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DIGITALLY VERIFIED RECORD

Design Report & Stability Certificate

Site Address

Plan showing the Proposed Construction of Stilt Floor + 5 floors (height - 18.30m) Residential Building with 35 dwelling units (Affordable Housing) at Elangovadigal Street and Kambar street, Tellus avenue, Rajakilpakkam, Chennai comprised in S.No.142/1C of Rajakilpakkam Village within the Limits of Tambaram Municipal Corporation.

S.Subramaniam, MS.(Struc).PDQS.DRTM.
Registered Structural Engineer Grade – 1
CMDA : (SE/GR-I/2024/02/008)
DTCP : (CGLDIST/SE/Grade-1/2019/05/005)

Kannimar Consultants

Industrial Building Consultants
Structural Design

New No.14, Kannimar Villa, Ganga Nagar, Jafferkhanpet, Ashok Nagar, Chennai – 83. Ph: 24749439, 95000 74947.
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S. Subramaniam, M.S. (Struc). PDQS. DRTM.
Chartered Engineer
Registered Structural Engineer Grade - I
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Stability Certificate

It is certified that Plan showing the Proposed Construction of Stilt Floor + 5 floors (Height - 18.30m) Residential Building with 35 dwelling units (Affordable Housing) at Elangovadigal Street and Kambar street, Tellus avenue, Rajakilpakkam, Chennai comprised in S.No.142/1C of Rajakilpakkam Village within the Limits of Tambaram Municipal Corporation to resist for earthquake, check has been made and found safe and sound

and I hereby certify that

- The Minimum grade of concrete is M25.
- The design analysis using the code of practice for loading standards as per IS-875 part and seismic force as per the IS 1893 & IS456-2000
- The above said building is designed for earthquake forces of Zone III. The relevant BIS codes were used for its design. Hence it is certified that the above said building is safe in its life circle against the forces like Service loads as well as seismic forces as per specifications given in Zone III of BIS 1893
- Minimum size of the column is 300 mm

S. Subramaniam, M.S.(Struc)., PDQS, DRTM.
Registered Structural Engineer Grade-I.
(SE / GR-I / 2024 / 02 / 008).
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Load calculation

Building Name: Residential
Number of Floor: Stilt + 5

Concrete Unit wt	25	kN/m^3
Brick work	20	kN/m^3
Live load -rooms	2	kN/m^2
Live load -stair&cordr	3	kN/m^2
Floor finish	1	kN/m^2
Floor Height		

Stilt floor	=	3.05 m	parking
First floor	=	3.05 m	Residence
Second floor	=	3.05 m	Residence
Third floor	=	3.05 m	Residence
Fourth floor	=	3.05 m	Residence
Fifth floor	=	3.05 m	Residence
Head room	=	3 m	

Load on Column **column** **D11** X= 4.27 Y = 3.429

Sl. No	Description	No	L	B	D	Qty	UnitLoad	Total Load
	Ground floor							
1	Column Load	1	0.23	0.525	5.75	0.69	25	17.36
2	Plinth beam	1	7.699	0.23	0.375	0.66	25	16.60
3	Roof beam	1	4.27	0.23	0.325	0.32	25	7.98
		1	3.429	0.23	0.325	0.26	25	6.41
4	Roof slab	1	4.27	3.429	0.125	1.83	25	45.76
5	Live load-all area	1	4.27	3.429	1	14.64	2	29.28
6	Floor finish	1	4.27	3.429	1	14.64	1.5	21.96
7	BW: up to FFL	1	7.699	0.23	0.75	1.33	20	26.56
8	BW: Above FFL							
	230 thick	1	0	0.25	2.675	0.00	20	0.00
	115 thick	1	0	0.15	2.675	0.000	20	0.00
	First floor/Typical Floor							**171.91**
1	Column Load	1	0.23	0.525	3.05	0.368	25	9.21
2	Roof slab	1	4.27	3.429	0.125	1.83	25	45.76
3	Roof beam	1	4.27	0.23	0.325	0.319	25	7.98
		1	3.429	0.23	0.325	0.256	25	6.41
4	Live load-all area	1	4.27	3.429	1	14.64	2	29.28
5	Floor finish	1	4.27	3.429	1	14.64	1.5	21.96
6	Brick wall-230 thick	1	0	0.25	2.675	0.00	20	0.00
7	Brick wall -115 thick	1	7.69	0.15	2.6	2.999	20	59.98
	Additional load	1	0	2.5	0.2	0.000	25	0.00
		First floor/Typical Floor						**180.58**
	Parapet load							
1	Brick wall	1	0	0.25	1	0	20	0
2	Weathering coarse material	1	4.27	3.429	0.1	1.46	20	29.28
		Parapet load						**29.28**

COLUMN TOTAL LOAD **column** **D11**

Sl.No	Description	Load
1	Stilt floor	171.91
2	First floor	180.58
3	Second floor	180.58
4	Third floor	180.58
5	Fourth floor	180.58
6	Fifth floor	180.58
7	Terrace	29.28
8	Total	1104.09
	Say	120.00 Mt

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[illegible]
[illegible]

COLUMN DESIGN

Column load as per load calculation		=	120	Mt			
Long Column design as per IS456-2000, Page 71							
Factored Load	P_u	=	$C_r(0.4\ f_{ck}.\ A_c + 0.67\ f_y.\ A_{sc})$				
Working load	P	=	$P_u/1.5$				
	C_r	=	$1.25 - [(l_e/D)/48]$				

PROCEDURE:

	F_{ck}	=	25	N/mm^2			
	F_y	=	415	N/mm^2			
Length of column	L	=	3.6	m			
	l_e	=	3.06	m	0.85* L		
	C_r	=	0.97				
Modulus of elasticity of concrete	E_c	=	25000.00	N/mm^2			
Ref IS 456-2000 Cl 6.2.3.1							
Flexural strength of concrete	f_{cr}	=	3.50	N/mm^2			
Ref IS 456-2000 Cl 6.2.2							
Maximum shear stress in concrete for limit state method of design							
Ref IS 456-2000 Table 20 Cl 40.2.3	$t_{c\,max}$	=	3.1	N/mm^2			
Permissible bearing stress		=	0.45*Fck				
		=	0.45	x	25		
Permissible bearing stress		=	11.25	N/mm^2			
Column size		=	230	525	mm		
Minimum Eccentricity,e		=	L/500 + Lateral dimension/30				
One direction		=	14.87	mm			
Another Direction		=	24.70	mm			
Minimum eccentricity		=	20	mm			
Consider Minimum Eccentricity		=	24.70	mm			
0.05*b		=	11.50		<		24.70
Area of column		=	120750	mm^2			
Number of rod		=					
		=	5	20	1570.60	mm^2	
		=	5	20	1570.60	mm^2	
Area of Steel(A_{sc})		=	3141.20	mm^2			
Area of Concrete(A_c)		=	117608.80	mm^2			
	P_u	=	1993805.762	N			
	P	=	1329203.841	N			
	Say	=	**132.92**	**Tonne**			
% of Reinforcement	**0.8**	<	**2.60**	<	**4**	%	
		SAFE		**SAFE**			
Column Load	132.92	>	120.00	**Mt**			
		SAFE					

Lateral Ties:

As per IS 456-2000; Clause 26.5.3.2.c-Page 49

Diameter shall not be less than	=	20 / 4		
	=	5	mm dia	
Provide	=	8	mm dia	

Spacing

Shall not be more than following				
Least dimension of column	=	230	mm	
16x Smallest dia of column rod	=	320	mm	
Not more than	=	300	mm	
Minimum of above	=	**230**	mm	
Provide 8	@	150	mm C/c	

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Development length in compression

$$Ld = \frac{\emptyset * \sigma s}{4 * T_{bd}}$$

$\emptyset$	=	Dia of bar	=	20.00 mm
σs	=	Stress in bar	=	360.87 N/mm^2
T_{bd}	=	Bond stress	=	2.8 N/mm^2

(Fy/1.15)
Page 43,26.2.1.1

Ld	=	20	360.87
		4	2.8
Ld	=	644.410	mm

SUMMARY

Column size	=	230	x	525	
Rebar	=	5	20		
		5	20		
Lateral tie	8	@	**150**	mm C/c	

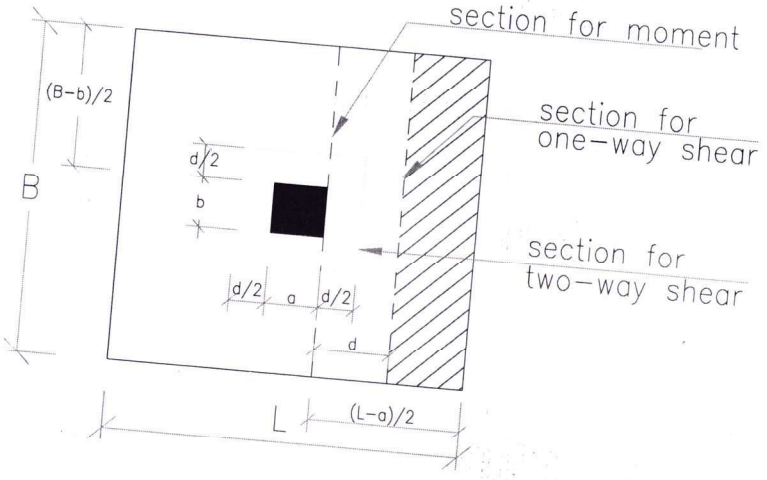
Bond stress for **Compression** 43,IS 456-2000

Grade of concrete	**Type**	**M20**	**M25**	**M30**	**M35**	**M40 & abo**
Design Bond Stress,N/mm^2	Plain	1.5	1.75	1.875	2.125	2.375
	Deformed	2.4	2.8	3	3.4	3.8

ISOLATED FOOTING- Regular

Load on Column(P)			1200 kN	
Ultimate column Load Pu = (1.5 xP)	=		1.5 x 1200 = 1800 kN	
Self Weight of footing(0.1P)	=		0.1 x 1200 = 120 kN	
Total Load on column for footing design			1200 + 120 = 1320	
SBC of soil			250 kN/m²	
f_{ck}	=		25 N/mm²	
f_y	=		415 N/mm²	
T_c max	=		3.1 N/mm²	
$X_{u\,max}/d$	=		0.48	IS456-2000,P73
Mu limit/ fck x b x dx d =	=		0.149	IS456-2000,P70
Assume footing depth	=		600 mm	
Column Size	a		0.23 m	230 mm
	b		0.525 m	525 mm
Area of footing,	A	=	1320 / 250.00	
Size of footing		=	5.28 m²	
Adopt footing size			2.30 m	
Footing area provided	L		2.4 m	B 2.4 m
Net upward pressure(P/A)			5.76 m²	
	p		208.33 < 250 kN/m²	
Ultimate Design Pressure	(1.5 xp)		SAFE	
			312.50 kN/m²	

Depth Required for B M Consideration



Max. BM along column edge = $\frac{P \times B \times (L-a)^2}{8}$

p = 208.33

B = 2.4

L-a = 2.4 - 0.23 = 2.17

$(L-a)^2$ = 4.7089

BM = $\frac{208.33 \times 2.4 \times 4.7089}{8}$

= 294.31

Max. BM = 294.31 kN.m

M_u(1.5 xBM) = 441.46 kN.m

d^2 = $\frac{Mu}{0.36f_{ck}\,(X_u/d)(1-.416X_u/d)1000}$

d^2 = $\frac{441459375.00}{3457.38}$

d^2 = 127686.01

d = **357.33 mm**

D = 600 mm Safe

d = 552 mm 0.552 m

Area of Tension steelfor BM

$BM = 0.87 \times F_y \times A_t\,(d - Fy \times A_t / F_{ck} \times b)$

441459375 = 199299.6 A_t - 2.497 A_t^2

a = 2.497

b = 199299.6

c = 441459375

2a = 4.99

b^2 = 39720330560

4ac = 4409759770

sqrt of b^2-4ac = 187911.07

A_t = 2280.20 mm^2

Per Rm = 950.08 mm^2

Minimum Rebar 0.12% = 662.4 mm^2

Adopt = 950.08 mm^2

16 mm 140 mm c/c

1436.0 > 950.1 mm^2 Per Rm

The design is Safe

P_t = **0.26 %**

Depth Required for Punching shear

Single Shear :Critical section is taken at distance "d" from the face of the column

Shear Force V = Shear area x Pressure

Shear area L = 2.4 m

b = 0.53 m

area = 1.28

V = 208.33 x 1.28

V = 266.50 kN

V_u = 1.50 x 266.50

V_u = 399.75 kN

T_v = $\frac{V_u}{bd}$

= $\frac{399750}{2400 \times 552}$

Nominal Shear Stress T_v = 0.302 N/mm^2

Percentage of steel provided	P_t	=	0.26	%
Shear strength of concrete	T_c	=		
Percentage of steel	P_t	=	0.26	%
Shear strength		=	kT_c	
	k	=	1	

Table19,page 73,IS 456-2000

% of steel	T_c
0.25	0.36
0.5	0.49

	For	0.26	0.37	
Now,kTc		=	0.37	N/mm^2
	0.302	<	0.37	N/mm^2
	T_v	<	kT_c	

The design is **Safe**

Double Shear :Critical section is taken at distance "0.5d" from the face of the column

Footing area		=	2.4	x	2.4
		=	5.76	m^2	
Critical section area		=	0.782	x	1.077
		=	0.84	m^2	
Net area		=	5.76	-	0.84
		=	4.92	m^2	
Shear Force		=	Shear area	x	Pressure
			4.92	x	208.33
	V		1024.54	kN	
	V_u	=	1.50	x	1024.54
Shear Force		=	1536.81	kN	
	T_v	=	V_u / bd		
	b	=	3718 mm		
	d	=	552		
		=	1536808.13		
		=	3718	x	552
Nominal Shear Stress		=	0.75 N/mm^2		
	T'_c	=	$K_s.T_c$		
	K_s	=	0.5+Bc		
	Bc	=	0.44	(a/b)	
	K_s	=	0.94		
Ks Not more than		=	1		
	K_s	=	0.938095238		
	Tc	=	1.250	(0.25*sqrtFck)	
	T'_c	=	1.173		
	Tv	<	T'_c		
	0.75	<	1.173	N/mm^2	

SAFE

SUMMARY

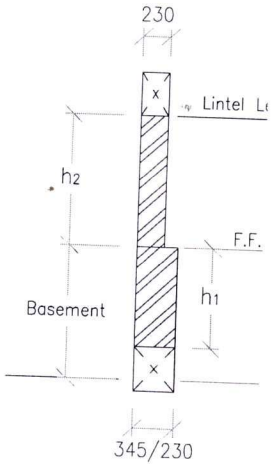
Footing Size	=	**2.4**	x	**2.4**	M
Footing concrete depth	=			**600**	mm
Footing rod	=	**16**	@	**140**	mm c/c

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PLINTH BEAM

Height	=	4.95	m
Wall thickness-Below basement	=	0.23	m
Wall height	=	0.75	m
Wall thick-above basement	=	0.15	m
Wall height	=	0	m
Beam Size b	=	230	mm
D	=	375	mm
d'	=	46	mm
d	=	329	mm
F_y	=	415	N/mm²
F_{ck}	=	25	N/mm²

l/16 = **309** mm
d'/d = 0.140



LOAD CALCULATIONS:

Self wt = b x D x 1 x 25	=	2.16	kN/m
Brick masonry weight below basement	=	3.45	kN/m
Brick masonry weight above basement	=	0	
Max Udl	w =	5.61	kN/m

Max B.M at Mid span = $(wl^2/20)$

5.61	4.95	4.95
	20	

BM = 6.87 kN.M

SF = wl/3 (0.5 x w x l)

5.61	x	4.95
	3	

SF = 9.25 kN

M_u/bd^2 =

1.5	6.87	1000000
230.00	329	329

= **0.41** N/mm²

Refer SP 16 ,Page 86,Pt =

A_{st} =

0.117	%	P_c	= 0.1
0.117	230	329	
	100		

Ast = 88 mm²

= 76 mm²

Provide

2	16
1	12
0	16

"A_{st}" Provided 515.16 > 88.49 **SAFE**

2	16
1	12
0	12

515.1568 > 75.67 **SAFE**

Min.Reinf = $(0.87 \times b \times d / F_y)$ mm²

0.870	230	329
	415	

Min.Reinf = 158.633 mm²

"A_{st}" Provided 515.2 > 158.6 mm² **SAFE**

CHECK FOR SHEAR STRENGTH

T_c Max = $0.62 \sqrt{F_{ck}}$

0.62	5

= 3.10 N/mm²

As per clause 40.2 (P73) of IS 456-2000

Percentage of steel P_t = **0.68** %

Shear strength = kT_c

k = 1

% of steel	T_c
0.5	0.49
0.75	0.57

For 0.68 0.55

kT_c = 1.00 X 0.55

Now kT_c = 0.55 N/mm² < 3.10 N/mm²

Nominal Shear stress T_v = $V_u/b.d$ **SAFE**

V_u = 1.5 X 9.25

= 13.875 kN

T_v = $V_u/b.d$

13.88	1000
230.00	329

T_v = 0.18 < 3.10 N/mm² **SAFE**

0.18 < 0.55 N/mm²

T_v < kT_c **SAFE**

Total shear strength V_u = 13875.47 N

Shear contribution by concrete $T_c b.d$ =

0.55	230	329

41456.1176

Shear contribution by stps V_{us} = V_u - T_c .b.d

13875.47 - 41456.12

-27580.65 N

Provide Y 8 -433 mm C/C

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Area or 2 legged stps — a = 101 mm^2

Spacing of stirrups — $\frac{0.87 * Fy * a * d}{V_{us}}$

0.87	415	101	329
	-27580.65		

= **-433** mm C/C

Provide shear Rebar without considering conc. shear — Y 8 — **861** mm C/C

Area or 2 legged stps — a = 101 mm^2

$\frac{0.87 * Fy * a * d}{V_u}$

0.87	415	101	329
	13875.47		

= **861 mm C/C**

V_{us}/d

-27580.65	10
329.00	1000

= -0.838 kN/cm

Minimum Stirrups Reinforcement — Y 8

A_{sv} = 100.52 mm^2

S_v = $\frac{0.87*Fy*Asv/0.4*b}{}$

0.87	415	101
0.4	230.00	

$\frac{36292.16832}{92}$

= **394** **mm** **C/C**

Maximum Spacing of Stirrups

= 0.75 *d = 246.75 mm

= 300 mm

Least of above = 246.75 mm

Provide — Y 8 @ 175

394 > 175 < 246.75 — **SAFE** **SAFE**

531 > 175 < 861 — **SAFE** **SAFE**

Development length in Tension

Ld = $\frac{\emptyset * \sigma s}{4 * T_{bd}}$

Ø = Dia of bar = 16 mm

σs = Stress in bar(Fy/1.15) = 360.87 N/mm^2

(0.87*Fy)

T_{bd} = Bond stress = 2.24 N/mm^2

Page 43,26.2.1.1

Ld =

16	360.8695652
4	2.24

Ld = 644.4 mm

Bond stress for **tension** P 43,IS 456-2000

Grade of concrete	Type	M20	M25	M30	M35	M40 & above
Design Bond Stress,N/mm^2	Plain	1.2	1.4	1.5	1.7	1.9
	Deformed	1.92	2.24	2.4	2.72	3.04

SLAB DESIGN AS PER BIS-2000 METHOD

Location:

L_x	=	3.69	m
L_y	=	5.56	m
f_{ck}	=	25	N/mm²
f_y	=	415	N/mm²
L_y/L_x	=	1.51	

Two Way Slab

Span	=	3.69	m	Span/32
Slab thickness	=	125	mm	115.3
Cover		20	mm	
Effective depth		105	mm	
Concrete wt	=	25	kN/m³	
Live Load on Slab	=	2	kN/m²	
Floor finish	=	1.5	kN/m²	

Design Load:

slab weight	=	3.125	kN/m²
Live + Floor finish Load	=	3.5	kN/m²
Total Load	=	6.63	kN/m²

$M_x = a_x w l^2_x$

$M_y = a_y w l^2_x$

As per IS456-2000-Table 26-Page No:91

Negative Moment at edge

L_y/L_x = **1.51**

a_y = 0.047

		Ly/Lx		For
		1.5	**1.75**	1.51
Negative Moment @ edge	a_x	*0.084*	*0.091*	0.084
Positive Moment at mid span	a_x	*0.064*	*0.069*	0.064

				M_{ux}	M_{uy}
M_x	=	7.59	kNM	11391708.04	
M_y	=	4.24	kNM		6359569.7
Maximum Bm	=	**7.59**	kNM		
"d" - reqd under compression	=	57.46	<	105	mm
			Safe		

		M_{ux}	M_{uy}	
$M_u/b.d^2$	=	1.03	0.58	N/mm²

As per SP16, Table 2,Page 48,

P_t	=	%	**0.301**	**0.164**	
Area of steel	=	mm²	316.48	172.54	
Adopt					
Y	10	140	mm C/C	10	140	**mm C/C**
	560.93	>	316.48	560.93	>	172.54
		Safe			**Safe**	

Positive Moment at mid span

a_y = 0.043

				M_{ux}	M_{uy}
M_x	=	5.79	kNM	8678174.288	
M_y	=	3.88	kNM		5818329.7
Maximum Bm	=	**5.785**	kNM		

$M_u/b.d^2$ =

As per SP16, Table 2,Page 48,

M_{ux}	M_{uy}	
0.79	0.53	N/mm²

P_t =

Area of steel = % | 0.227 | 0.150 |

Adopt = mm² | 237.98 | 157.47 |

Y | 10 | 140 | mm C/C | 10 | 140 | mm C/C

560.93 > 237.98 Safe 560.93 > 157.5 Safe

Check for Shear strength

As per clause 40.2 (P72) of IS 456-2000

T_c Max = 0.62 *sqrt(F_{ck})

0.62	5

= 3.10 N/mm²

For slab as per 40.2.3.1

T_c Max = 0.5*$T_c$max

0.50	3.10

T_c Max = 1.55 N/mm²

Percentage of steel **P_t = 0.53 %**

Shear strength = k t_c

Permissible shear stress in concrete (kt_c) for solid slabs in limit state design method

Ref IS 456:2000 Cl 40.2.1.1, Table 19

f_{ck} N/mm²	p_t %	D of slab	k	k t_c N/mm²
25	0.53	125	1.30	0.65

Now,kTc

k t_c = 0.65 < 1.55 N/mm²

Safe

Nominal Shear stress

T_v = $V_u/b.d$

V_u = 18.33469 kN

T_v = 0.17 < 1.55 N/mm²

Safe

T_v < kT_c

Safe

Check for Defflection

Live Load

2 < 3.01 kN/m²

Defflection calculation is Not Necessary

A_{st} required = 237.98 mm²

A_{st} Provided = 560.93 mm²

Steel stress for service Load F_s = 0.58 x F_y X $\frac{A_{st}\ required}{A_{st}\ Provided}$

As per Fig-4,IS 456-2000,Page38

0.58	415	237.98
	560.93	

F_s = **102.12 N/mm²**

Percentage of steel provided = **0.53 %**

Modification factor-Fig-4

Asper IS 456-2000-Page 38

f_y N/mm²	f_s N/mm²	$p_{t\ req.}$ %	$p_{t\ prov.}$ %	MF_t
415	102.12	0.23	0.53	IS 456 Fig 4
				2.00

Effective depth ratio

For,Simply supported = 20

Continues = 26

Cantilever

(Lx/d) Max		=	7		
		=	26	x	2.000
(Lx/d)Provided		=	52.00		
		=	3690		
			105		
(Lx/d) Max		=	35.143		
	52	>	35.14	(Lx/d)Provided	
		Safe			

Maximum diameter of bars for slabs

Ref IS 456-2000 Cl 26.5.2.2

D of slab mm	dia of bar mm	Result Cl 26.5.2.2
125	**10**	**Ok**

Centre Beam-Continues

Span	=	4.95	m			
Lateral span	=	3.43	m			
Wall height	=	2.6	m			
Wall thickness	=	0.15	m			
b	=	230	mm			
D	=	450	mm	l/12.5	**396**	mm
d'	=	50	mm	d'/d =	0.125	
d	=	400	mm			
f_y	=	415	N/mm^2			
f_{ck}	=	25	N/mm^2			

Slab Load:

Self wt	=	3.125	kN/m^2	slab thk	0.125 m
Live Load	=	2	kN/m^2		
Floor Finish	=	1.5	kN/m^2		
Mish. Load	=	1	kN/m^2		
		7.625	kN/m^2		

Load Calculations:

Brick work/ AAC Block	=	**20**	kN/m^3
Self wt – b x D x 1 x 25	=	2.59	kN/m
Brick work:	=	6.63	kN/m
Udl for slab	=	17.09	kN/m
Max Udl	w =	26.31	kN/m
M_u Limit	=	$0.138\ f_{ck}\ bd^2$	

0.138	25	230	160000

= 126960000.00 Nmm

126.96 > 87.91

M_u limit > M_u

Singly Reinforced

"d" - reqd = 332.84 < 400 mm

Safe

Max B.M at Mid span = $(wl^2/13)$

26.31	4.95	4.95
	13	

BM = 49.59 kN.M

M_u Midspan = **74.38 kN.M**

Max B.M at Support = $(wl^2/11)$

26.31	4.95	4.95
	11	

BM = 58.61 kN.M

M_u Support = **87.91 kN.M**

SF = wl/2 (0.5 x w x l)

26.31	x	4.95
	2	

SF **65.12 kN**

M_u/bd^2 @Mid span =

1.5	49.59	1000000
230.00	400	400

= **2.02** N/mm^2

M_u/bd^2 @Support =

1.5	58.61	1000000
230.00	400	400

= **2.39 N/mm^2**

Rebar @ Mid span

Refer SP 16 ,Page 86,Pt =

P_t	P_c
0.625	0.31

0.625 %

A_{st} =

0.625	230	400
	100	

	Ast	=	575	mm^2		=	287	mm^2
Provide	3	16				3	16		
	2	16				0	20		
	0	16				0	16		
"A_{st}" Provided	1005.18	>	574.96	mm^2		603.1104	>		
	1.09	**Safe**				**0.66**	**Safe**		

Rebar @ Support

		P_t	P_c	
Refer SP 16 ,Page 86,Pt	=	0.757	0.379	**0.757** %

A_{st}	=	0.757	230	400
			100	

	Ast	=	697	mm^2		=	348	mm^2
Provide	3	16				3	16		
	2	16				0	20		
	0	16				0	16		
"A_{st}" Provided	1005.18	>	696.54	mm^2		603.1104	>		
	1.09	**Safe**				**0.66**	**Safe**		

Min.Reinf = 0.87 x b x d / F_y mm^2

=	0.870	230	400	
		415		

Min.Reinf = 192.867 mm^2

"A_{st}" Provided 1005.184 > 192.867 mm^2

Safe

Min. % of steel required

As per Cl.26.5.1.1 IS456:2000 = 0.205 %

As per Cl.6.2.1 IS13920:1993 = 0.290 % (0.24 √ fck) /fy)

$p_{t\,min}$ = **0.290** % < 1.09 %

Safe

Max. % of steel to be used =

As per Cl.26.5.1.1 IS456:2000 = 4.000 %

As per Cl.6.2.1 IS13920:1993 = 2.500 %

$p_{t\,max}$ = **2.500** % > 1.09 %

Safe

CHECK FOR SHEAR STRENGTH

As per clause 40.2 (P73) of IS 456-2000 — Tc Max = 0.62 *sqrt(Fck)

=	0.62	5

= 3.10 N/mm^2

Percentage of steel P_t = **1.09** %

Permissible shear stress in concrete (kt_c) for solid slabs in limit state design method

Ref IS 456:2000 Cl 40.2.1.1, Table 19

f_{ck} N/mm^2	p_t %	D of slab	k	$k\,t_c$ N/mm^2
25	**1.09**	**450**	1.00	0.66

Now kT_c = 0.66 N/mm^2 < 3.10 N/m

Safe

Nominal Shear stress T_v = $V_u/b.d$

V_u = 1.5 X 65.12

97.676

T_v = $V_u/b.d$

=	97.68	1000
	230.00	400

= 1.06 < 3.10 N/mm^2

Safe

1.06 > 0.66 N/mm^2

T_v > kT_c

Provide shear Bar

Total shear strength V_u = 97675.50 N

Shear contribution by concrete $T_c b.d$ =

0.66	230	400

60720

Shear contribution by stps V_{us} = V_u - $T_c.b.d$

97675.50 - 60720

Minimum shear resistance 0.4bd = 36955.50 N

= 36800.00 N

Provide = 36955.50 N

Y 10

Area or 2 legged stps a = 614 mm C/C

Spacing of stirrups = 157 mm^2

$$\frac{0.87 * Fy * a * d}{V_{us}}$$

=

0.87	415	157	400
	36955.50		

614 mm C/C

Provide shear Rebar without considering conc. shear =

Y 10

a = **232** mm C/C

= 157 mm^2

$$\frac{0.87 * Fy * a * d}{V_u}$$

=

0.87	415	157	400
	97675.50		

232 mm C/C

Minimum Stirrups Reinforcement =

Y 10

A_{sv} = 157.06 mm^2

S_v = 0.87*Fy*Asv/0.4*b

0.87	415	157
0.4	230.00	

$$\frac{56706.513}{92}$$

Maximum Spacing of Stirrups = **616** **mm** **C/C**

= 0.75 *d

= 300 mm

Least of above = 300 mm

300 mm

Provide Y 10

@

616 > 150 < 300

Safe **Safe**

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STAIRECASE -DOG LEGGED MODEL

Location:

L_x	=	5.33	m			
F_{ck}	=	25	N/mm^2			
F_y	=	415	N/mm^2			
Step weight		20	kN/m^3			
Landing width	=	1.2				
Slope length	=	2.93				
Step tread	=	0.25	m			
Step riser	=	0.165	m			
Slope length for one step	=	0.300	m			
Number of tread	=	2.93				
	=	0.25				
	=	11.7	No			
Say	=	11	No			
Aditional slope length per flight	=	11		x	0.050	
	=	0.54				
Effective length	=	5.87	m			
Concrete wt	=	25	kN/m^3			
Waist slab thickness	=	0.140	m		(Assumed)	

Loads:

Dead load of Waist slab	=	3.5	kN/m^2			
Ceiling finish	=	0.25	kN/m^2			
Sub total	=	3.75	kN/m^2			
Dead Load on plan area	=	3.75		x	0.300	
					0.25	
	=	4.49	kN/m^2			
Brick load	=	0.165		x	20	
					2	
		1.65	kN/m^2			
Live load	=	3	kN/m^2			
Floor finish	=	1.5	kN/m^2			
Total load on staire	=	10.64	kN/m^2			

Maximum BM($w \times l^2/12$)	=	10.64		x	5.87 ^{2}	
	=				12	
	=	30.61	kN.M			
M_u	=	1.5	x		30612353	
		45918529.59	Nmm			

45918529.59		
0.138	25	1000

		13309.72				
sqrt	=	115.37	mm			
Cover	=	20.00	mm			
Total	=	135.37	mm			
Provide	=	140.00	mm			
d		117.00				
$M_u/b.d^2$		45918529.59				
		1000.00		117.00	117.00	
		3.35				

As per SP16, Table 2,Page 48,

P_t	=	**1.148**	%			
Area of steel	=	1.14849709		x	1000	x 117.00

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100

Adopt = 1343.74 mm^2

Y 16 140 **mm C/C**

1435.98 > 1343.74 mm^2

Safe

Distributer:

Provide minimum steel = 0.12%

0.12	1000	117.00
	100	

= **140.4** mm^2

Adopt

Y 10 150 **mm C/C**

523.53 > 140.4 mm^2

Safe

Check for Shear strength

As per clause 40.2 (P72)
of IS 456-2000

Percentage of steel P_t = $\frac{1435.98 \times 100}{1000 \times 117.00}$

P_t = **1.23** %

Shear strength = kT_c

k = 1.2

IS456-2000,Page73,table19

% of steel	T_c
1	0.64
1.25	0.7

For **1.23** 0.695 N/mm^2

kT_c = 1.200 x 0.695

0.833

Nominal Shear stress T_v = $V_u/b.d$

V_u

1.5	5.87	10.64
	2	

V_u = 46.8959 kN

T_v $\frac{46.8959 \times 1000}{1000 \times 117.00}$

T_v = 0.4008 < 0.8335

T_v < kT_c

SAFE

SUMMARY

Waist slab thick = **140.00 mm**

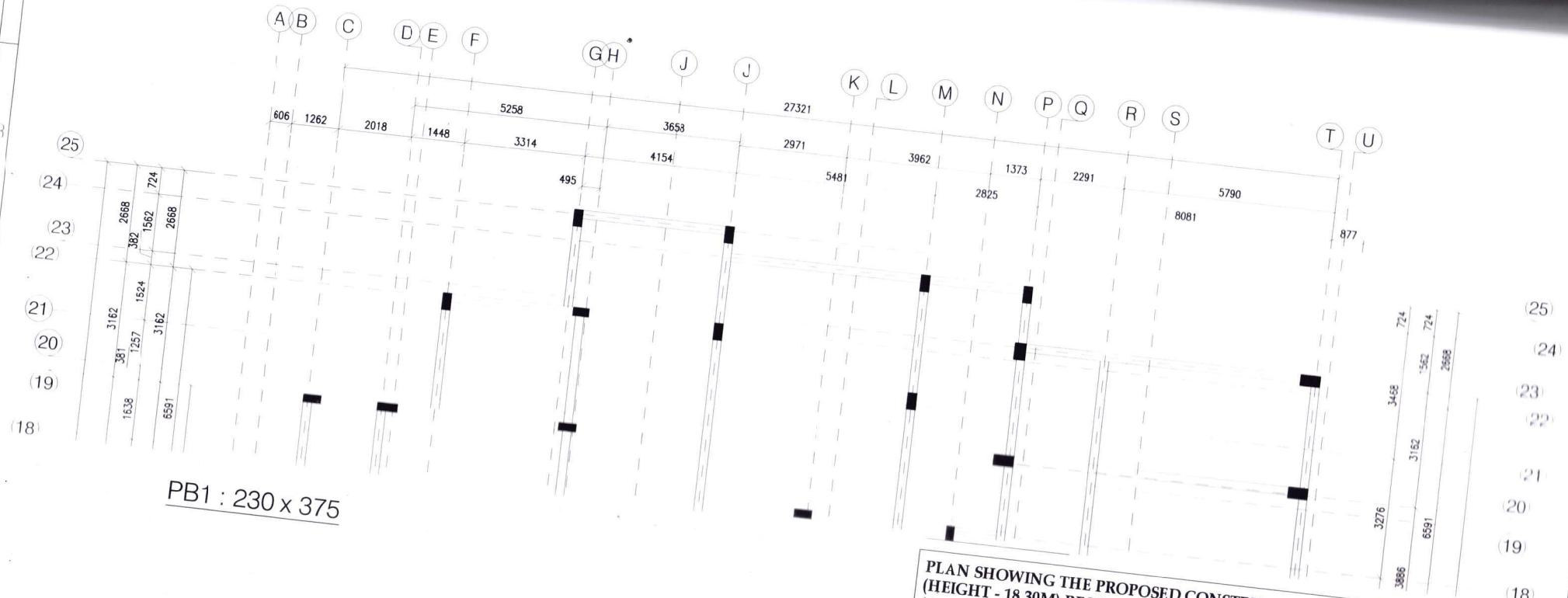
Main Rebar = **Y 16** @ 140 **mm C/C**

Distributer = Y 10 @ 150 **mm C/C**

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SUNSHADE DESIGN

1	Grade of concrete		F_{ck}	=	**25** N/ mm^2	
2	grade of steel		Fy	=	**415** N/ mm^2	
3	Width of sunshade			=	**0.6** m	
4	Sunshade thickness -	t_{max}		=	0.075 m	**75** mm
		t_{min}		=	0.1 m	**100** mm
		average		=	0.0875	87.5
		cover		=	0.014	**15**
		effective depth d		=	0.061 m	61 mm
5	Self weight of sunshade			=	2.19 kN/ m^2	
	Finishes			=	1 kN/ m^2	
	Live load			=	0.75 kN/ m^2	
			Total		3.94 kN/ m^2	
6	Maximum BM	W $L^2/2$		=	0.71 kN.M	
		"d" req		=	16.02 <	61 mm
					SAFE	
7	M_u/ bd^2			=	**0.29** N/mm^2	
		P_t		=	**0.085**	
	Area of steel			=	51.85 mm^2	
	Adopt		**Y 10**		**140 mm C/C**	
		560.93		>	51.85 mm^2	
					Safe	



PB1 : 230 x 375

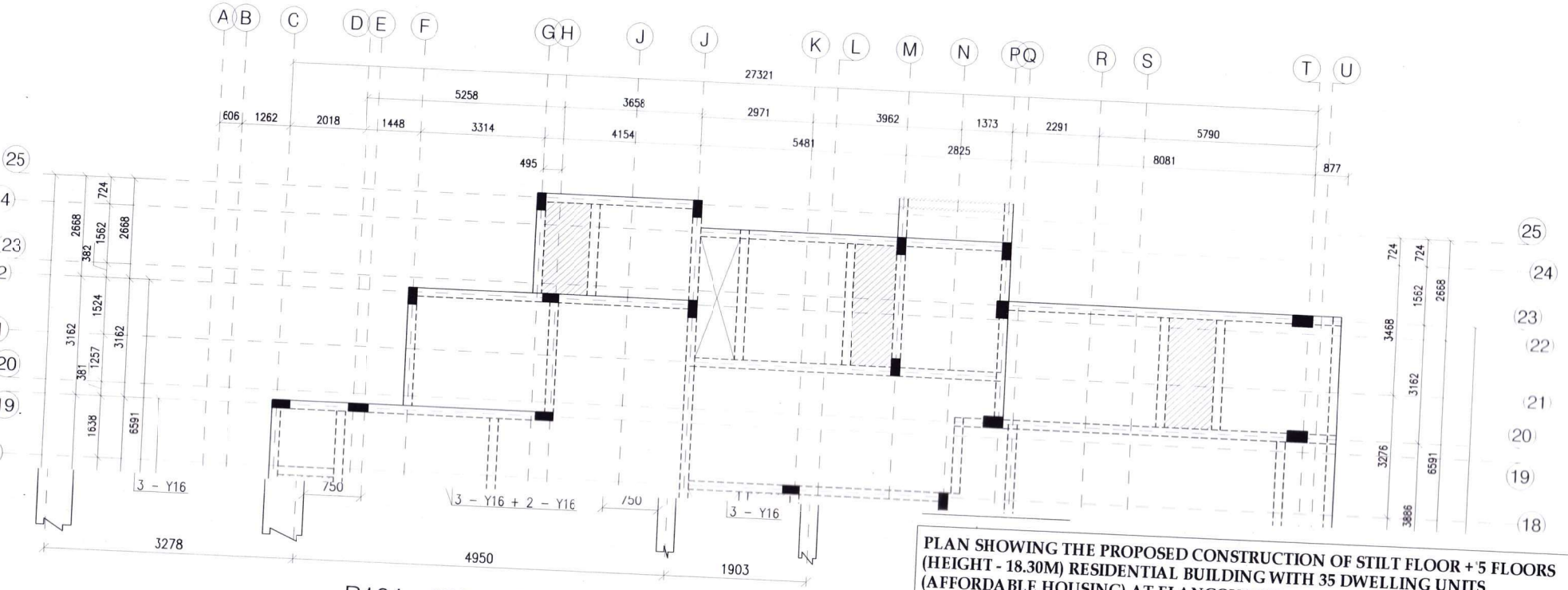
PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS (HEIGHT - 18.30M) RESIDENTIAL BUILDING WITH 35 DWELLING UNITS (AFFORDABLE HOUSING) AT ELANGOVADIGAL STREET AND KAMBAR STREET, TELLUS AVENUE, RAJAKILPAKKAM, CHENNAI COMPRISED IN S.NO.142/ 1C OF RAJAKILPAKKAM VILLAGE WITHIN THE LIMITS OF TAMBARAM MUNICIPAL CORPORATION.

Notes:

1.	All Dimensions Are In MM.
2.	Use Fe415/Fe500 Grade Steel.
3.	Use Mix M25 For all Works
4.	Clear Cover To The Reinforcement For Footing:50mm Column:40mm,Beam:30mm,Slab:20mm,Rcc Wall:20mm.

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B101 : 230 x 450

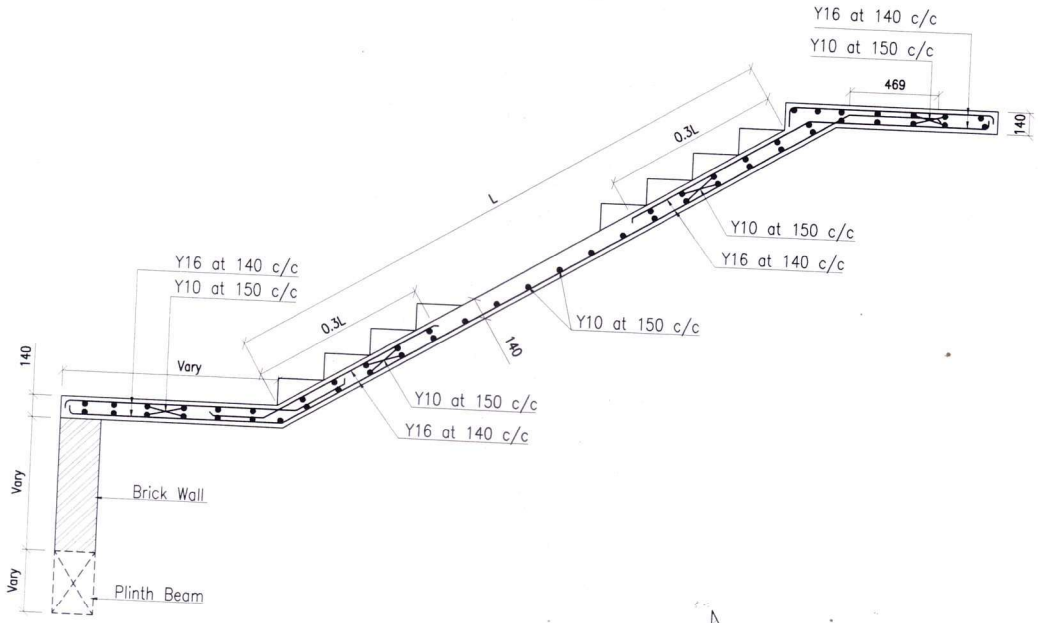
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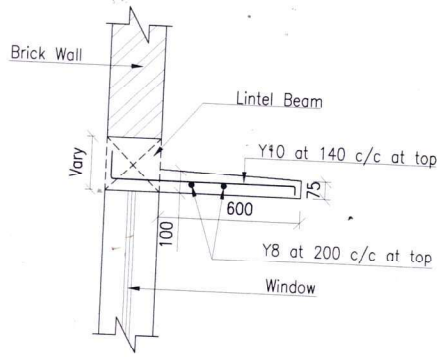
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C.S. of Staircase Details



Sunshade Detail (Typ)

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Site Address:

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