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Design Report & Stability Certificate

Site Address

The Proposed Construction of Stilt + 5 Floors Residential Building with 15 Dwelling units with 18.30m height in Plot No: 21 & 21A, Door No:13 , Kattabomman Street, Radha nagar, Chrompet, Chennai. Comprised in Old Survey No: 450/1 & 450/2, As per patta T.S.No: 49 & 50, Block No:15, Ward no: D of Zamin Pallavaram Village, Pallavaram Taluk, Within the limit of Tambaram Corporation.

S.Subramaniam, MS.(Struc).PDQS.DRTM.
Registered Structural Engineer Grade – 1
CMDA : (SE/GR-I/19/02/008)
Corporation: RSE100122019

Kannimar Consultants

Industrial Building Consultants
Structural Design

New No. 14, Old No.17A, Kannimar Villa, Ganga Nagar, Jafferkhanpet, Ashok Nagar, Chennai – 83. Ph: 24749439, 95000 74947.
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KC-6066

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S. Subramaniam, M.S. (Struc). PDQS. DRTM.
Chartered Engineer
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Stability Certificate

It is certified that The Proposed Construction of Stilt + 5 Floors Residential Building with 15 Dwelling units with 18.30m height in Plot No: 21 & 21A, Door No:13 , Kattabomman Street, Radha nagar, Chrompet, Chennai. Comprised in Old Survey No: 450/1 & 450/2, As per patta T.S.No: 49 & 50, Block No:15, Ward no: D of Zamin Pallavaram Village, Pallavaram Taluk, Within the limit of Tambaram Corporation is Designed for Stilt + 5 Floors to resist for earthquake, check has been made and found safe and sound

and I hereby certify that

- The Minimum grade of concrete is M25.
- The design analysis using the code of practice for loading standards as per IS-875 part and seismic force as per the IS 1893 & IS456-2000
- The above said building is designed for earthquake forces of Zone III. The relevant BIS codes were used for its design. Hence it is certified that the above said building is safe in its life circle against the forces like Service loads as well as seismic forces as per specifications given in Zone III of BIS 1893
- Minimum size of the column is 300 mm

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Load calculation

Building Name: Flats
Number of Floor: Stilt + 5

Concrete Unit wt	25	kN/m³
Brick work	20	kN/m³
Live load -rooms	2	kN/m²
Live load -stair&cordr	3	kN/m²
Floor finish	1	kN/m²
Floor Height		

Stilt floor	=	3 m	Parking
First floor	=	3.05 m	Resi
Second floor	=	3.05 m	Resi
Third floor	=	3.05 m	Resi
Head room	=	2.8 m	
Masonry Wt	=	8 kN/m³	BRICK/AAC

Load on Column **column** **G2** X= 4.5 Y = 4.89

Sl. No	Description	No	L	B	D	Qty	UnitLoad	Total Load
	Ground floor							
1	Column Load	1	0.3	0.6	6	1.08	25	27.00
2	Plinth beam	1	9.39	0.23	0.45	0.97	25	24.30
3	Roof beam	1	4.5	0.23	0.385	0.40	25	9.96
		1	4.89	0.23	0.325	0.37	25	9.14
4	Roof slab	1	4.5	4.89	0.14	3.08	25	77.02
5	Live load-all area	1	4.5	4.89	1	22.01	2	44.01
6	Floor finish	1	4.5	4.89	1	22.01	1.5	33.01
7	BW: up to FFL	1	9.39	0.23	0.75	1.62	20	32.40
8	BW: Above FFL							
	230 thick	1	0	0.25	0	0.000	8	0.000
	115 thick	1	0	0.15	0	0.000	8	0.000
	First floor/Typical Floor							**256.83**
1	Column Load	1	0.3	0.6	3.05	0.549	25	13.725
2	Roof slab	1	4.5	4.89	0.14	3.081	25	77.018
3	Roof beam	1	4.5	0.23	0.385	0.398	25	9.962
		1	4.89	0.23	0.325	0.366	25	9.138
4	Live load-all area	1	4.5	4.89	1	22.005	2	44.010
5	Floor finish	1	4.5	4.89	1	22.005	1.5	33.008
6	Brick wall-230 thick	1		0.25	2.6	0.000	8	0.000
7	Brick wall -115 thick	1	9.39	0.15	2.45	3.451	8	27.607
	Additional load	1	2.5	2.5	0.2	1.250	20	25.000
			First floor/Typical Floor					**239.47**
	Parapet load							
1	Brick wall	1	0	0.25	1	0	8	0
2	Weathering coarse material	1	4.5	4.89	0.1	2.20	20	44.01
			Parapet load					**44.01**

COLUMN TOTAL LOAD **column** **G2**

Sl.No	Description	Load
1	Stilt floor	256.83
2	First floor	239.47
3	Second floor	239.47
4	Third floor	239.47
5	Fourth floor	239.47
6	Fifth floor	239.47
7	Terrace	44.01
8	Total	1498.17
	Say	150.00 Mt

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COLUMN DESIGN

Column load as per load calculation = 150 Mt

Long Column design as per IS456-2000, Page 71

Factored Load P_u = $C_r(0.4\ f_{ck}.\ A_c + 0.67\ f_y.\ A_{sc})$

Working load P = $P_u/1.5$

PROCEDURE:

C_r = $1.25 - [(l_e/D)/48]$

F_{ck} = 25 N/mm²

F_y = 415 N/mm²

Length of column L = 3.6 m

l_e = 3.06 m (0.85* L)

C_r = 0.97

Modulus of elasticity of concrete E_c = 25000.00 N/mm²

Ref IS 456-2000 Cl 6.2.3.1

Flexural strength of concrete f_{cr} = 3.50 N/mm²

Ref IS 456-2000 Cl 6.2.2

Maximum shear stress in concrete for limit state method of design

Ref IS 456-2000 Table 20 Cl 40.2.3 $t_{c\,max}$ = 3.1 N/mm²

Permissible bearing stress = 0.45*Fck

= 0.45 x 25

Permissible bearing stress = 11.25 N/mm²

Column size = 300 | 600 mm

Minimum Eccentricity.e = L/500 + Lateral dimension/30

One direction = 17.20 mm

Another Direction = 27.20 mm

Minimum eccentricity = 20 mm

Consider Minimum Eccentricity = 27.20 mm

0.05*b = 15.00 < 27.20

Area of column = 180000 mm²

Number of rod =

5	25	2454.06	mm²
5	25	2454.06	mm²

Area of Steel(A_{sc}) = 4908.13 mm²

Area of Concrete(A_c) = 175091.88 mm²

P_u = 3030959.24 N

P = 2020639.494 N

Say = **202.06 Tonne**

% of Reinforcement **0.8** < **2.73** < **4** %

SAFE SAFE

Column Load 202.06 > 150.00 **Mt**

SAFE

Lateral Ties:

As per IS 456-2000; Clause 26.5.3.2.c-Page 49

Diameter shall not be less than = 25/4

Provide = 6.25 mm dia

Spacing = 8 mm dia

Shall not be more than following

Least dimension of column = 300 mm

16x Smallest dia of column rod = 400 mm

Not more than = 300 mm

Minimum of above = **300** mm

Provide 8 @ 150 mm C/c

Development length in compression

$Ld = \dfrac{\emptyset * \sigma s}{4 * T_{bd}}$

$\emptyset$ = Dia of bar = 25.00 mm

σs = Stress in bar = 360.87 N/mm² (0.87*Fy)

T_{bd} = Bond stress = 2.8 N/mm²

(Fy/1.15)

Page 43.26.2.1.1

$Ld = \dfrac{25 \mid 360.8696}{4 \mid 2.8}$

Ld = 805.512 mm

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SUMMARY

Column size		=	300	x	600
Rebar		=	5	25	
			5	25	
Lateral tie	8	@	**150**	mm C/c	

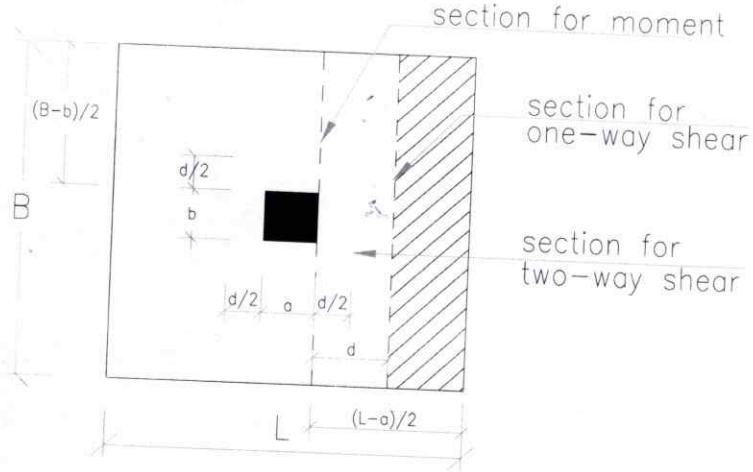
Bond stress for **Compression** 43,IS 456-2000

Grade of concrete	**Type**	**M20**	**M25**	**M30**	**M35**	**M40**
Design Bond Stress,N/mm^2	Plain	1.5	1.75	1.875	2.125	
	Deformed	2.4	2.8	3	3.4	

ISOLATED FOOTING- Regular

Load on Column(P)		=	1500 kN		
Ultimate column Load Pu = (1.5 xP)		=	1.5	x	1500
			2250 kN		
Self Weight of footing(0.1P)		=	0.1	x	1500
			150 kN		
Total Load on column for footing design			1500	+	150
			1650		
SBC of soil		=	300 kN/m^2		
f_{ck}		=	25 N/mm^2		
f_y		=	415 N/mm^2		
T_c max		=	3.1 N/mm^2		IS456-2000,P73
$X_{u\,max}/d$		=	0.48		IS456-2000,P70
Mu limit/ fck x b x dx d =		=	0.149		
Assume footing depth		=	675 mm		
Column Size	a		0.3 m		300 mm
	b		0.6 m		600 mm
Area of footing,	A	=	1650 / 300.00		
		=	5.50 m^2		
Size of footing			2.35 m		
Adopt footing size	L		2.5 m	B	2.5 m
Footing area provided			6.25 m^2		
Net upward pressure(P/A)	p		240.00	<	300 kN/m^2
				SAFE	
Ultimate Design Pressure	(1.5 xp)		360.00 kN/m^2		

Depth Required for B M Consideration



Max. BM along column edge $= \frac{P \times B \times (L-a)^2}{8}$

p = 240.00

B = 2.5

L-a = 2.5 - 0.3 =

$(L-a)^2$ = 4.84

BM = $\frac{240.00 \times 2.5 \times 4.84}{8}$

= 363

Max. BM = 363.00 kN.m

M_u(1.5 xBM) = 544.50 kN.m

$d^2 = \frac{Mu}{0.36 f_{ck} (X_u/d)(1-.416X_u/d)1000}$

$d^2 = \frac{544500000.00}{3457.38}$

d^2 = 157489.09

d = **396.85 mm**

D = 675 mm Safe

d = 627 mm 0.627 m

Area of Tension steelfor BM

$BM = 0.87 \times F_y \times A_t (d - Fy \times A_t / F_{ck} \times b)$

544500000 = 226378.35 A_t

a = 2.397

b = 226378.35

c = 544500000

2a = 4.79

b^2 = 51247157349

4ac = 5221476216

sqrt of b^2-4ac = 214535.967

A_t = 2469.87 mm^2

Per Rm = 987.95 mm^2

Minimum Rebar 0.12% = 752.4 mm^2

Adopt = 987.95 mm^2

16 mm 140 mm

1436.0 > 987.9 mm^2 Per R

The design is Safe

P_t = **0.23 %**

Depth Required for Punching shear

Single Shear :Critical section is taken at distance "d" from the face of the column

Shear Force V = Shear area x Pres

Shear area L = 2.5 m

b = 0.47 m

area = 1.18

V = 240.00 x 1

V = 283.80 kN

V_u = 1.50 x 28

V_u = 425.70 kN

$T_v = \frac{V_u}{bd}$

$= \frac{425700}{2500 \times 627}$

Nominal Shear Stress T_v = 0.272 N/mm^2

Percentage of steel provided	P_t	=	0.23	%
Shear strength of concrete	T_c	=		
Percentage of steel	P_t	=	0.23	%
Shear strength		=	kT_c	
	k	=	1	

Table19,page 73,IS 456-2000

% of steel	T_c
0.25	0.36
0.5	0.49

	For	0.23	0.35	
Now,kTc		=	0.35	N/mm^2
	0.272	<	0.35	N/mm^2
	T_v	<	kT_c	

The design is **Safe**

Double Shear :Critical section is taken at distance "0.5d" from the face of the column

Footing area		=	2.5	x	2.5
		=	6.25 m^2		
Critical section area		=	0.927	x	1.227
		=	1.14 m^2		
Net area		=	6.25	-	1.14
		=	5.11 m^2		
Shear Force		=	Shear area	x	Pressure
			5.11	x	240.00
	V		1227.02 kN		
Shear Force	V_u	=	1.50	x	1227.02
		=	1840.53 kN		
	T_v	=	V_u / bd		
	b	=	4308 mm		
	d	=	627		
		=	1840525.56		
Nominal Shear Stress		=	4308	x	627
		=	0.68 N/mm^2		
	T'_c	=	$K_s.T_c$		
	K_s	=	0.5+Bc		
	Bc	=	0.50	(a/b)	
	K_s	=	1.00		
Ks Not more than		=	1		
	K_s	=	1		
	Tc	=	1.250	(0.25*sqrtFck)	
	T'_c	=	1.250		
	Tv	<	T'_c		
	0.68	<	1.250	N/mm^2	

SAFE

SUMMARY

Footing Size	=	**2.5**	x	**2.5**	M
Footing concrete depth	=			**675**	mm
Footing rod	=	**16**	@	**140**	mm c/c

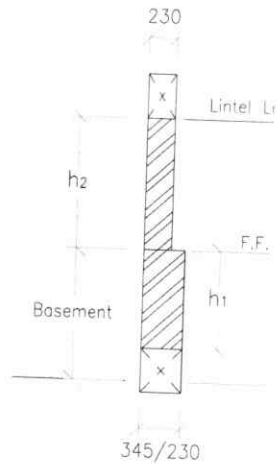
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PLINTH BEAM

Span = 5.461 m
Wall thickness-Below basement = 0.23 m
Wall height = 0.75 m
Wall thick-above basement = 0.25 m
Wall height = 0 m

Beam Size b = 230 mm
D = 375 mm
d' = 46 mm
d = 329 mm
F_y = 415 N/mm²
F_{ck} = 25 N/mm²

l/16 = **341** mm
d'/d = 0.140



LOAD CALCULATIONS:

Self wt = b x D x 1 x 25 = 2.16 kN/m
Brick masonry weight below basement = 3.45 kN/m
Brick masonry weight above basement = 0
Max Udl w = 5.61 kN/m
Max B.M at Mid span = $(wl^2/20)$

5.61	5.461	5.461
	20	

BM = 8.36 kN.M

SF = wl/3 (0.5 x w x l)

5.61	x	5.461
	3	

SF = 10.21 kN

M_u/bd^2 =

1.5	8.36	1000000
230.00	329	329

= **0.50** N/mm²

Refer SP 16 ,Page 86,Pt =

A_{st} =

0.143	%	P_c	=	0.1
0.143	230	329		
	100			

Ast = 108 mm² = 76 mm²

Provide

2	16
1	12
0	16

"A_{st}" Provided 515.16 > 108.18 **SAFE**

2	16
1	12
0	12

515.1568 > 75.67 **SAFE**

Min.Reinf = $(0.87 \times b \times d / F_{yl})$ mm²

0.870	230	329
	415	

Min.Reinf = 158.633 mm²
"A_{st}" Provided 515.2 > 158.6 mm² **SAFE**

CHECK FOR SHEAR STRENGTH

T_c Max = $0.62 * sqrt(F_{ck})$

0.62	5

= 3.10 N/mm²

As per clause 40.2 (P73) of IS 456-2000

Percentage of steel P_t = **0.68** %

Shear strength = kT_c

k = 1

% of steel	T_c
0.5	0.49
0.75	0.57

For 0.68 0.55

kT_c = 1.00 x 0.55

Now kT_c = 0.55 N/mm² < 3.10 N/mm²

Nominal Shear stress T_v = $V_u/b.d$ **SAFE**

V_u = 1.5 x 10.21

15.308 kN

T_v = $V_u/b.d$

15.31	1000
230.00	329

T_v = 0.20 < 3.10 N/mm² **SAFE**

0.20 < 0.55 N/mm²

T_v < kT_c **SAFE**

Total shear strength V_u = 15307.87 N

Shear contribution by concrete $T_c b.d$ =

0.55	230	329

41456.1176

Shear contribution by stps V_{us} = V_u - T_c b.d

15307.87 - 41456.12

-26148.25 N

Provide Y 8 -457 mm C/C

Area or 2 legged stps a = 101 mm²

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Spacing of stirrups = $\frac{0.87 * Fy * a * d}{V_{us}}$

=	0.87	415	101	329
		-26148.25		

= **-457** mm C/C

Provide shear Rebar without considering conc. shear — Y 8 — **780** mm C/C

Area or 2 legged stps — a = 101 mm^2

$\frac{0.87 * Fy * a * d}{V_{us}}$

=	0.87	415	101	329
		15307.87		

= **780 mm C/C**

V_{us}/d = $\frac{-26148.25}{329.00}$ | $\frac{10}{1000}$

= -0.795 kN/cm

Minimum Stirrups Reinforcement — Y 8

A_{sv} = 100.52 mm^2

S_v = 0.87*Fy*Asv/0.4*b

=	0.87	415	101
	0.4	230.00	

= $\frac{36292.16832}{92}$

= **394** mm C/C

Maximum Spacing of Stirrups = 0.75 *d

= 246.75 mm

= 300 mm

Least of above 246.75 mm

				Y @		
Provide		394	>	200	<	246.75
			SAFE		**SAFE**	
		531	>	200	<	780
			SAFE		**SAFE**	

Development length in Tension

Ld = $\frac{\emptyset * \sigma s}{4 * \tau_{bd}}$

$\emptyset$ = Dia of bar =

(0.87*Fy) σs = Stress in bar Fy/1.15) =

Page 43.26.2.1.1 T_{bd} = Bond stress =

Ld = $\frac{16}{4}$ | $\frac{360.8695652}{2.24}$

Ld = 644.4 mm

Bond stress for **tension** P 43,IS 456-2000

Grade of concrete	Type	M20	M25	M30	M35	M40 & a
Design Bond Stress,N/mm^2	Plain	1.2	1.4	1.5	1.7	1.9
	Deformed	1.92	2.24	2.4	2.72	3.04

Centre Beam-Continues

Span = 5.461 m
Lateral span = 4.88 m
Wall height = 2.525 m
Wall thickness = 0.15 m

b = 230 mm
D = 525 mm
d' = 50 mm
d = 475 mm
f_y = 415 N/mm²
f_{ck} = 25 N/mm²

l/12.5 **437** mm
d'/d = 0.105

Slab Load:

Self wt	=	3.125	kN/m²	slab thk 0.125 m
Live Load	=	2	kN/m²	
Floor Finish	=	1.5	kN/m²	
Mish. Load	=	2	kN/m²	
		8.625	kN/m²	

Load Calculations:

Brick work/ AAC Block = 8 kN/m³
Self wt = b x D x 1 x 25 = 3.02 kN/m
Brick work: = 2.5755 kN/m
Udl for slab = 23.28 kN/m
Max Udl w = 28.88 kN/m
M_u Limit = $0.138\ f_{ck}\ bd^2$

0.138	25	230	225625

= 179033437.50 Nmm

179.03 > 117.44
M_u limit > M_u

Singly Reinforced

"d" - reqd = 384.71 < 475 mm

Safe

Max B.M at Mid span = $(wl^2/13)$

28.88	5.461	5.461
	13	

BM = 66.25 kN.M
M_u Midspan = **99.37 kN.M**

Max B.M at Support = $(wl^2/11)$

28.88	5.461	5.461
	11	

BM = 78.29 kN.M
M_u Support = **117.44 kN.M**

SF = wl/2 (0.5 x w x l)

28.88	x	5.461
	2	

SF **78.85 kN**

M_u/bd^2 @Mid span =

1.5	66.25	1000000
230.00	475	475

= 1.91 N/mm²

M_u/bd^2 @Support =

1.5	78.29	1000000
230.00	475	475

= **2.26 N/mm²**

Rebar @ Mid span

Refer SP 16 ,Page 86,Pt =

P_t	P_c
0.588	0.29

0.588 %

A_{st} =

0.588	230	475
	100	

	Ast	=	642	mm^2	
Provide	2	20			
	2	16			
	0	16			
"A_{st}" Provided	1030.31	>	642.43	mm^2	
	0.94	**Safe**			

Rebar @ Support

		P_t	P_c
Refer SP 16 ,Page 86,Pt	=	0.711	0.356

A_{st}	=	0.711	230	475
			100	

	Ast	=	777	mm^2
Provide	2	20		
	2	20		
	0	16		
"A_{st}" Provided	1256.48	>	776.82	mm^2
	1.15	**Safe**		

Min.Reinf = 0.87 x b x d / F_y mm^2

=	0.870	230	475
		415	

Min.Reinf = 229.030 mm^2

"A_{st}" Provided 1030.3136 > 229.030 mm^2

Safe

Min. % of steel required

As per Cl.26.5.1.1 IS456:2000 = 0.205 %

As per Cl.6.2.1 IS13920:1993 = 0.290 % (0.24 √ fck) /fy)

$p_{t\,min}$ = **0.290** % <

Safe

Max. % of steel to be used =

As per Cl.26.5.1.1 IS456:2000 = 4.000 %

As per Cl.6.2.1 IS13920:1993 = 2.500 %

$p_{t\,max}$ = **2.500** % >

Safe

CHECK FOR SHEAR STRENGTH

As per clause 40.2 (P73) Tc Max = 0.62 *sqrt(Fck)

of IS 456-2000 = 0.62 | 5

= 3.10 N/mm^2

Percentage of steel P_t = **0.94** %

Permissible shear stress in concrete (kt_c) for solid slabs in limit state design method

Ref IS 456:2000 Cl 40.2.1.1, Table 19

f_{ck} N/mm^2	p_t %	D of slab	k	$k\,t_c$ N/mm^2
25	0.94	525	1.00	0.63

Now kT_c = 0.63 N/mm^2

Nominal Shear stress T_v = $V_u/b.d$

V_u = 1.5 X

118.278

T_v = $V_u/b.d$

118.28	1000
230.00	475

= 1.08 <

Safe

1.08 > 0.63 N/mm^2

T_v > kT_c

PROVIDE SHEAR REBAR

mm²

321.22

%

mm²

388.41

3.10 N/mm²

m²

Total shear strength	V_u	=	118278.07 N
Shear contribution by concrete	$T_c b.d$	=	

0.63	230	475

68827.5

Snear contribution by stps	V_{us}	=	V_u - T_c b.d
			118278.07 - 68827.5
			49450.57 N
Minimum shear resistance	0.4bd	=	43700.00 N
		=	49450.57 N
Provide	Y 8		349 mm C/C
Area or 2 legged stps	a	=	101 mm²
Spacing of stirrups		=	$\frac{0.87 * Fy * a * d}{V_{us}}$

0.87	415	101	475
	49450.57		

= **349** mm C/C

Provide shear Rebar without considering conc. shear

	Y 8		146 mm C/C
	a	=	101 mm²
		=	$\frac{0.87 * Fy * a * d}{V_u}$

0.87	415	101	475
	118278.07		

= **146 mm C/C**

Minimum Stirrups Reinforcement

	Y 8		
	A_{sv}	=	100.52 mm²
	S_v	=	0.87*Fy*Asv/0.4*b

0.87	415	101
0.4	230.00	

$\frac{36292.16832}{92}$

Maximum Spacing of Stirrups	=	**394**	**mm**	C/C
	=	0.75 *d		
	=	356.25	mm	
Least of above	=	300	mm	
		300	mm	
			Y	8
Provide			@	
	394	>	150	< 300
		Safe		**Safe**

SLAB DESIGN AS PER BIS-2000 METHOD

Location:

L_x	=	3.43 m	
L_y	=	5.36 m	
F_{ck}	=	25 N/mm²	
F_y	=	415 N/mm²	
L_y/L_x	=	1.56	
		TWO WAY SLAB	
Span	=	3.43 M	Span/32
Slab thickness	=	125 MM	107.2
Cover		20 MM	
Effective depth		105 MM	
Concrete wt	=	25 kN/m³	
Live Load on Slab	=	2 kN/m²	
Floor finish	=	1.5 kN/m²	
Design Load:			
slab weight	=	3.125 kN/m²	
Live + Floor finish Load	=	3.5 kN/m²	
Total Load	=	6.63 kN/m²	

$M_x = \alpha_x w l_x^2$

$M_y = \alpha_y w l_x^2$

As per IS456-2000-Table 26-Page No:91

Negative Moment at edge

L_y/L_x = **1.56**

α_x = 0.047

		Ly/Lx		For
		1.5	**1.75**	1.56
Negative Moment @ edge	α_x	0.075	0.084	0.077
Positive Moment at mid span	α_x	0.056	0.063	0.058

				M_{ux}	M_{uy}
M_x	=	6.02	kNM	9032349.769	
M_y	=	3.66	kNM		5494943.6
Maximum Bm	=	**6.02**	kNM		
'd' - reqd under compression	=	51.17	mm		

$M_u/b.d^2$ = | M_{ux} | M_{uy} | |
|---|---|---|
| 0.82 | 0.50 | N/mm² |

As per SP16, Table 2,Page 48,

P_t = | % | **0.236** | **0.141** |
|---|---|---|
| Area of steel = | mm² | 248.11 | 148.51 |
| Adopt | | | |

Y	10	140	mm C/C	10	140	mm C/C	
	560.93	>	248.11	560.93	>	148.51	
		SAFE			SAFE		

Positive Moment at mid span

α_y = 0.037

				M_{ux}	M_{uy}
M_x	=	4.50	kNM	6752362.313	
M_y	=	2.88	kNM		4325806.7
Maximum Bm	=	**4.502**	kNM		

$M_u/b.d^2$ = | M_{ux} | M_{uy} | |
|---|---|---|
| 0.61 | 0.39 | N/mm² |

As per SP16, Table 2,Page 48,

P_t = | % | **0.175** | **0.111** |
|---|---|---|
| Area of steel = | mm² | 183.53 | 116.30 |
| Adopt | | | |

Y	10	140	mm C/C	10	140	mm C/C	
	560.93	>	183.53	560.93	>	116.3	
		SAFE			SAFE		

Check for Shear strength

As per clause 40.2 (P72) of IS 456-2000

	Tc Max	=	0.62 *sqrt(Fck)	
		=	0.62	5
		=	3.10 N/mm²	
For slab as per 40.2.3.1	T_c Max	=	0.5*$T_c$max	
		=	0.50	3.10
	T_c Max	=	1.55 N/mm²	
Percentage of steel	P_t	=	**0.53** %	
Shear strength		=	k t_c	

Permissible shear stress in concrete (kt_c) for solid slabs in limit state design method

Ref IS 456:2000 Cl 40.2.1.1, Table 19

f_{ck} N/mm²	p_t %	D of slab	k	k t_c N/mm²
25	0.53	125	1.30	0.65

Now,kTc	k t_c	=	0.65	<	1.55 N/mm²
				Safe	
Nominal Shear stress	T_v	=	V_u/b.d		
	V_u	=	17.04281 kN		
	T_v	=	0.16	<	1.55 N/mm²
				Safe	
	T_v	<	kT_c		
		SAFE			

Check for Defflection

Live Load 2 < 3.01 kN/m²

Defflection calculation is Not Necessary

A_{st} required	=	248.1072 mm²	
A_{st} Provided	=	560.93 mm²	
Steel stress for service Load	F_s	=	0.58 x F_y X A_{st} required / A_{st} Provided
As per Fig-4,IS 456-2000,Page38	=	0.58 | 415 | 183.52856 / 560.93	
	F_s	=	**78.75 N/mm²**
Percentage of steel provided	=	**0.53 %**	

Modification factor-Fig-4
Asper IS 456-2000-Page 38

f_y	f_s	$p_{t\,req.}$	$p_{t\,prov.}$	MF_t
N/mm²	N/mm²	%	%	IS 456 Fig 4
415	78.75	**0.17**	**0.53**	2.00

Effective depth ratio

For,Simply supported		=	20		
Continues		=	26		
Cantilever		=	7		
(Lx/d) Max		=	26	x	2.000
		=	52.0000		
(Lx/d)Provided		=	3430 / 105		
		=	32.667		
(Lx/d) Max	52	>	32.67 (Lx/d)Provided		
		SAFE			

Maximum diameter of bars for slabs

Ref IS 456-2000 Cl 26.5.2.2

D of slab mm	dia of bar mm	Result Cl 26.5.2.2
125	10	Ok

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STAIRECASE -DOG LEGGED MODEL

Location:

L_x = 5.241 m

F_{ck} = 25 N/mm²

F_y = 415 N/mm²

Step weight = 20 kN/m³

Landing width = 0.9

Slope length = 3.441

Step tread = 0.25 m

Step riser = 0.165 m

Slope length for one step = 0.300 m

Number of tread = 3.441 / 0.25

= 13.764 No

Say = 11 No

Aditional slope length per flight = 11 x 0.050

= 0.54

Effective length = 5.79 m

Concrete wt = 25 kN/m³

Waist slab thickness = 0.140 m (Assumed)

Loads:

Dead load of Waist slab = 3.5 kN/m²

Ceiling finish = 0.25 kN/m²

Sub total = 3.75 kN/m²

Dead Load on plan area = 3.75 x 0.300 / 0.25

= 4.49 kN/m²

Brick load = 0.165 x 20 / 2

= 1.65 kN/m²

Live load = 3 kN/m²

Floor finish = 1.5 kN/m²

Total load on staire = 10.64 kN/m²

Maximum BM($w \times l^2/12$) = 10.64 x 5.79² / 12

= 29.69 kN.M

M_u = 1.5 x 29691882

44537823.08 Nmm

44537823.08		
0.138	25	1000

sqrt = 12909.51

Cover = 113.62 mm

Total = 20.00 mm

Provide = 133.62 mm

d = 140.00 mm

$M_u/b.d^2$ = 117.00

44537823.08		
1000.00	117.00	117.00

3.25

As per SP16, Table 2,Page 48,

P_t = **1.104** %

Area of steel = 1.10385657 x 1000 x 117.00

100

= 1291.51 mm^2

Adopt

Y 16 140 **mm C/C**

1435.98 > 1291.51 mm^2

Safe

Distributer:

Provide minimum steel = 0.12%

0.12	1000	117.00
	100	

= **140.4** mm^2

Adopt

Y 10 150 **mm C/C**

523.53 > 140.4 mm^2

Safe

Check for Shear strength

As per clause 40.2 (P72)
of IS 456-2000

Percentage of steel P_t = $\frac{1435.98 \times 100}{1000 \times 117.00}$

P_t = **1.23** %

Shear strength = kT_c

k = 1.2

IS456-2000,Page73,table19

% of steel	T_c
1	0.64
1.25	0.7

For **1.23** 0.695 N/mm^2

kT_c = 1.200 x 0.695

0.833

Nominal Shear stress T_v = $V_u/b.d$

V_u

1.5	5.79	10.64
	2	

V_u = 46.1855 kN

T_v $\frac{46.1855 \times 1000}{1000 \times 117.00}$

T_v = 0.3947 < 0.8335

T_v < kT_c

SAFE

SUMMARY

Waist slab thick = **140.00 mm**

Main Rebar = **Y 16** @ 140 **mm C/C**

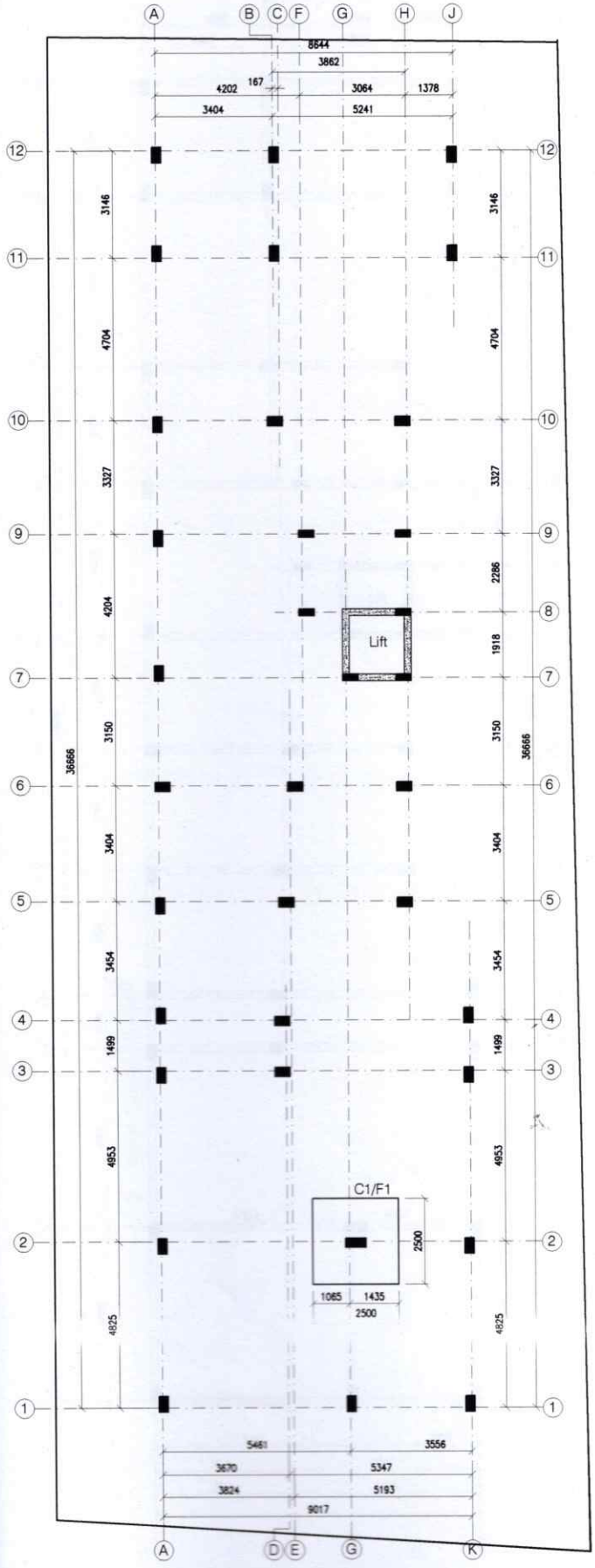
Distributer = Y 10 @ 150 **mm C/C**

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SUNSHADE DESIGN

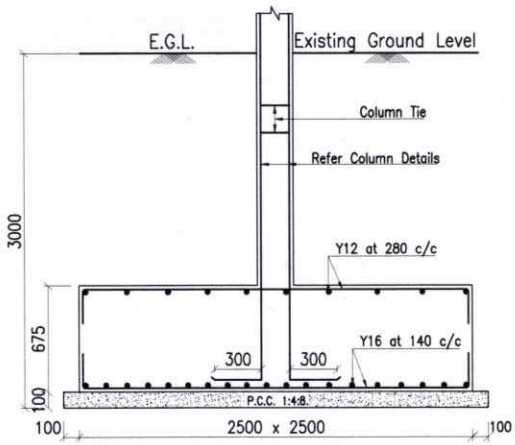
1	Grade of concrete		F_{ck}	=	**25** N/ mm^2	
2	grade of steel		Fy	=	**415** N/ mm^2	
3	Width of sunshade			=	**0.6** m	
4	Sunshade thickness -	t_{max}		=	0.075 m	**75** mm
		t_{min}		=	0.1 m	**100** mm
		average		=	0.0875	87.5
		cover		=	0.014	**15**
		effective depth d		=	0.061 m	61 mm
5	Self weight of sunshade			=	2.19 kN/ m^2	
	Finishes			=	1 kN/ m^2	
	Live load			=	0.75 kN/ m^2	
			Total		3.94 kN/ m^2	
6	Maximum BM	$W L^2/2$		=	0.71 kN.M	
		"d" req		=	16.02 <	61 mm
					SAFE	
7	M_u/ bd^2			=	**0.29** N/mm^2	
		P_t		=	**0.085**	
	Area of steel			=	51.85 mm^2	
	Adopt				**Y 10**	**140 mm C/C**
		560.93		>	51.85 mm^2	
					Safe	

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Footing & Column Layout for Stilt +5 Floors

Marked As	Column Schedule	Tie Arrangement
C1	300, 100 200, 4 – Y12, 10 – Y25, Y8 at 150 c/c, 600, 300 x 600	



C.S. of Footing F1
Size 2500 x 2500

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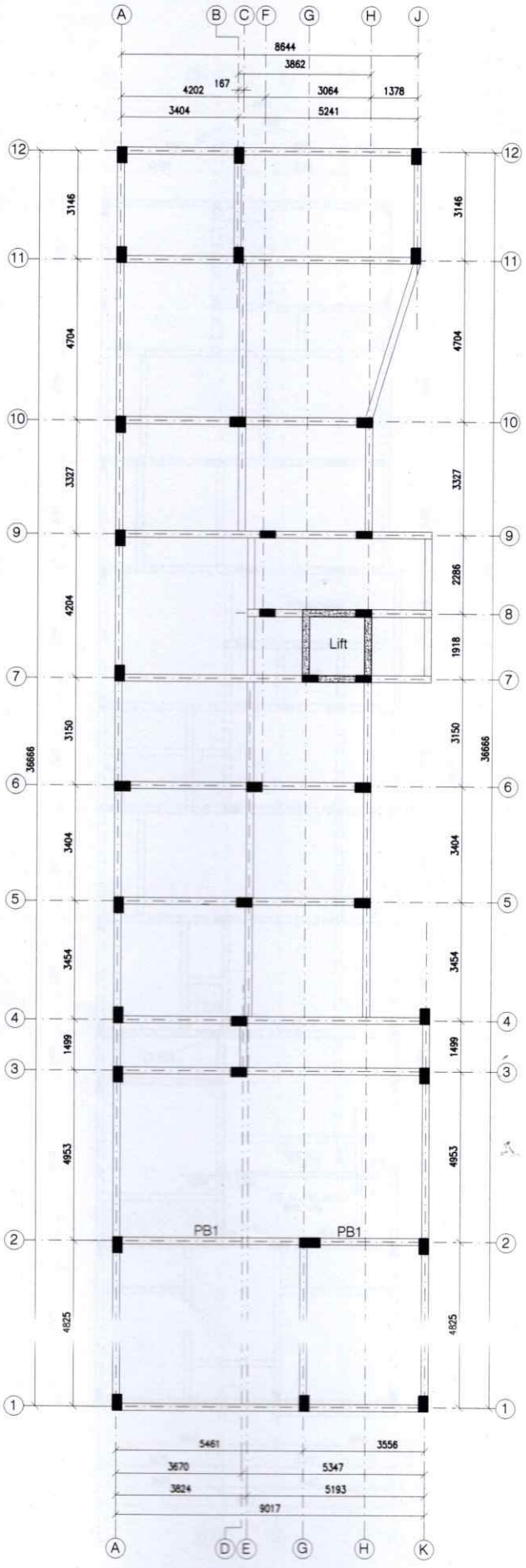
Site Address:

The Proposed Construction of Stilt + 5 Floors Residential Building with 15 Dwelling units with 18.30m height in Plot No: 21 & 21A, Door No:13 , Kattabomman Street, Radha nagar, Chrompet, Chennai. Comprised in Old Survey No: $\frac{450}{1}$ & $\frac{450}{2}$, As per patta T.S.No: 49 & 50, Block No:15, Ward no: D of Zamin Pallavaram Village, Pallavaram Taluk, Within the limit of Tambaram Corporation

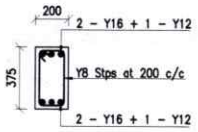
Notes:

1.	All Dimensions Are In MM.
2.	Use Fe415/Fe500 Grade Steel.
3.	Use Mix M25 For all Works
4.	Clear Cover To The Reinforcement For Footing:50mm Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

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Plinth Beam Layout



C.S of Plinth Beam PB1
Size 200 x 375

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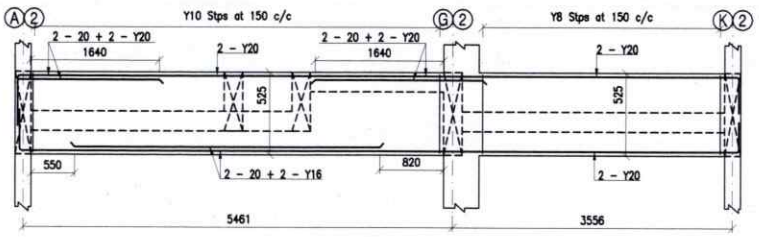
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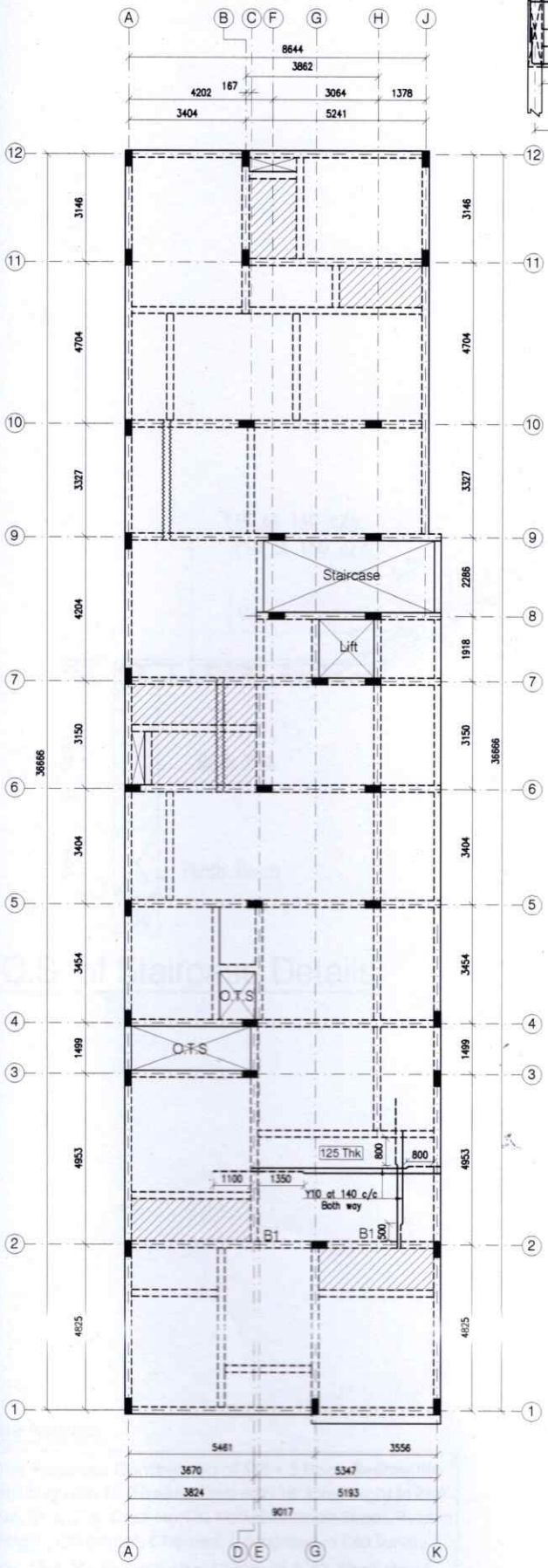
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L.S. of Beam B1 Size 200 x 525



Roof Beam & Slab Layout

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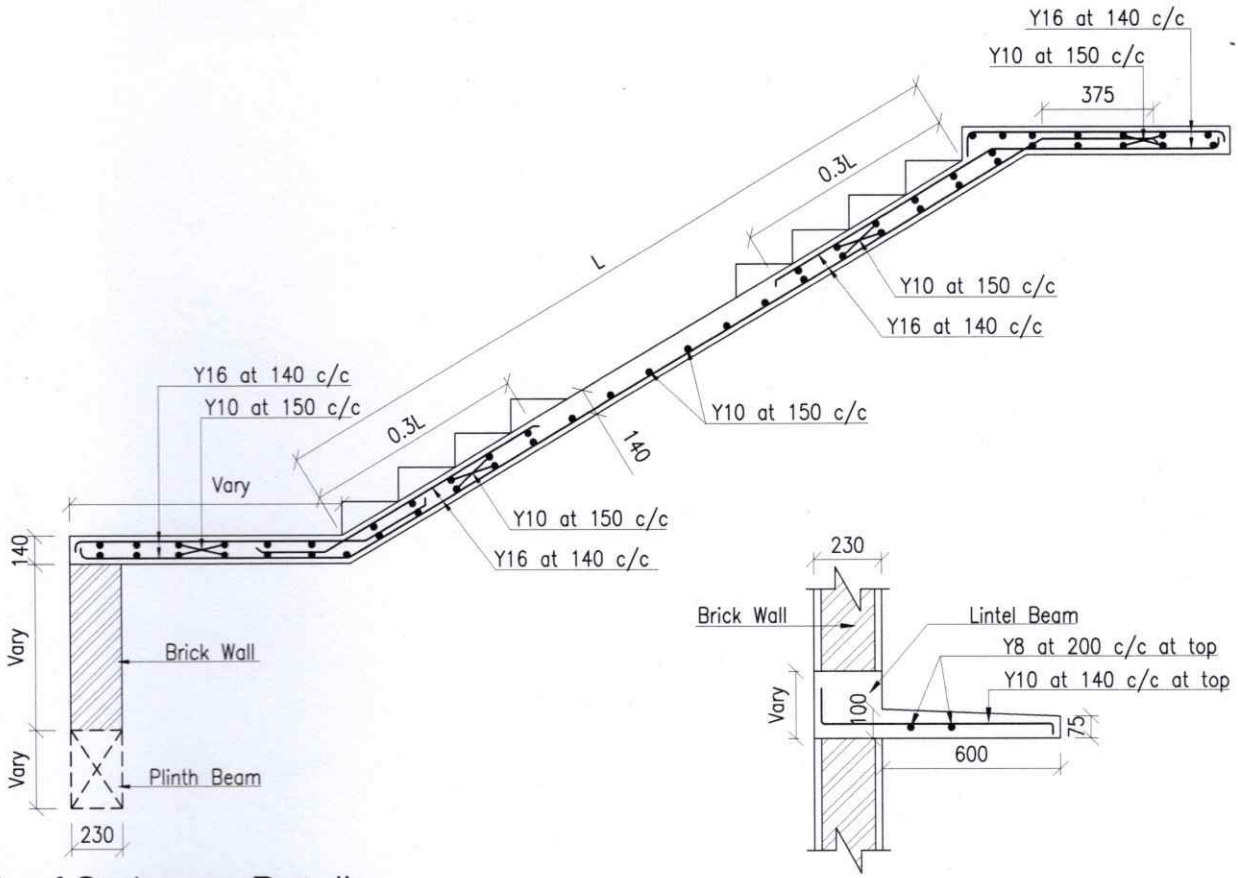
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C.S. of Staircase Details

Sunshade Detail (Typ)

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