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TRICHY RG ENGINEERING EXCELLENCE PRIVATE LIMITED
(Structural Design Consultants)

Date :

Structural Design Details

Of

The Proposed Construction of Affordable Residential Apartment Building after demolishing the Existing old Building in Door No : 13, Arokiyasamy Pillai Street at New T.S. No. 5 (S.F.No: 136/1A Part) Ward - AK, Block No : 8, K.Abishekapuram Village, Crawford, Zone- IV, Tiruchirappalli City Corporation.

Structural Details Design by

TRICHY RG ENGINEERING EXCELLENCE PRIVATE LIMITED

No. 64, Nandavanam Street,
LIC Colony
Trichy – 620021
Phone – 0431-4024691

STRUCTURAL DESIGN STABILITY CERTIFICATE.

I hereby certify that The Proposed Construction of Affordable Residential Apartment Building after demolishing the Existing old Building in Door No : 13, Arokiyasamy Pillai Street at New T.S. No. 5 (S.F.No: 136/1A Part) Ward - AK, Block No : 8, K.Abishekapuram Village, Crawford, Zone- IV, Truchirappalli City Corporation. The building will withstand against the Earthquake,(Seismic Zone II as per IS 1893 (Part I) 2002) loading stress parameters are within limits of National Building Code and Bureau of Indian standards code of practice for concrete and loading. The building consists of stilt + five floors. For external and internal partition walls 200/100 thick A. A. C block work walls are used.

The R.C.C building frame of the structure is designed as per the Indian Standard code of practice for concrete and loading as follows:

1. IS: 456-2000 Code of Practice for Plain and Reinforced concrete

2. IS: 875-1987 Code of Practice for Design loads for Buildings and structures

3. IS: 1893-2002 Criteria for Earthquakes resistant design of structures Part-1 General Provisions and Buildings

4. IS: 4326-1993 Code of Practice for Earthquakes resistant design & Construction of Buildings.

5 .IS:13920-1993 Code of Practice for Ductile detailing of concrete structures subjected to seismic forces and

6. National Building code of India-2005.

It is further certified that the above structure will be constructed from foundation to roof, as per structural designs and detailing of reinforcements furnished in our drawings. The building will be safe and Sound as per the design.

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LPA REG. No: SE/Gr/TLPA/MAY2019/029

DESIGN BASIS REPORT

For

The Proposed Construction of Affordable Residential Apartment Building after demolishing the Existing old Building in Door No : 13, Arokiyasamy Pillai Street at New T.S. No. 5 (S.F.No: 136/1A Part) Ward - AK, Block No : 8, K.Abishekapuram Village, Crawford, Zone- IV, Truchirappalli City Corporation..

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1.0 OBJECTIVE

The Proposed Construction of Affordable Residential Apartment Building after demolishing the Existing old Building in Door No : 13, Arokiyasamy Pillai Street at New T.S. No. 5 (S.F.No: 136/1A Part) Ward - AK, Block No : 8, K.Abishekapuram Village, Crawford, Zone- IV, Truchirappalli City Corporation.

The Building is designed for Stilt + 5 floors. The structure is supported on column in turn resting on column footing Foundation. The Structural System comprises columns, beams, slabs and wall structure.

3-D Analysis of all the building structures will be carried out using STAAD PRO Software package and analysis results shall be used for designing the various elements.

2.0 DESIGN LOADS

2.1 Dead Loads

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

1. Slab is assumed to be 125mm thick – 3.125 KN/m^2
2. Floor finish – 1.5KN/m^2
3. AAC Block masonry walls 200mm & 100mm thick are proposed to be used (location of walls per Architectural drawings) Unit weight is taken as 8 KN/m^3
4. Weathering course in Terrace finish –2 KN/m^2

2.2 Imposed Loads

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

1. Living = 2 KN/m^2
2. Staircase = 4 KN/m^2
3. Toilets = 2 KN/m^2
4. Terrace floors = 1.5 KN/m^2

2.3 Earthquake Load

The loading due to earthquake is assessed based on the provisions of **IS :1893-2016.** Structures with ductile detailing is considered as per **IS: 13920-2016.**

Madurai falls under Seismic Zone II

Zone factor **= 0.10**

Response reduction factor **= 3**

Importance factor **= 1.0**

Structure with ductile detailing is considered as per IS: 13920-2016

2.3 Load combinations

The various loads shall be combined in accordance with the stipulations in IS:875 (Part 5) – 1987. Whichever combinations produced the most unfavorable effect in the building, foundation or structural member concerned shall be adopted. The various load combinations considered in the analysis are as follows:

1. 1(DL + LL)
2. 1(DL + 0.8LL + 0.8 SQX + 1
3. 1(DL + 0.8LL + 0.8 SQX - 1
4. 1(DL + 0.8LL + 0.8 SQZ + 1
5. 1(DL + 0.8LL + 0.8 SQZ - 1
6. 1.0(DL + SQX + 1)
7. 1.0(DL + SQX - 1)
8. 1.0(DL + SQZ + 1)
9. 1.0(DL + SQZ - 1)
10. 1.5(DL + LL)
11. 1.5(DL + SQX + 1)
12. 1.5(DL + SQX - 1)
13. 1.5(DL + SQZ + 1)
14. 1.5(DL + SQZ – 1)
15. 1.2(DL + LL + SQX + 1)

16. 1.2(DL + LL + SQX – 1)
17. 1.2(DL + LL + SQZ + 1)
18. 1.2(DL + LL + SQZ – 1)
19. 0.9DL + 1.5SQX + 1
20. 0.9DL + 1.5SQX – 1
21. 0.9DL + 1.5SQZ + 1
22. 0.9DL + 1.5SQZ - 1

The above load combination will be considered and effect of worst combinations will be taken for design of various building elements.

3.0 ANALYSIS METHODS

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

4.0 DESIGN ASSUMPTION

4.1.1 The Base of the Foundation is assumed to be FIXED & PINNED.

4.1.2 All concrete elements shall be designed in accordance with IS 456:2000 Limit state design.

4.1.3 Appropriate loads and its combination as per relevant clauses, for the most unfavorable effects are chosen for design. (Refer Load Combination below).

5.0 FOUNDATION DESIGN

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

6.0 MATERIALS

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

S. no	Materials	Unit weight KN / m^3
1	Reinforced Cement Concrete	25
2	AAC Block / Brick WORK(for lift well& parapet)	8/20
3	Steel	78.50

Structural concrete shall be of grade M25 for all r.c.c work.
Steel reinforcement shall be of grade Fe 500 confirming to IS : 1786-2008.

7. 0 NOMINAL COVER TO REINFORCEMENT

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

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

Footing - 50mm

Column - 40mm

Beam - 32mm

Slab - 20mm

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Design of Isolated Footing with Moment

The values are Displayed in Blue color are the Input values

Support No = **COLUMN NO C45**

1 Design Forces From STAAD

Load Case = 5

1. Axial Load on column	=	1440 KN
2. Bending moment along x-x, Mx	=	0 KN.m
3. Bending moment along y-y, My	=	0 KN.m

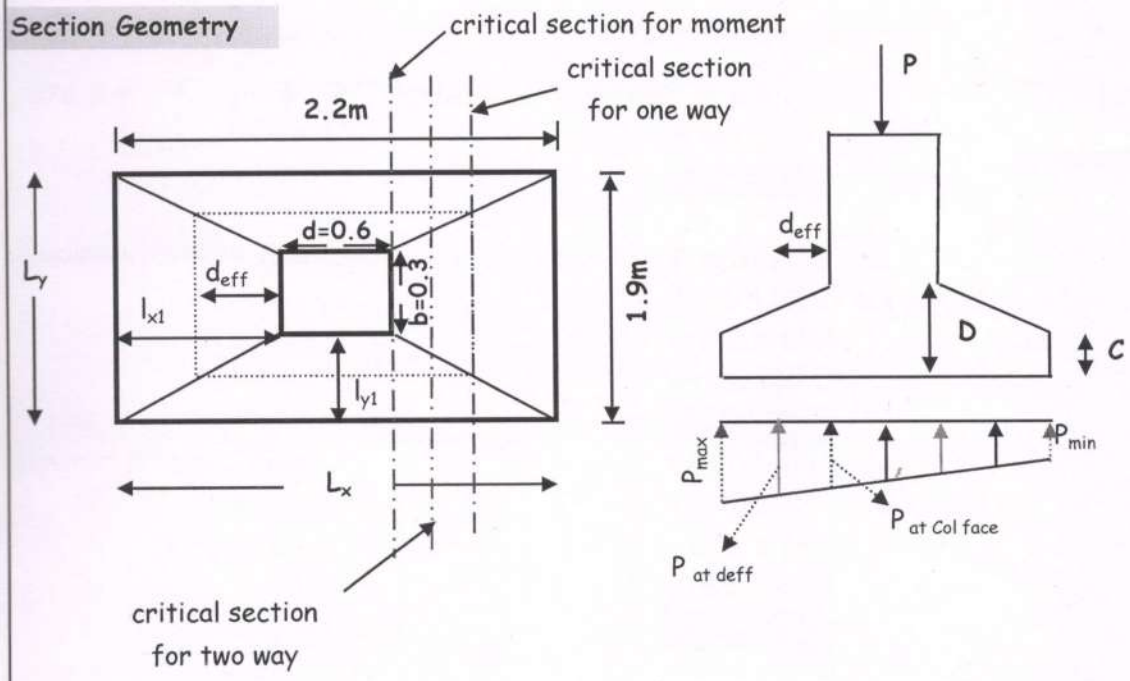
2 Design Datas

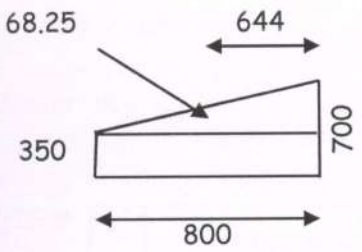
3. Compressive strength of Concrete, Fck	=	25 N/mm^2
4. Yield Strength of steel, Fy	=	500 N/mm^2
5.Diameter of Reinforcement, (x-direction)	=	12 mm
6.Diameter of Reinforcement, (y-direction)	=	12 mm
7. Clear cover to the reinforcement, C	=	50 mm
8. Safe bearing capacity of soil, SBC	=	390 KN/m^2
7 Type of Footing	=	Rectangular
8 Size of pedastal/Column	=	b x d
	=	0.3 x 0.6 m

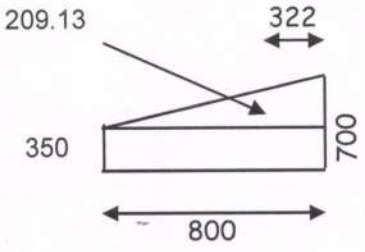
2 Assume trial size of footing

Area of footing		=	Total Load/SBC
Self Wt. of footing			
(Assume 10% of column load		=	144 KN
Soil weight		=	0 KN
Total Load		=	1584 KN
Area of footing required		=	1584 / 390
		=	4.06 m^2
Size Required	B	=	**1.6** m
	L	=	**2.4** m
Size Provided	B	=	1.9 m
	L	=	2.2 m
Area of Footing Provided		=	**4.18** m^2
			4.18 > 4.06
			O.K

3 Section Geometry







l_{x1} = $(L_x-d)/2$
= (2.2 - 0.6)/2
= **0.8** m

l_{y1} = $(L_y-d)/2$
= (1.9 - 0.3)/2
= **0.8** m

Assume Overall depth of footing, D	=	700 mm
Depth at free end, C	=	350 mm
d_{eff} at critical moment section	=	644 mm
d_{eff} at critical one way shear section	=	362.25 mm
d_{eff} at critical two way shear section	=	503.13 mm

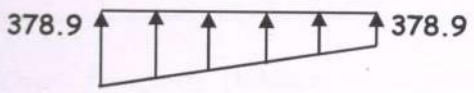
4 Check for Soil Pressure

A) Along X direction

Eccentricity, e_{xx} = (M_{xx}/P)

= 0 / 1584

= 0 m



$L_x/6$ = 0.367 m

0.367>0

$e_{xx} < L_x/6$

Maximum Pressure, Pmax = $P/A(1+6e/B)$

= $1584/4.18(1 + 6 \times (0+0/2.2)$

= **378.9** KN/m^2

378.9<390

Safe

Minimum Pressure, Pmin = $P/A(1-6e/B)$

= $1584/4.18(1 - 6 \times (0+0)/1.9)$

= **378.9** KN/m^2

= 378.9<390

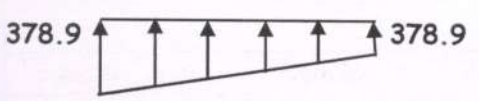
Safe

B) Along Y direction

Eccentricity, e_{yy} = (M_{yy}/P)

= 0 / 1584

= 0 m



$L_x/6$ = 0.317 m

0.317>0

$e_{xx} < L_y/6$

Maximum Pressure, Pmax = $(P/A(1+6e/B)$

= $1584/4.18(1 + 6 \times (0+0)/2.2)$

= **378.9** KN/m^2

378.9<390

Safe

Minimum Pressure, Pmin = $P/A(1-6e/B)$

= $1584/4.18(1 - 6 \times (0+0)/1.9)$

= **378.9** KN/m^2

= 378.9<390

Safe

5 Bending moment calculations

S.No	Direction	Pmax(net)	Pmin(net)	P at face of the column	Moment, KN/m
1	x	344.45	344.45	344.45	165.33
2	y	344.45	344.45	344.45	165.33

6 **Check for depth (Moment consideratin)**

$Mu.lim = (0.36 \times Fck \times (xu.max/d) \times (1-0.42(xu.max/d)) \times bd^2$

$xu.max/d = 0.46$

$Mu.lim = 3.34\ bd^2$

$d,reqd = (Mu.lim/Qb)^{1/2}$

$= (165330000/(3.34 \times 1000))^{1/2}$

$= 222.49$ mm

222.49 < 644

O.K

7 **Calculation of Reinforcement**

S. N	Direction	Mu/bd^2	pt from SP16	pt, min	pt,provided	Ast, mm^2
1	x	0.4	0.094	0.12	0.120	772.8
2	y	0.4	0.094	0.12	0.120	772.8

pt = 100Ast/bd

Ast = (pt/100)xbd

8 **Spacing of reinforcement**

Spacing, mm		Spacing provided, mm	Ast provided, mm^2
Reqd	Minimum		
146	300	125	904.32
146	300	125	904.32

pt.max, Provided = 0.1404 %

Spacing = (ast x 1000)/Ast

where,

ast= C/s area of bar

Ast=Area of reinforcement provided

9 **Check for one way shear**

S.No	Direction	Pmax(net)	Pmin(net)	P at critical 1way shear Xn	Shear, KN
1	x	344.45	344.45	344.45	80.595
2	y	344.45	344.45	344.45	80.595

Nominal Shear stress, tv = Vu/bd

		=	80595/1000 x 362.25
		=	0.22 N/mm^2
	pt.max, Provided	=	0.1404 %
	Allowable shear stress, tc (for pt,max)	=	0.2823 N/mm^2
			tv < tc
			O.K

10 Check for two way Shear

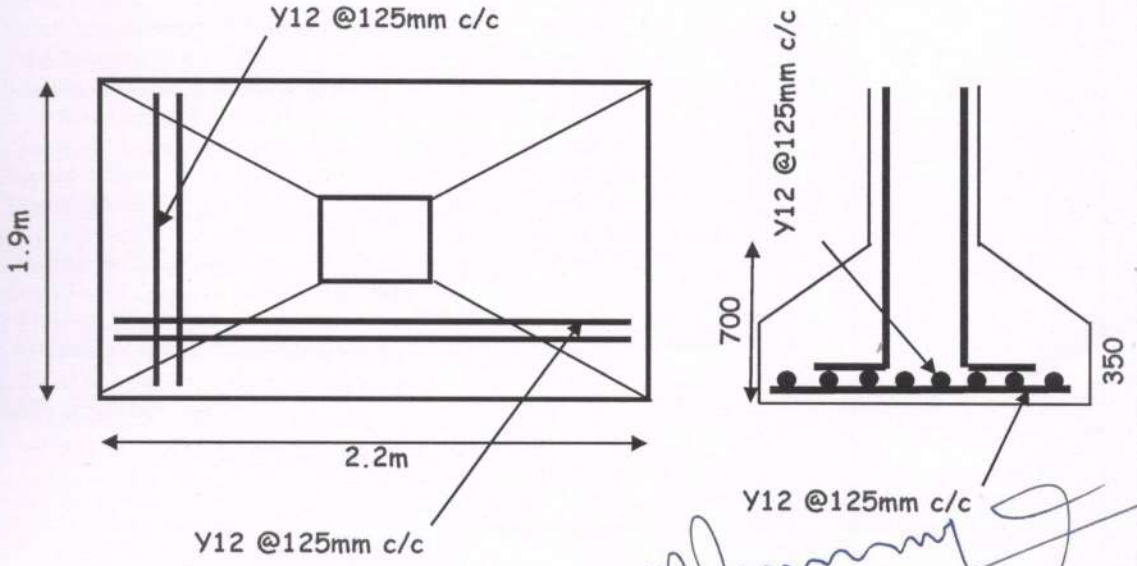
	Punching Shear,Vu	=	Net upward pressure x (A_F - A_c)
		=	2066.985 KN
	Punching Shear stress,	=	Vu/perimeter at critical section*d_{eff}
		=	0.9388 N/mm^2
	Allowable Stress	=	$0.25(fck)^{1/2}$
		=	1.25 N/mm^2
			O.K

11 Check for bearing stress

	Actual bearing stress,	=	2160 KN
	Limiting bearing stress @ Column - footing		
	interface, fbr,max	=	$0.45\ fck\ (A1/A2)^{1/2}$
	A1	=	400000 mm^2
	$(A1/A2)^{1/2}$	=	1
	fbr,max	=	11.25 N/mm^2
	Limiting bearing stress @ Column - footing		
	interface, fbr,max	=	$0.45\ fck\ (A1/A2)^{1/2}$
	A1	=	4180000 mm^2
	A2	=	400000 mm^2
	$(A1/A2)^{1/2}$	=	2
	fbr,max	=	22.5 N/mm^2
	Limiting Bearing resistance, Fbr	=	4500 KN
			4500>2160
		=	O.K
	0	=	0
	0	=	0
	0	=	0 Ø

11 Reinforcement Details

Direction	Reinforcement
X	Y12 @125mm c/c
Y	Y12 @125mm c/c



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Design of column with Biaxial Moment

Column No = C45 (up to stilt roof)

1 Design Forces From STAAD Load Case = C10

1. Axial Load on column	=	2049 KN
2. Bending moment along x-x, Mux	=	44 KN.m
3. Bending moment along y-y, Muy	=	27 KN.m

2 Design Datas

1. Compressive strength of Concrete, Fck	=	25 N/mm^2
2. Yield Strength of steel, Fy	=	500 N/mm^2
3.Diameter of Longitudinal Reinforcement,	=	16 mm
4.Diameter of lateral Reinforcement,	=	8 mm
5. Clear cover to the reinforcement, C	=	32 mm
6. Type of column	=	Rectangular
7. Size of Column	=	b x d
	=	300 x 600 mm
8. Unsupported Length of Column along x-x,L_x	=	3 m
9. Unsupported Length of Column along y-y,Ly	=	3 m
10. Effective length factor,	=	1
11. Effective Length of Column, along x-x, L_x	=	3 m
12. Effective Length of Column, along y-y, Ly	=	3 m

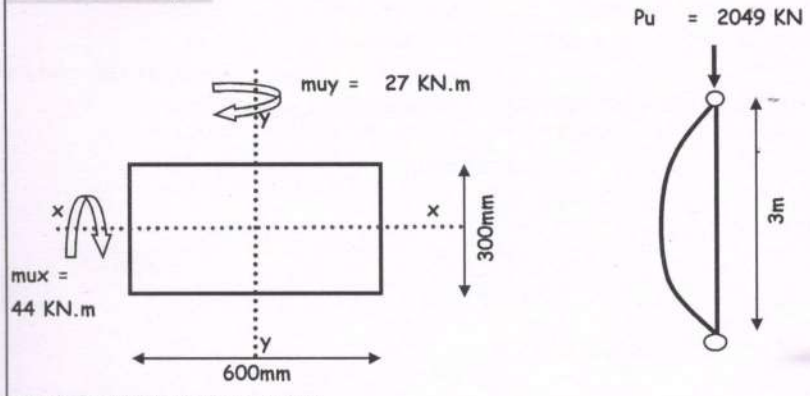
2 Check for leff/D

Effective length,lex/Lateral dimensions = L_{ex} / D
= 10
= 10< 12
= Short Column

As per clause 25.1.2.2, IS:456:2000

Effective length,ley/Lateral dimensions = L_{ex} / b
= 5
= 5< 12
= Short Column

3 Section Geometry



4 Check for Minimum Eccentricity

As per Clause 25.4, IS:456:2000

Applied eccentricties

ex	=	Mux/Pu
	=	44/2049
	=	21.474 mm
ey	=	Muy/Pu
	=	27/2049
	=	13.177 mm

Minimum eccenticity

e_{xx} = (lex/500)+(D/30)
= (3000/500) + (600/30)
= 26 mm or 20 mm
= 26 mm

e_{yy} = (ley/500)+(D/30)
= (3000/500) + (300/30)
= 16 mm or 20 mm
= 20 mm

5 **Moment due to Eccentricity**

m_{uex} = Pu x e_{xx}
= (2049x26)/1000
= 53.27 KN.m

m_{uey} = Pu x e_{yy}
= (2049x16)/1000
= 32.78 KN.m

6 **Design Moment**

mux = Mux or muex
= **53.27** KN.m

muy = Mux or muey
= **32.78** KN.m

7 **Calculation of Longitudinal reinforcement**

Assume percentage of reinforcement = 1 %
Asc, required = 1/100x 300x600
= 1800 mm^2
No of bars = 9 Nos
Asc, Provided = 1809 mm^2
pt, provided = 1.005 %

Moment Capacity Along x Direction

(Pu/fck b D) = (2049000/25 x 300 x 600) =
= 0.46
p/fck = 1.005/25
= 0.04

d'/D = 32/600
= 0.05

From interaction chart, SP16

$Mux1/fck\ b\ D^2$ = 0.06

Mux1 = 0.06 x 300x300x600x25

= 162 KN.m

Moment Capacity Along y Direction

(Pu/fck b D) = (2049000/25 x 300 x 600)

= 0.46

p/fck = 1.005/25

= 0.0402

b'/D = 32/300

= 0.11

From interaction chart, SP16

$Muy1/fck\ b\ D^2$ = 0.1

Muy1 = 0.1 x 300x300x600x25

= 270 KN.m

8 **Check for Moment Capcity**

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an} < 1$

Puz = (0.45 fck.Ac) +(0.75 fy -0.45fck)Asc

Ac = 180000 mm^2

Puz = 2683.0238 KN

Pu/Puz = 0.764

an = 1.94

For Pu/Puz =0.2 to 0.8
an varies from 1.0 to 2.0

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an}$ = 0.132

0.132< 1

O.K

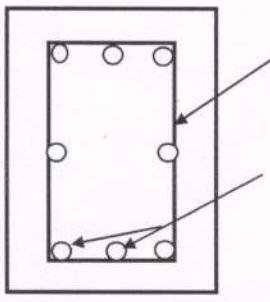
9 **Calculation of Lateral Reinforcement**

Spacing of ties

1. Least Lateral Dimensions of column = 300 mm
2. Sixteen times the least dia of Longi bar = 256 mm
3. 300mm = 300 mm

Adopt Spacing = 200 mm

10 **Details**



No of bars = 8 Nos

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Design of column with Biaxial Moment

Column No = **C45 (stilt roof to third floor roof)**

1 Design Forces From STAAD Load Case = C5

1. Axial Load on column	=	1720 KN
2. Bending moment along x-x, Mux	=	50 KN.m
3. Bending moment along y-y, Muy	=	20 KN.m

2 Design Datas

1. Compressive strength of Concrete, Fck	=	25 N/mm^2
2. Yield Strength of steel, Fy	=	500 N/mm^2
3.Diameter of Longitudinal Reinforcement,	=	16 mm
4.Diameter of lateral Reinforcement,	=	8 mm
5. Clear cover to the reinforcement, C	=	32 mm
6. Type of column	=	Rectangular
7. Size of Column	=	b x d
	=	230 x 600 mm
8. Unsupported Length of Column along x-x,L_x	=	3 m
9. Unsupported Length of Column along y-y,Ly	=	3 m
10. Effective length factor,	=	1
11. Effective Length of Column, along x-x, L_x	=	3 m
12. Effective Length of Column, along y-y, Ly	=	3 m

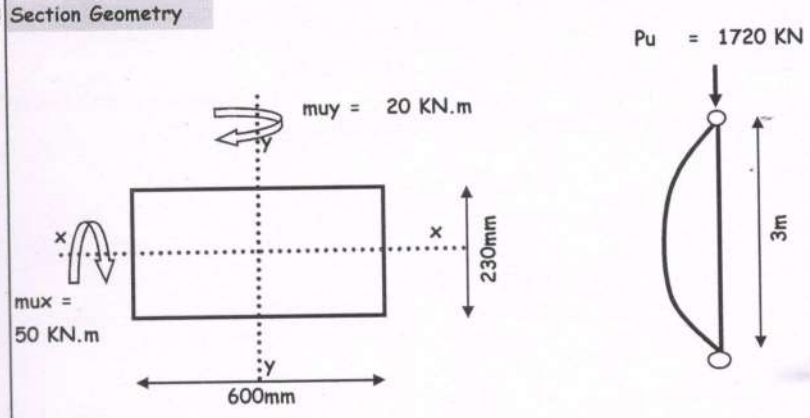
2 Check for leff/D

Effective length,lex/Lateral dimensions = L_{ex} / D
= 13.04
= 13.04>12
= Long Column

As per clause 25.1.2.2, IS:456:2000

Effective length,ley/Lateral dimensions = L_{ex} / b
= 5
= 5< 12
= Short Column

3 Section Geometry



4 Check for Minimum Eccentricity

As per Clause 25.4, IS:456:2000

Applied eccentricties

ex = Mux/Pu
= 50/1720
= 29.07 mm

ey = Muy/Pu
= 20/1720
= 11.628 mm

Minimum eccenticity

e_{xx} = (lex/500)+(D/30)
= (3000/500) + (600/30)
= 26 mm or 20 mm
= 26 mm

e_{yy} = (ley/500)+(D/30)
= (3000/500) + (230/30)
= 13.667 mm or 20 mm
= 20 mm

5 **Moment due to Eccentricity**

m_{uex} = Pu x e_{xx}
= (1720x26)/1000
= 44.72 KN.m

m_{uey} = Pu x e_{yy}
= (1720x13.67)/1000
= 23.51 KN.m

6 **Design Moment**

mux = Mux or muex
= **50** KN.m

muy = Mux or muey
= **23.51** KN.m

7 **Calculation of Longitudinal reinforcement**

Assume percentage of reinforcement = 1.2 %
Asc, required = 1.2/100x 230x600
= 1656 mm^2
No of bars = 9 Nos
Asc, Provided = 1809 mm^2
pt, provided = 1.311 %

Moment Capacity Along x Direction

(Pu/fck b D) = (1720000/25 x 230 x 600)
= 0.5
p/fck = 1.311/25
= 0.05

d'/D = 32/600
= 0.05

From interaction chart, SP16

$Mux1/fck\ b\ D^2$ = 0.06

Mux1 = 0.06 x 230x230x600x25

= 124.2 KN.m

Moment Capacity Along y Direction

(Pu/fck b D) = (1720000/25 x 230 x 600)

= 0.5

p/fck = 1.311/25

= 0.0524

b'/D = 32/230

= 0.14

From interaction chart, SP16

$Muy1/fck\ b\ D^2$ = 0.05

Muy1 = 0.05 x 230x230x600x25

= 103.5 KN.m

8 **Check for Moment Capcity**

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an} < 1$

Puz = (0.45 fck.Ac) +(0.75 fy -0.45fck)Asc

Ac = 138000 mm^2

Puz = 2210.5238 KN

Pu/Puz = 0.778

an = 1.9633

For Pu/Puz =0.2 to 0.8
an varies from 1.0 to 2.0

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an}$ = 0.222

0.222< 1

O.K

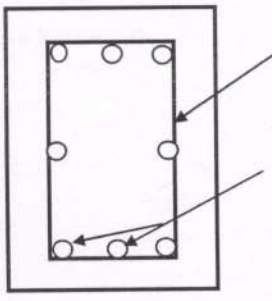
9 **Calculation of Lateral Reinforcement**

Spacing of ties

1. Least Lateral Dimensions of column = 230 mm
2. Sixteen times the least dia of Longi bar = 256 mm
3. 300mm = 300 mm

Adopt Spacing = 200 mm

10 **Details**



Y8@200mm c/c

No of bars = 8 Nos

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Design of column with Biaxial Moment

Column No = **C45(third roof to terrace)**

1 Design Forces From STAAD Load Case = C5

1. Axial Load on column	=	780	KN
2. Bending moment along x-x, Mux	=	54	KN.m
3. Bending moment along y-y, Muy	=	26	KN.m

2 Design Datas

1. Compressive strength of Concrete, Fck	=	25	N/mm^2
2. Yield Strength of steel, Fy	=	500	N/mm^2
3.Diameter of Longitudinal Reinforcement,	=	16	mm
4.Diameter of lateral Reinforcement,	=	8	mm
5. Clear cover to the reinforcement, C	=	32	mm
6. Type of column	=	Rectangular	
7. Size of Column	=	b x d	
	=	230 x 600	mm
8. Unsupported Length of Column along x-x, L_x	=	3	m
9. Unsupported Length of Column along y-y, Ly	=	3	m
10. Effective length factor,	=	1	
11. Effective Length of Column, along x-x, L_x	=	3	m
12. Effective Length of Column, along y-y, Ly	=	3	m

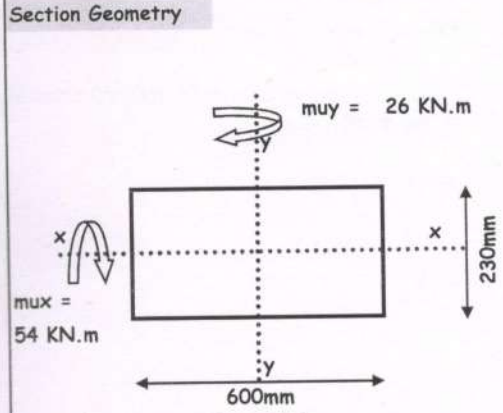
2 Check for leff/D

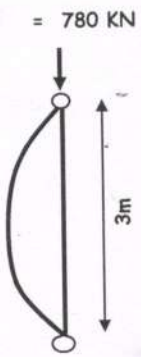
Effective length,lex/Lateral dimensions = L_{ex} / D
= 13.04
= 13.04>12
= Long Column

As per clause 25.1.2.2, IS:456:2000

Effective length,ley/Lateral dimensions = L_{ex} / b
= 5
= 5< 12
= Short Column

3 Section Geometry





4 Check for Minimum Eccentricity

As per Clause 25.4, IS:456:2000

Applied eccentricties

ex = Mux/Pu
= 54/780
= 69.231 mm

ey = Muy/Pu
= 26/780
= 33.333 mm

Minimum eccenticity

e_{xx} = (lex/500)+(D/30)
= (3000/500) + (600/30)
= 26 mm or 20 mm
= 26 mm

e_{yy} = (ley/500)+(D/30)
= (3000/500) + (230/30)
= 13.667 mm or 20 mm
= 20 mm

5 **Moment due to Eccentricity**

m_{uex} = Pu x e_{xx}
= (780x26)/1000
= 20.28 KN.m

m_{uey} = Pu x e_{yy}
= (780x13.67)/1000
= 10.66 KN.m

6 **Design Moment**

mux = Mux or muex
= **54** KN.m

muy = Mux or muey
= **26** KN.m

7 **Calculation of Longitudinal reinforcement**

Assume percentage of reinforcement = 1.2 %

Asc, required = 1.2/100x 230x600
= 1656 mm^2

No of bars = 9 Nos

Asc, Provided = 1809 mm^2

pt, provided = 1.311 %

Moment Capacity Along x Direction

(Pu/fck b D) = (780000/25 x 230 x 600)
= 0.23

p/fck = 1.311/25
= 0.05

d'/D = 32/600
= 0.05

From interaction chart, SP16

$Mux1/fck\ b\ D^2$ = 0.11

Mux1 = 0.11 x 230x230x600x25

= 227.7 KN.m

Moment Capacity Along y Direction

(Pu/fck b D) = (780000/25 x 230 x 600)

= 0.23

p/fck = 1.311/25

= 0.0524

b'/D = 32/230

= 0.14

From interaction chart, SP16

$Muy1/fck\ b\ D^2$ = 0.1

Muy1 = 0.1 x 230x230x600x25

= 207 KN.m

8 **Check for Moment Capcity**

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an} < 1$

Puz = (0.45 fck.Ac) +(0.75 fy -0.45fck)Asc

Ac = 138000 mm^2

Puz = 2210.5238 KN

Pu/Puz = 0.353

an = 1.255

For Pu/Puz =0.2 to 0.8
an varies from 1.0 to 2.0

$(Mux/Mux1)^{an} + (Muy/Muy1)^{an}$ = 0.238

0.238< 1

O.K

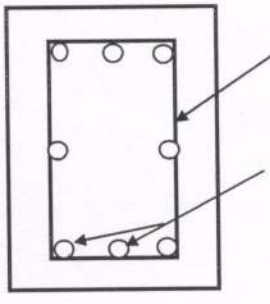
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Spacing of ties

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2. Sixteen times the least dia of Longi bar = 256 mm
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Adopt Spacing = 200 mm

10 Details



No of bars = 8 Nos

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Design of Beam SB24

Size of Beam	-230mm x 530mm
Concrete grade	- M25
Characteristic strength of reinforcement	- 500N/mm^2
Clear cover	- 32mm,
Effective depth = 530-32-25/2 = 485.5	- 485.5mm
Dia of rod used	- 25mm

From staadd out put result

Factored Shear force maximum	- 140 kN
Factored Sagging moment Mu_z	- 104knm
Factored Hogging moment Mu_z	- 161 knm

Reinforcement is at bottom:

$$M_u/bd^2 \text{ (sagging)} = = \frac{104 \times 10^6}{230 \times (485.5)^2} = 1.92 \text{ N/mm}^2$$

Using design aids, for M25, Fe 500, Table 3,

$P_t = 0.484\%$

$$A_t = \frac{0.484x230x485.5}{100} = 540 \text{ mm}^2$$

Provide 3Y16 = 603 mm^2 > 540 mm^2

Hence Safe

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Reinforcement at support section:

M_u/bd^2 (Hogging) = = $\frac{161 \times 10^6}{230x(485.5)^2}$ = 2.97 N/mm^2

Using design aids, for M25, Fe 500, Table 3,

P_t = 0.811 %

$A_t = \frac{0.811x230x485.5}{100}$ = 905 mm^2

Provide

2Y16 + 2Y20 = 1030mm^2 > 905 mm^2

Hence Safe.

Design for Shear:

T_v Max = $\frac{Vu}{bd} = \frac{140x1000}{230x485.5}$ = 1.26 N/mm^2

Ast provided 1030 mm^2

$P_t = \frac{1030x100}{230x485.5}$ =0.93 %

Refer table, 61 of SP16, for M25 grade Concrete

T_c = 0.62 N/mm^2

So shear taken by stirrups ,

$\frac{(Tv-Tc)Xbd}{1000} = \frac{(1.26-0.62)X230X485.5}{1000}$ = 71.47KN

Shear force per CM depth of beam = $\frac{71.47}{48.55}$ = 1.47 KN/cm depth of beam

Refer table No. 62,

Provide 2 legged Y8 @200mm C/C

Size of beam (200 x 530)mm
Span reinforcement (Bottom) – 3Y16
Support reinforcement (Top) – 2Y16 + 2Y20
Stirrups – Y8 @ 200mm C/C

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Design of slab

Four Edges Discontinuous

Fck	25	N/mm^2
Fy	500	N/mm^2
Dia of bar (Lx Direction)	10	mm
Dia of bar (Ly Direction)	8	mm
Clear cover	15	mm
Clear span Lx	3470	mm
Clear span Ly	5260	mm
Width of Beam	230	mm
Slab tk	125	mm
Floor Finish	45	mm
Weathering Coarse	5	mm
LIVE LOAD	2	KN/m2
Length of slab (lx)	3575	mm
Length of slab (ly)	5361	mm
Dead Load	4.08	KN/m2
LIVE LOAD	2	KN/m2
FD D.L	6.12	KN/m2
FD L.L	3	KN/m2
ly/lx	1.5159	IT IS TWO WAY SLAB

Bending Moment Coeffecient for Rectangular Panels Supported on Four Sides with Provision for Torsion at Corners (IS 456-2000 Table 26)

	short span		**long span**	
	(-ve Mx)	(+ve Mx	(-ve My)	(+ve My)
	0	0.1051	0	0.045737

support moment	Mx	0	KN.m
	My	0	KN.m
span moment	Mx	12.25	KN.m
	My	5.3311	KN.m

Xu max/d	0.46	
Q	3.3402	
d rquired	60.559	The depth provide is suffcient
Effective depth shorter span	105	
Effective depth longer span	96	
Ast (+ ve Shorter span)	283.66	mm^2
Ast (+ ve Longerer span)	131.32	mm^2
Ast (- ve Shorter span)	0	mm^2
Ast (- ve Longerer span)	0	mm^2
Min Ast	150	mm^2

SPAN REINFORCEMENT

TO PROVIDE 10 mm DIA OF BAR @277 mm SPACING IN 3470 mm DIRECTION

TO PROVIDE 8 mm DIA OF BAR @288 mm SPACING IN 5260 mm DIRECTION

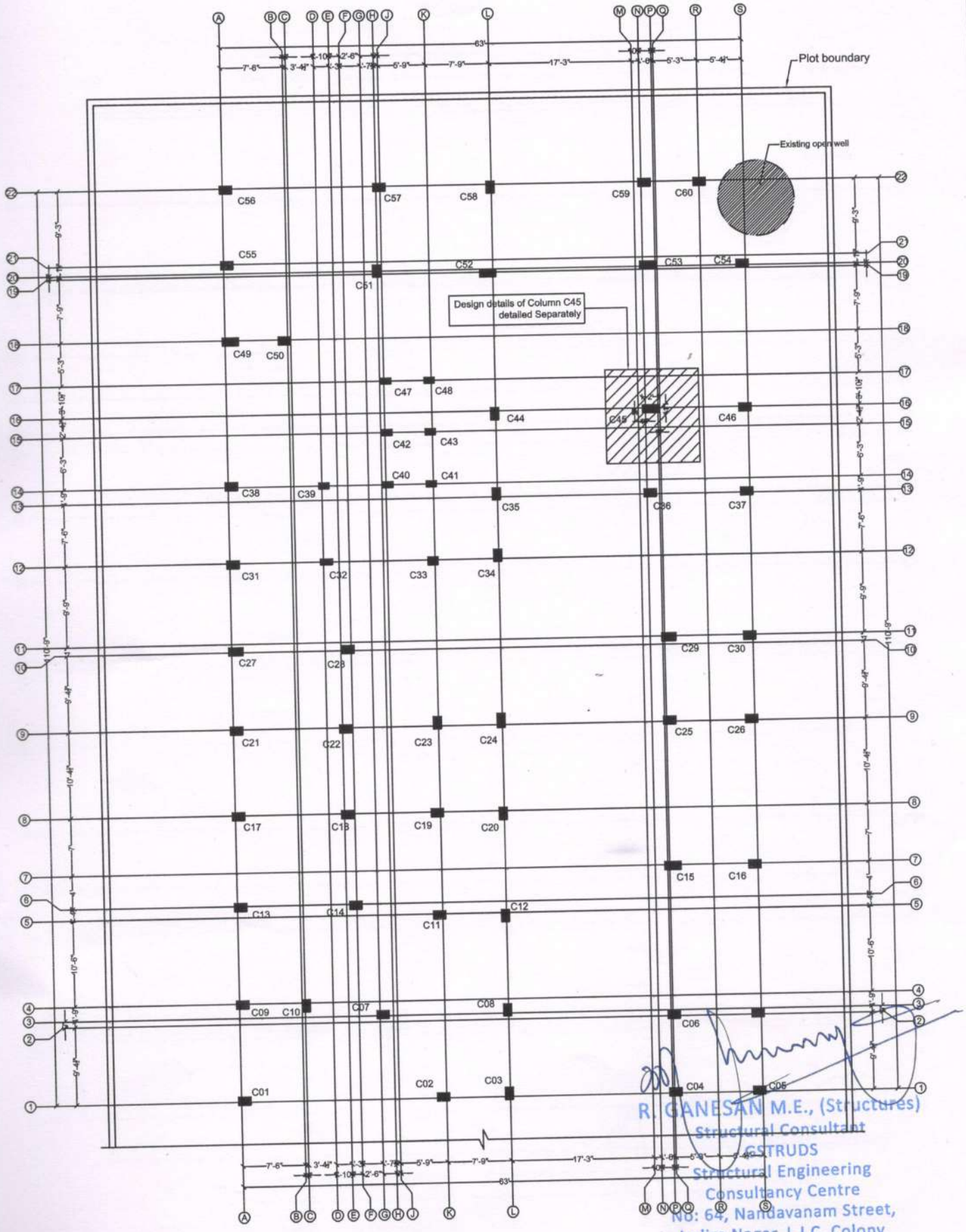
SUPPORT REINFORCEMENT

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Column & Grid Layout

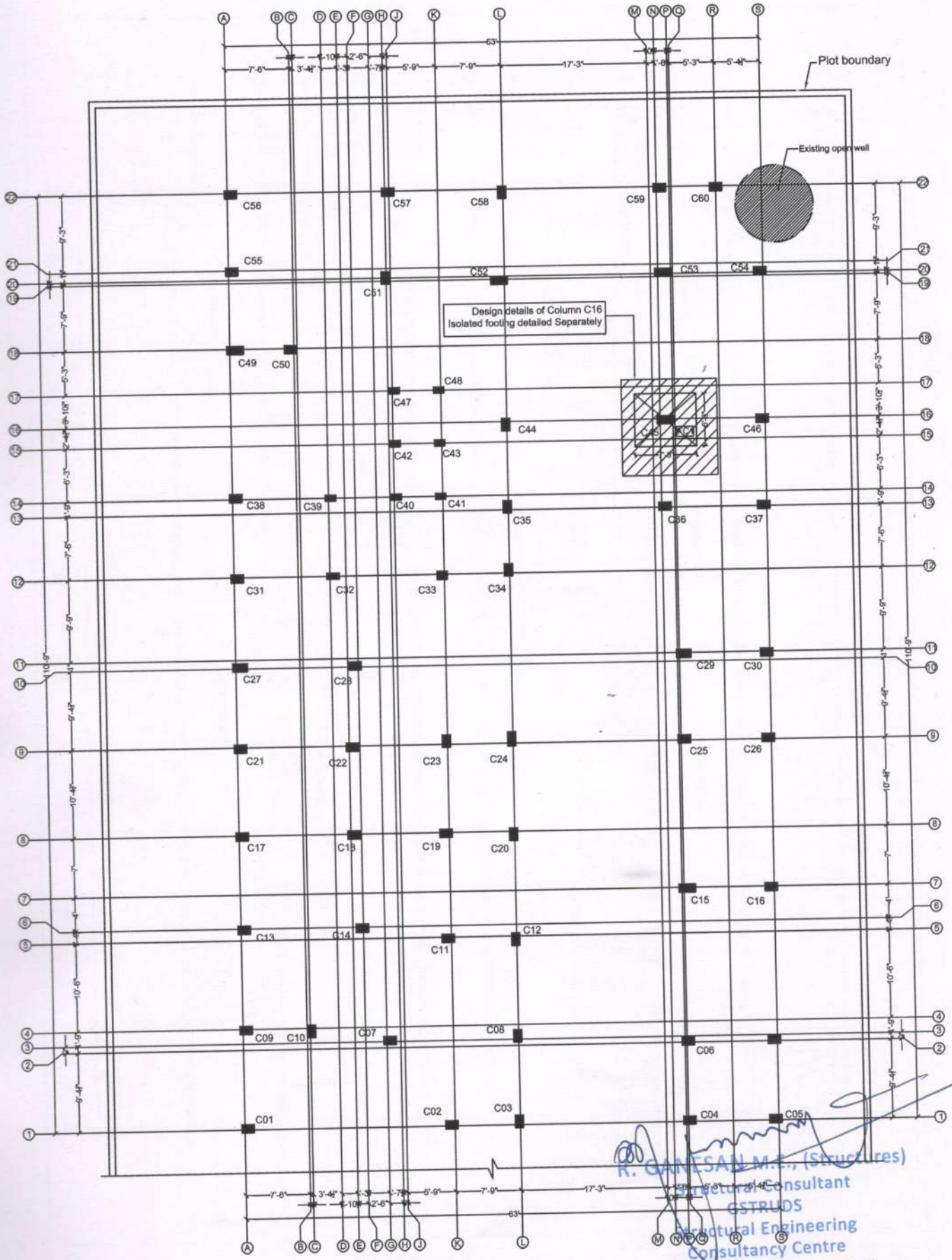


- Regular column

- Column to be terminated at stilt floor roof

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Foundation Layout

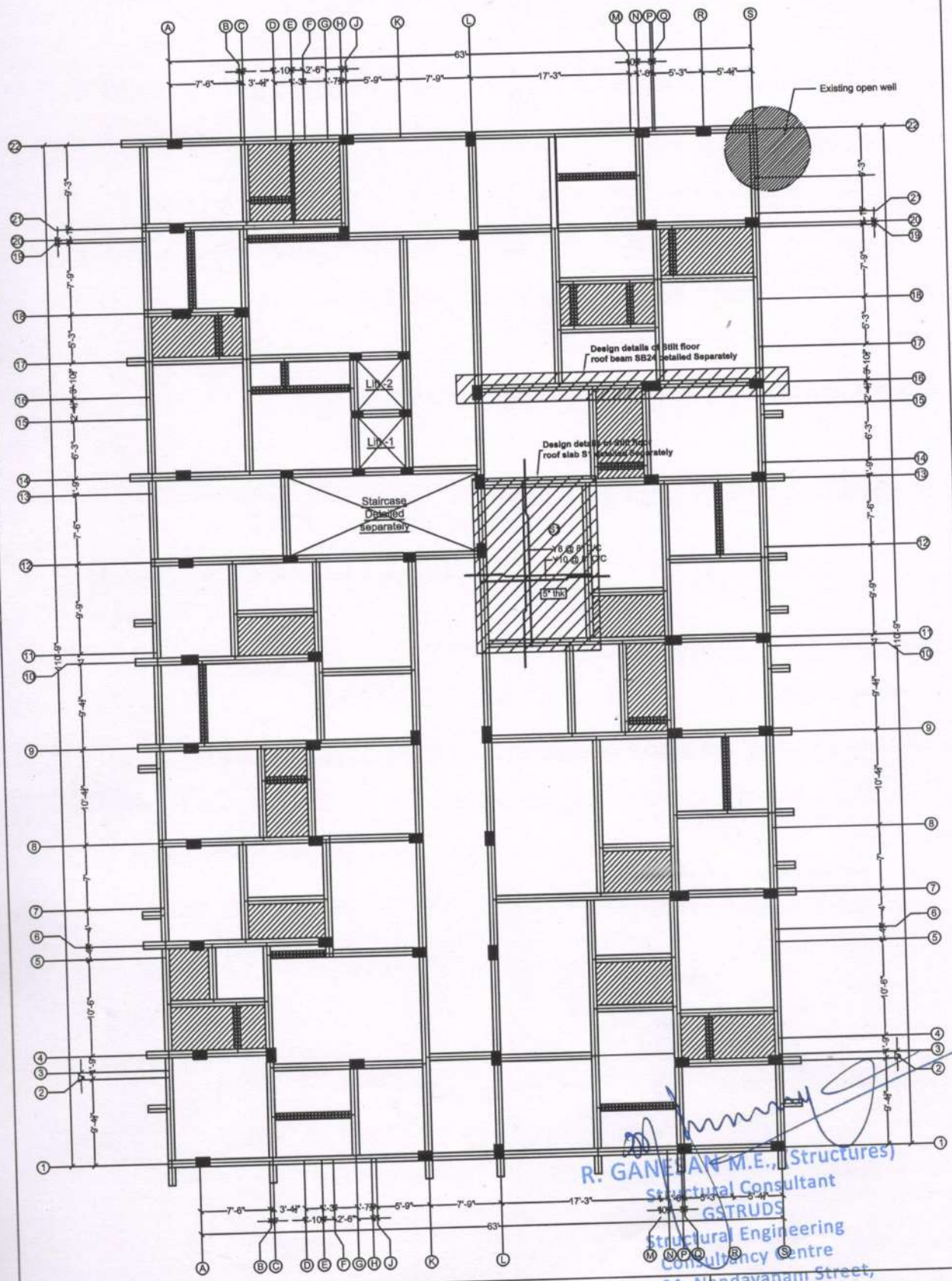


- Regular column

- Column to be terminated at still floor roof

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Stilt Floor Roof Beam Layout.



- Roof beam	Concealed beam - Sunken Slab
- Regular column	- Column to be terminated at stilt floor roof

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(807 Anna Salai, Chennai 600 002)

TIRUCHIRAPPALLI LOCAL PLANNING AUTHORITY

(Kajamalai Main road, Kajamalai, Tiruchy 620 023)

PROFESSIONAL REGISTRATION CERTIFICATE

This is to certify that Thiru **R.GANESAN** has enrolled as **STRUCTURAL ENGINEER GRADE-I** with this office who has the qualification of **M.E., in Structural Engineering** and experience in the relevant field for 29 years.

He has been given the Registration No.**SE/Gr.I/TLPA/May2019/029** on 08.05.2019.

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) Department dated 4.2.2019.

This Registration is valid up to 07.05.2024



திருச்சி உள்ளூர் திட்டக் குழுமம்
10 MAY 2019
திருச்சிராப்பள்ளி - 23

Member Secretary,
Tiruchirappalli Local Planning Authority,
Tiruchirappalli

SE/Gr.I/TLPA/2019
8.5.19

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