Ludhiana Gill Road

April 10, 2015

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA
Accredited by NBA (AICTE), New Delhi (ISO 9001:2000 Certified)
Testing & Consultancy Cell

email: tcc@gndec.ac.in   Phone: 0161-2491193

List of Faculty/Experts

Geotechnical	*Dr. J.N.Jha, Ph.D*
	Prof. Kulbir Singh Gill,M.E
	Dr. B.S.Walia, Ph.D.
	Prof. Harjinder Singh, M.E
	Prof. Gurdeepak Singh, M.Tech.
Structure	*Dr. Harpal Singh, Ph.D*
	Dr. Hardeep Singh Rai, Ph.D
	Prof. Harvinder Singh, M.Tech
	Dr. Jagbir Singh, Ph.D.
	Prof. Kanwarjit Singh Bedi, M.Tech.
	Prof. Parshant Garg, M.Tech
	Prof. Harpreet Kaur, M.Tech.
	Prof. Inderpreet Kaur, M.Tech.
Highway	*Prof. Kulbir Singh Gill, M.E*
Material Testing	*Dr. Jagbir Singh, Ph.D.*
	Prof. Kanwarjit Singh Bedi, M.Tech.
Material Testing	*Dr. Jagbir Singh, Ph.D.*
	Prof. Kanwarjit Singh Bedi, M.Tech.
Survey	*Dr. B.S.Walia, Ph.D.*
Chemical Testing	*Dr. R.P.Singh, Ph.D.*
Environmental Engg	*Prof. Puneet Pal Singh, M.E*

V-Bridge REPORT

1. **Date of Testing**   :   2015-04-10

2. **Type of Structure**   :   bridge

3. **Site location**   :   Latitude : 22 Longitude : 33

4. **Tested in Presence of**   :   5.6
     6.2

5. **Report Submitted to**   :   Seema
     Rajan
     Yadvir

6. **Report Prepared by**   :   Dr. J. N. Jha
     Prof. Kulbir Singh Gill
     Dr. B. S. Walia

1   Introduction

The soil investigation for the proposed **Ludhiana Gill Road** had been taken up on request of **Seema**, **Rajan**, **Yadvir** .The field soil investigation as per requirements was carried out on **2015-04-10** by testing team of this institution in the presence of **5.6**, **6.2** of the concerned department.

The purpose of this soil investigation was to determine the nature of the subsoil stratum and the safe net allowable bearing capacity of the soil.

2   Field Soil Investigation

1.3 bore holes were tested in the field Standard Penetration Test (S.P.T) was carried out at the proposed site for field soil investigation. The S.P. Test was carried out as per I.S. Code 2131-1981 in the soil deposits at the foundation level or at an interval of 1.5 m or at the location where change of soil strata takes place during the testing process. The samples of the soil both disturbed and tube samples were collected at different depths and were properly sealed in air-tight plastic bags after labelling them carefully to maintain the natural moisture content for laboratory testing.

3   Laboratory Testing

The various samples (disturbed and tube) collected during field soil investigation were tested in the laboratory (as per Standard Methods) for finding.

1. Grain size analysis and wet analysis

2. Atterberg's limits

3. Field moisture content

4. Bulk density

5. Direct/triaxial shear/Unconfined compression tests

4   Safe bearing capacity

As per I.S. Code 6403-1981, the least of the following shall be taken as safe net allowable bearing capacity of the soil.

1. The safe net allowable bearing capacity from shear considerations is obtained by dividing net ultimate bearing capacity by a suitable factor of safety.

2. The safe net allowable bearing pressure that can be imposed on the base of the foundation without the settlement exceeding a permissible value is calculated either from settlement analysis or from the Standard Penetration Test Values(N)whichever is applicable depending upon the nature of sub soil strata.

5   Underground Water Table

The underground (i.e. sub-soil) water was encountered at a depth 1.3 m at the time of field soil investigation.

5.1 CALCULATION OF SILT FACTOR

The silt factor was found from the average size of the bed particles for 1.4 m depth below the bed level of the.

SIEVE SIZE IN mm I	AVERAGE SIZE OF SIEVE II OPENING IN mm	PERCENTAGE MATERIAL RE-TAINED III	PRODUCT(II xIII)
1.180-0.600	0.8900	5.6	5.5
0.600-0.425	0.5125	6.2	6.1
0.425-0.300s	0.3625	6.9	6.8
0.300-0.150	0.2250	7.7	8.3
0.150-0.075	0.1125	9.2	9.1
(II xIII) = 1.9			

The average of bed particle size = m = $\frac{1.9}{100}$ = 2.0 mm

Silt factor = f= 1.76 $\sqrt{m}$ = 1.76 $\sqrt{2.0}$ = 2.1

5.2 Calculation of Depth of Foundation

The hydraulic data used in these calculations have been supplied by the department.

Discharge = Q = 2.2 cusec = 2.3 cumec.

Bed width of the 2.9 = B = 1.5 ft. = 2.4 m

Discharge per unit width = q = Q/B = $2.3/2.4$ = 2.6 cum/s

Normal depth of scour = R = 1.35 $[(\frac{1.5}{2.1})^2]^{1/3}$ = m

Maximum depth of scour = 2R = 2 x = 2.8 m

Depth of foundation from full supply level = $4/3 x 2.8$ = 2.9 m

Full supply depth = y = 3.0 ft. = 3.1 m

Depth of foundation from bed level of the 1.5 = 2.9 - 3.0 = 3.2 m, Say = 3.3 m.

6 Proposed Structure

The substructure i.e. foundation of the proposed Bridge is taken in the form of 1.6 foundation to be laid at a depth of 3.4 m below bed level of the 1.5 . The least soil properties have been taken for calculating the bearing capacity of soil for the following types of foundation.

6.1 Foundation

Depth of 1.6 foundation below the bed level of the 1.5 , Df = 3.4 m
Size of 1.6 foundation = 3.5 m x 3.6 m
Length of 1.6 foundation, L = 3.5 m
Width of 1.6 foundation, B = 3.6 m

The data obtained from the field soil investigation and the laboratory tests have been used in the preparation of this report.

7 Bearing Capacity Calculations

7.1 Bearing Capacity Based on Shear Considerations

(As per I.S.Code - 6403:1981)

7.2 Foundation

Depth of 1.6 foundation below the bed level of the 1.5 , Df	=	3.4	m
Size of 1.6 foundation	=	3.5 m x 3.6	m
Length of 1.6 foundation, L	=	3.5	m
Width of 1.6 foundation, B	=	3.6	m

The soil properties at the foundation level i.e. at 1.67 m depth are:

$$\gamma \quad = \quad 3.7 \text{ kN}/m^3 \ , \quad c = \quad 3.8 \ \text{kN}/m^2$$
$$\phi \quad = \quad 3.9 \ ° \ , \qquad \phi' = \quad 4.1 \ °$$

Bearing Capacity factors are:

$$\text{Nc'} \quad = \quad 4.1 \ , \text{Nq'} \quad = \quad 4.2 \quad \text{and} \quad N\gamma' \quad = \quad 4.3$$

Shape factors are:

$$\text{Sc} \quad = \quad \text{Sq} \quad = \quad 4.4 \ \text{S}\gamma \quad = \quad 4.5$$

Depth factors are:

dc = 4.6 , dq = d
= 4.7

Water table correction factor, w' = 4.8

Ultimate net bearing capacity, q_u' = 0.67 x x 4.1 x 4.4 x 4.6 + 3.7 x 3.4 x(1 - 4.2) x 4.4 x 4.7
+0.5 x 3.7 x 2.4 x 4.7 x 4.8
= 4.9 = kN/m^2

Safe net allowable bearing capacity = $q'_u/2.5 = /2.5 = \text{kN}/m^2$

8 Bearing Capacity Based on Standard Penetration Test Value

(As per I.S. Code -6403:1981)

Sr No.	Depth(m)	Overburden pressure (kN/m²)	Correction Factor	Observesd Value of N	Corrected Value of N
1	5.7	5.7	5.8	5.9	6.0
2	6.3	6.4	6.5	6.6	6.7
3	7.1	7.2	7.3	7.4	7.5
4	7.8	7.9	8.0	8.1	8.2
5	8.5	8.6	8.7	8.8	8.9
6	9.3	9.4	9.5	9.6	9.7
7	1.3	1.4	1.5	1.6	1.7

Depth of 1.6 foundation below the bed level of the 1.5 , Df = 3.4 m
Width of 1.6 foundation, B = 2.4 m

Safe net allowable bearing pressure for
B   =   2.4 , N   =   5.3 , S   =   5.3 & w' =   4.8]   =   5.4 kN/m^2
Taking least of A & B the safe net allowable bearing capacity   =   5.5 kN/m^2

The safe gross allowable bearing capacity for 1.6 foundation 3.5 m x 2.4 m size at depth of 3.4 m below the bed level of the 1.5 is 5.6 kN/m2.

9   Remarks:

1. The bore hole log showing the nature of sub-soil stratum along with standard penetration test values(N) at different depths & laboratory test results is attached.

2. The safe **Net** allowable bearing capacity for 1.6 foundation of size 3.5 m x 2.4 m at depth of 3.4 m below the bed level of the is 1.5 kN/m^2 is 5.5 .

3. The safe Gross allowable bearing capacity for 1.6 foundation of size 3.5 m x 2.4 m at depth of 3.4 below the bed level of the is 1.5 kN/m^2 5.6 .

4. The value of silt factor is 2.1 upto a depth of 1.4 m below bed level of the .

(Dr. B. S. Walia)
Associate Professor
Civil Engg. Department

(Prof. Kulbir Singh Gill)
Associate Professor
Civil Engg. Department

(Dr. J. N. Jha)
H.O.D., Civil Engg. Department

(Dr. H. S. Rai)
Dean Testing & Consultancy