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Design Report & Stability Certificate

Site Address

The Proposed Construction of Stilt+5 floors Residential Building at Vengaivasal, Chennai – 600 073. Comprised in S. No. 242/1C part as per patta no.9281 & S.No. 242/1D part as per patta no. 3371, Vengaivasal, Chennai.

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

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KC-6195

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

It is certified that The Proposed Construction of Stilt+5 floors Residential Building at Vengaivasal, Chennai – 600 073. Comprised in S. No. 242/1C part as per patta no.9281 & Sl.No. 242/1D part as per patta no. 3371, Vengaivasal, Chennai 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 at Stilt floor is 300 mm

For Dolly Homes Builders & Promoters

Partner

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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 -stairs & corri	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
Fourth Floor	=	3.05 m	
Fifth Floor	=	3.05 m	
Head room	=	2.8 m	

Brick wall/AAC Block - AAC block

Load on Column column B5 X= 4.34 Y= 5.61

Sl. No	Description	No	L	B	D	Qty	UnitLoad	Total Load
	Ground floor							
1	Column Load	1	0.2	0.75	6	0.90	25	22.50
2	Plinth Beam	1	9.95	0.23	0.375	0.86	25	21.45
3	Roof Beam	1	4.34	0.2	0.385	0.33	25	8.35
		1	5.61	0.2	0.385	0.43	25	10.80
4	Roof slab	1	4.34	5.61	0.14	3.41	25	85.22
5	Live load-all area	1	4.34	5.61	1	24.35	2	48.69
6	Floor finish	1	4.34	5.61	1	24.35	1.5	36.52
7	BW: up to FFL	1	7.96	0.23	0.75	1.37	20	27.46
8	BW: Above FFL							
	230 thick	1	0	0.25	0	0.000	20	0.00
	115 thick	1	0	0.15	0	0.000	20	0.00
								261.00
	First floor/Typical Floor							
1	Column Load	1	0.2	0.75	3.05	0.46	25	11.44
2	Roof slab	1	4.34	5.61	0.14	3.41	25	85.22
3	Roof Beam	1	4.34	0.2	0.385	0.33	25	8.35
		1	5.61	0.2	0.385	0.43	25	10.80
4	Live load-all area	1	4.34	5.61	1	24.35	2	48.69
5	Floor finish	1	4.34	5.61	1	24.35	1.5	36.52
6	AAC wall-200 thick	1	4.215	0.22	2.6	2.41	10	24.11
7	AAC wall - 100 thick	1	3.75	0.12	2.45	1.10	10	11.03
	Additional load	1	3	2.5	0.2	1.50	25	37.50
			First floor/Typical Floor					**273.66**
	Parapet load							
1	Brick wall	1	4.34	0.22	1	0.95	20	19.10
2	Weathering coarse material	1	4.34	5.61	0.1	2.43	20	48.69
			Parapet load					**67.79**

COLUMN TOTAL LOAD column B5

Sl.No	Description	Load
1	Stilt floor	261.00
2	First floor	273.66
3	Second floor	273.66
4	Third floor	273.66
5	Fourth Floor	273.66
6	Fifth Floor	273.66
7	terrace	67.79
8	total	1697.08
	Say	1700.00 kN

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Partner

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COLUMN DESIGN

Column load as per load calculation = 170 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 = $P_u/1.5$

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

PROCEDURE:

	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

= 11.25 N/mm²

Permissible bearing stress

Column size = 200 x 750 mm

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

One direction = 13.87 mm

Another Direction = 32.20 mm

Minimum eccentricity = 20 mm

Consider Minimum Eccentricity = 32.20 mm

0.05*b = 10.00 < 32.20

Area of column = 150000 mm²

Number of rod =

= 6 - 25 — 2944.88 mm²

= 6 - 25 — 2944.88 mm²

Area of Steel(A_{sc}) = 5889.75 mm²

Area of Concrete(A_c) = 144110.25 mm²

P_u = 2995085.871 N

P = 1996723.914 N

Say = **199.67 Tonne**

% of Reinforcement **0.8** < **3.93** < **4** %

SAFE **SAFE**

Column Load 199.67 > 170.00 **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

= 6.25 mm dia

= 8 mm dia

Provide

Spacing

Shall not be more than following

Least dimension of column = 200 mm

16x Smallest dia of column rod = 400 mm

Not more than = 300 mm

Minimum of above = **200** mm

Provide 8 @ 150 mm C/c

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Development length in compression

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

$\emptyset$	=	Dia of bar	=	25.00 mm
σs	=	Stress in bar	=	360.87 N/mm²
τ_{bd}	=	Bond stress	=	2.8 N/mm²

Ref : IS Code 456:2000 Page 43,26.2.1.1

$$Ld = \frac{25 \times 360.87}{4 \times 2.8}$$

Ld = 805.512 mm

SUMMARY

Column size	=	200	x	750
Rebar	=	6	25	
		6	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 & above
Design Bond Stress,N/mm²	Plain	1.5	1.75	1.875	2.125	2.375
	Deformed	2.4	2.8	3	3.4	3.8

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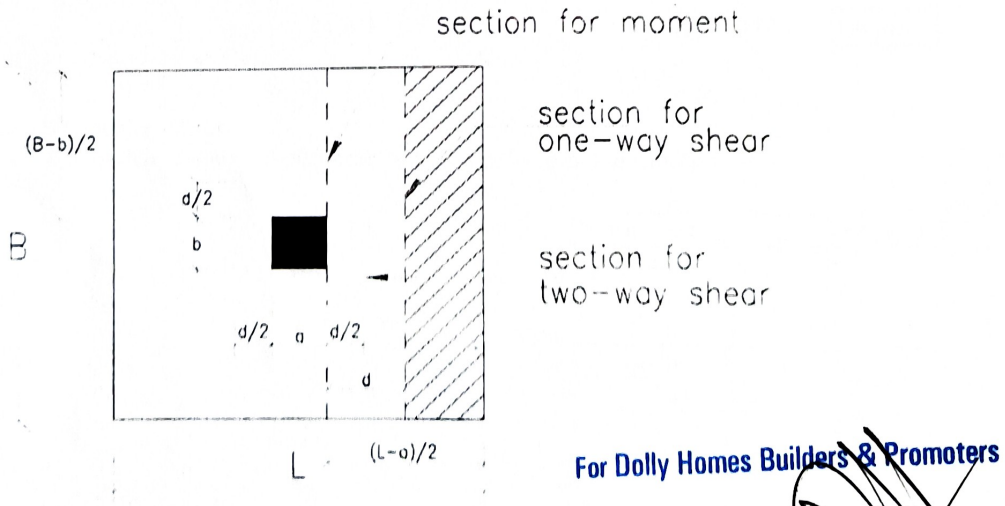
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ISOLATED FOOTING- Regular

Load on Column(P)		=	1700 kN			
Ultimate column Load Pu = (1.5 xP)		=	1.5	x	1700	
			2550 kN			
Self Weight of footing(0.1P)		=	0.1	x	1700	
			170 kN			
Total Load on column for footing design			1700	+	170	
			1870			
SBC of soil		=	250 kN/m²			
f_{ck}		=	25 N/mm²			
f_y		=	415 N/mm²			
T_c max		=	3.1 N/mm²		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		=	750 mm			
Column Size	a		0.3 m		300 mm	
	b		0.75 m		750 mm	
Area of footing,	A	=	1870 / 250.00			
		=	7.48 m²			
Size of footing			2.73 m			
Adopt footing size		L	2.8 m		B	2.8 m
Footing area provided			7.84 m²			
Net upward pressure(P/A)		p	216.84	<	250 kN/m²	
				SAFE		
Ultimate Design Pressure		(1.5 xp)	325.26 kN/m²			

Depth Required for B M Consideration



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

P	=	216.84		
B	=	2.8		
L-a	=	2.8	- 0.3 =	2.5
$(L-a)^2$	=	6.25		
BM	=	216.84 × 2.8 × 6.25 / 8		
	=	474.3303571		
Max. BM	=	474.33 kN.m		
M_u(1.5 xBM)	=	711.50 kN.m		

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

d^2 = $\frac{711495535.71}{3457.38}$

d^2 = 205790.23

d = **453.64 mm**

D = 750 mm Safe

d = 702 mm 0.702 m

Area of Tension steelfor BM

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

711495535.7 = 253457.1 A_t - 2.141 A_t^2

a	=	2.141
b	=	253457.1
c	=	711495535.7
2a	=	4.28
b^2	=	64240501540
4ac	=	6091855269
sqrt of b^2-4ac	=	241140.3041
A_t	=	2877.07 mm^2
Per Rm	=	1027.52 mm^2
Minimum Rebar 0.12%	=	842.4 mm^2
Adopt	=	1027.52 mm^2
		16 mm 140 mm c/c
1436.0	>	1027.5 mm^2 Per Rm
The design is	Safe	
P_t	=	**0.20 %**

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	Pressure
Shear area	L	=	2.8 m		
	b	=	0.55 m		
	area	=	1.53		
	V	=	216.84	x	1.53
	V	=	332.71 kN		
	V_u	=	1.50	x	332.71
	V_u	=	499.07 kN		
	T_v	=	V_u / bd		
		=	499071.4286 / 2800		702
Nominal Shear Stress	T_v	=	0.25 N/mm²		

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Percentage of steel provided	P_t	=	0.20	%
Shear strength of concrete	T_c	=		
Percentage of steel	P_t	=	0.20	%
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	0.20	0.34	
		=	0.34	N/mm^2
Now,kTc			0.34	N/mm^2
	0.25	<		
	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		=	2.8 x 2.8	
		=	7.84	m^2
Critical section area		=	1.002 x 1.452	
		=	1.45	m^2
Net area		=	7.84 - 1.45	
		=	6.39	m^2
		=	Shear area x Pressure	
Shear Force		=	6.39 x 216.84	
			1384.52	kN
	V		1.50 x 1384.52	
	V_u	=	2076.79	kN
Shear Force	T_v	=	V_u / bd	
		=	4908	mm
	b	=	702	
	d	=	2076785.051	
		=	4908 x 702	
		=	0.60	N/mm^2

Nominal Shear Stress	T'_c	=	$K_s.T_c$	
	K_s	=	0.5+Bc	
	Bc	=	0.40	(a/b)
	K_s	=	0.90	
Ks Not more than		=	1	
	K_s	=	0.9	
	Tc	=	1.250	(0.25*sqrtFck)
	T'_c	=	1.125	
	Tv	<	T'_c	
	0.60	<	1.125	N/mm^2

SAFE

SUMMARY

Footing Size	=	**2.8**	x	**2.8**	M
Footing concrete depth	=			**750**	mm
Footing rod	=	**16**	**@**	**140**	mm c/c

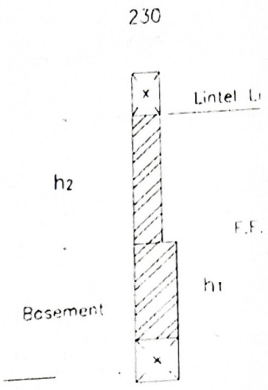
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PLINTH BEAM

Span	=	6.3 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	l/16 394 mm
D	=	375 mm	d'/d = 0.140
d'	=	46 mm	
d	=	329 mm	
F_y	=	415 N/mm²	
F_{ck}	=	25 N/mm²	



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 = (wl²/20)

5.61	6.3	6.3
	20	

= 11.13 kN.M

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

SF =

5.61	x	6.3
	3	

= 11.77 kN

SF

M_u/bd^2 =

1.5	11.13	1000000
230.00	329	329

= **0.67** N/mm²

Refer SP 16 Page 86.P1 = **0.192** % P_c = 0.1

A_{st} =

0.192	230	329
	100	

= 145 mm²

= 76 mm²

Ast =

Provide

2	16
1	12
0	16

"A_{st}" Provided 515.16 > 145.19 **SAFE**

2	16
1	12
0	12

515.1568 > 75.67 **SAFE**

Min.Reinf = (0.87 x b x d / F_y) 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 **SAFE**

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

V_u = 1.5 X 11.77

= 17.660 kN

T_v = $V_u/b.d$

T_v =

17.66	1000
230.00	329

T_v = 0.23 < 3.10 N/mm² **SAFE**

0.23 < 0.55 N/mm²

T_v < kT_c **SAFE**

Total shear strength V = 17659.69 N

Shear contribution by concrete T_c.b.d =

0.55	230	329

= 41456.1176

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

17659.69 - 41456.12

-23796.43 N

Provide Y 8 @ -502 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
	-23796.43		

-502 mm C/C

Provide shear Rebar without considering conc. shear — Y = 8 — 676 mm C/C

Area of 2 legged stps — a = 101 mm²

$\frac{0.87 * Fy * a * d}{V_u}$

0.87	415	101	329
	17659.69		

676 mm C/C

V_{us}/d

-23796.43	10
329.00	1000

-0.723 kN/cm

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	

36292.16832 / 92 = **394** mm C/C

Maximum Spacing of Stirrups

0.75 *d = 246.75 mm

300 mm

246.75 mm

Least of above

Y = 8

Provide 394 > 175 < 246.75 **SAFE**

531 > 175 < 676 **SAFE**

Development length in Tension

$L_d = \frac{\emptyset * \sigma s}{4 * T_{bd}}$

$\emptyset$ = Dia of bar = 16 mm

σs = Stress in bar(Fy/1.15) = 360.87 N/mm²

(0.87*Fy)

T_{bd} = Bond stress = 2.24 N/mm²

Page 43.26.2.1.i

16	360.8695652
4	2.24

Ld = 644.4 mm

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

Grade of concrete	Type	M20	M25	M30	M35	M40 & above
Design Bond Stress,N/mm²	Plain	1.2	1.4	1.5	1.7	1.9
	Deformed	1.92	2.24	2.4	2.72	3.04

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Centre Beam-Continues

Span	=	6.3	m		
Lateral span	=	4.34	m		
Wall height	=	2.525	m		
Wall thickness	=	0.13	m		
b	=	200	mm		
D	=	600	mm	l/12.5	**504** mm
d'	=	50	mm	d'/d =	0.091
d	=	550	mm		
f_y	=	415	N/mm²		
f_{ck}	=	25	N/mm²		

Slab Load:

Self wt	=	3.5	kN/m²	slab thk	0.14 m
Live Load	=	2	kN/m²		
Floor Finish	=	1.5	kN/m²		
Mish. Load	=	1.5	kN/m²		
		8.5	kN/m²		

Load Calculations:

Brick work/ AAC Block	=	**10**	kN/m³
Self wt = b x D x 1 x 25	=	3.00	kN/m
Brick work:	=	2.790125	kN/m
Udl for slab	=	24.18	kN/m
Max Udl	w =	29.97	kN/m

M_u Limit = $0.138\ f_{ck}\ bd^2$

0.138	25	200	302500

= 208725000.00 Nmm

208.73 > 162.23

M_u limit > M_u

Singly Reinforced

"d" - reqd = 484.88 < 550 mm

Safe

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

29.97	6.3	6.3
	13	

BM = 91.51 kN.M

M_u Midspan = **137.27 kN.M**

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

29.97	6.3	6.3
	11	

BM = 108.15 kN.M

M_u Support = **162.23 kN.M**

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

29.97	x	6.3
	2	

SF **94.42 kN**

M_u/bd^2 @Mid span =

1.5	91.51	1000000
200.00	550	550

= **2.27** N/mm²

M_u/bd^2 @Support =

1.5	108.15	1000000
200.00	550	550

= **2.68 N/mm²**

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Rebar @ Mid span

		P_t	P_c
Refer SP 16 ,Page 86,Pt	=	0.713	0.36

0.713 %

A_{st} =

0.713	200	550
	100	

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Ast = 784 mm²

2	20
2	20
0	16

Provide

"A_{st}" Provided 1256.48 > 784.47 mm² Safe

1.14

2	20
0	20
0	16

= 392 mm²

628.24 > 392

0.57 Safe

Rebar @ Support

Refer SP 16 ,Page 86,Pt = 0.868 %

P_t	P_c
0.868	0.434

A_{st} = 0.868 × 200 × 550 / 100 = 955 mm²

Ast = 955 mm²

2	20
2	20
0	16

Provide

"A_{st}" Provided 1256.48 > 954.97 mm² Safe

1.14

2	20
0	20
0	16

= 477 mm²

628.24 > 477

0.57 Safe

Min.Reinf

= 0.87 x b x d / F_y = 0.870 × 200 × 550 / 415 = 230.602 mm²

Min.Reinf = 230.602 mm²

"A_{st}" Provided 1256.48 > 230.602 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 %

$p_{t\,min}$ = **0.290 %** (0.24 √ fck) /fy) < 1.14 % 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 %** > 1.14 % Safe

CHECK FOR SHEAR STRENGTH

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

Tc Max = 0.62 *sqrt(Fck)

0.62	5

= 3.10 N/mm²

Percentage of steel P_t = **1.14** %

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	1.14	600	1.00	0.67

Now kt_c = 0.67 N/mm² < 3.10 N/mm² Safe

Nominal Shear stress T_v = V_u/b d

V_u = 1.5 X 94.42 = 141.625

T_v = V_u/b.d = 141.63 × 1000 / 200.00 × 550 = 1.29 < 3.10 N/mm²

Safe

1.29 > 0.67 N/mm²

T_v > kT_c

Provide shear Bar

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Total shear strength	V_u	=	141625.12 N
shear contribution by concrete	T_c b.d	=	0.67 | 200 | 550
			73700
Shear contribution by stps	V_{us}	=	V_u - T_c b.d
			141625.12 - 73700
			67925.12 N
Minimum shear resistance	0.4bd	=	44000.00 N
		=	67925.12 N
Provide	Y 10		459 mm C/C
Area or 2 legged stps	a	=	157 mm^2
Spacing of stirrups		=	$\frac{0.87 * Fy * a * d}{V_{us}}$
		=	0.87 | 415 | 157 | 550
			67925.12
		=	**459** mm C/C
Provide shear Rebar without considering conc. shear	Y 10		**220** mm C/C
	a	=	157 mm^2
		=	$\frac{0.87 * Fy * a * d}{V_u}$
		=	0.87 | 415 | 157 | 550
			141625.12
		=	**220** mm C/C

Minimum Stirrups Reinforcement

	Y 10		
	A_{sv}	=	157.06 mm^2
	S_v	=	0.87*Fy*Asv/0.4*b
			0.87 | 415 | 157
			0.4 | 200.00
			56706.513 / 80
		=	**709** mm C/C

Maximum Spacing of Stirrups

	=	0.75 *d	
	=	412.5	mm
	=	300	mm
Least of above		300	mm
		Y	10
		@	
Provide	709 >	150	< 300
		Safe	**Safe**

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DESIGN AS PER BIS-2000 METHOD

Calion:

L_x	=	3.38 m
L_y	=	6.63 m
F_{ck}	=	25 N/mm²
F_y	=	415 N/mm²
L_y/L_x	=	1.96

TWO WAY SLAB

Span	=	3.38 M	Span/32
Slab thickness	=	140 MM	105.6
Cover		20 MM	
Effective depth		120 MM	
Concrete wt	=	25 kN/m³	
Live Load on Slab	=	2 kN/m²	
Floor finish	=	1.5 kN/m²	
Design Load:			
slab weight	=	3.5 kN/m²	
Live + Floor finish Load	=	3.5 kN/m²	
Total Load	=	7.00 kN/m²	

$M_x = a_x w l_x^2$

$M_y = a_y w l_x^2$

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

Negative Moment at edge

L_y/L_x = **1.96**

a_x = 0.047

		Ly/Lx		For
		1.75	**2**	1.96
Negative Moment @ edge	a_x	0.084	0.091	0.090
Positive Moment at mid span	a_x	0.063	0.069	0.068

M_{ux}	M_{uy}
10786830.6	
	5637941.4

M_x = 7.19 kNM

M_y = 3.76 kNM

Maximum Bm = **7.19** kNM

"d" - read under compression = 55.92 mm

M_{ux}	M_{uy}	
0.75	**0.39**	N/mm²

$M_u/b.d^2$ =

As per SP16, Table 2,Page 48,

P_t =

%	**0.215**	**0.111**
mm²	258.32	132.63

Area of steel =

Adopt

Y	10	125	mm C/C	10	140	mm C/C

628.24 > 258.32 (SAFE) 560.93 > 132.63 (SAFE)

Positive Moment at mid span

a_y = 0.037

M_{ux}	M_{uy}
8166249	
	4438379.4

M_x = 5.44 kNM

M_y = 2.96 kNM

Maximum Bm = **5.444** kNM

M_u	M_{uy}	
0.57	0.31	N/mm²

$M_u/b.d^2$ =

As per SP16, Table 2,Page 48,

P_t =

%	**0.161**	**0.087**
mm²	193.77	103.99

Area of steel =

Adopt

Y	10	125	mm C/C	10	140	mm C/C

628.24 > 193.77 (SAFE) 560.93 > 104.0 (SAFE)

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Check for Shear strength

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

	τ_c Max	=	0.62 *sqrt(Fck)	
		=	0.62 | 5	
		=	3.10 N/mm²	
For slab as per 40.2.3.1	τ_c Max	=	0.5*τ_c max	
		=	0.50 | 3.10	
	τ_c Max	=	1.55 N/mm	
Percentage of steel	P_t	=	0.52 %	
Shear strength		=	k τ	

Permissible shear stress in concrete ($k\tau_c$) 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	$k\tau_c$ N/mm²
25	0.52	140	1.30	0.65

Now,kτc	$k\tau_c$	=	0.65	<	1.55 N/mm²
				Safe	
Nominal Shear stress	τ_v	=	V_u/b.d		
	V_u	=	17.745 kN		
	τ_v	=	0.15	<	1.55 N/mm²
				Safe	
	τ_v	<	$k\tau_c$		
		SAFE			

Check for Deflection

Live Load 2 < 3.01 kN/m²

Deflection calculation is Not Necessary

A_{st} required	=	258.3247	mm²
A_{st} Provided	=	628.24	mm²

Steel stress for service Load F_s = 0.58 x F_y X $\frac{A_{st}\ required}{A_{st}\ Provided}$

As per Fig-4,IS 456-2000,Page38

0.58	415	193.77213
	628.24	

F_s = **74.24 N/mm²**

Percentage of steel provided = **0.52 %**

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

f_y N/mm²	f_s N/mm²	$P_{t\,req.}$ %	$P_{t\,prov.}$ %	MF_t IS 456 Fig 4
415	74.24	0.16	0.52	2.00

	mf
0.2	3
0.4	2
0.360	2.000

Effective depth ratio

For,Simply supported		=	20		
Continues		=	26		
Cantilever		=	7		
(Lx/d) Max		=	26	x	2.000
		=	52.0000		
(Lx/d)Provided		=	3380 / 120		
		=	28.167		
(Lx/d) Max	52	>	28.17 (Lx/d)Provided		
		SAFE			

steel stress	mf
145	2
190	1.9
158.000	1.913

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
140	10	Ok

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STAIRECASE -DOG LEGGED MODEL

Location:

L_1	=	5.27 m	
F_{ck}	=	25 N/mm²	
F_y	=	415 N/mm²	
Step weight		20 kN/m³	
Landing width	=	0.9	
Slope length	=	3.47	
Step tread	=	0.25 m	
Step riser	=	0.165 m	
Slope length for one step	=	0.300 m	
Number of tread	=	3.47 / 0.25	
	=	13.88 No	
Say	=	11 No	
Aditional slope length per flight	=	11 x 0.050	
	=	0.54	
Effective length	=	5.81 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
	=	3 kN/m²
Live load	=	1.5 kN/m²
Floor finish	=	10.64 kN/m²
Total load on staire		
Maximum BM(w x l^2 /12)	=	10.64 x 5.81^2 / 12
	=	29.99 kN.M
M_u	=	1.5 x 29990268
		44985401.34 Nmm

44985401.34		
0.138	25	1000

13039.25

sqrt	=	114.19 mm
Cover	=	20.00 mm
Total	=	134.19 mm
Provide	=	140.00 mm
d		117.00

$M_u/b.d^2$	44985401.34	
	1000.00	117.00 117.00

3.29

As per SP16, Table 2,Page 48,

P_t = **1.118** %

Area of steel = 1.118212246 x 1000 x 117.00

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100

= 1308.31 mm^2

Adopt Y 16 @ 140 mm C/C

1435.98 > 1308.31 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 = $\frac{1435.98}{1000} \times \frac{100}{117.00}$

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	5.81	10.64
	2	

V_u = 46.4169 kN

T_v = $\frac{46.4169}{1000} \times \frac{1000}{117.00}$

T_v = 0.3967 < 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

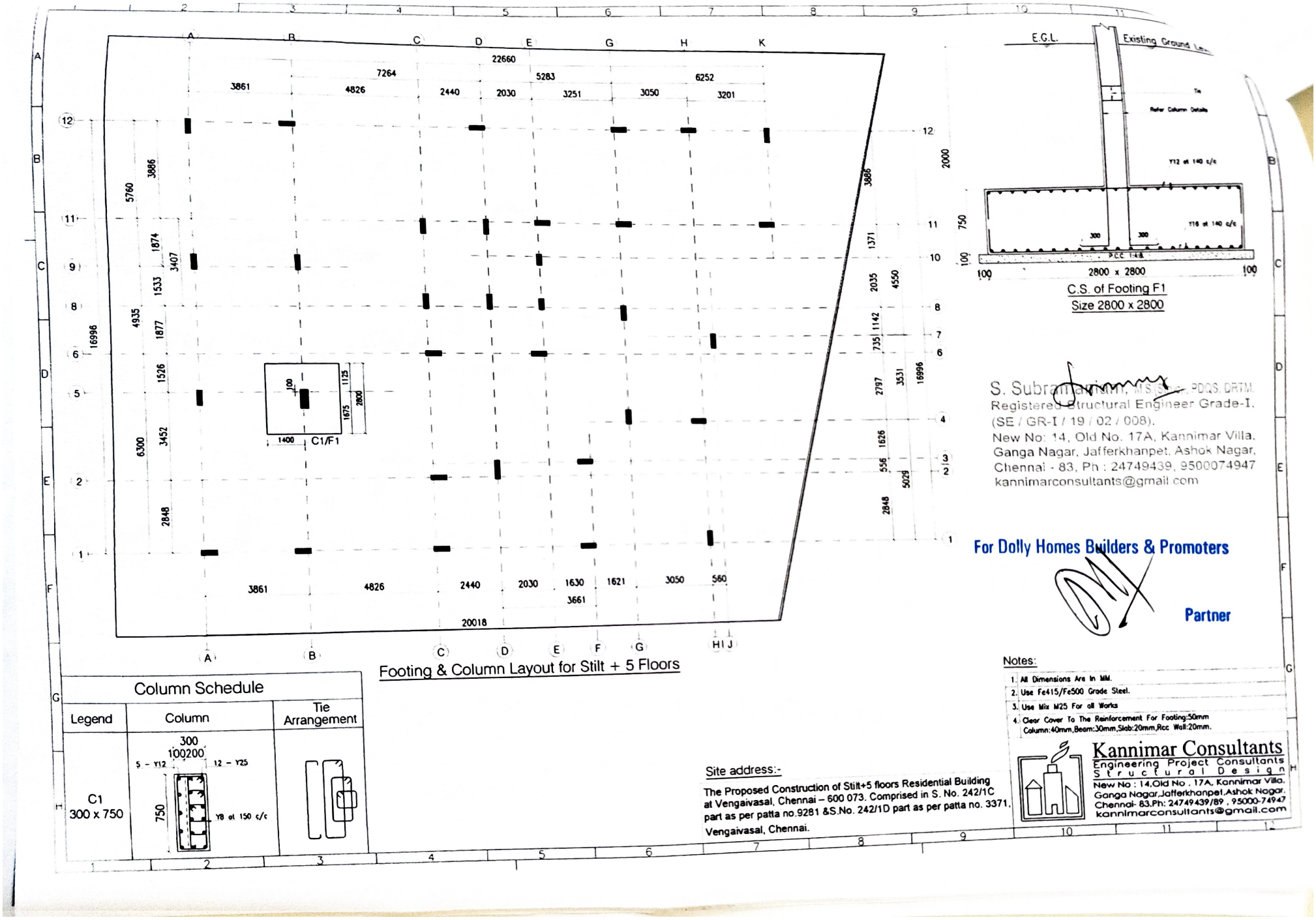
1	Grade of concrete		F_{ck}	=	**25**	N/ mm^2	
2	grade of steel		Fy	=	**415**	N/ mm^2	
3	Width of sunshade			=	**0.6**	m	
4	Sunshade thickness -	t_{max}		=	0.075	m	**75** mm
		t_{min}		=	0.1	m	**100** mm
		average		=	0.0875		87.5
		cover		=	0.014		**15**
		effective depth d		=	0.061	m	61 mm
5	Self weight 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	
			Sale				

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Footing & Column Layout for Stilt + 5 Floors

Column Schedule

Legend	Column	Tie Arrangement
C1 300 x 750	300 100 200 5 - Y12 12 - Y25 750 Y8 at 150 c/c	

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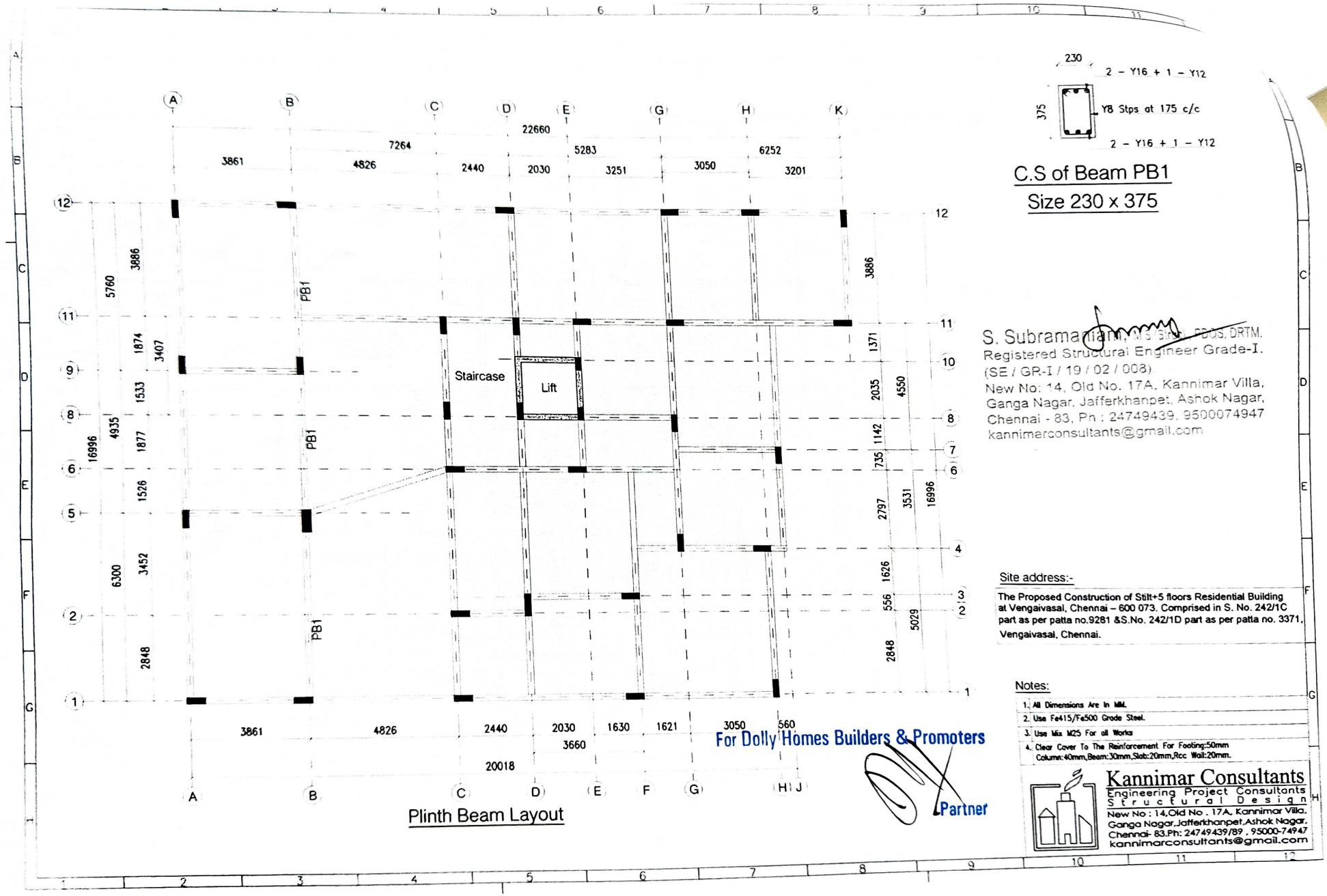
1. All Dimensions Are In MM.
2. Use Fe415/Fe500 Grade Steel.
3. Use Mix M25 For all Works
4. Clear Cover To The Reinforcement For Footing:50mm Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

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Site address:-

The Proposed Construction of Stilt+5 floors Residential Building at Vengaivasal, Chennai – 600 073. Comprised in S. No. 242/1C part as per patta no.9281 &S.No. 242/1D part as per patta no. 3371, Vengaivasal, Chennai.

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Plinth Beam Layout

C.S of Beam PB1

Size 230 x 375

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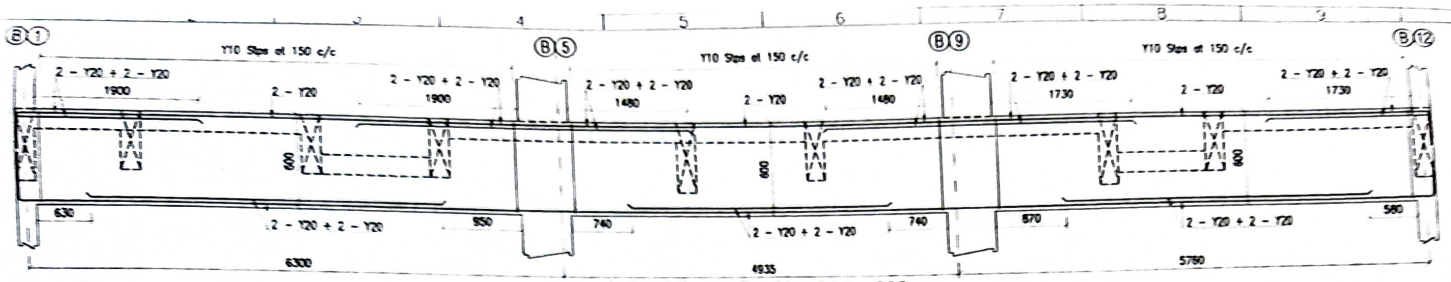
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L.S. of Beam B1 Size 200 x 600



Roof Beam & Slab Layout

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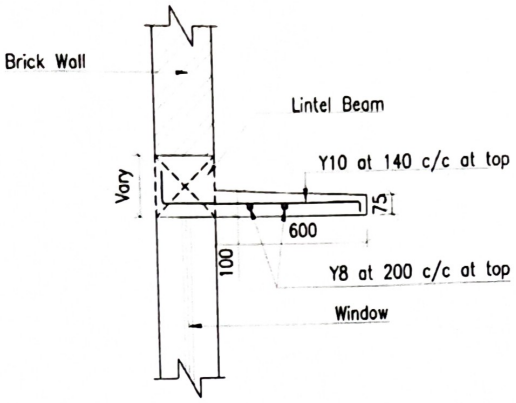
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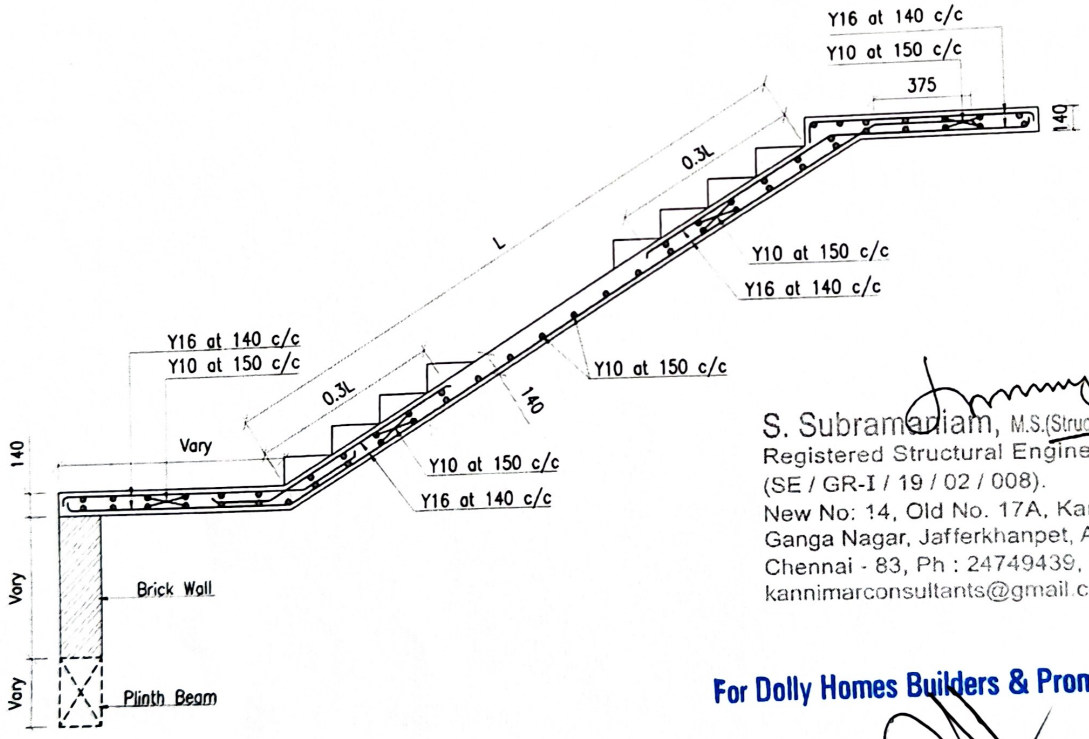
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Sunshade Detail (Typ)



C.S. of Staircase Details

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Notes:

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   Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

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