

# PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

**PROPOSED**  
**MULTI-SPECIALITY/ SUPER SPECIALITY HOSPITAL**  
**UNDER NON-BRGF**  
**AT BONGAON**

*Date : 14/10/2014*

## **ALLOWABLE BEARING PRESSURE CALCULATION**

### ***Shallow Foundation***

#### **(a) *Bearing Capacity Analysis for shallow foundation***

*The net ultimate bearing capacity ( $q_{ult}$ ) of shallow footings as per I.S.Code (I.S.6403-1981) is given by the equation:*

$$q_{ult} = C_u \cdot N_c \cdot s_c \cdot d_c \cdot i_c + s(N_q - 1) s_q \cdot i_q \cdot d_q + (1/2) B \cdot \gamma \cdot N_\gamma \cdot s_\gamma \cdot d_\gamma \cdot i_\gamma \cdot W'$$

$$q_{ult} = C_u \cdot N_c \cdot s_c \cdot d_c \cdot i_c \quad \{\text{For } \phi=0, \text{ Cohesive Soil}\}$$

where  $N_c = 5.14$  (For,  $\phi = 0$ )

$N_c, N_q, N_\gamma$  = Bearing capacity factors (As per I.S.6403-1981)

$s_c, s_q, s_\gamma$  = Shape factor.

$d_c, d_q, d_\gamma$  = Depth factor.

$i_c, i_q, i_\gamma$  = inclination factor.

$\gamma$  = Bulk unit weight of sub-soil.

$W'$  = Correction factor to account for the effect of water table.

$\sigma$  = Effective surcharge at the base level of foundation.

B = Width of footings

L = Length of footings

$D_f$  = Depth of foundation

$C_u$  = Undrained shear strength (From Laboratory Test)

N = SPT Values related to consistency of Clay Soil

$\phi$  = phi (From Field / Laboratory Test)

**(b) Settlement for shallow foundation**

Settlement=Immediate Settlement +Consolidation Settlement

$$S_f = S_i + S_c$$

$$S_i = q_{net} B^* \{ [1 - \mu^2] / E_s \}^* I_f$$

$q_{net}$  = Net foundation pressure/Intensity of contact pressure

B = Width of footing

$E_s$  = Undrained Modulus of elasticity of soil

$\mu$  = Poisson's Ratio of soil

$I_f$  = Influence coefficient, a function of ratio of length to width of footing=1.12

$$S_c = m_v \cdot \Delta p \cdot H$$

$m_v$  = Coefficient of volume change/compressibility.

$\Delta p$  = Pressure increment due to foundation loading

$$= (L \times B \times P) / \{ (L + H/2)(B + H/2) \}$$

H = Thickness of the stratum.

**(c) Data Required & Obtained from Laboratory & Field Test Results**

$C_u =$	3.10	$T/m^2$
$\gamma =$	1.80	$T/m^3$
$\phi =$	0	$^\circ$

**Allowable Bearing Pressure**

Sl. No.	Types of Footing	Footing Size (m x m)	Depth of footing below E.G.L. (m)	Net Safe Bearing Capacity ( $T/m^2$ )	Allowable Bearing Pressure ( $(T/m^2)$ )	Max. Permissible Settlement(mm)
1	Square	1.2 X 1.2	1.5	10.36	10.4	75
2	Square	1.5 X 1.5	1.5	9.94	9.9	75
3	Square	2.0 X 2.0	1.5	9.53	9.5	75
4	Square	2.5 X 2.5	1.5	9.28	9.3	75
5	Square	3.0 X 3.0	1.5	9.12	9.1	75
6	Rectangular	1.5 X 2.5	1.5	8.57	8.6	75
7	Rectangular	2.0 X 3.0	1.5	8.31	8.3	75
8	Rectangular	2.5 X 3.0	1.5	8.33	8.3	75
9	Strip (L/B $\leq$ 5)	1.5 m wide	1.5	7.96	8.0	75
10	Strip (L/B < 5)	2.0 m wide	1.5	7.62	7.6	75
11	Strip (L/B < 5)	2.5 m wide	1.5	7.42	7.4	75
12	Strip (L/B < 5)	3.0 m wide	1.5	7.29	7.3	75

**GEOTECHNICAL INVESTIGATION FOR PLANNING, DESIGN AND EXECUTION OF MULTI-SPECIALITY/ SUPERSPECIALITY HOSPITAL UNDER NON-BRGF**

Site: Bongaon Sub-Divisional Hospital, Bongaon, 24 Pargana (N)

Method of Boring : Shell & Auger Ground Elevation: E.G.L.

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 03.09.2014

Water Stuck : 1.0 m Depth of Casing : - Date of Completion : 04.09.2014

SAMPLE DETAILS							Thickness/Depth of Layer(m)	DESCRIPTION
Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	0.00						3.50	Soft to Medium to Stiff Brownish Grey Silty Clay/Clay Silt with Traces of mica.
DS	0.50							
DS	1.00							
SPT	1.50	1.95	4	5	6	11		
UDS	2.00							
	2.50							
SPT	3.00	3.45	2	2	3	5		
UDS	3.50						7.50	Medium to Stiff Greyish Silty Clay/Clayey Silt Traces of mica.
	4.00							
SPT	4.50	4.95	2	3	5	8		
UDS	5.00							
	5.50							
SPT	6.00	6.45	2	2	3	5		
UDS	6.50							
	7.00						Stiff to Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.	
SPT	7.50	7.95	3	6	9	15		
	8.00							
	8.50							
SPT	9.00	9.45	4	8	12	20		
	9.50							
	10.00							
SPT	10.50	10.95	9	12	12	24		
	11.00							
	11.50							
SPT	12.00	12.45	14	18	20	38		
	12.50							
	13.00							
SPT	13.50	13.95	15	19	21	40		
	14.00							
	14.50							
SPT	15.00	15.45	16	19	23	42		

UDS : Undisturbed Sample (U) 04

CS : Core Sample ( C )

DS : Disturbed Sample (D) 27

WS: Water Sample (W)

SPT : Standard Penetration Test (P) 25

VS : Vane Shear Test (V)

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SAMPLE DETAILS							Thickness/Depth of Layer(m)	DESCRIPTION
Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	15.50						Stiff to Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.	
	16.00							
SPT	16.50	16.95	18	18	25	43		
	17.00							
	17.50							
SPT	18.00	18.45	19	21	25	46		
	18.50							
	19.00							
SPT	19.50	19.95	15	19	22	41		
	20.00							
	20.50							
SPT	21.00	21.45	17	20	24	44		
	21.50							
	22.00							
SPT	22.50	22.95	19	20	27	47		
	23.00							
	23.50							
SPT	24.00	24.45	16	19	25	44		
	24.50							
	25.00							
SPT	25.50	25.95	19	23	30	53		
	26.00							
	26.50							
SPT	27.00	27.45	18	25	31	56		
	27.50							
	28.00							
SPT	28.50	28.95	20	27	32	59		
	29.00							
	29.50							
SPT	30.00	30.45	15	21	27	48		

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Site: Bongaon Sub-Divisional Hospital, Bongaon, 24 Pargana (N)

Method of Boring : Shell & Auger      Ground Elevation: E.G.L.  
 Diameter of Boring : 150 mm      Depth of Borehole : 40 m      Date of Commencement : 03.09.2014  
 Water Stuck : 1.0 m      Depth of Casing : -      Date of Completion : 04.09.2014

SAMPLE DETAILS							Thickness/Depth of Layer(m)	DESCRIPTION
Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	31.00						34.0	Stiff to Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.
	31.50							
SPT	32.00	32.45	22	28	34	62		
	32.50							
	33.00							
	33.50							
SPT	34.00	34.45	26	30	35	65		
	34.50							
	35.00							
	35.50							
SPT	36.00	36.45	28	30	37	67	40.0	Stiff to Very Stiff to Hard Greyish Silty Clay /Clayey Silt With Traces of Mica.
	36.50							
	37.00							
	37.50							
SPT	38.00	38.45	5	6	9	15		
	38.50							
	39.00							
	39.50							
SPT	40.00	40.45	6	8	11	19		

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Method of Boring : Shell & Auger Ground Elevation: E.G.L.

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 04.09.2014

Water Stuck : 1.3 m Depth of Casing : - Date of Completion : 05.09.2014

SAMPLE DETAILS							Thickness/Depth of Layer(m)	DESCRIPTION
Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	0.00						3.00	Soft to Medium Brownish Grey Silty Clay/Clayey Silt with Traces of Mica.
DS	0.50							
DS	1.00							
SPT	1.50	1.95	1	2	2	4		
UDS	2.00							
	2.50							
SPT	3.00	3.45	2	2	3	5	8.00	Soft to Medium to Stiff Greyish Silty Clay/Clayey Silt with Traces of Mica.
UDS	3.50							
	4.00							
SPT	4.50	4.95	1	2	2	4		
UDS	5.00							
	5.50							
SPT	6.00	6.45	4	4	5	9		
UDS	6.50							
	7.00							
SPT	7.50	7.95	6	8	10	18		
	8.00							
	8.50							
SPT	9.00	9.45	10	13	15	28	Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.	
	9.50							
	10.00							
SPT	10.50	10.95	9	10	13	23		
	11.00							
	11.50							
SPT	12.00	12.45	13	16	19	35		
	12.50							
	13.00							
SPT	13.50	13.95	14	21	20	41		
	14.00							
	14.50							
SPT	15.00	15.45	17	19	25	44		

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Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	15.50						Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.	
	16.00							
SPT	16.50	16.95	17	19	24	43		
	17.00							
	17.50							
SPT	18.00	18.45	20	20	26	46		
	18.50							
	19.00							
SPT	19.50	19.95	16	20	23	43		
	20.00							
	20.50							
SPT	21.00	21.45	16	22	23	45		
	21.50							
	22.00							
SPT	22.50	22.95	18	21	28	49		
	23.00							
	23.50							
SPT	24.00	24.45	17	20	26	46		
	24.50							
	25.00							
SPT	25.50	25.95	20	22	28	50		
	26.00							
	26.50							
SPT	27.00	27.45	17	26	32	58		
	27.50							
	28.00							
SPT	28.50	28.95	24	26	34	60		
	29.00							
	29.50							
SPT	30.00	30.45	15	21	27	48		
	30.50							

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SAMPLE DETAILS							Thickness/Depth of Layer(m)	DESCRIPTION
Type	DEPTH(M)		SPT: No Blows					
	From	To	0-15 cm	15-30 cm	30-45 cm	N' Value		
	31.00						35.5	Very Stiff to Hard Whitish Grey Fine Silty Sand/Sandy Silt With Traces of Mica.
	31.50							
SPT	32.00	32.45	23	29	25	54		
	32.50							
	33.00							
	33.50							
SPT	34.00	34.45	27	32	36	68		
	34.50							
	35.00							
	35.50							
SPT	36.00	36.45	27	29	38	67	40.0	Very Stiff to Hard Greyish Silty Clay /Clayey Silt With Traces of Mica.
	36.50							
	37.00							
	37.50							
SPT	38.00	38.45	6	8	10	18		
	38.50							
	39.00							
	39.50							
SPT	40.00	40.45	7	10	11	21		

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**SITE PLAN SHOWING LOCATION OF BOREHOLES AT SITE  
BONGAON SD HOSPITAL, BANGAON DIST-24 PARGANAS (N)**

