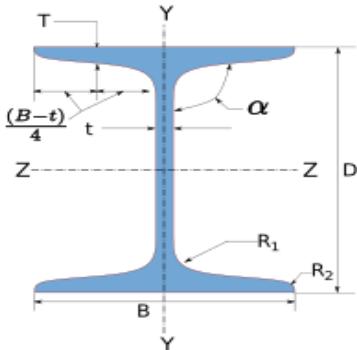




Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

## 1 Input Parameters

Main Module		Moment Connection		
Module		Beam-to-Beam End Plate Connection		
Connectivity		Coplanar Tension-Compression Flange		
End Plate Type		Extended Both Ways - Reversible Moment		
Bending Moment (kNm)		120.0		
Shear Force (kN)		75.0		
Axial Force (kN)		0.0		
Beam Section - Mechanical Properties				
	Beam Section		WPB 360 X 300 X 91.04	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, $F_u$ (MPa)		410	
	Yield Strength, $F_y$ (MPa)		250	
	Mass, $m$ (kg/m)	91.04	$I_z$ (cm <sup>4</sup> )	23000.0
	Area, $A$ (cm <sup>2</sup> )	10600.0	$I_y$ (cm <sup>4</sup> )	5410.0
	$D$ (mm)	339.0	$r_z$ (cm)	14.7
	$B$ (mm)	300.0	$r_y$ (cm)	7.12
	$t$ (mm)	9.0	$Z_z$ (cm <sup>3</sup> )	1350.0
	$T$ (mm)	12.0	$Z_y$ (cm <sup>3</sup> )	360.0
	Flange Slope	90	$Z_{pz}$ (cm <sup>3</sup> )	1490.0
	$R_1$ (mm)	27.0	$Z_{py}$ (cm <sup>3</sup> )	552.0
	$R_2$ (mm)	0.0		
Plate Details - Input and Design Preference				
Thickness (mm)		[16]		
Material		E 250 (Fe 410 W)A		
Ultimate Strength, $F_u$ (MPa)		410		
Yield Strength, $F_y$ (MPa)		250		
Bolt Details - Input and Design Preference				
Diameter (mm)		[20, 24]		
Property Class		[4.6, 4.8, 5.6, 5.8]		
Type		Bearing Bolt		
Bolt Tension		Non pre-tensioned		
Hole Type		Standard		



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Slip Factor, ( $\mu_f$ )	0.3
<b>Weld Details - Input and Design Preference</b>	
Type of Weld Fabrication	Shop Weld
Material Grade Overwrite, $F_u$ (MPa)	410.0
Beam Flange to End Plate	Groove Weld
Beam Web to End Plate	Fillet Weld
Stiffener	Fillet Weld
<b>Detailing - Design Preference</b>	
Edge Preparation Method	Rolled, machine-flame cut, sawn and planed
Gap Between Beams (mm)	0.0
Are the Members Exposed to Corrosive Influences?	False



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

## 2 Design Checks

Design Status	Pass
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### 2.1 Member Capacity

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{0.6 \times 315.0 \times 9.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 223.2$ <p>[Ref. IS 800:2007, Cl.10.4.3]</p>	Restricted to low shear
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{1 \times 14900000.0 \times 250}{1.1 \times 10^6}$ $= 306.82$ <p>[Ref. IS 800:2007, Cl.8.2.1.2]</p>	$V < 0.6 V_{dy}$

### 2.2 Load Consideration

Check	Required	Provided	Remarks
Shear Force (kN)	$V_y = 75.0$	$V_{y \min} = \min(0.15 V_{dy}, 40.0)$ $= \min(0.15 \times 223.2, 40.0)$ $= \min(33.48, 40.0)$ $= 33.48$ $V_u = \max(V_y, V_{y \min})$ $\text{but, } \leq V_{dy}$ $= \max(75.0, 33.48)$ $\text{but, } \leq 223.2$ $= 75.0$ <p>[Ref. IS 800:2007, Cl.10.7]</p>	Pass



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Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Axial Force (kN)		$P_x = 0.0$	OK
Bending Moment (kNm)	$M_z = 120.0$	$M_{z\min} = 0.5M_{dz}$ $= 0.5 \times 306.82$ $= 153.41$ $M_u = \max(M_z, M_{z\min})$ $\text{but, } \leq M_{dz}$ $= \max(120.0, 153.41)$ $\leq 306.82$ $= 153.41$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (kNm)		$M_{ue} = M_u + P_x \times \left( \frac{D}{2} - \frac{T}{2} \right) \times 10^{-3}$ $= 153.41 +$ $0.0 \times \left( \frac{339.0}{2} - \frac{12.0}{2} \right) \times 10^{-3}$ $= 153.41$	OK

## 2.3 Bolt Optimization

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Diameter Optimization	$d = 20$	Pass
Property Class	Bolt Property Class Optimization	4.6	Pass
Hole Diameter (mm)		$d_0 = 22.0$	OK
No. of Bolt Columns		$n_c = 4$	Pass
No. of Bolt Rows		$n_r = 6$	Pass
Total No. of Bolts		$n = n_r X n_c = 24$	Pass



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

## 2.4 Detailing

Check	Required	Provided	Remarks
Min. Pitch Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 20.0$ $= 50.0$  [Ref. IS 800:2007, Cl.10.2.2]	70	Pass
Max. Pitch Distance (mm)	$p_{\max} = \min(32t, 300)$ $= \min(32 \times 16.0, 300)$ $= \min(512.0, 300)$ $= 300$  Where, $t = \min(16.0, 16.0)$  [Ref. IS 800:2007, Cl.10.2.3]	70	Pass
Min. Gauge Distance (mm)	$g_{\min} = 2.5d$ $= 2.5 \times 20.0$ $= 50.0$  [Ref. IS 800:2007, Cl.10.2.2]	70	Pass
Max. Gauge Distance (mm)	$g_{\max} = \min(32t, 300)$ $= \min(32 \times 16.0, 300)$ $= \min(512.0, 300)$ $= 300$  Where, $t = \min(16.0, 16.0)$  [Ref. IS 800:2007, Cl.10.2.3]	70	Pass
Min. End Distance (mm)	$e_{\min} = 1.5d_0$ $= 1.5 \times 22.0$ $= 33.0$  [Ref. IS 800:2007, Cl.10.2.4.2]	35	Pass



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Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Max. End Distance (mm)	$e_{\max} = 12t\varepsilon; \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 16.0 \times \sqrt{\frac{250}{250}} = 192.0$ $e_2 = 12 \times 16.0 \times \sqrt{\frac{250}{250}} = 192.0$ $e_{\max} = \min(e_1, e_2) = 192.0$ <p>[Ref. IS 800:2007, Cl.10.2.4.3]</p>	35	Pass
Min. Edge Distance (mm)	$e'_{\min} = 1.5d_0$ $= 1.5 \times 22.0$ $= 33.0$ <p>[Ref. IS 800:2007, Cl.10.2.4.2]</p>	35	Pass
Max. Edge Distance (mm)	$e'_{\max} = 12t\varepsilon; \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 16.0 \times \sqrt{\frac{250}{250}} = 192.0$ $e_2 = 12 \times 16.0 \times \sqrt{\frac{250}{250}} = 192.0$ $e'_{\max} = \min(e_1, e_2) = 192.0$ <p>[Ref. IS 800:2007, Cl.10.2.4.3]</p>	35	Pass
Cross-centre Gauge Distance (mm)		106	Pass

## 2.5 Critical Bolt Design

Check	Required	Provided	Remarks
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Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dsb} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3} \gamma_{mb}}$ $= \frac{400.0 \times 1 \times 245}{1000 \times \sqrt{3} \times 1.25}$ $= 45.26$ <p>[Ref. IS 800:2007, Cl.10.3.3]</p>	OK
Kb		$k_b = \min \left( \frac{e}{3d_0}, \frac{p}{3d_0} - 0.25, \frac{f_{ub}}{f_u}, 1.0 \right)$ $= \min \left( \frac{35}{3 \times 22.0}, \frac{70}{3 \times 22.0} - 0.25, \frac{400.0}{410}, 1.0 \right)$ $= \min(0.53, 0.81, 0.98, 1.0)$ $= 0.53$ <p>[Ref. IS 800:2007, Cl.10.3.4]</p>	OK
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.53 \times 20.0 \times 16.0 \times 410}{1000 \times 1.25}$ $= 139.07$ <p>[Ref. IS 800:2007, Cl.10.3.4]</p>	OK
Bolt Capacity (kN)		$V_{db} = \min (V_{dsb}, V_{dpb})$ $= \min (45.26, 139.07)$ $= 45.26$ <p>[Ref. IS 800:2007, Cl.10.3.2]</p>	



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Large Grip Length Reduction Factor		$l_g = \sum (t_p + t_{\text{member}})$ $= \sum (16.0 + 16.0)$ $= 32.0 \text{ mm}$ $5d = 5 \times 20.0 = 100.0$ $8d = 8 \times 20.0 = 160.0$ Since, $l_g < 5d$ $\beta_{lg} = 1.0$ [Ref. IS 800 : 2007, Cl. 10.3.3.2]	Pass
Bolt Capacity (post reduction factor) (kN)		$V_{db} = V_{db} \beta_{lg}$ $= 45.26 \times 1.0$ $= 45.26$ [Ref. IS 800 : 2007, Cl. 10.3.3.2]	OK
Shear Demand (kN)	$V_{sb} = \frac{V_u}{n}$ $= \frac{75.0}{24}$ $= 3.12$	Vdb = 45.26	Pass





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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Lever Arm (mm)	$r = [327.0, 327.0, 0, 41.0, 216.0, 111.0]$  Note: $r_1$ and $r_2$ are the first rows outside and inside the tension/top flange. $r_3$ and $r_4$ are the first rows outside and inside the compression/bottom flange. $r_5$ is the second row inside tension/top flange, and $r_6$ is the second row inside the compression/bottom flange. row(s) $r_7$ and beyond are the rows inside the flange, placed in a symmetrical manner.  Note: The lever arm is computed by considering the N.A at the centre of the bottom flange. Rows with identical lever arm values mean they are considered acting as bolt group near the tension or compression flange.		Pass
Tension Due to Moment (kN)	$T_1 = \frac{M_{ue}}{2 \times n_c \times \left( r_1 + \sum_{i=4}^{n_r} \frac{r_i^2}{r_1} \right)}$ $= \frac{153.41 \times 10^3}{2 \times 4 \times \left( 327.0 + \sum_{i=4}^6 \frac{r_i^2}{327.0} \right)}$ $= 37.42$  Note: $T_1$ is the tension in the critical bolt. The critical bolt is the bolt nearest to the tension flange.		OK



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Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Prying Force (kN)	$Q = \frac{l_v}{2l_e} \left[ T_e - \frac{\beta \eta f_o b_e t^4}{27 l_e l_v^2} \right]$ $l_v = e - \frac{R_1}{2}$ $= 35 - \frac{27.0}{2} = 21.5 \text{ mm}$ $f_o = 0.7 f_{ub}$ $= 0.7 \times 400.0$ $= 280.0 \text{ N/mm}^2$ $l_e = \min \left( e, 1.1 t \sqrt{\frac{\beta f_o}{f_y}} \right)$ $= \min \left( 35, 1.1 \times 16 \times \sqrt{\frac{2 \times 280.0}{250}} \right)$ $= \min(35, 26.34) = 26.34 \text{ mm}$ $\beta = 2 \text{ (non pre-tensioned bolt)}$ $\eta = 1.5$ $b_e = \frac{B}{n_c}$ $= \frac{300.0}{4} = 75.0 \text{ mm}$ $Q = \frac{21.5}{2 \times 26.34} \times \left[ 37.42 - \left( \frac{2 \times 1.5 \times 280.0 \times 75.0 \times 16^4}{27 \times 26.34 \times 21.5^2} \right) \times 10^{-3} \right]$ $Q = 10.14$ <p>[Ref. IS 800:2007, Cl.10.4.7]</p>		OK



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Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Tension Demand (kN)	$T_b = T_1 + Q$ $= 37.42 + 10.14$ $= 47.56$	$T_{db} = 0.90 f_{ub} A_n / \gamma_{mb}$ $< f_{yb} A_{sb} (\gamma_{mb} / \gamma_{m0})$ $= \min \left( 0.90 \times 400.0 \times 245 / 1.25, \right.$ $\left. 240.0 \times 314.0 \times (1.25/1.1) \right)$ $= \min(70.56, 85.64)$ $= 68.51$  [Ref. IS 800:2007, Cl.10.3.5]	Pass
Combined Capacity, (I.R)	$\leq 1$	$\left( \frac{V_{sb}}{V_{db}} \right)^2 + \left( \frac{T_b}{T_{db}} \right)^2 \leq 1.0$ $\left( \frac{3.12}{45.26} \right)^2 + \left( \frac{47.56}{68.51} \right)^2 = 0.49$  [Ref. IS 800:2007, Cl.10.3.6]	Pass

## 2.6 Compression Flange Check

Check	Required	Provided	Remarks
Tension in Bolt Rows (kN)		$T = [37.42, 37.42, 0, 9.38, 49.43, 25.4]$	OK
Reaction at Compression Flange (kN)	$R_c = n_c \sum_{n_r=1}^{n_r} T_{n_r}$ $= 4 \times \sum_{n_r=1}^6 T_{n_r}$ $= 4 \times 159.05$ $= 636.2$	$F_c = A_g f_y / \gamma_{m0}$ $= \frac{B T f_y}{\gamma_{m0}}$ $= \frac{300.0 \times 12.0 \times 250}{1.1 \times 1000}$ $= 818.18$	Pass



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

## 2.7 End Plate Checks

Check	Required	Provided	Remarks
Height (mm)		$H_p = D + (2 \times (2 \times e))$ $= 339.0 + (2 \times (2 \times 35))$ $= 479.0$	Pass
Width (mm)		$B_p = B + 25$ $= 300.0 + 25$ $= 325.0$	Pass
Moment at Critical Section (kNm)		$M_{cr} = T_1 l_v - Q l_e$ $= (37.42 \times 21.5 - 10.14 \times 26.34) \times 10^{-3}$ $= 0.54$  Note: The critical section is at the toe of the weld or the edge of the flange from bolt center-line	OK
Plate Thickness (mm)	$t_p = \sqrt{\frac{4M_{cr}}{b_e(f_y/\gamma_{m0})}}$ $= \sqrt{\frac{4 \times 0.54 \times 10^6}{75 \times (250/1.1)}}$ $= 11.23$	16	Pass
Moment Capacity (kNm)	0.54	$M_p = \left(\frac{b_e t_p^2}{4}\right) \times \frac{f_y}{\gamma_{m0}}$ $= \frac{75 \times 16^2}{4} \times \frac{250}{1.1} \times 10^{-6}$ $= 1.09$	Pass

## 2.8 Stiffener Design

Check	Required	Provided	Remarks
Height (mm)		$H_{st} = \frac{H_p - D}{2}$ $= \frac{479.0 - 339.0}{2}$ $= 70$	Pass
Length (mm)		$L_{st} = \frac{H_{st}}{\tan 30^\circ}$ $= \frac{70}{\tan 30^\circ}$ $= 122$	Pass



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Check	Required	Provided	Remarks
Thickness (mm)	$t = 9.0$	$t_{st} = 10$	Pass
Weld Size (mm)	5	$t_w = 6$	Pass

## 2.9 Weld Design - Beam Web to End Plate Connection

Check	Required	Provided	Remarks
Weld Strength (N/mm <sup>2</sup> )	$f_{uw} = \min(f_w, f_u)$ $= \min(410.0, 410)$  [Ref. IS 800:2007, Cl.10.5.7.1.1]	$f_{uw} = 410.0$	Pass
Total Weld Length (mm)		$L_w = 2 \times [D - (2 \times T) - (2 \times R1) - 20]$ $= 2 \times [339.0 - (2 \times 12.0) - (2 \times 27.0) - 20]$ $= 482$  Note: Weld is provided on both sides of the web	
Weld Size (mm)	$t_w = \frac{V_u}{f_{uw} k L_w} \times \sqrt{3} \gamma_{mw}$ $= \frac{75.0 \times 10^3}{410.0 \times 0.7 \times 482} \times \sqrt{3} \times 1.25$ $= 1.17$  [Ref. IS 800:2007, Cl.10.5.7]	6	Pass



Company Name	IIT Bombay	Project Title	Moment Connection
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Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Min. Weld Size (mm)	<p>1) <math>t_{w\min}</math> – based on thickness of the thicker part</p> $t_{\text{thicker}} = \max(16.0, 9.0)$ $= 16.0$ $t_{w\min} = 5$ <p>2) <math>t_{w\min}</math> – based on thickness of the thinner part</p> $t_{\text{thinner}} = \min(16.0, 9.0)$ $= 9.0$ $t_{w\min} \leq \min(5, 9.0)$ <p>[Ref. IS 800:2007, Table 21, Cl 10.5.2.3]</p>	$t_w = \max(t_w, t_{w\min})$ $= \max(1.17, 5)$ $= 6$	Pass
Max. Weld Size (mm)	<p><math>t_{w\max}</math> based on thickness of the thinner part</p> $t_{\text{thinner}} = \min(16.0, 9.0)$ $= 9.0$ $t_{w\max} = 9.0$ <p>[Ref. IS 800:2007, Cl.10.5.3.1]</p>	$t_w \leq t_{w\max}$ $6 \leq 9.0$	Pass
Normal Stress (N/mm <sup>2</sup> )		$f_a = \frac{H}{0.7t_w L_w}$ $= \frac{0.0 \times 10^3}{0.7 \times 6 \times 482}$ $= 0.0$ <p>[Ref. IS 800:2007, Cl.10.5.9]</p>	OK



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

Check	Required	Provided	Remarks
Shear Stress (N/mm <sup>2</sup> )		$q = \frac{V}{0.7t_w L_w}$ $= \frac{75.0 \times 10^3}{0.7 \times 6 \times 482}$ $= 37.05$ [Ref. IS 800:2007, Cl.10.5.9]	OK
Equivalent Stress (N/mm <sup>2</sup> )	$f_e = \sqrt{f_a^2 + 3q^2}$ $= \sqrt{0.0^2 + (3 \times 37.05^2)}$ $= 64.17$ [Ref. IS 800:2007, Cl.10.5.10.1.1]	$f_w = \frac{f_u}{\sqrt{3}\gamma_{mw}}$ $= \frac{410.0}{\sqrt{3} \times 1.25}$ $= 189.37$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	Pass



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Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

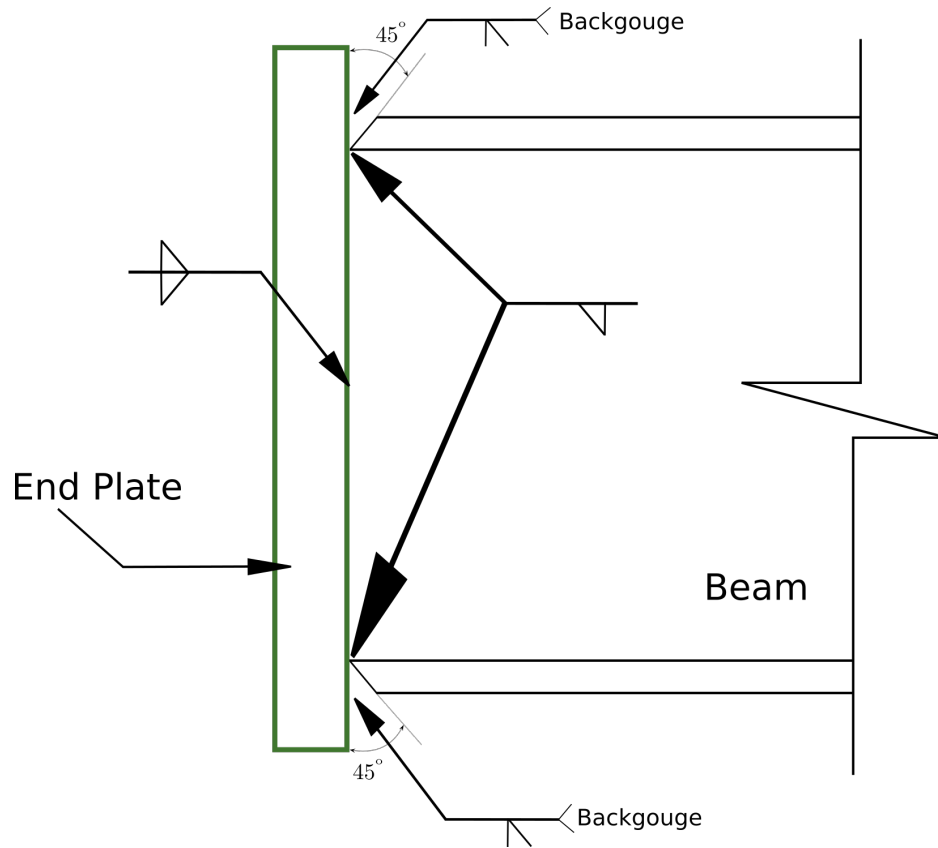


Figure 1: Typical Weld Details -- Beam to End Plate Connection

### 3 2D Drawings (Typical)





Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

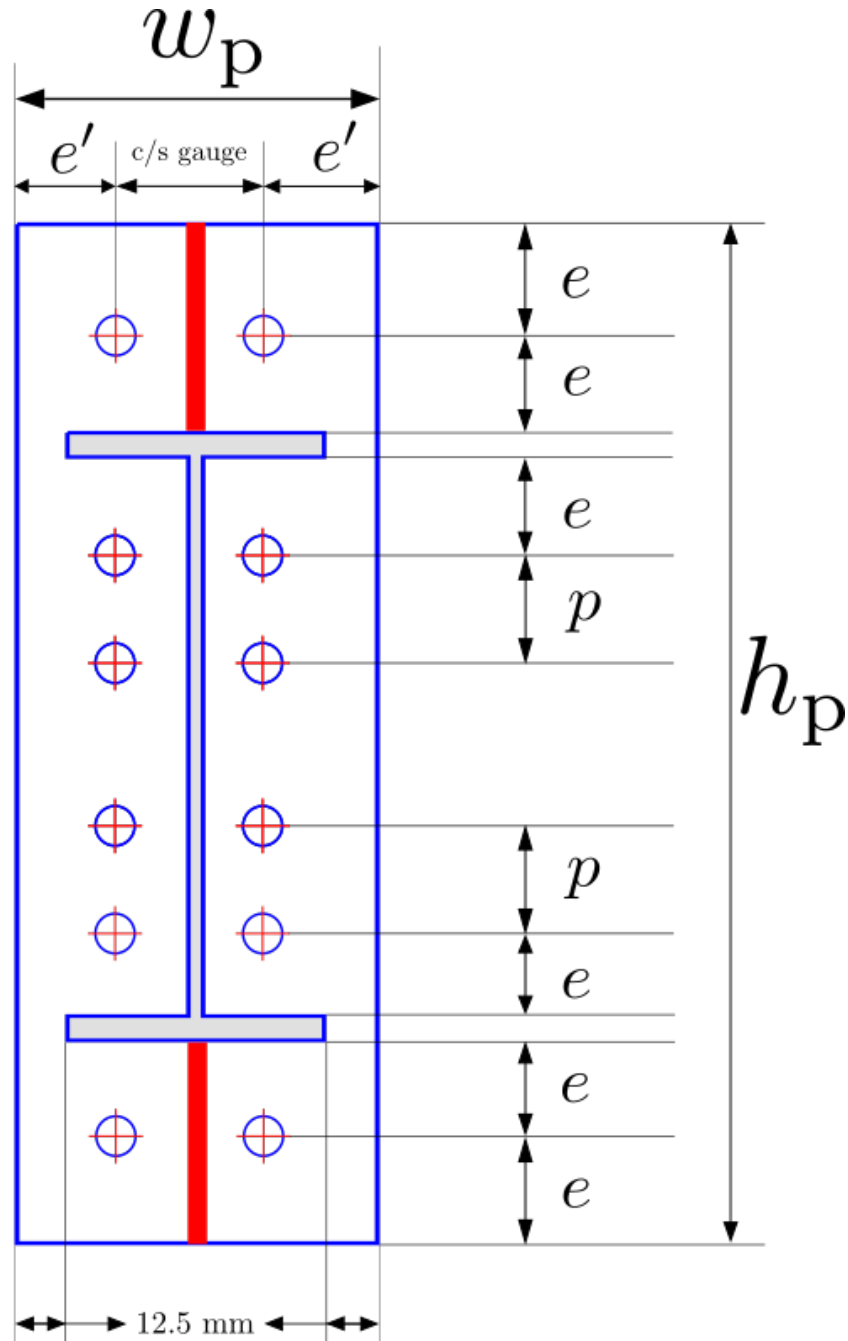


Figure 2: Typical Detailing



Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

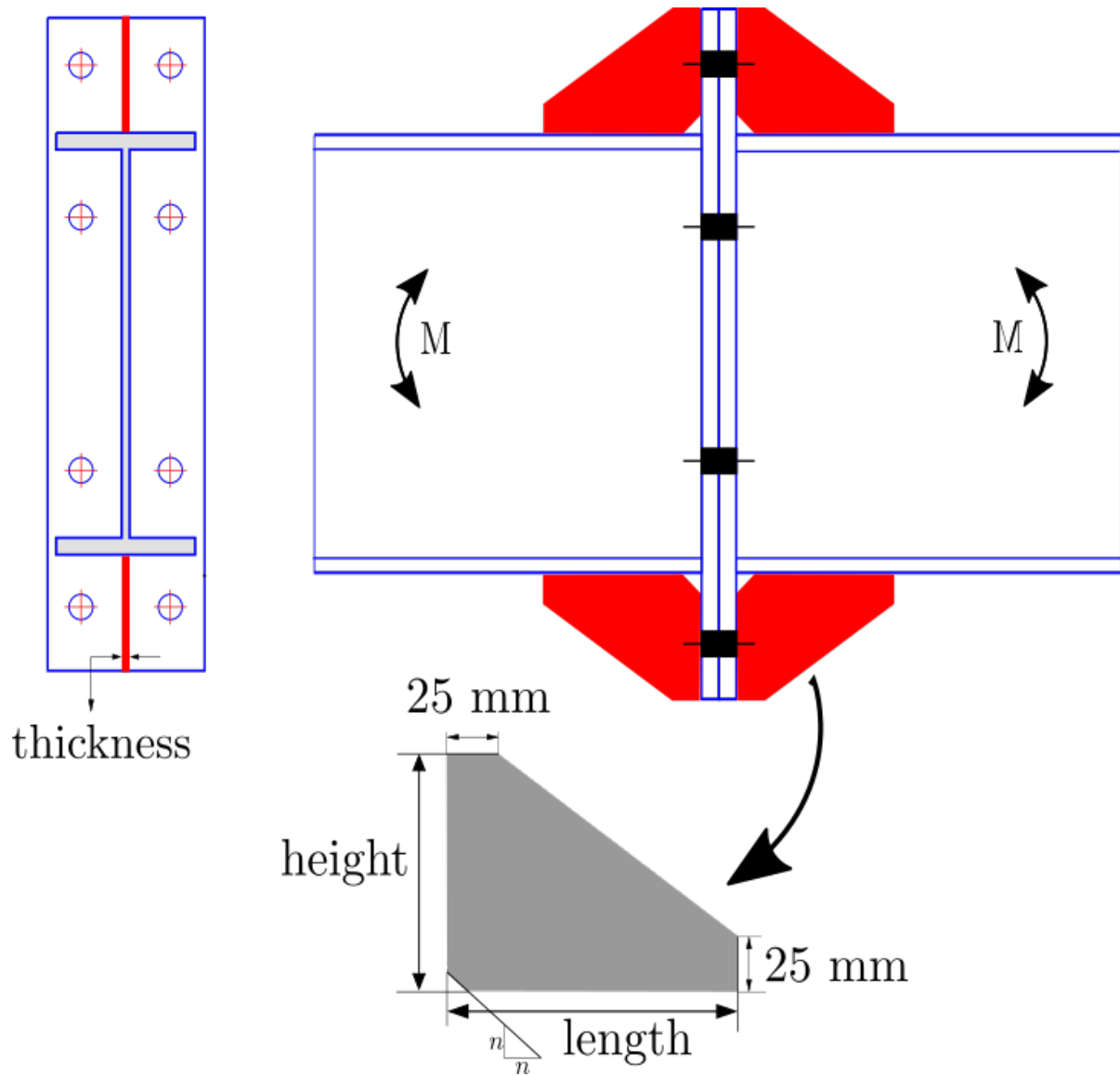
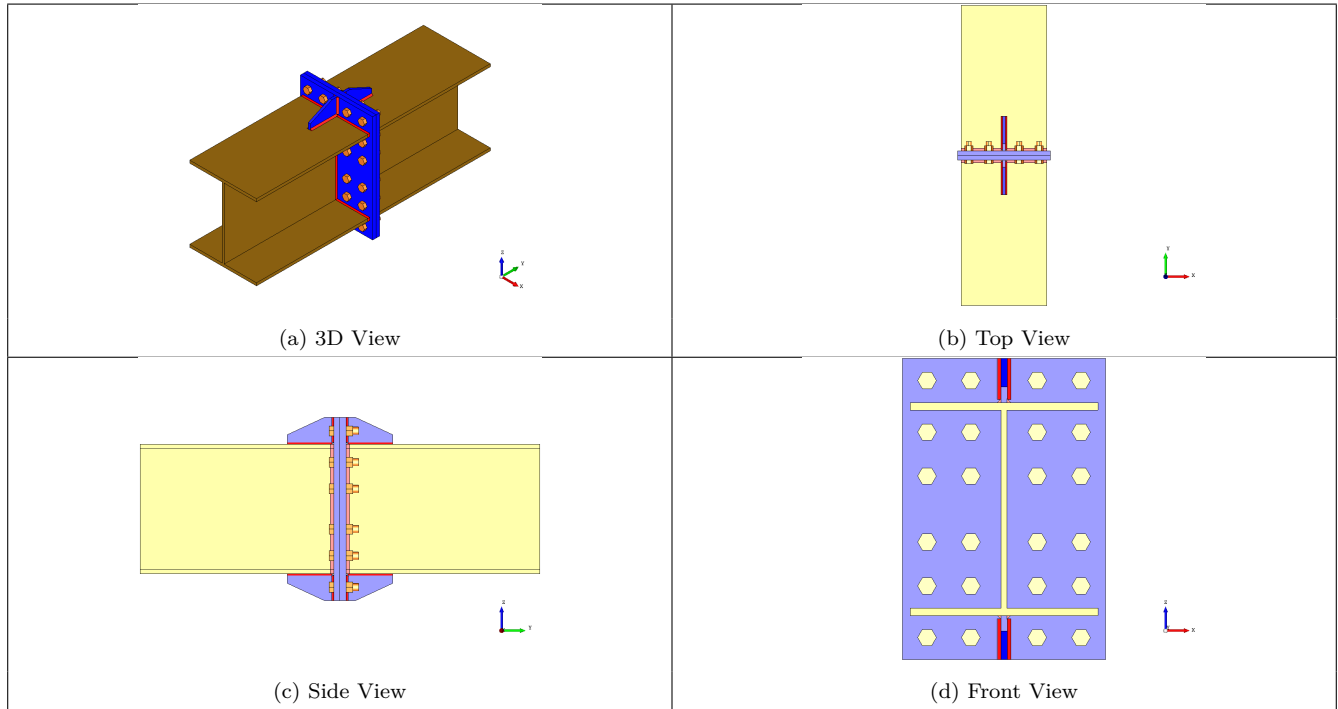


Figure 3: Typical Stiffener Details



Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

## 4 3D Views



## 5 Design Log

2021-02-04 13:32:03 - Osdag - WARNING - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-02-04 13:32:03 - Osdag - WARNING - [Minimum Factored Load] The external factored bending moment (120.0 kNm) is less than 0.5 times the plastic moment capacity of the beam (306.82 kNm)

2021-02-04 13:32:03 - Osdag - INFO - The minimum factored bending moment should be at least 0.5 times the plastic moment capacity of the beam to qualify the connection as rigid connection (Annex. F-4.3.1, IS 800:2007)

2021-02-04 13:32:03 - Osdag - INFO - The value of load(s) is/are set at minimum recommended value as per Cl.10.7 and Annex. F, IS 800:2007



2021-02-04 13:32:03 - Osdag - INFO - Designing the connection for a factored moment of 153.41 kNm

2021-02-04 13:32:03 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design

2021-02-04 13:32:03 - Osdag - INFO - The solver has selected 8 combinations of bolt diameter and grade to perform optimum bolt design in an iterative manner

2021-02-04 13:32:03 - Osdag - INFO - [Optimisation] Performing the design by optimising the plate thickness, using the most optimum plate and a suitable bolt diameter approach

2021-02-04 13:32:03 - Osdag - INFO - If you wish to optimise the bolt diameter-grade combination, pass a higher value of plate thickness

		Created with  Osdag®	
Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.3.1
Date	04 /02 /2021	Client	Mr. Pratip Bhattacharya, Kolkata

using the Input Dock

2021-02-04 13:32:03 - Osdag - INFO - [Flange Strength] The reaction at the compression flange of the beam 636.2 kN is less than the flange capacity 818.18 kN. The flange strength requirement is satisfied.

2021-02-04 13:32:03 - Osdag - INFO - [End Plate] The end plate of 16.0 mm passes the moment capacity check. The end plate is checked for yielding due tension caused by bending moment and prying force

2021-02-04 13:32:03 - Osdag - INFO - [Bolt Design] The bolt of 20.0 mm diameter and 4.6 grade passes the tension check

2021-02-04 13:32:03 - Osdag - INFO - Total tension demand on bolt (due to direct tension + prying action) is 47.56 kN and the bolt tension capacity is (68.51 kN)

2021-02-04 13:32:03 - Osdag - INFO - [Bolt Design] The bolt of 20.0 mm diameter and 4.6 grade passes the combined shear + tension check

2021-02-04 13:32:03 - Osdag - INFO - The Interaction Ratio (IR) of the critical bolt is 0.487

2021-02-04 13:32:03 - Osdag - INFO - : ===== Design Status =====

2021-02-04 13:32:03 - Osdag - INFO - : Overall beam to beam end plate splice connection design is SAFE

2021-02-04 13:32:03 - Osdag - INFO - : ===== End Of Design =====