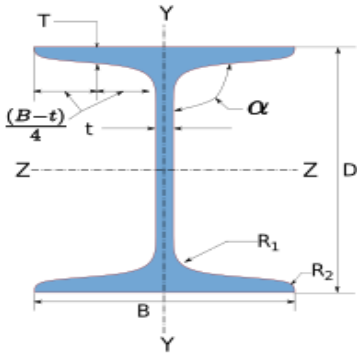
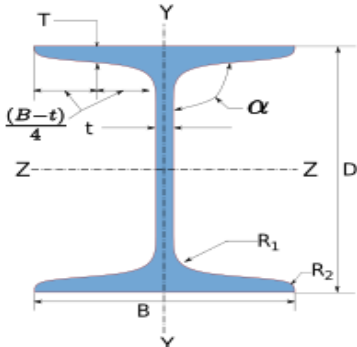




Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.2.1.1.3.2
Date	04 /02 /2021	Client	Mr. Manas M Ghosh, Kolkata

1 Input Parameters

Main Module		Moment Connection		
Module		Beam-to-Column End Plate Connection		
Connectivity		Column Flange-Beam Web		
End Plate Type		Extended Both Ways - Reversible Moment		
Bending Moment (kNm)		90.0		
Shear Force (kN)		45.0		
Axial Force (kN)		10.0		
Column Section - Mechanical Properties				
	Column Section		HB 300	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, Fu (MPa)		410	
	Yield Strength, Fy (MPa)		250	
	Mass, m (kg/m)	58.74	Iz (cm4)	12500.0
	Area, A (cm2)	74.8	Iy(cm4)	2190.0
	D (mm)	300.0	rz (cm)	12.9
	B (mm)	250.0	ry (cm)	5.41
	t (mm)	7.6	Zz (cm3)	836.0
	T (mm)	10.6	Zy (cm3)	175.0
	Flange Slope	94	Zpz (cm3)	921.0
	R1 (mm)	11.0	Zpy (cm3)	291.0
	R2 (mm)	5.5		
Beam Section - Mechanical Properties				
	Beam Section		LB(P) 300	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, Fu (MPa)		410	
	Yield Strength, Fy (MPa)		250	
	Mass, m (kg/m)	41.5	Iz (cm4)	8140.0
	Area, A (cm2)	52.8	Iy(cm4)	414.0
	D (mm)	300.0	rz (cm)	12.4
	B (mm)	140.0	ry (cm)	2.79
	t (mm)	7.0	Zz (cm3)	542.0
	T (mm)	11.6	Zy (cm3)	59.2
	Flange Slope	98	Zpz (cm3)	614.0



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	R_1 (mm)	15.0	Z_{py} (cm ³)	101.0
	R_2 (mm)	7.5		
Plate Details - Input and Design Preference				
Thickness (mm)			[18]	
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]	
Property Class			[8.8]	
Type			Friction Grip Bolt	
Bolt Tension			Pre-tensioned	
Hole Type			Standard	
Slip Factor, (μ_f)			0.33	
Weld Details - Input and Design Preference				
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	
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	



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2 Design Checks

Design Status	Fail
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2.1 Beam to Column - Compatibility Check

Check	Required	Provided	Remarks
Beam Section Compatibility	$B_{req} = B_b + 25$ $= 140.0 + 25$ $= 165.0$	$B_{available} = B_c$ $= 250.0$	Compatible

2.2 Member Capacity - Supported Section

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{0.6 \times 276.8 \times 7.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 152.55$ <p>[Ref. IS 800:2007, Cl.10.4.3]</p>	Restricted to low shear
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{1.0 \times 614000.0 \times 250}{1.1 \times 10^6}$ $= 139.55$ <p>[Ref. IS 800:2007, Cl.8.2.1.2]</p>	$V < 0.6 V_{dy}$



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2.3 Member Capacity - Supporting Section

Check	Required	Provided	Remarks
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{0.91 \times 921000.0 \times 250}{1.1 \times 10^6}$ $= 190.0$ <p>Note: The capacity of the section is not based on the beam-column or column design. The actual capacity might vary.</p> <p>[Ref. IS 800:2007, Cl.8.2.1.2]</p>	Semi-compact
Plastic Moment Capacity (kNm)		$M_{dy} = \frac{\beta_b Z_{py} f_y}{\gamma_{m0}}$ $= \frac{0.6 \times 291000.0 \times 250}{1.1 \times 10^6}$ $= 39.77$ <p>Note: The capacity of the section is not based on the beam-column or column design. The actual capacity might vary.</p> <p>[Ref. IS 800:2007, Cl.8.2.1.2]</p>	Semi-compact



2.4 Load Consideration

Check	Required	Provided	Remarks
Axial Force (kN)		$P_x = 10.0$	OK



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Check	Required	Provided	Remarks
Shear Force (kN)	$V_y = 45.0$	$V_{ymin} = \min(0.15V_{dy}, 40.0)$ $= \min(0.15 \times 152.55, 40.0)$ $= \min(22.88, 40.0)$ $= 22.88$ $V_u = \max(V_y, V_{ymin})$ $\text{but, } \leq V_{dy}$ $= \max(45.0, 22.88)$ $\text{but, } \leq 152.55$ $= 45.0$ [Ref. IS 800:2007, Cl.10.7]	Pass
Bending Moment (major axis) (kNm)	$M_z = 90.0$	$M_{zmin} = 0.5M_{dz}$ $= 0.5 \times 139.55$ $= 69.78$ $M_u = \max(M_z, M_{zmin})$ $\text{but, } \leq M_{dz} \text{ of the column section}$ $= \max(90.0, 69.78)$ ≤ 190.0 $= 90.0$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (major axis) (kNm)		$M_{ue} = M_u + P_x \times \left(\frac{D}{2} - \frac{T}{2} \right) \times 10^{-3}$ $= 90.0 +$ $10.0 \times \left(\frac{300.0}{2} - \frac{11.6}{2} \right) \times 10^{-3}$ $= 91.44$	OK

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2.5 Bolt Optimization

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Diameter Optimization	$d = 20$	Fail
Property Class	Bolt Property Class Optimization	8.8	Fail
Hole Diameter (mm)		$d_0 = 22.0$	OK
No. of Bolt Columns		$n_c = 0$	Fail
No. of Bolt Rows		$n_r = 0$	Fail
Total No. of Bolts		$n = n_r \cdot X n_c = 0$	Fail

3 Design Log

2021-02-04 13:54:23 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design

2021-02-04 13:54:23 - 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 13:54:23 - Osdag - WARNING - [Column Web] The web of the column is susceptible to shear buckling due to the reaction transferred by the beam to the column

2021-02-04 13:54:23 - Osdag - INFO - The minimum required thickness of the web is 7.72 mm

2021-02-04 13:54:23 - Osdag - INFO - Providing stiffening to the column web

2021-02-04 13:54:23 - 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 13:54:23 - 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 13:54:23 - Osdag - ERROR - [Detailing] The beam is not wide enough to accommodate a single column of bolt on either side

2021-02-04 13:54:23 - Osdag - ERROR - The defined beam is not suitable for performing connection design

2021-02-04 13:54:23 - Osdag - INFO - Please define another beam which has sufficient width (minimum, 176 mm) and re-design

2021-02-04 13:54:23 - Osdag - INFO - : ===== Design Status =====

2021-02-04 13:54:23 - Osdag - INFO - : Overall beam to column end plate connection design is UNSAFE

2021-02-04 13:54:23 - Osdag - INFO - : ===== End Of Design =====