

Construction of Auditorium Building at Baba Banda
Bahadur College of Nursing, Faridkot

February 5, 2015

GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA
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SOIL INVESTIGATION REPORT

1. **Date of Testing** : 13.04.2011
2. **Type of Structure** : Building
3. **Site location** : Latitude : 31.4177 Longitude : 75.9539

4. **Map**

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5. **Tested in Presence of** : Sh. Puneet Inder Bawa, Chairman
Sh. Ramesh Kumar, Superwiser
6. **Report Submitted to** : Sh. Puneet Inder Bawa, Chairman
Sh. Ramesh Kumar, Superwiser
7. **Report Prepared by** : Dr. J. N. Jha
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Dr. B. S. Walia

1 Introduction

The soil investigation for the proposed Construction of Auditorium Building at Baba Banda Bahadur College of Nursing, Faridkot had been taken up on request of Chairman, Baba Banda Bahadur College of Nursing, Vire Wala Road, Faridkot. The field soil investigation as per requirements was carried out on 13.04.2011 by testing team of this institution in the presence of Sh. Puneet Inder Bawa, Chairman, Sh. Ramesh Kumar, Superwiser 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

Three 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

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.

4 Water Table

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

5 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

$$\begin{array}{lll} \text{Depth of wall foundation, } D_f & = & 2 \\ \text{Width of wall foundation, } B & = & 3 \end{array}$$

2. Column Foundation

$$\begin{array}{lll} \text{Depth of column foundation, } D_f & = & 3\text{m} \\ \text{Size of column foundation} & = & 4.5\text{m} \times 3.5\text{m} \\ \text{Length of column foundation, } L & = & 3.5\text{m} \\ \text{Width of column foundation, } B & = & 3.5\text{m} \end{array}$$

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

6 Bearing Capacity Calculations

6.1 Bearing Capacity Based on Shear Considerations

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

6.2 Wall Foundation

$$\begin{array}{ll} \text{Depth of wall foundation, } D_f & = 3.5\text{m} \\ \text{Width of wall foundation, } B & = 3.0\text{m} \end{array}$$

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

$$\begin{array}{ll} \gamma & = 2\text{kN}/m^3, \quad c = 4 \text{ kN}/m^2 \\ \phi & = 5^\circ, \quad \phi' = 6^\circ \end{array}$$

Bearing Capacity factors are:

$$N_c' = 15.3, N_q' = 15.4 \quad \text{and} \quad N_{\gamma'} = 16.4$$

Shape factors are:

$$S_c = 3.3 \quad S_q = 4.3 \quad S_{\gamma} = 3.3$$

Depth factors are:

$$d_c = 3, d_q = d_{\gamma} = 4$$

Water table correction factor, $w' = 0.5$

$$\begin{aligned} \text{Ultimate net bearing capacity, } q_u' &= 0.67 \times 0.5 \times 15.26 \times 1.3 \times 1.38 + 17.66 \times 3.5 \times (1 - 0.672) \times 1.3 \\ &\times 1.19 + 0.5 \times 17.66 \times 3.0 \times 5.79 \times 1.3 \times 1.19 \times 0.5 \\ &= 9.03 + 504.87 + 73.0 = 586.90 \text{ kN}/m^2 \end{aligned}$$

$$\text{Safe net allowable bearing capacity} = q_u'/2.5 = 586.90/2.5 = 234.76 \text{ kN}/m^2$$

6.3 Column Foundation

$$\begin{array}{ll} \text{Depth of column foundation, } D_f & = 3 \\ \text{Size of column foundation} & = 4 \times 5 \\ \text{Length of column foundation, } L & = 5 \\ \text{Width of column foundation, } B & = T \end{array}$$

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

$$\begin{array}{ll} \gamma & = 3\text{kN}/m^3, \quad c = 4 \text{ kN}/m^2 \\ \phi & = 5^\circ, \quad \phi' = 5^\circ \end{array}$$

Bearing Capacity factors are:

$$N_c' = 3, N_q' = 5 \quad \text{and} \quad N_{\gamma'} = 6$$

Shape factors are:

$$S_c = 4 \quad S_q = 5 \quad S_{\gamma} = 6$$

Depth factors are:

$$dc = 4, dq = d\gamma = 5$$

Water table correction factor, $w' = 0.5$

Ultimate net bearing capacity, $q'_u = 0.67 \times 0.5 \times 15.26 \times 4 + 17.66 \times 3.5 \times (1 - 0.72) \times 4 + 0.5 \times 17.66 \times 3.0 \times 5.79 \times 4 \times 0.5$

$= 44.81 \text{ kN/m}^2 = \text{Safe net allowable bearing capacity} = q'_u / 2.5 = 17.92 \text{ kN/m}^2$

7 Bearing Capacity Based on Standard Penetration Test Value

The result of concrete cubes sent by you tested on 29.10.11 are as under:

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, $D_f = 4$

Width of wall foundation, $B = 5$

Safe net allowable bearing pressure for

$B = 6, N = 4, S = 3 \text{ \& } w' = 3] = 4 \text{ kN/m}^2$

Taking least of A & B the safe net allowable bearing capacity $= 3 \text{ kN/m}^2$

The safe gross allowable bearing capacity $= 5 \text{ kN/m}^2$

2.

Depth of wall foundation, $D_f = 4$

Width of wall foundation, $B = 5$

Safe net allowable bearing pressure for

$B = 6, N = 4, S = 3 \text{ \& } w' = 3] = 4 \text{ kN/m}^2$

Taking least of A & B the safe net allowable bearing capacity $= 3 \text{ kN/m}^2$

The safe gross allowable bearing capacity $= 5 \text{ kN/m}^2$

8 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 $4 \text{ kN}/m^2$
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 $5 \text{ kN}/m^2$
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 $6 \text{ kN}/m^2$
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 $8 \text{ kN}/m^2$
6. The sub-soil water was encountered at a depth 9 m investigation. at the time of field soil

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