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Exp No : 01 SIMPLY SUPPORTED BEAM

* PROBLEM STATEMENT : A simply supported beam of a residential building has been proposed as per the following details.
- Cross Section of beam - 230 x 450 mm
- clear span - 2m and Overall span - 2.46 m
- Main reinforcement (Ast) = 300 mm^2 at the bottom out of which half bars are curtailed near support
- Shear reinforcement (Stirraps) 6mm dia (2LVS) at 120mmc/c
- General details - Material used M_{20} Concrete, Fe415 steel.
- Overlap length - 35 times dia
- clear cover of main steel - 25 mm

* CALCULATION :

No of Bars = $\frac{Ast}{ast}$

$= \frac{300}{\pi/4 \times (10)^2}$

$= 3.82 \simeq 4$ bars

* Selection of bars.

S.N	Dia	Area of bar	No of bars	Total Ast	Remark
01	10	78.54 mm^2	3.82 ≃ 4	314.16 mm^2	✓
02	12	113.09 mm^2	2.05 ≃ 3	339.27 mm^2	

We have to provide 4 no of bars of diameter 10 mm.

c/c distance of outer bar = $180 - 10/2 - 10/2 = 170$ mm

c/c distance of each bar = $\frac{170}{3} = 56.67$ mm

Clear distance of each bar = $56.66 - \frac{10}{2} - \frac{10}{2} = 46.66$ mm

it should be greater than cover.

46.66 > 25 mm (Safe) (Cover)

Let us provide 2 bar straight and two bar curtailed bars are curtailed at a distance of $L/7$ from the support.

curtailed length from the support = 285 mm

2 curtailed bars are provided.

* Details of bars with notation :-

A - 2 number of 10 mm main bars straight at bottom.

B - 2 number of 10 mm curtailed at the bottom.

C - 6 mm 2LVS @ 120 c/c

D - 10 mm, 2 no's top hanger bars (assumed)

* GENERAL NOTES :-

1. Notes and drawing in sheet should be in mm.
2. Materials are used M20 and Fe415 Steel
3. Clear cover to the main steel is 25 on bottom top as well as sides.
4. Development length is 25ϕ and overlap length is 12ϕ.

* BAR WELDING SCHEDULE :-

Sl no	Perticulars	Dia of b (mm)	Cutting length of bar	no of bars	Total length of bar	wt of bar per meter length	weight in (kg)
01	Main bar at bottom	10	2460-25-25 = 2410	2	4.82	0.61	2.94
02	Curtailed bar in center @ L/7	10	2000-$\frac{2000}{7}$×2 = 1428.5	2	2.857	0.61	1.74
03	Stirrups	6	1232	$\frac{2410}{120}$+1 = 21.08 ≈ 22	27.104	0.22	5.96
04	Top Hanger	10	2410	2	4.86	0.61	2.94

Total = 13.58 kg

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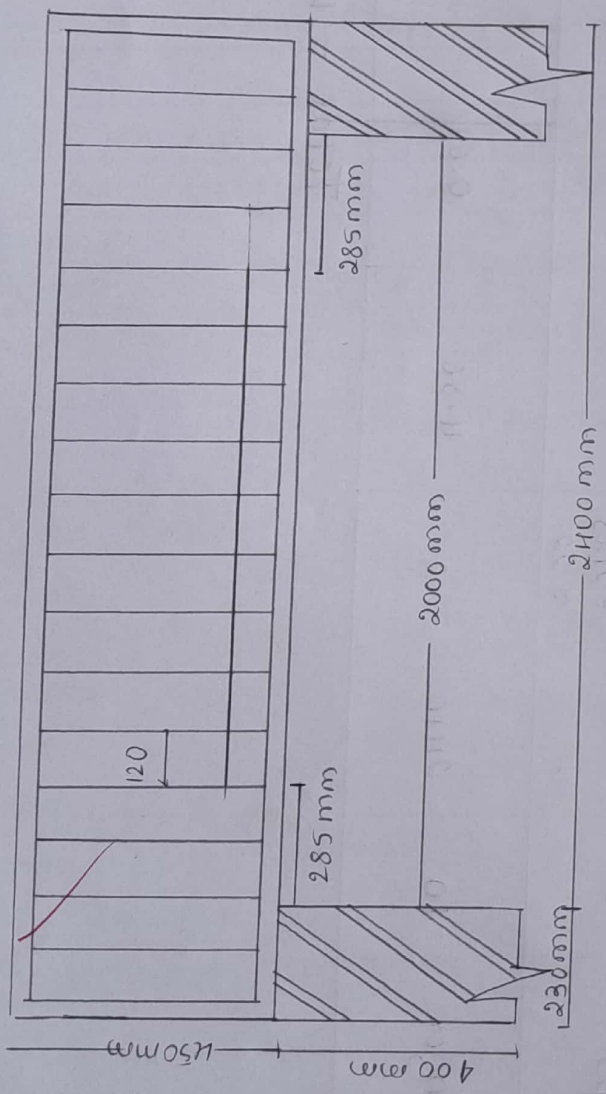
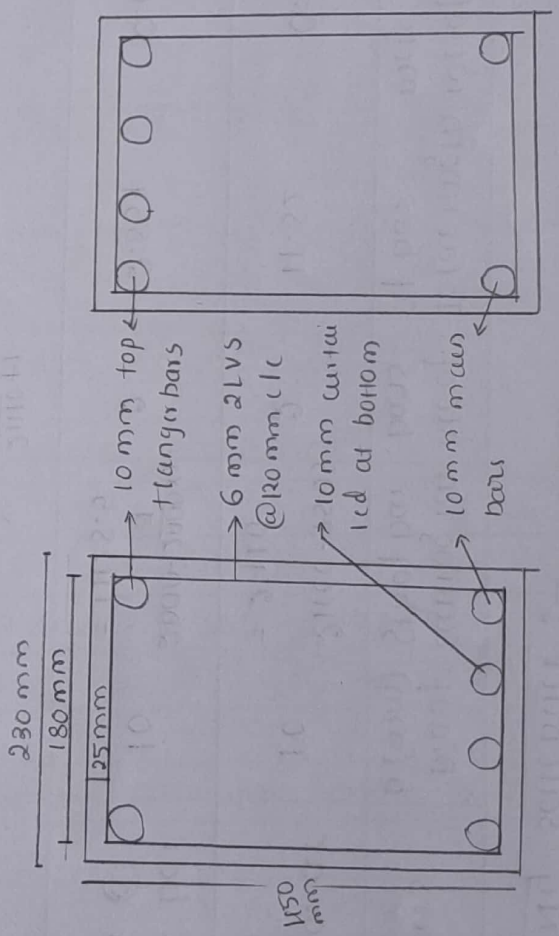
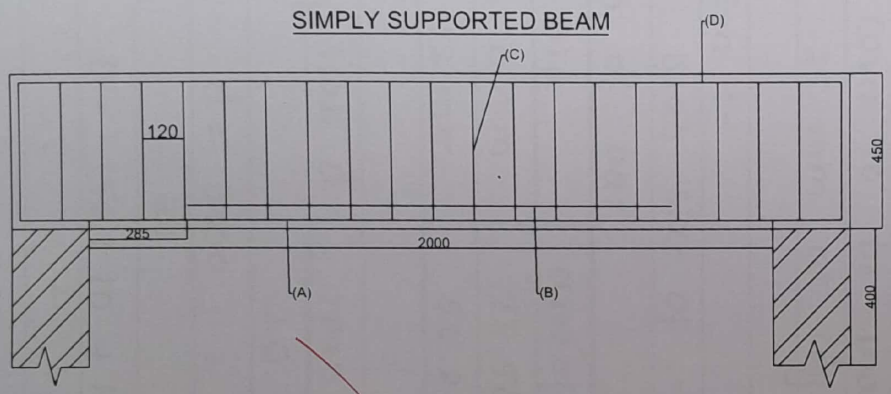
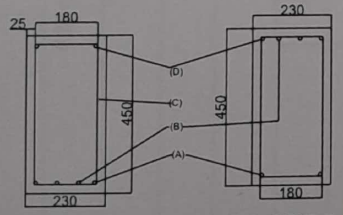




SIMPLY SUPPORTED BEAM



LONGITUDINAL SECTIONAL ELEVATION REINFORCEMENT DETAILS



C/S @ MIDSPAN C/S @ENDS

27/3/24

LEGEND :-

A - 2 NO OF 10 MM DIA MAIN BARS, STRAIGHT AT THE BOTTOM
B - 2 NO OF 10 MM CURTAILED AT THE BOTTOM
C - 6 MM 2 LEGGED VERTICAL STIRRUPS @ 120 MM C/C
D - 2 NO OF 10 MM TOP HANGER BARS

GENERAL DETAILS :-

1) ALL DIMENSIONS ARE IN MM
2) MATERIALS ARE USED ARE M20 GRADE CONCRETE AND Fe415 GRADE STEEL
3) CLEAR COVER TO THE MAIN STEEL IS 25 ON BOTTOM , TOP,SIDE
4) OVERLAP LENGTH - 12 DIA
5) DEVELOPMENT LENGTH - 25 DIA

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Ex No : 02 One way slab

* Geometric details :
Main bars of 1140 mm^2 are provided in which half of which mainly curtified at curtailed (1/2) are bent at a distance from the support.
- Distribution steel at 0.12 % of gross area.

* General Details :
1 Anchorage and Overlap length - 35 times dia and 12 mm dia respectively.
2 Materials used M20 Concrete Fe 415 Steel
3 Clear cover to be maintained 15 mm at top and bottom 25 mm at edge and ends.

* Solution :-
Consider slab size of = 3 x 8 m
Selection of bar

S.No	Dia	area of bar
1	10 mm	78.56 mm^2
2	12 mm	50.26 mm^2

Depth of slab $d = \frac{span}{20}$.

$d = \frac{3000}{20} = 150$ mm

$D = 150 + \frac{10}{2} + 15 = 170$ mm.

Wall thickness = 230 mm

- Main Ast = 440 mm²
- Distribution Ast 12% of GA

$$= \frac{0.12}{100} \times 170 \times 1000$$

$$= 264 \text{ mm}^2$$

- Assuming 10 mm dia main bars

$$\text{Spacing} = \frac{\frac{\pi}{4}(10)^2}{440} \times 100$$

$$= 178.49 \text{ mm}$$

∴ provide 10 mm @ 175 mm c/c

- No of bars $= \frac{8000}{175} + 1 = 46.7 \approx 47$ No's

No of main bars = 47

- length of main bar

$$L = 3000 - 25 - \frac{3000}{7} - 230 + 4 \times 10$$

$$= 3000 - 25 - 425 - 230 + 4 \times 10$$

$$= 2360 \text{ mm}.$$

- Spacing of an distribution steel (8mm)

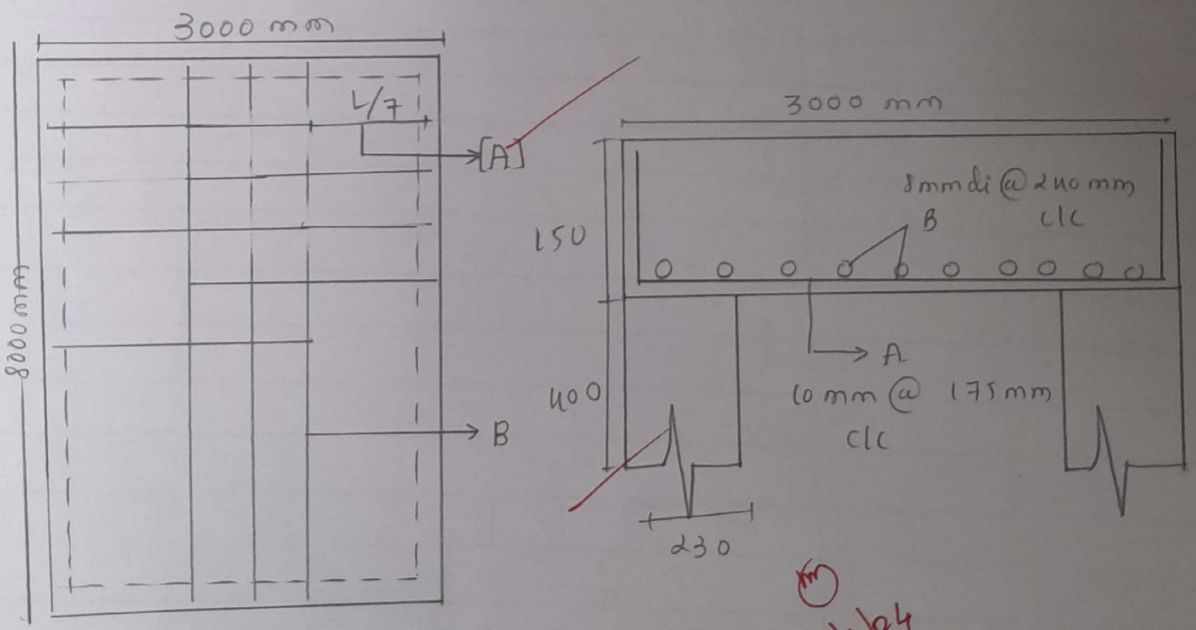
$$\text{Spacing} = \frac{\pi/4 \times (8)^2}{204} \times 1000$$

$$= 246.39 \text{ mm}$$

* Bar building Schedule

Sl No	Details	Dia (mm)	Length	No of bars	wt of bars	total wt
01	Main bars	10	2.36	47 = 110.92	0.61	67.66
02	Dist steel	8	8.014	14 = 112.19	0.39	43.75

= 111.41 Kg



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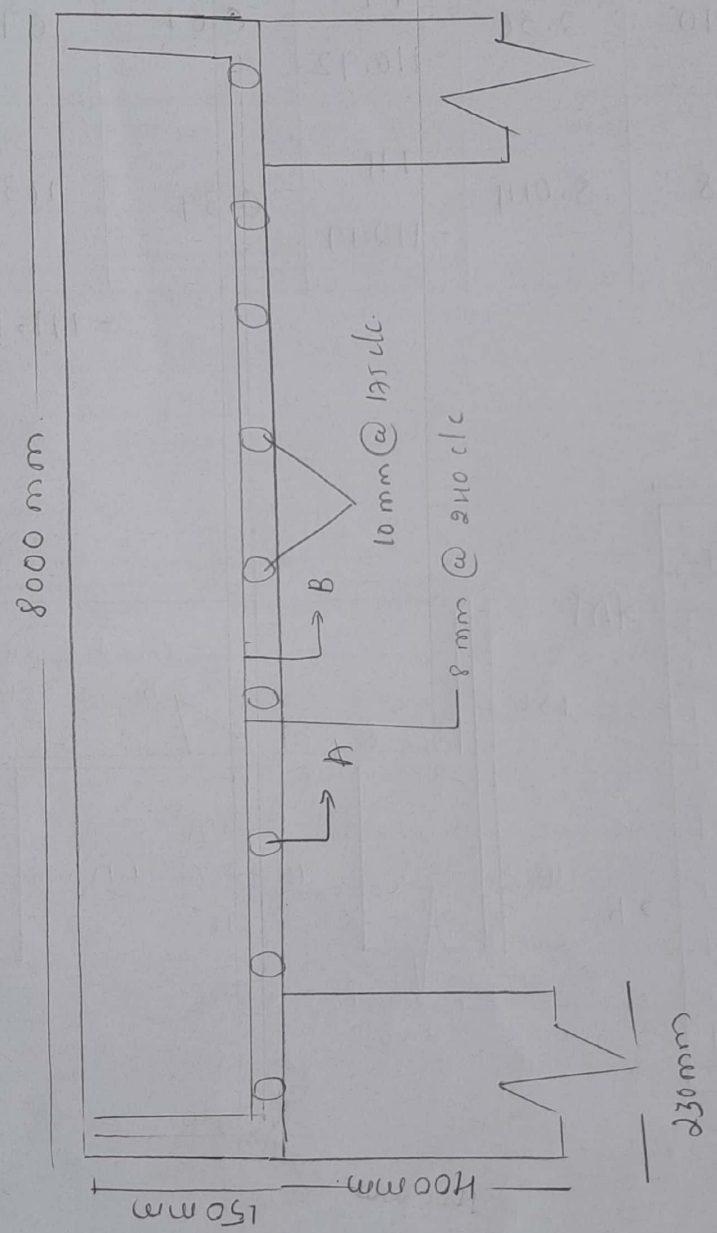

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Length of bar in x direction.

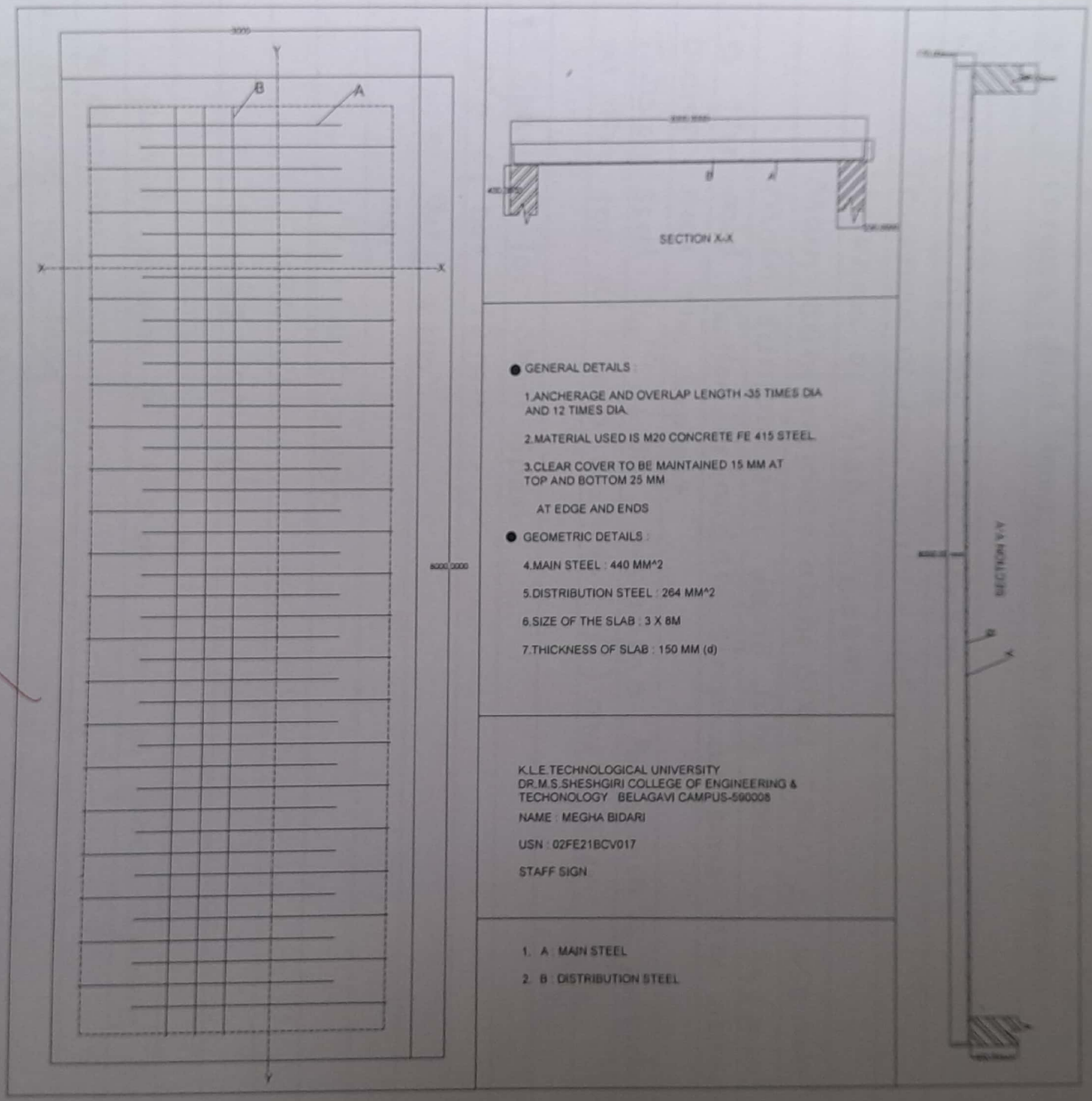
= 4460 − 2×25 + 4×10×2

= 4490 mm

Length of bar in y direction

= 5460 − 2×25 + 4×8×2

= 5474 mm



● GENERAL DETAILS :

1.ANCHERAGE AND OVERLAP LENGTH -35 TIMES DIA AND 12 TIMES DIA.

2.MATERIAL USED IS M20 CONCRETE FE 415 STEEL.

3.CLEAR COVER TO BE MAINTAINED 15 MM AT TOP AND BOTTOM 25 MM

AT EDGE AND ENDS

● GEOMETRIC DETAILS :

4.MAIN STEEL : 440 MM^2

5.DISTRIBUTION STEEL : 264 MM^2

6.SIZE OF THE SLAB : 3 X 8M

7.THICKNESS OF SLAB : 150 MM (d)

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1. A : MAIN STEEL
2. B : DISTRIBUTION STEEL

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Ex: No 03 Two way ~~simply~~ supported Slabs.

AIM: Design 2 way simply supported beam with corners held down condition for store room.

Data - size of the slab 4x5 m
Thickness of the wall - 4x5 m
Thickness of slab - 0.23 m
Main reinforcement along short span = 450 mm²
Main reinforcement along long span = 350 mm²
in the mid section or middle strip, all bars are alternate bentup near the support
Torsion steel 3/4th of the short span Ast which is provided at the top at each corners (1/5) mesh size

* Spacing for short span
Dia of bar 10 mm

$$= \frac{a_{st}}{A_{st}} \times 100$$

$$= \frac{\pi/4 \times (10)^2}{450} \times 1000$$

$$= 174.53 \text{ mm c/c}$$

∴ provide 10 mm @ 150 mm centre to centre spacing for x direction.

* Spacing for long span
Dia of bar 8 mm

$$= \frac{\pi/4 \times (8)^2}{350} \times 1000$$

$$= 143.61 \text{ mm}$$

∴ provide 8 mm @ 130 mm c/c spacing (y direction)

* Torsion Steel $= \frac{3}{4} \times 450 = 337.5 \approx 337$

Assume 8 mm dia bars

Spacing $= \frac{\frac{\pi}{4} \times (8)^2}{337} \times 1000$

$= 149.15 \approx$

≈ 150 mm

∴ provide 8mm @ 150 Centre to Centre.

Distance from end of wall $= \frac{5.46}{5} = 1.09 \approx 1$ m.

$\frac{L}{5} = \frac{4.46}{5} = 0.89 \approx 0.9$ m.

No of bars parallel to x direction

$= \frac{5.46}{150} \times 1000 + 1$

$= 37.4 \approx 38$ No's

No of bars parallel to y direction

$= \frac{4.46}{130} \times 1000 + 1$

$= 35.3 \approx 36$ No's

No of bar for torsion steel

in y- direction $= \frac{1000}{150} + 1 = 7.66 \approx 8$ No's

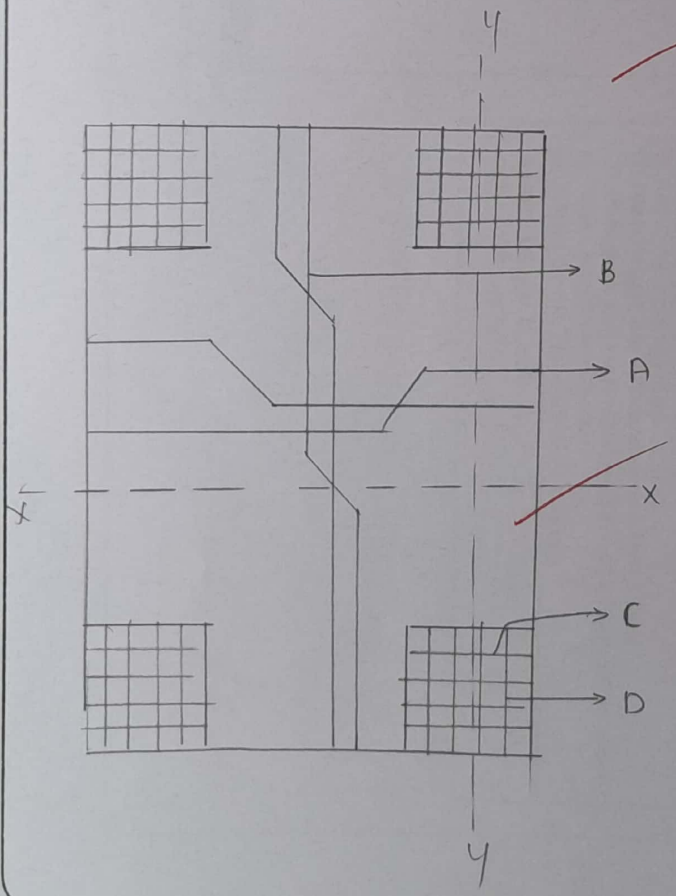
in x- direction $= \frac{900}{150} + 1 = 7$ No's

∴ provide 8mm bars @ 240 mm c/c dist std

- No of stars = $\frac{3000}{240} + 1 = 13.5 \approx 14$

- length of bar = $8000 - 2 \times 25 + 2 \times 14 \times 8$
= 8014 mm ≈ 8.014 m.

Sl No	particulars	dia	Length of bar (m)	No of bars	Total length of bar	wt of bar / m length	weight in kg
1	Main bar (SS)	10 mm	4.49	38	170.62	0.61	104.08
2.	Main bar (LD)	8 mm	5.474	36	197.06	0.39	76.85
3	Torsion steel in x direc^n	8 mm	0.9	7x4	25.2	0.39	9.83
	in y direc^n	8 mm	1.0	8x4	32	0.39	12.48

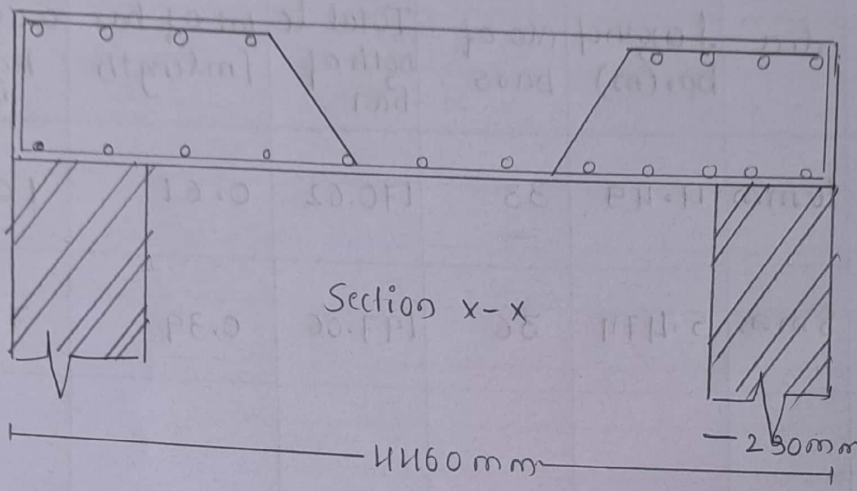


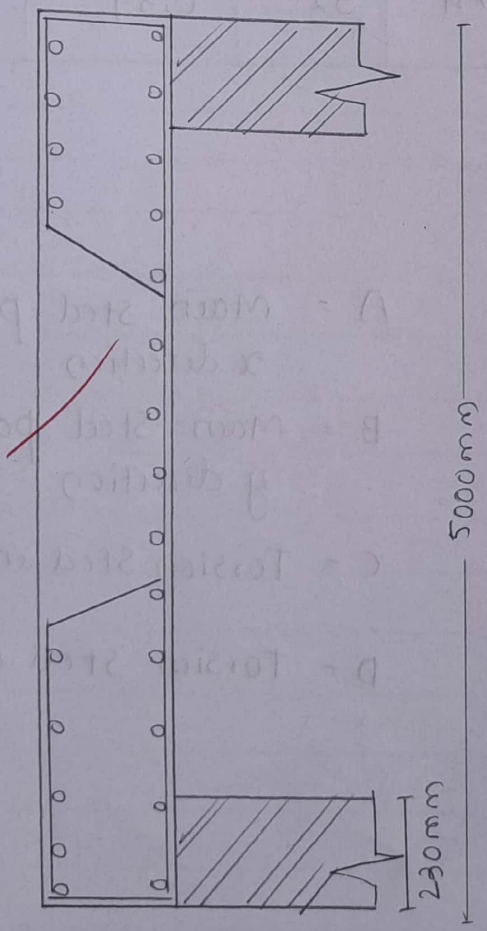
A = Main steel parallel to x direction

B = Main steel parallel to y direction

C = Torsion steel in x direction

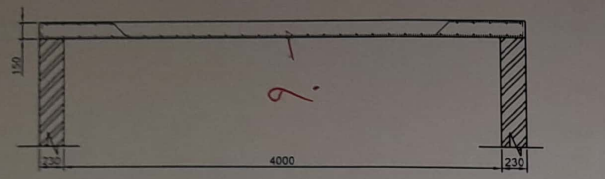
D = Torsion steel in y direction.



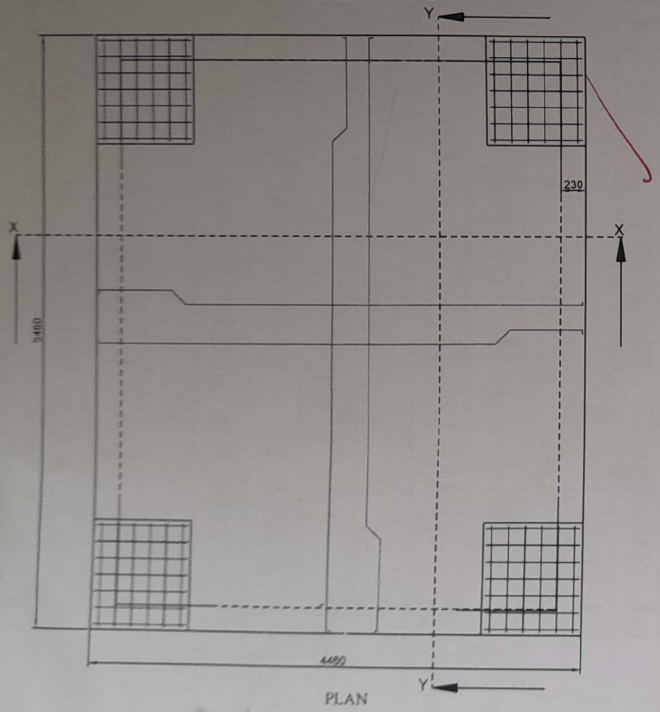


Section 4-4

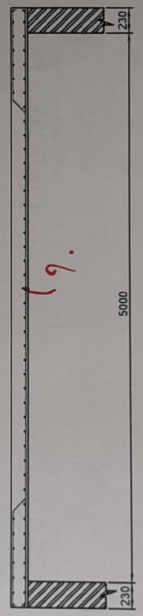
Two way Simply Supported Slab



CROSS SECTION X-X



PLAN



CROSS SECTION Y-Y

LEGEND :

A - 38 No. #10mm@150mm c/c Main Bars parallel to x direction
B - 36 No. #8 mm@130mm c/c Main Bars parallel to y direction
C - 8 No. #8 mm@150mm c/c Torsion Steel Bars
D - 7 No. #8mm@150mm c/c Torsion Steel Bars

GENERAL DETAILS :

1] All Dimensions are in mm
2] Material used are M20 concrete and Fe415 Steel
3] Clear cover to the main steel is 25 mm on bottom, top and sides
4] Side Clear Cover = 25 mm
5] Clear Cover at Top and Bottom = 15 mm

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Exp no: 04 Detailing of Dog legged staircase for ground floor.

The dog legged staircase has been proposed for ground floor of residential building with the following details.

*Geometric details :-

Planned dimensions of staircase room 4.5 x 2.1 m Clear.
level difference between floors = 3.3 m
no of flights = 2
width of landing and width of flight = 1 m
Thickness of waist slab of both flight = 200 mm
Thickness of landing slab = 200 mm
no of risers in each flight = 11 No's
each step has thread = 250 mm Riser = 150 mm.
Thickness of wall around = 230 mm
Depth of foundation below ground level = 0.3 m
Height of plinth above ground = 0.45 m
Thickness of Rcc wall in foundation = 200 mm
Rcc footing dimensions for each flight is 1 m x 1 m x 0.25 m

* Structural details:

The Rcc wall in the foundation after semi fixed condition to the lower end of first flight the landing slab spanning in perpendicular direction at mid height at first floor level after simple support action at their mid points of both flights both landing slab experiances and at the end wall support has been provided.

* Reinforcement details

waist slab = 590 mm² (main steel)

assume 10 mm dia bar

$A_{st} = \frac{\frac{\pi}{4} \times (10)^2}{590} \times 1000$

= 133.11 mm

∴ provide 130 mm spacing @ c/c of 10 mm dia bars, main steel in waist slab.

Distribution steel = 0.2 % gross cross sectional area

$= \frac{0.12}{100} \times 1000 \times 200$

= 240 mm²

$A_{st} = \frac{\frac{\pi}{4} \times (10)^2}{240} \times 1000$

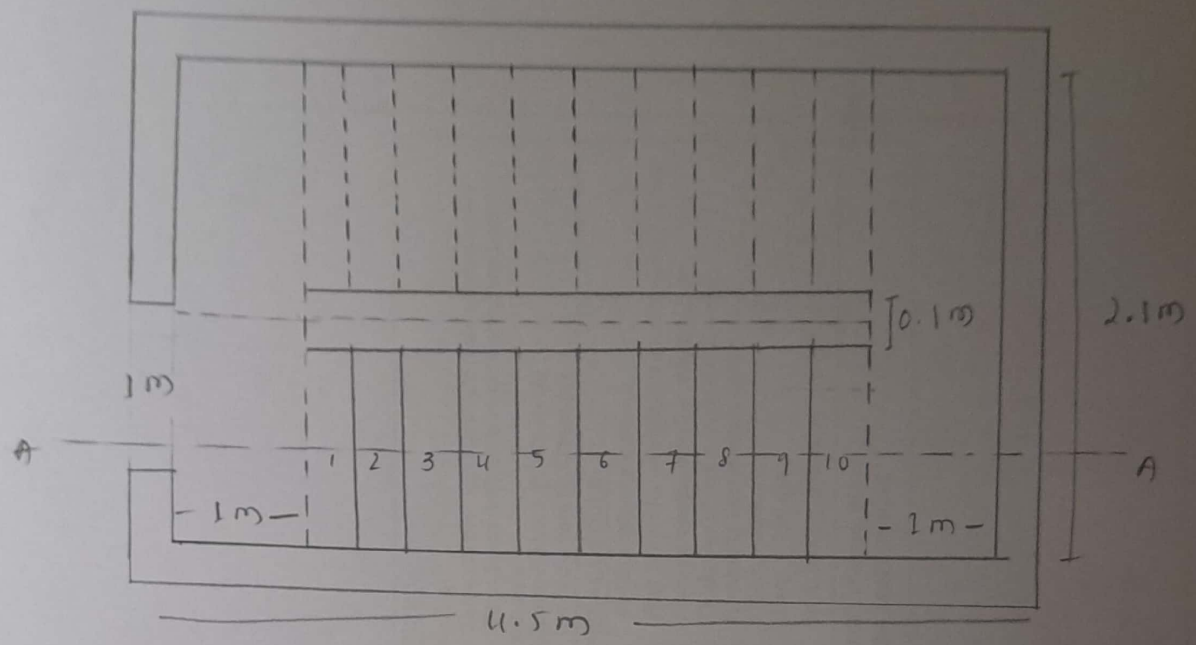
= 327.24 mm

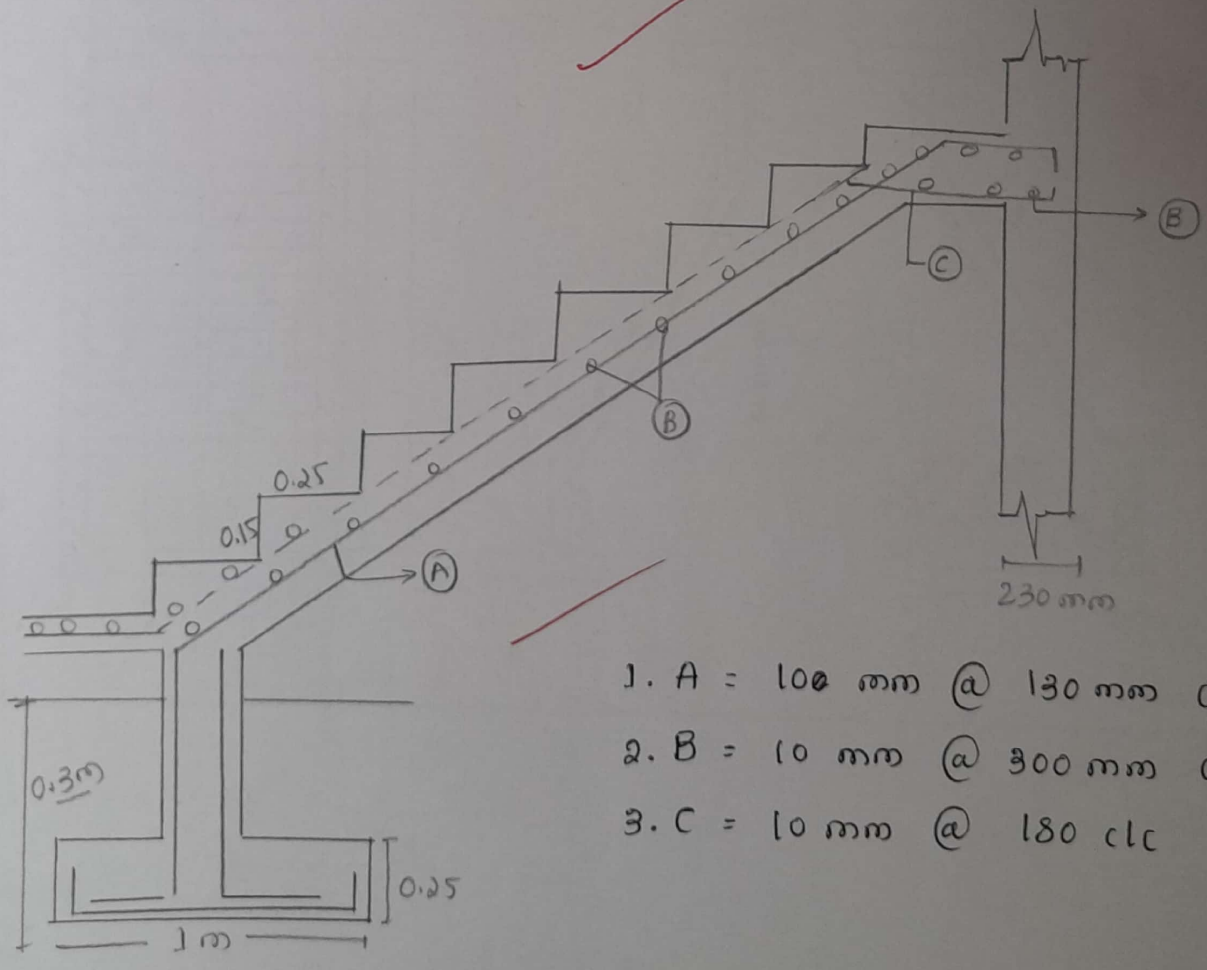
∴ provide 10 mm dia bar @ 300 mm c/c

- Landing slab reinforcement, main reinforcement along short span at bottom and ends of the landing slab

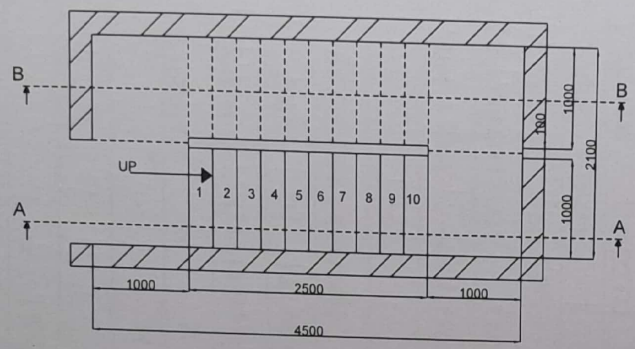
430 mm²

Spacing of landing slab $= \frac{\frac{\pi}{4} \times (10)^2}{430} \times 1000$

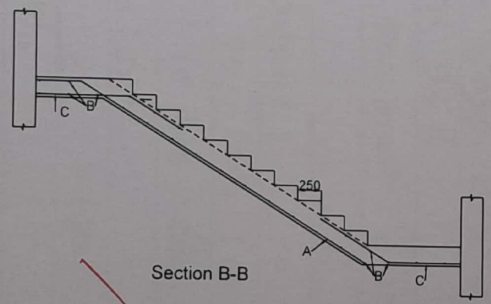




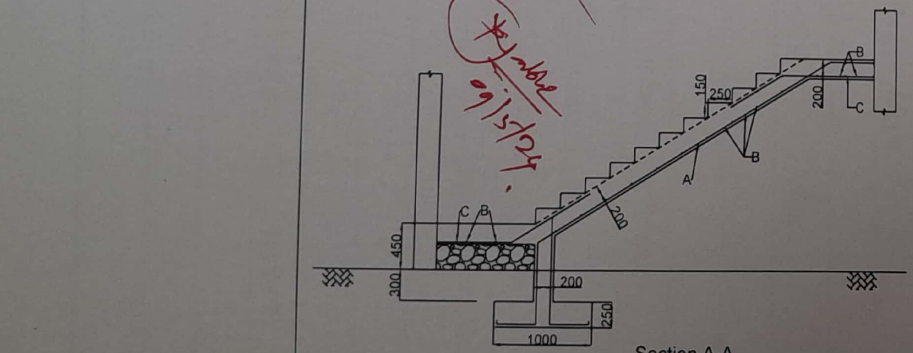
1. A = 10ø mm @ 130 mm c/c
2. B = 10 mm @ 300 mm c/c
3. C = 10 mm @ 180 c/c



Plan



Section B-B



Section A-A

LEGEND :

Waist slab:
A - 10mm dia bars @130mm c/c main reinforcement
B - 10mm dia bars @ 300mm c/c distribution bars
Landing slab:
C - 10mm dia bars @180mm c/c
B - 10mm dia bars @300mm c/c

GENERAL DETAILS :

1] All Dimensions are in mm
2] Plan dimension of staircase room = 4.5m X 2.1m
3] Level difference between floors = 3.3m
4] Thickness of wall all round = 230mm
5] Number of riser in each flight = 11
6] Tread = 250mm
Riser = 150 mm
7] RCC footing dimension = 1X1X0.25 m

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Exp No : DESIGN OF COLUMN FOOTING

* AIM : Design of Column footing as per the details given.

* Geometric details :
- Size of Column = 230 x 300 mm
- Size of footing = 1m x 1m
- Depth of footing = at edge 200 mm
  at face of Column 400 mm
- Height of the Column portion from the top of the footing to ground = 75 mm
- Clear Cover for column (side Cover) = 40 mm
- footing bottom Cover = 50 mm
- Side Cover = 75 mm
- Overlap length 12 times dia of the bar.
- Development length 35 d
- Ast for footing 500 mm^2 along each side.

* Reinforcement details :
- 3 bars of 12 mm on each face of the Column
- Spacing assuming 10 mm dia bars

$$\text{Spacing} = \frac{\frac{\pi}{4} \times (10)^2}{500} \times 100$$

$$= 157.07$$

∴ provide 10 mm @ 150 mm center to center on each side of the footing

* Stirrups = 6mm 2LVS @ 200 mm center to center

→ length of footing bar
= 1000 - 2x75 + 2x11x10 - (4ϕ)
= 930 mm

No of bars = $\frac{l}{\text{spacing}} + 1$

= $\frac{1000}{150} + 1$

= 8 bars

∴ provide 8 bars on each SI face.

→ size of the Column bar - 230 x 300 mm

length of the Coloumn bar
= 75 + 400 - 50 - 10 - 10 + 300 + 11x12 + 12x12
= 897 mm.

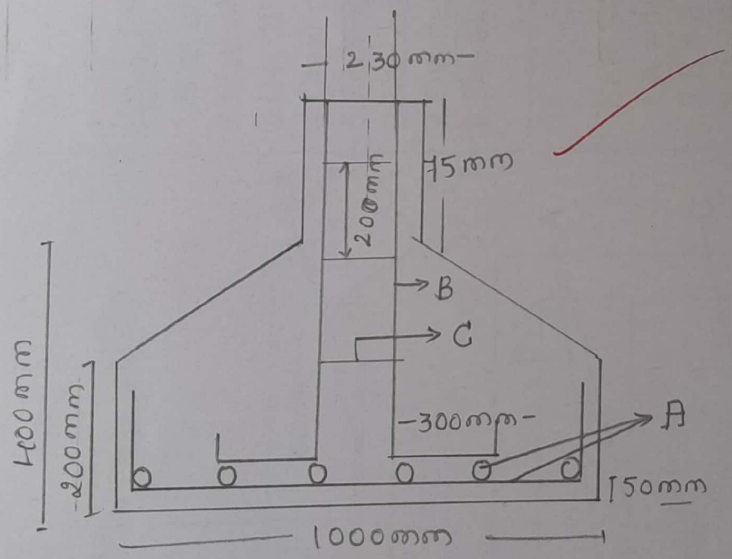
→ length of Stirrups
= (230 - 40x2) + (300 - 40x2) + (2x11x6)
= 418 mm

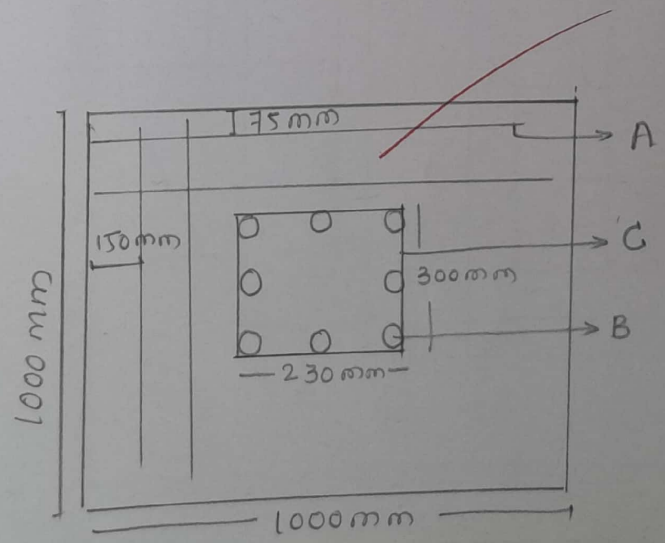
No of Stirrups = $\frac{897 - 300 - 12x12}{200} + 1$

= 3.26 ≈ 4 NOS

∴ provide 4 No of Stirrups.

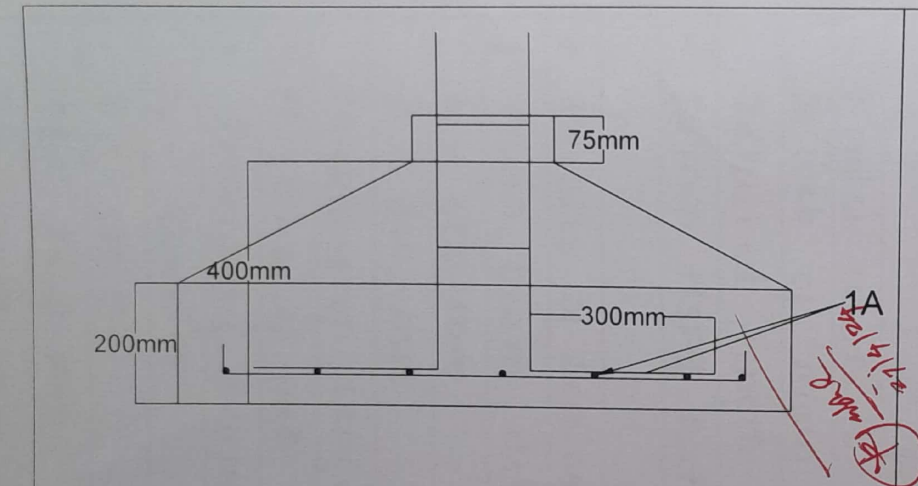
Sl no	Description	Dia	length of bar	no of bars	Total l of bar	wt of bar ($d^2/162$)	Total wt of bar (kgs)
1	footing straight bars on both faces	10 mm	0.93 m	8+8=16	14.88	0.61	9.08
2	Column bars	12 mm	0.897 m	8	7.176	0.89	6.38
3	Stirrups	6 mm	0.418 m	4	1.672	0.22	0.368
							= 15.83 kg

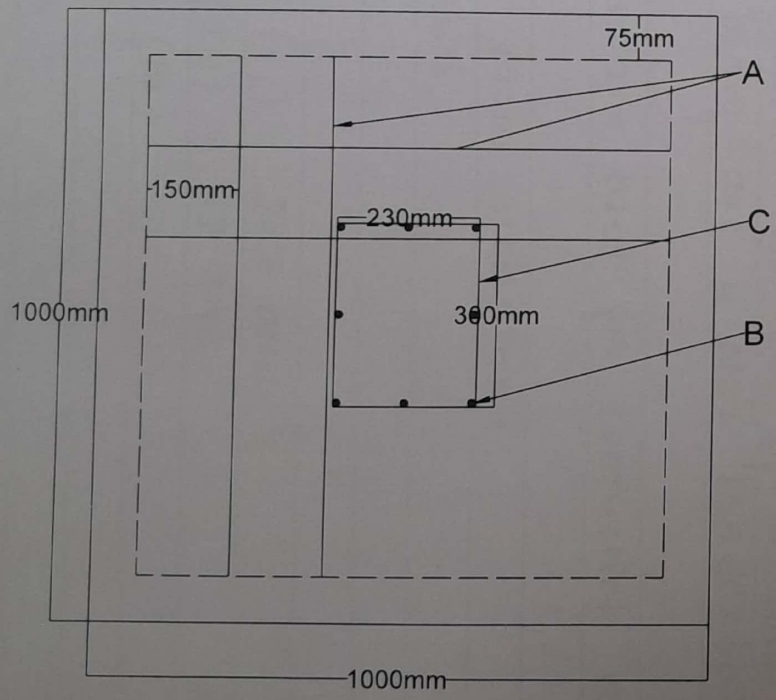




BAR SCHEDULE

1) A = 10 mm @ 150 clc
2) B = 8 # 12 mm
3) C = 6 mm 2LVs @ 200 mm clc





GEOMETRIC DETAILS :

1.Size of the column=230 X 300 mm
2.Size of the footing = 1m X 1m
3.Depth of the footing=400mm & 200mm @ the edge
4.Clear cover for the column 40mm
5.Footing bottom cover 50mm
6Side cover 75MM
7.Overlap length 12Xd
8.Development length 35d9.Ast for footing=500mm^2

BAR SCHEDUAL:

1 A = 10mm @ 150mm C/C
2 B = 8 # 12 mm
3 C = 6mm 2LVS @ 200 mm C/C

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Exp No: 07 Detailing of Beam-to-Beam connection with tops of flange at the same level.

B_2 and B_3 are secondary beam are connected to main beam

* Geometric details

- Top of all beams are located at the same level
- for the secondary beams are aligned along the straight line in the plan and are connected on the opposite side of the web of the main beam. (B_1)
- Section used - for main beam B1 IS MB 600 is used.
  for secondary beam B2 IS MB 500 is used
  for secondary beam B3 IS MB 400 is used.
- Angles used to connect the web of secondary beam to web of main beam are 4 Nos ISA 80×80×12 of required length
- 22 mm HSFG bolts are used for connection drawing.

* Details of section from steel table

1 Main beam details

h = 600 mm
b = 210 mm
thickness of flange (t_f) = 20.8 mm
thickness of web (t_w) = 12 mm

2 Secondary beam (B_2)

h = 500 mm
b = 180 mm
t_f = 17.2 mm
t_w = 10.2 mm

Page No. :
Date :

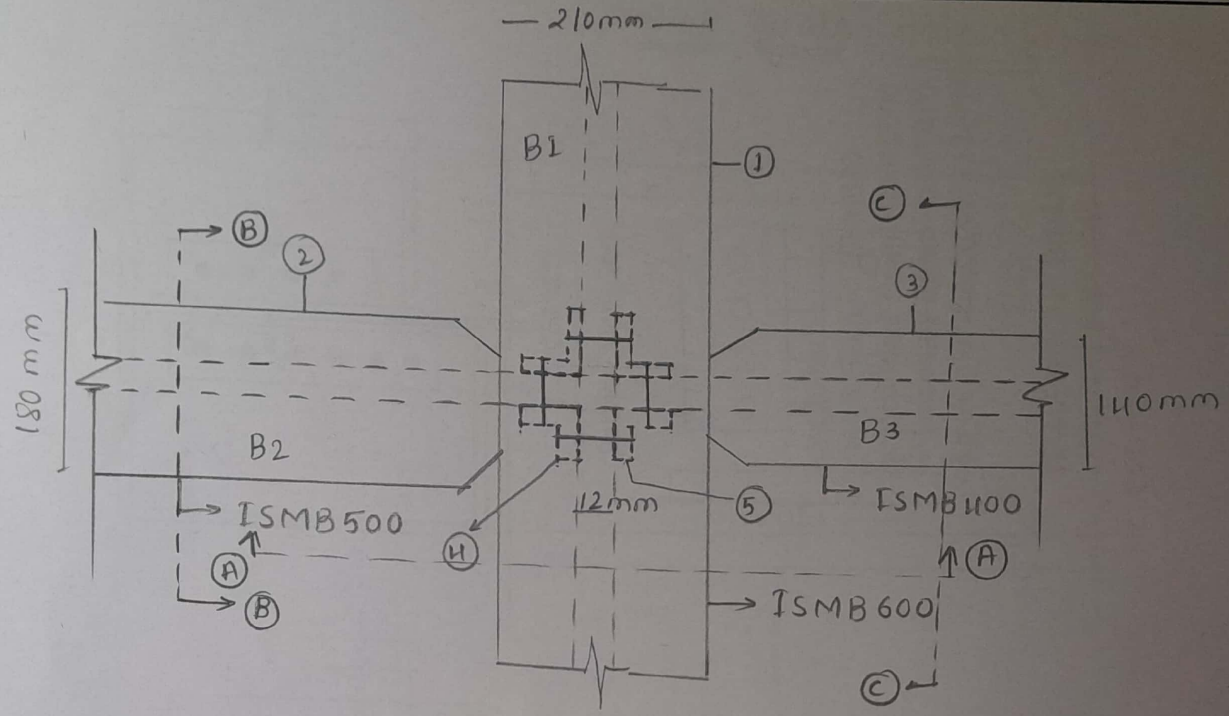
3. Secondary beam B_3

$D = 400$ mm

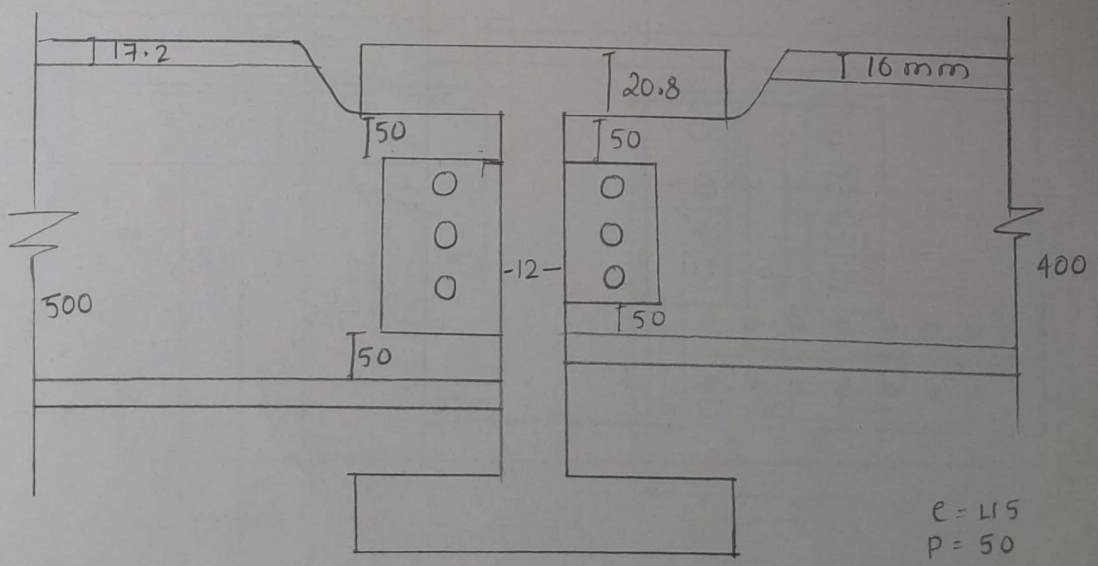
$b = 140$ mm

$t_f = 16$ mm

$t_w = 8.9$ mm



* Section along A-A



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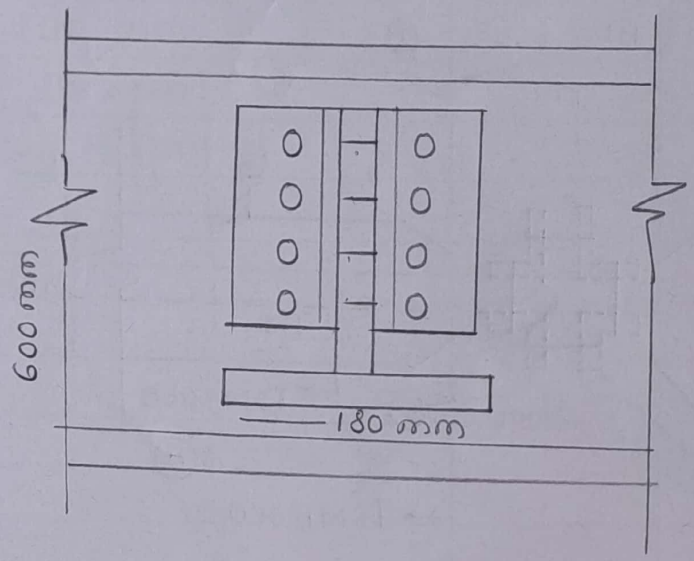
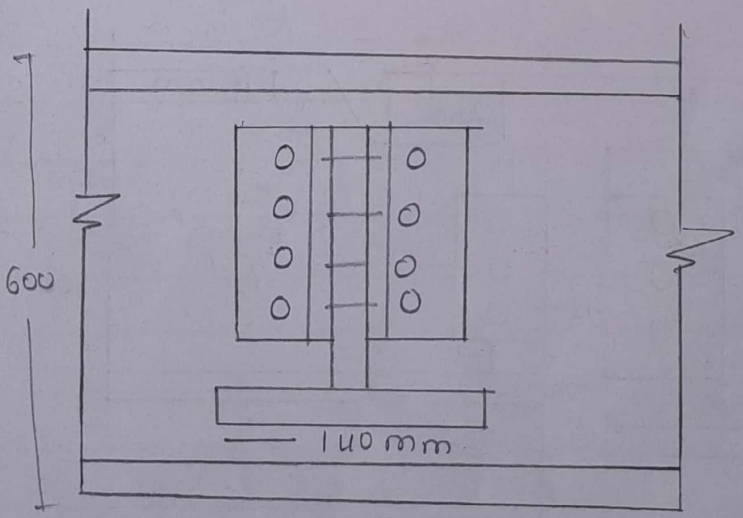
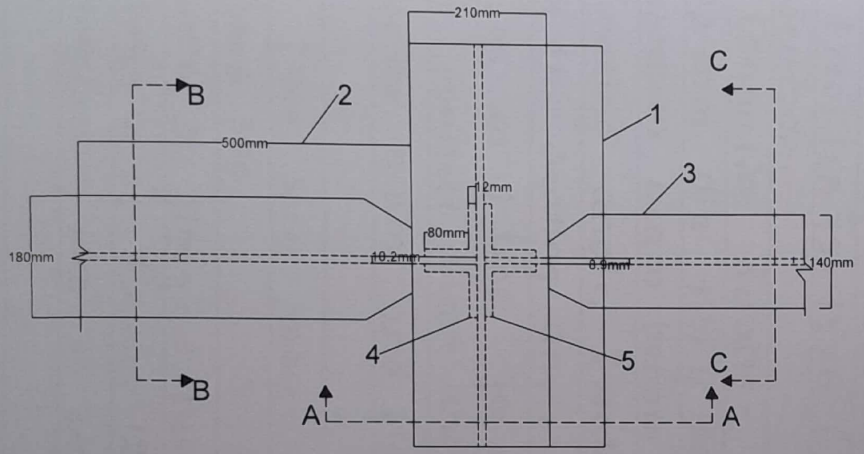
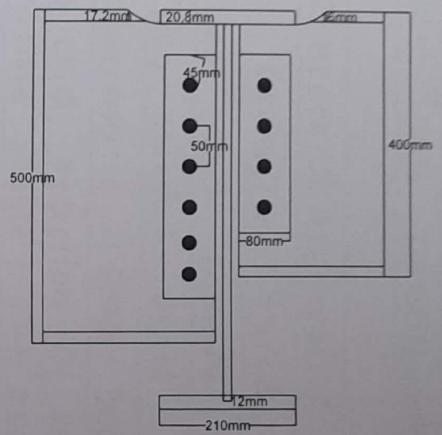
* Section along B-B



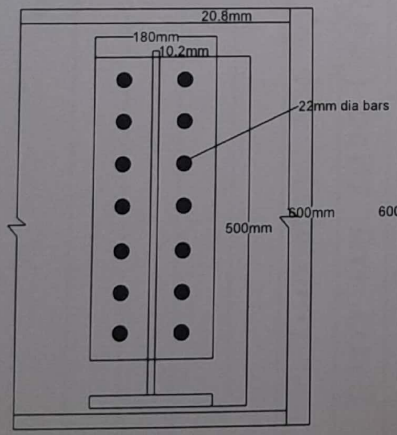
* Section along C-C



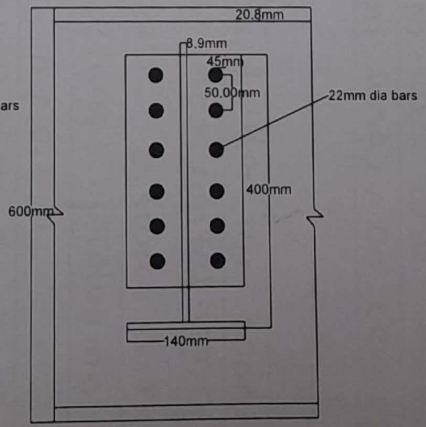




Section along A-A



Section along B-B



Section along C-C

Schedule:
1=Main Beam = ISMB600
2=Secondary Beam =ISMB500
3=Secondary Beam =ISMB400
4&5=Angle=ISA 80X80X12(4 No's)

NAME:MEGHA BIDARI
USN:02FE21BCV017

Experiment No : 08 Design of Unstiffened Seated Connection.

AIM : An unstiffened seated connection.

* PROBLEM STATEMENT :

An unstiffen seated connection is proposed between beam and column for the details given below.

Section used : Steel section used

- Column : ISMB 300, beam section : ISMB 300 with an end reaction of 200 KN.
- Seating Angle : ISA 200 x 150 x 10 mm (140 mm long) 1 No.
- Cleat Angle between beam web and column flange 1 No. ISA 75 x 75 x 6 (180 mm long), On each of the web section.

* Connection details :

- 22 mm dia HSFG bolts used for the connection. between beam bottom and horizontal leg of the seating angle. 2 No's of bolts. between vertical leg of the seating angle and flange of column 3 No of bolts in 1 line, for 2 lines 6 No.
- To connect cleat angles (2+2) bolts are used for web for the beam and flange of the column.

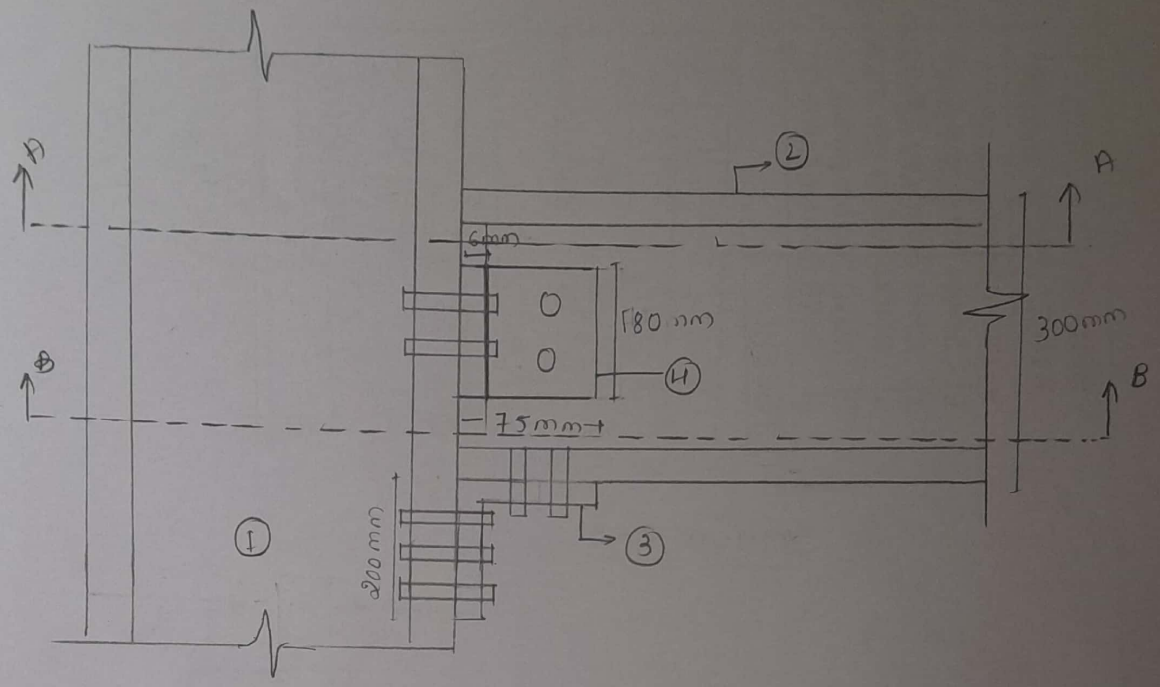
* from steel table

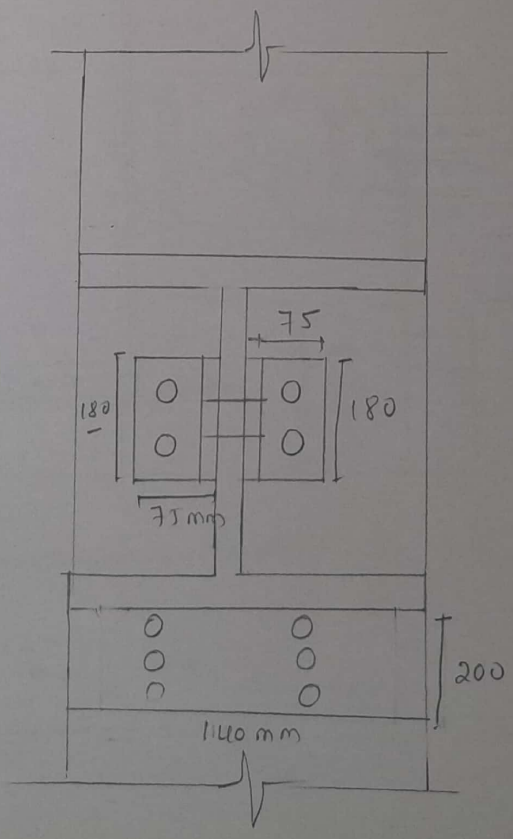
ISMB 300

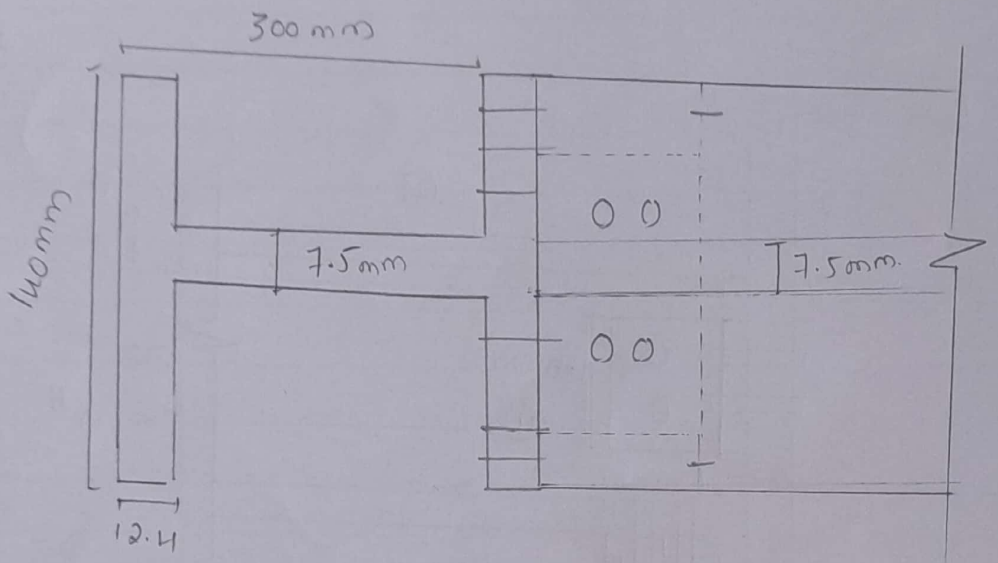
width of flange = 140 mm

thickness of flange = 12.4 mm

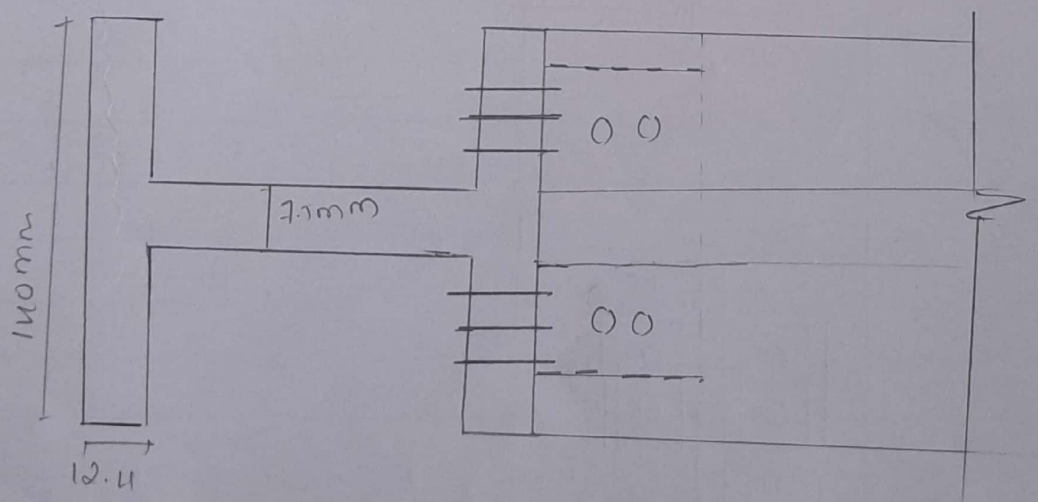
thickness of web = 7.5 mm

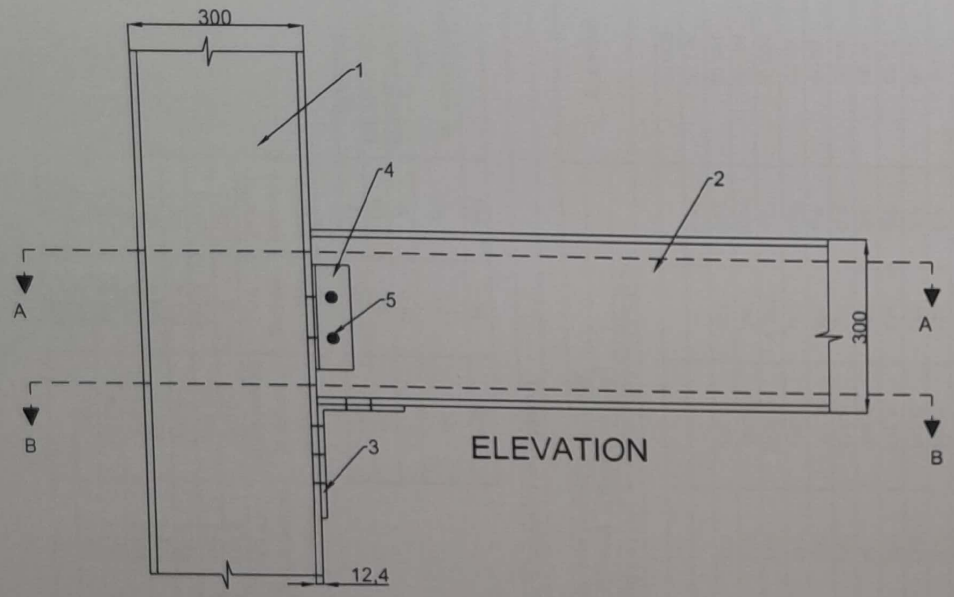




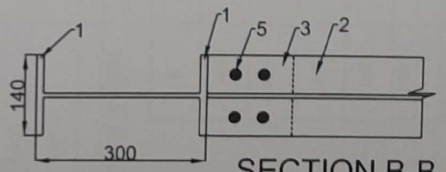


Section B-B

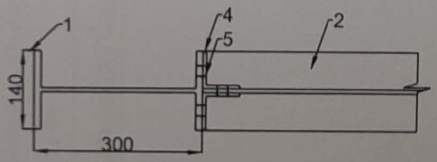




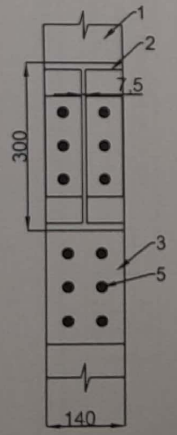
ELEVATION



SECTION B-B



SECTION A-A



FRONT
ELEVATION

LEGEND
1] ISMB 300 for Column 2] ISMB 300 for Beam 3] Seating Angle ISA 200X150X10 4] Cleat Angle ISA 65X65X6 5] 20mm Dia HSFG Bolts All dimension are in mm
NAME : MEGHA BIDARI **USN :** 02FE21BCV017

Exp No: 08 A Stiffened Seated beam- column Connection.

* problem Statement :
A stiffened seated beam- column connection has been designed with the following details :

(a) Section used : Column: ISHB 300 @ 586 N/m - One No
beam section ISLB 400 @ 569 N/m - one No
Seating angle : 2 No of ISA 130 x 130 x 10, 180 mm long
Stiffener angle : 2 No of ISA 90 x 90 x 10 each 390 mm long
Cleat angle between top flange of beam.
flange of column One No. of ISA 90 x 90 x 10, 180 mm long
packing plate = 10 mm thick may be given if necessary

(b) 22 mm dia HSFG bolts for connection between beam and seating angle 2 No; between vertical leg of seating angle of α flange of column 2 No;
between stiffening legs of stiffener angles = 5 No between column flange.
Stiffence angle legs (packing plate if given) = 10 No in one line x 2 line = 8 No in total.
To connect top flange of beam to cleat angles 2 No.
between vertical leg of cleat angles and column flange 2 No's.

- ISHB 300 @ 586 N/m
$b = 300$ mm
$b = 250$ mm
$t_f = 10.6$ mm
$t_w = 7.6$ mm.

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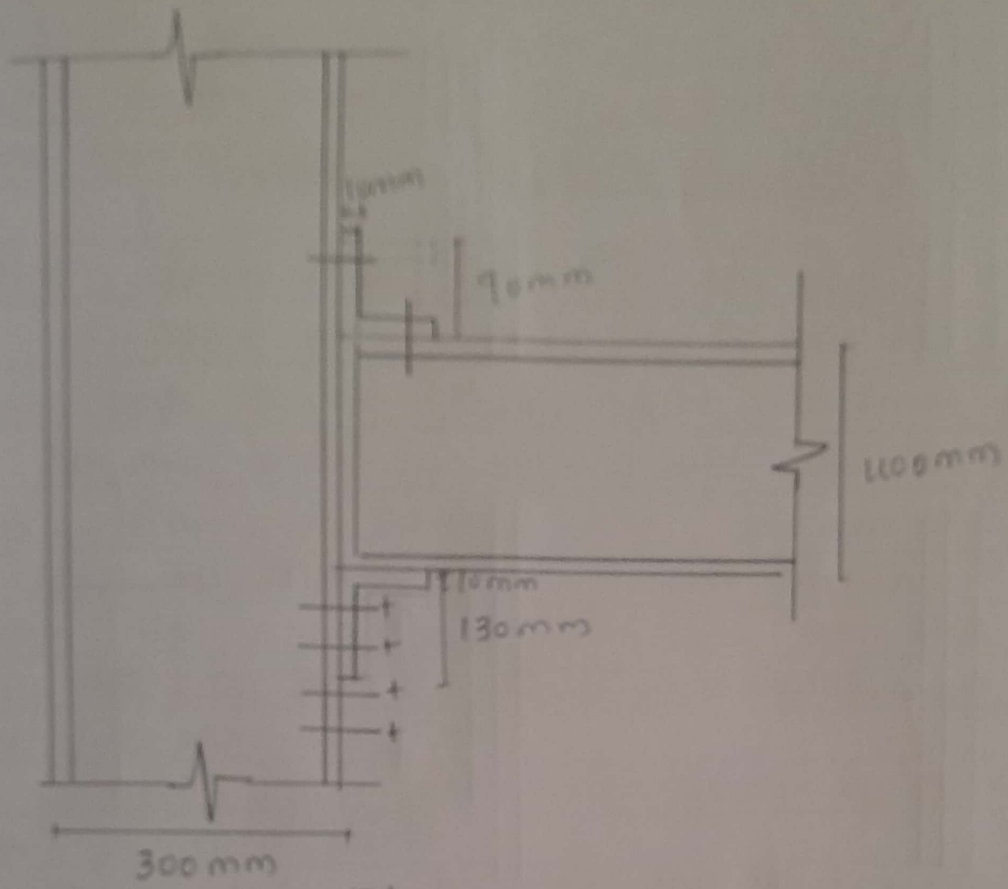
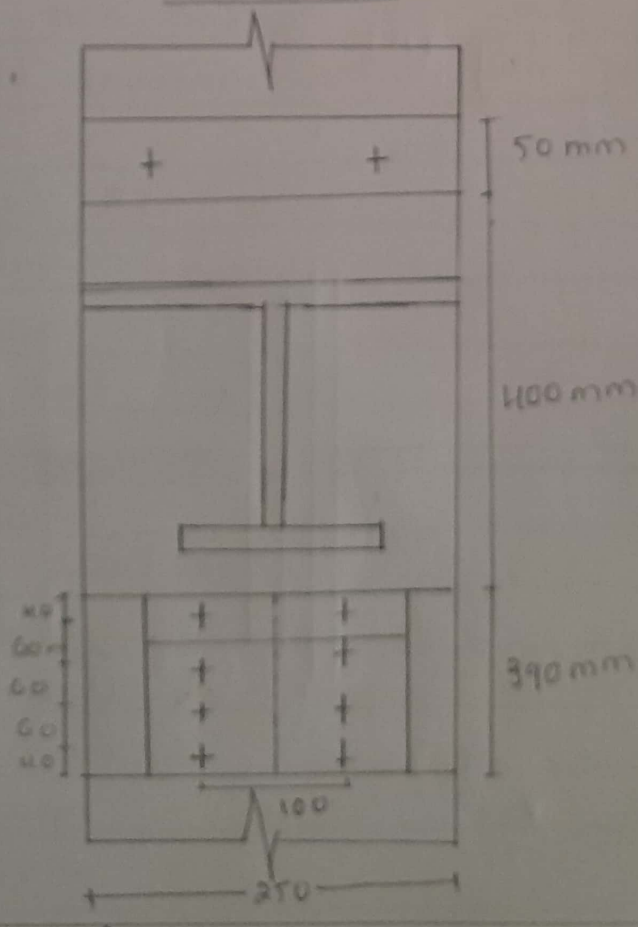
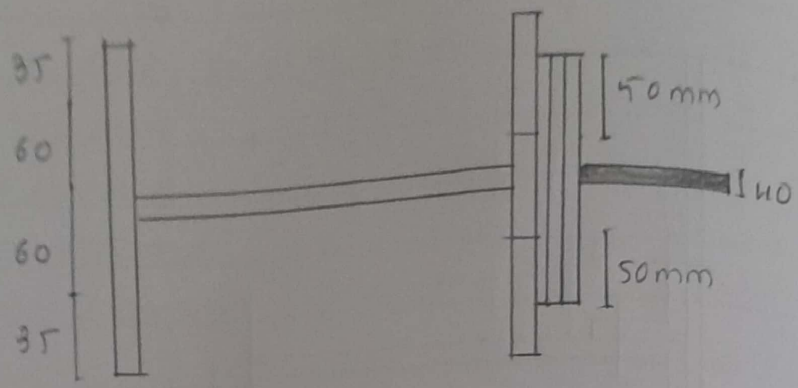
- ISLB 400 @ 569 N/m
h = 400 mm
b = 165 mm
t_f = 12.5 mm
t_w = 8.0 mm

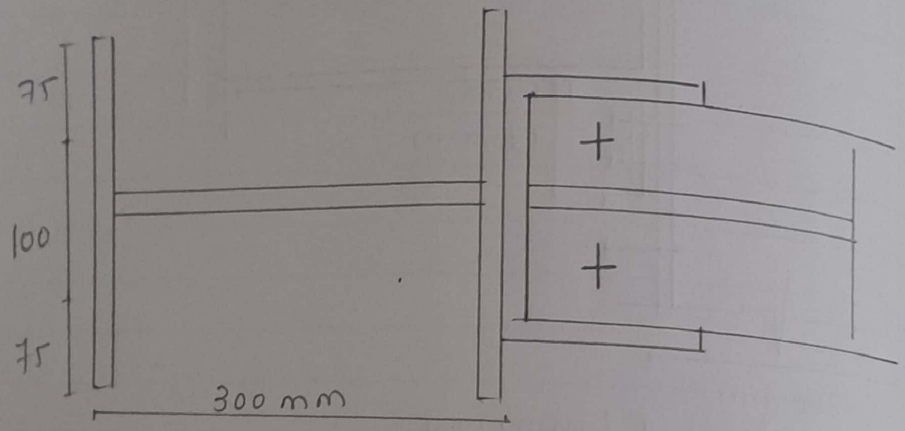


ELEVATION

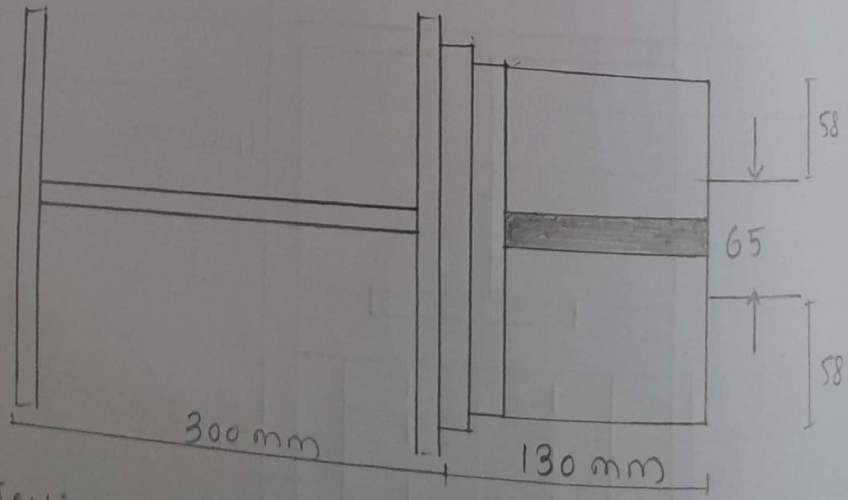


Front Elevation





Section along (A)



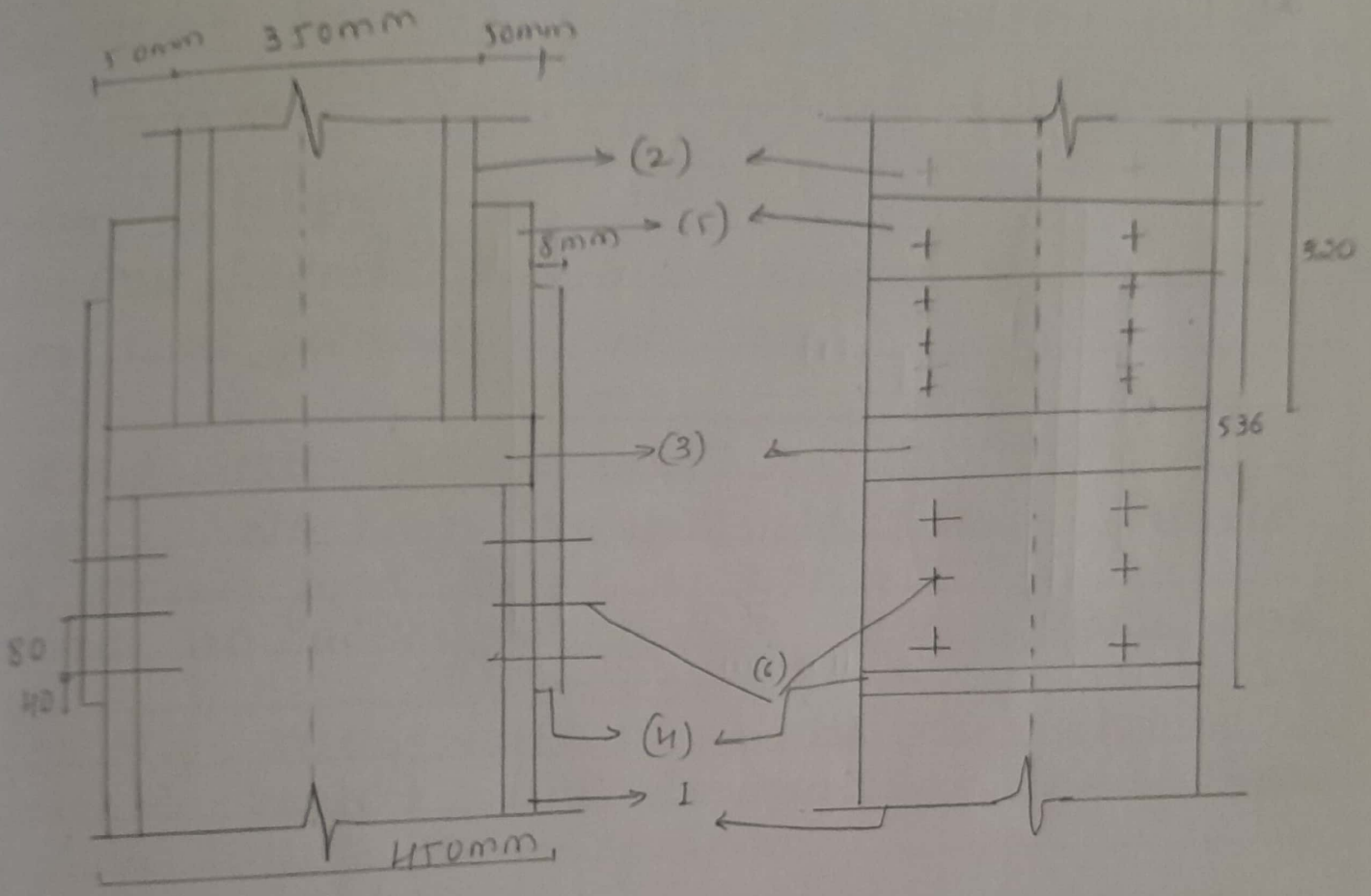
Section along (B)

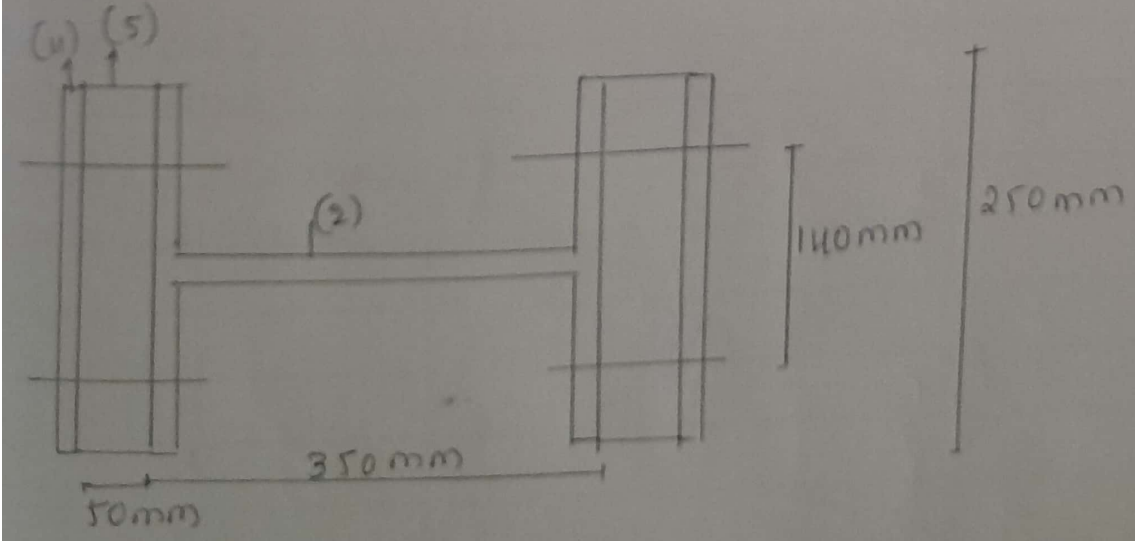
Exp No : 09. Detailing of splices for equal and unequal size of column sections, detailing of built up columns with lacing. Column splices has to be designed with following details

1 Section : lower portion ISHB 450 @ 872 N/m
upper portion ISHB 350 @ 672 N/m,
Bearing plate 50 mm thick, splice plate 8 mm thick, and 250 mm wide on both flanges and 536 mm long 2 No's, filler plate 50 mm thick, 250 mm wide and 320 mm long on both flanges of upper portion.
2 22 mm dia HSFG bolts used for connection, a total of 14 No's of bolts with edge distance 40, and pitch distance 80 mm are used.
- To connect splice plate and flange of the lower portion 6 No's on each flange
- To connect splice plate, filler plate and flange of the upper portion two no's on each flange provided.
Draw a side elevation, section and plan for the above detail.

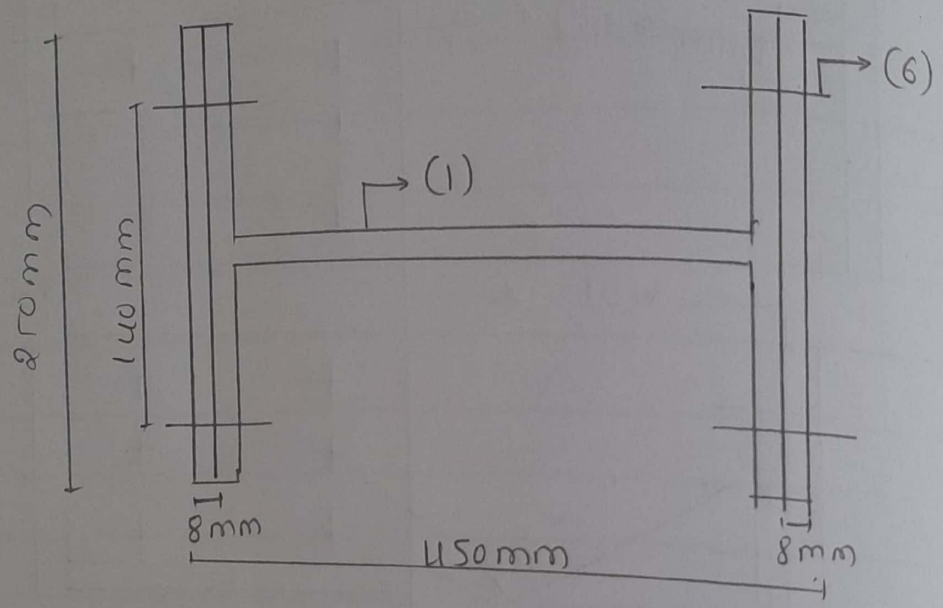
ISHB 450 @ 872 N/m
t_f = 13.7 mm
t_w = 9.8 mm
area = 11114 mm^2
h = 450 mm
b = 250 mm

ISHB 350 @ 672 N/m.
t_f = 11.6 mm
t_w = 8.3 mm
A = 8591 mm^2
h = 350 mm
b = 250 mm





Q1



EXP/NO/1 Built up Columns and Column Splices on battened Column.

* problem statement :
A built up Column has been designed with double lacing with following particulars.

(a) Rolled Steel Section used :
Column : 2 NO ISWB 400 with clc distance between web 325 mm for a height of 3.25 m.
- Battens : 400 wide and 10 thick at a pitch of 600 mm

(b) 22 dia HSFG bolts to connect the following 3 NO in Vertical line between each end of bottom of Outer side of flange of ISWB

Draw the following using above details.

- ISWB 400
b = 300 mm
b = 200 mm
flange = 16.0 mm tf.
tw = 7.4 mm.