FOOTING DESIGN (LSM-IS 456:2000)

DESIGN INPUT:

(a) Support reactions:

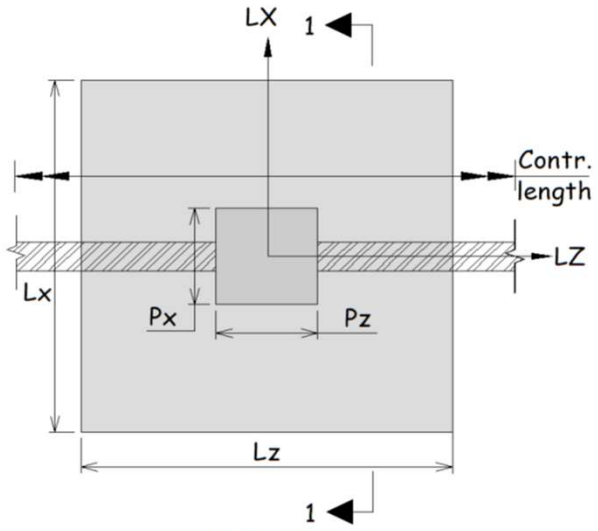
Table-A1 (Support reactions from structure analysis transformed to local ftg axes viz. LX, LY & LZ):

Design criterion	Node	L/C	Fx (kN)	Fy (kN)	Fz (kN)	Mx (kNm)	My (kNm)	Mz (kNm)	FOS	% backfill assumed
Below are factored loads for the governing LC for each design criterion										
Soil press. [1,2]	1	101	0.0	250	0.0	0.0	0.0	0.0	NA	NA
Uplift	1	101	0.0	250	0.0	0.0	0.0	0.0	1.1	100
Sliding	1	101	0.0	250	0.0	0.0	0.0	0.0	1.5	100
Overturning [3]	1	101	0.0	250	0.0	0.0	0.0	0.0	1.5	100

[1] Permissible loss of contact with soil: NA

[2] Increase in allowable stresses for gov. LC (101): NA

[3] Restoring moment for governing LC (101) = 100%



FOOTING PLAN

(b) Dimensions:

(i) Blockwall:

Length, Wl = 0 m; Height, Wh = 0 m

Thk., Wt = 0 m; Density, Wd = 0 kN/m³

(ii) Plinth beam:

Length, Tl = 0 m; Width, Tb = 0.23 m; Depth, TD = 0.4 m

(iii) Pedestal size:

Pz = 0.6 m; Px = 0.6 m

(c) Materials:

fck = 25 MPa

fy = 500 MPa

cc = 75 mm; Coeff. of friction bet. conc. and soil, μ = 0.4

(d) Soil data:

Unit wt. of soil, γs = 18 kN/m³

Net SBC of soil @ ftg. depth = 200 kPa

Depth of water table below ground, Dwt = 1 m

(e) Levels (Ref. section 1-1):

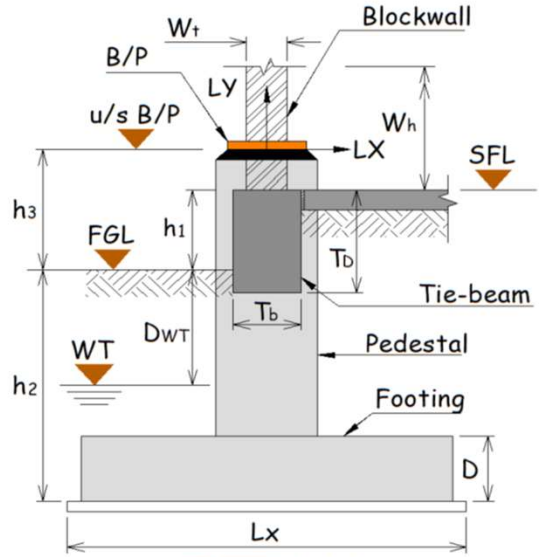
h1 = 0 m; h2 = 1.5 m; h3 = 1.5 m

(f) Footing size (assumed):

Dim. parallel to LX, Lx = 1 m

Dim. parallel to LZ, Lz = 1 m

Dim. parallel to LY, D = 0.3 m



SECTION 1-1

epicenter Consulting Engineers Pvt. Ltd.		Client : EPICENTER CONSULTING ENGINEERS					Element:	
		Project:	1001	Doc. No.:	1001-CV-001		Location/	
		Rev.	Ppd. by	Date	Chd. by	Date		
Project:	WAREHOUSE	2					Designation:	
Structure:	A-BUILDING	1					F1-HEATER	
Type:	PEB	0	-	20-12-2025	-	20-12-2025	Sht. 1 of 9	

BASE PRESSURE:

(a) Forces (For governing LC, SBC increase = 0%):

Fx = 0/ 1 = 0 kN; Fy = 250/ 1 = 250 kN; Fz = 0/ 1 = 0 kN

Mx = 0/ 1 = 0 kNm; My = 0/ 1 = 0 kNm; Mz = 0/ 1 = 0 kNm

Buoyancy force, Fb = 10 Lx.Lz (h2 - Dwt) = 5.00 kN [Water table depth < fdn. depth]

Vol. of soil above the ftg (Vs):

Vs = 0.5 {(h2 - D).(Lz.Lx - Pz.Px)} + 0.5 {(h1 + h2 - D).(Lz.Lx - Pz.Px)}

= 0.5 {(1.5 - 0.3).(1 x 1 - 0.6 x 0.6)} + 0.5 {(0 + 1.5 - 0.3).(1 x 1 - 0.6 x 0.6)} = 0.77 m^3

Wt. of soil, Sw = γs x Vs = 18 x 0.77 = 13.82 kN

Self-wt. of ftg., Fw = 25 Lx.Lz.D = 25 x 1 x 1 x 0.3 = 7.5 kN

Self-wt. of pedestal, Pw = 25 Px.Pz (h3 + h2 - D) = 25 x 0.6 x 0.6 x (1.5 + 1.5 - 0.3) = 24.30 kN

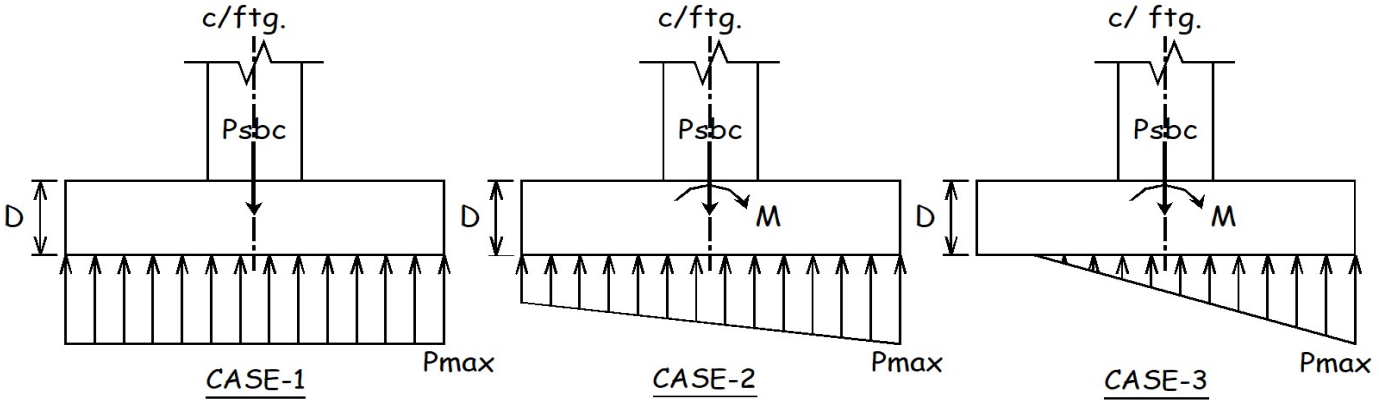
Self-wt. of blockwall, Ww = Wd.Wl.Wh.Wt = 0 x 0 x 0 x 0 = 0 kN

Self-wt. of tie-beam/wall, Wb = 25 Lb.Tb.TD = 25 x 4.53 x 0.23 x 0.4 = 10.41 kN

Unf. load on soil, Psbc = Fy/ 1.5 + Sw + Fw + Pw + Ww + Wb - Fb = 217.7 kN [LF = 1.5]

Unf. BM @ u/s of ftg. || to LX (Mz,tot) = Mz/ 1.5 + (Fx/ 1.5) x (h2 + h3) = 0 kNm [LF = 1.5]

Unf. BM @ u/s of ftg. || to LZ (Mx,tot) = Mx/ 1.5 + (Fz/ 1.5) x (h2 + h3) = 0 kNm [LF = 1.5]



(b) Eccentricity:

ex = Mz,tot/ Psbc = 0/ 217.7 = 0 m < Lx/ 6 [No loss of contact]

ez = Mx,tot/ Psbc = 0/ 217.7 = 0 m < Lz/ 6 [No loss of contact]

(c) Base pressure (Permissible LOC: NA; Ct = 0):

ex < = Lx/ 6 & ez < = Lz/ 6

=> pmax = (Psbc/ (Lx.Lz)).(1 + 6 ex/ Lx + 6 ez/ Lz)

= (217.7/ (1 x 1)) x (1 + 6 x 0 + 6 x 0) = 217.7 kPa

Design max. net press., pmax1 = pmax - γs.h2

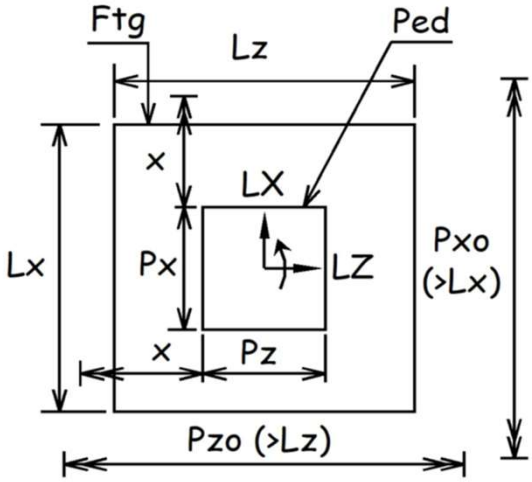
=> pmax1 = 217.7 - 18 x 1.5 = 190.7 kPa < SBC (= 200 kPa), OK

Max. unf. net press. intensity (pmax,npi):

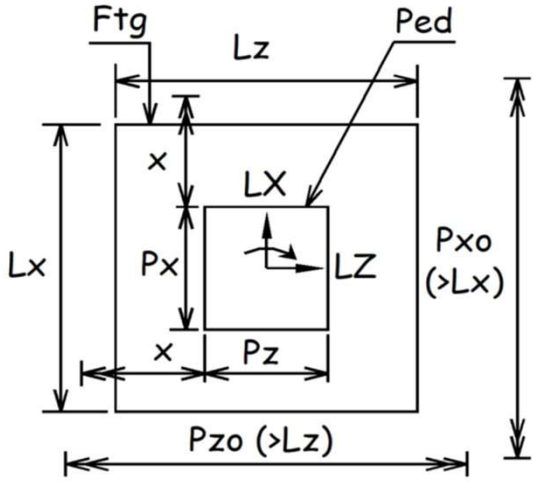
pmax,npi = pmax1 - Fw/ (Lz.Lx)

= 190.7 - 7.5/ (1 x 1) = 183.2 kPa

Max. fact. net press. intensity, fpu = 1.5 x pmax,npi = 1.5 x 183.2 = 274.8 kPa



2-WAY SHEAR (Mz BENDING)



2-WAY SHEAR (Mx BENDING)

TWO-WAY SHEAR [T12-B1 (@ LX); T12-B2 (@ LZ)]:

[Case: Pedestal is in direct compression for LC-101 at support joint-1]

(a) Eff. depth and perimeter dims. for punching shear:

dx = D - cc - Øx/ 2 = 0.22 m

dz = D - cc - Øx - Øz/ 2 = 0.21 m

=> davg = (dx + dz)/ 2 = 0.21 m

Pxo = Px + 3.d = 0.6 + 3 x 0.21 = 1.24 m > = Lx (= 1 m)

Pzo = Pz + 3.d = 0.6 + 3 x 0.21 = 1.24 m > = Lz (= 1 m)

(b) Max. design shear stress at column face (x = 0): [Cl. 40.2.3.1; IS 456]

Tc,max = 3.1 MPa (M25 conc.) [Table 20; IS 456]

Perimeter at critical section (x = 0), uo = 2 (Px + Pz) = 2 x (0.6 + 0.6) = 2.4 m

Area outside the critical section (x = 0), A_1 = 1 x 1 - 0.6 x 0.6 = 0.64 m^2

Resisting area at critical section (x = 0), A = uo.d = 2.4 x 0.21 = 0.51 m^2

vu (x = 0) = fpu x A_1/ A = (274.8 x 0.64/ 0.51)/ 1000 = 0.34 MPa < Tc,max/ 2 (= 1.2 MPa), OK

(c) Permissible shear stress: [Cl. 31.6.3.1; IS 456]

ßc = 0.6/ 0.6 = 1.00

=> ks = Min {(0.5 + 1.00), 1} = 1

τc = 0.25 x √fck = 1.25 MPa

=> ks.τc = 1 x 1.25 = 1.25 MPa

(d) 2-way shear with Mz moment: [Cl. 31.3.3; IS 456]

Here, Pxo >= Lx; Pzo >= Lz: Ax (Pxo > = Lx):

Since, Pxo > = Lx, Ax = 0 m^2

Fact. shear force, Vx = Ax.fpu = 0 x 274.8 = 0 kN

Fact. shear stress, τvx = Vx/ (Pzo.d)

=> τvx = 0 x 1000/ (1.24 x 0.21 x 1000000)

= 0 MPa > Ks.τc (= 1.25 MPa), OK

(i) Transfer of Mz moment to column: [Cl. 31.3.3; IS 456]

[This check is not required for pad footing]

(e) 2-way shear with Mx moment: [Cl. 31.3.3; IS 456]

Here, Pxo >= Lx; Pzo >= Lz: Az (Pzo > = Lz):

Since, Pzo > = Lz, Az = 0 m^2

Fact. shear force, Vz = Az.fpu

= 0 x 274.8 = 0 kN

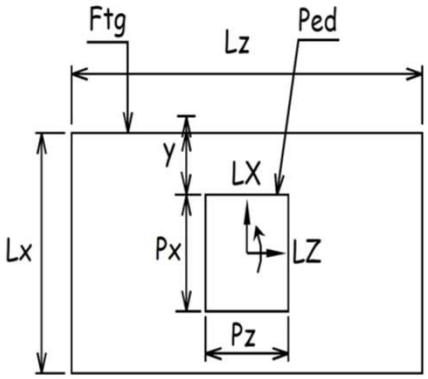
Fact. shear stress, τvz = Vz/ (Pxo.d)

=> τvz = 0 x 1000/ (1.24 x 0.21 x 1000000)

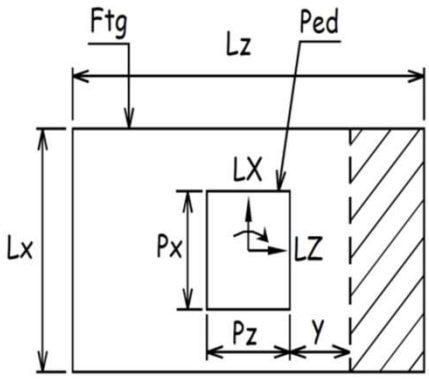
= 0 MPa <= Ks.τc (= 1.25 MPa), OK

(i) Transfer of Mx moment to column: [Cl. 31.3.3; IS 456]

[This check is not required for pad footing]



SHEAR IN LX-DIRN



SHEAR IN LZ-DIRN

ONE-WAY SHEAR [T12-B1 (@ LX); T12-B2 (@ LZ)]:

[Case: Pedestal is in direct compression for LC-101 at support joint-1]

Crit. sec. is at 'd' dist. from ped. face [Cl. 34.2.4; IS 456]

(a) Eff. depths for one-way shear:

dx = D - cc - Øx/ 2 = 0.22 m; dz = D - cc - Øx - Øz/ 2 = 0.21 m

(b) Shear in LX-direction (T12@200 c/c):

Ls = Lx/ 2 - Px/ 2 - dx = 1/ 2 - 0.6/ 2 - 0.22 = -0.02 m (<= 0)

Hence the critical section for 1-way shear does not exist

=> V = 0 kN

=> vu = V/ (Lz.dx) = 0 x 1000/ (1000 x 220) = 0 MPa

pt = 0.26% & Fcu = 25 MPa => τc = 0.36 MPa [Table 19; IS 456]

k = 1 (300 mm thk. ftg.) [Cl. 40.2.1.1; IS 456]

=> k.τc = 1 x 0.36 = 0.36 MPa > vu (= 0 MPa), OK

(c) Shear in LZ-direction (T12@200 c/c):

Ls = Lz/ 2 - Pz/ 2 - dz = 1/ 2 - 0.6/ 2 - 0.21 = 0.24 m

Shear force @ crit. section (Design max. net press. > 0):

V = fpu x Ls x Lx = 274.8 x 0.24 x 1 = 94.03 kN

=> vu = V/ (Lx.dz) = 94.03 x 1000/ (1000 x 210) = 0.3 MPa

pt = 0.27% & Fcu = 25 MPa => τc = 0.36 MPa [Table 19; IS 456]

k = 1 (300 mm thk. ftg.) [Cl. 40.2.1.1; IS 456]

=> k.τc = 1 x 0.37 = 0.37 MPa > vu (= 0.3 MPa), OK

FLEXURE:

(a) Bending @ LZ-axis:

Bending length, Lben = (Lx - Px)/ 2 = (1 - 0.6)/ 2 = 0.2 m

(i) Sagging moment (T12@200 c/c):

Msag = fpu x Lben²/2

= 274.8 x 0.2²/ 2 = 5.5 kNm/ m

As = 113.1 mm² => Pt = 0.26%

MRsag = 0.87fy {As/ (s.d)}.[1 - 1.005 {(As/ (s.d)).(fy/ fcu)}].(b.d²)

= [0.87 x 500 x {113.1/ (200 x 220)}] x

[1 - 1.005 x {(113.1/ (200 x 220)) x (500/ 25)}] x (1000 x 220²)

= 51.08 kNm/ m > = Msag (= 5.5 kNm/ m), OK

(ii) Hogging moment (T10@300 c/c):

Ct = 0 > 1 => Design top steel is required

Mhog = 1.5 {(25 D) + 18 (h2 - D)}.(Lben²/ 2)

= 1.5 x {(25 x 0.3) + 18 x (1.5 - 0.3)} x (0.2²/ 2)

= 4.42 kNm/ m

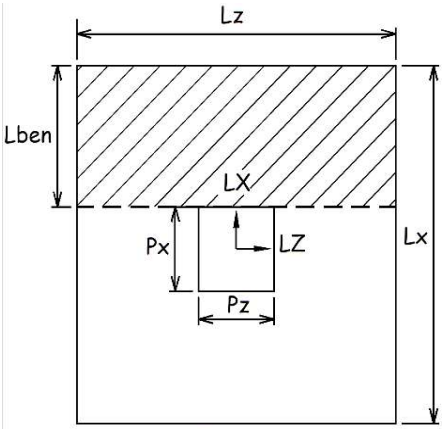
As = 78.5 mm² => Pt = 0.12%

MRhog = 0.87fy {As/ (s.d)}.[1 - 1.005 {(As/ (s.d)).(fy/ fcu)}].(b.d²)

= [0.87 x 500 x {78.5/ (300 x 220)}] x

[1 - 1.005 x {(78.5/ (300 x 220)) x (500/ 25)}] x (1000 x 220²)

= 24.45 kNm/ m > = Mhog (= 4.42 kNm/ m), OK



BM @ LZ-AXIS

(b) Bending @ LX-axis:

Bending length, Lben = (Lz - Pz)/ 2 = (1 - 0.6)/ 2 = 0.2 m

(i) Sagging moment (T12@200 c/c):

Msag = fpu x Lben²/2

= 274.8 x 0.2²/ 2 = 5.5 kNm/ m

As = 113.1 mm² => Pt = 0.27%

MRsag = 0.87fy {As/ (s.d)}.[1 - 1.005 {(As/ (b.d)).(fy/ fcu)}].(b.d²)

= [0.87 x 500 x {113.1/ (200 x 210)}] x

[1 - 1.005 x {(113.1/ (200 x 210)) x (500/ 25)}] x (1000 x 210²)

= 48.12 kNm/ m > = Msag (= 5.5 kNm/ m), OK

(ii) Hogging moment (T10@300 c/c):

Ct = 0 > 1 => Design top steel is required

Mhog = 1.5 {(25 D) + 18 (h2 - D)}.(Lben²/ 2)

= 1.5 x {(25 x 0.3) + 18 x (1.5 - 0.3)} x (0.2²/ 2)

= 4.42 kNm/ m

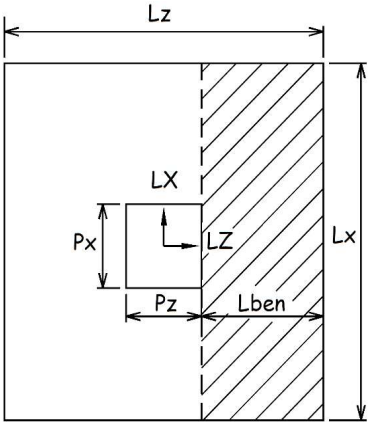
As = 78.5 mm² => Pt = 0.12%

MRhog = 0.87fy {As/ (s.d)}.[1 - 1.005 {(As/ (b.d)).(fy/ fcu)}].(b.d²)

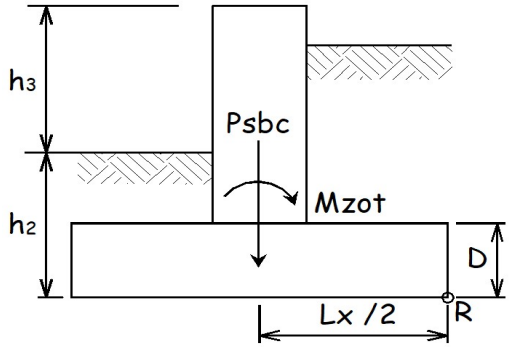
= [0.87 x 500 x {78.5/ (300 x 210)}] x

[1 - 1.005 x {(78.5/ (300 x 210)) x (500/ 25)}] x (1000 x 210²)

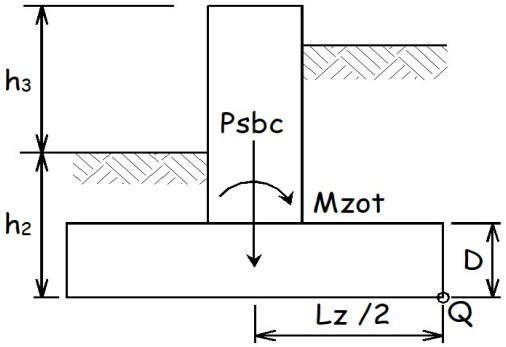
= 23.32 kNm/ m > = Mhog (= 4.42 kNm/ m), OK



BM @ LX-AXIS



OVERTURNING @ LZ-AXIS



OVERTURNING @ LX-AXIS

CHECK FOR OVERTURNING [MRF = 1]:

(a) Overturning @ Z-axis [Point R is the instantaneous center of rotation]:

Overturning moment, OMz = {Mz + Fx (h2 + h3)} + Fyt. Lx/2

= {0 + 0 x (1.5 + 1.5)} + (0 x 1/ 2) = 0 + 0 = 0 kN.m

Fres = Fyc + k3.Sw + Fw + Pw + Ww + Wb - Fb

= 250 + 1 x 13.82 + 7.5 + 24.3 + 0 + 10.41 - 5 = 301.03 kN

Restoring moment, RMz = MRF x Fres x Lx/2 = 1 x 301.03 x 1 / 2 = 150.52 kN.m

Since overturning moment, OMz = 0 kNm, ftg is safe (OK)

(b) Overturning @ X-axis [Point Q is the instantaneous center of rotation]:

Overturning moment, OMx = {Mx + Fz (h2 + h3)} + Fyt. Lz/2

= {0 + 0 x (1.5 + 1.5)} + (0 x 1/ 2) = 0 + 0 = 0 kN.m

Fres = Fyc + k3.Sw + Fw + Pw + Ww + Wb - Fb

= 250 + 1 x 13.82 + 7.5 + 24.3 + 0 + 10.41 - 5 = 301.03 kN

Restoring moment, RMx = MRF x Fres x Lz/2 = 1 x 301.03 x 1 / 2 = 150.52 kN.m

Since overturning moment, OMx = 0 kNm, ftg is safe (OK)

CHECK FOR UPLIFT:

Buoyancy force, Fb = 5.00 kN [Ref. base press. cals. on sheet-2]

Restoring Force, Fu = k1.Sw + Fw + Pw + Ww + Wb

= 1 x 13.82 + 7.5 + 24.3 + 0 + 10.41 = 56.03 kN

FOS,upl = (Fu + Fyc)/ Fb = (56.03 + 250) / 5

=> FOS,upl = 306.03/ 5 = 61.21 > = 1.1 (OK)

CHECK FOR SLIDING:

Fx = 0 kN; Fz = 0 kN => Resultant, R = $\sqrt{(Fx^2 + Fz^2)}$ = 0 kN

Normal reaction, N = Fy + k2.Sw + Fw + Pw + Ww + Wb - Fb

= 250 + 1 x 13.82 + 7.5 + 24.3 + 0 + 10.41 - 5 = 301.03 kN

Friction, F = 0.4 x 301.03 = 120.41 kN

Since resultant sliding force, R = 0 kN, ftg is safe (OK)

BILL OF QUANTITIES:

Table-Q1 (Concrete):

Material	Ftg. nos.	Footing dimensions			Quantity		Remarks
		Lx (m)	Lz (m)	D (m)	Vol./ ftg. (cu.m)	Total vol. (cu.m)	
Concrete	12	1.00	1.00	0.30	0.30	3.6	

Table-Q2 (Reinforcing steel): [Ref. AutoCAD dwg for accurate rebar quantities]

Bar layer	Ftg. nos.	Bar details				1 ftg. (kg)	Tot. qty (kg)	Remarks
		Dia. (mm)	l (m)	Spg. (mm)	No.			
Bot. bars || to GX	12	12	1.14	200	6	6	73	
Bot. bars || to GZ	12	12	1.14	200	6	6	73	
Top bars || to GX	12	10	1.14	300	4	3	34	
Top bars || to GZ	12	10	1.14	300	4	3	34	
Side face bars	-	-	-	-	-	-	-	Not required
					Total --->	18	213	

Table-Q3 (Formwork):

Material	Ftg. nos.	Footing dimensions			Quantity		Remarks
		Lx (m)	Lz (m)	D (m)	Area/ ftg. (sq.m)	Total area (sq.m)	
Formwork	12	1.00	1.00	0.30	1.20	14.4	

Table-Q4 (Cost):

Element	Unit rate		Ftg. nos.	Quantity			Cost (USD)		
	Rate (USD)	UOM		1 ftg.	All ftgs.	UOM	1 ftg.	All ftgs.	Ratio (%)
Concrete	65.0	cu.m	12	0.30	4.0	cu.m	20	234	50.2
Reinforcing steel	1.00	kg	12	18	213	kg	18	213	31.2
Formwork	6.00	sq.m	12	1.20	14.0	sq.m	7	86	18.6
						Total --->	39	466	100

Notes:

1. Dimensions Lx, Lz and D are footing dimensions in the local axes of the footing as shown in the diagrams in Sheet1 of the calculations.
2. Directions GX, GY & GZ correspond to structure global axes.

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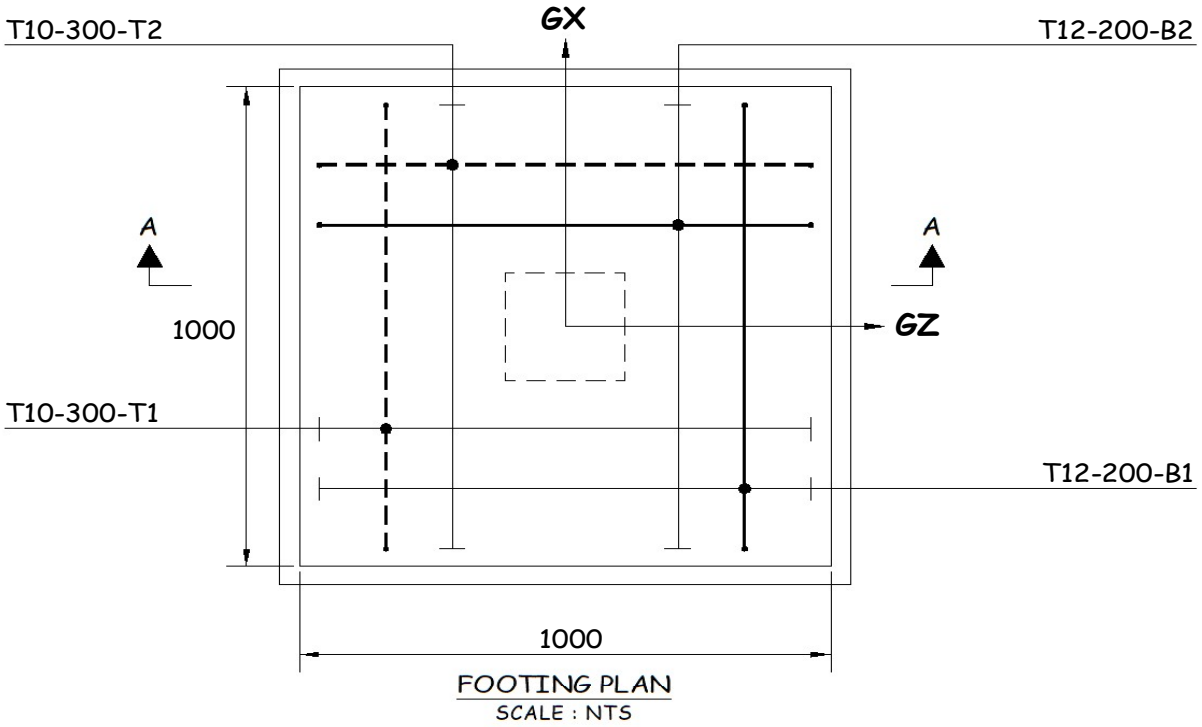
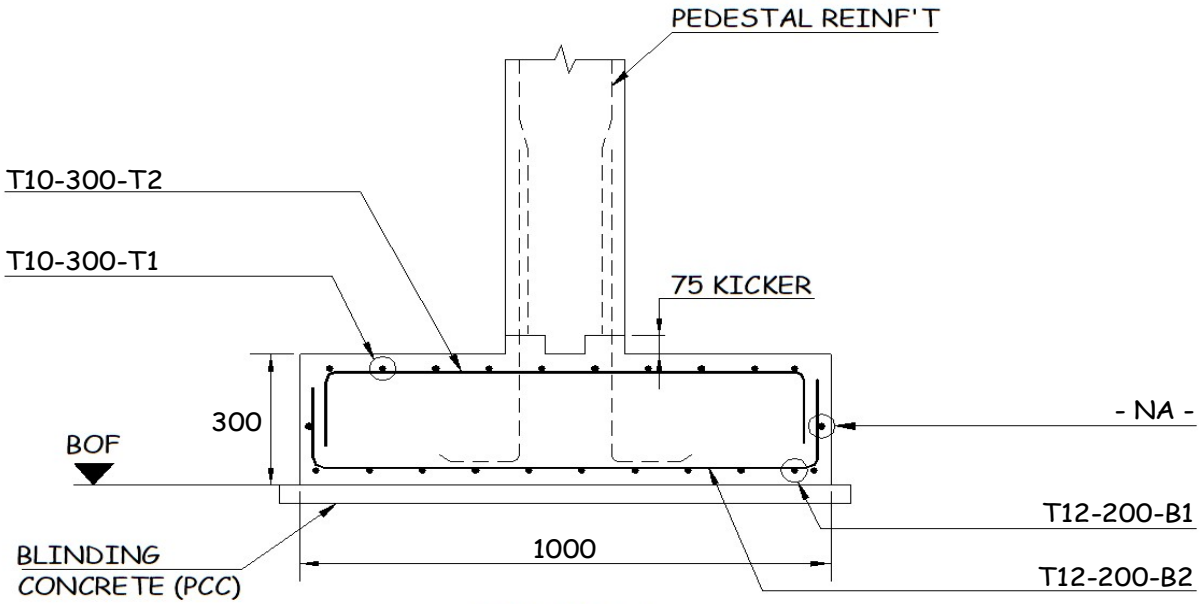


FOOTING PLAN
SCALE : NTS



SECTION A-A
SCALE : NTS

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. FOOTING AXES INDICATED CORRESPOND TO STRUCTURE GLOBAL AXES.
3. THE NOS AND SPACING OF BARS DEPICTED IN ABOVE DIAGRAMS SERVE AS A GUIDE. FOR CORRECT DETAILS, KINDLY FOLLOW WRITTEN INSTRUCTIONS.

epicenter Consulting Engineers Pvt. Ltd.	Client : EPICENTER CONSULTING ENGINEERS					Element:	
	Project:	1001	Doc. No.:	1001-CV-001		Location/	
	Rev.	Ppd. by	Date	Chd. by	Date		
Project: WAREHOUSE	2					Designation:	
Structure: A-BUILDING	1					F1-HEATER	
Type: PEB	0	-	20-12-2025	-	20-12-2025	Sht. 9 of 9	

StrSof
SOFTWARE SOLUTIONS

Client:	**EPICENTER CONSULTING ENGINEERS PVT. LTD.**	**Rev.:**	0	**Date:**	
		Prep. by:		**Chd. By:**	
Project:	**WAREHOUSE**	**Rev.:**	0	**Date:**	
Structure:	**A-BUILDING**	**Prep. by:**		**Chd. By:**	
Area/Unit:		**Rev.:**	0	**Date:**	
Member:	**FOOTING**	**Prep. by:**	-	**Chd. By:**	

Member	Bar mark	Type	Dia. (mm)	No of mbrs	Bars in each	Shape code	Bar dimensions (mm)					Total bars	Bar length (mm)	Tot. bar length (m)	Total weight (kg)
							A	B	C	D	E				
F1-HEATER	01	T	12	12	6	21	100	850	100	-	-	72	1125	80.99	71.90
	02	T	12	12	6	21	88	850	88	-	-	72	1125	80.99	71.90
	03	T	10	12	4	21	100	850	100	-	-	48	1110	53.26	32.84
	04	T	10	12	4	21	90	850	90	-	-	48	1094	52.50	32.37

OPTION NO.	FTG. DIMENSIONS (M)			RE-BAR DETS. (MM)													COST							
				BOTTOM BARS || TO GX			BOTTOM BARS || TO GZ			TOP BARS || TO GX			TOP BARS || TO GZ			SIDE FACE BARS		(%)			(USD)				COSTLIER THAN MOST COST-EFFECTIVE SIZE
	|| TO GX	|| TO GZ	|| TO GY	DIA.	SPG.	Pt (%)	DIA.	SPG.	Pt (%)	DIA.	SPG.	Pt (%)	DIA.	SPG.	Pt (%)	DIA.	NO OF LAYERS	CONC.	STEEL	FORM	CONC. (A)	STEEL (B)	FORM (C)	TOTAL (A+B+C)	
1	1.00	1.00	0.300	12	200	0.26	12	200	0.28	10	300	0.12	10	300	0.13	-	-	50.23%	31.22%	18.55%	19.5	12.1	7.2	39	0.00%
2	1.00	1.00	0.350	12	200	0.22	12	200	0.23	10	300	0.1	10	300	0.11	-	-	51.31%	29.75%	18.94%	22.8	13.2	8.4	44	14.21%
3	1.00	1.00	0.400	12	200	0.18	12	200	0.19	10	300	0.09	10	300	0.09	-	-	52.15%	28.59%	19.26%	26.0	14.3	9.6	50	28.41%
4	1.00	1.00	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	52.83%	27.66%	19.51%	29.3	15.3	10.8	55	42.62%
5	1.00	1.00	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	53.38%	26.91%	19.71%	32.5	16.4	12.0	61	56.82%
6	1.00	1.10	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	51.48%	30.38%	18.14%	21.5	12.7	7.6	42	7.32%
7	1.00	1.10	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	52.61%	28.85%	18.54%	25.0	13.7	8.8	48	22.52%
8	1.00	1.10	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	53.49%	27.66%	18.85%	28.6	14.8	10.1	53	37.72%
9	1.00	1.10	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	54.20%	26.70%	19.10%	32.2	15.9	11.3	59	52.92%
10	1.00	1.10	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	54.77%	25.93%	19.30%	35.8	16.9	12.6	65	68.11%
11	1.00	1.20	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	51.41%	31.19%	17.40%	23.4	14.2	7.9	46	17.25%
12	1.00	1.20	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	52.61%	29.58%	17.81%	27.3	15.4	9.2	52	33.66%
13	1.00	1.20	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	53.55%	28.33%	18.12%	31.2	16.5	10.6	58	50.08%
14	1.00	1.20	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	54.30%	27.32%	18.38%	35.1	17.7	11.9	65	66.50%
15	1.00	1.20	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	54.92%	26.49%	18.59%	39.0	18.8	13.2	71	82.92%
16	1.00	1.30	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	52.42%	30.46%	17.12%	25.4	14.7	8.3	48	24.57%
17	1.00	1.30	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	53.65%	28.83%	17.52%	29.6	15.9	9.7	55	41.98%
18	1.00	1.30	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	54.62%	27.54%	17.84%	33.8	17.0	11.0	62	59.39%
19	1.00	1.30	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	55.40%	26.51%	18.09%	38.0	18.2	12.4	69	76.80%
20	1.00	1.30	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	56.04%	25.66%	18.30%	42.3	19.3	13.8	75	94.21%
21	1.00	1.40	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	52.28%	31.17%	16.55%	27.3	16.3	8.6	52	34.49%
22	1.00	1.40	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	53.58%	29.46%	16.96%	31.9	17.5	10.1	59	53.12%
23	1.00	1.40	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	54.59%	28.13%	17.28%	36.4	18.8	11.5	67	71.75%
24	1.00	1.40	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	55.40%	27.07%	17.53%	41.0	20.0	13.0	74	90.38%
25	1.00	1.40	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	56.07%	26.18%	17.75%	45.5	21.2	14.4	81	109.01%
26	1.00	1.50	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	53.13%	30.52%	16.35%	29.3	16.8	9.0	55	41.81%
27	1.00	1.50	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	54.45%	28.80%	16.75%	34.1	18.1	10.5	63	61.44%
28	1.00	1.50	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	55.48%	27.45%	17.07%	39.0	19.3	12.0	70	81.06%
29	1.00	1.50	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	56.31%	26.36%	17.33%	43.9	20.5	13.5	78	100.68%
30	1.00	1.50	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	57%	25.46%	17.54%	48.8	21.8	15.0	86	120.30%
31	1.00	1.60	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	52.96%	31.15%	15.89%	31.2	18.4	9.4	59	51.74%
32	1.00	1.60	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	54.33%	29.37%	16.30%	36.4	19.7	10.9	67	72.58%
33	1.00	1.60	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	55.40%	27.98%	16.62%	41.6	21.0	12.5	75	93.42%
34	1.00	1.60	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	56.26%	26.86%	16.88%	46.8	22.3	14.0	83	114.27%
35	1.00	1.60	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	56.97%	25.94%	17.09%	52.0	23.7	15.6	91	135.11%
36	1.00	1.70	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	53.68%	30.58%	15.74%	33.2	18.9	9.7	62	59.06%
37	1.00	1.70	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	55.07%	28.78%	16.15%	38.7	20.2	11.3	70	80.89%
38	1.00	1.70	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	56.16%	27.37%	16.47%	44.2	21.5	13.0	79	102.73%
39	1.00	1.70	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	57.03%	26.25%	16.72%	49.7	22.9	14.6	87	124.56%
40	1.00	1.70	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	57.76%	25.31%	16.93%	55.3	24.2	16.2	96	146.40%
41	1.10	1.00	0.300	12	200	0.26	12	200	0.28	10	300	0.12	10	300	0.13	-	-	51.48%	30.38%	18.14%	21.5	12.7	7.6	42	7.32%
42	1.10	1.00	0.350	12	200	0.22	12	200	0.23	10	300	0.1	10	300	0.11	-	-	52.61%	28.85%	18.54%	25.0	13.7	8.8	48	22.52%
43	1.10	1.00	0.400	12	200	0.18	12	200	0.19	10	300	0.09	10	300	0.09	-	-	53.49%	27.66%	18.85%	28.6	14.8	10.1	53	37.72%
44	1.10	1.00	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	54.20%	26.70%	19.10%	32.2	15.9	11.3	59	52.92%
45	1.10	1.00	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	54.77%	25.93%	19.30%	35.8	16.9	12.6	65	68.11%
46	1.10	1.10	0.300	12	200	0.26	12	200	0.28	10	300	0.12	10	300	0.13	-	-	52.78%	29.50%	17.72%	23.6	13.2	7.9	45	15.15%
47	1.10	1.10	0.350	12	200	0.22	12	200	0.23	10	300	0.1	10	300	0.11	-	-	53.95%	27.94%	18.11%	27.5	14.3	9.2	51	31.42%
48	1.10	1.10	0.400	12	200	0.18	12	200	0.19	10	300	0.09	10	300	0.09	-	-	54.87%	26.71%	18.42%	31.5	15.3	10.6	57	47.69%
49	1.10	1.10	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	55.60%	25.74%	18.66%	35.4	16.4	11.9	64	63.97%
50	1.10	1.10	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	56.20%	24.94%	18.86%	39.3	17.5	13.2	70	80.24%
51	1.10	1.10	0.550	12	200	0.13	12	200	0.13	10	275	0.07	10	275	0.07	-	-	56.70%	24.27%	19.03%	43.3	18.5	14.5	76	96.51%
52	1.10	1.20	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	52.70%	30.35%	16.95%	25.7	14.8	8.3	49	25.80%
53	1.10	1.20	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	53.95%	28.70%	17.35%	30.0	16.0	9.7	56	43.38%
54	1.10	1.20	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	54.92%	27.41%	17.67%	34.3	17.1	11.0	62	60.96%
55	1.10	1.20	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	55.70%	26.38%	17.92%	38.6	18.3	12.4	69	78.53%
56	1.10	1.20	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	56.35%	25.52%	18.13%	42.9	19.4	13.8	76	96.11%
57	1.10	1.20	0.550	12	200	0.13	12	200	0.13	10	275	0.07	10	275	0.07	-	-	56.88%	24.82%	18.30%	47.2	20.6	15.2	83	113.69%
58	1.10	1.30	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	53.75%	29.60%	16.65%	27.9	15.4	8.6	52	33.63%
59	1.10	1.30	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	55.03%	27.92%	17.05%	32.5	16.5	10.1	59	52.28%
60	1.10	1.30	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	56.03%	26.61%	17.36%	37.2	17.7	11.5	66	70.93%
61	1.10	1.30	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	56.83%	25.56%	17.61%	41.8	18.8	13.0	74	89.58%
62	1.10	1.30	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	57.49%	24.70%	17.81%	46.5	20.0	14.4	81	108.24%
63	1.10	1.30	0.550	12	200	0.13	12	200	0.13	10	275	0.07	10	275	0.07	-	-	58.04%	23.98%	17.98%	51.1	21.1	15.8	88	126.89%
64	1.10	1.40	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	53.61%	30.32%	16.07%	30.0	17.0	9.0	56	44.28%
65	1.10	1.40	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	54.95%	28.58%	16.47%	35.0	18.2	10.5	64	64.24%
66	1.10	1.40	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	55.99%	27.23%	16.78%	40.0	19.5	12.0	72	84.19%
67	1.10	1.40	0.450	12	200	0.16	12	200	0.16	10	300	0.08	10	300	0.08	-	-	56.83%	26.14%	17.03%	45.0	20.7	13.5	79	104.15%
68	1.10	1.40	0.500	12	200	0.14	12	200	0.14	10	300	0.07	10	300	0.07	-	-	57.52%	25.24%	17.24%	50.1	22.0	15.0	87	124.11%
69	1.10	1.40	0.550	12	200	0.13	12	200	0.13	10	275	0.07	10	275	0.07	-	-	58.10%	24.49%	17.41%	55.1	23.2	16.5	95	144.06%
70	1.10	1.50	0.300	12	200	0.28	12	200	0.26	10	300	0.13	10	300	0.12	-	-	54.48%	29.67%	15.85%	32.2	17.5	9.4	59	52.11%
71	1.10	1.50	0.350	12	200	0.23	12	200	0.22	10	300	0.11	10	300	0.1	-	-	55.84%	27.91%	16.25%	37.5	18.8	10.9	67	73.14%
72	1.10	1.50	0.400	12	200	0.19	12	200	0.18	10	300	0.09	10	300	0.09	-	-	56.91%	26.53%	16.56%	42.9	20.0	12.5	75	94.17%