



## 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)
4670.264	3	ROAD	RUB	BH-01	199300	3005386	112.39

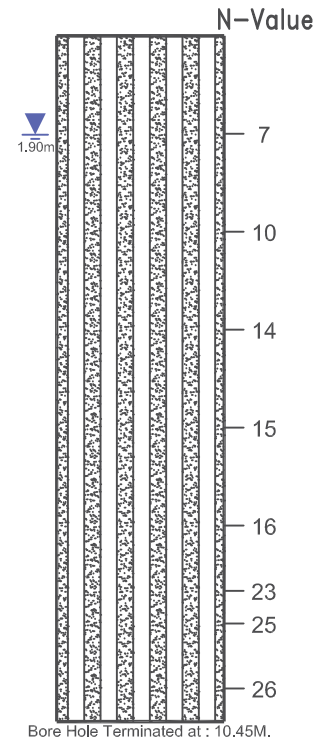
**SUBMITTED BY:**



# BOREHOLE PROFILE

## SECTION: CHITAUNI TO MADHUBANI

BRIDGE NO.: 03  
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. 3				BOREHOLE NO. BH- 01				GWT: 1.70 m				DATE STARTED : 18/01/2025																								
FIELD TEST RESULTS												LABORATORY TEST RESULTS																								
ELEVATION IN METERS	DEPTH IN METERS BELOW REFERENCE	NATURE OF SAMPLING	SAMPLE REFERENCE NO.	LEVEL OF WATER TABLE /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 <sub>v</sub> (kg/cm <sup>2</sup> )	Angle of friction (Degrees)		Compression Index(Cc)	pH	Chloride, %	Sulphate, %	pH	Chloride, mg/l	Sulphate, mg/l	
-0.50	0.5	DS	1	 1.70 m	0,00	0,50	DS	-	-		MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	0	71	28	1	NON-PLASTIC		1,58	-	-	-	-	-	-	-	-	-	-	7,22	0,03	NIL	-	-	-	
	1.0	SPT	1		0,50	0,95	7	30	7			13	-	0	68	30	2	NON-PLASTIC		1,74	-	-	-	2,52	-	-	-	-	-	-	7,32	0,02	NIL	-	-	-
	2.0	SPT	2		1,50	1,95	10	30	10			15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,47	0,02	NIL	-	-	-	
-3,00	3,0	DS	1		2,50	2,80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	4,0	SPT	3		3,00	3,45	14	30	14			18	-	0	65	33	2	NON-PLASTIC		2,02	-	-	-	2,54	-	-	-	-	-	-	-	-	-	-	-	-
	5,0	SPT	4		4,50	4,95	15	30	15			18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-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	64	35	1	NON-PLASTIC		2,03	-	-	-	2,55	-	-	-	-	-	-	-	-	-	-	-	-
	8,0	SPT	6		7,50	7,95	23	30	23			21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-9,00	9,0	DS	3		8,50	8,80	UDS SLIPPED					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	10,0	SPT	7		9,00	9,45	25	30	25			21	-	0	62	36	2	NON-PLASTIC		2,04	-	-	-	2,56	-	-	-	-	-	-	-	-	-	-	-	-
	11,0	SPT	8		10,00	10,45	26	30	26			21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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

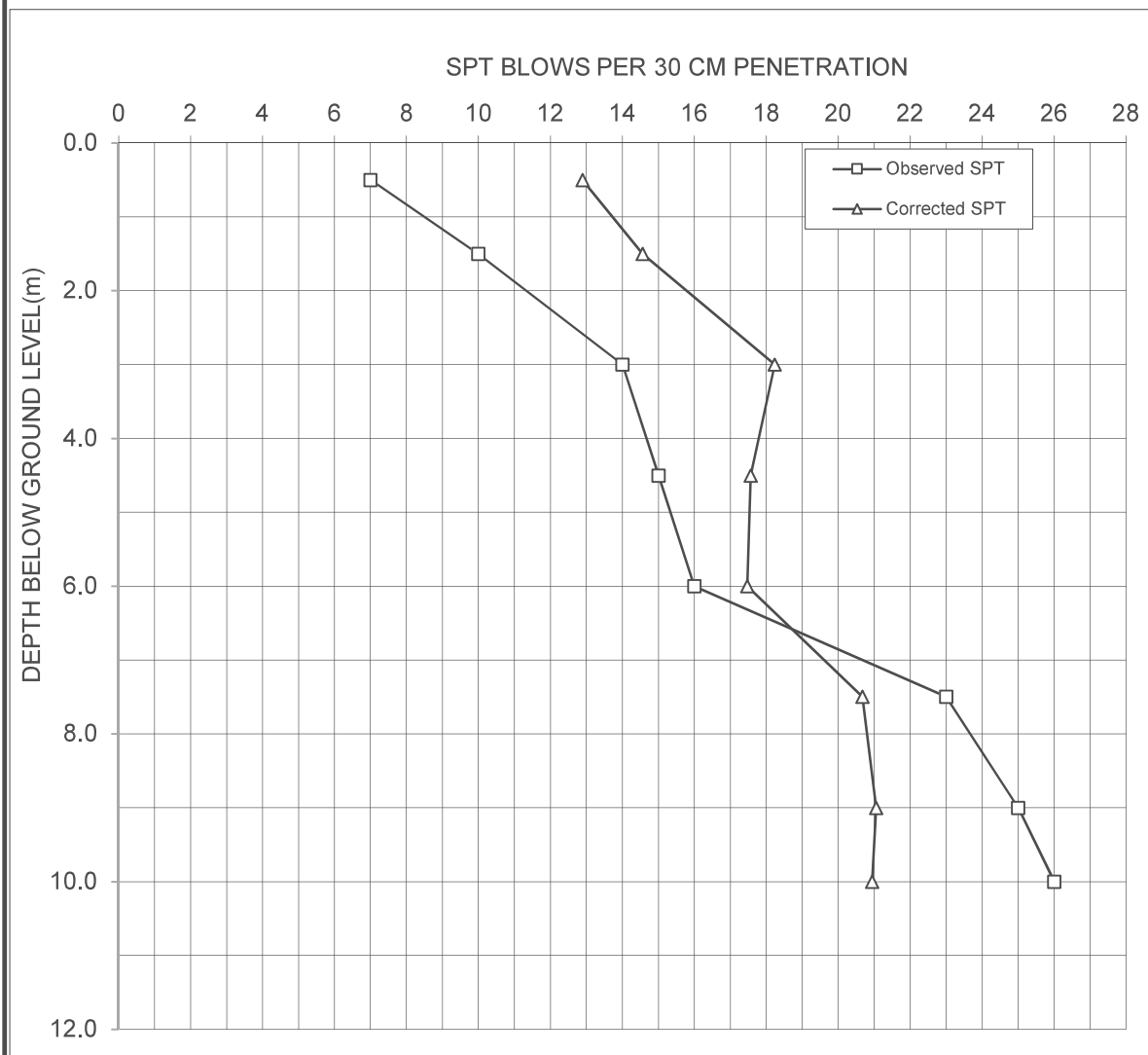
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE:-1.70m**

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	10	15	15
3.00	Non Plastic	14	21	18
4.50	Non Plastic	15	20	18
6.00	Non Plastic	16	20	17
7.50	Non Plastic	23	26	21
9.00	Non Plastic	25	27	21
10.00	Non Plastic	26	27	21

\* 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:3

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma'_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_u$	MSF	CRR	FOS	Conclusion
0.50	SM	7	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	12.46	4.83	1.17	19.42	0.21	25.54	0.87	1.00	1.00	1.19	0.25	0.68	Liquefiable
1.50	SM	10	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	17.81	4.83	1.17	25.68	0.31	37.56	0.81	1.00	1.00	1.19	0.36	1.01	Non Liquefiable
3.00	SM	14	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	28.25	5.00	1.20	38.90	NA	61.07	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	15	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	32.50	5.00	1.20	44.00	NA	67.50	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	16	2.03	1.03	36	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	5.00	1.20	40.05	NA	63.23	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	23	2.03	1.03	36	IV	0.24	7.00	0.94	14.33	6.83	0.31	1.21	1.33	1.000	1.05	0.95	1.00	36.94	5.00	1.20	49.32	NA	71.94	0.64	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	25	2.04	1.04	38	IV	0.24	7.00	0.93	17.37	8.37	0.30	1.09	1.33	1.000	1.05	1	1.00	38.16	5.00	1.20	50.79	NA	73.16	0.63	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	26	2.04	1.04	38	IV	0.24	7.00	0.91	19.41	9.41	0.29	1.03	1.33	1.000	1.05	1	1.00	37.43	5.00	1.20	49.92	NA	72.43	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

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



**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)

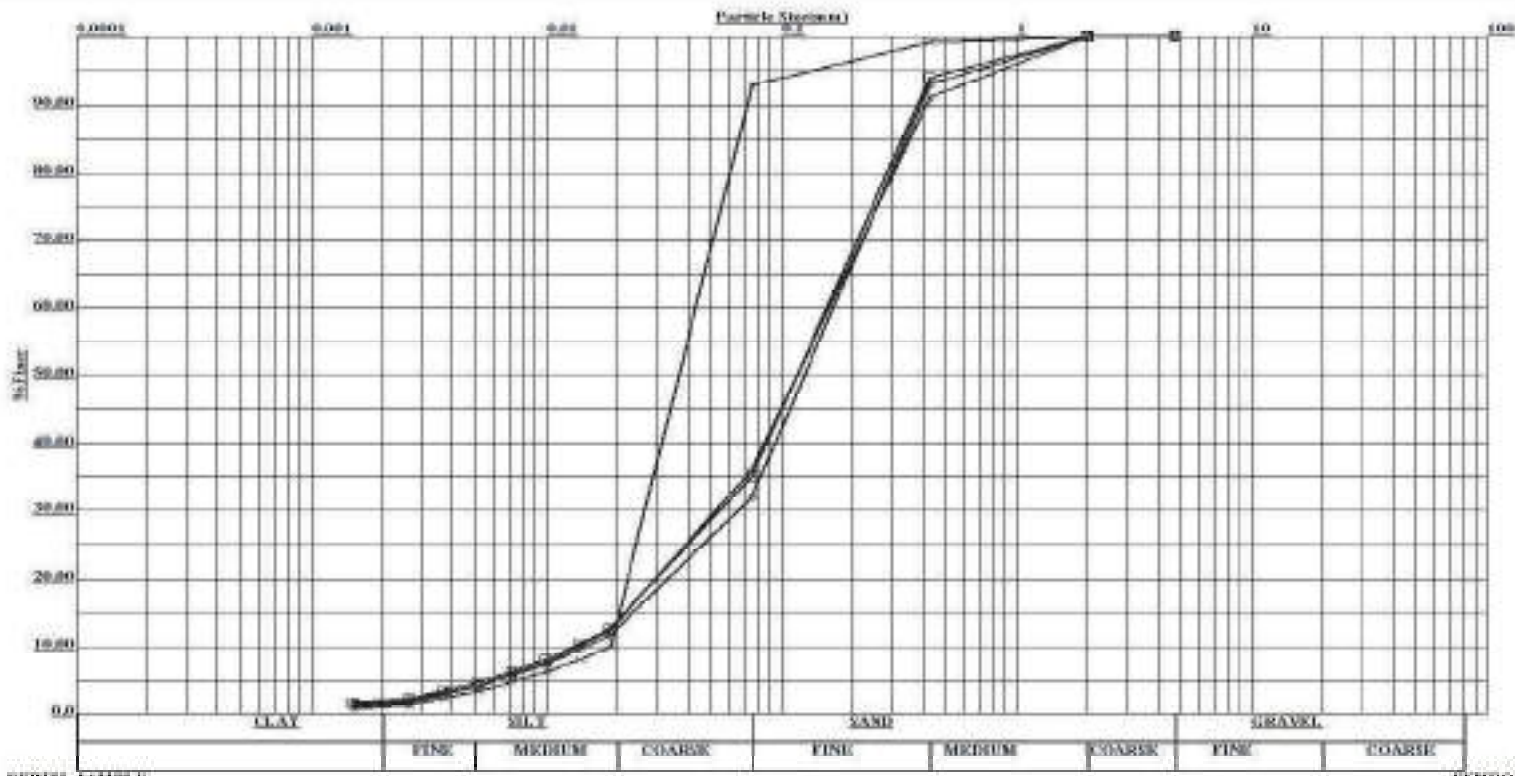
Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	BOREHOLE NO-01							Section : CHITAUUNI - MADHUBANI										Sandy Strata		Clayey Soil				
		From	To			Percentage Retained							Mean Particle Size (mm)							Mean Particle Size (dm)	Silt Factor in the layer= $1.76 \times \sqrt{\text{dm}}$	Average Cohesion Intercept - c (t/sqm)	Average Angle of Internal Friction (°)	F	Silt Factor = $\frac{K_{sf}c}{F \times (1 + \sqrt{\frac{c}{10}})}$				
						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										
1	BH-01	0.50	0.95	SILTY SAND	SM	0.0	0.0	0.0	7.0	37.0	24.0	32.0	0.00	0.00	0.00	4.99	11.19	3.06	1.200	0.204	0.796	-	-	-	-				
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	6.0	35.0	24.0	35.0	0.00	0.00	0.00	4.28	10.59	3.06	1.313	0.192	0.772	-	-	-	-				
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	9.0	34.0	21.0	36.0	0.00	0.00	0.00	6.41	10.29	2.68	1.350	0.207	0.801	-	-	-	-				

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)

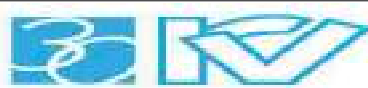
BRIDGE NO. - 03  
SECTION:CHITAUNI - MADHUBANI

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	71.00	28.00	1.00	2.32	0.85
○	0.5		0.00	68.00	30.00	2.00	11.12	1.72
□	3.0		0.00	65.00	33.00	2.00	11.83	1.46
◇	6.0		0.00	64.00	35.00	1.00	11.52	1.25

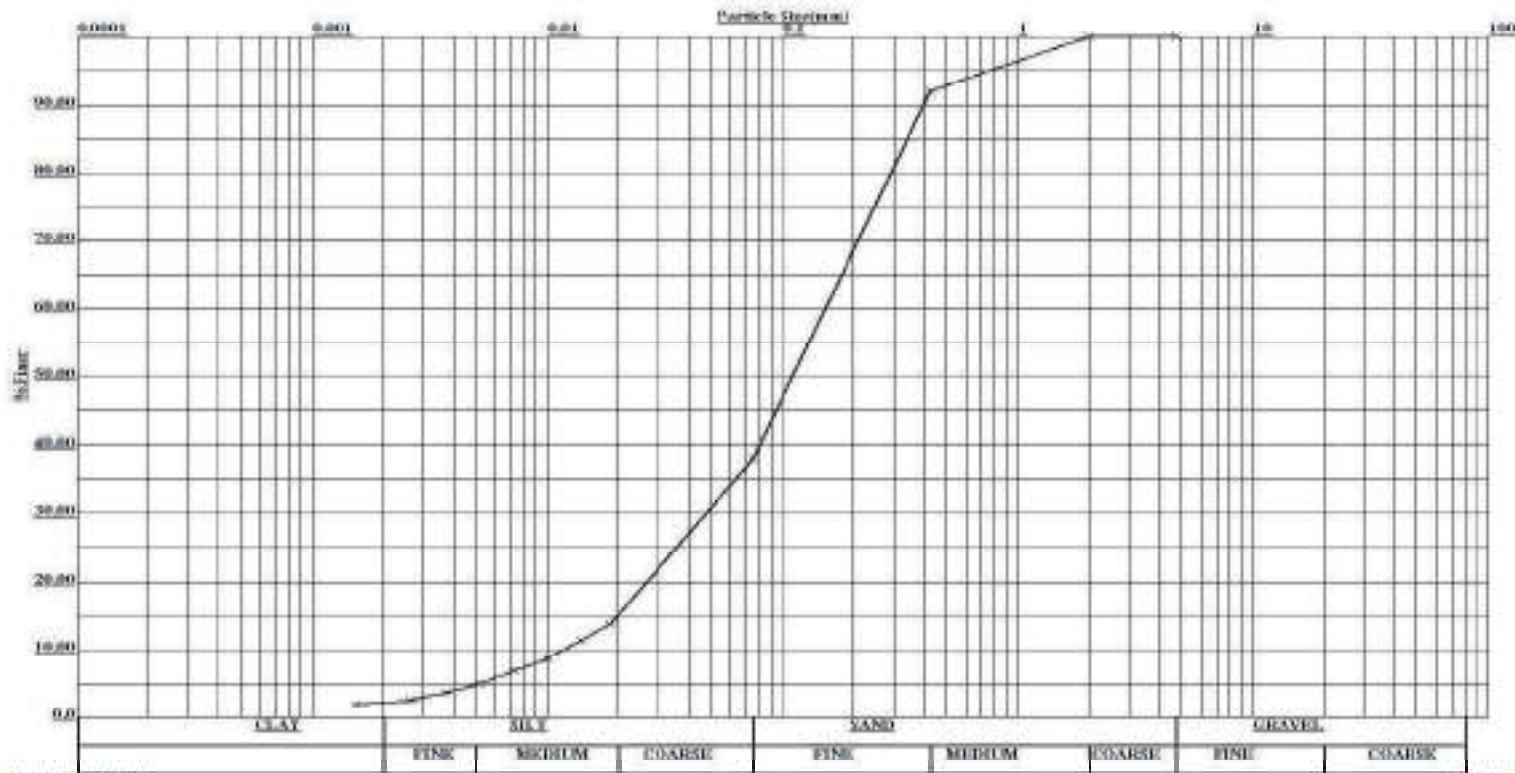


PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 03  
SECTION:CHITAUNI - 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	62.00	36.00	2.00	12.87	1.25





## 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)
7761.481	9	ROAD	RUB	BH-01	199726	3002345	110.55

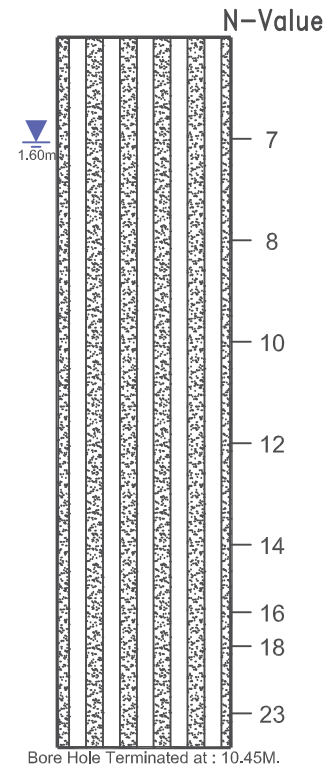
SUBMITTED BY:



# BOREHOLE PROFILE

## SECTION: CHITAUNI TO MADHUBANI

**BRIDGE NO.:** 09  
**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. 9				GWT: 1.60 m		DATE STARTED : 20/01/2025		 aarvee associates architects engineers & consultants pvt. ltd.																											
BOREHOLE NO. BH- 01				DATE COMPLETED : 20/01/2025																															
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 <sup>2</sup> )	Angle of friction (Degrees)		Compression Index(Cc)	pH	Chloride, %	Sulphate, %	pH	Chloride, mg/l	Sulphate, mg/l
-0.50	0.5	DS	1	 1.60 m	0.00	0.50	DS	-	-		MEDIUM, LITE GREY, SILTY SAND (SM)	-	0	73	26	1	NON-PLASTIC			-	-	-	-	-	-	-	-	-	-	7.41	0.01	NIL	-	-	-
	1.0	SPT	1		0.50	0.95	7	30	7			13	-	0	71	27	2	NON-PLASTIC			-	-	-	2.53	-	-	-	-	-	7.39	0.03	NIL	-	-	-
	2.0	SPT	2		1.50	1.95	8	30	8			12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7.35	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	68	31	1	NON-PLASTIC			-	-	-	2.55	-	-	-	-	-	-	-	-	-	-	
	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			16	-	0	66	32	2	NON-PLASTIC			-	-	-	2.54	-	-	-	-	-	-	-	-	-	-	-
	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			17	-	0	63	36	1	NON-PLASTIC			-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-
	11.0	SPT	8		10.00	10.45	23	30	23			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

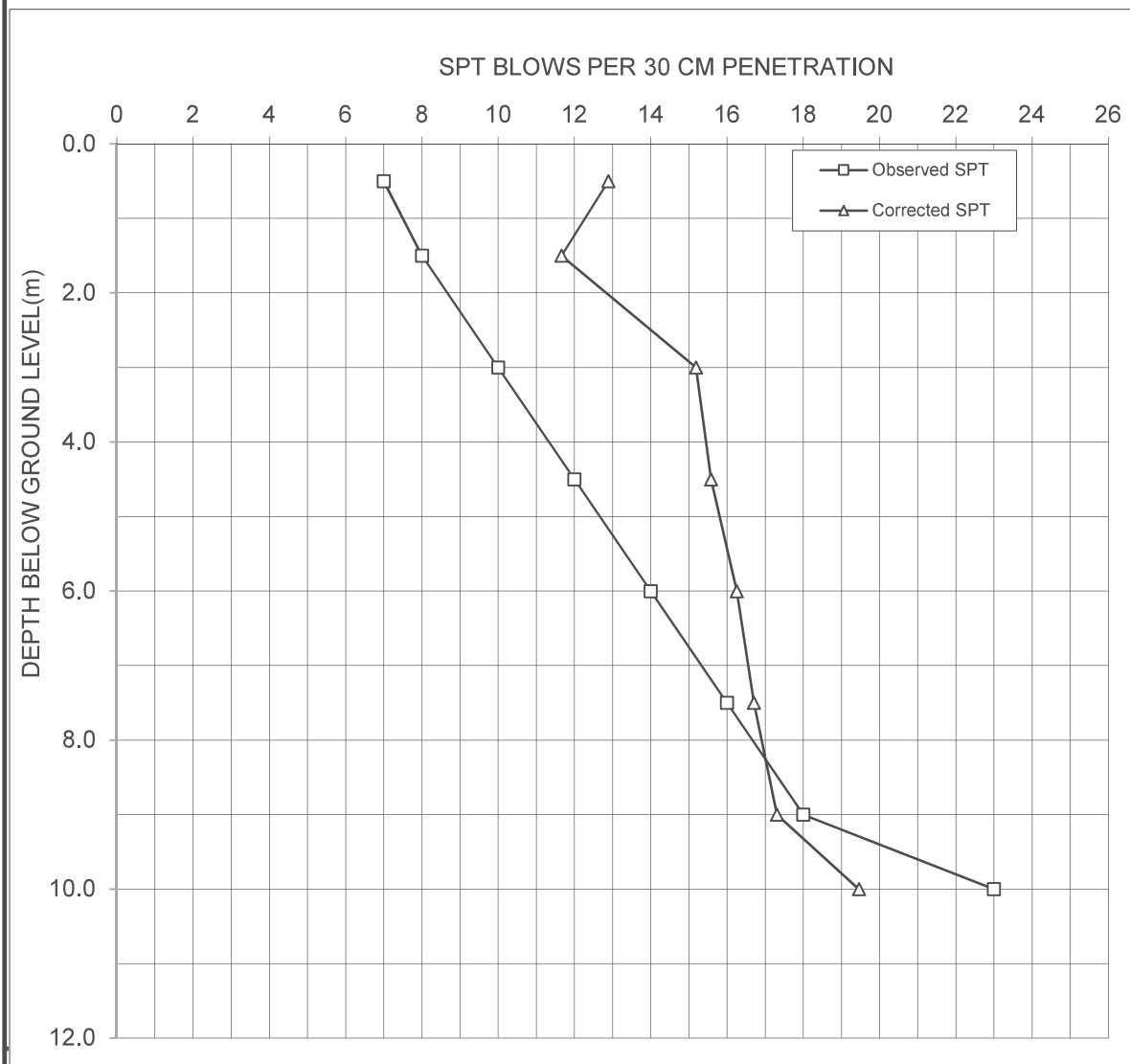
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :-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	7	13	13
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	14	18	16
7.50	Non Plastic	16	18	17
9.00	Non Plastic	18	20	17
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: 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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_u$	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

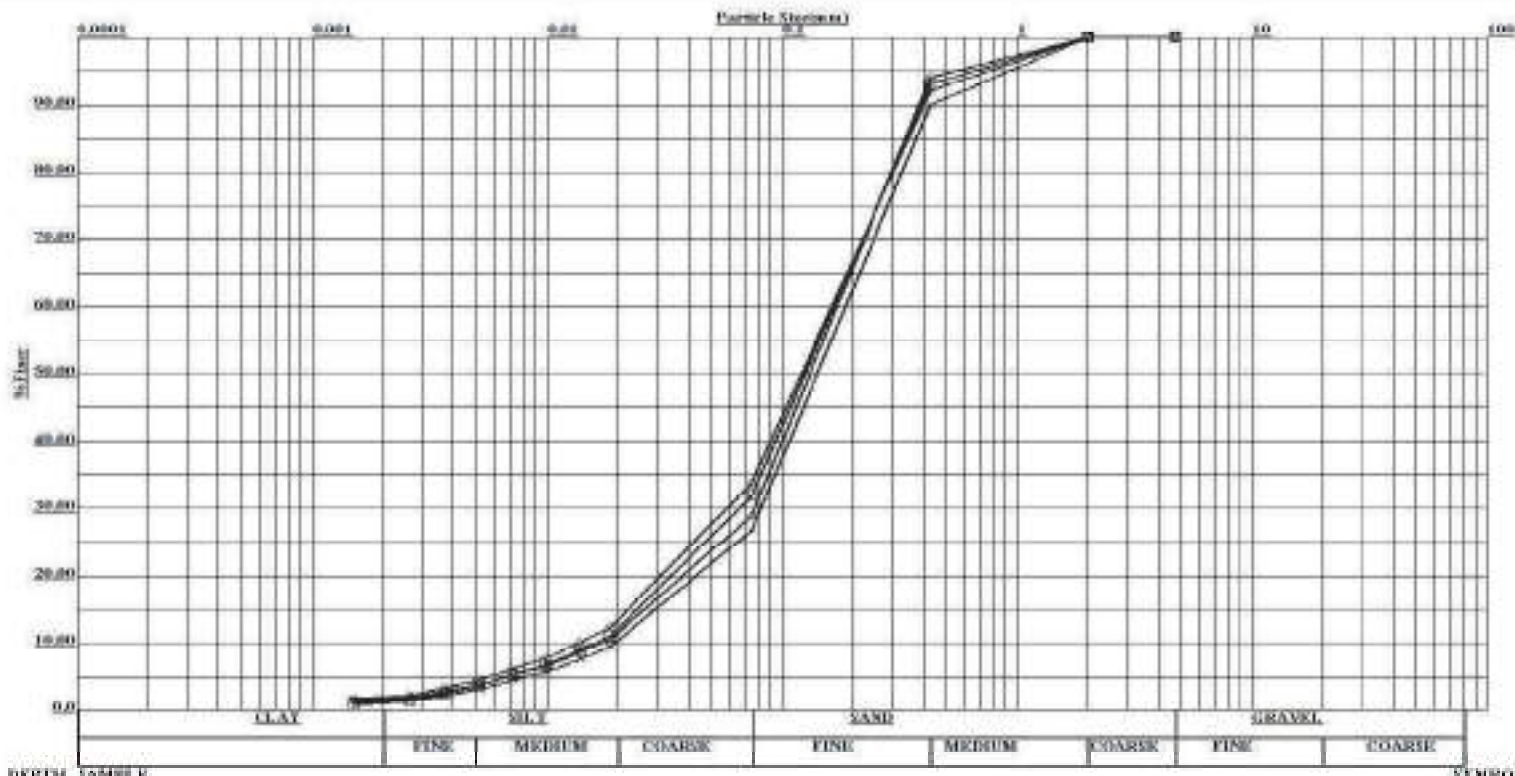
$K_u$  Correction for static shear stress is required only for sloping ground

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. - 09  
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



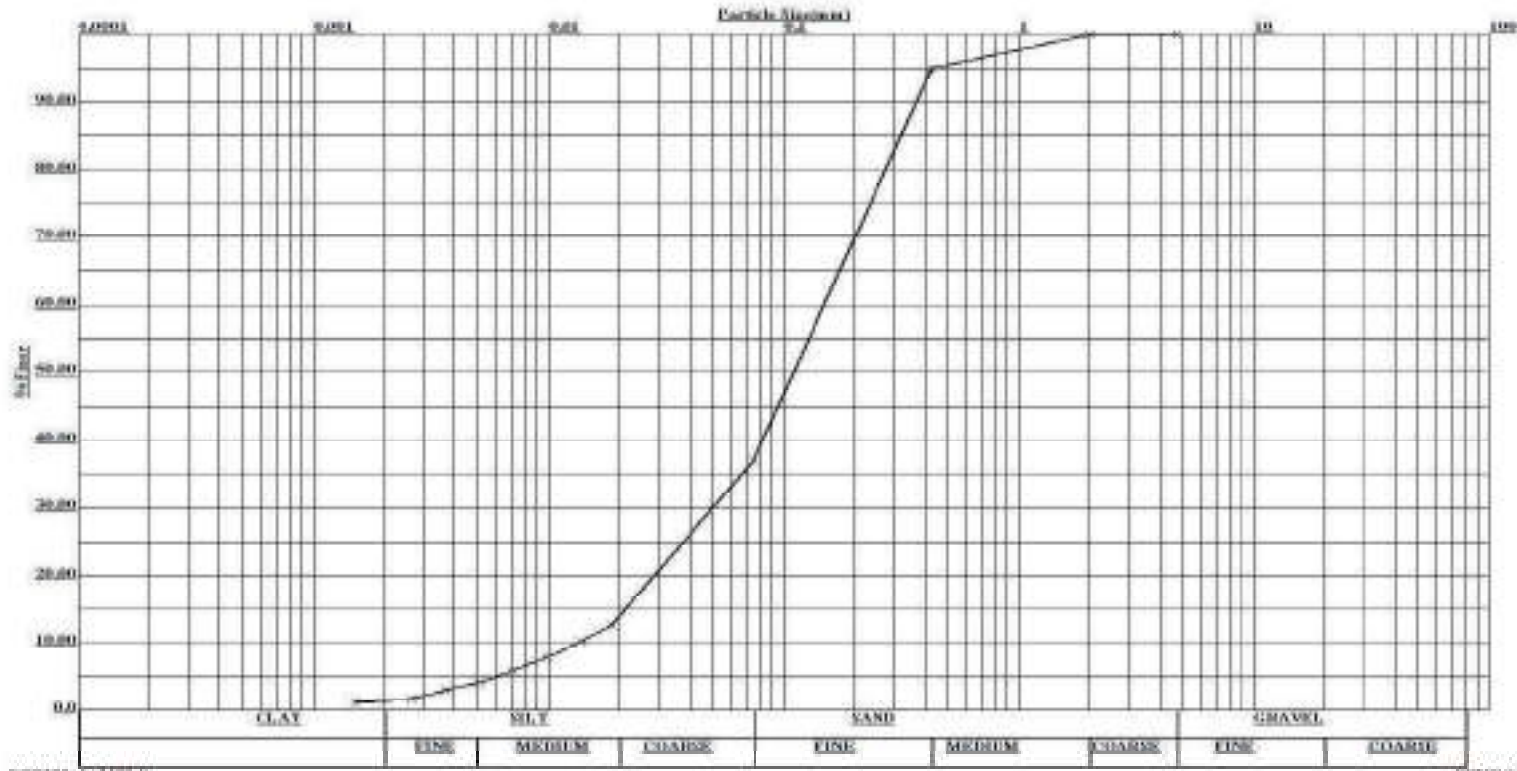
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	$C_u$	$C_c$
			(%)	(%)	(%)	(%)		
×	0.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	73.00	26.00	1.00	9.44	1.81
O	0.5		0.00	71.00	27.00	2.00	9.94	2.01
□	3.0		0.00	68.00	31.00	1.00	10.27	1.60
◇	6.0		0.00	66.00	32.00	2.00	11.84	1.49

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. - 09  
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)

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	BOREHOLE NO-01							Section : CHITAUUNI - MADHUBANI													
		From	To			Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil				
						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= $1.76 \times \sqrt{\text{dm}}$	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	6.0	37.0	28.0	29.0	0.00	0.00	0.00	4.28	11.19	3.57	1.088	0.201	0.790	-	-	-	-	
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	7.0	38.0	23.0	32.0	0.00	0.00	0.00	4.99	11.50	2.93	1.200	0.206	0.799	-	-	-	-	
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	8.0	34.0	24.0	34.0	0.00	0.00	0.00	5.70	10.29	3.06	1.275	0.203	0.793	-	-	-	-	





## 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)
9047.045	10	ROAD	RUB	BH-01	200321	3001206	111.15

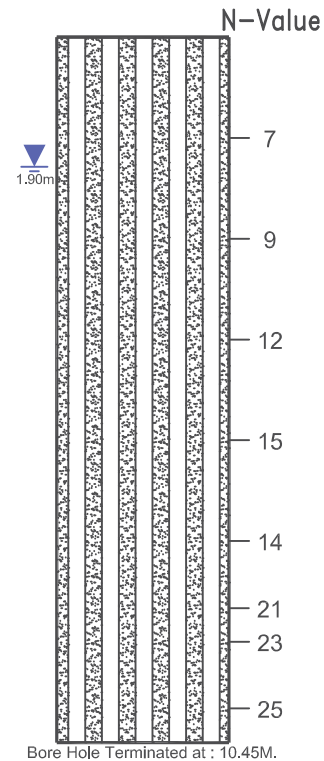
SUBMITTED BY:



# BOREHOLE PROFILE

## SECTION: CHITAUNI TO MADHUBANI

BRIDGE NO.: 10  
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)



### CALCULATIONS FOR CORRECTED SPT (N) VALUES

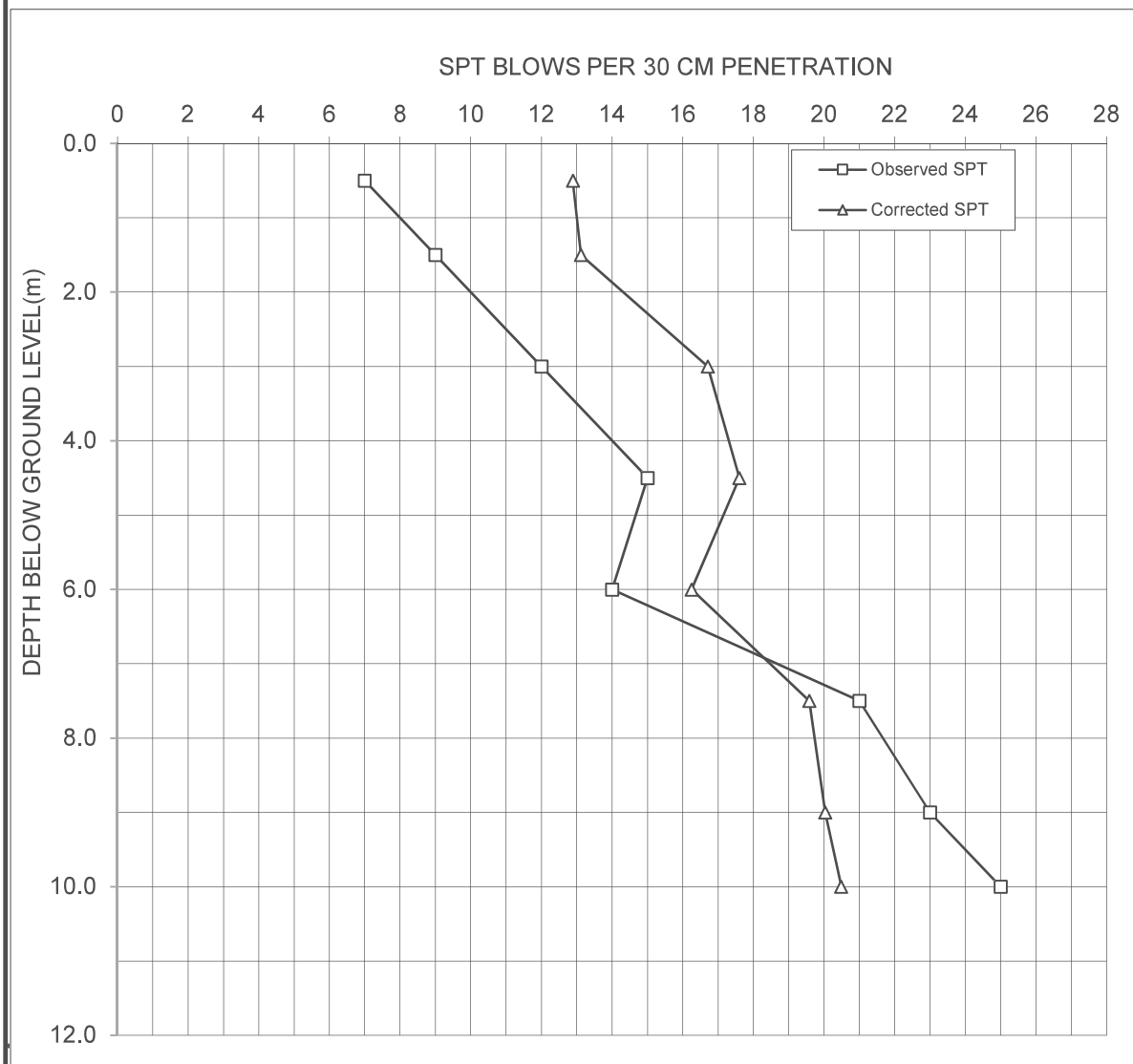
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :-1.90m**

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	12	18	17
4.50	Non Plastic	15	20	18
6.00	Non Plastic	14	18	16
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: 10

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 <sup>3</sup> )	Submerged Density (t/m <sup>3</sup> )	Fine Content ( % )	Earthquake Zone	Peak ground acceleration $a_{max}/g$	Earth quake magnitude (Mw)	Stress reduction coefficient (rd)	Total overburden pressure ( $\sigma_o$ ), t/m <sup>2</sup>	Effective overburden ( $\sigma'_o$ ), t/m <sup>2</sup>	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_\alpha$	MSF	CRR	FOS	Conclusion
0.50	SM	7	1.73	0.73	29	III	0.16	6.00	1.00	0.87	0.37	0.25	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	1.77	0.36	1.46	Non Liquefiable
1.50	SM	9	1.73	0.73	29	III	0.16	6.00	0.99	2.60	1.10	0.24	1.70	1.33	1.000	1.05	0.75	1.00	16.02	4.64	1.15	23.00	0.26	33.56	0.83	1.00	1.00	1.77	0.45	1.87	Non Liquefiable
3.00	SM	12	2.00	1.00	32	III	0.16	6.00	0.98	5.19	2.19	0.24	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	1.77	NA	>1.0	Non Liquefiable
4.50	SM	15	2.00	1.00	32	III	0.16	6.00	0.97	8.19	3.69	0.22	1.65	1.33	1.000	1.05	0.95	1.00	32.76	4.83	1.17	43.19	NA	67.76	0.66	1.00	1.00	1.77	NA	>1.0	Non Liquefiable
6.00	SM	14	2.01	1.01	34	III	0.16	6.00	0.95	11.19	5.19	0.21	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	1.77	NA	>1.0	Non Liquefiable
7.50	SM	21	2.01	1.01	34	III	0.16	6.00	0.94	14.21	6.71	0.21	1.22	1.33	1.000	1.05	0.95	1.00	34.02	4.93	1.19	45.36	NA	69.02	0.65	1.00	1.00	1.77	NA	>1.0	Non Liquefiable
9.00	SM	23	2.02	1.02	37	III	0.16	6.00	0.93	17.22	8.22	0.20	1.10	1.33	1.000	1.05	1	1.00	35.43	5.00	1.20	47.51	NA	70.43	0.65	1.00	1.00	1.77	NA	>1.0	Non Liquefiable
10.00	SM	25	2.02	1.02	37	III	0.16	6.00	0.91	19.24	9.24	0.20	1.04	1.33	1.000	1.05	1	1.00	36.32	5.00	1.20	48.58	NA	71.32	0.64	1.00	1.00	1.77	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m2)

$K_\alpha$  Correction for static shear stress is required only for sloping ground



aarvee associates

architects engineers & consultants pvt. ltd.

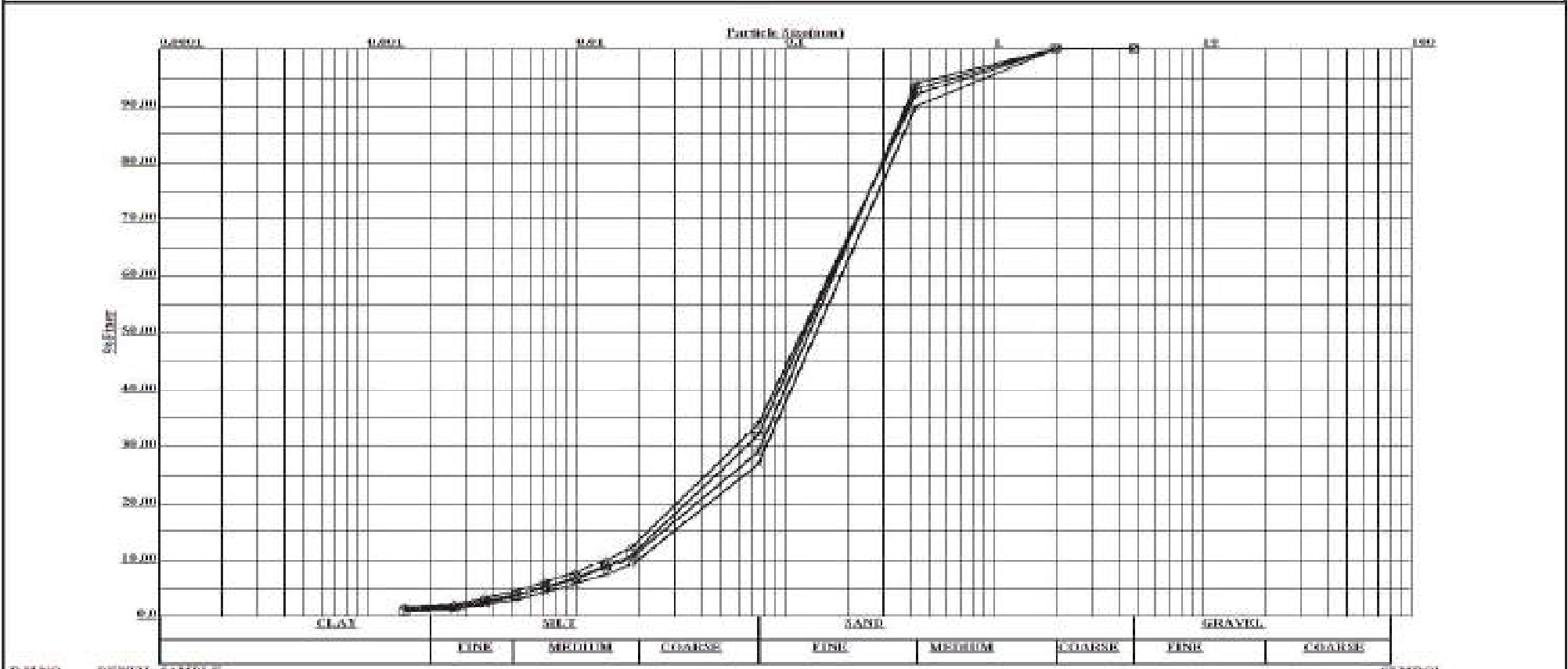
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 10

SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



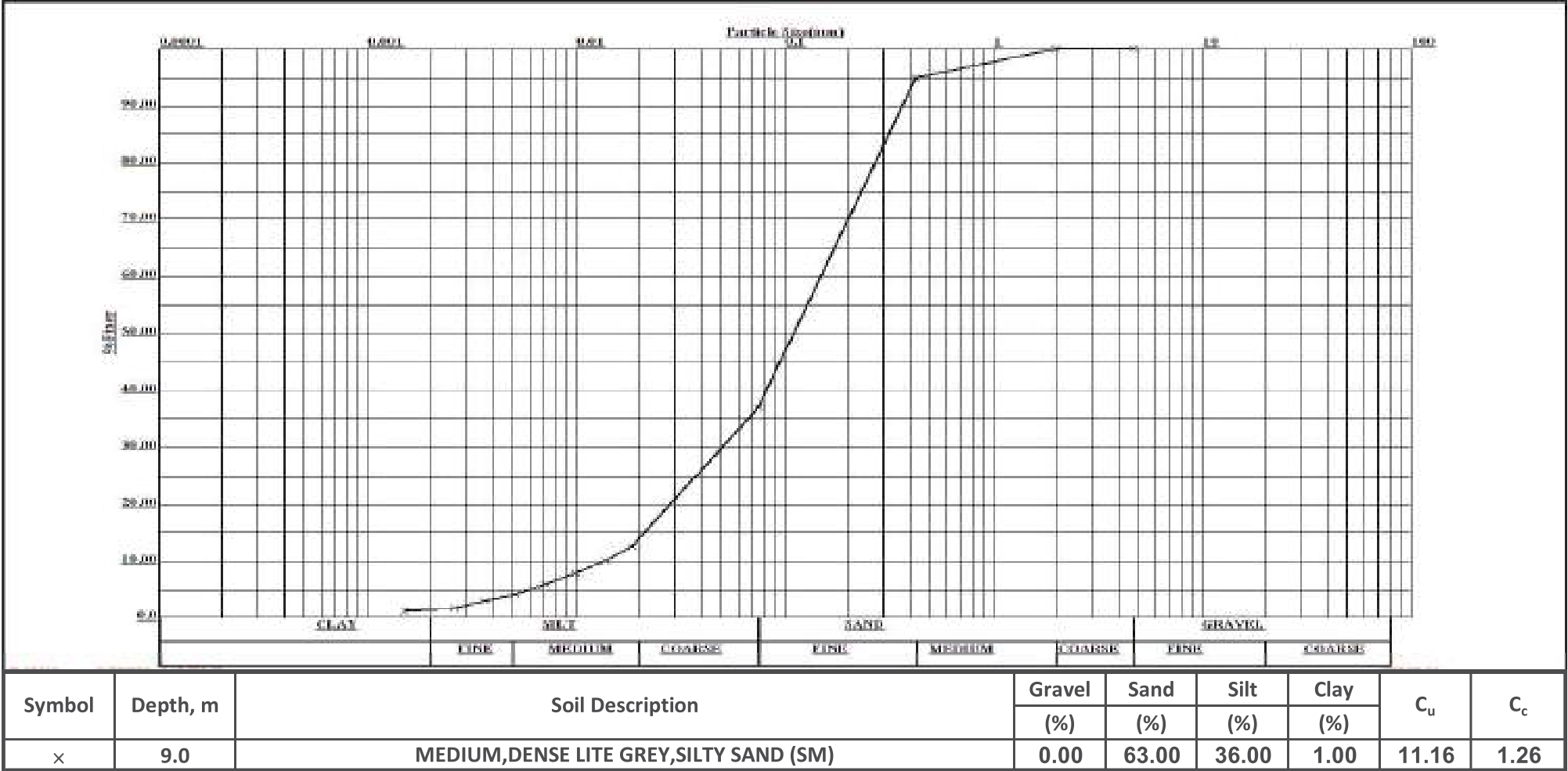
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	C <sub>u</sub>	C <sub>c</sub>
			(%)	(%)	(%)	(%)		
×	0.0	MEDIUM,DENSE LITE GREY,SILTY SAND (SM)	0.00	73.00	26.00	1.00	9.48	1.82
○	0.5		0.00	71.00	27.00	2.00	9.92	2.00
□	3.0		0.00	68.00	31.00	1.00	10.27	1.60
◇	6.0		0.00	66.00	32.00	2.00	11.84	1.49

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. - 10  
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. 10				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 = $\frac{K_{sfc}}{F \times (1 + \sqrt{F})}$		
1	BH-01	0.50	0.95	SILTY SAND	SM	0.0	0.0	0.0	6.0	37.0	28.0	29.0	0.00	0.00	0.00	4.28	11.19	3.57	1.088	0.201	0.790	-	-	-	-		
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	7.0	38.0	23.0	32.0	0.00	0.00	0.00	4.99	11.50	2.93	1.200	0.206	0.799	-	-	-	-		
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	8.0	34.0	24.0	34.0	0.00	0.00	0.00	5.70	10.29	3.06	1.275	0.203	0.793	-	-	-	-		





## 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)
9666.338	12	ROAD	RUB	BH-01	200608	3000657	111.40

**SUBMITTED BY:**

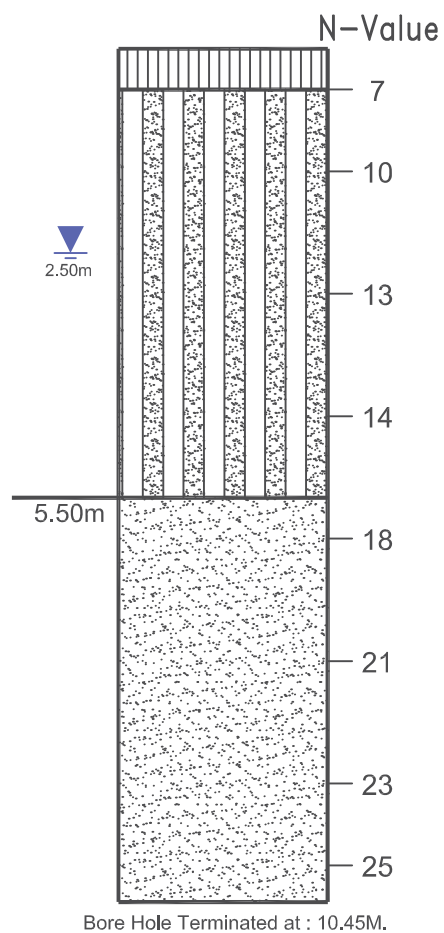


# BOREHOLE PROFILE





SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.-12

BOREHOLE NO.: BH- 01



## LEGENDS

-  Sandy Silty (ML)
-  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)





### CALCULATIONS FOR CORRECTED SPT (N) VALUES

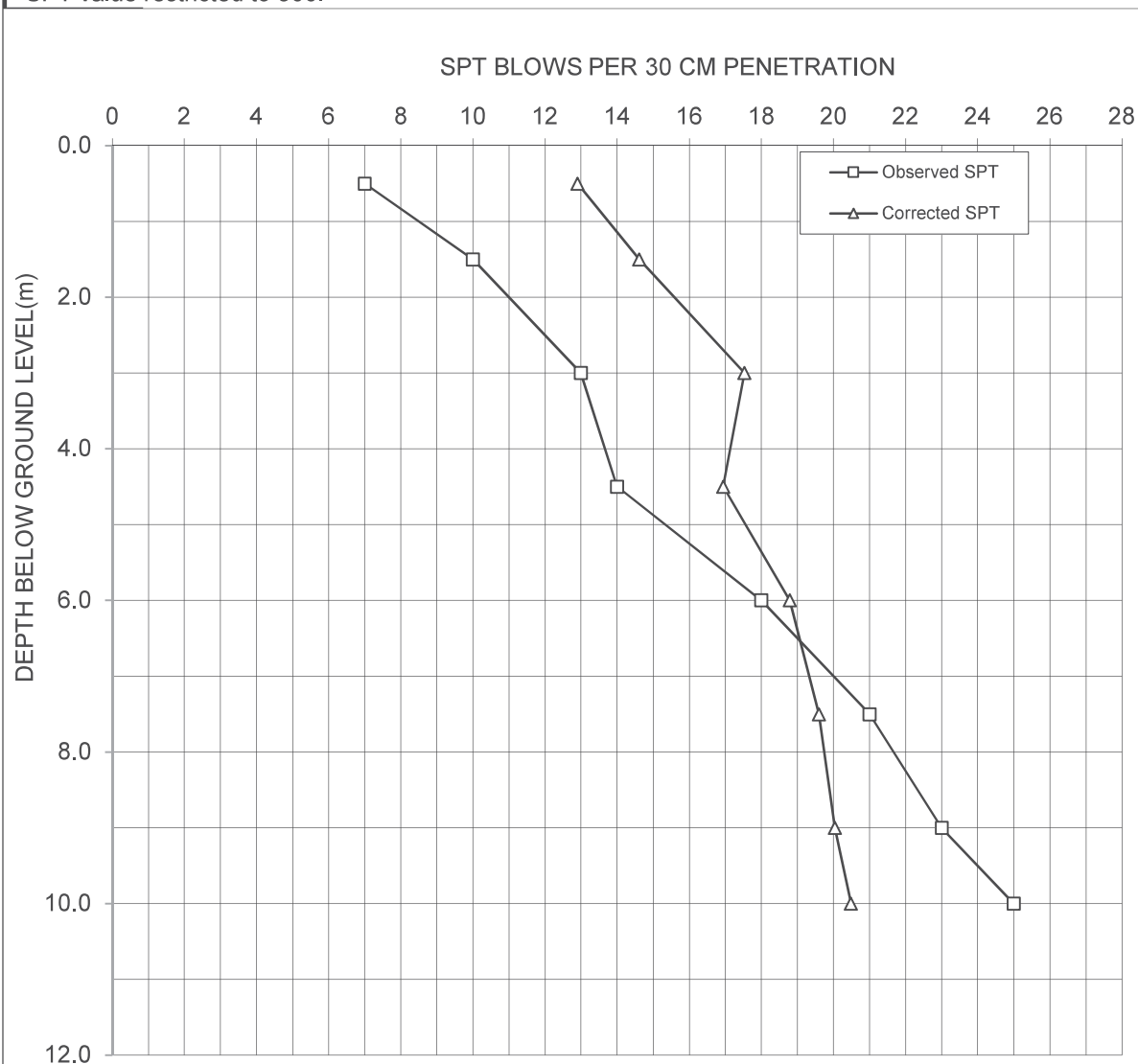
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :-2.50m**

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	7	13	13
1.50	Non Plastic	10	15	15
3.00	Non Plastic	13	20	18
4.50	Non Plastic	14	19	17
6.00	Non Plastic	18	23	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: 12

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_u$	MSF	CRR	FOS	Conclusion
0.50	SM	7	1.71	0.71	29	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	4.64	1.15	18.92	0.20	25.54	0.87	1.00	1.00	1.19	0.24	0.65	Liquefiable
1.50	SM	10	1.71	0.71	29	IV	0.24	7.00	0.99	2.57	1.07	0.37	1.70	1.33	1.000	1.05	0.75	1.00	17.81	4.64	1.15	25.05	0.29	37.56	0.81	1.00	1.00	1.19	0.35	0.94	Liquefiable
3.00	SM	13	2.01	1.01	32	IV	0.24	7.00	0.98	5.13	2.13	0.37	1.70	1.33	1.000	1.05	0.85	1.00	26.23	4.83	1.17	35.55	NA	56.52	0.72	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	14	2.01	1.01	32	IV	0.24	7.00	0.97	8.15	3.65	0.34	1.66	1.33	1.000	1.05	0.95	1.00	30.76	4.83	1.17	40.85	NA	65.76	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SP	18	2.02	1.02	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	33.24	0.00	1.00	33.24	NA	68.24	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SP	21	2.02	1.02	4	IV	0.24	7.00	0.94	14.19	6.69	0.31	1.22	1.33	1.000	1.05	0.95	1.00	34.06	0.00	1.00	34.06	NA	69.06	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SP	23	2.04	1.04	3	IV	0.24	7.00	0.93	17.22	8.22	0.30	1.10	1.33	1.000	1.05	1	1.00	35.43	0.00	1.00	35.43	NA	70.43	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SP	25	2.04	1.04	3	IV	0.24	7.00	0.91	19.26	9.26	0.29	1.04	1.33	1.000	1.05	1	1.00	36.28	0.00	1.00	36.28	NA	71.28	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

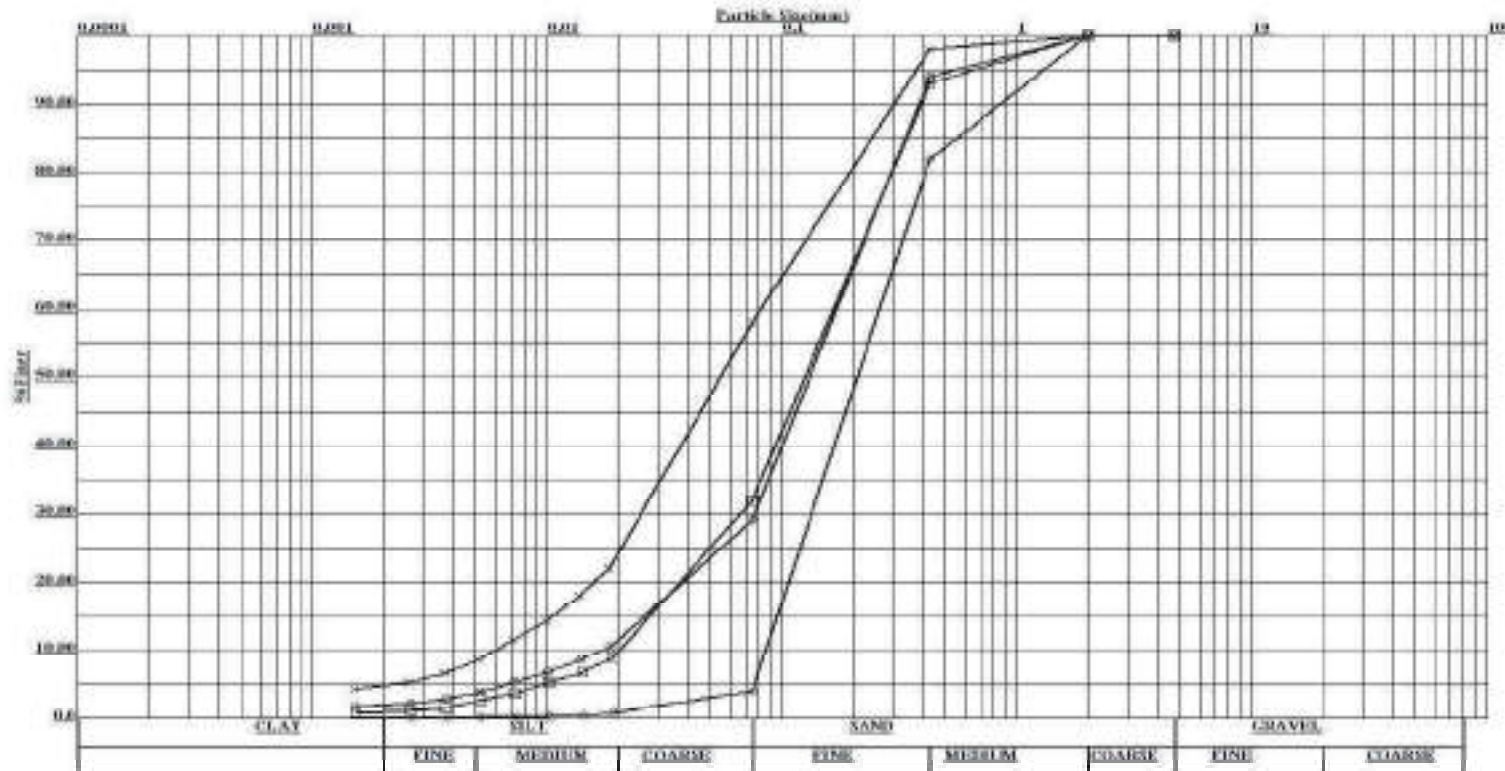
$K_u$  Correction for static shear stress is required only for sloping ground

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. - 12  
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



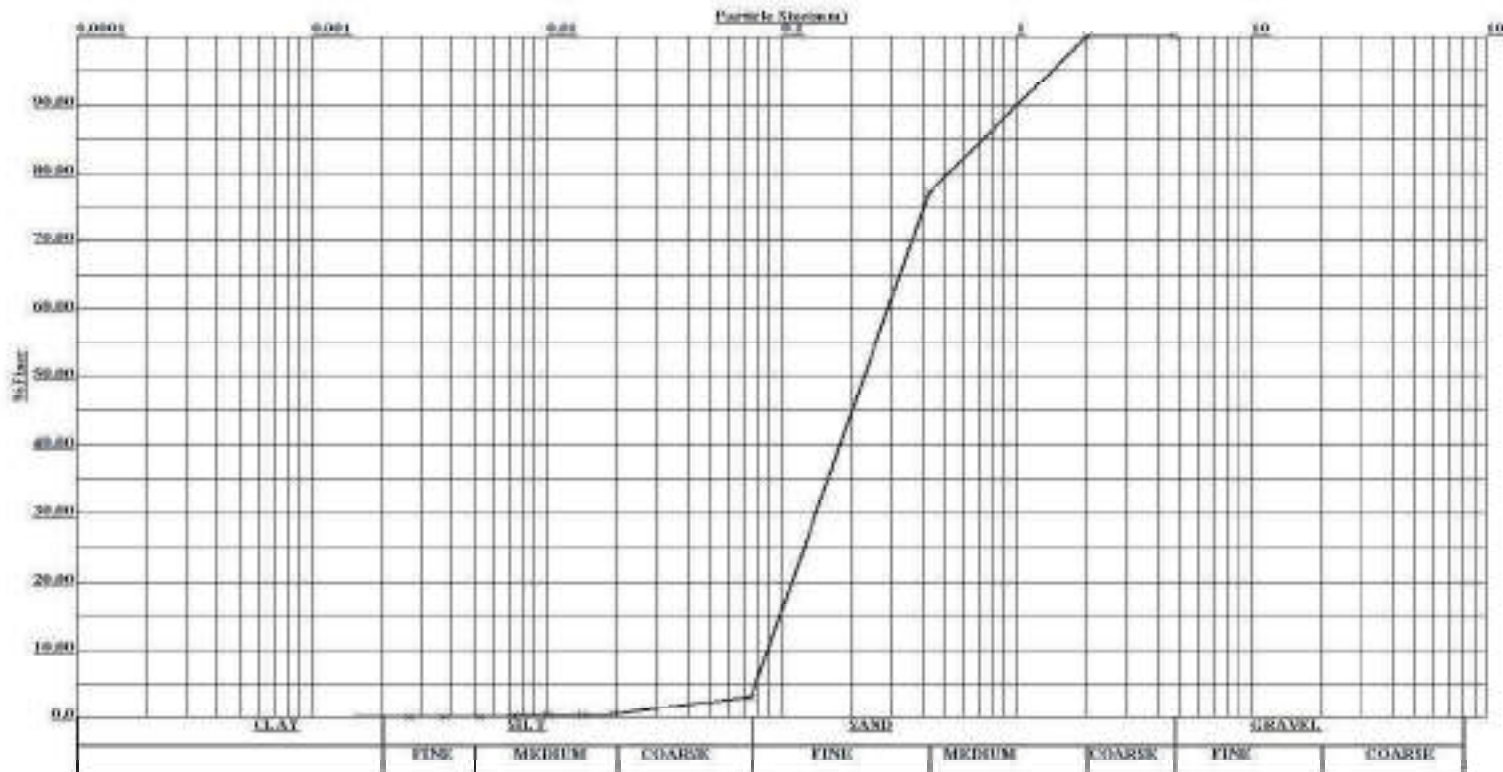
Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	$C_u$	$C_c$
			(%)	(%)	(%)	(%)		
×	0.0	LITE GREY, SANDY SILT (ML)	0.00	42.00	54.00	4.00	13.52	1.29
○	0.5	MEDIUM, LITE GREY, SILTY SAND (SM)	0.00	71.00	27.00	2.00	9.95	2.01
□	3.0		0.00	68.00	31.00	1.00	8.18	1.31
◇	6.0	MEDIUM, LITE GREY, POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.04	0.80

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. - 12  
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, LITE GREY, POORLY GRADED SAND (SP)	0.00	97.00	3.00	0.00	3.23	0.79



**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)

Sl.No.	Borehole No.	Depth (m)		Description of the Soil Strata	IS Classification	BOREHOLE NO-01							Section : CHITAU NI - MADHUBANI														
		From	To			Percentage Retained							Mean Particle Size (mm)							Sandy Strata		Clayey Soil					
						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 (t/sqm)	Average Angle of Internal Friction (°)	F	Silt Factor = Ksfc = F x (1 + sqrt(c/10))		
1	BH-01	0.00	0.50	SANDY SILT	ML	0.0	0.0	0.0	2.0	25.0	15.0	58.0	0.00	0.00	0.00	1.43	7.56	1.91	2.175	0.131	0.636	-	-	-	-		
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	7.0	38.0	23.0	32.0	0.00	0.00	0.00	4.99	11.50	2.93	1.200	0.206	0.799	-	-	-	-		
3		6.00	6.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	18.0	44.0	34.0	4.0	0.00	0.00	0.00	12.83	13.31	4.34	0.150	0.306	0.974	-	-	-	-		





## 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)
10853.137	15	ROAD	RUB	BH-01	201105	2999583	110.29

SUBMITTED BY:

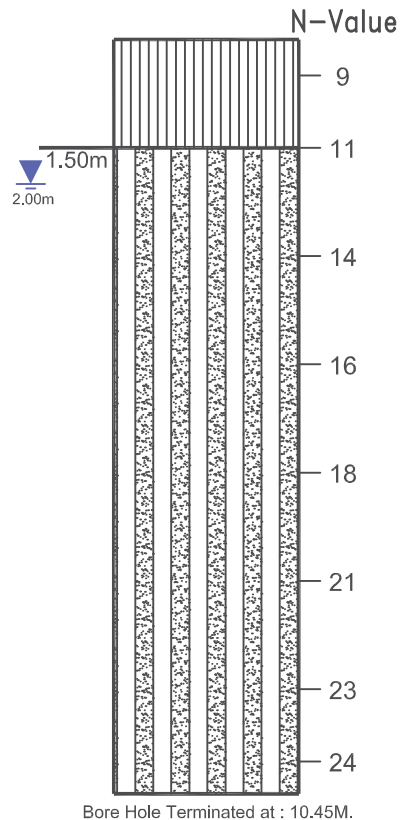


# BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

BRIDGE NO.- 15

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)

BRIDGE NO. 15				DATE STARTED : 22/01/2025				<div>aarvee associates architects engineers &amp; consultants pvt. ltd.</div>																												
BOREHOLE NO. BH- 01				DATE COMPLETED : 22/01/2025																																
GWT: 2.00 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 <sup>2</sup> )	Angle of friction (Degrees)		Compression Index (Cc)	SOIL SAMPLE			WATER SAMPLE			
-0.50	0.5	DS	1	<div>2.00 m</div>	0.00	0.50	DS	-	-		MEDIUM DENSE, LITE BROWN, SANDY SILT (ML)	-	0	44	52	4	NON-PLASTIC				-	-	-	2.51	-	-	-	-	7.32	0.01	NIL	-	-	-	-	
	1.0	SPT	1		0.50	0.95	9	30	9			-	0	42	53	5	NON-PLASTIC				-	-	-	2.51	-	-	-	-	7.36	0.02	NIL	-	-	-	-	
	2.0	SPT	2		1.50	1.95	11	30	11		MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	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	14	30	14			18	-	0	74	24	2	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	
	5.0	SPT	4		4.50	4.95	16	30	16			18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-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	72	27	1	NON-PLASTIC				-	-	-	2.54	-	-	-	-	-	-	-	-	-	-	-
	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	68	30	2	NON-PLASTIC				-	-	-	2.56	-	-	-	-	-	-	-	-	-	-	-
-11.00	11.0	SPT	8		10.00	10.45	24	30	24			20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>CLASSIFICATION OF SOIL AS PER IS : 1498</b> <b>ABBREVIATION USED :</b> 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: CHITAUUNI-MADHUBANI							

### CALCULATIONS FOR CORRECTED SPT (N) VALUES

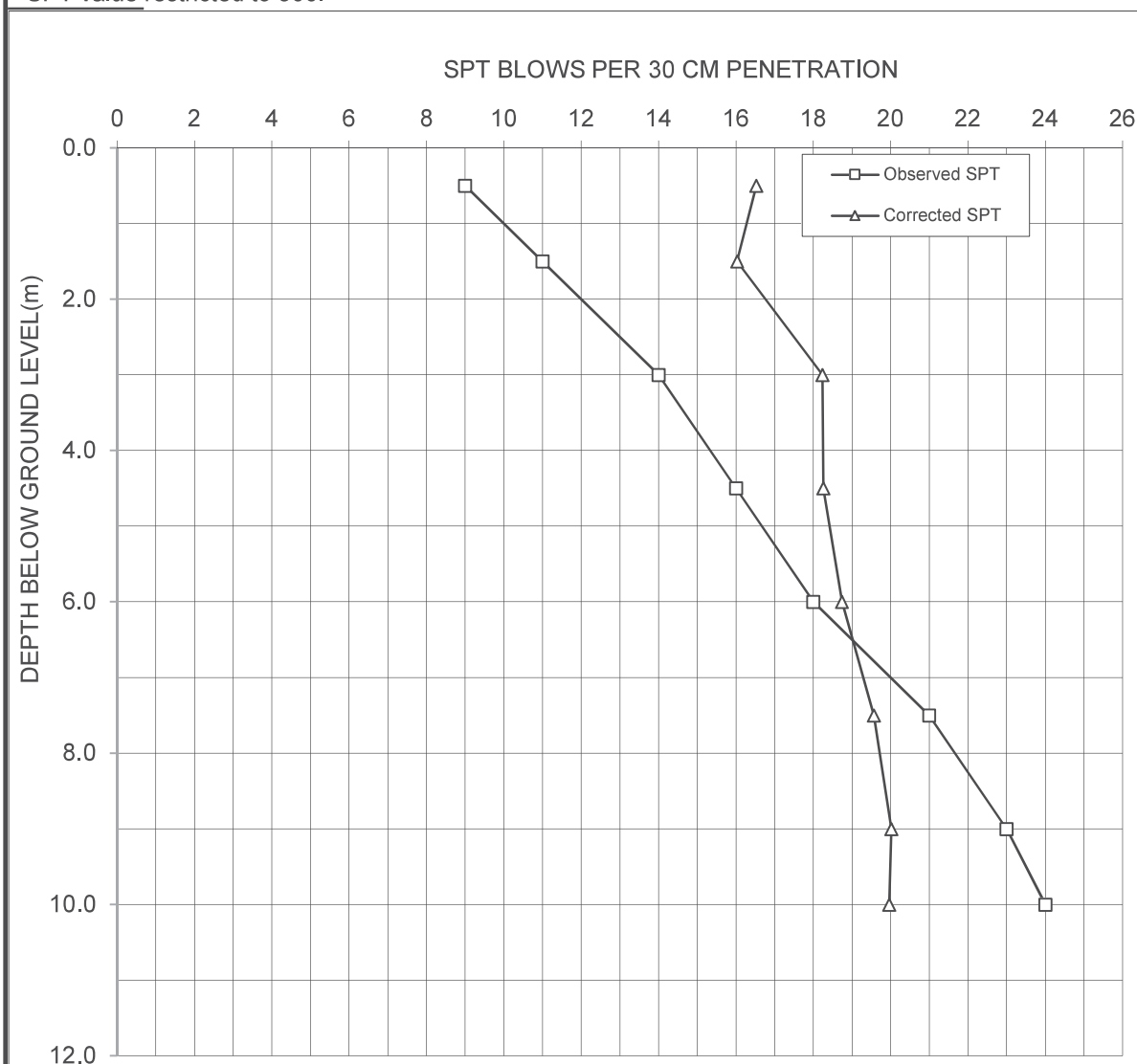
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :- 2.00 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	9	17	17
1.50	Non Plastic	11	16	16
3.00	Non Plastic	14	21	18
4.50	Non Plastic	16	22	18
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	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: 15

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma'_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_\alpha$	MSF	CRR	FOS	Conclusion
0.50	ML-NP	9	1.72	0.72	58	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	16.02	5.00	1.20	24.23	0.28	33.56	0.83	1.00	1.00	1.19	0.33	0.89	Liquefiable
1.50	SM	11	2.00	1.00	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	19.59	4.39	1.12	26.37	0.32	41.57	0.79	1.00	1.00	1.19	0.38	1.04	Non Liquefiable
3.00	SM	14	2.00	1.00	26	IV	0.24	7.00	0.98	5.58	2.58	0.33	1.70	1.33	1.000	1.05	0.85	1.00	28.25	4.39	1.12	36.10	NA	61.07	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	16	2.00	1.00	26	IV	0.24	7.00	0.97	8.58	4.08	0.32	1.57	1.33	1.000	1.05	0.95	1.00	33.23	4.39	1.12	41.69	NA	68.23	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	18	2.01	1.01	28	IV	0.24	7.00	0.95	11.58	5.58	0.31	1.34	1.33	1.000	1.05	0.95	1.00	31.97	4.56	1.14	40.95	NA	66.97	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	21	2.01	1.01	28	IV	0.24	7.00	0.94	14.60	7.10	0.30	1.19	1.33	1.000	1.05	0.95	1.00	33.08	4.56	1.14	42.21	NA	68.08	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	23	2.02	1.02	32	IV	0.24	7.00	0.93	17.61	8.61	0.30	1.08	1.33	1.000	1.05	1	1.00	34.62	4.83	1.17	45.36	NA	69.62	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	24	2.02	1.02	32	IV	0.24	7.00	0.91	19.63	9.63	0.29	1.02	1.33	1.000	1.05	1	1.00	34.15	4.83	1.17	44.82	NA	69.15	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure>10 T/m2)

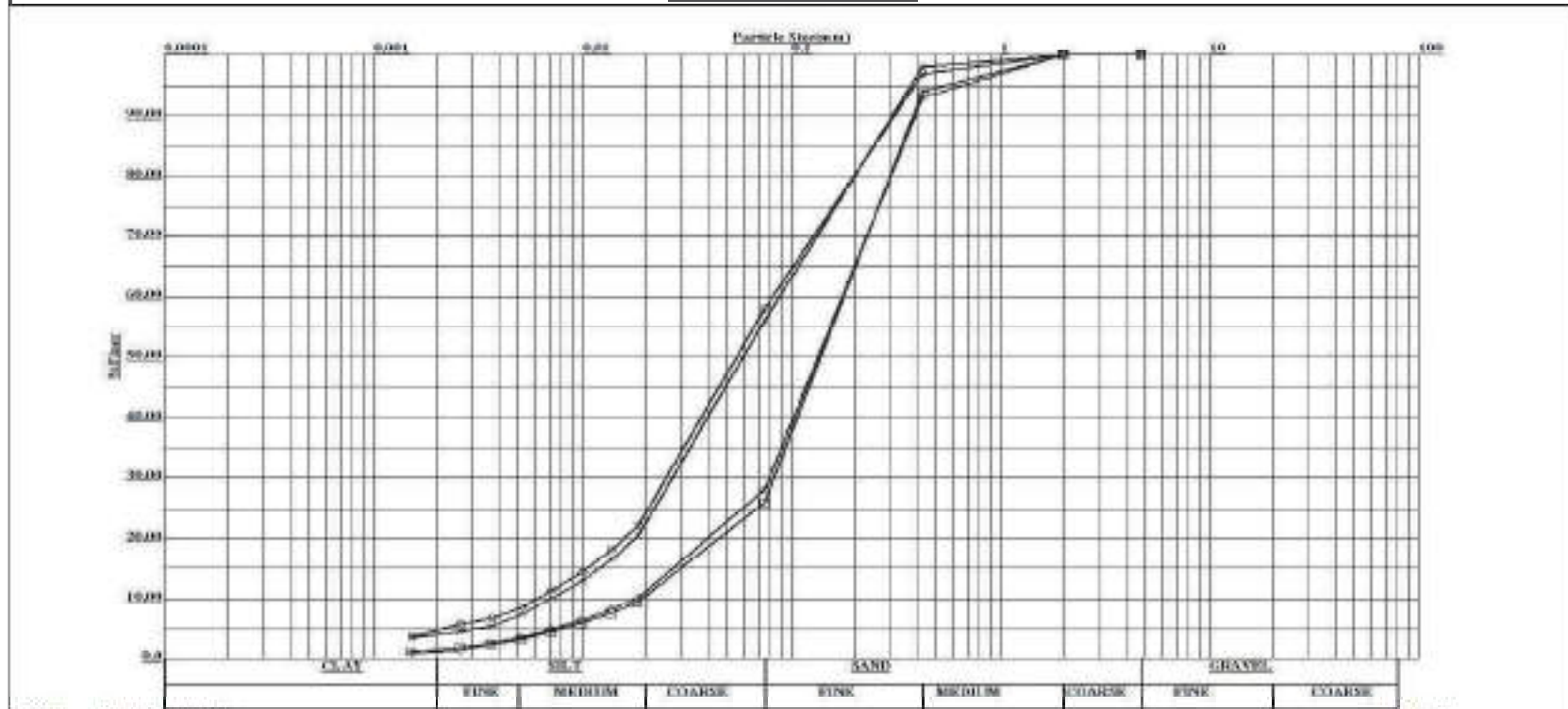
$K_\alpha$  Correction for static shear stress is required only for sloping ground

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. - 15  
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. -01

GRAIN SIZE ANALYSIS



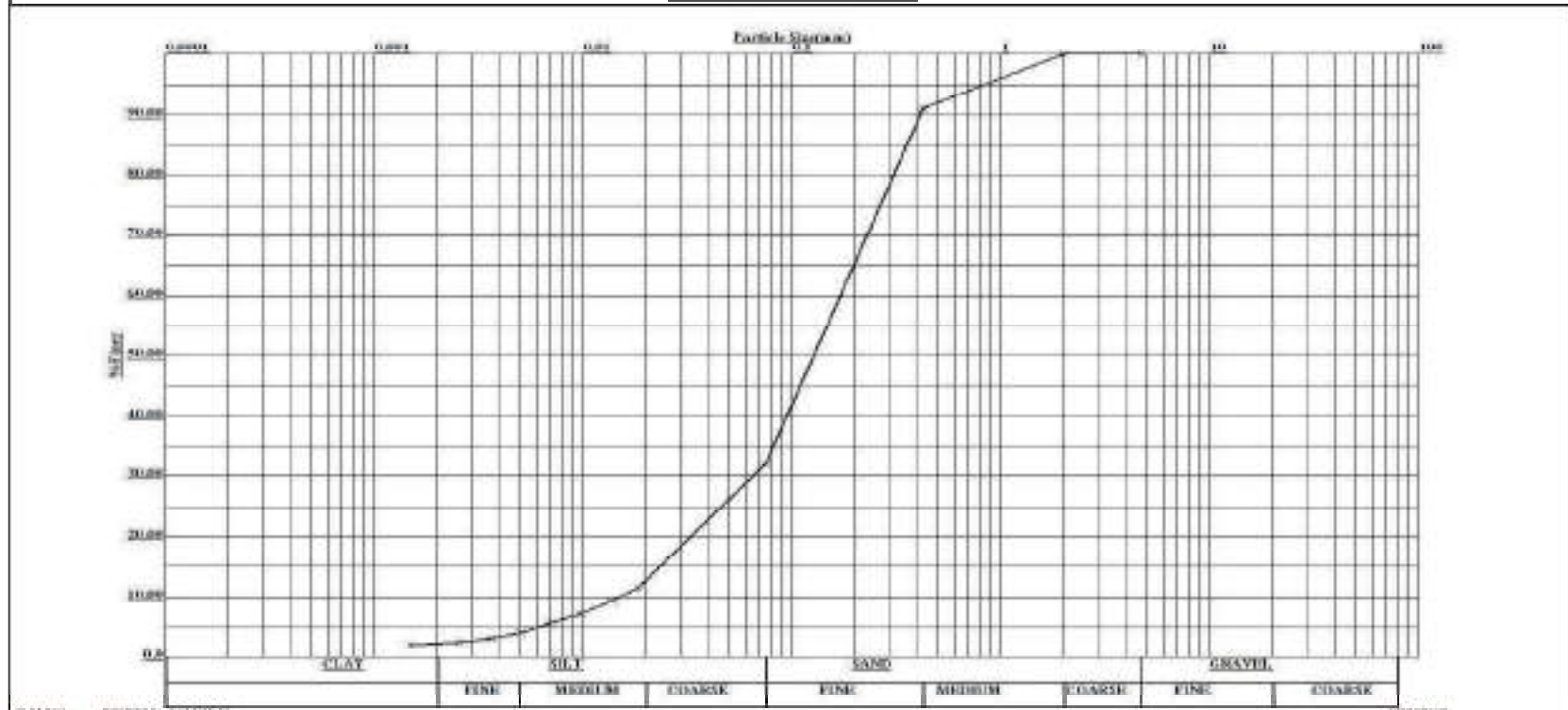
Symbol	Depth, m	Soil Description	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	$C_u$	$C_c$
×	0.0	MEDIUM DENSE, LITE BROWN, SANDY SILT (ML)	0.00	44.00	52.00	4.00	12.48	1.18
○	0.5		0.00	42.00	53.00	5.00	13.54	1.29
□	3.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	74.00	24.00	2.00	9.17	1.98
◇	6.0		0.00	72.00	27.00	1.00	9.66	1.95

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. - 15  
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	68.00	30.00	2.00	11.41	1.67

**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 &amp; 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. 15

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 <sub>sf</sub> c = F x (1 + sqrt(c))
1	BH-1	0.50	0.95	SANDY SILT	ML	0.0	0.0	0.0	3.0	28.0	11.0	58.0	0.00	0.00	0.00	2.14	8.47	1.40	2.175	0.142	0.663	-	-	-	-
2		3.00	3.45	SILTY SAND	SM	0.0	0.0	0.0	6.0	47.0	21.0	26.0	0.00	0.00	0.00	4.28	14.22	2.68	0.975	0.221	0.828	-	-	-	-
3		6.00	6.45	SILTY SAND	SM	0.0	0.0	0.0	7.0	45.0	20.0	28.0	0.00	0.00	0.00	4.99	13.61	2.55	1.050	0.222	0.829	-	-	-	-





## 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)
12202.116	18	ROAD	RUB	BH-01	201045	2998243	111.88

SUBMITTED BY:

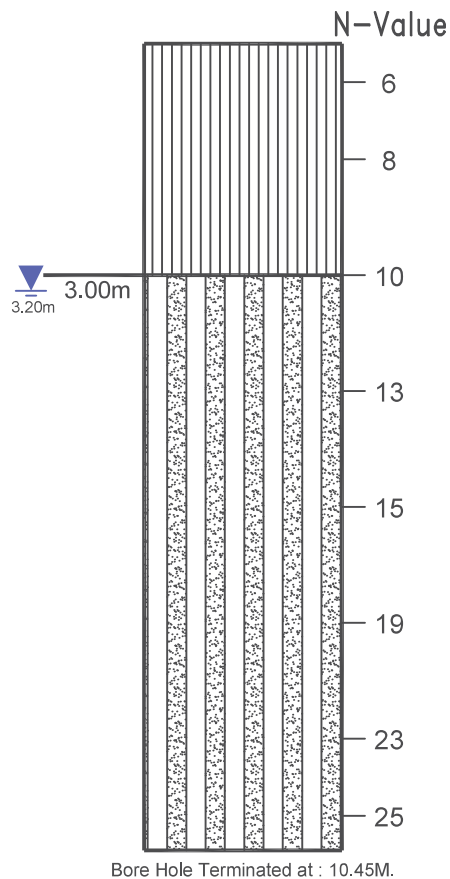


# BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-18

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

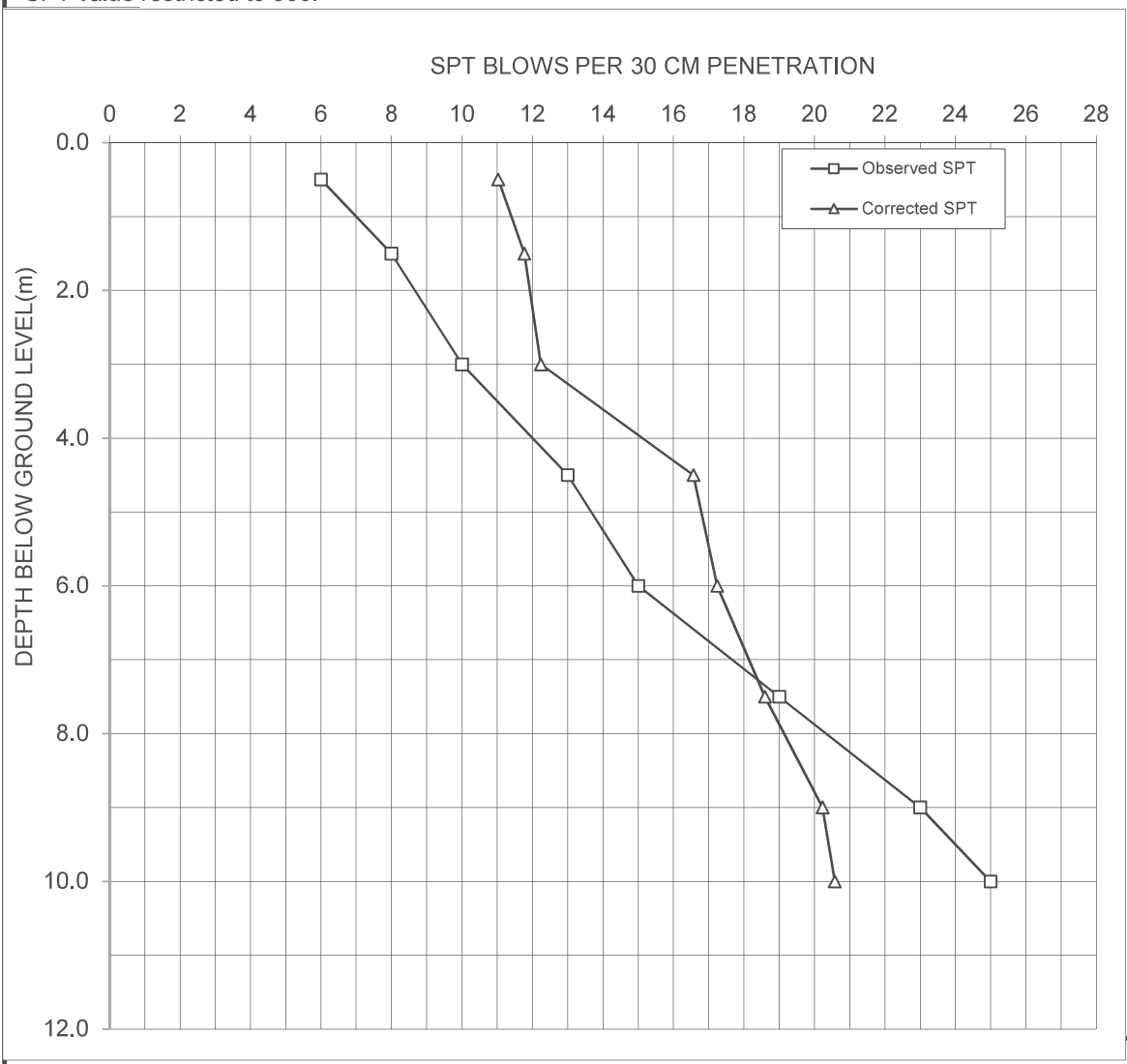
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :- 3.20m**

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	13	18	17
6.00	Non Plastic	15	19	17
7.50	Non Plastic	19	22	19
9.00	Non Plastic	23	25	20
10.00	Non Plastic	25	26	21

\* 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: 18

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, $D_r\%$	$f$	$K_\sigma$	$K_u$	MSF	CRR	FOS	Conclusion
0.50	ML	6	1.59	0.59	55	IV	0.24	7.00	1.00	0.80	0.30	0.42	1.70	1.33	1.000	1.05	0.75	1.00	10.68	5.00	1.20	17.82	0.19	NA	NA	1.00	1.00	1.19	0.23	>1.0	Non Liquefiable
1.50	ML	8	1.59	0.59	55	IV	0.24	7.00	0.99	2.39	0.89	0.42	1.70	1.33	1.000	1.05	0.75	1.00	14.24	5.00	1.20	22.09	0.24	NA	NA	1.00	1.00	1.19	0.29	>1.0	Non Liquefiable
3.00	SM	10	1.74	0.74	30	IV	0.24	7.00	0.98	4.77	1.77	0.41	1.70	1.33	1.000	1.05	0.85	1.00	20.18	4.71	1.15	28.00	0.37	42.90	0.79	1.00	1.00	1.19	0.44	1.07	Non Liquefiable
4.50	SM	13	1.74	0.74	30	IV	0.24	7.00	0.97	7.38	2.88	0.39	1.70	1.33	1.000	1.05	0.95	1.00	29.32	4.71	1.15	38.55	NA	63.47	0.68	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	15	2.03	1.03	30	IV	0.24	7.00	0.95	9.99	3.99	0.37	1.58	1.33	1.000	1.05	0.95	1.00	31.50	4.71	1.15	41.07	NA	66.50	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	19	2.03	1.03	30	IV	0.24	7.00	0.94	13.04	5.54	0.35	1.34	1.33	1.000	1.05	0.95	1.00	33.88	4.71	1.15	43.82	NA	68.88	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	23	2.04	1.04	30	IV	0.24	7.00	0.93	16.08	7.08	0.33	1.19	1.33	1.000	1.05	1	1.00	38.17	4.71	1.15	48.77	NA	73.17	0.63	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	25	2.04	1.04	30	IV	0.24	7.00	0.91	18.12	8.12	0.32	1.11	1.33	1.000	1.05	1	1.00	38.74	4.71	1.15	49.43	NA	73.74	0.63	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

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

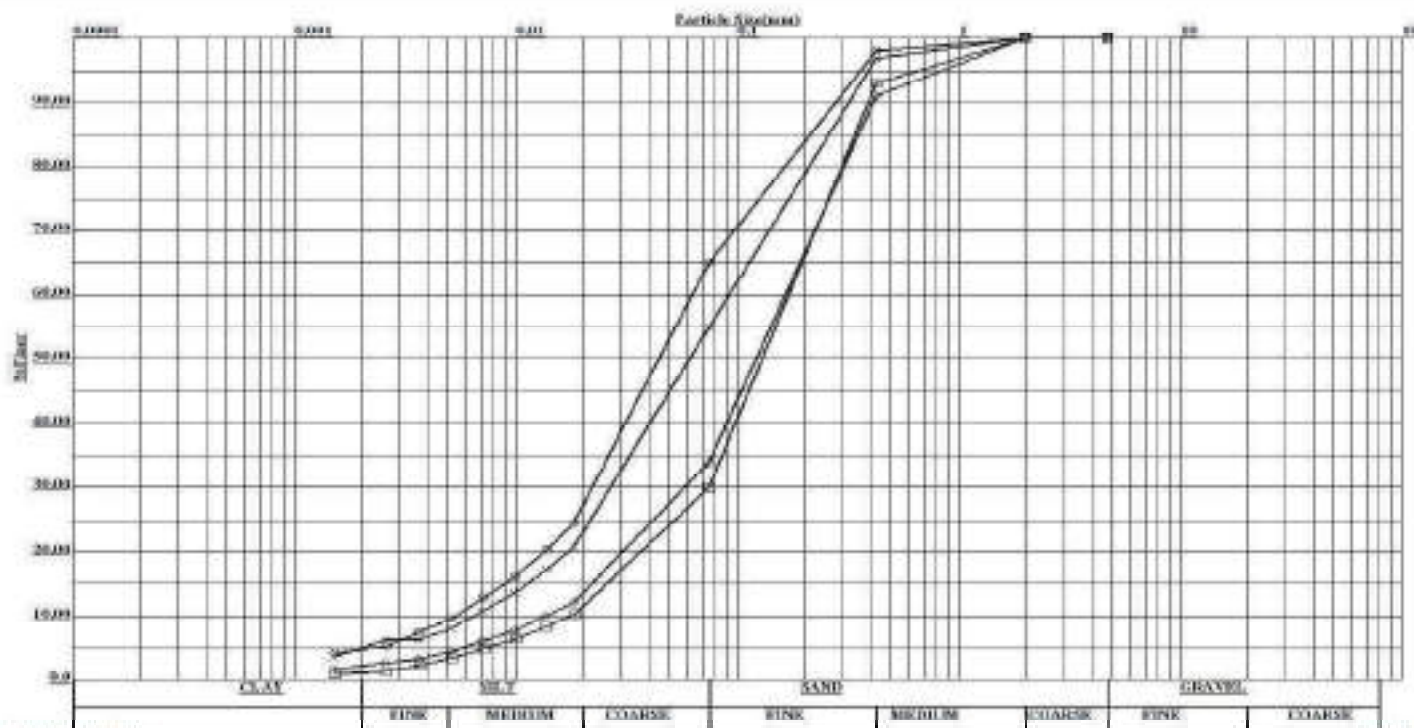
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 18

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	MEDIUM DENSE, LITE BROWN, SANDY SILT (ML)	0.00	45.00	50.00	5.00	14.30	1.22
○	2.5		0.00	35.00	60.00	5.00	11.81	1.47
□	6.0	MEDIUM DENSE, LITE GREY, SILTY SAND (SM)	0.00	70.00	29.00	1.00	9.65	1.85
◇	9.0		0.00	66.00	32.00	2.00	11.99	1.47



**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-18

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 <sub>sf</sub> c = F x (1 + sqrt(c))	
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	SANDY SILT	ML	0.0	0.0	0.0	2.0	21.0	12.0	65.0	0.00	0.00	0.00	1.43	6.35	1.53	2.438	0.117	0.603	-	-	-	-	
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	-	-	-	-	



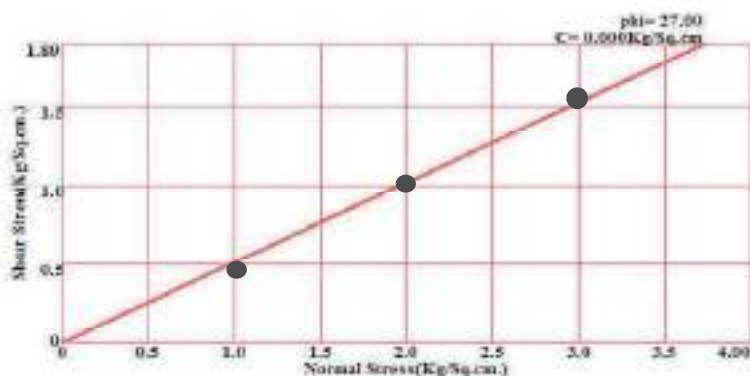
**aarvee associates**  
architects engineers & consultants pvt. ltd.

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)

**BOREHOLE NO. - 18**

**SECTION:CHITAUNI TO MADHUBANI**

**TRIAxIAL & DIRECT SHEAR GRAPH**



Bore Hole No. = 1(BR-18)  
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)
13474.604	21	ROAD	RUB	BH-01	201849	2997399	111.86

SUBMITTED BY:

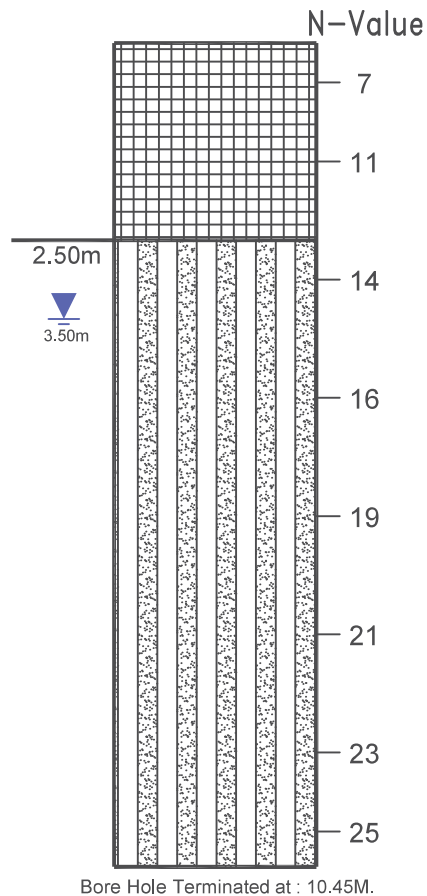


# BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR-21

BOREHOLE NO.: BH- 01



## LEGENDS



Silty Clay (CL)



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

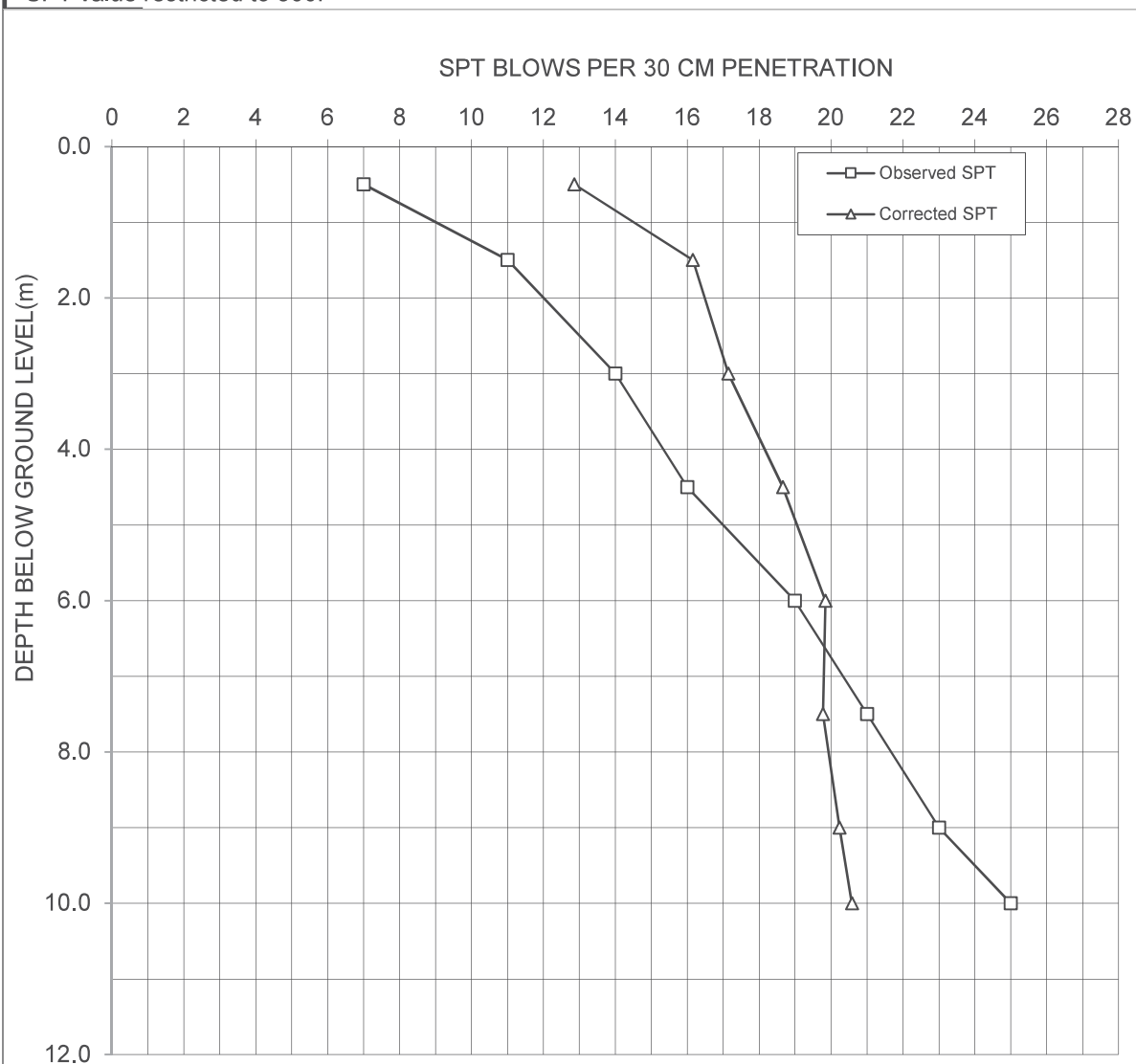
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :-3.50 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	11	16	16
3.00	Non Plastic	14	17	17
4.50	Non Plastic	16	22	19
6.00	Non Plastic	19	25	20
7.50	Non Plastic	21	25	20
9.00	Non Plastic	23	25	20
10.00	Non Plastic	25	26	21

\* 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: 21

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_u$	MSF	CRR	FOS	Conclusion
0.50	CL	7	1.60	0.60	94	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	12.46	5.00	1.20	19.96	0.21	NA	NA	1.00	1.00	1.19	0.26	>1.0	Non Liquefiable
1.50	CL	11	1.60	0.60	94	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	19.59	5.00	1.20	28.50	0.39	NA	NA	1.00	1.00	1.19	0.46	>1.0	Non Liquefiable
3.00	SM	14	1.73	0.73	28	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	28.25	4.56	1.14	36.72	NA	61.07	0.69	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SM	16	1.73	0.73	28	IV	0.24	7.00	0.97	7.40	2.90	0.38	1.70	1.33	1.000	1.05	0.95	1.00	36.09	4.56	1.14	45.63	NA	71.09	0.64	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SM	19	2.03	1.03	30	IV	0.24	7.00	0.95	9.99	3.99	0.37	1.58	1.33	1.000	1.05	0.95	1.00	39.91	4.71	1.15	50.77	NA	74.91	0.63	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SM	21	2.03	1.03	30	IV	0.24	7.00	0.94	13.04	5.54	0.35	1.34	1.33	1.000	1.05	0.95	1.00	37.45	4.71	1.15	47.93	NA	72.45	0.64	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SM	23	2.04	1.04	32	IV	0.24	7.00	0.93	16.08	7.08	0.33	1.19	1.33	1.000	1.05	1	1.00	38.17	4.83	1.17	49.53	NA	73.17	0.63	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SM	25	2.04	1.04	32	IV	0.24	7.00	0.91	18.12	8.12	0.32	1.11	1.33	1.000	1.05	1	1.00	38.74	4.83	1.17	50.20	NA	73.74	0.63	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

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

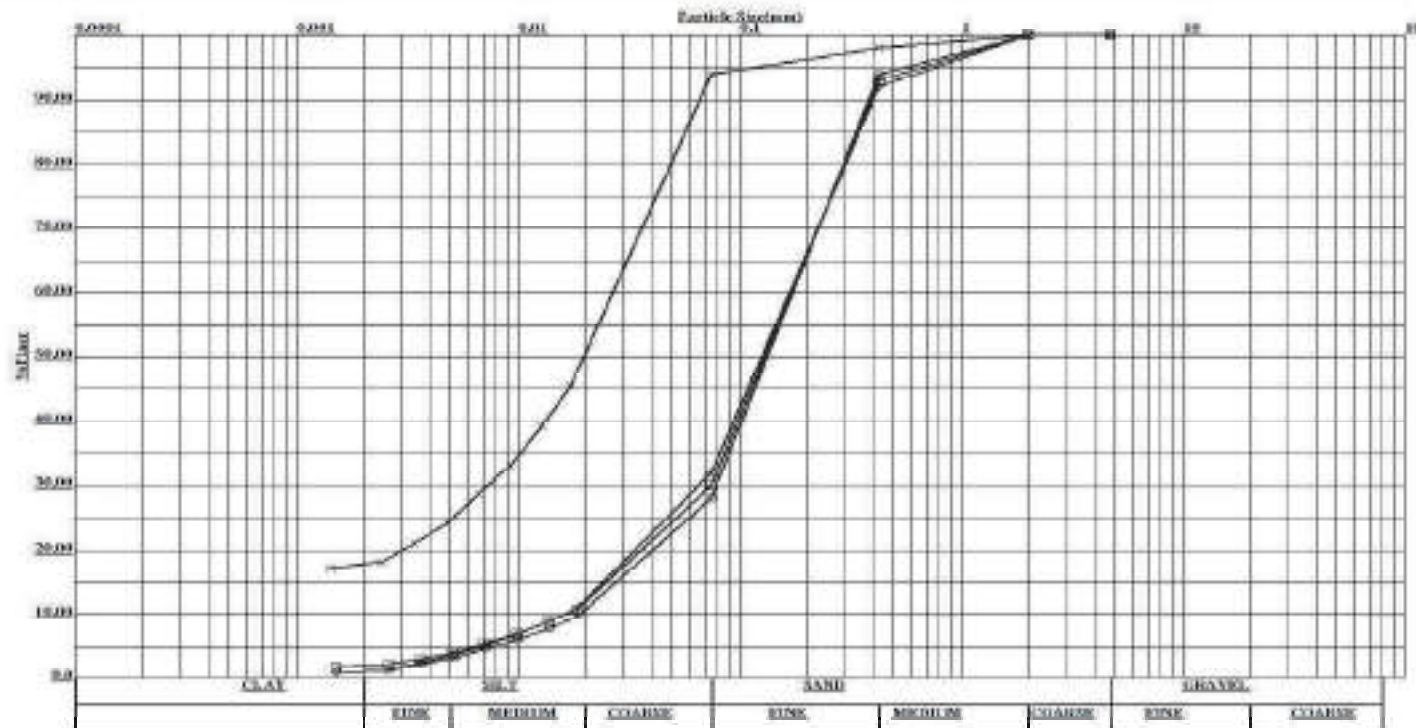
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 21

BOREHOLE NO. -BH 01

SECTION:CHITAUNI TO MADHUBANI

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	$C_u$	$C_c$
			(%)	(%)	(%)	(%)		
x	0.0	STIFF,LITE BROWN,LOW PLASTICITY CLAY(CL)	0.00	6.00	76.00	18.00	-	-
o	2.5	MEDIUM DENSE, LITE GREY,SILTY SAND (SM)	0.00	72.00	27.00	1.00	9.10	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	10.41	1.58



**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-21

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 <sub>sf</sub> c = F x (1 + sqrt(c))
1	BH-1	0.00	0.50	LOW PLASTICITY CLAY	CL	-	-	-	-	-	-	-	4.8	3.4	1.9	0.7125	0.3025	0.1275	0.0375	-	-	0.36	9	1.75	2.80
2		2.50	2.80	SILTY SAND	SM	0.0	0.0	0.0	6.0	45.0	21.0	28.0	0.00	0.00	0.00	4.28	13.61	2.68	1.050	0.216	0.818	-	-	-	-
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	-	-	-	-

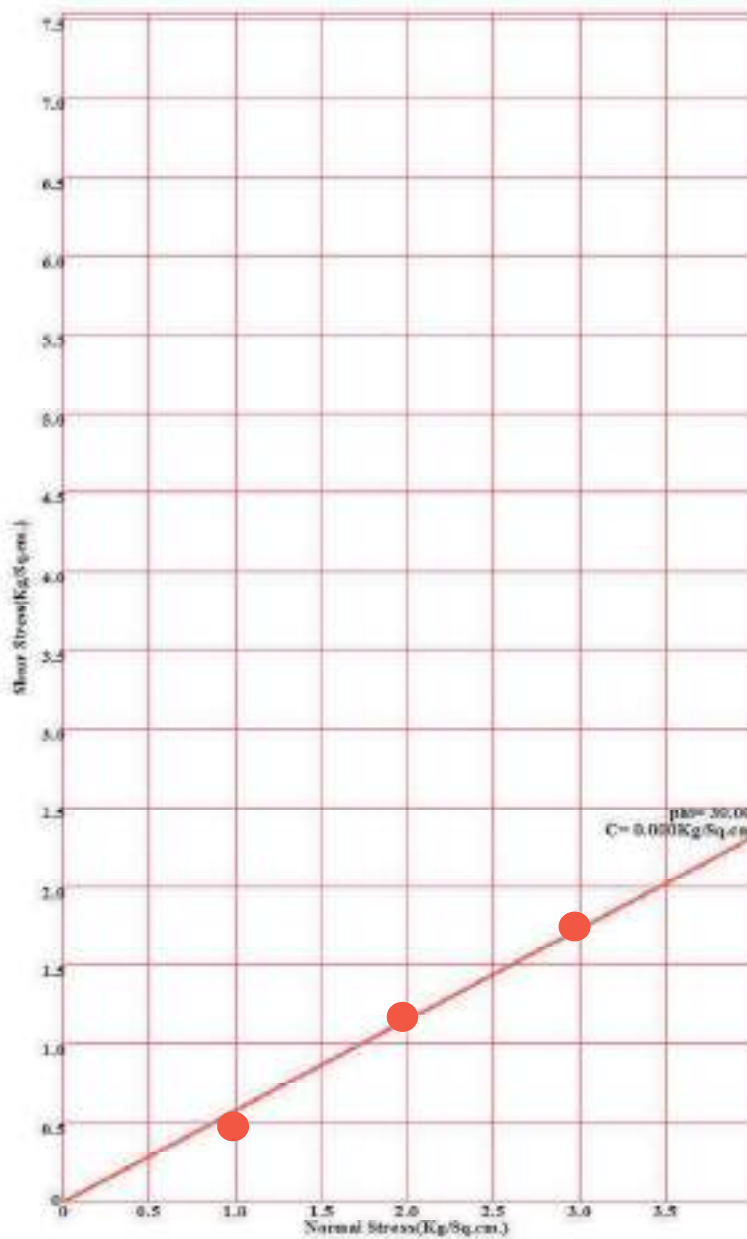
PROJECT: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

BRIDGE NO. - 21

BOREHOLE NO. - 1

SECTION:CHITAUNI TO MADHUBANI

DIRECT SHEAR GRAPH



Bore Hole No.- 1  
Sample No.- A-1/TB1  
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)
14281.371	23	ROAD	RUB	BH-01	202565	2997059	111.41

SUBMITTED BY:

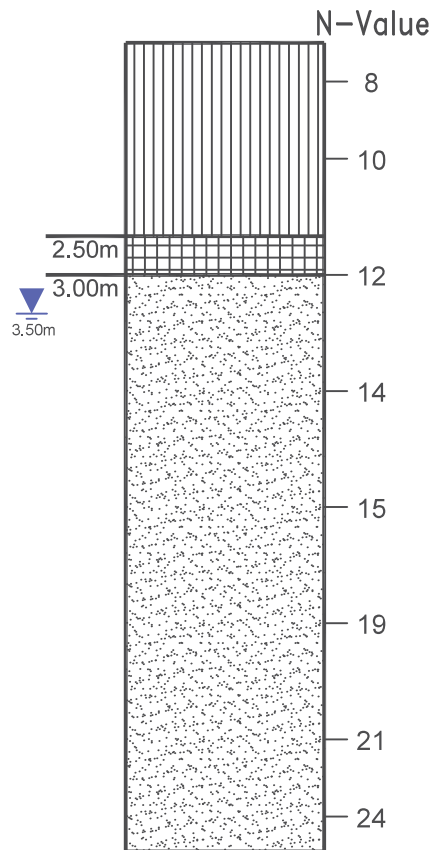


# BOREHOLE PROFILE

SECTION: CHITAUNI - MADHUBANI

IR BRIDGE NO.- BR- 23

BOREHOLE NO.: BH- 01



Bore Hole Terminated at : 10.45M.

## LEGENDS



Sandy Silt (ML)



Silty Clay (CL)








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.23 BOREHOLE NO. BH- 01										GWT: 3.50 m		DATE STARTED : 25/01/2025																								
												DATE COMPLETED : 25/01/2025				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 (kg/cm <sup>2</sup> )	Angle of friction (Degrees)		Compression Index(Cc)	pH	Chloride, %	Sulphate, %	pH	Chloride, mg/l	Sulphate, mg/l	
-0.50	0.5	DS	1	 3.50 m	0,00	0,50	DS	-	-	-		MEDIUM DENSE, LITE BROWN, SANDY SILT (ML)	-	0	45	50	5	NON-PLASTIC			-	-	-	-	-	-	-	-	-	-	7,10	0,03	NIL	-	-	-
	1.0	SPT	1		0,50	0,95	8	30	8	15			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	2.0	SPT	2		1,50	1,95	10	30	10	15			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-3.00	3.0	UD	1		2.50	2.80	-					STIFF, LITE BROWN, LOW PLASTICITY CLAY (CL)	-	0	5	78	17	33	21	12	1.74	-	-	-	2.65	-	0.38	10°	-	-	-	-	-	-	-	
	4.0	SPT	3		3,00	3,45	12	30	12	15			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	5.0	SPT	4		4,50	4,95	14	30	14	17			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-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	15	30	15	17			-	0	96	4	0	NON-PLASTIC			-	-	-	2.55	-	-	-	-	-	-	-	-	-	-		
	8.0	SPT	6		7,50	7,95	19	30	19	19			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-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	97	3	0	NON-PLASTIC			-	-	-	2.60	-	-	-	-	-	-	-	-	-	-	-	
	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

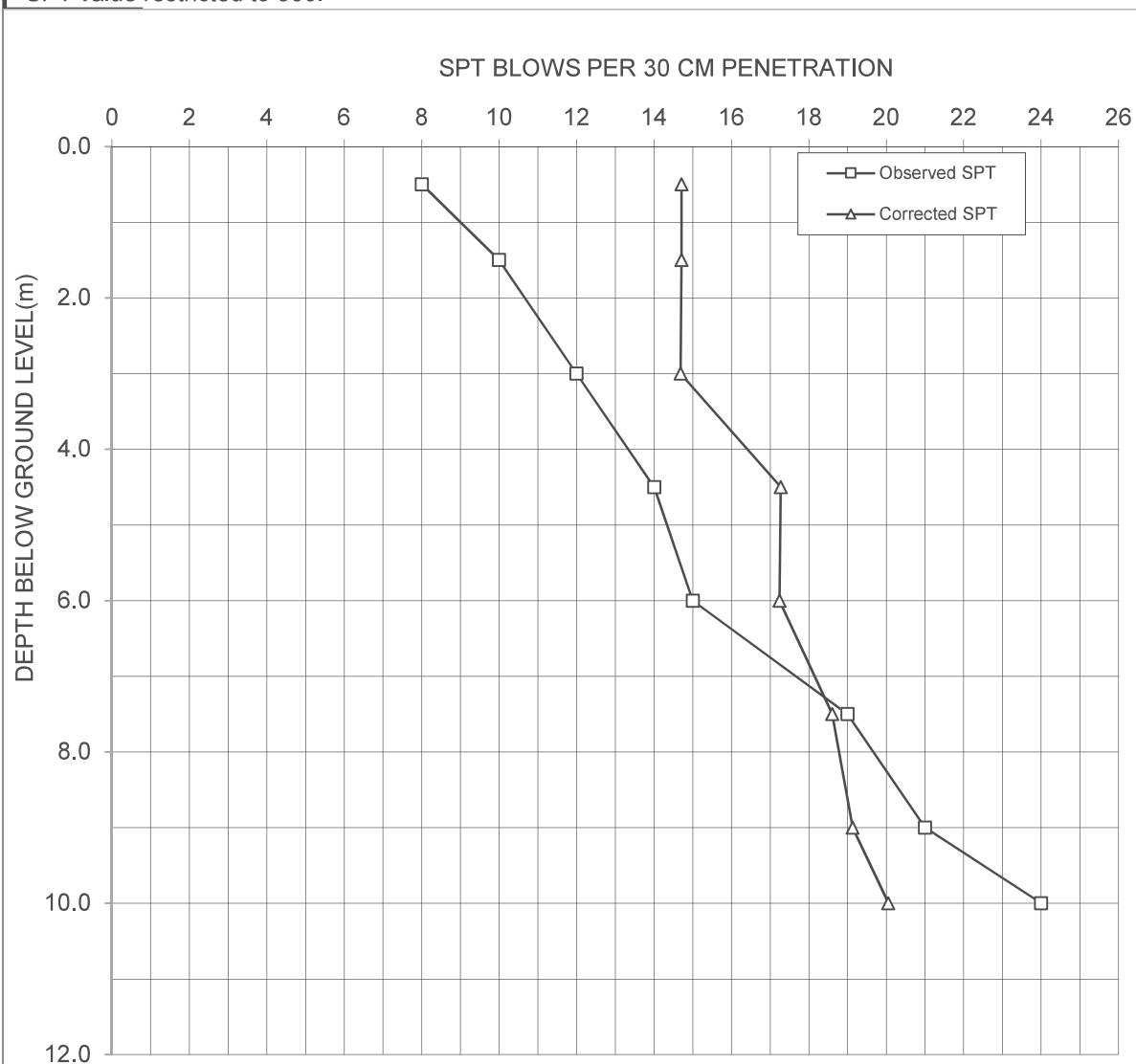
Project: Final location survey for New B.G Railway line projects (770.00 km.) and Final location survey for construction of Doubling/Third line/ 3rd & 4th line (252.00 km.) of North Eastern Railway (Total 1022.00 km)

**BOREHOLE NO. BH- 01**

**WATER TABLE :-3.50 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	8	15	15
1.50	Non Plastic	10	15	15
3.00	Non Plastic	12	15	15
4.50	Non Plastic	14	20	17
6.00	Non Plastic	15	19	17
7.50	Non Plastic	19	22	19
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: 23

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 ( $\sigma_o$ ), $t/m^2$	Effective overburden ( $\sigma_o$ ), $t/m^2$	Cyclic Stress ratio (CSR)	$C_N$	CE or CHT	CH or CHW	CB or CBD	CR or CRL	CS or CSS	SPT corrected ( $N_1$ ) <sub>60</sub>	$\alpha$	$\beta$	( $N_1$ ) <sub>60cs</sub>	$CRR_M = 7.5$	Relative Density, Dr%	f	$K_\sigma$	$K_u$	MSF	CRR	FOS	Conclusion
0.50	ML	8	1.59	0.59	55	IV	0.24	7.00	1.00	0.80	0.30	0.42	1.70	1.33	1.000	1.05	0.75	1.00	14.24	5.00	1.20	22.09	0.24	NA	NA	1.00	1.00	1.19	0.29	>1.0	Non Liquefiable
1.50	ML	10	1.59	0.59	55	IV	0.24	7.00	0.99	2.39	0.89	0.42	1.70	1.33	1.000	1.05	0.75	1.00	17.81	5.00	1.20	26.37	0.32	NA	NA	1.00	1.00	1.19	0.38	>1.0	Non Liquefiable
3.00	SP	12	1.74	0.74	95	IV	0.24	7.00	0.98	4.77	1.77	0.41	1.70	1.33	1.000	1.05	0.85	1.00	24.22	5.00	1.20	34.06	NA	51.98	0.74	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
4.50	SP	14	1.74	0.74	95	IV	0.24	7.00	0.97	7.38	2.88	0.39	1.70	1.33	1.000	1.05	0.95	1.00	31.57	5.00	1.20	42.89	NA	66.57	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
6.00	SP	15	2.03	1.03	4	IV	0.24	7.00	0.95	9.99	3.99	0.37	1.58	1.33	1.000	1.05	0.95	1.00	31.50	0.00	1.00	31.50	NA	66.50	0.67	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
7.50	SP	19	2.03	1.03	4	IV	0.24	7.00	0.94	13.04	5.54	0.35	1.34	1.33	1.000	1.05	0.95	1.00	33.88	0.00	1.00	33.88	NA	68.88	0.66	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
9.00	SP	21	2.04	1.04	3	IV	0.24	7.00	0.93	16.08	7.08	0.33	1.19	1.33	1.000	1.05	1	1.00	34.85	0.00	1.00	34.85	NA	69.85	0.65	1.00	1.00	1.19	NA	>1.0	Non Liquefiable
10.00	SP	24	2.04	1.04	3	IV	0.24	7.00	0.91	18.12	8.12	0.32	1.11	1.33	1.000	1.05	1	1.00	37.19	0.00	1.00	37.19	NA	72.19	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

$K_\sigma$  Correction for high overburden stress (for effective oberburden pressure > 10 T/m<sup>2</sup>)

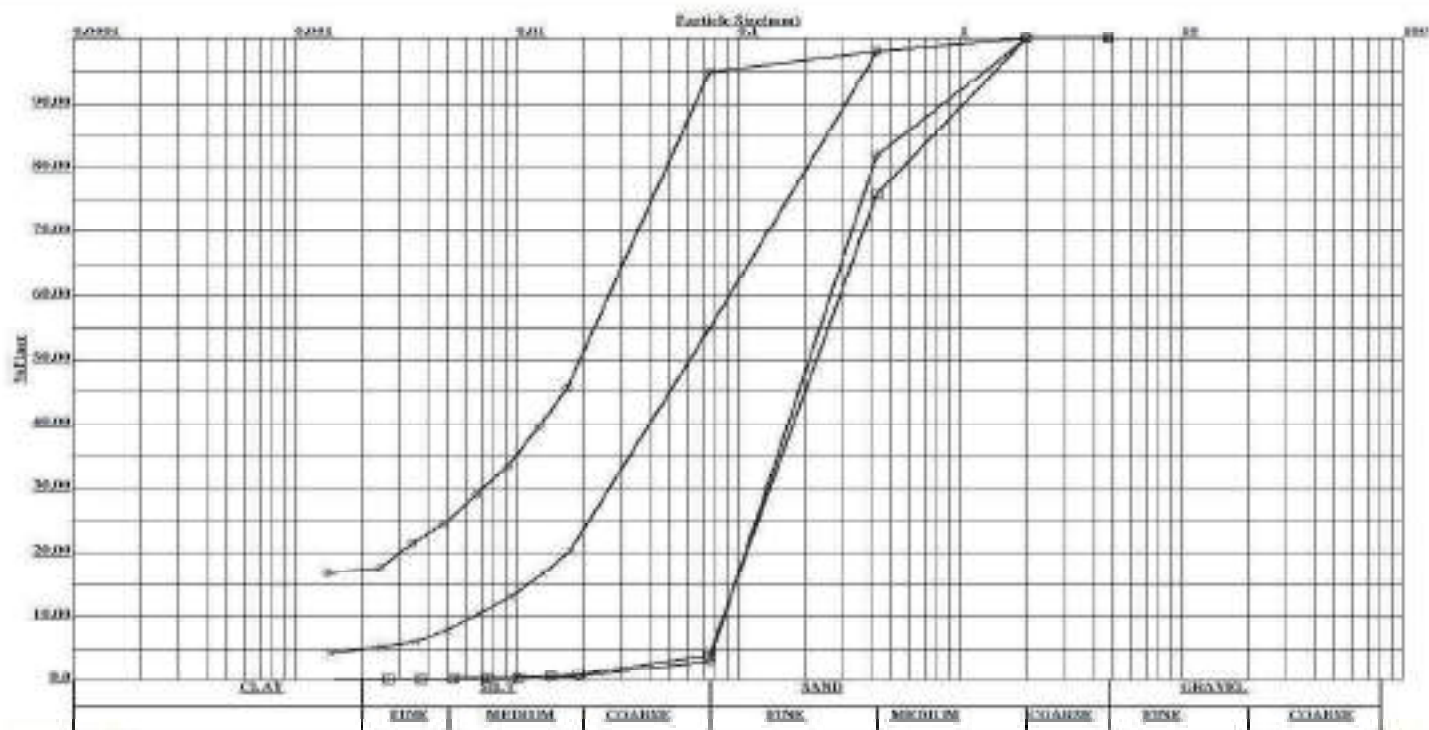
$K_u$  Correction for static shear stress is required only for sloping ground

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. - 23-RUB  
SECTION:CHITAUNI TO MADHUBANI

BOREHOLE NO. - 01

GRAIN SIZE ANALYSIS



Symbol	Depth, m	Soil Description	Gravel	Sand	Silt	Clay	$C_u$	$C_c$
			(%)	(%)	(%)	(%)		
x	0.0	MEDIUM DENSE,LITE BROWN, SANDY SILT,(ML)	0.00	45.00	50.00	5.00	14.25	1.20
O	2.5	STIFF, LITE BROWN,LOW PLASTICITY CLAY(CL)	0.00	5.00	78.00	17.00	-	-
□	6.0	MEDIUM DENSE, LITE GREY,POORLY GRADED SAND (SP)	0.00	96.00	4.00	0.00	3.34	0.79
◇	9.0		0.00	97.00	3.00	0.00	3.00	0.80



**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-23

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 <sub>sf</sub> c = F x (1 + sqrt(c))	
1	BH-1	0.00	0.50	SANDY SILT	ML	0.0	0.0	0.0	2.0	26.0	17.0	55.0	0.00	0.00	0.00	1.43	7.87	2.17	2.063	0.135	0.647	-	-	-	-	
2		2.50	2.80	LOW PLASTICITY CLAY	CL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	10	1.5	2.42		
3		6.00	6.45	POORLY GRADED SAND	SP	0.0	0.0	0.0	24.0	52.0	20.0	4.0	0.00	0.00	0.00	17.10	15.73	2.55	0.150	0.355	1.049	-	-	-	-	



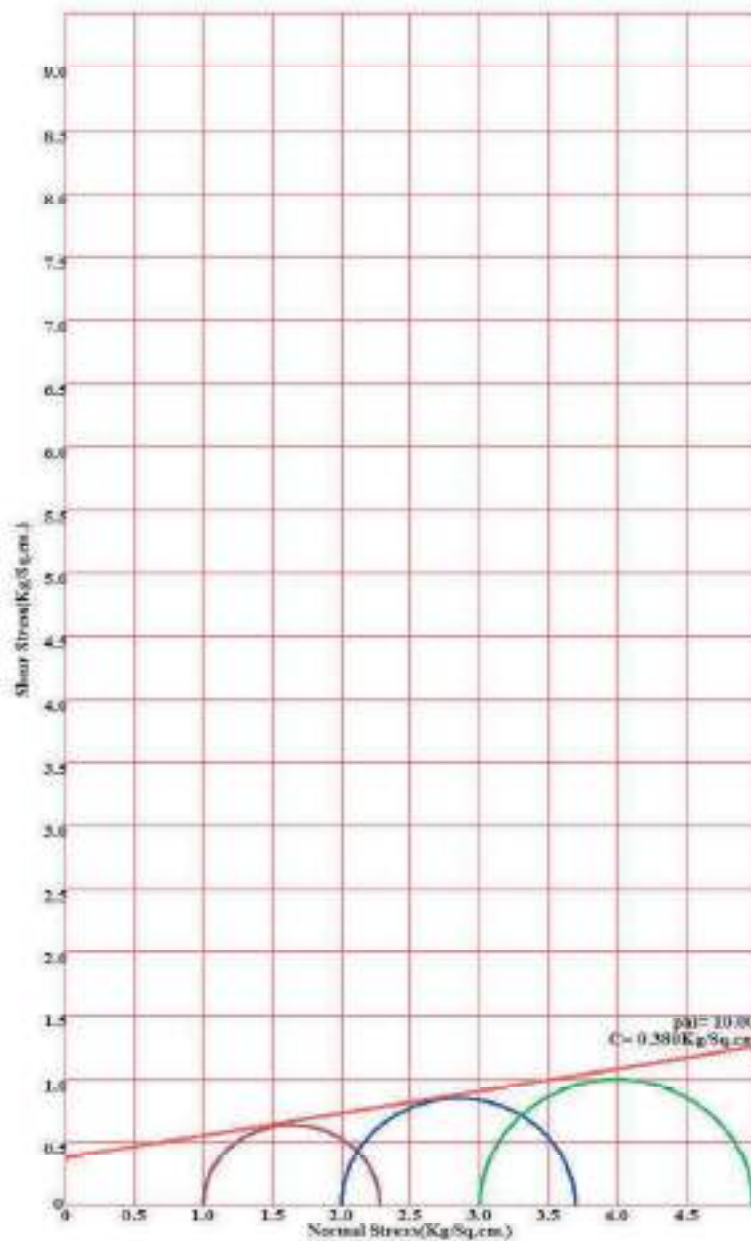
**aarvee associates**  
architects engineers & consultants pvt. ltd.

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)

**BOREHOLE NO. - 23-RUB**

**SECTION:CHITAUNI TO MADHUBANI**

**TRIAxIAL & DIRECT SHEAR GRAPH**



Bore Hole No. = 1  
Sample No. = A-1/UD1  
Depth = 2.5000031  
Type of Test = U.C.