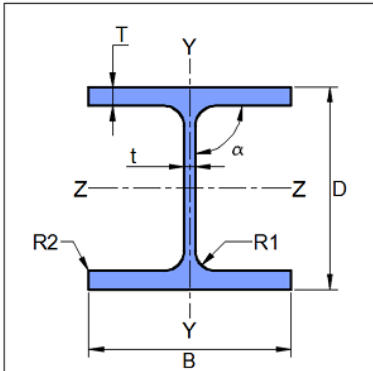
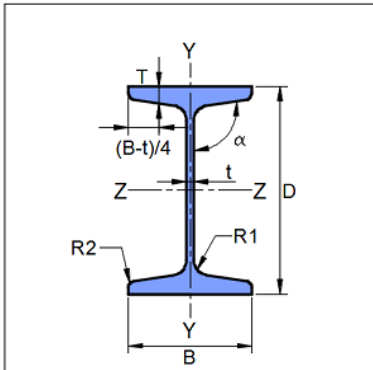




Company Name	IIT Bombay	Project Title	Shear Connection
Group/Team Name	Osdag	Subtitle	Seated Angle
Designer	Engineer#1	Job Number	1.1.4.1.2
Date	04 /02 /2021	Client	Prof. S R Satish Kumar, IIT Madras

## 1 Input Parameters

Module		Seated Angle Connection		
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, $F_u$ (MPa)		440	
	Yield Strength, $F_y$ (MPa)		300	
	Mass, $m$ (kg/m)	117.9	$I_z$ (cm <sup>4</sup> )	27672.0
	Area, $A$ (cm <sup>2</sup> )	150.2	$I_y$ (cm <sup>4</sup> )	9058.0
	$D$ (mm)	314.5	$r_z$ (cm)	13.6
	$B$ (mm)	307.4	$r_y$ (cm)	7.77
	$t$ (mm)	12.0	$Z_z$ (cm <sup>3</sup> )	1760.0
	$T$ (mm)	18.7	$Z_y$ (cm <sup>3</sup> )	589.0
	Flange Slope	90	$Z_{pz}$ (cm <sup>3</sup> )	1958.0
	$R_1$ (mm)	15.2	$Z_{py}$ (cm <sup>3</sup> )	895.0
	$R_2$ (mm)	0.0		
	Supported Section - Mechanical Properties			
	Supported Section		MB 500	
	Material		E 300 (Fe 440)	
	Ultimate Strength, $F_u$ (MPa)		440	
	Yield Strength, $F_y$ (MPa)		300	
	Mass, $m$ (kg/m)	86.88	$I_z$ (cm <sup>4</sup> )	45200.0
	Area, $A$ (cm <sup>2</sup> )	110.0	$I_y$ (cm <sup>4</sup> )	1360.0
	$D$ (mm)	500.0	$r_z$ (cm)	20.2
	$B$ (mm)	180.0	$r_y$ (cm)	3.51
	$t$ (mm)	10.2	$Z_z$ (cm <sup>3</sup> )	1800.0
	$T$ (mm)	17.2	$Z_y$ (cm <sup>3</sup> )	152.0
	Flange Slope	98	$Z_{pz}$ (cm <sup>3</sup> )	2070.0
	$R_1$ (mm)	17.0	$Z_{py}$ (cm <sup>3</sup> )	259.0
	$R_2$ (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, ( $\mu_f$ )	0.5
<b>Detailing - Design Preference</b>	
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 <sup>4</sup> )	1000.0
	Area, $A$ (cm <sup>2</sup> )	29.2	$I_v$ (cm <sup>4</sup> )	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 <sup>3</sup> )	58.0
	$C_y$ (mm)	40.8	$Z_y$ (cm <sup>3</sup> )	58.0
	$C_z$ (mm)	40.8	$Z_{pz}$ (cm <sup>3</sup> )	104.0
	$I_z$ (cm <sup>4</sup> )	633.0	$Z_{py}$ (cm <sup>3</sup> )	58.0
	$I_y$ (cm <sup>4</sup> )	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 <sup>4</sup> )	1000.0
	Area, $A$ (cm <sup>2</sup> )	29.2	$I_v$ (cm <sup>4</sup> )	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	Shear Connection
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$R_1$ (mm)	12.0	$r_v$ (cm)	2.98
$R_2$ (mm)	4.8	$Z_z$ (cm <sup>3</sup> )	58.0
$C_y$ (mm)	40.8	$Z_y$ (cm <sup>3</sup> )	58.0
$C_z$ (mm)	40.8	$Z_{pz}$ (cm <sup>3</sup> )	104.0
$I_z$ (cm <sup>4</sup> )	633.0	$Z_{py}$ (cm <sup>3</sup> )	58.0
$I_y$ (cm <sup>4</sup> )	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	Shear Connection
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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)		$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{500.0 \times 10.2 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 1338.4$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	185.0	$V_d = 0.6 V_{dy}$ $= 0.6 \times 1338.4$ $= 803.042$ [Limited to low shear]	Pass

### 2.2 Load Consideration

Check	Required	Provided	Remarks
Applied Shear Force (kN)	185.0	$V_{y_{\min}} = \min(0.15 V_{dy}, 40.0)$ $= \min(0.15 \times 1338.4, 40.0)$ $= 40$ $V_u = \max(V_y, V_{y_{\min}})$ $= \max(185.0, 40)$ $= 185.0$ [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	<p>if <math>l_g \geq 5d</math>, then <math>V_{rd} = \beta_{lg} V_{db}</math></p> <p>if <math>l_g &lt; 5d</math> then <math>V_{rd} = V_{db}</math></p> <p><math>l_g \leq 8d</math></p> <p>where,</p> <p><math>l_g = \Sigma(t_{ep} + t_{member})</math></p> <p><math>\beta_{lg} = 8d / (3d + l_g)</math></p> <p>but <math>\beta_{lg} \leq \beta_{lj}</math></p> <p>[Ref. IS 800:2007, Cl.10.3.3.2]</p>	<p><math>l_g = \Sigma(t_p + t_{member})</math></p> <p><math>= 28.7</math></p> <p><math>5d = 100.0</math></p> <p><math>8d = 160.0</math></p> <p>since, <math>l_g &lt; 5d</math>; <math>\beta_{lg} = 1.0</math></p> <p>[Ref. IS 800:2007, Cl.10.3.3.2]</p>	Pass
Minimum Width (mm) (on column)	$4 \times e' + 2 \times R_1 + t = 182.4$	$B = 307.4$	Pass
Min. Edge Distance (mm)	<p><math>e'_{min} = 1.5d_0</math></p> <p><math>= 1.5 \times 22.0</math></p> <p><math>= 33.0</math></p> <p>[Ref. IS 800:2007, Cl.10.2.4.2]</p>		
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	$V_{dy} = \frac{A_v f_y}{\sqrt{3} \gamma_{m0}}$ $= \frac{200.0 \times 10.0 \times 300}{\sqrt{3} \times 1.1 \times 1000}$ $= 314.918$ <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		$b_{l_{req}} = \frac{V \gamma_{m0}}{t_w f_y} - t_f - r_r$ $= \frac{185.0 \times 1.1}{10.2 \times 300} - 17.2 - 17.0$ $= 32.3$ $k = t_f + r_r$ $k = 17.2 + 17.0 = 34.2$ $b_1 = \max(b_{l_{req}}, k) = 34.2$ $b_2 = b_1 + \text{gap} - t - r_{ra}$ $b_2 = 34.2 + 10.0 - 10.0 - 12.0$ $b_2 = \max(b_2, 0) = 22.2$	
Minimum Leg Length (mm)	$b_1 + \text{gap} = 44.2$	150.0	Pass



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Check	Required	Provided	Remarks
Moment Capacity (kNm)	$M = V \times ecc$ $\text{if } b_2 \leq b_1, ecc = \frac{b_2}{b_1} \times \frac{b_2}{2}$ $ecc = \frac{22.2}{34.2} \times \frac{22.2}{2}$ $= 7.21$ $M = 185.0 \times 7.21 \times 10^{-3}$ $= 1.333$	$M_{dz} = \frac{\beta_b Z_p f_y}{\gamma_{m0} \times 10^6}$ $= \frac{1.0 \times 5000.0 \times 300}{1.1 \times 10^6}$ $= 1.36$ <p>[Ref. IS 800:2007, Cl.8.2.1.2]</p>	Pass

### 3 Design Log

2021-02-04 12:52:11 - Osdag - ERROR - sufficient leg size / flange width is not available for selected bolt, please select lower bolt diameter

2021-02-04 12:52:11 - Osdag - ERROR - It fails in detailing check