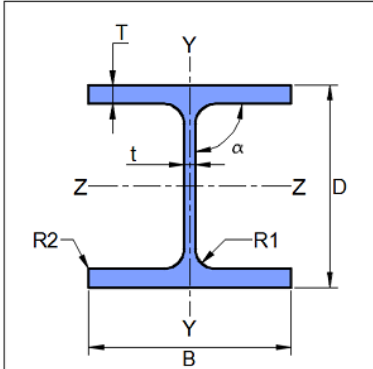
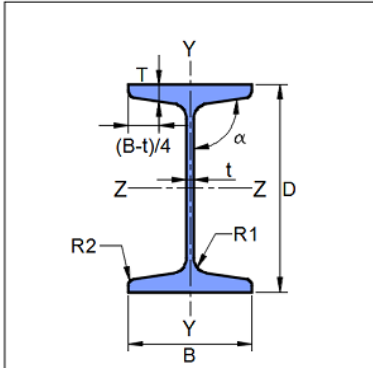




Company Name	IIT Bombay	Project Title	Sample Connection Design
Group/Team Name	Osdag	Subtitle	Seated Angle
Designer	Engineer #1	Job Number	1.1.4.1.2
Date	17 /12 /2020	Client	S R Satish Kumar, Professor, IIT Madras

1 Input Parameters

Module		Seated Angle		
Main Module		Shear Connection		
Connectivity		Column Flange-Beam Web		
Shear Force (kN)		185.0		
Supporting Section - Mechanical Properties				
	Supporting Section		UC 305 x 305 x 118	
	Material		E 300 (Fe 440)	
	Ultimate Strength, Fu (MPa)		440	
	Yield Strength, Fy (MPa)		300	
	Mass, m (kg/m)	117.9	Iz (cm4)	27672.0
	Area, A (cm2)	150.2	Iy(cm4)	9058.0
	D (mm)	314.5	rz (cm)	13.6
	B (mm)	307.4	ry (cm)	7.77
	t (mm)	12.0	Zz (cm3)	1760.0
	T (mm)	18.7	Zy (cm3)	589.0
	Flange Slope	90	Zpz (cm3)	1958.0
	R1 (mm)	15.2	Zpy (cm3)	895.0
	R2 (mm)	0.0		
	Supported Section - Mechanical Properties			
	Supported Section		MB 500	
	Material		E 300 (Fe 440)	
	Ultimate Strength, Fu (MPa)		440	
	Yield Strength, Fy (MPa)		300	
	Mass, m (kg/m)	86.88	Iz (cm4)	45200.0
	Area, A (cm2)	110.0	Iy(cm4)	1360.0
	D (mm)	500.0	rz (cm)	20.2
	B (mm)	180.0	ry (cm)	3.51
	t (mm)	10.2	Zz (cm3)	1800.0
	T (mm)	17.2	Zy (cm3)	152.0
	Flange Slope	98	Zpz (cm3)	2070.0
	R1 (mm)	17.0	Zpy (cm3)	259.0
	R2 (mm)	8.5		
	Bolt Details - Input and Design Preference			



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Diameter (mm)	[20]
Property Class	[8.8]
Type	Friction Grip Bolt
Hole Type	Standard
Slip Factor, (μ_f)	0.5
Detailing - Design Preference	
Edge Preparation Method	Rolled, machine-flame cut, sawn and planed
Gap Between Members (mm)	10.0
Are the Members Exposed to Corrosive Influences?	False

Seated and Top Angle Details

	Section Size*		150 x 150 x 10	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, F_u (MPa)		410	
	Yield Strength, F_y (MPa)		250	
	Mass, m (kg/m)	22.93	I_u (cm ⁴)	1000.0
	Area, A (cm ²)	29.2	I_v (cm ⁴)	259.0
	A (mm)	150.0	r_z (cm)	4.66
	B (mm)	150.0	r_y (cm)	4.66
	t (mm)	10.0	r_u (cm)	5.87
	R_1 (mm)	12.0	r_v (cm)	2.98
	R_2 (mm)	4.8	Z_z (cm ³)	58.0
	C_y (mm)	40.8	Z_y (cm ³)	58.0
	C_z (mm)	40.8	Z_{pz} (cm ³)	104.0
	I_z (cm ⁴)	633.0	Z_{py} (cm ³)	58.0
	I_y (cm ⁴)	633.0		
	Section Size*		150 x 150 x 10	
	Material		E 250 (Fe 410 W)A	
	Ultimate Strength, F_u (MPa)		410	
	Yield Strength, F_y (MPa)		250	
	Mass, m (kg/m)	22.93	I_u (cm ⁴)	1000.0
	Area, A (cm ²)	29.2	I_v (cm ⁴)	259.0
	A (mm)	150.0	r_z (cm)	4.66
	B (mm)	150.0	r_y (cm)	4.66
	t (mm)	10.0	r_u (cm)	5.87



Company Name	IIT Bombay	Project Title	Sample Connection Design
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R_1 (mm)	12.0	r_v (cm)	2.98
R_2 (mm)	4.8	Z_z (cm ³)	58.0
C_y (mm)	40.8	Z_y (cm ³)	58.0
C_z (mm)	40.8	Z_{pz} (cm ³)	104.0
I_z (cm ⁴)	633.0	Z_{py} (cm ³)	58.0
I_y (cm ⁴)	633.0		

1.1 List of Input Section

Seated Angle List	'150 x 150 x 10'
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1.2 List of Input Section

Top Angle List	'150 x 150 x 10'
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Company Name	IIT Bombay	Project Title	Sample Connection Design
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2 Design Checks

Design Status	Fail
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2.1 Section Design

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{mo}}$ $= \frac{500.0 \times 10.2 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 1338402.9$ [Ref.IS 800 : 2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	185.0	$V_d = 0.6 V_{dy}$ $= 0.6 \times 1338402.9$ $= 803041.7380546613$ [Limited to low shear]	Pass

2.2 Load Consideration

Check	Required	Provided	Remarks
Applied Shear Force (kN)	185.0	$V_{ymin} = \min(0.15 \times V_{dy}, 40.0)$ $= \min(0.15 \times 1338402.9, 40.0)$ $= 40$ $V_u = \max(V_y, V_{ymin})$ $= \max(185.0, 40)$ $= 185.0$ [Ref. IS 800 : 2007, Cl. 10.7]	



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2.3 Bolt Design Checks on Column

Check	Required	Provided	Remarks
Diameter (mm)		20.0	
Property Class		8.8	
Plate Thickness (mm)		10.0	
Large Grip Length Reduction Factor	$\text{if } l_g \geq 5d \text{ then } V_{rd} = \beta_{lg} V_{db}$ $\text{if } l_g < 5d \text{ then } V_{rd} = V_{db}$ $l_g \leq 8d$ where, $l_g = \Sigma(t_{ep} + t_{member})$ $\beta_{lg} = 8d/(3d + l_g)$ $\text{but } \beta_{lg} \leq \beta_{lj}$ [Ref. IS 800 : 2007, Cl. 10.3.3.2]	$l_g = \Sigma(t_p + t_{member})$ $= 28.7$ $5d = 100.0$ $8d = 160.0$ $\text{since, } l_g < 5d ; \beta_{lg} = 1.0$ [Ref. IS 800 : 2007, Cl. 10.3.3.2]	Pass
Min. Edge Distance (mm)	$e'_{min} = 1.5 d_0$ $= 1.5 \times 22.0$ $= 33.0$ [Ref. IS 800 : 2007, Cl. 10.2.4.2]		
Minimum Width (mm) On Column	$4 \times e' + 2 \times R_1 + t = 182.4$	$B = 307.4$	Pass
Minimum Width (mm) On Beam	$4 \times e' + 2 \times R_1 + t = 184.2$	$B = 180.0$	Fail



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2.4 Seated Angle Checks

Check	Required	Provided	Remarks
Designation		150 x 150 x 10	
Shear Capacity (kN)	185.0	$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{mo}}$ $= \frac{200.0 \times 10.0 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 314.918$ <p>[Ref.IS 800 : 2007, Cl.10.4.3]</p>	
Allowable Shear Capacity (kN)	185.0	$V_d = 0.6 V_{dy}$ $= 0.6 \times 314.918$ $= 188.95$ <p>[Limited to low shear]</p>	Pass
Bearing Length		$b_{lreq} = \frac{V \times \gamma_{m0}}{t_w \times f_y} - t_f - r_r$ $= \frac{185.0 \times 1.1}{10.2 \times 300} - 17.2 - 17.0$ $= 32.3$ $k = t_f + r_r$ $k = 17.2 + 17.0 = 34.2$ $b_1 = \max(b_{lreq}, k) = 34.2$ $b_2 = b_1 + gap - t - r_{ra}$ $b_2 = 34.2 + 10.0 - 10.0 - 12.0$ $b_2 = \max(b_2, 0) = 22.2$	
Minimum Leg Length (mm)	$b_1 + gap = 44.2$	150.0	Pass



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Check	Required	Provided	Remarks
Moment Capacity (kNm)	$M = V \times ecc$ $if\ b_2 \leq b_1, ecc = \frac{b_2}{b_1} \times \frac{b_2}{2}$ $ecc = \frac{22.2}{34.2} \times \frac{22.2}{2}$ $= 7.21$ $M = 185.0 \times 7.21 \times 10^{-3}$ $= 1.333$	$M_{dzz} = \frac{\beta_b \times Z_p \times fy}{\gamma_{mo} \times 10^6}$ $= \frac{1.0 \times 5000.0 \times 300}{1.1 \times 10^6}$ $= 1.36$ <p>[Ref. IS 800 : 2007, Cl. 8.2.1.2]</p>	Pass

3 Design Log

2020-12-17 23:22:51 - Osdag - INFO - The required seated angle thickness is available. Fetching angle leg size.

2020-12-17 23:22:51 - Osdag - ERROR - sufficient leg size / flange width is not available for selected bolt, please select lower bolt diameter

2020-12-17 23:22:51 - Osdag - ERROR - It fails in detailing check