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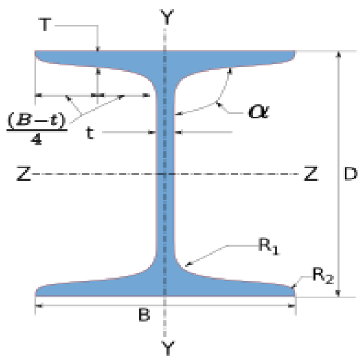
1 Input Parameters

Module	Beam Coverplate Connection
MainModule	Moment Connection
Moment(kNm)*	0.0
Shear(kN)*	0.0
Axial (kN) *	0.0

Section



Beam Section *		JB 150	
Preferences		Outside	
Material *		E 250 (Fe 410 W)A	
Ultimate strength, fu (MPa)		410	
Yield Strength , fy (MPa)	230	R2(mm)	1.5
Mass	7.1	Iz(mm4)	3220000.0
Area(mm2) - A	901.0	Iy(mm4)	92000.0
D(mm)	150.0	rz(mm)	59.800000000000004
B(mm)	50.0	ry(mm)	10.1
t(mm)	3.0	Zz(mm3)	42900.0
T(mm)	4.6	Zy(mm3)	3700.0
FlangeSlope	91.5	Zpz(mm3)	42900.0
R1(mm)	5.0	Zpy(mm3)	3700.0

Bolt Details

Diameter(mm)*	[12.0, 16.0, 20.0, 24.0, 30.0, 36.0]
Grade *	[3.6, 4.6, 4.8, 5.6, 5.8, 6.8, 8.8, 9.8, 10.9, 12.9]
Type *	Bearing Bolt
Bolt.fu	1200.0
Bolt.fy	1080.0000000000005
Bolt hole type	Standard
Slip factor (μ_f)	0.3
Type of edges	a - Sheared or hand flame cut
Gap between beam and support (mm)	10.0
Are the members exposed to corrosive influences	False

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2 Design Checks

2.1 Member Capacity

Check	Required	Provided	Remarks
Axial Capacity Member Ac (kN)		$Ac = \frac{A * f_y}{\gamma_{m0} * 1000}$ $= \frac{901.0 * 230}{1.1 * 1000}$ $= 188.39$	
Shear Capacity Member Sc (kN)		$S_c = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo} * 1000}$ $= \frac{140.8 * 3.0 * 230}{\sqrt{3} * 1.1 * 1000}$ $= 50.99158$	
Plastic Moment Capacity Pmc (kNm)		$Pmc = \frac{\beta_b * Z_p * fy}{\gamma_{mo} * 1000000}$ $= \frac{1 * 14868 * 230}{1.1 * 1000000}$ $= 3.11$	
Moment Deformation Criteria Mdc (kNm)		$Mdc = \frac{1.5 * Z_e * fy}{1.1}$ $= \frac{1.5 * 42900.0 * 230}{1.1}$ $= 13.46$	
Moment Capacity Member Mc (kNm)		$M_c = min(Pmc, Mdc)$ $= min(3.11, 13.46)$ $= 3.11$	

2.2 Load Considered

Check	Required	Provided	Remarks
Applied Axial Load Au (kN)	$Ac_{min} = 0.3 * A_c$ $= 0.3 * 188.39$ $= 56.52$	$Au = max(A, Ac_{min})$ $= max(0.0, 56.52)$ $= 56.52$	Pass
Applied Shear Load Vu (kN)	$Sc_{min} = 0.6 * A_c$ $= 0.6 * 50.99$ $= 30.59$	$Vu = max(V, Vc_{min})$ $= max(0.0, 30.59)$ $= 30.59$	Pass
Applied Moment Load Mu (kNm)	$Mc_{min} = 0.5 * M_c$ $= 0.5 * 3.11$ $= 1.55$	$Mu = max(M, Mc_{min})$ $= max(0.0, 1.55)$ $= 1.55$	Pass

Check	Required	Provided	Remarks
Forces Carried by Web		$A_w = Axial\ force\ in\ web$ $= \frac{(D - 2 * T) * t * Au}{A}$ $= \frac{(150.0 - 2 * 4.6) * 3.0 * 56.52}{901.0}$ $= 26.5$ $M_w = Moment\ in\ web$ $= \frac{Z_w * Mu}{Z}$ $= \frac{14868 * 1.55}{42900.0}$ $= 0.54$	
Forces Carried by Flange		$A_f = Axial\ force\ in\ flange$ $= \frac{Au * B * T}{A}$ $= \frac{56.52 * 50.0 * 4.6}{901.0}$ $= 14.43$ $M_f = Moment\ in\ flange$ $= Mu - M_w$ $= 1.55 - 0.54$ $= 1.02$ $f_f = flange\ force$ $= \frac{M_f * 1000}{D - T} + A_f$ $= \frac{1.02}{150.0 - 4.6} + 14.43$ $= 21.41$	

2.3 Flange Bolt Checks

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dsb} = \frac{f_u b\ n_n\ A_{nb}}{\sqrt{3}\ \gamma_{mb}}$ $= \frac{1200.0 * 1 * 84.3}{\sqrt{3}\ *\ 1.25}$ $= 46.72$	
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5\ k_b\ d\ t\ f_u}{\gamma_{mb}}$ $= \frac{2.5\ * 0.52 * 12.0 * 4.6 * 410}{1.25}$ $= 23.5$	
Bolt Capacity (kN)		$V_{db} = min\ (V_{dsb}, V_{dpb})$ $= min\ (46.72, 23.5)$ $= 23.5$	

Check	Required	Provided	Remarks
No of Bolts	$R_u = \sqrt{V_u^2 + A_u^2}$ $n_{trial} = R_u/V_{bolt}$ $R_u = \frac{\sqrt{0.0^2 + 21.41^2}}{23.5}$ $= 2$	0	
No of Columns		0.0	
No of Rows		0.0	
Min. Pitch (mm)	$p/g_{min} = 2.5\ d$ $=2.5 * 12.0 \quad = 30.0$	0.0	N/A
Max. Pitch (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 4.6,\ 300\ mm)$ $= 300$	0.0	N/A
Min. Gauge (mm)	$p/g_{min} = 2.5\ d$ $=2.5 * 12.0 \quad = 30.0$	0.0	N/A
Max. Gauge (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 4.6,\ 300\ mm)$ $= 300$	0.0	N/A
Min. End Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	0.0	N/A
Max. End Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$   $\varepsilon = \sqrt{\frac{250}{f_y}}$   $e/e`_{max} = 12\ * 6.0 * \sqrt{\frac{250}{230}}$ $= 74.88$	0.0	N/A
Min. Edge Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	0.0	N/A
Max. Edge Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$   $\varepsilon = \sqrt{\frac{250}{f_y}}$   $e/e`_{max} = 12\ * 6.0 * \sqrt{\frac{250}{230}}$ $= 74.88$	0.0	N/A

2.4 Web Bolt Checks

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dsb} = \frac{f_ub\ n_n\ A_{nb}}{\sqrt{3}\ \gamma_{mb}}$ $= \frac{1200.0 * 2 * 84.3}{\sqrt{3}\ *\ 1.25}$ $= 93.45$	

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Check	Required	Provided	Remarks
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5\ k_b\ d\ t\ f_u}{\gamma_{mb}}$ $= \frac{2.5\ * 0.52 * 12.0 * 3.0 * 410}{1.25}$ $= 15.33$	
Bolt Capacity (kN)		$V_{db} = min\ (V_{dsb}, V_{dpb})$ $= min\ (93.45, 15.33)$ $= 15.33$	
No of Bolts	$R_u = \sqrt{V_u^2 + A_u^2}$ $n_{trial} = R_u/V_{bolt}$ $R_u = \frac{\sqrt{30.59^2 + 26.5^2}}{15.33}$ $= 6$	9	
No of Columns		3	
No of Rows		3	
Min. Pitch (mm)	$p/g_{min} = 2.5\ d$ $= 2.5 * 12.0 \quad = 30.0$	30	Pass
Max. Pitch (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 3.0,\ 300\ mm)$ $= 300$	30	Pass
Min. Gauge (mm)	$p/g_{min} = 2.5\ d$ $= 2.5 * 12.0 \quad = 30.0$	35	Pass
Max. Gauge (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 3.0,\ 300\ mm)$ $= 300$	35	Pass
Min. End Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	25	Pass
Max. End Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$ $\varepsilon = \sqrt{\frac{250}{f_y}}$ $e/e`_{max} = 12\ * 6.0 * \sqrt{\frac{250}{230}}$ $= 74.88$	25	Pass
Min. Edge Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	25	Pass
Max. Edge Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$ $\varepsilon = \sqrt{\frac{250}{f_y}}$ $e/e`_{max} = 12\ * 6.0 * \sqrt{\frac{250}{230}}$ $= 74.88$	25	Pass

2.5 Outer flange plate Checks

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Check	Required	Provided	Remarks
Min. Plate Height (mm)	$min\ flange\ plate\ ht = beam\ width$ $= 50.0$	0.0	N/A
Min. Plate Length (mm)	$2[2*e_{min} + (\frac{bolt\ lines}{2} - 1)*p_{min})]$ $+ \frac{gap}{2}]$ $= 2*[(2*22.1 + (\frac{0.0}{2} - 1)*30.0$ $= +\frac{10.0}{2}]$ $= 38.400000000000006$	0.0	N/A
Min.Plate Thickness (mm)	$t_w = 4.6$	6.0	Pass

2.6 Member Checks

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)		$T_{dg} = \frac{l*t*f_y}{\gamma_{mo}}$ $= \frac{0.0*4.6*230}{\sqrt{3}*1.1}$ $= 88.32$	
Flange Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9*A_n*f_u}{\gamma_{m1}}$ $= \frac{0.9*(0.0-0.0*13.0)*4.6*410}{1.25}$ $= 0.0$	
Flange Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg}f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9A_{tn}f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9*A_{vn}f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg}f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 0.0$	
Flange Tension Capacity (kN)	21.41	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(88.32, 0.0, 0.0)$ $= 0.0$	N/A
Web Tension Yielding Capacity (kN)		$T_{dg} = \frac{l*t*f_y}{\gamma_{mo}}$ $= \frac{140.8*3.0*230}{\sqrt{3}*1.1}$ $= 0.0$	
Web Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9*A_n*f_u}{\gamma_{m1}}$ $= \frac{0.9*(140.8-3*13.0)*3.0*410}{1.25}$ $= 0.0$	

Check	Required	Provided	Remarks
Web Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 0.0$	
Tension Capacity (kN)	26.5	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(0.0, 0.0, 0.0)$ $= 0.0$	N/A

2.7 Flange Plate Capacity Checks in axial-Outside

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{0.0 * 6.0 * 230}{\sqrt{3} * 1.1}$ $= 0.0$	
Tension Rupture Capacity(kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (0.0 - 0.0 * 13.0) * 6.0 * 410}{1.25}$ $= 0.0$	
Block Shear Capacity (KN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 0.0$	
Plate Tension Capacity (kN)	21.41	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(0.0, 0.0, 0.0)$ $= 0.0$	N/A

2.8 Web Plate Capacity Checks in Axial

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{120 * 6.0 * 230}{\sqrt{3} * 1.1}$ $= 0.0$	
Tension Rupture Capacity(kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (120 - 3 * 13.0) * 6.0 * 410}{1.25}$ $= 0.0$	

Check	Required	Provided	Remarks
Block Shear Capacity (KN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 0.0$	
Plate Tension Capacity (kN)	26.5	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(0.0, 0.0, 0.0)$ $= 0.0$	N/A

2.9 Web Plate Capacity Checks in Shear

Check	Required	Provided	Remarks
Shear yielding Capacity (V_dy) (kN)		$V_{dg} = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo}}$ $= \frac{120 * 6.0 * 230}{\sqrt{3} * 1.1}$ $= 0.0$	
Shear Rupture Capacity (V_dn) (kN)		$V_{dn} = \frac{0.75 * A_{vn} * f_u}{\sqrt{3} * \gamma_{mo}}$ $= 0.9 * (120 - (1.5 * 13.0)) * 6.0 * 410$ $= 0.0$	
Block Shear Capacity in Shear (V_db) (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 0.0$	
Plate Shear Capacity (kN)	30.59	$V_d = Min(V_{dy}, V_{dn}, V_{db})$ $= Min(0.0, 0.0, 0.0)$ $= 0.0$	N/A

3 3D View

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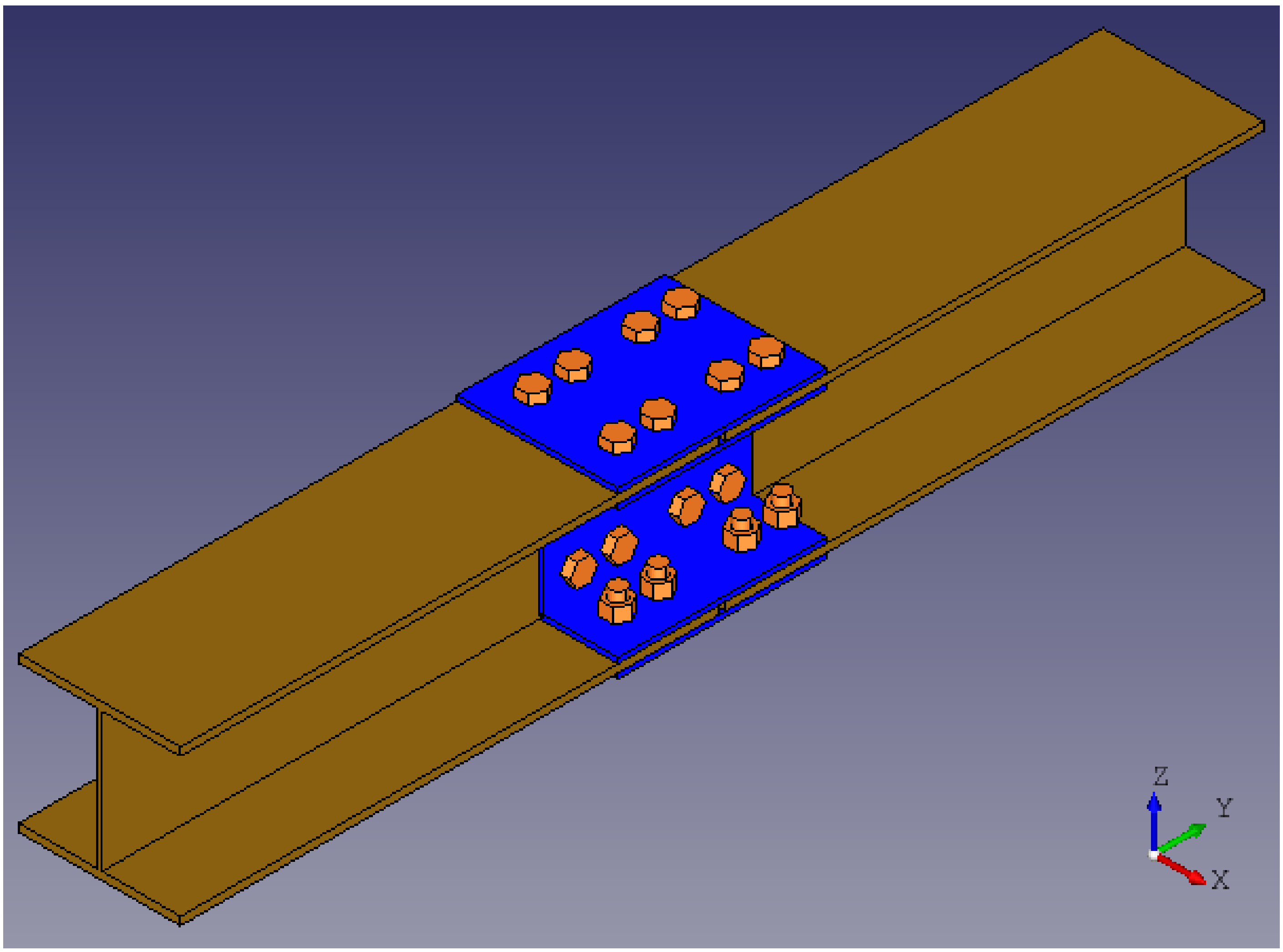

Figure 1: 3D View