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RE REGULATORY RECORD

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+91 9996 12 9996
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DIGITALLY VERIFIED RECORD

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY

Thalamuthu Natarajan Building, No.1, Gandhi Irwin Road, Egmore,
Chennai - 600 008
Phone : 28414855 Fax: 91-044-28548416
E-mail: mscmda@tn.gov.in
Web site: www.cmdachennai.gov.in.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that the Thiru / Tmt. / M/s. **M.SHANKAR** has enrolled as **Registered Structural Engineer Grade-I(SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E Structures** and experience in the relevant field for 7 years.

He/She has been given the Registration No. **SE/I/2024/4/0037** on **12-Apr-2024** He/She shall be required to comply with the duties and responsibilities prescribed by the Government of Tamil Nadu in Part V, "Registration of Professionals", Tamil Nadu Combined Development and Building Rules, 2019 approved vide G.O.(ms) No.18 MAWS (MA1) Dept. Dated. 04.02.2019.

This Registration is valid upto **11-Apr-2029.**

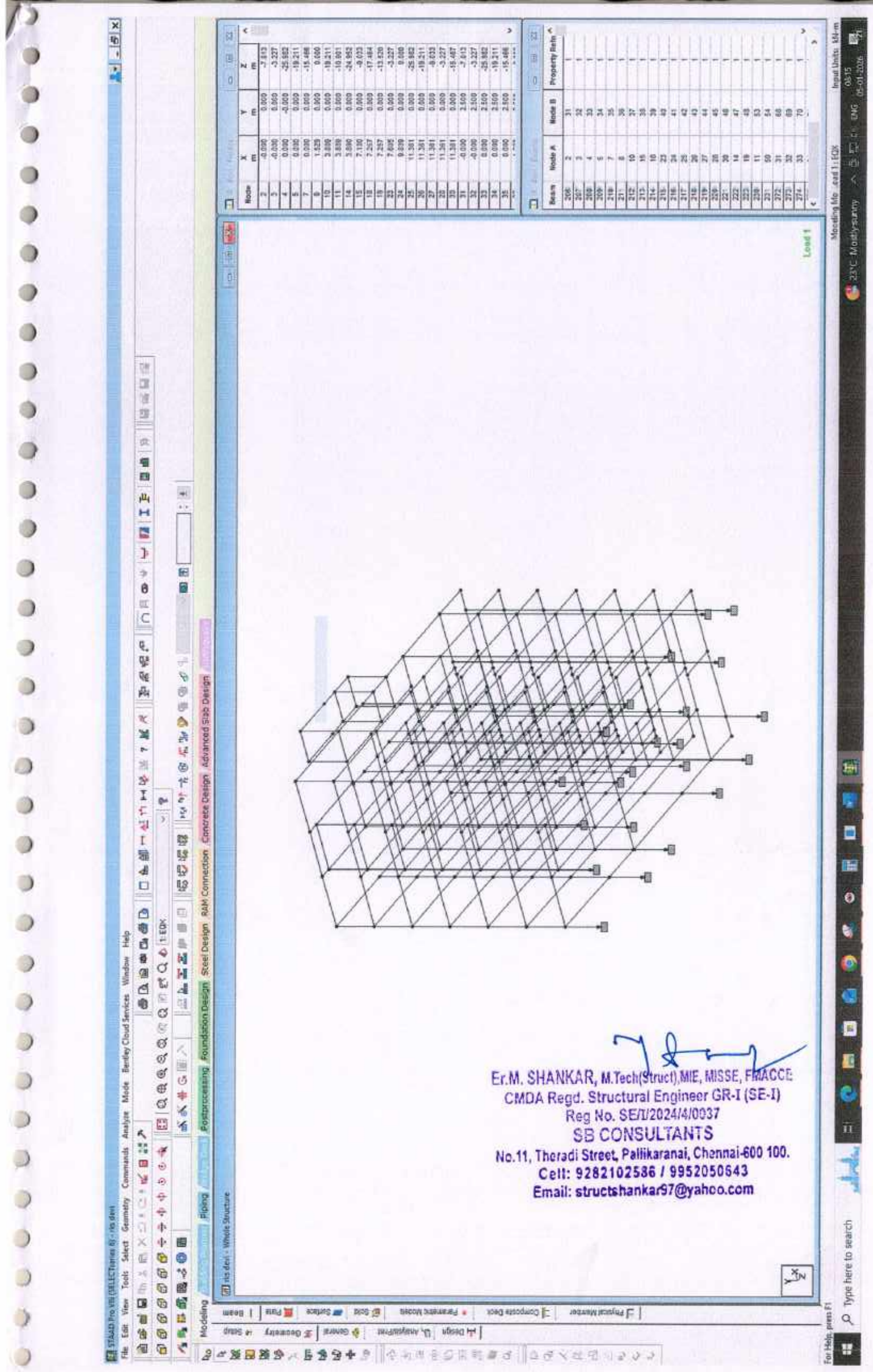
Signature valid
Name :A. Meganathan
Designation :Superintendent
Date :04/12/2024 3:58:02 PM



A Meganathan

Superintendent

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Load 1
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STABILITY CALCULATIONS FOR THE PROPOSED CONSTRUCTION OF STILT FLOOR +5 FLOORS RESIDENTIAL BUILDING WITH DWELLING UNITS (WITH HEIGHT 18.3 M) AVAILING PREMIUM FSI AT DOOR NO. 42ND STREET,COLONY, NANGANALLUR ,CHENNAI COMPRISED IN OLD S.NO.29(PART)&30 (PART) DOCUMENT AS PER PATTA,NEW T3 NO.38,19 WARD -B OF NANGANALLUR VILLAGE,ALANDUR WITH IN THE LIMITS OF GREATER CHENNAI CORPORATION

Design Data Report :

Footing Data:

Soil Parameters :

SBC of soil	=200.00 kN/m²
SBC Increment Factor for Seismic Load	= 1.500
SBC Increment Factor for Wind Load	= 1.500
Angle of friction,(phi)	= 30.00 degrees
Cohesion	= 60.00
Permissible factor of safty	= 1.400
Depth From Ground	= 2000 mm

Material Properties :

fck	= 30.00 N/mm²
fy	= 500.00 N/mm²

Footing Parameters :

Minimum steel Percentage	= 0.12
Minimum spacing between bars	= 100 mm
Maximum spacing between bars	= 200 mm
Diameters of selected bars	= 10 mm , 12 mm .
Bottom Cover	= 50 mm
End Cover	= 50 mm
Minimum Footing Depth	= 150 mm
Top Offset	= 50 mm
Bottom PCCOffset	= 150 mm
Bottom PCCDepth	= 150 mm
Pedestal Offset	= 150 mm
Pedestal Depth	= 150 mm
Size RoundingFactor	= 25 mm
Depth RoundingFactor	= 25 mm
Number of Steps	= 1

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Minimum Step Depth = 150 mm

Column Data:

Material Properties :

fck	= 25.00 N/mm²
fy	= 500.00 N/mm²
fy - Stirrups	= 500.00 N/mm²

Column Parameters :

Effective Length Factor (X - Axis) = 1.00
Effective Length Factor (Y - Axis) = 1.00
Minimum Eccentricity @ X-Axis = 20 mm
Minimum Eccentricity @ Y-Axis = 20 mm
Clear Cover = 40 mm

Design Considerations :

Design is done as per IS 456.
Detailing is done as per IS 13920.
Confinement reinforcement is provided.
Live Load reduction is considered.
Minimum steel percentage is based on provided section.

Reinforcement Details :

Steel Ratio(AstX/AstY)	= 1.00
ReinForcement Placing (on two sides or on four sides)	= 2
Minimum steel Percentage	= 0.80
Maximum steel Percentage	= 4.00
Minimum spacing between main bars	= 25 mm
Maximum spacing between main bars	= 300 mm
Minimum spacing between Stirrups	= 150 mm
Diameters of selected bars	= 12 mm , 16 mm , 20 mm , 25 mm , 32 mm .

Slab Data: Use Bent-up bars for steel detailing.

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Material Properties :

RCC Grade	= M20
Main Steel Grade	= Fe550
Distribution Steel Grade	= Fe550

Slab Parameters :

Effective Cover	= 25 mm
Minimum spacing between Main bars	= 75 mm
Maximum spacing between Main bars	= 200 mm
Minimum spacing between Dist.bars	= 75 mm
Maximum spacing between Dist.bars	= 300 mm
Maximum Main/Dist. bar Diameter	= 32 mm
Minimum Main bar Diameter	= 8 mm
Minimum Dist.bar Diameter	= 8 mm
Maximum Dimension to be used for Trapizoidal Slab	= Average of two parellel sides
Maximum Dimension to be used for General Slab	= Maximum of two parellel sides

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Beam Data:

Shear Design Data :

Minimun Stirrup Dia	= 8 mm
Stirrup Legs	= 2
Minimum Stirrups Spacing	= 100 mm
Stirrups Steel Grade Name	= Fe500

Effect of Concrete in shear considered

Beam Covers :

Tension Cover = 33 mm
Compression Cover = 33 mm
Side Cover = 25 mm

Beam sections are designed as Doubly Reinforced Section
Main Bars Detailing Straight + Curtailed
Detailing provision As per IS 13920 is followed
End Moments are calcultaed at c/c distance of the beam span for design
Torsion Moments are considered in beam design

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Anchor bar Dia	= 8 mm
Main Steel Grade	= Fe500
No. of division of the beam	= 10
Max. Aggregate size	= 20

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Annexure – XIV

[See rule 51 (3)]

Form 1

Structural Design Basis Report

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

Part1	**General Data**		
S.No.	**Description**	**Information**	**Notes**
1.	Site Address		
2	Name of Owner		
3	Name of Registered Developer along with the Registration Number		
4	Name of Registered Architect/Engineer along with the Registration Number		
5	Name of Registered Structural engineer along with the Registration Number	**SE/-I2024/4/0037**	
6	Use of the building	**RESIDENTIAL**	
7	Number of stories above ground level (including storeys to be added later, if any)	**STILT+5FLOOS**	
8	Number of basements below ground level	**NIL**	
9	Type of structure Load bearing walls R.C.C. frame R.C.C. frame and Shear Walls Steel frame	**RC FRAME**	
10	Soil data Type of soil Design safe bearing capacity	**INDIVIDUAL ISOLATED FOOTING WITH SBC 300KN/SQ.M**	IS:1893 C1.6.3.5.2 IS: 1904 IS: 1892 IS: 2131 IS: 2720

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11	Dead loads (unit weight adopted) • Earth: **18KN/CUM** • Water: **10KN/CUM** • Brick masonry:**19.2KN/CUM** • Plain cement concrete **24KN/CUM** • Reinforced cement concrete:**25 KN/CUM** • Floor finish **50KG/SQM** • Other fill materials		IS: 875 Part 1
12	Imposed (live) loads Floor loads Roof loads	**4KN/SQM** **1.5KN/SQM**	IS: 875 Part 2
13	Cyclone/Wind • Speed • Design pressure intensity	**N/A**	IS: 875 Part 3
14	Seismic zone	**III**	IS: 1893 (2002)
15	Importance factor	**1**	IS:1893(2002) Table 6
16	Seismic zone factor (Z)	**0.16**	IS:1893 Table 2
17	Response reduction factor		IS:1893 Table 7
18	Fundamental natural period – approx.	**0.29SEC**	IS:1893 C1.7.6
19	Design horizontal acceleration spectrum value (A_h)		IS: 1893 C1.6.4.2
20	♥ Expansion/Separation Joints	**N/A**	
21	Building is regular/irregular	**REGULAR**	IS 1893

♥ Enclose detailed drawings drawn to scale for each floor

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

Part 2	**Load bearing masonry buildings**		
Sl.No.	**Description**	**Information**	**Notes**
1	Building category	**N/A**	IS: 4326 C1.7 Read with IS:1893 Zone: II III IV V Bldg. Ordinary: B C D E Important: C D E E

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2	Basement Provided	**N/A**	
3	Number of floors including Ground Floor (all floors including stepped floors in hill slopes)	**N/A**	
4	Type of wall masonry	**N/A**	
5	Type and mix of Mortar	**N/A**	IS: 4326 C1.8.1.2
6	Re: size and position of openings (See note No.[i]) • Minimum distance (b5) • Ratio $(b_1+b_2+b_3)/l_1$ or $(b_6+b_7)/l_2$ • Minimum pier width between consequent opening (b_4) • Vertical distance (h_3) • Ratio of wall height to thickness 4 Ratio of wall length between cross wall to thickness	**N/A**	IS: 4326 Table 4, Fig.7
7	Horizontal seismic band • at plinth level **N/A** • at window sill level **N/A** • at lintel level **N/A** • at ceiling level **N/A**	P IP NA 〉 〉 〉 〉 〉 〉 〉 〉 〉 〉 〉 〉	(see note No.2) IS:4326 C1 8.4.6 IS: 4326 C1 8.3 IS: 4326 C1 8.4.2 IS: 4326 C1 8.4.3 IS: 4326 C1 8.4.3
	• at eave level of sloping roof **N/A** • at top of gable walls **N/A** • at top of ridge walls **N/A**	〉 〉 〉 〉 〉 〉 〉 〉 〉	IS: 4326 C1 8.4.3 IS: 4326 C1 8.4.4
8	Vertical reinforcing bar **N/A** at corners and T junction of walls at jambs of doors and window openings **N/A**	〉 〉 〉 〉 〉 〉	IS: 4326 C1 8.4.8. IS: 4326 C1 8.4.9
9	Integration of prefab roofing/flooring elements through reinforced concrete screed. **N/A**	〉 〉 〉	IS:4326 C1 9.1.4

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10	Horizontal bracings in pitched truss in horizontal plane at the level of ties in the slopes of pitched roofs **N/A**	} } } } } }	

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

(ii) IP indicated "Information Provided"

IP indicates "Information to be provided" NA indicates "Not Applicable"

Tick mark one box

Part 3	**Reinforced concrete framed buildings**		
Sl. No.	**Description**	**Information**	**Notes**
1	Type of building • Regular frames • Regular frames with Shear Walls • Irregular frames • Irregular frames with Shear Walls • Soft storey	**REGULAR FRAMES**	IS: 1893 C1 7.1
2	Number of basements	**NIL**	
3	Number of floors including ground floor	**S+5 TH FLOOR**	
4	Horizontal floor system • Beams and slabs • Waffles • Ribbed floor • Flat slab with drops • Flat plate without drops	**BEAM AND SLAB**	

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5	Soil data • Type of soil • Recommended type of foundation -Independent footings -Raft -Piles • Recommended bearing capacity of soil	**MEDIUM SOIL WITH ISOLATED FOOTING**	IS: 1498
	• 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	**INDIVIDUAL ISOLATED FOOTING**	
7	System of interconnecting foundations Plinth beams Foundation beams	**PLINTH BEAM**	IS: 1893 C1 7.12.1
8	Grades if concrete used in different parts of building	**M25 FOR COLUMNS& M30 FOR REST**	
9	Method of analysis used	**FEM**	
10	Computer software used	**STAAD PRO - V8SSI 6**	
11	Torsion included	**INCLUDED**	IS: 1893 C1 7.9
12	Base shear a. Based on approximate fundamental period b. Based on dynamic analysis c. Ratio of a/b	**BASED ON APPROXIMATE FUNDAMENTAL PERIOD**	IS: 1893 Cl. 7.5.3
13	Distribution of seismic forces along the height of the building.	**REFER SESIMIC JUSTIFICATION**	IS:1893 Cl.7.7 (Provide sketch)

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14	The Column of soft ground storey specially designed.	**YES**	IS: 1893 Cl.7.10
15	Clear minimum cover provided in • **Footing 50MM** • **Column 40MM** • **Beams 25MM** • **Slabs 20MM** • **Walls**		IS: 456 Cl. 26.4
16	Ductile detailing of RC frame • Type of reinforcement used **Fe 500D** • Minimum dimension of beams **230MM** • Minimum dimension of columns **230MM** • Minimum percentage of reinforcement of beams at any cross section **0.20%** • Maximum percentage of reinforcement at any section of beam **4%** • Spacing of transverse reinforcement in 2-d length of beams near the ends **100MM** • Ratio of capacity of beams in shear to capacity of beams in flexure **<1** • Maximum percentage of reinforcement in column **4%**		IS: 456 Cl. 5.6 IS: 13920 Cl.6.1 IS: 13920 Cl.7.1.2 IS: 456 Cl.26.5.1(a) IS: 13920 Cl.6.2.1 IS: 456 Cl.26.5.1.1(b) IS: 13920 Cl.6.2.2 IS: 13920 Cl.6.3.5 IS: 456 Cl.26.5.3.1 IS: 13920 Cl. 7.4
	• Confining stirrups near ends of columns and in beam-column joints Diameter **8mm** Spacing **100MM** • Ratio of shear capacity of columns to maximum seismic shear in the storey. **<1**		
17	Does the features require clearance by SDRP Example: High rise building Prefab building Building in hazard prone areas	**N/A**	

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Foundation

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

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

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

Idealization for Earthquake analysis

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

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

iii. Submit framing plans of each floor

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

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

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

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FOOTING DESIGN CALCULATIONS

Project Name : RKS DEVI

Client Name : Unassigned

Engineer Name : MS

Design File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\FOO.rcdx

Analysis File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\rks devi.std

Analysis Last Modified : 03-01-2026 11:54:49

Definitions:

1. α = Coefficient of Thermal Expansion
2. ε1 = Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
3. εm = Average steel strain at level considered
4. pact = Percentage steel provided
5. pcrit = Percentage steel critical as per code
6. A = Plan area of footing base
7. Acr = Distance from the point considered to the surface of the nearest longitudinal bar
8. AstPrv = Area of tensile reinforcement provided
9. Astrqd = Area of tensile reinforcement required
10. Asv = Area of shear reinforcement required
11. AsvPrv = Area of shear reinforcement provided
12. A1 = Bearing area of footing at slope of 1:2
13. A2 = C/s Area of column
14. B = Width of footing base
15. Beff = Effective width of footing
16. BoffB = Footing offset along B below column in plan
17. BoffT = Footing offset along B above column in plan
18. B1 = Width of sloped footing at top
19. ColOff = Column offset in sloped footing

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20.	D	=	Depth of footing
21	Deff	=	Effective Depth of footing
22	Df	=	Depth of founding layer
23	Dw	=	Ground water level
24.	Ec	=	Modulus of elasticity of concrete
25.	Es	=	Modulus of elasticity of steel
26.	Foss	=	Safety factor against sliding
27.	Fosu	=	Safety factor against uplift
28.	Fst	=	Stress in steel
29.	L	=	Length of footing base
30.	Leff	=	Effective length of footing
31.	LoffL	=	Footing offset along L on left side of column
32.	LoffR	=	Footing offset along L on right side of column
33.	L1	=	Length of sloped footing at top
34.	Mx	=	Bending Moment along column D
35.	Mx'	=	Bending Moment along column D due to odd shaped column
36.	Mex	=	Eccentricity moment along column D
37.	Mxx	=	Total Bending Moment along column D (Mx + Mx' + Mex)
38.	My	=	Bending Moment along column B
39.	My'	=	Bending Moment along column B due to odd shaped column
40.	Mey	=	Eccentricity moment along column B
41.	Myy	=	Total Bending Moment along column B (My + My' + Mey)
42.	Muy	=	Factored moment along column B
43.	Muy'	=	Factored Moment along column B due to odd shaped column
44.	Mux	=	Factored moment along column D
45.	Mux'	=	Factored Moment along column D due to odd shaped column
46.	Netdown	=	Net downward load
47.	OB	=	Maximum permissible offset on bottom side of column in plan
48.	OL	=	Maximum permissible offset on left side of column in plan
49.	OR	=	Maximum permissible offset on right side of column in plan
50.	OT	=	Maximum permissible offset on top side of column in plan

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51.	P	=	Axial load for footing sizing
52.	P1	=	Soil pressure at corner 1
53.	P2	=	Soil pressure at corner 2
54.	P3	=	Soil pressure at corner 3
55.	P4	=	Soil pressure at corner 4
56.	Pdelta	=	Column Load to be transferred by reinforcement
57.	Pt	=	Calculated percentage tensile reinforcement
58.	Pu	=	Factored axial load
59.	q	=	Surcharge Load
60.	sp	=	Spacing Between bars at outer most layer
61.	SPu	=	Upward Soil Pressure
62.	SPuL	=	Upward Soil Pressure from left
63.	SPuR	=	Upward Soil Pressure from right
64.	SPuB	=	Upward Soil Pressure from bottom
65.	SPuT	=	Upward Soil Pressure from top
66.	Tc	=	Design shear strength of concrete
67.	Temp1	=	Peak Hydration temperature
68.	Temp2	=	Seasonal Temperature Variations
69.	Tv	=	Nominal shear stress
70.	Vu	=	Design shear force
71.	Vus	=	Strength of shear reinforcement
72.	Vx	=	Shear along major axis
73.	Vy	=	Shear along minor axis
74.	Waterpr	=	Upward water pressure
75.	Waterup	=	Upward force due to water
76.	Wcr	=	Surface Crack Width
77.	WFoot	=	Add. Wt. due to difference in concrete and soil density
78.	WFootc	=	Weight of footing and column with concrete density
79.	WSoil	=	Weight of soil covering footing area
80.	Zx	=	Section modulus of footing base along L
81.	Zy	=	Section modulus of footing base along B

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Code References:

IS 456

	Parameter		Reference
1.	Ptmax	:	Cl. 26.5.2.1
2.	Ptmin	:	Cl. 26.5.2.1
3.	Pt	:	Cl. 38
4.	Tc	:	Cl. 40.2.1
5.	Tcmax	:	Cl. 40.2.3
6.	Asv	:	Cl. 40.4
7.	Min Shear Reinf:		Cl. 26.5.1.6
8.	Max Stirrup Spacing	:	Cl. 26.5.1.5
9.	Punching Shear design	:	Cl. 31.6.3
10.	Load transfer	:	Cl. 34.4
11.	Ptnominal	:	Cl. 34.5.2
12.	Crack width calculation	:	Annex-F
13.	Cracking	:	Cl. 35.3.2

BS 8007 (For Early / Initial Thermal Cracking)

1.	Surface Zone for suspended slab	:	Figure A.1
2.	Surface Zone for ground slab	:	Figure A.2
3.	Factors for the calculation of minimum reinforcement	:	Table A.1

Design Code	:	IS 456 : 2000 + IS 13920 : 2016	
Footing No	:	FC1	
Column No	:	C1	(230 mm X 600 mm)
Analysis No	:	208	
Concrete Grade	:	M25	N/sqmm
Steel Grade	:	Fe415	N/sqmm
Clear Cover	:	40	mm

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Df : 4 M

Dw : 1 M

Density of Soil = 18 kN/cum

Soil Bearing Capacity = 200 kN/sqm

Permissible SBC Increase for EQ = 25 %

Permissible SBC Increase for Wind = 25 %

Live Load Reduction = 50 %

Design cross section by : Average pressure

Footing Type : Sloped

Footing Size (Lx B x D) : 2250mm X 1900mm X 600mm, d =300mm

Column Offset : 50 mm

Without considering Effect of Water Table

Footing Self Wt., F1 = 45.81 kN

Soil Weight, S1 = 0.00 kN

Total Weight, W1 = F1 + S1

= 45.81 kN

Offset Along L (Loff) = 825 mm

Offset Along B (Boff) = 835 mm

Check For Maximum Soil Pressure:

Critical Load Combination = [3] : (LOAD 5: DL) +(LOAD 6: LL) +(LOAD 2: EQ-X)

Pcomb = 883.79 kN

P = Pcomb + W1

P = 929.60 kN

Mx = -9.16 kNm

My = -36.19 kNm

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P/A = 217.45 kN/sqm

Mx/Zx = 5.72 kN/sqm

My/Zy = -26.73 kN/sqm

Maximum Soil Pressure = 249.9 kN/sqm

Allowable Soil Pressure = 1.25x200 kN/sqm

= 250 kN/sqm

Check For Minimum Soil Pressure:

Critical Load Combination = [2] : (LOAD 5: DL) +(LOAD 6: LL) +(LOAD 1: EQX)

Pcomb = 679.87 kN

P = Pcomb + W1

P = 725.68 kN

Mx = 7.21 kNm

My = 31.66 kNm

P/A = 169.75 kN/sqm

Mx/Zx = 4.5 kN/sqm

My/Zy = 23.39 kN/sqm

Minimum Soil Pressure = 141.86 kN/sqm

> 0

Design For Bending:

Bottom Reinforcement Along L:

Critical Load Combination = [24] : 1.5 (LOAD 5: DL) +1.5 (LOAD 4: EQ-Z)

Pu = 1164.68 kN

Mux = 64.04 kNm

Muy = -3.19 kNm

P/A = 272.44 kN/sqm

Mx/Zx = 39.95 kN/sqm

My/Zy = -2.36 kN/sqm

Deff = 552 mm

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Beff = 526.25 mm

SPu = 312.39 kN/sqm

Mu = SPu X B X Loff X Loff / 2

= 201.99 kNm

Pt = 0.372 %

Ast Rqd (BM) = 1081 sqmm

Ast Prv (Distributed Across Total Width) = 14 - T10 @ 150

= 1100 sqmm

Top Reinforcement Along L:

(D+dmin) /2 = 450.00 mm

<= 1000 mm, Hence

Ast = Min Pt for Top Reinforcement X [(D+dmin)/2] X B

= 0.06% X 450 X 1900

= 513 sqmm

Ast Prv (Distributed Across Total Width) = 9 - T10 @ 300 c/c

= 628 sqmm

Bottom Reinforcement Along B:

Critical Load Combination = [20] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Pu = 1201.98 kN

Mux = -11.96 kNm

Muy = -53.58 kNm

P/A = 281.16 kN/sqm

Mx/Zx = -7.46 kN/sqm

My/Zy = -39.58 kN/sqm

Deff = 536 mm

Leff = 893.75 mm

SPu = 320.74 kN/sqm

Mu = SPu X L X Boff X Boff / 2

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= 251.58 kNm

Pt = 0.285 %

Ast Rqd (BM) = 1365 sqmm

Ast Prv (Distributed Across Total Length) – 18 - T10 @ 135

= 1414 sqmm

Top Reinforcement Along B:

(D+dmin) /2 = 450 mm

<= 1000 mm, Hence

Ast = Min Pt for Top Reinforcement X [(D+dmin)/2] X L

= 0.06% X 450 X 2250

= 608 sqmm

Ast Prv (Distributed Across Total Length) = 10 - T10 @ 300 c/c

= 707 sqmm

Design For Shear:

One Way Shear Along L:

Critical Section @ d from Column Face

= 552 mm

Critical Load Combination = [24] : 1.5 (LOAD 5: DL) +1.5 (LOAD 4: EQ-Z)

Pu = 1164.68 kN

Mux = 64.04 kNm

Muy = -3.19 kNm

P/A = 272.44 kN/sqm

Mx/Zx = 39.95 kN/sqm

My/Zy = -2.36 kN/sqm

Deff = 358 mm

Beff = 1346.95 mm

SPu = 312.39 kN/sqm

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Vu	=	SPu X (Loff - d) X B	
		162.01 kN	
Tv	=	Vu / (Beff X Deff)	
	=	0.34	N/sqmm
Tc	=	0.43	N/sqmm
Tv	<	Tc	

One Way Shear Along B:

Critical Section @ d from Column Face

	=	536	mm
Critical Load Combination	=	[20] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)	
Pu	=	1201.98	kN
Mux	=	-11.96	kNm
Muy	=	-53.58	kNm
P/A	=	281.16	kN/sqm
Mx/Zx	=	-7.46	kN/sqm
My/Zy	=	-39.58	kN/sqm
Deff	=	350	mm
Leff	=	1659.62	mm
SPu	=	320.74	kN/sqm
Vu	=	SPu X (Boff - d) X L	
	=	215.78	kN
Tv	=	Vu / (Leff X Deff)	
	=	0.37	N/sqmm
Tc	=	0.39	N/sqmm
Tv	<	Tc	

Design For Punching Shear:

Critical Section @ d/2 from Column Face

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	=	272	mm

Critical Load Combination - [20] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Pu	=	1201.98	kN
Mux	=	-11.96	kNm
Muy	=	-53.58	kNm
P/A	=	281.16	kN/sqm
Mx/Zx	=	-7.46	kN/sqm
My/Zy	=	-39.58	kN/sqm

Deff	=	459	mm
Leff	=	1144	mm
Beff	=	774	mm
Punching Perimeter	=	3836	mm
Punching Area	=	1761337.76	sqmm

SPu	=	Average Pressure
	=	281.16 kN/sqm
Vu	=	SPu X ((L X B)-(Leff X Beff))
	=	953.02 kN
Tv	=	Vu / Punching Area
	=	0.541 N/sqmm
Tc	=	1.104 N/sqmm
Tv	<	Tc

Load Transfer Check For Load Transfer From Column To Footing

Critical Load Combination = [20] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Pu	=	1201.98	kN
A2	=	0.14	sqm
A1	=	7.89	sqm
Base Area	=	4.28	sqm
A1	>	Base Area	

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Thus, A1	=	4.28	
Modification Factor	=	SquareRoot(A1/A2)	< = 2
SquareRoot(A1/A2)	=	5.5291	
Thus, Modification Factor	=	2	
Concrete Bearing Capacity	=	0.45 X Fck X Modification Factor X Column Area	
=	3105 kN		
Concrete Bearing Capacity	>	Pu, Hence Safe.	

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COLUMN DESIGN CALCULATIONS

Project Name : Unassigned

Client Name : Unassigned

Engineer Name : Unassigned

Design File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\COL.rcdx

Analysis File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\rks devi.std

Analysis Last Modified : 03-01-2026 12:36:34

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

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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)
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 Annes A of IS 13920 - 2016
33	Mux	=	Factored moment Along D (Momemt About Major Axis)
34	Muy	=	Factored moment Along B (Momemt 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

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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 D

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	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

Sway Calculation (Stability Index)

For Global-X Direction

Level (mm)	Load Name	Storey Height (m)	Gravity Load P (kN)	Relative Displacements			
	Storey Shear (kN)	Stability Index	Sway Condition				
A	B	C	D	B x C / (A x D)			
0 m to 2.5 m	LOAD 1: EQX	2.5	22659.54	2.578	491.143	0.048	Sway
2.5 m to 5.5 m	LOAD 1: EQX	3	21893.173	5.626	491.143	0.084	Sway
5.5 m to 8.5 m	LOAD 1: EQX	3	18234.65	5.985	477.673	0.076	Sway
8.5 m to 11.5 m	LOAD 1: EQX	3	14423.586	5.731	443.949	0.062	Sway
11.5 m to 14.5 m	LOAD 1: EQX	3	10657.858	5.075	383.062	0.047	Sway
14.5 m to 17.5 m	LOAD 1: EQX	3	6833.085	3.949	284.053	0.032	Non Sway

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17.5 m to 20.5 m	LOAD 1: EQX	3	3365.891	2.454	156.347	0.018	Non Sway
20.5 m to 23.5 m	LOAD 1: EQX	3	219.417	2.63	9.666	0.02	Non Sway

For Global-Y Direction

Level (mm)	Load Name	Storey Height (m)	Gravity Load P (kN)	Relative Displacements			
	Storey Shear (kN)		Stability Index	Sway Condition			
A	B	C	D	B x C / (A x D)			

Lateral Load case is not been considered in analysis in Global-Y Direction

General Data

Column No. : C1

Level : 0 m To 2.5 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 = 600 mm

Clear Cover = 50 mm

Clear Floor Height @ B = 1900 mm

Clear Floor Height @ D = 1900 mm

No Of Floors = 1

No Of Columns In Group = 1

Column Type : UnBraced

Minimum eccentricity check : One Axis at a Time

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Code defined D/B ratio : 4

D/B Ratio : 2.61 <= 4 Hence, Design as Column

Flexural Design (Analysis Forces)

Analysis Reference No. = 208

Load Combination = [14] : 1.5 (LOAD 5: DL) -1.5 (LOAD 1: EQX)

Critical Location = Bottom Joint

Pu	=	1190.86	kN
Mux	=	-9.82	kNm
Muy	=	-48.69	kNm
Vux	=	34.33	kN
Vuy	=	-3.69	kN

Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta
Beam 1				
(Length x Width x Depth)		Beam 2		
(Length x Width x Depth)		Beam 1 Beam 2		
N-m x 10^6	mm mm	N-m x 10^6	N-m x 10^6	
Bottom	165.6 No Beam	No Beam	- -	1
Top	165.6 No Beam	6771 x 230 x 600	-	61.143 0.832

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.94

Calculation Along Minor Axis Of Column

Joint Column Stiffness

Beam Sizes

Beam Stiffness

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Beta

Beam 1

(Length x Width x Depth)	Beam 2				
(Length x Width x Depth)	Beam 1	Beam 2			
N-m x 10^6	mm	mm	N-m x 10^6	N-m x 10^6	
Bottom	24.334	No Beam	No Beam	-	- 1
Top	24.334	11361 x 230 x 600	No Beam	36.44	- 0.55

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 2.63

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

= 11.47 mm

Mminy = Pu x Minimum Eccentricity

= 23.82 kNm

Slenderness Check

Max Slenderness Ratio(L/B) = 8.26

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.94

Slenderness Ratio = Effective Length / D

= 2.98, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 2.63

Slenderness Ratio = Effective Length / B

= 21.73, Column Slender Along B

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Slenderness moment along B = (Pu B/ 2000) (Ley/B)^2

= 64.64 kNm

Design slenderness moment along B

Puz = 3025.11 kN

Pb = 452.29 kN

Reduction factor 'k' for slenderness moment = (Puz - Pu) / (Puz - Pb) < = 1

= 0.71 < = 1, Hence k=0.71

Mslndy = k x 64.64

= 46.09 kNm

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
A	B	C	E	F	
Major Axis - Mux	-9.82	---	-9.82	0	-9.82
Minor Axis - Muy	-48.69	23.82	-48.69	46.09	-94.78

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 = 1190.86 kN

Mux = -9.82 kNm

Muy = -94.78 kNm

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Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 3.56

Reinforcement Provided= 10-T25

Load Angle = Tan-1(Muy/Mux)

= 84.08 deg

MRes = 95.29 kNm

MCap = 96.17 kNm

Capacity Ratio = MRes/ MCap

= 0.99 <= 1

Shear Calculation	Along D	Along B
Critical Load Combination	[20] : 0.9 (LOAD 5: DL) +1.5 (LOAD 3: EQ+Z)	[18] : 0.9 (LOAD 5: DL) +1.5 (LOAD 1: EQX)
Design shear force, Vu (kN)	-28.0405	-30.9067
Pu (kN)	513.66	481.97
Deff , Beff (mm)	537.5	167.5
Aeff (sqmm)	123625	100500
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.2268	0.3075
Pt (%)	1.779	1.779
Design shear strength, Tc (N/sqmm)	0.7867	0.7867
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	1.4986	1.5755
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.4986	1.5
Enhanced shear strength, Tc-e (N/sqmm)	1.1789	1.18
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

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Links in the zone where special confining links are not required

Normal Links

Diameter of link= 8 mm

> Max. longitudinal bar dia / 4

= 6.25 mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16 = 400 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	---

General Data

Column No. : C1

Level : 2.5 m To 5.5 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

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Column D = 600 mm

Clear Cover = 50 mm

Clear Floor Height @ B = 2400 mm

Clear Floor Height @ D = 2400 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 : 2.61 <= 4 Hence, Design as Column

Flexural Design (Analysis Forces)

Analysis Reference No. = 274

Load Combination = [14] : 1.5 (LOAD 5: DL) -1.5 (LOAD 1: EQX)

Critical Location= Bottom Joint

Pu = 1125.18 kN

Mux = 7.11 kNm

Muy = -55.72 kNm

Vux = 37.89 kN

Vuy = 16 kN

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Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta
Beam 1				
(Length x Width x Depth)		Beam 2		
(Length x Width x Depth)		Beam 1 Beam 2		
N-m x 10^6	mm mm	N-m x 10^6	N-m x 10^6	
Bottom 138	No Beam	6771 x 230 x 600	-	61.143 0.832

Top	138	No Beam	6771 x 230 x 600	-	61.143	0.819	

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.87

Calculation Along Minor Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta	Beam 1	Beam 2
		(Length x Width x Depth)			(Length x Width x Depth)	
					Beam 1	Beam 2
	N-m x 10^6	mm	mm	N-m x 10^6	N-m x 10^6	
Bottom	20.278	11361 x 230 x 600	No Beam	36.44	-	0.55
Top	20.278	11361 x 230 x 600	No Beam	36.44	-	0.527

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 1.55

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

= 12.47 mm

Mminy = Pu x Minimum Eccentricity

= 22.5 kNm

Slenderness Check

Max Slenderness Ratio(L/B) = 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

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Effective Length Factor = 0.87

Slenderness Ratio = Effective Length / D

= 3.48, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 1.55

Slenderness Ratio = Effective Length / B

= 16.17, Column Slender Along B

Slenderness moment along B = (Pu B/ 2000) (Ley/B)^2

= 33.85 kNm

Design slenderness moment along B

Puz = 2707.03 kN

Pb = 485.49 kN

Reduction factor 'k' for slenderness moment = (Puz - Pu) / (Puz - Pb) < = 1

= 0.71 < = 1, Hence k=0.71

Mslndy = k x 33.85

= 24.1 kNm

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
A B C	E	F			
Major Axis - Mux	7.11	---	7.11	0	7.11
Minor Axis - Muy	-55.72	22.5	-55.72	24.1	-79.82

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

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Final Critical Design Forces

Pu = 1125.18 kN

Mux = 7.11 kNm

Muy = -79.82 kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 2.79

Reinforcement Provided= 4-T25 + 6-T20

Load Angle = Tan-1(Muy/Mux)

= 84.91 deg

MRes = 80.14 kNm

MCap = 86.07 kNm

Capacity Ratio = MRes/ MCap

= 0.93 <= 1

Shear Calculation	Along D	Along B
Critical Load Combination	[16] : 1.5 (LOAD 5: DL) -1.5 (LOAD 3: EQ+Z)	[11] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)
Design shear force, Vu (kN)	43.9149	37.8888
Pu (kN)	1087.47	1110.54
Deff , Beff (mm)	537.5	167.5
Aeff (sqmm)	123625	100500
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.3552	0.377
Pt (%)	1.394	1.394
Design shear strength, Tc (N/sqmm)	0.7236	0.7236
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	2.0556	2.326

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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)	1.0854	1.0854
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

= 6.25 mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16	=	320	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	---	

General Data

Column No. : C1

Level : 5.5 m To 8.5 m

Frame Type = Non-Ductile

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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	=	600	mm
Clear Cover	=	50	mm
Clear Floor Height @ B	=	2400	mm
Clear Floor Height @ D	=	2400	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	:	2.61 <= 4 Hence, Design as Column	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	421	
Load Combination	=	[14] : 1.5 (LOAD 5: DL) -1.5 (LOAD 1: EQX)	
Critical Location	=	Top Joint	
Pu	=	907.54	kN
Mux	=	-47.96	kNm
Muy	=	62.03	kNm
Vux	=	41.26	kN
Vuy	=	33.13	kN

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Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness (Length x Width x Depth)	Beam Sizes (Length x Width x Depth)	Beam Stiffness Beam 1	Beam Stiffness Beam 2	Beta Beam 1	Beta Beam 2
	N-m x 10^6 mm mm		N-m x 10^6	N-m x 10^6		
Bottom	138	No Beam	6771 x 230 x 600	-	61.143	0.819
Top	138	No Beam	6771 x 230 x 600	-	61.143	0.819

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.87

Calculation Along Minor Axis Of Column

Joint	Column Stiffness (Length x Width x Depth)	Beam Sizes (Length x Width x Depth)	Beam Stiffness Beam 1	Beam Stiffness Beam 2	Beta Beam 1	Beta Beam 2
	N-m x 10^6 mm mm		N-m x 10^6	N-m x 10^6		
Bottom	20.278	11361 x 230 x 600	No Beam	36.44	-	0.527
Top	20.278	11361 x 230 x 600	No Beam	36.44	-	0.527

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 1.53

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

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= 24.8 mm

Minimum Eccentricity > 20 mm

Mminx = Pu x Minimum Eccentricity

= 22.51 kNm

Slenderness Check

Max Slenderness Ratio(L/B) = 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.87

Slenderness Ratio = Effective Length / D

= 3.48, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 1.53

Slenderness Ratio = Effective Length / B

= 15.97, Column Slender Along B

Slenderness moment along B = (Pu B/ 2000) (Ley/B)^2

= 26.6 kNm

Design slenderness moment along B

Puz = 2102.9 kN

Pb = 564.93 kN

Reduction factor 'k' for slenderness moment = (Puz - Pu) / (Puz - Pb) < = 1

= 0.78 < = 1, Hence k=0.78

Mslndy = k x 26.6

= 20.68 kNm

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Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
A	B	C	E	F	

Major Axis - Mux	-47.96	22.51	-47.96	0	-47.96
Minor Axis - Muy	62.03	---	62.03	20.68	82.71

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 = 907.54 kN

Mux = -47.96 kNm

Muy = 82.71 kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 1.33

Reinforcement Provided= 8-T16 + 2-T12

Load Angle = Tan-1(Muy/Mux)

= 59.89 deg

MRes = 95.61 kNm

MCap = 99.11 kNm

Capacity Ratio = MRes/ MCap

= 0.96 <= 1

Shear Calculation Along D Along B

Critical Load Combination [16] : 1.5 (LOAD 5: DL) -1.5 (LOAD 3: EQ+Z) [11] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Design shear force, Vu (kN) 59.4714 41.2635

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Pu (kN)	890.97	907.54	
Deff , Beff (mm)	542	172	
Aeff (sqmm)	124000	103200	
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)	
Tv (N/sqmm)	0.4771	0.3998	
Pt (%)	0.665	0.665	
Design shear strength, Tc (N/sqmm)	0.5482	0.5482	
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)		
	1.8577	2.0553	
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)	0.8223	0.8223	
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

= 4 mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16	=	192	mm
Min. dimension of column	=	230	mm
Max. 300 mm	=	300	mm
Provided spacing	=	175	mm

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Table For Links

Required	Provided

Normal Design	Shear Design		Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing	175		175		

General Data

Column No. : C1

Level : 8.5 m To 11.5 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 = 600 mm

Clear Cover = 50 mm

Clear Floor Height @ B = 2400 mm

Clear Floor Height @ D = 2400 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 : 2.61 <= 4 Hence, Design as Column

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Flexural Design (Analysis Forces)

Analysis Reference No. = 503

Load Combination = [19] : 0.9 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Critical Location = Top Joint

Pu = 116.29 kN

Mux = -25.01 kNm

Muy = 53.92 kNm

Vux = 35.56 kN

Vuy = 16.65 kN

Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta
	Beam 1			
	(Length x Width x Depth)	Beam 2		
	(Length x Width x Depth)	Beam 1 Beam 2		
	N-m x 10^6 mm mm	N-m x 10^6	N-m x 10^6	
Bottom	138 No Beam	6771 x 230 x 600	-	61.143 0.819
Top	138 No Beam	6771 x 230 x 600	-	61.143 0.819

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.87

Calculation Along Minor Axis Of Column

Joint Column Stiffness

Beam Sizes

Beam Stiffness

Beta

Beam 1

(Length x Width x Depth) Beam 2

(Length x Width x Depth) Beam 1 Beam 2

N-m x 10^6 mm mm N-m x 10^6 N-m x 10^6

Bottom 20.278 11361 x 230 x 600 No Beam 36.44 - 0.527

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Top	20.278	11361 x 230 x 600	No Beam	36.44	-	0.527

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 1.53

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

= 24.8 mm

Minimum Eccentricity > 20 mm

Mminx = Pu x Minimum Eccentricity

= 11.07 kNm

Slenderness Check

Max Slenderness Ratio(L/B) = 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.87

Slenderness Ratio = Effective Length / D

= 3.48, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 1.53

Slenderness Ratio = Effective Length / B

= 15.97, Column Slender Along B

Slenderness moment along B = (Pu B/ 2000) (Ley/B)^2

= 13.08 kNm

Design slenderness moment along B

Puz = 1997.35 kN

Pb = 570.67 kN

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Reduction factor 'k' for slenderness moment = (Puz - Pu) / (Puz - Pb) < = 1

= 1.09 > = 1, Hence k=1

MsIndy = k x 13.08

= 13.08 kNm

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	MsIndx (Abs)	Mdesign-final
A B	C	E	F		
Major Axis - Mux	-25.01	11.07	-25.01	0	-25.01
Minor Axis - Muy	53.92	---	53.92	13.08	67

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 = 446.29 kN

Mux = -25.01 kNm

Muy = 67 kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 1.07

Reinforcement Provided= 4-T16 + 6-T12

Load Angle = Tan-1(Muy/Mux)

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=	69.53	deg	
MRes	=	71.52	kNm
MCap	=	75.65	kNm
Capacity Ratio	=	MRes/ MCap	
=	0.95 <= 1		

Shear Calculation	Along D	Along B
Critical Load Combination	[16] : 1.5 (LOAD 5: DL) -1.5 (LOAD 3: EQ+Z)	[22] : 0.9 (LOAD 5: DL) -1.5 (LOAD 1: EQX)
Design shear force, Vu (kN)	56.011	35.562
Pu (kN)	693.22	446.29
Deff , Beff (mm)	542	172
Aeff (sqmm)	124660	103200
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.4493	0.3446
Pt (%)	0.537	0.537
Design shear strength, Tc (N/sqmm)	0.5034	0.5034
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	1.6673	1.5189
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)	0.7551	0.7551
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		
=	4	mm	

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Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16	=	192	mm	
Min. dimension of column	=	230	mm	
Max. 300 mm	=	300	mm	
Provided spacing	=	175	mm	

Table For Links

Required	Provided				
Normal Design	Shear Design		Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing 175	---	---	175	---	

General Data

Column No.	:	C1		
Level	:	11.5 m To 14.5 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	=	600	mm	
Clear Cover	=	50	mm	
Clear Floor Height @ B	=	2400	mm	
Clear Floor Height @ D	=	2400	mm	
No Of Floors	=	1		

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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 : 2.61 <= 4 Hence, Design as Column

Flexural Design (Analysis Forces)

Analysis Reference No. = 585

Load Combination = [19] : 0.9 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Critical Location = Top Joint

Pu = 315.18 kN

Mux = -24.69 kNm

Muy = 49.71 kNm

Vux = 32.36 kN

Vuy = 16.96 kN

Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness (N-m x 10^6)	Beam Sizes (Length x Width x Depth) Beam 1	Beam Sizes (Length x Width x Depth) Beam 2	Beam Stiffness Beam 1 (N-m x 10^6)	Beam Stiffness Beam 2 (N-m x 10^6)	Beta
Bottom	138	No Beam	6771 x 230 x 600	-	61.143	0.819
Top	138	No Beam	6771 x 230 x 600	-	61.143	0.819

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.87

Calculation Along Minor Axis Of Column

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Joint Column Stiffness

Beam Sizes

Beam Stiffness

Beta

Beam 1

(Length x Width x Depth) Beam 2

(Length x Width x Depth) Beam 1 Beam 2

	N-m x 10^6	mm	mm	N-m x 10^6	N-m x 10^6		
Bottom	20.278	11361 x 230 x 600		No Beam	36.44	-	0.527
Top	20.278	11361 x 230 x 600		No Beam	36.44	-	0.527

Sway Condition (as per Stability Index) = Sway

Effective Length Factor along Minor axis = 1.53

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

= 24.8 mm

Minimum Eccentricity > 20 mm

Mminx = Pu x Minimum Eccentricity

= 7.82 kNm

Slenderness Check

Max Slenderness Ratio(L/B) = 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.87

Slenderness Ratio = Effective Length / D

= 3.48, Column not Slender Along D

Column Is Unbraced Along B

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Slenderness Check Along B:

Effective Length Factor – 1.53

Slenderness Ratio = Effective Length / B

= 15.97, Column Slender Along B

Slenderness moment along B = (Pu B/ 2000) (Ley/B)^2

= 9.24 kNm

Design slenderness moment along B

Puz = 1929.49 kN

Pb = 573.99 kN

Reduction factor 'k' for slenderness moment = (Puz - Pu) / (Puz - Pb) < = 1

= 1.19 > = 1, Hence k=1

MsIndy = k x 9.24

= 9.24 kNm

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	MsIndx (Abs)	Mdesign-final
A B C	E	F			
Major Axis - Mux	-24.69	7.82	-24.69	0	-24.69
Minor Axis - Muy	49.71	---	49.71	9.24	58.95

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

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Pu	=	315.18	kN
Mux	=	-24.69	kNm
Muy	=	58.95	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 0.91

Reinforcement Provided= 4-T16 + 4-T12

Load Angle = Tan-1(Muy/Mux)

= 67.28 deg

MRes = 63.91 kNm

MCap = 72.49 kNm

Capacity Ratio = MRes/ MCap

= 0.88 <= 1

Shear Calculation	Along D	Along B
Critical Load Combination	[16] : 1.5 (LOAD 5: DL) -1.5 (LOAD 3: EQ+Z)	[22] : 0.9 (LOAD 5: DL) -1.5 (LOAD 1: EQX)
Design shear force, Vu (kN)	53.4573	32.3634
Pu (kN)	496.57	315.18
Deff , Beff (mm)	542	172
Aeff (sqmm)	124660	103200
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.4288	0.3136
Pt (%)	0.455	0.455
Design shear strength, Tc (N/sqmm)	0.4704	0.4704
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	1.478	1.3665
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.478	1.3665
Enhanced shear strength, Tc-e (N/sqmm)	0.6953	0.6428

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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

= 4 mm

Criterion for spacing of normal links

Min. Longitudinal Bar dia X 16 = 192 mm

Min. dimension of column = 230 mm

Max. 300 mm = 300 mm

Provided spacing = 175 mm

Table For Links

Required	Provided				
Normal Design	Shear Design		Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing 175	---	---	175	---	

General Data

Column No. : C1

Level : 14.5 m To 17.5 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

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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 = 600 mm

Clear Cover = 50 mm

Clear Floor Height @ B = 2400 mm

Clear Floor Height @ D = 2400 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 : 2.61 <= 4 Hence, Design as Column

Flexural Design (Analysis Forces)

Analysis Reference No. = 667

Load Combination = [19] : 0.9 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)

Critical Location = Top Joint

Pu = 189.09 kN

Mux = -25.42 kNm

Muy = 39.68 kNm

Vux = 25.57 kN

Vuy = 17.6 kN

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Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta
Beam 1				

(Length x Width x Depth)		Beam 2				
(Length x Width x Depth)		Beam 1 Beam 2				
N-m x 10^6	mm	mm	N-m x 10^6	N-m x 10^6		
Bottom 138		No Beam	6771 x 230 x 600	-	61.143	0.819
Top 138		No Beam	6771 x 230 x 600	-	61.143	0.819

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.87

Calculation Along Minor Axis Of Column

Joint Column Stiffness

Beam Sizes

Beam Stiffness

Beta

Beam 1

(Length x Width x Depth)		Beam 2				
(Length x Width x Depth)		Beam 1 Beam 2				
N-m x 10^6	mm	mm	N-m x 10^6	N-m x 10^6		
Bottom 20.278		11361 x 230 x 600	No Beam	36.44	-	0.527
Top 20.278		11361 x 230 x 600	No Beam	36.44	-	0.527

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Minor axis = 0.7

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

= 24.8 mm

Minimum Eccentricity > 20 mm

Mminx = Pu x Minimum Eccentricity

= 4.69 kNm

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Slenderness Check

Max Slenderness Ratio(l/D) 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.87

Slenderness Ratio = Effective Length / D

= 3.48, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 0.7

Slenderness Ratio = Effective Length / B

= 7.3, 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	-25.42	4.69	-25.42 0	-25.42	
Minor Axis - Muy	39.68	---	39.68 0	39.68	

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

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Pu	=	189.09	kN
Mux	=	-25.42	kNm
Muy	=	39.68	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 0.49

Reinforcement Provided= 6-T12

Load Angle = Tan-1(Muy/Mux)

= 57.36 deg

MRes = 47.13 kNm

MCap = 62.01 kNm

Capacity Ratio = MRes/ MCap

= 0.76 <= 1

Shear Calculation	Along D	Along B
Critical Load Combination	[16] : 1.5 (LOAD 5: DL) -1.5 (LOAD 3: EQ+Z)	[11] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)
Design shear force, Vu (kN)	49.3117	30.3078
Pu (kN)	303.65	304.4
Deff , Beff (mm)	544	174
Aeff (sqmm)	125120	104400
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.3941	0.2903
Pt (%)	0.246	0.246
Design shear strength, Tc (N/sqmm)	0.3621	0.3621
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	1.2912	1.3499
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.2912	1.3499
Enhanced shear strength, Tc-e (N/sqmm)	0.4676	0.4888

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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 = 230 mm

Max. 300 mm = 300 mm

Provided spacing = 175 mm

Table For Links

Required	Provided				
Normal Design	Shear Design		Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing 175	---	---	175	---	

General Data

Column No. : C1

Level : 17.5 m To 20.5 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

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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	=	600	mm
Clear Cover	=	50	mm
Clear Floor Height @ B	=	2400	mm
Clear Floor Height @ D	=	2400	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	:	2.61 <= 4 Hence, Design as Column	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	749	
Load Combination	=	[13] : 1.5 (LOAD 5: DL) +1.5 (LOAD 4: EQ-Z)	
Critical Location	=	Top Joint	
Pu	=	115.09	kN
Mux	=	-83.76	kNm
Muy	=	17.22	kNm
Vux	=	11.65	kN
Vuy	=	47.93	kN

Effective Length Calculation

Calculation Along Major Axis Of Column

Joint	Column Stiffness	Beam Sizes	Beam Stiffness	Beta
Beam 1				

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(Length x Width x Depth)		Beam 2			
(Length x Width x Depth)		Beam 1 Beam 2			
N-m x 10^6	mm mm	N-m x 10^6	N-m x 10^6		
Bottom 138	No Beam	6771 x 230 x 600	-	61.143	0.819
Top 138	No Beam	6771 x 230 x 600	-	61.143	0.693

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.83

Calculation Along Minor Axis Of Column

Joint Column Stiffness

Beam Sizes

Beam Stiffness

Beta

Beam 1					
(Length x Width x Depth)		Beam 2			
(Length x Width x Depth)		Beam 1 Beam 2			
N-m x 10^6	mm mm	N-m x 10^6	N-m x 10^6		
Bottom 20.278	11361 x 230 x 600	No Beam	36.44	-	0.527
Top 20.278	11361 x 230 x 600	No Beam	36.44	-	0.358

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Minor axis = 0.66

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

= 24.8 mm

Minimum Eccentricity > 20 mm

Mminx = Pu x Minimum Eccentricity

= 2.85 kNm

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Slenderness Check

Max Slenderness Ratio(L/B) = 10.43

< 60 (Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor = 0.83

Slenderness Ratio = Effective Length / D

= 3.32, Column not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor = 0.66

Slenderness Ratio = Effective Length / B

= 6.89, 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	-83.76	2.85	-83.76	0	-83.76
Minor Axis - Muy	17.22	---	17.22	0	17.22

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

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Pu	=	115.09	kN
Mux	=	83.76	kNm
Muy	=	17.22	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated = 0.49

Reinforcement Provided= 6-T12

Load Angle = Tan-1(Muy/Mux)

= 11.62 deg

MRes	=	85.51	kNm
MCap	=	88.61	kNm

Capacity Ratio = MRes/ MCap

= 0.96 <= 1

Shear Calculation	Along D	Along B
Critical Load Combination	[1] : 1.5 (LOAD 5: DL) +1.5 (LOAD 6: LL)	[11] : 1.5 (LOAD 5: DL) +1.5 (LOAD 2: EQ-X)
Design shear force, Vu (kN)	49.4484	21.0125
Pu (kN)	129.63	113.88
Deff , Beff (mm)	544	174
Aeff (sqmm)	125120	104400
Design shear stress, Tv	Vu / (B x Deff)	Vu / (D x Beff)
Tv (N/sqmm)	0.3952	0.2013
Pt (%)	0.246	0.246
Design shear strength, Tc (N/sqmm)	0.3621	0.3621
Shear Strength Enhancement Factor (Compressive Force)	1 + 3 x Pu / (B x D x Fck)	
	1.1243	1.1309
Shear Strength Enhancement Factor (Tensile Force)	-	-
Shear Strength Enhancement Factor (max)	1.5	1.5
Shear Strength Enhancement Factor	1.1243	1.1309
Enhanced shear strength, Tc-e (N/sqmm)	0.4071	0.4095

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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 = 230 mm

Max. 300 mm = 300 mm

Provided spacing = 175 mm

Table For Links

Required	Provided				
Normal Design	Shear Design		Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing 175	---	---	175	---	

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BEAM DESIGN CALCULATION

Sr.No.	Symbol		Definitions
1	α	=	Angle formed with horizontal by diagonal reinforcement
2	ε1	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
3	εm	=	Average steel strain at level considered
4	Acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
5	Adr	=	Area of diagonal reinforcement in coupler beam
6	AstCalc	=	Area of Tension reinforcement required in sqmm
7	Ast comp	=	Ast at compression side
8	AstCrack	=	Area of Tension reinforcement for Crack Width required in sqmm
9	AstPrv	=	Area of reinforcement provided at given section in sqmm
10	Asv	=	Area of shear reinforcement required per meter length in sqmm
11	Asv Reqd	=	Min area shear reinforcement as per clause 41.4.3
12	Asv Total Prv	=	Total area of shear reinforcement provided, including that for torsion
13	Asv Torsion	=	Area of Stirrups over the corner bars to resist shear and torsion as per clause 41.4.3
14	Asv Torsion Prv	=	Area of shear reinforcement resisting torsion (outer legs only)
15	b	=	Width of the Beam in mm
16	bw	=	Width of Web in mm
17	Ceff	=	Effective Cover of Beam in mm
18	Cmin	=	Clear cover to top and bottom reinforcement in mm
19	Cside	=	Clear cover to side reinforcement in mm
20	d	=	Effective depth of Beam in mm
21	d'	=	Clear cover to reinforcement at compression side,
22	D	=	Depth of Beam in mm
23	D'	=	Distance (c/c) between top-most and bottom-most bars

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24 Df = Thickness of Flange in mm

25 Ec = Modulus of elasticity of concrete

26 Es = Modulus of elasticity of steel

27 FcPerm = Permissible Stress in Concrete required in N/sqmm

28 Fst = Stress in steel

29 FstPerm = Permissible Stress in Steel required in N/sqmm

30 Legs = Number of legs of the shear reinforcement

31 lo = Effective Length of Beam in mm

32 Mh = Hogging Moment of Resistance in kNm

33 Ms = Sagging Moment of Resistance in kNm

34 MTu = Converted Bending Moment due to Torsion at a section in kNm

35 Mu = Factored Bending Moment in Limit State at a section in kNm

36 Mud = Total Design Moment = Mu + MTu in kNm

37 MuLim = Limiting Moment of Resistence of Singly Reinforced Section

38 NA angle (ϕ) = It is a neutral axis angle corresponding to load angle to find out MCap

39 Pcclc = Calculated percentage compression steel

40 Ptclc = Calculated percentage tension steel

41 Ptmin = Minimum percentage steel as per code

42 PtPrv = provided percentage steel

43 R = Moment Ratio Mud/Bd2

44 Reinf = Rebar arrangement provided

45 sp = Spacing Between bars at outer most layer

46 Spc1 to Spc6 = Max Stirrup Criteria in mm

47 Stirrup Dia = Diameter of shear stirrups in mm

48 SvCalc = Stirrup spacing calculated as per Asv in mm

49 SvPrv = Stirrup spacing provided in m

50 Tc = Permissible Shear stress in concrete at a given section in N/sqmm Calculated as per Tensile reinforcement

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51	Tce	=	Earthquake inducted shear stress in N/sqmm
52	Tcep	=	Permissible value of shear stress for checking of coupling action in N/sqmm
53	Tu	=	Factored Torsional Moment in Limit State at a section in kNm
54	Tv	=	Shear stress due to Vud in N/sqmm
55	VD+L	=	Shear force 1.2x(Dead Load + Live Load) in kN
56	Vc	=	Shear capacity of concrete section due to Tc in kN
57	Vu	=	Factored Shear Force in Limit State at a section in kN
58	Vu-A1	=	VD+LLeft - 1.4 x (MsLeft + MhRight)/L in kN
59	Vu-A2	=	VD+LLeft + 1.4 x (MhLeft + MsRight)/L in kN
60	Vu-B1	=	VD+LRight + 1.4 x (MsLeft + MhRight)/L in kN
61	Vu-B2	=	VD+LRight - 1.4 x (MhLeft + MsRight)/L in kN
62	Vud	=	Design Shear Force (Max of Vus and Vu-sway) in kN
63	Vue	=	Earthquake inducted shear in kN
64	Vu-sway	=	Max of (Vu-A1 and Vu-A2) & (Vu-B1 and Vu-B2) in kN
65	Vus	=	Vud - Vc Design Shear Force for reinforcement, in kN
66	Vut	=	Total Shear Force = Vu + VTu in kN
67	VTu	=	Converted Shear Force due to Torsion at a section in kN
68	Wcr	=	Surface Crack Width
69	WcrPerm	=	Permissible Crack Width required in mm
70	X1	=	Smaller c/c dimension of outermost Stirrups
71	Y1	=	Larger c/c dimension of outermost Stirrups

All 6mm diameter bars are assumed 250 grade with fy = 250 N/sqmm

All Forces are in 'kN', 'kNm', Stress in 'N/sqmm' & Dimension are in 'mm'.

Code References

IS 456

Sr.No.	Item	Clause / Table

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1.	Ptmax	:	26.5.1.1
2.	Ptmin	:	26.5.1.1
3.	MTu	:	41.4.2
4.	VTu	:	41.3.1
5.	Ptclc	:	38
6.	Tc	:	40.2.1
7.	Tcmax	:	40.2.3
8.	Asv	:	40.4
9.	Min Shear Reinf:		26.5.1.6
10.	Max Stirrup Spacing	:	26.5.1.5
11.	Shear Reinf - Torsion	:	26.5.1.7
12.	Side Face Reinforcement	:	26.5.1.3
13.	crack width calculation	:	Annex-F
14.	cracking	:	Clause 35.3.2

IS 13920 - 2016

Sr.No.	Item		Clause / Table
1.	Ptmax	:	6.2.2
2.	Ptmin	:	6.2.1
3.	Astmin	:	6.2.3 & 6.2.4
4.	Svclc	:	6.3.5
5.	Shear Capacity	:	6.3.4
6.	Coupling Beams:		10.5

Group	:	G1	
Beam No	:	B1	
Analysis Reference (Member)	:	303,304,314 (5.5 m)	
Beam Length	:	11361	mm
Breadth (B)	:	230	mm

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Depth (D)	:	600	mm	
Effective Depth (d)	:	545	mm	
Design Code	:	IS 456		
Beam Type	:	Regular Beam		
Grade Of Concrete (Fck)	:	M25	N/sqmm	
Grade Of Steel (Main)	:	Fe415	N/sqmm	
Grade Of Steel (Shear)	:	Fe415	N/sqmm	
Top/Bottom Clear Cover (Cmin)	:	25	mm	
Side Clear Cover	:	25	mm	
Es	:	2x10^5	N/sqmm	
Ptnominal (%) (Bn)	:	0.2	%	

Flexure Design

Beam Bottom			Beam Top					
Left	Mid	Right	Left	Mid	Right			
Critical L/C - RCDC			10	11	11	11	11	10
Mu (kNm)		81.49	41.74	85.23	125.56	53.55	116.85	
Tu (kNm)		5.08	4.76	4.76	2.99	4.76	3.29	
MTu (kNm)		10.77	10.1	10.1	6.36	10.1	6.98	
Mud (kNm)		92.27	51.84	95.33	131.91	63.65	123.83	
MuLim (kNm)		236	236	236	236	236	236	
R	1.351	0.759	1.395	1.931	0.932	1.813		
Ptmin (%) (A)		0.205	0.205	0.205	0.205	0.205	0.205	
Ptclc (%) (B')		0.401	0.218	0.415	0.594	0.27	0.553	
Pcclc (%) (C)		0	0	0	0	0	0	
PtPrv (%)		0.451	0.271	0.451	0.783	0.321	0.783	
AstCalc (sqmm)		502.5	273.42	520.5	744.07	338.73	693.3	
AstPrv (sqmm)		565.5	339.3	565.5	981.74	402.12	981.74	

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Reinforcement Provided3 T12

2-T12 3-T12 3-T12

2-T12 2-T25 2-T16 2-T25

Note: Calculation of Ast

AstCalc = Max {B',C} x B X d (for Mu > 0)

AstCalc = Bn x B X d (for Mu = 0)

Where,

A = Ptmin = Min % area of flexural reinforcement

B' = Ptclc = Maximum of % reinforcement required for Bending Moment and Min % area of flexural reinforcement (A)

Bn = Ptnominal = Nominal % area of reinforcement

C = Pcclc = % area of compression reinforcement required

D = AstCrack = Area of reinforcement required for Crackwidth

Shear Design

	Left	Mid	Right
Critical L/C - RCDC		10	11	11
PtPrv (%)	0.321	0.321	0.321
Vu (kN)	85.66	88.08	88.08
Tu (kNm)	5.08	4.76	4.76
VTu (kN)	35.31	33.1	33.1
Vut (kN)	120.97	121.18	121.18
Tv (N/sqmm)	0.97	0.97	0.97
Tc (N/sqmm)	0.41	0.41	0.41
Vc (kN)	50.91	50.91	50.91
Vus=Vut-Vc (kN)	70.06	70.27	70.27
Legs	2	2	2

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Stirrup Rebar	8	8	8
Asv Torsion (sqmm)	353.511	333.201	347.8
Asv Torsion Prv (sqmm)	543.46	543.46	543.46
Asv Reqd (sqmm/m)	356.06	357.11	357.11
SvCalc (mm)	185	185	185
SvPrv (mm)	185	185	185
Asv Total Prv (sqmm)	543.46	543.46	543.46

Maximum Spacing Criteria

Basic

Spc1 =0.75d = 409 mm

Spc2 = 300 mm

For Torsion

(X1 = 190, Y1 = 560)

Spc3 = X1 = 190 mm

Spc4=(X1+Y1)/4 = 185 mm

SFR Design

Beam Width = 230 mm

Beam Depth = 600 mm

Torsion = 5.08 > 0kNm

Beam Depth >750 Or Torsion > 0,

Hence SFR Provided

Asr = 138 sqmm

SFR Provided = 2-T8EF

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ASFR Provided = 201.08 sqmm

Spacing Criteria

Provided Spacing	=	161.4	mm
1.<= beam Width	=	230	mm
2. Not Greater Than	=	300	mm

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SLAB DESIGN CALCULATIONS

Project Name : Unassigned

Client Name : Unassigned

Engineer Name : Unassigned

Design File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\CMDA\SLAB.rcdx

Analysis File : E:\MS\2025\AANIRUDTH FOUNDATIONS\RKS DEVI\rks devi.std

Analysis Last Modified : 03-01-2026 12:36:34

NOTES:

1. Slab is designed as per 1 M width of panel.
2. Density of concrete assumed as 25 kN/Cum.
3. Maximum spacing of Main steel is smaller of (3 x Deff and 300 mm)
4. Maximum spacing of Distribution steel is smaller of (5 x Deff and 450 mm)
5. All 6 mm diameter bars assumed of Fe250 grade with Fy=250 N/sq.mm

Definitions Of Terms:

1. α = Coefficient of Thermal Expansion
2. acr = Distance from the point considered to the surface of the nearest longitudinal bar
3. εm = Average steel strain at level considered
4. ε1 = Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
5. ρact = Percentage steel provided
6. ρcrit = Percentage steel critical as per code
7. BM = Bending moment in kNm
8. D = Overall depth of slab in mm
9. Deff = Effective depth of slab in mm
10. Ec = Modulus of elasticity of concrete
11. Es = Modulus of elasticity of steel
12. Fck = Characteristic compressive strength of concrete cube in N/sqmm

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13.	Fst	=	Stress in steel
14.	Fy	=	Yield Stress Of Steel in N/sqmm
15.	Mu	=	Factored Bending moment in kNm
16.	Sp	=	Spacing Between bars at outer most layer
17.	Tc	=	Permissible Shear stress in concrete in N/sqmm
18.	Temp1	=	Peak Hydration temperature
19.	Temp2	=	Seasonal Temperature Variations
20.	Tv	=	Shear stress due to Vu in N/sqmm
21.	V	=	Shear force in kN
22.	Vu	=	Factored shear force in kN
23.	Wcr	=	Surface Crack Width

Code References :

IS 456

	ELEMENT		CLAUSE / TABLE
1.	Moment Coeffs For 2-Way Slabs :		Greschoff-Rankine Formulation and yield line theory
2.	Ptmin :	26.5.2.1	
3.	Ptcalculated :	38	
4.	Shear Strength Of Concrete	:	40.3
5.	Modification Factor for Shear	:	40.2.1.1
6.	Max Nominal Shear Stress	:	40.2.3
7.	Basic Span To Depth Ratio	:	23.2.1
8.	Tensile Steel Factor :	23.2.1	
9.	Compression Steel Factor	:	23.2.1
10.	Flange correction factor :	23.2.1	
11.	spacing between main bars	:	26.3.3
12.	spacing between distribution bars	:	26.3.3
13.	crack width calculation :	Annex-F	
14.	cracking :	Clause 35.3.2	

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BS 8007 (For Early / Initial Thermal Cracking)

	ELEMENT	CLAUSE / TABLE
1.	Surface Zone for suspended slab	: Figure A.1
2.	Surface Zone for ground slab	: Figure A.2
3.	Factors for the calculation of minimum reinforcement	: Table A.1

Slab No. : S1

Level = 5.5 m

Design Code = IS 456 : 2000 + IS 13920 : 2016

Grade Of Concrete = M25

Grade Of Steel = Fe415

Clear Cover = 20.000 mm

Long Span, Ly = 3.390 m

Short Span, Lx = 1.030 m

Imposed Load = 5.120 kN/sqm

Live Load = 2.000 kN/sqm

Dead Load,DL = 8.245 kN/sqm

Slab Thickness = 125.000 mm

Effective Depth Along LX, Deffx = 100.000 mm

Self Weight = 3.125 kN/sqm

Total Load, TL = 10.245 kN/sqm

Span = 1-Way

End Conditions = End Span

Load Combination = 1.5 DL + 1.5 LL

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Design Moments:

Short Span Positive Moment at Mid Span -

Moment Coefficient(DL), M1 = 0.083

Moment Coefficient(LL), M2 = 0.100

BM = M1 x DL x Lx x Lx + M2 x LL x Lx x Lx = 0.941 kNm

Mu = 1.5 X BM = 1.412 kNm

Area Of Reinforcement Required (Mu) = 150.000 sqmm/m

Reinforcement Provided= T8 @ 300 C/C

= 168.000 sqmm/m

Long Span Positive Reinforcement -

Area Of Reinforcement Required = 150.000 sqmm/m

Reinforcement Provided= T8 @ 300 C/C

= 168.000 sqmm/m

Short Span Negative Moment at Continuous Support -

Moment Coefficient(DL), M3 = 0.100

Moment Coefficient(LL), M4 = 0.111

BM = M3 x DL x Lx x Lx + M4 x LL x Lx x Lx = 1.110 kNm

Mu = 1.5 X BM = 1.666 kNm

Area Of Reinforcement Required (Mu) = 150.000 sqmm/m

Reinforcement Provided= T8 @ 300 C/C

= 168.000 sqmm/m

All Other Sections provide Minimum Steel @ 0.12% -

Area Of Reinforcement Required = 120.000 sqmm/m

Reinforcement Provided= T8 @ 300 C/C

= 168.000 sqmm/m

Shear Check :

Shear Coefficient(DL), SF1 = 0.400

Shear Coefficient(LL), SF2 = 0.450

V = SF1 x DL x Lx + SF2 x LL x Lx = 6.331 kN

Vu = 1.5 X V = 9.497 kN

Shear Stress, Tv = 0.095 N/sqmm

Nominal Shear Stress, Tc = 0.291 N/sqmm

Modification Factor 'K' = 1.300

K x Tc = 0.378

> 0.095 Slab Is Safe In Shear

Deflection Check:

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CMDA Regd. Structural Engineer GR-I (SE-I)
Reg No. SEI/2024/4/0037
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No.11, Thandi Street, Pallikaranai, Chennai-600 100.
Cell: 9282102586 / 9952050643
Email: structshankar97@yahoo.com

Basic Span To Depth Ratio = 26.000

Span Correction Factor = 1.000

Tensile Steel Factor = 2.304

Compression Steel Factor = 1.000

Flange Correction Factor = 1.000

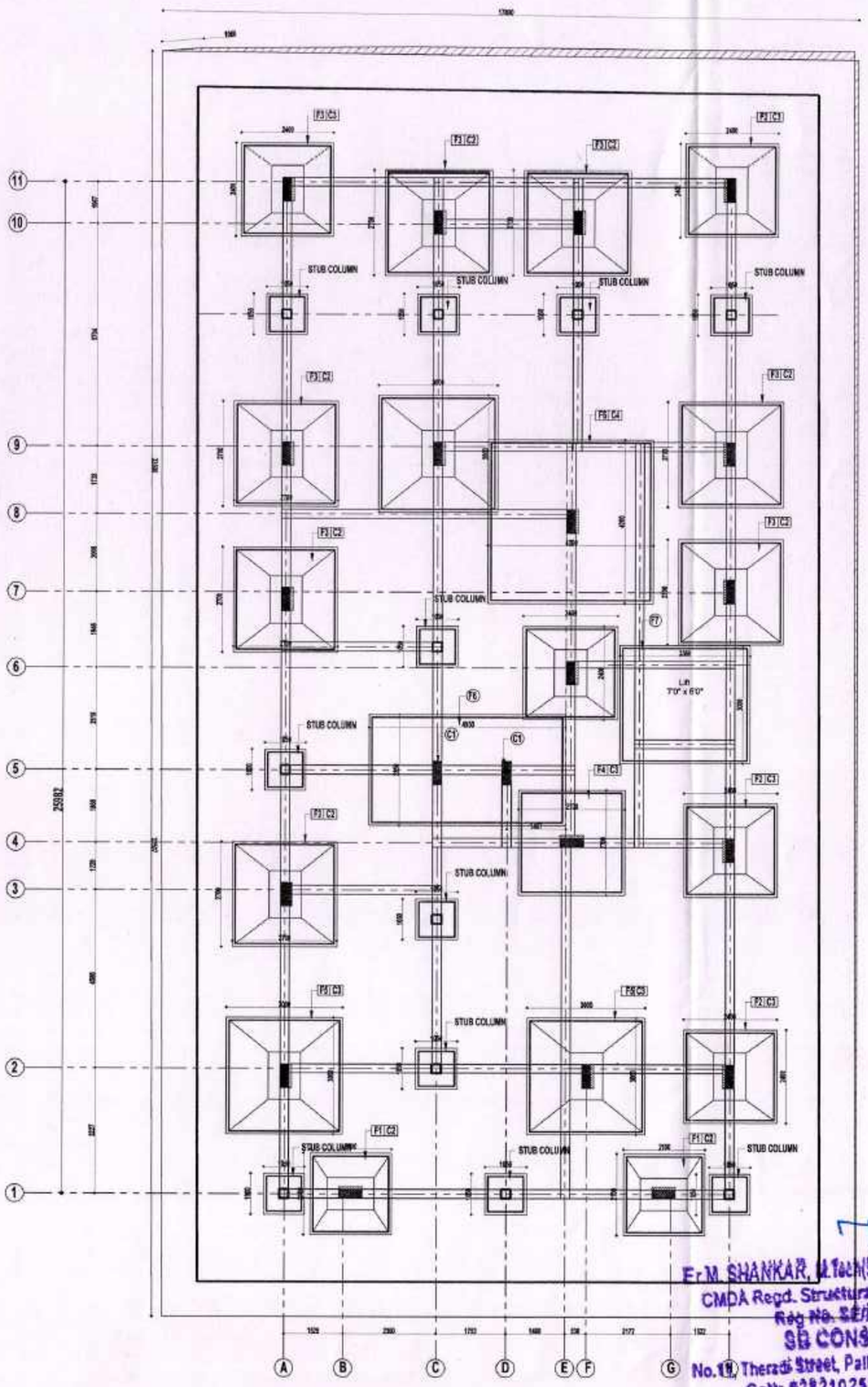
Max Span To Depth Ratio = 26.00 x 1.00 x 2.30 x 1.00 x 1.00

= 59.914

Lx/d = 10.300

< 59.914 Slab Is Safe In Deflection

Er.M. SHANKAR, M.Tech(Struct),MIE, MISSE, FMACCE
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Cell: 9282102586 / 9952050643
mail: shankarshankar97@yahoo.com



FOUNDATION LAYOUT.

PROJECT:

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS RESIDENTIAL BUILDING WITH DWELLING UNITS (WITH HEIGHT 16.30M) AVAILING PREMIUM FSI AT DOOR NO. —42 ND STREET,COLONY,NANGANALLUR, CHENNAI COMPRISED IN OLD S.NO.29,(PART)&30 (PART) DOCUMENT AS PER PATTA NEW T.S .NO.36, 19 WARD- B OF NANGANALUR VILLAGE,ALANDUR AND WITH IN THE LIMITS GREATER CHENNAI CORPORATION.

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHER WISE SPECIFIED
2. M30 GRADE OF CONCRETE FOR COLUMNS AND FE 500 GRADE WITH MCC 320KG/CUM BY DESIGN MIX CONFIRMING TO I.S 456-2000 &IS 10262-1982 UNLESS OTHER WISE SPECIFIED.
03.CLEAR COVER TO MAIN STEEL SHALL BE
25MM FOR BEAMS
40MM FOR COLUMNS.
50MM FOR FOOTINGS,
15MM FOR SLABS&SUNSHADES
4.FOUNDATION IS DESIGNED FOR STILT+5 FLOOR ONLY.
5.SBC CONSIDERED AT 2.5MM BELOW EXG. GL IS 300KN/SQ.M AS PER SOIL REPORT
6.BUILDING IS DESIGNED FOR SEISMIC+WIND LOAD ONLY.
7.'Y' DENOTES TOR 40 STEEL CONFIRMING TO IS 1786-1985.
8. 'R' DENOTES MILD STEEL CONFIRMING TO I.S.432-1982.
9.FORM WORK TO BE REMOVED FOR SPANS
UPTO 6M—3M 7DAYS
3M—4.5M 14DAYS
4.5M—6M 21DAYS
10.AVOID CLAY SOIL FILLING IN BASEMENT.
11.USE 1:1:2 MIX FOR STARTERS
12.USE OPC FOR ALL CONCRTE WORKS.
13.LAP LENGTH SHALL BE 47 TIMES THE DIA OF BAR.
14.ALL COLUMN RODS TO BE STAGGERED
15.NO DIMENSION SHOULD BE SCALED OFF FROM THE DRG. ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
16.USE CHAIR RODS FOR TOP REINFORCEMENT
17.CANTILEVER PROPS SHOULD NOT BE RELEASED UNTIL ROOF IS CONCRETED.
18.ALL FOOTING RODS BENT 6"UP.
19.ALL BEAM TOP RODS SHALL BE PROPERLY IN COLUMNS

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- ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

R.NO.	REVISION	DATE	SIGN
1.			
2.			
3.			

PROJECT NO:

DRG TITLE: **FOUNDATION LAYOUT**

STRUCTURAL DRAWING

DRG.NO : SD-01 ONLY.

SCALE : 1"=4'-0" & 1"=2'-0"

DATE : 3.1.2026

SHEET SIZE : A1 (1/1)

DRAWN BY : K.Uma

CAD FILE: E:\SHANKAR\2025\ANIRUDH FOUNDATION\RKS SRI DEVI\FDN

GOOD FOR CONSTRUCTION

AANIRUDH FOUNDATION PVT LTD

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Email : engg@aanirudhflatpromoters.in
Web : www.aanirudhflatpromoters.in

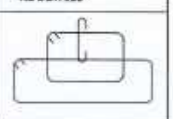
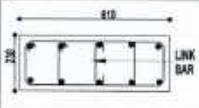
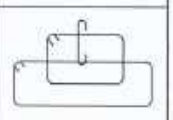
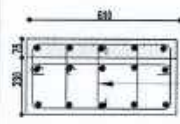
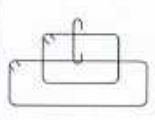
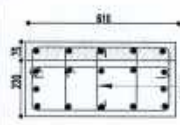
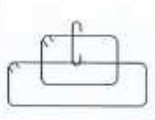
N

STRUCTURAL CONSULTANTS:

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e-mail:m_shankarengineer@yahoo.co.in

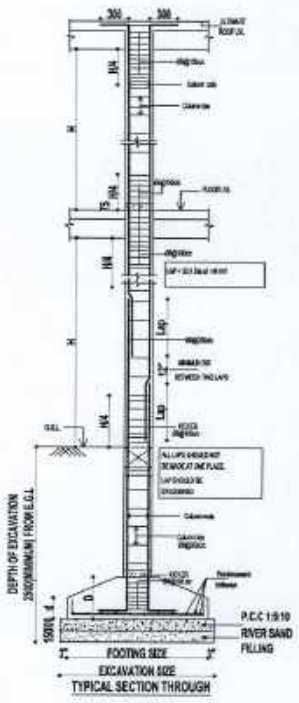
Er.M.SHANKAR, M.Tech(Struct),MIE, MISSE, FMACCE
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COLUMN SCHEDULE

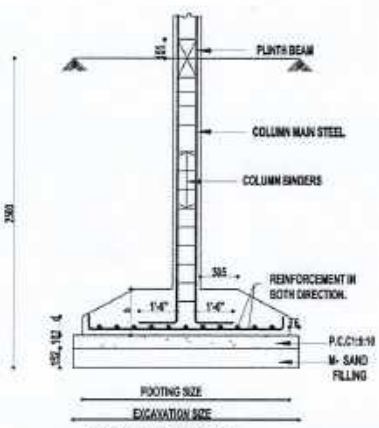
SNO	COLUMN REFERENCE	SIZE	COLUMN SHAPE	MAINSTEEL	BINDERS	BINDERS	TIE DETAILS
01.	C1	230X610		10Y25	–REFER – –SECTION–	M_{25}	
02.	C2	230X610		10Y20	–REFER – –SECTION–	M_{25}	
03.	C3	300X610		10Y25	–REFER – –SECTION–	M_{25}	
04.	C3	300X610		12Y25	–REFER – –SECTION–	M_{25}	

FOOTING SCHEDULE:

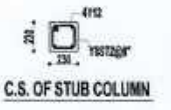
SL.NO	FOOT.REF	EX.SIZE	FOOTING SIZE	DEPTH d	DEPTH D	REINFT SH.DIR	REINFT LO.DIR	MIX
1	F1	2100X2100	1950X1950	200	650	Y12 at 150	Y12 at 150	M_{25}
2	F2	2400X2400	2250X2250	200	750	Y12 at 150	Y12 at 150	M_{25}
3	F3	2700X2700	2550X2550	200	800	Y12 at 150	Y12 at 150	M_{25}
4	F4	2700X2700	2550X2550	—	800	Y12 at 150	Y12 at 150	M_{25}
5	F5	3000X3000	2850X2850	—	900	Y12 at 100	Y12 at 100	M_{25}
6	F6	4950X3000	4800X2850	—	800	Y12 at 150	Y12 at 150	M_{25}
7	F7	3360X3060	3210X2950	REFER SECTION				M_{25}



TYPICAL SECTION THROUGH COLUMN FOOTING



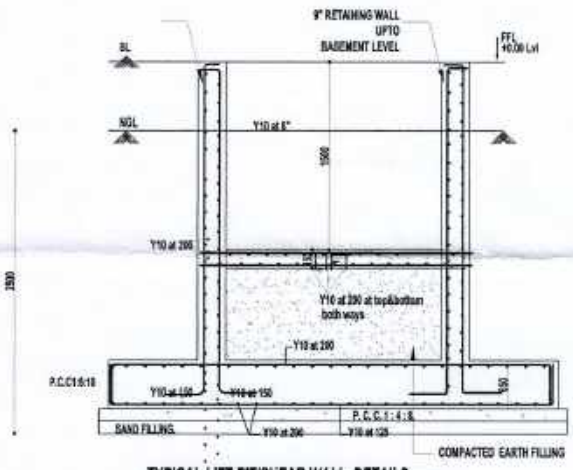
TYPICAL DETAILS OF SQUARE SLOPED FOOTING



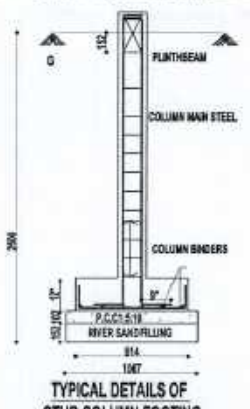
C.S. OF STUB COLUMN



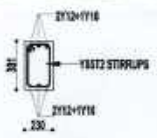
TYPICAL DETAILS OF BINDERS/STIRRUPS.



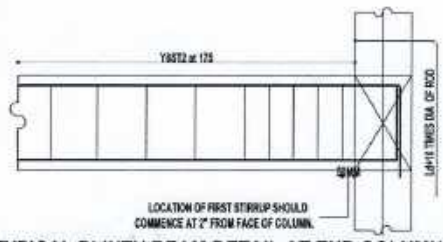
TYPICAL LIFT PIT/SHEAR WALL DETAILS.
(WATER PROOFING TO BE DONE ON BOTH POSITIVE AND NEGATIVE SIDES.)



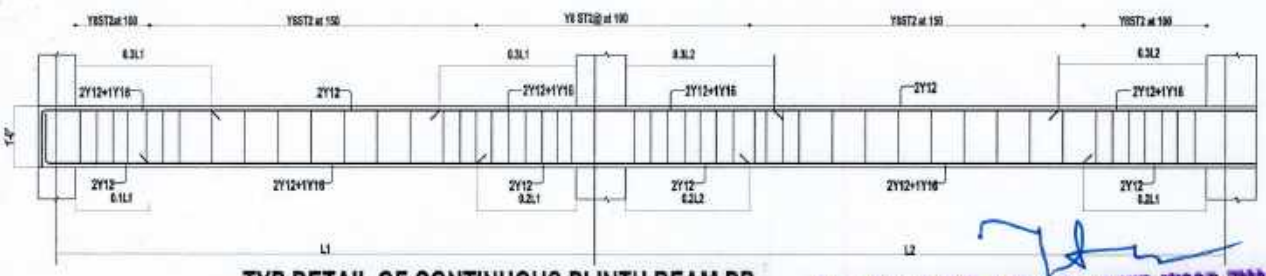
TYPICAL DETAILS OF STUB COLUMN FOOTING.



C.S.OF PB



TYPICAL PLINTH BEAM DETAIL AT END COLUMNS.



TYP.DETAIL OF CONTINUOUS PLINTH BEAM PB

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GMDA Regd. Structural Engineer GR-I (SE-I)
Reg No. SE/I/2024/4/0037
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Email: structshankar97@yahoo.com

PROJECT:

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT + 5 FLOORS 5 FLOORS RESIDENTIAL BUILDING WITH 14 DWELLING UNITS OF 18.30M HEIGHT AVAILING PREMIUM FSI AT PLOT NO: C-70, 44th STREET, NCBS NANGANALLUR, CHENNAI-600 061 COMPRISED IN O.S.Nos.29 & 30, AS PER PATTA S.NO:28/1, 29/2PT, T.S.NO.7, BLOCK NO.20, NANGANALLUR VILLAGE, ALANDUR TALUK AND WITHIN THE LIMITS OF GREATER CHENNAI CORPORATION. ZONE:- XII; DIVISION:- 167

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHER WISE SPECIFIED
2. M20 GRADE OF CONCRETE AND FE 415 GRADE SHALL BE USED
3. CLEAR COVER TO MAIN STEEL SHALL BE
   25MM FOR BEAMS
   40MM FOR COLUMNS.
   50MM FOR FOOTINGS,
   15MM FOR SLABS&SUNSHADES
4. FOUNDATION IS DESIGNED FOR STILT+5 FLOOR ONLY.
5. SBC CONSIDERED AT 2.50M BELOW EXG. GL IS 330KN/SQ.M AS PER SOIL REPORT
6. BUILDING IS DESIGNED FOR SEISMIC+WIND LOAD ONLY.
7. Y DENOTES TOR 40 STEEL CONFIRMING TO IS 1786-1985.
8. 'R' DENOTES MILD STEEL CONFIRMING TO I.S.432-1982.
9. FORM WORK TO BE REMOVED FOR SPANS
   UPTO 0M—3M 7DAYS
   3M—4.5M 14DAYS
   4.5M—6M 21DAYS
10. AVOID CLAY SOIL FILLING IN BASEMENT.
11. USE 1:1:2 MIX FOR STARTERS
12. USE OPC FOR ALL CONCRTE WORKS.
13. LAP LENGTH SHALL BE 47 TIMES THE DIA OF BAR.
14. ALL COLUMN RODS TO BE STAGGERED
15. NO DIMENSION SHOULD BE SCALED OFF FROM THE DRG. ONLY WRITTEN DIMENSION SHOULD BE FOLLOWED.
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17. CANTILEVER PROPS SHOULD NOT BE RELEASED UNTIL ROOF IS CONCRETED.
18. ALL FOOTING RODS BENT 6"UP.
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ELEVATION LEVELS ARE FINISHED FLOOR LEVEL

STRUCTURAL ENGINEER RESPONSIBILITY IS LIMITED TO DESIGN & ISSUAL OF STRUCTURAL DRAWING ONLY

ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

R.NO.	REVISION	DATE	SIGN
1. 2. 3.			

PROJECT NO:

DRG TITLE: **COLUMN&FOOTING DETAILS**

STRUCTURAL DRAWING

DRG.NO : SD-01 ONLY.

SCALE : 1"=4'-0" & 1"=2'-8"

DATE : 3.01.2026

SHEET SIZE : A1 — 1/2

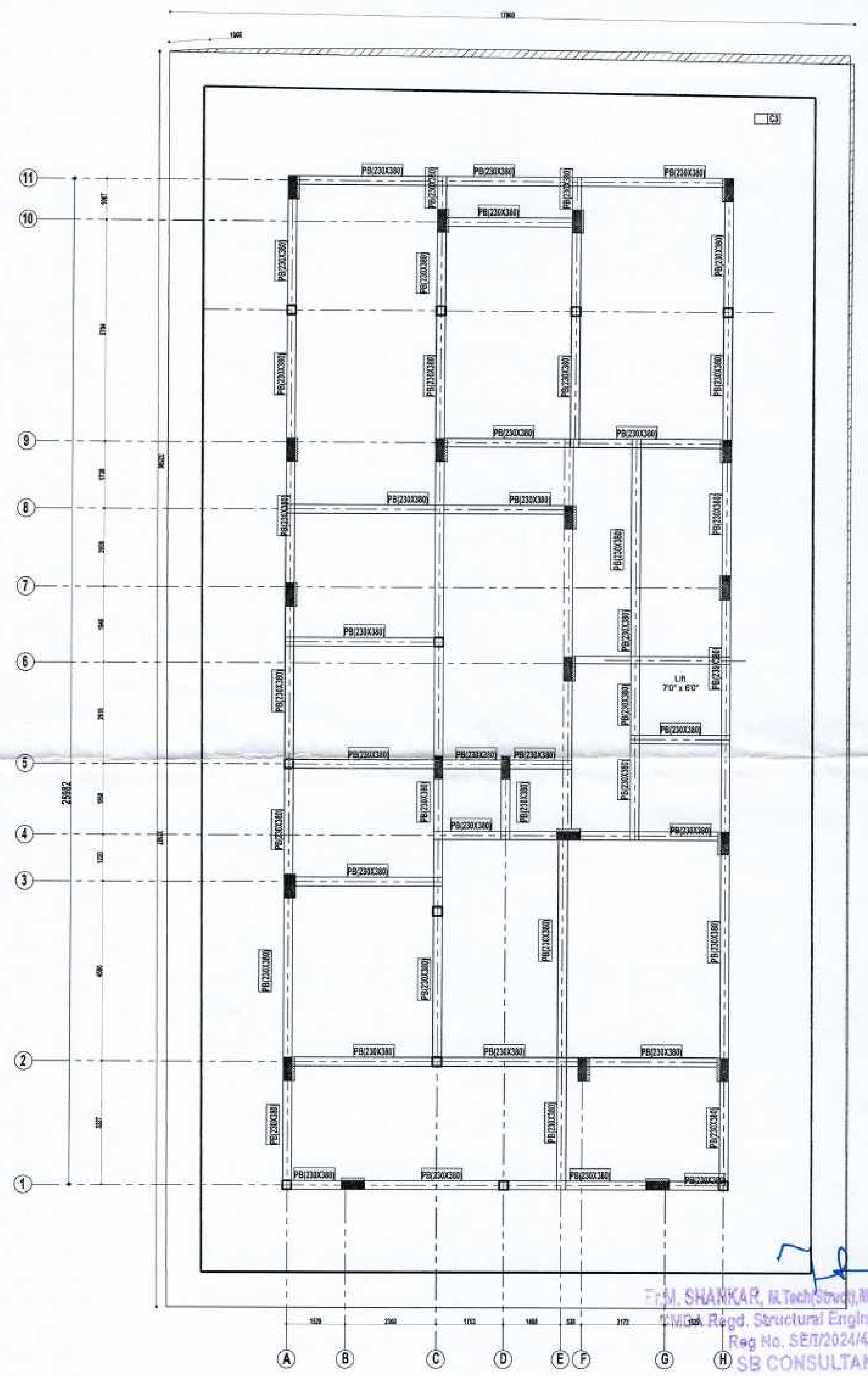
DRAWN BY : K.Uma

CAD FILE: E:\SHANKAR\2022\ANIRUDH FOUNDATION\2024\NANGANALLUR\FDN

GOOD FOR CONSTRUCTION

AANIRUDH FOUNDATION PVT LTD
No.4, Lakshmi Nagar, 10th Street,
Nanganallur, Chennai - 600 061
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E-mail : engg@aanirudhflatpromoters.in
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STRUCTURAL CONSULTANTS:
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CHARTERED ENGINEER/STRUCTURAL ENGINEER GRADE- I(SE-I)
SENIOR PROFESSIONAL ENGINEER
SB CONSULTANTS,
11,THERADI STREET, PALLIKKARANAI CHENNAI-600100.
MOBILE:9282102586: 9952050643
e-mail m_shankarengineer@yahoo.co.in



FOUNDATION LAYOUT.

PROJECT:

PLAN SHOWING THE PROPOSED CONSTRUCTION OF STILT FLOOR + 5 FLOORS RESIDENTIAL BUILDING WITH DWELLING UNITS (WITH HEIGHT 18.30M) AVAILING PREMIUM FSI AT DOOR NO. —42 ND STREET, COLONY, NANGANALLUR, CHENNAI COMPRISED IN OLD S.NO.26(PART)&30 (PART) DOCUMENT AS PER PATTA NEW T.S .NO.36, 19 WARD- B OF NANGANALLUR VILLAGE, ALANDUR AND WITH IN THE LIMITS GREATER CHENNAI CORPORATION.

NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHER WISE SPECIFIED
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03.CLEAR COVER TO MAIN STEEL SHALL BE
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- ONUS OF CONSTRUCTION LIES WITH CONTRACTOR/OWNER

R.NO.	REVISION	DATE	SIGN
1.			
2.			
3.			

PROJECT NO:

DRG TITLE: **PLINTH BEAM LAYOUT**

STRUCTURAL DRAWING

DRG.NO : SB-01 ONLY.

SCALE : 1"=4'-0" & 1"=2'-0"

DATE : 3.1.2024

SHEET SIZE : A1 | 1/1

DRAWN BY : E.Jes

CAD FILE: E:\SHANKAR\2025\ANIRUDH FOUNDATION\RG SRI DEVI\FDN

GOOD FOR CONSTRUCTION

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N

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CHARTERED ENGINEER/STRUCTURAL ENGINEER GRADE- I(SE-I)
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SB CONSULTANTS structural consultants

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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.