Bismillahirrah Manir-Rahim

Bogra Polytechnic Institute

Civil Engineering Project.

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Department:-Civil Technology

Semester:-7th, shift:-1st

Session:-2021-2022

DIRECTED BY

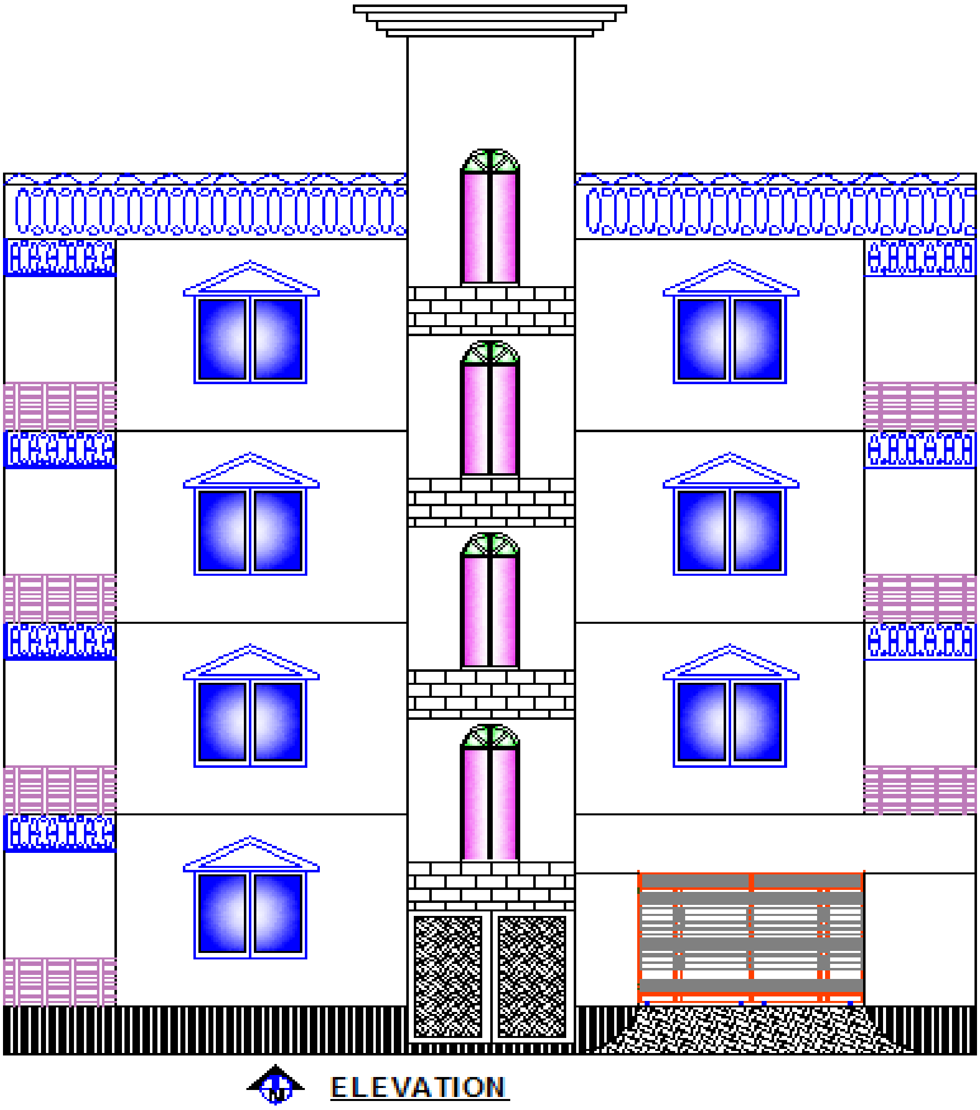
Md. ABDUL MALEK

Chief instructor

Bogura polytechnic institute

PROJECT NAME

4TH FLOOR RESIDENTIAL BUILDING



ELEVATION

ABOUT PROJECT

The role of Civil Diploma Engineers in the construction field of this country are very important.

According to the survey report of the earth quake association of Bangladesh , "88% building of Dhaka city are risky against normal earth quake thrust.

Frame structural building construction practice is more essential for the present earth quake situation of this country.

But actual analysis of frame structural building is not possible for the civil diploma engineers.

To face this situation , every civil diploma engineers must have to earn minimum structural concept.

The main objectives of this project work is to fulfill that target.

In this project work , to determining the design load , maximum vertical shear , maximum bending moment and other cases , co -efficient and lamsum methods has followed but analysis and design steps are rightly applied.

In this project work , I have try to build up maximum structural concept about frame structural building.

I think , the person who are successfully completed the project work , can take good participation in building construction field of this country.

I hope this concept help the civil diploma engineers to play right role in the construction field.

MD. ABDUL MALEK

Chief Instructor (Civil Eng. Department)

Acknowledgement

Preparing "Civil Engineering Project" as a part of Diploma Engineering Course is an innovative idea. Unfortunately we are student at Polytechnic institute level do not get any other opportunity to do such practical experience. So I am grateful to the respected curriculum director of the Diploma in Civil Engineering Course.

We mamboing gratefully every singe contribution of the Civil Engineering Department of B.P.I related to preparing of this project.

We are especially grateful to librarian who provides some important books regarding this project.

At the out set we do express our gratitude to our guide teacher Engineer Mr. Nuruzzaman Instructor (Civil Department) Bogra Polytechnic institute for his meticulous guidance , most worth advice and continual encouragement with out which we must avow , it would not have been possible on our part to accomplish this project. His very friendly behavior and benevolent attitude for us moral support to work agonist our constraints to complete this project.This was most important for us.

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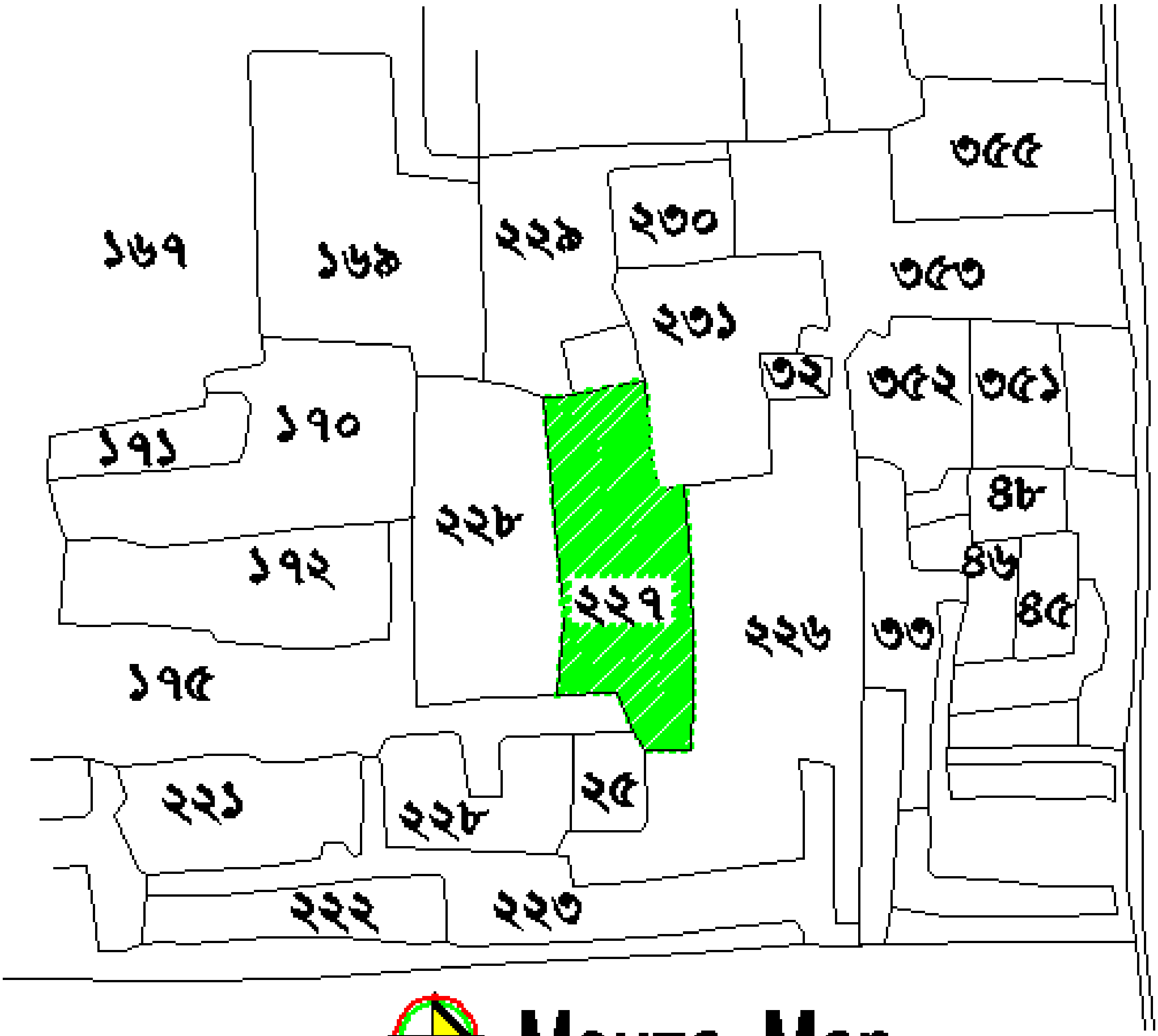
Part-01
Architectural Design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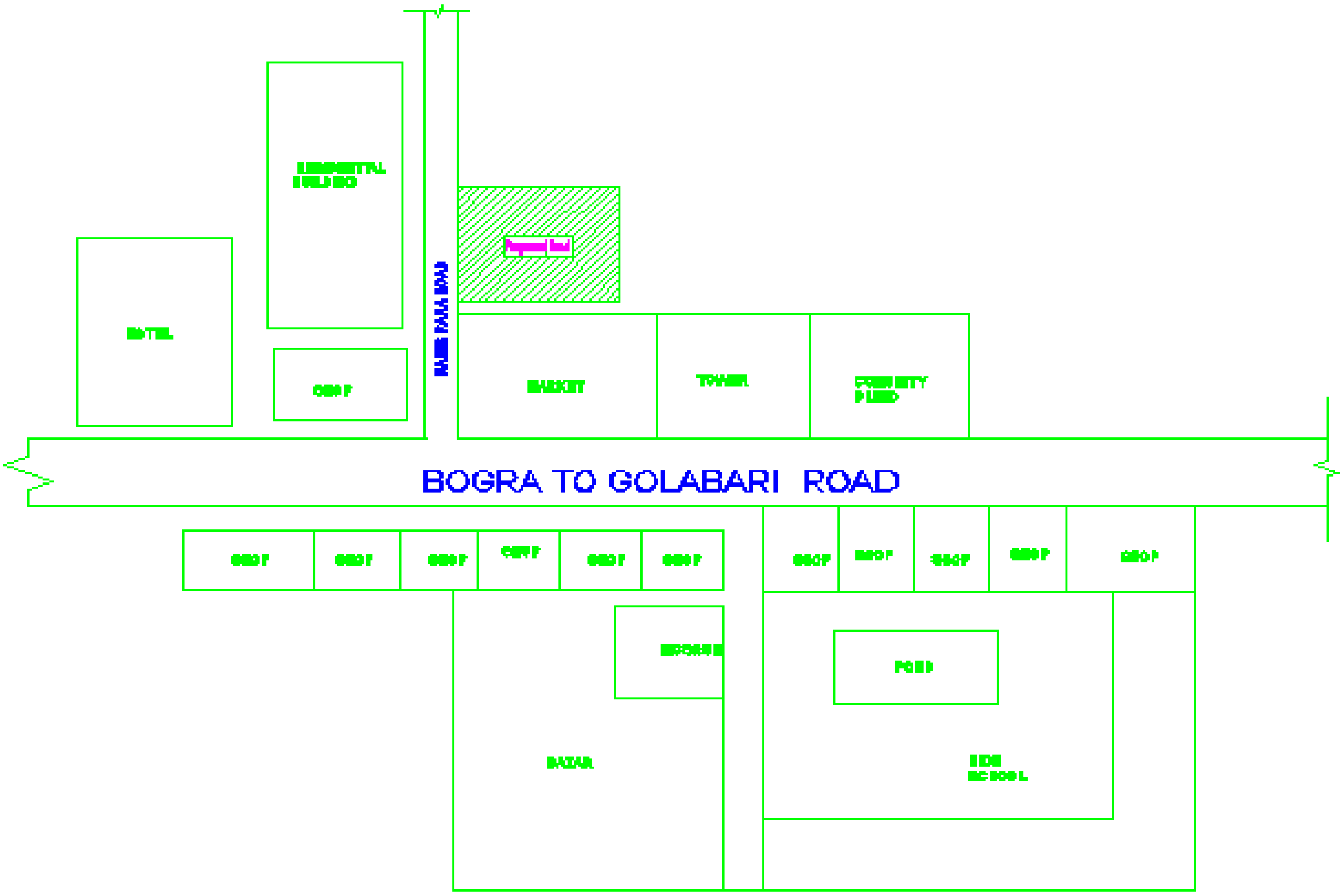
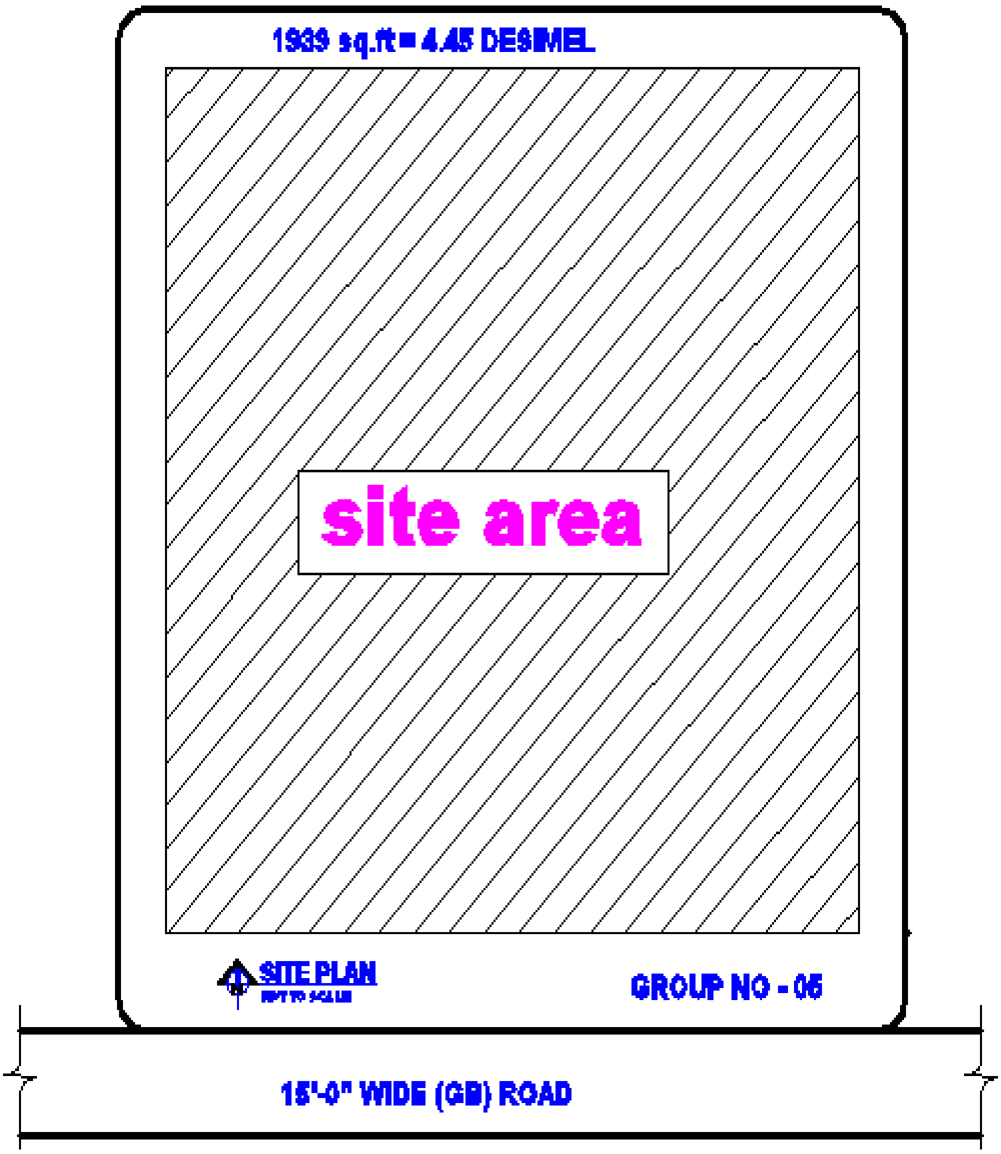
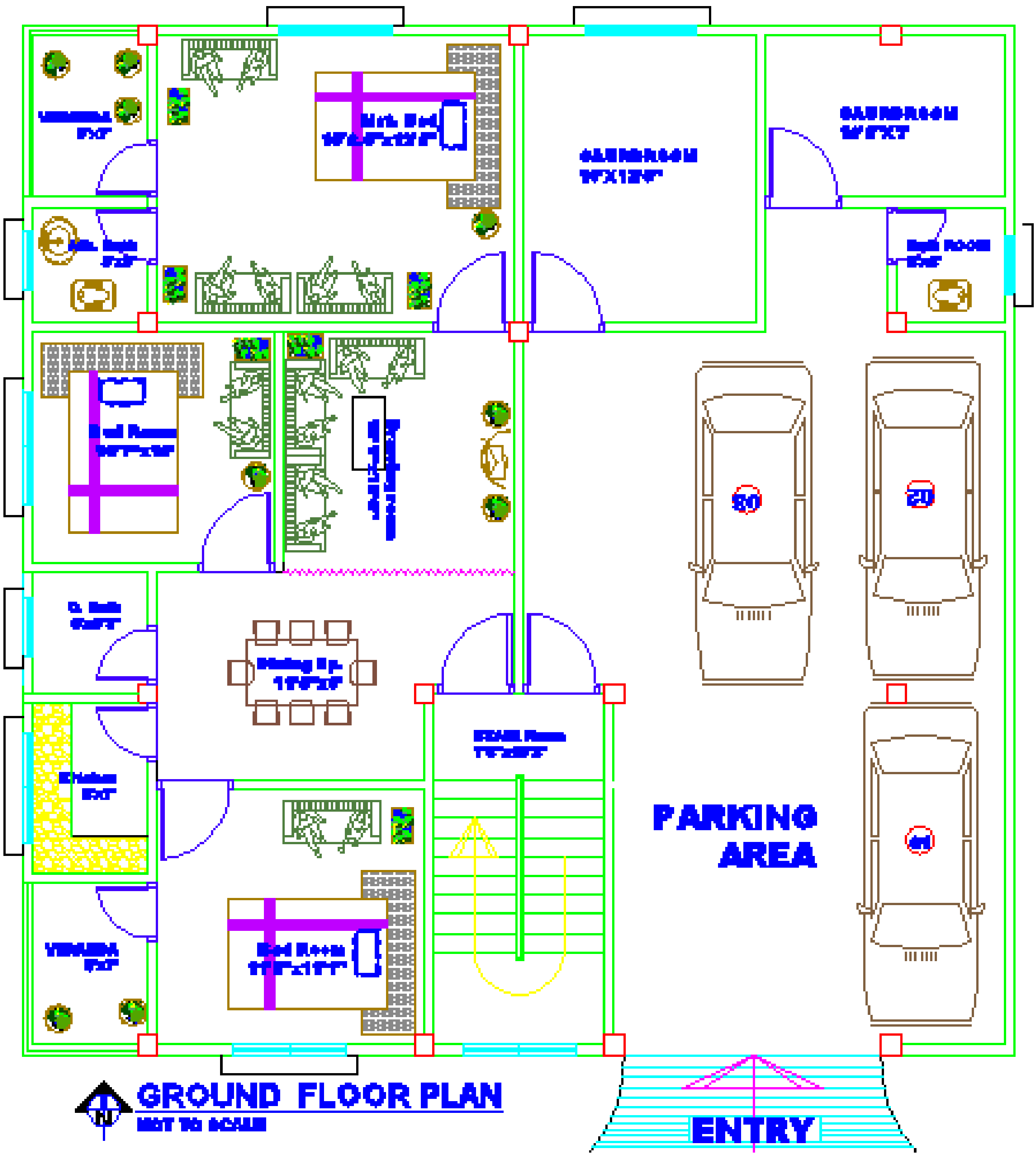
Mouza Map

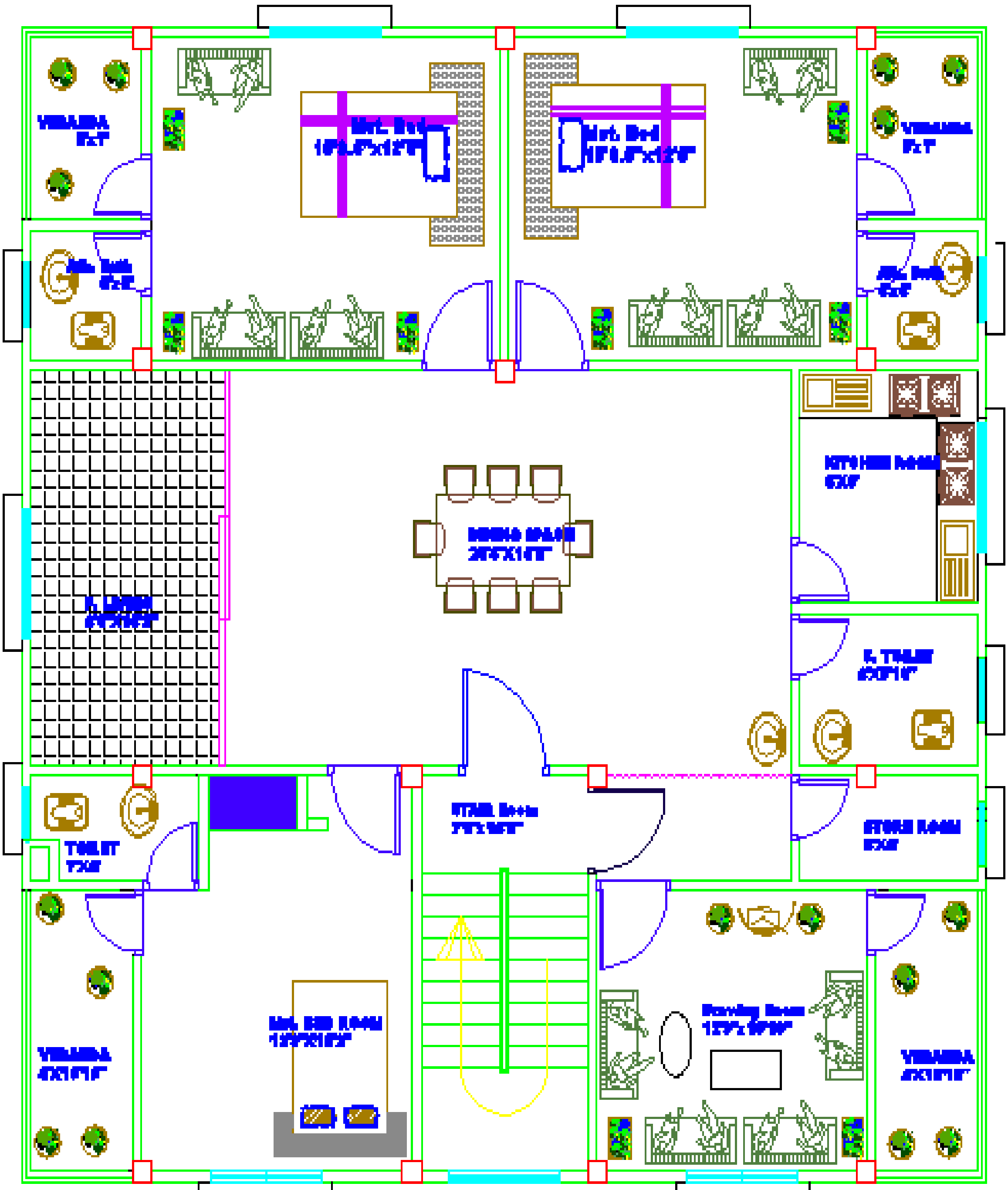


LOCATION MAP


1939 sq.ft = 4.45 DESIMEL
site area
SITE PLAN
GROUP NO - 05
15'-0" WIDE (GB) ROAD

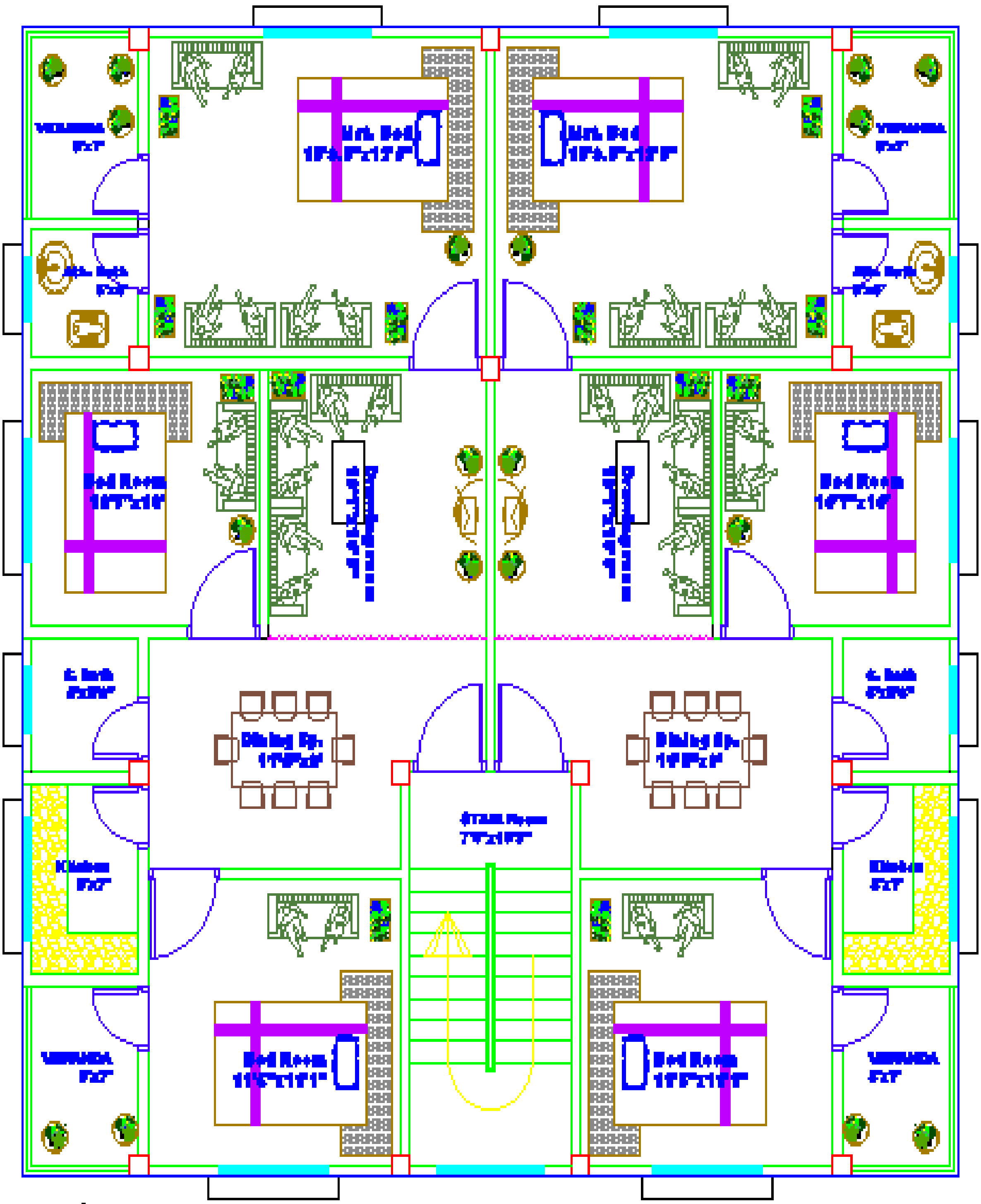


GROUND FLOOR PLAN
NOT TO SCALE



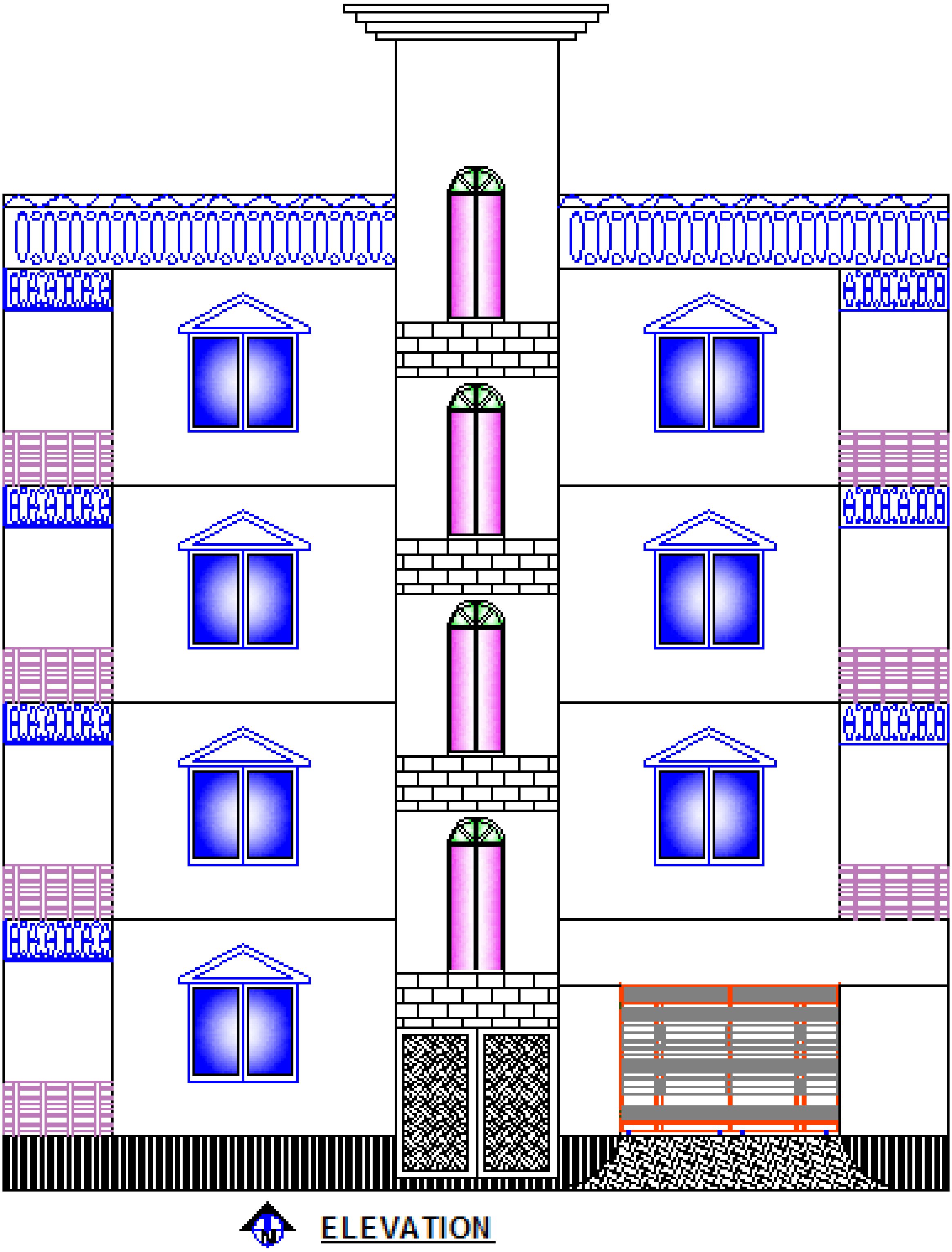
1ST FLOOR PLAN

GROUP NO - 05

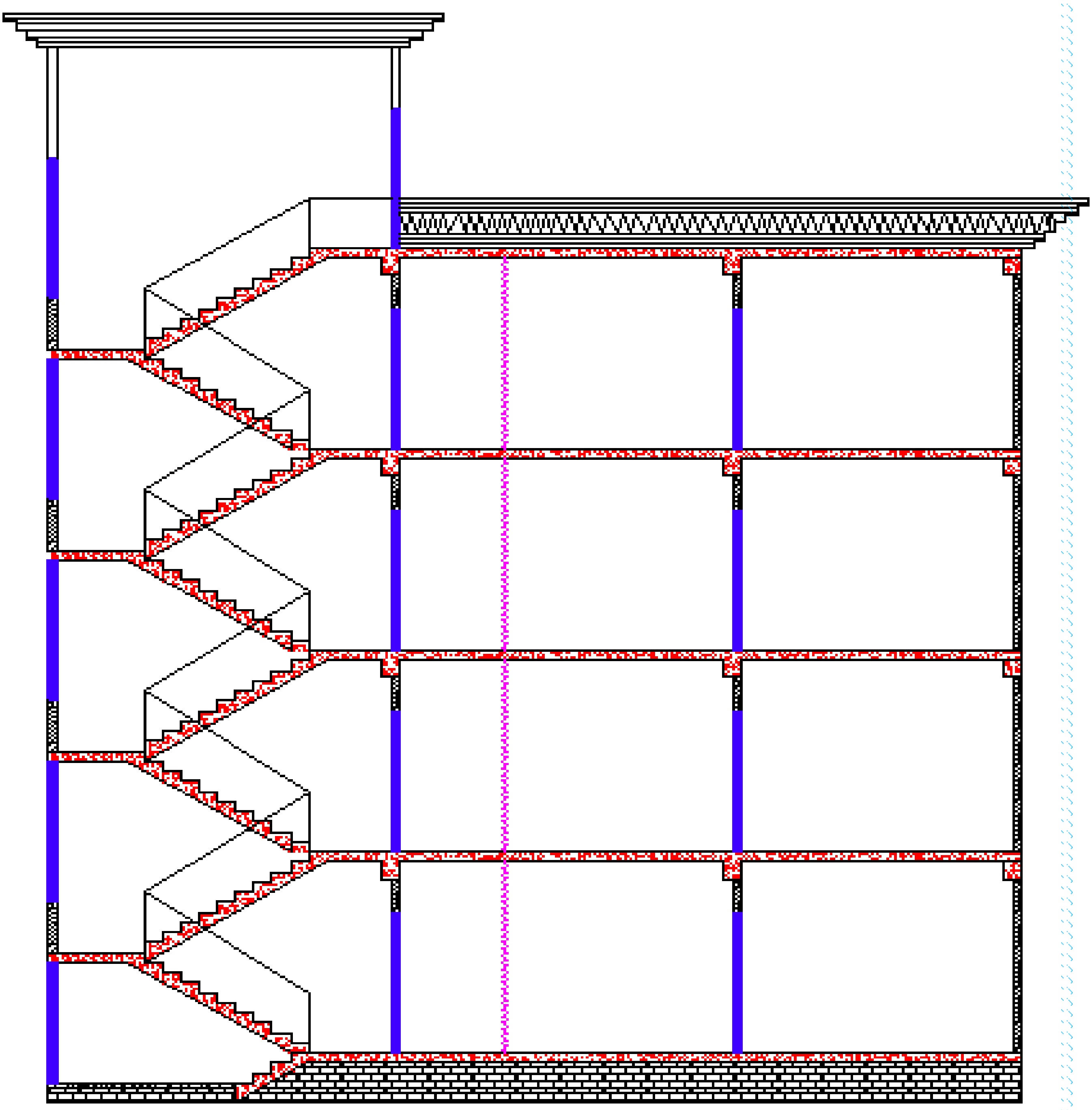


2ND & 3RD FLOOR PLAN

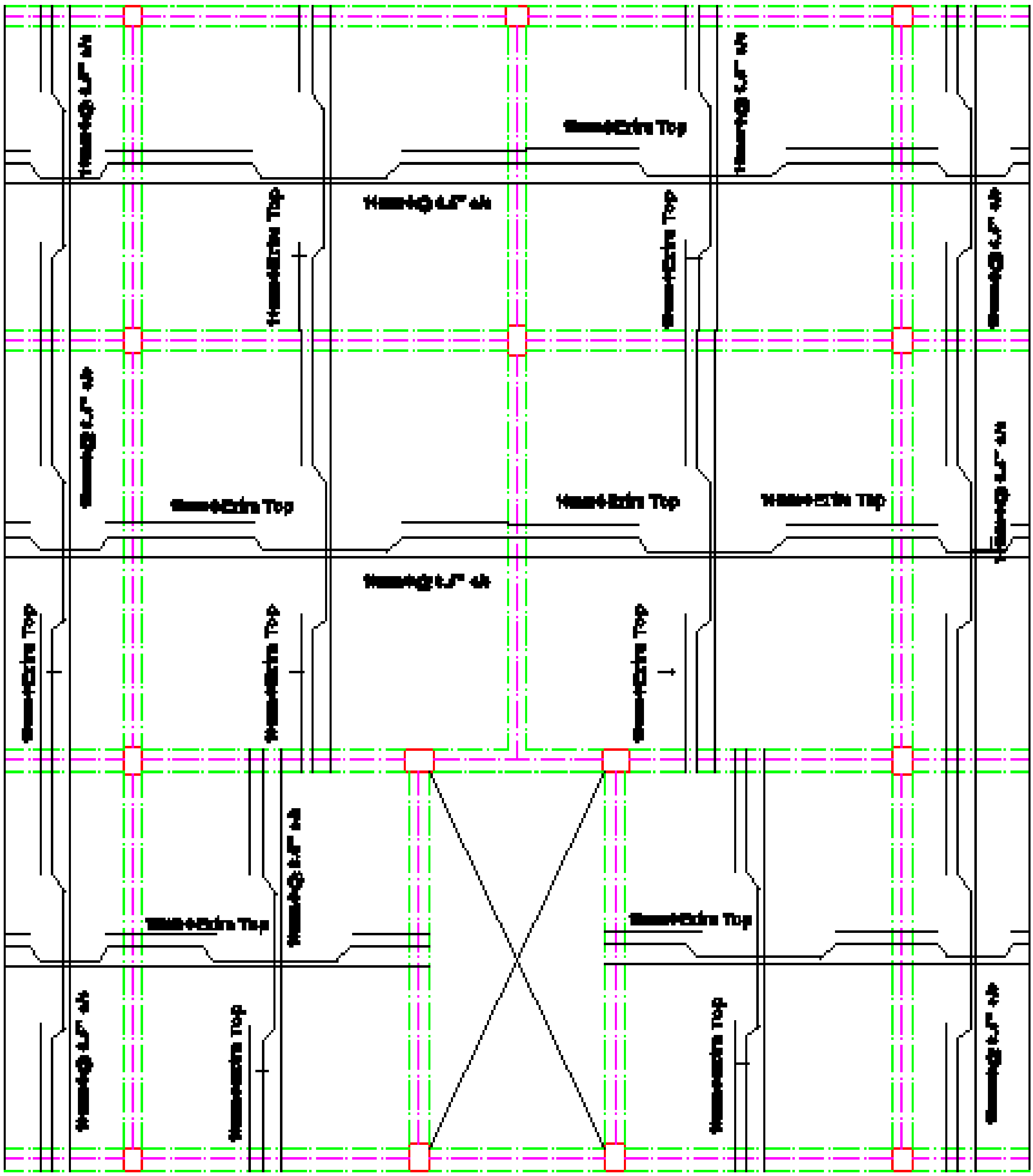
GROUP NO - 05



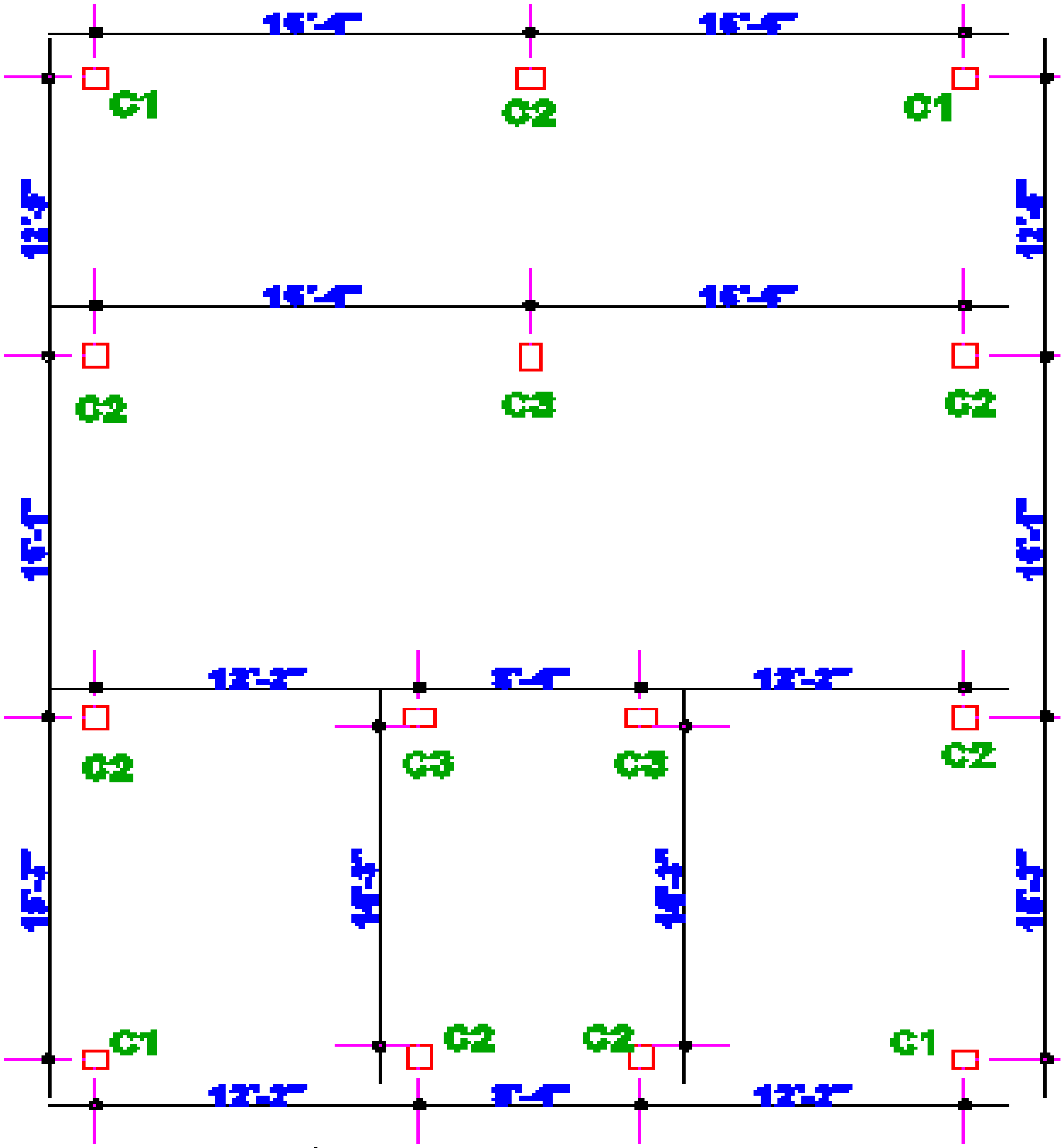
ELEVATION



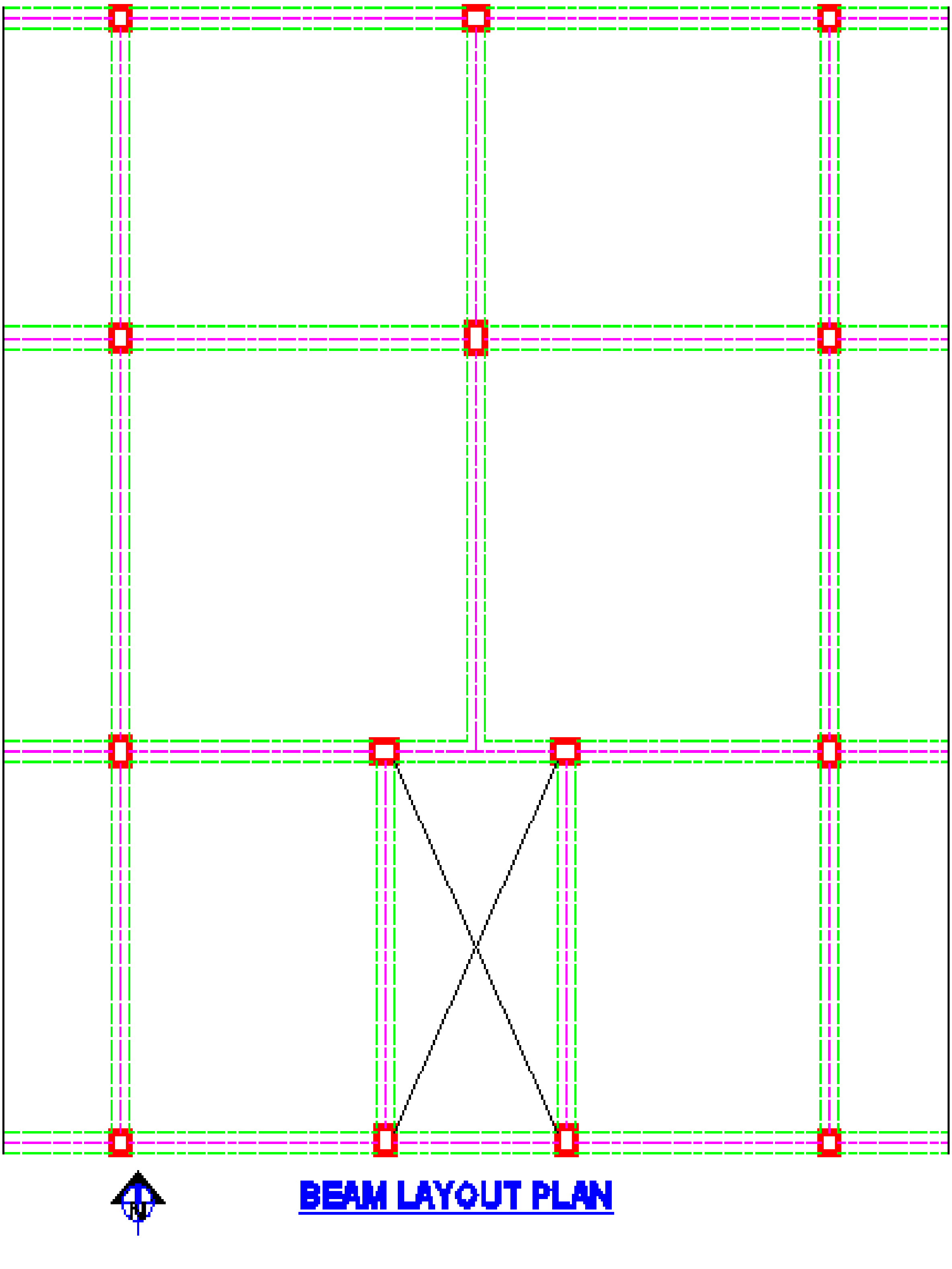
SECTION OF PLAN



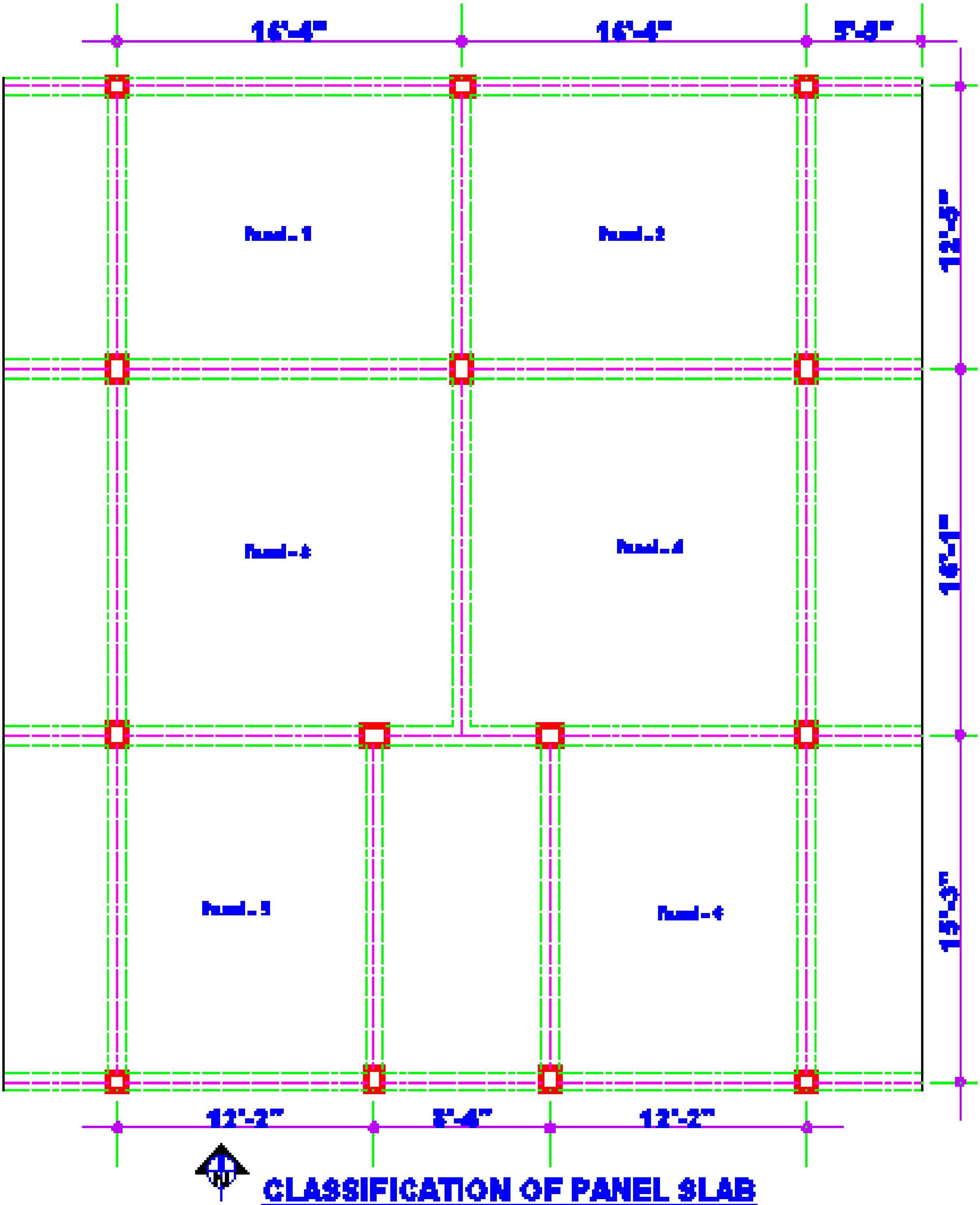
Slab Reinforcement Plan



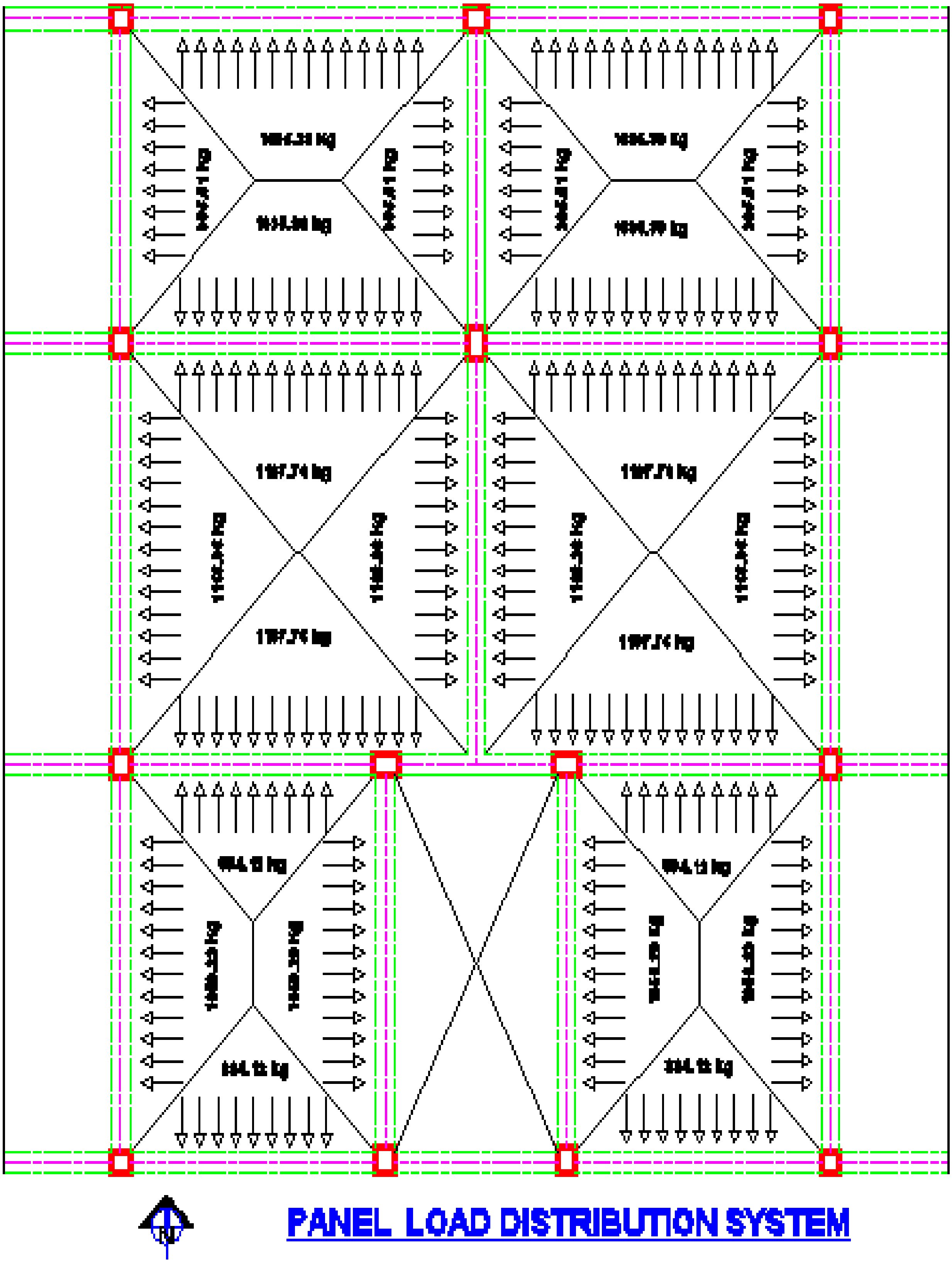
COLUMN LAYOUT PLAN



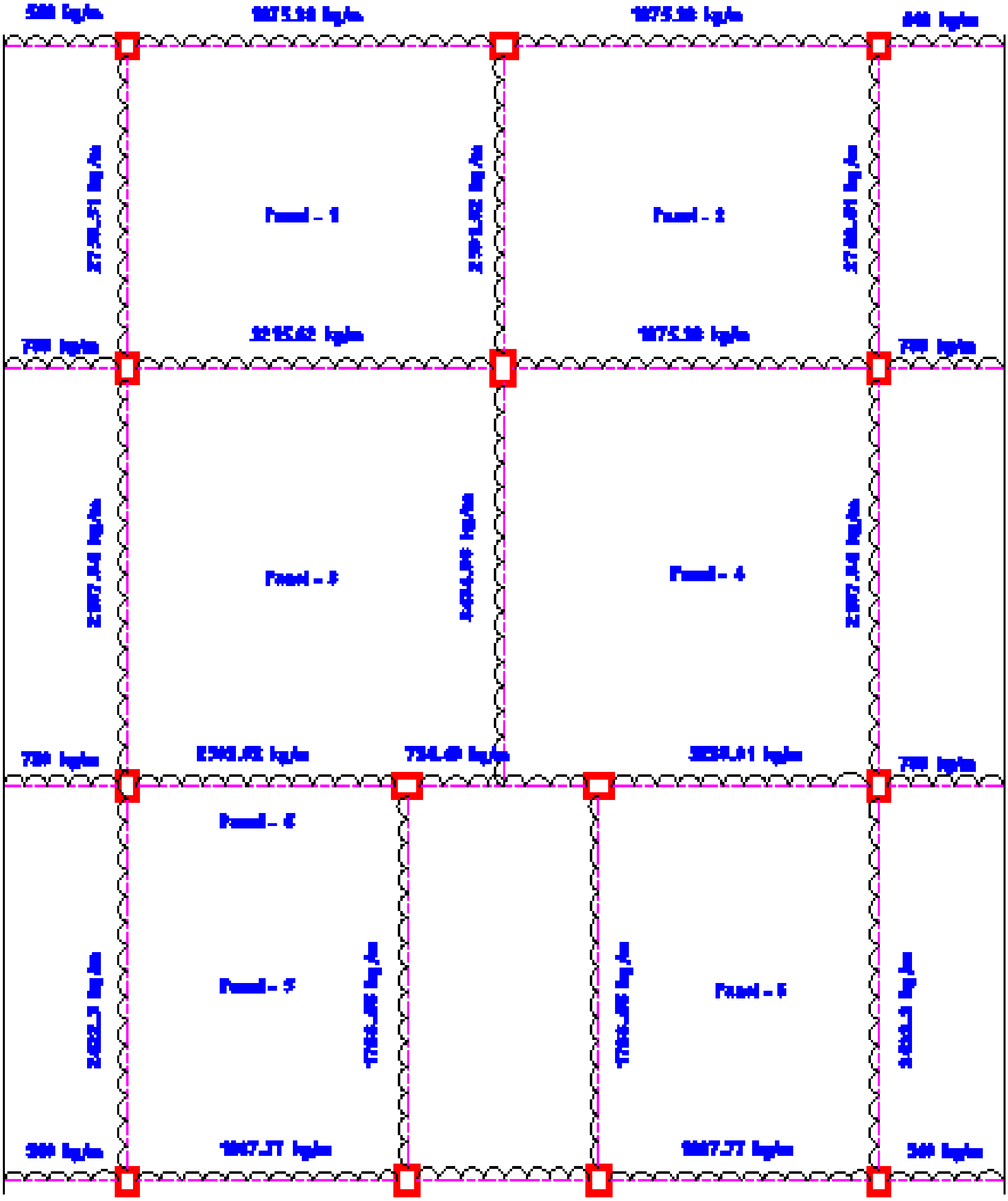
BEAM LAYOUT PLAN



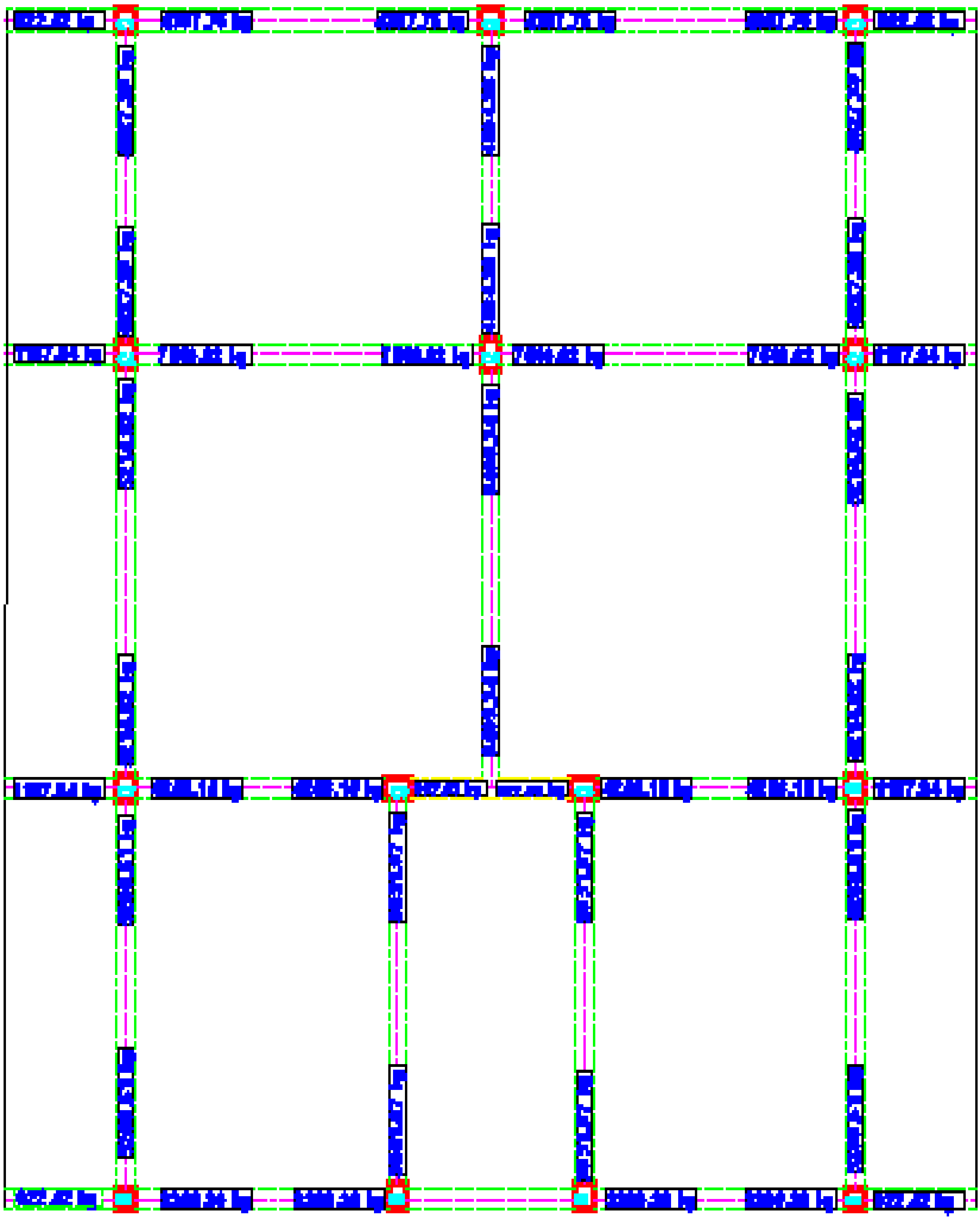
CLASSIFICATION OF PANEL SLAB



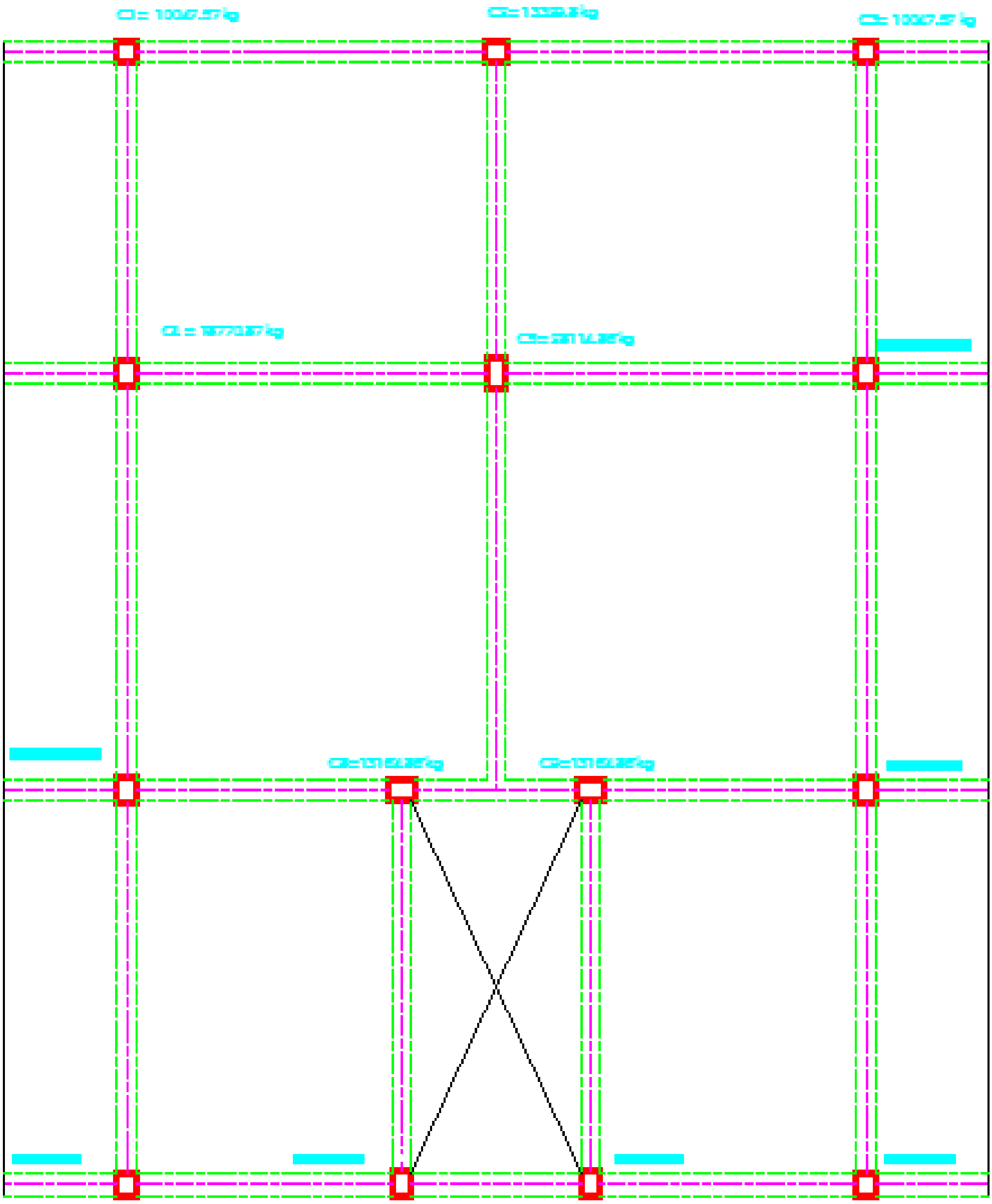
PANEL LOAD DISTRIBUTION SYSTEM



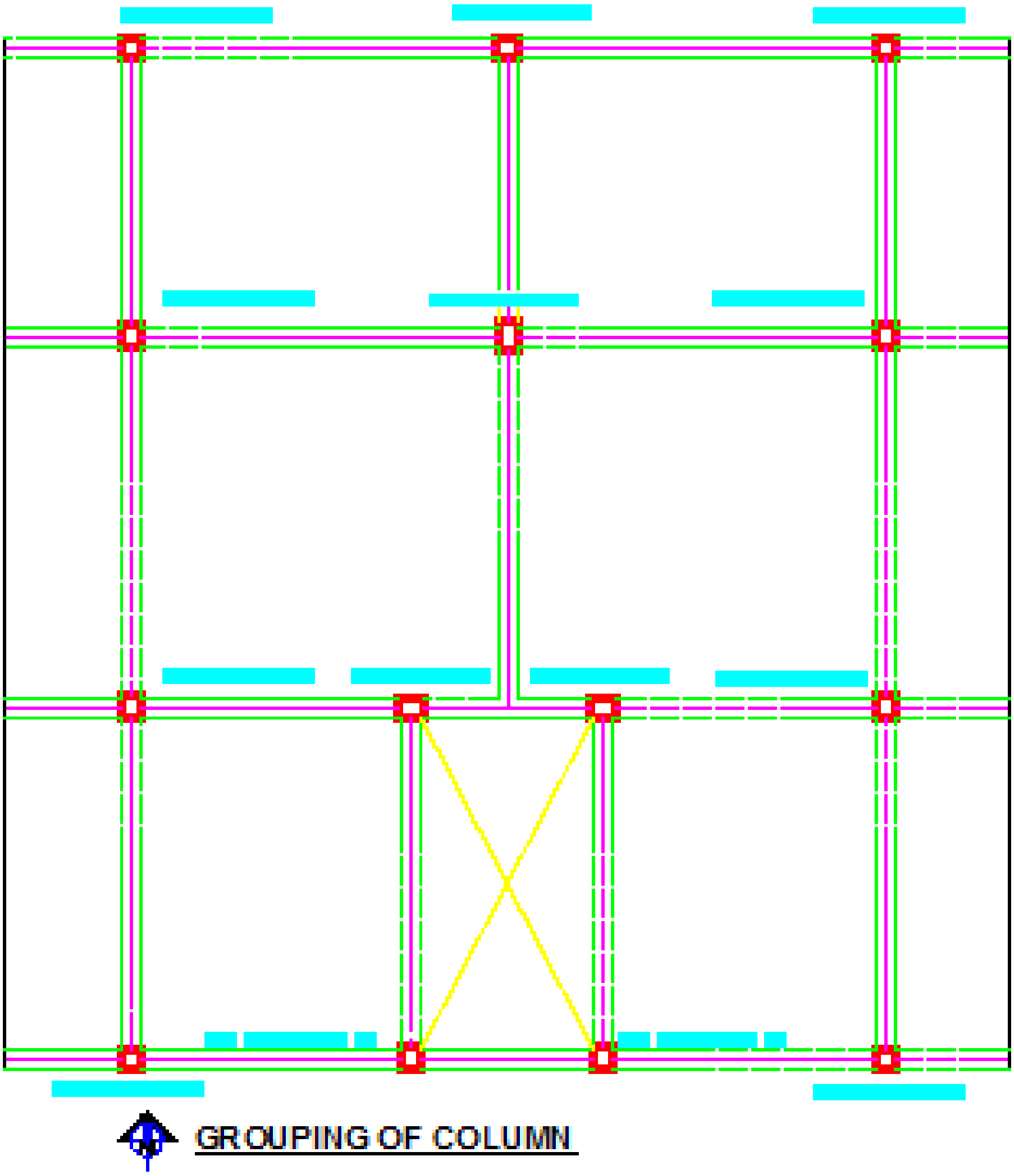
SUPER IMPOSED LOAD ON BEAM



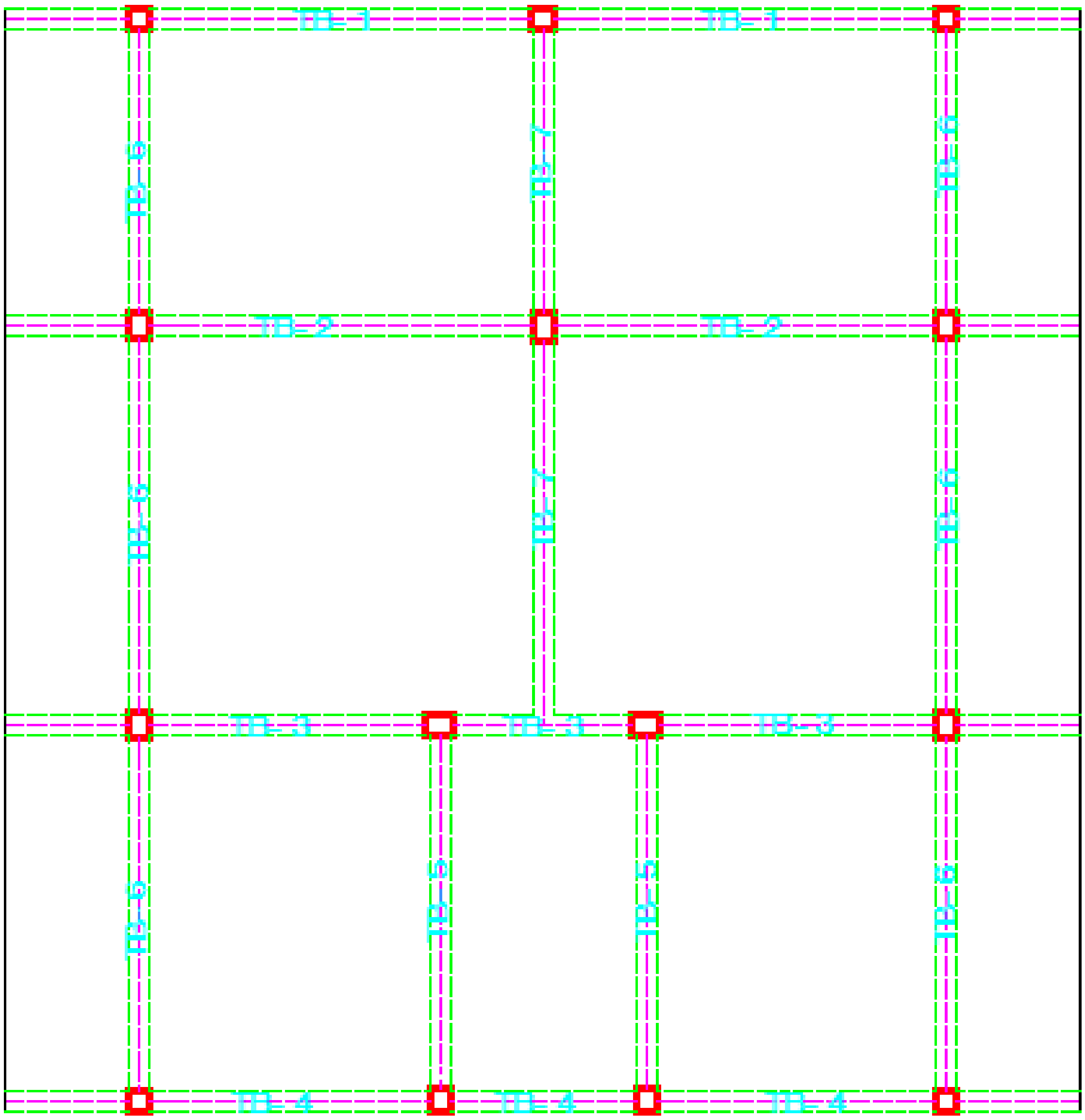
LOAD ON COLUMN



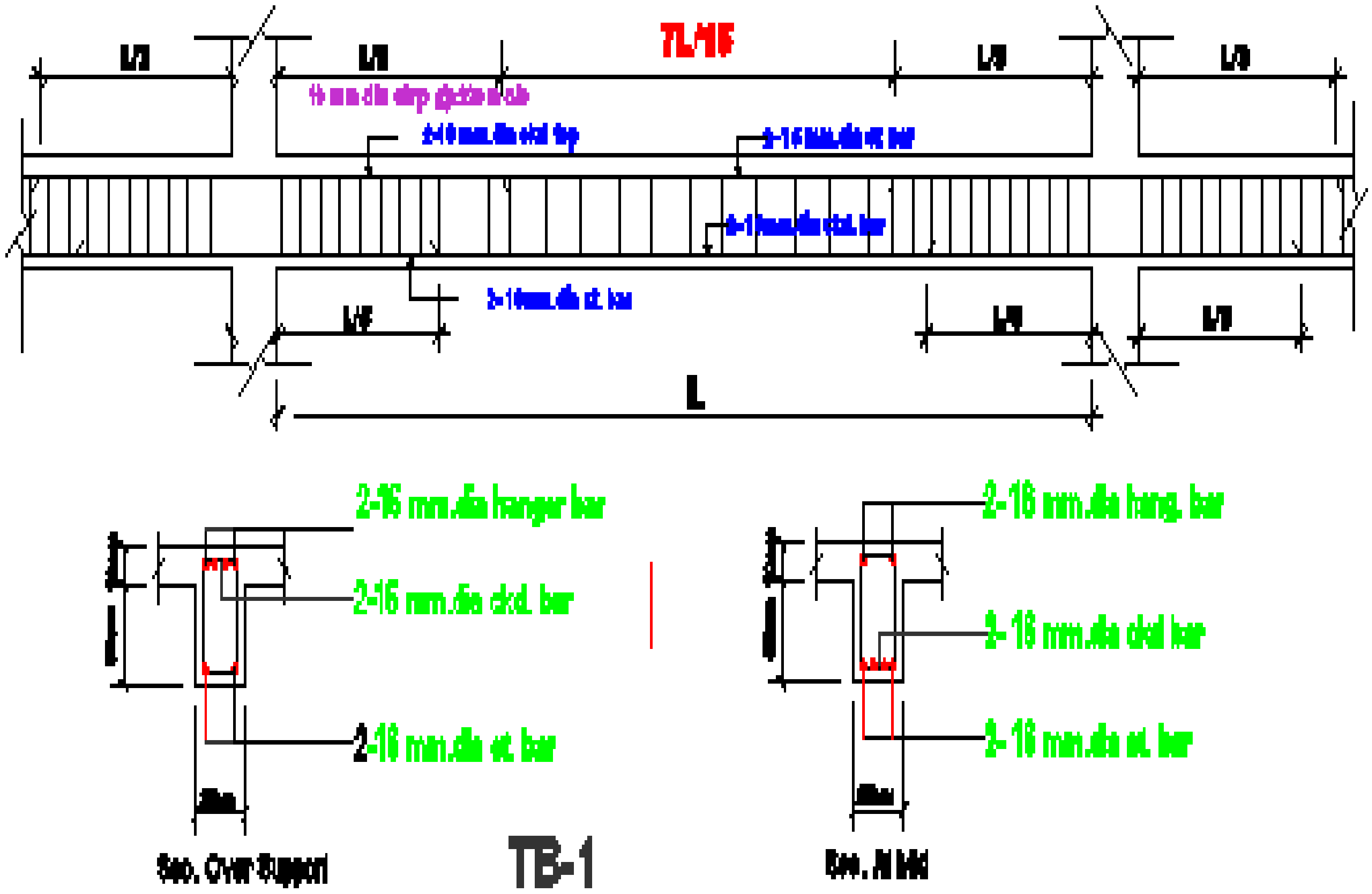
LOAD ON COLUMN



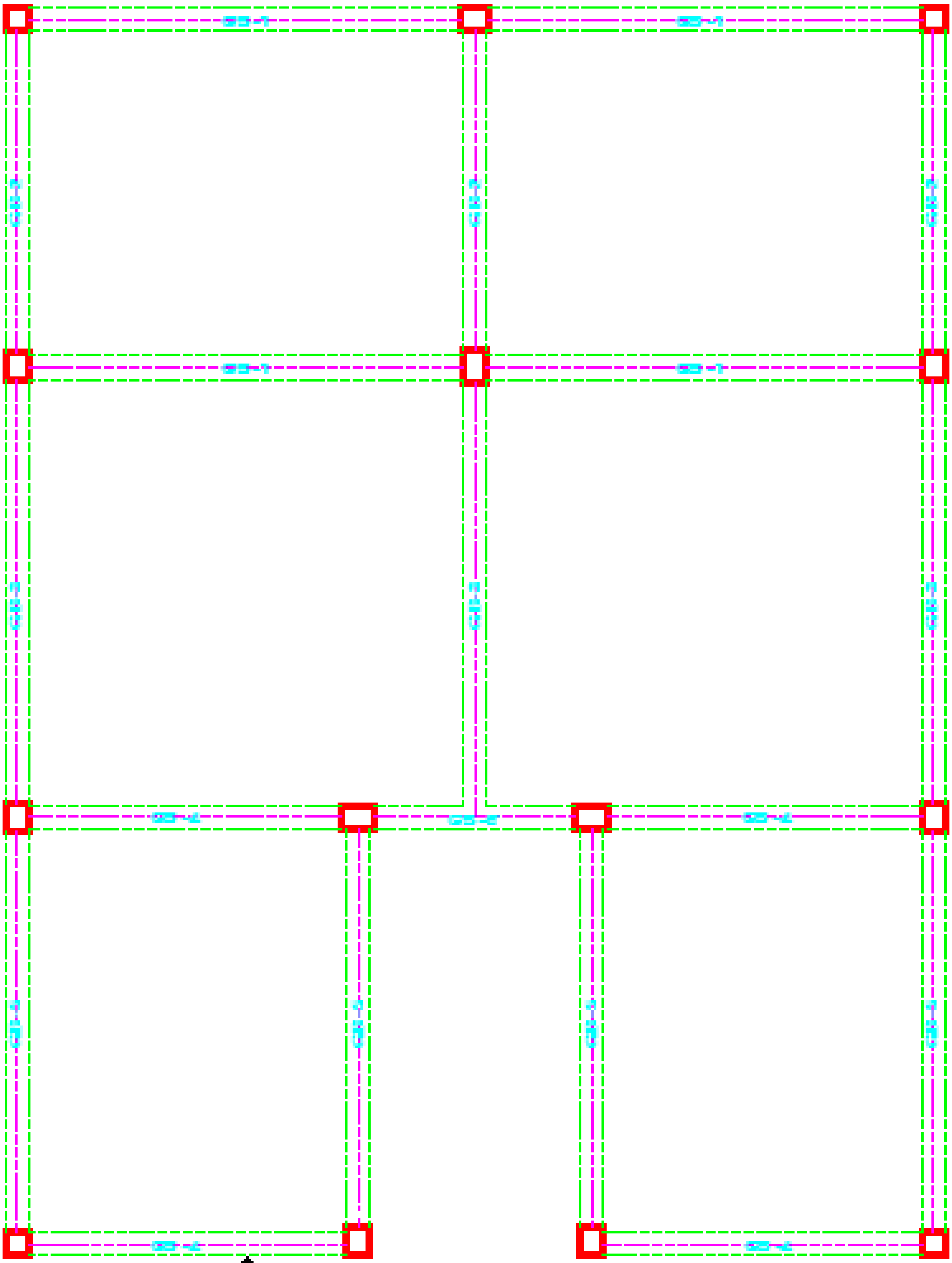
GROUPING OF COLUMN



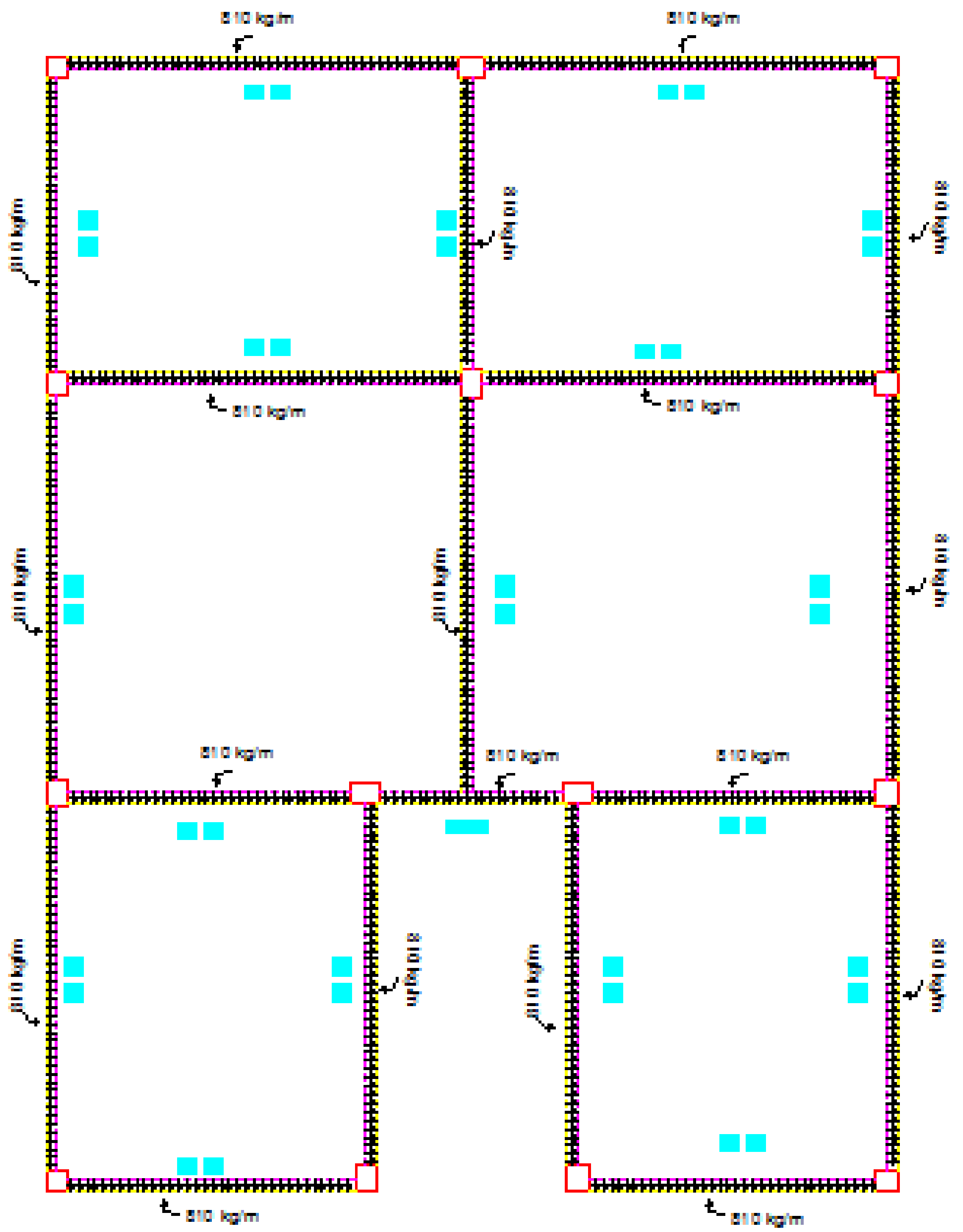
classification of T-Beam



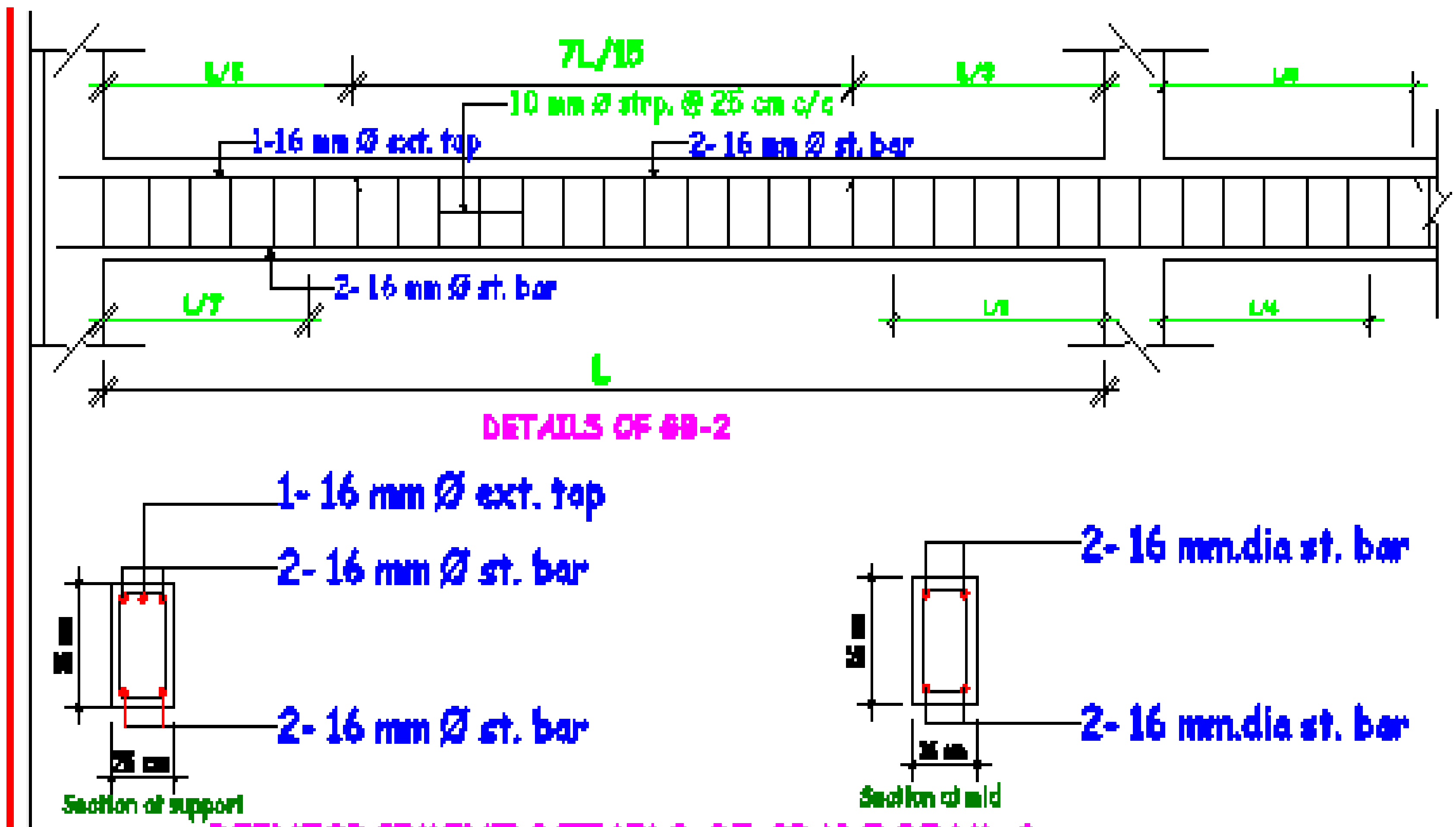
Reinforcement Details Of T-Beam



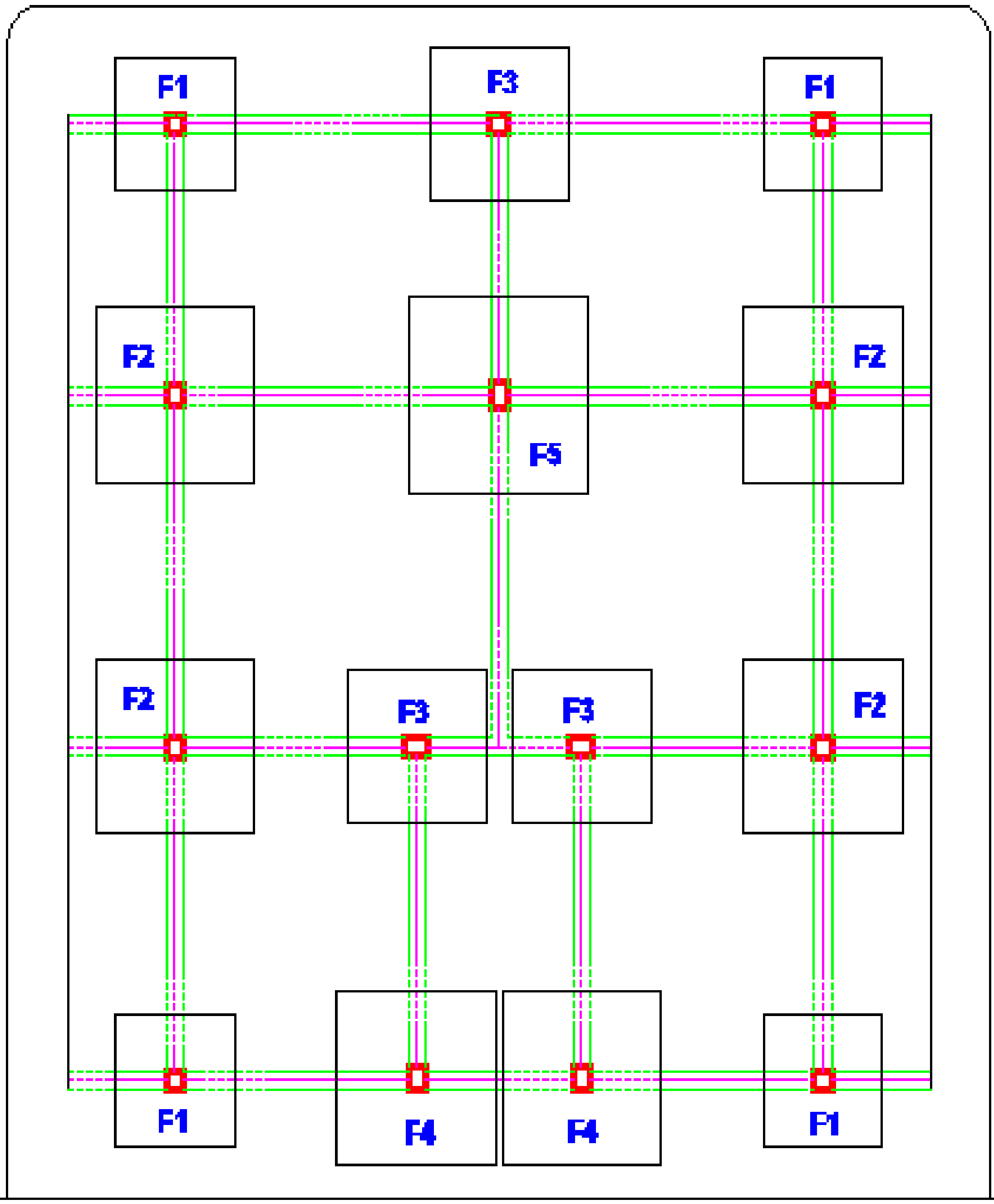
GRADE BEAM LAYOUT



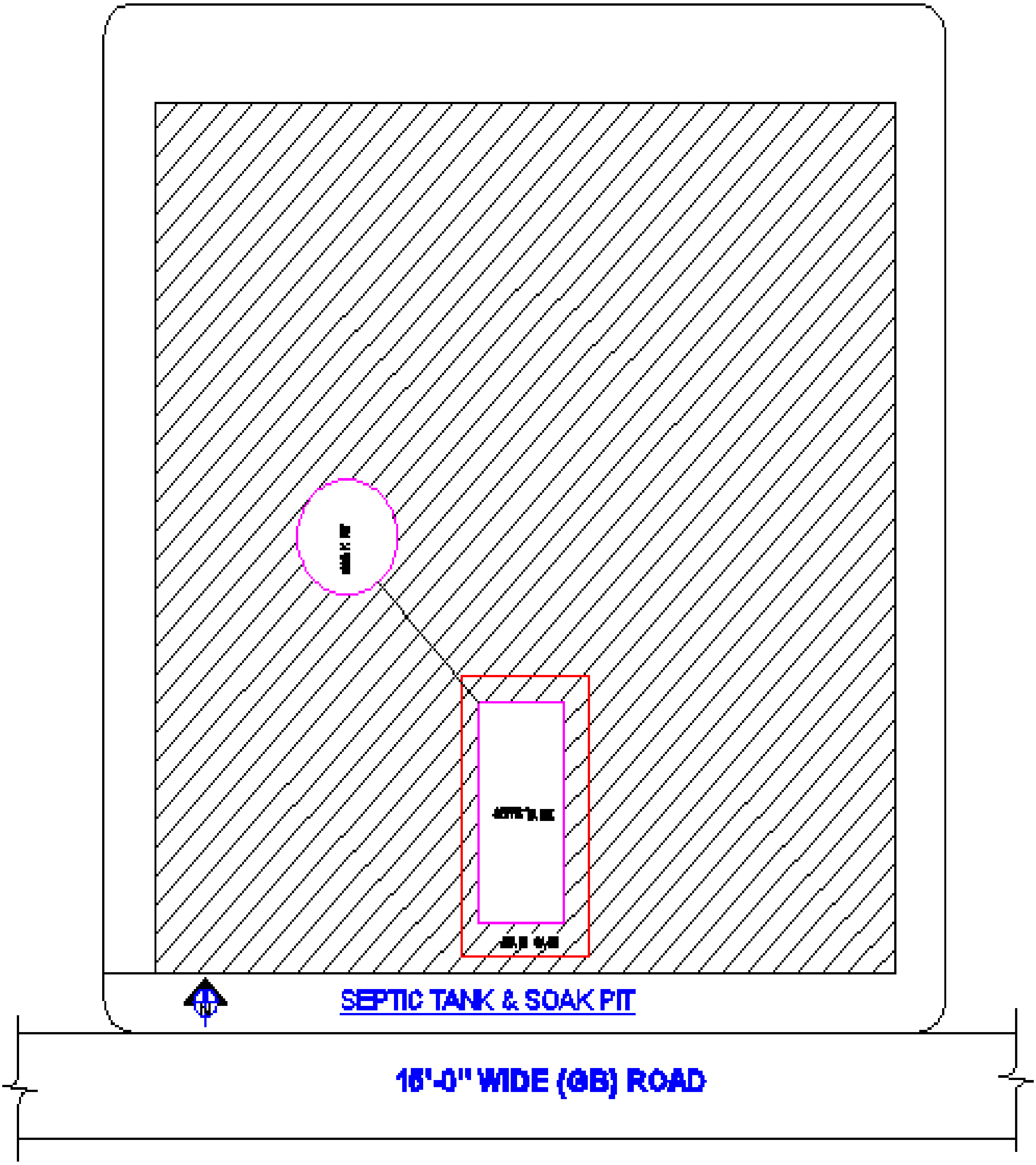
SUPER IMPOSED LOAD ON GRADE BEAM

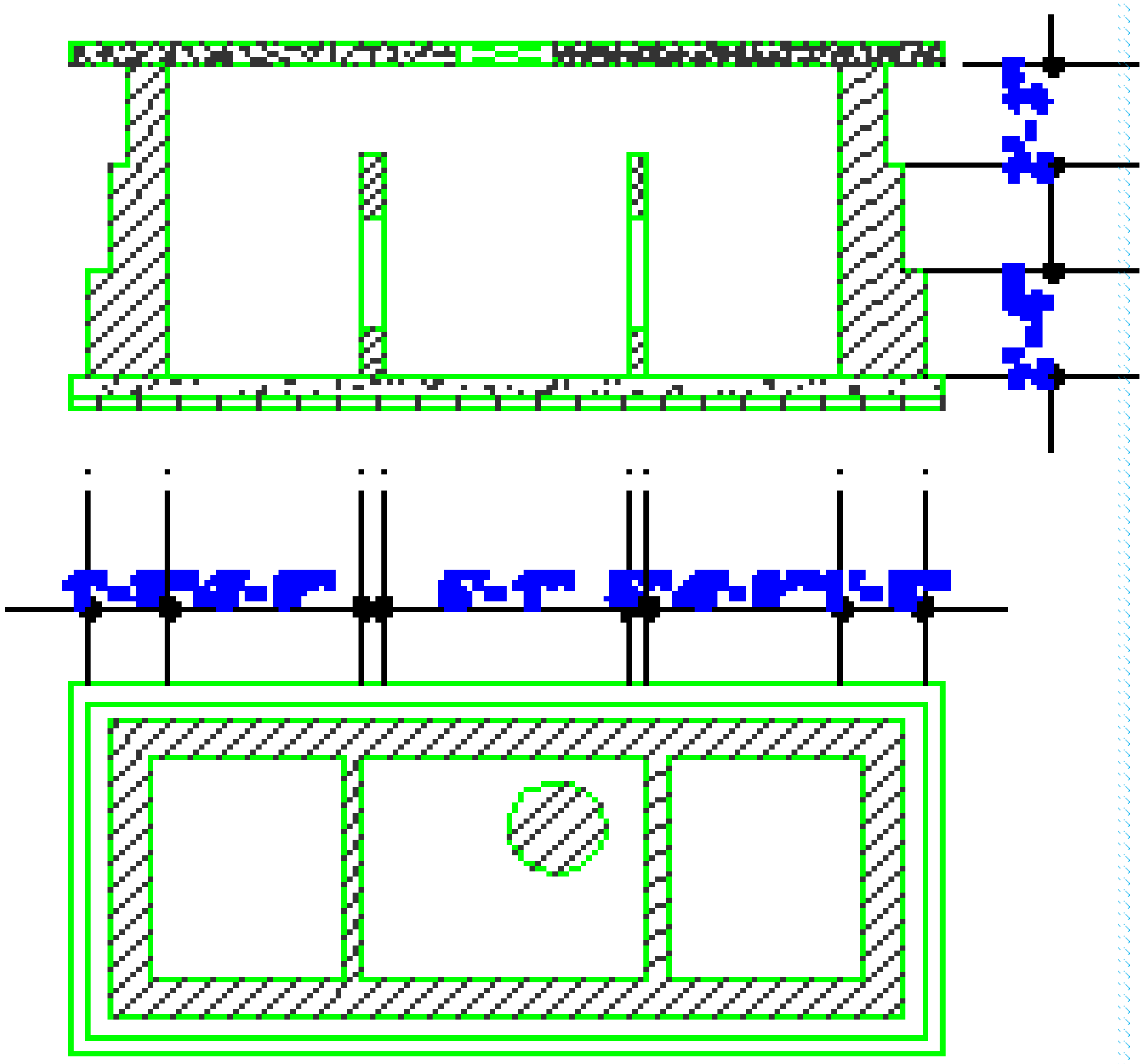


REINFORCEMENT DETAILS OF GRADE BEAM-2

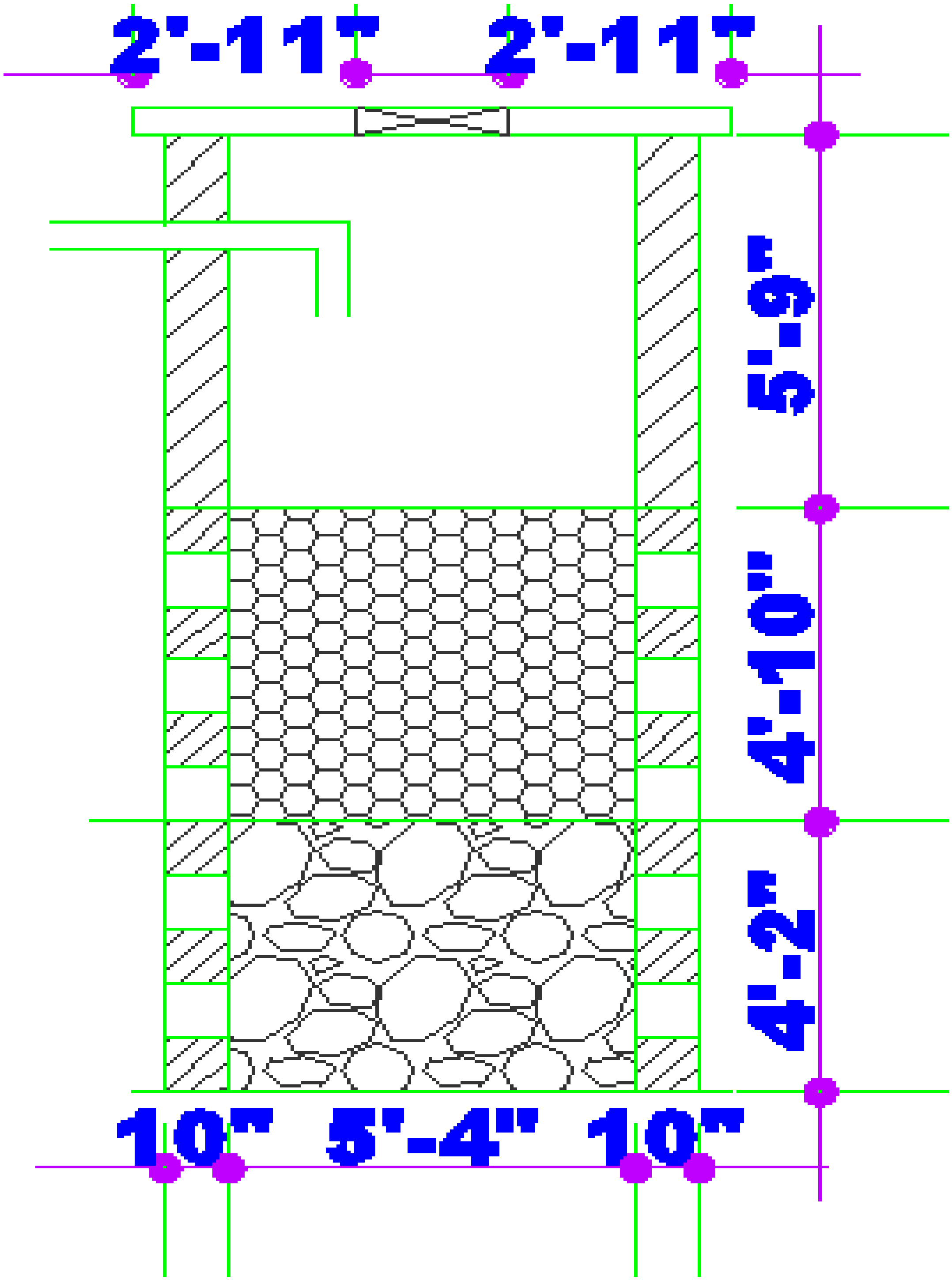


FOOTINTG LAYOUT

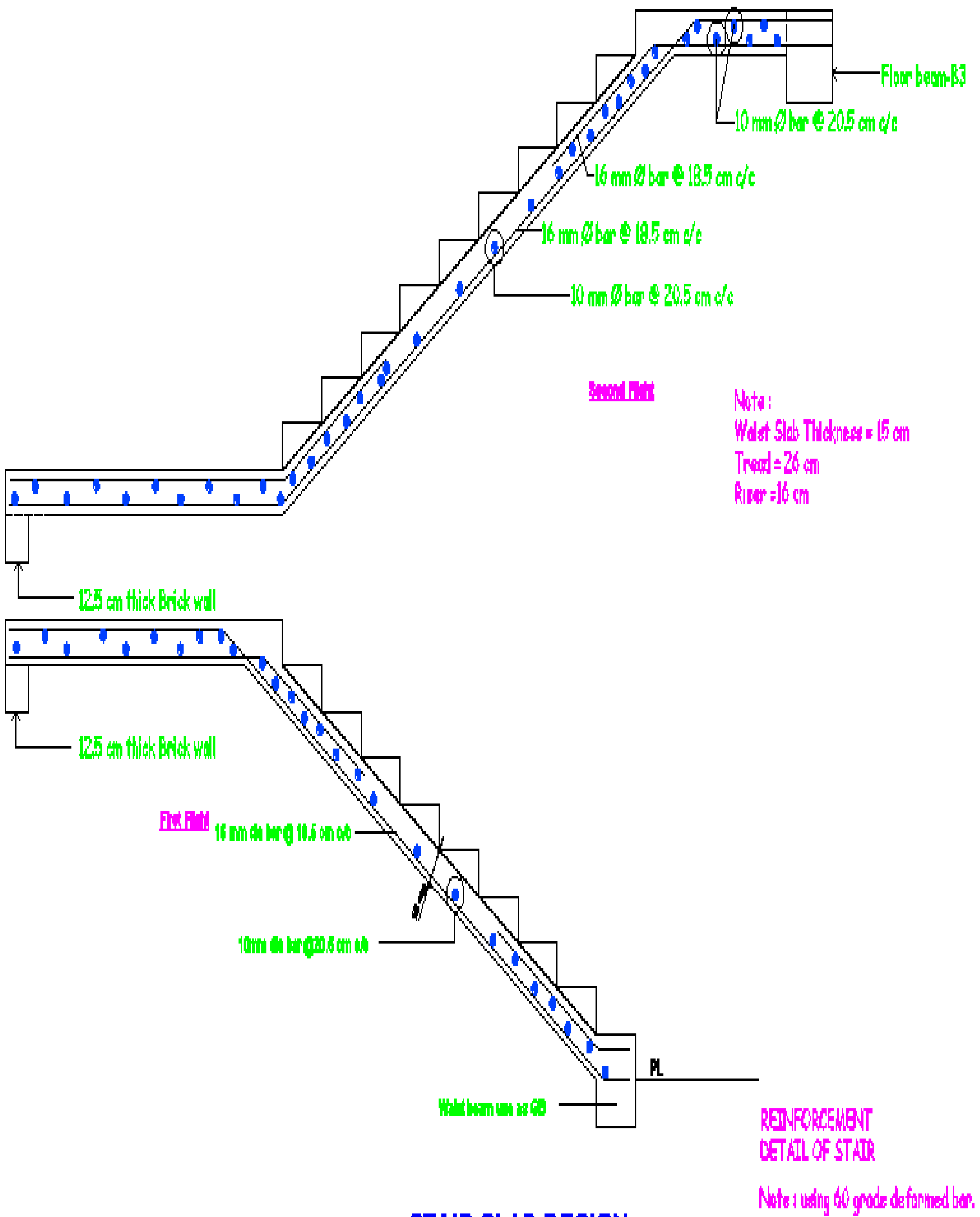

SEPTIC TANK & SOAK PIT
15'-0" WIDE (GB) ROAD



SEPTIC TANK DESIGN



SOAK PIT DESIGN



STAIR SLAB DESIGN

Design part

Panel Design

Panel-1 Design

Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5 kg/cm^2

f'c= 210 kg/cm^2

n=10

Live load = 300 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 300 kg/m
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	= 1x25	= 25 kg/m
		W= 713 kg/m

Step:-2

Maximum Vertical Shear Force- V

Here,

$\frac{S}{L}= \frac{3.81}{5}$=0.762

a) For Short Span

V1=$\frac{ws}{3}x\frac{3-m^2}{2}$

$= \frac{713x3.81}{3} x \frac{3-0.762^2}{2}$

=1095.38 Kg

b) For Long Span

V2=$\frac{ws}{3}$

$= \frac{613x3.81}{3}$

=905.51 Kg

Step:-3

Maximum B.M- M (case-III)

a) For Short Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.055x713x$(4.98)^2$x100 | C=0.062

= 94256.40 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= 0.031x613x$(4.98)^2$x100 | C= 0.031

= 47128.20 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

= 0.047x613x$(4.98)^2$x100 | C= 0.047

= 71452.43 Kg-cm

b) For Long Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.041x613x$(4.98)^2$x100 | C=0.041

= 62330.85 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= 0.021x613x$(4.98)^2$x100 | C=0.021

= 31925.55 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

$= 0.031x613x(4.98)^2x100$ C=0.031

= 47128.20 Kg-cm

Step:-4

Effective depth-d

a) For Short Span – ds

$ds= \frac{\sqrt{Ms(max)}}{Rb}$

$= \frac{\sqrt{94256.40}}{14.93x100}$

= 7.95 cm

Using 12mm φ bar and 2 cm clear cover .

Total depth = 7.95+2+$\frac{1.2}{2}$ = 10.55 cm.<12 cm.

R=.5x94.5x.88x.359

Hence ok

$k= \frac{n}{n+\frac{fs}{fc}}$

$= \frac{10}{10+\frac{1687}{94.5}}$

= .359

$j= 1-\frac{0.359}{3}$

=0.88

=14.93

Acceptable total depth = 12 cm.

Actual effective depth = (12-2–$\frac{1.2}{2}$) cm.

= 9.4 cm.

a) For Long Span – dL

$dL= \frac{\sqrt{ML(max)}}{Rb}$

$= \frac{\sqrt{62330.85}}{14.93x100}$

= 6.46 cm.

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+1.2+.6= 3.8 cm.

R=.5x94.5x.88x.359

Total depth = 6.46+3.8 = 10.26 cm.<12 cm.

$k= \frac{n}{n+\frac{fs}{fc}}$

$k= \frac{10}{10+\frac{1687}{94.5}}$

= .359

$J= 1-\frac{0.359}{3}$

=0.88

=14.93

Hence ok

Acceptable total depth = 12 cm.

Actual effective depth = (12-1.2-$\frac{1.2}{2}$) cm.

= 8.2 cm.

Step:-5

Area of tensile steel – As

a) For Short Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{94256.40}{1687x.88x9.4}$

$=6.75\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{6.75}$= 16.74 cm c/c.

2) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{47128.20}{1687x.88x9.4}$

$= 3.377\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{3.377}$= 33 cm c/c.

Maximum Spacing =3t=3x12=36 cm.

3) (–)ve As mid span = $\frac{M}{fsjd}$

$=\frac{71452.43}{1687x.88x9.4}$

$=5.12\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{5.12}$= 22.07 cm c/c.

Maximum Spacing =3t=3x12=36 cm.

b) For Long Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{62330.85}{1687x.88x8.2}$

$=5.12\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{5.12}$= 22.07 cm c/c.

2) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

=$\frac{31925.55}{1687x.88x8.2}$

= 2.62 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{2.62}$= 44.84 ≅ 43.13 cm c/c.

Maximum Spacing =3t=3x12=36 cm

3) (–)ve As for mid span = $\frac{M}{fsjd}$

=$\frac{47128.20}{1687x.88x8.2}$

=3.05 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{3.05}$= 37.05 ≅33.5 cm c/c.

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$

= 4.23 kg/ cm^2.

a) For Short Span,

V1= $\frac{V}{bd}$

= $\frac{1233.27}{100x9.4}$

=1.31 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

b) For Long Span,

V2= $\frac{V}{bd}$

= $\frac{1017.58}{100x8.2}$

= 1.24 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

Step:-7

Check for bond stress – u

Uall = $\frac{3.23x\sqrt{f'c}}{1.2}$

= $\frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=$\frac{100}{42.5}x1.2x\pi$

=8.87

a) For Short Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{1233.27}{8.87x.88x9.4}$

= 16.81 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

b) For Long Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{1017.58}{8.47x.88x8.2}$

= 16.65 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

$\varepsilon o = N\varphi\pi$

=$\frac{100}{44.5}x1.2x\pi$

Panel-2 Design

**Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5kg/cm^2

f'c= 210 kg/cm^2

n=10

Live load = 200 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 200 kg/m
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	= 1x25	= 25 kg/m
		W= 613 kg/m

Step:-2

Maximum Vertical Shear Force- V

Here,

$\frac{S}{L}$= $\frac{3.71}{4.6}$=0.8

a) For Short Span

V1=$\frac{ws}{3}x\frac{3-m^2}{2}$

=$\frac{613x3.71}{3}x\frac{3-0.8^2}{2}$

= 894.52 Kg

b) For Long Span

$V2=\frac{ws}{3}$

$=\frac{613x3.71}{3}$

= 758.07 Kg

Step:-3

Maximum B.M- M (case-III)

a) For Short Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.064x613x$(3.71)^2$x100 | C=0.064

= 53999.31 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= 0.032x613x$(3.71)^2$x100 | C= 0.032

= 26999.65 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

= 0.018x613x$(3.71)^2$x100 | C=0.018

= 15187.30 Kg-cm

b) For Long Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.04x613x$(3.71)^2$x100 | C=0.04

= 33749.57 Kg-cm

1) (–)ve bending moment at discont. Edge = cws^2x100

= 0.025x613x$(3.71)^2$x100 | C=0.025

= 21093.48 Kg-cm

2) (+)ve bending moment at mid span = cws^2x100

= 0.037x613x$(3.71)^2$x100 | C=0.037

= 31218.35 Kg-cm

Step:-3

Effective depth-d

a) For Short Span – ds

$$ds = \frac{\sqrt{Ms(max)}}{Rb}$$

$$= \frac{\sqrt{67978.01}}{14.93x100}$$

= 6.75 cm

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+$\frac{1.2}{2}$ cm.

Total depth = 6.75+2+$\frac{1.2}{2}$ = 9.35 cm.<12 cm.

R=.5x94.5x.88x.359

Hence ok

$$k = \frac{n}{n+\frac{fs}{fc}}$$

$$= \frac{10}{10+\frac{1687}{94.5}}$$

= .359

j= 1-$\frac{0.359}{3}$

=0.88

=14.93

Acceptable total depth = 12 cm.

Actual effective depth = (12-2-$\frac{1.2}{2}$) cm.

= 9.4 cm.

1) For Long Span – dL

$$dL = \frac{\sqrt{ML(max)}}{Rb}$$

$$= \frac{\sqrt{60016.62}}{14.93x100}$$

= 6.34 cm.

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+1.2+$\frac{1.2}{2}$ = 3.8 cm.

R=.5x94.5x.88x.359

Total depth = 6.34+2+1.2+$\frac{1.2}{2}$ = 10.14 cm.<12 cm.

Hence ok

$$k = \frac{n}{n+\frac{fs}{fc}}$$

$$k = \frac{10}{10+\frac{1687}{94.5}}$$

= .359

J= 1-$\frac{0.359}{3}$

=0.88

=14.93

Acceptable total depth = 12 cm.

Actual effective depth = (12-2-1.2-$\frac{1.2}{2}$) cm.

= 8.2 cm.

Step:-5

Area of tensile steel – As

b) For Short Span

2) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{67978.01}{1687x.88x9.4}$

$=4.88\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.88}$= 23.15 ≅23 cm c/c.

3) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{36744.77}{1687x.88x9.4}$

$= 2.63\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{2.63}$= 42.97 ≅42.5 cm c/c.

4) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{55729.72}{1687x.88x9.4}$

$=3.99\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{3.99}$= 28.32 ≅28 cm c/c.

5) For Long Span

6) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{60016.62}{1687x.88x8.2}$

$=4.94\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{4.94}$= 11.37 ≅11 cm c/c.

7) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{30620.72}{1687x.88x8.2}$

= 2.52 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{2.52}$= 44.84 ≅ 44.5 cm c/c.

8) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{45318.67}{1687x.88x8.2}$

=3.37 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{3.37}$= 33.53 ≅33.5 cm c/c.

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$

= 4.23 kg/ cm^2.

a) For Short Span,

V1= $\frac{V}{bd}$

= $\frac{1040.24}{100x9.4}$

= 1.106 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

b) For Long Span,

V2= $\frac{V}{bd}$

= $\frac{1017.58}{100x8.2}$

= 1.113 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

Step:-7

Check for bond stress – u

Uall = $\frac{3.23x\sqrt{f'c}}{1.2}$

= $\frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=$\frac{100}{42.5}x1.2x\pi$

=8.87

c) For Short Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{1040.24}{8.87x.88x9.4}$

= 14.17 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

d) For Long Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{913.37}{8.47x.88x8.2}$

= 14.94 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

$\varepsilon o = N\varphi\pi$

=$\frac{100}{44.5}x1.2x\pi$

Panel-3 Design

**Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5kg/cm^2

f'c= 210 kg/cm^2

n=10

Live load = 300 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 300 kg/m
Partition wall	=3.18x.125x3x1920)/(4.99x4.94)= 92.89kg/m	
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	= 1x25	= 25 kg/m
Total		W=805.89kg/m

Step:-2

Maximum Vertical Shear Force- V

Here,

m= $\frac{S}{L}$= $\frac{4.94}{4.99}$=0.99

a) For Long Span

$V1=\frac{ws}{3}x\frac{3-m^2}{2}$

$=\frac{805.89x4.94}{3}x\frac{3-0.99^2}{2}$

= 1340.24 Kg/m

b) For Short Span

$V2=\frac{ws}{3}$

$= \frac{805.89x4.94}{3}$

= 1327.04 Kg/m

Step:-3

Maximum B.M- M (case-III)

a) For Short Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.033x713x$(4.98)^2$x100

= 58352.86 Kg-cm

C= $\frac{0.049+0.057}{2}$

= 0.053

2) (+)ve bending moment at mid span = cws^2x100

= 0.025x713x$(4.98)^2$x100

= 42972.69 Kg-cm

For Long Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.033x713x$(4.98)^2$x100

= 56723.95 Kg-cm

2) (+)ve bending moment at mid span = cws^2x100

= 0.025x713x$(4.98)^2$x100

= 42972.68 Kg-cm

Step:-4

Effective depth-d

a) For Short Span – ds

k= $\frac{n}{n+\frac{fs}{fc}}$

$ds = \frac{\sqrt{Ms(max)}}{Rb}$

$= \frac{\sqrt{56723.948}}{14.93x100}$

= 6.13 cm

Using 12mm φ bar and 2 cm clear cover . The total cover = $2+\frac{1.2}{2}$=2.6 cm.

Total depth = $6.13+2+\frac{1.2}{2}$ = 8.76 cm.<12 cm.

R=.5x94.5x.88x.359

=14.93

<u>Hence ok</u>

Acceptable total depth = 12 cm.

Actual effective depth = $(12-2-\frac{1.2}{2})$ cm.

= 9.4 cm.

$= \frac{10}{10+\frac{1687}{94.5}}$

= .359

$j= 1-\frac{0.359}{3}$

=0.88

c) <u>For Long Span – dL</u>

$dL = \frac{\sqrt{ML(max)}}{Rb}$

$= \frac{\sqrt{56723.95}}{14.93x100}$

= 6.16 cm.

$k = \frac{n}{n+\frac{fs}{fc}}$

$k = \frac{10}{10+\frac{1687}{94.5}}$

= .359

$J= 1-\frac{0.359}{3}$

=0.88

Using 12mm φ bar and 2 cm clear cover .

R=.5x94.5x.88x.359

=14.93

Total depth = $6.19+2+1.2+\frac{1.2}{2}$ = 9.96 cm.<12 cm.

<u>Hence ok</u>

Acceptable total depth = 12 cm.

Actual effective depth = $(12-2-1.2-\frac{1.2}{2})$ cm.

= 8.2 cm.

Step:-5

Area of tensile steel – As

a) For Short Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{56723.95}{1687x.88x9.4}$

$=4.61\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.61}$= 24.53 ≅25 cm c/c.

2) (–)ve As for mid span = $\frac{M}{fsjd}$

$=\frac{42872.69}{1687x.88x9.4}$

$=3.49\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{3.49}$= 32.41 ≅33 cm c/c.

b) For Long Span

9) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{56723}{1687x.88x8.2}$

$=5.28\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{5.28}$= 21.42 ≅22 cm c/c.

1) (+)ve As for mid span = $\frac{M}{fsjd}$

$=\frac{42972}{1687x.88x8.2}$

$=4.00\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.00}$= 28.27 ≅28 cm c/c.

Step:-6

Check for shear stress- v

$Vc= .292\sqrt{f'c}$

$= .292\sqrt{210}$

= 4.23 kg/ cm^2.

c) sFor Short Span,

$V1= \frac{V}{bd}$

$= \frac{1187.76}{100x9.4}$

= 1.26 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

d) For Long Span,

$V2= \frac{V}{bd}$

$= \frac{1166.94}{100x8.2}$

= 1.42 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

Step:-7

Check for bond stress – u

$Uall = \frac{3.23x\sqrt{f'c}}{1.2}$

$= \frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

$= \frac{100}{42.5} x1.2x\pi$

=11.42

3) For Short Span,

$u= \frac{V}{\varepsilon o\ jd}$

$= \frac{1187.76}{11.42x.88x9.4}$

= 12.57 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

4) For Long Span,

$u= \frac{V}{\varepsilon o\ jd}$

$= \frac{1166.94}{13.46x.88x8.2}$

= 12.14 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

$\varepsilon o = N\varphi\pi$

$= \frac{100}{28} x1.2x\pi$

Panel-4 Design

**Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5kg/cm^2

f’c= 210 kg/cm^2

n=10

Live load = 200 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 200 kg/m
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	= 1x25	= 25 kg/m
		W= 613 kg/m

Step:-2

Maximum Vertical Shear Force- V

Here,

m= $\frac{S}{L}$= $\frac{3.71}{4.6}$=0.80

5) For Long Span

V1=$\frac{ws}{3}\, x \,\frac{3-m^2}{2}$

= $\frac{613x3.71}{3}\, x\, \frac{3-0.8^2}{2}$

= 894.53 Kg

6) For Short Span

V2=$\frac{ws}{3}$

= $\frac{613x3.71}{3}$

= 758.077 Kg

Step:-3

Maximum B.M- M (case-II)

a) For Short Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= $0.055 \times 613 \times (3.71)^2 \times 100$ | C=0.055

= 46405.66 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= $0.027 \times 613 \times (3.71)^2 \times 100$ | C= 0.027

= 60749.23 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

= $0.041 \times 613 \times (3.71)^2 \times 100$ | C= 0.041

= 34593.31 Kg-cm

b) For Long Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= $0.041 \times 613 \times (3.71)^2 \times 100$ | C=0.041

= 34593.31 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= $0.021 \times 613 \times (3.71)^2 \times 100$ | C=0.021

= 17718.53 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

= $0.031 \times 613 \times (3.71)^2 \times 100$ | C=0.031

= 26155.92 Kg-cm

Step:-3

Effective depth-d

b) For Short Span – ds

$k = \frac{n}{n+\frac{fs}{fc}}$

$ds = \frac{\sqrt{Ms(max)}}{Rb}$

$= \frac{10}{10+\frac{1687}{94.5}}$

$= \frac{\sqrt{60749.23}}{14.93x100}$

= .359

= 6.38 cm

j= 1-$\frac{0.359}{3}$

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+$\frac{1.2}{2}$ cm.

=0.88

Total depth = 6.38+2+$\frac{1.2}{2}$ = 8.98≅9 cm.<12 cm.

R=.5x94.5x.88x.359

=14.93

Hence ok

Acceptable total depth = 12 cm.

Actual effective depth = (12-2-$\frac{1.2}{2}$) cm.

= 9.4 cm.

c) For Long Span – dL

$dL = \frac{\sqrt{ML(max)}}{Rb}$

$k = \frac{n}{n+\frac{fs}{fc}}$

$= \frac{\sqrt{34593.31}}{14.93x100}$

$k = \frac{10}{10+\frac{1687}{94.5}}$

= 4.81 cm.

= .359

J= 1-$\frac{0.359}{3}$

=0.88

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+1.2+.6= 3.8 cm.

R=.5x94.5x.88x.359

=14.93

Total depth = 4.81+2+1.2+.6= 8.61 cm.<12 cm.

Hence ok

Acceptable total depth = 12 cm.

Actual effective depth = (12-2+1.2+.6) cm.

= 8.2 cm.

Step:-5

Area of tensile steel – As

a) For Short Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{46405.66}{1687x.88x9.4}$

$=3.33cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{3.33}$= 33.93 ≅33.5 cm c/c.

2) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{60749.23}{1687x.88x9.4}$

= 4.35 cm^2.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.35}$= 25.98 ≅25.5 cm c/c.

3) (+)ve As for mid span = $\frac{M}{fsjd}$

$=\frac{34593.31}{1687x.88x9.4}$

=2.48 cm^2.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{2.48}$= 45.56 ≅45.5 cm c/c.

Maximum Spacing =3φ=3x12=36 cm

b) For Long Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{34593.31}{1687x.88x8.2}$

=2.84 cm^2.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{2.84}$= 39.79 cm c/c.

Maximum Spacing =3φ=3x12=36 cm

2) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{17718.53}{1687x.88x8.2}$

$= 1.46\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{1.46}$= 77.39 cm c/c.

Maximum Spacing =3φ=3x12=36 cm

3) (–)ve As for mid span = $\frac{M}{fsjd}$

$=\frac{26155.92}{1687x.88x8.2}$

$=2.15\ cm^2$.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{2.15}$= 52.55 cm c/c.

Maximum Spacing =3φ=3x12=36 cm.

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$

= 4.23 kg/ cm^2.

e) For Short Span,

V1= $\frac{V}{bd}$

= $\frac{758.077}{100x9.4}$

= 0.806 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

f) For Long Span,

V2= $\frac{V}{bd}$

= $\frac{894.53}{100x8.2}$

= 1.09 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

Step:-7

Check for bond stress – u

Uall = $\frac{3.23x\sqrt{f'c}}{1.2}$

= $\frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=$\frac{100}{42.5}x1.2x\pi$

=8.87

7) For Short Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{1040.24}{8.87x.88x9.4}$

= 14.17 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

8) For Long Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{913.37}{8.47x.88x8.2}$

= 14.94 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

$\varepsilon o = N\varphi\pi$

=$\frac{100}{44.5}x1.2x\pi$

Panel-5 Design

**Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5kg/cm^2

f'c= 210 kg/cm^2

n=10

Live load = 300 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 300 kg/m
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	**= 1x25**	**= 25**
Partition wall load		=121.60

W= 834.6 kg/m

Step:-2 Maximum Vertical Shear Force- V

Here,

$\frac{S}{L}=\frac{3.72}{4.66}$=0.79

a) For Short Span

V1=$\frac{ws}{3}x\frac{3-m^2}{2}$

$=\frac{834.6x3.72}{3}x\frac{3-0.79^2}{2}$

= 1229.41 Kg

b) For Long Span

V2=$\frac{ws}{3}$

$=\frac{834.6x3.72}{3}$

= 1034.90Kg

Step:-3

Maximum B.M- M (case-IV)

a) For Short Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.0755x713x$(3.72)^2$x100

=54267.28 Kg-cm

2) (+)ve bending moment at mid span = cws^2x100

= 0.041x713x$(3.72)^2$x100

=41108.90 Kg-cm

For Long Span

1) (–)ve bending moment at cont. Edge = cws^2x100

= 0.041x713x$(3.72)^2$x100 | C=

= 18159.56 Kg-cm

2) (–)ve bending moment at discont. Edge = cws^2x100

= 0.021x713x$(3.72)^2$x100 | C=

=20720.23 Kg-cm

3) (+)ve bending moment at mid span = cws^2x100

= 0.031x713x$(3.72)^2$x100 | C=

= 30587.01 Kg-cm

Step:-4

Effective depth-d

c) For Short Span – ds

ds= $\frac{\sqrt{Ms(max)}}{Rb}$

= $\frac{\sqrt{54267.28}}{14.93x100}$

= 6.28 cm

k= $\frac{n}{n+\frac{fs}{fc}}$

= $\frac{10}{10+\frac{1687}{94.5}}$

= .359

j= 1-$\frac{0.359}{3}$

Using 12mm φ bar and 2 cm clear cover . =0.88

Total depth = 6.28+2+$\frac{1.2}{2}$ = 8.63 cm.<12 cm. R=.5x94.5x.88x.359

Hence ok =14.93

Acceptable total depth = 12 cm.

Actual effective depth = (12-2-$\frac{1.2}{2}$) cm.

= 9.4 cm.

4) For Long Span – dL

dL= $\frac{\sqrt{ML(max)}}{Rb}$

= $\frac{\sqrt{40453.79}}{14.93x100}$

= 5.20 cm.

k= $\frac{n}{n+\frac{fs}{fc}}$

k= $\frac{10}{10+\frac{1687}{94.5}}$

= .359

J= 1-$\frac{0.359}{3}$

=0.88

Using 12mm φ bar and 2 cm clear cover .

R=.5x94.5x.88x.359

=14.93

Total depth = 5.2+2+1.2+ $\frac{1.2}{2}$ = 9 cm.<12 cm.

Hence ok

Acceptable total depth = 12 cm.

Actual effective depth = (12-2-1.2- $\frac{1.2}{2}$) =8.2cm.

Step:-5

Area of tensile steel – As

c) For Short Span

1) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{54267.28}{1687x.88x9.4}$

=3.88 cm^2

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{3.88}$= 33 cm c/c.

∴Maximum spacing =3t=3x12=36cm

2) (+)ve As mid span= $\frac{M}{fsjd}$

$=\frac{41108.90}{1687x.88x9.4}$

=2.94 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{2.94}$= 38 cm c/c.

∴Maximum spacing =3t=3x12=36cm

5) For Long Span

6) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{40453.79}{1687x.88x8.2}$

=3.323 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{3.323}$= 34 cm c/c.

∴Maximum spacing =3t=3x12=36cm

2) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{20720.23}{1687x.88x8.2}$

= 1.70cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{1.70}$= 66 cm c/c.

∴Maximum spacing =3t=3x12=36cm

3) (–)ve As mid span = $\frac{M}{fsjd}$

$=\frac{30587.01}{1687x.88x8.2}$

=2.51 cm^2.

Spacing, S = $\frac{100xas}{As}$=$\frac{100x1.13}{2.51}$= 45 cm c/c.

∴Maximum spacing =3t=3x12=36cm

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

$= .292\sqrt{210}$

$= 4.23$ kg/ cm^2.

g) <u>For Short Span,</u>

V1= $\frac{V}{bd}$

$= \frac{1050.29}{100x9.4}$

= 1.117 kg/ cm^2<4.23 kg/ cm^2.

<u>Hence ok</u>

h) <u>For Long Span,</u>

V2= $\frac{V}{bd}$

$= \frac{884.12}{100x8.2}$

= 1.07 kg/ cm^2<4.23 kg/ cm^2.

<u>Hence ok</u>

Step:-7

<u>Check for bond stress – u</u>

Uall = $\frac{3.23x\sqrt{f'c}}{1.2}$

$= \frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

$=\frac{100}{38}x1.2x\pi$

=10.47

3) For Short Span,

u= $\frac{V}{\varepsilon o\ jd}$

$= \frac{1050.29}{9.92x.88x9.4}$

= 12.79 kg/ cm^2<39.005 kg/ cm^2.

<u>Hence ok</u>

4) For Long Span,

u= $\frac{V}{\varepsilon o\ jd}$

$= \frac{884.12}{5.71x.88x8.2}$

= 21.45 kg/ cm^2<39.005 kg/ cm^2.

<u>Hence ok</u>

$\varepsilon o = N\varphi\pi$

$=\frac{100}{66}x1.2x\pi$

=5.71

Panel-6 Design

**Given Data

fy= 5075 kg/cm^2

fs= 1687 kg/cm^2

fc= 94.5kg/cm^2

f'c= 210 kg/cm^2

n=10

Live load = 200 kg/m^2

Floor Finish = 100 kg/m^2

Suspended Ceiling = 25 kg/m^2

Unit weight of concrete = 2400 kg/m^3

Unit weight of Brick = 1920 kg/m^3

Slab thickness = 12 cm

Step:-1

Load Calculation-w

Assume Slab thickness, t = 12 cm

Consider 1m strip.

Self wt. Of slab	= 1x$\frac{12}{100}$x2400	= 288 kg/m
Live load	= 1x200	= 200 kg/m
Floor finish	= 1x100	= 100 kg/m
Suspended ceiling	= 1x25	= 25 kg/m
		W= 613 kg/m

Step:-2

Maximum Vertical Shear Force- V

Here,

$\frac{S}{L}$= $\frac{4.47}{5.26}$=0.85

5) For Short Span

V1=$\frac{ws}{3}x\frac{3-m^2}{2}$

= $\frac{613x4.47}{3}x\frac{3-0.85^2}{2}$

= 930.75 Kg

6) For Long Span

V2=$\frac{ws}{3}$

= $\frac{613x4.47}{3}$

= 913.37 Kg

Step:-3

Maximum B.M- M (case-III)

4) For Short Span

7) (–)ve bending moment at cont. Edge = cws^2x100

= 0.0555x613x$(4.47)^2$x100 | C= $\frac{0.057+0.054}{2}$

= 67978.01 Kg-cm | = 0.0555

8) (–)ve bending moment at discont. Edge = cws^2x100

= 0.03x613x$(4.47)^2$x100 | C= $\frac{0.028+0.032}{2}$

= 36744.87 Kg-cm | = 0.03

9) (+)ve bending moment at mid span = cws^2x100

= 0.0455x613x$(4.47)^2$x100 | C= $\frac{0.043+0.048}{2}$

= 55729.72 Kg-cm | = 0.0455

5) For Long Span

6) (–)ve bending moment at cont. Edge = cws^2x100

= 0.049x613x$(4.47)^2$x100 | C=0.049

= 60016.62 Kg-cm

7) (–)ve bending moment at discont. Edge = cws^2x100

= 0.025x613x$(4.47)^2$x100 | C=0.025

= 30620.72 Kg-cm

8) (+)ve bending moment at mid span = cws^2x100

= 0.037x613x$(4.47)^2$x100 | C=0.037

= 45318.67 Kg-cm

Step:-3

Effective depth-d

d) For Short Span – ds

ds= $\frac{\sqrt{Ms(max)}}{Rb}$

k= $\frac{n}{n+\frac{fs}{fc}}$

= $\frac{10}{10+\frac{1687}{94.5}}$

$= \frac{\sqrt{67978.01}}{14.93x100}$ = .359

= 6.75 cm $j = 1 - \frac{0.359}{3}$

Using 12mm φ bar and 2 cm clear cover . The total cover = 2.6 cm. =0.88

Total depth = 6.75+2.6 = 9.35 cm.<12 cm.

R=.5x94.5x.88x.359

<u>Hence ok</u> =14.93

Acceptable total depth = 12 cm.

Actual effective depth = (12-2.6) cm.

= 9.4 cm.

7) <u>For Long Span – dL</u>

$dL = \frac{\sqrt{ML(max)}}{Rb}$

$= \frac{\sqrt{60016.62}}{14.93x100}$

= 6.34 cm.

$k = \frac{n}{n + \frac{fs}{fc}}$

$k = \frac{10}{10 + \frac{1687}{94.5}}$

= .359

$J = 1 - \frac{0.359}{3}$

=0.88

Using 12mm φ bar and 2 cm clear cover . The total cover = 2+1.2+.6= 3.8 cm.

R=.5x94.5x.88x.359 =14.93

Total depth = 6.34+3.8 = 10.14 cm.<12 cm.

<u>Hence ok</u>

Acceptable total depth = 12 cm.

Actual effective depth = (12-3.8) cm.

= 8.2 cm.

Step:-5

Area of tensile steel – As

4) For Short Span
5) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{67978.01}{1687x.88x9.4}$

$=4.88\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.88}$= 23.15 ≅23 cm c/c.

6) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{36744.77}{1687x.88x9.4}$

$= 2.63\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{2.63}$= 42.97 ≅42.5 cm c/c.

7) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{55729.72}{1687x.88x9.4}$

$=3.99\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{3.99}$= 28.32 ≅28 cm c/c.

8) For Long Span
8) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$=\frac{60016.62}{1687x.88x8.2}$

$=4.94\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{4.94}$= 11.37 ≅11 cm c/c.

9) (–)ve As for discont. Edge = $\frac{M}{fsjd}$

$=\frac{30620.72}{1687x.88x8.2}$

$= 2.52\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{2.52}$= 44.84 ≅ 44.5 cm c/c.

10) (–)ve As for cont. Edge = $\frac{M}{fsjd}$

$$=\frac{45318.67}{1687x.88x8.2}$$
$=3.37\ cm^2$.

Spacing, S = $\frac{100xas}{As}=\frac{100x1.13}{3.37}$= 33.53 ≅33.5 cm c/c.

Step:-6

Check for shear stress- v

Vc= $.292\sqrt{f'c}$

= $.292\sqrt{210}$

= 4.23 kg/ cm^2.

i) For Short Span,

V1= $\frac{V}{bd}$

= $\frac{1040.24}{100x9.4}$

= 1.106 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

j) For Long Span,

V2= $\frac{V}{bd}$

= $\frac{913.37}{100x8.2}$

= 1.113 kg/ cm^2<4.23 kg/ cm^2.

Hence ok

Step:-7

Check for bond stress – u

Uall = $\frac{3.23x\sqrt{f'c}}{1.2}$

= $\frac{3.23x\sqrt{210}}{1.2}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

$=\frac{100}{42.5}x1.2x\pi$

=8.87

10) For Short Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{1040.24}{8.87x.88x9.4}$

= 14.17 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

11) For Long Span,

u= $\frac{V}{\varepsilon o\ jd}$

= $\frac{913.37}{8.47x.88x8.2}$

= 14.94 kg/ cm^2<39.005 kg/ cm^2.

Hence ok

$\varepsilon o = N\varphi\pi$

=$\frac{100}{44.5}x1.2x\pi$

T-BEAM DESIGN

T-BEAM-01

Step:-1

Design Load Calculation-

ω =2495.34 kg/m

W= ωL =2495.34x5.26=13125.49 kg

Step:-2

Maximum Vertical Shear Force- V

1. At cont. end:-

   V1 = .6W = .6x13125.49= 7875.29 kg

2. At discount. end:-

   V2 =.4W = .4x13125.49=5250.20 kg

At discont. end:-

$$-M=\frac{\omega L^2}{16} = \frac{13125.49X\ 5.26}{16}x100$$

=431500.43 kg.cm

At mid:(+M)

$$=\frac{\omega L^2}{14} = \frac{12135.49x5.26}{14}x100$$

=493143.35 kg-cm

At cont.edge (-m)= $\frac{\omega L^2}{9}=\frac{13125.49X\ 5.26}{9}x100$

=767111.88 kg

Step:-4

Effective depth-d

$$D=\frac{\sqrt{M(max)}}{Rb}$$

$$=\frac{\sqrt{767111.88}}{14.93x25}$$

=45.34 cm =45.5cm

Using 6 cm total covering. Total depth D=45.5+6=51.5 cm.

R=.5x94.5x.88x.359

=14.93

$$n=\frac{10}{10+\frac{1687}{94.5}}$$

= .359

$$j= 1-\frac{0.359}{3}$$

=0.88

Step:-5

Area of tensile steel – As

1) For dis continuous edge As=$\frac{M}{fsjd}$

$$=\frac{431500.43}{1687x.88x45.5}$$

=6.40 cm^2

Using 4-16 mm φ as main bar and supplied area

= 4x2.01=8.04 cm^2> As

So ok.

10) For mid, As=$\frac{M}{fsjd}$

$=\frac{493143.35}{1687\ x\ .89\ x\ 45.5}$

$=7.3\ cm^2$

Using 4-16 mm φ as main bar and supplied area

=4 x 2.01=8.04 cm^2> As cm^2

So ok.

For continuous edge As=$\frac{M}{fsjd}$

$=\frac{767111.88}{1687x.88x45.5}$

$=11.36\ cm^2$

Using 3-22 mm φ as main bar and supplied area

=4 x 3.14=12.56 cm^2> As cm^2

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$

= 4.23 kg/ cm^2.

Vd= V-$wx\frac{d}{100}$

= 7875.29- $2495.34x\frac{45.5}{100}$

=6739.92 kg.

1) For continuous edge

v= $\frac{Vd}{bd}$

= $\frac{6739.44}{25x45.55}$

= 5.92 kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must be required.

Excess shear v'=v-vc=5.92-4.23=1.69 kg/ cm^2.

2) For Discontinuous edge

v= $\frac{Vd}{bd}$

= $\frac{4114.82}{25x45.5}$

Vd= V-$wx\frac{d}{100}$

=5250.20 -$2495.34\frac{45.5}{100}$

= 3.61 kg/ cm^2<4.23 kg/ cm^2.

=4114.83 kg.

Hence Stirrups must not be required.

So ok.

Step:-7

Portion required for stirrups-(a+2d)

1) For continuous edge

a= $(\frac{l}{2}$-d)x$\frac{v'}{v}$

=$(\frac{5.26x100}{2}$-45.5)x$\frac{1.69}{5.92}$

=62.09 cm.

(a+2d)= 62.09+45.5x2=154 cm.

Step:-8

Spacing of stirrups –S

Using 10 mm φ as stirrups. Av= 1.58 cm^2.

1) S = $\frac{Avfv}{v'b}$=$\frac{1.57x1687}{1.69x25}$=52 cm c/c.
2) S = $\frac{Av}{0.0015b}$=$\frac{1.57}{0.0015x25}$=41.86 cm c/c.
3) S = $\frac{d}{2}$=$\frac{45.5}{2}$=22.75 cm c/c.

Using 10 mm φ bar as stirrup @22.5 cm c/c.

Step:-9

Check for bond stress - u

uall = $\frac{3.23x\sqrt{f'c}}{\varphi}$

= $\frac{3.23x\sqrt{210}}{1.6}$

= 39.005 kg/ cm^2.

$\varepsilon = N\varphi\pi$

=4x3.1416x1.6

=20.09 cm

$u = \frac{V}{\varepsilon ojd}$

$= \frac{7875.29}{20.08x0.88x45.5}$

=9.68 kg/ cm^2.> u

So ok

Step-10

Sketching-

T-BEAM-02

Step:-1

Design Load Calculation-

ω =2996.65 kg/m

W= ωL =2996.65x4.47=13395.03 kg

Step:-2

Maximum Vertical Shear Force- V

1. At cont. end:-

   V1 = .6W = .6x13395.03 = 8037.018 kg

2. At discount. end:-

   V2 =.4W = .4x13395.03=5358.012 kg

Step:-3

Maximum B.M- M

1. At cont. end:-

   $-M = \frac{\omega L^2}{9}$

$=\frac{2996.65x4.47^2}{9}$x100

=665286.27 kg.cm

2. At mid:-

+M =$\frac{\omega L^2}{14}$

= $\frac{2996.65x4.47^2}{14}$x100

=427684.03 kg-cm

3. At discount. end:-

-M=$\frac{\omega L^2}{16}$

$=\frac{2996.65x4.47^2}{16}$x100

=374223.5 kg

Step:-3

Effective depth-d

D=$\frac{\sqrt{M(max)}}{Rb}$

= $\frac{\sqrt{74714.58}}{14.93x100}$

= 7.08 cm

Using 6.5 cm total covering. Total depth D=42.5+6.5=49 cm.

R=.5x94.5x.88x.359

=14.93

n= $\frac{10}{10+\frac{1687}{94.5}}$

= .359

j= 1-$\frac{0.359}{3}$

=0.88

Step:-5

Area of tensile steel – As

2) For continuous edge As=$\frac{M}{fsjd}$

$=\frac{665286.27}{1687x.88x42.5}$

=10.54 cm^2

Using 4-20 mm φ as main bar and supplied area

= 3.1416x4=12.57 cm^2> As

So ok.

3) For mid, $As=\frac{M}{fsjd}$

$=\frac{427684.03}{1687x.88x42.5}$

$=6.78\ cm^2$

Using 4-16 mm φ as main bar and supplied area

$= 2.01x4=8.04\ cm^2 >$ As

So ok.

4) For discontinuous edge $As=\frac{M}{fsjd}$

$=\frac{374223.52}{1687x.88x42.5}$

$=5.93\ cm^2$

Using 3-16 mm φ as main bar and supplied area

$= 2.01x3=6.03\ cm^2 >$ As

So ok.

Step:-6

Check for shear stress- v

Vc= $.292\sqrt{f'c}$

$= .292\sqrt{210}$

= 4.23 kg/ cm^2.

Vd= V-$wx\frac{d}{100}$

= 8037.018- $2996.65x\frac{42.5}{100}$

=6763.44 kg.

1) For continuous edge

v= $\frac{Vd}{bd}$

$= \frac{6763.44}{25x42.5}$

= 6.37 kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must be required.

Excess shear v'=v-vc=6.37-4.23=2.17 kg/ cm^2.

2) For Discontinuous edge

Vd= V-$wx\frac{d}{100}$

=5358.012- $2996.65x\frac{42.5}{100}$

v= $\frac{Vd}{bd}$

$= \frac{4084.44}{25x42.5}$

= 3.84 kg/ cm^2<4.23 kg/ cm^2. =4084.44 kg.

Hence Stirrups must not be required.

So ok.

Step:-7

Portion required for stirrups-(a+2d)

1) For continuous edge
   a= (0.6L-d)x$\frac{v'}{v}$
   =(0.6x470-42.5)x$\frac{2.17}{6.37}$
   =76.89 cm.
   (a+2d)= 76.89+42.50x2=161.89 cm.
2) For discontinuous edge

No Need

Step:-8

Spacing of stirrups –S

Using 10 mm φ as stirrups. Av= 1.58 cm^2.

1) S = $\frac{Avfv}{v'b}$=$\frac{1.57x1687}{2.17x25}$=48.82 cm c/c.
2) S = $\frac{Av}{0.0015b}$=$\frac{1.57}{0.0015x25}$=41.87 cm c/c.
3) S = $\frac{d}{2}$=$\frac{42.5}{2}$=21.25 cm c/c.

Using 10 mm φ @ 21 cm c/c.

Step:-9

Check for bond stress - u

uall = $\frac{3.23x\sqrt{f'c}}{\varphi}$

= $\frac{3.23x\sqrt{210}}{1.6}$

= 29.25 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=3x3.1416x1.6

=15.08 cm

= 39.005 kg/ cm^2.

u=$\frac{V}{\varepsilon ojd}$

=$\frac{8037.018}{15.08x0.88x42.5}$

=14.25 kg/ cm^2.> u

So ok

T-BEAM -03

Step:-1

Design Load Calculation-

ω =2362.26 kg/m

W= ωL =2362.26X4.37=10323.08 kg

Step:-2

Maximum Vertical Shear Force- V

1. At cont. end:-

   V1 = .6W = .6x10323.08= 6193.85 kg

2. At discount. end:-

   V2 =.4W = .4x10323.08=4129.23 kg

Step:-3

Maximum B.M- M

4. At cont. end:-

   -M=$\frac{\omega L^2}{9}$

   =$\frac{2362.26X4.37^2}{9}$x100

   =501242.7 kg.cm

5. At mid:-

$+M = \frac{\omega L^2}{14}$

$= \frac{2362.26X4.37^2}{14}$x100

=322227.27 kg-cm

6. At discount. end:-

$-M = \frac{\omega L^2}{16}$

$= \frac{2362.26X4.37^2}{16}$x100

=281949.02 kg

Step:-4

Effective depth-d

$D = \frac{\sqrt{M(max)}}{Rb}$

$= \frac{\sqrt{501242.70}}{14.93x100}$

= 37 cm

Using 6.5 cm total covering. Total depth D=37+6.5=43.5cm.

R=.5x94.5x.88x.359

=14.93

$K = \frac{10}{10+\frac{1687}{94.5}}$

= .359

$j = 1 - \frac{0.359}{3}$

=0.88

Step:-5

Area of tensile steel – As

5) For continuous edge $As = \frac{M}{fsjd}$

$= \frac{501242.7}{1687x.88x37}$

=9.12 cm^2

Using 3-20 mm φ as main bar and supplied area

= 3.1416x4=6.03 cm^2> As

So ok.

6) For mid, $As = \frac{M}{fsjd}$

$=\frac{322227.45}{1687x.88x37}$

$=5.86\ cm^2$

Using 3-16 mm φ as main bar and supplied area

$= 2.01x4=6.03 cm^2 >$ As

So ok.

7) For discontinuous edge As=$\frac{M}{fsjd}$

$=\frac{281949.02}{1687x.88x37}$

$=5.93\ cm^2$

Using 3-16 mm φ as main bar and supplied area

$= 2.01x3=6.03\ cm^2 >$ As

So ok.

Step:-6

Check for shear stress- v

Vc= $.292\sqrt{f'c}$

$= .292\sqrt{210}$

= 4.23 kg/ cm^2.

Vd= V-$wx\frac{d}{100}$

= 6193.85-$2362.26x\frac{37}{100}$

=5319.81 kg.

3) For continuous edge

v= $\frac{Vd}{bd}$

$= \frac{5319.81}{25x37}$

= 5.75 kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must be required.

Excess shear v'=v-vc=5.75-4.23=1.55 kg/ cm^2.

4) For Discontinuous edge

v= $\frac{Vd}{bd}$

$= \frac{3255.19}{25x37}$

= 3.51 kg/ cm^2<4.23 kg/ cm^2.

Hence Stirrups must not be required.

So ok.

Vd= V-$wx\frac{d}{100}$

=4129.23-2362.26$\frac{37}{100}$

=3255.19 kg.

Step:-7

Portion required for stirrups-(a+2d)

3) For continuous edge Type equation here.

a= (0.6L-d)x$\frac{v'}{v}$

=(0.6x437-37)x$\frac{1.55}{5.75}$

=60.70 cm.

(a+2d)= 60.70+37x2=134.7 cm.

4) For discontinuous edge

No Need

Step:-8

Spacing of stirrups –S

Using 10 mm φ as stirrups. Av= 1.58 cm^2.

4) S = $\frac{Avfv}{v'b}$=$\frac{1.57x1687}{1.55x25}$=48.82 cm c/c.
5) S = $\frac{Av}{0.0015b}$=$\frac{1.57}{0.0015x25}$=41.87 cm c/c.
6) S = $\frac{d}{2}$=$\frac{37}{2}$=18.5 cm c/c.

Using 10 mm φ @ 18.5 cm c/c.

Step:-9

Check for bond stress - u

uall = $\frac{3.23x\sqrt{f'c}}{\varphi}$

= $\frac{3.23x\sqrt{210}}{1.6}$

=3x3.1416x1.6

= 29.25 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=15.08 cm

u=$\frac{V}{\varepsilon ojd}$

=$\frac{6193.85}{15.08x0.88x37}$

=12.61 kg/ cm^2.> u

So ok

T-BEAM-04

Step:-1

Design Load Calculation-

ω =1933.57 kg/m

W= ωL =1933.57x3.71=7173.55 kg

Step:-2

Maximum Vertical Shear Force- V

V= $\frac{W}{2}$=$\frac{7173.55}{2}$=3586.77 kg

Step:-3

Maximum B.M- M

7. At cont. end:-

-M=$\frac{\omega L^2}{9}$ = $\frac{7173.55\ X\ 3.71}{9}$x100

=295709.47 kg.cm

8. At mid:(+M) =$\frac{\omega L^2}{14}$ = $\frac{1933.57X3.71^2}{14}$x100

=190098.94 kg-cm

Step:-4

Effective depth-d

D=$\frac{\sqrt{M(max)}}{Rb}$

$n = \frac{10}{10+\frac{1687}{94.5}}$

$= \frac{\sqrt{295709.47}}{14.93x100}$

= .359

= 28.97 cm =29cm

$j = 1-\frac{0.359}{3}$

Using 6.5 cm total covering. Total depth D=29+6=35 cm.

=0.88

R=.5x94.5x.88x.359

=14.93

Step:-5

<u>Area of tensile steel – As</u>

8) For continuous edge As=$\frac{M}{fsjd}$

$=\frac{295709.47}{1687x.88x29}$

=6.79 cm^2

Using 2-22 mm φ as main bar and supplied area

= 2x3.79=7.58 cm^2> 6.79

So ok.

9) For mid, As=$\frac{M}{fsjd}$

$=\frac{190098.94}{1687\ x\ .89\ x\ 29}$

=4.36 cm^2

Using 2-19 mm φ as main bar and supplied area

= 2 x 2.83=5.66 cm^2> 4.36 cm^2

So ok

Using 2-19 mm φ as main bar and supplied area

= 2x 2.84=5.66 cm^2> As

So ok.

Step:-6

<u>Check for shear stress- v</u>

Vc= .292$\sqrt{f'c}$

Vd= V-$wx\frac{d}{100}$

$= .292\sqrt{210}$ $= 3586.77-1933.57x\frac{29}{100}$

$= 4.23$ kg/ cm^2. $=3026.03$kg.

5) For continuous edge

v= $\frac{Vd}{bd}$

$= \frac{3026.03}{25x29}$

= 4.17 kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must not be required.

Step:-7

Portion required for stirrups-(a+2d)

No need

Step:-8

Spacing of stirrups –S

No need

Step:-9

Check for bond stress - u

uall = $\frac{3.23x\sqrt{f'c}}{\varphi}$

$= \frac{3.23x\sqrt{210}}{1.6}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=x3.1416x2.2

=13.82 cm

u=$\frac{V}{\varepsilon ojd}$

$=\frac{8037.018}{15.08x0.88x29}$

=10.23 kg/ cm^2.> u

So ok

T-BEAM-05

Step:-1

Design Load Calculation-

ω =2901.82 kg/m

W= ωL =2901.82x4.6=13348.37 kg

Step:-2

Maximum Vertical Shear Force- V

V= $\frac{W}{2}$=$\frac{13348.37}{2}$=6674.186 kg

Step:-3

Maximum B.M- M

9. At discont. end:-

-M=$\frac{\omega L^2}{9}$ = $\frac{2901.82\ X\ 4.6^2}{9}$x100

=383765.69 kg.cm

At mid:(+M)

=$\frac{\omega L^2}{14}$ = $\frac{2901.4.6^2}{14}$x100

=438589.37 kg-cm

Step:-4

Effective depth-d

D=$\frac{\sqrt{M(max)}}{Rb}$

=$\frac{\sqrt{438589.37}}{14.93x25}$ $\frac{438589.37}{14.}$

n= $\frac{10}{10+\frac{1687}{94.5}}$

= .359

= 35.28 cm =36cm

$j= 1-\frac{0.359}{3}$

Using 6 cm total covering. Total depth D=36+6=42 cm.

=0.88

R=.5x94.5x.88x.359

=14.93

Step:-5

<u>Area of tensile steel – As</u>

10) For dis continuous edge $As=\frac{M}{fsjd}$

$=\frac{383765.70}{1687x.88x36}$

$=7\ cm^2$

Using 2-22 mm φ as main bar and supplied area

$= 2x3.79=7.58\ cm^2 >$ As

So ok.

10) For mid, $As=\frac{M}{fsjd}$

$=\frac{438589.37}{1687\ x\ .89\ x\ 36}$

$=8.11\ cm^2$

Using 2-25 mm φ as main bar and supplied area

$= 2\ x\ 4.91=9.8\ cm^2 >$ As cm^2

So ok

Step:-6

<u>Check for shear stress- v</u>

$Vc= .292\sqrt{f'c}$

$= .292\sqrt{210}$

= 4.23 kg/ cm^2.

6) <u>For continuous edge</u>

$Vd= V-wx\frac{d}{100}$

$= 3586.77-1933.57x\frac{29}{100}$

=3026.03kg.

$v = \frac{Vd}{bd}$

$= \frac{5629.53}{25x36}$

= 6.25kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must not be required.

∴Excess shear stress v =6.25-4.23=2.02 kg/ cm^2.

Step:-7

<u>Portion required for stirrups-(a+2d)</u>

2) <u>For continuous edge Type equation here.</u>

$a = (\frac{l}{2} - d)x\frac{v'}{v}$

$= (\frac{460}{2} - 36)x\frac{2.02}{6.25}$

=62.70 cm.

(a+2d)= 62.70+36x2=134.7 cm.

Step:-8

<u>Spacing of stirrups –S</u>

Using 10 mm φ as stirrups. Av= 1.58 cm^2.

4) $S = \frac{Avfv}{v\prime b} = \frac{1.57x1687}{2.02x25}$=52 cm c/c.
5) $S = \frac{Av}{0.0015b} = \frac{1.57}{0.0015x25}$=41.86 cm c/c.
6) $S = \frac{d}{2} = \frac{36}{2}$=18 cm c/c.

Using 10 mm φ bar as stirrup 18 cm c/c.

Step:-9

<u>Check for bond stress - u</u>

uall = $\frac{3.23x\sqrt{f'c}}{\varphi}$

$= \frac{3.23x\sqrt{210}}{1.6}$

= 39.005 kg/ cm^2.

$\varepsilon o = N\varphi\pi$

=x3.1416x2.2

=13.82 cm

u=$\frac{V}{\varepsilon ojd}$

=$\frac{8037.018}{15.08x0.88x29}$

=10.23 kg/ cm^2.> u

So ok

Grouping of column

C1=C1,C3,C11,C14 =10047.57 Kg

C2=C4,C6,C7,C10 =18770.87 Kg

C3=C2,C8,C9 =13329.80 Kg

C4=C12,C13 =7060.27 Kg

C5=C 5 =28114.86Kg

LOAD ON FOOTING

F1=3X10047.57+10047.57X.80+180X16+3341.25=44402.016 Kg

F2=3X18770.87+18770.87.80+180X16+5571.99 =79781.296 Kg

F3=3X13329.80+13329.8X.80+5252.85+180x16 =58786.09 kg

F4=3X7060.27+7060.27.80+180X16+3175.25 =33050.276 Kg

F5=3X28114.86+28114.86X.80+180X15+7135.29 =116851.75Kg

COLUMN LOAD FROM FLOOR TO FLOOR

COLUMN	LOAD ON G.F	LOAD ON 2^{ND} FLOOR
C1=F1	44402.016+44402.016X.15=51062.31 Kg	10047.57X2+10047.57X.80+180X7=29393.196Kg
2=F2	79781.296+79781.29X.15 = 91748.49 Kg	18770.87X2+18770.87X.80+180X7 =53818.44 Kg
C3=F3	58786.09+5878.09X.15= 67604.00 Kg	13329.80X2+13329.80X.8+180X7 = 38582.8 Kg
C4=F4	27415.82+27415.82X.15=38007.82 Kg	7060.276X2+7060.276X.8+180X7 = 21828.76 Kg
C5=F5	116851.75+116851.75X.15=134379.51 Kg	28114.86X2+28114.86X.80+180X7=79981.61 Kg

Column Design

Column-01 (Ground floor)

Given data,

P= 51062.31 kg

Column size= 25cmx25cm

f_s= 1400 kg/cm^2

f'_c = 200 kg/cm^2

<u>Solution:</u>

A_g = 25x25 = 625 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or, 51062.31 = .85x625x(.25x200+1400xP_g)

Or, 51062.31 = 26562.5+743750xP_g

Or, 743750xP_g= 51062.31-26562.5

∴ P_g = 0.03

[So ok.]

Area of main bar, A_{st}=P_gxA_g=0.03x625= 18 cm^2

Use 10-16mm φ bar.

<u>Tie Spacing:</u>

1. 16x1.6 = 35.2 cm=35cm c/c
2. 48x0.08 = 34.4 cm c/c

3. Minimum side size= 25cm c/c.

Use 8mmφ @25cm c/c.

Column-01 (2nd floor)

Given data,

P= 29393.19 kg

Column size= 25cmx25cm

f_s=1400 kg/cm^2

f'_c = 200 kg/cm^2

Solution:

A_g = 25x25= 625 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,29393.19 = .85x625x(.25x200+1400xP_g)

Or,29393.19 = 26562.5+743750P_g)

∴ P_g=.**0**2>.01<.08

[So ok.]

Area of main bar, ∴ A_{st}=P_gxA_g=.02x750= 12.55 cm^2

Use 6-16mm φ bar.

Tie Spacing:

1. 16x1.6 = 32.0 cm c/c
2. 48x0.08 = 48 cm c/c
3. Minimum side size = 25cm c/c.

Use 8mmφ @25cm c/c.

Column-02 (Ground floor)

Given data,

P= 91748.49 kg

Column size= 25cmx30cm

f_s=1687 kg/cm^2

f'_c = 210 kg/cm^2

Solution:

A_g =25x30=750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,91748.49 = .85x750x(.25x210+1687xP_g)

Or,91748.49 = 33468.75+1075462.5P_g)

$\therefore P_g$=.0541>.01<.08

[So ok.]

$\therefore$ A_{st}=P_gxA_g= 0.0541x750= 40.575 cm^2

Use 8-25mm φ bar.

Tie Spacing:

1.16x2.5 = 40 cm = 40 cm c/c

2. 48x0.08 = 38.4 cm c/c

3. Minimum side size = 25cm c/c.

Use 8 mmφ @25cm c/c.

Column-02 (2nd floor)

Given data,

P= 53818.344kg

Column size= 25cmx30cm

f_s=1687 kg/cm^2

f'_c = 210 kg/cm^2

Solution:

A_g =25x30=750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,53818.44=.85x750x(.25x210+1687xP_g)

Or,53818.44=33468.75+1075462.5P_g)

$\therefore$ P_g=.02>.01<.08

[So ok.]

Area of main bar, $\therefore$ A_{st}=P_gxA_g=.02x750= 15 cm^2

Use 8-16mm φ bar.

Tie Spacing:

4. 16x1.6 = 25.6 cm c/c
5. 48x0.08 = 38.4 cm c/c
6. Minimum side size = 25cm c/c.

Use 8mmφ @25cm c/c.

Column-03 (Ground floor)

Given data,

P= 67604 kg

Column size= 35cmx35cm

f_s=1400 kg/cm^2

f'_c = 210 kg/cm^2

Solution:

A_g = 35x35= 1252 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,67604 =.85x750x(.25x210+1400xP_g)

$\therefore$ P_g=.0088>.01<.08

[So ok.]

Area of main bar, $\therefore$ A_{st}=P_gxA_g=.0088x1225= 10.78 cm^2

Use 6-16mm φ bar.

Tie Spacing:

4. 16x1.6 = 25.6cm=25.6cm c/c
5. 48x0.08 = 38.4 cm c/c
6. Minimum side size = 35cm c/c.

Use 8mmφ @25.6cm c/c.

Column-03 (2nd floor)

Given data,

P=38582.8 kg

Column size= 35cmx35cm

f_s=1400 kg/cm^2

f'_c = 210 kg/cm^2

Solution:

A_g =35x35=1225 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,38582.5 =.85x1225x(.25x210+1400xP_g)

Or,38582.5 =54665.63+1457750P_g

$\therefore$ P_g=.011>.01<.08

[So ok.]

Area of main bar, ∴ A_{st}=P_gxA_g=.011x1225= 13.514 cm^2

Use 7-16mm φ bar.

Tie Spacing:

7. 16x1.6 = 25.6 cm c/c
8. 48x0.08 = 38.4 cm c/c
9. Minimum side size = 35cm c/c.

Use 8mmφ @25.6cm c/c.

Column-04 (Ground floor)

Given data,

P= 38007.82 kg

Column size= 35cmx30cm

f_s=1400 kg/cm^2

f'_c = 200 kg/cm^2

Solution:

A_g = 25cmx30cm = 750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,38007.82 =.85x750x(.25x200+1400xP_g)

$\therefore P_g$=0.02>.01<.08

[So ok.]

Area of main bar, $\therefore$ A_{st}=P_gxA_g=.02x750= 15 cm^2

Use 8-16mm φ bar.

Tie Spacing:

7. 16x1.6 = 25.6cm=25.6cm c/c
8. 48x0.08 = 38.4 cm c/c
9. Minimum side size = 25cm c/c.

Use 8mmφ @25cm c/c.

Column-04 (2nd floor)

Given data,

P=21828.76 kg

Column size= 25cmx30cm

f_s=1400 kg/cm^2

f'_c = 200 kg/cm^2

Solution:

A_g =25x30= 750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,21828.76 =.85x750x(.25x210+1400xP_g)

Or,21828.76 =31875+892500P_g

$\therefore P_g$=.01>.01<.08

[So ok.]

Area of main bar, $\therefore$ A_{st}=P_gxA_g=.010x750= 7.5 cm^2

Use 4-16mm φ bar.

Tie Spacing:

10. 16x1.6 = 25.6 cm c/c
11. 48x0.08 = 38.4 cm c/c
12. Minimum side size = 25cm c/c.

Use 8mmφ @25 cm c/c.

Column-05 (Ground floor)

Given data,

P= 134379.511 kg

Column size= 35cmx30cm

f_s=1400 kg/cm^2

f'_c = 200 kg/cm^2

Solution:

A_g = 25cmx30cm = 750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,134379.511 =.85x750x(.25x210+1687xP_g)

∴ P_g=0.01>.01<.08

[So ok.]

Area of main bar, ∴ A_{st}=P_gxA_g=.01x750= 7.5 cm^2

Use 6-20mm φ bar.

Tie Spacing:

10. 16x2.0 = 32cm= 32cm c/c
11. 48x0.08 = 38.4 cm c/c
12. Minimum side size = 25cm c/c.

Use 8mmφ @25cm c/c.

Column-05 (2nd floor)

Given data,

P= 79981.61 kg

Column size= 25cmx30cm

f_s=1400 kg/cm^2

f'_c = 200 kg/cm^2

Solution:

A_g =25x30= 750 cm^2

We know,

P= .85xA_g(.25f'_c+$f_s P_g$)

Or,79981.61 =.85x750x(.25x210+1400xP_g)

Or,79981.61 =31875+892500P_g

∴ P_g=.02>.01<.08

[So ok.]

Area of main bar, ∴ A_{st}=P_gxA_g=.02x750= 15 cm^2

Use 5-20mm φ bar.

<u>Tie Spacing:</u>

13. 2.0 = 32 cm c/c
14. 48x0.08 = 38.4 cm c/c
15. Minimum side size = 25cm c/c.

Use 8mmφ @25 cm c/c.

Footing Design

Footing-01

Step:-1:Load Calculation-w

Super imposed load = 44402.016 kg
Self wt.of Footing (8%) = 3552.16 kg

Total load = 47954.176 kg

Step:-2 :Size of footing

Area of footing A = $\frac{Total\ load}{bearing\ capacity\ of\ soil}$

$$=\frac{47954.176}{16500}$$

$$A = 2.90\ m^2$$

∴ size of footing $L = \sqrt{\frac{2.9}{1}}$

$= 1.7$ m

Size of footing = (1.7mx1.7m)

Step:-3: Bending Moment calculation

$$M=\frac{wlc^2}{2}x100$$

$$= \frac{15364.8x1.7x.725^2}{2}x100$$

$=686470.45$ kg-cm

$$c=\frac{L-a}{2}$$

$$=\frac{1.7-.25}{2}$$

$=0.725$

Step:-4: Effective depth of Footing-d

Due to shear stress:

$V_v = (c-d_v)$XLxW $=(.725-\frac{dv}{100})$X15364.8

$= (19590.12 - 261.2016\ d_v)$

$$d_v = \frac{V_v}{v_c x b}$$

$$=\frac{(19590.12-261.2016\ d_v)}{4.23x170}$$

$V_c = .292\sqrt{f'_c}$

$=.292\sqrt{210}=4.23$ kg/cm²

∴ d_v =19.98cm=20cm

use 20mmφ bar

∴ Total depth$=20+7.5+\frac{2.0}{2}$

=27.5cm

Step:-5

Area of tensile steel – As

$A_s = \frac{M}{fsjd}$

$= \frac{686470.45}{1400x.866x27}$

$= 20.97\ cm^2$

Number of rod = $\frac{20.97}{3.14}$ = 6.96 Nos = 7nos

Use 20 mm φ as tensile steel.

Spacing, S= $\frac{100x3.14}{20.97}$

=14.9 cm≅ 15 cm c/c

Step-6

Temp. Bar

Ast =.0025bt =0.0025x100x37= 9.25 cm^2

Spacing ,S= $\frac{100x1.13}{9.25}$ = 12.22 cm ≅ 12.0 cm c/c

Footing-02

Step:-1

Load Calculation-w

Super imposed load = 79781.296 kg

Self wt.of Footing (8%) = 6382.5 kg

Total load = 86163.79 kg

Step:-2

Size of footing

Area of footing A = $\frac{Total\ load}{bearing\ capacity\ of\ soil}$

$=\frac{86163.79}{16500}$

A = 5.22 m^2

LxL =5.22 m^2

L^2 =5.22

L= 2.28 m^2

∴ size of footing =2.28m x 2.28m

Step:-3

Bending Moment calculation

M=$\frac{\omega lc^2}{2}$= $\frac{15283.77x1^2}{2}$x100

=1742349.78 kg-cm

c=$\frac{L-a}{2}$

=$\frac{2.28-.3}{2}$

=1

Step:-4

Effective depth of Footing-d

Due to punching shear:

d_0 =$\frac{V_0}{b_0 v_0}$

d_0 =$\frac{((2.28^2-(.3+0.01d0)\ ^2)X15283.77)}{4x(30+d_0)x7.60}$

0.01d0) ^{2})X15283.77)

d_0 =36.17 cm

use 20mmφ bar

∴ Total depth=36.17+7.5+$\frac{2}{2}$ +2

=46.67 =47 cm

V_0 =(($L^2-(a+d0)\ ^2$)xω

V_0 =(($2.28^2-(.3+$

b_0=4(a+d_0)=4(30+d_0)

v_0=.53$\sqrt{f}$`c=.53√210=7.6 kg/cm^2

Step:-5

Area of tensile steel – As

$A_s = \frac{M}{fsjd}$

$= \frac{1742349.78}{1687x.88x36.17}$

$= 32.44\ cm^2$

Use 20 mm φ as tensile steel.

Spacing, S=$\frac{100x3.14}{32.44}$

=9.68 cm≅ 10 cm c/c

Step-6

Temp. Bar

Ast =.0025bt =0.0025x262x67.5= 44.21 cm^2

Spacing ,S= $\frac{100x1.13}{44.21}$= 2.55 cm ≅ 2.5 cm c/c

Footing-03

Step:-1

Load Calculation-w

Super imposed load =58786.09 kg

Self wt.of Footing (8%) =4702.88 kg

Total load = 63488.98 kg

Step:-2

Size of footing

Area of footing A = $\frac{Total\ \ load}{bearing\ capacity\ of\ soil}$

$=\frac{63488.98}{16500}$

A =3.85 m^2

LxL =3.85 m^2

L^2 =3.85

L= 1.96 m^2

∴ size of footing =1.96m x 1.96m

Upword pressure =$\frac{5878666.09}{3.85}$

ω =15269.14/m^2

Step:-3

Bending Moment calculation

M=$\frac{\omega lc^2}{2}$= $\frac{15269.14x1.96x.805^2}{2}$x100

=969688.87 kg-cm

c=$\frac{L-a}{2}$

=$\frac{1.96-.35}{2}$

=0.805

Step:-4

Effective depth of Footing-d

Due to punching shear:

d_0 =$\frac{V_0}{b_0 v_0}$

d_0 =$\frac{((1.96^2-(.35+.01d0)\ ^2)x15269.14}{4x(35+d_0)x7.68}$

d_0 =27.69 cm

use 20mm φbar

∴ Total depth=27.69+7.5+$\frac{2}{2}$ +2

=38 cm

V_0 =(($L^2-(a+d0)\ ^2$)xω

V_0 =(($1.96^2-(.35+.01d0)\ ^2$)x15269.14)

b_0=4(a+d_0)=4(35+d_0)

v_0=.53$\sqrt{f`c}$=.53√210=7.68 kg/cm^2

Step:-5

Area of tensile steel – As

$A_s = \frac{M}{fsjd}$

$= \frac{969688.87}{1400x.866x38}$

=21.05 cm^2

Use 20 mm φ as tensile steel.

Spacing, S=$\frac{100x3.14}{21.05}$

=14.91 cm≅ 15 cm c/c

Step-6

Temp. Bar

Ast =.0025bt =0.0025x206x52= 26.78 cm^2

Spacing ,S= $\frac{100x1.13}{26.78}$= 4.22 cm ≅ 4.00 cm c/c

Footing-04

Step:-1

Load Calculation-w

Super imposed load =78645.41 kg

Self wt.of Footing (10%) =7864.541 kg

Total load = 86509.95 kg

Step:-2

Size of footing

Area of footing A = $\frac{Total\ \ load}{bearing\ capacity\ of\ soil}$

$=\frac{86509.95}{15500}$

A = 5.58 m^2

LxL =5.58 m^2

L^2 =5.58

L= 2.36 m^2

∴ size of footing =2.36x2.36 m

Upword pressure =$\frac{78645.41}{2.36}$

ω =15492.17kg/m^2

Step:-3

Bending Moment calculation

M=$\frac{\omega lc^2}{2}$= $\frac{86509.951x2.36x1.055^2}{2}$x100

=18545.40 kg-cm

c=$\frac{L-a}{2}$

=$\frac{2.36-.25}{2}$

=1.055

Step:-4

Effective depth of Footing-d

Due to punching shear:

$d_0 = \frac{V_0}{b_0 v_0}$

$d_0 = \frac{2.36^2-(.25+.01d_0)^2 x86509.951}{4x(.25+d_0)x7.7}$

d_0 =40.99=41 cm

∴ Total depth=41+7.5+$\frac{2.0}{2}$ +2

=51.5 cm =52 cm

V_0 =$((L^2-(a+d0)\ ^2)$xω

V_0 =$((2.36^2-(.25+.01d0)\ ^2)$x86509.951

b_0=4(a+d_0)=4(.25+d_0)

v_0=.53$\sqrt{f`c}$=.53√210=7.68 kg/cm^2

Step:-5

Area of tensile steel – As

$A_s = \frac{M}{fsjd}$

$= \frac{18545140}{1687x.88x41}$

$=30.12\ cm^2$

Use 20 mm φ as tensile steel.

Spacing, S=$\frac{100x3.14}{30.12}$

=10.42 cm≅ 10 cm c/c

Step-6

Temp. Bar

Ast =.0025bt =0.0025x206x52= 26.78 cm^2

Spacing ,S= $\frac{100x1.13}{26.78}$= 4.22 cm ≅ 4.00 cm c/c

Footing-05

Step:-1

Load Calculation-w

Super imposed load =116851.75 kg

Self wt.of Footing (10%) =9348.15 kg

Total load = 126199.891 kg

Step:-2

Size of footing

Area of footing A = $\frac{Total\ \ load}{bearing\ capacity\ of\ soil}$

$=\frac{126199.89}{16500}$

A = 7.69 m^2

LxL =7.69 m^2

L^2 =7.69

L= 2.76m

∴ size of footing =2.76m x2.76m

Step:-3

Bending Moment calculation

M=$\frac{\omega lc^2}{2}$= $\frac{15339.70x2.76x1.23^2}{2}$x100

=5207521.35 kg-cm

c=$\frac{L-a}{2}$

=$\frac{2.76-.3}{2}$

=1.23

Step:-4

Effective depth of Footing-d

Due to punching shear:

d_0 =$\frac{V_0}{b_0 v_0}$

V_0 =(($L^2-(a+d0)^{\ 2}$)xω

d_0 =$\frac{((2.76^2-(.35+.01d0)^{\ 2})x15339.70)}{4x(25+d_0)x7.68}$

V_0 =(($2.76^2-(.35+$

$.01d0)^{\ 2}$)x15339.70)

d_0 =44.76

∴ Total depth=44.76+7.5+$\frac{2.0}{2}$ +2

b_0=4(a+d_0)=4(25+d_0)

=55.26 cm

v_0=.53$\sqrt{f`c}$=.53√210=7.68 kg/cm^2

= 56cm

Step:-5

Area of tensile steel – As

A_s=$\frac{M}{fsjd}$

$=\frac{5207521.35}{1687x.88x44.76}$

$=78.36\ cm^2$

Use 20 mm φ as tensile steel.

Spacing, S=$\frac{100x3.14}{78.36}$

=4.004cm≅ 4.00 cm c/c

nos of bar= $\frac{78.36}{3.14}$

= 25.08

= 26 nos

Step-6

Temp. Bar

Ast =.0025bt =0.0025x206x52= 26.78 cm^2

Spacing ,S= $\frac{100x1.13}{26.78}$= 4.22 cm ≅ 4.00 cm c/c

GRADE BEAM DESIGN

GRADE BEAM -01

Step:-1

Design Load Calculation-W

Self wt of beam = $1x\frac{b}{100}x\frac{d}{100}x2400$

$= 1x\frac{25}{100}x\frac{35}{100}x2400$

= 210kg/m

Super imposed load ω =810kg/m

Design load w = 1020kg/m

Step:-2

Maximum Vertical Shear Force- V

$V= \frac{WL}{2}= \frac{1020x3.43}{2}$=1530 kg.

Step:-3

Effective depth-d

D= $\sqrt{\frac{M}{Rb}}$

= $\sqrt{\frac{4373.25}{16.37x25}}$

=10.33cm = 11cm

Using 6 cm total covering. Total depth D=11+6=17 cm.

So ok

k= $\frac{10}{10+\frac{1400}{94.5}}$

= .40

j= 1-$\frac{0.40}{3}$

=0.866

R=.5x94.5x.866x.
40

=16.37

Step:-5

Area of tensile steel – As

A_s=$\frac{M}{fsjd}$=$\frac{43732.5}{1400x0.866x17}$=2.12 cm^2

Using 2-12 mm φ as main bar .

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$ =4.23 kg/ cm^2.

v= $\frac{v_{cr}}{bd}$

= $\frac{1173}{30x17}$

= 2.3kg/ cm^2<4.23 kg/ cm^2.

Hence Stirrups must not be required.

Nominal stirrup must be required.

Spacing of stirrup = 30 cm c/c.

.

v_{cr}= v - $\frac{Wd}{100}$

= 153-$\frac{10250x35}{100}$

= 1173kg

Step:-7

No need.

Step:-8

Spacing required for stirrup-s

No need.

Step:-9

Check for bond stress - u

u= $\frac{V}{\varepsilon ojd}$

= $\frac{1530}{35.17 x 0.866 x 17}$

=2.95 kg/ cm^2.> U_{all}

So ok

$\varepsilon o = N\varphi\pi$

=4x3.1416x1.2

=15.08 cm

GRADE BEAM -02

Step:-1

Design Load Calculation-W

Self wt of beam = $1x\frac{b}{100}x\frac{d}{100}x2400$

$= 1x\frac{25}{100}x\frac{35}{100}x2400$

= 210kg/m

Super imposed load =810kg/m

Design load ω = 1020kg/m

Total design load W = ωxl=1020x3.45=35149kg

Step:-2

Maximum Vertical Shear Force- V

At cont. edge= 0.6x3519= 2111.4kg

At discount. Edge = 0.4x3519=844.56kg

Step:-3

Maximum B.M- M

$M=\frac{wL}{10}=\frac{3519x3.45}{10}$=x100= 121405.5 kg-cm.

Step:-4

Effective depth-d

D=$\sqrt{\frac{\text{M}}{\text{Rb}}}$

R=.5x94.5x.88x.359

=14.96

=$\sqrt{\frac{121405.5}{25\text{x}14.96}}$

=18.01 cm=18.5cm

Using 6.5 cm total covering. Total depth D=18.5+6.5=25 cm.

So ok

Step:-5

Area of tensile steel – As

$\text{A}_s=\frac{M}{fsjd}=\frac{121405.5}{1687\text{x}0.88\text{x}25}$=3.27 cm^2

Using 2-16 mm φ as main bar

Step:-6

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$ =4.23 kg/ cm^2.

v= $\frac{V}{bd}$

= $\frac{1231.65}{25\text{x}35}$

= 2.01kg/ cm^2<4.23 kg/ cm^2.

Hence Stirrups must not be required.

Nominal stirrup must be required.

Spacing of stirrup = 25 cm c/c.

Step:-7

No need.

Step:-8

portion required for stirrup-s

No need.

Step:-9

Check for bond stress - u

u=$\frac{V}{\varepsilon ojd}$

=$\frac{2111.4}{10.05x0.88x18.5}$

=13.26 kg/ cm^2.> U_{all}

So ok

$\varepsilon o = N\varphi\pi$

=2x3.1416x1.6

=10.05 cm

GRADE BEAM -03

Step:-1

Design Load Calculation-W

Self wt of beam= 1x.25x.35x2400=210kg/m

Super imposed load=810kg/m

ω =1020kg/m

total design load=1020x4.6=4692kg

Step:-2

Maximum Vertical Shear Force- V

$V= \frac{W}{2}= \frac{4692}{2}$=2346 kg.

Step:-3

Maximum B.M- M

$M=\frac{wL}{8}=\frac{4692x4.6}{8}$x100= 269790 kg-cm.

Step:-4

Effective depth-d

$D= \sqrt{\frac{M}{Rb}}$

$= \sqrt{\frac{269790}{14.93x25}}$

$n = \frac{10}{10+\frac{1687}{94.5}}$

= 26.88≅ 27cm

=10.80 cm.

$j = 1-\frac{0.359}{3}$

Using 5 cm total covering. Total depth D=27+5=32<35

=0.88

R=.5x94.5x.88x.359

So ok

=14.93

Step:-5

<u>Area of tensile steel – As</u>

$A_s = \frac{M}{fsjd} = \frac{269790}{1687x.87x27} = 6.88\ cm^2$

Using 2-16 mm φ as main bar

$A_s = 2.01 cm^2$

Nos of rod=$\frac{6.88}{2}$=3.44≅4nos

Step:-6

<u>Check for shear stress- v</u>

Vc= $.292\sqrt{f'c}$

= $.292\sqrt{210}$ =4.23 kg/ cm^2.

v= $\frac{v_{cr}}{bd}$

= $\frac{10516.2}{25x27}$

= 15.57kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must be required.

V′=V-V_c=15.57-4.23

= 11.34kg-cm

v_{cr}= v - $\frac{Wd}{100}$

= 10791.6-$\frac{1020x27}{100}$

= 10516.2kg

<u>Step:-7</u>

<u>portion required for stirrup:</u>

a = $(\frac{L}{2}$-d)x$\frac{V'}{V}$

=($\frac{460}{2}$-27)x$\frac{11.34}{15.57}$

= 147.8cm

Spacing for stirrup = a+2d

=147.28+2x27

=201.84cm

Step:-8

Spacing for stirrup-s

Use10mmØ bar stirrup

a_v=1.57cm^2

1)s=$\frac{A_v f_v}{v'b}$=$\frac{1.57x1687}{11.34x25}$=9.34cm=9cm c/c

2)s=$\frac{a_v}{0.0015b}$=$\frac{1.57}{0.0015x27}$=38cm c/c

3)s=$\frac{d}{2}$=$\frac{27}{2}$=13.5 cm c/c

Use 10 mmØ bar for stirrup 13.5cm c/c

Step:-9

Check for bond stress - u

u=$\frac{V}{\varepsilon ojd}$

=$\frac{10791.6}{20.10x.87x27}$

=23kg/ cm^2.> u_{all}

So ok

U_{all}=$\frac{3.23\sqrt{210}}{1.6}$=29.25kg/cm^2

$\varepsilon o = N\varphi\pi$

=4x3.1416x1.6

=20.10 cm

GRADE BEAM -04

Step:-01

Design Load Calculation-W

Self wt of beam = $1x\frac{b}{100}x\frac{d}{100}x2400xL$

$= 1x\frac{25}{100}x\frac{35}{100}x2400x3.45$

= 724.5kg/m

Super imposed load =810kg/mx3.45=2794.5

Total design load W = 3519kg/m

Step:-02

Maximum Vertical Shear Force- V

$V= \frac{w}{2}= \frac{3519}{2}$=1759.5 kg.

Step:-03

1) Maximum B.M- M

$M=\frac{WL}{8}=\frac{3519x3.5}{8}$x100= 153956.25 kg-cm.

2)Registing moment M_1 = Rbd^2

$=14.76x25x30^2$

=332100kg-cm

3) Extra moment M_2 = M-M_1

= 153956.25-332100

= 178144kg-cm

$k= \frac{9}{9+\frac{1350}{90}}$

= .375

$j= 1-\frac{0.375}{3}$

=0.875

R=.5x90x0.875x0.375

So ok

=14.76

Step:-04

Area of tensile steel – As

1) Tensile reinforcement-

$A_{s1}=\frac{M_1}{fsjd}=\frac{332100}{1350x0.875x30}$=9.37 cm^2

$A_{s2}=\frac{M_2}{fs(d-d')}$

$=\frac{178144}{1350(35-5)}$

= 4.39kg-cm

Total area of tensile steel,

$A_s= A_{s1}+A_{s2}$=9.37+4.39

= 13.76

Use6- 22mm φ as main bar

Step:-5

Check for shear stress- v

Vc= .292$\sqrt{f'c}$

= .292$\sqrt{210}$ =4.23 kg/ cm^2.

v= $\frac{v_{cr}}{bd}$

= $\frac{1402.5}{25x30}$

= 9.85kg/ cm^2>4.23 kg/ cm^2.

Hence Stirrups must be required.

V′=V-V_c=9.85-4.15

= 5.72kg-cm

v_{cr}= v - $\frac{Wd}{100}$

= 153-$\frac{10250x35}{3.45x100}$

= 1402.5kg

Step:-06:

portion required for stirrup-s

a = ($\frac{L}{2}$-d)x$\frac{V'}{V}$

=($\frac{700}{2}$-35)x$\frac{5.72}{9.85}$

= 182.92cm

Spacing for stirrup = a+2d

=182.92+35

=252.92

Step:-07

spacing for stirrup

use 10mm φas stirrup a_v= 1.57

we know,

1) $s = \frac{a_v f_v}{v'b} = \frac{1.57x1350}{5.72x30}$=12.35cm
2) $s = \frac{a_v}{0.0015b} = \frac{1.57}{0.0015x30}$= 34.88cm
3) $s = \frac{d}{2} = \frac{45}{2}$=22.5cm

use 10mmφ@12cm c/c

Step:-08

check for bond streess

$U=\frac{v}{\varepsilon o x jd}$

$= \frac{1759.5}{70.34x0.875x35}$= 0.816

$U_{all}= \frac{3.23\sqrt{f'_c}}{D} = \frac{3.23\sqrt{200}}{3.2}$= 14.27kg/cm^2

$U<u_{all}$

so ok

GRADE BEAM -05

Step:-1

Design Load Calculation-W

Self wt of beam = $1x\frac{b}{100}x\frac{d}{100}x2400$

$= 1x\frac{25}{100}x\frac{35}{100}x2400$

= 210kg/m

Super imposed load ω =810kg/m

Design load w = 1020kg/m

total design load W= wL= 1020x4.36=4447.2kg

Step:-2

Maximum Vertical Shear Force- V

$V= \frac{w}{2}= \frac{4447.2}{2}$=2223.6 kg.

Step:-3

Maximum B.M- M

$M=\frac{wl}{8}=\frac{4447.2x4.36}{8}$x100= 242372.4 kg-cm.

Step:-4

Effective depth-d

$D= \sqrt{\frac{M}{Rb}}$

k=.40

$= \sqrt{\frac{242372.4}{16.49x25}}$

j=0.86

= 24.5cm= 25cm

R=16.49

total depth D= 25+5=30cm

Step:-5

Area of tensile steel – As

$A_s = \frac{M}{fsjd} = \frac{242372.4}{1400x0.866x30} = 7.00\ cm^2$

Using 4-16 mm φ as main bar .

Step:-6

Check for shear stress- v

Vc= $.292\sqrt{f'c}$

= $.292\sqrt{210}$ =4.23 kg/ cm^2.

v= $\frac{v_{cr}}{bd}$

= $\frac{1917.6}{25x30}$

= 2.55kg/ cm^2<4.23 kg/ cm^2.

Hence Stirrups must not be required.

Nominal stirrup must be required.

Spacing of stirrup = 30 cm c/c.

.

v_{cr}= v - $\frac{Wd}{100}$

= $2223.6 - \frac{1020x30}{100}$

= 1917.6kg

Step:-7

No need.

Step:-8

Spacing required for stirrup-s

No need.

Step:-9

Check for bond stress - u

u=$\frac{V}{\varepsilon ojd}$

$=\frac{2223.6}{20.10x.866x30}$

=4.25kg/ cm^2.> U_{all}

So ok

$U_{all}=\frac{3.23\sqrt{f\prime_c}}{D}=\frac{3.23\sqrt{210}}{1.6}$

= 23.25kg/cm^2

$\varepsilon o = N\varphi\pi$

=4x3.1416x1.6

=20.10 cm

GRADE BEAM -06

Step:-1

Design Load Calculation-W

Self wt of beam = $1x\frac{b}{100}x\frac{d}{100}x2400$

$= 1x\frac{25}{100}x\frac{35}{100}x2400$

= 210kg/m

Super imposed load ω =810kg/m

Design load w = 1020kg/m

total design load W= wL= 2.8=2856kg

Step:-2

Maximum Vertical Shear Force- V

$V= \frac{w}{2}= \frac{2856.2}{2}=1428$ kg.

Step:-3

Maximum B.M- M

1) B.M, $M=\frac{wl}{8}=\frac{2856x2.80}{8}x100=$ 999600 kg-cm.

k= k=.40

2)Registing moment M_1 = Rbd^2

$=16.36x25x30^2$

=368100kg-cm

j= j=0.866

R=16.36

3) Extra moment $M_2 = M-M_1$

= 999600−368100

= 631500kg-cm

Step:-04

Area of tensile steel – As

2) Tensile reinforcement-

$A_{s1} = \frac{M_1}{fsjd} = \frac{368100}{1400x0.866x30} = 10.12\ cm^2$

$A_{s2} = \frac{M_2}{fs(d-d')}$

$= \frac{631500}{1400(30-5)}$

= 18.04kg-cm

Total area of tensile steel,

$A_s = A_{s1} + A_{s2} = 10.12 + 18.04$

$= 28.16 cm^2$

Use11- 22mm φ as main bar

Step:-5

Check for shear stress- v

$Vc = .292\sqrt{f'c}$

$= .292\sqrt{210} = 4.23$ kg/ cm^2.

$v = \frac{v_{cr}}{bd}$

$= \frac{1071}{25x35}$

$= 1.22$ kg/ cm^2 < 4.23 kg/ cm^2.

Hence Stirrups must not be required.

Nominal stirrup must be required.

Spacing of stirrup = 25 cm c/c.

.

$v_{cr} = v - \frac{Wd}{Lx100}$

$= 1428 - \frac{2856x35}{2.8x100}$

= 1071kg

Step:-7

No need.

Step:-8

Spacing required for stirrup-s

No need.

Step:-9

Check for bond stress - u

$u=\frac{V}{\varepsilon ojd}$

$=\frac{1428}{50.24x.866x35}$

$\varepsilon o = N\varphi\pi$

=5x3.1416x3.2

=50.24 cm

=0.93kg/ cm^2.> U_{all}

So ok

$U_{all}=\frac{3.23\sqrt{f'_c}}{D}=\frac{3.23\sqrt{210}}{3.2}$

= 14.62kg/cm^2

Stair Design

Given data,

Span length = 3.43 m

Rise = 16 cm

Nos of riser = 11 nos

Tread = 26 cm

Nos of tread = 10 nos

Tread space = 260 cm

Step- 1: load calculation-w

Considering 1m stirup of stair,

Given,

Design span, L = 3.37 m

Assume minimum thickness of weist slab,

S = 15 cm

Given, T = 26 cm

R = 16

1. Wt of weist slab = s$\sqrt{R^2+T^2}$x1x$\frac{24}{T}$

   = 15 $\sqrt{16^2+26^2}$x1x$\frac{24}{26}$ = 42270 kg/m
2. Wt of step = 12xR = 12 x 16= 192 kg/m
3. Live load = 430 kg/m
4. Railing = 50 kg/m

Total w = 1094.7 kg/m

Total design load W = wl =1094.7x3.43 = 3754.82 kg

Step- 2 : Maxm Bending moment–M

$$M = \frac{wl}{8} x\ 100 = \frac{3754.82 \times 3.43}{8} x100 = 160988 \text{ kg-cm}$$

Step- 4 Effective depth of stair - d

$$D = \sqrt{\frac{M}{Rb}}$$

$$= \sqrt{\frac{160988}{15.61 \times 100}}$$

= 10.15 cm

Using 16 mm Ø bar and 2 cm clear cover

The total depth,t = 10.15+ 2+ $\frac{1.6}{2}$ = 12.95 cm < 15 cm

Hence ok,

Acceptable total depth = 15 cm

Actual Effective depth = 15 – 2.8 = 12.20 cm

Step- 5: Area of tensile steel - A_s

$$A_s = \frac{M}{f_s jd} = \frac{160988}{1400 \times .87 \times 12.2}$$

$= 10.78\ cm^2$

Using 12 mm Ø bar, a_s = 1.13 cm

$\therefore$ spacing = $\frac{100 \times as}{As}$ = $\frac{100 \times 2.00}{10.78}$ = 18.55 cm c/c

Using 16 mm Ø bar @ 18.55 cm c/c

Step- 6: check for stress – v

$$v = \frac{V}{bd} = \frac{1877.41}{100 \times 12.2} = 1.53\ kg/cm^2$$

Step- 7: check for bond stress-u

$U = \frac{V}{\sum 0 jd}$

$= \frac{1874.41}{27.09 \times 0.87 \times 12.2}$

$= 6.49$ kg/cm^2

$\sum 0 = N\pi D$

$= \frac{100}{18.55} \times \pi$ X 1.6

= 27.09 cm

Hence ok

Step- 8:Area of temperature bar-A'$_s$

$A'_s = 0.0025bt$

$= 0.0025$ x100x15=3.75 cm^2

Using 10 mm ∅ bar , a_s = .79 cm^2

∴spacing = $\frac{100 \times .79}{3.75}$ = 20.93 cm ≅ 24 cm c/c

Using 10 mm ∅ bar@ 24 cm c/c

Design of lintel

Step-1

Load calculation-w

Design span length of beam, L= 1.52+.15=1.65m

Thickness of wall = 12.5 cm

Width of lintel = 12.5 cm

Assume Total depth of lintel ,D =15 cm

Height of Wall h w =1.5 m

Height of triangle, ht =(L\2)x tan 60 = 1.42 m<1.5 m

Trianguller calculation is acceptable .

Self wt. of Lintel w_1 =1.65x.125x.15x2400 = 74.25 kg

Wt. of brick wall W_2 = .5x1.65x1.42x.125x1920 = 281.16 kg

Total load = 355.41 kg

Step -2

Maxm V. shear force

$= \frac{W}{2} = \frac{355.41}{2} = 177.70$ kg

Step -3

Maxm B.M- M

$= (\frac{w_{1L}}{8} + \frac{w_{2L}}{6})x100$

$= (\frac{74.25x1.65}{8} + \frac{281.16x1.65}{6})x100$

= 9263.30 kg

Step -4

Depth calculation :

$d_L = \sqrt{\frac{M}{Rb}}$

$= \sqrt{\frac{9263.30}{14.93x12.5}}$

= 7.50 cm.

Using 12mm φ bar and 5 cm clear cover .

R=.5x94.5x.88x.359

Total depth = 7.5+5= 12.5 cm.<21.5 cm.

Step -5

Area of tensile steel- As

$As = \frac{M}{f_s jd} = \frac{9263.30}{1687x.97x7.50}$

=0.75 cm^2

Using 2-8mm dia bar.

Step-6

Cheek for shear stress –v

No need

.

$k = \frac{n}{n+\frac{fs}{fc}}$

$k = \frac{10}{10+\frac{1687}{94.5}}$

= .359

$J = 1-\frac{0.359}{3}$

=0.88

=14.93

SEPTIC Tank DESIGN

সমাধানঃ

মনে করি,

মাথাপিছু দৈনিক সর্বোচ্চ সুয়েজ প্রবাহের হার= ১৩৫ লিটার

‡gvU wmD‡qR Gi cwigvb = 135x80=10800 wjt/w`b

=10.8 Nb wgUvi/w`b

Ae‡iva Kvj = 24 N›Uv = 1 w`b

K‡ÿi Zi‡ji avib ÿgZv = 10.8x1=10.8 Nb wgUvi / w`b

g‡bKwi,

Zi‡ji K‡ÿi MfxiZv = 1.6 wg

K‡ÿi Zj‡`‡ki †ÿÎdj $=\frac{10.8}{1.6}$= 6.75 eM© wgUvi

g‡bKwi ,

U&¨vs‡Ki cÖ¯’ = B, ‰`N©&¨, L= 3B

Zj‡`‡ki †ÿÎdj = LxB=3BxB = $3B^2$

kZ©g‡Z,

$3B^2$=6.75

B=$\sqrt{\frac{6.75}{3}}$

=1.5 m

U&¨vs‡Ki ‰`N©¨ , L= 3x1.5 = 4.5 m.

Lwi gy³ GjvKvi MfxiZv =0.5 m

K‡ÿi †gvU MfxiZv = 1.5+0.5 =2.10 m

K‡ÿi gvc = 4.5 m x 1.5 m x2.1 m

Check

g‡bKwi,

w_Zvb MfxiZv = 25 cm.

1) w_Zvb GjvKvi AvqZb = 4.5 x 1.5 x $\frac{25}{100}$ = 1.69 m^3
2) ¯øvR we‡qvRb GjvKvi AvqZb = 0.033 x 100 = 3.30 m^3

3) we‡qvwRZ ¯øv gRyZ = 0.037 x 100 m^3 =3.70 m^3
4) ¯‹¨vg GjvKvi AvqZb = 0.01 x 100 =1.00 m^3

---

†gvU = 9.69 m^3

Zi‡ji Rb&¨ RvqMv †`Iv Av‡Q, = 4.5x1.5x1.6 = 10.8 m^3 hv 9.69 GjvKvi †P‡q †ewk

wWRvBb wVK Av‡Q|

‡mvKwcU wWRvBb

‡gvU wmD‡qR cwigvb = 10800 m^3
aiv hvK ,
gvwUi Aby¯ªeb ÿgZv =1500 m^3/L cÖwZw`b|
‡mvKwc‡Ui Kvh©Ki AvqZb = $\frac{10800}{15}$=9 m^3

Liv hvK
AvMgb b‡ji wb‡P †mvKwc‡Ui Kvh©Kix MfxiZv = 4.5 m
‡mvKwc‡Ui Zj‡`‡ki †ÿÎdj = $\frac{9}{4.5}$=2.0 m^2
‡mvKwc‡Ui e&¨vm = D n‡j,

$$\frac{\pi}{4}D^2 = 2$$

$$D = \sqrt{\frac{4x2}{\pi}}$$

=1.60 m

‡mvKwc‡Ui e&¨vm D = 1.60 m.

Estimating & costing

1.0: Earth work in excavation

for footing

$F_1=4x1.7x1.7x1.5=17.34m^3$

$F_2=4x2.28x2.28x1.5=31.19\ m^3$

$F_3=3x1.96x1.96x1.5=17.28\ m^3$

F_4=2x2.4x2.4x1.5=17.28 m^3

F_5=1x2.76x2.76x1.5=11.43 m^3

Total =95.06 m^3

Rate analysis:

Cost of labour

(consider 10 m^3, explain the terms lead=30m and lift 1.5 m)

Head massion-$\frac{1}{6}$Nos @ Tk.500/Nos=83 Tk.

Labour-4 nos@Tk.300/Nos=1200 Tk.

Lumsum- =100 Tk.

Total =1383 Tk.

Contractor profrit 10% of Total Tk.=138.3Tk.

Overhead cost 3.5% of total Tk. =48.41 Tk.

Vat 4.5% of total cost =62.24 Tk.

Total =1631.95 Tk.

Cost for per m^3 = $\frac{1631.95}{10}$=163.19 tk.

Total cost for filling= 163.19x95.06=15513.27 Tk.

1.1:Earth filling for foundation:

$\frac{1}{5}$ of total earth work in excavation

= $\frac{1}{5}$x95.06=19.01m^3

Rate analysis:

Cost of labour

consider 10 m^3

compaction labour= 2 nos@Tk.300/nos=600Tk.

Labour-12 nos@Tk.300/Nos=3600 Tk.

Lumsum- =100 Tk.

Total =4300 Tk.

Contractor profrit 10% of Total Tk.=430Tk.

Overhead cost 3.5% of total Tk. =107.5 Tk.

Vat 4.5% of total cost =193.5 Tk.

Total =5031 Tk.

Cost for per $m^3 = \frac{5031}{10}$=503.1 tk.

Total cost for filling= 503.19.01=9563.93 Tk.

1.2: Sand filling:

Stair-1x2.26x4.65x.45=4.73m^3

Ver-4x1.52x2.14x0.45=5.855 m^3

At.bath+kitchen-4x1.52x1.52=.0.45=4.16 m^3

C.Bath-2x1.25x1.60x0.45=2.079 m^3

M.Bed-2x4.79x4.79x.45=20.65 m^3

Bed room-2x3.23x3.23x.45=9.39 m^3

Drg.room-2x3.08x3.08x.45=8.54 m^3

Dinning sp.-2x3.48x2.75x.45=8.61 m^3

Bed room-2x3.48x3.48x.45=10.899 m^3

Total =74.913 m^3

Rate analysis:

consider 30 m^3@Tk.1400/ m^3=42000 Tk.

Cost of labour

Labour-12nos@Tk.300/Nos=3600 Tk.

Lumsum- =200 Tk.

Total =45800 Tk.

Contractor profrit 10% of Total Tk.=4580Tk.

Overhead cost 3.5% of total Tk. =1603 Tk.

Vat 4.5% of total cost =2061 Tk.

Total =54044 Tk.

Cost for per m^3 = $\frac{54044}{30}$=1801.47 tk.

Total cost for filling= 1801.47 x74.913=134953.27 Tk.

1.3: Brick flat solling work:

For footing:

F_1=4x1.82x1.82=13.24m^2

F_2=4x2.43x2.43=23.61 m^2

F_3=3x2.13x2.13=13.61 m^2

F_4=2x2.43x2.43=11.80 m^2

F_5=1x2.74x2.74=7.50 m^2

Total =69.76 m^2

F_1=4x1.82x1.82=13.24 m^2

F_2=4x2.43x2.43=23.61 m^2

F_3=3x2.13x2.13=13.61 m^2

F_4=2x2.43x2.43=11.80 m^2

F_5=1x2.74x2.74=7.50 m^2

Total =69.76 m^2

veranda- 3.5x2.14=7.49 m^2

m.bed-3.5x4.79=16.76 m^2

at. bath- 3.5x1.52=5.32 m^2

bed room-3.5x3.23=11.30 m^2

drg. room-3.5x3.08/=10.78 m^2

kitchen-3.5x1.52=5.32 m^2

dinning sp.-3.5x2.75=9.62 m^2

veranda-3.5x2.14=7.49 m^2

bed room= 3.5x3.48=132.18 m^2

bed room-3.5x3.48=12.18 m^2

veranda-3.5x2.14x=7.49 m^2

kitchen-3.5x1.52=5.32 m^2

dinning sp-3.5x2.75=9.62 m^2

c. bath=3.5x1.6=5.6 m^2

drg.room3.5x3.08=10.78 m^2

bed room-3.5x3.23=11.30 m^2

m.bed-3.5x4.79=16.76 m^2

at bath-3.5x152=5.32 m^2

veranda-3.5x2.14=7.49 m^2

total =183.72

Rate analysis for B.F.S

cost of materials is (considering $10m^2$(

Brick: 10x31 nos=310@Tk.9500/thousand=2945Tk.

Sand(F.M 2.5): 10x 0.02=$0.20m^3$@Tk.1400/m^3=280 Tk.

Labour cost:

Massion-o.25 Nos@Tk.400/head/day=100 Tk.

Skill labour- 1 Nos @Tk.300/Head/day=300 Tk.

Lumsum- =50 Tk.

Total = 3675 Tk.

Contractor profit 10% of total tk. = 368Tk.

Overhead cost 3.5% of total tk. =129 Tk.

Vat 4.5% of total tk. =166 Tk.

G. Total =4338 Tk.

Cost for per m^2 $= \frac{4338}{10}$

= 433.8 Tk

Total cost for Brick Flat Solling(B.F.S) =(183.72+69.76)x433.8=109959 Tk.

1.4: Form work:

FOR GRADE BEAM :

BOTTOM : 4X4.69X.25 =4.69

SIDE : 4X2X4.69X.35 =13.13

For Grade beam-2 :

Bottom : 3x3.50x.25 =2.625

Side : 3x2x3.5x.35 = 7.35

FOR GRADE BEAM - 3:

BOTTOM : 3X4.6X.25= 2.625

SIDE : 63X2X4.6X.35 =9.66

FOR GRADE BEAM -4:

BOTTOM : 4X3.45X.25 =3.45

SIDE : 4X2X3.45X.35 = 9.66

FOR GRADE BEAM -5:

BOTTOM : 4X4.36X.25 =4.36

SIDE : 4X2X4.36X.35= 12.20

FOR GRADE BEAM -6:

BOTTOM : 1X2.79X.25 = 0.69

SIDE : 1X2X2.79X.35 =1.95

T- BEAM -1:

BOTTOM : 4X13.23X.25 = 13.23

SIDE : 4X2X13.25X.45 =15.9

T- BEAM –2:

BOTTOM : 2X13.58X.25= 6.79

SIDE : 2X2X13.58X.25= 13.58

T- BEAM –3:

BOTTOM : 1X8.43X.25 = 2.10

SIDE : 1X2X8.43X.45 = 7.58

T- BEAM –3:

BOTTOM : 2X4.34X.25 = 2.17

SIDE : 2X2X4.34X.25 = 4.34

FOR ROOTING BASE SIDE :

F1 = 4X7.28X.235 =6.84

F2 = 4X9.72X.305 =11.85

F3 =3 X8.52X.355 =9.07

F4 = 2X9.72 X.385 = 7.48

F5 = 1X10.96X.425 = 4.658

FOR LANDING BEAM

BOTTOM : 1.22X1.15X3 = 4.209

SIDE : (1.22+1.15) X4X.15X3 =4.266

FOR SLAB

BOTTOM : 13.25X13.58X3 = 539.805

SIDE : (13.25X2) + (13.58X2)X.15X3 = 38.72

FOR COLUMN BELOW G.L :

C1: 4X1.2X1.5 = 7.2

C2: 4X1.2X1.5 = 7.2

C3: 3X1.2X1.5 = 5.4

C4: 2X1.4X1.5 = 4.2

C5: 1X1.6X1.5 =2.4

FOR COLUMN ABOVE G.L

C1 : 4X1X12.2= 48.8

C1 : 4X1X10 = 40.0

C1 : 3X1X10 = 30

C1 : 2X1.2 X10 = 24

C1 : 1X1.4X10 = 14

G. TOTAL = 948.93

TOTAL FORM WORK = 948.93

TOTAL WORK FORM WORK = 948.93X.025 = 23.72

RATE ANALYSIS

CONSIDERING = 2.83

COST OF SUTTER : 8000

COST OF LABOUR : 2000 TK

LUMSUM : 50

PIN = 50

TOTAL = 10100 TK

CONTRACTOR PROFIT 10% @ TOTAL TK = 1010 TK

OVER HEAD COST 3.5% @TOTAL = 354 TK

VAT 4.5% @ TOTAL TK = 455 TK

G.L TOTAL = 11919 TK

PER COST = 11919/2.83 = 4211.67 TK

TOTAL COST = 4211.67 X23.72 = 99900.81 TK

1.5: R.C.C work:

R.C.C Work for Footing:

F_1-4x1.83x1.83x0.38=5.10 m^3

F_2-4x2.43x2.43x0.48=11.33 m^3

F_3-3x2.13x2.13x.40=5.44 m^3

F_4-2x2.43x2.43x.35=4.13 m^3

F_5-1x2.7x2.7x.58=4.22 m^3

total =30.22m^3

R.C.C work for column:

for column below-G.L

C_1-4x.30x.30x1.14=0.41 m^3

C_2-4x.30x.35x1.14=0.48 m^3

C_3-3x0.40x0.40x1.14=0.55 m^3

C_4-2x.30x.35x1.14=0.24 m^3

C_5-1x.40x.4x1.14=0.18 m^3

total =1.86m^3

Above G.L

C_1-4x.25x.25x12.6=3.15 m^3

C_2-4x.25xx.30x12.6=3.78 m^3

C_3-3x0.35x.35x12.6=4.63 m^3

C_4-2x.25x.30x12.6=1.89 m^3

C_5-1x.35x.35x12.6=1.54 m^3

total =15 m^3

For beam:

Grade beam-1(o/w):1x46.73x.35x.35=5.72 m^3

Grade beam-2(I/w):1x33.63x.25x.30=2.52 m^3

Lintel:3x74x.25x.15=8.23 m^3

beam(1):3x12.62x.25x.25=2.36 m^3

beam(2):3x6.64x.25x.25=1.245 m^3

beam(3):3x6.96x.30x.25=1.56 m^3

beam(4):3x10x.25x.25=1.87 m^3

beam(5):3x14.79x.30x.25=3.32 m^3

beam(6):3x12.46x.30x.30=3.36 m^3

Landing beam-3x2.26x.25x.125=0.21 m^3

slab-1:3x13.25x13.58x.10=53.98 m^3

---

total = 84.376m^3

Total R.C.C=84.37+15+1.86+30.22=131.456 m^3

Rate analysis:

Considering10 m^3

Dry = 10x1.5=15 m^3

Ratio-1+2+4=7

Cement=$\frac{15x1}{7}$x30=64.28≅65bag

Sand=$\frac{15x2}{7}$=4.29 m^3

Khoa-$\frac{15x4}{7}$=8.57m^3@350nos/m^3=2999=3000 Nos

Cost for materials:

Cement- 65 bag@Tk.490/bag=31850 Tk.

Sand -4.29 m^3@Tk.1400/ m^3=6006 Tk.

Brick-3000 Nos@tk.9000/thousand=2700 0 Tk.

Cost of labour:

Head massion: 1 Nos@Tk.500/Nos/day=500 Tk.

Massion- 3 nos@tk.400/Nos=1200 Tk.

Labour- 25 N0s@Tk.300/Nos=7500 Tk.

Curing-7Nos@Tk.250/nos=1750 Tk.

mix. machine-Tk.2000/ day=2000 Tk.

Vibrato m.- Tk.500/day =500

total =78306 Tk.

Contractor profrit 10% of Total Tk.=7830.6Tk.

Overhead cost 3.5% of total Tk. =2740 Tk.

Vat 4.5% of total cost =3523.78 Tk.

Total =92400.38 Tk.

Cost for per $m^3 = \frac{92400.38}{10}$=9240.038 tk.

Total cost for R.C.C= 9240.038 x131.456=1214658.43 Tk.

1.6: MS WORK

Long direction

(i) **12 mm φ bar @ 15 cm c/c. = 10.00 x 41 = 410 @ .89 kg/m = 364.9x4=1469 kg**
No = 41 st and 41 ckd
Ckd , l = 10.60 m
St L= 10.47 m x41 = 429.27 m @ .89 kg/m = 382.05x4=1528.2 kg

Ext top

10 mm φ bar @ 30 cm c/c. = 2.24x41= 91.84 m @ .62 kg/m = 56.94x4= 227.76 kg.

Nos = 41

Middle

2.27x41x.62 =57.70x4= 230.8 kg.

Short Direction

12 mm φ bar @ 15 cm c/c.

No = $\frac{1325-15}{15}$**+1**

=90 Nos

St = 45

k

Ckd L= 1325+.45x8x8 = 1294.80 cm = 42.05x45x.89 = 1684.74x4= 6736. 41 kg

St = 13.25x45x.89 = 530.66x4=2122.66 kg

Ext Top

10 mm φ bar @ 30 cm c/c. = 0.565 x 45 x .62 = 15.76x4=63.05 kg.

(i) 2.67 x 45 x .62 x 4 = 297.97x4= 1191 kg
(ii) 1.31 x 45 x .62 = 36.54x4=146.19 kg

Total slab steel = 13715.07 kg.

Footing

F1

a) 20-20 mm φ bar @ 15 cm c/c. = 20 x 2.85x 2.46 = 140.25 kg
L= 300-7.5x2 = 2.85

b) 19-12mm φ bar @ 15 cm c/c. = 19x 2.85x.88 = 47.65 kg

= 187.9x4=751.6 kg.

F2

a) 25-20 mm φ bar @ 15 cm c/c. = 25x 2.46x 2.46 = 151.29 kg
L= 261-15=246 cm.

b) 25-20 mm φ bar @ 15 cm c/c. =69.96 kg

= 221.25x 4 = 885 kg

F3

a) 22-20 mm φ bar @ 15 cm c/c. = 1.92 x 22 x 2.46 = 103.51 kg

b) 22-12 mm φ bar @ 15 cm c/c. = 37.18kg.

= 141.09x3 = 423.27 kg

F4

a) 25-20 mm φ bar @ 15 cm c/c. = 1.35 x25 x 2.46 = 83.02kg

b) 25-12mm φ bar @ 15 cm c/c. = 29.7 kg.

= 112.72 x 2 = 225.45 kg

F5

a) 28-16 mm φ bar @ 15 cm c/c. = 2.22 x 28x 1.58 = 98.21 kg

b) 28-12 mm φ bar @ 15 cm c/c. = 54.7 kg.

=152.91 kg

In total = 2438.23 kg

MS Work for column

Total 20 mm φ bar as main v. bar = 1956 kg

Total 16 mm φ bar as v. bar = 1325 kg

Total 10 mm φ bar as tie bar = 156 kg

MS Work for Grade beam

Total 4-16 mm φ bar as main bar = 4x109.47 @ 1.58 kg/m = 79.85 kg.

Total 4-12 mm φ bar as hanger bar = 2x109.47@.89 kg/m = 194.86 kg.

10 mm φ bar as stirrup = 366 x 1.2 @ .62 kg / m = 282.3 kg.

MS Work for lintel

4-8 mm φ bar as main bar = 4x109.44 @ .39 kg/m. = 170.77x4=683.08 kg.

8- mm φ bar as nominal stirrup = 366 x .53 @ .39 kg / m = 76x4=304 kg.

T-beam

Total 20 mm φ bar = 48x4=192 kg

Total 16 mm φ bar =347.67x4=1390.68 kg

Total 22 mm φ bar = 68.15 x 4= 272.6 kg

Total 20 mm φ bar = 42.2x4=168.8 kg

Total 10 mm φ stirrups = 44.5 x 4=178 kg

Stair

Total 12 mm φ bar = 358.12x11 =3938 kg

Total 10 mm φ bar = 121.04 x 11= 1331.44 kg

Sunshade

W

10 mm φ main bar = 4.34x31 = 134.54 kg

10 mm φ as tem bar = 2.69 x 31 = 78.01 kg.

W1

10 mm φ main bar = 2.6x25= 65 kg.

10 mm φ tem bar   = 1.58 x 25 = 39.5 kg.

Septic Tank

Nos of Rod = $\frac{543-10}{15}$+1=37 nos

Length = 2.48 – 2x.5 = 2.38 m.

(i) 9-12 mm φ st bar as bar = 19x2.38@.89 kg/m.=40.25 kg.

(ii) 8-12 mm φ ckd bar as= 18x2.43 @ .89 kg/m = 38.93 kg.

Temp bar

12 mm φ as temp bar = 17x5.33 @ .89 kg/m = 80.64 kg.

Total 8- mm φ bar = 987.08 kg

Total 10- mm φ bar = 3618.32 kg

Total 12- mm φ bar = 8939.98 kg

Total 16- mm φ bar = 6812.42 kg

Total 20- mm φ bar = 2646.80 kg

Total 22- mm φ bar = 817.80 kg

Total Steel = 36750.03 kg

RATE ANAYSIS

a. **TOTAL STEEL = 36750.03 KG** @ 60TK/KG =2205001.80 TK

1.7: 1st ClassBrick Work

Ground Floor:

Total length(CL)=56.38=39.01=95.39m

Brick work: 95.39x.125x2.5=29.80m^3

Deduction:

D_1=7x1.2x2.1x.125=2.20 m^3

D_2=6x.80x2.1x.125=1.26 m^3

W_1=5x1.8x1.2x.125=1.35 m^3

W_2=3x.60x.60x.125=.135 m^3

Total =4.95 m^3

Actual brick work=29.80-4.95=24.85 m^3≅25 m^3

Brick work for 1st,2nd,3rd floor:

Total length(CL)=54.14+55.61=109.75=110m

Brick work: 110x.125x2.5=34.375 m^3

Deduction:

D_1=8x1.2x2.1x.125=2.52 m^3

D_2=10x.80x2.1x.125=2.10m^3

W_1=8x1.8x1.2x.125=2.16 m^3

W_2=4x.60x.60x.125=.18 m^3

Total =6.96 m^3

Actual brick work=34.375-6.96=27.41 m^3

Total brick work = 3x27.41=82.245m^3

All brick work=25+82.245=107.245 m^3

Rate analysis:

Considering10 m^3

Dry = 10x.35=3.5 m^3

Ratio-1+6=7

Brick-10m^3@410nos/ m^3=4100

Cement=$\frac{3.5x1}{7}$x30=15bag

Sand=$\frac{3.5x6}{7}$=3 m^3

Cost for materials:

Brick-4100Nos@tk.9000/thousand=36900 Tk

Cement- 15 bag@Tk.490/bag=7350 Tk.

Sand -3 m^3@Tk.1200/ m^3=3600 Tk.

.

Cost of labour:

Head massion: . 5 Nos@Tk.500/Nos/day=250 Tk.

Massion- 8 nos@tk.400/Nos=3200 Tk.

Ordinary Labour- 4 N0s@Tk.350/Nos=1400 Tk.

Curing labour- 2 nos@300/Nos=600Tk.

total =56300 Tk.

Contractor profrit 10% of Total Tk.=5630Tk.

Overhead cost 3.5% of total Tk. =1970 Tk.

Vat 4.5% of total cost =2533 Tk.

Total =66433.5 Tk.

Cost for per m^3 = $\frac{66433.5}{10}$=6643.3 tk.

Total cost for R.C.C= 6643.3 x107.245=712460.70 Tk.

1.8: Plaster work:

Ground floor (in side)

Garage – L=9.45+1.52+4.4+4.6+6.5=26.46m^2

Guard room-(3x2)+(3.78x2)=13.56 m^2

Store room-(3.2x2)+(2.1x2)=1o.6 m^2

Bath-(1.52x2)+(1.52x2)=6.08 m^2

Bed room-(4.79+3.79)x2=17.15 m^2

Ver-2x(1.52=2.14)x2=14.64 m^2

At. Bath+kitchen-2x(1.52+1.52)x2=12.16 m^2

c.Bath-(1.52+1.60)x2=4.86 m^2

Bed-2:(3.23+3.23)x2=12.92 m^2

Drg.room-(3.08+3.08)x2=12.32 m^2

Dinning sp-(3.48+2.75)x2=12.25 m^2

Bed-3:(3.48+3.48)x2=13.92 m^2

Total =100.32 m^2

Deduction :

D_1=7x1.20x2.10=17.64 m^2

D_2=6x.80x2.10=10.08 m^2

W_1=5x1.80x1.20=10.8 m^2

W_2=3x1.20x1.20=4.32 m^2

Total =42.72 m^2

Actual plaster for wall=100.32-42.72=57.56 m^2

Rate analysis:

Considering50 m^2

Volume=50x0.012=0.6m^3

Dry = 0.6x1.5=0.9 m^3

Ratio-1+6=7

Cement=$\frac{0.9x1}{7}$x30=3.85≅4 bag

Sand=$\frac{0.9x6}{7}$=0.77 m^3

Cost for materials:

Cement- 4 bag@Tk.490/bag=1960 Tk.

Sand -0.77 m^3@Tk.1400/ m^3=1078 Tk.

Cost of labour:

Head massion: $\frac{1}{6}$ Nos@Tk.500/Nos=83.33 Tk.

Massion- 5 nos@tk.400/Nos=2000 Tk.

Labour- 8 N0s@Tk.300/Nos=2400 Tk.

Lumsum - =200 Tk.

=7721.33 Tk.

Contractor profrit 10% of Total Tk.=772.13Tk.

Overhead cost 3.5% of total Tk. =270.25 Tk.

Vat 4.5% of total cost =347.45 Tk.

Total =9111.169 Tk.

Cost for per m^2 = $\frac{9111.169}{50}$=182.22 tk.

Total cost for plaster= 182.22x56.45=10488.78 Tk.

Outside:

(13.25+13.58)x2=53.66x3=160.98 m^2

Actual total plaster work=(160.98-15)=145.98 m^2

Rate analysis:

Considering100 m^2

Volume=100x0.018=1.8 m^3

Dry = 1.8x1.5=2.7 m^3

Ratio-1+6=7

Cement=$\frac{2.7x1}{7}$x30=11.57≅12bag

Sand=$\frac{2.7x6}{7}$=2.31 m^3

Cost for materials:

Cement- 12 bag@Tk.490/bag=5880 Tk.

Sand -2.31 m^3@Tk.1400/ m^3=3234Tk.

Cost of labour:

Head massion: $\frac{1}{3}$ Nos@Tk.500/Nos=166.66 Tk.

Massion- 10 nos@tk.400/Nos=4000 Tk.

Labour- 16 N0s@Tk.300/Nos=4800 Tk.

Lumsum - =200 Tk.

total =18280.66 Tk.

Contractor profrit 10% of Total Tk.=1828.066Tk.

Overhead cost 3.5% of total Tk. =639.82 Tk.

Vat 4.5% of total cost =822.63 Tk.

Total =21571.17 Tk.

Cost for per m^3 = $\frac{21571.17}{100}$=215.71 tk.

Total cost for plaster= 215.71x145.98=31489.59 Tk.

Plaster work for 1st, 2nd, 3rd floor:

siling

M. Bed-2x4.79x4.79=45.88 m^2

Ver=4x1.52x2.14=13.01 m^2

At.Bath-2x1.52x1.52=4.62 m^2

Bed room-2x3.23x3.23=20.85 m^2

Drg. Room-2x3.01x3.01=18.97 m^2

C. Bath-2x1.52x1.60=4.86 m^2

Kitchen-2x1.52x1.52=4.62 m^2

Bed room-2x3.41x3.41=24.22 m^2

Dinning sp.-2x3.48x2.75=19.14 m^2

Stair room-2.26x4.65=10.51 m^2

Landing-1.22x1.15=1.403 m^2

Total =168.08 m^2

=168.08x4

=672.32 m^2

Rate analysis:

Considering100 m^2

Volume=100x0.006=0.6 m^3

Dry = 0.6x1.5=0.9 m^3

Ratio-1+6=7

Cement=$\frac{0.9x1}{7}$x30=3.87≅4bag

Sand=$\frac{o.9x6}{7}$=0.77 m^3

Cost for materials:

Cement- 4 bag@Tk.490/bag=1960 Tk.

Sand –o.77 m^3@Tk.1400/ m^3=1078Tk.

Cost of labour:

Head massion: $\frac{1}{3}$ Nos@Tk.500/Nos=166.66 Tk.

Massion- 10 nos@tk.400/Nos=4000 Tk.

Labour- 16 N0s@Tk.300/Nos=4800 Tk.

Lumsum - =200 Tk.

total =12204.66Tk.

Contractor profrit 10% of Total Tk.=1220.466Tk.

Overhead cost 3.5% of total Tk. =427.16 Tk.

Vat 4.5% of total cost =549.21 Tk.

Total =14401.50 Tk.

Cost for per m^3 = $\frac{14401.50}{100}$=144.015 Tk.

Total cost for plaster= 144.015 x672.32 = 96824.16 Tk.

Inside wall:

M.Bed-(4.79+4.79)x2x2x3=114.96 m^2

Ver – (1.52+2.14)x2x2x3=43.92 m^2

At.bath-(1.52+1.52)x2x2x3=36.48 m^2

Bed room-(3.23=3.23)x2x2x3=77.52 m^2

Drg.room-(3.08=3.08)x2x2x3=73.92 m^2

C.Bath-(1.52+1.60)x2x2x3=37.44 m^2

Kitchen-(1.52+1.52)x2x2x3=36.48 m^2

Bed room-(3.48+3.48)x2x2x3=83.52 m^2

Dinning sp.-(3.48=2.75)x2x2x3=74.76 m^2

Stair –(2.26+4.65)x2x3 =37.38 m^2

Landing-(1.22+1.15)x2x3 =14.22 m^2

Total =631.28 m^2

Deduction :

D_1=8x1.20x2.10=20.16 m^2

D_2=10x.80x2.10=16.8 m^2

W_1=6x1.80x1.20=12.96 m^2

W_2=3x1.20x1.20=4.32 m^2

W_3=4x0.6x0.6=1.44 m^2

Total =55.68 m^2

Actual plaster work inside =575.6 m^2

=575.6x3

=1726.8 m^2

Rate analysis:

Considering100 m^2

Volume=100x0.012=1.2 m^3

Dry = 1.2x1.5=1.8 m^3

Ratio-1+6=7

Cement=$\frac{1.8x1}{7}$x30=7.71≅8bag

Sand=$\frac{1.8x6}{7}$=1.54 m^3

Cost for materials:

Cement- 8bag@Tk.490/bag=3920Tk.

Sand –1.54 m^3@Tk.1400/ m^3=2156Tk.

Cost of labour:

Head massion: $\frac{1}{3}$ Nos@Tk.500/Nos=166.66 Tk.

Massion- 10 nos@tk.400/Nos=4000 Tk.

Labour- 16 N0s@Tk.300/Nos=4800 Tk.

Lumsum - =200 Tk.

total =15042.66Tk.

Contractor profrit 10% of Total Tk.=1504.266Tk.

Overhead cost 3.5% of total Tk. =526.49 Tk.

Vat 4.5% of total cost =676.89 Tk.

Total =17750.31 Tk.

Cost for per m^3 = $\frac{17750.31}{100}$=177.50 Tk.

Total cost for plaster= 177.50 x1726.8=306507 Tk.

Outside plaster:

(13.25+13.58)x2=53.66x10.5=663.43 m^2

Sunshade:

W_1=2.1x.45x2+.45x($\frac{.10+.06}{2}$)x6=2.106 m^2

W_2=1.5x.45x2+.45x($\frac{.10+.06}{2}$)x3=1.46 m^2

W_3=0.9x.45x2+.45($\frac{.10+.06}{2}$)x4 =0.954 m^2

Total =4.52 m^2

=4.52x3

=13.56+663.43

=676.99m^2

W_1=6x1.80x1.20=12.96 m^2

W_2=3x1.20x1.20=4.32 m^2

W_3=4x0.6x0.6=1.44 m^2

Total =18.72 m^2

=18.72x3

=56.16 m^2

Actual total outside plaster work=676.99-56.16=620.83 m^2

Rate analysis:

Considering100 m^2

Volume=100x0.018=1.8 m^3

Dry = 1.8x1.5=2.7 m^3

Ratio-1+6=7

Cement=$\frac{2.7x1}{7}$x30=11.57≅12bag

Sand=$\frac{2.7x6}{7}$=2.31 m^3

Cost for materials:

Cement- 12 bag@Tk.490/bag=5880 Tk.

Sand -2.31 m^3@Tk.1400/ m^3=3234Tk.

Cost of labour:

Head massion: $\frac{1}{3}$ Nos@Tk.500/Nos=166.66 Tk.

Massion- 10 nos@tk.400/Nos=4000 Tk.

Labour- 16 N0s@Tk.300/Nos=4800 Tk.

Lumsum - =200 Tk.

total =18280.66 Tk.

Contractor profrit 10% of Total Tk.=1828.066Tk.

Overhead cost 3.5% of total Tk. =639.82 Tk.

Vat 4.5% of total cost =822.63 Tk.

Total =21571.17 Tk.

Cost for per m^3 = $\frac{21571.17}{100}$=215.71 tk.

Total cost for plaster= 215.71x620.83 =133919.24 Tk.

Paint work:

Plaster work and paint work same as

So paint work = total plaster work=3222.5 x 3 = 9667.5 m^2

RATE ANALYSIS

TOTAL COST = 9667.5 m^2 X@ 28 Tk / m^2 = 270690 Tk.

1.9: Tiles Work:

veranda-1.52x2.14=3.25 m^2

at.bath-1.52x1.52=2.31 m^2

m. bed-4.79x4.79=22.94 m^2

bed room-3.23x3.23-9.57 m^2

c. bath-1.52x1.60=2.43 m^2

dinning sp.-3.48x2.75=9.57 m^2

kitchen-1.52x1.52=2.31 m^2

veranda-1.52x2.14==3.25 m^2

bed room-3.48x3.48=12.11 m^2

bed room-3.48x3.48=12.11 m^2

veranda-1.52x2.14=3.25 m^2

kitchen-1.52x1.52=2.31 m^2

dinning sp.-3.48x2.75=9.57 m^2

c.bath-1.52x1.60=2.43 m^2

drg.room-3.08x3.08=9.48 m^2

bed room-3.23x3.23=6.46 m^2

at.bath-1.52x1.52=2.31 m^2

veranda-1.52x2.14=3.25 m^2

m.bed=4.79x4.79=22.94 m^2

total =152.19m^2

For four flat=4x152.19

=608.76m^2

Rate analysis:

Considering100m^2

Volume=100x0.02=2m^3

Dry =2x1.5=3 m^3

Ratio-1+6=7

Cement=$\frac{2x1}{7}$x30=8.7 bag

Sand=$\frac{2x6}{7}$=1.71 m^3

Tiles size = 20cmx20cm

Tiles need=2500 Nos

Cost for materials:

Cement- 8.7 bag@Tk.500/bag=4350Tk.

Sand(F.M 1.5) -1.71m^3@Tk.1000/ m^3=1710 Tk.

Cost of labour:

Head massion: 1 Nos@Tk.500/Nos=500 Tk.

Massion- 15 nos@tk.400/Nos=6000 Tk.

Labour- 17 N0s@Tk.300/Nos=5100 Tk.

Palising Labour- 100 Nos@Tk.200/Nos=20000 Tk.

Palis stone- =500 Tk.

Lumsum - =100 Tk.

=60010 Tk.

Contractor profrit 10% of Total Tk.= 6001Tk.

Overhead cost 3.5% of total Tk. =2100 Tk.

Vat 4.5% of total cost =2700 Tk.

Total =70811 Tk.

Cost for per m^2 = $\frac{70811}{100}$=708.11 tk.

Total cost for Tiles= 708.11x608.76=10488.78 Tk.

2.0: Lime concrete

For chilakota=14.17x14.50x.075=15.40m^3

Rate analysis:

Considering=7.5m^3

Dry volume=7.5x1.5=11.25 m^3

Ratio=2+2+7=11

Lime stone=$\frac{11.25x2}{11}$=2.05 m^3@960 m^3=1968kg

Surkey=2.05 m^3

Khoa = $\frac{11.25x7}{11}$=7.15 m^3@300 Nos m^3 = 2147.72 Nos

<u>Cost of materials :</u>

Brick=2147.72 Nos @tk.9500/thousand=20404 Tk.

Lime stone=1968kg@tk.20/bag=39360 Tk.

Khoa= 9 $m^3$380/ m^3=3420 Tk.

Surkey = 2.05 m^3 @tk.1600/ m^3=3280 tk.

<u>Cost for labour:</u>

Head massion-0.5 nos @ Tk.500/Head/day=250Tk.

Massion-15 Nos@Tk.400/Head/day=6000 Tk.

Labour(woman)- 100 Nos@Tk.250/head/day=25000 Tk.

Lamsum- = 100Tk.

Total =97814Tk.

Contractor profit(10% of total tk.) = 9781.4 Tk.

Overhead cost 3.5% of total Tk. = 3423.49Tk.

Vat 4.5% of total tk.; =4401.64 Tk.

Total =115421 Tk.

Cost for per m^3 =$\frac{115421}{7.5}$]

=15390 Tk.

Total cost =15390x15.40 =237006 Tk.

<u>2.1: Door work:</u>

<u>Door</u>

Main Door = 1 @ 25000 tk/nos = 25000 Taka

D(Room)= 30 @ 18000 tk/nos = 540000 taka

D1(Veranda & kitchen) = 15 @ 12000 tk/nos = 180000 taka

D1(Bath room) = 15 @ 3500 tk/nos = 52500 taka

Window

W

Thai Glass = 29x18 = 522 sft @ 475 tk/sft=262200 Taka

Grill = 29x18= 522 sft @ 120 @sft/taka = 62640 Taka

W1

Thai Glass = 22x18 =396 sft @ 475 tk/sft= 188100 Taka

Grill = 22x18= 396 sft @ 120 @sft/taka = 47520 Taka

W_2=(1.20-2x0.08+2x0.0125)x(1.2-2x0.08+2x0.0125)x3=3.40m^3

$W_3$0.60-2x0.08+2x0.0125)x(0.6o-2x0.08+2x0.0125)x4=0.91m^3

Total palla = (17.21+13.43+9.74+3.40+0.91)=44.69m^3

Rate analysis:

Grill of Veranda

= 702.74 sft @ 120 tk/sft = 84330 taka.

Plumbing and Fittings Work

Bath room = 15 @ 30000 tk/nos = 450000 taka

Pan = 15 @ 1250 tk/nos= 18750 taka

Commode = 15 @ 7000 tk/nos =105000 taka

Electric Instrument

Total Electric cost = 7 unit @ 55000 tk/unit = 385000 taka

Water Tank

2 Nos @ 4000 tk/nos = 8000 tk

Paint cost

Rate = 1600 sft = 45000 taka.

Total cost = 3076.75 sft @ 28 tk/sft = 926963 taka.

Polithine

= 4x 20 = 80 kg @ 225 tk/kg = 18000 taka

G.I Cable = 15 kg x 4 = 60 kg @ 95 kg / tk = 5700 taka

Tarkata = 4x15 = 60 kg @ 65 tk/kg = 3900 taka

Mixture & Vibrate Machine = 10 Nos @ 2000 tk/Nos = 20000 taka

Khoa Vanga= 42307 Nos @ 500 tk/thousand = 21154 taka.

Labour cost

Foundation to Grade beam

1) 1543 sft @ 105 tk/sft = 162015 taka
2) 4x1543= 6172 sft @ 140 tk/sft = 684080 taka

Septic Tank =30000 taka

Total = 8158844 taka

2.2: White Wash:

Total white wash work=Total plaster work

=2379.22 m^2

Rate analysis:

Total cost = 3019.75m^2@Tk.15=45296.25 Tk.

2.3: PAINITING WORK:

DOOR:

D1: 8X3X1.80X1.2=60.48 **m^2**

D2: 10x3x.80x2.10=50.4 **m^2**

Total: 110.88 **m²**

WINDOW:

W1: 6X3X1.80X1.20=38.88 **m²**

W2= 3X3X1.20X1.20= 12.96 **m²**

W3= 4X3X.60X.60= 4.32 **m²**

TOTAL= 56.16 **m²**

GRILL:

VER-1 : 4X3X1.52X2.14 = 39.03 **m²**

G. TOTAL = 206.07 **m²**

Considering Luvard Door 8 Window

The total work =2.25x206.07 m =463.65 m²

Rate analysis

Toatal painting work = 463.65 **m²**

2.4: Estimate for septictank

1) Earth work

=NxLxBxH

=1x5.51x2.51x2.58

= 35.68 m^3.

N=1

L=5.51 m

B=2.51 m

H= 2.58 m

2) Brick Flat Soling

=NxLxB

=1x5.51x2.51

= 13.83 m^2.

Brick =13.83x31= 429 nos.

N=1

L=5.51 m

B=2.51 m

3) C.C Work(1:3:6)

=NxLxBxH

=2x5.51x2.51x.15

= 4.14 m^3.

Dry mortar = 4.14x1.5= 6.21 m^3.

N=2

L=5.51 m

B=2.51 m

H= .15 m

Ratio= 1+3+6=10

Cement =$\frac{6.21}{10}$ x1= 0.62m^3@30 bag/ m^3 =19 bag

Sand = $\frac{6.21}{10}$ x3 = 1.863 m^3

Khoa = $\frac{6.21}{10}$ x6 =3.73 m^3 @ 350 nos/m^3 = 1305 nos

1) Brick Work

Long Wall

1^{st} Fotting

=NxLxBxH

N=2

=2x5.52x0.508x0.762

= 4.27 m^3.

L=5.52 m

B=.508 m

H= .762 m

2nd Fotting

=NxLxBxH

=2x5.26x0.381x0.762

= 3.05 m^3.

N=2

L=5.26 m

B=.381 m

H= .762 m

3rd Fotting

=NxLxBxH

=2x5.008x0.254x0.6858

= 1.74 m^3.

N=2

L=5.008 m

B=.254 m

H= .6858 m

Short Wall

1st Fotting

=NxLxBxH

=2x1.5x0.508x0.762

= 1.16 m^3.

N=2

L=1.5 m

B=.508 m

H= .762 m

2nd Fotting

=NxLxBxH

=2x1.5x0.381x0.762

= 0.87 m^3.

N=2

L=1.5 m

B=.381 m

H= .762 m

3rd Fotting

=NxLxBxH N=2

=2x1.5x0.254x0.6858 L=5.008 m

= 0.52 m^3. B=.254 m

H= .6858 m

Middle Wall

=NxLxBxH N=2

=2x1.5x0.254x0.6858 L=1.5 m

= 0.55 m^3. B=.125 m

H= .1.49 m

Total brick work = 11.61 m^3

Dry mortar =11.61 x.35= 4.07 m^3

Ratio =1+6 = 7

Cement =$\frac{4.07}{7}$ x1 =0.58 m^3@ 30 bag/m^3=18 bag

Sand =$\frac{4.07}{7}$x6= 3.5 m^3

Brick = 410 x 11.61 = 4760 Nos

R.C.C Work

=NxLxBxH N=2

= 5.51x2.51x.15 L=5.51 m

= 2.08 m^3. B=2.51 m

H= .15 m

Dry mortar =2.08 x.1.5= 3.14 m^3

Ratio =1+2+4 = 7

Cement =$\frac{3.14}{7}$ x1 =0.45 m^3@ 30 bag/m^3=14 bag

Sand =$\frac{3.14}{7}$x2= .9 m^3

Khoa = $\frac{3.14}{7}$x4 = 1.80 m^3 @ 350 nos/m^3= 628 Nos

Total Cement = 51 bag.

Total Sand = 6.26 m^3

Total Brick = 7122 Nos

সিঁড়ির এস্টিমেটিং

একটি ল্যান্ডিং এর জন্যঃ

Landing=1.22m

Stair room=2.26mx4.65m

Trade=10

Riser=11

সিড়ির আনুভূমিক দূরত্ব=27x10=270cm=2.70m

সিড়ির উল্লম্ব দূরত্ব=16x111=176cm=1.76m

1)ওয়েস্ট স্লাবের দূরত্ব=$\sqrt{2.70^2 + 1.76^2}$=3.22m

ওয়েস্ট স্লাবের প্রস্থ=1.13m

ওয়েস্ট স্লাবের পুরত্ব=0.10m

R.C.C কাজের পরিমান=3.22x1.33x0.10=0.36386m^3

2) Landing length=1.22m

Width=2.26m

Thickness=15cm

R.C.C কাজের পরিমান=1.22x2.26x.15=0.41358m^3

3) Landing beam length=2.26m

Width=0.2om

Thickness=0.20cm

R.C.C কাজের পরিমান=2.26x.20x.20=0.0904m^3

4)step:-0.5x0.27x0.16x1.13=0.0244 m^3

মোট R.C.C কাজের পরিমান=0.36386m^3+0.41358m^3+0.0904m^3+0.0244 m^3

২ টি ল্যান্ডিং এর জন্য=0.89224 m^{3}x2=1.7844 m^3

ভেজা আয়তন=1.7844x1.5=2.67672 m^3

আনুপাতের যোগফল=1+2+4=7

Cement=$\frac{1x2.67672}{7}$x30=12 bag

Sand=$\frac{2x2.67672}{7}$=0.764 m^3

Brick=$\frac{4x2.67672}{7}$x418=650 Nos

রডের হিসাবঃ

সোজা রডের সংখ্যা=$\frac{.13x100}{16}$+1=8 টি

দৈর্ঘ্য=3.22+1.22+10x0.016=4.6m

মোট ওজন=$\frac{16^2}{162.2}$x4.6x8=58kg

Nos of temp. bar=$\frac{3.22x100}{22}$+1=16টি

দৈর্ঘ্য=1.22m

ওজন=$\frac{16^2}{162.2}$x16x1.22=13kg

Extra top length=$\frac{3.22}{4}$=0.805+2x10x0.12=1.125m

সংখ্যা=$\frac{1.22x100}{13.5}$+1=10 Nos

ওজন=$\frac{16^2}{162.2}$x10x1.25=17.75kg

মোট ওজন=(58+13+17.75)x2=177.5 kg

Costing Schedule

Totlal Cost Schedule

S.L NO	Description	quantity	Unit rate	Total cost
1	**Earth work In excavation**	**95.06m^3**	**163.19/ m^3**	**15513.27 Tk.**
2	**Earth filling in foundation**	**9.01 m^3**	**503.1/ m^3**	**9563.93 Tk.**
3	**Sand filling**	**74.913 m^3**	**1801.47/ m^3**	**134953.27 Tk.**
4	**Brick flat solling**	**253.48 m^2**	**433.8/ m^2**	**109959 Tk.**
5	**C.C work in plinth(1:3:6)**	**11.56 m^3**	**6000/ m^3**	**69600 Tk.**

6	**From work**	**23.72 m^2**	**4211.67/ m^2**	**99900.81 Tk.**
7	**R.C.C(1:2:4)**	**131.456 m^3**	**9240.04/ m^3**	**1214658.43 Tk.**
8	**M.S work**	**36750.03 kg**	**Tk.6o/kg**	**2205001.80 Tk.**
9	**1st class brick work in superstructure wall(1:6)**	**107.25 m^2**	**6643.3/ m^2**	**712460.70 Tk.**
10	**Plaster work**	**1903.21m^2**	**215.71/ m^2**	**266266.02 Tk.**
11	**Tiles**	**608.76 m^2**	**708.11/ m^2**	**10488.78 Tk.**
12	**Lime concrete**	**15.40m^3**	**Tk.15390/15.40m^3**	**237006Tk.**
13	**Door, Window with all extra work**			**4304698 Tk.**
14	**STAIR**			**272570tk.**
15	**SEPTIC TANK**			**183490tk**

Total cost of building= 9937800 Tk.

COST OF PER Sq/Ft = 5125.22 Tk.

Total cost of building= 11640000 Tk.

COST OF PER Sq/Ft = 6000 Tk.(all floors)

COST OF PER Sq/Ft = 1500 Tk.(per floor)

Plinth Area=1940 sft

THANK'S ALL