



**DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LTD.
(A Govt. of India Enterprise)**

Design and Construction of Important & Major Bridges (54 nos.) of Western Freight Corridor between Vaitarna and Utran (Approx. 200 KMs) on Vasai-Bharuch section in the states of Maharashtra and Gujarat, India on lump sum contract basis.

Tender No. HQ/EN/WC/Bridges/D&B/1

July '08.

WESTERN FREIGHT CORRIDOR

Tender Document

Volume –IV

(Section- X)

(PART –V- Preliminary Geotechnical Investigation Data)

(Comprising summary of Geotech Investigation Reports and Bore charts)

As per Addendum and Corrigendum No. - 2

**Dedicated Freight Corridor Corporation of India Limited
IVth floor, Palika Bhawan
Sector –XIII, R.K. Puram,
New Delhi – 110066**

**PRELIMINARY
GEOTECHNICAL
INVESTIGATION
REPORTS**

Volume IV Section X Part II

PRELIMINARY GEOTECHNICAL INVESTIGATION DATA.

INDEX

Sr. No	Bridge No	Page Nos.		Remark
		From	To	
1	Executive Summary	1	1	
2	92	2	16	
3	93	17	38	
4	98	-	-	Hard rock at bed level or at shallow depth
5	99	-	-	Hard rock at bed level or at shallow depth
6	115	39	45	
7	119	46	52	
8	125	-	-	Similar to Bridge no.126
9	126	53	55	
10	135	-	-	Similar to Bridge no.136
11	136	56	60	
12	139	61	64	
13	143	65	68	
14	144	69	75	
15	163	76	80	
16	166	81	89	
17	169	90	93	
18	173	94	97	
19	182	98	102	
20	192	103	107	
21	203	108	111	
22	228	112	117	
23	230	118	120	
24	239	-	-	Not available.
25	263	121	124	
26	264	-	-	Similar to Bridge no. 263
27	284	125	128	
28	287	129	133	
29	288	134	137	
30	304	138	141	

Sr. No	Bridge No	Page Nos.		Remark
		From	To	
31	318	142	146	
32	325	147	150	
33	332	151	155	
34	336	156	165	
35	339	166	171	
36	340	-	-	Not available.
37	344	-	-	Not available.
38	352	-	-	Not available.
39	358	172	177	
40	359	178	183	
41	368	184	197	
42	369	198	205	
43	370	-	-	Similar to Bridge no. 369
44	372	-	-	Similar to Bridge no. 369
45	387	-	-	Hard rock at bed level or at shallow depth
46	400	206	226	
47	401	227	255	
48	405	256	264	
49	411	265	273	
50	417	274	291	
51	419	292	302	
52	422	303	312	
53	428	313	321	
54	440	-	-	Similar to Bridge no. 428
	442	-	-	Similar to Bridge no. 428

PRELIMINARY GEOTECHNICAL INVESTIGATION REPORTS

EXECUTIVE SUMMARY

Brief reports on Geotechnical Investigation (comprising summary of Geotech Investigation and Bore charts) carried out at the sites of majority of bridges are presented in this document. The investigation is carried out by taking limited number of boreholes at the bridge sites and this fact needs to be accounted for by the Bidders while preparing their bids. However, the data presented in this report provides fairly representative data at the bridge sites covered by the investigations. General Arrangement Drawings which form a part of this Bid Document have been prepared based on this Data.

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 92

VAITARNA (BRIDGE NO. 92)

Topographically this is a prominent river of the area . is fairly leveled plain terrain with marshy and sand dredging units on both sides of alignment . The river seems to slightly meandering in nature.

1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Two bore holes has been planned for this site . In all total 11 nos. undisturbed and 19 nos. disturbed soil samples excluding S.P.T. samples have been collected from 2 nos. bore holes . The details are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	25.90 m	2.20 m	5	10	11
2.	2	24.40 m	2.50 m	6	8	8

1.1. GROUND WATER :

The water samples were collected from the site .

1.2 STANDARD PENETRATION TESTS : (IS 2131-1981)

This test was carried out using a Terzaghi spoon sampler driven by a 63.50 k.g. Hammer weight falling freely through a height 750 m.m. A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	1.05 --- 1.50	03-05-06	11 Blackish Clayey Sand
	2	2.45 --- 2.90	06-08-08	16 Sandy Clay
	3	4.45 --- 4.90	07-09-10	19 Dense Silty Sand
	4	5.95 --- 6.40	08-10-11	21 Dense Silty Sand
	5	7.00 --- 7.45	15-17-18	35 Sandy Clayey Silts
	6	8.50 --- 8.95	18-20-21	41 Sandy Clayey Silts
	7	10.00 --- 10.45	20-22-22	44 Sandy Clayey Silts
	8	11.45 --- 14.90	20-22-23	45 Sandy Clayey Soil
	9	12.50 --- 12.95	23-25-26	51 Sandy Clayey Soil
	10	13.90 --- 14.00	21-32 (10 cm)	R Refusal
2.	1	1.00 --- 1.45	03-05-05	10 Blackish Clayey Sand
	2	2.45 --- 2.90	03-06-07	13 Sandy Clay
	3	4.45 --- 4.90	07-09-09	18 Dense Silty Sand
	4	5.85 --- 6.30	09-11-11	22 Dense Silty Sand
	5	6.75 --- 7.20	03-16-16	32 Sandy Clayey Silt
	6	8.60 --- 9.00	18-20-21	41 Sandy Clay Soil
	7	10.00 --- 10.45	22-24-24	48 Sandy Clay Soil
	8	11.00 --- 11.00	23 (0 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

I) RESIDUAL SOIL FORMATION : (Average thickness 0.00 m to 12.50 m)

The overburden essentially is Blackish Clayey coarse grained Clayey Sands to Sandy Clays . Soils are of stiff to very stiff consistency with low plasticity values . Sand gravel contents are on increase in lower section of the bore . S.P.T. values in 10 m zone of both bore holes display 10 nos. to 48 nos. . This also confirms that a hard stiff stratum is existing beyond 10 m depth. S.P.T. values beyond 10 m depth are quite high.

II) HIGHLY to MODERATELY WEATHERED BASALT ROCKS :
(Average thickness **12.50 m to 25.15 m**)

Highly to Moderately weathered basalt rocks have been observed in lower stratum of exploration studies . These rocks are the fine grained black to grayish black compact homogeneous mass . Rocks are quite hard and tough . Rocks also present good crushing strengths . Highly to Moderately weathered rocks have been observed . In bore hole no. 1 Black fine grained compact basalt rock have been observed at 15.85 m depth . Generally both the bores display a core recovery of 26 % to 75 % and R.Q.D. value of 21 % to 65 % . Hence rock stratum varies from highly weathered to Moderately weathered basalt rocks.

2.0. LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 and 1.4 .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL
SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.5	11	
2.	Grain Size Analysis	1.6	11	
3.	Specific Gravity, Liquid , Plastic	1.7	11	
4.	Triaxial Shear Test (UU)	1.8	11	
5.	Direct Shear Test	1.9	5	
6.	Chemical test on soil sample	1.10	1	

The laboratory tests results have been presented in following pages .

TABLE NO. 1.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK
SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	1.11	8	
2.	Density & Specific Gravity	1.12	7	
	Water Absorption and Porosity	1.12	7	
3.	Point Load Strength	1.13	8	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.5**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	0.60 – 1.05	UDS1	1.73	19.40
2.	1	2.00 – 2.45	UDS2	1.75	18.70
3.	1	3.00 – 3.45	UDS3	1.69	24.80
4.	1	4.00 – 4.45	UDS4	1.72	23.10
5.	1	5.50 – 5.95	UDS5	1.83	20.05
6.	2	0.55 – 1.00	UDS1	1.76	16.40
7.	2	2.00 – 2.45	UDS2	1.80	18.05
8.	2	3.00 – 3.45	UDS3	1.73	23.10
9.	2	4.00 – 4.45	UDS4	1.84	21.50
10.	2	5.40 – 5.85	UDS5	1.89	16.50
11.	2	6.30 – 6.75	UDS6	1.93	15.06

**TABLE NO. 1.6
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	0.60 – 1.05	UDS1	7.40	48.50	44.10	
2.	1	2.00 – 2.45	UDS2	3.20	53.40	43.40	
3.	1	3.00 – 3.45	UDS3	1.20	12.30	86.50	
4.	1	4.00 – 4.45	UDS4	2.00	14.30	83.70	
5.	1	5.50 – 5.95	UDS5	4.00	49.50	46.50	
6.	2	0.55 – 1.00	UDS1	1.20	53.40	54.60	
7.	2	2.00 – 2.45	UDS2	4.40	61.50	34.10	
8.	2	3.00 – 3.45	UDS3	0.08	14.30	85.62	
9.	2	4.00 – 4.45	UDS4	7.20	48.20	44.60	
10.	2	5.40 – 5.85	UDS5	8.30	51.40	40.30	
11.	2	6.30 – 6.75	UDS6	6.40	56.40	37.20	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.7**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	0.60 – 1.05	UDS1	2.64	48	25	23
2.	1	2.00 – 2.45	UDS2	2.68	45	23	22
3.	1	3.00 – 3.45	UDS3	2.61	71	34	39
4.	1	4.00 – 4.45	UDS4	2.65	69	32	37
5.	1	5.50 – 5.95	UDS5	2.70	47	25	22
6.	2	0.55 – 1.00	UDS1	2.66	51	27	24
7.	2	2.00 – 2.45	UDS2	2.69	--	NP	--
8.	2	3.00 – 3.45	UDS3	2.63	70	36	34
9.	2	4.00 – 4.45	UDS4	2.63	50	27	23
10.	2	5.40 – 5.85	UDS5	2.67	43	22	21
11.	2	6.30 – 6.75	UDS6	2.70	40	18	22

**TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	0.60 – 1.05	UDS1	0.137	20.45
2.	1	2.00 – 2.45	UDS2	0.156	22.34
3.	1	3.00 – 3.45	UDS3	0.321	11.30
4.	1	4.00 – 4.45	UDS4	0.389	10.55
5.	1	5.50 – 5.95	UDS5	0.201	23.50
6.	2	0.55 – 1.00	UDS1	0.141	21.39
7.	2	2.00 – 2.45	UDS2	0.178	25.50
8.	2	3.00 – 3.45	UDS3	0.416	9.87
9.	2	4.00 – 4.45	UDS4	0.189	11.67
10.	2	5.40 – 5.85	UDS5	0.211	27.40
11.	2	6.30 – 6.75	UDS6	0.193	28.38

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.9**

UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	0.60 – 1.05	UDS1	0.156	19.05
2.	1	2.00 – 2.45	UDS2	0.216	23.18
3.	1	3.00 – 3.45	UDS3	0.393	12.56
4.	2	0.55 – 1.00	UDS1	0.167	21.90
5.	2	2.00 – 2.45	UDS2	0.208	26.15

**TABLE NO. 1.10
CHEMICAL ANALYSIS
OF
SOIL SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	2	3.00	8.35	0.038	0.089

**LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.11
UNCONFINED COMPRESSION STRENGTH**

Sr. No.	Bore hole No.	Depth, m	Unconfined Compression Strength Kg/cm ²	Saturated Unconfined Compression Strength kg/cm ²
1.	1	14.00 m – 15.85 m	395.50	356.70
2.	1	15.85 m – 17.10 m	412.50	340.20
3.	1	17.10 m – 19.00 m	518.60	434.20
4.	1	19.00 m – 20.50 m	408.60	389.30
5.	2	11.00 m – 13.00 m	349.50	276.60
6.	2	13.00 m---14.85 m	479.40	423.50
7.	2	14.85 m---16.00 m	508.40	472.60
8.	2	16.00 m---18.00 m	505.30	478.50

**TABLE No. 1.12
UNIT WEIGHT AND WATER ABSORPTION**

Sr. No.	Bore hole No.	Depth	Density Gm/cm ³	Specific Gravity	Water Absorption, %	Porosity %
1.	1	14.00 m – 15.85 m	2.720	2.75	3.940	4.94
2.	1	15.85 m – 17.10 m	2.780	2.76	3.780	4.70
3.	1	17.10 m – 19.00 m	2.800	2.74	3.820	4.38
4.	1	19.00 m – 20.50 m	2.790	2.73	3.058	3.29
5.	2	11.00 m – 13.00 m	2.780	2.72	3.658	4.55
6.	2	13.00 m---14.85 m	2.860	2.73	2.510	3.51
7.	2	14.85 m---16.00 m	2.890	2.75	2.340	3.08

**LABORATORY TESTS
ON
ROCK SAMPLES
POINT LOAD STRENGTH TEST
TABLE NO. 1.13**

Sr. No.	Bore hole No.	Depth, m	Point Load Strength kg/cm ²
1.	1	14.00 m – 15.85 m	16.80
2.	1	15.85 m – 17.10 m	17.20
3.	1	17.10 m – 19.00 m	21.89
4.	1	19.00 m – 20.50 m	17.90
5.	2	11.00 m – 13.00 m	15.86
6.	2	13.00 m---14.85 m	20.80
7.	2	14.85 m---16.00 m	22.10
8.	2	16.00 m---18.00 m	20.65

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 1(Bridge no. 92, Vaitarna)

Sheet No. 1 of 3

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Vaitarna, Virara Side

T.D (m) :- :- 25.90 m

Date: 23-05-008 to 25--05-008

GWL : 2.2m below BGL .

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.60	DS1				----	Blackish Clayey coarse grained sands .							
	0.60-1.05	UDS1				----								
1	1.05-1.50	SPT1	11			----								
	1.50-2.00					----								
2	2.00--2.45	UDS2				----								
	2.45--2.90	SPT2	16			----	Sandy Clay of stiff consistency .							
3	2.90--3.00					----								
	3.00-3.45	UDS3				----								
	3.45-4.00					----								
4	4.00-4.45	UDS4				----								
	4.45-4.90	SPT3	19			----	Dense Silty Sands .							
5	4.90--5.50					----								
	5.50--5.95	UDS5				----								
6	5.95-6.40	SPT4	21			----								
	6.40--7.00					----	Very dense silty sands .							
7	7.00--7.45	SPT5	35			----								
	7.45--8.50					----	Very hard Consistency Sandy Clayey Silts .							
8						----								
	8.50-8.95	SPT6	41			----								
9	8.95-10.00					----								
10	10.00-10.45	SPT7	44			----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No. 1(Bridge no. 92, Vaitarna)									
CLIENT: Stup Consultants Pvt. Ltd.						Sheet No. 2 of 3									
						(BGL) R. L. :- 0.00 m									
Casing diameter (mm) : i) 100mm and ii) 76mm						T.D (m) :- :- 25.90 m									
Casing diameter (mm) : i) 100mm and ii) 76mm						Location:- (As per sketch) Vaitarna, Virara Side				Date: 23-05-008 to 25--05-008					
						GWL : 2.2m below BGL .									
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%	
	Depth (m)	Type													
11	10.45-11.45	SPT8	45			-----	Very hard Consistency Sandy Clayey Soils								
	11.45-11.90														
12	11.90-12.50	SPT9	51			-----									
	12.50-12.95 12.95-13.90														
13	13.90-14.00	SPT10	R			-----									
	14.00-15.85	CORE													
14						\\ \\	Highly weathered Basalt rock							26.4	22.6
15						\\ \\	Black fine grained compact basalt rock								
16	15.85-17.10	CORE				\\ \\									38.6
17	17.10-19.00	CORE				\\ \\								43.8	39.5
18						\\ \\									
19	19.00-20.50	CORE				\\ \\								56.5	48.5
20						\\ \\									

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No. 1(Bridge no. 92, Vaitarna)								
CLIENT: Stup Consultants Pvt. Ltd.						Sheet No. 3 of 3								
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m								
Casing diameter (mm) : i) 100mm and ii) 76mm						T.D (m) :- :- 25.90 m								
Location:- (As per sketch) Vaitarna, Virara Side						Date: 23-05-008 to 25--05-008								
						GWL : 2.2m below BGL .								
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	20.50-22.15	CORE				/// //	Moderately weathered basalt rock .						60.2	52.3
22	22.15-24.00	CORE				/// //							65.3	51.5
23	24.00-25.90	CORE				/// //							63.2	52.1
24	25.90--					/// //								
25						/// //								
26						/// //								
Bore Hole terminated at 25.90 m depth														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 2(Bridge no. 92, Vaitarna)
 Sheet No. 1 of 3
 (BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm
 Location:- (As per sketch)
 Vaitarna, Surat side

T.D (m) :- 24.40 m
 Date: 25-05-008 to 28--05-008
 GWL : 2.5m below BGL .

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.55	DS1				-----	Blackish Clayey coarse grained sands .							
	0.55-1.00	UDS1												
1	1.00-1.45	SPT1	10			-----								
	1.45-2.00													
2	2.00--2.45	UDS2				-----								
	2.45--2.90	SPT2												
3	2.90--3.00		13			-----	Sandy Clay of stiff consistency .							
	3.00-3.45	UDS3												
4	3.45-4.00					-----								
	4.00-4.45	UDS4												
5	4.45-4.90	SPT3	18			-----	Dense Silty Sands .							
	4.90--5.40													
6	5.40--5.85	UDS5				-----								
	5.85---6.30	SPT4												
7	6.30--6.75	UDS6				-----								
	6.75--7.20	SPT4												
8	7.20--8.60		32			-----	Very hard Consistency Sandy Clayey Silts .							
	8.60-9.00	SPT5												
9	9.00-10.00		41			-----	Very hard Consistency coarser Sandy Clay soils.							
	10.00-10.45	SPT6												
10			48			-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 2(Bridge no. 92, Vaitarna)

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Vaitarna, Surat side

T.D (m) :- 24.40 m

Date: 25-05-008 to 28--05-008

GWL : 2.5m below BGL .

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.00-10.45	SPT7	48			-----								
	10.45--11.00													
12	11.00--11.00	SPT8	R			-----								
	11.00--13.00	CORE												
13	13.00-14.85	CORE				\\ \\	Highly to Moderately weathered Basalt rock .						27.5	21.4
14	14.85-16.00	CORE				\\ \\							38.4	28.7
15	16.00-18.00	CORE				\\ \\							35.1	31.7
16	18.00-19.90	CORE				\\ \\							45.3	42.3
17	19.90-21.40	CORE				\\ \\							54.8	48.5
18						\\ \\								
						\\ \\								
19						\\ \\								
						\\ \\								
20						\\ \\								
						\\ \\								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No. 2(Bridge no. 92, Vaitarna)									
CLIENT: Stup Consultants Pvt. Ltd.						Sheet No. 3 of 3									
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m									
Casing diameter (mm) : i) 100mm and ii) 76mm						T.D (m) :- 24.40 m									
Location:- (As per sketch) Vaitarna, Surat side						Date: 25-05-008 to 28--05-008									
						GWL : 2.5m below BGL .									
Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%	
	Depth (m)	Type													
21	19.90-21.40	CORE				/// ///	Highly to Moderately weathered Basalt rock .						58.5	51.4	
	21.40-22.65	CORE				/// ///							63.4	56.4	
22	22.65-24.40	CORE				/// ///								65.5	61.2
						/// ///									
23	24.40--					/// ///									
						/// ///									
24						/// ///									
Bore Hole terminated at 24.40 m depth															

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 93

VAITARNA (BRIDGE NO. 93)

Topographically site is fairly leveled plain terrain with marshy area and extensive san on both sides of alignment . The river seems to slightly meandering in nature.

1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Five bore holes has been planned for this site . In all total 24 nos. undisturbed and 39 nos. disturbed soil samples excluding S.P.T. samples have been collected from 5 nos. bore holes . The details are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	19.80 m	1.50 m	5	6	6
2.	2	20.60 m	5.00 m	4	6	6
3.	3	24.00 m	5.00 m	4	7	7
4.	4	22.00 m	5.00 m	6	11	11
5.	5	19.00 m	2.50 m	5	5	9

1.1. GROUND WATER :

The water samples were collected from the site .

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

This test was carried out using a Terzaghi spoon sampler driven by a 63.50 k.g. Hammer weight falling freely through a height 750 m.m. A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
	1.	0.95 --- 1.40	03-05-05	10 Clayey Silty Sands
	2	2.45 --- 2.90	05-07-07	14 Sandy Clay
	3	4.45 --- 4.90	07-09-09	18 Dense Silty Sands
	4	5.95 --- 6.40	09-11-12	23 Dense Silty Sands
	5	7.00 --- 7.45	18-20-20	40 Sandy Clayey Silts
	6	8.00 --- 8.30	26-34-36 (0 cm)	R Refusal
	2.	0.95 --- 1.40	03-06-06	12 Medium Dense Sand
	2	2.95 --- 3.40	06-08-09	17 Clayey Sand
	3	4.45 --- 4.90	08-10-11	21 Dense Silty Sand
	4	6.45 --- 6.90	13-15-15	30 Dense Silty Sand
	5	7.50 --- 7.95	15-17-18	35 Dense Silty Sand
	6	9.00 --- 9.10	23-35 (10 cm)	R Refusal
	3.	1.45 --- 1.90	05-07-08	15 Clayey Silty Sand
	2	3.30 --- 3.75	06-08-08	16 Clayey Silty Sand
	3	4.20 --- 4.65	08-10-10	20 Dense Silty Sand
	4	5.45 --- 5.90	09-11-11	22 Dense Silty Sand
	5	7.00 --- 7.45	17-19-19	38 Sandy Clayey Silt
	6	8.60 --- 9.05	19-21-22	43 Silty Clayey
	7	9.75 --- 10.00	22-36-41 (5 cm)	R Refusal
4. Sand	1	1.05 --- 1.50	03-06-06	12 Blackish Coarse
	2	2.45 --- 2.90	06-08-08	16 Sandy Clay
	3	3.45 --- 3.90	07-09-09	18 Sandy Clay
	4	4.45 --- 4.90	08-10-11	21 Dense Silty Sand
	5	5.95 --- 6.40	10-12-12	24 Dense Silty Sand
	6	7.20 --- 7.65	15-17-18	35 Sandy Clayey Silt
	7	8.50 --- 8.95	18-20-21	41 Sandy Clayey Silt
	8	10.45 --- 10.90	20-22-22	44 Sandy Clayey Silt
	9	12.00 --- 12.45	21-23-23	46 Residual Sand
	10	13.50 --- 13.95	23-25-25	50 Residual Sand
	11	14.45 --- 14.50	21-32 (5 cm)	R Refusal

Continued

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
5.	1	2.45 --- 2.90	06-08-09	17 Sandy Clay
	2	4.45 --- 4.90	06-08-08	16 Sandy Clay
	3	7.00 --- 7.45	19-21-22	43 Sandy Clayey Silts
	4	8.00 --- 8.00	22 (0 cm)	R Refusal
	5	9.00 --- 9.05	28 (5 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

I) RESIDUAL SOIL FORMATION : (Average thickness 0.00 m to 10.20 m)

The overburden essentially is Blackish Clayey coarse grained sands . Soils are of Clayey Silty Sands of dense to very dense consistency . Sand gravel contents are on increase in lower section of the bore . High S.P.T. values in the 10 m zone of stratum are consistent for all the bores ,

II) COMPLETELY / HIGHLY / MODERATELY WEATHERED BASALT ROCKS : (Average thickness 10.20 m to 21.10 m)

Completely / Highly / Moderately weathered basalt rocks have been observed in lower stratum of exploration studies . These rocks are Amygdaloidal basalts of fine grained texture with metallic sound and compact mass. Rocks are quite hard and tough . Rocks also present good crushing strengths . Completely to highly weathered rocks have been observed . In Bore hole no. 1 and 3 Fine grained blackish gray Basalt rock have been observed at 10.00 m depth . Similarly in Bore hole no. 4 Coarse grained weathered blackish gray rock have been observed at 10.50 m depth and Fine grained compact basalt rock at 11.50 m depth . Generally all the bores display a core recovery of Nil % to 95 % and R.Q.D. value of Nil to 62 % .

2.0 LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 and 1.4.

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL
SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.5	24	
2.	Grain Size Analysis	1.6	15	
3.	Specific Gravity, Liquid , Plastic	1.7	15	
4.	Triaxial Shear Test (UU)	1.8	15	
5.	Direct Shear Test	1.9	8	
6	Chemical test on soil sample	1.10	1	

The laboratory tests results have been presented in following pages .

TABLE NO. 1.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK
SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	1.11	15	
2.	Density & Specific Gravity	1.12	10	
	Water Absorption and Porosity	1.12	10	
3.	Point Load Strength	1.13	10	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.5**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	0.50 – 0.95	UDS1	1.71	16.00
2.	1	2.00 – 2.45	UDS2	1.75	15.60
3.	1	2.90 – 3.35	UDS3	1.83	14.59
4.	1	4.00 – 4.45	UDS4	1.89	16.40
5.	1	5.50 – 5.95	UDS5	1.70	17.10
6.	2	0.50 – 0.95	UDS1	1.84	14.10
7.	2	2.50 – 2.95	UDS2	1.88	13.69
8.	2	4.00 – 4.45	UDS3	1.90	16.40
9.	2	6.00 – 6.45	UDS4	1.86	13.80
10.	3	1.00 – 1.45	UDS1	1.74	16.40
11.	3	2.50 – 2.95	UDS2	1.80	16.90
12.	3	3.75 – 4.20	UDS3	1.83	13.78
13.	3	5.00 – 5.45	UDS4	1.90	14.50
14.	4	0.60 – 1.05	UDS1	1.76	16.40
15.	4	2.00 – 2.45	UDS2	1.82	14.70
16.	4	3.00 – 3.45	UDS3	1.87	13.60
17.	4	4.00 – 4.45	UDS4	1.92	16.20
18.	4	5.50 – 5.95	UDS5	1.93	13.70
19.	4	10.00 – 10.45	UDS6	2.03	17.20
20.	5	1.00 – 1.45	UDS1	1.80	18.0
21.	5	2.00 – 2.45	UDS2	1.83	17.30
22.	5	3.00 – 3.45	UDS3	1.87	13.79
23.	5	4.00 – 4.45	UDS4	1.90	14.50
24.	5	5.50 – 5.95	UDS5	1.92	16.50

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.6
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	2.00 – 2.45	UDS2	2.00	56.60	41.40	
2.	1	4.00 – 4.45	UDS4	3.60	67.50	28.90	
3.	1	5.50 – 5.95	UDS5	8.40	57.50	34.10	
4.	2	2.50 – 2.95	UDS2	3.20	62.40	34.40	
5.	2	4.00 – 4.45	UDS3	9.40	71.40	19.20	
6.	2	6.00 – 6.45	UDS4	11.20	65.40	23.40	
7.	3	2.50 – 2.95	UDS2	1.80	45.30	52.90	
8.	3	3.75 – 4.20	UDS3	3.50	58.50	38.00	
9.	3	5.00 – 5.45	UDS4	7.80	64.50	27.70	
10.	4	4.00 – 4.45	UDS4	8.90	68.40	22.70	
11.	4	5.50 – 5.95	UDS5	12.30	61.40	26.30	
12.	4	10.00 – 10.45	UDS6	8.50	57.80	33.70	
13.	5	3.00 – 3.45	UDS3	1.20	49.50	49.30	
14.	5	4.00 – 4.45	UDS4	7.68	60.3	32.02	
15.	5	5.50 – 5.95	UDS5	5.60	65.70	28.70	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.7**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	2.00 – 2.45	UDS2	2.65	43	22	21
2.	1	4.00 – 4.45	UDS4	2.69	---	N.P.	---
3.	1	5.50 – 5.95	UDS5	2.64	38	17	21
4.	2	2.50 – 2.95	UDS2	2.67	---	N.P.	---
5.	2	4.00 – 4.45	UDS3	2.70	---	N.P.	---
6.	2	6.00 – 6.45	UDS4	2.69	---	N.P.	---
7.	3	2.50 – 2.95	UDS2	2.62	54	28	26
8.	3	3.75 – 4.20	UDS3	2.66	---	N.P.	---
9.	3	5.00 – 5.45	UDS4	2.61	---	N.P.	---
10.	4	4.00 – 4.45	UDS4	2.67	---	N.P.	---
11.	4	5.50 – 5.95	UDS5	2.69	---	N.P.	---
12.	4	10.00 – 10.45	UDS6	2.67	---	N.P.	---
13.	5	3.00 – 3.45	UDS3	2.62	56	29	27
14.	5	4.00 – 4.45	UDS4	2.65	---	N.P.	---
15.	5	5.50 – 5.95	UDS5	2.70	---	N.P.	---

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.8**

UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	2.00 – 2.45	UDS2	0.287	21.30
2.	1	4.00 – 4.45	UDS4	0.189	24.35
3.	1	5.50 – 5.95	UDS5	0.234	23.67
4.	2	2.50 – 2.95	UDS2	0.256	22.26
5.	2	4.00 – 4.45	UDS3	0.134	26.50
6.	2	6.00 – 6.45	UDS4	0.187	27.40
7.	3	2.50 – 2.95	UDS2	0.288	22.10
8.	3	3.75 – 4.20	UDS3	0.219	24.20
9.	3	5.00 – 5.45	UDS4	0.205	26.20
10.	4	4.00 – 4.45	UDS4	0.178	27.50
11.	4	5.50 – 5.95	UDS5	0.208	26.89
12.	4	10.00 – 10.45	UDS6	0.256	28.20
13.	5	3.00 – 3.45	UDS3	0.310	23.45
14.	5	4.00 – 4.45	UDS4	0.187	27.56
15.	5	5.50 – 5.95	UDS5	0.135	29.20

**TABLE NO. 1.9
UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	2.00 – 2.45	UDS2	0.256	22.68
2.	1	2.90 – 3.35	UDS3	0.298	21.89
3.	2	2.50 – 2.95	UDS2	0.309	23.29
4.	2	4.00 – 4.45	UDS3	0.167	27.10
5.	3	2.50 – 2.95	UDS2	0.312	22.78
6.	4	2.00 – 2.45	UDS2	0.179	21.40
7.	5	1.00 – 1.45	UDS1	0.231	24.80
8.	5	2.00 – 2.45	UDS2	0.295	23.60

LABORATORY TESTS
TABLE NO. 1.10
CHEMICAL ANALYSIS
OF
SOIL SAMPLE

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	4	4.00	8.50	0.068	0.092

LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.11
UNCONFINED COMPRESSION STRENGTH

Sr. No.	Bore hole No.	Depth, m	Unconfined Compression Strength Kg/cm ²	Saturated Unconfined Compression Strength kg/cm ²
1.	1	8.30 m – 10.00 m	318.50	289.74
2.	1	10.00 m – 12.80 m	518.40	408.25
3.	1	12.80 m – 15.00 m	550.50	446.30
4.	2	10.50 m – 11.50 m	397.60	326.20
5.	2	11.50 m – 12.50 m	487.30	408.50
6.	2	12.50 m---15.00 m	512.40	477.60
7.	3	10.00 m---12.00 m	318.40	290.40
8.	3	12.00 m---14.50 m	486.50	412.45
9.	3	14.50 m – 17.50 m	512.53	488.74
10.	4	16.10 m – 17.85 m	378.50	310.20
11.	4	17.85 m – 19.40 m	551.65	467.12
12.	4	19.40 m – 20.95 m	478.30	390.43
13.	5	10.50 m – 11.50 m	319.50	285.65
14.	5	11.50 m---13.00 m	489.50	412.55
15.	5	13.00 m---14.50 m	534.45	462.16

**LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.12
UNIT WEIGHT AND WATER ABSORPTION**

Sr. No.	Bore hole No.	Depth	Density Gm/cm ³	Specific Gravity	Water Absorption, %	Porosity %
1.	1	10.00 m – 12.80 m	2.750	2.73	2.980	4.22
2.	1	12.80 m – 15.00 m	2.800	2.75	3.240	3.72
3.	2	11.50 m – 12.50 m	2.830	2.77	2.870	3.86
4.	2	12.50 m---15.00 m	2.860	2.73	2.145	4.12
5.	3	12.00 m---14.50 m	2.890	2.75	3.056	4.85
6.	3	14.50 m – 17.50 m	2.960	2.77	2.260	3.21
7.	4	17.85 m – 19.40 m	2.840	2.73	2.890	2.88
8.	4	19.40 m – 20.95 m	2.900	2.71	2.340	3.21
9.	5	17.85 m – 19.40 m	2.780	2.74	1.950	4.56
10.	5	19.40 m – 20.95 m	2.850	2.76	2.085	4.10

**POINT LOAD STRENGTH TEST
TABLE NO. 1.13**

Sr. No.	Bore hole No.	Depth, m	Point Load Strength kg/cm ²
1.	1	10.00 m – 12.80 m	22.12
2.	1	12.80 m – 15.00 m	23.35
3.	2	11.50 m – 12.50 m	22.13
4.	2	12.50 m---15.00 m	21.60
5.	3	12.00 m---14.50 m	20.17
6.	3	14.50 m – 17.50 m	23.07
7.	4	17.85 m – 19.40 m	22.78
8.	4	19.40 m – 20.95 m	19.80
9.	5	11.50 m – 13.00 m	20.39
10.	5	13.00 m – 14.50 m	22.67

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.1(Bridge no. 93)Vaitarna							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 20.60 m							
Location:- (As per sketch) Vaitarna (Surat side)							Date: 05-05-008 to 10--05-008							
							W.T.: Standing water depth 5m above bed level							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.50	DS1	12			-----	Blackish coarse grained sands with quern pieces .							
	0.50-0.95	UDS1												
1	0.95-1.40	SPT1												
	1.40-2.50	DS	17			-----	Medium dense sand .							
2														
	2.50-2.95	UDS2												
	2.95-3.40	SPT2	21			-----	Clayey fine grained sand .							
3														
	3.40-4.00	DS												
	4.00-4.45	UDS3	30			-----	Greyish to black coarse grained sand .							
4														
	4.45-4.90	SPT3												
	4.90-6.00		35			-----	Greyish Dense silty sands .							
5														
	6.00-6.45	UDS4												
	6.45-6.90	SPT4	R			-----	Very dense silty sands .							
6														
	6.90-7.50	DS												
	7.50-7.95	SPT5	R			-----	Very dense silty sands .							
7														
	7.95-9.00	DS												
	9.00-9.10	SPT6	R			\\ \\	Boulder pieces							
8														
	9.10-10.50	CORE												
			R			\\ \\	Completely weathered Basalt rock .						Nil	-
9														
10														

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 2(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 19.80 m							
Location:- (As per sketch) Vaitarna Surat end Land Borehole							Date: 05-05-008 to 10--05-008							
							W.T.: 1.50 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.50	DS1				----	Blackish Clayey coarse grained sands .							
1	0.50-0.95	UDS1	10			----	Clayey silty fine grained Sands.							
	0.95-1.40	SPT1				----								
	1.40--2.00	DS				----								
2	2.00--2.45	UDS2	14			----	Sandy Clay of stiff consistency .							
	2.45--2.90	SPT2				----								
	2.90--3.35	UDS3				----								
3	3.35--4.00	DS	18			----	Dense Silty Sands .							
	4.00-4.45	UDS4				----								
	4.45-4.90	SPT3				----								
4	4.90--5.50		23			----	Very dense silty sands .							
	5.50--5.95	UDS5				----								
	5.95-6.40	SPT4				----								
5	6.40--7.00		40		8.3	----	Very hard Consistency Sandy Clayey Silts .							
	7.00--7.45	SPT5				----								
	7.45--8.00					----								
6	8.00--8.30	SPT6	R			----	Completely weathered basalt rock.						27.4	12.5
	8.30--10.00	CORE				\\ \\								
						\\ \\								
7						\\ \\	Highly weathered basalt rock .						38.6	27.8
						\\ \\								
						\\ \\								
8	10.00--12.80	CORE				\\ \\								
						\\ \\								
						\\ \\								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 2(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 2 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 19.80 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							Date: 05-05-008 to 10--05-008							
Location:- (As per sketch) Vaitarna, Surat side							W.T.: 1.50 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.00--12.80	CORE				\\ \\	Fine grained blackish gray Basalt rock .						38.6	27.8
12						\\ \\	Highly weathered basalt rock .							
13	12.80--15.00	CORE				\\ \\	Highly weathered basalt rock .						54.6	43.4
14						\\ \\								
15	15.00-17.00	CORE				\\ \\	Highly weathered Basalt rock .						60.9	43.6
16						\\ \\								
17	17.00--19.80	CORE				\\ \\	Moderately weathered basalt Rock						67.6	52.8
18						\\ \\								
19						\\ \\								
20	19.80....					\\ \\								
Bore hole terminated at 19.80 m														

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 3(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 1 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 24.00 m							
Location:- (As per sketch) Vaitarna River gorge portion							Date: 11-05-008 to 17--05-008							
							W.T.: Standing water depth 5m above bed level							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00--1.00	DS1				-----	Blackish coarse grained Sands .							
1	1.00--1.45	UDS1				-----	Clayey silty fine grained Sands.							
2	1.45--1.90	SPT1	15			-----								
	1.90--2.50	DS2												
3	2.50--2.95	UDS2				-----	Clayey silty fine grained Sands.							
	2.95--3.30													
4	3.30--3.75	SPT2	16			-----								
	3.75--4.20	UDS3												
5	4.20--4.65	SPT3	20			-----	Dense Silty Sands .							
	4.65--5.00	UDS4												
6	5.45--5.90	SPT4	22			-----	Very dense silty sands .							
	5.90--7.00													
7	7.00--7.45	SPT5	38			-----	Very hard Consistency Sandy Clayey Silts .							
	7.45--8.60													
8	8.60--9.05	SPT6	43			-----	Very hard consistency Silty Clayey gravel pieces .							
	9.05--9.75													
9	9.75--10.00	SPT7	R			-----								
	10.00--12.00	CORE												
10						\\ \\	Highly weathered basalt rock .						40.8	25.4

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 3(Bridge no. 93, Vaitarna)							
							Sheet No. 2 of 3							
CLIENT: Stup Consultants Pvt. Ltd.							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 24.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch)		Date: 11-05-008 to 17--05-008							
					Vaitarna, River gorge portion		W.T.: Water standing 5m above bed level .							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.00--12.00	CORE				\\ \\	Fine grained blackish gray Basalt rock . Highly weathered basalt rock .						40.8	25.4
12	12.00--14.50	CORE				\\ \\							57.8	42.5
13						\\ \\								
14						\\ \\								
15	14.50--17.50	CORE				\\ \\	Highly weathered Basalt rock .						61.3	45.7
16						\\ \\								
17						\\ \\								
18	17.50--20.00	CORE				\\ \\							67.8	48.2
19						\\ \\								
20	20.00--23.00	CORE				\\ \\	Moderately weathered basalt Rock .						65.4	57.6

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 3(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 3 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 24.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							Date: 11-05-008 to 17--05-008							
Location:- (As per sketch) Vaitarna River gorge portion							W.T.: Standing water depth 5m above bed le							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	20.00--23.00	CORE				// //	Moderately weathered basalt Rock						65.4	57.6
22						// //								
23	23.00-24.00	CORE				// //							58.0	53.0
24	24.00--					// //								
Bore hole terminated at 24.00 m														

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 4(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 22.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							Date: 18-05-008 to 22--05-008							
Location:- (As per sketch) Vaitarna River gorge portion							W.T.: Water standing 5m above bed .							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.60	DS1				-----	Blackish Croarse sand with quartz pieces.							
	0.60-1.05	UDS1												
1	1.05-1.50	SPT1	12			-----								
	1.50-2.00													
2	2.00--2.45	UDS2				-----								
	2.45--2.90	SPT2												
3	2.90--3.00		16			-----	Sandy Clay of stiff consistency .							
	3.00-3.45	UDS3												
4	3.45-3.90	SPT3	18			-----								
	3.90-4.00													
5	4.00-4.45	UDS4	21			-----	Dense Silty Sands .							
	4.45-4.90	SPT3												
6	4.90--5.50					-----								
	5.50--5.95	UDS5												
7	5.95-6.40	SPT4	24			-----								
	6.40--7.20													
8	7.20-7.65	SPT5	35			-----	Very hard Consistency Sandy Clayey Silts .							
	7.65-8.50													
9	8.50-8.95	SPT6	41			-----								
	8.95-10.00													
10	10.00--10.45	UDS6	44			-----								
	10.45-10.90	SPT7												

RENUKA ENGINEERS														
PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .									B. H. No. 4(Bridge no. 93, Vaitarna)					
									Sheet No. 2 of 2					
CLIENT: Stup Consultants Pvt. Ltd.									(BGL) R. L. :- 0.00 m					
Casing diameter (mm) : i) 100mm and ii) 76mm									T.D (m) :- 22.00 m					
Casing diameter (mm) : i) 100mm and ii) 76mm						Location:- (As per sketch) Vaitarna, River Gorge portion			Date: 18-05-008 to 22--05-008					
									W.T.: Water standing 5m above bed .					
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.90-12.00					----- -----	Residual reddish coloured gravelly sand							
12	12.00-12.45 12.45-13.50	SPT8	46			----- ----- ----- -----								
13	13.50-13.95 13.95-14.45	SPT9	50			----- ----- -----								
14	14.45-14.50 14.50-16.10	SPT10 CORE	R			----- -----								
15						\\ \\	Completely weatherd disintegrated rock formation						10.0	0.0
16	16.10-17.85	CORE				\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\							35.0	0.0
17	17.85-19.40	CORE				\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	Highly weathered amagdolidal basalt rock formation						63.0	14.0
18	19.40-20.95	CORE				\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\							77.0	10.0
19	20.95-22.00	CORE				\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\	Moderately weathered basalt rock formation						82.0	62.0
20	22.00--					\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\								
Bore hole terminated at 22.00 m														

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 5(Bridge no. 93, Vaitarna)							
CLIENT: Stup Consultants Pvt. Ltd.							Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 19.00 m							
Location:- (As per sketch) Vaitarna Mumbai end							Date: 05-05-008 to 10--05-008							
							GWL : 2.5 m below BGL .							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.45	DS1				----	Blackish Clayey coarse grained sands .							
	0.45-0.90					----								
	0.90-1.00					----	Clayey silty fine grained Sands.							
1	1.00-1.45	UDS1				----								
	1.40--2.00	DS				----								
2	2.00--2.45	UDS2				----								
	2.45--2.90	SPT1	17			----	Sandy Clay of stiff consistency .							
	2.90--3.00					----								
3	3.00-3.45	UDS3				----								
	4.00-4.45	UDS4				----								
	4.45-4.90	SPT2	16			----	Dense Silty Sands .							
	4.90--5.50					----								
5	5.50--5.95	UDS5				----								
	5.95--7.00					----	Very dense silty sands .							
	7.00--7.45	SPT3	43			----								
	7.45--8.00					----	Very hard Consistency Sandy Clayey Silts .							
8	8.00--8.00	SPT4	R			----								
	8.00-9.00					----								
9	9.00-9.05	SPT5	R			----								
	9.05-10.50	CORE				----	Completely weathered basalt rock.						17.0	0.0
10						\\ \\								

RENUKA ENGINEERS															
PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No. 5(Bridge no. 93, Vaitarna)									
						Sheet No. 2 of 2 (BGL) R. L. :- 0.00 m									
CLIENT: Stup Consultants Pvt. Ltd.						T.D (m) :- 19.00 m									
Casing diameter (mm) : i) 100mm and ii) 76mm				Location:- (As per sketch) Vaitarna, Virara Side		Date: 05-05-008 to 10--05-008									
Casing diameter (mm) : i) 100mm and ii) 76mm						GWL : 2.5 m below BGL .									
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%	
	Depth (m)	Type													
11	10.50-11.50	CORE				\ \	Completely weathered basalt rock.							43.0	0.0
12						\ \									
13	11.50-13.00	CORE				\ \	Highly weathered basalt rock formation.							61.0	12.0
14						\ \									
15	13.00-14.50	CORE				\ \								44.0	0.0
16	14.50-16.00	CORE				\ \	Completely weathered Amygdaloidal Basalt rock .							82.0	43.0
17	16.00-17.50	CORE				\ \	Highly weathered Amygdaloidal Basalt rock .							95.0	46.0
18						\ \									
19	17.50-19.00	CORE				\ \								85.0	51.0
	19.00--					\ \									
Bore hole terminated at 19.00 m															

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 115

BH. NO. 1**BRIDGE NO. 115**

There is overburden up to depth 6.00m. The N value in this zone varies between N=25 and N=33. Below this up to depth 12.00 m moderately to highly weathered broken amygdaloidal basalt with white and green infillings fragments occurs. In this zone, core recovery varies between 5% and 80% R.Q.D. Varies between Nil and 80%

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
14	11.70	418.45

BH. NO. 2**BRIDGE NO. 115**

There is no overburden. Up to depth 6.00 m moderately to highly weathered broken rock fragments occurs. In this zone, core recovery varies between 9% and 16% R.Q.D. is Nil. Below this amygdaloidal basalt with white and green infillings occurs up to depth 12.00 m. In this zone, core recovery varies between 18% and 60% R.Q.D. varies between Nil and 36%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
36	11.05	105.21

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 115 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

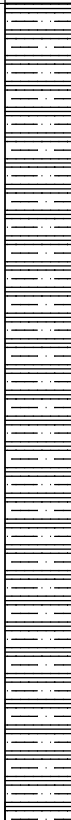

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 6.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm		Silty clay											
1.50				SPT	12	15	10	20	25					
2.10														
3.00				SPT	10	13	13	18	26					
3.60														
4.50				SPT	14	16	17	21	33					
5.10														
6.00	Nx		Amygdaloidal basalt with white infillings	6.00										
7.00				CORE						5	NIL			
8.00											17	NIL		
8.50				CORE										
9.00														
10.00				10.00	CORE					23	23			

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 115 (MAJOR BRIDGE) SHEET NO. : 2 OF 2

LOCATION : DATE :

CHAINAGE(m.) : METHOD : ROTARY DRILLING

GROUND R. L. : CASING : Nx upto 6.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
11.00	Nx	▽▽▽▽	Amygdaloidal basalt with white infillings								17	9		
		11.50		CORE										
12.00		12.00		CORE								80	80	

BORE HOLE TERMINATED AT DEPTH 12.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : **Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL**

BORE HOLE NO. : 2 BR. NO. 115 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 6.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE				BLOWS/15cm	SPT N	C R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30						45	60
1.00	150mm Nx	++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++ ++++	Moderately to highly weathered broken rock fragments	1.00	CORE					16	NIL			
2.00				2.00	CORE					14	NIL			
3.00				3.00	CORE					13	NIL			
4.00				4.00	CORE					10	NIL			
5.00				5.00	CORE					15	NIL			
6.00				6.00	CORE					9	NIL			
7.00				7.00	▽▽▽▽	Amygdaloidal basalt with white and green infillings						18	NIL	
8.00				8.00	CORE						32	NIL		
9.00				9.00	CORE						21	NIL		
10.00				10.00	CORE						26	23		

SPT N =STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 2 BR. NO. 115 (MAJOR BRIDGE)

SHEET NO. : 2 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 6.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx	▽▽▽▽	Amygdaloidal basalt with white and green infillings	11.00	CORE						58	35	
12.00		▽▽▽▽		12.00	CORE						60	36	

BORE HOLE TERMINATED AT DEPTH 12.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 119

REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 119 AT KM /---

1.0 **PRESENTATION OF BORE HOLE DATA:**

To get the description about sub soil condition and to classify depth wise strata. The drilled depth of bore hole is shown in Table-1

TABLE – 1
DEPTH OF BOREHOLES

SR.NO	BH.NO.	DEPTH (m)
1.	BH-1	11.05

2.0 **FIELD TESTS:**

2.1 **STANDARD PENETRATION TESTS:**

The Standard Penetration Test were conducted in exploratory borehole at different depths shown in borelogs as per the procedure stipulated in I.S.2131 (1981) and indicated in Table – 2.

Numbers of blows required for each 15 cm penetration upto 45 cm penetration were recorded and the numbers of blows for later 30 cm penetration are counted as standard penetration value (N).

TABLE – 2
STANDARD PENETRATION TEST

SR.NO.	BH.NO.	DEPTH (m)	N VALUE
1	BH-1	1.50-1.95	7
2		3.50-3.95	9

3.0 **LABORATORY TESTS:**

The results of soil, rock and water samples tested in laboratory are given below:

3.1 **GRAIN SIZE ANALYSIS:**

The grain size analysis of different samples collected from borehole was done as per I.S. -2720 (Part – IV) and the results are shown in Table – 3.

TABLE – 3
GRAIN SIZE DISTRIBUTION

SR. NO.	BH NO.	Depth	% Gravel 75mm-4.75 mm	% Sand 4.75mm-0.075mm	%Silt & % Clay < 0.075 mm
1.	BH-1	1.00	39.70	24.80	35.50

3.2 **ATTERBERG'S LIMITS:**

The liquid limit and plastic limit tests were conducted as per I.S.-2720 (Part – V) on soil samples and the test results are shown in Table – 4.

TABLE – 4
ATTERBERG'S LIMIT

SR. NO.	BH NO.	Depth (m)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)
1.	BH-1	1.00	25.4	16.8	8.6

3.3 FIELD DENSITY AND MOISTURE CONTENT:

The Undisturbed Soil Samples/SPT Samples were tested for field density and moisture content. As per I.S.2720 (Part – II) and the results are given in Table – 5

TABLE – 5
FIELD DENSITY & MOISTURE CONTENT

SR. NO.	BH NO.	Depth	Bulk Density (g/cc)	N.M.C (%)	Dry Density (g/cc)
1.	BH-1	1.00	1.783	14.30	1.560

3.4 CHEMICAL ANALYSIS OF SOIL:

Chemical analysis of soil samples were conducted and the test results are given in Table – 6

TABLE – 6
CHEMICAL ANALYSIS OF SOIL

SR. NO.	BH NO.	Depth	PH	Sulphates (ppm)	Chlorides (ppm)
1.	BH-1	1.00	7.12	180	275

3.5 CHEMICAL ANALYSIS OF WATER:

Chemical analysis of water sample was conducted and the test result is given in Table – 7

TABLE – 7
CHEMICAL ANALYSIS OF WATER

SR. NO.	BH NO.	PH	Sulphates (ppm)	Chlorides (ppm)
1.	BH-1	7.13	160	245











3.6 **ROCK TEST ANALYSIS:**

Rock samples were collected from the bore holes and tested in laboratory. The results are given in Table – 8

TABLE – 8
ROCK TEST ANALYSIS

SR.NO	BH.NO.	Sample No.	Depth (m)	Dry Density (gm/cc)	Crushing Strength (Kg/cm²)
1.	BH	7	6.6	2.31	93.51
2.		30	9.75	2.37	133.60
3.		44	10.70	2.51	178.13

ORIENTAL CONSULTING ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 1							
							Bridge No. 119							
CLIENT:As per Western Railway Record							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 14.00 m							
					Location:- (As per sketch) Sachin		Date: 30.01.2004 to 01.11.2004							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0														
1	0.60 - 1.00	DS-1					Brownish Soil with Gravels							
	1.00 - 1.45	UDS-1												
2	1.50 - 1.90	SPT-1					Yellowish Stiff Clay							
3	3.00 - 3.45	SPT-1					Yellowish Stiff Clay							
4	3.45 - 4.00						Yellowish Stiff Clay							
	4.00 - 4.95						Yellowish Stiff Clay							
5	4.95 - 5.00						Yellowish Gray Jointed Weathered Rock.							NIL
6	4.95 - 6.00						Yellowish Gray Jointed Weathered Rock.							7.3
7	6.00 - 7.50						Yellowish Gray Jointed Weathered Rock.							NIL
8	7.50 - 8.40						Yellowish Gray Jointed Weathered Rock.							NIL
9	8.40 - 9.40						Yellowish Gray Jointed Weathered Rock.							46.2
10	9.40 - 10.05						Grayish Blue Jointed Rock							15.0
11	10.05 - 11.05						Grayish Blue Jointed Rock							
12							Bore hole is terminated at depth of 11.05 m below G.L.							
13							Bore hole is terminated at depth of 11.05 m below G.L.							
14							Bore hole is terminated at depth of 11.05 m below G.L.							

ORIENTAL CONSULTING ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. 1							
CLIENT:As per Western Railway Record							Bridge No. 119							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 14.00 m							
							Date: 30.01.2004 to 01.11.2004							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0														
1	0.60 - 1.00 1.00 - 1.45	DS-1 UDS-1					Brownish Soil with Gravels							
2	1.50 - 1.90	SPT-1					Yellowish Stiff Clay							
3	3.00 - 3.45	SPT-1					Yellowish Stiff Clay							
4	3.45 - 4.00						Yellowish Stiff Clay							
5	4.00 - 4.95 4.95 - 5.00						Yellowish Stiff Clay Yellowoish Gray Jointed Weathered Rock.							NIL
6	4.95 - 6.00						Yellowoish Gray Jointed Weathered Rock.							7.3
7	6.00 - 7.50						Yellowoish Gray Jointed Weathered Rock.							NIL
8	7.50 - 8.40						Yellowoish Gray Jointed Weathered Rock.							NIL
9	8.40 - 9.40						Yellowoish Gray Jointed Weathered Rock.							46.2
10	9.40 - 10.05						Grayish Blue Jointed Rock							15.0
11	10.05 - 11.05						Grayish Blue Jointed Rock							
12							Bore hole is terminated at depth of 11.05 m below G.L.							
13							Bore hole is terminated at depth of 11.05 m below G.L.							
14							Bore hole is terminated at depth of 11.05 m below G.L.							

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 126

BH. NO. 1

BRIDGE NO. 126

There is overburden up to depth 4.50m for the bore taken at the ambankment of the channel.. The N value in this zone varies between N=19 and N=R. Below this up to depth 10.50m porphyritic basalt with white and green infillings fragments occurs. In this zone, core recovery varies between 80% and 90% R.Q.D. Varies between 65% and 85%

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
8	5.85	757.6

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 126 (MAJOR BRIDGE)

SHEET NO. : 1 OF 1

LOCATION :

DATE :

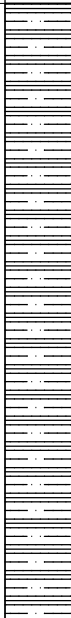
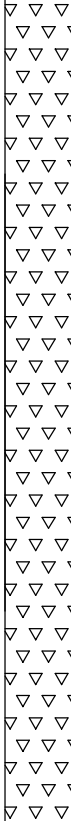
CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 4.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
1.00	150mm		Silty clay												
				1.50	SPT	6	8	11	12	19					
2.00					2.10										
3.00					3.00	SPT	8	9	12	15	21	13	NIL		
					3.60										
4.00	Nx		Porphyritic basalt with white and green infillings	4.50	SPT	53	-	-	-	R					
5.00				4.52							87	72			
				5.50	CORE										
6.00				6.10	CORE						85	85			
7.00											85	85			
				7.60	CORE										
8.00											87	65			
9.00				9.10	CORE										
											89	82			
10.00				10.60	CORE										

BORE HOLE TERMINATED AT DEPTH 10.60m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 136

BH. NO. 1

BRIDGE NO. 136

There is overburden up to depth 14.00m. The N value in this zone varies between N=20 and N=40. Below this up to depth 34.00m amygdaloidal basalt with white and green infillings fragments occurs. In this zone, core recovery varies between 55% and 80% R.Q.D. Varies between 27% and 80%

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
13	16.50	399.83

184

CLIENT : STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for JFDCL	
HOLE NO. : I BR. NO. 136 (MINOR BRIDGE)	SHEET NO. 1 OF 3
LOCATION :	DATE :
CHAINAGE (m.) :	METHOD : ROTARY DRILLING
GROUND R. L. :	CASING : Nx upto 1400m
GROUND W. T. :	

DEPTH (m.)	DIA. OF BORE HOLE	LOC.	STRATA DESCRIPTION	SAMPLE DEPTH (m)	TYPE	BLOWS/30cm				SPT N	C.R. %	R.Q.D. %	OTHER TESTS
						12	30	45	60				
1.00				1.50	SPT	32	15	20	20	25			
2.00				2.10									
3.00				3.00	SPT	10	12	14	18	16			
4.00				4.50	SPT	7	8	10	14	18			
5.00				5.10									
6.00				6.00	SPT	14	18	21	24	39			
7.00				7.50	SPT	12	14	16	18	30			
8.00				8.10									
9.00				9.00	SPT	11	13	15	18	25			
10.00				10.50	SPT	7	9	14	16	23			
				11.30									

SPT N = STANDARD PENETRATION TEST VALUE ROD = ROCK QUALITY DESIGNATION UCS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY OS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE	SCALE : 1-50 Project	Chkt. By	Prepd. By
--	-------------------------	----------	-----------

CLIENT: STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT: Geotechnical Investigation - VAHARNA TO BHELAD SECTION - proposed major & minor bridges for DFCCIL	
BORE HOLE NO. : 1 BR. NO. 136 (MINOR BRIDGE)	SHEET NO : 2 OF 3
LOCATION :	DATE :
CHAINAGE(m) :	METHOD : ROTARY DRILLING
GROUND R. L. :	CASING : Nx upto 14.00m
GROUND W. T. :	

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	CR %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
11.00	150mm														
12.00				2.00	SPT	10	12	14	16	26					
13.00															
14.00				4.20	CORRE										
15.00	Nx	▽▽▽▽	Amygdaloidal basalt with green and white nodules	5.00	CORE						55	35			
16.00												77	75		
17.00															
18.00				18.00	CORE										
19.00													71	27	
20.00				19.30	CORE								72	67	

SPT N = STANDARD PENETRATION TEST VALUE ROD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY CS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1-50	Chkd. By :	Prepd. By
Project	----	----

CLIENT: **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT: **Geotechnical Investigation - VAJARN A TO BEHLAD SECTION - proposed major & minor bridges for DFCCIL**

BORE HOLE NO.: **1 B.L. NO. 136 (MINOR BRIDGE)** SHEET NO.: **3 OF 3**

LOCATION: _____ DATE: _____

CHAINAGE(m): _____ METHOD: **ROTARY DRILLING**

GROUND R.L.: _____ CASING: **Nr upto 14.00m**

GROUND W.T.: _____

DEPTH (m.)	DIA OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C.R. %	R.Q.D. %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
21.00	75	▽▽▽▽	Amalgamoidal basalt with green and white fillings	21.50	CORE						72	67	
22.00		22.50		CORE						69	36		
23.00		23.50								71	61		
24.00		24.00		CONE									
25.00		25.50		CONE						66	68		
26.00		26.50								66	63		
27.00		27.00		CORE									
28.00		28.50		CORE						82	82		
29.00		29.50								84	82		
30.00		30.00		CORE									

BORE HOLE TERMINATED AT DEPTH 30.00m BELOW G.L.

SPT N = STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE: 1:50 Chkd. By: _____ Prep'd. By: _____
 Project: _____

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 139

BH. NO. 1**BRIDGE NO. 139**

There is overburden of silty clay up to depth 4.50m. The N value in this zone varies between N=26 and N=R. Below this up to depth 7.00m Moderately to highly weathered broken rock fragments occurs. In this zone, core recovery varies between 20% and 40% R.Q.D. is Nil. From depth 7.00 m to 14.00 m amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 65% and 85% R.Q.D. varies between 16% and 90%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
41	11.40	378.80

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 139 (MAJOR BRIDGES)

SHEET NO. : 1 OF 2

LOCATION :

DATE : 14.5.08 to 16.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 4.50m

GROUND W. T. : 6.00m B. GL.

DEPTH (m.)	DIA. OF B. HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	100mm Nx		Silty clay											
				1.50	SPT	10	12	14	18	26				
2.00				2.10										
				3.00	SPT	12	15	18	20	33				
3.00				3.60										
				4.50	SPT	52	-	-	-	R				
4.00				4.52										
				5.00	CORE						40	NIL		
5.00				6.00	CORE						20	NIL		
				7.00	CORE						31	NIL		
7.00	8.00	CORE						69	54					
	9.00	CORE						54	16					
9.00	10.00	CORE						90	90					
10.00														

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT., LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 139 (MAJOR BRIDGES)

SHEET NO. : 2 OF 2

LOCATION :

DATE : 14.5.08 to 16.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 4.50m

GROUND W. T. : 6.00m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
11.00	Nx	▽▽▽▽	Amygdaloidal basalt with white and green infillings	11.00	CORE						80	62		
12.00		▽▽▽▽									91	91		
13.00		▽▽▽▽												
14.00		▽▽▽▽				14.00	CORE						88	88

BORE HOLE TERMINATED AT DEPTH 14.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 143

BH. NO. 1**BRIDGE NO. 143**

There is no overburden. Up to depth 3.00m moderately to highly weathered broken rock fragments occurs. In this zone, core recovery varies between 20% and 40% R.Q.D. is Nil. From depth 3.00 m to 6.00 m amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 50% and 55% R.Q.D. is Nil.

From depth 6.00 m to 13.50 m porphyritic basalt with white infillings occurs. In this zone, core recovery varies between 60% and 90% R.Q.D. varies between Nil and 75%

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
69	08.00	462.96

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 143 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	100mm	++++	Moderately to highly weathered broken rock fragments	0.50	CORE						22	NIL	
				1.00	CORE						44	NIL	
2.00	Nx	++++	Moderately to highly weathered broken rock fragments	2.00	CORE						42	NIL	
				3.00	CORE						33	NIL	
4.00	Nx	▽▽▽	Amygdaloidal basalt with white and green infillings	4.00	CORE						52	NIL	
				5.00	CORE						50	NIL	
6.00	Nx	▽▽▽	Amygdaloidal basalt with white and green infillings	6.00	CORE						50	NIL	
				7.00	CORE						60	NIL	
8.00	Nx	▽▽▽	Porphyritic basalt with white infillings	8.00	CORE						89	NIL	
				9.00	CORE						71	23	
10.00	Nx	▽▽▽											

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT., LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By :

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 143 (MAJOR BRIDGE) SHEET NO. : 2 OF 2

LOCATION : DATE :

CHAINAGE(m.) : METHOD : ROTARY DRILLING

GROUND R. L. : CASING : Nx upto 1.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx	▽▽▽▽	Porphyritic basalt with white infillings	10.50	CORE								
12.00		▽▽▽▽		12.00	CORE						82	76	
13.00		▽▽▽▽		13.50	CORE						77	54	

BORE HOLE TERMINATED AT DEPTH 13.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 144

**REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 144 AT KM 99/24-26**

1.0 PRESENTATION OF BORE HOLE DATA:

To get the description about sub soil condition and to classify depth wise strata, borehole was drilled at the proposed site. The drilled depth of borehole is shown in Table -1.

**TABLE – 1
DEPTH OF BOREHOLES**

Sr. No.	BH.No.	DEPTH (m)
1	1	16.04

2.0 STANDARD PENETRATION TEST:

The Standard Penetration Test was conducted in each exploratory borehole at different depths as per the Procedure stipulated in I.S.- 2131 (1981) and indicated in Table -2.

Numbers of blows required for each 15cm penetration up to 45cm penetration were recorded and the numbers of blows for later 30cm penetration are counted as standard penetration value (N).

**TABLE- 2
STANDARD PENETRATION TEST**

SR. NO.	BH. NO.	DEPTH (m)	'N' VALUE
1	BH-1	1.50-1.95	35

3.0 SUB-SOIL PROFILE:

3.1 SUB SOIL PROFILE OF BOREHOLE – 1:

The borehole is drilled upto the depth of 16.04 m below G.L. From the Bore- log, it can be seen that Soil with Gravels exists at ground level. The thickness of this layer is 3.00 m. The N value observed in this layer at a depth of 1.50 m is 35.

Highly weathered rock is followed by Soil with Gravel layer. The thickness of this layer is 12.65m. The core recovery of highly weathered rock is observed as nit to 41.66 % but RQD is not observed in this layer. Hard rock encountered at depth of 14.20 m below ground level. The drilled thickness of this layer is 1.84m. The core recovery as well as RQD of hard rock varied from 17.93% to 92.31%.

The ground water level observed at 1.00 m below ground level.

4.0 LABORATORY TESTS:

The results of soil, rock and water samples tested in laboratory are given below:

4.1 GRAIN SIZE ANALYSIS:

The grain size analysis of different samples collected form boreholes were done as per I.S. – 2720 (Part – IV) and the results are shown in Table-3.

TABLE – 3
GRAIN SIZE DISTRIBUTION

BH No.	Depth (m)	% Gravel 75 mm – 4.75 mm	% Sand 4.75 mm -0.075 mm	% Silt and Clay < 0.075 mm
BH-1	1.50	18.44	43.22	38.34

4.2 ATTERBERG'S LIMITS:

The liquid and plastic limit tests were conducted as per I.S. – 2720 (Part-V) on soil samples and the results are shown in Table – 4

**TABLE – 4
ATTERBERG'S LIMIT**

Sr. No.	BH. No.	Depth	LIQUID LIMIT (%)	PLASTIC LIMIT INDEX (%)	PLASTICITY INDEX (%)
1	BH-1	1.50	32.18	15.34	16.84

4.3 UNCONFINED COMPRESSIVE STRENGTH:

Unconfined Compression shear tests were conducted on undisturbed soil samples and the results are given in Table- 5.

**TABLE – 5
UNCONFINED COMPRESSION SHEAR TEST**

Sr. No.	BH No.	Depth (m)	Cohesion, c (Kg/cm) ²
1	BH-1	1.50	0.17

4.4 CHEMICAL ANALYSIS OF SOIL:

Chemical analysis of soil samples was conducted and the test results are given in Table – 6.

**TABLE – 6
CHEMICAL ANALYSIS OF SOIL**

Sr. No.	BH. NO.	Ph	SULPHITES (ppm)	CHLORIDES (ppm)
1	BH-1	7.3	545	1185
Limit IS 456 – 2000		6-9	Clause 8.2.2.4 Table – 4	Clause 8.2.2.4 Table -4

4.5 CHEMICAL ANALYSIS OF WATER:

Chemical analysis of water sample was conducted and the test results are given in Table – 7.

TABLE – 7
CHEMICAL ANALYSIS OF WATER

Sr. No.	BH. NO.	pH	SULPHATES (ppm)	CHLORIDES (ppm)
1.	BH-1	7.7	580	1140
Limit IS 456 – 2000		Clause 5.4.2	Clause 5.4 Table 1	Clause 5.4 Table – 1

4.6 ROCK TEST ANALYSIS :

Rock samples were collected from the boreholes and tested in laboratory. The results are given in Table- 8.

TABLE – 8
ROCK TEST ANALYSIS

Sr. No.	BH. No.	Sample No.	Depth m	SPECIFIC GRAVITY	POROSITY	SATURATED CRUSHING STRENGTH (KG/CM ²)
1	BH-1	9	1.75	2.18	0.96	104.12

ORIENTAL CONSULTING ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
							Bridge No. 144							
							Sheet No. 1 of 1							
CLIENT: As per Western Railway Record							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 17.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch) Sachin		Date: 09.11.2002 to 22.11.2002							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0														
1	1.50 - 1.95	SPT 1					Soil with gravels							
2	1.95 - 3.00						Soil with gravels							
3	1.95 - 3.00						Soil with gravels							
4	3.00 - 3.50													nil
5	3.50 - 5.00													nil
6	5.00 - 6.50													
7	6.50 - 8.00													
8	8.00 - 9.00						Highly wethered rock							nil
9	9.00 - 9.80						Highly wethered rock							nil
10	9.80 - 10.65						Highly wethered rock							nil
11	10.65-11.25						Highly wethered rock							nil
12	11.25-13.40						Highly wethered rock							nil
13	11.25-13.40						Highly wethered rock							nil
14	13.40-14.20						Highly wethered rock							nil
15	14.20-15.65						Hard Basalt Rock							17.9
16	15.65-16.04													92.3
17							Thebore hole is terminated at dept of 16.04 m below gorund level.							

ORIENTAL CONSULTING ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
ORIENTAL CONSULTING ENGINEERS

B. H. No. 1

Bridge No. 144

Sheet No. 1 of 1

(BGL) R. L. :- 0.00 m

CLIENT: As per Western Railway Record

Casing diameter (mm) : i) 100mm and ii) 76mm
















T.D (m) :- 17.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

Date: 09.11.2002 to 22.11.2002

W.T.:

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type											
0													
1	1.50 - 1.95	SPT 1				Soil with gravels							
2	1.95 - 3.00					Soil with gravels							
3	1.95 - 3.00					Soil with gravels							
4	3.00 - 3.50												nil
5	3.50 - 5.00												nil
6	5.00 - 6.50												
7	6.50 - 8.00												
8	8.00 - 9.00					Highly wethered rock							nil
9	9.00 - 9.80					Highly wethered rock							nil
10	9.80 - 10.65					Highly wethered rock							nil
11	10.65 - 11.25					Highly wethered rock							nil
12	11.25 - 13.40					Highly wethered rock							nil
13	11.25 - 13.40					Highly wethered rock							nil
14	13.40 - 14.20					Highly wethered rock							nil
15	14.20 - 15.65					Hard Basalt Rock							17.9
16	15.65 - 16.04												92.3
17						Thebore hole is terminated at depth of 16.04 m below gorund level.							

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 163

BH. NO. 1**BRIDGE NO. 163**

There is overburden up to depth 7.00m. The N value in this zone varies between N=24 and N=R. Below this up to depth 17.00 m moderately to highly weathered broken rock fragments occurs. In this zone, core recovery varies between 13% and 28% R.Q.D. Varies between Nil and 13% Between depth 17.00 and 21.00 m flows of amygdaloidal basalt with white and green infillings occurs. The rock is jointed. In this zone, core recover varies between 40%and 87% R.Q.D. varies between Nil and 86%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
62	18.50	440.10
65	19.20	421.00
70	20.00	631.00

CLIENT: STUP CONSULTANTS PVT. LTD., NAVI MUMBAI

PROJECT: Geotechnical Investigation - VAIARNA TO BHILAD SECTION proposed major & minor bridges for DFCCIL

BORE HOLE NO. 1 DR. NO. 143 (MAJOR BRIDGE) **SHEET NO. 1 OF 3**

LOCATION **DATE:**

CHANGAGE(m.) **METHOD: ROTARY DRILLING**

GROUND R. L. **CASING: Nk upto 5.00m**

GROUND W. T.

DEPTH (m.)	DIA. OF B. HOLE	LOG	STRATA DESCRIPTION	SAMPLE		BLOWS/1.5m				SPT N	C.R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
1.00	150mm			1.50	SPT	10	11	13	16	24					
2.00				2.10											
3.00				3.00	SPT	12	18	15	18	27					
4.00				3.60											
5.00				4.50	SPT	10	4	14	21	28					
6.00				5.10											
6.00				6.00	SPT						R				
7.00				6.10									NIL	NIL	
8.00				7.00	CORE								13	NIL	
9.00				8.00	CORE								23	NIL	
10.00	9.00	CORE								17	NIL				
	10.00	CORE													

SPT N - STANDARD PENETRATION TEST VALUE RQD - ROCK QUALITY DESIGNATION UDS - UNDISTURBED SOIL SAMPLE
 CR - CORE RECOVERY DS - DISTURBED SOIL SAMPLE VST - VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE 1:50 Chkd. By: Prepd. By:

CLIENT: **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT: Geotechnical Investigation - VAIARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORF HOLE NO.: 1 BR NO 163 (MAJOR BRIDGE)

SHEET NO.: 2 OF 3

LOCATION:

DATE:

CEANAGE(m.):

METHOD: ROTARY DRILLING

GROUND R.L.:

CASING: Nx upto 5.00m

GROUND W.T.:

DEPTH (m.)	DIA. OF BORE HOLE	LOC	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	CR %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00				11.00	CORE						22	10	
12.00				12.50	CORE						20	NL	
13.00				14.00	CORE						25	NL	
14.00				15.50	CORE						25	13	
15.00				17.00	CORE						28	NIL	
16.00				18.50	CORE						40	NIL	
17.00				19.50	CORE						87	51	
18.00													
19.00													
20.00													

SPT N = STANDARD PENETRATION TEST VALUE

RQD = ROCK QUALITY DESIGNATION

UDS = UNDISTURBED SOIL SAMPLE

CR = CORE RECOVERY

DS = DISTURBED SOIL SAMPLE

VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE: 1: 50

Chkd. By:

Prepd. By:

Project

CLIENT: STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT: Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL	
BORE HOLE NO.: 1 DR. NO. 163(MAJOR BRIDGE)	SHEET NO.: 3 OF 3
LOCATION:	DATE:
CHAINAGE(m.):	METHOD: ROTARY DRILLING
GROUND R.L.:	CASING: Nx upto 6.00m
GROUND W.T.:	

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE				BLOWS-15cm	SPT N	CR %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30					
21.00	Nx			21.00	CORE					86		

BORE HOLE TERMINATED AT DEPTH 21.00m BELOW G.L.

SPT N - STANDARD PENETRATION TEST VALUE	RQD - ROCK QUALITY DESIGNATION	UDS - UNDISTURBED SOIL SAMPLE
CR - CORE RECOVERY	DS - DISTURBED SOIL SAMPLE	VST - VANE SHEAR TEST
MONARCH SURVEYORS AND CONTRACTORS PVT. LTD, PUNE		SCALE : 1:50
		Checked By : _____
		Project : _____
		Prep'd. By : ****

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 166

REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 166 AT KM 118/2-4

BH-2

0-0.80	Overburden
0.80-6.0	Greenish grey, fine to medium grained. Sparsely distributes amygdaloidal basalt. Amygdaloidal Basalt. Amygdals of calcite & zeolite varying in size from 1 mm to 6 mm.
6.0-10 m	Yellowish to brownish grey medium grained trap basalt with intrusion of secondary veins thread like, and iron stained. It shows weathered to moderately weathered grade rock quality.
10-12.40 m	It is medium grained greenish grey amygdaloidal basalt with attractive outlook. The sporty white amygdals of calcite and zeolite are given nice appearance to the rock with fairly good core recovery.

BH-3

0-0.15 m	Overburden
0.15-1.00	Rock cutting of weathered trap
1.0-3.0	Yellowish to buff coloured medium grained, highly to moderately weathered trap rock
3.0-6.0	Greenish grey, medium grained amygdaloidal basalt. It is moderately olivine basalt
6.0-11.00 m	Yellowish to brownish grey, moderately weathered basalt with less amygdals
11-14	Greenish to yellowish grey, fine to medium grained micro amygdaloidal weathered basalt.
14-16	It is green grey, fine grained fresh, hard and compact basalt with serpentine and olivine minerals in predominant.

Table-3

COMPRESSIVE STRENGTH OF ROCK AT DIFFERENT DEPTHS

Bore Hole No.	Depth from G.I. (m)	Safe Bearing Capacity t/m²	Compressive strength (Saturated) Kg/cm²	Remarks
1	0.80-3.00	-	38	Rock
	3.00-4.50	-	54	
	4.50-6.00	-	84	
	6.00-7.50	-	96	
	7.50-9.00	-	112	
	9.00-10.00	-	127	
	10.00-12.40	-	132	
2	1.05-3.05	-	51	Rock
	3.05-6.06	-	68	
	6.06-11.02	-	96	
	11.02-14.00	-	168	
	14.00-16.00	-	212	

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Virar & Surat .	B. H. No. 2
	Bridge No. 166
	Sheet No. 1 of 1
CLIENT: From Western Railway Records	(BGL) R. L. :- 0.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	T.D (m) :- 12.40 m
Casing diameter (mm) : i) 100mm and ii) 76mm	Location:- (As per sketch) Mindola
	Date:
	W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent.	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxia l C kg/cm ² / φ	LL%	PL%	TCR %	RQD%
	Depth (m)	Type												
0	0.00-0.80	DS1					Over burden							
	0.80-0.89		>100				Highly weathered rock							
1	0.89-1.00	DS2												11.00
	1.00-2.00	DS2												
2	2.00-3.00	DS2												
3	3.00-3.06	SPT2					Greenish grey, fine to medium grained, sparsely distributes amygdaloidal basalt, amygdals of calcite & zeolite varing in size from 1mm to 6mm.							12.00
	3.06-4.00	DS3	>100											
4	4.00-4.50	DS3												20.00
	4.50-4.55	SPT3												
	4.55-5.00	DS4	>100											
5	5.00-6.00	DS4												
6	6.00-6.07	SPT4												23.00
	6.07-7.00	DS5	>100											
7	7.00-7.50	DS5					Yellowish to brownish grey medium grained trap basal with intrusion of secondary veins thread like, and iron stained. It shows weathered to moderately weathered grade rock quality.							27.00
	7.50-7.55	SPT5												
	7.55-8.00	DS6	>100											
8	8.00-9.00	DS6												
9	9.00-9.05	SPT6												31.00
	9.05-10.00	DS7	>100											
10	10.00-11.00	DS8												
11	11.00-12.00	DS8					It is medium grained greenish grey amygdaloidal basalt with attractive outlook. The sporty white amygdals of calcite and zeolite are giving nice appearance to the rock with fairly good core recovery.							37.00
12	12.00-12.40	DS8												

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Virar & Surat .

B. H. No. 3

Bridge No. 166

Sheet No. 1 of 1

(BGL) R. L. :- 0.00 m

CLIENT: From Western Railway Records

T.D (m) :- 16.00 m












Casing diameter (mm) : i) 100mm and ii) 76mm

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Date:

W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent.	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	RQD%
	Depth (m)	Type												
0	0.00-0.15	DS1	>100				Silty sand of non plasticity.							
	0.15-1.00	DS2					Rock cutting of weathered trap							
1	1.00-1.05	SPT1	>100				Yellowish to buff coloured medium grained. Highly to moderately weathered trap rock.							17.00
	1.05-2.00	DS3												
2	2.00-3.00	DS3	>100				Greenish grey, medium grained amygdaloidal basalt. It is moderately weathered olivin basalt.							22.00
3	3.00-3.05	SPT2												
	3.05-4.00	DS4	>100				Yellowish to brownish grey, moderately weathered basalt with less amyodals.							27.00
4	4.00-5.00	DS4												
5	5.00-6.00	DS4	>100				Yellowish to brownish grey, moderately weathered basalt with less amyodals.							34.00
6	6.00-6.06	SPT3												
	6.06-7.00	DS5	>100				Greenish to yellowish grey, fine to medium grained micro amygdaloidal weathered basalt.							36.00
7	7.00-8.00	DS5												
8	8.00-9.00	DS5	>100				It is greenish grey, fine grained fresh, hard and compact basalt with serpentine and olivin minerals in predominant.							
9	9.00-10.00	DS5												
10	10.00-1.00	DS5	>100											
11	11.00-11.02	SPT4												
	11.02-12.00	DS6	>100											
12	12.00-13.00	DS6												
13	13.00-14.00	DS6	>100											
14	14.00-15.00	DS17												
15	15.00-16.00	DS17	>100											

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Virar & Surat .

B. H. No. 2

Bridge No. 166

Sheet No. 1 of 2

(BGL) R. L. :- 0.00 m

CLIENT: From Western Railway Records

T.D (m) :- 12.40 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date:

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent. Observed	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	RQD%
	Depth (m)	Type												
0	0.00-0.80	DS1					Over burden							
	0.80-0.89		>100				Highly weathered rock							
1	0.89-1.00	DS2												11.00
	1.00-2.00	DS2												
2	2.00-3.00	DS2												
3	3.00-3.06	SPT2					Greenish grey, fine to medium grained, sparesely distributes amygdaloidal basalt, amygdals of calcite & zeolite varing in size from 1mm to 6mm.							12.00
	3.06-4.00	DS3	>100											
	4.00-4.50	DS3												
	4.50-4.55	SPT3												20.00
	4.55-5.00	DS4												
5	5.00-6.00	DS4	>100											
6	6.00-6.07	SPT4												23.00
	6.07-7.00	DS5	>100											
7	7.00-7.50	DS5												
	7.50-7.55	SPT5												27.00
	7.55-8.00	DS6					Yellowish to brownish grey medium grained trap basal with intrusion of secondary veins thread like, and iron stained. It shows weathered to moderately weathered grade rock quality.							
8	8.00-9.00	DS6	>100											
9	9.00-9.05	SPT6												31.00
	9.05-10.00	DS7	>100											

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Virar & Surat .

B. H. No. 2

Bridge No. 166

Sheet No. 2 of 2

(BGL) R. L. :- 0.00 m

CLIENT: From Western Railway Records

T.D (m) :- 12.40 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date:

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent. Observed	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	RQD%	
	Depth (m)	Type													
11	10.00-11.00	DS8					It is medium grained greenish grey amygdaloidal basalt with attractive outlook. The sporty white amygdals of calcite and zeolite are giving nice appearance to the rock with fairly good core recovery.								
	11.00-12.00	DS8													37.00
12	12.00-12.40	DS8													

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Virar & Surat .

B. H. No. 3

Bridge No. 166

Sheet No. 1 of 2

(BGL) R. L. :- 0.00 m

CLIENT: From Western Railway Records

T.D (m) :- 16.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date:

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent.	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	RQD%
	Depth (m)	Type	Observed											
0	0.00-0.15	DS1					Silty sand of non plasticity.							
	0.15-1.00	DS2												
1			>100				Rock cutting of weathered trap							
	1.00-1.05	SPT1												
	1.05-2.00	DS3												
2	2.00-3.00	DS3					Yellowish to buff coloured medium grained. Highly to moderately weathered trap rock.							17.00
	3.00-3.05	SPT2												
	3.05-4.00	DS4												22.00
	4.00-5.00	DS4												
5	5.00-6.00	DS4	>100				Greenish grey, medium grained amygdaloidal basalt. It is moderately weathered olivin basalt.							
	6.00-6.06	SPT3												
	6.06-7.00	DS5												27.00
	7.00-8.00	DS5												
8														
	8.00-9.00	DS5	>100				Yellowish to brownish grey, moderately weathered basalt with less amyodals.							
9														
	9.00-10.00	DS5												
10														

CHAUDHARI CONSTRUCTION

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Virar & Surat .

CLIENT: From Western Railway Records

B. H. No. 3

Bridge No. 166

Sheet No. 2 of 2

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 16.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Date:

W.T.:

Depth m	Sample & Insitu test		SPT Blows for 30 cm Pent. Observed	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	RQD%
	Depth (m)	Type												
11	10.00-11.00	DS5	>100				Yellowish to brownish grey, moderately weathered basalt with less amyodals.							27.00
	11.00-11.02	SPT4												
12	11.02-12.00	DS6												34.00
	12.00-13.00	DS6												
13	13.00-14.00	DS6					Greenish to yellowish grey, fine to medium grained micro amygdaloidal weathered basalt.							
14	14.00-15.00	DS17												36.00
15	15.00-16.00	DS17					It is greenish grey, fine grained fresh, hard and compact basalt with serpentine and olivin minerals in predominant.							
16														

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 169

BH. NO. 1**BRIDGE NO. 169**

There is no overburden. From ground surface up to depth 10.50m flows of amygdaloidal basalt with white and green infillings occurs. Up to depth 9.50m the rock is closely jointed and is moderately to highly weathered and is broken into small pieces. In this zone, core recovery varied between 14% and 45% R.Q.D. varies between Nil and 14%. Between depth 10.50m and 14.50m hydro thermally altered amygdaloidal basalt with white infillings occurs. In this zone, core recovery varies between 82% and 86% R.O.D. varies between 10% and 61%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
34	4.65	126.25
84	11.00	168.35
96	12.65	378.80

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 169 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm Nx			1.00	CORE						14	NIL	
				1.50	CORE						9	NIL	
2.00				2.50	CORE						45	10	
				3.50	CORE						32	NIL	
4.00				4.50	CORE						62	31	
				5.50	CORE						53	14	
6.00				6.00	CORE						34	NIL	
				7.00	CORE						14	NIL	
8.00				8.50	CORE						36	NIL	
				9.50	CORE						22	NIL	
10.00										86	10		

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 169 (MAJOR BRIDGE) SHEET NO. : 2 OF 2

LOCATION : DATE :

CHAINAGE(m.) : METHOD : ROTARY DRILLING

GROUND R. L. : CASING : Nx upto 1.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx			10.50	CORE						86	10	
12.00				11.50	CORE						84	61	
13.00				13.00	CORE						82	60	
14.00					14.50	CORE						86	21

BORE HOLE TERMINATED AT DEPTH 14.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 173

BH. NO. 1**BRIDGE NO. 173**

There is no overburden. From ground surface up to depth 7.5 m flows of amygdaloidal basalt with white and green infillings occurs. Up to depth 7.50 m the rock is jointed and is moderately weathered. In this zone, core recovery varied between NIL to 51% and R.Q.D. varies between Nil and 30%. Beyond 7.5 m amygdaloidal basalt with white infillings occurs. In this zone, core recovery varies between 79% and 89% R.O.D. varies between 57% and 86%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
27	08.00	210.42

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 173 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 2.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm Nx			1.00	CORE								
2.00				2.00	CORE								
3.00				3.00	CORE								
4.00				4.00	CORE					7	NIL		
5.00				5.00	CORE					6	NIL		
6.00				6.00	CORE					55	30		
7.00				7.00	CORE					51	22		
				7.50	CORE					86	86		
8.00				8.00									
9.00				9.00	CORE					79	57		
10.00			10.00						89	83			

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 173 (MAJOR BRIDGE) SHEET NO. : 2 OF 2

LOCATION : DATE :

CHAINAGE(m.) : METHOD : ROTARY DRILLING

GROUND R. L. : CASING : Nx upto 2.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx			10.50	CORE						89	83	
12.00				12.00	CORE						87	82	

BORE HOLE TERMINATED AT DEPTH 12.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 182

BH. NO. 1

BRIDGE NO. 182

TOP R.L. 94.55m

There is no overburden up to depth 2.50m. Below this up to depth 22.00 m moderately to highly weathered broken rock fragments occurs. Between depth 2.50 m and 22.00 m core recovery varies between Nil and 20%. R.Q.D. is Nil Between depth 22.00 m and 30.00 m porphyritic with green infillings occurs. In this zone, core recovery varies between 21% and 90% R.Q.D. varies between Nil and 43%.

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 182 (MAJOR BRIDGE)

SHEET NO. : 1 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 2.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm Nx			1.00	CORE									
2.00				2.50	CORE						NIL	NIL		
3.00														
4.00					4.00	CORE					11	NIL		
5.00					4.00	CORE					7	NIL		
6.00														
7.00					4.00	CORE					5	NIL		
8.00					4.00	CORE						NIL	NIL	
9.00														
10.00					4.00	CORE						NIL	23	

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By :

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 182 (MAJOR BRIDGE)

SHEET NO. : 2 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
11.00	Nx										17	NIL		
		11.50	CORE											
12.00												9	NIL	
		13.00	CORE											
14.00												15	NIL	
		14.50	CORE											
15.00												9	NIL	
		16.00	CORE											
17.00												10	NIL	
		17.50	CORE											
18.00											10	NIL		
	19.00	CORE												
20.00											29	NIL		

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 182 (MAJOR BRIDGE) SHEET NO. : 3 OF 3

LOCATION : DATE :

CHAINAGE(m.) : METHOD : ROTARY DRILLING

GROUND R. L. : CASING : Nx upto 1.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
21.00	Nx			20.50	CORE						20	NIL	
22.00				22.00	CORE						45	7	
23.00				23.50	CORE						21	NIL	
24.00				25.00	CORE						37	NIL	
25.00				26.50	CORE						58	39	
26.00				28.00	CORE						89	43	
27.00				29.50	CORE						90	34	
28.00				30.00	CORE								
29.00													
30.00													

BORE HOLE TERMINATED AT DEPTH 30.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By :

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 192

BH. NO. 1

BRIDGE NO. 192

There is overburden of 2.5 m. Below 2.5 m flows of amygdaloidal basalt with white and green infillings occurs. Core recovery varied between 16% and 72%.

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 192 (MINOR BRIDGE)

SHEET NO. : 1 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 3.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS				
				DEPTH (m)	TYPE	15	30	45	60								
1.00	150mm		Overburden														
2.00				1.50	SPT	4	6	6	8	12							
				2.10													
				2.50													
3.00	Nx		Amygdaloidal basalt with white and green infillings	3.00	CORE						32	NIL					
													20	NIL			
4.00				4.00	CORE								16	NIL			
														27	NIL		
5.00				5.00	CORE									20	NIL		
															33	NIL	
6.00				6.00	CORE										36	NIL	
7.00				7.50	CORE												
8.00				9.00	CORE												
9.00																	
10.00																	

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 192 (MINOR BRIDGE)

SHEET NO. : 2 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 3.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx	▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽	Amygdaloidal basalt with white and green infillings	10.50	CORE								
12.00				12.00	CORE						25	NIL	
13.00				13.50	CORE						39	23	
14.00				15.00	CORE						74	67	
15.00				16.00	CORE						50	NIL	
16.00				17.50	CORE						59	17	
17.00				19.00	CORE						43	7	
18.00				20.00	CORE						45	15	
19.00													
20.00													

SPT N =STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE : 1: 50 Chkd. By : Prepd. By :
 106 Project - - - - - - ****

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 192 (MINOR BRIDGE)

SHEET NO. : 3 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 3.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
21.00	Nx	▽▽▽▽	Amygdaloidal basalt with white and green infillings	21.50	CORE						39	9	
22.00		▽▽▽▽							71	23			
23.00		▽▽▽▽							52	36			
24.00		▽▽▽▽							75	27			
25.00		▽▽▽▽							78	67			
26.00		▽▽▽▽							76	41			
27.00		▽▽▽▽							48	33			
28.00		▽▽▽▽											
29.00		▽▽▽▽											
30.00		▽▽▽▽											

BORE HOLE TERMINATED AT DEPTH 30.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 203

BH. NO. 1

BRIDGE NO. 203

TOP R.L. 95.43m

There is overburden up to depth 1.00m. Below this up to depth 16.50m porphyritic basalt with white infillings occurs. Between depth 1 m and 9 m the rock is closely jointed, highly weathered and is broken into small pieces. In this zone, core recovery varies between 4% and 23% R.Q.D. varies between Nil and 9% Below this core recovery varies between 56% and 77% R.Q.D. varies between 24% and 85%.

CLIENT : STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT : Geotechnical Investigation - VAJARNNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL	
BORE HOLE NO. : 1 BR. NO. 203 (MAJOR BRIDGE)	SHEET NO : 1 OF 2
LOCATION :	DATE :
CHAINAGE(m.) :	METHOD : ROTARY DRILLING
GROUND R. L. :	CASING : Max upto 1.50m
GROUND W. T. :	

DEPTH (m.)	DIA. OF B. HOLE	LOG	STRATA DESCRIPTION	SAMPLE		BLOWS/ Scan				SPT N	CR %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm			1.00	DS									
				1.50	CORE					4		NIL		
2.00											17		NIL	
					3.00	CORE								
3.00												22		NIL
					4.50	CORE								
4.50												23		9
					6.00	CORE								
6.00												15		7
					7.50	CORE								
7.50											19		NIL	
				9.00	CORE									
9.00											56		24	
10.00														

SPT N = STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION LOGS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VS = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE - 1:50 Chkd. By : Prepd By :
 Project : --- --- ---

CLIENT: STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT: <i>Geotechnical Investigation - VAI TARNNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL</i>	
BORE HOLE NO. : BR. NO. 203 (MAJOR BRIDGE)	SHEET NO. : 2 OF 2
LOCATION :	DATE :
CHAINAGE(m.) :	METHOD : RUTARY DRILLING
GROUND R. L. :	CASING : Nx upto 1.50m
GROUND W. T. :	

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE				BLOWS/1.5m				SPT N	C.R %	RQU %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60						
11.00				11.90	CORE								56	24	
12.00				12.00	CORE								58	55	
13.00				13.00	CORE								67	77	
14.00				14.00	CORE								81	75	
15.00				15.00	CORE								81	85	
16.00				16.50	CORE								81	85	

BORE HOLE TERMINATED AT DEPTH 16.50m BELOW G.L.

SPT N = STANDARD PENETRATION TEST VALUE ROD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE YST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1:50
Project

Chgd. By

Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 228

BH. NO. 1

BRIDGE NO. 228

TOP R.L. 94.90 m

There is overburden up to depth 4.00m. The N value in this zone is N= 21. Below this up to depth 10.00 m flows of amygdaloidal basalt with white and green infillings with black techalytic basalt injections occurs. In this zone, core recovery varies between 30% and 49% R.Q.D. varies between Nil and 15%. Below this up to depth 14.70 m flows of amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 53% and 81% R.Q>D. varies between 19% and 79%..

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
17	6.75	273.56
51	12.00	568.26

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 228 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m Below GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm			1.00									
2.00				1.50		10	30	45	60	N			
				1.60	SPT	58	-	-	-	R			
3.00													
				4.00									
5.00				4.50		12	30	45	60	N			
				4.60	SPT	55	-	-	-	R			
6.00													
				7.00									
8.00				7.50		15	30	45	60	N			
	7.95	SPT	10	12	15	-	27						
9.00								43	8				
	9.50												
10.00	Nx												

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 288 (MAJOR BRIDGE)

SHEET NO. : 2 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx			11.00							92	65	
12.00				12.50							88	76	
13.00					14.00							89	77
14.00													

BORE HOLE TERMINATED AT DEPTH 13.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 2 BR. NO. 228 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m Below GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
1.00	150mm		Filling	1.00											
2.00			1.50			15	30	45	60						
			2.10	SPT		8	10	4	13	21					
3.00			2.50												
			3.50												
4.00			Nx		Black fine sand	4.00						NIL	NIL		
5.00					4.50								30	NIL	
					6.00								49	15	
7.00					7.50								60	19	
8.00					9.00								60	38	
9.00	10.00								53	NIL					

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 2 BR. NO. 288 (MAJOR BRIDGE)

SHEET NO. : 2 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx			11.00	CORE						78	44	
12.00				12.00	CORE						80	38	
13.00				13.50	CORE						87	79	
14.00				14.70	CORE						86	71	
15.00													

BORE HOLE TERMINATED AT DEPTH 13.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 230

BH. NO. 1

BRIDGE NO. 230

TOP R.L. 97.88m

There is overburden up to depth 0.50m. Below this up to depth 4.00m moderately to highly weathered broken rock fragments occurs. In this zone, core recovery varies between 8% and 16% R.Q.D. is Nil. Between depth 4.00m and 10.50m flows of amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 43% and 97% R.Q.D. varies between Nil and 97%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
15	4.10	105.23
27	6.50	378.95
37	8.90	437.69

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 230 (MAJOR BRIDGE)

SHEET NO. : 1 OF 1

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm			0.50	D.S.								
				1.00	CORE						16	NIL	
2.00											11	NIL	
				2.50	CORE								
3.00													
				4.00	CORE								
4.00											76	51	
				5.00	CORE								
5.00											43	NIL	
				6.00	CORE								
6.00	Nx										77	71	
				7.50	CORE								
7.00											87	82	
				9.00	CORE								
8.00											97	97	
				10.50	CORE								

BORE HOLE TERMINATED AT DEPTH 10.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 263

BH. NO. 1

BRIDGE NO. 263

There is overburden up to depth of 1.5 m. Below this up to depth 8.00m weathered rock is observed. In this zone core recovery varies between Nil and 8 % R.Q.D. is Nil. Between depth 8 m and 14m flows of amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 21% and 89% R.Q.D. varies between 21% and 89%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
7	09.25	483.91
17	12.50	315.65

CLIENT : STUP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT : Geotechnical Investigation - VAJRANA TO BHILAD SECTION proposed major & minor bridges for DFCCIL	
BOREHOLE NO. : 1 BR. NO. 263 (MAJOR BRIDGE)	SHEET NO. : 1 OF 2
LOCATION :	DATE :
CHAINAGE(m.) :	METHOD : ROTARY DRILLING
GROUND R.L. :	CASING : Nx upto 6.00m
GROUND W.T. :	

DEPTH (m)	DIA. OF B. HOLE	LOG	STRATA DESCRIPTION	SAMPLE				BLOWS/15cm				SPT N	CR %	ROD %	OTHER TESTS			
				DEPTH (m)	TYPE	15	30	45	60									
0.50	150mm												NIL	NIL				
1.00															NIL	NIL		
1.50				SPT	56	-	-	-			R				NIL	NIL		
1.55																		
2.00				CORE												NIL	NIL	
2.50				CORE												NIL	NIL	
3.00				SPT	52	-	-	-			R					NIL	NIL	
3.08																		
3.50				CORE												NIL	NIL	
4.00				CORE												NIL	NIL	
4.50	SPT	58	-	-	-			R					NIL	NIL				
4.56																		
5.00													NIL	NIL				
5.50	CORE																	
6.00	SPT	53	-	-	-			R					NIL	NIL				
6.04																		
7.00	CORE												NIL	NIL				
8.00													8	NIL				
8.00	CORE																	
9.00													21	NIL				
9.00	CORE																	
10.00													82	82				

SPT N = STANDARD PENETRATION TEST VALUE		ROD = ROCK QUALITY DESIGNATION		UES = UNDISTURBED SOIL SAMPLE	
CR = CORE RECOVERY		DS = DISTURBED SOIL SAMPLE		VST = VANE SHEAR TEST	
MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE				SCALE : 1:50	Chkd. By :
				Project	Prepd. By

CLIENT : STIP CONSULTANTS PVT. LTD., NAVI MUMBAI	
PROJECT : Geotechnical Investigation - VAITARNA FO BHILAD SECTION - proposed major & minor bridges for DFCCIL	
BORE HOLE NO. : 1 BR. NO. 263 (MAJOR BRIDGE)	SHEET NO. : 2 OF 2
LOCATION :	DATE :
CHAINAGE(m.) :	METHOD : ROTARY DRILLING
GROUND R. L. :	CASING : Nx upto 6.00m
GROUND W. T. :	

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm			SPT N	C.R. %	R.Q.D. %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45				
11.00				10.50	CORE					42	42	
12.00				12.00	CORE					89	89	
13.00				13.50	CORE					47	47	
14.00				14.20	CORE					54	54	

BORE HOLE TERMINATED AT DEPTH 14.20m BELOW G.L.

SPT N - STANDARD PENETRATION TEST VALUE	R.Q.D. - ROCK QUALITY DESIGNATION	U.S.S. - UNDISTURBED SOIL SAMPLE
CR - CORE RECOVERY	DS - DISTURBED SOIL SAMPLE	V.S.T. - VANE SHEAR TEST
MONARCH SURVEYORS AND CONTRACTORS PVT. LTD, PUNE		SCALE : 1:50
		Chkd. By :
		Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 284

BH. NO. 1**BRIDGE NO.284**

There is overburden up to 2.00m. The N value in this Zone is N= 17. Below this up to depth 10.00m highly weathered small broken rock fragments occur. In this zone core recovery varies between Nil and 9% R.Q.D. is Nil. Between depth 10m and 15m flows of amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery varies between 43% and 88% R.Q.D. varies between 13% and 53%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
20	11.50	126.25
32	13.25	147.30
45	14.62	168.35

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 284 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m Below GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm													
				1.50			15	30	45	80	N			
2.00				2.10	SPT	4	7	10	12	17				
				2.70										
3.00				3.00								NIL	NIL	
				4.00								9	NIL	
4.00				5.00								NIL	NIL	
				6.00								3	NIL	
5.00				7.00								6	NIL	
				8.00								NIL	NIL	
6.00	9.00								4	NIL				
	10.00								4	NIL				
7.00														
8.00														
9.00														
10.00														

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 284 (MAJOR BRIDGE)

SHEET NO. : 2 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
11.00	Nx			11.00							43	13		
12.00				12.50	CORE						78	53		
13.00														
14.00					14.00	CORE						78	48	
15.00				15.00	CORE						88	33		

BORE HOLE TERMINATED AT DEPTH 13.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 287

BH. NO. 1

BRIDGE NO. 287

There is overburden up to depth 1.5m. Below this up to depth 6.00m porphyritic basalt with green infillings occurs. In this zone, core recovery varies between 70% and 90% R.Q.D. varies between 40% and 90%. From depth 6.00 m to 6.50 m volcanic breccia with zeolites occurs. In this zone, core recovery is 75% and R.Q.D. is 50%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
19B	04.90	866.00

BH. NO. 2

BRIDGE NO. 287

There is overburden up to depth 0.5m. Below this up to depth 2.00m amygdaloidal basalt with green infillings occurs. In this zone, core recovery is between 70% and R.Q.D. is 65%. From depth 2.00 m to 6.00 m volcanic breccia with zeolites occurs. In this zone, core recovery varies between 75% and 90% R.Q.D. varies 75% and 90%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
11	03.35	417.30

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 287 (MAJOR BRIDGE)

SHEET NO. : 1 OF 1

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm		Overburden											
			1.50	SPT	51	-	-	-	R					
2.00	Nx		Porphyritic basalt with green infillings	1.51							76	49		
3.00				3.00	CORE									
4.00				4.50	CORE							71	39	
5.00				5.50	CORE							92	82	
				5.60										
6.00			Volcanic breccia with zeolites							77	52			
				6.50	CORE									

BORE HOLE TERMINATED AT DEPTH 6.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 2 BR. NO. 287 (MAJOR BRIDGE)

SHEET NO. : 1 OF 1

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 1.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm Nx		Overburden	0.50									
2.00			Amygdaloidal basalt with green infillings	2.00	CORE						71	65	
3.00			Volcanic breccia with zeolites	3.50	CORE						77	77	
4.00				5.00	CORE						83	83	
5.00				5.60	CORE						90	90	

BORE HOLE TERMINATED AT DEPTH 5.60m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By :

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 288

BH. NO. 1

BRIDGE NO. 288

There is overburden up to depth of 7.5 m. In this region N values varies between 27 to R. Below this up to depth 2.00m amygdaloidal basalt with green infillings occurs. In this zone, core recovery is between 82% and 93% and R.Q.D. is between 65% and 89%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
14	09.75	547.16

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 288 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m Below GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS			
				DEPTH (m)	TYPE	15	30	45	60							
1.00	150mm			1.00												
2.00				1.50	SPT	7	11	16	20	27						
				2.10												
3.00																
4.00																
5.00							4.50	SPT	9	12	16	2	28			
							5.10									
6.00																
7.00							7.20									
							7.50	SPT	50	-	-	-	R			
8.00				7.55							25	NIL				
				8.50	CORE											
9.00	Nx										82	65				
10.00				10.00	CORE											

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 288

SHEET NO. : 2 OF 2

LOCATION :

DATE : 22.5.08 to 24.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 7.50m

GROUND W. T. : 3.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx										89	89	
		11.50	CORE										
12.00											93	83	
13.00				13.00	CORE								

BORE HOLE TERMINATED AT DEPTH 13.00m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 304

BH. NO. 1**BRIDGE NO. 304**

There is overburden up to depth 6.0m. Below this up to depth 7.00m highly weathered small fragments occurs. In this zone, core recovery is 19% and R.Q.D. is Nil. From depth 7.00 m to 9.50 m hydrothermally altered amygdaloidal basalt with white infillings occurs. In this zone, core recovery is 70% and R.Q.D. varies between 50% and 70%. From depth 9.50 m to 12.5 m. amygdaloidal basalt with green infillings occurs. Core recovery varies between 65% and 80% and R.Q.D. varies between 50% and 75%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
14	08.00	205.65

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 304

SHEET NO. : 1 OF 2

LOCATION :

DATE : 19.5.08 to 21.5.08


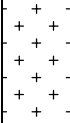

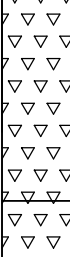
CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 4.50m

GROUND W. T. : 1.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
1.00	150mm Nx		Silty clay with gravels												
1.50				SPT	6	9	13	18	22						
2.10															
2.00															
3.00															
4.00															
4.50				4.50	SPT	52	-	-	-	R					
4.60				4.60											
6.00				6.00											
7.00			Highly weathered small fragments	7.00	CORE						19	NIL			
8.00			Hydrothermally altered amygdaloidal basalt with white infillings	8.00	CORE						69	56			
9.00												80	71		
9.50				9.50	CORE										
10.00			Amygdaloidal basalt with green infillings												

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By:

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 304

SHEET NO. : 2 OF 2

LOCATION :

DATE : 19.5.08 to 21.5.08

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 4.50m

GROUND W. T. : 1.50m B. GL.

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx	▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽ ▽▽▽▽	Amygdaloidal basalt with green infillings	11.00	CORE						67	49	
12.00											79	76	
						12.50	CORE						

BORE HOLE TERMINATED AT DEPTH 12.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By:

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 318

BH. NO. 1**BRIDGE NO. 318**

There is overburden up to depth 12.50. The N value in this zone varies between N=21 and N=R. Below this up to depth 22.00m flows of amygdaloidal basalt with white and green infillings occurs. Between depth 12.50 m and 16.00m the rock is moderately to highly weathered and is broken into small pieces. In this zone core recovery varies between 5% and 70 % and R.Q.D. varies between Nil and 23% Below this core recovery varies between 70 % and 90% R.Q.D. varies between 44% and 656%.

CLIENT : STUP CONSULTANTS PVT. LTD., NAVI MUMBAI
PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL
BORE HOLE NO. : 1 BR. NO. 311 (MAJOR BRIDGE) **SHEET NO. :** 1 OF 3
LOCATION : **DATE :**
CHAINAGE (m.) : **METHOD :** ROTARY DRILLING
GROUND R. L. : **CASING :** Nx upto 11.50m
GROUND W. T. :

DEPTH (m.)	DIA. OF B. HOLE (mm)	LOG	STRATA DESCRIPTION	SAMPLE		FLOW/15cm				SPT N	CR %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
1.00	150mm			1.50	SPT	55	-	-	-	8				
2.00				1.60										
3.00														
4.00														
5.00					4.50	SPT	8	10	11	25	21			
6.00					5.10									
7.00														
8.00					7.50	SPT	7	9	13	15	22			
9.00					8.10									
10.00														

SPT N = STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY DS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE : 1: 50 Chkd. By : Prepd. By :

Project :

CLIENT: STUP CONSULTANTS PVT. LTD., NAVI MUMBAI

PROJECT: Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 318 (MAJOR BRIDGE)

SHEET NO. : 2 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R.L. :

CASING : Nx upto 11.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE		DLOWS/15cm				SPT N	CR %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
11.00	150mm			10.50	SPT					R					
				11.05								NIL	NIL		
12.00				11.50	CORE										
					12.50	CORE							NIL	NIL	
13.00					13.50	CORE							5	NIL	
14.00					14.50	CORE							20	NIL	
15.00					15.00	CORE							70	23	
16.00					17.50	CORE							70	44	
17.00		Nx			18.00								88	65	
18.00					19.00	CORE							90	60	
19.00				20.00											

SPT N = STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD, MUMBAI

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT: **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT: **Geotechnical Investigation - VAIARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL**

BORE HOLE NO. : **1 BR. NO. 318 (MAJOR BRIDGE)** SHEET NO. : **3 OF 3**

LOCATION : _____ DATE : _____

CHAINAGE (m.) : _____ METHOD : **ROTARY DRILLING**

GROUND R. L. : _____ CASING : **Nx upto 11.50m**

GROUND W. T. : _____

DEPTH (m.)	DIA. OF BORE HOLE	LOG	STRATA DESCRIPTION	SAMPLE		BLU/WS/1.5cm				SPT N	CR %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
21.00	150mm			20.50	CORE						90	60	
21.00											87	60	
22.00					22.00	CORE							

BORE HOLE TERMINATED AT DEPTH 22.00m BELOW G.L.

SPT N = STANDARD PENETRATION TEST VALUE RQD = ROCK QUALITY DESIGNATION UDS = UNDISTURBED SOIL SAMPLE
 CR = CORE RECOVERY OS = DISTURBED SOIL SAMPLE VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE SCALE : 1: 50 Chkd. By : _____ Prepd. By : _____
 Project : _____

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 325

BH. NO. 1

BRIDGE NO. 325

There is overburden up to depth 9.0m. N values in this region varies between 12 and 36. Below this up to depth 13.50m amygdaloidal basalt with white and green infillings occurs. In this zone, core recovery is 80% and R.Q.D. varies between 36% and 80%. From depth 13.50 m to 18.50 m porphyritic basalt with green infillings occurs. In this zone, core recovery varies between 70% and 80% R.Q.D. varies between 30% and 70%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
3	08.90	201.30

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 325 (MAJOR BRIDGE)

SHEET NO. : 1 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 8.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
1.00	150mm		Silty clay with gravels										
1.50				SPT	3	5	7	10	12				
2.10													
3.00				SPT	5	8	12	15	20				
3.60													
4.00													
4.50				SPT	4	7	10	13	17				
5.10													
6.00				SPT	6	9	11	13	20				
6.60													
7.00													
7.50	SPT	9	15	21	27	36							
8.10													
8.70													
9.00	Nx		Amygdaloidal basalt with white and green infillings							85	80		
10.00				10.20	CORE								

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By :

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 325 (MAJOR BRIDGE)

SHEET NO. : 2 OF 2

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 8.50m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	Nx	▽▽▽▽	Amygdaloidal basalt with white and green infillings							75	36		
12.00		▽▽▽▽		11.70	CORE								
13.00		▽▽▽▽		13.20	CORE						83	72	
14.00		▽▽▽▽		13.41									
15.00		▽▽▽▽	▽▽▽▽	Porphyritic basalt with green infillings							80	75	
16.00		▽▽▽▽	14.70		CORE								
17.00		▽▽▽▽	16.20		CORE						78	63	
18.00		▽▽▽▽	17.10		CORE						70	31	
		▽▽▽▽								74	71		
		▽▽▽▽		18.50	CORE								

BORE HOLE TERMINATED AT DEPTH 18.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project - - - - -

Chkd. By :
- -

Prepd. By:

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 332

BH. NO. 1

BRIDGE NO. 332

There is overburden up to depth 16.0m. N values in this region varies between 20 and 30 Below this up to depth 22.00m amygdaloidal basalt with green infillings occurs. In this zone, core recovery varies between 40% and 90% and R.Q.D. varies between 55% and 90%.

LABORATORY TEST RESULTS

P.No.	Depth (m)	Crushing Strength (Kg/cm²)
22	18.85	613.31

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 332

SHEET NO. : 1 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 14.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS		
				DEPTH (m)	TYPE	15	30	45	60						
1.00	150mm		Silty clay												
1.50				SPT	5	9	11	15	20						
2.10															
3.00				SPT	7	11	13	19	24						
3.60															
4.50				SPT	6	8	12	15	20						
5.10															
6.00				SPT	8	11	13	18	24						
6.60															
7.50				SPT	7	10	13	19	23						
8.10															
9.00				SPT	8	11	13	16	24						
9.60															
10.50	SPT	6	9	12	15	21									
11.10															

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 332 (MAJOR BRIDGE)

SHEET NO. : 2 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 14.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS
				DEPTH (m)	TYPE	15	30	45	60				
11.00	150mm		Silty clay	12.00	SPT	9	11	14	17	25			
12.00				12.60									
13.00				13.50	SPT	13	19	28	48	47			
14.00				14.10									
15.00	Nx		Silty clay with gravels	16.50	CORE								
16.00				17.50	CORE						42	NIL	
17.00				18.50	CORE						80	55	
18.00				20.00	CORE						89	77	
19.00			Amygdaloidal basalt with green infillings										
20.00													

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project

Chkd. By :

Prepd. By

CLIENT : **STUP CONSULTANTS PVT. LTD., NAVI MUMBAI**

PROJECT : Geotechnical Investigation - VAITARNA TO BHILAD SECTION - proposed major & minor bridges for DFCCIL

BORE HOLE NO. : 1 BR. NO. 332 (MAJOR BRIDGE)

SHEET NO. : 3 OF 3

LOCATION :

DATE :

CHAINAGE(m.) :

METHOD : ROTARY DRILLING

GROUND R. L. :

CASING : Nx upto 14.00m

GROUND W. T. :

DEPTH (m.)	DIA. OF BORE HOLE	LOG.	STRATA DESCRIPTION	SAMPLE		BLOWS/15cm				SPT N	C R %	RQD %	OTHER TESTS	
				DEPTH (m)	TYPE	15	30	45	60					
21.00	Nx	▽▽▽▽	Amygdaloidal basalt with green infillings								93	93		
		21.50		CORE										
22.00												94	94	
		▽▽▽▽		22.50	CORE									

BORE HOLE TERMINATED AT DEPTH 22.50m BELOW G.L.

SPT N =STANDARD PENETRATION TEST VALUE
CR = CORE RECOVERY

RQD = ROCK QUALITY DESIGNATION
DS = DISTURBED SOIL SAMPLE

UDS = UNDISTURBED SOIL SAMPLE
VST = VANE SHEAR TEST

MONARCH SURVEYORS AND CONTRACTORS PVT. LTD., PUNE

SCALE : 1: 50
Project -----

Chkd. By :

Prepd. By

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 336

**REPORT ON
GEOTECHNICAL INVESTIGATION FOR
BRIDGE NO. 336 AT KM 202/4-6**

1.0 PRESENTATION OF BORELOG

1.1 Bore hole No. 1

Bh No 1 was drilled at the stipulated location. The following 4 Horizons were observed.

Horizon I

This horizon extends up to 4.50m below G.L. It consists of Brownish stiff sandy silt. The SPT conducted at 3.00 m and 4.50m and gave N value 13 and 17 respectively.

Horizon II

This horizon starts at 4.50m and extends up to 12.00 m below G.L. It consists of Brownish very stiff and silt. The SPT conducted at 6.00m, 7.50m, 9.00m, 10.50m and 12.00m and gave N value 16, 23, 18, and 23 respectively.

Horizon III

This horizon starts at 13.50 m and extends up to 20.50 below G.L. It consists of yellowish completely weathered rock.

Horizon IV

This horizon starts at 20.50 m and extends up to 25.00 m below G.L. It consists of Grayish yellow slightly weathered basalt. Core recovery is in the range of 52.00% to 75.00% and RQD is in the range of 0.00% to 22.50%.

The Ground water table is found at 1.50m below G.L.

The borehole is terminated at 25.00m below G.L.

2.0 SUMMARY

2.1 Sub-Surface Profile:

The BH-1 was drilled at bridge no. 336 at Km 202/4-6 between BL-DGI stations on VR-ST section. The Sub surface profile reveals that brownish stiff sandy silt upto the depth of 4.50m below G.L. depth followed by brownish very stiff sandy silt upto the depth of 13.50m below G.L. Then Yellowish completely weathered rock is seen upto 20.50m below G.L. and grayish yellow slightly weathered basalt is seen upto termination depth.

The N value is in the range of 13 to 35. The grain size analysis shown Gravel 8.04%, Sand 33.83%, Silt 33.25% and Clay 24.87. The atterberg limits show L.L. 46.76% P.L. 26.65%. P.I. 20.11% and S.L. 18.76%. The specific gravity is 2.69, NMC 24.48% and Dry density 1.50 g/cc. The core recovery is in the range of 52% to 75% and RQD 0% to 22.50%.

2.2 Type of Foundation:

From the grain size analysis it is clear that Gravel 8.04%, Sand 33.83%, Silt 33.25% and Clay 24.87. The direct shear tests on UDS sample show $C = 0.22 \text{ kg/cm}^2$ and $\phi = 18.43$. Taking all these facts into consideration, the open foundation is not recommended for the proposed railway bridge. Alternatively it is recommended to adopt pile foundation for the proposed bridge.


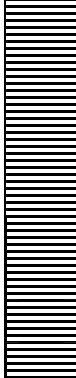
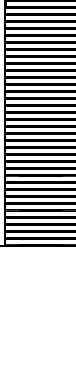


2.3 Depth of Foundation:

The sub soil exploration shows brownish stiff sandy silt is observed at the depth of 4.5m. It is then followed by brownish very stiff sandy silt upto depth of 13.5, then yellowish completely weathered rock upto the depth of 20.50m and grayish yellow slightly weathered rock is observed upto termination depth. Taking all the strata in account the pile foundation depth in the two borehole is given in the table below:

BH No.	Founding Strata	Pile Depth
1	Slightly weathered hard rock	20.50m

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
							Bridge No. 336							
CLIENT: As per Western Railway Record							Sheet No. 1 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 30.00 m							
					Location:- (As per sketch) Sachin		Date: 07.07.2005 to 13.07.2005							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0														
0.5														
1														
1.5	1.50	UDS 1												
2							Brownish stiff sandy							
2.5							Silt							
3	3.00	SPT 1	13											
3.5														
4														
4.5	4.50	SPT 2	17											
5														
5.5														
6	6.00	SPT 3	16											
6.5														
7														
7.5	7.50	SPT 4	23											
8														
8.5							Brownish very stiff sandy silt							
9		SPT 5	18											








PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
							Bridge No. 336							
CLIENT: As per Western Railway Record							Sheet No. 2 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 30.00 m							
					Location:- (As per sketch) Sachin		Date: 07.07.2005 to 13.07.2005							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
9.5														
10														
10.5		SPT 6	27											
11														
11.5														
12		SPT 17	23											
12.5														
13							Brownish very stiff							
13.5		SPT 8	35				Sandy silt							
14														
14.5														
15														
15.5														
16														
16.5														
17							Yellowish completely weathered rock							
17.5														
18														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1								
							Bridge No. 336								
CLIENT: As per Western Railway Record							Sheet No. 3 of 3								
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m								
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch) Sachin		T.D (m) :- 30.00 m								
							Date: 07.07.2005 to 13.07.2005								
							W.T.:								
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%	
	Depth (m)	Type													
18.5															
19															
19.5															
20															
20.5															
21															
21.5															
22															
22.5							Grayish yellow								22.5
23							Slightly weathered basalt								
23.5															
24															
24.5															
25															

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 336							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 4							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
W.T.:							Date: 07.07.2005 to 13.07.2005							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0														
0.5														
1														
1.5	1.50	UDS 1												
2							Brownish stiff sandy							
2.5							Silt							
3	3.00	SPT 1	13											
3.5														
4														
4.5	4.50	SPT 2	17											
5														
5.5														
6	6.00	SPT 3	16											
6.5														
7														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 336							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 2 of 4							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
							Date: 07.07.2005 to 13.07.2005							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
7.5	7.50	SPT 4	23											
8														
8.5							Brownish very stiff sandy silt							
9		SPT 5	18											
9.5														
10														
10.5		SPT 6	27											
11														
11.5														
12		SPT 17	23											
12.5														
13							Brownish very stiff							
13.5		SPT 8	35				Sandy silt							
14														
14.5														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 336							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 3 of 4							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
							Date: 07.07.2005 to 13.07.2005							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
15														
15.5														
16														
16.5														
17							Yellowish completely weathered rock							
17.5														
18														
18.5														
19														
19.5														
20														
20.5														
21														
21.5														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 336							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 4 of 4							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
W.T.:							Date: 07.07.2005 to 13.07.2005							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
22														
22.5							Grayish yellow Slightly weathered basalt							22.5
23														
23.5														
24														
24.5														
25														

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 339

**REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 339 AT KM 202/---**

1.0 PRESENTATION OF BORELOG

The subsurface exploration was done. The exploration consisted of drilling boreholes and conducting field tests. Field data of 1 borehole is presented below.

1.1 Bore Hole No: 1

The following three Horizons were observed.

Horizon I

This horizon extends up to 1.50 m below G.L. It consists of brownish sandy silt.

Horizon II

This Horizon consists of yellowish stiff sandy silt. It starts at 1.50 m below G.L. and extends up to 6.00 m below G.L. The standard penetration test conducted at 3.00m, 4.50 m and 6.00 show N values 13, 13 and 16 respectively.

Horizon III

This horizon consists of completely weathered rock. It starts from 6.00 m below G.L. and extends up to 9.00 m below G.L. The standard penetration test conducted at 7.50 m shows N value 38.

Horizon IV

This horizon consists of Brownish slightly basalt. It starts from 9.00 m below G.L. and extends up to 12.00 m below G.L. Core recovery is 56.70 and RQD is 53.33.

The Ground water table not struck.

The borehole is terminated at 12.00 m below G.L.

2.0 GEOLOGY AND TOPOGRAPHY

The general topography of the study area is; mostly flat to undulating. The site is under investigation, covered with overburden from 0.0 to 6.40 m. variable depth, overlain by Deccan trap Basalt formation which is found in the explanatory drill holes. The chronological order of geological formations in this area is as under:-

SAFE BEARING CAPACITY, COMPRESSIVE STRENGTH OF ROCK

Bore Hole No.	Depth from G.I. (m)	Safe Bearing Capacity t/m ²	Compressive strength (Saturated) Kg/cm ²	Remarks
1	3.0	18	-	Soil
	4.5	24	-	
	5.10-6.00	-	164	Rock
	6.00-8.00	-	385	
	8.00-11.50	-	430	

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 339							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
Date: 03.07.2005 to 06.07.2005							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0							Brownish Clay							
1														
1.5	1.50	UDS												
2														
3	3.00	SPT 1	23											
4							Yellowish very stiff clay							
4.5	4.50	SPT 2	25											
5														
5.5														
6	6.00	SPT3	25											
7														
7.5	7.50													
8														
8.5							Yellowish hard murum with rock pieces							
9														
10	10.00			24										
11	11.00			20										

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
							Bridge No. 339							
CLIENT: As per Western Railway Record							Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 30.00 m							
							Date: 03.07.2005 to 06.07.2005							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0							Brownish Clay							
0.5														
1														
1.5	1.50	UDS												
2														
2.5														
3	3.00	SPT 1	23											
3.5														
4							Yellowish very stiff clay							
4.5	4.50	SPT 2	25											
5														
5.5														
6	6.00	SPT3	25											
6.5														
7														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, ORIENTAL CONSULTING ENGINEERS							B. H. No. 1							
CLIENT: As per Western Railway Record							Bridge No. 339							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 2 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 30.00 m							
W.T.:							Date: 03.07.2005 to 06.07.2005							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
7.5	7.50													
8														
8.5							Yellowish hard murum with rock pieces							
9														
9.5														
10	10.00			24										
10.5														
11	11.00			20										

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 358

REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 358 AT KM 202/---

ENGINEERING PROPERTIES OF SOIL

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P _{IER 8}	BR. NO. 358	1.50	19	1.72	1.45	2.68	66	14	20	0	39	19	20	0.23	07°	15	0.85
		3.50	08	2.03	1.75	2.64	15	14	66	05	35	16	19	0.06	34°	16	0.51
		6.50	09	1.79	1.65	2.64	16	15	65	04	35	16	19	0.07	32°	18	0.60
		9.00	08	1.81	1.68	2.64	15	16	65	04	35	18	15	0.08	29°	19	0.57

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P _{IER 8}	BR. NO. 358	2.00	12	1.85	1.65	2.683	37	45	18	0	46	20	26	0.79	07°	16	0.62
		3.00	12	1.90	1.70	2.684	38	44	18	0	37	47	27	0.82	06°	17	0.58
		4.00	11	1.94	1.75	2.682	38	45	19	0	40	19	21	0.80	07°	17	0.53
		6.00	12	2.01	1.80	2.683	37	45	18	0	41	20	21	0.80	07°	18	0.49
		7.50	10	1.92	1.75	2.646	14	12	74	0	38	18	20	0.03	20°	19	0.51
		11.00	09	1.90	1.75	2.647	15	13	72	0	37	17	20	0.04	21°	20	0.512

SAFE BEARING CAPACITY AND COMPRESSIVE STRENGTH AT DIFFERENT DEPTH OF FOUNDATION

Bore Hole No.	Depth from G.I. (m)	Safe Bearing Capacity t/m ²	Compressive strength (Saturated) Kg/cm ²	Remarks
P _{IER 4}	3.0	19	-	Soil
	4.5	26	-	
	6.00	42	-	
	6.00-8.00	-	385	Rock
	8.00-11.50	-	430	

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-4							
							Bridge No. 358							
CLIENT: Western Railway Records							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 11.75 m							
					Location:- (As per sketch) Sachin		Date:							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-5.00													
5	5.00-6.00						Clayey sand							
6	6.00-7.00													
7	7.00-8.00													
8	8.00-8.70													
9	8.70-9.00						Rock							
10	9.00-10.00													
11	10.00-11.00													
12	11.00-11.75													

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-4							
CLIENT: Western Railway Records							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 11.75 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							Date:							
Location:- (As per sketch) Sachin							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-5.00													
5	5.00-6.00						Clayey sand							
6	6.00-7.00													
7	7.00-8.00													
8	8.00-8.70													
9	8.70-9.00						Rock							
10	9.00-10.00													
11	10.00-11.00													
12	11.00-11.75													

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-8							
CLIENT: Western Railway Records							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 11.75 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							Date:							
Location:- (As per sketch) Sachin							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-4.50													
5	4.50-5.00						Clayey sand							
6	5.00-6.00													
7	6.00-7.00													
8	7.00-7.50													
9	7.50-8.00						Rock							
10	8.00-9.00													
11	9.00-10.00													
12	10.00-11.00													
	11.00-11.75													

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 359

REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 359 AT KM -----

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P _{IER 5}	BR. NO. 359	2.00	19	2.01	1.689	2.684	28	52	18	02	45	19	26	0.75	07°	16	0.59
		2.50	19	2.00	1.686	2.685	27	51	18	04	39	19	20	0.72	08°	18	0.59
		4.00	09	1.80	1.656	2.649	15	12	71	02	34	18	16	0.07	34°	19	0.60

179

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P _{IER 10}	BR. NO. 359	2.00	22	1.708	1.40	2.672	50	20	30	-	40	22	18	0.45	06°	25	0.91
		4.00	25	1.82	1.45	2.671	55	15	30	-	45	25	20	0.48	08°	28	0.81

**SAFE BEARING CAPACITY, COMPRESSIVE STRENGTH OF ROCK
AT DIFFERENT DEPTHS**

Bore Hole No.	Depth from G.I. (m)	Safe Bearing Capacity t/m²	Compressive strength (Saturated) Kg/cm²	Remarks
P _{IER 4}	3.0	21	-	Soil
	4.5	29	-	
	6.00	41	-	
	6.00-8.00	-	383	Rock
	8.00-11.50	-	431	

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-5							
							Bridge No. 359							
CLIENT: Western Railway Records							Sheet No. 1 of 1							
							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 11.25 m							
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch) Sachin		Date:							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-5.00													
5	5.00-6.00													
6	6.00-7.00						Clayey sand							
7	7.00-8.00													
8	8.00-9.00													
9	9.00-10.00						Rock							
10	10.00-11.00													
11	11.00-11.25													
12														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-5							
CLIENT: Western Railway Records							Bridge No. 359							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 11.25 m							
							Date:							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-5.00													
5	5.00-6.00													
6	6.00-7.00						Clayey sand							
7	7.00-8.00													
8	8.00-9.00													
9	9.00-10.00						Rock							
10	10.00-11.00													
11	11.00-11.25													
12														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. PIER-10							
CLIENT: Western Railway Records							Bridge No. 359							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 1							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 11.25 m							
							Date:							
							W.T.:							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00						Clay							
1	1.00-2.00													
2	2.00-3.00													
3	3.00-4.00													
4	4.00-5.00													
5	5.00-6.00						Clayey sand							
6	6.00-7.00													
7	7.00-8.00													
8	8.00-9.00						Rock							
9	9.00-10.00													
10	10.00-11.00													
11	11.00-11.25													
12														

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 368

AMBICA (BRIDGE NO. 368)

Topographically site is well defined gorge with high banks . The river gorge is slightly meandering in nature.

1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Two bore holes has been planned for this site . In all total 11 nos. undisturbed and 13 nos. disturbed soil samples excluding S.P.T. samples have been collected from 2 nos. bore holes . The details are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	30.80 m	2.10 m	5	7	5
2.	2	33.25 m	2.10 m	6	9	8

1.1. GROUND WATER :

The water samples were collected from the site .

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

This test was carried out using a Terzaghi spoon sampler driven by a 63.50 k.g. Hammer weight falling freely through a height 750 m.m. A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	1.50 --- 2.10	03-06-06-08	12 Marine Clay
	2	2.55 --- 3.00	02-04-04	08 Soft to Medium Clay
	3	4.45 --- 4.90	02-02-03	05 Soft to Medium Clay
	4	7.50 --- 8.10	08-10-11-13	21 Blackish stiff silty clays
	5	10.50 --- 11.10	12-14-14-16	28 Blackish Silty Clays
	6	13.50 --- 14.10	19-21-22-24	43 Blackish Silty Clays
	7	22.00 --- 22.10	21-32 (10 cm)	R Refusal
2.	1	1.50 --- 2.10	03-04-06-08	10 Medium Marine Clay
	2	2.55 --- 3.00	06-08-10	18 Stiff Clay
	3	4.45 --- 4.90	07-08-08	16 Stiff Clay
	4	7.50 --- 8.10	09-10-10-12	20 Very Stiff Clay
	5	10.50 --- 11.10	11-12-14-15	26 Brownish Silty Clay
	6	13.50 --- 14.10	14-16-18-17	34 Hard Stiff Clay
	7	16.50 --- 17.10	16-17-19-20	36 Sandy Silty Clay
	8	19.50 --- 20.10	18-19-21-22	40 Sandy Silty Clay
	9	22.00 --- 22.10	22-31 (10 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

D) RESIDUAL SOIL FORMATION: (Average thickness 0.00 m to 18.10 m)

The overburden essentially is Blackish soft ,Stiff ,very stiff and hard consistency Silty Clays . Soils are Marine Clays of high plasticity and in lower part Silty sands are predominant as the depth increases. Both bore hole shows Blackish Gray Marine Clay up to 12.0 m depth . In lower portion Silty Sands are prominent. Gravel contents are on increase in lower section of the bore . S.P.T. values in the 10 m zone are comparatively are below 30 . Beyond 10 m S.P.T. values increase upto refusal at rock surface interface . In bore hole no.14 value of S.P.T. is 43 at weathered rock interface. In bore hole no.2 , refusal S.P.T. is observed at 22 m depth.

II) COMPLETELY / HIGHLY / MODERATELY WEATHERED BASALT ROCKS : (Average thickness 18.10 m to 32.00 m)

Completely / Highly / Moderately weathered basalt rocks have been observed in lower stratum of exploration studies . Rock interface is at different levels in both the bore holes. A level difference of 8 m has been observed. Rocks are quite hard and tough . Rocks also have good crushing strengths . Completely to highly weathered rocks have been observed . Generally both the bores display a core recovery of 17 % to 83 % and R.Q.D. value of 12 % to 53 % .

2.0 LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 and 1.4 .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.5	11	
2.	Grain Size Analysis	1.6	11	
3.	Specific Gravity, Liquid , Plastic	1.7	11	
4.	Triaxial Shear Test (UU)	1.8	11	
5.	Direct Shear Test	1.9	6	
6.	Chemical test on soil sample	1.10	1	

TABLE NO. 1.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	1.11	8	
2.	Density & Specific Gravity	1.12	6	
	Water Absorption and Porosity	1.12	6	
3.	Point Load Strength	1.13	6	

The laboratory tests results have been presented in following pages .

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.5**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	2.10 – 2.55	UDS1	1.70	19.86
2.	1	3.00 – 3.45	UDS2	1.74	22.36
3.	1	4.00 – 4.45	UDS3	1.79	21.40
4.	1	4.90 – 5.35	UDS4	1.73	19.20
5.	1	8.10 – 8.55	UDS5	1.81	17.40
6.	2	2.10 – 2.55	UDS1	1.69	22.30
7.	2	3.00 – 3.45	UDS2	1.72	23.30
8.	2	4.00 – 4.45	UDS3	1.78	19.06
9.	2	4.90 – 5.35	UDS4	1.80	18.67
10.	2	8.10 – 8.55	UDS5	1.91	17.30
11.	2	16.00 – 16.45	UDS6	1.95	16.35

**TABLE NO. 1.6
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	2.10 – 2.55	UDS1	0.50	3.87	95.63	
2.	1	3.00 – 3.45	UDS2	2.76	8.39	88.85	
3.	1	4.00 – 4.45	UDS3	1.86	11.76	86.38	
4.	1	4.90 – 5.35	UDS4	5.56	17.56	76.88	
5.	1	8.10 – 8.55	UDS5	8.35	21.60	70.05	
6.	2	2.10 – 2.55	UDS1	4.00	9.76	86.24	
7.	2	3.00 – 3.45	UDS2	2.78	11.77	85.45	
8.	2	4.00 – 4.45	UDS3	6.45	23.50	70.05	
9.	2	4.90 – 5.35	UDS4	8.76	15.50	75.74	
10.	2	8.10 – 8.55	UDS5	9.80	21.85	68.35	
11.	2	16.00 – 16.45	UDS6	6.80	57.90	35.30	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.7**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	2.10 – 2.55	UDS1	2.70	78.70	37.60	41.10
2.	1	3.00 – 3.45	UDS2	2.65	74.60	38.40	36.20
3.	1	4.00 – 4.45	UDS3	2.62	73.56	37.00	36.56
4.	1	4.90 – 5.35	UDS4	2.66	69.50	33.60	35.90
5.	1	8.10 – 8.55	UDS5	2.69	71.30	34.00	37.30
6.	2	2.10 – 2.55	UDS1	2.64	76.40	36.00	40.40
7.	2	3.00 – 3.45	UDS2	2.68	73.40	35.10	38.30
8.	2	4.00 – 4.45	UDS3	2.70	65.70	32.00	33.70
9.	2	4.90 – 5.35	UDS4	2.63	71.52	34.00	37.52
10.	2	8.10 – 8.55	UDS5	2.70	68.40	32.70	35.70
11.	2	16.00 – 16.45	UDS6	2.72	39.00	19.00	20.00

**TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	2.10 – 2.55	UDS1	0.298	8.90
2.	1	3.00 – 3.45	UDS2	0.381	12.56
3.	1	4.00 – 4.45	UDS3	0.368	14.87
4.	1	4.90 – 5.35	UDS4	0.427	16.69
5.	1	8.10 – 8.55	UDS5	0.508	18.56
6.	2	2.10 – 2.55	UDS1	0.278	9.80
7.	2	3.00 – 3.45	UDS2	0.404	11.52
8.	2	4.00 – 4.45	UDS3	0.388	13.67
9.	2	4.90 – 5.35	UDS4	0.469	16.45
10.	2	8.10 – 8.55	UDS5	0.357	20.40
11.	2	16.00 – 16.45	UDS6	0.216	32.30

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.9**

UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction "φ ⁰ "
1.	1	2.10 – 2.55	UDS1	0.352	7.65
2.	1	3.00 – 3.45	UDS2	0.456	13.65
3.	1	4.00 – 4.45	UDS3	0.492	13.84
4.	2	2.10 – 2.55	UDS1	0.316	11.53
5.	2	3.00 – 3.45	UDS2	0.478	12.80
6.	2	4.00 – 4.45	UDS3	0.463	14.34

**TABLE NO. 1.10
CHEMICAL ANALYSIS
OF
SOIL SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	2	4.00	8.35	Traces	0.089

**LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.11
UNCONFINED COMPRESSION STRENGTH**

Sr. No.	Bore hole No.	Depth, m	Unconfined Compression Strength kg/cm ²	Saturated Unconfined Compression Strength kg/cm ²
1.	1	14.10 m – 16.00 m	185.50	---
2.	1	16.00 m – 18.00 m	423.60	387.50
3.	1	18.00 m – 20.00 m	476.50	415.60
4.	1	20.00 m – 22.00 m	387.80	341.70
5.	2	22.10 m – 24.50 m	247.50	---
6.	2	24.50 m---26.00 m	439.60	376.80
7.	2	26.00 m---28.00 m	532.40	432.40
8.	2	28.00 m---30.80 m	505.30	478.50

TABLE No. 1.12
UNIT WEIGHT AND WATER ABSORPTION

Sr. No.	Bore hole No.	Depth	Density Gm/cm ³	Specific Gravity	Water Absorption, %	Porosity %
1.	1	16.00 m – 18.00 m	2.780	2.74	3.653	4.82
2.	1	18.00 m – 20.00 m	2.840	2.73	2.750	5.35
3.	1	20.00 m – 22.00 m	2.880	2.75	3.320	4.58
4.	2	22.10 m – 24.50 m	2.720	2.70	4.158	5.29
5.	2	24.50 m---26.00 m	2.890	2.77	2.435	3.850
6.	2	26.00 m---28.00 m	2.856	2.73	2.950	3.72

LABORATORY TESTS
ON
ROCK SAMPLES
POINT LOAD STRENGTH TEST
TABLE NO. 1.13

Sr. No.	Bore hole No.	Depth, m	Point Load Strength kg/cm ²
1.	1	16.00 m – 18.00 m	17.80
2.	1	18.00 m – 20.00 m	19.70
3.	1	20.00 m – 22.00 m	17.50
4.	2	24.50 m---26.00 m	19.50
5.	2	26.00 m---28.00 m	21.30
6.	2	28.00 m---30.80 m	22.40

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 368

Sheet No. 1 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.80 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 5/6/08 to 7/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mumbai end Abutment

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.50	DS1				-----	Brownish soft to Stiff Silty Clays .							
1						-----								
	1.50-2.10	SPT1	12			-----	Blackish Gray Marine Clays .							
2	2.10--2.55	UDS1		GWL @ 2.10 m		-----								
	2.55--3.00	SPT2	8			-----	Very soft to medium consistency Clays.							
3	3.00--3.45	UDS2				-----								
	3.45--4.00	DS2				-----								
4	4.00--4.45	UDS3				-----								
	4.45--4.90	SPT3	5			-----								
5	4.90--5.35	UDS4			13.5	-----								
	5.35--7.50	DS3				-----								
6						-----								

7						-----								
	7.50-8.10	SPT4	21			-----	Blackish coloured silty sand							
8	8.10-8.55	UDS5				-----								

9	8.55--10.50					-----								

10						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 368

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.80 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

Date: 5/6/08 to 7/6/08

Ambika

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.50-11.10	SPT5	28			-----	Blackish coloured silty sand mixed with gravels							
12	11.10-13.50				13.50	-----								
13						-----								
14	13.50-13.55	SPT6	43				Completely weathered rock formation							
15	14.10-16.00	CORE					Completely weathered breccia rock formation						17.0	0.0
16														
17	16.00-18.00	CORE			16.8								23.0	0.0
18														
19	18.00-20.00	CORE											####	0.0
20														

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 368

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :-30.80 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

Date: 5/6/08 to 7/6/08

Ambika

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	20.10-22.00					\\	Highly weathered breccia rock formation						63.0	21.0
22	22.00--22.10	SPT7	R			\\								
23	22.10--24.50	CORE			16.80	\\							65.0	15.0
24						\\								
25	24.50-26.00	CORE				\\							73.0	17.0
26						\\								
27	26.00-27.75	CORE				\\							71.0	12.0
28	27.75-29.25	CORE				\\	Moderately weathered basalt rock formation						70.0	32.0
29						\\								
30	29.25-30.80	CORE				\\							83.0	23.0
	30.80--					\\								

Bore hole terminated at 30.80 m

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 368

Sheet No. 1 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 33.25 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Abutment at surat end

Date: 5/6/08 to 18/6/08

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.50	DS1				-----	Brownish soft to Stiff Silty Clays .							
1						-----								
	1.50-2.10	SPT1	12			-----	Blackish Gray Marine Clays .							
2	2.10--2.55	UDS1		GWL @ 2.10 m		-----								
	2.55--3.00	SPT2	8			-----	Very soft to medium consistency Clays.							
3	3.00--3.45	UDS2				-----								
	3.45--4.00	DS2				-----								
4	4.00--4.45	UDS3			24.5	-----								
	4.45--4.90	SPT3	5			-----								
5	4.90--5.35	UDS4				-----								
	5.35--7.50	DS3				-----								
6						-----								

7						-----								
	7.50-8.10	SPT4	6			-----	Very soft to medium consistency Clays.							
8	8.10-8.55	UDS5				-----								

9	8.55--10.50					-----								

10						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 368

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 33.25m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Abutment at surat end

Date: 5/6/08 to 18/6/08

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.50-11.10	SPT5	9			-----	Brownish blackish Silty Clays .							
12	11.10-13.50					-----	Soft Consistency Clays .							
13						-----								
14	13.50-14.10 14.10-16.00	SPT6	10			-----	Medium stiff Cinsistency Clays .							
15					24.5	-----								
16	16.00--16.45	UDS6				-----								
17	16.50-17.10 17.10-19.50	SPT7	11			-----	Sandy Sllty Clays of stiff consistency.							
18						-----								
19						-----								
20	19.50-20.10	SPT8	10			-----	Sandy Sllty Clays of Stiff consistency.							
	20.10-22.00					-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 368

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :-33.25 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Abutment at surat end

Date: 5/6/08 to 18/6/08

W.T.: 2.10 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR%	ROD%	
	Depth (m)	Type													
21	20.10-22.00		R			-----	Brownish Stiff to very stiff Silty Clays .								
22	22.00--22.10	SPT9					-----								
23	22.10--24.50	CORE					-----								
24							-----								
25	24.50-26.00	CORE					\\ \\	Completely weathered rock formation						17.0	0.0
26	26.00-27.75	CORE					\\ \\	Completely weathered Amagdaloidal basalt rock formation						23.0	0.0
27	27.75-29.25	CORE				8.25	\\ \\							47.0	0.0
28	29.25-30.80	CORE					\\ \\	Hihgly weathered basalt rock formation						63.0	15.0
30	30.80--33.25 33.25--	CORE					\\ \\							71.0	22.0

Bore hole terminated at 33.25 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 369

VANGARI (BRIDGE NO. 369)

Topographically site is well defined gorge with high banks . The river gorge is fairly straight and uniform in pattern .

1. EXPLORATION CHARACTERISTICS :

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only one no. bore hole has been planned for this site . In all total 3 nos. undisturbed and 5 nos. disturbed soil samples excluding S.P.T. samples have been collected from this bore hole . The details are presented in Table no. 1.1.

**TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES**

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	16.00 m	3.00 m	3	3	5

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

This test was carried out using a Terzaghi spoon sampler driven by a 63.50 k.g. Hammer weight falling freely through a height 750 m.m. A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

**TABLE 1.2
STANDARD PENETRATION TEST RESULTS**

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	1.35 --- 1.95	05-06-06	12 Silty Clays
	2	5.00 --- 5.60	10-11-12-14	23 Soft to Medium Clay
	3	8.00 --- 8.30	23-44 (10 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

I) RESIDUAL SOIL FORMATION: (0.00 m to 8.30 m)

The overburden essentially is Brownish soft to Stiff Silty Clays followed by dense Silty Sands . Soils are of medium plasticity . In lower part Silty sands are predominant as the depth increases Gravel contents are on increase . S.P.T. value at 5.0 m depth is 23 . S.P.T. at 8.00 m depth is refusal .

II) COMPLETELY/HIGHLY/MODERATELY WEATHERED BASALT ROCKS : (8.30 m to 16.00 m)

Completely / Highly / Moderately weathered basalt rocks have been observed in lower stratum of exploration studies . Rocks are quite hard , tough and compact. Rocks also have good crushing strengths . Completely to highly weathered rocks have been observed . Bore display a core recovery of 27 % to 85 % and R.Q.D. value of 17 % to 64 % .

2.0 LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 and 1.4 .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.5	3	
2.	Grain Size Analysis	1.6	3	
3.	Specific Gravity, Liquid , Plastic	1.7	3	
4.	Triaxial Shear Test (UU)	1.8	3	
5.	Direct Shear Test	1.9	2	
6.	Chemical test on soil sample	1.10	1	

TABLE NO. 1.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	1.11	4	
2.	Density & Specific Gravity	1.12	4	
	Water Absorption and Porosity	1.12	4	
3.	Point Load Strength	1.13	3	

The laboratory tests results have been presented in following pages .

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.5

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	0.90 – 1.35	UDS1	1.68	23.06
2.	1	4.00 – 4.45	UDS2	1.75	19.10
3.	1	7.00 – 7.45	UDS3	1.82	17.85

TABLE NO. 1.6
PARTICLE SIZE DISTRIBUTION

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	0.90 – 1.35	UDS1	1.50	8.17	90.33	
2.	1	4.00 – 4.45	UDS2	4.70	58.40	36.90	
3.	1	7.00 – 7.45	UDS3	8.90	64.30	26.80	

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.7**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	0.90 – 1.35	UDS1	2.61	57.70	27.50	30.20
2.	1	4.00 – 4.45	UDS2	2.67	39.80	19.40	20.40
3.	1	7.00 – 7.45	UDS3	2.71	----	N.P.	----

**TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	0.90 – 1.35	UDS1	0.348	8.92
2.	1	4.00 – 4.45	UDS2	0.238	24.50
3.	1	7.00 – 7.45	UDS3	0.189	27.51

**TABLE NO. 1.9
UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	0.90 —1.35	UDS1	0.378	7.85
2.	1	4.00—4.45	UDS2	0.306	25.20

**TABLE NO. 1.10
CHEMICAL ANALYSIS
OF
SOIL SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	4.00	8.20	Traces	0.062

**LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.11
UNCONFINED COMPRESSION STRENGTH**

Sr. No.	Bore hole No.	Depth, m	Unconfined Compression Strength kg/cm ²	Saturated Unconfined Compression Strength kg/cm ²
1.	1	9.50 m – 11.50 m	255.50	---
2.	1	11.50 m – 13.00 m	389.45	320.90
3.	1	13.00 m – 14.50 m	512.40	457.26
4.	1	14.50 m – 15.50 m	480.38	413.75

**TABLE No. 1.12
UNIT WEIGHT AND WATER ABSORPTION**

Sr. No.	Bore hole No.	Depth	Density Gm/cm ³	Specific Gravity	Water Absorption, %	Porosity %
1.	1	9.50 m – 11.50 m	2.710	2.72	3.953	5.12
2.	1	11.50 m – 13.00 m	2.780	2.74	2.370	4.23
3.	1	13.00 m – 14.50 m	2.890	2.76	1.890	3.80
4.	1	14.50 m – 15.50 m	2.950	2.73	1.6579	3.19

**POINT LOAD STRENGTH TEST
TABLE NO. 1.13**

Sr. No.	Bore hole No.	Depth, m	Point Load Strength kg/cm ²
1.	1	11.50 m – 13.00 m	15.50
2.	1	13.00 m – 14.50 m	21.65
3.	1	14.50 m – 15.50 m	20.86

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 369

Sheet No. 1 of 2

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 16.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 15/6/08 to 21/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

W.T.: 3.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%		
	Depth (m)	Type														
0	0.00-0.45	DS1	12	GWL @ 3.00 m		----	Brownish Silty Clay.									
	0.45-0.90							----								
1	0.90-1.35	UDS1						----								
	1.35-1.95	SPT1						----								
2						----										
	1.95-4.00					----										
3						----										
	4.00-4.45	UDS2				----	Brownish colour Gravelly sand formation .									
	4.45-5.00					----										
5						----										
	5.00-5.60	SPT2	14			----										
	5.60-7.00					----										
7	7.00-7.45	UDS3				----										
	7.45-8.00					----										
8	8.00-8.30	SPT3	R			----										
	8.30-9.50	CORE				\\ \\	Completely weathered rock .						15.0	Nil		
9						\\ \\										
						\\ \\										
	9.50-11.50	CORE				\\ \\							33.0	Nil		
10						\\ \\										
						\\ \\										

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 369

Sheet No. 2 of 2

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 16.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

Date: 15/6/08 to 21/6/08

W.T.: 3.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%										
	Depth (m)	Type																						
11	9.50-11.50	CORE				\\ \\	Completely weathered rock .						33.0	Nil										
	12	11.50-13.00	CORE			\\ \\																		
						\\ \\																		
						\\ \\																		
13	13.00-14.50	CORE				\\ \\							33.0	Nil										
						14									14.50-15.50	CORE			\\ \\					
																			15	15.50-16.00	CORE			\\ \\
																								16

Bore hole terminated at 16.00 m

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 400

**REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 400 AT KM 238/5-11**

ENGINEERING PROPERTIES OF SOIL IN DIFFERENT HORIZONS

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₂	BR. NO. 400	1.50	19	1.72	1.45	2.68	66	14	20	0	39	19	20	0.23	07°	15	0.85
		3.50	08	2.03	1.75	2.64	15	14	66	05	35	16	19	0.06	34°	16	0.51
		6.50	09	1.79	1.65	2.64	16	15	65	04	35	16	19	0.07	32°	18	0.60
		9.00	08	1.81	1.68	2.64	15	16	65	04	35	18	15	0.08	29°	19	0.57
		12.00	18	1.91	1.62	2.64	16	14	66	04	35	18	15	0.08	30°	20	0.63
		15.00	20	1.73	1.44	2.68	50	14	18	18	42	20	22	0.88	08°	12	0.86
		16.00	20	1.75	1.46	2.68	52	15	17	16	40	20	20	0.92	07°	14	0.81
		18.00	20	1.77	1.48	2.68	50	12	17	21	41	20	21	0.91	07°	17	0.81
		19.00	21	1.83	1.51	2.68	54	11	18	17	45	21	24	0.92	07°	14	0.77
		21.00	21	1.84	1.52	2.68	57	12	16	15	44	21	23	0.90	08°	15	0.76
		22.50	21	1.84	1.52	2.68	53	10	18	19	46	21	25	0.89	08°	16	0.751
		27.00	15	1.75	1.52	2.661	08	07	30	55	40	15	25	0.08	33°	15	0.76
		30.00	14	1.85	1.62	2.67	05	05	30	60	40	14	26	0.07	34°	16	0.65
		33.00	18	1.981	1.679	2.692	14	10	54	22	36	18	18	0.07	36°	16	0.59
		37.00	19	1.974	1.659	2.694	15	15	62	08	38	19	19	0.05	38°	18	0.60
40.00	19	1.93	1.62	2.692	15	10	55	20	36	19	17	0.11	35°	17	0.63		
43.50	19	1.937	1.628	2.686	14	10	55	21	35	19	16	0.11	34°	19	0.63		

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₃	BR. NO. 400	2.00	19	2.01	1.689	2.684	28	52	18	02	45	19	26	0.75	07°	16	0.59
		2.50	19	2.00	1.686	2.685	27	51	18	04	39	19	20	0.72	08°	18	0.59
		4.00	09	1.80	1.656	2.649	15	12	71	02	34	18	16	0.07	34°	19	0.60
		7.00	09	1.80	1.654	2.65	15	13	69	03	35	19	16	0.09	30°	15	0.65
		10.50	10	1.86	1.692	2.65	14	15	69	02	36	20	16	0.08	32°	16	0.61
		13.00	08	1.83	1.697	2.65	15	14	69	02	35	19	16	0.09	30°	17	0.57
		14.50	19	1.69	1.42	2.689	53	11	16	20	40	19	21	0.92	08°	14	0.89
		16.00	19	1.71	1.44	2.689	51	09	17	23	39	19	20	0.93	08°	18	0.86
		17.50	19	1.78	1.50	2.682	51	10	17	22	40	19	21	0.93	08°	19	0.79
		18.50	20	1.82	1.52	2.645	51	12	16	21	45	20	25	0.97	07°	12	0.74
		20.50	20	1.83	1.53	2.695	54	11	16	19	44	20	24	0.97	07°	15	0.76
		21.50	19	1.83	1.54	2.685	57	10	18	15	40	19	21	0.92	07°	15	0.74
		23.50	10	1.67	1.52	2.663	08	07	30	55	38	18	20	0.08	34°	15	0.752
		26.50	09	1.76	1.62	2.668	05	05	30	60	40	20	20	0.06	35°	16	0.65
		30.00	09	1.79	1.654	2.645	15	11	56	18	35	18	17	0.05	38°	16	0.60
		33.50	10	1.78	1.62	2.648	15	12	55	18	36	17	19	0.06	37°	17	0.57
		36.00	08	1.90	1.756	2.649	14	13	65	08	36	19	17	0.07	35°	19	0.51
39.00	08	1.82	1.692	2.647	15	11	54	20	35	19	17	0.06	38°	13	0.57		
42.00	09	1.80	1.654	2.644	15	12	58	15	36	18	18	0.06	37°	12	0.60		
44.50	09	1.75	1.607	2.642	14	14	55	17	35	19	17	0.05	39°	18	0.65		

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₅	BR. NO. 400	2.00	12	1.85	1.65	2.683	37	45	18	0	46	20	26	0.79	07°	16	0.62
		3.00	12	1.90	1.70	2.684	38	44	18	0	37	47	27	0.82	06°	17	0.58
		4.00	11	1.94	1.75	2.682	38	45	19	0	40	19	21	0.80	07°	17	0.53
		6.00	12	2.01	1.80	2.683	37	45	18	0	41	20	21	0.80	07°	18	0.49
		7.50	10	1.92	1.75	2.646	14	12	74	0	38	18	20	0.03	20°	19	0.51
		11.00	09	1.90	1.75	2.647	15	13	72	0	37	17	20	0.04	21°	20	0.512
		14.00	19	1.725	1.45	2.680	69	08	23	0	46	19	27	0.96	07°	21	0.85
		15.00	20	1.74	1.45	2.680	68	09	23	0	48	20	28	0.97	07°	22	0.83
		16.50	20	1.80	1.50	2.680	68	10	22	0	40	20	20	0.97	06°	22	0.79
		19.00	19	2.08	1.75	2.677	66	09	25	0	40	20	20	0.90	07°	20	0.53
		22.00	12	1.66	1.48	2.672	08	07	35	50	38	16	16	0.07	32°	15	0.80
		25.00	14	1.71	1.50	2.662	08	07	35	50	38	16	16	0.06	33°	14	0.774
		28.00	10	1.69	1.54	2.668	09	06	30	55	40	77	23	0.07	37°	12	0.73
		36.50	10	1.92	1.75	2.643	15	10	68	07	30	18	12	0.08	32°	10	0.51
		39.50	09	1.90	1.75	2.644	15	12	67	06	31	17	14	0.07	32°	11	0.51
41.50	10	2.05	1.86	2.648	14	10	65	21	33	16	17	0.05	38°	13	0.42		
44.50	10	1.82	1.655	2.649	15	10	53	22	34	17	17	0.06	38°	14	0.43		

SWAYIN & ASSOCIATES

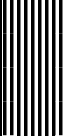
PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat . CLIENT: As per Western Railway Records	B. H. No.P2
	Bridge No. 400
	Sheet No. 1 of 3
	(BGL) R. L. :- 0.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	T.D (m) :- 45.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	Date: 30/03/08 to 10/04/08
	W.T.: 0.00 m
	Location:- (As per sketch) Sachin

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%	
	Depth (m)	Type													
0	0 - 1.0	DS					Clayey soil								
1	1 - 1.5	UDS					Clayey soil								
2	1.5 - 2 2 - 2.15	DS					Clayey soil Sand								
3	2.15 - 3	SPT	13				Sand								
4	3.0 - 4.0	DS					Sand								
5	4.0 - 5.0	DS					Sand								
6	5.0 - 6.0	SPT	16				Sand								
7	6.0 - 7.5	DS													
8	7.5 - 8.0	DS					Sand								
9	8.0 - 9.0	SPT	18				Sand								
10	10.0 - 10.5	DS					Sand								
11	10.5 - 11.0	UDS					Sand								
12	11.0 - 12.00	DS					Sand								
13	12.0 - 13.5 13.5 - 13.8	DS DS					Sand Sand								
14	13.8 - 14.0	DS					Stiff clay with pebbles								
15	14.0 - 15.0	SPT	33				Stiff clay with pebbles								
16	15.0 - 16.0	UDS					Stiff clay with pebbles								
17	16.0 - 17.0	DS					Stiff clay with pebbles								

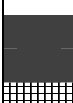


















SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P2							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 2 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
18	17.0 - 18.0	SPT	39				Stiff clay with pebbles							
19	18.0 - 19.0	UDS					Stiff clay with pebbles							
20	19.0 - 20.0	DS					Stiff clay with pebbles							
21	20.0 - 21.0	SPT	43				Stiff clay with pebbles							
22	21.0 - 22.0	UDS					Stiff clay with pebbles							
23	22.0 - 23.0	DS					Stiff clay with pebbles							
24	23.0 - 24.0	SPT	46				Boulders with sand							
25	24.0 - 25.0	DS					Boulders with sand							
26	25.0 - 26.0	DS					Boulders with sand							
27	26.0 - 27.0	SPT	52				Boulders with sand							
28	27.0 - 28.5	DS					Boulders with sand							
29	28.5 - 29.0						Boulders with sand							
30	29.0 - 30.0	SPT	55				Boulders with sand							
31	30.0 - 31.10	DS					Boulders with sand							
32	31.10 - 32.0	DS					Boulders with sand							
33	32.0 - 33.0	SPT	57				Fine sand with pebbles							
34	33.0 - 34.0	DS					Fine sand with pebbles							
35	34.0 - 35.0	DS					Fine sand with pebbles							
36	35.0 - 36.0	DS					Coarse sand							




















SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P2							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 3 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
37	36.0 - 37.0	SPT	62				Coarse sand							
38	37.0 - 38.0	DS					Coarse sand							
39	38.0 - 39.12	DS					Fine sand with gravels							
40	39.12 - 40.0	SPT	65				Fine sand with gravels							
41	40.0 - 41.0	DS					Fine sand with gravels							
42	41.0 - 42.5	DS					Fine sand with gravels							
43	42.5 - 43.5	SPT	71				Fine sand with gravels							
44	43.5 - 44.0	DS												

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P3							
							Bridge No. 400							
CLIENT: As per Western Railway Records							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 45.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch) Sachin		Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0 – 0.70	DS					Water							
1	0.70 - 1.50	DS					Black cotton soil							
	1.50 - 1.55	UDS					Black cotton soil							
2	1.55 - 2.5	SPT	1				Silty clay							
3	2.5 - 3.10	DS					Fine sand							
4	3.10 - 4.0	SPT	7				Fine sand							
5	4.0 - 5.0	DS					Fine sand							
6	5.0 - 6.0	DS					Fine sand							
7	6.0 - 7.0	SPT	10				Fine sand							
8	7.0 - 8.0	DS					Fine sand							
9	8.0 - 9.0	DS					Fine sand							
10	9.0 - 10.0	SPT	12				Fine sand							
11	10.0 - 11.5	DS					Fine sand							
12	11.50 - 12.0	DS					Fine sand							
13	12.0 - 13.0	SPT	15				Fine sand							
	13.0 - 13.5	DS			Fine sand									
	13.5 - 13.57	DS			Fine sand									
14	13.57 - 14.5	SPT	25				Stiff clay with pebbles							
15	14.5 - 15.0	DS					Stiff clay with pebbles							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P3							
							Bridge No. 400							
CLIENT: As per Western Railway Records							(BGL) R. L. :- 0.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm							T.D (m) :- 45.00 m							
Casing diameter (mm) : i) 100mm and ii) 76mm					Location:- (As per sketch) Sachin		Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0 – 0.70	DS					Water							
1	0.70 - 1.50	DS					Black cotton soil							
	1.50 - 1.55	UDS					Black cotton soil							
2	1.55 - 2.5	SPT	1				Silty clay							
3	2.5 - 3.10	DS					Fine sand							
4	3.10 - 4.0	SPT	7				Fine sand							
5	4.0 - 5.0	DS					Fine sand							
6	5.0 - 6.0	DS					Fine sand							
7	6.0 - 7.0	SPT	10				Fine sand							
8	7.0 - 8.0	DS					Fine sand							
9	8.0 - 9.0	DS					Fine sand							
10	9.0 - 10.0	SPT	12				Fine sand							
11	10.0 - 11.5	DS					Fine sand							
12	11.50 - 12.0	DS					Fine sand							
13	12.0 - 13.0	SPT	15				Fine sand							
	13.0 - 13.5	DS			Fine sand									
	13.5 - 13.57	DS			Fine sand									
14	13.57 - 14.5	SPT	25				Stiff clay with pebbles							
15	14.5 - 15.0	DS					Stiff clay with pebbles							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No.P5

Bridge No. 400

Sheet No. 1 of 3

CLIENT: As per Western Railway Records

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm








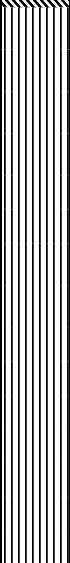
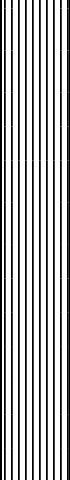
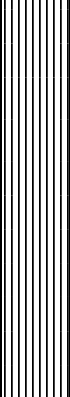
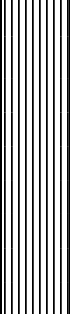

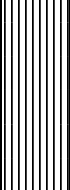
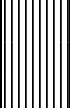




T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

Date: 30/03/08 to 10/04/08

W.T.: 0.00 m

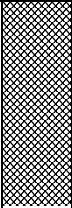










Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
1	0 - 1.0	UDS					Black colour silty clay							
2	1.0 -2.0	SPT	2				Black colour silty clay							
3	2.0 - 3.0	UDS`					Black colour silty clay							
4	3.0 - 4.0	DS					Black colour silty clay							
5	4.0 - 5.0	DS					Black colour silty clay							
6	5.0 - 6.5	SPT	3				Black colour silty clay							
	6.5 - 6.55	DS					Black colour silty clay							
7	6.55 - 7.5	SPT	9				Black colour fine sand							
8	7.5 - 8.5	DS					Black colour fine sand							
9	8.5 - 9.0	DS					Black colour fine sand							
10	9.0 - 10.0	DS					Black colour fine sand							
	10.0 - 10.5	SPT	10				Black colour fine sand							
11	10.5 - 11.0	DS					Black colour fine sand							
12	11.0 - 12.0	DS					Black colour fine sand							
13	12.0 - 13.5	SPT	12				Black colour fine sand							
14	13.5 - 14.5	DS					Black colour stiff clay							
15	14.5 - 15.0	SPT	16				Black colour stiff clay							
16	15.0 - 16.0	UDS					Black colour stiff clay							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat . CLIENT: As per Western Railway Records	B. H. No.P5
	Bridge No. 400
	Sheet No. 2 of 3
	(BGL) R. L. :- 0.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	T.D (m) :- 45.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	Location:- (As per sketch) Sachin
	Date: 30/03/08 to 10/04/08
	W.T.: 0.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
17	16.0 - 17.0	DS					Black colour stiff clay							
18	17.0 - 18.30	DS					Black colour stiff clay							
19	18.30 - 18.35	DS					Brown colour stiff clay							
	18.35 - 18.50	SPT	19				Brown colour stiff clay							
	18.50 - 19.00						Brown colour stiff clay							
20	19.0 - 20.0	DS					Brown colour stiff clay							
21	20.0 - 21.05	DS					Boulders with fine sand							
22	21.05 - 22.0	SPT	28				Boulders with fine sand							
23	22.0 - 23.0	DS					Boulders with fine sand							
24	23.0 - 24.0						Boulders with fine sand							
25	24.0 - 25.0	SPT	38				Boulders with fine sand							
26	25.0 - 26.0	DS					Boulders with fine sand							
27	26.0 - 27.0						Boulders with fine sand							
28	27.0 - 28.0	SPT	39				Boulders with fine sand							
29	28.0 - 29.0	DS					Boulders with fine sand							
30	29.0 - 30.0						Boulders with fine sand							
31	30.0 - 31.0	DS					Boulders with fine sand							
32	31.0 - 32.0	DS					Boulders with fine sand							
33	32.0 - 33.0	SPT	48				Boulders with fine sand							
34	33.0 - 34.0	DS					Boulders with fine sand							

SWAYIN & ASSOCIATES









PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P5							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 3 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
35	34.0 - 35.5	SPT	52				Boulders with fine sand							
36	35.5 - 36.0	DS					Boulders with fine sand							
37	36.0 - 37.5	DS					Boulders with fine sand							
38	37.5 - 38.0	SPT	57				Fine sand							
39	38.0 - 39.0	DS					Fine sand							
40	39.0 - 40.0	DS					Fine sand							
41	40.0 - 41.0	SPT	61				Fine sand							
42	41.0 - 42.5	SPT	66				Fine sand with gravels							
43	42.50 - 43.0	DS					Fine sand with gravels							
44	43.0 - 44.0	DS					Fine sand with gravels							
45	44.0 - 45.0	SPT	73				Fine sand with gravels							

SWAYIN & ASSOCIATES













PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P2								
CLIENT: As per Western Railway Records						Bridge No. 400								
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 1 of 5								
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m								
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m								
						Date: 30/03/08 to 10/04/08								
						W.T.: 0.00 m								
Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
1	0 - 1.0	DS					CLAYEY SOIL							
	1 - 1.5	UDS					CLAYEY SOIL							
2	1.5 - 2						CLAYEY SOIL							
	2 - 2.15	DS					SAND							
3	2.15 - 3	SPT	13				SAND							
	3.0 - 4.0	DS					SAND							
5	4.0 - 5.0	DS					SAND							
6	5.0 - 6.0	SPT	16				SAND							
7	6.0 - 7.5	DS					SAND							
8	7.5 - 8.0	DS					SAND							
9	8.0 - 9.0	SPT	18				SAND							
10	10.0 - 10.5	DS					SAND							








PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P2							
CLIENT: As per Western Railway Records						Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 2 of 5							
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m							
						Date: 30/03/08 to 10/04/08							
						W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL% PL%	TCR %	ROD%
	Depth (m)	Type											
11	10.5 - 11.0	UDS					SAND						
12	11.0 - 12.00	DS					SAND						
13	12.0 - 13.5	DS					SAND						
	13.5 - 13.8	DS					SAND						
14	13.8 - 14.0	DS					STIFF CLAY WITH PEBBLES						
15	14.0 - 15.0	SPT	33				STIFF CLAY WITH PEBBLES						
16	15.0 - 16.0	UDS					STIFF CLAY WITH PEBBLES						
17	16.0 - 17.0	DS					STIFF CLAY WITH PEBBLES						
18	17.0 - 18.0	SPT	39				STIFF CLAY WITH PEBBLES						
19	18.0 - 19.0	UDS					STIFF CLAY WITH PEBBLES						
20	19.0 - 20.0	DS					STIFF CLAY WITH PEBBLES						







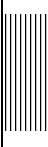

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P2							
CLIENT: As per Western Railway Records						Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 3 of 5							
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m							
						Date: 30/03/08 to 10/04/08							
						W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL% PL%	TCR %	ROD%
	Depth (m)	Type											
21	20.0 - 21.0	SPT	43				STIFF CLAY WITH PEBBLES						
22	21.0 - 22.0	UDS					STIFF CLAY WITH PEBBLES						
23	22.0 - 23.0	DS					STIFF CLAY WITH PEBBLES						
24	23.0 - 24.0	SPT	46				BOULDERS WITH SAND						
25	24.0 - 25.0	DS					BOULDERS WITH SAND						
26	25.0 - 26.0	DS					BOULDERS WITH SAND						
27	26.0 - 27.0	SPT	52				BOULDERS WITH SAND						
28	27.0 - 28.5	DS					BOULDERS WITH SAND						
29	28.5 - 29.0						BOULDERS WITH SAND						
30	29.0 - 30.0	SPT	55				BOULDERS WITH SAND						

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P2								
CLIENT: As per Western Railway Records						Bridge No. 400								
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 4 of 5								
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m								
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m								
						Date: 30/03/08 to 10/04/08								
						W.T.: 0.00 m								
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
31	30.0 - 31.10	DS					BOULDERS WITH SAND							
32	31.10 - 32.0	DS					BOULDERS WITH SAND							
33	32.0 - 33.0	SPT	57				FINE SAND WITH PEBBLES							
34	33.0 - 34.0	DS					FINE SAND WITH PEBBLES							
35	34.0 - 35.0	DS					FINE SAND WITH PEBBLES							
36	35.0 - 36.0	DS					COARSE SAND							
37	36.0 - 37.0	SPT	62				COARSE SAND							
38	37.0 - 38.0	DS					COARSE SAND							
39	38.0 - 39.12	DS					FINE SAND WITH GRAVELS							
40	39.12 - 40.0	SPT	65				FINE SAND WITH GRAVELS							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P2							
CLIENT: As per Western Railway Records						Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 5 of 5							
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m							
						Date: 30/03/08 to 10/04/08							
						W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL% PL%	TCR %	ROD%
	Depth (m)	Type											
41	40.0 - 41.0	DS					FINE SAND WITH GRAVELS						
42	41.0 - 42.5	DS					FINE SAND WITH GRAVELS						
43	42.5 - 43.5	SPT	71				FINE SAND WITH GRAVELS						
44	43.5 - 44.0	DS											

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P3							
CLIENT: As per Western Railway Records						Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 1 of 2							
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m							
						Date: 30/03/08 to 10/04/08							
						W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL% PL%	TCR %	ROD%
	Depth (m)	Type											
	0 - 0.70	DS					WATER						
1	0.70 - 1.50	DS					BLACK COTTON SOIL						
	1.50 - 1.55	UDS					BLACK COTTON SOIL						
2	1.55 - 2.5	SPT	1				SILTY CLAY						
3	2.5 - 3.10	DS					FINE SAND						
4	3.10 - 4.0	SPT	7				FINE SAND						
5	4.0 - 5.0	DS					FINE SAND						
6	5.0 - 6.0	DS					FINE SAND						
7	6.0 - 7.0	SPT	10				FINE SAND						
8	7.0 - 8.0	DS					FINE SAND						
9	8.0 - 9.0	DS					FINE SAND						
10	9.0 - 10.0	SPT	12				FINE SAND						

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .						B. H. No.P3								
CLIENT: As per Western Railway Records						Bridge No. 400								
Casing diameter (mm) : i) 100mm and ii) 76mm						Sheet No. 2 of 2								
Casing diameter (mm) : i) 100mm and ii) 76mm						(BGL) R. L. :- 0.00 m								
Location:- (As per sketch) Sachin						T.D (m) :- 45.00 m								
						Date: 30/03/08 to 10/04/08								
						W.T.: 0.00 m								
Depth m	Sample & Insitu test		SPT N value	Casing water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.0 - 11.5	DS					FINE SAND							
12	11.50 - 12.0	DS					FINE SAND							
13	12.0 - 13.0	SPT	15				FINE SAND							
	13.0 - 13.5	DS					FINE SAND							
	13.5 - 13.57	DS					FINE SAND							
14	13.57 - 14.5	SPT	25				STIFF CLAY WITH PEBBLES							
15	14.5 - 15.0	DS					STIFF CLAY WITH PEBBLES							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P5							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 1 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing water Depth	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
1	0 - 1.0	UDS					BLACK COLOUR SILTY CLAY							
2	1.0 -2.0	SPT	2				BLACK COLOUR SILTY CLAY							
3	2.0 - 3.0	UDS`					BLACK COLOUR SILTY CLAY							
4	3.0 - 4.0	DS					BLACK COLOUR SILTY CLAY							
5	4.0 - 5.0	DS					BLACK COLOUR SILTY CLAY							
6	5.0 - 6.5	SPT	3				BLACK COLOUR SILTY CLAY							
	6.5 - 6.55	DS		BLACK COLOUR SILTY CLAY										
7	6.55 - 7.5	SPT	9				BLACK COLOUR FINE SAND							
8	7.5 - 8.5	DS					BLACK COLOUR FINE SAND							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P5							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 2 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing water Depth	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
9	8.5 - 9.0	DS					BLACK COLOUR FINE SAND							
10	9.0 - 10.0	DS					BLACK COLOUR FINE SAND							
	10.0 - 10.5	SPT	10				BLACK COLOUR FINE SAND							
11	10.5 - 11.0	DS					BLACK COLOUR FINE SAND							
12	11.0 - 12.0	DS					BLACK COLOUR FINE SAND							
13	12.0 - 13.5	SPT	12				BLACK COLOUR FINE SAND							
14	13.5 - 14.5	DS					BLACK COLOUR STIFF CLAY							
15	14.5 - 15.0	SPT	16				BLACK COLOUR STIFF CLAY							
16	15.0 - 16.0	UDS					BLACK COLOUR STIFF CLAY							
17	16.0 - 17.0	DS					BLACK COLOUR STIFF CLAY							
18	17.0 - 18.30	DS					BLACK COLOUR STIFF CLAY							
19	18.30 - 18.35	DS					BROWN COLOUR STIFF CLAY							
	18.35 - 18.50	SPT	19				BROWN COLOUR STIFF CLAY							
	18.50 - 19.00						BROWN COLOUR STIFF CLAY							
20	19.0 - 20.0	DS					BROWN COLOUR STIFF CLAY							
21	20.0 - 21.05	DS					BOULDERS WITH FINE SAND							
22	21.05 - 22.0	SPT	28				BOULDERS WITH FINE SAND							
23	22.0 - 23.0	DS					BOULDERS WITH FINE SAND							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No.P5							
CLIENT: As per Western Railway Records							Bridge No. 400							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 3 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Sachin							T.D (m) :- 45.00 m							
							Date: 30/03/08 to 10/04/08							
							W.T.: 0.00 m							
Depth m	Sample & Insitu test		SPT N value	Casing water Depth	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
24	23.0 - 24.0						BOULDERS WITH FINE SAND							
25	24.0 - 25.0	SPT	38				BOULDERS WITH FINE SAND							
26	25.0 - 26.0	DS					BOULDERS WITH FINE SAND							
27	26.0 - 27.0						BOULDERS WITH FINE SAND							
28	27.0 - 28.0	SPT	39				BOULDERS WITH FINE SAND							
29	28.0 - 29.0	DS					BOULDERS WITH FINE SAND							
30	29.0 - 30.0						BOULDERS WITH FINE SAND							
31	30.0 - 31.0	DS					BOULDERS WITH FINE SAND							
32	31.0 - 32.0	DS					BOULDERS WITH FINE SAND							
33	32.0 - 33.0	SPT	48				BOULDERS WITH FINE SAND							
34	33.0 - 34.0	DS					BOULDERS WITH FINE SAND							
35	34.0 - 35.5	SPT	52				BOULDERS WITH FINE SAND							
36	35.5 - 36.0	DS					BOULDERS WITH FINE SAND							
37	36.0 - 37.5	DS					BOULDERS WITH FINE SAND							
38	37.5 - 38.0	SPT	57				FINE SAND							
39	38.0 - 39.0	DS					FINE SAND							
40	39.0 - 40.0	DS					FINE SAND							
41	40.0 - 41.0	SPT	61				FINE SAND							
42	41.0 - 42.5	SPT	66				FINE SAND WITH GRAVELS							
43	42.50 - 43.0	DS					FINE SAND WITH GRAVELS							
44	43.0 - 44.0	DS					FINE SAND WITH GRAVELS							
45	44.0 - 45.0	SPT	73				FINE SAND WITH GRAVELS							

**GEO-TECHNICAL INVESTIGATION REPORT
FROM WESTERN RAILWAY RECORDS**

BRIDGE NO. 401

**REPORT ON
GEOTECHNICAL INVESTIGATION FOR
PROPOSED BRIDGE NO. 401 AT KM 238/29-239/1**

ENGINEERING PROPERTIES OF SOIL IN DIFFERENT HORIZONS

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₂	BR. NO. 401	2.00	18	1.77	1.50	2.682	30	50	20	-	32	18	14	0.10	10°	20	0.79
		4.00	20	1.74	1.45	2.683	25	55	20	-	35	20	15	0.15	12°	18	0.85
		5.50	14	1.85	1.62	2.656	25	10	65	-	30	14	16	0.11	23°	15	0.64
		8.50	18	1.83	1.55	2.66	30	10	60	-	30	18	12	0.12	25°	16	0.71
		11.50	16	1.86	1.60	2.66	30	15	55	-	26	16	10	0.11	27°	18	0.66
		15.00	20	1.73	1.44	2.673	60	15	25	-	48	20	28	0.55	06°	22	0.85
		18.00	22	1.83	1.50	2.672	65	10	25	-	46	22	24	0.65	07°	25	0.78
		20.50	15	1.75	1.52	2.672	10	05	55	30	35	15	20	0.09	28°	16	0.76
		23.00	15	1.72	1.50	2.650	10	10	50	30	25	15	10	0.10	30°	18	0.77
		26.00	14	1.73	1.52	2.66	12	08	60	20	30	14	16	0.12	32°	15	0.75
		29.00	18	1.98	1.68	2.65	20	15	65	-	30	18	12	0.13	35°	18	0.57
		32.00	16	1.97	1.70	2.66	30	10	60	-	28	16	12	0.12	37°	15	0.56
		34.00	15	1.80	1.52	2.655	15	15	70	-	30	15	15	0.11	37°	16	0.75
		37.00	18	2.91	1.62	2.65	20	05	75	-	20	18	02	0.12	38°	18	0.64
40.60	17	1.91	1.63	2.66	35	10	55	-	26	17	09	0.10	38°	17	0.63		

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₃ 229	BR. NO. 401	2.00	22	1.708	1.40	2.672	50	20	30	-	40	22	18	0.45	06°	25	0.91
		4.00	25	1.82	1.45	2.671	55	15	30	-	45	25	20	0.48	08°	28	0.81
		8.00	22	1.687	1.35	2.673	60	10	20	10	40	22	18	0.62	08°	25	0.98
		21.00	15	1.932	1.52	2.65	10	05	60	25	30	15	15	0.09	32°	15	0.74
		24.00	14	2.00	1.54	2.658	15	10	55	20	30	14	16	0.08	33°	17	0.72
		27.00	18	1.77	1.50	2.656	25	10	65	-	32	18	14	0.9	35°	18	0.77
		30.00	25	1.75	1.40	2.674	55	20	25	-	48	25	23	0.55	07°	27	0.91
		33.00	22	1.805	1.48	2.67	60	10	30	-	45	22	23	0.75	06°	32	0.8
		36.00	25	1.80	1.50	2.672	65	10	25	-	50	25	25	0.82	07°	35	0.78
		39.00	20	1.94	1.62	2.675	55	10	10	25	40	20	20	0.93	08°	28	0.65
		42.00	22	2.00	1.64	2.674	60	05	10	25	45	22	23	0.95	08°	25	0.63
		45.00	13	1.90	1.68	2.656	10	05	55	30	30	13	17	0.07	38°	18	0.58
		48.50	14	1.94	1.70	2.654	10	10	60	20	28	14	14	0.08	40°	19	0.56
		51.00	15	2.08	1.81	2.654	10	05	60	25	30	15	15	0.08	35°	15	0.55
		54.00	15	2.10	1.83	2.651	05	05	70	20	30	15	15	0.07	38°	18	0.45
		57.00	15	2.11	1.84	2.656	10	05	55	30	30	15	15	0.09	42°	16	0.44

Bore Hole No.	Chainage	Depth in Mtrs.	NMC %	Density in gm/cc		Sp. gr.	Clay %	Silt %	Sand %	Gravels %	Consistency Limits			Shear Test		DFS %	Void ratio (e)
				Bulk	Dry						LL %	PL %	PI	C in kg/cm ²	φ in degree		
P ₄	BR. NO. 401	4.00	20	1.68	1.40	2.684	35	50	15	-	40	20	20	0.58	06°	28	0.91
		5.00	18	1.83	1.55	2.66	25	15	60	-	30	18	12	0.15	25°	15	0.67
		8.00	15	1.80	1.50	2.93	35	20	55	-	30	15	15	0.16	28°	18	0.95
		10.00	20	1.63	1.38	2.671	55	15	30	-	48	20	28	1.20	06°	25	0.94
		18.50	24	1.88	1.52	2.674	60	05	10	25	45	24	21	1.25	07°	25	0.76
		21.50	25	1.85	1.48	2.67	60	10	30	-	48	25	23	1.43	06°	23	0.80
		29.50	15	1.75	1.70	2.657	10	10	55	25	30	15	15	0.13	35°	18	0.563
		32.50	14	1.92	1.68	2.655	12	08	60	20	40	14	26	0.09	37°	20	0.58
		35.00	15	2.01	1.75	2.657	05	05	70	20	38	15	23	0.11	38°	15	0.52
		38.50	15	2.07	1.80	2.653	10	05	65	20	37	15	22	0.10	40°	17	0.473
A ₂	BR. NO. 401	33.50	15	2.016	1.68	2.659	15	15	70	-	32	15	17	0.43	37°	16	0.58
		36.00	18	2.10	1.78	2.652	13	12	75	-	30	18	12	0.11	37°	15	0.50
		39.50	22	1.80	1.48	2.675	60	08	12	20	45	22	23	1.65	08°	19	0.81
		42.50	15	1.67	1.45	2.658	25	15	60	-	30	15	15	0.10	38°	18	0.84
		45.00	24	1.86	1.58	2.674	60	05	10	25	45	24	21	1.70	08°	22	0.69
		48.00	15	1.932	1.72	2.656	10	10	60	20	30	15	15	1.10	38°	15	0.54
		51.50	18	2.07	1.76	2.654	10	05	60	25	30	18	12	1.11	39°	17	0.52
		54.50	16	2.184	1.82	2.653	05	05	65	25	32	16	16	0.09	39°	19	0.45
		57.00	17	2.152	1.84	2.657	05	05	70	20	30	17	13	0.09	40°	20	0.44

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No.P2

Bridge No. 401

Sheet No. 1 of 2

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

Date: 06/04/08 to 07/04/08

W.T.: 0.00 m

Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.5						Top Soil							
	0.5 - 1.0	DS					Silty Clay							
1	1.0-2.0	UDS					Silty Clay							
2	2.0 - 3.0	SPT					Silty Clay							
3	3.0 - 4.0	UDS					Silty Clay							
4	4.0-4.5	UDS					Silty Clay							
5	4.5-5.50	SPT	13				Fine Sand							
6	5.5 - 7.0	DS					Fine Sand							
7	7.0 - 8.5	SPT	17				Fine Sand							
8	8.5 - 10.0	DS					Fine Sand							
9	10.0 - 11.5	SPT	20				Fine Sand							
10	11.5 - 13.50	DS					Fine Sand							
11	13.5 - 14.00	SPT	22				Stiff Clay							
12	14.00 - 15.00	UDS					Stiff Clay							
13	15.00 - 16.00	DS					Stiff Clay							
14	16.00 - 17.00	SPT	27				Stiff Clay							
15	17.00 - 18.00	UDS					Stiff Clay							
16	18.00 - 19.00	DS					Stiff Clay							
	19.00 - 19.50	DS					Stiff Clay							
17	19.00 - 20.00	SPT	32				Fine Sand with Gravels							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No.P2

Bridge No. 401

Sheet No. 2 of 2

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm


















T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

Date: 06/04/08 to 07/04/08

W.T.: 0.00 m

Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
18	20.00 - 21.00	DS					Fine Sand with Gravels							
19	21.00- 22.00	DS					Fine Sand with Gravels							
20	22.00 - 23.00	SPT	37				Fine Sand with Gravels							
21	23.00 - 24.50	DS					Fine sand with gravels							
22	24.50 - 26.00	SPT	40				Fine sand with gravels							
23	26.00 - 27.50	DS					Fine sand with gravels							
24	27.50 - 29.00	SPT	47				Coarse Sand							
25	29.00 - 30.00	DS					Coarse Sand							
26	30.00 - 31.00	DS					Coarse Sand							
27	31.00 - 32.00	SPT	58				Coarse Sand							
28	32.00 - 33.00	DS					Coarse Sand							
29	33.00 - 33.10	SPT	62				Coarse Sand							
30	33.10 - 34.00	DS					Coarse Sand							
31	34.00 - 35.50	DS					Coarse Sand							
32	35.50 - 37.00	SPT	69				Fine Sand							
33	37.00 - 38.50	DS					Fine Sand							
34	38.50 - 40.60	SPT	73				Fine Sand							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 1 of 3

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm




















T.D (m) :- 60 m

Casing diameter (mm) : i) 100mm and ii) 76mm

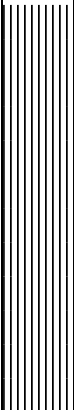
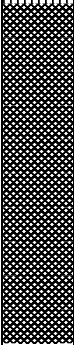
Location:- (As per sketch)
Metikhadi

Date: 20/5/08 to 23/5/08

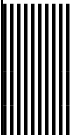

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.00	DS					Clayey Soil							
1	1.00-2.00	UDS					Clayey Soil							
2	2.00-3.00	SPT	7				Clayey Soil							
3	3.00-4.00	UDS					Clayey Soil							
4	4.00-5.00	DS					Clayey Soil							
5	5.00-6.00	SPT	9				Clayey Soil							
6	6.00-6.50	DS					Clayey Soil							
7	6.50-6.51	DS					Stiff Clay with Pebbles							
8	6.51-8.00	UDS					Stiff Clay with Pebbles							
9	8.00-9.00	SPT	14				Stiff Clay with Pebbles							
10	9.00 - 10.50	DS					Stiff Clay with Pebbles							
11	10.50 - 12.00	SPT	17				Stiff Clay with Pebbles							
12	12.00 - 14.00	DS					Stiff Clay with Pebbles							
13	14.00 - 15.00	SPT	33				Stiff Clay with Pebbles							
14	15.00 - 16.50	DS					Stiff Clay with Pebbles							
15	16.50 - 18.00	SPT	37				Stiff Clay with Pebbles							
16	18.00 - 19.50	DS					Stiff Clay with Pebbles							
17	19.50 - 19.59	DS					Stiff Clay with Pebbles							
18	19.59 - 21.00	SPT	46				Coarse Sand with Gravels							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. P3							
CLIENT: Stup Consultants Pvt. Ltd.							Bridge No. 401							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 2 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Metikhadi							T.D (m) :- 60 m							
							Date: 20/5/08 to 23/5/08							
							W.T.: 0.50 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
19	21.00 - 22.50	DS					Coarse Sand with Gravels							
20	22.50 - 24.00	SPT	48				Coarse Sand with Gravels							
21	24.00 - 25.50	DS					Coarse Sand with Gravels							
22	25.50 - 26.00	DS					Coarse Sand with Gravels							
23	26.00 - 27.00	SPT	52				Coarse Sand with Gravels							
24	27.00 - 29.00	DS					Fine Sand							
25	29.00 - 30.00	SPT	54				Stiff clay							
26	30.00 - 31.50	DS					Stiff Clay							
27	31.50 - 33.00	SPT	56				Stiff Clay							
28	33.00 - 34.50	DS					Stiff Clay							
29	34.50 - 36.00	SPT	63				Stiff Clay							
30	36.00 - 38.00	DS					Stiff Clay							
31	38.00 - 38.10	DS					Stiff Clay with Gravels							
32	38.10 - 39.00	SPT	64				Stiff Clay with Gravels							
33	39.00 - 40.50	DS					Stiff Clay with Gravels							
34	40.50 - 42.00	SPT	67				Stiff Clay with Gravels							
35	42.00 - 44.00	DS					Stiff Clay with Gravels							
36	44.00 - 44.12	DS					Coarse Sand with Gravels							
37	44.12 - 45.00	SPT	73				Coarse Sand with Gravels							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat .							B. H. No. P3							
CLIENT: Stup Consultants Pvt. Ltd.							Bridge No. 401							
Casing diameter (mm) : i) 100mm and ii) 76mm							Sheet No. 3 of 3							
Casing diameter (mm) : i) 100mm and ii) 76mm							(BGL) R. L. :- 0.00 m							
Location:- (As per sketch) Metikhadi							T.D (m) :- 60 m							
							Date: 20/5/08 to 23/5/08							
							W.T.: 0.50 m							
Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
38	45.00 - 48.00	SPT	78				Coarse Sand with Gravels							
39	48.00-49.50	DS					Coarse Sand with Gravels							
40	49.50-51.00	SPT	81				Coarse Sand with Gravels							
41	51.00-52.50	DS					Coarse Sand with Gravels							
42	52.50-54.00	SPT	85				Coarse Sand with Gravels							
43	54.00 - 55.50	DS					Coarse Sand with Gravels							
44	55.50 - 57.00	SPT	91				Coarse Sand with Gravels							
45	57.00 - 58.00						Coarse Sand with Gravels							
46	58.00 - 59.00	C1					Hard Rock							
47	59.00 - 60.00						Hard Rock							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various
Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. P4

Bridge No. 401

Sheet No. 1 of 1

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

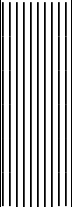





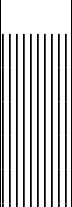

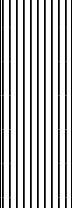
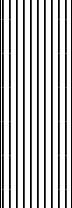
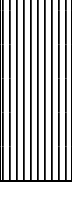


T.D (m) :- 15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

Date: 13/5/08 to 14/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	00 - 3.00	DS					Water							
1	3.00 - 3.05													
2	3.05 - 4.00	UDS					Silty Clay							
3	4.00 - 4.50	UDS					Silty Clay							
4	4.50 - 4.59	DS					Silty Clay							
5	4.59 - 5.00	SPT	15				Fine Sand							
6	5.00 - 6.50	DS					Fine Sand							
7	6.50 - 8.00	SPT	20				Fine Sand							
8	8.00 - 8.45	DS					Fine Sand							
9	8.45 - 8.50						Stiff Clay							
10	8.50 - 10.00	UDS					Stiff Clay							
11	10.00-11.00	SPT	33				Stiff Clay							
12	11.00-12.50	DS					Stiff Clay							
13	12.50-14.00	SPT	35				Stiff Clay							
14	14.00-15.00													

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. A2
Bridge No. 401
Sheet No. 1 of 3
(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch) Metikhadi

T.D (m) :- 61 m




















Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0		DS					Stiff Clay							
1		UDS					Stiff Clay							
2	2.00 - 3.00	SPT	9				Stiff Clay							
3	3.00 - 4.00	UDS					Stiff Clay							
4	4.00 - 5.00	DS					Stiff Clay							
5	5.00 - 6.00	SPT	12				Stiff Clay							
6	6.00 - 7.00	UDS					Stiff Clay							
7	7.00 - 8.00	DS					Stiff Clay							
8	8.00 - 9.00	SPT	15				Stiff Clay							
9	9.00 - 10.50	DS					Stiff Clay							
10	10.50-12.00	SPT	22				Stiff Clay							
11	12.00-13.00	UDS					Stiff Clay with Pebbles							
12	13.00-14.00	DS					Stiff Clay with Pebbles							
13	14.00-15.00	SPT	32				Stiff Clay with Gravels							
14	15.00-16.00	DS					Stiff Clay with Gravels							
15	16.00-17.00	DS					Stiff Clay with Gravels							
16	17.00-18.00	SPT	35				Stiff Clay with Pebbles							
17	18.00-19.00	UDS					Stiff Clay with Pebbles							
18	19.00-20.00	DS					Stiff Clay with Pebbles							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges, DFCC project Between Vaitarna & Surat . CLIENT: Stup Consultants Pvt. Ltd.	B. H. No. A2
	Bridge No. 401
	Sheet No. 2 of 3
	(BGL) R. L. :- 0.00 m
Casing diameter (mm) : i) 100mm and ii) 76mm	T.D (m) :- 61 m
Casing diameter (mm) : i) 100mm and ii) 76mm	Location:- (As per sketch) Metikhadi
	Date: 20/04/08 to 29/04/08
	W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
19	20.00-21.00	SPT	42				Stiff Clay with Pebbles							
20	21.00-22.00	DS					Stiff Clay with Pebbles							
21	22.00-22.10	DS					Stiff Clay with Gravels							
22	22.10-23.00	UDS					Stiff Clay with Gravels							
23	23.00-24.00	SPT	47				Stiff Clay with Gravels							
24	24.00-25.50	DS					Stiff Clay with Gravels							
25	25.50-27.00	SPT	52				Stiff Clay with Gravels							
26	27.00-28.50	DS					Fine Sand							
27	28.50-30.00	SPT	55				Fine Sand							
28	30.00-31.00	DS					Sand							
29	31.00-31.12	DS					Sand							
30	31.12-32.00	DS					Coarse Sand							
31	32.00-33.00	SPT	58				Coarse Sand							
32	33.00-34.50	DS					Coarse Sand							
33	34.50-35.00	SPT	64				Coarse Sand							
34	35.00-37.50	DS					Coarse Sand							
35	37.50-37.55	DS					Stiff Clay with Gravels							
36	37.55-39.00	SPT	68				Stiff Clay with Gravels							
37	39.00-40.00	DS					Stiff Clay with Gravels							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
 DFCC project Between Vaitarna & Surat .








CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. A2
Bridge No. 401
 Sheet No. 3 of 3
 (BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm
 Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch) Metikhadi

T.D (m) :- 61 m
 Date: 20/04/08 to 29/04/08
 W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing / water Depth (m)	Thick ness (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
38	40.00-41.00	DS					Stiff Clay with Gravels							
39	41.00-41.08	DS					Fine Sand							
40	41.08-42.00	SPT	76				Fine Sand							
41	42.00-43.50	DS					Fine Sand							
42	43.50- 44.35	DS					Fine Sand							
43	44.35-44.50	DS					Stiff Clay with Gravels							
44	44.50-45.00	SPT	79				Stiff Clay with Gravels							
45	45.00-46.50	DS					Stiff Clay with Gravels							
46	46.50-48.00	SPT	81				Stiff Clay with Gravels							
47	48.00-48.20						Stiff Clay with Gravels							
48	48.20-49.50	DS					Coarse Sand with Gravels							
49	49.50-51.00	SPT	87				Coarse Sand with Gravels							
50	51.00-52.50	DS					Coarse Sand with Gravels							
51	52.50-54.00	SPT	90				Coarse Sand with Gravels							
52	54.00-55.50	DS					Coarse Sand with Gravels							
53	55.50-57.00	SPT	93				Coarse Sand with Gravels							
54	57.00-57.85						Coarse Sand with Gravels							
54	57.85-58.50						Coarse Sand with Gravels							
55	58.50-60.40						Hard rock							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No.P2

Bridge No. 401

Sheet No. 1 of 4

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Sachin

Date: 06/04/08 to 07/04/08

W.T.: 0.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.5	DS					Top Soil							
	0.5 - 1.0						Silty Clay							
1	1.0-2.0	UDS					Silty Clay							
2	2.0 - 3.0	SPT					Silty Clay							
3	3.0 - 4.0	UDS					Silty Clay							
4	4.0-4.5	UDS					Silty Clay							
5	4.5-5.50	SPT 13					Fine Sand							
6	5.5 - 7.0	DS					Fine Sand							
7	7.0 - 8.5	SPT 17					Fine Sand							
8	8.5 - 10.0	DS					Fine Sand							
9	10.0 - 11.5	SPT 20	Fine Sand											
10	11.5 - 13.50	DS	Fine Sand											

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P2

Bridge No. 401

Sheet No. 2 of 4

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm












T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Sachin

Date: 06/04/08 to 07/04/08

W.T.: 0.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	13.5 - 14.00	SPT	22				Stiff Clay							
12	14.00 - 15.00	UDS					Stiff Clay							
13	15.00 - 16.00	DS					Stiff Clay							
14	16.00 - 17.00	SPT	27				Stiff Clay							
15	17.00 - 18.00	UDS					Stiff Clay							
16	18.00 - 19.00	DS					Stiff Clay							
	19.00 - 19.50	DS					Stiff Clay							
17	19.00 - 20.00	SPT	32				Fine Sand with							
18	20.00 - 21.00	DS					Fine Sand with							
19	21.00- 22.00	DS					Fine Sand with							
20	22.00 - 23.00	SPT	37				Fine Sand with							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P2

Bridge No. 401

Sheet No. 3 of 4

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm




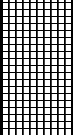
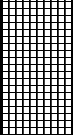
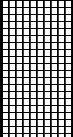
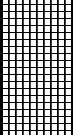
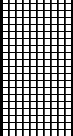
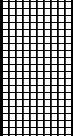


T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Sachin

Date: 06/04/08 to 07/04/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	23.00 - 24.50	DS					Fine sand with gravels							
22	24.50 - 26.00	SPT	40				Fine sand with gravels							
23	26.00 - 27.50	DS					Fine sand with gravels							
24	27.50 - 29.00	SPT	47				Coarse Sand							
25	29.00 - 30.00	DS					Coarse Sand							
26	30.00 - 31.00	DS					Coarse Sand							
27	31.00 - 32.00	SPT	58				Coarse Sand							
28	32.00 - 33.00	DS					Coarse Sand							
29	33.00 - 33.10	SPT	62				Coarse Sand							
30	33.10 - 34.00	DS					Coarse Sand							
31	34.00 - 35.50	DS					Coarse Sand							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P2

Bridge No. 401

Sheet No. 4 of 4

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 45.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 06/04/08 to 07/04/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
32	35.50 - 37.00	SPT	69				Fine Sand							
33	37.00 - 38.50	DS					Fine Sand							
34	38.50 - 40.60	SPT	73				Fine Sand							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 1 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm












T.D (m) :- 60 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 20/5/08 to 23/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	00 - 1.00	DS					Clayey Soil							
1	1.00 - 2.00	UDS					Clayey Soil							
2	2.00 - 3.00	SPT	7				Clayey Soil							
3	3.00 - 4.00	UDS					Clayey Soil							
4	4.00 - 5.00	DS					Clayey Soil							
5	5.00 - 6.00	SPT	9				Clayey Soil							
6	6.00 - 6.50	DS					Clayey Soil							
7	6.50 - 6.51	DS					Stiff Clay with							
8	6.51 - 8.00	UDS					Stiff Clay with							
9	8.00 - 9.00	SPT	14				Stiff Clay with							
10	9.00 - 10.50	DS					Stiff Clay with							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 2 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 60.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

Date: 20/5/08 to 23/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.50 - 12.00	SPT	17				Stiff Clay with							
12	12.00 - 14.00	DS					Stiff Clay with							
13	14.00 - 15.00	SPT	33				Stiff Clay with							
14	15.00 - 16.50	DS					Stiff Clay with							
15	16.50 - 18.00	SPT	37				Stiff Clay with							
16	18.00 - 19.50	DS					Stiff Clay with							
17	19.50 - 19.59	DS												
18	19.59 - 21.00	SPT	46				Coarse Sand with							
19	21.00 - 22.50	DS					Coarse Sand with							
20	22.50 - 24.00	SPT	48				Coarse Sand with							
21	24.00 - 25.50	DS					Coarse Sand with							

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 3 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm












T.D (m) :- 60.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi)

Date: 20/5/08 to 23/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
22	25.50 - 26.00	DS					Coarse Sand with							
23	26.00 - 27.00	SPT	52				Coarse Sand with							
24	27.00 - 29.00	DS					Fine Sand							
25	29.00 - 30.00	SPT	54				Stiff clay							
26	30.00 - 31.50	DS					Stiff Clay							
27	31.50 - 33.00	SPT	56				Stiff Clay							
28	33.00 - 34.50	DS					Stiff Clay							
29	34.50 - 36.00	SPT	63				Stiff Clay							
30	36.00 - 38.00	DS					Stiff Clay							
31	38.00 - 38.10	DS					Stiff Clay with							
32	38.10 - 39.00	SPT	64				Stiff Clay with							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 4 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 60.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

Date: 20/5/08 to 23/5/08

Metikhadi

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
33	39.00 - 40.50	DS					Stiff Clay with							
34	40.50 - 42.00	SPT	67				Stiff Clay with							
35	42.00 - 44.00	DS					Stiff Clay with							
36	44.00 - 44.12	DS					Coarse Sand with							
37	44.12 - 45.00	SPT	73				Coarse Sand with							
38	45.00 - 48.00	SPT	78				Coarse Sand with Gravels							
39	48.00 - 49.50	DS					Coarse Sand with Gravels							
40	49.50 - 51.00	SPT	81				Coarse Sand with Gravels							
41	51.00 - 52.50	DS					Coarse Sand with Gravels							
42	52.50 - 54.00	SPT	85				Coarse Sand with Gravels							
43	54.00 - 55.50	DS					Coarse Sand with Gravels							

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P3

Bridge No. 401

Sheet No. 5 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

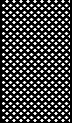
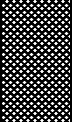
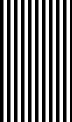
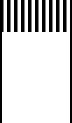
T.D (m) :- 60.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 20/5/08 to 23/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
44	55.50 - 57.00	SPT	91				Coarse Sand with Gravels							
45	57.00 - 58.00						Coarse Sand with Gravels							
46	58.00 - 59.00	C1					Hard Rock							
47	59.00 - 60.00						Hard Rock							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P4

Bridge No. 401

Sheet No. 1 of 2

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm










T.D (m) :- 15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 13/5/08 to 14/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	00 - 3.00	DS					Water							
1	3.00 - 3.05													
2	3.05 - 4.00	UDS					Silty Clay							
3	4.00 - 4.50	UDS					Silty Clay							
4	4.50 - 4.59	DS					Silty Clay							
5	4.59 - 5.00	SPT	15				Fine Sand							
6	5.00 - 6.50	DS					Fine Sand							
7	6.50 - 8.00	SPT	20				Fine Sand							
8	8.00 - 8.45	DS					Fine Sand							
9	8.45 - 8.50						Stiff Clay							
10	8.50 - 10.00	UDS					Stiff Clay							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. P4

Bridge No. 401

Sheet No. 2 of 2

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 15.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 13/5/08 to 14/5/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.00 - 11.00	SPT	33				Stiff Clay							
12	11.00 - 12.50	DS					Stiff Clay							
13	12.50 - 14.00	SPT	35				Stiff Clay							
14	14.00 - 15.00													

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. A2

Bridge No. 401

Sheet No. 1 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 61 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	00 - 1.00	DS					Stiff Clay							
1	1.00 - 2.00	UDS					Stiff Clay							
2	2.00 - 3.00	SPT	9				Stiff Clay							
3	3.00 - 4.00	UDS					Stiff Clay							
4	4.00 - 5.00	DS					Stiff Clay							
5	5.00 - 6.00	SPT	12				Stiff Clay							
6	6.00 - 7.00	UDS					Stiff Clay							
7	7.00 - 8.00	DS					Stiff Clay							
8	8.00 - 9.00	SPT	15				Stiff Clay							
9	9.00 - 10.50	DS					Stiff Clay							
10	10.50 - 12.00	SPT	22				Stiff Clay							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. A2

Bridge No. 401

Sheet No. 2 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 61.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi

Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	12.00 - 13.00	UDS					Stiff Clay with							
12	13.00 - 14.00	DS					Stiff Clay with							
13	14.00 - 15.00	SPT	32				Stiff Clay with							
14	15.00 - 16.00	DS					Stiff Clay with							
15	16.00 - 17.00	DS					Stiff Clay with							
16	17.00 - 18.00	SPT	35				Stiff Clay with							
17	18.00 - 19.00	UDS					Stiff Clay with							
18	19.00 - 20.00	DS					Stiff Clay with							
19	20.00 - 21.00	SPT	42				Stiff Clay with							
20	21.00 - 22.00	DS					Stiff Clay with							
21	22.00 - 22.10	DS					Stiff Clay with							

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. A2

Bridge No. 401

Sheet No. 3 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 61.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch Metikhadi)

Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
22	22.10 - 23.00	UDS					Stiff Clay with							
23	23.00 - 24.00	SPT	47				Stiff Clay with							
24	24.00 - 25.50	DS					Stiff Clay with							
25	25.50 - 27.00	SPT	52				Stiff Clay with							
26	27.00 - 28.50	DS					Fine Sand							
27	28.50 - 30.00	SPT	55				Fine Sand							
28	30.00 - 31.00	DS					Sand							
29	31.00 - 31.12	DS					Sand							
30	31.12 - 32.00	DS					Coarse Sand							
31	32.00 - 33.00	SPT	58				Coarse Sand							
32	33.00 - 34.50	DS					Coarse Sand							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. A2

Bridge No. 401

Sheet No. 4 of 5

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

Casing diameter (mm) : i) 100mm and ii) 76mm

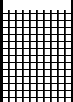
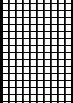
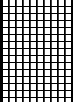
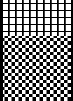
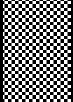
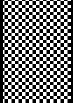
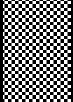
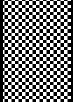
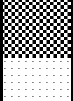
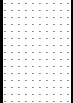
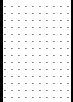
T.D (m) :- 61.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
33	34.50 - 35.00	SPT	64				Coarse Sand							
34	35.00 - 37.50	DS					Coarse Sand							
35	37.50 - 37.55	DS					Stiff Clay with							
36	37.55 - 39.00	SPT	68				Stiff Clay with							
37	39.00 - 40.00	DS					Stiff Clay with							
38	40.00 - 41.00	DS					Stiff Clay with							
39	41.00 - 41.08	DS					Fine Sand							
40	41.08 - 42.00	SPT	76				Fine Sand							
41	42.00 - 43.50	DS					Fine Sand							
42	43.50 - 44.35	DS					Fine Sand							
43	44.35 - 44.50	DS					Stiff Clay with Gravels							

SWAYIN & ASSOCIATES

PROJECT:- Geotechnical Investigation for construction of various DFCC project Between Vaitarna & Surat .

B. H. No. A2

Bridge No. 401

Sheet No. 5 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm














T.D (m) :- 61.0 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

Date: 20/04/08 to 29/04/08

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
44	44.50 - 45.00	SPT	79				Stiff Clay with Gravels							
45	45.00 - 46.50	DS					Stiff Clay with Gravels							
46	46.50 - 48.00	SPT	81				Stiff Clay with Gravels							
47	48.00 - 48.20						Stiff Clay with Gravels							
48	48.20 - 49.50	DS					Coarse Sand with Gravels							
49	49.50 - 51.00	SPT	87				Coarse Sand with Gravels							
50	51.00 - 52.50	DS					Coarse Sand with Gravels							
51	52.50 - 54.00	SPT	90				Coarse Sand with Gravels							
52	54.00 - 55.50	DS					Coarse Sand with Gravels							
53	55.50 - 57.00	SPT	93				Coarse Sand with Gravels							
54	57.00 - 57.85						Coarse Sand with Gravels							
54	57.85 - 58.50						Coarse Sand with Gravels							
55	58.50 - 60.40						Hard rock							

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 405

KHARIYA (BRIDGE NO. 405)

Khariya Bridge no. 405 is an ideal topographical situation for a proposed structure . Banks on both sides are quite raised and form firm approach on both sides .

1. EXPLORATION CHARACTERISTICS :

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only one bore hole has been planned for this site . In all total 7 nos. undisturbed and 15 nos. disturbed soil samples excluding S.P.T. samples have been collected from 1 nos. bore holes .Ground water samples have been collected . The details are presented in Table no. 1.1.

**TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES**

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	30.00 m	2.00 m	7	12	15

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

**TABLE 1.2
STANDARD PENETRATION TEST RESULTS**

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	1.00 --- 1.45	03-05-06	11 Brownish Stiff
	2	3.05 --- 3.60	10-12-12	24 Brownish Stiff
	3	5.45 --- 5.90	12-14-15	29 Clayey Silts
	4	6.00 --- 6.60	15-16-17-19	33 Clayey Silts
	5	8.00 --- 8.60	18-19-20-22	39 Clayey Sands

Continued

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	6	9.00 --- 9.60	21-22-23-23	45 Very Dense Sands
	7	12.00 --- 12.60	18-20-21-23	41 Brownish Clay
	8	15.00 --- 15.30	24-28 -20(0 cm)	R Refusal
	9	21.00 --- 21.30	25-26 -19(0 cm)	R Refusal
	10	24.00 --- 24.15	26--12 (0 cm)	R Refusal
	11	27.00 --- 27.60	30-32-33-36	65 Hard Cementious
	12	30.00 --- 30.30	26-30-17 (0 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

I) RESIDUAL CLAYEY SILTS: (0.00 m to 30.00 m)

The overburden essentially is Brownish soft to stiff consistency Clayey Silts . Silts of low plasticity have rather more frictional component . In the lower reach increased sand component has been observed . S.P.T. values varying between 11 to 45 have been observed in the range of 1.0 m to 12.00 m depth .

2.0. LABORATORY TESTS :

The laboratory tests conducted on undisturbed soil samples and rock samples recovered from bore holes are given in Table No. 1.3.

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND
WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.4	5	
2.	Grain Size Analysis	1.5	5	
3.	Specific Gravity, Limit States.	1.6	5	
4.	Triaxial Shear Test (UU)	1.7	6	
5.	Direct Shear Test	1.8	2	
6.	Consolidation Test	1.9	3	
7.	Chemical test on soil sample	1.10	1	
8.	Chemical test on water sample	1.11	1	

The laboratory tests results have been presented in following pages .

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.4

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	1.45 – 1.90	UDS1	1.78	20.08
2.	1	2.60 – 3.05	UDS2	1.92	19.87
3.	1	4.00 – 4.45	UDS3	1.89	21.20
4.	1	5.00 – 5.45	UDS4	1.87	20.50
5.	1	18.00 – 18.45	UDS6	1.96	19.74

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.5
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	(Silt + Clay) %
1.	1	1.45 – 1.90	UDS1	2.90	8.40	88.70
2.	1	2.60 – 3.05	UDS2	4.40	21.90	73.70
3.	1	4.00 – 4.45	UDS3	6.40	17.80	75.80
4.	1	5.00 – 5.45	UDS4	2.00	21.30	76.70
5.	1	18.00 – 18.45	UDS6	8.90	28.70	62.40

**LIMIT STATES
TABLE NO. 1.6**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	1.45 – 1.90	UDS1	2.66	53.60	25.30	28.30
2.	1	2.60 – 3.05	UDS2	2.70	51.50	24.00	27.50
3.	1	4.00 – 4.45	UDS3	2.72	48.50	23.60	24.90
4.	1	5.00 – 5.45	UDS4	2.64	50.00	24.00	26.00
5.	1	18.00 – 18.45	UDS6	2.69	44.60	23.60	21.00

**TABLE NO. 1.7
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	1.45 – 1.90	UDS1	0.285	18.40
2.	1	2.60 – 3.05	UDS2	0.341	25.30
3.	1	4.00 – 4.45	UDS3	0.467	27.60
4.	1	5.00 – 5.45	UDS4	0.410	28.80
5.	1	8.60—9.00	UDS5	0.336	31.20
6.	1	18.00 – 18.45	UDS6	0.521	32.10

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	5.00 – 5.45	UDS4	0.386	29.10
2.	1	18.00 – 18.45	UDS5	0.452	32.90

**TABLE NO. 1.9
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio “e”	Compression Index “C _c ”
1.	1	4.00 – 4.45	UDS3	1.2312	0.213
2.	1	5.00 – 5.45	UDS4	1.1756	0.131
3.	1	18.00 – 18.45	UDS5	1.0452	0.106

**TABLE NO. 1.10
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	5.00	8.50	0.040	0.089

**TABLE NO. 1.11
CHEMICAL ANALYSIS
OF
WATER SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate ppm	Chloride ppm
1.	1	7.00	8.30	101	187

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 405

Sheet No. 1 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.30 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 3/6/08 to 5/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Kharia Tank

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00--1.00	DS1				-----	Brownish soft to stiff consistency Clayey Silts .							
1	1.00--1.45	SPT1	11	GWL @ 2.00 m		-----								
	1.45--1.90	UDS1												
2	1.90--2.60					-----								
	2.60--3.05	UDS2				-----								
3	3.05--3.60	SPT2	24			-----	Very stiff consistency Clayey Silts							
	3.60-4.00													
4	4.00--4.45	UDS3				-----								
	4.45--5.00	DS				-----								
5	5.00--5.45	UDS4				-----								
	5.45--5.90	SPT3	29			-----	Hard Consistency Clayey Silts .							
6	6.00-6.60	SPT4		33			-----	Hard Consistency Clayey Silts .						
	6.60--7.00						-----							
7	7.00-7.45	UDS5				-----								
	7.45-8.00	DS				-----								
8	8.00--8.60	SPT5	39			-----	Fine Grained Clayey Sands .							
	8.60--9.00	UDS6					-----							
9	9.00-9.60	SPT6	45			-----	Dense coarse grained Sands .							
	9.60-12.00						-----							
10						-----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 405

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.30 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 3/6/08 to 5/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Kharia Tank

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	9.60-12.00					-----	Dense coarse grained Sands .							
12	12.00-12.60 12.60-15.00	SPT7	41			-----	Brownish Silty Sandy hard consistency Clays .							
13						-----								
14						-----								
15	15.00-15.30 15.30-18.00	SPT8	R			-----	Very hard consistency Clayey Silts .							
16						-----								
17						-----								
18	18.00-18.45 18.45-21.00	UDS7				-----	Brownish Sandy Clayey Silts . coarse pebbles gravel presence .							
19						-----								
20						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 405

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.30 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Kharia Tank

Date: 3/6/08 to 5/6/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	18.45-21.00					-----	Brownish Sandy Clayey Silts . coarse pebbles gravel presence .							
	21.00-21.30	SPT9	R			-----	Very hard Gravel pebbles coarse sands observed.							
	21.30-24.00					-----								
22						-----								
23						-----								
24	24.00-24.15	SPT10	R			-----	Hard Gravel Sandy Clays .							
	24.15-27.00					-----								
25						-----								
26						-----								
27	27.00-27.60	SPT11	65			-----	Hard cementious congalomereate pieces .							
	27.60-30.00					-----								
28						-----								
29						-----								
30	30.00-30.30	SPT12	R			-----	Hard cementious congalomereate pieces .							
	30.30--					-----								

Bore hole terminated at 30.30 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 411

SAGARA (BRIDGE NO. 411)

River stretch at location is fairly at right angle to the Railway alignment. The key plan of site is attached.

1. EXPLORATION CHARACTERISTICS :

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only one bore hole has been planned for this site. In all total 4 nos. undisturbed and 11 nos. disturbed soil samples excluding S.P.T. samples have been collected from 1 no. bore hole. Ground water sample has been collected. The details are presented in Table no. 1.1.

**TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL SAMPLES**

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	30.45	2.40 m	4	9	11

1.2 STANDARD PENETRATION TESTS : (IS 2131-1981)

A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler, are presented in Table no. 1.2.

**TABLE 1.2
STANDARD PENETRATION TEST RESULTS**

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	3.00 --- 3.60	11-13-14-16	27 Clayey Silts
	2	6.00 --- 6.60	15-16-17-18	33 Clayey Silts
	3	9.00 --- 9.60	17-18-19-20	37 Clayey Sands
	4	12.00 --- 12.60	19-20-22-24	42 Clayey Sands
	5	18.00 --- 18.45	21-22-23	45 Clayey Sands

Continued

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
	6	21.00 --- 21.45	24-24-25	49 Dense Sands
	7	24.00 --- 24.45	24-25-26	51 Clayey Sands
	8	27.00 --- 27.60	23-25-25-27	50 Clayey Sands
	9	30.00 --- 30.45	31-46-52	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

D) RESIDUAL CLAYEY SILTS: (0.00 m to 30.45 m)

The initial overburden essentially is Brownish soft consistency clayey silts . The coloured of the soil is Brownish firm silty clay mixed with sand . Soils are of medium , stiff very stiff and hard consistency . Beyond 10 m thickness of the overburden fine grained to coarse grained sands including conglomerate have been observed .

S.P.T. values in 12.0 m depth range vary between 27 to 37. Beyond 12.00 m depth of the stratum consistent “refusal” S.P.T. have been observed.

2.0. LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3. The tests as specified in schedule only have been conducted .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND
WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.4	4	
2.	Grain Size Analysis	1.5	4	
3.	Specific Gravity, Limit States	1.6	4	
4.	Triaxial Shear Test (UU)	1.7	4	
5.	Direct Shear Test	1.8	1	
6.	Consolidation Test	1.9	2	
7.	Chemical test on soil sample	1.10	1	
8.	Chemical test on water sample	1.11	1	

The laboratory tests results have been presented in following pages .

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.4

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	1.50 – 1.95	UDS1	1.85	20.50
2.	1	3.60 – 4.05	UDS2	1.91	21.30
3.	1	6.60 – 7.05	UDS3	1.95	22.18
4.	1	15.00 – 15.40	UDS4	2.06	19.40

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.5
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	1.50 – 1.95	UDS1	0.00	9.30	90.70	
2.	1	3.60 – 4.05	UDS2	1.60	16.40	82.00	
3.	1	6.60 – 7.05	UDS3	5.60	18.20	76.20	
4.	1	15.00 – 15.40	UDS4	7.30	21.20	71.50	

**LIMIT STATES
TABLE NO. 1.6**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	1.50 – 1.95	UDS1	2.65	58.80	27.00	31.80
2.	1	3.60 – 4.05	UDS2	2.70	52.40	25.00	27.40
3.	1	6.60 – 7.05	UDS3	2.72	49.20	24.86	24.34
4.	1	15.00 – 15.40	UDS4	2.62	47.60	23.00	24.60

**TABLE NO. 1.7
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	1.50 – 1.95	UDS1	0.320	23.50
2.	1	3.60 – 4.05	UDS2	0.426	27.50
3.	1	6.60 – 7.05	UDS3	0.510	31.40
4.	1	15.00 – 15.40	UDS4	0.608	32.90

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.8**

UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	6.60 – 7.05	UDS3	0.610	32.70

**TABLE NO. 1.9
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio “e”	Compression Index “C _c ”
1.	1	6.60 – 7.05	UDS3	0.6152	32.40
2.	1	15.00 – 15.40	UDS4	0.6596	34.10

**TABLE NO. 1.10
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	6.60	8.80	0.026	0.092

**TABLE NO. 1.11
CHEMICAL ANALYSIS
OF
WATER SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate ppm	Chloride ppm
1.	1	3.00	8.67	81	115

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 411

Sheet No. 1 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 5/6/08 to 8/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

W.T.: 2.40 m

Maruli

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.50	DS1				-----	Brownish soft consistency clayey silts .							
1						-----								
2	1.50-1.95 1.95-3.00	UDS1		GWL @ 2.40 m		-----								
3							-----							
4	3.00-3.60 3.60-4.05	SPT1 UDS2	27			-----	Fine grained very stiff clayey silts .							
5						-----								
6	4.05-6.00					-----								
7	6.00-6.60 6.60-7.05	SPT2 UDS3	33			-----	Hard consistency clayey silts .							
8						-----								
9	7.05-9.00					-----								
10	9.00-9.60 9.60-12.00	SPT3	37			-----	Fine grained clayey sands .							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 411

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 5/6/08 to 8/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Maruli

W.T.: 2.40 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	9.60-12.00					-----	Brownish silty clay.							
12	12.00-12.60 12.60-15.00	SPT4	42			-----	Very hard and dense clayey sands .							
13						-----								
14						-----								
15	15.00-15.40 15.40-18.00	UDS4				-----	Hard consistency clayey silts .							
16						-----								
17						-----								
18	18.00-18.45 18.45-21.00	SPT5	45			-----	Very hard cemented pebbles clayey silts to clay sands .							
19						-----								
20						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 411

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Maruli

Date: 5/6/08 to 8/6/08

W.T.: 2.40 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
	18.45-21.00					----	Brownish clayey coarse sands .							
21	21.00-21.45 21.45-24.00	SPT6	49			----	Very Dense Sands .							
22						----								
23						----								
24	24.00-24.45 24.45-27.00	SPT7	51			----	Sticky clayey greyish sands with pebbles, gravel .							
25						----								
26						----								
27	27.00-27.60 27.60-30.00	SPT8	50			----	Stiff hard clayey sands .							
28						----								
29						----								
30	30.00-30.45 30.45--	SPT9	R			----	Hard cementious conglomerate pieces .							

Bore hole terminated at 30.45 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 417

MINDOLA (BRIDGE NO. 417)

Mindola site is one of the proposed Railway bridge project . River is meandering with well defined gorge of uniform width with raised banks and cultivated lands on both ends .

1. EXPLORATION CHARACTERISTICS:

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only two bore hole has been planned for this site . In all total 11 nos. undisturbed and 34 nos. disturbed soil samples excluding S.P.T. samples have been collected from 2 nos. bore holes . The details of bore holes are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL /WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2 (DS)	D.S. S3
1.	1	45.15 m	2.50 m	6	15	18
2.	2	45.15 m	2.00 m	5	15	16

1.2. GROUND WATER :

The water samples were collected from the site . The water samples were collected before the start of the further boring work of the day so as to collect the natural ground water contents .

1.3 STANDARD PENETRATION TESTS : (IS 2131-1981)

This test was carried out using a Terzaghi spoon sampler driven by a 63.50 k.g. Hammer weight falling freely through a height 750 m.m. A comparative study of “ N ” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks

1.	1	3.00 --- 3.60	06-08-08-10	16 Very Stiff
	2	6.00 --- 6.60	08-10-10-12	20 Very Stiff
	3	9.00 --- 9.60	11-13-13-15	26 Brownish clayey Silt
	4	12.00 --- 12.60	10-12-13-15	25 Brownish very Stiff
	5	15.00 --- 15.60	12-14-14-16	28 Brownish very Stiff
	6	18.00 --- 18.60	13-15-15-18	30 Hard Clayey Silts
	7	21.00 --- 21.60	12-14-15-18	29 Brownish Stiff
	8	24.00 --- 24.60	14-16-16-18	32 Brownish Stiff
	9	27.00 --- 27.60	15-17-17-19	34 Brownish Clay
	10	30.00 --- 30.60	29-31-32-34	63 Brownish Clay
	11	33.00 --- 33.30	26-32 (0 cm)	R Refusal
	12	36.00 --- 36.60	31-33-34-36	67 Sandy Gravel
	13	39.00 --- 39.45	24-32-41	R Refusal
	14	42.00 --- 42.47	30-36-45 (2 cm)	R Refusal
	10	45.00 --- 45.15	36 (0 cm)	R Refusal

2.	1	3.00 --- 3.60	05-08-09-11	17 Brownish Stiff
	2	6.00 --- 6.60	07-09-10-12	19 Brownish Stiff
	3	9.00 --- 9.60	09-11-12-14	23 Brownish Stiff
	4	12.00 --- 12.60	11-13-14-16	27 Brownish Stiff
	5	15.00 --- 15.60	10-12-13-15	25 Brownish Stiff
	6	18.00 --- 18.60	08-10-11-13	21 Brownish Stiff
	7	21.00 --- 21.60	28-20-21-23	41 Brownish Stiff
	8	24.00 --- 24.60	17-19-19-21	38 Brownish Stiff
	9	27.00 --- 27.60	21-23-23-25	46 Brownish Stiff
	10	30.00 --- 30.60	29-31-32-34	63 Brownish Stiff
	11	33.00 --- 33.30	22-24-24	48 Brownish Stiff
	12	36.00 --- 36.60	31-33-34-36	67 Brownish Stiff
	13	39.00 --- 39.45	22-24-25	49 Brownish Stiff
	14	42.00 --- 42.47	28-30-31-33	61 Brownish Stiff
	10	45.00 --- 45.15	34 (0 cm)	R Refusal

1.4. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

D) RESIDUAL SOIL FORMATION: (0.00 m to 45.15 m)

The initial overburden consists of residual soil formation . Brownish to yellowish medium to stiff , very stiff and hard consistency low plasticity Clay to Sandy Clays predominance is for major 45 m thickness of the stratum . There is gradual increase in stiffness of the Clay stratum . The lowest stratum shows even refusal . In general Clay stratum is Inorganic Silts of medium to low plasticity. S.P.T. values in the initial reach of 10 m depth vary from 12 to 27 . In later portion S.P.T. values vary from 32 to refusal . In lowest zone Clay stratum is hard and tough .

2.0 LABORATORY TESTS :

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 . The tests as specified in schedule only have been conducted . The soil samples have been tested as per IS codes . The important IS codes for soils are IS: 2720 – 1985 (part--4), IS: 2720—1980 (part--3), IS: 2720— 1973 (part – 2, 4, 10, 24 & 26), IS: 2720--1986 (part-15) and IS: 9259 (part-1979).

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.4	11	
2.	Grain Size Analysis	1.5	11	
3.	Specific Gravity and Limit States	1.6	11	
4.	Triaxial Shear Test (UU)	1.7	11	
5.	Direct Shear Test	1.8	4	
6.	Consolidation Test	1.9	6	
7.	Chemical test on soil sample	1.10	1	
8.	Chemical test on water sample	1.11	1	

The laboratory tests results have been presented in following pages .

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.4**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	1.50 – 1.90	UDS1	1.79	19.20
2.	1	3.60 – 4.05	UDS2	1.82	17.76
3.	1	5.00 – 5.45	UDS3	1.76	18.40
4.	1	6.60 – 7.05	UDS4	1.80	16.98
5.	1	8.00 – 8.45	UDS5	1.83	18.29
6.	1	19.00 – 19.40	UDS6	1.85	17.40
7.	2	1.50 – 1.95	UDS1	1.74	18.60
8.	2	5.00 – 5.45	UDS2	1.77	17.40
9.	2	8.00 – 8.45	UDS3	1.82	18.30
10.	2	10.00 – 10.45	UDS4	1.79	19.00
11.	2	17.00 – 17.45	UDS5	1.83	17.50

**TABLE NO. 1.5
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt + Clay %
1.	1	1.50 – 1.90	UDS1	0.20	11.40	88.40
2.	1	3.60 – 4.05	UDS2	1.00	15.30	83.70
3.	1	5.00 – 5.45	UDS3	0.00	18.50	81.50
4.	1	6.60 – 7.05	UDS4	3.20	17.00	79.80
5.	1	8.00 – 8.45	UDS5	4.00	21.40	74.60
6.	1	19.00 – 19.40	UDS6	3.90	29.50	66.60
7.	2	1.50 – 1.95	UDS1	0.00	9.60	90.40
8.	2	5.00 – 5.45	UDS2	5.40	24.30	70.30
9.	2	8.00 – 8.45	UDS3	5.00	32.30	62.70
10.	2	10.00 – 10.45	UDS4	11.40	27.50	61.10
11.	2	17.00 – 17.45	UDS5	8.90	18.40	72.70

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.6**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	1.50 – 1.90	UDS1	2.67	53	28	25
2.	1	3.60 – 4.05	UDS2	2.63	55	29	26
3.	1	5.00 – 5.45	UDS3	2.69	51	24	27
4.	1	6.60 – 7.05	UDS4	2.71	48	25	23
5.	1	8.00 – 8.45	UDS5	2.64	44	23	21
6.	1	19.00 – 19.40	UDS6	2.67	42	24	18
7.	2	1.50 – 1.95	UDS1	2.69	50	26	24
8.	2	5.00 – 5.45	UDS2	2.71	54	28	26
9.	2	8.00 – 8.45	UDS3	2.66	57	26	31
10.	2	10.00 – 10.45	UDS4	2.63	50	24	26
11.	2	17.00 – 17.45	UDS5	2.67	44	24	20

**TABLE NO. 1.7
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	1.50 – 1.90	UDS1	0.22	12.40
2.	1	3.60 – 4.05	UDS2	0.38	21.40
3.	1	5.00 – 5.45	UDS3	0.33	25.50
4.	1	6.60 – 7.05	UDS4	0.39	27.10
5.	1	8.00 – 8.45	UDS5	0.41	25.59
6.	1	19.00 – 19.40	UDS6	0.49	28.40
7.	2	1.50 – 1.95	UDS1	0.24	11.10
8.	2	5.00 – 5.45	UDS2	0.36	23.30
9.	2	8.00 – 8.45	UDS3	0.32	24.40
10.	2	10.00 – 10.45	UDS4	0.38	26.30
11.	2	17.00 – 17.45	UDS5	0.41	25.06

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.8**

UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	6.60 – 7.05	UDS4	0.34	25.05
2.	1	8.00 – 8.45	UDS5	0.38	23.15
3.	2	8.00 – 8.45	UDS3	0.37	19.60
4.	2	10.00 – 10.45	UDS4	0.35	23.70

**TABLE NO. 1.9
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio “e”	Compression Index “C _c ”
1.	1	5.00 – 5.45	UDS3	0.1234	0.231
2.	1	6.60 – 7.05	UDS4	0.1182	0.198
3.	1	8.00 – 8.45	UDS5	0.1215	0.116
4.	2	5.00 – 5.45	UDS2	0.2196	0.210
5.	2	8.00 – 8.45	UDS3	0.1578	0.189
6.	2	10.00 – 10.45	UDS4	0.1092	0.141

**TABLE NO. 1.10
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, M	pH	Sulphate %	Chloride %
1.	2	5.00	8.70	0.023	0.048

LABORATORY TESTS
TABLE NO. 1.11
CHEMICAL ANALYSIS
OF
WATER SAMPLE

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate ppm	Chloride ppm
1.	1	8.00	8.50	078	140

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 1
Bridge No. 417
Sheet No. 1 of 5
(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm
Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.15 m
Date: 24/5/08 to 28/5/08
W.T.: 2.50 m

Location:- (As per sketch)
Mindola

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%		
	Depth (m)	Type														
0	0.00-1.50	DS1	16	GWL @ 2.50 m		-----	Brownish silty clay to silty clay soils of stiff consistency.									
1	1.50-1.90	UDS1				-----										
2	1.90-3.00					-----										
3	3.00-3.60	SPT1	20			-----	Very stiff consistency clayey silts .									
4	3.60-4.05	UDS2				-----										
5	4.05-5.00	UDS3	20			-----	Very stiff to hard consistency clayey silts .									
6	5.00-5.45					SPT2		-----								
7	5.45-6.00	UDS4	26			-----	Brownish hard clayey silts with gravel .									
8	6.00-6.60	SPT3				-----										
9	6.60-7.05	UDS5				-----										
10	7.05-8.00	SPT3				-----										
	8.00-8.45	SPT3				-----										
	8.45-9.00					-----										
	9.00-9.60	SPT3				-----										
	9.60-12.00					-----										

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 1

Bridge No. 417

Sheet No. 2 of 5

(BGL) R. L. :- 0.00 m

T.D (m) :- 45.15 m

Date: 24/5/08 to 28/5/08

W.T.: 2.50 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	9.60-12.00					-----	Brownish stiff silty clays with gravel .							
12	12.00-12.60	SPT4	25			-----								
13	12.60-15.00					-----								
14						-----								
15	15.00-15.60	SPT5	28			-----	Brownish stiff silt clay with gravel .							
16	15.60-18.00					-----								
17						-----								
18	18.00-18.60	SPT6	30			-----	Fine Clayey hard Silts .							
19	18.60-19.00					-----								
19	19.00-19.40	UDS5				-----								
20	19.40-21.00					-----								
20						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 417

Sheet No. 3 of 5

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 24/5/08 to 28/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.: 2.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	19.40-21.00					-----	Brownish stiff Silty Clay with gravel .							
22	21.00-21.60 21.60-24.00	SPT6	29			-----	Brownish very Stiff Silty Clays .							
23						-----								
24	24.00-24.60 24.60-27.00	SPT7	32			-----	Brownish Stiff Clayey Silts with gravel .							
25						-----								
26						-----								
27	27.00-27.60 27.60-30.00	SPT8	34			-----	Brownish hard clay with gravel .							
28						-----								
29						-----								
30	30.00-30.60	SPT9	63			-----	Brownish clay with hard Gravelly clays.							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 417

Sheet No. 4 of 5

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 24/5/08 to 28/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.: 2.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
31	30.60-33.00					----	Brownish hard Gravelly, sandy clays .							
32						----								
33	33.00-33.30 33.30-36.00	SPT10	R			----	Hard clayey sand gravel stratum .							
34						----								
35						----								
36	36.00-36.60 36.60-39.00	SPT11	67			----	Hard clayey sandy Gravel .							
37						----								
38						----								
39	39.00-39.45 39.45-42.00	SPT12	R			----	Blackish fine grained sands with pebble.							
40						----								

RENUKA ENGINEERSPROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .**B. H. No. 1****Bridge No. 417**

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 5 of 5

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Date: 24/5/08 to 28/5/08

W.T.: 2.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxial C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
41	39.45-42.00					-----	Blackish grey pebbles fine grained sands .							
42	42.00-42.47 42.47-45.00	SPT13	R			-----								
43						-----								
44						-----								
45	45.00-45.15 45.15--	SPT14	R			-----	Blackish sand with Gravel pieces .							

Bore hole terminated at 45.15 m

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 417

Sheet No. 1 of 5

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Date: 29/5/08 to 31/5/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.50	DS1				-----	Brownish to black silty clays of medium consistency.							
1	1.50-1.95	UDS1				-----	Stiff consistency Clayey Silts .							
2	1.95-3.00					-----								
3	3.00-3.60	SPT1	17			-----	Brownish stiff silty clay .							
4	3.60-5.00					-----								
5	5.00-5.45	UDS2				-----								
6	5.45-6.00					-----								
7	6.00-6.60	SPT2	19			-----	Brownish very stiff Silty Clays							
8	6.60-8.00					-----								
9	8.00-8.45	UDS3				-----								
10	8.45-9.00					-----								
9	9.00-9.60	SPT3	23			-----	Brownish very stiff silty clays with gravel .							
10	9.60-10.00					-----								
10	10.00-10.45	UDS4				-----								
	10.45-12.00					-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 417

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 2 of 5

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

Date: 29/5/08 to 31/5/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.45-12.00					-----	Brownish very stiff silty clays with gravel .							
12	12.00-12.60 12.60-15.00	SPT4	27			-----	Very stiff to hard consistency Clays .							
13						-----								
14						-----								
15	15.00-15.60 15.60-17.00	SPT5	25			-----	Brownish very stiff silt clay with sands .							
16						-----								
17	17.00-17.45 17.45-18.00	UDS5				-----								
18	18.00-18.60 18.60-21.00	SPT6	21			-----	Brownish very stiff silt clay with sands .							
19						-----								
20						-----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 417

Sheet No. 3 of 5

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 29/5/08 to 31/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	18.60-21.00					-----	Brownish very stiff silty clay with gravel .							
22	21.00-21.60 21.60-24.00	SPT6	41			-----	Brownish hard consistency Clay.							
23						-----								
24	24.00-24.60 24.60-27.00	SPT7	38			-----	Brownish stiff silt clay with gravel .							
25						-----								
26						-----								
27	27.00-27.60 27.60-30.00	SPT8	46			-----	Brownish hard clay with gravel .							
28						-----								
29						-----								
30	30.00-30.60	SPT9	63			-----	Brownish hard clay with gravel .							

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 417

Sheet No. 4 of 5

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 29/5/08 to 31/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Mindola

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
31	30.60-33.00					-----	Brownish hard clay with gravel .							
32						-----								
33	33.00-33.30 33.30-36.00	SPT10	48			-----	Brownish hard clay with gravel with pebbles cementation pieces.							
34						-----								
35						-----								
36	36.00-36.60 36.60-39.00	SPT11	67			-----	Conglomerate type stratum							
37						-----								
38						-----								
39	39.00-39.45 39.45-42.00	SPT12	49			-----	Very hard fine grained sandy clays with hard cemented pieces of gravel.							
40						-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 2

Bridge No. 417

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 5 of 5

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 45.15 m

Casing diameter (mm) : i) 100mm and ii) 76mm Location:- (As per sketch)
Mindola

Date: 29/5/08 to 31/5/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / ϕ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
41	39.30-42.00					-----	Brownish hard clay with gravel .							
42	42.00-42.60 42.60-45.00	SPT13	61			-----	Very hard fine grained sandy clays .							
43						-----								
44						-----								
45	45.00-45.15 45.15--	SPT14	R			-----	Very hard cementatious clay binder pebbles cementation pieces.							

Bore hole terminated at 45.15 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 419

MITHI KHADI (BRIDGE NO. 419)

Topographically site gorge is rather flatter in middle portion . The key plan of site is attached .

1. EXPLORATION CHARATCTERISTICS:

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

One bore hole has been planned for this site . In all total 7 nos. undisturbed and 15 nos. disturbed soil samples excluding S.P.T. samples have been collected from 1 no. bore hole . The details are presented in Table no. 1.1.

**TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES**

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	30.45 m	0.50 m	7	10	12

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

**TABLE 1.2
STANDARD PENETRATION TEST RESULTS**

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
	1.	3.00 --- 3.60	04-06-07-09	13 Blackish Stiff
	2	6.00 --- 6.60	12-14-16-18	30 Blackish Very Stiff
	3	7.45 --- 7.90	17-19-20-23	39 Blackish Very hard
	4	9.00 --- 9.60	20-21-22-25	43 Very Stiff
	5	12.00 --- 12.60	20-22-21-20	43 Very Hard Stiff

Continued

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	6	15.00 --- 15.60	21-23-24-26	47 Brownish Clay
	7	18.00 --- 18.60	19-21-21-23	42 Brownish Clay
	8	21.00 --- 21.20	26-35-42-51	R Refusal Conglomerate
	9	24.00 --- 24.05	31-46-51-56	R Refusal ---- “ ----
	10	27.00 --- 27.10	30-42-54-58	R Refusal----- “ “ ----

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.2 and the details are specified as below.

I) BROWNISH CLAYEY SILTS : (0.00 m---21.20 m)

Overburden of soft stratum is Blackish soft to stiff firm silty clay . At 15.00 m depth Brownish Blackish Gravelly Sandy Silty Clay compact solid hard stratum has been observed . S.P.T. values in 10 m thickness vary between 13 to 43. Average S.P.T value is 33. Beyond 15 m thickness brownish blackish Gravelly Sandy Silty compact mass pieces are observed . Soils are of medium to low plasticity Silts .

Moreover stratum is over consolidated . Void ratios are less than with one and coefficient of compression is also quite low . Considering the S.P.T. values angle of intergranular friction is quite large i.e. about 30° .

II) CONGLOMERATE ROCKS : (21.20 m — 30.45 m)

Stratum beyond 21.20 m consists of cemented rock mass of Silty Clay Sand Conglomerate rock stratum. Rock is a strong and compact mixture of pebbles cemented rock mass. It has good strength and is tough mass. Recovery variation of 38 % to 67 % and R.Q.D. variation of 23 % to 45 % have been observed. Rock mass is good hard stratum for resting piles .

2.0 LABORATORY TESTS:

The laboratory tests conducted on undisturbed soil samples and rock samples recovered from bore holes are given in Table No. 1.3 and 1.4 .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND
WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.5	7	
2.	Grain Size Analysis	1.6	13	
3.	Specific Gravity, Limit States	1.7	10	
4.	Triaxial Shear Test (UU)	1.8	7	
5.	Direct Shear Test	1.9	2	
6.	Consolidation Test	1.10	7	
7.	Chemical test on soil sample	1.11	1	
8.	Chemical test on water sample	1.12	1	

The laboratory tests results have been presented in following pages .

TABLE NO. 1.4
DETAILS OF LABORATORY TESTS CONDUCTED ON ROCK
SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Unconfined Compression Strength	1.13	3	
2.	Density & Specific Gravity	1.14	3	
	Water Absorption and Porosity	1.14	3	
3.	Point Load Strength	1.15	3	

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.5

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	0.50 - 0.95	UDS1	1.76	19.52
2.	1	1.50 - 1.95	UDS2	1.84	20.74
3.	1	3.60 - 4.00	UDS3	1.87	21.42
4.	1	4.00 - 4.45	UDS4	1.90	19.61
5.	1	7.00 - 7.45	UDS5	1.92	20.54
6.	1	10.00 - 10.45	UDS6	1.88	17.46
7.	1	11.00 - 11.45	UDS7	1.88	18.24

**LABORATORY TESTS
ON
UNDISTURBED / DISTURBED SOIL SAMPLES
TABLE NO. 1.6
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	0.50 - 0.95	UDS1	0.00	3.50	96.50	
2.	1	1.50 - 1.95	UDS2	1.20	6.90	91.90	
3.	1	3.60 - 4.00	UDS3	0.00	9.50	90.50	
4.	1	4.00 - 4.45	UDS4	3.20	11.40	84.40	
5.	1	7.00 - 7.45	UDS5	4.40	13.70	81.90	
6.	1	10.00 - 10.45	UDS6	5.10	23.60	71.30	
7.	1	11.00 - 11.45	UDS7	6.90	34.20	58.90	
8.	1	3.00 – 3.60	SPT1	0.00	5.00	95.00	
9.	1	6.00 – 6.60	SPT2	0.00	10.00	90.00	
10.	1	12.00 – 12.60	SPT5	11.00	77.00	12.00	
11.	1	15.00 – 15.60	SPT6	0.00	83.00	17.00	
12.	1	21.00 – 21.60	SPT8	0.00	91.00	9.00	
13.	1	30.00 – 30.45	SPT11	7.00	39.00	54.00	

**LABORATORY TESTS
ON
UNDISTURBED / DISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.7**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	0.50 - 0.95	UDS1	2.62	57.50	25.00	32.50
2.	1	1.50 - 1.95	UDS2	2.67	54.50	23.00	31.50
3.	1	3.60 - 4.00	UDS3	2.69	57.00	24.00	33.00
4.	1	4.00 - 4.45	UDS4	2.66	48.00	23.00	25.00
5.	1	7.00 - 7.45	UDS5	2.61	49.60	22.50	27.10
6.	1	10.00 - 10.45	UDS6	2.69	46.0	21.00	25.00
7.	1	11.00 - 11.45	UDS7	2.71	42.00	20.00	22.00
8.	1	3.00 – 3.60	SPT1	---	58.07	20.07	38.00
9.	1	6.00 – 6.60	SPT2	---	47.88	24.45	23.43
10.	1	30.00 – 30.45	SPT11	--	51.32	27.45	23.87

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.8**

UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	0.50 - 0.95	UDS1	0.480	16.50
2.	1	1.50 - 1.95	UDS2	0.367	21.40
3.	1	3.60 - 4.00	UDS3	0.391	25.60
4.	1	4.00 - 4.45	UDS4	0.408	27.86
5.	1	7.00 - 7.45	UDS5	0.392	30.20
6.	1	10.00 - 10.45	UDS6	0.489	32.50
7.	1	11.00 - 11.45	UDS7	0.563	33.40

**LABORATORY TESTS
ON
UNDISTURBED / DISTURBED SOIL SAMPLES
TABLE NO. 1.9**

UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	1.50—1.95	UDS2	0.421	23.08
2.	1	3.60—4.00	UDS3	0.460	26.70

**TABLE NO. 1.10
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio “e”	Compression Index “C _c ”
1.	1	0.50 - 0.95	UDS1	1.4354	0.340
2.	1	1.50 - 1.95	UDS2	1.3416	0.289
3.	1	3.60 - 4.00	UDS3	1.2985	0.278
4.	1	4.00 - 4.45	UDS4	1.1063	0.198
5.	1	7.00 - 7.45	UDS5	1.1864	0.119
6.	1	10.00 - 10.45	UDS6	1.1088	0.121
7.	1	11.00 - 11.45	UDS7	1.2057	0.117

**TABLE NO. 1.11
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	4.00	8.40	0.028	0.076

**TABLE NO. 1.12
CHEMICAL ANALYSIS
OF
WATER SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate ppm	Chloride ppm
1.	1	7.00	8.80	78	96

**LABORATORY TESTS
ON
ROCK SAMPLES
TABLE No. 1.13
UNCONFINED COMPRESSION STRENGTH**

Sr. No.	Bore hole No.	Depth, m	Unconfined Compression Strength kg/cm ²	Saturated Unconfined Compression Strength kg/cm ²
1.	1	21.20 m – 24.00 m	215.50	---
2.	1	24.05 m – 27.00 m	320.40	234.90
3.	1	27.10 m – 30.45 m	407.40	317.20

**TABLE No. 1.14
UNIT WEIGHT AND WATER ABSORPTION**

Sr. No.	Bore hole No.	Depth	Density Gm/cm ³	Specific Gravity	Water Absorption, %	Porosity %
1.	1	21.20 m – 24.00 m	2.650	2.71	4.853	5.29
2.	1	24.05 m – 27.00 m	2.750	2.75	3.270	4.67
3.	1	27.10 m – 30.45 m	2.850	2.72	3.982	4.85

POINT LOAD STRENGTH TEST
TABLE NO. 1.15

Sr. No.	Bore hole No.	Depth, m	Point Load Strength kg/cm ²
1.	1	21.20 m – 24.00 m	9.50
2.	1	24.05 m – 27.00 m	13.25
3.	1	27.10 m – 30.45 m	16.26

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 1
Bridge No. 419
Sheet No. 1 of 3
(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 25/5/08 to 22/5/08

Location:- (As per sketch)
Metikhadi

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-0.50	DS1		GWL @ 0.50 m		-----	Blackish soft to stiff firm silty clay.							
	0.50-0.95	UDS1												
	0.95-1.50	DS2												
1														
	1.50-1.95	UDS2				-----								
	1.95-3.00	DS3												
2														
3	3.00-3.60	SPT1	13			-----	Blackish stiff silty clays.							
	3.60-4.00	UDS3												
4	4.00-4.45	UDS4				-----								
	4.45-6.00													
5														
6	6.00-6.60	SPT2	22			-----	Blackish very stiff clayey silts .							
	6.60--7.00	DS4												
7	7.00--7.45	UDS5				-----								
	7.45---7.90	SPT3												
	7.90--9.00													
8														
9	9.00-9.60	SPT4	27			-----	Very stiff Clayey silts							
	9.60-10.00													
10	10.00-10.45	UDS6												

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 419

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 25/5/08 to 22/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
	10.45-11.00	DS				----	Blackish very stiff clayey silt .							
11	11.00--11.45	UDS7				----								
	11.45--12.00					----								
12	12.00-12.60	SPT5	35			----	Very hard stiff Clay Sand Stratum.							
	12.60-15.00					----								
13						----								
14					17.00	----								
15	15.00-15.60	SPT6	46			----	Brownish Blackish Gravelly Sandy Silty Clay compact solid hard stratum .							
	15.60-18.00					----								
16						----								
17						----								
18	18.00-18.60	SPT7	42			----	Brownish clay gravelly sands mixed kankars. (Conglomerated mixture).							
	18.60-21.00					----								
19						----								
20						----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 419

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.45 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 25/5/08 to 22/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Metikhadi

W.T.: 0.50 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	18.60-21.00					-----	Brownish sandy gravel with mixed kankars. (Conglomerated mixture).							
	21.00-21.60	SPT8	R			-----	Blackish dark clayey sands .							
22	21.60-24.00					-----								
23						-----								
24	24.00-24.60	SPT9	R			-----	Brownish conglomerated sandy cemented stratum .							
25	24.60-27.00					-----								
26						-----								
27	27.00-27.60	SPT10	R			-----	Brownish whitish colour gravelly silty conglomerated mixture .							
28	27.60-30.00					-----								
29						-----								
30	30.00-30.45					-----								
	30.45--					-----								

Bore hole terminated at 30.45 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 422

HANUMAN KHADI (BRIDGE NO. 422)

Topographically site terrain is a normal gorge portion with Silty Sandy Clay bed stratum .

1. EXPLORATION CHARACTERISTICS :

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only one bore hole has been planned for this site . In all total 6 nos. undisturbed and 16 nos. disturbed soil samples excluding S.P.T. samples have been collected from 1 no. bore hole . Ground water sample has also been collected . The details are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL / WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L.	Ground Water Level	U D S S1	S.P.T. S2(DS)	D.S. S3
1.	1	30.00 m	2.00 m	6	12	16

1.2. STANDARD PENETRATION TESTS : (IS 2131-1981)

A comparative study of “N” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	2.50 --- 2.95	07-09-09	18 Brownish Stiff
	2	3.00 --- 3.60	08-10-11-13	21 Brownish Stiff
	3	4.50 --- 5.10	12-14-15-17	29 Very Stiff
	4	7.45 --- 7.90	18-20-20	40 Brownish Clay

Continued

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	5	10.50 --- 11.10	19-20-19-21	39 Brownish Clay
	6	12.00 --- 12.45	18-20-22	42 Brownish Clay
	7	13.50 --- 14.10	26-31-42-50	R Refusal
	8	16.00 --- 16.35	24-30-24 (5 cm)	R Refusal
	9	18.50 --- 18.70	30-23 (5 cm)	R Refusal
	10	21.00 --- 21.20	26-20 (5 cm)	R Refusal
	11	25.50 --- 25.70	31-22 (5 cm)	R Refusal
	12	30.00 --- 30.00	23 (0 cm)	R Refusal

1.3. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.2 and the details are specified as below.

D) RESIDUAL SOIL FORMATION: (0.00 m to 30.00 m)

The overburden properties vary from brownish Silty Clays to Clayey Sandy Silts of low plasticity . In lower depths gravelly pebbles cemented materials as well as Fine Grained to Coarse Grained Sands are predominant . S.P.T. values in initial depth of 10 m vary between 18 to 40 .

Beyond 13.0 m depth S.P.T. values are invariably refusal . Clayey Silty Sands with dense to very dense are common in lower reach . Soils display medium to low plasticity characteristics . Slight to significant % of sand and gravel is observed in lower depths . In extreme lower portion conglomerate rock pieces have been observed .

2.0. LABORATORY TESTS :

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 .

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND
WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.4	6	
2.	Grain Size Analysis	1.5	12	
3.	Specific Gravity, Limit States	1.6	8	
4.	Triaxial Shear Test (UU)	1.7	6	
5.	Direct Shear Test	1.8	1	
6.	Consolidation Test	1.9	6	
7.	Chemical test on soil sample	1.10	1	

The laboratory tests results have been presented in following pages .

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.4

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	1.50 - 1.95	UDS1	1.85	19.86
2.	1	3.60 - 4.05	UDS2	1.76	23.62
3.	1	5.50 - 6.10	UDS3	1.71	19.35
4.	1	7.00 - 7.45	UDS4	1.82	18.62
5.	1	8.10 - 8.55	UDS5	1.70	20.43
6.	1	11.10 - 11.55	UDS6	1.95	17.66

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.5
PARTICLE SIZE DISTRIBUTION**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt %	Clay %
1.	1	1.50 - 1.95	UDS1	1.04	12.42	86.54	
2.	1	3.60 - 4.05	UDS2	6.50	22.80	70.70	
3.	1	5.50 - 6.10	UDS3	3.46	20.25	76.29	
4.	1	7.00 - 7.45	UDS4	6.60	48.35	45.05	
5.	1	8.10 - 8.55	UDS5	10.54	28.34	61.12	
6.	1	11.10 - 11.55	UDS6	9.57	60.25	30.18	
7.	1	3.00 - 3.60	SPT2	22.00	28.00	50.00	
8.	1	7.45 - 7.90	SPT4	10.00	47.00	43.00	
9.	1	13.50 - 14.10	SPT7	19.00	69.00	12.00	
10.	1	21.00 - 21.05	SPT10	0.00	88.00	12.00	
11.	1	25.50 - 25.60	SPT11	2.00	70.00	28.00	
12.	1	30.00 - 30.00	SPT12	0.00	82.00	18.00	

**LIMIT STATES
TABLE NO. 1.6**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	1.50 - 1.95	UDS1	2.65	56.00	27.00	29.00
2.	1	3.60 - 4.05	UDS2	2.69	51.00	25.00	26.00
3.	1	5.50 - 6.10	UDS3	2.64	54.00	26.00	28.00
4.	1	7.00 - 7.45	UDS4	2.70	---	N.P.	---
5.	1	8.10 - 8.55	UDS5	2.68	47.00	24.00	23.00
6.	1	11.10 - 11.55	UDS6	2.66	---	N.P.	---
8.	1	7.45 - 7.90	SPT4	---	---	N.P.	---

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES**

**TABLE NO. 1.7
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	1.50 - 1.95	UDS1	0.371	18.60
2.	1	3.60 - 4.05	UDS2	0.382	24.40
3.	1	5.50 - 6.10	UDS3	0.430	26.30
4.	1	7.00 - 7.45	UDS4	0.380	29.30
5.	1	8.10 - 8.55	UDS5	0.475	32.14
6.	1	11.10 - 11.55	UDS6	0.320	33.50

**TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	5.50	UDS3	0.324	27.40

**TABLE NO. 1.9
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio “e”	Compression Index “C _c ”
1.	1	1.50 - 1.95	UDS1	1.3563	0.389
2.	1	3.60 - 4.05	UDS2	1.2851	0.218
3.	1	5.50 - 6.10	UDS3	1.3216	0.278
4.	1	7.00 - 7.45	UDS4	1.1455	0.187
5.	1	8.10 - 8.55	UDS5	1.0864	0.141
6.	1	11.10 - 11.55	UDS6	1.1656	0.131

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.10
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	3.60	8.40	0.015	0.029

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 422

Sheet No. 1 of 3

CLIENT: Stup Consultants Pvt. Ltd.

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)

Date: 15/5/08 to 16/5/08

Sachin

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-1.50	DS1				-----	Brownish soft consistency Clayey silts.							
1	1.50-1.95	UDS1				-----	Brownish sandy clayey silts .							
2	1.95-2.50	DS2				-----								
				GWL @ 2.00 m		-----	Brownish silty clay mixed sand .							
3	2.50--2.95	SPT1	18					-----						
	2.95--3.00					-----	Silty clay mixed with white gravels . Very stiff stratum of Sandy Silty Clay.							
4	3.00-3.60	SPT2	21			-----								
	3.60--4.05	UDS2				-----	Brownish silty clay mixed gravels.							
5	4.05--4.50	DS3				-----								
	4.50-5.10	SPT3	29			-----	Brownish silty clay with medium sand .							
6	5.10-5.50	DS4				-----								
	5.50-6.10	UDS3				-----	Brownish silty clay with medium sand .							
7	6.10-7.00	DS5				-----								
	7.00-7.45	UDS4				-----	Brownish silty clay with medium sand .							
8	7.45--7.90	SPT4	40			-----								
	7.90--8.10	DS6				-----	Brownish silty clay with medium sand .							
9	8.10--8.55	UDS5				-----								
	8.55--10.50	DS7				-----	Brownish silty clay with medium sand .							
10	10.50-11.10	SPT5	39			-----								

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 422

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 15/5/08 to 16/5/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.50-11.10	SPT5	39			-----	Brownish Silty clayey medium dense sands .							
	11.10--11.55	UDS6				-----								
	11.55--12.00					-----								
12	12.00--12.45	SPT6	42			-----								
	12.45--13.50					-----								
13	13.50-14.10	SPT7	R			-----	Extreme hard stratum of cementitious pebbles conglomerate material .							
14	14.10-15.00				17.00	-----								
	15.00-16.00					-----								
15	16.00--16.35	SPT8	R			-----	Hard silty fine grained sands .							
16	16.35-18.50					-----	Brownish silty clay mixed with sand , pebbles .							
17						-----								
18						-----								
19	18.50--18.70 18.70--21.00	SPT9	R			-----	Gravelly clayey sands of hard consistency.							
20						-----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 422

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin

Date: 15/5/08 to 16/5/08

W.T.: 2.00 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	18.55-21.00	SPT10	R			-----	Brownish coloured silty clay mixed with sand .							
	21.00--21.20													
	21.20-23.00													
22		SPT11	R			-----	Brownish colour gravelly mixed with gravelly.							
23		SPT11	R			-----	Gravelly clayey conglomerated mixtures.							
24		SPT11	R			-----	Gravelly clayey conglomerated mixtures.							
25		SPT11	R			-----	Gravelly clayey conglomerated mixtures.							
26		SPT11	R			-----	Gravelly clayey conglomerated mixtures.							
27		SPT11	R			-----	Gravelly clayey conglomerated mixtures.							
28		SPT12	R			-----	Brownish silty clay with whitish coloured gravel .							
29		SPT12	R			-----	Brownish silty clay with whitish coloured gravel .							
30		SPT12	R			-----	Hard pebbles cemented gravel sand conglomerate .							
	30.00--					-----								

Bore hole terminated at 30.00 m

GEO-TECHNICAL INVESTIGATION REPORT

BRIDGE NO. 428

SACHIN (BRIDGE NO. 428)

Topographically terrain is fairly leveled plain with agricultural lands on both sides of the existing alignment .

1. EXPLORATION CHARACTERISTICS DETAILS :

1.1. UNDISTURBED AND DISTURBED SOIL SAMPLES :

Only one bore hole has been planned for this site . In all total 5 nos. undisturbed and 12 nos. disturbed soil samples excluding S.P.T. samples have been collected from 1 no. bore hole . The details of bore holes are presented in Table no. 1.1.

TABLE NO. 1.1
DETAILS OF BORE HOLES AND SOIL /WATER SAMPLES

Sr. No.	Bore hole no.	Depth Below G.L	Ground Water Level	U D S S1	S.P.T. S2 (DS)	D.S. S3
1.	1	30.30 m	1.70 m	5	9	12

1.2. GROUND WATER :

The water samples were collected from the site .

1.3. STANDARD PENETRATION TESTS : (IS 2131-1981)

A comparative study of “ N ” values (i.e. no. of blows / 30 cm) penetration using Terzaghi’s split spoon sampler , are presented in Table no. 1.2.

TABLE 1.2
STANDARD PENETRATION TEST RESULTS

B.H. No.	Sr. No.	Depth of test m	“ N ” Value blows/30 cms	Remarks
1.	1	3.00 --- 3.60	09-11-13-17	24 Brownish Stiff
	2	6.00 --- 6.60	22-42-36-41	35 Very hard
	3	9.00 --- 9.60	07-11-40-48	51 Brownish hard
	4	12.00 --- 12.60	25-27-41-45	68 Brownish Hard
	5	15.00 --- 15.30	30-36 (0 cm)	R Refusal
	6	21.00 --- 21.30	40-49 (0 cm)	R Refusal
	7	24.00 --- 24.15	49 (0 cm)	R Refusal
	8	27.00 --- 27.60	19-30-35-41	65 Sand Stratum
	9	30.00 --- 30.30	30-48 (0 cm)	R Refusal

1.4. SOIL PROFILE:

The soil profile is presented in Annexure - I Fig. No. 1.1 and the details are specified as below.

D) RESIDUAL SOIL FORMATION: (0.00 m to 30.30 m)

The initial overburden consists of residual soil formation . Brownish to yellowish medium to stiff , very stiff and hard consistency low plasticity Clayey Silts predominance is for major thickness of the stratum . There is significant increase in stiffness of the Clayey Silt stratum . The stratum at 9.0 m shows even refusal . In general Clay stratum is MH Inorganic Silts of medium to low plasticity. S.P.T. values in the initial reach of 10 m depth vary from 24 to 51 . In later portion S.P.T. values vary from 68 to refusal . In lowest zone Clay stratum is hard and tough .

2.0. LABORATORY TESTS :

The laboratory tests conducted on undisturbed soil samples recovered from bore holes are given in Table No. 1.3 . The tests as specified in schedule only have been conducted . The soil samples have been tested as per IS codes . The important IS codes for soils are IS: 2720 – 1985 (part--4), IS: 2720—1980 (part--3), IS: 2720— 1973 (part – 2, 4, 10, 24 & 26), IS: 2720--1986 (part-15) and IS: 9259 (part-1979).

TABLE NO. 1.3
DETAILS OF LABORATORY TESTS CONDUCTED ON SOIL AND
WATER SAMPLES

S.No	Description	Table Nos.	Nos.	Remarks
1.	Bulk Density & N.M.C.	1.4	4	
2.	Grain Size Analysis	1.5	4	
3.	Specific Gravity, Limit	1.6	4	
4.	Triaxial Shear Test (UU)	1.7	4	
5.	Direct Shear Test	1.8	2	
6.	Consolidation Test	1.9	2	
7.	Chemical test on soil sample	1.10	1	
8.	Chemical test on water sample	1.11	1	

The laboratory tests results have been presented in following pages .

LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
BULK DENSITY AND N.M.C.
TABLE NO. 1.4

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Bulk Density gm/cc	N.M.C. %
1.	1	2.00 – 2.45	UDS1	1.820	18.30
2.	1	5.00 – 5.45	UDS2	1.890	17.50
3.	1	7.50 – 7.95	UDS3	1.950	19.10
4.	1	10.00 – 10.45	UDS4	2.040	18.06

TABLE NO. 1.5
PARTICLE SIZE DISTRIBUTION

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Gravel %	Sand %	Silt - Clay %
1.	1	2.00 – 2.45	UDS1	0.00	10.20	89.80
2.	1	5.00 – 5.45	UDS2	3.40	13.40	83.20
3.	1	7.50 – 7.95	UDS3	6.90	18.30	74.80
4.	1	10.00 – 10.45	UDS4	5.40	21.30	73.30

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
LIMIT STATES
TABLE NO. 1.6**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Specific Gravity	Liquid Limit	Plastic Limit	Plasticity Index
1.	1	2.00 – 2.45	UDS1	2.61	49	25	24
2.	1	5.00 – 5.45	UDS2	2.66	47	24	23
3.	1	7.50 – 7.95	UDS3	2.67	43	24	19
4.	1	10.00 – 10.45	UDS4	2.70	52	27	25

**TABLE NO. 1.7
UNCONSOLIDATED UNDRAINED TRIAXIAL SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	2.00 – 2.45	UDS1	0.316	22.30
2.	1	5.00 – 5.45	UDS2	0.425	26.70
3.	1	7.50 – 7.95	UDS3	0.530	25.30
4.	1	10.00 – 10.45	UDS4	0.620	25.80

**TABLE NO. 1.8
UNCONSOLIDATED UNDRAINED DIRECT SHEAR TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Cohesion Kg/cm ²	Angle of Friction “ ϕ^0 ”
1.	1	2.00 – 2.45	UDS1	0.364	24.10
2.	1	5.00 – 5.45	UDS2	0.460	25.90

**LABORATORY TESTS
ON
UNDISTURBED SOIL SAMPLES
TABLE NO. 1.9
CONSOLIDATION TEST**

Sr. No.	Bore hole No.	Depth, m	Type of Sample	Void Ratio "e"	Compression Index "C _c "
1.	1	2.00 – 2.45	UDS1	1.3024	0.138
2.	1	5.00 – 5.45	UDS2	1.1652	0.117

**TABLE NO. 1.10
CHEMICAL ANALYSIS OF SOILS**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate %	Chloride %
1.	1	7.50	8.20	traces	0.07

**LABORATORY TESTS
TABLE NO. 1.11
CHEMICAL ANALYSIS
OF
WATER SAMPLE**

Sr. No.	Bore hole No.	Depth, m	pH	Sulphate ppm	Chloride ppm
1.	1	5.00	8.00	29	75

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

CLIENT: Stup Consultants Pvt. Ltd.

B. H. No. 1
Bridge No. 428
Sheet No. 1 of 3
(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm
Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.30 m
Date: 31/5/08 to 2/6/08
W.T.: 1.70 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
0	0.00-2.00	DS1				-----	Brownish clayey soft to stiff consistency silts .							
1						-----								
2	2.00-2.45 2.45-3.00	UDS1		GWL @ 1.70 m		-----								
3	3.00-3.60 3.60-5.00	SPT1	24			-----	Very stiff consistency clayey silts .							
4						-----								
5	5.00-5.45 5.45-6.00	UDS2				-----								
6	6.00-6.60 6.60-7.50	SPT2	78			-----	Brownish hard consistency silts .							
7						-----								
8	7.50-7.95	UDS3				-----								
9	9.00-9.60 9.60-10.00	SPT3	51			-----	Large pebble sandy clays of hard consistency.							
10	10.00-10.45	UDS4				-----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 428

Sheet No. 2 of 3

(BGL) R. L. :- 0.00 m

CLIENT: Stup Consultants Pvt. Ltd.

T.D (m) :- 30.30 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Date: 31/5/08 to 2/6/08

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin Near Uma Cold Store

W.T.: 1.70 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
11	10.45-12.00					-----	Brownish silty clay.							
12	12.00-12.60 12.60-15.00	SPT4	68			-----	Brownish silty clay with reti .							
13						-----								
14						-----								
15	15.00-15.30 15.30-18.00	SPT5	R			-----								
16						-----								
17						-----								
18	18.00-18.45 18.45-21.00	UDS4				-----	Brownish clay reti .							
19						-----								
20						-----								

RENUKA ENGINEERS

PROJECT:- Geotechnical Investigation for construction of various Railway Bridges,
DFCC project Between Vaitarna & Surat .

B. H. No. 1

Bridge No. 428

CLIENT: Stup Consultants Pvt. Ltd.

Sheet No. 3 of 3

(BGL) R. L. :- 0.00 m

Casing diameter (mm) : i) 100mm and ii) 76mm

T.D (m) :- 30.30 m

Casing diameter (mm) : i) 100mm and ii) 76mm

Location:- (As per sketch)
Sachin Near Uma Cold Store

Date: 31/5/08 to 2/6/08

W.T.: 1.70 m

Depth m	Sample & Insitu test		SPT N value	Casing/ water Depth (m)	Thickn ess (m)	Log	Description	UCT	Silt + clay %	Triaxi al C kg/cm ² / φ	LL%	PL%	TCR %	ROD%
	Depth (m)	Type												
21	18.45-21.00	SPT6	R			-----	Brownish hard consistency clayey sandy silts .							
	21.00-21.30													
	21.30-24.00													
22		SPT7	R			-----	Silty clays with large size sands and pebbles .							
	24.00-24.15													
	24.15-27.00													
23		SPT8	65			-----	Coarser pebble sand stratum .							
	27.00-27.60													
	27.60-30.00													
24		SPT9	R			-----	Conglomerate stratum .							
	30.00-30.30													
	30.30--													

Bore hole terminated at 30.30 m