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RE REGULATORY RECORD

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DIGITALLY VERIFIED RECORD

Dated. 25/07/2025
F.No.

BELLIAPPA & ASSOCIATES
CONSULTING ENGINEERS & VALUERS

STABILITY CERTIFICATE

(To be furnished while filing application for registration of building)

The detailed engineering and structure design of the proposed building comprising High Rise Residential Use Building consists of Stilt +9 floors (Height 30.00 m) with 78 dwelling units and Gym, Indoor Games & Association Room at 1st Floor level at Stilt +9 Floors at Door No.3/532, Kundrathur Main Road, Madhananthapuram, Chennai - 600 125 and comprised in New S.No.69/2B1 & 70/5A1H2 (Old Survey No. 69/2B & 70/5) of Madhananthapuram Village, Alandur Taluk, within the limits of Greater Chennai Corporation, has been done by us based on the report of geotechnical investigation (Soil Test) done by M/s.Nagadi Consultants Private Limited, Report No.G(C)9894, dated 06.02.2024 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. We have checked various parameters and found that the proposed building would be safe.

3.We further certify that:

(i) The minimum grade of concrete used is M30 grade

(ii) The design and analysis has been done using the code of practice for plain and reinforced concrete as per IS 456, design loads as per IS 875:1987 part 2 and design of earthquake resistant structure as per IS 1893:2016

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

Stamp and Signature

Encl.: Structure Design Calculation

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Gazetted Valuer-C.B.D.T. CI / 189 of 90

Annexure – XIV

[See rule 51 (3)]

Form 1

Structural Design Basis Report

(1) This report to accompany the application for Building Developments

Part1	General Data		
S.No.	**Description**	**Information**	**Notes**
1.	Site Address		
2	Name of Owner		
3	Name of Registered Developer along with the Registration Number		
4	Name of Registered Architect/Engineer along with the Registration Number		
5	Name of Registered Structural engineer along with the Registration Number	BOPAYYA SE/I/2024/6/0125 RSE 100552019 (CORP OF CHENNAI)	
6	Use of the building		
7	Number of stories above ground level (including storeys to be added later, if any)	S+9	
8	Number of basements below ground level		
9	Type of structure Load bearing walls R.C.C. frame R.C.C. frame and Shear Walls Steel frame	R.C.C FRAME	
10	Soil data Type of soil Design safe bearing capacity		IS:1893 C1.6.3.5.2 IS: 1904 IS: 1892 IS: 2131 IS: 2720
11	Dead loads (unit weight adopted) • Earth • Water • Brick masonry • Plain cement concrete • Reinforced cement concrete • Floor finish • Other fill materials	17.5 KN/m3 10.0 KN/m3 20.0 KN/m3 19.5 KN/m3 25.0 KN/m3 20.0 KN/m3	IS: 875 Part 1
12	Imposed (live) loads Floor loads Roof loads	7.5 KN/m2 1.5 KN/m2	IS: 875 Part 2
13	Cyclone/Wind • Speed • Design pressure intensity		IS: 875 Part 3

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14	Seismic zone	III	IS: 1893 (2002)
15	Importance factor	1	IS:1893(2002) Table 6
16	Seismic zone factor (Z)	0.16	IS:1893 Table 2
17	Response reduction factor	5	IS:1893 Table 7
18	Fundamental natural period – approx.	t_x = 2.439s t_y = 1.071s	IS:1893 C1.7.6
19	Design horizontal acceleration spectrum value (A_h)	A_{hx} = 0.011 A_{hy} = 0.018	IS: 1893 C1.6.4.2
20	♥ Expansion/Separation Joints	NIL	
21	Building is regular/irregular		IS 1893

♥ Enclose detailed drawings drawn to scale for each floor ENCLOSED EACH FLOOR DRAWING

♦ In case terrace garden is provided, indicate additional fill load and live load along with the detailed drawings drawn to scale NIL

Part 2	**Load bearing masonry buildings** N.A		
Sl.No.	**Description**	**Information**	**Notes**
1	Building category		IS: 4326 C1.7 Read with IS:1893 Zone: II III IV V Bldg. Ordinary: B C D E Important: C D E E
2	Basement Provided		
3	Number of floors including Ground Floor (all floors including stepped floors in hill slopes)		
4	Type of wall masonry		
5	Type and mix of Mortar		IS: 4326 C1.8.1.2
6	Re: size and position of openings (See note No.[i]) • Minimum distance (b5) • Ratio $(b_1+b_2+b_3)/l_1$ or $(b_6+b_7)/l_2$ • Minimum pier width between consequent opening (b_4) • Vertical distance (h_3) • Ratio of wall height to thickness 4 Ratio of wall length between cross wall to thickness		IS: 4326 Table 4, Fig.7
7	Horizontal seismic band • at plinth level • at window sill level • at lintel level • at ceiling level	P IP NA ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	(see note No.2) IS:4326 C1 8.4.6 IS: 4326 C1 8.3 IS: 4326 C1 8.4.2 IS: 4326 C1 8.4.3 IS: 4326 C1 8.4.3

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	• at eave level of sloping roof • at top of gable walls • at top of ridge walls	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	IS: 4326 C1 8.4.3 IS: 4326 C1 8.4.4
8	Vertical reinforcing bar at corners and T junction of walls at jambs of doors and window openings	☐ ☐ ☐ ☐ ☐ ☐	IS: 4326 C1 8.4.8. IS: 4326 C1 8.4.9
9	Integration of prefab roofing/flooring elements through reinforced concrete screed.	☐ ☐ ☐	IS:4326 C1 9.1.4
10	Horizontal bracings in pitched truss in horizontal plane at the level of ties in the slopes of pitched roofs	☐ ☐ ☐ ☐ ☐ ☐	

Notes: (i) Information in Item 6 should be given on separate A4 sheets for all walls with large number of openings

(ii) IP indicated "Information Provided"

IP indicates "Information to be provided"

NA indicates "Not Applicable"

Tick mark one box

Part 3	Reinforced concrete framed buildings		
Sl. No.	**Description**	**Information**	**Notes**
1	Type of building • Regular frames • Regular frames with Shear Walls • Irregular frames • Irregular frames with Shear Walls • Soft storey	REGULAR FRAME	IS: 1893 C1 7.1
2	Number of basements	NIL	
3	Number of floors including ground floor	S+9	
4	Horizontal floor system • Beams and slabs • Waffles • Ribbed floor • Flat slab with drops • Flat plate without drops	BEAMS AND SLABS	
5	Soil data • Type of soil • Recommended type of foundation -Independent footings -Raft -Piles • Recommended bearing capacity of soil	PILES REFER SOIL REPORT	IS: 1498

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	• Recommended type, length, diameter and load capacity of piles • Depth of water table • Chemical analysis of ground water • Chemical analysis of soil		
6	Foundations Depth below ground level Type Independent Interconnected Raft Piles	PILES	
7	System of interconnecting foundations Plinth beams Foundation beams	PLINTH AND GRADE BEAMS	IS: 1893 Cl 7.12.1
8	Grades if concrete used in different parts of building	BEAMS AND SLABS (M30) COLUMN (M45)	
9	Method of analysis used	DYNAMIC RESPONSE SPECTRUM METHOD	
10	Computer software used	ETABS AND SUBSTITUTE FRAME ANALYSIS	
11	Torsion included		IS: 1893 Cl 7.9
12	Base shear a. Based on approximate fundamental period b. Based on dynamic analysis c. Ratio of a/b	BASED ON APPROXIMATE	IS: 1893 Cl. 7.5.3
13	Distribution of seismic forces along the height of the building.		IS:1893 Cl.7.7 (Provide sketch)
14	The Column of soft ground storey specially designed.	NO	IS: 1893 Cl.7.10
15	Clear minimum cover provided in • Footing • Column • Beams • Slabs • Walls	50mm 40mm 25mm 15mm 25mm	IS: 456 Cl. 26.4
16	**Ductile detailing of RC frame** • **Type of reinforcement used** • **Minimum dimension of beams** • **Minimum dimension of columns** • Minimum percentage of reinforcement of beams at any cross section • Maximum percentage of reinforcement at any section of beam • Spacing of transverse reinforcement in 2-d length of beams near the ends • Ratio of capacity of beams in shear to capacity of beams in flexure • Maximum percentage of reinforcement in column	Fe 500 230mm 230mm 0.2% 4% d/4 or 8 times OF LONGITUDINAL DIAMETER 4%	**IS: 456 Cl. 5.6** **IS: 13920 Cl.6.1** **IS: 13920 Cl.7.1.2** IS: 456 Cl.26.5.1(a) IS: 13920 Cl.6.2.1 IS: 456 Cl.26.5.1.1(b) IS: 13920 Cl.6.2.2 IS: 13920 Cl.6.3.5 IS: 456 Cl.26.5.3.1 IS: 13920 Cl. 7.4

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	• Confining stirrups near ends of columns and in beam-column joints Diameter Spacing • Ratio of shear capacity of columns to maximum seismic shear in the storey.	8mm 100mm	
17	Does the features require clearance by SDRP Example: High rise building Prefab building Building in hazard prone areas	No	

Foundation

i. In case raft foundation has been adopted, indicate K value used for analysis of the raft.

ii. Incase pile foundations have been used, give full particulars of the piles, type, dia, length, capacity

iii. In case of high water table, indicate system of countering water pressure, and indicate the existing water table, and that assumed to design foundations.

Idealization for Earthquake analysis

i. In case of composite system of shear walls and rigid frames, give distribution of base shear in the two systems on the basis of analysis, and that used for design of each system

ii. Indicate the idealization of frames and shear walls adopted in the analysis with the help of sketches.

iii. Submit framing plans of each floor

iv. In case of basements, indicate the system used to contain earth pressures.

Part 4	**Buildings in structural steel** N.A		
1	Adopted method of design	o Simple o Semi-rigid o Rigid	IS:800 Cl 3.4.4 IS:800 Cl.3.4.5 IS:800 Cl.3.5.6
2	Design based on	o Elastic analysis o Plastic analysis	IS: 800 Section-9 SP;6 (6)
3	Floor construction	o Composite o Non composite o Boarded	
4	Roof construction	o Composite o Non composite o Metal o Any other	
5	Horizontal force resisting system adopted	Frames Braced frames Frames & shear walls	Note: Seismic force As per IS:1893 Would depend on system
6	Slenderness ratios maintained	Members defined in Table 3.1, IS:800	IS 800; Cl.3.7
7	Member deflection	Beams, Rafters	IS:800 Cl.3.13

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	limited to	Crane Girders, Purlins Top of columns	
8	Structural members	o Encased in concrete Not encased	IS: 800 Section-10
9	Proposed material	o General weld-able o High strength o Cold formed o Tubular	IS: 2062 IS: 8500 IS: 801, 811 IS: 806
10.	Minimum metal thickness Specified for corrosion protection	o Hot rolled sections o Cold formed sections o Tubes	IS: 800, Cl.3.8 Cl.3.8.1 to Cl.3.8.4 Cl.3.8.5
11	Structural connections	o Rivets o CT Bolts o S H F G Bolts o Black Bolts o Welding field Shop (Specify welding type proposed) Composite	IS: 800, Section-8 IS: 1929, 2155, 1149 IS 6639, 1367 IS 3757, 4000 IS: 1363, 1367 IS: 816, 814,1395, 7280, 3613, 6419, 6560, 813, 9595
12	Minimum Fire rating proposed, with method	o Rating.....hours o Method proposed. -In tumescent painting -Spraying -Quilting -Fire retardant boarding	IS: 1641, 1642, 1643

Part-5

Any special weakness in the building making it vulnerable for stability related failure and the precaution to be taken during execution/completion and finishing to be indicated.

Part-6

Recommendations of structural Engineer with respect to special requirements needed with respect to structural safety and stability to be taken note of by competent authority feature like incorporation of swimming pool, heavy load on roof ,prefabricated structure or any other hazardous features should be included.

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PILE CAP DESIGN

TWO PILE CAP DESIGN

1 Pile capacity 150 Tons (given by soil report)

2 20mm rods are provided 600 diameter pile.

3 The development length in to the pile cap = 50 x D = 50 x 20 = 1000

4 Considering the development length the pile cap depth

d + d' + pile d = 1000 + 125 + 75 = 1200

5 The spacing of pile = 2.50 x D = 2.5 x 600 = 1500 mm

6 The over hang of the pile cap from the center of pile = 1.25 x D = 1.25 x 600 = 750 mm

7 It's always preferable to provide pedestal for the column

That is size of pedestal 900 mm x 900 mm x H (H is up to top of the plinth beam).

8 Grade beam is provided connecting all the pile caps in both direction to take horizontal force.

9 The top of the grade beam will be same level of top of the pile cap.

10 The pile is embedded in to the pile cap by 75 mm.

PILE CAP DESIGN

1 Design depth = 1200 - 75 = 1125

2 The effective depth = 1125 - 60 = 1065

3 Critical section distance = 1065 / 2 = 533

4 The Bending Moment = Pile reaction X Span

5 $$\text{Span} = \frac{1500 - 900}{2} = 300.0 \text{ mm}$$

6 Therefore the minimum Bending Moment = 150 x 0.3 = 45.00 T-m

7 $$\text{Depth required (d)} = \sqrt{\frac{\text{Bending moment} \times 1000 \times 100}{8.5 \times 150}}$$

R = 8.5 B = 150 cm

$$d = \sqrt{\frac{45 \times 1000 \times 100}{8.5 \times 150}} = 59.41 \text{ cm}$$

Provided depth (d) = 1065 mm (This is required for the development length)

8 $$\text{Area of steel (Ast)} = \frac{\text{Bending moment} \times 1000 \times 100}{2300 \times 0.87 \times 106.5}$$

$$Ast = \frac{45 \times 1000 \times 100}{2300 \times 0.87 \times 106.5} = 21.12 \text{ cm}^2$$

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However we have to considered pile cap as a deep beam as per IS code 456 : 2000 @ page no 51 cl.29.2

Lever arm z = 0.2 (L + 2D) where L 1500 mm D = 1125 mm

L/D = 1500/1125 = 1.33 m (1 ≤ 1.33 ≤ 2)

Z = 0.2 (1.5 + 2 x 1.125) = 0.750 m

Therefore Z for design (Lever arm) = 0.75 m

1 Area of steel Ast = $\frac{\text{Bending moment x 1000 x 100}}{2300 \times 75}$

$$d = \frac{45 \times 1000 \times 100}{2300 \times 75} = 26.09 \text{ cm}^2 \text{ (Required)}$$

2 Provided steel 11 - Y 20 34.54 cm² > 26.09 cm²

3 As per code minimum Ast for beam is 0.2% of Cross section area

$$\frac{0.2 \times 150 \times 112.5}{100} = 33.75 \text{ cm}^2$$

Provide bottom steel 11 - Y20 and Top steel 11 - Y12

SHEAR

As per code IS 456 : 2000 at page 65 class 34.2.4.2

Critical section will be at a distance d/2 from the face of the pedestal

$$\text{critical section} = \frac{1065}{2} = 533 \text{ mm}$$

Pedestal or Column face to Pile center = 300 (Span)

Pedestal or Column face to Pile Edge = 532.5 - 300 = 233 mm

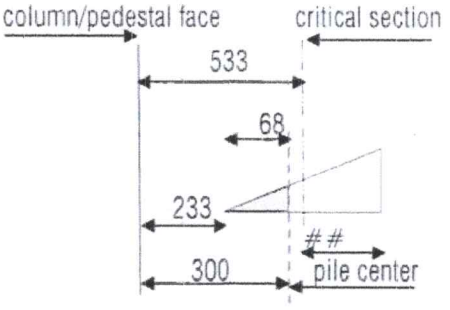
Pile Edge to Pile Centre Distance = 300 - 232.5 = 68 mm

X	67.50
150.00	600.00

X = (67.5 x 150)/600

X = 16.88 T Design shear

$$\text{Shear stress} = \frac{16.88 \times 1000}{150 \times 106.5} = 1.06 \text{ Kg/cm}^2$$



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Therefore stirrups are required **0.2 %** steel stress = 0.20 N/mm^2 = 2.00 Kg/cm^2

IS 456 : 2000 at Table 23 @ 84 page

$$\text{Shear taken by concrete} = \frac{2 \times 150 \times 106.5}{1000} = 31.95 \text{ T}$$

$$\text{Net Shear} = 16.88 - 31.95 = -15.08 \text{ T}$$

$$\text{Spacing (Sv)} = \frac{\text{Asv} \times \text{fy} \times \text{d}}{\text{Shear}}$$

Provide shear steel dia = 12 mm Area = 1.13 cm^2

$$\text{Spacing (Sv)} = \frac{1.13 \times 2 \times 2300 \times 106.5}{\text{Zero shear}}$$ Minimum stirrups

Therefore minimum stirrups provided as per IS **456 : 2000** at cl 26.5.1.6

$$\frac{\text{Asv}}{\text{b} \times \text{sv}} = \frac{0.4}{0.87 \times \text{fy}}$$

$$\text{Spacing (Sv)} = \frac{\text{Asv} \times 0.87 \times \text{fy}}{0.4 \times \text{b}}$$

$$\text{Spacing (Sv)} = \frac{113 \times 2 \times 0.87 \times 415}{0.4 \times 1500}$$

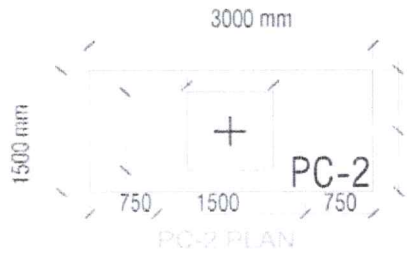
Spacing (Sv) = 136 mm

Provide = **Y12 mm 2L - ST @ 125 C/C**

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Result

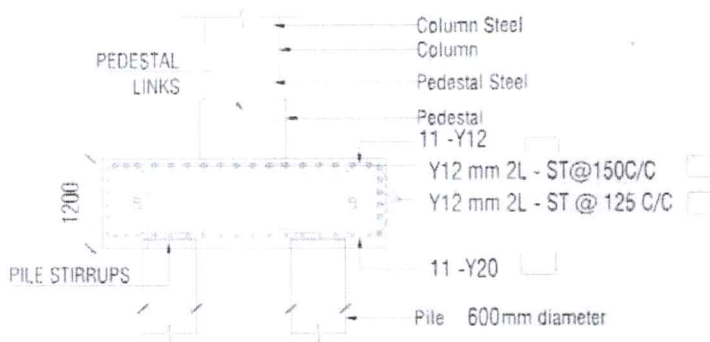
Pile cap size		Reinforcement steel	
Length =	3000 mm	Top steel =	11 -Y12
Bredth =	1500 mm	Bottom Steel =	11 -Y20
Depth =	1200 mm	Stirrups =	Y12 mm 2L - ST @ 125 C/C



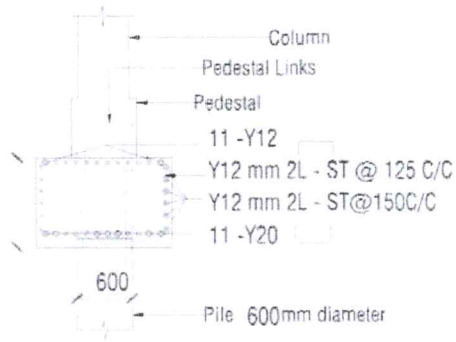
PC-2 PLAN

600

2 PILE CAP 600mm DIAMETER PILE



SECTION X-X



SECTION Y-Y



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PILE CAP DESIGN

THREE PILE CAP DESIGN

1 Pile capacity 150 Tons (given by soil report)

2 20mm rods are provided 600 diameter pile.

3 The development length in to the pile cap = 50 x D = 50 x 20 = 1000

4 Considering the development length the pile cap depth

d + d' + pile d = 1000 + 125 + 75 = 1200 mm

5 The spacing of pile = 2.50 x D = 2.5 x 600 = **1500 mm**

6 The over hang of the pile cap from the center of pile = 1.25 x D = 1.25 x 600 = **750 mm**

7 It's always preferable to provide pedestal for the column

That is size of pedestal 900 mm x 900 mm x H (H is up to top of the plinth beam).

8 Grade beam is provided connecting all the pile caps in both direction to take horizontal force.

9 The top of the grade beam will be same level of top of the pile cap.

10 The pile is embedded in to the pile cap by 75 mm.

Right angle traiangle hypotenuse 1500

Right angle traiangle adjacenet side 750

Right angle traiangle Opposite side $\sqrt{1500^2 - 750^2}$ = 1300 mm

2/3 rd Distance = 867 mm

PILE CAP DESIGN

1 Design depth = 1200 - 75 = 1125

2 The effective depth = 1125 - 60 = **1065**

3 Critical section distance = 1065 / 2 = **533**

4 The Bending Moment = Pile reaction X Span

Span @ X Direction = 866.6666666 = **416.7 mm**

5 Span @ Y Direction = $\frac{1500 - 900}{2}$ = **300.0 mm**

6 Therefore the minimum Bending Moment @ X Dir = 150 x 0.416666666666667

= 62.50 T-m

6 Therefore the minimum Bending Moment @ Y Dir = 150 x 0.3

= 45.00 T-m

7 Depth required (d) = $\sqrt{\frac{\text{Bending moment x 1000 x 100}}{8.5 \times 150}}$

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R = 8.5 B = 150 cm

$$d = \sqrt{\frac{62.5 \times 1000 \times 100}{8.5 \times 150}} = 70.01 \text{ cm}$$

Provided depth (d) = 1065 mm (This is required for the development length)

However we have to considered pile cap as a deep beam as per IS code 456 : 2000 @ page no 51 cl.29.2

Lever arm z = 0.2 (L + 2D) where L 1500 mm D = 1125 mm

L/D = 1500/1125 = 1.33 m $(1 \leq 1.33 \leq 2)$

Z = 0.2 (1.5 + 2 x 1.125) = 0.750 m

Therefore Z for design (Lever arm) = 0.75 m

8 Area of steel @ X Direction (Ast) = $\frac{\text{Bending moment} \times 1000 \times 100}{2300 \times 75}$

$$Ast = \frac{62.5 \times 1000 \times 100}{2300 \times 75} = 36.23 \text{ cm}^2 \text{ (Required)}$$

Provided steel 12 - Y 20 37.68 cm² > 36.23 cm²

As per code minimum Ast for beam is 0.2% of Cross section area

$$\frac{0.2 \times 150 \times 112.5}{100} = 33.75 \text{ cm}^2$$

Provide bottom steel 12 - Y20 and Top steel 12 - Y12

Area of steel @ Y Direction (Ast) = $\frac{\text{Bending moment} \times 1000 \times 100}{2300 \times 75}$

$$Ast = \frac{45 \times 1000 \times 100}{2300 \times 75} = 26.09 \text{ cm}^2$$

2 Provided steel 12 - Y 20 37.68 cm² > 33.75 cm²

SHEAR

As per code IS 456 : 2000 at page 65 class 34.2.4.2

Critical section will be at a distance d/2 from the face of the pedestal

$$\text{critical section} = \frac{1065}{2} = 533 \text{ mm}$$

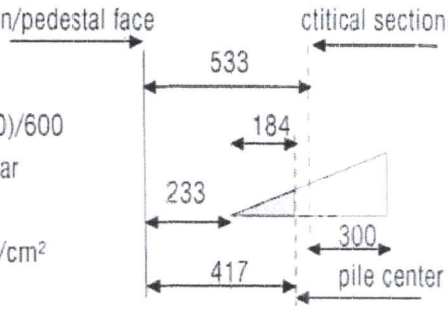
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CGLRGN/SE/Gr-I/2019/11/048.

Pedestal or Column face to Pile Centre = 416.666666666667 (Span)

Pedestal or Column face to Pile Edge = 532.5 - 300 = 233 mm

Pile Edge to Pile Centre Distance = 416.666666666667 - = 184 mm

X	184.17
150.00	600.00



X = (184.166666666667 x 150)/600

X = 46.04 T Design shear

$$\text{Shear stress} = \frac{46.04 \times 1000}{150 \times 106.5} = 2.88 \text{ Kg/cm}^2$$

Therefore stirrups are required 0.2 % steel stress = 2.00 Kg/cm²

IS 456 : 2000 at Table 25 @ 83 page

$$\text{Shear taken by concrete} = \frac{2 \times 150 \times 106.5}{1000} = 31.95 \text{ T}$$

Net Shear = 46.04 - 31.95 = 14.09 T

$$\text{Spacing (Sv)} = \frac{\text{Asv} \times \text{fy} \times \text{d}}{\text{Shear}}$$

Provide shear steel dia = 12 mm Area = 1.13 cm²

$$\text{Spacing (Sv)} = \frac{1.13 \times 2 \times 2300 \times 106.5}{14091.66667} = 39.28 \text{ cm}$$

Minimum stirrup

Therefore minimum stirrups provided as per **IS 456 : 2000** at cl **26.5.1.6**

$$\frac{\text{Asv}}{\text{b} \times \text{sv}} = \frac{0.4}{0.87 \times \text{fy}}$$

$$\text{Spacing (Sv)} = \frac{\text{Asv} \times 0.87 \times \text{fy}}{0.4 \times \text{b}}$$

$$\text{Spacing (Sv)} = \frac{113 \times 2 \times 0.87 \times 415}{0.4 \times 1500}$$

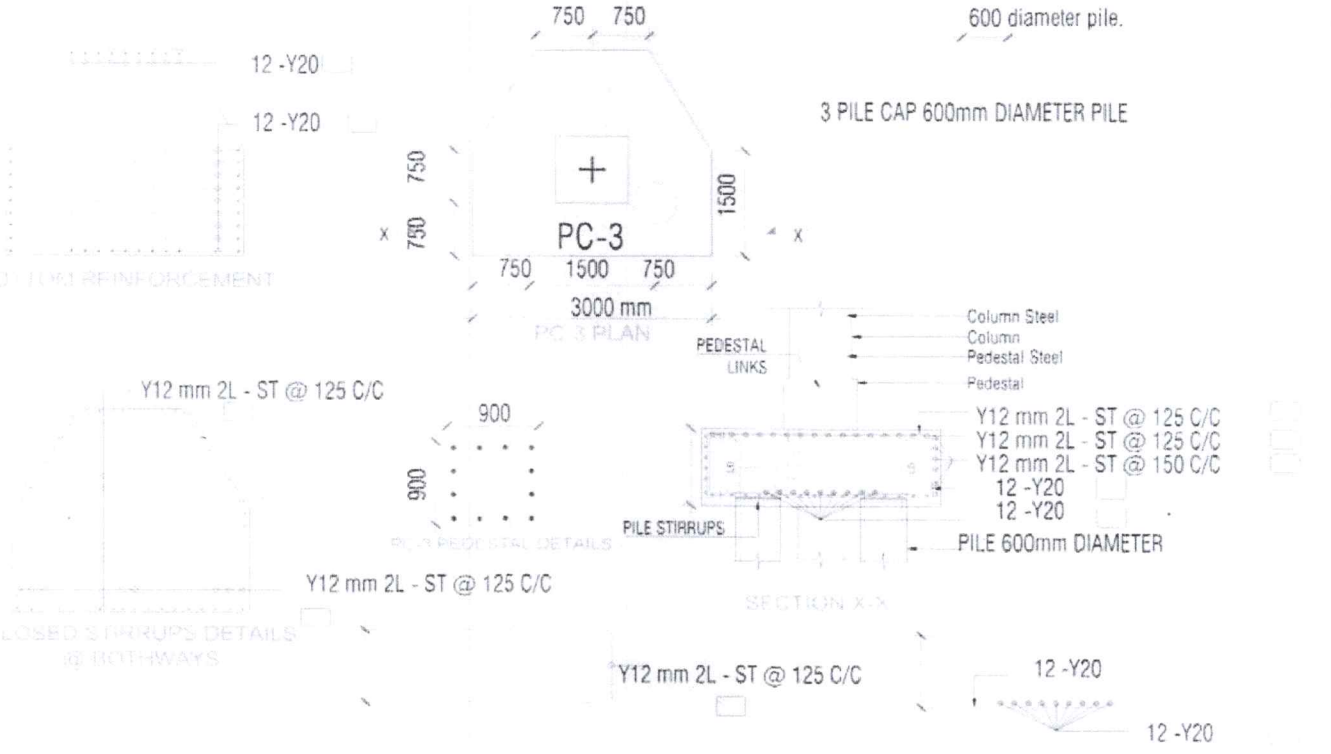
Spacing (Sv) = 136 mm Both direction

Provide = **Y12 mm 2L - ST @ 125 C/C**

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CGLRGN/SE/Gr-I/2019/11/048.

Result

Pile cap size		Reinforcement steel	
Length =	3000 mm		
Bredth =	1500 mm	Bottom Steel =	12 -Y20
Depth =	1200 mm	Stirrups =	Y12 mm 2L - ST @ 125 C/C



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PILE CAP DESIGN

FOUR PILE CAP DESIGN

1 Pile capacity 150 Tons (given by soil report)

2 20mm rods are provided 600 diameter pile.

3 The development length in to the pile cap = 50 x D = 50 x 20 = 1000

4 Considering the development length the pile cap depth

d + d' + pile d = 1000 + 125 + 75 = 1200 mm

5 The spacing of pile = 2.50 x D = 2.5 x 600 = 1500 mm

6 The over hang of the pile cap from the center of pile = 1.25 x D = 1.25 x 600 = 750 mm

7 It's always preferable to provide pedestal for the column

That is size of pedestal 900 mm x 900 mm x H (H is up to top of the plinth beam).

8 Grade beam is provided connecting all the pile caps in both direction to take horizontal force.

9 The top of the grade beam will be same level of top of the pile cap.

10 The pile is embedded in to the pile cap by 75 mm.

Pile cap size 3000 mm x 3000 mm x 1200 mm

PILE CAP DESIGN

1 Design depth = 1200 - 75 = 1125

2 The effective depth = 1125 - 60 = 1065

3 Critical section distance = 1065 / 2 = 533

4 The Bending Moment = Pile reaction X Span

5 $$\text{Span} = \frac{1500 - 900}{2} = 300.0 \text{ mm}$$

6 Therefore the minimum Bending Moment = 150 x 2 x 0.3 90.00 T-m

7 $$\text{Depth required (d)} = \sqrt{\frac{\text{Bending moment} \times 1000 \times 100}{8.5 \times 300}}$$

R = 8.5 B = 300 cm

$$d = \sqrt{\frac{90 \times 1000 \times 100}{8.5 \times 300}} = 59.41 \text{ cm}$$

Provided depth (d) = 1065 mm (This is required for the development length)

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8 Area of steel (Ast) = $\frac{\text{Bending moment x 1000 x 100}}{2300 \times 0.87 \times 106.5}$

$$Ast = \frac{90 \times 1000 \times 100}{2300 \times 0.87 \times 106.5} = 42.23 \text{ cm}^2$$

However we have to considered pile cap as a deep beam as per IS code 456 : 2000 @ page no 51 cl.29.2

Lever arm z = 0.2 (L + 2D) where L 1500 mm D = 1125 mm

L/D = 1500/1125 = 1.33 m (1 ≤ 1.33 ≤ 2)

Z = 0.2 (1.5 + 2 x 1.125) = 0.750 m

Therefore Z for design (Lever arm) = 0.75 m

1 Area of steel Ast = $\frac{\text{Bending moment x 1000 x 100}}{2300 \times 75}$

$$d = \frac{90 \times 1000 \times 100}{2300 \times 75} = 52.17 \text{ cm}^2 \text{ (Required)}$$

2 Provided steel 22 - Y 20 69.08 cm² >67.5 cm²

3 As per code minimum Ast for beam is 0.2% of Cross section area

$$\frac{0.2 \times 300 \times 112.5}{100} = 67.50 \text{ cm}^2$$

Provide bottom steel 22 - Y20 and Top steel 22 - Y12

SHEAR

As per code IS 456 : 2000 at page 65 class 34.2.4.2

Critical section will be at a distance d/2 from the face of the pedestal

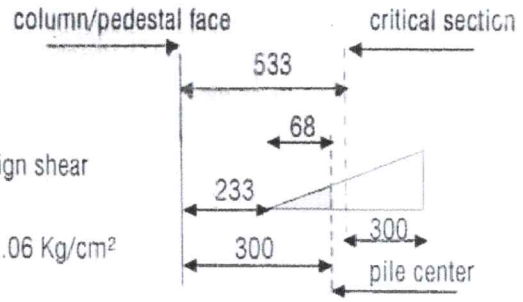
$$\text{critical section} = \frac{1065}{2} = 533 \text{ mm}$$

Pedestal or Column face to Pile Center = 300 (Span)

Pedestal or Column face to Pile Edge = 532.5 - 300 = 233 mm

Pile Edge to Pile Centre Distance = 300 - 232.5 = 68 mm

X	67.50
300.00	600.00



X = (67.5 x 300)/600

X = 33.75 T Design shear

$$\text{Shear stress} = \frac{33.75 \times 1000}{300 \times 106.5} = 1.06 \text{ Kg/cm}^2$$

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Therefore stirrups are required 0.2 % steel stress = 0.20 N/mm² = 2.00 Kg/cm²

IS 456 : 2000 at Table 23 @ 84 page

$$\text{Shear taken by concrete} = \frac{2 \times 300 \times 106.5}{1000} = 63.90 \text{ T}$$

Net Shear = 33.75 - 63.9 -= 30.15 T

Provide shear steel dia = 20 mm Area = 3.14 cm²

$$\text{Spacing (Sv)} = \frac{3.14 \times 2 \times 2300 \times 106.5}{63900} = 24.07 \text{ cm}$$

Therefore minimum stirrups provided as per IS 456 : 2000 at cl 26.5.1.6

$$\frac{Asv}{b \times sv} = \frac{0.4}{0.87 \times fy}$$

$$\text{Spacing (Sv)} = \frac{Asv \times 0.87 \times fy}{0.4 \times b}$$

$$\text{Spacing (Sv)} = \frac{314 \times 2 \times 0.87 \times 415}{0.4 \times 3000}$$

Spacing (Sv) = 189 mm

Provide = Y20 mm 2L - ST @ 175 C/C 16 Nos

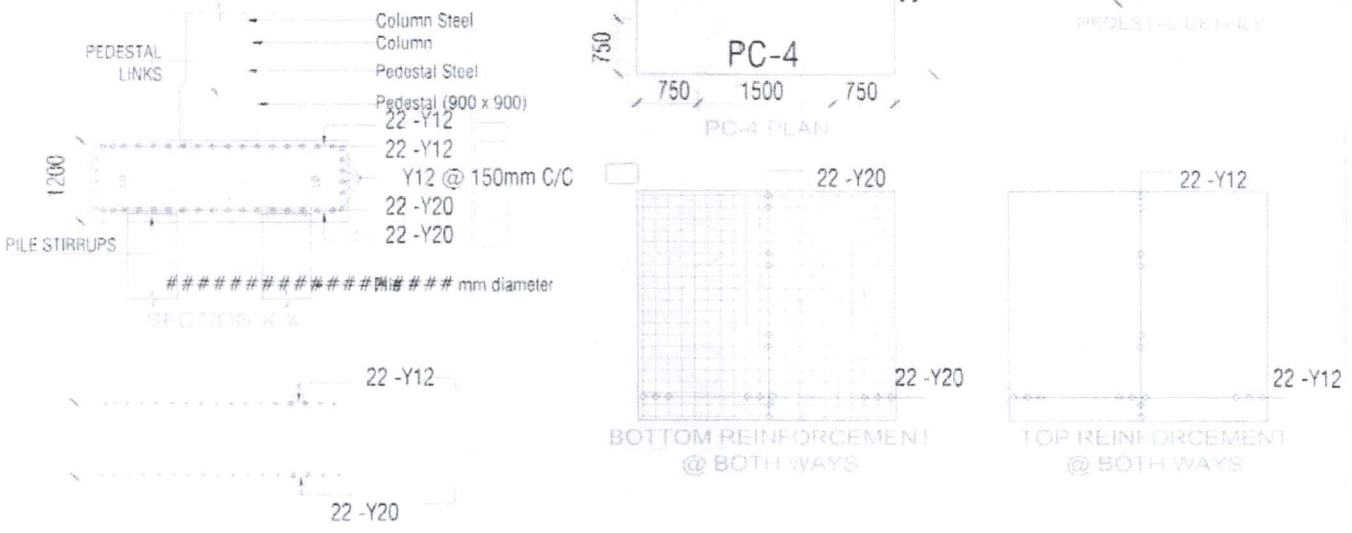
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Result

Pile cap size		Reinforcement steel	
Length =	3000 mm	Top steel =	22 -Y12
Bredth =	3000 mm	Bottom Steel =	22 -Y20
Depth =	1200 mm	Stirrups =	Y20 mm 2L - ST @ 175 C/C

600 diameter pile.

4 PILE CAP600mm DIAMETER PILE



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CONCRETE GRADE : 30 N/mm^2 | **DESIGN OF ONE WAY SLAB** | PAGE NO : 1

STEEL GRADE : 500 N/mm^2 | Over Ground Floor | DONE BY : SAM

S --> SIMPLY SUPPORTED | JOB NO : 6458

C --> CONTINUOUS | PROJECT : GATALA - MADHANATHAPURAM

SLAB NAME	Lx	Lx^2	W	WLx^2	1.5WLx^2	D	COND S (OR) C	1.5WLx^2 / 8	1.5WLx^2 / 10	1.5WLx^2 / 12
	m	m^2	kg/m^2	kg-m	kg-m	cm		kg-m	kg-m	kg-m
S18, S20 S40, S68	1.78	3.17	1720	5449.65	8174.472	12.5	S	10.22	0.00	0.00
				"D" based on l/d =		8.90		2.70	0.00	0.00
				C/C SPACING IN CMS OF DIA		8	mm	17.50	ERR	ERR

RESULT D = 12.5 cm | Y8 @ 7 inch

Load Transfer On Beam Along Lx Direction

In Shoter Direction 1530.8

S19	3.88	15.05	700	10538.1	15807.12	14.0	S	19.76	0.00	0.00
				"D" based on l/d =		19.40		4.54	0.00	0.00
				C/C SPACING IN CMS OF DIA		10	mm	15.00	ERR	ERR

RESULT D = 14.0 cm | Y10 @ 6 inch

Load Transfer On Beam Along Lx Direction

In Shoter Direction 1358

S45	3.73	13.91	700	9739.03	14608.55	14.0	S	18.26	0.00	0.00
				"D" based on l/d =		18.65		4.20	0.00	0.00
				C/C SPACING IN CMS OF DIA		8	mm	10.00	ERR	ERR

RESULT D = 14.0 cm | Y8 @ 4 inch

Load Transfer On Beam Along Lx Direction

In Shoter Direction 1305.5

S46	1.73	2.99	800	2394.32	3591.48	12.5	S	4.49	0.00	0.00
				"D" based on l/d =		8.65		1.19	0.00	0.00
				C/C SPACING IN CMS OF DIA		8	mm	30.00	ERR	ERR

RESULT D = 12.5 cm | Y8 @ 12 inch

Load Transfer On Beam Along Lx Direction

In Shoter Direction 692

		0.00		0	0	14.0	S	0.00	0.00	0.00
				"D" based on l/d =		0.00		0.00	0.00	0.00
				C/C SPACING IN CMS OF DIA		12	mm	ERR	ERR	ERR

RESULT D = ERR | ERR @ ERR

Load Transfer On Beam Along Lx Direction

In Shoter Direction ERR

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RSE100552019
GR-I/2019/11/043.

JOB NO : 6458

TWO WAY SLAB DESIGN (AS PER IS 456)

PROJECT NAME : 6458 - GATAL MADHANATHAPURAM

CONCRETE MIX : 30 n / m^2 STEEL GRADE : 500 n / m^2

NAME	Lx	Ly	Lx^2	W	1.5WLx^2	Ly/Lx	Cond	D	Mx	(kn-m)	My	(kn-m)
Units	m	m	m^2	kg / m^2	kg-m	-	-	cm	-&x	+&x	-&y	+&y
S1	3.12	3.72	9.7	700	10221.12	1.19	9	12.5	0	0.072	0	0.056
			Ly/Lx	ROUND	TO = = =	1.2			0.00	7.36	0.00	5.72
						Lx/35	= = = = = =	8.9	0.00	1.94	0.00	1.51
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	25	ERR	30

RESULT : D = 12.50 cm | Y 8 @ 10 inch | Y 8 @ 12 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **836** In Shoter Direction **728**

S3, S32	3.07	3.72	9.4	700	9896.145	1.21	9	12.5	0	0.079	0	0.056
			Ly/Lx	ROUND	TO = = =	1.3			0.00	7.82	0.00	5.54
						Lx/35	= = = = = =	8.8	0.00	2.07	0.00	1.46
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	22.5	ERR	30

RESULT : D = 12.50 cm | Y 8 @ 9 inch | Y 8 @ 12 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **831** In Shoter Direction **716**

S31	3.73	4.72	13.9	700	14600.713	1.27	4	12.5	-0.065	0.049	-0.047	0.035
			Ly/Lx	ROUND	TO = = =	1.3			-9.49	7.15	-6.86	5.11
						Lx/35	= = = = = =	10.7	-2.51	1.89	-1.81	1.35
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	20	25	27.5	30

RESULT : D = 12.50 cm | Y 8 @ 8 inch | Y 8 @ 11 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **1034** In Shoter Direction **870**

S44	2.97	4.47	8.8	700	9261.945	1.51	9	12.5	0	0.100	0	0.056
			Ly/Lx	ROUND	TO = = =	1.75			0.00	9.26	0.00	5.19
						Lx/35	= = = = = =	8.5	0.00	2.45	0.00	1.37
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	20	ERR	30

RESULT : D = 12.50 cm | Y 8 @ 8 inch | Y 8 @ 12 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **887** In Shoter Direction **693**

S58, S77	3.12	3.72	9.7	700	10221.12	1.19	9	12.5	0	0.072	0	0.056
			Ly/Lx	ROUND	TO = = =	1.2			0.00	7.36	0.00	5.72
						Lx/35	= = = = = =	8.9	0.00	1.94	0.00	1.51
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	25	ERR	30

RESULT : D = 12.50 cm | Y 8 @ 10 inch | Y 8 @ 12 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **836** In Shoter Direction **728**

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JOB NO : 6458

TWO WAY SLAB DESIGN (AS PER IS 456)

PROJECT NAME : 6458 - GATAL MADHANATHAPURAM

CONCRETE MIX : 30 n / m^2 | STEEL GRADE : 500 n / m^2

NAME	Lx	Ly	Lx^2	W	1.5WLx^2	Ly/Lx	Cond	D	Mx	(kn-m)	My	(kn-m)
Units	m	m	m^2	kg / m^2	kg-m	-	-	cm	-&x	+&x	-&y	+&y
S57	3.43	4.47	11.8	1260	22235.661	1.30	9	12.5	0	0.085	0	0.056
			Ly/Lx	ROUND	TO = = =	1.4			0.00	18.90	0.00	12.45
						Lx/35	= = = = = =	9.8	0.00	4.99	0.00	3.29
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	10	ERR	15

RESULT : D = 12.50 cm | Y 8 @ 4 inch | Y 8 @ 6 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **1737** In Shoter Direction **1441**

S75	3.12	5.27	9.7	700	10221.12	1.69	9	12.5	0	0.100	0	0.056
			Ly/Lx	ROUND	TO = = =	1.75			0.00	10.22	0.00	5.72
						Lx/35	= = = = = =	8.9	0.00	2.70	0.00	1.51
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	ERR	17.5	ERR	30

RESULT : D = 12.50 cm | Y 8 @ 7 inch | Y 8 @ 12 inch

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **964** In Shoter Direction **728**

			0.0		0	#DIV/0!	4	12.5	#DIV/0!	#DIV/0!	-0.047	0.035
			Ly/Lx	ROUND	TO = = =	#DIV/0!			#DIV/0!	#DIV/0!	0.00	0.00
						Lx/35	= = = = = =	0	#DIV/0!	#DIV/0!	0.00	0.00
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

RESULT : D = 12.50 cm | Y 8 @ #DIV/0! | Y 8 @ #DIV/0!

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **#DIV/0!** In Shoter Direction **0**

			0.0		0	#DIV/0!	9	12.5	#DIV/0!	#DIV/0!	0	0.056
			Ly/Lx	ROUND	TO = = =	#DIV/0!			#DIV/0!	#DIV/0!	0.00	0.00
						Lx/35	= = = = = =	0	#DIV/0!	#DIV/0!	0.00	0.00
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	#DIV/0!	#DIV/0!	ERR	#DIV/0!

RESULT : D = 12.50 cm | Y 8 @ #DIV/0! | Y 8 @ #DIV/0!

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **#DIV/0!** In Shoter Direction **0**

			0.0		0	#DIV/0!	9	12.5	#DIV/0!	#DIV/0!	0	0.056
			Ly/Lx	ROUND	TO = = =	#DIV/0!			#DIV/0!	#DIV/0!	0.00	0.00
						Lx/35	= = = = = =	0	#DIV/0!	#DIV/0!	0.00	0.00
			C/C Spacing in CMS Diameter - - - - - - - - - - - - - - -					8	#DIV/0!	#DIV/0!	ERR	#DIV/0!

RESULT : D = 12.50 cm | Y 8 @ #DIV/0! | Y 8 @ #DIV/0!

Load Transfer On Beam Along Lx & Ly Direction

In Longer Direction **#DIV/0!** In Shoter Direction **0**

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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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