

REFERENCE

Parameters

UnitMeter

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

STRUCURAL MEMBER

FOOTING (COLUMN)

NAME:

F-2

FOOTING TYPE:

ISOLATED FOOTING

UNIT:

mm

DIMENSIONS

L

3800

W

3800

T

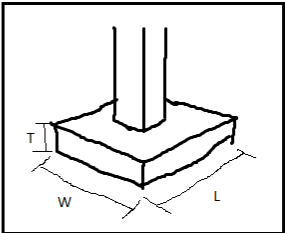
500

QUANTITY

12

DEPTH

1500



LONGITUDINAL REINFORCEMENT

DIAMETER

25

QUANTITY

11

HOOK

90

TRANSVERSE REINFORCEMENT

DIAMETER

25

QUANTITY

11

HOOK

90

Parameters

UnitMillimeter

Earthworks

Formworks

Concrete

Reinforcements

Paint

Tiles

LAP SPLICES LENGTH

TENSION BARS

COMPRESSION BARS

BAR SIZES (DEFORMED MM)

f_c

20.7

f_c

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

BAR END HOOKS

MAIN BARS

STIRRUPS & TIES

BAR SIZE (DEFORMED)

90°

135°

180°

10

100

115

105

12

115

125

165

16

150

180

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

0.615

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

SPLICING

COLUMN

BEAM

SLAB

WALLS

STAIRS

SPLICE LOCATION

1/2

of clear height

SPLICE ZONE

1/2

of clear height

ALLOWABLE PERCENTAGE

50

MINIMUM VERTICAL DISTANCE OF ADJACENT BARS

600

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

STRUCURAL MEMBER

COLUMN

NAME:

C-1

COLUMN TYPE:

RECTANGULAR RCD COLUMN

UNIT:

mm

DIMENSIONS

B

600

D

600

H

3350

H_c

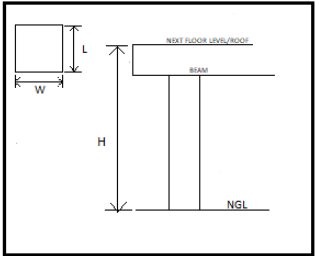
2650

QUANTITY

13

CONNECTION BELOW

F-2



MAIN REINFORCEMENTS:

DIA.

32

QTY:

24

SPLICE TYPE:

LAPPED SPLICE

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)

Rest @

100

1

@

50

@

@

@ GROUND FLOOR

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

COLUMN

NAME:

C-1

COLUMN TYPE:

RECTANGULAR RCD COLUMN

UNIT:

mm

DIMENSIONS

L

600

W

600

H

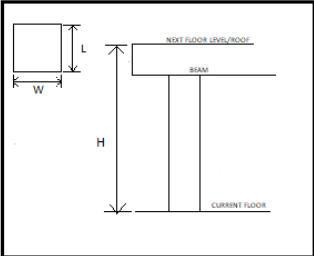
3150

H_c

2450

QUANTITY

13



MAIN REINFORCEMENTS:

DIA.

32

QTY:

16

SPLICE TYPE:

LAPPED SPLICE

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

STRUCURAL MEMBER

COLUMN

NAME:

C-1

COLUMN TYPE:

RECTANGULAR RCD COLUMN

UNIT:

mm

DIMENSIONS

B

600

D

600

H

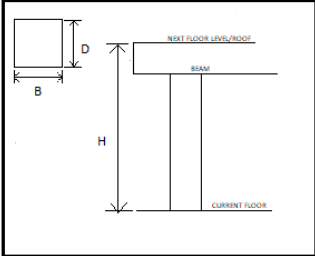
4500

H_c

3900

QUANTITY

13



MAIN REINFORCEMENTS:

DIA.

32

QTY:

12

SPLICE TYPE:

LAPPED SPLICE

LATERAL TIES

Dia.

12

Lateral Ties Configuration 2

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

@ 4TH FLOOR

1. 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

CC_F

= Footing Concrete Cover (based on parameters)

d_{bLF}

= diameter of longitudinal bars

d_{bTF}

= diameter of transverse bars

$Qty_{TE(x)}$

= Quantity of Lateral Ties below NGL

$S_{E(x)}$

= Spacing of Lateral Ties below NGL

$Qty_{T(@rest)}$

= Quantity of @ rest Lateral Ties

$S_{(@rest)}$

= Spacing of @rest Lateral Ties

Qty_{Tx}

= Quantity of Lateral Ties @ floor **n**

$S_{(x)}$

= Spacing of Lateral Ties @ floor **n**

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

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

Then,

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

And,

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

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

$$Qty_{T(@rest)} = \frac{H_C - 2(\sum_1^x Qty_{T(x)} S_{(x)}) - CC_F - d_{bTF} - d_{bTF} - d_{bMR}}{S_{(@rest)}} + 1$$

And,

$$Qty_{TQ} = \frac{H - H_C}{S_{TJ}} - 1$$

- For the upper floors

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

And

$$Qty_{TQ} = \frac{H - H_C}{S_{TJ}} - 1$$

Note:

If the **Answer** ≥ 0 , then Round Up to whole number

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

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

$$CC_F = 75$$

@ Ground Floor

H 3350

H_c 2650

QUANTITY 13

CONNECTION BELOW

F-2

MAIN REINFORCEMENTS:

DIA. 32

QTY: 24

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

@

H

NGL

$H_C = 2650 \text{ and } d_{bMR} = 32$

STRUCTURAL MEMBER

FOOTING (COLUMN)

NAME:

F-2

FOOTING TYPE:

ISOLATED FOOTING

UNIT: mm

DIMENSIONS

L 3800

W 3800

T 500

QUANTITY 12

DEPTH 1500

LONGITUDINAL REINFORCEMENT

DIAMETER 25

QUANTITY 11

HOOK TYPE 90

TRANSVERSE REINFORCEMENT

DIAMETER 25

QUANTITY 11

HOOK TYPE 90

T

W

L

$D_F = 1500, d_{bLF} = 25, \text{ and } d_{bTF} = 25$

Since there are Lateral Ties (Below NGL)

$$Qty_{TE(1)} = \frac{D_F - (\sum_2^3 Qty_{TE(x)} S_{E(x)}) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{E(1)}}$$
$$Qty_{TE(1)} = \frac{1500 - [1(50) + 0(0)] - 75 - 25 - 25 - 32}{100} = 12.93 \rightarrow 13$$

Then,

$$Qty_{T(@rest)} = \frac{H_C + D_F - (\sum_1^3 Qty_{TE(x)} S_{E(x)}) - (\sum_1^2 Qty_{T(x)} S_{(x)}) - CC_F - d_{bLF} - d_{bTF} - d_{bMR}}{S_{(@rest)}} + 1$$
$$= \frac{2650 + 1500 - [13(100) + 1(50) + 0(0)] - [1(50) + 14(100)] - 75 - 25 - 25 - 32}{150} + 1$$
$$Qty_{T(@rest)} = 8.95 \rightarrow 9$$

And

$$Qty_{TQ} = \frac{H - H_C}{S_{TJ}} = \frac{3350 - 2650}{100} - 1 = 6$$

@ 2nd – 3rd Floor

H

3150

H_c

2450

QUANTITY

13

MAIN REINFORCEMENTS:

DIA.

32

QTY:

16

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

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

H

4500

H_c

3900

QUANTITY

13

MAIN REINFORCEMENTS:

DIA.

32

QTY:

12

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

LATERAL TIES

Dia.

12

Lateral Ties Configuration 2

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

$$Qty_{T(@rest)} = \frac{H_{C2} - 2(\sum_1^2 Qty_{T(x)} S_{(x)})}{S_{(@rest)}} + 1$$

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

And,

$$Qty_{TQ} = \frac{H - H_C}{S_{TJ}} - 1 = \frac{3150 - 2450}{100} - 1 = 6$$

@ 4th Floor

H

4500

H_c

3900

QUANTITY

13

MAIN REINFORCEMENTS:

DIA.

32

QTY:

12

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

LATERAL TIES

Dia.

12

Lateral Ties Configuration 2

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

H

4500

H_c

3900

QUANTITY

13

MAIN REINFORCEMENTS:

DIA.

32

QTY:

12

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

LATERAL TIES

Dia.

12

Lateral Ties Configuration 2

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

$$Qty_{T(@rest)} = \frac{H_{C4} - 2(\sum_1^2 Qty_{T(x)} S_{(x)})}{S_{(@rest)}} + 1$$

$$Qty_{T(@rest)} = \frac{3900 - 2[1(50) + 14(100)]}{150} + 1 = 7.667 \rightarrow 8$$

And,

$$Qty_{TQ} = \frac{H - H_C}{S_{TJ}} - 1 = \frac{4500 - 3900}{100} - 1 = 5$$

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

LEGEND:

CC_C = Concrete Cover of the column(exposed to weather)

d_T = diameter of the lateral ties of the columns current floor

d_M = diameter of the main reinforcement of the columns current floor

H_{L(135)} = Hook length (depends on the table of 135 degree hook in parameters)

S_W = Spacing @ the width of the column

S_L = Spacing @ the length of the column

Note: (For R_L

Case 1: d_{Mb} = 10 mm → 16 mm

$$R_L = 2d_T$$

Case 2: d_{Mb} = 20 mm → 25 mm

$$R_L = 2.5d_T$$

- For Lateral Ties Configuration 1

LATERAL TIES		Dia. <input type="text"/>
	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. <input type="text"/>
	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"/>
	Lateral Ties Configuration 3 ▼ 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"/>
	Lateral Ties Configuration 4 ▼ 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.

B

D

Lateral Ties Configuration 5

Qty of Ties

Qty of Ties

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

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

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

- For Lateral Ties Configuration 6

LATERAL TIES

Dia.

W

L

Lateral Ties Configuration 6

Qty of Ties

Qty of Ties

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

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

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

Example:

CONCRETE COVER

FOOTINGS	<input type="text" value="75"/>
SUSPENDED SLAB	<input type="text" value="20"/>
SLAB ON GRADE	<input type="text" value="40"/>
BEAMS EXPOSED ON EARTH	<input type="text" value="40"/>
BEAMS EXPOSED ON WEATHER	<input type="text" value="40"/>
COLUMNS EXPOSED ON EARTH	<input type="text" value="75"/>
COLUMNS EXPOSED ON WEATHER	<input type="text" value="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.

QTY:

SPLICE TYPE:

JOINT TIES

Dia. Spacing

LATERAL TIES

Dia.

Lateral Ties Configuration

Qty of bars

Qty of bars

Qty of bars

Qty of bars

Spacing

@ Rest Spacing

Qty Spacing

Qty Spacing

LATETRAL TIES (BELOW NGL)

Spacing

Rest @

1 @

@

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

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

$$= 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

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

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

$$= 2(600) + 2[32(3) + 45.3333(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

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

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

$$= 2(600) + 2[32(3) + 45.3333(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

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

@ 2nd – 3rd Floor

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

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

$$S_B = 84$$

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

$$S_D = 84$$

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

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

$$= 2(600 + 600) - 8(40) + 2(125) - 3(24)$$

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

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

$$= 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

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

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

$$= 2(600) + 2[32(3) + 84(3 - 1) + 2(12)] - 4(40) + 2(125) - 3(24)$$

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

@ 4th Floor

MAIN REINFORCEMENTS:	
DIA.	32
QTY:	12
<div> <div>LATERAL TIES</div> <div> <div>Dia.</div> <div>12</div> </div> <div> <div>Lateral Ties Configuration 2</div> <div>▼</div> </div> </div> <div> </div> <div> <div>Spacing</div> <div> <div>• @ Rest</div> <div>Spacing</div> <div>150</div> </div> <div> <div>• Qty</div> <div>1</div> <div>Spacing</div> <div>50</div> </div> <div> <div>• Qty</div> <div>14</div> <div>Spacing</div> <div>100</div> </div> </div>	
<div> <div>SPLICE TYPE:</div> <div>LAPPED SPLICE ▼</div> </div> <div> <div>JOINT TIES</div> <div> <div>Dia.</div> <div>10</div> <div>Spacing</div> <div>100</div> </div> </div>	

Since the **Lateral Tie Configuration 2** is chosen. Thus,

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

$$\begin{aligned} L_{B(a)} &= 2(B + D) - 8(CC_C) + 2H_{L(135)} - 3R_L \\ &= 2(600 + 600) - 8(40) + 2(125) - 3(24) \end{aligned}$$

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

$$\begin{aligned} L_{B(b)} &= 4 \sqrt{\left(\frac{B}{2} - CC_C\right)^2 + \left(\frac{D}{2} - CC_C\right)^2} + 2H_{L(135)} - 3R_L \\ &= 4 \sqrt{\left(\frac{600}{2} - 40\right)^2 + \left(\frac{600}{2} - 40\right)^2} + 2(125) - 3(24) \end{aligned}$$

$$L_{B(b)} = 1648.78 \rightarrow \text{round up to whole number} \rightarrow \mathbf{1649 \text{ mm}}$$

3. 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

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

$$L_{B(b)} \text{ of } Qty_{TQ} = L_{B(b)} \text{ of } Qty_T - 2(H_{L(180)} \text{ of } Qty_T - H_{L(180)} \text{ of } Qty_{TQ})$$

$$L_{B(c)} \text{ of } Qty_{TQ} = L_{B(c)} \text{ of } Qty_T - 2(H_{L(180)} \text{ of } Qty_T - H_{L(180)} \text{ of } Qty_{TQ})$$

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

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

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

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

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

$$= 2258 - 2(125 - 115) - 3(20) + 3(24)$$

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

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

$$= 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(b)}\text{ of }Qty_{TQ} = \mathbf{1632\text{ mm}}$$

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

$$= 1640 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(c)}\text{ of }Qty_{TQ} = \mathbf{1632\text{ mm}}$$

@ 2nd – 3rd Floor

MAIN REINFORCEMENTS:

DIA.

32

QTY:

16

SPLICE TYPE:

LAPPED SPLICE

JOINT TIES

Dia.

10

Spacing

100

LATERAL TIES

Dia.

12

Lateral Ties Configuration

Qty of bars

3

Qty of bars

4

Qty of bars

3

Qty of bars

1

Spacing

@ Rest

Spacing

150

Qty

1

Spacing

50

Qty

14

Spacing

100

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

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

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

$$= 2258 - 2(125 - 115) - 3(20) + 3(24)$$

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

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

$$= 1794 - 2(125 - 115) - 3(20) + 3(24)$$

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

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

$$= 1794 - 2(125 - 115) - 3(20) + 3(24)$$

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

@ 4th Floor

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

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

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

$$= 2258 - 2(125 - 115) - 3(20) + 3(24)$$

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

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

$$= 1649 - 2(125 - 115) - 3(20) + 3(24)$$

$$L_{B(b)} \text{ of } Qty_{TQ} = \mathbf{1641 \text{ mm}}$$

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

LEGEND:

Qty_{Pn} = no. of pcs. produced

Qty_{Mn} = no. of manufactured pcs.

L_M = Available Manufactured Reinforcement Length

L_W = Wastage Length

L_E = Excess manufactured bar length

L_{CBn} = Chosen Manufactured Bar Length

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

- 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

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

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

Qty_{Mn} = $\frac{[(\sum Qty_{TE(x)} + \sum Qty_{Tx} + Qty_{T(@rest)}) \text{ or } Qty_{TQ}]Qty_{RED}}{Qty_{Pn}} \cdot Qty_{Column} \quad \therefore \text{for } L_{B(c)}$

- For Upper Floors

If the Lateral Ties Configuration 1-4

Qty_{Mn} = $\frac{(2 \sum Qty_{Tx} + Qty_{T(@rest)}) \text{ or } Qty_{TQ}}{Qty_{Pn}} \cdot Qty_{Column}$

If the Lateral Ties Configuration 5-6

Qty_{Mn} = $\frac{(2 \sum Qty_{Tx} + Qty_{T(@rest)}) \text{ or } Qty_{TQ}}{Qty_{Pn}} \cdot Qty_{Column} \quad \therefore \text{for } L_{B(a)}$

Qty_{Mn} = $\frac{[(2 \sum Qty_{Tx} + Qty_{T(@rest)}) \text{ or } Qty_{TQ}]Qty_{GREEN}}{Qty_{Pn}} \cdot Qty_{Column} \quad \therefore \text{for } L_{B(b)}$

Qty_{Mn} = $\frac{[(2 \sum Qty_{Tx} + Qty_{T(@rest)}) \text{ or } Qty_{TQ}]Qty_{RED}}{Qty_{Pn}} \cdot Qty_{Column} \quad \therefore \text{for } L_{B(c)}$

Then,

$L_W = [Qty_{Pn} - Qty_{Pn} \text{ (round down into whole number)}] \times L_B$

$L_E \text{ (m)} = [Qty_{Mn} \text{ (round up)} - Qty_{Mn}] \times L_M$

And

$Total \text{ Wasage} = L_E + L_W [Qty_{Mn} \text{ (round down into whole number)}]$

Example:

@ Ground Floor

- For Lateral Ties

$\sum_1^3 Qty_{TE(x)} = (13 + 1 + 0) = 14 \text{ \& } \sum_1^2 Qty_{T(x)} + Qty_{T(@rest)} = (1 + 14) + 9 = 24$

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 $L_{CM(a)} = 12$ and $Qty_{M(a)} = 97$

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

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

- 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	1.500	0	58.500
7.5				3.33	3	26	26	0.750	0	19.500
10.5				4.67	4	19.5	20	1.500	5.25	33.750
12				5.33	5	15.6	16	0.750	4.8	16.050

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

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	1.104	0	28.704
7.5				4.60	4	19.5	20	0.972	3.75	22.218
10.5				6.43	6	13	13	0.708	0	9.204
12				7.35	7	11.14	12	0.576	10.2857	16.622

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

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	1.104	0	28.704
7.5				4.60	4	19.5	20	0.972	3.75	22.218
10.5				6.43	6	13	13	0.708	0	9.204
12				7.35	7	11.14	12	0.576	10.2857	16.622

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

@ 2nd 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	1.484	0	270.09
7.5				3.32	3	121.3	122	0.726	5	92.85
10.5				4.65	4	91	91	1.468	0	133.59
12				5.31	5	72.8	73	0.710	2.4	53.52

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

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	0.618	4	78.78
7.5				4.18	4	91	91	0.324	0	29.48
10.5				5.85	5	72.8	73	1.530	2.1	112.26
12				6.69	6	60.67	61	1.236	4	78.16

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

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	0.618	4	78.78
7.5				4.18	4	91	91	0.324	0	29.48
10.5				5.85	5	72.8	73	1.530	2.1	112.26
12				6.69	6	60.67	61	1.236	4	78.16

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

- 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	1.500	0	58.500
7.5				3.33	3	26	26	0.750	0	19.500
10.5				4.67	4	19.5	20	1.500	5.25	33.750
12				5.33	5	15.6	16	0.750	4.8	16.050

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

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	0.642	0	16.692
7.5				4.20	4	19.5	20	0.356	3.75	10.514
10.5				5.88	5	15.6	16	1.570	4.2	27.750
12				6.72	6	13	13	1.284	0	16.692

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

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	0.642	0	16.692
7.5				4.20	4	19.5	20	0.356	3.75	10.514
10.5				5.88	5	15.6	16	1.570	4.2	27.750
12				6.72	6	13	13	1.284	0	16.692

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

@ 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	1.484	0	366.55
7.5				3.32	3	164.7	165	0.726	2.5	121.56
10.5				4.65	4	123.5	124	1.468	5.25	185.81
12				5.31	5	98.8	99	0.710	2.40	71.98

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

b) $L_{B(b)}$

L [M]	Qty [TQ]	L [B]	Qty (Column)	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	38	1.649	13	3.64	3	164.7	165	1.053	2	174.692
7.5				4.55	4	123.5	124	0.904	3.75	114.942
10.5				6.37	6	82.33	83	0.606	7	56.692
12				7.28	7	70.57	71	0.457	5.14	37.133

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

- For Joint Ties

$$Qty_{TQ} = 5$$

a) $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column)	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	5	2.25	13	2.67	2	32.5	33	1.500	3	51.000
7.5				3.33	3	21.67	22	0.750	2.5	18.250
10.5				4.67	4	16.25	17	1.500	7.875	31.875
12				5.33	5	13	13	0.750	0	9.750

Thus $L_{CM(4a)} = 12$ and $Qty_{M(4a)} = 13$

b) $L_{B(a)}$

L [M]	Qty [TQ]	L [B]	Qty (Column)	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	5	1.641	13	3.66	3	21.67	22	1.077	2	24.617
7.5				4.57	4	16.25	17	0.936	5.625	20.601
10.5				6.40	6	10.83	11	0.654	1.75	8.290
12				7.31	7	9.286	10	0.513	8.57	13.188

Thus $L_{CM(4b)} = 10.5$ and $Qty_{M(4b)} = 11$

5. The program will compute the price of the Lateral Ties.

REINFORCEMENT GRADE

Columns

Columns

(Lateral Ties):

Beams

Beams

(Stirrups):

Footings:

Slabs

Stairs

Walls

$$Price_{Total} = \sum Qty_{M(Lateral\ Ties)} Price_{M(Lateral\ Ties)} + \sum Qty_{M(Joint\ Ties)} Price_{M(Joint\ Ties)}$$

Where:

$Price_M$ = Price of the steel reinforcement based on Pricing
= Sorted through Reinforcement Grade, diameter, and Manufactured Length

Example

@ Ground Floor

MAIN REINFORCEMENTS:

DIA.

32

QTY:

24

SPLICE TYPE:

LAPPED SPLICE

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

$$d_{LT} = 12\ mm$$

Rebar GRADE 40 (ø12mm) [6m]- P 234.43

Rebar GRADE 40 (ø12mm) [7.5m]- P 293.04

Rebar GRADE 40 (ø12mm) [9m]- P 351.65

Rebar GRADE 40 (ø12mm) [10.5m]- P 410.26

Rebar GRADE 40 (ø12mm) [12m]- P 468.86

$$Qty_{M(a)} = 97 \ \& \ L_{CM(a)} = 12\ m \therefore Price_{M(a)} = \text{₹ } 468.86$$

$$Qty_{M(b)} = 71 \ \& \ L_{CM(b)} = 12\ m \therefore Price_{M(b)} = \text{₹ } 468.86$$

$$Qty_{M(c)} = 71 \ \& \ L_{CM(c)} = 12\ m \therefore Price_{M(c)} = \text{₹ } 468.86$$

$$\sum Qty_{M(LT)} Price_{M(LT)} = 97(468.86) + 71(468.86) + 71(468.86) = \text{₹ } 112,058.54$$

- Joint Ties

$$d_{JT} = 10\ mm$$

Rebar GRADE 40 (ø10mm) [6m]- P 162.62

Rebar GRADE 40 (ø10mm) [7.5m]- P 203.28

Rebar GRADE 40 (ø10mm) [9m]- P 243.94

Rebar GRADE 40 (ø10mm) [10.5m]- P 284.59

Rebar GRADE 40 (ø10mm) [12m]- P 325.25

$$Qty_{M(a)} = 16 \ \& \ L_{CM(a)} = 12\ m \therefore Price_{M(a)} = \text{₹ } 325.25$$

$Qty_{M(b)} = 13 \ \& \ L_{CM(b)} = 10.5 \ m \ \therefore Price_{M(b)} = \text{₹ } 284.59$

$Qty_{M(c)} = 13 \ \& \ L_{CM(c)} = 10.5 \ m \ \therefore Price_{M(c)} = \text{₹ } 284.59$

$\sum Qty_{M(JT)} Price_{M(JT)} = 16(325.25) + 13(284.59) + 13(284.59) = \text{₹ } 12,603.34$

- Total

$Price_{Total} = 112,058.54 + 12,603.34 = \text{₹ } 124,660.88$

@ 2nd – 3rd Floor

MAIN REINFORCEMENTS:
DIA.
QTY:

SPLICE TYPE:
JOINT TIES
Dia. Spacing

LATERAL TIES
Lateral Ties Configuration

Qty of bars
Qty of bars
Qty of bars
Qty of bars
Spacing
• @ Rest Spacing
• Qty Spacing
• Qty Spacing

- Lateral Ties

$d_{LT} = 12 \ mm$

Rebar GRADE 40 (ϕ12mm) [6m]- P **234.43**

Rebar GRADE 40 (ϕ12mm) [7.5m]- P **293.04**

Rebar GRADE 40 (ϕ12mm) [9m]- P **351.65**

Rebar GRADE 40 (ϕ12mm) [10.5m]- P **410.26**

Rebar GRADE 40 (ϕ12mm) [12m]- P **468.86**

$Qty_{M(a)} = 73 \ \& \ L_{CM(a)} = 12 \ m \ \therefore Price_{M(a)} = \text{₹ } 468.86$

$Qty_{M(b)} = 91 \ \& \ L_{CM(b)} = 7.5 \ m \ \therefore Price_{M(b)} = \text{₹ } 293.04$

$Qty_{M(c)} = 91 \ \& \ L_{CM(c)} = 7.5 \ m \ \therefore Price_{M(c)} = \text{₹ } 293.04$

$\sum Qty_{M(LT)} Price_{M(LT)} = 73(468.86) + 91(293.04) + 91(293.04) = \text{₹ } 87,560.06$

- Joint Ties

$d_{JT} = 10 \ mm$

Rebar GRADE 40 (ϕ10mm) [6m]- P **162.62**

Rebar GRADE 40 (ϕ10mm) [7.5m]- P **203.28**

Rebar GRADE 40 (ϕ10mm) [9m]- P **243.94**

Rebar GRADE 40 (ϕ10mm) [10.5m]- P **284.59**

Rebar GRADE 40 (ϕ10mm) [12m]- P **325.25**

$Qty_{M(a)} = 16 \ \& \ L_{CM(a)} = 12 \ m \ \therefore Price_{M(a)} = \text{₹ } 325.25$

$Qty_{M(b)} = 20 \ \& \ L_{CM(b)} = 7.5 \ m \ \therefore Price_{M(b)} = \text{₹ } 203.28$

$Qty_{M(c)} = 20 \ \& \ L_{CM(c)} = 7.5 \ m \ \therefore Price_{M(c)} = \text{₹ } 203.28$

$\sum Qty_{M(JT)} Price_{M(JT)} = 16(325.25) + 20(203.28) + 20(203.28) = \text{₹ } 13,335.2$

- Total

$Price_{Total} = 87,560.06 + 13,335.2 = \text{₹ } 100,895.26$

@ 4th Floor

LATERAL TIES
Dia.

Spacing
• @ Rest Spacing
• Qty Spacing
• Qty Spacing

JOINT TIES
Dia. Spacing

- Lateral Ties

$d_{LT} = 12 \ mm$

Rebar GRADE 40 (ø12mm) [6m]- P 234.43
Rebar GRADE 40 (ø12mm) [7.5m]- P 293.04
Rebar GRADE 40 (ø12mm) [9m]- P 351.65
Rebar GRADE 40 (ø12mm) [10.5m]- P 410.26
Rebar GRADE 40 (ø12mm) [12m]- P 468.86

$Qty_{M(a)} = 99 \ \& \ L_{CM(a)} = 12 \ m \ \therefore Price_{M(a)} = \text{P } 468.86$

$Qty_{M(b)} = 71 \ \& \ L_{CM(b)} = 12 \ m \ \therefore Price_{M(b)} = \text{P } 468.86$

$\sum Qty_{M(LT)} Price_{M(LT)} = 99(468.86) + 71(468.86) = \text{P } 79,706.2$

- Joint Ties

$d_{JT} = 10 \ mm$

Rebar GRADE 40 (ø10mm) [6m]- P 162.62
Rebar GRADE 40 (ø10mm) [7.5m]- P 203.28
Rebar GRADE 40 (ø10mm) [9m]- P 243.94
Rebar GRADE 40 (ø10mm) [10.5m]- P 284.59
Rebar GRADE 40 (ø10mm) [12m]- P 325.25

$Qty_{M(a)} = 13 \ \& \ L_{CM(a)} = 12 \ m \ \therefore Price_{M(a)} = \text{P } 325.25$

$Qty_{M(b)} = 11 \ \& \ L_{CM(b)} = 10.5 \ m \ \therefore Price_{M(b)} = \text{P } 284.59$

$\sum Qty_{M(JT)} Price_{M(JT)} = 13(325.25) + 11(284.59) = \text{P } 7,358.74$

- Total

$Price_{Total} = 79,706.2 + 7,358.74 = \text{P } 87,064.94$

6. The program will compute the weight of the reinforcement.

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

Where:

$\omega = 1.0 \ (for \ the \ mean \ time)$

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. 32QTY: 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. 10Spacing 100

LATETRAL TIES (BELOW NGL)

Spacing

Rest @ 100

1 @ 50

@

- Lateral Ties

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

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

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

- Joint Ties

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

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

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

@ 2nd – 3rd Floor

- Lateral Ties

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

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

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

- Joint Ties

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

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

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

@ 4th Floor

- Lateral Ties

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

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

$$W_{LT} = 1.0 \cdot [12(99) + 12(71)] \cdot 0.888 = 1811.52 \text{ kg}$$

- Joint Ties

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

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

$$W_{JT} = 1.0 \cdot [12(13) + 10.5(11)] \cdot 0.616 = 167.244 \text{ kg}$$

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

$$W_{Total} = W_{LT} + W_{JT}$$

Example:

@ Ground Floor

$W_{Total} = W_{LT} + W_{JT}$
 $W_{Total} = 2546.78 + 286.44$
 $W_{Total} = \mathbf{2,833.22\ kg}$

@ 2nd – 3rd Floor
 $W_{Total} = W_{LT} + W_{JT}$
 $W_{Total} = 1990.008 + 303.072$
 $W_{Total} = \mathbf{2,293.08\ kg}$

@ 4th Floor
 $W_{Total} = W_{LT} + W_{JT}$
 $W_{Total} = 1811.52 + 167.244$
 $W_{Total} = \mathbf{1,978.764\ kg}$

8. The program will determine the Labor Price for the Lateral Ties of Columns

CATEGORY: LABOR RATE (REBAR PER KG) - 9 Items	
FOOTING [KG]- P	17
WALL FOOTING [KG]- P	17
COLUMN [KG]- P	15
STAIRS [KG]- P	15
BEAM [KG]- P	16
FOOTING TIE BEAM [KG] - P	16
SLAB ON GRADE [KG]- P	17
SUSPENDED SLAB [KG]- P	18
WALLS [KG]- P	16

$Price_{Labor} = W \cdot L_R$

Example:

$L_R = \text{₹ } 15$

@ Ground Floor
 $Price_{Labor} = W \cdot L_R$
 $Price_{Labor} = 2,833.22(15)$
 $Price_{Labor} = \text{₹ } \mathbf{42,498.30}$

@ 2nd – 3rd Floor
 $Price_{Labor} = W \cdot L_R$
 $Price_{Labor} = 2,293.08(15)$
 $Price_{Labor} = \text{₹ } \mathbf{34,396.20}$

@ 4th Floor
 $Price_{Labor} = W \cdot L_R$
 $Price_{Labor} = 1,978.764(15)$
 $Price_{Labor} = \text{₹ } \mathbf{29,681.46}$