Verified RealEstate™

RE REGULATORY RECORD

RERA Document

The document as the regulator published it, reproduced in full behind this page.

Published for reference. The authority's own register is the operative record.

Verified RealEstate™
3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai 600 097, India

hello@verified.realestate
+91 9996 12 9996
verified.realestate

DIGITALLY VERIFIED RECORD

No.50, Kirupasankari Street, West Mambalam, Chennai - 600 033. ☎: 044-2485 4603.
E-Mail : bournace@gmail.com

BOURNA
CONSULTANTS - ENGINEERS

S.P.S. Inbarajan, M.E. (Structural)
Structural Consultant

Date: 29-01-2025

STRUCTURAL DESIGN STABILITY CERTIFICATE.

It is certified that the Proposed Commercial Cum Residential Building comprising **Stilt Floor + Five floors with 10 Dwelling Units** to be set up **Door Nos:111/1, 111/3,113/4, 113/1, 113/2 & 113/3 OLD DOOR NOS: 58/1, 58/3, 58/4, 58/2/1, 58/2/2 & 58/2/3, Plot No:6, 6A, Chamiers Road, R.A.Puram, Chennai-600 028, Comprised In Survey Nos:3925/23, 3925/32, Block No:86, Mylapore Village, Mylapore- Triplicane Taluk, Within The Limits Of Greater Chennai Corporation.Zone – 09,Division - 122.**have been designed as a RCC structure to withstand the Dead Load, Imposed Load and Wind Load / Earthquake loads ensuring Structural Safety and service ability as per the norms and guidelines prescribed in the following codes of Bureau of Indian Standards.

1. IS: 456-2000 Code of Practice for Plain and Reinforced concrete.
2. IS: 875-1987 Code of Practice for Design loads for Buildings and Structures.
3. IS: 1893-2002 Criteria for Earthquake resistant design of Structures Part-1 general Provisions and Buildings.
4. IS: 4236-1993 Code of Practice for Earthquake resistant design & Construction of Buildings.
5. IS: 13920-1993 Code of Practice for Ductile detailing of concrete structures subjected to seismic forces and
6. National Building code of India – 2005.

It is further certified that the above structures will be constructed from foundation to roof as per structural designs and detailing of reinforcements furnished in our drawings.

Hence, I hereby certify that the Building will be structurally safe and sound for occupation.

For **BOURNA CONSULTANTS ENGINEERS,**

(S.P.S. INBARAJAN.)
Chief Consultant.

S. P. S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302024 Dt. 09.10.2024
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

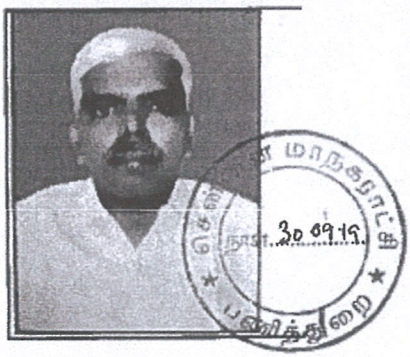
GREATER CHENNAI CORPORATION
WORKS DEPARTMENT

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that **Thiru. Inbarajan S P S** has been enrolled as **Registered Structural Engineer Grade- I (RSE)** in Greater Chennai Corporation (GCC) who has the qualification of **M.E.,(Structural Engg.)** with minimum of **5 Years** experience in the relevant field.

The Registration No. is **RSE100302019** dated **30.09.2019.** It is informed herewith to comply with the scope of work, duties and responsibilities as 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 **29.09.2024.**



30/9/19

Superintending Engineer (Works)
Greater Chennai Corporation.

RGN No: RSE100302019
Dated: 30.09.2019

30/09/19

30.9.19

S. P. S. INBARAJAN
M.E., (Structural) A.M.I.E.,
Structural Consultant
Registered Structural Engineer
Grade-I (RSE) in Greater Chennai Corporation
Reg/ No. RSE 100302019 dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

No.50, Kirupasankari Street, West Mambalam, Chennai - 600 033. ☎: 044-2485 4603.
E-Mail : bournace@gmail.com

BOURNA
CONSULTANTS - ENGINEERS

S.P.S. Inbarajan, M.E. (Structural)
Structural Consultant

STRUCTURAL DESIGN STABILITY CERTIFICATE.

I hereby certify that the Proposed Construction of Commercial Cum Residential Building with 10 Dwelling Units Availing Premium FSI at Door Nos:111/1, 111/3,113/4, 113/1, 113/2 & 113/3 Old Door Nos: 58/1, 58/3, 58/4, 58/2/1, 58/2/2 & 58/2/3, Plot No:6, 6a, Chamiers Road, R.A.Puram, Chennai-600 028, Comprised In Survey Nos:3925/23, 3925/32, Block No:86, Mylapore Village, Mylapore- Triplicane Taluk.Zone – 09,Division - 122.Greater Chennai Corporation. To certify that the building will withstand against the Earthquake, (Seismic Zone III as per IS 1893 (Part I) 2002) loading stress parameters are within limits of National Building Code and Bureau of Indian standards code of practice for concrete and loading. The building consists of Stilt + 5 floors upper floors. The R.C.C. building frame of the structure is designed as per the Indian Standard code of practice for concrete and loadings. The structure will be constructed as per our structural design and detailing of reinforcements given in our drawing from foundation to roof slab and beam. For external and internal partition walls 230/115 thick brick work walls are used.

For **BOURNA CONSULTANTS ENGINEERS,**

(S.P.S. INBARAJAN.)
Chief Consultant.

S. P S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

DESIGN BASIS REPORT

FOR

M/S. INDIA BUILDERS

THE PROPOSED CONSTRUCTION OF COMMERCIAL CUM RESIDENTIAL BUILDING WITH 10 DWELLING UNITS AVAILING PREMIUM FSI AT DOOR NOS:111/1, 111/3,113/4, 113/1, 113/2 & 113/3 OLD DOOR NOS: 58/1, 58/3, 58/4, 58/2/1, 58/2/2 & 58/2/3, PLOT NO:6, 6A, CHAMIERS ROAD, R.A.PURAM, CHENNAI-600 028, COMPRISED IN SURVEY NOS:3925/23, 3925/32, BLOCK NO:86, MYLAPORE VILLAGE, MYLAPORE- TRIPLICANE TALUK, WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.ZONE – 09,DIVISION - 122.

S. P S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

TABLE OF CONTENTS

1.0 OBJECTIVE

2.0 DESIGN LOADS

2.1 Dead Loads

2.2 Imposed Loads

2.3 Earthquake Loads

2.4 Load Combinations

3.0 ANALYSIS METHOD

4.0 DESIGN ASSUMPTION

5.0 FOUNDATION DESIGN

6.0 MATERIALS

7.0 NOMINAL COVER TO REINFORCEMENT

S. P. S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

1.0 OBJECTIVE

The Design basis covers the basic requirement that will be followed for the design of THE PROPOSED CONSTRUCTION OF COMMERCIAL CUM RESIDENTIAL BUILDING FOR M/S.INDIA BUILDERS WITH 10 DWELLING UNITS AVAILING PREMIUM FSI AT DOOR NOS:111/1, 111/3,113/4, 113/1, 113/2 & 113/3 OLD DOOR NOS: 58/1, 58/3, 58/4, 58/2/1, 58/2/2 & 58/2/3, PLOT NO:6, 6A, CHAMIERS ROAD, R.A.PURAM, CHENNAI-600 028, COMPRISED IN SURVEY NOS:3925/23, 3925/32, BLOCK NO:86, MYLAPORE VILLAGE, MYLAPORE- TRIPLICANE TALUK, WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION.ZONE – 09,DIVISION - 122.

The building is designed for Stilt + 5 Floors. The structure is supported on column in turn resting on Pile Foundation. The Structural system comprises columns, beams, slabs and wall structure.

3-D Analysis of all the building structures will be carried out using STAAD PRO software package and analysis results shall be used for designing the various elements.

2.0 DESIGN LOADS

2.1 Dead Loads

The Dead loads that are envisaged to act permanently are considered as per IS**: 875 (Part 1) – 1987 – Dead loads.** Indian Standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures"**.

1. Slab is assumed to be 150mm thick – 3.75 KN/m²
2. Slab is assumed to be 125mm thick – 3.125 KN/m²
3. Floor finish – 1.5KN/m²
4. Brick work masonry walls 230thick are proposed to be used (location of walls per Architectural drawings) Unit weight is taken as 20 KN/m^3
5. Weathering course in Terrace finish – 3 KN/m^2

S P S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

2.2 Imposed Loads

The imposed loads that are envisaged to act permanently are considered as per **IS : 875 (Part 2) – 1987** . Indian Standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures"**.

1. Living = 2 KN/m^2
2. Staircase = 4 KN/m^2
3. Toilets = 2 KN/m^2
4. Terrace floors = 1.5 KN/m^2

2.3 Earthquake Load

The loading due to earthquake is assessed based on the provisions of **IS: 1893-2016**. Structure with ductile detailing is considered as per **IS: 13920-2016.**

CHENNAI falls under Seismic Zone III

Zone factor	=	**0.16**
Response reduction factor	=	**5**
Importance factor	=	**1.0**

Structure with ductile detailing is considered as per IS: 13920-2016

2.4 Load Combinations

The various loads shall be combined in accordance with the stipulations in IS: 875 (Part 5) – 1987. Whichever combinations produced the most unfavorable effect in the building, foundations or structural member concerned shall be adopted. The various load combinations considered in the analysis are as follows:

1. 1(DL+LL)
2. 1 DL+0.8 LL+ 0.8 SQX +1
3. 1 DL+0.8 LL+ 0.8 SQX -1
4. 1 DL+0.8 LL+ 0.8 SQZ +1
5. 1 DL+0.8 LL+ 0.8 SQZ -1

6. 1.0 (DL+SQX +)
7. 1.0 (DL+SQX -1)
8. 1.0 (DL+SQZ +1)
9. 1.0 (DL+SQZ -1)
10. 1.5(DL+LL)
11. 1.5(DL+SQX +1)
12. 1.5(DL+SQX -1)
13. 1.5(DL+SQZ +1)
14. 1.5(DL+SQZ -1)
15. 1.2(DL+LL+SQX +1)
16. 1.2(DL+LL+SQX -1)
17. 1.2(DL+LL+SQZ +1)
18. 1.2(DL+LL+SQZ -1)
19. 0.9DL+1.5SQX+1
20. 0.9DL+1.5SQX -1
21. 0.9DL+1.5SQZ +1
22. 0.9DL+1.5SQZ -1

The above load combinations will be considered and effect of worst combinations Will be taken for design of various building elements.

3.0 ANALYSIS METHODS

The analysis of the structures is carried out using the STAAD PRO. The entire super-structure is modeled using frame elements as appropriate. Beams and columns are modeled as frame elements. Appropriate loads and its combinations, as per relevant IS code clauses, for most unfavorable effects are chosen for design. Various load cases considered in the analysis are briefed above.

4.0DESIGNASSUMPTION

4.1.1 The Base of the Foundation is assumed to be FIXED.

4.1.2 All Concrete elements shall be designed in accordance with IS456:2000 Limit State Design.

4.1.3 Appropriate loads and its combinations, as per relevant clauses, for the most unfavorable effects are chosen for design.(Refer Load Combination below).

5.0FOUNDATIONDESIGN

Type of Foundation : Pile foundation.

Depth of Foundation : 30 m

6.0MATERIALS

The self-weight of the various elements are computed based on the unit weight of materials a sgiven below:

S.no	Materials	Unit weight KN/m^3
1	Reinforced Cement Concrete	25
2	Solid Block/Brick	20
3	Steel	78.50

Structural concrete shall be of grade M25 for Pile

Structural concrete shall be of grade M20 for Pilecap & Column

Structural concrete shall be of grade M20 for Beam & Slab

Steel reinforcement shall be of Grade Fe500 confirming to IS:1786-2008.

7.0NOMINALCOVERTOREINFORCEMENT

From Durability requirement, exposure conditionis assumed as mild for structural elements above ground level and moderate for structural elements below ground level.

The Clear cover to reinforcement to meet durability requirement shall be as follows:

Column –40mm

Pile cap – 100mm

Beam – 25mm

Slab – 20mm

DESIGN OF BEAM: 1

Beam size: 230mm x 450mm

Bending moment at support = 140kNm

Bending moment at mid span = 133kNm

Shear force, Vu = 149kN

Bending moment at support, Mu = 140kNm

$R = (140 \times 10^6)/230x409^2$

$= 3.64$

Pt/100 =Ast/bd = fck/2fy [1-Sq.rt (1-4.598xR/fck)\

fck = 20 N/mm^2

fy = 500 N/mm^2

Pt = 1.07%

Ast required = 1013 mm^2

Provide 6nos of 16Y

Ast provided = 1206 mm^2

Hence safe.

Bending moment at mid span, Mu = 133kNm

$R = (133 \times 10^6)/230 \times 409^2$

$= 3.46$

Pt = 1.0%

Ast required = 944 mm^2

Provide 6nos of 16Y

Ast provided = 1206 mm^2

Hence it is safe

Shear force, Vu, = 149kN

τv = Vu/bd

= $(149 \times 10^3)/ 230 \times 409$

= $1.58\ N/mm^2$

Hence ok.

Shear capacity of concrete:

Pt = 1.0 %

τc = 0.62

= τc bd

= 0.62X 230 X 409

= 58323 N (or) 58 kN

Shear to be carried by stirrups

Vu = Vs – τc bd

= 149 – 58 kN

= 91kN

Therefore, provide 2 legged 10Y @ 150 mm C/C at the supports.

Provide 2 legged 10Y @ 200mm C/C at the midspan.

DESIGN OF BEAM: 2

Beam size: 230mm x 525mm

Bending moment at support = 132kNm

Bending moment at mid span = 111kNm

Shear force, Vu = 96kN

Bending moment at support, Mu = 132kNm

R = $(132 \times 10^6)/230x484^2$

= 2.44

Pt/100 =Ast/bd = fck/2fy [1-Sq.rt (1-4.598xR/fck)\

fck = 20 N/mm^2

fy = 500 N/mm^2

Pt = 0.65%

Ast required = 725 mm^2

Provide 4nos of 16Y

Ast provided = 804 mm^2

Hence safe.

Bending moment at mid span, Mu = 111kNm

R = (111 x 10^6)/230 x 484^2

= 2.06

Pt = 0.53%

Ast required = 593 mm^2

Provide 4 nos of 16Y

Ast provided = 804 mm^2

Hence it is safe

Shear force, Vu, = 96kN

τv = Vu/bd

= 96 x 10^3 / 230 x 484

= 0.86 N/mm^2

Hence ok.

<u>Shear capacity of concrete:</u>

Pt = 0.65 %

τc = 0.53

= τc bd

= 0.53 X 230 X 484

	=	58999 N (or) 59kN

Shear to be carried by stirrups

Vu	=	Vs – τc bd
	=	96 – 59 kN
	=	37kN

Therefore, provide 2 legged 8Y @ 100 mm C/C at the supports.

Provide 2 legged 8Y @ 200 mm C/C at the midspan.

Design of Pile Cap :

Safe load for 600mm Dia pile	=	1130 KN
Concrete grade for pile cap	=	M20
Un factored Column load	=	1442KN
No of piles required	=	1442/1130 = 1.28
Provide 2 nos of Pile (600Ø)		
Spacing of Piles	=	1800mm
	=	1.8m
Factored load	=	1442 x 1.5
	=	2163
Bending moment WL/4	=	2163 x 1.8 / 4
	=	973KNM
R = MU/bd^2	=	973 x 10^6 / 975 x 875^2
	=	1.3
fck	=	20N/mm^2
fy	=	500N/mm^2
Pt/100 = Ast/bd	=	fck/2fy [1-sqrt (1 - 4.598xR/20)]

Ast required = 2739 mm^2

Provide 7 nos of 25 Dia bar

Ast provided = 3437mm^2

Ast required > Ast provided

Hence it is safe.

DESIGN OF COLUMN C1

Length of column	D	450	mm	
Breadth of column	b	230	mm	
Unsupported length (longer direction)	L_x	2700	mm	
Unsupported length (shorter direction)	L_y	2700	mm	
Eff. Length (longer direction)	L_{ex}	2160	mm	
Eff. Length (shorter direction)	L_{ey}	2160	mm	
Factored Load	P_u	1051	kN	
Factored moment (longer direction)	Mux	65	kNm	
Factored moment (shorter direction)	Muz	21	kNm	
Charac. comp strength of concrete	f_{ck}	20	N/mm^2	
Yield stress of steel	f_y	500	N/mm^2	
Dia of bar used	Φ	20	mm	
Clear cover		40	mm	
Effective cover	d'	50	mm	
Effective depth	d	400	mm	
Check for slenderness				
Longer Direction				
Slenderness ratio	L_{ex}/D	4.80	**short**	
Additional moment due to slenderness	M_{ax}	0	kN-m	
Shorter Direction				
Slenderness ratio	L_{ey}/b	9.39	**short**	
Additional moment due to slenderness	M_{ay}	0	kN-m	
Calculation of P_{uz}				
No of bars used		8		
Area of reinforcement	Ast	2512		
Provided steel		8 nos Y20		
Percentage of reinforcement	p_t	2.427	%	
Area of concrete	Ag	103500	mm^2	
Ultimate axial load (without moments)	P_{uz}	1851	kN	
Calculation of P_b:				
Longer Direction				
	d'/D	0.111		
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1x}	0.204	From Sp16	
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2x}	0.398		
Axial load corresponding to balanced failure	P_{bx}	523	kN	
Reduction factor for additional moments	k_x	1.000		
Moment due to slenderness	M_{ax}	**0.00**	kN-m	
Shorter Direction				
	d'/b	0.217		
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1y}	0.179		
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2y}	0.143		
Axial load corresponding to balanced failure	P_{by}	406	kN	
Reduction factor for additional moments	k_y	0.554		
Moment due to slenderness	M_{ax}	**0.00**	kN-m	
Check for moments due to min. eccentricity				
Longer Direction				
Minimum eccentricity	e_x	20.40	mm	

Moment due to min. eccentricity			M_x	21.44	kN-m
Moment in longer direction			M_{ux}	65.00	kNm
Shorter direction					
Minimum eccentricity			e_y	13.07	mm
Moment due to min. eccentricity			M_y	13.73	kN-m
Moment in shorter direction			M_{uy}	21	kNm
Final design moments					
Moment in longer direction			M_{ux}	**65.00**	kNm
Moment in shorter direction			M_{uy}	**21.00**	kNm
Check for interaction					
			d'/D	0.111	
			d'/b	0.217	
p/f_{ck}			p/f_{ck}	0.121	
$P_u/f_{ck}bD$ value			$P_u/f_{ck}bD$	0.508	
$M_{ux1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{ux1}/f_{ck}bD^2$	0.130	
Uniaxial moment capacity (longer direction)			M_{ux1}	**121.095**	kNm
$M_{uy1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{uy1}/f_{ck}bD^2$	0.110	
Uniaxial moment capacity (shorter direction)			M_{uy1}	**52.371**	kNm
P_u/P_{uz} ratio			P_u/P_{uz}	**0.568**	
Value of exponent				1.614	
Interaction ratio				**0.595**	
Percentage reinforcement satisfactory or not				**safe**	
b/D ratio			b/D	0.51111111	
Status of dimensions				**OK**	
Gross area			A_g	103500	mm^2
Area of core			A_k	60800	mm^2
Spacing of lateral ties			S	57.5	mm
Larger dimension of the hoop			H	230	mm
Cross sectional area of hoop			A_{sh}	66.87	mm^2

DESIGN OF COLUMN C2

Length of column		D	375	mm
Breadth of column		b	300	mm
Unsupported length (longer direction)		L_x	2700	mm
Unsupported length (shorter direction)		L_y	2700	mm
Eff. Length (longer direction)		L_{ex}	2160	mm
Eff. Length (shorter direction)		L_{ey}	2160	mm
Factored Load		P_u	895	kN
Factored moment (longer direction)		Mux	41	kNm
Factored moment (shorter direction)		Muz	11	kNm
Charac. comp strength of concrete		f_{ck}	20	N/mm^2
Yield stress of steel		f_y	500	N/mm^2
Dia of bar used		Φ	16	mm
Clear cover			40	mm
Effective cover		d'	48	mm
Effective depth		d	327	mm
Check for slenderness				
Longer Direction				
Slenderness ratio		L_{ex}/D	5.76	**short**
Additional moment due to slenderness		M_{ax}	0	kN-m
Shorter Direction				
Slenderness ratio		L_{ey}/b	7.20	**short**
Additional moment due to slenderness		M_{ay}	0	kN-m
Calculation of P_{uz}				
No of bars used			8	
Area of reinforcement		Ast	1607.68	
Provided steel			8 nos Y16	
Percentage of reinforcement		p_t	1.429	%
Area of concrete		Ag	112500	mm^2
Ultimate axial load (without moments)		P_{uz}	1601	kN
Calculation of P_b:				
Longer Direction				
		d'/D	0.128	
Coefficient k_1(from TABLE 60 of SP:1980)		k_{1x}	0.200	From Sp16
Coefficient k_2(from TABLE 60 of SP:1980)		k_{2x}	0.358	
Axial load corresponding to balanced failure		P_{bx}	508	kN
Reduction factor for additional moments		k_x	1.000	
Moment due to slenderness		M_{ax}	**0.00**	kN-m
Shorter Direction				
		d'/b	0.160	
Coefficient k_1(from TABLE 60 of SP:1980)		k_{1y}	0.193	
Coefficient k_2(from TABLE 60 of SP:1980)		k_{2y}	0.281	
Axial load corresponding to balanced failure		P_{by}	479	kN
Reduction factor for additional moments		k_y	0.629	
Moment due to slenderness		M_{ax}	**0.00**	kN-m
Check for moments due to min. eccentricity				
Longer Direction				
Minimum eccentricity		e_x	17.90	mm

Moment due to min. eccentricity			M_x	16.02	kN-m
Moment in longer direction			M_{ux}	41.00	kNm
Shorter direction					
Minimum eccentricity			e_y	15.40	mm
Moment due to min. eccentricity			M_y	13.78	kN-m
Moment in shorter direction			M_{uy}	13.783	kNm
Final design moments					
Moment in longer direction			M_{ux}	**41.00**	kNm
Moment in shorter direction			M_{uy}	**13.78**	kNm
Check for interaction					
			d'/D	0.128	
			d'/b	0.160	
p/f_{ck}			p/f_{ck}	0.071	
$P_u/f_{ck}bD$ value			$P_u/f_{ck}bD$	0.398	
$M_{ux1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{ux1}/f_{ck}bD^2$	0.090	
Uniaxial moment capacity (longer direction)			M_{ux1}	**75.9375**	kNm
$M_{uy1}/f_{ck}bD^2$ value (from SP 16:1980 charts)			$M_{uy1}/f_{ck}bD^2$	0.090	
Uniaxial moment capacity (shorter direction)			M_{uy1}	**60.75**	kNm
P_u/P_{uz} ratio			$P_u/P_{[illegible]}$	**0.559**	
Value of exponent				1.599	
Interaction ratio				**0.466**	
Percentage reinforcement satisfactory or not				**safe**	
b/D ratio			b/D	0.8	
Status of dimensions				**OK**	
Gross area			A_g	112500	mm^2
Area of core			A_k	70150	mm^2
Spacing of lateral ties			S	75	mm
Larger dimension of the hoop			H	230	mm
Cross sectional area of hoop			A_{sh}	74.98	mm^2

DESIGN OF SLAB S1

ROOF LEVEL SLAB

Design of two way Slab

Basic Data

Grade of concrete (fck)		=	M 20	
Grade of steel (fy)		=	Fe 500	
Thickness of slab (D)		=	125	mm
Clear cover (cc)		=	15	mm
Effective thickness of slab (deff)	= 125 - 15 - 8 /2	=	106	mm
Unit weight of concrete		=	25	KN/m^3
Effective Shorter Span (Lx)		=	3.18	m
Effective Longer Span (Ly)		=	3.467	m
Aspect ratio Ly/Lx		=	1.09	**Two way slab**

Edge Condition : **Two adjacent Edges Discontinous**

Load Data

Dead Load	= 0.13 x 25	=	3.125	KN/m^2
Floor finish		=	1.50	KN/m^2
Imposed Load		=	2.00	KN/m^2
Total load		=	6.63	KN/m^2
Design load (Wu) = 1.5 x 6.625		=	**9.94**	KN/m^2

Moment and Shear Calculations

Short Span Direction

ax for positive moment	1	→	0.035		
	1.1	→	0.04		
	for 1.09	αx	=	0.040	
Positive moment Mx	0.040 x 9.94 x 3.18 ^2		=	**3.97**	KN-m
ax for negative moment	1	→	0.047		
	1.1	→	0.053		
	for 1.09	αx	=	0.052	
Negative moment Mx :	0.052 x 9.94 x 3.18 ^2		=	**5.27**	KN-m

Long Span Direction

For positive moment		αy	=	0.035	
Positive moment My :	0.035 x 9.94 x 3.18 ^2		=	**3.52**	KN-m
For negative moment		αy	=	0.047	
Negative moment My :	0.047 x 9.94 x 3.18 ^2		=	**4.72**	KN-m

Shear force V_u = 9.94 x 3.2 x 0.5 = **15.80** KN

Check Effective Depth for Bending

Depth required = $(M_x / (0.133x\ fck \times b))^{1/2}$ = 44.50 mm

Depth provided = 125 - 15 - 8 /2 = 106 mm

Hence O.K

Reinforcement calculations

Short Span Direction @ Support

$Mu/bd^2 = \frac{5.27 \times 10 \wedge 6}{1000 \times 106 \times 106} = \mathbf{0.469}$

Pt = **0.11** %

Area of steel Ast = 0.00111 x 1000 x 106 = 117.55 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C

Short Span Direction @ Mid Span

$Mu/bd^2 = \frac{3.97 \times 10 \wedge 6}{1000 \times 106 \times 106} = 0.353$

Pt = 0.083 %

Area of steel Ast = 0.00083 x 1000 x 106 = 87.982 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C 100

Provided % of Tension Reinforcement (pt) = **0.316** %

Long Span Direction @ Support

$Mu/bd^2 = \frac{4.72 \times 10 \wedge 6}{1000 \times 106 \times 106} = 0.420$

Pt = 0.099 %

Area of steel Ast = 0.00099 x 1000 x 106 = 105.09 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C

Long Span Direction @ mid Span

$Mu/bd^2 = \frac{3.52 \times 10 \wedge 6}{1000 \times 106 \times 106} = 0.313$

Pt = 0.073 %

Area of steel Ast = 0.00073 x 1000 x 106 = 77.742 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C

Check for Deflection:

Basic Span/depth Ratio = 22

% of Tension Reinforcement provided (pt) = 0.316 %

Service stress of steel (fs) : 0.58fy(Ast_r/Ast_p) = 76.14 N/mm^2

Modification Factor for Tension Reinforcement (F1) = 2.00

Allowable Span/Eff Depth Ratio = 44

Actual Span/Eff Depth Ratio = 3.18 x 1000 / 106 = 30.00

Hence O.K

DESIGN OF SLAB S2

ROOF LEVEL SLAB

Design of two way Slab

Basic Data

Grade of concrete (fck)	=	M 20	
Grade of steel (fy)	=	Fe 500	
Thickness of slab (D)	=	125	mm
Clear cover (cc)	=	15	mm
Effective thickness of slab (deff) = 125 - 15 - 8 /2	=	106	mm
Unit weight of concrete	=	25	KN/m^3
Effective Shorter Span (Lx)	=	3.35	m
Effective Longer Span (Ly)	=	3.467	m
Aspect ratio Ly/Lx	=	1.03	**Two way slab**

Edge Condition : **Two adjacent Edges Discontinous**

Load Data

Dead Load = 0.13 x 25	=	3.125	KN/m^2
Floor finish	=	1.50	KN/m^2
Imposed Load	=	2.00	KN/m^2
Total load	=	6.63	KN/m^2
Design load (Wu) = 1.5 x 6.625	=	**9.94**	KN/m^2

Moment and Shear Calculations

Short Span Direction

ax for positive moment 1 →		0.035	
1.1 →		0.04	
for 1.03 αx	=	0.037	
Positive moment Mx 0.037 x 9.94 x 3.35 ^2	=	**4.10**	KN-m
ax for negative moment 1 →		0.047	
1.1 →		0.053	
for 1.03 αx	=	0.049	
Negative moment Mx : 0.049 x 9.94 x 3.35 ^2	=	**5.48**	KN-m

Long Span Direction

For positive moment αy	=	0.035	
Positive moment My : 0.035 x 9.94 x 3.35 ^2	=	**3.90**	KN-m
For negative moment αy	=	0.047	
Negative moment My : 0.047 x 9.94 x 3.35 ^2	=	**5.24**	KN-m

S. P. S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

Shear force V_u = 9.94 x 3.4 x 0.5 = **16.65** KN

Check Effective Depth for Bending

Depth required = $(M_x / (0.133x\ fck \times b))^{1/2}$ = 45.37 mm

Depth provided = 125 - 15 - 8 /2 = 106 mm

Hence O.K

Reinforcement calculations

Short Span Direction @ Support

Mu/bd^2 = $\frac{5.48 \times 10 \wedge 6}{1000 \times 106 \times 106}$ = **0.487**

Pt = **0.12** %

Area of steel Ast = 0.00115 x 1000 x 106 = 122.33 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 402.12 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **125** mm C/C

Short Span Direction @ Mid Span

Mu/bd^2 = $\frac{4.10 \times 10 \wedge 6}{1000 \times 106 \times 106}$ = 0.365

Pt = 0.086 %

Area of steel Ast = 0.00086 x 1000 x 106 = 90.868 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 402.12 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **125** mm C/C 100

Provided % of Tension Reinforcement (pt) = **0.379** %

Long Span Direction @ Support

S. P S. INBARAJAN, M.E., (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600

$Mu/bd^2 = \frac{5.24 \times 10 \wedge 6}{1000 \times 106 \times 106} = 0.467$

Pt = 0.110 %

Area of steel Ast = 0.00110 x 1000 x 106 = 116.96 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C

Long Span Direction @ mid Span

$Mu/bd^2 = \frac{3.90 \times 10 \wedge 6}{1000 \times 106 \times 106} = 0.347$

Pt = 0.082 %

Area of steel Ast = 0.00082 x 1000 x 106 = 86.458 mm^2

Minimum area of steel 0.0012 x 1000 x 125 = 150.00 mm^2

Spacing of Y **8** bars 50.27 x 1000 / 150.00 = 334.93 mm

Ast provided = 335.1 mm^2

Check for Spacing

Minimum of

1) 3d = 318 mm

2) = 300 mm

3) = 334.93 mm

Therefore provide Y **8** @ **150** mm C/C

Check for Deflection:

Basic Span/depth Ratio = 22

% of Tension Reinforcement provided (pt) = 0.379 %

Service stress of steel (fs) : 0.58fy(Ast_r/Ast_p) = 65.53 N/mm^2

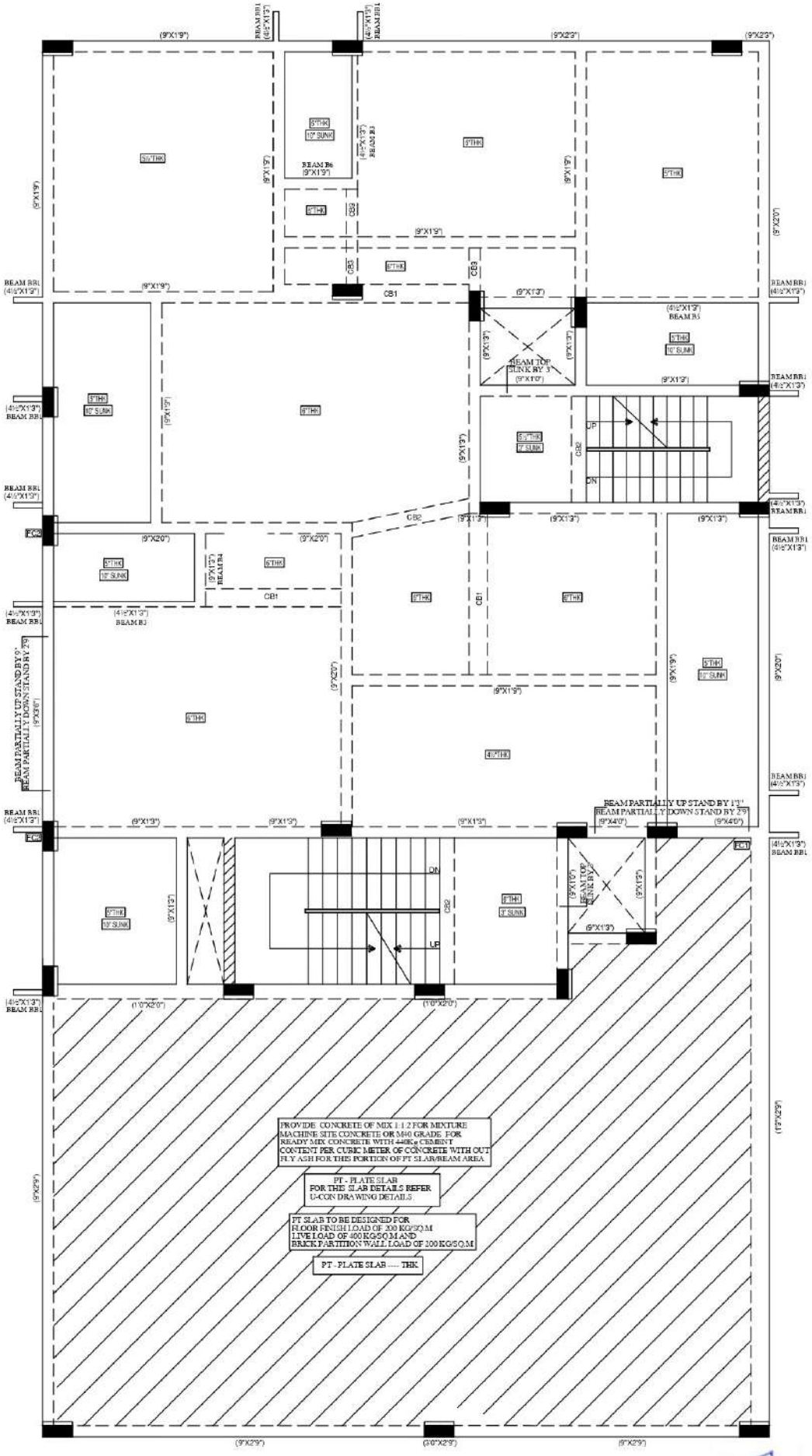
Modification Factor for Tension Reinforcement (F1) = 2.00

Allowable Span/Eff Depth Ratio = 44

Actual Span/Eff Depth Ratio = 3.35 x 1000 / 106 = 31.60

Hence O.K

S. INBARAJAN, M.E. (Struct)
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
Grade-I (RSE) in Greater Chennai Corporation
Reg. No. RSE 100302019 Dt. 30.09.2019
Door No:50, Kirupasankari Street,
West Mambalam, Chennai-600 033.



TYPICAL FLOOR PLAN
I, II, III, IV AND V

S. P. S. INBARAJAN
M.E., (Structural) A.M.I.E.,
Structural Consultant
Registered Structural Engineer
Grade-I (RSE) in Greater Chennai Corporation
Reg/ No. RSE 100302019 dt. 30.09.2019
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

Verified RealEstate
3/350/2 Mettukuppam,
OMR Thoraipakkam,
Chennai 600 097, India
hello@verified.realestate
+91 9996 12 9996

Prepared from the registers named on the page each finding sits on. Where a register could not be read, this document says so in its place rather than leaving the gap to be read as a clean result.