

## REFERENCE

Parameters

Unit

Meter

Earthworks

Formworks

Concrete

Reinforcements

Paint

Tiles

CONCRETE MIX

FOOTINGS

COLUMNS

BEAMS

SLABS

WALLS

CONCRETE GRADE

GRAVEL TYPE

READY MIX

3000PSI @ 28 DAYS

CONCRETE COVER

FOOTINGS

SUSPENDED SLAB

SLAB ON GRADE

BEAMS EXPOSED ON EARTH

BEAMS EXPOSED ON WEATHER

COLUMNS EXPOSED ON EARTH

COLUMNS EXPOSED ON WEATHER

75

20

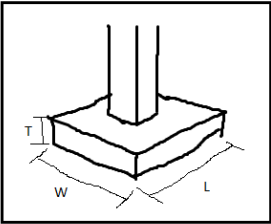
40

40

40

75

40

ADD STRUCTURAL MEMBER			
<b>STRUCTURAL MEMBER</b> <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> FOOTING (COLUMN) <span style="margin-left: 10px;">▼</span> </div>	<b>NAME:</b> <div style="border: 1px solid black; padding: 2px; min-height: 20px;">FOOTING - 1</div>		
<b>FOOTING TYPE:</b> <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> ISOLATED FOOTING <span style="margin-left: 10px;">▼</span> </div>	<b>UNIT:</b> mm <span style="margin-left: 10px;">▼</span>		
<b>DIMENSIONS</b> L <div style="border: 1px solid black; padding: 2px; width: 100px; text-align: center;">3800</div> W <div style="border: 1px solid black; padding: 2px; width: 100px; text-align: center;">3800</div> T <div style="border: 1px solid black; padding: 2px; width: 100px; text-align: center;">500</div> QUANTITY <div style="border: 1px solid black; padding: 2px; width: 100px; text-align: center;">13</div> DEPTH <div style="border: 1px solid black; padding: 2px; width: 100px; text-align: center;">1500</div>			
<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>LONGER SIDE REINFORCEMENT</b> </div> DIA METER <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">25</div> QUANTITY <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">11</div> HOOK TYPE <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">90 ▼</div>	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <b>SHORTER SIDE REINFORCEMENT</b> </div> DIA METER <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">25</div> QUANTITY <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">11</div> HOOK TYPE <div style="border: 1px solid black; padding: 2px; width: 50px; text-align: center;">90 ▼</div>		

Parameters

Unit

Millimeter

Earthworks

Formworks

Concrete

Reinforcements

Paint

Tiles

LAP SPICES LENGTH

TENSION BARS

COMPRESSION BARS

BAR SIZES (DEFORMED MM)

f<sub>c</sub>

20.7

f<sub>c</sub>

27.6

Lapped Splice

Lapped Splice

10	300	300
12	300	300
16	400	400
20	500	500
25	625	625
28	675	675
32	775	775

SPLICING

COLUMN

BEAM

SLAB

WALLS

STAIRS

SPICE LOCATION

1/2

of clear height

SPICE ZONE

1/2

of clear height

ALLOWABLE PERCENTAGE

50

MINIMUM VERTICAL DISTANCE OF ADJACENT BARS

600

BAR END HOOKS

MAIN BARS

STIRRUPS & TIES

BAR SIZE (DEFORMED)

90°

135°

180°

10

100

115

105

12

115

125

165

16

150

160

160

20

300

235

235

32

405

345

345

⊗

WEIGHT

BAR SIZE (Diameter)

kg / m

6 mm	0.222
8 mm	0.395
10 mm	0.616
12 mm	0.888
16 mm	1.577
20 mm	2.466
25 mm	3.854
28 mm	4.833
32 mm	6.313
36 mm	7.991
40 mm	9.864
44 mm	11.926
50 mm	15.413
56 mm	19.318

REINFORCEMENT GRADE

COLUMNS

FOOTINGS

BEAMS

STAIRS

WALLS

SLABS

MANUFACTURED LENGTH

COLUMN FOOTING	6.0	7.5	9.0	10.5	12.0	13.5	15.0
WALL FOOTING	6.0	7.5	9.0	10.5	12.0	13.5	15.0
COLUMN	6.0	7.5	9.0	10.5	12.0	13.5	15.0
BEAM/GIRDER	6.0	7.5	9.0	10.5	12.0	13.5	15.0
WALL	6.0	7.5	9.0	10.5	12.0	13.5	15.0
SLAB ON GRADE	6.0	7.5	9.0	10.5	12.0	13.5	15.0
SUSPENDED SLAB	6.0	7.5	9.0	10.5	12.0	13.5	15.0
STAIRS	6.0	7.5	9.0	10.5	12.0	13.5	15.0

AVAILABLE

NOT-AVAILABLE

## ADD STRUCTURAL MEMBER

STRUCTURAL MEMBER

NAME:

COLUMN

C-1

COLUMN TYPE:

RECTANGULAR RCD COLUMN

UNIT: mm

DIMENSIONS

L 600

W 600

H 3350

QUANTITY 13

CONNECTION BELOW

F-2

MAIN REINFORCEMENTS:

CLEAR HEIGHT

DIA. 32

QTY: 24

Beam - to - Beam

LATERAL TIES

Dia. 12

Lateral Ties Configuration

Qty of bars	3
Qty of bars	2
Qty of bars	3
Qty of bars	2

Spacing

- @ Rest Spacing 150
- Qty 1 Spacing 50
- Qty 14 Spacing 100

JOINT TIES

Dia. 10

Spacing 100

LATENTIAL TIES (BELOW NGL)

Spacing

- Rest @ 100
- 1 @ 50
- @

@ GROUND FLOOR

## ADD STRUCTURAL MEMBER

STRUCTURAL MEMBER

COLUMN
▼

NAME:

C-1
▼

COLUMN TYPE:

RECTANGULAR RCD COLUMN
▼

UNIT: mm ▼

DIMENSIONS

L 600

W 600

H 3150

QUANTITY 13

CONNECTION BELOW

C-1
▼

MAIN REINFORCEMENTS:

DIA. 32 QTY: 16

LATERAL TIES

Dia. 12

Lateral Ties Configuration ▼

	Qty of bars	3
	Qty of bars	1
	Qty of bars	3
	Qty of bars	1

Spacing

• @ Rest
Spacing
150

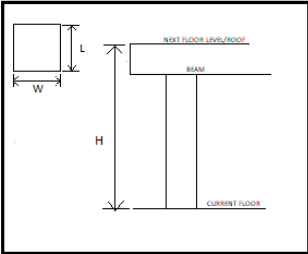

• Qty
1
Spacing
50

• Qty
14
Spacing
100

JOINT TIES

Dia. 10 Spacing 100

@ 2ND & 3RD FLOOR

ADD STRUCTURAL MEMBER													
STRUCTURAL MEMBER		NAME:											
<div style="border: 1px solid black; padding: 2px; display: inline-block;">COLUMN</div> <div style="border: 1px solid black; width: 20px; height: 20px; float: right;"></div>		<div style="border: 1px solid black; padding: 2px; display: inline-block;">C-1</div> <div style="border: 1px solid black; width: 20px; height: 20px; float: right;"></div>											
COLUMN TYPE:													
<div style="border: 1px solid black; padding: 2px; display: inline-block;">RECTANGULAR RCD COLUMN</div> <div style="border: 1px solid black; width: 20px; height: 20px; float: right;"></div>		UNIT: <div style="border: 1px solid black; padding: 2px; display: inline-block;">mm</div> <div style="border: 1px solid black; width: 20px; height: 20px; float: right;"></div>											
DIMENSIONS													
L	<div style="border: 1px solid black; padding: 2px; display: inline-block;">600</div>												
W	<div style="border: 1px solid black; padding: 2px; display: inline-block;">600</div>												
H	<div style="border: 1px solid black; padding: 2px; display: inline-block;">4500</div>												
QUANTITY <div style="border: 1px solid black; padding: 2px; display: inline-block;">13</div>													
CONNECTION BELOW													
<div style="border: 1px solid black; padding: 2px; display: inline-block;">C-1</div> <div style="border: 1px solid black; width: 20px; height: 20px; float: right;"></div>													
													
MAIN REINFORCEMENTS:													
DIA. <div style="border: 1px solid black; padding: 2px; display: inline-block;">32</div> QTY: <div style="border: 1px solid black; padding: 2px; display: inline-block;">12</div>													
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> LATERAL TIES <span style="float: right;">Dia. <div style="border: 1px solid black; padding: 2px; display: inline-block;">12</div></span> </div> <div style="border: 1px solid black; padding: 5px;"> <div style="display: flex; align-items: center;">  <table border="1" style="margin-left: 10px;"> <thead> <tr> <th colspan="2">Lateral Ties Configuration</th> </tr> </thead> <tbody> <tr> <td>Qty of bars</td> <td>2</td> </tr> <tr> <td>Qty of bars</td> <td>1</td> </tr> <tr> <td>Qty of bars</td> <td>2</td> </tr> <tr> <td>Qty of bars</td> <td>1</td> </tr> </tbody> </table> </div> </div> </div> <div style="width: 50%;"> <div style="margin-top: 20px;">JOINT TIES</div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> DIA. <div style="border: 1px solid black; padding: 2px; display: inline-block;">10</div> Spacing <div style="border: 1px solid black; padding: 2px; display: inline-block;">100</div> </div> </div> </div> <div style="margin-top: 10px;"> <div style="border: 1px solid black; padding: 5px;"> Spacing <div style="float: right; text-align: center;">+</div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div>• @ Rest</div> <div>Spacing <div style="border: 1px solid black; padding: 2px; display: inline-block;">150</div></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div>• Qty <div style="border: 1px solid black; padding: 2px; display: inline-block;">1</div></div> <div>Spacing <div style="border: 1px solid black; padding: 2px; display: inline-block;">50</div></div> </div> <div style="display: flex; justify-content: space-between; margin-top: 5px;"> <div>• Qty <div style="border: 1px solid black; padding: 2px; display: inline-block;">14</div></div> <div>Spacing <div style="border: 1px solid black; padding: 2px; display: inline-block;">100</div></div> </div> <div style="text-align: center; margin-top: 10px;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 0 auto;"></div> </div> </div>				Lateral Ties Configuration		Qty of bars	2	Qty of bars	1	Qty of bars	2	Qty of bars	1
Lateral Ties Configuration													
Qty of bars	2												
Qty of bars	1												
Qty of bars	2												
Qty of bars	1												

@ 4TH FLOOR

@ 2nd & 3rd Floor

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-1

BEAM TYPE

SUSPENDED BEAM

UNIT:

mm

Quantity

3

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-1	B-1	5000	1	C-1 (D)	C-1 (D)
B-1	B-1	4500	2	C-1 (D)	C-1 (D)

SUSPENDED BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
B-1	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Dia. 12 1 @ 50 Qty. 16	Dia. 12 1 @ 100 Qty. 16
B-2	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 200 Qty. 2	Dia. 12 1 @ 50 Qty. 16
B-3	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 75 Qty. 2	Dia. 12 1 @ 50 Qty. 16

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-2

BEAM TYPE

SUSPENDED BEAM

UNIT:

mm

Quantity

4

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-2	B-2	3000	1	C-1 (B)	C-1 (B)
B-3	B-3	7000	1	C-1 (B)	C-1 (B)

SUSPENDED BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
B-1	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Dia. 12 1 @ 50 Qty. 16	Dia. 12 1 @ 100 Qty. 16
B-2	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 200 Qty. 2	Dia. 12 1 @ 50 Qty. 16
B-3	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 75 Qty. 2	Dia. 12 1 @ 50 Qty. 16

@ 4th Floor

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-1

BEAM TYPE

SUSPENDED BEAM

UNIT:

mm

Quantity

3

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-1	B-1	5000	1	C-1 (D)	C-1 (D)
B-1	B-1	4500	2	C-1 (D)	C-1 (D)

SUSPENDED BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
B-1	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Dia. 12 1 @ 50 Qty. 16	Dia. 12 1 @ 100 Qty. 16
B-2	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 200 Qty. 2	Dia. 12 1 @ 50 Qty. 16
B-3	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 75 Qty. 2	Dia. 12 1 @ 50 Qty. 16

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-2

BEAM TYPE

SUSPENDED BEAM

UNIT:

mm

Quantity

4

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-2	B-2	3000	1	C-1 (B)	C-1 (B)
B-3	B-3	7000	1	C-1 (B)	C-1 (B)

SUSPENDED BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
B-1	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Dia. 12 1 @ 50 Qty. 16	Dia. 12 1 @ 100 Qty. 16
B-2	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 200 Qty. 2	Dia. 12 1 @ 50 Qty. 16
B-3	450	700	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 5	Cnv. 5	Rest. @ 75 Qty. 2	Dia. 12 1 @ 50 Qty. 16

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

RBR-1

BEAM TYPE

ROOF BEAM

UNIT:

mm

Quantity

3

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
RBR-1	RBR-1	5000	1	C-1 (D)	C-1 (D)
		4500	2	C-1 (D)	C-1 (D)

ROOF BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
RBR-1	300	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 3	Cnv. 5	Dia. 10 1 @ 50 Qty. 16	Dia. 10 1 @ 100 Qty. 16
RBR-2	350	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 4	Cnv. 2	Cnv. 4	Rest. @ 200 Qty. 2	Dia. 10 1 @ 50 Qty. 16
RBR-3	300	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 3	Cnv. 4	Cnv. 3	Rest. @ 200 Qty. 2	Dia. 10 1 @ 50 Qty. 16

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

RBR-2

BEAM TYPE

ROOF BEAM

UNIT:

mm

Quantity

4

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE

Top Reinforcement

1/3 L<sub>c</sub> or Clear Length

Bottom Reinforcement

1/5 L<sub>c</sub> or Clear Length

BEAM ROW	Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
RBR-2	RBR-2	3000	1	C-1 (B)	C-1 (B)
RBR-3	RBR-3	7000	1	C-1 (B)	C-1 (B)

ROOF BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
RBR-1	300	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 5	Cnv. 3	Cnv. 5	Dia. 10 1 @ 50 Qty. 16	Dia. 10 1 @ 100 Qty. 16
RBR-2	350	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 4	Cnv. 2	Cnv. 4	Rest. @ 200 Qty. 2	Dia. 10 1 @ 50 Qty. 16
RBR-3	300	500	<div><div></div><div></div><div></div><div></div></div>	Dia. 25 Qty. 3	Cnv. 4	Cnv. 3	Rest. @ 200 Qty. 2	Dia. 10 1 @ 50 Qty. 16

STEPS

- 1. The program will check the availability of the manufactured bar lengths.  
**Example:** The available manufactured bar lengths are 6, 7.5, 10.5, and 12 meters.
- 2. The program then will check the “connection below” in order to determine total height of the column  
**Example:** @ C – 1  
Ground Floor; Connected to F – 2  
Second Floor & Third Floor; Connected to C – 1 (they are typical)  
Fourth Floor; Connected to C – 1
- 3. The program will determine the largest depth of the suspended beam and roof beam that is connected to the column in its respected floor

Note:

- It is only applied on 2nd floor and above.
- The indicator that the particular beam is connected to the column is if the column is selected as a support on the beam. As shown in this picture.

**Example:**  
@ 2nd & 3rd Floor; B-1 (D=700), B-2 (D=700), and B-3 (D=700).  
@ 4th Floor; B-1 (D=700), B-2 (D=700), B-3 (D=700), RB-1(D=300), RB-2 (D=350), and RB-3 (D=300)

Thus,  
@2nd & 3rd Floor;  $D_{B2} = D_{B3} = 700\text{ mm}$   
@ 4th Floor;  $D_{B4} = 700\text{ mm}$  and  $D_{RB4} = 350\text{ mm}$

- 4. The program then will compute the clear height of the column in its respected floor  
 $H_{C1} = H_n + D_F - (D_{B(2)} \text{ or } D_{RB1})$  for ground floor  
 $H_{Cn} = H_n - (D_{B(n+1)} \text{ or } D_{RB(n)})$  for upper floors

Note: the largest between  $D_{B(n+1)}$  and  $D_{RB}$  will be chosen

LEGEND:

**Example:**

- For Ground Floor  
 $H_{C1} = H_1 + D_F - D_{B2} = 3350 + 1500 - 700 = 4150\text{ mm}$
- For 2nd  
 $H_{C2} = H_2 - D_{B3} = 3150 - 700 = 2450\text{ mm}$
- For3rd Floor  
 $H_{C3} = H_3 - D_{B4} = 3150 - 700 = 2450\text{ mm}$
- For 4th Floor  
Since the there is no suspended beam of the upper floor connected thus,  
 $D_{B(n+1)} = 0$

$$H_{C4} = Hn - D_{RB} = 4500 - 350 = 3900 \text{ mm}$$

5. The program will compute the required quantity of @rest lateral ties, lateral ties below NGL (if there is), and joint ties for each column.

### LEGEND

- For Ground Floor
  - a) If there are lateral ties (Below NGL)

$$Qty_{TE(1)} = \frac{D_F - \left( \sum_2^3 Qty_{TE(x)} S_{E(x)} \right) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{E(1)}}$$

Then,

$$Qty_{T(@rest)} = \frac{H_{C1} - \left( \sum_1^3 Qty_{TE(x)} S_{E(x)} \right) - \left( \sum_1^x Qty_{T(x)} S_{(x)} \right) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{(@rest)}} + 1$$

And,

$$Qty_{TQ} = \frac{D_{B(n+1)} \text{ or } D_{RB}}{S_{TI}} - 1$$

- b) If there are NO lateral ties (Below NGL)

$$Qty_{T(@rest)} = \frac{H_{C1} - 2 \left( \sum_{x=1}^x Qty_{T(x)} S_{(x)} \right) - CC_F - d_{bTF} - d_{bTF} - d_{bMR}}{S_{(@rest)}} + 1$$

And,

$$Qty_{TQ} = \frac{D_{B(n+1)} \text{ or } D_{RB}}{S_{TI}} - 1$$

- For the upper floors

$$Qty_{T(@rest)} = \frac{H_{Cn} - 2 \left( \sum_1^x Qty_{T(x)} S_{(x)} \right)}{S_{(@rest)}} + 1$$

And

$$Qty_{TQ} = \frac{D_{B(n+1)} \text{ or } D_{RB}}{S_{TL}} - 1$$

Note:

If the  $Answer \geq 0$ , then Round Up to whole number

If the *Answer*  $< 0$ , then Round Down to whole number

**Example:**

@ Ground Floor

MAIN REINFORCEMENTS:

DIA.

QTY:

CLEAR HEIGHT

Beam - to - Beam

LATERAL TIES

Dia.

Lateral Ties Configuration

Qty of bars

Qty of bars

Qty of bars

Qty of bars

Spacing

@ Rest

@ Qty

@ Qty

JOINT TIES

Dia.

Spacing

LATERAL TIES (BELOW NGL)

Spacing

Rest @

@

@

Since there are Lateral Ties (Below NGL)

$$Qty_{TE(1)} = \frac{D_F - \left( \frac{\sum Qty_{TE(x)} S_{E(x)}}{2} \right) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{E(1)}}$$

$$Qty_{TE(1)} = \frac{1500 - [1(50) + 0(0)] - 75 - 25 - 25 - 32}{100} = 12.93 \rightarrow 13$$

Then,

$$Qty_{T(@rest)} = \frac{H_{C1} - \left( \frac{\sum Qty_{TE(x)} S_{E(x)}}{1} \right) - \left( \frac{\sum Qty_{T(x)} S_{(x)}}{1} \right) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{(@rest)}} + 1$$

$$Qty_{T(@rest)} = \frac{4150 - [13(100) + 1(50) + 0(0)] - [1(50) + 14(100)] - 75 - 25 - 25 - 32}{150} + 1$$


$$Qty_{T(@rest)} = 8.95 \rightarrow 9$$

And

$$Qty_{TQ} = \frac{D_{B(1+1)} \text{ or } D_{RB}}{S_{Tj}} = \frac{D_{B(3)}}{S_{Tj}} = \frac{700}{100} - 1 = 6$$

@ 2nd Floor

MAIN REINFORCEMENTS:  
DIA. 32 QTY: 16

LATERAL TIES  
DIA. 12  
Lateral Ties Configuration  


Qty of bars	3
Qty of bars	1
Qty of bars	3
Qty of bars	1

Spacing  
• @ Rest Spacing 150  
• Qty 1 Spacing 50  
• Qty 14 Spacing 100

JOINT TIES  
DIA. 10 Spacing 100

$$Qty_{T(@rest)} = \frac{H_{C2} - 2 \left( \frac{\sum Qty_{T(x)} S_{(x)}}{1} \right)}{S_{(@rest)}}$$


$$Qty_{T(@rest)} = \frac{2450 - 2[1(50) + 14(100)]}{150} + 1 = -2$$

And,

$$Qty_{TQ} = \frac{D_{B(2+1)} \text{ or } D_{RB}}{S_{Tj}} - 1 = \frac{700}{100} - 1 = 6$$

@ 3rd Floor

MAIN REINFORCEMENTS:  
DIA. 32 QTY: 16

LATERAL TIES  
DIA. 12  
Lateral Ties Configuration  


Qty of bars	3
Qty of bars	1
Qty of bars	3
Qty of bars	1

Spacing  
• @ Rest Spacing 150  
• Qty 1 Spacing 50  
• Qty 14 Spacing 100

JOINT TIES  
DIA. 10 Spacing 100

$$Qty_{T(@rest)} = \frac{H_{C3} - 2 \left( \frac{\sum Qty_{T(x)} S_{(x)}}{1} \right)}{S_{(@rest)}} - 1$$

$$Qty_{T(@rest)} = \frac{2450 - 2[1(50) + 14(100)]}{150} + 1 = -2$$

And,

$$Qty_{TQ} = \frac{D_{B(3+1)} \text{ or } D_{RB}}{S_{Tj}} - 1 = \frac{700}{100} - 1 = 6$$

MAIN REINFORCEMENTS:

DIA.32

QTY:12

LATERAL TIES

Dia.12

Lateral Ties Configuration

Qty of bars2

Qty of bars1

Qty of bars2

Qty of bars1

Spacing

• @ Rest

Spacing150

• Qty1

Spacing50

• Qty14

Spacing100

JOINT TIES

Dia.10

Spacing100

$$Qty_{T(@rest)} = \frac{H_{C4} - 2 \left( \sum_1^2 Qty_{T(x)} S_{(x)} \right)}{S_{(@rest)}}$$
$$Qty_{T(@rest)} = \frac{3900 - 2[1(50) + 14(100)]}{150} + 1 = 7.667 \rightarrow 8$$

And,

$$Qty_{TQ} = \frac{D_{B(2+1)} \text{ or } D_{RB}}{S_{Tj}} - 1 = \frac{350}{100} - 1 = 2.5 \rightarrow 3$$

6. The program will compute the length of the lateral ties. Depending on what Lateral Ties configuration.

LEGEND:

Note: (For  $R_L$

Case 1:  $d_{Mb} = 10\text{ mm} \rightarrow 16\text{ mm}$

$$R_L = 2d_T$$

Case 2:  $d_{Mb} = 20\text{ mm} \rightarrow 25\text{ mm}$

$$R_L = 2.5d_T$$

- For Lateral Ties Configuration 1

LATERAL TIES

Dia.

B

D

Lateral Ties Configuration 1

$$L_B = 2(B + D) - 8(CC_C) + 2H_{L(d)} - 3R_L$$

- For Lateral Ties Configuration 2

LATERAL TIES

Dia.

B

D

Lateral Ties Configuration 2

$$L_{B(a)} = 2(B + D) - 8(CC_C + d_T) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 4\sqrt{\left(\frac{B}{2} - CC_C\right)^2 + \left(\frac{D}{2} - CC_C\right)^2} + 2H_{L(135)} - 3R_L$$

- For Lateral Ties Configuration 3

LATERAL TIES		Dia. <input type="text"/>	
		<b>Lateral Ties Configuration 3</b> ▼	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	

$$S_B = \frac{B - 2(CC_c + d_T) - d_M(Qty_{BLUE} + 2Qty_{ORANGE})}{Qty_{BLUE} + 2Qty_{ORANGE} - 1}$$

$$S_D = \frac{D - 2(CC_c + d_T) - d_M(Qty_{RED} + 2Qty_{GREEN})}{Qty_{RED} + 2Qty_{GREEN} - 1}$$

$$L_{B(a)} = 2(B + D) - 8(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 2D + 2[d_MQty_{BLUE} + S_B(Qty_{BLUE} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{D(c)} = 2B + 2[d_MQty_{RED} + S_D(Qty_{RED} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

- For Lateral Ties Configuration 4

LATERAL TIES		Dia. <input type="text"/>	
		<b>Lateral Ties Configuration 4</b> ▼	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	
	Qty of bars	<input type="text"/>	

$$S_B = \frac{B - 2(CC_c + d_T) - d_M(Qty_{BLUE} + 2Qty_{ORANGE})}{Qty_{BLUE} + 2Qty_{ORANGE} - 1}$$

$$S_D = \frac{D - 2(CC_c + d_T) - d_M(Qty_{RED} + 2Qty_{GREEN})}{Qty_{RED} + 2Qty_{GREEN} - 1}$$

$$L_{B(a)} = 2(W + L) - 8(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 4\sqrt{\left(\frac{W}{2} - CC_c\right)^2 + \left(\frac{L}{2} - CC_c\right)^2} + 2H_{L(135)} - 3R_L$$

$$L_{B(c)} = 2D + 2[d_MQty_{BLUE} + S_B(Qty_{BLUE} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(d)} = 2B + 2[(d_MQty_{RED} + S_D(Qty_{RED} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

- For Lateral Ties Configuration 5

LATERAL TIES		Dia. <input type="text"/>	
		<b>Lateral Ties Configuration 5</b> ▼	
	Qty of Ties	<input type="text"/>	
	Qty of Ties	<input type="text"/>	

$$L_{B(a)} = 2(B + D) - 8(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = B - 2(CC_c) + H_{L(135)} + H_{L(90)}$$

$$L_{B(c)} = D - 2(CC_c) + H_{L(135)} + H_{L(90)}$$

- For Lateral Ties Configuration 6

LATERAL TIES		Dia. <input type="text"/>	
		<b>Lateral Ties Configuration 6</b> ▼	
	Qty of Ties	<input type="text"/>	
	Qty of Ties	<input type="text"/>	

$$L_{B(a)} = 2(B + D) - 8(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = B - 2(CC_c) + 2H_{L(180)}$$

$$L_{B(c)} = D - 2(CC_c) + 2H_{L(180)}$$

Example:

CONCRETE COVER	
FOOTINGS	75
SUSPENDED SLAB	20
SLAB ON GRADE	40
BEAMS EXPOSED ON EARTH	40
BEAMS EXPOSED ON WEATHER	40
COLUMNS EXPOSED ON EARTH	75
COLUMNS EXPOSED ON WEATHER	40

BAR END HOOKS			
MAIN BARS		STIRRUPS & TIES	
BAR SIZE (DEFORMED)	L		
	90°	135°	180°
10	100	115	105
12	115	125	165
16	150	160	160
20	300	235	235
32	405	345	345
⊕			

@ Ground Floor

MAIN REINFORCEMENTS:  
DIA. 32 QTY: 24

CLEAR HEIGHT  
Beam - to - Beam

LATERAL TIES  
Dia. 12  
Lateral Ties Configuration  
Qty of bars 3  
Qty of bars 2  
Qty of bars 3  
Qty of bars 2  
Spacing  
• @ Rest Spacing 150  
• Qty 1 Spacing 50  
• Qty 14 Spacing 100

JOINT TIES  
Dia. 10 Spacing 100  
LATETRAL TIES (BELOW NGL)  
Spacing  
Rest @ 100  
1 @ 50  
 @

Since the **Lateral Tie Configuration 3** is chosen. Thus,

$$S_D = \frac{B - 2(CC_c + d_T) - d_M(Qty_{BLUE} + 2Qty_{ORANGE})}{Qty_{BLUE} + 2Qty_{ORANGE} - 1} = \frac{600 - 2(40 + 12) - 32[3 + 2(2)]}{3 + 2(2) - 1}$$

$$S_D = 45.33333$$

$$S_D = \frac{D - 2(CC_c + d_T) - d_M(Qty_{RED} + 2Qty_{GREEN})}{Qty_{RED} + 2Qty_{GREEN} - 1} = \frac{600 - 2(40 + 12) - 32[3 + 2(2)]}{3 + 2(2) - 1}$$

$$S_D = 45.33333$$

Since  $d_T = 12\text{ mm}$  thus,  $H_{L(135)} = 125\text{ mm}$  &  $R_L = 2d_T = 2(12) = 24$

$$L_{B(a)} = 2(B + D) - 8(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(a)} = 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

$$L_{B(a)} = 2258\text{ mm}$$

$$L_{B(b)} = 2D + 2[d_MQty_{BLUE} + S_B(Qty_{BLUE} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 2(600) + 2[32(3) + 45.3333(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(b)} = 1639.333 \rightarrow \text{round up to whole number} \rightarrow 1640\text{ mm}$$

$$L_{B(c)} = 2B + 2[d_MQty_{RED} + S_D(Qty_{RED} - 1) + 2d_T] - 4(CC_c) + 2H_{L(135)} - 3R_L$$

$$L_{B(c)} = 2(600) + 2[32(3) + 45.3333(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(c)} = 1639.333 \rightarrow \text{round up to whole number} \rightarrow 1640\text{ mm}$$

@ 2nd Floor



MAIN REINFORCEMENTS:

DIA.

32

QTY:

16

LATERAL TIES

Dia.

12

Lateral Ties Configuration

Qty of bars

3

Qty of bars

1

Qty of bars

3

Qty of bars

1

Spacing

•@ Rest

Spacing

150

•Qty

1

Spacing

50

•Qty

14

Spacing

100

JOINT TIES

Dia.

10

Spacing

100

Since the **Lateral Tie Configuration 3** is chosen. Thus,

$$S_B = \frac{W-2\left(CC_c+d_T\right)-d_M(Qty_{BLUE}+2Qty_{ORANGE})}{Qty_{BLUE}+2Qty_{ORANGE}-1} = \frac{600-2(40+12)-32[3+2(1)]}{3+2(1)-1}$$

$$S_B = 84$$

$$S_D = \frac{D-2\left(CC_c+d_T\right)-d_M(Qty_{RED}+2Qty_{GREEN'})}{Qty_{RED}+2Qty_{GREEN}-1} = \frac{600-2(40+12)-32[3+2(1)]}{3+2(1)-1}$$

$$S_D = 84$$

Since  $db_T = 12\text{ mm}$  thus,  $H_{L(135)} = 125\text{ mm}$ ,  $R_L = 2d_T = 2(12) = 24$

$$L_{B(a)} = 2(B + D) - 8\left(CC_c\right) + 2H_{L(135)} - 3R_L$$

$$L_{B(a)} = 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

$$L_{B(a)} = 2258\text{ mm}$$

$$L_{B(b)} = 2D + 2\Big[d_MQty_{BLUE} + S_B\Big(Qty_{BLUE} - 1\Big) + 2d_T\Big] - 4\left(CC_c\right) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(b)} = 1794\text{ mm}$$

$$L_{B(c)} = 2B + 2\Big[d_MQty_{RED} + S_D\Big(Qty_{RED} - 1\Big) + 2d_T\Big] - 4\left(CC_c\right) + 2H_{L(135)} - 3R_L$$

$$L_{B(c)} = 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(c)} = 1794\text{ mm}$$

@ 3rd Floor

MAIN REINFORCEMENTS:

DIA.

32

QTY:

16

LATERAL TIES

Dia.

12

Lateral Ties Configuration

Qty of bars

3

Qty of bars

1

Qty of bars

3

Qty of bars

1

Spacing

•@ Rest

Spacing

150

•Qty

1

Spacing

50

•Qty

14

Spacing

100

JOINT TIES

Dia.

10

Spacing

100

Since the **Lateral Tie Configuration 3** is chosen. Thus,

$$S_B = \frac{B-2\left(CC_c+d_T\right)-d_M(Qty_{BLUE}+2Qty_{ORANGE})}{Qty_{BLUE}+2Qty_{ORANGE}-1} = \frac{600-2(40+12)-32[3+2(1)]}{3+2(1)-1}$$

$$S_B = 84$$

$$S_D = \frac{D-2\left(CC_c+d_T\right)-d_M(Qty_{RED}+2Qty_{GREEN'})}{Qty_{RED}+2Qty_{GREEN}-1} = \frac{600-2(40+12)-32[3+2(1)]}{3+2(1)-1}$$

$$S_D = 84$$

Since  $db_T = 12\text{ mm}$  thus,  $H_{L(135)} = 125\text{ mm}$ ,  $R_L = 2d_T = 2(12) = 24$

$$L_{B(a)} = 2(B + D) - 8\left(CC_c\right) + 2H_{L(135)} - 3R_L$$

$$L_{B(a)} = 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

$$L_{B(a)} = 2258 \text{ mm}$$

$$L_{B(b)} = 2D + 2[d_M Qty_{BLUE} + S_B(Qty_{BLUE} - 1) + 2d_T] - 4(CC_C) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(b)} = 1794 \text{ mm}$$

$$L_{B(c)} = 2B + 2[d_M Qty_{RED} + S_D(Qty_{RED} - 1) + 2d_T] - 4(CC_C) + 2H_{L(135)} - 3R_L$$

$$L_{B(c)} = 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(c)} = 1794 \text{ mm}$$

@ 4th Floor

Since the **Lateral Tie Configuration 3** is chosen. Thus,

$$S_W = \frac{B - 2(CC_C + d_T) - d_M(Qty_{BLUE} + 2Qty_{ORANGE})}{Qty_{BLUE} + 2Qty_{ORANGE} - 1} = \frac{600 - 2(40 + 12) - 32[2 + 2(1)]}{2 + 2(1) - 1}$$

$$S_W = 122.6667$$

$$S_L = \frac{D - 2(CC_C + d_T) - d_M(Qty_{RED} + 2Qty_{GREEN})}{Qty_{RED} + 2Qty_{GREEN} - 1} = \frac{600 - 2(40 + 12) - 32[2 + 2(1)]}{2 + 2(1) - 1}$$

$$S_L = 122.6667$$

Since  $db_T = 12 \text{ mm}$  thus,  $H_{L(135)} = 125 \text{ mm}$ ,  $R_L = 2d_T = 2(12) = 24$

$$L_{B(a)} = 2(B + D) - 8(CC_C) + 2H_{L(135)} - 3R_L$$

$$L_{B(a)} = 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

$$L_{B(a)} = 2258 \text{ mm}$$

$$L_{B(b)} = 2D + 2[d_M Qty_{BLUE} + S_B(Qty_{BLUE} - 1) + 2d_T] - 4(CC_C) + 2H_{L(135)} - 3R_L$$

$$L_{B(b)} = 2(600) + 2[32(2) + 122.6667(2 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

$$L_{B(b)} = 1639333 \rightarrow \text{round up to whole number} \rightarrow 1640 \text{ mm}$$

$$L_{B(c)} = 2W + 2[d_M Qty_{RED} + S_D(Qty_{RED} - 1) + 2d_T] - 4(CC_C) + 2H_{L(135)} - 3R_L$$

$$L_{B(c)} = 2(600) + 2[32(2) + 122.6667(2 - 1) + 2(12)] - 4(40) + 2(125)$$

$$L_{B(c)} = 1639.333 \rightarrow \text{round up to whole number} \rightarrow 1640 \text{ mm}$$

7. The program will compute the length of the joint ties. Depending on what Lateral Ties configuration.

- For Lateral Tie Configurations 1 – 4

$$L_{B(x)} \text{ of } Qty_{TQ} = L_{B(x)} \text{ of } Qty_T - 2(H_{L(135)} \text{ of } Qty_T - H_{L(135)} \text{ of } Qty_{TQ}) - 3R_V + 3R_L$$

- For Lateral Tie Configuration 5

$$L_{B(a)} \text{ of } Qty_{TQ} = L_{B(a)} \text{ of } Qty_T - 2(H_{L(135)} \text{ of } Qty_T - H_{L(135)} \text{ of } Qty_{TQ}) - 3R_V + 3R_L$$

$$L_{B(b)} \text{ of } Qty_{TQ} = L_{B(b)} \text{ of } Qty_T - (H_{L(135)} \text{ of } Qty_T - H_{L(135)} \text{ of } Qty_{TQ}) - (H_{L(90)} \text{ of } Qty_T - H_{L(90)} \text{ of } Qty_{TQ})$$

$$L_{B(c)} \text{ of } Qty_{TQ} = L_{B(c)} \text{ of } Qty_T - (H_{L(135)} \text{ of } Qty_T - H_{L(135)} \text{ of } Qty_{TQ}) - (H_{L(90)} \text{ of } Qty_T - H_{L(90)} \text{ of } Qty_{TQ})$$

- For Lateral Tie Configuration 6

$$L_{B(a)}\text{ of Qty}_{TQ} = L_{B(a)}\text{ of Qty}_T - 2\big(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}\big) - 3R_V + 3R_L$$

$$L_{B(b)}\text{ of Qty}_{TQ} = L_{B(b)}\text{ of Qty}_T - 2\big(H_{L(180)}\text{ of Qty}_T - H_{L(180)}\text{ of Qty}_{TQ}\big)$$

$$L_{B(c)}\text{ of Qty}_{TQ} = L_{B(c)}\text{ of Qty}_T - 2\big(H_{L(180)}\text{ of Qty}_T - H_{L(180)}\text{ of Qty}_{TQ}\big)$$

**Where:** For  $R_V$

Case 1:  $d_{TQ} = 10\text{ mm}\rightarrow 16\text{ mm}$

$$R_V = 2d_{TQ}$$

Case 2:  $d_{TQ} = 20\text{ mm}\rightarrow 25\text{ mm}$

$$R_V = 2.5d_{TQ}$$

**Example:**

BAR END HOOKS

MAIN BARS		STIRRUPS & TIES		
BAR SIZE (DEFORMED)		L		
		90°	135°	180°
10		100	115	105
12		115	125	165
16		150	160	160
20		300	235	235
32		405	345	345

@ Ground Floor

MAIN REINFORCEMENTS:

DIA.

32

QTY:

24

CLEAR HEIGHT

Beam - to - Beam

LATERAL TIES

Dia.

12

Lateral Ties Configuration

Qty of bars

3

Qty of bars

2

Qty of bars

3

Qty of bars

2

Spacing

@ Rest

Spacing

150

Qty

1

Spacing

50

Qty

14

Spacing

100

JOINT TIES

Dia.

10

Spacing

100

LATETRAL TIES (BELOW NGL)

Spacing

Rest @

100

1

@

50

@

Since the **Lateral Tie Configuration 3** is chosen. Thus,

Since  $d_{TQ} = 10\text{ mm}$  thus,  $H_{L(135)}\text{ of Qty}_{TQ} = 115\text{ mm}$ ,  $R_V = 2d_{TQ} = 2(10) = 20$

$$L_{B(a)}\text{ of Qty}_{TQ} = L_{B(a)}\text{ of Qty}_T - 2\big(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}\big) - 3R_V + 3R_L$$

$$L_{B(a)}\text{ of Qty}_{TQ} = 2258 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(a)}\text{ of Qty}_{TQ} = 2250\text{ mm}$$

$$L_{B(b)}\text{ of Qty}_{TQ} = L_{B(b)}\text{ of Qty}_T - 2\big(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}\big) - 3R_V + 3R_L$$

$$L_{B(a)}\text{ of Qty}_{TQ} = 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(b)}\text{ of Qty}_{TQ} = 1632\text{ mm}$$

$$L_{B(c)}\text{ of Qty}_{TQ} = L_{B(b)}\text{ of Qty}_T - 2\big(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}\big) - 3R_V + 3R_L$$

$$L_{B(c)}\text{ of Qty}_{TQ} = 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(c)}\text{ of Qty}_{TQ} = 1632\text{ mm}$$

@ 2nd Floor

MAIN REINFORCEMENTS:
DIA. 32 QTY: 16

LATERAL TIES
DIA. 12

Lateral Ties Configuration
Qty of bars 3
Qty of bars 1
Qty of bars 3
Qty of bars 1

Spacing
Qty 1 Spacing 150
Qty 1 Spacing 50
Qty 14 Spacing 100

JOINT TIES
DIA. 10 Spacing 100

Since the **Lateral Tie Configuration 3** is chosen. Thus,

Since  $db_{TQ} = 10\text{ mm}$  thus,  $H_{L(135)}\text{ of }Qty_{TQ} = 115\text{ mm}$ ,  $R_V = 2d_{TQ} = 2(10) = 20$

$L_{B(a)}\text{ of }Qty_{TQ} = L_{B(a)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(a)}\text{ of }Qty_{TQ} = 2258 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(a)}\text{ of }Qty_{TQ} = 2250\text{ mm}$

$L_{B(b)}\text{ of }Qty_{TQ} = L_{B(b)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(b)}\text{ of }Qty_{TQ} = 1794 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(b)}\text{ of }Qty_{TQ} = 1786\text{ mm}$

$L_{B(c)}\text{ of }Qty_{TQ} = L_{B(c)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(c)}\text{ of }Qty_{TQ} = 1794 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(c)}\text{ of }Qty_{TQ} = 1786\text{ mm}$

@ 3rd Floor

MAIN REINFORCEMENTS:
DIA. 32 QTY: 16

LATERAL TIES
DIA. 12

Lateral Ties Configuration
Qty of bars 3
Qty of bars 1
Qty of bars 3
Qty of bars 1

Spacing
Qty 1 Spacing 150
Qty 1 Spacing 50
Qty 14 Spacing 100

JOINT TIES
DIA. 10 Spacing 100

Since the **Lateral Tie Configuration 3** is chosen. Thus,

Since  $db_{TQ} = 10\text{ mm}$  thus,  $H_{L(135)}\text{ of }Qty_{TQ} = 115\text{ mm}$ ,  $R_V = 2d_{TQ} = 2(10) = 20$

$L_{B(a)}\text{ of }Qty_{TQ} = L_{B(a)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(a)}\text{ of }Qty_{TQ} = 2258 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(a)}\text{ of }Qty_{TQ} = 2250\text{ mm}$

$L_{B(b)}\text{ of }Qty_{TQ} = L_{B(b)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(b)}\text{ of }Qty_{TQ} = 1794 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(b)}\text{ of }Qty_{TQ} = 1786\text{ mm}$

$L_{B(c)}\text{ of }Qty_{TQ} = L_{B(c)}\text{ of }Qty_T - 2(H_{L(135)}\text{ of }Qty_T - H_{L(135)}\text{ of }Qty_{TQ}) - 3R_V + 3R_L$

$L_{B(c)}\text{ of }Qty_{TQ} = 1794 - 2(125 - 115) - 3(20) + 3(24)$

$L_{B(c)}\text{ of }Qty_{TQ} = 1786\text{ mm}$

@ 4th Floor

MAIN REINFORCEMENTS:
DIA. 32
QTY: 12

LATERAL TIES
DIA. 12

Lateral Ties Configuration
Qty of bars 2
Qty of bars 1
Qty of bars 2
Qty of bars 1

Spacing
• @ Rest Spacing 150
• Qty 1 Spacing 50
• Qty 14 Spacing 100

JOINT TIES
DIA. 10
Spacing 100

Since the **Lateral Tie Configuration 3** is chosen. Thus,

Since  $db_{TQ} = 10\text{ mm}$  thus,  $H_{L(135)}\text{ of Qty}_{TQ} = 115\text{ mm}$ ,  $R_v = 2d_{TQ} = 2(10) = 20$

$$L_{B(a)}\text{ of Qty}_{TQ} = L_{B(a)}\text{ of Qty}_T - 2(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}) - 3R_v + 3R_L$$

$$L_{B(a)}\text{ of Qty}_{TQ} = 2258 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(a)}\text{ of Qty}_{TQ} = 2250\text{ mm}$$

$$L_{B(b)}\text{ of Qty}_{TQ} = L_{B(a)}\text{ of Qty}_T - 2(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}) - 3R_v + 3R_L$$

$$L_{B(b)}\text{ of Qty}_{TQ} = 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(b)}\text{ of Qty}_{TQ} = 1632\text{ mm}$$

$$L_{B(c)}\text{ of Qty}_{TQ} = L_{B(a)}\text{ of Qty}_T - 2(H_{L(135)}\text{ of Qty}_T - H_{L(135)}\text{ of Qty}_{TQ}) - 3R_v + 3R_L$$

$$L_{B(c)}\text{ of Qty}_{TQ} = 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(c)}\text{ of Qty}_{TQ} = 1632\text{ mm}$$

8. The program will determine the respective manufactured bars and no. of manufactured pcs.

LEGEND:

$$Qty_{Pn} = \frac{L_M}{(L_B\text{ of Qty}_T)\text{ or } (L_B\text{ of Qty}_{TQ})}$$

- For Ground Floor

Note: If  $\sum Qty_{TE(x)} = 0$  thus,  $\sum Qty_{Tx}$  will replace  $\sum Qty_{TE(x)}$ .

If the Lateral Ties Configuration 1-4

$$Qty_{Mn} = \frac{(\sum Qty_{TE(x)} + \sum Qty_{Tx} + Qty_{T(@rest)})\text{ or } Qty_{TQ}}{Qty_{Pn}} \cdot Qty_{Column}$$

If the Lateral Ties Configuration 5 & 6

$$Qty_{Mn} = \frac{(\sum Qty_{TE(x)} + \sum Qty_{Tx} + Qty_{T(@rest)})\text{ or } Qty_{TQ}}{Qty_{Pn}} \cdot Qty_{Column} \text{ :for } L_{B(a)}$$

$$Qty_{Mn} = \frac{\left[ (\sum Qty_{TE(x)} + \sum Qty_{Tx} + Qty_{T(@rest)})\text{ or } Qty_{TQ} \right] Qty_{GREEN}}{Qty_{Pn}} \cdot Qty_{Column} \text{ :for } L_{B(b)}$$

Qty\_Mn = [((ΣQty\_TE(x)+ΣQty\_Tx+Qty\_T(@rest)) or Qty\_TQ)Qty\_RED / Qty\_Pn] • Qty\_Column ∴for L\_B(c)

- For Upper Floors

If the Lateral Ties Configuration 1-4

Qty\_Mn = ((2ΣQty\_Tx+Qty\_T(@rest)) or Qty\_TQ / Qty\_Pn) • Qty\_Column

If the Lateral Ties Configuration 5-6

Qty\_Mn = ((2ΣQty\_Tx+Qty\_T(@rest)) or Qty\_TQ / Qty\_Pn) • Qty\_Column ∴for L\_B(a)

Qty\_Mn = [((2ΣQty\_Tx+Qty\_T(@rest)) or Qty\_TQ)Qty\_GREEN / Qty\_Pn] • Qty\_Column ∴for L\_B(b)

Qty\_Mn = [((2ΣQty\_Tx+Qty\_T(@rest)) or Qty\_TQ)Qty\_RED / Qty\_Pn] • Qty\_Column ∴for L\_B(c)

Then,

L\_W = [Qty\_Pn - Qty\_Pn (round down into whole number)] × L\_B

L\_E (m) = [Qty\_Mn (round up) - Qty\_Mn] × L\_M

And

Total Wasage = L\_E + L\_W[Qty\_Mn (round down into whole number)]

Example:

@ Ground Floor

- For Lateral Ties

Σ\_1^3 Qty\_TE(x) = (13 + 1 + 0) = 14 & Σ\_1^2 Qty\_T(x) + Qty\_T(@rest) = (1 + 14) + 9 = 24

a) L\_B(a)

L [M]	Qty [T]	Qty [TE]	Total	L [B(a)]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	24	14	38	2.258	13	2.66	2	240.5	241	1.484	3.00	359.160
7.5						3.32	3	160.3	161	0.726	5.00	121.160
10.5						4.65	4	120.3	121	1.468	7.88	184.035
12						5.31	5	96.2	97	0.710	9.60	77.760

Thus L\_CM(1a) = 12 and Qty\_M(1a) = 97

b) L\_B(b)

L [M]	Qty [T]	Qty [TE]	Total	L [B(b)]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	24	14	38	1.64	13	3.66	3	164.67	165	1.080	2.00	179.12
7.5						4.57	4	123.50	124	0.940	3.75	119.37
10.5						6.40	6	82.33	83	0.660	7.00	61.12
12						7.32	7	70.57	71	0.520	5.14	41.54

Thus L\_CM(1b) = 12 and Qty\_M(1b) = 71

c)  $L_{B(c)}$

L [M]	Qty [T]	Qty [TE]	Total	L [B(a)]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	24	14	38	1.64	13	3.66	3	164.67	16 5	1.080	2.00	179.12
7.5						4.57	4	123.50	12 4	0.940	3.75	119.37
10.5						6.40	6	82.33	83	0.660	7.00	61.12
12						7.32	7	70.57	71	0.520	5.14	41.54

Thus  $L_{CM(1c)} = 12$  and  $Qty_{M(1c)} = 71$

- For Joint Ties

$Qty_{TQ} = 6$

a)  $L_{B(a)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	2.25	13	2.67	2	39	39	1.50 0	0	58.500
7.5				3.33	3	26	26	0.75 0	0	19.500
10.5				4.67	4	19.5	20	1.50 0	5.25	33.750
12				5.33	5	15.6	16	0.75 0	4.8	16.050

Thus  $L_{CM(1a)} = 12$  and  $Qty_{M(1a)} = 16$

b)  $L_{B(b)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.632	13	3.68	3	26	26	1.10 4	0	28.704
7.5				4.60	4	19.5	20	0.97 2	3.75	22.218
10.5				6.43	6	13	13	0.70 8	0	9.204
12				7.35	7	11.14	12	0.57 6	10.285 7	16.622

Thus  $L_{CM(1b)} = 10.5$  and  $Qty_{M(1b)} = 13$

c)  $L_{B(c)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.632	13	3.68	3	26	26	1.10 4	0	28.704
7.5				4.60	4	19.5	20	0.97 2	3.75	22.218
10.5				6.43	6	13	13	0.70 8	0	9.204
12				7.35	7	11.14	12	0.57 6	10.285 7	16.622

Thus  $L_{CM(1c)} = 10.5$  and  $Qty_{M(1c)} = 13$

• For Lateral Ties

Since there is no  $Qty_{TE(x)}$  thus,  $\sum Qty_{T(x)}$  will be multiply in 2

$$2\sum Qty_{T(x)} + Qty_{T(@rest)} = 2(1 + 14) + (- 2) = 28$$

a)  $L_{B(a)}$

L [M]	Qty [T]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	2.258	13	2.66	2	182	182	1.48 4	0	270.09
7.5				3.32	3	121. 3	122	0.72 6	5	92.85
10.5				4.65	4	91	91	1.46 8	0	133.59
12				5.31	5	72.8	73	0.71 0	2.4	53.52

Thus  $L_{CM(2a)} = 12$  and  $Qty_{M(2c)} = 73$

b)  $L_{B(b)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	1.794	13	3.34	3	121. 3	122	0.61 8	4	78.78
7.5				4.18	4	91	91	0.32 4	0	29.48
10.5				5.85	5	72.8	73	1.53 0	2.1	112.26
12				6.69	6	60.6 7	61	1.23 6	4	78.16

Thus  $L_{CM(2b)} = 7.5$  and  $Qty_{M(2b)} = 91$

c)  $L_{B(c)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	1.794	13	3.34	3	112.7	113	0.61 8	2	71.216
7.5				4.18	4	84.5	85	0.32 4	3.75	30.966
10.5				5.85	5	67.6	68	1.53 0	4.2	106.710
12				6.69	6	56.3 3	57	1.23 6	8	77.216

Thus  $L_{CM(2c)} = 7.5$  and  $Qty_{M(2c)} = 91$

• For Joint Ties

$$Qty_{TQ} = 6$$

a)  $L_{B(a)}$  of  $Qty_{TQ}$



L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	2.25	13	2.67	2	39	39	1.50 0	0	58.500
7.5				3.33	3	26	26	0.75 0	0	19.500
10.5				4.67	4	19.5	20	1.50 0	5.25	33.750
12				5.33	5	15.6	16	0.75 0	4.8	16.050

Thus  $L_{CM(2a)} = 12$  and  $Qty_{M(2a)} = 16$

b)  $L_{B(b)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.786	13	3.36	3	26	26	0.64 2	0	16.692
7.5				4.20	4	19.5	20	0.35 6	3.75	10.514
10.5				5.88	5	15.6	16	1.57 0	4.2	27.750
12				6.72	6	13	13	1.28 4	0	16.692

Thus  $L_{CM(2b)} = 7.5$  and  $Qty_{M(2b)} = 20$

c)  $L_{B(c)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.786	13	3.36	3	26	26	0.64 2	0	16.692
7.5				4.20	4	19.5	20	0.35 6	3.75	10.514
10.5				5.88	5	15.6	16	1.57 0	4.2	27.750
12				6.72	6	13	13	1.28 4	0	16.692

Thus  $L_{CM(2c)} = 7.5$  and  $Qty_{M(2c)} = 20$

@ 3rd Floor

- For Lateral Ties

Since there is no  $Qty_{TE(x)}$  thus,  $\sum Qty_{T(x)}$  will be multiply in 2

$$2\sum Qty_{T(x)} + Qty_{T(@rest)} = 2(1 + 14) - 2 = 28$$

a)  $L_{B(a)}$

L [M]	Qty [T]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	2.258	13	2.66	2	182	182	1.48 4	0	270.09

7.5				3.32	3	121. 3	122	0.72 6	5	92.85
10.5				4.65	4	91	91	1.46 8	0	133.59
12				5.31	5	72.8	73	0.71 0	2.4	53.52

Thus  $L_{CM(2a)} = 12$  and  $Qty_{M(2c)} = 73$

b)  $L_{B(b)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	1.794	13	3.34	3	121. 3	122	0.61 8	4	78.78
7.5				4.18	4	91	91	0.32 4	0	29.48
10.5				5.85	5	72.8	73	1.53 0	2.1	112.26
12				6.69	6	60.6 7	61	1.23 6	4	78.16

Thus  $L_{CM(2b)} = 7.5$  and  $Qty_{M(2b)} = 91$

c)  $L_{B(c)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	28	1.794	13	3.34	3	121. 3	122	0.61 8	4	78.78
7.5				4.18	4	91	91	0.32 4	0	29.48
10.5				5.85	5	72.8	73	1.53 0	2.1	112.26
12				6.69	6	60.6 7	61	1.23 6	4	78.16

Thus  $L_{CM(2c)} = 7.5$  and  $Qty_{M(2c)} = 91$

- For Joint Ties

$$Qty_{TQ} = 6$$

a)  $L_{B(a)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	2.25	13	2.67	2	39	39	1.50 0	0	58.500
7.5				3.33	3	26	26	0.75 0	0	19.500
10.5				4.67	4	19.5	20	1.50 0	5.25	33.750
12				5.33	5	15.6	16	0.75 0	4.8	16.050

Thus  $L_{CM(2a)} = 12$  and  $Qty_{M(2a)} = 16$

b)  $L_{B(b)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.786	13	3.36	3	26	26	0.64 2	0	16.692
7.5				4.20	4	19.5	20	0.35 6	3.75	10.514
10.5				5.88	5	15.6	16	1.57 0	4.2	27.750
12				6.72	6	13	13	1.28 4	0	16.692

Thus  $L_{CM(2b)} = 7.5$  and  $Qty_{M(2b)} = 20$

c)  $L_{B(c)}$  of  $Qty_{TQ}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	1.786	13	3.36	3	26	26	0.64 2	0	16.692
7.5				4.20	4	19.5	20	0.35 6	3.75	10.514
10.5				5.88	5	15.6	16	1.57 0	4.2	27.750
12				6.72	6	13	13	1.28 4	0	16.692

Thus  $L_{CM(2c)} = 7.5$  and  $Qty_{M(2c)} = 20$

@ 4th Floor

- For Lateral Ties

Since there is no  $Qty_{TE(x)}$  thus,  $\sum Qty_{T(x)}$  will be multiply in 2

$$2\sum Qty_{T(x)} + Qty_{T(@rest)} = 2(1 + 14) + 8 = 38$$

a)  $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	38	2.258	13	2.66	2	247	247	1.48 4	0	366.55
7.5				3.32	3	164. 7	165	0.72 6	2.5	121.56
10.5				4.65	4	123. 5	124	1.46 8	5.25	185.81
12				5.31	5	98.8	99	0.71 0	2.40	71.98

Thus  $L_{CM(4a)} = 12$  and  $Qty_{M(4a)} = 99$

b)  $L_{B(b)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	38	1.64	13	3.66	3	164. 7	165	1.08 0	2	179.12

7.5				4.57	4	123.5	124	0.940	3.75	119.37
10.5				6.40	6	82.33	83	0.660	7	61.12
12				7.32	7	70.57	71	0.520	5.14	41.54

Thus  $L_{CM(4b)} = 12$  and  $Qty_{M(4b)} = 71$

c)  $L_{B(c)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	38	1.64	13	3.66	3	164.7	165	1.080	2	179.12
7.5				4.57	4	123.5	124	0.940	3.75	119.37
10.5				6.40	6	82.33	83	0.660	7	61.12
12				7.32	7	70.57	71	0.520	5.14	41.54

Thus  $L_{CM(4c)} = 12$  and  $Qty_{M(4c)} = 71$

- For Joint Ties

$Qty_{TQ} = 3$

a)  $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	3	2.25	13	2.66	2	19.5	20	1.484	3	31.500
7.5				3.32	3	13	13	0.726	0	9.750
10.5				4.65	4	9.75	10	1.468	2.625	16.125
12				5.31	5	7.8	8	0.710	2.4	7.650

Thus  $L_{CM(4a)} = 12$  and  $Qty_{M(4a)} = 8$

b)  $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	3	1.632	13	3.68	3	13	13	1.104	0	14.352
7.5				4.60	4	9.75	10	0.972	1.875	10.623
10.5				6.43	6	6.5	7	0.708	5.25	9.498
12				7.35	7	5.571	6	0.576	5.14286	8.023

Thus  $L_{CM(4b)} = 12$  and  $Qty_{M(4b)} = 6$

c)  $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column )	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
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6	3	1.632	13	3.68	3	13	13	1.10 4	0	14.352
7.5				4.60	4	9.75	10	0.97 2	1.875	10.623
10.5				6.43	6	6.5	7	0.70 8	5.25	9.498
12				7.35	7	5.57 1	6	0.57 6	5.1428 6	8.023

Thus  $L_{CM(4c)} = 12$  and  $Qty_{M(4c)} = 6$

9. The program will then compute the weight of the reinforcement.

$$W = \omega \left[ \sum L_{CM} Qty_M \right] W_D$$

Where:

$$\omega = 1.0 \text{ (for the mean time)}$$

Example:

WEIGHT

BAR SIZE (Diameter)	kg / m
6 mm	0.222
8 mm	0.395
10 mm	0.616
12 mm	0.888
16 mm	1.597
20 mm	2.466
25 mm	3.854
28 mm	4.833
32 mm	6.313
36 mm	7.991
40 mm	9.864
44 mm	11.926
50 mm	15.413
56 mm	19.318

@Ground Floor

MAIN REINFORCEMENTS:

DIA.

32

QTY:

24

CLEAR HEIGHT

Beam - to - Beam

LATERAL TIES

Dia.

12

Lateral Ties Configuration

Qty of bars

3

Qty of bars

2

Qty of bars

3

Qty of bars

2

Spacing

•@ Rest

Spacing

150

•Qty

1

Spacing

50

•Qty

14

Spacing

100

JOINT TIES

Dia.

10

Spacing

100

LATETRAL TIES (BELOW NGL)

Spacing

Rest @

100

1

@

50

@

- Lateral Ties

Since the diameter for lateral ties is **12 mm**. Thus, the  $W_D = 0.888 \text{ kg/m}$

$$W_{1(LT)} = \omega \left[ \sum L_{CM} Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM} Qty_M \right] W_D$$

$$W_{1(LT)} = 1.0 \cdot [12(97) + 12(71) + 12(71)] \cdot 0.888 = 2546.78 \text{ kg}$$

- Joint Ties

Since the diameter for lateral ties is **10 mm**. Thus, the  $W_D = 0.616 \text{ kg/m}$

$$W_{1(JT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{1(JT)} = 1.0 \cdot [12(16) + 10.5(13) + 10.5(13)] \cdot 0.616 = 286.44 \text{ kg}$$

@ 2nd Floor

MAIN REINFORCEMENTS:
DIA. 
QTY:

LATERAL TIES
DIA.

Lateral Ties Configuration
Qty of bars 
Qty of bars 
Qty of bars 
Qty of bars

JOINT TIES
DIA. 
Spacing

Spacing
• @ Rest Spacing 
• Qty  Spacing 
• Qty  Spacing

- Lateral Ties

Since the diameter for lateral ties is **12 mm**. Thus, the  $W_D = 0.888 \text{ kg/m}$

$$W_{2(LT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{2(LT)} = 1.0 \cdot [12(73) + 7.5(91) + 7.5(91)] \cdot 0.888 = 1990.008 \text{ kg}$$

- Joint Ties

Since the diameter for lateral ties is **10 mm**. Thus, the  $W_D = 0.616 \text{ kg/m}$

$$W_{2(JT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{2(JT)} = 1.0 \cdot [12(16) + 7.5(20) + 7.5(20)] \cdot 0.616 = 303.072 \text{ kg}$$

@ 3rd Floor

MAIN REINFORCEMENTS:
DIA. 
QTY:

LATERAL TIES
DIA.

Lateral Ties Configuration
Qty of bars 
Qty of bars 
Qty of bars 
Qty of bars

JOINT TIES
DIA. 
Spacing

Spacing
• @ Rest Spacing 
• Qty  Spacing 
• Qty  Spacing

- Lateral Ties

Since the diameter for lateral ties is **12 mm**. Thus, the  $W_D = 0.888 \text{ kg/m}$

$$W_{3(LT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{3(LT)} = 1.0 \cdot [12(73) + 7.5(91) + 7.5(91)] \cdot 0.888 = 1990.008 \text{ kg}$$

- Joint Ties

Since the diameter for lateral ties is **10 mm**. Thus, the  $W_D = 0.616 \text{ kg/m}$

$$W_{3(JT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{3(JT)} = 1.0 \cdot [12(16) + 7.5(20) + 7.5(20)] \cdot 0.616 = 303.072 \text{ kg}$$

@ 4th Floor

MAIN REINFORCEMENTS:

DIA. 32QTY: 12

LATERAL TIES

Dia. 12

Lateral Ties Configuration

Qty of bars2

Qty of bars1

Qty of bars2

Qty of bars1

Spacing

•@ RestSpacing150

•Qty1Spacing50

•Qty14Spacing100

JOINT TIES

Dia. 10Spacing100

• Lateral Ties

Since the diameter for lateral ties is **12 mm**. Thus, the  $W_D = 0.888\text{ kg/m}$

$$W_{4(LT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{4(LT)} = 1.0 \cdot [12(99) + 12(71) + 12(71)] \cdot 0.888 = 2568.096\text{ kg}$$

• Joint Ties

Since the diameter for lateral ties is **10 mm**. Thus, the  $W_D = 0.616\text{ kg/m}$

$$W_{4(JT)} = \omega \left[ \sum L_{CM}Qty_M \right] W_D = \omega \left[ \sum_a^c L_{CM}Qty_M \right] W_D$$

$$W_{4(JT)} = 1.0 \cdot [12(8) + 12(6) + 12(6)] \cdot 0.616 = 147.84\text{ kg}$$

10. The program will compute the total weight of the ties in the column.

$$W_T = \sum W$$

Example:

$$W_T = \sum W = W_{1(LT)} + W_{1(JT)} + W_{2(LT)} + W_{2(JT)} + W_{3(LT)} + W_{3(JT)} + W_{4(LT)} + W_{4(JT)}$$

$$W_T = 2546.78 + 286.44 + 1990.008 + 303.072 + 1990.008 + 303.072 + 2568.096 + 147.84$$

$$W_T = 10438.388\text{ kg}$$