FOUNDATION DESIGN REPORT OF SST 32 M

STANDAR SST 32 M

[redacted]

TBG B2S PROJECT

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ICT Consulting at it's Best

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[redacted]

3. FOUNDATION ANALYSIS

A. LOAD CASE

*Table of Maximum Support Reaction at Pedestal**

Pedestal	Case 1 - Overturning to The Corner of Slab					Pedestal	Case 2 - Overturning to The Edge of Slab				
	Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN-m)	My (kN-m)		Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN-m)	My (kN-m)
1	-7.565	6.144	**16.621**	-0.072	-0.060	1	-15.447	-6.910	**180.887**	-0.055	-0.029
2	-16.528	16.526	**-255.372**	0.007	0.007	2	-14.884	7.155	**-170.048**	0.044	-0.035
3	-6.142	7.568	**16.748**	16.748	-0.060	3	-14.698	-4.811	**-147.512**	0.044	-0.035
4	-17.951	17.949	**288.710**	0.019	0.019	4	-16.981	7.903	**203.380**	0.059	-0.025
Resultant	-48.186	48.187	**66.707**	16.702	-0.094	Resultant	-62.010	3.337	**66.707**	0.092	-0.124

**Taken from MS Tower analysis output*

B. FOUNDATION GEOMETRY AND SOIL PARAMETER

Table of Foundation Geometry and Soil Parameter

Foundation Geometry												Soil Parameter			
S (m)	B_1 (m)	B_2 (m)	B (m)	D (m)	T (m)	H_1 (m)	H_2 (m)	H (m)	z (m)	R_1 (m)	R_2 (m)	γ_{soil} (ton/m^3)	c (ton/m^2)	ϕ (degree)	Frustum (degree)
3.243	0.80	2.69	5.40	0.35	0.55	0.70	1.15	1.85	1.50	4.59	1.53	1.77	2.15	20	30

E (m)	F (m)
0.00	0.00

GWT - z_1 (m)
NO

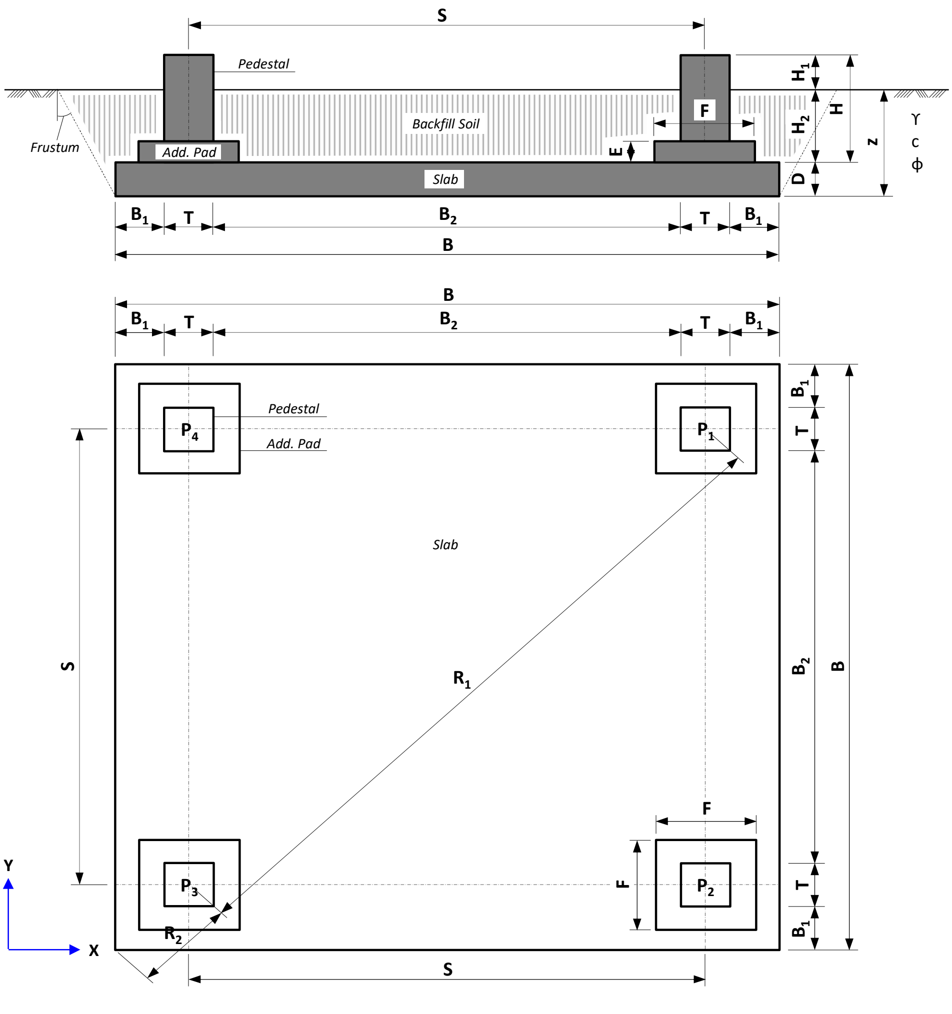


Figure 1. Foundation Geometry

3. FOUNDATION ANALYSIS

C. EFFECT OF GROUND WATER TABLE

Ground Water Table (GWT) probably happen in one of these following conditions :

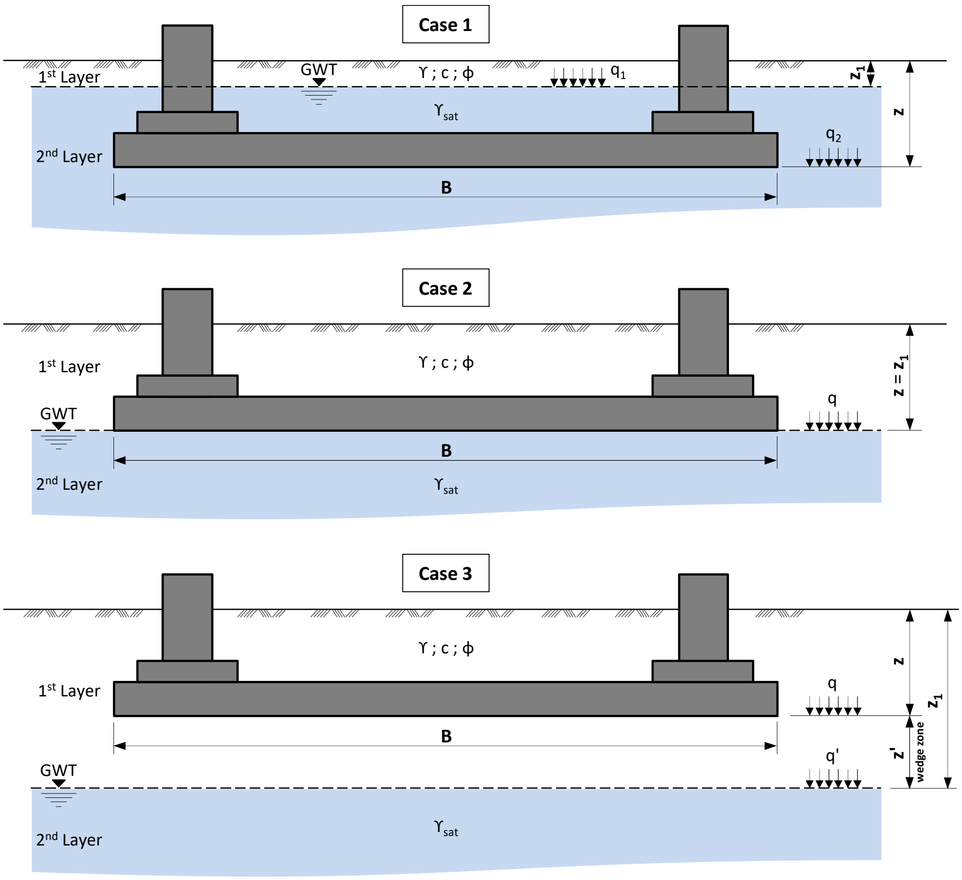


Figure 2. Ground Water Table (GWT) Conditions

Case of GWT : **N/A**

Depth of GWT from base of foundation :

z' (m) = 0.00

Approximately depth of wedge zone :

$\mathbf{z_e}$ (m) = 0.5B tan (45 + ϕ/2) **(Eq. C.1)**

= N/A

Unit weight of soil in saturated condition :

γ_{sat} (ton/m^3) = $\gamma_w + (V_v \cdot \gamma_{dry})$ = N/A **(Eq. C.2)**

where :

V_v (m^3) = 1 - V_s = N/A	γ_{dry} (ton/m^3) = γ_{wet} / (1 + w) = N/A	GS : Specific gravity of soil	= N/A
V_s (m^3) = γ_{dry} / (GS . γ_w) = N/A		γ_w (ton/m^3) : Unit weight of water	= N/A
		γ_{wet} (ton/m^3) : Unit weight of soil	= N/A
		w (%) : Moisture content	= N/A

Volume of backfill soil above the slab :

1st layer volume - $\mathbf{V_{s1}}$ (m^3) = 41.1

2nd layer volume - $\mathbf{V_{s2}}$ (m^3) = 0.0

Total volume - $\mathbf{V_s}$ (m^3) = 41.1

Soil above the slab has only one layer

Weight of backfill soil above the slab :

1st layer weight - $\mathbf{W_{s1}}$ (kN) = 712.8

2nd layer weight - $\mathbf{W_{s2}}$ (kN) = 0.0

Total weight - $\mathbf{W_s}$ - (kN) = 712.8

Soil pressure above the slab :

$\mathbf{P_s}$ (kN/m^2) = W_s / A ; A (m^2) = 28.0

= 25.503

$\mathbf{P_s}$ (Pa) = 25503

Pedestal pressure above the slab :

$\mathbf{P_s}$ (kg/m^2) = H x $\gamma_{concrete}$

= 4440.00

$\mathbf{P_s}$ (Pa) = 43542

3. FOUNDATION ANALYSIS

D. CONCRETE GRADE

Grade of Concrete - **K** (kg/cm^2) = 175 **f'$_c$** (kg/cm^2) = 145.25

E. SOIL BEARING CAPACITY FROM SONDIR TEST

Soil Bearing Capacity - **q_c** (kg/cm^2) = 23

Allowable Soil Bearing Capacity - **q_{all}** (ton/m^2) = q_c / 15 = 15.33

q_{all} (kN/m^2) = 150.4

Modulus Subgrade Reaction - **k_s** (kN/m^3) = 40 (SF) q_{all} SF = 3.0

= 18044.9

F. BEARING CAPACITY OF FOUNDATION

For relatively uniform column loads (which **do not vary more than 20 percent between adjacent column**) and relatively uniform column spacing, the mat may be considered rigid when the column spacing is less than 1.75/λ. The characteristic coefficient λ is defined by Hetenyi (1946) :

$$\lambda\ (m) = \sqrt[4]{\frac{k_b b}{4E_c I}} = 0.515 \qquad \textbf{(Eq. F.1)}$$

where :

k_b = k_s = modulus subgrade reaction (kN/m^3) = 18044.9

b = width of a strip of mat between centers of adjacent bays (m) = 2.700

E_c = modulus of elasticity of concrete (MPa)

$= 4700\ x\ \sqrt{f'_c}$ = 17912.49 **(Eq. F.2)**

= modulus of elasticity of concrete (kN/m^2) = 1.79E+07

I = moment of inertia of the strip of width b (m^4) = 0.010

1.75/λ (m) = 3.396

check :

Differentiation of adjacent column loads - Case 1 = 193% > 20% .... (The Mat Considered Elastic)

Differentiation of adjacent column loads - Case 2 = 106% > 20% .... (The Mat Considered Elastic)

Spacing between adjacent column (m) = 3.24 < 3.40 .... (The Mat Considered Rigid)

Load differentiation of Case 1 versus spacing of adjacent column = the mat considered elastic

Load differentiation of Case 2 versus spacing of adjacent column = the mat considered elastic

The mat considered elastic, analyzed by finite element method !

Based on the result from PCA Mats as a Finite Element Analysis, bearing capacity of foundation is :

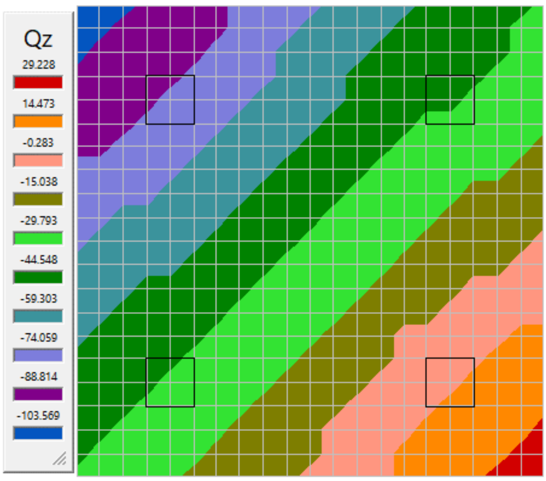


Figure 3a. Base Pressure Contour of Foundation - Case 1

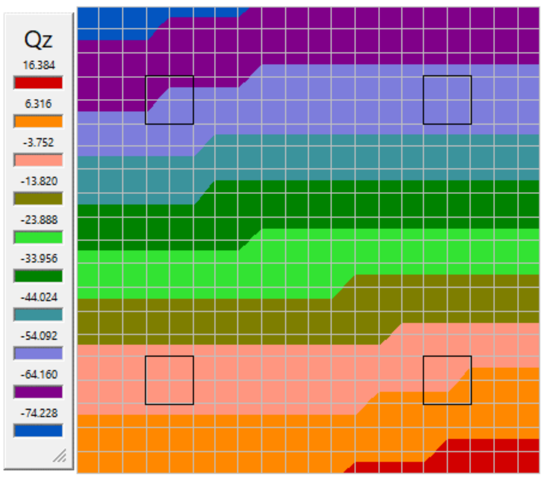


Figure 3b. Base Pressure Contour of Foundation - Case 2

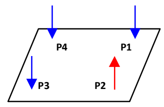
Max. Base Pressure (kN/m^2) = 103.569 < q_{all} .... OK ! (Bearing Capacity of Foundation is Sufficient)

3. FOUNDATION ANALYSIS

G. CAPACITY AGAINST OVERTURNING

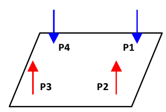
Table of Overturning Calculation

CASE - 1 (Overturning to The Corner of Slab)

Item	Fx (kN)	Fy (kN)	Fz (kN)	Moment Arm (m) H (m)	Moment Arm (m) L (m)	Overturning Moment (kN-m)	Resisting Moment (kN-m)	Force Illustration
P1	-7.565	6.144	16.621	2.20	3.82	1410.79	4407.99	
P2	-16.528	16.526	-255.372	2.20	6.11			
P3	-6.142	7.568	16.748	2.20	3.82			
P4	-17.951	17.949	288.710	2.20	1.53			
Weight of Soil (kN)		712.82		3.82				
Weight of Conc. (kN)		292.90		3.82				

Actual SF	Min. Allow. SF	Check
3.1	2.0	OK !

CASE - 2 (Overturning to The Edge of Slab)

Item	Fx (kN)	Fy (kN)	Fz (kN)	Moment Arm (m) H (m)	Moment Arm (m) L (m)	Overturning Moment (kN-m)	Resisting Moment (kN-m)	Force Illustration
P1	-15.447	-6.910	180.887	2.20	1.08	1379.68	3129.88	
P2	-14.884	7.155	-170.048	2.20	4.32			
P3	-14.698	-4.811	-147.512	2.20	4.32			
P4	-16.981	7.903	203.380	2.20	1.08			
Weight of Soil (kN)		712.82		2.70				
Weight of Conc. (kN)		292.90		2.70				

Actual SF	Min. Allow. SF	Check
2.3	2.0	OK !

H. CAPACITY AGAINST SLIDING

Requirement :

SF = (ΣV/ΣH) δ > 2.0 **(Eq. H.1)**

where :

ΣV (kN) = total vertical force = $W_{concrete}$ + C = 359.61

ΣH (kN) = total horizontal force = 62.01

δ = friction coefficient of concrete with soil = 0.45

thus :

SF = 2.61 > 2.0 .... OK ! (Foundation is Sufficient Against Sliding)

I. PUNCHING SHEAR ON SLAB

Two-Way Punching Shear

Requirement :

$\phi V_c > V_u$

where :

φ = shear strength reduction factor

= 0.75

V_{c1} = 1st formula of concrete shear strength

$$= \left(2 + \frac{4}{\beta_c}\right)\sqrt{f'_c}b_0 d$$ **(Eq. I.1)**

β_c = ratio of long side to short side of the column, concentrated load or reaction area

= 1

b_0 (m) = 4 (D + T) or 4 (D + E + T)

= 3.60

d (m) = D (without add. pad) or D+E (with add. pad)

0.35

thus :

V_{c1} (ton) = 239.68

V_{c2} = 2nd formula of concrete shear strength

$$= \left(\frac{\alpha_s d}{b_0} + 2\right)\sqrt{f'_c}b_0 d$$ **(Eq. I.2)**

α_s = corner column

= 20

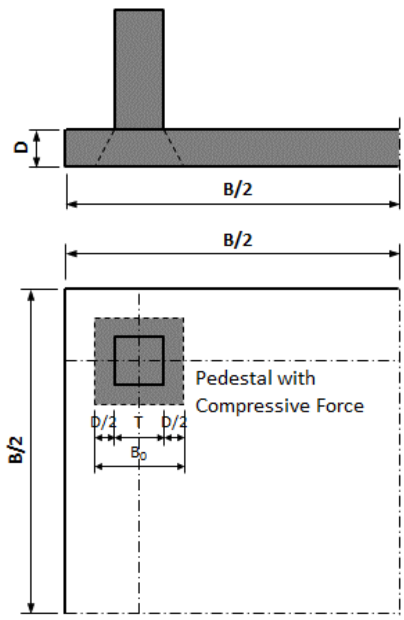


Figure 4a. Two-Way Punching Shear (without Add. Pad)

thus :

V_{c2} (ton) = 157.57

V_{c3} = 3rd formula of concrete shear strength

= $4\sqrt{f'_c}b_0 d$ **(Eq. I.3)**

thus :

V_{c3} (ton) = 159.78

The smallest **V_c** (ton) = 157.57

Hence :

ϕV_c (ton) = **118.17**

then :

V_u (ton) = factored shear force on critical area = C . Shade Ratio

where :

Shade Ratio = $\frac{Footing\ Area \quad Pu\ nc\ ingArea}{Footing\ Area}$ = 0.89

C (ton) = minimum compressive force - **Fz** = 20.74

Hence :

V_u (ton) = **19.78**

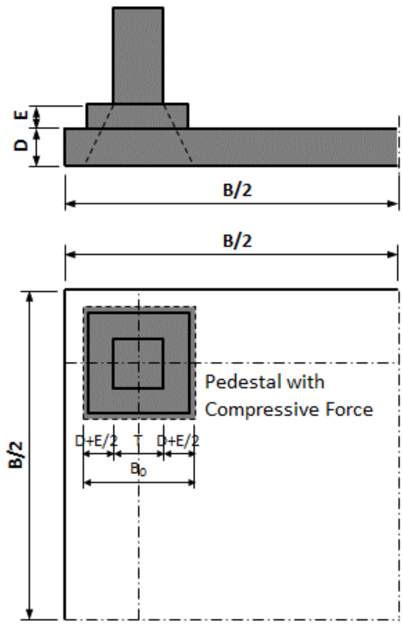


Figure 4b. Two-Way Punching Shear (with Add. Pad)

Check :

ϕV_c > V_u .... OK ! (Foundation is Sufficient to Support Two-Way Punching Shear)

One-Way Punching Shear

Requirement :

ϕV_c > V_u

where :

ϕ = shear strength reduction factor

= 0.75

V_{c1} = 1st formula of concrete shear strength

= $\left(2+\frac{4}{\beta_c}\right)\sqrt{f'_c}b_0 d$

β_c = ratio of long side to short side of the column, concentrated load or reaction area

= 1

b_0 (m) = B

= 5.40

d (m) = D (without add. pad) or D+E (with add. pad)

0.35

thus :

V_{c1} (ton) = 359.52

V_{c2} = 2nd formula of concrete shear strength

= $\left(\frac{\alpha_s d}{b_0}+2\right)\sqrt{f'_c}b_0 d$

α_s = edge column

= 30

thus :

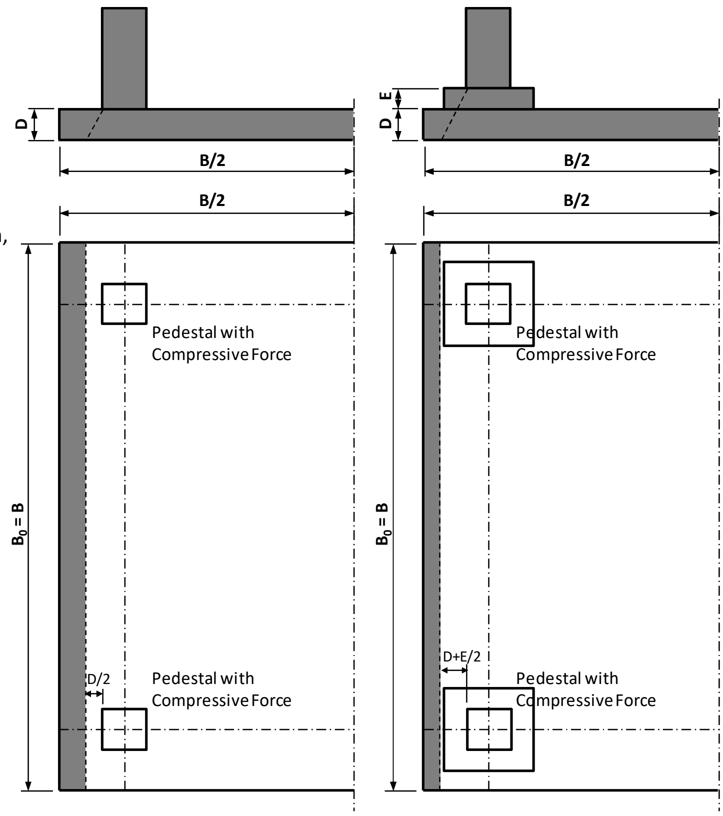
V_{c2} (ton) = 236.35

V_{c3} = 3rd formula of concrete shear strength

= $4\sqrt{f'_c}b_0 d$

thus :

V_{c3} (ton) = 239.68



(a) ***(b)***

Figure 5. One-Way Punching Shear (a) without Add. Pad (b) with Add. Pad

The smallest V_c (ton) = 236.35

Hence :

ϕV_c (ton) = **177.26**

then :

V_u (ton) = factored shear force on critical area = C . Shade Ratio

where :

Shade Ratio = $\dfrac{Footing\ Area \quad Pu\ nc\ ingArea}{Footing\ Area}$ = 0.77

C (ton) = minimum compressive force - **Fz** = 20.74

Hence :

V_u (ton) = **34.52**

Check :

ϕV_c > V_u .... OK ! (Foundation is Sufficient to Support One-Way Punching Shear)

J. REQUIRED REINFORCEMENT

Pedestal Reinforcement

Design of Longitudinal Reinforcement

Minimum Percentage of Reinforcement = 1.00 %   Actual Percentage of Reinforcement = 1.33 %

Gross Area of Section - A_g (m^2) = 0.3025

Total Area of Longitudinal Reinforcement - A_{st1} (m^2) = 0.0030

Try to Use Reinforcement :

Number of Rebar = 20

Dia. (mm) = 16

Total Area of Longitudinal Reinforcement - A_{st2} (m^2) = 0.0040

A_{st2} > A_{st1} .... OK ! (Assumption Rebar Area is Sufficient)

Type and Grade of Reinforcement = Deformed

Tensile Strength - f_u (MPa) = 560

Minimum Yield Stress - f_y (MPa) = 390

Concrete Cover (mm) = 50

Requirement :

ϕP_n > P_u

where :

P_u (ton) = Fz = 20.74

P_n (ton) = **$0.80\ [0.85\ f_c'\ (A_g - A_{st}) + f_y\ A_{st}]$** ϕ = tied column = 0.65   **(Eq. J.1)**

= 428.68

ϕP_n (ton) = 278.64

Check Axial Load Capacity of Pedestal :

ϕP_n > P_u .... OK ! (Pedestal is Sufficient to Support Axial Load)

Used Longitudinal Reinforcement : 20 D 16

Design of Confinement

Try to Use Reinforcement : Type = Plain f_u (MPa) = 380

Dia. (mm) = 10 f_y (MPa) = 235

Spacing (S) of stirrup is the smallest from :

16 x dia. of longitudinal reinforcement (mm) = 256

48 x dia. of stirrup (mm) = 480

The smallest of pedestal width (mm) = 550

The smallest spacing - **S** (mm) = 256

Used spacing - **S** (mm) = 250

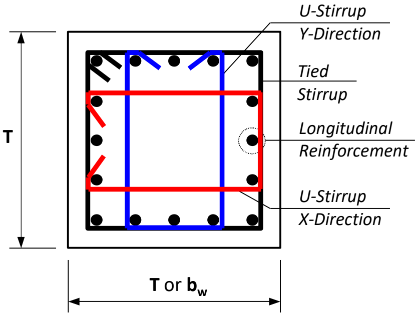


Figure 6. Illustration of Pedestal Reinforcement

3. FOUNDATION ANALYSIS

Check for Requirement Shear Reinforcement Area :

$A_{smin\text{-}1}$ (mm^2) = $\frac{1}{16}\sqrt{f'_c}\frac{b_w S}{f_y}$ not less than $A_{smin\text{-}2}$ (mm^2) = $\frac{b_w S}{3 f_y}$ used A_{smin} (mm^2) = **195.04**   **(Eq. J.2)**

= 137.97   = 195.04

Actual Shear Reinforcement Area :

A_v (mm^2) = 2 (πr^2) = **157.08**

thus :

A_v < used A_{smin} ➤ ***Need Additional U-Stirrup !*** ➤

Try to Use U-Stirrup Dia. (mm) = 10
Direction of U-Stirrup = 1
Spacing of U-Stirrup (mm) = 250
A_{v1} (mm^2) = 157.08

then, Actual Shear Reinforcement Area become :

$A_{v'}$ (mm^2) = $A_v + A_{v1}$ = **314.16**

check :

$A_{v'}$ > A_{smin} .... (Minimum Shear Reinforcement Area is Sufficient)

Design of Cross Sections Subject to Shear :

$\phi V_n \geq V_u$

where :

ϕ = shear strength reduction factor
= 0.65

$V_n = V_c + V_s$

$$V_c \text{ (lb)} = 2\left(1+\frac{N_u}{2000A_g}\right)\sqrt{f'_c}b_w d$$ **(Eq. J.3)**

where :

N_u (lb) = C = 64904.58
A_g (in^2) = b x h = 469
b_w (in) = T = 21.65
d (in) = h - c - D_s - (D/2) = 18.98
f'_c (psi) = 2065.94

thus :

V_c (lb) = 39938.59 V_c (ton) = 18.12

$$V_s \text{ (ton)} = \frac{A_v f_y d}{S} = 7.26$$ **(Eq. J.4)**

hence :

V_n (ton) = 25.38
ϕV_n (ton) = **16.49**
V_u (ton) = **H** = **1.83** ➤ ***No Need Additional U-Stirrup !*** ➤

Try to Use U-Stirrup Dia. (mm) = N/A
$A_{v'}$ (mm^2) = N/A
Direction of U-Stirrup = N/A
Spacing of U-Stirrup (mm) = N/A
$V_{s'}$ (ton) = N/A

After add U-Stirrup, we get :

V_n (ton) = V_c + ($V_s + V_{s'}$) = **N/A**
ϕV_n (ton) = **N/A**

check :

ϕV_n > V_u .... OK ! (Shear Strength Capacity of Pedestal is Sufficient)

Used Tied Reinforcement	:	**Ø 10**	**250**
Used U-Stirrup Reinforcement	:	**Ø 10**	**250**

3. FOUNDATION ANALYSIS

Slab Reinforcement

Based on the result from PCA Mats as a Finite Element Analysis, required slab reinforcement is :

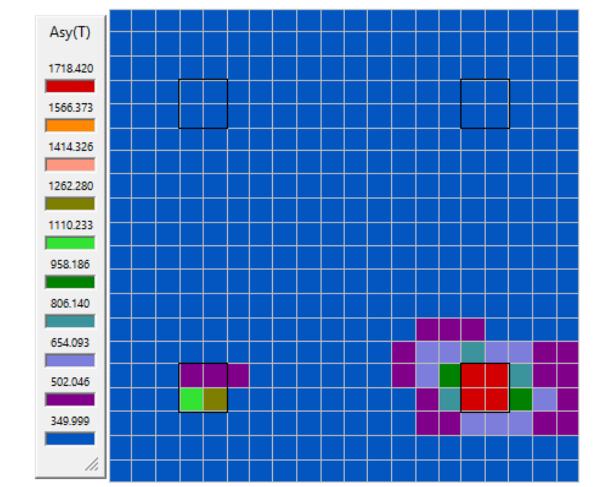


Figure 7a. Required Top Reinforcement of Slab

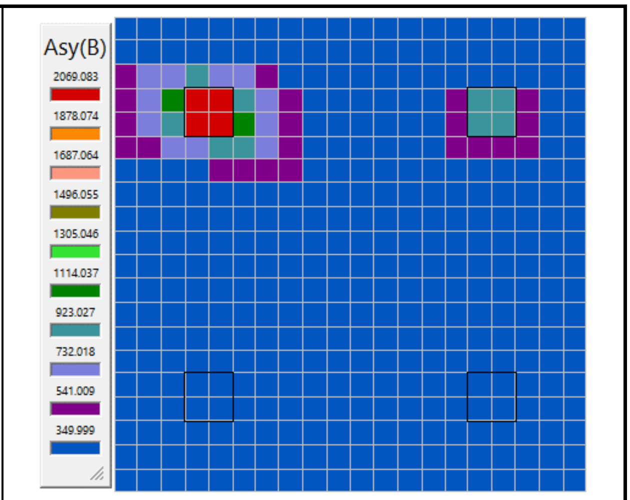


Figure 7b. Required Bottom Reinforcement of Slab

Required Reinforcement Area - $\mathbf{A}_{sreq.}$ (mm^2) = 2069.08 + 2069.08 = 4138.17 (Top and Bottom Reinforcement)

Try to Use Reinforcement : Concrete Cover of Slab (mm) = 50

Dia. (mm) = 16 Type : f_u (MPa) = 560

Spacing (mm) = 200 Deformed f_y (MPa) = 390

Hence :

Number of Reinforcement on Each Direction (X & Y) for Top and Bottom (pcs) = 55

Total Reinforcement Area - $\mathbf{A}_{stotal}$ (mm^2) = 11058.41

Check :

A_{total} > $A_{sreq.}$ .... OK ! (Assumption Rebar Area is Sufficient)

Used Top X - Reinforcement	:	**D 16**	**200**
Used Top Y - Reinforcement	:	**D 16**	**200**
Used Bott. X - Reinforcement	:	**D 16**	**200**
Used Bott. Y - Reinforcement	:	**D 16**	**200**

Pad Reinforcement

Required Reinforcement Area - $\mathbf{A}_{sreq.}$ (mm^2) = N/A Concrete Cover of Slab (mm) = N/A

Try to Use Reinforcement :

Dia. (mm) = N/A Type : f_u (MPa) = N/A

Spacing (mm) = N/A N/A f_y (MPa) = N/A

Hence :

Number of Reinforcement on Each Direction (X & Y) (pcs) = N/A

Total Reinforcement Area - $\mathbf{A}_{stotal}$ (mm^2) = N/A

Check :

A_{total} # $A_{sreq.\ act.}$ N/A

Used X - Reinforcement	:	**I/A N/I**	**N/A**
Used Y - Reinforcement	:	**I/A N/I**	**N/A**

3. FOUNDATION ANALYSIS

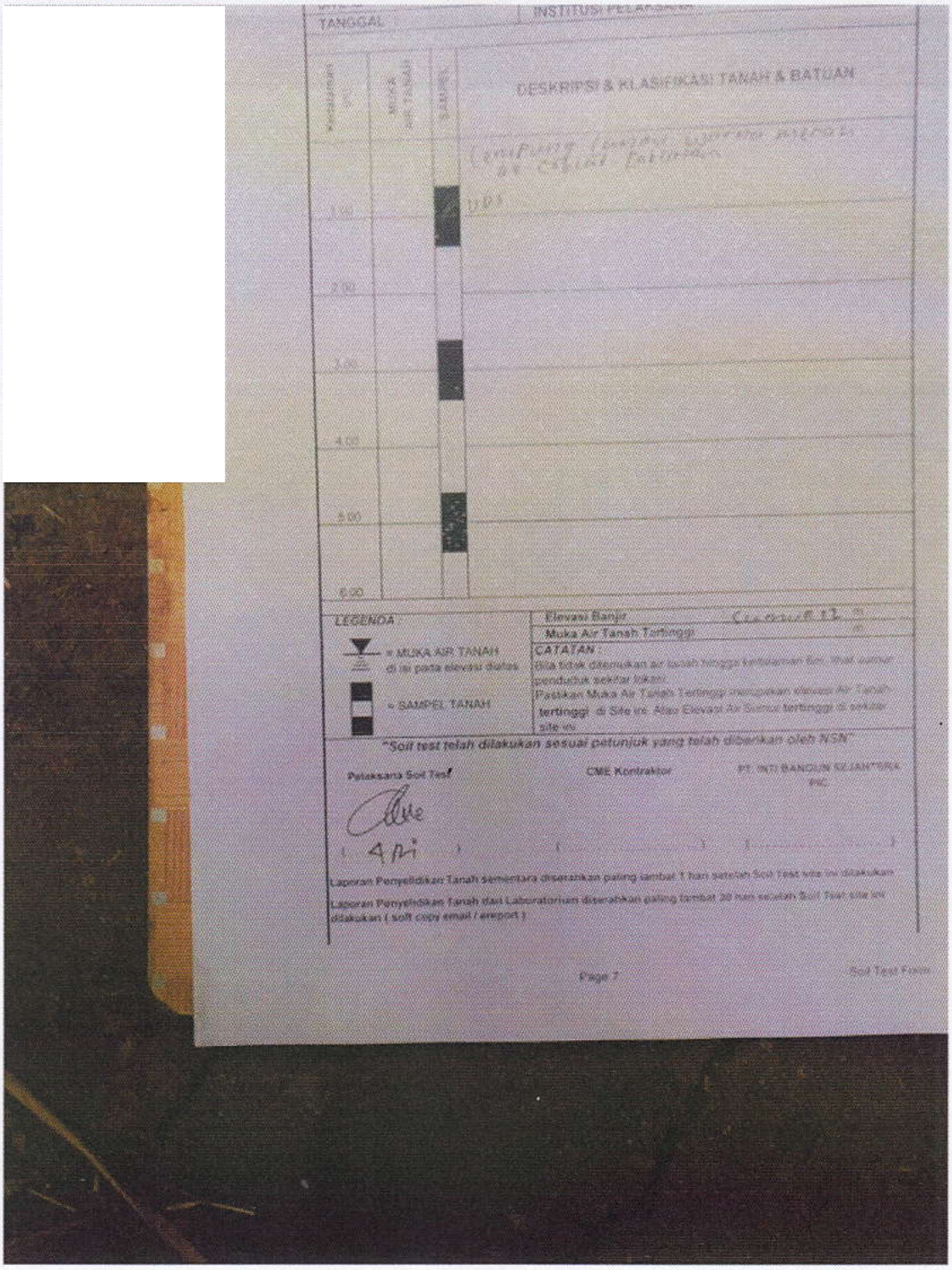
K. SUMMARY OF ANALYSIS

Table of Summary of Analysis

Foundation Stability				
Design Requirement	**Max. Base Pressure** (kN/m^2)	**q_{all}** (kN/m^2)	**Ratio**	**Remark for Analysis Result**
Bearing Capacity	103.57	150.37	1.45	**OK - design is sufficient**
Design Requirement	**Actual Safety Factor**	**Minimum Allowable Safety Factor**	**Ratio**	**Remark for Analysis Result**
Overturning Capacity - Case 1	3.1	2.0	1.56	**OK - design is sufficient**
Overturning Capacity - Case 2	2.3	2.0	1.13	**OK - design is sufficient**
Design Requirement	**Actual Safety Factor**	**Minimum Allowable Safety Factor**	**Ratio**	**Remark for Analysis Result**
Sliding Capacity	2.6	2.0	1.30	**OK - design is sufficient**
Concrete Assessment				
Design Requirement	**Ultimate Axial Force - P_u** (ton)	**Design Axial Force - ϕP_n** (ton)	**Ratio**	**Remark for Analysis Result**
Pedestal - Axial Capacity	20.74	278.64	13.43	**OK - design is sufficient**
Design Requirement	**Ultimate Shear Force - V_u** (ton)	**Design Shear Force - ϕV_n** (ton)	**Ratio**	**Remark for Analysis Result**
Pedestal - Shear Capacity	1.83	16.49	9.01	**OK - design is sufficient**
Design Requirement	**Ultimate Shear Force - V_u** (ton)	**Design Shear Force - ϕV_c** (ton)	**Ratio**	**Remark for Analysis Result**
Slab - Punching Shear - One Way	34.52	177.26	5.14	**OK - design is sufficient**
Slab - Punching Shear - Two Ways	19.78	118.17	5.97	**OK - design is sufficient**

Appendix A

Soil Test Report



TANGGAL | INSTITUSI PELAKSANA

KEDALAMAN (m)	MUKA AIR TANAH	SAMPEL	DESKRIPSI & KLASIFIKASI TANAH & BATUAN
1.00			
2.00			
3.00			
4.00			
5.00			
6.00			

LEGENDA :

= MUKA AIR TANAH di isi pada elevasi diatas

= SAMPEL TANAH

Elevasi Banjir ... m

Muka Air Tanah Tertinggi ... m

CATATAN :

Bila tidak ditemukan air tanah hingga kedalaman 6m, lihat sumur penduduk sekitar lokasi.

Pastikan Muka Air Tanah Tertinggi merupakan elevasi Air Tanah **tertinggi** di Site ini. Atau Elevasi Air Sumur tertinggi di sekitar site ini.

"Soil test telah dilakukan sesuai petunjuk yang telah diberikan oleh NSN"

Pelaksana Soil Test	CME Kontraktor	PT. INTI BANGUN SEJAHTERA PIC
(Api)	( )	( )

Laporan Penyelidikan Tanah sementara diserahkan paling lambat 1 hari setelah Soil Test site ini dilakukan

Laporan Penyelidikan Tanah dari Laboratorium diserahkan paling lambat 30 hari setelah Soil Test site ini dilakukan (soft copy email / ereport)

Page 7

Soil Test Form

DATA SONDIR   NO TITIK: S1

SITE ID :

SITE NAME :

TANGGAL :

INSTITUSI PELAKSANA :

Kedalaman (m)	Penetrasi Konus (kg/cm²)	Jumlah Perlawanan (kg/cm²)	Kedalaman (m)	Penetrasi Konus (kg/cm²)	Jumlah Perlawanan (kg/cm²)	Kedalaman (m)	Penetrasi Konus
0.00							
0.20	8	12	10.20			20.20	
0.40	10	14	10.40			20.40	
0.60	12	16	10.60			20.60	
0.80	14	18	10.80			20.80	
1.00	16	20	11.00			21.00	
1.20	18	22	11.20			21.20	
1.40	20	24	11.40			21.40	
1.60	23	26	11.60			21.60	
1.80	18	22	11.80			21.80	
2.00	16	20	12.00			22.00	
2.20	14	10	12.20			22.20	
2.40	12	16	12.40			22.40	
2.60	10	14	12.60			22.60	
2.80	8	12	12.80			22.80	
3.00	11	13	13.00			23.00	
3.20	13	17	13.20			23.20	
3.40	16	20	13.40			23.40	
3.60	18	23	13.60			23.60	
3.80	20	25	13.80			23.80	
4.00	22	28	14.00			24.00	
4.20	24	30	14.20			24.20	
4.40	27	32	14.40			24.40	
4.60	29	34	14.60			24.60	
4.80	32	38	14.80			24.80	
5.00	34	40	15.00			25.00	
5.20	36	42	15.20			25.20	
5.40	40	47	15.40			25.40	
5.60	42	50	15.60			25.60	
5.80	44	52	15.80			25.80	
6.00	65	85	16.00			26.00	
6.20	75	109	16.20			26.20	
6.40	100	125	16.40			26.40	
6.60	124	137	16.60			26.60	
6.80	155	175	16.80			26.80	
7.00	175	200	17.00			27.00	
7.20	200	230	17.20			27.20	
7.40			17.40			27.40	
7.60			17.60			27.60	
7.80			17.80			27.80	
8.00			18.00			28.00	
8.20			18.20			28.20	

DATA SONDIR NO TITIK. S2

SITE ID :
SITE NAME :
TANGGAL :
INSTITUSI PELAKSANA :

Kedalaman (m)	Penetrasi Konus (kg/cm^2)	Jumlah Perlawanan (kg/cm^2)
0.00		
0.20	10	14
0.40	11	20
0.60	[illegible]	24
0.80	14	30
1.00	12	32
1.20	20	36
1.40	14	40
1.60	38	42
1.80	42	54
2.00	53	68
2.20	75	96
2.40	100	118
2.60	125	137
2.80	140	153
3.00	175	186
3.20	192	210
3.40	200	220
3.60		
3.80		
4.00		
4.20		
4.40		
4.60		
4.80		
5.00		
5.20		
5.40		
5.60		
5.80		
6.00		
6.20		
6.40		
6.60		
6.80		
7.00		
7.20		
7.40		
7.60		
7.80		
8.00		
8.20		
8.40		
8.60		
8.80		
9.00		
9.20		
9.40		
9.60		
9.80		
10.00		

Kedalaman (m)	Penetrasi Konus (kg/cm^2)	Jumlah Perlawanan (kg/cm^2)
10.20		
10.40		
10.60		
10.80		
11.00		
11.20		
11.40		
11.60		
11.80		
12.00		
12.20		
12.40		
12.60		
12.80		
13.00		
13.20		
13.40		
13.60		
13.80		
14.00		
14.20		
14.40		
14.60		
14.80		
15.00		
15.20		
15.40		
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15.80		
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16.20		
16.40		
16.60		
16.80		
17.00		
17.20		
17.40		
17.60		
17.80		
18.00		
18.20		
18.40		
18.60		
18.80		
19.00		
19.20		
19.40		
19.60		
19.80		
20.00		

Kedalaman (m)	Penetrasi Konus (kg/cm^2)
20.20	
20.40	
20.60	
20.80	
21.00	
21.20	
21.40	
21.60	
21.80	
22.00	
22.20	
22.40	
22.60	
22.80	
23.00	
23.20	
23.40	
23.60	
23.80	
24.00	
24.20	
24.40	
24.60	
24.80	
25.00	
25.20	
25.40	
25.60	
25.80	
26.00	
26.20	
26.40	
26.60	
26.80	
27.00	
27.20	
27.40	
27.60	
27.80	
28.00	
28.20	
28.40	
28.60	
28.80	
29.00	
29.20	
29.40	
29.60	
29.80	
30.00	

Note Sondir up qc to 200 kg/cm or 30 m