



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
7379.350	8	WATERWAY	MINOR BRIDGE	BH-01	199567	3002692	110.00

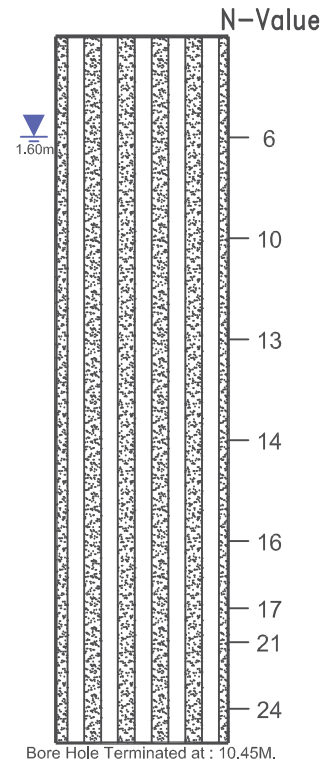
SUBMITTED BY:



BOREHOLE PROFILE

SECTION: CHITAUNI TO MADHUBANI

BRIDGE NO.: 08
BOREHOLE NO.: 01






LEGENDS

 SILTY SAND (SM)

 Ground Water Table



Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 8				BOREHOLE NO. BH- 01				GWT: 1.60 m				DATE STARTED : 19/01/2025				<div> aarvee associates architects engineers & consultants pvt. ltd.</div>																				
FIELD TEST RESULTS												CONSOLIDATED LOGS INCLUDING LABORATORY TEST RESULTS OF SOIL																								
LABORATORY TEST RESULTS																																				
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE /LWL	SPT TEST RESULTS					SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (gm /cc)	DRY DENSITY (gm/cc)	MOISTURE CONTENT (%)	FREESWELL INDEX (%)	SPECIFIC GRAVITY	SUBMERGED DENSITY (gm /cc)	SHEAR STRENGTH CHARACTERISTICS		CONSOLIDATION CHARACTERISTICS	Chemical Analysis Result							
					DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N VALUE (Recorded)	N VALUE (Corrected)				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)										Cohesion, C _v (kg/cm ²)	Angle of friction (Degrees)		Compression Index(C _c)	SOIL SAMPLE			WATER SAMPLE			
-0.50	0.5	DS	1	<div> 1.60 m</div>	0.00	0.50	DS	-	-	-	<div></div>	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	73	26	1	NON-PLASTIC		-	-	-	-	-	-	-	-	-	-	7.22	0.03	NIL	-	-	-	
	1.0	SPT	1		0.50	0.95	6	30	6	11			-	0	71	27	2	NON-PLASTIC		-	-	-	2.52	-	-	-	-	-	7.28	0.03	NIL	-	-	-		
	2.0	SPT	2		1.50	1.95	10	30	10	15			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.34	0.02	NIL	-	-	-			
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	4.0	SPT	3		3.00	3.45	13	30	13	17			-	0	68	31	1	NON-PLASTIC		-	-	-	2.54	-	-	-	-	-	-	-	-	-	-	-		
	5.0	SPT	4		4.50	4.95	14	30	14	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-6.00	6.0	DS	2		5.50	5.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	7.0	SPT	5		6.00	6.45	16	30	16	17			-	0	66	32	2	NON-PLASTIC		-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0	SPT	6		7.50	7.95	17	30	17	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-9.00	9.0	DS	3		8.50	8.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	SPT	7		9.00	9.45	21	30	21	19			-	0	63	36	1	NON-PLASTIC		-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-	-	-
	11.0	SPT	8		10.00	10.45	24	30	24	20			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CLASSIFICATION OF SOIL AS PER IS : 1498 ABBREVIATION USED : DS = DISTURBED SAMPLE , SPT = STANDARD PENETRATION TEST, UDS = UNDISTURBED SAMPLE, DST = DIRECT SHEAR TEST, UC : UNCONFINED COMPRESSION TEST UU : UNCONSOLIDATED UNDRAINED TRIAXIAL TEST * UCS BASED ON POINT LOAD TEST													Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)																							
												SECTION: CHITAUNI-MADHUBANI																								

CALCULATIONS FOR CORRECTED SPT (N) VALUES

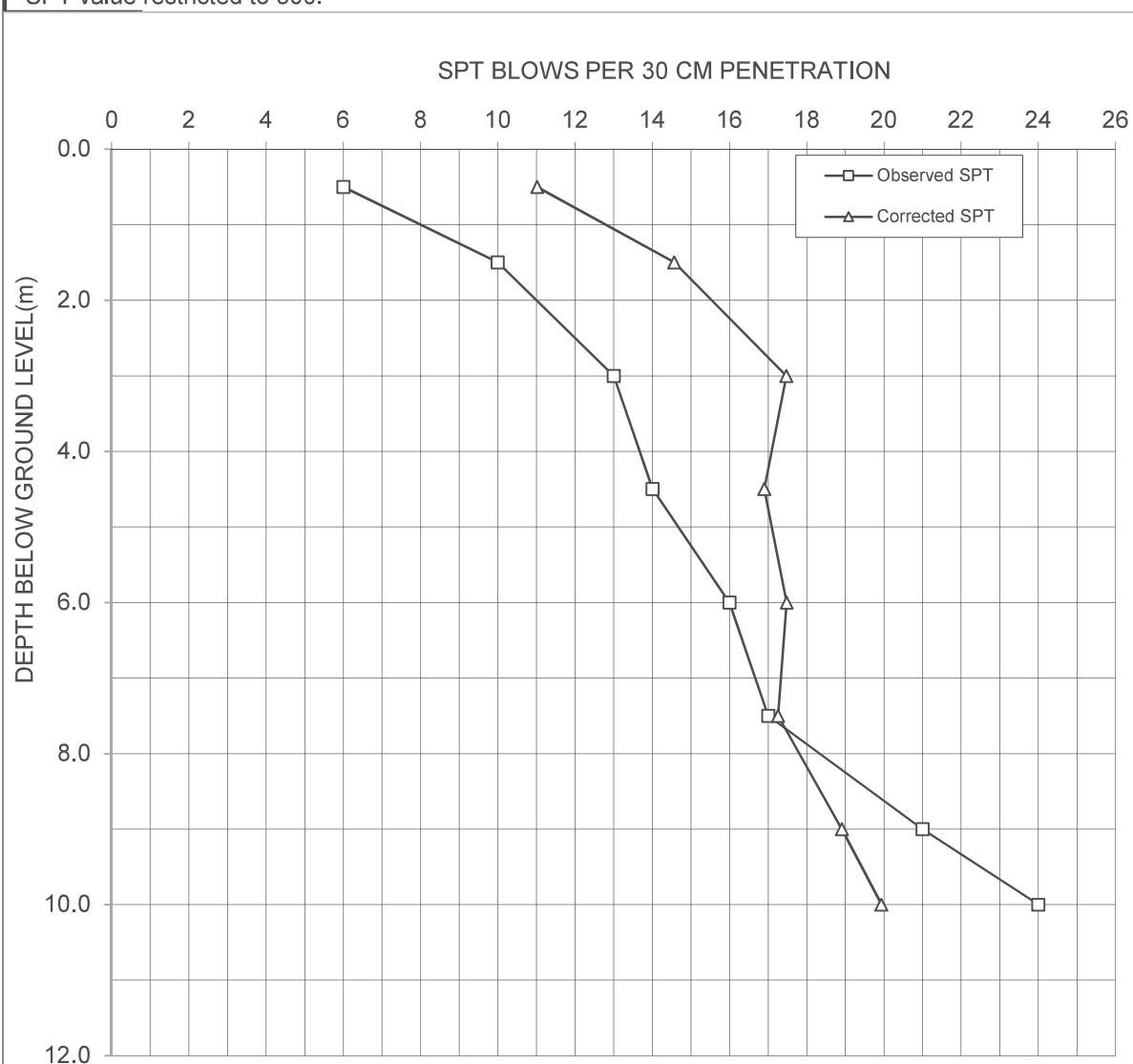
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :-1.60m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	6	11	11
1.50	Non Plastic	10	15	15
3.00	Non Plastic	13	20	17
4.50	Non Plastic	14	19	17
6.00	Non Plastic	16	20	17
7.50	Non Plastic	17	20	17
9.00	Non Plastic	21	23	19
10.00	Non Plastic	24	25	20

* SPT value restricted to 300.



Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 9

BOREHOLE NO.

BH-01

SECTION: CHITAUUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_u	MSF	CRR	FOS	Conclusion
0.50	SM	7	1.73	0.73	29	IV	0.24	7.00	1.00	0.87	0.37	0.37	1.70	1.33	1.000	1.05	0.75	1.00	12.46	4.64	1.15	18.92	0.20	25.54	0.87	1.00	1.00	1.19	0.24	0.66	Liquefiable
1.50	SM	8	1.73	0.73	29	IV	0.24	7.00	0.99	2.60	1.10	0.37	1.70	1.33	1.000	1.05	0.75	1.00	14.24	4.64	1.15	20.96	0.23	29.55	0.85	1.00	1.00	1.19	0.27	0.74	Liquefiable
3.00	SM	10	2.00	1.00	32	IV	0.24	7.00	0.98	5.19	2.19	0.36	1.70	1.33	1.000	1.05	0.85	1.00	20.18	4.83	1.17	28.46	0.39	42.90	0.79	1.00	1.00	1.19	0.46	1.28	Non Liquefiable
4.50	SM	12	2.00	1.00	32	IV	0.24	7.00	0.97	8.19	3.69	0.33	1.65	1.33	1.000	1.05	0.95	1.00	26.21	4.83	1.17	35.52	NA	56.47	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	14	2.01	1.01	34	IV	0.24	7.00	0.95	11.19	5.19	0.32	1.39	1.33	1.000	1.05	0.95	1.00	25.78	4.93	1.19	35.57	NA	55.51	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	16	2.01	1.01	34	IV	0.24	7.00	0.94	14.21	6.71	0.31	1.22	1.33	1.000	1.05	0.95	1.00	25.92	4.93	1.19	35.73	NA	55.83	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	18	2.02	1.02	37	IV	0.24	7.00	0.93	17.22	8.22	0.30	1.10	1.33	1.000	1.05	1	1.00	27.73	5.00	1.20	38.27	NA	59.88	0.70	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	23	2.02	1.02	37	IV	0.24	7.00	0.91	19.24	9.24	0.29	1.04	1.33	1.000	1.05	1	1.00	33.41	5.00	1.20	45.10	NA	68.41	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_S or C_{SS} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure > 10 T/m²)

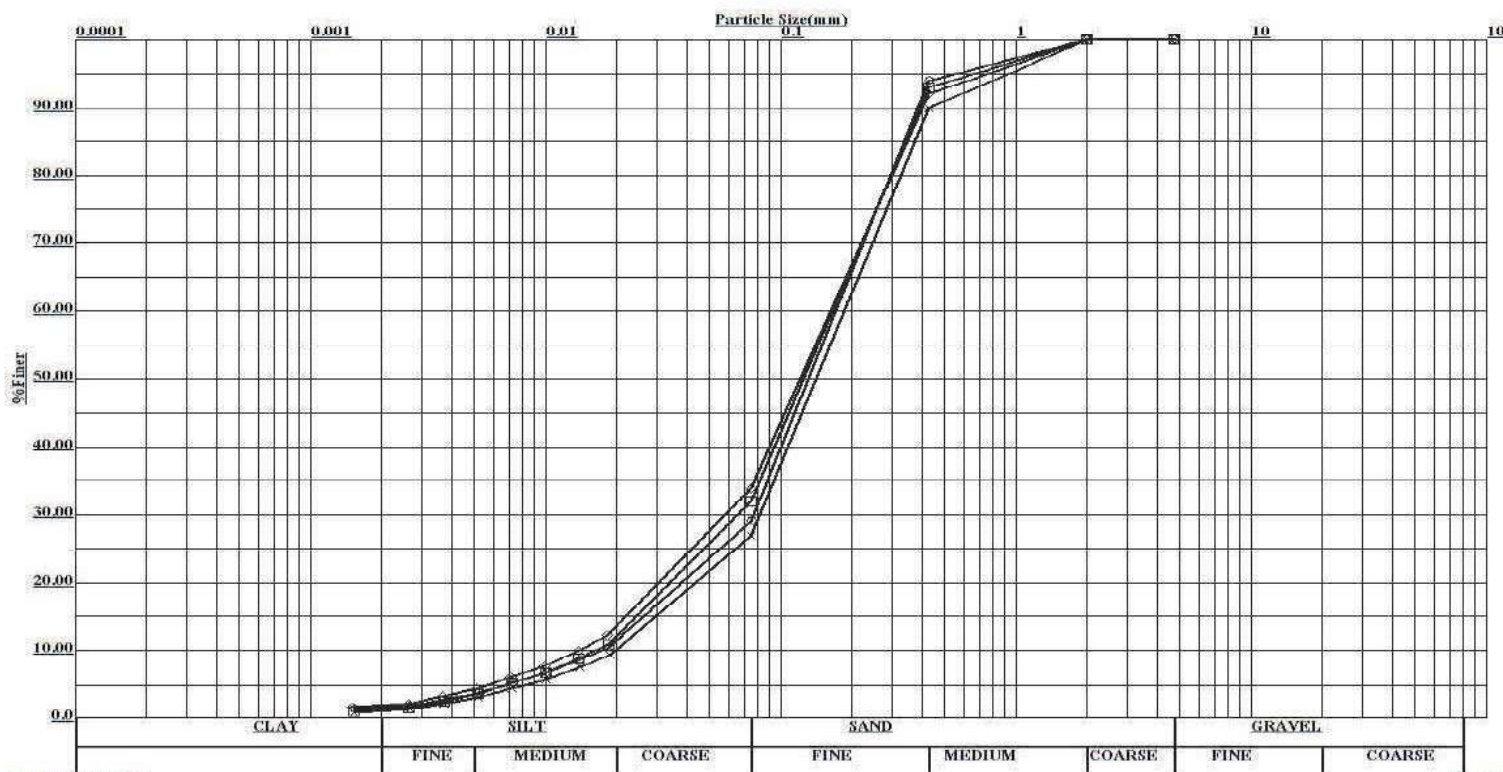
K_u Correction for static shear stress is required only for sloping ground

PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 08
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



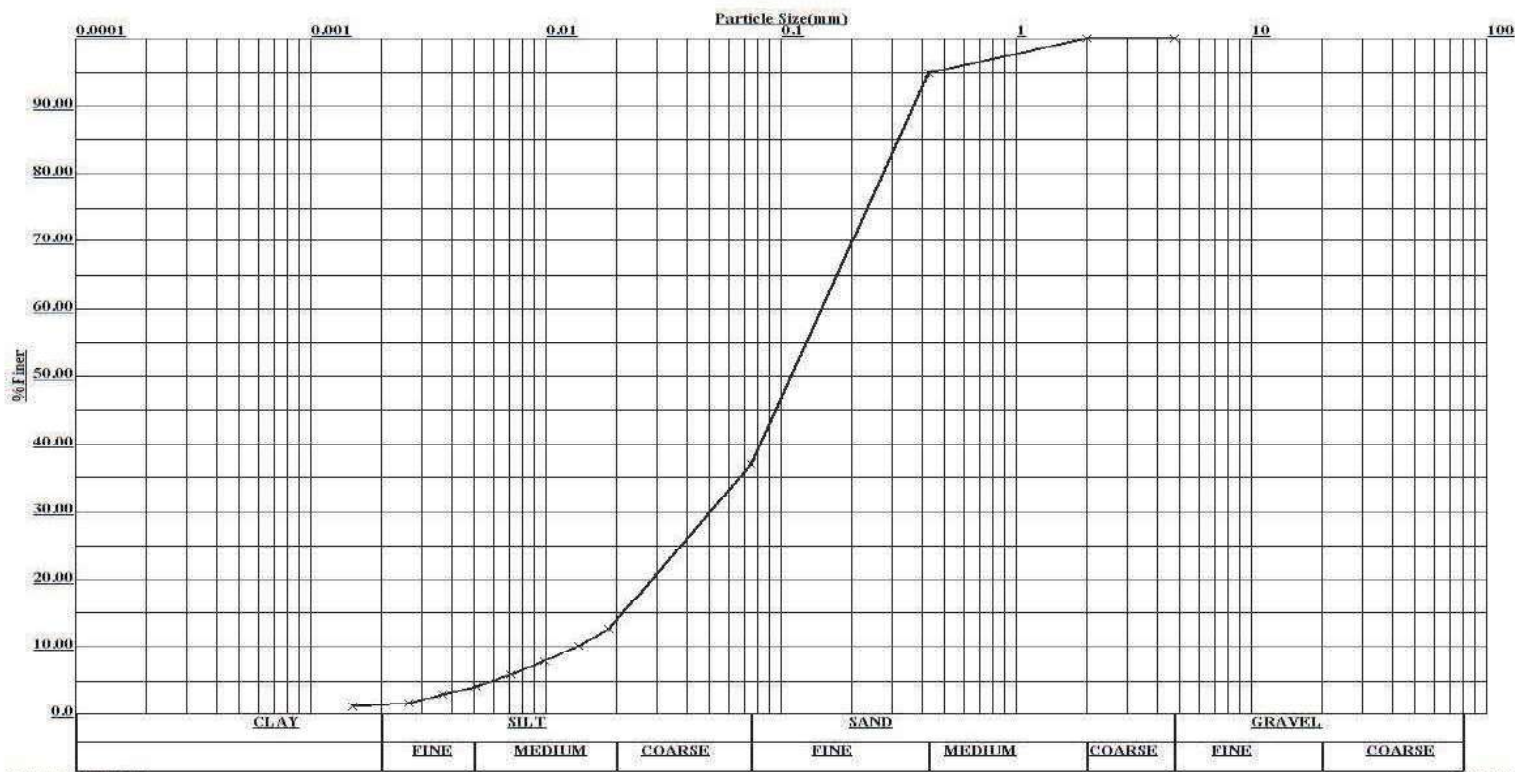
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	73.00	26.00	1.00	9.43	1.81
○	0.5		0.00	71.00	27.00	2.00	9.95	2.00
□	3.0		0.00	68.00	31.00	1.00	10.27	1.60
◇	6.0		0.00	66.00	32.00	2.00	11.83	1.49

PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 08
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	9.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	63.00	36.00	1.00	11.16	1.26



COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO.-8

BOREHOLE NO-01

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil				
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= $1.76 \times \sqrt{d_m}$	Average Cohesion Intercept - c (Kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = $\frac{K_{sf}c}{F \times (1 + \sqrt{c})}$	
1	BH-01	0.50	0.95	SILTY SAND	SM	0.0	0.0	0.0	7.0	37.0	26.0	30.0	0.00	0.00	0.00	4.99	11.19	3.32	1.125	0.206	0.799	-	-	-	-	-
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	8.0	35.0	24.0	33.0	0.00	0.00	0.00	5.70	10.59	3.06	1.238	0.206	0.799	-	-	-	-	-
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	8.0	34.0	23.0	35.0	0.00	0.00	0.00	5.70	10.29	2.93	1.313	0.202	0.792	-	-	-	-	-



NORTH EASTERN RAILWAY

FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
9793.494	13	WATERWAY	MINOR	BH-01	200667	3000544	110.16

SUBMITTED BY:

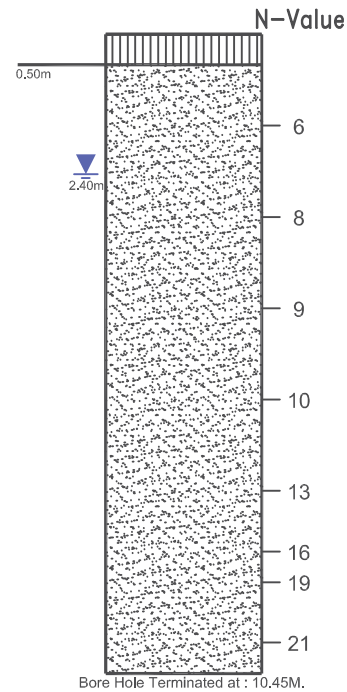


aarvee associates
architects engineers & consultants pvt. ltd


BOREHOLE PROFILE

SECTION: CHITAUNI TO MADHUBANI

BRIDGE NO.: 13
BOREHOLE NO.: 01





LEGENDS

-  **SANDY-SILT (ML)**
-  **POORLY GRADED SAND (SP)**
-  **Ground Water Table**



Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 13 BOREHOLE NO. BH-01				GWT: 2.40 m		DATE STARTED : 21/01/2025		<div> aarvee associates architects engineers & consultants pvt. ltd.</div>																							
CONSOLIDATED LOGS INCLUDING LABORATORY TEST RESULTS OF SOIL																															
FIELD TEST RESULTS										LABORATORY TEST RESULTS																					
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE / LWL	SPT TEST RESULTS					SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LABORATORY TEST RESULTS								SHEAR STRENGTH CHARACTERISTICS		CONSOLIDATION CHARACTERISTICS	Chemical Analysis Result			
					DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N VALUE (Recorded)	N VALUE (Corrected)				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (gm/cc)	DRY DENSITY (gm/cc)	MOISTURE CONTENT (%)	FREESWELL INDEX (%)	SPECIFIC GRAVITY	SUBMERGED DENSITY (gm/cc)	Cohesion, Cc (kg/cm ²)	Angle of friction (Degrees)	Compression Index (Cc)	pH	Chloride, %	Sulphate, %
-0.50	0.5	DS	1	 2.40 m	0.00	0.50	DS	-	-	-	LITE GREY, SANDY SILT (ML)	-	0	45	51	4	NON-PLASTIC			-	-	-	-	-	-	-	-	-	-	-	-
	1.0	SPT	1		0.50	0.95	6	30	6	11		-	0	96	4	0	NON-PLASTIC			-	-	-	2.56	-	-	-	-	-	-	-	-
	2.0	SPT	2		1.50	1.95	8	30	8	12		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-3.00	3.0	UDS	1		2.50	2.80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	4.0	SPT	3		3.00	3.45	9	30	9	14		-	0	97	3	0	NON-PLASTIC			-	-	-	2.57	-	-	-	-	-	-	-	-
	5.0	SPT	4		4.50	4.95	10	30	10	13		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-6.00	6.0	DS	2		5.50	5.80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7.0	SPT	5		6.00	6.45	13	30	13	16		-	0	96	4	0	NON-PLASTIC			-	-	-	2.58	-	-	-	-	-	-	-	-
	8.0	SPT	6		7.50	7.95	16	30	16	17		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-9.00	9.0	DS	3		8.50	8.80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	SPT	7		9.00	9.45	19	30	19	18		-	0	97	3	0	NON-PLASTIC			-	-	-	2.60	-	-	-	-	-	-	-	-
	11.0	SPT	8		10.00	10.45	21	30	21	18		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
CLASSIFICATION OF SOIL AS PER IS : 1498. ABBREVIATION USED :- DS = DISTURBED SAMPLE, SPT = STANDARD PENETRATION TEST, UDS = UNDISTURBED SAMPLE, DST = DIRECT SHEAR TEST, UC : UNCONFINED COMPRESSION TEST UU : UNCONSOLIDATED UNDRAINED TRIAXIAL TEST * UCS BASED ON POINT LOAD TEST												Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km) SECTION: CHITAUNI-MADHUBANI																			



CALCULATIONS FOR CORRECTED SPT (N) VALUES

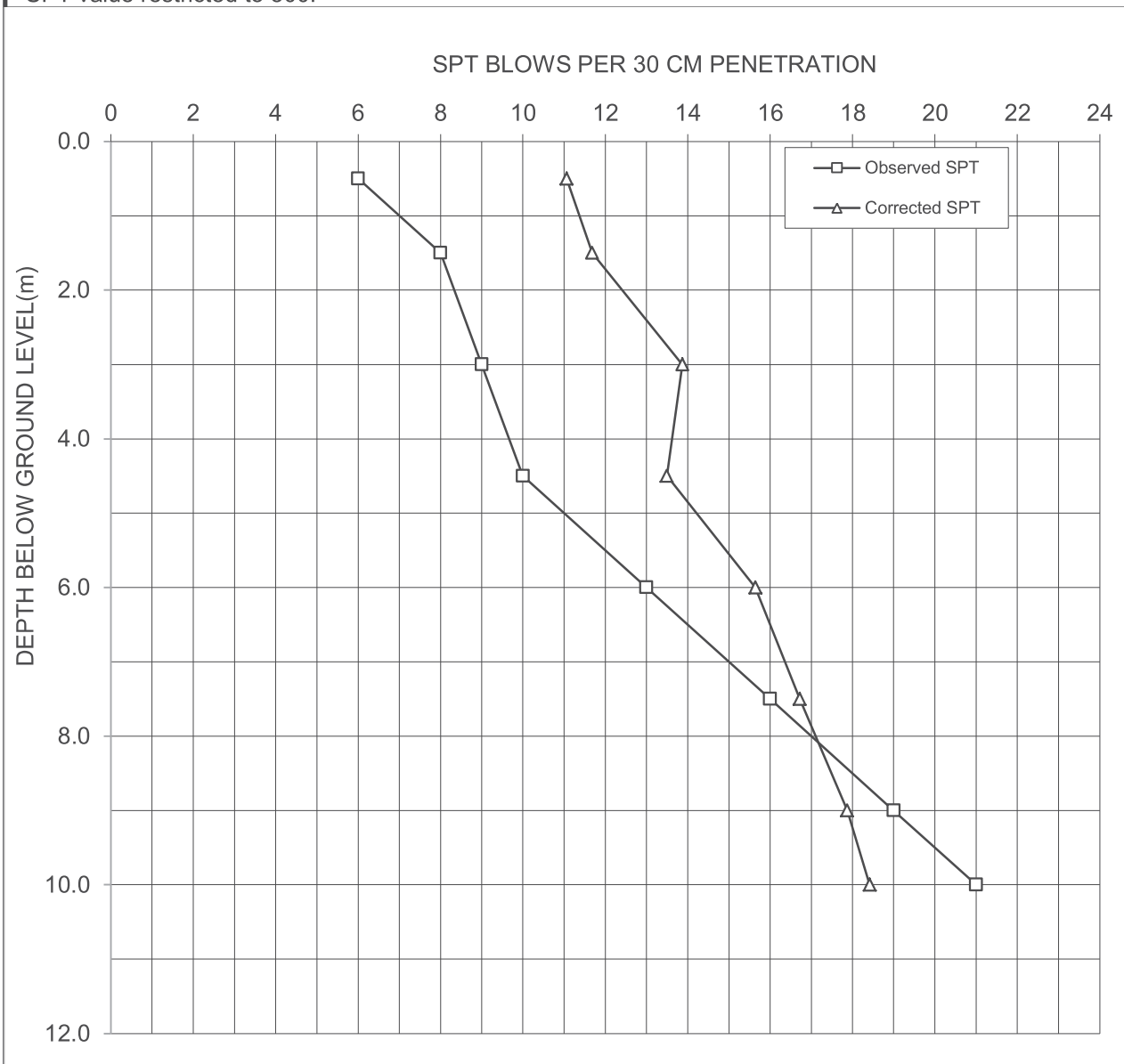
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE IN METER:-2.40m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	6	11	11
1.50	Non Plastic	8	12	12
3.00	Non Plastic	9	14	14
4.50	Non Plastic	10	13	13
6.00	Non Plastic	13	16	16
7.50	Non Plastic	16	18	17
9.00	Non Plastic	19	21	18
10.00	Non Plastic	21	22	18

* SPT value restricted to 300.



Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 13

BOREHOLE NO.

BH-01

SECTION: CHITAUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, $D_r\%$	f	K_σ	K_u	MSF	CRR	FOS	Conclusion
0.50	SP	6	1.72	0.72	4	IV	0.24	7.00	1.00	0.86	0.36	0.37	1.70	1.33	1.000	1.05	0.75	1.00	10.68	0.00	1.00	10.68	0.12	21.54	0.89	1.00	1.00	1.19	0.14	0.38	Liquefiable
1.50	SP	8	1.72	0.72	4	IV	0.24	7.00	0.99	2.58	1.08	0.37	1.70	1.33	1.000	1.05	0.75	1.00	14.24	0.00	1.00	14.24	0.15	29.55	0.85	1.00	1.00	1.19	0.18	0.49	Liquefiable
3.00	SP	9	2.00	1.00	3	IV	0.24	7.00	0.98	5.16	2.16	0.36	1.70	1.33	1.000	1.05	0.85	1.00	18.16	0.00	1.00	18.16	0.19	38.36	0.81	1.00	1.00	1.19	0.23	0.63	Liquefiable
4.50	SP	10	2.00	1.00	3	IV	0.24	7.00	0.97	8.16	3.66	0.34	1.65	1.33	1.000	1.05	0.95	1.00	21.93	0.00	1.00	21.93	0.24	46.84	0.77	1.00	1.00	1.19	0.29	0.86	Liquefiable
6.00	SP	13	2.01	1.01	4	IV	0.24	7.00	0.95	11.16	5.16	0.32	1.39	1.33	1.000	1.05	0.95	1.00	24.01	0.00	1.00	24.01	0.27	51.52	0.74	1.00	1.00	1.19	0.33	1.01	Non Liquefiable
7.50	SP	16	2.01	1.01	4	IV	0.24	7.00	0.94	14.18	6.68	0.31	1.22	1.33	1.000	1.05	0.95	1.00	25.98	0.00	1.00	25.98	0.31	55.96	0.72	1.00	1.00	1.19	0.37	1.19	Non Liquefiable
9.00	SP	19	2.03	1.03	3	IV	0.24	7.00	0.93	17.19	8.19	0.30	1.10	1.33	1.000	1.05	1	1.00	29.32	0.00	1.00	29.32	0.43	63.47	0.68	1.00	1.00	1.19	0.51	1.67	Non Liquefiable
10.00	SP	21	2.03	1.03	3	IV	0.24	7.00	0.91	19.22	9.22	0.29	1.04	1.33	1.000	1.05	1	1.00	30.54	0.00	1.00	30.54	NA	65.54	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_S or C_{SS} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure > 10 T/m²)

K_u Correction for static shear stress is required only for sloping ground

Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
×	0.0	LITE GREY, SANDY SILT (ML)	0.00	45.00	51.00	4.00	12.67	1.15
○	0.5	MEDIUM, DENSE LITE GREY,POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.34	0.79
□	3.0		0.00	97.00	3.00	0.00	3.00	0.80
◇	6.0		0.00	96.00	4.00	0.00	3.45	0.78

COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 13				BOREHOLE NO-01										Section : CHITAUNI - MADHUBANI													
Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil					
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = $\frac{K_{sfc}}{F \times (1 + \sqrt{c})}$		
1	BH-01	0.00	0.50	SANDY SILT	ML	0.0	0.0	0.0	2.0	28.0	15.0	55.0	0.00	0.00	0.00	1.43	8.47	1.91	2.063	0.139	0.655	-	-	-	-		
2		3.00	3.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	18.0	52.0	27.0	3.0	0.00	0.00	0.00	12.83	15.73	3.44	0.113	0.321	0.997	-	-	-	-		
3		6.00	6.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	26.0	44.0	26.0	4.0	0.00	0.00	0.00	18.53	13.31	3.32	0.150	0.353	1.046	-	-	-	-		



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
12186.843	17	WATERWAY	MINOR	BH-01	201045	2998259	109.44

SUBMITTED BY:



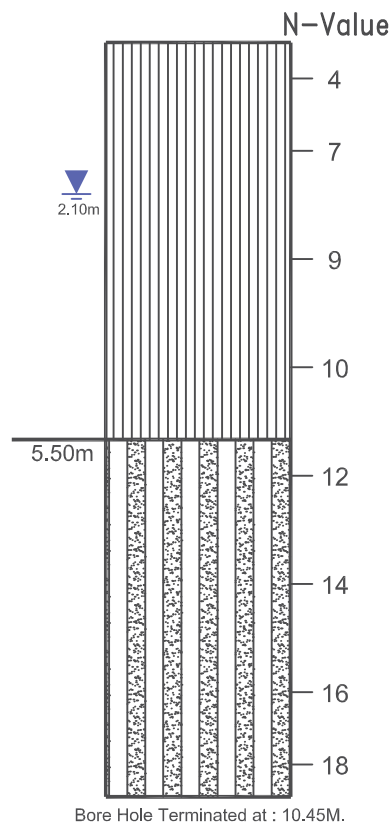
aarvee associates
architects engineers & consultants pvt. ltd.

BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.- 17

BOREHOLE NO.: BH- 01



LEGENDS



Sandy Silt (ML)



Silty Sand (SM)



Ground Water Table



Project: FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

CALCULATIONS FOR CORRECTED SPT (N) VALUES

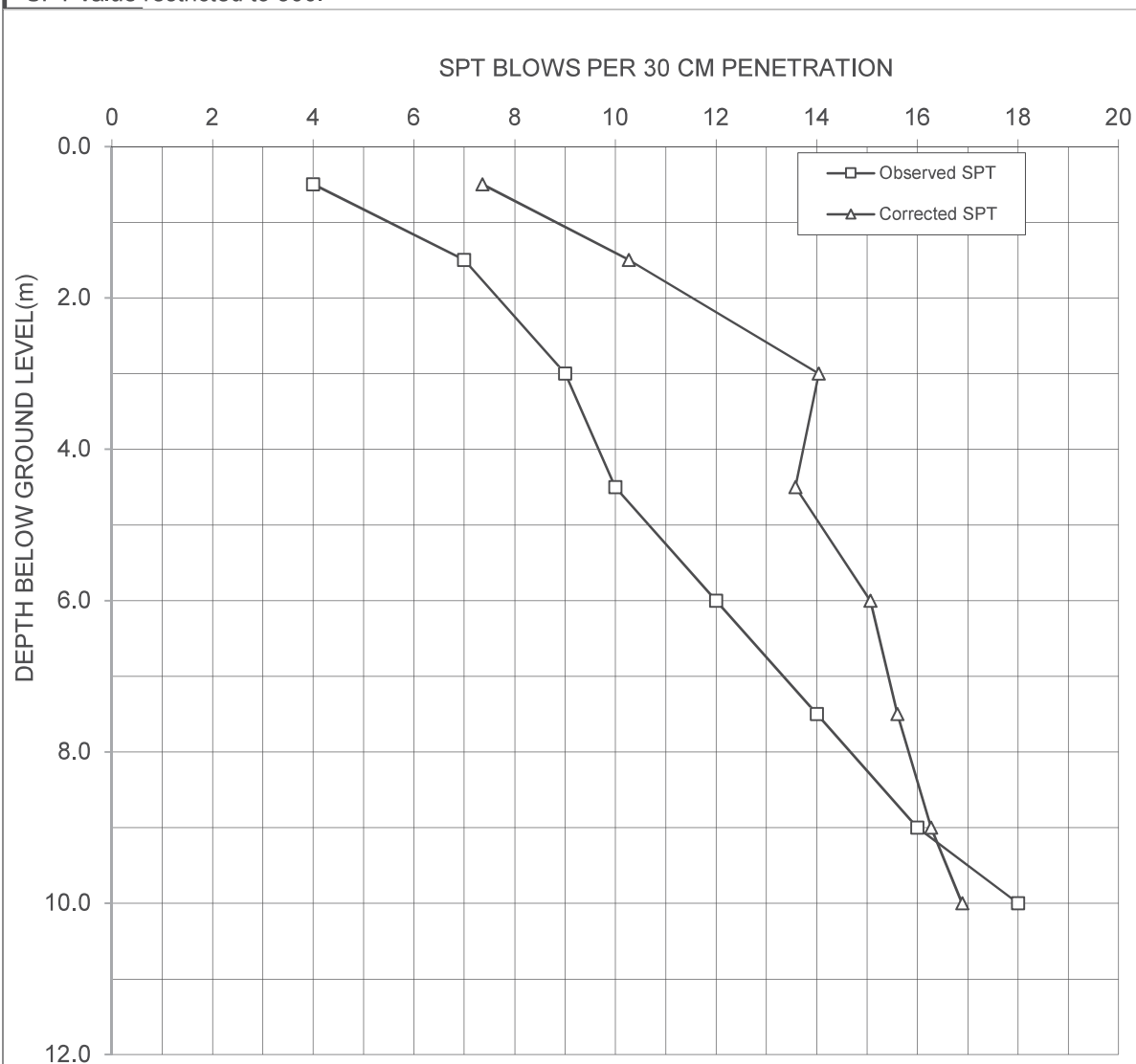
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :-2.10 m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	4	7	7
1.50	Non Plastic	7	10	10
3.00	Non Plastic	9	14	14
4.50	Non Plastic	10	14	14
6.00	Non Plastic	12	15	15
7.50	Non Plastic	14	16	16
9.00	Non Plastic	16	18	16
10.00	Non Plastic	18	19	17

* SPT value restricted to 300.





Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 17

BOREHOLE NO.

BH-01

SECTION: CHITAUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ'_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_α	MSF	CRR	FOS	Conclusion
0.50	ML-NP	4	1.64	0.64	64	IV	0.24	7.00	1.00	0.82	0.32	0.40	1.70	1.33	1.000	1.05	0.75	1.00	7.12	5.00	1.20	13.55	0.15	15.20	0.92	1.00	1.00	1.19	0.17	0.44	Liquefiable
1.50	ML-NP	7	1.64	0.64	64	IV	0.24	7.00	0.99	2.46	0.96	0.40	1.70	1.33	1.000	1.05	0.75	1.00	12.46	5.00	1.20	19.96	0.21	25.54	0.87	1.00	1.00	1.19	0.26	0.65	Liquefiable
3.00	ML-NP	9	2.01	1.01	67	IV	0.24	7.00	0.98	4.92	1.92	0.39	1.70	1.33	1.000	1.05	0.85	1.00	18.16	5.00	1.20	26.79	0.33	38.36	0.81	1.00	1.00	1.19	0.40	1.02	Non Liquefiable
4.50	ML-NP	10	2.01	1.01	67	IV	0.24	7.00	0.97	7.94	3.44	0.35	1.70	1.33	1.000	1.05	0.95	1.00	22.55	5.00	1.20	32.06	NA	48.25	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	12	2.02	1.02	27	IV	0.24	7.00	0.95	10.95	4.95	0.33	1.42	1.33	1.000	1.05	0.95	1.00	22.63	4.48	1.13	30.06	NA	48.41	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	14	2.02	1.02	27	IV	0.24	7.00	0.94	13.98	6.48	0.32	1.24	1.33	1.000	1.05	0.95	1.00	23.07	4.48	1.13	30.56	NA	49.41	0.75	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	16	2.04	1.04	32	IV	0.24	7.00	0.93	17.01	8.01	0.31	1.12	1.33	1.000	1.05	1	1.00	24.97	4.83	1.17	34.06	NA	53.67	0.73	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	18	2.04	1.04	32	IV	0.24	7.00	0.91	19.05	9.05	0.30	1.05	1.33	1.000	1.05	1	1.00	26.42	4.83	1.17	35.77	NA	56.95	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_s or C_{ss} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure>10 T/m2)

K_α Correction for static shear stress is required only for sloping ground

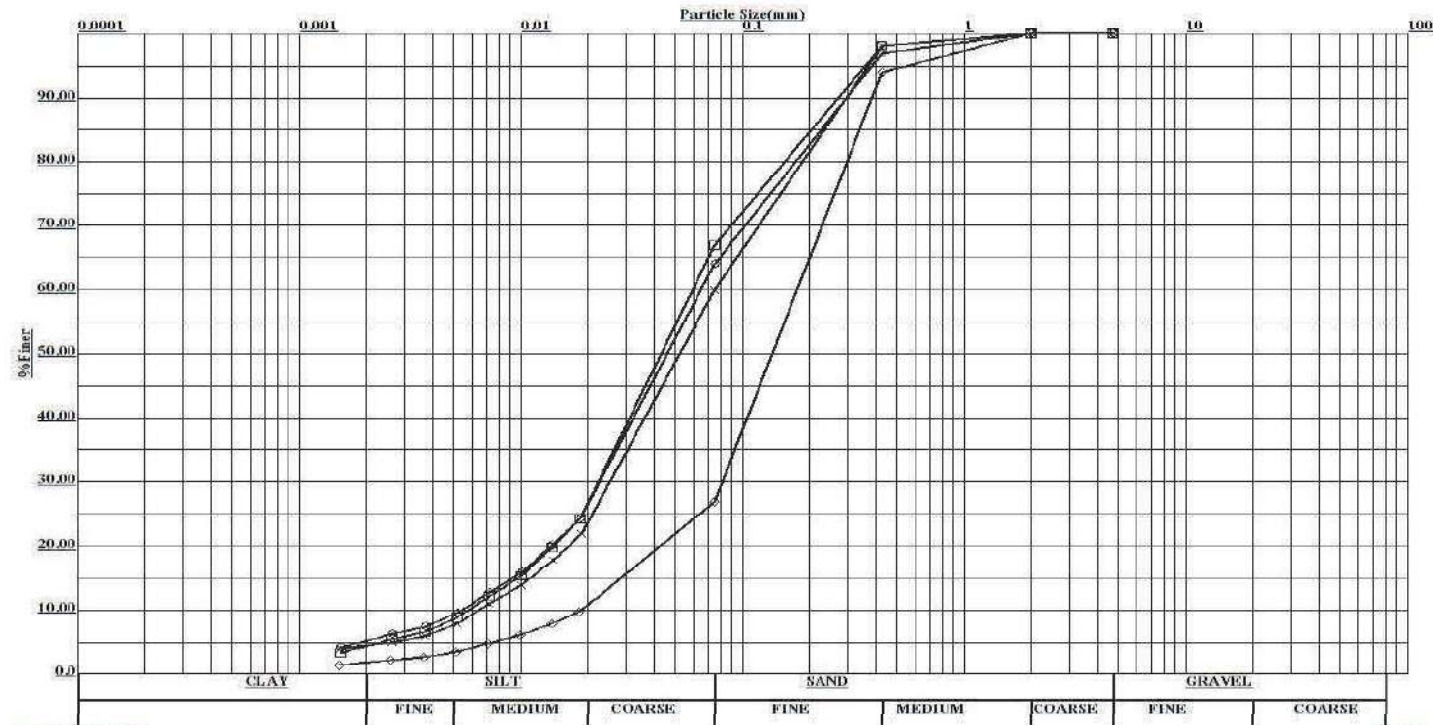


PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 17
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	LOOSE TO MEDIUM DENSE, LITE BROWN, SANDY SILT (ML)	0.00	40.00	56.00	4.00	11.45	1.29
○	0.5		0.00	36.00	59.00	5.00	11.98	1.46
□	3.0		0.00	33.00	63.00	4.00	10.25	1.45
◇	6.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	73.00	25.00	2.00	9.33	1.97



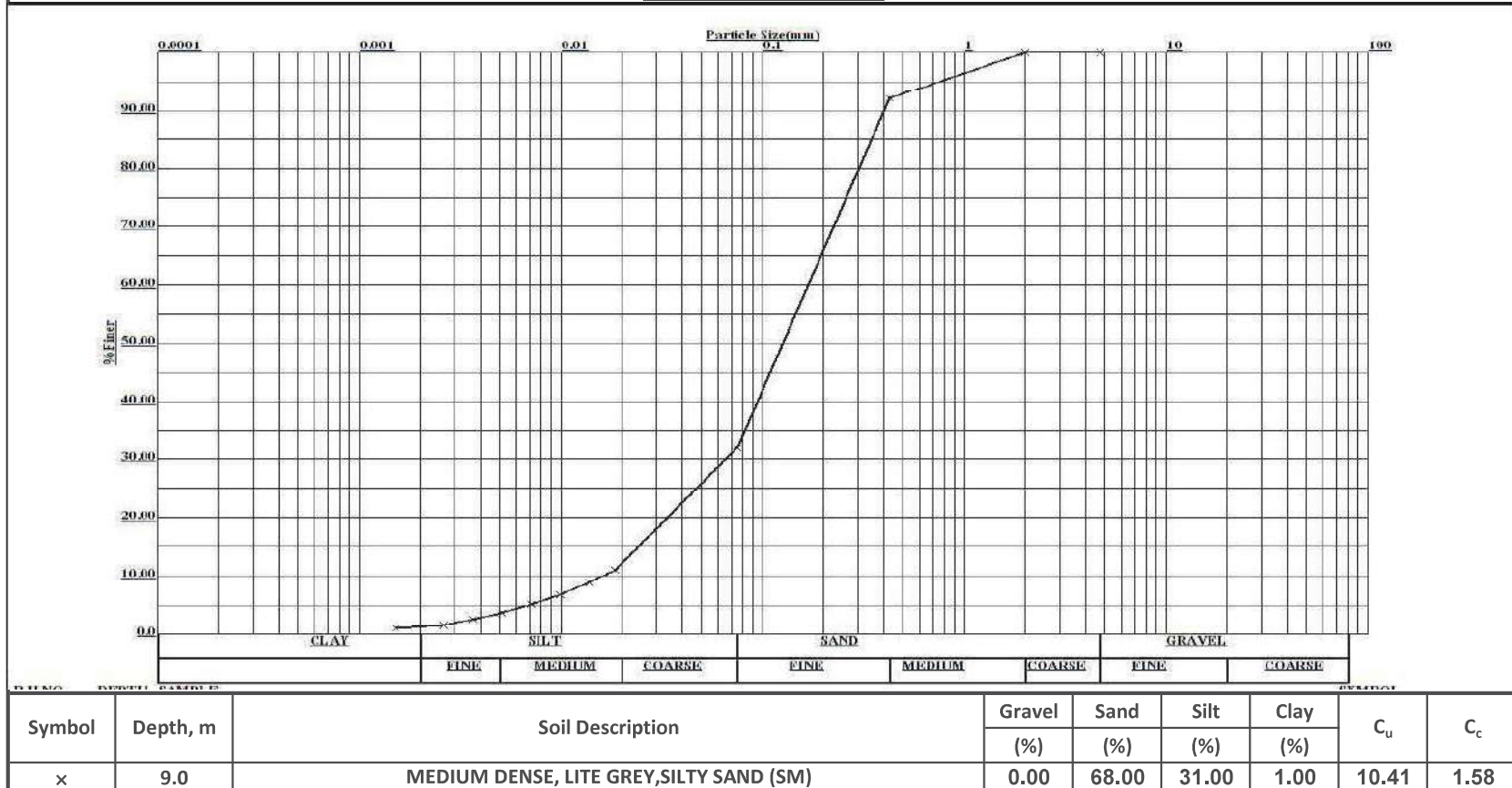
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architects engineers & consultants pvt. ltd.

PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 17
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 17

BOREHOLE NO- 1

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil			
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = K _{sf} c = F x (1 + sqrt(c))
1	BH-1	0.50	0.95	SANDY SILT	ML	0.0	0.0	0.0	3.0	25.0	8.0	64.0	0.00	0.00	0.00	2.14	7.56	1.02	2.400	0.131	0.637	-	-	-	-
2		3.00	3.45	SANDY SILT	ML	0.0	0.0	0.0	2.0	23.0	8.0	67.0	0.00	0.00	0.00	1.43	6.96	1.02	2.513	0.119	0.608	-	-	-	-
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	6.0	45.0	22.0	27.0	0.00	0.00	0.00	4.28	13.61	2.81	1.013	0.217	0.820	-	-	-	-



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
17747.927	29	WATERWAY	MINOR	BH-01	205328	2994969	106.80

SUBMITTED BY:



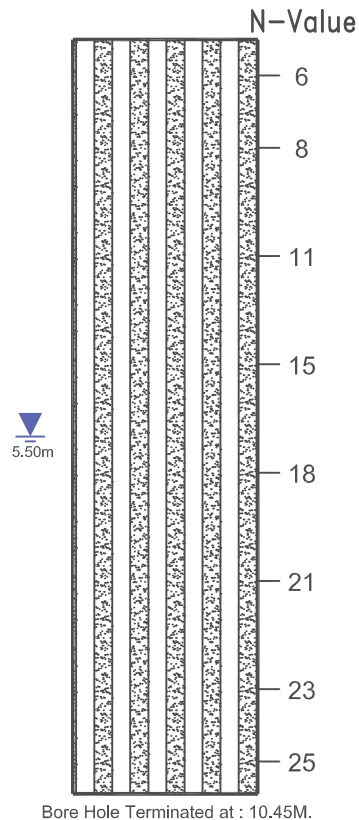
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BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.- 29

BOREHOLE NO.: BH- 01



LEGENDS






Silty Sand (SM)



Ground Water Table



Project: FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

BRIDGE NO. 29				BOREHOLE NO. BH- 01				GWT: 5.50 m				DATE STARTED : 26/01/2025				DATE COMPLETED : 26/01/2025																							
FIELD TEST RESULTS												LABORATORY TEST RESULTS																											
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE / L.W.L	SPT TEST RESULTS						SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (gm/cc)	DRY DENSITY (gm/cc)	MOISTURE CONTENT (%)	FREESWELL INDEX (%)	SPECIFIC GRAVITY	SUBMERGED DENSITY (gm/cc)	SHEAR STRENGTH CHARACTERISTICS		CONSOLIDATION CHARACTERISTICS	Chemical Analysis Result									
					DEPTH IN METERS		NO. OF BLOWS	PENETRATION (CM)	N VALUE (Recorded)	N VALUE (Corrected)				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)										Cohesion, C (kg/cm ²)	Angle of friction (Degrees)		Compression Index (Cc)	pH	Chloride %	Sulphate %	pH	Chloride mg/l	Sulphate mg/l			
-0.50	0.5	DS	1	<div>5.50 m</div> 	0.00	0.50	DS	-	-	-		MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	70	29	1	NON-PLASTIC		-	-	-	-	-	-	-	-	-	-	-	7.32	0.01	NIL	-	-	-			
	1.0	SPT	1		0.50	0.95	6	30	6	11			-	0	69	29	2	NON-PLASTIC		-	-	-	2.52	-	-	-	-	-	-	-	7.36	0.02	NIL	-	-	-			
	2.0	SPT	2		1.50	1.95	8	30	8	12			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.44	0.02	NIL	-	-	-			
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	4.0	SPT	3		3.00	3.45	11	30	11	13			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	5.0	SPT	4		4.50	4.95	15	30	15	16			-	0	67	32	1	NON-PLASTIC		-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	-	-	-			
-6.00	6.0	DS	2		5.50	5.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-					
	7.0	SPT	5		6.00	6.45	18	30	18	19			-	0	65	33	2	NON-PLASTIC		-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8.0	SPT	6		7.50	7.95	21	30	21	20			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
-9.00	9.0	DS	3		8.50	8.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-				
	10.0	SPT	7		9.00	9.45	23	30	23	20			-	0	62	37	1	NON-PLASTIC		-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	11.0	SPT	8		10.00	10.45	25	30	25	20			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
CLASSIFICATION OF SOIL AS PER IS : 1498 ABBREVIATION USED DS = DISTURBED SAMPLE , SPT = STANDARD PENETRATION TEST, UDS = UNDISTURBED SAMPLE, DST = DIRECT SHEAR TEST, UC : UNCONFINED COMPRESSION TEST UU : UNCONSOLIDATED UNDRAINED TRIAXIAL TEST * UCS BASED ON POINT LOAD TEST													Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)																										
												SECTION: CHITAUNI-MADHUBANI																											

CALCULATIONS FOR CORRECTED SPT (N) VALUES

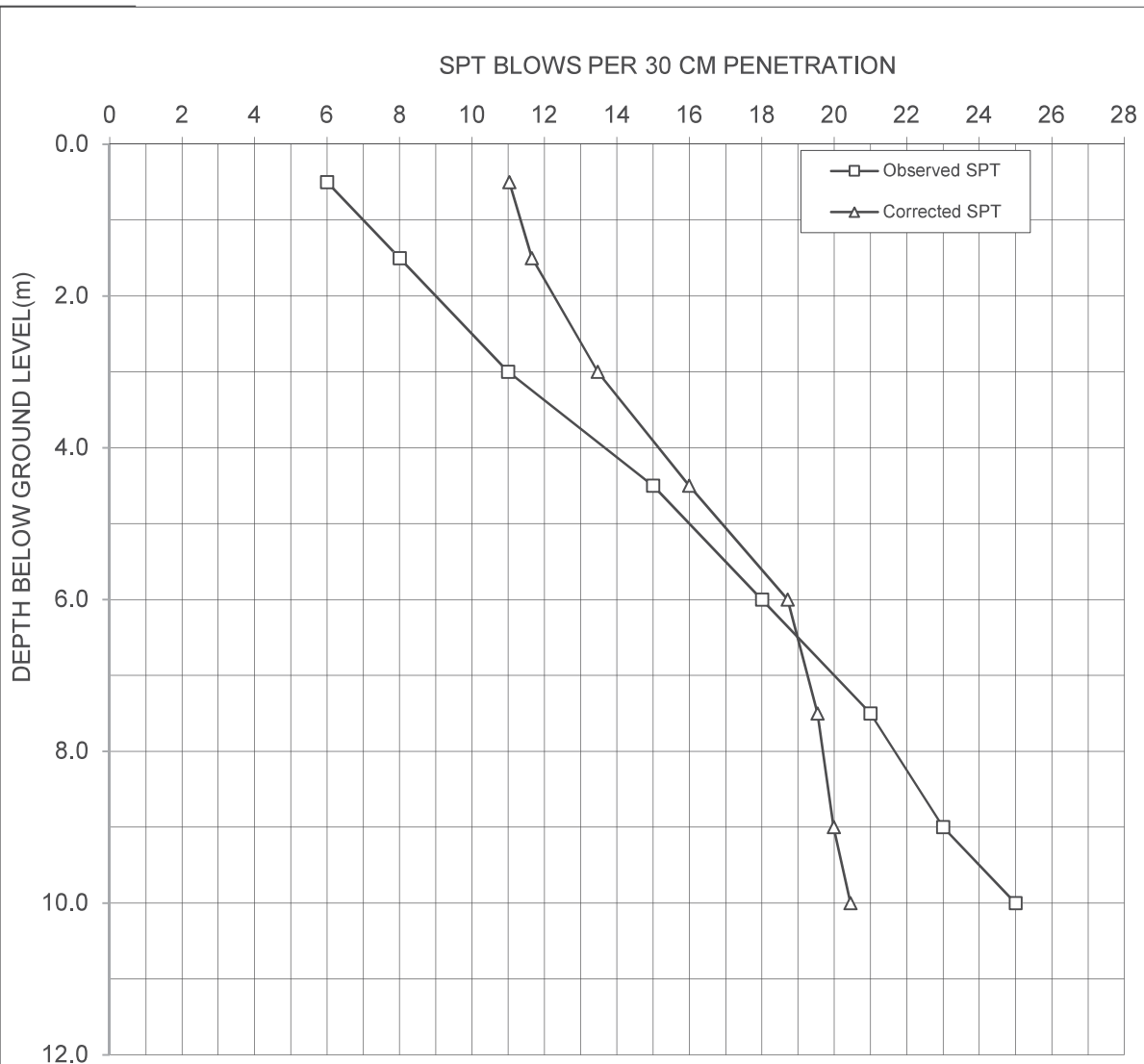
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :- 5.50m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	6	11	11
1.50	Non Plastic	8	12	12
3.00	Non Plastic	11	13	13
4.50	Non Plastic	15	16	16
6.00	Non Plastic	18	22	19
7.50	Non Plastic	21	24	20
9.00	Non Plastic	23	25	20
10.00	Non Plastic	25	26	20

* SPT value restricted to 300.





Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 29

BOREHOLE NO.

BH-01

SECTION: CHITAUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ'_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_α	MSF	CRR	FOS	Conclusion
0.50	SM	6	1.74	0.74	31	IV	0.24	7.00	1.00	0.87	0.37	0.37	1.70	1.33	1.000	1.05	0.75	1.00	10.68	4.77	1.16	17.19	0.18	21.54	0.89	1.00	1.00	1.19	0.22	0.60	Liquefiable
1.50	SM	8	1.74	0.74	31	IV	0.24	7.00	0.99	2.61	1.11	0.36	1.70	1.33	1.000	1.05	0.75	1.00	14.24	4.77	1.16	21.33	0.23	29.55	0.85	1.00	1.00	1.19	0.28	0.77	Liquefiable
3.00	SM	11	2.01	1.01	33	IV	0.24	7.00	0.98	5.22	2.22	0.36	1.70	1.33	1.000	1.05	0.85	1.00	22.20	4.88	1.18	31.07	NA	47.44	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	15	2.01	1.01	33	IV	0.24	7.00	0.97	8.24	3.74	0.33	1.64	1.33	1.000	1.05	0.95	1.00	32.56	4.88	1.18	43.29	NA	67.56	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	18	2.02	1.02	35	IV	0.24	7.00	0.95	11.25	5.25	0.32	1.38	1.33	1.000	1.05	0.95	1.00	32.96	5.00	1.20	44.55	NA	67.96	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	21	2.02	1.02	35	IV	0.24	7.00	0.94	14.28	6.78	0.31	1.21	1.33	1.000	1.05	0.95	1.00	33.84	5.00	1.20	45.60	NA	68.84	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	23	2.03	1.03	38	IV	0.24	7.00	0.93	17.31	8.31	0.30	1.10	1.33	1.000	1.05	1	1.00	35.23	5.00	1.20	47.28	NA	70.23	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	25	2.03	1.03	38	IV	0.24	7.00	0.91	19.34	9.34	0.29	1.03	1.33	1.000	1.05	1	1.00	36.12	5.00	1.20	48.35	NA	71.12	0.64	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_s or C_{ss} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure>10 T/m2)

K_α Correction for static shear stress is required only for sloping ground

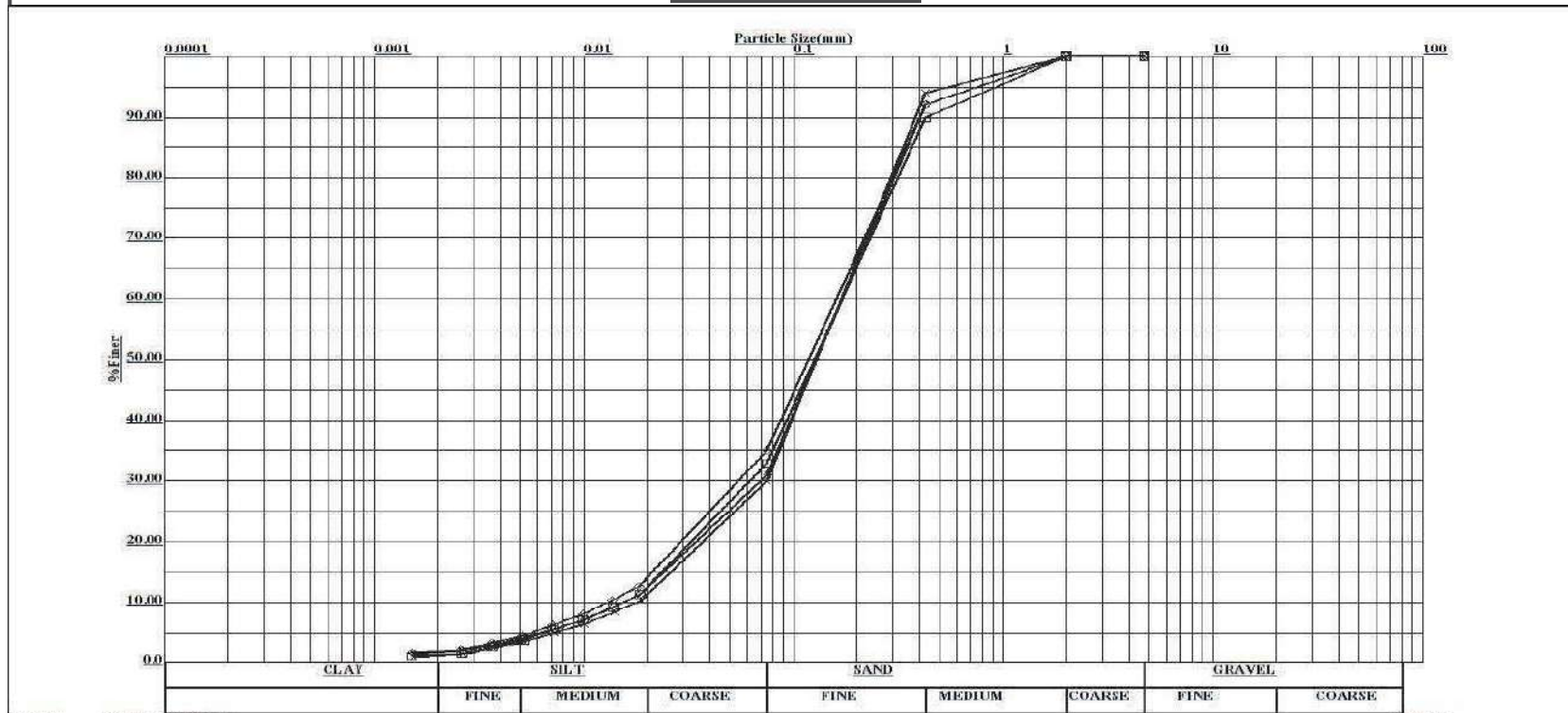
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 29

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	70.00	29.00	1.00	9.54	1.88
○	0.5		0.00	69.00	29.00	2.00	10.94	1.83
□	3.0		0.00	67.00	32.00	1.00	10.99	1.44
◇	6.0		0.00	65.00	33.00	2.00	12.13	1.42



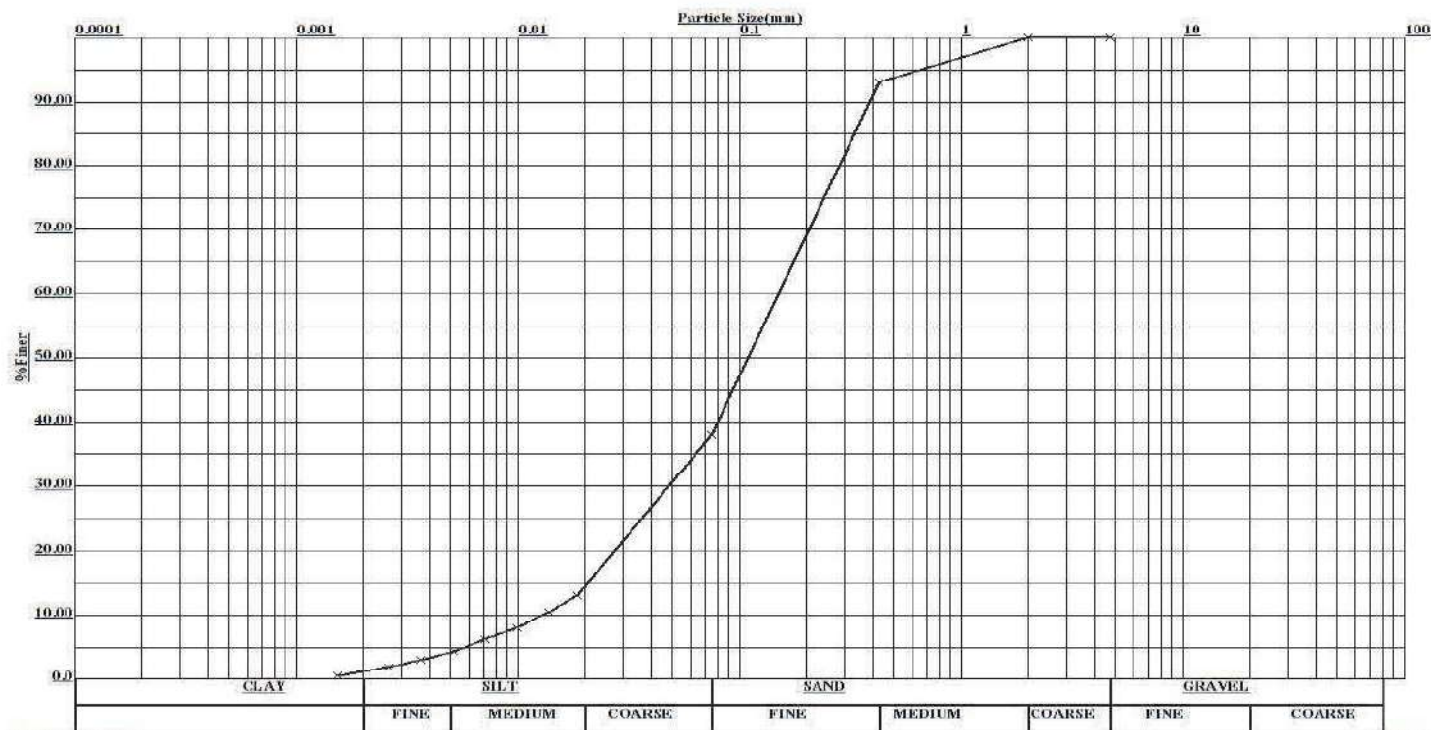
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 29

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	9.0	MEDIUM DENSE, LITE GREY,SILTY SAND (SM)	0.00	62.00	37.00	1.00	11.64	1.19

COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 29

BOREHOLE NO- 1

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil				
		From	To			5,60 to 4,00	4,00 to 2,80	2,80 to 1,00	1,00 to 0,425	0,425 to 0,180	0,180 to 0,075	0,075 to 0	4,8	3,4	1,9	0,7125	0,3025	0,1275	0,0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = K _{sf} c = F x (1 + sqrt(c))	
1	BH-1	0.50	0.95	SILTY SAND	SM	0.0	0.0	0.0	8.0	38.0	23.0	31.0	0.00	0.00	0.00	5.70	11.50	2.93	1.163	0.213	0.812	-	-	-	-	
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	10.0	40.0	17.0	33.0	0.00	0.00	0.00	7.13	12.10	2.17	1.238	0.226	0.837	-	-	-	-	
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	8.0	41.0	16.0	35.0	0.00	0.00	0.00	5.70	12.40	2.04	1.313	0.215	0.815	-	-	-	-	



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
18402.134	31	WATERWAY	MINOR	BH-01	205877	2994613	106.65

SUBMITTED BY:

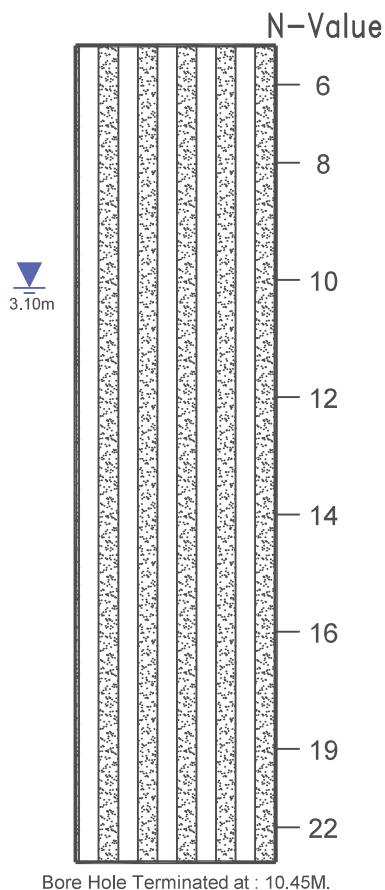


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-31

BOREHOLE NO.: BH- 01



LEGENDS






Silty Sand (SM)



Ground Water Table



Project: FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

BRIDGE NO. 31 BOREHOLE NO. BH- 01					GWT: 3.10 m		DATE STARTED : 27/01/2025		<div>aarvee associates architects engineers & consultants pvt. ltd.</div>																												
FIELD TEST RESULTS										LABORATORY TEST RESULTS																											
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE /L.W/L	SPT TEST RESULTS					SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (gm /cc)	DRY DENSITY (gm/cc)	MOISTURE CONTENT (%)	FREESWELL INDEX (%)	SPECIFIC GRAVITY	SUBMERGED DENSITY (gm /cc)	SHEAR STRENGTH CHARACTERISTICS		CONSOLIDATION CHARACTERISTICS	Chemical Analysis Result								
					DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N VALUE (Recorded)	N VALUE (Corrected)				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)										Cohesion, C _v (kg/cm ²)	Angle of friction (Degrees)		Compression Index(Cc)	SOIL SAMPLE			WATER SAMPLE				
-0.50	0.5	DS	1	<div>3.10 m</div> <div></div>	0,00	0,50	DS	-	-	-		MEDIUM, LITE GREY, SILTY SAND (SM)	-	0	68	31	1	NON-PLASTIC				-	-	-	-	-	-	-	-	-	-	7,46	0,02	NIL	-	-	-
	1.0	SPT	1		0,50	0,95	6	30	6	11			-	0	66	32	2	NON-PLASTIC				-	-	-	2,54	-	-	-	-	-	-	7,52	0,02	NIL	-	-	-
	2.0	SPT	2		1,50	1,95	8	30	8	12			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,56	0,03	NIL	-	-	-	
-3,00	3,0	UD	1		2,50	2,80	-						-	0	65	34	1	NON-PLASTIC			1,64	-	-	-	2,56	-	0	31°	-	-	-	-	-	-	-		
	4,0	SPT	3		3,00	3,45	10	30	10	12			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	5,0	SPT	4		4,50	4,95	12	30	12	16			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-6,00	6,0	DS	2		5,50	5,80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	7,0	SPT	5		6,00	6,45	14	30	14	17			-	0	64	34	2	NON-PLASTIC				-	-	-	2,55	-	-	-	-	-	-	-	-	-	-	-	
	8,0	SPT	6		7,50	7,95	16	30	16	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-9,00	9,0	DS	3		8,50	8,80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	10,0	SPT	7		9,00	9,45	19	30	19	18			-	0	62	37	1	NON-PLASTIC				-	-	-	2,55	-	-	-	-	-	-	-	-	-	-	-	
	11,0	SPT	8		10,00	10,45	22	30	22	19			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLASSIFICATION OF SOIL AS PER IS : 1498 ABBREVIATION USED : DS = DISTURBED SAMPLE , SPT = STANDARD PENETRATION TEST, UDS = UNDISTURBED SAMPLE, DST = DIRECT SHEAR TEST, UC : UNCONFINED COMPRESSION TEST UU : UNCONSOLIDATED UNDRAINED TRIAXIAL TEST * UCS BASED ON POINT LOAD TEST													Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)																								
												SECTION: CHITAUNI-MADHUBANI																									

CALCULATIONS FOR CORRECTED SPT (N) VALUES

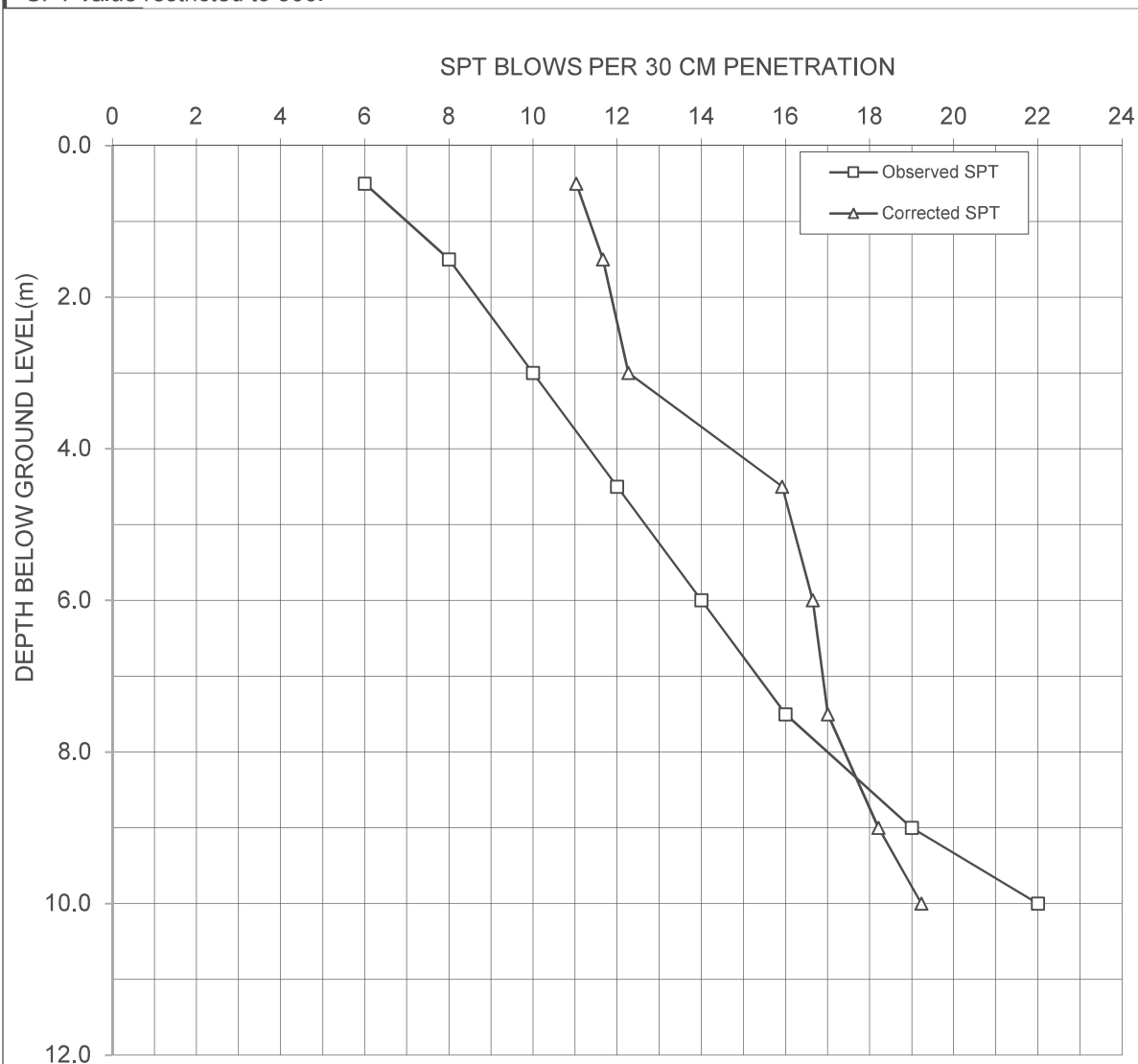
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :-3.10m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	6	11	11
1.50	Non Plastic	8	12	12
3.00	Non Plastic	10	12	12
4.50	Non Plastic	12	17	16
6.00	Non Plastic	14	18	17
7.50	Non Plastic	16	19	17
9.00	Non Plastic	19	21	18
10.00	Non Plastic	22	23	19

* SPT value restricted to 300.



Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 31

BOREHOLE NO.

BH-01

SECTION: CHITAUUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ'_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_u	MSF	CRR	FOS	Conclusion
0.50	SM	6	1.72	0.72	34	IV	0.24	7.00	1.00	0.86	0.36	0.37	1.70	1.33	1.000	1.05	0.75	1.00	10.68	4.93	1.19	17.63	0.19	21.54	0.89	1.00	1.00	1.19	0.22	0.60	Liquefiable
1.50	SM	8	1.72	0.72	34	IV	0.24	7.00	0.99	2.58	1.08	0.37	1.70	1.33	1.000	1.05	0.75	1.00	14.24	4.93	1.19	21.86	0.24	29.55	0.85	1.00	1.00	1.19	0.29	0.78	Liquefiable
3.00	SM	10	1.64	0.64	35	IV	0.24	7.00	0.98	5.16	2.16	0.36	1.70	1.33	1.000	1.05	0.85	1.00	20.18	5.00	1.20	29.22	0.42	42.90	0.79	1.00	1.00	1.19	0.50	1.38	Non Liquefiable
4.50	SM	12	1.64	0.64	35	IV	0.24	7.00	0.97	7.62	3.12	0.37	1.70	1.33	1.000	1.05	0.95	1.00	27.06	5.00	1.20	37.48	NA	58.39	0.71	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	14	2.01	1.01	36	IV	0.24	7.00	0.95	10.08	4.08	0.37	1.57	1.33	1.000	1.05	0.95	1.00	29.08	5.00	1.20	39.89	NA	62.93	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	16	2.01	1.01	36	IV	0.24	7.00	0.94	13.10	5.60	0.34	1.34	1.33	1.000	1.05	0.95	1.00	28.38	5.00	1.20	39.05	NA	61.35	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	19	2.04	1.04	38	IV	0.24	7.00	0.93	16.11	7.11	0.33	1.19	1.33	1.000	1.05	1	1.00	31.47	5.00	1.20	42.76	NA	66.47	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	22	2.04	1.04	38	IV	0.24	7.00	0.91	18.15	8.15	0.32	1.11	1.33	1.000	1.05	1	1.00	34.03	5.00	1.20	45.84	NA	69.03	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_S or C_{SS} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure > 10 T/m²)

K_u Correction for static shear stress is required only for sloping ground

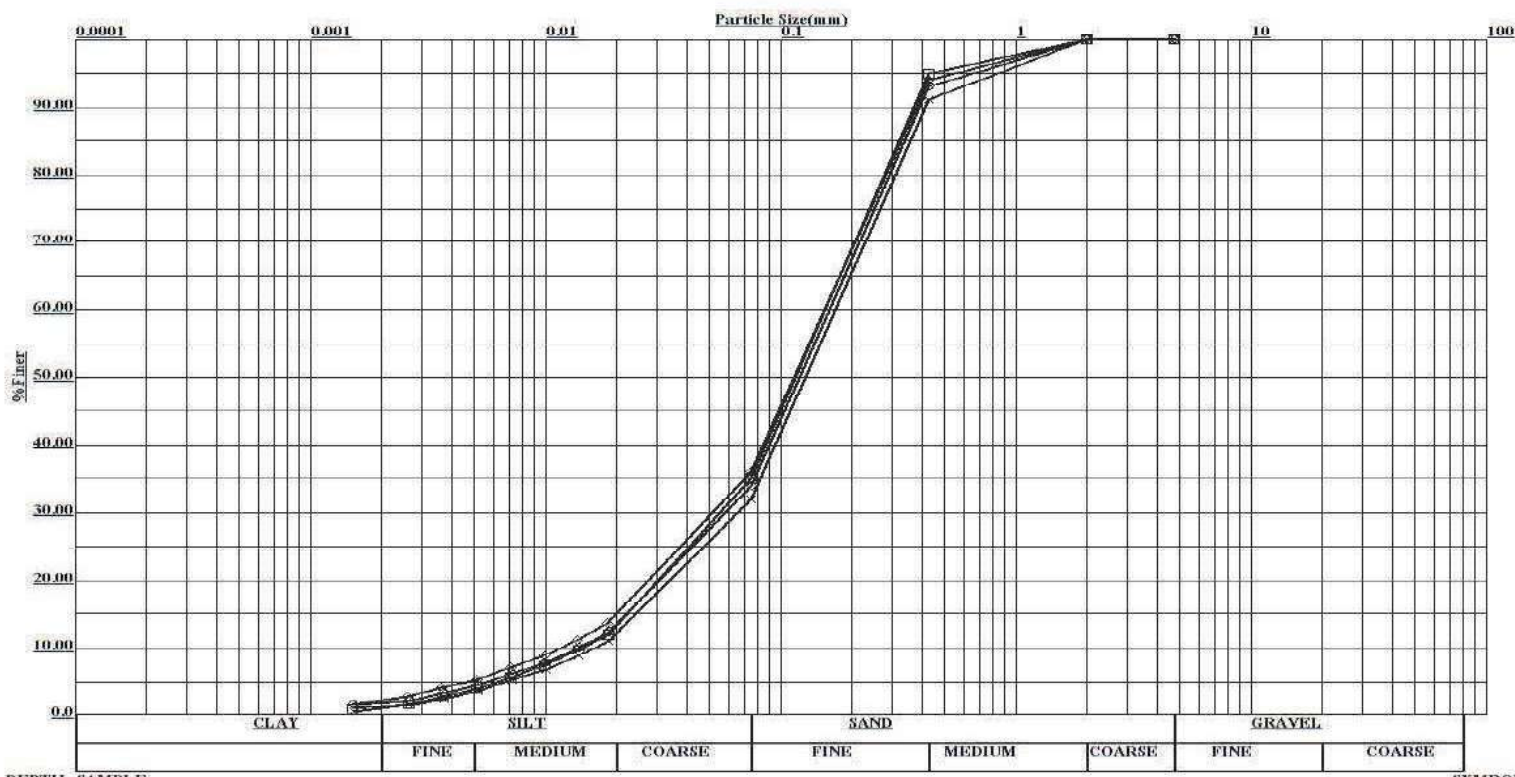


PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 31
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	C _u	C _c
×	0.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	68.00	31.00	1.00	10.56	1.56
○	0.5		0.00	66.00	32.00	2.00	11.68	1.51
□	2.5		0.00	65.00	34.00	1.00	10.75	1.37
◇	6.0		0.00	64.00	34.00	2.00	13.20	1.48

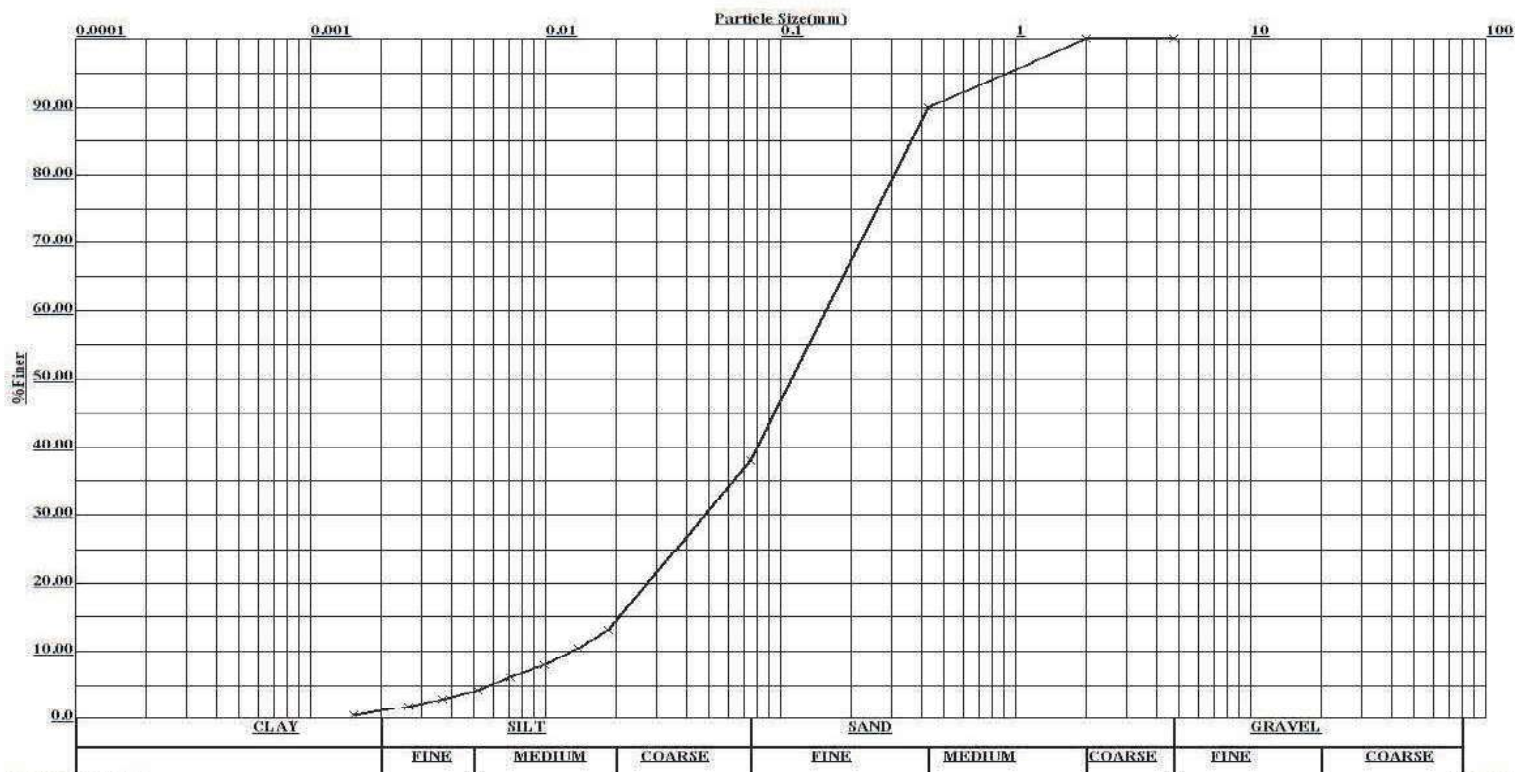


PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 31
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. -BH- 01

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	9.0	MEDIUM DENSE, LITE GREY,SILTY SAND (SM)	0.00	62.00	37.00	1.00	12.11	1.14



COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO.-31

BOREHOLE NO- 1

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil				
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = K _{sf} c = F x (1 + sqrt(c))	
																									Silt Factor	
1	BH-1	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	9.0	38.0	21.0	32.0	0.00	0.00	0.00	6.41	11.50	2.68	1.200	0.218	0.821	-	-	-	-	-
2		2.50	2.80	SILTY SAND	SM	0.0	0.0	0.0	5.0	43.0	17.0	35.0	0.00	0.00	0.00	3.56	13.01	2.17	1.313	0.201	0.788	-	-	-	-	-
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	6.0	42.0	16.0	36.0	0.00	0.00	0.00	4.28	12.71	2.04	1.350	0.204	0.794	-	-	-	-	-



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
19919.534	34	WATERWAY	MINOR	BH-01	206987	2993592	106.16

SUBMITTED BY:



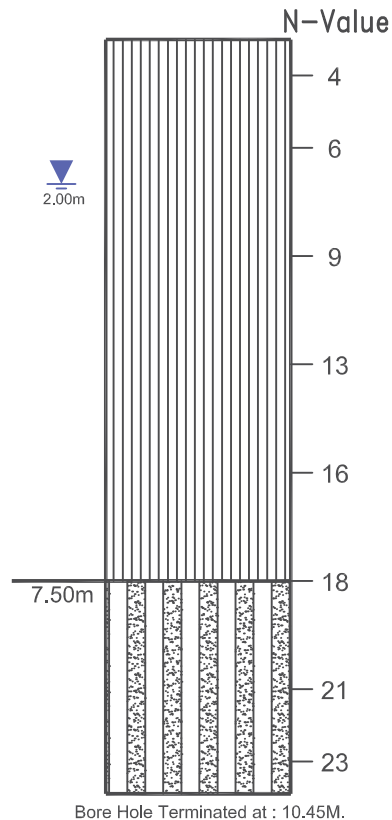
aarvee associates
architects engineers & consultants pvt. ltd.

BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.- 34

BOREHOLE NO.: BH- 01



LEGENDS



Sandy Silt (ML)



Silty Sand (SM)



Ground Water Table



Project: FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

CALCULATIONS FOR CORRECTED SPT (N) VALUES

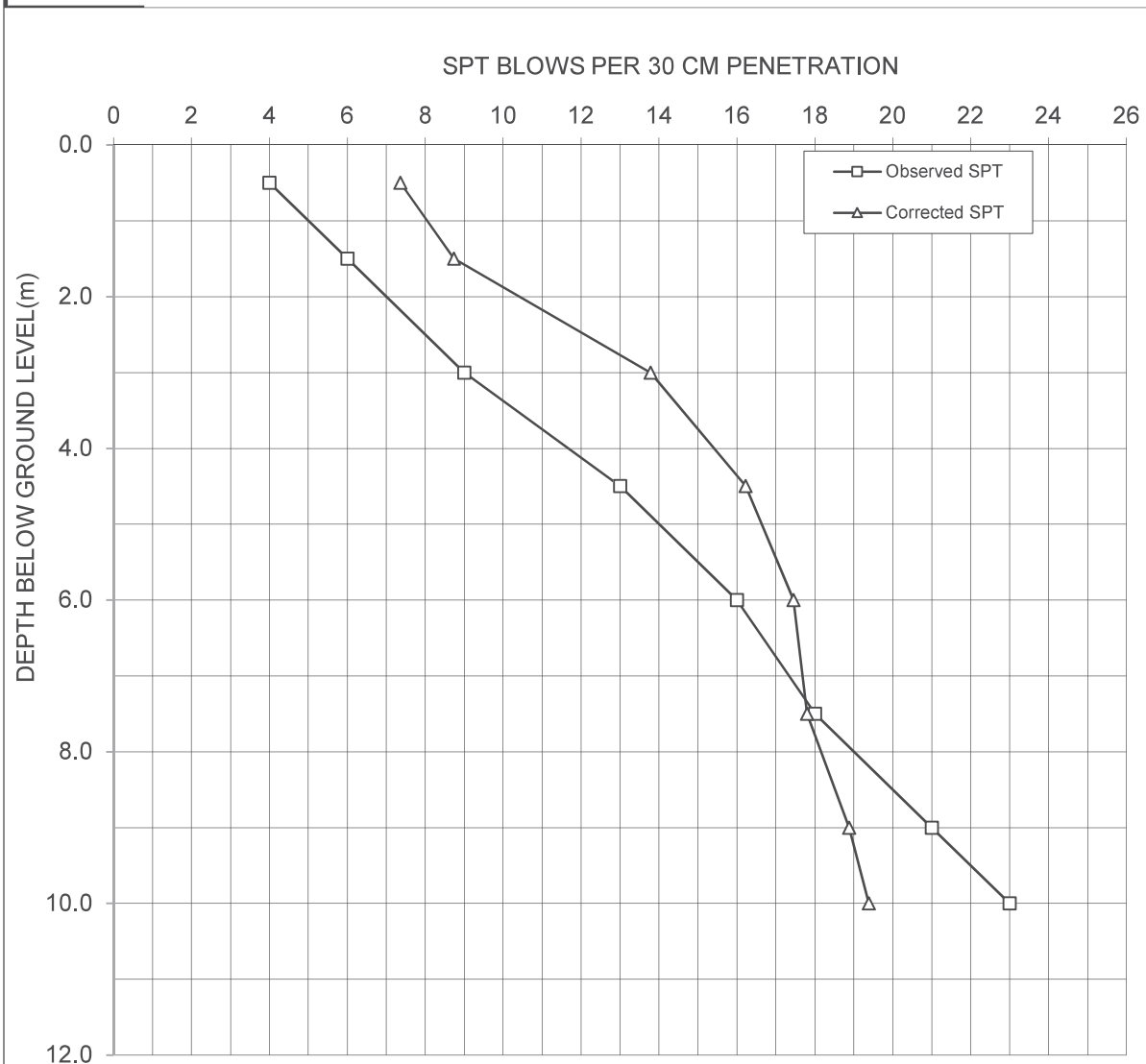
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :-2.00 m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	4	7	7
1.50	Non Plastic	6	9	9
3.00	Non Plastic	9	14	14
4.50	Non Plastic	13	17	16
6.00	Non Plastic	16	20	17
7.50	Non Plastic	18	21	18
9.00	Non Plastic	21	23	19
10.00	Non Plastic	23	24	19

* SPT value restricted to 300.





Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 34

BOREHOLE NO.

BH-01

SECTION: CHITAUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ'_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_α	MSF	CRR	FOS	Conclusion
0.50	ML-NP	4	1.75	0.75	68	IV	0.24	7.00	1.00	0.88	0.38	0.36	1.70	1.33	1.000	1.05	0.75	1.00	7.12	5.00	1.20	13.55	0.15	15.20	0.92	1.00	1.00	1.19	0.17	0.48	Liquefiable
1.50	ML-NP	6	1.75	0.75	68	IV	0.24	7.00	0.99	2.63	1.13	0.36	1.70	1.33	1.000	1.05	0.75	1.00	10.68	5.00	1.20	17.82	0.19	21.54	0.89	1.00	1.00	1.19	0.23	0.63	Liquefiable
3.00	ML-NP	9	2.02	1.02	72	IV	0.24	7.00	0.98	5.25	2.25	0.36	1.70	1.33	1.000	1.05	0.85	1.00	18.16	5.00	1.20	26.79	0.33	38.36	0.81	1.00	1.00	1.19	0.40	1.12	Non Liquefiable
4.50	ML-NP	13	2.02	1.02	72	IV	0.24	7.00	0.97	8.28	3.78	0.33	1.63	1.33	1.000	1.05	0.95	1.00	28.05	5.00	1.20	38.66	NA	60.62	0.70	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	ML-NP	16	2.03	1.03	75	IV	0.24	7.00	0.95	11.31	5.31	0.32	1.37	1.33	1.000	1.05	0.95	1.00	29.13	5.00	1.20	39.96	NA	63.04	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	18	2.03	1.03	13	IV	0.24	7.00	0.94	14.36	6.86	0.31	1.21	1.33	1.000	1.05	0.95	1.00	28.84	1.89	1.04	31.79	NA	62.40	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	21	2.04	1.04	13	IV	0.24	7.00	0.93	17.40	8.40	0.30	1.09	1.33	1.000	1.05	1	1.00	32.00	1.89	1.04	35.07	NA	67.00	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	23	2.04	1.04	13	IV	0.24	7.00	0.91	19.44	9.44	0.29	1.03	1.33	1.000	1.05	1	1.00	33.06	1.89	1.04	36.17	NA	68.06	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_s or C_{ss} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure>10 T/m2)

K_α Correction for static shear stress is required only for sloping ground



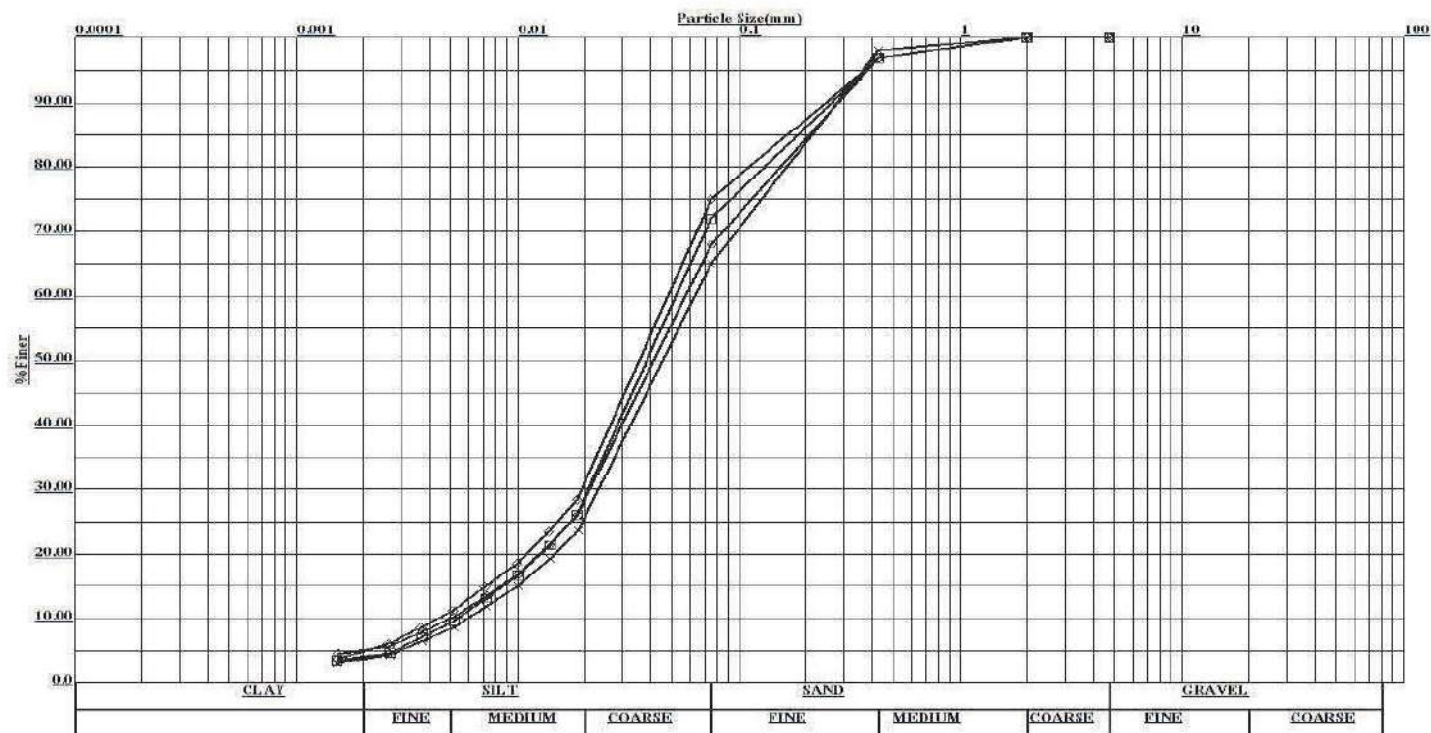
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 34

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	LOOSE TO MEDIUM, LITE BROWN, SANDY SILT (ML)	0.00	35.00	61.00	4.00	10.55	1.41
○	0.5		0.00	32.00	63.00	5.00	11.32	1.56
□	3.0		0.00	28.00	68.00	4.00	9.59	1.56
◇	6.0		0.00	25.00	70.00	5.00	10.79	1.78



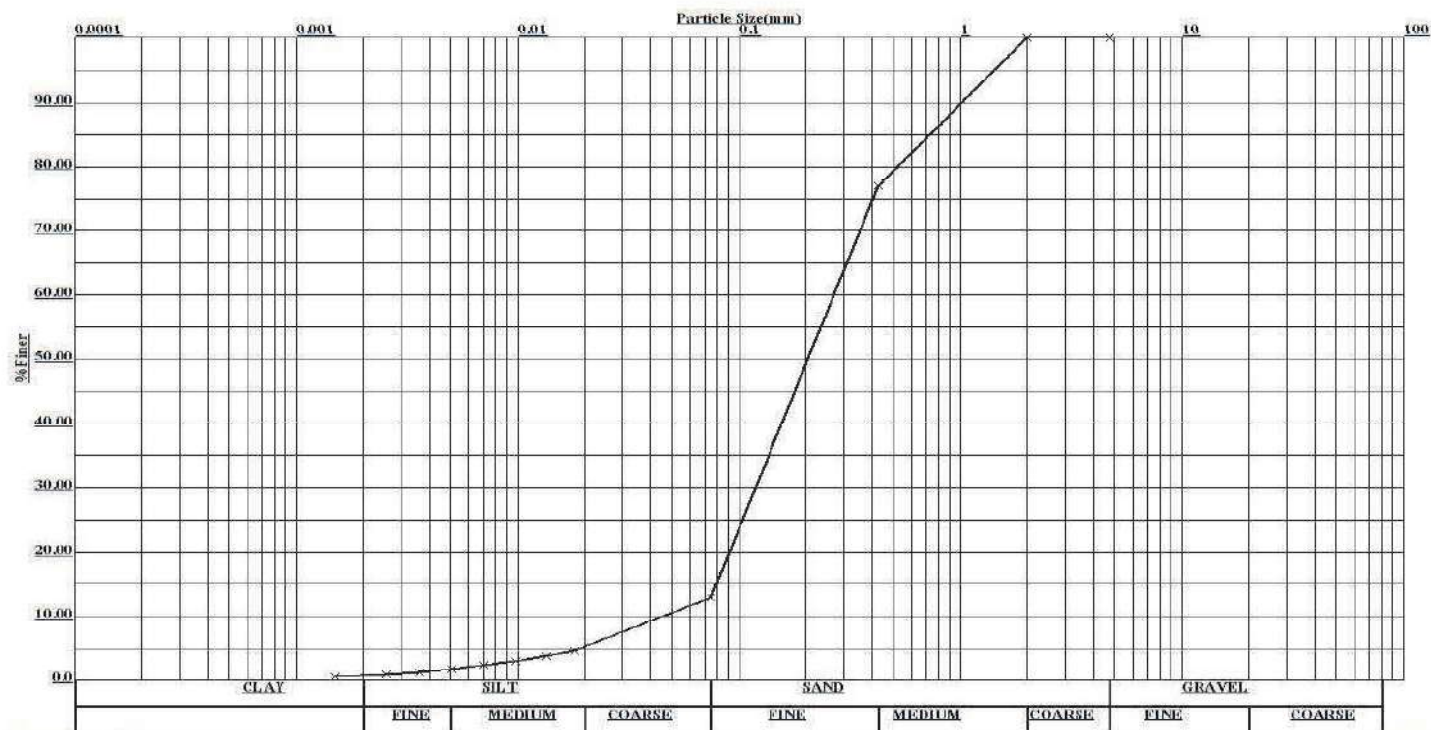
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 34

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	9.0	MEDIUM, LITE GREY, SILTY SAND (SM)	0.00	87.00	12.00	1.00	5.94	1.17

COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 34

BOREHOLE NO- 1

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil			
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = K _{sf} c = F x (1 + sqrt(c))
1	BH-1	0.50	0.95	SANDY SILT	ML	0.0	0.0	0.0	3.0	21.0	8.0	68.0	0.00	0.00	0.00	2.14	6.35	1.02	2.550	0.121	0.611	-	-	-	-
2		3.00	3.45	SANDY SILT	ML	0.0	0.0	0.0	3.0	20.0	5.0	72.0	0.00	0.00	0.00	2.14	6.05	0.64	2.700	0.115	0.597	-	-	-	-
3		6.00	6.45	SANDY SILT	ML	0.0	0.0	0.0	3.0	18.0	4.0	75.0	0.00	0.00	0.00	2.14	5.45	0.51	2.813	0.109	0.581	-	-	-	-



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY
FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD &
4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022.00 KM)**

SECTION: CHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
23580.567	41	WATERWAY	MINOR	BH-01	207667	2989998	105.03

SUBMITTED BY:

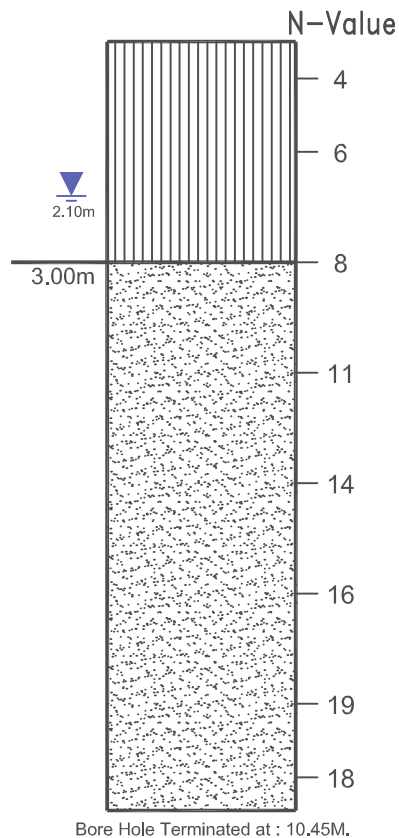


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.- 41

BOREHOLE NO.: BH- 01



LEGENDS



Sandy Silt (ML)







Poorly Graded Sand (SP)



Ground Water Table



Project: FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE PROJECTS (770.00 KM.) AND FINAL LOCATION SURVEY FOR CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH LINE (252.00 KM.) OF NORTH EASTERN RAILWAY (TOTAL 1022.00 KM)

BRIDGE NO. 41 BOREHOLE NO. BH- 01										GWT: 2.10 m		DATE STARTED : 29/01/2025		DATE COMPLETED : 29/01/2025		 aarvee associates architects engineers & consultants pvt. ltd.																						
FIELD TEST RESULTS												CONSOLIDATED LOGS INCLUDING LABORATORY TEST RESULTS OF SOIL																										
												LABORATORY TEST RESULTS																										
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE / L.W.L	SPT TEST RESULTS					SYMBOLIC REPRESENTATION	DESCRIPTION OF SOIL WITH I.S. CLASSIFICATION	TYPE OF TEST CONDUCTED IN THE LABORATORY	GRAIN SIZE ANALYSIS				LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	BULK DENSITY (gm /cc)	DRY DENSITY (gm/cc)	MOISTURE CONTENT (%)	FREESWELL INDEX (%)	SPECIFIC GRAVITY	SUBMERGED DENSITY (gm /cc)	SHEAR STRENGTH CHARACTERISTICS		CONSOLIDATION CHARACTERISTICS	Chemical Analysis Result									
					DEPTH IN METERS	NO. OF BLOWS	PENETRATION (CM)	N VALUE (Recorded)	N VALUE (Corrected)				GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)										Cohesion, C _v (kg/cm ²)	Angle of friction (Degrees)		Compression Index (Cc)	pH	Chloride, %	Sulphate, %	pH	Chloride, mg/l	Sulphate, mg/l			
-0.50	0.5	DS	1	 2.10 m	0.00	0.50	DS	-	-	-		LOOSE, LITE BROWN, SANDY SILT (ML)	-	0	35	60	5	NON-PLASTIC				-	-	-	-	-	-	-	-	-	-	-	7.41	0.02	NIL	-	-	-
	1.0	SPT	1		0.50	0.95	4	30	4	7			-	0	28	68	4	NON-PLASTIC				-	-	-	2.52	-	-	-	-	-	-	7.46	0.02	NIL	-	-	-	
	2.0	SPT	2		1.50	1.95	6	30	6	9			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.52	0.03	NIL	-	-	-		
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	4.0	SPT	3		3.00	3.45	8	30	8	13		MEDIUM DENSE, LITE GREY, POORLY GRADED SAND (SP)	-	0	96	4	0	NON-PLASTIC				-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0	SPT	4		4.50	4.95	11	30	11	15			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
-6.00	6.0	DS	2		5.50	5.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	7.0	SPT	5		6.00	6.45	14	30	14	16			-	0	97	3	0	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-		
	8.0	SPT	6		7.50	7.95	16	30	16	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-9.00	9.0	DS	3		8.50	8.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	10.0	SPT	7		9.00	9.45	19	30	19	18			-	0	96	4	0	NON-PLASTIC				-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	-	-	
	11.0	SPT	8		10.00	10.45	18	30	18	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
CLASSIFICATION OF SOIL AS PER IS : 1498 ABBREVIATION USED: DS = DISTURBED SAMPLE , SPT = STANDARD PENETRATION TEST, UDS = UNDISTURBED SAMPLE, DST = DIRECT SHEAR TEST, UC : UNCONFINED COMPRESSION TEST UU : UNCONSOLIDATED UNDRAINED TRIAXIAL TEST * UCS BASED ON POINT LOAD TEST													Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)																									
												SECTION: CHITAUNI-MADHUBANI																										



CALCULATIONS FOR CORRECTED SPT (N) VALUES

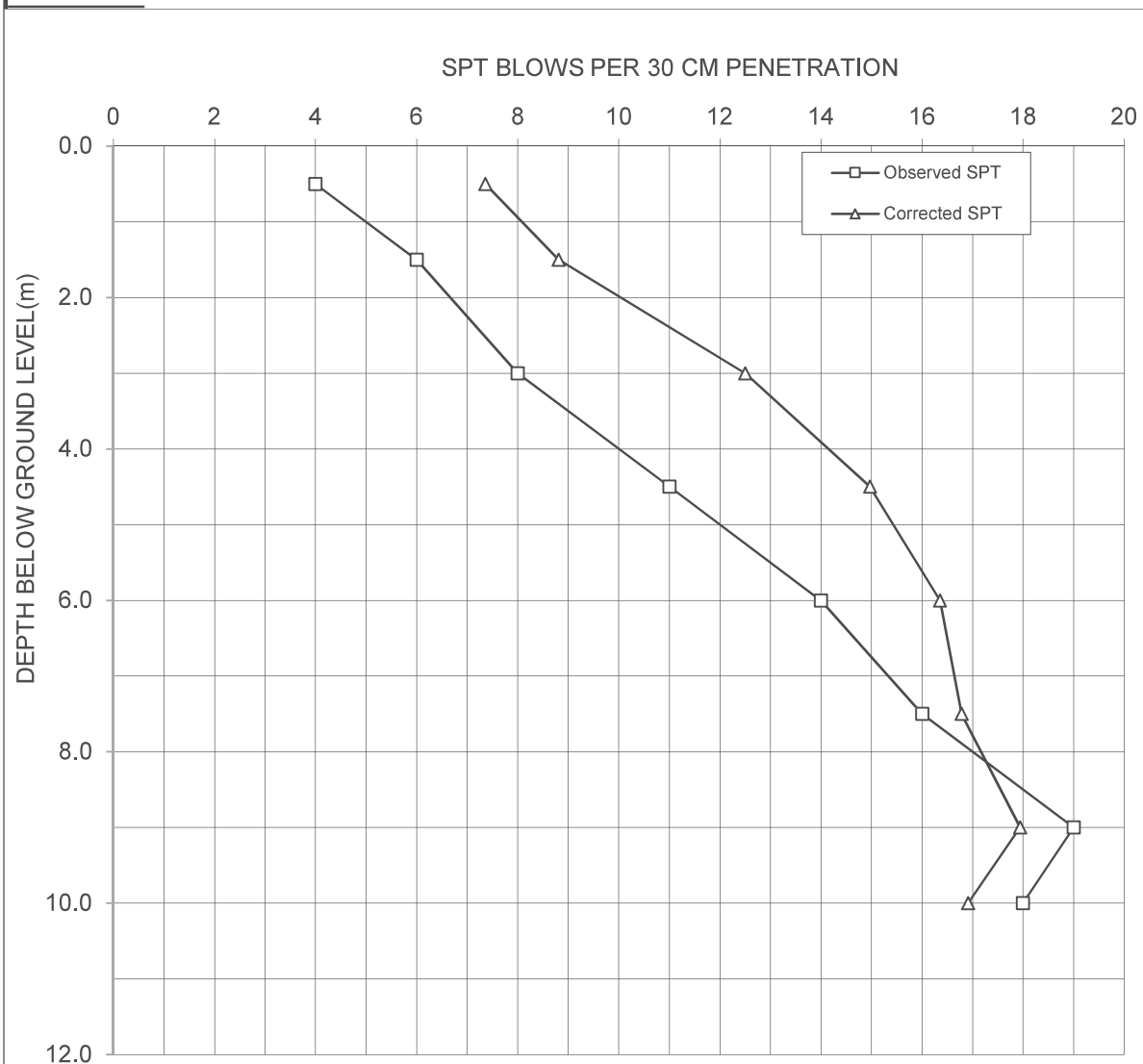
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BOREHOLE NO. BH- 01

WATER TABLE :-2.10 m

DEPTH OF SAMPLE	TYPE OF SOIL	OBSERVED SPT 'N' VALUE	CORRECTED SPT (N') VALUE (FOR OVERBURDEN)	FINAL CORRECTED VALUE AFTER DILATANCY CORRECTION (N'')
0.50	Non Plastic	4	7	7
1.50	Non Plastic	6	9	9
3.00	Non Plastic	8	13	13
4.50	Non Plastic	11	15	15
6.00	Non Plastic	14	18	16
7.50	Non Plastic	16	19	17
9.00	Non Plastic	19	21	18
10.00	Non Plastic	18	19	17

* SPT value restricted to 300.





Typical Computation of Liquefaction Potential as per IRC:SP: 114 / IS: 1893

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO: 41

BOREHOLE NO.

BH-01

SECTION: CHITAUNI-MADHUBANI

Water table assumed for Calculation: 0.00 m

Depth below EGL, m	Type of Strata	Observed SPT Value	Saturated density (t/m^3)	Submerged Density (t/m^3)	Fine Content (%)	Earthquake Zone	Peak ground acceleration a_{max}/g	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure (σ_o), t/m^2	Effective overburden (σ'_o), t/m^2	Cyclic Stress ratio (CSR)	C_N	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected (N_1) ₆₀	α	β	(N_1) _{60cs}	$CRR_M = 7.5$	Relative Density, Dr%	f	K_σ	K_α	MSF	CRR	FOS	Conclusion
0.50	ML-NP	4	1.62	0.62	72	IV	0.24	7.00	1.00	0.81	0.31	0.41	1.70	1.33	1.000	1.05	0.75	1.00	7.12	5.00	1.20	13.55	0.15	15.20	0.92	1.00	1.00	1.19	0.17	0.43	Liquefiable
1.50	ML-NP	6	1.62	0.62	72	IV	0.24	7.00	0.99	2.43	0.93	0.40	1.70	1.33	1.000	1.05	0.75	1.00	10.68	5.00	1.20	17.82	0.19	21.54	0.89	1.00	1.00	1.19	0.23	0.56	Liquefiable
3.00	SP	8	2.00	1.00	4	IV	0.24	7.00	0.98	4.86	1.86	0.40	1.70	1.33	1.000	1.05	0.85	1.00	16.14	0.00	1.00	16.14	0.17	33.82	0.83	1.00	1.00	1.19	0.20	0.51	Liquefiable
4.50	SP	11	2.00	1.00	4	IV	0.24	7.00	0.97	7.86	3.36	0.35	1.70	1.33	1.000	1.05	0.95	1.00	24.81	0.00	1.00	24.81	0.29	53.32	0.73	1.00	1.00	1.19	0.34	0.98	Liquefiable
6.00	SP	14	2.02	1.02	3	IV	0.24	7.00	0.95	10.86	4.86	0.33	1.43	1.33	1.000	1.05	0.95	1.00	26.64	0.00	1.00	26.64	0.33	57.45	0.71	1.00	1.00	1.19	0.39	1.18	Non Liquefiable
7.50	SP	16	2.02	1.02	3	IV	0.24	7.00	0.94	13.89	6.39	0.32	1.25	1.33	1.000	1.05	0.95	1.00	26.55	0.00	1.00	26.55	0.33	57.25	0.71	1.00	1.00	1.19	0.39	1.22	Non Liquefiable
9.00	SP	19	2.03	1.03	4	IV	0.24	7.00	0.93	16.92	7.92	0.31	1.12	1.33	1.000	1.05	1	1.00	29.81	0.00	1.00	29.81	0.46	64.58	0.68	1.00	1.00	1.19	0.54	1.75	Non Liquefiable
10.00	SP	18	2.03	1.03	4	IV	0.24	7.00	0.91	18.95	8.95	0.30	1.06	1.33	1.000	1.05	1	1.00	26.57	0.00	1.00	26.57	0.33	57.28	0.71	1.00	1.00	1.19	0.39	1.30	Non Liquefiable

Note: Values of all Parameters are as per IRC:SP: 114 / IS 1893: 2016

C_E or C_{HT} (Correction for hammer energy ratio) = $ER/60$, ER for Rope and pully System = 80 % , Hence $C_E = 80/60 = 1.33$

C_H or C_{HW} (Correction for hammer) = 1.00

Borehole Diameter = 150 mm , Hence C_B or C_{BD} (Correction for Borehole diameter), = 1.05

C_s or C_{ss} (Correction for Standard sampler) = 1.00

K_σ Correction for high overburden stress (for effective oberburden pressure>10 T/m2)

K_α Correction for static shear stress is required only for sloping ground



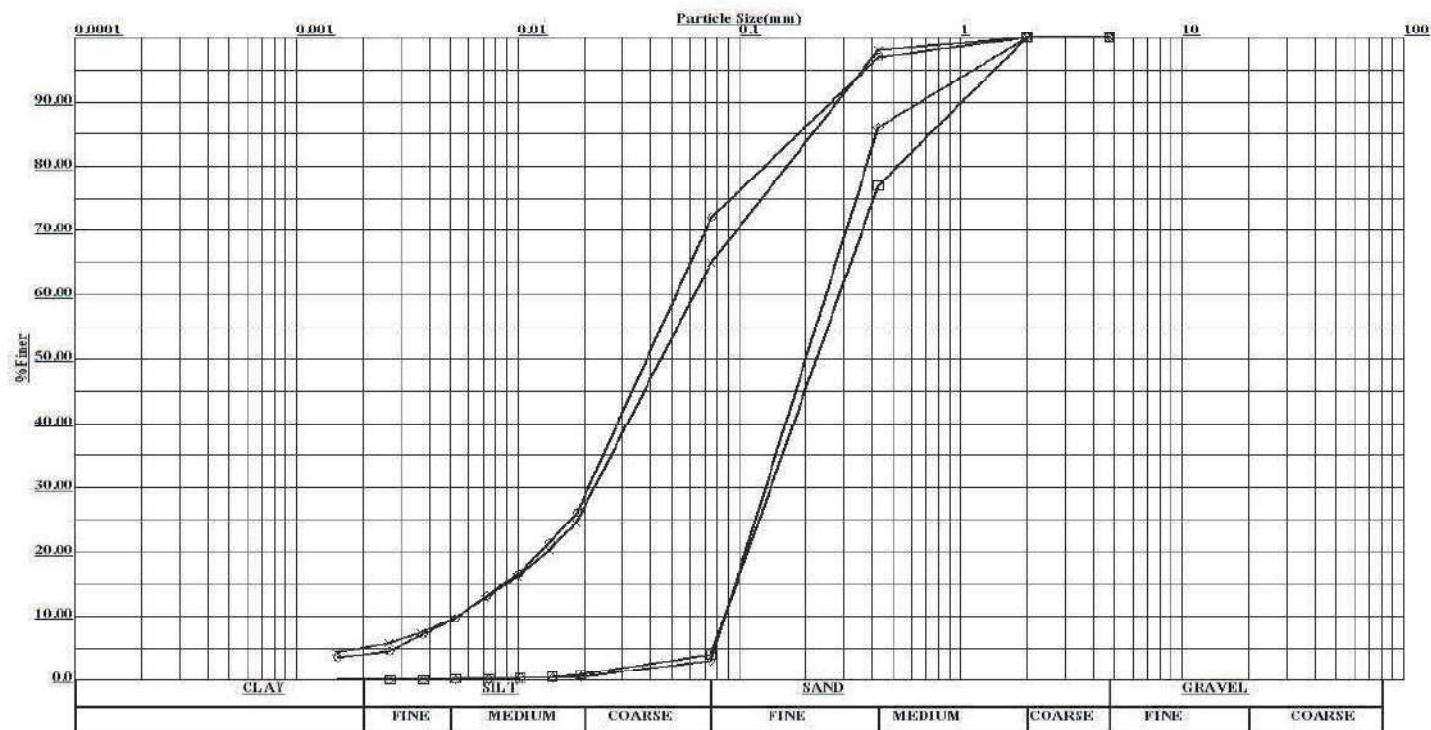
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 41

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	0.0	LOOSE, LITE BROWN, SANDY SILT (ML)	0.00	35.00	60.00	5.00	11.81	1.47
o	0.5		0.00	28.00	68.00	4.00	9.60	1.55
□	3.0	MEDIUM DENSE, LITE GREY, POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.28	0.79
◇	6.0		0.00	97.00	3.00	0.00	2.84	0.81



aarvee associates
architects engineers & consultants pvt. ltd.

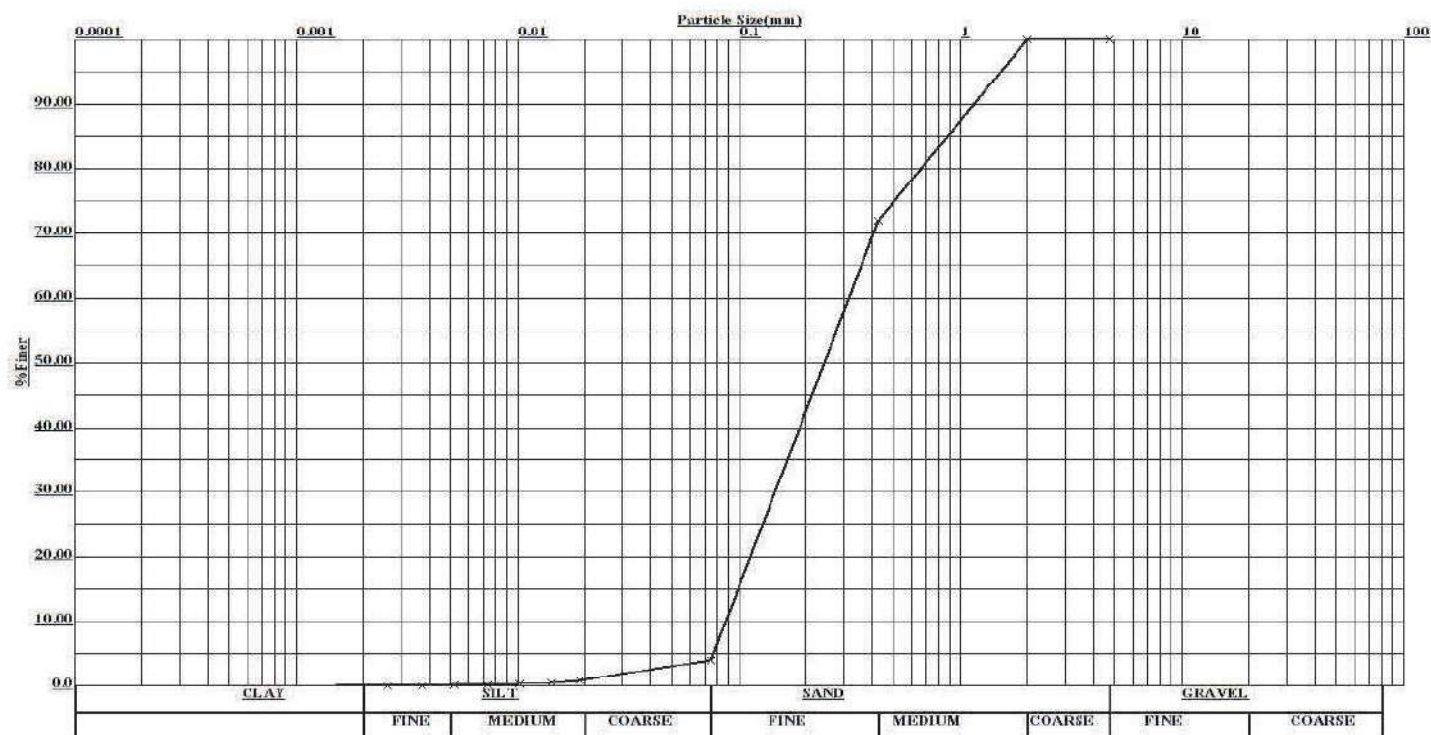
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BRIDGE NO. - 41

BOREHOLE NO. - 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
x	9.0	MEDIUM DENSE, LITE GREY, POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.58	0.77

COMPUTATION OF WEIGHTED MEAN DIAMETER OF PARTICLES AND SILT FACTOR

Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 41

BOREHOLE NO- 1

Section : CHITAUNI - MADHUBANI

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil			
		From	To			5.60 to 4.00	4.00 to 2.80	2.80 to 1.00	1.00 to 0.425	0.425 to 0.180	0.180 to 0.075	0.075 to 0	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	Mean Particle Size (dm)	Silt Factor in the layer= 1.76 x sqrt(dm)	Average Cohesion Intercept - c (kg/sqcm)	Average Angle of Internal Friction (°)	F	Silt Factor = K _{sf} c = F x (1 + sqrt(c))
1	BH-1	0.50	0.95	SANDY SILT	ML	0.0	0.0	0.0	3.0	19.0	6.0	72.0	0.00	0.00	0.00	2.14	5.75	0.77	2.700	0.114	0.593	-	-	-	-
2		3.00	3.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	23.0	53.0	20.0	4.0	0.00	0.00	0.00	16.39	16.03	2.55	0.150	0.351	1.043	-	-	-	-
3		6.00	6.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	14.0	55.0	28.0	3.0	0.00	0.00	0.00	9.98	16.64	3.57	0.113	0.303	0.969	-	-	-	-