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STRUCTURAL STABILITY DESIGN BASIS CALCULATION REPORT

FOR

CONSTRUCTION OF

STILT FLOOR + 5 FLOORS RESIDENTIAL BUILDING

BLOCK - A & BLOCK - B (HEIGHT 18.30M) WITH

15 DWELLING UNITS (AVAILING PREMIUM FSI),

AT BLOCK NO: 12 & PLOT NO. 81, VGP NAGAR,

VIOLET APARTMENTS STREET AND VELLALAR STREET,

MOGAPPAIR WEST, CHENNAI - 600037,

COMPRISED IN OLD S.NO:

245/2&3, T.S.NO: 29/2 & 3, 65/2 & 3,

BLOCK NO.36, WARD - H OF MOGAPPAIR VILLAGE,

AMBATTUR TALUK, WITHIN THE LIMITS OF

GREATER CHENNAI CORPORATION.

CLIENT: M/s. NEXA INFRA PROJECT.

31-07-2025

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STRUCTURAL STABILITY CERTIFICATE

I Hereby Certify That the Proposed Residential Building at **Construction of Stilt Floor + 5 Floors Residential Building Block - A & Block - B (Height 18.30m) With 15 Dwelling Units (Availing Premium FSI), At Block No: 12 & Plot No. 81, VGP Nagar, Violet Apartments Street And Vellalar Street, Mogappair West, Chennai - 600037, Comprised In Old S.No: 245/2&3, T.S.No: 29/2 & 3, 65/2 & 3, Block No.36, Ward - H of Mogappair Village, Ambattur Taluk, Within The Limits Of Greater Chennai Corporation.**

Designed and Checked for Dead Load and Live Load and Also Resist Earthquake Forces and Found Safe. Reference: **BOOSHNAM ASSOCIATES/ JOB NO: BAG/M/s. NEXA INFRA PROJECTS/D-1738/25-26.**

The following assumptions and basic values are considered for the design and analysis of the structure under the title of the project.

1. The least dimension of the column for the **Stilt floor is 300 mm, and for other columns is 230mm.**
2. The grade of concrete for **structural elements is M30.**
3. The **Safe Load Carrying Capacity of pile is 55 MT** as per the soil report.
4. The proposed type of foundation is **Pile Foundation.**
5. The length of pile as per soil report is **20.20 m** below existing ground level.
6. The design, analysis, detailing and drafting is carried out using the various code of practice namely and as per IS 875 for Loads and loading combinations, IS 1786 for High Tensile Reinforcement bar, IS 456 for Practice of plain and reinforced concrete and IS 1893 for Seismic design. Etc.
7. The Registered Construction Project Engineer at site shall take necessary precautions in adhering to the relevant Code provisions while executing the above work.

NOTE: The structural design is prepared based on the copy of Approval Plan of the building. Any change/alteration/ addition/ modification of the building plan in further Approval or during construction hereafter, it should be brought to the knowledge of structural engineer and work shall be carried out with new structural design report by the engineer.

STRUCTURAL DESIGN ANALYSIS FOR PROPOSED BUILDING

Name of work:

Construction of Stilt Floor + 5 Floors Residential Building Block - A & Block - B (Height 18.30m) With 15 Dwelling Units (Availing Premium FSI), At Block No: 12 & Plot No. 81, VGP Nagar, Violet Apartments Street And Vellalar Street, Mogappair West, Chennai - 600037, Comprised In Old S.No: 245/2&3, T.S.No: 29/2 & 3, 65/2 & 3, Block No.36, Ward - H of Mogappair Village, Ambattur Taluk, Within The Limits Of Greater Chennai Corporation.

Preambles:

1. I hereby certify that the structural design is done by **limit state method, as per relevant sections of IS 456.**
2. I hereby certify that the structural design sheet is done for critical column, beam, slab and foundation for the proposed building.
3. The usage of the building is **Block-A (Stilt+05) & Block-B (Stilt+05) Floors Residential Building.**
4. The building consists of For **Proposed Construction of the Block-A (Stilt+05) & Block-B (Stilt+05) Floors Residential Building.**
5. The superstructure is built on **230 mm thick outer walls and 115 mm thick inner walls.**
6. The structural design includes the **earthquake Criteria as per the IS 1893.**

IS Code:

IS 456 for concrete.

IS 875 for design load.

IS 1786 for steel reinforcement.

IS1893 for earthquake design.

IS13920 for ductile design.

GENERAL NOTES ON STRUCTURAL DESIGN

- **General:**

Design Basis

Design Of The Building Is Carried Out By RCC Frame Analysis Using Etabs Software And Critical Members Are Checked And Designed By RCDC software output As Enclosed Below.

- **Codes and Standards**

All Structural design is carried out confirming to the provisions in National Building Code of India and other relevant Indian Codes and Standards.

IS Code used for design purposes were:

IS 456:2000 for Concrete

IS 875:2007for Design Load

IS 1786: 2008 for Steel Reinforcement

IS 1893:2002 for Earthquake design

- **Concrete:**

The concrete shall be in grades designated as per Table 5 of IS 456-2000. Recommended grades for the different members is as follows:

Foundation	M30
Columns	M30
Roof beams and slab	M30

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- **Material, Workmanship, Inspection and testing:**

The Proposed RCC Structure will consist of cement concrete and reinforcement as the main material used for construction of the structure. The specifications for these materials are discussed below.

- **Design methods:**

General Design and Detailing of concrete members / elements are done confirming to the provisions of IS. 456 and other relevant IS codes. Limit State Method is followed for the design.

Seismic Zone III load is taken into account for the analysis. The predominant direction of vibration is horizontal. Relevant combination of forces has been taken into account.

- **Minimum Cover:**

Slab	20mm
Beam	25mm
Columns	40mm
Foundation	50mm

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PILECAP DESIGN CALCULATIONS

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. A1	=	Area of Base for Load Transfer
7. A2	=	Area of Bearing under column
8. acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
9. AsfrPrv	=	Area of face reinforcement provided
10. AsfrReq	=	Area of face reinforcement required
11. AstPrv	=	Area of tensile reinforcement provided
12. AstReq	=	Area of tensile reinforcement required
13. AsvPrv	=	Area of shear reinforcement provided
14. AsvReq	=	Area of shear reinforcement required
15. Av	=	Location of section of shear-check from Pile Center
16. Beff	=	Effective Width for design for bending and shear
17. Beffsfr	=	Effective Width for design for Face Reinforcement
18. BMux	=	Factored Bending Moment for pile-cap along column D
19. BMuy	=	Factored Bending Moment for pile-cap along column B
20. D	=	Depth of Pilecap
21. Deff	=	Effective Depth of Pilecap
22. DfCol	=	Distance of Pile center to face of column
23. Ec	=	Modulus of elasticity of concrete
24. Es	=	Modulus of elasticity of steel
25. Fst	=	Stress in steel
26. Mx	=	Bending Moment in column along Column D
27. My	=	Bending Moment in column along Column B

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28. P	=	Axial load in pile due to Ptotal
29. Pcomb	=	Axial load in column for a load combination
30. Ppile	=	Axial Load on pile
31. Ptotal	=	Total vertical load on pile-cap for a load combination
32. Pmx	=	Axial load on pile due to moment Mx
33. Pmy	=	Axial load on pile due to moment My
34. sp	=	Spacing Between bars at outer most layer
35. Tc	=	Design Shear Strength of Concrete
36. Tce	=	Enhanced Shear Strength of concrete
37. Temp1	=	Peak Hydration temperature
38. Temp2	=	Seasonal Temperature Variations
39. Tv	=	Nominal shear stress
40. Vu	=	Design shear force
41. Vus	=	Design shear force for stirrups
42. Wcr	=	Surface Crack Width

Code References:

IS 456

1. Ptmax	:	clause 26.5.1.1
2. Ptmin	:	clause 26.5.2.1
3. Pt	:	clause 38
4. Tc	:	clause 40.2.1
5. Tcmax	:	clause 40.2.3
6. AsvReq	:	clause 40.4
7. Min Shear Reinf	:	clause 26.5.1.6
8. Max Stirrup Spacing	:	clause 26.5.1.5
9. One Way Shear Criteria	:	clause 34.2.4.2
10. Load transfer	:	clause 34.4
11. Ptnominal	:	clause 34.5.2
12. crack width calculation	:	Annex-F
13. cracking	:	clause. 35.3.2

IS 2911 Part-1 Section 2

1. Pile capacity check	:	clause 5.10

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	
Pilecap No	:	PC2	
Column No	:	C1	(300mm x 900mm)
Member Ref. No	:	159	
Concrete Grade	:	M30	
Steel Grade	:	Fe550	
Clear Cover	:	75	mm
Top of pile-cap below ground	:	1.0	m
Density of Soil	=	18	kN/cum
Founding Depth	=	4	m
Pile Capacity in Compression	=	750	kN
Pile Capacity in Tension	=	780	kN
Pile Capacity in Shear	=	70	kN
Pile Capacity Reduction	=	0	%
Pile Overloading	=	10	%
Pile Group Overloading	=	10	%
Pile Capacity Increase for EQ	=	25	%
Pile Capacity Increase for Wind	=	25	%
Live Load Reduction	=	0	%
Consider Capacity Design	:	No	
Consider Overburden Pressure	:	No	
No. of Piles	=	4	
Pile Diameter	=	600	mm
Pilecap Offset	=	150	mm
Pile Spacing	=	3.0	x Ø
Pilecap Size	=	2.40 x 2.40	m
Pilecap Depth	=	1000	mm
Pile-cap Wt.	=	21.094	kN

For design, moments along shorter direction of pile cap has been ignored

Check for Maximum Compressive Load on One Pile:

Critical Analysis Load Combination	:	302
Critical Load Combination	:	[2] : (LOAD 9: DL) +0.8 (LOAD 10: LL) +0.8 (LOAD 1: EQ+X)
Pcomb	=	1048.05 kN

Ptotal	=	Pcomb + Pilecap Wt.	
	=	1069.14	kN
Mx	=	-24.17	kNm
My	=	0.8	kNm
P	=	Ptotal/ No. of Piles	
	=	534.57	kN
Pmx	=	21.484	kN
Pmy	=	0	kN
Maximum Compressive load on pile	=	556.06	kN
Allowable Compressive load on pile	=	600 x 1.25 x 1.1	
	=	825	kN

Check for Maximum Compressive Load on Pile Group:

Critical Analysis Load Combination	:	301	
Critical Load Combination	:	[1] : (LOAD 9: DL) +(LOAD 10: LL)	
Pcomb	=	1046.66	kN
Ptotal	=	Pcomb + P ilecap Wt.	
	=	1067.75	kN
Mx	=	4.89	kNm
My	=	0.2	kNm
Maximum Compressive load on pile group	=	1067.76	kN
Allowable Compressive load on pile group	=	2 x 600 x 1.1	
	=	1320	kN

Check for Maximum shear on Pile Group:

Critical Analysis Load Combination	:	307	
Critical Load Combination	:	[7] : (LOAD 9: DL) +(LOAD 2: EQ-X)	
Pcomb	=	821.46	kN
Ptotal	=	Pcomb + Pilecap Wt.	
	=	842.55	kN
Mx	=	39.88	kNm
My	=	-0.74	kNm
Vx	=	-2.05	kNm
Vy	=	-28.68	kNm
Maximum shear on pile group	=	$\text{sqrt}(-2.05^2 + -28.68^2)$	
	=	28.75	kN

Shear capacity of pile group	=	2 x 100 x 1 x 1.25	
	=	250	kN

Check for Tensile Load on One Pile:

No Tensile load in pile group.

Check for Maximum Tensile Load on Pile Group:

No Tensile load in pile group.

Design for Bending:

Bottom Reinforcement Along Column-D

Critical Analysis Load Combination	:	401	
Critical Load Combination	:	[74] : 1.5 (LOAD 9: DL) +1.5 (LOAD 10: LL)	
Pcomb	=	1569.99	kN
Ptotal	=	Pcomb + Pilecap Wt.	
	=	1601.631	kN
Mx	=	7.33	kNm
My	=	0.3	kNm
Ppile	=	Max Load on pile	
	=	807.33	kN
Deff	=	540	mm
Beff	=	750	mm
DfCol	=	0.34	m
BMux	=	Ppile x DfCol	
	=	272.48	kNm
PtReq	=	0.27	%
AstReq (BM)	=	1481	sqmm/m
AstPrv	=	T16 @ 150 C/C	
	=	1608.48	sqmm/m

Top Reinforcement Along Column-D

There is no Tensile Force, hence Minimum Percentage of steel will be provided.

D	=	1150	mm
AstReq (BM)	=	Min Pt for Top Reinforcement x D x 1000/100	
	=	0.06 x 1150 x 1000/100	
	=	690	sqmm/m
AstPrv	=	T12 @ 150 C/C	
	=	392.7	sqmm/m

Bottom Reinforcement Along Column-B

There is no Compressive Force, hence Minimum Percentage of steel will be provided.

D	=	1150	mm
AstReq (BM)	=	Min Pt for Bottom Reinforcement x D x 1000/100	
	=	0.2 x 1150 x 1000/100	
	=	2300	sqmm/m
AstPrv	=	T16 @ 150 C/C	
	=	1340.4	sqmm/m

Top Reinforcement Along Column-B

There is no Tensile Force, hence Minimum Percentage of steel will be provided.

D	=	1150	mm
AstReq (BM)	=	Min Pt for Top Reinforcement x D x 1000/100	
	=	0.06 x 1150 x 1000/100	
	=	690	sqmm/m
AstPrv	=	T12 @ 200 C/C	
	=	392.7	sqmm/m

Design for One Way Shear:

Along Column-D (Compression Case)

Critical Analysis Load Combination	:	401	
Critical Load Combination	:	[74] : 1.5 (LOAD 9: DL) +1.5 (LOAD 10: LL)	
Pcomb	=	1569.99	kN
Ptotal	=	Pcomb + Pile :ap Wt.	
	=	1601.63	kN
Mx	=	7.33	kNm
My	=	0.3	kNm
Ppile	=	Max Load on pile	
	=	807.3347	kN

Location of critical section is at d/2 from face of column

Section Location from column center	=	495	mm

Data for Piles

Pile No	Load (kN)	% covered	Shear (kN)
P1	600	40	460
P2	600	40	460
P3	600	40	460
P4	600	40	460

Design Shear Force (Vu)	=	Max. of (Shear due to P1, P2)	
	=	524.77	kN
Deff	=	540	mm
Beff	=	750	mm
Tv	=	Vu/(Beff x Deff)	
	=	1.3	N/sqmm
Tc	=	0.384	N/sqmm
Av	=	67.5	mm
Shear enhancement factor	=	2 x Deff / Av	
	=	16	
Enhanced shear strength (Tce)	=	3.5	N/sqmm
Tv	<	Tce, Hence Shear Reinforcement is not required	

Along Column-D (Tension Case)

All Load Combination having Compressive Force. Thus, One way Shear is not applicable for Tensile Force.

Along Column-B (Compression Case)

One way shear check do not applicable for 2 pile pile-cap design

Along Column-B (Tension Case)

One way shear check do not applicable for 2 pile pile-cap design

Design of Face Reinforcement:

Asfr Req	=	SFR % x D x Beffsfr	
	=	0.05 x 600 x 500 / 100	
	=	150	sqmm
Asfr Prv	=	2-T10	
	=	157	sqmm

Check for Load Transfer from Column to PileCap

Critical Analysis Load Combination	=	401	
Critical Load Combination	:	[74] : 1.5 (LOAD 9: DL) +1.5 (LOAD 10: LL)	
P	=	1569.99	kN
A2	=	0.14	sqm
A1	=	1.41	sqm
Base Area	=	1.41	sqm
A1	<	Base Area	
Modification Factor	=	SquareRoot(A1/A2) < = 2	
SquareRoot(A1/A2)	=	3.23	
Thus, Modification Factor	=	2	

Concrete Bearing Capacity	=	0.45 x Fck x Modication Factor x Column Area
	=	3645 kN
Concrete Bearing Capacity	>	P, Hence Safe.

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COLUMN DESIGN CALCULATIONS

Definitions Of Terms:

All forces in units kN and m

All reinforcement details like area, spacing are mm

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

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

1	β	=	Stiffness proportion factor at joint (column stiffness/sum of stiffness of all members connected at joint)
2	Δu	=	Elastically computed first order lateral deflection. (Relative deflections)
3	ε1	=	Strain at level considered, Calculated ignoring the stiffening of the concrete in tension zone
4	εm	=	Average steel strain at level considered
5	acr	=	Distance from the point considered to the surface of the nearest longitudinal bar
6	Ag	=	Gross area of the column cross section
7	Aeff	=	Effective area of column / wall considered for shear check in sqmm
8	Ak	=	Area of confined concrete core
9	Ash	=	Area of link cross section
10	b	=	Effective Width of Column in mm
11	beff	=	Effective Width of Column in mm
12	B	=	Width / Smaller Dimension of Column in mm
13	d	=	Effective Depth of Column in mm
14	deff	=	Effective Depth of Column in mm
15	D	=	Depth / Larger Dimension of Column OR Diameter of Circular Column in mm
16	Dk	=	Diameter Of core measured to the outside of circular link
17	Ec	=	Modulus of elasticity of concrete
18	Es	=	Modulus of elasticity of steel
19	FcPerm	=	Permissible Stress in Concrete required in N/ (sqmm)
20	Fst	=	Stress in steel
21	FstPerm	=	Permissible Stress in Steel required in N/ (sqmm)

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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
44 Shear Strength Enhancement Factor	=	Multiplying factor for shear strength of concrete as per 40.2.2
45 Vur	=	Factored resultant shear force acting on the column
46 Vux	=	Factored shear force Along B
47 Vuy	=	Factored shear force Along D
48 Wcr	=	Surface Crack Width
49 WcrPerm	=	Permissible Crack Width required in mm
50 β	=	It is a Neutral Axis angle corresponding to load angle to find out MCap

Code References:

IS 456

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

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	Load Name	Storey Height	Gravity Load P	Relative Displacements	Storey Shear	Stability Index	Sway Condition

		(m)	(kN)	(mm)	(kN)		
		A	B	C	D	B x C / (A x D)	
FOUNDATION to GRADE BEAM	EQ+X	1	15492.026	0.313	1139.527	0.004	Non Sway
GRADE BEAM to GFR	EQ+X	3	15027.2	3.121	1138.902	0.014	Non Sway
GFR to FFR	EQ+X	3	12520.649	5.207	1118.162	0.019	Non Sway
FFR to SFR	EQ+X	3	10057.709	6.003	1054.932	0.019	Non Sway
SFR to TFR	EQ+X	3	7594.768	5.806	925.891	0.016	Non Sway
TFR to 4FR	EQ+X	3	5131.827	5.003	707.812	0.012	Non Sway
4FR to 5FR	EQ+X	3	2668.886	4.024	377.467	0.009	Non Sway
5FR to HR	EQ+X	2.5	205.95	74189743848.581	65.231	93694455.086	Sway

For Global-Y Direction

Level	Load Name	Storey Height (m)	Gravity Load P (kN)	Relative Displacements (mm)	Storey Shear (kN)	Stability Index	Sway Condition
		A	B	C	D	B x C / (A x D)	
FOUNDATION to GRADE BEAM	EQ+Y	1	15492.026	0.613	1179.326	0.008	Non Sway
GRADE BEAM to GFR	EQ+Y	3	15027.2	5.887	1178.679	0.025	Non Sway
GFR to FFR	EQ+Y	3	12520.649	8.269	1157.215	0.03	Non Sway
FFR to SFR	EQ+Y	3	10057.709	8.333	1091.777	0.026	Non Sway
SFR to TFR	EQ+Y	3	7594.768	7.427	958.229	0.02	Non Sway
TFR to 4FR	EQ+Y	3	5131.827	5.796	732.533	0.014	Non Sway
4FR to 5FR	EQ+Y	3	2668.886	3.757	390.651	0.009	Non Sway
5FR to HR	EQ+Y	2.5	205.95	1534422225453.62	67.509	1872429192.299	Sway

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	FOUNDATION To GRADE BEAM	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	300	mm
Wall D	=	900	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	550	mm
Clear Floor Height @ D	=	550	mm

No Of Floors	=	1
No Of Walls In Group	=	1
Wall Type	:	UnBraced
Minimum eccentricity check	:	One Axis at a Time
Code defined D/B ratio	:	4
D/B Ratio	:	4.07 >= 4 Hence, Design as Wall

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[29] : 1.5 (DL) -1.5 (EQ-X)	
Critical Location	=	Bottom Joint	
Pu	=	2307.35	kN
Mux	=	1180.55	kNm
Muy	=	-24.27	kNm
Vux	=	-27.19	kN
Vuy	=	279.03	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	4972.905	No Beam	No Beam	-	-	1
Top	4972.905	No Beam	11790 x 230 x 450	-	16.228	0.998

Sway Condition (as per Stability Index)	=	Non Sway
Effective Length Factor along Major Axis	=	1

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	300.7	No Beam	No Beam	-	-	1
Top	300.7	No Beam	10200 x 230 x 450	-	18.757	0.955

Sway Condition (as per Stability Index)	=	Non Sway
Effective Length Factor along Minor axis	=	0.98

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	
	=	11.1	mm
Mminy	=	Pu x Minimum Eccentricity	
	=	46.15	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	1.83	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	1
Slenderness Ratio	=	Effective Length / D
	=	0.45, Wall not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.98
Slenderness Ratio	=	Effective Length / B
	=	1.8, Wall Not Slender Along B

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	1180.55	---	1180.55	0	1180.55
Minor Axis - Muy	-24.27	46.15	-46.15	0	-46.15

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	=	2307.35	kN
Mux	=	1180.55	kNm
Muy	=	-46.15	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.89	
Reinforcement Provided	=	14-T25 +12-T20 + 8-T12	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	2.24	deg
MRes	=	1181.46	kNm
MCap	=	1241.82	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.95 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	7-T16	4-T12	7-T16
Ast provided	1407.43	452.39	1407.43
Pt as % of entire wall	0.38 %	0.12 %	0.38 %
Pt as % of zone	1.56 %	0.24 %	1.56 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[26] : 1.5 (DL) +1.5 (EQ+X)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	279.0333	-90.4618
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	0.953	0.309
Pt (%)	0.446	0.446
Height of Wall, Hw (mm)	550	550
Length of Wall, Lw (mm)	1220	300
Hw/Lw	0.4508	1.8333
	<= 1	> 1
Thus Shear Strength,Tc	3.0-(Hw/Lw) x K1 x SquareRoot(Fck)	K2 x SquareRoot(Fck)* (Hw/Lw + 1)/(Hw/Lw - 1)
K1	0.2	-
K2	-	0.045
Tc (N/sqmm)	2.7925	0.838
Tcmin	K3 x SquareRoot(Fck)	
K3	-	0.15
Tcmin (N/sqmm)	-	0.8216
Hence Design Tc (N/sqmm)	-	0.838
Tcmax	0.17 x Fck	

	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	2.7925	0.838
	Since, Tv < Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Not Required**	**Shear Links Not Required**

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	125	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	900	mm
Maximum	=	450	mm
Spacing considered	=	125	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	---	---	8	---
Spacing	125	---	---	125	---

Secondary Links:

Other link T8@125c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	GRADE BEAM To GFR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	300	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm

Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm
No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	4.07 >= 4 Hence, Design as Wall	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[29] : 1.5 (DL) -1.5 (EQ-X)	
Critical Location	=	Bottom Joint	
Pu	=	2237.76	kN
Mux	=	992.33	kNm
Muy	=	-49.39	kNm
Vux	=	-55.98	kN
Vuy	=	291.53	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	1657.635	No Beam	11790 x 230 x 450	-	16.228	0.998
Top	1657.635	No Beam	11790 x 230 x 765	-	79.727	0.973

Sway Condition (as per Stability Index)	=	Non Sway
Effective Length Factor along Major Axis	=	0.99

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	100.233	No Beam	10200 x 230 x 450	-	18.757	0.955
Top	100.233	No Beam	10200 x 230 x 765	-	92.156	0.612

Sway Condition (as per Stability Index)	=	Non Sway	
Effective Length Factor along Minor axis	=	0.84	

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	101.01	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	7.45	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.99	
Slenderness Ratio	=	Effective Length / D	
	=	1.81, Wall not Slender Along D	

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.84	
Slenderness Ratio	=	Effective Length / B	
	=	6.26, Wall Not Slender Along B	

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	992.33	101.01	992.33	0	992.33
Minor Axis - Muy	-49.39	---	-49.39	0	-49.39

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	=	2237.76	kN
Mux	=	992.33	kNm
Muy	=	-49.39	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.56	
Reinforcement Provided	=	14-T25 +12-T20 + 8-T12	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	2.85	deg
MRes	=	993.56	kNm
MCap	=	1017.43	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.98 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	7-T12	4-T12	7-T12
Ast provided	791.68	452.39	791.68
Pt as % of entire wall	0.22 %	0.12 %	0.22 %
Pt as % of zone	0.88 %	0.24 %	0.88 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[26] : 1.5 (DL) +1.5 (EQ+X)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	291.5331	-152.2779
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	0.9957	0.5201
Pt (%)	0.278	0.278
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	300
Hw/Lw	1.832	7.45
	> 1	> 1
Thus Shear Strength, Tc	K2 x SquareRoot(Fck)*(Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.3229
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15

Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	
	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not Required**
Pt	0.2781	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	245.66	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	45.88	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	600	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	167	-
Spacing of links prvd, Sv (mm)	150	-
Asv Provided (sqmm)	670.21	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	150	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	900	mm
Maximum	=	450	mm
Spacing considered	=	150	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone

Link Dia.	8	8	---	8	---
Spacing	150	168	---	150	---

Secondary Links:

Other link T8@150c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	GFR To FFR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	230	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm
No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	5.3 >= 4 Hence, Design as Wall	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[29] : 1.5 (DL) -1.5 (EQ-X)	
Critical Location	=	Bottom Joint	
Pu	=	1865.16	kN
Mux	=	834.25	kNm
Muy	=	-91.71	kNm
Vux	=	-62.42	kN
Vuy	=	366.34	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	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.973
Top	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.98

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	45.168	No Beam	10200 x 230 x 765	-	92.156	0.612
Top	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Minor axis = 0.72

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	84.19	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	9.72	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.98
Slenderness Ratio	=	Effective Length / D
	=	1.8, Wall not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.72
Slenderness Ratio	=	Effective Length / B
	=	7, Wall 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	834.25	84.19	834.25	0	834.25
Minor Axis - Muy	-91.71	---	-91.71	0	-91.71

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	=	1865.16	kN
Mux	=	834.25	kNm
Muy	=	-91.71	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	1.02	
Reinforcement Provided	=	14-T25 +12-T20	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	6.27	deg
MRes	=	839.28	kNm
MCap	=	959.17	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.88 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	6-T16	4-T12	6-T16
Ast provided	1206.37	452.39	1206.37
Pt as % of entire wall	0.43 %	0.16 %	0.43 %
Pt as % of zone	1.75 %	0.32 %	1.75 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[26] : 1.5 (DL) +1.5 (EQ+X)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	366.3371	-159.7374
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	1.6319	0.7116
Pt (%)	0.511	0.511
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	230
Hw/Lw	1.832	9.7174
	> 1	> 1
Thus Shear Strength, Tc	K2 x SquareRoot(Fck)*(Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.303
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15
Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	
	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not Required**
Pt	0.5105	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	188.34	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	178	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	505.13	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	199	-

Spacing of links prvd, Sv (mm)	175	-
Asv Provided (sqmm)	574.46	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	175	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	690	mm
Maximum	=	450	mm
Spacing considered	=	175	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	8	---	8	---
Spacing	175	199	---	175	---

Secondary Links:

Other link T8@175c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	FFR To SFR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	230	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm

No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	5.3 >= 4 Hence, Design as Wall	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[29] : 1.5 (DL) -1.5 (EQ-X)	
Critical Location	=	Bottom Joint	
Pu	=	1483.93	kN
Mux	=	576.87	kNm
Muy	=	-97.34	kNm
Vux	=	-64.78	kN
Vuy	=	343.62	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	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97
Top	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97

Sway Condition (as per Stability Index)	=	Non Sway
Effective Length Factor along Major Axis	=	0.98

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	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495
Top	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495

Sway Condition (as per Stability Index)	=	Non Sway
Effective Length Factor along Minor		

axis	=	0.69	

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	66.98	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	9.72	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.98	
Slenderness Ratio	=	Effective Length / D	
	=	1.8, Wall not Slender Along D	

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.69	
Slenderness Ratio	=	Effective Length / B	
	=	6.7, Wall Not Slender Along B	

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	576.87	66.98	576.87	0	576.87
Minor Axis - Muy	-97.34	---	-97.34	0	-97.34

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	=	1483.93	kN
Mux	=	576.87	kNm
Muy	=	-97.34	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.64	
Reinforcement Provided	=	14-T25 +12-T20	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	9.58	deg
MRes	=	585.02	kNm
MCap	=	778.8	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.75 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	6-T12	4-T12	6-T12
Ast provided	678.58	452.39	678.58
Pt as % of entire wall	0.24 %	0.16 %	0.24 %
Pt as % of zone	0.98 %	0.32 %	0.98 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[26] : 1.5 (DL) +1.5 (EQ+X)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	343.6223	-166.838
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	1.5307	0.7432
Pt (%)	0.322	0.322
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	230
Hw/Lw	1.832	9.7174
	> 1	> 1
Thus Shear Strength,Tc	K2 x SquareRoot(Fck)*(1Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.303
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15
Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	

	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not Required**
Pt	0.3225	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	188.34	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	155.29	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	460	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	218	-
Spacing of links prvd, Sv (mm)	200	-
Asv Provided (sqmm)	502.65	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	200	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	690	mm
Maximum	=	450	mm
Spacing considered	=	200	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	8	---	8	---
Spacing	200	219	---	200	---

Secondary Links:

Other link T8@200c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	SFR To TFR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	230	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm
No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	5.3 >= 4 Hence, Design as Wall	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[31] : 1.5 (DL) +1.5 (EQ-Y)	
Critical Location	=	Bottom Joint	
Pu	=	1097.37	kN
Mux	=	272.18	kNm
Muy	=	-230.5	kNm
Vux	=	-155.28	kN
Vuy	=	196.25	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	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97
Top	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.98

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	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495
Top	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Minor axis = 0.69

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	49.53	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	9.72	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.98
Slenderness Ratio	=	Effective Length / D
	=	1.8, Wall not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.69
Slenderness Ratio	=	Effective Length / B
	=	6.7, Wall 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	272.18	49.53	272.18	0	272.18
Minor Axis - Muy	-230.5	---	-230.5	0	-230.5

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	=	1097.37	kN
Mux	=	272.18	kNm
Muy	=	-230.5	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.64	
Reinforcement Provided	=	14-T25 +12-T20	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	40.26	deg
MRes	=	356.67	kNm
MCap	=	569.02	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.63 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	6-T12	4-T12	6-T12
Ast provided	678.58	452.39	678.58
Pt as % of entire wall	0.24 %	0.16 %	0.24 %
Pt as % of zone	0.98 %	0.32 %	0.98 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load	[26] : 1.5 (DL) +1.5	[32] : 1.5 (DL) -1.5

Combination	(EQ+X)	(EQ+Y)
Design shear force, Vu (kN)	322.4764	-155.2845
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	1.4365	0.6918
Pt (%)	0.322	0.322
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	230
Hw/Lw	1.832	9.7174
	> 1	> 1
Thus Shear Strength,Tc	K2 x SquareRoot(Fck)*(Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.303
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15
Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	
	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not Required**
Pt	0.3225	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	188.34	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	134.14	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	460	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	218	-
Spacing of links prvd, Sv (mm)	200	-
Asv Provided (sqmm)	502.65	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	200	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	690	mm
Maximum	=	450	mm
Spacing considered	=	200	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	8	---	8	---
Spacing	200	219	---	200	---

Secondary Links:

Other link T8@200c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	TFR To 4FR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	230	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm
No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	

D/B Ratio : 5.3 >= 4 Hence, Design as Wall

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[31] : 1.5 (DL) +1.5 (EQ-Y)	
Critical Location	=	Bottom Joint	
Pu	=	710.22	kN
Mux	=	224.74	kNm
Muy	=	-198.35	kNm
Vux	=	-133.23	kN
Vuy	=	165.09	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	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97
Top	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Major Axis = 0.98

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	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495
Top	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495

Sway Condition (as per Stability Index) = Non Sway

Effective Length Factor along Minor axis = 0.69

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	32.06	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	9.72	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.98
Slenderness Ratio	=	Effective Length / D
	=	1.8, Wall not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.69
Slenderness Ratio	=	Effective Length / B
	=	6.7, Wall Not Slender Along B

Calculation of Design Moment

Direction	Manalysis	Mmin (Abs)	Mdesign	Mslndx (Abs)	Mdesign-final
	A	B	C	E	F
Major Axis - Mux	224.74	32.06	224.74	0	224.74
Minor Axis - Muy	-198.35	---	-198.35	0	-198.35

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	=	710.22	kN
Mux	=	224.74	kNm
Muy	=	-198.35	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.64

Reinforcement Provided	=	14-T25 +12-T20	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	41.43	deg
MRes	=	299.75	kNm
MCap	=	506.51	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.59 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	6-T12	4-T12	6-T12
Ast provided	678.58	452.39	678.58
Pt as % of entire wall	0.24 %	0.16 %	0.24 %
Pt as % of zone	0.98 %	0.32 %	0.98 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[26] : 1.5 (DL) +1.5 (EQ+X)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	260.42	-133.2321
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)
	1.1601	0.5935
Pt (%)	0.322	0.322
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	230
Hw/Lw	1.832	9.7174
	> 1	> 1
Thus Shear Strength,Tc	K2 x SquareRoot(Fck)*(Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.303
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15
Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	
	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not**

		Required
Pt	0.3225	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	188.34	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	72.08	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	460	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	218	-
Spacing of links prvd, Sv (mm)	200	-
Asv Provided (sqmm)	502.65	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	200	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	690	mm
Maximum	=	450	mm
Spacing considered	=	200	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	8	---	8	---
Spacing	200	219	---	200	---

Secondary Links:

Other link T8@200c/c

General Data

Wall No.	:	C1	
Frame Type	=	Non-Ductile	
Level	:	4FR To 5FR	
Design Code	=	IS 456 - 2000 + IS 13920 - 2016	
Grade Of Concrete	=	M30	N/sqmm
Grade Of Steel (Main)	=	Fe550	N/sqmm
Grade Of Steel (Shear)	=	Fe415	N/sqmm
Grade Of Steel - Flexural Design	=	Fe550	N/sqmm
Grade Of Steel - Shear Design	=	Fe415	N/sqmm
Wall B	=	230	mm
Wall D	=	1220	mm
Clear Cover	=	40	mm
Clear Floor Height @ B	=	2235	mm
Clear Floor Height @ D	=	2235	mm
No Of Floors	=	1	
No Of Walls In Group	=	1	
Wall Type	:	UnBraced	
Minimum eccentricity check	:	One Axis at a Time	
Code defined D/B ratio	:	4	
D/B Ratio	:	5.3 >= 4 Hence, Design as Wall	

Flexural Design (Analysis Forces)

Analysis Reference No.	=	C1	
Load Combination	=	[29] : 1.5 (DL) -1.5 (EQ-X)	
Critical Location	=	Top Joint	
Pu	=	326.79	kN
Mux	=	-450.77	kNm
Muy	=	65.5	kNm
Vux	=	-77.2	kN
Vuy	=	320.87	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	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.97
Top	1270.853	No Beam	11790 x 230 x 765	-	79.727	0.941

Sway Condition (as per Stability

Index)	=	Non Sway
Effective Length Factor along Major Axis	=	0.96

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	45.168	No Beam	10200 x 230 x 765	-	92.156	0.495
Top	45.168	No Beam	10200 x 230 x 765	-	92.156	0.329

Sway Condition (as per Stability Index)	=	Non Sway	
Effective Length Factor along Minor axis	=	0.64	

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	
	=	45.14	mm
Minimum Eccentricity	>	20	mm
Mminx	=	Pu x Minimum Eccentricity	
	=	14.75	kNm

Slenderness Check

Max Slenderness Ratio(L/B)	=	9.72	
	<	60	(Hence Ok)

Column Is Unbraced Along D

Slenderness Check Along D:

Effective Length Factor	=	0.96
Slenderness Ratio	=	Effective Length / D
	=	1.76, Wall not Slender Along D

Column Is Unbraced Along B

Slenderness Check Along B:

Effective Length Factor	=	0.64
Slenderness Ratio	=	Effective Length / B
	=	6.22, Wall Not Slender Along B

Calculation of Design Moment

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

Major Axis - Mux	-450.77	14.75	-450.77	0	-450.77
Minor Axis - Muy	65.5	---	65.5	0	65.5

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	=	326.79	kN
Mux	=	-450.77	kNm
Muy	=	65.5	kNm

Resultant Moment (Combined Action)

Moment Capacity Check

Pt Calculated	=	0.64	
Reinforcement Provided	=	14-T25 +12-T20	
Load Angle	=	Tan^{-1}(Muy/Mux)	
	=	8.27	deg
MRes	=	455.51	kNm
MCap	=	562.2	kNm
Capacity Ratio	=	MRes/ MCap	
	=	0.81 <= 1	

Wall Configuration

	Z1	Mid	Z1
Length (mm)	300	620	300
Reinforcement	6-T12	4-T12	6-T12
Ast provided	678.58	452.39	678.58
Pt as % of entire wall	0.24 %	0.16 %	0.24 %
Pt as % of zone	0.98 %	0.32 %	0.98 %

Design Of Shear

Shear Calculation	Along D	Along B
Critical Load Combination	[1] : 1.5 (DL) +1.5 (LL)	[32] : 1.5 (DL) -1.5 (EQ+Y)
Design shear force, Vu (kN)	330.6075	-130.2947
Design shear stress, Tv (N/sqmm)	Vu / (B x 0.8 x D)	Vu / (B x 0.8 x D)

	1.4728	0.5804
Pt (%)	0.322	0.322
Height of Wall, Hw (mm)	2235	2235
Length of Wall, Lw (mm)	1220	230
Hw/Lw	1.832	9.7174
	> 1	> 1
Thus Shear Strength, Tc	K2 x SquareRoot(Fck)*(Hw/Lw + 1)/(Hw/Lw - 1)	
K1	-	-
K2	0.045	0.045
Tc (N/sqmm)	0.839	0.303
Tcmin	K3 x SquareRoot(Fck)	
K3	0.15	0.15
Tcmin (N/sqmm)	0.8216	0.8216
Hence Design Tc (N/sqmm)	0.839	0.8216
Tcmax	0.17 x Fck	
	5.1	5.1
	Tc < Tcmax	Tc < Tcmax
Thus, Tc (N/sqmm)	0.839	0.8216
	Since, Tv > Tc	Since, Tv < Tc
Shear Links Design	**Shear Links Required**	**Shear Links Not Required**
Pt	0.3225	-
Shear resisted by concrete Vc (kN)	(Tc-e) x (B x Deff)	-
	188.34	-
Shear to be resisted by shear reinforcement = Vus (kN)	Vu - Vc	
	142.27	-
Area of shear reinforcement required, Asv (sqmm)	(Vus x 1000) / (Deff x 0.87 x Fy)	(Vus x 1000) / (Beff x 0.87 x Fy)
	460	-
Master Link Rebar (mm)	T8	-
Number of legs provided	2	-
Spacing of links reqd (mm)	218	-
Spacing of links prvd, Sv (mm)	200	-
Asv Provided (sqmm)	502.65	-

Design Of Links

Main Links

Links in the zone where special confining links are not required

Normal Links

Diameter of main horizontal steel	=	8	mm
Thus, Spacing	=	200	mm
Spacing of horizontal reinforcement is minimum of following			
D / 5	=	244	mm
3 x B	=	690	mm
Maximum	=	450	mm
Spacing considered	=	200	mm

Table For Links

	Required			Provided	
	Normal Design	Shear Design	Ductile Design	Normal Zone	Ductile Zone
Link Dia.	8	8	---	8	---
Spacing	200	219	---	200	---

Secondary Links:

Other link T8@200c/c

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GRADE 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 layer
24	Df	=	Thickness of Flange in mm
25	Ec	=	Modulus of elasticity of concrete
26	Es	=	Modulus of elasticity of steel

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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	M_{Tu}	=	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 + M_{Tu} 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/Bd^2
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
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	V^{D+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	=	V^{D+L}Left - 1.4 x (MsLeft + MhRight)/L in kN
59	Vu-A2	=	V^{D+L}Left + 1.4 x (MhLeft + MsRight)/L in kN
60	Vu-B1	=	V^{D+L}Right + 1.4 x (MsLeft + MhRight)/L in kN
61	Vu-B2	=	V^{D+L}Right - 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 + V_{Tu} in kN
67	V_{Tu}	=	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
1.	Ptmax	: 26.5.1.1
2.	Ptmin	: 26.5.1.1
3.	M_{Tu}	: 41.4.2
4.	V_{Tu}	: 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	: G6	
Beam No	: G B 2 A	
Analysis Reference (Member)	: 69,81 (0 m)	
Beam Length	: 580	mm
Breadth (B)	: 300	mm
Depth (D)	: 450	mm
Effective Depth (d)	: 395	mm
Design Code	: IS 456 : 2000 + IS 13920 : 2016	
Beam Type	: Ductile Beam	
Grade Of Concrete (Fck)	: M30	N/sqmm
Grade Of Steel (Main)	: Fe550	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)	: 0.21	%

Flexure Design						
	Beam Bottom			Beam Top		
	Left	Mid	Right	Left	Mid	Right
Critical L/C - Analysis	406	406	407	407	406	406
Critical L/C - RCDC	31	31	32	32	31	31
Mu (kNm)	10.58	11.06	9.14	34.19	11.9	35.87
Tu (kNm)	0.31	0.31	0.23	1.19	0.31	0.31
M_{Tu} (kNm)	0.54	0.54	0.4	2.08	0.54	0.54
Mud (kNm)	11.12	11.61	9.54	36.27	12.44	36.41
MuLim (kNm)	117	117	117	117	117	117
R	0.31	0.323	0.266	1.011	0.347	1.015
Ptmin (%) (A)	0.218	0.218	0.218	0.218	0.218	0.218
Ptclc (%) (B')	0.218	0.218	0.218	0.222	0.218	0.223
Pcclc (%) (C)	0	0	0	0	0	0
PtPrv (%)	0.373	0.373	0.373	0.373	0.373	0.373
Ast (sqmm)	198.22	198.22	198.22	201.8	198.22	202.63
AstDuctile (sqmm) (E)	169.65	84.82	169.65	84.82	84.82	84.82
AstFinal (Max(Ast, AstDuctile)) (sqmm)	198.22	198.22	198.22	201.8	198.22	202.63
AstPrv (sqmm)	339.3	339.3	339.3	339.3	339.3	339.3
Reinforcement Provided	3-T16	3-T16	3-T16	3-T16	3-T16	3-T16

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
E	=	AstDuctile	=	Area of reinforcement as per ductile detailing requirements

Ductile Detailing

AstDuctile - Bottom (left & Right)	=	Max(50% of Ast provided at top, 25% of max Ast provided from all zones)
AstDuctile - Top (left & Right), Bottom (Mid) & Top (Mid)	=	25% of max Ast provided from all zones

Shear Design			
	Left	Mid	Right
Critical L/C - Analysis	409	409	406
Critical L/C - RCDC	34	34	31

PtPrv (%)	0.373	0.373	0.373
Vu (kN)	27.16	23.34	19.09
Tu (kNm)	6.61	6.61	0.31
V_{Tu} (kN)	46	46	2.18
Vut (kN)	73.16	69.34	21.27
V^{D+L} (kN)	14.18	11.08	11.53
Mh (kNm)	58.83		58.83
Ms (kNm)	58.83		58.83
Sway-Right (kN)	10.63	13.73	36.34
Sway-Left (kN)	38.99	35.89	14.81
Vu-Sway (kN)	38.99	35.89	36.34
Vud (kN)	73.16	69.34	36.34
Tv (N/sqmm)	0.43	0.76	0.4
Tc (N/sqmm)	0	0	0
Vc (kN)	0	0	0
Vus=Vud-Vc (kN)	73.16	69.34	36.34
Legs	2	2	2
Stirrup Rebar	8	8	8
Asv Torsion (sqmm)	358.506	347.604	67.803
Asv Torsion Prv (sqmm)	1436.29	670.27	1436.29
Asv Reqd (sqmm/m)	512.96	486.19	254.83
SvCalc (mm)	70	150	70
SvPrv (mm)	70	150	70
Asv Total Prv (sqmm)	1436.29	670.27	1436.29

Maximum Spacing Criteria

Basic

Spc1 =0.75d = 296 mm

Spc2 = 300 mm

For Torsion

(X1 = 190, Y1 = 410)

Spc3 = X1 = 190 mm

Spc4=(X1+Y1)/4 = 150 mm

For Ductility

Left Section

Spc5 = d / 4 = 99 mm

Spc6 = 6 x Small Longitudinal Dia = 70 mm

Spc7 = 100 mm

Mid Section

Spc5 = d / 2 = 198 mm

Right Section

Spc5 = d / 4	=	99	mm
Spc6 = 6 x Small Longitudinal Dia	=	70	mm
Spc7	=	100	mm

SFR Design

Beam Width	= 230	mm
Beam Depth	= 450	mm
Web Depth	= 450 <= 750	mm

Side Face Reinforcement not required.

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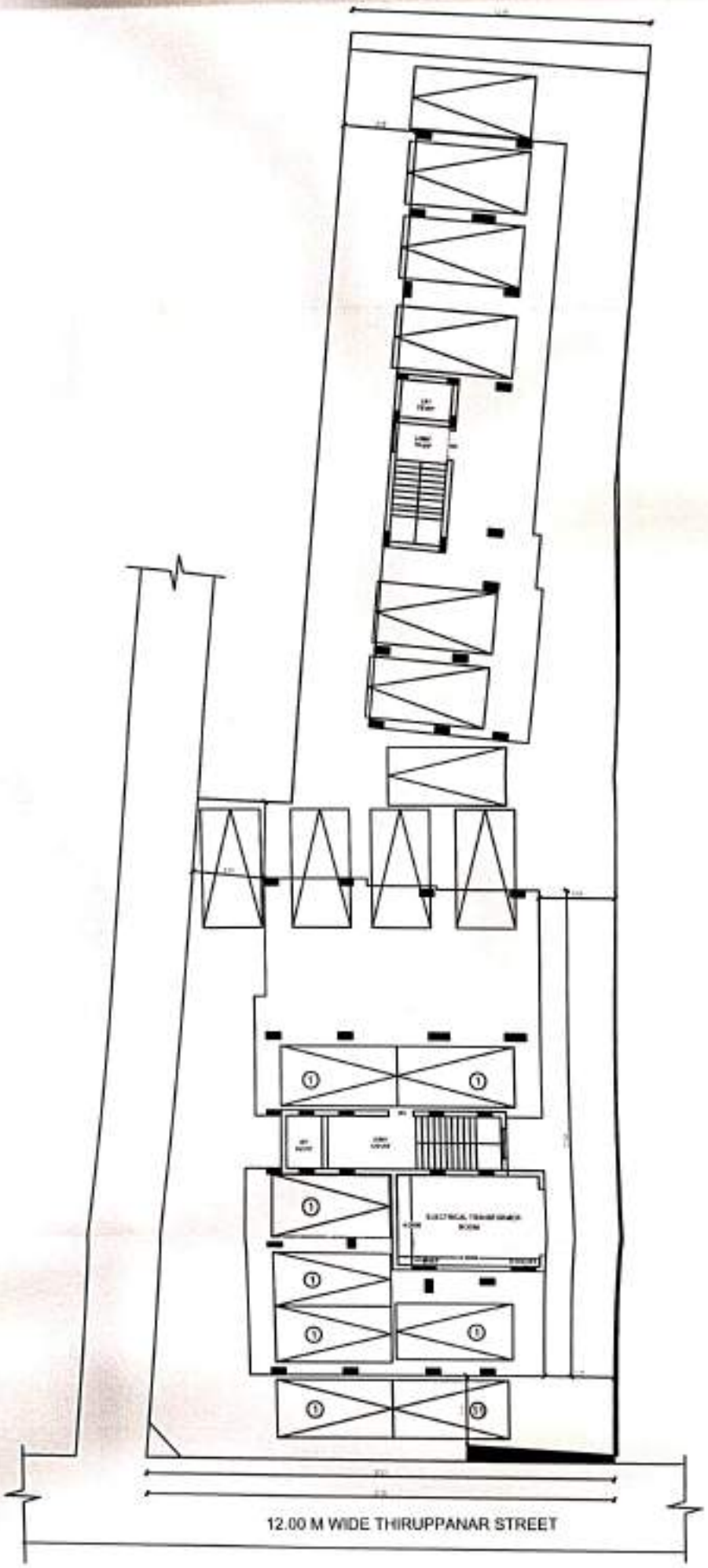
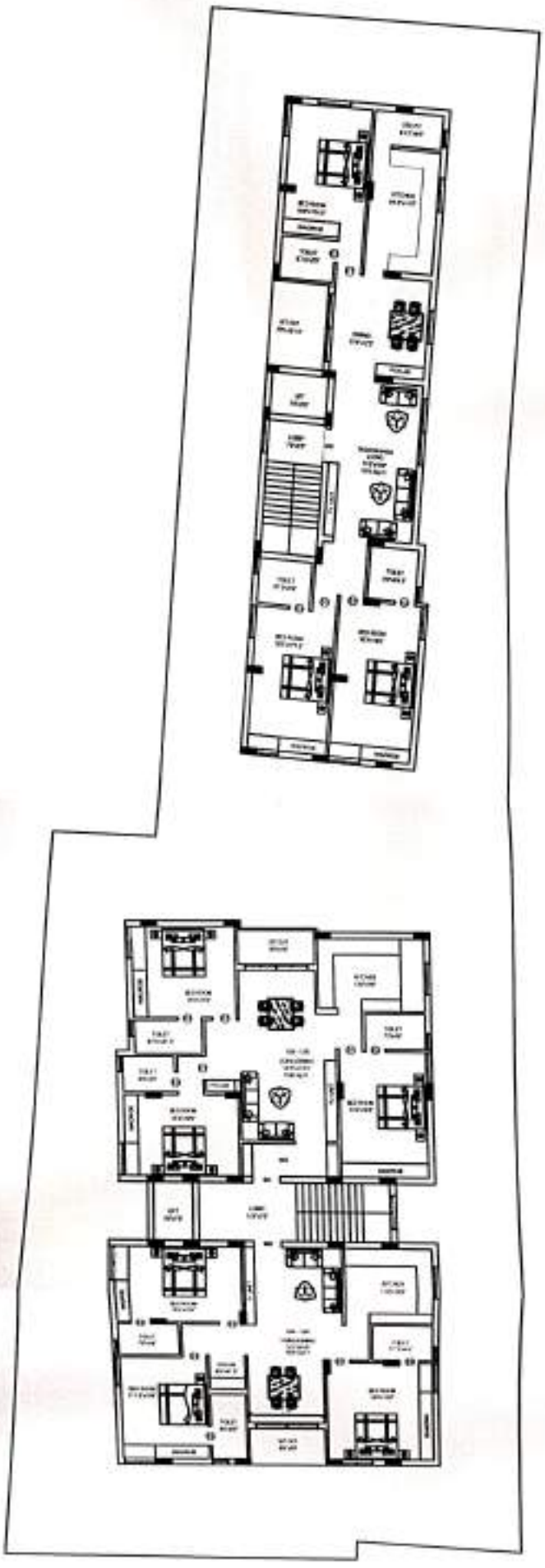
FLOORS RESIDENTIAL BUILDING AT MOGAPPAIR



STILT FLOOR

FLOORS RESIDENTIAL BUILDING AT MOGAPPAIR



TYPICAL FLOOR PLAN
FIRST, SECOND, THIRD,
FOURTH AND FIFTH FLOOR

CHENNAI METROPOLITAN DEVELOPMENT AUTHORITY
'Thalamuthu Natarajan Building', No.1, Gandhi Irwin Road,
Egmore, Chennai-600 008.

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that **Thiru. VIJAYAN. S** has enrolled as **Registered Structural Engineer Grade-I (SE)** with Chennai Metropolitan Development Authority (CMDA) who has the qualification of **M.E., (Structural Engg.)** and experience in the relevant field for **5 years.**

He has been given the Registration No.**SE/GR-I/2022/11/346** on **08.11.2022.** He 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 **07.11.2027.**

(A. MEGANATHAN)
Superintendent

GREATER CHENNAI CORPORATION
TOWN PLANNING DEPARTMENT

PROFESSIONAL REGISTRATION CERTIFICATE

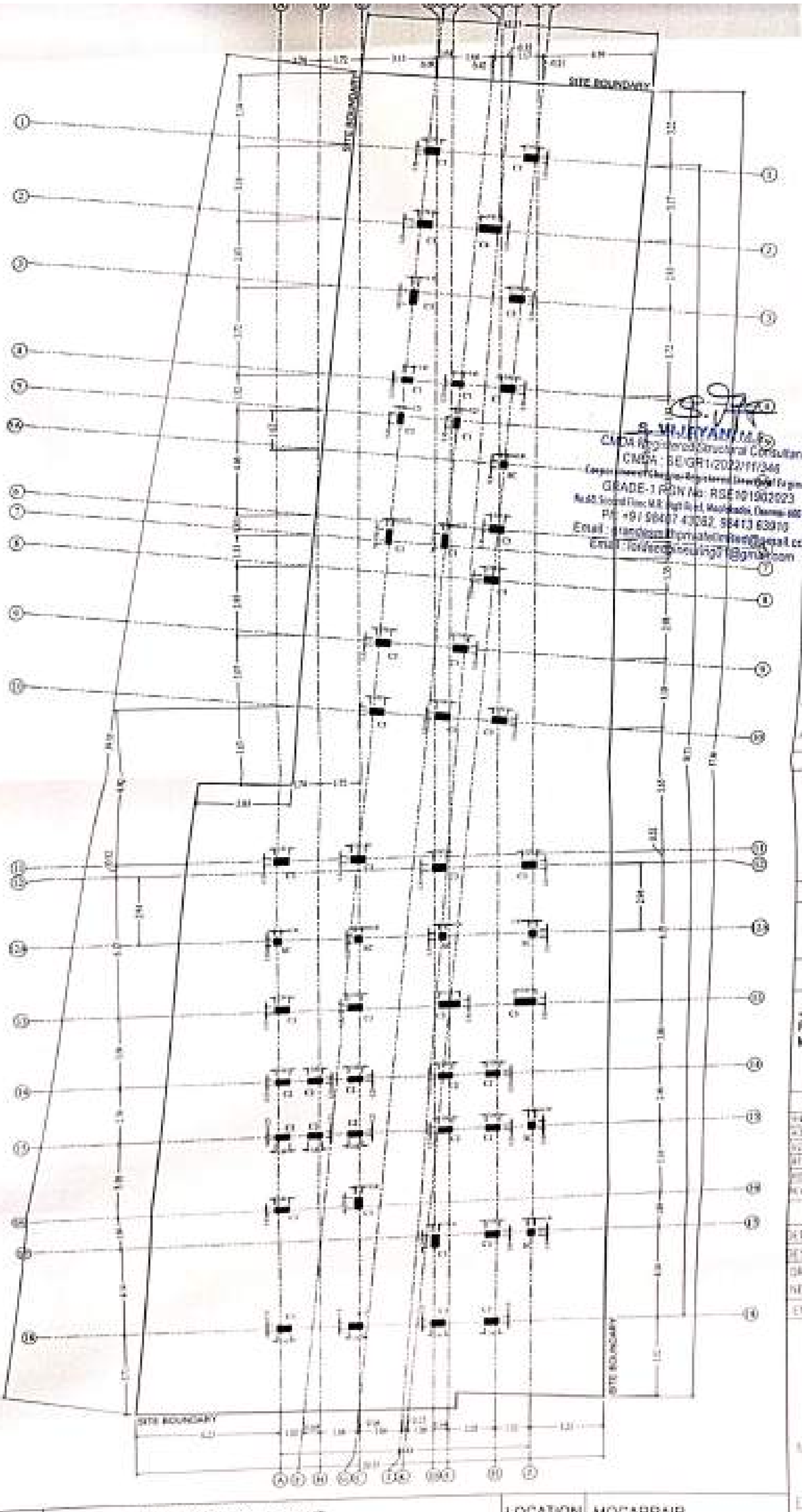
This is to certify that **Mr.Vijayan S** has been enrolled as **Registered Structural Engineer Grade- I (RSE)** in Greater Chennai Corporation (GCC) who has the qualification of **M.E.(Structural Engg.)** with minimum of **5 years** experience in the relevant field.

The Registration No. is **RSE101902023** dated **08.01.2024**. It is informed herewith to comply with the scope of work, duties and responsibilities as 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 MA&WS (MA1) Dept. dated 04.02.2019. and as amended in G.O.(MS) No.16 MA&WS (MA1) Dept. dated 31.01.2020.

This Registration is valid upto . **07.01.2029**

Superintending Engineer (Electrical)
Greater Chennai Corporation.

RGN No: RSE101902023
Dated :08.01.2024



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REFERENCES:

3. DO NOT SCALE THE DRAWING. WRITTEN DIMENSIONS ARE TO BE FOLLOWED.

5. REFER IS 456 – 2000 FOR RCC CONSTRUCTION AND PRACTICE.

GENERAL NOTES

CLEAR COVER

1. COLUMN = 40mm.
2. ROOF BEAM = 25mm.
3. ROOF SLAB = 20mm.
4. GRADE BEAM = 25mm.
5. FOOTING BASE = 75mm.
6. FOOTING SIDE = 50mm.

LEGEND

RC COLUMN
M 30 CONCRETE
Fe 550 STEEL

ARCHITECT

JC250688–NEXA–ASTA–(S+03) RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

REV	DESCRIPTION	DATE
R0	ISSUED FOR CONSTRUCTION	30.07.2025

AMENDMENTS

DETAILED: K.MADI — SCALE: FIT
DESIGN: BALAKRISHNAN.M — CHKD: S.VIJEYAN
DRAWING NO: NEXA–ASTA–MOGA–STR–01–R0 — REV: 00

ENGINEERING – DESIGN – CONSULTANCY

LORDS ENGINEERING STRUCTURAL

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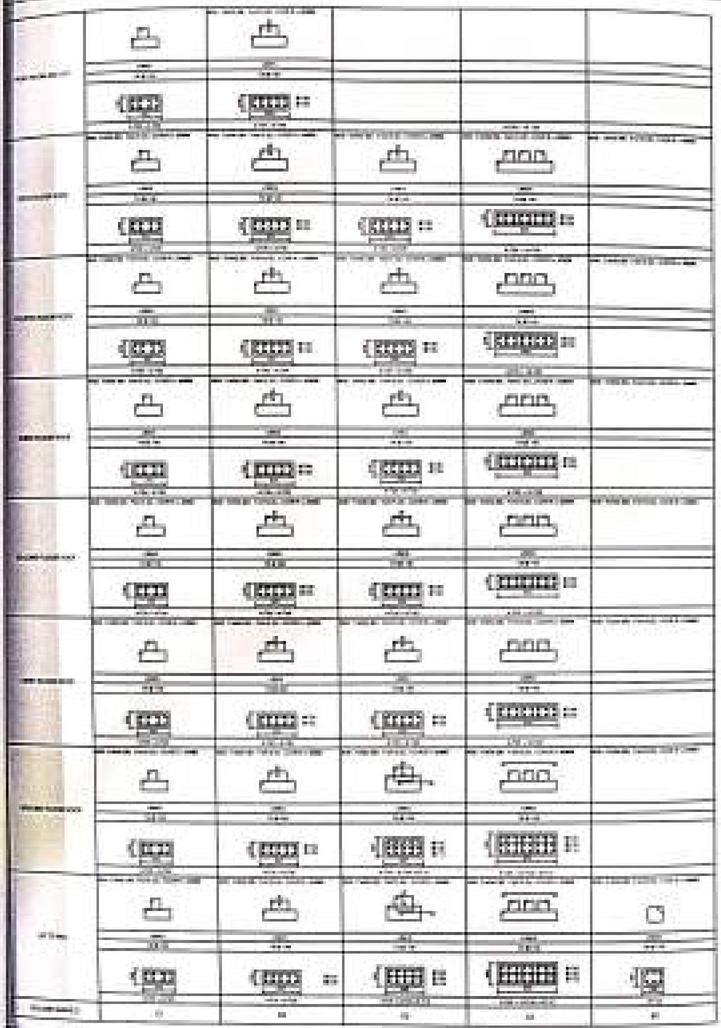
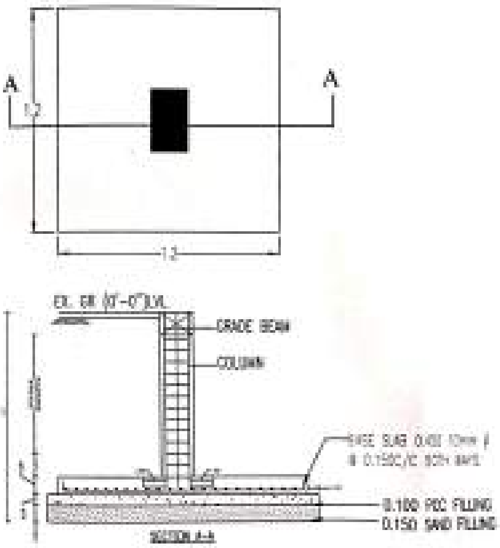
Mobile: +91 98407 43262

TITLE: COLUMN GRID MARKING LAYOUT

LOCATION: MOGAPPAIR





PLAN

STUB FOOTING DETAILS

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TECHNICAL SPECIFICATIONS

REFERENCES

GENERAL NOTES

CLEAR COVER

LEGEND

RC COLUMN
M30 CONCRETE
Fe500 STEEL

ARCHITECT

JC250688-NEXA-ASTA-(S+05)
RESIDENTIAL BUILDING AT MOGAPPAIR

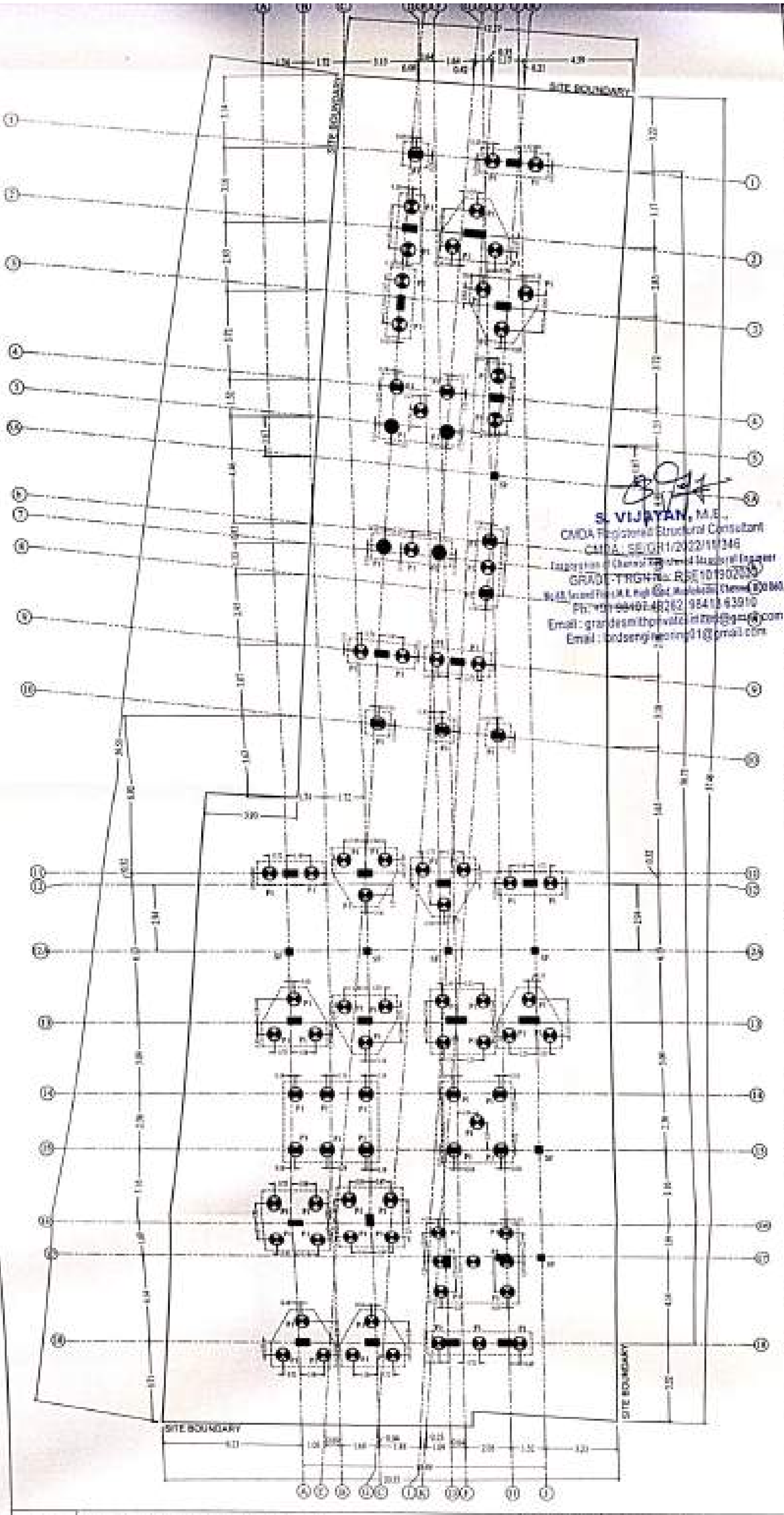
DATE : 30.07.2025

DESCRIPTION

AMENDMENTS

LORDS ENGINEERING

PROJECT: JC250688-NEXA-ASTA-(S+05) | SITE: MAGAPPAIR | TITLE: COLUMN REINFORCEMENT SCHEDULE



[illegible]

2. [illegible]

3. [illegible] CONCRETE WORKS

4. COARSE AGGREGATE [illegible]

5. [illegible] TO REMOVE DUST PARTICLES

6. RIVER SAND SHALL BE [illegible] TO REMOVE ORGANIC MATTER

7. PROPER DESIGN MIX OF CEMENT CONCRETE SHALL BE ACHIEVED THROUGH WEIGHT BATCHING AND THE SAME SHALL BE FOLLOWED THROUGH OUT THE CONSTRUCTION

8. COMPRESSIVE STRENGTH OF CEMENT CONCRETE SHALL BE TESTED DURING CONSTRUCTION FOR ALL COMPONENTS OF THE BUILDING AND RECORDED

9. WATER SHALL BE OF GOOD QUALITY AND IT SHALL BE TESTED IN A REPUTED LABORATORY TO ASCERTAIN THE SUITABILITY FOR CEMENT CONCRETE WORK

10. CURING OF CONCRETE STRUCTURES BY APPROPRIATE METHOD SHALL BE SUFFICIENTLY DONE TO ACHIEVE THE DESIRED DESIGN STRENGTH [illegible]

REFERENCES:

1. ALWAYS REFER THE LATEST REVISION OF THE SAME DRAWING NUMBER

2. REFER RELEVANT ARCHITECTURAL DRAWINGS FOR CORRECT BUILDING COMPONENT MEASUREMENTS, [illegible]

3. DO NOT SCALE THE DRAWING. WRITTEN DIMENSIONS [illegible]

4. ALL DIMENSIONS ARE IN [illegible] (FEET AND INCHES) UNLESS OTHERWISE MENTIONED. MEASUREMENTS IN METRIC ARE MENTIONED ALONG THE VALUES WHEREVER NECESSARY

5. REFER IS 456 – 2000 FOR RCC CONSTRUCTION AND PRACTICE

6. REFER IS [illegible] – 2004 FOR REINFORCEMENT DETAILING IN RCC STRUCTURES

7. LAP LENGTH FOR REINFORCEMENT [illegible]

8. REFER IS 2911 – 1997 FOR PILE FOUNDATION

10. REFER IS 3370 – 2009 FOR CONCRETE STRUCTURES FOR LIQUID RETAINING

11. REFER IS 800 – 2007 FOR STEEL STRUCTURAL DESIGN & CONSTRUCTION

GENERAL NOTES

1. OVER LOADING OF THE STRUCTURE WITH DUMPING OF BUILDING MATERIALS AND EQUIPMENTS AT ONE PLACE SHALL BE AVOIDED DURING THE CONSTRUCTION

2. USE OF LIGHT WEIGHT CONCRETE BLOCKS FOR WALLS IS RECOMMENDED WHERE EVER POSSIBLE TO REDUCE THE SELF WEIGHT OF THE STRUCTURE

3. USE OF LOW DENSITY MATERIAL CONCRETE IS [illegible]

CLEAR COVER

1. COLUMN = 40mm.
2. ROOF BEAM = 25mm.
3. ROOF SLAB = 20mm.
4. GRADE BEAM = 25mm.
5. FOOTING BASE = 75mm.
6. FOOTING SIDE = 50mm.

LEGEND

RC COLUMN
M 30 CONCRETE
Fe 550 STEEL

ARCHITECT

JC250688–NEXA–ASTA–(S+03) RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

R4		
R3		
R2		
R1		
R0	ISSUED FOR CONSTRUCTION	30.07.2025
REV	DESCRIPTION	DATE

AMENDMENTS

DETAILED: K.MADI	SCALE:FIT	
DESIGNER: BALAKRISHNAN.M	CHAD: JAYAKUMAR.M	
DRAWING NO.		REV
NEXA–ASTA–MOGA–STRU–01–003		R0

ENGINEERING – DESIGN – CONSULTANCY

LORDS ENGINEERING STRUCTURAL
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TITLE	PILE GRID MARKING LAYOUT	LOCATION	MOGAPPAIR

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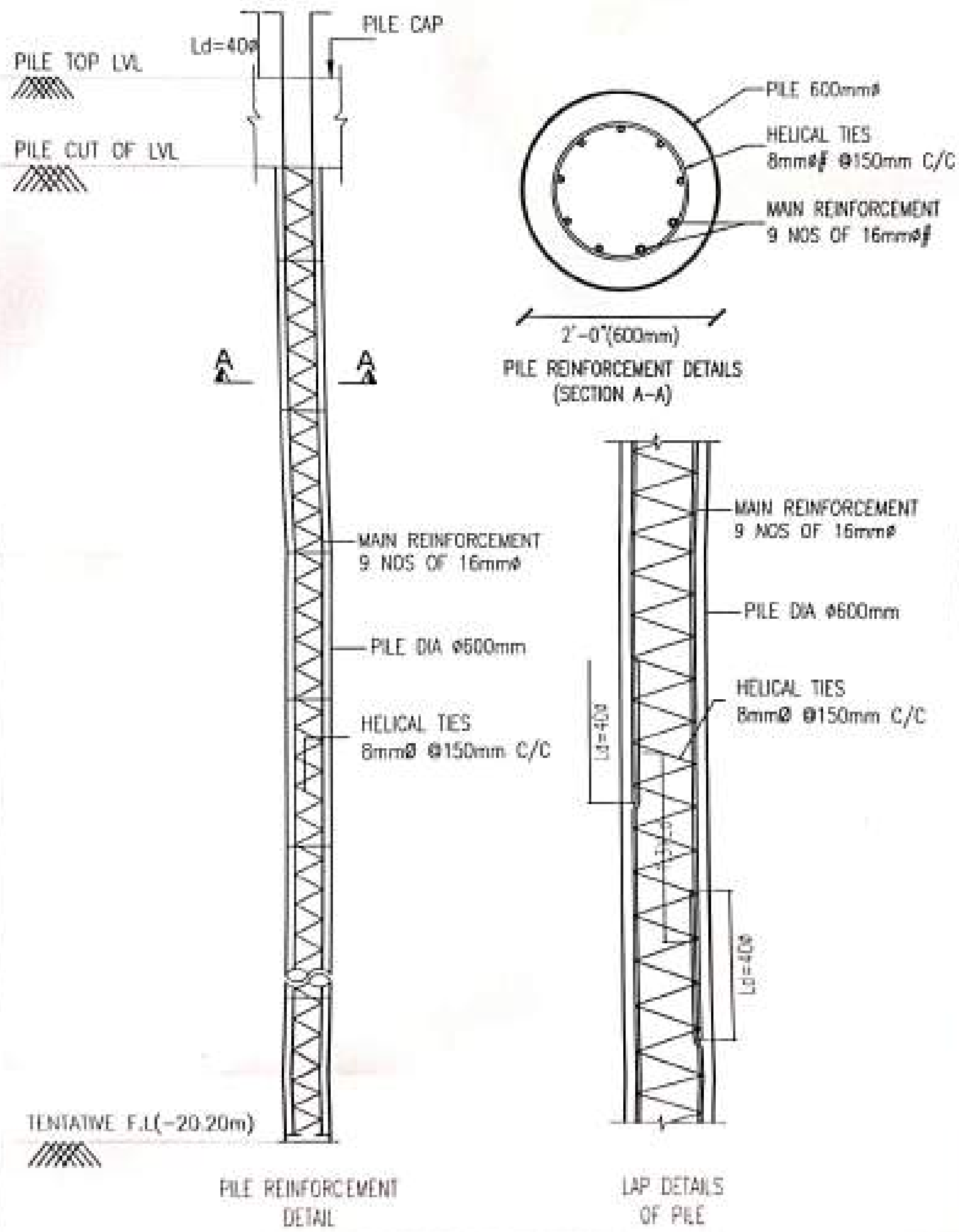


P1-PILE REINFORCEMENT DETAILS

TECHNICAL SPECIFICATIONS

REFERENCES:

GENERAL NOTES

CLEAR COVER

1. COLUMN = 40mm
2. ROOF BEAM = 25mm
3. ROOF SLAB = 20mm
4. GRADE BEAM = 25mm
5. FOOTING BASE = 75mm
6. FOOTING SIDE = 50mm

LEGEND

RC COLUMN
M 30 CONCRETE
Fe 550 STEEL

ARCHITECT

JC250688-NEXA-ASTA-(S+03)
RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

R4		
R3		
R2		
R1		
R0	ISSUED FOR CONSTRUCTION	30.07.2025
REV	DESCRIPTION	DATE

AMENDMENTS

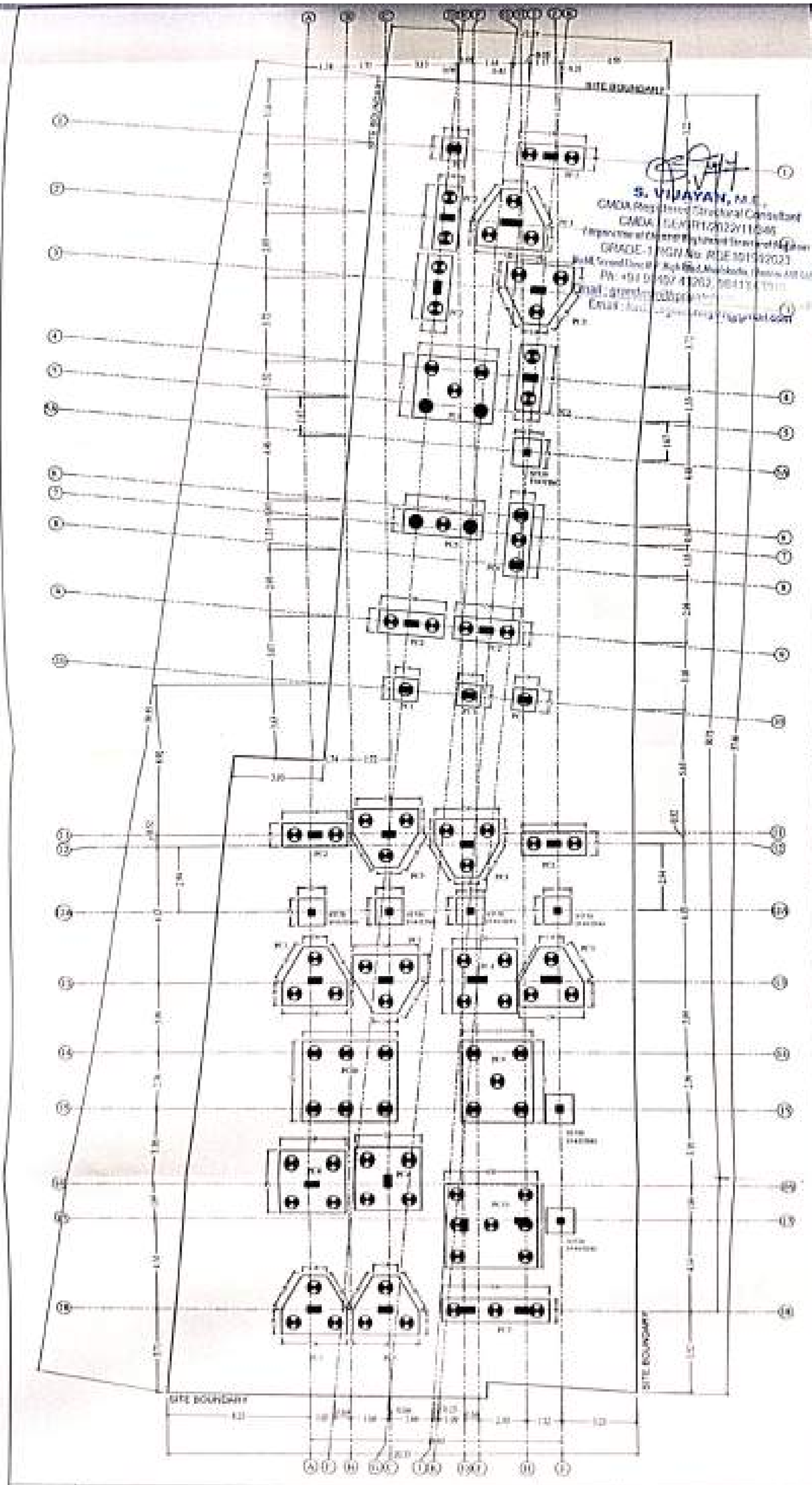
DETAILED: A.NAGI	SCALE: FIT
DESIGN: BALAKRISHNAN M	CHKD: JAYAKUMAR M
DRAWING NO. NEXA-ASTA-MOGA-STRU-01-004	REV R0

ENGINEERING - DESIGN - CONSULTANCY

LORDS ENGINEERING STRUCTURAL

No.68, SECOND FLOOR, MADHAVARAM REDHILLS HIGHROAD, MOOLAKADAI, PERAMBUR, CHENNAI-600 060.
E-Mail: lordsengineering01@gmail.com
Mobile: +91 98407 43262

TITLE	PILE SECTION DETAILS	LOCATION	MOGAPPAIR



REFERENCES:

GENERAL NOTES

CLEAR COVER

1. COLUMN = 40mm.
2. ROOF BEAM = 25mm.
3. ROOF SLAB = 20mm.
4. GRADE BEAM = 25mm.
5. FOOTING BASE = 75mm.
6. FOOTING SIDE = 50mm.

LEGEND

RC COLUMN
M 30 CONCRETE
FE 550 STEEL

ARCHITECT

JC250688-NEXA-ASTA-(S+03) RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

R4		
R3		
R2		
R1		
R0	ISSUED FOR CONSTRUCTION	30.07.2025
REV	DESCRIPTION	DATE

A M E N D M E N T S

DETAILED: K.NAGI	SCALE: NTS
DESIGN: BALAKRISHNAN.S.M	CHKD: JAYAKUMAR.M
DRAWING NO: NEXA-ASTA-MOGA-STRU-07-005	REV R0

ENGINEERING – DESIGN – CONSULTANCY

LORDS ENGINEERING STRUCTURAL

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Mobile: +91 99407 45262

TITLE	PILE CAP MARKING LAYOUT	LOCATION	MOGAPPAIR

TECHNICAL SPECIFICATIONS

REFERENCES

GENERAL NOTES

CLEAR COVER

LEGEND

RC COLUMN
M30 CONCRETE
Fe500 STEEL

ARCHITECT

JC250888-NEXA-ASTA-(S+03) RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

LORDS ENGINEERING

PILE CAP SCHEDULE (M30:Fe550)

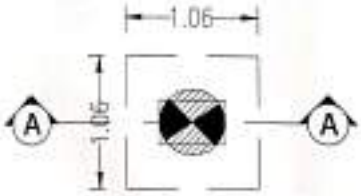
PILE CAP MARK	PILES	DIMENSIONS (m)			REINFORCEMENT			
					BOTTOM		TOP	
		L	B	D	ALONG L	ALONG B	ALONG L	ALONG B
PC1	600 DIA	1.06	1.06	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC2	600 DIA	2.86	1.06	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC3	600 DIA	AS PER	AS PER	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC4	600 DIA	2.86	2.86	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC5	600 DIA	3.42	1.04	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC6	600 DIA	3.24	1.06	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC7	600 DIA	4.66	1.06	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC8	600 DIA	3.42	2.70	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC9	600 DIA	3.12	3.42	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC10	600 DIA	4.16	3.42	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C
PC11	600 DIA	4.00	4.00	1.0	T16@150 C/C	T16@150 C/C	T12@150 C/C	T12@150 C/C

NOTE: PILECAP DEPTH

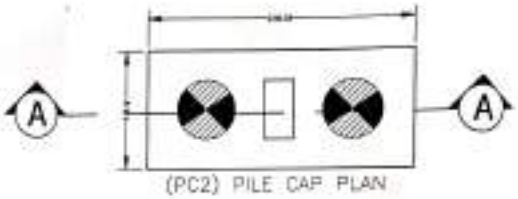
PILECAP DEPTH FROM NGL TO BOTTOM OF THE PILECAP: 1m

S. VIJAYAN, M.E.,
CMDA Registered Structural Consultant

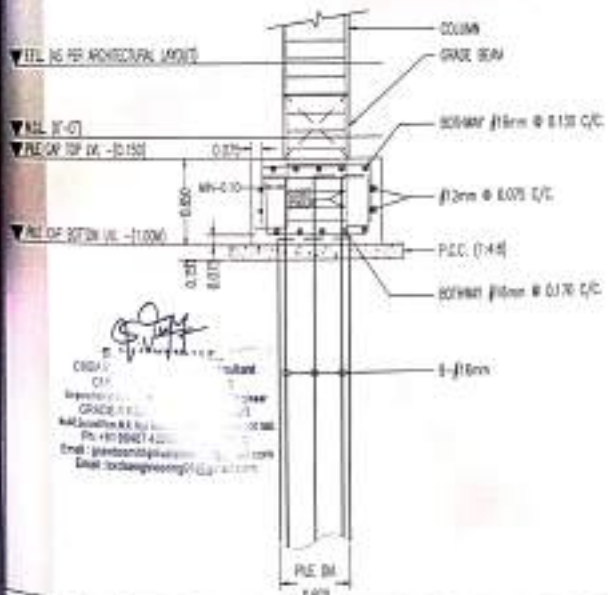
PROJECT: JC250888-NEXA-ASTA-(S+05) | SITE: MAGAPPAIR | TITLE: PILE CAP REINFORCEMENT SCHEDULE

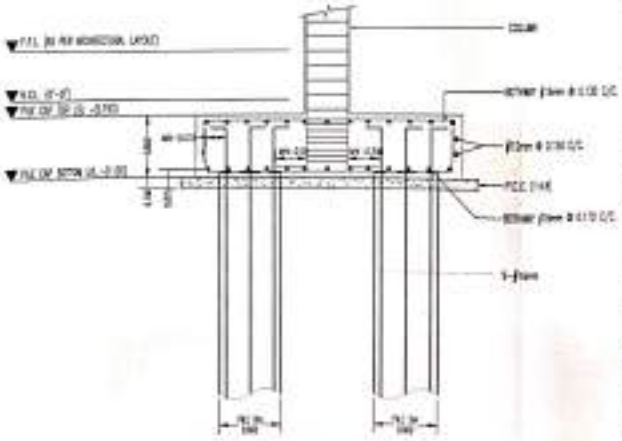


PLAN – P1/PC1



(PC2) PILE CAP PLAN





CROSS SECTION–A (PC2)

TECHNICAL SPECIFICATIONS

REFERENCES:

GENERAL NOTES

CLEAR COVER

LEGEND

RC COLUMN
M30 CONCRETE
Fe500 STEEL

ARCHITECT

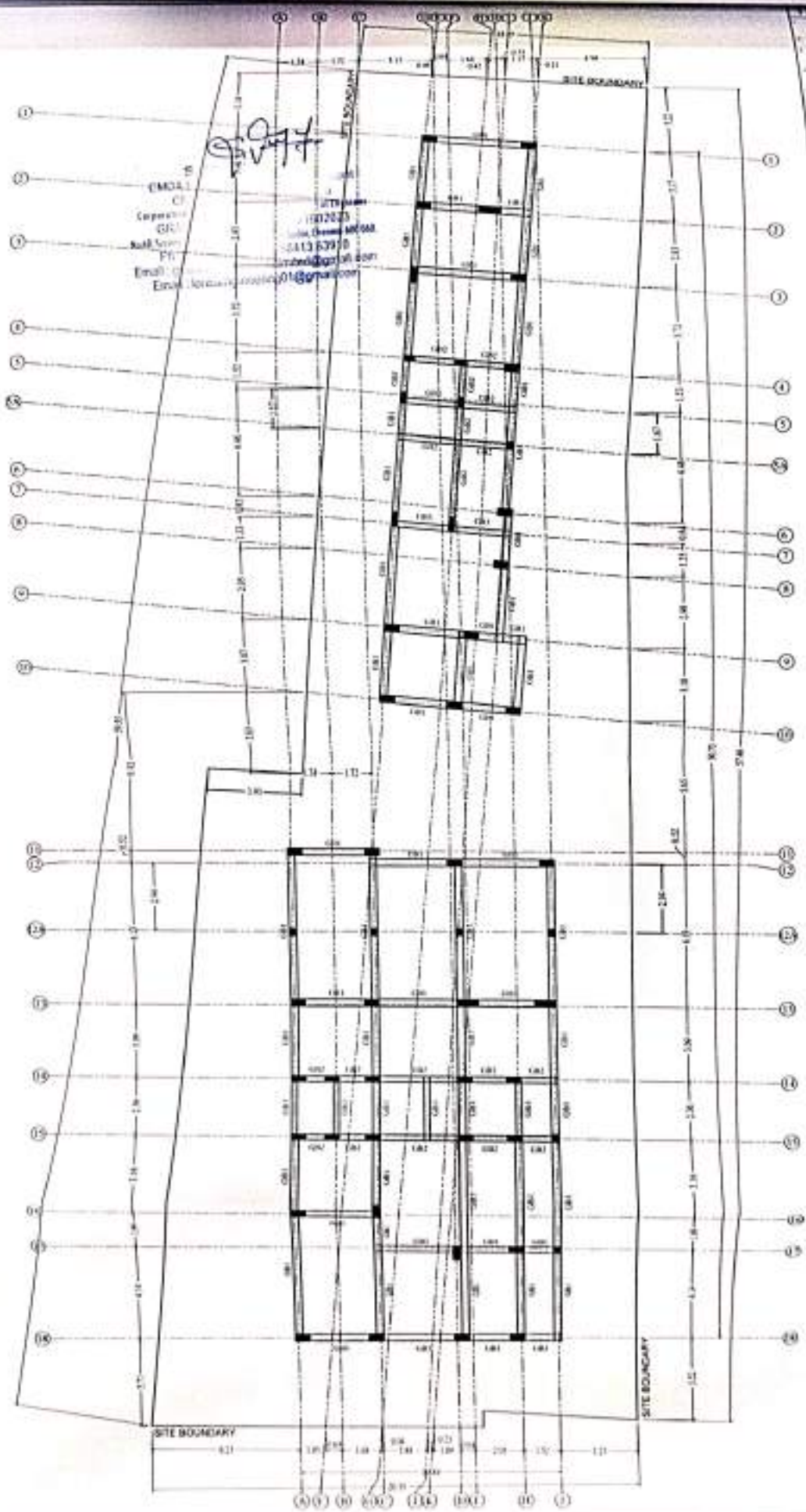
JC250688–NEXA–ASTA–(S+05)
RESIDENTIAL BUILDING AT
MOGAPPAIR

DATE : 30.07.2025

NO	DESCRIPTION	DATE
	AMENDMENTS	

LORDS ENGINEERING

PROJECT:	JC250688–NEXA–ASTA–(S+05)	SITE:	MAGAPPAIR	TITLE:	PILE CAP SECTION DETAILS



REFERENCES:

GENERAL NOTES

CLEAR COVER

1. COLUMN = 40mm.
2. ROOF BEAM = 25mm.
3. ROOF SLAB = 20mm.
4. GRADE BEAM = 25mm.
5. FOOTING BASE = 75mm.
6. FOOTING SIDE = 50mm.

LEGEND

RC COLUMN
M 30 CONCRETE
Fe 550 STEEL

ARCHITECT

JC250688-NEXA-ASTA-(S+0.3) RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

04		
03		
02		
01		
NO	ISSUED FOR CONSTRUCTION	30.07.2025
NO	DESCRIPTION	DATE

AMENDMENTS

DRAWING NO.	REV
NEXA-ASTA-MOGA-STRU-01-008	00

ENGINEERING - DESIGN - CONSULTANCY

LORDS ENGINEERING STRUCTURAL
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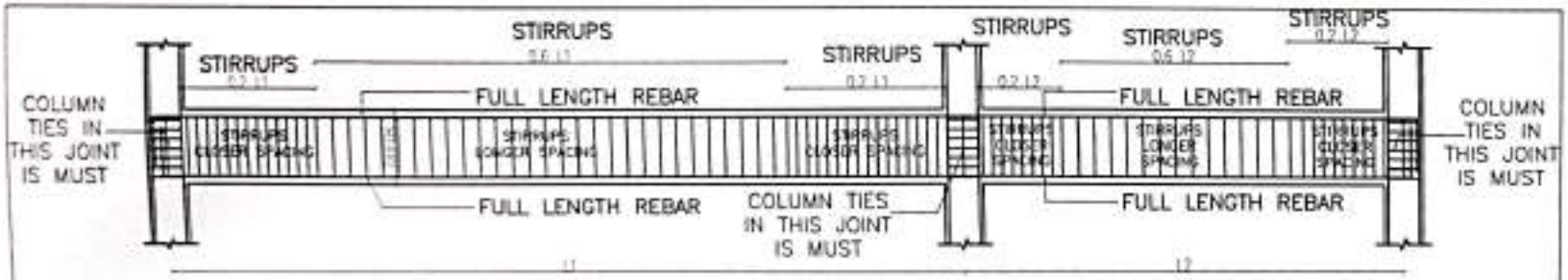
Mobile: +91 98407 45262

TITLE	GRADE BEAM MARKING LAYOUT	LOCATION	MOGAPPAIR

GRADE BEAM SCHEDULE

TYPE	BEAM SIZE b X d	GRADE BEAM REINFORCEMENT				
		AT COLUMN JUNCTION			AT MID SPAN	
		MAIN REIN.	VERTICAL STIRRUPS FOR A LENGTH=0.2L	GRADE BEAM CROSS SECTION	VERTICAL STIRRUPS FOR A LENGTH=0.6L	STIRRUP SHAPE
GB1	300X450	FOR FULL LENGTH ● 3NOSx16mm dia FOR FULL LENGTH ● 3NOSx16mm dia	FOR A LENGTH=0.2L 8mm# @ 120mm C/C	450 / 300	FOR A LENGTH=0.6L 8mm# @ 150mm C/C	8 mm DIA
GB2	230X450	FOR FULL LENGTH ● 3NOSx16mm dia FOR FULL LENGTH ● 3NOSx16mm dia	FOR A LENGTH=0.2L 8mm# @ 120mm C/C	450 / 230	FOR A LENGTH=0.6L 8mm# @ 150mm C/C	8 mm DIA
GB3	230X450	FOR FULL LENGTH ○ 2NOSx12mm dia ● 1NOSx16mm dia FOR FULL LENGTH ○ 2NOSx12mm dia ● 1NOSx16mm dia	FOR A LENGTH=0.2L 8mm# @ 120mm C/C	450 / 230	FOR A LENGTH=0.6L 8mm# @ 150mm C/C	8 mm DIA



TYPICAL SECTION OF BEAM SHOWING STIRRUPS SPACING

NO CRANKING OF RODS IS REQUIRED – ALL RODS ARE STRAIGHT – AT TOP AND BOTTOM
NO CURTAILMENT OF MAIN RODS IS MENTIONED . ALL RODS ARE FULL LENGTH.
TOP REINFORCEMENT OF CANTILEVER BEAMS AS WELL AS RECTANGULAR BEAMS SHALL NOT BE LAPPED.

S. VIJAYAN, M.E.,
CMDA Registered Structural Consultant
CMDA : SE/GR1/2022/11846
Corporation of Chennai Registered Structural Engineer
GRADE-I REGN. No. RSE1019022023
No.18, Second Floor, M.S. High Road, Mogappair, Chennai-600 037.
Ph: +91 98407 43262, 98413 63910
Email : grandesmithprivatelimited@gmail.com
Email : lordsengineering01@gmail.com

REFERENCES:

GENERAL NOTES

CLEAR COVER

1. COLUMN	=	40mm.
2. ROOF BEAM	=	25mm.
3. ROOF SLAB	=	20mm.
4. GRADE BEAM	=	25mm.
5. FOOTING BASE	=	75mm.
6. FOOTING SIDE	=	50mm.

LEGEND

RC COLUMN
M30 CONCRETE
Fe500 STEEL

ARCHITECT

JC250688–NEXA–ASTA–(S+03)
RESIDENTIAL BUILDING AT MOGAPPAIR

DATE : 30.07.2025

REV	DESCRIPTION	DATE
	AMENDMENTS	

LORDS ENGINEERING

PROJECT:	JC250688–NEXA–ASTA–(S+05)	SITE:	MAGAPPAIR	TITLE:	GRADE BEAM REINFORCEMENT SCHEDULE