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DIGITALLY VERIFIED RECORD

ANJU CONSTRUCTIONS
GST- 33AAPPU0795B2ZI

Plot No. A-24, Door No.17,
6th Cross Street, Anna Nagar,
Chengalpattu - 603001.
E-mail : anjuconstructions05@gmail.com
Cell : +91 94431 01912

Er. S. Udhayakumar, Proprietor
B.E.,M.Tech(Struct).,M.Sc.,(REV),F.I.V.,

Date ;.....

STRUCTURAL ANALYSIS & DESIGN FOR THE PROPOSED BUILDING

Name of work : **THE PROPOSED CONSTRUCTION RESIDENTIAL BUILDING AT PLOT No.B-26, V th CROSS STREET, ANNA NAGAR, IN OLD S.No.200/1,2 & 201/A1, TOWN SURVEY No.27, BLOCK No.6, WARD No.VI, CHENGALPATTU TOWN / MUNICIPALITY / DISTRICT.**

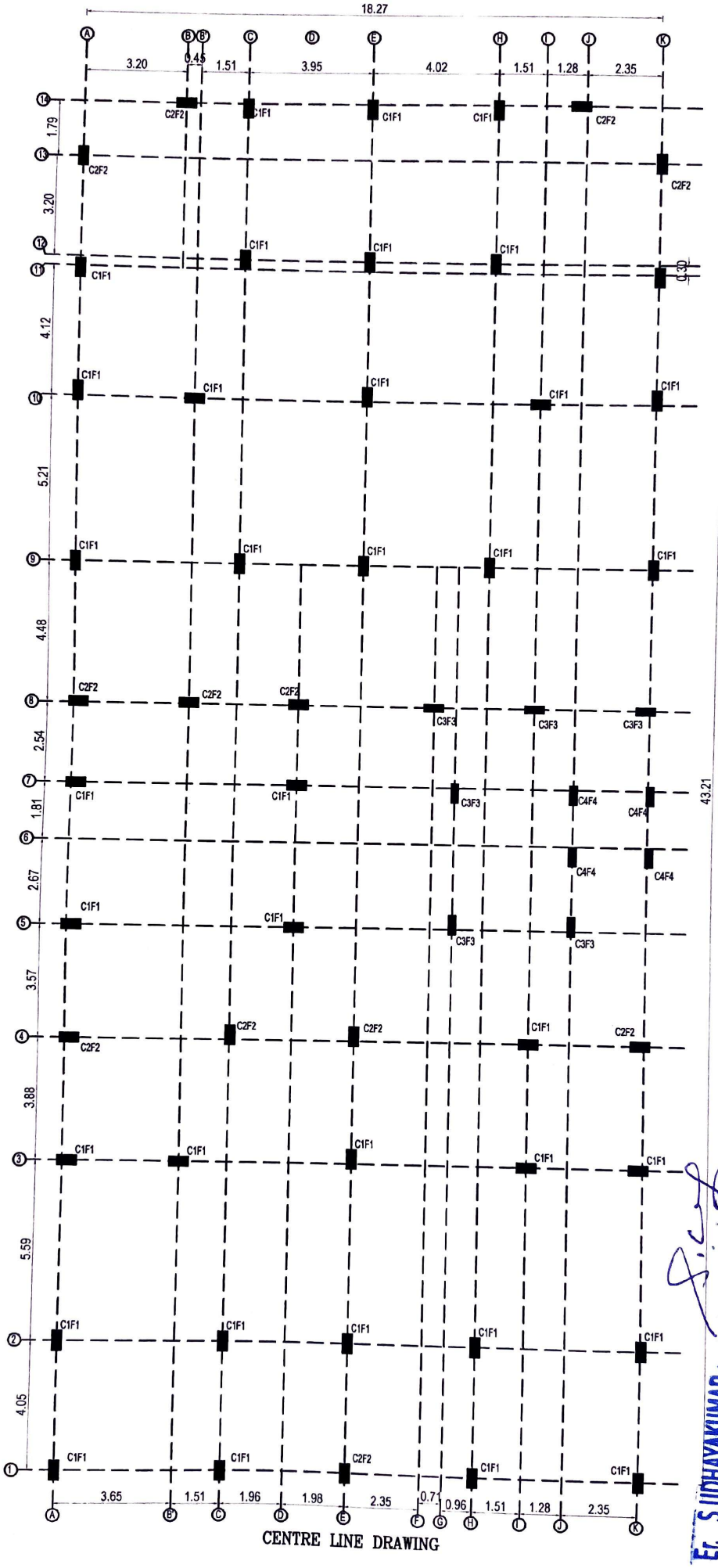
Preamble :

1. I hereby certify that the structural design is done by working stress method, as per section 6 of IS 456 and Limit State Method as per IS 456
2. I hereby certify that the Structural design sheet is done for critical column, Beam, slab and footing for the proposed building.
3. The usage of the building in stilt floor for car parking and all other Floors for fully Residential purpose .
4. The building consists of stilt + Four Upper Floors
5. The superstructure is built on 230 mm thick outer walls and 115 mm thick inner walls.
6. The soil is Greyish fine clayey sand upto 10.0 M depth in layer.
7. The safe bearing capacity of soil is 16 ton/m^2
8. All concrete for all proposed RCC members in Ground Floors are 1:1:2 mix (M25 concrete)
9. The structural design includes the earthquake Criteria as per the IS Code :

   IS 456 - 2000 for concrete
   IS 875 for design load
   IS 432 for Steel Reinforcement
   IS 1893 for earthquake resistant design

Er. S.UDHAYAKUMAR, B.E.,M.Tech(Struct),M.Sc(Rev),FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

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CENTRE LINE DRAWING

Er. S.UDHAYAKUMAR, B.E., M.Tech(Struct), M.Sc(Rev), FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

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DESIGN OF ONE WAY CONTINUOUS SLAB

Input data:

short span		=	2.54	m	
Slab thickness		=	150	mm	
Assume slab thickness		=	150	mm	(say)
Self weight of the slab		=	3.75	kN/m^2	
Filling load in toilet slab		=	2.00	kN/m^2	
Finishes load		=	1.50	kN/m^2	
Machine/Equipment load		=		kN/m^2	
Water proof course load		=	0.00	kN/m^2	
water tank load		=	0.00	kN/m^2	
Live load		=	2.00	kN/m^2	
Edge condition		=	2.00		
Total load intensity on slab		=	9.25	kN/m^2	
Take	w	=	9.25	kN/m^2	
	f_{ck}	=	25	N/mm^2	
	f_y	=	500	N/mm^2	
Clear Cover		=	20	mm	
Diameter of the Bar	Dia main	=	10	mm	Ok
	Dia sec	=	8	mm	
Minimum Steel		=	0.12	%	
	D	=	150.00	mm	
	d main	=	125.00	mm	
	d sec	=	116.00	mm	
	l_y/l_x	=	0.00		

2.54 m

2 Calculations:

Panel type		*short span*	Positive (span moments)	5.19	kN-m
2.00		2.54	Negative (supports moments)	6.11	kN-m
M_x		M_x +ve		M_x -ve	
Moment	=	5.19	kN-m	6.11	kN-m
Factored M_u	=	7.78	kN-m	9.17	kN-m
d	=	125.00	mm	116.00	mm
M_u/bd^2	=	0.50	N/mm^2	0.68	N/mm^2
p_t	=	0.118	%	0.162	%
A_{st} reqd	=	150.00	mm^2	188.06	mm^2
Diameter of bar	=	10	mm	10	mm
Spacing required	=	524	mm c/c	418	mm c/c
Spacing provided	=	150	mm c/c	200	mm c/c
A_{st} provided	=	523.6	mm^2	392.7	mm^2

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3 Check for Deflection:

span/depth	=	20.32	Permissible value		=	101.44
		Area of steel provided		=	523.60	
		Provided p_t		=	0.419	%
			f_s	=	83.08	
		Modification factor		=	3.901	from IS 456
						Safe

4 Check for shear stress:

Factored V_u	=	14.48	kN	
Shear stress	=	0.116	N/mm^2	
τ_{cmax}	=	3.1	N/mm^2	Safe
Provided p_t	=	0.419	%	
τ_c	=	0.448	N/mm^2	
modification factor k	=	1.3		
$\tau_{cmodified}$	=	0.58	N/mm^2	Safe

5 Distribution Reinforcement:

A_{st} reqd	=	180	mm^2
Diameter of bar	=	8	mm
Spacing required	=	279	mm c/c
Spacing provided	=	200	mm c/c

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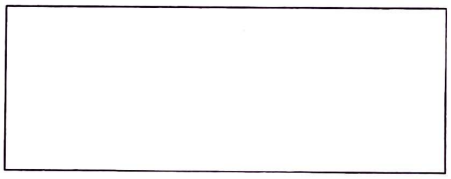
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DESIGN OF TWO WAY RESTRAINED SLAB

1 Input data:

Long span		=	5.59	m	
Short span		=	5.16	m	
l_y/l_x		=	1.08		Hence ok
Slab thickness		=	161	mm	
Assume slab thickness		=	150	mm	(say)
Self weight of the slab		=	3.75	kN/m^2	
Filling load in toilet slab		=	0.00	kN/m^2	
Finishes load		=	1.50	kN/m^2	
Machine/Equipment load		=	0.00	kN/m^2	
Water proof course load		=	0.00	kN/m^2	
water tank load		=	0.00	kN/m^2	
Live load		=	2.00	kN/m^2	
Edge condition		=	4.00		
Total load intensity on slab		=	7.25	kN/m^2	
Take	w	=	7.25	kN/m^2	
	f_{ck}	=	25	N/mm^2	
	f_y	=	500	N/mm^2	
Clear Cover		=	20	mm	
Diameter of the Bar	Dia main	=	10	mm	Ok
	Dia sec	=	10	mm	
Minimum Steel		=	0.12	%	
	D	=	150.00	mm	
	d main	=	125.00	mm	
	d sec	=	115.00	mm	
	l_y/l_x	=	1.08		
		5.59	m		

5.16 m



2 Calculations:

PANEL	l_y/l_x	short span		α_x	M_x	α_y	M_y	
4.00	1.08	5.16	Negative	0.052	10.04	0.047	9.07	
			Positive	0.039	7.56	0.035	6.76	
		M_x -ve	M_x +ve		M_y -ve		M_y +ve	
Moment	=	10.038	7.56		9.07		6.76	
Factored M_u	=	15.06	11.34		13.61		10.13	
d	=	125.00	125.00		115.00		115.00	
M_u/bd^2	=	0.96	0.73		1.03		0.77	
p_t	=	0.233	0.173		0.250		0.183	
A_{st} reqd	=	290.68	216.49		286.98		210.35	
Diameter of bar	=	10	10		10		10	
Spacing required	=	270.2	363		274		373	
Spacing provided	=	150	150		180		180	(say)
A_{st} provided	=	523.6	523.6		436.3		436.3	

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3 Check for Deflection:

span/depth = 41.28 Permissible value = 69.35

Area of steel provided = 523.60

Provided p_t = 0.419 %

f_s = 119.91

Modification factor = 2.667 from IS 456

Safe

4 Check for shear stress:

Factored V_u	=	28.06	kN	
Shear stress	=	0.224	N/mm^2	
τ_{cmax}	=	3.1	N/mm^2	Safe
Provided p_t	=	0.419	%	
τ_c	=	0.448	N/mm^2	
modification factor k	=	1.3		
$\tau_{cmodified}$	=	0.58	N/mm^2	Safe

5 Torsional reinforcement:

Torsional reinforcement is provided in 4 layers (Top and bottom in both directions)

Case 1 At corner where the slab is discontinuous on both sides (C1)

Dimensions from edges

l_x	=	1.03	m	
l_y	=	1.03	m	
A_{st}	=	393	mm^2	In each layer
Dia of bar	=	10	mm	
Spacing	=	200	mm c/c	
Provide spacing	=	200	mm c/c	

Case 2 At corner contained by edges over one of which is continuous (C2)

Dimensions from edges

l_x	=	1.03	m	
l_y	=	2.064	m	
A_{st}	=	196	mm^2	In each layer
Dia of bar	=	10	mm	
Spacing	=	400	mm c/c	
Provide spacing	=	200	mm c/c	

Case 3 At corner contained by edges over both of which the slab is continuous (C3)

Torsional reinforcement is not required

Details of torsional reinforcement (In each layer)

Type	Dimensions along		Bar dia(mm)	Spacing(mm c/c)
	x(m)	y(m)		
C1	1.03	1.03	10	200
C2	1.03	2.064	10	200
C2	2.064	1.03	10	200

Er. S.UDHAYAKUMAR, B.E., M.Tech (Struct), M.Sc (Rev), FI
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/00
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

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DESIGN OF STAIRCASE

1 Input Data:

Height of flight	=	1.5	m	
Riser	=	150	mm	
Tread	=	300	mm	
Effective span(c/c between supports),l	=	3.00	m	
Initial span/depth ratio	=	26		
No. of risers in each flight	=	10.0	Nos	
No. of Tread in each flight	=	10.0	Nos	
Waist slab thickness,t	=	3/26*1000		
	=	115.4	mm	
	=	150	mm	(say)
Nominal cover to reintorcement	=	20	mm	
Dia of main bars	=	12	mm	
Dia of distribution bars	=	10	mm	
Effective depth,d	=	150-20-12/2		
	=	124	mm	
f_{ck}	=	25	N/mm^2	
f_y	=	500	N/mm^2	

2 Loads on going

Self weight of slab	=	{25x150xsq.root(150^2 + 300^2)/300}	
	=	4.19	kN/m^2
Self weight of steps	=	{25x150/2}/1000	
	=	1.88	kN/m^2
Finishes	=	1.5	kN/m^2
Live load	=	2	kN/m^2
Reaction from other flight/ other loads	=	2	kN/m^2
Total load	=	4.19+1.875+1.5+2+2	
	=	11.57	kN/m^2
	=	11.57	kN/m^2
Factored load, ***w***	=	1.5x11.5676274578121	
	=	17.35	kN/m^2
Design moment, considering 1m width	=	$wl^2/10$	
M_u	=	17.3514411867182x3^2/10	
	=	15.62	kN-m
M_u/bd^2	=	15.6162970680463x10^6/(1000x124^2)	
	=	1.02	N/mm^2
Percentage of steel (A_{st}/bd)	=	0.246	%
A_{st}	=	305	mm^2

Spacing of 12mm dia. bars	=	1000x(π/4)x12^2/305.11		
	=	371	mm	
Spacing of main bars	=	**150**	mm c/c	(say)
Provide steel A_{st}	=	753.84	mm^2	
Provided p_t	=	0.61	%	
Distribution steel =0.0012bD	=	0.0012x1000x150		
	=	180	mm^2	
Spacing of distributors	=	1000x(π/4)x10^2/180		
	=	436	mm	
Spacing to be provided for distributors	=	**150**	mm	(say)

3 *Check for deflection:*

Actual span/depth ratio	=	24.19		
Moditier tor span/depth ratio	=	2.14	(Based on Cl.23.2.1, IS 456)	
Span/depth ratio to be checked tor	=	26		
.: Modified span/depth ratio	=	26x2.13	=	55.6
		Safe		

4 *Development length:*

Development length L_d	=	583	mm
Provide L_d	=	**900**	mm

5 *Check for shear stress:*

Factored V_u	=	26.03	kN	
Shear stress	=	0.210	N/mm^2	
τ_{cmax}	=	3.1	N/mm^2	**Safe**
Provided p_t	=	0.608	%	
τ_c	=	0.525	N/mm^2	
modification factor k	=	1.3		
$\tau_{cmodified}$	=	0.68	N/mm^2	**Safe**

Er. S.UDHAYAKUMAR, B.E., M.Tech (Struct), M.Sc (Rev), FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

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RB1

DESIGN OF BEAM AS PER IS 456:2000

Density of conc=	25	Kn/m3			fck	20	N/mm2
Density of brick=	19.2	Kn/m3			fy	500	N/mm2
Density of mortar=	20.8	Kn/m3					

span of beam, l=	5.59	m				Wall length=	5.36	m
Assume, D=	0.45	m	450	mm	d= 417	wall height=	3	m
b=	0.23	m	230	m		width of wall=	0.23	m
Self weight of beam, u1=	2.5875	KN/m				Plaster Thickness=	0.03	m
wall load, u2=	15.12	KN/m						
Total udl, w=u1+u2=	17.7075	KN/m						

Bending moment for span,M1=wl^2/24	23.05523878	Kn-m	M1u=	34.58285817
Bending moment for support,M2=wl^2/12	46.11047756	Kn-m	M2u=	69.16571634

Area of Steel of Single Bar for various diameter:

Dia(mm)	Area
12	113.04
16	200.96
20	314
25	490.625
32	803.84

For Support:

Check: 1 Type of beam:(balanced/under reinforced/over reinforced)

	M2u=	69.16571634	Kn-m
Pt=	50*(fck/fy)*[1-(1-4.6Mu/fck*b*d^2)^0.5]=	0.447914769	%
	4.6*Mu/(b*d^2)=	0.397757859	
	1-4.6*Mu/(b*d^2)=	0.602242141	
	[1-4.6*Mu/(b*d^2)]^0.5=	0.776042615	
	1-[1-4.6*Mu/(b*d^2)]^0.5=	0.223957385	
	50*(fck/fy)*[1-(1-4.6Mu/fck*b*d^2)^0.5]=	0.447914769	
Ast=		463.591786	mm2
0.36fck*Xu*b=0.87*fy*Ast			
Xu/d=	2.42*(fy/fck)*(Ast/bd)	0.270988435	
Xumax,=		0.46	For Fe 500

As Xu/d< Xumax/d, hence section is under reinforced section.

Limiting neutral axis depth			
	Fe250	FE415	Fe500
Xumax/d=	0.53	0.48	0.46

limiting moment coefficient				
	Fe250	FE415	Fe500	
Mu,lim/fc*b*d^2=	0.149	0.138	0.133	

Modification factor for tension reinforcement				
Ref IS 456:2000 Fig 4				
f_y	f_s	$p_{t\,req.}$	$p_{t\,prov.}$	MF_t
N/mm^2	N/mm^2	%	%	IS 456 Fig 4
500	49.59	0.447915	2.619122	1.55

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Check: 2 **Singly reinforced/doubly reinforecd**

	M2u=	69.16572	Kn-m
	Mu,lim= 0.133fc*b*d^2	106.3853	Kn-m
	M2u< Mu, lim, Hence, singly reinforced beam.		
Check: 3	**Check for deflection**		
a	**Modification for tension reinf.**		
	Area of tension reinf. Required		
	Ast(req)	463.5918	mm2
	% Pt(req)=	0.447915	%
	Area of tension reinf. Provided		
	Ast(Prov.) (4-20+4-20Φ)	2512	mm2
	% Pt(Prov.)=	2.619122	%
	Modification factor, M1=	**1.55**	
b	**Modification for compression reinf.**		
	Pc(comp)= (2-20Φ)	628	
	% Pc=	0.654781	%
	modification factor, M2=	**1.20**	
basic L/d for continuos beam,=		26	
d=		215	
d with modification, =(d* M1*M2)		398.7117	
over all depth, D=		433.7117	
Depth assumed,= D assumed		**450**	

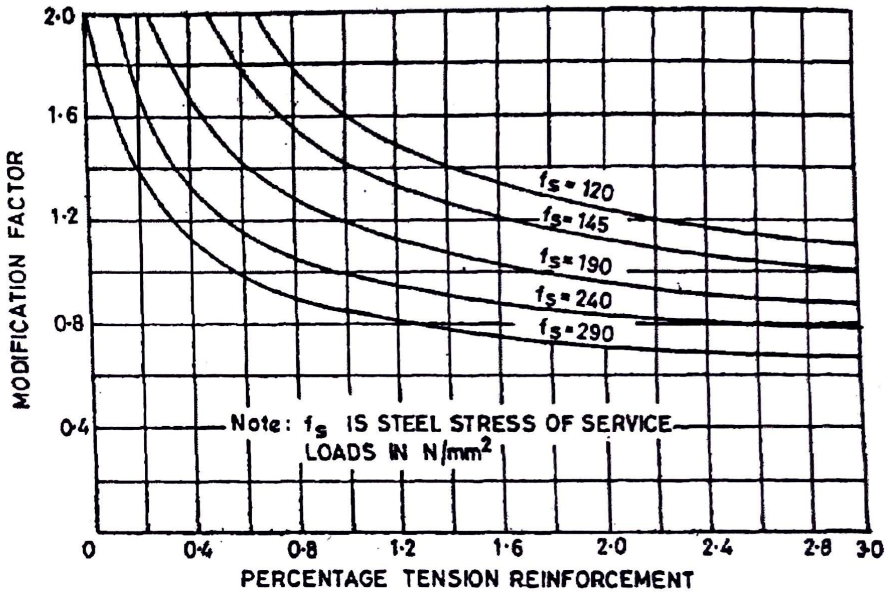
As D assumed > depth cal.(hence, safe for deflection)

For Span:

Check: 1 **Type of beam:(balanced/under reinforced/over reinforced)**

	M1u=	34.58285817	Kn-m
Pt=	50*(fck/fy)*[1-(1-4.6Mu/fck*b*d^2)^0.5]=	0.178769149	%
	4.6*Mu/(b*d^2)=	0.170779547	
	1-4.6*Mu/(b*d^2)=	0.829220453	

Modification factor for compression reinforcement				
Ref IS 456:2000 Fig 5				
p_c	MF_c			
%	IS 456 Fig 5			
0.654780523	1.20			



$$f_s = 0.58\, f_y \frac{\text{Area of cross-section of steel required}}{\text{Area of cross-section of steel provided}}$$

FIG. 4 MODIFICATION FACTOR FOR TENSION REINFORCEMENT

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[1-4.6*Mu/(b*d^2)]^0.5=	0.910615426		
1-[1-4.6*Mu/(b*d^2)]^0.5=	0.089384574		
50*(fck/fy)*[1-(1-4.6Mu/fck*b*d^2)^0.5]=	0.178769149		
Ast=	185.0260689	mm2	
0.36fck*Xu*b=0.87*fy*Ast			
Xu/d= 2.42*(fy/fck)*(Ast/bd)	0.108155335		
Xumax,=	0.46	For FE500	

As Xu/d< Xumax/d, hence section is under reinforced section.

Check: 2 Singly reinforced/doubly reinforecd

M2u=	34.58286	Kn-m
Mu,lim= 0.133fc*b*d^2	106.3853	Kn-m

M2u< Mu, lim, Hence, singly reinforced beam.

Check: 3 Check for deflection

a	**Modification for tension reinf.**		
	Area of tension reinf. Required		
	Ast(req)	185.0261	mm2
	% Pt(req)=	0.178769	%
	Area of tension reinf. Provided		
	Ast(Prov.) (4-20+4-20Φ)	2512	mm2
	% Pt(Prov.)=	2.619122	%
	Modification factor, M1=	**1.82**	
b	**Modification for compression reinf.**		
	Pc(comp)= (2-20Φ)	628	
	% Pc=	0.654781	%
	modification factor, M2=	**1.20**	
basic L/d for continuos beam,=		26	
d=		215	
d with modification, =(d* M1*M2)		468.1647	
over all depth, D=		503.1647	
Depth assumed,= D assumed		**450**	

As D assumed > depth cal.(hence, safe for deflection)

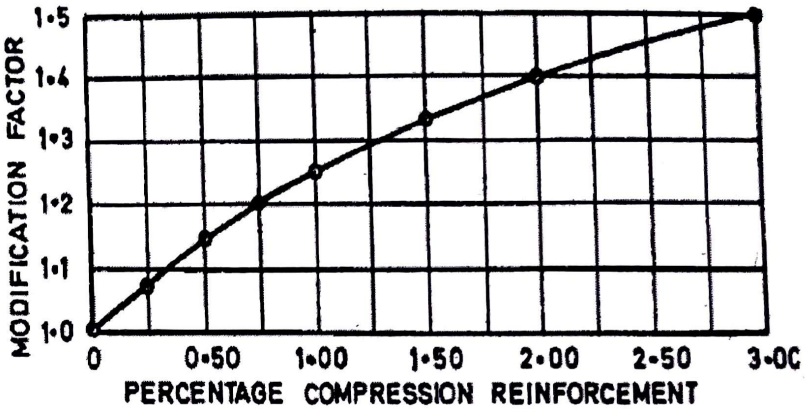


FIG. 5 MODIFICATION FACTOR FOR COMPRESSION REINFORCEMENT

Modification factor for tension reinforcement				
Ref IS 456:2000 Fig 4				
f_y	f_s	$p_{t\ req.}$	$p_{t\ prov.}$	MF_t
N/mm^2	N/mm^2	%	%	IS 456 Fig 4
500	19.79	**0.178769**	**2.619122**	1.82

Modification factor for compression reinforcement				
Ref IS 456:2000 Fig 5				
p_c	MF_c			
%	IS 456 Fig 5			
0.654780523	1.20			

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COLUMN DESIGN C1

This Design Document represents Design of RC Column with 4 Sided equally Distrubuted R/f with Provisions of **IS 456 : 2000**

DESIGN DATA :

Factored Axial Load = P_u =	200	T
Factored Moment about Major Axis = Mux =	1	T-m
Factored Moment about Minor Axis = Muy =	1	T-m

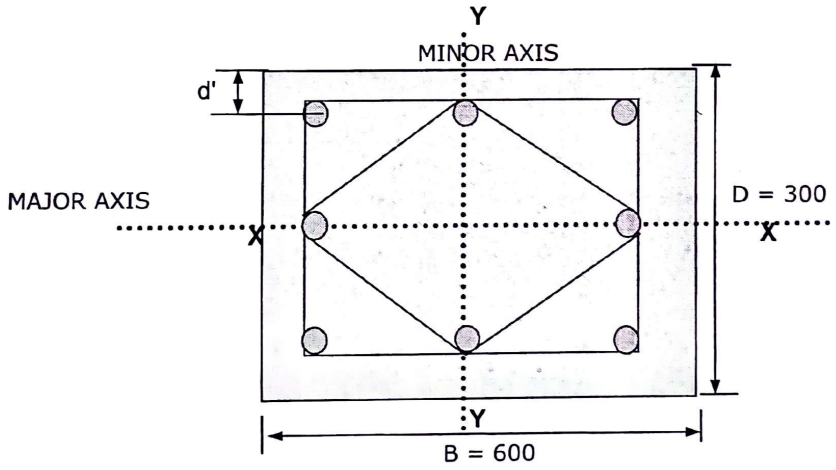
PROPERTIES OF SECTION :

B = Width of Column i.e Minor Axis Size =	0.6	m
D = Depth of Column i.e Major Axis Size =	0.3	m
Lx = Unsupported Length about Major Axis =	2.7	m
Ly = Unsupported Length about Minor Axis =	2.7	m

MATERIAL SPECIFICATION :

Concrete Grade :	M - 25	N/mm^2
R/f Grade :	Fe - 415	N/mm^2

GO TO SUMMARY



NOTE :
R/F SHOWN IS INDICATIVE ONLY
CHECK FOR SLENDERNESS :

Lx = Unsupported Length about Major Axis = 2.7 m
lex = Effective Length about Major Axis = **Kx = 1.2**
l_{ex} = Kx * Lx= (1.2 x 2.7) = 3.24 m

CLICK FOR EFECTIVE LENG

Ly = Unsupported Length about Minor Axis = 2.7 m
ley = Effective Length about Minor Axis = **Ky = 1.2**
l_{ey} = Kx * Ly= (1.2 x 2.7) = 3.24 m

λx =Slenderness Ratio about Major Axis =
λx = (l_{ex} / D) = (3.24 / 0.3) = 10.8

M_{usx} = Moment due to Slenderness about Major Axis

$$M_{usx} = \frac{(P_u * D) * [l_{ex}/D]^2}{2000} = 0 \text{ T-m}$$

M_{usx} is Zero, if (λx) is <= 12

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λx =Slenderness Ratio about Minor Axis =

$\lambda y = (l_{ey} / B) =$ (3.24 / 0.6) = 5.40

M_{usy} = Moment due to Slenderness about Minor Axis

$$M_{usy} = \frac{(P_u * B) * [l_{ey}/B]^2}{2000} = 0 \text{ T-m}$$

M_{usy} is Zero, if (λy) is <= 12

EFFECT OF MINIMUM ECCENTRICITY : (ECCENTRICITY ABOUT BOTH AXIS CONSIDERED)

Minimum Eccentricity about Major Axis (e_{min-x}) =

$e_{min-x} = (Lx / 500) + (D/ 30) =$ 0.020 m

Or **0.02m** whichever is greater

Minimum Eccentricity about Minor Axis (e_{min-y}) =

$e_{min-y} = (Ly / 500) + (B/ 30) =$ 0.025 m

Or **0.02m** whichever is greater

Moment due to minimum Eccentricity about Major Axis =

$M_{ecc-x} = P_u * e_{min-x} =$ 4.000 T-m

Moment due to minimum Eccentricity about Minor Axis =

$M_{ecc-y} = P_u * e_{min-y} =$ 5.080 T-m

DESIGN FACTORED FORCES :

Factored Axial Load = P_u = 200 T

Factored Moment about Major Axis = Mux =

$M_{ux} = [(M_{ux(i)}$ **OR** $M_{ecc-x}) + M_{usx}] =$ 4 T-m

(Note := M_{usx} shall be added only if Slenderness ratio is greater than **12**)

Factored Moment about Minor Axis = Muy =

$M_{uy} = [(M_{uy(i)}$ **OR** $M_{ecc-y}) + M_{usy}] =$ 5.08 T-m

(Note := M_{usy} shall be added only if Slenderness ratio is greater than **12**)

Reinforcement to be distributed equally on **FOUR SIDES .**

Adopt Bar Combination = **12 - 20 #**

Total Area of Steel A_s(Total) = 3768 mm^2

Corresponding Percentage of Steel = p_t % = 2.09 %

UNIAXIAL BENDING CAPACITY ABOUT MAJOR AXIS = M_{UX1}

Bars Contribution in Major Axis = **12 - 20 #**

Percentage of Steel about Major Axis = p_t % = 2.10 %

Area of Steel = Ast = $p_t * B * D =$ 3768 mm^2

pt / fck = (2.1 / 25) = 0.084

d' = Effective Cover = **40** mm

d' / D = (40 / 300) = 0.13 **REFER CHART- 45 of d' / D = 0.15**

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CLICK FOR CHART

P_u / fck * B * D =

(2000000 / 25 x 600 x 300) = 0.444

M_{ux1} / fck * B * D^2 = **0.05**

(Mux1 = 0.05 x 25 x 600 x 300 ^2) = 6.75 T-m

UNIAXIAL BENDING CAPACITY ABOUT MINOR AXIS = M_{UY1}

Bars Contribution in Minor Axis = **12 - 20 #**

Percentage of Steel about Minor Axis = p_t % = 2.10 %

Area of Steel = Ast = pt * B * D = 3768 mm^2

pt / fck = (2.1 / 25) = 0.084

d' = Effective Cover = **40** mm

d' / B = (40 / 600) = 0.07 REFER CHART-44 of d' / D = 0.1

CLICK FOR CHART

P_u / fck * B * D =

(2000000 / 25 x 600 x 300) = 0.444

M_{uy1} / fck * D * B^2 = **0.05**

(Muy1 = 0.05 x 25 x 300 x 600 ^2) = 13.5 T-m

CHECK FOR INTERACTION RATIO :

$$\left(\frac{M_{ux}}{M_{ux1}}\right)^{\alpha_n} + \left(\frac{M_{uy}}{M_{uy1}}\right)^{\alpha_n} \leq 1.0$$

where,

M_{ux} = Factored Moment about Major Axis due to Design Loads =

M_{ux} = 4 T-m

Mux1 = Maximum Uniaxial Bending Moment Capacity about major Axis for an Axial Load of Pu

M_{ux1} = 6.75 T-m

M_{uy} = Factored Moment about Minor Axis due to Design Loads =

M_{uy} = 5.08 T-m

Muy1 = Maximum Uniaxial Bending Moment Capacity about minor Axis for an Axial Load of Pu

M_{uy1} = 13.5 T-m

α_n is related to P_u / P_{uz}

where, P_{uz} = 0.45 fck * Ac + 0.75 fy * A_{sc}

P_{uz} = (0.45 x 25 x (600 x 300 - 3768) + 0.75 x 415 x 3768)

$\therefore$ P_{uz} = 315.54 T

$\left(\frac{P_u}{P_{uz}}\right)$ = 0.634 $\therefore \alpha_n$ = 1.72 (α_n = 1.0, if (P_u / P_{uz}) <= 0.2 ; α_n = 2.0, if (P_u / P_{uz}) >= 0.8)

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$$\therefore \left(\frac{M_{ux}}{M_{ux1}}\right)^{1.72} + \left(\frac{M_{uy}}{M_{uy1}}\right)^{1.72} = 0.406 + 0.186 = 0.592$$

HENCE ASSUMED R/F IS ADEQUATE

TRANSVER R/F :

Use Diameter of Transverse R/f = 8 mm

The Pitch of Tranverse R/f shall be not more than the least of following.

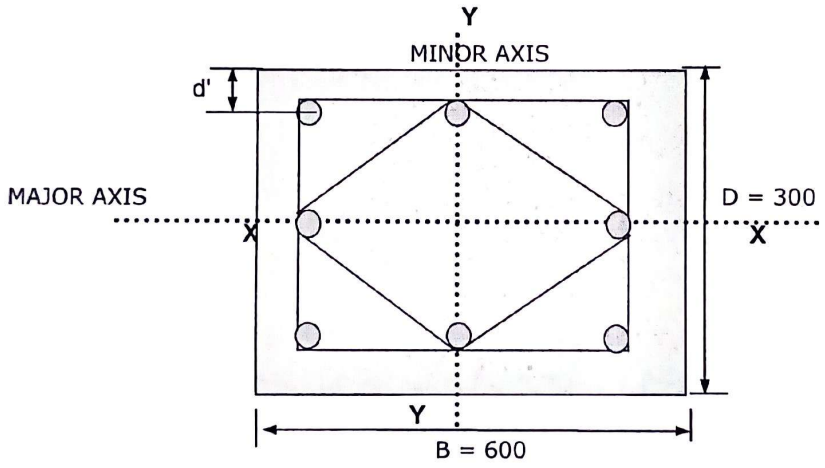
1. Least Lateral dimension of column = 300 mm
2. 16 x Smallest Dia of Longitudinal R/f = 320 mm
3. Minimum 300 mm

Provide 8 # with 295 c/c as Transverse R/f

DESIGN SUMMARY :

B =	600	mm	Main R/f =	12 - 20 #	
D =	300	mm	Links =	8 # @ 295 c/c	
fck	M - 25	N/mm²	Eff. Cover =	40	mm
fy =	Fe - 415	N/mm²			

SKETCH :

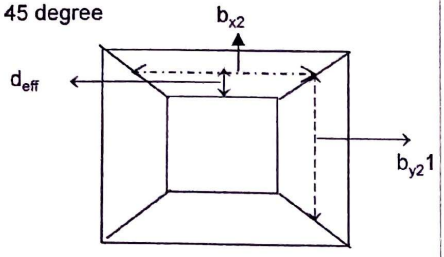


Er. S.UDHAYAKUMAR, B.E., M.Tech (Struct), M.Sc (Rev), FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

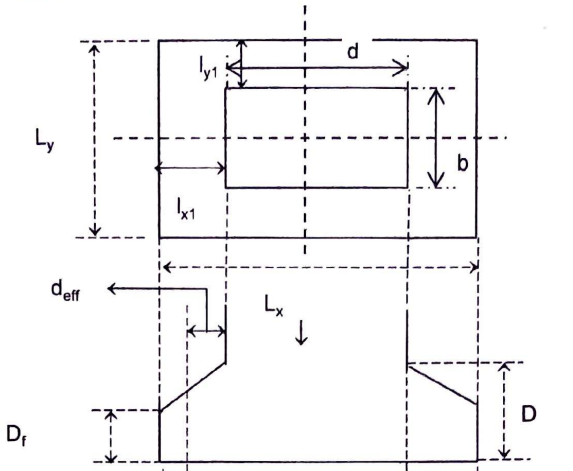
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Isolated footing - F1

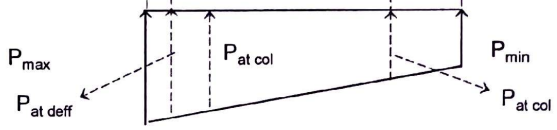
Columns seated on isolated column heads which in turn transmits the load on to the hard stratum by dispersion in concrete with > 45 degree



Shear force location at "d_{eff}" distance from column face.



Load Case - DL + LL

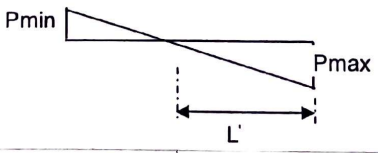


Axial Load on column (P) =	2000	KN
Self weight of footing = 10% of column load	200	KN
Total Load = Axial Load + self weight of footing	2200	KN
M_x Moment on column footing	222.509	KN-m
M_y Moment on column footing	134.274	KN-m
Grade of Concrete	25	N/mm^2
Grade of Steel	415	N/mm^2
Clear Cover (minimum 50 mm)	54	mm
Diameter of rod	12	mm
SBC = (____T/ m^2 x 9.807)	160	KN/m^2
Area = Total Load / SBC	13.75	m^2
Assume size of footing		
L_x =	3.8	m
L_y =	3.8	m
Column size(bx d)	0.3	0.6
l_{x1} =(L_x - b) / 2	1.75	m
l_{y1} =(L_y - d) / 2	1.60	m
Base Pressure at Footing base due to direct load = Total load / area of footing	152.35	KN/m^2
Along X direction		
Eccentricity	0.111	<L/6 m
Soil pressure along x direction		
Maximum pressure =P/A(1+ 6e/B)	162.83	KN/m^2
Minimum pressure =P/A(1- 6e/B)	114.17	KN/m^2
Pressure at column face= P_{min} +((P_{max} -P_{min})/Lx).l_{x1}	136.58	KN/m^2
Along y direction		
Eccentricity	0.067	m

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Isolated footing - F1		
Maximum pressure =P/A(1+ 6e/B)	153.19	KN/m^2
Minimum pressure =P/A(1- 6e/B)	123.82	
Pressure at column face= P_{min} +((P_{max} -P_{min})/L_y).l_{y1}	136.19	
Assume overall depth of footing D =	0.7	m
Depth at free end Df = 0.4D	0.3	m
d_{eff} = (D - Clear cover - 1 / 2 dia)	0.64	m
Bending Moment Considerations:		
Pressure at face of pedestal =	149.71	
Bending moment @ column face (M_{xx}) =	871.12	KN-m
kx = 1.5 (M_{xx} / B (d_{eff})^2)	0.84	N/mm^2
pst (from table 1 - 4 of SP16) =	0.085	%
Ast = pst(B x d) /100 Minimum Ast = 0.12 % of bd	2067.20	mm^2
No of bars	18.29	
Spacing of bars	54.68	mm
Provided spacing	100.00	mm
Ast provided	2260.80	
Pressure at face of pedestal =	144.69	
Bending moment @ column face (M_{yy}) =	703.75	KN-m
ky = 1.5(M_{yy} / B(d_{eff})^2)	0.68	N/mm^2
pst = (from table 1-4 of SP 16)	0.085	%
Ast = pst (Bd) /100 Minimum Ast = 0.12 % of bd	2067.20	mm^2
No of bars =	18.29	
Spacing of bars	54.68	
Provided spacing	100.00	
Ast provided	1808.64	
Check for shear stress :		
Shear force at "d_{eff}" distance from the column face		
At Shear Location		
Breath at x direction (b_{x2}) =b+((L_x-b)/l_{y1}* d_{eff})	1.70	m
d_{x2} =D_f+((D-D_f)/l_{x1})*(l_{x1}-d_{eff})	0.55	m
$d_{x2\ eff}$ =	0.49	mm
at y direction (b_{y2}) =d+((L_y-d)/l_{x1}*deff)	1.77	m
d_{y2} =D_f+((D-D_f)/l_{y1})*(l_{y1}-d_{eff})	0.54	m
d_{y2eff} =	0.48	m
Pressure P at deff distance in xdirection=P_{min}+((P_{max} -P_{min})/L_x)*(l_{x1}-d_{eff})	128.39	KN/m^2
Shear force (V_{x2}) =	240.87	KN
Shear stress τ_{vx} = 1.5 (V_{x2} / b_{y2} x d_{x2eff}) / 10^3	0.37	N/mm^2
Actual P_{tx} = (Ast / bx_2 x $d_{x2\ eff}$) x 100	0.27	

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Isolated footing - F1				
Allowable shear stress from table 61 (τ_c)			0.48	N/mm^2
Pressure P_{y2} at deff distance in ydirection=$P_{min}+((P_{max}-P_{min})/L_y)*(l_{y1}-d_{eff})$			126.47	KN/m^2
Shear force (V_{y2}) =			230.68	KN
Shear stress τ_{vy} = 1.5 (V_{y2} / b_{x2} x d_{y2eff}) / 10^3			0.42	N/mm^2
Actual P_{ty} = (Ast / by_2 x d_{y2eff}) x 100			0.21	
Allowable shear stress from table 61 (τ_c)			0.52	N/mm^2
τ_v < Allowable (τ_c)				
Check for punching shear				
Punching force = net upward pressure x (area of footing - column area)			2172.58	KN
Punching stress = Punching force/ Perimeter of column x depth of footing x 10^3			0.13	N/mm^2
< 0.25 Sqrt (fck) (refer SP 24 30.6.3.1)			1.25	N/mm^2
Check for bearing pressure on footing top:				
Bearing stress at top of footing = Load / b x d			0.14	N/mm^2
Allowable bearing stress with out longidutional reinforcement = 0.25 fck (Clause 34.4 of IS 456)			6.25	N/mm^2
Hence safe				
Footing Size	L_x =		3.8	m
	L_y =		3.8	
Footing Depth	D =		0.7	m
	D_f =		0.3	
Area of steel in X direction Adopt	**18.29**	**no of**	12	mm dia bars
Area of steel in Y direction Adopt	**18.29**	**no of**	12	mm dia bars
Note:				
IF e =L/6 Pmax = 2W/L Pmin = 0				
If e >L/6 Pmax = 4W/3L(1/(1-2e/L) Pmin = 2W/L				

Er. S.UDHAYAKUMAR, B.E., M.Tech (Struct), M.Sc (Rev), FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com Mob : 9443101912

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ANNEXURE – XIV
[See Rule 51 (3)]
Form – I
STRUCTURAL DESIGN BASIS REPORT FOR NEW PROPOSAL OF RESIDENTIAL BUILDING

PART - I	**GENERAL DATA**		
S.No:	Description	Information	Notes
1	Site Address	**PLOT NO-1, S.NO: 111/2A1A1A, 2A1A2, 3A3A1 & 3A3B OF KANATHDUR REDDYKUPPAM VILLAGE AND PANCHAYAT, THIRUPORUR TALUK, CHENGALPATTU DISTRICT. THIRUPORUR PANCHAYAT UNION LIMIT.**	
2	Name of Owner	**Mr.P.KARTIC** **S/O.Mr.PREMKUMAR**	
3	Name of Registered Developer along with the Registration Number	NOT APPLICABLE	
4	Name of Registered Architect/Engineer along with the Registration Number		
5	Name of Registered Structural Engineer along with the Registration Number	S. Udhayakumar, Reg Str. Engg . **CGLDIST/SE/ GR -1/2019/05/003**	
6	Use of the Building	RESIDENTIAL APARTMENT	
7	Number of Stories above Ground Level [including stories to be added later if any]	STILT + FOUR FLOOR	
8	Number of Basements below Ground Level	NO BASEMENT FLOOR	
9	Type of structure • Load Bearing Walls • RCC Frame • RCC Frame with Shear walls • Steel Frame	RCC FRAMED	
10	Soil Data • Type of Soil • Design Safe Bearing capacity	i) Depth below ground level: Soil report ii) Nature of soil met with at Foundation level: As per Soil report iii) Probable Safe bearing capacity of the Strain met with at foundation:160 kN/sqm iv) Pressure at foundation : 152.35 kN/sqm	IS: 1893 Cl: 6.3.5.2 IS: 1904

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	Dead Loads [Unit weight adopted] • Earth • Water • Brick Masonry • Plain Cement concrete • Reinforced Cement Concrete • Floor Finish • Other Fill Materials	 2000 kg per cum 1000 kg per cum 1900 kg per cum 2400 kg per cum 2500 kg per cum - -	IS: 875 Part I The Structural soundness of the building has been verified with reference with ISI loading standards 895[latest version] and other IS codes.
12	Imposed [Live] Loads • Floor Loads • Roof Loads	2 kN/sqm 2 kN/sqm 2 kN/sqm	IS: 875 Part 2
13	Cyclone/Wind • Speed • Design Pressure Intensity	Design Calculations	IS: 875 Part 3
14	Seismic zone	Design Calculations	IS: 1893 [2002]
15	Importance Factor	Design Calculations	IS: 1893 [2002] Table 6
16	Seismic Zone Factor [Z]	Design Calculations	IS: 1893 [2002] Table 2
17	Response reduction factor	Design Calculations	IS: 1893 [2002] Table 7
18	Fundamental Natural Period - approx	Design Calculations	IS: 1893 [2002] Cl 7.6
19	Design horizontal acceleration spectrum value[An]	Design Calculations	IS: 1893 [2002] Cl 6.4.2
20	Expansion/ Separation Joints	As per standard provisions	
21	Building is regular/ irregular	Regular	IS: 1893 [2002]

PART - 3	**REINFORCED CONCRETE FRAMED BUILDINGS**		
S.No:	Description	Information	Notes
1	Type of Building • Regular Frames • RCC Frame with Shear walls • Irregular Frames • Irregular Frames with Shear walls • Soft Story	Regular Frames	IS: 1893 Cl 7.1
2	Number of Basements	Not Applicable	
3	Number of Floors including Ground Floor	STILT + FOUR FLOOR	
4	• Horizontal Floor System • Beams and Slabs • Waffles • Ribbed floor • Flat slab with drops • Flat plate without drops	Design Calculations	
5	Soil Data • Type of Soil • Recommended type of	As per Soil report	IS : 1498

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	Foundation • Independent Footings • Raft • Piles • Recommended Bearing capacity of soil • 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	i) Maximum stress in the most critical: RCC column footing Section of masonry and concrete: 1: 1.5: 3 – 49 kN/sqm ii) Nature of masonry and concrete and its : Brick in CM 50 kN/sqm iii). safe permissible stresses RCC M20 mix – 4.40 N/sqm	
7	System of Interconnecting foundations • Plinth Beams • Foundation Beams	Design calculations	
8	Grades if Concrete used in different parts of Building	Grade of Concrete: M25 is the minimum grade of RCC	
9	Method of Analysis used	Building - 2 D frame analysis using ETABS	
10	Computer software used	ETABS	
11	Torsion included	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	Design calculations	IS: 1893 Cl 7.5.3
13	Distribution Seismic forces along the height of the Building	Design calculations	IS: 1893 Cl 7.7 [Provide Sketch]
14	The column of stilt ground story specially designed	Design calculations	IS: 1893 Cl 7.10
15	Clear minimum cover- provided in • Footing • Column • Beams • Slabs • Walls	As per standard provisions	IS: 456 Cl 6.4
16	Ductile Detailing of RC Frame Type of Reinforcement used Minimum Dimension of Beams Minimum Dimension of Columns Minimum Percentage of reinforcement of	 As per standard provisions 230mm 300mm As per standard provisions	 IS: 456 Cl 5.6 IS: 13920 Cl 6.1 IS: 456 Cl 26.5.1

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	Beams at any Cross section Maximum Percentage of reinforcement of Beams at any Cross section 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 Columns Confining stirrups near ends of Columns and in beam – column J • Diameter • Spacing Ratio of Shear Capacity of Columns to Maximum Seismic shear in the storey	 As per standard provisions As per standard provisions As per standard provisions As per standard provisions As per standard provisions As per standard provisions	(a) IS: 13920 Cl 6.2.1 IS: 456 Cl 26.5.1 (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
17	Does the Features require clearance by SDRP	Not applicable	

Er. S.UDHAYAKUMAR, B.E., M.Tech (Struct), M.Sc (Env), FIV
Reg. Structural Eng. DTCP - CGLRGN/SE/GR - 1/2019/05/003
No : 20, 4th Cross Street, Anna Nagar, Chengalpattu
E-Mail : anjuconstructions05@gmail.com, Mob : 9443101912

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

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