DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 100'
SIDE COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

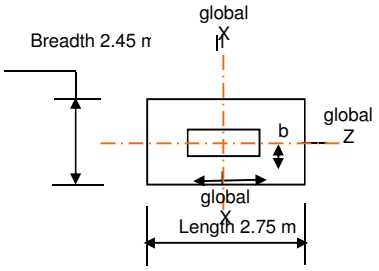
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	3000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	15	15	0	KN
Self Weight Of pedestal =	108	108	108	
Weight of Earthfill on Foundation	238.3875	238.3875	238.3875	
TOTALAXIAL LOAD (P1)	361.3875	361.3875	346.3875	
Moment about Z axis (M_z) =	0	19	0	KN-m
Moment about X axis (M_x) =	3	172	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	2.75	m
Foot Breadth (B, dim. || X axis) =	2.45	m
Thickness of footing (D) =	380	mm
Thickness of footing at edge(t) =	380	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	324	mm
Effective thickness at edge(ti) =	324	mm
Selfweight of the footing =	64.01	KN
Area of Footing(A) =	6.74	m^2
Sect mod of foot about Z axis (Zz) =	2.75	m^3
Sec mod of foot about X axis (Zx) =	3.09	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	425.39	425.39	410.39	KN
Maximum bearing pressure =	**64.11**	**125.74**	**60.91**	KN/m^2
Minimum bearing pressure =	62.17	0.53	60.91	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	64.11	125.74	60.91	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	64.11	125.74	60.91	KN/m^2
Max.total base pressure p max =	64.11	125.74	60.91	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\} \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**3.34**	**188.62**	**91.37**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**188.62**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **138.78** KN-m
Mulimit = **887.31** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **324.0** mm

Hence, Ast = **1010.9** mm^2
Spacing required = **274** mm (considering max of above two calculated values of Ast)
Spacing provided = **150** mm
Hence provide 12 mm dia bar @ 150 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **101.31** KN-m The section is singly reinforced

Mulimit = **995.96** KN-m per meter

EFFECTIVE DEPTH **324.0** mm

Calc. Ast = **731.2** mm^2

Spacing required = **425** mm (considering max of above two calculated values of Ast)

Spacing provided = **150** mm

Hence provide 12 mm dia bar @ 150 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 324.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.451 m

Width of footing at this section at the top of footing =B-2*B1 = 1.848 m

Shear force Vs =pe max x 0.451 x w width of foo footing = **208.41** KN

Percentage at critical section = 0.23 %

Shear stress τ_v = Vs/resisting area = **0.26** N/mm^2

τ_c = **0.35** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 324.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.301** m

Width of footing at this section at the top of footing =L-2*L1 = 1.848 m

Shear force Vs =pe max x 0.301 x width of footing = **156.13** KN

Percentage at critical section = 0.23 %

Shear stress τ_v = Vs/resting area= **0.175** N/mm^2

τ_c = **0.35** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 324.00 mm

Width at critical sections =(l+d),(b+d)= 1524 mm 1524 mm

Shear force Vs = 188.615 (2.75 x 2.45 - 1.524 x 1.524) = **832.72** KN

Length of critical section = 2 x (1524 + 1524) = **6096** mm

Area of the critical section (length of critical sec x eff. d) = **1975104** mm^2

Hence shear stress τ_v = **0.422** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 100'
CENTRAL COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

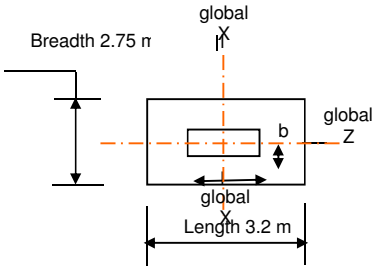
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	3000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	20	20	0	KN
Self Weight Of pedestal =	108	108	108	
Weight of Earthfill on Foundation	331.2	331.2	331.2	
TOTALAXIAL LOAD (P1)	459.2	459.2	439.2	
Moment about Z axis (M_z) =	0	0	0	KN-m
Moment about X axis (M_x) =	3	289	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	3.2	m
Foot Breadth (B, dim. || X axis) =	2.75	m
Thickness of footing (D) =	400	mm
Thickness of footing at edge(t) =	400	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	344	mm
Effective thickness at edge(ti) =	344	mm
Selfweight of the footing =	88.00	KN
Area of Footing(A) =	8.80	m^2
Sect mod of foot about Z axis (Zz) =	4.03	m^3
Sec mod of foot about X axis (Zx) =	4.69	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	547.20	547.20	527.20	KN
Maximum bearing pressure =	**62.82**	**123.76**	**59.91**	KN/m^2
Minimum bearing pressure =	61.54	0.61	59.91	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	62.82	123.76	59.91	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	62.82	123.76	59.91	KN/m^2
Max.total base pressure p max =	62.82	123.76	59.91	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\} \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**3.41**	**185.64**	**89.86**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**185.64**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **255.25** KN-m
Mulimit = **1122.71** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **344.0** mm

Hence, Ast = **1773.1** mm^2
Spacing required = **175** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **178.40** KN-m The section is singly reinforced

Mulimit = **1306.43** KN-m per meter

EFFECTIVE DEPTH **344.0** mm

Calc. Ast = **1219.8** mm^2

Spacing required = **297** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 344.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.656 m

Width of footing at this section at the top of footing =B-2*B1 = 1.888 m

Shear force Vs =pe max x 0.656 x w width of foo footing = **334.89** KN

Percentage at critical section = 0.26 %

Shear stress τ_v = Vs/resisting area = **0.35** N/mm^2

τ_c = **0.37** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 344.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.431** m

Width of footing at this section at the top of footing =L-2*L1 = 1.888 m

Shear force Vs =pe max x 0.431 x width of footing = **256.03** KN

Percentage at critical section = 0.26 %

Shear stress τ_v = Vs/resting area= **0.233** N/mm^2

τ_c = **0.37** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 344.00 mm

Width at critical sections =(l+d),(b+d)= 1544 mm 1544 mm

Shear force Vs = 185.637 (3.2 x 2.75 - 1.544 x 1.544) = **1191.06** KN

Length of critical section = 2 x (1544 + 1544) = **6176** mm

Area of the critical section (length of critical sec x eff. d) = **2124544** mm^2

Hence shear stress τ_v = **0.561** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 120'
SIDE COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

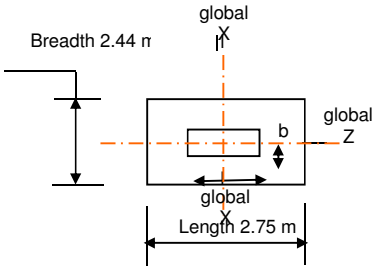
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	4000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	15	20	0	KN
Self Weight Of pedestal =	144	144	144	
Weight of Earthfill on Foundation	316.2	316.2	316.2	
TOTALAXIAL LOAD (P1)	475.2	480.2	460.2	
Moment about Z axis (M_z) =	0	35	0	KN-m
Moment about X axis (M_x) =	3	195	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	2.75	m
Foot Breadth (B, dim. || X axis) =	2.44	m
Thickness of footing (D) =	375	mm
Thickness of footing at edge(t) =	375	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	319	mm
Effective thickness at edge(ti) =	319	mm
Selfweight of the footing =	62.91	KN
Area of Footing(A) =	6.71	m^2
Sect mod of foot about Z axis (Zz) =	2.73	m^3
Sec mod of foot about X axis (Zx) =	3.08	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	538.11	543.11	523.11	KN
Maximum bearing pressure =	**81.17**	**157.17**	**77.96**	KN/m^2
Minimum bearing pressure =	79.22	4.71	77.96	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	81.17	157.17	77.96	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	81.17	157.17	77.96	KN/m^2
Max.total base pressure p max =	81.17	157.17	77.96	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\{ \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**3.35**	**235.76**	**116.94**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**235.76**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **172.75** KN-m
Mulimit = **856.62** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **319.0** mm

Hence, Ast = **1288.2** mm^2
Spacing required = **214** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **124.61** KN-m The section is singly reinforced

Mulimit = **965.46** KN-m per meter

EFFECTIVE DEPTH **319.0** mm

Calc. Ast = **917.6** mm^2

Spacing required = **339** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 319.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.456 m

Width of footing at this section at the top of footing =B-2*B1 = 1.838 m

Shear force Vs =pe max x 0.456 x w width of foo footing = **262.31** KN

Percentage at critical section = 0.28 %

Shear stress τ_v = Vs/resisting area = **0.34** N/mm^2

τ_c = **0.39** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 319.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.301** m

Width of footing at this section at the top of footing =L-2*L1 = 1.838 m

Shear force Vs =pe max x 0.301 x width of footing = **195.15** KN

Percentage at critical section = 0.28 %

Shear stress τ_v = Vs/resting area= **0.222** N/mm^2

τ_c = **0.39** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 319.00 mm

Width at critical sections =(l+d),(b+d)= 1519 mm 1519 mm

Shear force Vs = 235.758 (2.75 x 2.44 - 1.519 x 1.519) = **1037.96** KN

Length of critical section = 2 x (1519 + 1519) = **6076** mm

Area of the critical section (length of critical sec x eff. d) = **1938244** mm^2

Hence shear stress τ_v = **0.536** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 120'
CENTRAL COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

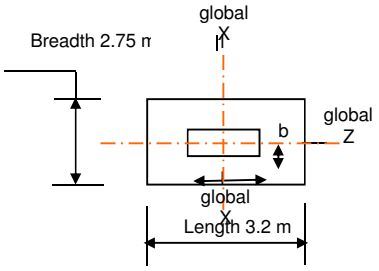
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	4000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	26	26	0	KN
Self Weight Of pedestal =	144	144	144	
Weight of Earthfill on Foundation	441.6	441.6	441.6	
TOTALAXIAL LOAD (P1)	611.6	611.6	585.6	
Moment about Z axis (M_z) =	0	0	0	KN-m
Moment about X axis (M_x) =	3	346	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	3.2	m
Foot Breadth (B, dim. || X axis) =	2.75	m
Thickness of footing (D) =	460	mm
Thickness of footing at edge(t) =	460	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	404	mm
Effective thickness at edge(ti) =	404	mm
Selfweight of the footing =	101.20	KN
Area of Footing(A) =	8.80	m^2
Sect mod of foot about Z axis (Zz) =	4.03	m^3
Sec mod of foot about X axis (Zx) =	4.69	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	712.80	712.80	686.80	KN
Maximum bearing pressure =	**81.64**	**154.72**	**78.05**	KN/m^2
Minimum bearing pressure =	80.36	7.28	78.05	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	81.64	154.72	78.05	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	81.64	154.72	78.05	KN/m^2
Max.total base pressure p max =	81.64	154.72	78.05	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\{ \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**4.43**	**232.08**	**117.07**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**232.08**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **319.11** KN-m
Mulimit = **1548.51** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **404.0** mm

Hence, Ast = **1880.4** mm^2
Spacing required = **165** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **223.03** KN-m The section is singly reinforced

Mulimit = **1801.90** KN-m per meter

EFFECTIVE DEPTH **404.0** mm

Calc. Ast = **1295.7** mm^2

Spacing required = **279** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 404.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.596 m

Width of footing at this section at the top of footing =B-2*B1 = 2.008 m

Shear force Vs =pe max x 0.596 x w width of foo footing = **380.38** KN

Percentage at critical section = 0.22 %

Shear stress τ_v = Vs/resisting area = **0.34** N/mm^2

τ_c = **0.35** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 404.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.371** m

Width of footing at this section at the top of footing =L-2*L1 = 2.008 m

Shear force Vs =pe max x 0.371 x width of footing = **275.53** KN

Percentage at critical section = 0.22 %

Shear stress τ_v = Vs/resting area= **0.213** N/mm^2

τ_c = **0.35** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 404.00 mm

Width at critical sections =(l+d),(b+d)= 1604 mm 1604 mm

Shear force Vs = 232.082 (3.2 x 2.75 - 1.604 x 1.604) = **1445.22** KN

Length of critical section = 2 x (1604 + 1604) = **6416** mm

Area of the critical section (length of critical sec x eff. d) = **2592064** mm^2

Hence shear stress τ_v = **0.558** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 150'
SIDE COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

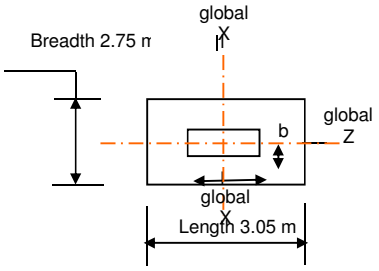
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	4000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	20	20	0	KN
Self Weight Of pedestal =	144	144	144	
Weight of Earthfill on Foundation	416.85	416.85	416.85	
TOTALAXIAL LOAD (P1)	580.85	580.85	560.85	
Moment about Z axis (M_z) =	0	44	0	KN-m
Moment about X axis (M_x) =	3	235.35	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	3.05	m
Foot Breadth (B, dim. || X axis) =	2.75	m
Thickness of footing (D) =	400	mm
Thickness of footing at edge(t) =	400	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	344	mm
Effective thickness at edge(ti) =	344	mm
Selfweight of the footing =	83.88	KN
Area of Footing(A) =	8.39	m^2
Sect mod of foot about Z axis (Zz) =	3.84	m^3
Sec mod of foot about X axis (Zx) =	4.26	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	664.73	664.73	644.73	KN
Maximum bearing pressure =	**79.96**	**145.90**	**76.87**	KN/m^2
Minimum bearing pressure =	78.55	12.61	76.87	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	79.96	145.90	76.87	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	79.96	145.90	76.87	KN/m^2
Max.total base pressure p max =	79.96	145.90	76.87	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\} \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**3.58**	**218.85**	**115.30**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**218.85**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **257.47** KN-m
Mulimit = **1122.71** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **344.0** mm

Hence, Ast = **1789.1** mm^2
Spacing required = **174** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **200.45** KN-m The section is singly reinforced

Mulimit = **1245.19** KN-m per meter

EFFECTIVE DEPTH **344.0** mm

Calc. Ast = **1376.3** mm^2

Spacing required = **251** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 344.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.581 m

Width of footing at this section at the top of footing =B-2*B1 = 1.888 m

Shear force Vs =pe max x 0.581 x w width of foo footing = **349.66** KN

Percentage at critical section = 0.26 %

Shear stress τ_v = Vs/resisting area = **0.37** N/mm^2

τ_c = **0.37** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 344.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.431** m

Width of footing at this section at the top of footing =L-2*L1 = 1.888 m

Shear force Vs =pe max x 0.431 x width of footing = **287.68** KN

Percentage at critical section = 0.26 %

Shear stress τ_v = Vs/resting area= **0.274** N/mm^2

τ_c = **0.37** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 344.00 mm

Width at critical sections =(l+d),(b+d)= 1544 mm 1544 mm

Shear force Vs = 218.845 (3.05 x 2.75 - 1.544 x 1.544) = **1313.85** KN

Length of critical section = 2 x (1544 + 1544) = **6176** mm

Area of the critical section (length of critical sec x eff. d) = **2124544** mm^2

Hence shear stress τ_v = **0.618** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 150'
CENTRE COLUMN FOOTING

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

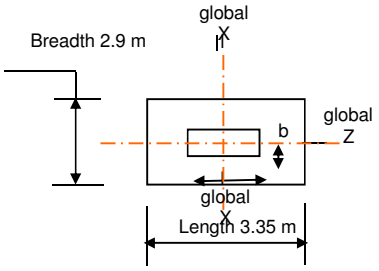
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	4000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	40	40	0	KN
Self Weight Of pedestal =	144	144	144	
Weight of Earthfill on Foundation	496.5	496.5	496.5	
TOTALAXIAL LOAD (P1)	680.5	680.5	640.5	
Moment about Z axis (M_z) =	0	0	0	KN-m
Moment about X axis (M_x) =	3	437	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	3.35	m
Foot Breadth (B, dim. || X axis) =	2.9	m
Thickness of footing (D) =	530	mm
Thickness of footing at edge(t) =	530	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	474	mm
Effective thickness at edge(ti) =	474	mm
Selfweight of the footing =	128.72	KN
Area of Footing(A) =	9.72	m^2
Sect mod of foot about Z axis (Zz) =	4.70	m^3
Sec mod of foot about X axis (Zx) =	5.42	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	809.22	809.22	769.22	KN
Maximum bearing pressure =	**83.85**	**163.86**	**79.18**	KN/m^2
Minimum bearing pressure =	82.74	2.73	79.18	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	83.85	163.86	79.18	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	83.85	163.86	79.18	KN/m^2
Max.total base pressure p max =	83.85	163.86	79.18	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\} \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**6.18**	**245.79**	**118.77**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**245.79**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **411.86** KN-m
Mulimit = **2247.88** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **474.0** mm

Hence, Ast = **2060.2** mm^2
Spacing required = **159** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **297.45** KN-m The section is singly reinforced

Mulimit = **2596.69** KN-m per meter

EFFECTIVE DEPTH **474.0** mm

Calc. Ast = **1470.6** mm^2

Spacing required = **258** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 474.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.601 m

Width of footing at this section at the top of footing =B-2*B1 = 2.148 m

Shear force Vs =pe max x 0.601 x w width of foo footing = **428.39** KN

Percentage at critical section = 0.19 %

Shear stress τ_v = Vs/resisting area = **0.31** N/mm^2

τ_c = **0.32** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 474.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.376** m

Width of footing at this section at the top of footing =L-2*L1 = 2.148 m

Shear force Vs =pe max x 0.376 x width of footing = **309.60** KN

Percentage at critical section = 0.19 %

Shear stress τ_v = Vs/resting area= **0.195** N/mm^2

τ_c = **0.32** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 474.00 mm

Width at critical sections =(l+d),(b+d)= 1674 mm 1674 mm

Shear force Vs = 245.791 (3.35 x 2.9 - 1.674 x 1.674) = **1699.09** KN

Length of critical section = 2 x (1674 + 1674) = **6696** mm

Area of the critical section (length of critical sec x eff. d) = **3173904** mm^2

Hence shear stress τ_v = **0.535** N/mm^2

tv < allowable hence O.K.

DESIGN OF BI-AXIAL ISOLATED RCC FOOTING (IS 456, 2000)

NAME HOARDING 120' ON 2 SUPPORTS
SIDE COLUMN FOOTINGS

Grade of concrete f_{ck} =	25	N/mm^2
Grade of steel f_y =	500	N/mm^2
GROSS SBC of soil =	150	KN/m^2
Soil Density =	15	KN/m^2

COLUMN

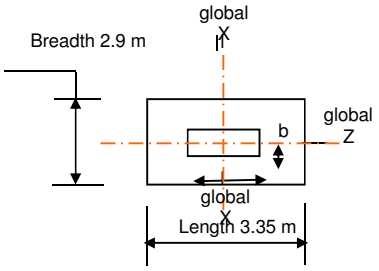
Length (l, dim. || Z axis) =	1200	mm
Breadth (b, dim. || X axis) =	1200	mm
Height of Pedestal	4000	mm

LOADS (WORKING)

	(DL)	(DL+WQ)	(DL+WQ)	
Axial load from output =	30	30	0	KN
Self Weight Of pedestal =	144	144	144	
Weight of Earthfill on Foundation	496.5	496.5	496.5	
TOTALAXIAL LOAD (P1)	670.5	670.5	640.5	
Moment about Z axis (M_z) =	0	84	0	KN-m
Moment about X axis (M_x) =	10	340	0	KN-m

FOOTING

Foot length (L, dim. || Z axis) =	3.35	m
Foot Breadth (B, dim. || X axis) =	2.9	m
Thickness of footing (D) =	530	mm
Thickness of footing at edge(t) =	530	mm
sloping depth	0	
Clear cover of footing =	50	mm
Main bar dia of footing =	12	mm
Effective depth of footing (d)=	474	mm
Effective thickness at edge(ti) =	474	mm
Selfweight of the footing =	128.72	KN
Area of Footing(A) =	9.72	m^2
Sect mod of foot about Z axis (Zz) =	4.70	m^3
Sec mod of foot about X axis (Zx) =	5.42	m^3



Footing Dimensions

CHECK FOR BEARING PRESSURE

	(DL+LL)	(DL+EQ)	(DL+EQ)	
P = (P1+foot self wt) =	799.22	799.22	769.22	KN
Maximum bearing pressure =	**84.11**	**162.84**	**79.18**	KN/m^2
Minimum bearing pressure =	80.42	1.70	79.18	KN/m^2
Max. base pressure pl =Px2/(xl*B)=	84.11	162.84	79.18	KN/m^2
Max. base pressure pb=Px2/(xl*B)=	84.11	162.84	79.18	KN/m^2
Max.total base pressure p max =	84.11	162.84	79.18	KN/m^2
Safe net bearing pressure =	150.00	187.50	187.50	KN/m^2
Hence footing is	**Safe**	**Safe**	**Safe**	For WIND load increasing SBC b 25%

$$\left\} \frac{P}{A} \pm \frac{M_y}{Z_y} \pm \frac{M_x}{Z_x} \right.$$

DESIGN FORCES

	(DL+LL)	(DL+EQ)	(DL+EQ)	
Load Factor =	1.5	1.5	1.5	KN
Factored upward soil pressure p_e =	**4.63**	**244.26**	**118.77**	**KN/m^2**
Max. Factored effective soil pressure $p_{e\,max}$ =			**244.26**	**KN/m^2**

Design of footing is done using above maximum effective upward soil pressure

CALCULATION FOR BOTTOM STEEL

Mu about X X = (pe max x length^2/2)= **409.29** KN-m
Mulimit = **2247.88** KN-m
The section is singly reinforced

$$A_{st} = \frac{0.5 f_{ck}}{f_y}\left[1 - \sqrt{1 - \frac{4.6 M_u}{f_{ck} b d^2}}\right] bd$$

EFFECTIVE DEPTH **474.0** mm

Hence, Ast = **2047.0** mm^2
Spacing required = **160** mm (considering max of above two calculated values of Ast)
Spacing provided = **125** mm
Hence provide 12 mm dia bar @ 125 mm c/c parellel to length of footing (|| to Z)

Mu about Z Z = (pe max x length^2/2)= **295.60** KN-m The section is singly reinforced

Mulimit = **2596.69** KN-m per meter

EFFECTIVE DEPTH **474.0** mm

Calc. Ast = **1461.2** mm^2

Spacing required = **259** mm (considering max of above two calculated values of Ast)

Spacing provided = **125** mm

Hence provide 12 mm dia bar @ 125 mm c/c parellel to breadth of footing (|| to X)

CHECK FOR ONE WAY SHEAR :

One way shear at effective depth from col face ‖ to x-x.

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}d 474.0 mm

Distance of critical sec. from edge of footing (L1) =(L/2-l/2)-d = 0.601 m

Width of footing at this section at the top of footing =B-2*B1 = 2.148 m

Shear force Vs =pe max x 0.601 x w width of foo footing = **425.72** KN

Percentage at critical section = 0.19 %

Shear stress τ_v = Vs/resisting area = **0.31** N/mm^2

τ_c = **0.32** N/mm^2

tv < tc hence O.K.

One way shear at effective depth from col face ‖ to z-z.

Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)}d 474.0 mm

Distance of critical sec. from edge of footing (B1)=(B/2-b/2)-d = **0.376** m

Width of footing at this section at the top of footing =L-2*L1 = 2.148 m

Shear force Vs =pe max x 0.376 x width of footing = **307.67** KN

Percentage at critical section = 0.19 %

Shear stress τ_v = Vs/resting area= **0.194** N/mm^2

τ_c = **0.32** N/mm^2

tv < tc hence O.K.

CHECK FOR TWO WAY SHEAR

Two way shear at d/2 from col face

Allowable shear stress $\tau_{v\ allowable}$ = $k_s \tau_c$

k_s = (0.5 + bc) = **1.5** >1

Hence, k_s= **1**

τ_c = 0.25 (fck)$^{0.5}$ = **1.25** N/mm^2

$\tau_{v\ allowable}$ = k_s x τ_c = **1.25** N/mm^2

Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}0.5d 474.00 mm

Width at critical sections =(l+d),(b+d)= 1674 mm 1674 mm

Shear force Vs = 244.257 (3.35 x 2.9 - 1.674 x 1.674) = **1688.48** KN

Length of critical section = 2 x (1674 + 1674) = **6696** mm

Area of the critical section (length of critical sec x eff. d) = **3173904** mm^2

Hence shear stress τ_v = **0.532** N/mm^2

tv < allowable hence O.K.