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Cerus Engineering ,Cheinnai

DATE	REV. NO.	DESCRIPTION	CHECKED	APPROVED

REVISIONS

CLIENT :

CONSULTANTS
M/s CERUS ENGINEERING
CHENNAI

PROJECT : PROPOSED RESIDENTIAL BUILDING AT AT PLOT NO: 3 & 4, KANNAPPAN NAGAR, 3rd CROSS STREET, THIRUVANMIYUR, CHENNAI - 600041,

JOB No.

TOTAL NO. OF PAGES

	NAME	SIGN	DATE
DESN	ESD		
CHKD	ESD		
APPD	ESD		

TITLE :

DESIGN BASIS REPORT - STRUCTURAL

D. EUGIN SYRIN DHAS, M.E.(Structure)
(Structural Engineer)
CMDA REG. No. SE/GR-I / 19/05/130
Door No.2, Shop No.12, R.K.Mutt Road,
Luz Corner, Mylapore, Chennai - 600 004.

DOC. No.	CODE	REV.
0 0 0 1	IS	A

RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☐ APPROVAL ☐ CONSTRUCTION

	M/s .CERUS ENGINEERING CHENNAI		
PROJECT:	PROPOSED RESIDENTIAL BUILDING AT AT PLOT NO: 3 & 4, KANNAPPAN NAGAR, 3rd CROSS STREET, THIRUVANMIYUR, CHENNAI - 600041,	DESIGNED	CHECKED
TITLE :	DESIGN BASIS REPORT :	EUGIN	PKC

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1.0 **Design Basis:**

The Design Basis Report is based on the basic drawing issued by Client

The Salient points pertaining to the design of the building have been highlighted.

1.1 **Design Life:**

The design life for the buildings are assumed as 50 years. This requirement is not applicable to replaceable finishing materials.

1.2 **Structural System:**

The Structure is of Framed structure Stilt+5 Floors with R.C.C slabs, beams , Columns and Pile

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1.3 **Soil Parameters :**

450mm Dia Pile, Vertical load carrying capacity of single pile 640KN,Maximum Depth of Pile16M

2.0 **DESIGN LOADS**

2.1 **Dead loads**

The Dead loads are as per IS:875-Part :1

2.2 **Imposed Loads:**

The imposed loads that are envisaged to act permanently (wherever applicable)

are as following:

The superimposed load or otherwise live load is assessed based on the

occupancy classifications as per IS : 875(Part 2)-1987 a

2..3 **Wind Load**

The wind pressure is calculated based on the data furnished below

and other provisions laid in IS:875(Part 3)-2015

Basic wind speed Vb = 50 m/sec.

2..4 **Earthquake load**

The sesmic loads is calculated based on the data provisions laid in 1893-2016

SESMIC ZONE -III

ZONE FACTOR= 0.16

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2.6 **Basic Load cases and Load Combinations**

The various loads are combined in accordance with the stipulations in IS:875 (Part 5) - 1987.

For Frame Analysis

I) Load Case

LOAD 1 D.L

LOAD 2 L.L

LOAD 3 WIND- X DIR

LOAD 4 WIND- X DIR

LOAD 5 Sesmic-SLX

LOAD 6 sesmic-SLZ

2.5 **Load Factors for Design**

Load	**Limit State of Collapse**					
Combination	*DL*	*LL*			*LL*	*WL/EL*
DL + LL	1.5	1.5			1.0	—
DL + WL	1.5 or 0.9*	—	1.5	1.0	—	1.0
DL+LL+WL	1.2	1.2	1.2	1.0	0.8	0.8

* This value is to be considered when stabilty against overturning or stress reversal is critical.

Where, DL - Dead Load LL - Live Load

WL - Wind Load EL - Earthquake Load

2.6 **Permissible increase of stresses in materials :**

(As per IS : 456 -2000 / IS:800-1984)

When stresses due to earthquake/wind forces,temperature and shrinkage effect are combined with other designforces(DL / LL),then the allowable stresses shall be increased to $33^{1/3}$%.

2.7 **Permissible increase in allowable bearing capacity of soil :**

When earthquake / wind forces are combined along with other normal loads (DL / LL) then the capacity of pile is increased by 25%.

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3.0	**ANALYSIS METHODS**		
	Modelling and analysis of the structures shall be carried out using		
	STAAD Version. Appropriate loads and its combinations, as per		
	relevant clauses in IS codes, for most unfavourable effects shall be		
	chosen for design.		
4.0	**DESIGN METHODOLOGY**		
	All structural elements shall be designed according to the Limit state		
	Method as specified in IS : 456-2000 and structural steel shall be		
	designed as per the IS : 800-1984. Appropriate loads and its		
	combinations, as per relevant clauses in IS codes, for the most		
	unfavourable effects are chosen for design.		

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5.0 MATERIALS

The self weight of the various elements are computed based on the unit weight of materials as given below:

Materials	Unit weight kN/m^3
Steel	78.50
Plain Concrete	24.00
Reinforced Concrete	25.00
Brickwork	19.20
Solid Blockwork	24.00
Hollow Blockwork	18.00
BJCC	18.00
Soil	18.00
Water	10.00
Sand	18.00

5.1 Concrete

Concrete item	Grade	Max size of aggregate (mm)	Type of cement
Pile & Pilecap	M25	20	OPC/BC/PPC
Columns	M25	20	OPC/BC/PPC
Slab & beams	M25	20	OPC/BC/PPC
Walls	M25	20	OPC/BC/PPC

5.2 Reinforcing steel

Steel Reinforcement shall be of Grade Fe550 conforming to IS-1786 and Mild steel Fe250 conforming to IS 432-1982

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6.0 COVER TO REINFORCEMENT

From durability considerations, exposure condition is assumed as Mild

The clear cover to all reinforcement shall be as follows: —

Slabs -	25mm or diameter of largest bar, whichever is greater
Beams -	30mm or diameter of largest bar, whichever is greater
Columns/ Walls -	40mm
RAFT -	50mm
PileCap(Bottom)	75mm
PileCap(Top & sides)	50mm

For any other elements not specified above, clear cover shall be as stipulated in Clause 26.4 of IS: 456-2000.

7.0 DESIGN STANDARDS

The relevant Indian Standard Codes, as given below, have been followed for structural design:

Sl. No	Code	Description
1	IS: 875(Part 1)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Unit Weights of Buildings Materials and Stored Material
2	IS: 875(Part 2)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Imposed Loads
3	IS: 875(Part 3)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Wind Loads
Sl. No	**Code**	**Description**
4	IS: 875(Part 5)-2015	Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures - Special Loads and Load Combinations
5	IS:1893-2016	Code of Practice for Earthquake Loads
7	IS: 456-2000	Code of Practice for Plain and Reinforced Concrete
8	IS: 1786-1985	Specification for High Strength Deformed Steel Bars and Wires for Concrete Reinforcement
9	IS : 432(Part 1)-1982	Specification for Mild Steel and Medium Tensile Steel Bars and Hard Drawn Steel Wire for Concrete Reinforcement - Mild steel and Medium Tensile Steel Bars
10	IS: 800-2007	Code of Practice for General Construction in steel.

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CERUS ENGINEERING

PART: PLINTH BEAM DESIGN CALCULATION

Group	:	**G1**	
Beam No	:	**B1**	
Analysis Reference (Member) 0m	:	30,307	
Beam Length	:	3800	mm
Breadth (B)	:	230	mm
Depth (D)	:	450	mm
Effective Depth (d)	:	335	mm
Design Code	:	IS 456	
Beam Type	:	Regular Beam	
Grade Of Concrete (Fck)	:	M25	N/sqmm
Grade Of Steel	:	Fe550	N/sqmm
Clear Cover (Cmin)	:	30	mm
Es	:	2x10^5	N/sqmm

Flexure Design

	Beam Bottom			Beam Top		
	Left	**Mid**	**Right**	**Left**	**Mid**	**Right**
Critical L/C - Analysis	4	4	4	4	4	4
Critical L/C - RCDC	2	2	2	2	2	2
Mu (kNm)	-	73.695	15.98	60.071	-	79.392
Tu (kNm)	3.131	3.131	3.13	3.131	3.131	3.131
M_{Tu} (kNm)	4.84	4.84	4.84	4.84	4.84	4.84
Mud (kNm)	4.84	78.54	20.83	64.91	4.84	84.24
MuLim (kNm)	67	67	67	67	67	67
R	0.188	3.043	0.807	2.515	0.188	3.263
Ptmin (%)	0.2	0.2	0.2	0.2	0.2	0.2
Ptclc (%)	0.2	0.771	0.2	0.638	0.2	0.824
Pcclc (%)	0.04	0.117	0	0	0.04	0.176
PtPrv (%)	0.522	0.783	0.522	0.734	0.294	0.881
AstCalc (sqmm)	154.1	594.34	154.1	491.68	154.1	634.7
AstPrv (sqmm)	402.12	603.18	402.12	565.5	226.2	678.6
Reinforcement	2-T16	3-T16	2-T16	3-T12 2-T12	2-T12	3-T12 3-T12

Shear Design

	Left	**Mid**	**Right**
Critical L/C - Analysis	4	4	4
Critical L/C - RCDC	2	2	2
PtPrv (%)	0.734	0.783	0.881
Vu (kN)	88.186	107.257	131.94
Tu (kNm)	3.131	3.131	3.131

CERUS ENGINEERING

PART: PLINTH BEAM DESIGN CALCULATION

V_{Tu} (kN)	21.78	21.78	21.78
Vut (kN)	109.96	129.04	153.72
Tv (N/sqmm)	1.43	1.67	2
Tc (N/sqmm)	0.56	0.57	0.59
Vc (kN)	42.8	43.85	45.8
Vus=Vut-Vc (kN)	67.16	85.19	107.92
Legs	2	2	2
Stirrup Rebar	8	8	8
Asv Torsion (sqmm)	567.256	641.916	738.543
Asv Torsion Prv (sqmm)	804.32	804.32	914
Asv Reqd (sqmm)	555.34	704.327	892.21
SvCalc (mm)	125	125	110
SvPrv (mm)	125	125	110
Asv Total Prv (sqmm)	804.32	804.32	914

Maximum Spacing Criteria

Basic

Spc1 =0.75d = 251 mm

Spc2 = 300 mm

For Torsion

(X1 = 180, Y1 = 325)

Spc3 = X1 = 180 mm

Spc4=(X1+Y1)/4 = 125 mm

SFR Design

Beam Width = 230 mm

Beam Depth = 375 mm

Web Depth = 375 <= 750 mm

Side Face Reinforcement Not Required.

PROJECT: PROPOSED RESIDENTIAL BUILDING AT PLOT NO: 3 & 4, KANNAPPAN NAGAR, 3rd CROSS STREET, THIRUVANMIYUR, CHENNAI - 600041,

CERUS ENGINEERING

PART: FIRST FLOOR BEAM DESIGN CALCULATION

Group		**: G2**	
Beam No		**: B102**	
Analysis Reference (Member)	3.35m	: 171,172	
Beam Length		: 4790	mm
Breadth (B)		: 300	mm
Depth (D)		: 450	mm
Effective Depth (d)		: 315	mm
Design Code		: IS 456	
Beam Type		: Regular Beam	
Grade Of Concrete (Fck)		: M25	N/sqmm
Grade Of Steel		: Fe500	N/sqmm
Clear Cover (Cmin)		: 30	mm
Es		: 2x10^5	N/sqmm

Flexure Design

	Beam Bottom			Beam Top		
	Left	**Mid**	**Right**	**Left**	**Mid**	**Right**
Critical L/C - Analysis	4	4	4	4	4	4
Critical L/C - RCDC	2	2	2	2	2	2
Mu (kNm)	18.835	56.779	-	55.791	-	81.676
Tu (kNm)	2.281	2.281	2.28	2.281	2.281	2.281
M_{Tu} (kNm)	3.53	3.53	3.53	3.53	3.53	3.53
Mud (kNm)	22.37	60.31	3.53	59.32	3.53	85.21
MuLim (kNm)	76	76	76	76	76	76
R	0.98	2.643	0.155	2.599	0.155	3.734
Ptmin (%)	0.2	0.2	0.2	0.2	0.2	0.2
Ptclc (%)	0.237	0.708	0.2	0.694	0.2	1.059
Pcclc (%)	0	0	0.036	0	0.036	0.138
PtPrv (%)	0.555	0.833	0.555	0.833	0.312	1.388
AstCalc (sqmm)	171.37	513.2	144.9	503.16	144.9	767.42
AstPrv (sqmm)	402.12	603.18	402.12	603.18	226.2	1005.3
Reinforcement	2-T16	3-T16	2-T16	3-T16	2-T12	3-T16 2-T16

Shear Design

	Left	**Mid**	**Right**
Critical L/C - Analysis	4	4	4
Critical L/C - RCDC	2	2	2
PtPrv (%)	0.833	0.833	1.388
Vu (kN)	90.613	61.834	92.351

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CERUS ENGINEERING

PART: FIRST FLOOR BEAM DESIGN CALCULATION

Tu (kNm)	2.281	2.281	2.281
V_{Tu} (kN)	15.87	15.87	15.87
Vut (kN)	106.48	77.7	108.22
Tv (N/sqmm)	1.47	1.07	1.49
Tc (N/sqmm)	0.6	0.6	0.72
Vc (kN)	43.36	43.36	52.34
Vus=Vut-Vc (kN)	63.12	34.34	55.88
Legs	2	2	2
Stirrup Rebar	8	8	8
Asv Torsion (sqmm)	472.966	366.331	479.406
Asv Torsion Prv (sqmm)	804.32	804.32	804.32
Asv Reqd (sqmm)	555.045	301.999	491.381
SvCalc (mm)	125	125	125
SvPrv (mm)	125	125	125
Asv Total Prv (sqmm)	804.32	804.32	804.32

Maximum Spacing Criteria

Basic

Spc1 =0.75d = 236 mm

Spc2 = 300 mm

For Torsion

(X1 = 180, Y1 = 325)

Spc3 = X1 = 180 mm

Spc4=(X1+Y1)/4 = 125 mm

SFR Design

Beam Width = 230 mm

Beam Depth = 375 mm

Web Depth = 375 <= 750 mm

Side Face Reinforcement Not Required.

Group : **G2**

Beam No : **B102**

Analysis Reference (Member) 3.35m : 173

Beam Length : 3580 mm

Breadth (B) : 300 mm

Depth (D) : 450 mm

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PART: FIRST FLOOR BEAM DESIGN CALCULATION

Effective Depth (d)	: 315	mm
Design Code	: IS 456	
Beam Type	: Regular Beam	
Grade Of Concrete (Fck)	: M25	N/sqmm
Grade Of Steel	: Fe500	N/sqmm
Clear Cover (Cmin)	: 30	mm
Es	: 2x10^5	N/sqmm

Flexure Design

	Beam Bottom			Beam Top		
	Left	**Mid**	**Right**	**Left**	**Mid**	**Right**
Critical L/C - Analysis	4	4	4	4	4	4
Critical L/C - RCDC	2	2	2	2	2	2
Mu (kNm)	-	12.219	8.83	32.278	4.885	-
Tu (kNm)	0.935	0.935	0.93	0.935	0.935	0.935
M_{Tu} (kNm)	1.45	1.45	1.45	1.45	1.45	1.45
Mud (kNm)	1.45	13.67	10.27	33.72	6.33	1.45
MuLim (kNm)	76	76	76	76	76	76
R	0.063	0.599	0.45	1.478	0.277	0.063
Ptmin (%)	0.2	0.2	0.2	0.2	0.2	0.2
Ptclc (%)	0.2	0.2	0.2	0.367	0.2	0.2
Pcclc (%)	0.015	0	0	0	0	0.015
PtPrv (%)	0.312	0.312	0.312	1.388	0.312	0.312
AstCalc (sqmm)	144.9	144.9	144.9	265.7	144.9	144.9
AstPrv (sqmm)	226.2	226.2	226.2	1005.3	226.2	226.2
Reinforcement	2-T12	2-T12	2-T12	3-T16 2-T16	2-T12	2-T12

Shear Design

	Left	**Mid**	**Right**
Critical L/C - Analysis	4	4	4
Critical L/C - RCDC	2	2	2
PtPrv (%)	1.388	0.312	0.312
Vu (kN)	36.387	23.725	18.35
Tu (kNm)	0.935	0.935	0.935
V_{Tu} (kN)	6.5	6.5	6.5
Vut (kN)	42.89	30.23	24.85
Tv (N/sqmm)	0.59	0.42	0.34
Tc (N/sqmm)	0.72	0.4	0.4
Vc (kN)	52.34	29.08	29.08
Vus=Vut-Vc (kN)	0	1.15	0
Legs	2	2	2

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PART: FIRST FLOOR BEAM DESIGN CALCULATION

Stirrup Rebar	8	8	8
Asv Torsion (sqmm)	191.04	140.818	121.163
Asv Torsion Prv (sqmm)	359.07	359.07	359.07
Asv Reqd (sqmm)	254.812	254.812	254.812
SvCalc (mm)	280	280	280
SvPrv (mm)	280	280	280
Asv Total Prv (sqmm)	359.07	359.07	359.07

Maximum Spacing Criteria

Basic

Spc1 =0.75d	= 236	mm
Spc2	= 300	mm

SFR Design

Beam Width	= 230	mm
Beam Depth	= 375	mm
Web Depth	= 375 <= 750	mm

Side Face Reinforcement Not Required.

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PART: COLUMN DESIGN CALCULATION

General Data

Column No.	:	C2	
Level	:	-2.75m To 0m	
Design Code	=	IS 456 + IS 13920 - 1993	
Grade Of Concrete	=	M25	N/sqmm
Grade Of Steel	=	Fe550	N/sqmm
Column B	=	230	mm
Column D	=	450	mm
Clear Floor Height @ B	=	1620	mm
Clear Floor Height @ D	=	1620	mm
No Of Floors	=	1	
No Of Columns In Group	=	1	
Column Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	

Load Data

Analysis Reference No.	=	250	
Critical Analysis Load Combination	:	4	
Load Combination	=	[2] : 1.5 (LOAD 1: DL) +1.5 (LOAD 2: LL)	
Critical Location	=	Bottom Joint	
Pu	=	1353.22	kN
Mux	=	0	kNm
Muy	=	0	kNm
Vux	=	6.42	kN
Vuy	=	-4.01	kN

Effective Length Calculation

User Defined Effective Length Factor

Minimum Eccentricity Check

Since Axial Force is compressive, Min. Eccentricity check to be performed

Most critical case is with Min. Eccentricity check in X-direction

Minimum Eccentricity Along D:

Minimum Eccentricity	=	Unsupported Length / 500 + D / 30	
	=	18.24	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	27.06	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	7.04	

PART: COLUMN DESIGN CALCULATION

	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	1.2	
Slenderness Ratio	=	Effective Length / D	
	=	4.32, Column not Slender Along D	

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	1.2	
Slenderness Ratio	=	Effective Length / B	
	=	8.45, Column not Slender Along B	

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	0	27.06	0	0	0
Minor Axis - Muy	0	---	0	0	0

Where

A = Moments directly from analysis

B = Moments due to minimum eccentricity

C = Maximum of analysis moment and min. eccentricity = Max (A,B)

E = Moment due to slenderness effect

F = Final design Moment = Max(C- Top Bottom , D- Top Bottom) + E

Final Critical Design Forces

Pu	=	1353.22	kN
Mux	=	0	kNm
Muy	=	0	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	1.55	
Reinforcement Provided	=	8-T16	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	73.4	deg
MRes	=	28.09	kNm
MCap	=	37.41	kNm

CERUS ENGINEERING

PART: COLUMN DESIGN CALCULATION

Capacity Ratio	=	MRes/ MCap	
	=	0.75 <= 1	

Design Of Shear

Design for shear along D

Critical Analysis Load Combination	:	4	
Critical Load Combination	=	[2] : 1.5 (LOAD 1: DL) +1.5 (LOAD 2: LL)	
Design shear force, Vuy	=	-4.0144	kN
Pu	=	1345.9	
Deff	=	402	mm
Design shear stress, Tvy	=	Vuy / (Bx Deff)	N/sqmm
	=	0.0434	N/sqmm
Pt	=	0.777	%
Design shear strength, Tc	=	0.5827	N/sqmm
Shear Strength Enhancement Factor	=	1 + 3 x Pu / (B x D x Fck)	
	=	2.5605	
Shear Strength Enhancement Factor (max)	=	1.5	
Shear Strength Enhancement Factor	=	1.5	
Enhanced shear strength, Tc-e	=	0.8741	N/sqmm
Design shear check	=	Tvy < Tc x Enhancement factor	

Link for Shear Design along D are not required

Design for shear along B

Critical Analysis Load Combination	:	4	
Critical Load Combination	=	[2] : 1.5 (LOAD 1: DL) +1.5 (LOAD 2: LL)	
Design shear force, Vux	=	6.4187	kN
Pu	=	1345.9	
Beff	=	182	mm
Design shear stress, Tvx	=	Vux / (D x Beff)	kN
	=	0.0784	N/sqmm
Pt	=	0.777	%
Design shear strength, Tc	=	0.5827	N/sqmm
Shear Strength Enhancement Factor	=	1 + 3 x Pu / (B x D x Fck)	
	=	2.5605	
Shear Strength Enhancement Factor (max)	=	1.5	
Shear Strength Enhancement Factor	=	1.5	
Enhanced shear strength, Tc-e	=	0.8741	N/sqmm
Design shear check	=	Tvx < Tc x Enhancement factor	

CERUS ENGINEERING

PART: COLUMN DESIGN CALCULATION

Link for Shear Design along B are not required

Design Of Links

Links in the zone where special confining links are not required

Normal Links

Diameter of link	=	8	mm
	>	Max. longitudinal bar dia / 4	
	=	4	mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16	=	256	mm
Min. dimension of column	=	230	mm
Max. 300 mm	=	300	mm
Provided spacing	=	225	mm

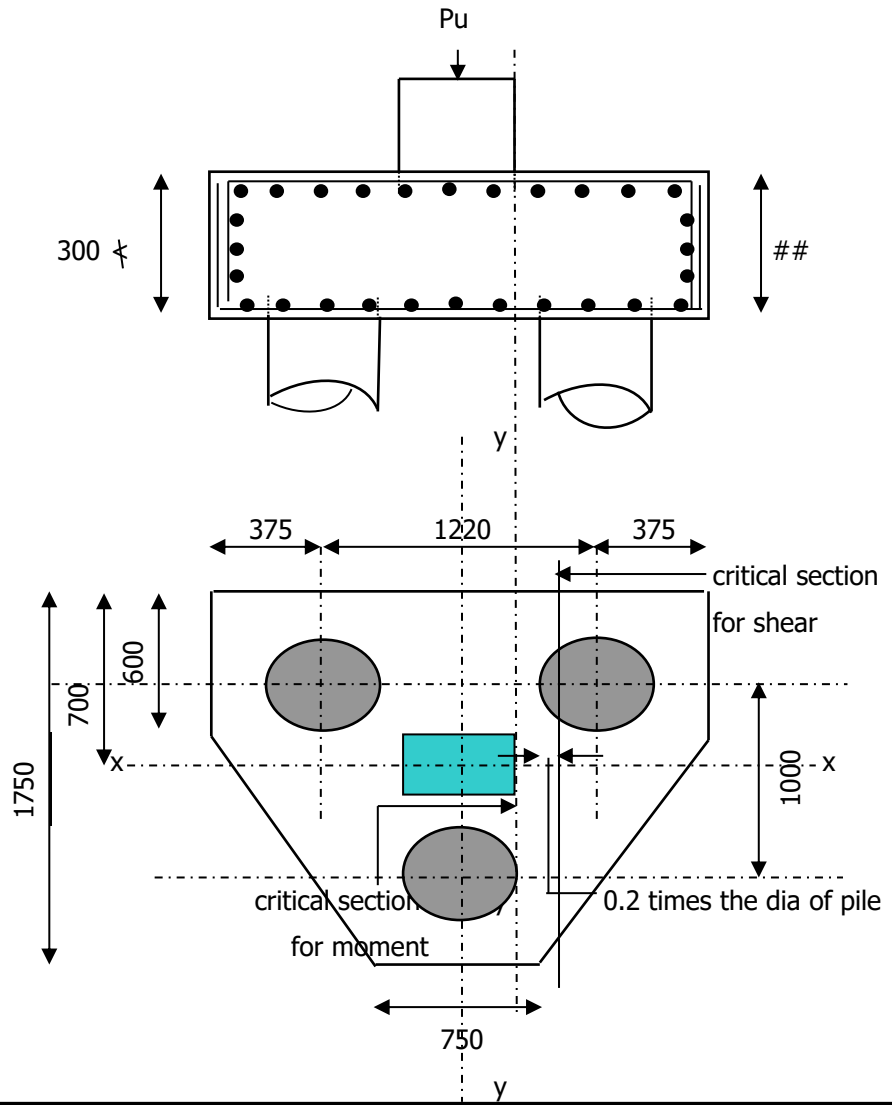
Table For Links

	Required			Provided	
	Normal Design	**Shear Design**	**Ductile Design**	**Normal Zone**	**Ductile Zone**
Link Dia.	8	---	---	8	---
Spacing	225	---	---	225	---

Design of pile cap

Project/Client :-	PROPOSED RESIDENTIAL BUILDING AT PLOT NO: 3 & 4, KANNAPPAN NAGAR, 3rd CROSS STREET, THIRUVANMIYUR, CHENNAI - 600041,

S.No	Calculations				References
1	**Design forces**				
	Axial load on column	=	1475	KN	From analysis
	Nature of loading	=	Compression		
	Bending moment about xx	=	8	KN.m	
	Bending moment about yy	=	8	KN.m	
	Lataral force along xx	=	0	KN	
	Lataral force along yy	=	0	KN	
	Axial load carrying capaciy of pile	=	640	KN	From soil report
	Lateral load carrying capacity of pile	=	64	KN	
2	**Geometric properties of Pile & Pile cap**				

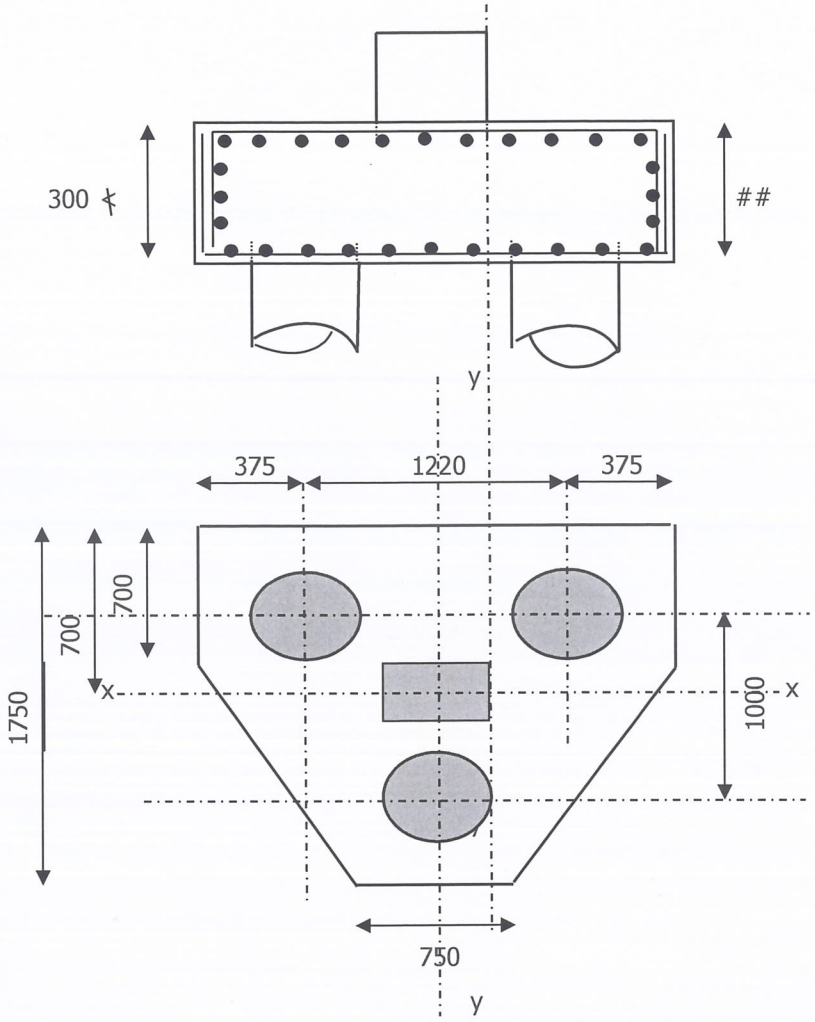


	Dia. Of pile		=	450	mm	
	Width of column/pedestal		=	450	mm	
	Depth of column/pedestal		=	450	mm	
	Minimum spacing of piles		=	1125	mm	As per IS:2911-
	Centre to Centre distance of two adjacent pile		=	1220	mm	Part-1, clause:5.6
	Edge projection from face of piles					
	(Min 100-150mm)		=	150	mm	
	Width of pile cap		=	1970	mm	As per IS:2911-
	Length of pile cap		=	1750	mm	Part-1,
	Depth of pile cap (assumed)		=	1100	mm	clause:5.12.5
	Clear cover to the reinforcement		=	75	mm	
	Grade of concrete	fck	=	25	Mpa	
	Grade of Steel	fy	=	500	Mpa	
3	**Load calculations**					
	Weight of pile cap		=	94.806	KN	
	Additional load due to moment		=	6.56	KN	
	Total load on each pile		=	529.83	KN	
			=	**O.K**		
4	**Calculation of reinforcement-xx**					
	a)Bending theory					
	Bending moment about xx		=	227.83	KN.m	
	Design bending moment		=	341.74	KN.m	
	Dia of Main reinforcement		=	16	mm	
	Dia of secondary reinforcement		=	16	mm	
	Effective depth of pile cap		=	1017	mm	
		Mu/bd2	=	0.17		
		pt	=	0.039	%	
		pt,min	=	0.12	%	
	Area of steel required		=	2404.2	mm^2	
	b)Truss theory					
	Tension at bottom		=	$Pu/12ld(3l^2-a^2)$		
			=	620.54	KN	
	Area of steel required		=	1426.5	mm^2	
	Area of steel required					
	(max of bending & truss theory)		=	2404.2	mm^2	
	No of bars required		=	12	Nos	
	No of bars provided		=	12	Nos	
	Area of steel provided		=	2411.5	mm^2	

5	**Calculation of reinforcement-yy**					
	a)Bending theory					
	Bending moment about xx		=	169.55	KN.m	
	Design bending moment		=	254.32	KN.m	
	Dia of Main reinforcement		=	16	mm	
	Dia of secondary reinforcement		=	16	mm	
	Effective depth of pile cap		=	1017	mm	
		Mu/bd2	=	0.09		
		pt	=	0.021	%	
		pt,min	=	0.12	%	
	Area of steel required		=	2934.1	mm^2	
	Area of steel required					
	(max of bending & truss theory)		=	2934.1	mm^2	
	No of bars required		=	15	Nos	
	No of bars provided		=	15	Nos	
	Area of steel provided		=	3014.4	mm^2	
5	**Check for shear**					
	a)One way shear xx					
	Percentage of steel provided		=	0.12	%	
		ß	=	0.87fy/6.89pt		
			=	26.31		
	Permissible shear stress, ζc		=	0.253	Mpa	Clause 40.5
	Nominal shear stress ,ζv		=	0.4	Mpa	IS:456-2000
	Shear span, av(C/C of pile/2-d/2+20% pile dia)		=	0.19	m	
	Enhancement factor (2d/av)		=	10.71		
	Modified shear strength, ζv		=	2.71	Mpa	
				2.71>0.4		
				O K		
	b)One way shear yy					
	Percentage of steel provided		=	0.169	%	
		ß	=	0.87fy/6.89pt		
			=	18.68		
	Permissible shear stress, ζc		=	0.296	Mpa	Clause 40.5
	Nominal shear stress ,ζv		=	0.45	Mpa	IS:456-2000
	Shear span, av(C/C of pile/2-d/2+20% pile dia)		=	0.08	m	
	Enhancement factor (2d/av)		=	25.43		
	Modified shear strength, ζv		=	7.52	Mpa	
				7.52>0.45		
				O K		

b)Two way shear

Punching shear, V	=	2212.5 KN	
Perrimeter of column,	=	1800 mm	
Punching shear stress,	=	1.21 Mpa	Clause 31.6.3
Permissible shear stress,	=	1.25 Mpa	IS:456-2000
		1.25>1.21	
		O K	



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THE LANDLENS SUITE

Eight ways to know a piece of land before you pay for it.

This report covers one part of the picture. These cover the rest, drawn from the same government records, for any property in Tamil Nadu.

LandLens One
Ask anything about a property and get an answer grounded in live government records, with the sources shown.
/landlens/one

Verify My Land
Every record check run on one property and returned as a single report.
/landlens/verify-my-land

Legal Opinion
An advocate's written opinion on the title, built on the records we pull for it.
/landlens

One Map
Every layer on one map: the parcel, its boundary, zoning, water bodies and what sits around it.
/landlens/one/map

PriceMap
What land actually changed hands for around this plot, taken from the registered deeds.
/landlens/pricemap

Build Scope
What you are allowed to build here: floor space, height, coverage and setbacks.
/landlens/build-scope

Property Tracker
Watch a property and hear about it when something new is registered against it.
/landlens/property-tracker

Deal Room
Run the transaction in one place: documents, stamping, signatures and the parties.
/landlens/deal-room

FREE TOOLS · NO ACCOUNT NEEDED

Twenty-four checks you can run yourself, at no cost.

Records and verification

The registers themselves, read for you.

- Encumbrance Certificate
- Patta and Chitta
- Field Measurement Sketch
- EC Analyzer
- Bank charge check
- Court case search
- Seller background check
- Approval check by survey

Value and duty

What it is worth and what it costs to register.

- Guideline value by street
- Guideline value by survey
- Stamp duty and registration fees
- Capital gains
- Floor space index
- Area unit converter

Zoning and land use

What the plan says can happen on this land.

- Land use zone finder
- CMDA land use check
- Coastal regulation zone
- Master plan check
- Water bodies finder
- Airport height clearance

Registers and directories

Who holds it, and which office keeps the record.

- Find your registering office
- Temple property check
- Waqf property check
- RERA register

Every free tool
/tools

Services we run for you
/services

The LandLens suite
/landlens/one

Verified RealEstate™

Every claim in this document traces back to a government record.

- Legal opinions, due diligence and title verification
- Building plan, layout and sub-division approvals
- Completion and occupancy certificates, regularisation
- Escrow, negotiation and NRI property management
- Land survey, soil testing, architecture and construction

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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.