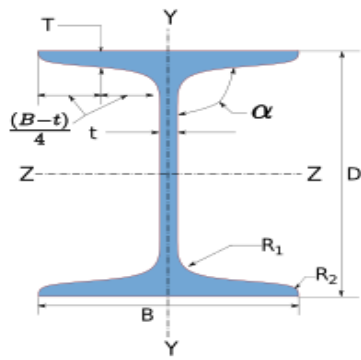




Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Beam-to-Beam End Plate
Designer	Engineer#1	Job Number	1.2.1.2.1.2.2
Date	04 /02 /2021	Client	Mr. Manas M Ghosh, Kolkata

## 1 Input Parameters

Main Module		Moment Connection		
Module		Beam-to-Beam End Plate Connection		
Connectivity		Coplanar Tension-Compression Flange		
End Plate Type		Extended One Way - Irreversible Moment		
Bending Moment (kNm)		110.0		
Shear Force (kN)		55.0		
Axial Force (kN)		15.0		
Beam Section - Mechanical Properties				
	Beam Section		LB 400	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, $F_u$ (MPa)		410	
	Yield Strength, $F_y$ (MPa)		250	
	Mass, $m$ (kg/m)	56.82	$I_z$ (cm <sup>4</sup> )	19300.0
	Area, $A$ (cm <sup>2</sup> )	7240.0	$I_y$ (cm <sup>4</sup> )	716.0
	$D$ (mm)	400.0	$r_z$ (cm)	16.3
	$B$ (mm)	165.0	$r_y$ (cm)	3.14
	$t$ (mm)	8.0	$Z_z$ (cm <sup>3</sup> )	965.0
	$T$ (mm)	12.5	$Z_y$ (cm <sup>3</sup> )	86.8
	Flange Slope	98	$Z_{pz}$ (cm <sup>3</sup> )	1090.0
	$R_1$ (mm)	16.0	$Z_{py}$ (cm <sup>3</sup> )	151.0
	$R_2$ (mm)	8.0		
Plate Details - Input and Design Preference				
Thickness (mm)		[12]		
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		[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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## 2 Design Checks

Design Status	Fail
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### 2.1 Member Capacity

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{0.6 \times 375.0 \times 8.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 236.19$ <p>[Ref. IS 800:2007, Cl.10.4.3]</p>	Restricted to low shear
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_{pz} f_y}{\gamma_{m0}}$ $= \frac{1 \times 1090000.0 \times 250}{1.1 \times 10^6}$ $= 247.73$ <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)	$V_y = 55.0$	$V_{y\min} = \min(0.15 V_{dy}, 40.0)$ $= \min(0.15 \times 236.19, 40.0)$ $= \min(35.43, 40.0)$ $= 35.43$ $V_u = \max(V_y, V_{y\min})$ $\text{but, } \leq V_{dy}$ $= \max(55.0, 35.43)$ $\text{but, } \leq 236.19$ $= 55.0$ <p>[Ref. IS 800:2007, Cl.10.7]</p>	Pass



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Date	04 /02 /2021	Client	Mr. Manas M Ghosh, Kolkata

Check	Required	Provided	Remarks
Axial Force (kN)		$P_x = 15.0$	OK
Bending Moment (kNm)	$M_z = 110.0$	$M_{zmin} = 0.5M_{dz}$ $= 0.5 \times 247.73$ $= 123.86$ $M_u = \max(M_z, M_{zmin})$ $\text{but, } \leq M_{dz}$ $= \max(110.0, 123.86)$ $\leq 247.73$ $= 123.86$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (kNm)		$M_{ue} = M_u + P_x \times \left( \frac{D}{2} - \frac{T}{2} \right) \times 10^{-3}$ $= 123.86 +$ $15.0 \times \left( \frac{400.0}{2} - \frac{12.5}{2} \right) \times 10^{-3}$ $= 126.77$	OK

### 3 Design Log

2021-02-04 13:31:05 - Osdag - WARNING - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-02-04 13:31:05 - Osdag - WARNING - [Minimum Factored Load] The external factored bending moment (110.0 kNm) is less than 0.5 times the plastic moment capacity of the beam (247.73 kNm)



2021-02-04 13:31:05 - 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 13:31:05 - 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 13:31:05 - Osdag - INFO - Designing the connection for a factored moment of 123.86 kNm

2021-02-04 13:31:05 - Osdag - WARNING - [End Plate] The end plate of 12.0 mm is thinner than the thickest part of the elements being connected

2021-02-04 13:31:05 - Osdag - INFO - Selecting a plate of higher thickness which is at least 12.5 mm thick

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2021-02-04 13:31:05 - Osdag - ERROR - [End Plate] The list of plate thicknesses passed into the solver is insufficient to perform end plate design

2021-02-04 13:31:05 - Osdag - WARNING - The end plate should at least be thicker than the maximum thickness of the connecting elements

2021-02-04 13:31:05 - Osdag - INFO - Provide a plate/list of plates with a minimum thickness of 14 mm

2021-02-04 13:31:05 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design

2021-02-04 13:31:05 - Osdag - INFO - The solver has selected 1 combinations of bolt diameter and grade to perform optimum bolt design in an iterative manner

2021-02-04 13:31:05 - 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 13:31:05 - 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 13:31:05 - Osdag - INFO - : ===== Design Status =====

2021-02-04 13:31:05 - Osdag - INFO - : Overall beam to beam end plate splice connection design is UNSAFE

2021-02-04 13:31:05 - Osdag - INFO - : ===== End Of Design =====