

**GURU NANAK DEV ENGINEERING COLLEGE, LUDHIANA**

*Accredited by NBA (AICTE), New Delhi (ISO 9001:2000 Certified)*

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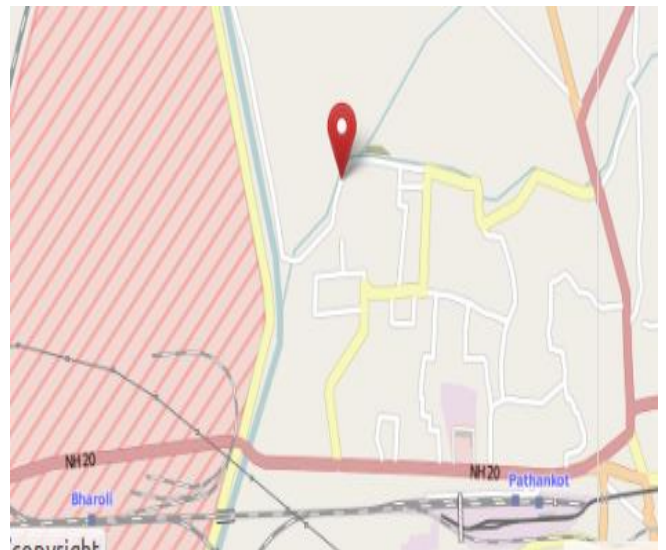
# SOIL INVESTIGATION REPORT

1. **Date of Testing** : *11.06.2015 to 13.06.2015*

2. **Type of Structure** : *Bridge*

3. **Site location** : *Latitude : 32.28413 Longitude : 75.63406*

4. **Map** :



5. **Tested in Presence of** : *S. Gurmeet Singh, AGM, Ansal City*

6. **Report Submitted to** : *AGM  
Ansal City  
Pathankot*

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

# Construction of Bridge to APOCH Ansal City, Near Abrol Nagar, Pathankot

## **Introduction**

The soil investigation for the proposed **Construction of Bridge to APOCH Ansal City, Near Abrol Nagar, Pathankot** had been taken up on request of **AGM, Ansal City, Pathankot**. The field soil investigation as per requirements was carried out on **11.06.2015 to 13.06.2015** by testing team of this institution in the presence of **S. Gurmeet Singh, AGM, Ansal City** 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.

## **Field Soil Investigation**

Two 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.

## **Laboratory Testing**

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

- (i) Grain size analysis and wet analysis
- (ii) Atterberg's limits
- (iii) Field moisture content
- (iv) Bulk density
- (v) Direct/ triaxial shear/Unconfined compression tests

## **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.

- (i) The safe net allowable bearing capacity from shear considerations is obtained by dividing net ultimate bearing capacity by a suitable factor of safety.
- (ii) 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.

## **Water Table**

The underground (i.e. sub-soil) water was encountered at a depth 4.5 m at the time of field soil investigation.

.....2/-

## CALCULATION OF SILT FACTOR

The silt factor was found from the average size of the bed particles for 10.0 m depth below the bed level of the drain.

SIEVE SIZE IN mm I	AVERAGE SIZE OF SIEVE OPENING IN mm II	PERCENTAGE MATERIAL RETAINED III	PRODUCT (II xIII)
19 -10	14.50	08	116.0
10 -4.75	7.37	10.5	77.38
4.75 -2.36	3.55	12	42.60
2.36 -1.180	1.77	12.5	22.12
1.180-0.600	0.8900	10	8.90
0.600-0.425	0.5125	9.5	4.87
0.425-0.300	0.3625	10	5.44
0.300-0.150	0.2250	15	4.50
0.150-0.075	0.1125	10	1.12
0.075	0.0375	2.5	0.090
(II xIII) =			283.02

The average of bed particle size =  $m = 283.02/100 = 2.83$  mm

Silt factor =  $f = 1.76\sqrt{m} = 1.76\sqrt{2.83} = 2.96$

### Calculation of Depth of Foundation

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

Discharge =  $Q = 16025$  cusec = 432.67 cumec.

Bed width of the drain =  $B = 39.8$  m

Discharge per unit width =  $q = \frac{Q}{B} = \frac{432.67}{39.8} = 10.87$  cum/s

Normal depth of scour =  $R = 1.35 \left[ \frac{(10.87)^2}{2.96} \right]^{1/3} = 4.56$  m

Maximum depth of scour =  $2R = 2 \times 4.56 = 9.12$  m

Depth of foundation from full supply level =  $\frac{4}{3} \times 9.12 = 12.13$  m

Full supply depth =  $y = 2.5$  m

Depth of foundation from bed level of the drain =  $12.13 - 2.5 = 9.63$  m, Say = 10.0 m.

### Proposed Substructure

The substructure i.e. foundation of the proposed Bridge is taken in the form of well foundation to be laid

at a depth of 13.0 m (As desired by designer) below bed level of the drain. The least soil properties have been taken for calculating the bearing capacity of soil for the following types of foundation.

.....3/-

-:3:-

### Well Foundation

Depth of well foundation below the bed level of the drain,  $D_f = 13.0$  m (As desired by designer)

Size of well foundation = 13.0 m x 6.5 m

Length of well foundation,  $L = 13.0$  m

Width of well foundation,  $B = 6.5$  m

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

### Bearing Capacity Calculations

#### (A) Bearing Capacity Based on Shear Considerations

Refer I.S. Code - 6403-1981

### Well Foundation

Depth of well foundation below the bed level of the drain,  $D_f = 13.0$  m (As desired by designer)

Width of well foundation =  $B = 6.5$  m

The soil properties at the foundation level i.e. at 13.0 m below the bed level are:

$\gamma = 19.5$  kN/m<sup>3</sup>,  $c = 0.0$  kN/m<sup>2</sup>

$\phi = 30^\circ$ ,  $\phi' = 21.10^\circ$

Bearing Capacity factors are:

$N_c' = 16.60$ ,  $N_q' = 7.34$  and  $N_\gamma' = 6.60$

Shape factors are:

$S_c = S_q = 1.10$   $S_\gamma = 0.80$

Depth factors are:

$d_c = 1.53$ ,  $d_q = d_\gamma = 1.27$

Water table correction factor,  $w' = 0.5$  (submerged case)

Ultimate net bearing capacity,  $q_u' = 0.67 \times 0.0 \times 16.60 \times 1.10 \times 1.53 + 19.5 \times 13.0 \times 6.34 \times 1.10 \times 1.27 + 0.5 \times 19.5 \times 6.5 \times 6.60 \times 1.10 \times 1.27 \times 0.5 = 2245.24 + 212.48 = 2457.73$  kN/m<sup>2</sup>

Safe net allowable bearing capacity =  $q_u'/2.5 = 2457.73/2.5 = 983.09$  kN/m<sup>2</sup> ..... (a)

#### (B) Bearing Capacity Based on Standard Penetration Test Value(N)

Refer I.S. Code -6403, 1981

S.No.	Depth (m)	Overburden pressure (kN/m <sup>2</sup> )	Correction factor	Observed value of N	Corrected value of N
1	13.0	192.65	0.78	36	28.08
2	15.0	206.90	0.76	38	28.88

3	16.5	221.15	0.74	39	28.86
4	18.0	235.40	0.72	41	29.80
5	19.5	249.65	0.695	43	29.88

.....4/-

:-4:-

Depth of well foundation below the bed level of the drain,  $D_f = 13.0$  m

Width of well foundation,  $B = 6.5$  m

Safe net allowable bearing pressure for

$$B = 6.5 \text{ m, } N = 29.04, \text{ } S = 0.06 \text{ m \& } w' = 0.5 \text{ ] } = \underline{295.94 \text{ kN/m}^2} \text{ .....(a)}$$

Taking least of (a) & (b), the safe net allowable bearing capacity =  $\underline{295.94 \text{ kN/m}^2}$

The safe gross allowable bearing capacity for well foundation  $13.0 \text{ m} \times 6.5 \text{ m}$  size at depth of  $13.0 \text{ m}$  below the bed level of the drain is  $\underline{427.94 \text{ kN/m}^2}$ .

## REMARKS

- (i) 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.
- (ii) The safe **Net** allowable bearing capacity for well foundation of size  $13.0 \text{ m} \times 6.5 \text{ m}$  at depth of  $13.0 \text{ m}$  below the bed level of the drain is  $\underline{295.94 \text{ kN/m}^2}$ .
- (iii) The safe **Gross** allowable bearing capacity for well foundation of size  $13.0 \text{ m} \times 6.5 \text{ m}$  at depth of  $13.0$  below the bed level of the drain is  $\underline{427.94 \text{ kN/m}^2}$ .
- (iv) The value of silt factor is 2.96 upto a depth of  $10.0 \text{ m}$  below bed level of the drain.
- (v) The sub-soil water table was encountered at a depth  $4.5 \text{ m}$  at the time of field soil investigation.

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**(Dr. Kulbir Singh Gill)**  
**Assistant Professor**  
**Civil Engg. Department**

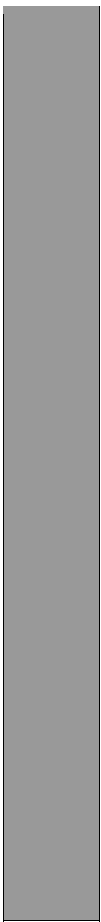
**(Dr. J. N. Jha)**  
**H.O.D., Civil Engg. Department**

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





Sand (SP)



-

-

19.5

11.8

-

89

11

-

0.0

30<sup>0</sup>

30

Refu

36

38

39

41

43

19.5

18

16.5

15

13.5

12

10.5

12.0

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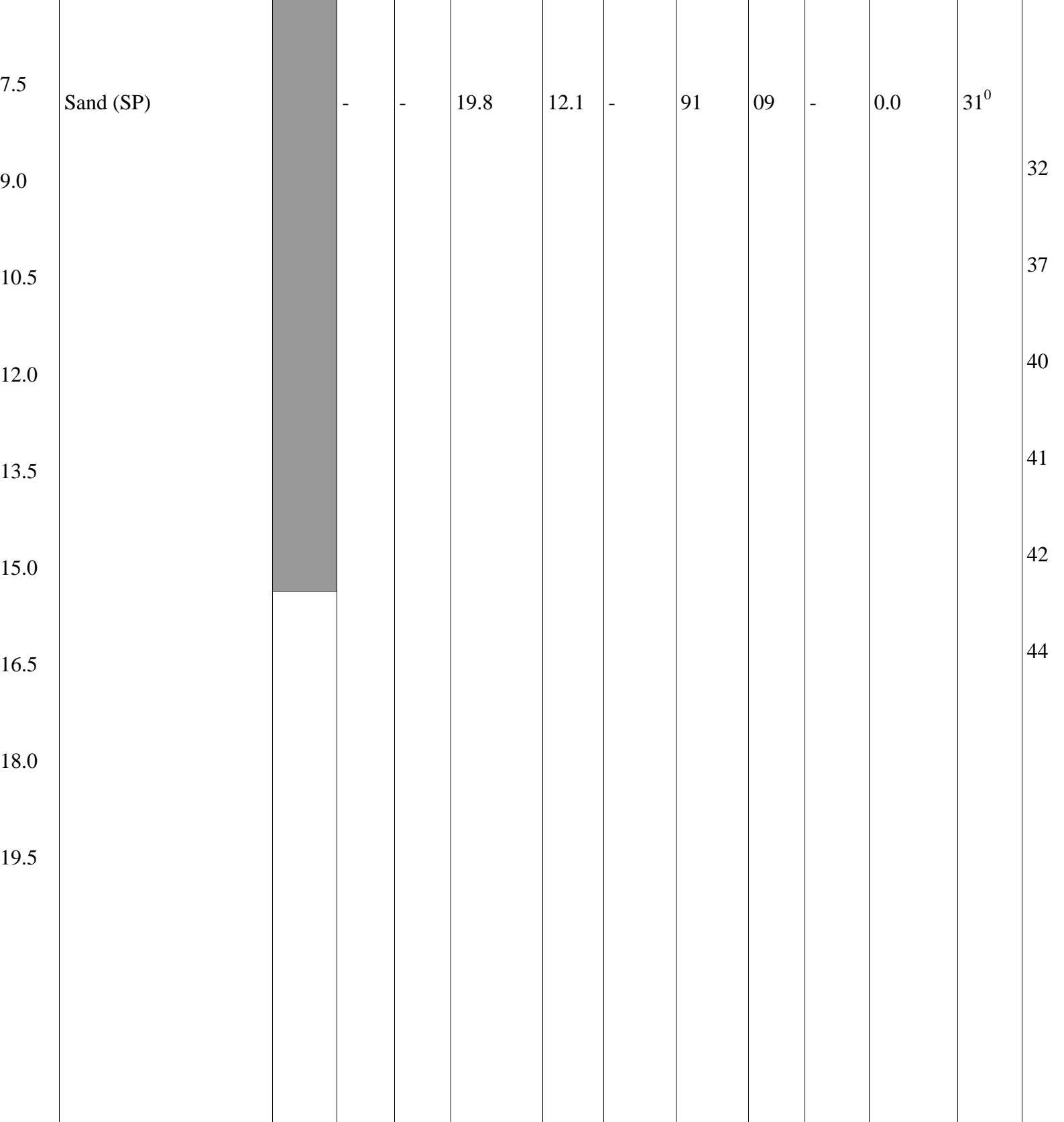
16.5

18.0

19.5







Sand (SP)

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19.8

12.1

-

91

09

-

0.0

31<sup>0</sup>

32

37

40

41

42

44

