



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)
15869.784	27	ROAD	RUB	BH-01	203816	2996081	111.92

SUBMITTED BY:

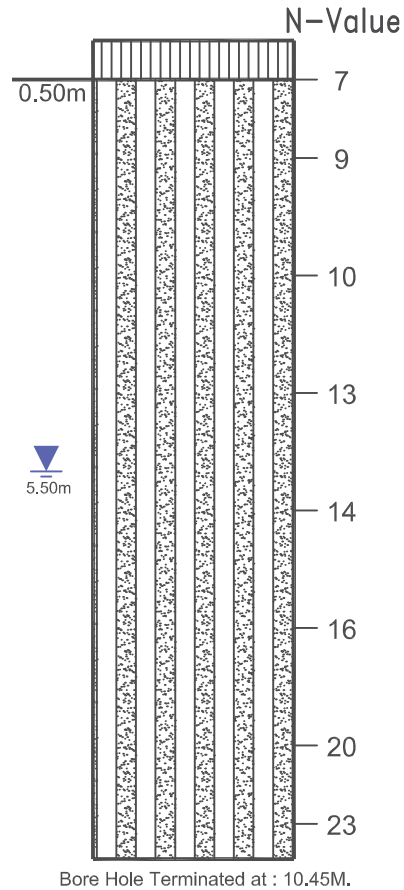


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.-27

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

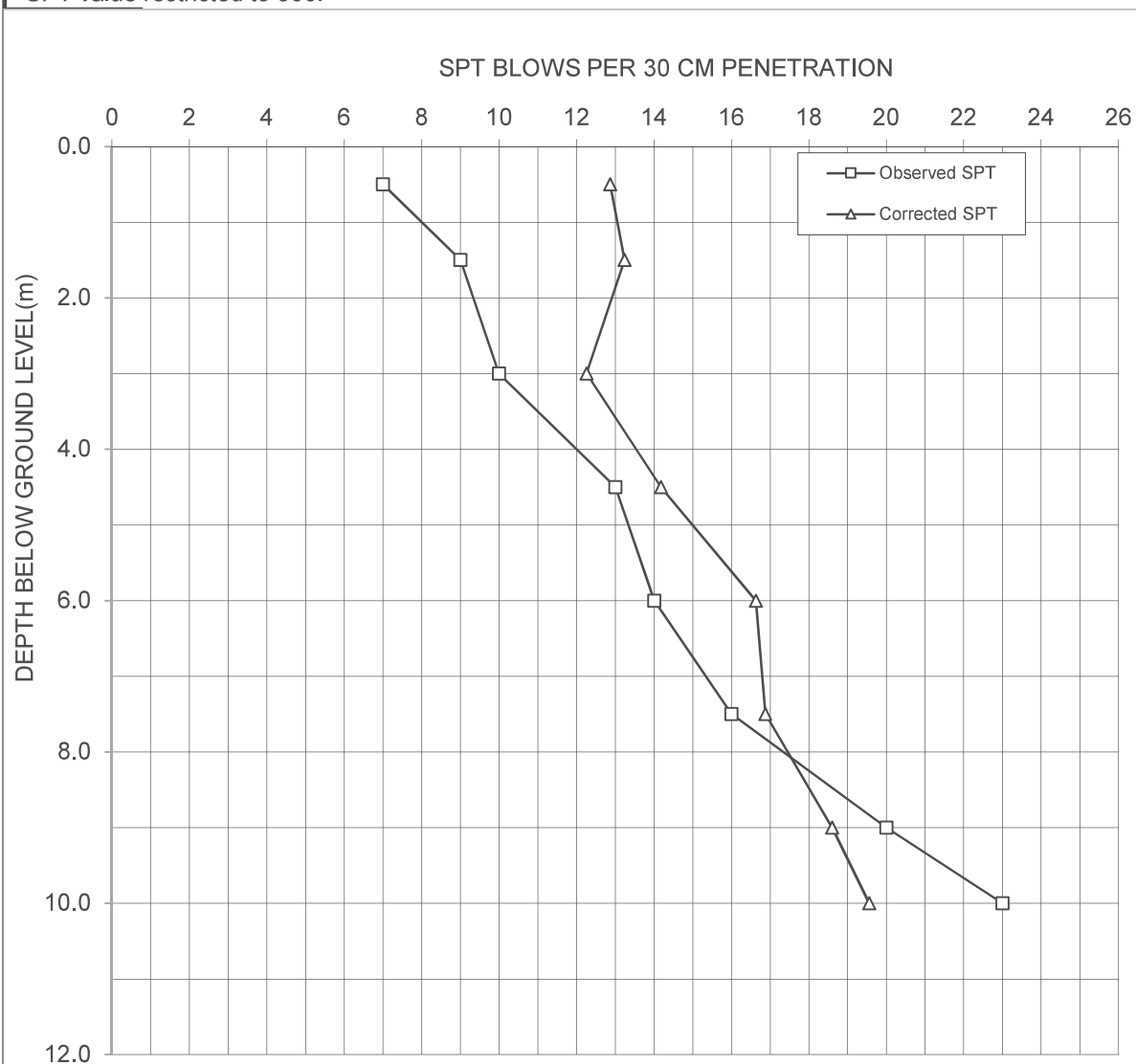
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE :-5.50 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	7	13	13
1.50	Non Plastic	9	13	13
3.00	Non Plastic	10	12	12
4.50	Non Plastic	13	14	14
6.00	Non Plastic	14	18	17
7.50	Non Plastic	16	19	17
9.00	Non Plastic	20	22	19
10.00	Non Plastic	23	24	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: 27

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	1.72	0.72	28	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	12.46	4.56	1.14	18.75	0.20	25.54	0.87	1.00	1.00	1.19	0.24	0.64	Liquefiable
1.50	SM	9	1.72	0.72	28	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	16.02	4.56	1.14	22.80	0.25	33.56	0.83	1.00	1.00	1.19	0.30	0.82	Liquefiable
3.00	SM	10	1.72	0.72	28	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	4.56	1.14	27.53	0.35	42.90	0.79	1.00	1.00	1.19	0.42	1.16	Non Liquefiable
4.50	SM	13	1.72	0.72	28	IV	0.24	7.00	0.97	7.74	3.24	0.36	1.70	1.33	1.000	1.05	0.95	1.00	29.32	4.56	1.14	37.93	NA	63.47	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	14	2.03	1.03	30	IV	0.24	7.00	0.95	10.32	4.32	0.36	1.52	1.33	1.000	1.05	0.95	1.00	28.26	4.71	1.15	37.33	NA	61.08	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	16	2.03	1.03	30	IV	0.24	7.00	0.94	13.37	5.87	0.34	1.31	1.33	1.000	1.05	0.95	1.00	27.72	4.71	1.15	36.70	NA	59.86	0.70	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	20	2.04	1.04	32	IV	0.24	7.00	0.93	16.41	7.41	0.32	1.16	1.33	1.000	1.05	1	1.00	32.45	4.83	1.17	42.82	NA	67.45	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	23	2.04	1.04	32	IV	0.24	7.00	0.91	18.45	8.45	0.31	1.09	1.33	1.000	1.05	1	1.00	34.94	4.83	1.17	45.75	NA	69.94	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)

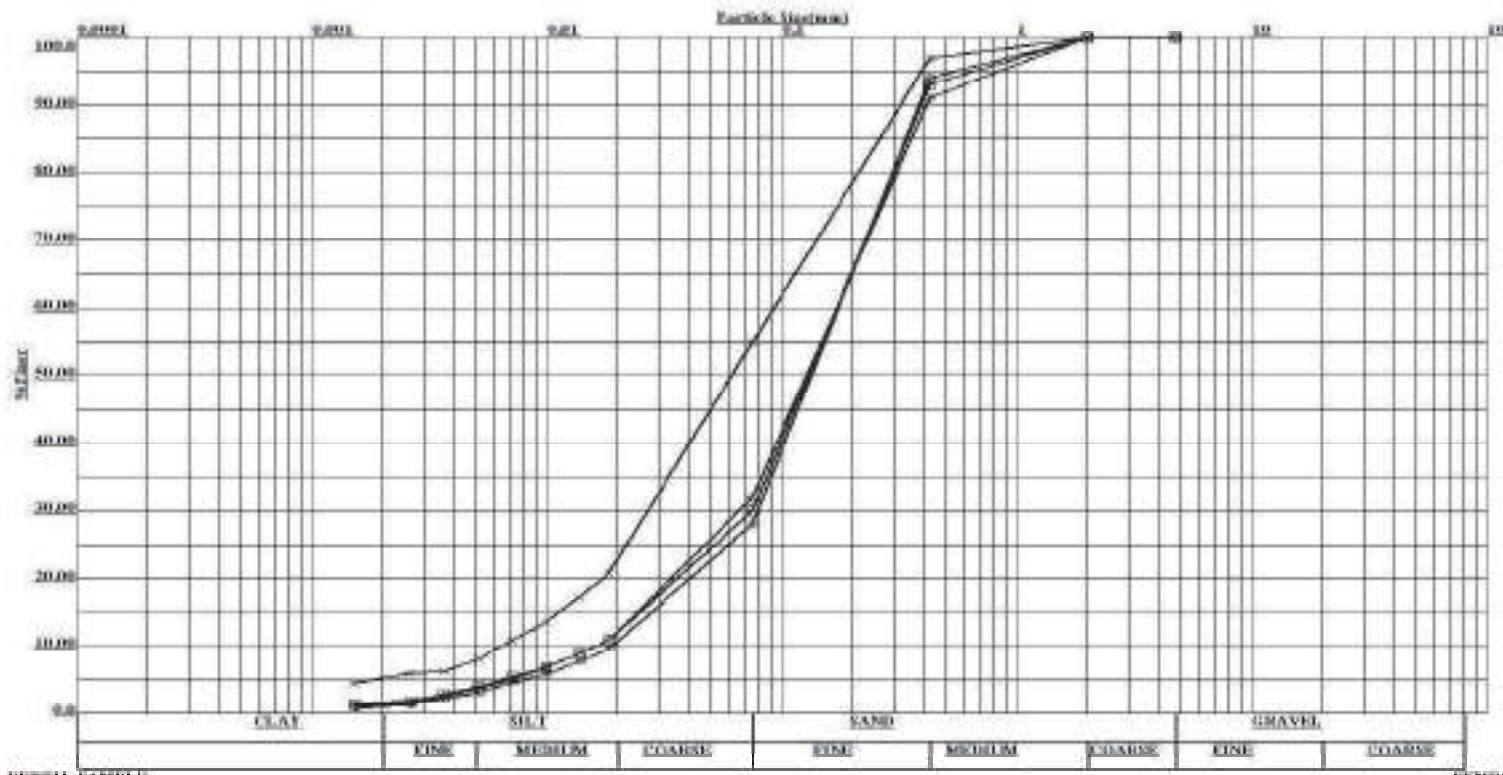
K_u Correction for static shear stress is required only for sloping ground

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. - 27
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



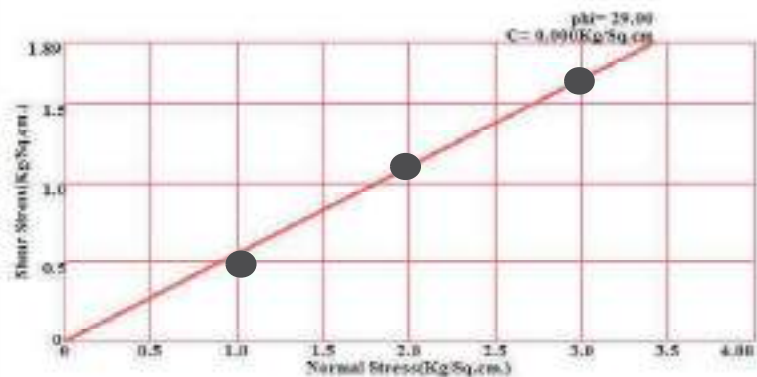
Symbol	Depth, m	Soil Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	C_u	C_c
×	0.0	LITE BROWN,SANDY SILT (ML)	0.00	45.00	50.00	5.00	14.30	1.22
○	2.5	MEDIUM DENSE, LITE GREY,SILTY SAND (SM)	0.00	72.00	27.00	1.00	9.09	1.88
□	6.0		0.00	70.00	28.00	2.00	10.44	2.00
◇	9.0		0.00	68.00	31.00	1.00	10.55	1.56

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. - 27

SECTION:CHITAUNI TO MADHUBANI

TRIAXIAL & DIRECT SHEAR GRAPH



Bore Hole No. = 1(BR-27)
Sample No. = A-1/UD1
Depth = 2.50000M
Type of Test = C.D.



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. -27

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															
1	BH-1	0.00	0.50	SANDY SILT	ML	0.0	0.0	0.0	3.0	25.0	17.0	55.0	0.00	0.00	0.00	2.14	7.56	2.17	2.063	0.139	0.657	-	-	-	-		
2		2.50	2.80	SILTY SAND	SM	0.0	0.0	0.0	6.0	44.0	22.0	28.0	0.00	0.00	0.00	4.28	13.31	2.81	1.050	0.214	0.815	-	-	-	-		
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	7.0	41.0	22.0	30.0	0.00	0.00	0.00	4.99	12.40	2.81	1.125	0.213	0.813	-	-	-	-		



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)
17791.905	30	ROAD	RUB	BH-01	205365	2994945	108.56

SUBMITTED BY:

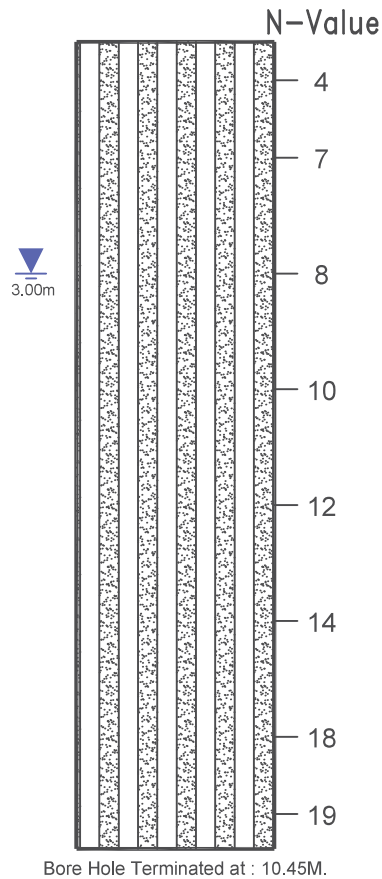


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-30

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)

CALCULATIONS FOR CORRECTED SPT (N) VALUES

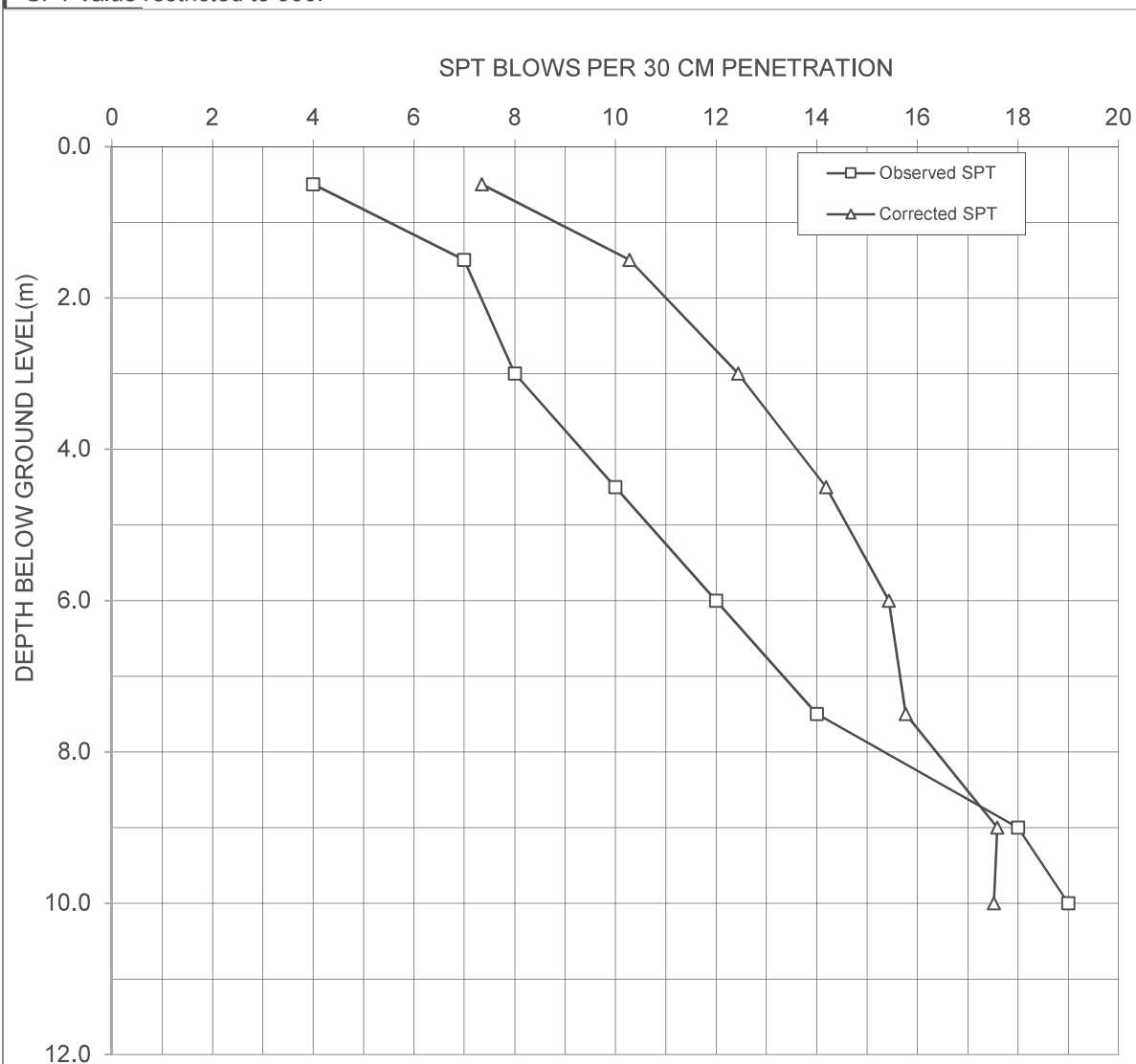
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BOREHOLE NO. BH- 01

WATER TABLE :-3.00 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	7	10	10
3.00	Non Plastic	8	12	12
4.50	Non Plastic	10	14	14
6.00	Non Plastic	12	16	15
7.50	Non Plastic	14	17	16
9.00	Non Plastic	18	20	18
10.00	Non Plastic	19	20	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: 30

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_u	MSF	CRR	FOS	Conclusion
0.50	SM	4	1.60	0.60	32	IV	0.24	7.00	1.00	0.80	0.30	0.41	1.70	1.33	1.000	1.05	0.75	1.00	7.12	4.83	1.17	13.17	0.14	15.20	0.92	1.00	1.00	1.19	0.17	0.41	Liquefiable
1.50	SM	7	1.60	0.60	32	IV	0.24	7.00	0.99	2.40	0.90	0.41	1.70	1.33	1.000	1.05	0.75	1.00	12.46	4.83	1.17	19.42	0.21	25.54	0.87	1.00	1.00	1.19	0.25	0.60	Liquefiable
3.00	SM	8	1.64	0.64	34	IV	0.24	7.00	0.98	4.80	1.80	0.41	1.70	1.33	1.000	1.05	0.85	1.00	16.14	4.93	1.19	24.11	0.28	33.82	0.83	1.00	1.00	1.19	0.33	0.81	Liquefiable
4.50	SM	10	1.64	0.64	34	IV	0.24	7.00	0.97	7.26	2.76	0.40	1.70	1.33	1.000	1.05	0.95	1.00	22.55	4.93	1.19	31.73	NA	48.25	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	12	2.03	1.03	36	IV	0.24	7.00	0.95	9.72	3.72	0.39	1.64	1.33	1.000	1.05	0.95	1.00	26.10	5.00	1.20	36.32	NA	56.23	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	14	2.03	1.03	36	IV	0.24	7.00	0.94	12.77	5.27	0.36	1.38	1.33	1.000	1.05	0.95	1.00	25.60	5.00	1.20	35.72	NA	55.09	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	18	2.04	1.04	38	IV	0.24	7.00	0.93	15.81	6.81	0.34	1.21	1.33	1.000	1.05	1	1.00	30.46	5.00	1.20	41.55	NA	65.46	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	19	2.04	1.04	38	IV	0.24	7.00	0.91	17.85	7.85	0.32	1.13	1.33	1.000	1.05	1	1.00	29.95	5.00	1.20	40.94	NA	64.88	0.68	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



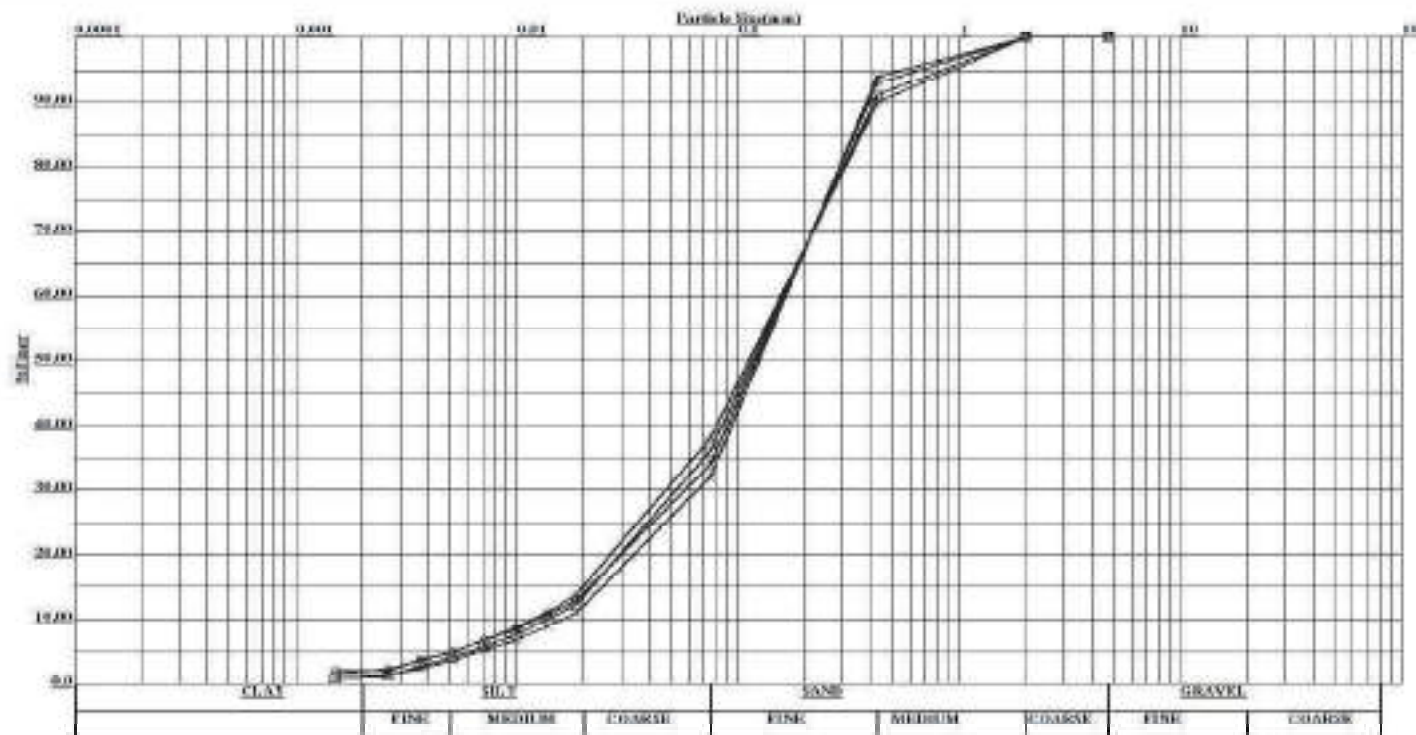
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 30 (RUB)

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 DENSE, LITE GREY, SILTY SAND (SM)	0.00	68.00	31.00	1.00	10.14	1.62
○	2.5		0.00	66.00	32.00	2.00	12.75	1.63
□	6.0		0.00	64.00	35.00	1.00	11.52	1.25
◇	9.0		0.00	62.00	36.00	2.00	13.22	1.21



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. BR-30

BOREHOLE NO- BH 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 = K _{sf} c = F x (1 + sqrt(c))
1	BH 01	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	6.0	38.0	24.0	32.0	0.00	0.00	0.00	4.28	11.50	3.06	1.200	0.200	0.788	-	-	-	-
2		2.50	2.80			0.0	0.0	0.0	7.0	39.0	20.0	34.0	0.00	0.00	0.00	4.99	11.80	2.55	1.275	0.206	0.799	-	-	-	-
3		6.00	6.45			0.0	0.0	0.0	9.0	38.0	17.0	36.0	0.00	0.00	0.00	6.41	11.50	2.17	1.350	0.214	0.815	-	-	-	-

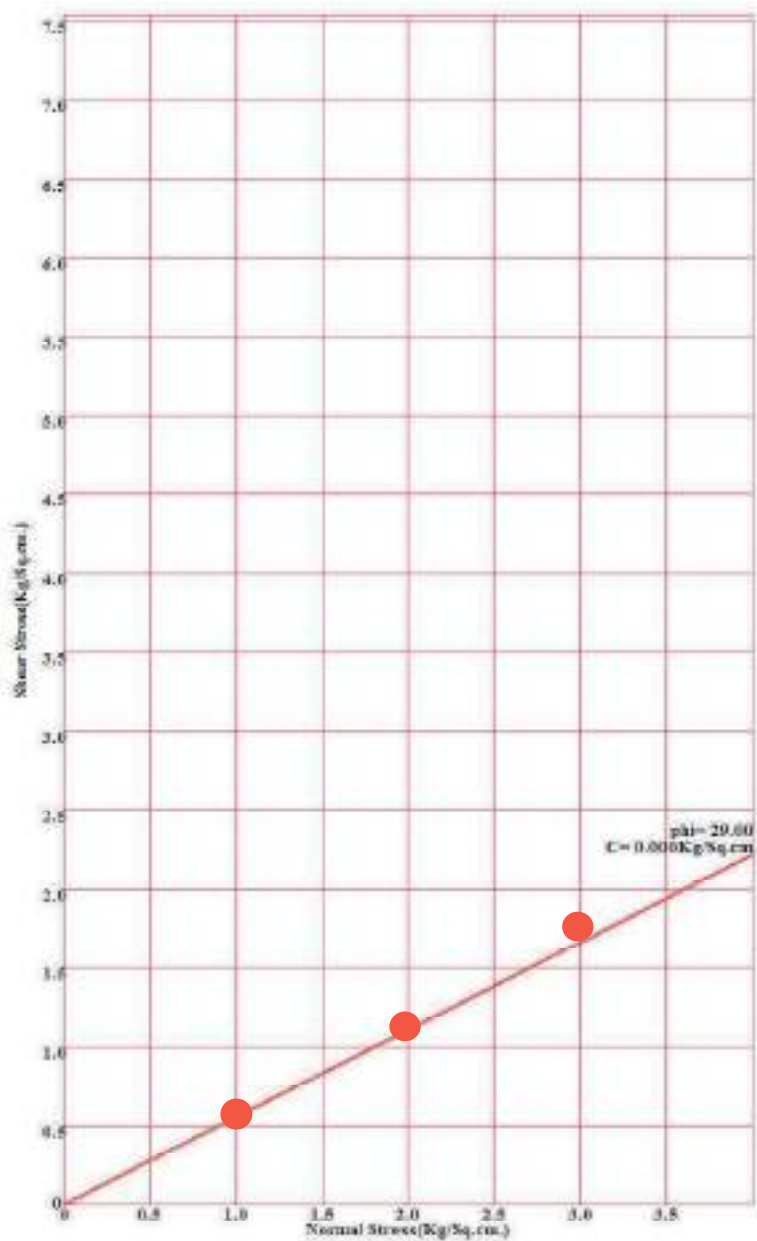
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BRIDGE NO. -30 (RUB)

BOREHOLE NO. -BH 1

SECTION:CHITAUNI TO MADHUBANI

DIRECT SHEAR GRAPH



Bore Hole No.= 1
Sample No.= A-1/UD1
Depth= 2.50000M
Type of Test= C.D.



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)
19079.729	32	ROAD	RUB	BH-01	206401	2994184	107.62

SUBMITTED BY:

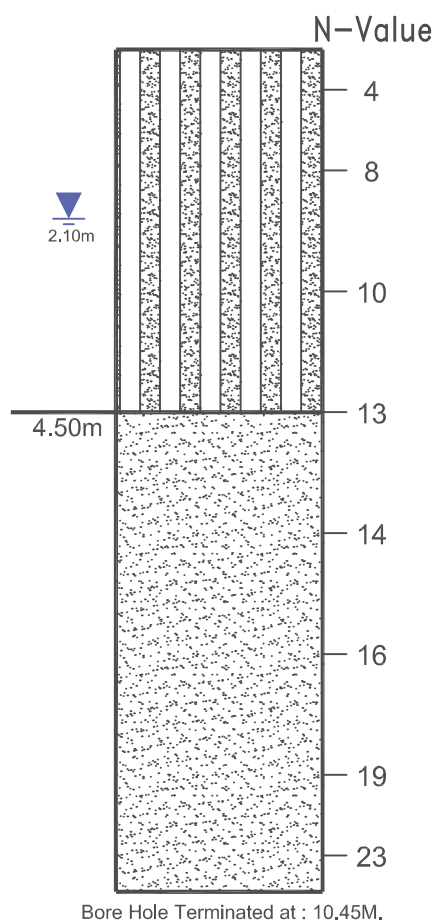


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-32

BOREHOLE NO.: BH- 01



LEGENDS



Silty Sand (SM)





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.32				DATE STARTED : 28/01/2025																															
BOREHOLE NO. BH- 01				GWT: 2.10 m				DATE COMPLETED : 28/01/2025																											
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				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)	pH	Chloride, %	Sulphate, %	pH	Chloride, mg/l
-0.50	0.5	DS	1	 2.10m	0.00	0.50	DS	-	-	-	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	72	26	2	NON-PLASTIC				-	-	-	-	-	-	-	-	-	7.22	0.03	NIL	-	-	-
	1.0	SPT	1		0.50	0.95	4	30	4	7		-	0	68	31	1	NON-PLASTIC				-	-	-	2.54	-	-	-	-	-	7.28	0.03	NIL	-	-	-
	2.0	SPT	2		1.50	1.95	8	30	8	12		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.36	0.02	NIL	-	-	-	
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			
	4.0	SPT	3		3.00	3.45	10	30	10	15		-	0	65	33	2	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	
	5.0	SPT	4		4.50	4.95	13	30	13	16		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-6.00	6.0	DS	2		5.50	5.80	UDS SLIPPED					MEDIUM DENSE, LITE GREY, POORLY GRADED SAND (SP)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	7.0	SPT	5		6.00	6.45	14	30	14	16	-		0	96	4	0	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	97	3	0	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-
	11.0	SPT	8		10.00	10.45	23	30	23	19	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLASSIFICATION OF SOIL AS PER IS : 1488 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

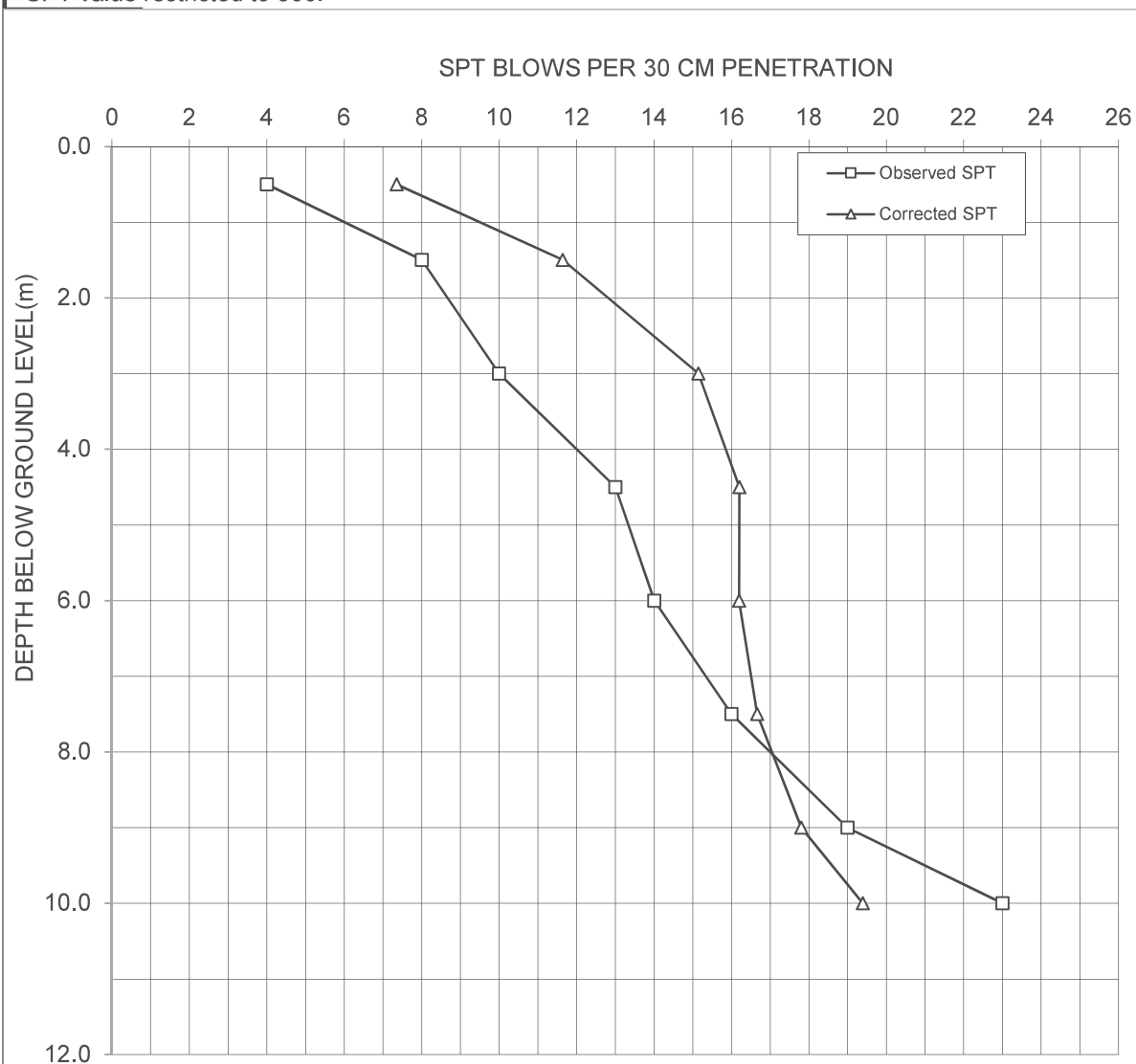
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE:-2.10m

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	4	7	7
1.50	Non Plastic	8	12	12
3.00	Non Plastic	10	15	15
4.50	Non Plastic	13	17	16
6.00	Non Plastic	14	17	16
7.50	Non Plastic	16	18	17
9.00	Non Plastic	19	21	18
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: 32

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	4	1.74	0.74	32	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	7.12	4.83	1.17	13.17	0.14	15.20	0.92	1.00	1.00	1.19	0.17	0.46	Liquefiable
1.50	SM	8	1.74	0.74	32	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	4.83	1.17	21.51	0.24	29.55	0.85	1.00	1.00	1.19	0.28	0.77	Liquefiable
3.00	SM	10	2.02	1.02	35	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	20.18	5.00	1.20	29.22	0.42	42.90	0.79	1.00	1.00	1.19	0.50	1.40	Non Liquefiable
4.50	SM	13	2.02	1.02	35	IV	0.24	7.00	0.97	8.25	3.75	0.33	1.63	1.33	1.000	1.05	0.95	1.00	28.16	5.00	1.20	38.80	NA	60.87	0.70	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SP	14	2.01	1.01	4	IV	0.24	7.00	0.95	11.28	5.28	0.32	1.38	1.33	1.000	1.05	0.95	1.00	25.56	0.00	1.00	25.56	0.30	55.01	0.72	1.00	1.00	1.19	0.36	1.14	Non Liquefiable
7.50	SP	16	2.01	1.01	4	IV	0.24	7.00	0.94	14.30	6.80	0.31	1.21	1.33	1.000	1.05	0.95	1.00	25.75	0.00	1.00	25.75	0.31	55.44	0.72	1.00	1.00	1.19	0.37	1.19	Non Liquefiable
9.00	SP	19	2.04	1.04	3	IV	0.24	7.00	0.93	17.31	8.31	0.30	1.10	1.33	1.000	1.05	1	1.00	29.11	0.00	1.00	29.11	0.42	62.99	0.69	1.00	1.00	1.19	0.50	1.64	Non Liquefiable
10.00	SP	23	2.04	1.04	3	IV	0.24	7.00	0.91	19.35	9.35	0.29	1.03	1.33	1.000	1.05	1	1.00	33.22	0.00	1.00	33.22	NA	68.22	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)

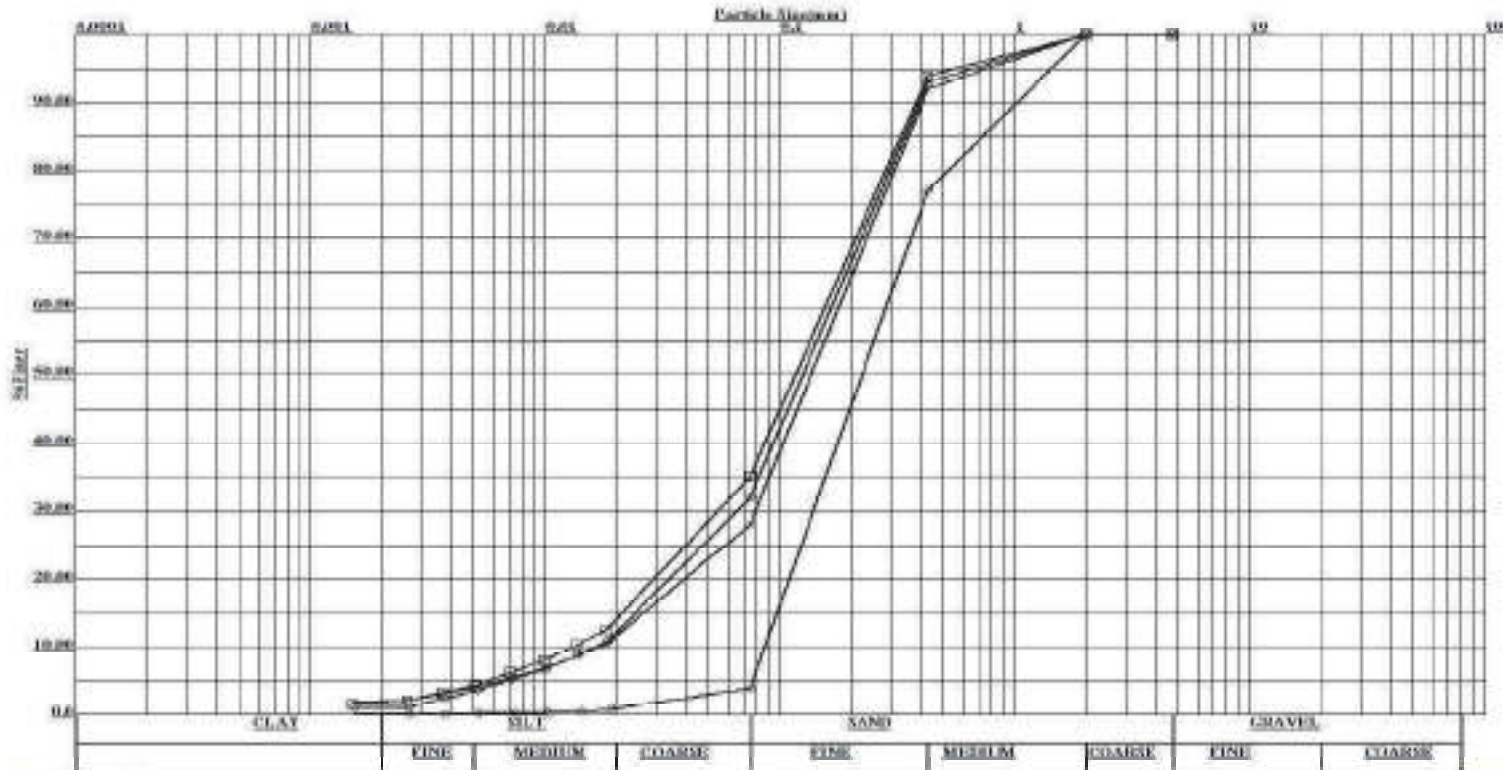
K_u Correction for static shear stress is required only for sloping ground

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. - 32
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



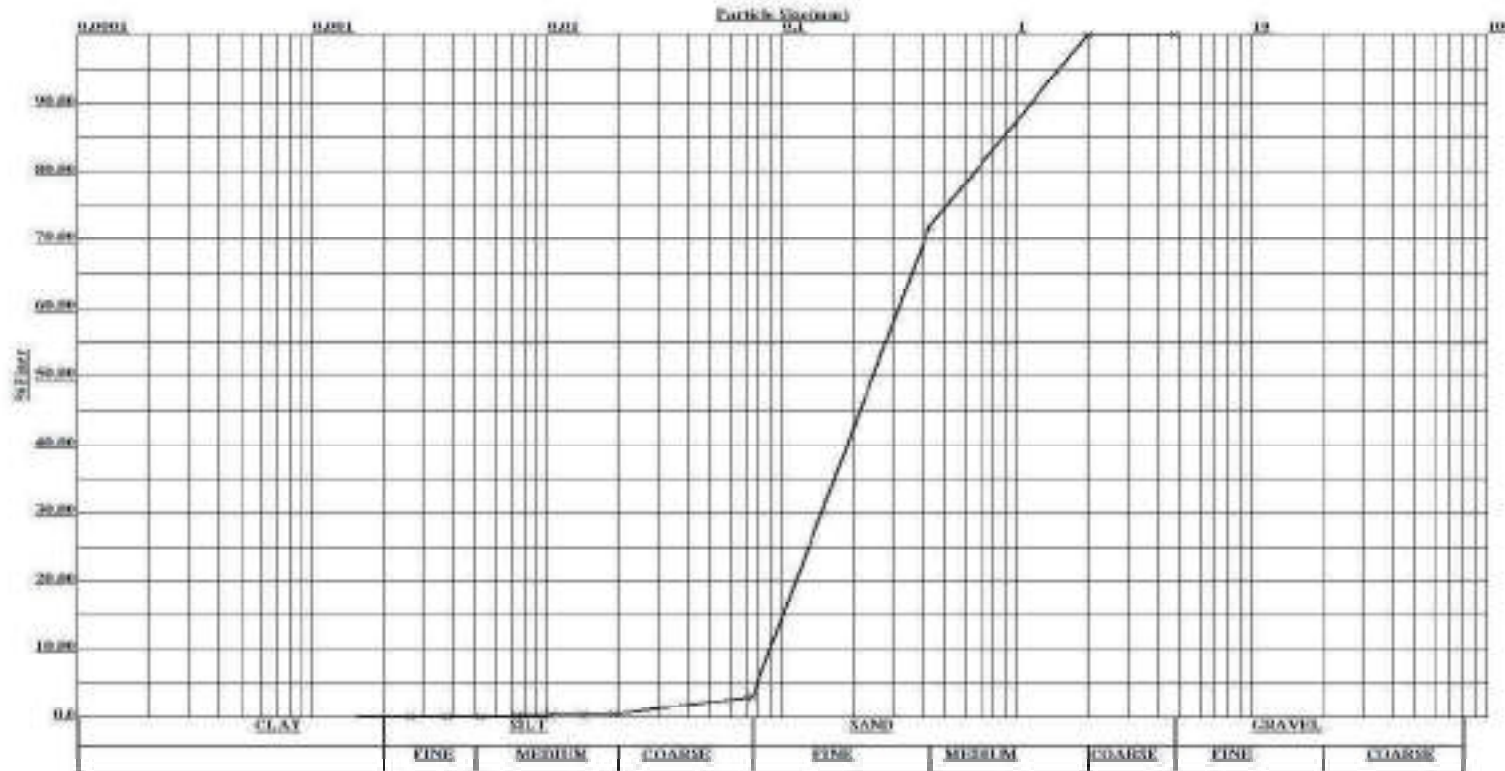
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	72.00	26.00	2.00	10.59	2.08
○	0.5		0.00	68.00	31.00	1.00	10.28	1.60
□	3.0		0.00	65.00	33.00	2.00	11.82	1.45
◇	6.0	MEDIUM DENSE, LITE GREY, POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.28	0.79

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. - 32
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, POORLY GRADED SAND (SP)	0.00	97.00	3.00	0.00	3.51	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. BR- 32

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	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	7.0	42.0	19.0	32.0	0.00	0.00	0.00	4.99	12.71	2.42	1.200	0.213	0.813	-	-	-	-
2		3.50	3.95			0.0	0.0	0.0	6.0	41.0	18.0	35.0	0.00	0.00	0.00	4.28	12.40	2.30	1.313	0.203	0.793	-	-	-	-
3		6.50	6.95	POORLY GRADED SAND	SP	0.0	0.0	0.0	23.0	45.0	28.0	4.0	0.00	0.00	0.00	16.39	13.61	3.57	0.150	0.337	1.022	-	-	-	-



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)
19371.356	33	ROAD	RUB	BH-01	206624	2993996	107.50

SUBMITTED BY:

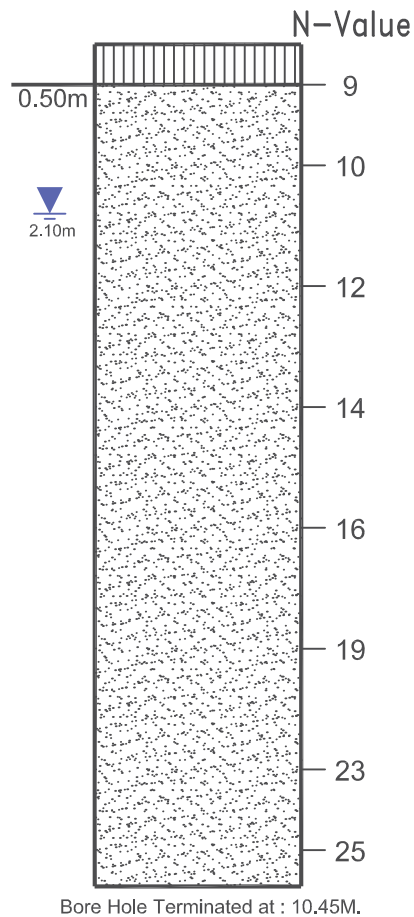


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-33

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.33				DATE STARTED : 28/01/2025																															
BOREHOLE NO. BH- 01				GWT: 2.10 m				DATE COMPLETED : 28/01/2025				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				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	 2.10m	0,00	0,50	DS	-	-	-	 MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	75	23	2	NON-PLASTIC				-	-	-	-	-	-	-	-	-	7,01	0,03	NIL	-	-	-
	1.0	SPT	1		0,50	0,95	9	30	9	17		-	0	74	25	1	NON-PLASTIC				-	-	-	2,54	-	-	-	-	-	6,95	0,03	NIL	-	-	-
	2.0	SPT	2		1,50	1,95	10	30	10	15		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6,91	0,02	NIL	-	-	-	
-3.00	3.0	DS	1		2,50	2,80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4.0	SPT	3		3,00	3,45	12	30	12	17		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	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	19	30	19	18		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-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	64	35	1	NON-PLASTIC				-	-	-	2,56	-	-	-	-	-	-	-	-	-	
	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

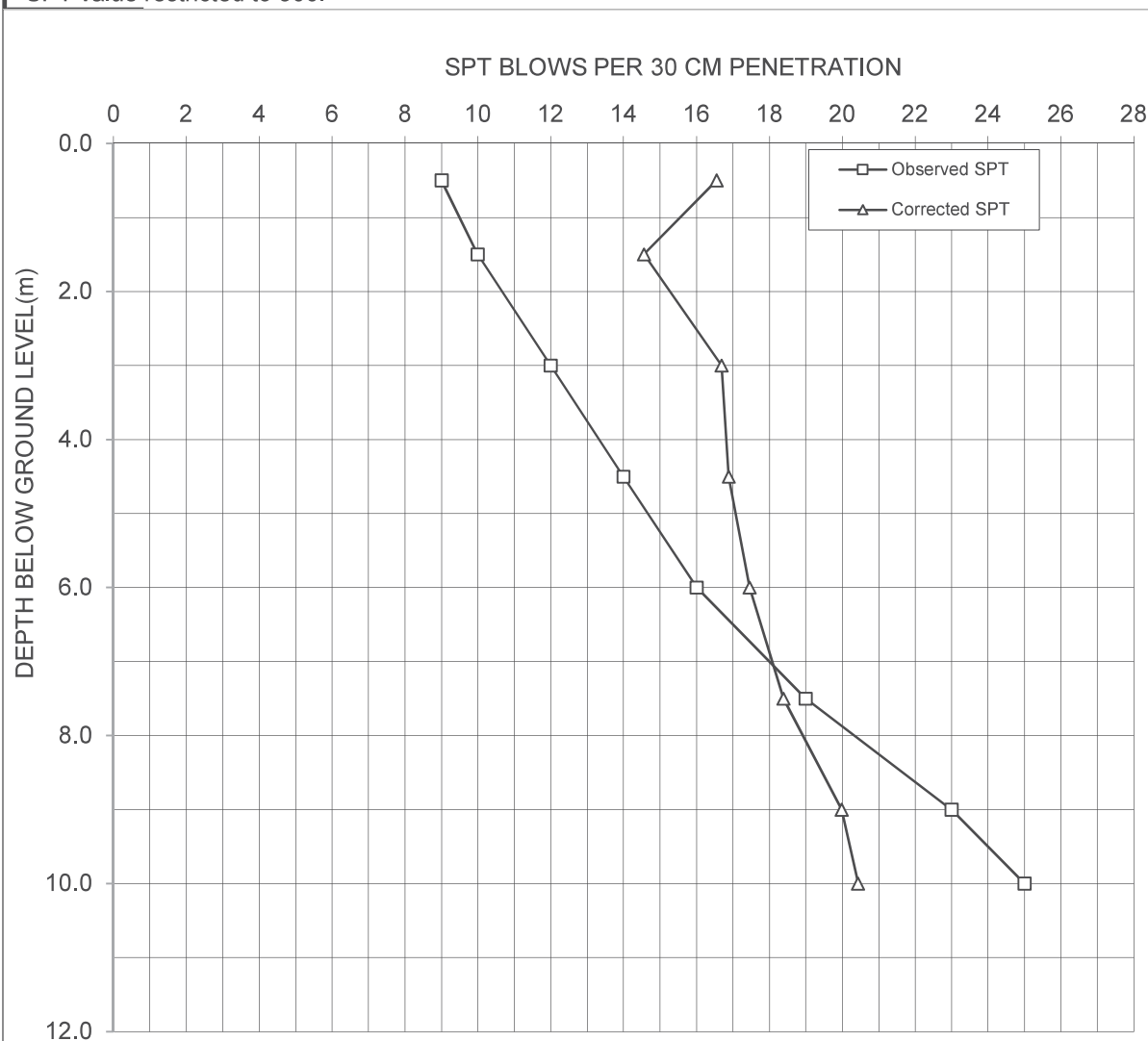
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE:-2.10m

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	9	17	17
1.50	Non Plastic	10	15	15
3.00	Non Plastic	12	18	17
4.50	Non Plastic	14	19	17
6.00	Non Plastic	16	20	17
7.50	Non Plastic	19	22	18
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: 33

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_u	MSF	CRR	FOS	Conclusion
0.50	SM	9	1.74	0.74	26	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	16.02	4.39	1.12	22.38	0.25	33.56	0.83	1.00	1.00	1.19	0.30	0.81	Liquefiable
1.50	SM	10	1.74	0.74	26	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	17.81	4.39	1.12	24.38	0.28	37.56	0.81	1.00	1.00	1.19	0.33	0.92	Liquefiable
3.00	SM	12	2.02	1.02	32	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	24.22	4.83	1.17	33.18	NA	51.98	0.74	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	14	2.02	1.02	32	IV	0.24	7.00	0.97	8.25	3.75	0.33	1.63	1.33	1.000	1.05	0.95	1.00	30.33	4.83	1.17	40.35	NA	65.33	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	16	2.01	1.01	34	IV	0.24	7.00	0.95	11.28	5.28	0.32	1.38	1.33	1.000	1.05	0.95	1.00	29.21	4.93	1.19	39.64	NA	63.23	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	19	2.01	1.01	34	IV	0.24	7.00	0.94	14.30	6.80	0.31	1.21	1.33	1.000	1.05	0.95	1.00	30.58	4.93	1.19	41.27	NA	65.58	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	23	2.04	1.04	36	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	2.04	1.04	36	IV	0.24	7.00	0.91	19.35	9.35	0.29	1.03	1.33	1.000	1.05	1	1.00	36.11	5.00	1.20	48.33	NA	71.11	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)

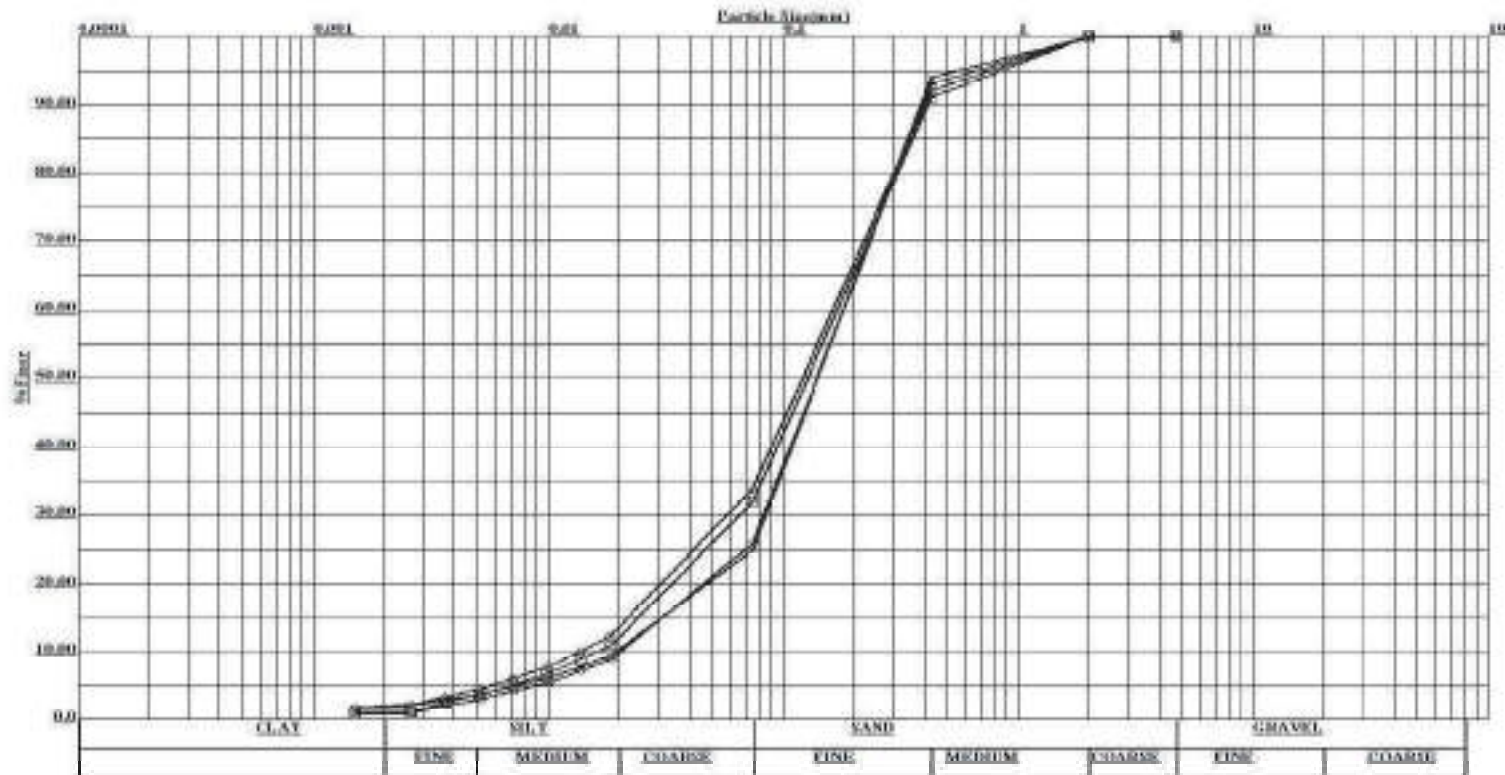
K_u Correction for static shear stress is required only for sloping ground

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. - 33
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



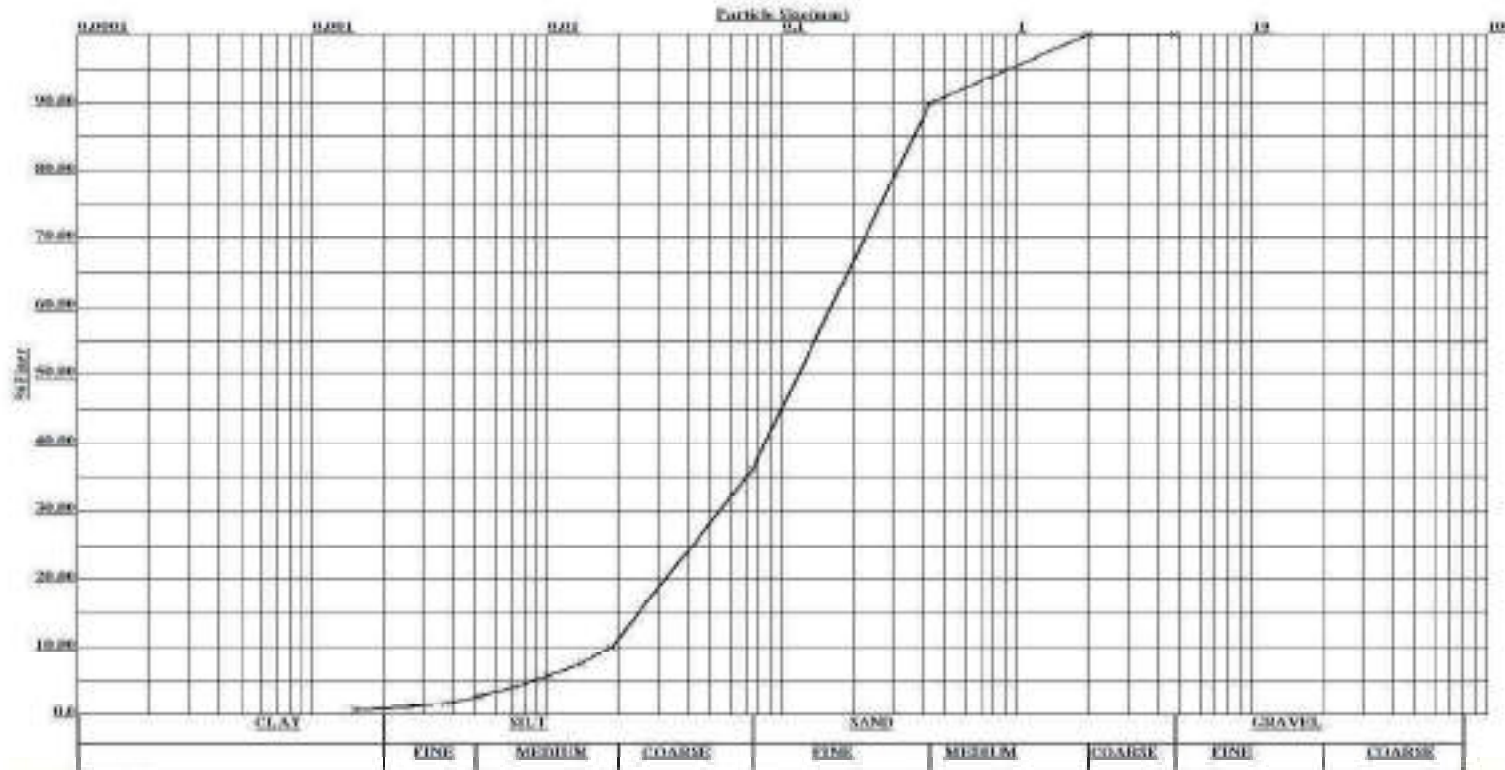
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
×	0.0	,LITE BROWN , SANDY SILT(SM)	0.00	75.00	23.00	2.00	9.34	2.07
○	0.5	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	74.00	25.00	1.00	8.91	1.89
□	3.0		0.00	68.00	31.00	1.00	10.55	1.56
◇	6.0		0.00	66.00	32.00	2.00	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. - 33
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	64.00	35.00	1.00	8.55	0.97



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. BR- 33

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 = F 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	7.0	42.0	25.0	26.0	0.00	0.00	0.00	4.99	12.71	3.19	0.975	0.219	0.823	-	-	-	-
2		3.50	3.95			0.0	0.0	0.0	9.0	41.0	18.0	32.0	0.00	0.00	0.00	6.41	12.40	2.30	1.200	0.223	0.831	-	-	-	-
3		6.50	6.95			0.0	0.0	0.0	8.0	39.0	19.0	34.0	0.00	0.00	0.00	5.70	11.80	2.42	1.275	0.212	0.810	-	-	-	-



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)
20022.765	35	ROAD	RUB	BH-01	207028	2993497	107.88

SUBMITTED BY:

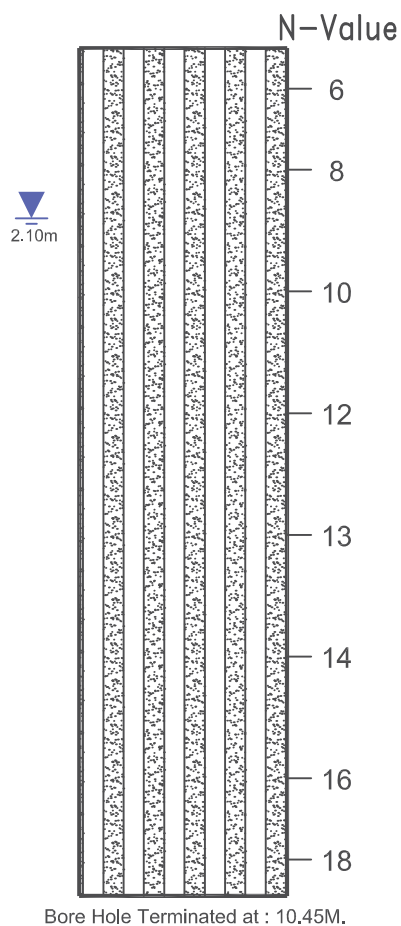


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.-35

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.35				DATE STARTED : 29/01/2025																															
BOREHOLE NO. BH- 01				DATE COMPLETED : 29/01/2025																															
GWT: 2.10 m				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				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)	pH	Chloride %	Sulphate %	pH	Chloride mg/l	Sulphate mg/l
-0.50	0.5	DS	1	 2.10m	0.00	0.50	DS	-	-	-	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	75	23	2	NON-PLASTIC		-	-	-	-	-	-	-	-	-	-	7.44	0.02	NIL	-	-	-	
	1.0	SPT	1		0.50	0.95	6	30	6	11		-	0	74	25	1	NON-PLASTIC		-	-	-	2.55	-	-	-	-	-	-	7.41	0.04	NIL	-	-	-	
	2.0	SPT	2		1.50	1.95	8	30	8	12		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.35	0.03	NIL	-	-	-		
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED			-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4.0	SPT	3		3.00	3.45	10	30	10	15		-	0	68	31	1	NON-PLASTIC		-	-	-	2.54	-	-	-	-	-	-	-	-	-	-	-	-	
	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	13	30	13	16		-	0	66	32	2	NON-PLASTIC		-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0	SPT	6		7.50	7.95	14	30	14	16		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-9.00	9.0	DS	3		8.50	8.80	UDS SLIPPED			-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	SPT	7		9.00	9.45	16	30	16	16		-	0	64	35	1	NON-PLASTIC		-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	-	-	-
	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: CHITAUANI-MADHUBANI						

CALCULATIONS FOR CORRECTED SPT (N) VALUES

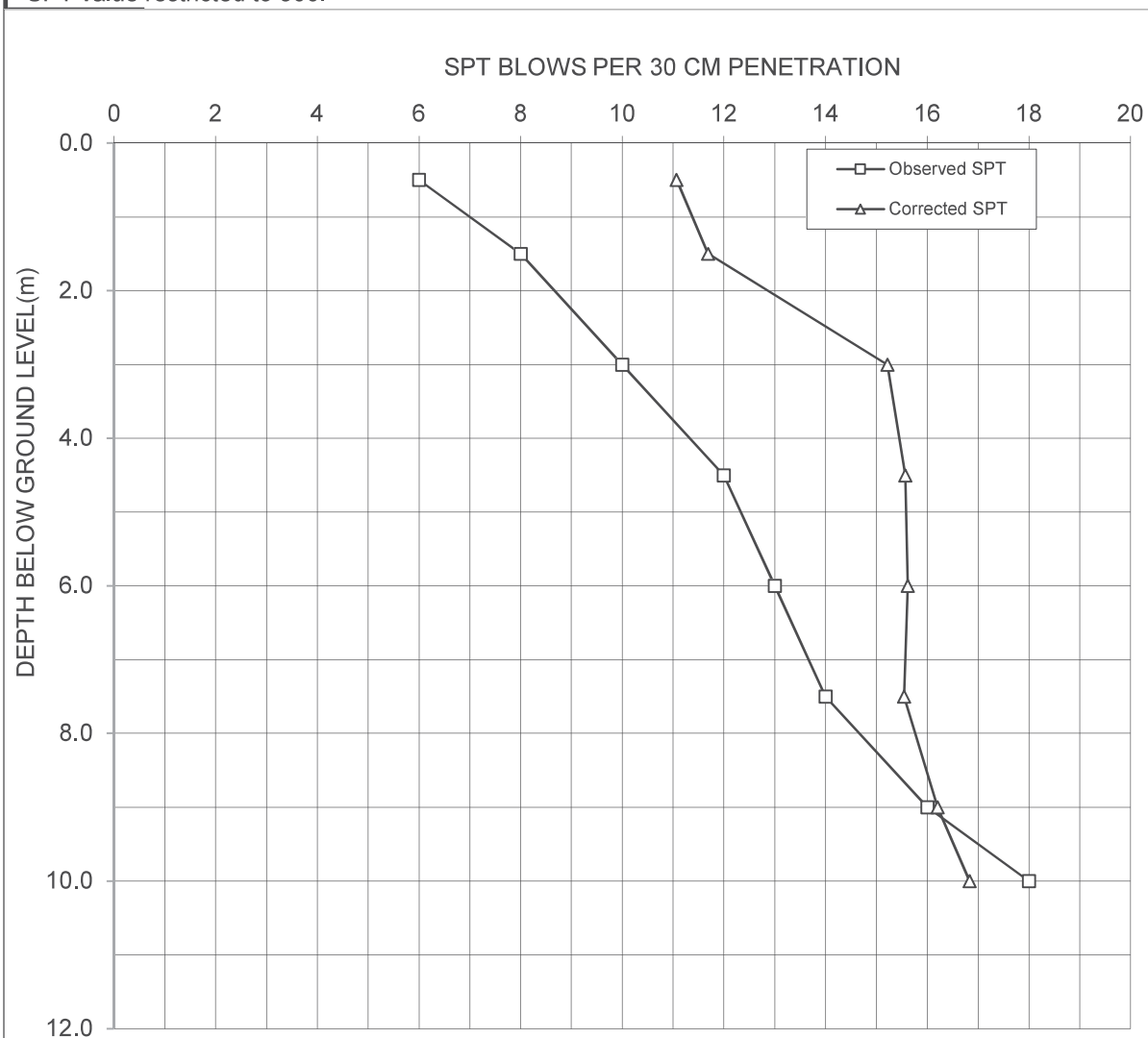
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE:-2.10m

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	15	15
4.50	Non Plastic	12	16	16
6.00	Non Plastic	13	16	16
7.50	Non Plastic	14	16	16
9.00	Non Plastic	16	17	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: 35

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	SM	6	1.72	0.72	26	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	4.39	1.12	16.38	0.17	21.54	0.89	1.00	1.00	1.19	0.21	0.56	Liquefiable
1.50	SM	8	1.72	0.72	26	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	4.39	1.12	20.38	0.22	29.55	0.85	1.00	1.00	1.19	0.26	0.71	Liquefiable
3.00	SM	10	2.04	1.04	32	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	4.83	1.17	28.46	0.39	42.90	0.79	1.00	1.00	1.19	0.46	1.27	Non Liquefiable
4.50	SM	12	2.04	1.04	32	IV	0.24	7.00	0.97	8.22	3.72	0.33	1.64	1.33	1.000	1.05	0.95	1.00	26.10	4.83	1.17	35.39	NA	56.23	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	13	2.02	1.02	34	IV	0.24	7.00	0.95	11.28	5.28	0.32	1.38	1.33	1.000	1.05	0.95	1.00	23.74	4.93	1.19	33.13	NA	50.90	0.75	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	14	2.02	1.02	34	IV	0.24	7.00	0.94	14.31	6.81	0.31	1.21	1.33	1.000	1.05	0.95	1.00	22.51	4.93	1.19	31.68	NA	48.14	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	16	2.03	1.03	36	IV	0.24	7.00	0.93	17.34	8.34	0.30	1.10	1.33	1.000	1.05	1	1.00	24.47	5.00	1.20	34.36	NA	52.55	0.74	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	18	2.03	1.03	36	IV	0.24	7.00	0.91	19.37	9.37	0.29	1.03	1.33	1.000	1.05	1	1.00	25.97	5.00	1.20	36.16	NA	55.93	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)

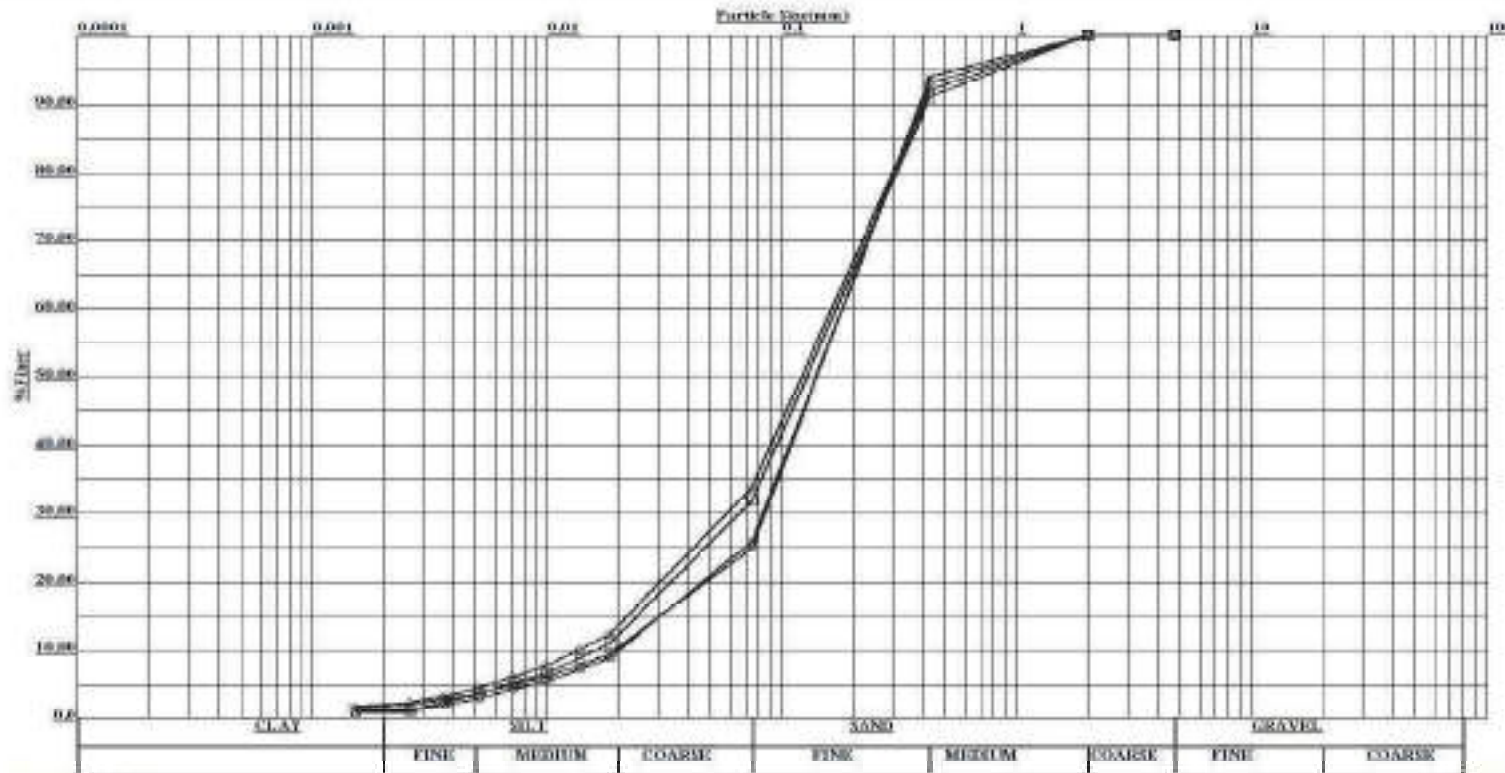
K_u Correction for static shear stress is required only for sloping ground

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. - 35
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



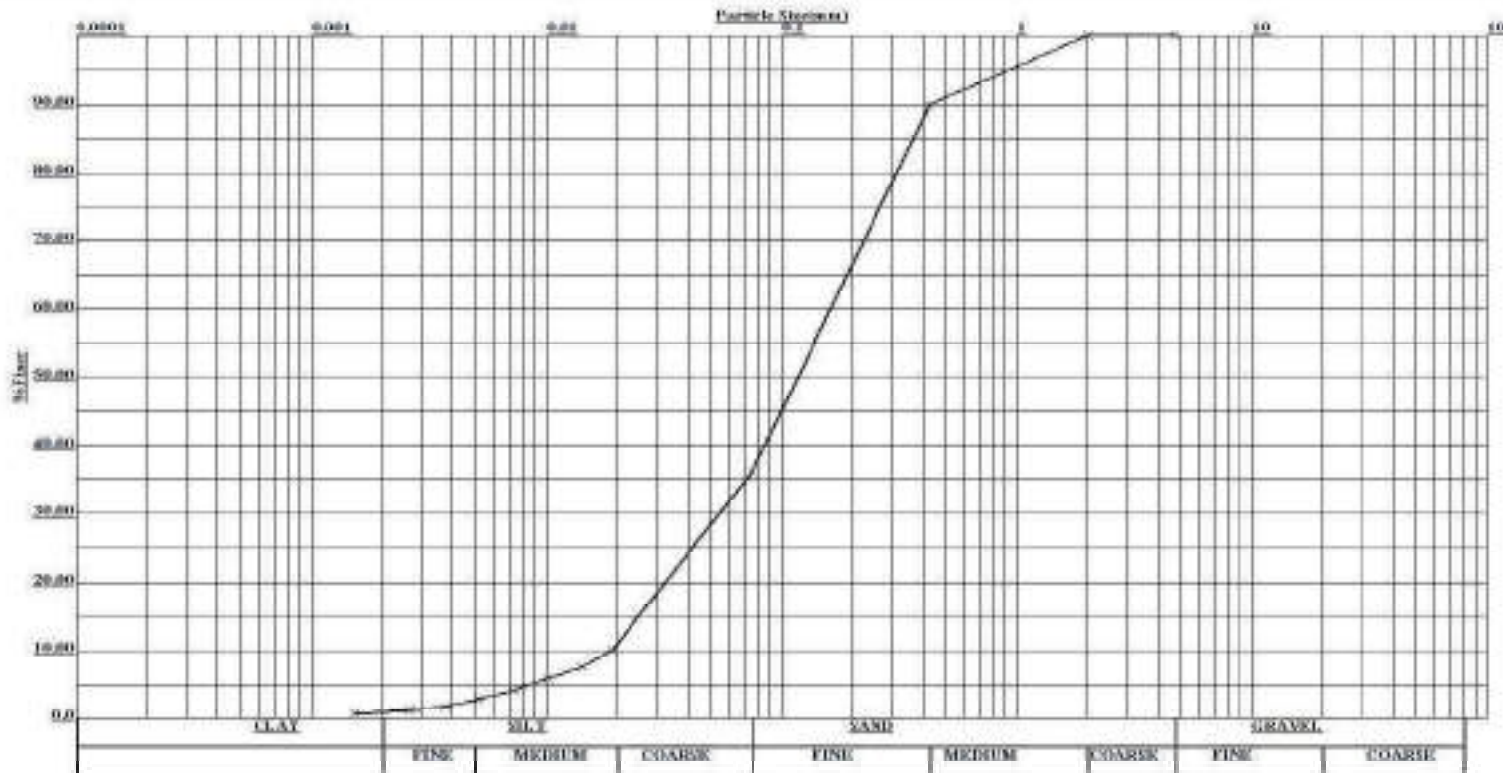
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	75.00	23.00	2.00	9.35	2.07
○	0.5		0.00	74.00	25.00	1.00	8.93	1.89
□	3.0		0.00	68.00	31.00	1.00	10.56	1.56
◇	6.0		0.00	66.00	32.00	2.00	11.83	1.49

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. - 35
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	64.00	35.00	1.00	8.54	0.97



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.- 35

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	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	7.0	42.0	25.0	26.0	0.00	0.00	0.00	4.99	12.71	3.19	0.975	0.219	0.823	-	-	-	-
2		3.50	3.95			0.0	0.0	0.0	9.0	41.0	18.0	32.0	0.00	0.00	0.00	6.41	12.40	2.30	1.200	0.223	0.831	-	-	-	-
3		6.50	6.95			0.0	0.0	0.0	8.0	39.0	19.0	34.0	0.00	0.00	0.00	5.70	11.80	2.42	1.275	0.212	0.810	-	-	-	-



NORTH EASTERN RAILWAY

**FINAL LOCATION SURVEY FOR NEW B.G RAILWAY LINE
PROJECTS (770 KM.) AND FINAL LOCATION SURVEY FOR
CONSTRUCTION OF DOUBLING/THIRD LINE/ 3RD & 4TH
LINE (252 KM.) OF NORTH EASTERN RAILWAY
(TOTAL 1022 KM.)**

SECTION: CHHITAUNI-MADHUBANI

Chainage	Br. No	Type of Crossing	Type of Bridge	Borehole No.	Easting (m)	Northing (m)	Reduced Level (m)
20793.12	37	Road	RUB	BH-01	207154	2992738	108.34

SUBMITTED BY:

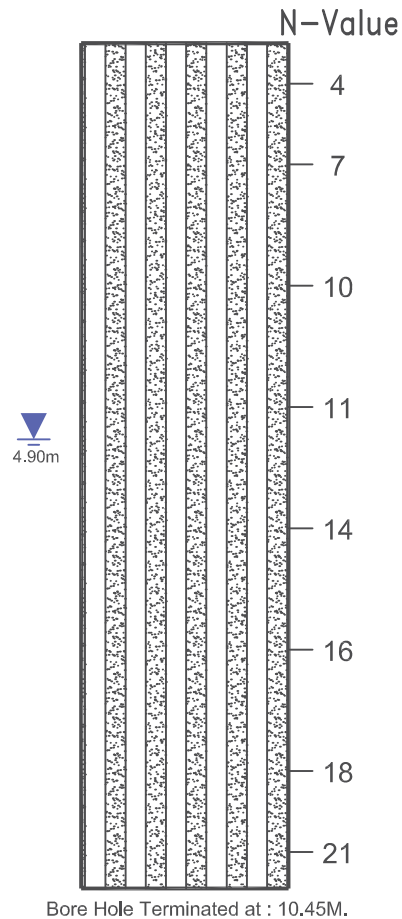


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.-37

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.37					DATE STARTED : 30/01/2025					<div>aarvee associates architects engineers & consultants pvt. ltd.</div>																											
BOREHOLE NO. BH- 01					DATE COMPLETED : 30/01/2025																																
GWT: 4.90 m					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				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)	SOIL SAMPLE			WATER SAMPLE				
-0.50	0.5	DS	1	<div>4.90m</div> <div></div> <div>-11-</div>	0.00	0.50	DS	-	-	-		LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	72	26	2	NON-PLASTIC				-	-	-	-	-	-	-	-	-	-	7.10	0.01	NIL	-	-	-
	1.0	SPT	1		0.50	0.95	4	30	4	7			-	0	68	31	1	NON-PLASTIC				-	-	-	2.54	-	-	-	-	-	-	7.15	0.02	NIL	-	-	-
	2.0	SPT	2		1.50	1.95	7	30	7	10			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.21	0.03	NIL	-	-	-	
-3.00	3.0	DS	1		2.50	2.80	UDS SLIPPED						-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4.0	SPT	3		3.00	3.45	10	30	10	12			-	0	65	33	2	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-	
	5.0	SPT	4		4.50	4.95	11	30	11	12			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-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	62	36	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	18	30	18	18			-	0	64	35	1	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-	-
	11.0	SPT	8		10.00	10.45	21	30	21	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

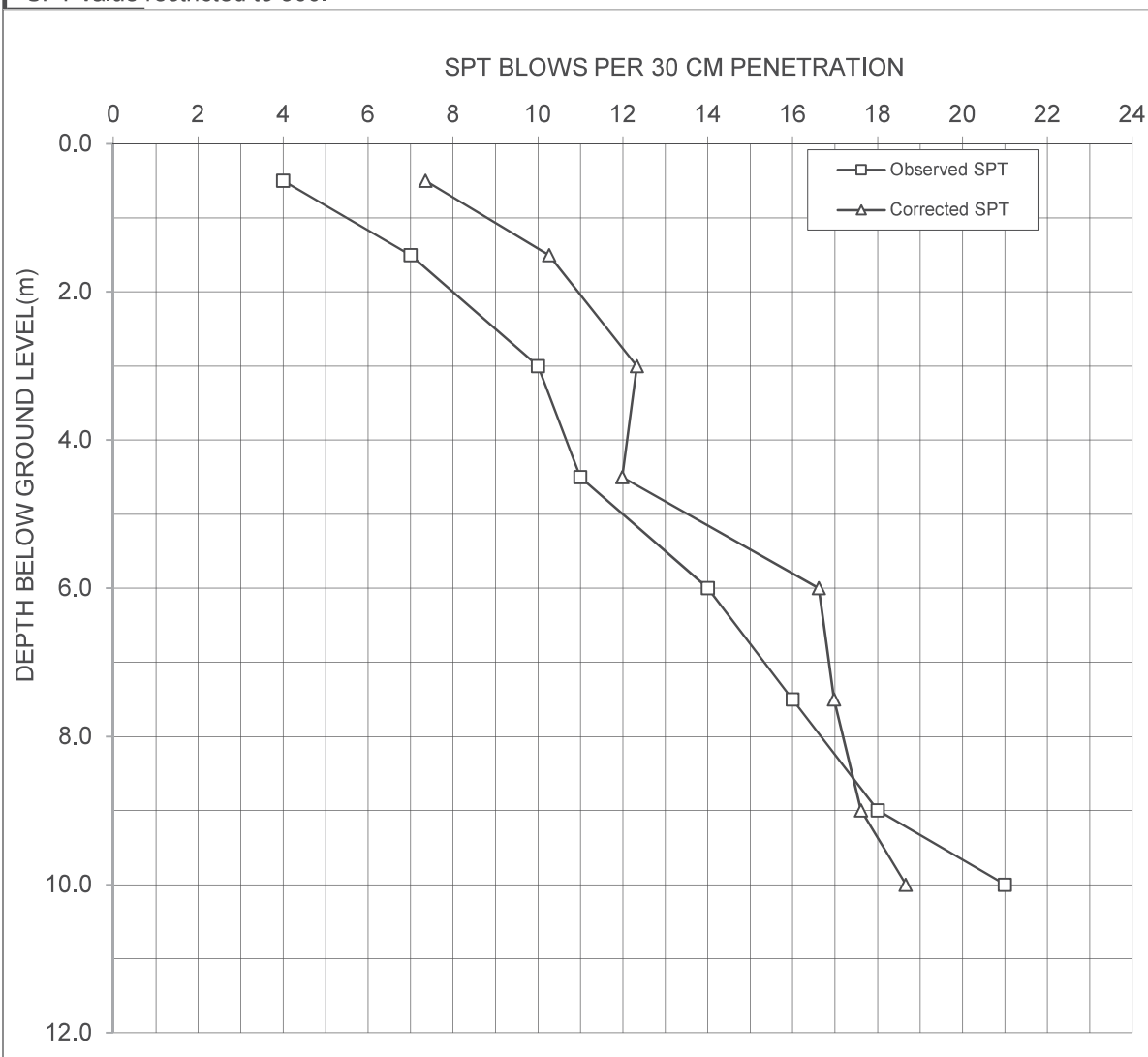
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE:-4.90 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	10	12	12
4.50	Non Plastic	11	12	12
6.00	Non Plastic	14	18	17
7.50	Non Plastic	16	19	17
9.00	Non Plastic	18	20	18
10.00	Non Plastic	21	22	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: 37

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	4	1.64	0.64	32	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	4.83	1.17	13.17	0.14	15.20	0.92	1.00	1.00	1.19	0.17	0.43	Liquefiable
1.50	SM	7	1.64	0.64	32	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	4.83	1.17	19.42	0.21	25.54	0.87	1.00	1.00	1.19	0.25	0.63	Liquefiable
3.00	SM	10	1.74	0.74	35	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	20.18	5.00	1.20	29.22	0.42	42.90	0.79	1.00	1.00	1.19	0.50	1.29	Non Liquefiable
4.50	SM	11	1.74	0.74	35	IV	0.24	7.00	0.97	7.53	3.03	0.37	1.70	1.33	1.000	1.05	0.95	1.00	24.81	5.00	1.20	34.77	NA	53.32	0.73	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	14	2.02	1.02	38	IV	0.24	7.00	0.95	10.14	4.14	0.36	1.55	1.33	1.000	1.05	0.95	1.00	28.87	5.00	1.20	39.64	NA	62.45	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	16	2.02	1.02	38	IV	0.24	7.00	0.94	13.17	5.67	0.34	1.33	1.33	1.000	1.05	0.95	1.00	28.19	5.00	1.20	38.83	NA	60.93	0.70	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	18	2.04	1.04	36	IV	0.24	7.00	0.93	16.20	7.20	0.33	1.18	1.33	1.000	1.05	1	1.00	29.62	5.00	1.20	40.55	NA	64.15	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	21	2.04	1.04	36	IV	0.24	7.00	0.91	18.24	8.24	0.31	1.10	1.33	1.000	1.05	1	1.00	32.31	5.00	1.20	43.77	NA	67.31	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)

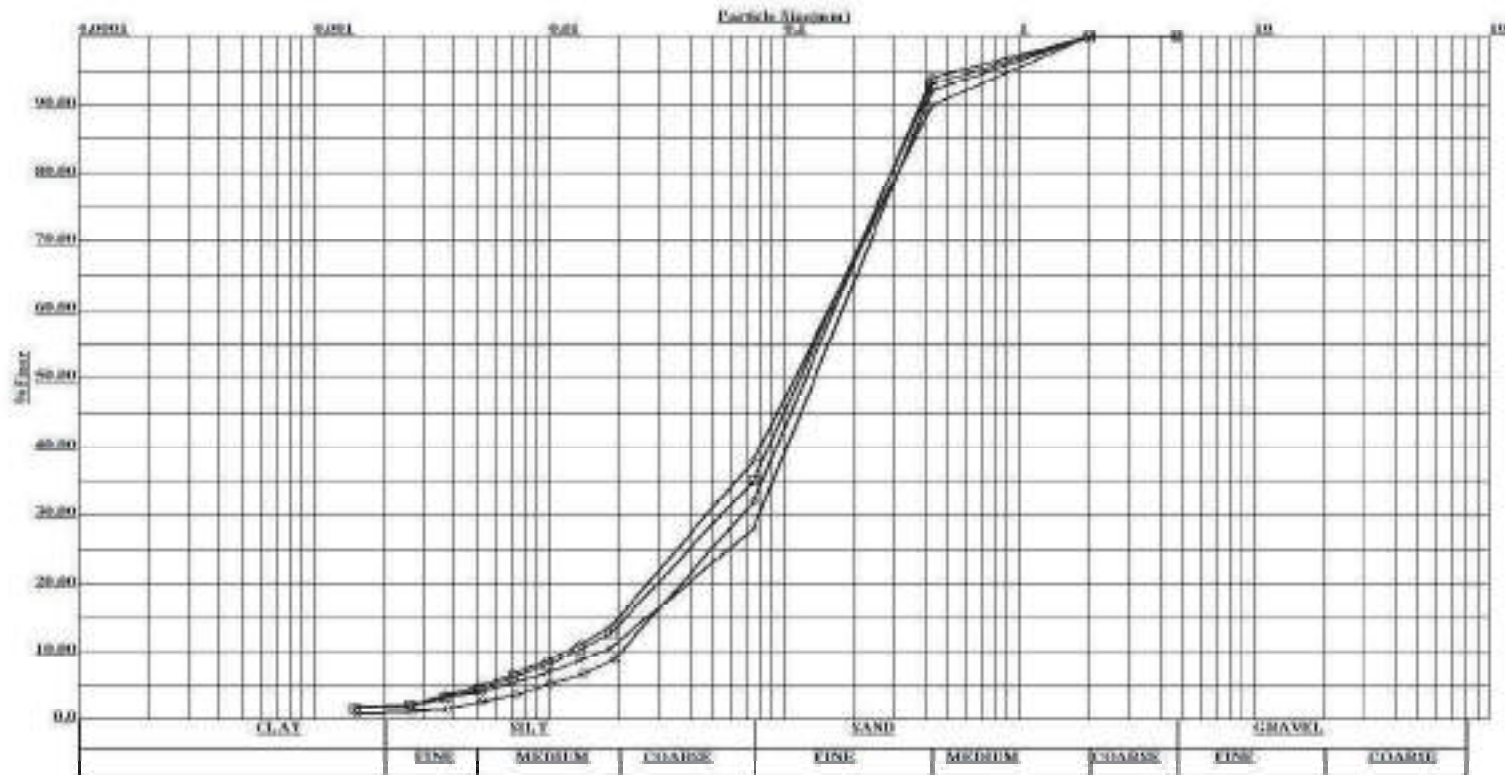
K_u Correction for static shear stress is required only for sloping ground

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. - 37
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



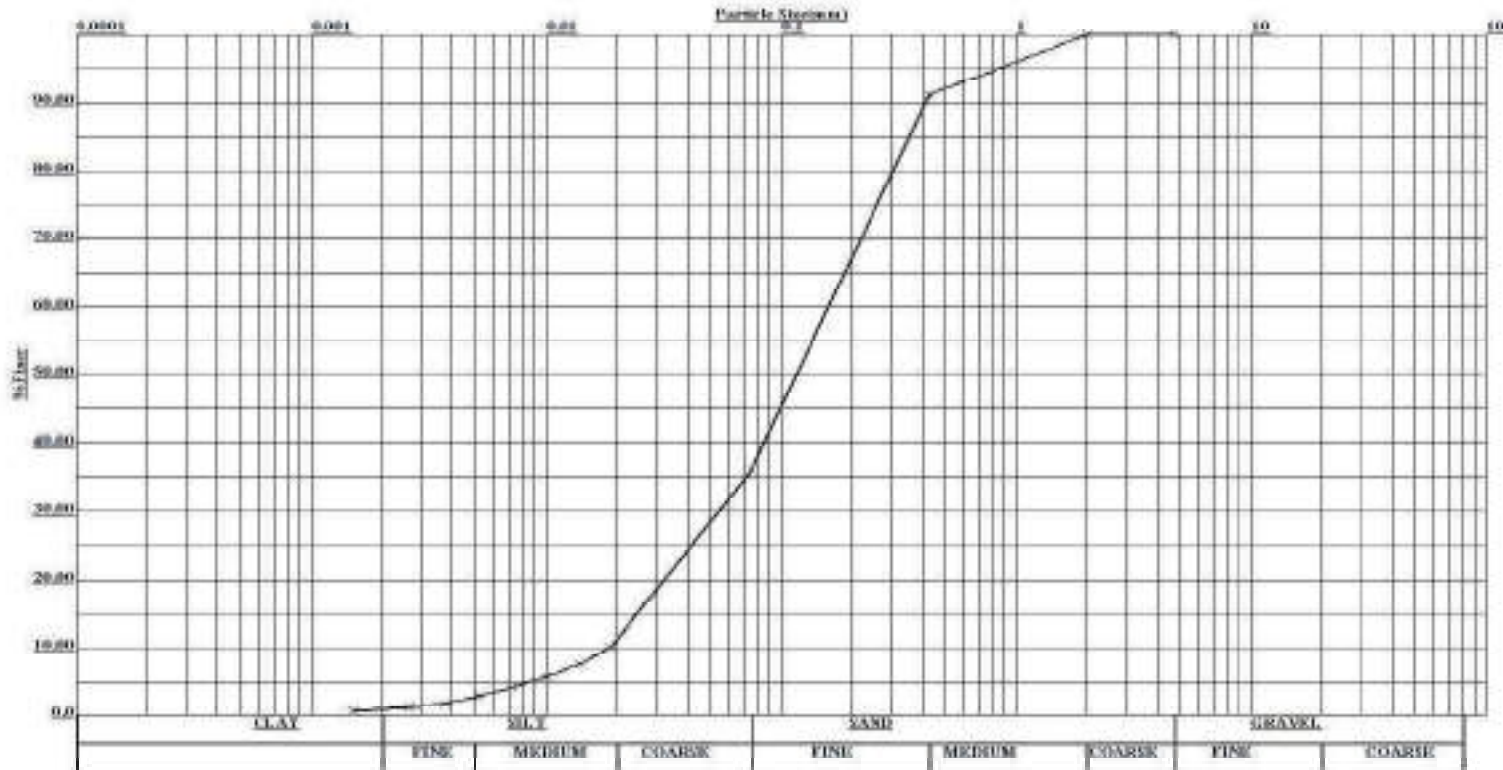
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C_u	C_c
			(%)	(%)	(%)	(%)		
×	0.0	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	72.00	26.00	2.00	10.59	2.08
○	0.5		0.00	68.00	31.00	1.00	8.08	1.33
□	3.0		0.00	65.00	33.00	2.00	11.97	1.43
◇	6.0		0.00	62.00	36.00	2.00	13.22	1.21

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. - 37
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	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	64.00	35.00	1.00	8.44	0.98



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.- 37

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	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	6.0	42.0	20.0	32.0	0.00	0.00	0.00	4.28	12.71	2.55	1.200	0.207	0.801	-	-	-	-
2		3.50	3.95			0.0	0.0	0.0	7.0	41.0	17.0	35.0	0.00	0.00	0.00	4.99	12.40	2.17	1.313	0.209	0.804	-	-	-	-
3		6.50	6.95			0.0	0.0	0.0	10.0	39.0	13.0	38.0	0.00	0.00	0.00	7.13	11.80	1.66	1.425	0.220	0.826	-	-	-	-



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)
21825.315	38	ROAD	RUB	BH-01	207342	2991723	112.44

SUBMITTED BY:

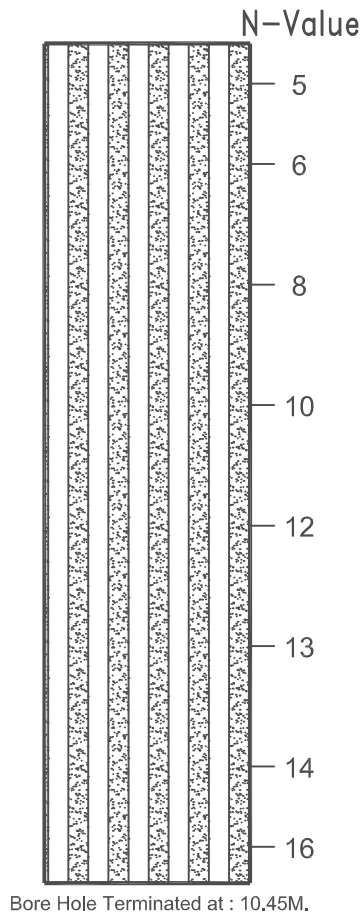


BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.-38

BOREHOLE NO.: BH- 01



LEGENDS




Silty Sand (SM)



Ground Water Table- NOT MET



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.38					DATE STARTED : 30/01/2025					<div>aarvee associates architects engineers & consultants pvt. ltd.</div>																									
BOREHOLE NO. BH- 01					DATE COMPLETED : 30/01/2025																														
GWT: NOT-MET					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				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	NOT-MET	0,00	0,50	DS	-	-	-	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	75	24	1	NON-PLASTIC				-	-	-	-	-	-	-	-	-	7,44	0,04	NIL	-	-	-
	1.0	SPT	1		0,50	0,95	5	30	5	9		-	0	72	27	1	NON-PLASTIC				-	-	-	2,54	-	-	-	-	-	7,48	0,03	NIL	-	-	-
	2.0	SPT	2		1,50	1,95	6	30	6	9		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,56	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	10		-	0	68	30	2	NON-PLASTIC				-	-	-	2,55	-	-	-	-	-	-	-	-	-	-	
	5.0	SPT	4		4,50	4,95	10	30	10	11		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-6.00	6.0	DS	2		5,50	5,80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	7.0	SPT	5		6,00	6,45	12	30	12	12		-	0	64	35	1	NON-PLASTIC				-	-	-	2,54	-	-	-	-	-	-	-	-	-	-	
	8.0	SPT	6		7,50	7,95	13	30	13	12		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-9.00	9.0	DS	3		8,50	8,80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	SPT	7		9,00	9,45	14	30	14	12		-	0	65	33	2	NON-PLASTIC				-	-	-	2,56	-	-	-	-	-	-	-	-	-	-	
	11.0	SPT	8		10,00	10,45	16	30	16	13		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
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

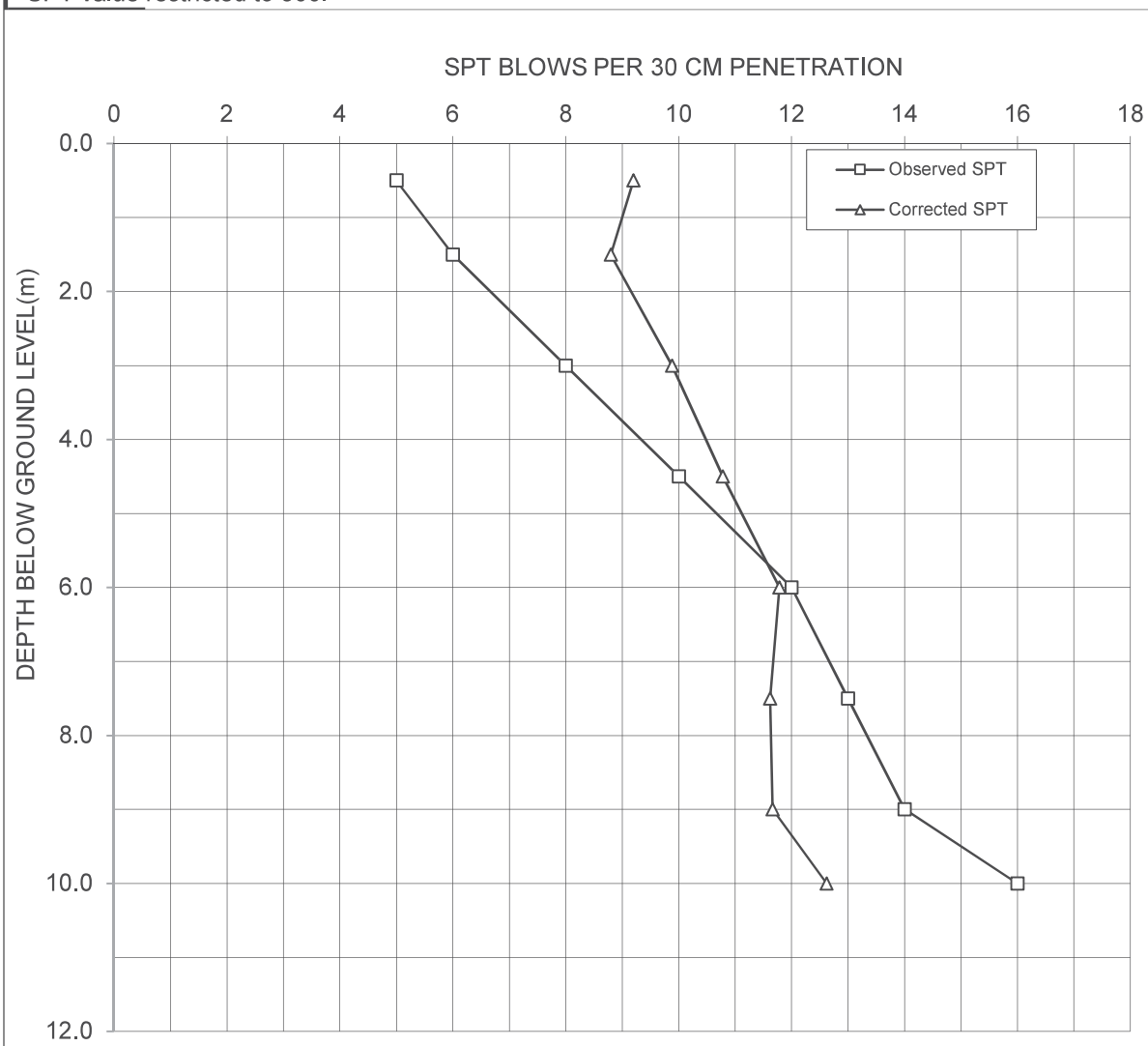
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BOREHOLE NO. BH- 01

WATER TABLE:-NOT-MET

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	5	9	9
1.50	Non Plastic	6	9	9
3.00	Non Plastic	8	10	10
4.50	Non Plastic	10	11	11
6.00	Non Plastic	12	12	12
7.50	Non Plastic	13	12	12
9.00	Non Plastic	14	12	12
10.00	Non Plastic	16	13	13

* 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: 38

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	5	1.64	0.64	28	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	8.90	4.56	1.14	14.69	0.16	18.17	0.91	1.00	1.00	1.19	0.19	0.47	Liquefiable
1.50	SM	6	1.64	0.64	28	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	10.68	4.56	1.14	16.72	0.18	21.54	0.89	1.00	1.00	1.19	0.21	0.54	Liquefiable
3.00	SM	8	1.94	0.94	32	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	16.14	4.83	1.17	23.73	0.27	33.82	0.83	1.00	1.00	1.19	0.32	0.82	Liquefiable
4.50	SM	10	1.94	0.94	32	IV	0.24	7.00	0.97	7.83	3.33	0.35	1.70	1.33	1.000	1.05	0.95	1.00	22.55	4.83	1.17	31.24	NA	48.25	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	12	2.00	1.00	36	IV	0.24	7.00	0.95	10.74	4.74	0.34	1.45	1.33	1.000	1.05	0.95	1.00	23.12	5.00	1.20	32.75	NA	49.53	0.75	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	13	2.00	1.00	36	IV	0.24	7.00	0.94	13.74	6.24	0.32	1.27	1.33	1.000	1.05	0.95	1.00	21.83	5.00	1.20	31.20	NA	46.62	0.77	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	14	2.02	1.02	35	IV	0.24	7.00	0.93	16.74	7.74	0.31	1.14	1.33	1.000	1.05	1	1.00	22.22	5.00	1.20	31.67	NA	47.50	0.76	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	16	2.02	1.02	35	IV	0.24	7.00	0.91	18.76	8.76	0.30	1.07	1.33	1.000	1.05	1	1.00	23.87	5.00	1.20	33.65	NA	51.21	0.74	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)

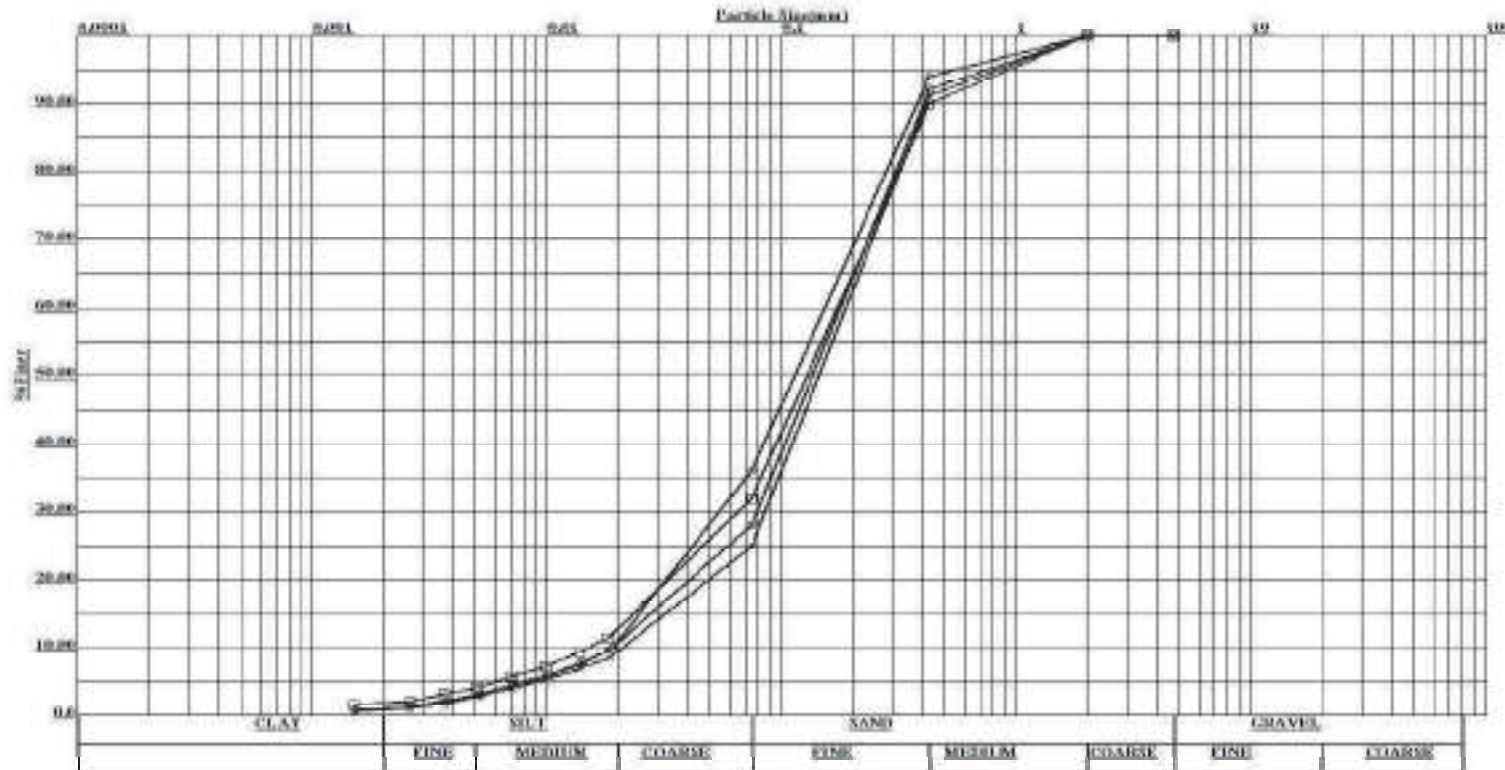
K_u Correction for static shear stress is required only for sloping ground

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. - 38
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



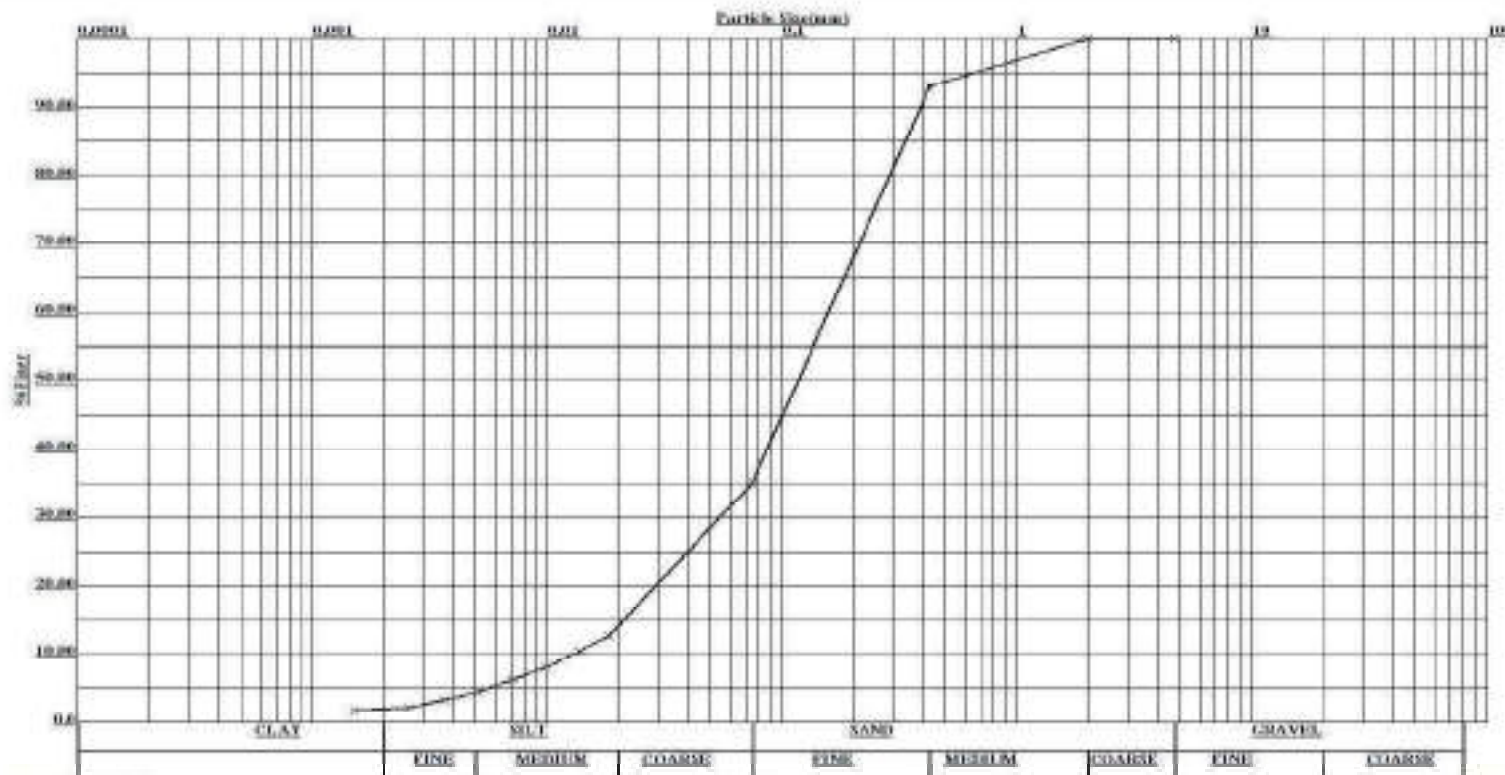
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C _u	C _c
			(%)	(%)	(%)	(%)		
×	0.0	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	75.00	24.00	1.00	8.99	1.86
○	0.5		0.00	72.00	27.00	1.00	9.33	1.83
□	3.0		0.00	68.00	30.00	2.00	11.58	1.65
◇	6.0		0.00	64.00	35.00	1.00	8.09	1.02

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. - 38
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	LOOSE TO MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	65.00	33.00	2.00	11.97	1.43



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.- 38

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								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	0.00	0.50	SILTY SAND	SM	0.0	0.0	0.0	8.0	42.0	22.0	28.0	0.00	0.00	0.00	5.70	12.71	2.81	1.050	0.223	0.830	-	-	-	-
2		3.50	3.95			0.0	0.0	0.0	10.0	41.0	17.0	32.0	0.00	0.00	0.00	7.13	12.40	2.17	1.200	0.229	0.842	-	-	-	-
3		6.50	6.95			0.0	0.0	0.0	6.0	39.0	19.0	36.0	0.00	0.00	0.00	4.28	11.80	2.42	1.350	0.198	0.784	-	-	-	-