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Kannimar Consultants
Industrial Building Consultants
Structural Design
14, Old No. 17A, Kannimar Villa, Ganga Nagar, Jafferkhanpet,
ngar, Chennai - 83. Ph. : 24749439, 94441 83538, 9500074947

S. Subramaniam, M.S. (Struc). PDQS. DRTM.
Chartered Engineer
Registered Structural Engineer Grade - I
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Stability Certificate

It is certified that The Proposed Construction of Stilt + 5 Floors Residential Building at Door No:9/6, Vaigai Street, Bharathi nagar, Adambakkam, Chennai-600 088. Comprised in patta no: 339,340 &341, Survey No: 236/7, T.S. No: 29,41&42, Block No:10, Ward no: F of Adambakkam Village, Greater Chennai Corporation, Zone -XII, Division-165 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/m^3
Brick work	20	kN/m^3
Live load -rooms	2	kN/m^2
Live load -stair&cordr	3	kN/m^2
Floor finish	1	kN/m^2

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	Resi
Fifth Floor		3.05 m	Resi
Head room	=	2.8 m	
Masonry Wt	=	20 kN/m^3	BRICK/AAC

Load on Column **column** **L2** X= 5.1 Y = 4.25

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	9.35	0.23	0.375	0.81	25	20.16
3	Roof beam	1	5.1	0.23	0.46	0.54	25	13.49
		1	4.25	0.23	0.31	0.30	25	7.58
4	Roof slab	1	5.1	4.25	0.14	3.03	25	75.86
5	Live load-all area	1	5.1	4.25	1	21.68	2	43.35
6	Floor finish	1	5.1	4.25	1	21.68	1.5	32.51
7	BW: up to FFL	1	9.35	0.23	0.75	1.61	20	32.26
8	BW: Above FFL							
	230 thick	1	0	0.25	0	0.000	20	0.000
	115 thick	1	0	0.15	0	0.000	20	0.000
								252.21
	First floor/Typical Floor							
1	Column Load	1	0.3	0.6	3.05	0.549	25	13.725
2	Roof slab	1	5.1	4.25	0.14	3.035	25	75.863
3	Roof beam	1	5.1	0.23	0.375	0.440	25	10.997
		1	4.25	0.23	0.31	0.303	25	7.576
4	Live load-all area	1	5.1	4.25	1	21.675	2	43.350
5	Floor finish	1	5.1	4.25	1	21.675	1.5	32.513
6	Brick wall-230 thick	1	0	0.25	2.6	0.000	20	0.000
7	Brick wall -115 thick	1	9.35	0.15	2.6	3.647	20	72.930
	Additional load	1	2.5	2.5	0.2	1.250	20	25.000
			First floor/Typical Floor					**281.95**
	Parapet load							
1	Brick wall	1	0	0.25	1	0	20	0
2	Weathering coarse material	1	5.1	4.25	0.1	2.17	20	43.35
			Parapet load					**43.35**

COLUMN TOTAL LOAD **column** **L2**

Sl.No	Description	Load
1	Stilt floor	252.21
2	First floor	281.95
3	Second floor	281.95
4	Third floor	281.95
5	Fourth floor	281.95
6	Fifth floor	281.95
7	Terrace	43.35
8	Total	1705.32
	Say	1750.00 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	=	$P_u/1.5$				
	C_r	=	$1.25 - [(l_e/D)/48]$				
PROCEDURE:							
	F_{ck}	=	25	N/mm^2			
	F_y	=	415	N/mm^2			
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/mm^2			
Ref IS 456-2000 Cl 6.2.3.1							
Flexural strength of concrete	f_{cf}	=	3.50	N/mm^2			
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/mm^2			
Permissible bearing stress		=	0.45*Fck				
		=	0.45	x	25		
Permissible bearing stress		=	11.25	N/mm^2			
Column size		=	300	675	mm		
Minimum Eccentricity,e		=	L/500 + Lateral dimension/30				
One direction		=	17.20	mm			
Another Direction		=	29.70	mm			
Minimum eccentricity		=	20	mm			
Consider Minimum Eccentricity		=	29.70	mm			
0.05*b		=	15.00		<		29.70
Area of column		=	202500	mm^2			
Number of rod		=					
		=	5	25	2454.06	mm^2	
		=	5	25	2454.06	mm^2	
Area of Steel(A_{sc})		=	4908.13	mm^2			
Area of Concrete(A_c)		=	197591.88	mm^2			
	P_u	=	3249845.11	N			
	P	=	2166563.407	N			
	Say	=	**216.66**	**Tonne**			
% of Reinforcement	**0.8**	<	**2.42**	<	**4**	%	
		SAFE		SAFE			
Column Load	216.66	>	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				
		=	6.25	mm dia			
Provide		=	8	mm dia			

Spacing

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	=	$\frac{Ø\ *\sigma s}{4*T_{bd}}$				
	Ø	=	Dia of bar	=	25.00	mm	
(Fy/1.15)	σs	=	Stress in bar	=	360.87	N/mm^2	(0.87*Fy)
Page 43.26.2.1.1	T_{bd}	=	Bond stress	=	2.8	N/mm^2	
	Ld	=	25 / 4	360.8696 / 2.8			
	Ld	=	805.512	mm			

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SUMMARY

Column size		=	300	x	675
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 & above**
Design Bond Stress,N/mm^2	Plain	1.5	1.75	1.875	2.125	2.375
	Deformed	2.4	2.8	3	3.4	3.8

M40 & above
2.375
3.8

Pile Design

Pile capacity as per soil report

Dia"mm"	e Load in "Mt"
450	65
0	0
0	0
0	0

Pile depth			7	M
Actual Load from the column		=	1800	kN
Add pile cap weight-5%		=	90	kN
Total weight on pile		=	1890	kN
Dia of pile adopted		=	450	mm
Capacity of pile as per soil report		=	65	T
Number of pile to be provided		=	1890	
		=	650	
No. of pile		=	2.91	No
Say		=	3	Nos
Rebar Calculation		=		
Provide minimum rebar		=	0.6	%
Area of rebar		=	954.14	mm^2
Provide	7	16		
	0	12		
"A_{st}" Provided	1407.26	>	954.14	mm^2
		Safe		
%age of steel provided		**0.88 %**		

Lateral Ties:

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

Diameter shall not be less than		=	16	
			4	
		=	4	mm dia
Provide		=	8	mm dia

Spacing

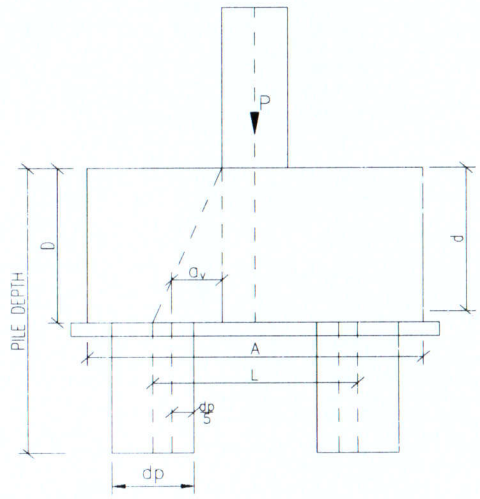
Shall not be more than following				
Least dimension of column		=	450	mm
16x Smallest dia of column rod		=	256	mm
Not more than		=	300	mm
Minimum of above		=	256	mm
Provide	8	@	150	mm C/c

Summary

Pile size		=	450	mm
No. Of pile		=	3	No
Rebar	7	NOS	Y 16	
Lateral tie	8	@	**150**	mm C/c

CAP DESIGN : 3 Pile

Limit state design of Reinforced Concrete-P C Varghese



...ed on Column	P	=	180	Mt	
...tored load		=	2700	kN	
...lumn size	a,b	=	300	600 mm	
...of pile		=	3	No	
...ad per pile		=	900	kN	
...e diameter	d_p	=	450	mm	
...tance between pile	L	=	1350	mm	1350
...ap size		=	2100	mm	2100
		=	1920	mm	1919.1
...pth of pile cap		=	1200	mm	1000
...ective cover		=	68	mm	
...ective depth	d	=	1132	mm	d
	f_y	=	415	N/mm²	
	f_{ck}	=	25	N/mm²	

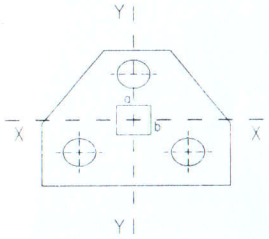
Pilecap (2.5D)			Pilecap (3.0D)	
Pile Dia	Area	Perimeter	Area	Perimeter
0.45	2.68	6.37	3.24	7.05
0.5	3.18	6.95	3.85	7.7
0.55	3.72	7.52	4.51	8.35
0.6	4.3	8.1	5.23	9
0.75	6.29	9.82	7.7	10.95
0.9	8.67	11.55	10.64	12.9

...eck for Compression :

Area of pile cape	=	3.24	m^2		
Wt.of pile cape	=	3.24	1.2	25	
	=	97.2			
Pile cap Load taken by one pile	=	32.40	kN		
Column load taken by one pile	=	180 / 3	=	60.00	kN
...Taken by pile inc . Colum +cap	=	60.00	+	3.24	
	=	63.24			
...ify as per load test/soil report	=	65	>	63.24	Mt
			Safe		
	a_v	=	240		
	a_v/d	=	0.21	<	2

Adopt Truss theory

...nsile forces along X-X axis	=	362190.8	N
...nsile forces along Y-Y axis	=	322438.2	N



T parallel to xx = $\frac{p}{36Ld}\left[4L^2 + b^2 - 3a^2\right]$

T parallel to yy = $\frac{p}{18Ld}\left[2L^2 - b^2\right]$

%of steel	M25	M30
0.15	0.29	0.29
0.25	0.36	0.37
0.5	0.49	0.5
0.75	0.57	0.59
1	0.64	0.66
1.25	0.7	0.71
1.5	0.74	0.76
1.75	0.78	0.8
2	0.82	0.84
2.25	0.85	0.88
2.5	0.88	0.91
2.75	0.9	0.94
3&above	0.92	0.96

Area of steel-XX axis = 1003.16 mm^2

Area of steel-YY axis = 893.06 mm^2

Area of steel = 1003.16 mm^2

Minimum area of steel = 3260.16 mm^2 0.15%

Area of reinforcement atBottom = 3260.16 mm^2

Provide	11	20
	0	16

Area of steel provided 3455.32 > 3260.16 mm^2

Design is Safe

Check for Shear

%ge of steel = 0.16 %

Asper clause 40.5.1 of IS456-2000 page-74

Enhanced shear stress T_v

T_c = $T_c \times 2d / a_v$

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

% of steel	T_c
0.15	0.29
0.25	0.36

For 0.16 0.30

T_c = 0.30 N/mm^2

T_c = $\frac{Tc \times 2 \times d}{a_v}$

T_c = $\frac{0.30 \quad 2 \quad \mathbf{1132}}{\quad 240 \quad}$

= 2.79 N/mm^2

T_c 2.79 < 3.05 N/mm^2

Safe

Shear stress 1.24 < **2.79** N/mm^2

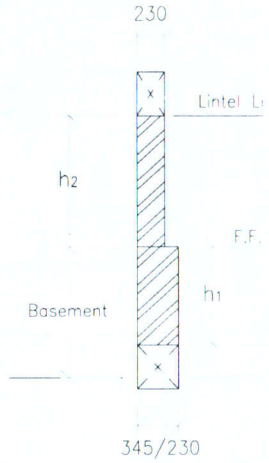
Safe

nsultants.

TH BEAM

	=	6.56	m
thickness-Below basement	=	0.23	m
height	=	0.75	m
Wall thick-above basement	=	0.25	m
Wall height	=	0	m

Beam Size b	=	230	mm			
D	=	450	mm	l/16	**410**	mm
d'	=	46	mm	d'/d =	0.114	
d	=	404	mm			
F_y	=	415	N/mm²			
F_{ck}	=	25	N/mm²			



D CALCULATIONS:

Self wt = b x D x 1 x 25	=	2.59	kN/m	
ick masonry weight below basement	=	3.45	kN/m	
ick masonry weight above basement	=	0		
Max Udl	w =	6.04	kN/m	
Max B.M at Mid span	=	(wl²/20)		

6.04	6.56	6.56
	20	

BM 12.99 kN.M

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

6.04	x	6.56
	3	

SF 13.20 kN

M_u/bd^2 =

1.5	12.99	1000000
230.00	404	404

= **0.52** N/mm²

Refer SP 16 ,Page 86,Pt = **0.147** % P_c = 0.1

A_{st} =

0.147	230	404
	100	

Ast = 137 mm² = 93 mm²

Provide						
	2	16		2	16	
	1	12		1	12	
	0	16		0	12	
"A_{st}" Provided	515.16	>	137.01	515.1568	>	92.92
		SAFE			**SAFE**	

Min.Reinf = (0.87 x b x d / F_y) mm²

0.870	230	404
	415	

Min.Reinf = 194.796 mm²

"A_{st}" Provided 515.2 > 194.8 mm²

SAFE

CK 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 = **0.55** %

Shear strength = kT_c

k = 1

% of steel	T_c
0.5	0.49
0.75	0.57

For 0.55 0.51

kT_c = 1.00 X 0.51

Now kT_c = 0.51 N/mm² < 3.10 N/mm²

minal Shear stress T_v = V_u/b.d **SAFE**

V_u = 1.5 X 13.20

19.803 kN

T_v = V_u/b.d

T_v =

19.80	1000
230.00	404

T_v = 0.21 < 3.10 N/mm²

SAFE

0.21 < 0.51 N/mm²

T_v < kT_c

SAFE

Total shear strength V_u = 19803.00 N

Shear contribution by concrete T_c b.d =

0.51	230	404

47148.6176

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

19803.00 - 47148.62

-27345.62 N

Provide Y 8 -536 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	404
	-27345.62		

= -536 mm C/C

Provide shear Rebar without considering conc. shear

Y 8 **740** mm C/C

Area or 2 legged stps a = 101 mm^2

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

0.87	415	101	404
	19803.00		

= **740 mm C/C**

V_{us}/d =

-27345.62	10
404.00	1000

= -0.677 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	

= 36292.16832 / 92

= **394 mm C/C**

Maximum Spacing of Stirrups

= 0.75 *d

= 303 mm

= 300 mm

Least of above 300 mm

			Y	@	8	
Provide	394	>	200	<	300	
		SAFE		**SAFE**		
	531	>	200	<	740	
		SAFE		**SAFE**		

Development length in Tension

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

$\emptyset$ = Dia of bar = 16 mm

(0.87*Fy) σs = Stress in bar(Fy/1.15) = 360.87 N/mm^2

Page 43.26.2.1.1 T_{bd} = Bond stress = 2.24 N/mm^2

Ld =

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

SLAB DESIGN AS PER BIS-2000 METHOD

Location:

L_x	=	4.88	m	
L_y	=	7.05	m	
F_{ck}	=	25	N/mm^2	
F_y	=	415	N/mm^2	
L_y/L_x	=	1.44		
		TWO WAY SLAB		
Span	=	4.88	M	Span/32
Slab thickness	=	150	MM	152.5
Cover		20	MM	
Effective depth		130	MM	
Concrete wt	=	25	kN/m^3	
Live Load on Slab	=	2	kN/m^2	
Floor finish	=	1.5	kN/m^2	
Design Load:				
Slab weight	=	3.75	kN/m^2	
Live + Floor finish Load	=	3.5	kN/m^2	
Total Load	=	7.25	kN/m^2	

$M_x = \alpha_x w l_x^2$

$M_y = \alpha_y w l_x^2$

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

Negative Moment at edge

L_y/L_x = **1.44**

α_x = 0.047

		Ly/Lx		For
		1.4	**1.5**	1.44
Negative Moment @ edge	α_x	0.071	0.075	0.073
Positive Moment at mid span	α_x	0.053	0.056	0.054

				M_{ux}	M_{uy}
M_x	=	12.57	kNM	18850464	
M_y	=	8.11	kNM		12172135
Maximum Bm	=	**12.57**	kNM		
d' reqd under compression	=	73.92	mm		

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	1.12	0.72	N/mm^2

As per SP16, Table 2,Page 48,

P_t	=	%	**0.327**	**0.207**	
Area of steel	=	mm^2	424.87	268.68	
Adopt					
Y	10	125	mm C/C	10	125	mm C/C
	628.24	>	424.87	628.24	>	268.68
		SAFE			SAFE	

Positive Moment at mid span

α_y = 0.037

				M_{ux}	M_{uy}
M_x	=	9.38	kNM	14073102.6	
M_y	=	6.39	kNM		9582319.2
Maximum Bm	=	**9.382**	kNM		

		M_{ux}	M_{uy}	
$M_u/b.d$	=	0.83	0.57	N/mm^2

As per SP16, Table 2,Page 48,

P_t	=	%	**0.240**	**0.161**	
Area of steel	=	mm^2	312.45	209.88	
Adopt					
Y	10	125	mm C/C	10	125	mm C/C
	628.24	>	312.45	628.24	>	209.9
		SAFE			SAFE	

Check for Shear strength

As per clause 40.2 (P72)	Tc Max	=	0.62 *sqrt(Fck)	
of IS 456-2000		=	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	=	0.48 %	
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	0.48	150	1.30	0.62

Now,kTc	k t_c	=	0.62	<	1.55 N/mm²
				Safe	
Nominal Shear stress	T_v	=	V_u/b.d		
	V_u	=	26.535 kN		
	T_v	=	0.20	<	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	=	424.8671 mm²		
A_{st} Provided	=	628.24 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 / 628.24 = 312.44857
	F_s	=	119.71 N/mm²	
Percentage of steel provided		=	0.48 %	

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	119.71	0.24	0.48	2.00

	m
0.2	2
0.4	2
0.360	2.0

steel stress	m
145	2
190	1.
158.000	1.9

Effective depth ratio

For,Simply supported		=	20		
Continues		=	26		
Cantilever		=	7		
(Lx/d) Max		=	26	x	2.000
		=	52.0000		
(Lx/d)Provided		=	4880 / 130		
		=	37.538		
(Lx/d) Max	52	>	37.54 (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
150	10	Ok

Centre Beam-Continues

Span	=	6.55 m				
Lateral span	=	4.25 m				
Wall height	=	2.45 m				
Wall thickness	=	0.15 m				
b	=	230 mm				
D	=	600 mm		l/12.5	**524**	mm
d'	=	50 mm		d'/d =	0.091	
d	=	550 mm				
f_y	=	415 N/mm^2				
f_{ck}	=	25 N/mm^2				

Slab Load:

Self wt	=	3.75	kN/m^2	slab thk 0.15 m
Live Load	=	2	kN/m^2	
Floor Finish	=	1.5	kN/m^2	
Mish. Load	=	0	kN/m^2	
		7.25	kN/m^2	

Load Calculations:

Brick work/ AAC Block	=	**20** kN/m^3
Self wt = b x D x 1 x 25	=	3.45 kN/m
Brick work:	=	6.2475 kN/m
Udl for slab	=	20.82 kN/m
Max Udl w =		30.51 kN/m

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

0.138	25	230	302500

= 240033750.00 Nmm

240.03 > 178.51

M_u limit > M_u

Singly Reinforced

"d" - read = 474.31 < 550 mm

Safe

	mf
0.2	2
0.4	2
0.360	2.000

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

30.51	6.55	6.55
	13	

BM = 100.70 kN.M

M_u Midspan = **151.05 kN.M**

steel stress	mf
145	2
190	1.7
158.000	1.913

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

30.51	6.55	6.55
	11	

BM = 119.01 kN.M

M_u Support = **178.51 kN.M**

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

30.51	x	6.55
	2	

SF **99.93 kN**

M_u/bd^2 @Mid span =

1.5	100.70	1000000
230.00	550	550

= **2.17** N/mm^2

M_u/bd^2 @Support =

1.5	119.01	1000000
230.00	550	550

= **2.57** N/mm^2

Rebar @ Mid span

Refer SP 16 ,Page 86 Pt =

P_t	P_c
0.678	0.34

0.678 %

A_{st} =

0.678	230	550
	100	

Ast = 858 mm^2

Provide

2	20
2	20
0	16

= 429 mm^2

2	20
0	20
0	16

"A_{st}" Provided	1256.48	>	857.55	mm²	628.24	>	428.77
	0.99	**Safe**			**0.50**	**Safe**	

Rebar @ Support

		P_t	P_c			
Refer SP 16 ,Page 86,Pt	=	0.824	0.412		**0.824**	%

A_{st}	=	0.824	230	550			
			100				
Ast	=	1042	mm²		=	521	mm²

Provide	2	20			2	32		
	2	20			0	20		
	0	16			0	16		
"A_{st}" Provided	1256.48	>	1041.86	mm²	1608.294	>	520.93
	0.99	**Safe**			**1.27**	**Safe**	

Min.Reinf	=	0.87 x b x d / F_y	mm²		
	=	0.870	230	550	
			415		
Min.Reinf	=	265.193	mm²		
"A_{st}" Provided	1256.48	>	265.193	mm²	
		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** %	<	0.99	%
			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** %	>	0.99	%
			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/mm²	
Percentage of steel	P_t	=	**0.99** %	

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	0.99	600	1.00	0.64

Now	kT_c	=	0.64	N/mm²	<	3.10	N/mm²
Nominal Shear stress	T_v	=	$V_u/b.d$		**Safe**		
	V_u	=	1.5	X	99.93		
			149.898				
	T_v	=	$V_u/b.d$				
		=	149.90 | 1000				
			230.00 | 550				
		=	1.18	<	3.10	N/mm²	
				Safe			
	1.18	>	0.64 N/mm²				
	T_v	>	kT_c				

PROVIDE SHEAR REBAR

Total shear strength	V_u	=	149897.95 N		
Shear contribution by concrete	T_c.b.d	=	0.64 | 230 | 550		
			80960		
Shear contribution by stps	V_{us}	=	V_u	-	T_c b.d
			149897.95	-	80960
			68937.95 N		
Minimum shear resistance	0.4bd	=	50600.00 N		
		=	68937.95 N		

> 428.77
afe

824 %

21 mm²
32
20
16

> 520.93
afe

3.10 N/mm²

m²

Provide Y 8 290 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	550
	68937.95		

290 mm C/C

Provide shear Rebar without considering conc. shear Y 8 133 mm C/C

a = 101 mm²

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

=

0.87	415	101	550
	149897.95		

133 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	

$\frac{36292.16832}{92}$

= **394** mm C/C

Maximum Spacing of Stirrups = 0.75 *d = 412.5 mm

= 300 mm

Least of above 300 mm

Provide Y 8 @ 150

394 > **Safe** < 300 **Safe**

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AIRECASE -DOG LEGGED MODEL

cation:

L_x	=	5.7	m		
F_{ck}	=	25	N/mm^2		
F_y	=	415	N/mm^2		
Step weight		20	kN/m^3		
Landing width	=	1.5			
Slope length	=	2.7			
Step tread	=	0.25	m		
Step riser	=	0.165	m		
Slope length for one step	=	0.300	m		
Number of tread	=	2.7			
	=	0.25			
	=	10.8	No		
Say	=	10	No		
ditional slope length per flight	=	10	x	0.050	
	=	0.50			
Effective length	=	6.20	m		
oncrete wt	=	25	kN/m^3		
aist slab thickness	=	0.140	m	(Assumed)	

oads:

ead load of Waist slab	=	3.5	kN/m^2		
iling finish	=	0.25	kN/m^2		
b total	=	3.75	kN/m^2		
ead Load on plan area	=	3.75 x 0.300 / 0.25			
	=	4.49	kN/m^2		
ick load	=	0.165 x 20 / 2			
		1.65	kN/m^2		
ve load	=	3	kN/m^2		
or finish	=	1.5	kN/m^2		
tal load on staire	=	10.64	kN/m^2		

aximum BM($w \times l^2/12$)	=	10.64 x 6.20^2 / 12			
	=	34.04	kN.M		
M_u	=	1.5 x		34043033	
		51064550.00	Nmm		

51064550.00		
0.138	25	1000

14801.32

rt	=	121.66	mm		
over	=	20.00	mm		
tal	=	141.66	mm		
ovide	=	140.00	mm		
		117.00			

$M_u/b.d^2$

51064550.00		
1000.00	117.00	117.00

3.73

s per SP16, Table 2,Page 48,

P_t	=	**1.325**	%		
Area of steel	=	1.325251619	x	1000	x 117.00

$$= \frac{1608.29}{1000} \times \frac{100}{117.00}$$

$$= 1550.54 \text{ mm}^2$$

Adopt

Y 16 @ 125 **mm C/C**

1608.3 > 1550.5 mm^2

Safe

Distributer:

Provide minimum steel = 0.12%

$$= \frac{\mathbf{0.12} \times 1000 \times 117.00}{100}$$

$$= \mathbf{140.4} \text{ mm}^2$$

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 $P_t = \frac{1608.29}{1000} \times \frac{100}{117.00}$

P_t = **1.37** %

Shear strength = kT_c

k = 1.2

IS456-2000,Page73,table19

% of steel	T_c
0.75	0.57
1	0.64

For **1.37** 0.745 N/mm^2

kT_c = 1.200 x 0.745

0.894

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

V_u

1.5	6.20	10.64
	2	

V_u = 49.4539 kN

$T_v = \frac{49.4539}{1000} \times \frac{1000}{117.00}$

T_v = 0.4227 < 0.8939

$T_v < kT_c$

SAFE

SUMMARY

Waist slab thick = **140.00 mm**

Main Rebar = **Y 16** @ 125 **mm C/C**

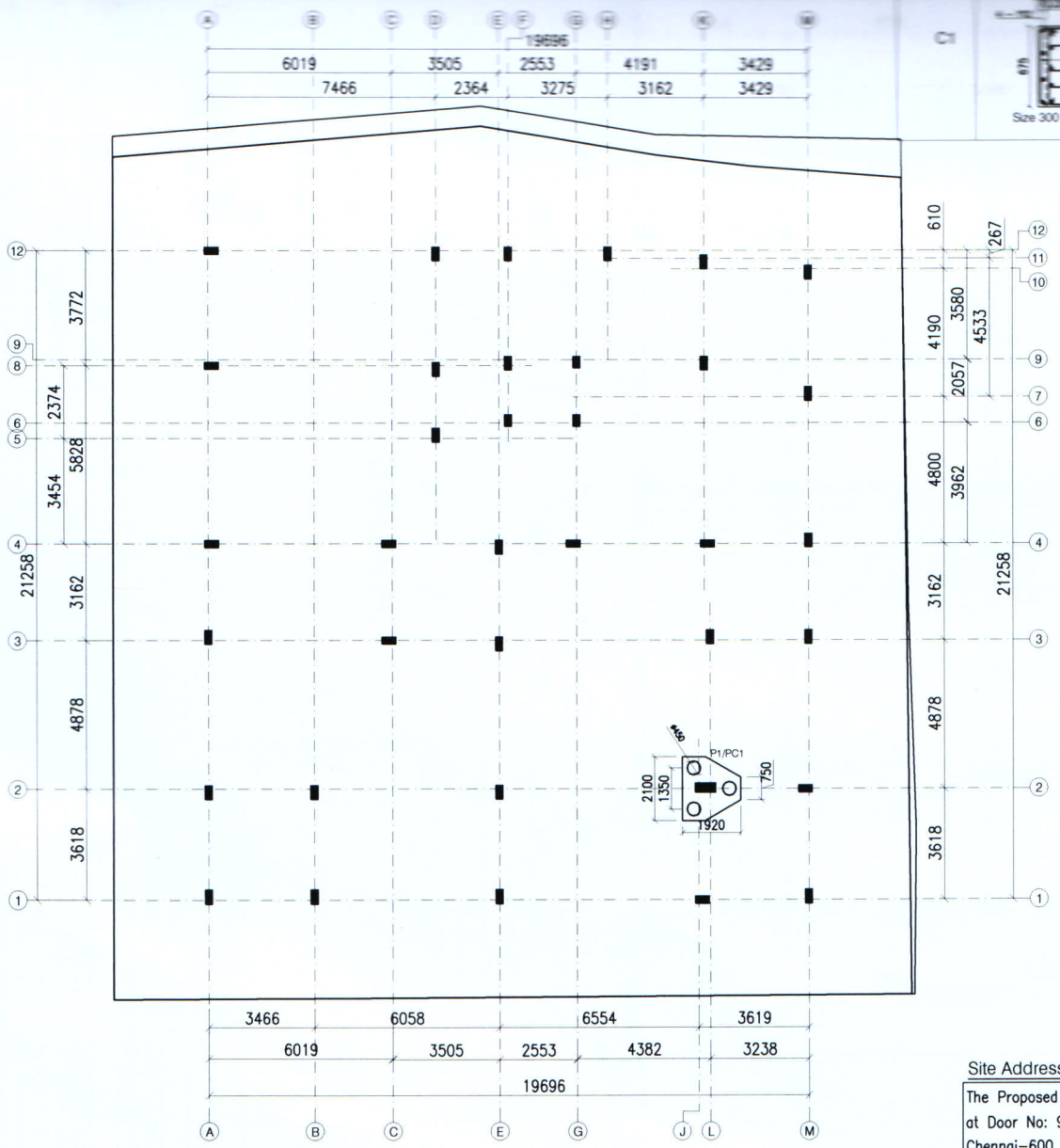
Distributer = Y 10 @ 150 **mm C/C**

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0439

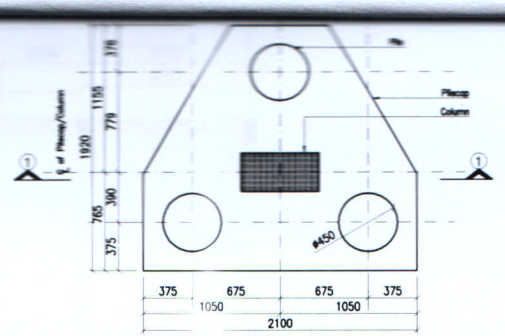
SUNSHADE DESIGN

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			

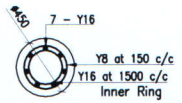
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Registered Structural Engineer Grade-I.
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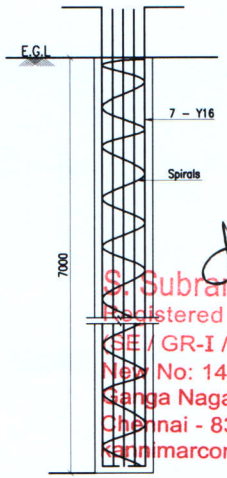
Pile & Pilecap Layout
(For Stilt +5 Floors)



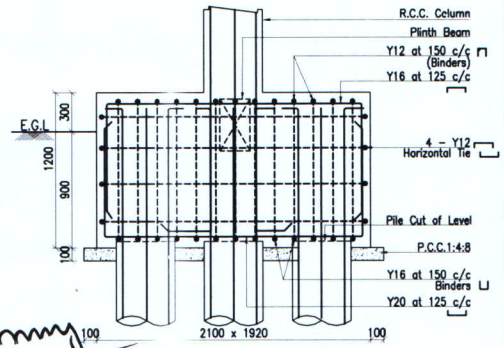
Plan of Pilecap PC1
Size 2100 x 1920



C.S. of Pile P1
Size 450 Ø



L.S. of Pile P1
Size 450 Ø



C.S. of Pilecap PC1
Size 2100 x 1920
Section "1 - 1"

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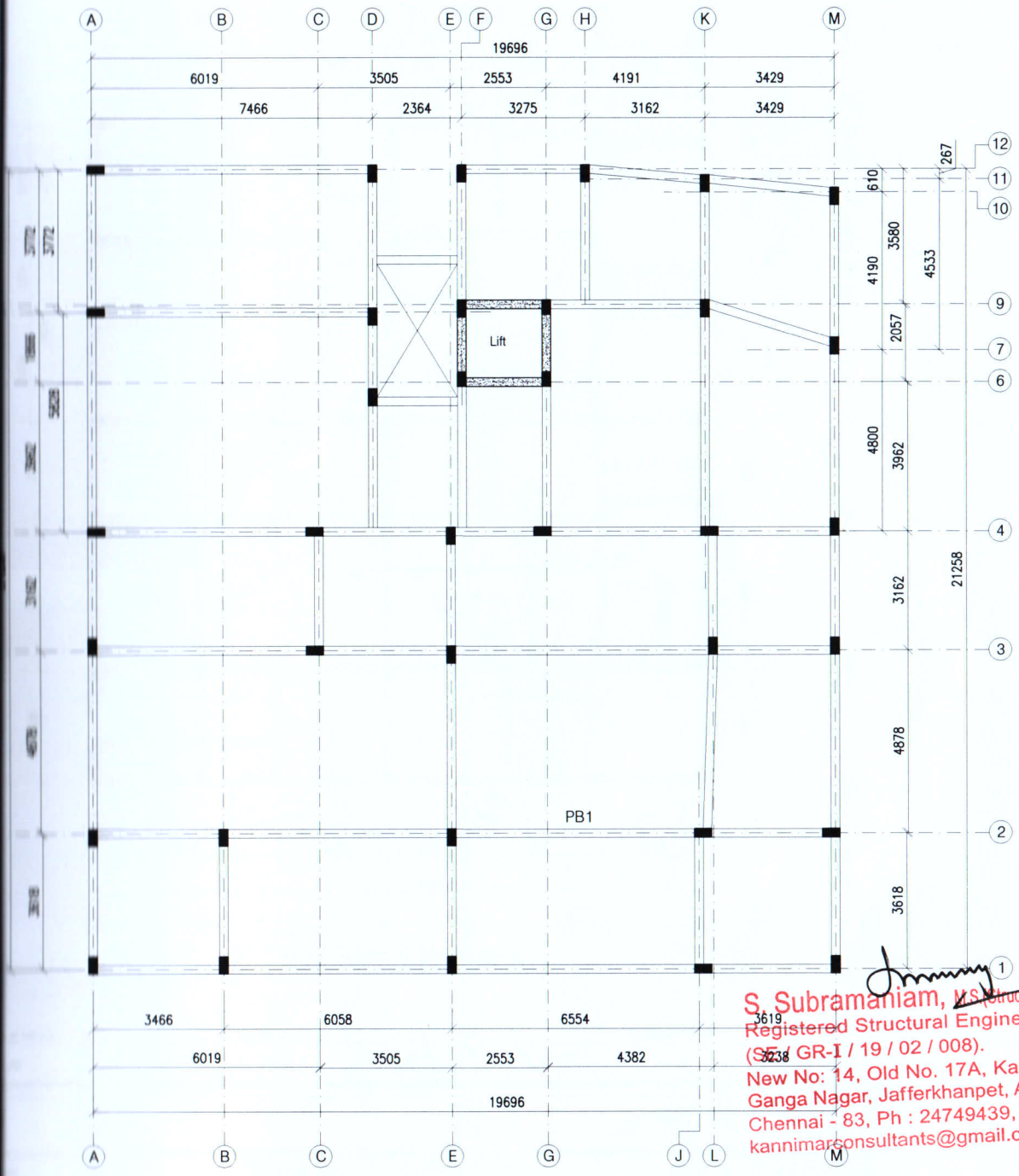
Notes:

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.

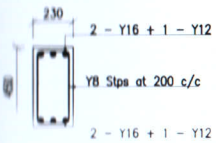
Site Address:-

The Proposed Construction of Stilt+5 Floors Residential Building at Door No: 9/6,Vaigai Street, Bharathi nagar, Adambakkam, Chennai-600 088. Comprised in patta no: 339,340 &341, Survey No: 236/7,T.S.No: 29,41&42,Block No:10,Ward no: F of Adambakkam Village, Greater Chennai Corporation, Zone -XII, Division-165.

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Plinth Beam Layout



C.S. of Plinth Beam PB1
Size 230 x 450

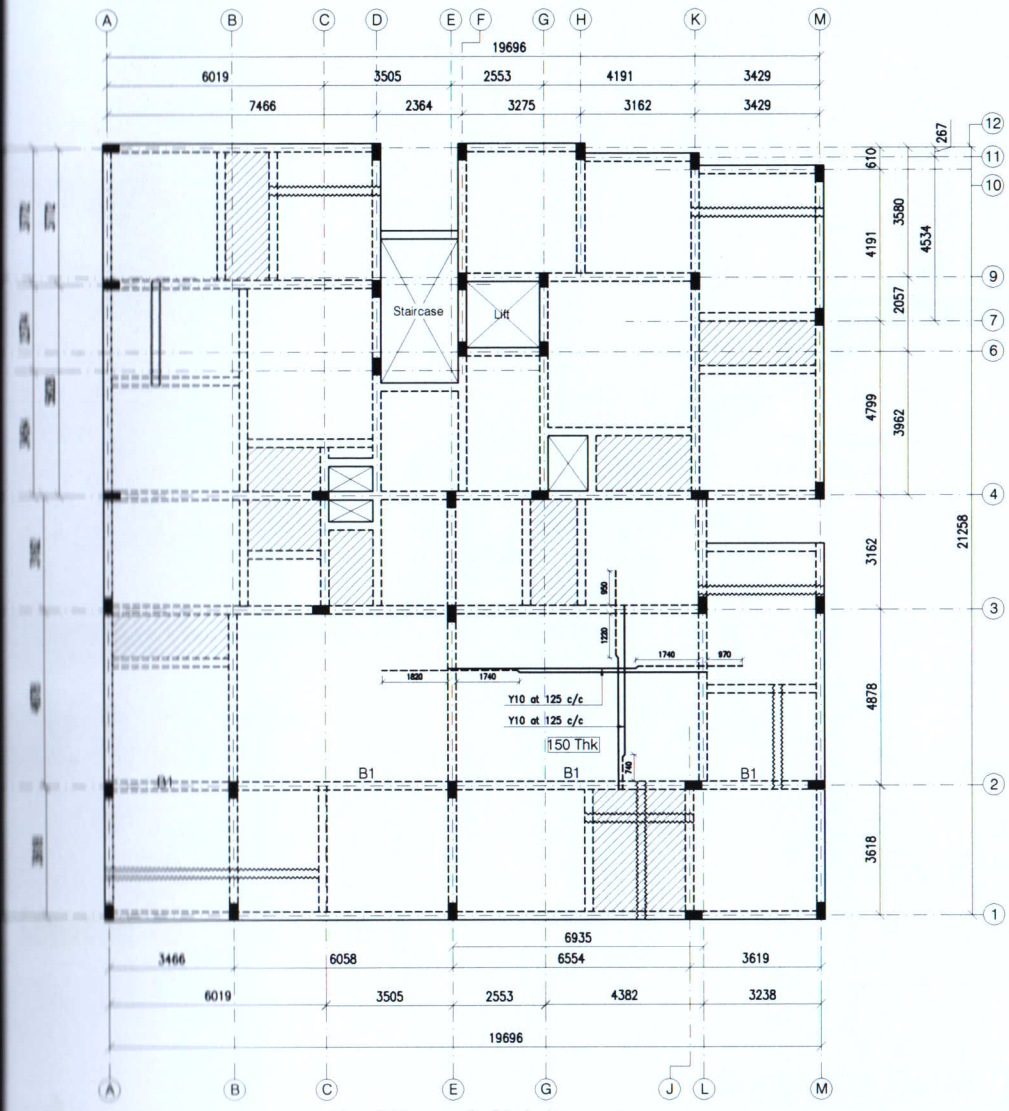
Notes:

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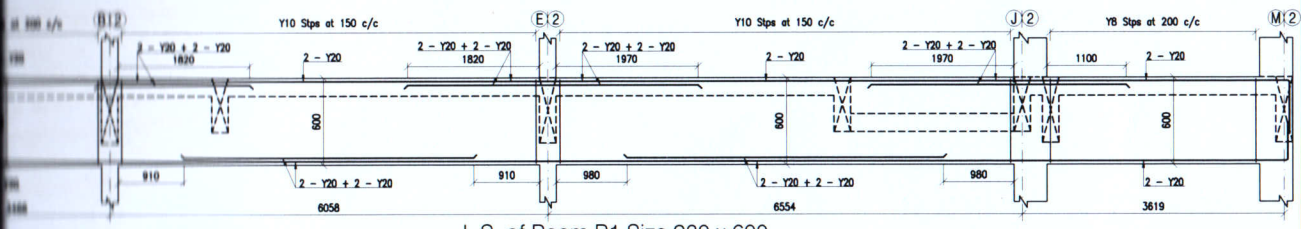
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...d Construction of Stilt+5 Floors Residential Building
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...088. Comprised in patta no: 339,340 &341,
...236/7,T.S.No: 29,41&42,Block No:10,Ward no: F
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Roof Beam & Slab Layout



L.S. of Beam B1 Size 230 x 600

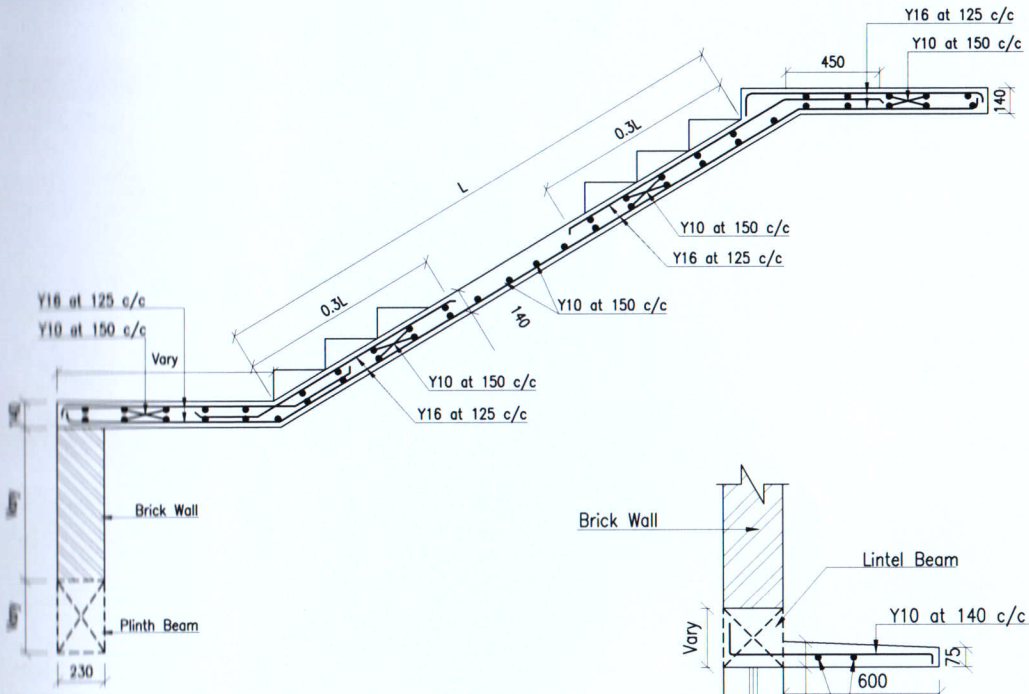
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Notes:

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Construction of Stilt+5 Floors Residential Building
76,Valgai Street, Bharathi nagar, Adambakkam,
Comprised in patta no: 339,340 &341,
T.S.No: 29,41&42,Block No:10,Ward no: F
Village, Greater Chennai Corporation,
165.

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Detail of Staircase (Typical)

Sunshade Detail (Typ)

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