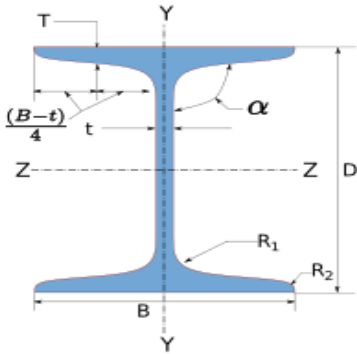
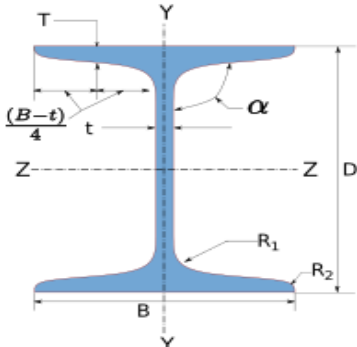




Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.2.1.1.2.2
Date	04 /02 /2021	Client	Prof. Meera Raghunandan, IIT Bombay

1 Input Parameters

Main Module		Moment Connection		
Module		Beam-to-Column End Plate Connection		
Connectivity		Column Flange-Beam Web		
End Plate Type		Extended One Way - Irreversible Moment		
Bending Moment (kNm)		100.0		
Shear Force (kN)		55.0		
Axial Force (kN)		12.0		
Column Section - Mechanical Properties				
	Column Section		PBP 300 X 124.2	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, F_u (MPa)		410	
	Yield Strength, F_y (MPa)		250	
	Mass, m (kg/m)	124.2	I_z (cm ⁴)	26900.0
	Area, A (cm ²)	158.0	I_y (cm ⁴)	8850.0
	D (mm)	312.0	r_z (cm)	13.0
	B (mm)	313.0	r_y (cm)	7.48
	t (mm)	17.3	Z_z (cm ³)	1720.0
	T (mm)	17.3	Z_y (cm ³)	565.0
	Flange Slope	90	Z_{pz} (cm ³)	1950.0
	R_1 (mm)	15.0	Z_{py} (cm ³)	870.0
	R_2 (mm)	0.0		
	Beam Section - Mechanical Properties			
	Beam Section		LB 450	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, F_u (MPa)		410	
	Yield Strength, F_y (MPa)		250	
	Mass, m (kg/m)	65.22	I_z (cm ⁴)	27500.0
	Area, A (cm ²)	83.1	I_y (cm ⁴)	853.0
	D (mm)	450.0	r_z (cm)	18.2
	B (mm)	170.0	r_y (cm)	3.2
	t (mm)	8.6	Z_z (cm ³)	1220.0
	T (mm)	13.4	Z_y (cm ³)	100.0
	Flange Slope	98	Z_{pz} (cm ³)	1400.0



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	R_1 (mm)	16.0	Z_{py} (cm ³)	174.0
	R_2 (mm)	8.0		
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)			[24]	
Property Class			[10.9]	
Type			Bearing Bolt	
Bolt Tension			Non pre-tensioned	
Hole Type			Standard	
Slip Factor, (μ_f)			0.3	
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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Date	04 /02 /2021	Client	Prof. Meera Raghunandan, IIT Bombay

2 Design Checks

Design Status	Fail
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2.1 Beam to Column - Compatibility Check

Check	Required	Provided	Remarks
Beam Section Compatibility	$B_{req} = B_b + 25$ $= 170.0 + 25$ $= 195.0$	$B_{available} = B_c$ $= 313.0$	Compatible

2.2 Member Capacity - Supported Section

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{0.6 \times 423.2 \times 8.6 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 286.54$ <p>[Ref. IS 800:2007, Cl.10.4.3]</p>	Restricted to low shear
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{1.0 \times 1400000.0 \times 250}{1.1 \times 10^6}$ $= 318.18$ <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)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{0.88 \times 1950000.0 \times 250}{1.1 \times 10^6}$ $= 390.91$ <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)		$M_{dy} = \frac{\beta_b Z_{py} f_y}{\gamma_{m0}}$ $= \frac{0.65 \times 870000.0 \times 250}{1.1 \times 10^6}$ $= 128.41$ <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)		$P_x = 12.0$	OK



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Date	04 /02 /2021	Client	Prof. Meera Raghunandan, IIT Bombay

Check	Required	Provided	Remarks
Shear Force (kN)	$V_y = 55.0$	$V_{ymin} = \min(0.15V_{dy}, 40.0)$ $= \min(0.15 \times 286.54, 40.0)$ $= \min(42.98, 40.0)$ $= 40.0$ $V_u = \max(V_y, V_{ymin})$ $\text{but, } \leq V_{dy}$ $= \max(55.0, 40.0)$ $\text{but, } \leq 286.54$ $= 55.0$ [Ref. IS 800:2007, Cl.10.7]	Pass
Bending Moment (major axis) (kNm)	$M_z = 100.0$	$M_{zmin} = 0.5M_{dz}$ $= 0.5 \times 318.18$ $= 159.09$ $M_u = \max(M_z, M_{zmin})$ $\text{but, } \leq M_{dz} \text{ of the column section}$ $= \max(100.0, 159.09)$ ≤ 390.91 $= 159.09$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (major axis) (kNm)		$M_{ue} = M_u + P_x \times \left(\frac{D}{2} - \frac{T}{2} \right) \times 10^{-3}$ $= 159.09 +$ $12.0 \times \left(\frac{450.0}{2} - \frac{13.4}{2} \right) \times 10^{-3}$ $= 161.71$	OK

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3 Design Log

2021-02-04 13:50:21 - Osdag - WARNING - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-02-04 13:50:21 - Osdag - WARNING - [Minimum Factored Load] The external factored bending moment (100.0 kNm) is less than 0.5 times the plastic moment capacity of the beam (318.18 kNm)

2021-02-04 13:50:21 - 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 13:50:21 - 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 13:50:21 - Osdag - INFO - Designing the connection for a factored moment of 159.09 kNm

2021-02-04 13:50:21 - Osdag - WARNING - [End Plate] The end plate of 16.0 mm is thinner than the thickest of the elements being connected

2021-02-04 13:50:21 - Osdag - INFO - Selecting a plate of higher thickness which is at least 17 mm thick

2021-02-04 13:50:21 - Osdag - ERROR - [End Plate] The list of plate thicknesses passed into the solver is insufficient to perform end plate design

2021-02-04 13:50:21 - Osdag - WARNING - The end plate should at least be thicker than the maximum thickness of the connecting element(s)

2021-02-04 13:50:21 - Osdag - INFO - Provide a plate/list of plates with a minimum thickness of 17.3 mm

2021-02-04 13:50:21 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design

2021-02-04 13:50:21 - 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 13:50:21 - Osdag - WARNING - [Column Web] The web of the column is safe against shear buckling due to the reaction transferred by the beam to the column

2021-02-04 13:50:21 - Osdag - INFO - The minimum required thickness of the web i.e. 8.75 mm is satisfied

2021-02-04 13:50:21 - Osdag - INFO - Additional stiffening of the column web is not required

2021-02-04 13:50:21 - 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 13:50:21 - 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 13:50:21 - Osdag - INFO - : ===== Design Status =====

2021-02-04 13:50:21 - Osdag - INFO - : Overall beam to column end plate connection design is UNSAFE

2021-02-04 13:50:21 - Osdag - INFO - : ===== End Of Design =====