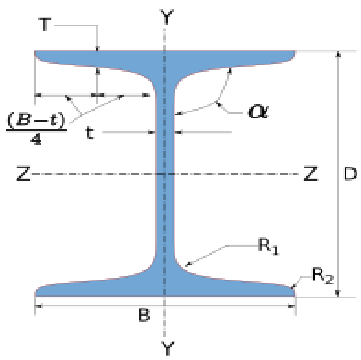
Company Name		Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	30 /04 /2020	Client	

1 Input Parameters

<table>
<tr><td colspan="3">Module</td><td colspan="2">Beam Coverplate Connection</td></tr>
<tr><td colspan="3">MainModule</td><td colspan="2">Moment Connection</td></tr>
<tr><td colspan="3">Moment(kNm)*</td><td colspan="2">10.0</td></tr>
<tr><td colspan="3">Shear(kN)*</td><td colspan="2">10.0</td></tr>
<tr><td colspan="3">Axial (kN) *</td><td colspan="2">10.0</td></tr>
<tr><td colspan="5">Section</td></tr>
<tr><td rowspan="14">
</td><td colspan="2">Beam Section *</td><td colspan="2">UB 457 x 152 x 60</td></tr>
<tr><td colspan="2">Preferences</td><td colspan="2">Outside + Inside</td></tr>
<tr><td colspan="2">Material *</td><td colspan="2">E 250 (Fe 410 W)A</td></tr>
<tr><td colspan="2">Ultimate strength, fu (MPa)</td><td colspan="2">410</td></tr>
<tr><td>Yield Strength , fy (MPa)</td><td>230</td><td>R2(mm)</td><td>0.0</td></tr>
<tr><td>Mass</td><td>59.8</td><td>Iz(mm4)</td><td>255000000.0</td></tr>
<tr><td>Area(mm2) - A</td><td>7620.0</td><td>Iy(mm4)</td><td>7940000.0</td></tr>
<tr><td>D(mm)</td><td>455.0</td><td>rz(mm)</td><td>183.0</td></tr>
<tr><td>B(mm)</td><td>152.9</td><td>ry(mm)</td><td>32.0</td></tr>
<tr><td>t(mm)</td><td>8.1</td><td>Zz(mm3)</td><td>1122000.0</td></tr>
<tr><td>T(mm)</td><td>13.3</td><td>Zy(mm3)</td><td>104000.0</td></tr>
<tr><td>FlangeSlope</td><td>90</td><td>Zpz(mm3)</td><td>1287000.0</td></tr>
<tr><td>R1(mm)</td><td>10.2</td><td>Zpy(mm3)</td><td>104000.0</td></tr>
<tr><td colspan="5">Bolt Details</td></tr>
<tr><td colspan="3">Diameter(mm)*</td><td colspan="2">[12.0, 16.0, 20.0, 24.0, 30.0, 36.0]</td></tr>
<tr><td colspan="3">Grade *</td><td colspan="2">[3.6, 4.6, 4.8, 5.6, 5.8, 6.8, 8.8, 9.8, 10.9, 12.9]</td></tr>
<tr><td colspan="3">Type *</td><td colspan="2">Bearing Bolt</td></tr>
<tr><td colspan="3">Bolt.fu</td><td colspan="2">600.0</td></tr>
<tr><td colspan="3">Bolt.fy</td><td colspan="2">479.9999999999999</td></tr>
<tr><td colspan="3">Bolt hole type</td><td colspan="2">Standard</td></tr>
<tr><td colspan="3">Slip factor (µ_f)</td><td colspan="2">0.3</td></tr>
<tr><td colspan="3">Type of edges</td><td colspan="2">a - Sheared or hand flame cut</td></tr>
<tr><td colspan="3">Gap between beam and
support (mm)</td><td colspan="2">10.0</td></tr>
<tr><td colspan="3">Are the members exposed to
corrosive influences</td><td colspan="2">False</td></tr>
</table>

2 Design Checks

2.1 Member Capacity

Check	Required	Provided	Remarks
Axial Capacity Member Ac (kN)		$Ac = \frac{A * f_y}{\gamma_{m0} * 1000}$ $= \frac{7620.0 * 230}{1.1 * 1000}$ $= 1593.27$	
Shear Capacity Member Sc (kN)		$S_c = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo} * 1000}$ $= \frac{428.4 * 8.1 * 230}{\sqrt{3} * 1.1 * 1000}$ $= 418.89869$	
Plastic Moment Capacity Pmc (kNm)		$Pmc = \frac{\beta_b * Z_p * fy}{\gamma_{mo} * 1000000}$ $= \frac{1 * 371641 * 230}{1.1 * 1000000}$ $= 77.71$	
Moment Deformation Criteria Mdc (kNm)		$Mdc = \frac{1.5 * Z_e * fy}{1.1}$ $= \frac{1.5 * 1122000.0 * 230}{1.1}$ $= 351.9$	
Moment Capacity Member Mc (kNm)		$M_c = min(Pmc, Mdc)$ $= min(77.71, 351.9)$ $= 77.71$	

2.2 Load Considered

Check	Required	Provided	Remarks
Applied Axial Load Au (kN)	$Ac_{min} = 0.3 * A_c$ $= 0.3 * 1593.27$ $= 477.98$	$Au = max(A, Ac_{min})$ $= max(10.0, 477.98)$ $= 477.98$	Pass
Applied Shear Load Vu (kN)	$Sc_{min} = 0.6 * A_c$ $= 0.6 * 418.9$ $= 251.34$	$Vu = max(V, Vc_{min})$ $= max(10.0, 251.34)$ $= 251.34$	Pass
Applied Moment Load Mu (kNm)	$Mc_{min} = 0.5 * M_c$ $= 0.5 * 77.71$ $= 38.85$	$Mu = max(M, Mc_{min})$ $= max(10.0, 38.85)$ $= 38.85$	Pass

Company Name		Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	30 /04 /2020	Client	

Check	Required	Provided	Remarks
Forces Carried by Web		$A_w = Axial\ force\ in\ web$ $= \frac{(D-2*T)*t*Au}{A}$ $= \frac{(455.0-2*13.3)*8.1*477.98}{7620.0}$ $= 217.67$ $M_w = Moment\ in\ web$ $= \frac{Z_w * Mu}{Z}$ $= \frac{371641*38.85}{1287000.0}$ $= 11.22$	
Forces Carried by Flange		$A_f = Axial\ force\ in\ flange$ $= \frac{Au*B*T}{A}$ $= \frac{477.98*152.9*13.3}{7620.0}$ $= 127.56$ $M_f = Moment\ in\ flange$ $= Mu - M_w$ $= 38.85 - 11.22$ $= 27.63$ $f_f = flange\ force$ $= \frac{M_f*1000}{D-T} + A_f$ $= \frac{27.63}{455.0-13.3} + 127.56$ $= 190.12$	

2.3 Flange Bolt Checks

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dsb} = \frac{f_ub\ n_n\ A_{nb}}{\sqrt{3}\ \gamma_{mb}}$ $= \frac{600.0*2*84.3}{\sqrt{3}\ *\ 1.25}$ $= 46.72$	
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5\ k_b\ d\ t\ f_u}{\gamma_{mb}}$ $= \frac{2.5\ *0.52*12.0*13.3*410}{1.25}$ $= 67.95$	
Bolt Capacity (kN)		$V_{db} = min\ (V_{dsb}, V_{dpb})$ $= min\ (46.72, 67.95)$ $= 46.72$	

Check	Required	Provided	Remarks
No of Bolts	$R_u = \sqrt{V_u^2 + A_u^2}$ $n_{trial} = R_u/V_{bolt}$ $R_u = \frac{\sqrt{0.0^2 + 190.12^2}}{46.72}$ $= 10$	12	
No of Columns		6	
No of Rows		2	
Min. Pitch (mm)	$p/g_{min} = 2.5\ d$ $= 2.5 * 12.0 \quad = 30.0$	30	Pass
Max. Pitch (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 8.0,\ 300\ mm)$ $= 300$	30	Pass
Min. Gauge (mm)	$p/g_{min} = 2.5\ d$ $= 2.5 * 12.0 \quad = 30.0$	0.0	N/A
Max. Gauge (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 8.0,\ 300\ mm)$ $= 300$	0.0	N/A
Min. End Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	25	Pass
Max. End Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$ $\varepsilon = \sqrt{\frac{250}{f_y}}$ $e/e`_{max} = 12\ * 8.0 * \sqrt{\frac{250}{230}}$ $= 99.84$	25	Pass
Min. Edge Distance (mm)	$e/e`_{min} = [1.5\ or\ 1.7] * d_0$ $= 1.7 * 13.0 = 22.1$	31.1	Pass
Max. Edge Distance (mm)	$e/e`_{max} = 12\ t\ \varepsilon$ $\varepsilon = \sqrt{\frac{250}{f_y}}$ $e/e`_{max} = 12\ * 8.0 * \sqrt{\frac{250}{230}}$ $= 99.84$	31.1	Pass

2.4 Web Bolt Checks

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{dsb} = \frac{f_u b\ n_n\ A_{nb}}{\sqrt{3}\ \gamma_{mb}}$ $= \frac{600.0 * 2 * 84.3}{\sqrt{3}\ *\ 1.25}$ $= 46.72$	

Company Name		Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	30 /04 /2020	Client	

Check	Required	Provided	Remarks
Bearing Capacity (kN)		$V_{dpb} = \frac{2.5\ k_b\ d\ t\ f_u}{\gamma_{mb}}$ $= \frac{2.5\ * 0.52 * 12.0 * 8.1 * 410}{1.25}$ $= 41.38$	
Bolt Capacity (kN)		$V_{db} = min\ (V_{dsb}, V_{dpb})$ $= min\ (46.72, 41.38)$ $= 41.38$	
No of Bolts	$R_u = \sqrt{V_u^2 + A_u^2}$ $n_{trial} = R_u/V_{bolt}$ $R_u = \frac{\sqrt{251.34^2 + 217.67^2}}{41.38}$ $= 18$	32	
No of Columns		4	
No of Rows		8	
Min. Pitch (mm)	$p/g_{min} = 2.5\ d$ $=2.5 * 12.0 \quad = 30.0$	30	Pass
Max. Pitch (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 6.0,\ 300\ mm)$ $= 300$	30	Pass
Min. Gauge (mm)	$p/g_{min} = 2.5\ d$ $=2.5 * 12.0 \quad = 30.0$	45	Pass
Max. Gauge (mm)	$p/g_{max} = \min(32\ t,\ 300\ mm)$ $= \min(32 *\ 6.0,\ 300\ mm)$ $= 300$	45	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 Inner and Outer flange plate Checks

Check	Required	Provided	Remarks
Min. Plate Height (mm)	$min\ flange\ plate\ ht = beam\ width$ $= 152.9$	152.9	Pass
Min. Plate Length (mm)	$2[2 * e_{min} + (\frac{bolt\ lines}{2} - 1) * p_{min})]$ $+ \frac{gap}{2}]$ $= 2 * [(2 * 22.1 + (\frac{6}{2} - 1) * 30.0$ $= + \frac{10.0}{2}]$ $= 218.4$	230.0	Pass
Min. Inner Plate Height (mm)	$= \frac{B - t - (2 * R1)}{2}$ $= \frac{152.9 - 8.1 - 2 * 10.2}{2}$ $= 62.2$	62.2	Pass
Max. Inner Plate Height (mm)	$= \frac{B - t - (2 * R1)}{2}$ $= \frac{152.9 - 8.1 - 2 * 10.2}{2}$ $= 62.2$	62.2	Pass
Min. Inner Plate Length (mm)	$2[2 * e_{min} + (\frac{bolt\ lines}{2} - 1) * p_{min})]$ $+ \frac{gap}{2}]$ $= 2 * [(2 * 22.1 + (\frac{6}{2} - 1) * 30.0$ $= + \frac{10.0}{2}]$ $= 218.4$	230.0	Pass
Min.Plate Thickness (mm)	$t_w = 6.65$	8.0	Pass

2.6 Member Checks

Check	Required	Provided	Remarks
Flange Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{152.9 * 13.3 * 230}{\sqrt{3} * 1.1}$ $= 425.2$	
Flange Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (152.9 - 2 * 13.0) * 13.3 * 410}{1.25}$ $= 498.23$	

Check	Required	Provided	Remarks
Flange Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 410983.346$	
Flange Tension Capacity (kN)	190.12	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(425.2, 498.23, 410.98)$ $= 410.98$	Pass
Web Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{428.4 * 8.1 * 230}{\sqrt{3} * 1.1}$ $= 725.55$	
Web Tension Rupture Capacity (kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (428.4 - 8 * 13.0) * 8.1 * 410}{1.25}$ $= 775.68$	
Web Block Shear Capacity (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 702.95$	
Tension Capacity (kN)	217.67	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(725.55, 775.68, 702.95)$ $= 702.95$	Pass

2.7 Flange Plate Capacity Checks in axial-Outside/Inside

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{277.3 * 8.0 * 230}{\sqrt{3} * 1.1}$ $= 463.85$	
Tension Rupture Capacity(kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (277.3 - 2 * 13.0) * 8.0 * 410}{1.25}$ $= 593.47$	
Block Shear Capacity (KN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 542.09$	

Check	Required	Provided	Remarks
Plate Tension Capacity (kN)	190.12	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(463.85, 593.47, 542.09)$ $= 463.85$	Pass

2.8 Web Plate Capacity Checks in Axial

Check	Required	Provided	Remarks
Tension Yielding Capacity (kN)		$T_{dg} = \frac{l * t * f_y}{\gamma_{mo}}$ $= \frac{365 * 6.0 * 230}{\sqrt{3} * 1.1}$ $= 915.82$	
Tension Rupture Capacity(kN)		$T_{dn} = \frac{0.9 * A_n * f_u}{\gamma_{m1}}$ $= \frac{0.9 * (365 - 8 * 13.0) * 6.0 * 410}{1.25}$ $= 924.57$	
Block Shear Capacity (KN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 1041.41$	
Plate Tension Capacity (kN)	217.67	$T_d = Min(T_{dg}, T_{dn}, T_{db})$ $= Min(915.82, 924.57, 1041.41)$ $= 915.82$	Pass

2.9 Web Plate Capacity Checks in Shear

Check	Required	Provided	Remarks
Shear yielding Capacity (V_dy) (kN)		$V_{dg} = \frac{A_v * f_y}{\sqrt{3} * \gamma_{mo}}$ $= \frac{365 * 6.0 * 230}{\sqrt{3} * 1.1}$ $= 528.75$	
Shear Rupture Capacity (V_dn) (kN)		$V_{dn} = \frac{0.75 * A_{vn} * f_u}{\sqrt{3} * \gamma_{mo}}$ $= 0.9 * (365 - (2.0 * 13.0)) * 6.0 * 410$ $= 533.8$	
Block Shear Capacity in Shear (V_db) (kN)		$T_{db1} = \frac{A_{vg} f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{tn} f_u}{\gamma_{m1}}$ $T_{db2} = \frac{0.9 * A_{vn} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{tg} f_y}{\gamma_{m0}}$ $T_{db} = min(T_{db1}, T_{db2}) = 633.96$	

Check	Required	Provided	Remarks
Plate Shear Capacity (kN)	251.34	$V_d = Min(V_{dy}, V_{dn}, V_{db})$ $= Min(528.75, 533.8, 1041.41)$ $= 528.75$	Pass

Company Name		Project Title	
Group/Team Name		Subtitle	
Designer		Job Number	
Date	30 /04 /2020	Client	

3 3D View

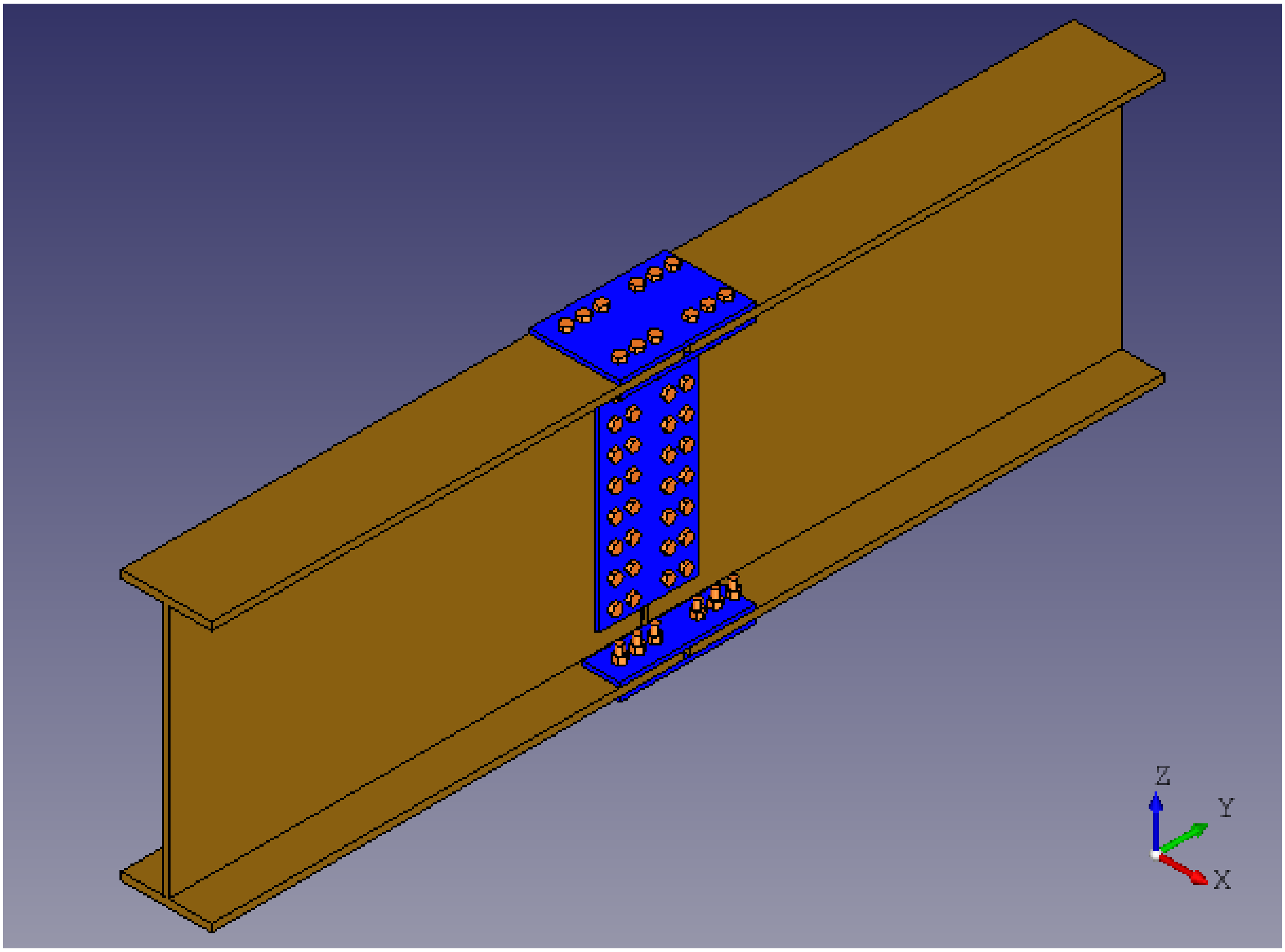


Figure 1: 3D View