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DESIGN BASIS REPORT

FOR

M/S. STERLING ESTATES AND PROPERTIES LTD

THE PROPOSED CONSTRUCTION OF RESIEDENTIAL BUILDING WITH 14 DWELLING UNITS AT PLOT NO.25 & 118, OLD DOOR NO.22, NEW DOOR NO.40, MANGADU SWAMY STREET, NUNGAMBAKKAM, CHENNAI-600 034. COMPRISED IN OLD S.NO.132, NEW S.NO.303/1, 303/2, BLOCK NO.25 OF NUNGAMBAKKAM VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION. DIVISION: 113, ZONE:IX.

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Reg. No. SE/GR-1/2024/02/009 dt. 27.02.2024
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Reg. No. RSE 100302024 Dt. 09.10.2024
Door No.50, Kirupasankari Street,
West Mambalam, Chennai-600 033.

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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 RESIEDENTIAL BUILDING WITH 14 DWELLING UNITS FOR M/S. STERLING ESTATES AND PROPERTIES LTD AT PLOT NO.25 & 118, OLD DOOR NO.22, NEW DOOR NO.40, MANGADU SWAMY STREET, NUNGAMBAKKAM, CHENNAI-600 034. COMPRISED IN OLD S.NO.132, NEW S.NO.303/1, 303/2, BLOCK NO.25 OF NUNGAMBAKKAM VILLAGE WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION. DIVISION: 113, ZONE:IX.

The building is designed for Stilt + 3 Floors. The structure is R.C.C framed 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

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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. All floors = 4 KN/m^2
2. 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

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. 1.0 (DL+LL)
2. 1.0 DL+ 1.0 SQX+1
3. 1.0 DL+ 1.0 SQX-1
4. 1.0 DL+ 1.0 SQZ+1
5. 1.0 DL+ 1.0 SQZ-1
6. 1.0 DL+ 0.8 LL + 0.8 SQX+1

7. 1.0 DL+ 0.8 LL + 0.8 SQX-1
8. 1.0 DL+ 0.8 LL + 0.8 SQZ+1
9. 1.0 DL+ 0.8 LL + 0.8 SQZ-1
10. 1.5 (DL+LL)
11. 1.2 (DL+LL+EQX+1)
13. 1.2 (DL+LL-EQX-1)
14. 1.2 (DL+LL+EQZ+1)
15. 1.2 (DL+LL-EQZ-1)
16. 1.5 (DL+EQX+1)
17. 1.5 (DL+EQX-1)
18. 1.5 (DL+EQZ+1)
19. 1.5 (DL+EQZ-1)
20. 0.9 DL + 1.5 EQX+1
21. 0.9 DL + 1.5 EQX-1
22. 0.9 DL + 1.5 EQZ+1
23. 0.9 DL + 1.5 EQZ-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.

4.0 DESIGNASSUMPTION

4.1.1 The Base of the Foundation is assumed to be PINNED

4.1.2 SBC of soil is taken as 150 kN/m2 at a depth of 2.00m.

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

4.1.4 Appropriate load sand its combinations, as per relevant clauses, for the most un favorable effects are chosen for design.(Refer Load Combination below)

5.0 MATERIALS

The self-weight of the various elements are computed based on the unit weight of materials as given 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 M20 for all structural Elements.

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

6.0 NOMINAL COVER TO REINFORCEMENT

From Durability requirement, exposure condition is 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

Footing –50mm

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

$R = (140 \times 10^6)/230 \times 409^2$

$= 3.64$

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

fck = 20 N/mm^2

fy = 415 N/mm^2

Pt = 1.19%

Ast required = 1119 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 = 1.1%

Ast required = 1035 mm^2

Provide 6nos of 16Y

Ast provided = 1206 mm^2

Hence it is safe

Shear force, Vu, = 149kN

$\tau v = Vu/bd$

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

= 1.58 N/mm^2

Hence ok.

Shear capacity of concrete:

Pt = 1.28 %

$\bar{C}c$ = 0.68

= $\bar{C}c$ bd

= 0.68 X 230 X 409

= 63968 N (or) 64 kN

Shear to be carried by stirrups

Vu = Vs – $\bar{C}c$ bd

= 149 – 64 kN

= 85kN

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 = 415 N/mm^2

Pt = 0.81%

Ast required = 781 mm^2

Provide 4nos of 16Y

Ast provided = 804 mm^2

Hence safe.

Bending moment at mid span, Mu = 111kNm

R = $(111 \times 10^6)/230 \times 484^2$

= 2.06

Pt = 0.55%

Ast required = 612 mm^2

Provide 4 nos of 16Y

Ast provided = 804 mm^2

Hence it is safe

Shear force, Vu, = 96kN

τv = Vu/bd

= $96 \times 10^3 / 230 \times 484$

= 0.86 N/mm^2

Hence ok.

Shear capacity of concrete:

Pt = 0.72 %

τc = 0.55

= τc bd

= 0.55 X 230 X 484

= 61226 N (or) 61.23kN

Shear to be carried by stirrups

Vu = Vs – τc bd

$= \quad 96 - 61.23kN$

$= \quad 35kN$

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 COLUMN C1

Length of column	D	375	mm	
Breadth of column	b	375	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	1978	kN	
Factored moment (longer direction)	Mux	124	kNm	
Factored moment (shorter direction)	Muz	20	kNm	
Charac. comp strength of concrete	f_{ck}	20	N/mm^2	
Yield stress of steel	f_y	415	N/mm^2	
Dia of bar used	Φ	25	mm	
Clear cover		40	mm	
Effective cover	d'	52.5	mm	
Effective depth	d	322.5	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	5.76	**short**	
Additional moment due to slenderness	M_{ay}	0	kN-m	
Calculation of P_{uz}				
No of bars used		12		
Area of reinforcement	Ast	5887.5		
Provided steel		12 nos Y25		
Percentage of reinforcement	p_t	4.187	%	
Area of concrete	Ag	140625	mm^2	
Ultimate axial load (without moments)	P_{uz}	3045	kN	
Calculation of P_b:				
Longer Direction				
	d'/D	0.140		
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1x}	0.197	From Sp16	
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2x}	0.329		
Axial load corresponding to balanced failure	P_{bx}	749	kN	
Reduction factor for additional moments	k_x	1.000		
Moment due to slenderness	M_{ax}	**0.00**	kN-m	
Shorter Direction				
	d'/b	0.140		
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1y}	0.197		
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2y}	0.329		
Axial load corresponding to balanced failure	P_{by}	749	kN	
Reduction factor for additional moments	k_y	0.465		
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	35.41	kN-m
Moment in longer direction		M_{ux}	124.00	kNm
Shorter direction				
Minimum eccentricity		e_y	17.90	mm
Moment due to min. eccentricity		M_y	35.41	kN-m
Moment in shorter direction		M_{uy}	35.4062	kNm
Final design moments				
Moment in longer direction		M_{ux}	**124.00**	kNm
Moment in shorter direction		M_{uy}	**35.41**	kNm
Check for interaction				
		d'/D	0.140	
		d'/b	0.140	
p/f_{ck}		p/f_{ck}	0.209	
$P_u/f_{ck}bD$ value		$P_u/f_{ck}bD$	0.703	
$M_{ux1}/f_{ck}bD^2$ value (from SP 16:1980 charts)		$M_{ux1}/f_{ck}bD^2$	0.130	
Uniaxial moment capacity (longer direction)		M_{ux1}	**137.109375**	kNm
$M_{uy1}/f_{ck}bD^2$ value (from SP 16:1980 charts)		$M_{uy1}/f_{ck}bD^2$	0.130	
Uniaxial moment capacity (shorter direction)		M_{uy1}	**137.109375**	kNm
P_u/P_{uz} ratio		P_u/P_{uz}	**0.650**	
Value of exponent			1.750	
Interaction ratio			**0.932**	
Percentage reinforcement satisfactory or not			**safe**	
b/D ratio		b/D	1	
Status of dimensions			**OK**	
Gross area		A_g	140625	mm^2
Area of core		A_k	93025	mm^2
Spacing of lateral ties		S	93.75	mm
Larger dimension of the hoop		H	230	mm
Cross sectional area of hoop		A_{sh}	95.71	mm^2

DESIGN OF COLUMN C2

Length of column	D	375	mm
Breadth of column	b	375	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	1535	kN
Factored moment (longer direction)	Mux	124	kNm
Factored moment (shorter direction)	Muz	19	kNm
Charac. comp strength of concrete	f_{ck}	20	N/mm^2
Yield stress of steel	f_y	415	N/mm^2
Dia of bar used	Φ	25	mm
Clear cover		40	mm
Effective cover	d'	52.5	mm
Effective depth	d	322.5	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	5.76	**short**
Additional moment due to slenderness	M_{ay}	0	kN-m
Calculation of P_{uz}			
No of bars used		10	
Area of reinforcement	Ast	4906.25	
Provided steel		10 nos Y25	
Percentage of reinforcement	p_t	3.489	%
Area of concrete	Ag	140625	mm^2
Ultimate axial load (without moments)	P_{uz}	2749	kN
Calculation of P_b:			
Longer Direction			
	d'/D	0.140	
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1x}	0.197	From Sp16
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2x}	0.329	
Axial load corresponding to balanced failure	P_{bx}	717	kN
Reduction factor for additional moments	k_x	1.000	
Moment due to slenderness	M_{ax}	**0.00**	kN-m
Shorter Direction			
	d'/b	0.140	
Coefficient k_1(from TABLE 60 of SP:1980)	k_{1y}	0.197	
Coefficient k_2(from TABLE 60 of SP:1980)	k_{2y}	0.329	
Axial load corresponding to balanced failure	P_{by}	717	kN
Reduction factor for additional moments	k_y	0.597	
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	27.48	kN-m
Moment in longer direction		M_{ux}	124.00	kNm
Shorter direction				
Minimum eccentricity		e_y	17.90	mm
Moment due to min. eccentricity		M_y	27.48	kN-m
Moment in shorter direction		M_{uy}	27.4765	kNm
Final design moments				
Moment in longer direction		M_{ux}	**124.00**	kNm
Moment in shorter direction		M_{uy}	**27.48**	kNm
Check for interaction				
		d'/D	0.140	
		d'/b	0.140	
p/f_{ck}		p/f_{ck}	0.174	
$P_u/f_{ck}bD$ value		$P_u/f_{ck}bD$	0.546	
$M_{ux1}/f_{ck}bD^2$ value (from SP 16:1980 charts)		$M_{ux1}/f_{ck}bD^2$	0.140	
Uniaxial moment capacity (longer direction)		M_{ux1}	**147.65625**	kNm
$M_{uy1}/f_{ck}bD^2$ value (from SP 16:1980 charts)		$M_{uy1}/f_{ck}bD^2$	0.140	
Uniaxial moment capacity (shorter direction)		M_{uy1}	**147.65625**	kNm
P_u/P_{uz} ratio		$P_u/P_{[illegible]}$	**0.558**	
Value of exponent			1.598	
Interaction ratio			**0.825**	
Percentage reinforcement satisfactory or not			**safe**	
b/D ratio		b/D	1	
Status of dimensions			**OK**	
Gross area		A_g	140625	mm^2
Area of core		A_k	93025	mm^2
Spacing of lateral ties		S	93.75	mm
Larger dimension of the hoop		H	230	mm
Cross sectional area of hoop		A_{sh}	95.71	mm^2

DESIGN OF FOOTING F1

Basic Data

Material Data

Grade of Concrete	f_{ck}	=	M20
Yeild Strength of Reinforcement	f_y	=	415 N/mm^2
Unit Weight of Concrete	γ_c	=	25.0 kN/m^3
Unit Weight of Soil	γ_s	=	18.0 kN/m^3
Frictional Factor bet. Soil & Concrete	μ	=	0.35

Soil Data:

Type of soil in foundation			MEDIUM
Net Safe Bearing Capacity	SBC	=	150 kN/m^2

Clear cover to Reinforcement

Clear Cover to Footing Slab		=	50.0 mm
Clear Cover to Pedestal		=	40.0 mm

Basic Dimensions

Size of Pedestal

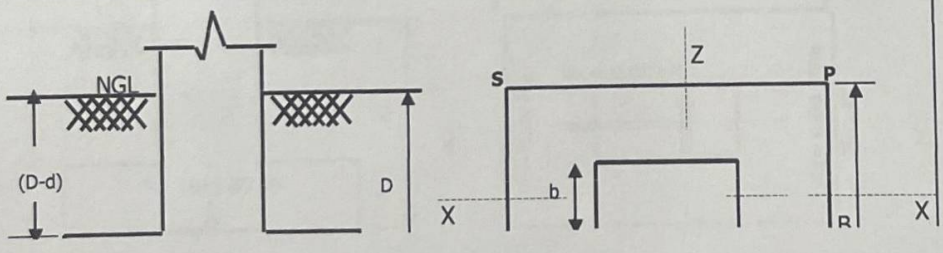
Length	l	=	0.375 m
Breadth	b	=	0.375 m
Depth of foundation from GL	D	=	1.750 m

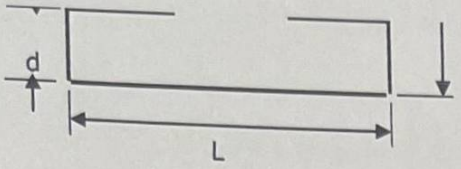
Size of Foundation Pad

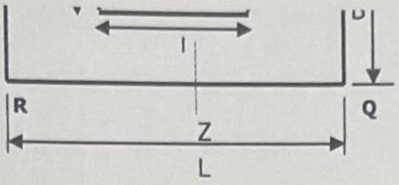
Length	L	=	3.150 m
Breadth	B	=	3.150 m
Thickness of Base Slab	d	=	0.975 m
Thickness @ edge of footing	e	=	0.230 m

Analysis Results

Loads	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Dead Load	1309.00	0.00	0.00	0.00	0.00
Live Load	0.00	0.00	0.00	0.00	0.00
Wind or Seismic Load	± 0.00	± 0.00	± 0.00	± 0.00	± 0.00







Load Combination

Load Combination for Design

1) 1.5DL + 1.5LL
2) 1.2DL + 1.2LL + 1.2WL(OR)SL
3) 1.5DL + 1.5WL(OR)SL
4) 0.9DL + 1.5WL(OR)SL

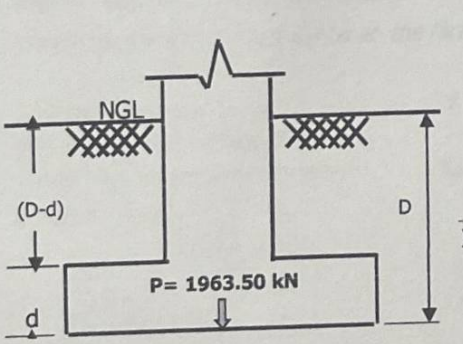
Unfactored Loads

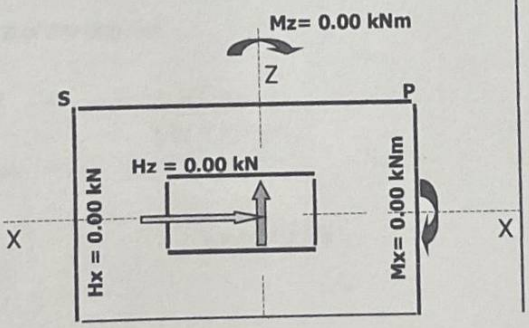
Load Combinaion	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Case 1) DL + LL	1309.00	0.00	0.00	0.00	0.00
Case 2) DL + LL + WL(OR)SL	1309.00	0.00	0.00	0.00	0.00
Case 3) DL + WL(OR)SL	1309.00	0.00	0.00	0.00	0.00

Factored loads

Load Combinaion	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Case 1) 1.5DL + 1.5LL	1963.50	0.00	0.00	0.00	0.00
Case 2) 1.2DL + 1.2LL + 1.2WL(OR)SL	1570.80	0.00	0.00	0.00	0.00
Case 3) 1.5DL + 1.5WL(OR)SL	1963.50	0.00	0.00	0.00	0.00
Case 4) 0.9DL + 1.5WL(OR)SL	1178.10	0.00	0.00	0.00	0.00

Design of Footing for Case 3







Calculation of Bearing Pressure under the Footing

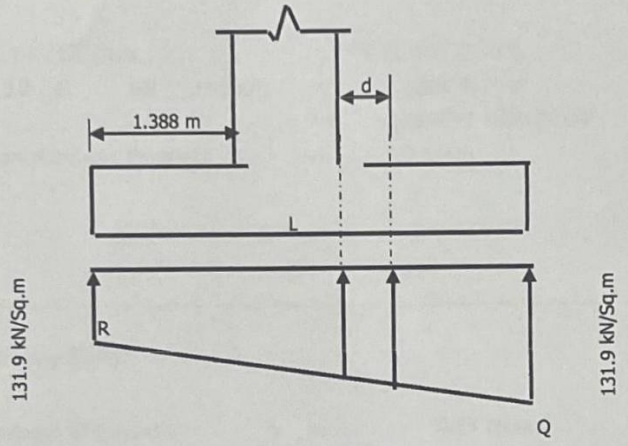
eccentricity	e_z	=	M_{xx}/W	=	0.000 m	
			e_z/B	=	0.000	
			B/6	=	0.525	> 0.000
eccentricity	e_x	=	M_{zz}/W	=	0.000 m	
			e_x/L	=	0.000	
			L/6	=	0.525	> 0.000

Hence all the four edges are in contact with Soil

Soil Pressure at Point Q qmax	=	131.9223986	kN/m^2
S.B.C. of Soil	=	**150**	kN/m^2
		HENCE SAFE	

Design of Foundation Pad along X direction

Bearing Pressure Distribution



PRESSURE DISTRIBUTION DIAGRAM

Depth of Pad	d	=	975	mm
Therefore, effective depth	d_{eff}	=	919	mm
Pressure at face of Pedestal		=	197.88	kN/m^2
Pressure @ dist "d" from face of pedestal		=	197.88	kN/m^2

Depth required for Bending Moment

Critical section for moment will be at the face of the pedestal.

Overhang distance	x	=	1.388	m
Bending Moment at face of Pedestal		=	**190.5**	kNm/m
Depth reqd for the above moment	d_{eff1}	=	263	mm
Provided Depth		=	919	mm
		>	**263**	**HENCE OK**

Area of Steel Required for Bending

$$\frac{x}{d} =$$

$$= 0.0318$$

Lever Arm Depth $Z =$

$$= 906.84 \text{ mm}$$

Reinforcement Required $A_{st} = \dfrac{M_u}{0.87 f_y Z}$

$$= 581.765593 \text{ mm}^2$$

Minimum Area of Steel Required

Minimum reinforcement required: $= 1170 \text{ mm}^2$

Reinforcement Provided

Spacing of Y 12 bars $= 96.66461538$ mm

Provide Y **12** at **90** mm c/c $= \mathbf{1256.6} \text{ mm}^2$

$> \mathbf{1170.00}$ **HENCE OK**

Percentage of Reinforcement Provided $= \mathbf{0.14\%}$

Check for One Way Shear

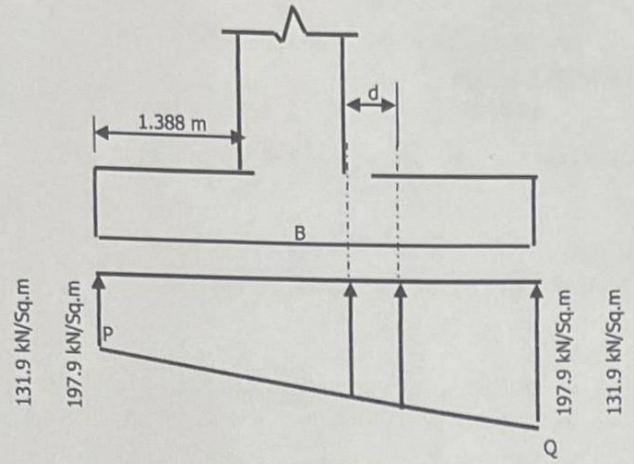
Design Shear Strength of Concrete	τ_c	=	0.28 N/mm^2
	K	=	1.00
τ_c for Solid Slab	$\tau_c k$	=	0.28 N/mm^2
Pressure at dist "d" from face of pedestal		=	197.88 kN/m^2
SF at dist "d" from face of pedestal	V	=	92.71 kN
Depth required for one way shear	d_{eff2}	=	336 mm
Provided Depth		=	440 mm
		>	**336 HENCE OK**

Check for Two Way Shear

Maximum shear stress= $0.25(fck)^{0.5}$	τ_c	=	1.12 N/mm^2
Vertical load punching the base slab		=	1963.50 kN
Preimeter		=	5176 mm
Depth required for two way shear	d_{eff3}	=	339 mm
Provided Depth		=	701 mm
		>	**339 HENCE OK**

Design of Foundation Pad along Z direction

Bearing Pressure Distribution



PRESSURE DISTRIBUTION DIAGRAM

Depth of Pad	d	=	975 mm
Therefore, effective depth	d_{eff}	=	907 mm
Pressure at face of Pedestal		=	197.88 kN/m^2
Pressure at dist "d" from face of pedestal		=	197.88 kN/m^2

Depth required for Bending Moment

Critical section for moment will be at the face of the pedestal.

Overhang distance	y	=	1.388 m
Bending Moment at face of Pedestal		=	**190.48** kNm/m
Depth reqd for the above moment	d_{eff1}	=	263 mm
Provided Depth		=	907 mm
		>	**263 HENCE OK**

Area of Steel Required for Bending

$$\frac{x}{d} = 0.0327$$

Lever Arm Depth $Z = 894.67$ mm

Reinforcement Required

$$A_{st} = \frac{M_u}{0.87 f_y Z} = 589.68 \text{ mm}^2$$

Minimum Area of Steel Required

Minimum reinforcement required: = 1170.00 mm^2

Reinforcement Provided

Spacing of Y 12 bars		=	96.66	mm
Provide Y **12** at **90** mm c/c		=	**1256.64**	mm^2
		>	**1170.00**	**HENCE OK**
Percentage of Reinforcement Provided		=	**0.14%**	

Check for One Way Shear

Design Shear Strength of Concrete	t_c	=	0.28	N/mm^2
	K	=	1.00	
t_c for Solid Slab	t_ck	=	0.28	N/mm^2
Pressure at dist "d" from face of pedestal		=	197.88	kN/m^2
SF at dist "d" from face of pedestal	V	=	95.08	kN
Depth required for one way shear	d_{eff2}	=	343	mm
Provided Depth		=	440	mm
		>	**343**	**HENCE OK**

Check for Two Way Shear

Maximum shear stress= $0.25(fck)^{0.5}$	τ_c	=	1.12	N/mm^2
Vertical load punching the base slab		=	1963.50	kN
Preimeter		=	5128	mm
Depth required for two way shear	d_{eff3}	=	342	mm
Provided Depth		=	701	mm
		>	**342**	**HENCE OK**

DESIGN OF FOOTING F2

Basic Data

Material Data

Grade of Concrete	f_{ck}	=	M20
Yeild Strength of Reinforcement	f_y	=	415 N/mm^2
Unit Weight of Concrete	γ_c	=	25.0 kN/m^3
Unit Weight of Soil	γ_s	=	18.0 kN/m^3
Frictional Factor bet. Soil & Concrete	μ	=	0.35

Soil Data:

Type of soil in foundation			MEDIUM
Net Safe Bearing Capacity	SBC	=	150 kN/m^2

Clear cover to Reinforcement

Clear Cover to Footing Slab		=	50.0 mm
Clear Cover to Pedestal		=	40.0 mm

Basic Dimensions

Size of Pedestal

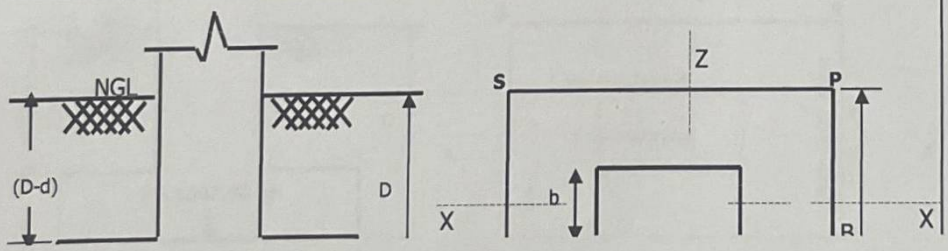
Length	l	=	0.375 m
Breadth	b	=	0.375 m
Depth of foundation from GL	D	=	1.750 m

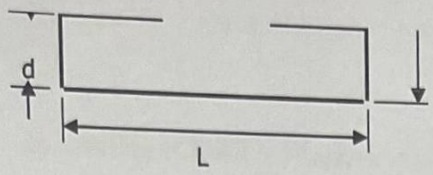
Size of Foundation Pad

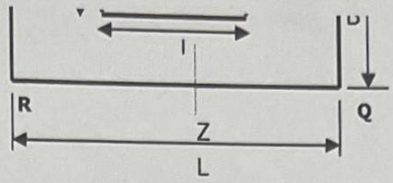
Length	L	=	2.900 m
Breadth	B	=	2.900 m
Thickness of Base Slab	d	=	0.935 m
Thickness @ edge of footing	e	=	0.230 m

Analysis Results

Loads	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Dead Load	1045.00	0.00	0.00	0.00	0.00
Live Load	0.00	0.00	0.00	0.00	0.00
Wind or Seismic Load	± 0.00	± 0.00	± 0.00	± 0.00	± 0.00







Load Combination

Load Combination for Design

1) 1.5DL + 1.5LL
2) 1.2DL + 1.2LL + 1.2WL(OR)SL
3) 1.5DL + 1.5WL(OR)SL
4) 0.9DL + 1.5WL(OR)SL

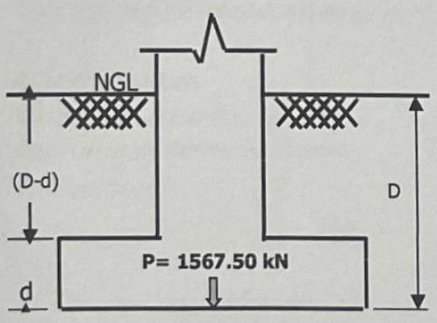
Unfactored Loads

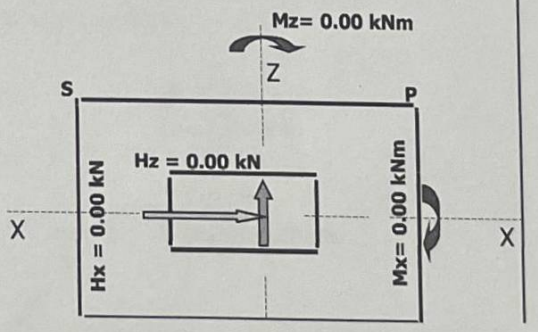
Load Combinaion	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Case 1) DL + LL	1045.00	0.00	0.00	0.00	0.00
Case 2) DL + LL + WL(OR)SL	1045.00	0.00	0.00	0.00	0.00
Case 3) DL + WL(OR)SL	1045.00	0.00	0.00	0.00	0.00

Factored loads

Load Combinaion	V	Mzz	Hx	Mxx	Hz
	kN	kN m	kN	kN m	kN
Case 1) 1.5DL + 1.5LL	1567.50	0.00	0.00	0.00	0.00
Case 2) 1.2DL + 1.2LL + 1.2WL(OR)SL	1254.00	0.00	0.00	0.00	0.00
Case 3) 1.5DL + 1.5WL(OR)SL	1567.50	0.00	0.00	0.00	0.00
Case 4) 0.9DL + 1.5WL(OR)SL	940.50	0.00	0.00	0.00	0.00

Design of Footing for Case 3







Calculation of Bearing Pressure under the Footing

eccentricity	e_z	=	M_{xx}/W	=	0.000 m	
			e_z/B	=	0.000	
			B/6	=	0.483	> 0.000
eccentricity	e_x	=	M_{zz}/W	=	0.000 m	
			e_x/L	=	0.000	
			L/6	=	0.483	> 0.000

Hence all the four edges are in contact with Soil

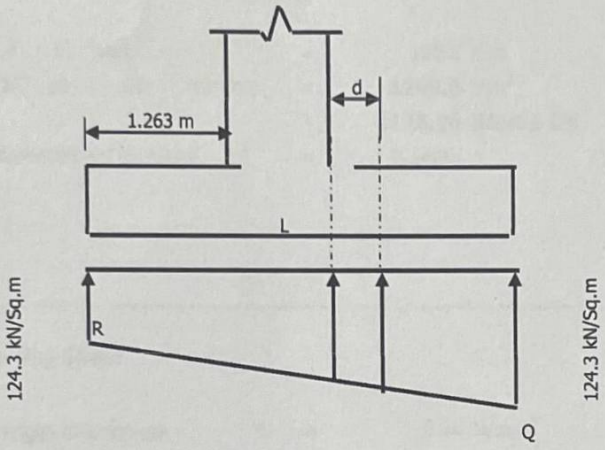
Soil Pressure at Point Q qmax = 124.2568371 kN/m^2

S.B.C. of Soil = **150** kN/m^2

HENCE SAFE

Design of Foundation Pad along X direction

Bearing Pressure Distribution



PRESSURE DISTRIBUTION DIAGRAM

Depth of Pad	d	=	935 mm
Therefore, effective depth	d_{eff}	=	879 mm
Pressure at face of Pedestal		=	186.39 kN/m^2
Pressure @ dist "d" from face of pedestal		=	186.39 kN/m^2

Depth required for Bending Moment

Critical section for moment will be at the face of the pedestal.

Overhang distance	x	=	1.263 m
Bending Moment at face of Pedestal		=	**148.5** kNm/m
Depth reqd for the above moment	d_{eff1}	=	232 mm
Provided Depth		=	879 mm
		>	**232 HENCE OK**

Area of Steel Required for Bending

	$\frac{x}{d}$	=	
		=	0.0271
Lever Arm Depth	Z	=	
		=	869.11 mm
Reinforcement Required	A_{st}	=	$\frac{M_u}{0.87 f_y Z}$
		=	473.3742723 mm^2

Minimum Area of Steel Required

Minimum reinforcement required:		=	1122 mm^2

Reinforcement Provided

Spacing of Y 12 bars		=	100.8 mm
Provide Y **12** at **90** mm c/c		=	**1256.6** mm^2
		>	**1122.00 HENCE OK**
Percentage of Reinforcement Provided		=	**0.14%**

Check for One Way Shear

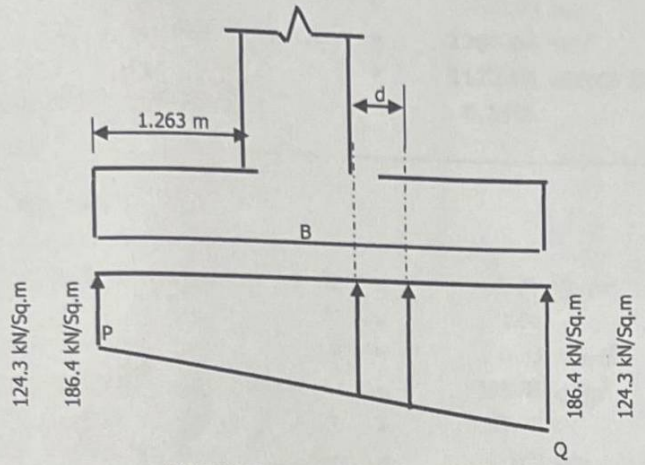
Design Shear Strength of Concrete	τ_c	=	0.28 N/mm^2
	K	=	1.00
τ_c for Solid Slab	$\tau_c k$	=	0.28 N/mm^2
Pressure at dist "d" from face of pedestal		=	186.39 kN/m^2
SF at dist "d" from face of pedestal	V	=	71.48 kN
Depth required for one way shear	d_{eff2}	=	254 mm
Provided Depth		=	402 mm
		>	**254 HENCE OK**

Check for Two Way Shear

Maximum shear stress= $0.25(fck)^{0.5}$	τ_c	=	1.12 N/mm^2
Vertical load punching the base slab		=	1567.50 kN
Preimeter		=	5016 mm
Depth required for two way shear	d_{eff3}	=	280 mm
Provided Depth		=	663 mm
		>	**280 HENCE OK**

Design of Foundation Pad along Z direction

Bearing Pressure Distribution



PRESSURE DISTRIBUTION DIAGRAM

Depth of Pad	d	=	935 mm
Therefore, effective depth	d_{eff}	=	867 mm
Pressure at face of Pedestal		=	186.39 kN/m^2
Pressure at dist "d" from face of pedestal		=	186.39 kN/m^2

Depth required for Bending Moment

Critical section for moment will be at the face of the pedestal.

Overhang distance	y	=	1.263 m
Bending Moment at face of Pedestal		**=**	**148.54** kNm/m
Depth reqd for the above moment	d_{eff1}	=	232 mm
Provided Depth		=	867 mm
		>	**232 HENCE OK**

Area of Steel Required for Bending

$$\frac{x}{d} = 0.0278$$

Lever Arm Depth Z = 856.96 mm

Reinforcement Required

$$A_{st} = \frac{M_u}{0.87\, f_y Z} = 480.08 \text{ mm}^2$$

Minimum Area of Steel Required

Minimum reinforcement required: = 1122.00 mm^2

Reinforcement Provided

Spacing of Y 12 bars	=	100.80	mm
Provide Y **12** at **90** mm c/c	=	**1256.64**	mm^2
	>	**1122.00**	**HENCE OK**
Percentage of Reinforcement Provided	=	**0.14%**	

Check for One Way Shear

Design Shear Strength of Concrete	t_c	=	0.28	N/mm^2
	K	=	1.00	
t_c for Solid Slab	t_ck	=	0.28	N/mm^2
Pressure at dist "d" from face of pedestal		=	186.39	kN/m^2
SF at dist "d" from face of pedestal	V	=	73.72	kN
Depth required for one way shear	d_{eff2}	=	260	mm
Provided Depth		=	402	mm
		>	**260**	**HENCE OK**

Check for Two Way Shear

Maximum shear stress= $0.25(fck)^{0.5}$	τ_c	=	1.12	N/mm^2
Vertical load punching the base slab		=	1567.50	kN
Preimeter		=	4968	mm
Depth required for two way shear	d_{eff3}	=	282	mm
Provided Depth		=	663	mm
		>	**282**	**HENCE OK**

DESIGN CALCULATIONS

Design of slab

Basic Data

Grade of concrete		=	20	Mpa
Grade of steel		=	415	Mpa
Thickness of slab	D	=	125	mm
Effective thickness of slab		=	100	mm
Unit weight of concrete		=	25	KN/m^3
Effective span in X- direction		=	3.3	m
Effective span in Y- direction		=	9.14	m
Aspect ratio ly/lx		=	2.77	**Oneway Slab**

Load Data

Dead load	=	3.125	KN/m^2
Floor finish	=	1.50	KN/m^2
Live load	=	4.00	KN/m^2
Total load	=	8.63	KN/m^2
Total factored load	=	12.94	KN/m^2

Moment and Shear Calculations

Total load on slab per meter width		W	=	42.694	KN/m
Bending moment	M = (W * L)/10		=	14.089	KN-m
Shear force	V = W/2		=	21.347	KN

Check for Depth from Bending

Depth required,d	= $(M/(0.138*f_{ck}*b))^{1/2}$	=	71.45	mm
Depth provided		=	100	mm **Hence O.K**

Check for Depth from Shear

Calculated shear strength	τv = V / bd	=	0.2135	Mpa	
Design shear strength	τc	=	0.61	Mpa	**Hence O.K**

DESIGN CALCULATIONS

Reinforcement Calculations

Main Reinforcement

Mu = 0.87*fy*Ast(d-0.42*xu)

Xu = 0.0501 Ast

$7.6042\ Ast^2 - 36105\ Ast + 14088937.5 = 0$

Area of steel Ast	=	428.98	mm^2
Minimum area of steel Astmin	=	204.82	mm^2
Spacing of ϒ **12** bars	=	264	mm

Check for Spacing

Minimum of	1) 3d	=	300	mm
	2)		300	mm

Therefore provide ϒ **10** @ 125 mm C/C

Ast Provided	=	628.32	mm^2
Percentage of Reinforcement	=	0.628	

Distribution reinforcement

Area of steel	=	150.00	mm^2
Spacing of ϒ **8** bars	=	754	mm

Check for spacing

Minimum of	1) 5d	=	500	mm
	2)		450	mm

Therefore provide ϒ **10** @ 20 mm C/C

Provided Reinforcement	=	3927	mm^2

Check for Deflection:

Basic Span/depth Ratio	=	23	
% of Tension Reinforcement provided (pt)	=	0.628	%
Service stress of steel (fs) : 0.58fy(Ast_r/Ast_p)	=	164.34	N/mm^2
Modification Factor for Tension Reinforcement (F1)	=	1.59	
Allowable Span/Eff Depth Ratio	=	36.623	
Actual Span/Eff Depth Ratio	=	33.00	

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

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Door No.50, Kirupasankari Street,
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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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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

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