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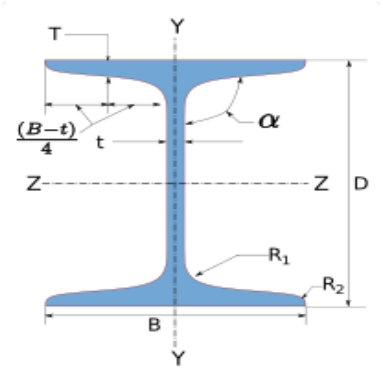
1 Input Parameters

Module		Beam Coverplate Weld Connection	
MainModule		Moment Connection	
Moment(kNm)*		10.0	
Shear (kN)*		100.0	
Axial (kN) *		80.0	
Section			
	Beam Section *	NPB 300x150x36.5	
	Preferences	Outside	
	Material *	E 250 (Fe 410 W)A	
	Ultimate strength, fu (MPa)	410	
	Yield Strength , fy (MPa) 250	R1(mm)	1.5
	Mass 36.52	R2(mm)	0.0
	Area(mm2) - A 4650.0	Iz(mm4)	71735000.0
	D(mm) 297.0	Iy(mm4)	5183900.0
	B(mm) 150.0	rz(mm)	124.2
	t(mm) 6.1	ry(mm)	33.4
	T(mm) 9.2	Zz(mm3)	483060.0
	FlangeSlope 90	Zy(mm3)	69120.0
Weld Details			
Weld Type		Fillet	
Type of weld fabrication		Shop Weld	
Material grade overwrite (MPa) Fu		410.0	
Safety Factors - IS 800:2007 Table 5 (Clause 5.4.1)			
Governed by Yielding		$\gamma_{m0} = 1.1$	
Governed by Ultimate Stress		$\gamma_{m1} = 1.25$	
Connection Weld		$\gamma_{mw} = 1.25$	

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2 Design Checks

2.1 Member Capacity

Check	Required	Provided	Remarks
Axial Capacity Member Ac (kN)		$A_c = \frac{A * f_y}{\gamma_{m0} * 10^3}$ $= \frac{4650.0 * 250}{1.1 * 10^3}$ $= 1056.82$	
Shear Capacity Member Sc (kN)		$S_c = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo} * 10^3}$ $= \frac{278.6 * 6.1 * 250}{\sqrt{3} * 1.1 * 10^3}$ $= 223.0$	
Plastic Moment Capacity Pmc (kNm)		$Pmc = \frac{\beta_b * Z_p * fy}{\gamma_{mo} * 10^6}$ $= \frac{1 * 118367.39 * 250}{1.1 * 10^6}$ $= 26.9$	
Moment Deformation Criteria Mdc (kNm)		$Mdc = \frac{1.5 * Z_e * fy}{1.1 * 10^6}$ $= \frac{1.5 * 483060.0 * 250}{1.1 * 10^6}$ $= 164.68$	
Moment Capacity Member Mc (kNm)		$M_c = min(Pmc, Mdc)$ $= min(26.9, 164.68)$ $= 26.9$	

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2.2 Load Consideration

Check	Required	Provided	Remarks
Applied Axial Load Au (kN)	$Ac_{min} = 0.3 * A_c$ $= 0.3 * 1056.82$ $= 317.05$ $Ac_{max} = Ac$ $= 1056.82$	$A_u = 317.05$	Pass
Applied Shear Load Vu (kN)	$Vc_{min} = 0.6 * S_c$ $= 0.6 * 223.0$ $= 133.8$ $Vc_{max} = Sc$ $= 223.0$	$V_u = 133.8$	Pass
Applied Moment Load Mu (kNm)	$Mc_{min} = 0.5 * M_c$ $= 0.5 * 26.9$ $= 13.45$ $Mc_{max} = Mc$ $= 26.9$	$M_u = 13.45$	Pass
Forces Carried by Web		$A_w = Axial\ force\ in\ web$ $= \frac{(D - 2 * T) * t * Au}{A}$ $= \frac{(297.0 - 2 * 9.2) * 6.1 * 317.05}{4650.0}$ $= 115.87\ kN$ $M_w = Moment\ in\ web$ $= \frac{Z_w * Mu}{Z}$ $= \frac{118367.39 * 13.45}{541790.0}$ $= 2.94\ kNm$	
Forces Carried by Flange		$A_f = Axial\ force\ in\ flange$ $= \frac{Au * B * T}{A}$ $= \frac{317.05 * 150.0 * 9.2}{4650.0}$ $= 94.09\ kN$ $M_f = Moment\ in\ flange$ $= Mu - M_w$ $= 13.45 - 2.94$ $= 10.51\ kNm$ $F_f = flange\ force$ $= \frac{M_f * 10^3}{D - T} + A_f$ $= \frac{10.51 * 10^3}{297.0 - 9.2} + 94.09$ $= 130.62\ kN$	

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2.3 Initial Member Check

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)	$F_f = 130.62$	$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{1 * 150.0 * 9.2 * 250}{1.1}$ $= 313.64$	Pass
Web Tension Yielding Capacity (kN)	$A_w = 115.87$	$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{1 * 278.6 * 6.1 * 250}{1.1}$ $= 386$	Pass

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2.4 Initial flange plate height check

Check	Required	Provided	Remarks
flange_plate.Height	Outer.b >= 50	$outer.b = B - (2 * 20)$ $= 150.0 - (2 * 20)$ $= 110.0$	Pass

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2.5 Flange plate thickness

Check	Required	Provided	Remarks
Thickness (mm)*	$T = 9.2$	$t_f = 14.0$	Pass
Plate Area check (mm2)	$pt.area >= connected\ member\ area * 1.05$ $= 1449.0$	$outer.b = B - (2 * 20)$ $= 150.0 - (2 * 20)$ $= 110.0$ $pt.area = 14.0 * 110.0$ $= 1540.0$	Pass

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2.6 Web plate thickness

Check	Required	Provided	Remarks
Thickness (mm)*	$t = 3.05$	$t_w = 6.0$	Pass
Plate Area check (mm2)	$pt.area >= connected\ member\ area * 1.05 = 1765$	$web\ b = D - (2 * T) - (2 * r_1) - (2 * 20) = 297.0 - (2 * 9.2) - (2 * 1.5) - (2 * 20) = 235.6$ $pt.area = 6.0 * 2 * 235.6 = 2827.2$	Pass

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2.7 Flange Weld Design Check

Check	Required	Provided	Remarks
Min Weld Size (mm)	$Thickness\ of\ Thicker\ part$ $= max(9.2, 14.0)$ $= 14.0$ $IS800:2007\ cl.10.5.2.3\ Table21,$ $t_{w_{min}} = 5$	$t_w = 7$	Pass
Max Weld Size (mm)	$Thickness\ of\ Thinner\ part$ $= min(9.2, 14.0) = 9.2$ $t_{w_{max}} = 9.2$	$t_w = 7$	Pass
Clearance (mm)	$sp = max(15, (t_w + 5))$ $= max(15, (7 + 5))$ $= 15$	$sp = 15$	Pass
Throat Thickness (mm)	$t_t \geq 3$	$t_t = 0.7 * t_w$ $= 0.7 * 7 = 4.9$ $t_t = 4.9$	Pass
Effective length (mm)		$l_{eff} = (2 * l_w) + b_{fp} - 2 * t_w$ $= (2 * 120) + 120 - 2 * 7$ $= 350$	
Flange Weld Strength (N/mm)	$Stress = \frac{F_f * 10^3}{l_{eff}}$ $= \frac{130.62 * 10^3}{350}$ $= 377.51$	$f_w = \frac{t_t * f_u}{\sqrt{3} * \gamma_{mw}}$ $= \frac{4.9 * 410}{\sqrt{3} * 1.25}$ $= 927.92$	Pass

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2.8 Flange Plate Check

Check	Required	Provided	Remarks
Min. Plate Height (mm)	50	$b_{fp} = B - 2 * sp$ $= 150.0 - 2 * 15$ $= 120$	Pass
Max. Plate Height (mm)	$b_{fp} = B - 2 * sp$ $= 150.0 - 2 * 15$ $= 120$	120	Fail
Min. Plate Length (mm)	120	$l_{fp} = [2 * (l_w + 2 * t_w) + g]$ $= [2 * (120 + 2 * 7) + 10.0]$ $= 280$	Pass

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2.9 Web Weld Design Check

Check	Required	Provided	Remarks
Min Weld Size (mm)	$Thickness\ of\ Thicker\ part$ $= max(6.1, 6.0)$ $= 6.1$ $IS800:2007\ cl.10.5.2.3\ Table21,$ $t_{w_{min}} = 3$	$t_w = 4$	Pass
Max Weld Size (mm)	$Thickness\ of\ Thinner\ part$ $= min(6.1, 6.0) = 6.0$ $t_{w_{max}} = 6.0$	$t_w = 4$	Pass
Effective length (mm)		$l_{eff} = (2 * l_w) + b_{fp} - 2 * t_w$ $= (2 * 245) + 245 - 2 * 4$ $= 730$	
Clearance (mm)	$sp = max(15, (t_w + 5))$ $= max(15, (4 + 5))$ $= 15$	$sp = 15$	Pass
Throat Thickness (mm)	$t_t \geq 3$	$t_t = 0.7 * t_w$ $= 0.7 * 4 = 2.8$ $t_t = 3$	Pass
Moment Demand (kNm		$M_d = (V_u * ecc + M_w)$ $= \frac{(66.9 * 10^3 * 162.43 + 1.47 * 10^6)}{10^6}$ $= 12.34$	
Web Weld Strength (N/mm)	$R_w = \sqrt{(T_{wh} + A_{wh})^2 + (T_{wv} + V_{wv})^2}$ $T_{wh} = \frac{M_d * y_{max}}{Ipw}$ $= \frac{12336031.71 * 82.57}{12838139.23}$ $T_{wv} = \frac{M_d * x_{max}}{Ipw}$ $= \frac{12336031.71 * 118.5}{12838139.23}$ $V_{wv} = \frac{V_u}{l_{eff}}$ $= \frac{66898.88}{730}$ $A_{wh} = \frac{A_u}{l_{eff}}$ $= \frac{57936.14}{730}$ $R_w = \sqrt{(79.34 + 79.36)^2 + (113.87 + 91.64)^2}$ $= 260.15$	$f_w = \frac{t_t * f_u}{\sqrt{3} * \gamma_{mw}}$ $= \frac{3 * 410}{\sqrt{3} * 1.25}$ $= 568.11$	Pass

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2.10 Web Plate Check

Check	Required	Provided	Remarks
Min. Plate Height (mm)	50	$b_{fp} = D - 2 * T - (2 * R_1) - 2 * sp$ $= 297.0 - 2 * 9.2 - (2 * 1.5) - 2 * 15$ $= 245$	Pass
Min. Plate Length (mm)	120	$l_{fp} = [2 * (l_w + 2 * t_w) + g]$ $= [2 * (245 + 2 * 4) + 10.0]$ $= 520$	Pass

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2.11 Member Checks

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}} = \frac{1 * 150.0 * 9.2 * 250}{1.1} = 313.64$	
Flange Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}} = \frac{0.9 * 1 * 150.0 * 9.2 * 410}{1.25} = 407.38$	
Flange Tension Capacity (kN)	$f_f = 130.62$	$T_d = min(T_{dg}, T_{dn}) = min(313.64, 407.38) = 313.64$	Pass
Web Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}} = \frac{1 * 278.6 * 6.1 * 250}{1.1} = 386.24$	
Web Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}} = \frac{0.9 * 1 * 278.6 * 6.1 * 410}{1.25} = 501.68$	
Web Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 833.38$	
Web Tension Capacity (kN)	$A_w = 115.87$	$T_d = min(T_{dg}, T_{dn}, T_{db}) = min(386.24, 501.68, 833.38) = 386.24$	Pass

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2.12 Flange Plate Capacity Checks in axial-Outside

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{1 * 120 * 14.0 * 250}{1.1}$ $= 381.82$	
Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * 1 * 120 * 14.0 * 410}{1.25}$ $= 495.94$	
Plate Tension Capacity (kN)	$f_f = 130.62$	$T_d = min(T_{dg}, T_{dn})$ $= min(381.82, 495.94)$ $= 381.82$	Pass

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2.13 Web Plate Capacity Checks in Axial

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{2 * 245 * 6.0 * 250}{1.1}$ $= 668.18$	
Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * 2 * 245 * 6.0 * 410}{1.25}$ $= 867.89$	
Plate Tension Capacity (kN)	$A_w = 115.87$	$T_d = min(T_{dg}, T_{dn})$ $= min(668.18, 867.89)$ $= 668.18$	Pass

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2.14 Web Plate Capacity Checks in Shear

Check	Required	Provided	Remarks
Shear yielding Capacity (V_dy) (kN)		$V_{dy} = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo}}$ $= \frac{2 * 245 * 6.0 * 250}{\sqrt{3} * 1.1}$ $= 385.77$	
Shear Rupture Capacity (V_dn) (kN)		$V_{dn} = \frac{0.9 * A_{vn} * f_u}{\sqrt{3} * \gamma_{m1}}$ $= \frac{0.9 * 2 * 245 * 6.0 * 410}{\sqrt{3} * 1.25}$ $= 501.08$	
Plate Shear Capacity (kN)	$V_u = 133.8$	$V_d = min(V_{dy}, V_{dn})$ $= min(385.77, 501.08)$ $= 385.77$	Pass

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3 3D View

Figure 1: 3D View