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Design Report & Stability Certificate

Site Address

The Proposed Stilt + 3 Floors Residential Building (Height -12.00m) at New Door No.7, Old Door No.2, South Kavarai Street, and Sai Baba Street, West Mambalam, Chennai - 600 033. Comprised in T.S.No : 68, Block No. 24, Mambalam Village Within the Limits of Greater Chennai 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.
E – mail : kannimarconsultants@gmail.com

KC-6176

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

S. Subramaniam, M.S. (Struct). PDOS. DRTM.
Chartered Engineer
Registered Structural Engineer Grade - I
E-mail : kannimarconsultants@gmail.com

Stability Certificate

It is certified that The Proposed Stilt + 3 Floors Residential Building (Height - 12.00m) at New Door No.7, Old Door No.2, South Kavarai Street, and Sai Baba Street, West Mambalam, Chennai - 600 033. Comprised In T.S.No : 68, Block No. 24, Mambalam Village Within the Limits of Greater Chennai Corporation is Designed For Stilt + 3 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

S. Subramaniam, M.S.(Struct)., PDOS, DRTM.
Registered Structural Engineer Grade-I.
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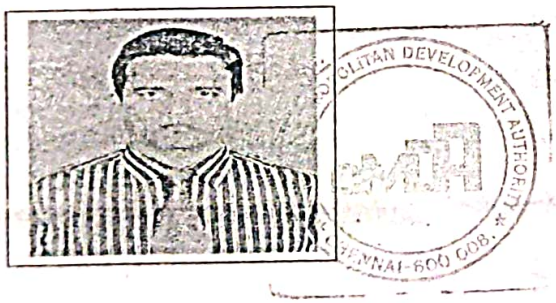
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru. S. SUBRAMANIAM** has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **A.M.I.E.,M.S.,** and experience in the relevant field for **32years**.

He has been given the Registration No.**SE/GR-I/2024/02/008** on **27.02.2024.** He shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part-V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(Ms) No.18 MAWS (MA1) Dept. dated 04.02.2019.

This Registration is valid upto **26.02.2029.**



5/11/24.

S. Subramaniam, M.S.(Struct), PDQS, DRTM.
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(SE / GR-I / 2024 / 02 / 008).
Old No. 17A, Kannimar Villa,
Jafferkhanpet, Ashok Nagar,
24749439, 9500074947

22/2/2024

(A. MEGANATHAN)
Superintendent

Kannimar Consultants
Chenna
24749439

Load calculation

Building Name Flats
Number of Floor Stilt + 3

Concrete Unit wt	25	kN/m³
Brick work	20	kN/m³
Live load rooms	2	kN/m²
Live load stair&corrdr	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	

Load on Column column B11 X= 3.46 Y= 4.36

Sl No	Description	No	L	B	D	Qty	UnitLoad	Total Load
	Ground floor							
1	Column Load	1	0.23	0.45	6	0.62	25	15.53
2	Plinth beam	1	7.82	0.23	0.375	0.67	25	16.86
3	Roof beam	1	3.46	0.23	0.325	0.26	25	6.47
		1	4.36	0.23	0.4	0.40	25	10.03
4	Roof slab	1	3.46	4.36	0.125	1.89	25	47.14
5	Live load-all area	1	3.46	4.36	1	15.09	2	30.17
6	Floor finish	1	3.46	4.36	1	15.09	1.5	22.63
7	BW up to FFL	1	7.82	0.23	0.75	1.35	20	26.98
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
								175.80
	First floor/Typical Floor							
1	Column Load	1	0.23	0.45	3.05	0.316	25	7.89
2	Roof slab	1	3.46	4.36	0.125	1.886	25	47.14
3	Roof beam	1	3.46	0.23	0.325	0.259	25	6.47
		1	4.36	0.23	0.4	0.401	25	10.03
4	Live load-all area	1	3.46	4.36	1	15.086	2	30.17
5	Floor finish	1	3.46	4.36	1	15.086	1.5	22.63
6	Brick wall-230 thick	1	7.82	0.25	2.6	5.083	20	101.66
7	Brick wall -115 thick	1	0	0.15	2.6	0.000	20	0.00
	Additional load	1	0	2.5	0.2	0.000	25	0.00
			First floor/Typical Floor					225.99
	Parapet load							
1	Brick wall	1	0	0.25	1	0	20	0
2	Weathering coarse material	1	3.46	4.36	0.1	1.51	20	30.17
			Parapet load					30.17

COLUMN TOTAL LOAD column B11

Sl.No	Description	Load	
1	Stilt floor	175.80	
2	First floor	225.99	
3	Second floor	225.99	
4	Third floor	225.99	
7	Terrace	30.17	
8	Total	883.94	
	Say	90.00	MT

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RSE100122019
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COLUMN DESIGN

Column load as per load calculation = 90 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
Permissible bearing stress		=	11.25	N/mm²	
Column size		=	230	450	mm
Minimum Eccentricity,e		=	L/500 + Lateral dimension/30		
One direction		=	14.87	mm	
Another Direction		=	22.20	mm	
Minimum eccentricity		=	20	mm	
Consider Minimum Eccentricity		=	22.20	mm	
0.05*b		=	11.50		< 22.20
Area of column		=	103500	mm²	
Number of rod		=			
		=	4	20	1256.48 mm²
		=	4	20	1256.48 mm²
Area of Steel(A_{sc})		=	2512.96	mm²	
Area of Concrete(A_c)		=	100987.04	mm²	
	P_u	=	1662169.609	N	
	P	=	1108113.073	N	
	Say	=	**110.81**	**Tonne**	
% of Reinforcement	**0.8**	<	**2.43**	<	**4** %
		SAFE		**SAFE**	
Column Load	110.81	>	90.00	**Mt**	
		SAFE			

Lateral Ties:

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

Diameter shall not be less than = $\frac{20}{4}$

= 5 mm dia

Provide = 8 mm dia

Spacing

Shall not be more than following

Least dimension of column	=	230	mm	
16x Smallest dia of column rod	=	320	mm	
Not more than	=	300	mm	
Minimum of above	=	**230**	mm	
Provide	8 @	150	mm C/c	

Development length in compression

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

Ø	=	Dia of bar	=	20.00 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 = $\frac{20 \quad 360.8696}{4 \quad 2.8}$

Ld = 644.410 mm

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SUMMARY

Column size = 230 x 450

Rebar =

4	20
4	20

Lateral tie 8 @ 150 mm C/c

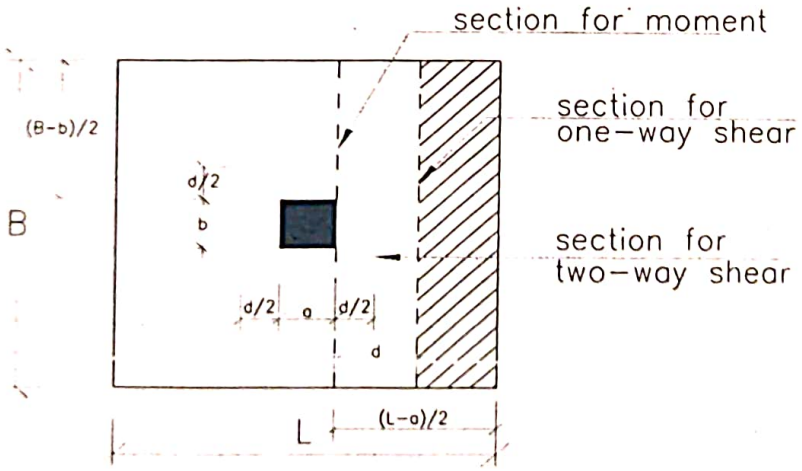
Bond stress for **Compression** 43,IS 456-2000

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

ISOLATED FOOTING- Regular

Load on Column(P)		=	900 kN			
Ultimate column Load Pu = (1.5 xP)		=	1.5	x	900	
			1350 kN			
Self Weight of footing(0.1P)		=	0.1	x	900	
			90 kN			
Total Load on column for footing design			900	+	90	
			990			
SBC of soil		=	150 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	
$X_{c\,max}/d$		=	0.48		IS456-2000,P70	
Mu limit/ fck x b x dx d =		=	0.149			
Assume footing depth		=	550 mm			
Column Size	a		0.23 m		230 mm	
	b		0.45 m		450 mm	
Area of footing,	A	=	990 / 150.00			
		=	6.60 m^2			
Size of footing			2.57 m			
Adopt footing size		L	2.6 m		B	2.6 m
Footing area provided			6.76 m^2			
Net upward pressure(P/A)		p	133.14	<	150 kN/m^2	
				SAFE		
Ultimate Design Pressure		(1.5 xp)	199.70 kN/m^2			

Depth Required for B M Consideration



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

P = 133.14

B = 2.6

L-a = 2.6 - 0.23 = 2.37

$(L-a)^2$ = 5.6169

BM = $\frac{133.14 \times 2.6 \times 5.6169}{8}$

= 243.0389423

Max. BM = 243.04 kN.m

M_u(1.5 xBM) = 364.56 kN.m

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

d^2 = $\frac{364558413.46}{3457.38}$

d^2 = 105443.47

d = **324.72 mm**

D = 550 mm Safe

d = 502 mm 0.502 m

Area of Tension steelfor BM

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

364558413.5 = 181247.1 A_t - 2.305 A_t^2

a = 2.305

b = 181247.1

c = 364558413.5

2a = 4.61

b^2 = 32850511258

4ac = 3361469742

sqrt of b^2-4ac = 171723.736

A_t = 2065.66 mm^2

Per Rm = 794.48 mm^2

Minimum Rebar 0.12% = 602.4 mm^2

Adopt = 794.48 mm^2

12 mm 125 mm c/c

904.7 > 794.5 mm^2 Per Rm

The design is Safe

P_t = **0.18 %**

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 = 2.6 m

b = 0.68 m

area = 1.78

V = 133.14 x 1.78

V = 236.42 kN

V_u = 1.50 x 236.42

V_u = 354.63 kN

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

= $\frac{354634.6154}{2600 \quad 502}$

Nominal Shear Stress T_v = 0.272 N/mm^2

Percentage of steel provided P_t = 0.18 %

Shear strength of concrete T_c =

Percentage of steel P_t = 0.18 %

Shear strength = kT_c

k = 1

Table19,page 73,IS 456-2000

% of steel	T_c
0.15	0.29
0.25	0.36

For 0.18 0.31

Now,kTc = 0.31 N/mm²

0.272 < 0.31 N/mm²

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 = 2.6 x 2.6

= 6.76 m²

Critical section area = 0.732 x 0.952

= 0.70 m²

Net area = 6.76 - 0.70

= 6.06 m²

Shear Force = Shear area x Pressure

6.06 x 133.14

V = 807.22 kN

V_u = 1.50 x 807.22

Shear Force = 1210.83 kN

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

b = 3368 mm

d = 502

= 1210833.373

3368 x 502

Nominal Shear Stress = 0.72 N/mm²

T'_c = $K_s.T_c$

K_s = 0.5+Bc

Bc = 0.51 (a/b)

K_s = 1.01

Ks Nof more than = 1

K_s = 1

Tc = 1.250 (0.25*sqrtFck)

T'_c = 1.250

Tv < T'_c

0.72 < 1.250 N/mm²

SAFE

SUMMARY

Footing Size = **2.6** x **2.6** M

Footing concrete depth = **550** mm

Footing rod = **12** @ **125** mm c/c

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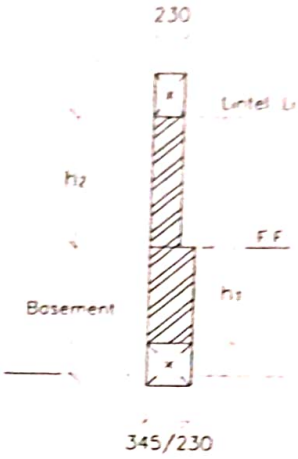
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PLINTH BEAM

Span = 5.56 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 = 348 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	5.56	5.56
	20	

BM = 8.67 kN.M

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

5.61	x	5.56
	3	

SF = 10.39 kN

M_u/bd^2 =

1.5	8.67	1000000
230.00	329	329

= 0.52 N/mm²

Refer SP 16 ,Page 86,Pt = 0.148 %

A_{st} = P_c = 0.1

0.148	230	329
	100	

Ast = 112 mm² = 76 mm²

Provide

2	12
1	12
0	16

"A_{st}" Provided 339.25 > 112.24 SAFE

2	12
1	12
0	12

339.25 > 75.67 SAFE

Min.Reinf = $(0.87 \times b \times d / F_y$ mm²

0.870	230	329
	415	

Min.Reinf = 158.633 mm²

"A_{st}" Provided 339.2 > 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 = 0.45 %

Shear strength = kT_c

k = 1

% of steel	T_c
0.25	0.36
0.5	0.49

For 0.45 0.46

kT_c = 1.00 x 0.46

Now kT_c = 0.46 N/mm² < 3.10 N/mm² SAFE

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

V_u = 1.5 x 10.39 = 15.585 kN

T_v = $V_u/b.d$

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τ_v = | 15.59 | 1000 | / | 230.00 | 329 | = 0.21 < 3.10 N/mm²

SAFE

0.21 < τ_v < $k\tau_c$

0.46 N/mm²

SAFE

Total shear strength V_u = 15585.38 N

Shear contribution by concrete $\tau_c b d$ = | 0.46 | 230 | 329 | = 35045.0792

Shear contribution by stps V_{us} = V_u − $\tau_c b d$ = 15585.38 − 35045.1 = -19459.70 N

Provide Y 8 @ -614 mm C/C

Area of 2 legged stps a = 101 mm²

Spacing of stirrups = $\frac{0.87 * fy * a * d}{V_{us}}$ = | 0.87 | 415 | 101 | 329 | / | | -19459.70 | | | = -614 mm C/C

Provide shear Rebar without considering conc. shear Y 8 @ 766 mm C/C

Area of 2 legged stps a = 101 mm²

= $\frac{0.87 * fy * a * d}{V_u}$ = | 0.87 | 415 | 101 | 329 | / | | 15585.38 | | | = 766 mm C/C

V_{us}/d = | -19459.70 | 10 | / | 329.00 | 1000 | = -0.591 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

Least of above 246.75 mm

Provide Y @ 200

394 > 200 SAFE < 246.75 SAFE

531 > 200 SAFE < 766 SAFE

Development length in Tension

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

$\varnothing$ = Dia of bar = 16 mm

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

(0.87*Fy)

τ_{bd} = Bond stress = 2.24 N/mm²

Page 43.26.2.1.1

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

Centre Beam-Continues

Span	=	5.56 m			
Lateral span	=	3.46 m			
Wall height	=	2.6 m			
Wall thickness	=	0.25 m			
b	=	230 mm			
D	=	525 mm	l/12.5	**445**	mm
d'	=	50 mm	d'/d =	0.105	
d	=	475 mm			
f_y	=	415 N/mm²			
f_{ck}	=	25 N/mm²			

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	=	**20**	kN/m³
Self wt = b x D x 1 x 25	=	3.02	kN/m
Brick work:	=	11.05	kN/m
Udl for slab	=	20.56	kN/m
Max Udl	w =	34.63	kN/m

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

0.138	25	230	225625

= 179033437.50 Nmm

179.03 > 145.96

M_u limit > M_u

Singly Reinforced

"d" - reqd = 428.89 < 475 mm

Safe

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

34.63	5.56	5.56
	13	

BM = 82.34 kN.M

M_u Midspan = **123.51 kN.M**

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

34.63	5.56	5.56
	11	

BM = 97.31 kN.M

M_u Support = **145.96 kN.M**

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

34.63	x	5.56
	2	

SF **96.26 kN**

M_u/bd^2 @Mid span

1.5	82.34	1000000
230.00	475	475

= **2.38** N/mm²

M_u/bd^2 @Support

1.5	97.31	1000000
230.00	475	475

= **2.81 N/mm²**

Rebar @ Mid span

P_t	P_c
0.754	*0.38*

Refer SP 16 ,Page 86,Pt = **0.754** %

A_{st} =

0.754	230	475
	100	

Ast = 824 mm²

Provide

2	20
2	16
0	16

"A_{st}" Provided 1030.31 > 823.60 mm²

0.94 Safe

= 412 mm²

2	20
0	16
0	16

628.24 > 411.

0.58 Safe

Rebar @ Support

0.920 %

Refer SP 16 ,Page 86,Pt = P_t = 0.920, P_c = 0.460

A_{st} = 0.920 × 230 × 475 / 100 mm² = 1005 mm²

Ast = 1005 mm²

Provide

2	20
3	16
0	16

"A_{st}" Provided 1231.35 > 1005.01 mm²

1.13 Safe

= 503 mm²

2	32
0	20
0	16

1608.294 > 502.

1.47 Safe

Min.Reinf = 0.87 × b × d / F_y mm²

= 0.870 × 230 × 475 / 415 mm²

Min.Reinf = 229.030 mm²

"A_{st}" Provided 1030.3136 > 229.030 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 %** < 1.13 %

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 %** > 1.13 %

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 = **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/mm²	P_t %	D of slab	k	$k\,t_c$ N/mm²
25	0.94	525	1.00	0.63

Now kT_c = 0.63 N/mm² < 3.10 N/mm²

Safe

Nominal Shear stress T_v = V_u/b.d

V_u = 1.5 X 96.26 = 144.389

T_v = V_u/b.d = 144.39 × 1000 / 230.00 × 475 = 1.32 < 3.10 N/mm²

Safe

1.32 > 0.63 N/mm²

T_v > kT_c

Provide shear Bar

Total shear strength V_u = 144389.27 N

Shear contribution by concrete $T_c b d$ =

0.63	230	475

68827.5

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

144359.27 - 68827.5

75561.77 N

Minimum shear resistance 0.4bd = 43700.00 N

= 75561.77 N

Provide Y 10 @ 356 mm C/C

Area or 2 legged stps a = 157 mm²

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

0.87	415	157	475
	75561.77		

= 356 mm C/C

Provide shear Rebar without considering conc. shear

Y 10 @ 187 mm C/C

a = 157 mm²

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

0.87	415	157	475
	144389.27		

= 187 mm C/C

Minimum Stirrups Reinforcement

Y 10

A_{sv} = 157.06 mm²

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 *a

= 356.25 mm

= 300 mm

Least of above 300 mm

Provide Y 10 @ 150

616 > 150 **Safe**

< 300 **Safe**

SLAB DESIGN AS PER BIS-2000 METHOD

Location:

L_x	=	3.23 m	
L_y	=	6.3 m	
F_{ck}	=	25 N/mm²	
F_y	=	415 N/mm²	
L_y/L_x	=	1.95	
		TWO WAY SLAB	
Span	=	3.23 M	Span/32
Slab thickness	=	125 MM	100.9
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 = 1.95

α_y = 0.047

		Ly/Lx		For
		1.75	2	1.95
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	=	6.19	kNM	9290802.281		
M_y	=	3.25	kNM		4872816.4	
Maximum Bm	=	6.19	kNM			
"d" - read under compression	=	51.89	mm			

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	0.84	0.44	N/mm²

As per SP16, Table 2,Page 48,

P_t	=	%	0.243	0.125	
Area of steel	=	mm²	255.52	131.33	
Adopt					
Y	10	140	mm C/C	10	140	mm C/C
	560.93	>	255.52	560.93	>	131.33
		SAFE			SAFE	

Positive Moment at mid span

α_y = 0.037

				M_{ux}	M_{uy}
M_x	=	4.69	kNM	7030452.319	
M_y	=	2.56	kNM		3836046.9
Maximum Bm	=	4.687	kNM		

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	0.64	0.35	N/mm²

As per SP16, Table 2,Page 48,

P_t	=	%	0.182	0.098	
Area of steel	=	mm²	191.33	102.91	
Adopt					
Y	10	140	mm C/C	10	140	mm C/C
	560.93	>	191.33	560.93	>	102.9
		SAFE			SAFE	

Check for Shear strength

As per clause 40.2 (P72) of IS 456 2000

T_c Max = 0.62 *sqrt(F.ck)

0.62	5

= 3.10 N/mm²

For slab as per 40.2.3.1

T_c Max = 0.5*T_max

0.50	3.10

T_c Max = 1.55 N/mm

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 kt_c $k t_c$ = 0.65 < 1.55 N/mm² Safe

Nominal Shear stress T_v = V_u/b.d

V_u = 16.04906 kN

T_v = 0.15 < 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 = 255.5181 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	191.33005
	560.93	

F_s = 82.10 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_t IS 456 Fig 4
415	82.10	0.18	0.53	2.00

	mf
0.2	2
0.4	2
0.360	2.000

N/mm

steel stress	mf
145	2
190	1.7
158.000	1.913

N/mm

Effective depth ratio

For,Simply supported = 20

Continues = 26

Cantilever = 7

(Lx/d) Max = 26 x 2.000 = 52.0000

(Lx/d)Provided = 3230 / 105 = 30.762

(Lx/d) Max 52 > 30.76 (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	=	6.48 m			
f_{ck}	=	25 N/mm²			
f_y	=	415 N/mm²			
Step weight		20 kN/m³			
Landing width	=	0.9			
Slope length	=	4.68			
Step tread	=	0.25 m			
Step riser	=	0.165 m			
Slope length for one step	=	0.300 m			
Number of tread	=	4.68			
	=	0.25			
	=	18.72	No		
Say	=	10	No		
Aditional slope length per flight	=	10	x	0.050	
	=	0.50			
Effective length	=	6.98	m		
Concrete wt	=	25 kN/m³			
Waist slab thickness	=	0.150 m		(Assumed)	

Loads:

Dead load of Waist slab	=	3.75 kN/m²			
Ceiling finish	=	0.25 kN/m²			
Sub total	=	4 kN/m²			
Dead Load on plan area	=	4.00	x	0.300	
			0.25		
	=	4.79 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	=	10.94 kN/m²			
Maximum BM(w x l² /12)	=	10.94	x	6.98 ²	
	=		12		
	=	44.37 kN.M			
M_u	=	1.5 x	44369198		
		66553796.30 Nmm			

66553796.30		
0.138	25	1000

19290.96

Sqrt	=	138.89 mm	
Cover	=	20.00 mm	
Total	=	158.89 mm	
Provide	=	150.00 mm	
d		127.00	

$M_u/b.d^2$

66553796.30		
1000.00	127.00	127.00

4.13

As per SP16, Table 2,Page 48.

P_t	=	1.534	%		
Area of steel	=	1.534139629	x	1000	x 127.00

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100

= 1948.36 mm^2

Adopt

Y 16 @ 100 mm C/C

2010.37 > 1948.36 mm^2

Safe

Distributer:

Provide minimum steel = 0.12%

0.12	1000	127.00
	100	

= **152.4** mm^2

Adopt

Y 10 @ 150 mm C/C

523.53 > 152.4 mm^2

Safe

Check for Shear strength

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

Percentage of steel P_t = $\frac{2010.37 \times 100}{1000 \times 127.00}$

P_t = **1.58 %**

Shear strength = kT_c

k = 1.2

IS456-2000,Page73,table19

% of steel	T_c
0.75	0.57
1	0.64

For **1.58** 0.803 N/mm^2

kT_c = 1.200 x 0.803

0.964

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

V_u

1.5	6.98	10.94
	2	

V_u = 57.2472 kN

T_v = $\frac{57.2472 \times 1000}{1000 \times 127.00}$

T_v = 0.4508 < 0.9639

T_v < kT_c

SAFE

SUMMARY

Waist slab thick	=	**150.00 mm**		
Main Rebar	=	**Y 16**	@	100 **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					

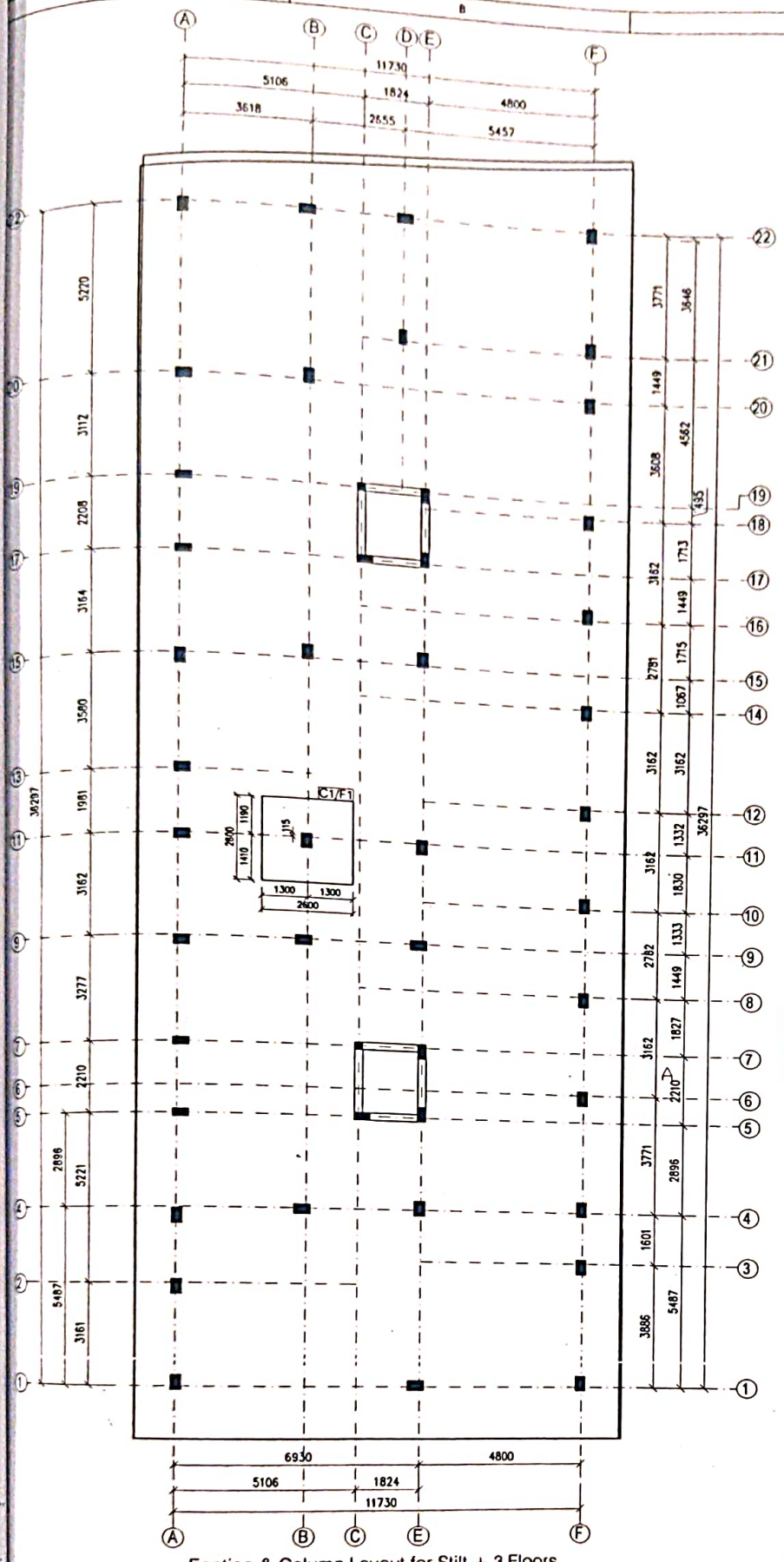
Y 10 **140 mm C/C**

560.93 > 51.85 mm^2

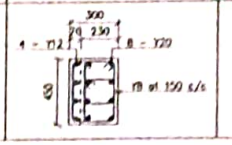
Safe

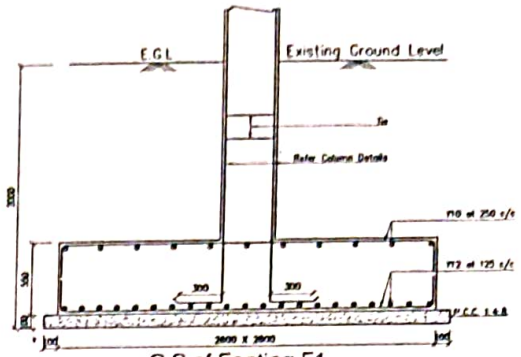
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Column Schedule

Legend	Column	Tie Arrangement
C1 300 x 450		



C.S of Footing F1
Size 2600 x 2600

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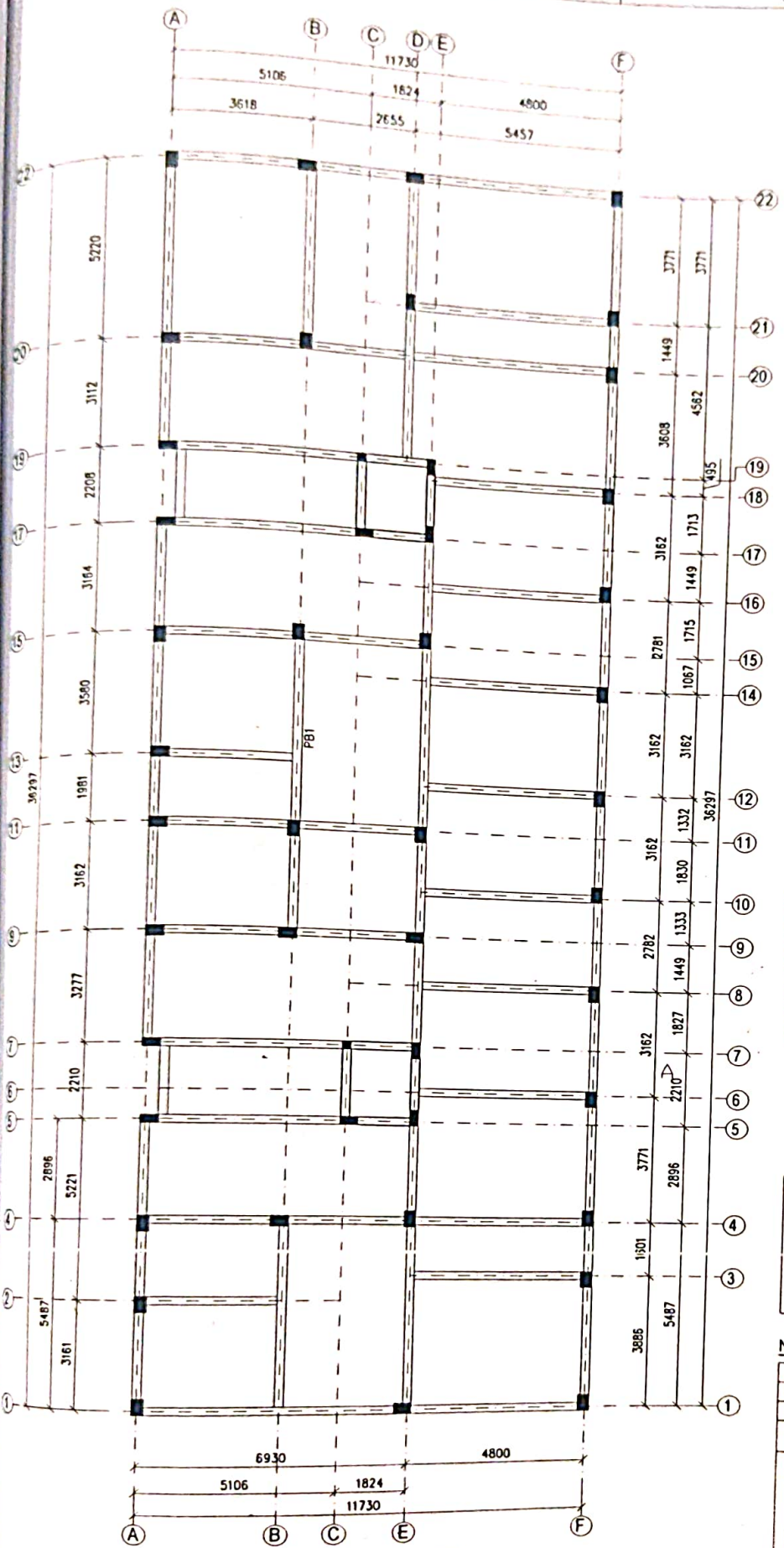
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PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR FIRST FLOOR + SECOND FLOOR PART + THIRD FLOOR PART RESIDENTIAL BUILDING (HEIGHT -12.00M) AT NEW DOOR NO.7, OLD DOOR No.2, SOUTH KAVARAI STREET, AND SAI BABA STREET, WEST MAMBALAM, CHENNAI - 600 033. COMPRISED IN T S.NO : 68, BLOCK No. 24, MAMBALAM VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION

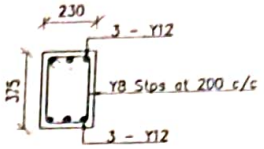
Notes:

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 Beam PB1
Size 230 x 375

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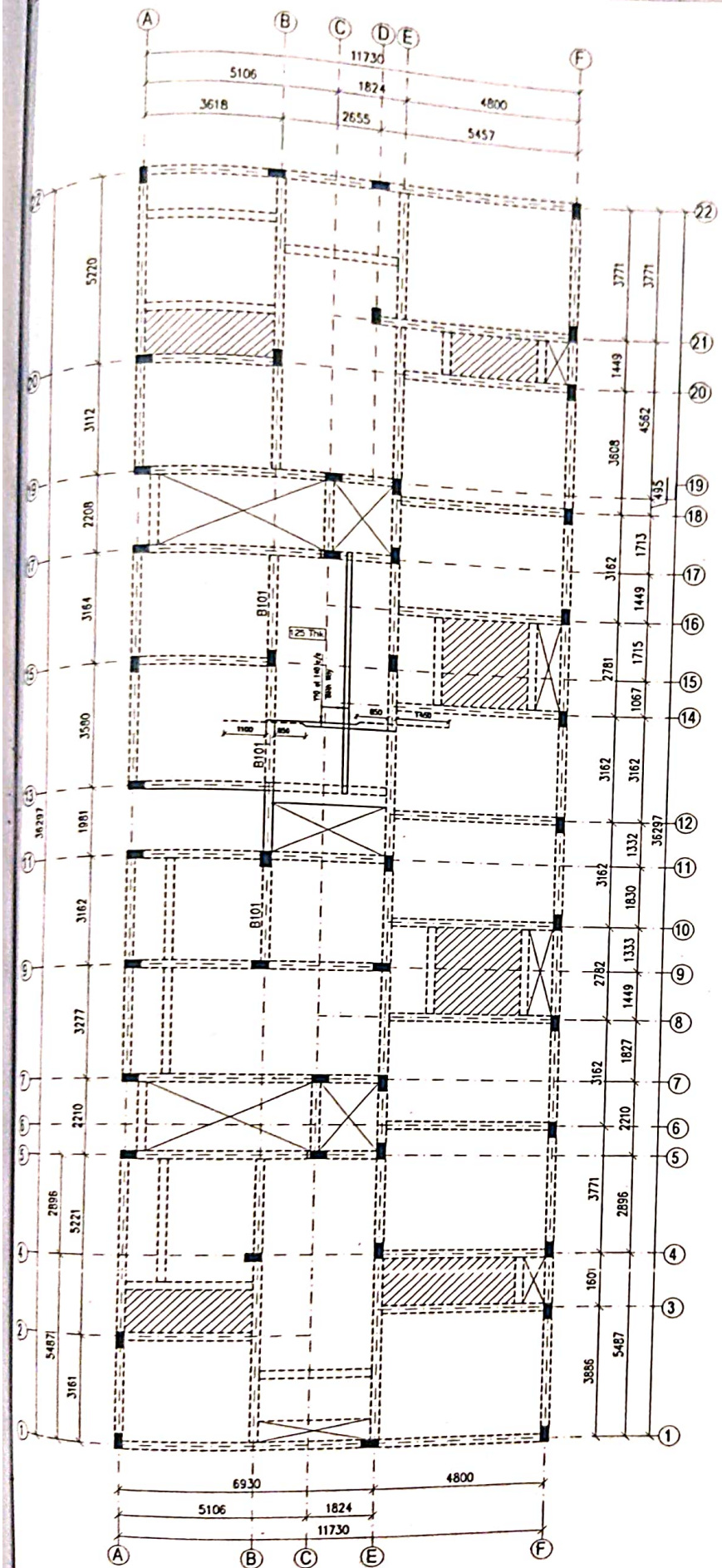
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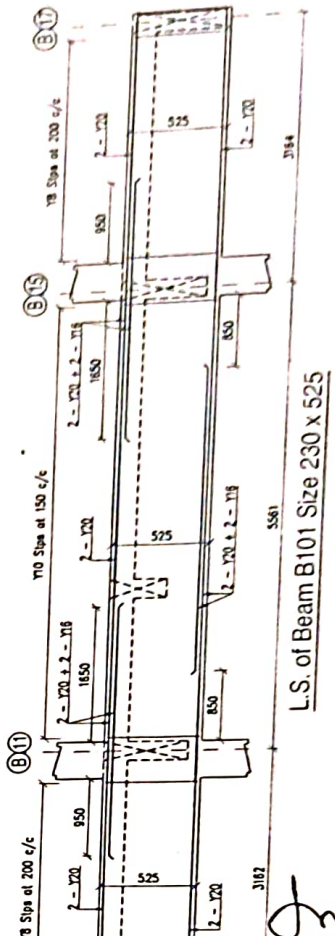
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Roof Beam & Slab Layout



L.S. of Beam B101 Size 230 x 525

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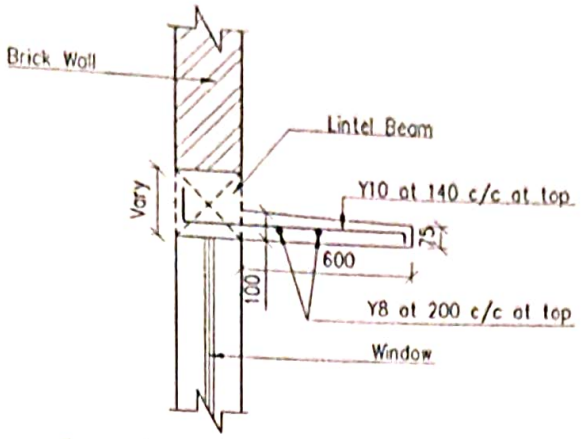
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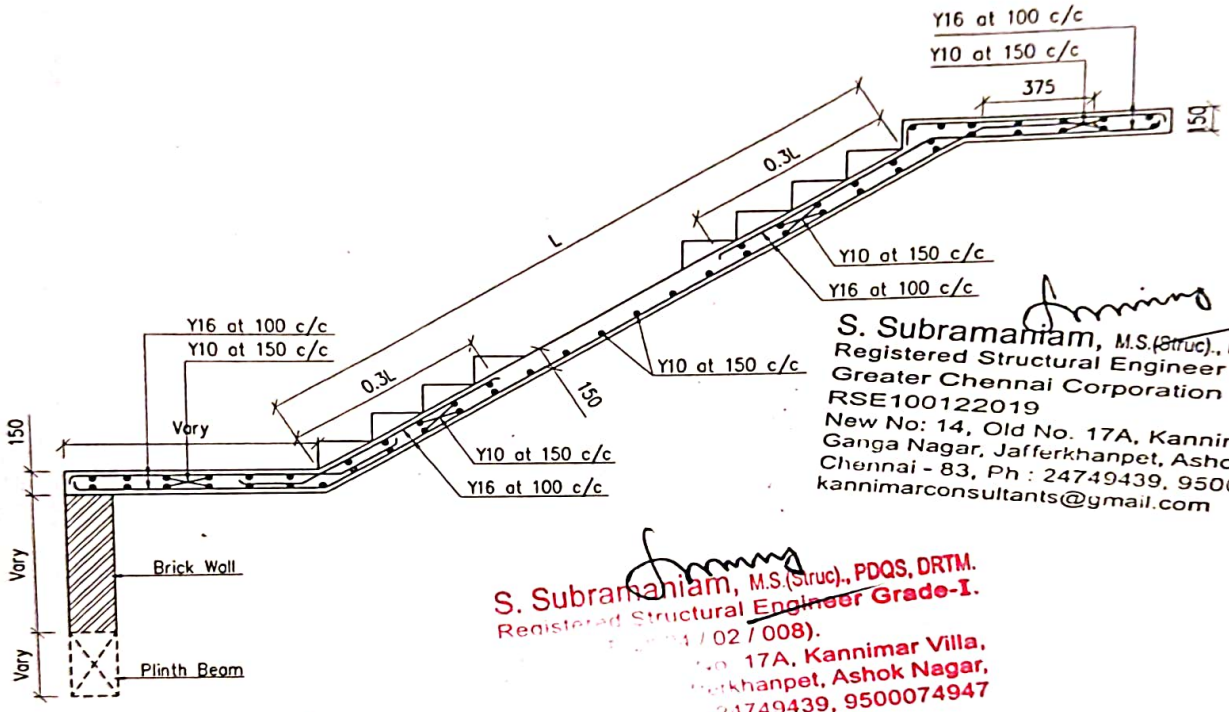
Notes:

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4.	Clear Cover To The Reinforcement For Footing: 50mm Column: 40mm, Beam: 30mm, Slab: 20mm, Rcc Wall: 20mm.

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Sunshade Detail (Typ)



C.S. of Staircase Details

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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.

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR FIRST FLOOR + SECOND FLOOR PART + THIRD FLOOR PART RESIDENTIAL BUILDING (HEIGHT -12.00M) AT NEW DOOR NO.7, OLD DOOR No.2, SOUTH KAVARAI STREET, AND SAI BABA STREET, WEST MAMBALAM, CHENNAI - 600 033. COMPRISED IN T.S.NO : 68, BLOCK No. 24, MAMBALAM VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION

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