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Design Report & Stability Certificate

Site Address

The Proposed Construction of Residential Building Stilt+4 Floors + 5th Floor Part Residential Apartment Building With 39 Dwelling Units 18.30M Height, In Selvaganapathy Nagar, Comprised in Patta No : 7398 and 7082, as Per Patta S.Nos: 32/1b1b1, 32/2b2a, 32/2b2b and 32/3 of Medavakkam Village, Tambaram Taluk, Chengalpattu District. Within the limits of St. Thomas Mount, Panchayat Union.

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

It is certified that The Proposed Construction of Residential Building Stilt+4 Floors + 5th Floor Part Residential Apartment Building With 39 Dwelling Units 18.30M Height, In Selvaganapathy Nagar, Comprised in Patta No : 7398 and 7082, as Per Patta S.Nos: 32/1b1b1, 32/2b2a, 32/2b2b and 32/3 of Medavakkam Village, Tambaram Taluk, Chengalpattu District. Within the limits of St. Thomas Mount, Panchayat Union 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
Fourth floor		3.05	Resi
Fifth floor		3.05	Resi
Head room	=	2.8 m	

Load on Column **column** **L2** X= 4.95 Y = 5.1

SL No	Description	No	L	B	D	Qty	UnitLoad	Total Load
	Ground floor							
1	Column Load	1	0.375	0.6	6	1.35	25	33.75
2	Plinth beam	1	10.05	0.23	0.375	0.87	25	21.67
3	Roof beam	1	4.95	0.23	0.475	0.54	25	13.52
		1	5.1	0.23	0.475	0.56	25	13.93
4	Roof slab	1	4.95	5.1	0.125	3.16	25	78.89
5	Live load-all area	1	4.95	5.1	1	25.25	2	50.49
6	Floor finish	1	4.95	5.1	1	25.25	1.5	37.87
7	BW: up to FFL	1	10.05	0.23	0.75	1.73	20	34.67
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
								284.79
	First floor/Typical Floor							
1	Column Load	1	0.375	0.6	3.05	0.686	25	17.16
2	Roof slab	1	4.95	5.1	0.125	3.156	25	78.89
3	Roof beam	1	4.95	0.23	0.475	0.541	25	13.52
		1	5.1	0.23	0.475	0.557	25	13.93
4	Live load-all area	1	4.95	5.1	1	25.245	2	50.49
5	Floor finish	1	4.95	5.1	1	25.245	1.5	37.87
6	Brick wall-230 thick	1	0	0.25	2.6	0.000	20	0.00
7	Brick wall -115 thick	1	10.05	0.15	2.45	3.693	20	73.87
	Additional load	1	3	2.5	0.2	1.500	25	37.50
			First floor/Typical Floor					**323.22**
	Parapet load							
1	Brick wall	1	0	0.25	1	0	20	0
2	Weathering coarse material	1	4.95	5.1	0.1	2.52	20	50.49
			Parapet load					**50.49**

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

Sl.No	Description	Load
1	Stilt floor	284.79
2	First floor	323.22
3	Second floor	323.22
4	Third floor	323.22
5	Fourth floor	323.22
6	Fifth floor	323.22
7	Terrace	50.49
8	Total	1951.38
	Say	200.00 MT

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COLUMN DESIGN

Column load as per load calculation		=	200 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	=	$1.25 - [(l_o/D)/48]$			
PROCEDURE:						
	F_{ck}	=	25	N/mm²		
	F_y	=	415	N/mm²		
Length of column	L	=	3.6	m		
	l_o	=	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_{cl}	=	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	$I_{c\ max}$	=	3.1	N/mm²		
Permissible bearing stress		=	0.45*Fck			
		=	0.45	x	25	
Permissible bearing stress		=	11.25	N/mm²		
Column size		=	375	600	mm	
Minimum Eccentricity,e		=	L/500 + Lateral dimension/30			
One direction		=	19.70	mm		
Another Direction		=	27.20	mm		
Minimum eccentricity		=	20	mm		
Consider Minimum Eccentricity		=	27.20	mm		
0.05*b		=	18.75		<	27.20
Area of column		=	225000	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)		=	219110.25	mm²		
	P_u	=	3724705.436	N		
	P	=	2483136.957	N		
	Say	=	**248.31**	**Tonne**		
% of Reinforcement	**0.8**	**<**	**2.62**	**<**	**4**	%
		SAFE		**SAFE**		
Column Load	248.31	**>**	200.00	**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	=	375	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

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

Ø	=	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

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

Ld = 805.512 mm

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SUMMARY

Column size = 375 x 600

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/mm^2	Plain	1.5	1.75	1.875	2.125	2.375
	Deformed	2.4	2.8	3	3.4	3.8

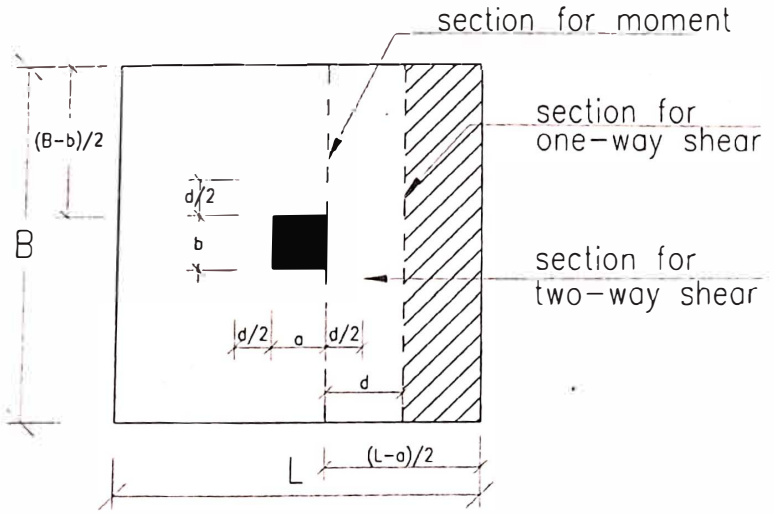
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ISOLATED FOOTING- Regular

Load on Column(P)		=	2000 kN		
Ultimate column Load Pu = (1.5 xP)		=	1.5 x 2000		
			3000 kN		
Self Weight of footing(0.1P)		=	0.1 x 2000		
			200 kN		
Total Load on column for footing design			2000 + 200		
			2200		
SBC of soil		=	220 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		0.375 m	375 mm	
	b		0.6 m	600 mm	
Area of fooling,	A	=	2200 / 220.00		
		=	10.00 m²		
Size of footing			3.16 m		
Adopt footing size		L	3.3 m	B	3.3 m
Footing area provided			10.89 m²		
Nel upward pressure(P/A)		p	183.65 <	220 kN/m²	
			SAFE		
Ullimate Design Pressure		(1.5 xp)	275.48 kN/m²		

Depth Required for B M Consideration



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

= 183.65

p = 3.3

B = 3.3

L-a = 3.3 - 0.375 = 2.925

$(L-a)^2$ = 8.555625

= $\frac{183.65 \times 3.3 \times 8.555625}{8}$

= 648.1534091

BM = 648.15 kN.m

Max. BM = 972.23 kN.m

M_u(1.5 xBM) =

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

$d^2 = \frac{972230113.64}{3457.38}$

d^2 = 281204.10

d = **530.29 mm**

= 750 mm Safe

D = 702 mm 0.702 m

d =

Area of Tension steelfor BM

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

972230113.6 = 253457.1 A_t - 1.816 A_t^2

a = 1.816

b = 253457.1

c = 972230113.6

2a = 3.63

b^2 = 64240501540

4ac = 7063021976

sqrt of b^2-4ac = 239118.1289

A_t = 3947.54 mm^2

Per Rm = 1196.22 mm^2

Minimum Rebar 0.12% = 842.4 mm^2

Adopt = 1196.22 mm^2

16 mm 140 mm c/c

1436.0 > 1196.2 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 = 3.3 m

b = 0.76 m

area = 2.51

V = 183.65 x 2.51

V = 460.91 kN

V_u = 1.50 x 460.91

V_u = 691.36 kN

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

= $\frac{691363.6364}{3300 \times 702}$

Nominal Shear Stress T_v = 0.298 N/mm^2

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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	
Now,kTc		=	0.34	N/mm^2
	0.298	<	0.34	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		=	3.3	x	3.3
		=	10.89 m^2		
Critical section area		=	1.077	x	1.302
		=	1.40 m^2		
Nel area		=	10.89	-	1.40
		=	9.49 m^2		
Shear Force		=	Shear area	x	Pressure
			9.49	x	183.65
	V		1742.47 kN		
	V_u	=	1.50	x	1742.47
Shear Force		=	2613.70 kN		
	T_v	=	V_u / bd		
	b	=	4758 mm		
	d	=	702		
		=	2613704.132		
		=	4758 x 702		
Nominal Shear Stress		=	0.78 N/mm^2		
	T'_c	=	$K_s.T_c$		
	K_s	=	0.5+Bc		
	Bc	=	0.63	(a/b)	
	K_s	=	1.13		
Ks Not more than		=	1		
	K_s	=	1		
	Tc	=	1.250	(0.25*sqrtFck)	
	T'_c	=	1.250		
	Tv	<	T'_c		
	0.78	<	1.250	N/mm^2	

SAFE

SUMMARY

Footing Size	=	**3.3**	x	**3.3**	M
Footing concrete depth	=			**750**	mm
Footing rod	=	**16**	@	**140**	mm c/c

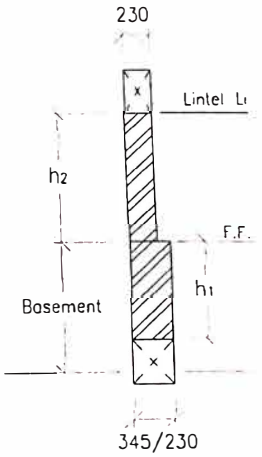
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PLINTH BEAM

Span	=	5.29 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		l/16	331	mm
d'	=	46 mm		d'/d =	0.140	
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	=	$(wl^2/20)$		

5.61	5.29	5.29
	20	

BM = 7.84 kN.M

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

5.61	x	5.29
	3	

SF = 9.89 kN

M_u/bd^2 =

1.5	7.84	1000000
230.00	329	329

= 0.47 N/mm²

Refer SP 16 ,Page 86,Pt = 0.134 % P_c = 0.1

A_{st} =

0. 134	230	329
	100	

Ast = 101 mm² = 76 mm²

Provide							
	2	16			2	16	
	1	12			1	12	
	0	16			0	12	
"A_{st}" Provided	515.16	>	101.36		515.1568	>	75.67
		SAFE				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

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

V_u = 1.5 X 9.89

14.829 kN

T_v = $V_u/b.d$

T_v =

14.83	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 = 14828.53 N

Shear contribution by concrete T_cb.d =

0.55	230	329

41456.1176

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

14828.53 - 41456.12

-26627.59 N

Provide Y 8 -448 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
	-26627.59		

-448 mm C/C

= **805** mm C/C

Provide shear Rebar without considering conc. shear — Y 8 — 101 mm^2

Area or 2 legged stps — a =

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

0.87	415	101	329
	14828.53		

805 mm C/C

V_{us}/d =

-26627.59	10
329.00	1000

-0.809 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 8 @

Provide 394 > 200 < 246.75

SAFE **SAFE**

531 > 200 < 805

SAFE **SAFE**

Development length in Tension

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

$\emptyset$ = 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 τ_{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

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Centre Beam-Continues

Span	=	5.29	m			
Lateral span	=	4.95	m			
Wall height	=	2.45	m			
Wall thickness	=	0.25	m			
b	=	230	mm			
D	=	600	mm	l/12.5	**423**	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	=	3.125	kN/m^2	slab thk	0.125 m
Live Load	=	2	kN/m^2		
Floor Finish	=	1.5	kN/m^2		
Mish. Load	=	1.5	kN/m^2		
		8.125	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:	=	10.4125	kN/m
Udl for slab	=	21.40	kN/m
Max Udl	w =	35.26	kN/m

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

0.138	25	230	302500

= 240033750.00 Nmm

240.03 > 134.57

M_u limit > M_u

Singly Reinforced

"d" - reqd = 411.81 < 550 mm

Safe

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

35.26	5.29	5.29
	13	

BM = 75.91 kN.M

M_u Midspan = **113.87 kN.M**

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

35.26	5.29	5.29
	11	

BM = 89.71 kN.M

M_u Support = **134.57 kN.M**

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

35.26	x	5.29
	2	

SF **93.27 kN**

M_u/bd^2 @Mid span =

1.5	75.91	1000000
230.00	550	550

= **1.64** N/mm^2

M_u/bd^2 @Support =

1.5	89.71	1000000
230.00	550	550

= **1.93** N/mm^2

Rebar @ Mid span

Refer SP 16 ,Page 86,Pt =

P_t	P_c
0.494	0.25

0.494 %

A_{st} =

0.494	230	550
	100	

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Ast	=	625	mm^2	=	312			
Provide		3	20		3	20		
		2	20		0	20		
		0	16		0	16		
"A_{st}" Provided		1570.60	>	624.95	mm^2	942.36	>	
		1.24	**Safe**			**0.74**	**Safe**	

Rebar @ Support

Refer SP 16 ,Page 86,PT

		P_t	P_c		
	=	0.595	0.297		0.595

A_{st}	=	0.595	230	550	
			100		
		752	mm^2		

Ast	=	752	mm^2	=	376			
Provide		3	20		3	32		
		3	20		0	20		
		0	16		0	16		
"A_{st}" Provided		1884.72	>	752.27	mm^2	2412.442	>	
		1.49	**Safe**			**1.91**	**Safe**	

Min.Reinf

		$0.87 \times b \times d / F_y$			mm^2
=		0.870	230	550	
=			415		
		265.193	mm^2		

Min.Reinf	=	265.193	mm^2		
"A_{st}" Provided	1570.6	>	265.193	mm^2	
		Safe			

Min. % of steel required
As per Cl.26.5.1.1 IS456:2000
As per Cl.6.2.1 IS13920:1993

	=	0.205 %		(0.24 √ fck) /fy)	
	=	0.290 %		<	1.49 %
$p_{t\,min}$	=	**0.290 %**		**Safe**	

Max. % of steel to be used
As per Cl.26.5.1.1 IS456:2000
As per Cl.6.2.1 IS13920:1993

	=				
	=	4.000 %			
	=	2.500 %			
$p_{t\,max}$	=	**2.500 %**		>	1.49 %
				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/mm^2			
Percentage of steel	P_t	=	**1.24**	%	

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	1.24	600	1.00	0.69

Now	kT_c	=	0.69	N/mm^2	<		
Nominal Shear stress	T_v	=	$V_u/b.d$		**Safe**		
	V_u	=	1.5	X	93.27		
			139.911				
	T_v	=	$V_u/b.d$				
		=	139.91	1000			
			230.00	550			
		=	1.11	<	3.10	N/mm^2	
				Safe			
	1.11	>	0.69 N/mm^2				
	T_v	>	kT_c				

Provide shear R -

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Total shear strength V_u = 139911.30 N

Shear contribution by concrete $T_c b.d$ =

0.69	230	550

87285

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

139911.30 - 87285

52626.30 N

Minimum shear resistance 0.4bd = 50600.00 N

= 52626.30 N

Provide Y 10 @ 593 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
	52626.30		

= **593** mm C/C

Provide shear Rebar without considering conc. shear Y 10 @ **223** mm C/C

a = 157 mm^2

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

=

0.87	415	157	550
	139911.30		

= **223 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	230.00	

$\frac{56706.513}{92}$

= **616** mm C/C

Maximum Spacing of Stirrups = 0.75 *d

= 412.5 mm

= 300 mm

Least of above 300 mm

Provide Y 10 @

616 > 150 < 300

Safe **Safe**

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SLAB DESIGN AS PER BIS-2000 METHOD

Location:

L_x	=	3.58 m	
L_y	=	6.136 m	
F_{ck}	=	25 N/mm^2	
F_y	=	415 N/mm^2	
L_y/L_x	=	1.71	
		TWO WAY SLAB	
Span	=	3.58 M	Span/32
Slab thickness	=	125 MM	111.9
Cover		20 MM	
Effective depth		105 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	=	3.125 kN/m^2	
Live + Floor finish Load	=	3.5 kN/m^2	
Total Load	=	6.63 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 = **1.71**

α_y = 0.047

		Ly/Lx		For
		1.5	**1.75**	**1.71**
Negative Moment @ edge	α_x	0.084	0.091	0.090
Positive Moment at mid span	α_x	0.063	0.069	0.068

				M_{ux}	M_{uy}
M_x	=	7.64	kNM	11461529.31	
M_y	=	3.99	kNM		5986059.8
Maximum Bm	=	**7.64**	kNM		
"d" - read under compression	=	57.64	mm		

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	1.04	0.54	N/mm^4

As per SP16, Table 2,Page 48,

P_t	=	%	**0.303**	**0.154**	
Area of steel	=	mm^2	318.52	162.14	
Adopt					
Y	10	140	mm C/C	10	140	mm C/C
	560.93	>	318.52	560.93	>	162.14
		SAFE			SAFE	

Positive Moment at mid span

α_y = 0.037

				M_{ux}	M_{uy}
M_x	=	5.79	kNM	8677901.205	
M_y	=	3.14	kNM		4712430.1
Maximum Bm	=	**5.785**	kNM		

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	**0.79**	**0.43**	N/mm^4

As per SP16, Table 2,Page 48,

P_t	=	%	**0.227**	**0.121**	
Area of steel	=	mm^2	237.97	126.91	
Adopt					
Y	10	140	mm C/C	10	140	mm C/C
	560.93	>	237.97	560.93	>	126.9
		SAFE			SAFE	

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Check for Shear strength
As per clause 40.2 (P72)
of IS 456-2000

T_c 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

= 1.55 N/mm²

T_c Max =

Percentage of steel P_t = **0.53 %**

Shear strength = $k\,t_c$

Permissible shear stress in concrete ($k t_c$) 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 = 17.78813 kN

T_v = 0.17 < 1.55 N/mm² **Safe**

T_v < kT_c **SAFE**

Check for Deflection
Live Load 2 < 3.01 kN/m²

Deflection calculation is Not Necessary

A_{st} required = 318.5244 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	237.97411
	560.93	

F_s = **102.12 N/mm²**

Percentage of steel provided = **0.53 %**

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_1
415	102.12	0.23	0.53	IS 456 Fig 4 2.00

	mf
0.2	2
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 = 3580 / 105 = 34.095

(Lx/d) Max 52 > 34.10 (Lx/d)Provided **SAFE**

steel stress	mf
145	2
190	1.7
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
125	10	Ok

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STAIRECASE -DOG LEGGED MODEL

Location:

L_x	=	4.724	m		
F_{ck}	=	25	N/mm^2		
F_y	=	415	N/mm^2		
Step weight		20	kN/m^3		
Landing width	=	0.9			
Slope length	=	2.924			
Step tread	=	0.25	m		
Step riser	=	0.165	m		
Slope length for one step	=	0.300	m		
Number of tread	=	2.924			
	=	0.25			
	=	11.696	No		
Say	=	7	No		
Aditional slope length per flight	=	7	x	0.050	
	=	0.35			
Effective length	=	5.07	m		
Concrete wt	=	25	kN/m^3		
Waist slab thickness	=	0.125	m	(Assumed)	

Loads:

Dead load of Waist slab	=	3.125	kN/m^2		
Ceiling finish	=	0.25	kN/m^2		
Sub total	=	3.375	kN/m^2		
Dead Load on plan area	=	3.38	x	0.300	
				0.25	
	=	4.04	kN/m^2		
Brick load	=	0.165	x	20	
				2	
		1.65	kN/m^2		
Live load	=	3	kN/m^2		
Floor finish	=	1.5	kN/m^2		
Total load on staire	=	10.19	kN/m^2		

Maximum BM($w \times l^2/12$)	=	10.19	x	5.07^2	
	=			12	
	=	21.84	kN.M		
M_u	=	1.5 x		21842699	
		32764049.08	Nmm		

32764049.08		
0.138	25	1000

9496.83

sqrt	=	97.45	mm
Cover	=	20.00	mm
Total	=	117.45	mm
Provide	=	125.00	mm
d		102.00	

$M_u/b.d^2$

32764049.08		
1000.00	102.00	102.00

3.15

As per SP16, Table 2,Page 48,

P_t	=	**1.059**	%			
Area of steel	=	1.058737315	x	1000	x	102.00

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100

= 1079.91 mm^2

Adopt

Y 12 @ 100 **mm C/C**

1130.83 > 1079.91 mm^2

Safe

Distributer:

Provide minimum steel = 0.12%

0.12	1000	102.00
	100	

= **122.4** mm^2

Adopt

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

523.53 > 122.4 mm^2

Safe

Check for Shear strength

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

Percentage of steel P_l = $\frac{1130.83 \times 100}{1000 \times 102.00}$

P_l = **1.11 %**

Shear strength = kT_c

k = 1.2

IS456-2000,Page73,table19

% of steel	T_c
1	0.64
1.25	0.7

For **1.11** 0.666 N/mm^2

kT_c = 1.200 x 0.666

0.799

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

V_u

1.5	5.07	10.19
	2	

V_u = 38.768 kN

T_v

T_v = $\frac{38.768 \times 1000}{1000 \times 102.00}$

0.3801 < 0.7993

T_v < kT_c

SAFE

SUMMARY

Waist slab thick = **125.00 mm**

Main Rebar = Y 12 @ 100 **mm C/C**

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

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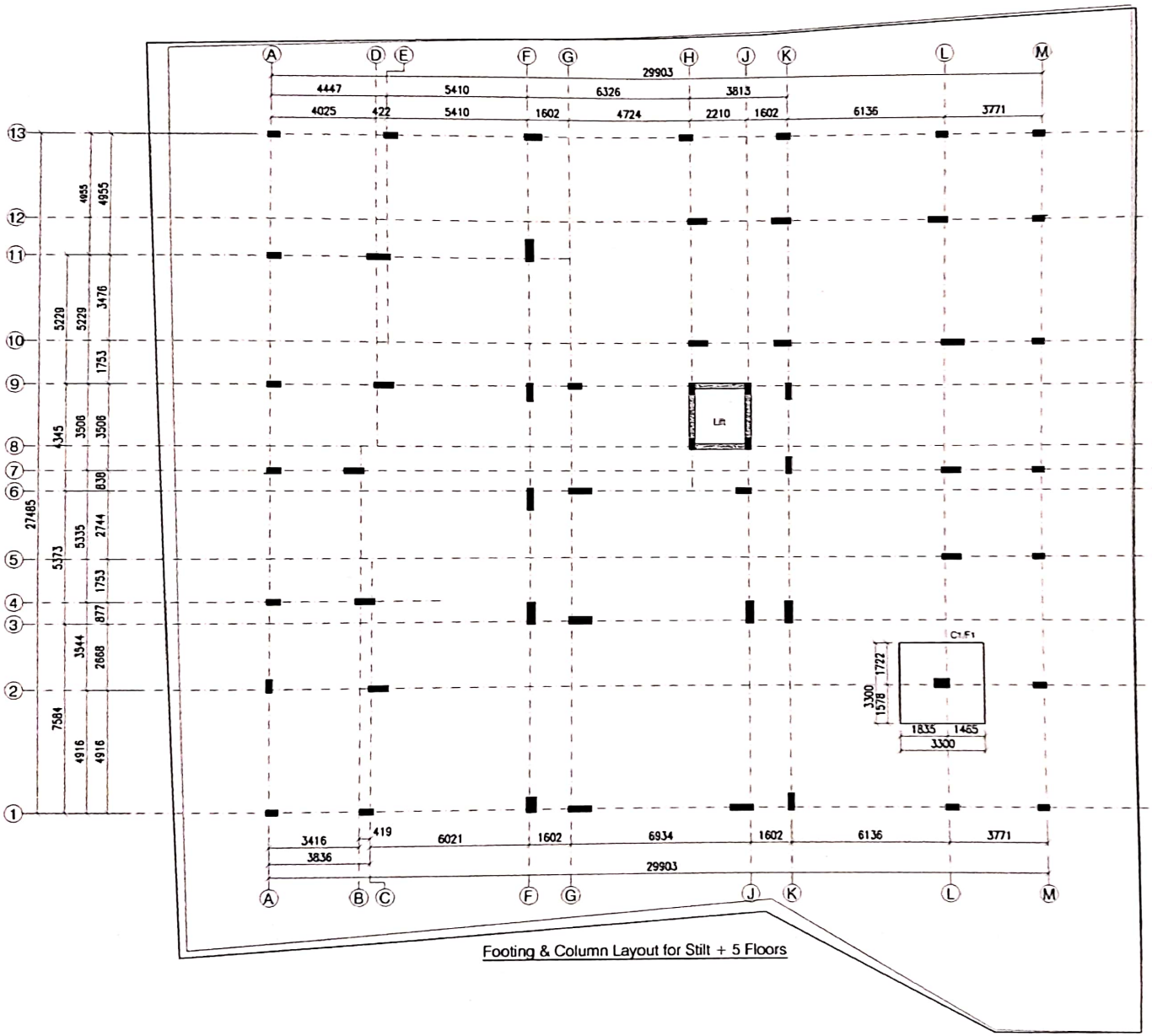
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SUNSHADE DESIGN

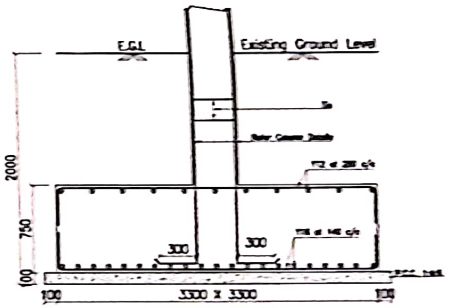
1	Grade of concrete		F_{ck}	=	**25** N/ mm^2	
2	grade of steel		Fy	=	**415** N/ mm^2	
3	Width of sunshade			=	**0.6** m	
4	Sunshade thickness -	t_{max}		=	0.075 m	**75** mm
		t_{min}		=	0.1 m	**100** mm
		average		=	0.0875	87.5
		cover		=	0.014	**15**
		effective depth d		=	0.061 m	61 mm
5	Self weight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



C.S of Footing F1
Size 3300 x 3300

Column Schedule		
Legend	Column	Tie Arrangement
C1 375 x 600	375 / 600	

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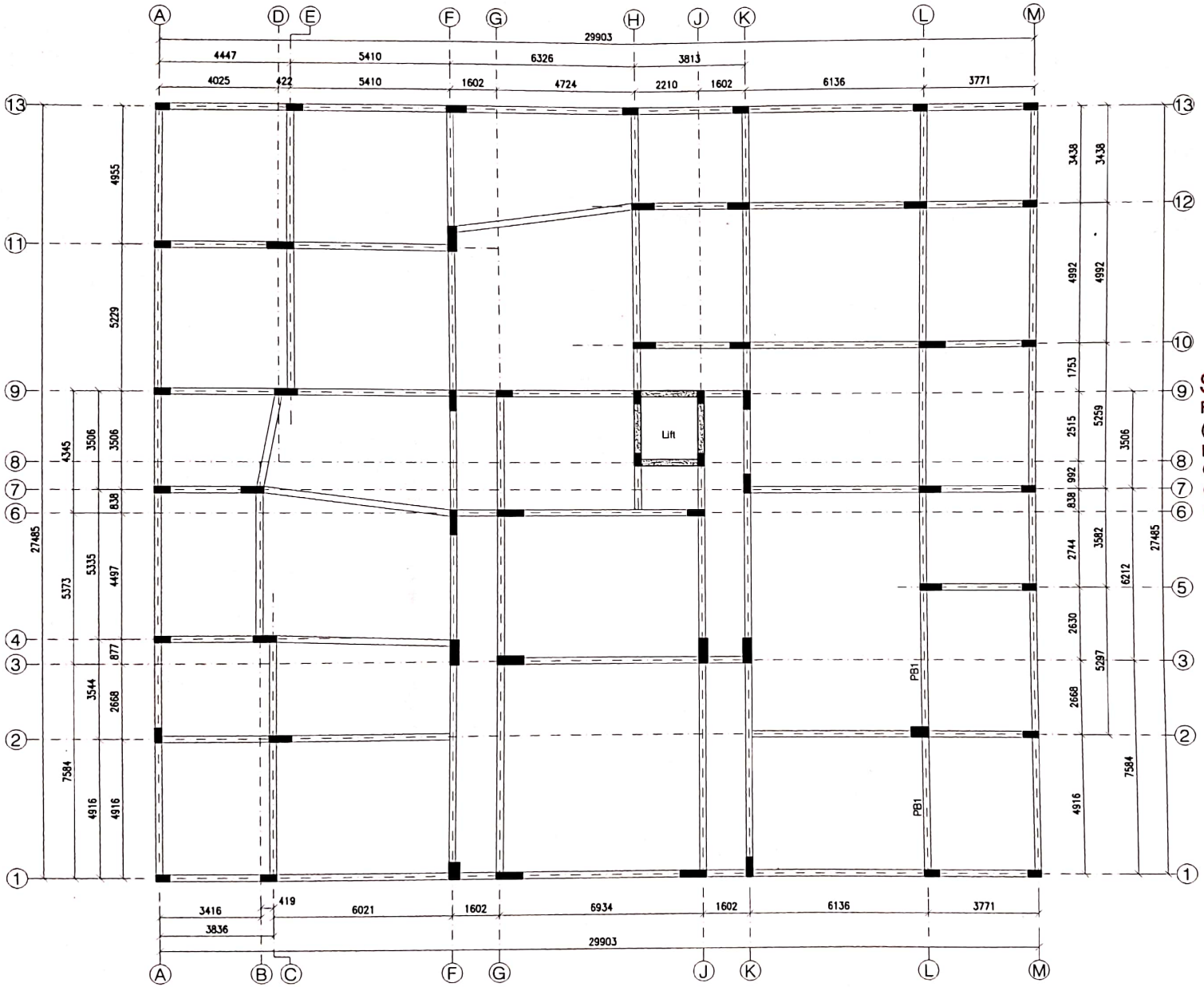
THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS + 5TH FLOOR PART RESIDENTIAL APARTMENT BUILDING WITH 39 DWELLING UNITS 18.30 M HEIGHT, IN SELVAGANAPATHY NAGAR, COMPRISED IN PATTA NO 7396 AND 7082, AS PER PATTA S NOS 30/1B1B1, 30/2B2A, 30/2B2B AND 30/3 OF MEDAVAKKAM VILLAGE, TAMBARAM TALUK, CHENGALPATTU DISTRICT WITHIN THE LIMITS OF ST. THOMAS MOUNT PANCHAYAT UNION

Notes:

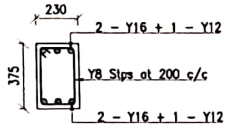
1. All Dimensions Are In MM.
2. Use Fe415/Fe500 Grade Steel.
3. Use Mix M25 For all Works
4. Clear Cover To The Reinforcement For Footing:50mm Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

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Plinth Beam Layout



C.S of Beam PB1

Size 230 x 375

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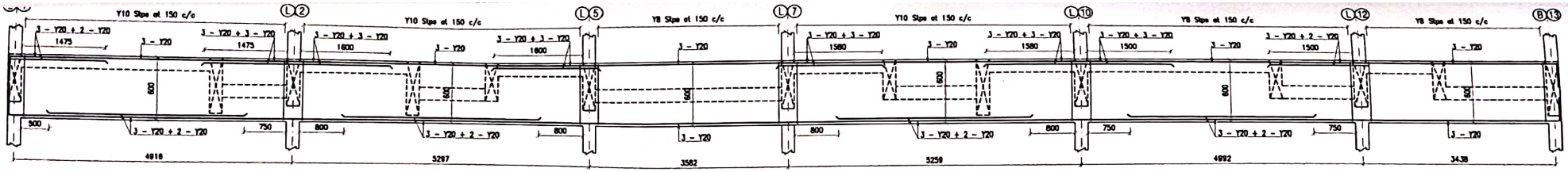
THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS + 5TH FLOOR PART RESIDENTIAL APARTMENT BUILDING WITH 39 DWELLING UNITS 18.30 M HEIGHT, IN SELVAGANAPATHY NAGAR, COMPRISED IN PATTA NO : 7398 AND 7082, AS PER PATTA S NOS. 32/1B1B1, 32/2B2A, 32/2B2B AND 32/3 OF MEDAVAKKAM VILLAGE, TAMBARAM TALUK, CHENGALPATTU DISTRICT. WITHIN THE LIMITS OF ST. THOMAS MOUNT PANCHAYAT UNION

Notes:

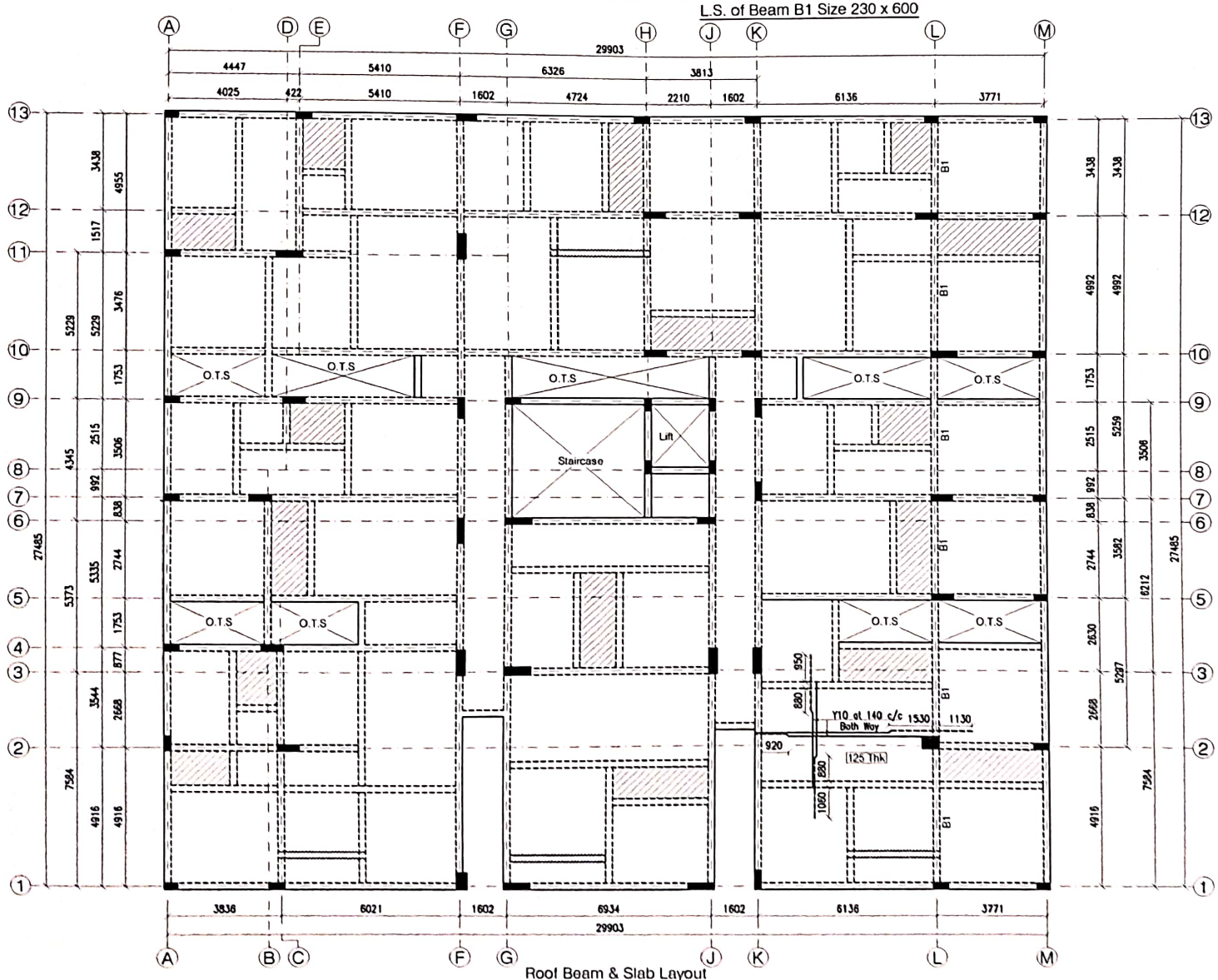
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L.S. of Beam B1 Size 230 x 600



Roof Beam & Slab Layout

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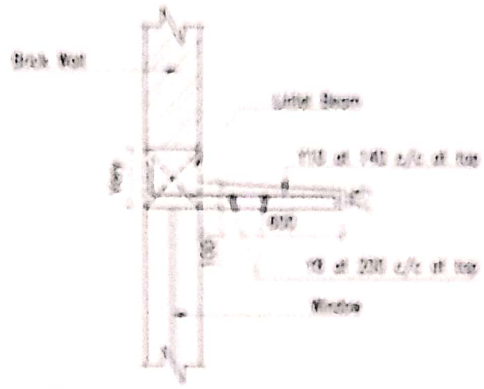
THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS + 5TH FLOOR PART RESIDENTIAL APARTMENT BUILDING WITH 39 DWELLING UNITS 18.30 M HEIGHT, IN SELVAGANAPATHY NAGAR, COMPRISED IN PATTA NO : 7398 AND 7082, AS PER PATTA S.NOS: 32/1B1B1, 32/2B2A, 32/2B2B AND 32/3 OF MEDAVAKKAM VILLAGE, TAMBARAM TALUK, CHENGALPATTU DISTRICT, WITHIN THE LIMITS OF ST. THOMAS MOUNT PANCHAYAT UNION

Notes:

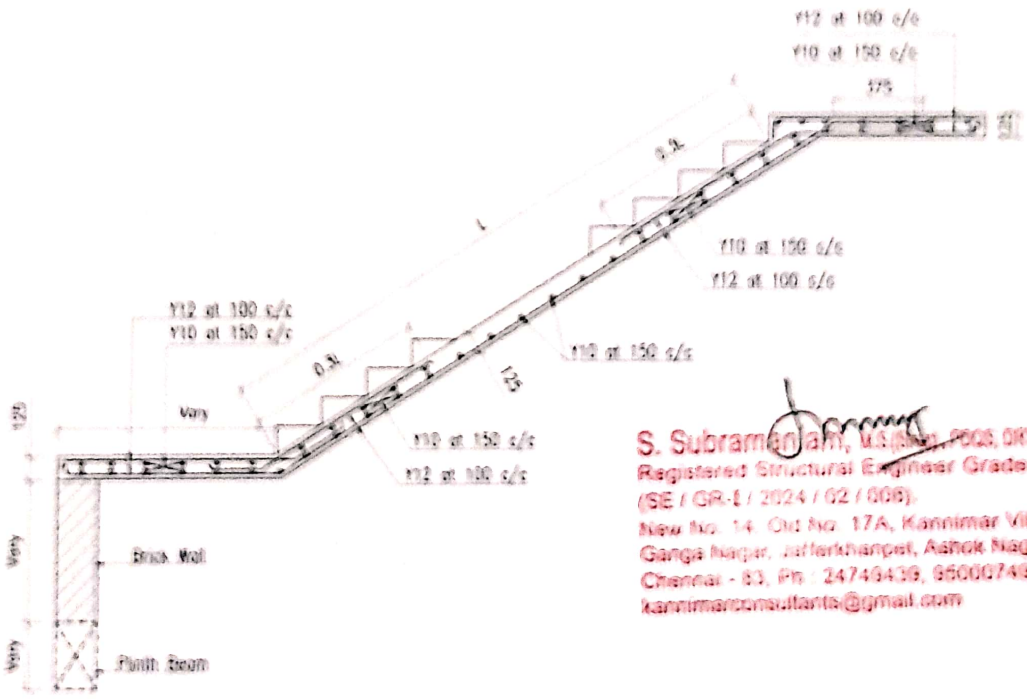
1. All Dimensions Are In MM.
2. Use Fe415/Fe500 Grade Steel.
3. Use Mix M25 For all Works
4. Clear Cover To The Reinforcement For Footing:50mm Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

Kannimar Consultants
Engineering Project Consultants
Structural Design
New No : 14,Old No . 17A, Kannimar Villa,
Ganga Nagar,Jafferkhanpet,Ashok Nagar,
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Sunshade Detail (Typ)



C.S. of Staircase Details

S. Subramanian, M.S.(Struct.), PGCS, DRTM.
Registered Structural Engineer Grade-I.
(SE / GR-I / 2024 / 02 / 006).
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Notes

1. All Dimensions are in mm.
2. Use Fe415/Fe500 Grade Steel.
3. Use M20 / M25 as indicated.
4. Clear Cover to the Reinforcement for Footing 50mm
Column 40mm, Beam 30mm, Slab 20mm, Rcc Wall 20mm.

THE PROPOSED CONSTRUCTION OF STILT FLOOR + 4 FLOORS + STH FLOOR PART RESIDENTIAL APARTMENT BUILDING WITH 39 DWELLING UNITS 16.20 M HEIGHT IN SELVAGANAPATHY NAGAR COMPRISED IN PATTA NO. 7308 AND 7082 AS PER PATTA 5 NOS. 82/1B1B1, 82/2B2A, 82/2B2B AND 82/3 OF MEDAVAKKAM VILLAGE, TAMBARAM TALUK, CHENGALPATTU DISTRICT WITHIN THE LIMITS OF ST. THOMAS MOUNT PANCHAYAT UNION

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Vastu & Property Management Tools

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