

STRUCTURAL DRAWINGS

PUMP HOUSE

PROJECT
LOCATION

CONSTRUCTION OF 66/33kV SUBSTATION AND ASSOCIATED WORKS
: JAMTSHOLING, TASHICHOLING (SIPSOO), SAMTSE, BHUTAN

GENERAL NOTES

- READ THIS DRAWINGS IN CONJUNCTION WITH ENGINEERS' AND OTHER RELAVANT ENGINEERS' DRAWING.
- ALL DIMENSIONS ARE IN MILIMETER UNLESS NOTED OTHERWISE.
- DRAWINGS SHALL NOT BE SCALED. ONLY WRITTEN DIMENSIONS ARE TO BE FOLLOWED.

DESIGN CONFIRMS TO:

- IS-456:2000 - CONCRETE DESIGN
- IS-13920:1993 - DUCTILE DETAILING OF REINFORCE CONCRETE STRUCTURES SUBJECTED TO SEISMIC FORCES.
- IS-1893:2002 - CRITERIA FOR EARTHQUAKE RESISTANT DESIGN OF STRUCTURES & BUILDING CODE OF BHUTAN 2003.
- IS-806 - DESIGN OF STEEL STRUCTURES
- SP 34 : 1987 - HAND BOOK ON CONCRETE REINFORCEMENT AND DETAILING
- WIND LOAD IN ACCORDANCE WITH IS 875, PART 3 ASSUMING WIND SPEED OF 44M/S

NOMINAL LOADS USED FOR DESIGN OF STRUCTURE:

- UNIT WEIGHT OF RCC = 25KN/M3
- UNIT WEIGHT OF PCC = 24KN/M3
- UNIT WEIGHT OF BRICK = 20KN/M3
- UNIT WEIGHT OF CEMENT MORTAR = 20KN/M3
- LIVE LOAD ON ROOF = 0.75KN/M2

FOUNDATION:


- THE DEPTH OF FOUNDATION SHALL EXTENDED TO A MINIMUM OF THE SPECIFIED DEPTH OR TO A STABLE HARD STRATA WHICHEVER IS MORE.
- BEARING CAPACITY OF SOIL FOR DESIGN WORKS= 150KN/M2 (AS PER ACTUAL SOIL TEST REPORT BY BSB)

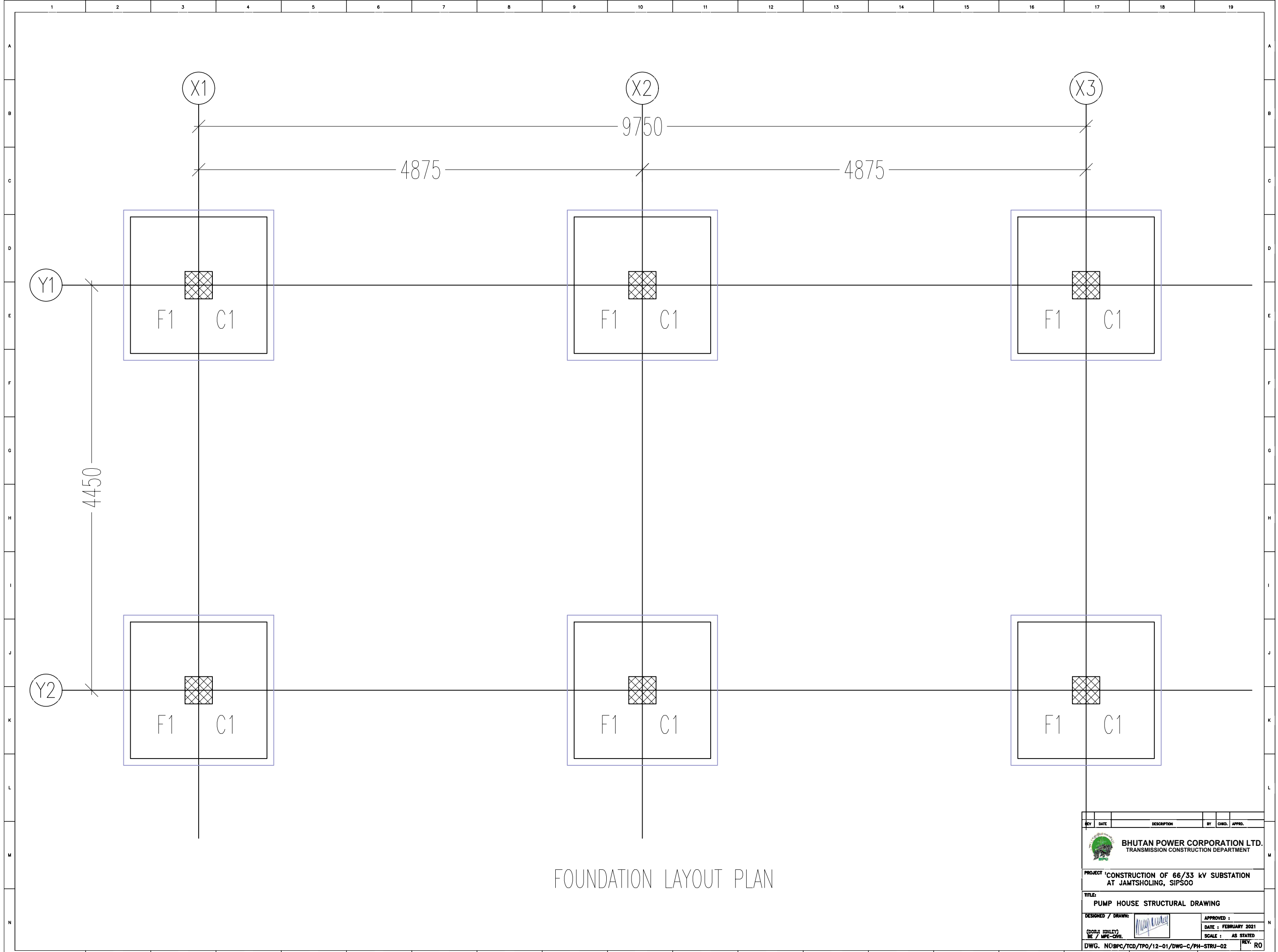
REINFORCEMENTS:

- ALL REINFORCEMENT BARS SHOWN AS ϕ ARE Fe 500 (TMT).
- SPlicing/LAPPING OF BARS SHALL BE STAGGERED AND IN NO CASE MORE THAN 50% BARS SHALL BE LAPPED AT ANY SECTION.
- LAPPING OF BARS FOR BEAMS & SLABS SHALL BE AVOIDED IN THE MAXIMUM TENSION ZONES.
- REINFORCEMENT SHALL BE SUITABLY ADJUSTED AT SITE TO CLEAR POCKETS, BOLTS, OPENINGS, CUTOUTS ETC... AS APPROVED BY THE ENGINEER IN CHARGE UNLESS SHOWN OTHERWISE IN THE DRAWINGS.



CONCRETE WORKS:

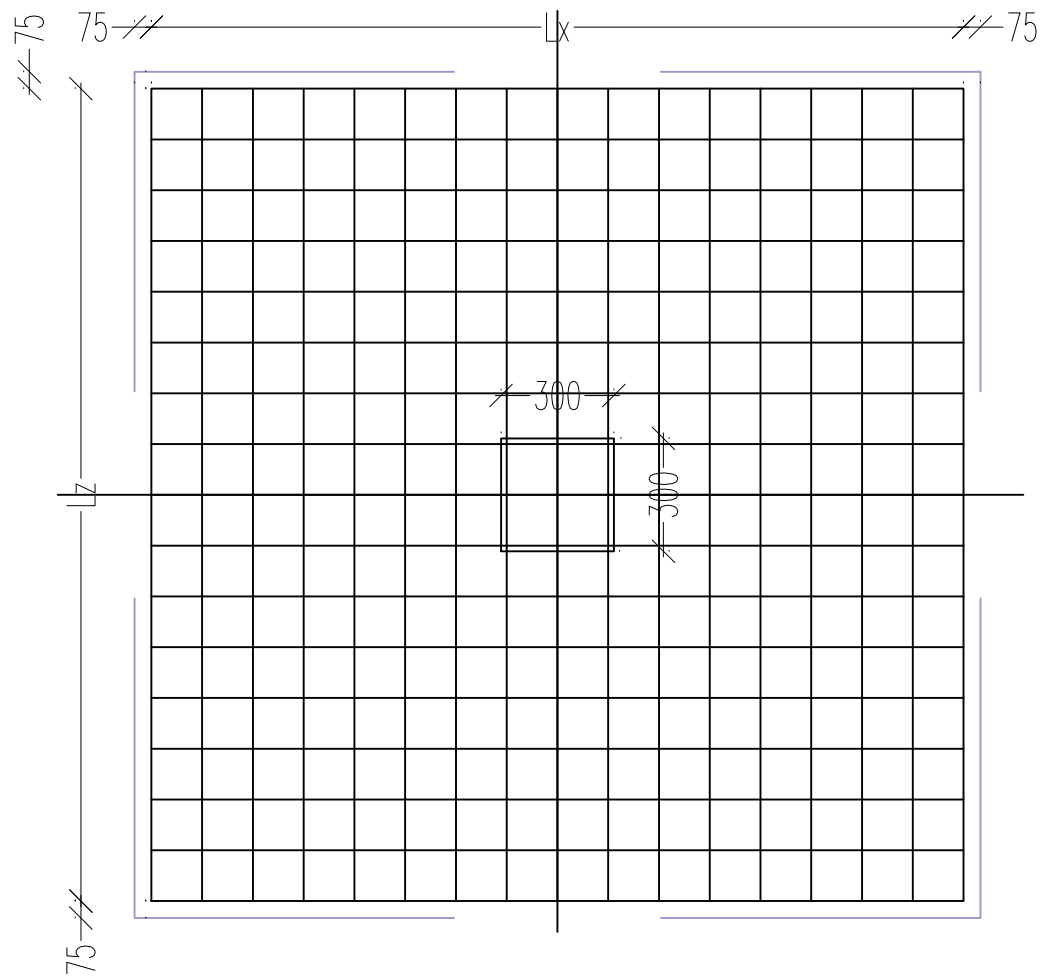
- ALL STRUCTURAL REINFORCED CONCRETE WORKS SHALL BE WITH MIX CONCRETE GRADE OF M20 UNLESS SPECIFIED OTHERWISE.
- AGGREGATE FOR ALL RCC WORKS SHALL BE WELL GRADED AND MAXIMUM SIZE OF 20MM UNLESS STATED OTHERWISE.
- WATER CEMENT RATIO SHALL BE MAXIMUM OF 0.55.
- LEAN CONCRETE FOR FILLING UNDER FOUNDATION SHALL BE 1:4:8 WITH AGGT. OF 40MM.
- LOCATION OF CONSTRUCTION JOINTS IF ANY IN STRUCTURAL CONCRETE SHALL BE AS PER THE APPROVAL TAKEN FROM THE ENGINEER-IN-CHARGE BEFORE EXECUTION.
- MINIMUM CLEAR CONCRETE COVER FROM THE OUTSIDE FACE OF THE MAIN BAR AS PER IS 456 2000 SHALL BE AS FOLLOWS.
 - FOUNDATION = 50MM
 - COLUMN = 40MM
 - BEAM = 25MM
 - SLAB AND STAIRCASE = 20MM
- ALL EXPOSED CONCRETE SURFACES SHALL BE NEAT PLASTER FINISHES.
- FOR POSITION AND SIZE OF CUTOUT IN R.C SLAB PLEASE REFER TO THE CORRESPONDING DRAWINGS OF OTHER DECIPLINE, UNLESS SHOWN OTHERWISE.
- DO NOT PLACE ANY CONDUITS AND OTHER PIPES THROUGH BEAMS & COLUMNS UNLESS APPROVAL FROM THE STRUCTURAL ENGINEER
- CONCRETE SHALL BE VIBRATED BY USING NEEDLE VIBRATORS PROPERLY AS PER STANDARD CODE OF PRACTICE.
- ALL CONSTRUCTION SHALL BE CARRIED OUT AS PER THE LATEST SQCA OR ANY RELEVANT AGENCIES SPECIFICATION AND RELEVANT CODE OF PRACTICES.

REV	DATE	DESCRIPTION	BY	CHKD.	APPRD.
 BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT					
PROJECT : CONSTRUCTION OF 66/33 kV SUBSTATION AT JAMTSHOLING, SIPSOO					
TITLE: PUMP HOUSE STRUCTURAL DRAWING					
DESIGNED / DRAWN:			APPROVED :		
(SIGNATURE)			(SIGNATURE)		
DATE : FEBRUARY 2021			SCALE : AS STATED		
DWG. NO: BPC/TCD/TPO/12-01/DWG-C/PH-STRU-01					REV. RO



FOUNDATION LAYOUT PLAN

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TITLE : PUMP HOUSE STRUCTURAL DRAWING					
DESIGNED / DRAWING : 			APPROVED :		
(DORJI KHILEY) BE / MPE-CIVIL			DATE : FEBRUARY 2021		
DWG. NO: BPC/TCD/TPO/12-01/DWG-C/PH-STRU-02			SCALE : AS STATED		
			REV. RO		

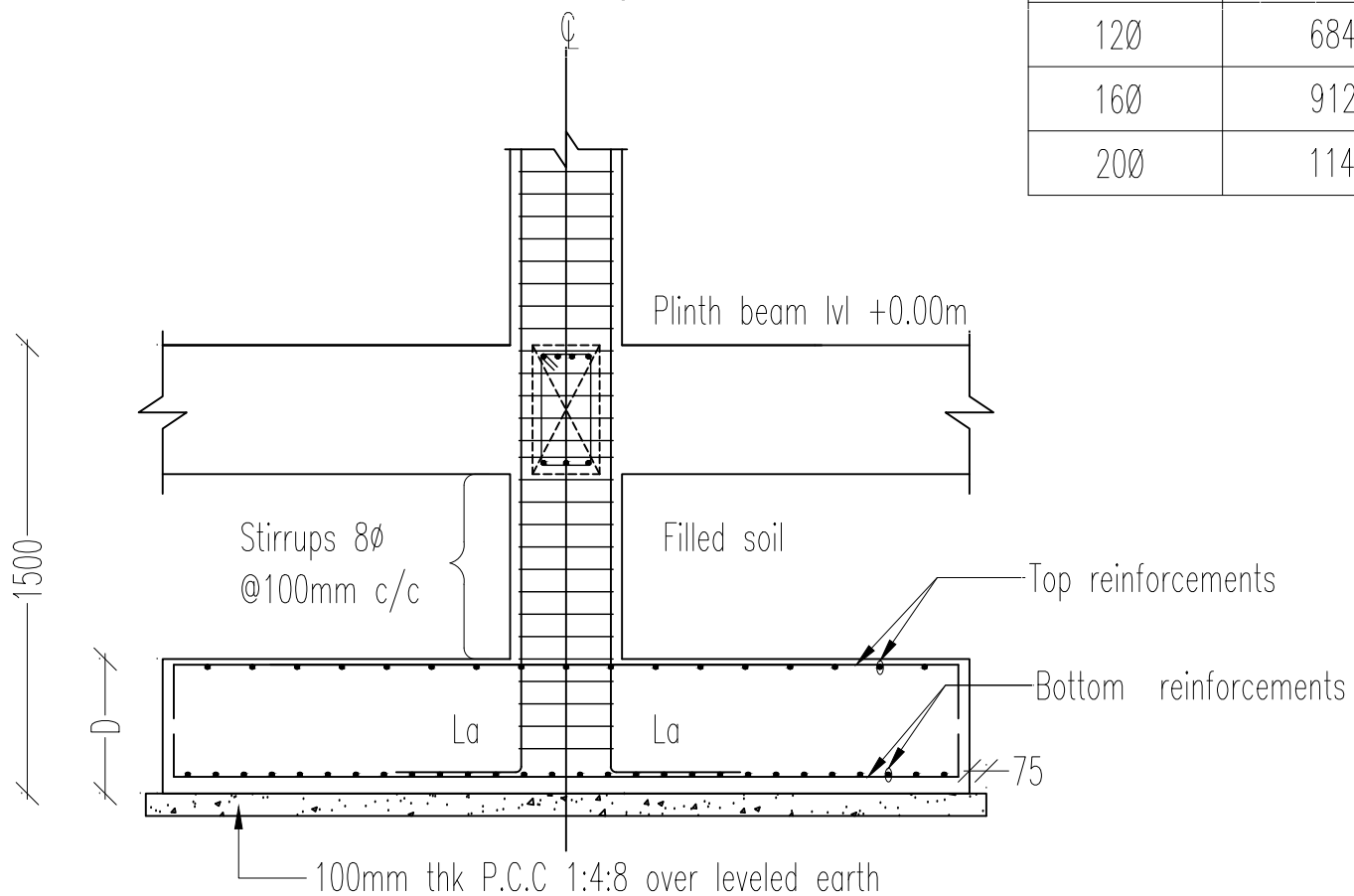


TYPICAL FOOTING PLAN OF F1, F2, F3 & F4

Material specifications:

1. Grade of concrete for RC footing works shall be...M20;
2. Grade of steel/rebars for RC beam works shall be...Fe 500 (BSB approved brands);
3. Aggregates for all RC works shall be of nominal size....20mm;
4. Water fit for drinking shall be used for concrete mix designs;
5. Minimum clear cover to the footing reinforcement...50 mm.



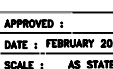
Bar Dia.	Development Length (Ld)	Anchorage Length (La)
12Ø	684	804
16Ø	912	1072
20Ø	1140	1340

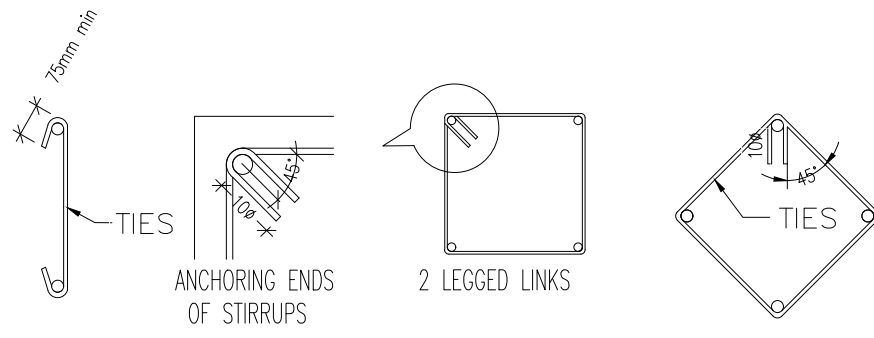


SECTIONAL ELEVATION

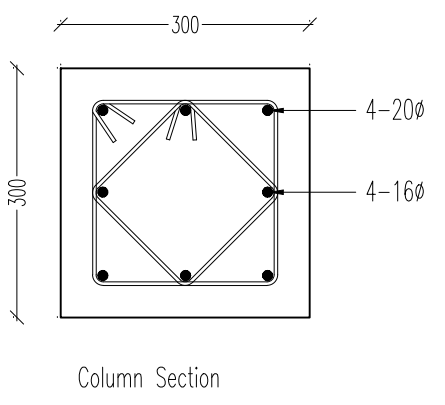
SCHEDULE OF FOOTINGS

Sl.No.	ISOLATED FOOTING	SIZE (Lx x Ly)	COLUMN SIZE	BOTTOM REBAR		TOP REBAR		PAD DEPTH D	FOUNDATION DEPTH Fdn. D
				X	Y	X	Y		
1	F-1	1500 x 1500	300 x 300	12Ø@150C/C	12Ø@150C/C	10Ø@150C/C	10Ø@150C/C	300	1500

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DESIGNED / DRAWN: 			APPROVED: 		
(DR. H. KHILEY) BE / MPE-CIVIL			DATE: FEBRUARY 2021		
DWG. NO: BPC/TCD/TPD/12-01/DWG-C/PH-STRU-03			SCALE: AS STATED		
			REV. RO		



Bar Dia.	Development Length (Ld)	Anchorage Length (La)
12Ø	684	804
16Ø	912	1072
20Ø	1140	1340
25Ø	1425	1675

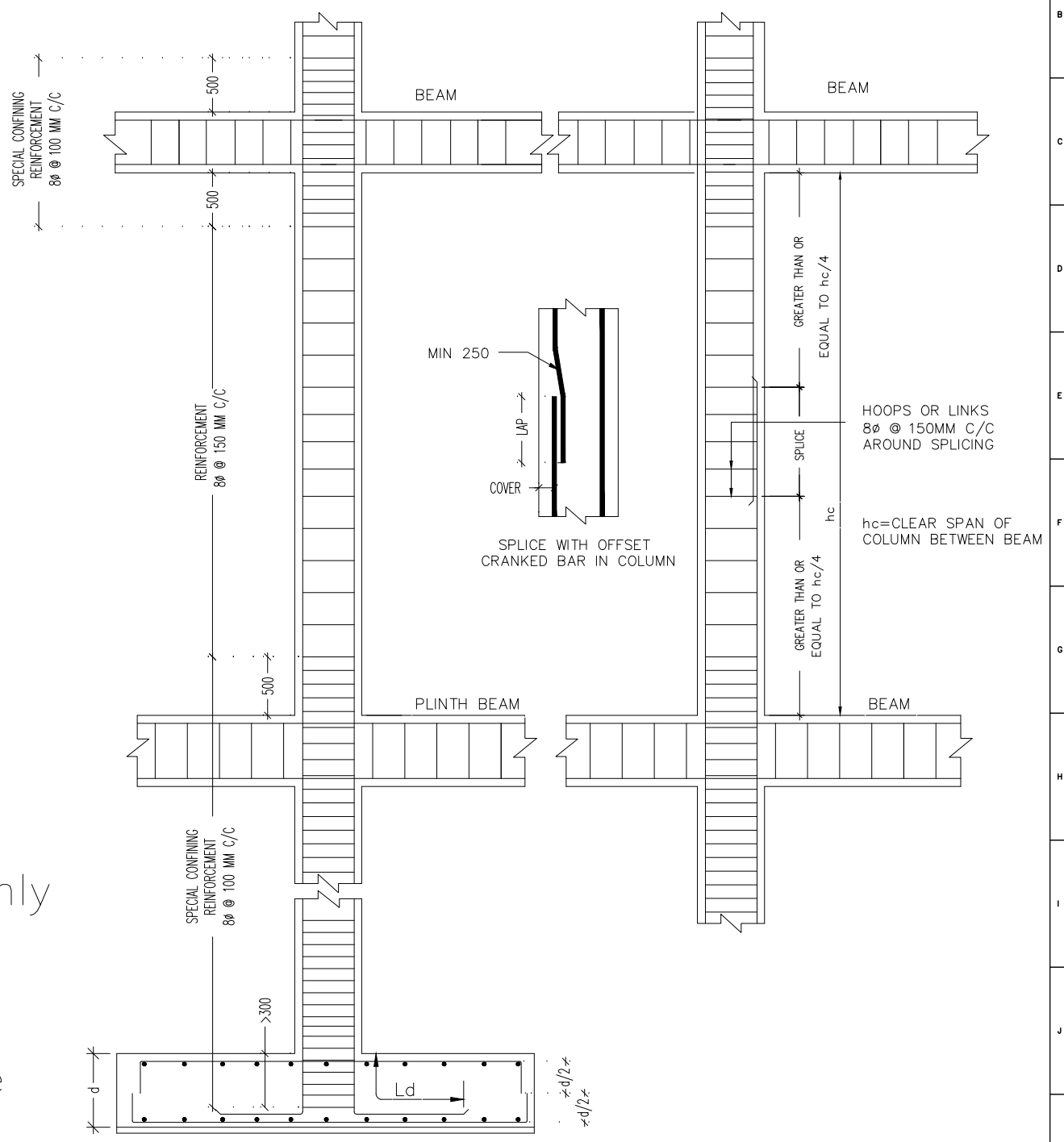


SCHEDULE FOR COLUMN

SL.NO	COLUMN	SIZE	REINFORCEMENTS		
			LONGITUDINAL	TIES	
				NORMAL	SPECIAL CONFINING
1	C1	300x300	4-20Ø+4-16Ø	8Ø @ 150 C/C	8Ø @ 100 C/C

NOTE:-

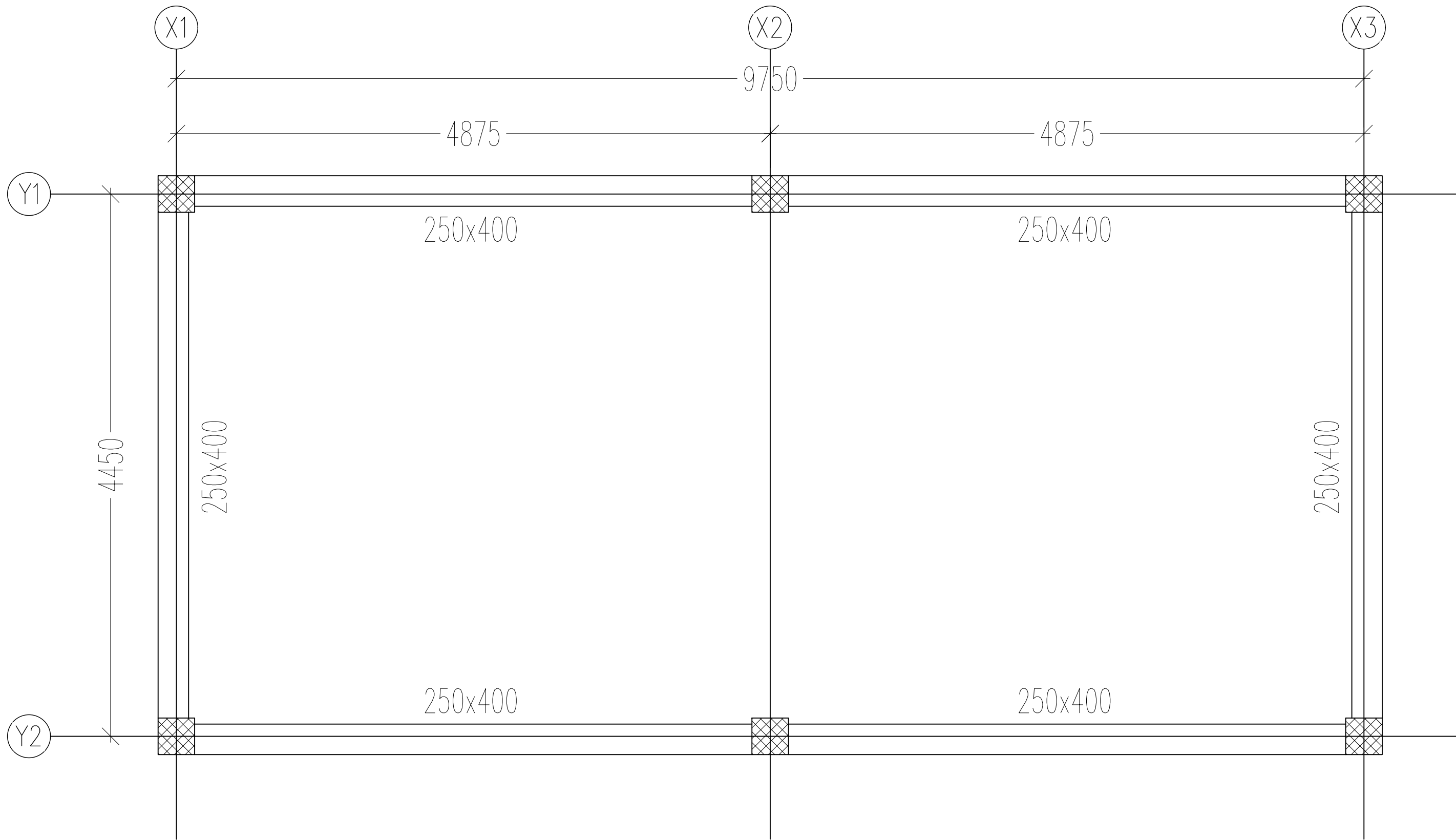
1. Main Bars splices in column shall be located only in the central half of the column length
2. Only 50% of the bars shall be spliced at any storey, but if more than 50% of the bars are spliced at one location, the lap length shall be increased by 30%;
3. Same section and main reinforcement shall be provided for entire length of the column;
4. Special confining steel shall be provided as shown in the drawing and should continue at least 500mm on either sides of the beams;





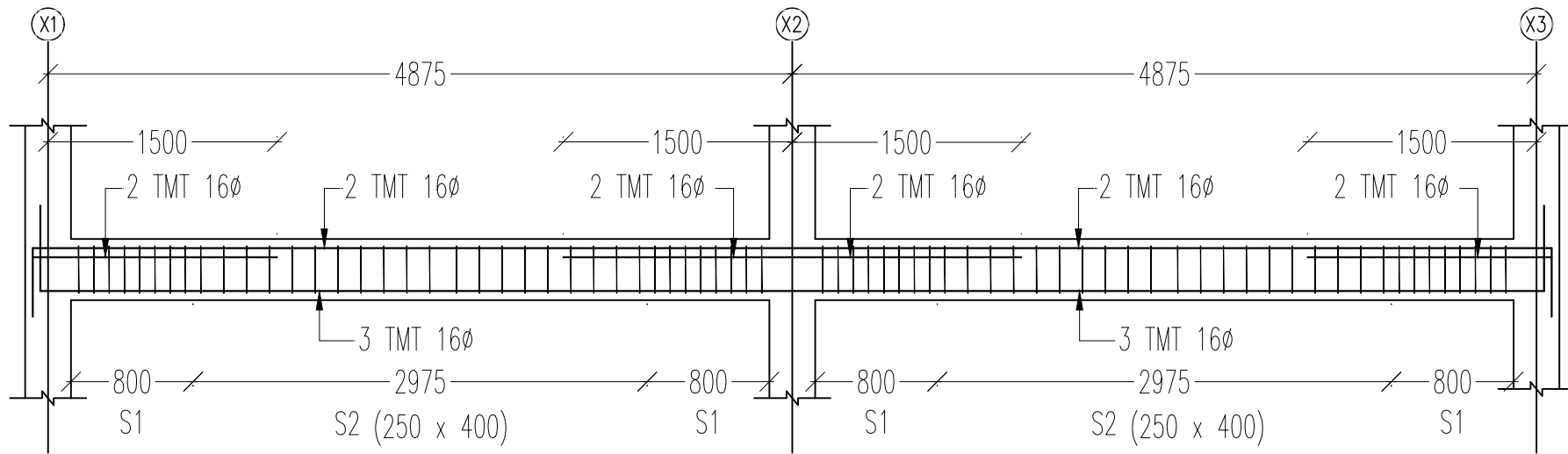
COLUMN & JOINT DETAILING

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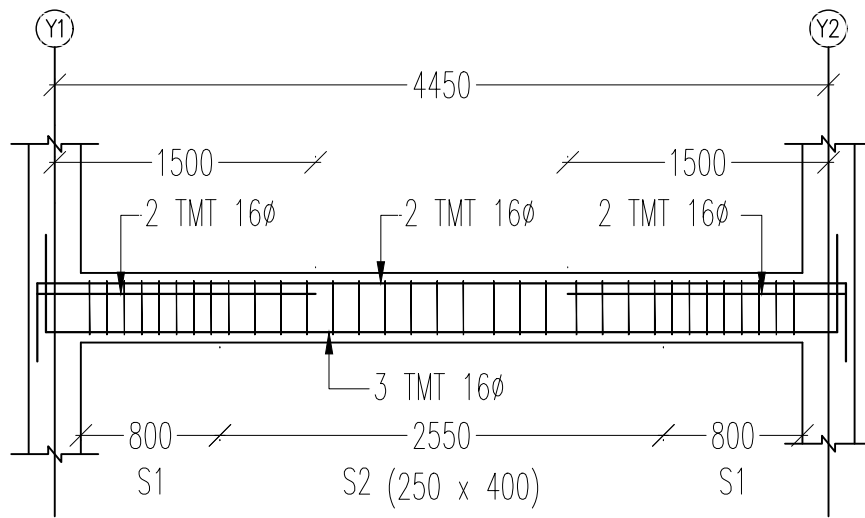
PLINTH BEAM LAYOUT PLAN @ 300MM



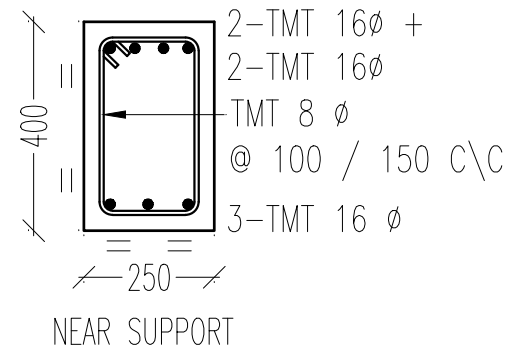
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DESIGNED / DRAWN:			APPROVED:		
(S. H. KHILY) / BE / MPE-CIVIL			 DATE : FEBRUARY 2021		
DWG. NO: BPC/TCD/TPD/12-01/DWG-C/PH-STRU-05			SCALE : AS STATED		
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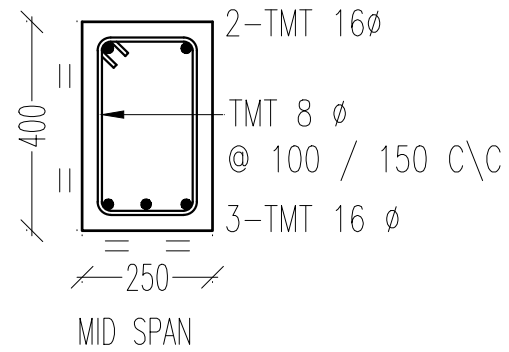
PLINTH BEAM SECTION ALONG GRID Y1 & Y2



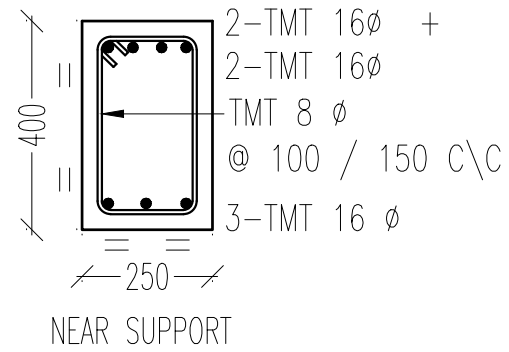
PLINTH BEAM SECTION ALONG GRID X1 & X3



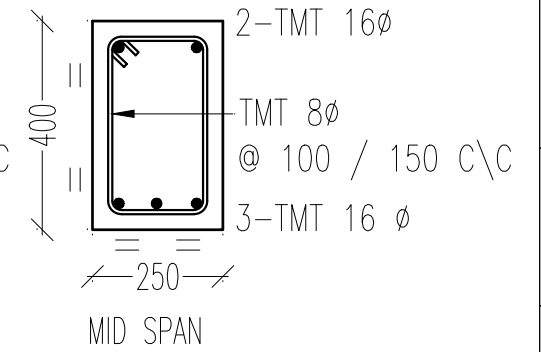
NEAR SUPPORT



MID SPAN




NEAR SUPPORT

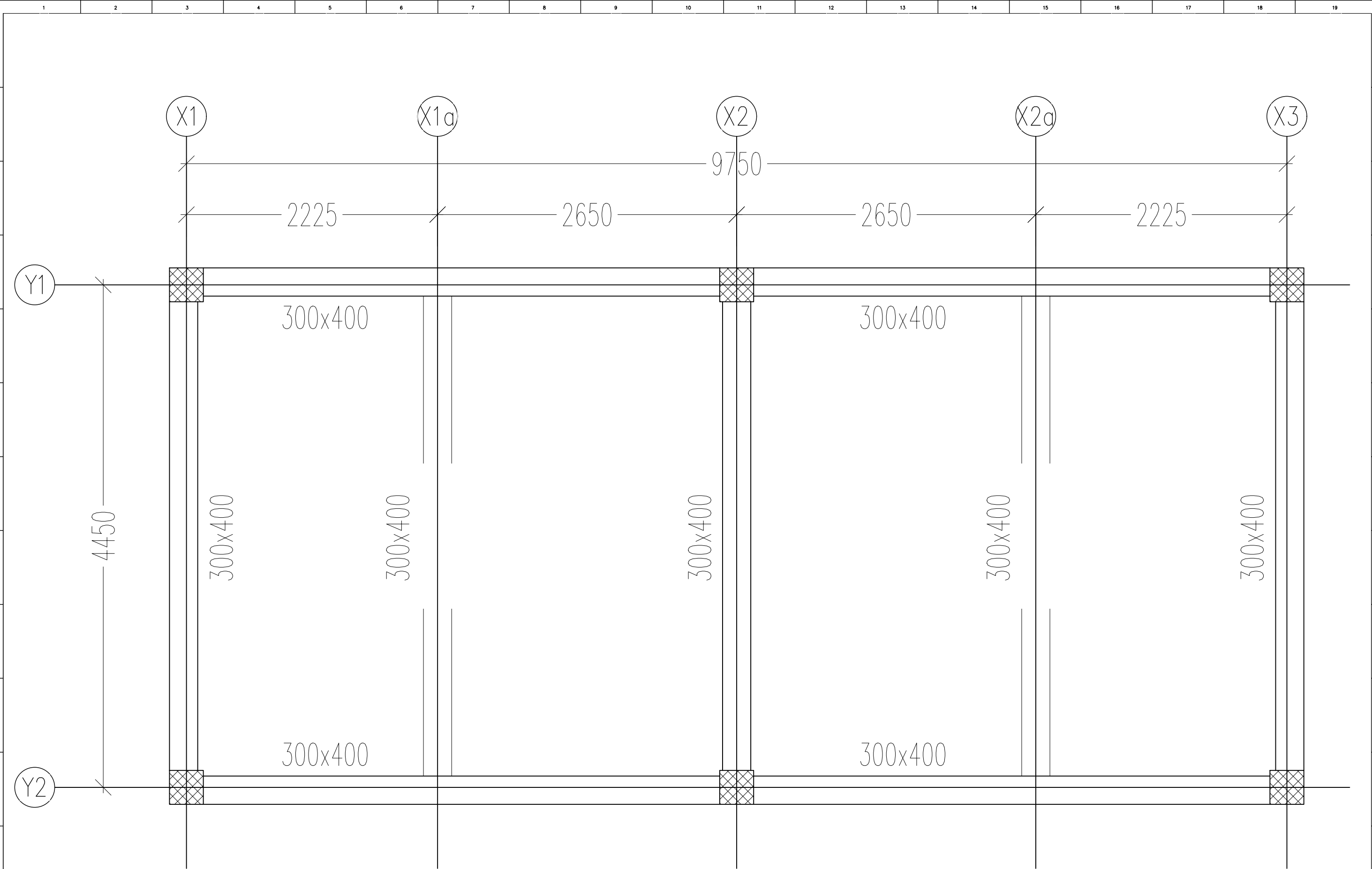


MID SPAN

IMPORTANT NOTE:

1. $S1=2xD$; WHERE D= TOTAL DEPTH OF BEAM.
2. AT S1 TIES ARE TMT 8 ϕ @ 100 mm C\C.
3. AT S2 TIES ARE TMT 8 ϕ @ 150 mm C\C.

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DWG. NO/BPC/TCD/TPD/12-01/DWG-C/PH-STRU-06			REV. RO		



ROOF BEAM LAYOUT PLAN @ 3900MM

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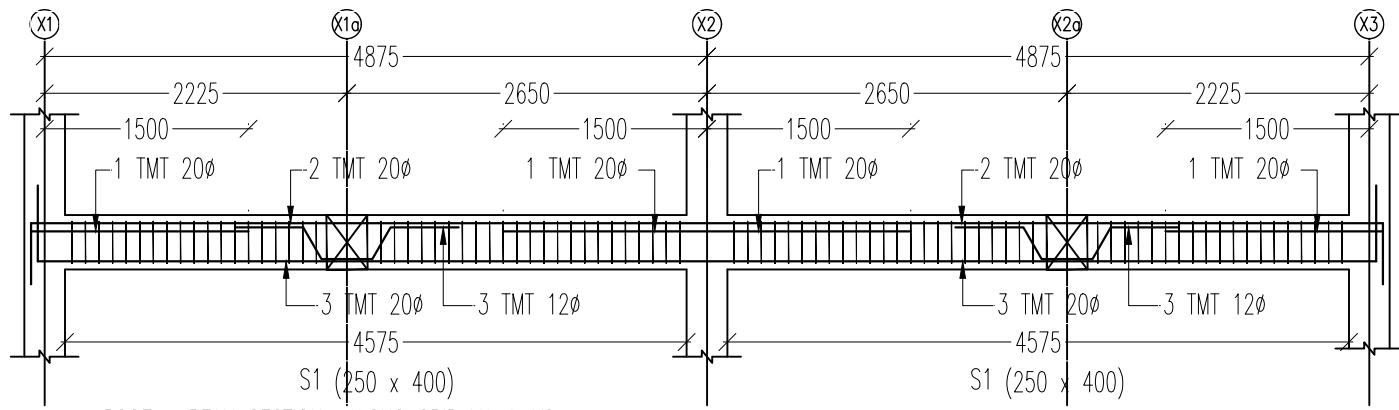
BHUTAN POWER CORPORATION LTD.
TRANSMISSION CONSTRUCTION DEPARTMENT

PROJECT: CONSTRUCTION OF 66/33 kV SUBSTATION
AT JAMTSHOLING, SIPSOG

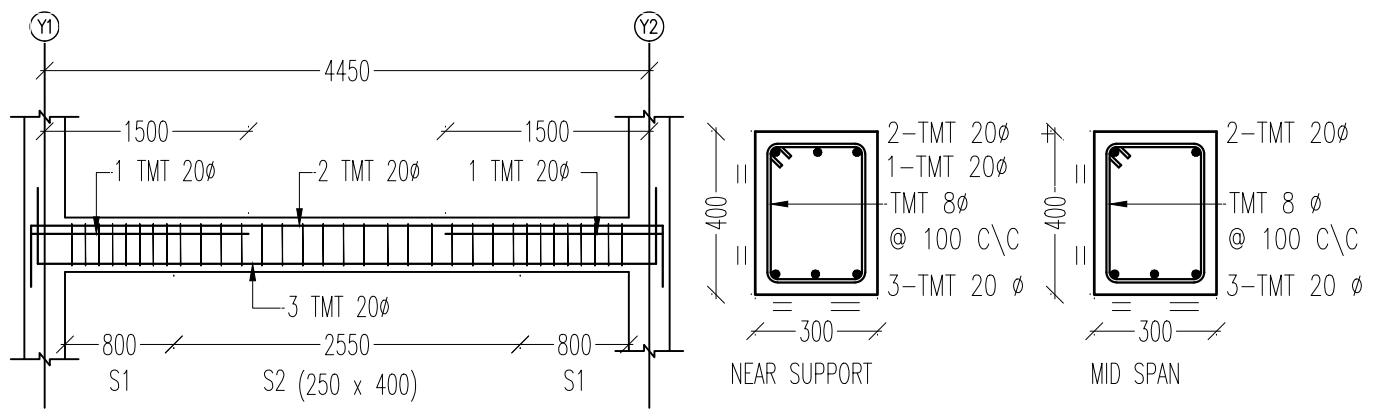
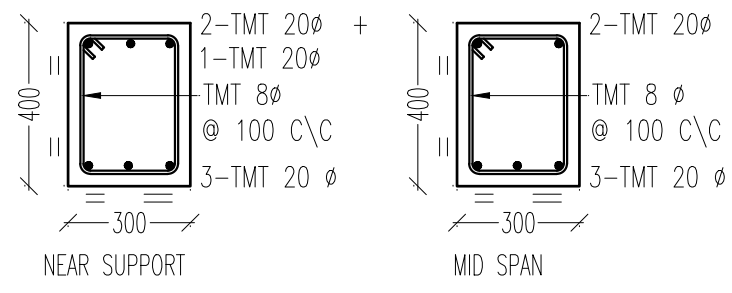
TITLE:
PUMP HOUSE STRUCTURAL DRAWING

DESIGNED / DRAWN: *[Signature]* APPROVED: *[Signature]*
DATE: FEBRUARY 2021
SCALE: AS STATED

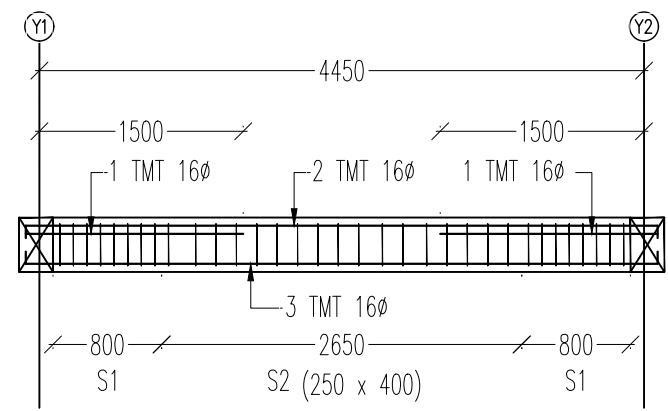
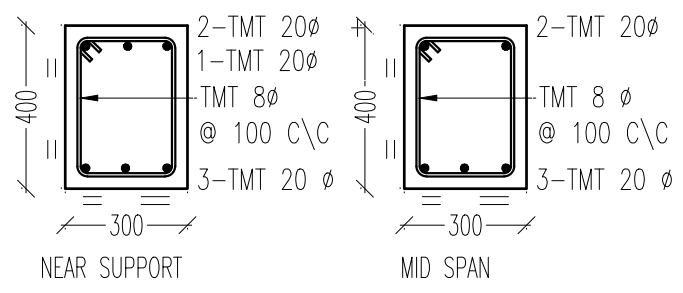
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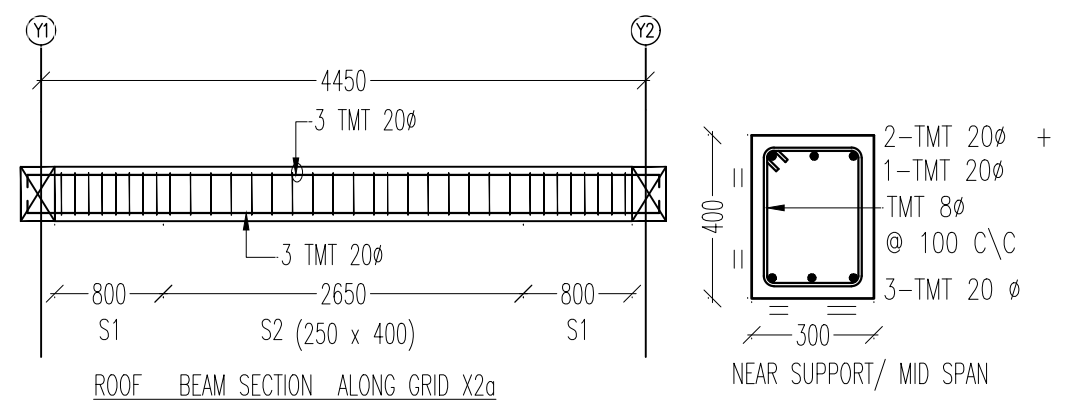
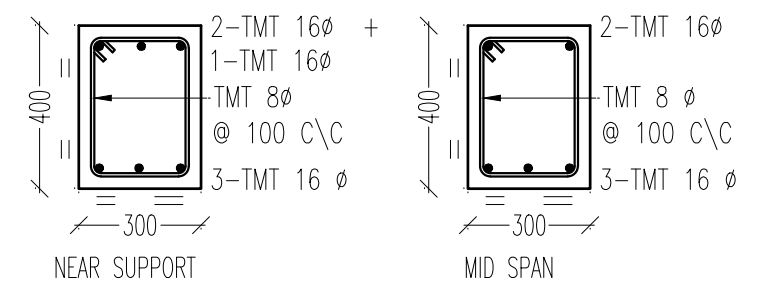
ROOF BEAM SECTION ALONG GRID Y1 & Y2



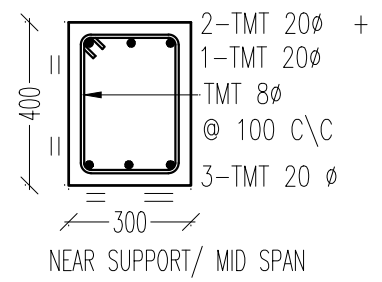
ROOF BEAM SECTION ALONG GRID X1, X2 & X3



ROOF BEAM SECTION ALONG GRID X1a




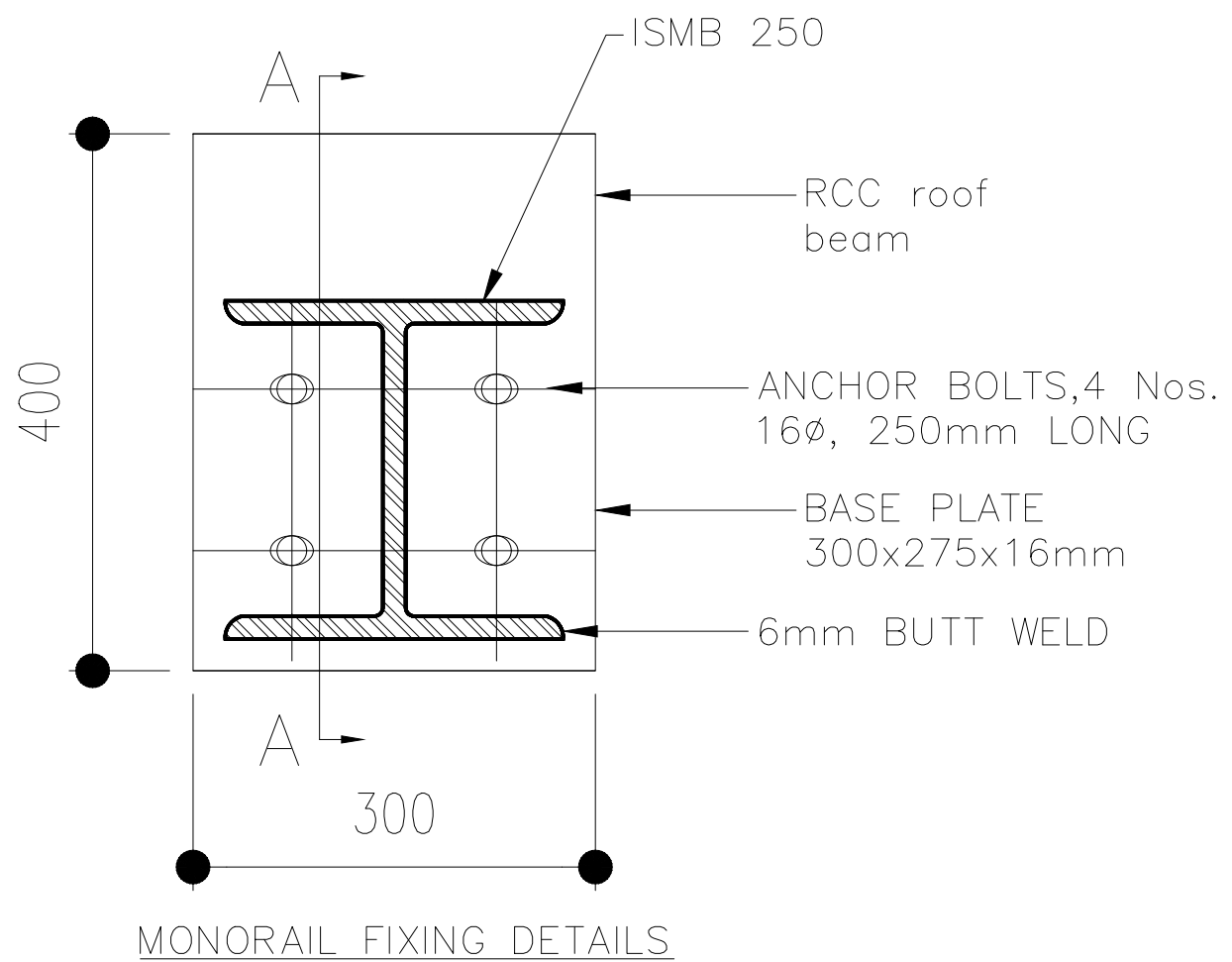
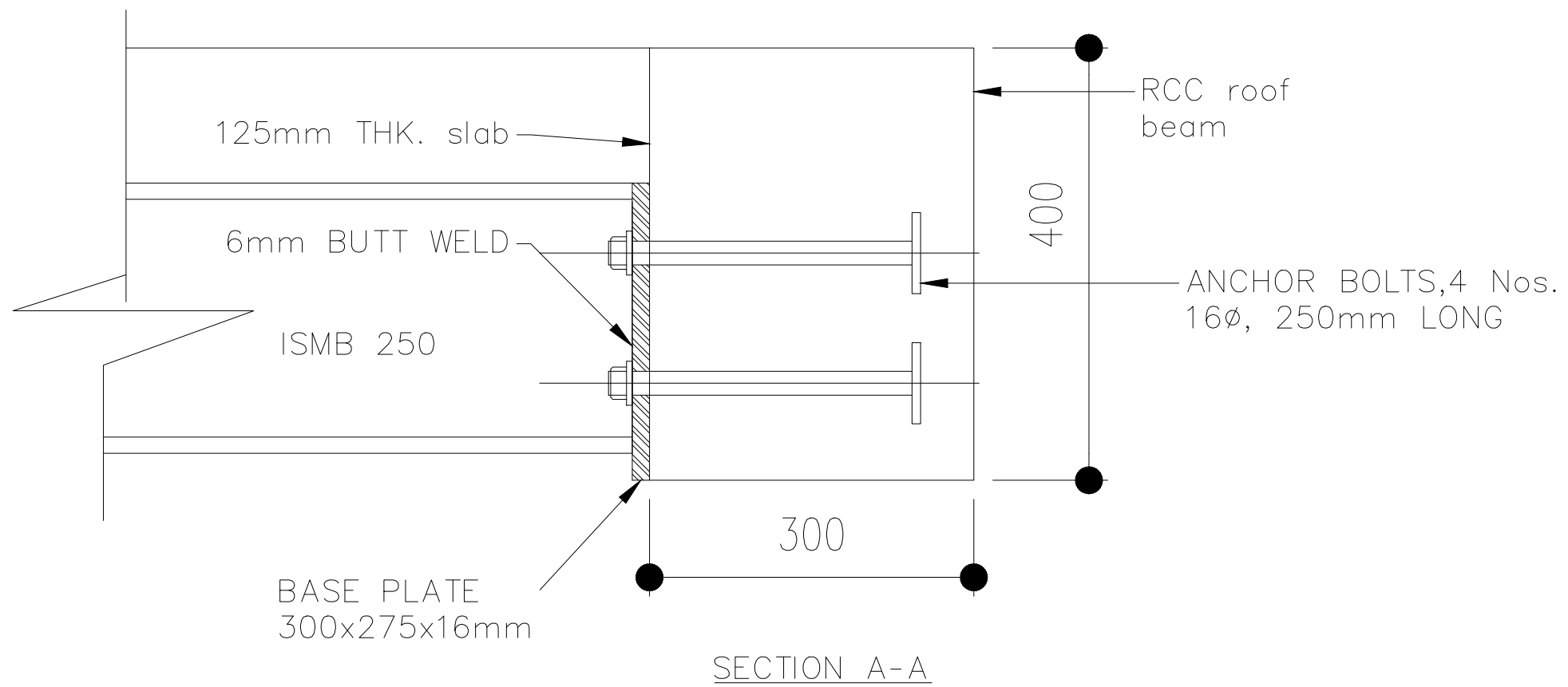
ROOF BEAM SECTION ALONG GRID X2a




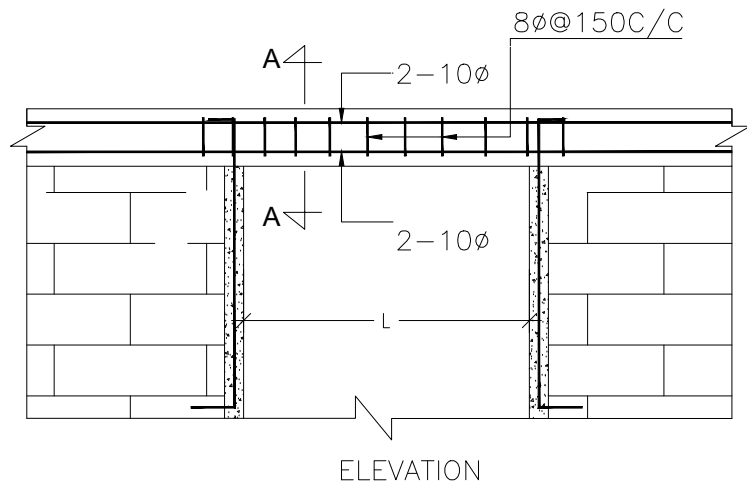
IMPORTANT NOTE:

- S1=2xD ; WHERE D= TOTAL DEPTH OF BEAM.
- AT S1 TIES ARE TMT 8 φ @ 100 mm C\C.
- AT S2 TIES ARE TMT 8 φ @ 150 mm C\C.

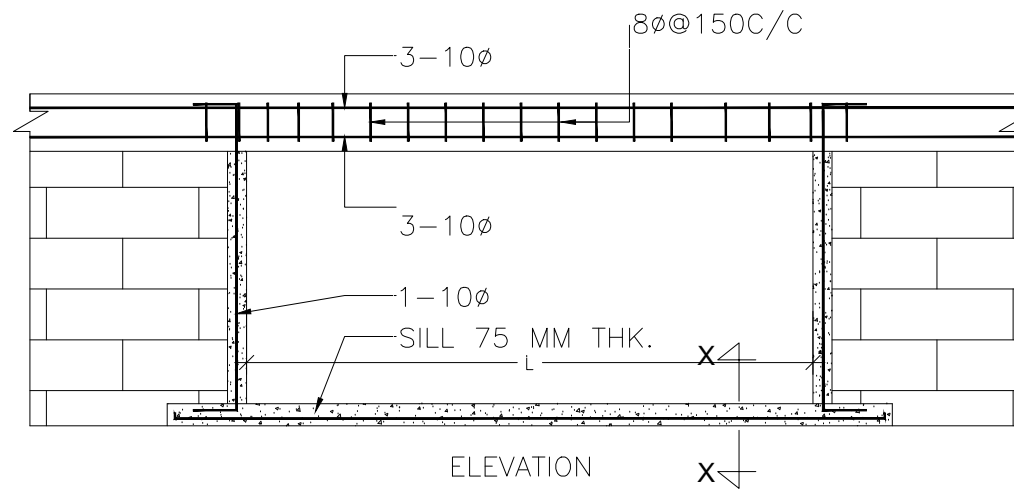
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(DORJI KHILEY) BE / MPE-CIVIL			DATE : FEBRUARY 2021		
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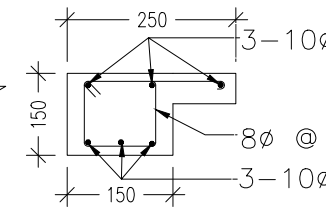
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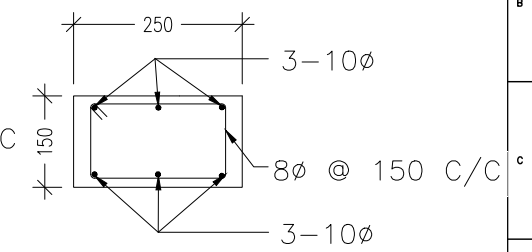
ELEVATION



ELEVATION

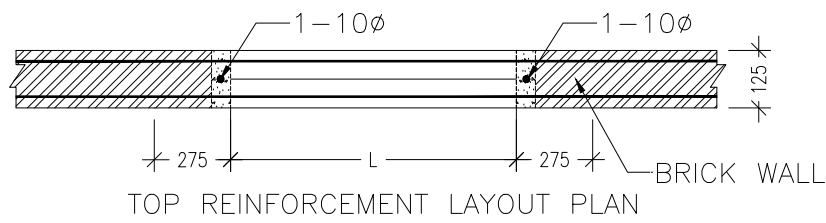


SECTION C-C

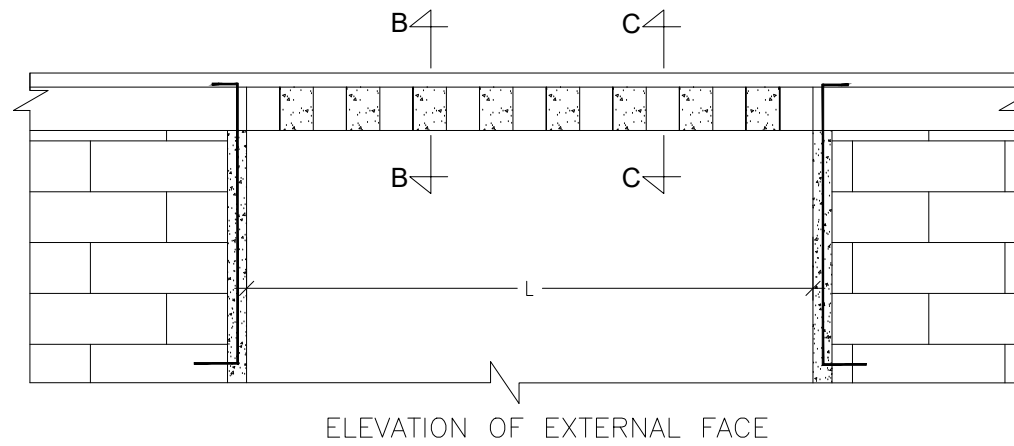


SECTION B-B

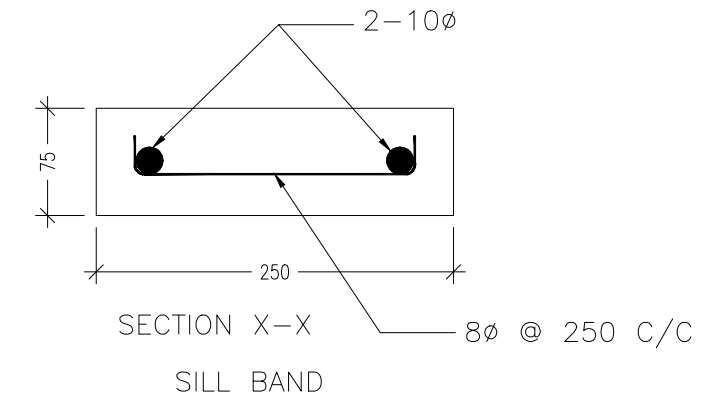
LINTEL SECTION DETAILS FOR 250mm THICK WALL



TOP REINFORCEMENT LAYOUT PLAN

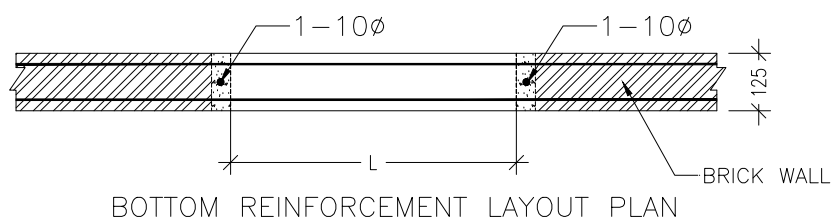


ELEVATION OF EXTERNAL FACE

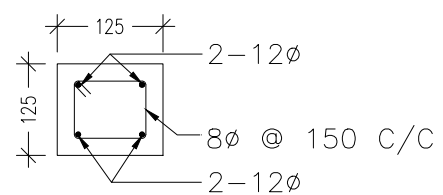


SECTION X-X

SILL BAND



BOTTOM REINFORCEMENT LAYOUT PLAN



SECTION A-A

LINTEL DETAILS FOR 125MM THICK. WALL



TOP REINFORCEMENT LAYOUT PLAN




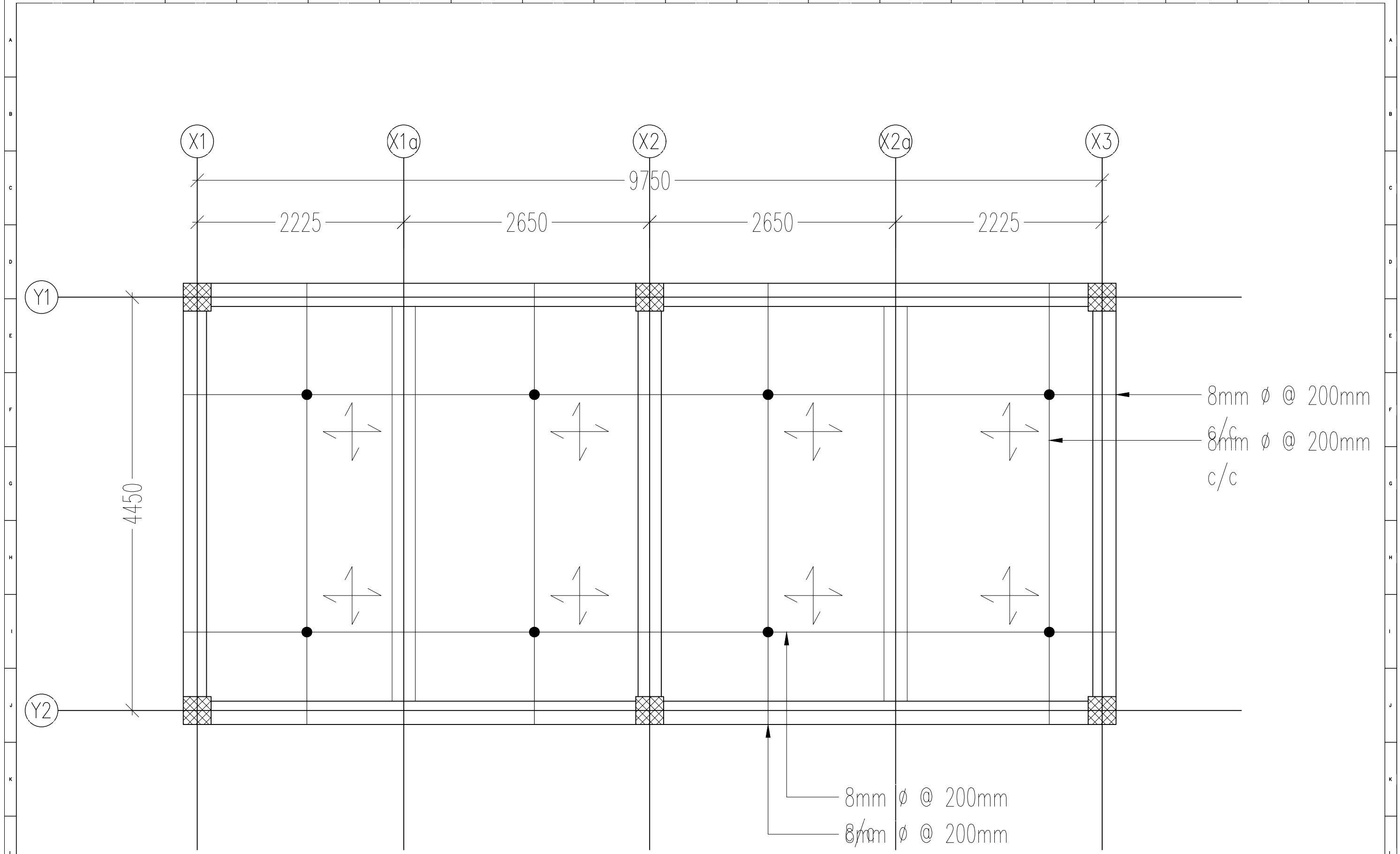
BOTTOM REINFORCEMENT LAYOUT PLAN

LINTEL DETAIL FOR 250 MM THICK. WALL

LINTEL BEAM DETAIL

NOTE:
LINTEL SHOULD BE PROVIDED AROUND THE MAIN WALL



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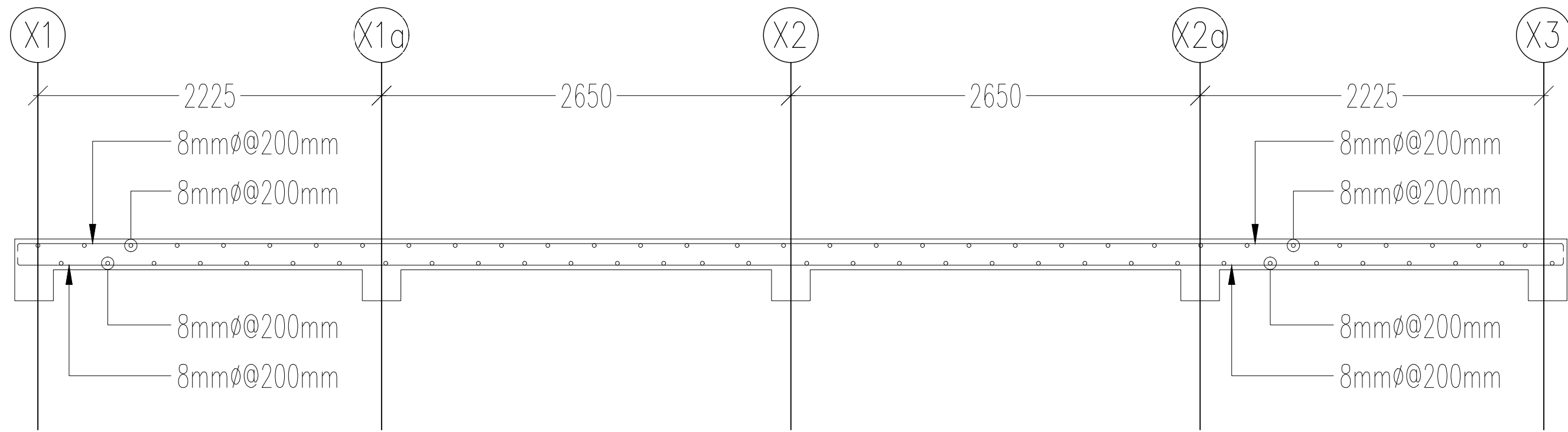


8mm ϕ @ 200mm
 8/c ϕ @ 200mm
 c/c

8mm ϕ @ 200mm
 8/c ϕ @ 200mm
 c/c

ROOF SLAB REINFORCEMENT LAYOUT PLAN@ 3.900M



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(DOB: 1985) BE / MPE-CIVIL			DATE : FEBRUARY 2021		
DWG. NO: BPC/TCD/TPD/12-01/DWG-C/PH-STRU-10			SCALE : AS STATED		
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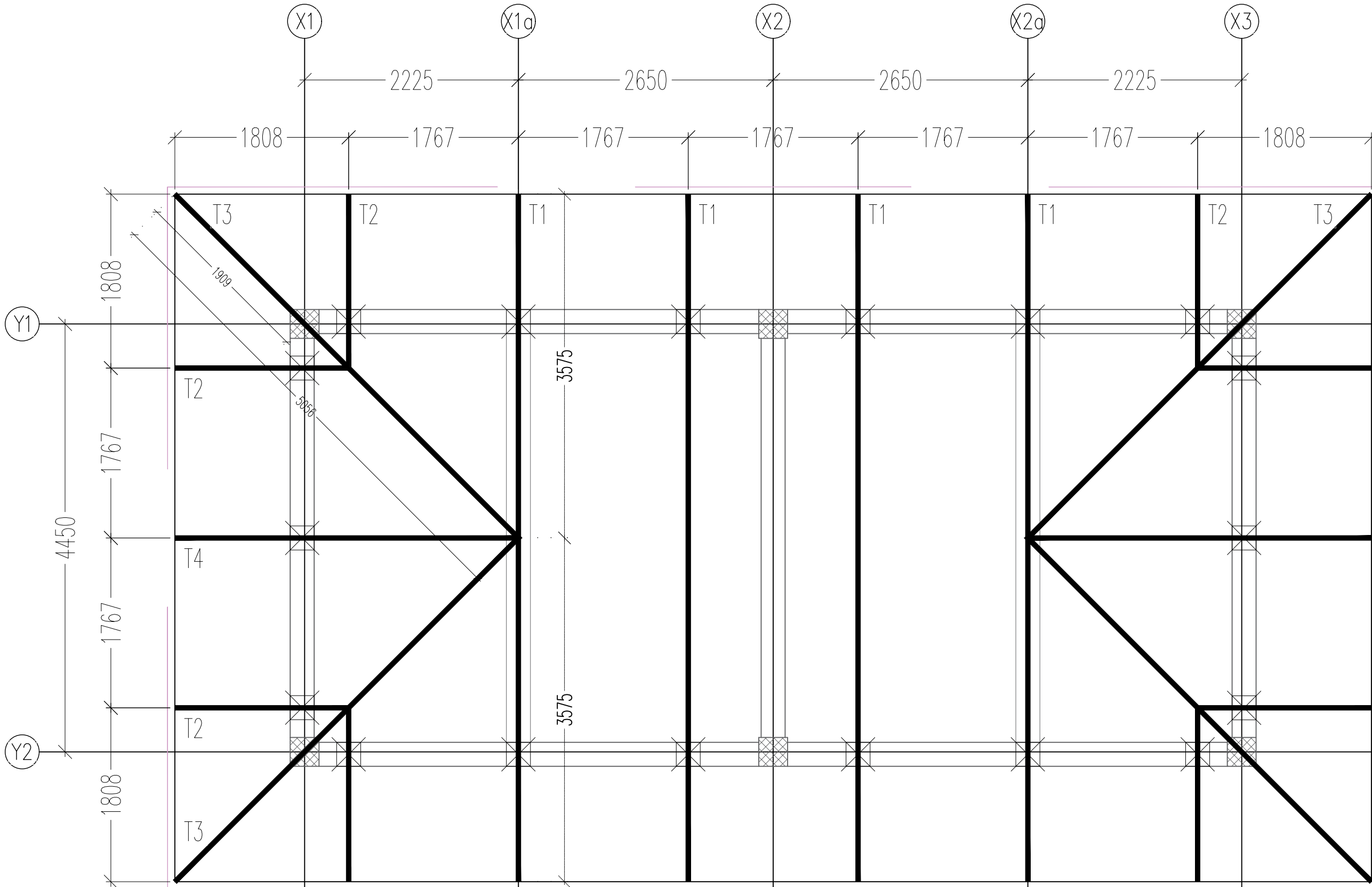


SECTION THROUGH X-X FOR ROOF SLAB



detailing notes:

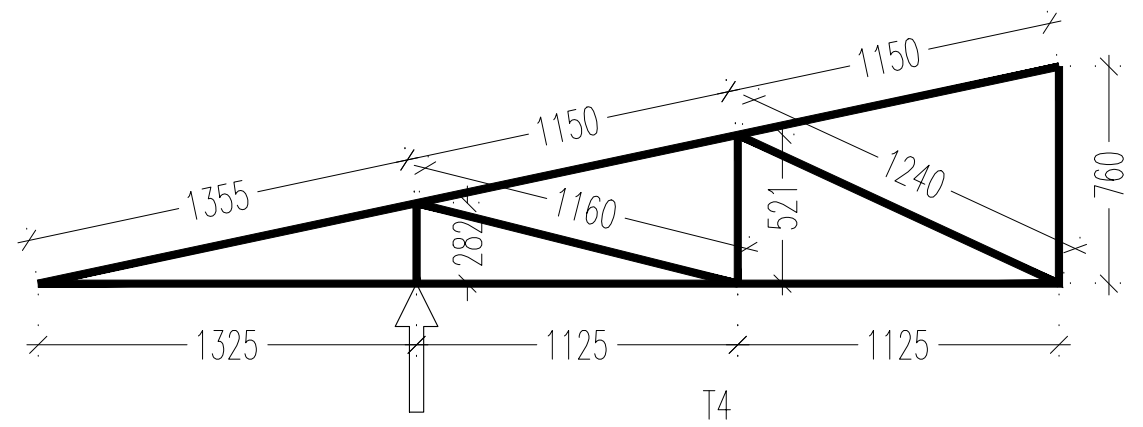
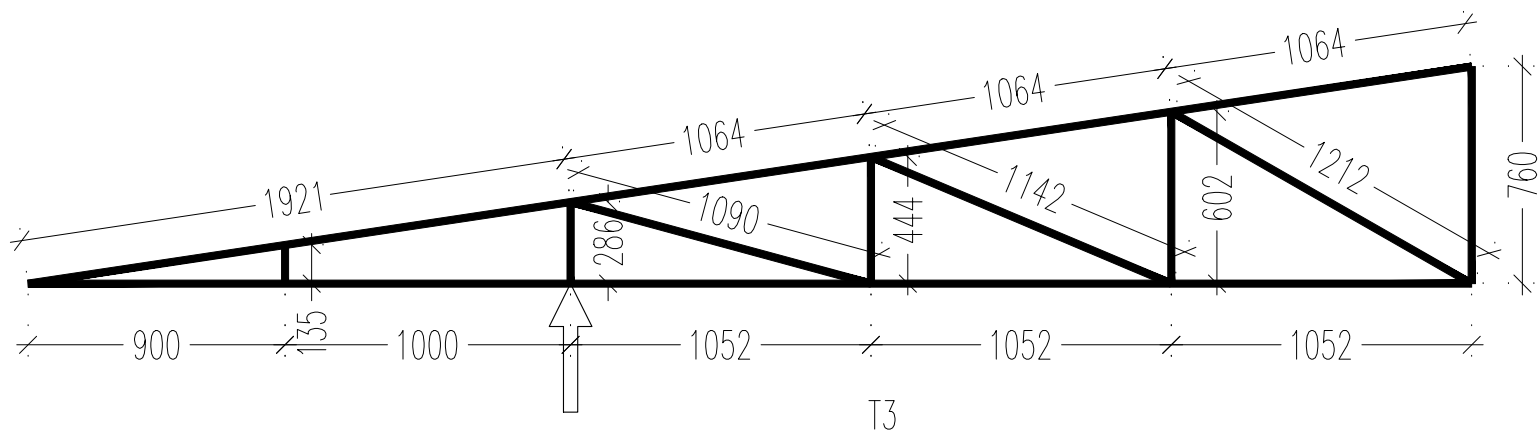
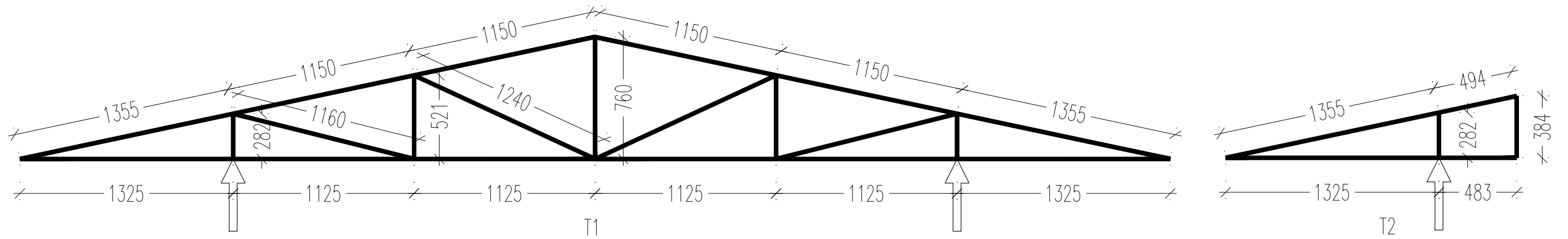
1. Floor slab thickness = 125 mm for all floors.
2. Slab bottom reinforcements will be TMT-8 \emptyset @ 200 c/c bothways.
3. Slab top reinforcements will be TMT- 8 \emptyset @ 200 c/c bothways.
4. The main reinforcement shall be place at bottom in the shorter direction,
5. Grade of steel for RCC slab work...Fe 500 (BSB approved brands),
6. Grade of concrete for RCC slabs work...M20,
7. Chairs shall be placed at appropriate location to prevent the bars from bending and reducing effective depth of the slab,
8. The slab shall be cast monolithically with the floor beam/bands and must be connected properly with the rc beams/bands..
9. Builder is to provide adequate bar chairs or support cages to support top reinforcement at the correct centres(spacing)

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			REV. RO		





ROOF TRUSS LAYOUT PLAN

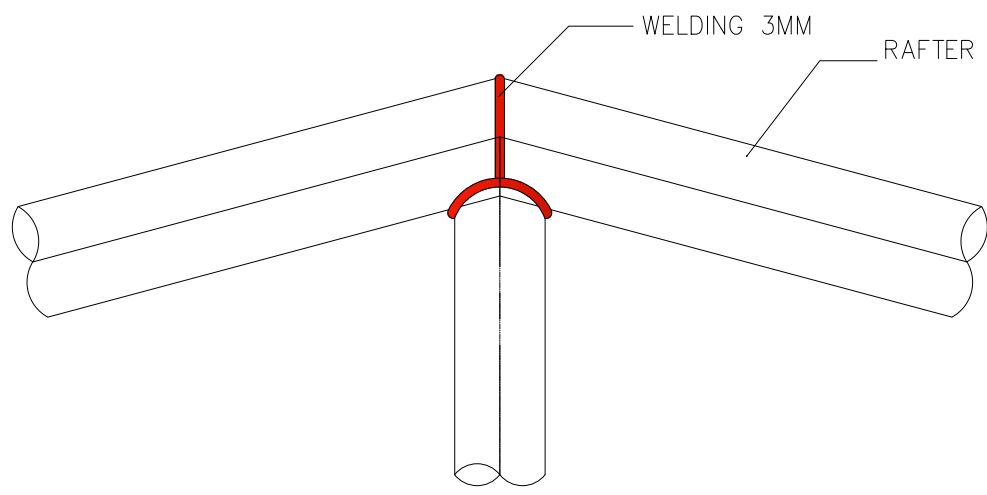
REV.	DATE	DESCRIPTION	BY	CHKD.	APPRD.
 BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT					
PROJECT : CONSTRUCTION OF 66/33 kV SUBSTATION AT JAMTSHOLING, SIPSOO					
TITLE : PUMP HOUSE STRUCTURAL DRAWING					
DESIGNED / DRAWING :			APPROVED :		
(DORJI KHILEY) BE / MPE-CIVIL			 DATE : FEBRUARY 2021		
DWG. NO: BPC/TCD/TPO/12-01/DWG-C/PH-STRU-12					REV. RO
SCALE : AS STATED					



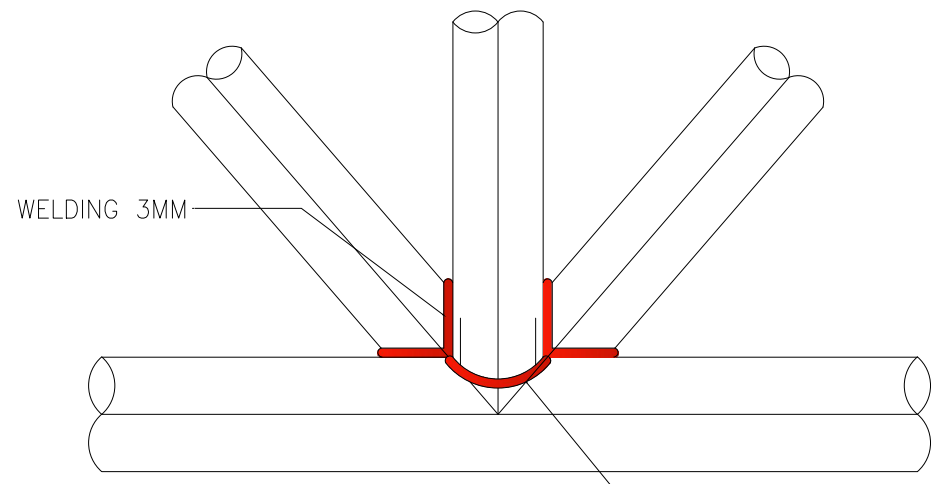
TRUSS MEMBER SIZE

Sl. No	MEMBERS	SIZE
1	Bottom Chords	60.3mm OD, 3.6mm thick, 5.03kg/m
2	Rafters	60.3mm OD, 3.6mm thick, 5.03kg/m
3	Vertical struts	48.3mm OD, 3.2mm thick, 3.56kg/m
4	Inclined struts	48.3mm OD, 3.2mm thick, 3.56kg/m
5	Purlins	48.3mm OD, 3.2mm thick, 3.56kg/m @ 900c/c(max)

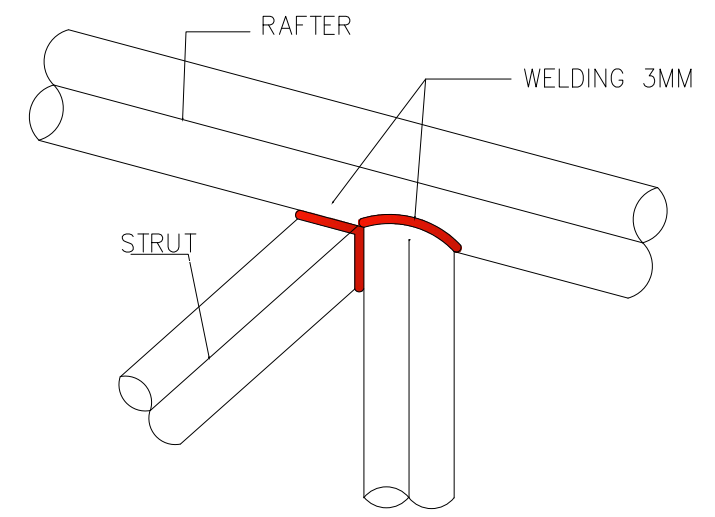
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DWG. NO: BPC/TCD/TPO/12-01/DWG-C/PH-STRU-13			SCALE: AS STATED		
			REV. RO		



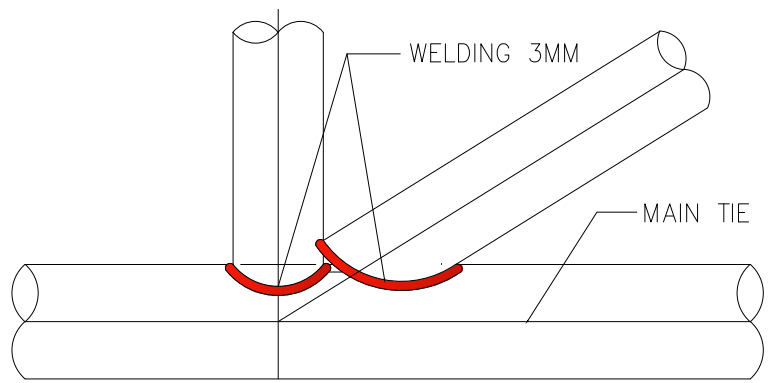
DETAIL AT A



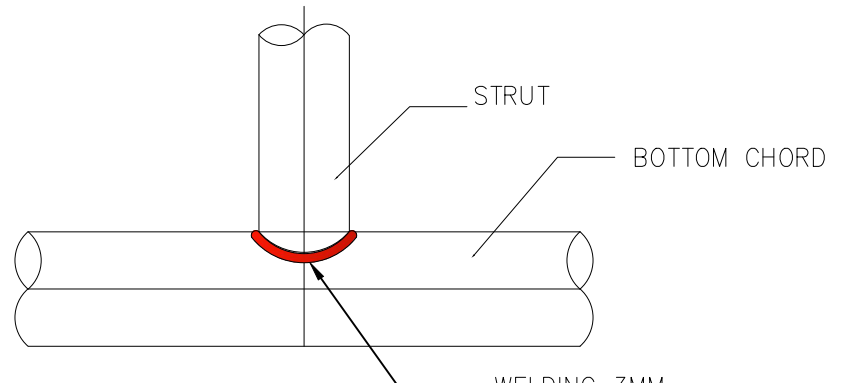
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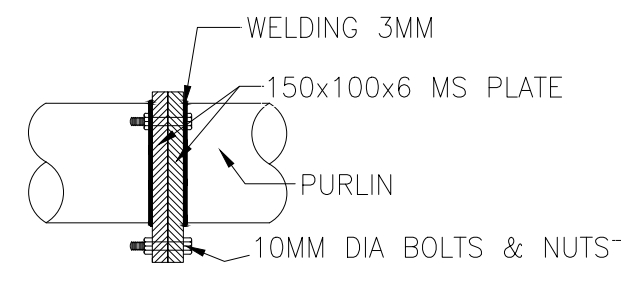
DETAIL AT C



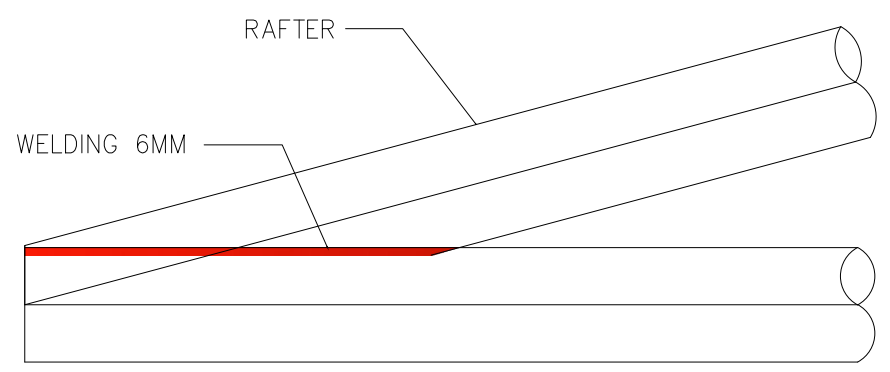
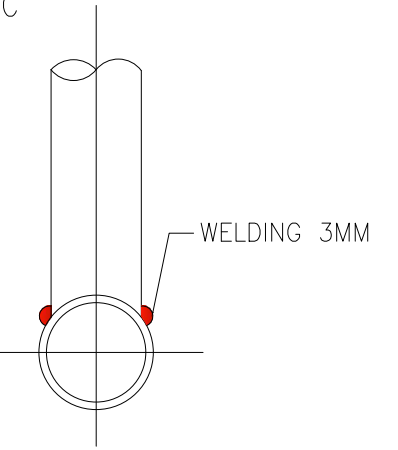
DETAIL AT D



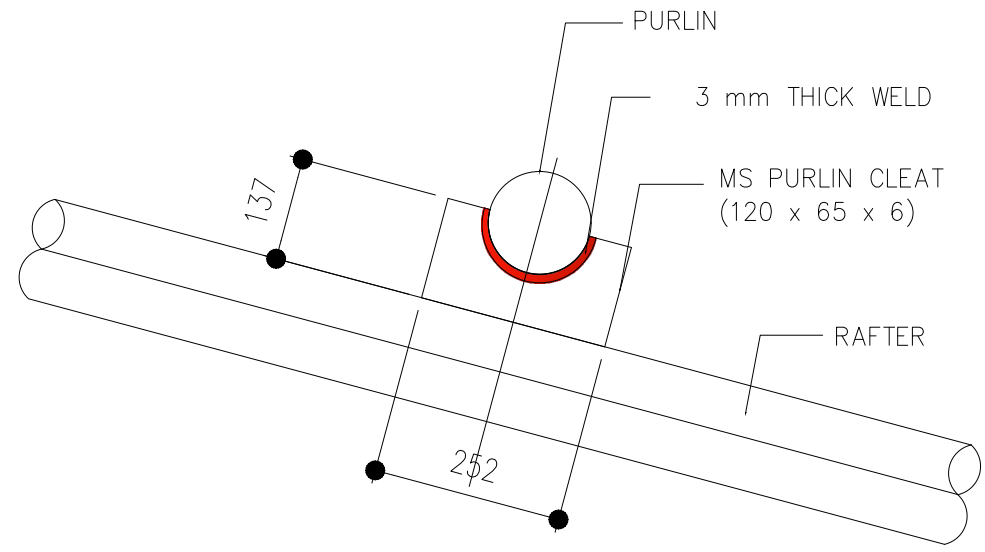
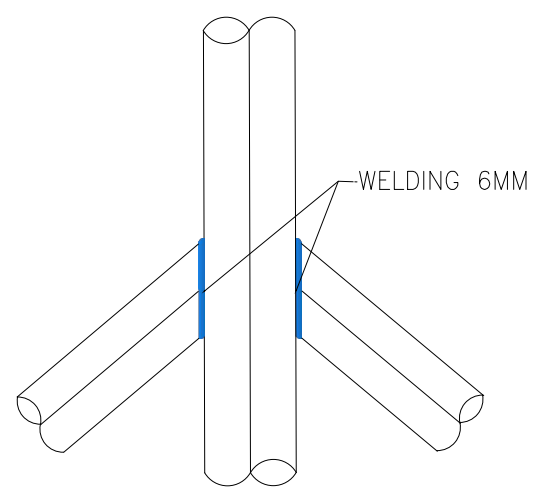
DETAIL AT E




TYPICAL PURLIN & RAFTER JOINERY DETAIL

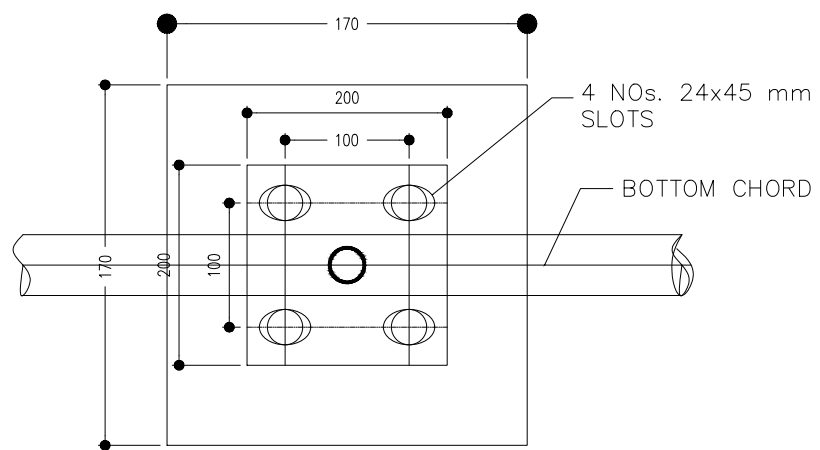


DETAIL AT F

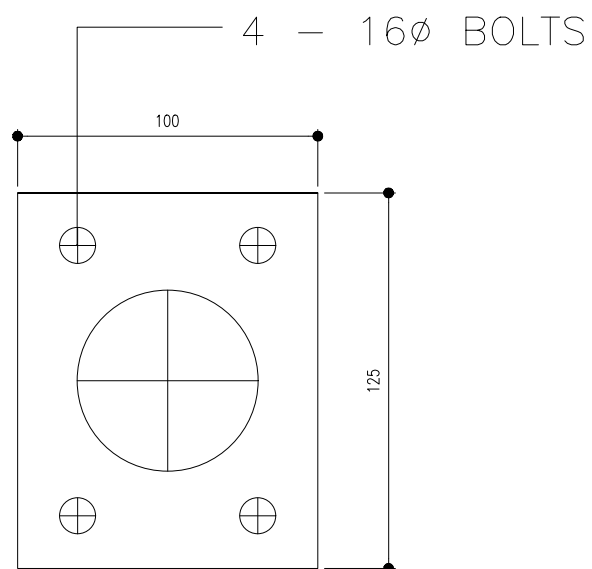


TYPICAL TRUSS JOINERY DETAILS

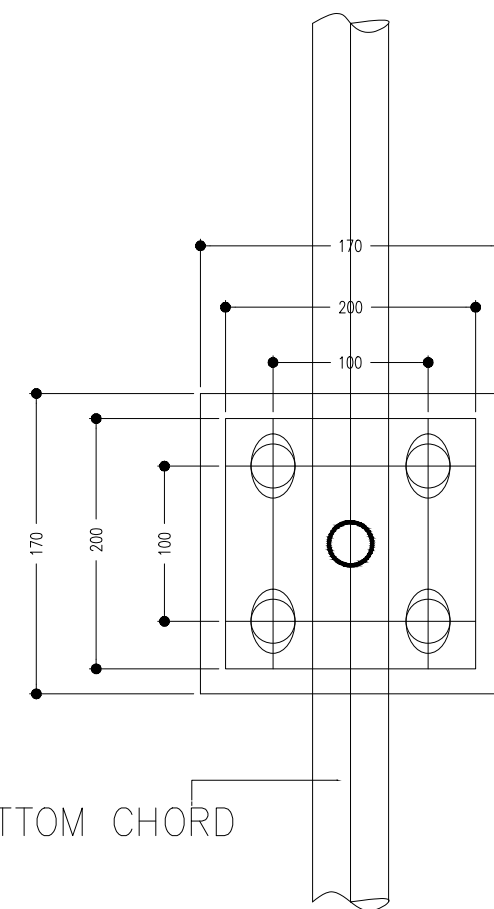
REV	DATE	DESCRIPTION	BY	CHKD.	APPRD.
 BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT					
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(SIGNED)			(SIGNED)		
DWG. NO: BPC/TCD/TPO/12-01/DWG-C/PH-STRU-14			DATE: FEBRUARY 2021		
			SCALE: AS STATED		
			REV. RO		



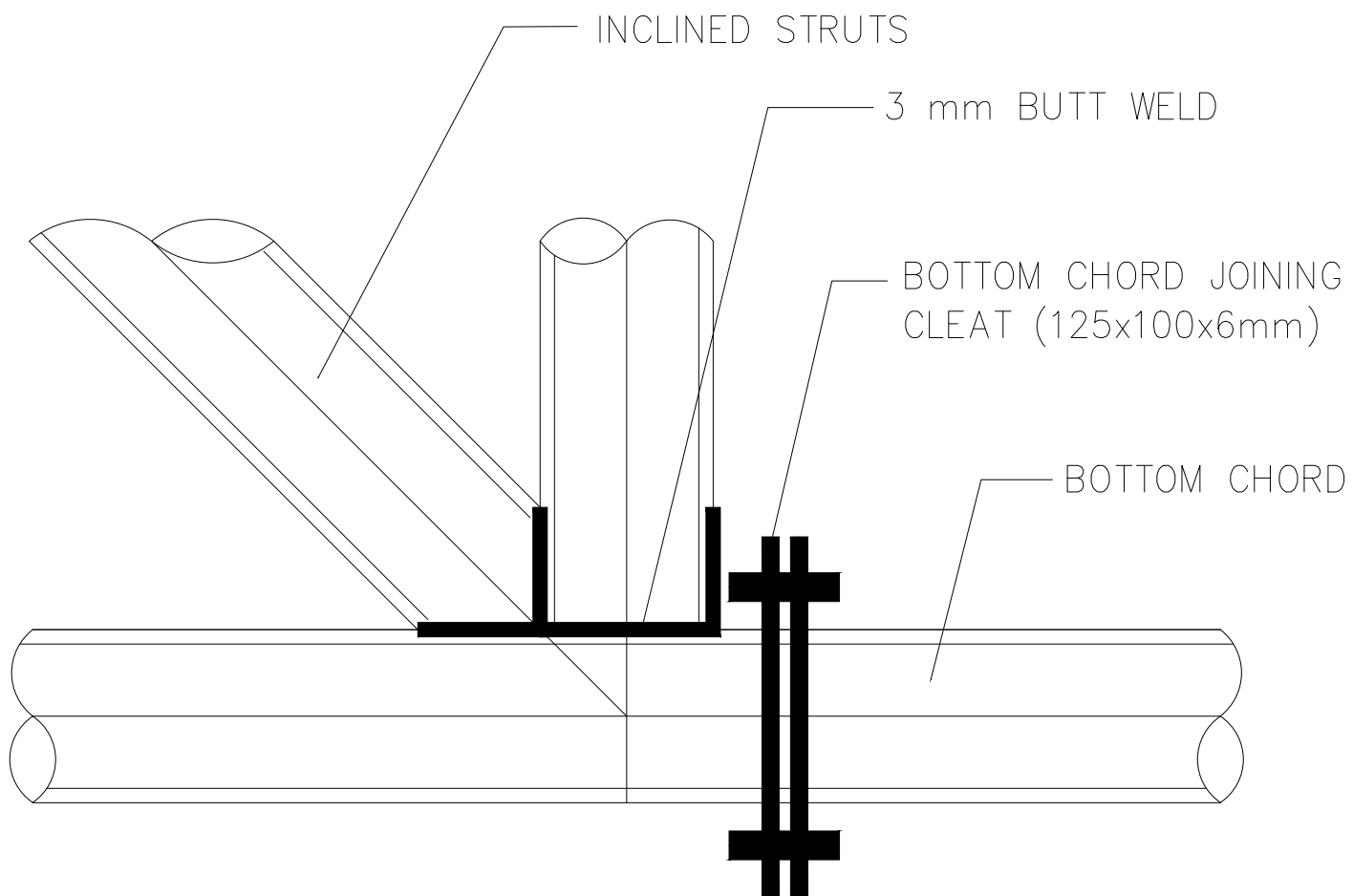
TRUSS HOLD-DOWN IN X DIRECTION



BOTTOM CHORD JOINING PLATE/CLEAT



TRUSS HOLD-DOWN IN Y DIRECTION



BOTTOM CHORD JOINING DETAILS

NOTES (FOR ROOF TRUSS):

1. THE GUSSET PLATES ARE MS PLATE OF DIFFERENT THICKNESS AND DESIGN CONFIRMS TO IS 806:1968
2. WELDING SHALL CONFORM TO IS:816
3. ALL ELECTRODES SHALL CONFORM TO IS:814 (PART-1).
4. ALL M.S. BOLTS & NUTS SHALL CONFORM TO IS:1363(PART1-3)
5. WASHERS SHALL CONFORM TO IS:5369,IS:5370,IS:5372/IS:5374
6. HOLE SIZE = DIA OF BOLT + 1.5mm.
7. ALL STRUCTURES AFTER FABRICATION SHALL BE PAINTED WITH ANTI-CORROSIVE PAINTS.
8. ALL STRUCTURAL STEEL CONTACT SURFACES SHALL BE CLEANED OF ANY RUST, OIL, GREASE etc. BEFORE WELDING/PAINTING.
9. WRITTEN DIMENSIONS SHALL BE FOLLOWED & DOUBT MUST BE CLARIFIED BEFORE EXECUTION OF THE WORK.
10. FABRICATION AND ERECTION WORK SHALL BE CHECKED BY ENGINEER-IN-CHARGE.

NOTE:

1. ALL THE SECTION DETAILS WILL BE SAME AS SHOWN BY SECTIONS A-A & B-B
2. THE PURLINS ARE SPACED AT 1200mm C/C

REV	DATE	DESCRIPTION	BY	CHKD.	APPRD.

BHUTAN POWER CORPORATION LTD.
TRANSMISSION CONSTRUCTION DEPARTMENT

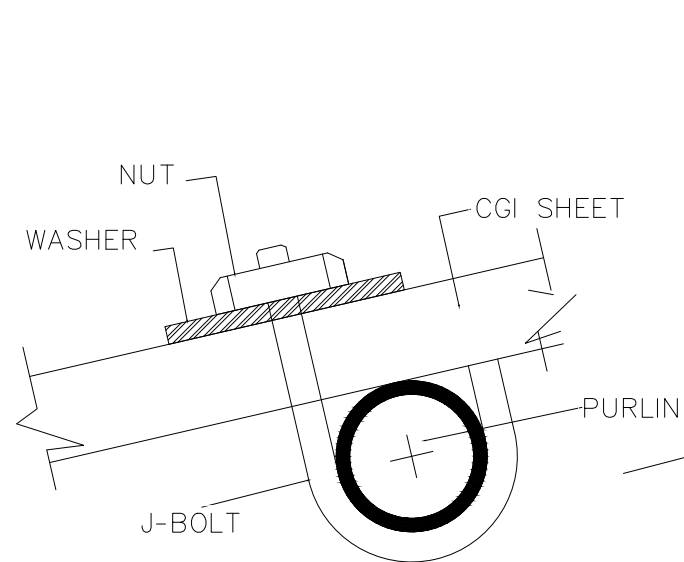
PROJECT: CONSTRUCTION OF 66/35 KV SUBSTATION AT JAMTSHOLING, SIPSOG

TITLE: PUMP HOUSE STRUCTURAL DRAWING

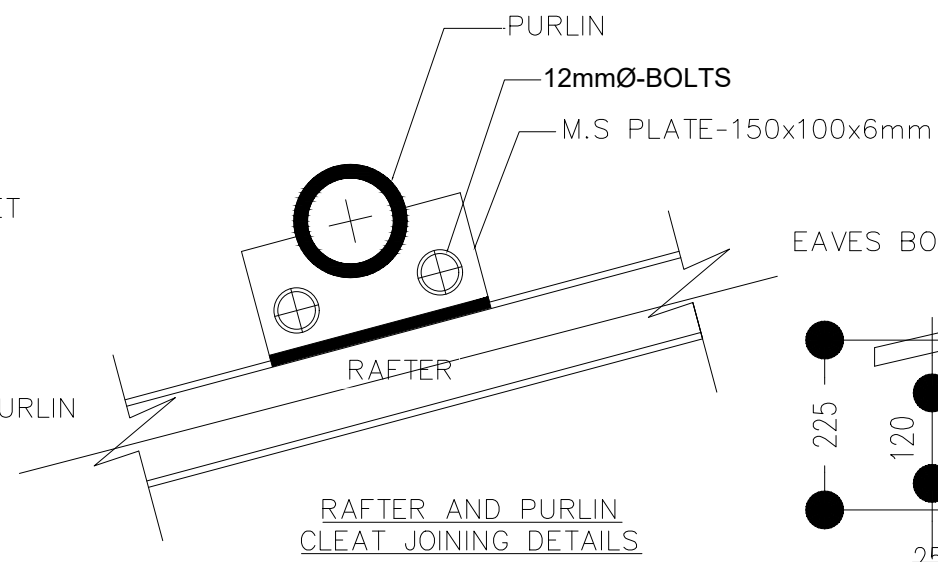
DESIGNED / DRAWN: *[Signature]* APPROVED: *[Signature]*

DATE: FEBRUARY 2021 SCALE: AS STATED

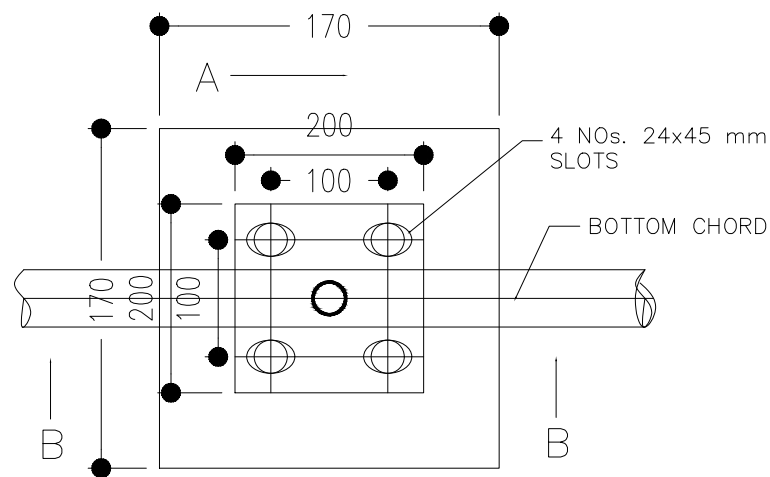
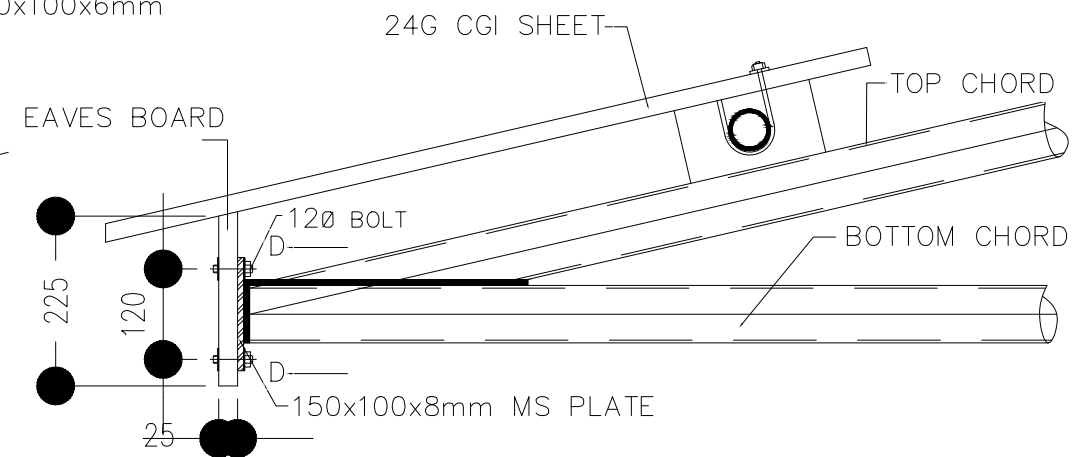
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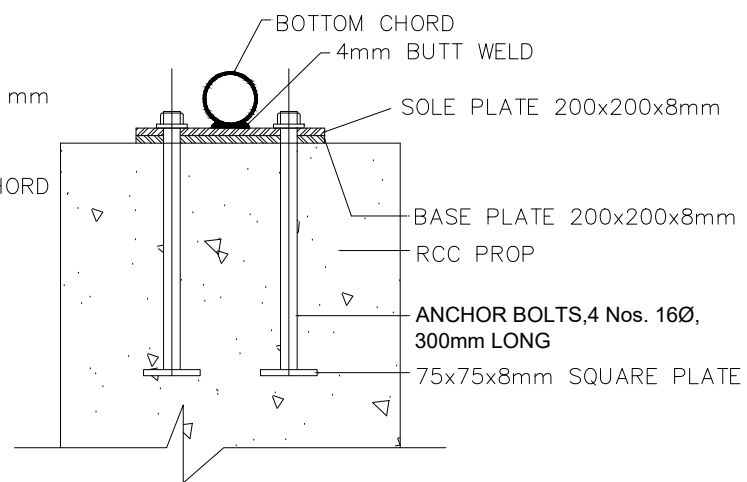
CONNECTION OF CGI SHEET TO PURLIN



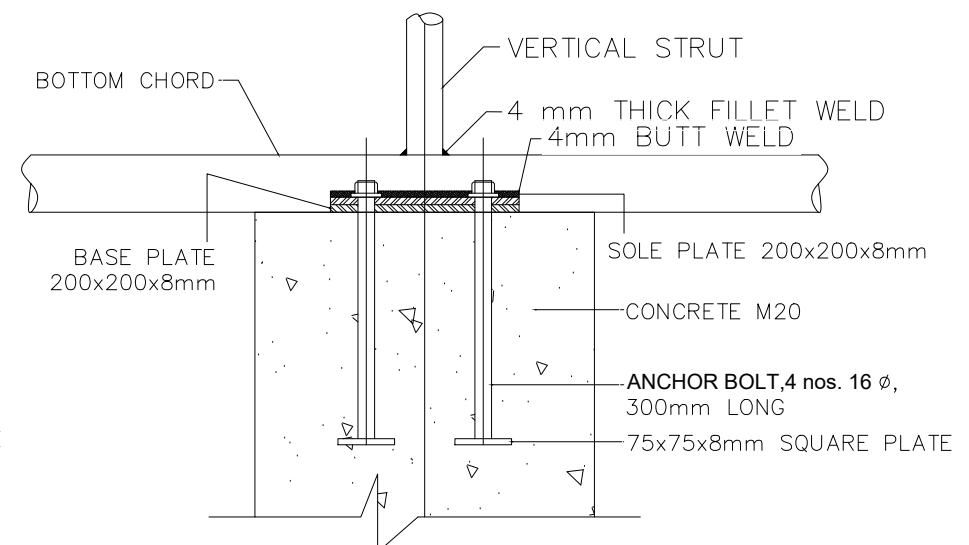
RAFTER AND PURLIN CLEAT JOINING DETAILS




TRUSS HOLDING DOWN DETAILS

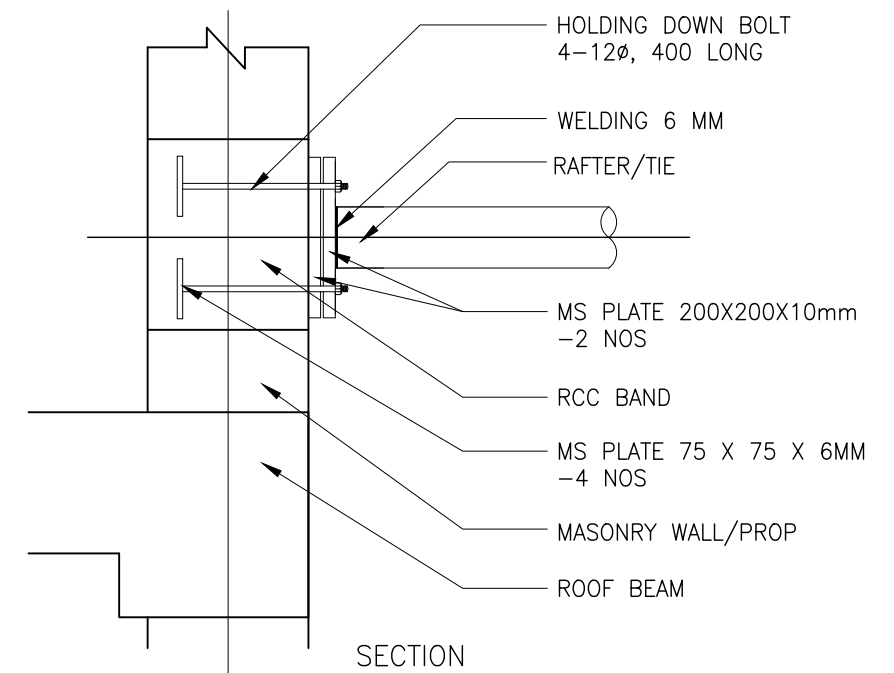
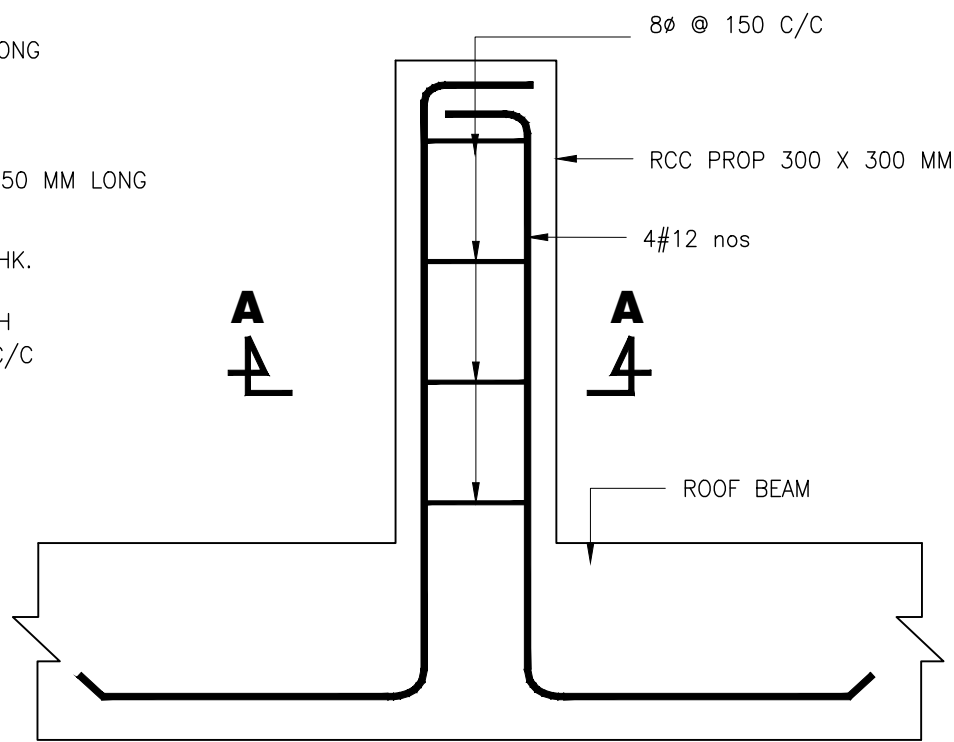
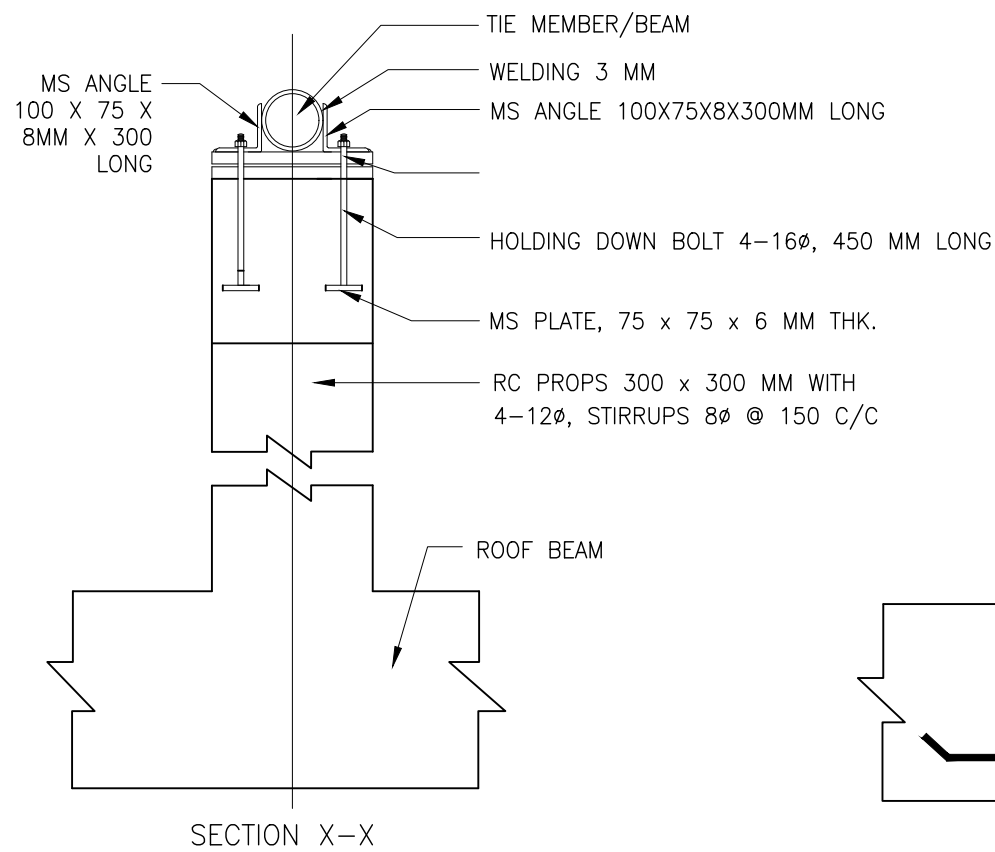
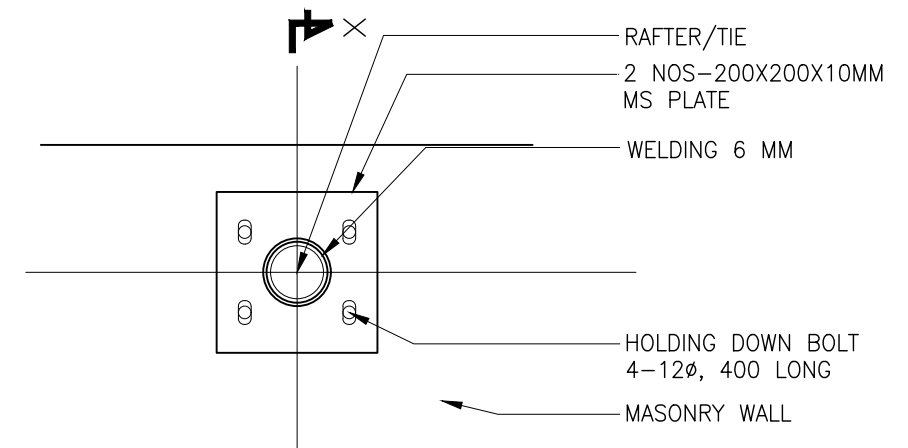
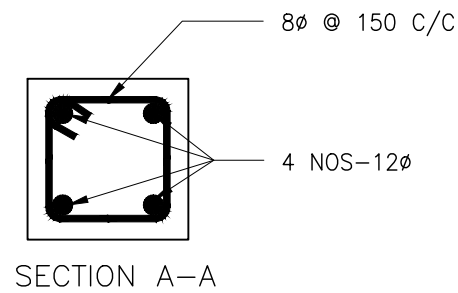
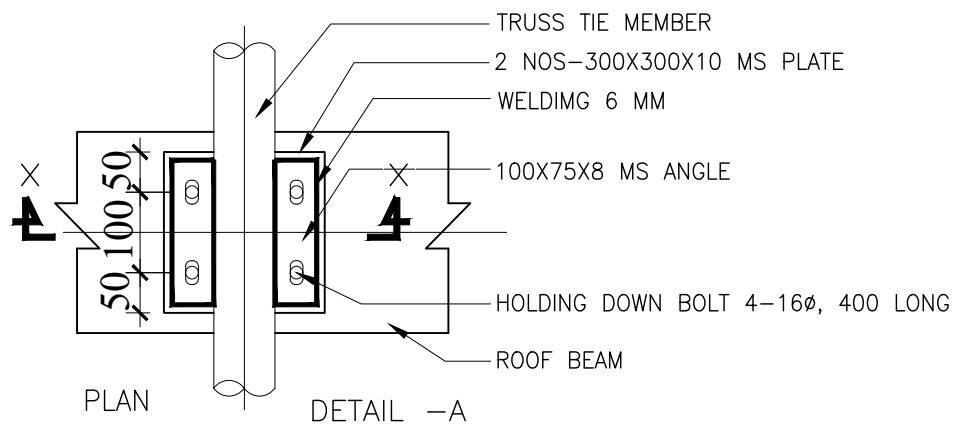


SECTION A-A




SECTION B-B

REV	DATE	DESCRIPTION	BY	CHKD.	APPRD.
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(SIGNED)			DATE : FEBRUARY 2021		
DWG. NO: BPC/TCD/TPD/12-01/DWG-C/PH-STRU-16			SCALE : AS STATED		
			REV. RO		



ANCHORAGE DETAILS ON WALLS/BAND

DETAILS OF RCC PROP

REV	DATE	DESCRIPTION	BY	CHKD.	APPRD.
 BHUTAN POWER CORPORATION LTD. TRANSMISSION CONSTRUCTION DEPARTMENT					
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(SIGNED)			DATE : FEBRUARY 2021		
DWG. NO/BPC/TCD/TPD/12-01/DWG-C/PH-STRU-17			SCALE : AS STATED		
			REV. RO		