

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

STRUCTURAL STABILITY CERTIFICATE

Name of work:

THE PROPOSED CONSTRUCTION OF STILT FLOOR (PARKING) + 4 FLOORS +5TH FLOOR PART RESIDENTIAL BUILDING WITH 9 DWELLING UNITS (18.30 M HEIGHT) AVAILING PREMIUM FSI WITH TOD BENEFIT AT OLD DOOR NO.5, NEW DOOR NO.17, KRISHNAMMA ROAD AND NAGESWARA ROAD, NUNGAMBAKKAM, CHENNAI 600034 AND COMPRISED IN R.S.NO.144/5 AND 144/15 IN BLOCK NO.21 OF NUNGAMBAKKAM VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION

Preamble

:

1. I hereby certify that the structural design sheet is done for column, Foundation, Slab and beam.
2. The usage of the building is Stilt floor + 5 upper Floors.
3. The Super Structure is built on outer 200mm walls and inner 100mm walls.
4. All concrete for RCC members in Stilt + 5 Floors are M30 concrete.
5. The structural design includes the Earth quake Criteria as per IS: 1893(part 1)-latest revision.

This is to certify that the Structural Design of the proposed construction of residential building at above said site has been DESIGNED on the basis of EARTHQUAKE RESISTANT DESIGN OF STRUCTURES IS 1893 (Part1): 2002 General Provisions & Buildings, with latest declaration of Seismic Zone III, Zone factor 0.16 and according to I.S. Loading standards I.S. – 875 All precautions have been taken as per the CONTENTS OF REPORT FOUNDATION ANALYSIS. This Report has recommendations for effect of Seismic Condition for this Soil.


Er. P. RAMAN, B.E. (Civil), M.E. (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1 (SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

CALCULATION OF SEISMIC CO-EFFICIENT

Name of city	: Chennai
Type of Building	: Residential Building
Building Frame System	: Special RC-Moment resisting frame (SMRF)
Fundamental Natural Period (Ts)	: $(0.075)h^{3/4} = 0.655 \text{sec.}$
Soil conditions	: medium
Zone Factor (Refer Table:2) (Z)	: 0.16 (moderate)
Importance Factor (Refer Table:6) (I)	: 1
Response Reduction (Refer Table:7)	: 5.0
Average response acceleration Co-efficient (Sa/g)	: 2.35

EARTH QUAKE ANALYSIS:

Horizontal Seismic Co-efficient (Ah)	$= (Z/2)(I/R)(Sa/g)$ $= (0.16/2)(1/5.0)(2.35)$ $= 0.038$
Design value of Ah	$= 0.038$
Type of Foundation	: Pile foundation


Er. P. RAMAN, B.E.(Civil).. M.E (Struct).. MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

1. GENERAL LOADING CONDITIONS:

(a) Imposed loads on Roof	- 1.50kN/m ²
(b) Imposed loads on Hall, Kitchen. & Bed, Residential	- 2.00kN/m ²
(d) Dead weight of R.C.C	- 25kN/m ³
(e) Dead weight of Brick Work	- 20kN/m ³

2.LOADING ON SLABS:

2.1 Loading on Roof slab:

Roof finished with lime concrete terracing	= (0.10)(20) = 2.000kN/m ²
S/W of slab 125mm thick	= (.125)(25) = 3.125kN/m ²
Dead load	= 5.125kN/m ²
Live load	= 1.50kN/m ²
Total load on Roof	= 6.625kN/m ²

2.2 Loading on Floor slabs:

Floor finish	= 1.00kN/m ²
S/w of slab 125mm thick	= 3.125kN/m ²
Dead load	= 4.125kN/m ²
Live load	= 2.00kN/m ²
Total load on Roof	= 6.125kN/m ²


Er. P. RAMAN, B.E. (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

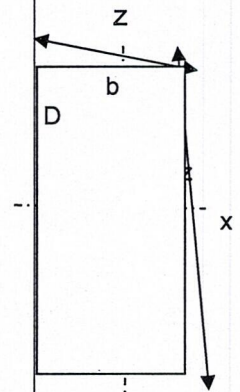
Phone: 9840202004

E-mail: raman_str@yahoo.co.in

3DESIGN:

3.1 COLUMN DESIGN

Grade of Concrete			M 30	
Characteristic Strength of Reinf.		N/mm ²	500	
Width of Column	b	mm	300	
Depth of Column	D	mm	850	
Unsupported Length of Column	l _x	mm	3000	
Unsupported Length of Column	l _y	mm	3000	
Clear Cover to Reinf.		mm	40	
Diameter of Bar		mm	20	
Load		T		
Moment	M _{xx}	T.m		
Moment	M _{zz}	T.m		
Factored Load	P _u	kN	850.000	1
Factored Moment	M _{ux}	kN.m	89.950	1
Factored Moment	M _{uz}	kN.m	32.510	1
Effective Length of Column	l _{ex}	mm	3600	1.2
	l _{ez}	mm	3600	1.2
	l _{ex} /D		4.2352941	0
			<12- Short Column	
	l _{ey} /b		12	0
			<12- Short Column	
Additional Moment due to Slender	M _{ax}	kN.m	0	
Additional Moment due to Slender	M _{az}	kN.m	0	
Percentage of Reinf.	p	%	1.9	
Gross Area of Cross Section	A _g	mm ²	255000	
Ultimate Axial Load	P _{uz}	kN	5193.9675	
d'/D (about x-x axis)			0.059	
d'/D (about y-y axis)			0.167	



Er. P. RAMAN, B.E (Civl).. M.E (Struct).. MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

(Table 60)	k1		0.207	
	k2		0.328	
	P _{bx}	kN	1742.466	
	k1		0.184	
	k2		0.028	
	P _{bz}	kN	1421.166	
	k _x		1.000	
	k _y		1.000	
Minimum Eccentricity	e _x	mm	34.333333	
	e _y	mm	16	
Moments due to min. eccentricity	M _{ex}	kN.m	29.18	<
			89.950	kN.m
Moments due to min. eccentricity	M _{ez}	kN.m	13.60	<
			32.510	kN.m
Total Moments for which the column is to be designed are				
	M _{ux}	kN.m	89.950	
	M _{uz}	kN.m	32.510	
The section is to be checked for biaxial bending				
	P _u /f _{ck} bD		0.111	
	p/f _{ck}		0.0633333	
Referring (d'/D is 0.1)	M _u /f _{ck} bD		0.05	
	M _{ux1}	kN.m	325.125	
Referring to (d'/D = 0.2)	M _u /f _{ck} bD		0.090	
	M _{uy1}	kN.m	206.550	
	M _{ux} /M _{ux1}		0.277	
	M _{uy} /M _{uy1}		0.157	
	P _u /P _{uz}		0.164	
	a		0	1
Mux/Mux1 + Muy/Muy1			0.434	< 1
Area of Reinforcement	As	mm ²	4845	OK
Minimum no of to be provided			8	
No of Bars to be provided	Nos.		16	
Provide 16 Nos of 20 Diameter				

Er. P. RAMAN, B.E (Civil).. M.E (Struct).. M.E., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

3.2 FOUNDATION DESIGN

3.2.1 PILE CAP DESIGN

SLAB						
Bending moment		Req.depth	Total depth	Bar dia.	Clear cover	Effect. depth
(Mu)		(D)	(D)			(d)
(kN-m/m)		(mm)	(mm)	(mm)	(mm)	(mm)
Mx (+) =	547.00	675.15	830	20	50	770
Mx (-) =	621.00	719.37	830	20	50	770
My (+) =	11.00	95.74	830	20	50	750
My (-) =	398.00	575.91	830	20	50	750

Width	Mu/bd ²	p _r required	Ast required	S required	S provided	p _t provided	Remarks
(b)							
(mm)		(%)	(mm ² /m)	mm c/c	mm c/c	(%)	
1000	0.923	0.219	1686.30	186	125	0.272	20Y @ 125 c/c
1000	1.047	0.249	1917.30	164	125	0.272	20Y @ 125 c/c
1000	0.020	0.170	1275.00	246	125	0.279	20Y @ 125 c/c
1000	0.708	0.170	1275.00	246	125	0.279	20Y @ 125 c/c

Check for Shear stresses :				
Shear stress		p _t provided	τ _c	Remarks
(τ _v)			table 19, IS:456	
(N/mm ²)		(%)	(N/mm ²)	
SQx =	0.04	0.272	0.390	safe
SQy =	0.01	0.279	0.394	safe


Er. P. RAMAN, B.E.(Civl), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

3.3 BEAM DESIGN

Beam Design

Beam Data

width	200 mm
depth	700 mm
clear cover to main reinf.	30 mm
Slab Thickness	125 mm

d'	51 mm	$= cc + sdia + mdia/2$
eff depth	650 mm	$= d - d'$

Material Grades

Concrete	30 MPa
Steel	500 MPa

Span Moment 326 KN-m

Support Moment 335 KN-m 335 KN-m
0 KN-m

	Span Moment	Support Moment
Mu/bd ²	3.86	3.97
x _{umax}	296	296
M _{ulim}	337	337
M _{ulim} /bd ²	3.99	3.99

Span Reinforcement

Beam is designed as Singly Reinforced Beam

Area of Steel	Tension (Ast)	Compr (Asc)
Percentage	1.086 %	---
Area of Steel	1410 sqmm	

Refer Table 2 SP 16 pg 48

661 KN-m

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	25 mm	3	1473 sqmm
Layer 2	20 mm	2	628 sqmm
Layer 3	-		
Total Steel Provided			2101 sqmm
Provided Steel OK			

2391 sqmm

1.617 %

Compression Reinforcement

Type	Bar dia	Nos	Area of
------	---------	-----	---------


Er. P. RAMAN, B.E (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

Steel		
Layer 1	-	
Layer 2	-	
Layer 3		
Total Steel Provided		

#VALUE!

Support Reinforcement

Beam is designed as Singly
Reinforced Beam

Area of Steel	Tension (Ast)	Compr (Asc)
Percentage	1.125 %	-----
Area of Steel	1461 sqmm	

Refer Table 2 SP 16 pg
48

Tension Reinforcement

Type	Bar dia	Nos	Area of Steel
Layer 1	20 mm	3	942 sqmm
Layer 2	25 mm	3	1473 sqmm
Layer 3	-		
Total Steel Provided			2415 sqmm
Provided Steel OK			

1.859 %

3.47655076176700
-
0.773499575108680
-
0.038938932347594

2181 sqmm
1822 sqmm

**Compression
Reinforcement**

Type	Bar dia	Nos	Area of Steel
Layer 1	-		
Layer 2	-		
Layer 3			
Total Steel Provided			

#VALUE!

2863 sqmm

Shear Force (Vu)

60 KN

ζ_v

0.462

$=V_u / (b * d)$

ζ_c

0.783

Refer Table 61 SP 16 pg 179

ζ_{cmax}

3.5

Refer Table J SP 16 pg 175

or
 $= (0.85 * \sqrt{(0.8 * f_{ck}) * \sqrt{(1 + 5\beta) - 1}}) / (6\beta)$

Er. P. RAMAN, B.E (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

Type	Bar Dia	Nos	Area of Steel
Layer 1	-		
Layer 2	-		
Layer 3	-		
			0 sqmm

0.000 %

Sectional Dimensions OK
Shear Check OK

Provide Nominal Shear
Reinforcement

Steel	415 MPa
Type of stirrup	2 legged
Stirrup diameter	8 mm
Spacing	300 c/c

Vus/d

-0.643 kN/cm

1.458

Safe


Er. P. RAMAN, B.E (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
 NO 24 GROUND FLOOR ,
 CRR PURAM PHASE -3.,
 MANAPAKKAM ,
 Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

3.4 TWO WAY SLAB DESIGN

Slab Design

Slab thickness	t	125 mm
Concrete	fck	30 MPa
Steel	fy	500 MPa

Sunken Depth	0 mm
--------------	------

Loading

Slab Load

Dead Load	DL	3.125 KN/m
Live Load	LL	3.000 KN/m
Finishes Load	WL	1.000 KN/m
Total Load	Ws	7.125 KN/m
Factored Load	Wsu	11 KN/m

Sunken Slab Load

Dead Load	DL	3.125 KN/m
Filler Load	FL	0 KN/m
Live Load	LL	0.0 KN/m
Finishes Load	WL	0.0 KN/m
Total Load	Wsk	3.13 KN/m
Factored Load	Wsku	5 KN/m

Slab Data

Slab Type	Regular
Load	11 KN/m
Longer Span (ly)	6.33 m
Shorter Span (lx)	3.62 m

ly/lx ratio	1.75
Slab type	+

Loading on edges

W_{longer}	17 KN/m
$W_{shorter}$	13 KN/m

one way

$$.=w*lx/2$$

two way

$$.=(w*lx/2) + (1-(1/3)*(lx/ly)^2)$$

$$.=w*lx/3$$

Moments

M_x	12 KN-m
M_y	8 KN-m

one way

$$.=w*lx^2/8$$

two way

$$.=\alpha_x * w*lx^2$$

$$.=\alpha_y * w*lx^2$$


Er. P. RAMAN, B.E (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
 CMDA Reg. No.: SE/GR-1/2024/02/006
 No.24, Ground Floor, CRR Puram Phase-3,
 Manapakkam, Chennai- 600 125.

Er. P.RAMAN,B.E.,(CIVIL)M.E.,(Struct)
STRUCTURAL ENGINEER.
NO 24 GROUND FLOOR ,
CRR PURAM PHASE -3.,
MANAPAKKAM ,
Chennai- 600 125.

Phone: 9840202004

E-mail: raman_str@yahoo.co.in

Thickness Check	OK	$\therefore M_{ulim} > M_{ux} \text{ or } M_{uy}$
Deflection	50 mm	$\therefore \frac{5 \cdot W \cdot l^4}{384EI}$

Area of Steel	Astx	Asty	Refer Chart 4 SP 16 pg 21 Refer Table 5- 44 SP 16 pg 51-80
	285 sqmm	176 sqmm	

or

Spacing required in mm

8#		10#		12#		16#	
x	y	x	y	x	y	x	x
176 c/c	285 c/c	275 c/c	446 c/c	397 c/c	642 c/c	705 c/c	1141 c/c

$\therefore \text{ast of bar} \cdot 1000 / \text{ast req}$

Final Ast provided	x	y
	10# @ 150c/c	10# @ 150c/c


Er. P. RAMAN, B.E. (Civil), M.E (Struct), MIE., C.Eng.,
Registered Structural Engineer Grade-1(SE)
CMDA Reg. No.: SE/GR-1/2024/02/006
No.24, Ground Floor, CRR Puram Phase-3,
Manapakkam, Chennai - 600 125.