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VRP CONSULTANTS
CONSULTING ENGINEERS
NO.18, VATHIYAR THOTAM MAIN ROAD
KODAMBAKKAM, CHENNAI - 600 024.

☎ : +91 44-24810096
✉ : vrpconsultants@gmail.com
: +91 – 97910 20760

17.08.2024

To
Tamil Nadu Real Estate Regulatory Authority (TNRERA),
1st Floor, Tower – II,
CMDA,
No.1A, Gandhi Irwin Bridge Road,
Egmore, Chennai – 600 008

CERTIFICATE

The proposed Residential building of **Stilt + 5 Floors (18.00m Height) with 50 dwelling units** at **Plot No: 1 in Approved Layout PPD.Lo.No. 34/2016, KCP Road, Thiruvotriyur, Chennai 600 019 comprised in T.S.No. 7/12, Old S.No. 276, 277, 278 & 279, Ward G, Block no.18 of Thiruvotriyur village within the limit of Greater Chennai Corporation,** has been designed as per IS Codal regulations and the construction will be carried out as per Standard Engineering Practice and hence the building is certified to be structurally safe and sound.

The cantilever projections shall be designed with all safety precautions as per IS Codal regulation to support the slab and walls at every floor level.

V.R. RAVINDRAN.
Structural Consultant
V R P CONSULTANTS

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
Chennai Corpn. Reg.No: RSE 101812023
E-mail: vrpconsultants@gmail.com
Web: www.vrpconsultants.com

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Design of Structure:

The structure has been modeled in software "ETABS". The columns and beams have been modeled as per plan. The slab has been given as plate model and loadings are applied as per IS Codal regulations. The wall load has been applied on beams as per plan.

The structure has been analysed as three-dimensional structure. The earthquake forces are applied as per IS 1893-2002. The ductile detailing has been followed as per IS 13920-1993.

The loads on columns are taken and foundation is designed as per IS Code. Beams and columns are designed by ETABS. The floor slab is designed manually using IS Codal regulations.

Soil bearing capacity as per soil report is 200 kN/sq.m and this has been considered in the design of foundation.

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V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-9 2625 11348

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STABILITY CERTIFICATE

It is certified that Residential building **Stilt + 5 Floors (18.00m Height) with 50 dwelling units** at **Plot No: 1 in Approved Layout PPD.Lo.No. 34/2016, KCP Road, Thiruvotriyur, Chennai 600 019 comprised in T.S.No. 7/12, Old S.No. 276, 277, 278 & 279, Ward G, Block no.18 of Thiruvotriyur village within the limit of Greater Chennai Corporation,** 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

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CIDA Reg.No.SE/CR-179/04/105
5, Kaja Nagar First Street,
Kodambakkam, Chennai-600 024
PH: 044-24810096

DESIGN OF SLAB

Data:

Concrete	M25	fck	=	25	N/mm²
Steel	Fe 500	fy	=	500	N/mm²
Shorter Span		Lx	=	3.05	m
Longer Span		Ly	=	5.41	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	=	3.18	m
Eff. Longer Span		l_y	=	5.54	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	3			=	10.95 kN/m²
Span Ratio			ℓ_y/ℓ_x	=	5.54 / 3.18
				=	1.74

2. Bending Moment Calculation:

Support Condition: 3 — One Long Edge Discontinuous

From IS 456-2000 Table 26

α_{Nx}	=	0.077	
α_{Px}	=	0.059	
α_{Ny}	=	0.037	
α_{Py}	=	0.028	

Shorter Span:

Negative Moment (Support) M_{Nx} = $\alpha_{Nx} \times w_u \times l_x^2$

= 0.077 x 10.95 x 3.18² = 8.47 kN.m

Positive Moment (Mid span) M_{Px} = $\alpha_{Px} \times w_u \times l_x^2$

= 0.059 x 10.95 x 3.18² = 6.49 kN.m

Longer Span :

Negative Moment (Support) M_{Ny} = $\alpha_{Ny} \times w_u \times l_x^2$

= 0.037 x 10.95 x 3.18² = 4.09 kN.m

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-99625 11348

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 = 3176 / 126
= **25.21**

Actual span/depth ratio < Modified span/depth ratio 25.21 < 52.00

SAFE

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-99625 11348

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 = $\frac{7.75 \times 3.660}{3}$

= 9 kN/m

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

= 1.8 kN/m

Total = 10.8 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 = 3.66 m

Effective span = 3.66 m

Max. BM = $\frac{10.8 \times 3.660 \times 3.660}{8}$

= 18 kN.m

Req.depth **d** = $\left[\frac{1.5 \times 18 \times 10 \text{ ^ } 6}{2.76 \times 230}\right]^{1/2}$

= 206 mm

DESIGN OF COLUMN

Data :

Total No. of floors		=	5
Total No. of Roof		=	6
Storey height		=	3.05 m
Breadth of column	b	=	300 mm
		=	0.3 m
Depth of column	D	=	530 mm
			0.53 m
	fck	=	25 N/mm²

Total axial load

Dead load & live load from one floor		=	200 kN
Total axial load all floors		=	6 x 200
		=	1200 kN
Column dimension		=	300 x 530 mm
Self weight of column		=	0.3 x 0.53 x 6 x 25 x 3.1
		=	73 kN
Total load		=	(1,200 + 73) x 1.5
	Pu	=	1909.5 kN

Area of Reinforcement

	$\frac{d'}{D}$	=	0.1
	d'	=	53 mm
	$\frac{Pu}{fck.b.D}$	=	$\frac{1,910 \times 10^{3}}{25 \times 300 \times 530}$
		=	0.48
	$\frac{Mu}{fck.b.D^2}$	=	$\frac{1.7 \times 1.5 \times 15.4 \times 10^{6}}{25 \times 300 \times 530 \times 530}$
		=	0.02

Refering to chart in SP:16 for values

$\frac{Pu}{fck.b.D}$ = 0.48 ; $\frac{Mu}{fck.b.D^2}$ = 0.02

The value of $\frac{P}{fck}$ = 0.08

DESIGN OF FOUNDATION

Design of Isolated footing for intermediate column

Data :

Column size	L	=	300	mm
	B	=	530	mm
Size of footing	L	=	3	m
	B	=	3	m
Safe Bearing capacity of soil	SBC	=	200	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	=	0.68	m
cover		=	50	mm

1. Loading on footing

Axial load on column		=	1273 kN
Self weight of footing (10%)		=	127.3 kN
Total load on footing	W	=	1400.3 kN
Adpot size of footing		=	3.00 x 3.00 m
		=	9 m²
Soil pressure,	P / A	=	1400.3 / 9
		=	156 kN/m²
Gross safe bearing capacity		=	250 kN/m²

Hence safe

2. Moment calculation

Face of the column		=	(3.00 - 0.30) / 2
		=	1.35 m
Design pressure		=	103 kN/m²
Moment	M	=	[103 x (1.35)^2 / 2]
		=	94 kN.m
Factored moment	Mu	=	141 kN.m

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 1,273

= 50.9 kN

Total no of columns = 71

Shear per column = $\frac{50.9}{71}$

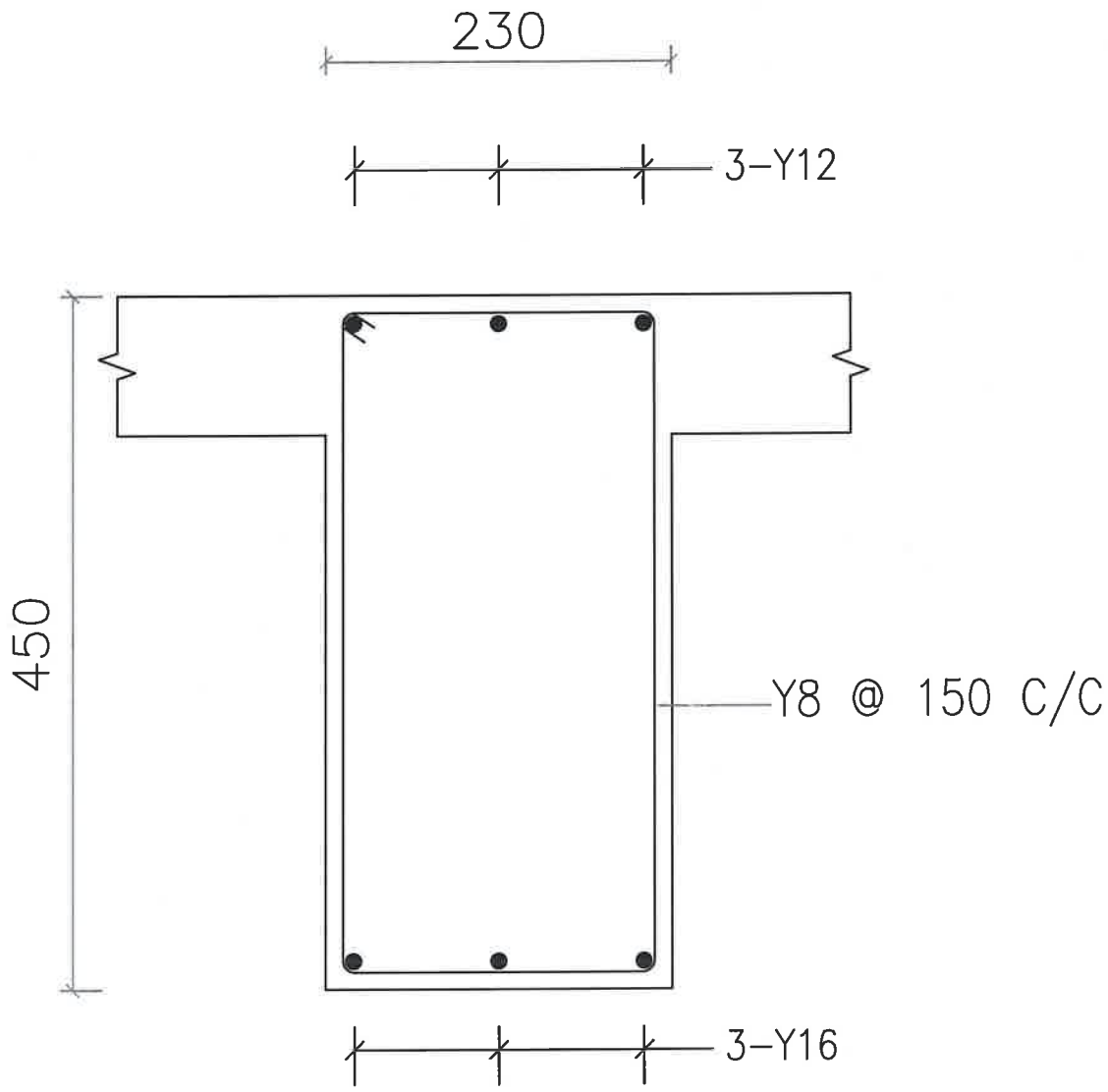
= 0.72

Seismic moment per column = $\frac{0.72 \times 3}{4}$

= 0.5 T-m

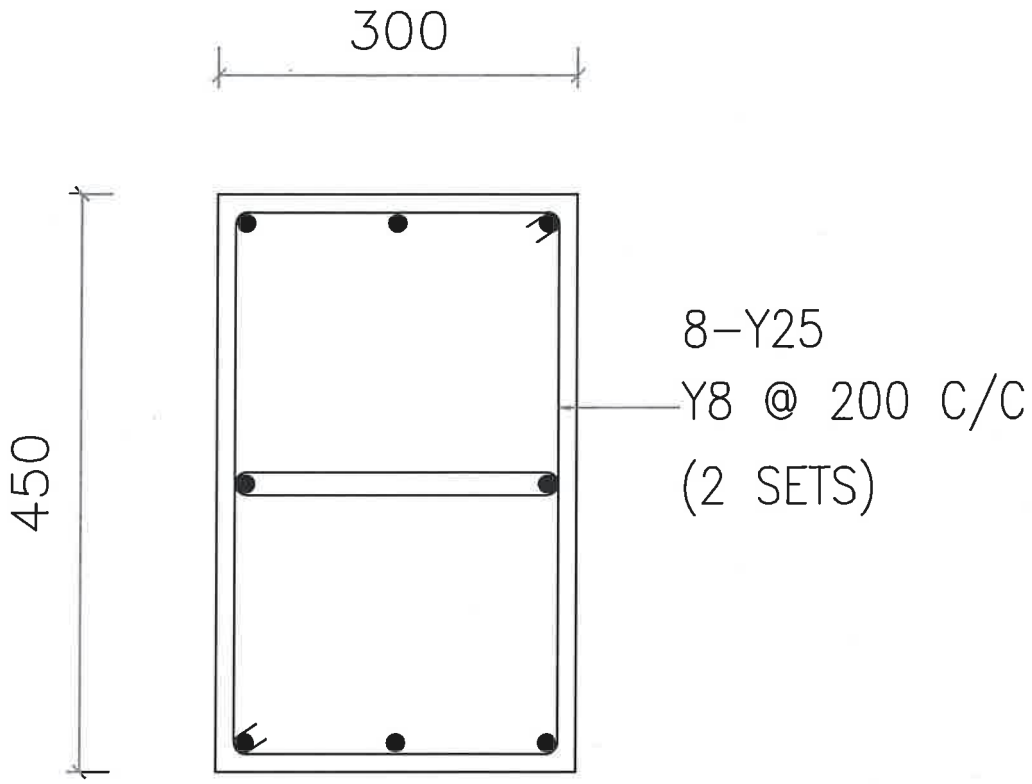
Column Provided = 300 x 530 mm with 8 - Y25

Hence safe



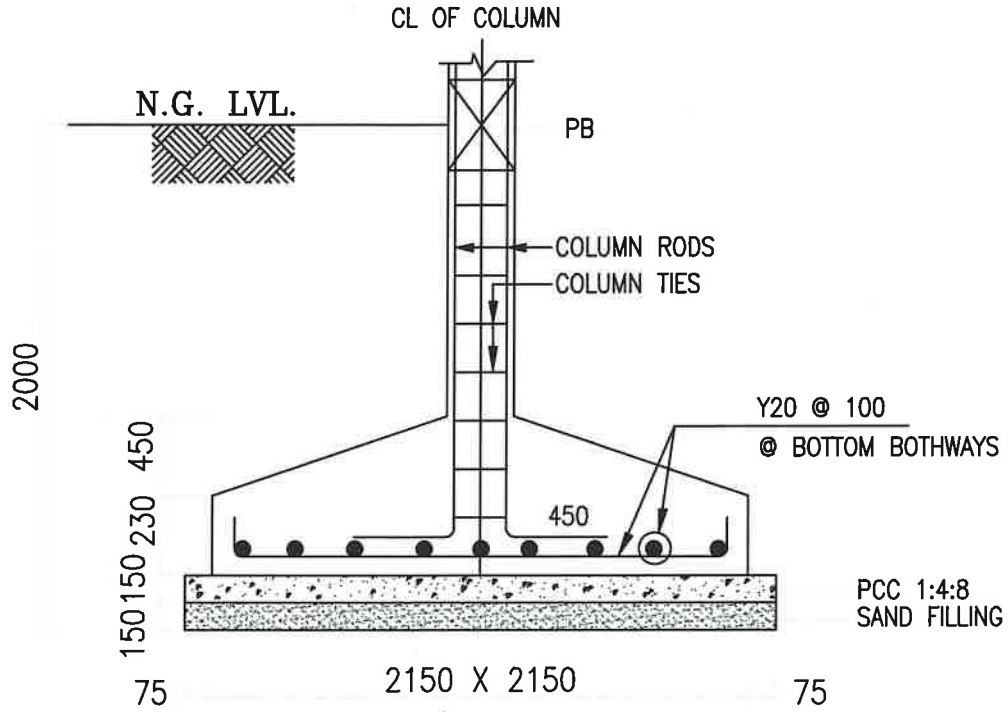
SECTION THRU'
FLOOR BEAM

...RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-99625 11348

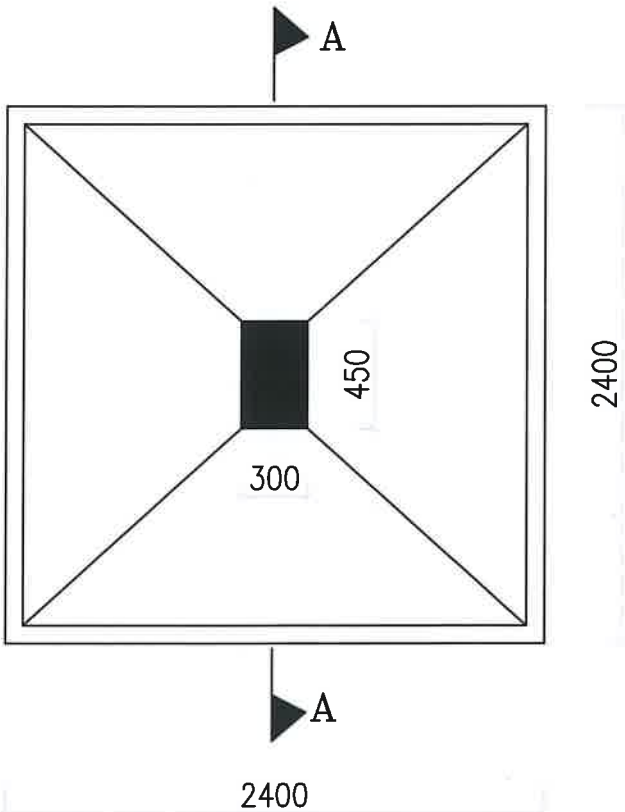


SECTION THRU' COLUMN

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-99625 11348

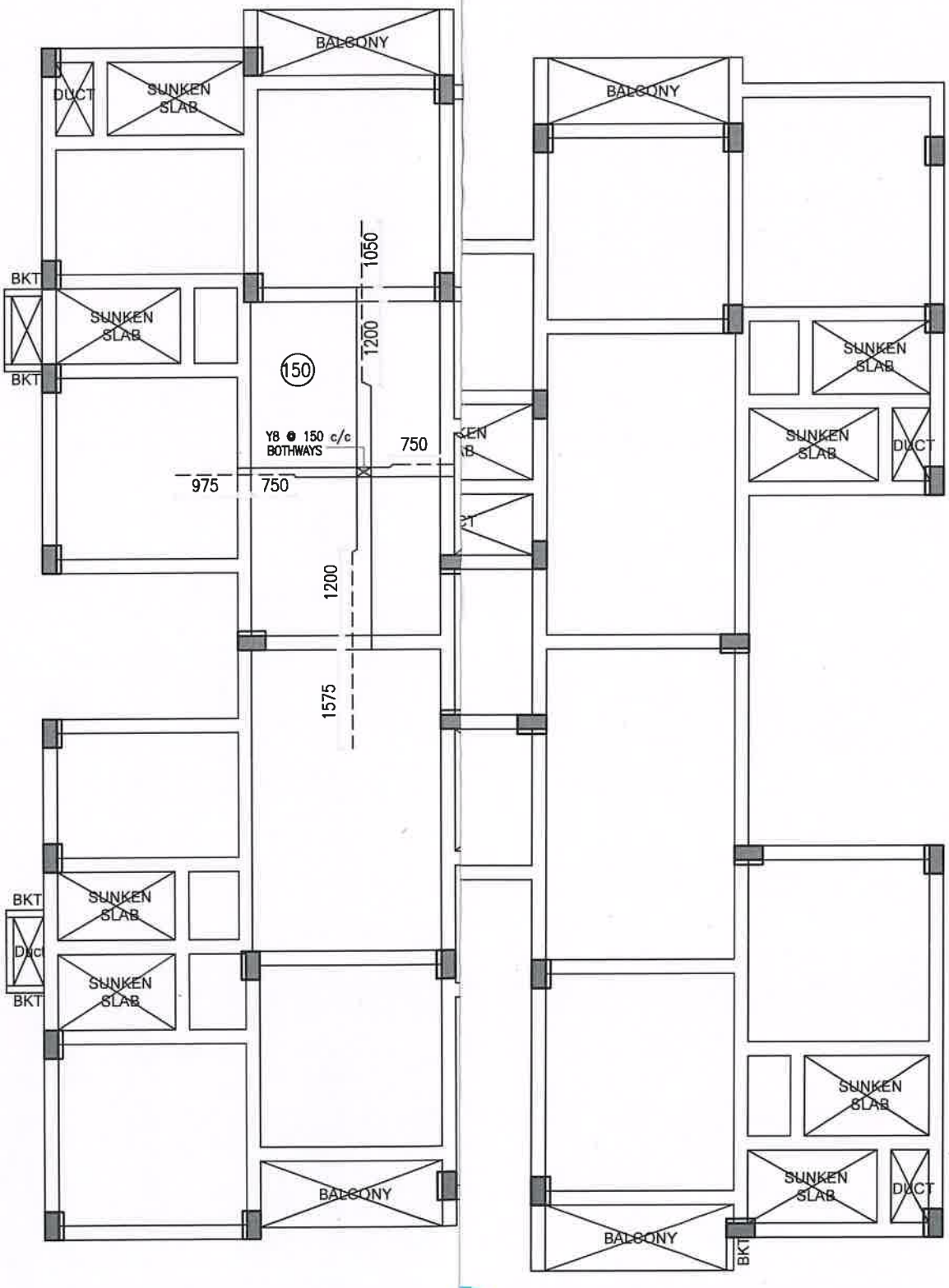


SECTION A–A
THRU' FOOTING



PLAN OF FOOTING

V.R. RAVINDRAN, M.E.,M.I.E.,
Structural Consultant
CMDA Reg.No: SE/GR-I/19/04/105
5/3, Aziz Nagar First Street,
Kodambakkam, Chennai-600 024
Ph: +91-99625 11348


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Y8 @ 150 c/c BOTHWAYS
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