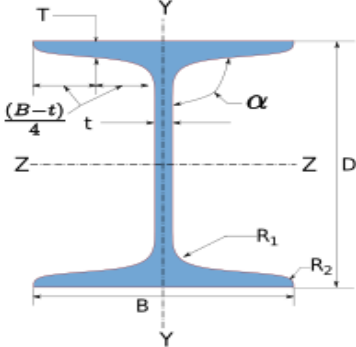




Company Name	IIT Bombay	Project Title	Moment Connection
Group/Team Name	Osdag	Subtitle	Column-to-Column End Plate
Designer	Engineer#1	Job Number	1.2.3.3.2.2
Date	04 /02 /2021	Client	Mr. Manas M Ghosh, Kolkata

1 Input Parameters

Module		Column-to-Column End Plate Connection		
Main Module		Moment Connection		
Bending Moment (kNm)		50.0		
Shear Force (kN)		20.0		
Axial Force (kN)		250.0		
Column Section - Mechanical Properties				
	Beam Section *		PBP 300 X 95	
	Material		E 300 (Fe 440)	
	Ultimate Strength, F_u (MPa)		440	
	Yield Strength, F_y (MPa)		300	
	Mass, m (kg/m)	95.0	I_z (cm ⁴)	20000.0
	Area, A (cm ²)	121.0	I_y (cm ⁴)	6540.0
	D (mm)	304.0	r_z (cm)	12.8
	B (mm)	309.0	r_y (cm)	7.36
	t (mm)	13.3	Z_z (cm ³)	1320.0
	T (mm)	13.3	Z_y (cm ³)	423.0
	Flange Slope	90	Z_{pz} (cm ³)	1470.0
	R_1 (mm)	15.0	Z_{py} (cm ³)	649.0
	R_2 (mm)	0.0		
Bolt Details - Input and Design Preference				
Diameter (mm)		[30]		
Property Class		[9.8]		
Type		Friction Grip Bolt		
Bolt Tension		Pre-tensioned		
Hole Type		Standard		
Slip Factor, (μ_f)		0.3		
Detailing - Design Preference				
Edge Preparation Method		Rolled, machine-flame cut, sawn and planed		
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
Section Classification		Semi-Compact [Ref: Table 2, Cl.3.7.2 and 3.7.4, IS 800:2007]	
Axial Capacity Member (kN)	250	$T_{dg} = \frac{A_g f_y}{\gamma_{m0}}$ $= \frac{12100.0 \times 300}{1.1 \times 10^3}$ $= 3300.0$ [Ref. IS 800:2007, Cl.6.2]	Pass
Shear Capacity Member (kN)	20	$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{277.4 \times 13.3 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 580.93$ [Ref. IS 800:2007, Cl.10.4.3]	Pass
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_p f_y}{\gamma_{m0} \times 10^6}$ $= \frac{0.9 \times 1470000.0 \times 300}{1.1 \times 10^6}$ $= 360.0$ [Ref. IS 800:2007, Cl.8.2.1.2]	
Moment Deformation Criteria (kNm)		$M_{dc} = \frac{1.5 Z_e f_y}{\gamma_{m0} \times 10^6}$ $= \frac{1.5 \times 1320000.0 \times 300}{1.1 \times 10^6}$ $= 540.0$ [Ref. IS 800:2007, Cl.8.2.1.2]	



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Check	Required	Provided	Remarks
Moment Capacity Member (kNm)	50	$M_{dz} = \min(M_{dz}, M_{dc})$ $= \min(360.0, 540.0)$ $= 360.0$ [Ref. IS 800:2007, Cl.8.2]	Pass

2.2 Load Consideration

Check	Required	Provided	Remarks
Interaction Ratio		I.R. axial $= P_x / T_{dg}$ $= 250.0 / 3300.0$ $= 0.08$ I.R. moment $= M_z / M_{dz}$ $= 50.0 / 360.0$ $= 0.14$ I.R. sum $= \text{I.R. axial} + \text{I.R. moment}$ $= 0.08 + 0.14$ $= 0.21$	



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Check	Required	Provided	Remarks
Minimum Required Load	<p>if I.R. axial < 0.3 and I.R. moment < 0.5</p> $P_{xmin} = 0.3T_{dg}$ $M_{zmin} = 0.5M_{dz}$ <p>elif sum I.R. ≤ 1.0 and I.R. moment < 0.5</p> <p>if $(0.5 - \text{I.R. moment}) < (1 - \text{sum I.R.})$</p> $M_{zmin} = 0.5 \times M_{dz}$ <p>else</p> $M_{zmin} = M_z + ((1 - \text{sum I.R.}) \times M_{dz})$ $P_{xmin} = P_x$ <p>elif sum I.R. ≤ 1.0 and I.R. axial < 0.3</p> <p>if $(0.3 - \text{I.R. axial}) < (1 - \text{sum I.R.})$</p> $P_{xmin} = 0.3T_{dg}$ <p>else</p> $P_{xmin} = P_x + ((1 - \text{sum I.R.}) \times T_{dg})$ $M_{zmin} = M_z$ <p>else</p> $P_{xmin} = P_x$ $M_{zmin} = M_z$ <p>Note: AL is the user input for load</p>	$M_{zmin} = 180.0$ $P_{xmin} = 990.0$ <p>[Ref. IS 800:2007, Cl.10.7]</p>	
Applied Axial Force (kN)	250.0	$P_u = \max(P_x, P_{xmin})$ $= \max(250.0, 990.0)$ $= 990.0$	



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Check	Required	Provided	Remarks
Applied Shear Force (kN)	20.0	$V_{ymin} = \min(0.15V_{dy}, 40.0)$ $= \min(0.15 \times 968.22, 40.0)$ $= 40.0$ $V_u = \max(V_y, V_{ymin})$ $= \max(20.0, 40.0)$ $= 40.0$ [Ref. IS 800:2007, Cl.10.7]	
Applied Moment (kNm)	50.0	$M_u = \max(M_z, M_{zmin})$ $= \max(50.0, 180.0)$ $= 180.0$ [Ref. IS 800:2007, Cl.8.2.1.2]	

3 Design Log

2021-02-04 15:12:37 - Osdag - INFO - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-02-04 15:12:37 - Osdag - INFO - The value of load(s) is/are set at minimum recommended value as per IS 800:2007, Cl.10.7.

2021-02-04 15:12:37 - Osdag - ERROR - The number of bolt row(s) are not sufficient to cater for the given section and load combination.

2021-02-04 15:12:37 - Osdag - INFO - Try Cover Plate connection.