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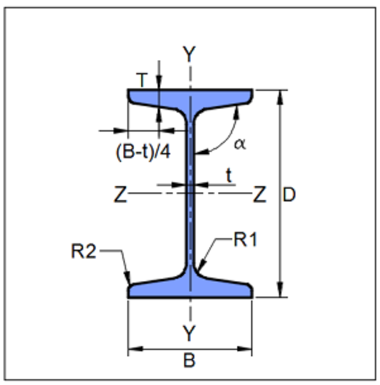
Company Name	Daredevil Developers	Project Title	Osdag on Web
Group/Team Name	Web Development Teams	Subtitle	
Designer	Gyrnaskha Aahoa	Job Number	0
Date	10 /03 /2023	Client	The No Name Guy

1 Input Parameters

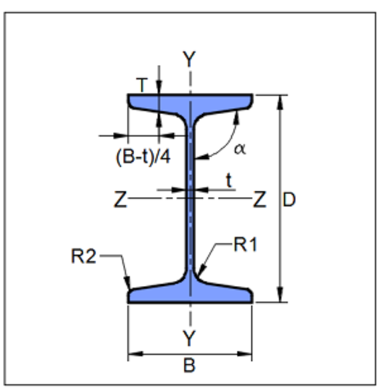
Main Module	Shear Connection
Module	Fin Plate Connection
Connectivity	Column Flange-Beam Web
Shear Force (kN)	10.0
Axial Force (kN)	30.0

Supporting Section - Mechanical Properties



Supporting Section		HB 150	
Material		E 250 (Fe 410 W)A	
Ultimate Strength, F_u (MPa)		410	
Yield Strength, F_y (MPa)		250	
Mass, m (kg/m)	27.06	I_z (cm^4)	1450.0
Area, A (cm^2)	34.4	I_y(cm^4)	431.0
D (mm)	150.0	r_z (cm)	6.49
B (mm)	150.0	r_y (cm)	3.53
t (mm)	5.4	Z_z (cm^3)	194.0
T (mm)	9	Z_y (cm^3)	57.5
Flange Slope	94	Z_{pz} (cm^3)	215.0
R_1 (mm)	8.0	Z_{py} (cm^3)	92.7
R_2 (mm)	4.0		

Supported Section - Mechanical Properties



Supported Section		JB 150	
Material		E 250 (Fe 410 W)A	
Ultimate Strength, F_u (MPa)		410	
Yield Strength, F_y (MPa)		250	
Mass, m (kg/m)	7.07	I_z (cm^4)	321.0
Area, A (cm^2)	9.0	I_y(cm^4)	9.21
D (mm)	150.0	r_z (cm)	5.97
B (mm)	50.0	r_y (cm)	1.01
t (mm)	3.0	Z_z (cm^3)	42.8
T (mm)	4.6	Z_y (cm^3)	3.68
Flange Slope	91.5	Z_{pz} (cm^3)	49.5
R_1 (mm)	5.0	Z_{py} (cm^3)	5.96
R_2 (mm)	1.5		

Bolt Details - Input and Design Preference	
Diameter (mm)	[8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 42, 45, 48, 52, 56, 60, 64]
Property Class	['3.6', '4.6', '4.8', '5.6', '5.8', '6.8', '8.8', '9.8', '10.9', '12.9']
Type	Bearing Bolt
Hole Type	Standard
Bolt Tension	Non pre-tensioned
Slip Factor, (μ_f)	0.3
Detailing - Design Preference	
Edge Preparation Method	Sheared or hand flame cut
Gap Between Members (mm)	10.0
Are the Members Exposed to Corrosive Influences?	False
Plate Details - Input and Design Preference	
Thickness (mm)	[8, 10, 12, 14, 16, 18, 20, 22, 25, 28, 32, 36, 40, 45, 50, 56, 63, 75, 80, 90, 100, 110, 120]
Material	E 250 (Fe 410 W)A
Ultimate Strength, Fu (MPa)	410
Yield Strength, Fy (MPa)	250
Weld Details - Input and Design Preference	
Weld Type	Fillet
Type of Weld Fabrication	Shop Weld
Material Grade Overwrite, Fu (MPa)	410.0

2 Design Checks

Design Status	Fail

2.1 Initial Section Check

Check	Required	Provided	Remarks
Shear Yielding Capacity (kN)	10.0	$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{150.0 \times 3.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 59.05$ [Ref. IS 800:2007, Cl.10.4.3]	Pass
Allowable Shear Capacity (kN)	10.0	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 59.05$ $= 35.43$ [Limited to low shear]	Pass
Tension Yielding Capacity (kN)	30.0	$T_{\mathrm{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 150.0 \times 3.0$ $= \frac{450.0 \times 250}{1.1 \times 10^3}$ $= 102.27$ [Ref. IS 800:2007, Cl.6.2]	Pass

2.2 Load Consideration

Check	Required	Provided	Remarks
Applied Axial Force (kN)	30.0	30.0	

Check	Required	Provided	Remarks
Applied Shear Force (kN)	10.0	$V_{y_{\min}} = \min(0.15V_{d_y},\ 40.0)$ $= \min(0.15 \times 59.05,\ 40.0)$ $= 40$ $V_u = \max(V_y,\ V_{y_{\min}})$ $= \max(10.0, 40)$ $= 40$ [Ref. IS 800:2007, Cl.10.7]	

2.3 Bolt Design

Check	Required	Provided	Remarks
Diameter (mm)		10.0	
Property Class		6.8	
Plate Thickness (mm)	$t_w = 3.0$	8.0	**Pass**
No. of Bolt Columns		1	**Pass**
No. of Bolt Rows		3	
Min. Pitch Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 10.0$ $= 25.0$ [Ref. IS 800:2007, Cl.10.2.2]	40	**Pass**
Max. Pitch Distance (mm)	$p/g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 3.0,\ 300)$ $= \min(96.0,\ 300)$ $= 96.0$ Where, $t = \min(8.0, 3.0)$ [Ref. IS 800:2007, Cl.10.2.3]	40	**Pass**

Check	Required	Provided	Remarks
Min. Gauge Distance (mm)	$p_{\text{min}} = 2.5d$ $= 2.5 \times 10.0$ $= 25.0$ [Ref. IS 800:2007, Cl.10.2.2]	0.0	
Max. Gauge Distance (mm)	$p/g_{\text{max}} = \min(32t,\ 300)$ $= \min(32 \times 3.0,\ 300)$ $= \min(96.0,\ 300)$ $= 96.0$ Where, $t = \min(8.0, 3.0)$ [Ref. IS 800:2007, Cl.10.2.3]	0.0	
Min. End Distance (mm)	$e_{\text{min}} = 1.7d_0$ $= 1.7 \times 10$ $= 17.0$ [Ref. IS 800:2007, Cl.10.2.4.2]	20	**Pass**
Max. End Distance (mm)	$e_{\text{max}} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 8.0 \times \sqrt{\frac{250}{250}} = 96.0$ $e_2 = 12 \times 3.0 \times \sqrt{\frac{250}{250}} = 36.0$ $e_{\text{max}} = \min(e_1,\ e_2) = 36.0$ [Ref. IS 800:2007, Cl.10.2.4.3]	20	**Pass**
Min. Edge Distance (mm)	$e'_{\text{min}} = 1.7d_0$ $= 1.7 \times 10$ $= 17.0$ [Ref. IS 800:2007, Cl.10.2.4.2]	20	**Pass**

Check	Required	Provided	Remarks
Max. Edge Distance (mm)	$e'_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 8.0 \times \sqrt{\frac{250}{250}} = 96.0$ $e_2 = 12 \times 3.0 \times \sqrt{\frac{250}{250}} = 36.0$ $e'_{\max} = min(e_1,\ e_2) = 36.0$ [Ref. IS 800:2007, Cl.10.2.4.3]	20	**Pass**
Moment Demand (kNm)		$M_d = (V_u \times \text{ecc} + M_w)$ $\text{ecc} = \text{eccentricity}$ $M_w = \text{external moment acting on web}$ $= \frac{(10.0 \times 10^3 \times 30.0 + 0.0 \times 10^6)}{10^6}$ $= 0.3$	
Bolt Force Parameter(s) (mm)	$l_n = \text{length available}$ $l_n = p\ (n_r - 1)$ $= 40 \times (3 - 1)$ $= 80$ $y_{\max} = l_n/2$ $= 80/2$ $= 40.0$ $x_{\max} = g(n_c - 1)/2$ $= 0.0 \times (1 - 1)/2$ $= 0.0$		

Check	Required	Provided	Remarks
Bolt Force (kN)	$vbv = V_u/(n_r \times n_c) = \frac{10.0}{(3 \times 1)} = 3.33$ $tmh = \frac{M_d \times y_{\max}}{\Sigma r_i^2} = \frac{0.3 \times 40.0}{3.2} = 3.75$ $tmv = \frac{M_d \times x_{\max}}{\Sigma r_i^2} = \frac{0.3 \times 0.0}{3.2} = 0.0$ $abh = \frac{A_u}{(n_r \times n_c)} = \frac{30.0}{(3 \times 1)} = 10.0$ $v_{\text{res}} = \sqrt{(vbv + tmv)^2 + (tmh + abh)^2} = \sqrt{(3.33 + 0.0)^2 + (3.75 + 10.0)^2} = 14.15$		
Shear Capacity (kN)		$V_{\text{dsb}} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}} = \frac{600.0 \times 1 \times 58}{1000 \times \sqrt{3} \times 1.25} = 16.07$ [Ref. IS 800:2007, Cl.10.3.3]	

Check	Required	Provided	Remarks
Kb		$k_b = \min\left(\frac{e}{3d_0},\ \frac{p}{3d_0} - 0.25,\ \frac{f_{ub}}{f_u},\ 1.0\right)$ $= \min\left(\frac{20}{3 \times 10},\ \frac{40}{3 \times 10} - 0.25,\ \frac{600.0}{410},\ 1.0\right)$ $= \min(0.67, 1.08, 1.46, 1.0)$ $= 0.67$ [Ref. IS 800:2007, Cl.10.3.4]	
Bearing Capacity (kN)		$V_{\text{dpb}} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.67 \times 10.0 \times 3.0 \times 410}{1000 \times 1.25}$ $= 16.48$ [Ref. IS 800:2007, Cl.10.3.4]	
Capacity (kN)		$V_{\text{db}} = \min\ (V_{\text{dsb}},\ V_{\text{dpb}})$ $= \min\ (16.07,\ 16.48)$ $= 16.07$ [Ref. IS 800:2007, Cl.10.3.2]	
Long Joint Reduction Factor	if $l_j \geq 15d$ then $V_{\text{rd}} = \beta_{lj} V_{\text{db}}$ if $l_j < 15d$ then $V_{\text{rd}} = V_{\text{db}}$ where, $l_j = ((nc \text{ or } nr) - 1) \times (p \text{ or } g)$ $\beta_{lj} = 1.075 - l/(200d)$ but $0.75 \leq \beta_{lj} \leq 1.0$ [Ref. IS 800:2007, Cl.10.3.3.1]	$l_j = (n_r - 1) \times p$ $= (3 - 1) \times 40 = 80$ $l = 80$ $15 \times d = 15 \times 10.0 = 150.0$ since, $l_j < 15 \times d$ then $\beta_{lj} = 1.0$ [Ref. IS 800:2007, Cl.10.3.3.1]	
Capacity (kN)	14.15	16.07	Pass

2.4 Plate Design

Check	Required	Provided	Remarks
Min. Plate Height (mm)	$0.6 \times (d_b - 2 \times t_f - 2 \times r_r)$ $= 0.6 \times (150.0 - 2 \times 4.6 - 2 \times 5.0)$ $= 78.48$ [Ref. INSDAG, Ch.5, sec.5.2.3]	120	**Pass**
Max. Plate Height (mm)	$d_b - 2(t_{bf} + r_{b1} + \text{gap})$ $= 150.0 - 2 \times (4.6 + 5.0 + 10)$ $= 130.8$	120	**Pass**
Min. Plate Width (mm)	$2e_{\min} + (n_c - 1)p_{\min})$ $= 2 \times 17.0 + (1 - 1) \times 25.0$ $= 44.0$	50.0	**Pass**
Min. Plate Thickness (mm)	$t_w = 3.0$	8.0	**Pass**
Shear Yielding Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{120 \times 8.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 125.97$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	$V = 10.0$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 125.97$ $= 75.58$ [Limited to low shear]	**Pass**
Shear Rupture Capacity (kN)		$V_{d_n} = \frac{0.75 A_{v_n} f_u}{\sqrt{3}\gamma_{m1}}$ $= 1 \times \frac{(120 - (3 \times 10)) \times 8.0 \times 410}{\sqrt{3} \times 1.25}$ $= 221.4$ [Ref. AISC, sect. J4]	

Check	Required	Provided	Remarks
Block Shear Capacity in Shear (kN)		$V_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $V_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $V_{\text{db}} = \min(V_{db1},\ V_{db2}) = 138.62$ [Ref. IS 800:2007, Cl.6.4]	
Shear Capacity (kN)	10.0	$V_d = \min(S_c,\ V_{d_n},\ V_{d_b})$ $= \min(75.58,\ 221.4,\ 138.62)$ $= 75.58$ [Ref. IS 800:2007, Cl.6.1]	**Pass**
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 120 \times 8.0$ $= \frac{960.0 \times 250}{1.1 \times 10^3}$ $= 218.18$ [Ref. IS 800:2007, Cl.6.2]	
Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (120 - 3 \times 10) \times 8.0 \times 410}{1.25}$ $= 259.78$ [Ref. IS 800:2007, Cl.6.3.1]	

Check	Required	Provided	Remarks
Block Shear Capacity in Tension (kN)		$T_{\mathrm{dbl1}} = \frac{A_{\mathrm{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\mathrm{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\mathrm{db}} = \min(T_{db1},\ T_{db2}) = 183.69$ [Ref. IS 800:2007, Cl.6.4]	
Tension Capacity (kN)	30.0	$T_{\mathrm{d}} = \min(T_{\mathrm{dg}},\ T_{\mathrm{dn}},\ T_{\mathrm{db}})$ $= \min(218.18, 259.78, 183.69)$ $= 183.69$ [Ref.IS 800:2007, Cl.6.1]	Pass
Moment Capacity (kNm)	0.3	$M_{d_{\mathrm{z}}} = \frac{\beta_b Z_p f y}{\gamma_{m0} \times 10^6}$ $= \frac{1.0 \times 28800.0 \times 250}{1.1 \times 10^6}$ $= 6.55$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Interaction Ratio	≤ 1	$\frac{0.3}{6.55} + \frac{30.0}{183.69} = 0.21$ [Ref. IS 800:2007, Cl.10.7]	Pass

2.5 Section Design

Check	Required	Provided	Remarks
Shear Yielding Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{150.0 \times 3.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 59.05$ [Ref. IS 800:2007, Cl.10.4.3]	

Check	Required	Provided	Remarks
Allowable Shear Capacity (kN)	$V = 10.0$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 59.05$ $= 35.43$ [Limited to low shear]	Pass
Shear Rupture Capacity (kN)		$V_{d_n} = \frac{0.75 A_{v_n} f_u}{\sqrt{3}\gamma_{m1}}$ $= 1 \times \frac{(150.0 - (3 \times 10)) \times 3.0 \times 410}{\sqrt{3} \times 1.25}$ $= 110.7$ [Ref. AISC, sect. J4]	
Block Shear Capacity in Shear (kN)		$V_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $V_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $V_{\text{db}} = \min(V_{db1},\ V_{db2}) = 51.98$ [Ref. IS 800:2007, Cl.6.4]	
Shear Capacity (kN)	10.0	$V_d = \min(S_c,\ V_{d_n},\ V_{d_b})$ $= \min(35.43,\ 110.7,\ 51.98)$ $= 35.43$ [Ref. IS 800:2007, Cl.6.1]	Pass
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 150.0 \times 3.0$ $= \frac{450.0 \times 250}{1.1 \times 10^3}$ $= 102.27$ [Ref. IS 800:2007, Cl.6.2]	

Check	Required	Provided	Remarks
Tension Rupture Capacity (kN)		$T_{\rm dn} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (150.0 - 3 \times 10) \times 3.0 \times 410}{1.25}$ $= 106.27$ [Ref. IS 800:2007, Cl.6.3.1]	
Block Shear Capacity in Tension (kN)		$T_{\rm dbl1} = \frac{A_{\rm vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\rm dbl2} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\rm db} = \min(T_{db1},\ T_{db2}) = 68.88$ [Ref. IS 800:2007, Cl.6.4]	
Tension Capacity (kN)	30.0	$T_{\rm d} = \min(T_{\rm dg},\ T_{\rm dn},\ T_{\rm db})$ $= \min(102.27, 106.27, 68.88)$ $= 68.88$ [Ref.IS 800:2007, Cl.6.1]	**Pass**
Moment Capacity (kNm)	0.3	$M_{d_{\rm z}} = \frac{\beta_b Z_p f y}{\gamma_{m0} \times 10^6}$ $= \frac{1.0 \times 49500.0 \times 250}{1.1 \times 10^6}$ $= 11.25$ [Ref. IS 800:2007, Cl.8.2.1.2]	**Pass**
Interaction Ratio	≤ 1	$\frac{0.3}{11.25} + \frac{30.0}{68.88} = 0.46$ [Ref. IS 800:2007, Cl.10.7]	**Pass**

2.6 Weld Design

Check	Required	Provided	Remarks
Min. Weld Size (mm)	$t_{w_{\min}}$ based on thinner part $= \max(8,\ 8)$ $s_{\min}$ based on thicker part $= 3$ [Ref. IS 800:2007, Table 21, Cl.10.5.2.3]	3	**Pass**
Max. Weld Size (mm)	Thickness of thinner part $= \min(9,\ 8.0) = 8.0$ $s_{\max} = 8$ [Ref. IS 800:2007, Cl.10.5.3.1]	3	**Pass**
Weld Strength (N/mm)	$R_{\text{w}} = \sqrt{(T_{\text{wh}} + A_{\text{wh}})^2 + (T_{\text{wv}} + V_{\text{wv}})^2}$ $T_{\text{wh}} = \frac{M \times y_{\max}}{I_{pw}} = \frac{300000.0 \times 57.0}{246924.0}$ $T_{\text{wv}} = \frac{M \times x_{\max}}{I_{pw}} = \frac{300000.0 \times 0.0}{246924.0}$ $V_{\text{wv}} = \frac{V}{l_w} = \frac{10000.0}{228}$ $A_{\text{wh}} = \frac{A}{l_w} = \frac{30000.0}{228}$ $R_{\text{w}} = \sqrt{(69.25 + 131.58)^2 + (0.0 + 43.86)^2}$ $= 205.56$	$f_w = \frac{t_t f_u}{\sqrt{3}\gamma_{mw}}$ $= \frac{3 \times 410}{\sqrt{3} \times 1.25}$ $= 568.11$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	**Pass**

3 Design Log