

Construction of Boundary Wall at Gurudwara
Sahib,Kapurgarh,Amlah,Distt. Fatehgarh Sahib

February 5, 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.

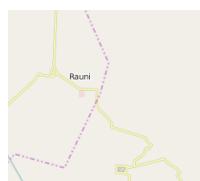
Environmental Engg

Prof. Puneet Pal Singh, M.E

SOIL INVESTIGATION REPORT

1. **Date of Testing** : 14.01.2015
2. **Type of Structure** : Boundary Wall
3. **Site location** : Latitude : 30.56529 Longitude : 76.11579

4. **Map**



5. **Tested in Presence of** : S.Harbhajan Singh
S.Baljeet Singh, Garanhi
6. **Report Submitted to** : Manager
Gurudwara Sahib
Kapurgarh, Amloh Distt. Fatehgarh Sahib
7. **Report Prepared by** : Dr. J. N. Jha
Prof. Kulbir Singh Gill
Dr. B. S. Walia

1 Introduction

The soil investigation for the proposed Construction of Boundary Wall at Gurudwara Sahib, Kapurgarh, Amloh, Distt. Fatehgarh Sahib had been taken up on request of Manager Gurudwara Sahib Kapurgarh, Amloh Distt. Fatehgarh Sahib. The field soil investigation as per requirements was carried out on 14.01.2015 by testing team of this institution in the presence of S. Harbhajan Singh & S. Baljeet Singh, Garanthi 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

Four bore holes were tested in the field Standard Penetration Test (S.P.T) was carried out at the proposed site as per I.S. Code 2131-1981 in the soil deposits at the foundation level and at an interval of 1.5 m or at the location where change of soil strata takes place during field testing. 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.

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. Atterberg's limits
6. 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 structure.

5 Water Table

The underground (i.e. sub-soil) water was encountered at a depth 0.6 m at the time of field soil investigation.

6 Proposed Substructure

The substructures i.e. foundations of the proposed Building may be taken as wall footing and isolated column foundation. The least soil properties have been taken for calculating the bearing capacity of soil for the following types of foundations.

1. Wall Foundation

$$\begin{array}{lll} \text{Depth of wall foundation, } D_f & = & 1.5\text{m} \\ \text{Width of wall foundation, } B & = & 1.0\text{m} \end{array}$$

2. Column Foundation

$$\begin{array}{lll} \text{Depth of column foundation, } D_f & = & 1.0\text{m} \\ \text{Size of column foundation} & = & 2.0\text{m} \times 2.0\text{m} \times 2.0\text{m} \\ \text{Length of column foundation, } L & = & 2.0\text{m} \\ \text{Width of column foundation, } B & = & \end{array}$$

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 Wall Foundation

$$\begin{array}{lll} \text{Depth of wall foundation, } D_f & = & 1.5\text{m} \\ \text{Width of wall foundation, } B & = & 1.0\text{m} \end{array}$$

The least soil properties at the foundation level i.e. at 1.5 m depth are:

$$\begin{array}{lll} \gamma & = & 16.8\text{kN}/\text{m}^3, \quad c = 6.0\text{ kN}/\text{m}^2 \\ \phi & = & 24^\circ, \quad \phi' = 16.6^\circ \end{array}$$

Bearing Capacity factors are:

$$N_{c'} = 12.31, N_{q'} = 4.73 \quad \text{and} \quad N_{\gamma'} = 3.53$$

Shape factors are:

$$S_c = 1.0 \quad S_q = 1.0 \quad S_\gamma = 1.0$$

Depth factors are:

$$d_c = 1.40, d_q = d_\gamma = 1.20$$

Water table correction factor, $w' = 1.0$

$$\begin{aligned} \text{Ultimate net bearing capacity, } q_u' &= 0.67 \times 6.0 \times 12.31 \times 1.0 \times 1.40 + 16.8 \times 1.5 \times 3.73 \times 1.0 \times 1.20 \\ &+ 0.5 \times 16.8 \times 1.0 \times 3.53 \times 1.0 \times 1.20 \times 1.0 \\ &= 68.35 + 111.69 + 35.11 = 215.15 \text{ kN}/\text{m}^2 \end{aligned}$$

$$\text{Safe net allowable bearing capacity} = q_u' / 2.5 = 215.15 / 2.5 = \underline{86.06 \text{ kN}/\text{m}^2}$$

7.3 Column Foundation

Depth of column foundation, D_f = 3
 Size of column foundation = 4 x 5
 Length of column foundation, L = 5
 Width of column foundation, B = T

he least soil properties at the foundation level i.e. at 3.5 m depth are:

$$\begin{aligned}\gamma &= 16.8 \text{ kN/m}^3, & c &= 6.0 \text{ kN/m}^2 \\ \phi &= 24^\circ, & \phi' &= 16.6^\circ\end{aligned}$$

Bearing Capacity factors are:

$$N_c' = 12.31, N_q' = 4.73 \quad \text{and} \quad N_{\gamma}' = 3.53$$

Shape factors are:

$$S_c = 1.0 \quad S_q = 1.0 \quad S_{\gamma} = 1.0$$

Depth factors are:

$$d_c = 1.40, d_q = d_{\gamma} = 1.20$$

Water table correction factor, $w' = 1.0$

Ultimate net bearing capacity, $q_u' = 0.67 \times 6.0 \times 12.31 \times 1.0 \times 1.40 + 16.8 \times 1.5 \times 3.73 \times 1.0 \times 1.20 + 0.5 \times 16.8 \times 1.0 \times 3.53 \times 1.0 \times 1.20 \times 1.0$

$$= 68.35 + 111.69 + 35.11 = 215.15 \text{ kN/m}^2$$

$$\text{Safe net allowable bearing capacity} = q_u' / 2.5 = 215.15 / 2.5 = 86.06 \text{ kN/m}^2$$

8 Bearing Capacity Based on Standard Penetration Test Value

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

Sr No.	Depth(m)	Overburden pressure (kN/m ²)	Correction Factor	Observed Value of N	Corrected Value of N
1	3.5	29	1.36	03	04.80
1	3.5	29	1.36	03	04.80
1	3.5	29	1.36	03	04.80
1	3.5	29	1.36	03	04.80
1	3.5	29	1.36	03	04.80
1	3.5	29	1.36	03	04.80

1.

Depth of wall foundation, D_f = 1.5m

Width of wall foundation, B = 1.0m

Safe net allowable bearing pressure for

$$B = 1.0 \text{ m}, N = 7.00, S = 0.04 \text{ m} \quad \& \quad w' = 1.0 \quad] = 93.58 \text{ kN/m}^2$$

Taking least of A & B the safe net allowable bearing capacity = 86.06 kN/m²

The safe gross allowable bearing capacity = 111.26 kN/m²

2.

Depth of wall foundation, D_f = 1.0m

Width of wall foundation, B = 2.0m

Safe net allowable bearing pressure for

B = 2.0m, N = 7.21, S = 0.04m & $w' = 1.0$] = 77.19 kN/m²

Taking least of A & B the safe net allowable bearing capacity = 77.19 kN/m²

The safe gross allowable bearing capacity = 102.39 kN/m²

9 Remarks:

1. The bore hole logs showing the nature of subsoil stratum alongwith standard penetration test values(N) at different depths and soil properties from laboratory test results are attached.
2. The safe **net** allowable bearing capacity for wall foundation 3.0 m wide at a depth of 3.5 m from the existing surface is 86.06 kN/m²
3. The safe **gross** allowable bearing capacity for wall foundation 3.0 m wide at a depth of 3.5 m from the existing surface is 111.26 kN/m²
4. The safe **net** allowable bearing capacity for column foundation of size 3.0 x3.0 m at a depth of 3.5 m from the existing surface is 77.19 kN/m²
5. The safe **gross** allowable bearing capacity for column foundation of size 3.0 m x3.0 m at a depth of 3.5 m from the existing surface is 102.39 kN/m²
6. The sub-soil water was encountered at the time of field soil investigation

(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