Subject: Construction of Onshore Facilities at 08 Locations in West Bengal under JMVP-II.

Reference: IN-IWAI-411477-CW-RFB-2

CPP Portal Tender no: 2024_IWAWB_805971_1

Amendment – 2

Amendment triggered due to pre-bid responses.

S. No.	Bid document Section, Clause	As per Bidding Documents	Amended
1	Scope of work, point no 4.3 (g), page no 33	The major structural & MEP designs & drawings along with soil test reports are also attached with the tender documents. The successful bidder is required to execute the works as per the drawings.	Scope of work, point no 4.3 (g), page no 33 may be read as: "The major structural & MEP designs & drawings along with soil test reports are also attached with the tender documents. The successful bidder is required to execute the works as per the drawings. The Soil Test Reports of 8 locations are attached as Annexure-A"
2	Clause no 1 at page no 5	The Approximate value of Works (Rs.): Rs 6,99,95,739.00.	Clause no 1 at page no 5 may be read as: "The Approximate value of Works (Rs.): Rs 6,99,95,739.00 exclusive of GST".
All other terms and conditions shall remain unaltered			

Annexure-A

VMT
GEOTECH & MATERIAL TESTING

TC-8969

REPORT NO. – VMT 129 B/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT NARKALBARI IN WEST BENGAL

Prepared By -

VIVEK MATERIAL TESTING LABORATORY

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ACKNOWLEDGEMENT

WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 14/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	**Site**	**Borehole Nos.**	**Coordinates**		**Depth below existing ground level (m)**
			Latitude	**Longitude**	
1.	NARKALBARI	BH-01 (LHS)	23.8398374	88.2166931	10.0
2.		BH-02 (LHS)	23.83998184	88.21707834	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'CI' group of IS classification (clayey soil) having 79 to 99 percent material finer than 75 micron and coarse-grained soils (sandy soil) comprise of 'ML' and 'SM' group of IS classification having 49 to 61 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 2.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 2.50 metre to 7.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity,

third strata, from 7.00 metre to 8.50 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity

fourth strata, from 8.50 metre to 10.00 metre, consists of a layer of ML group of IS classification which is inorganic silts with none to low plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 4.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 4.00 metre to 8.50 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity

third strata, from 8.50 metre to 10.00 metre, consists of a layer of ML group of IS classification which is inorganic silts with none to low plasticity.

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 4 to 8 indicating 'Soft' to 'Medium' 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 12 to 14 indicating 'Medium' relative density.

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

WATER TABLE

Water Table at the Site was observed at a depth from 3.00 metre to 4.50 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 2.00 metre to 3.50 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	7.89	28.02	-
		2.00	1.20 x 1.20	8.95	27.18	-
		2.50	1.20 x 1.20	11.70	29.53	-
		1.50	2.00 x 2.00	7.36	38.24	-
		2.00	2.00 x 2.00	8.17	36.75	-
		2.50	2.00 x 2.00	10.39	39.00	-
		1.50	2.50 x 2.50	7.26	44.52	-
		2.00	2.50 x 2.50	7.97	41.03	-
		2.50	2.50 x 2.50	10.03	45.31	-
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	11.21	35.03	-
		2.00	1.20 x 1.20	12.74	33.59	-
		2.50	1.20 x 1.20	13.80	31.52	-
		1.50	2.00 x 2.00	10.57	47.18	-
		2.00	2.00 x 2.00	11.64	44.68	-
		2.50	2.00 x 2.00	12.40	41.68	-
		1.50	2.50 x 2.50	10.34	53.73	9.39
		2.00	2.50 x 2.50	11.34	49.84	-
		2.50	2.50 x 2.50	12.05	48.68	-

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

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BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	3.00		Factor of safety	2.50
				Water table used for calculation (m)	2.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.78	17.46	1.78	17.46	0.15	11	7.42	0.699	26.18	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	290.39	160.41	193.55	**77.42**
2	SQUARE	2.00	1.20	1.20	1.78	17.46	1.82	17.85	0.15	11	7.42	0.699	34.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.40	1.20	1.20	1.40	1.20	1.20	1.00	1.00	1.00	328.98	181.84	219.36	**87.74**
3	SQUARE	2.50	1.20	1.20	1.78	15.50	1.82	15.89	0.20	10	6.74	0.688	38.74	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.50	1.25	1.25	1.50	1.25	1.25	1.00	1.00	1.00	410.93	231.07	286.83	**114.73**
4	SQUARE	1.50	2.00	2.00	1.78	17.46	1.78	17.46	0.15	11	7.42	0.699	26.18	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.18	1.09	1.09	1.18	1.09	1.09	1.00	1.00	1.00	270.85	149.53	180.47	**72.19**
5	SQUARE	2.00	2.00	2.00	1.78	17.46	1.82	17.85	0.15	11	7.42	0.699	34.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	300.43	165.98	200.26	**80.10**
6	SQUARE	2.50	2.00	2.00	1.78	15.50	1.82	15.89	0.20	10	6.74	0.688	38.74	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	365.05	205.22	254.77	**101.91**
7	SQUARE	1.50	2.50	2.50	1.78	17.46	1.78	17.46	0.15	11	7.42	0.699	26.18	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.15	1.07	1.07	1.15	1.07	1.07	1.00	1.00	1.00	267.16	147.45	177.98	**71.19**
8	SQUARE	2.00	2.50	2.50	1.78	17.46	1.82	17.85	0.15	11	7.42	0.699	34.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.19	1.10	1.10	1.19	1.10	1.10	1.00	1.00	1.00	293.20	161.94	195.41	**78.16**
9	SQUARE	2.50	2.50	2.50	1.78	15.50	1.82	15.89	0.20	10	6.74	0.688	38.74	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	352.42	198.09	245.93	**98.37**

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	77.42	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.688	0.135	0.00	39.57	29.32	-	-	28.885	-	28.02
3	3	CLAY	3.00	4.00	1.00	1.86	0.690	0.137	0.00	57.17	10.89	-	-	6.137	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	87.74	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						27.18
2	2	CLAY	2.00	3.50	1.50	1.82	0.688	0.135	0.00	47.25	33.23	-	-	27.745	-	
3	3	CLAY	3.50	4.50	1.00	1.86	0.690	0.137	0.00	63.80	12.34	-	-	6.224	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	114.73	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						29.53
2	2	CLAY	2.50	4.00	1.50	1.86	0.690	0.137	0.00	56.46	43.45	-	-	30.138	-	
3	3	CLAY	4.00	5.00	1.00	1.90	0.669	0.130	0.00	72.72	16.13	-	-	6.778	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	72.19	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.688	0.135	0.00	39.57	38.18	-	-	35.191	-	38.24
3	3	CLAY	3.00	4.50	1.50	1.86	0.690	0.137	0.00	59.28	15.99	-	-	12.608	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	80.10	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	3.50	1.50	1.82	0.688	0.135	0.00	47.25	42.37	-	-	33.349	-	36.75
3	3	CLAY	3.50	5.00	1.50	1.86	0.690	0.137	0.00	65.91	17.74	-	-	12.586	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	101.91	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						39.00
2	2	CLAY	2.50	4.00	1.50	1.86	0.690	0.137	0.00	56.46	53.90	-	-	35.393	-	
3	3	CLAY	4.00	5.50	1.50	1.90	0.669	0.130	0.00	74.93	22.57	-	-	13.360	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	71.19	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	0.000	0.000	0.00	Depth of foundation						44.52
2	2	CLAY	1.50	3.50	2.00	1.82	0.688	0.135	0.00	42.63	36.32	-	-	42.809	-	
3	3	CLAY	3.50	5.25	1.75	1.86	0.690	0.137	0.00	66.46	15.40	-	-	12.841	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	78.16	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						41.03
2	2	CLAY	2.00	4.00	2.00	1.86	0.690	0.137	0.00	51.49	39.88	-	-	40.384	-	
3	3	CLAY	4.00	5.50	1.50	1.90	0.669	0.130	0.00	73.90	17.72	-	-	10.909	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	3.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	98.37	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						45.31
2	2	CLAY	2.50	4.50	2.00	1.86	0.690	0.137	0.00	59.59	50.19	-	-	43.018	-	
3	3	CLAY	4.50	6.25	1.75	1.90	0.669	0.130	0.00	82.29	21.28	-	-	13.616	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	4.50		Factor of safety	2.50
				Water table used for calculation (m)	3.50		Assumed post monsoon rise (m)	1.00

VMT
GEOTECH & MATERIAL TESTING

Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.80	17.65	1.80	17.65	0.20	12	8.11	0.686	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.31	1.15	1.15	1.31	1.15	1.15	1.00	1.00	1.00	398.10	216.83	274.84	**109.94**
2	SQUARE	2.00	1.20	1.20	1.80	17.65	1.88	18.44	0.20	12	8.11	0.686	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.41	1.21	1.21	1.41	1.21	1.21	1.00	1.00	1.00	452.36	246.47	312.35	**124.94**
3	SQUARE	2.50	1.20	1.20	1.80	17.65	1.88	18.44	0.15	13	8.79	0.660	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.52	1.26	1.26	1.52	1.26	1.26	1.00	1.00	1.00	455.51	242.40	338.30	**135.32**
4	SQUARE	1.50	2.00	2.00	1.80	17.65	1.80	17.65	0.20	12	8.11	0.686	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	375.52	204.28	259.08	**103.63**
5	SQUARE	2.00	2.00	2.00	1.80	17.65	1.88	18.44	0.20	12	8.11	0.686	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.25	1.12	1.12	1.25	1.12	1.12	1.00	1.00	1.00	413.37	225.03	285.30	**114.12**
6	SQUARE	2.50	2.00	2.00	1.80	17.65	1.88	18.44	0.15	13	8.79	0.660	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	409.37	217.64	303.92	**121.57**
7	SQUARE	1.50	2.50	2.50	1.80	17.65	1.80	17.65	0.20	12	8.11	0.686	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.15	1.07	1.07	1.15	1.07	1.07	1.00	1.00	1.00	367.53	199.86	253.51	**101.40**
8	SQUARE	2.00	2.50	2.50	1.80	17.65	1.88	18.44	0.20	12	8.11	0.686	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	402.87	219.23	277.99	**111.20**
9	SQUARE	2.50	2.50	2.50	1.80	17.65	1.88	18.44	0.15	13	8.79	0.660	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	398.00	211.47	295.41	**118.16**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	109.94	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.88	0.660	0.130	0.00	40.31	41.63	-	-	36.195	-	35.03
3	3	CLAY	3.00	4.00	1.00	1.91	0.669	0.134	0.00	63.50	15.46	-	-	7.598	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	124.94	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						33.59
2	2	CLAY	2.00	3.50	1.50	1.88	0.660	0.130	0.00	49.13	47.31	-	-	34.409	-	
3	3	CLAY	3.50	4.50	1.00	1.91	0.669	0.134	0.00	72.33	17.57	-	-	7.583	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	135.32	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.50	4.00	1.50	1.91	0.669	0.134	0.00	60.14	51.25	-	-	32.235	-	31.52
3	3	CLAY	4.00	5.00	1.00	1.90	0.701	0.136	0.00	83.02	19.03	-	-	7.166	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	103.63	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						47.18
2	2	CLAY	1.50	3.00	1.50	1.88	0.660	0.130	0.00	40.31	54.81	-	-	43.803	-	
3	3	CLAY	3.00	4.50	1.50	1.91	0.669	0.134	0.00	68.18	22.95	-	-	15.174	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	114.12	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						44.68
2	2	CLAY	2.00	3.50	1.50	1.88	0.660	0.130	0.00	49.13	60.36	-	-	40.881	-	
3	3	CLAY	3.50	5.00	1.50	1.91	0.669	0.134	0.00	76.27	25.27	-	-	14.968	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	121.57	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						41.68
2	2	CLAY	2.50	4.00	1.50	1.91	0.669	0.134	0.00	60.14	64.30	-	-	38.032	-	
3	3	CLAY	4.00	5.50	1.50	1.90	0.701	0.136	0.00	86.83	26.92	-	-	14.067	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	101.40	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						53.73
2	2	CLAY	1.50	3.50	2.00	1.88	0.660	0.130	0.00	44.92	51.73	-	-	52.126	-	
3	3	CLAY	3.50	5.25	1.75	1.91	0.669	0.134	0.00	78.52	21.94	-	-	15.034	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	92.10	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.88	0.660	0.130	0.00	44.92	46.99	-	-	48.702	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.91	0.669	0.134	0.00	78.52	19.92	-	-	13.799	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	111.20	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.88	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.91	0.669	0.134	0.00	55.61	56.73	-	-	49.042	-	49.84
3	3	CLAY	4.00	5.50	1.50	1.90	0.701	0.136	0.00	86.97	25.22	-	-	13.260	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

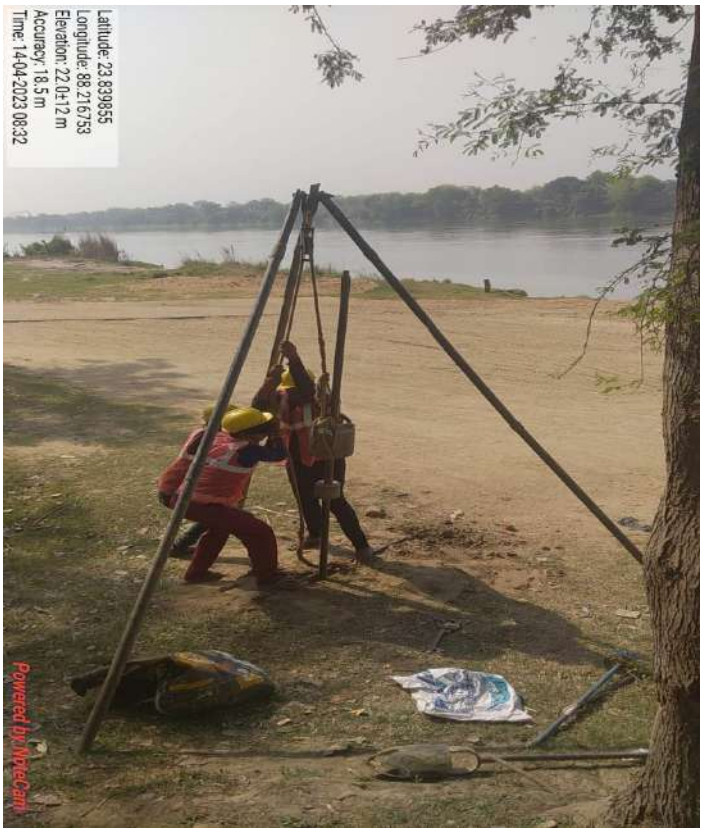
SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	118.16	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						48.68
2	2	CLAY	2.50	4.50	2.00	1.91	0.669	0.134	0.00	64.82	60.29	-	-	45.853	-	
3	3	CLAY	4.50	6.25	1.75	1.90	0.701	0.136	0.00	91.28	25.56	-	-	15.003	-	

SITE PHOTOS DURING SITE INVESTIGATION



RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**1 (L.H.S.)**		**Coordinate**		**Easting**				**Depth of Water Level**			3.00		**VIVEK MATERIAL TESTING LABORATORY**									
Total depth of Bore Hole	**10.00**				**Northing**				**Commenced on**			4/14/2023											
					Elevation		**100.000**		**Completed on**			4/14/2023											

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	100	98	90	34	22	12	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	99	33	20	13	CL				1.78	16.2	1.53	2.60	0.699	0.15	11°	0.139
1.35 - 1.80	98.650 - 98.200	SPT									4	5.49	5.49								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	99	36	18	18	CI				1.82	18.4	1.54	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									5	7.19	7.19								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	98	37	20	17	CI				1.86	20.1	1.55	2.62	0.690	0.20	10°	0.137
4.35 - 4.80	95.650 - 95.200	SPT									5	6.52	6.52								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	98	39	25	14	CI				1.90	21.2	1.57	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									8	9.63	9.63								
7.00 - 7.35	93.000 - 92.650	UD	100	100	98	49	NON PLASTIC			SM				1.87	22.3	1.53	2.58	0.686	0	29°	-
7.35 - 7.80	92.650 - 92.200	SPT									12	13.57	13.57								
8.50 - 8.85	91.500 - 91.150	UD	100	100	99	61	NON PLASTIC			ML				1.86	20.7	1.54	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									14	14.99	14.99								
9.30 - 10.00	90.700 - 90.000	DS	100	100	99	54	NON PLASTIC			ML					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**2 (L.H.S.)**		**Coordinate**		**Easting**				**Depth of Water Level**			4.50		**VIVEK MATERIAL TESTING LABORATORY**										
Total depth of Bore Hole	**10.00**				**Northing**				**Commenced on**			4/14/2023												
					Elevation		**100.000**		**Completed on**			4/14/2023												

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	100	100	99	79	30	16	14	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	97	32	22	10	CL				1.80	15.6	1.56	2.63	0.686	0.20	12°	0.138
1.35 - 1.80	98.650 - 98.200	SPT									5	6.84	6.84								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	99	34	21	13	CL				1.88	18.4	1.59	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									7	8.11	8.11								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	98	38	22	16	CI				1.91	21.8	1.57	2.62	0.669	0.25	9°	0.134
4.35 - 4.80	95.650 - 95.200	SPT									6	7.71	7.71								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	99	39	26	13	CI				1.90	23.1	1.54	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									5	5.96	5.96								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	99	40	20	20	CI				1.99	24.2	1.60	2.65	0.656	0.15	12°	0.132
7.35 - 7.80	92.650 - 92.200	SPT									8	8.89	8.89								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	60	NON PLASTIC			ML				1.87	23.3	1.52	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									13	13.71	13.71								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	54	NON PLASTIC			ML					-	-	-	-	-	-	-

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

WATER TABLE 3.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			1	2	2	4	
2.50-2.85	SILTY-CLAY	U.D.	CI						
2.85-3.30		S.P.T.			2	2	3	5	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			2	2	3	5	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			2	3	5	8	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			3	5	7	12	
8.50-8.85	SANDY-SILT	U.D.	ML						
8.85-9.30		S.P.T.			5	6	8	14	
9.30-10.00	SANDY-SILT	D.	ML						

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

WATER TABLE 4.50 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			1	2	3	5	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			2	3	4	7	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			2	2	4	6	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			2	2	3	5	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			3	4	4	8	
8.50-8.85	SANDY-SILT	U.D.	ML						
8.85-9.30		S.P.T.			5	6	7	13	
9.30-10.00	SANDY-SILT	D.	ML						

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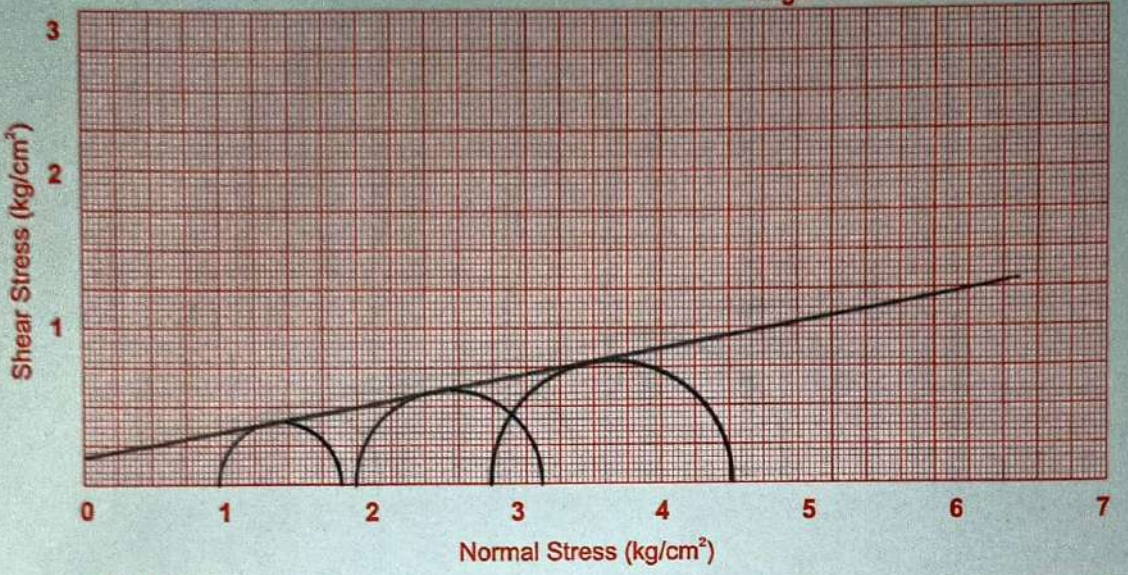
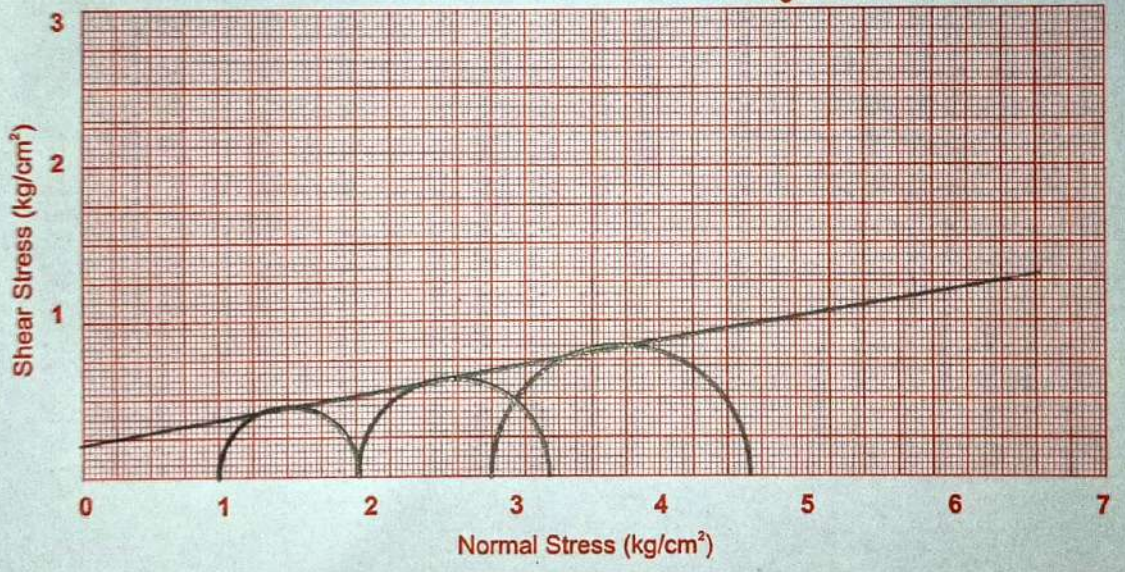
B.H. No. :- 01
Depth -1.00-1.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 11° *



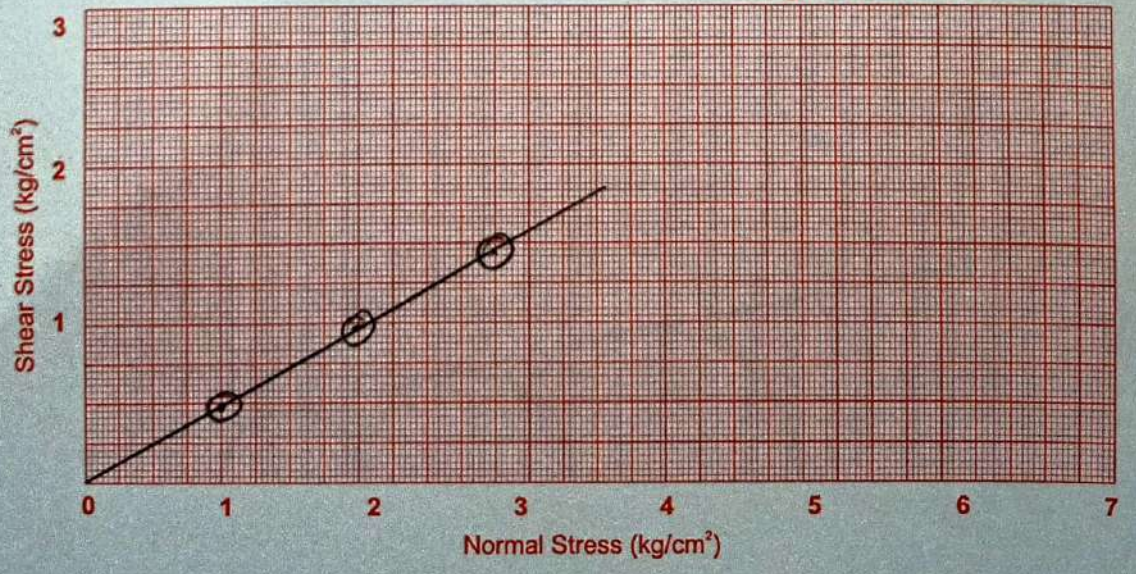
B.H. No. :- 01
Depth :- 4.00-4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 10° *



B.H. No. :- 01
Depth :- 7.00-7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 29° *



VMT/129B/23-24

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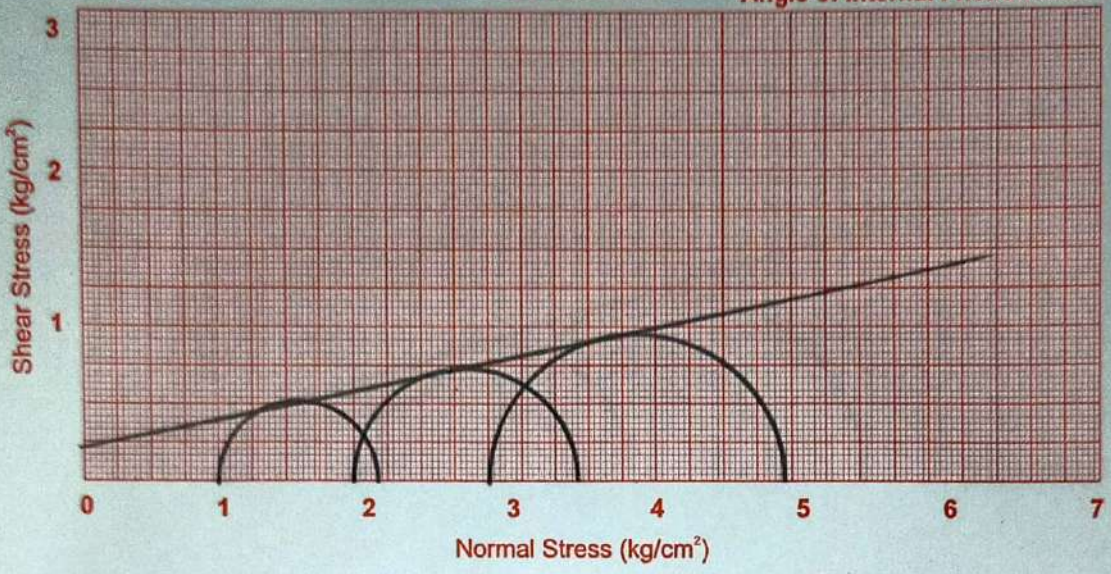
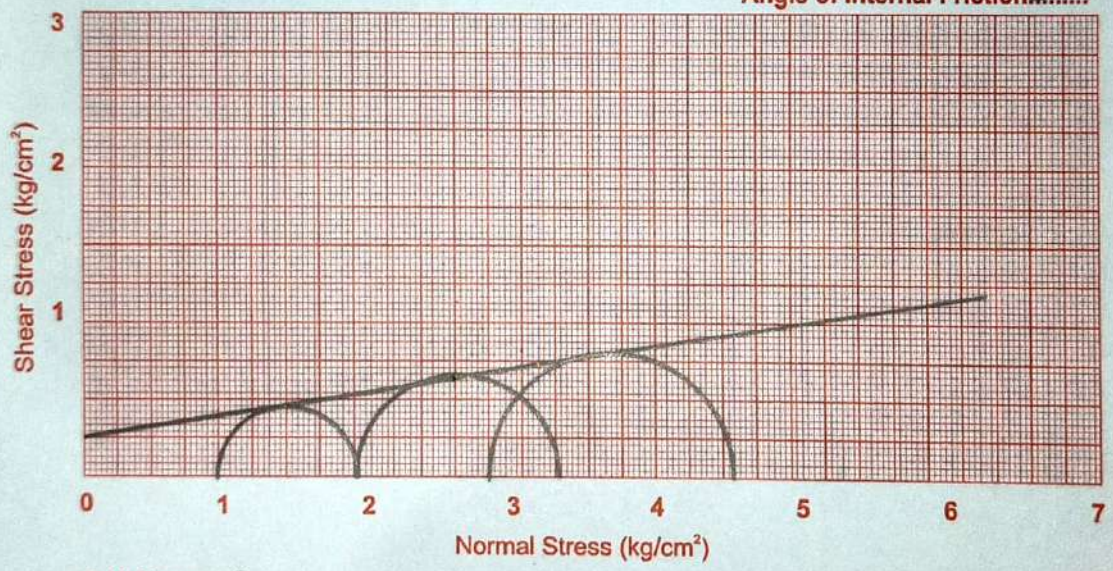
B.H. No. :- 02
Depth - 1.00-1.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 12° *



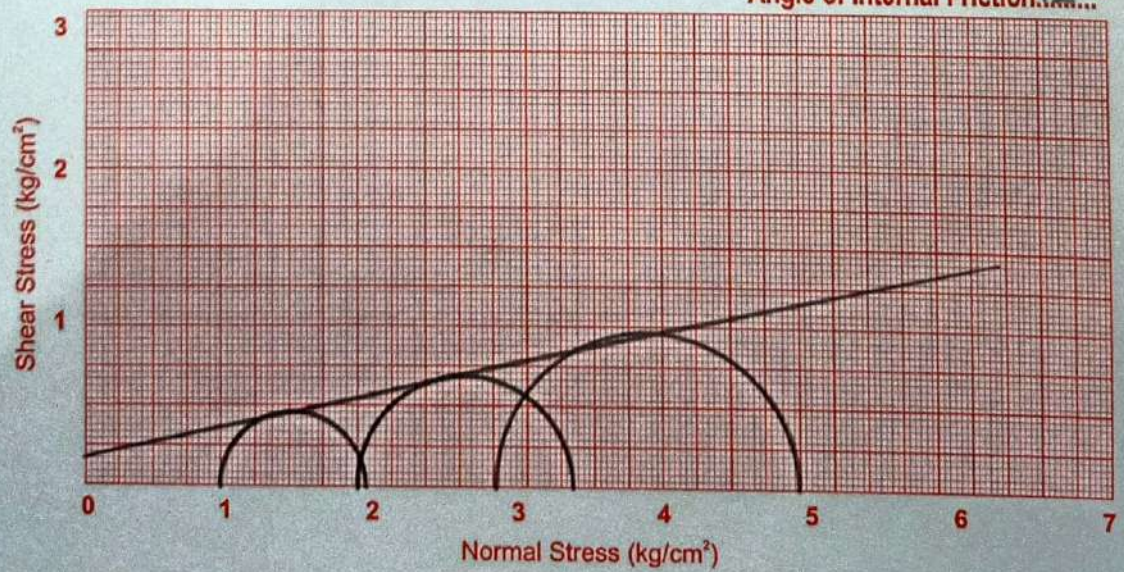
B.H. No. :- 02
Depth :- 4.00-4.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 9° *



B.H. No. :- 02
Depth :- 7.00-7.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 12° *



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TC-8969

REPORT NO. – VMT 129 A/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT MAGANPARA IN WEST BENGAL

Prepared By -

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ACKNOWLEDGEMENT

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THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 13/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	MAGANPARA	BH-01 (RHS)	23.83807188	88.21512401	10.0
2.		BH-02 (RHS)	23.83845431	88.21508244	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' group of IS classification (clayey soil) having 95 to 99 percent material finer than 75 micron and coarse-grained soils (sandy soil) comprise of 'SM' group of IS classification having 31 to 49 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 7.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 7.00 metre to 10.00 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 2.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 2.50 metre to 10.00 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity.

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 5 to 8 indicating 'Medium' 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 9 to 19 indicating 'Loose' to 'Medium' relative density.

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

WATER TABLE

Water Table at the Site was observed at a depth from 1.30 metre to 5.40 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 0.30 metre to 4.40 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	9.95	32.09
		2.00	1.20 x 1.20	11.51	31.10
		2.50	1.20 x 1.20	11.98	27.42
		1.50	2.00 x 2.00	9.47	43.50
		2.00	2.00 x 2.00	10.70	41.75
		2.50	2.00 x 2.00	11.09	37.11
		1.50	2.50 x 2.50	9.44	48.39
		2.00	2.50 x 2.50	10.53	45.63
		2.50	2.50 x 2.50	10.80	42.74
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	7.92	12.43
		2.00	1.20 x 1.20	9.07	14.23
		2.50	1.20 x 1.20	8.36	11.36
		1.50	2.00 x 2.00	7.48	19.98
		2.00	2.00 x 2.00	8.38	22.38
		2.50	2.00 x 2.00	8.19	18.92
		1.50	2.50 x 2.50	7.44	20.27
		2.00	2.50 x 2.50	8.26	19.72
		2.50	2.50 x 2.50	8.31	19.58

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	5.40		Factor of safety	2.50
				Water table used for calculation (m)	4.40		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.83	17.95	1.83	17.95	0.15	13	8.79	0.679	26.92	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	349.63	185.84	243.99	**97.60**
2	SQUARE	2.00	1.20	1.20	1.83	17.95	1.85	18.14	0.15	13	8.79	0.679	35.89	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.42	1.21	1.21	1.42	1.21	1.21	1.00	1.00	1.00	404.40	215.07	282.28	**112.91**
3	SQUARE	2.50	1.20	1.20	1.83	17.95	1.85	18.14	0.10	16	10.88	0.712	44.87	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.55	1.28	1.28	1.55	1.28	1.28	1.00	1.00	1.00	494.51	246.64	293.74	**117.50**
4	SQUARE	1.50	2.00	2.00	1.83	17.95	1.83	17.95	0.15	13	8.79	0.679	26.92	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	333.20	176.74	232.28	**92.91**
5	SQUARE	2.00	2.00	2.00	1.83	17.95	1.85	18.14	0.15	13	8.79	0.679	35.89	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	376.33	199.75	262.44	**104.98**
6	SQUARE	2.50	2.00	2.00	1.83	17.95	1.85	18.14	0.10	16	10.88	0.712	44.87	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.33	1.17	1.17	1.33	1.17	1.17	1.00	1.00	1.00	458.60	227.97	271.79	**108.72**
7	SQUARE	1.50	2.50	2.50	1.83	17.95	1.83	17.95	0.15	13	8.79	0.679	26.92	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.15	1.08	1.08	1.15	1.08	1.08	1.00	1.00	1.00	332.34	176.06	231.54	**92.62**
8	SQUARE	2.00	2.50	2.50	1.83	17.95	1.85	18.14	0.15	13	8.79	0.679	35.89	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	370.27	196.33	258.08	**103.23**
9	SQUARE	2.50	2.50	2.50	1.83	17.95	1.85	18.14	0.10	16	10.88	0.712	44.87	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.27	1.13	1.13	1.27	1.13	1.13	1.00	1.00	1.00	447.04	221.99	264.75	**105.90**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	97.60	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.85	0.712	0.136	0.00	40.53	36.96	-	-	33.542	-	32.09
3	3	CLAY	3.00	4.00	1.00	1.91	0.682	0.130	0.00	63.50	13.73	-	-	6.568	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	112.91	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	3.50	1.50	1.85	0.712	0.136	0.00	49.50	42.76	-	-	32.220	-	31.10
3	3	CLAY	3.50	4.50	1.00	1.91	0.682	0.130	0.00	72.47	15.88	-	-	6.649	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	117.50	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.85	0.000	0.000	0.00	Depth of foundation						27.42
2	2	CLAY	2.50	4.00	1.50	1.91	0.682	0.130	0.00	59.41	44.50	-	-	28.148	-	
3	3	CLAY	4.00	5.00	1.00	1.94	0.660	0.129	0.00	82.97	16.52	-	-	6.130	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	92.91	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.85	0.712	0.136	0.00	40.53	49.14	-	-	41.098	-	43.50
3	3	CLAY	3.00	4.50	1.50	1.91	0.682	0.130	0.00	68.18	20.58	-	-	13.278	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	104.98	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						41.75
2	2	CLAY	2.00	3.50	1.50	1.85	0.712	0.136	0.00	49.50	55.53	-	-	38.928	-	
3	3	CLAY	3.50	5.00	1.50	1.91	0.682	0.130	0.00	77.16	23.25	-	-	13.261	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	108.72	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.85	0.000	0.000	0.00	Depth of foundation						37.11
2	2	CLAY	2.50	4.00	1.50	1.91	0.682	0.130	0.00	59.41	57.50	-	-	34.087	-	
3	3	CLAY	4.00	5.50	1.50	1.94	0.660	0.129	0.00	87.59	24.08	-	-	12.294	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	92.62	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.85	0.000	0.000	0.00	Depth of foundation						48.39
2	2	CLAY	1.50	3.50	2.00	1.91	0.682	0.130	0.00	45.95	47.26	-	-	47.482	-	
3	3	CLAY	3.50	5.25	1.75	1.94	0.660	0.129	0.00	81.32	20.04	-	-	13.008	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	103.23	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.85	0.000	0.000	0.00	Depth of foundation						45.63
2	2	CLAY	2.00	4.00	2.00	1.91	0.682	0.130	0.00	55.02	52.67	-	-	45.084	-	
3	3	CLAY	4.00	5.50	1.50	1.94	0.660	0.129	0.00	87.88	23.41	-	-	11.954	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	5.40	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	105.90	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.85	0.000	0.000	0.00	Depth of foundation						42.74
2	2	CLAY	2.50	4.50	2.00	1.91	0.682	0.130	0.00	64.09	54.03	-	-	41.047	-	
3	3	CLAY	4.50	6.25	1.75	1.94	0.660	0.129	0.00	98.30	22.91	-	-	12.373	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	1.30		Factor of safety	2.50
				Water table used for calculation (m)	0.30		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																	Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.83	10.10	1.83	10.10	0.10	17	11.58	0.695	15.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.34	1.17	1.17	1.34	1.17	1.17	1.00	1.00	1.00	308.63	150.94	194.30	**77.72**
2	SQUARE	2.00	1.20	1.20	1.83	9.61	1.78	9.12	0.10	17	11.58	0.695	19.22	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.45	1.23	1.23	1.45	1.23	1.23	1.00	1.00	1.00	353.09	172.82	222.39	**88.96**
3	SQUARE	2.50	1.20	1.20	1.83	9.32	1.78	8.83	0.00	26	18.10	0.735	23.29	22.25	11.85	12.53	13.19	5.31	4.12	1.30	1.20	0.80	1.67	1.33	1.33	1.67	1.33	1.33	1.00	1.00	1.00	473.15	183.17	204.92	**81.97**
4	SQUARE	1.50	2.00	2.00	1.83	10.10	1.83	10.10	0.10	17	11.58	0.695	15.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	291.91	142.29	183.44	**73.38**
5	SQUARE	2.00	2.00	2.00	1.83	9.61	1.78	9.12	0.10	17	11.58	0.695	19.22	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.27	1.14	1.14	1.27	1.14	1.14	1.00	1.00	1.00	326.87	159.50	205.53	**82.21**
6	SQUARE	2.50	2.00	2.00	1.83	9.32	1.78	8.83	0.00	26	18.10	0.735	23.29	22.25	11.85	12.53	13.19	5.31	4.12	1.30	1.20	0.80	1.40	1.20	1.20	1.40	1.20	1.20	1.00	1.00	1.00	468.90	179.08	200.82	**80.33**
7	SQUARE	1.50	2.50	2.50	1.83	10.10	1.83	10.10	0.10	17	11.58	0.695	15.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.16	1.08	1.08	1.16	1.08	1.08	1.00	1.00	1.00	290.59	141.36	182.40	**72.96**
8	SQUARE	2.00	2.50	2.50	1.83	9.61	1.78	9.12	0.10	17	11.58	0.695	19.22	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.22	1.11	1.11	1.22	1.11	1.11	1.00	1.00	1.00	322.50	157.08	202.57	**81.03**
9	SQUARE	2.50	2.50	2.50	1.83	9.32	1.78	8.83	0.00	26	18.10	0.735	23.29	22.25	11.85	12.53	13.19	5.31	4.12	1.30	1.20	0.80	1.32	1.16	1.16	1.32	1.16	1.16	1.00	1.00	1.00	478.64	181.45	203.74	**81.50**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	77.72	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						
2	2	SAND	1.50	3.00	1.50	1.78	0.000	0.000	12.92	30.70	29.43	0.199	0.500	-	11.727	12.43
3	3	SAND	3.00	4.00	1.00	1.86	0.000	0.000	14.33	40.65	10.93	0.174	0.500	-	3.813	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	88.96	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						14.23
2	2	SAND	2.00	3.50	1.50	1.78	0.000	0.000	12.92	34.77	33.69	0.199	0.500	-	13.423	
3	3	SAND	3.50	4.50	1.00	1.86	0.000	0.000	14.33	44.72	12.51	0.174	0.500	-	4.364	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	81.97	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	SAND	0.00	2.50	2.50	1.78	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	2.50	4.00	1.50	1.86	0.000	0.000	14.33	38.20	31.04	0.174	0.500	-	10.829	11.36
3	3	SAND	4.00	5.00	1.00	1.89	0.000	0.000	16.54	48.89	11.53	0.146	0.500	-	3.365	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	73.38	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						
2	2	SAND	1.50	3.00	1.50	1.78	0.000	0.000	12.92	30.70	38.81	0.235	0.500	-	18.271	19.98
3	3	SAND	3.00	4.50	1.50	1.86	0.000	0.000	14.33	42.76	16.25	0.206	0.500	-	6.698	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	82.21	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	2.00	3.50	1.50	1.78	0.000	0.000	12.92	34.77	43.48	0.235	0.500	-	20.470	22.38
3	3	SAND	3.50	5.00	1.50	1.86	0.000	0.000	14.33	46.83	18.21	0.206	0.500	-	7.504	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	80.33	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	SAND	0.00	2.50	2.50	1.78	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	2.50	4.00	1.50	1.86	0.000	0.000	14.33	38.20	42.49	0.206	0.500	-	17.513	18.92
3	3	SAND	4.00	5.50	1.50	1.89	0.000	0.000	16.54	51.07	17.79	0.172	0.500	-	6.136	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	72.96	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	1.50	3.50	2.00	1.78	0.000	0.000	12.92	32.61	37.22	0.248	0.500	-	18.475	20.27
3	3	SAND	3.50	5.25	1.75	1.86	0.000	0.000	14.33	47.64	15.78	0.217	0.500	-	6.859	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	81.03	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	SAND	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	2.00	4.00	2.00	1.86	0.000	0.000	14.33	36.48	41.34	0.217	0.500	-	17.965	19.72
3	3	SAND	4.00	5.50	1.50	1.89	0.000	0.000	16.54	51.46	18.37	0.182	0.500	-	6.681	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	1.30	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	81.50	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	SAND	0.00	2.50	2.50	1.78	0.000	0.000	0.00	Depth of foundation						
2	2	SAND	2.50	4.50	2.00	1.86	0.000	0.000	14.33	40.31	41.58	0.217	0.500	-	18.069	19.58
3	3	SAND	4.50	6.25	1.75	1.89	0.000	0.000	16.54	56.38	17.63	0.182	0.500	-	6.411	

SITE PHOTOS DURING SITE INVESTIGATION

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**1 (R.H.S.)**		**Coordinate**		**Easting**				**Depth of Water Level**			5.40		**VIVEK MATERIAL TESTING LABORATORY**									
Total depth of Bore Hole	**10.00**				**Northing**				**Commenced on**			4/13/2023											
					Elevation		**100.000**		**Completed on**			4/13/2023											
Depth of Bore Hole	**Reduced Level**		**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**		
				4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**			
metre	**metre**			**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**	
1	**2**		**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	
0.00 - 0.50	100.000 - 99.500		DS	98	98	97	95	29	21	8	CL					-	-	-	-	-	-	-	
1.00 - 1.35	99.000 - 98.650		UD	100	100	99	98	30	20	10	CL				1.83	17.3	1.56	2.62	0.679	0.15	13°	0.134	
1.35 - 1.80	98.650 - 98.200		SPT									6	8.18	8.18									
2.50 - 2.85	97.500 - 97.150		UD	100	100	100	98	32	21	11	CL				1.85	20.8	1.53	-	-	-	-	-	
2.85 - 3.30	97.150 - 96.700		SPT									5	5.80	5.80									
4.00 - 4.35	96.000 - 95.650		UD	100	100	100	99	28	20	8	CL				1.91	21.4	1.57	2.64	0.682	0.20	14°	0.130	
4.35 - 4.80	95.650 - 95.200		SPT									7	7.21	7.21									
5.50 - 5.85	94.500 - 94.150		UD	100	100	100	99	31	20	11	CL				1.94	22.3	1.59	-	-	-	-	-	
5.85 - 6.30	94.150 - 93.700		SPT									8	9.51	9.51									
7.00 - 7.35	93.000 - 92.650		UD	100	100	100	33	NON PLASTIC			SM				1.88	23.1	1.53	2.58	0.686	0	28°	-	
7.35 - 7.80	92.650 - 92.200		SPT									13	14.52	14.52									
8.50 - 8.85	91.500 - 91.150		UD	100	100	100	31	NON PLASTIC			SM				1.89	21.1	1.56	-	-	-	-	-	
8.85 - 9.30	91.150 - 90.700		SPT									15	15.87	15.44									
9.30 - 10.00	90.700 - 90.000		DS	100	100	99	31	NON PLASTIC			SM					-	-	-	-	-	-	-	

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**2 (R.H.S.)**		**Coordinate**		**Easting**				**Depth of Water Level**			1.30		**VIVEK MATERIAL TESTING LABORATORY**									
Total depth of Bore Hole	**10.00**				**Northing**				**Commenced on**			4/13/2023											
					Elevation		**100.000**		**Completed on**			4/13/2023											

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	100	100	95	28	18	10	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	96	31	20	11	CL				1.83	18.6	1.54	2.61	0.695	0.10	17°	0.136
1.35 - 1.80	98.650 - 98.200	SPT									5	8.15	8.15								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	38	NON PLASTIC			SM				1.78	21.3	1.47	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									9	12.92	12.92								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	41	NON PLASTIC			SM				1.86	23.2	1.51	2.57	0.702	0	27°	-
4.35 - 4.80	95.650 - 95.200	SPT									11	14.33	14.33								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	35	NON PLASTIC			SM				1.89	22.1	1.55	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									15	18.07	16.54								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	49	NON PLASTIC			SM				1.91	20.7	1.58	2.56	0.620	0	30°	-
7.35 - 7.80	92.650 - 92.200	SPT									17	19.18	17.09								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	44	NON PLASTIC			SM				1.89	18.3	1.60	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									19	20.27	17.64								
9.30 - 10.00	90.700 - 90.000	DS	100	100	99	38	NON PLASTIC			SM					-	-	-	-	-	-	-

BORE-LOG CHART

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NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

WATER TABLE 5.40 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	3	3	6	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			2	2	3	5	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			2	3	4	7	
5.50-5.85	SILTY-CLAY	U.D.	CL						
5.85-6.30		S.P.T.			3	3	5	8	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			4	6	7	13	
8.50-8.85	SILTY-SAND	U.D.	SM						
8.85-9.30		S.P.T.			5	7	8	15	
9.30-10.00	SILTY-SAND	D.	SM						

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NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GARDUARA FERRY GHAT IN WEST BENGAL

WATER TABLE 1.30 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	2	3	5	
2.50-2.85	SILTY-SAND	U.D.	SM						
2.85-3.30		S.P.T.			3	3	6	9	
4.00-4.35	SILTY-SAND	U.D.	SM						
4.35-4.80		S.P.T.			4	5	6	11	
5.50-5.85	SILTY-SAND	U.D.	SM						
5.85-6.30		S.P.T.			5	7	8	15	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			6	8	9	17	
8.50-8.85	SILTY-SAND	U.D.	SM						
8.85-9.30		S.P.T.			7	9	10	19	
9.30-10.00	SILTY-SAND	D.	SM						

VMT/129/A/23-24

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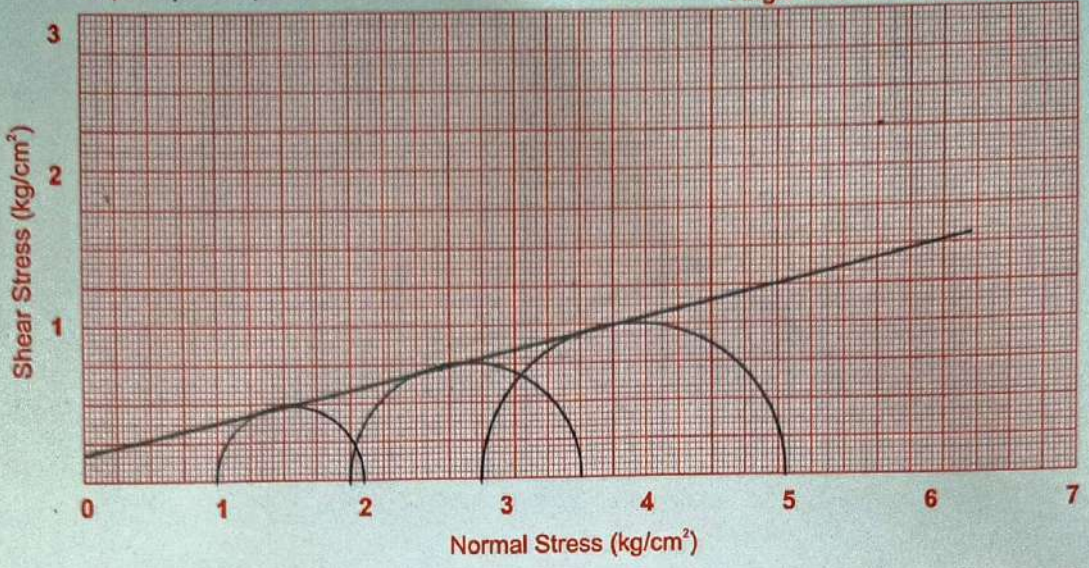
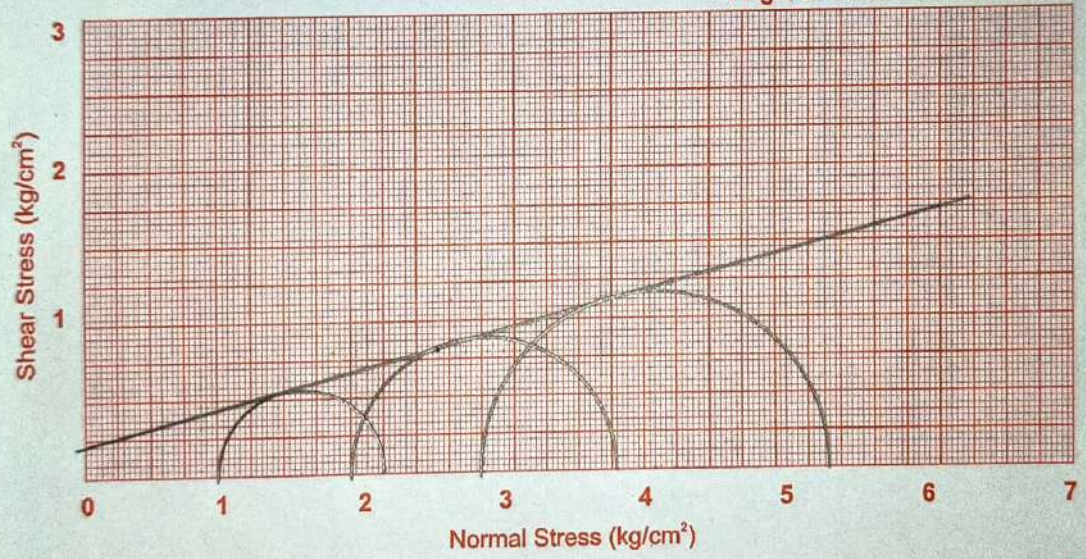
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 13° *



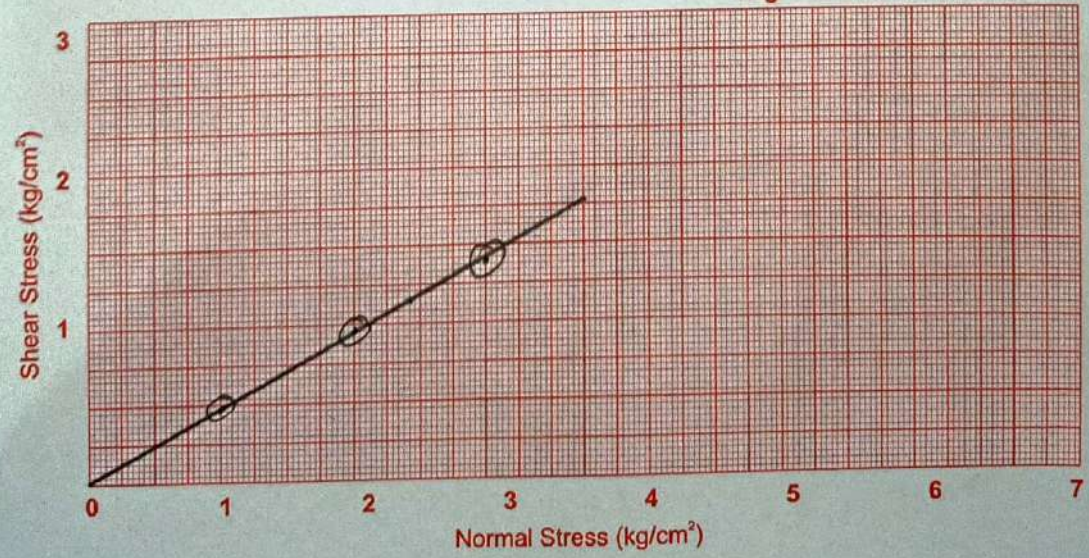
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 14° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 28° *



VMT/129A/23-24

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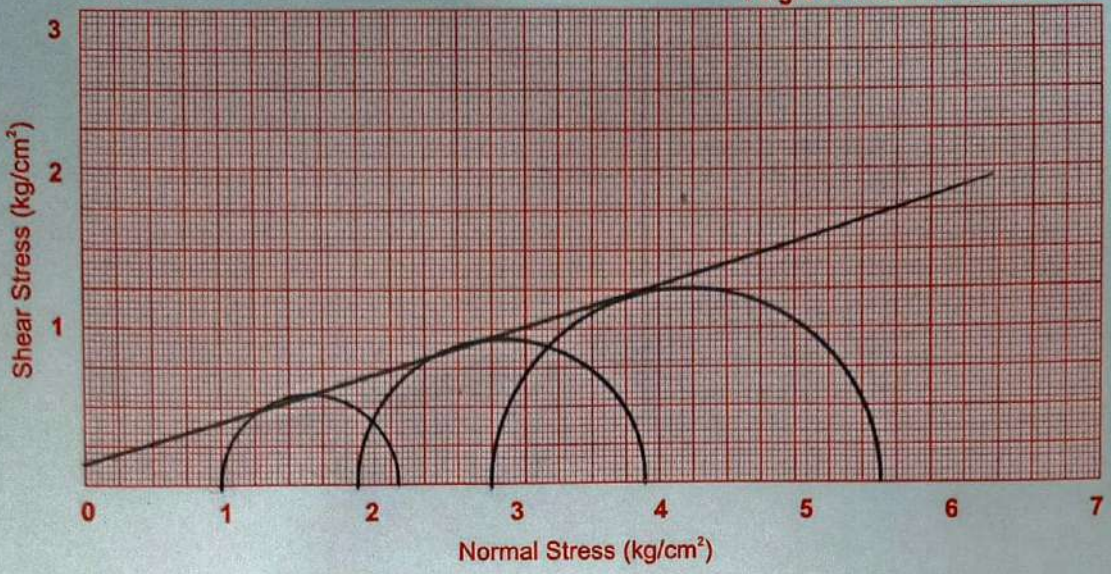
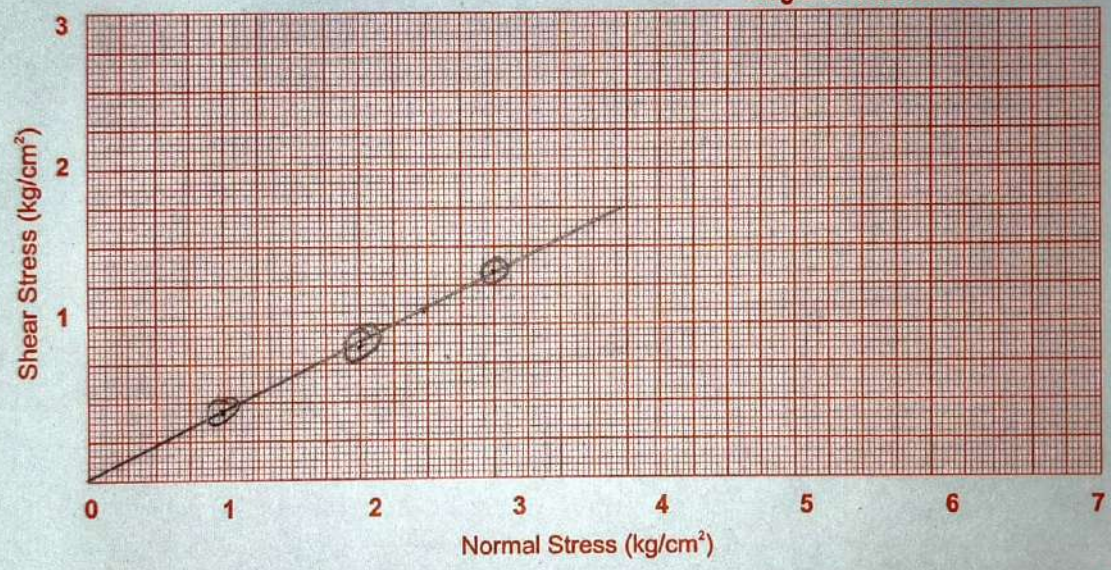
B.H. No. :- 02
Depth - 1.00 - 1.35

Cohesion 'c' 0.10 Kg/cm²
Angle of Internal Friction 17° *



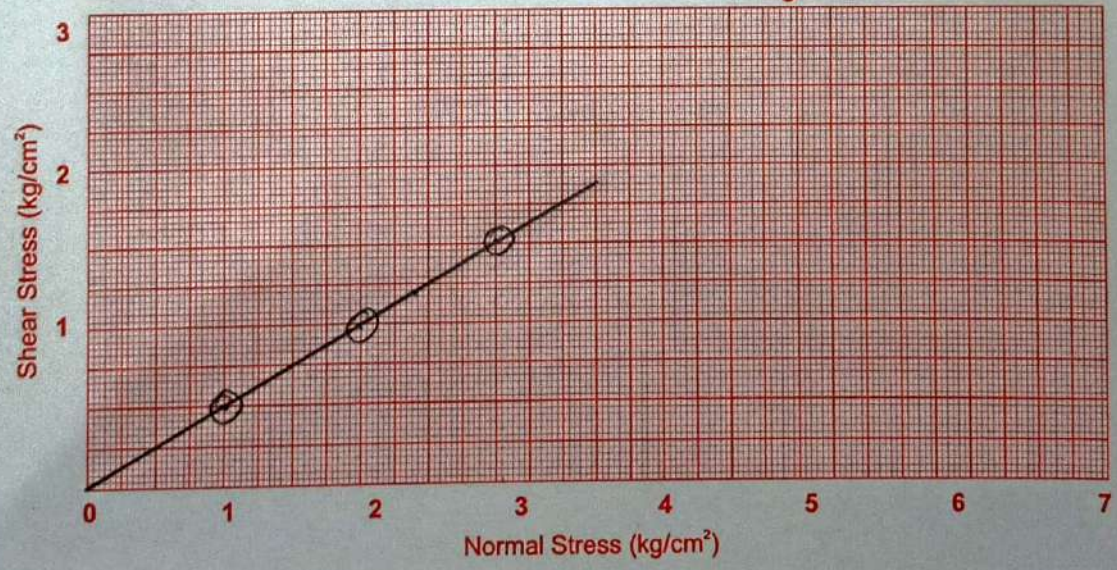
B.H. No. :- 02
Depth :- 4.00 - 4.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 27° *



B.H. No. :- 02
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 30° *

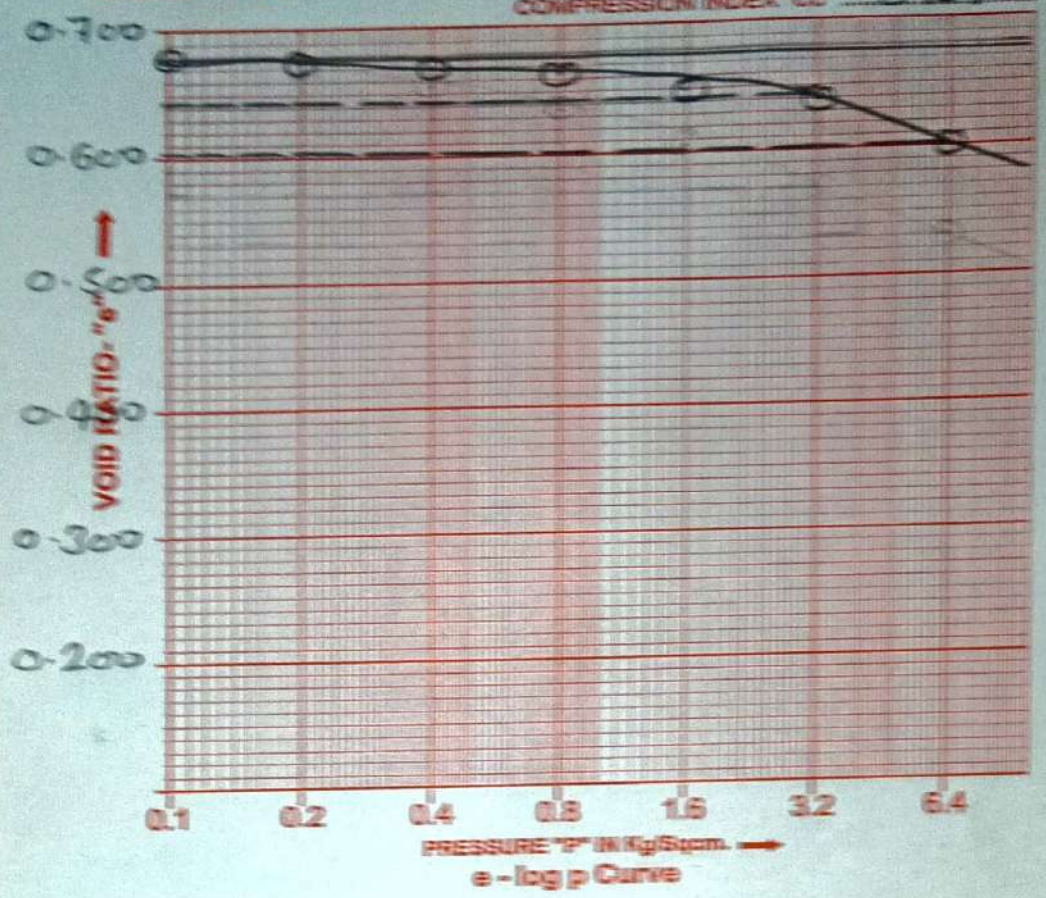


VMT/123A/23-24

VIVEK MATERIAL TESTING

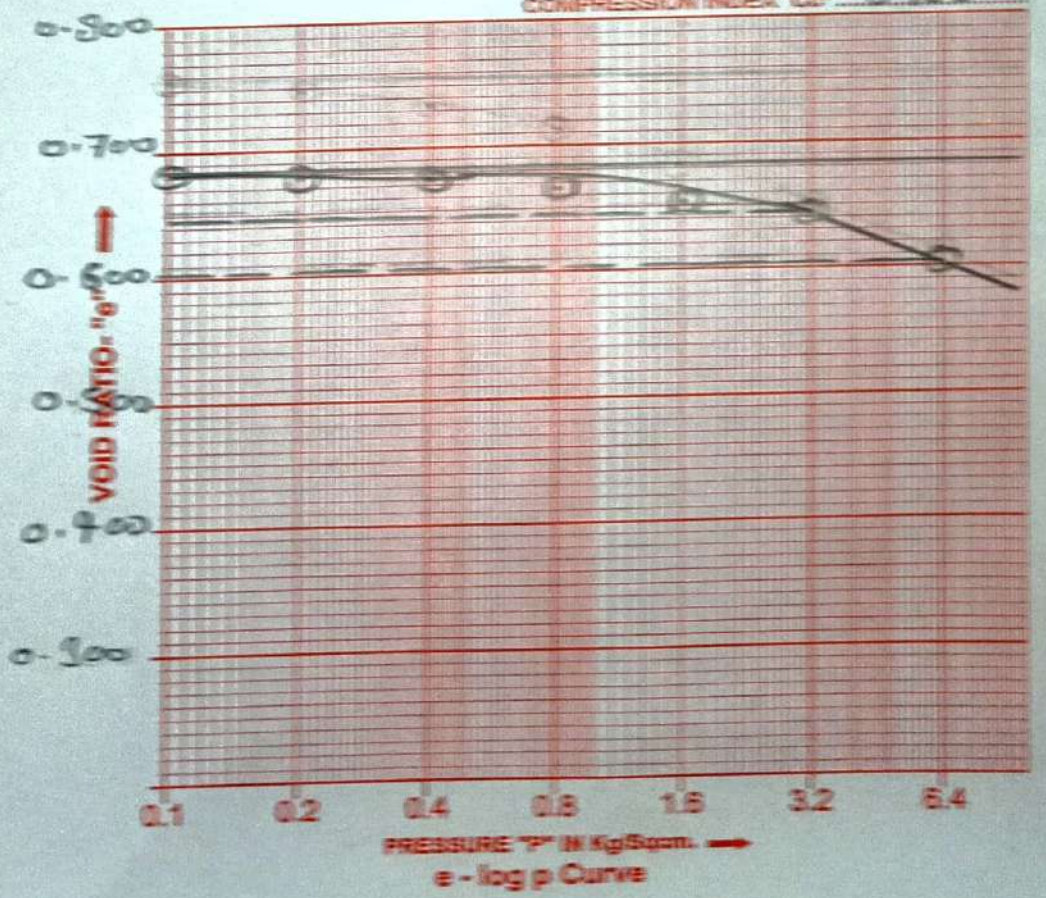
VMT

BORE HOLE NO. 01
DEPTH 1.00 - 1.65
COMPRESSION INDEX 'Cc' 0.134



e - log p Curve

BORE HOLE NO. 01
DEPTH 4.00 - 4.35
COMPRESSION INDEX 'Cc' 0.170



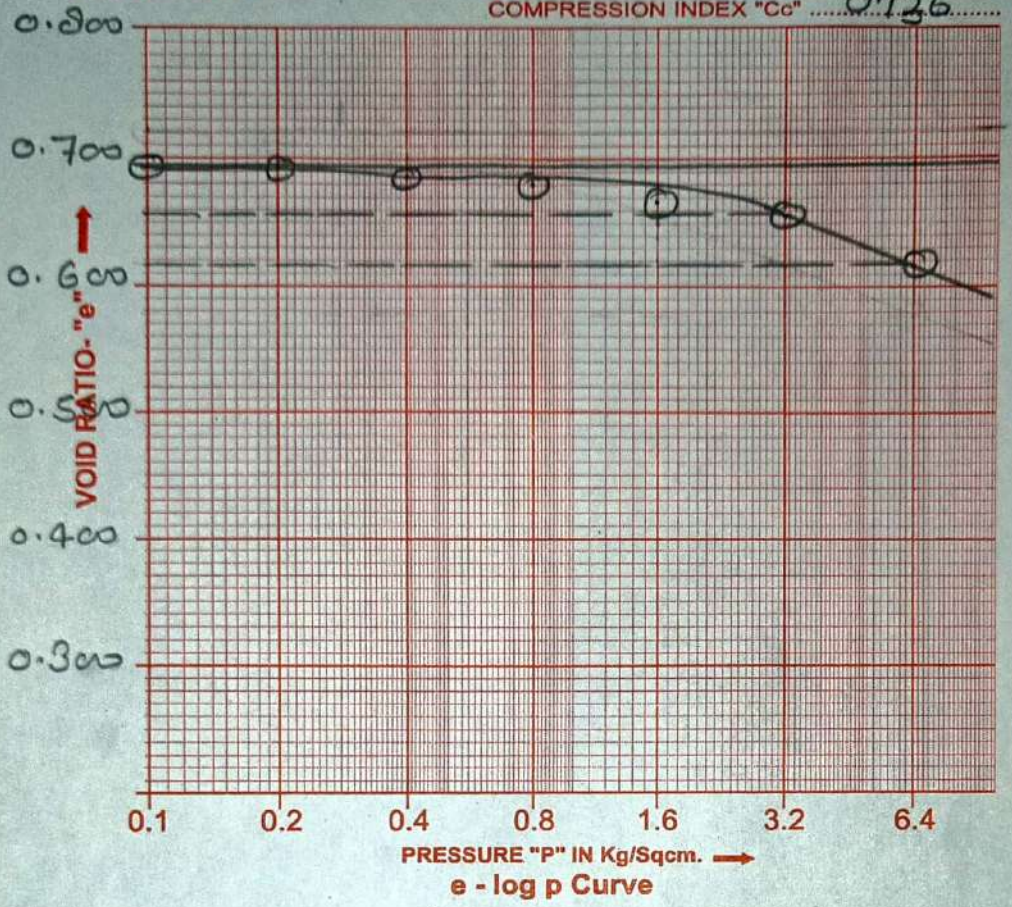
e - log p Curve

VMT/129A/23-24

VIVEK MATERIAL TESTING

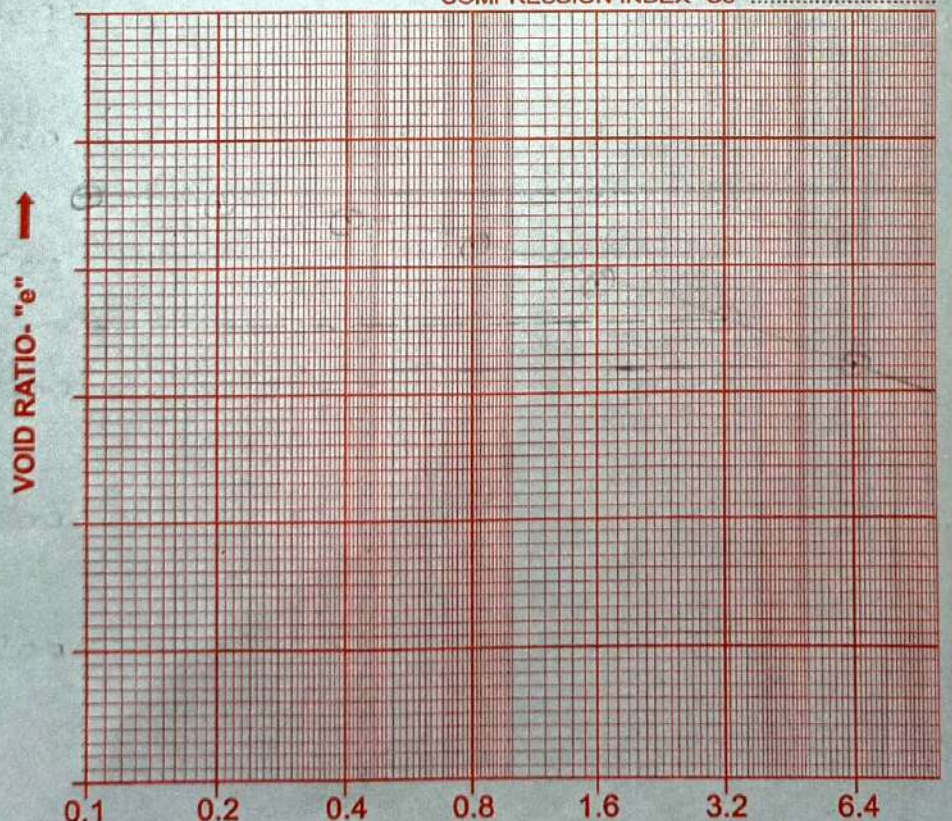
VMT
GEOTECH & MATERIAL TESTING

BORE HOLE NO. 9
DEPTH 1.00 - 1.35
COMPRESSION INDEX "Cc" 0.126



e - log p Curve

BORE HOLE NO.
DEPTH
COMPRESSION INDEX "Cc"



e - log p Curve

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TC-8969

REPORT NO. – VMT 133 A/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE (GORAIPARA OPP.)IN WEST BENGAL

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ACKNOWLEDGEMENT

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THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

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SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 18/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	GORAIPARA FERRY GHAT VILLAGE SIDE	BH-01 (RHS)	24.8051423	87.9049081	10.0
2.		BH-02 (RHS)	24.80510304	87.90486351	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'CI' group of IS classification (clayey soil) having 95 to 99 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 4.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 4.00 metre to 10.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 4.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 4.00 metre to 10.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity.

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 4 to 22 indicating 'Soft' to 'Very Stiff' consistency.

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

WATER TABLE

Water Table at the Site was observed at a depth from 2.00 metre to 4.50 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 1.00 metre to 3.50 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	10.34	35.44	-
		2.00	1.20 x 1.20	11.24	35.65	-
		2.50	1.20 x 1.20	8.81	26.07	-
		1.50	2.00 x 2.00	9.63	47.78	-
		2.00	2.00 x 2.00	10.17	47.48	-
		2.50	2.00 x 2.00	7.84	34.64	-
		1.50	2.50 x 2.50	9.40	55.58	8.16
		2.00	2.50 x 2.50	9.94	51.83	9.47
		2.50	2.50 x 2.50	7.59	40.46	-
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	12.56	37.29	-
		2.00	1.20 x 1.20	14.36	35.95	-
		2.50	1.20 x 1.20	16.19	33.83	-
		1.50	2.00 x 2.00	11.85	49.95	-
		2.00	2.00 x 2.00	13.12	47.53	-
		2.50	2.00 x 2.00	14.35	44.05	-
		1.50	2.50 x 2.50	11.63	57.22	9.68
		2.00	2.50 x 2.50	12.76	51.56	12.24
		2.50	2.50 x 2.50	13.84	51.23	13.40

NOTE: -

The above recommendations are based on the field investigation data results and 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.

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BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

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BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	2.00		Factor of safety	2.50
				Water table used for calculation (m)	1.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.82	14.58	1.82	14.58	0.25	9	6.06	0.690	21.87	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.29	1.00	1.00	1.29	1.00	1.00	1.00	1.00	1.00	361.62	207.22	253.54	**101.42**
2	SQUARE	2.00	1.20	1.20	1.82	12.95	1.86	13.34	0.25	9	6.06	0.690	25.89	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.39	1.00	1.00	1.39	1.00	1.00	1.00	1.00	1.00	392.90	225.16	275.48	**110.19**
3	SQUARE	2.50	1.20	1.20	1.82	11.96	1.86	12.36	0.15	11	7.42	0.712	29.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.51	1.25	1.25	1.51	1.25	1.25	1.00	1.00	1.00	338.72	187.18	215.97	**86.39**
4	SQUARE	1.50	2.00	2.00	1.82	14.58	1.82	14.58	0.25	9	6.06	0.690	21.87	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.18	1.00	1.00	1.18	1.00	1.00	1.00	1.00	1.00	336.90	193.03	236.19	**94.48**
5	SQUARE	2.00	2.00	2.00	1.82	12.95	1.86	13.34	0.25	9	6.06	0.690	25.89	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.23	1.00	1.00	1.23	1.00	1.00	1.00	1.00	1.00	355.67	203.80	249.36	**99.74**
6	SQUARE	2.50	2.00	2.00	1.82	11.96	1.86	12.36	0.15	11	7.42	0.712	29.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	301.44	166.50	192.14	**76.86**
7	SQUARE	1.50	2.50	2.50	1.82	14.58	1.82	14.58	0.25	9	6.06	0.690	21.87	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.14	1.00	1.00	1.14	1.00	1.00	1.00	1.00	1.00	328.68	188.31	230.42	**92.17**
8	SQUARE	2.00	2.50	2.50	1.82	12.95	1.86	13.34	0.25	9	6.06	0.690	25.89	7.89	2.25	1.03	6.78	1.72	0.58	1.30	1.20	0.80	1.19	1.00	1.00	1.19	1.00	1.00	1.00	1.00	1.00	347.49	199.10	243.62	**97.45**
9	SQUARE	2.50	2.50	2.50	1.82	11.96	1.86	12.36	0.15	11	7.42	0.712	29.91	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	292.13	161.30	186.16	**74.46**

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	101.42	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.86	0.712	0.137	0.00	38.00	38.41	-	-	36.412	-	35.44
3	3	CLAY	3.00	4.00	1.00	1.91	0.686	0.130	0.00	53.69	14.26	-	-	7.888	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	110.19	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						35.65
2	2	CLAY	2.00	3.50	1.50	1.86	0.712	0.137	0.00	42.02	41.73	-	-	35.951	-	
3	3	CLAY	3.50	4.50	1.00	1.91	0.686	0.130	0.00	52.81	15.50	-	-	8.616	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	86.39	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						26.07
2	2	CLAY	2.50	4.00	1.50	1.91	0.686	0.130	0.00	47.39	32.72	-	-	26.366	-	
3	3	CLAY	4.00	5.00	1.00	1.97	0.613	0.123	0.00	58.84	12.15	-	-	6.216	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	94.48	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.86	0.712	0.137	0.00	38.00	49.97	-	-	43.759	-	47.78
3	3	CLAY	3.00	4.50	1.50	1.91	0.686	0.130	0.00	55.92	20.92	-	-	15.964	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	99.74	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						47.48
2	2	CLAY	2.00	3.50	1.50	1.86	0.712	0.137	0.00	42.02	52.76	-	-	42.399	-	
3	3	CLAY	3.50	5.00	1.50	1.91	0.686	0.130	0.00	55.04	22.09	-	-	16.947	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	76.86	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						34.64
2	2	CLAY	2.50	4.00	1.50	1.91	0.686	0.130	0.00	47.39	40.65	-	-	31.112	-	
3	3	CLAY	4.00	5.50	1.50	1.97	0.613	0.123	0.00	61.22	17.02	-	-	12.186	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	92.17	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						55.58
2	2	CLAY	1.50	3.50	2.00	1.86	0.712	0.137	0.00	40.81	47.03	-	-	53.279	-	
3	3	CLAY	3.50	5.25	1.75	1.91	0.686	0.130	0.00	62.66	19.94	-	-	16.191	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	80.05	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.86	0.712	0.137	0.00	40.81	40.84	-	-	48.205	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.91	0.686	0.130	0.00	62.66	17.32	-	-	14.300	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	97.45	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.86	0.000	0.000	0.00	Depth of foundation						51.83
2	2	CLAY	2.00	4.00	2.00	1.91	0.686	0.130	0.00	45.41	49.72	-	-	49.530	-	
3	3	CLAY	4.00	5.50	1.50	1.97	0.613	0.123	0.00	61.47	22.10	-	-	15.257	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	92.87	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.86	0.000	0.000	0.000	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.91	0.686	0.130	0.000	45.41	47.38	-	-	47.864	-	50.00
3	3	CLAY	4.00	5.50	1.50	1.97	0.613	0.123	0.000	61.47	21.06	-	-	14.635	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	74.46	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						40.46
2	2	CLAY	2.50	4.50	2.00	1.91	0.686	0.130	0.00	49.62	37.99	-	-	38.072	-	
3	3	CLAY	4.50	6.25	1.75	1.97	0.613	0.123	0.00	66.87	16.11	-	-	12.508	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	4.50		Factor of safety	2.50
				Water table used for calculation (m)	3.50		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.80	17.65	1.80	17.65	0.20	13	8.79	0.671	26.48	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	429.68	228.47	307.95	**123.18**
2	SQUARE	2.00	1.20	1.20	1.80	17.65	1.87	18.34	0.20	13	8.79	0.671	35.31	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.42	1.21	1.21	1.42	1.21	1.21	1.00	1.00	1.00	491.31	261.33	352.17	**140.87**
3	SQUARE	2.50	1.20	1.20	1.80	17.65	1.87	18.34	0.25	10	6.74	0.650	44.13	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.50	1.25	1.25	1.50	1.25	1.25	1.00	1.00	1.00	508.34	285.77	397.06	**158.82**
4	SQUARE	1.50	2.00	2.00	1.80	17.65	1.80	17.65	0.20	13	8.79	0.671	26.48	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	405.65	215.33	290.51	**116.20**
5	SQUARE	2.00	2.00	2.00	1.80	17.65	1.87	18.34	0.20	13	8.79	0.671	35.31	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	448.81	238.45	321.54	**128.62**
6	SQUARE	2.50	2.00	2.00	1.80	17.65	1.87	18.34	0.25	10	6.74	0.650	44.13	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	450.53	253.22	351.88	**140.75**
7	SQUARE	1.50	2.50	2.50	1.80	17.65	1.80	17.65	0.20	13	8.79	0.671	26.48	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.15	1.08	1.08	1.15	1.08	1.08	1.00	1.00	1.00	398.43	211.38	285.26	**114.10**
8	SQUARE	2.00	2.50	2.50	1.80	17.65	1.87	18.34	0.20	13	8.79	0.671	35.31	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	436.67	231.88	312.77	**125.11**
9	SQUARE	2.50	2.50	2.50	1.80	17.65	1.87	18.34	0.25	10	6.74	0.650	44.13	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	434.35	244.09	339.22	**135.69**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	123.18	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.87	0.650	0.127	0.00	40.23	46.65	-	-	38.601	-	37.29
3	3	CLAY	3.00	4.00	1.00	1.93	0.636	0.125	0.00	63.45	17.32	-	-	8.009	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	140.87	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						35.95
2	2	CLAY	2.00	3.50	1.50	1.87	0.650	0.127	0.00	49.06	53.35	-	-	36.900	-	
3	3	CLAY	3.50	4.50	1.00	1.93	0.636	0.125	0.00	72.28	19.81	-	-	8.038	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	158.82	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						33.83
2	2	CLAY	2.50	4.00	1.50	1.93	0.636	0.125	0.00	60.04	60.14	-	-	34.543	-	
3	3	CLAY	4.00	5.00	1.00	1.99	0.596	0.120	0.00	83.51	22.33	-	-	7.739	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	116.20	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						49.95
2	2	CLAY	1.50	3.00	1.50	1.87	0.650	0.127	0.00	40.23	61.46	-	-	46.495	-	
3	3	CLAY	3.00	4.50	1.50	1.93	0.636	0.125	0.00	68.18	25.73	-	-	15.938	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	128.62	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						47.53
2	2	CLAY	2.00	3.50	1.50	1.87	0.650	0.127	0.00	49.06	68.03	-	-	43.618	-	
3	3	CLAY	3.50	5.00	1.50	1.93	0.636	0.125	0.00	76.27	28.48	-	-	15.794	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	140.75	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						44.05
2	2	CLAY	2.50	4.00	1.50	1.93	0.636	0.125	0.00	60.04	74.45	-	-	40.139	-	
3	3	CLAY	4.00	5.50	1.50	1.99	0.596	0.120	0.00	87.54	31.17	-	-	14.919	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	114.10	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						57.22
2	2	CLAY	1.50	3.50	2.00	1.87	0.650	0.127	0.00	44.82	58.21	-	-	55.652	-	
3	3	CLAY	3.50	5.25	1.75	1.93	0.636	0.125	0.00	78.49	24.68	-	-	15.878	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	94.98	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.87	0.650	0.127	0.00	44.82	48.46	-	-	49.002	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.93	0.636	0.125	0.00	78.49	20.55	-	-	13.502	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	125.11	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.87	0.000	0.000	0.00	Depth of foundation						51.56
2	2	CLAY	2.00	4.00	2.00	1.93	0.636	0.125	0.00	55.61	63.83	-	-	50.737	-	
3	3	CLAY	4.00	5.50	1.50	1.99	0.596	0.120	0.00	87.83	28.37	-	-	13.710	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	120.04	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.87	0.000	0.000	0.000	Depth of foundation						50.00
2	2	CLAY	2.00	4.00	2.00	1.93	0.636	0.125	0.000	55.61	61.24	-	-	49.284	-	
3	3	CLAY	4.00	5.50	1.50	1.99	0.596	0.120	0.000	87.83	27.22	-	-	13.223	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	135.69	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						51.23
2	2	CLAY	2.50	4.50	2.00	1.93	0.636	0.125	0.00	64.78	69.23	-	-	48.244	-	
3	3	CLAY	4.50	6.25	1.75	1.99	0.596	0.120	0.00	92.20	29.35	-	-	15.795	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

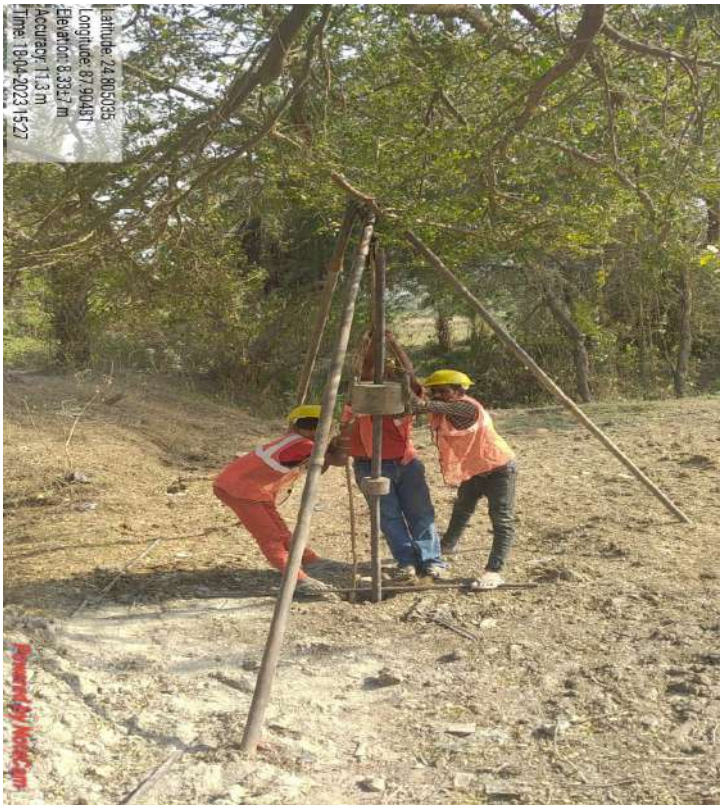
CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	4.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	131.38	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.000	Depth of foundation						
2	2	CLAY	2.50	4.50	2.00	1.93	0.636	0.125	0.000	64.78	67.03	-	-	47.146	-	50.00
3	3	CLAY	4.50	6.25	1.75	1.99	0.596	0.120	0.000	92.20	28.42	-	-	15.355	-	

SITE PHOTOS DURING SITE INVESTIGATION



RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**1 (R.H.S.)**		**Coordinate**	**Easting**					**Depth of Water Level**			2.00		**VIVEK MATERIAL TESTING LABORATORY**									
Total depth of Bore Hole	**10.00**			**Northing**					**Commenced on**			4/18/2023											
				Elevation	**100.000**				**Completed on**			4/18/2023											

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	100	100	99	33	23	10	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	99	96	29	18	11	CL				1.82	17.1	1.55	2.62	0.690	0.25	9°	0.135
1.35 - 1.80	98.650 - 98.200	SPT									6	8.20	8.20								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	99	33	22	11	CL				1.86	21.8	1.53	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									4	5.69	5.69								
4.00 - 4.35	96.000 - 95.650	UD	100	98	97	96	37	26	11	CI				1.91	22.5	1.56	2.63	0.686	0.15	12°	0.130
4.35 - 4.80	95.650 - 95.200	SPT									7	9.01	9.01								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	99	39	25	14	CI				1.97	20.9	1.63	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									12	14.23	14.23								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	97	38	26	12	CI				1.96	18.5	1.65	2.62	0.588	0.30	12°	0.123
7.35 - 7.80	92.650 - 92.200	SPT									15	16.64	15.82								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	99	40	22	18	CI				1.95	16.8	1.67	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									18	18.85	16.93								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	99	41	21	20	CI					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**2 (R.H.S.)**		**Coordinate**	**Easting**							**Depth of Water Level**			4.50		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**			**Northing**							**Commenced on**			4/18/2023									
				Elevation			**100.000**				**Completed on**			4/18/2023									

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N"	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	100	100	100	97	30	21	9	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	98	97	96	29	17	12	CL				1.80	13.7	1.58	2.64	0.671	0.20	13°	0.127
1.35 - 1.80	98.650 - 98.200	SPT									8	10.96	10.96								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	95	28	15	13	CL				1.87	16.8	1.60	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									10	11.60	11.60								
4.00 - 4.35	96.000 - 95.650	UD	100	100	98	96	39	22	17	CI				1.93	19.3	1.62	2.65	0.636	0.30	13°	0.125
4.35 - 4.80	95.650 - 95.200	SPT									12	15.43	15.22								
5.50 - 5.85	94.500 - 94.150	UD	100	100	99	98	42	22	20	CI				1.99	20.1	1.66	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									15	17.74	16.37								
7.00 - 7.35	93.000 - 92.650	UD	100	100	99	97	40	22	18	CI				1.99	18.6	1.68	2.66	0.583	0.25	14°	0.117
7.35 - 7.80	92.650 - 92.200	SPT									19	20.98	17.99								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	39	23	16	CI				1.98	16.5	1.70	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									22	22.91	18.96								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	99	38	20	18	CI					-	-	-	-	-	-	-

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL

WATER TABLE 2.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	3	3	6	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			1	2	2	4	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			3	3	4	7	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			4	5	7	12	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			5	7	8	15	
8.50-8.85	SILTY-CLAY	U.D.	CI						
8.85-9.30		S.P.T.			6	8	10	18	
9.30-10.00	SILTY-CLAY	D.	CI						

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT VILLAGE SIDE IN WEST BENGAL

WATER TABLE 4.50 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	3	5	8	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			3	4	6	10	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			4	5	7	12	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			5	7	8	15	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			6	8	11	19	
8.50-8.85	SILTY-CLAY	U.D.	CI						
8.85-9.30		S.P.T.			7	10	12	22	
9.30-10.00	SILTY-CLAY	D.	CI						

VMT/133/23-24 (R.H.S.) W.B.

VMT
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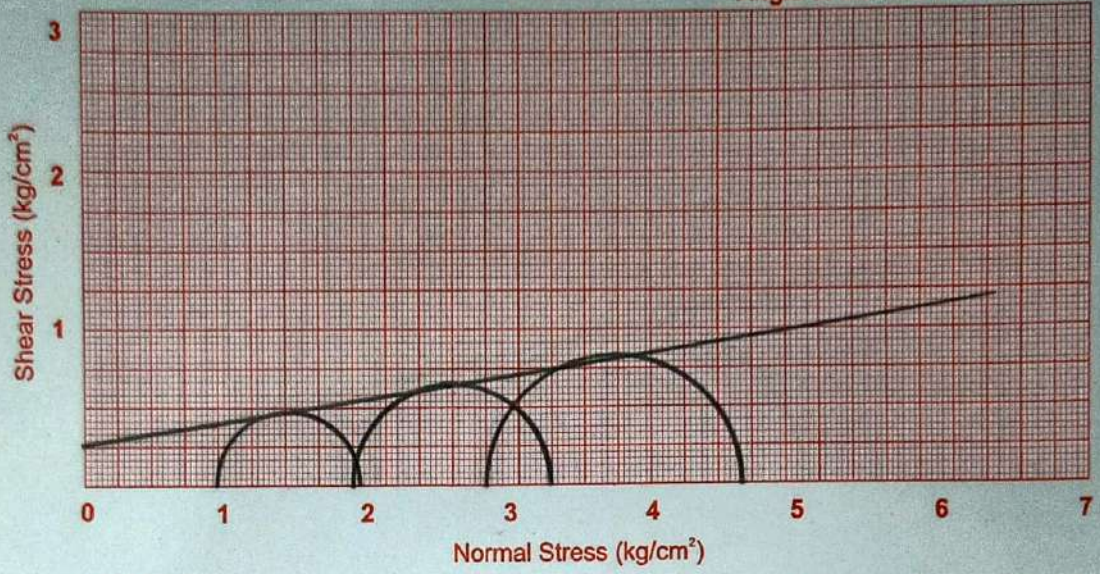
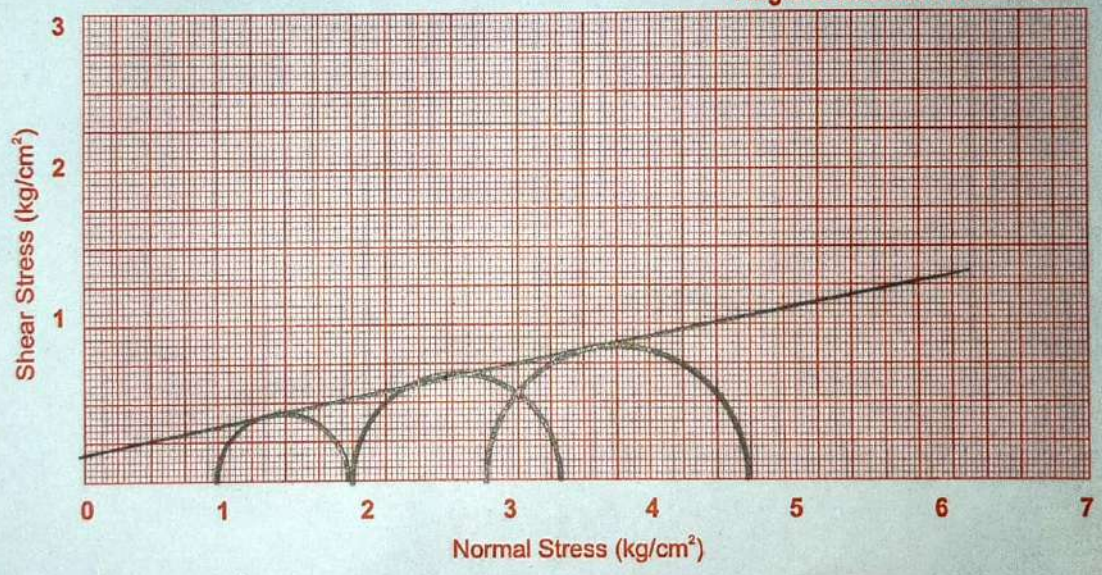
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 9° *



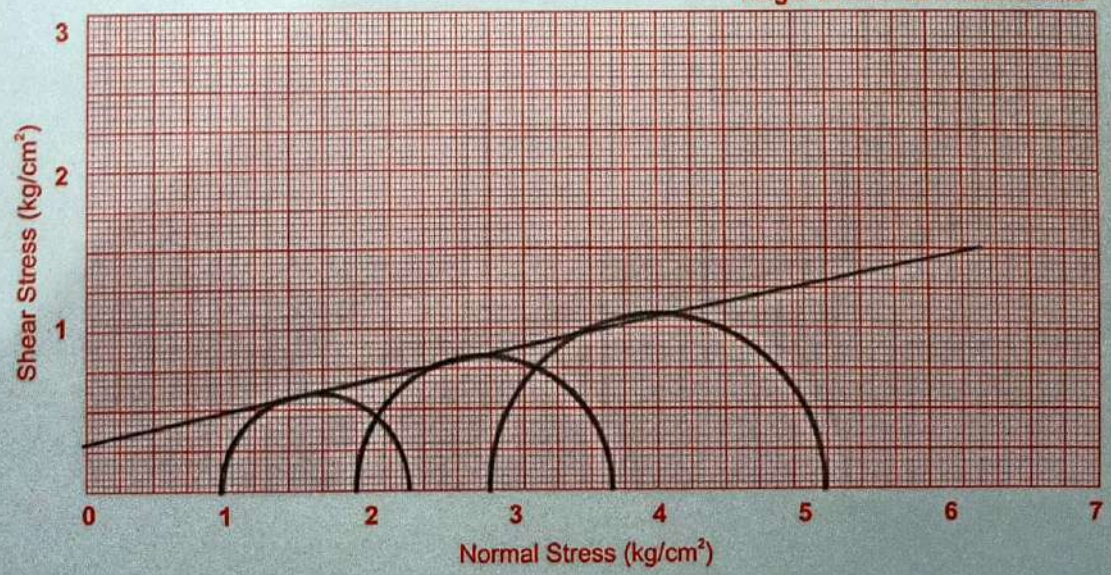
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 12° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 12° *



VMT/133/23-24

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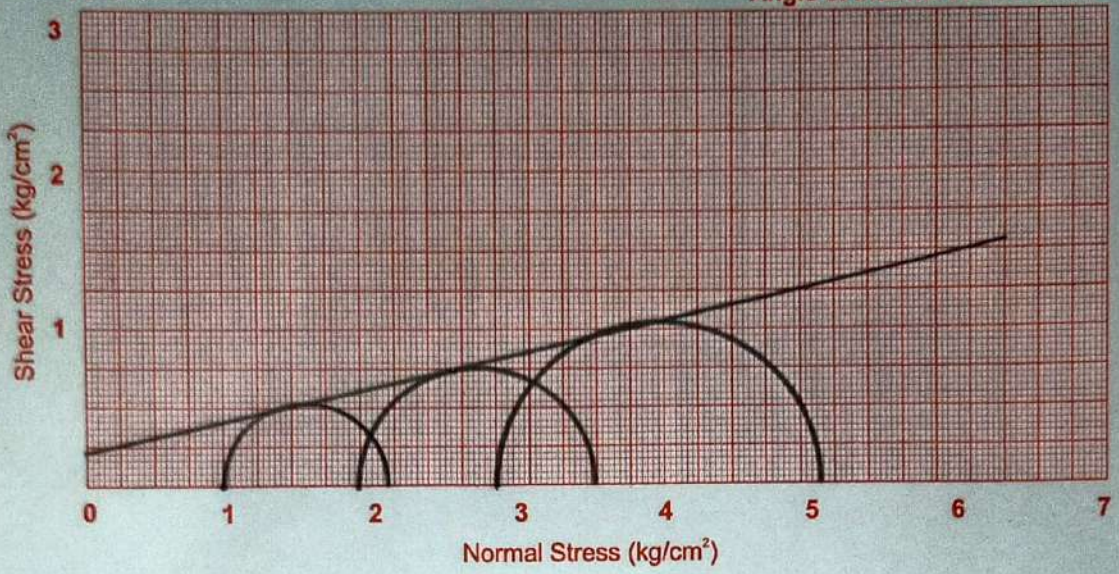
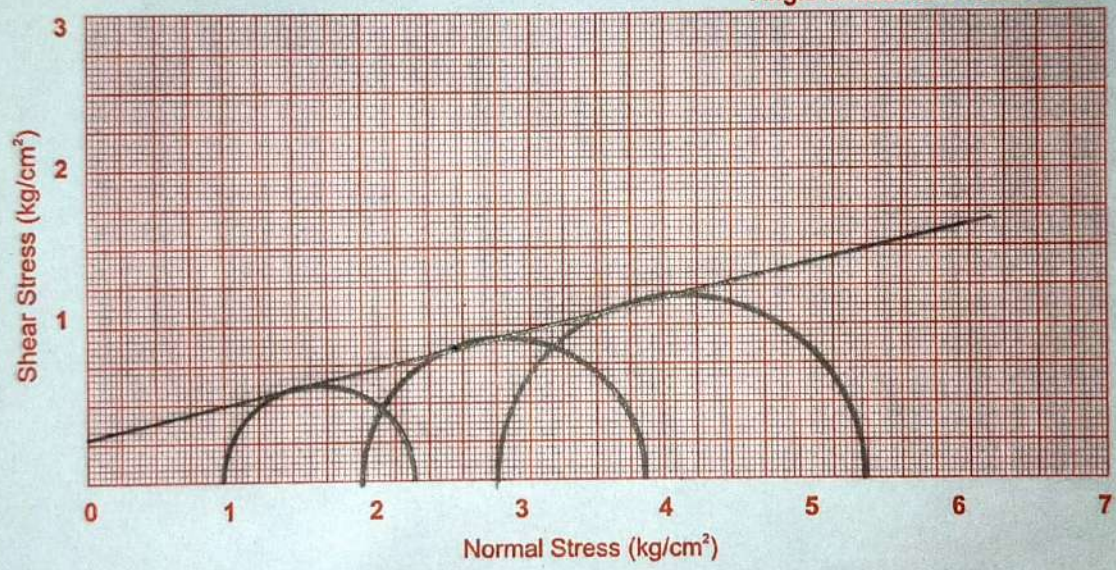
B.H. No. :- 02
Depth - 1.00-1.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 13° *



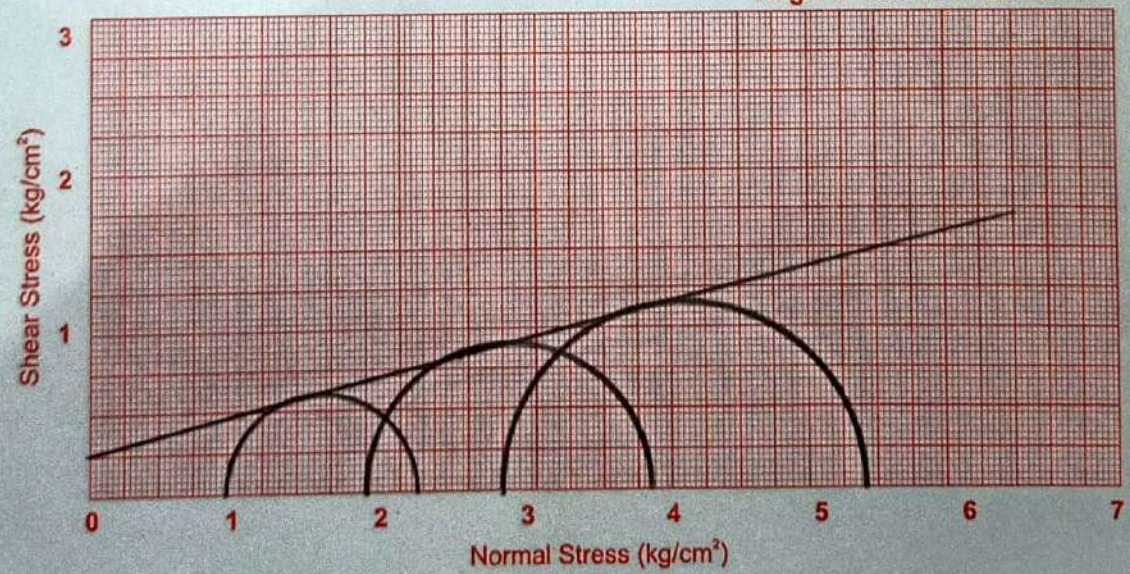
B.H. No. :- 02
Depth :- 4.00-4.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 13° *



B.H. No. :- 02
Depth :- 7.00-7.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 14° *



VMT
GEOTECH & MATERIAL TESTING

TC-8969

REPORT NO. – VMT 133 B/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT (L.H.S.) IN WEST BENGAL

Prepared By -

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ACKNOWLEDGEMENT

WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 19/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	**Site**	**Borehole Nos.**	**Coordinates**		**Depth below existing ground level (m)**
			Latitude	**Longitude**	
1.	GORAIPARA FERRY GHAT	BH-01 (LHS)	24.80523269	87.90574294	10.0
2.		BH-02 (LHS)	24.80546977	87.90557899	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'CI' group of IS classification (clayey soil) having 90 to 99 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 4.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 4.00 metre to 10.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 5.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 5.50 metre to 10.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity.

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 5 to 15 indicating 'Medium' to 'Stiff' consistency.

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

WATER TABLE

Water Table at the Site was observed at a depth from 1.50 metre to 5.00 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 0.50 metre to 4.00 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	15.42	43.11	-
		2.00	1.20 x 1.20	17.37	41.20	-
		2.50	1.20 x 1.20	21.45	42.18	-
		1.50	2.00 x 2.00	14.45	57.24	11.88
		2.00	2.00 x 2.00	15.91	54.29	14.14
		2.50	2.00 x 2.00	19.12	55.07	16.67
		1.50	2.50 x 2.50	14.22	65.75	9.73
		2.00	2.50 x 2.50	15.47	60.21	11.98
		2.50	2.50 x 2.50	18.49	63.55	13.34
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	8.36	32.81	-
		2.00	1.20 x 1.20	9.57	33.47	-
		2.50	1.20 x 1.20	10.61	31.97	-
		1.50	2.00 x 2.00	7.89	44.92	-
		2.00	2.00 x 2.00	8.86	45.30	-
		2.50	2.00 x 2.00	9.49	42.37	-
		1.50	2.50 x 2.50	7.84	53.10	7.24
		2.00	2.50 x 2.50	8.74	49.93	-
		2.50	2.50 x 2.50	9.21	49.56	-

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	5.00		Factor of safety	2.50
				Water table used for calculation (m)	4.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.80	17.65	1.80	17.65	0.25	12	8.11	0.640	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.31	1.15	1.15	1.31	1.15	1.15	1.00	1.00	1.00	475.51	259.03	378.09	**151.24**
2	SQUARE	2.00	1.20	1.20	1.80	17.65	1.87	18.34	0.25	12	8.11	0.640	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.41	1.21	1.21	1.41	1.21	1.21	1.00	1.00	1.00	535.59	291.84	425.90	**170.36**
3	SQUARE	2.50	1.20	1.20	1.80	17.65	1.87	18.34	0.25	13	8.79	0.630	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.52	1.26	1.26	1.52	1.26	1.26	1.00	1.00	1.00	646.94	344.29	525.88	**210.35**
4	SQUARE	1.50	2.00	2.00	1.80	17.65	1.80	17.65	0.25	12	8.11	0.640	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	445.84	242.62	354.39	**141.76**
5	SQUARE	2.00	2.00	2.00	1.80	17.65	1.87	18.34	0.25	12	8.11	0.640	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.25	1.12	1.12	1.25	1.12	1.12	1.00	1.00	1.00	490.57	267.04	389.98	**155.99**
6	SQUARE	2.50	2.00	2.00	1.80	17.65	1.87	18.34	0.25	13	8.79	0.630	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	576.93	306.75	468.86	**187.54**
7	SQUARE	1.50	2.50	2.50	1.80	17.65	1.80	17.65	0.25	12	8.11	0.640	26.48	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.15	1.07	1.07	1.15	1.07	1.07	1.00	1.00	1.00	438.68	238.56	348.63	**139.45**
8	SQUARE	2.00	2.50	2.50	1.80	17.65	1.87	18.34	0.25	12	8.11	0.640	35.31	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	477.04	259.58	379.18	**151.67**
9	SQUARE	2.50	2.50	2.50	1.80	17.65	1.87	18.34	0.25	13	8.79	0.630	44.13	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	557.95	296.53	453.38	**181.35**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	151.24	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.87	0.630	0.125	0.00	40.23	57.27	-	-	44.224	-	43.11
3	3	CLAY	3.00	4.00	1.00	1.93	0.598	0.123	0.00	63.45	21.27	-	-	9.663	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	170.36	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						41.20
2	2	CLAY	2.00	3.50	1.50	1.87	0.630	0.125	0.00	49.06	64.52	-	-	41.935	-	
3	3	CLAY	3.50	4.50	1.00	1.93	0.598	0.123	0.00	72.28	23.96	-	-	9.570	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	210.35	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						42.18
2	2	CLAY	2.50	4.00	1.50	1.93	0.598	0.123	0.00	60.04	79.66	-	-	42.343	-	
3	3	CLAY	4.00	5.00	1.00	1.91	0.648	0.130	0.00	83.60	29.58	-	-	10.378	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	141.76	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.87	0.630	0.125	0.00	40.23	74.98	-	-	52.560	-	57.24
3	3	CLAY	3.00	4.50	1.50	1.93	0.598	0.123	0.00	68.18	31.39	-	-	18.990	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	116.51	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.87	0.630	0.125	0.00	40.23	61.63	-	-	46.40	-	50.00
3	3	CLAY	3.00	4.50	1.50	1.93	0.598	0.123	0.00	68.18	25.80	-	-	16.09	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	155.99	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						54.29
2	2	CLAY	2.00	3.50	1.50	1.87	0.630	0.125	0.00	49.06	82.51	-	-	49.282	-	
3	3	CLAY	3.50	5.00	1.50	1.93	0.598	0.123	0.00	77.01	34.54	-	-	18.582	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	138.67	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	2.00	3.50	1.50	1.87	0.630	0.125	0.00	49.06	73.35	-	-	45.676	-	
3	3	CLAY	3.50	5.00	1.50	1.93	0.598	0.123	0.00	77.01	30.71	-	-	16.827	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	187.54	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						55.07
2	2	CLAY	2.50	4.00	1.50	1.93	0.598	0.123	0.00	60.04	99.19	-	-	48.905	-	
3	3	CLAY	4.00	5.50	1.50	1.91	0.648	0.130	0.00	87.62	41.53	-	-	19.938	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	163.47	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.50	4.00	1.50	1.93	0.598	0.123	0.00	60.04	86.46	-	-	44.727	-	50.00
3	3	CLAY	4.00	5.50	1.50	1.91	0.648	0.130	0.00	87.62	36.20	-	-	17.772	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	139.45	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						65.75
2	2	CLAY	1.50	3.50	2.00	1.87	0.630	0.125	0.00	44.82	71.15	-	-	63.325	-	
3	3	CLAY	3.50	5.25	1.75	1.93	0.598	0.123	0.00	79.31	30.17	-	-	18.858	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	95.40	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	1.50	3.50	2.00	1.87	0.630	0.125	0.00	44.82	48.67	-	-	48.975	-	
3	3	CLAY	3.50	5.25	1.75	1.93	0.598	0.123	0.00	79.31	20.64	-	-	13.530	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	151.67	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.87	0.000	0.000	0.00	Depth of foundation						60.21
2	2	CLAY	2.00	4.00	2.00	1.93	0.598	0.123	0.00	55.61	77.38	-	-	58.297	-	
3	3	CLAY	4.00	5.50	1.50	1.91	0.648	0.130	0.00	87.91	34.39	-	-	16.967	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	117.48	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.87	0.000	0.000	0.000	Depth of foundation						50.00
2	2	CLAY	2.00	4.00	2.00	1.93	0.598	0.123	0.000	55.61	59.94	-	-	48.897	-	
3	3	CLAY	4.00	5.50	1.50	1.91	0.648	0.130	0.000	87.91	26.64	-	-	13.602	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	181.35	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						63.55
2	2	CLAY	2.50	4.50	2.00	1.93	0.598	0.123	0.00	64.78	92.53	-	-	59.317	-	
3	3	CLAY	4.50	6.25	1.75	1.91	0.648	0.130	0.00	98.38	39.23	-	-	20.121	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	130.80	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.000	Depth of foundation						50.00
2	2	CLAY	2.50	4.50	2.00	1.93	0.598	0.123	0.000	64.78	66.73	-	-	47.345	-	
3	3	CLAY	4.50	6.25	1.75	1.91	0.648	0.130	0.000	98.38	28.30	-	-	15.156	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	1.50		Factor of safety	2.50
				Water table used for calculation (m)	0.50		Assumed post monsoon rise (m)	1.00

VMT
GEOTECH & MATERIAL TESTING

Input Parameters														Shearing Resistance Parameters																	Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.83	11.41	1.83	11.41	0.10	17	11.58	0.690	17.11	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.34	1.17	1.17	1.34	1.17	1.17	1.00	1.00	1.00	319.01	156.07	204.95	**81.98**
2	SQUARE	2.00	1.20	1.20	1.83	10.59	1.89	11.18	0.10	17	11.58	0.690	21.18	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.45	1.23	1.23	1.45	1.23	1.23	1.00	1.00	1.00	365.12	178.70	234.63	**93.85**
3	SQUARE	2.50	1.20	1.20	1.83	10.10	1.89	10.69	0.15	12	8.11	0.665	25.25	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.51	1.26	1.26	1.51	1.26	1.26	1.00	1.00	1.00	352.38	192.09	260.21	**104.08**
4	SQUARE	1.50	2.00	2.00	1.83	11.41	1.83	11.41	0.10	17	11.58	0.690	17.11	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	301.67	147.10	193.47	**77.39**
5	SQUARE	2.00	2.00	2.00	1.83	10.59	1.89	11.18	0.10	17	11.58	0.690	21.18	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.27	1.14	1.14	1.27	1.14	1.14	1.00	1.00	1.00	338.72	165.27	217.31	**86.92**
6	SQUARE	2.50	2.00	2.00	1.83	10.10	1.89	10.69	0.15	12	8.11	0.665	25.25	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.31	1.15	1.15	1.31	1.15	1.15	1.00	1.00	1.00	315.29	171.74	232.75	**93.10**
7	SQUARE	1.50	2.50	2.50	1.83	11.41	1.83	11.41	0.10	17	11.58	0.690	17.11	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.16	1.08	1.08	1.16	1.08	1.08	1.00	1.00	1.00	300.17	146.09	192.31	**76.92**
8	SQUARE	2.00	2.50	2.50	1.83	10.59	1.89	11.18	0.10	17	11.58	0.690	21.18	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.22	1.11	1.11	1.22	1.11	1.11	1.00	1.00	1.00	334.47	162.89	214.36	**85.74**
9	SQUARE	2.50	2.50	2.50	1.83	10.10	1.89	10.69	0.15	12	8.11	0.665	25.25	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.25	1.12	1.12	1.25	1.12	1.12	1.00	1.00	1.00	306.00	166.59	225.84	**90.34**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	81.98	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.89	0.665	0.130	0.00	33.47	31.05	-	-	33.382	-	32.81
3	3	CLAY	3.00	4.00	1.00	1.91	0.667	0.127	0.00	44.47	11.53	-	-	7.626	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	93.85	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						33.47
2	2	CLAY	2.00	3.50	1.50	1.89	0.665	0.130	0.00	37.54	35.54	-	-	33.886	-	
3	3	CLAY	3.50	4.50	1.00	1.91	0.667	0.127	0.00	48.54	13.20	-	-	7.957	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	104.08	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						31.97
2	2	CLAY	2.50	4.00	1.50	1.91	0.667	0.127	0.00	43.22	39.41	-	-	32.164	-	
3	3	CLAY	4.00	5.00	1.00	1.94	0.656	0.125	0.00	54.53	14.64	-	-	7.795	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	77.39	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	-	-	-	Depth of foundation						44.92
2	2	CLAY	1.50	3.00	1.50	1.89	0.665	0.130	0.00	33.47	40.93	-	-	40.635	-	
3	3	CLAY	3.00	4.50	1.50	1.91	0.667	0.127	0.00	46.71	17.14	-	-	15.513	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	86.92	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.83	0.000	0.000	0.00	Depth of foundation						45.30
2	2	CLAY	2.00	3.50	1.50	1.89	0.665	0.130	0.00	37.54	45.97	-	-	40.674	-	
3	3	CLAY	3.50	5.00	1.50	1.91	0.667	0.127	0.00	50.78	19.25	-	-	15.952	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	93.10	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						42.37
2	2	CLAY	2.50	4.00	1.50	1.91	0.667	0.127	0.00	43.22	49.24	-	-	37.741	-	
3	3	CLAY	4.00	5.50	1.50	1.94	0.656	0.125	0.00	56.83	20.62	-	-	15.220	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	76.92	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	0.000	0.000	0.00	Depth of foundation						53.10
2	2	CLAY	1.50	3.50	2.00	1.89	0.665	0.130	0.00	35.65	39.24	-	-	50.345	-	
3	3	CLAY	3.50	5.25	1.75	1.91	0.667	0.127	0.00	52.19	16.64	-	-	16.026	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	71.02	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.83	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.89	0.665	0.130	0.00	35.65	36.23	-	-	47.563	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.91	0.667	0.127	0.00	52.19	15.36	-	-	14.942	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	85.74	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.89	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.91	0.667	0.127	0.00	41.09	43.74	-	-	47.971	-	49.93
3	3	CLAY	4.00	5.50	1.50	1.94	0.656	0.125	0.00	56.93	19.44	-	-	14.447	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

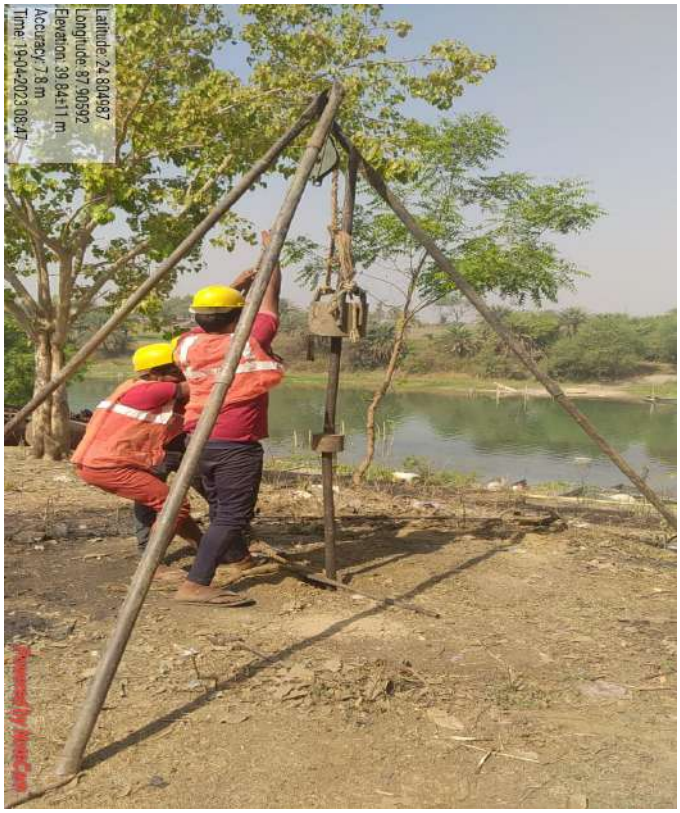
CALCULATION SHEET 6

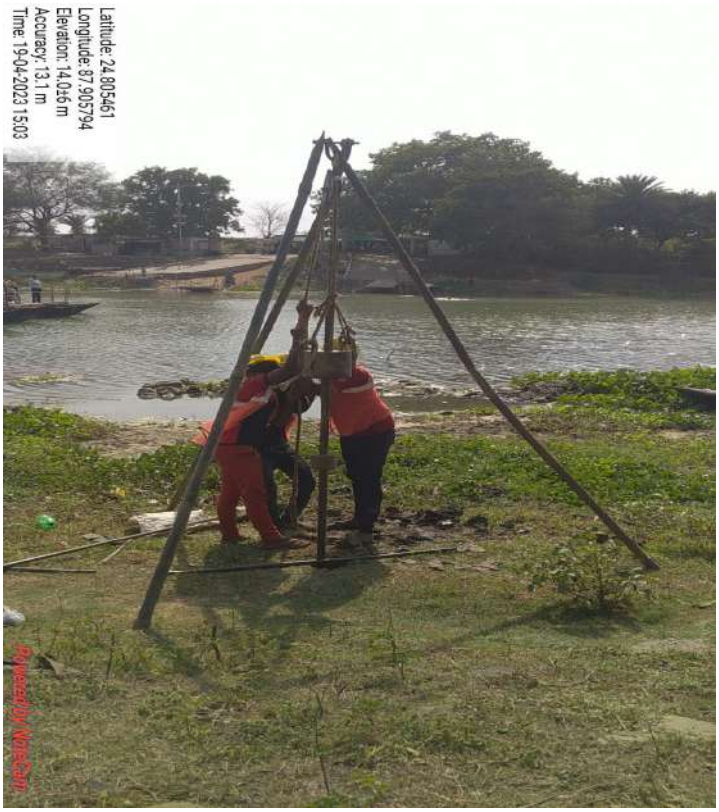
Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	
Length	2.50	metre	Water Table depth for calculation	1.50	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	90.34	kN/m2		Type of foundation	SQUARE	

BOREHOLE 2

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						49.56
2	2	CLAY	2.50	4.50	2.00	1.91	0.667	0.127	0.00	45.46	46.09	-	-	46.329	-	
3	3	CLAY	4.50	6.25	1.75	1.94	0.656	0.125	0.00	62.45	19.54	-	-	15.621	-	

SITE PHOTOS DURING SITE INVESTIGATION





RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**1 (L.H.S.)**		**Coordinate**		**Easting**						**Depth of Water Level**				5.00		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**						**Commenced on**			4/19/2023										
					Elevation		**100.000**				**Completed on**			4/19/2023										

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	100	100	98	93	34	23	11	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	98	95	90	35	21	14	CL				1.80	12.1	1.61	2.64	0.640	0.25	12°	0.127
1.35 - 1.80	98.650 - 98.200	SPT									11	15.05	15.05								
2.50 - 2.85	97.500 - 97.150	UD	100	100	97	94	34	25	9	CL				1.87	15.3	1.62	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									12	13.91	13.91								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	99	36	18	18	CI				1.93	17.6	1.64	2.62	0.598	0.30	15°	0.123
4.35 - 4.80	95.650 - 95.200	SPT									14	14.40	14.40								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	98	37	22	15	CI				1.91	20.1	1.59	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									8	9.52	9.52								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	97	39	23	16	CI				1.94	21.3	1.60	2.63	0.644	0.20	12°	0.130
7.35 - 7.80	92.650 - 92.200	SPT									11	12.25	12.25								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	38	25	13	CI				1.95	18.4	1.65	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									15	15.77	15.39								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	99	40	21	19	CI					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**2 (L.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**			1.50		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/19/2023										
					Elevation		**100.000**			**Completed on**			4/19/2023										

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	99	97	95	30	20	10	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	98	29	17	12	CL				1.83	18.3	1.55	2.62	0.690	0.10	17°	0.135
1.35 - 1.80	98.650 - 98.200	SPT									5	8.13	8.13								
2.50 - 2.85	97.500 - 97.150	UD	100	100	99	97	28	20	8	CL				1.89	19.6	1.58	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									7	9.89	9.89								
4.00 - 4.35	96.000 - 95.650	UD	100	100	98	96	33	21	12	CL				1.91	20.3	1.59	2.65	0.667	0.25	12°	0.127
4.35 - 4.80	95.650 - 95.200	SPT									9	11.53	11.53								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	99	37	22	15	CI				1.94	21.2	1.60	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									9	10.66	10.66								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	99	38	24	14	CI				1.95	18.6	1.64	2.62	0.598	0.30	13°	0.123
7.35 - 7.80	92.650 - 92.200	SPT									13	14.42	14.42								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	39	25	14	CI				1.95	17.3	1.66	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									14	14.66	14.66								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	97	40	20	20	CI					-	-	-	-	-	-	-

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL

WATER TABLE 5.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			3	5	6	11	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			4	5	7	12	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			4	6	8	14	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			3	3	5	8	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			4	5	6	11	
8.50-8.85	SILTY-CLAY	U.D.	CI						
8.85-9.30		S.P.T.			5	7	8	15	
9.30-10.00	SILTY-CLAY	D.	CI						

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GORAIPARA FERRY GHAT IN WEST BENGAL

WATER TABLE 1.50 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	2	3	5	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			2	3	4	7	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			3	4	5	9	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			4	4	5	9	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			5	6	7	13	
8.50-8.85	SILTY-CLAY	U.D.	CI						
8.85-9.30		S.P.T.			4	6	8	14	
9.30-10.00	SILTY-CLAY	D.	CI						

VMT/133/23-24-(L.H.S) W.B

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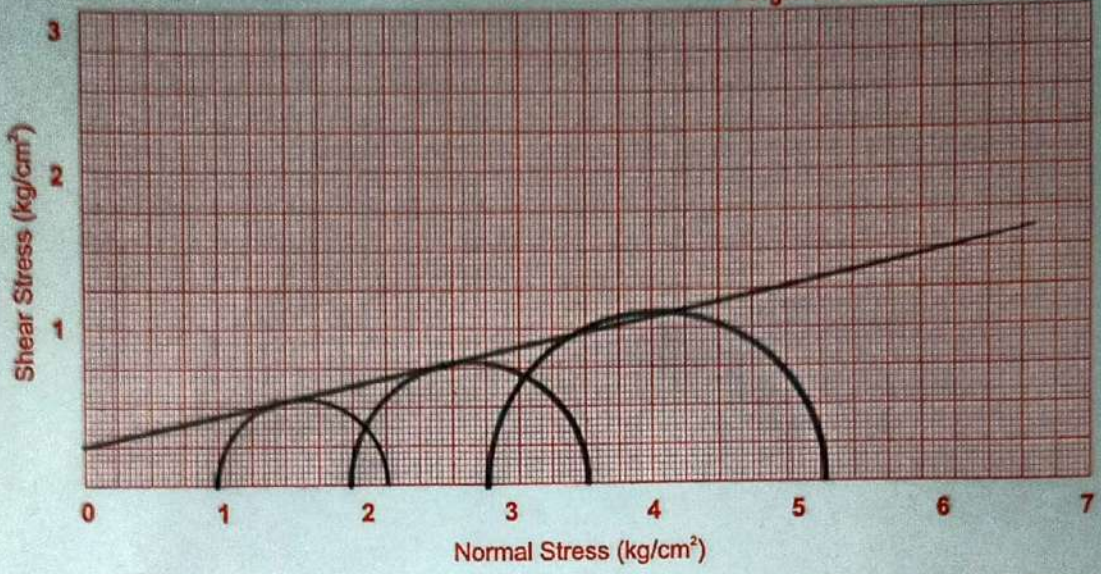
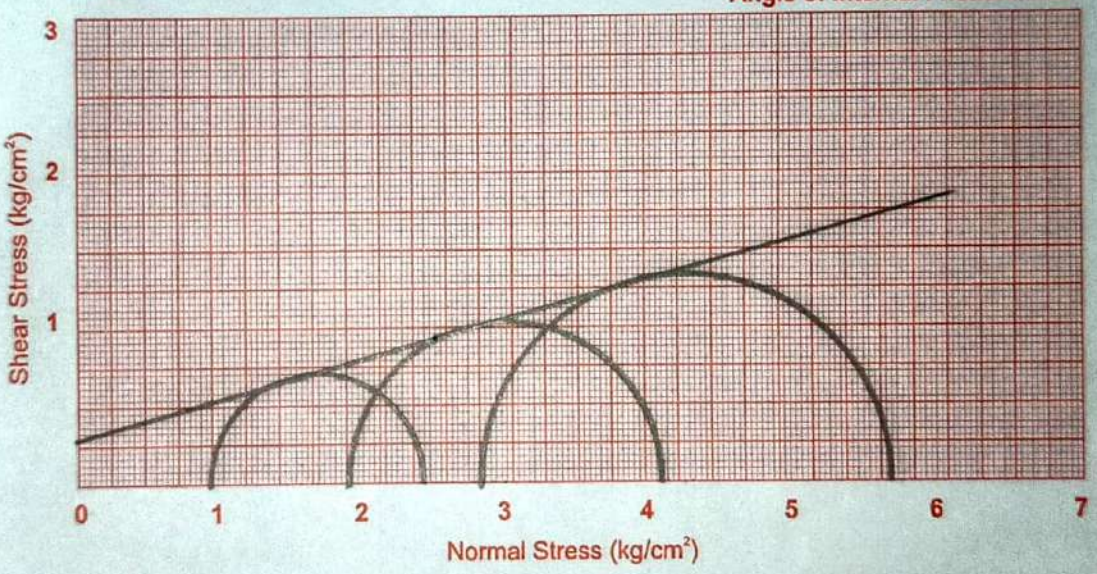
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 12° *



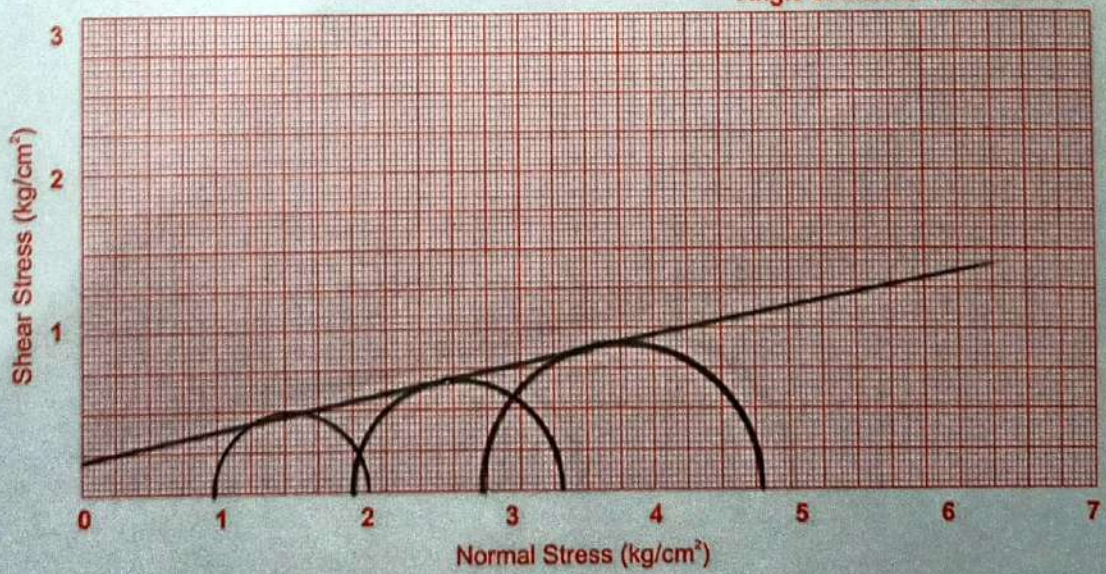
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 15° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 12° *



VMT/133/23-24 (L.H.S)

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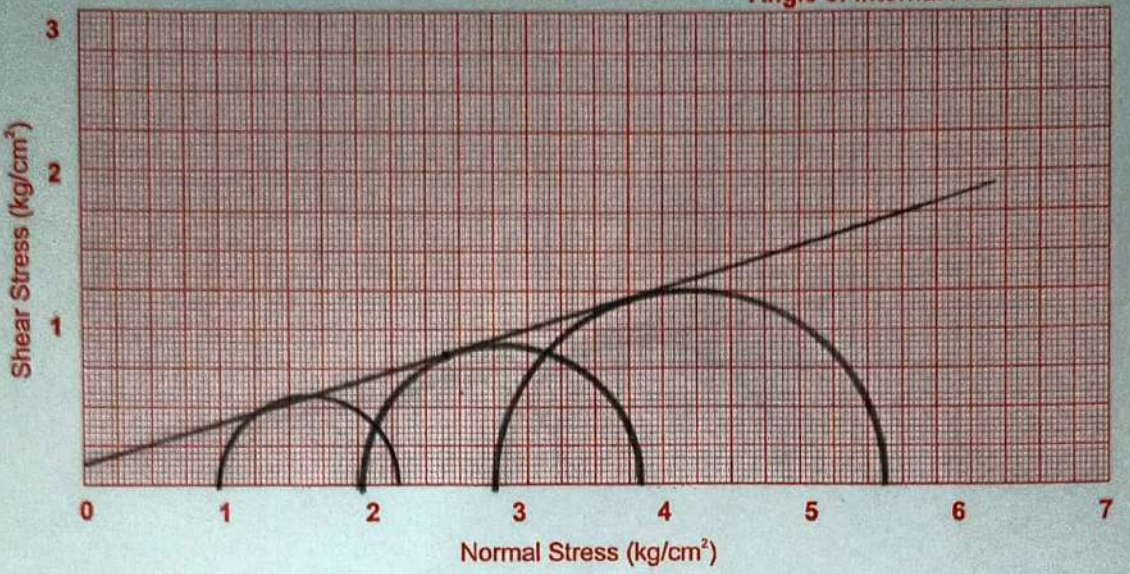
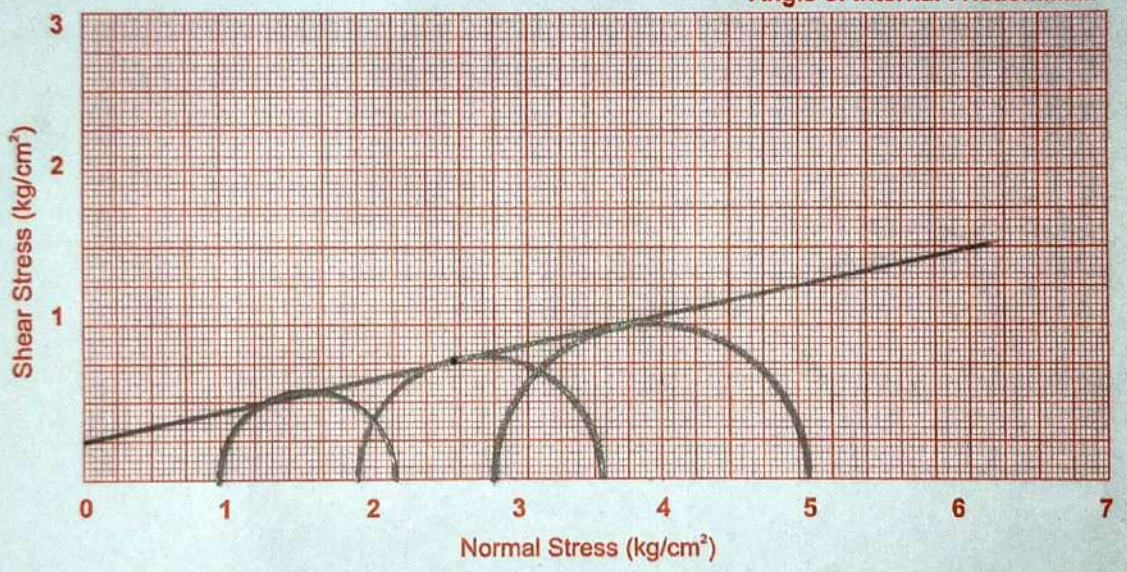
B.H. No. :- 02
Depth - 1.00 - 1.35

Cohesion 'c' 0.10 Kg/cm²
Angle of Internal Friction 17°



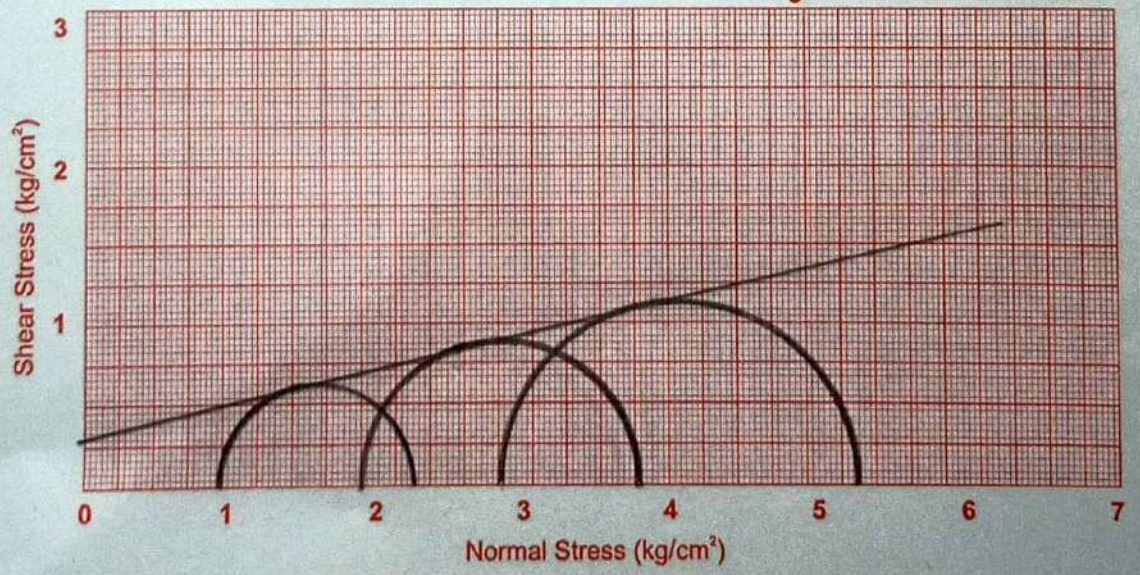
B.H. No. :- 02
Depth :- 4.00 - 4.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 12°



B.H. No. :- 02
Depth :- 7.00 - 7.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 13°



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TC-8969

REPORT NO. – VMT 132 A/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT (L.H.S.) IN WEST BENGAL

Prepared By -

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ACKNOWLEDGEMENT

WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 16/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	LALBAGH FERRY GHAT	BH-01 (LHS)	24.1706269	88.26898679	10.0
2.		BH-02 (LHS)	24.17039443	88.26892644	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' group of IS classification (clayey soil) having 96 to 99 percent material finer than 75 micron and coarse-grained soils (sandy soil) comprise of 'SM' group of IS classification having 40 to 46 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 7.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 7.00 metre to 10.00 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 7.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 7.00 metre to 10.00 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity.

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 5 to 11 indicating 'Medium' 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 13 to 19 indicating 'Medium' relative density.

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

WATER TABLE

Water Table at the Site was observed at a depth from 2.15 metre to 2.20 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 1.15 metre to 1.10 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	10.02	34.05	-
		2.00	1.20 x 1.20	11.01	31.95	-
		2.50	1.20 x 1.20	14.45	37.53	-
		1.50	2.00 x 2.00	9.29	45.87	-
		2.00	2.00 x 2.00	9.99	42.70	-
		2.50	2.00 x 2.00	12.77	49.21	-
		1.50	2.50 x 2.50	9.14	53.57	8.34
		2.00	2.50 x 2.50	9.71	46.73	-
		2.50	2.50 x 2.50	12.30	57.65	10.17
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	9.78	33.44	-
		2.00	1.20 x 1.20	11.15	32.27	-
		2.50	1.20 x 1.20	9.80	27.98	-
		1.50	2.00 x 2.00	9.29	45.92	-
		2.00	2.00 x 2.00	10.34	43.89	-
		2.50	2.00 x 2.00	8.72	37.17	-
		1.50	2.50 x 2.50	9.23	54.03	8.32
		2.00	2.50 x 2.50	10.16	48.79	-
		2.50	2.50 x 2.50	8.45	43.56	-

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	2.15		Factor of safety	2.50
				Water table used for calculation (m)	1.15		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.80	15.36	1.80	15.36	0.20	11	7.42	0.686	23.05	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	353.10	195.06	245.63	**98.25**
2	SQUARE	2.00	1.20	1.20	1.80	13.48	1.87	14.17	0.20	11	7.42	0.686	26.97	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.40	1.20	1.20	1.40	1.20	1.20	1.00	1.00	1.00	388.15	214.45	270.03	**108.01**
3	SQUARE	2.50	1.20	1.20	1.80	12.36	1.87	13.04	0.25	10	6.74	0.665	30.89	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.50	1.25	1.25	1.50	1.25	1.25	1.00	1.00	1.00	473.56	266.21	354.33	**141.73**
4	SQUARE	1.50	2.00	2.00	1.80	15.36	1.80	15.36	0.20	11	7.42	0.686	23.05	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.18	1.09	1.09	1.18	1.09	1.09	1.00	1.00	1.00	327.40	180.79	227.71	**91.08**
5	SQUARE	2.00	2.00	2.00	1.80	13.48	1.87	14.17	0.20	11	7.42	0.686	26.97	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	352.05	194.42	244.86	**97.94**
6	SQUARE	2.50	2.00	2.00	1.80	12.36	1.87	13.04	0.25	10	6.74	0.665	30.89	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	418.52	235.23	313.13	**125.25**
7	SQUARE	1.50	2.50	2.50	1.80	15.36	1.80	15.36	0.20	11	7.42	0.686	23.05	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.15	1.07	1.07	1.15	1.07	1.07	1.00	1.00	1.00	322.24	177.89	224.08	**89.63**
8	SQUARE	2.00	2.50	2.50	1.80	13.48	1.87	14.17	0.20	11	7.42	0.686	26.97	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.19	1.10	1.10	1.19	1.10	1.10	1.00	1.00	1.00	342.42	189.05	238.13	**95.25**
9	SQUARE	2.50	2.50	2.50	1.80	12.36	1.87	13.04	0.25	10	6.74	0.665	30.89	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	403.18	226.57	301.63	**120.65**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	98.25	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.87	0.665	0.131	0.00	38.15	37.21	-	-	34.890	-	34.05
3	3	CLAY	3.00	4.00	1.00	1.90	0.671	0.130	0.00	54.23	13.82	-	-	7.668	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	108.01	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						31.95
2	2	CLAY	2.00	3.50	1.50	1.87	0.665	0.131	0.00	46.22	40.90	-	-	32.490	-	
3	3	CLAY	3.50	4.50	1.00	1.90	0.671	0.130	0.00	61.55	15.19	-	-	7.452	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	141.73	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						37.53
2	2	CLAY	2.50	4.00	1.50	1.90	0.671	0.130	0.00	49.04	53.67	-	-	37.471	-	
3	3	CLAY	4.00	5.00	1.00	1.96	0.640	0.125	0.00	60.36	19.93	-	-	9.445	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	91.08	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	-	-	-	Depth of foundation						45.87
2	2	CLAY	1.50	3.00	1.50	1.87	0.665	0.131	0.00	38.15	48.17	-	-	41.854	-	
3	3	CLAY	3.00	4.50	1.50	1.90	0.671	0.130	0.00	56.44	20.17	-	-	15.486	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	97.94	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.80	0.000	0.000	0.00	Depth of foundation						42.70
2	2	CLAY	2.00	3.50	1.50	1.87	0.665	0.131	0.00	46.22	51.80	-	-	38.531	-	
3	3	CLAY	3.50	5.00	1.50	1.90	0.671	0.130	0.00	63.76	21.69	-	-	14.839	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	125.25	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						49.21
2	2	CLAY	2.50	4.00	1.50	1.90	0.671	0.130	0.00	49.04	66.25	-	-	43.325	-	
3	3	CLAY	4.00	5.50	1.50	1.96	0.640	0.125	0.00	62.72	27.74	-	-	18.184	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	89.63	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						53.57
2	2	CLAY	1.50	3.50	2.00	1.87	0.665	0.131	0.00	41.04	45.73	-	-	51.170	-	
3	3	CLAY	3.50	5.25	1.75	1.90	0.671	0.130	0.00	63.31	19.39	-	-	15.796	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	81.77	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.80	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.87	0.665	0.131	0.00	41.04	41.72	-	-	47.937	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.90	0.671	0.130	0.00	63.31	17.69	-	-	14.568	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	95.25	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.87	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.90	0.671	0.130	0.00	50.78	48.60	-	-	45.373	-	46.73
3	3	CLAY	4.00	5.50	1.50	1.96	0.640	0.125	0.00	71.93	21.60	-	-	13.037	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	120.65	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.00	Depth of foundation						57.65
2	2	CLAY	2.50	4.50	2.00	1.90	0.671	0.130	0.00	51.24	61.56	-	-	53.319	-	
3	3	CLAY	4.50	6.25	1.75	1.96	0.640	0.125	0.00	68.31	26.10	-	-	18.746	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	99.72	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.87	0.000	0.000	0.000	Depth of foundation						
2	2	CLAY	2.50	4.50	2.00	1.9	0.671	0.130	0.000	51.24	50.88	-	-	46.598	-	50.00
3	3	CLAY	4.50	6.25	1.75	1.96	0.640	0.125	0.000	68.31	21.57	-	-	15.899	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	2.20		Factor of safety	2.50
				Water table used for calculation (m)	1.20		Assumed post monsoon rise (m)	1.00

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GEOTECH & MATERIAL TESTING

Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.81	15.79	1.81	15.79	0.10	18	12.28	0.695	23.68	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.34	1.17	1.17	1.34	1.17	1.17	1.00	1.00	1.00	385.91	184.23	239.69	**95.88**
2	SQUARE	2.00	1.20	1.20	1.81	13.83	1.86	14.32	0.10	18	12.28	0.695	27.66	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.46	1.23	1.23	1.46	1.23	1.23	1.00	1.00	1.00	439.83	210.05	273.24	**109.30**
3	SQUARE	2.50	1.20	1.20	1.81	12.65	1.86	13.14	0.15	11	7.42	0.684	31.63	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.51	1.25	1.25	1.51	1.25	1.25	1.00	1.00	1.00	343.12	189.62	240.28	**96.11**
4	SQUARE	1.50	2.00	2.00	1.81	15.79	1.81	15.79	0.10	18	12.28	0.695	23.68	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.21	1.10	1.10	1.21	1.10	1.10	1.00	1.00	1.00	367.21	174.71	227.65	**91.06**
5	SQUARE	2.00	2.00	2.00	1.81	13.83	1.86	14.32	0.10	18	12.28	0.695	27.66	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.28	1.14	1.14	1.28	1.14	1.14	1.00	1.00	1.00	408.96	194.68	253.61	**101.44**
6	SQUARE	2.50	2.00	2.00	1.81	12.65	1.86	13.14	0.15	11	7.42	0.684	31.63	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	305.49	168.75	213.87	**85.55**
7	SQUARE	1.50	2.50	2.50	1.81	15.79	1.81	15.79	0.10	18	12.28	0.695	23.68	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.17	1.08	1.08	1.17	1.08	1.08	1.00	1.00	1.00	365.32	173.47	226.23	**90.49**
8	SQUARE	2.00	2.50	2.50	1.81	13.83	1.86	14.32	0.10	18	12.28	0.695	27.66	13.11	5.26	4.07	9.42	3.05	1.76	1.30	1.20	0.80	1.22	1.11	1.11	1.22	1.11	1.11	1.00	1.00	1.00	402.04	191.01	249.04	**99.62**
9	SQUARE	2.50	2.50	2.50	1.81	12.65	1.86	13.14	0.15	11	7.42	0.684	31.63	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	296.07	163.49	207.24	**82.90**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	95.88	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.86	0.684	0.133	0.00	38.35	36.31	-	-	34.278	-	33.44
3	3	CLAY	3.00	4.00	1.00	1.89	0.686	0.132	0.00	54.43	13.48	-	-	7.525	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	109.30	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.81	0.000	0.000	0.00	Depth of foundation						32.27
2	2	CLAY	2.00	3.50	1.50	1.86	0.684	0.133	0.00	46.45	41.39	-	-	32.782	-	
3	3	CLAY	3.50	4.50	1.00	1.89	0.686	0.132	0.00	61.76	15.37	-	-	7.556	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	96.11	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						27.98
2	2	CLAY	2.50	4.00	1.50	1.89	0.686	0.132	0.00	49.21	36.40	-	-	28.240	-	
3	3	CLAY	4.00	5.00	1.00	1.95	0.654	0.127	0.00	60.41	13.52	-	-	6.733	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	91.06	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.86	0.684	0.133	0.00	38.35	48.16	-	-	41.861	-	45.92
3	3	CLAY	3.00	4.50	1.50	1.89	0.686	0.132	0.00	56.61	20.17	-	-	15.540	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	101.44	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.81	0.000	0.000	0.00	Depth of foundation						43.89
2	2	CLAY	2.00	3.50	1.50	1.86	0.684	0.133	0.00	46.45	53.65	-	-	39.505	-	
3	3	CLAY	3.50	5.00	1.50	1.89	0.686	0.132	0.00	63.95	22.46	-	-	15.355	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	85.55	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						37.17
2	2	CLAY	2.50	4.00	1.50	1.89	0.686	0.132	0.00	49.21	45.25	-	-	33.259	-	
3	3	CLAY	4.00	5.50	1.50	1.95	0.654	0.127	0.00	62.74	18.95	-	-	13.199	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	90.49	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	0.000	0.000	0.00	Depth of foundation						54.03
2	2	CLAY	1.50	3.50	2.00	1.86	0.684	0.133	0.00	41.22	46.17	-	-	51.545	-	
3	3	CLAY	3.50	5.25	1.75	1.89	0.686	0.132	0.00	63.46	19.58	-	-	15.998	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	81.61	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.86	0.684	0.133	0.00	41.22	41.64	-	-	47.893	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.89	0.686	0.132	0.00	63.46	17.65	-	-	14.605	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	99.62	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.86	0.000	0.000	0.00	Depth of foundation						48.79
2	2	CLAY	2.00	4.00	2.00	1.89	0.686	0.132	0.00	50.60	50.83	-	-	47.286	-	
3	3	CLAY	4.00	5.50	1.50	1.95	0.654	0.127	0.00	71.71	22.59	-	-	13.697	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.20	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	82.90	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.86	0.000	0.000	0.00	Depth of foundation						43.56
2	2	CLAY	2.50	4.50	2.00	1.89	0.686	0.132	0.00	51.39	42.30	-	-	40.837	-	
3	3	CLAY	4.50	6.25	1.75	1.95	0.654	0.127	0.00	68.27	17.93	-	-	13.612	-	

SITE PHOTOS DURING SITE INVESTIGATION

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**1 (L.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**				2.15		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/16/2023										
					Elevation	**100.000**				**Completed on**			4/16/2023										
Depth of Bore Hole	**Reduced Level**		**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
				4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre			(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	**2**		**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500		DS	100	100	100	98	29	20	9	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650		UD	100	100	99	97	28	19	9	CL				1.80	15.3	1.56	2.63	0.686	0.20	11°	0.133
1.35 - 1.80	98.650 - 98.200		SPT									6	8.21	8.21								
2.50 - 2.85	97.500 - 97.150		UD	100	100	100	99	30	19	11	CL				1.87	18.4	1.58	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700		SPT									7	9.96	9.96								
4.00 - 4.35	96.000 - 95.650		UD	100	100	100	98	32	16	16	CL				1.90	20.2	1.58	2.64	0.671	0.30	7°	0.130
4.35 - 4.80	95.650 - 95.200		SPT									8	10.32	10.32								
5.50 - 5.85	94.500 - 94.150		UD	100	100	100	96	30	16	14	CL				1.96	21.8	1.61	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700		SPT									11	13.07	13.07								
7.00 - 7.35	93.000 - 92.650		UD	100	100	100	41	NON PLASTIC			SM				1.90	23.6	1.54	2.59	0.682	0	29°	-
7.35 - 7.80	92.650 - 92.200		SPT									13	14.50	14.50								
8.50 - 8.85	91.500 - 91.150		UD	100	100	100	40	NON PLASTIC			SM				1.93	22.2	1.58	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700		SPT									17	17.91	16.46								
9.30 - 10.00	90.700 - 90.000		DS	100	100	100	40	NON PLASTIC			SM					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**2 (L.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**			2.20		**VIVEK MATERIAL TESTING LABORATORY**								
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/16/2023											
					Elevation		**100.000**			**Completed on**			4/16/2023											

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N''**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	100	100	98	34	22	12	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	98	97	31	20	11	CL				1.81	17.4	1.54	2.61	0.695	0.10	18°	0.135
1.35 - 1.80	98.650 - 98.200	SPT									5	6.84	6.84								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	98	33	19	14	CL				1.86	20.3	1.55	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									6	8.54	8.54								
4.00 - 4.35	96.000 - 95.650	UD	100	100	97	96	34	21	13	CL				1.89	21.4	1.56	2.63	0.686	0.25	11°	0.132
4.35 - 4.80	95.650 - 95.200	SPT									7	9.03	9.03								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	98	35	21	14	CL				1.95	22.6	1.59	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									10	11.90	11.90								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	43	NON PLASTIC			SM				1.91	23.1	1.55	2.58	0.665	0	28°	-
7.35 - 7.80	92.650 - 92.200	SPT									14	15.62	15.31								
8.50 - 8.85	91.500 - 91.150	UD	100	100	98	44	NON PLASTIC			SM				1.92	20.2	1.60	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									19	20.04	17.52								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	46	NON PLASTIC			SM					-	-	-	-	-	-	-

BORE-LOG CHART

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VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL

WATER TABLE 2.15 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	3	3	6	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			2	3	4	7	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			3	4	4	8	
5.50-5.85	SILTY-CLAY	U.D.	CL						
5.85-6.30		S.P.T.			4	5	6	11	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			5	6	7	13	
8.50-8.85	SILTY-SAND	U.D.	SM						
8.85-9.30		S.P.T.			6	8	9	17	
9.30-10.00	SILTY-SAND	D.	SM						

BORE-LOG CHART

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VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT IN WEST BENGAL

WATER TABLE 2.20 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	2	3	5	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			2	3	3	6	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			2	3	4	7	
5.50-5.85	SILTY-CLAY	U.D.	CL						
5.85-6.30		S.P.T.			4	5	5	10	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			5	7	7	14	
8.50-8.85	SILTY-SAND	U.D.	SM						
8.85-9.30		S.P.T.			7	9	10	19	
9.30-10.00	SILTY-SAND	D.	SM						

VMT/132/23-24 (LHS) WB

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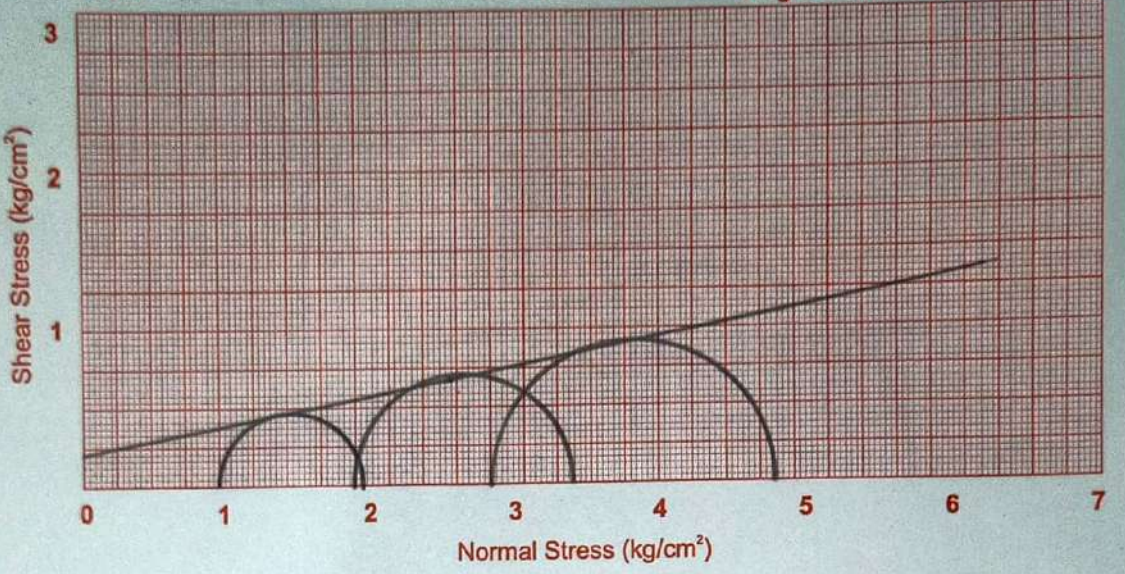
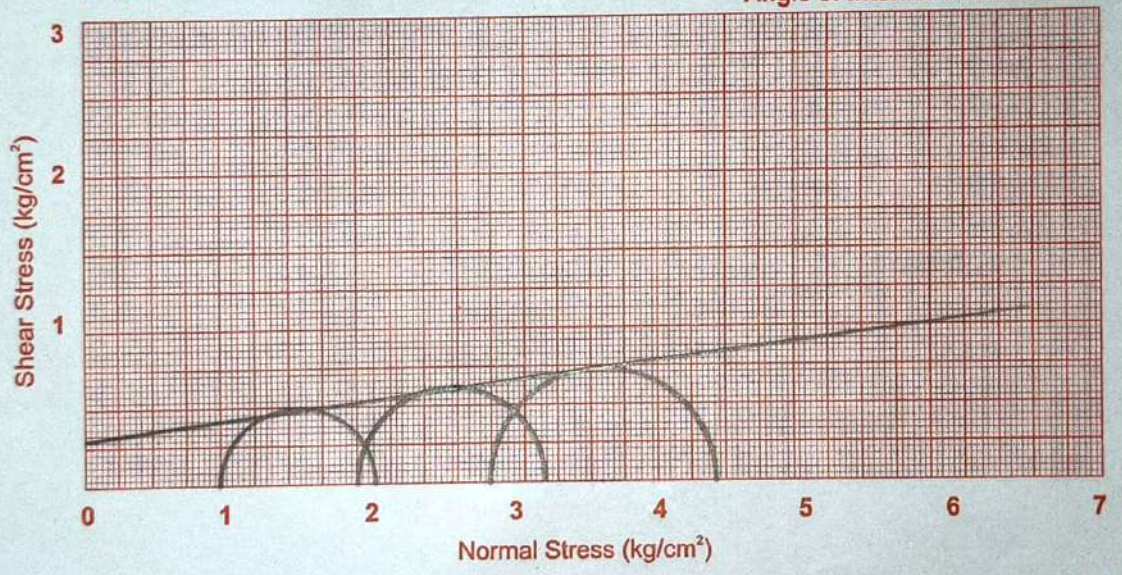
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 11° *



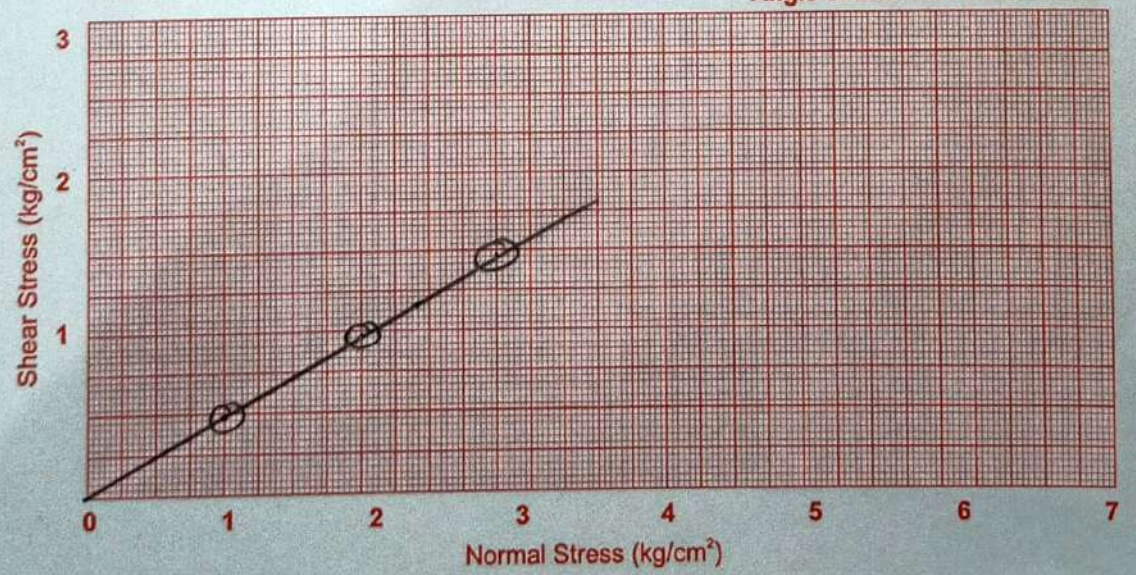
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 7° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 29° *



VMT/132/23-24 (L.H.S) W.B.

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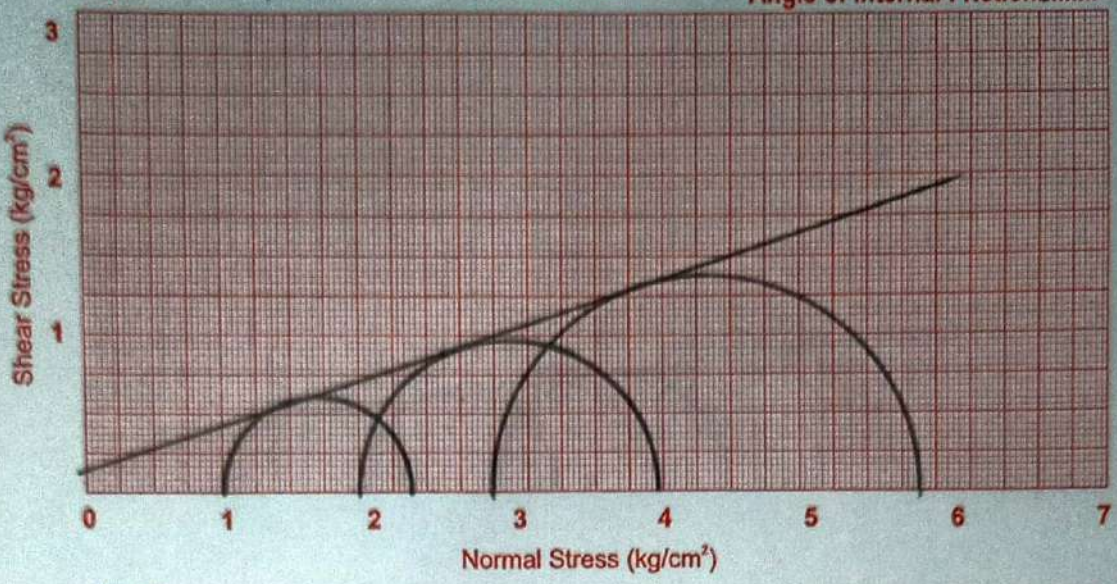
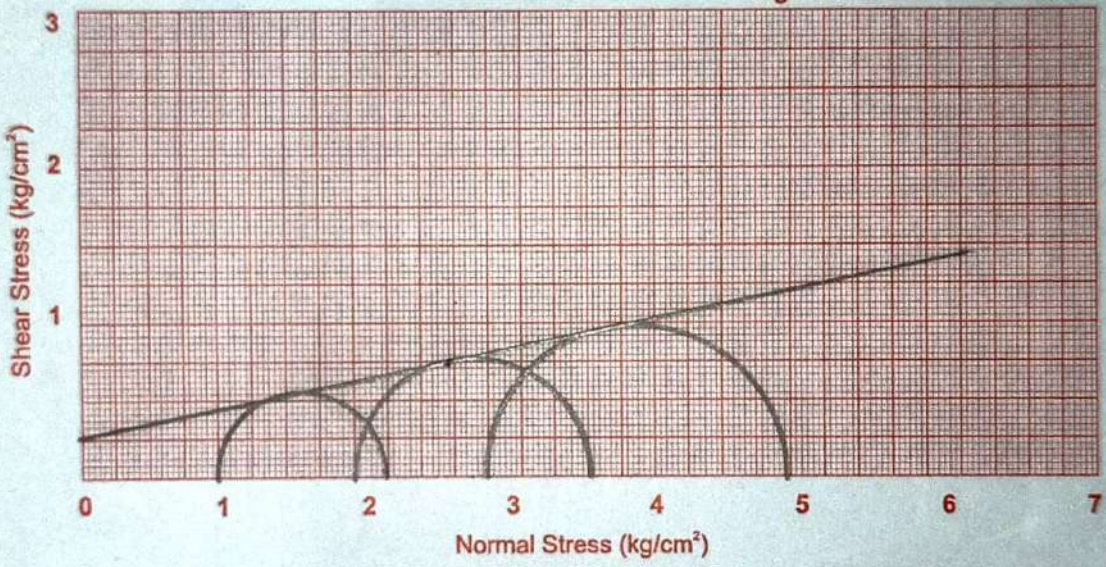
B.H. No. :- 02
Depth - 1.00 - 1.35

Cohesion 'c' 0.10 Kg/cm²
Angle of Internal Friction 18° *



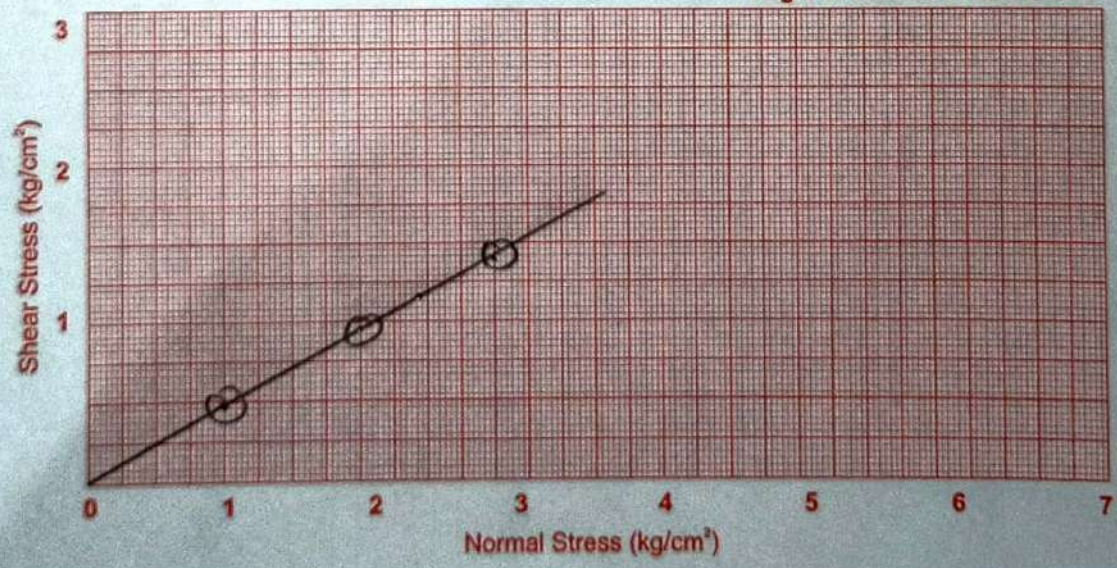
B.H. No. :- 02
Depth :- 4.00 - 4.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 11° *



B.H. No. :- 02
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 28° *



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TC-8969

REPORT NO. – VMT 132 B/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE (R.H.S.) IN WEST BENGAL

Prepared By -

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ACKNOWLEDGEMENT

WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 17/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	LALBAGH FERRY GHAT OPOOSITE	BH-01 (RHS)	24.17059937	88.26650675	10.0
2.		BH-02 (RHS)	24.17004572	88.26657582	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'CI' group of IS classification (clayey soil) having 95 to 99 percent material finer than 75 micron and coarse-grained soils (sandy soil) comprise of 'ML' group of IS classification having 71 to 88 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 7.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity,

second strata, from 7.00 metre to 10.00 metre, consists of a layer of ML group of IS classification which is inorganic silts with none to low plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 2.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 2.50 metre to 7.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity,

third strata, from 7.00 metre to 10.00 metre, consists of a layer of ML group of IS classification which is inorganic silts with none to low plasticity.

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 4 to 9 indicating 'Soft' to 'Medium' 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 9 to 16 indicating 'Loose' to 'Medium' relative density.

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

WATER TABLE

Water Table at the Site was observed at a depth from 2.00 metre to 2.15 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 1.00 metre to 1.15 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	11.06	37.45	-
		2.00	1.20 x 1.20	11.99	37.67	-
		2.50	1.20 x 1.20	9.87	30.28	-
		1.50	2.00 x 2.00	10.23	50.43	10.11
		2.00	2.00 x 2.00	10.84	50.33	10.74
		2.50	2.00 x 2.00	8.75	39.99	-
		1.50	2.50 x 2.50	10.03	58.87	8.06
		2.00	2.50 x 2.50	10.48	57.04	8.78
		2.50	2.50 x 2.50	8.44	46.69	-
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	9.07	32.33	-
		2.00	1.20 x 1.20	10.12	30.62	-
		2.50	1.20 x 1.20	12.10	33.15	-
		1.50	2.00 x 2.00	8.48	43.85	-
		2.00	2.00 x 2.00	9.23	41.10	-
		2.50	2.00 x 2.00	10.77	43.86	-
		1.50	2.50 x 2.50	8.35	51.22	8.09
		2.00	2.50 x 2.50	9.00	44.52	-
		2.50	2.50 x 2.50	10.42	51.39	10.05

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

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BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	2.00		Factor of safety	2.50
				Water table used for calculation (m)	1.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.81	14.48	1.81	14.48	0.30	7	4.70	0.690	21.72	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.28	1.00	1.00	1.28	1.00	1.00	1.00	1.00	1.00	376.98	225.79	271.15	**108.46**
2	SQUARE	2.00	1.20	1.20	1.81	12.85	1.82	12.95	0.30	7	4.70	0.690	25.69	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.38	1.00	1.00	1.38	1.00	1.00	1.00	1.00	1.00	408.62	244.75	293.91	**117.56**
3	SQUARE	2.50	1.20	1.20	1.81	11.87	1.82	11.96	0.20	10	6.74	0.724	29.67	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.50	1.25	1.25	1.50	1.25	1.25	1.00	1.00	1.00	390.93	219.77	242.02	**96.81**
4	SQUARE	1.50	2.00	2.00	1.81	14.48	1.81	14.48	0.30	7	4.70	0.690	21.72	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.17	1.00	1.00	1.17	1.00	1.00	1.00	1.00	1.00	348.83	208.92	250.89	**100.36**
5	SQUARE	2.00	2.00	2.00	1.81	12.85	1.82	12.95	0.30	7	4.70	0.690	25.69	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.23	1.00	1.00	1.23	1.00	1.00	1.00	1.00	1.00	369.51	221.32	265.78	**106.31**
6	SQUARE	2.50	2.00	2.00	1.81	11.87	1.82	11.96	0.20	10	6.74	0.724	29.67	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	346.65	194.83	214.57	**85.83**
7	SQUARE	1.50	2.50	2.50	1.81	14.48	1.81	14.48	0.30	7	4.70	0.690	21.72	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.14	1.00	1.00	1.14	1.00	1.00	1.00	1.00	1.00	341.87	204.74	245.88	**98.35**
8	SQUARE	2.00	2.50	2.50	1.81	12.85	1.82	12.95	0.30	7	4.70	0.690	25.69	7.17	1.88	0.71	6.44	1.53	0.42	1.30	1.20	0.80	1.18	1.00	1.00	1.18	1.00	1.00	1.00	1.00	1.00	357.06	213.86	256.82	**102.73**
9	SQUARE	2.50	2.50	2.50	1.81	11.87	1.82	11.96	0.20	10	6.74	0.724	29.67	8.34	2.47	1.22	7.03	1.83	0.67	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	334.50	187.97	207.02	**82.81**

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	108.46	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.724	0.136	0.00	37.56	41.07	-	-	37.969	-	37.45
3	3	CLAY	3.00	4.00	1.00	1.87	0.695	0.136	0.00	52.76	15.25	-	-	8.848	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	117.56	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.81	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	3.50	1.50	1.82	0.724	0.136	0.00	41.53	44.52	-	-	37.436	-	37.67
3	3	CLAY	3.50	4.50	1.00	1.87	0.695	0.136	0.00	51.83	16.53	-	-	9.647	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	96.81	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						30.28
2	2	CLAY	2.50	4.00	1.50	1.87	0.695	0.136	0.00	46.12	36.66	-	-	30.577	-	
3	3	CLAY	4.00	5.00	1.00	1.92	0.662	0.130	0.00	57.03	13.61	-	-	7.272	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	100.36	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	-	-	-	Depth of foundation						50.43
2	2	CLAY	1.50	3.00	1.50	1.82	0.724	0.136	0.00	37.56	53.08	-	-	45.273	-	
3	3	CLAY	3.00	4.50	1.50	1.87	0.695	0.136	0.00	54.89	22.23	-	-	17.768	-	

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SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	99.15	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.724	0.136	0.00	37.56	52.44	-	-	44.91	-	50.00
3	3	CLAY	3.00	4.50	1.50	1.87	0.695	0.136	0.00	54.89	21.96	-	-	17.59	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	106.31	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.81	0.000	0.000	0.00	Depth of foundation						50.33
2	2	CLAY	2.00	3.50	1.50	1.82	0.724	0.136	0.00	41.53	56.23	-	-	43.993	-	
3	3	CLAY	3.50	5.00	1.50	1.87	0.695	0.136	0.00	53.96	23.54	-	-	18.924	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	105.35	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.81	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	2.00	3.50	1.50	1.82	0.724	0.136	0.00	41.53	55.72	-	-	43.725	-	
3	3	CLAY	3.50	5.00	1.50	1.87	0.695	0.136	0.00	53.96	23.33	-	-	18.781	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	85.83	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						39.99
2	2	CLAY	2.50	4.00	1.50	1.87	0.695	0.136	0.00	46.12	45.40	-	-	35.821	-	
3	3	CLAY	4.00	5.50	1.50	1.92	0.662	0.130	0.00	59.28	19.01	-	-	14.171	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	98.35	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	0.000	0.000	0.00	Depth of foundation						58.87
2	2	CLAY	1.50	3.50	2.00	1.82	0.724	0.136	0.00	40.27	50.18	-	-	55.443	-	
3	3	CLAY	3.50	5.25	1.75	1.87	0.695	0.136	0.00	61.38	21.28	-	-	18.148	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	79.00	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.81	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	1.50	3.50	2.00	1.82	0.724	0.136	0.00	40.27	40.31	-	-	47.524	-	50.00
3	3	CLAY	3.50	5.25	1.75	1.87	0.695	0.136	0.00	61.38	17.09	-	-	14.978	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	102.73	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						57.04
2	2	CLAY	2.00	4.00	2.00	1.87	0.695	0.136	0.00	44.23	52.41	-	-	54.473	-	
3	3	CLAY	4.00	5.50	1.50	1.92	0.662	0.130	0.00	59.53	23.29	-	-	16.828	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	86.06	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.000	Depth of foundation						50.00
2	2	CLAY	2.00	4.00	2.00	1.87	0.695	0.136	0.000	44.23	43.91	-	-	48.053	-	
3	3	CLAY	4.00	5.50	1.50	1.92	0.662	0.130	0.000	59.53	19.51	-	-	14.448	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	2.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	82.81	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						46.69
2	2	CLAY	2.50	4.50	2.00	1.87	0.695	0.136	0.00	48.25	42.25	-	-	43.833	-	
3	3	CLAY	4.50	6.25	1.75	1.92	0.662	0.130	0.00	64.68	17.91	-	-	14.535	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	2.15		Factor of safety	2.50
				Water table used for calculation (m)	1.15		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.82	15.56	1.82	15.56	0.15	13	8.79	0.688	23.34	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	328.48	174.84	222.47	**88.99**
2	SQUARE	2.00	1.20	1.20	1.82	13.68	1.88	14.27	0.15	13	8.79	0.688	27.36	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.42	1.21	1.21	1.42	1.21	1.21	1.00	1.00	1.00	366.19	194.94	248.03	**99.21**
3	SQUARE	2.50	1.20	1.20	1.82	12.55	1.88	13.14	0.20	12	8.11	0.706	31.38	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.51	1.26	1.26	1.51	1.26	1.26	1.00	1.00	1.00	459.82	250.72	296.72	**118.69**
4	SQUARE	1.50	2.00	2.00	1.82	15.56	1.82	15.56	0.15	13	8.79	0.688	23.34	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	307.12	163.29	207.88	**83.15**
5	SQUARE	2.00	2.00	2.00	1.82	13.68	1.88	14.27	0.15	13	8.79	0.688	27.36	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	334.29	177.77	226.29	**90.52**
6	SQUARE	2.50	2.00	2.00	1.82	12.55	1.88	13.14	0.20	12	8.11	0.706	31.38	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.31	1.15	1.15	1.31	1.15	1.15	1.00	1.00	1.00	409.29	223.03	264.01	**105.60**
7	SQUARE	1.50	2.50	2.50	1.82	15.56	1.82	15.56	0.15	13	8.79	0.688	23.34	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.15	1.08	1.08	1.15	1.08	1.08	1.00	1.00	1.00	302.65	160.80	204.77	**81.91**
8	SQUARE	2.00	2.50	2.50	1.82	13.68	1.88	14.27	0.15	13	8.79	0.688	27.36	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	326.27	173.38	220.78	**88.31**
9	SQUARE	2.50	2.50	2.50	1.82	12.55	1.88	13.14	0.20	12	8.11	0.706	31.38	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.25	1.12	1.12	1.25	1.12	1.12	1.00	1.00	1.00	396.00	215.70	255.37	**102.15**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	88.99	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.88	0.706	0.139	0.00	38.52	33.70	-	-	33.364	-	32.33
3	3	CLAY	3.00	4.00	1.00	1.92	0.686	0.133	0.00	54.77	12.51	-	-	7.050	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	99.21	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	3.50	1.50	1.88	0.706	0.139	0.00	46.69	37.57	-	-	31.337	-	30.62
3	3	CLAY	3.50	4.50	1.00	1.92	0.686	0.133	0.00	62.19	13.95	-	-	6.934	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	118.69	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						33.15
2	2	CLAY	2.50	4.00	1.50	1.92	0.686	0.133	0.00	49.43	44.95	-	-	33.237	-	
3	3	CLAY	4.00	5.00	1.00	1.97	0.654	0.129	0.00	60.95	16.69	-	-	8.198	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	83.15	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						43.85
2	2	CLAY	1.50	3.00	1.50	1.88	0.706	0.139	0.00	38.52	43.98	-	-	40.427	-	
3	3	CLAY	3.00	4.50	1.50	1.92	0.686	0.133	0.00	57.03	18.41	-	-	14.380	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	90.52	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						41.10
2	2	CLAY	2.00	3.50	1.50	1.88	0.706	0.139	0.00	46.69	47.88	-	-	37.463	-	
3	3	CLAY	3.50	5.00	1.50	1.92	0.686	0.133	0.00	64.45	20.05	-	-	13.918	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	105.60	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						43.86
2	2	CLAY	2.50	4.00	1.50	1.92	0.686	0.133	0.00	49.43	55.85	-	-	38.857	-	
3	3	CLAY	4.00	5.50	1.50	1.97	0.654	0.129	0.00	63.33	23.39	-	-	15.968	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	81.91	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						51.22
2	2	CLAY	1.50	3.50	2.00	1.88	0.706	0.139	0.00	41.43	41.79	-	-	49.364	-	
3	3	CLAY	3.50	5.25	1.75	1.92	0.686	0.133	0.00	63.98	17.72	-	-	14.658	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	79.36	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	1.50	3.50	2.00	1.88	0.706	0.139	0.00	41.43	40.49	-	-	48.249	-	
3	3	CLAY	3.50	5.25	1.75	1.92	0.686	0.133	0.00	63.98	17.17	-	-	14.252	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00		BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	88.31	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.88	0.000	0.000	0.00	Depth of foundation						44.52
2	2	CLAY	2.00	4.00	2.00	1.92	0.686	0.133	0.00	51.17	45.06	-	-	43.274	-	
3	3	CLAY	4.00	5.50	1.50	1.97	0.654	0.129	0.00	72.60	20.02	-	-	12.377	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	102.15	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.00	Depth of foundation						51.39
2	2	CLAY	2.50	4.50	2.00	1.92	0.686	0.133	0.00	51.68	52.12	-	-	47.781	-	
3	3	CLAY	4.50	6.25	1.75	1.97	0.654	0.129	0.00	69.03	22.10	-	-	16.463	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	2.15	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	98.52	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.88	0.000	0.000	0.000	Depth of foundation						50.00
2	2	CLAY	2.50	4.50	2.00	1.92	0.686	0.133	0.000	51.68	50.27	-	-	46.547	-	
3	3	CLAY	4.50	6.25	1.75	1.97	0.654	0.129	0.000	69.03	21.31	-	-	15.950	-	

SITE PHOTOS DURING SITE INVESTIGATION

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**1 (R.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**			2.00		**VIVEK MATERIAL TESTING LABORATORY**								
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/17/2023											
					Elevation		**100.000**			**Completed on**			4/17/2023											

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	100	100	98	95	36	21	15	Cl					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	99	97	38	22	16	Cl				1.81	16.5	1.55	2.62	0.690	0.30	7°	0.132
1.35 - 1.80	98.650 - 98.200	SPT									6	8.21	8.21								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	99	39	24	15	Cl				1.82	19.7	1.52	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									4	5.73	5.73								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	97	40	22	18	Cl				1.87	21.4	1.54	2.61	0.695	0.20	12°	0.136
4.35 - 4.80	95.650 - 95.200	SPT									5	6.50	6.50								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	98	41	25	16	Cl				1.92	22.3	1.57	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									7	8.40	8.40								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	76	NON PLASTIC			ML				1.82	23.8	1.47	2.56	0.741	0	29°	-
7.35 - 7.80	92.650 - 92.200	SPT									9	10.18	10.18								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	71	NON PLASTIC			ML				1.86	21.7	1.53	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									13	13.92	13.92								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	73	NON PLASTIC			ML					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL**																						
Client Name																							
Bore Hole No.	**2 (R.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**			2.15		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/17/2023										
					Elevation			**100.000**		**Completed on**			4/17/2023										

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	99	98	98	97	34	23	11	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	99	98	97	35	22	13	CL				1.82	18.2	1.54	2.60	0.688	0.15	13°	0.137
1.35 - 1.80	98.650 - 98.200	SPT									5	6.83	6.83								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	98	38	24	14	CI				1.88	22.7	1.53	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									4	5.67	5.67								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	99	36	22	14	CI				1.92	23.1	1.56	2.63	0.686	0.20	12°	0.133
4.35 - 4.80	95.650 - 95.200	SPT									6	7.70	7.70								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	97	37	23	14	CI				1.97	24.2	1.59	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									9	10.64	10.64								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	81	NON PLASTIC			ML				1.90	22.8	1.55	2.58	0.665	0	30°	-
7.35 - 7.80	92.650 - 92.200	SPT									14	15.55	15.28								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	88	NON PLASTIC			ML				1.89	20.3	1.57	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									16	16.84	15.92								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	78	NON PLASTIC			ML					-	-	-	-	-	-	-

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL

WATER TABLE 2.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CI						
1.00-1.35	SILTY-CLAY	U.D.	CI						
1.35-1.80		S.P.T.			2	3	3	6	
2.50-2.85	SILTY-CLAY	U.D.	CI						
2.85-3.30		S.P.T.			1	2	2	4	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			2	2	3	5	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			2	3	4	7	
7.00-7.35	SANDY-SILT	U.D.	ML						
7.35-7.80		S.P.T.			3	4	5	9	
8.50-8.85	SANDY-SILT	U.D.	ML						
8.85-9.30		S.P.T.			4	6	7	13	
9.30-10.00	SANDY-SILT	D.	ML						

BORE-LOG CHART

VMT
GEOTECH & MATERIAL TESTING

VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT LALBAGH FERRY GHAT OPOOSITE IN WEST BENGAL

WATER TABLE 2.15 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	2	3	5	
2.50-2.85	SILTY-CLAY	U.D.	CI						
2.85-3.30		S.P.T.			2	2	2	4	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			2	3	3	6	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			3	4	5	9	
7.00-7.35	SANDY-SILT	U.D.	ML						
7.35-7.80		S.P.T.			4	6	8	14	
8.50-8.85	SANDY-SILT	U.D.	ML						
8.85-9.30		S.P.T.			5	7	9	16	
9.30-10.00	SANDY-SILT	D.	ML						

VMT/132/23-24 (R.H.S)

VMT
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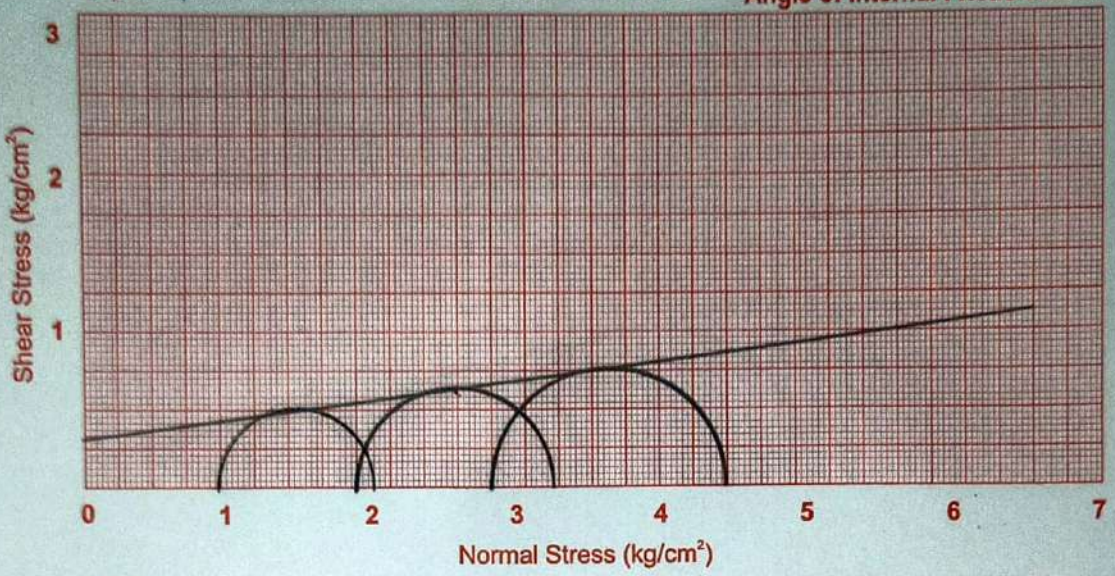
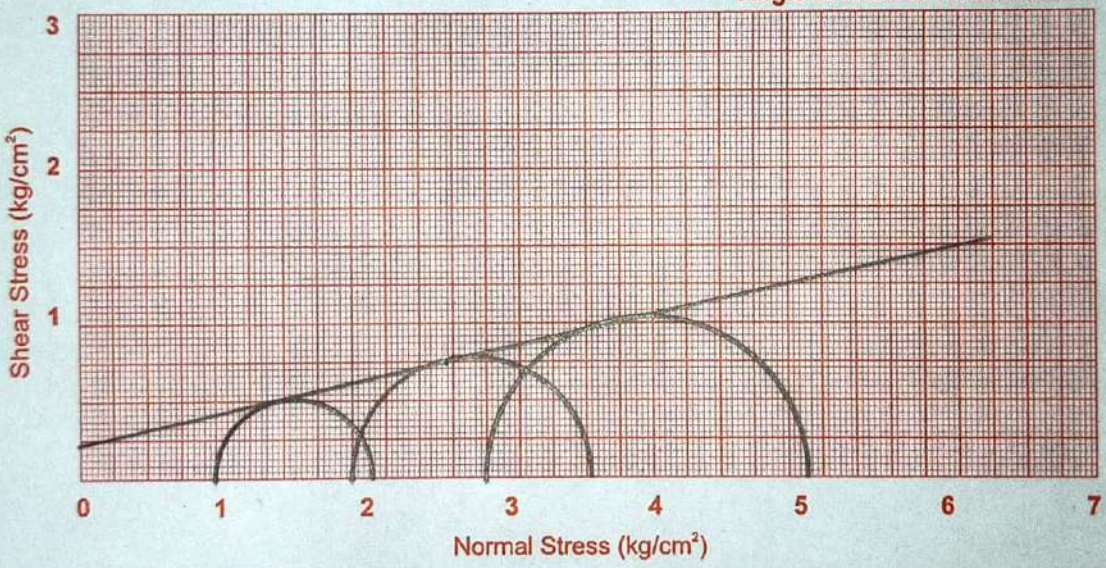
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 7° *



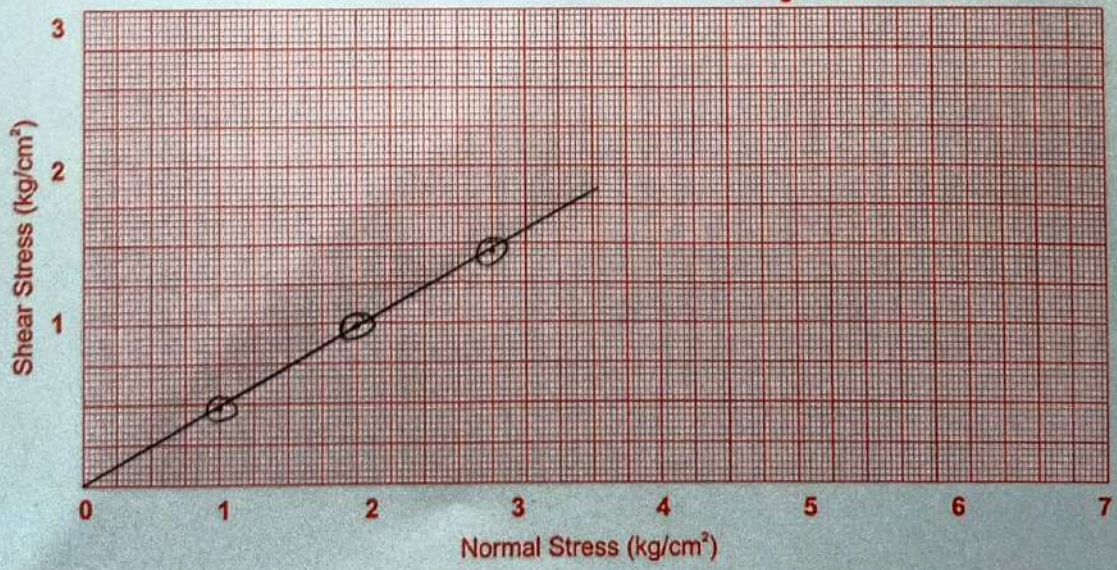
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 12° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 29° *

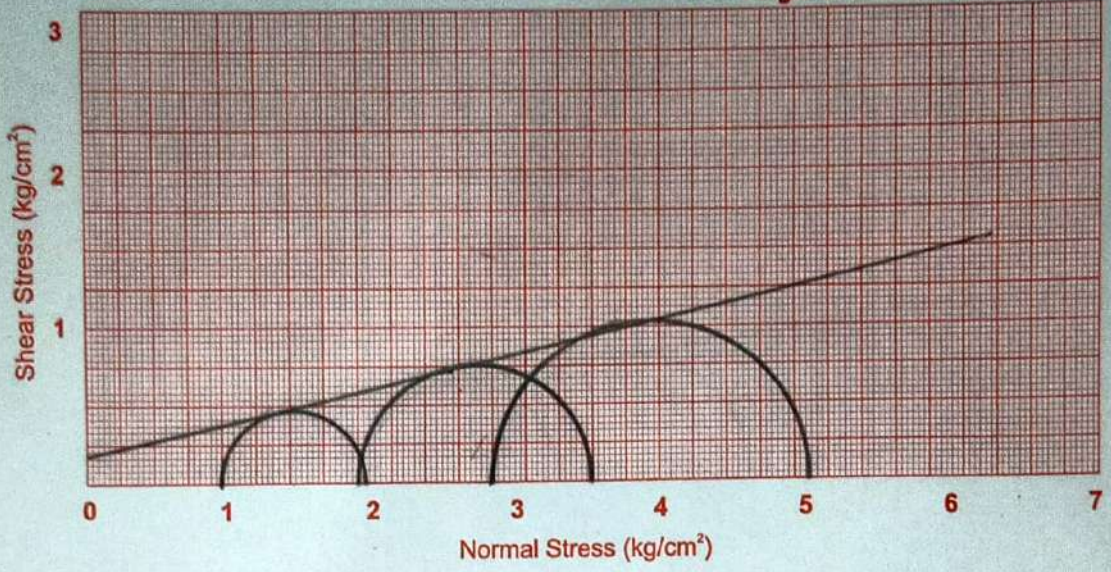


VMT/132/23-24 (R.H.S.)

VMT
GEOTECH & MATERIAL TESTING

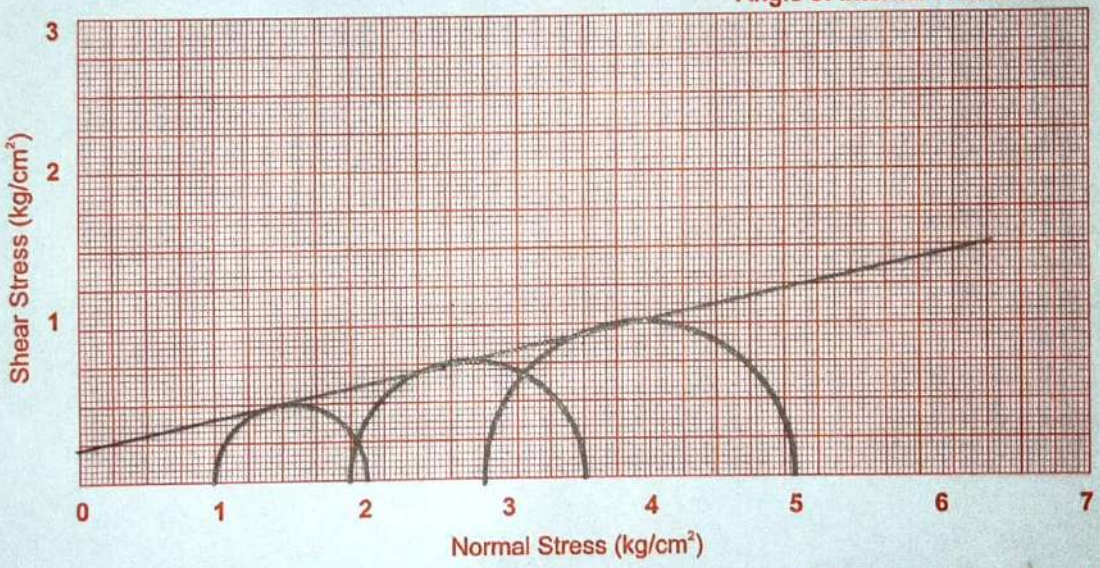
B.H. No. :- 02
Depth - 1.00 - 1.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 13° *



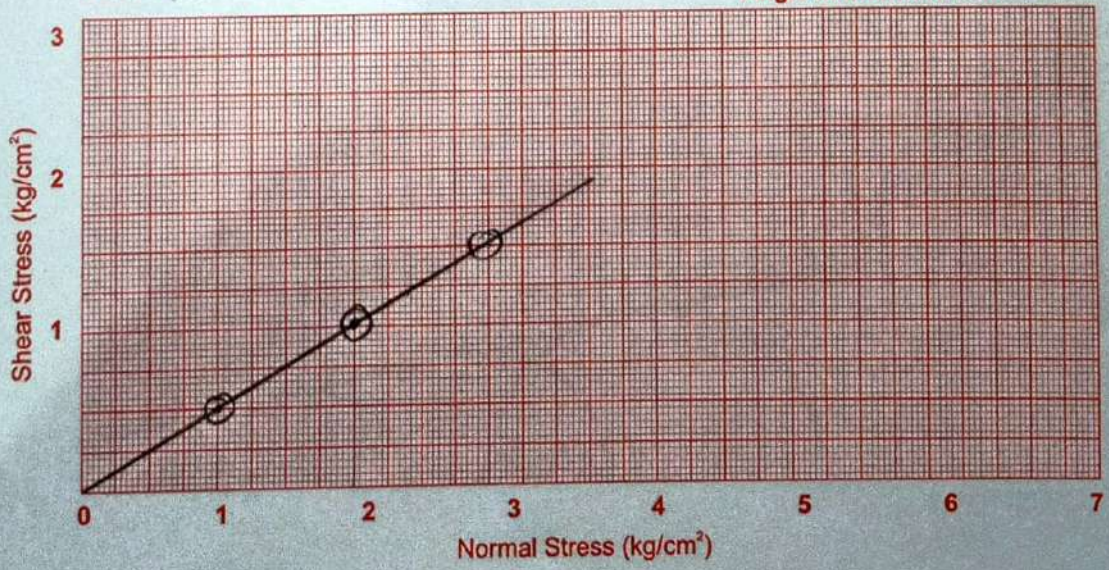
B.H. No. :- 02
Depth :- 4.00 - 4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 12° *



B.H. No. :- 02
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 30° *



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GEOTECH & MATERIAL TESTING

TC-8969

REPORT NO. – VMT 134/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT (R.H.S.) IN WEST BENGAL

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WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

INDEX

SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 20/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	TALTALA GHAT	BH-01 (RHS)	24.813268	87.91631855	10.0
2.		BH-02 (RHS)	24.81275552	87.91642584	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'ML' group of IS classification (clayey soil) having 87 to 99 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 2.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 2.50 metre to 4.00 metre, consists of a layer of ML group of IS classification which is inorganic silts with none to low plasticity

third strata, from 4.00 metre to 10.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 10.00 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity.

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 5 to 17 indicating 'Medium' to 'Stiff' consistency.

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

WATER TABLE

Water Table at the Site was observed at a depth 7.00 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 6.00 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	8.53	28.08	-
		2.00	1.20 x 1.20	9.80	27.09	-
		2.50	1.20 x 1.20	13.87	31.60	-
		1.50	2.00 x 2.00	8.10	38.32	-
		2.00	2.00 x 2.00	9.09	36.60	-
		2.50	2.00 x 2.00	12.91	42.70	-
		1.50	2.50 x 2.50	8.03	43.75	-
		2.00	2.50 x 2.50	8.97	41.40	-
		2.50	2.50 x 2.50	12.79	49.85	-
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	13.22	39.05	-
		2.00	1.20 x 1.20	15.14	37.75	-
		2.50	1.20 x 1.20	19.33	39.07	-
		1.50	2.00 x 2.00	12.47	52.29	11.70
		2.00	2.00 x 2.00	13.95	50.14	13.90
		2.50	2.00 x 2.00	17.25	50.96	16.80
		1.50	2.50 x 2.50	12.36	60.06	9.62
		2.00	2.50 x 2.50	13.70	55.05	12.02
		2.50	2.50 x 2.50	16.75	58.86	13.45

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	7.00		Factor of safety	2.50
				Water table used for calculation (m)	6.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.76	17.26	1.76	17.26	0.15	12	8.11	0.701	25.89	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.31	1.15	1.15	1.31	1.15	1.15	1.00	1.00	1.00	318.72	173.57	209.13	**83.65**
2	SQUARE	2.00	1.20	1.20	1.76	17.26	1.82	17.85	0.15	12	8.11	0.701	34.52	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.41	1.21	1.21	1.41	1.21	1.21	1.00	1.00	1.00	366.22	199.52	240.36	**96.14**
3	SQUARE	2.50	1.20	1.20	1.76	17.26	1.82	17.85	0.10	17	11.58	0.692	43.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.56	1.28	1.28	1.56	1.28	1.28	1.00	1.00	1.00	533.81	261.00	340.11	**136.04**
4	SQUARE	1.50	2.00	2.00	1.76	17.26	1.76	17.26	0.15	12	8.11	0.701	25.89	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	303.11	164.82	198.70	**79.48**
5	SQUARE	2.00	2.00	2.00	1.76	17.26	1.82	17.85	0.15	12	8.11	0.701	34.52	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.25	1.12	1.12	1.25	1.12	1.12	1.00	1.00	1.00	340.02	184.98	222.96	**89.18**
6	SQUARE	2.50	2.00	2.00	1.76	17.26	1.82	17.85	0.10	17	11.58	0.692	43.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.34	1.17	1.17	1.34	1.17	1.17	1.00	1.00	1.00	498.02	242.50	316.60	**126.64**
7	SQUARE	1.50	2.50	2.50	1.76	17.26	1.76	17.26	0.15	12	8.11	0.701	25.89	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.15	1.07	1.07	1.15	1.07	1.07	1.00	1.00	1.00	300.57	163.29	196.92	**78.77**
8	SQUARE	2.00	2.50	2.50	1.76	17.26	1.82	17.85	0.15	12	8.11	0.701	34.52	9.27	2.97	1.69	7.58	2.08	0.88	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	335.68	182.46	220.00	**88.00**
9	SQUARE	2.50	2.50	2.50	1.76	17.26	1.82	17.85	0.10	17	11.58	0.692	43.15	12.33	4.77	3.53	9.08	2.86	1.58	1.30	1.20	0.80	1.27	1.14	1.14	1.27	1.14	1.14	1.00	1.00	1.00	494.01	239.96	313.63	**125.45**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	83.65	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.76	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.692	0.128	0.00	39.28	31.68	-	-	29.146	-	28.08
3	3	CLAY	3.00	4.00	1.00	1.89	0.650	0.130	0.00	61.93	11.76	-	-	5.950	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	96.14	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.76	0.000	0.000	0.00	Depth of foundation						27.09
2	2	CLAY	2.00	3.50	1.50	1.82	0.692	0.128	0.00	47.91	36.41	-	-	27.859	-	
3	3	CLAY	3.50	4.50	1.00	1.89	0.650	0.130	0.00	70.56	13.52	-	-	5.998	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	136.04	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						31.60
2	2	CLAY	2.50	4.00	1.50	1.89	0.650	0.130	0.00	58.52	51.52	-	-	32.409	-	
3	3	CLAY	4.00	5.00	1.00	1.95	0.630	0.127	0.00	81.99	19.13	-	-	7.097	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	79.48	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.76	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.82	0.692	0.128	0.00	39.28	42.04	-	-	35.862	-	38.32
3	3	CLAY	3.00	4.50	1.50	1.89	0.650	0.130	0.00	66.57	17.60	-	-	12.042	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	89.18	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.76	0.000	0.000	0.00	Depth of foundation						36.60
2	2	CLAY	2.00	3.50	1.50	1.82	0.692	0.128	0.00	47.91	47.17	-	-	33.779	-	
3	3	CLAY	3.50	5.00	1.50	1.89	0.650	0.130	0.00	75.20	19.75	-	-	11.969	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	126.64	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						42.70
2	2	CLAY	2.50	4.00	1.50	1.89	0.650	0.130	0.00	58.52	66.98	-	-	39.158	-	
3	3	CLAY	4.00	5.50	1.50	1.95	0.630	0.127	0.00	86.77	28.04	-	-	14.215	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	78.77	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.76	0.000	0.000	0.00	Depth of foundation						43.75
2	2	CLAY	1.50	3.50	2.00	1.82	0.692	0.128	0.00	43.74	40.19	-	-	42.823	-	
3	3	CLAY	3.50	5.25	1.75	1.89	0.650	0.130	0.00	77.81	17.04	-	-	11.859	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	88.00	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						41.40
2	2	CLAY	2.00	4.00	2.00	1.89	0.650	0.130	0.00	54.23	44.90	-	-	41.276	-	
3	3	CLAY	4.00	5.50	1.50	1.95	0.630	0.127	0.00	87.11	19.95	-	-	10.469	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	125.45	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.82	0.000	0.000	0.00	Depth of foundation						49.85
2	2	CLAY	2.50	4.50	2.00	1.89	0.650	0.130	0.00	63.16	64.01	-	-	47.893	-	
3	3	CLAY	4.50	6.25	1.75	1.95	0.630	0.127	0.00	98.43	27.14	-	-	14.420	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (R.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	7.00		Factor of safety	2.50
				Water table used for calculation (m)	6.00		Assumed post monsoon rise (m)	1.00

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Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors							Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																			kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.78	17.46	1.78	17.46	0.20	13	8.79	0.654	26.18	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.31	1.16	1.16	1.31	1.16	1.16	1.00	1.00	1.00	428.53	227.87	324.19	**129.68**
2	SQUARE	2.00	1.20	1.20	1.78	17.46	1.91	18.73	0.20	13	8.79	0.654	34.91	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.42	1.21	1.21	1.42	1.21	1.21	1.00	1.00	1.00	490.47	260.87	371.08	**148.43**
3	SQUARE	2.50	1.20	1.20	1.78	17.46	1.91	18.73	0.25	11	7.42	0.613	43.64	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.51	1.25	1.25	1.51	1.25	1.25	1.00	1.00	1.00	551.65	304.74	473.87	**189.55**
4	SQUARE	1.50	2.00	2.00	1.78	17.46	1.78	17.46	0.20	13	8.79	0.654	26.18	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.19	1.09	1.09	1.19	1.09	1.09	1.00	1.00	1.00	404.45	214.70	305.78	**122.31**
5	SQUARE	2.00	2.00	2.00	1.78	17.46	1.91	18.73	0.20	13	8.79	0.654	34.91	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.25	1.13	1.13	1.25	1.13	1.13	1.00	1.00	1.00	452.39	240.21	342.06	**136.82**
6	SQUARE	2.50	2.00	2.00	1.78	17.46	1.91	18.73	0.25	11	7.42	0.613	43.64	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	492.42	271.85	422.94	**169.18**
7	SQUARE	1.50	2.50	2.50	1.78	17.46	1.78	17.46	0.20	13	8.79	0.654	26.18	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.15	1.08	1.08	1.15	1.08	1.08	1.00	1.00	1.00	400.91	212.60	302.99	**121.20**
8	SQUARE	2.00	2.50	2.50	1.78	17.46	1.91	18.73	0.20	13	8.79	0.654	34.91	9.79	3.26	1.97	7.82	2.21	0.99	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	444.30	235.68	335.82	**134.33**
9	SQUARE	2.50	2.50	2.50	1.78	17.46	1.91	18.73	0.25	11	7.42	0.613	43.64	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	478.30	263.95	410.78	**164.31**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	129.68	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.91	0.613	0.125	0.00	40.23	49.11	-	-	40.275	-	39.05
3	3	CLAY	3.00	4.00	1.00	1.94	0.598	0.125	0.00	63.79	18.24	-	-	8.541	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	148.43	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						37.75
2	2	CLAY	2.00	3.50	1.50	1.91	0.613	0.125	0.00	48.96	56.21	-	-	38.598	-	
3	3	CLAY	3.50	4.50	1.00	1.94	0.598	0.125	0.00	72.52	20.87	-	-	8.593	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	189.55	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.91	0.000	0.000	0.00	Depth of foundation						39.07
2	2	CLAY	2.50	4.00	1.50	1.94	0.598	0.125	0.00	61.10	71.78	-	-	39.593	-	
3	3	CLAY	4.00	5.00	1.00	1.93	0.669	0.130	0.00	84.83	26.66	-	-	9.243	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	122.31	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.91	0.613	0.125	0.00	40.23	64.69	-	-	48.392	-	52.29
3	3	CLAY	3.00	4.50	1.50	1.94	0.598	0.125	0.00	68.55	27.09	-	-	16.968	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	114.77	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.91	0.613	0.125	0.00	40.23	60.70	-	-	46.44	-	50.00
3	3	CLAY	3.00	4.50	1.50	1.94	0.598	0.125	0.00	68.55	25.42	-	-	16.07	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	136.82	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						50.14
2	2	CLAY	2.00	3.50	1.50	1.91	0.613	0.125	0.00	48.96	72.37	-	-	45.813	-	
3	3	CLAY	3.50	5.00	1.50	1.94	0.598	0.125	0.00	77.28	30.30	-	-	16.857	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	136.30	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.78	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	2.00	3.50	1.50	1.91	0.613	0.125	0.00	48.96	72.09	-	-	45.698	-	
3	3	CLAY	3.50	5.00	1.50	1.94	0.598	0.125	0.00	77.28	30.18	-	-	16.802	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	169.18	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.91	0.000	0.000	0.00	Depth of foundation						50.96
2	2	CLAY	2.50	4.00	1.50	1.94	0.598	0.125	0.00	61.10	89.48	-	-	45.965	-	
3	3	CLAY	4.00	5.50	1.50	1.93	0.669	0.130	0.00	89.56	37.47	-	-	17.733	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.00	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	164.72	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.91	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	2.50	4.00	1.50	1.94	0.598	0.125	0.00	61.10	87.12	-	-	45.161	-	
3	3	CLAY	4.00	5.50	1.50	1.93	0.669	0.130	0.00	89.56	36.48	-	-	17.337	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	121.20	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	0.000	0.000	0.00	Depth of foundation						60.06
2	2	CLAY	1.50	3.50	2.00	1.91	0.613	0.125	0.00	44.92	61.84	-	-	58.273	-	
3	3	CLAY	3.50	5.25	1.75	1.94	0.598	0.125	0.00	80.29	26.22	-	-	16.799	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	94.35	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.78	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	1.50	3.50	2.00	1.91	0.613	0.125	0.00	44.92	48.14	-	-	49.029	-	
3	3	CLAY	3.50	5.25	1.75	1.94	0.598	0.125	0.00	80.29	20.41	-	-	13.465	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	134.33	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.91	0.000	0.000	0.00	Depth of foundation						55.05
2	2	CLAY	2.00	4.00	2.00	1.94	0.598	0.125	0.00	56.49	68.54	-	-	53.979	-	
3	3	CLAY	4.00	5.50	1.50	1.93	0.669	0.130	0.00	89.71	30.46	-	-	14.833	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	117.90	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.91	0.000	0.000	0.000	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.94	0.598	0.125	0.000	56.49	60.15	-	-	49.264	-	50.00
3	3	CLAY	4.00	5.50	1.50	1.93	0.669	0.130	0.000	89.71	26.73	-	-	13.235	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	164.31	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.91	0.000	0.000	0.00	Depth of foundation						58.86
2	2	CLAY	2.50	4.50	2.00	1.94	0.598	0.125	0.00	65.85	83.83	-	-	55.788	-	
3	3	CLAY	4.50	6.25	1.75	1.93	0.669	0.130	0.00	101.44	35.55	-	-	17.784	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2	
Length	2.50	metre	Water Table depth for calculation	7.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	131.87	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.91	0.000	0.000	0.000	Depth of foundation						
2	2	CLAY	2.50	4.50	2.00	1.94	0.598	0.125	0.000	65.85	67.28	-	-	47.827	-	50.00
3	3	CLAY	4.50	6.25	1.75	1.93	0.669	0.130	0.000	101.44	28.53	-	-	14.670	-	

SITE PHOTOS DURING SITE INVESTIGATION

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**1 (R.H.S.)**		**Coordinate**		**Easting**						**Depth of Water Level**			7.00		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**						**Commenced on**			4/20/2023										
					Elevation		**100.000**				**Completed on**			4/20/2023										

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N"	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	100	100	98	97	30	21	9	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	99	27	18	9	CL				1.76	14.2	1.54	2.62	0.701	0.15	12°	0.136
1.35 - 1.80	98.650 - 98.200	SPT									5	6.88	6.88								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	87	26	22	4	ML				1.82	16.8	1.56	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									7	8.18	8.18								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	99	33	22	11	CL				1.89	18.3	1.60	2.64	0.650	0.20	14°	0.130
4.35 - 4.80	95.650 - 95.200	SPT									9	9.33	9.33								
5.50 - 5.85	94.500 - 94.150	UD	100	100	99	96	34	20	14	CL				1.95	20.1	1.62	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									10	9.40	9.40								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	97	35	23	12	CL				1.95	19.7	1.63	2.62	0.607	0.25	13°	0.125
7.35 - 7.80	92.650 - 92.200	SPT									11	12.32	12.32								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	34	21	13	CL				1.96	17.3	1.67	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									17	17.95	16.48								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	99	29	18	11	CL					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL**																							
Client Name																								
Bore Hole No.	**2 (R.H.S.)**		**Coordinate**		**Easting**						**Depth of Water Level**			7.00		**VIVEK MATERIAL TESTING LABORATORY**							
Total depth of Bore Hole	**10.00**				**Northing**						**Commenced on**			4/20/2023										
					Elevation		**100.000**				**Completed on**			4/20/2023										

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	**metre**		**(mm)**	**(mm)**	**(mm)**	**(mm)**	**%**	**%**	**%**		**N**	**N'**	**N"**	**(gms/cc)**	**%**	**(gms/cc)**	**(G)**		**(Kg/sqcm)**	**(Ø)**	**(Cc)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	100	100	100	99	29	20	9	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	98	98	28	14	14	CL				1.78	12.1	1.59	2.63	0.654	0.20	13°	0.129
1.35 - 1.80	98.650 - 98.200	SPT									9	12.35	12.35								
2.50 - 2.85	97.500 - 97.150	UD	100	100	97	96	30	22	8	CL				1.91	17.3	1.63	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									11	12.73	12.73								
4.00 - 4.35	96.000 - 95.650	UD	100	100	99	98	32	20	12	CL				1.94	18.1	1.64	2.62	0.598	0.25	12°	0.125
4.35 - 4.80	95.650 - 95.200	SPT									13	13.35	13.35								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	97	34	21	13	CL				1.93	23.1	1.57	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									7	6.53	6.53								
7.00 - 7.35	93.000 - 92.650	UD	100	100	100	99	33	20	13	CL				1.96	21.2	1.62	2.65	0.636	0.30	10°	0.126
7.35 - 7.80	92.650 - 92.200	SPT									11	12.19	12.19								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	30	16	14	CL				1.99	20.5	1.65	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									15	15.67	15.34								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	99	31	20	11	CL					-	-	-	-	-	-	-

BORE-LOG CHART

VMT
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VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL

WATER TABLE 7.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			2	2	3	5	
2.50-2.85	CLAYEY-SILT	U.D.	ML						
2.85-3.30		S.P.T.			2	3	4	7	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			3	3	6	9	
5.50-5.85	SILTY-CLAY	U.D.	CL						
5.85-6.30		S.P.T.			4	5	5	10	
7.00-7.35	SILTY-CLAY	U.D.	CL						
7.35-7.80		S.P.T.			5	5	6	11	
8.50-8.85	SILTY-CLAY	U.D.	CL						
8.85-9.30		S.P.T.			6	8	9	17	
9.30-10.00	SILTY-CLAY	D.	CL						

BORE-LOG CHART

VMT
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VIVEK MATERIAL TESTING LABORATORY

NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT TALTALA GHAT IN WEST BENGAL

WATER TABLE 7.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (R.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			3	4	5	9	
2.50-2.85	SILTY-CLAY	U.D.	CL						
2.85-3.30		S.P.T.			3	4	7	11	
4.00-4.35	SILTY-CLAY	U.D.	CL						
4.35-4.80		S.P.T.			4	5	8	13	
5.50-5.85	SILTY-CLAY	U.D.	CL						
5.85-6.30		S.P.T.			3	3	4	7	
7.00-7.35	SILTY-CLAY	U.D.	CL						
7.35-7.80		S.P.T.			4	5	6	11	
8.50-8.85	SILTY-CLAY	U.D.	CL						
8.85-9.30		S.P.T.			5	7	8	15	
9.30-10.00	SILTY-CLAY	D.	CL						

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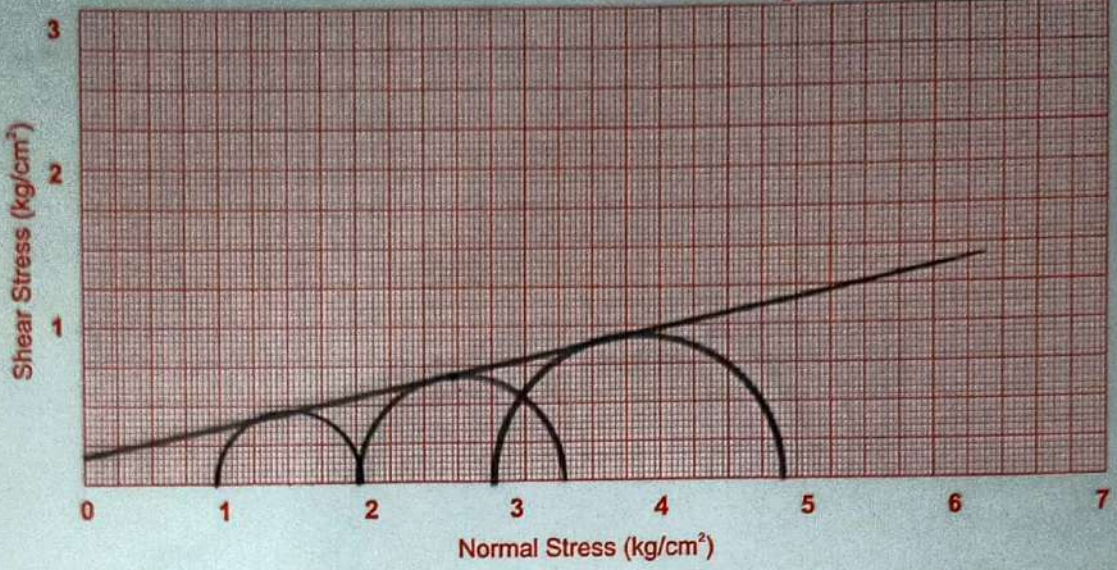
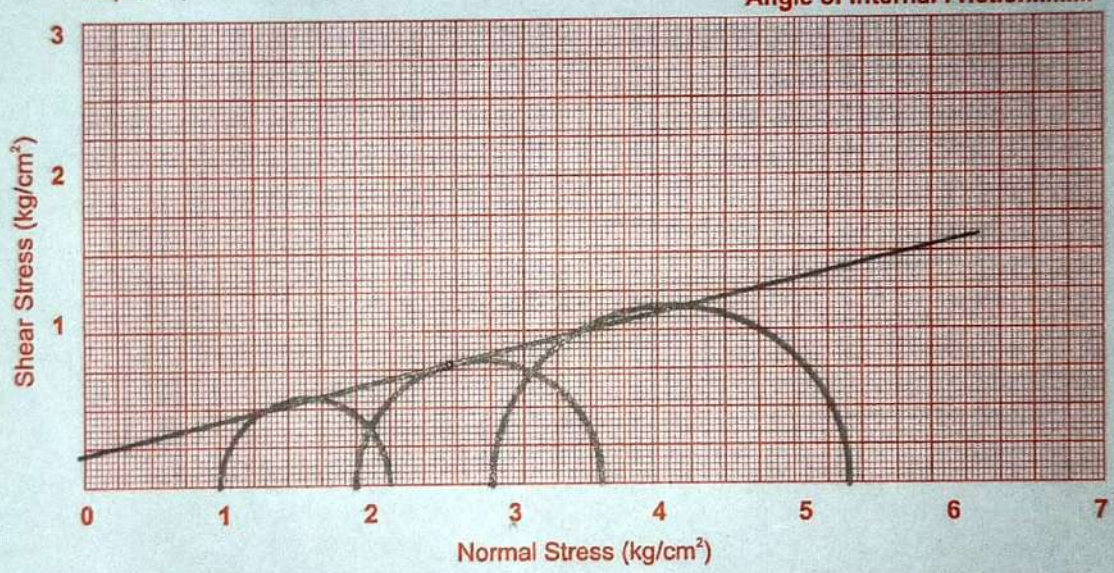
B.H. No. :- 01
Depth - 1.00-1.35

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 12°



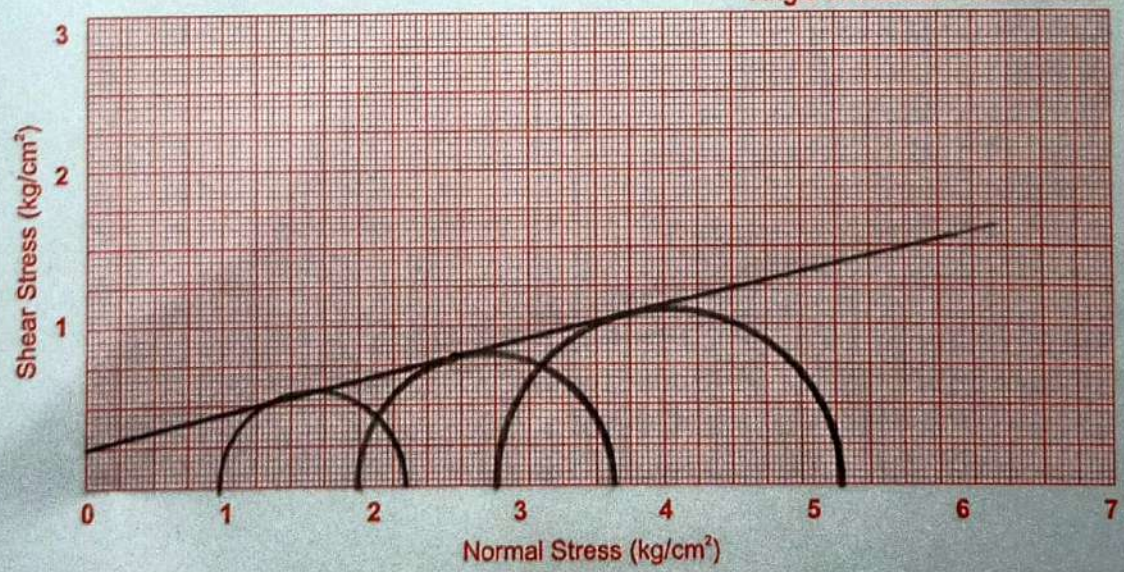
B.H. No. :- 01
Depth :- 4.00-4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 14°



B.H. No. :- 01
Depth :- 7.00-7.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 13°



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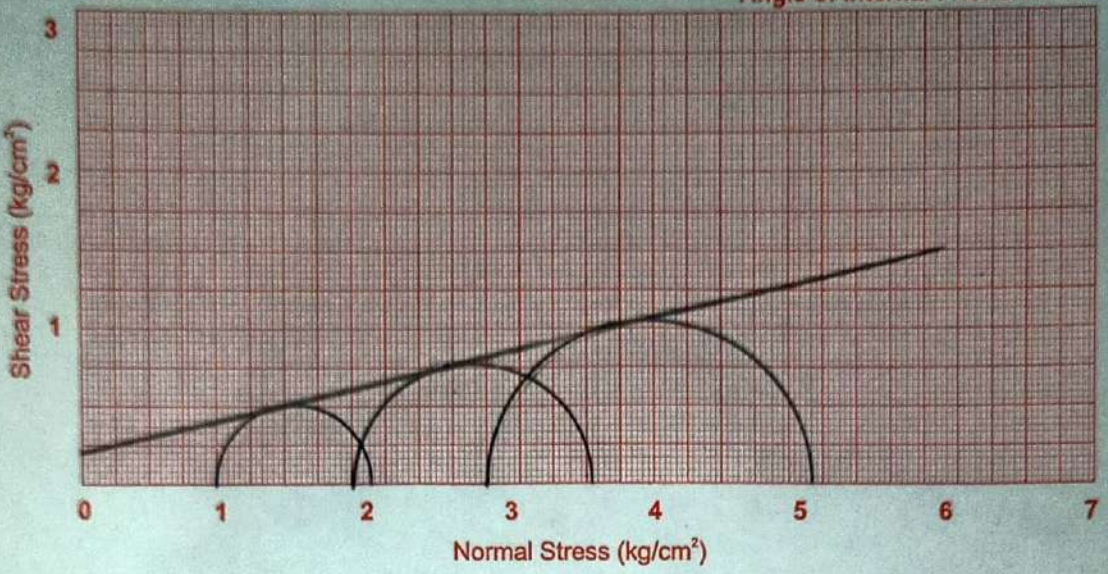
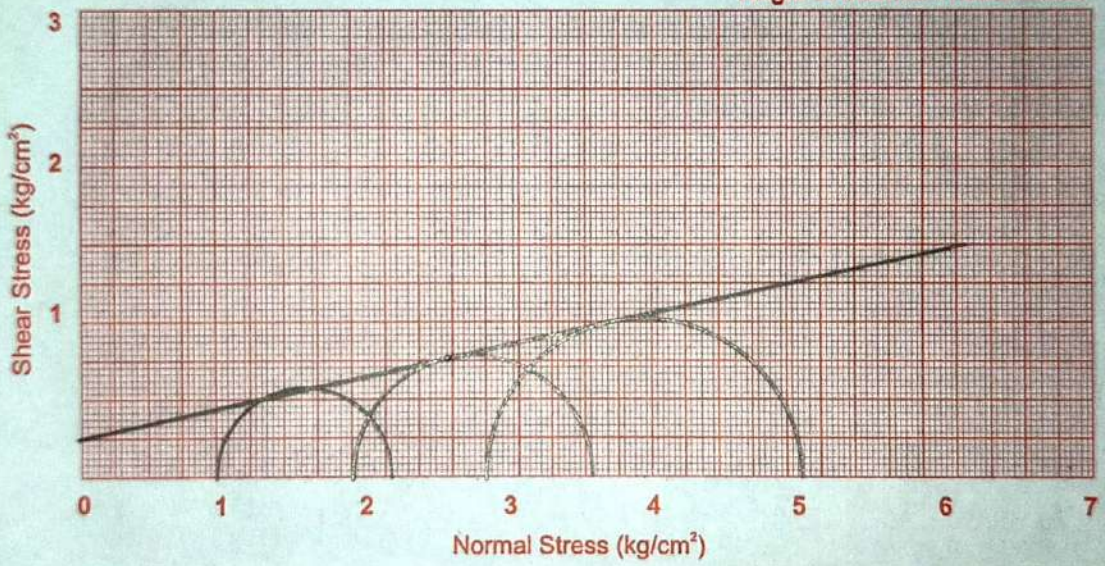
B.H. No. :- 02
Depth - 1.00 - 1.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 13° *



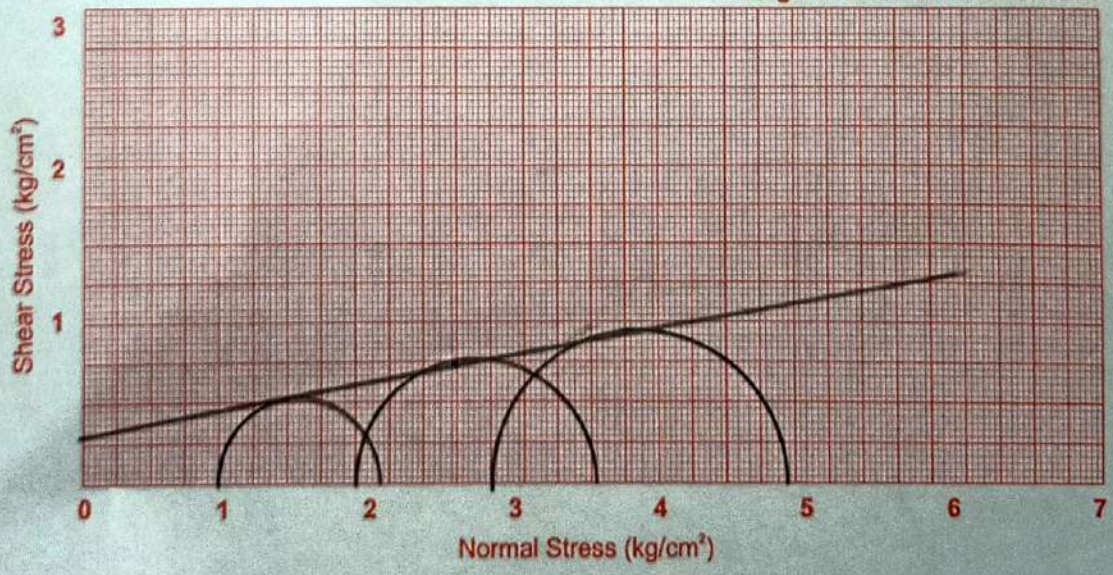
B.H. No. :- 02
Depth :- 4.00 - 4.35

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 12° *



B.H. No. :- 02
Depth :- 7.00 - 7.35

Cohesion 'c' 0.30 Kg/cm²
Angle of Internal Friction 10° *



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TC-8969

REPORT NO. – VMT 130/2023-2024

GEOTECH INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT (L.H.S.) IN WEST BENGAL

Prepared By -

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ACKNOWLEDGEMENT

WE ARE GRATEFUL TO M/s KITCO LTD., KERLA FOR PROVIDING US THE OPPORTUNITY TO CARRY OUT THESE INVESTIGATIONS.

THE CO-OPERATION EXTENDED BY THEIR ENGINEERS DURING FIELD INVESTIGATIONS IS THANKFULLY ACKNOWLEDGED.

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SUB-SOIL INVESTIGATION REPORT FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL

INTRODUCTION

The work of sub-soil exploration was awarded to us by M/s KITCO LTD., KERLA Order no. – 6777:DP 1083: RG: 2023 dated 21/03/2023. 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.

The fieldwork consisted of 02 bore holes of 10.00 metre depth each. The fieldwork was conducted on 15/04/2023. The location of the bore holes is shown in the Site location.

REFERENCES

1. **IS: 1892-2021** for field work including existent ground water table.
2. **IS: 2132-1986** for sampling in Undisturbed and Disturbed form.
3. **IS: 2131-1981** for Standard Penetration Test.
4. **IS: 2720** for all laboratory tests on soil samples collected.
5. **IS: 6403-1981** for determination of Bearing Capacity.
6. **IS: 8009(Part I)-1976** for calculation of settlement of foundations.
7. **IS: 1904-2021** for permissible maximum settlement, differential settlement and angular distortion.

SCOPE OF WORK

The scope consisted of drilling of boreholes down to maximum depth of 10.00 m in normal soils / rock, Standard Penetration Testing, collection of samples, laboratory testing and preparation and submission of Geotechnical Investigation report.

Summary of the fieldwork					
Sl. No.	Site	Borehole Nos.	Coordinates		Depth below existing ground level (m)
			Latitude	Longitude	
1.	GOPAL GHAT	BH-01 (LHS)	24.11603815	88.24637409	10.0
2.		BH-02 (LHS)	24.11614128	88.24654642	10.0

SITE LOCATION

INTERPRETATION OF THE LAB TEST RESULTS

GENERAL NATURE OF SOIL STRATA

The bore hole log charts and lab test results of bore holes 1 and 2 indicate that the strata at the site is found to comprise of both cohesive as well as non-cohesive soil.

The results of classification tests indicate that the natural soil stratum present at the Site is found to comprise of both fine-grained soils comprising of 'CL' and 'CI' group of IS classification (clayey soil) having 84 to 99 percent material finer than 75 micron and coarse-grained soils (sandy soil) comprise of 'SM' group of IS classification having 14 to 28 percent material finer than 75 micron.

The bore hole log charts and lab test results of bore holes 1 indicate that:

first strata, from 0.00 metre to 2.50 metre, consists of a layer of CL group of IS classification which is inorganic clays of low plasticity,

second strata, from 2.50 metre to 7.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity,

third strata, from 7.00 metre to 10.00 metre, consists of a layer of SM group of IS classification which is silty Sand with none plasticity.

The bore hole log charts and lab test results of bore holes 2 indicate that:

first strata, from 0.00 metre to 4.80 metre, consists of a layer of **filled up soil (Brick Pieces + Sand)**,

second strata, from 4.80 metre to 10.00 metre, consists of a layer of CI group of IS classification which is inorganic clays of medium plasticity.

S.P.T. VALUES

The S.P.T. values recorded in the filled up soil zone present up to 4.80 metre depth below ground level in borehole 2 are found to range from 5 to 9.

The S.P.T. values obtained in the respective clayey layer region present as per bore-log charts enclosed are found to range 4 to 9 indicating 'Soft' to 'Medium' 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 14 to 15 indicating 'Medium' relative density.

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

WATER TABLE

Water Table at the Site was observed at a depth from 1.00 metre to 5.00 metre below ground level on the day of soil investigation during the Third week of April 2023. However, the existing water table may rise by 1.00 metre in the post-monsoon period in general. Therefore, a water table at a depth of 0.00 metre to 4.00 metre below ground level has been adopted for calculation purposes.

RECOMMENDATIONS FOR PROPOSED CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL

NET SAFE BEARING CAPACITY/SAFE ALLOWABLE PRESSURE

Bore Hole Nos.	Type of Structure	Depth of Foundation (metres)	Size of Footing (L x B) (metres)	Net Safe Bearing Capacity (Tonne/sqm.)	Settlement Produced (mm)	Safe Allowable Pressure for Permissible Settlement 50 mm (Tonne/sqm.)
1	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	6.69	31.50	-
		2.00	1.20 x 1.20	7.68	31.82	-
		2.50	1.20 x 1.20	9.27	32.09	-
		1.50	2.00 x 2.00	6.33	43.11	-
		2.00	2.00 x 2.00	7.12	43.03	-
		2.50	2.00 x 2.00	8.23	42.23	-
		1.50	2.50 x 2.50	6.29	50.52	6.20
		2.00	2.50 x 2.50	7.00	47.05	-
		2.50	2.50 x 2.50	7.97	49.05	-
2	ISOLATED RCC SQUARE	1.50	1.20 x 1.20	6.33	28.45	-
		2.00	1.20 x 1.20	7.40	27.76	-
		2.50	1.20 x 1.20	9.68	29.43	-
		1.50	2.00 x 2.00	6.08	39.07	-
		2.00	2.00 x 2.00	6.92	37.66	-
		2.50	2.00 x 2.00	8.78	38.95	-
		1.50	2.50 x 2.50	6.07	45.04	-
		2.00	2.50 x 2.50	6.77	40.92	-
		2.50	2.50 x 2.50	7.52	40.63	-

NOTE: -

The above recommendations are based on the field investigation data results and 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. Akhil Singh
TECHNICAL MANAGER
VIVEK MATERIAL TESTING LABORATORY

Shubham Singh
Dy. TECHNICAL MANAGER/ QUALITY MANAGER
VIVEK MATERIAL TESTING LAORATORY

BEARING CAPACITY CALCULATIONS

Soil when stressed due to loading, tend to deform. The resistance to deformation of the soil depends upon factors like water content, bulk density, angle of internal friction and the manner in which load is applied on the soil. The maximum load per unit area which the soil or rock can carry without yielding or displacement is termed as the bearing capacity of soils. The Safe Bearing Capacity of the proposed STRUCTURE without any distress is determined from the considerations of the following criteria.

[A] SHEAR CRITERIA

The soil beneath the foundation shall be safe from risk of shear failure.

[B] SETTLEMENT CRITERIA

The settlement due to load is caused basically on account of two factors, namely,

(i) the soil below footing gets compressed by certain amount and

(ii) since the foundations cover only a limited area there is a possibility that the concentrated stresses developed are so high as to cause actual rupture (shear failure) and displacement of soil below.

The foundation should not settle or deflect to an extent causing damage to the Structure or impair its usefulness.

The Bearing Capacity Calculations for the Foundation shall be governed as per IS: 6403-1981, IS: 8009(Part-I)-1976 and IS: 1904-2021 on the basis of available information regarding the proposed design.

BEARING CAPACITY ON SHEAR CONSIDERATIONS

ULTIMATE NET BEARING CAPACITY

As per IS: 6403-1981, the Ultimate Net Bearing Capacity 'qd' on shear consideration for a Structure is given by the formula: -

FOR GENERAL SHEAR FAILURE

qd = c.Nc.Sc.dc.ic+q(Nq-1).sq.dq.iq + 1/2 B.r.Nr.Sr.dr.ir.W'.

FOR LOCAL SHEAR FAILURE

q'd = 2/3 c.N'c.Sc.dc.ic+q(N'q-1).Sq.dq.iq + 1/2 B.r.N'r.Sr.dr.ir.W'.

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 01 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	1.00		Factor of safety	2.50
				Water table used for calculation (m)	0.00		Assumed post monsoon rise (m)	1.00

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Input Parameters													Shearing Resistance Parameters																		Ultimate Net Bearing Capacity			Net Safe Bearing Capacity
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.82	8.04	1.82	8.04	0.10	16	10.88	0.706	12.06	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.33	1.17	1.17	1.33	1.17	1.17	1.00	1.00	1.00	269.44	134.32	164.05	**65.62**
2	SQUARE	2.00	1.20	1.20	1.82	8.04	1.89	8.73	0.10	16	10.88	0.706	16.08	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.44	1.22	1.22	1.44	1.22	1.22	1.00	1.00	1.00	309.13	154.18	188.27	**75.31**
3	SQUARE	2.50	1.20	1.20	1.82	8.04	1.89	8.73	0.15	11	7.42	0.673	20.10	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.51	1.25	1.25	1.51	1.25	1.25	1.00	1.00	1.00	313.69	173.27	227.33	**90.93**
4	SQUARE	1.50	2.00	2.00	1.82	8.04	1.82	8.04	0.10	16	10.88	0.706	12.06	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	255.45	126.97	155.24	**62.10**
5	SQUARE	2.00	2.00	2.00	1.82	8.04	1.89	8.73	0.10	16	10.88	0.706	16.08	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.27	1.13	1.13	1.27	1.13	1.13	1.00	1.00	1.00	287.11	142.79	174.54	**69.82**
6	SQUARE	2.50	2.00	2.00	1.82	8.04	1.89	8.73	0.15	11	7.42	0.673	20.10	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.30	1.15	1.15	1.30	1.15	1.15	1.00	1.00	1.00	278.49	153.75	201.77	**80.71**
7	SQUARE	1.50	2.50	2.50	1.82	8.04	1.82	8.04	0.10	16	10.88	0.706	12.06	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.16	1.08	1.08	1.16	1.08	1.08	1.00	1.00	1.00	254.00	126.02	154.18	**61.67**
8	SQUARE	2.00	2.50	2.50	1.82	8.04	1.89	8.73	0.10	16	10.88	0.706	16.08	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.21	1.11	1.11	1.21	1.11	1.11	1.00	1.00	1.00	282.75	140.38	171.70	**68.68**
9	SQUARE	2.50	2.50	2.50	1.82	8.04	1.89	8.73	0.15	11	7.42	0.673	20.10	8.80	2.71	1.44	7.29	1.95	0.77	1.30	1.20	0.80	1.24	1.12	1.12	1.24	1.12	1.12	1.00	1.00	1.00	269.83	148.91	195.46	**78.18**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	65.62	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.89	0.673	0.132	0.00	28.42	24.85	-	-	32.297	-	31.50
3	3	CLAY	3.00	4.00	1.00	1.92	0.675	0.130	0.00	39.47	9.23	-	-	7.081	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	75.31	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						31.82
2	2	CLAY	2.00	3.50	1.50	1.89	0.673	0.132	0.00	32.44	28.52	-	-	32.426	-	
3	3	CLAY	3.50	4.50	1.00	1.92	0.675	0.130	0.00	43.49	10.59	-	-	7.345	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	1.20	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	90.93	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.50	4.00	1.50	1.92	0.675	0.130	0.00	38.39	34.44	-	-	32.369	-	32.09
3	3	CLAY	4.00	5.00	1.00	1.93	0.644	0.128	0.00	49.72	12.79	-	-	7.739	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	62.10	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	-	-	-	Depth of foundation						43.11
2	2	CLAY	1.50	3.00	1.50	1.89	0.673	0.132	0.00	28.42	32.85	-	-	39.485	-	
3	3	CLAY	3.00	4.50	1.50	1.92	0.675	0.130	0.00	41.73	13.75	-	-	14.402	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	69.82	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.82	0.000	0.000	0.00	Depth of foundation						43.03
2	2	CLAY	2.00	3.50	1.50	1.89	0.673	0.132	0.00	32.44	36.93	-	-	39.069	-	
3	3	CLAY	3.50	5.00	1.50	1.92	0.675	0.130	0.00	45.75	15.46	-	-	14.721	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.00	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80		
Width	2.00	metre	Applied Pressure at foundation base	80.71	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						42.23
2	2	CLAY	2.50	4.00	1.50	1.92	0.675	0.130	0.00	38.39	42.69	-	-	37.797	-	
3	3	CLAY	4.00	5.50	1.50	1.93	0.644	0.128	0.00	52.00	17.87	-	-	14.985	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	61.67	kN/m2		Type of foundation	SQUARE		

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						50.52
2	2	CLAY	1.50	3.50	2.00	1.89	0.673	0.132	0.00	30.60	31.46	-	-	48.466	-	
3	3	CLAY	3.50	5.25	1.75	1.92	0.675	0.130	0.00	47.22	13.34	-	-	14.678	-	

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1	
Length	2.50	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80		
Width	2.50	metre	Applied Pressure at foundation base	60.84	kN/m2		Type of foundation	SQUARE		

FINAL TRIAL

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.82	0.000	0.000	0.00	Depth of foundation						50.00
2	2	CLAY	1.50	3.50	2.00	1.89	0.673	0.132	0.00	30.60	31.04	-	-	47.997	-	
3	3	CLAY	3.50	5.25	1.75	1.92	0.675	0.130	0.00	47.22	13.16	-	-	14.503	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	68.68	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.89	0.000	0.000	0.00	Depth of foundation						47.05
2	2	CLAY	2.00	4.00	2.00	1.92	0.675	0.130	0.00	36.29	35.04	-	-	45.560	-	
3	3	CLAY	4.00	5.50	1.50	1.93	0.644	0.128	0.00	52.15	15.57	-	-	13.254	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 1
Length	2.50	metre	Water Table depth for calculation	1.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	78.18	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.89	0.000	0.000	0.00	Depth of foundation						49.05
2	2	CLAY	2.50	4.50	2.00	1.92	0.675	0.130	0.00	40.65	39.89	-	-	46.092	-	
3	3	CLAY	4.50	6.25	1.75	1.93	0.644	0.128	0.00	57.65	16.91	-	-	15.222	-	

VIVEK MATERIAL TESTING LABORATORY

BEARING CAPACITY CALCULATION

BEARING CAPACITY CALCULATION SHEET AS PER IS: 6403-1981

NAME OF PROJECT								
BOREHOLE 02 (L.H.S.)	Depth of borehole	10.00	metre	Water table below borehole level (m)	5.00		Factor of safety	2.50
				Water table used for calculation (m)	4.00		Assumed post monsoon rise (m)	1.00

VMT
GEOTECH & MATERIAL TESTING

Input Parameters														Shearing Resistance Parameters																Ultimate Net Bearing Capacity			
S. No.	Type of foundation	Depth	Length	Width	Density Above Foundation Level	Density Including water effect	Density Below Foundation Level	Density Including water effect	Cohesion	Angle of Shearing Resistance		Void Ratio	Effective Surcharge	Bearing Capacity Factors						Shape Factors			Depth Factors						Inclination Factors			General shear	Local shear	Intermediate	Net Safe Bearing Capacity
					Bulk		Bulk		c	Ø	Ø'	e	q	Nc	Nq	Nγ	Nc'	Nq'	Nγ'	Sc	Sq	Sγ	Dc	Dq	Dγ	Dc'	Dq'	Dγ'	Ic	Iq	Iγ				
		(m)	(m)	(m)	(gms/cc)	(kN/m3)	(gms/cc)	(kN/m3)	Kg/cm2	°	°		kN/m2																		kN/m2	kN/m2	kN/m2	kN/m2
1	SQUARE	1.50	1.20	1.20	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	20.59	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.33	1.16	1.16	1.33	1.16	1.16	1.00	1.00	1.00	290.55	147.99	155.12	**62.05**
2	SQUARE	2.00	1.20	1.20	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	27.46	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.43	1.22	1.22	1.43	1.22	1.22	1.00	1.00	1.00	339.49	173.05	181.37	**72.55**
3	SQUARE	2.50	1.20	1.20	1.40	13.73	1.40	13.73	0.10	16	10.88	0.730	34.32	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.55	1.28	1.28	1.55	1.28	1.28	1.00	1.00	1.00	432.12	215.61	237.26	**94.90**
4	SQUARE	1.50	2.00	2.00	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	20.59	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.20	1.10	1.10	1.20	1.10	1.10	1.00	1.00	1.00	279.77	142.05	148.94	**59.58**
5	SQUARE	2.00	2.00	2.00	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	27.46	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.26	1.13	1.13	1.26	1.13	1.13	1.00	1.00	1.00	318.58	161.93	169.76	**67.90**
6	SQUARE	2.50	2.00	2.00	1.40	13.73	1.40	13.73	0.10	16	10.88	0.730	34.32	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.33	1.17	1.17	1.33	1.17	1.17	1.00	1.00	1.00	392.91	195.62	215.35	**86.14**
7	SQUARE	1.50	2.50	2.50	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	20.59	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.16	1.08	1.08	1.16	1.08	1.08	1.00	1.00	1.00	280.00	141.90	148.81	**59.52**
8	SQUARE	2.00	2.50	2.50	1.40	13.73	1.40	13.73	0.10	15	10.18	0.740	27.46	10.97	3.94	2.65	8.41	2.51	1.26	1.30	1.20	0.80	1.21	1.10	1.10	1.21	1.10	1.10	1.00	1.00	1.00	311.81	158.35	166.02	**66.41**
9	SQUARE	2.50	2.50	2.50	1.40	13.73	1.40	13.73	0.10	16	10.88	0.730	34.32	11.65	4.34	3.06	8.74	2.68	1.41	1.30	1.20	0.80	1.27	1.13	1.13	1.27	1.13	1.13	1.00	1.00	1.00	382.07	190.04	209.24	**83.70**

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	62.05	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.40	-	-	-	Depth of foundation						
2	2	CLAY	1.50	3.00	1.50	1.40	0.730	0.140	0.00	30.89	23.50	-	-	29.822	-	28.45
3	3	CLAY	3.00	4.00	1.00	1.45	0.720	0.137	0.00	48.30	8.73	-	-	5.745	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	72.55	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.40	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	3.50	1.50	1.40	0.730	0.140	0.00	37.76	27.47	-	-	28.825	-	27.76
3	3	CLAY	3.50	4.50	1.00	1.45	0.720	0.137	0.00	55.16	10.20	-	-	5.870	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	1.20	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	1.20	metre	Applied Pressure at foundation base	94.90	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.40	0.000	0.000	0.00	Depth of foundation						29.43
2	2	CLAY	2.50	4.00	1.50	1.45	0.720	0.137	0.00	44.99	35.94	-	-	30.465	-	
3	3	CLAY	4.00	5.00	1.00	1.87	0.686	0.131	0.00	64.82	13.35	-	-	6.317	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 1

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	59.58	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.40	-	-	-	Depth of foundation						39.07
2	2	CLAY	1.50	3.00	1.50	1.40	0.730	0.140	0.00	30.89	31.51	-	-	37.069	-	
3	3	CLAY	3.00	4.50	1.50	1.45	0.720	0.137	0.00	51.85	13.19	-	-	11.763	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 2

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	67.90	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.40	0.000	0.000	0.00	Depth of foundation						37.66
2	2	CLAY	2.00	3.50	1.50	1.40	0.730	0.140	0.00	37.76	35.91	-	-	35.239	-	
3	3	CLAY	3.50	5.00	1.50	1.45	0.720	0.137	0.00	58.72	15.04	-	-	11.830	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 3

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.00	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.00	metre	Applied Pressure at foundation base	86.14	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.40	0.000	0.000	0.00	Depth of foundation						38.95
2	2	CLAY	2.50	4.00	1.50	1.45	0.720	0.137	0.00	44.99	45.56	-	-	36.295	-	
3	3	CLAY	4.00	5.50	1.50	1.87	0.686	0.131	0.00	68.74	19.08	-	-	12.396	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 4

Depth	1.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	59.52	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	1.50	1.50	1.40	0.000	0.000	0.00	Depth of foundation						45.04
2	2	CLAY	1.50	3.50	2.00	1.40	0.730	0.140	0.00	34.32	30.37	-	-	44.548	-	
3	3	CLAY	3.50	5.25	1.75	1.45	0.720	0.137	0.00	60.09	12.88	-	-	11.754	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 5

Depth	2.00	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	66.41	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.00	2.00	1.40	0.000	0.000	0.00	Depth of foundation						
2	2	CLAY	2.00	4.00	2.00	1.45	0.720	0.137	0.00	41.68	33.88	-	-	41.161	-	40.92
3	3	CLAY	4.00	5.50	1.50	1.87	0.686	0.131	0.00	68.99	15.06	-	-	9.994	-	

VIVEK MATERIAL TESTING LABORATORY

SETTLEMENT CALCULATION

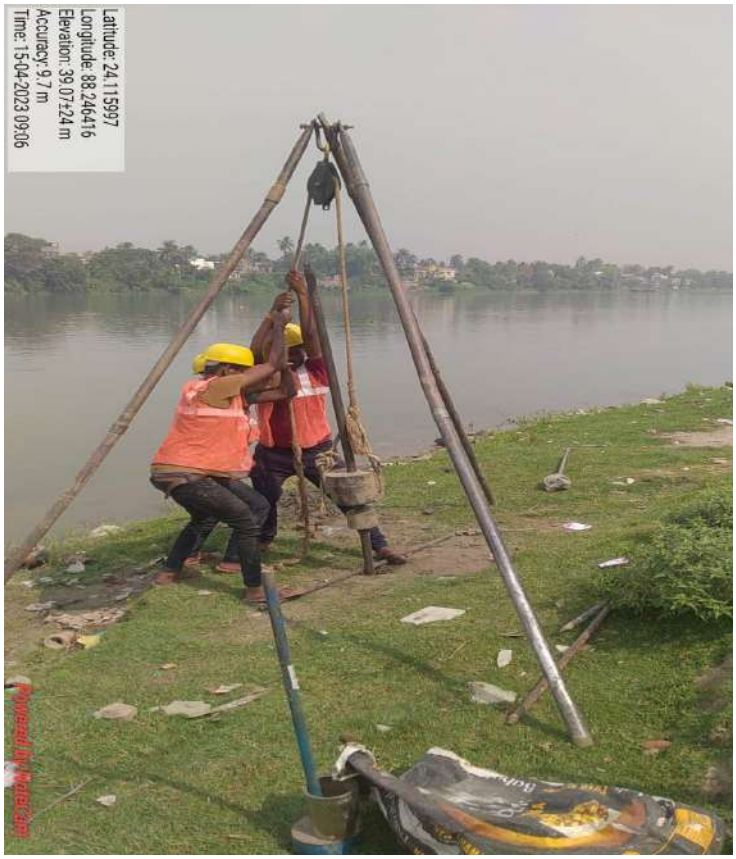
SETTLEMENT CALCULATION AS PER IS 8009 (PART 1) : 1976

CALCULATION SHEET 6

Depth	2.50	metre	Settlement effective zone depth	1.50	X Width		Depth factor	1.00	BOREHOLE 2
Length	2.50	metre	Water Table depth for calculation	5.00	(m) bgl		Rigidity factor	0.80	
Width	2.50	metre	Applied Pressure at foundation base	73.70	kN/m2		Type of foundation	SQUARE	

S. No.	Layer No.	Type of Layer	Layer Start depth	Layer End depth	Layer Thickness	Density	Void Raito	Compression Index	Corrected SPT	Effective stress	Increment stress	Settlement for Unit Pressure	Water Correction factor	Consolidation settlement	Immediate settlement	Total settlement
		CLAY					e	Cc	N''	P_o	ΔP		W'			
		SAND	(m)	(m)	(m)	(gms/cc)				kN/m2	kN/m2	(mm)		(mm)	(mm)	(mm)
1	1	CLAY	0.00	2.50	2.50	1.40	0.000	0.000	0.00	Depth of foundation						40.63
2	2	CLAY	2.50	4.50	2.00	1.45	0.720	0.137	0.00	48.54	37.60	-	-	39.682	-	
3	3	CLAY	4.50	6.25	1.75	1.87	0.686	0.131	0.00	77.10	15.94	-	-	11.100	-	

SITE PHOTOS DURING SITE INVESTIGATION



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RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL**
Client Name	

Bore Hole No.	**1 (L.H.S.)**	**Coordinate**	**Easting**		**Depth of Water Level**	1.00	**VIVEK MATERIAL TESTING LABORATORY**
Total depth of Bore Hole	**10.00**		**Northing**		**Commenced on**	4/15/2023	
			Elevation	**100.000**	**Completed on**	4/15/2023	

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
0.00 - 0.50	100.000 - 99.500	DS	98	95	90	84	33	23	10	CL					-	-	-	-	-	-	-
1.00 - 1.35	99.000 - 98.650	UD	100	100	100	99	32	21	11	CL				1.82	18.7	1.53	2.61	0.706	0.10	16°	0.140
1.35 - 1.80	98.650 - 98.200	SPT									4	6.53	6.53								
2.50 - 2.85	97.500 - 97.150	UD	100	100	100	98	38	19	19	CI				1.89	21.4	1.56	-	-	-	-	-
2.85 - 3.30	97.150 - 96.700	SPT									6	8.49	8.49								
4.00 - 4.35	96.000 - 95.650	UD	100	100	100	99	39	25	14	CI				1.92	22.5	1.57	2.63	0.675	0.20	13°	0.130
4.35 - 4.80	95.650 - 95.200	SPT									7	8.97	8.97								
5.50 - 5.85	94.500 - 94.150	UD	100	100	100	99	41	21	20	CI				1.93	20.7	1.60	-	-	-	-	-
5.85 - 6.30	94.150 - 93.700	SPT									9	10.67	10.67								
7.00 - 7.35	93.000 - 92.650	UD	100	100	99	28	NON PLASTIC			SM				1.88	21.3	1.55	2.59	0.671	0	29°	-
7.35 - 7.80	92.650 - 92.200	SPT									14	15.60	15.30								
8.50 - 8.85	91.500 - 91.150	UD	100	100	99	21	NON PLASTIC			SM				1.88	19.6	1.57	-	-	-	-	-
8.85 - 9.30	91.150 - 90.700	SPT									15	15.85	15.43								
9.30 - 10.00	90.700 - 90.000	DS	100	100	98	14	NON PLASTIC			SM					-	-	-	-	-	-	-

RESULT SHEET

NAME OF THE PROJECT	**CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL**																								
Client Name																									
Bore Hole No.	**2 (L.H.S.)**		**Coordinate**		**Easting**					**Depth of Water Level**				5.00		**VIVEK MATERIAL TESTING LABORATORY**									
Total depth of Bore Hole	**10.00**				**Northing**					**Commenced on**			4/15/2023												
					Elevation	**100.000**				**Completed on**			4/15/2023												

Depth of Bore Hole	**Reduced Level**	**Types of Samples**	**% Material Passing IS Sieve**				**Atterberg Limits**			**IS group symbol**	**SPT Value**	**SPT Value corrected due to overburden**	**SPT Value corrected due to dilatancy**	**Wet Bulk Density**	**Original Moisture**	**Dry Bulk Density**	**Specific Gravity**	**Void Ratio**	**Shear Characterisitics**		**Compression Index**
			4.750	**2.000**	**0.425**	**0.075**	**LL**	**PL**	**PI**										**Cohesion**	**Angle of Internal Friction**	
metre	metre		(mm)	(mm)	(mm)	(mm)	%	%	%		N	N'	N''	(gms/cc)	%	(gms/cc)	(G)		(Kg/sqcm)	(Ø)	(Cc)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
0.00 - 0.50	100.000 - 99.500	DS	FILLED UP SOIL UP TO 4.80 METRE DEPTH BELOW GROUND LEVEL (BRICK PIECES + SAND)																		
1.00 - 1.35	99.000 - 98.650	UD																			
1.35 - 1.80	98.650 - 98.200	SPT																			
2.50 - 2.85	97.500 - 97.150	UD																			
2.85 - 3.30	97.150 - 96.700	SPT																			
4.00 - 4.35	96.000 - 95.650	UD																			
4.35 - 4.80	95.650 - 95.200	SPT																			
5.50 - 5.85	94.500 - 94.150	UD	100	100	98	97	36	20	16	CI				1.87	20.1	1.56	2.63	0.686	0.25	10°	0.131
5.85 - 6.30	94.150 - 93.700	SPT									7	8.34	8.34								
7.00 - 7.35	93.000 - 92.650	UD	100	100	99	98	38	24	14	CI				1.92	21.3	1.58	-	-	-	-	-
7.35 - 7.80	92.650 - 92.200	SPT									8	8.90	8.90								
8.50 - 8.85	91.500 - 91.150	UD	100	100	100	98	37	23	14	CI				1.97	22.2	1.61	2.64	0.640	0.15	14°	0.127
8.85 - 9.30	91.150 - 90.700	SPT									9	9.40	9.40								
9.30 - 10.00	90.700 - 90.000	DS	100	100	100	97	39	25	14	CI					-	-	-	-	-	-	-

BORE-LOG CHART

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NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL

WATER TABLE 1.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 01 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50	SILTY-CLAY	D.	CL						
1.00-1.35	SILTY-CLAY	U.D.	CL						
1.35-1.80		S.P.T.			1	2	2	4	
2.50-2.85	SILTY-CLAY	U.D.	CI						
2.85-3.30		S.P.T.			2	3	3	6	
4.00-4.35	SILTY-CLAY	U.D.	CI						
4.35-4.80		S.P.T.			2	3	4	7	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			3	4	5	9	
7.00-7.35	SILTY-SAND	U.D.	SM						
7.35-7.80		S.P.T.			4	6	8	14	
8.50-8.85	SILTY-SAND	U.D.	SM						
8.85-9.30		S.P.T.			5	7	8	15	
9.30-10.00	SILTY-SAND	D.	SM						

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NAME OF THE PROJECT:- CONSTRUCTION OF BOAT IN THE IDENTIFIED COMMUNITY JETTY AT GOPAL GHAT IN WEST BENGAL

WATER TABLE 5.00 METRE DEPTH BELOW GROUND LEVEL

BORE HOLE NO.:- 02 (L.H.S.)

DEPTH IN METRES BELOW GROUND LEVEL	VISUAL FIELD OBSERVATIONS	SAMPLE	I.S.		S.P.T. VALUE				S.P.T. VALUES
			GROUP	HATCHING	N1	N2	N3	N2+N3	10 20 30 40 50 60 70 80 90 100
0.00-0.50		D.		FILLED UP SOIL UP TO 4.80 METRE DEPTH BELOW GROUND LEVEL (BRICK PIECES + SAND)					
1.00-1.35		U.D.							
1.35-1.80		S.P.T.			2	3	4	7	
2.50-2.85		U.D.							
2.85-3.30		S.P.T.			2	2	3	5	
4.00-4.35		U.D.							
4.35-4.80		S.P.T.			3	4	5	9	
5.50-5.85	SILTY-CLAY	U.D.	CI						
5.85-6.30		S.P.T.			2	3	4	7	
7.00-7.35	SILTY-CLAY	U.D.	CI						
7.35-7.80		S.P.T.			2	3	5	8	
8.50-8.85	SILTY-CLAY	U.D.	CI						
8.85-9.30		S.P.T.			3	4	5	9	
9.30-10.00	SILTY-CLAY	D.	CI						

VMT/130/23-24

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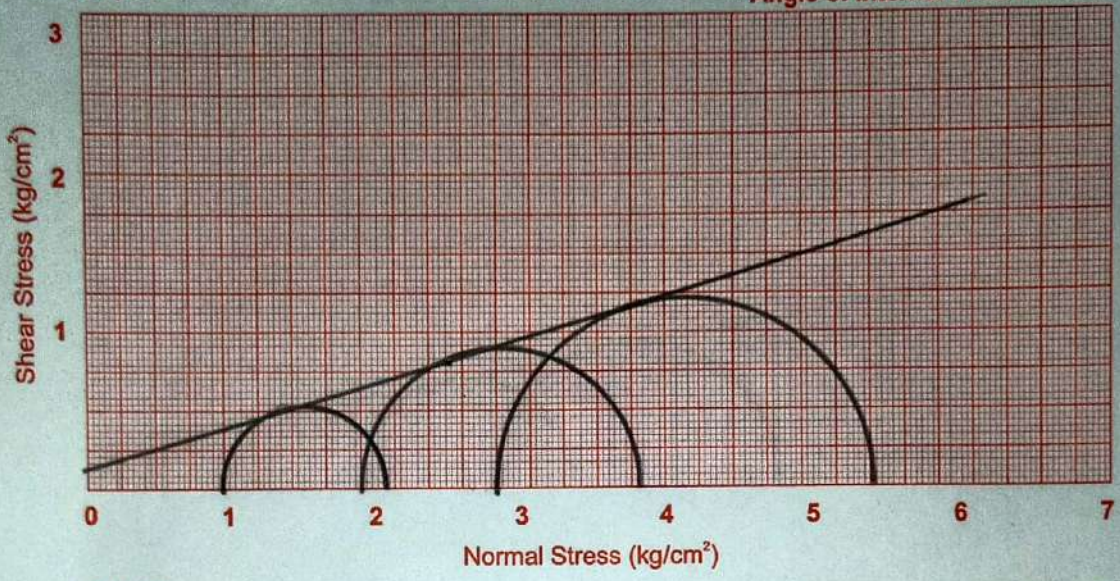
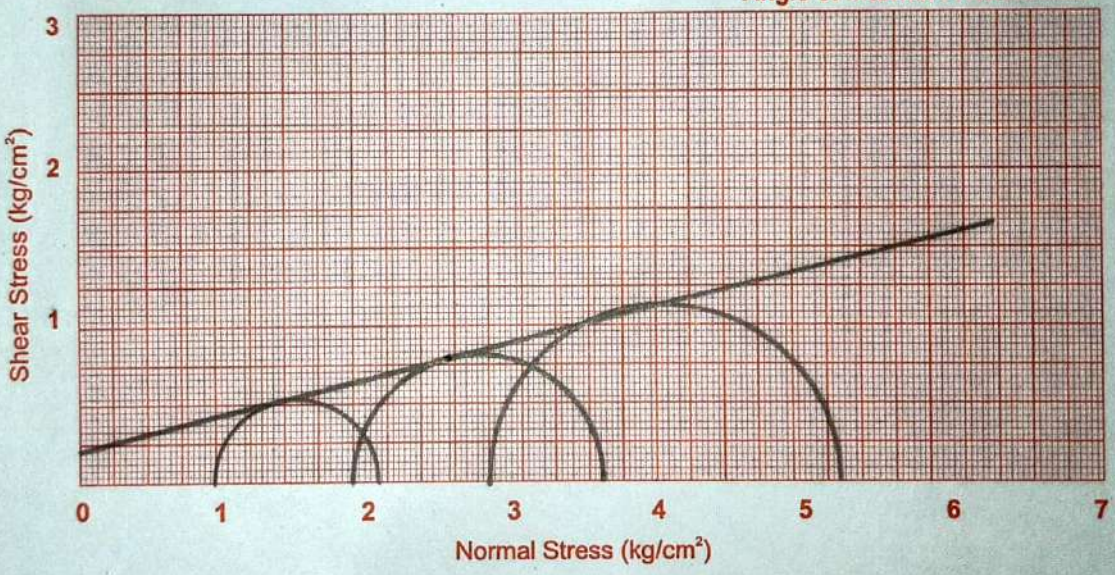
B.H. No. :- 01
Depth - 1.00 - 1.35

Cohesion 'c' 0.10 Kg/cm²
Angle of Internal Friction 16° *



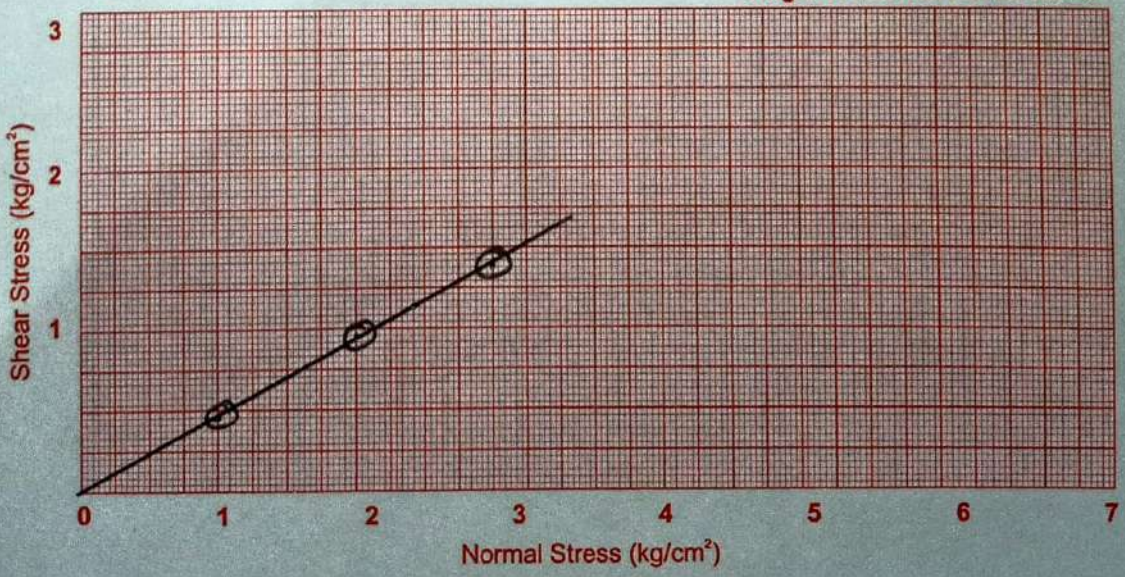
B.H. No. :- 01
Depth :- 4.00 - 4.35

Cohesion 'c' 0.20 Kg/cm²
Angle of Internal Friction 13° *



B.H. No. :- 01
Depth :- 7.00 - 7.35

Cohesion 'c' 0 Kg/cm²
Angle of Internal Friction 29° *



VMT/130/23-24

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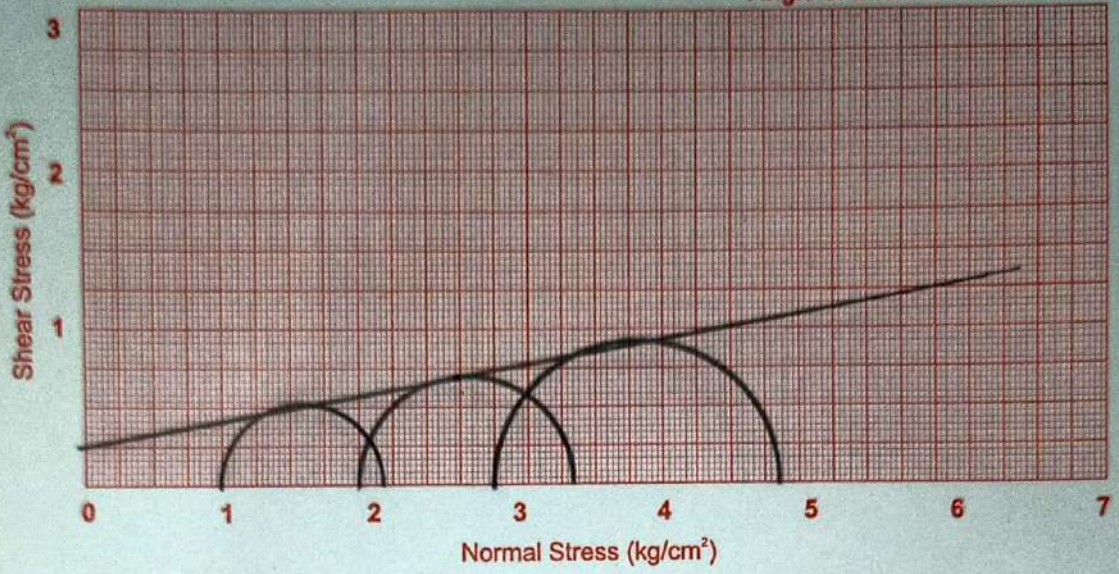
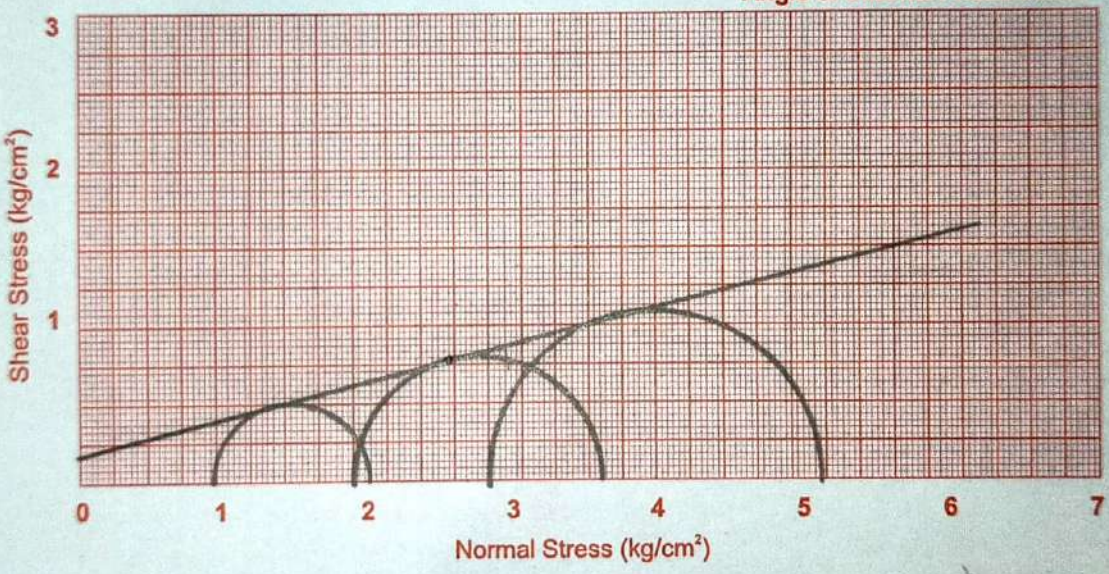
B.H. No. :- 02
Depth - 5.50 - 5.85

Cohesion 'c' 0.25 Kg/cm²
Angle of Internal Friction 10°



B.H. No. :- 02
Depth :- 8.50 - 8.85

Cohesion 'c' 0.15 Kg/cm²
Angle of Internal Friction 14°



B.H. No. :-
Depth :-

Cohesion 'c' ..... Kg/cm²
Angle of Internal Friction ..... °