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STABILITY CERTIFICATE

It is certified that Residential building at **Block No.6, 11th Cross Street, RBI Quarters, Besant Nagar, Chennai-600090, TN,** has been designed to resist earthquake, check has been made and found safe and I hereby certify that

1. The least dimension of the column is 300 mm.
2. The grade of concrete is **M-25**.
3. The design and analysis is done using the codes of practice for loading standards as per IS: 875 Parts and Seismic force as per the code IS 1893-2002 & IS 456:2000

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DESIGN OF SLAB

Data:

Concrete	M25		fck	=	25	N/mm²
Steel	Fe 500		fy	=	500	N/mm²
Shorter Span			Lx	=	3.77	m
Longer Span			Ly	=	3.77	m
Assuming Depth of Slab			D	=	150	mm
Assuming Dia of reinf.				=	8	mm
Clear Cover				=	20	mm
Eff. Depth of Slab			d	=	126	mm
Eff.Shorter Span			l_x	=	3.90	m
Eff. Longer Span			l_y	=	3.90	m

1. Load Calculations:

Self weight of slab	0.15	x	25.00	=	3.75	kN/m²
Floor Finish load	0.075	x	20.00	=	1.50	kN/m²
Live load				=	2.00	kN/m²
Total load				=	7.30	kN/m²
Load Factor				=	1.50	
Factored Load	4			=	10.95	kN/m²
Span Ratio			ℓ_y/ℓ_x	=	3.90 / 3.90	
				=	1.00	

2. Bending Moment Calculation:

Support Condition — 4 — Two Adjacent edges Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.047	
α_{Px}	=	0.035	
α_{Ny}	=	0.047	
α_{Py}	=	0.035	

Shorter Span:

Negative Moment (Support)	M_{Nx}	=	$\alpha_{Nx} \times w_u \times l_x^2$	
		=	0.047 x 10.95 x 3.90²	
		=	7.81	kN.m
Positive Moment (Mid span)	M_{Px}	=	$\alpha_{Px} \times w_u \times l_x^2$	
		=	0.035 x 10.95 x 3.90²	
		=	5.82	kN.m

Longer Span :

Negative Moment (Support)	M_{Ny}	=	$\alpha_{Ny} \times w_u \times l_x^2$	
		=	0.047 x 10.95 x 3.90²	
		=	7.81	kN.m

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Positive Moment (Mid span)		M_{Py}	=	$\alpha_{Py} \times w_u \times l_x^2$
			=	0.035 x 10.95 x 3.90²
			=	5.82 kN.m

Reinforcement:

Required in Shorter Span	Reinf Required		Reinf Provided
Support	8Ø @ 330mm c/c	-	8 dia @ 150 mm c/c
Mid span	8Ø @ 330mm c/c	-	8 dia @ 150 mm c/c
Required in Longer Span			
Support	8Ø @ 330mm c/c	-	8 dia @ 150 mm c/c
Mid span	8Ø @ 330mm c/c	-	8 dia @ 150 mm c/c

3. Check for Shear:

As per BS:8110 Shear coefficients

Max Shear coeff. for continuous edge in short direction	γcx =	0.40
Shear coefficient for discontinuous edge in short direction	γdcx =	0.26
Shear coefficient for continuous edge in long direction	γcy =	0.40
Shear coefficient for discontinuous edge in long direction	γdcx =	0.26

S.F for continuous edge in short direction	Vcx	=	$\gamma cx * \ell x * W$
Maximum Shear Force	Vu	=	0.40 x 3.896 x 10.95
		=	17.06 kN
S.F for discontinuous edge in short direction	Vdcx	=	$\gamma dcx * \ell x * W$
		=	0.26 x 3.896 x 10.95
		=	11.092kN
S.F for continuous edge in long direction	Vcy	=	$\gamma cy * \ell x * W$
		=	0.40 x 3.896 x 10.95
		=	17.064kN
S.F for discontinuous edge in long direction	Vdcy	=	$\gamma dcy * \ell x * W$
		=	0.26 x 3.896 x 10.95
		=	11.092kN

S.F for continuous edge in short direction	Vu	=	17.064
Design Shear stress τv	Vu/bd	=	17064 / (1000 x 126)
		=	0.135 N/mm²

Reinforcement provided in the slab is		=	8Ø @ 150 mm c/c
% of reinforcement provided	pt	=	0.266
IS:456 Table 19			
Allowable shear stress	τc	=	0.37 N/mm²
As per IS:456 cl. 40.2.1.1 k value for slab		=	1.30

Design shear stress for concrete	k x τc	=	1.30 x 0.375
		=	0.487 N/mm²

Actual Shear Stress < Design Shear Stress 0.135 < 0.487

SAFE

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4. Check for deflection

Allowable span / depth Ratio		l/d	=	26	
% of Tension reinforcement		pt	=	0.266	
Corresponding Compression reinf.		Bar dia	=	0	mm
		spacing	=	150	mm
% of Compression reinforcement		pc	=	0.000	
Modification factor for Tension reinf.	F1	=	2.00	(From Fig 4 in IS 456 - 2000)	
Modification factor for Comp. reinf.	F2	=	1.00	(From Fig 5 in IS 456 - 2000)	

Modified span/depth ratio = l/d x F1 x F2

= 26 x 2.00 x 1.00

= **52.00**

Actual span/depth ratio = 3896 / 126

= **30.92**

Actual span/depth ratio < Modified span/depth ratio 30.92 < 52.00

SAFE

DESIGN OF BEAM

Data:

Effective span		=	5.061 m
		=	5061 mm
Breadth of beam		=	230 mm
Overall depth (assumed)		=	450 mm
Characterstic strength of steel			
	fy	=	500 N/mm²
	fck	=	25 N/mm²
Cover		=	25 mm

Total load

Dead load from slab		=	3.75 kN/m²
Floor finish		=	1 kN/m²
Partition		=	1 kN/m²
Total dead load		=	5.75 kN/m²
Live load		=	2 kN/m²
	Total load	=	7.75 kN/m²

Effective depth = **d** = $450 - 25 - \frac{25}{2}$

= 412.5 mm

Distance of centroid of Compression reinforcement from the extreme compression fibre =

d' = 25 + (25/2)

= 37.5 mm

$\frac{d'}{d} = \frac{37.5}{412.5}$

= 0.1

Minimum Reinforcement

The min. area of tension reinforcement shall not be less than the given,

$$\frac{As}{bd} = \frac{0.85}{fy}$$

Where ,

As	=	Min. area of tension reinforcement
b	=	Breadth of the beam or breadth of web of T-beam
d	=	Effective depth

fy = Characterstic strength of reinforcement

$$As = \frac{0.85 \times b \times d}{fy}$$

$$= \frac{0.85 \times 230 \times 412.5}{500}$$

$$= 161.29 \text{ mm}^2$$

Refering Design Aids **IS:456**, The reinforcement as shown in the sketch

Overall depth of beam = $\frac{1}{12}$ to $\frac{1}{20}$ of the span

Provide over all depth = 450 mm

Width of rib = $\frac{2}{3}$ (depth of rib) = $\frac{2}{3}$ (450 - 150)

= 200 mm

Loading on the beam

From the slab = $\frac{7.75 \times 5.061}{3}$

= 13 kN/m

D.L of the rib = 0.23 x 0.3 x 25 kN/m

= 1.8 kN/m

Total = 14.8 kN/m

Provide 20 mm dia bars at clear cover 25 mm

Effective cover = 25 + 10

= 35 mm

Effective depth d = 415 mm

Center to Center bearing = 5.061 m

Effective span = 5.061 m

Max. BM = $\frac{14.8 \times 5.061 \times 5.061}{8}$

= 47 kN.m

Req.depth **d** = $\left[\frac{1.5 \times 47 \times 10 \text{ ^ } 6}{2.76 \times 230}\right]^{1/2}$

= 333 mm

DESIGN OF COLUMN

Data :

Total No. of floors		=	5
Total No. of Roof		=	6
Storey height		=	3.05 m
Breadth of column	b	=	230 mm
		=	0.23 m
Depth of column	D	=	450 mm
			0.45 m
	fck	=	25 N/mm²

Total axial load

Dead load & live load from one floor		=	300 kN
Total axial load all floors		=	6 x 300
		=	1800 kN
Column dimension		=	230 x 450 mm
Self weight of column		=	0.2 x 0.45 x 6 x 25 x 3.1
		=	47 kN
Total load		=	(1,800 + 47) x 1.5
	Pu	=	2770.5 kN

Area of Reinforcement

	$\frac{d'}{D}$	=	0.1
	d'	=	45 mm
	$\frac{Pu}{fck.b.D}$	=	$\frac{2,771 \times 10^{3}}{25 \times 230 \times 450}$
		=	1.07
	$\frac{Mu}{fck.b.D^2}$	=	$\frac{1.7 \times 1.5 \times 15.4 \times 10^{6}}{25 \times 230 \times 450 \times 450}$
		=	0.03

Refering to chart in SP:16 for values

$\frac{Pu}{fck.b.D}$ = 1.07 ; $\frac{Mu}{fck.b.D^2}$ = 0.03

The value of $\frac{P}{fck}$ = 0.05

DESIGN OF FOUNDATION

Design of Isolated footing for intermediate column

Data :

Column size	L	=	230	mm
	B	=	600	mm
Size of footing	L	=	2.1	m
	B	=	2.1	m
Safe Bearing capacity of soil	SBC	=	250	kN/m²
Depth of footing below GL		=	2	m
Density of soil	g	=	18	kN/m³
Characterstic strength of concrete	fck	=	25	N/mm²
Characterstic strength of Steel	fy	=	500	N/mm²
Depth of footing provided	D	=	0.525	m
cover		=	50	mm

1. Loading on footing

Axial load on column		=	1847	kN
Self weight of footing (10%)		=	184.7	kN
Total load on footing	W	=	2031.7	kN
Adpot size of footing		=	2.10 x 2.10	m
		=	4.4	m²
Soil pressure,	$\frac{P}{A}$	=	$\frac{2031.7}{4.4}$	
		=	97	kN/m²
Gross safe bearing capacity		=	312.5	kN/m²

Hence safe

2. Moment calculation

Face of the column		=	$\frac{2.10 - 0.23}{2}$	
		=	0.94	m
Design pressure		=	48	kN/m²
Moment	M	=	$\left[\frac{48 \times (0.94)^{\wedge}2}{2}\right]$	
		=	21	kN.m
Factored moment	Mu	=	31.5	kN.m

3. Area of Reinforcement

Effective depth d = 465 mm (or) 0.465 m

Dia of bar provided Ø = 20 mm

Provided spacing = 100 mm

$$\frac{Mu}{b.d^2} = \frac{32 \times 10\ \text{^6}}{1000 \times 465 \times 465}$$

$$= 0.15$$

Percentage of tension reinforcement

$$pt = \frac{fck}{2 \times fy}\left\{1 - \left(SQRT\left[1 - \frac{4 \times (Mu/b \times d^2)}{0.87 \times fck}\right]\right)\right\} \times 100$$

$$= 0.03\ \%$$

Required, Ast $= \frac{0.03 \times 1000 \times 465}{100}$

$= 139.5\ mm^2$

Provided, Ast = 3142 mm^2

= 0.68 %

Hence safe

4. Check for One way shear

Vu = 1.5 x 48.00 x(((2.10 x 0.5) - (0.23 x 0.5)) - 0.47)

= 34 kN

Permissible shear stress, $= \frac{34 \times 1000}{1000 \times 465}$

$= 0.07\ N/mm^2$

Allowable shear stress, $= 0.55\ N/mm^2$

Hence safe

5. Check for Punching shear

Punching force Pf = $\left[48 \times (4.4 - ((0.23 + 0.47) \times (0.60 + 0.47)))\right] \times 1.5$

= 264 kN

Punching shear stress $= \frac{264 \times 1000}{465 \times 2 \times (230 + 600 + (2 \times 465))}$

$= 0.16\ N/mm^2$

Allowable shear stress $= 1.10\ N/mm^2$ **Hence safe**

EARTH QUAKE ANALYSIS

1. Calculation of horizontal seismic Coefficient

As per IS 1893 - 2002

$$Ah = \frac{z \cdot I}{2 \cdot R} \frac{Sa}{g}$$

Zone factor,	Z	=	0.16	(As per table 7)
Importance factor,	I	=	1	
Response reduction factor,	R	=	5	

$$\frac{sa}{g} = 2.5$$

Natural period, Ta = 0.075 h ¾

(Clause.7.6) = 0.075 x 18.3 ^0.75

= 0.66 sec

h = height of the building

$$Ah = \frac{0.16 \times 1 \times 2.5}{2 \times 5}$$

= 0.04

2. Calculation of Base shear & seismic forces

Base shear V = An ∑ Wi

= 0.040 x 1,847

= 73.9 kN

Total no of columns = 19

Shear per column = $\frac{73.9}{19}$

= 3.89

Seismic moment per column = $\frac{3.89 \times 3}{4}$

= 2.9 T-m

Column Provided = 230 x 450 mm with 8 - Y25

Hence safe

3. Checking for footing

SBC = 31.25 T/m²

Soil pressure = 9.7 T/m²

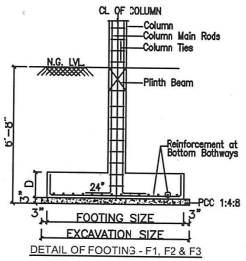
$$= \frac{p}{A} \pm \frac{2.90 \times 6}{12}$$

$$= 9.7 \pm 1.45$$

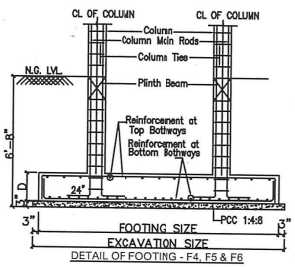
$$= 11.15$$

$$= 8.25 \text{ T/m}^2 < 31.25 \text{ T/m}^2$$

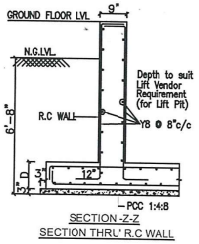
Hence safe



DETAIL OF FOOTING - F1, F2 & F3



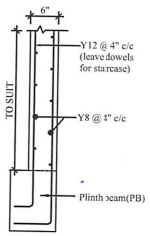
DETAIL OF FOOTING - F4, F5 & F6



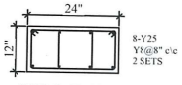
SECTION-Z-Z
SECTION THRU' R.C WALL

FOOTING SCHEDULE

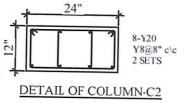
FOOTING MKD	FOOTING SIZE	EXCAVATION SIZE	D	REINFORCEMENT AT BOTTOM (BOTHWAYS)	REINFORCEMENT AT TOP (BOTHWAYS)
F1	7'-0" X 7'-0"	7'-6" X 7'-6"	21"	Y12 @ 4" C/C	----------
F2	8'-6" X 8'-6"	9'-0" X 9'-0"	24"	Y16 @ 4" C/C	----------
F3	10'-0" X 10'-0"	10'-6" X 10'-6"	27"	Y16 @ 4" C/C	----------
F4	16'-0" X 9'-0"	16'-6" X 9'-6"	24"	Y16 @ 6" C/C	Y12 @ 6" C/C
F5	17'-0" X 10'-0"	17'-6" X 10'-6"	21"	Y16 @ 4" C/C	Y12 @ 6" C/C
F6	16'-0" X 20'-0"	16'-6" X 20'-6"	24"	Y12 @ 4" C/C	Y12 @ 6" C/C



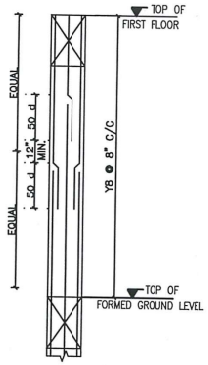
SECTION X-X



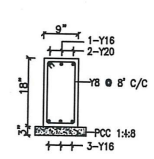
DETAIL OF COLUMN-C1



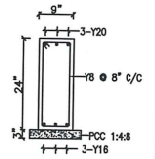
DETAIL OF COLUMN-C2



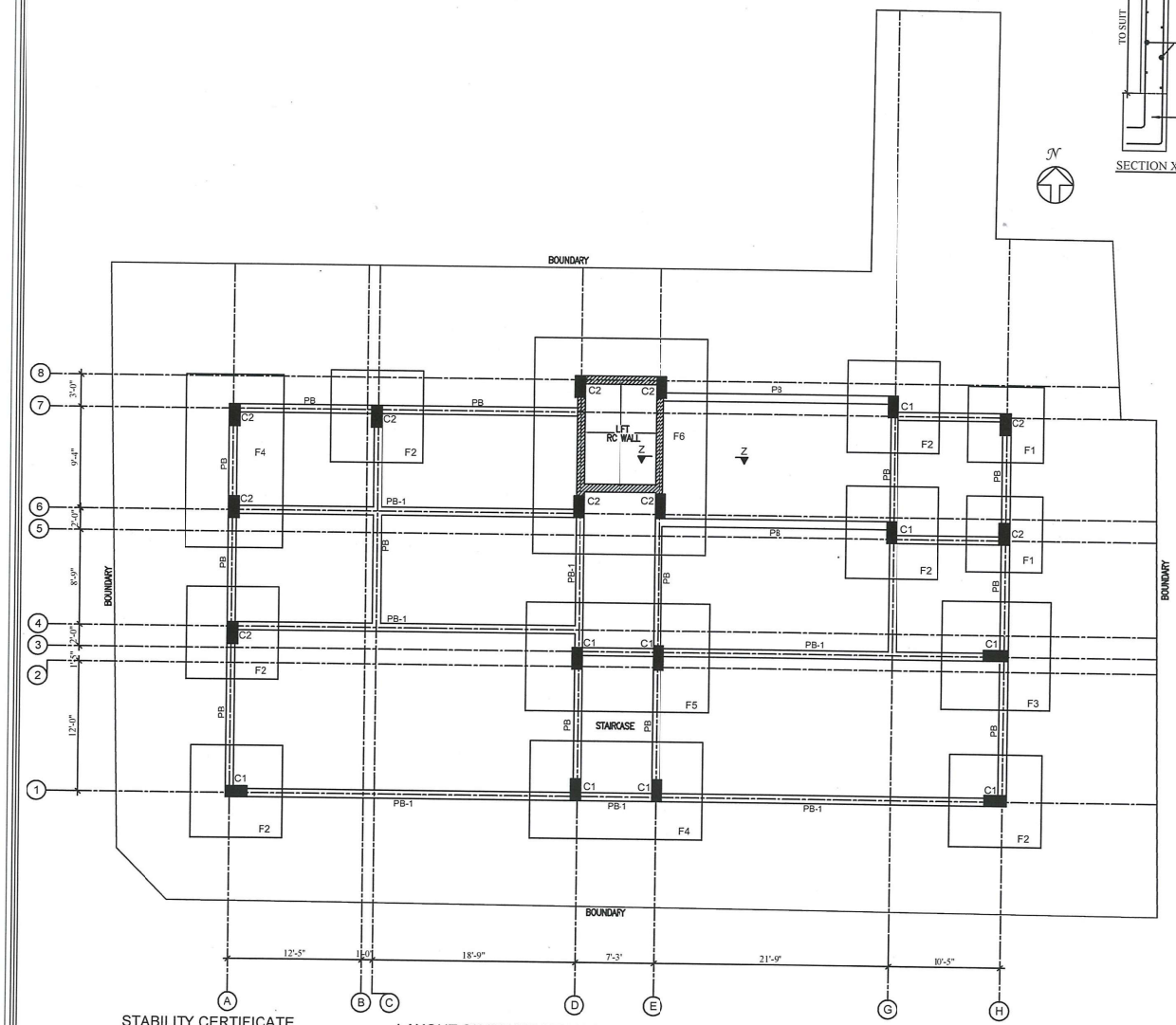
TYPICAL DETAIL OF COLUMN FOR LAPPING OF COLUMN BARS



C.S OF PLINTH BEAM-PB



C.S OF PLINTH BEAM-PB-1



STABILITY CERTIFICATE

LAYOUT OF FOUNDATION,COLUMN & PLINTH BEAM
(ALL GRID DIMENSIONS SHALL BE CHECKED WITH ARCHITECTURAL DRG.)

GENERAL NOTES :

1. Grade of Concrete and steel : M–25 & Fe–550–D.
2. Mix of Concrete shall be designed as per IS 456 – 2000.
3. Cement shall be generally be of 43 Grade – unless otherwise specified.
4. Clear cover to reinforcement shall be as follows:
   - Footing – 2"
   - Column – 1½"
   - Plinth beam – 1"
5. Lapping shall be 50 times diameter of smaller bar
6. Lapping shall be staggered.
7. For columns, if lapping is required, it shall be provided at midway between two floors.
8. For beams, lcpping of bars shall be avoided at bottom at center of beam (i.e)at span.
9. For beams, lapping of bars shall be avoided at top of beam at Column – Beam joint (i.e) at support.

SOIL BEARING CAPACITY
25 T/sq.m AS PER SOIL REPORT

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NOTES:

1. This drawing should be read along with Architectural drawing.
2. Foundation has been designed for STLT+ FIVE FLOORS ONLY
3. All dimensions are in feet & inches.

Structural Consultants :

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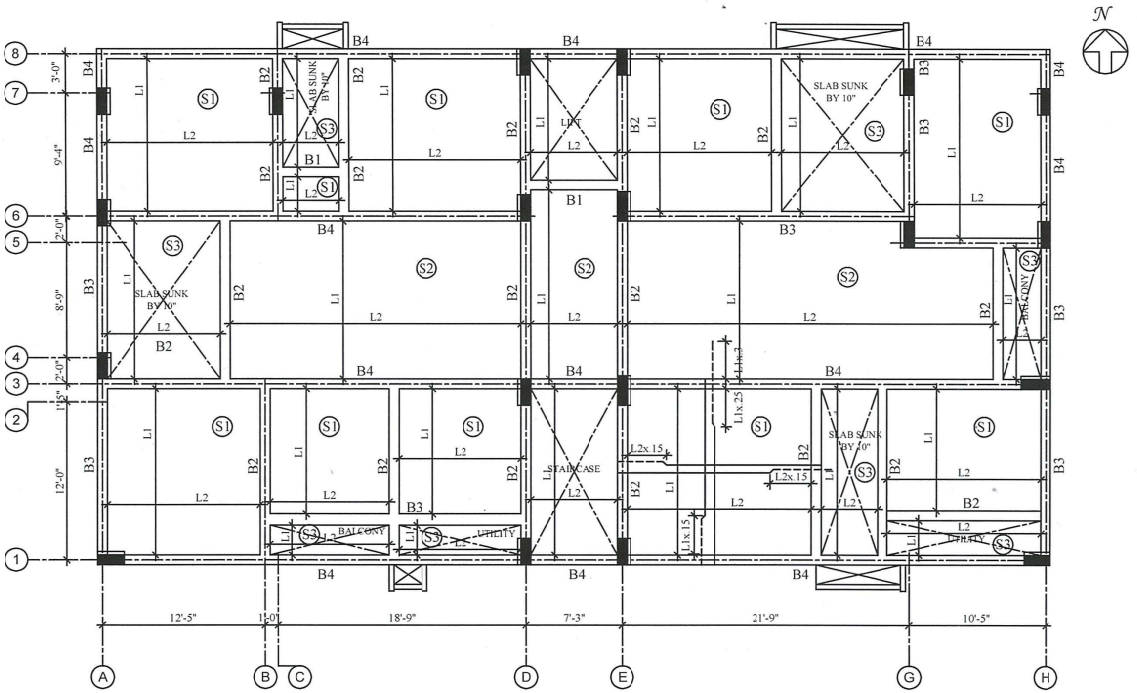
PROPOSED RESIDENTIAL APARTMENT BUILDING AT, BLOCK NO.6, 11TH CROSS STREET, RBI QUARTERS BESANT NAGAR, CHENNAI–600090.

LAYOUT & DETAILS OF FOUNDATION COLUMN AND PLINTH BEAM

DATE : 08.05.2025

DWG NO : 01 16

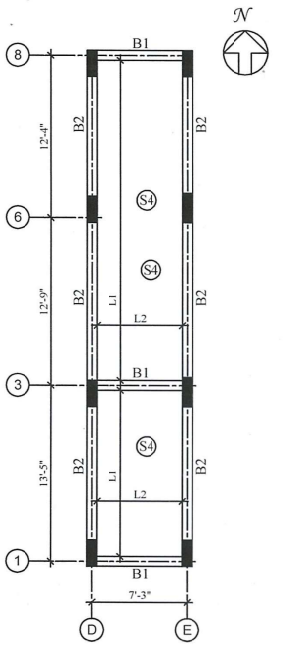
FILE :D/IB/RAGHU/FDN,COL & PB.



LAYOUT OF TYPICAL ROOF SLAB & BEAMS

(ALL GRID DIMENSIONS SHALL BE CHECKED WITH ARCHITECTURAL DRG.)

(ALL SLABS ARE OF 6" THK (U.N.O.)

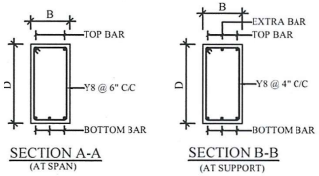


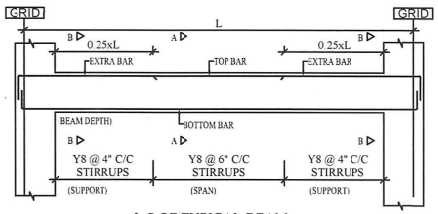
LAYOUT OF ROOF SLAB & BEAMS FOR STAIRCASE HEADRCOM

(ALL GRID DIMENSIONS SHALL BE CHECKED WITH ARCHITECTURAL DRG.)

SLAB REINFORCEMENT DETAIL			
BEAM MKD	BEAM SIZE	SHORTER SPAN	LONGER SPAN
S1	6"	Y8 @ 6" C/C	Y8 @ 6" C/C
S2	6"	Y8 @ 8" C/C	Y8 @ 6" C/C
S3	6"	Y8 @ 4" C/C	Y8 @ 6" C/C
S4	6"	Y8 @ 4" C/C	Y8 @ 4" C/C

BEAM REINFORCEMENT DETAIL				
BEAM MKD	BEAM SIZE (B X D)	TOP BAR		BOTTOM BAR
		AT SUPPORT	AT SPAN	
B1	9" X 15"	2-Y16+1-Y16	2-Y16	2-Y16+1-Y16
B2	9" X 18"	2-Y20+1-Y20	2-Y20	2-Y20+1-Y20
B3	9" X 24"	2-Y20+1-Y25	2-Y20	2-Y20+1-Y25
B4	9" X 33"	2-Y25+1-Y25	2-Y25	2-Y25+1-Y25





L.S OF TYPICAL BEAM

STABILITY CERTIFICATE

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2. Mix of Concrete shall be designed as per IS 456 – 2000.
3. Cement shall be generally be of 43 Grade – unless otherwise specified.
4. Clear cover to reinforcement shall be as follows:
   Floor beam – 1"
   Floor slab – 3/4"
5. Lapping shall be 50 times diameter of smaller bar
6. Lapping shall be staggered.
7. For beams, lapping of bars shall be avoided at bottom at center of beam (i.e) at span.
8. For beams, lapping of bars shall be avoided at top of beam at Column – Beam joint (i.e) at support.
9. For Slabs–Chair rods shall be provided to keep Top reinforcement in place.
10. For Slabs–Provide Y8 @ 8" C/C wherever bars are not shown.

STRIPPING TIME FOR FORMWORK

	Time duration
1. Vertical Formwork to Columns, Walls and Beams	1 day
2. Soffit Formwork to Slabs	3 days
3. Soffit Formwork to Beams	7 days
4. Props to Slabs	
a. Spanning upto 4.5m(15'–0")	7 days
b. Spanning over 4.5m(15'–0")	14 days
5. Props to Beams	
a. Spanning upto 6m(20'–0")	14 days
b. Spanning over 6m(20'–0")	21 days

Props to be refixed immediately after removal of formwork at soffit of slabs and beams.

SPECIFICATION FOR SHUTTERING :

Shuttering of adequate strength with necessary props, bracing and struts shall be provided as per IS 456:2000 & IS 14687.

NOTES:

1. This drawing should be read along with Architectural drawing.
2. All dimensions are in feet & inches.

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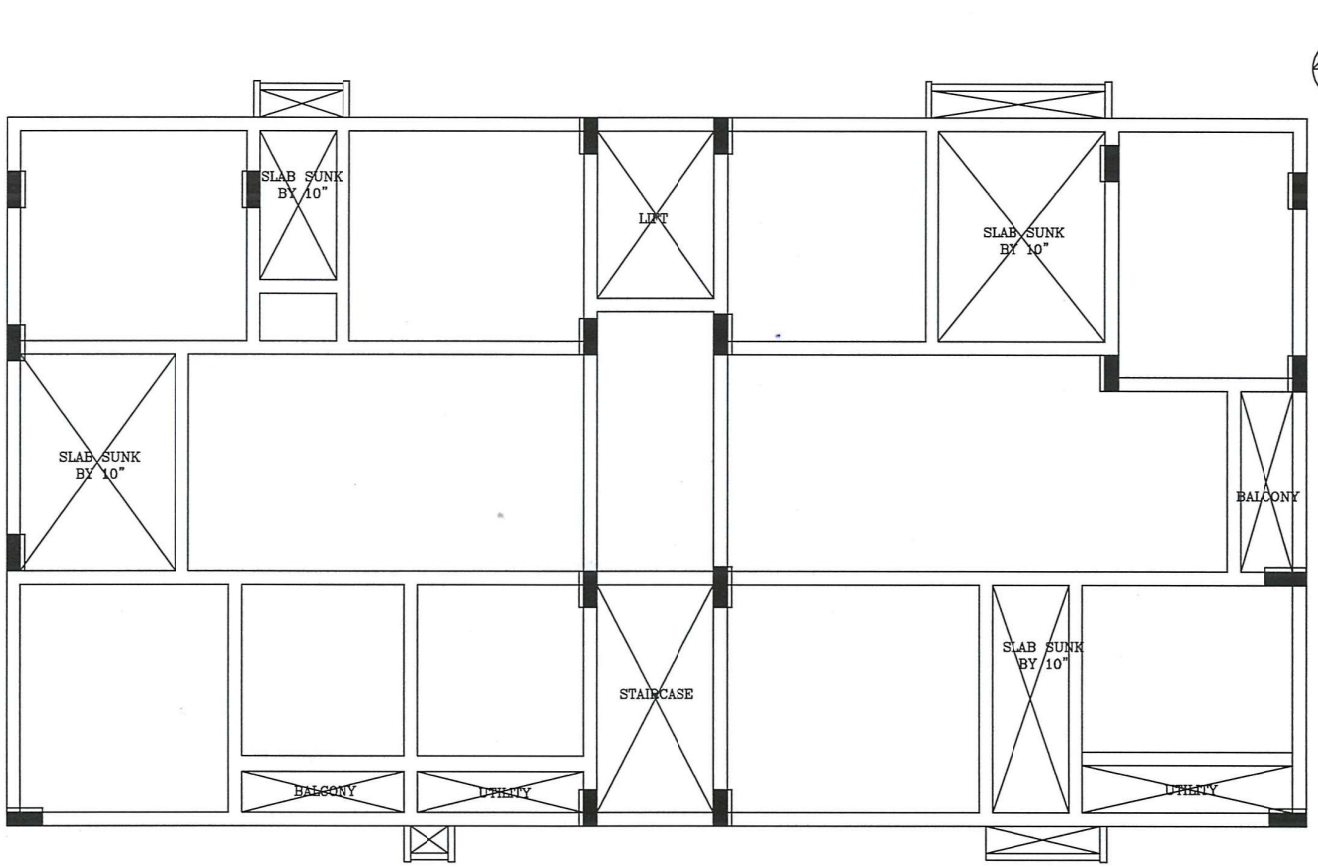
PROPOSED RESIDENTIAL APARTMENT BUILDING AT, BLOCK NO.6, 11TH CROSS STREET, RBI QUARTERS BESANT NAGAR, CHENNAI–600090.

LAYOUT & DETAILS OF ROOF SLAB & BEAMS OVER TYPICAL FLOOR

DATE : 08.05.2025

DWG NO : 02

FILE :D/IB/RAGHU/TYP ROOF DRG.



LAYOUT OF TYPICAL ROOF SLAB & BEAMS

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STABILITY CERTIFICATE

GENERAL NOTES :

1. Grade of Concrete and steel : M-25 & Fe-550-D.
2. Mix of Concrete shall be designed as per IS 456 – 2000.
3. Cement shall be generally be of 43 Grade – unless otherwise specified.
4. Clear cover to reinforcement shall be as follows:
   Floor beam – 1"
   Floor slab – 3/4"
5. Lapping shall be 50 times diameter of smaller bar
6. Lapping shall be staggered.
7. For beams, lapping of bars shall be avoided at bottom at center of beam (i.e) at span.
8. For beams, lapping of bars shall be avoided at top of beam at Column – Beam joint (i.e) at support.
9. For Slabs–Chair rods shall be provided to keep Top reinforcement in place.
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SPECIFICATION FOR SHUTTERING :

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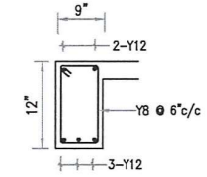
PROPOSED RESIDENTIAL APARTMENT BUILDING AT, BLOCK NO.6, 11TH CROSS STREET, RBI QUARTERS BESANT NAGAR, CHENNAI-600090.

LAYOUT & DETAILS OF ROOF SLAB & BEAMS OVER TYPICAL FLOOR

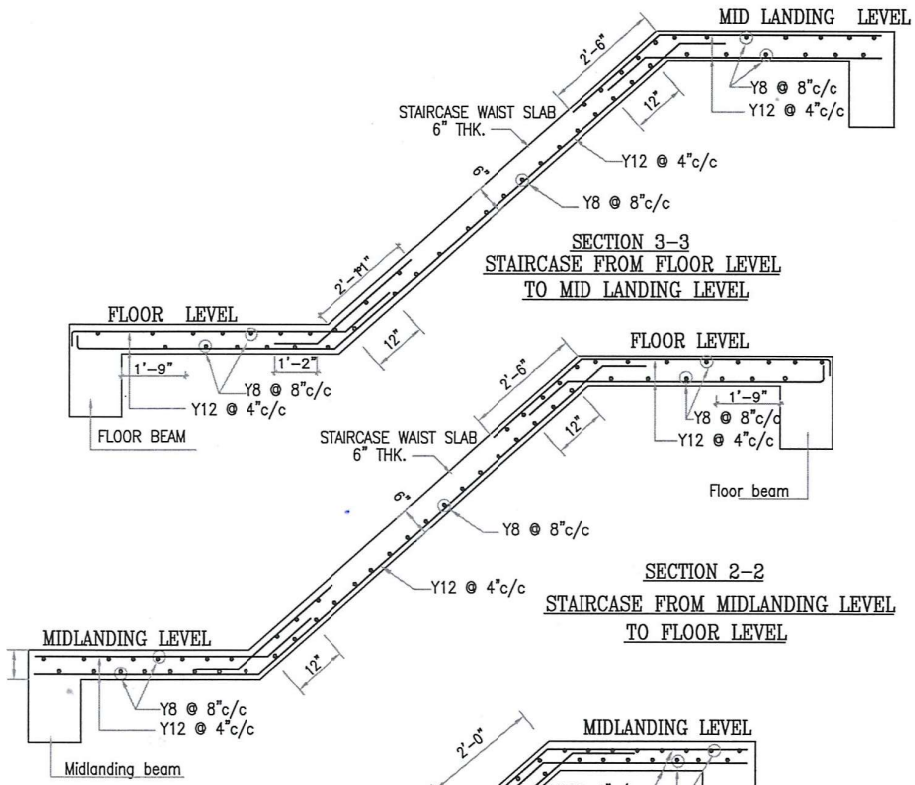
DATE : 08.05.2025

DWG NO : 03

FILE :D/IB/RAGHU/TYP BEAMLAYOUT.



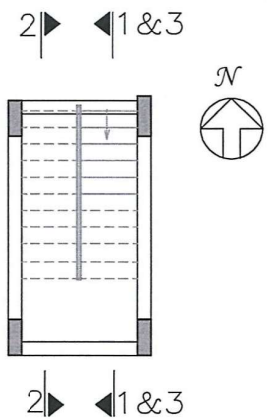
Mid Landing Beam



SECTION 3–3
STAIRCASE FROM FLOOR LEVEL
TO MID LANDING LEVEL

SECTION 2–2
STAIRCASE FROM MIDLANDING LEVEL
TO FLOOR LEVEL

SECTION 1–1
STAIRCASE FROM GROUND FLOOR LEVEL
TO MID LANDING LEVEL
(STAIRCASE START FROM
PLINTH BEAM)



PLAN OF STAIRCASE

STABILITY CERTIFICATE

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NOTES:

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PROPOSED RESIDENTIAL APARTMENT BUILDING AT, BLOCK NO.6, 11TH CROSS STREET, RBI QUARTERS BESANT NAGAR, CHENNAI–600090.

LAYOUT & DETAILS OF STAIRCASE

DATE : 08.05.2025

DWG NO : 04

FILE :IB/RAGHU/STAIRCASE