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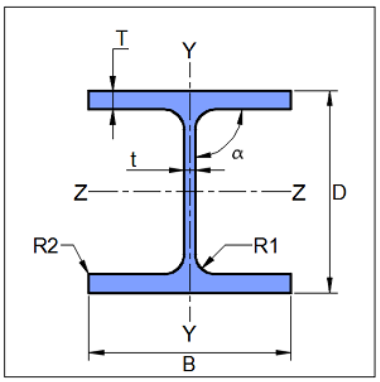
Company Name		Project Title	splice
Group/Team Name		Subtitle	
Designer		Job Number	
Date	17 /04 /2021	Client	

1 Input Parameters

Module	Beam-to-Beam Cover Plate Bolted Connection
Main Module	Moment Connection
Bending Moment (kNm)	12.167
Shear Force (kN)	131.628
Axial Force (kN)	147.368
Beam Section - Mechanical Properties	



Beam Section		GROUP4-S-+	
Material		E 250 (Fe 410 W)A	
Ultimate Strength, F_u (MPa)		410	
Yield Strength, F_y (MPa)		240	
Mass, m (kg/m)	328.22	I_z (cm^4)	51152.0
Area, A (cm^2)	41900.0	I_y(cm^4)	42926.0
D (mm)	824.0	r_z (cm)	34.9
B (mm)	500.0	r_y (cm)	10.12
t (mm)	12.0	Z_z (cm^3)	13034.0
T (mm)	20.0	Z_y (cm^3)	2071.0
Flange Slope	90	Z_{pz} (cm^3)	7374.9
R_1 (mm)	20.0	Z_{py} (cm^3)	15512.0
R_2 (mm)	10.0		

Bolt Details - Input and Design Preference	
Diameter (mm)	[8, 10, 12, 14, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 42, 45]
Property Class	[8.8, 9.8, 10.9, 12.9]
Type	Bearing Bolt
Hole Type	Standard
Slip Factor, (μ_f)	0.3
Edge Preparation Method	Sheared or hand flame cut
Gap Between Beams (mm)	3.0
Are the Members Exposed to Corrosive Influences?	False
Plate Details - Input and Design Preference	
Preference	Outside + Inside
Ultimate Strength, F_u (MPa)	410

Yield Strength, F_y (MPa)	250
Material	E 250 (Fe 410 W)A
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]

2 Design Checks

Design Status	Pass

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)	$P_x = 147.368$	$T_{\mathrm{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $= \frac{41900.0 \times 240}{1.1 \times 10^3}$ $= 9141.82$ [Ref. IS 800:2007, Cl.6.2]	
Shear Capacity Member (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{784.0 \times 12.0 \times 240}{\sqrt{3} \times 1.1 \times 1000}$ $= 1185.1$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	$V_y = 131.628$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 1185.1$ $= 711.06$ [Limited to low shear]	Pass
Plastic Moment Capacity (kNm)		$M_{dz} = \frac{\beta_b Z_p fy}{\gamma_{m0} \times 10^6}$ $= \frac{1.77 \times 7374900.0 \times 240}{1.1 \times 10^6}$ $= 2843.78$ [Ref. IS 800:2007, Cl.8.2.1.2]	

Check	Required	Provided	Remarks
Moment Deformation Criteria (kNm)		$M_{dc} = \frac{1.5 Z_e fy}{\gamma_{m0} \times 10^6}$ $= \frac{1.5 \times 13034000.0 \times 240}{1.1 \times 10^6}$ $= 4265.67$ [Ref. IS 800:2007, Cl.8.2.1.2]	
Moment Capacity Member (kNm)	$M_z = 12.167$	$M_{d_z} = \min(M_{d_z},\ M_{d_c})$ $= \min(2843.78, 4265.67)$ $= 2843.78$ [Ref. IS 800:2007, Cl.8.2]	

2.2 Load Consideration

Check	Required	Provided	Remarks
Interaction Ratio		I.R. axial $= P_{\mathrm{x}}/T_{\mathrm{dg}}$ $= 147.368/9141.82$ $= 0.0161$ I.R. moment $= M_{\mathrm{z}}/M_{d_{\mathrm{z}}}$ $= 12.167/2843.78$ $= 0.0043$ I.R. sum $=$ I.R. axial + I.R. moment $= 0.0161 + 0.0043$ $= 0.0204$	

Check	Required	Provided	Remarks
Minimum Required Load	if I.R. axial < 0.3 and I.R. moment < 0.5 $P_{\mathrm{x}\,\mathrm{min}} = 0.3T_{\mathrm{dg}}$ $M_{\mathrm{z}\,\mathrm{min}} = 0.5M_{d\mathrm{z}}$ elif sum I.R. <= 1.0 and I.R. moment < 0.5 if $(0.5 - \text{I.R. moment}) < (1 - \text{sum I.R.})$ $M_{\mathrm{z}\,\mathrm{min}} = 0.5 \times M_{d\mathrm{z}}$ else $M_{\mathrm{z}\,\mathrm{min}} = M_{\mathrm{z}} + ((1 - \text{sum I.R.}) \times M_{d\mathrm{z}})$ $P_{\mathrm{x}\,\mathrm{min}} = P_{\mathrm{x}}$ elif sum I.R. <= 1.0 and I.R. axial < 0.3 if $(0.3 - \text{I.R. axial}) < (1 - \text{sum I.R.})$ $P_{\mathrm{x}\,\mathrm{min}} = 0.3T_{\mathrm{dg}}$ else $P_{\mathrm{x}\,\mathrm{min}} = P_{\mathrm{x}} + ((1 - \text{sum I.R.}) \times T_{\mathrm{dg}})$ $M_{\mathrm{z}\,\mathrm{min}} = M_{\mathrm{z}}$ else $P_{\mathrm{x}\,\mathrm{min}} = P_{\mathrm{x}}$ $M_{\mathrm{z}\,\mathrm{min}} = M_{\mathrm{z}}$ Note: AL is the user input for load	$M_{\mathrm{z}\,\mathrm{min}} = 1421.89$ $P_{\mathrm{x}\,\mathrm{min}} = 2742.55$ [Ref. IS 800:2007, Cl.10.7]	
Applied Axial Force (kN)	$P_x = 147.368$	$P_u = \max(P_{\mathrm{x}},\ P_{\mathrm{x}\,\mathrm{min}})$ $= \max(147.368, 2742.55)$ $= 2742.55$	

Check	Required	Provided	Remarks
Applied Shear Force (kN)	$V_y = 131.628$	$V_{y_{\min}} = \min(0.15V_{d_y},\ 40.0)$ $= \min(0.15 \times 1185.1,\ 40.0)$ $= 40.0$ $V_u = \max(V_y,\ V_{y_{\min}})$ $= \max(131.628, 40.0)$ $= 131.63$ [Ref. IS 800:2007, Cl.10.7]	
Applied Moment (kNm)	$M_z = 12.167$	$M_u = \max(M_z,\ M_{z_{\min}})$ $= \max(12.167,\ 1421.89)$ $= 1421.89$ [Ref. IS 800:2007, Cl.8.2.1.2]	
Force Carried by Web		$A_w =$ Axial force in web $= \frac{(D-2T)tAu}{A}$ $= \frac{(824.0 - 2 \times 20.0) \times 12.0 \times 2742.55}{41900.0}$ $= 615.8$ kN $M_w =$ Moment in web $= \frac{Z_w Mu}{Z}$ $= \frac{1229312.0 \times 1421.89}{7374900.0}$ $= 237.01$ kNm	

Check	Required	Provided	Remarks
Force Carried by Flange		A_f = Axial force in flange $= \frac{AuBT}{A}$ $= \frac{2742.55 \times 500.0 \times 20.0}{41900.0}$ $= 654.55$ kN M_f = Moment in flange $= Mu - M_w$ $= 1421.89 - 237.01$ $= 1184.88$ kNm F_f = flange force $= \frac{M_f \times 10^3}{D - T} + A_f$ $= \frac{1184.88 \times 10^3}{824.0 - 20.0} + 654.55$ $= 2128.27$ kN	

2.3 Flange Bolt Check

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Quantity Optimization	$d = 42.0$	
Property Class	Bolt Grade Optimization	8.8	
Bolt Ultimate Strength (N/mm2)		$f_{ub} = 830.0$	
Bolt Yield Strength (N/mm2)		$f_{yb} = 660.0$	
Nominal Stress Area (mm2)		$A_{nb} = 1080 \ (Ref\ IS\ 1367-3\ (2002))$	
Hole Diameter (mm)		$d_0 = 45.0$	
Min. Flange Plate Thickness (mm)	$T/2 = 10.0$	$t_{ifp} = 12.0$	**Pass**
No. of Bolt Columns		$n_c = 6$	
No. of Bolt Rows		$n_r = 2$	

Check	Required	Provided	Remarks
Min. Pitch Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 42.0$ $= 105.0$ [Ref. IS 800:2007, Cl.10.2.2]	105	**Pass**
Max. Pitch Distance (mm)	$p/g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 12.0,\ 300)$ $= \min(384.0,\ 300)$ $= 300$ Where, $t = \min(12.0, 20.0)$ [Ref. IS 800:2007, Cl.10.2.3]	105	**Pass**
Min. Gauge Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 42.0$ $= 105.0$ [Ref. IS 800:2007, Cl.10.2.2]	0	
Max. Gauge Distance (mm)	$p/g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 12.0,\ 300)$ $= \min(384.0,\ 300)$ $= 300$ Where, $t = \min(12.0, 20.0)$ [Ref. IS 800:2007, Cl.10.2.3]	0	
Min. End Distance (mm)	$e_{\min} = 1.7d_0$ $= 1.7 \times 45.0$ $= 76.5$ [Ref. IS 800:2007, Cl.10.2.4.2]	80	**Pass**

Check	Required	Provided	Remarks
Max. End Distance (mm)	$e_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 24.0 \times \sqrt{\frac{250}{250}} = 288.0$ $e_2 = 12 \times 20.0 \times \sqrt{\frac{250}{240}} = 244.95$ $e_{\max} = \min(e_1,\ e_2) = 244.95$ [Ref. IS 800:2007, Cl.10.2.4.3]	80	Pass
Min. Edge Distance (mm)	$e_{\min} = 1.7d_0$ $= 1.7 \times 45.0$ $= 76.5$ [Ref. IS 800:2007, Cl.10.2.4.2]	112.0	Pass
Max. Edge Distance (mm)	$e'_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 24.0 \times \sqrt{\frac{250}{250}} = 288.0$ $e_2 = 12 \times 20.0 \times \sqrt{\frac{250}{240}} = 244.95$ $e'_{\max} = min(e_1,\ e_2) = 244.95$ [Ref. IS 800:2007, Cl.10.2.4.3]	112.0	Pass
Shear Capacity (kN)		$V_{\text{dsb}} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}}$ $= \frac{830.0 \times 2 \times 1080}{1000 \times \sqrt{3}\ \times\ 1.25}$ $= 828.06$ [Ref. IS 800:2007, Cl.10.3.3]	

Check	Required	Provided	Remarks
Kb		$k_b = \min\left(\frac{e}{3d_0},\ \frac{p}{3d_0} - 0.25,\ \frac{f_{ub}}{f_u},\ 1.0\right)$ $= \min\left(\frac{80}{3\times45.0},\ \frac{105}{3\times45.0} - 0.25,\ \frac{830.0}{410},\ 1.0\right)$ $= \min(0.59, 0.53, 2.02, 1.0)$ $= 0.53$ [Ref. IS 800:2007, Cl.10.3.4]	
Bearing Capacity (kN)		$V_{\text{dpb}} = \frac{2.5k_b dt f_u}{\gamma_{mb}}$ $= \frac{2.5\times0.53\times42.0\times20.0\times410}{1000\times1.25}$ $= 365.06$ [Ref. IS 800:2007, Cl.10.3.4]	
Bolt Capacity (kN)		$V_{\text{db}} = \min\ (V_{\text{dsb}},\ V_{\text{dpb}})$ $= \min\ (828.06,\ 365.06)$ $= 365.06$ [Ref. IS 800:2007, Cl.10.3.2]	

Check	Required	Provided	Remarks
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]	$l\ = ((n_c \text{ or } n_r) - 1) \times (p \text{ or } g)$ $l_r = 2 \times \left(\left(\frac{6}{2} - 1\right) \times 105 + 80\right) + 3.0$ $= 583.0$ $l_c = 2 \times \left(\left(\frac{2}{2} - 1\right) \times 0 + 112.0\right)$ $+ 20.0) + 12.0 = 276.0$ $l\ = 583.0$ $15d = 15 \times 42.0 = 630.0$ since, $l < 15d$ then $V_{\text{rd}} = V_{\text{db}}$ $V_{\text{rd}} = 365.06$ [Ref. IS 800:2007, Cl. 10.3.3.1]	
Large Grip Length Reduction Factor	if $l_g \geq 5d,$ then $V_{\text{rd}} = \beta_{lg} V_{\text{db}}$ if $l_g < 5d$ then $V_{\text{rd}} = V_{\text{db}}$ $l_g \leq 8d$ where, $l_g = \Sigma(t_{\text{ep}} + t_{\text{member}})$ $\beta_{lg} = 8d/(3d + l_g)$ but $\beta_{lg} \leq \beta_{lj}$ [Ref. IS 800:2007, Cl.10.3.3.2]	$l_g = \Sigma\ (t_p + t_{\text{member}})$ $= 44.0$ $5d = 210.0$ $8d = 336.0$ since, $l_g < 5d$; $\beta_{lg} = 1.0$ [Ref. IS 800:2007, Cl.10.3.3.2]	

Check	Required	Provided	Remarks
Capacity (kN)	$V_{res} = \dfrac{2\sqrt{V_u^2 + A_u^2}}{bolts_{\text{req}}}$ $= \dfrac{2 \times \sqrt{0.0^2 + 2128.27^2}}{12}$ $= 354.71$	$V_{\text{rd}} = \beta_{lj}\beta_{lg}V_{\text{db}}$ $= 1.0 \times 1.0 \times 365.06$ $= 365.06$	**Pass**

2.4 Web Bolt Check

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Quantity Optimization	$d = 42.0$	
Property Class	Bolt Grade Optimization	8.8	
Min. Web Plate Thickness (mm)	$t/2 = 6.0$	$t_{wp} = 12.0$	**Pass**
No. of Bolt Columns		$n_c = 4$	
No. of Bolt Rows		$n_r = 6$	
Min. Pitch Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 42.0$ $= 105.0$ [Ref. IS 800:2007, Cl.10.2.2]	105	**Pass**
Max. Pitch Distance (mm)	$p/g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 12.0,\ 300)$ $= \min(384.0,\ 300)$ $= 300$ Where, $t = \min(12.0, 12.0)$ [Ref. IS 800:2007, Cl.10.2.3]	105	**Pass**
Min. Gauge Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 42.0$ $= 105.0$ [Ref. IS 800:2007, Cl.10.2.2]	105	**Pass**

Check	Required	Provided	Remarks
Max. Gauge Distance (mm)	$p/g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 12.0,\ 300)$ $= \min(384.0,\ 300)$ $= 300$ Where, $t = \min(12.0, 12.0)$ [Ref. IS 800:2007, Cl.10.2.3]	105	**Pass**
Min. End Distance (mm)	$e_{\min} = 1.7 d_0$ $= 1.7 \times 45.0$ $= 76.5$ [Ref. IS 800:2007, Cl.10.2.4.2]	80	**Pass**
Max. End Distance (mm)	$e_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 24.0 \times \sqrt{\frac{250}{250}} = 288.0$ $e_2 = 12 \times 12.0 \times \sqrt{\frac{250}{240}} = 146.97$ $e_{\max} = \min(e_1,\ e_2) = 146.97$ [Ref. IS 800:2007, Cl.10.2.4.3]	80	**Pass**
Min. Edge Distance (mm)	$e_{\min} = 1.7 d_0$ $= 1.7 \times 45.0$ $= 76.5$ [Ref. IS 800:2007, Cl.10.2.4.2]	80	**Pass**

Check	Required	Provided	Remarks
Max. Edge Distance (mm)	$e'_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 24.0 \times \sqrt{\frac{250}{250}} = 288.0$ $e_2 = 12 \times 12.0 \times \sqrt{\frac{250}{240}} = 146.97$ $e'_{\max} = min(e_1,\ e_2) = 146.97$ [Ref. IS 800:2007, Cl.10.2.4.3]	80	**Pass**
Shear Capacity (kN)		$V_{\text{dsb}} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}}$ $= \frac{830.0 \times 2 \times 1080}{1000 \times \sqrt{3}\ \times\ 1.25}$ $= 828.06$ [Ref. IS 800:2007, Cl.10.3.3]	
Kb		$k_b = \min\left(\frac{e}{3d_0},\ \frac{p}{3d_0} - 0.25,\ \frac{f_{ub}}{f_u},\ 1.0\right)$ $= \min\left(\frac{80}{3 \times 45.0},\ \frac{105}{3 \times 45.0} - 0.25,\ \frac{830.0}{410},\ 1.0\right)$ $= \min(0.59, 0.53, 2.02, 1.0)$ $= 0.53$ [Ref. IS 800:2007, Cl.10.3.4]	
Bearing Capacity (kN)		$V_{\text{dpb}} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.53 \times 42.0 \times 12.0 \times 410}{1000 \times 1.25}$ $= 219.04$ [Ref. IS 800:2007, Cl.10.3.4]	
Bolt Capacity (kN)		$V_{\text{db}} = \min\ (V_{\text{dsb}},\ V_{\text{dpb}})$ $= \min\ (828.06,\ 219.04)$ $= 219.04$ [Ref. IS 800:2007, Cl.10.3.2]	

Check	Required	Provided	Remarks
Bolt Force Parameter(s) (mm)	l_n = length available $l_n = g\ (n_r - 1)$ $= 105 \times (6 - 1)$ $= 525$ $y_{\max} = l_n/2$ $= 525/2$ $= 262.5$ $x_{\max} = p(\frac{n_c}{2} - 1)/2$ $= 105 \times (\frac{4}{2} - 1)/2$ $= 52.5$		
Moment Demand (kNm)	$M_d = (V_u \times \text{ecc} + M_w)$ ecc = eccentricity M_w = external moment acting on web $= \frac{(131.63 \times 10^3 \times 134.0 + 237.01 \times 10^6)}{10^6}$ $= 254.65$		

Check	Required	Provided	Remarks
Bolt Force (kN)	$vbv = V_u/(n_r \times (n_c/2)) = \frac{131.63}{(6 \times (4/2))} = 10.97$ $tmh = \frac{M_d \times y_{\max}}{\Sigma r_i^2} = \frac{254.65 \times 262.5}{418.95} = 159.56$ $tmv = \frac{M_d \times x_{\max}}{\Sigma r_i^2} = \frac{254.65 \times 52.5}{418.95} = 31.91$ $abh = \frac{A_u}{(n_r \times n_c/2)} = \frac{615.8}{(6 \times (4/2))} = 51.32$ $v_{\text{res}} = \sqrt{(vbv + tmv)^2 + (tmh + abh)^2} = \sqrt{(10.97 + 31.91)^2 + (159.56 + 51.32)^2} = 215.19$		

Check	Required	Provided	Remarks
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]	$l = ((n_c \text{ or } n_r) - 1) \times (p \text{ or } g)$ $l_r = 2 \times \left(\left(\frac{4}{2} - 1\right) \times 105 + 80\right) + 3.0$ $= 373.0$ $l_c = (6 - 1) \times 105 = 525$ $l = 525$ $15d = 15 \times 42.0 = 630.0$ since, $l < 15d$ then, $V_{\text{rd}} = V_{\text{db}}$ $V_{\text{rd}} = 219.04$ [Ref. IS 800:2007, Cl.10.3.3.1]	
Large Grip Length Reduction Factor	if $l_g \geq 5d$, then $V_{\text{rd}} = \beta_{lg} V_{\text{db}}$ if $l_g < 5d$ then $V_{\text{rd}} = V_{\text{db}}$ $l_g \leq 8d$ where, $l_g = \Sigma(t_{\text{ep}} + t_{\text{member}})$ $\beta_{lg} = 8d/(3d + l_g)$ but $\beta_{lg} \leq \beta_{lj}$ [Ref. IS 800:2007, Cl.10.3.3.2]	$l_g = \Sigma\ (t_p + t_{\text{member}})$ $= 36.0$ $5d = 210.0$ $8d = 336.0$ since, $l_g < 5d$; $\beta_{lg} = 1.0$ [Ref. IS 800:2007, Cl.10.3.3.2]	
Capacity (kN)	215.19	$V_{\text{rd}} = \beta_{lj} \beta_{lg} V_{\text{db}}$ $= 1.0 \times 1.0 \times 219.04$ $= 219.04$	**Pass**

2.5 Flange Plate Dimension Check - Outside/Inside

Check	Required	Provided	Remarks
Min. Flange Plate Width (mm)	min. flange plate height = beam width $= 500.0$	500.0	**Pass**
Min. Flange Plate Length (mm)	$2 \times [2e_{min} + (\frac{n_c}{2} - 1) \times p_{min})]$ $+ \frac{gap}{2}]$ $= 2 \times [(2 \times 76.5 + (\frac{6}{2} - 1) \times 105.0$ $= + \frac{3.0}{2}]$ $= 729.0$	743.0	**Pass**
Min. Inner Plate Width (mm)	>=50	220	**Pass**
Max. Inner Plate Width (mm)	$= \frac{B - t - (2R1)}{2}$ $= \frac{500.0 - 12.0 - 2 \times 20.0}{2}$ $= 224$	220	**Pass**
Min. Inner Plate Length (mm)	$2 \times [2e_{min} + (\frac{n_c}{2} - 1) \times p_{min})]$ $+ \frac{gap}{2}]$ $= 2 \times [(2 \times 76.5 + (\frac{6}{2} - 1) \times 105.0$ $= + \frac{3.0}{2}]$ $= 729.0$	743.0	**Pass**
Min. Flange Plate Thickness (mm)	$T/2 = 10.0$	$t_{ifp} = 12.0$	**Pass**
Plate Area Check (mm2)	plate area >= 1.05 X connected member area $= 10500.0$ [Ref: Cl.8.6.3.2, IS 800:2007]	plate area $= (B_{fp} + (2 \times B_{ifp})) \times t_{ifp}$ $= (500.0 + (2 \times 220)) \times 12.0$ $= 11280.0$	**Pass**

2.6 Web Plate Dimension Check

Check	Required	Provided	Remarks
Min. Web Plate Height (mm)	$0.6 \times (d_b - 2 \times t_f - 2 \times r_r)$ $= 0.6 \times (824.0 - 2 \times 20.0 - 2 \times 20.0)$ $= 446.4$ [Ref. INSDAG, Ch.5, sec.5.2.3]	685	Pass
Min. Web Plate Width (mm)	$2 \times [2e_{min} + (\frac{n_c}{2} - 1) \times p_{min})]$ $+ \frac{gap}{2}]$ $= 2 \times [(2 \times 76.5 + (\frac{4}{2} - 1) \times 105.0$ $= + \frac{3.0}{2}]$ $= 519.0$	533.0	Pass
Min. Web Plate Thickness (mm)	$t/2 = 6.0$	$t_{wp} = 12.0$	Pass
Plate Area Check (mm2)	plate area >= 1.05 X connected member area $= 9878.4$ [Ref: Cl.8.6.3.2, IS 800:2007]	plate area $= 2 \times W_{wp} \times t_{wp}$ $= 2 \times 685 \times 12.0$ $= 16440.0$	Pass

2.7 Member Check

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 500.0 \times 20.0$ $= \frac{10000.0 \times 240}{1.1 \times 10^3}$ $= 2181.82$ [Ref. IS 800:2007, Cl.6.2]	

Check	Required	Provided	Remarks
Flange Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (500.0 - 2 \times 45.0) \times 20.0 \times 410}{1.25}$ $= 2420.64$ [Ref. IS 800:2007, Cl.6.3.1]	
Flange Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3} \gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3} \gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 2187.53$ [Ref. IS 800:2007, Cl.6.4]	
Flange Tension Capacity (kN)	$F_f = 2128.27$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(2181.82, 2420.64, 2187.53)$ $= 2181.82$ [Ref.IS 800:2007, Cl.6.1]	**Pass**
Web Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 784.0 \times 12.0$ $= \frac{9408.0 \times 240}{1.1 \times 10^3}$ $= 2052.65$ [Ref. IS 800:2007, Cl.6.2]	
Web Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (784.0 - 6 \times 45.0) \times 12.0 \times 410}{1.25}$ $= 1820.79$ [Ref. IS 800:2007, Cl.6.3.1]	

Check	Required	Provided	Remarks
Web Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 1905.41$ [Ref. IS 800:2007, Cl.6.4]	
Web Tension Capacity (kN)	$A_w = 615.8$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(2052.65, 1820.79, 1905.41)$ $= 1820.79$ [Ref.IS 800:2007, Cl.6.1]	Pass

2.8 Flange Plate Capacity Check for Axial Load - Outside/Inside

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = lt = 940.0 \times 12.0$ $= \frac{11280.0 \times 250}{1.1 \times 10^3}$ $= 2563.64$ [Ref. IS 800:2007, Cl.6.2]	
Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{1 \times\ 0.9 \times (940.0 - 2 \times 45.0) \times 12.0 \times 410}{1.25}$ $= 3011.04$ [Ref. IS 800:2007, Cl.6.3.1]	

Check	Required	Provided	Remarks
Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 2673.91$ [Ref. IS 800:2007, Cl.6.4]	
Flange Plate Tension Capacity (kN)	$F_f = 2128.27$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(2563.64, 3011.04, 2673.91)$ $= 2563.64$ [Ref.IS 800:2007, Cl.6.1]	Pass

2.9 Web Plate Capacity Check for Axial Load

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{\text{dg}} = \frac{A_g f_y}{\gamma_{m0}}$ $A_g = 2lt = 2 \times 685 \times 12.0$ $= \frac{8220.0 \times 250}{1.1 \times 10^3}$ $= 3736.36$ [Ref. IS 800:2007, Cl.6.2]	
Tension Rupture Capacity (kN)		$T_{\text{dn}} = \frac{0.9 A_n f_u}{\gamma_{m1}}$ $= \frac{2 \times\ 0.9 \times (685 - 6 \times 45.0) \times 12.0 \times 410}{1.25}$ $= 2940.19$ [Ref. IS 800:2007, Cl.6.3.1]	

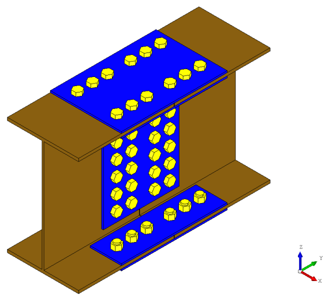
Check	Required	Provided	Remarks
Block Shear Capacity (kN)		$T_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{\text{db}} = \min(T_{db1},\ T_{db2}) = 3857.42$ [Ref. IS 800:2007, Cl.6.4]	
Web Plate Tension Capacity (kN)	$A_w = 615.8$	$T_{\text{d}} = \min(T_{\text{dg}},\ T_{\text{dn}},\ T_{\text{db}})$ $= \min(3736.36, 2940.19, 3857.42)$ $= 2940.19$ [Ref.IS 800:2007, Cl.6.1]	**Pass**

2.10 Web Plate Capacity Checks for Shear Load

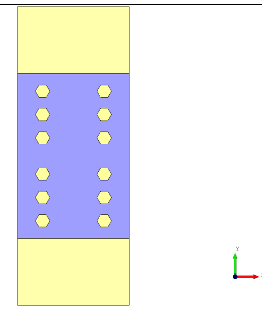
Check	Required	Provided	Remarks
Shear Yielding Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{2 \times 685 \times 12.0 \times 250}{\sqrt{3} \times 1.1 \times 1000}$ $= 2157.19$ [Ref. IS 800:2007, Cl.10.4.3]	
Allowable Shear Capacity (kN)	$V = 131.628$	$V_d = 0.6\ V_{dy}$ $= 0.6 \times 2157.19$ $= 1294.31$ [Limited to low shear]	**Pass**

Check	Required	Provided	Remarks
Shear Rupture Capacity (kN)		$V_{d_n} = \frac{0.75 A_{v_n} f_u}{\sqrt{3}\gamma_{m1}}$ $= 2 \times \frac{(685 - (6 \times 45.0)) \times 12.0 \times 410}{\sqrt{3} \times 1.25}$ $= 1414.6$ [Ref. AISC, sect. J4]	
Block Shear Capacity (kN)		$V_{\text{dbl1}} = \frac{A_{\text{vg}} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $V_{\text{dbl2}} = \frac{0.9 A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $V_{\text{db}} = \min(V_{db1},\ V_{db2}) = 2471.41$ [Ref. IS 800:2007, Cl.6.4]	
Web Plate Shear Capacity (kN)		$V_d = \min(S_c,\ V_{d_n},\ V_{d_b})$ $= \min(1294.31,\ 1414.6,\ 2471.41)$ $= 1294.31$ [Ref. IS 800:2007, Cl.6.1]	**Pass**

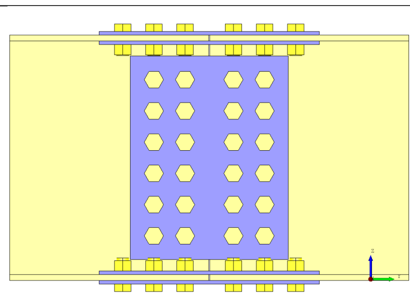
3 3D Views



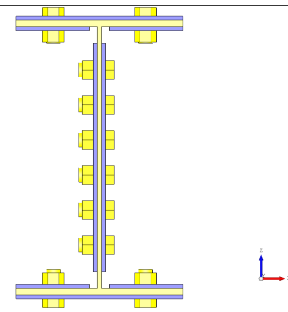
(a) 3D View



(b) Top View



(c) Side View



(d) Front View

4 Design Log

2021-04-17 20:31:31 - Osdag - INFO - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2021-04-17 20:31:31 - Osdag - INFO - The value of load(s) is/are set at minimum recommended value as per IS 800:2007, Cl.10.7.
2021-04-17 20:31:31 - Osdag - INFO - : Overall bolted cover plate splice connection design is safe
2021-04-17 20:31:31 - Osdag - INFO - :=========End Of design===========