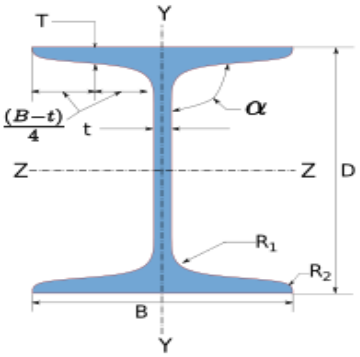
Company Name	IIT Bombay	Project Title	Sample Connection Design
Group/Team Name	Osdag	Subtitle	Column-Column End Plate
Designer	Engineer #1	Job Number	1.2.3.3.2.2
Date	18 /12 /2020	Client	Pratip Bhattacharya, TCE, Kolkata

1 Input Parameters

Module			Column End Plate	
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, Fu (MPa)		440	
	Yield Strength, Fy (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, (mu_f)			0.3	
Detailing - Design Preference				
Edge Preparation Method			Rolled, machine-flame cut, sawn and planed	
Are the Members Exposed to Corrosive Influences?			False	

2 Design Checks

Design Status	Fail

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	$T_{dg} = \frac{A_g f_y}{\gamma_{mo}}$ $= \frac{12100.0 \times 300}{1.1 \times 10^3}$ $= 3300.0$ $[Ref.\ IS\ 800:2007,\ Cl.\ 6.2]$	**Pass**
Shear Capacity Member (kN)	20	$V_{dy} = \frac{A_v\ f_y}{\sqrt{3}\ \gamma_{mo}}$ $= \frac{277.4 \times 13.3 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 580.93$ $[Ref.IS\ 800:2007, Cl.10.4.3]$	**Pass**
Plastic Moment Capacity (kNm)		$M_{dzz} = \frac{\beta_b \times Z_p \times fy}{\gamma_{mo} \times 10^6}$ $= \frac{0.9 \times 1470000.0 \times 300}{1.1 \times 10^6}$ $= 360.0$ $[Ref.\ IS\ 800:2007,\ Cl.\ 8.2.1.2]$	
Moment Deformation Criteria (kNm)		$Mdc = \frac{1.5 \times Z_e \times fy}{1.1 \times 10^6}$ $= \frac{1.5 \times 1320000.0 \times 300}{1.1 \times 10^6}$ $= 540.0$ $[Ref.\ IS\ 800:2007,\ Cl.\ 8.2.1.2]$	

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

2.2 Load Consideration

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

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Check	Required	Provided	Remarks
Minimum Required Load	*if* $IR\ axial < 0.3$ *and* $IR\ moment < 0.5$ $P_{x\,min} = 0.3 \times T_{dg}$ $M_{z\,min} = 0.5 \times M_{dzz}$ *elif* $sum\ IR <= 1.0$ *and* $IR\ moment < 0.5$ *if* $(0.5 - IR\ moment) < (1 - sum\ IR)$ $M_{z\,min} = 0.5 \times M_{dzz}$ *else* $M_{z\,min} = M_z + ((1 - sum\ IR) \times M_{dzz})$ $P_{x\,min} = P_x$ *elif* $sum\ IR <= 1.0$ *and* $IR\ axial < 0.3$ *if* $(0.3 - IR\ axial) < (1 - sum\ IR)$ $P_{x\,min} = 0.3 \times T_{dg}$ *else* $P_{x\,min} = P_x + ((1 - sum\ IR) \times T_{dg})$ $M_{z\,min} = M_z$ *else* $P_{x\,min} = P_x$ $M_{z\,min} = M_z$ $Note:\ AL =\ User\ Applied\ Load$	$M_{z\,min} = 180.0$ $P_{x\,min} = 990.0$ $[Ref.\ IS\ 800:2007,\ Cl.\ 10.7]$	
Applied Axial Force (kN)	250.0	$P_u = max(P_x,\ P_{x\,min})$ $= max(250.0, 990.0)$ $= 990.0$	

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

3 Design Log

2020-12-18 01:33:23 - Osdag - INFO - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2020-12-18 01:33:23 - Osdag - INFO - The value of load(s) is/are set at minimum recommended value as per IS 800:2007, Cl.10.7.
2020-12-18 01:33:23 - Osdag - ERROR - The number of bolt row(s) are not sufficient to cater for the given section and load combination.

2020-12-18 01:33:23 - Osdag - INFO - Try Cover Plate connection.