73.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x1.2x1.2

73.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I*.

(c) Borelogs and sub soil profile shown in *ANNEXURE-II*.

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III*.

(e) Calculations of Probable Settlement in *ANNEXURE-IV*.

(f) Depth of water Table ≥25.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 1.50	Filled up Strata	Loose
	1.50 to 3.00	Silty Sand	Medium Dense
	3.00 to 7.50	Clayey Silt with Sand	Medium Dense
	7.50 to 12.00	Silty Sand	Medium Dense

73.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.40	NIL	0.0048	NIL	0.0014	0.098
	6.00	8.10	0.005	0.0025	NIL	0.0012	0.074

73.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	23.00
	6.00	20.00

73.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	09.00
	3.00	13.00
	4.50	20.00
	6.00	21.00

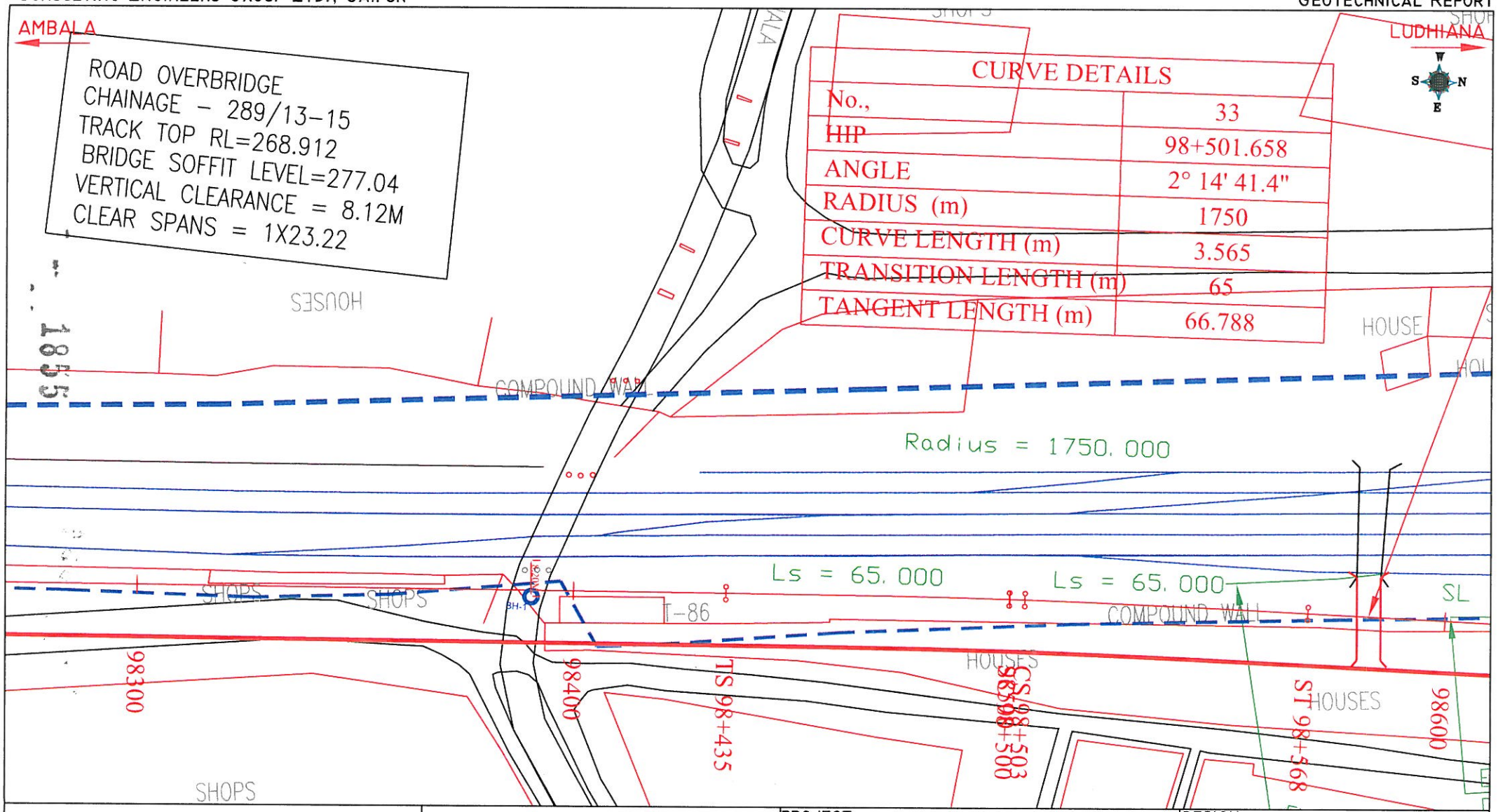
73.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

73.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 4.50 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I

LOCATION PLAN OF PROPOSED MINOR BRIDGE CH-289/8-10

RL OF BH-I =

PROJECT :-

LUDHIANA-AMBALA (DFCCIL)

DESIGN :-

CONSULTING ENGINEERS GROUP LTD.
E-12,Moji Colony,Malviya Nagar Jaipur-17
Tel: +91-141- 2520899, 2521899, 2520556
Fax: 2521348, E-Mail: ceg@cegindia.com

ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1 FOR MINOR BRIDGE No. 325B AT CHAINAGE 289/8-10

Project :	Chainage 289/8-10 Bridge No. 325B			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				18.06.2009 to 18.06.2009	1	1	below 20.00 m.	12.00mtr	

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Filled up strata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.50	10	1.45	14.50	Silty Sand	3.59	2.77	76.22	15.87	0.97	0.58	0.00	26	NP	NIL	-	-	-	-	-	-
3.00	UDS	-	-	Clayey silt with sand	20.12	69.06	7.32	0.46	0.74	2.30	0.00	37	20	17	1.77	10.66	1.60	2.62	0.20	15.0
4.50	13	1.08	14.04	Clayey silt with sand	14.89	64.36	19.72	0.89	0.14	0.00	0.00	26	14	12	-	-	-		-	-
6.00	UDS	-	-	Clayey silt with sand	18.10	55.47	16.04	2.90	3.90	3.59	0.00	31	16	15	1.84	13.11	1.63	2.6	0.20	17.0
7.50	14	0.90	12.60	Silty Sand	2.67	33.22	57.33	6.78	0.00	0.00	0.00	23	NP	NIL	-	-	-	-	-	-
10.50	18	0.79	14.22	Silty Sand	2.00	36.43	50.12	11.39	0.06	0.00	0.00	22	NP	NIL	-	-	-	-	-	-
12.00	23	0.74	17.02	Silty Sand	2.16	23.78	58.69	13.22	2.15	0.00	0.00	22	NP	NIL	-	-	-	-	-	-

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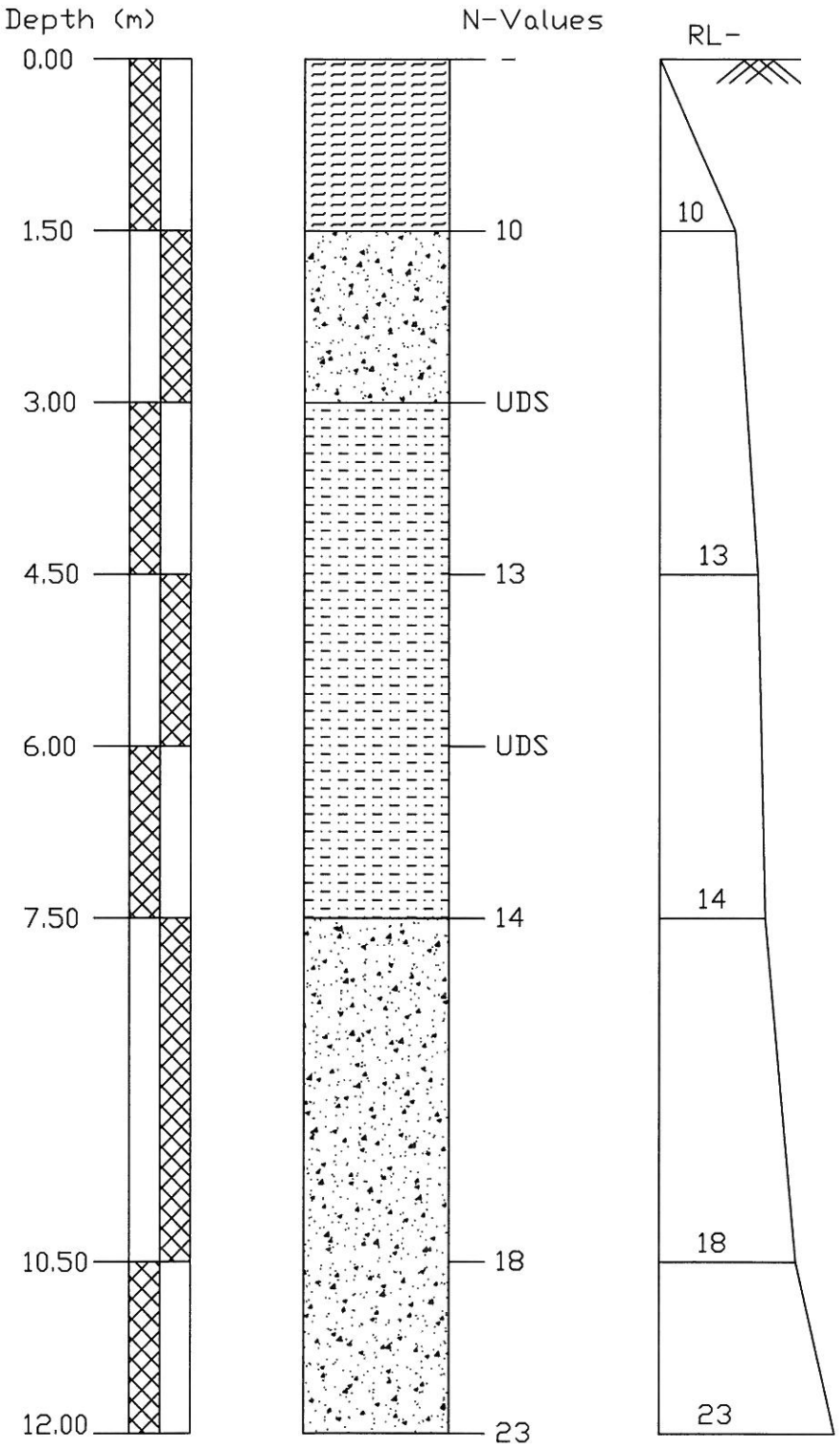
BORELOG OF BH–1(LHS) AT EXISTING KM–289/8–10 FOR MINOR BRIDGE NO.–325 B, ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	FILLED UP STRATA
	SILTY SAND
	CLAYEY SILT WITH SAND

1857

CONSULTING Engineers Group Ltd.

CHAPTER - 74

"Minor Bridge No. 323",

Location – Existing Km. - 285/14-16

74.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 2x3.05

74.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥25.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 4.50	Clayey Silt with Sand	Medium Dense
	4.50 to 12.00	Silty Sand	Medium Dense

74.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.00	NIL	0.0025	NIL	0.0011	0.062
	6.00	7.80	NIL	0.0014	NIL	0.0010	0.014

74.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	18.00
	6.00	NIL

74.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	12.00
	3.00	18.50
	4.50	20.00
	6.00	22.00

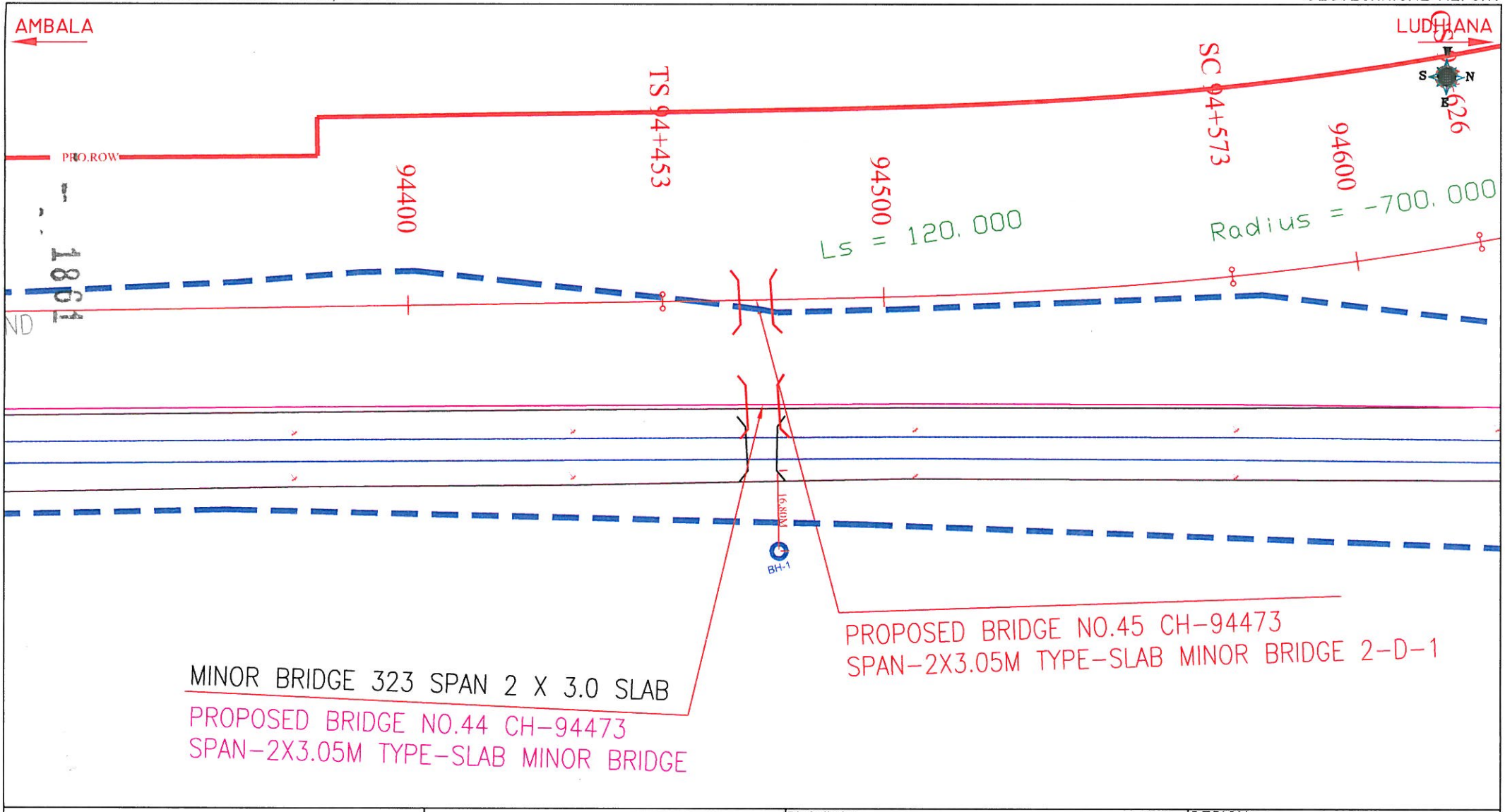
74.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

74.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER FIG.:-I LOCATION PLAN OF PROPOSED MINOR BRIDGE CH-285/14-16	RL OF BH-I = 266.567	PROJECT :- LUDHIANA-AMBALA (DFCCIL)	DESIGN :- CONSULTING ENGINEERS GROUP LTD. E-12,Moji Colony,Malviya Nagar Jaipur-17 Tel: +91-141- 2520899, 2521899, 2520556 Fax: 2521348, E-Mail: ceg@cegindia.com

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(A1) FOR MINOR BRIDGE No. 323 AT CHAINAGE 285/14-16

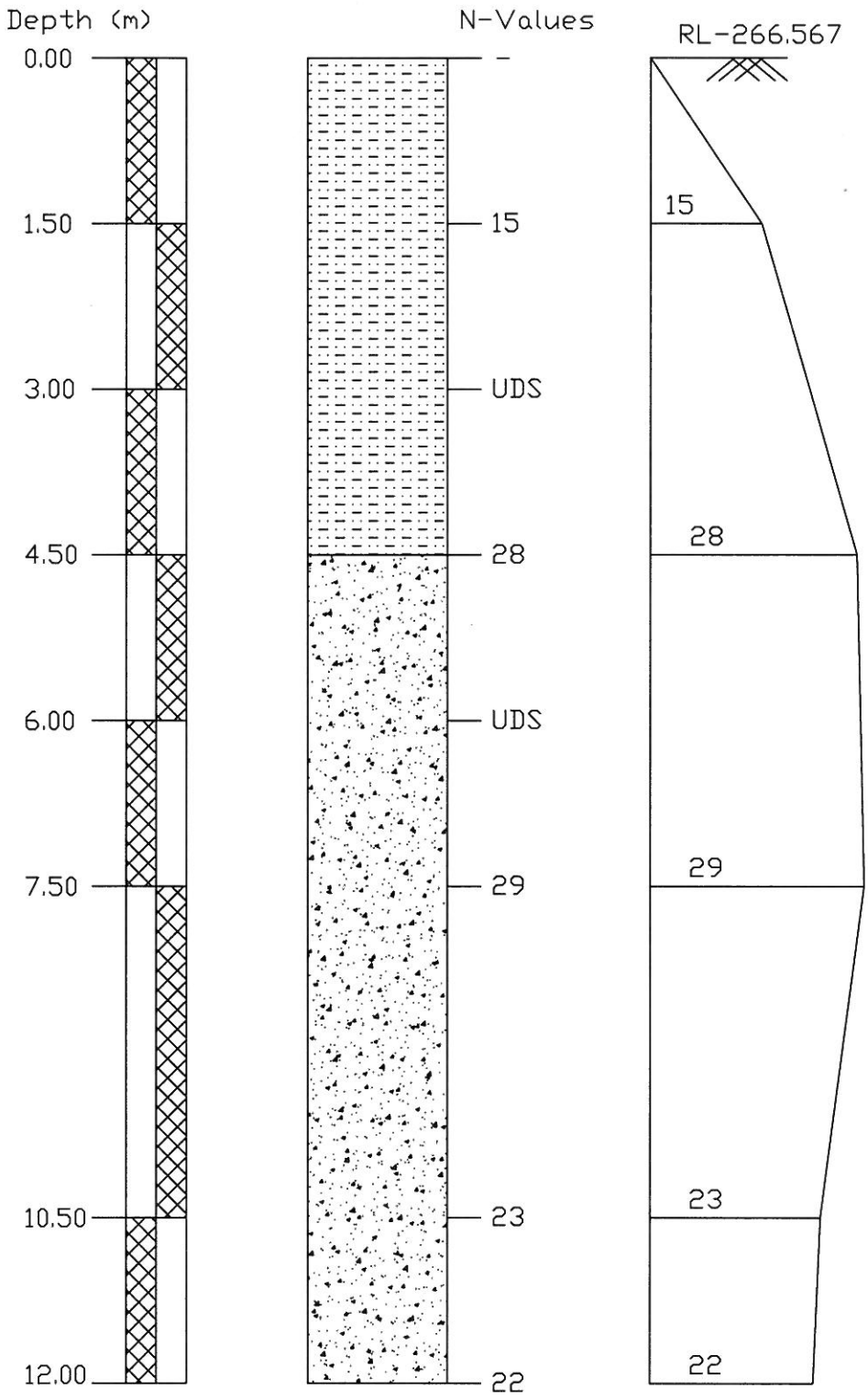
Project :	Chainage 285/14-16 Bridge No. 323			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation	Ref. Code
				19.06.2009 to 19.06.2009	1	1	below 20.00 m.	12.00mtr	266.567	

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey silt with sand	12.85	59.48	20.36	4.26	2.10	0.95	0.00	27	17	10	-	-	-	-	-	-
1.50	15	1.44	21.60	Clayey silt with sand	10.99	58.41	27.45	2.15	0.46	0.54	0.00	24	15	9	-	-	-	-	-	-
3.00	UDS	-	-	Clayey silt with sand	16.52	78.62	4.42	0.44	0.00	0.00	0.00	31	18	13	1.82	7.72	1.69	2.67	0.15	18.00
4.50	28	1.07	29.96	Silty Sand	2.32	47.40	45.32	2.21	2.10	0.65	0.00	24	NP	NIL	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	2.30	10.88	86.82	0.00	0.00	0.00	0.00	25	NP	NIL	1.94	12.83	1.72	2.62	0.00	28.50
7.50	29	0.89	25.81	Silty Sand	2.66	10.79	83.00	3.31	0.05	0.19	0.00	27	NP	NIL	-	-	-	-	-	-
10.50	23	0.77	17.71	Silty Sand	0.00	6.83	92.33	0.84	0.00	0.00	0.00	26	NP	NIL	-	-	-	-	-	-
12.00	22	0.73	16.06	Silty Sand	0.00	10.61	84.26	3.25	1.22	0.66	0.00	24	NP	NIL	-	-	-	-	-	-

CONSULTING Engineers Group Ltd.

BORELOG OF BH–1(LHS) AT EXISTING KM–285/14–16 FOR MINOR BRIDGE NO.–323,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SILTY SAND

1863

CONSULTING Engineers Group Ltd.

CHAPTER – 75

"Minor Bridge No. 322",

Location – Existing Km. - 282/28 - 283/02

75.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x3x2

75.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥20.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 12.00	Clayey Silt with Sand	Medium Dense

75.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.60	0.002	0.0014	NIL	0.0011	0.052
	6.00	8.80	0.007	0.0041	NIL	0.0012	0.076

75.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	20
	6.00	22

75.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	12.00
	3.00	15.00
	4.50	15.00
	6.00	16.00

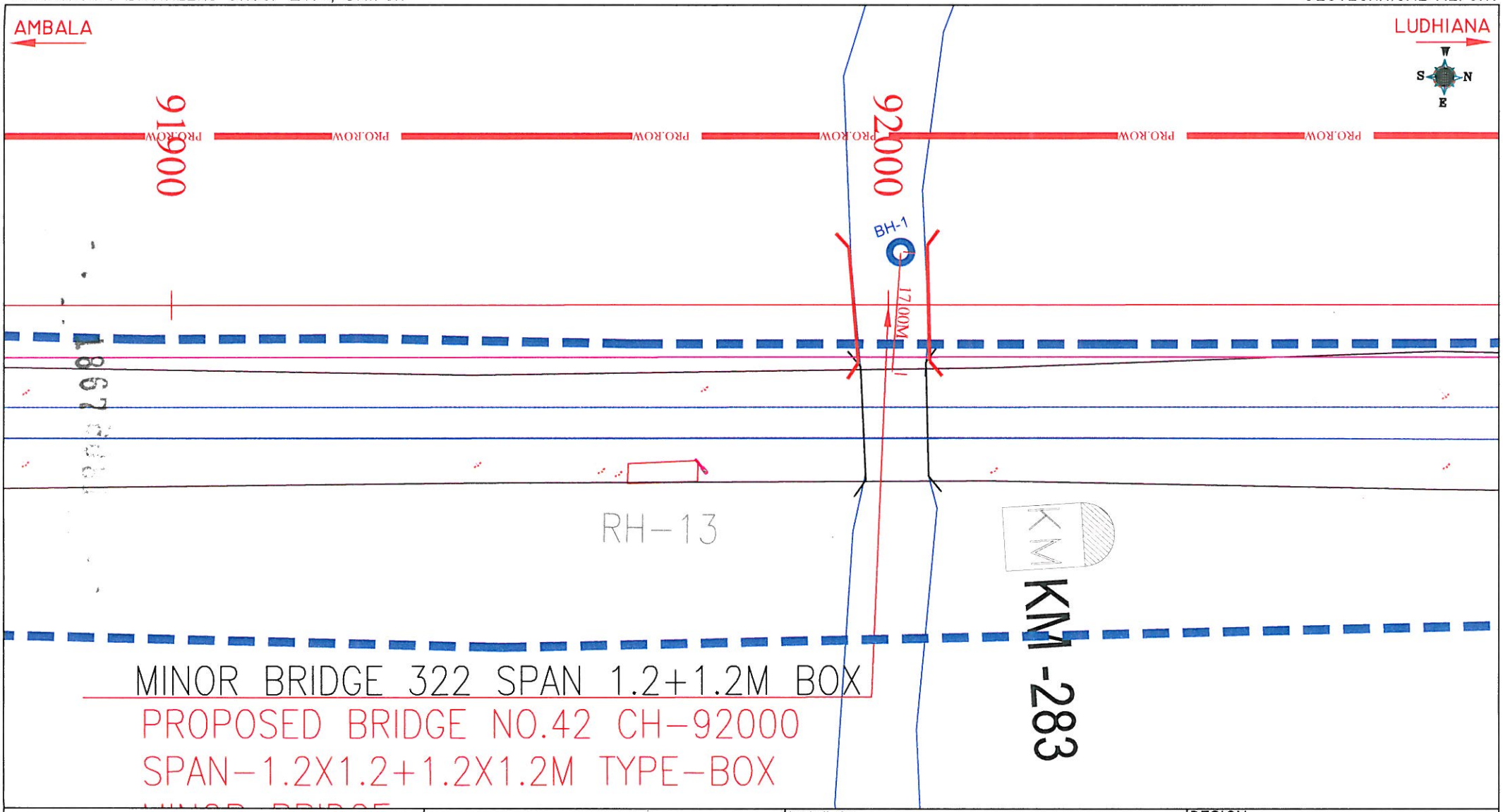
75.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

75.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER FIG.:-I LOCATION PLAN OF PROPOSED MINOR BRIDGE CH-282/27-29	RL OF BH-I = 267.300	PROJECT :- LUDHIANA-AMBALA (DFCCIL)	DESIGN :- CONSULTING ENGINEERS GROUP LTD. E-12,Moji Colony,Malviya Nagar Jaipur-17 Tel: +91-141- 2520899, 2521899, 2520556 Fax: 2521348, E-Mail: ceg@cegindia.com

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 322 AT CHAINAGE 282/27-29

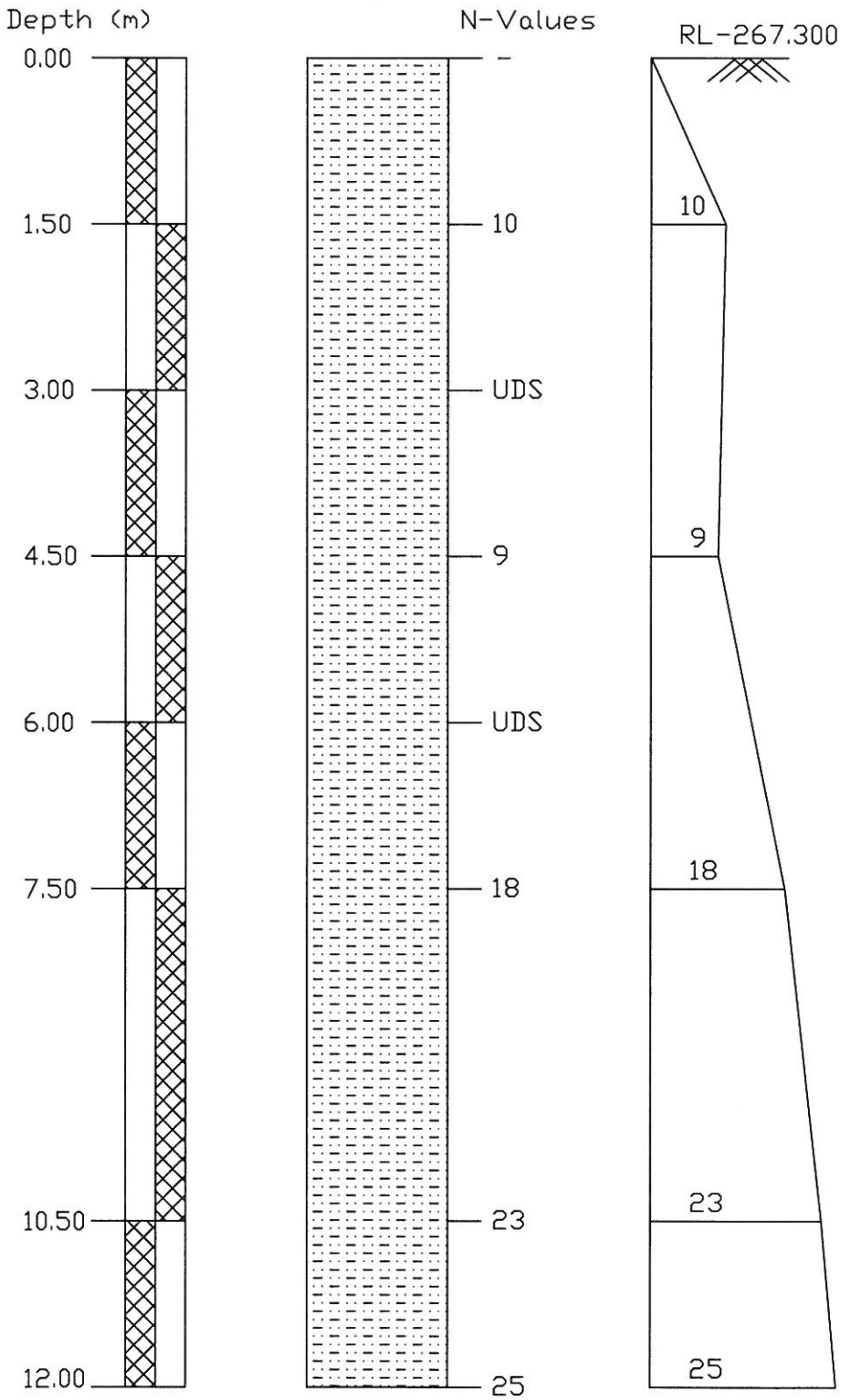
Project :	Chainage 286/27-29 Bridge No. 322			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				26.11.2009 to 27.11.2009	1	1 (LHS)	below 20.00 m.	12.00mtr	267.300

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey Silt with Sand	13.24	76.94	8.22	1.10	0.39	0.11	0.00	30	18	12	-	-	-	-	-	-
1.50	10	1.42	14.20	Clayey Silt with Sand	15.39	76.54	6.90	0.78	0.27	0.12	0.00	33	19	14	-	-	-	-	-	-
3.00	UDS	-	-	Clayey Silt with Sand	18.96	76.29	4.25	0.24	0.26	0.00	0.00	40	23	17	1.94	13.50	1.71	2.65	0.21	14.0
4.50	9	1.05	9.45	Clayey Silt with Sand	16.32	76.54	5.08	1.06	0.54	0.46	0.00	33	18	15	-	-	-	-	-	-
6.00	UDS	-	-	Clayey Silt with Sand	21.22	72.73	3.04	1.84	0.74	0.43	0.00	44	25	19	2.07	15.92	1.78	2.63	0.25	12.0
7.50	18	0.85	15.30	Clayey Silt with Sand	18.62	74.92	3.91	1.39	0.77	0.39	0.00	38	21	17	-	-	-	-	-	-
10.50	23	0.74	17.02	Clayey Silt with Sand	20.15	72.70	3.08	1.50	0.98	1.59	0.00	41	23	18	-	-	-	-	-	-
12.00	25	0.70	17.50	Clayey Silt with Sand	22.35	71.46	2.18	1.53	1.14	1.34	0.00	42	22	20	-	-	-	-	-	-

CONSULTING Engineers Group Ltd.

BORELOG OF BH–1 AT EXISTING KM–282/27–29 FOR MINOR BRIDGE NO.–322,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND

1869

CONSULTING Engineers Group Ltd.

CHAPTER – 76

"Minor Bridge No. 321",

Location – Existing Km. - 281/14-16

76.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x2x2

76.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥20.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 1.50	Filled up Strata	Loose
	1.50 to 3.00	Sitly Sand	Medium Dense
	3.00 to 4.50	Sandy Silt with Clay	Medium Dense
	4.50 to 9.00	Clayey Silt	Medium Dense
	9.00 to 12.00	Sandy Silt with Clay	Medium Dense
	Below 12.00	Silty Sand	Medium Dense

76.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.40	NIL	0.0021	NIL	0.0012	0.067

76.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	11.00
	9.00	NIL

76.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	11.00
	3.00	14.50
	4.50	16.00
	6.00	18.00

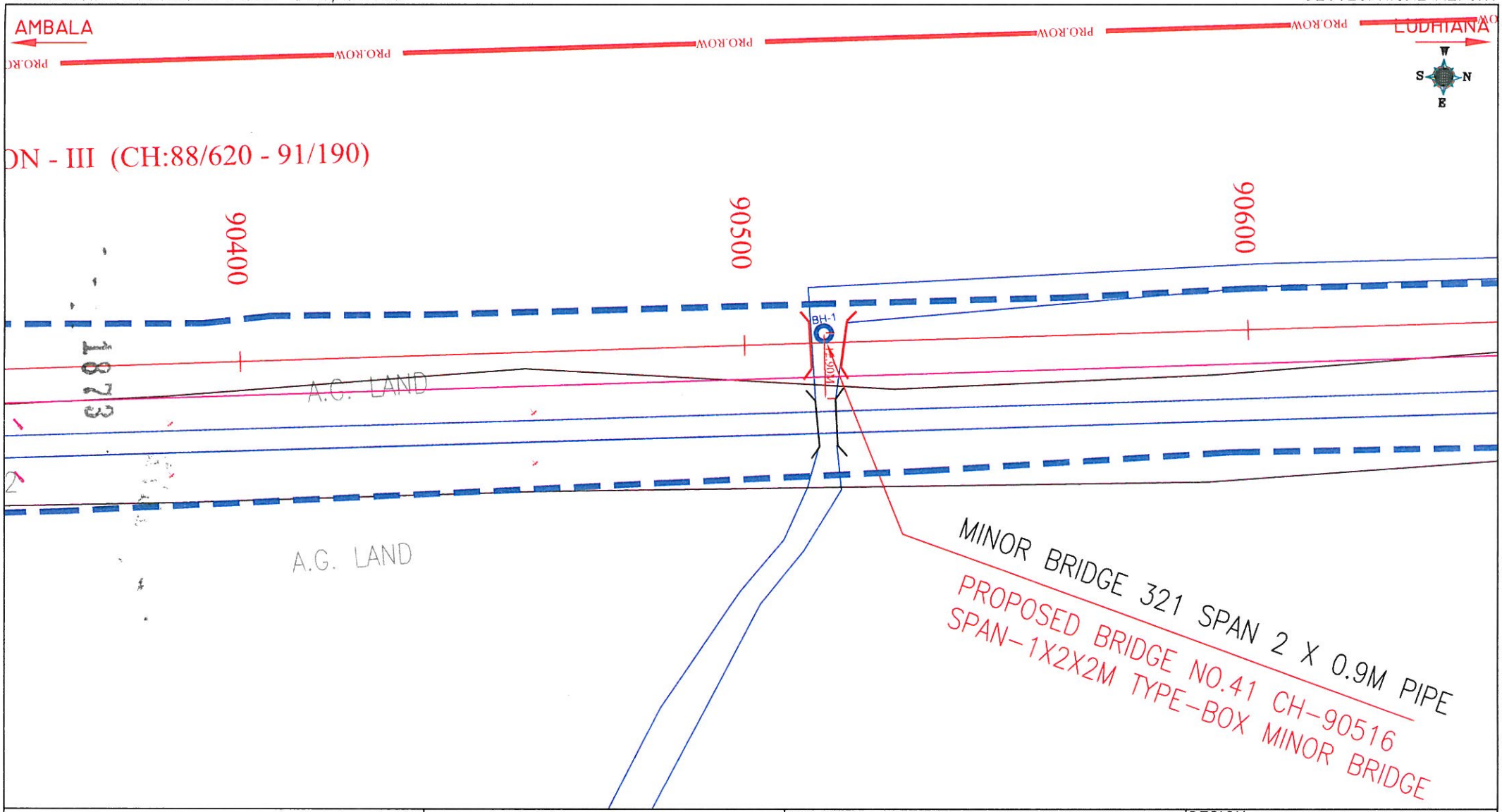
76.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

76.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I
LOCATION PLAN OF PROPOSED MINOR BRIDGE
CH-281/14-16

RL OF BH-I = 268.736

PROJECT :-
LUDHIANA-AMBALA (DFCCIL)

DESIGN :-
CONSULTING
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E-12,Moji Colony,Malviya Nagar Jaipur-17
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ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 000 AT CHAINAGE 281/14-16

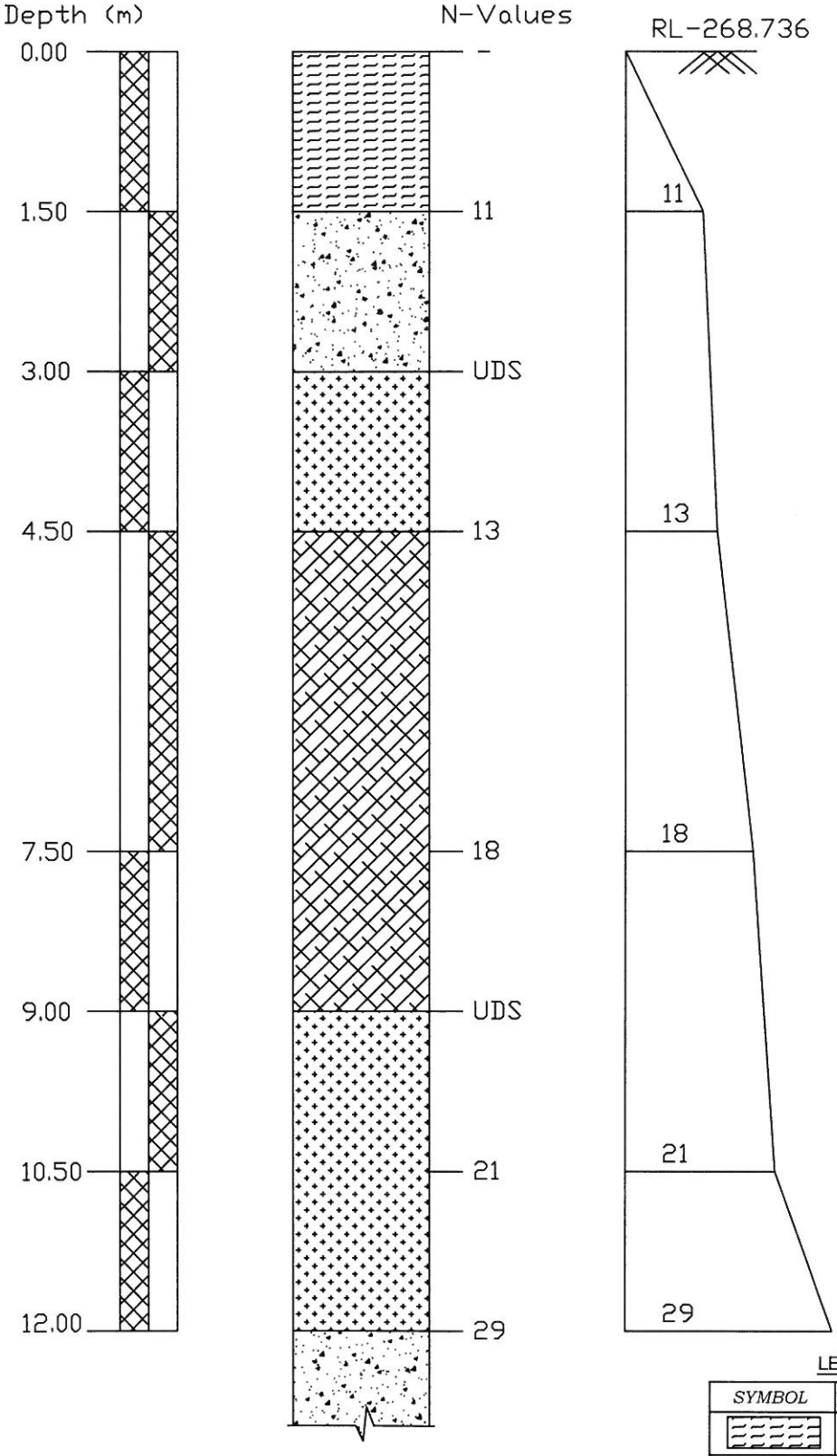
Project :	Chainage 281/14-16 Bridge No. 000			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				28.11.2009 to 28.11.2009	1	1 (LHS)	below 20.00 m.	12.00mtr	268.736

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Filled up Strata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1.50	11	1.44	15.84	Silty Sand	2.35	10.03	86.65	0.48	0.25	0.24	0.00	25	NP	NIL	-	-	-	-	-	-
3.00	UDS	-	-	Sandy Silty with Clay	9.68	60.62	21.10	1.74	1.19	5.67	0.00	28	19	9	1.80	14.00	1.58	2.59	0.08	22.0
4.50	13	1.07	13.91	Clayey Silt	20.18	77.89	1.27	0.30	0.16	0.20	0.00	37	19	18	-	-	-	-	-	-
7.50	18	0.90	16.20	Clayey Silt	19.68	74.83	2.06	0.67	0.11	2.65	0.00	36	18	18	-	-	-	-	-	-
9.00	UDS	-	-	Sandy Silty with Clay	6.21	57.97	30.65	1.15	0.50	3.52	0.00	25	18	7	1.85	15.32	1.60	2.60	0.08	21.0
10.50	21	0.78	16.38	Sandy Silty with Clay	15.34	63.76	14.03	2.65	2.19	2.03	0.00	34	20	14	-	-	-	-	-	-
12.00	29	0.74	21.46	Silty Sand	2.69	17.49	79.73	0.09	0.00	0.00	0.00	24	NP	NIL	-	-	-	-	-	-

CONSULTING Engineers Group Ltd.

BORELOG OF BH–1 AT EXISTING KM–281/14–16 FOR MINOR BRIDGE NO.–321,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	FILLEDUP STRATA
	SILTY SAND
	SANDY SILT WITH CLAY
	CLAYEY SILT

1875

CONSULTING Engineers Group Ltd.

CHAPTER – 77

"Minor Bridge No. 320",

Location – Existing Km. - 281/02-04

77.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x2x2

77.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥20.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 1.50	Silty Sand	Loose
	1.50 to 3.00	Silty Sand	Loose
	3.00 to 4.50	Clayey Silt with Sand	Loose
	4.50 to 6.00	Clayey Silt with Sand	Medium Dense
	6.00 to 7.50	Silty Sand	Medium Dense
	7.50 to 12.00	Clayey Silt with Sand	Medium Dense
	Below 12.00	Silty Sand	Medium Dense

77.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.30	NIL	0.0024	NIL	0.0012	0.069
	6.00	8.30	NIL	0.0024	NIL	0.0014	0.073

77.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	10.00
	6.00	NIL

77.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	09.00
	3.00	14.50
	4.50	16.00
	6.00	18.00

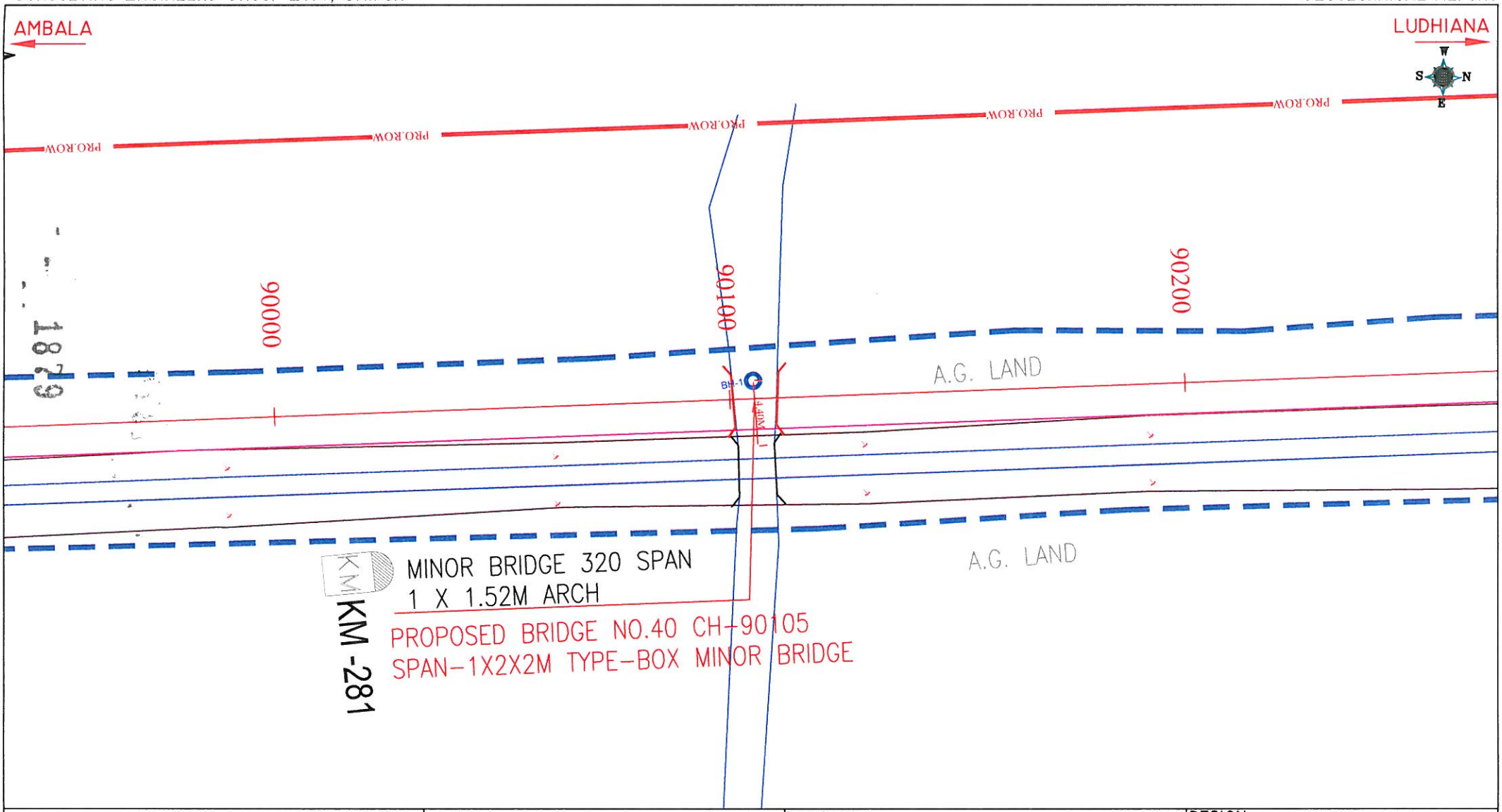
77.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

77.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I
LOCATION PLAN OF PROPOSED MINOR BRIDGE
CH-281/2-4

RL OF BH-I = 267.735

PROJECT :-
LUDHIANA-AMBALA (DFCCIL)

DESIGN :-
CONSULTING
ENGINEERS GROUP LTD.
E-12,Moji Colony,Malviya Nagar Jaipur-17
Tel: +91-141- 2520899, 2521899, 2520556
Fax: 2521348, E-Mail: ceg@cegindia.com

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 320 AT CHAINAGE 281/2-4

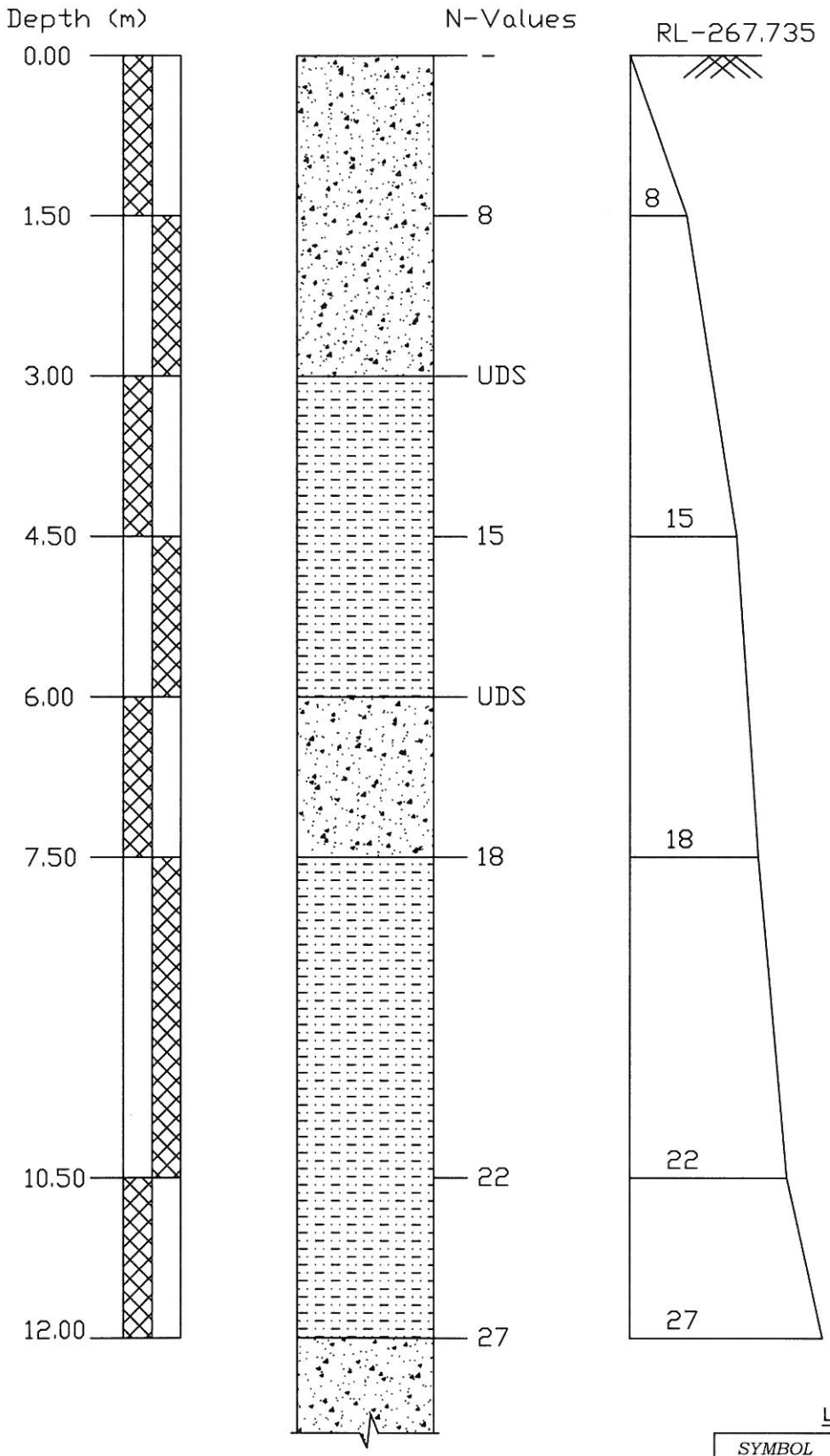
Project :	Chainage 281/2-4 Bridge No. 320			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				28.11.2009 to 28.11.2009	1	1 (LHS)	below 20.00 m.	12.00mtr	267.735

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Silty Sand	2.68	26.80	68.59	1.35	0.58	0	0	24	NP	NIL	-	-	-	-	-	-
1.50	8	1.44	11.52	Silty Sand	3.14	32.62	63.71	0.41	0.12	0.00	0.00	27	NP	NIL	-	-	-	-	-	-
3.00	UDS	-	-	Clayey Silt with Sand	8.21	86.26	4.57	0.86	0.10	0.00	0.00	31	23	8	1.80	12.94	1.59	2.62	0.09	22.0
4.50	15	1.07	16.05	Clayey Silt with Sand	22.35	71.97	4.94	0.28	0.06	0.40	0.00	38	18	20	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	4.14	34.40	59.58	1.70	0.18	0.00	0.00	28	NP	NIL	1.97	20.17	1.64	2.60	0.00	27.5
7.50	18	0.87	15.66	Clayey Silt with Sand	19.68	74.33	3.36	0.96	0.55	1.12	0.00	39	21	18	-	-	-	-	-	-
10.50	22	0.76	16.72	Clayey Silt with Sand	20.33	74.81	3.28	1.45	0.13	0.00	0.00	44	25	19	-	-	-	-	-	-
12.00	27	0.71	19.17	Silty Sand	4.36	86.36	6.39	2.57	0.32	0.00	0.00	29	NP	NIL	-	-	-	-	-	-

CONSULTING
Engineers Group Ltd.

BORELOG OF BH–1(LHS) AT EXISTING KM–281/2–4 FOR MINOR BRIDGE NO.–320,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	SILTY SAND
	CLAYEY SILT WITH SAND

1881

CONSULTING Engineers Group Ltd.

CHAPTER – 78

"Minor Bridge No. 318",

Location – Existing Km. - 280/12-14

78.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x2x2

78.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥17.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 4.50	Clayey Silt with Sand	Loose
	4.50 to 7.50	Sandy Silt with Clay	Medium Dense
	7.50 to 12.00	Clayey Silt with Sand	Medium Dense

78.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.10	NIL	0.0021	NIL	0.0012	0.067
	9.00	8.80	0.007	0.0052	NIL	0.0015	0.280

78.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	15.00
	9.00	18.00

78.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	14.00
	3.00	18.00
	4.50	20.00
	6.00	23.00

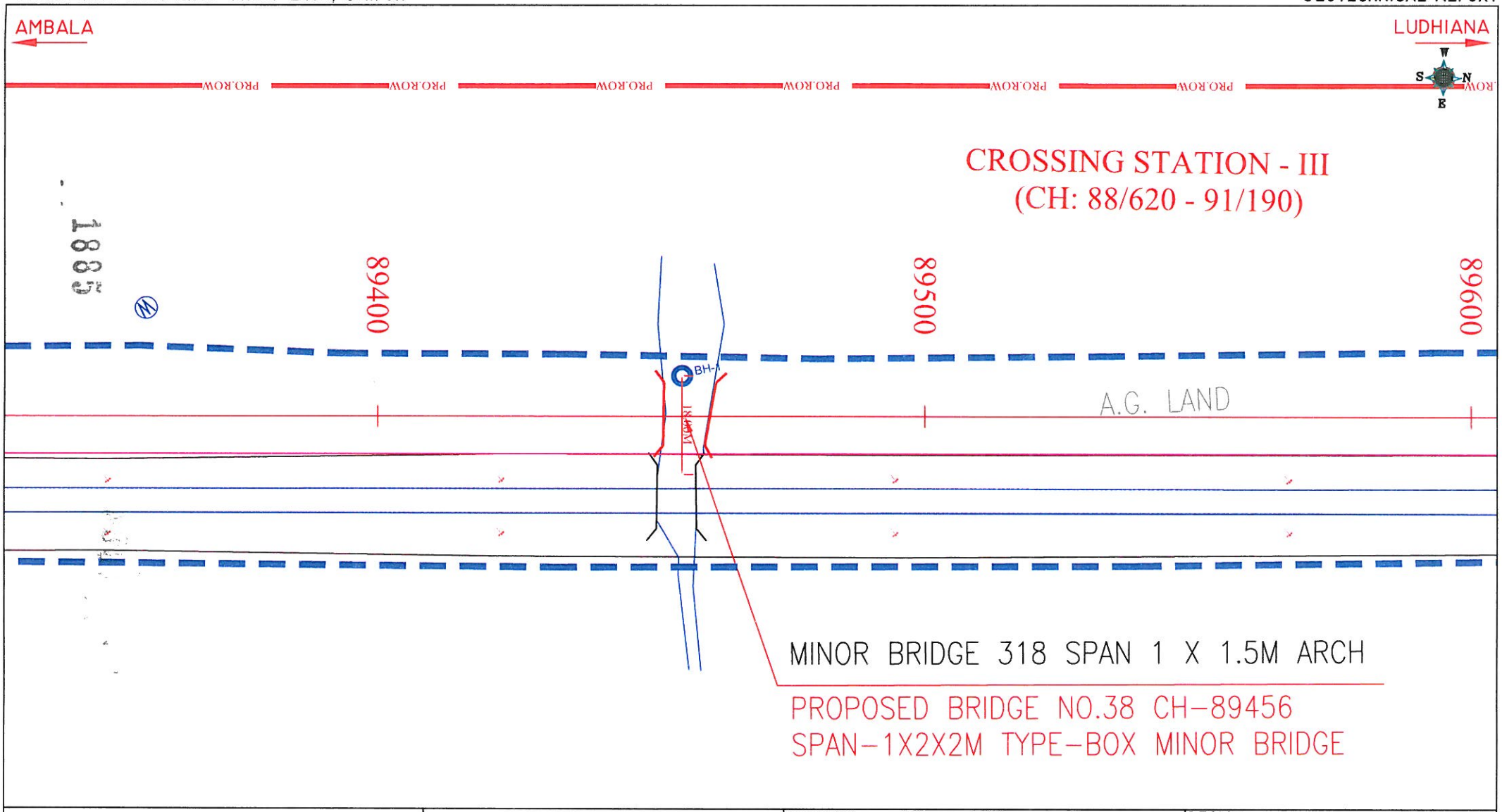
78.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

78.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER FIG.:-I LOCATION PLAN OF PROPOSED MINOR BRIDGE CH-280/12-14	RL OF BH-I = 267.853	PROJECT :- LUDHIANA-AMBALA (DFCCIL)	DESIGN :- CONSULTING ENGINEERS GROUP LTD. E-12,Moji Colony,Malviya Nagar Jaipur-17 Tel: +91-141- 2520899, 2521899, 2520556 Fax: 2521348, E-Mail: ceg@cegindia.com

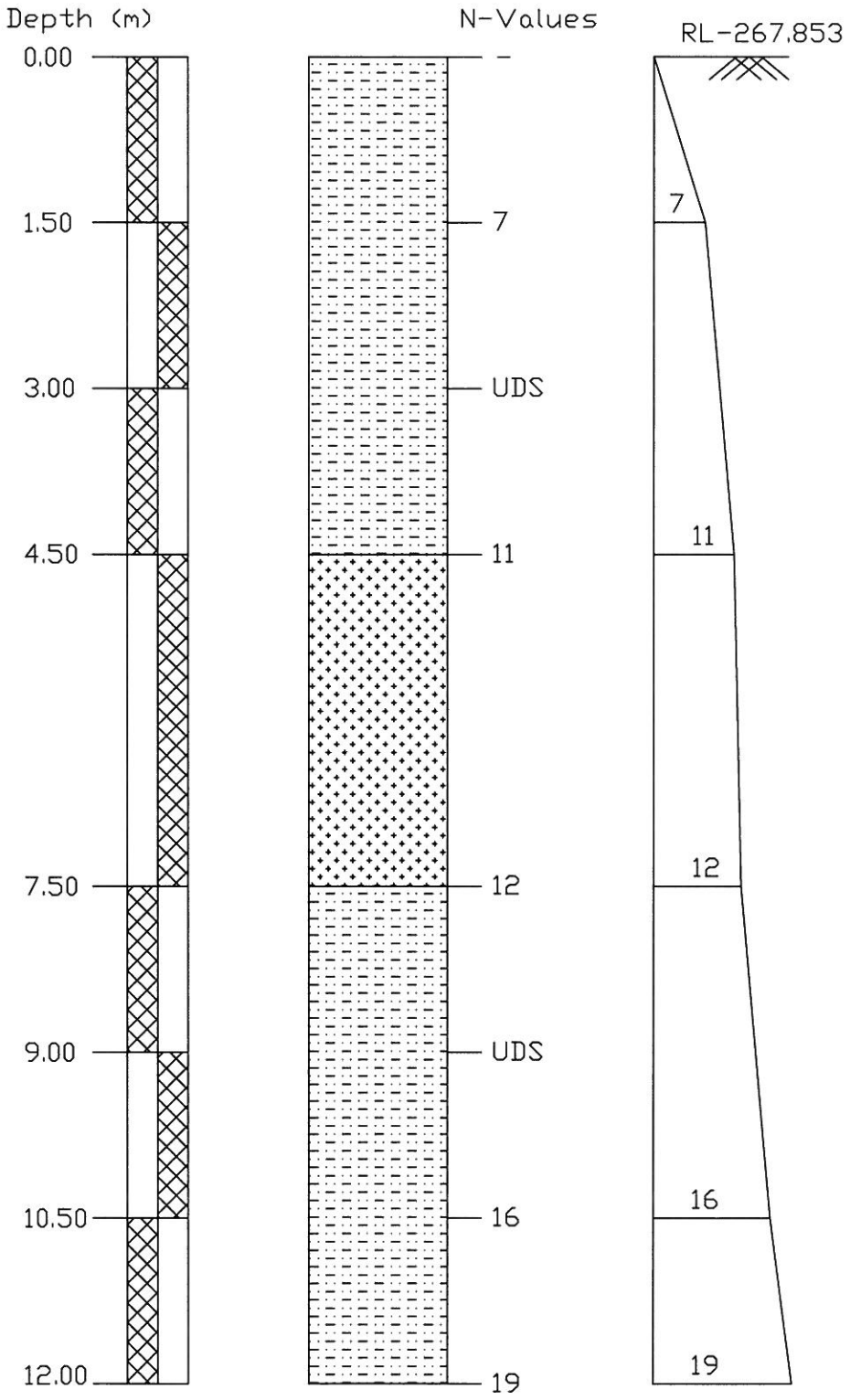
SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 318 AT CHAINAGE 280/12-14

Project :	Chainage 280/12-14 Bridge No. 318			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				29.11.2009 to 29.11.2009	1	1 (LHS)	below 17.00 m.	12.00mtr	267.853

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel									Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey Silt with Sand	11.15	77.93	8.59	1.32	0.26	0.75	0.00	28	18	10	-	-	-	-	-	-
1.50	7	1.40	9.80	Clayey Silt with Sand	12.24	80.15	6.37	0.91	0.18	0.15	0.00	30	19	11	-	-	-	-	-	-
3.00	UDS	-	-	Clayey Silt with Sand	14.00	73.73	11.82	0.45	0.00	0.00	0.00	30	17	13	2.00	12.13	1.78	2.62	0.14	19.0
4.50	11	1.04	11.44	Sandy Silt with Clay	8.62	75.59	15.20	0.38	0.05	0.16	0.00	27	19	8	-	-	-	-	-	-
7.50	12	0.87	10.44	Clayey Silt with Sand	16.98	65.08	12.62	2.69	1.94	0.69	0.00	34	19	15	-	-	-	-	-	-
9.00	UDS	-	-	Clayey Silt with Sand	18.33	72.04	4.37	2.90	1.30	1.06	0.00	37	21	16	2.02	15.00	1.76	2.63	0.20	16.0
10.50	16	0.75	12.00	Clayey Silt with Sand	17.83	61.68	14.20	2.72	2.33	1.24	0.00	35	19	16	-	-	-	-	-	-
12.00	19	0.71	13.49	Clayey Silt with Sand	27.34	63.00	7.41	0.93	0.46	0.86	0.00	51	26	25	-	-	-	-	-	-

CONSULTING Engineers Group Ltd.

BORELOG OF BH–1(LHS) AT EXISTING KM–280/12–14 FOR MINOR BRIDGE NO.–318, ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SANDY SILT WITH CLAY

1887

CONSULTING Engineers Group Ltd.

CHAPTER – 79

"Minor Bridge No. 317",

Location – Existing Km. - 278/13-15

79.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x3.66

79.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥13.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 3.00	Silty Sand	Loose
	3.00 to 4.50	Sandy Silt with Clay	Loose
	4.50 to 9.00	Clayey Silt with Sand	Medium Dense
	9.00 to 10.50	Clayey Silt	Medium Dense
	10.50 to 12.00	Clayey Silt with Sand	Medium Dense
	Below 12.00	Sandy Silt with Clay	Medium Dense

79.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.10	NIL	0.0014	NIL	0.0011	0.055
	9.00	8.30	NIL	0.0024	NIL	0.0014	0.088

79.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	10.00
	6.00	25.00

79.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	08.00
	3.00	15.00
	4.50	17.00
	6.00	18.00

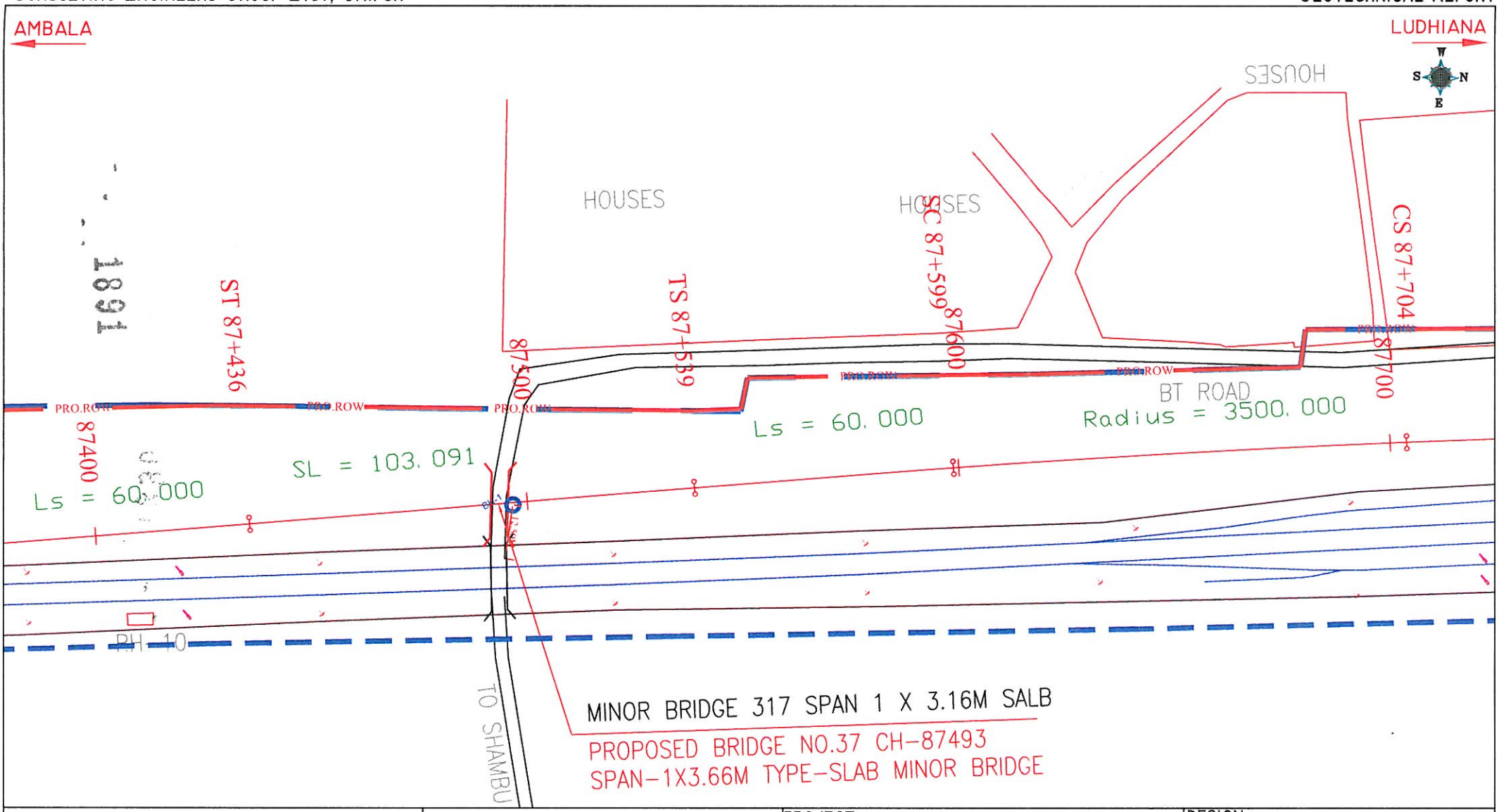
79.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

79.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER FIG.:-I LOCATION PLAN OF PROPOSED MINOR BRIDGE CH-278/13-15	RL OF BH-I = 266.787	PROJECT :- LUDHIANA-AMBALA (DFCCIL)	DESIGN :- CONSULTING ENGINEERS GROUP LTD. E-12,Moji Colony,Malviya Nagar Jaipur-17 Tel: +91-141- 2520899, 2521899, 2520556 Fax: 2521348, E-Mail: ceg@cegindia.com

ANNEXURE - I

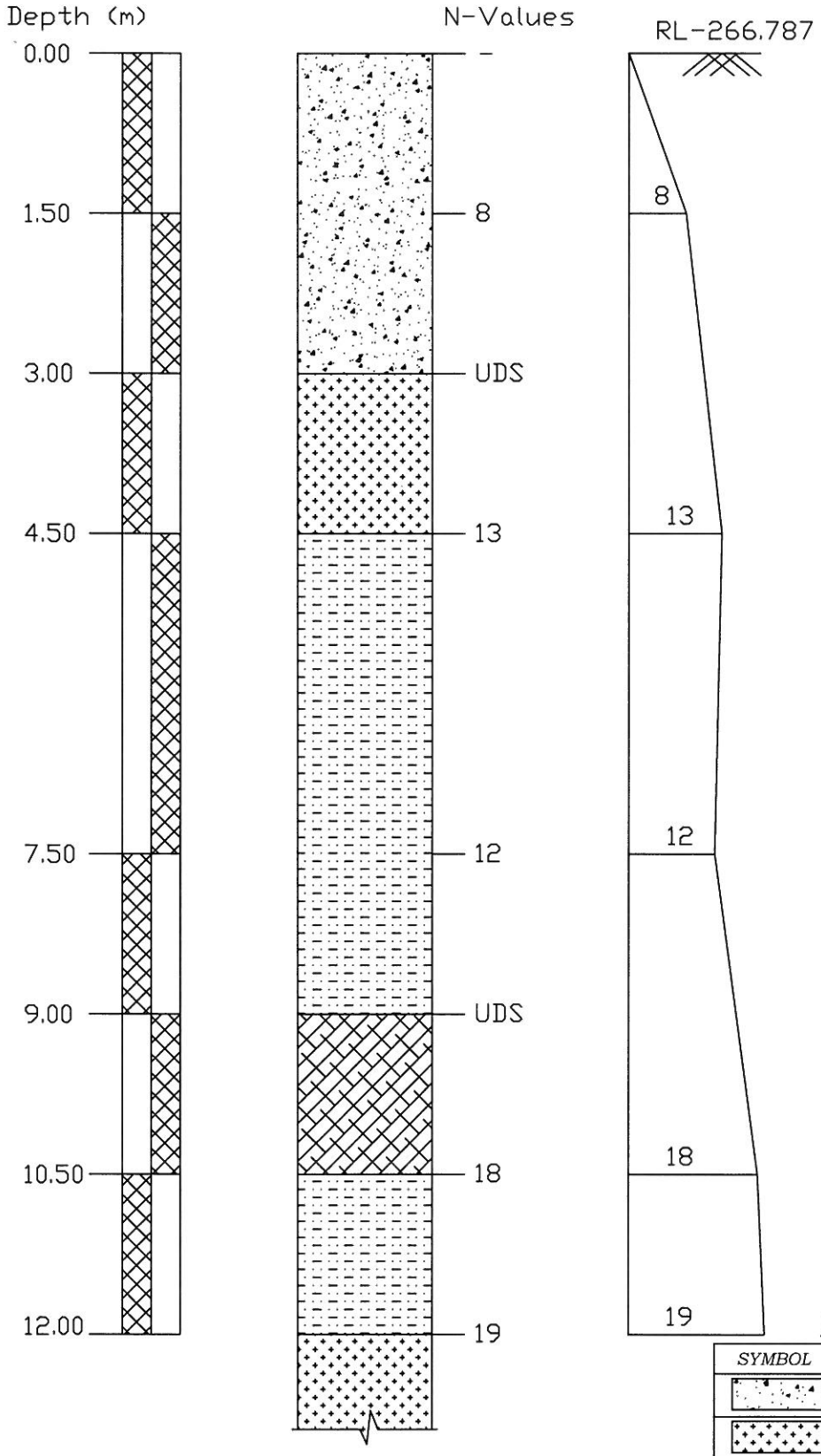
SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 317 AT CHAINAGE 278/13-15

Project :	Chainage 278/13-15 Bridge No. 317			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				26.11.2009 to 26.11.2009	1	1 (RHS)	below 13.00 m.	12.00mtr	266.787

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel									Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Silty Sand	2.39	15.64	75.62	2.55	0.66	3.14	0.00	22	NP	NIL	-	-	-	-	-	-
1.50	8	1.40	11.20	Silty Sand	2.68	21.58	71.03	1.52	0.44	2.75	0.00	25	NP	NIL	-	-	-	-	-	-
3.00	UDS	-	-	Sandy silt with Clay	8.11	50.82	41.07	0.00	0.00	0.00	0.00	23	15	8	2.00	12.64	1.78	2.59	0.09	22.0
4.50	13	1.04	13.52	Clayey Silt with Sand	12.24	74.50	11.05	1.03	0.90	0.28	0.00	27	16	11	-	-	-	-	-	-
7.50	12	0.87	10.44	Clayey Silt with Sand	15.69	75.61	6.02	1.22	0.49	0.97	0.00	33	19	14	-	-	-	-	-	-
9.00	UDS	-	-	Clayey Silt	21.11	77.80	1.09	0.00	0.00	0.00	0.00	47	29	18	2.02	17.10	1.72	2.59	0.25	12.0
10.50	18	0.75	13.50	Clayey Silt with Sand	19.38	71.02	5.18	1.63	0.97	1.82	0.00	42	24	18	-	-	-	-	-	-
12.00	19	0.71	13.49	Sandy silt with Clay	9.38	71.41	14.88	3.58	0.10	0.65	0.00	26	17	9	-	-	-	-	-	-

CONSULTING
Engineers Group Ltd.

BORELOG OF BH–1(RHS) AT EXISTING KM–278/13–15 FOR MINOR BRIDGE NO.–317, ON KESARI TO SANEHWAL, LUDHIANA



1893

79.1 LOCATION OF STRUCTURE:

Proposed Minor Bridge of Span 1x3.66

79.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table ≥13.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1	0.00 to 3.00	Silty Sand	Loose
	3.00 to 4.50	Sandy Silt with Clay	Loose
	4.50 to 9.00	Clayey Silt with Sand	Medium Dense
	9.00 to 10.50	Clayey Silt	Medium Dense
	10.50 to 12.00	Clayey Silt with Sand	Medium Dense
	Below 12.00	Sandy Silt with Clay	Medium Dense

79.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1	3.00	8.10	NIL	0.0014	NIL	0.0011	0.055
	9.00	8.30	NIL	0.0024	NIL	0.0014	0.088

79.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1	3.00	10.00
	6.00	25.00

79.5 NET ALLOWABLE BEARING PRESSURE

Borehole No.	Depth from EGL (m)	Net Allowable Bearing Pressure (t/m^2)
BH-1	1.50	08.00
	3.00	15.00
	4.50	17.00
	6.00	18.00

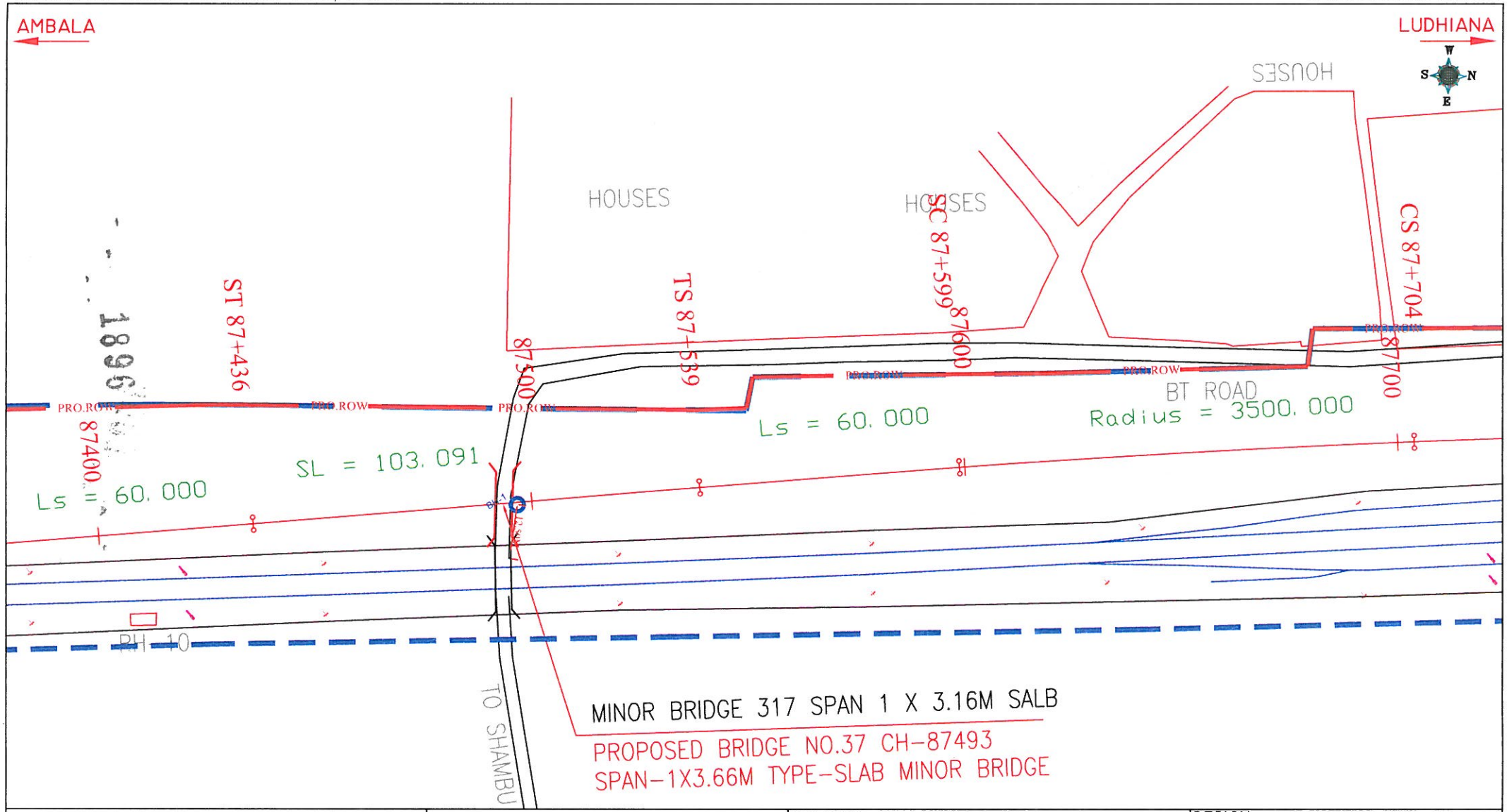
79.6 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.

79.7 RECOMMENDATIONS

(i)	*Type of foundation*	Open foundation
(ii)	*Depth of foundation below GL*	Below 3.00 m from EGL

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I
LOCATION PLAN OF PROPOSED MINOR BRIDGE
CH-278/13-15

RL OF BH-I = 266.787

PROJECT :-
LUDHIANA-AMBALA (DFCCIL)

DESIGN :-
CONSULTING
ENGINEERS GROUP LTD.
E-12,Moji Colony,Malviya Nagar Jaipur-17
Tel: +91-141- 2520899, 2521899, 2520556
Fax: 2521348, E-Mail: ceg@cegindia.com

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1(LHS) FOR MINOR BRIDGE No. 317 AT CHAINAGE 278/13-15

Project :	Chainage 278/13-15 Bridge No. 317			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				26.11.2009 to 26.11.2009	1	1 (RHS)	below 13.00 m.	12.00mtr	266.787

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Silty Sand	2.39	15.64	75.62	2.55	0.66	3.14	0.00	22	NP	NIL	-	-	-	-	-	-
1.50	8	1.40	11.20	Silty Sand	2.68	21.58	71.03	1.52	0.44	2.75	0.00	25	NP	NIL	-	-	-	-	-	-
3.00	UDS	-	-	Sandy silt with Clay	8.11	50.82	41.07	0.00	0.00	0.00	0.00	23	15	8	2.00	12.64	1.78	2.59	0.09	22.0
4.50	13	1.04	13.52	Clayey Silt with Sand	12.24	74.50	11.05	1.03	0.90	0.28	0.00	27	16	11	-	-	-	-	-	-
7.50	12	0.87	10.44	Clayey Silt with Sand	15.69	75.61	6.02	1.22	0.49	0.97	0.00	33	19	14	-	-	-	-	-	-
9.00	UDS	-	-	Clayey Silt	21.11	77.80	1.09	0.00	0.00	0.00	0.00	47	29	18	2.02	17.10	1.72	2.59	0.25	12.0
10.50	18	0.75	13.50	Clayey Silt with Sand	19.38	71.02	5.18	1.63	0.97	1.82	0.00	42	24	18	-	-	-	-	-	-
12.00	19	0.71	13.49	Sandy silt with Clay	9.38	71.41	14.88	3.58	0.10	0.65	0.00	26	17	9	-	-	-	-	-	-

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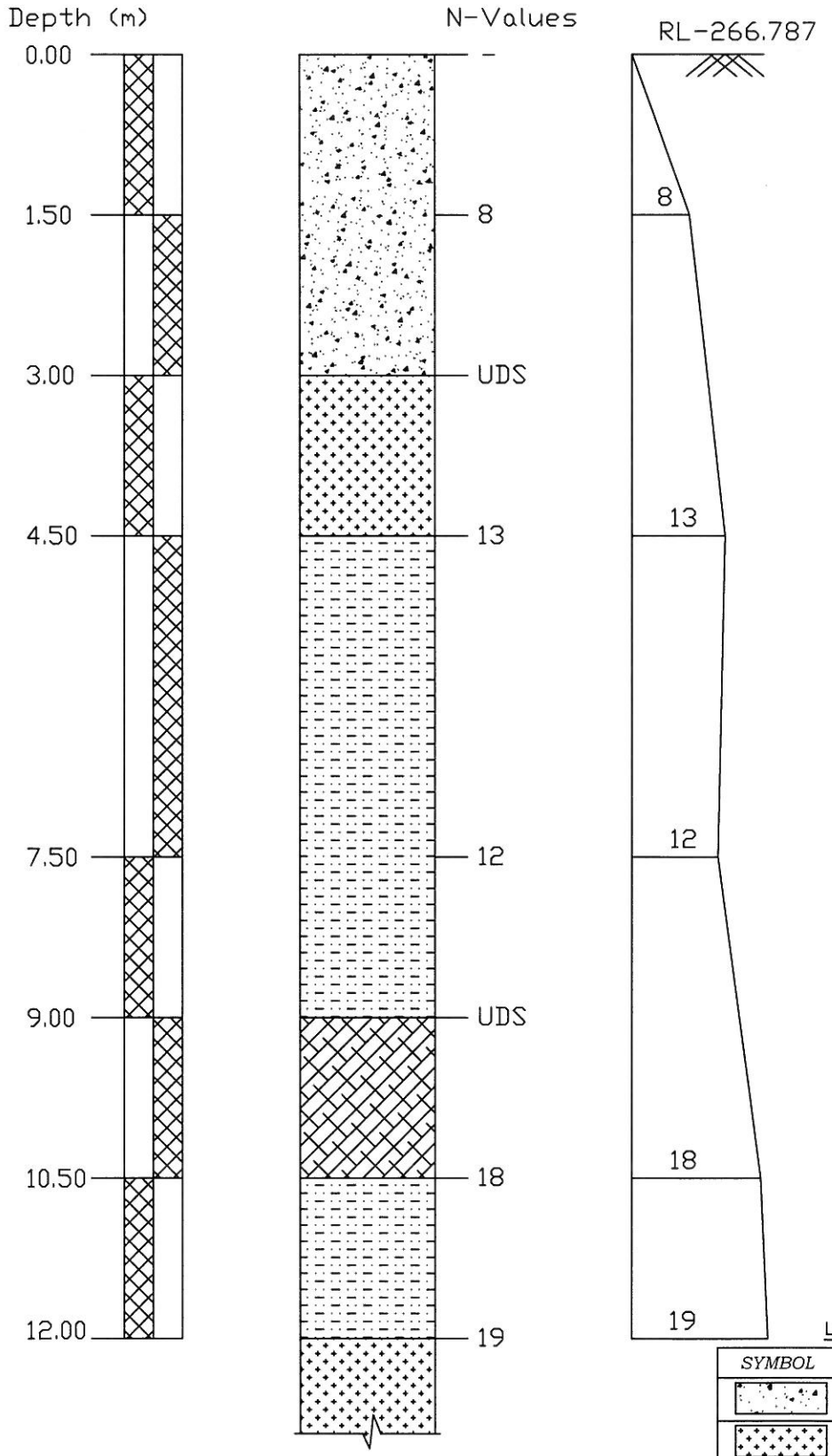
BORELOG OF BH–1(RHS) AT EXISTING KM–278/13–15 FOR MINOR BRIDGE NO.–317, ON KESARI TO SANEHWAL, LUDHIANA



1898

CHAPTER – 80

"Major Bridge No. 351",

Location – Existing Km. - 306/12-14

80.1 LOCATION OF STRUCTURE:

Proposed Major Bridge of Span 5x6.1

80.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table 15.50m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1(A1)	0.00 to 3.00	Sandy Silt with Clay	Loose
	3.00 to 4.50	Silty Sand	Loose
	4.50 to 13.50	Silty Sand	Medium Dense
	13.50 to 15.00	Sandy Silt with Clay	Medium Dense
	15.00 to 16.50	Sandy Silt with Gravels	Medium Dense
	16.50 to 19.50	Silty Sand	Medium Dense
	19.50 to 25.50	Silty Sand	Dense
	25.50 to 28.50	Sandy Silt with Gravels	Very Dense
	28.50 to 30.00	Sandy Silt with Clay & Gravels	Very Dense
BH-2(P3)	0.00 to 1.50	Sandy Silt with Clay	Loose
	1.50 to 4.50	Silty Sand	Loose
	4.50 to 12.00	Silty Sand	Medium Dense
	12.00 to 13.50	Sandy Silt with Clay	Medium Dense
	13.50 to 22.50	Silty Sand	Dense
	22.50 to 30.00	Silty Sand	Very Dense
BH-3(A2)	0.00 to 3.00	Sandy Silt with Clay	Loose
	3.00 to 4.50	Silty Sand	Loose
	4.50 to 12.00	Silty Sand	Medium Dense
	12.00 to 13.50	Sandy Silt	Dense
	13.50 to 25.50	Silty Sand	Dense
	25.50 to 30.00	Silty Sand	Very Dense

80.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1 (A1)	3.00	7.80	NIL	0.0011	NIL	0.0009	0.023
	6.00	8.80	0.007	0.0024	NIL	0.0011	0.027
	15.00	9.10	0.005	0.0014	NIL	0.0009	0.024
BH-2 (P3)	3.00	8.60	0.010	0.0021	NIL	0.0011	0.021
	12.00	8.70	0.002	0.0014	NIL	0.0009	0.024
BH-3 (A2)	6.00	8.80	0.007	0.0021	NIL	0.0011	0.021

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80.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1 (A1)	3.00	NIL
	6.00	NIL
	15.00	NIL
BH-2 (P3)	3.00	NIL
	12.00	16.00
	25.50	NIL
BH-3 (A2)	3.00	NIL
	6.00	NIL
	28.50	NIL

80.5 CHEMICAL ANALYSIS OF ENCOUNTERED WATER FROM BOREHOLE

Chemical Properties	pH Value	Chlorides mg/lit	Sulphate mg/lit	Organic Matter mg/lit	Inorganic Matter mg/lit	Acidity (ml)	Alkalinity (ml)	Total Disso. Solids (ppm)	Conductivity (µS/cm)
Test Result	7.2	76	88	189	750	0.1	2.1	960	620
Requirement as per IS: 456 / Mosrth's	Not less then 6.0	2000 for CC and 500 for RCC	400	200	3000	5 ml of 0.02 normal NaoH	25 ml of 0.02 normal H_2SO_4	-	-

80.6 SAFE BEARING CAPACITY (t/m^2)

BH -NO.	DEPTH (mtr)	Net Allowable Bearing Pressure (t/m^2)
BH-1 (A1)	1.50m	7.00
	3.00m	12.00
	4.50m	13.00
	6.00m	19.00
BH-3 (A2)	1.50m	9.00
	3.00m	17.00
	4.50m	18.00
	6.00m	18.50

80.7 PILE LOAD CARRYING CAPACITY

80.7.1 Normal Bored Cast in- situ Pile Foundations:

Normal bored cast in situ RCC pile foundation is envisaged for the proposed bridge and have been analysed in the subsequent paragraphs. The Axial load carrying capacity of Pile in Rock is determined as per IRC- 78: 2000 appendix-5.

The safe Load carrying capacities of piles have been worked out on the basis of IRC-78 as per provision/assumptions provided therein.. For calculating designed Capacity of pile recommendation of IS: 2911 should be followed. The minimum factor of safety on ultimate axial capacity should be as per clause 709.3.2 of IRC 78: 2000.The final design/construction of foundations, the safe /allowable load carrying capacity of these piles should be taken by conducting actual initial load tests on these piles casted in the respective area.

Further the piles should have necessary structural strength to transmit/sustain the design load.

Pile load carrying capacity in t

BH -NO.	PILE DEPTH (mtr)	PILE CARRYING CAPACITY IN TONNE	
		Pile Diameter= 1.0 m	Pile Diameter= 1.2 m
BH-1 (A1)	17.00	140.00	180.00
	20.00	180.00	240.00
	23.00	250.00	330.00
BH-2 (P3)	17.00	120.00	160.00
	20.00	150.00	200.00
	23.00	190.00	250.00
BH-3 (A2)	17.00	140.00	190.00
	20.00	180.00	240.00
	23.00	230.00	300.00

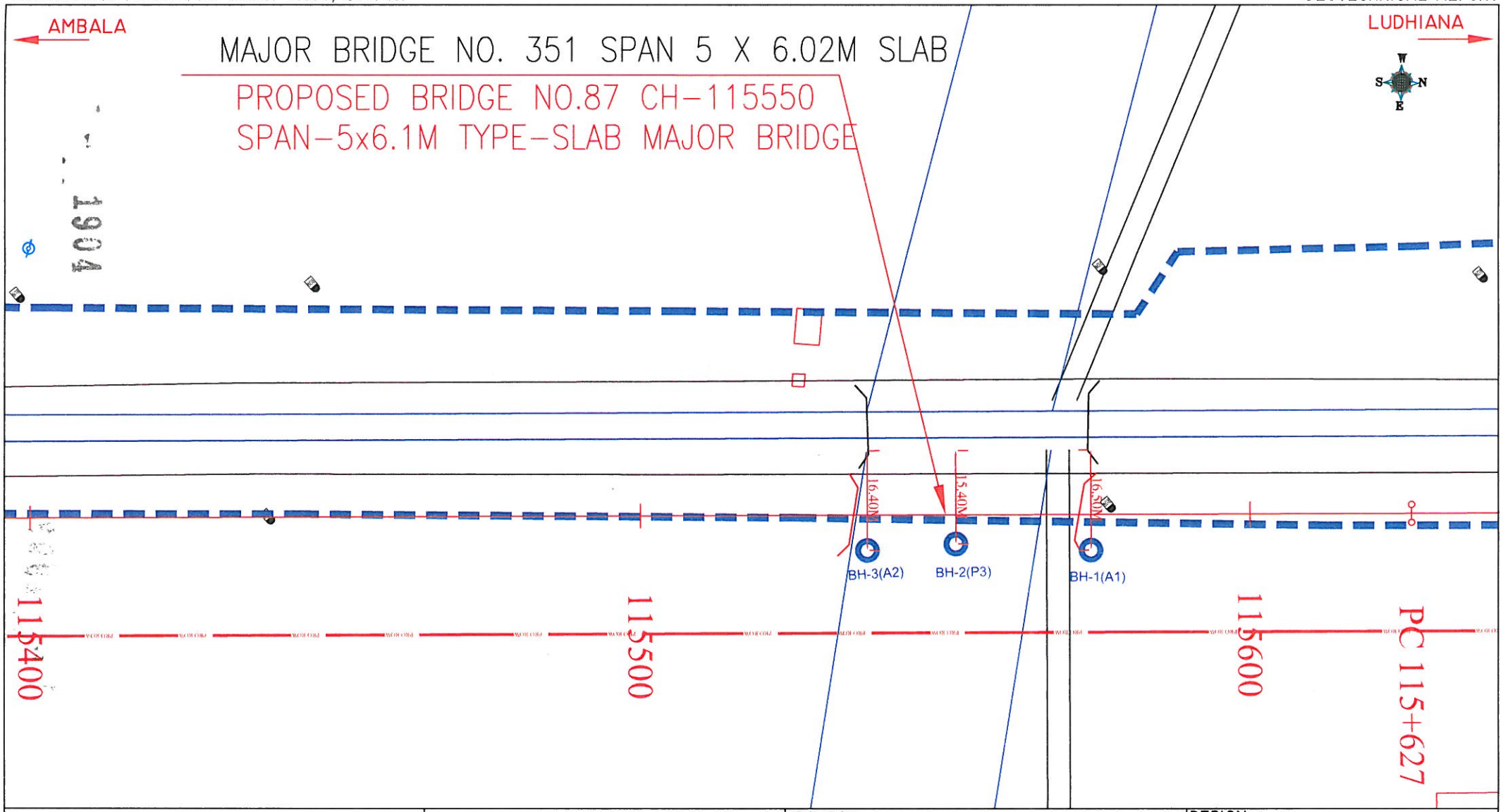
80.8 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.
- Chemical contents of Water are within the safe limits for construction purpose.

80.9 RECOMMENDATIONS

(i)	*Type of foundation*	Pile foundation

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I

LOCATION PLAN OF PROPOSED MAJOR BRIDGE AT CH. 306/12-14

RL OF BH (A1) = 263.776
RL OF BH (P3) = 263.775
RL OF BH (A2) = 263.796

PROJECT :-

LUDHIANA-AMBALA (DFCCIL)

DESIGN :-

CONSULTING ENGINEERS GROUP LTD.
E-12,Moji Colony,Malviya Nagar Jaipur-17
Tel: +91-141- 2520899, 2521899, 2520556
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SOIL CHARACTERISTICS OF BORE HOLE AT BH-1 (A1) OF MAJOR BRIDGE No. 351 AT CHAINAGE 306/12-14

Project :	Chainage 306/12-14 Bridge No. 351			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				11.06.2009 to 11.06.2009	A1	1	15.50 m.	30.00mtr	263.776

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Sandy silt with clay	11.59	50.30	35.26	2.15	0.48	0.22	0.00	26	17	9	-	-	-	-	-	-
1.50	9	1.51	13.59	Sandy silt with clay	10.23	44.89	41.50	1.78	0.70	0.90	0.00	24	16	8	-	-	-	-	-	-
3.00	UDS	-	-	Silty Sand	2.36	13.23	58.37	25.95	0.09	0.00	0.00	27	NIL	NP	1.63	7.19	1.52	2.63	0.00	26.00
4.50	15	1.10	16.50	Silty Sand	2.52	5.93	84.17	7.28	0.10	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	2.66	3.55	69.89	20.95	1.43	1.52	0.00	26	NIL	NP	1.74	8.54	1.60	2.62	0.00	27.50
7.50	18	0.92	16.56	Silty Sand	2.67	9.40	82.55	5.17	0.21	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
10.50	24	0.81	19.44	Silty Sand	2.71	9.91	82.13	5.08	0.17	0.00	0.00	27	NIL	NP	-	-	-	-	-	-
12.00	14	0.76	10.64	Silty Sand	2.98	5.36	85.69	5.68	0.29	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
13.50	19	0.72	13.68	Sandy silt with clay	12.98	55.39	27.74	0.82	0.16	2.91	0.00	29	18	11		-	-	-	-	-
15.00	UDS	-	-	Sandy Silt with Gravels	1.86	55.71	29.67	2.43	5.08	5.25	0.00	22	NIL	NP	2.02	19.36	1.69	2.68	0.00	28.50
16.50	24	0.64	15.18	Silty Sand	3.59	7.68	81.17	7.13	0.43	0.00	0.00	29	NIL	NP		-	-	-	-	-
18.00	28	0.61	16.04	Silty Sand	3.58	7.81	80.21	7.90	0.50	0.00	0.00	25	NIL	NP	-	-	-	-	-	-
19.50	38	0.58	18.52	Silty Sand	3.55	6.82	80.87	8.13	0.63	0.00	0.00	27	NIL	NP	-	-	-	-	-	-
22.50	45	0.53	19.43	Silty Sand	2.94	7.65	80.79	8.03	0.59	0.00	0.00	26	NIL	NP		-	-	-	-	-
25.50	50	0.48	19.50	Sandy silt with Gravels	2.21	72.66	11.98	4.05	3.01	6.09	0.00	24	NIL	NP	-	-	-	-	-	-
28.50	52	0.44	18.94	Sandy Silt with Clay and Gravels	12.36	61.70	12.18	3.56	3.62	6.58	0.00	28	18	10	-	-	-	-	-	-
30.00	58	0.42	19.68	Sandy Silt with Clay and Gravels	13.21	60.19	12.39	3.68	3.71	6.82	0.00	28	18	10	-	-	-	-	-	-

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SOIL CHARACTERISTICS OF BORE HOLE AT BH-2 (P3) OF MAJOR BRIDGE No. 351 AT CHAINAGE 306/12-14

Project :	Chainage 306/12-14 Bridge No. 351			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				11.06.2009 to 12.06.2009	P3	2	15.50 m.	30.00mtr	263.775

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Sandy silt with clay	12.1	58.18	20.36	4.56	3.25	1.55	0.00	29	20	9	-	-	-	-	-	-
1.50	9	1.52	13.68	Silty Sand	2.36	42.23	49.73	3.43	0.55	1.70	0.00	25	NIL	NP	-	-	-	-	-	-
3.00	UDS	-	-	Silty Sand	2.58	13.63	64.30	18.82	0.19	0.48	0.00	25	NIL	NP	1.60	5.23	1.52	2.64	0.00	26.50
4.50	15	1.11	16.65	Silty Sand	2.11	7.90	82.75	6.51	0.41	0.32	0.00	27	NIL	NP	-	-	-	-	-	-
6.00	20	1.02	20.40	Silty Sand	3.94	7.15	81.78	6.40	0.40	0.33	0.00	28	NIL	NP		-	-	-	-	-
7.50	23	0.94	21.62	Silty Sand	4.59	5.40	82.80	6.43	0.43	0.35	0.00	29	NIL	NP	-	-	-	-	-	-
10.50	27	0.83	22.41	Silty Sand	4.88	5.22	82.75	6.41	0.41	0.33	0.00	30	NIL	NP	-	-	-	-	-	-
12.00	UDS	-	-	Sandy silt with clay	14.56	67.99	15.20	1.80	0.45	0.00	0.00	31	19	12	1.63	7.56	1.52	2.63	0.14	20.00
13.50	32	0.74	23.68	Silty Sand	3.15	8.89	78.74	8.76	0.21	0.25	0.00	25	NIL	NP		-	-	-	-	-
16.50	38	0.67	20.23	Silty Sand	3.66	8.50	78.71	8.69	0.23	0.21	0.00	26	NIL	NP		-	-	-	-	-
19.50	40	0.62	19.90	Silty Sand	3.10	9.07	78.52	8.89	0.19	0.23	0.00	25	NIL	NP	-	-	-	-	-	-
22.50	50	0.57	21.75	Silty Sand	2.56	17.42	78.61	0.93	0.20	0.28	0.00	24	NIL	NP		-	-	-	-	-
25.50	UDS	-	-	Silty Sand	2.62	22.98	71.23	1.29	1.20	0.68	0.00	22	NIL	NP	1.93	18.56	1.63	2.67	0.00	27.50
28.50	34	0.48	15.66	Silty Sand	2.68	5.88	76.08	14.98	0.38	0.00	0.00	23	NIL	NP	-	-	-	-	-	-
30.00	36	0.46	15.78	Silty Sand	2.00	6.51	76.01	15.06	0.42	0.00	0.00	24	NIL	NP	-	-	-	-	-	-

ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-3 (A2) OF MAJOR BRIDGE No. 351 AT CHAINAGE 306/12-14

Project :	Chainage 306/12-14 Bridge No. 351			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				11.06.2009 to 11.06.2009	A2	3	15.50 m.	30.00mtr	263.796

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Sandy silt with clay	12.11	61.32	20.39	1.26	1.66	3.26	0.00	27	17	10	-	-	-	-	-	-
1.50	9	1.51	13.59	Sandy silt with clay	15.89	42.21	33.98	1.90	1.05	4.97	0.00	29	15	14	-	-	-	-	-	-
3.00	UDS	-	-	Silty Sand	2.33	13.03	80.23	2.56	1.20	0.65	0.00	23	NIL	NP	1.65	5.36	1.57	2.63	0.00	26.00
4.50	13	1.10	14.30	Silty Sand	3.12	9.57	83.00	3.71	0.24	0.36	0.00	24	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	4.25	29.22	61.76	4.02	0.16	0.59	0.00	28	NIL	NP	1.70	6.25	1.60	2.64	0.00	27.50
7.50	17	0.93	15.81	Silty Sand	2.33	8.63	81.91	5.76	0.20	1.17	0.00	24	NIL	NP	-	-	-	-	-	-
10.50	25	0.81	20.25	Silty Sand	2.15	5.67	87.70	4.01	0.47	0.00	0.00	22	NIL	NP	-	-	-	-	-	-
12.00	30	0.77	23.10	Sandy silt	4.58	79.69	13.87	1.86	0.00	0.00	0.00	32	NIL	NP	-	-	-	-	-	-
13.50	34	0.73	24.82	Silty Sand	2.33	4.85	88.87	3.84	0.11	0.00	0.00	25	NIL	NP	-	-	-	-	-	-
16.50	37	0.66	19.71	Silty Sand	2.14	6.62	86.90	4.16	0.18	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
19.50	40	0.60	19.50	Silty Sand	3.22	5.99	87.18	3.34	0.13	0.14	0.00	24	NIL	NP	-	-	-	-	-	-
22.50	45	0.56	20.10	Silty Sand	4.10	3.85	87.27	4.60	0.18	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
25.50	50	0.51	20.25	Silty Sand	2.31	7.03	86.15	4.32	0.19	0.00	0.00	23	NIL	NP	-	-	-	-	-	-
28.50	UDS	-	-	Silty Sand	2.15	8.60	82.36	5.66	1.23	0.00	0.00	22	NIL	NP	2.10	19.59	1.76	2.64	0.00	30.00
30.00	44	0.45	17.40	Silty Sand	2.65	5.76	86.96	4.34	0.29	0.00	0.00	23	NIL	NP	-	-	-	-	-	-

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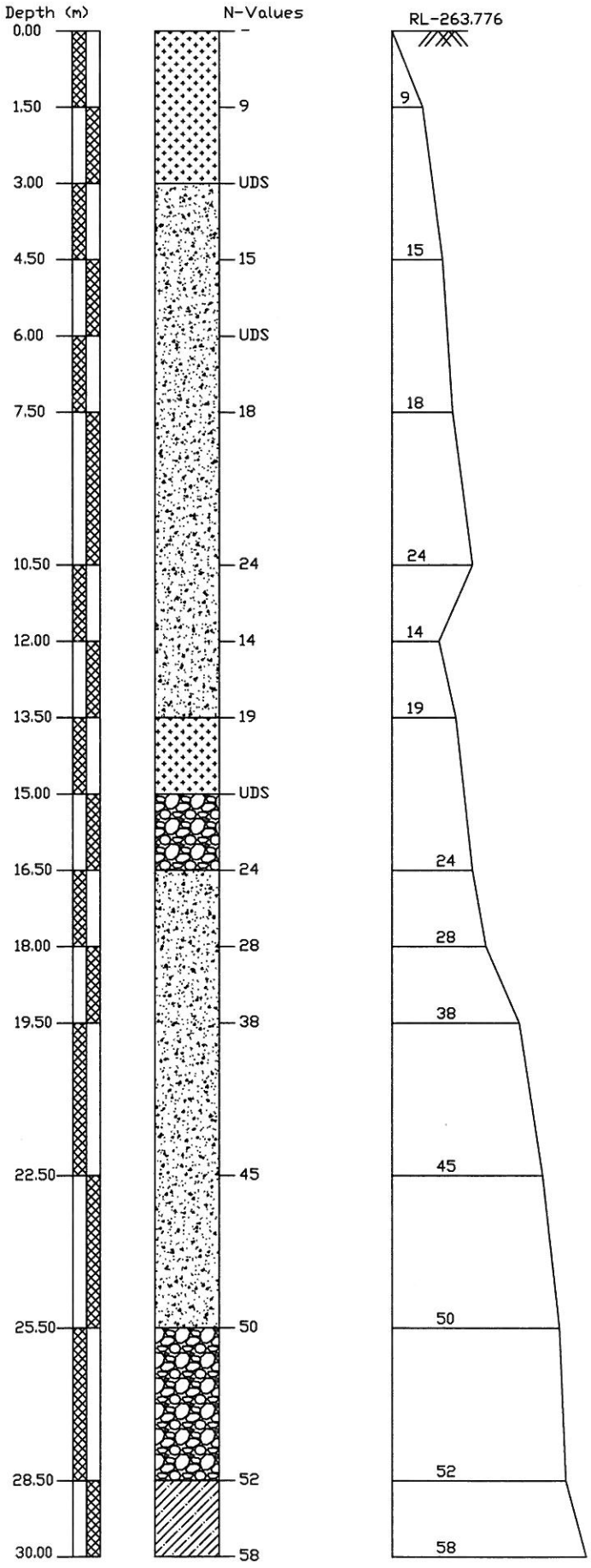
BORELOG OF BH–1(A1) AT EXISTING KM–306/12–14 FOR MAJOR BRIDGE NO.–351,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	SANDY SILT WITH CLAY
	SILTY SAND
	SANDY SILT WITH GRAVELS
	SANDY SILT WITH CLAY & GRAVELS

1908

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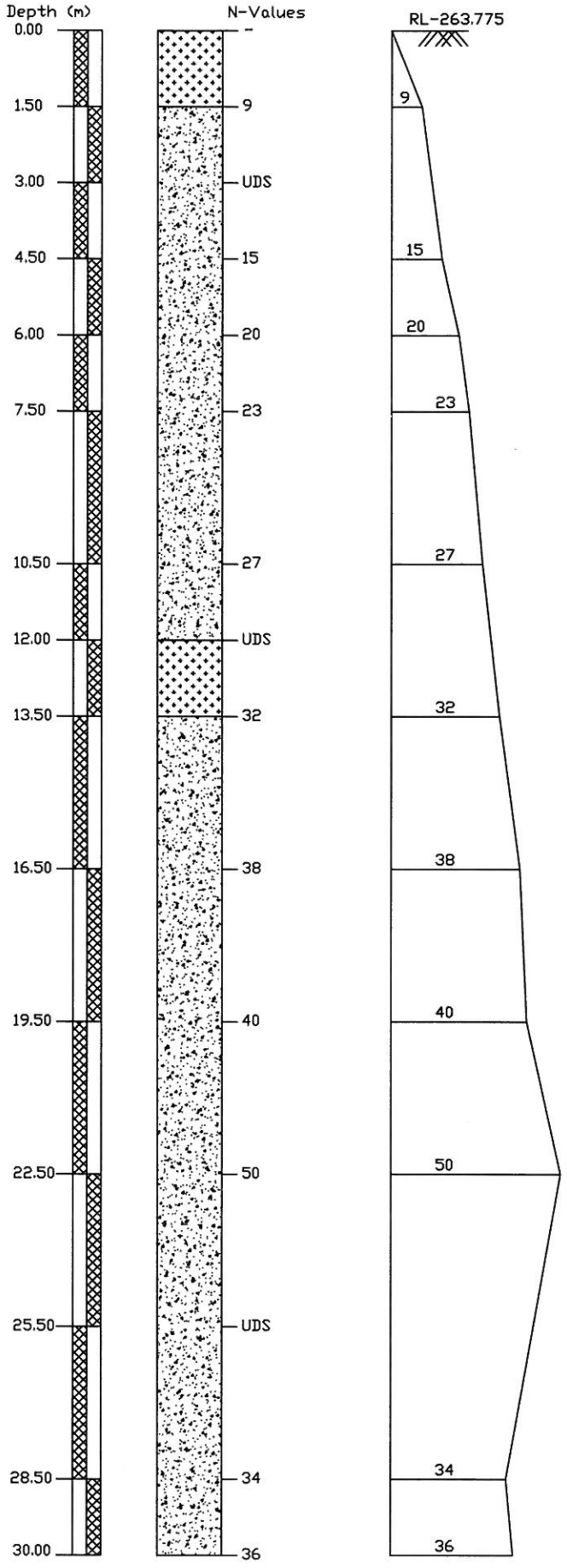
BORELOG OF BH–2(P3) AT EXISTING KM–306/12–14 FOR MAJOR BRIDGE NO.–351,
ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	SANDY SILT WITH CLAY
	SILTY SAND

1909

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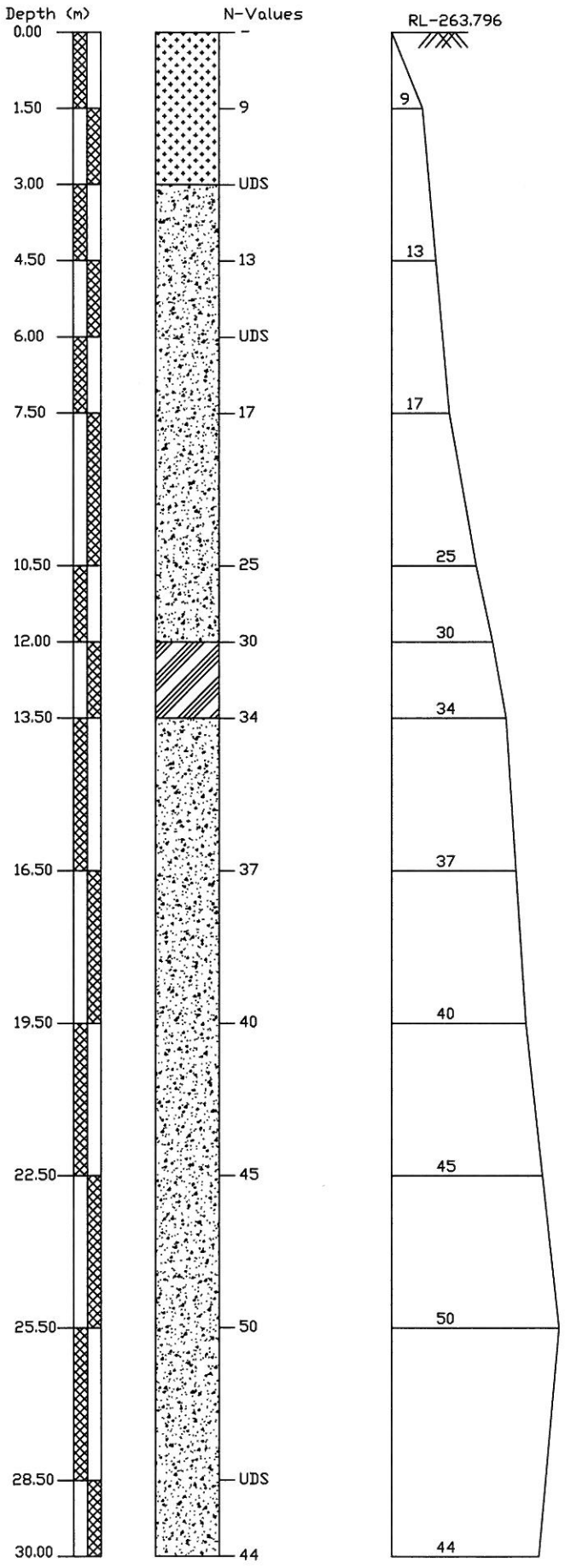
BORELOG OF BH–3(A2) AT EXISTING KM–306/12–14 FOR MAJOR BRIDGE NO.–351,
ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	SANDY SILT WITH CLAY
	SILTY SAND
	SANDY SILT

1910

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CHAPTER – 81

"Major Bridge No. 344",

Location – Existing Km. - 304/2-4

81.1 LOCATION OF STRUCTURE:

Proposed Major Bridge of Span 8 x 6.1

81.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table 21.00m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1(A1)	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 3.00	Clayey Silt with Sand	Medium Dense
	3.00 to 4.50	Sandy Silt	Medium Dense
	4.50 to 10.50	Silty Sand	Medium Dense
	10.50 to 13.50	Silty Sand	Dense
	13.50 to 14.00	Clayey Silt with Sand	Dense
	14.00 to 19.50	Silty Sand	Dense
	19.50 to 30.00	Silty Sand	Very Dense
BH-2(P4)	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 4.50	Clayey Silt with Sand	Medium Dense
	4.50 to 7.50	Silty Sand	Medium Dense
	7.50 to 10.50	Silty Sand	Dense
	10.50 to 13.50	Silty Sand	Very Dense
	13.50 to 16.50	Clayey Silt with Sand	Very Dense
	16.50 to 30.00	Silty sand	Very Dense
BH-3(A2)	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 3.00	Clayey Silt with Sand	Medium Dense
	3.00 to 4.50	Sandy Silt with Clay	Medium Dense
	4.50 to 7.50	Silty Sand	Medium Dense
	7.50 to 13.50	Silty Sand	Dense
	13.50 to 19.50	Clayey Silt with Sand	Dense
	19.50 to 22.50	Silty Sand	Dense
	22.50 to 30.00	Silty Sand	Very Dense

81.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1 (A1)	3.00	9.20	0.015	0.0028	NIL	0.0012	0.041
	6.00	9.10	0.012	0.0017	NIL	0.0011	0.026
	14.00	8.80	0.007	0.0024	NIL	0.0011	0.026

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BH-2 (P4)	3.00	8.60	0.010	0.0021	NIL	0.0011	0.021
	12.00	9.00	0.012	0.0017	NIL	0.0011	0.022
BH-3 (A2)	3.00	8.80	0.005	0.0011	NIL	0.0010	0.032
	9.00	9.00	0.010	0.0014	NIL	0.0011	0.020
	15.00	8.80	0.002	0.0014	NIL	0.0009	0.027
	21.00	8.80	0.007	0.0014	NIL	0.0010	0.019

81.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1 (A1)	3.00	NIL
	6.00	NIL
	14.00	NIL
	18.00	NIL
BH-2 (P4)	3.00	16.00
	6.00	NIL
	21.00	NIL
BH-3 (A2)	3.00	10.00
	9.00	NIL
	15.00	12.00
	21.00	NIL

81.5 CHEMICAL ANALYSIS OF ENCOUNTERED WATER FROM BOREHOLE

Chemical Properties	pH Value	Chlorides mg/lit	Sulphate mg/lit	Organic Matter mg/lit	Inorganic Matter mg/lit	Acidity (ml)	Alkalinity (ml)	Total Disso. Solids (ppm)	Conductivity (µS/cm)
Test Result	7.0	82	92	180	742	0.2	2.1	956	639
Requirement as per IS: 456 / Mosrth's	Not less then 6.0	2000 for CC and 500 for RCC	400	200	3000	5 ml of 0.02 normal NaoH	25 ml of 0.02 normal H_2SO_4	-	-

81.6 SAFE BEARING CAPACITY (t/m²)

BH -NO.	DEPTH (mtr)	Net Allowable Bearing Pressure (t/m²)
BH-1 (A1)	1.50m	7.00
	3.00m	13.00
	4.50m	16.00
	6.00m	18.00
BH-3 (A2)	1.50m	7.50
	3.00m	12.00
	4.50m	20.00
	6.00m	21.00

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81.7 PILE LOAD CARRYING CAPACITY

81.7.1 Normal Bored Cast in- situ Pile Foundations:

Normal bored cast in situ RCC pile foundation is envisaged for the proposed bridge and have been analysed in the subsequent paragraphs. The Axial load carrying capacity of Pile in Rock is determined as per IRC- 78: 2000 appendix-5.

The safe Load carrying capacities of piles have been worked out on the basis of IRC-78 as per provision/assumptions provided therein.. For calculating designed Capacity of pile recommendation of IS: 2911 should be followed. The minimum factor of safety on ultimate axial capacity should be as per clause 709.3.2 of IRC 78: 2000.The final design/construction of foundations, the safe /allowable load carrying capacity of these piles should be taken by conducting actual initial load tests on these piles casted in the respective area.

Further the piles should have necessary structural strength to transmit/sustain the design load.

Pile load carrying capacity in t

BH -NO.	PILE DEPTH (mtr)	PILE CARRYING CAPACITY IN TONNE	
		Pile Diameter= 1.0 m	Pile Diameter= 1.2 m
BH-1 (A1)	17.00	140.00	180.00
	20.00	180.00	240.00
	23.00	250.00	330.00
BH-2 (P4)	17.00	120.00	160.00
	20.00	160.00	200.00
	23.00	200.00	250.00
BH-3 (A2)	17.00	140.00	190.00
	20.00	180.00	240.00
	23.00	230.00	300.00

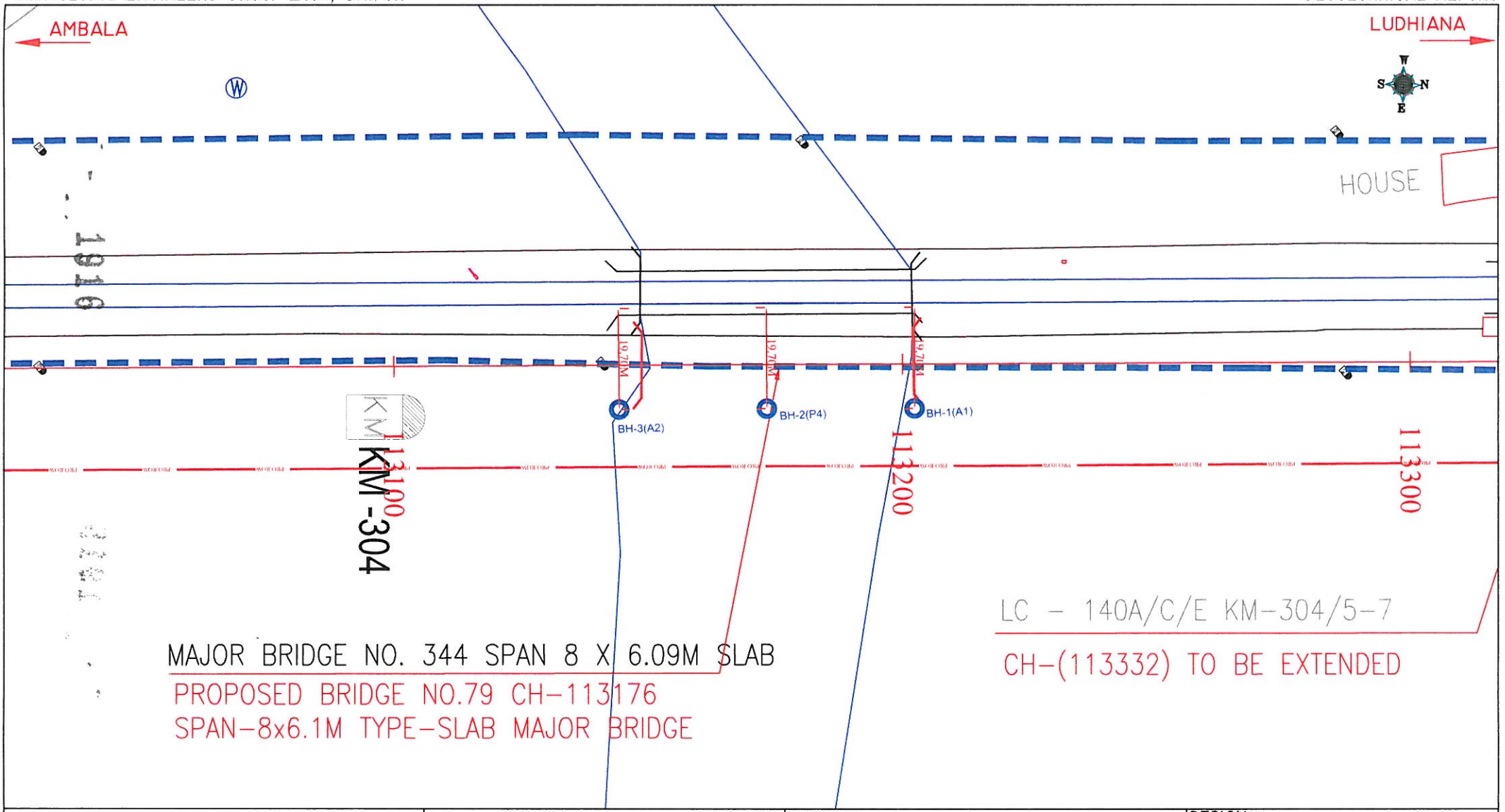
81.8 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.
- Chemical contents of Water are within the safe limits for construction purpose.

81.9 RECOMMENDATIONS

(i)	*Type of foundation*	Pile foundation

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER FIG.:-I LOCATION PLAN OF PROPOSED MAJOR BRIDGE AT CH. 304/2-4	RL OF BH (AI) = 263.949 RL OF BH (P4) = 264.058 RL OF BH (A2) = 263.999	PROJECT :- LUDHIANA-AMBALA (DFCCIL)	DESIGN :- CONSULTING ENGINEERS GROUP LTD. E-12,Moji Colony,Malviya Nagar Jaipur-17 Tel: +91-141- 2520899, 2521899, 2520556 Fax. 2521348, E-Mail: ceg@cegindia.com

ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1 (A1) OF MAJOR BRIDGE No. 344 AT CHAINAGE 304/2-4

Project :	Chainage 304/2-4 Bridge No. 344			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				12.06.2009 to 12.06.2009	A1	1	21.00 m.	30.00mtr	263.949

Depth from GL (m)	Observed N	Correction Factor C_n	Corrected N_n	Soil Description (Soil Group)	Grain Size Distribution % wt retained							Atterberg Limits %			B.D. gm/cc	M.C. %	D.D. gm/cc	Specific Gravity	Shear Strength	
					Clay	Silt	Sand			Gravel									c kg/cm^2	ϕ degree
							Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.						
0.00	-	-	-	Clayey silt with sand	22.69	59.71	10.23	3.23	1.02	3.12	0	40	20	20	-	-	-	-	-	-
1.50	10	1.51	15.10	Clayey silt with sand	25.36	62.52	6.16	2.03	1.05	2.88	0.00	42	19	23	-	-	-	-	-	-
3.00	UDS	-	-	Sandy Silt	3.25	77.07	18.38	0.73	0.57	0.00	0.00	26	NIL	NP	1.62	5.66	1.53	2.63	0.00	26.00
4.50	26	1.11	28.86	Silty sand	2.15	7.76	81.75	7.51	0.43	0.40	0.00	25	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Silty sand	4.12	13.26	69.46	7.07	3.57	2.52	0.00	27	NIL	NP	1.65	6.58	1.55	2.64	0.00	26.50
7.50	25	0.93	23.25	Silty Sand	2.55	6.85	76.24	11.81	1.24	1.31	0.00	24	NIL	NP	-	-	-	-	-	-
10.50	40	0.82	32.80	Silty Sand	2.36	7.27	76.13	11.75	1.21	1.28	0.00	23	NIL	NP	-	-	-	-	-	-
13.50	24	0.74	17.76	Clayey silt with sand	27.55	53.45	6.32	4.43	3.94	4.31	0.00	45	20	25	-	-	-	-	-	-
14.00	UDS	-	-	Silty Sand	4.11	6.03	77.22	10.79	1.06	0.79	0.00	26	NIL	NP	1.84	8.23	1.70	2.65	0.00	29.00
16.50	26	0.66	17.16	Silty Sand	1.56	36.66	54.18	6.53	1.07	0.00	0.00	20	NIL	NP		-	-	-	-	-
18.00	UDS	-	-	Silty Sand	0.00	5.72	83.46	10.82	0.00	0.00	0.00	22	NIL	NP	1.87	9.32	1.71	2.67	0.00	29.50
19.50	55	0.60	33.00	Silty Sand	2.89	7.20	79.76	8.24	1.91	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
22.50	64	0.55	25.10	Silty Sand	4.12	6.17	79.63	8.21	1.87	0.00	0.00	27	NIL	NP		-	-	-	-	-
25.50	68	0.50	24.50	Silty Sand	0.00	6.69	79.53	13.61	0.17	0.00	0.00	25	NIL	NP	-	-	-	-	-	-
28.50	72	0.46	24.06	Silty Sand	1.56	5.31	79.40	13.58	0.15	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
30.00	79	0.44	24.88	Silty Sand	4.22	11.60	70.56	13.51	0.11	0.00	0.00	28	NIL	NP	-	-	-	-	-	-

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SOIL CHARACTERISTICS OF BORE HOLE AT BH-2 (P4) OF MAJOR BRIDGE No. 344 AT CHAINAGE 304/2-4

Project :	Chainage 304/2-4 Bridge No. 344			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				13.06.2009 to 13.06.2009	P4	2	21.00 m.	30.00mtr	264.058

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey silt with sand	18.21	67.91	5.26	2.15	3.25	3.22	0.00	36	21	15	-	-	-	-	-	-
1.50	13	1.52	19.76	Clayey silt with sand	20.85	58.04	7.20	6.72	2.98	4.21	0.00	40	22	18	-	-	-	-	-	-
3.00	UDS	-	-	Clayey silt with sand	15.11	74.41	5.49	0.77	0.73	3.49	0.00	30	18	12	1.60	5.26	1.52	2.64	0.13	20.00
4.50	27	1.11	29.97	Silty Sand	3.25	5.93	85.50	4.03	0.22	1.07	0.00	26	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	4.15	26.31	56.02	12.15	0.54	0.83	0.00	28	NIL	NP	1.69	8.22	1.56	2.65	0.00	26.00
7.50	35	0.93	32.55	Silty Sand	4.12	9.20	83.21	2.87	0.19	0.41	0.00	27	NIL	NP	-	-	-	-	-	-
10.50	51	0.82	41.82	Silty Sand	4.55	8.72	80.23	5.11	0.29	1.10	0.00	29	NIL	NP	-	-	-	-	-	-
13.50	61	0.73	44.53	Clayey silt with sand	23.85	59.30	4.92	3.42	4.13	4.38	0.00	43	22	21	-	-	-	-	-	-
16.50	50	0.66	33.00	Silty Sand	0.00	5.31	89.73	4.84	0.12	0.00	0.00	28	NIL	NP		-	-	-	-	-
19.50	55	0.61	33.55	Silty Sand	0.00	2.97	91.42	5.08	0.00	0.53	0.00	30	NIL	NP	-	-	-	-	-	-
21.00	UDS	-	-	Silty Sand	0.00	40.78	52.23	5.21	1.22	0.56	0.00	26	NIL	NP	2.00	20.26	1.66	2.65	0.00	27.50
22.50	62	0.55	24.55	Silty Sand	0.00	6.04	85.60	8.13	0.23	0.00	0.00	28	NIL	NP		-	-	-	-	-
25.50	67	0.50	24.25	Silty Sand	0.00	2.92	92.25	4.83	0.00	0.00	0.00	31	NIL	NP	-	-	-	-	-	-
28.50	74	0.46	24.52	Silty Sand	0.00	5.60	90.49	3.64	0.27	0.00	0.00	30	NIL	NP	-	-	-	-	-	-
30.00	76	0.44	24.22	Silty Sand	0.00	5.60	89.79	4.61	0.00	0.00	0.00	28	NIL	NP	-	-	-	-	-	-

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ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-3 (A2) OF MAJOR BRIDGE No. 344 AT CHAINAGE 304/2-4

Project :	Chainage 304/2-4 Bridge No. 344			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				12.06.2009 to 12.06.2009	A2	3	21.00 m.	30.00mtr	263.999

Depth from GL (m)	Observ-ed N	Correction Factor C_n	Corrected N_n	Soil Description (Soil Group)	Grain Size Distribution % wt retained							Atterberg Limits %			B.D. gm/cc	M.C. %	D.D. gm/cc	Specific Gravity	Shear Strength	
					Clay	Silt	Sand			Gravel									c kg/cm^2	ϕ degree
							Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.						
0.00	-	-	-	Clayey silt with sand	18.12	67.59	8.23	2.25	1.66	2.15	0.00	37	23	15	-	-	-	-	-	-
1.50	11	1.51	16.61	Clayey silt with sand	22.89	62.29	9.36	2.22	1.02	2.22	0.00	40	20	20	-	-	-	-	-	-
3.00	UDS	-	-	Sandy Silt with clay	10.95	57.53	22.25	1.31	3.10	4.86	0.00	25	17	8	1.63	6.23	1.53	2.63	0.08	22.00
4.50	27	1.11	29.97	Silty Sand	3.59	9.95	82.05	4.33	0.08	0.00	0.00	27	NIL	NP	-	-	-	-	-	-
7.50	31	0.93	28.83	Silty Sand	4.59	2.78	88.11	4.39	0.13	0.00	0.00	29	NIL	NP	-	-	-	-	-	-
9.00	UDS	-	-	Silty Sand	3.59	30.09	65.34	0.49	0.17	0.32	0.00	27	NIL	NP	1.73	8.55	1.59	2.64	0.00	26.00
10.50	34	0.82	27.88	Silty Sand	4.88	11.62	81.37	2.13	0.00	0.00	0.00	29	NIL	NP	-	-	-	-	-	-
13.50	21	0.73	15.33	Clayey silt with sand	11.12	80.91	7.20	0.15	0.09	0.53	0.00	31	22	9		-	-	-	-	-
15.00	UDS	-	-	Clayey silt with sand	9.55	56.20	28.27	1.13	0.73	4.12	0.00	25	18	7	1.87	15.26	1.62	2.65	0.07	27.50
16.50	28	0.65	18.20	Clayey silt with sand	12.94	86.63	0.43	0.00	0.00	0.00	0.00	33	22	11	-	-	-	-	-	-
19.50	44	0.59	25.96	Silty Sand	2.85	27.62	69.28	0.25	0.00	0.00	0.00	26	NIL	NP		-	-	-	-	-
21.00	UDS	-	-	Silty Sand	2.15	6.27	89.93	0.98	0.47	0.20	0.00	23	NIL	NP	2.05	19.65	1.71	2.65	0.00	29.00
22.50	62	0.54	24.24	Silty Sand	2.25	5.41	81.98	10.31	0.05	0.00	0.00	25	NIL	NP	-	-	-	-	-	-
25.50	69	0.49	24.41	Silty Sand	2.00	5.85	80.65	11.43	0.07	0.00	0.00	23	NIL	NP	-	-	-	-	-	-
28.50	72	0.45	23.70	Silty Sand	0.00	7.99	81.42	10.53	0.06	0.00	0.00	22	NIL	NP	-	-	-	-	-	-
30.00	80	0.43	24.70	Silty Sand	0.00	9.82	74.51	15.58	0.09	0.00	0.00	23	NIL	NP	-	-	-	-	-	-

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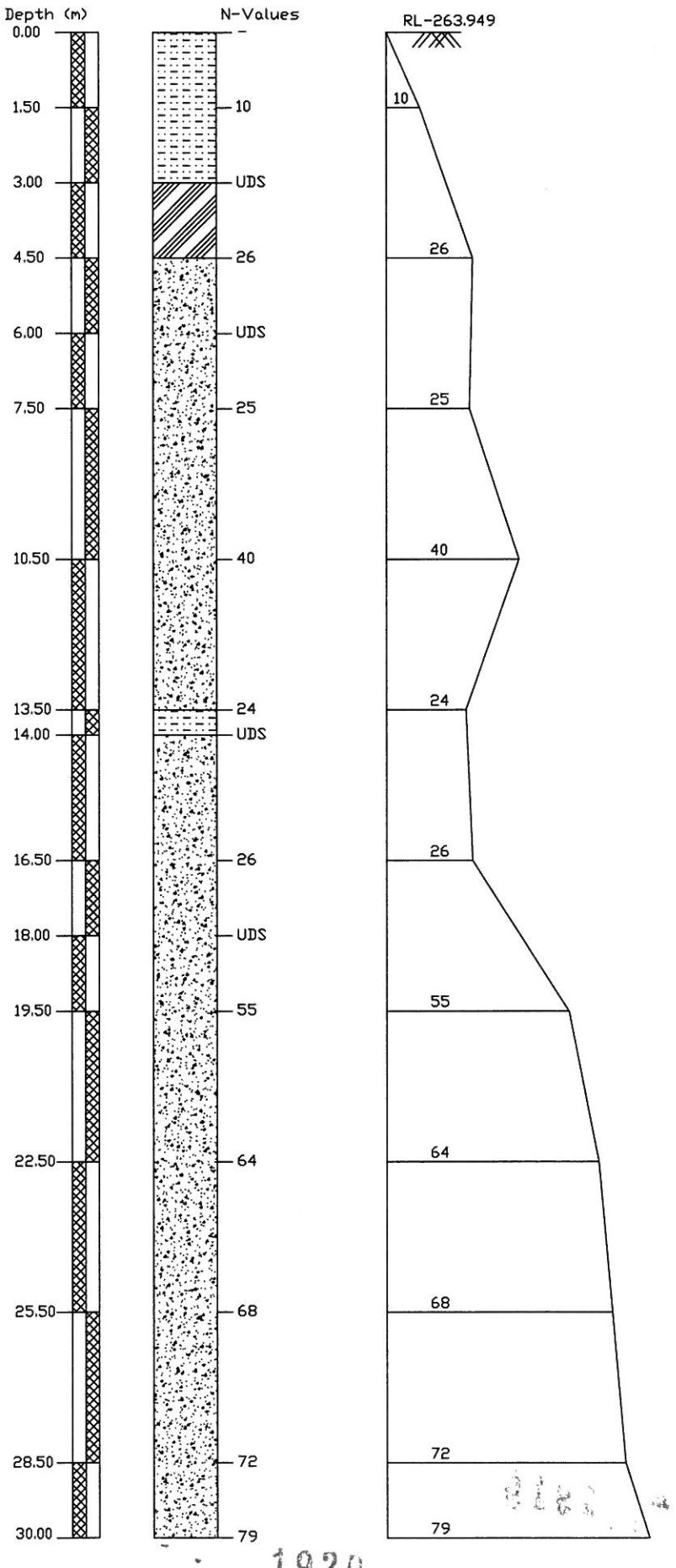
BORELOG OF BH–1(A1) AT EXISTING KM–304/2–4 FOR MAJOR BRIDGE NO.–344,
ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SANDY SILT
	SILTY SAND

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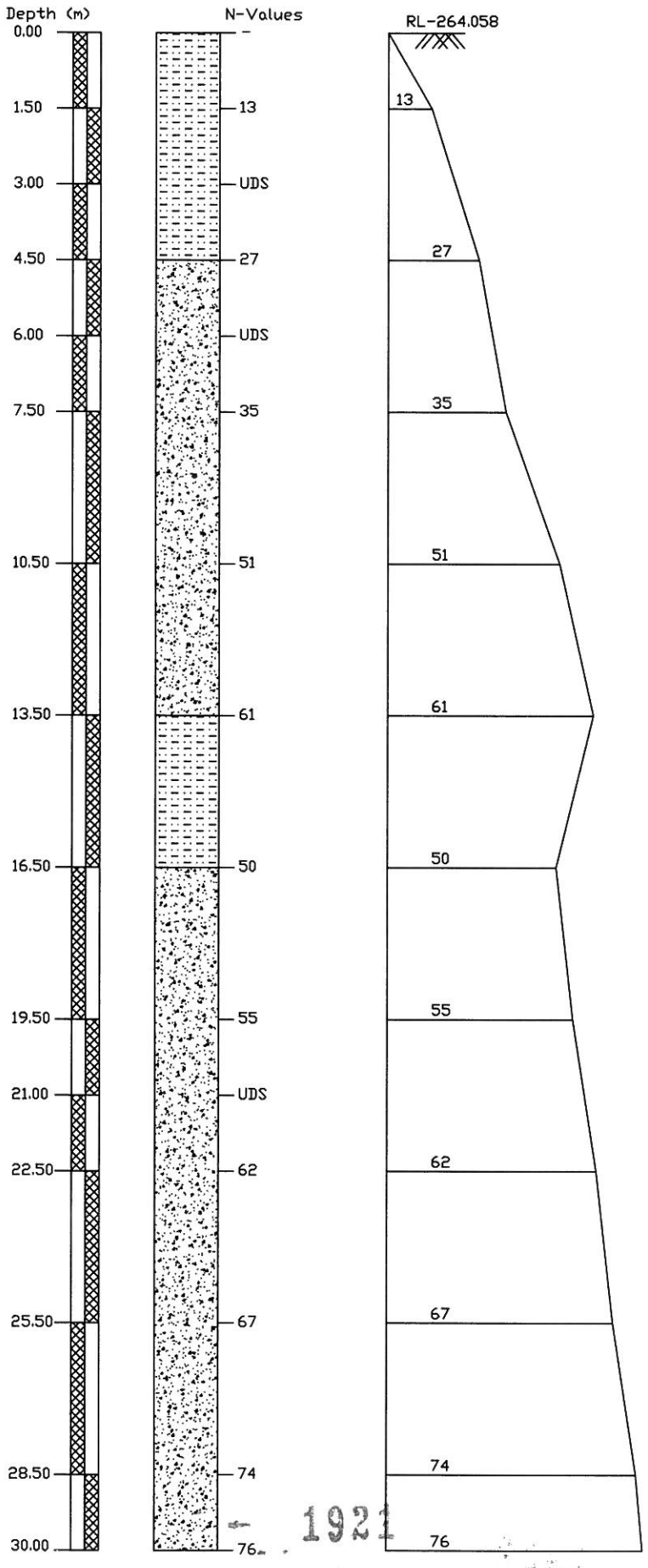
BORELOG OF BH–2(P4) AT EXISTING KM–304/2–4 FOR MAJOR BRIDGE NO.–344,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SILTY SAND

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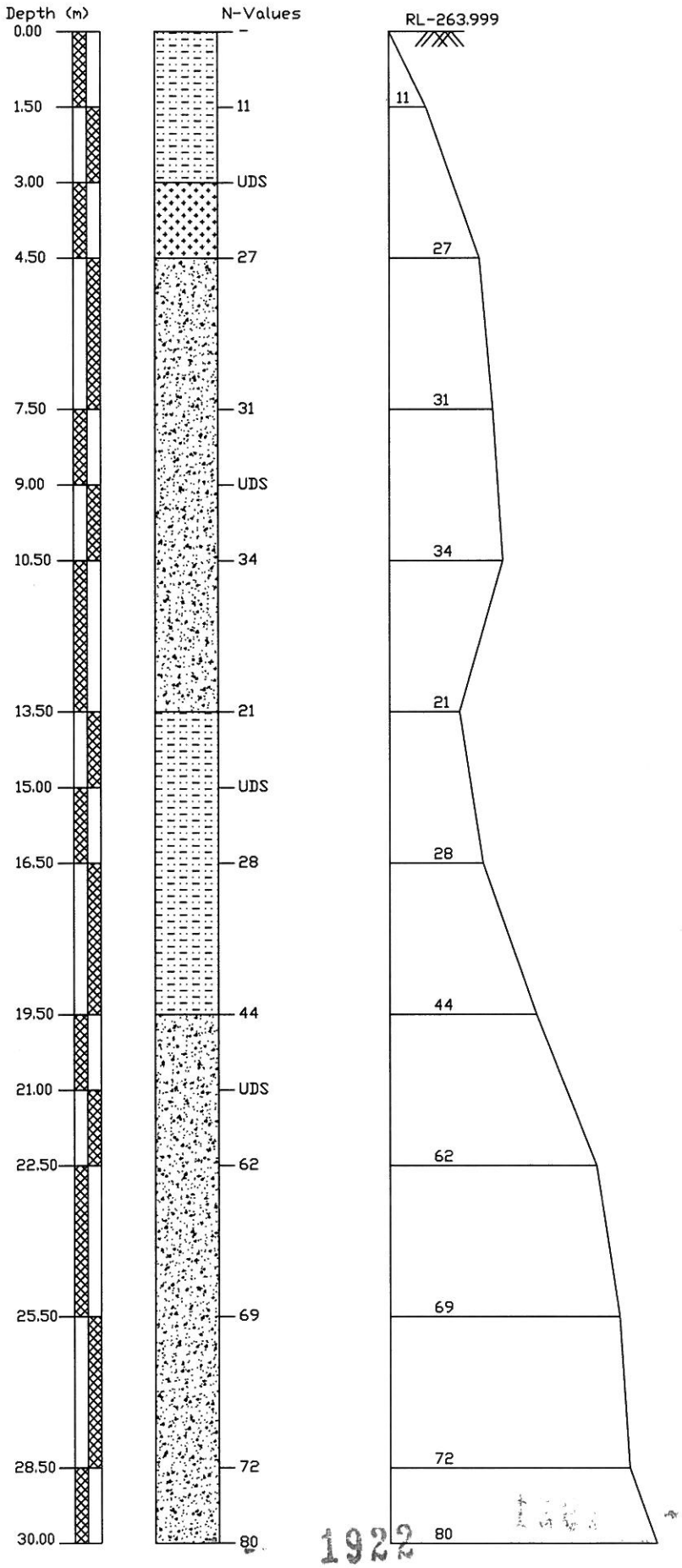
BORELOG OF BH–3(A2) AT EXISTING KM–304/2–4 FOR MAJOR BRIDGE NO.–344,
ON KESARI TO SANEHWAL, LUDHIANA



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LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SANDY SILT WITH CLAY
	SILTY SAND

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CHAPTER – 82

"Major Bridge No. 339",

Location – Existing Km. - 301/20-22

82.1 LOCATION OF STRUCTURE:

Proposed Major Bridge of Span 8x6.1

82.2 BOREHOLE DESCRIPTIONS:

(a) Location of Structure, Boreholes with RL shown in **FIGURE-1**.

(b) Subsurface Characteristic of Soil/Rock shown in *ANNEXURE-I.*

(c) Borelogs and sub soil profile shown in *ANNEXURE-II.*

(d) Calculations of Safe Bearing Capacities in *ANNEXURE-III.*

(e) Calculations of Probable Settlement in *ANNEXURE-IV.*

(f) Depth of water Table 21.70m below EGL.

Subsurface profile at the site

BOREHOLE No.	Depth (m)	Type of Soil/Rock	Soil/Rock Characteristics
BH-1(A1)	0.00 to 4.50	Clayey Silt with Sand	Loose
	4.50 to 6.00	Silty Sand	Medium Dense
	6.00 to 7.50	Clayey Silt with Sand	Medium Dense
	7.50 to 10.50	Sandy Silt	Medium Dense
	10.50 to 16.50	Silty Sand	Medium Dense
	16.50 to 25.50	Silty Sand	Dense
	25.50 to 30.00	Silty Sand	Very Dense
BH-2(P4)	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 3.00	Clayey Silt with Sand	Medium Dense
	3.00 to 7.50	Silty Sand	Medium Dense
	7.50 to 22.50	Silty Sand	Dense
	22.50 to 30.00	Silty Sand	Very Dense
BH-3(A2)	0.00 to 1.50	Clayey Silt with Sand	Loose
	1.50 to 4.50	Clayey Silt with Sand	Medium Dense
	4.50 to 6.00	Silty Sand	Medium Dense
	6.00 to 10.50	Clayey Silt with Sand	Medium Dense
	10.50 to 13.50	Silty Sand	Medium Dense
	13.50 to 25.50	Silty Sand	Dense
	25.50 to 30.00	Silty Sand	Very Dense

82.3 CHEMICAL ANALYSIS OF SOIL:

BOREHOLE		CHEMICAL PROPERTIES					
No.	Depth (m)	pH	Carbonate	Chlorides %	Sulphate %	Nitrate %	Salinity %
BH-1 (A1)	3.00	9.50	0.020	0.0035	NIL	0.0013	0.099
	6.00	9.10	0.012	0.0021	NIL	0.0013	0.038
	12.00	9.30	0.017	0.0017	NIL	0.0011	0.022
BH-2 (P4)	3.00	8.90	0.020	0.0028	NIL	0.0013	0.065
	6.00	9.20	0.012	0.0024	NIL	0.0013	0.031
BH-3 (A2)	3.00	9.00	0.030	0.0050	NIL	0.0014	0.111

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82.4 DIFFERENTIAL FREE SWELL INDEX (DFS)

Bore Hole No.	Depth (m)	DFS Index in %
BH-1 (A1)	3.00	14.00
	6.00	19.00
	12.00	NIL
BH-2 (P4)	3.00	NIL
	6.00	NIL
BH-3 (A2)	3.00	12.00
	6.00	20.00

82.5 CHEMICAL ANALYSIS OF ENCOUNTERED WATER FROM BOREHOLE

Chemical Properties	pH Value	Chlorides mg/lit	Sulphate mg/lit	Organic Matter mg/lit	Inorganic Matter mg/lit	Acidity (ml)	Alkalinity (ml)	Total Disso. Solids (ppm)	Conductivity (µS/cm)
Test Result	7.3	102	89	186	680	0.1	2.1	890	575
Requirment as per IS: 456 / Mosrth's	Not less then 6.0	2000 for CC and 500 for RCC	400	200	3000	5 ml of 0.02 normal NaoH	25 ml of 0.02 normal H_2SO_4	-	-

82.6 SAFE BEARING CAPACITY t/m2

BH -NO.	DEPTH (mtr)	Net Allowable Bearing Pressure (t/m^2)
BH-1 (A1)	1.50m	7.00
	3.00m	8.50
	4.50m	15.00
	6.00m	16.00
BH-3 (A2)	1.50m	6.00
	3.00m	9.50
	4.50m	13.00
	6.00m	14.00

82.7 PILE LOAD CARRYING CAPACITY

82.7.1 Normal Bored Cast in- situ Pile Foundations:

Normal bored cast in situ RCC pile foundation is envisaged for the proposed bridge and have been analysed in the subsequent paragraphs. The Axial load carrying capacity of Pile in Rock is determined as per IRC- 78: 2000 appendix-5.

The safe Load carrying capacities of piles have been worked out on the basis of IRC-78 as per provision/assumptions provided therein.. For calculating designed Capacity of pile recommendation of IS: 2911 should be followed. The minimum factor of safety on ultimate axial capacity should be as per clause 709.3.2 of IRC 78: 2000.The final design/construction of foundations, the safe /allowable load

carrying capacity of these piles should be taken by conducting actual initial load tests on these piles casted in the respective area.

Further the piles should have necessary structural strength to transmit/sustain the design load.

Pile load carrying capacity in t

BH -NO.	PILE DEPTH (mtr)	PILE CARRYING CAPACITY IN TONNE	
		Pile Diameter= 1.0 m	Pile Diameter= 1.2 m
BH-1 (A1)	17.00	140.00	190.00
	20.00	180.00	240.00
	23.00	230.00	300.00
BH-2 (P4)	17.00	120.00	160.00
	20.00	160.00	210.00
	23.00	200.00	250.00
BH-3 (A2)	17.00	120.00	160.00
	20.00	160.00	210.00
	23.00	200.00	260.00

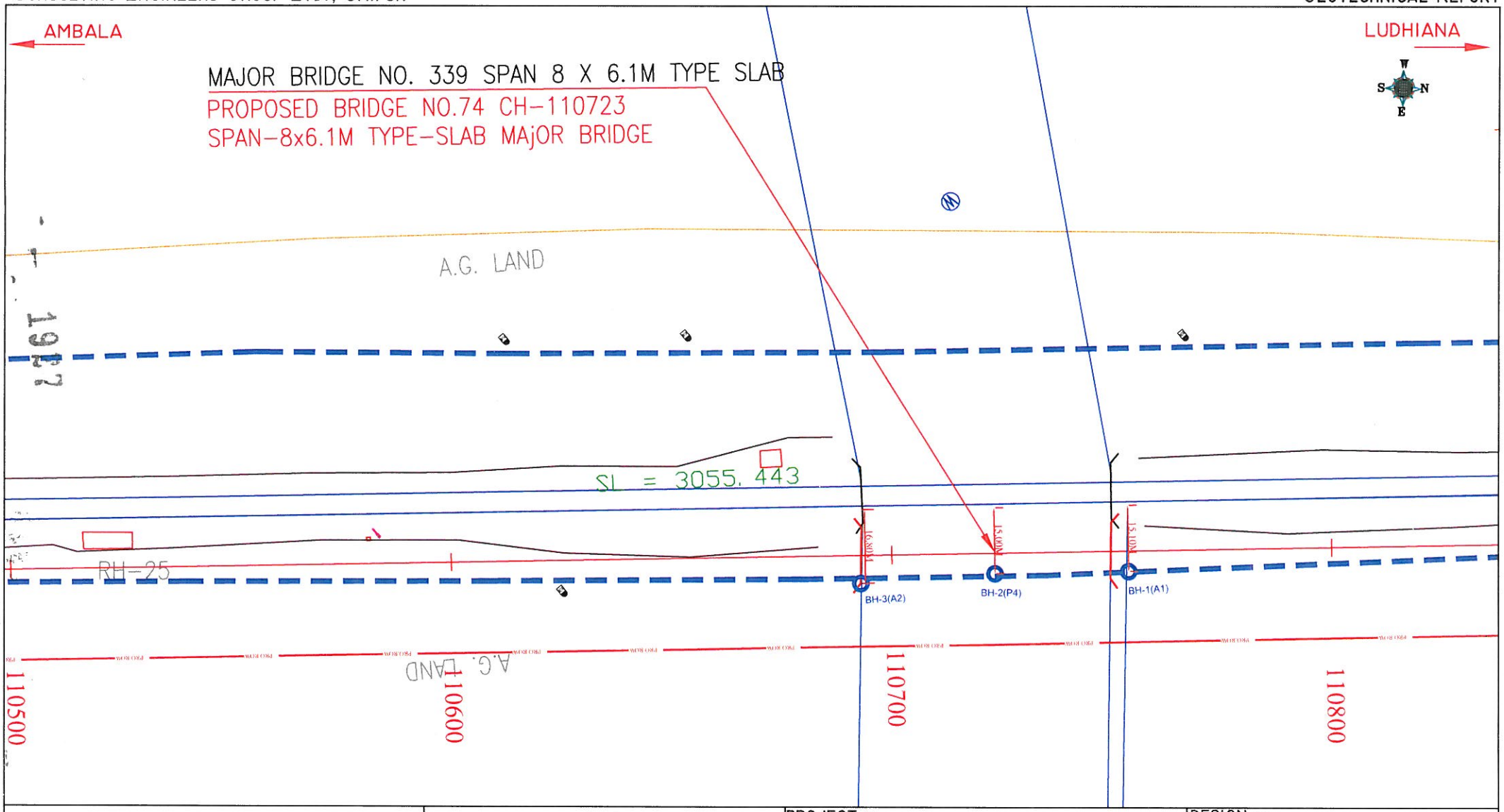
82.8 CONCLUSIONS

- Subsurface Profiles indicates suitable Soil formation for foundations.
- Chemical contents of Water are within the safe limits for construction purpose.

82.9 RECOMMENDATIONS

(i)	*Type of foundation*	Pile foundation

Note- The above recommendations are based on the field and laboratory tests conducted on the soil, and our experience in this regard. If the actual subsoil conditions during excavation for the foundation differ from the observations reported here, the design experts/consultants should be referred for suggestion, further investigations. However, the Depth and Type of foundation is to be decided by the structure designer depending upon the type of loading/structure and site conditions.



ALL DIMENSIONS IN METER

FIG.:-I

LOCATION PLAN OF PROPOSED MAJOR BRIDGE AT CH. 301/20-22

RL OF BH (A1) = 264.319
RL OF BH (P4) = 263.178
RL OF BH (A2) = 263.276

PROJECT :-

LUDHIANA-AMBALA (DFCCIL)

DESIGN :-

CONSULTING ENGINEERS GROUP LTD.
E-12,Moji Colony,Malviya Nagar Jaipur-17
Tel: +91-141- 2520899, 2521899, 2520556
Fax: 2521348, E-Mail: ceg@cegindia.com

SOIL CHARACTERISTICS OF BORE HOLE AT BH-1 (A1) OF MAJOR BRIDGE No. 339 AT CHAINAGE 301/20-22

Project :	Chainage 301/20-22 Bridge No. 339			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				14.06.2009 to 14.06.2009	A1	1	21.80 m.	30.00mtr	264.319

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey silt with sand	18.21	76.58	2.36	2.2	0.65	0	0	35	20	15	-	-	-	-	-	-
1.50	9	1.51	13.59	Clayey silt with sand	19.22	75.42	5.31	0.05	0.00	0.00	0.00	40	23	17	-	-	-	-	-	-
3.00	UDS	-	-	Clayey silt with sand	13.21	65.25	8.23	4.78	6.45	2.08	0.00	28	18	10	1.65	8.55	1.52	2.63	0.11	19.00
4.50	17	1.09	18.53	Silty sand	3.59	6.17	89.94	0.30	0.00	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Clayey silt with sand	17.11	64.95	16.68	0.28	0.09	0.89	0.00	34	20	14	1.76	8.43	1.62	2.64	0.17	16.00
7.50	13	0.92	11.96	Sandy silt	4.53	90.61	2.98	0.29	0.49	1.10	0.00	28	NIL	NP	-	-	-	-	-	-
10.50	19	0.80	15.20	Silty Sand	4.58	8.63	83.62	3.17	0.00	0.00	0.00	30	NIL	NP	-	-	-	-		-
12.00	UDS	-	-	Silty Sand	3.25	11.74	83.06	0.93	0.19	0.83	0.00	26	NIL	NP	1.82	10.36	1.65	2.67	0.00	27.50
13.50	23	0.71	16.33	Silty Sand	2.52	8.67	85.78	2.38	0.00	0.65	0.00	25	NIL	NP	-	-	-	-	-	-
16.50	38	0.64	24.32	Silty Sand	4.11	8.28	85.32	2.05	0.24	0.00	0.00	28	NIL	NP		-	-	-	-	-
19.50	44	0.59	25.96	Silty Sand	2.69	32.56	52.31	11.39	0.96	0.09	0.00	25	NIL	NP	-	-	-	-	-	-
22.50	48	0.54	20.46	Silty Sand	2.00	11.31	84.07	2.62	0.00	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
25.50	57	0.50	21.75	Silty Sand	2.00	11.61	83.77	2.15	0.28	0.19	0.00	24	NIL	NP	-	-	-	-	-	-
28.50	67	0.46	22.91	Silty Sand	2.16	16.32	78.68	2.19	0.21	0.44	0.00	25	NIL	NP	-	-	-	-	-	-
30.00	73	0.44	23.56	Silty Sand	2.34	14.74	80.94	1.98	0.00	0.00	0.00	24	NIL	NP	-	-	-	-	-	-

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1928

ANNEXURE - I

SOIL CHARACTERISTICS OF BORE HOLE AT BH-2 (P4) OF MAJOR BRIDGE No. 339 AT CHAINAGE 301/20-22

Project :	Chainage 301/20-22 Bridge No. 339			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				14.06.2009 to 14.06.2009	P4	2	22.0	30.00mtr	263.178

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Clayey silt with sand	12.26	55.78	20.36	6.29	3.16	2.15	0	30	20	10	-	-	-	-	-	-
1.50	12	1.51	18.12	Clayey silt with sand	13.58	60.61	14.21	6.40	4.01	1.19	0.00	32	21	11	-	-	-	-	-	-
3.00	UDS	-	-	Silty Sand	2.25	40.02	56.45	0.25	0.24	0.79	0.00	23	NIL	NP	1.64	5.29	1.56	2.65	0.00	26.00
4.50	27	1.10	29.70	Silty Sand	4.12	9.96	82.24	3.68	0.00	0.00	0.00	27	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Silty Sand	2.31	2.11	94.36	0.86	0.36	0.00	0.00	21	NIL	NP	1.76	8.59	1.62	2.65	0.00	27.50
7.50	36	0.92	33.12	Silty Sand	2.52	5.22	90.67	1.33	0.26	0.00	0.00	23	NIL	NP	-	-	-	-	-	-
10.50	39	0.81	31.59	Silty Sand	2.10	6.26	90.27	1.18	0.19	0.00	0.00	21	NIL	NP	-	-	-	-	-	-
13.50	42	0.72	30.24	Silty Sand	2.66	10.94	85.12	1.13	0.15	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
16.50	43	0.65	27.95	Silty Sand	3.26	5.46	87.44	3.70	0.14	0.00	0.00	25	NIL	NP		-	-	-	-	-
19.50	46	0.59	27.14	Silty Sand	4.26	11.23	81.11	3.29	0.11	0.00	0.00	27	NIL	NP	-	-	-	-	-	-
22.50	52	0.55	21.80	Silty Sand	3.66	5.17	87.53	3.51	0.13	0.00	0.00	26	NIL	NP	-	-	-	-	-	-
25.50	59	0.50	22.25	Silty Sand	2.50	4.27	90.57	2.44	0.22	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
28.50	73	0.47	24.66	Silty Sand	2.00	12.56	83.13	2.13	0.18	0.00	0.00	23	NIL	NP	-	-	-	-	-	-
30.00	75	0.45	24.38	Silty Sand	2.10	21.67	73.69	2.33	0.21	0.00	0.00	25	NIL	NP	-	-	-	-	-	-

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SOIL CHARACTERISTICS OF BORE HOLE AT BH-3 (A2) OF MAJOR BRIDGE No. 339 AT CHAINAGE 301/20-22

Project :	Chainage 301/20-22 Bridge No. 339			Date of Testing	Location at	B.H. No.	Depth of Water Table	Termination Depth	Surface Elevation
				13.06.2009 to 13.06.2009	A2	3	21.70 m.	30.00mtr	263.276

Depth	Observ-	Correction	Corrected	Soil	Grain Size Distribution % wt retained							Atterberg Limits %			B.D.	M.C.	D.D.	Specific	Shear Strength	
from	ed	Factor		Description	Clay	Silt	Sand			Gravel								Gravity	c kg/cm^2	ϕ
GL (m)	N	C_n	N_n	(Soil Group)			Fine	Medium	Coarse	Fine	Coarse	L.L.	P.L.	P.I.	gm/cc	%	gm/cc			degree
0.00	-	-	-	Cl;ayey silt with sand	23.15	62.71	10.25	3.21	0.68	0.00	0.00	40	20	20	-	-	-	-	-	-
1.50	10	1.52	15.20	Clayey silt with sand	26.59	61.42	8.90	2.36	0.73	0.00	0.00	43	19	24	-	-	-	-	-	-
3.00	UDS	-	-	Clayey silt with sand	10.11	62.91	25.55	0.80	0.47	0.16	0.00	26	19	7	1.61	5.89	1.52	2.64	0.08	22.00
4.50	15	1.11	16.65	Silty Sand	2.15	6.81	88.40	2.64	0.00	0.00	0.00	24	NIL	NP	-	-	-	-	-	-
6.00	UDS	-	-	Clayey silt with sand	16.88	57.74	13.26	6.28	2.55	3.29	0.00	33	19	14	1.63	6.23	1.53	2.63	0.15	19.00
7.50	19	0.94	17.86	Clayey silt with sand	17.11	57.13	11.26	7.08	3.85	3.57	0.00	32	18	14	-	-	-	-	-	-
10.50	22	0.82	18.04	Silty Sand	2.56	7.57	82.01	7.23	0.35	0.28	0.00	25	NIL	NP	-	-	-	-	-	-
13.50	30	0.74	22.20	Silty Sand	2.11	7.04	82.38	7.77	0.38	0.32	0.00	23	NIL	NP	-	-	-	-	-	-
16.50	35	0.67	23.45	Silty Sand	3.69	5.05	82.54	7.97	0.40	0.35	0.00	27	NIL	NP		-	-	-	-	-
19.50	39	0.62	24.18	Silty Sand	2.10	10.47	78.59	8.03	0.43	0.38	0.00	23	NIL	NP	-	-	-	-	-	-
22.50	46	0.57	20.61	Silty Sand	2.95	5.07	88.54	3.13	0.21	0.10	0.00	26	NIL	NP	-	-	-	-	-	-
25.50	50	0.53	20.75	Silty Sand	2.56	8.50	83.51	5.11	0.19	0.13	0.00	25	NIL	NP	-	-	-	-	-	-
28.50	62	0.49	22.69	Silty Sand	4.21	5.30	85.64	4.53	0.23	0.09	0.00	27	NIL	NP	-	-	-	-	-	-
30.00	74	0.47	24.89	Silty Sand	4.52	8.77	82.78	3.61	0.19	0.13	0.00	28	NIL	NP	-	-	-	-	-	-

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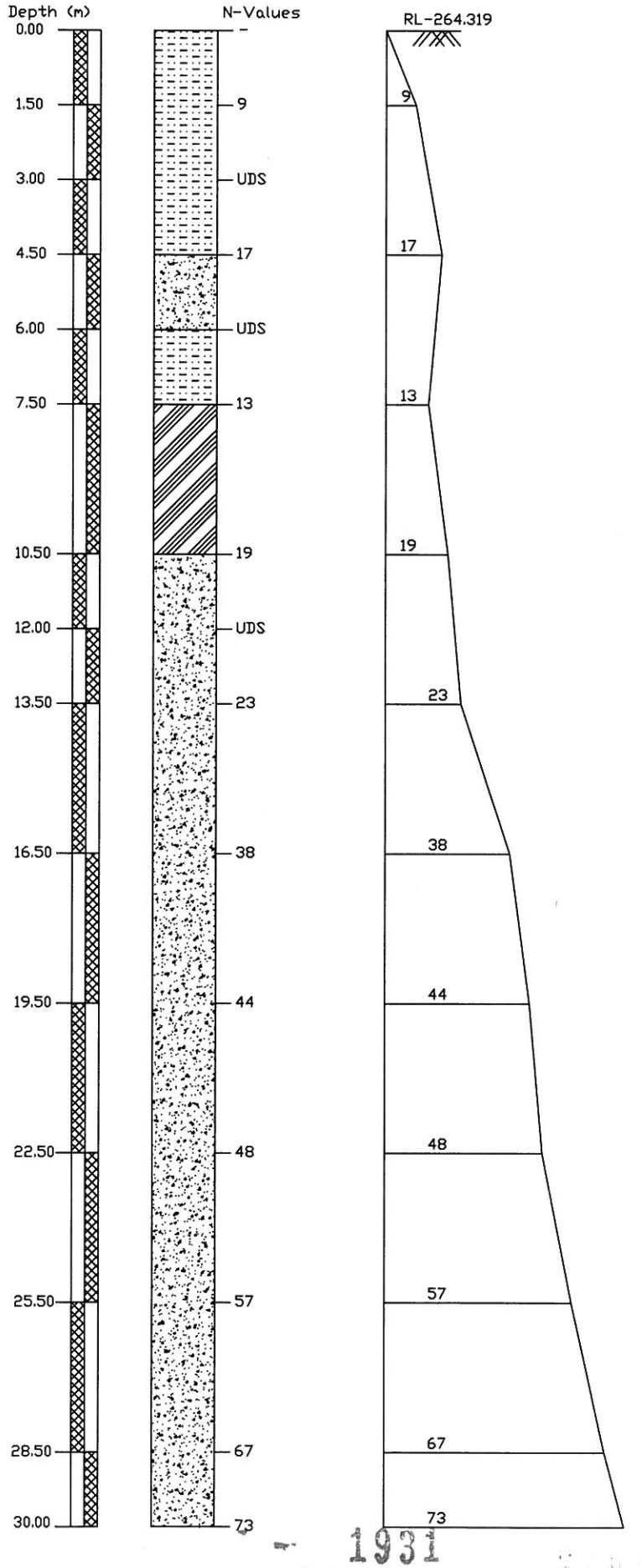
BORELOG OF BH–1(A1) AT EXISTING KM–301/20–22 FOR MAJOR BRIDGE NO.–339,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SILTY SAND
	SANDY SILT

1931

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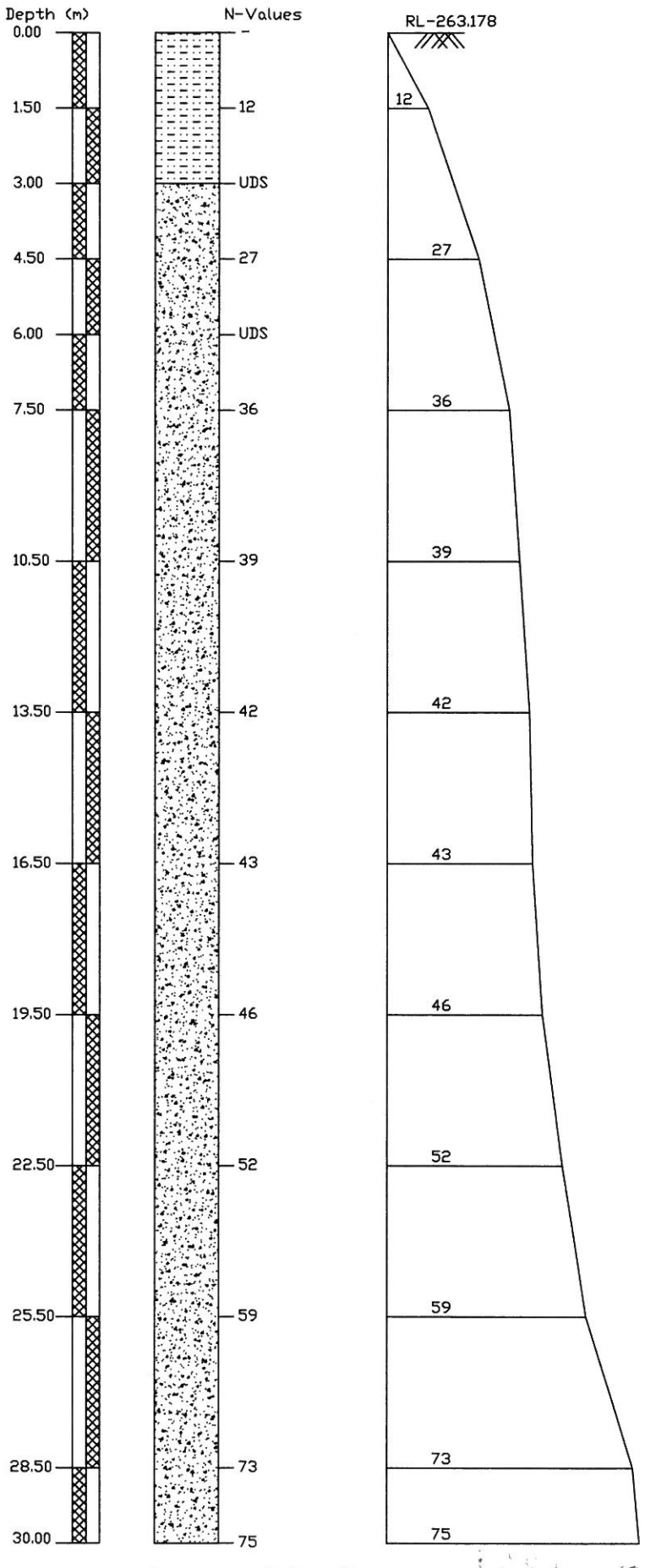
BORELOG OF BH–2(P4) AT EXISTING KM–301/20–22 FOR MAJOR BRIDGE NO.–339,
ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

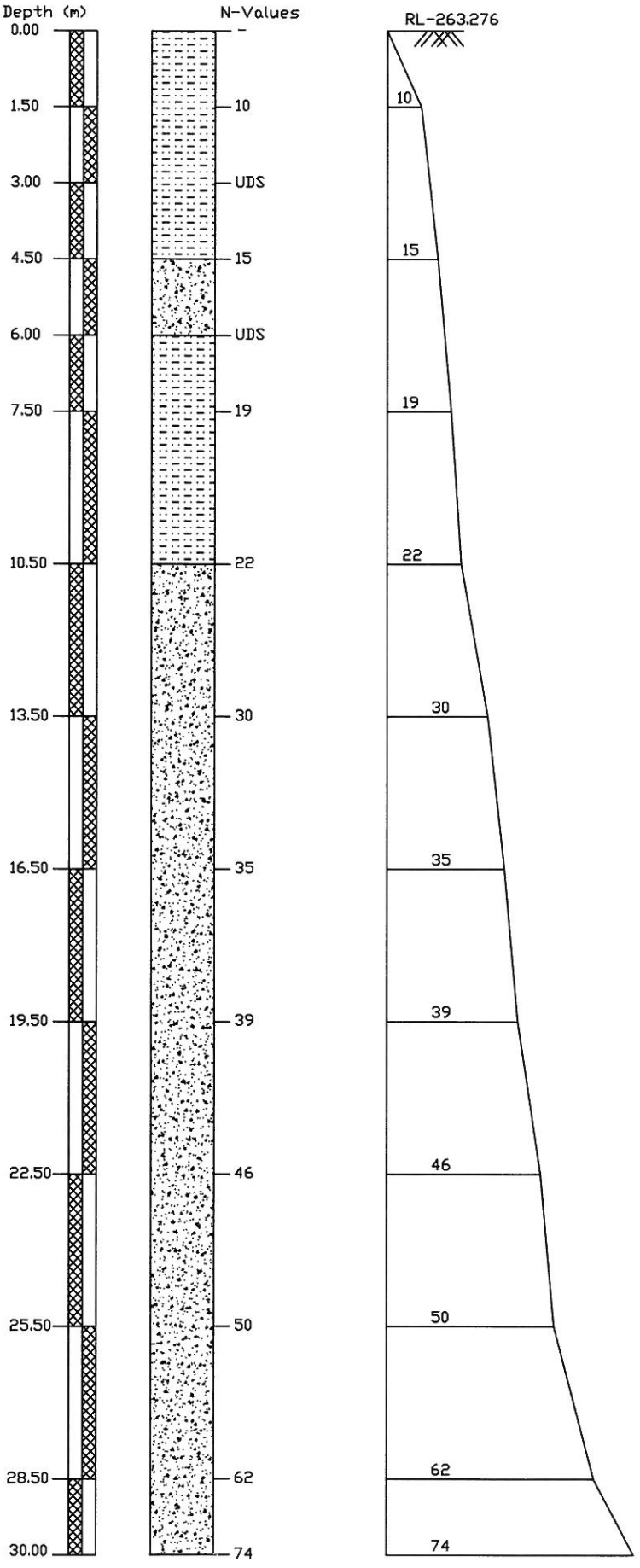
SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SILTY SAND

1932

CONSULTING Engineers Group Ltd.

BORELOG OF BH–3(A2) AT EXISTING KM–301/20–22 FOR MAJOR BRIDGE NO.–339,

ON KESARI TO SANEHWAL, LUDHIANA



LEGEND

SYMBOL	DESCRIPTION
	CLAYEY SILT WITH SAND
	SILTY SAND

1933

CONSULTING Engineers Group Ltd.