

REFERENCE

FILE HOME PRICE VIEW HELP

IMPORT PARAMETERS PAGE NAME (6 / 15) 24.8%

ADD FLOOR

- 1 > GROUND FLOOR
 - > FOOTING
 - CF-1
 - CF-2
 - CF-3
 - WF-1
 - V COLUMN
 - V WALL
- 2 V 2ND - 3RD FLOOR
- 3 V 4TH FLOOR

STRUCT. MEMBER

Parameters

Unit

Millimeter

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

SPLICING

COLUMN

BEAM

SLAB

WALL

STAIRS

SPLICE LOCATION

1/2

of clear height

SPLICE ZONE

1/2

of clear height

ALLOWABLE PERCENTAGE

50

MINIMUM VERTICAL DISTANCE OF ADJACENT BARS

500

BAR END HOOKS

MAIN BARS

STIRRUPS & TIES

BAR SIZE (DEFORMED)	30"	135"	180"
10	150	125	125
12	200	190	190
16	250	175	175
20	300	200	200
25	450	220	220
28	550	350	350
32	600	450	450

WEIGHT

kg / m

10 mm	0.222
8 mm	0.395
10 mm	0.616
12 mm	0.698
16 mm	1.597
20 mm	2.466
25 mm	3.853
32 mm	6.313
36 mm	7.991
40 mm	9.864
44 mm	11.936
50 mm	15.412
56 mm	19.218

REINFORCEMENT GRADE

COLUMN

POSITIVE

BEAM

STAIRS

WALLS

SLABS

MANUFACTURED LENGTH

COLUMN FOOTING

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0' 19.0'

WALL FOOTING

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

COLUMN

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

BEAM/GIRDER

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

WALL

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

SLAB ON GRADE

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

SUSPENDED SLAB

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

STAIRS

6.0' 7.0' 8.0' 10.0' 12.0' 14.0' 16.0' 18.0'

NOT AVAILABLE

Parameters

Unit

Earthworks

Formworks

Concrete

Reinforcements

Paint

Tiles

FOOTINGS

COLUMNS

BEAMS

SLABS

WALLS

CONCRETE

GRADE

GRAVEL

TYPE

READY MIX

4000 PSI @ 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

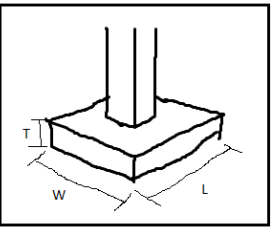
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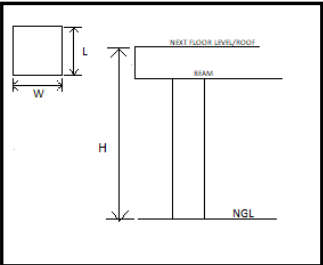

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40

75

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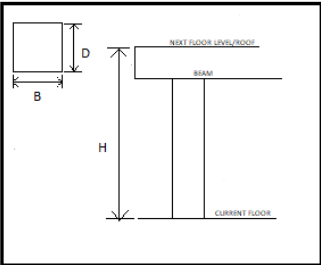

ADD STRUCTURAL MEMBER																			
STRUCTURAL MEMBER <div style="border: 1px solid black; padding: 2px; display: inline-block;">FOOTING (COLUMN) ▼</div>		NAME: <div style="border: 1px solid black; padding: 2px; display: inline-block;">FOOTING - 1</div>																	
FOOTING TYPE: <div style="border: 1px solid black; padding: 2px; display: inline-block;">ISOLATED FOOTING ▼</div>		UNIT: <div style="border: 1px solid black; padding: 2px; display: inline-block;">mm ▼</div>																	
DIMENSIONS L <div style="border: 1px solid black; padding: 2px; display: inline-block;">3800</div> W <div style="border: 1px solid black; padding: 2px; display: inline-block;">3800</div> T <div style="border: 1px solid black; padding: 2px; display: inline-block;">500</div> QUANTITY <div style="border: 1px solid black; padding: 2px; display: inline-block;">13</div> DEPTH <div style="border: 1px solid black; padding: 2px; display: inline-block;">1500</div>																			
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ADD STRUCTURAL MEMBER	
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<div style="display: flex; justify-content: space-between;"> <div style="width: 60%;"> COLUMN TYPE: <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> RECTANGULAR RCD COLUMN ▼ </div> </div> <div style="width: 35%;"> UNIT: <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> mm ▼ </div> </div> </div>	
<div style="display: flex;"> <div style="width: 35%;"> DIMENSIONS <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> B 600 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> D 600 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> H 3350 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> QUANTITY 13 </div> </div> <div style="width: 65%;">  </div> </div>	
CONNECTION BELOW <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> F-2 ▼ </div>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> MAIN REINFORCEMENTS: <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> DIA. 32 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> QTY: 24 </div> </div> <div style="width: 55%;"> SPLICE ALTERNATING <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> ENABLE ▼ </div> SPLICE TYPE: <div style="border: 1px solid black; padding: 2px; display: flex; justify-content: space-between;"> LAPPED SPLICE ▼ </div> </div> </div>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> LATERAL TIES <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Dia. 12 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Lateral Ties Configuration ▼ </div> <div style="display: flex; align-items: center;">  <div style="margin-left: 10px;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; display: flex; justify-content: space-between;"> Qty of bars 3 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; display: flex; justify-content: space-between;"> Qty of bars 2 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; display: flex; justify-content: space-between;"> Qty of bars 3 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px; display: flex; justify-content: space-between;"> Qty of bars 2 </div> </div> </div> <div style="width: 55%;"> JOINT TIES <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Dia. 10 Spacing 100 </div> </div> </div> </div>	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Spacing 150 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Qty 1 Spacing 50 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Qty 14 Spacing 100 </div> </div> <div style="width: 55%;"> LATERAL TIES (BELOW NGL) Spacing <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> Rest @ 100 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> 1 @ 50 </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 5px; display: flex; justify-content: space-between;"> @ </div> </div> </div>	

@ GROUND FLOOR

<h2>ADD STRUCTURAL MEMBER</h2>																															
STRUCTURAL MEMBER	NAME:																														
COLUMN ▼	C-1 ▼																														
COLUMN TYPE:																															
RECTANGULAR RCD COLUMN ▼	UNIT: mm ▼																														
DIMENSIONS																															
L 600	<p>The diagram shows a cross-section of a rectangular column with width W and height L. To its right, a vertical dimension line indicates the total height H from the 'CURRENT FLOOR' to the 'NEXT FLOOR LEVEL / ROOF'. A horizontal beam is shown at the top floor level.</p>																														
W 600																															
H 3150																															
QUANTITY 13																															
CONNECTION BELOW																															
C-1 ▼																															
MAIN REINFORCEMENTS:																															
DIA. 32	SPlice ALTERNATING ENABLE ▼																														
QTY: 16	SPlice TYPE: LAPPED SPlice ▼																														
JOINT TIES																															
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@ 2ND & 3RD FLOOR

ADD STRUCTURAL MEMBER			
STRUCTURAL MEMBER		NAME:	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> COLUMN </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> C-1 </div>	
COLUMN TYPE:		UNIT:	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> RECTANGULAR RCD COLUMN </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> mm </div>	
DIMENSIONS			
B			
D			
H			
QUANTITY			
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 13 </div>			
CONNECTION BELOW			
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> C-1 </div>			
MAIN REINFORCEMENTS:			
DIA.		SPLICE ALTERNATING	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 32 </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> ENABLE </div>	
QTY:		SPLICE TYPE:	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 12 </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> LAPPED SPLICE </div>	
JOINT TIES			
DIA.		Spacing	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 10 </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 100 </div>	
LATERAL TIES			
DIA.		Lateral Ties Configuration 2	
<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> 12 </div>		<div style="border: 1px solid black; padding: 2px; display: flex; align-items: center;"> Lateral Ties Configuration 2 </div>	
<div style="border: 1px solid black; padding: 5px; display: flex; align-items: center;">  </div>			
Spacing			
<div style="display: flex; align-items: center;"> <div style="flex: 1;"> <p>• @ Rest Spacing <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center; width: 100px;">150</div></p> <p>• Qty <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center; width: 50px;">1</div> Spacing <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center; width: 100px;">50</div></p> <p>• Qty <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center; width: 50px;">14</div> Spacing <div style="border: 1px solid black; padding: 2px; display: flex; align-items: center; width: 100px;">100</div></p> </div> <div style="flex: 0.5; text-align: center;"> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 5px auto;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 5px auto;"></div> <div style="border: 1px solid black; width: 20px; height: 20px; margin: 5px auto;"></div> </div> </div>			

@ 4TH FLOOR

Connected Beams

@ Ground Floor

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

RBR-1

BEAM TYPE

UNIT:

ROOF BEAM

mm

Quantity

3

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

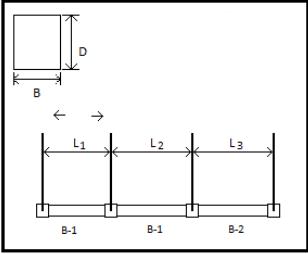
90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE



Top Reinforcement

1/3 L_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

BEAM ROW

Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
RBR-1	2500	1	C-1 (D)	

ROOF BEAM SCHEDULE

Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
RBR-1	200	350		Dia. 25 Qty 3	Dia. 12 Qty 3	Dia. 12 Qty 3	Dia. 12 Qty 1 @ 50	Dia. 12 Qty 16
				Dia. 25 Qty 2	Dia. 12 Qty 2	Dia. 12 Qty 2	Dia. 8 Qty 8 @ 100	Dia. 12 Qty 2

@ 2nd & 3rd Floor

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-1

BEAM TYPE

UNIT:

SUSPENDED BEAM

mm

Quantity

3

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

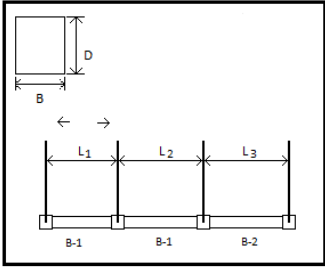
90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE



Top Reinforcement

1/3 L_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

BEAM ROW

Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-1	5000	1	C-1 (D)	C-1 (D)
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		Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 1 @ 50	Dia. 12 Qty 16
				Dia. 25 Qty 3	Dia. 12 Qty 3	Dia. 12 Qty 3	Dia. 10 Qty 10 @ 100	Dia. 12 Qty 2
				Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 8 Qty 8 @ 200	Dia. 12 Qty 2
B-2	450	700		Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 1 @ 50	Dia. 12 Qty 16
				Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 8 Qty 8 @ 100	Dia. 12 Qty 2
				Dia. 25 Qty 6	Dia. 12 Qty 6	Dia. 12 Qty 6	Dia. 14 Qty 14 @ 100	Dia. 12 Qty 2
B-3	450	700		Dia. 25 Qty 6	Dia. 12 Qty 6	Dia. 12 Qty 6	Dia. 14 Qty 14 @ 100	Dia. 12 Qty 2

@ 4th Floor

ADD STRUCTURAL MEMBER

STRUCURAL MEMBER

NAME:

BEAM

BR-2

BEAM TYPE

UNIT:

SUSPENDED BEAM

mm

Quantity

4

STEEL REINFORCEMENT BARS SPACER

Diameter

25

Spacing (On-Center)

1000

MAIN BARS HOOK TYPE

Top

90°

Bottom

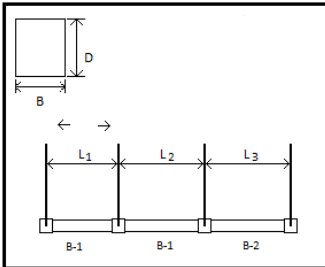
90°

STIRRUP HOOK TYPE

135°

SPLICE ALTERNATING

ENABLE



Top Reinforcement

1/3 L_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

BEAM ROW

Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)
B-2	3000	1	C-1 (B)	C-1 (B)
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		Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 1 @ 50	Dia. 12 Qty 16
				Dia. 25 Qty 3	Dia. 12 Qty 3	Dia. 12 Qty 3	Dia. 10 Qty 10 @ 100	Dia. 12 Qty 2
				Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 8 Qty 8 @ 200	Dia. 12 Qty 2
B-2	450	700		Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 1 @ 50	Dia. 12 Qty 16
				Dia. 25 Qty 5	Dia. 12 Qty 5	Dia. 12 Qty 5	Dia. 8 Qty 8 @ 100	Dia. 12 Qty 2
				Dia. 25 Qty 6	Dia. 12 Qty 6	Dia. 12 Qty 6	Dia. 14 Qty 14 @ 100	Dia. 12 Qty 2
B-3	450	700		Dia. 25 Qty 6	Dia. 12 Qty 6	Dia. 12 Qty 6	Dia. 14 Qty 14 @ 100	Dia. 12 Qty 2

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_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

BEAM ROW					
Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)	
B-2	3000	1	C-1 (B)	C-1 (B)	
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		Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 12 Qty 10 @ 100 Qty. 2	Dia. 12 Qty. 2
B-2	450	700		Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 12 Qty 1 @ 50 Qty. 2	Dia. 12 Qty. 2
B-3	450	700		Dia. 25 Qty 6	Dia. 25 Qty 6	Dia. 25 Qty 6	Dia. 12 Qty 1 @ 50 Qty. 2	Dia. 12 Qty. 2

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_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

BEAM ROW					
Beam Name	Length	Quantity	End Support (Left/Top)	End Support (Right/Bottom)	
B-1	5000	1	C-1 (D)	C-1 (D)	
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		Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 12 Qty 1 @ 50 Qty. 2	Dia. 12 Qty. 2
B-2	450	700		Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 25 Qty 5	Dia. 12 Qty 1 @ 50 Qty. 2	Dia. 12 Qty. 2
B-3	450	700		Dia. 25 Qty 6	Dia. 25 Qty 6	Dia. 25 Qty 6	Dia. 12 Qty 1 @ 50 Qty. 2	Dia. 12 Qty. 2

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_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

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

ROOF BEAM SCHEDULE								
Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
RB-1	300	500		Dia. 25 Qty 5	Dia. 25 Qty 3	Dia. 25 Qty 5	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2
RB-2	350	500		Dia. 25 Qty 4	Dia. 25 Qty 2	Dia. 25 Qty 4	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2
RB-3	300	500		Dia. 25 Qty 3	Dia. 25 Qty 3	Dia. 25 Qty 3	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2

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_c or Clear Length

Bottom Reinforcement

1/5 L_c or Clear Length

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

ROOF BEAM SCHEDULE								
Name	B	D	Properties	Ext. Support	Midspan	Int. Support	Stirrups	Web Bars
RB-1	300	500		Dia. 25 Qty 5	Dia. 25 Qty 3	Dia. 25 Qty 5	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2
RB-2	350	500		Dia. 25 Qty 4	Dia. 25 Qty 2	Dia. 25 Qty 4	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2
RB-3	300	500		Dia. 25 Qty 3	Dia. 25 Qty 3	Dia. 25 Qty 3	Dia. 10 Qty 1 @ 50 Qty. 2	Dia. 10 Qty. 2

STEPS

1. The program will check the availability of the manufactured bar lengths.

Example: The available manufactured bar lengths (L_M) are 6, 7.5, 10.5, and 12 meters.

- The program then will check the “connection below” in order to determine the required variables for the column and the n_{TOP} .

Example: @ C – 1

- Ground Floor; Connected to F – 2
- Second Floor & Third Floor; Connected to C – 1(Ground Floor) - (they are typical)
- Fourth Floor; Connected to C – 1(2nd-3rd Floor)

Since C – 1 is connected from Ground Floor to 4th Floor. Thus, $n_{TOP} = 4$

- Check the allowable percentage and compute the number of floor addition (Z), where it will also represent the first Z floors.

$$Z = \frac{100}{Allowable\ Bars(\%)}$$

Note:

- If $Z < 2$, it must be **round down to whole number**
- If $Z \geq 2$, it must be **round up to whole number**

Example:

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

$Allowable\ Percentage(\%) = 50$, then. $Z = \frac{100}{50} = 2$

- The program will then compute the quantity of the reinforcement of each required bar length of their respected set.

LEGEND

Note:

- If n is greater than or equal to the maximum (number of floors), thus will be replaced by .
- If the quantity of the bar has a decimal, the quantity of the odd number will be rounded down, while the quantity of the even number will be rounded up

If n is Odd

$$Qty_n (Req) = \frac{Allowable\ Bars(\%)(Qty_{(n+Z-1)})}{100}$$

Example:

The quantity of column main reinforcement of Ground Floor, 2nd & 3rd Floor, and 4th Floor are 24, 16, and 12 respectively

$$Qty_1 (Req) = \frac{50(Qty_{n+Z-1})}{100} = \frac{50(Qty_{1+2-1})}{100} = \frac{50(Qty_2)}{100} = \frac{50(16)}{100} = 8\ pcs$$

$$Qty_2 (Req) = \frac{50(Qty_{n+Z-1})}{100} = \frac{50(Qty_{2+2-1})}{100} = \frac{50(Qty_3)}{100} = \frac{50(16)}{100} = 8\ pcs$$

$$Qty_3 (Req) = \frac{50(Qty_{n+Z-1})}{100} = \frac{50(Qty_{3+2-1})}{100} = \frac{50(Qty_4)}{100} = \frac{50(12)}{100} = 6\ pcs$$

$$Qty_4 (Req) = \frac{50(Qty_{n+Z-1})}{100} = \frac{50(Qty_{4+2-1})}{100} = \frac{50(Qty_5)}{100} \rightarrow \frac{50(Qty_4)}{100} = \frac{50(12)}{100} = 6\ pcs$$

- Then the program will compute the quantity of extra bars.

For $n \leq Z$

- For $Qty_{G(n)} (Req)$

If $n < Z$

$$Qty_{G(n)}(Req) = Qty_n - \sum_1^Z Qty_n(Req) - \sum_{n+1}^Z Qty_{G(n)}(Req)$$

If $n = Z$

$$Qty_{G(n)}(Req) = Qty_n - \sum_1^Z Qty_n(Req)$$

- For $Qty_{A(n)}(Req)$, The program will create a sequence of quantities where it starts from $n + Z$, Where the answers from the previous equation will subtract the current answer

$$Qty_{A(n)}(Req) = \frac{Qty_n}{Z} - Qty_{(n+Z)}(Req) - \sum_{x=a}^x Qty_{A(n)}(Req)$$

Every computation, the program will check the condition using this equation

If $n < Z$

$$y = Qty_{(n)}(Req) - Qty_{(n+Z)}(Req) - \sum Qty_{A(n)}(Req)$$

If $n = Z$

$$y = Qty_{(n)}(Req) + Qty_{G(n)}(Req) - Qty_{(n+Z)}(Req) - \sum Qty_{A(n)}(Req)$$

Note:

- If $y \leq 0$, the rest of $Qty_{A(n)}(Req)$ of the sequence will become zero, and if $(n + Z - m) < n$ then the sequence will stop.
- $x =$ It is an indicator for the sequence, for example: if $x = a$ it means the computation is at floor $n + Z$. And if $x = a$ it means the computation is at floor $n + Z - 1$.
- $\sum_{n+x}^{n+Z} Qty_{A(n)}(Req)$ is the series of $Qty_{A(n)}$ from $n + Z$. And at the beginning of the sequence. This equation will be zero.

For $n > Z$

For $Qty_{A(n)}(Req)$, The program will create a sequence of quantities where it starts from $n + Z$ up to n , Where the answers from the previous equation will subtract the current answer

$$Qty_{A(n)}(Req) = \frac{Qty_{(n+Z-m)}}{Z} - Qty_{(n+Z)}(Req) - \sum_{x=a}^x Qty_{A(n)}(Req)$$

Every computation, the program will check the condition using this equation

$$y = Qty_{(n)}(Req) + Qty_{A((n-Z)a)}(Req) - Qty_{(n+Z)}(Req) - \sum Qty_{A(n)}(Req)$$

Note:

- $\sum_{n+Z+1-m}^{n+Z} Qty_{A(n)}(Req)$ is the series of $Qty_{A(n)}$ from $n + Z$. And at the beginning of the sequence. This equation will be zero.
- If $(n + z) \geq n_{TOP}$, thus n_{TOP} will replace $n + z$

Example:

- For $Qty_1(Ground Floor) 2 = 2:n = Z$

$$Qty_{G(1)}(Req) = Qty_1 - \sum_1^2 Qty_n(Req) - \sum_{1+1}^2 Qty_{G(n)}(Req)$$

$$Qty_{G(1)}(Req) = Qty_1 - \sum_1^2 Qty_n(Req) - \left[Qty_2 - \sum_1^2 Qty_n(Req) \right]$$

$$Qty_{G(1)}(Req) = 24 - [8 + 8] - [16 - (8 + 8)]$$

$$Qty_{G(1)}(Req) = 8 \text{ pcs}$$

The sequence starts from $(n + Z - 0) = (1 + 2 - 0) = 3$

$$Qty_{A(1a)}(Req) = \frac{Qty_{(n+Z-m)}}{Z} - Qty_1(Req) - \sum_{n+Z+1-m}^{n+Z} Qty_{A(n)}(Req)$$

$$Qty_{A(1a)}(Req) = \frac{Qty_{1+2-0}}{Z} - Qty_1(Req) - (0)$$

$$Qty_{A(1a)}(Req) = \frac{16}{2} - 6 - (0) = 2$$

Checking:

$$y_a = Qty_{(n)}(Req) - Qty_{(n+Z)}(Req) - \sum Qty_{A(nx)}(Req)$$

$$y_a = Qty_{(1)}(Req) - Qty_{(1+2)}(Req) - \sum Qty_{A(nx)}(Req)$$

$y_a = 8 - 6 - 2 = 0$, Since $y = 0$, the succeeding $Qty_{A(1x)}(Req)$ will be equal to **zero**.

Succeeding $Qty_{A(1x)}$

$$@ (n + Z - 1) = (1 + 2 - 1) = 2: Qty_{A(1b)}(Req) = 0$$

$$@ (n + Z - 2) = (1 + 2 - 2) = 1: Qty_{A(1c)}(Req) = 0$$

$$@ (n + Z - 3) = (1 + 2 - 3) = 0: \text{ Since } (n + Z - m) < n \text{ the sequence will stop}$$

- For Qty_2 (2nd Floor). $2 = 2 \therefore n = Z$

$$Qty_{G(2)}(Req) = Qty_2 - \sum_1^2 Qty_n(Req) = 16 - [8 + 8] = 0$$

$$@ (n + Z - 0) = (2 + 2 - 0) = 4: Qty_{A(2a)}(Req)$$

$$Qty_{A(2a)}(Req) = \frac{Qty_{(n+Z-m)}}{Z} - Qty_{(n+Z)}(Req) - \sum_{x=a}^x Qty_{A(nx)}(Req)$$

$$Qty_{A(2a)}(Req) = \frac{Qty_{(2+2-0)}}{Z} - Qty_{(2+2)}(Req) - (0)$$

$$Qty_{A(2a)}(Req) = \frac{12}{2} - 6 - 0 = 0$$

Checking:

$$y_a = Qty_{(2)}(Req) + Qty_{G(2)}(Req) - Qty_{(2+2)}(Req) - \sum Qty_{A(2x)}(Req)$$

$$y_a = 8 + 0 - 6 - (0) = 2 \therefore \text{The Succeeding } Qty_{A(4x)}(Req) \neq 0$$

$$@ (n + Z - 1) = (2 + 2 - 1) = 3: Qty_{A(2b)}(Req)$$

$$Qty_{A(2b)}(Req) = \frac{Qty_{(2+2-1)}}{2} - Qty_{(2+2)}(Req) - \sum_{x=a}^a Qty_{A(nx)}(Req)$$

$$Qty_{A(2b)}(Req) = \frac{Qty_{(3)}}{2} - Qty_{(4)}(Req) - (Qty_{A(2a)}(Req))$$

Since the is at , then this equation will be zero.

Since the is at , then this equation will be zero.

$$Qty_{A(2b)}(Req) = \frac{16}{2} - 6 - (0) = 2$$

Checking:

$$y_b = Qty_{(2)}(Req) + Qty_{G(2)}(Req) - Qty_{(2+2)}(Req) - \sum Qty_{A(2x)}(Req)$$

$$y_b = Qty_{(2)}(Req) + Qty_{G(2)}(Req) - Qty_{(4)}(Req) - (Qty_{A(2a)}(Req) + Qty_{A(2b)}(Req))$$

$$y_b = 8 + 0 - 6 - (0 + 2) = 0, \text{ Since } y_b = 0, \text{ the succeeding } Qty_{A(2x)}(Req) \text{ will be equal to zero.}$$

Succeeding $Qty_{A(2x)}$

$$@ (n + Z - 2) = (2 + 2 - 2) = 2: Qty_{A(2c)}(Req) = 0$$

$$@ (n + Z - 3) = (2 + 2 - 3) = 1: \text{ Since } (n + Z - 3) < n, \text{ thus the sequence will stop.}$$

- For Qty_3 (3rd Floor). $3 > 2 \therefore n > Z$

$$@ (n + Z - 0) = (3 + 2 - 0) = 5: Qty_{A(3a)}(Req)$$

$$Qty_{A(3a)}(Req) = \frac{Qty_{(n+Z-m)}}{Z} - Qty_{(n+Z)}(Req) - \sum_{x=a}^x Qty_{A(3x)}(Req)$$

$$Qty_{A(3a)}(Req) = \frac{Qty_{(3+2-0)}}{Z} - Qty_{(3+2)}(Req) - 0$$

$$Qty_{A(3a)}(Req) = \frac{Qty_{(4)}}{Z} - Qty_{(4)}(Req) - 0 \quad \text{Since } (n + Z) > n_{TOP}$$

$$Qty_{A(3a)}(Req) = \frac{12}{2} - 6 - 0 = 0$$

Checking:

$$y_a = Qty_{(3)}(Req) + Qty_{A((3-2)a)}(Req) - Qty_{(3+2)}(Req) - \sum Qty_{A(3x)}(Req) y_a = Qty_{(3)}(Req) + Qty_{A(1a)}(Req) - Qty_{(4)}(Req)$$

$$y_a = 6 + 2 - 6 - (Qty_{A(3a)}(Req)) = 6 + 2 - 6 - (0) = 2 \therefore \text{The Succeeding } Qty_{A(3x)}(Req) \neq 0$$

$$@ (n + Z - 1) = (3 + 2 - 1) = 4: Qty_{A(3b)}(Req)$$

$$Qty_{A(3b)}(Req) = \frac{Qty_{(3+2-1)}}{Z} - Qty_{(3+2)}(Req) - \sum_{x=a}^a Qty_{A(3x)}(Req)$$

$$Qty_{A(3b)}(Req) = \frac{Qty_{(4)}}{2} - Qty_{(4)}(Req) - (Qty_{A(3a)}(Req)) \quad \text{Since } (n + Z) > n_{TOP}$$

$$Qty_{A(3b)}(Req) = \frac{12}{2} - 6 - (0) = 0$$

Checking:

$$y_b = Qty_{(3)}(Req) + Qty_{A((3-2)a)}(Req) - Qty_{(3+2)}(Req) - \sum Qty_{A(3x)}(Req)$$

$$y_b = Qty_{(3)}(Req) + Qty_{A(1a)}(Req) - Qty_{(4)}(Req) - \sum Qty_{A(3x)}(Req)$$

$$y_b = 6 + 2 - 6 - (0 + 0) = 2 \therefore \text{The Succeeding } Qty_{A(3x)}(Req) \neq 0$$

$$@ (n + Z - 2) = (3 + 2 - 2) = 3: Qty_{A(3c)}(Req)$$

$$Qty_{A(3c)}(Req) = \frac{Qty_{(3+2-2)}}{Z} - Qty_{(3+2)}(Req) - \sum_{x=a}^b Qty_{A(3x)}(Req)$$

$$Qty_{A(3c)}(Req) = \frac{Qty_{(3)}}{2} - Qty_{(4)}(Req) - (Qty_{A(3a)}(Req) + Qty_{A(3b)}(Req)) \quad \text{Since } (n + Z) > n_{TOP}$$

Since the is at , then this equation will be zero.

$$Qty_{A(3c)}(Req) = \frac{18}{2} - 6 - (0 + 0) = 2$$

Checking:

$$y_c = Qty_{(3)}(Req) + Qty_{A((3-2)a)}(Req) - Qty_{(3+2)}(Req) - \sum Qty_{A(3x)}(Req)$$

$$y_c = 6 + 2 - 6 - (0 + 0 + 2) = 0, \text{ Since } y_c = 0, \text{ the succeeding } Qty_{A(3x)}(Req) \text{ will be equal to zero}$$

The Succeeding $Qty_{A(3x)}(Req)$:

$$@ (n + Z - 3) = (3 + 2 - 3) = 2: \text{ Since } (n + Z - 3) < n, \text{ thus the sequence will stop.}$$

- For Qty_4 (4th Floor)

$$@ (n + Z - 0) = (4 + 2 - 0) = 6: Qty_{A(4a)}(Req)$$

$$Qty_{A(4a)}(Req) = \frac{Qty_{(4+2-0)}}{Z} - Qty_{(4+2)}(Req) - \sum_{x=a}^x Qty_{A(4x)}(Req)$$

$$Qty_{A(4a)}(Req) = \frac{Qty_{(4)}}{Z} - Qty_{(4)}(Req) - 0$$

$$Qty_{A(4a)}(Req) = \frac{12}{2} - 6 = 0$$

Checking:

$$y_a = Qty_{(4)}(Req) + Qty_{A((4-2)a)}(Req) - Qty_{(4+2)}(Req) - \sum Qty_{A(4x)}(Req)$$

$$y_a = 6 + 2 - 6 - (0) = 2: \text{The Succeeding } Qty_{A(4x)}(Req) \neq 0$$

$$@ (n + Z - 1) = (4 + 2 - 1) = 5: Qty_{A(4b)}(Req)$$

$$Qty_{A(4b)}(Req) = \frac{Qty_{(4+2-0)}}{Z} - Qty_{(4+2)}(Req) - \sum_{x=a}^a Qty_{A(3x)}(Req)$$

$$Qty_{A(4b)}(Req) = \frac{Qty_{(4)}}{Z} - Qty_{(4)}(Req) - (Qty_{A(3a)}(Req))$$

$$Qty_{A(4b)}(Req) = \frac{12}{2} - 6 - (0) = 0$$

Checking:

$$y_b = Qty_{(4)}(Req) + Qty_{A((4-2)a)}(Req) - Qty_{(4+2)}(Req) - \sum Qty_{A(4x)}(Req)$$

$$y_b = 6 + 2 - 6 - (0 + 0) = 2: \text{The Succeeding } Qty_{A(4x)}(Req) \neq 0$$

$$@ (n + Z - 2) = (4 + 2 - 2) = 4: Qty_{A(4c)}(Req)$$

$$Qty_{A(4c)}(Req) = \frac{Qty_{(4+2-2)}}{Z} - Qty_{(4+2)}(Req) - \sum_{x=a}^b Qty_{A(3x)}(Req)$$

$$Qty_{A(4c)}(Req) = \frac{Qty_{(4)}}{Z} - Qty_{(4)}(Req) - (Qty_{A(3a)}(Req) + Qty_{A(3b)}(Req))$$

$$Qty_{A(4c)}(Req) = \frac{12}{2} - 6 - (0 + 0) = 0$$

Checking:

$$y_b = Qty_{(4)}(Req) + Qty_{A((4-2)a)}(Req) - Qty_{(4+2)}(Req) - \sum Qty_{A(4x)}(Req)$$

$$y_b = 6 + 2 - 6 - (0 + 0 + 0) = 2: \text{The Succeeding } Qty_{A(4x)}(Req) \neq 0$$

$$@ (n + Z - 2) = (4 + 2 - 2) = 4: \text{ Since } (n + Z - 3) < n, \text{ thus the sequence will stop.}$$

Since the is at , then this equation will be zero.

6. The program will check if the difference of the columns effective dimension of the current floor to the floor below. [CC_{cw} = Column Concrete Cover exposed to weather]

$$Dim_{B(n)} = (B_{n+1} - CC_{cw}) - (B_n - CC_{cw})$$

$$Dim_{D(n)} = (D_{n+1} - CC_{cw}) - (D_n - CC_{cw})$$

Example:

Dimensions; @Ground Floor (D = 600, B = 600), @2nd & 3rd Floor (D = 600, B = 600), and @4th Floor (D = 600, B = 600).

- For Ground Floor:

$$Dim_{D(1)} = (D_{1+1} - CC_{cw}) - (D_1 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

$$Dim_{B(1)} = (B_{1+1} - CC_{cw}) - (B_1 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

- For 2nd Floor

$$Dim_{D2} = (D_{2+1} - CC_{cw}) - (D_2 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

$$Dim_{B2} = (B_{2+1} - CC_{cw}) - (B_2 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

- For 3rd Floor

$$Dim_{D3} = (D_{3+1} - CC_{cw}) - (D_3 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

$$Dim_{B2} = (B_{3+1} - CC_{cw}) - (B_3 - CC_{cw}) = (600 - 40) - (600 - 40) = 0$$

7. The program will determine the largest depth of the **suspended beam** and **roof beam** that is connected to the column

Note:

- 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.

- If the column of the current floor both have Suspended and Roof Beam, thus they will be compared

Like @ Ground Floor there is a Roof Beam (RB-1) with D=400 and @ 2nd Floor there is a Suspended Beam (B-1) with D=700, Since D=400< D=700, thus B-1 will be chosen.

Example:

@ Ground Floor: B-1 (D = 700), B-2 (D = 700), B-3 (D = 700), and RB-1 (D = 350)

@ 2nd Floor: B-1 (D = 700), B-2 (D = 700), and B-3 (D = 700).

@ 3rd Floor: B-1 (D = 700), B-2 (D = 700), and B-3 (D = 700)

@ 4th Floor: RB-1(D = 300), RB-2 (D = 350), and RB-3 (D = 300)

Thus,

@ Ground Floor: $Dim_{Beam(1)} = 700\text{ mm}$

@ 2nd Floor: $Dim_{Beam(2)} = 700\text{ mm}$

@ 3rd Floor; $Dim_{Beam(3)} = 700\text{ mm}$

@ 4th Floor; $Dim_{Beam(4)} = 350\text{ mm}$

8. The program will then compute the Diagonal Length of the column on their respective floors.

Legend:

a) If $n < n_{Top}$

$$L_D = \sqrt{(Dim_{Dn})^2 + (Dim_{Bn})^2 + (Dim_{Beam(n)})^2}$$

b) If $n = n_{Top}$

$$L_D = \frac{B_n - 2CC_{CW} - 2d_t}{2} - CC_{CW} - R_L$$

Where R_L :

Case 1: $d_{Mb} = 10\text{ mm} \rightarrow 25\text{ mm}$

$$R_L = 2.5d_{Mb}$$

Case 2: $d_{Mb} = 28\text{ mm} \rightarrow 36\text{ mm}$

$$R_L = 3d_{Mb}$$

Case 2: $d_{Mb} = 40\text{ mm} \rightarrow 56\text{ mm}$

$$R_L = 3.5d_{Mb}$$

Example:

For Ground Floor

Since the *Hook Type*: 90° and the diameter of main reinforcement is 32 mm , Thus

$$L_{D(1)} = \sqrt{(Dim_{D1})^2 + (Dim_{B1})^2 + (Dim_{Beam(1)})^2} = \sqrt{(0)^2 + (0)^2 + (700)^2} = 700$$

For 2nd Floor

$$L_{D(2)} = \sqrt{(Dim_{D2})^2 + (Dim_{B2})^2 + (Dim_{Beam(2)})^2} = \sqrt{(0)^2 + (0)^2 + (700)^2} = 700$$

For 3rd Floor

$$L_{D(3)} = \sqrt{(Dim_{D3})^2 + (Dim_{B3})^2 + (Dim_{Beam(3)})^2} = \sqrt{(0)^2 + (0)^2 + (700)^2} = 700$$

For 4th Floor

Since the bar diameter (d_{Mb}) is 32 mm . Thus,

$$R_L = 3d_{Mb} = 3(32) = 96$$

$$L_{D(4)} = \frac{B_4 - 2CC_{CW} - 2d_t}{2} - CC_{CW} - R_L = \frac{600 - 2(40) - 2(10)}{2} - 40 - 96 = 114$$

9. The program then will compute the clear height of the column in its respected floor

$$H_C = H_n - Dim_{Beam(n)}$$

Example:

For Ground Floor

$$H_{C1} = H_1 - D_{Beam(1)} = 3350 - 700 = 2650\text{ mm}$$

For 2nd Floor

$$H_{C2} = H_2 - D_{Beam(2)} = 3150 - 700 = 2450\text{ mm}$$

For 3rd Floor

$$H_{C3} = H_3 - D_{Beam(3)} = 3150 - 700 = 2450\text{ mm}$$

4th Floor

$$H_C = H_n - D_{Beam(4)} = 4500 - 350 = 4150\text{ mm}$$

10. The program will determine the Splice Length.

Case 1: The Splice Type is **Mechanical** or **Welded Splice (Butt)**

$$S_L = 0$$

Case 2: The Splice Type is **Lapped Splice** or **Welded Splice (Lapped)**

$$S_L = (Based\ on\ the\ table\ @\ Compression)$$

Example:

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

CONCRETE MIX

FOOTINGS

COLUMNS

BEAMS

SLABS

WALLS

CONCRETE GRADE

GRAVEL TYPE

READY MIX

4000 PSI @ 28 Days

The Concrete Strength (f_c') = 4000 psi or 27.6

For Ground Floor

The Splice Type is **Lapped Splice** and main rebar diameter is 32 mm

$$S_{L(1)} = 775\ mm$$

For 2nd Floor

The Splice Type is **Lapped Splice** and main rebar diameter is 32 mm

$$S_{L(2)} = 775\ mm$$

For 3rd Floor

The Splice Type is **Lapped Splice** and main rebar diameter is 32 mm

$$S_{L(3)} = 775\ mm$$

For 4th Floor

The Splice Type is **Lapped Splice** and main rebar diameter is 32 mm

$$S_{L(4)} = 775\ mm$$

11. The program first determines the Effective Length

LEGEND:

If the Splice Alternating is **Enable**, then;

$$E_{Dn} = \left(1 - S_{LOC}\right)H_C - \frac{S_L}{2}$$

If the Splice Alternating is **Disable**, then;

$$E_{Dn} = \left(1 - S_{LOC}\right)H_C + \frac{D_A}{2}$$

Example:

SPlicing				
COLUMN	BEAM	SLAB	WALLS	STAIRS
SPlice LOCATION		<input type="text" value="1/2"/>	of clear height	
SPlice ZONE		<input type="text" value="1/2"/>	of clear height	
ALLOWABLE PERCENTAGE		<input type="text" value="50"/>		
MINIMUM VERTICAL DISTANCE OF ADJACENT BARS		<input type="text" value="600"/>		

For Ground Floor: *Splice Alternating* is **Enable**

$$E_{D(1)} = \left(1 - S_{LOC}\right)H_{C(1)} - \frac{S_{L(1)}}{2} = \left(1 - \frac{1}{2}\right)(2650) - \frac{775}{2} = 937.5$$

For 2nd Floor: *Splice Alternating* is **Enable**

$$E_{D(2)} = \left(1 - S_{LOC}\right)H_{C(2)} - \frac{S_{L(2)}}{2} = \left(1 - \frac{1}{2}\right)(2450) - \frac{775}{2} = 837.5$$

For 3rd Floor: *Splice Alternating* is **Enable**

$$E_{D(3)} = \left(1 - S_{LOC}\right)H_{C(3)} - \frac{S_{L(3)}}{2} = \left(1 - \frac{1}{2}\right)(2450) - \frac{775}{2} = 837.5$$

For 4th Floor: *Splice Alternating* is **Enable**

$$E_{D(4)} = \left(1 - S_{LOC}\right)H_{C(4)} - \frac{S_{L(4)}}{2} = \left(1 - \frac{1}{2}\right)(4150) - \frac{775}{2} = 1687.5$$

12. the program then, will compute the required length for Qty_n (Req).

(Must be converted into meter)

Legend:

[must be based on the table in the parameters]

If $n_{Top} = 1$

$$L_B\ of\ Qty_n\ (Req) = H_{C(n)} + L_{D(n)} + D_F + L_{H(90^{\circ})} - d_{bs} - d_{bl} - CC_F$$

If $n_{Top} > 1$

If the *Splice Alternating* is **Enable**

- Case 1: $n \leq Z$ and $n < (n_{Top} - Z + 1)$

$$L_B\ of\ Qty_n\ (Req) = \left[\sum_1^n H_{C(n)}\right] + \left[\sum_0^{n-1} L_{D(n)}\right] + D_F + L_{H(90^{\circ})} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

- Case 2: $n \leq Z$ and $n \geq (n_{Top} - Z + 1)$

$$L_{B(a)}\ of\ Qty_n\ (Req) = \left[\sum_1^n H_{C(n)}\right] + \left[\sum_0^{n-1} L_{D(n)}\right] + D_F + L_{H(90^{\circ})} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_{B(b)}\ of\ Qty_n\ (Req) = \left[\sum_n^{n_{Top}} H_{C(n)}\right] + \left[\sum_n^{n_{Top}} L_{D(n)}\right] + E_{Dn} + S_{L(n)} - H_{C(n)}$$

And if $\left[L_{B(a)}\ of\ Qty_n\ (Req) + L_{B(b)}\ of\ Qty_n\ (Req) - 2S_{Ln}\right] \leq Largest\ L_M$. $L_{B(c)}\ of\ Qty_n\ (Req)$ will

replace both $L_{B(a)}\ of\ Qty_n\ (Req)$ and $L_{B(b)}\ of\ Qty_n\ (Req)$, Where.

$$L_{B(c)}\ of\ Qty_n\ (Req) = L_{B(a)}\ of\ Qty_n\ (Req) + L_{B(b)}\ of\ Qty_n\ (Req) - S_{Ln}$$

- Case 3: $n > Z$ and $n < (n_{Top} - Z + 1)$

$$L_B \text{ of } Qty_n (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

- Case 4: $n > Z$ and $n \geq (n_{Top} - Z + 1)$

$$L_{B(a)} \text{ of } Qty_n (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

$$L_{B(b)} \text{ of } Qty_n (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} + S_{L(n)} - H_{C(n)}$$

And if $[L_{B(a)} \text{ of } Qty_n (Req) + L_{B(b)} \text{ of } Qty_n (Req) - 2S_{Ln}] \leq \text{Largest } L_M$. $L_{B(c)} \text{ of } Qty_n (Req)$ will

replace both $L_{B(a)} \text{ of } Qty_n (Req)$ and $L_{B(b)} \text{ of } Qty_n (Req)$, Where.

$$L_{B(c)} \text{ of } Qty_n (Req) = L_{B(a)} \text{ of } Qty_n (Req) + L_{B(b)} \text{ of } Qty_n (Req) - S_{Ln}$$

If the *Splice Alternating* is **Disable**

- Case 1: $n \leq Z$ and $n < (n_{Top} - Z + 1)$

$$L_{B(a)} \text{ of } Qty_a (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_{B(b)} \text{ of } Qty_a (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} + S_{Ln} + D_A - d_{bs} - d_{bl} - CC_F$$

Case 2: $n \leq Z$ and $n \geq (n_{Top} - Z + 1)$

$$L_{B(a)} \text{ of } Qty_a (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_{B(b)} \text{ of } Qty_a (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} + S_{Ln} + D_A - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_{B(c)} \text{ of } Qty_n (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} + S_{Ln} - H_{C(n)}$$

$$L_{B(d)} \text{ of } Qty_n (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} - D_A - H_{C(n)}$$

And if $[L_{B(a)} \text{ of } Qty_n (Req) + L_{B(c)} \text{ of } Qty_n (Req) - 2S_{Ln}] \leq \text{Largest } L_M$. $L_{B(e)} \text{ of } Qty_n (Req)$ will

replace both $L_{B(a)} \text{ of } Qty_n (Req)$ and $L_{B(c)} \text{ of } Qty_n (Req)$, Where.

$$L_{B(e)} \text{ of } Qty_n (Req) = L_{B(a)} \text{ of } Qty_n (Req) + L_{B(c)} \text{ of } Qty_n (Req) - S_{Ln}$$

And if $[L_{B(b)} \text{ of } Qty_n (Req) + L_{B(d)} \text{ of } Qty_n (Req) - 2S_{Ln}] \leq \text{Largest } L_M$. $L_{B(f)} \text{ of } Qty_n (Req)$ will

replace both $L_{B(b)} \text{ of } Qty_n (Req)$ and $L_{B(d)} \text{ of } Qty_n (Req)$, Where.

$$L_{B(f)} \text{ of } Qty_n (Req) = L_{B(b)} \text{ of } Qty_n (Req) + L_{B(d)} \text{ of } Qty_n (Req) - S_{Ln}$$

- Case 3: $n > Z$ and $n < (n_{Top} - Z + 1)$

$$L_{B(a)} \text{ of Qty}_a (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

$$L_{B(b)} \text{ of Qty}_a (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{Ln} - E_{Dn}$$

- Case 4: $n > Z$ and $n \geq (n_{Top} - Z + 1)$

$$L_{B(a)} \text{ of Qty}_a (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

$$L_{B(b)} \text{ of Qty}_a (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{Ln} - E_{Dn}$$

$$L_{B(c)} \text{ of Qty}_n (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} + S_{Ln} - H_{C(n)}$$

$$L_{B(d)} \text{ of Qty}_n (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} - D_A - H_{C(n)}$$

And if $[L_{B(a)} \text{ of Qty}_n (Req) + L_{B(c)} \text{ of Qty}_n (Req) - 2S_{Ln}] \leq \text{Largest } L_M$. $L_{B(e)} \text{ of Qty}_n (Req)$ will

replace both $L_{B(a)} \text{ of Qty}_n (Req)$ and $L_{B(c)} \text{ of Qty}_n (Req)$, Where.

$$L_{B(e)} \text{ of Qty}_n (Req) = L_{B(a)} \text{ of Qty}_n (Req) + L_{B(c)} \text{ of Qty}_n (Req) - S_{Ln}$$

And if $[L_{B(b)} \text{ of Qty}_n (Req) + L_{B(d)} \text{ of Qty}_n (Req) - 2S_{Ln}] \leq \text{Largest } L_M$. $L_{B(f)} \text{ of Qty}_n (Req)$ will

replace both $L_{B(b)} \text{ of Qty}_n (Req)$ and $L_{B(d)} \text{ of Qty}_n (Req)$, Where.

$$L_{B(f)} \text{ of Qty}_n (Req) = L_{B(b)} \text{ of Qty}_n (Req) + L_{B(d)} \text{ of Qty}_n (Req) - S_{Ln}$$

Example:

BAR END HOOKS

MAIN BARS		STIRRUPS & TIES	
BAR SIZE (DEFORMED)	L		
	90°	135°	180°
10	150		125
12	200		150
16	250		175
20	300		200
25	450		230
28	550		350
32	600		450
⊕			

The Splice Alternating is **Enable** $Z = 2$ $n_{Top} = 4$ $(n_{Top} - Z + 1) = 4 - 2 + 1 = 3$

For Ground Floor ($n = 1$)

$1 < 2 : n < 2$ and $1 < 3 : n < (n_{Top} - Z + 1)$, Thus **Case 1**: Main Bar Diameter is **32 mm**

$$L_B \text{ of Qty}_1 (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_B \text{ of Qty}_1 (Req) = \left[\sum_1^1 H_{C(n)} \right] + \left[\sum_0^0 L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{D(1)} - d_{bs} - d_{bl} - CC_F$$

$$L_B \text{ of Qty}_1 (Req) = [2650] + [0] + 1500 + 600 - 937.5 - 25 - 25 - 75$$

$$L_B \text{ of Qty}_1 (Req) = 3687.5 \text{ mm} \rightarrow 3.6875 \text{ m}$$

For 2nd Floor ($n = 2$)

$2 = 2 : n = Z$ and $2 < 3 : n < (n_{Top} - Z + 1)$, Thus **Case 1**: Main Bar Diameter is **32 mm**

$$L_B \text{ of Qty}_2 (Req) = \left[\sum_1^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_B \text{ of Qty}_2 (Req) = \left[\sum_1^2 H_{C(n)} \right] + \left[\sum_0^1 L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{D(2)} - d_{bs} - d_{bl} - CC_F$$

$$L_B \text{ of Qty}_2 (Req) = [2650 + 2450] + [700] + 1500 + 600 - 837.5 - 25 - 25 - 75$$

$$L_B \text{ of Qty}_2 (Req) = 6937.5 \text{ mm} \rightarrow 6.9375 \text{ m}$$

For 3rd Floor ($n = 3$)

$3 > 2 : n > Z$ and $3 = 3 : n = (n_{Top} - Z + 1)$, Thus **Case 4**: Main Bar Diameter is **32 mm**

$$L_{B(a)} \text{ of Qty}_3 (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

$$L_{B(a)} \text{ of Qty}_3 (Req) = \left[\sum_{3-2+1}^3 H_{C(n)} \right] + \left[\sum_{3-2}^{3-1} L_{D(n)} \right] + E_{D(3-2)} + S_{L(3-2)} - E_{D(3)}$$

$$L_{B(a)} \text{ of Qty}_3 (Req) = [2450 + 2450] + [700 + 700] + 937.5 + 775 - 837.5$$

$$L_{B(a)} \text{ of Qty}_3 (Req) = 7175 \text{ mm} \rightarrow 7.175 \text{ m}$$

$$L_{B(b)} \text{ of Qty}_3 (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} + S_{L(n)} - H_{C(n)}$$

$$L_{B(b)} \text{ of Qty}_3 (Req) = \left[\sum_3^4 H_{C(n)} \right] + \left[\sum_3^4 L_{D(n)} \right] + E_{D(3)} + S_{L(3)} - H_{C(3)}$$

$$L_{B(b)} \text{ of Qty}_3 (Req) = [2450 + 4150] + [700 + 114] + 837.5 + 775 - 2450$$

$$L_{B(b)} \text{ of Qty}_3 (Req) = 6576.5 \text{ mm} \rightarrow 6.5765 \text{ m}$$

Checking:

$$(L_{B(a)} \text{ of Qty}_3 (Req) + L_{B(a)} \text{ of Qty}_3 (Req) - S_{L(3)}) = 7175 + 6576.5 - (775)$$

$$(L_{B(a)} \text{ of Qty}_3 (Req) + L_{B(a)} \text{ of Qty}_3 (Req) - S_{L(3)}) = 12976.5 \text{ mm} \rightarrow 12.9765 \text{ m}$$

$$\text{Largest Available } L_M = 12 \text{ m}$$

Since $12.9765 \text{ m} > 12 \text{ m}$, thus $L_{B(c)} \text{ of Qty}_3 (Req)$ will not replace both $L_{B(a)} \text{ of Qty}_3 (Req)$ and

$$L_{B(b)} \text{ of Qty}_3 (Req)$$

For 4th Floor ($n = 4$)

$3 > 2 : n > Z$ and $4 > 3 : n > (n_{Top} - Z + 1)$, Thus **Case 4**: Main Bar Diameter is **32 mm**

$$L_{B(a)} \text{ of Qty}_4 (Req) = \left[\sum_{n-Z+1}^n H_{C(n)} \right] + \left[\sum_{n-Z}^{n-1} L_{D(n)} \right] + E_{D(n-Z)} + S_{L(n-Z)} - E_{Dn}$$

$$L_{B(a)} \text{ of Qty}_4 (Req) = \left[\sum_{4-2+1}^4 H_{C(n)} \right] + \left[\sum_{4-2}^{4-1} L_{D(n)} \right] + E_{D(4-2)} + S_{L(4-2)} - E_{D(4)}$$

$$L_{B(a)} \text{ of Qty}_4 (Req) = [2450 + 4150] + [700 + 700] + 837.5 + 775 - 1687.5$$

$$L_{B(a)} \text{ of Qty}_4 (Req) = 7925 \text{ mm} \rightarrow 7.925 \text{ m}$$

$$L_{B(b)} \text{ of Qty}_4 (Req) = \left[\sum_n^{n_{Top}} H_{C(n)} \right] + \left[\sum_n^{n_{Top}} L_{D(n)} \right] + E_{Dn} + S_{L(n)} - H_{C(n)}$$

$$L_{B(b)} \text{ of } Qty_4 (Req) = \left[\sum_4^4 H_{C(n)} \right] + \left[\sum_4^4 L_{D(n)} \right] + E_{D(4)} + S_{L(4)} - H_{C(4)}$$

$$L_{B(b)} \text{ of } Qty_4 (Req) = [4150] + [114] + 1687.5 + 775 - 4150$$

$$L_{B(b)} \text{ of } Qty_4 (Req) = 2576.5 \text{ mm} \rightarrow 2.5765$$

Checking:

$$\left(L_{B(a)} \text{ of } Qty_3 (Req) + L_{B(a)} \text{ of } Qty_3 (Req) - S_{L(3)} \right) = 7925 + 2576.5 - (775)$$

$$\left(L_{B(a)} \text{ of } Qty_3 (Req) + L_{B(a)} \text{ of } Qty_3 (Req) - S_{L(3)} \right) = 9726.5 \text{ mm} \rightarrow 9.7265 \text{ m}$$

$$\text{Largest Available } L_M = 12 \text{ m}$$

Since $9.7265 \text{ m} < 12 \text{ m}$, thus $L_{B(c)} \text{ of } Qty_3 (Req)$ will replace both $L_{B(a)} \text{ of } Qty_3 (Req)$ and

$L_{B(b)} \text{ of } Qty_3 (Req)$, where

$$L_{B(c)} \text{ of } Qty_3 (Req) = L_{B(a)} \text{ of } Qty_3 (Req) + L_{B(a)} \text{ of } Qty_3 (Req) - S_{L(3)} = 9.7265 \text{ m}$$

13. The program will determine the length of extra bars

Legend:

[must be based on the table in the parameters]

And

Total number of floors above the current floor that have the same as the floor

For $Qty_{G(n)} (Req)$ will use the equation

If $Qty_{G(n)} (Req) \leq 0$

$$L_B \text{ of } Qty_{G(n)} (Req) = 0$$

If $Qty_{G(n)} (Req) > 0$

If the *Splice Alternating* is **Enable**

- Case 1: $n < Z$

$$L_B \text{ of } Qty_{G(n)} (Req) = H_n + \left[\sum_0^{n-1} H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - d_{bs} - d_{bl} - CC_F - CC_{CW}$$

- Case 2: $n = Z$

$$L_B \text{ of } Qty_{G(n)} (Req) = \left[\sum_0^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

If the *Splice Alternating* is **Disable**

- Case 1: $n < Z$

$$L_B \text{ of } Qty_{G(n)} (Req) = H_n + \left[\sum_0^{n-1} H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - d_{bs} - d_{bl} - CC_F - CC_{CW}$$

- Case 2: $n = Z$

$$L_{B(a)} \text{ of } Qty_{G(na)} (Req) = \left[\sum_0^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

$$L_{B(b)} \text{ of } Qty_{G(nb)} (Req) = \left[\sum_0^n H_{C(n)} \right] + \left[\sum_0^{n-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} + S_{Ln} + D_A - E_{Dn} - d_{bs} - d_{bl} - CC_F$$

For $Qty_{A(nx)} (Req)$ will use the equation

If $Qty_{A(nx)}(Req) \leq 0$

$$L_B \text{ of } Qty_{A(nx)}(Req) = 0$$

If $Qty_{A(nx)}(Req) > 0$

If the *Splice Alternating* is **Enable**

- Case 1: $(n + Z - m) = n$ & $(n + Z - m) < (n + Z)$

$$L_B \text{ of } Qty_{A(nx)}(Req) = Dim_{Beam(n)} + E_{Dn} + S_{Ln} - CC_{CW}$$

- Case 2: $(n + Z - m) > n$ & $(n + Z - m) < (n + Z)$

$$L_B \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + Dim_{Beam(n+Z-m)} + E_{Dn} + S_{Ln} - CC_{CW}$$

- Case 3: $(n + Z - m) > n$ & $(n + Z - m) = (n + Z)$

$$L_B \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + E_{Dn} + S_{Ln} - E_{D(n+Z-m)}$$

If the *Splice Alternating* is **Disable**

- Case 1: $(n + Z - m) = n$ & $(n + Z - m) < (n + Z)$

$$L_{B(a)} \text{ of } Qty_{A(nx)}(Req) = Dim_{Beam(n)} + E_{Dn} + S_{Ln} - CC_{CW}$$

$$L_{B(b)} \text{ of } Qty_{A(nx)}(Req) = Dim_{Beam(n)} + E_{Dn} - D_A - CC_{CW}$$

- Case 2: $(n + Z - m) > n$ & $(n + Z - m) < (n + Z)$

$$L_{B(a)} \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + Dim_{Beam(n+Z-m)} + E_{Dn} + S_{Ln} - CC_{CW}$$

$$L_{B(b)} \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + Dim_{Beam(n+Z-m)} + E_{Dn} + D_A - CC_{CW}$$

- Case 3: $(n + Z - m) > n$ & $(n + Z - m) = (n + Z)$

$$L_{B(a)} \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + E_{Dn} + S_{Ln} - E_{D(n+Z-m)}$$

$$L_{B(b)} \text{ of } Qty_{A(nx)}(Req) = \left[\sum_{n+1}^{n+Z-m} H_{C(n)} \right] + \left[\sum_n^{n+Z-m-1} L_{D(n)} \right] + E_{Dn} + S_{Ln} - E_{D(n+Z-m)}$$

Example:

BAR END HOOKS

MAIN BARS		STIRRUPS & TIES	
BAR SIZE (DEFORMED)	L		
	90°	135°	180°
10	150		125
12	200		150
16	250		175
20	300		200
25	450		230
28	550		350
32	600		450
⊕			

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

- @ Ground Floor: *Splice Alternating* is **Enable**, and $1 < 2 \therefore n < Z$

For $Qty_{G(n)}(Req) > 0$,

$$L_B \text{ of } Qty_{G(1)}(Req) = H_1 + \left[\sum_0^{1-1} H_{C(n)} \right] + \left[\sum_0^{1-1} L_{D(n)} \right] + D_F + L_{H(90^\circ)} - d_{bs} - d_{bl} - CC_F - CC_{CW}$$

$$L_B \text{ of } Qty_{G(1)}(Req) = 3350 + [0] + [0] + 1500 + 600 - 25 - 25 - 75 - 40$$

$$L_B \text{ of } Qty_{G(1)}(Req) = 5285 \text{ mm} \rightarrow 5.285 \text{ m}$$

For $Qty_{A(1a)}(Req) = 2 > 0$, $(1 + 2 - 0) = (1 + 2)$ & $(1 + 2 - 0) > 2$, thus Case 3.

$$L_B \text{ of Qty}_{A(1a)}(Req) = \left[\sum_{1+1}^{1+2-0} H_{C(n)} \right] + \left[\sum_1^{1+2-0-1} L_{D(n)} \right] + E_{D1} + S_{L1} - E_{D(1+2-0)}$$

$$L_B \text{ of Qty}_{A(1a)}(Req) = \left[\sum_2^3 H_{C(n)} \right] + \left[\sum_1^2 L_{D(n)} \right] + E_{D1} + S_{L1} - E_{D(3)}$$

$$L_B \text{ of Qty}_{A(1a)}(Req) = [2450 + 2450] + [700 + 700] + 937.5 + 775 - 837.5$$

$$L_B \text{ of Qty}_{A(1a)}(Req) = 7175 \text{ mm} \rightarrow 7.175 \text{ m}$$

$$\text{For Qty}_{A(1b)}(Req) = 0 = 0, \text{ thus } L_B \text{ of Qty}_{A(1b)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(1c)}(Req) = 0 = 0, \text{ thus } L_B \text{ of Qty}_{A(1c)}(Req) = 0 \text{ m}$$

- @ 2nd Floor: *Splice Alternating* is **Enable**, and $2 = 2:n = Z$

$$\text{For Qty}_{G(2)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{G(2)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(2a)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(2a)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(2b)}(Req) = 2 > 0, (2 + 2 - 1) < (2 + 2) \ \& \ (2 + 2 - 1) > 2, \text{ thus Case 2.}$$

$$L_B \text{ of Qty}_{A(2b)}(Req) = \left[\sum_{2+1}^{2+2-1} H_{C(n)} \right] + \left[\sum_2^{2+2-1-1} L_{D(n)} \right] + Dim_{Beam(2+2-1)} + E_{D2} + S_{L2} - CC_{CW}$$

$$L_B \text{ of Qty}_{A(2b)}(Req) = \left[\sum_3^3 H_{C(n)} \right] + \left[\sum_2^2 L_{D(n)} \right] + Dim_{Beam(3)} + E_{D2} + S_{L2} - CC_{CW}$$

$$L_B \text{ of Qty}_{A(2b)}(Req) = [2450] + [700] + 700 + 837.5 + 775 - 40$$

$$L_B \text{ of Qty}_{A(2b)}(Req) = 5422.5 \text{ mm} \rightarrow 5.4225 \text{ m}$$

$$\text{For Qty}_{A(2c)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(2c)}(Req) = 0 \text{ m}$$

- @3rd Floor: *Splice Alternating* is **Enable**, and $3 > 2:n > Z$

$$\text{For Qty}_{A(3a)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(3a)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(3b)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(3b)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(3c)}(Req) = 2 > 0, (2 + 2 - 2) < (2 + 2) \ \& \ (2 + 2 - 2) = 2, \text{ thus Case 1.}$$

$$L_B \text{ of Qty}_{A(3c)}(Req) = Dim_{Beam(3)} + E_{D3} + S_{L3} - CC_{CW}$$

$$L_B \text{ of Qty}_{A(3c)}(Req) = 700 + 837.5 + 775 - 40$$

$$L_B \text{ of Qty}_{A(3c)}(Req) = 2272.5 \text{ mm} \rightarrow 2.2725 \text{ m}$$

- @4th Floor: *Splice Alternating* is **Enable**, and $4 > 2:n > Z$

$$\text{For Qty}_{A(4a)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(4a)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(4b)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(4b)}(Req) = 0 \text{ m}$$

$$\text{For Qty}_{A(4c)}(Req) = 0, \text{ thus } L_B \text{ of Qty}_{A(4c)}(Req) = 0 \text{ m}$$

14. After determining the quantities of main reinforcement and their respective required bar length, the program will determine their respective manufactured bars and no. of manufactured pcs

LEGEND:

- For Qty_n

If the $Qty_n (Req)$ or its L_B is equal to ZERO then,

$$Qty_{Mn} = 0 \text{ pcs}$$

$$L_{CBn} = 0 \text{ m}$$

If $Qty_n (Req)$ or its L_B is greater than ZERO then,

The program will compute.

$$Difference = |L_B - L_M|$$

Note:

$m = 1$: If the Splice Alternating is Enable

$m = 0.5$: If the Splice Alternating is Disable

a) Case 1: $Difference \leq 150 \text{ mm}$ or 0.15 m then,

$$Qty_{Mn} = m \cdot Qty_n (Req) \cdot Qty_{Cn}$$

$$L_{CBn} = L_M$$

b) Case 2: $Difference > 150 \text{ mm}$ or 0.15 m then

$$Qty_{Pn} = \frac{L_M}{L_B \text{ of } Qty_n (Req)}$$

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

$$Qty_{Mn} = m \cdot \frac{Qty_n (Req)}{Qty_{Pn}} \cdot Qty_{Cn}$$

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

And

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

Then the program will choose the manufactured bar length with the lowest *Total wastage*,

- For Qty_{Gn}

If $Qty_{Gn} (Req)$ or its L_B is equal to ZERO then,

$$Qty_{Mn} = 0 \text{ pcs}$$

$$L_{CBn} = 0 \text{ m}$$

If $Qty_{Gn} (Req)$ or its L_B is greater than ZERO then,

The program will compute.

$$Difference = |L_B - L_M|$$

Note:

$m = 0.5$: If the $n = Z$ and Splice Alternating is Disable

$m = 1.0$: Else

a) Case 1: $Difference \leq 150 \text{ mm}$ or 0.15 m then,

$$Qty_{Mn} = m \cdot Qty_{Gn} (Req) \cdot Qty_{Cn}$$

$$L_{CBn} = L_M$$

b) Case 2: $Difference > 150 \text{ mm}$ or 0.15 m then

$$Qty_{Pn} = \frac{L_M}{L_B \text{ of } Qty_{Gn} (Req)}$$

$$Qty_{Mn} = m \cdot \frac{Qty_{An}(Req)}{Qty_{Pn}} \cdot Qty_{Cn}$$

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

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

And

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

Then the program will choose the manufactured bar length with the lowest *Total wastage*

- For Qty_{An}

If $Qty_{A(nx)}(Req)$ or its L_B is equal to ZERO then,

$$Qty_{Mn} = 0\ pcs$$

$$L_{CBn} = 0\ m$$

If $Qty_{A(nx)}(Req)$ or its L_B is greater than ZERO then,

The program will compute.

$$Difference = |L_B - L_M|$$

Note:

$m = 0.5$: If Splice Alternating is Disable

$m = 1.0$: If Splice Alternating is Enable

- Case 1: $Difference \leq 150\ mm$ or $0.15\ m$ then,

$$Qty_{Pn} = m \cdot Qty_{An}(Req) \cdot Qty_{Cn}$$

$$L_{CBn} = L_M$$

- Case 2: $Difference > 150\ mm$ or $0.15\ m$ then

$$Qty_{Pn} = \frac{L_M}{L_B\ of\ Qty_{An}(Req)}$$

$$Qty_{Mn} = m \cdot \frac{Qty_{An}(Req)}{Qty_{Pn}} \cdot Qty_{Cn}$$

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

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

And

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

Then the program will choose the manufactured bar length with the lowest *Total wastage*

Example:

The available manufactured bar lengths are **6, 7.5, 10.5, and 12** meters

- @Ground Floor $Qty_{C1} = 13$

- For $Qty_1(Req)$; Where $Qty_1(Req) = 8\ pcs$ & $L_B\ of\ Qty_1(Req) = 3.6875$

Compute

L [m]	Difference
6	2.313
7.5	3.813
10.5	6.813
12.5	8.813

Since the *Lowest Difference* = 2.313 m > 0.15 m Thus,

L [M]	Qty [1]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	8	3.6875	13	1	1.63	1	104	104	2.313	0	240.500
7.5					2.03	2	52	52	0.125	0	6.500
10.5					2.85	2	52	52	3.125	0	162.500
12					3.25	3	34.67	35	0.938	4	35.875

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$$L_{CB(1a)} = 7.5\text{ m with }Qty_{M(1a)} = 52\text{ pcs.}$$

b) For $Qty_{G1}(Req)$; Where $Qty_{G1}(Req) = 4\text{ pcs}$ & $L_B\text{ of }Qty_{G1}(Req) = 5.285\text{ m}$

L [m]	Differenc e
6	0.715
7.5	2.215
10.5	5.215
12.5	7.215

Since the *Lowest Difference* = 0.715 m > 0.15 m

L [M]	Qty [G(1)]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	4	5.285	13	1	1.14	1	52	52	0.715	0	37.180
7.5					1.42	1	52	52	2.215	0	115.180
10.5					1.99	1	52	52	5.215	0	271.180
12					2.27	2	26	26	1.430	0	37.180

The Lowest *Average L* Manufactured Bar Length is 6 m. Thus,

$$L_{CB(1b)} = 6\text{ m with }Qty_{M(1b)} = 52\text{ pcs.}$$

c) For $Qty_{A(1a)}(Req)$; Where $Qty_{A(1a)}(Req) = 2\text{ pcs}$ & $L_B\text{ of }Qty_{A(1a)}(Req) = 5.285\text{ m}$

Compute

L [m]	Differenc e
6	1.175
7.5	0.325
10.5	3.325
12.5	5.325

Since the *Lowest Difference* = 0.325 m > 0.15 m

L [M]	Qty [A(1a)]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	2	7.175	13	1	0.84	0	#####	#####	0.000	#DIV/0!	#DIV/0!
7.5					1.05	1	26	26	0.325	0	8.450

10.5					1.46	1	26	26	3.325	0	86.450
12					1.67	1	26	26	4.825	0	125.450

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$$L_{CB(1c)} = 7.5\text{ m with }Qty_{M(1c)} = 26\text{ pcs.}$$

d) For $Qty_{A(1b)}(Req)$; Where $Qty_{A(1b)}(Req) = 0\text{ pcs}$ & $L_B\text{ of }Qty_{A(1a)}(Req) = 0\text{ m}$

$$Qty_{M(1d)} = 0\text{ pcs}$$

$$L_{CB(1d)} = 0\text{ m}$$

e) For $Qty_{A(1c)}(Req)$; Where $Qty_{A(1c)}(Req) = 0\text{ pcs}$ & $L_B\text{ of }Qty_{A(1a)}(Req) = 0\text{ m}$

$$Qty_{M(1e)} = 0\text{ pcs}$$

$$L_{CB(1e)} = 0\text{ m}$$

- @ 2nd Floor $Qty_{c2} = 13$

a) For $Qty_2(Req)$; Where $Qty_2(Req) = 8\text{ pcs}$ & $L_B\text{ of }Qty_2(Req) = 6.9375\text{ m}$

L [m]	Differenc e
6	0.938
7.5	0.563
10.5	3.563
12.5	5.563

Since the *Lowest Difference* = 0.563 m > 0.15 m

L [M]	Qty [2]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	8	6.9375	13	1	0.86	0	#####	#####	0.000	#DIV/0!	#DIV/0!
7.5					1.08	1	104	104	0.563	0	58.500
10.5					1.51	1	104	104	3.563	0	370.500
12					1.73	1	104	104	5.063	0	526.500

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$$L_{CB(2a)} = 7.5\text{ m with }Qty_{M(2a)} = 104\text{ pcs.}$$

b) For $Qty_{g2}(Req)$; Where $Qty_{g2}(Req) = 0\text{ pcs}$ & $L_B\text{ of }Qty_{g2}(Req) = 0\text{ m}$

$$Qty_{M(2b)} = 0\text{ pcs}$$

$$L_{CB(2b)} = 0\text{ m}$$

c) For $Qty_{A(2a)}(Req)$; Where $Qty_{A(2a)}(Req) = 0\text{ pcs}$ & $L_B\text{ of }Qty_{A(2a)}(Req) = 0\text{ m}$

$$Qty_{M(2c)} = 0\text{ pcs}$$

$$L_{CB(2c)} = 0\text{ m}$$

d) For $Qty_{A(2b)}(Req)$; Where $Qty_{A(2b)}(Req) = 2\text{ pcs}$ & $L_B\text{ of }Qty_{A(2b)}(Req) = 5.4225$

Compute:

L [m]	Differenc e
6	0.578
7.5	2.078
10.5	5.078
12.5	7.078

Since the *Lowest Difference* = 0.578 m > 0.15 m

L [M]	Qty [A(2b)]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastag e
6	2	5.4225	13	1	1.11	1	26	26	0.578	0	15.015
7.5					1.38	1	26	26	2.078	0	54.015
10.5					1.94	1	26	26	5.078	0	132.015
12					2.21	2	13	13	1.155	0	15.015

The Lowest *Average L* Manufactured Bar Length is 6 m. Thus,

$$L_{CB(2d)} = 6\;m\; \text{with}\; Qty_{M(2d)} = 26\;pcs.$$

e) For $Qty_{A(2c)} (Req)$; Where $Qty_{A(2c)} (Req) = 0\;pcs$ & L_B of $Qty_{A(2c)} (Req) = 0\;m$

$$Qty_{M(2e)} = 0\;pcs$$

$$L_{CB(2e)} = 0\;m$$

- @ 3rd Floor $Qty_{c3} = 13$

a) For $Qty_3 (Req)$; Where $Qty_3 (Req) = 6\;pcs$, & $L_{B(a)}$ of $Qty_3 (Req) = 7.175\;m$

Compute

L [m]	Differenc e
6	1.175
7.5	0.325
10.5	3.325
12.5	5.325

Since the *Lowest Difference* = 0.325 m > 0.15 m

L [M]	Qty [3]	L [B(a)]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	7.175	13	1	0.84	0	#####	#####	0.000	#DIV/0!	#DIV/0!
7.5					1.05	1	78	78	0.325	0	25.350
10.5					1.46	1	78	78	3.325	0	259.350
12					1.67	1	78	78	4.825	0	376.350

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$$L_{CB(3a)} = 7.5\;m\; \text{with}\; Qty_{M(3a)} = 78\;pcs.$$

b) For $Qty_3 (Req)$; Where $Qty_3 (Req) = 6\;pcs$, & $L_{B(b)}$ of $Qty_3 (Req) = 6.5765\;m$

Compute

L [m]	Differenc e
6	0.577
7.5	0.924
10.5	3.924
12.5	5.924

Since the *Lowest Difference* = 0.577 m > 0.15 m

L [M]	Qty [3]	L [B(b)]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	6.5765	13	1	0.91	0	#####	#####	0.000	#DIV/0!	#DIV/0!
7.5					1.14	1	78	78	0.924	0	72.033
10.5					1.60	1	78	78	3.924	0	306.033
12					1.82	1	78	78	5.424	0	423.033

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$L_{CB(3b)} = 7.5\text{ m}$ with $Qty_{M(3b)} = 78\text{ pcs}$.

c) For $Qty_{A(3a)}(Req)$; Where $Qty_{A(3a)}(Req) = 0\text{ pcs}$, & L_B of $Qty_{A(3a)}(Req) = 0\text{ m}$

$Qty_{M(3c)} = 0\text{ pcs}$

$L_{CB(3c)} = 0\text{ m}$

d) For $Qty_{A(3b)}(Req)$; Where $Qty_{A(3b)}(Req) = 0\text{ pcs}$, & L_B of $Qty_{A(3b)}(Req) = 0\text{ m}$

$Qty_{M(3d)} = 0\text{ pcs}$

$L_{CB(3d)} = 0\text{ m}$

e) For $Qty_{A(3c)}(Req)$; Where $Qty_{A(3c)}(Req) = 2\text{ pcs}$, & L_B of $Qty_{A(3c)}(Req) = 2.2725\text{ m}$

Compute

L [m]	Differenc e
6	3.728
7.5	5.228
10.5	8.228
12.5	10.228

Since the *Lowest Difference* = 3.728 m > 0.15 m

L [M]	Qty A[3c]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastag e
6	2	2.2725	13	1	2.64	2	13	13	1.455	0	18.915
7.5					3.30	3	8.667	9	0.683	2.5	7.960
10.5					4.62	4	6.5	7	1.410	5.25	13.710
12					5.28	5	5.2	6	0.637	9.6	12.788

The Lowest *Average L* Manufactured Bar Length is 6 m. Thus,

$L_{CB(3e)} = 7.5\text{ m}$ with $Qty_{M(3e)} = 9\text{ pcs}$.

- @ 4th Floor $Qty_{C4} = 13$

a) For $Qty_4(Req)$; Where $Qty_4(Req) = 6\text{ pcs}$, & $L_{B(c)}$ of $Qty_4(Req) = 9.7265\text{ m}$

Compute

L [m]	Differenc e
6	2.952
7.5	1.452
10.5	1.549
12.5	3.549

Since the *Lowest Difference* = 1.452 m > 0.15 m

L [M]	Qty [4]	L [B]	Qty (Column)	m	Qty [P]		Qty [M]		L [W]	L [E]	Total Wastage
6	6	9.7265	13	1	0.67	0	#####	#####	0.000	#DIV/0!	#DIV/0!
7.5					0.84	0	#####	#####	0.000	#DIV/0!	#DIV/0!
10.5					1.08	1	78	78	0.738	0	60.333
12					1.34	1	78	78	3.049	0	177.333

The Lowest *Average L* Manufactured Bar Length is 7.5 m. Thus,

$$L_{CB(4a)} = 10.5\text{ m with }Qty_{M(4a)} = 78\text{ pcs.}$$

$$\text{b) For }Qty_{A(4a)}(Req); \text{ Where }Qty_{A(4a)}(Req) = 6\text{ pcs, \& }L_{B(a)}\text{ of }Qty_{A(4a)}(Req) = 0\text{ m}$$

$$Qty_{M(4b)} = 0\text{ pcs}$$

$$L_{CB(4b)} = 0\text{ m}$$

$$\text{c) For }Qty_{A(4a)}(Req); \text{ Where }Qty_{A(4a)}(Req) = 6\text{ pcs, \& }L_{B(a)}\text{ of }Qty_{A(4a)}(Req) = 0\text{ m}$$

$$Qty_{M(4c)} = 0\text{ pcs}$$

$$L_{CB(4c)} = 0\text{ m}$$

$$\text{d) For }Qty_{A(4a)}(Req); \text{ Where }Qty_{A(4a)}(Req) = 6\text{ pcs, \& }L_{B(a)}\text{ of }Qty_{A(4a)}(Req) = 0\text{ m}$$

$$Qty_{M(4d)} = 0\text{ pcs}$$

$$L_{CB(4d)} = 0\text{ m}$$

15. The program will then compute the weight of the main reinforcement of each floor of the column.

$$W_n = \left(\sum L_{CBn}Qty_{Mn} \right)W_{D(n)}$$

Where:

W_D = Weight based of the cdiameter of the main reinforcement.

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

$$\text{a) Ground Floor: Main rebar diameter is 32 mm}$$

$$W_1 = \left(\sum_{x=a}^e L_{CB(1x)}Qty_{M(1x)} \right)W_{D(1)}$$

$$W_1 = [7.5(52) + 6(52) + 7.5(26) + 0(0) + 0(0)] \times 6.313 = 5662.761\text{ kg}$$

$$\text{b) 2nd Floor: Main rebar diameter is 32 mm}$$

$$W_2 = \left(\sum_{x=a}^e L_{CB(2x)}Qty_{M(2x)} \right)W_{D(2)}$$

$$W_2 = [7.5(104) + 0(0) + 0(0) + 6(26) + 0(0)] \times 6.313 = 5908.968\text{ kg}$$

$$\text{c) 3rd Floor: Main rebar diameter is 32 mm}$$

$$W_3 = \left(\sum_{x=a}^e L_{CB(3x)}Qty_{M(3x)} \right)W_{D(3)}$$

$$W_3 = [7.5(78) + 7.5(78) + 0(0) + 0(0) + 7.5(9)] \times 6.313 = 7812.3375\text{ kg}$$

$$\text{d) 4th Floor: Main rebar diameter is 32 mm}$$

$$W_4 = \left(\sum_{x=a}^d L_{CB(4x)}Qty_{M(4x)} \right)W_{D(4)}$$

$$W_4 = [10.5(78) + 0(0) + 0(0) + 0(0)] \times 6.313 = 5170.347\text{ kg}$$

16. The program will compute the total weight of the column.

$$W_{Total} = \sum_1^{n_{TOP}} W_n$$

Example:

$$W_{Total} = \sum_1^{n_{TOP}} W_n$$

$$W_{Total} = \sum_1^4 W_n$$

$$W_{Total} = 5662.761 + 5908.968 + 7812.3375 + 5170.347$$

$$W_{Total} = 24554.4135 \text{ kg}$$