

# PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT

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

*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:*

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

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

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**

$C_u =$	3.00	$T/m^2$
$\gamma =$	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	10.02	10.0	75
2	Square	1.5 X 1.5	1.5	9.62	9.6	75
3	Square	2.0 X 2.0	1.5	9.22	9.2	75
4	Square	2.5 X 2.5	1.5	8.98	9.0	75
5	Square	3.0 X 3.0	1.5	8.82	8.8	75
6	Rectangular	1.5 X 2.5	1.5	8.29	8.3	75
7	Rectangular	2.0 X 3.0	1.5	8.04	8.0	75
8	Rectangular	2.5 X 3.0	1.5	8.06	8.1	75
9	Strip (L/B $\leq$ 5)	1.5 m wide	1.5	7.70	7.7	75
10	Strip (L/B < 5)	2.0 m wide	1.5	7.38	7.4	75
11	Strip (L/B < 5)	2.5 m wide	1.5	7.18	7.2	75
12	Strip (L/B < 5)	3.0 m wide	1.5	7.06	7.1	75

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

Site: Kalna Sub-Divisional Hospital, Kalna ,Dist-Burdwan

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

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 27.09.2014

Water Stuck : 0.5 m Depth of Casing : - Date of Completion : 28.09.2014

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							
DS	0.50							
DS	1.00							
SPT	1.50	1.95	2	2	2	4		
UDS	2.00							
	2.50							
SPT	3.00	3.45	2	2	3	5		
UDS	3.50							
	4.00							
SPT	4.50	4.95	3	4	4	8		
UDS	5.00							
	5.50							
SPT	6.00	6.45	2	3	4	7		
UDS	6.50							
	7.00							
SPT	7.50	7.95	3	3	4	7		
UDS	8.00							
	8.50							
SPT	9.00	9.45	3	5	7	12		
UDS	9.50							
	10.00							
SPT	10.50	10.95	6	6	6	12		
UDS	11.00							
	11.50							
SPT	12.00	12.45	8	8	10	18		
	12.50							
	13.00							
SPT	13.50	13.95	4	4	5	9		
UDS	14.00							
	14.50							
SPT	15.00	15.45	6	6	8	14		

Soft to Medium Greyish Brown/ Brownish Grey Silty Clay/Clayey Silt.

Soft to Medium Greyish Silty Clay/Clayey Silt with Small pieces Grits & Kankars.

UDS : Undisturbed Sample (U) 08

CS : Core Sample ( C )

DS :Disturbed Sample (D) 27

WS: Water Sample (W)

SPT : Standard Penetration Test (P) 25

VS : Vane Shear Test (V)

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

Site: Kalna Sub-Divisional Hospital, Kalna ,Dist-Burdwan

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

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 27.09.2014

Water Stuck : 0.5 m Depth of Casing : - Date of Completion : 28.09.2014

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		
	15.50							
	16.00							
SPT	16.50	16.95	2	1	2	3		
	17.00							
	17.50							
SPT	18.00	18.45	2	2	2	4		
	18.50							
	19.00							
SPT	19.50	19.95	2	2	2	4		
	20.00							
	20.50							
SPT	21.00	21.45	2	3	3	6		
	21.50							
	22.00							
SPT	22.50	22.95	3	4	6	10		
	23.00							
	23.50							
SPT	24.00	24.45	5	8	12	20		
	24.50							
	25.00							
SPT	25.50	25.95	7	9	16	25		
	26.00							
	26.50							
SPT	27.00	27.45	8	10	18	28		
	27.50							
	28.00							
SPT	28.50	28.95	9	14	20	34		
	29.00							
	29.50							
SPT	30.00	30.45	11	18	22	40	30.00	

Soft to Medium to Very Stiff Greyish Silty Clay/Clayey Silt with Small pieces Grits & Kankars.

UDS : Undisturbed Sample (U) 08

CS : Core Sample ( C )

DS :Disturbed Sample (D) 27

WS: Water Sample (W)

SPT : Standard Penetration Test (P) 25

VS : Vane Shear Test (V)

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

Site: Kalna Sub-Divisional Hospital, Kalna ,Dist-Burdwan

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

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 27.09.2014

Water Stuck : 0.5 m Depth of Casing : - Date of Completion : 28.09.2014

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						Dense to Very Dense Greyish Silty Sand /Sandy Silt with Traces of Mica.	
	31.50							
SPT	32.00	32.45	12	19	23	42		
	32.50							
	33.00							
	33.50							
SPT	34.00	34.45	13	20	24	44		
	34.50							
	35.00							
	35.50							
SPT	36.00	36.45	15	24	30	54		
	36.50							
	37.00							
	37.50							
SPT	38.00	38.45	16	26	36	62		
	38.50							
	39.00							
	39.50							
SPT	40.00	40.45	17	29	42	71		

UDS : Undisturbed Sample (U) 08

CS : Core Sample ( C )

DS :Disturbed Sample (D) 27

WS: Water Sample (W)

SPT : Standard Penetration Test (P) 25

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

Site: Kalna Sub-Divisional Hospital, Kalna ,Dist-Burdwan

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

Diameter of Boring : 150 mm Depth of Borehole : 40 m Date of Commencement : 29.09.2014

Water Stuck : 0.8 m Depth of Casing : - Date of Completion : 30.09.2014

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		
	15.50							
	16.00							
SPT	16.50	16.95	2	2	2	4		
	17.00							
	17.50							
SPT	18.00	18.45	2	2	2	4		
	18.50							
	19.00							
SPT	19.50	19.95	2	2	3	5		
	20.00							
	20.50							
SPT	21.00	21.45	2	4	4	8		
	21.50							
	22.00							
SPT	22.50	22.95	3	3	6	9		
	23.00							
	23.50							
SPT	24.00	24.45	7	10	13	23		
	24.50							
	25.00							
SPT	25.50	25.95	8	10	16	26		
	26.00							
	26.50							
SPT	27.00	27.45	9	12	17	29		
	27.50							
	28.00							
SPT	28.50	28.95	10	15	21	36		
	29.00							
	29.50							
SPT	30.00	30.45	12	19	23	42		

Soft to Medium to Very Stiff Greyish Silty Clay/Clayey Silt with Small pieces Grits & Kankars.

UDS : Undisturbed Sample (U) 01	CS : Core Sample ( C )
DS :Disturbed Sample (D) 27	WS: Water Sample (W)
SPT : Standard Penetration Test (P) 25	VS : Vane Shear Test (V)

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

**Site: Kalna Sub-Divisional Hospital, Kalna ,Dist-Burdwan**

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

**Diameter of Boring :** 150 mm **Depth of Borehole :** 40 m **Date of Commencement :** 29.09.2014

**Water Stuck :** 0.8 m **Depth of Casing :** - **Date of Completion :** 30.09.2014

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						Dense to Very Dense Greyish Silty Sand /Sandy Silt with Traces of Mica.	
	31.50							
SPT	32.00	32.45	13	20	23	43		
	32.50							
	33.00							
	33.50							
SPT	34.00	34.45	15	21	25	46		
	34.50							
	35.00							
	35.50							
SPT	36.00	36.45	16	24	29	53		
	36.50							
	37.00							
	37.50							
SPT	38.00	38.45	17	28	37	65		
	38.50							
	39.00							
	39.50							
SPT	40.00	40.45	19	30	45	75		
						40.0		

**UDS : Undisturbed Sample (U) 01**

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**VS : Vane Shear Test (V)**



**SITE PLAN SHOWING LOCATION OF BOREHOLES AT SITE**  
**KALNA SD HOSPITAL, KALNA DIST-BURDWAN**

