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DIGITALLY VERIFIED RECORD

KAARVENS

Date :29.06.26

STABILITY CERTIFICATE

The detailed engineering and structure design of the proposed building comprising of **Stilt Floor + 5 Floors (65 Dwelling Units)** at **Plot No.408 North Part, 409 & 410** Survey Nos. **205/4E2B, 205/4F1A2, 205/4H1B1A, 205/4I2A1A, 205/85 & 205/86 Morais City Extension-I, Keelakurichi Village, Thiruverumbur Panchayat Union, Thiruverumbur Taluk, Tiruchirappalli District** has been done by me/us based on the report of geotechnical investigation (soil test) done by **Dr. B.N. KRISHNASWAMI** Report No.**18B** Dated **February 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. I have checked various parameters and found that the proposed building would be safe.

3. I further certify that:

(i) The minimum grade of concrete is M30 for column & M25 for all other structural elements.

(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 Codes No IS : 875 (Part – 1) – 1987 & IS : 875 (Part 2) – 1987 and design of earthquake resistant structure as per IS Code No IS 1893 (Part 1) – 2016.

4. The building will be **SAFE and SOUND** when used for the purpose for which it is designed.

S.K. Arun Kamaraj

Stamp and Signature

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STRUCTURAL DESIGN CALCULATION REPORT

PROPOSED CONSTRUCTION OF STILT+5FLOORS (HEIGHT-20.72m) RESIDENTIAL APARTMENT BUILDING AT SURVEY NO: 205/4E2B, 205/4F1A2, 205/4H1B1A, 205/4I2A1A,205/85 & 205/86, PLOT NO.408 NORTH PART,409 & 410, KEELAKURICHI VILLAGE, THIRUVERUMBUR TALUK, THIRUCHIRAPALLI DISTRICT.

	R0		R1		R2		R3		ISSUE
	INITIALS	SIGN.	INITIALS	SIGN.	INITIALS	SIGN.	INITIALS	SIGN.	
PPD. BY	KA								R0
CHD. BY	JS								
APD. BY	SKAK								
DATE	24.06.2026								

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1.0 OBJECTIVE:

The Proposed Construction of Residential Apartment Building at Survey No: 205/4E2B, 205/4F1A2,205/4H1B1A, 205/4I2A1A,205/85 & 205/86,Plot No; 408 North Part,409 & 410, Keelakurichi Village, Thiruverumbur Taluk, Thiruchirapalli District.

The building is designed for stilt + five floors. The structure is supported on column in turn resting on column footing foundation. The structure system comprises column, beam, and slab structure.

3D Analysis of all the building structure will be carried out using STAAD.PRO Sowftware package and analysis result shall be used for the various elements.

2.0 DESIGN LOADS:

2.1 Dead Loads:

The Dead loads that are envisaged to act permanently are considered as per IS:875 (Part 1) – 1987 – Dead loads. Indian standard **"Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures."**

1. Slab is assumed to be 150 mm thick – 3.755 kN/m²
2. Floor finish – 1.5 kN/m²
3. AAC Block masonry walls 230mm & 115mm thick are proposed to be used (location of walls as per Architectural drawings). Unit weight is taken as 10 kN/m³

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2.2 Imposed Loads

The imposed loads that are envisaged to get permanently are considered as per IS: 875 (Part – 2) 1987. Indian standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures".**

1. Living = 2 kN/m²
2. Staircase = 3 kN/m²
3. Toilets = 2 kN/m²
4. Terrace floors = 2 kN/m²

2.3 Load combination

Load combination condition is considered as per IS 456.

Table 18 Values of Partial Safety Factor γ_f for Loads

(*Clauses* 18.2.3.1, 36.4.1 *and* B-4.3)

Load Combination	Limit State of Collapse			Limit States of Serviceability		
	DL	*IL*	*WL*	*DL*	*IL*	*WL*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
DL + *IL*	1.5		1.0	1.0	1.0	–
DL + *WL*	1.5 or 0.9[1]	–	1.5	1.0	–	1.0
DL + *IL* + *WL*	1.2			1.0	0.8	0.8

NOTES

1 While considering earthquake effects, substitute *EL* for *WL*.

2 For the limit states of serviceability, the values of γ_f given in this table are applicable for short term effects. While assessing the long term effects due to creep the dead load and that part of the live load likely to be permanent may only be considered.

[1] This value is to be considered when stability against overturning or stress reversal is critical.

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3.0 ANALYSIS METHODS:

The analysis of the structures is carried out using the STAAD Pro. The entire super structure is modeled using frame elements as appropriate. Beams and columns are modeled as frame elements. Appropriate loads and its combinations as per relevant IS code clauses, for most unfavorable effects are chosen for design. Various load cases considered in the analysis are briefed above.

4.0 DESIGN ASSUMPTION:

1. The Base of the Foundation is assumed to be FIXED
2. All concrete elements shall be designed in accordance with IS 456:2000 Limit state design
3. Appropriate loads and its combination as per relevant clauses, for the most unfavorable effects are chosen for design. (Refer Load Combination in Cl.2.3 in the report)

5.0 FOUNDATION DESIGN:

Type of foundation	: Isolated footing
Depth of foundation	: 3 m below natural ground level

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6.0 MATERIALS:

The self- weight of the various element are computed based on the unit weight of material as give below:

Sl.No.	MATERIAL	UNIT WEIGHT kN/m^3
1	REINFORCED CEMENT CONCRETE	25
2	AAC BLOCK	10
3	STEEL	78.50

Structural concrete shall be of grade M25 for all R.C.C work.

Steel reinforcement shall be of grade Fe 550 confirming to IS: 1786-2008.

7.0 NOMINAL COVER TO REINFORCEMENT

From Durability requirement, exposure condition is assumed as mild for structural elements above ground level and moderate for structural elements below ground level.

The clear cover to reinforcement to meet durability requirement shall be as follows:

- Footing -50mm
- Column - 40mm
- Beam - 25mm
- Slab - 20mm

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8.0 DESIGN CALCULATION:

8.1 FOOTING DESIGN CALCULATION:

GENERAL DATA

Member identification (Node No. / Load Case)	=	
Design Method	=	Limit-State of IS:456-2000
Unfactored axial load (without selfwt)	=	419 kN
Unfactored moment about X (Anticlock +ve)	=	2 kN.m
Unfactored moment about Z (Antidock +ve)	=	2 kN.m
Net Safe bearing capacity of soil @ 3.0 m below Finished grade lvl	=	300 kN/m²
Concrete mix	=	M 25
Density of concrete	=	25 kN/m³
Density of soil	=	18 kN/m³
Factor of Safety	=	1.50
Provide size of footing	=	1.22 x 1.22 x 0.38 m
Depth of Ftg @ Edge of Ftg.	=	0.23 m
Size of Column	=	0.38 x 0.23 m
Depth of footing below ground level	=	3 m
Clear cover to steel	=	40 mm
Width of Shoe all round Column	=	0.15 m

VERTICAL LOAD:

Weight of entire foundation

((0.38-0.23)/3)* [((((0.23+(2*0.15))*(0.38+(2*0.15))) +(1.22*1.22)+ SQRT[(((0.23+(2*0.15))*(0.38+(2*0.15))) * (1.22*1.22)])*25+(1.22*1.22*0.23*25)

= 11.78 kN

Weight of soil

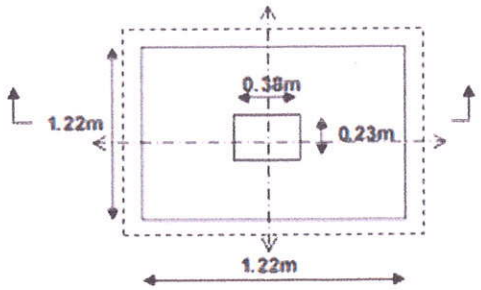
(1.22*1.22*3*18)-11.78

= 68.59 kN

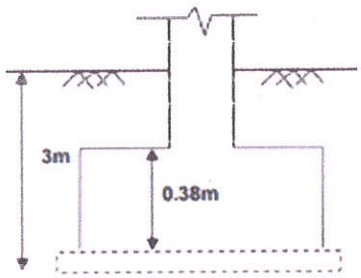
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PLAN



SECTION

DESIGN CALCULATION

CHECK FOR BEARING PRESSURE:

Total Vertical Load

a) Weight of foundation	=	11.78	kN
b) Weight of soil	=	68.59	kN
c) Vertical load from structures	=	419	kN
TOTAL DOWNWARD LOAD	=	11.78+68.59+419	
	=	**499.4**	**kN**

Section Modulus about XX (Zxx)	=	1.22*1.22^2/6	
	=	0.303	Cum
Section Modulus about YY (Zyy)	=	1.22*1.22^2/6	
	=	0.303	Cum

Actual base pressure	=	**(499.37/1.22/1.22)+(ABS(2)/0.303)+ (ABS(2)/0.303)**	
qmax	=	**348.71**	**kN/m²**
qmin	=	**322.31**	**kN/m²**

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Max Net Pressure, qmax-γ H	=	348.71-3*18
	=	**294.71 kN/m²**
	<	**300 kN/m²**
		Hence Safe

DESIGN OF FOOTING SLAB:

Maximum base pressure	=	348.71 kN/m²
Maximum overhang of pad	=	(1.22-0.38)/2 =
	=	0.42 m
Pressure due to over burden of soil & pad	=	(3-0.38)*18+0.38*25
	=	56.66 kN/m²
Base pressure at face of the pedestal =	=	(322.31+((348.71-322.31)/1.22*(1.22-0.42)
	=	339.62 kN/m²
Maximum cantilever moment at the face of pedestal	=	0.5*(348.71+339.62)*0.42*(0.42/3*(339.62+2*348.71)/(339.62+348.71))-56.66*0.42*(0.42/2)
	=	25.490 kNm

Overall depth provided 380 mm

Diameter of reinforcement bar =		10 mm
Effective depth provided	=	380-40-10/2
	=	335 mm
Mu/bd²	=	1.5*25.49*1000000/(1000*335^2)
	=	0.3407
Percentage of reinforcement required (Pt)	=	0.0797 **(As per Table 2 of SP16)**
A_{st} required	=	0.0797/100*(1000*335)
	=	267 mm²

Minimum reinforcement = 0.12/100*(1000*0.38*1000) = 456 mm²

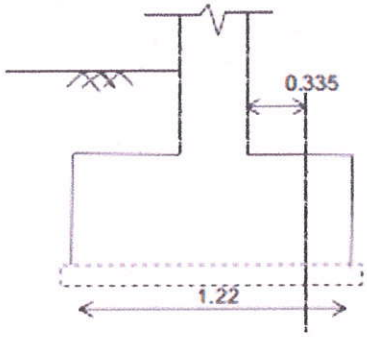
Provide 10 @ 150 c/c m both ways at bottom.
(A_{st} provided = 524 mm²)
Pt provided = 100*524/(1000*335)= 0.157 mm²

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CHECK FOR SHEAR

One Way Shear



Overhang of footing beyond critical section for shear	=	(1.22-0.38)/2-0.335
	=	0.085 m
Maximum base pressure	=	348.71 KN/m²
Depth at Critical Section	=	335 mm
	=	0.335 m
Base pressure at a distance "d" from face of the pedestal =	=	(322.31+((348.71-322.31)/1.22*(1.22-335/1000)
	=	341.46 KN/m²
Downward force from footing	=	56.66 KN/m²
Shear force at critical section V	=	0.5*(348.71+341.46)*0.085-56.66*0.085
	=	24.516 kN/m
Shear stress τ_v	=	1.5*24.516*1000/(1000*1000*0.335)
	=	0.1098 N/mm²
τ_c (Table 19 of IS 456-2000)	=	0.297 N/mm²

Hence Safe

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Two Way Shear

Perimeter of the critical section around the pedetal at a distance d/2 from face of pedestal	=	((0.38+2*(335/2/1000))*2)+((0.23+2*(335/2/1000))*2) 2.560 m
Depth at Critical Section	=	335 mm
	=	0.335 m

Allowable punching shear stress

$\tau_c = k_s \cdot \tau_c$

$ks = 0.5 + \beta_c$

β_c = 0.38/0.23 = 1.66217

ks	=	0.5 + 2
	=	2.2
ks should not be greater than 1	=	1
$\tau_c = 0.25 \sqrt{f_{ck}}$	=	0.25 x √ 25
	=	1.25 N/mm²
Allowable maximum load (unfactored) on pedestal from punching shear point of view	=	1.25*(2.56*1000)*0.335/1.5
	=	714.667 kN
Total Downward load	=	419 kN

Hence Safe

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8.2 COLUMN DESIGN CALCULATION:

COLUMN DESIGN CALCULATIONS

Project Name	:	EDEN APARTMENT
Client Name	:	MOARIS
Engineer Name	:	SH
Analysis File	:	D:\desktop\JS\EDEN APARTMENT\staad\Morais Eden and Morais Opal Apartment-MOS-25-05(EDEN)-R0-24.12.2025-SH.std
Analysis Last Modified	:	24-06-26 4:08:55 PM

Definitions Of Terms:

All forces in units kN and m

All reinforcement details like area, spacing are mm

Grade Of steel for 6 mm dia. bars is Fe250. It is irrespective of the grade of steel defined by user in column design.

Neutral axis angle for resultant design moment is with respect to local major axis.

1	β	=	Stiffness proportion factor at joint (column stiffness/sum of stiffness of all members connected at joint)
2	Δu	=	Elastically computed first order lateral deflection. (Relative deflections)
3	ε1	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
4	εm	=	Average steel strain at level considered
5	acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
6	Ag	=	Gross area of the column cross section
7	Aeff	=	Effective area of column / wall considered for shear check in sqmm
8	Ak	=	Area of confined concrete core
9	Ash	=	Area of link cross section
10	b	=	Effective Width of Column in mm
11	beff	=	Effective Width of Column in mm
12	B	=	Width / Smaller Dimension of Column in mm
13	d	=	Effective Depth of Column in mm
14	deff	=	Effective Depth of Column in mm
15	D	=	Depth / Larger Dimension of Column OR Diameter of Circular Column in mm
16	Dk	=	Diameter Of core measured to the outside of circular link
17	Ec	=	Modulus of elasticity of concrete
18	Es	=	Modulus of elasticity of steel
19	FcPerm	=	Permissible Stress in Concrete required in N/ (sqmm)
20	Fst	=	Stress in steel
21	FstPerm	=	Permissible Stress in Steel required in N/ (sqmm)
22	Fck	=	Characteristic compressive strength of concrete cube in N/sqmm
23	Fy	=	Yield Stress Of Steel in N/sqmm
24	h	=	Longer dimension of rectangular link measured to its outer face
25	Hu	=	Total lateral force acting within the story(Story shear)
26	Hs	=	Height of the story (Floor height)
27	k	=	Reduction factor for slenderness moments
28	Max	=	Additional moment due to slenderness about major axis (Along D)
29	May	=	Additional moment due to slenderness about minor axis (Along B)

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30	Mminx	-	Moment due to minimum eccentricity along D
31	Mminy	-	Moment due to minimum eccentricity along B
32	Muv	-	Moment capacity of web portion of wall as per clause 9.4.2 and Annex A of IS 13920 - 2016
33	Mux	-	Factored moment Along D (Moment About Major Axis)
34	Muy	-	Factored moment Along B (Moment About Minor Axis)
35	MCap	-	Moment capacity of section for NA angle at design Pu
36	MRes	-	Resultant design moment at angle to local major axis
37	Pb	-	Axial capacity of column along B as defined in 39.7.1.1
38	Pd	-	Axial capacity of column along D as defined in 39.7.1.1
39	Pu	-	Factored axial force
40	Puz	-	Axial load on column as defined in 39.6
41	Pu_Total	-	Sum of Axial loads on all column in the story (Gravity Load)
42	Q	-	Stability Index (factor for checking sway/ non sway condition for a given story)
43	S	-	Link Spacing
44	Shear Strength Enhancement Factor	-	Multiplying factor for shear strength of concrete as per 40.2.2
45	Vur	-	Factored resultant shear force acting on the column
46	Vux	-	Factored shear force Along B
47	Vuy	-	Factored shear force Along D
48	Wcr	-	Surface Crack Width
49	WcrPermn	-	Permissible Crack Width required in mm
50	β	-	It is a Neutral Axis angle corresponding to load angle to find out MCap

Code References:

IS 456

	ELEMENT		CLAUSE / table
1	Max area of reinforcement	:	26.5.3.1-a & b
2	Min area of reinforcement	:	26.5.3.1-a & b
3	Min number of bars	:	26.5.3.1-c
4	Minimum Eccentricity Calc	:	25.4 & 39.2
5	Effective Length	:	25.2
6	Slenderness Moments	:	25.3 & 39.7
7	Design for axial loads	:	39.3
8	Design for axial loads And uniaxial bending	:	39.5
9	Design for axial loads And Biaxial bending	:	39.6
10	Design of horizontal links	:	26.5.3.2
11	Design shear strength	:	40.2
12	Stiffness Proportion Factor, β	:	E-1
13	Stability(Index, Q)	:	E -2
14	Crack width calculation	:	3.8
15	Multiplying factor to Beam Stiffness for effective length calculation	:	SP 24 1983 APPENDIX D

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IS 13920 - 2016

	ELEMENT		CLAUSE / table
1	Spacing of special confining reinforcement	:	10.4 and 7.6
2	C/s area of special confining reinforcement	:	7.6.1
3	Applicability of boundary element	:	10.4.1
4	Muv-Moment Capacity of Web	:	Annex
5	Additional Compressive Force in BE	:	10.4.2
6	Check for BE in tension and compression	:	10.4.2.1 and 10.4.3
7	Shear include due to Beam	:	7.5
8	Minimum Flexural Strength of Column	:	7.2
9	Shear Check at Column Joint	:	9.1
10	Length of wall to thickness ratio	:	10.1.3
11	Type of wall & Minimum reinforcement	:	10.1.4
12	Largest diameter of longitudinal steel bar	:	10.1.8
13	Shear reinforcement in RC wall	:	10.2.3
14	Special confinement reinforcement in Boundary Element	:	10.4.4
15	Minimum vertical reinforcement across horizontal construction joint	:	10.7

General Data

Column No.	:	C12	
Level	:	-3.05 m To 0 m	
Frame Type	=	Non-Ductile	
Response Reduction Factor	=	3	
Design Code	=	IS 456 : 2000 + IS 13920 : 2016	
Grade Of Concrete	=	M25	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe500	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Column B	=	300	mm
Column D	=	380	mm
Clear Cover	=	50	mm
Clear Floor Height @ B	=	3050	mm
Clear Floor Height @ D	=	2600	mm
No Of Floors	=	1	
No Of Columns In Group	=	1	
Column Type	:	Unfraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	1.27 <= 4 Hence, Design as Column	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	1024	
Critical Analysis Load Combination	:	201	
Load Combination	=	[2] : 1.5 (LOAD 1: WDL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)	
Critical Location	=	Top Joint	
Pu	=	1264.36	kN
Mux	=	4.87	kNm

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Muy	=	2.12	kNm
Vux	=	3.01	kN
Vuy	=	-1.95	kN

Minimum Eccentricity Check

Since Axial Force is compressive, Min. Eccentricity check to be performed
Most critical case is with Min. Eccentricity check in Y-direction
Minimum Eccentricity Along B :

Minimum Eccentricity	=	Unsupported Length / 500 + B / 30	
	=	16.1	mm
Mminy	=	Pu x Minimum Eccentricity	
	=	25.29	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	10.17	
	<	60	(Hence Ok)

Column Is Unbraced Along D
Slenderness Check Along D:

Effective Length Factor	=	1	
Slenderness Ratio	=	Effective Length / D	
	=	6.84, Column not Slender Along D	

Column Is Unbraced Along B
Slenderness Check Along B:

Effective Length Factor	=	1	
Slenderness Ratio	=	Effective Length / B	
	=	10.17, 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	4.87	---	4.87	0	4.87
Minor Axis - Muy	2.12	25.29	25.29	0	25.29

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	=	1264.36	kN
Mux	=	4.87	kNm
Muy	=	25.29	kNm

Resultant Moment (Combined Action)

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Moment Capacity Check

Pt Calculated	=	0.79	
Reinforcement Provided	=	8-T12	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	79.1	deg
MRes	=	25.75	kNm
MCap	=	37.46	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.69 <= 1	

Shear Calculation	**Along D**	**Along B**
Critical Analysis Load Combination	201	201
Critical Load Combination	[2] : 1.5 (LOAD 1: WDL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)	[2] : 1.5 (LOAD 1: WDL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)
Design shear force, Vu (kN)	-1.9483	3.0136
Pu (kN)	1264.36	1264.36
Deff , Beff (mm)	324	244
Aeff (sqmm)	97200	92720
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.02	0.0325
Pt (%)	0.397	0.397
Design shear strength, Tc (N/sqmm)	0.4443	0.4443
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	2.5609	2.6364
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.5	1.5
Enhanced shear strength, Tc-e (N/sqmm)	0.6665	0.6665
Design shear check	Tv < Tc x Enhancement factor	Tv < Tc x Enhancement factor
Shear Links Design	**Shear Links Not Required**	**Shear Links 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	
	=	3	mm
Criterion for spacing of normal links			
Min. Longitudinal Bar dia X 16	=	192	mm
Min. dimension of column	=	300	mm

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Max. 300 mm	=	300	mm
Provided spacing	=	150	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing	150	---	---	150	---

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8.2 BEAM DESIGN CALCULATION:

KAARVENS	Project	EDEN APARTMENT						Document No./		Date																				
	Title	FIRST FLOOR								1.06.2026																				
Grade of Con. (fc') (N/Sq.mm)		25	Grade of Steel (fy)		500	Cover		25																						
DESIGN PARAMETERS								DESIGN FOR BENDING						SIDE FACE REINFORCEMENT					DESIGN FOR SHEAR									CHECK FOR DEFLECTION		
Beam No. From STAAD	Ult. Mom (Mu) from STAAD (kNm)	Ult. Shear (Vu) from STAAD (kN)	Size (m)			Max. Beam Span (m)	Basic Span to depth ratio (Ref. IS 456: 23.2.1)	Dia of Stir. (mm)	Slender Beam Check	Check for Tension Rft.	Check for Comp. Rft.	0.1 % of Web area	Rft.			Ast (Prov.) (Sq.mm)	Check	Spacing at Support (c/c) (mm)	Stirrup spacing adopted		Check	Depth Req. (mm)	Check
			b	D									No. of Bars (No.)	Bar Dia (mm)				Center (c/c) (mm)						
B1	36.00	58.00	0.23	0.3		5.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	229.08	Safe
B2	50.00	76.00	0.23	0.38		6.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	271.99	Safe
B3	65.00	86.00	0.23	0.38		6.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		175	Spac Ok	306.66	Safe
B4	70.00	160.00	0.23	0.45		5.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	222.12	Safe
B5	100.00	123.00	0.23	0.45		6.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		175	Spac Ok	284.04	Safe
B6	125.00	128.00	0.23	0.45		8.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	314.67	Safe
B7	152.00	152.00	0.23	0.45		6.00	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		175	Spac Ok	321.72	Safe
B8	180.00	188.00	0.23	0.45		7.10	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	125		125	Spac Ok	363.37	Safe
B9	232.00	283.00	0.3	0.45		7.20	20	10	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	125		125	Spac Ok	382.53	Safe
B10	271.00	280.00	0.3	0.45		8.20	20	10	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	125		125	Spac Ok	380.45	Safe
B11	343.00	254.00	0.38	0.45		7.60	20	10	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	379.84	Safe
B12	490.00	284.00	0.45	0.45		8.40	20	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		175	Spac Ok	359.76	Safe
B13	820.00	310.00	0.75	0.45		8.40	20	10	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	387.00	Safe
B6/CAB1	47.00	90.00	0.23	0.45		2.50	7	8	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	150		150	Spac Ok	204.95	Safe
	970.00	1457.00	0.68	0.75		1.40	7	10	SIZE OK	Safe	Safe	N/A	2	12		226.2	Size ok	125		125	Spac Ok	175.84	Safe

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8.3 SLAB DESIGN CALCULATION:

Project: EDEN Apartment

Title: Terrace Floor

Garde of steel fy 500 N/mm²

Garde of concrete fck 25 N/mm²

Clear cover 15.00 mm

Slab ID	Shorter Span		Longer Span		Shorter Span	Longer Span	Span Ratio	Overall depth	Effective Depth		Floor Finish	Load Factor	Live Load	Check for Deflection							Check
									Shorter	Longer				Type of Slab	Allow Span/ Depth Ratio	Fs=0.58xFyxArea of Steel req/Provi.,	Modification Factor		Span/ Depth =L/dxF1xF2	Actual Span/Depth Ratio	
	ft	in	ft	in	(m)	(m)		(mm)	(mm)	(mm)	(kN/m²)	kN/m²	(kN/m²)			N/mm2	Tens.,(F1)	Comp.,(F2)			
S1	10	0	17	3	3.05	5.26	1.72	125	106	98	1.50	1.50	2.00	S.S	20	208.350	1.850	1.079	39.913	28.774	Safe
S2	12	0	16	0	3.66	4.88	1.33	125	106	98	1.50	1.50	2.00	S.S	20	212.207	1.680	1.089	36.589	34.528	Safe
S3	12	0	22	0	3.66	6.71	1.83	150	130	120	1.50	1.50	2.00	S.S	20	177.990	1.960	1.098	43.054	28.154	Safe
S4	17	8	22	4	5.39	6.81	1.26	150	130	120	1.50	1.50	2.00	S.S	20	97.988	2.000	1.149	45.941	41.462	Safe

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STRUCTURAL DESIGN CALCULATION REPORT

PROPOSED CONSTRUCTION OF STILT+5FLOORS (HEIGHT-20.72m) RESIDENTIAL APARTMENT BUILDING AT SURVEY NO: 205/4E2B, 205/4F1A2, 205/4H1B1A, 205/4I2A1A,205/85 & 205/86, PLOT NO.408 NORTH PART,409 & 410, KEELAKURICHI VILLAGE, THIRUVERUMBUR TALUK, THIRUCHIRAPALLI DISTRICT.

REV. NO.	R0		R1		R2		R3		ISSUE
	INITIALS	SIGN.	INITIALS	SIGN.	INITIALS	SIGN.	INITIALS	SIGN.	
PPD. BY	KA								R0
CHD. BY	JS								
APD. BY	SKAK								
DATE	24.06.26								

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1.0 OBJECTIVE:

The Proposed Construction of Residential Apartment Building at Survey No: 205/4E2B, 205/4F1A2,205/4H1B1A, 205/4I2A1A,205/85 & 205/86,Plot No; 408-410, Keelakurichi Village, Thiruverumbur Taluk, Thiruchirapalli District.

The building is designed for stilt + five floors. The structure is supported on column in turn resting on column footing foundation. The structure system comprises column, beam, and slab structure.

3D Analysis of all the building structure will be carried out using STAAD.PRO Sowftware package and analysis result shall be used for the various elements.

2.0 DESIGN LOADS:

2.1 Dead Loads:

The Dead loads that are envisaged to act permanently are considered as per IS:875 (Part 1) – 1987 – Dead loads. Indian standard **"Code of Practice for Design Loads (other than earthquakes) for Buildings and Structures."**

1. Slab is assumed to be 150 mm thick – 3.755 kN/m²
2. Floor finish – 1.5 kN/m²
3. AAC Block masonry walls 230mm & 115mm thick are proposed to be used (location of walls as per Architectural drawings). Unit weight is taken as 10 kN/m³

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2.2 Imposed Loads

The imposed loads that are envisaged to get permanently are considered as per IS: 875 (Part – 2) 1987. Indian standard **"Code of Practice for Design Loads (other than earthquake) for Buildings and Structures".**

1. Living = 2 kN/m²
2. Staircase = 3 kN/m²
3. Toilets = 2 kN/m²
4. Terrace floors = 2 kN/m²

2.3 Load combination

Load combination condition is considered as per IS 456.

Table 18 Values of Partial Safety Factor γ_f for Loads
(Clauses 18.2.3.1, 36.4.1 and B-4.3)

Load Combination	Limit State of Collapse			Limit States of Serviceability		
	DL	*IL*	*WL*	*DL*	*IL*	*WL*
(1)	(2)	(3)	(4)	(5)	(6)	(7)
DL + IL	1.5		1.0	1.0	1.0	–
DL + WL	1.5 or 0.9[1]	–	1.5	1.0	–	1.0
DL + IL + WL	1.2			1.0	0.8	0.8

NOTES
1 While considering earthquake effects, substitute *EL* for *WL*.
2 For the limit states of serviceability, the values of γ_f given in this table are applicable for short term effects. While assessing the long term effects due to creep the dead load and that part of the live load likely to be permanent may only be considered.
[1] This value is to be considered when stability against overturning or stress reversal is critical.

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3.0 ANALYSIS METHODS:

The analysis of the structures is carried out using the STAAD Pro. The entire super structure is modeled using frame elements as appropriate. Beams and columns are modeled as frame elements. Appropriate loads and its combinations as per relevant IS code clauses, for most unfavorable effects are chosen for design. Various load cases considered in the analysis are briefed above.

4.0 DESIGN ASSUMPTION:

1. The Base of the Foundation is assumed to be FIXED
2. All concrete elements shall be designed in accordance with IS 456:2000 Limit state design
3. Appropriate loads and its combination as per relevant clauses, for the most unfavorable effects are chosen for design. (Refer Load Combination in Cl.2.3 in the report)

5.0 FOUNDATION DESIGN:

Type of foundation	: Isolated footing
Depth of foundation	: 3 m below natural ground level

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6.0 MATERIALS:

The self- weight of the various element are computed based on the unit weight of material as give below:

Sl.No.	MATERIAL	UNIT WEIGHT kN/m^3
1	REINFORCED CEMENT CONCRETE	25
2	AAC BLOCK	10
3	STEEL	78.50

Structural concrete shall be of grade M25 for all R.C.C work.

Steel reinforcement shall be of grade Fe 550 confirming to IS: 1786-2008.

7.0 NOMINAL COVER TO REINFORCEMENT

From Durability requirement, exposure condition is assumed as mild for structural elements above ground level and moderate for structural elements below ground level.

The clear cover to reinforcement to meet durability requirement shall be as follows:

- Footing -50mm
- Column - 40mm
- Beam - 25mm
- Slab - 20mm

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8.0 DESIGN CALCULATION:

8.1 FOOTING DESIGN CALCULATION:

GENERAL DATA

Member identification (Node No./ Load Case)	=	
Design Method	=	Limit-State of IS:456-2000
Unfactored axial load (without selfwt)	=	415 kN
Unfactored moment about X (Anticlock +ve)	=	3 kN.m
Unfactored moment about Z (Antidock +ve)	=	3 kN.m
Net Safe bearing capacity of soil @ 3.0 m below Finished grade lvl	=	300 kN/m²
Concrete mix	=	M 25
Density of concrete	=	25 kN/m³
Density of soil	=	18 kN/m³
Factor of Safety	=	1.50
Provide size of footing	=	1.22 x 1.22 x 0.3 m
Depth of Ftg @ Edge of Ftg.	=	0.23 m
Size of Column	=	0.38 x 0.23 m
Depth of footing below ground level	=	3 m
Clear cover to steel	=	40 mm
Width of Shoe all round Column	=	0.15 m

VERTICAL LOAD:

Weight of entire foundation

((0.3-0.23)/3)* ((((0.23+(2*0.15))*(0.38+(2*0.15))) +(1.22*1.22)+ SQRT(((0.23+(2*0.15))*(0.38+(2*0.15)))
* (1.22*1.22)))*25+(1.22*1.22*0.23*25)

= 10.06 kN

Weight of soil

(1.22*1.22*3*18)-10.06

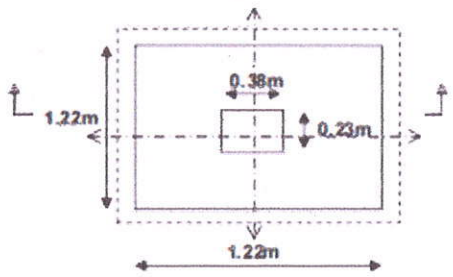
= 70.31 kN

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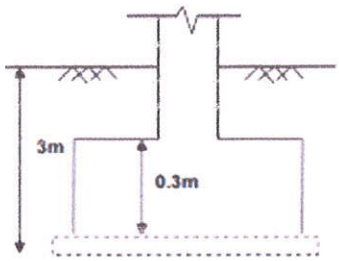
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PLAN



SECTION

DESIGN CALCULATION

CHECK FOR BEARING PRESSURE:

Total Vertical Load

i) Weight of foundation	=	10.06	kN
ii) Weight of soil	=	70.31	kN
iii) Vertical load from structures	=	415	kN
TOTAL DOWNWARD LOAD	=	10.06+70.31+415	
	=	495.4	kN

Section Modulus about XX (Zxx)	=	1.22*1.22^2/6	
	=	0.303	Cum
Section Modulus about YY (Zyy)	=	1.22*1.22^2/6	
	=	0.303	Cum

Actual base pressure	=	(495.37/1.22/1.22)+(ABS(3)/0.303)+ (ABS(3)/0.303)	
qmax	=	352.62	kN/m²
qmin	=	313.02	kN/m²

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Max Net Pressure, qmax-γ H	=	352.62-3*18
	=	**298.62 kN/m²**
	<	**300 kN/m²**
		Hence Safe

DESIGN OF FOOTING SLAB:

Maximum base pressure	=	352.62 kN/m²
Maximum overhang of pad	=	(1.22-0.38)/2 =
	=	0.42 m
Pressure due to over burden of soil & pad	=	(3-0.3)*18+0.3*25
	=	56.1 kN/m²
Base pressure at face of the pedestal =	=	(313.02+((352.62-313.02)/1.22*(1.22-0.42)
	=	338.99 kN/m²
Maximum cantilever moment at the face of pedestal	=	0.5*(352.62+338.99)*0.42*(0.42/3*(338.99+2*352.62)/(338.99+352.62))-56.1*0.42*(0.42/2)
	=	25.750 kNm

Overall depth provided 300 mm

Diameter of reinforcement bar =		10 mm
Effective depth provided	=	300-40-10/2
	=	255 mm
Mu/bd²	=	1.5*25.75*1000000/(1000*255^2)
	=	0.594
Percentage of reinforcement required (Pt)	=	0.1406 **(As per Table 2 of SP16)**
A_{st} required	=	0.1406/100*(1000*255)
	=	358.53 mm²

Minimum reinforcement = 0.12/100*(1000*0.3*1000) = 360 mm²

Provide 10 @ 150 c/c m both ways at bottom.

(A_{st} provided = 524 mm²)

Pt provided = 100*524/(1000*255)= 0.206 mm²

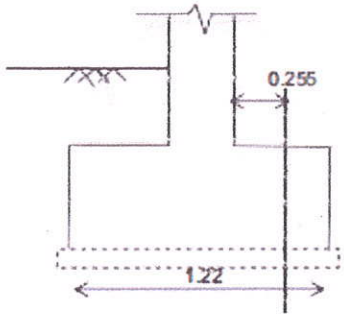
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CHECK FOR SHEAR

One Way Shear



Overhang of footing beyond critical section for shear	=	(1.22-0.38)/2-0.255
	=	0.165 m
Maximum base pressure	=	352.62 KN/m²
Depth at Critical Section	=	255 mm
	=	0.255 m
Base pressure at a distance "d" from face of the pedestal	=	(313.02+((352.62-313.02)/1.22*(1.22-255/1000)
	=	344.34 KN/m²
Downward force from footing	=	56.1 KN/m²
Shear force at critical section V	=	0.5*(352.62+344.34)*0.165-56.1*0.165
	=	48.243 kN/m
Shear stress τ_v	=	1.5*48.243*1000/(1000*1000*0.255)
	=	0.2838 N/mm²
τ_c (Table 19 of IS 456-2000)	=	0.335 N/mm²
		Hence Safe

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Two Way Shear

Perimeter of the critical section around the pedetal at a distance d/2 from face of pedestal	=	((0.38+2*(255/2/1000))*2)+((0.23+2*(255/2/1000))*2) 2.240 m
Depth at Critical Section	=	255 mm
	=	0.255 m

Allowable punching shear stress

$\tau_c = k_s \cdot \tau_c$

$k_s = 0.5 + \beta_c$

$\beta_c = 0.38/0.23 = 1.65217$

k_s	=	0.5 + 2
	=	2.2
k_s should not be greater than 1	=	1
$\tau_c = 0.25 \sqrt{f_{ck}}$	=	0.25 x √ 25
	=	1.25 N/mm²
Allowable maximum load (unfactored) on pedestal from punching shear point of view	=	1.25*(2.24*1000)*0.255/1.5
	=	476.000 kN
Total Downward load	=	415 kN

Hence Safe

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8.2 COLUMN DESIGN CALCULATION:

COLUMN DESIGN CALCULATIONS

Project Name	:	OPAL APARTMENT
Client Name	:	MOS
Engineer Name	:	BR
Analysis File	:	D:\desktop\JS\opal\staad\(op1) (Opal) canti Morais Eden and Morais Opal Apartment-MOS-25-05-BR-R2-25.05.26 (1).STD
Analysis Last Modified	:	24-06-26 4:08:58 PM

Definitions Of Terms:

All forces in units kN and m

All reinforcement details like area, spacing are mm

Grade Of steel for 6 mm dia. bars is Fe250. It is irrespective of the grade of steel defined by user in column design.

Neutral axis angle for resultant design moment is with respect to local major axis.

1	β	=	Stiffness proportion factor at joint (column stiffness/sum of stiffness of all members connected at joint)
2	Δu	=	Elastically computed first order lateral deflection (Relative deflections)
3	cl	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
4	cm	=	Average steel strain at level considered
5	acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
6	Ag	=	Gross area of the column cross section
7	Aeff	=	Effective area of column / wall considered for shear check in sqmm
8	Ak	=	Area of confined concrete core
9	Ash	=	Area of link cross section
10	b	=	Effective Width of Column in mm
11	beff	=	Effective Width of Column in mm
12	B	=	Width / Smaller Dimension of Column in mm
13	d	=	Effective Depth of Column in mm
14	deff	=	Effective Depth of Column in mm
15	D	=	Depth / Larger Dimension of Column OR Diameter of Circular Column in mm
16	Dk	=	Diameter Of core measured to the outside of circular link
17	Ec	=	Modulus of elasticity of concrete
18	Es	=	Modulus of elasticity of steel
19	FcPerm	=	Permissible Stress in Concrete required in N/ (sqmm)
20	Fst	=	Stress in steel
21	FstPerm	=	Permissible Stress in Steel required in N/ (sqmm)
22	Fck	=	Characteristic compressive strength of concrete cube in N/sqmm
23	Fy	=	Yield Stress Of Steel in N/sqmm
24	h	=	Longer dimension of rectangular link measured to its outer face
25	Hu	=	Total lateral force acting within the story(Story shear)
26	Hs	=	Height of the story (Floor height)
27	k	=	Reduction factor for slenderness moments
28	Max	=	Additional moment due to slenderness about major axis (Along D)
29	May	=	Additional moment due to slenderness about minor axis (Along B)

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30	Mminx	–	Moement due to minimum eccentricity along D
31	Mminy	–	Moement due to minimum eccentricity along B
32	Muv	–	Moement capacity of web portion of wall as per clause 9.4.2 and Annex A of IS 13920 - 2016
33	Mux	–	Factored moment Along D (Momemt About Major Axis)
34	Muy	–	Factored moment Along B (Moement About Minor Axis)
35	MCap	–	Moement capacity of section for NA angle at design Pu
36	MRes	–	Resultant design moment at angle to local major axis
37	Pb	–	Axial capacity of column along B as defined in 39.7.1.1
38	Pd	–	Axial capacity of column along D as defined in 39.7.1.1
39	Pu	–	Factored axial force
40	Puz	–	Axial load on column as defined in 39.6
41	Pu_Total	–	Sum of Axial loads on all column in the story (Gravity Load)
42	Q	–	Stability Index (factor for checking sway/ non sway condition for a given story)
43	S	–	Link Spacing
44	Shear Strength Enhancement Factor	–	Multiplying factor for shear strength of concrete as per 40.2.2
45	Vur	–	Factored resultant shear force acting on the column
46	Vux	–	Factored shear force Along B
47	Vuy	–	Factored shear force Along D
48	Wcr	–	Surface Crack Width
49	WcrPerm	–	Permissible Crack Width required in mm
50	β	–	It is a Neutral Axis angle corresponding to load angle to find out MCap

Code References:

IS 456

	ELEMENT		CLAUSE / table
1	Max area of reinforcement	:	26.5.3.1-a & b
2	Min area of reinforcement	:	26.5.3.1-a & b
3	Min number of bars	:	26.5.3.1-c
4	Minimum Eccentricity Calc	:	25.4 & 39.2
5	Effective Length	:	25.2
6	Slenderness Moments	:	25.3 & 39.7
7	Design for axial loads	:	39.3
8	Design for axial loads And uniaxial bending	:	39.5
9	Design for axial loads And Biaxial bending	:	39.6
10	Design of horizontal links	:	26.5.3.2
11	Design shear strength	:	40.2
12	Stiffness Proportion Factor, β	:	E-1
13	Stability(Index, Q)	:	E -2
14	Crack width calculation	:	3.8
15	Multiplying factor to Beam Stiffness for effective length calculation	:	SP 24 1983 APPENDIX D

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IS 13920 - 2016

	ELEMENT		CLAUSE / table
1	Spacing of special confining reinforcement	:	10.4 and 7.6
2	C/s area of special confining reinforcement	:	7.6.1
3	Applicability of boundary element	:	10.4.1
4	Mav-Moment Capacity of Web	:	Annex
5	Additional Compressive Force in BE	:	10.4.2
6	Check for BE in tension and compression	:	10.4.2.1 and 10.4.3
7	Shear include due to Beam	:	7.5
8	Minimum Flexural Strength of Column	:	7.2
9	Shear Check at Column Joint	:	9.1
10	Length of wall to thickness ratio	:	10.1.3
11	Type of wall & Minimum reinforcement	:	10.1.4
12	Largest diameter of longitudinal steel bar	:	10.1.8
13	Shear reinforcement in RC wall	:	10.2.3
14	Special confinement reinforcement in Boundary Element	:	10.4.4
15	Minimum vertical reinforcement across horizontal construction joint	:	10.7

General Data

Column No.	:	C50	
Level	:	-3 m To 0 m	
Frame Type	=	Non-Ductile	
Response Reduction Factor	=	3	
Design Code	=	IS 456 : 2000 + IS 13920 : 2016	
Grade Of Concrete	=	M25	N/sqmm
Grade Of Steel (Main)	=	Fe415	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe415	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Column B	=	230	mm
Column D	=	450	mm
Clear Cover	=	50	mm
Clear Floor Height @ B	=	2700	mm
Clear Floor Height @ D	=	2700	mm
No Of Floors	=	1	
No Of Columns In Group	=	1	
Column Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	1.96 <= 4 Hence, Design as Column	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	1335	
Critical Analysis Load Combination	:	201	
Load Combination	=	[2] : 1.5 (LOAD 1: DL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)	
Critical Location	=	Bottom Joint	
Pu	=	1298.23	kN
Mux	=	5.61	kNm

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Muy	=	-0.21	kNm
Vux	=	0.28	kN
Vuy	=	3.06	kN

Minimum Eccentricity Check

Since Axial Force is compressive, Min. Eccentricity check to be performed
Most critical case is with Min. Eccentricity check in Y-direction

Minimum Eccentricity Along B :

Minimum Eccentricity	=	Unsupported Length / 500 + B / 30	
	=	13.07	mm
Mminy	=	Pu x Minimum Eccentricity	
	=	25.96	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	11.74	
	<	60	(Hence Ok)

Column Is Unbraced Along D
Slenderness Check Along D:

Effective Length Factor	=	1	
Slenderness Ratio	=	Effective Length / D	
	=	6, Column not Slender Along D	

Column Is Unbraced Along B
Slenderness Check Along B:

Effective Length Factor	=	1	
Slenderness Ratio	=	Effective Length / B	
	=	11.74, Column Not Slender Along B	

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	MsIndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	5.61	---	5.61	0	5.61
Minor Axis - Muy	-0.21	25.96	-25.96	0	-25.96

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	=	1298.23	kN
Mux	=	5.61	kNm
Muy	=	-25.96	kNm

Resultant Moment (Combined Action)

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Moment Capacity Check

Pt Calculated	=	0.79	
Reinforcement Provided	=	8-T12	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	79.1	deg
MRes	=	25.75	kNm
MCap	=	37.46	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.69 <= 1	

Shear Calculation	**Along D**	**Along B**
Critical Analysis Load Combination	201	201
Critical Load Combination	[2] : 1.5 (LOAD 1: WDL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)	[2] : 1.5 (LOAD 1: WDL) +1.5 (LOAD 2: SDL) +1.5 (LOAD 3: LL)
Design shear force, Vu (kN)	-1.9483	3.0136
Pu (kN)	1264.36	1264.36
Deff , Beff (mm)	324	244
Aeff (sqmm)	97200	92720
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.02	0.0325
Pt (%)	0.397	0.397
Design shear strength, Tc (N/sqmm)	0.4443	0.4443
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	2.5609	2.6364
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.5	1.5
Enhanced shear strength, Tc-e (N/sqmm)	0.6665	0.6665
Design shear check	Tv < Tc x Enhancement factor	Tv < Tc x Enhancement factor
Shear Links Design	**Shear Links Not Required**	**Shear Links 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	
	=	3	mm
Criterion for spacing of normal links			
Min. Longitudinal Bar dia X 16	=	192	mm
Min. dimension of column	=	300	mm

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Max. 300 mm	=	300	mm
Provided spacing	=	150	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing	150	---	---	150	---

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8.3 BEAM DESIGN CALCULATION:

KAARVENS	Project	OPAL APARTMENT													Document No. /		Approved		Date		
	Title	FIRST FLOOR																	1.06.2026		
Grade of Con. (fc) (N/Sq mm)		25	Grade of Steel (fy) (N/Sq.mm)		500	Clear cover (mm)	25														
DESIGN PARAMETERS															DESIGN FOR BENDING					CHECK FOR DELFECTION	
Beam No. from STAAD	Ult. Mom (Mu) from STAAD (kNm)	Ult. Shear (Vu) from STAAD (kN)	Size (m)		max. Beam Span (m)	Basic Span to depth ratio (Ref. IS 456: 23.2.1)	Dia of Stir. (mm)	Slender Beam Check	Ast (Prov.) (Sq.mm) (Ten.)	Ast (Prov.) (Sq.mm) (Comp.)	Check for Tension Rft.	Check for Comp. Rft.	Depth Req. (mm)	Check
			b	D																	
B1	36.00	58.00	0.23	0.3	5.00	20	8	SIZE OK	339.3	339.3	Revi	Safe	229.08	Safe
B2	50.00	76.00	0.23	0.38	6.00	20	8	SIZE OK	339.3	339.3	Revi	Safe	271.99	Safe
B3	65.00	86.00	0.23	0.38	6.00	20	8	SIZE OK	452.4	226.2	Revi	Safe	306.66	Safe
B4	70.00	160.00	0.23	0.45	5.00	20	8	SIZE OK	402.2	402.2	Revi	Safe	222.12	Safe
B5	100.00	123.00	0.23	0.45	6.00	20	8	SIZE OK	603.3	603.3	Revi	Safe	284.04	Safe
B6	125.00	128.00	0.23	0.45	6.00	20	8	SIZE OK	804.4	402.2	Revi	Safe	314.67	Safe
B7	152.00	152.00	0.23	0.45	6.00	20	8	SIZE OK	1005.4	402.2	Revi	Safe	321.72	Safe
B8	180.00	186.00	0.23	0.45	7.10	20	8	SIZE OK	1256.8	628.4	Safe	Safe	363.37	Safe
B9	232.00	283.00	0.3	0.45	7.20	20	10	SIZE OK	1610.3	628.4	Safe	Safe	382.53	Safe
B10	271.00	280.00	0.3	0.45	8.20	20	10	SIZE OK	2101.2	1472.8	Safe	Safe	380.45	Safe
B11	343.00	254.00	0.38	0.45	7.60	20	10	SIZE OK	2454.7	1472.8	Safe	Safe	379.84	Safe

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8.4 SLAB DESIGN CALCULATION:

Project: OPAL Apartment

Title: Terrace Floor

Garde of steel fy 500 N/mm²

Garde of concrete fck 25 N/mm²

Clear cover 15.00 mm

Slab ID	Shorter Span		Longer Span		Shorter Span	Longer Span	Span Ratio	Overall Depth	Effective Depth		Floor Finish	Load Factor	Live Load	Check for Deflection							
									Shorter	Longer				Type of Slab	Allow Span/ Depth Ratio	Fs=0.58xFyxArea of Steel req/Provi.,	Modification Factor		Span/ Depth =L/dxF1xF2	Actual Span/Depth Ratio	Check
	ft	in	ft	in	(m)	(m)		(mm)	(mm)	(mm)	kN/m²	kN/m²	kN/m²			N/mm2	Tens.,(F1)	Comp.,(F2)			
S1	10	0	17	3	3.05	5.26	1.72	125	106	98	1.50	1.50	2.00	S.S	20	208.350	1.850	1.079	39.913	28.774	Safe
S2	12	0	16	0	3.66	4.88	1.33	125	106	98	1.50	1.50	2.00	S.S	20	212.207	1.680	1.089	36.589	34.528	Safe
S3	12	0	22	0	3.66	6.71	1.83	150	130	120	1.50	1.50	2.00	S.S	20	177.990	1.960	1.098	43.054	28.154	Safe
S4	17	8	22	4	5.39	6.81	1.26	150	130	120	1.50	1.50	2.00	S.S	20	97.988	2.000	1.149	45.941	41.462	Safe

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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.