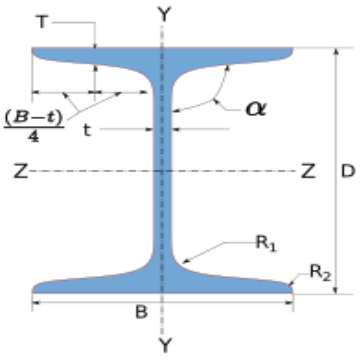
Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.2.1.2.3.2
Date	04 /02 /2021	Client	Mr. Yogesh D Pisal, Mumbai

1 Input Parameters

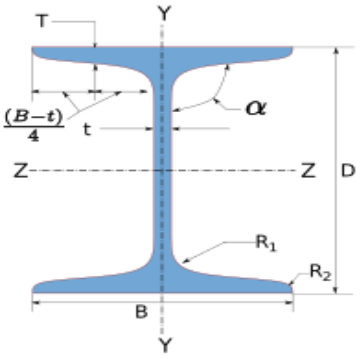
Main Module	Moment Connection
Module	Beam-to-Column End Plate Connection
Connectivity	Column Web-Beam Web
End Plate Type	Extended Both Ways - Reversible Moment
Bending Moment (kNm)	85.0
Shear Force (kN)	120.0
Axial Force (kN)	18.0

Column Section - Mechanical Properties



Column Section		PBP 400 X 212.5	
Material		E 250 (Fe 410 W)A	
Ultimate Strength, Fu (MPa)		410	
Yield Strength, Fy (MPa)		240	
Mass, m (kg/m)	212.5	I_z (cm^4)	63800.0
Area, A (cm^2)	270.0	I_y(cm^4)	25600.0
D (mm)	368.0	r_z (cm)	15.4
B (mm)	400.0	r_y (cm)	9.7
t (mm)	24.0	Z_z (cm^3)	3460.0
T (mm)	24	Z_y (cm^3)	1280.0
Flange Slope	90	Z_{pz} (cm^3)	3940.0
R_1 (mm)	15.0	Z_{py} (cm^3)	1960.0
R_2 (mm)	0.0		

Beam Section - Mechanical Properties



Beam Section		MB 500	
Material		E 250 (Fe 410 W)A	
Ultimate Strength, F_u (MPa)		410	
Yield Strength, F_y (MPa)		250	
Mass, m (kg/m)	86.88	I_z (cm^4)	45200.0
Area, A (cm^2)	110.0	I_y(cm^4)	1360.0
D (mm)	500.0	r_z (cm)	20.2
B (mm)	180.0	r_y (cm)	3.51
t (mm)	10.2	Z_z (cm^3)	1800.0
T (mm)	17.2	Z_y (cm^3)	152.0
Flange Slope	98	Z_{pz} (cm^3)	2070.0

	R_1 (mm)	17.0	Z_{py} (cm^3)	259.0
	R_2 (mm)	8.5		

Plate Details - Input and Design Preference	
Thickness (mm)	[20]
Material	E 300 (Fe 440)
Ultimate Strength, Fu (MPa)	440
Yield Strength, Fy (MPa)	290
Bolt Details - Input and Design Preference	
Diameter (mm)	[20]
Property Class	[8.8]
Type	Friction Grip Bolt
Bolt Tension	Pre-tensioned
Hole Type	Standard
Slip Factor, (μ_f)	0.5
Weld Details - Input and Design Preference	
Type of Weld Fabrication	Shop Weld
Material Grade Overwrite, F_u (MPa)	500.0
Beam Flange to End Plate	Groove Weld
Beam Web to End Plate	Fillet Weld
Stiffener	Fillet Weld
Continuity Plate	Fillet Weld
Detailing - Design Preference	
Edge Preparation Method	Rolled, machine-flame cut, sawn and planed
Gap Between Members (mm)	0.0
Are the Members Exposed to Corrosive Influences?	False

2 Design Checks

Design Status	Pass

2.1 Beam to Column - Compatibility Check

Check	Required	Provided	Remarks
Beam Section Compatibility	$B_{\text{req}} = B_b + 25$ $= 180.0 + 25$ $= 205.0$	$B_{available} = D_c - (2T_c) - (2R_{1c}) - 10$ $= 368.0 - (2 \times 24) - (2 \times 15.0) - 10$ $= 280.0$	Compatible

2.2 Member Capacity - Supported Section

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{0.6 \times 465.6 \times 10.2 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 373.9$ [Ref. IS 800:2007, Cl.10.4.3]	Restricted to low shear
Plastic Moment Capacity (kNm)		$M_{d_z} = \frac{\beta_b Z_{p_z} fy}{\gamma_{m0}}$ $= \frac{1.0 \times 2070000.0 \times 250}{1.1 \times 10^6}$ $= 470.45$ [Ref. IS 800:2007, Cl.8.2.1.2]	V < 0.6 Vdy

2.3 Member Capacity - Supporting Section

Check	Required	Provided	Remarks
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} fy}{\gamma_{m0}}$ $= \frac{0.88 \times 3940000.0 \times 240}{1.1 \times 10^6}$ $= 754.91$ Note: The capacity of the section is not based on the beam-colum or column design. The actual capacity might vary. [Ref. IS 800:2007, Cl.8.2.1.2]	Semi-compact
Plastic Moment Capacity (kNm)		$M_{dy} = \frac{\beta_b Z_{py} fy}{\gamma_{m0}}$ $= \frac{0.65 \times 1960000.0 \times 240}{1.1 \times 10^6}$ $= 279.27$ Note: The capacity of the section is not based on the beam-colum or column design. The actual capacity might vary. [Ref. IS 800:2007, Cl.8.2.1.2]	Semi-compact

2.4 Load Consideration

Check	Required	Provided	Remarks
Axial Force (kN)		$P_x = 18.0$	OK

Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.2.1.2.3.2
Date	04 /02 /2021	Client	Mr. Yogesh D Pisal, Mumbai

Check	Required	Provided	Remarks
Shear Force (kN)	$V_y = 120.0$	$V_{y_{min}} = \min(0.15V_{d_y},\ 40.0)$ $= \min(0.15 \times 373.9,\ 40.0)$ $= \min(56.08,\ 40.0)$ $= 40.0$ $V_u = \max(V_y,\ V_{y_{min}})$ but, $\leq V_{dy}$ $= \max(120.0,\ 40.0)$ but, ≤ 373.9 $= 120.0$ [Ref. IS 800:2007, Cl.10.7]	Pass
Bending Moment (major axis) (kNm)	$M = 85.0$	$M_{z_{min}} = 0.5M_{d_z}$ $= 0.5 \times 470.45$ $= 235.22$ $M_u = \max(M_z,\ M_{z_{min}})$ but, $\leq M_{d_y}$ of the column section $= \max(85.0, 235.22)$ ≤ 279.27 $= 235.22$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (major axis) (kNm)		$M_{ue} = M_u + P_x \times \left(\frac{D}{2} - \frac{T}{2}\right) \times 10^{-3}$ $= 235.22 +$ $18.0 \times \left(\frac{500.0}{2} - \frac{17.2}{2}\right) \times 10^{-3}$ $= 239.57$	OK

2.5 Bolt Optimization

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Diameter Optimization	$d = 20$	Pass
Property Class	Bolt Property Class Optimization	8.8	Pass
Hole Diameter (mm)		$d_0 = 22.0$	OK
No. of Bolt Columns		$n_c = 2$	Pass
No. of Bolt Rows		$n_r = 6$	Pass
Total No. of Bolts		$n = n_r X n_c = 12$	Pass

2.6 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)	$p_{\max} = \min(32t,\ 300)$ $= \min(32 \times 20.0,\ 300)$ $= \min(640.0,\ 300)$ $= 300$ Where, $t = \min(20.0, 20.0)$ [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

Check	Required	Provided	Remarks
Max. End Distance (mm)	$e_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 20.0 \times \sqrt{\frac{250}{290}} = 222.83$ $e_2 = 12 \times 20.0 \times \sqrt{\frac{250}{290}} = 222.83$ $e_{max} = \min(e_1,\ e_2) = 222.83$ [Ref. IS 800:2007, Cl.10.2.4.3]	35	**Pass**
Min. Edge 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**
Max. Edge Distance (mm)	$e'_{max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 20.0 \times \sqrt{\frac{250}{290}} = 222.83$ $e_2 = 12 \times 20.0 \times \sqrt{\frac{250}{290}} = 222.83$ $e'_{max} = min(e_1,\ e_2) = 222.83$ [Ref. IS 800:2007, Cl.10.2.4.3]	35	**Pass**
Cross-centre Gauge Distance (mm)		98	**Pass**

2.7 Critical Bolt Design

Check	Required	Provided	Remarks

Check	Required	Provided	Remarks
Slip Resistance (kN)	$V_{sf} = \frac{V_u}{n}$ $= \frac{120.0}{12}$ $= 10.0$	$V_{dsf} = \frac{\mu_f n_e K_h F_o}{\gamma_{mf}}$ Where , $F_o = 0.7 f_{ub} A_{nb}$ $V_{dsf} = \frac{0.5 \times 1 \times 1 \times 0.7 \times 830.0 \times 245}{1.25 \times 10^3}$ $= 56.94$ [Ref. IS 800:2007, Cl.10.4.3]	**Pass**
Lever Arm (mm)	$r = [482.8, 482.8, 0, 43.6, 369.2, 113.6]$ 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**

Check	Required	Provided	Remarks
Tension Due to Moment (kN)	$T_1 = \frac{M_{ue}}{2 \times n_c \times \left(r_1 + \sum_{i=4}^{n_r} \frac{r_i^2}{r_1} \right)}$ $= \frac{239.57 \times 10^3}{2 \times 2 \times \left(482.8 + \sum_{i=4}^{6} \frac{r_i^2}{482.8} \right)}$ $= 75.26$ Note: T_1 is the tension in the critical bolt. The critical bolt is the bolt nearest to the tension flange.		OK

Check	Required	Provided	Remarks
Prying Force (kN)	$Q = \frac{l_v}{2l_e}\left[T_e - \frac{\beta\eta f_o b_e t^4}{27 l_e l_v^2}\right]$ $l_v = e - \frac{R_1}{2}$ $= 35 - \frac{17.0}{2} = 26.5$ mm $f_o = 0.7 f_{ub}$ $= 0.7 \times 830.0$ $= 581.0$ N/mm^2 $l_e = \min\left(e, 1.1t\sqrt{\frac{\beta f_o}{f_y}}\right)$ $= \min\left(35, 1.1 \times 20 \times \sqrt{\frac{1 \times 581.0}{290}}\right)$ $= \min(35,\ 31.14) = 31.14$ mm $\beta = 1$ (pre-tensioned bolt) $\eta = 1.5$ $b_e = \frac{B}{n_c}$ $= \frac{180.0}{2} = 90.0$ mm $Q = \frac{26.5}{2 \times 31.14} \times$ $\left[75.26 - \left(\frac{1 \times 1.5 \times 581.0 \times 90.0 \times 20^4}{27 \times 31.14 \times 26.5^2}\right) \times 10^{-3}\right]$ $Q = 22.98$ [Ref. IS 800:2007, Cl.10.4.7]		OK

Check	Required	Provided	Remarks
Tension Demand (kN)	$T_f = T_1 + Q$ $= 75.26 + 22.98$ $= 98.24$	$T_f = 0.90 f_{ub} A_n \ / \ \gamma_{mf}$ $< \ f_{yb} A_{sb} (\gamma_{m1} \ / \ \gamma_{m0})$ $= \min\left(0.90 \times 830.0 \times 245 \ / \ 1.25,\right.$ $\left. 660.0 \times 314.0 \times (1.25/1.1)\right)$ $= \min(146.41,\ 235.5)$ $= 146.41$ [Ref. IS 800:2007, Cl.10.3.5]	**Pass**
Combined Capacity, (I.R)	≤ 1	$\left(\frac{V_{sf}}{V_{df}}\right)^2 + \left(\frac{T_f}{T_{df}}\right)^2 \leq 1.0$ $\left(\frac{10.0}{56.94}\right)^2 + \left(\frac{98.24}{146.41}\right)^2 = 0.48$ [Ref. IS 800:2007, Cl.10.3.6]	**Pass**

2.8 Compression Flange Check

Check	Required	Provided	Remarks
Tension in Bolt Rows (kN)		$T = [75.26, 75.26, 0, 13.59, 115.11, 35.42]$	**OK**
Reaction at Compression Flange (kN)	$R_c = n_c \sum_{n_r=1}^{n_r} T_{n_r}$ $= 2 \times \sum_{n_r=1}^{6} T_{n_r}$ $= 2 \times 314.64$ $= 629.28$	$F_c = A_g f_y \ / \ \gamma_{m0}$ $= \frac{BTf_y}{\gamma_{m0}}$ $= \frac{180.0 \times 17.2 \times 250}{1.1 \times 1000}$ $= 703.64$	**Pass**

2.9 End Plate Checks

Check	Required	Provided	Remarks
Height (mm)		$H_p = D + (2 \times (2 \times e))$ $= 500.0 + (2 \times (2 \times 35))$ $= 640.0$	**Pass**
Width (mm)		$B_p = B + 25$ $= 180.0 + 25$ $= 205.0$	**Pass**
Moment at Critical Section (kNm)		$M_{cr} = T_1\ l_v - Q\ l_e$ $= (75.26 \times 26.5 - 22.98 \times 31.14) \times 10^{-3}$ $= 1.28$ 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)	$t_p = \sqrt{\frac{4M_{cr}}{b_e(f_y/\gamma_{m0})}}$ $= \sqrt{\frac{4 \times 1.28 \times 10^6}{90 \times (290/1.1)}}$ $= 14.68$	20	**Pass**
Moment Capacity (kNm)	1.28	$M_p = \left(\frac{b_e t_p^2}{4}\right) \times \frac{f_y}{\gamma_{m0}}$ $= \frac{90 \times 20^2}{4} \times \frac{290}{1.1} \times 10^{-6}$ $= 2.37$	**Pass**

2.10 Stiffener Design

Check	Required	Provided	Remarks
Height (mm)		$H_{st} = \frac{H_p - D}{2}$ $= \frac{640.0 - 500.0}{2}$ $= 70.0$	**70.0**
Length (mm)		$L_{st} = \frac{H_{st}}{\tan 30^\circ}$ $= \frac{70.0}{\tan 30^\circ}$ $= 122$	**Pass**

Check	Required	Provided	Remarks
Thickness (mm)	$t = 10.2$	$t_{st} = 12$	**Pass**
Weld Size (mm)	5	$t_w = 6$	**Pass**

2.11 Weld Design - Beam Web to End Plate Connection

Check	Required	Provided	Remarks
Weld Strength (N/mm2)	$f_{u_w} = \min(f_w,\ f_u)$ $= \min(500.0,\ 440)$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	$f_{u_w} = 440$	**Pass**
Total Weld Length (mm)		$L_w = 2 \times \left[D - (2 \times T) - (2 \times R1) - 20\right]$ $= 2 \times \left[500.0 - (2 \times 17.2) - (2 \times 17.0) - 20\right]$ $= 813.0$ Note: Weld is provided on both sides of the web	**OK**
Weld Size (mm)	$t_w = \frac{V_u}{f_{uw} k L_w} \times \sqrt{3}\ \gamma_{mw}$ $= \frac{120.0 \times 10^3}{440 \times 0.7 \times 813.0} \times \sqrt{3} \times 1.25$ $= 1.04$ [Ref. IS 800:2007, Cl.10.5.7]	6	**Pass**

Check	Required	Provided	Remarks
Min. Weld Size (mm)	1) $t_{w\,\min}$ – based on thickness of the thicker part $t_{\text{thicker}} = \max(20.0,\ 10.2)$ $= 20.0$ $t_{w\,\min} = 5$ 2) $t_{w\,\min}$ – based on thickness of the thinner part $t_{\text{thinner}} = \min(20.0,\ 10.2)$ $= 10.2$ $t_{w\,\min} \leq \min(5,\ 10.2)$ [Ref. IS 800:2007, Table 21, Cl 10.5.2.3]	$t_w = \max(t_w,\ t_{w\,\min})$ $= \max(1.04,\ 5)$ $= 6$	**Pass**
Max. Weld Size (mm)	$t_{w\,\max}$ based on thickness of the thinner part $t_{\text{thinner}} = \min(20.0,\ 10.2)$ $= 10.2$ $t_{w\,\max} = 10.2$ [Ref. IS 800:2007, Cl.10.5.3.1]	$t_w \leq t_{w\,\max}$ $6 \leq 10.2$	**Pass**
Normal Stress (N/mm2)		$f_a = \dfrac{H}{0.7 t_w L_w}$ $= \dfrac{18.0 \times 10^3}{0.7 \times 6 \times 813.0}$ $= 5.27$ [Ref. IS 800:2007, Cl.10.5.9]	

Check	Required	Provided	Remarks
Shear Stress (N/mm2)		$q = \frac{V}{0.7 t_w L_w}$ $= \frac{120.0 \times 10^3}{0.7 \times 6 \times 813.0}$ $= 35.14$ [Ref. IS 800:2007, Cl.10.5.9]	
Equivalent Stress (N/mm2)	$f_e = \sqrt{f_a^2 + 3q^2}$ $= \sqrt{5.27^2 + (3 \times 35.14^2)}$ $= 60.91$ [Ref. IS 800:2007, Cl.10.5.10.1.1]	$f_w = \frac{f_u}{\sqrt{3}\gamma_{mw}}$ $= \frac{440}{\sqrt{3} \times 1.25}$ $= 203.23$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	Pass

2.12 Continuity Plate Design

Check	Required	Provided	Remarks
Notch Size (mm)		$n = 24$	OK
Length (mm)		l_{cp1} = Outer length $l_{cp1} = D_c - 2T_c$ $= 368.0 - (2 \times 24)$ $= 320.0$ l_{cp2} = Inner length $l_{cp2} = D_c - 2(T_c + n)$ $= 368.0 - \left[2 \times (24 + 24)\right]$ $= 272.0$	OK
Width (mm)		$w_{cp} = \frac{B_c - T_c - 2n}{2}$ $= \frac{400.0 - 24.0 - 2 \times 24}{2}$ $= 164.0$	OK
Thickness (mm)	tc = 24.0	25	Pass

2.13 Weld Design - Continuity Plate

Check	Required	Provided	Remarks
Weld Strength (N/mm2)	$f_{uw} = \min(f_w,\ f_{u_{cp}})$ $= \min(500.0,\ 440)$ [*Ref. IS* 800 : 2007, *Cl.* 10.5.7.1.1]	$f_{u_w} = 440$	**Pass**
Total (effective) Weld Length (mm)		$L_{w\,cp} = 248.0$ Note: Provide weld on one side of the continuity plate	**OK**
Weld Size (mm)	6	6	**Pass**
Min. Weld Size (mm)	1) $t_{w\,\min}$ – based on thickness of the thicker part $t_{\text{thicker}} = \max(25,\ 24.0)$ $= 25$ $t_{w\,\min} = 6$ 2) $t_{w\,\min}$ – based on thickness of the thinner part $t_{\text{thinner}} = \min(25,\ 24.0)$ $= 24.0$ $t_{w\,\min} \leq \min(6,\ 24.0)$ [Ref. IS 800:2007, Table 21, Cl 10.5.2.3]	$t_w = \max(t_w,\ t_{w\,\min})$ $= \max(6,\ 6)$ $= 6$	**Pass**
Max. Weld Size (mm)	$t_{w\,\max}$ based on thickness of the thinner part $t_{\text{thinner}} = \min(25,\ 24.0)$ $= 24.0$ $t_{w\,\max} = 24$ [Ref. IS 800:2007, Cl.10.5.3.1]	$t_w \leq t_{w\,\max}$ $6 \leq 24$	**Pass**

Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.2.1.2.3.2
Date	04 /02 /2021	Client	Mr. Yogesh D Pisal, Mumbai

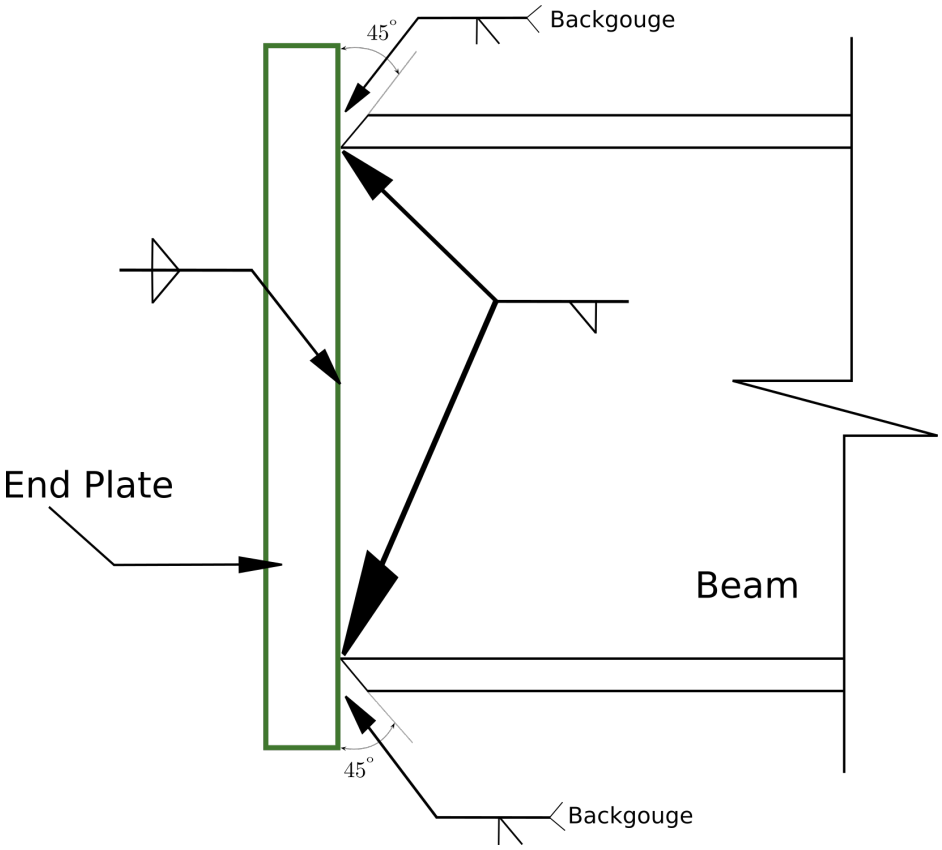


Figure 1: Typical Weld Details -- Beam to End Plate Connection

3 2D Drawings (Typical)

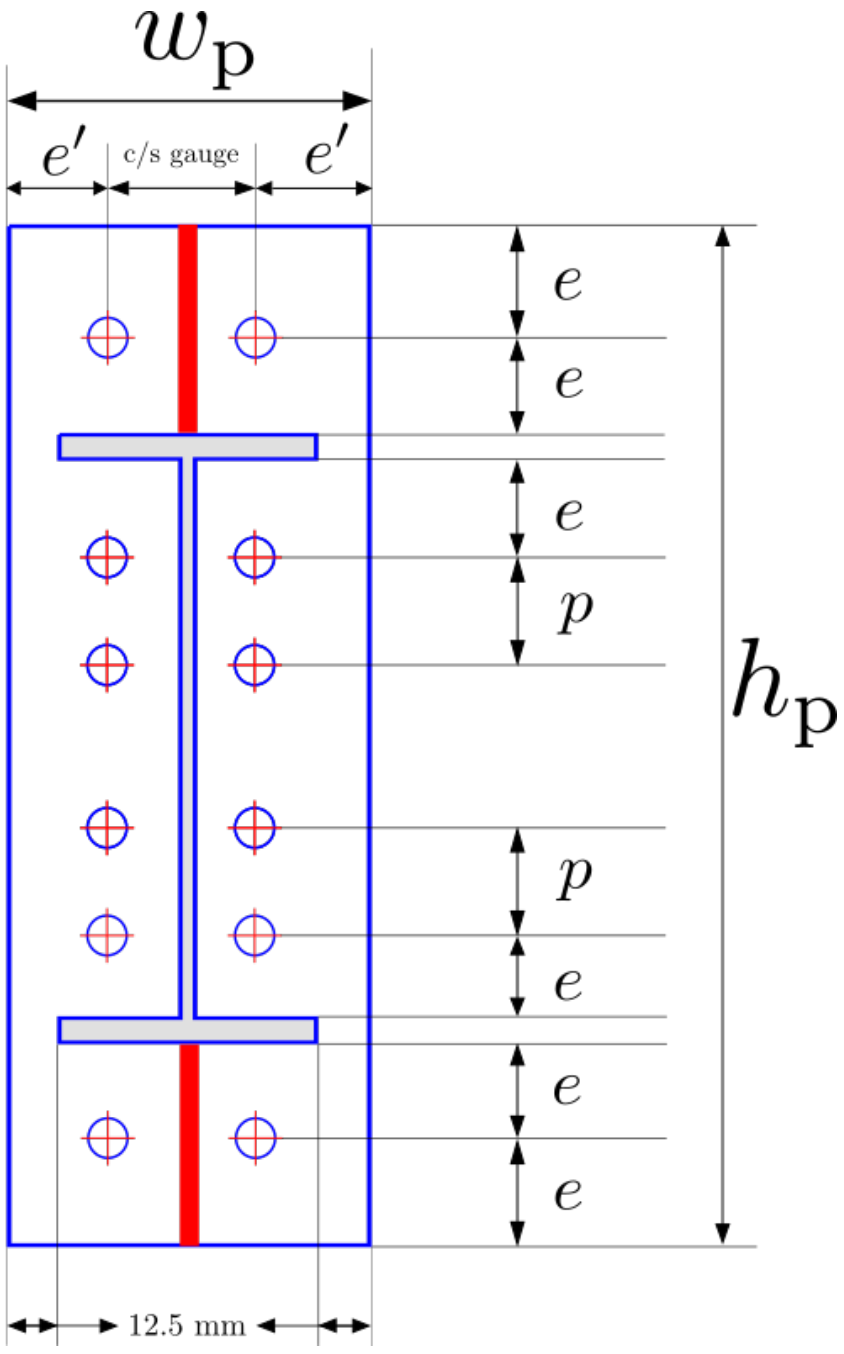


Figure 2: Typical Detailing

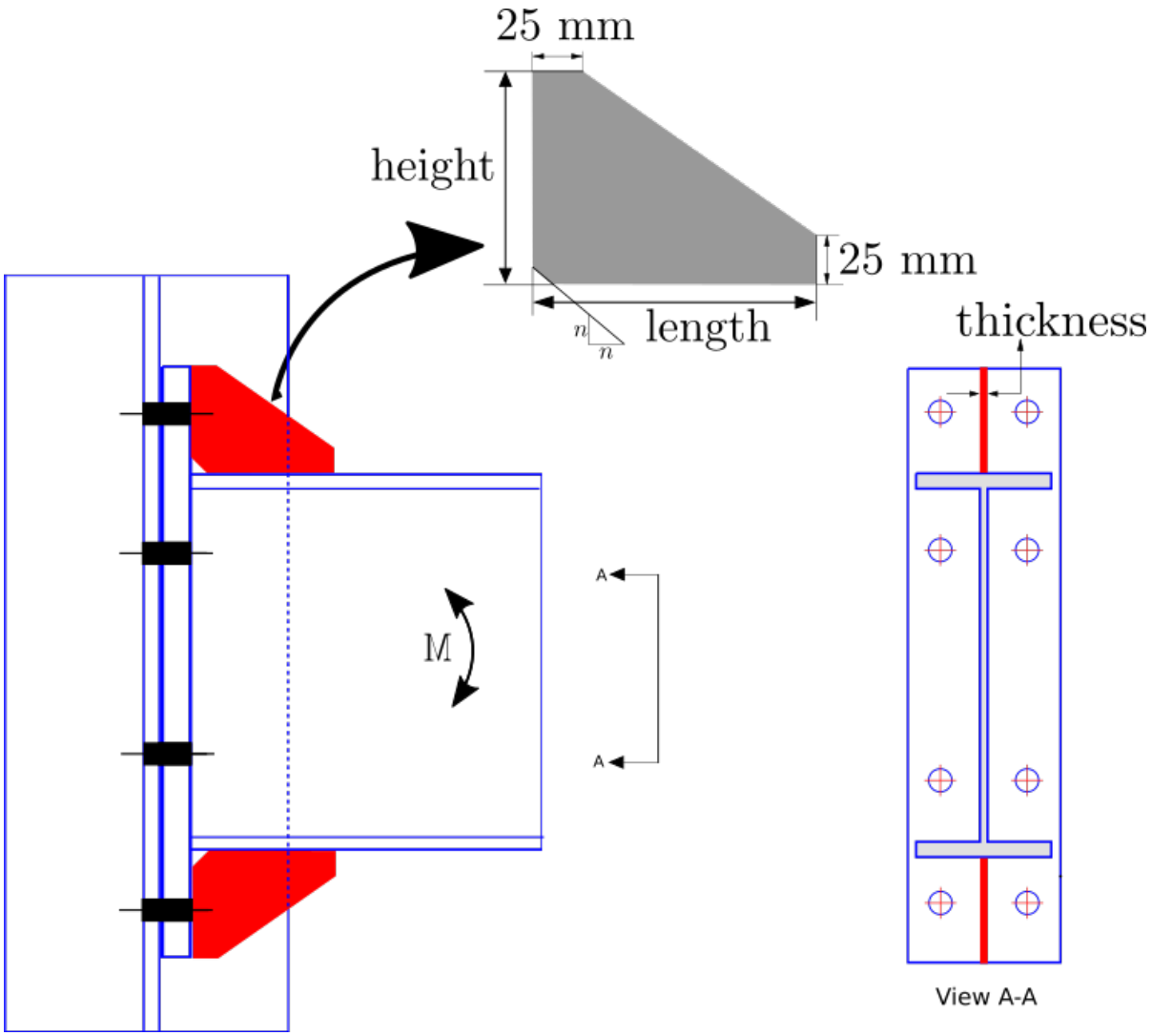
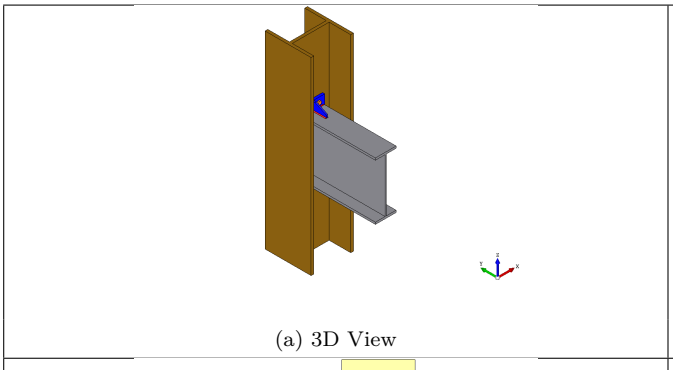
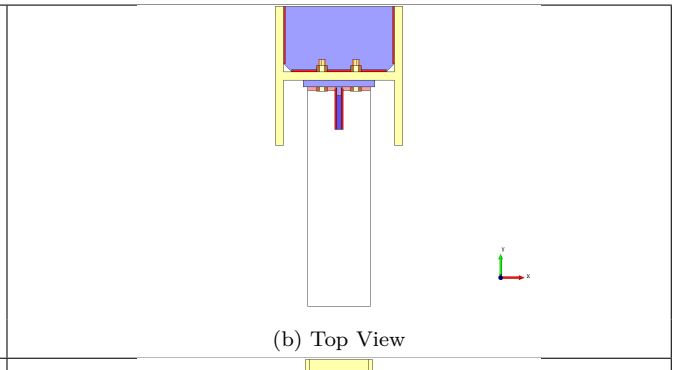


Figure 3: Typical Stiffener Details

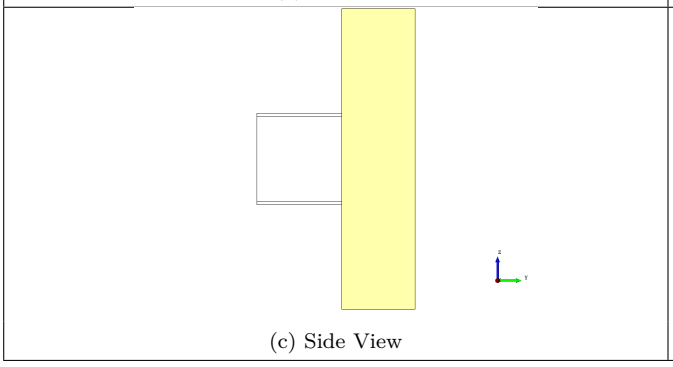
4 3D Views



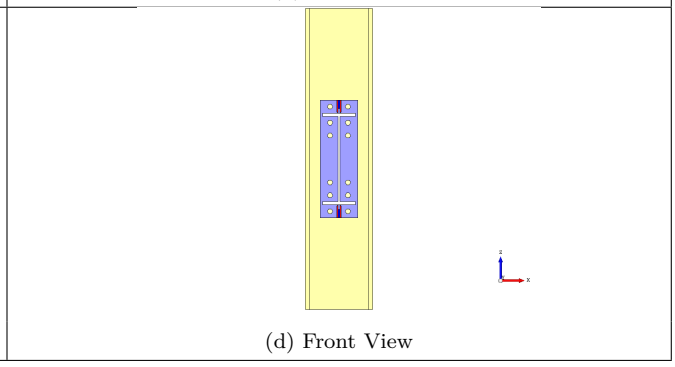
(a) 3D View



(b) Top View



(c) Side View



(d) Front View

5 Design Log

2021-02-04 14:10:08 - Osdag - WARNING - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-02-04 14:10:08 - Osdag - WARNING - [Minimum Factored Load] The external factored bending moment (85.0 kNm) is less than 0.5 times the plastic moment capacity of the beam (470.45 kNm)

2021-02-04 14:10:08 - 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 14:10:08 - 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 14:10:08 - Osdag - INFO - Designing the connection for a factored moment of 235.22 kNm

2021-02-04 14:10:08 - Osdag - WARNING - [End Plate] The end plate of 20.0 mm is thinner than the thickest of the elements being connected

2021-02-04 14:10:08 - Osdag - INFO - Selecting a plate of higher thickness which is at least 24 mm thick

2021-02-04 14:10:08 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design

2021-02-04 14:10:08 - Osdag - INFO - The solver has selected 1.0 combinations of bolt diameter and grade to perform optimum bolt design in an iterative manner

2021-02-04 14:10:08 - 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 14:10:08 - Osdag - INFO - If you wish to optimise the bolt diameter-grade combination, pass a higher value of plate thickness using the Input Dock
2021-02-04 14:10:08 - Osdag - INFO - [Flange Strength] The reaction at the compression flange of the beam 629.28 kN is less than the flange capacity 703.64 kN. The flange strength requirement is satisfied.
2021-02-04 14:10:08 - Osdag - INFO - [End Plate] The end plate of 20.0 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 14:10:08 - Osdag - INFO - [Bolt Design] The bolt of 20.0 mm diameter and 8.8 grade passes the tension check
2021-02-04 14:10:08 - Osdag - INFO - Total tension demand on bolt (due to direct tension + prying action) is 98.24110433241786 kN and the bolt tension capacity is (146.41 kN)
2021-02-04 14:10:08 - Osdag - INFO - [Bolt Design] The bolt of 20.0 mm diameter and 8.8 grade passes the combined shear + tension check
2021-02-04 14:10:08 - Osdag - INFO - The Interaction Ratio (IR) of the critical bolt is 0.481
2021-02-04 14:10:08 - Osdag - INFO - : ========== Design Status ==========
2021-02-04 14:10:08 - Osdag - INFO - : Overall beam to column end plate connection design is SAFE
2021-02-04 14:10:08 - Osdag - INFO - : ========== End Of Design ==========