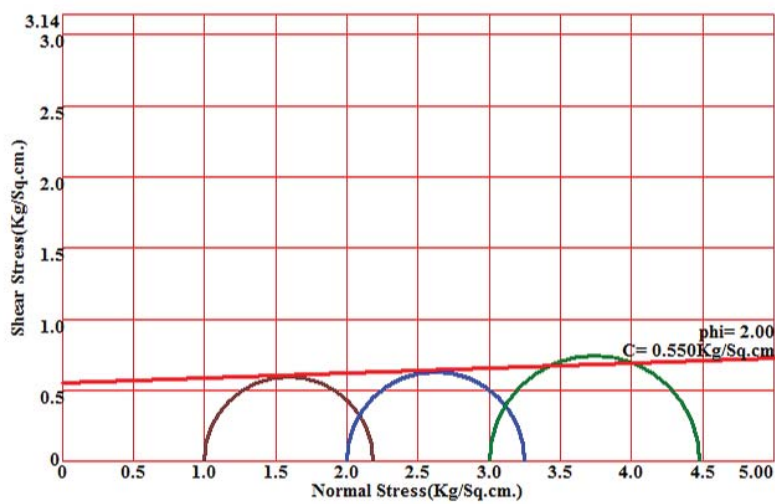
Bore Hole No.= 1
Sample No.= D-1/3
Depth= 4.000000M
Type of Test= C.D.



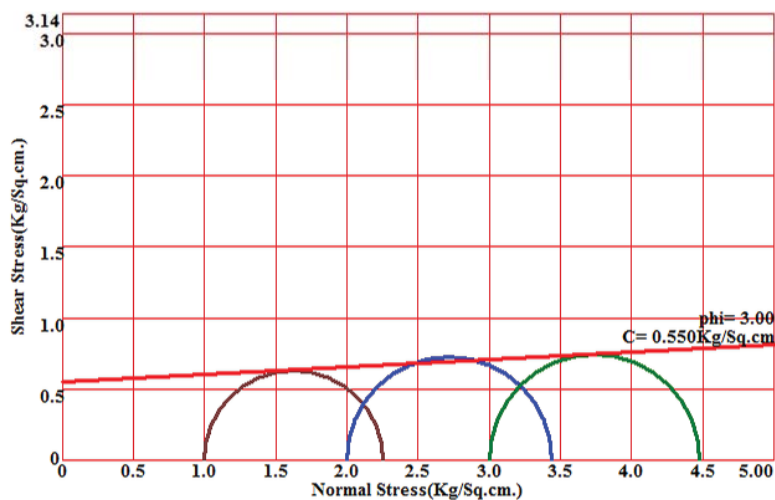
Bore Hole No.= 1
Sample No.= D-1/5
Depth= 7.000000M
Type of Test= C.D.



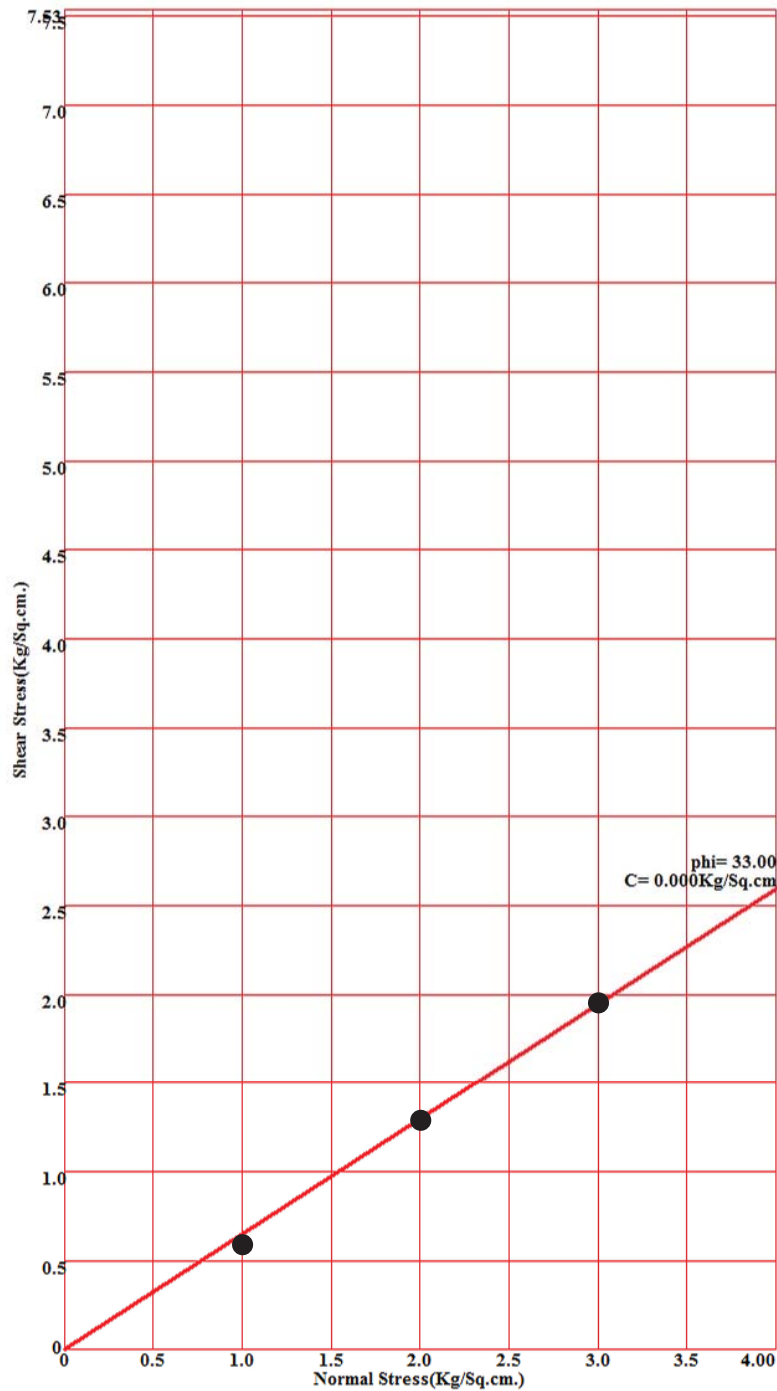
Bore Hole No.= 1
Sample No.= D-1/7
Depth= 10.000000M
Type of Test= U.U.



Bore Hole No.= 1
Sample No.= D-1/9
Depth= 13.000000M
Type of Test= U.U.



Bore Hole No.= 1
Sample No.= D-1/11
Depth= 16.000000M
Type of Test= U.U.



Bore Hole No.= 1
Sample No.= D-1/14
Depth= 20.500000M
Type of Test= C.D.

SITE PHOTOGRAPHS





Latitude: 12.95124
Longitude: 74.809224
Elevation: 21.05±6 m
Accuracy: 4.3 m
Time: 11:02
Note: CH.46+545 BH.N.1 ROB KIOCL JUNCTION TO

Powered by NotCam



Latitude: 12.95454
Longitude: 74.80893
Elevation: 19.23±12 m
Accuracy: 8.2 m
Time: 12:44

Note: CH.46+210 BH.N.1 ROB KIOCL JUNCTION TO **Powered by NSECON** NH



Latitude: 12.936309
Longitude: 74.819033
Elevation: 28.97±12 m
Accuracy: 7.0 m
Time: 15:39

Note: CH.47+500 BH.N.1 ROB KIDOL JUNCTION TO **Powered by NoteCam**