NAME HOARDING 100' SIDE COLUMN FOOTINGS		Grade of o Grade of s GROSS SBC o Soil Density	25 N/mm <sup>2</sup> 500 N/mm <sup>2</sup> 150 KN/m <sup>2</sup> 15 KN/m <sup>2</sup>	
COLUMN				
Length (I, dim.    Z axis) = Breadth (b, dim.    X axis) = Height of Pedestal LOADS (WORKING)	1200 1200 3000	mm		
	(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 <sub>z</sub> ) =	0	19	0	KN-m
Moment about X axis $(M_x) =$	3	172	0	KN-m

FOOTING Foot length (L, dim.    Z axis) = Foot Breadth (B, dim.    X axis) = Thickness of footing (D) = Thickness of footing at edge(t) = sloping depth Clear cover of footing = Main bar dia of footing = Effective depth of footing (d)= Effective thickness at edge(ti) = Selfweight of the footing = Area of Footing(A) = Sect mod of foot about Z axis (Zz) = Sec mod of foot about X axis (Zx) =	2.75 m 2.45 m 380 mm 0 50 mm 324 mm 324 mm 324 mm 64.01 KN 6.74 m <sup>2</sup> 2.75 m <sup>3</sup> 3.09 m <sup>3</sup>	Breadth 2.45 rr	global IX global global Length 2.75 m	global Z
CHECK FOR BEARING PRESSURE	E	Foo	ting Dimensions	

### CHECK FOR BEARING PRESSURE

(DL+LL)	(DL+EQ)	(DL+EQ)	
425.39	425.39	410.39	KN
64.11	125.74	60.91	KN/m <sup>2</sup> $\left[\frac{P}{P} + \frac{M_y}{M_x} + \frac{M_x}{M_x}\right]$
62.17	0.53	60.91	$KN/m^2 \int A Z_y Z_x$
64.11	125.74	60.91	KN/m <sup>2</sup>
64.11	125.74	60.91	KN/m <sup>2</sup>
64.11	125.74	60.91	KN/m <sup>2</sup>
150.00	187.50	187.50	KN/m <sup>2</sup>
Safe	Safe	Safe	For WIND load increasing SBC b25%
	425.39 64.11 62.17 64.11 64.11 64.11 150.00	425.39         425.39           64.11         125.74           62.17         0.53           64.11         125.74           64.11         125.74           64.11         125.74           64.11         125.74           64.11         125.74           64.10         125.74           64.11         125.74           64.11         125.74           64.50         187.50	425.39         425.39         410.39           64.11         125.74         60.91           62.17         0.53         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.11         125.74         60.91           64.50         187.50         187.50

#### DESIGN FORCES

DESIGN FUNCES						
	(DL+LL)	(DL+EQ)	(DL+EQ)			
Load Factor =	1.5	1.5	1.5	KN		
Factored upward soil pressure pe =	3.34	188.62	91.37	KN/m <sup>2</sup>		
Max. Factored effective soil pressure p <sub>e max</sub> = 188.62						
Design of footing is done using above maximum effective upward soil pressure						

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

$$A_{st} = \frac{0.5 f_{ck}}{f_{y}} \left[ 1 - \sqrt{1 - \frac{4.6M_{u}}{f_{ck} b d^{2}}} \right] b d$$

# 138.78 KN-m Mulimit = 887.31 KN-m The section is singly reinforced

#### EFFECTIVE DEPTH

324.0 mm

Hence, Ast = 1010.9 mm<sup>2</sup> 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 <sup>2</sup> /2)= <b>EFFECTIVE DEPTH</b> Calc. Ast = <b>731.2</b> mm <sup>2</sup> Spacing required = <b>425</b> mm (considering Spacing provided = <b>150</b> mm Hence provide 12 mm dia bar @ 150 mm c/c parellel t	-	995.96 KN-m per meter 324.0 mm o calculated values of Ast)
CHECK FOR ONE WAY SHEAR :One way shear at effective depth from col face    toEffective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}Distance of critical sec. from edge of footing (L1) = (L/2Width of footing at this section at the top of footing =BShear force Vs =pe max x 0.451 x w width of foo fooPercentage at critical section =0.23 %Shear stress $\tau_v$ = Vs/resisting area = $\tau_c$ =0.35 N/mm²	ed 2-I/2)-d = -2*B1 =	324.0 mm 0.451 m 1.848 m <b>208.41</b> KN
<b>tv</b> < <b>tc</b> hence O.K. <b>One way shear at effective depth from col face</b>    <b>to</b> Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)} Distance of critical sec. from edge of footing (B1)=(B/2) Width of footing at this section at the top of footing = L- Shear force Vs =pe max x 0.301 x width of footing = Percentage at critical section = 0.23 % Shear stress $\tau_v =$ Vs/resting area= $\tau_c = 0.35$ N/mm <sup>2</sup> <b>tv</b> < <b>tc</b> hence O.K.	)}d 2-b/2)-d =	324.0 mm 0.301 m 1.848 m 156.13 KN
$\begin{array}{l} \mbox{CHECK FOR TWO WAY SHEAR} \\ \mbox{Two way shear at d/2 from col face} \\ Allowable shear stress $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$ $$	1524 mm 24) =	324.00 mm 1524 mm 832.72 KN 6096 mm 1975104 mm <sup>2</sup>

		• •	,		
NAME HOARDING 100' CENTRAL COLUMN FOOTINGS		Grade of Grade of GROSS SBC Soil Density	,	25 N/ 500 N/ 150 KI 15 KI	mm² V/m²
COLUMN Length (I, dim.    Z axis ) = Breadth (b, dim.    X axis) = Height of Pedestal LOADS (WORKING)	1200 1200 3000	mm mm			
	(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	
<b>FOOTING</b> Foot length (L, dim.    Z axis) = Foot Breadth (B, dim.    X axis) = Thickness of footing (D) = Thickness of footing at edge(t) = sloping depth Clear cover of footing = Main bar dia of footing = Effective depth of footing (d)= Effective thickness at edge(ti) = Selfweight of the footing = Area of Footing(A) = Sect mod of foot about Z axis (Zz) = Sec mod of foot about X axis (Zx) =	400 0 50 12 344	m mm mm mm mm mm KN m <sup>2</sup> m <sup>3</sup>	Breadth 2.75	global n p global Length 3.2 m	global Z
CHECK FOR BEARING PRESSURE				Footing Dimensions	
	(DL+LL)	(DL+EQ)	(DL+EQ)		
P = (P1+foot self wt) =	547.20	547.20	527.20	KN	$P \downarrow N$
Maximum bearing pressure -	62.82	123.76	59.91	KN/m <sup>2</sup>	· · ·

	(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 <sup>2</sup> $\left\{ \frac{P}{P} \pm \frac{M_y}{m} \pm \frac{M_x}{m} \right\}$
Minimum bearing pressure =	61.54	0.61	59.91	$KN/m^2$ $\int A Z_y Z_x$
Max. base pressure pl =Px2/(xl*B)=	62.82	123.76	59.91	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	62.82	123.76	59.91	KN/m <sup>2</sup>
Max.total base pressure p max =	62.82	123.76	59.91	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b 25%

#### DESIGN FORCES

DESIGN FUNCES						
	(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 <sup>2</sup>		
Max. Factored effective soil pressure p <sub>e max</sub> = 185.64						
Design of footing is done using above maximum effective upward soil pressure						

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

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

## 255.25 KN-m Mulimit = 1122.71 KN-m The section is singly reinforced

EFFECTIVE DEPTH Hence, Ast =  $1773.1 \text{ mm}^2$  344.0 mm

Spacing provided = 175 mm (considering max of above two calculated values of Ast) 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 <sup>2</sup> /2)= EFFECTIVE DEPTH	<b>178.40</b> KN-r Mulimit =	m The section is singly reinforced 1306.43 KN-m per meter 344.0 mm
Calc. Ast = <b>1219.8</b> mm <sup>2</sup>	a may of above t	wo calculated values of Ast)
Spacing provided = 125 mm (considering Hence provide 12 mm dia bar @ 125 mm c/c parellel	•	·
CHECK FOR ONE WAY SHEAR :		
One way shear at effective depth from col face    to		
Effective depth at critical section(dc) = $d-{(d-t)/0.5(L-I)}$		344.0 mm
Distance of critical sec. from edge of footing $(L1) = (L/2)$	,	0.656 m
Width of footing at this section at the top of footing =B		1.888 m
Shear force $Vs = pe max \times 0.656 \times w$ width of foo foo	iting =	334.89 KN
Percentage at critical section = 0.26 %	0.35 N/mr	m <sup>2</sup>
Shear stress $\tau_v = Vs/resisting area =$	0.35	
$\tau_{\rm c} = 0.37  {\rm N/mm^2}$		
tv < tc hence O.K. One way shear at effective depth from col face I to		
Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b) Distance of critical sec. from edge of footing (B1)=(B/2) Width of footing at this section at the top of footing = L Shear force Vs =pe max x 0.431 x width of footing = Percentage at critical section = 0.26 % Shear stress $\tau_v = Vs/resting area =$	)}d 2-b/2)-d = -2*L1 =	344.0 mm <b>0.431</b> m 1.888 m <b>256.03</b> KN m <sup>2</sup>
NU 2	0.233	
5		
tv < tc hence O.K.		
CHECK FOR TWO WAY SHEAR Two way shear at d/2 from col face Allowable shear stress $\tau_{v \text{ allowable}} = k_s \tau_c$		
$k_s = (0.5 + bc) =$ 1.5 >1		
Hence, k <sub>s</sub> = 1		
$\tau_{\rm c} = 0.25  ({\rm fck})^{0.5} =$ <b>1.25</b> N/mm <sup>2</sup>		
$\tau_{\rm x allowable} = k_{\rm s} \times \tau_{\rm c} =$ <b>1.25</b> N/mm <sup>2</sup>		
Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)} Width at critical sections =(l+d),(b+d)= Shear force Vs = 185.637 ( $3.2 \times 2.75 - 1.544 \times 1.544$ Length of critical section = $2 \times (1544 + 1544) =$ Area of the critical section (length of critical sec $\times$ eff. of Hence shear stress $\tau_v = 0.561 \text{ N/mm}^2$	1544 mm 4) =	344.00 mm 1544 mm 1191.06 KN 6176 mm 2124544 mm <sup>2</sup>
tv < allowable hence O.K.		

NAME HOARDING 120' SIDE COLUMN FOOTINGS		Grade of Grade of GROSS SBC of Soil Density	25 N/mm <sup>2</sup> 500 N/mm <sup>2</sup> 150 KN/m <sup>2</sup> 15 KN/m <sup>2</sup>	
COLUMN Length (I, dim.    Z axis ) =	1200	mm		
Breadth (b, dim. $   Z axis ) =$	1200			
Height of Pedestal	4000	mm		
LOADS (WORKING)				
	<u>(DL)</u>	(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 <sup>2</sup>
Sect mod of foot about Z axis (Zz) =	2.73 m <sup>3</sup>
Sec mod of foot about X axis (Zx) =	3.08 m <sup>3</sup>

#### 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 <sup>2</sup> $\left\{ \frac{P}{2} \pm \frac{M_y}{2} \pm \frac{M_x}{2} \right\}$
Minimum bearing pressure =	79.22	4.71	77.96	KN/m <sup>2</sup> $\int A Z_y Z_x$
Max. base pressure pl =Px2/(xl*B)=	81.17	157.17	77.96	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	81.17	157.17	77.96	KN/m <sup>2</sup>
Max.total base pressure p max =	81.17	157.17	77.96	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b25%

#### **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 <sup>2</sup>		
Max. Factored effective soil pressure p <sub>e max</sub> = 235.76						
Design of footing is done using above maximum effective upward soil pressure						

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

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

#### Mulimit = 856.62 KN-m The section is singly reinforced

172.75 KN-m

#### 319.0 mm

global

¥

global

Footing Dimensions

Length 2.75 m

global

Z

b

\$

Breadth 2.44 m

EFFECTIVE DEPTH Hence, Ast = **1288.2** mm<sup>2</sup> Spacing required = Spacing provided =

214 mm (considering max of above two calculated values of Ast) 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 <sup>2</sup> /2)= <b>EFFECTIVE DEPTH</b> Calc. Ast = <b>917.6</b> mm <sup>2</sup> Spacing required = <b>339</b> mm (considering Spacing provided = <b>125</b> mm Hence provide 12 mm dia bar @ 125 mm c/c parellel to		965.46 KN-m per meter 319.0 mm o calculated values of Ast)
CHECK FOR ONE WAY SHEAR : One way shear at effective depth from col face    to Effective depth at critical section(dc) = d-{(d-t)/0.5(L-l)}. Distance of critical sec. from edge of footing (L1) = (L/2) Width of footing at this section at the top of footing =B- Shear force Vs =pe max x 0.456 x w width of foo foot Percentage at critical section = 0.28 % Shear stress $\tau_v$ = Vs/resisting area = $\tau_c$ = 0.39 N/mm <sup>2</sup>	d -l/2)-d = 2*B1 =	319.0 mm 0.456 m 1.838 m <b>262.31</b> KN
$\tau_{c} = 0.39 \text{ N/IIIII}$ <b>tv &lt; tc hence O.K. One way shear at effective depth from col face   to</b> Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)} Distance of critical sec. from edge of footing (B1)=(B/2) Width of footing at this section at the top of footing =L-: Shear force Vs =pe max x 0.301 x width of footing = Percentage at critical section = 0.28 % Shear stress $\tau_{v}$ = Vs/resting area= $\tau_{c}$ = 0.39 N/mm <sup>2</sup> <b>tv &lt; tc hence O.K.</b>	}d -b/2)-d =	319.0 mm <b>0.301</b> m 1.838 m <b>195.15</b> KN
$\begin{array}{l} \mbox{CHECK FOR TWO WAY SHEAR} \\ \mbox{Two way shear at d/2 from col face} \\ \mbox{Allowable shear stress } & \tau_{vallowable} = k_s \tau_c \\ \mbox{k}_s = (0.5 + bc) = & 1.5 > 1 \\ \mbox{Hence, } k_s = & 1 \\ \mbox{$\tau_c$ = 0.25$ (fck)^{0.5} = $ 1.25$ N/mm^2 \\ \mbox{$\tau_{vallowable} = k_s \ x \ \tau_c = $ 1.25$ N/mm^2 \\ \mbox{Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)} \\ Width at critical sections = (I+d), (b+d) = $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $	1519 mm 9) =	319.00 mm 1519 mm 1037.96 KN 6076 mm 1938244 mm <sup>2</sup>

			-	
NAME HOARDING 120' CENTRAL COLUMN FOOTINGS		Grade of Grade of	concrete $f_{ck} =$ steel $f_y =$	25 N/mm <sup>2</sup> 500 N/mm <sup>2</sup>
		GROSS SBC	of soil =	150 KN/m <sup>2</sup> 15 KN/m <sup>2</sup>
COLUMN		,		
Length (I, dim.    Z axis ) = Breadth (b, dim.    X axis) =	1200 1200			
Height of Pedestal	4000			
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
<b>FOOTING</b> Foot length (L, dim.    Z axis) = Foot Breadth (B, dim.    X axis) = Thickness of footing (D) = Thickness of footing at edge(t) = sloping depth Clear cover of footing = Main bar dia of footing = Effective depth of footing (d)= Effective thickness at edge(ti) = Selfweight of the footing = Area of Footing(A) = Sect mod of foot about Z axis (Zz) = Sec mod of foot about X axis (Zx) =	460 0 50 12 404	m mm mm mm mm Mm KN m <sup>2</sup> m <sup>3</sup>	Breadth 2.75	global global Length 3.2 m
CHECK FOR BEARING PRESSURE			(DL+EQ)	Footing Dimensions
D (D1 fact calf ut)	(DL+LL)	(DL+EQ)		

	(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 <sup>2</sup> $\left[\frac{P}{M} + \frac{M_y}{y} + \frac{M_x}{z}\right]$
Minimum bearing pressure =	80.36	7.28	78.05	$KN/m^2$ $\int A Z_y Z_x$
Max. base pressure pl =Px2/(xl*B)=	81.64	154.72	78.05	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	■ 81.64	154.72	78.05	KN/m <sup>2</sup>
Max.total base pressure p max =	81.64	154.72	78.05	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b 25%

#### DESIGN FORCES

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 <sup>2</sup>		
Max. Factored effective soil pressure p <sub>e max</sub> = 232.08						
Design of footing is done using above maximum effective upward soil pressure						

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

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

### 319.11 KN-m Mulimit = 1548.51 KN-m The section is singly reinforced

319.11 KN-m

#### 404.0 mm

EFFECTIVE DEPTH Hence, Ast = **1880.4** mm<sup>2</sup>

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

Mu shout $7.7$ (no may x longth <sup>2</sup> /2)	223.03 KN-m The section is singly reinforced
Mu about Z Z = ( pe max x length <sup>2</sup> /2)=	Mulimit = 1801.90 KN-m per meter
EFFECTIVE DEPTH	404.0 mm
Calc. Ast = <b>1295.7</b> mm <sup>2</sup>	
	max of above two calculated values of Ast)
Spacing provided = 125 mm	a broadth of faction ( 11 to V)
Hence provide 12 mm dia bar @ 125 mm c/c parellel to	o breadth of tooting (    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 = d = d = d = d = d = d = d = $	
Distance of critical sec. from edge of footing $(L1) = (L/2)$	
Width of footing at this section at the top of footing =B- $t$	,
Shear force Vs =pe max x 0.596 x w width of foo footi	
Percentage at critical section = 0.22 %	
Shear stress $\tau_v = Vs/resisting area =$	0.34 N/mm <sup>2</sup>
$\tau_{\rm c} = 0.35  {\rm N/mm^2}$	
tv < tc hence O.K.	
One way shear at effective depth from col face    to	
Effective depth at critical section(dc) = $d - {(d-t)/0.5(B-b)}$	
Distance of critical sec. from edge of footing $(B1)=(B/2-Width of footing at this section at the top of footing =L-2$	,
Shear force Vs =pe max x $0.371$ x width of footing =	275.53 KN
Percentage at critical section = 0.22 %	
Shear stress $\tau_v = Vs/resting area =$	0.213 N/mm <sup>2</sup>
$\tau_{\rm c} = 0.35  {\rm N/mm^2}$	
tv < tc hence O.K.	
CHECK FOR TWO WAY SHEAR	
Two way shear at d/2 from col face	
Allowable shear stress $\tau_{v \text{ allowable}} = k_s \tau_c$	
$k_s = (0.5 + bc) =$ <b>1.5</b> >1	
Hence, k <sub>s</sub> = 1	
$\tau_{\rm c}$ = 0.25 (fck) <sup>0.5</sup> = 1.25 N/mm <sup>2</sup>	
$\tau_{v \text{ allowable}} = k_s x \tau_c = 1.25 \text{ N/mm}^2$	
Effective depth at critical section(dc) = $d{(d-t)/0.5(L-b)}$	0.5d 404.00 mm
Width at critical sections =(I+d),(b+d)=	1604 mm 1604 mm
Shear force Vs = $232.082 (3.2 \times 2.75 - 1.604 \times 1.604)$	
Length of critical section = $2 \times (1604 + 1604) =$	6416 mm ) = 2592064 mm <sup>2</sup>
Area of the critical section (length of critical sec x eff. d Hence shear stress $\tau_v = 0.558 \text{ N/mm}^2$	) = 2392004 11111
tv < allowable hence O.K.	

NAME HOARDING 150'	Grade of concrete $f_{ck} = \frac{25}{25}$ N/mm <sup>2</sup>					
SIDE COLUMN FOOTINGS		Grade of	steel f <sub>y</sub> =	500 N/mm <sup>2</sup>		
		GROSS SBC	of soil =	150 KN/m <sup>2</sup>		
		Soil Density	=	15 KN/m <sup>2</sup>		
COLUMN						
Length (I, 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			

m m

mm mm mm

344 mm

344 mm

83.88 KN

8.39 m<sup>2</sup>

3.84 m<sup>3</sup> 4.26 m<sup>3</sup>

400 mm

580.8

44

235.35

KN-m

KN-m

Breadth 2.75 rr

global

¥

global

Footing Dimensions

Length 3.05 m

global

Z

b

ŧ

TOTALAXIAL LOAD (P1) Moment about Z axis (M<sub>z</sub>) = Moment about X axis  $(M_x) =$ 

#### FOOTING

Foot length (L, dim.    Z axis) =	
Foot Breadth (B, dim.    X axis) =	
Thickness of footing (D) =	
Thickness of footing at edge(t) =	
sloping depth	
Clear cover of footing =	
Main bar dia of footing =	
Effective depth of footing (d)=	
Effective thickness at edge(ti) =	
Selfweight of the footing =	
Area of Footing(A) =	
Sect mod of foot about Z axis (Zz) =	
Sec mod of foot about X axis (Zx) =	

#### CHECK FOR BEARING PRESSURE

P = (P1+foot self wt) =	(DL+LL) 664.73	(DL+EQ) 664.73	(DL+EQ) 644.73	KN $P \cdot M \cdot M$
Maximum bearing pressure =	79.96	145.90	76.87	$\frac{1}{1} + \frac{y}{2} + \frac{x}{2}$
Minimum bearing pressure =	78.55	12.61	76.87	KN/m <sup>2</sup> $\int A Z_{y} Z_{x}$
Max. base pressure pl =Px2/(xl*B)=	79.96	145.90	76.87	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	79.96	145.90	76.87	KN/m <sup>2</sup>
Max.total base pressure p max =	79.96	145.90	76.87	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b 25%

#### **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 <sup>2</sup>	
Max. Factored effective soil pressure p <sub>e max</sub> = 218.85					
Design of footing is done using above maximum effective upward soil pressure					

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

$$A_{st} = \frac{0.5 f_{ck}}{f_{y}} \left[ 1 - \sqrt{1 - \frac{4.6M_{u}}{f_{ck} b d^{2}}} \right] b d$$

344.0 mm

257.47 KN-m Mulimit = **1122.71** KN-m The section is singly reinforced

EFFECTIVE DEPTH

Hence, Ast = **1789.1** mm<sup>2</sup> Spacing required = Spacing provided = 125 mm

174 mm (considering max of above two calculated values of Ast)

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 <sup>2</sup> /2)= <b>EFFECTIVE DEPTH</b> Calc. Ast = 1376.3 mm <sup>2</sup>		1245.19 KN-m per meter 344.0 mm
Spacing required = 251 mm (considering Spacing provided = 125 mm Hence provide 12 mm dia bar @ 125 mm c/c parellel to		o calculated values of Ast) ng (    to X)
CHECK FOR ONE WAY SHEAR :One way shear at effective depth from col face    toEffective depth at critical section(dc) = d-{(d-t)/0.5(L-1)}cDistance of critical sec. from edge of footing (L1) = (L/2-Width of footing at this section at the top of footing =B-Shear force Vs =pe max x 0.581 x w width of foo footingPercentage at critical section =0.26 %Shear stress $\tau_v =$ Vs/resisting area = $\tau_c =$ 0.37 N/mm <sup>2</sup>	d -l/2)-d = 2*B1 =	344.0 mm 0.581 m 1.888 m <b>349.66</b> KN
tv < tc hence O.K. One way shear at effective depth from col face [  to : Effective depth at critical section(dc) = d-{(d-t)/0.5(B-b)} Distance of critical sec. from edge of footing (B1)=(B/2- Width of footing at this section at the top of footing =L-2 Shear force Vs =pe max x 0.431 x width of footing = Percentage at critical section = 0.26 % Shear stress $\tau_v = Vs/resting area =$ $\tau_c = 0.37 \text{ N/mm}^2$ tv < tc hence O.K.	}d -b/2)-d =	344.0 mm 0.431 m 1.888 m 287.68 KN
$\begin{array}{l} \mbox{CHECK FOR TWO WAY SHEAR} \\ \mbox{Two way shear at d/2 from col face} \\ \mbox{Allowable shear stress } & \tau_{v  allowable} = k_s \tau_c \\ \mbox{k}_s = (0.5 + bc) = & 1.5 > 1 \\ \mbox{Hence, } k_s = & 1 \\ \mbox{$\tau_c$ = 0.25$ (fck)^{0.5} = $ 1.25$ N/mm^4$ } \\ \mbox{$\tau_v$ allowable = k_s x \tau_c = $ 1.25$ N/mm^4$ } \\ \mbox{$T_v$ allowable = k_s x \tau_c = $ 1.25$ N/mm^4$ } \\ \mbox{Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}} \\ Width at critical sections = (I+d), (b+d) = $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $ $	1544 mm 4) =	344.00 mm 1544 mm 1313.85 KN 6176 mm 2124544 mm <sup>2</sup>

NAME HOARDING 150' CENTRE COLUMN FOOTING		Grade of Grade of GROSS SBC of Soil Density	25 N/mm <sup>2</sup> 500 N/mm <sup>2</sup> 150 KN/m <sup>2</sup> 15 KN/m <sup>2</sup>	
COLUMN Length (I, dim.    Z axis ) = Breadth (b, dim.    X axis) = Height of Pedestal LOADS (WORKING)	1200 1200 4000	mm mm	=	r
	(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 (Mz) =	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 length (L, dim.    Z axis) =	3.35 m			
Foot Breadth (B, dim.    X axis) =	2.9 m			
Thickness of footing (D) =	530 mm		global	
Thickness of footing at edge(t) =	530 mm	Breadth 2.9 m	¥	
sloping depth	0			
Clear cover of footing =	50 mm			
Main bar dia of footing =	12 mm			qlobal
Effective depth of footing (d)=	474 mm		b	7
Effective thickness at edge(ti) =	474 mm			
Selfweight of the footing =	128.72 KN	<u> </u>		
Area of Footing(A) =	9.72 m <sup>2</sup>	i	global	
Sect mod of foot about Z axis (Zz) =	4.70 m <sup>3</sup>		Length 3.35 m	
Sec mod of foot about X axis $(Zx) =$	5.42 m <sup>3</sup>	- I	7	
CHECK FOR BEARING PRESSURE		Foot	ting Dimensions	

#### CHECK FOR BEARING PRESSURE

P = (P1+foot self wt) =	(DL+LL) 809.22	(DL+EQ) 809.22	(DL+EQ) 769.22	KN
Maximum bearing pressure =	83.85	163.86	79.18	$\text{KN/m}^2$ $\left\{ \frac{P}{M} \pm \frac{M_y}{M_x} \pm \frac{M_x}{M_x} \right\}$
Minimum bearing pressure =	82.74	2.73	79.18	KN/m <sup>2</sup> $\int A Z_{y} Z_{x}$
Max. base pressure pl =Px2/(xl*B)=	83.85	163.86	79.18	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	83.85	163.86	79.18	KN/m <sup>2</sup>
Max.total base pressure p max =	83.85	163.86	79.18	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b 25%

#### DESIGN FORCES

DESIGN FURGES				
	(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 <sup>2</sup>
Max. Factored effective soil pressure	p <sub>e max</sub> =		245.79	KN/m <sup>2</sup>
Design of footing is done using above	maximum ef	ffective upward	soil pressure	

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

$$A_{st} = \frac{0.5 f_{ck}}{f_{y}} \left[ 1 - \sqrt{1 - \frac{4.6M_{u}}{f_{ck} b d^{2}}} \right] b d$$

### 411.86 KN-m Mulimit = 2247.88 KN-m The section is singly reinforced

411.86 KN-m

#### EFFECTIVE DEPTH

474.0 mm

Hence, Ast = 2060.2 mm<sup>2</sup> Spacing provided = 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 <sup>2</sup> /2)= EFFECTIVE DEPTH	<b>297.45</b> KN Mulimit =	-m The section is singly reinforced 2596.69 KN-m per meter 474.0 mm
Calc. Ast = 1470.6 mm <sup>2</sup> Spacing required = 258 mm (cons Spacing provided = 125 mm Hence provide 12 mm dia bar @ 125 mm c/c p	0	two calculated values of Ast) pting (    to X)
CHECK FOR ONE WAY SHEAR : One way shear at effective depth from col fa Effective depth at critical section(dc) = $d-\{(d-t)/C$ Distance of critical sec. from edge of footing (L Width of footing at this section at the top of foot Shear force Vs =pe max x 0.601 x w width of	.5(L-I)}d ) =(L/2-I/2)-d = ing =B-2*B1 = oo footing =	474.0 mm 0.601 m 2.148 m <b>428.39</b> KN
Percentage at critical section = 0. Shear stress $\tau_v = Vs/resisting area =$ $\tau_c =$ 0.32 N/mm <sup>2</sup>	19 % 0.31 <sup>N/n</sup>	nm²
tv < tc hence O.K.One way shear at effective depth from col faEffective depth at critical section(dc) = d-{(d-t)/CDistance of critical sec. from edge of footing (BWidth of footing at this section at the top of footShear force Vs =pe max x 0.376 x width of footPercentage at critical section =0.36 x rv = Vs/resting area= $\tau_c =$ 0.32 N/mm²tv < tc hence O.K.	.5(B-b)}d )=(B/2-b/2)-d = ng =L-2*L1 =	474.0 mm 0.376 m 2.148 m 309.60 KN
CHECK FOR TWO WAY SHEAR Two way shear at d/2 from col face Allowable shear stress $\tau_{v \text{ allowable}} = k_s \tau_c$ $k_s = (0.5 + bc) = 1.5 > 1$ Hence, $k_s = 1$ $\tau_c = 0.25$ (fck) <sup>0.5</sup> = 1.25 N/mm <sup>2</sup> $\tau_{v \text{ allowable}} = k_s x \tau_c = 1.25 \text{ N/mm2}$ Effective depth at critical section(dc) = d-{(d-t)/C} Width at critical sections = (1+d), (b-d) = Shear force Vs = 245.791 (3.35 x 2.9 - 1.674 Length of critical section (length of critical section Hence shear stress $\tau_v = 0.535 \text{ N/mm2}$	1674 mm x 1.674) =	474.00 mm n 1674 mm 1699.09 KN 6696 mm 3173904 mm <sup>2</sup>

		<b>、</b>	,	
NAME HOARDING 120' ON 2 SIDE COLUMN FOOTINGS	2 SUPPORTS	Grade of Grade of	concrete $f_{ck} =$ steel $f_y =$	25 N/mm <sup>2</sup> 500 N/mm <sup>2</sup>
		GROSS SBC	of soil =	150 KN/m <sup>2</sup>
		Soil Density	=	15 KN/m <sup>2</sup>
COLUMN Length (I, dim.    Z axis) = Breadth (b, dim.    X axis) = Height of Pedestal LOADS (WORKING)	1200 1200 4000	mm		
. ,	(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) = Foot Breadth (B, dim.    X axis) = Thickness of footing (D) = Thickness of footing at edge(t) = sloping depth Clear cover of footing = Main bar dia of footing = Effective depth of footing (d)= Effective thickness at edge(ti) = Selfweight of the footing = Area of Footing(A) = Sect mod of foot about Z axis (Zz) = Sec mod of foot about X axis (Zx) =		m mm mm mm mm mm KN m <sup>2</sup> m <sup>3</sup>	Breadth 2.9 m	global X global global global Length 3.35 m

#### 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 <sup>2</sup> $\left[\frac{P}{P} + \frac{M_y}{w} + \frac{M_x}{w}\right]$
Minimum bearing pressure =	80.42	1.70	79.18	$KN/m^2 \int A Z_v Z_r$
Max. base pressure pl =Px2/(xl*B)=	84.11	162.84	79.18	KN/m <sup>2</sup>
Max. base pressure pb=Px2/(xl*B)=	84.11	162.84	79.18	KN/m <sup>2</sup>
Max.total base pressure p max =	84.11	162.84	79.18	KN/m <sup>2</sup>
Safe net bearing pressure =	150.00	187.50	187.50	KN/m <sup>2</sup>
Hence footing is	Safe	Safe	Safe	For WIND load increasing SBC b 25%

409.29 KN-m Mulimit = 2247.88 KN-m The section is singly reinforced

474.0 mm

Footing Dimensions

#### DESIGN FORCES

EFFECTIVE DEPTH

DESIGN FUNCES						
	(DL+LL)	(DL+EQ)	(DL+EQ)			
Load Factor =	1.5	1.5	1.5	KN		
Factored upward soil pressure pe =	4.63	244.26	118.77	KN/m <sup>2</sup>		
Max. Factored effective soil pressure	p <sub>e max</sub> =		244.26	KN/m <sup>2</sup>		
Design of footing is done using above maximum effective upward soil pressure						

#### CALCULATION FOR BOTTOM STEEL

Mu about X X = ( pe max x length<sup>2</sup>/2)=

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

#### -

2

Hence, Ast = 2047.0 mm<sup>2</sup> Spacing required = 160 mm (considering max of above two calculated values of Ast) Spacing provided = 125 mm Large metric 40 90 mm dis here the face that for the fa

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 <sup>2</sup> /2)= <b>EFFECTIVE DEPTH</b>	<b>295.60</b> KN- Mulimit =	-m The section is singly reinforced 2596.69 KN-m per meter 474.0 mm
Calc. Ast = 1461.2 mm <sup>2</sup> Spacing required = 259 mm (considerin Spacing provided = 125 mm Hence provide 12 mm dia bar @ 125 mm c/c parellel		two calculated values of Ast) oting (    to X)
CHECK FOR ONE WAY SHEAR : One way shear at effective depth from col face    to Effective depth at critical section(dc) = d-{(d-t)/0.5(L-I) Distance of critical sec. from edge of footing (L1) = (L/ Width of footing at this section at the top of footing =	)}d  2-l/2)-d =	474.0 mm 0.601 m 2.148 m
Shear force Vs =pe max x 0.601 x w width of foo foo Percentage at critical section = 0.19 % Shear stress $\tau_v = Vs/resisting area =$		425.72 KN
$\tau_{\rm c} =$ 0.32 N/mm <sup>2</sup>		
One way shear at effective depth from col face    to Effective depth at critical section(dc) = d-{(d-t)/0.5(B-t) Distance of critical sec. from edge of footing (B1)=(B/t) Width of footing at this section at the top of footing = Shear force Vs =pe max x 0.376 x width of footing = Percentage at critical section = 0.19 % Shear stress $\tau_v = Vs/resting area =$	b)}d 2-b/2)-d = ₋-2*L1 =	474.0 mm <b>0.376</b> m 2.148 m <b>307.67</b> KN
$\tau_{\rm c} = 0.32 {\rm N/mm^2}$		
tv < tc hence O.K.		
CHECK FOR TWO WAY SHEAR Two way shear at d/2 from col faceAllowable shear stress $\tau_{v \text{ allowable}} = k_s \tau_c$ $k_s = (0.5 + bc) =$ $1.5 > 1$ Hence, $k_s =$ $1$ $\tau_c = 0.25 \text{ (fck)}^{0.5} =$ $1.25 \text{ N/mm^2}$ $\tau_{v \text{ allowable}} = k_s x \tau_c =$ $1.25 \text{ N/mm^2}$ Effective depth at critical section(dc) = d-{(d-t)/0.5(L-b)}	)))0.5d	474.00 mm
Width at critical sections =(I+d),(b+d) = 0 ((d+),(b+d) = Shear force Vs = 244.257 (3.35 x 2.9 - 1.674 x 1.67 Length of critical section = 2 x (1674 + 1674) = Area of the critical section (length of critical sec x eff. Hence shear stress $\tau_v$ = 0.532 N/mm <sup>2</sup> tv < allowable hence O.K.	1674 mm (4) =	