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BOURNA
CONSULTANTS - ENGINEERS

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

STABILITY CERTIFICATE

(to be furnished while filling application for registration of building)

The detailed engineering and structure design of the proposed building comprising of Residential Building with 10 dwelling (Stilt + 5 upper floors) at M/s Khurinji Homes Private Limited – Project Name: Khurinji's Verbena, Plot No.4& 5, Old Door No.8 & 9, New Door No.6 & 8, Venkatrathnam Nagar Extension 1st Street, Adyar, Chennai - 600020, Comprised in Old S.No.26/3 (Part) (Document) and T.S.No.22/6 & 22/7, Block 8 of Pallipattu Village,within the limit of Greater Chennai Corporation has been done by me/us based on the report of geotechnical investigation (Soil Test) done by M/s NAGADI CONSULTANTS PRIVATE LIMITED, NO.61C, EAST COAST ROAD, THIRUVANMIYUR, CHENNAI 600041, Report No.G(C) 9979, Dt.22.10.2024 and considering the functional requirement of the Building.

2. It is certified that among other factors, the proposed building has been designed to resist earthquake. I/We have checked various parameters and found that the proposed building would be safe.

3. I/We further certify that:

(i) The minimum grade of concrete is M_{25}

(ii) The design and analysis have been done using the code of practice for plain and reinforced concrete as per IS456, design loads as per IS Code No . IS 875 and design of earthquake resistant structure as per IS Code NO. IS 1893

4. The building will be safe and sound when used for the purpose for which it is designed.

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.

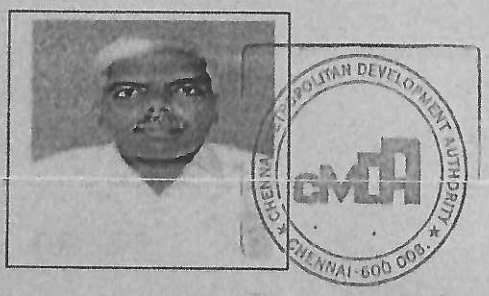
CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'ThalamuthuNatarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the **Thiru. S.P.S. INBARAJAN** has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E.,(Structural Engg.)** and experience in the relevant field for **30 years.**

He has been given the Registration No.**SE/GR-I/2024/02/009** 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.**



22/2/24

(A. MEGANATHAN)
Superintendent

S. P S. INBARAJAN.
M.E., (Struct)A.M.I E.,
Structural Consultant
Registered Structural Engineer
Grade-I (SE) in CMDA
Reg. No SE/GR-1/2024/02/009 Dt. 27.02.202
Door No.50, Kirupasankari St
West Mambalam Chenn

DESIGN BASIS REPORT

FOR

M/s. Khurinji Homes Private Limited.

THE PROPOSED CONSTRUCTION OF RESIDENTIAL BUILDING WITH 10 DWELLING AT PLOT NO: 4 & 5, OLD DOOR NO: 8 & 9, NEW DOOR NO: 6 & 8, VENKATRATHNAM NAGAR EXTENSION 1st STREET, ADYAR, CHENNAI - 600020. COMPRISED IN OLD S.NO: 26/3 (Part) (Document) ANDT.S.NO:-22/6 & 22/7, BLOCK NO:8 OF PALLIPATTU VILLAGE, WITHIN THE LIMIT OF GREATER CHENNAI CORPORATION. DIVISION NO:- 175. ZONE :- 13.

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Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

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Reg. No. RSE 15/302/24 Dt. 09.10.2024
Door No 50, Krupasankari 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 RESIDENTIAL BUILDING WITH 10 DWELLING AT PLOT NO: 4 & 5, OLD DOOR NO: 8 & 9, NEW DOOR NO: 6 & 8, VENKATRATHNAM NAGAR EXTENSION 1st STREET, ADYAR, CHENNAI - 600020. COMPRISED IN OLD S.NO: 26/3 (Part) (Document) ANDT.S.NO:-22/6 & 22/7, BLOCK NO:8 OF PALLIPATTU VILLAGE, WITHIN THE LIMIT OF GREATER CHENNAI CORPORATION. DIVISION NO:- 175. ZONE :- 13.

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/m^2
2. Slab is assumed to be 125mm thick – 3.125 KN/m^2
3. Floor finish – 1.5KN/m^2
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

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Reg. No. RSE 100302024 Dt. 09.10.2024
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 AllConcreteelementsshallbedesignedinaccordancewithIS456:2000LimitState Design.

4.1.3 Appropriate loads and its combinations, as per relevant clauses, for themostunfavorableeffectsarechosenfordesign.(ReferLoadCombinationbelow)

.

5.0FOUNDATIONDESIGN

Type of Foundation : Pile foundation.

Depth of Foundation : 14.0m

6.0MATERIALS

Theself-

weightofthevariouselementsarecomputedbasedontheunitweightofmaterialsasgivenb

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 Pile cap& Column

Structural concrete shall be of grade M20for Beam & Slab

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

7.0NOMINALCOVERTOREINFORCEMENT

From Durability requirement, exposure condition is assumed as mild for structural elements above ground level and mode rate for structural elements below ground level.

The Clear cove 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

τ_v = Vu/bd

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

= $1.58\ N/mm^2$

Hence ok.

Shear capacity of concrete:

Pt = 1.0 %

τ_c = 0.62

= τ_c bd

= 0.62X 230 X 409

= 58323 N (or) 58 kN

Shear to be carried by stirrups

Vu = Vs – τ_c 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

τ_v = 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 %

τ_c = 0.53

= τ_c bd

= 0.53 X 230 X 484

= 58999 N (or) 59kN

Shear to be carried by stirrups

Vu = Vs – $\bar{C}$c 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 = $973 \times 10^6 / 975 \times 875^2$

= 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_{uz}	**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 = $(M_x / (0.133x\ fck\ x\ b))^{1/2}$ = 44.50 mm

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

Hence O.K

Reinforcement calculations

Short Span Direction @ Support

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

Provided % of Tension Reinforcement (pt) = **0.316** % 100

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

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

Check Effective Depth for Bending

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

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

100

Long Span Direction @ Support

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

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

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GREATER CHENNAI CORPORATION
TOWN PLANNING DEPARTMENT

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that **Mr. S.P.S. Inbarajan** has been enrolled as **Registered Structural Engineer Grade- I (RSE)** in Greater Chennai Corporation (GCC) who has the qualification of **M.E., (Structural Engg.,)** has been renewed for the period up to 08.10.2029

The Registration No. is **RSE100302024** dated **09.10.2024** 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 MA&WS (MA1) Dept. dated 04.02.2019. and as amended in G.O.(MS) No.16 MA&WS (MA1) Dept, dated 31.01.2020.

This Registration is valid upto **08.10.2029**



RGN No: RSE100302024
Dated : 09.10.2024

9/10/24

Superintending Engineer (TP)
Greater Chennai Corporation. 2/2

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