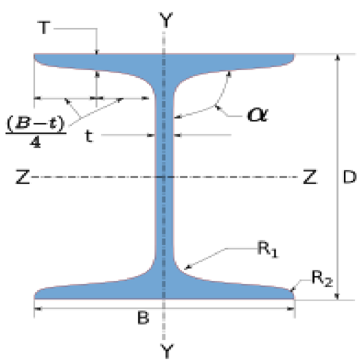
		Created with Osdag®	
Company Name		Project Title	beam to column end plate connection
Group/Team Name		Subtitle	
Designer		Job Number	
Date	21 /01 /2025	Client	

1 Input Parameters

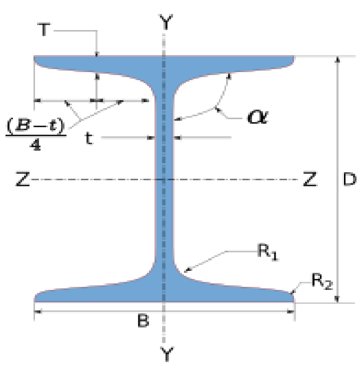
Main Module	Moment Connection
Module	Beam-to-Column End Plate Connection
Connectivity *	Column Flange-Beam Web
End Plate Type *	Extended One Way - Irreversible Moment
Bending Moment (kNm) *	23.0
Shear Force (kN) *	233.0
Axial Force (kN)	233.0

Column Section - Mechanical Properties



Column Section		HB 150	
Material *		E 165 (Fe 290)	
Ultimate Strength, Fu (MPa)		290	
Yield Strength, Fy (MPa)		165	
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		

Beam Section - Mechanical Properties



Beam Section		UB 1016 x 305 x 349	
Material *		E 165 (Fe 290)	
Ultimate Strength, F_u (MPa)		290	
Yield Strength, F_y (MPa)		165	
Mass, m (kg/m)	349.4	I_z (cm^4)	723131.0
Area, A (cm^2)	445.2	I_y(cm^4)	18446.0
D (mm)	1008.1	r_z (cm)	40.3
B (mm)	302.0	r_y (cm)	6.4
t (mm)	21.1	Z_z (cm^3)	14346.0
T (mm)	40.0	Z_y (cm^3)	1222.0
Flange Slope	90	Z_{pz} (cm^3)	16592.0

	R_1 (mm)	30.0	Z_{py} (cm^3)	1941.0
	R_2 (mm)	0.0		

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 165 (Fe 290)
Ultimate Strength, Fu (MPa)	290
Yield Strength, Fy (MPa)	165
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
Bolt Tension	Non pre-tensioned
Hole Type	Standard
Slip Factor, (μ_f)	0.3
Weld Details - Input and Design Preference	
Type of Weld Fabrication	Shop Weld
Material Grade Overwrite, F_u (MPa)	290.0
Beam Flange to End Plate	Groove Weld
Beam Web to End Plate	Fillet Weld
Stiffener	Fillet Weld
Continuity Plate	Fillet Weld
Detailing - Design Preference	
Edge Preparation Method	Sheared or hand flame cut
Gap Between Members (mm)	0.0
Are the Members Exposed to Corrosive Influences?	False

2 Design Checks

Design Status	Fail

2.1 Beam to Column - Compatibility Check

Check	Required	Provided	Remarks
Beam Section Compatibility	$B_{\text{req}} = B_b + 25$ $= 302.0 + 25$ $= 327.0$	$B_{\text{available}} = B_c$ $= 150.0$	**Not compatible**

2.2 Member Capacity - Supported Section

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{d_y} = \frac{A_v f_y}{\sqrt{3}\gamma_{m0}}$ $= \frac{0.6 \times 928.1 \times 21.1 \times 165}{\sqrt{3} \times 1.1 \times 1000}$ $= 1017.56$ [Ref. IS 800:2007, Cl.10.4.3]	**Restricted to low shear**
Plastic Moment Capacity (kNm)		$M_{d_z} = \frac{\beta_b Z_{p_z} fy}{\gamma_{m0}}$ $= \frac{1.0 \times 16592000.0 \times 165}{1.1 \times 10^6}$ $= 2488.8$ [Ref. IS 800:2007, Cl.8.2.1.2]	**V < 0.6 Vdy**

2.3 Member Capacity - Supporting Section

Check	Required	Provided	Remarks
Plastic Moment Capacity (kNm)		$M_{d_z} = \frac{\beta_b Z_{p_z} fy}{\gamma_{m0}}$ $= \frac{0.9 \times 215000.0 \times 165}{1.1 \times 10^6}$ $= 29.1$ Note: The capacity of the section is not based on the beam-colum or column design. The actual capacity might vary. [Ref. IS 800:2007, Cl.8.2.1.2]	**Semi-compact**
Plastic Moment Capacity (kNm)		$M_{d_y} = \frac{\beta_b Z_{py} fy}{\gamma_{m0}}$ $= \frac{0.62 \times 92700.0 \times 165}{1.1 \times 10^6}$ $= 8.62$ Note: The capacity of the section is not based on the beam-colum or column design. The actual capacity might vary. [Ref. IS 800:2007, Cl.8.2.1.2]	**Semi-compact**

2.4 Load Consideration

Check	Required	Provided	Remarks
Axial Force (kN)		$P_x = 233.0$	**OK**

Check	Required	Provided	Remarks
Shear Force (kN) *	$V_y = 233.0$	$V_{y\,\text{min}} = \min(0.15 V_{d_y},\ 40.0)$ $= \min(0.15 \times 1017.56,\ 40.0)$ $= \min(152.63,\ 40.0)$ $= 40.0$ $V_u = \max(V_y,\ V_{y\,\text{min}})$ but, $\leq V_{dy}$ $= \max(233.0,\ 40.0)$ but, ≤ 1017.56 $= 233.0$ [Ref. IS 800:2007, Cl.10.7]	Pass
Bending Moment (major axis) (kNm)	$M_z = 23.0$	$M_{z\,\text{min}} = 0.5 M_{d_z}$ $= 0.5 \times 2488.8$ $= 1244.4$ $M_u = \max(M_z,\ M_{z\,\text{min}})$ but, $\leq M_{d_z}$ of the column section $= \max(23.0, 1244.4)$ ≤ 29.1 $= 29.1$ [Ref. IS 800:2007, Cl.8.2.1.2]	Pass
Effective Bending Moment (major axis) (kNm)		$M_{ue} = M_u\ +\ P_x \times \left(\frac{D}{2} - \frac{T}{2}\right) \times 10^{-3}$ $= 29.1 +$ $233.0 \times \left(\frac{1008.1}{2} - \frac{40.0}{2}\right) \times 10^{-3}$ $= 141.88$	OK

2.5 Bolt Optimization

Check	Required	Provided	Remarks
Diameter (mm)	Bolt Diameter Optimization	$d = 8$	**Fail**
Property Class	Bolt Property Class Optimization	3.6	**Fail**
Hole Diameter (mm)		$d_0 = 8$	**OK**
No. of Bolt Columns		$n_c = 4$	**Fail**
No. of Bolt Rows		$n_r = 5$	**Fail**
Total No. of Bolts		$n = n_r X n_c = 20$	**Fail**

2.6 Detailing

Check	Required	Provided	Remarks
Min. Pitch Distance (mm)	$p_{\min} = 2.5d$ $= 2.5 \times 8.0$ $= 20.0$ [Ref. IS 800:2007, Cl.10.2.2]	30	**Pass**
Max. Pitch Distance (mm)	$p_{\max} = \min(32t,\ 300)$ $= \min(32 \times 40.0,\ 300)$ $= \min(1280.0,\ 300)$ $= 300$ Where, $t = \min(40.0, 40.0)$ [Ref. IS 800:2007, Cl.10.2.3]	30	**Pass**
Min. Gauge Distance (mm)	$g_{\min} = 2.5d$ $= 2.5 \times 8.0$ $= 20.0$ [Ref. IS 800:2007, Cl.10.2.2]	30	**Pass**

Check	Required	Provided	Remarks
Max. Gauge Distance (mm)	$g_{\max} = \min(32t,\ 300)$ $= \min(32 \times 40.0,\ 300)$ $= \min(1280.0,\ 300)$ $= 300$ Where, $t = \min(40.0, 40.0)$ [Ref. IS 800:2007, Cl.10.2.3]	30	Pass
Min. End Distance (mm)	$e_{\min} = 1.7 d_0$ $= 1.7 \times 8$ $= 13.6$ [Ref. IS 800:2007, Cl.10.2.4.2]	15	Pass
Max. End Distance (mm)	$e_{\max} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 40.0 \times \sqrt{\frac{250}{165}} = 590.84$ $e_2 = 12 \times 40.0 \times \sqrt{\frac{250}{165}} = 590.84$ $e_{\max} = \min(e_1,\ e_2) = 590.84$ [Ref. IS 800:2007, Cl.10.2.4.3]	15	Pass
Min. Edge Distance (mm)	${e'}_{\min} = 1.7 d_0$ $= 1.7 \times 8$ $= 13.6$ [Ref. IS 800:2007, Cl.10.2.4.2]	15	Pass

Check	Required	Provided	Remarks
Max. Edge Distance (mm)	$e'_{\text{max}} = 12t\varepsilon;\ \varepsilon = \sqrt{\frac{250}{f_y}}$ $e_1 = 12 \times 40.0 \times \sqrt{\frac{250}{165}} = 590.84$ $e_2 = 12 \times 40.0 \times \sqrt{\frac{250}{165}} = 590.84$ $e'_{\text{max}} = min(e_1,\ e_2) = 590.84$ [Ref. IS 800:2007, Cl.10.2.4.3]	15	Pass
Cross-centre Gauge Distance (mm)		82	Pass

2.7 Critical Bolt Design

Check	Required	Provided	Remarks
Shear Capacity (kN)		$V_{\text{dsb}} = \frac{f_{ub} n_n A_{nb}}{\sqrt{3}\gamma_{mb}}$ $= \frac{330.0 \times 1 \times 36.6}{1000 \times \sqrt{3} \times 1.25}$ $= 5.58$ [Ref. IS 800:2007, Cl.10.3.3]	OK
Kb		$k_b = \min\left(\frac{e}{3d_0},\ \frac{p}{3d_0} - 0.25,\ \frac{f_{ub}}{f_u},\ 1.0\right)$ $= \min\left(\frac{15}{3 \times 8},\ \frac{30}{3 \times 8} - 0.25,\ \frac{330.0}{290},\ 1.0\right)$ $= \min(0.62, 1.0, 1.14, 1.0)$ $= 0.62$ [Ref. IS 800:2007, Cl.10.3.4]	OK

Check	Required	Provided	Remarks
Bearing Capacity (kN)		$V_{\text{dpb}} = \frac{2.5 k_b d t f_u}{\gamma_{mb}}$ $= \frac{2.5 \times 0.62 \times 8.0 \times 40.0 \times 290}{1000 \times 1.25}$ $= 115.07$ [Ref. IS 800:2007, Cl.10.3.4]	OK
Bolt Capacity (kN)		$V_{\text{db}} = \min\ (V_{\text{dsb}},\ V_{\text{dpb}})$ $= \min\ (5.58,\ 115.07)$ $= 5.58$ [Ref. IS 800:2007, Cl.10.3.2]	
Large Grip Length Reduction Factor		$l_g = \sum \left(t_p + t_{\text{member}}\right)$ $= \sum \left(40.0 + 9\right)$ $= 49.0$ mm $5d = 5 \times 8.0 = 40.0$ $8d = 8 \times 8.0 = 64.0$ Since, $5d <\ l_g \leq 8d$ $\beta_{lg} = 8/(3 + l_g/d)$ $= \frac{8}{3 + 49.0/8.0}$ $= 0.88$ $[Ref.\ IS\ 800:2007,\ Cl.\ 10.3.3.2]$	Pass
Bolt Capacity (post reduction factor) (kN)		$V_{\text{db}} = V_{\text{db}} \beta_{lg}$ $= 5.58 \times 0.88$ $= 4.91$ $[Ref.\ IS\ 800:2007,\ Cl.\ 10.3.3.2]$	OK

Check	Required	Provided	Remarks
Shear Demand (per bolt) (kN)	$V_{sb} = \frac{V_u}{n}$ $= \frac{233.0}{20}$ $= 11.65$	$V_{db} = 4.91$	**Fail**
Lever Arm (mm)	$r = [968.1, 968.1, 35.0, 334.37, 633.73]$ Note: $r_1$is the first row outside tension/top flange, r_2 is the first row inside tension/top flange, r_3 is the first row inside compression/bottom flange, r_4 is the second row inside tension/top flange, r_5 is the second row outside tension/top flange, row(s) r_6 and beyond are rows inside the flange. Note: The lever arm is computed by considering the N.A at the centre of the bottom flange. Rows with identical lever arm values mean they are considered acting as bolt group near the tension or compression flange.		**Fail**
Tension Due to Moment (kN)	$T_1 = \frac{M_{ue}}{4 \times n_c \times \left(r_1 + \sum_{i=3}^{n_r=3} \frac{r_i^2}{r_1}\right)}$ $= \frac{141.88 \times 10^3}{4 \times 4 \times \left(968.1 + \sum_{i=3}^{n_r=3} \frac{r_i^2}{968.1}\right)}$ $= 11.83$ Note: T_1 is the tension in the critical bolt. The critical bolt is the bolt nearest to the tension flange.		**OK**

Check	Required	Provided	Remarks
Prying Force (kN)	$Q = \frac{l_v}{2l_e}\left[T_e - \frac{\beta\eta f_o b_e t^4}{27 l_e l_v^2}\right]$ $l_v = e - \frac{R_1}{2}$ $= 15 - \frac{30.0}{2} = 0.0$ mm $f_o = 0.7 f_{ub}$ $= 0.7 \times 330.0$ $= 231.0$ N/mm^2 $l_e = \min\left(e, 1.1t\sqrt{\frac{\beta f_o}{f_y}}\right)$ $= \min\left(15, 1.1 \times 40 \times \sqrt{\frac{2 \times 231.0}{165}}\right)$ $= \min(15,\ 73.63) = 15$ mm $\beta = 2$ (non pre-tensioned bolt) $\eta = 1.5$ $b_e = \frac{B}{n_c}$ $= \frac{302.0}{4} = 75.5$ mm $Q = \frac{0.0}{2 \times 15} \times$ $\left[11.83 - \left(\frac{2 \times 1.5 \times 231.0 \times 75.5 \times 40^4}{27 \times 15 \times 0.0^2}\right) \times 10^{-3}\right]$ $Q = nan$ [Ref. IS 800:2007, Cl.10.4.7]		**Fail**

Check	Required	Provided	Remarks
Tension Demand (kN)	$T_b = T_1 + Q$ $= 11.83 + nan$ $= nan$	$T_{\text{db}} = 0.90 f_{ub} A_n \ / \ \gamma_{mb}$ $< \ f_{yb} A_{sb} (\gamma_{mb} \ / \ \gamma_{m0})$ $= \min\Big(0.90 \times 330.0 \times 36.6 \ / \ 1.25,$ $190.0 \times 50 \times (1.25/1.1)\Big)$ $= \min(8.7, \ 10.8)$ $= 8.64$ [Ref. IS 800:2007, Cl.10.3.5]	**Fail**
Combined Capacity (I.R.)	≤ 1	$\left(\frac{V_{sb}}{V_{\text{db}}}\right)^2 + \left(\frac{T_{\text{b}}}{T_{\text{db}}}\right)^2 \leq 1.0$ $\left(\frac{11.65}{4.91}\right)^2 + \left(\frac{nan}{8.64}\right)^2 = nan$ [Ref. IS 800:2007, Cl.10.3.6]	**Fail**

2.8 Compression Flange Check

Check	Required	Provided	Remarks
Tension in Bolt Rows (kN)		$T = [11.83, 11.83, 0.86, 15.48, 15.48]$	**OK**
Reaction at Compression Flange (kN)	$R_c = n_c \sum_{n_r=1}^{n_r} T_{n_r}$ $= 4 \times \sum_{n_r=1}^{5} T_{n_r}$ $= 4 \times 55.48$ $= 221.92$	$F_c = A_g f_y \ / \ \gamma_{m0}$ $= \frac{B T f_y}{\gamma_{m0}}$ $= \frac{302.0 \times 40.0 \times 165}{1.1 \times 1000}$ $= 1812.0$	**Pass**

2.9 End Plate Checks

Check	Required	Provided	Remarks
Height (mm)		$H_p = D + 12.5 + (2 \times e) + p$ $= 1008.1 + 12.5 + (2 \times 15) + 30$ $= 1080.6$	**Pass**
Width (mm)		$B_p = B + 25$ $= 302.0 + 25$ $= 327.0$	**Pass**
Moment at Critical Section (kNm)		$M_{cr} = T_1\ l_v - Q\ l_e$ $= (11.83 \times 0.0 - nan \times 15) \times 10^{-3}$ $= nan$ Note: The critical section is at the toe of the weld or the edge of the flange from bolt center-line	**OK**
Plate Thickness (mm)	$t_p = \sqrt{\frac{4M_{cr}}{b_e(f_y/\gamma_{m0})}}$ $= \sqrt{\frac{4 \times nan \times 10^6}{75 \times (165/1.1)}}$ $= nan$	40	**Fail**
Moment Capacity (kNm)	nan	$M_p = \left(\frac{b_e t_p^2}{4}\right) \times \frac{f_y}{\gamma_{m0}}$ $= \frac{75 \times 40^2}{4} \times \frac{165}{1.1} \times 10^{-6}$ $= 4.53$	**Fail**

2.10 Stiffener Design

Check	Required	Provided	Remarks
Height (mm)		$H_{\mathrm{st}} = H_p - D - 12.5$ $= 1080.6 - 1008.1 - 12.5$ $= 59.999999999999886$	**59.999999999999886**
Length (mm)		$L_{\mathrm{st}} = \frac{H_{\mathrm{st}}}{\tan 30°}$ $= \frac{59.999999999999886}{\tan 30°}$ $= 104$	**Pass**

Check	Required	Provided	Remarks
Thickness (mm)	$t = 21.1$	$t_{st} = 22$	Pass
Weld Size (mm)	10	$t_w = 10$	Pass

2.11 Weld Design - Beam Web to End Plate Connection

Check	Required	Provided	Remarks
Weld Strength (N/mm2)	$f_{u_w} = \min(f_{\mathrm{w}},\ f_u)$ $= \min(290.0,\ 290)$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	$f_{u_w} = 290.0$	Pass
Total Weld Length (mm)		$L_w = 2 \times \left[D - (2 \times T) - (2 \times R1) - 20\right]$ $= 2 \times \left[1008.1 - (2 \times 40.0) - (2 \times 30.0) - 20\right]$ $= 1675.1$ Note: Weld is provided on both sides of the web	OK
Weld Size (mm)	$t_w = \dfrac{V_u}{f_{uw} k L_w} \times \sqrt{3}\ \gamma_{mw}$ $= \dfrac{233.0 \times 10^3}{290.0 \times 0.7 \times 1675.1} \times \sqrt{3} \times 1.25$ $= 1.48$ [Ref. IS 800:2007, Cl.10.5.7]	10	Pass

Check	Required	Provided	Remarks
Min. Weld Size (mm)	1) $t_{w\,\min}-$ based on thickness of the thicker part $t_{\text{thicker}} = \max(40.0,\ 21.1)$ $= 40.0$ $t_{w\,\min} = 10$ 2) $t_{w\,\min}-$ based on thickness of the thinner part $t_{\text{thinner}} = \min(40.0,\ 21.1)$ $= 21.1$ $t_{w\,\min} \leq \min(10,\ 21.1)$ [Ref. IS 800:2007, Table 21, Cl 10.5.2.3]	$t_w = \max(t_w,\ t_{w\,\min})$ $= \max(1.48,\ 10)$ $= 10$	Pass
Max. Weld Size (mm)	$t_{w\,\max}$ based on thickness of the thinner part $t_{\text{thinner}} = \min(40.0,\ 21.1)$ $= 21.1$ $t_{w\,\max} = 21.1$ [Ref. IS 800:2007, Cl.10.5.3.1]	$t_w \leq t_{w\,\max}$ $10 \leq 21.1$	Pass
Normal Stress (N/mm2)		$f_a = \dfrac{H}{0.7 t_w L_w}$ $= \dfrac{233.0 \times 10^3}{0.7 \times 10 \times 1675.1}$ $= 19.87$ [Ref. IS 800:2007, Cl.10.5.9]	

Check	Required	Provided	Remarks
Shear Stress (N/mm2)		$q = \dfrac{V}{0.7 t_w L_w}$ $= \dfrac{233.0 \times 10^3}{0.7 \times 10 \times 1675.1}$ $= 19.87$ [Ref. IS 800:2007, Cl.10.5.9]	
Equivalent Stress (N/mm2)	$f_e = \sqrt{f_a^2 + 3q^2}$ $= \sqrt{19.87^2 + (3 \times 19.87^2)}$ $= 34.7$ [Ref. IS 800:2007, Cl.10.5.10.1.1]	$f_w = \dfrac{f_u}{\sqrt{3}\gamma_{mw}}$ $= \dfrac{290.0}{\sqrt{3} \times 1.25}$ $= 133.95$ [Ref. IS 800:2007, Cl.10.5.7.1.1]	Pass

2.12 Continuity Plate Check - Compression Flange

Check	Required	Provided	Remarks
Local Web Yielding Capacity (kN)		$P_{cw_1} = \dfrac{f_{wc}\ (5k + T_b)}{\gamma_{m0}}$ $k = T_c + R_{1c}$ $= 9 + 8.0$ $= 17.0$ $f_{wc} = f_{yc} t_c$ $= 165.0 \times 5.4$ $= 891.0$ $P_{cw_1} = \dfrac{891.0 \times ((5 \times 17.0) + 40.0)}{1.1 \times 1000}$ $= 101.25$ Note: subscript c denotes column section, and, subscript b denotes beam section	OK

Check	Required	Provided	Remarks
Web Compression Buckling Capacity (kN)		$P_{cw_2} = 10710 \left(\frac{t_c^3}{h_c}\right) \sqrt{\frac{f_{yc}}{\gamma_{m0}}}$ $h_c = D_c - (2k)$ $= 150.0 - (2 \times 17.0)$ $= 116.0$ $P_{cw_2} = 10710 \times \frac{5.4^3}{116.0} \times \sqrt{\frac{165.0}{1.1}} \times 10^{-3}$ $= 178.06$	OK
Web Crippling Capacity (kN)		$P_{cw_3} = \left(\frac{300t_c^2}{\gamma_{m1}}\right) \left[1 + 3\left(T_{\mathrm{b}}/D_c\right)\left(t_c/T_c\right)^{1.5}\right] \sqrt{f_{yc}\left(T_c/t_c\right)}$ $= \left(\frac{300 \times 5.4^2}{1.25}\right) \times \left[1 + 3 \times \left(40.0/150.0\right) \times\right.$ $\left.\left(5.4/9\right)^{1.5}\right] \times \sqrt{165.0 \times \left(9/5.4\right)} \times 10^{-3}$ $= 159.21$	OK
Compression Strength (kN)		$P_{cw} = \min(P_{cw_1},\ P_{cw_2},\ P_{cw_3})$ $= \min(101.25,\ 178.06,\ 159.21)$ $= 101.25$	OK
Continuity Plate Required?	$R_c = 221.92$	$P_{cw} = 101.25$	Yes

2.13 Continuity Plate Design - Compression Flange

Check	Required	Provided	Remarks
Area Required (mm2)	$A_{cp} = \frac{R_c - P_{cw}}{f_{y_{cp}} \gamma_{m0}}$ $= \frac{\left(221.92 - 101.25\right) \times 10^3}{165 \times 1.1}$ $= 664.85$		OK

Check	Required	Provided	Remarks
Notch Size (mm)		$n = 12$	**OK**
Length (mm)		$l_{cp1} =$ Outer length $l_{cp1} = D_c - 2T_c$ $= 150.0 - (2 \times 9)$ $= 132.0$ $l_{cp2} =$ Inner length $l_{cp2} = D_c - 2(T_c + n)$ $= 150.0 - \left[2 \times (9 + 12)\right]$ $= 108.0$	**OK**
Width (mm)		$w_{cp} = \frac{B_c - T_c - 2n}{2}$ $= \frac{150.0 - 5.4 - 2 \times 12}{2}$ $= 60.0$	**OK**

Check	Required	Provided	Remarks
Thickness (mm)	t_{cp1} = Minimum area criteria $t_{cp1} = \frac{A_{cp}/2}{w_{cp}}$ $= \frac{664.85/2}{60.0}$ $= 5.54$ t_{cp2} = Limiting b/t ratio criteria $t_{cp2} = \frac{l_{cp1}}{29.3\ \epsilon_{cp}}$ $\epsilon_{cp} = \sqrt{\frac{250}{{f_y}_{cp}}}$ $= \sqrt{\frac{250}{165}}$ $= 1.23$ $= \frac{132.0}{29.3 \times 1.23}$ $= 3.66$ t_{cp3} = Minimum thickness criteria $t_{cp3} = T_{\mathrm{b}}$ $= 40.0$ $t_{cp} = \max(t_{cp1},\ t_{cp2},\ t_{cp3})$ $= \max(5.54, 3.66, 40.0)$ $= 40.0$	40	**Pass**

2.14 Continuity Plate Check - Tension Flange

Check	Required	Provided	Remarks
Continuity Plate Required?	$= 0.4\sqrt{\frac{B_b T_b}{\gamma_{m0}}}$ $= 0.4\sqrt{\frac{302.0 \times 40.0}{1.1}}$ $= 41.92$	$T_c = 9$	**Yes**

2.15 Continuity Plate Design - Tension Flange

Check	Required	Provided	Remarks
Notch Size (mm)		$n = 12$	**OK**
Length (mm)		$l_{cp1} =$ Outer length $l_{cp1} = D_c - 2T_c$ $= 150.0 - (2 \times 9)$ $= 132.0$ $l_{cp2} =$ Inner length $l_{cp2} = D_c - 2(T_c + n)$ $= 150.0 - \left[2 \times (9 + 12)\right]$ $= 108.0$	**OK**
Width (mm)		$w_{cp} = \frac{B_c - T_c - 2n}{2}$ $= \frac{150.0 - 5.4 - 2 \times 12}{2}$ $= 60.0$	**OK**

Check	Required	Provided	Remarks
Thickness (mm)	t_{st1} = Minimum area criteria $t_{st1} = \frac{A_{cp}/2}{w_{cp}}$ $= \frac{664.85/2}{60.0}$ $= 5.54$ t_{st2} = Minimum thickness criteria $t_{st2} = T_{\mathrm{b}}$ $= 40.0$ $t_{\mathrm{st}} = \max(t_{st1},\ t_{st2})$ $= \max(5.54,\ 40.0)$ $= 40.0$	40	Pass

2.16 Weld Design - Continuity Plate

Check	Required	Provided	Remarks
Weld Strength (N/mm2)	$f_{uw} = \min(f_{\mathrm{w}},\ f_{u_{cp}})$ $= \min(290.0,\ 290)$ $[Ref.\ IS\ 800:2007,\ Cl.\ 10.5.7.1.1]$	$f_{u_w} = 290.0$	Pass
Total (effective) Weld Length (mm)		$L_{w\,cp} = 205.2$ Note: Provide weld on both the sides of the continuity plate	OK
Weld Size (mm)	$t_{w\,cp} = \frac{V_{cp}/2}{f_{uw} k L_{w\,cp}} \times \sqrt{3}\gamma_{mw}$ $= \frac{R_c - P_{cw}}{2 \times f_{uw} k L_{w\,cp}} \times \sqrt{3}\gamma_{mw}$ $= \frac{(221.92 - 101.25) \times 10^3}{2 \times 290.0 \times 0.7 \times 205.2} \times \sqrt{3} \times 1.25$ $= 3.14$ $[Ref.\ IS\ 800:2007,\ Cl.\ 10.5.7]$	5.4	Pass

Check	Required	Provided	Remarks
Min. Weld Size (mm)	1) $t_{w\,\mathrm{min}}-$ based on thickness of the thicker part $t_{\mathrm{thicker}} = \max(40,\ 5.4)$ $= 40$ $t_{w\,\mathrm{min}} = 5.4$ 2) $t_{w\,\mathrm{min}}-$ based on thickness of the thinner part $t_{\mathrm{thinner}} = \min(40,\ 5.4)$ $= 5.4$ $t_{w\,\mathrm{min}} \leq \min(5.4,\ 5.4)$ [Ref. IS 800:2007, Table 21, Cl 10.5.2.3]	$t_w = \max(t_w,\ t_{w\,\mathrm{min}})$ $= \max(3.14,\ 5.4)$ $= 5.4$	Pass
Max. Weld Size (mm)	$t_{w\,\mathrm{max}}$ based on thickness of the thinner part $t_{\mathrm{thinner}} = \min(40,\ 5.4)$ $= 5.4$ $t_{w\,\mathrm{max}} = 5$ [Ref. IS 800:2007, Cl.10.5.3.1]	$t_w \leq t_{w\,\mathrm{max}}$ $5.4 \leq 5$	Pass

2.17 Column Web Shear Check

Check	Required	Provided	Remarks
Web Stiffener Plate Required?	$t_{wc} = \frac{1.9M_{ue}}{D_c D_b f_{yc}}$ $= \frac{1.9 \times 141.88}{150.0 \times 1008.1 \times 165.0}$ $= 10.8$	$t_c = 5.4$	Yes

2.18 Column Web Stiffener Plate Design

Check	Required	Provided	Remarks
Depth (mm)		$D_{st} = D_b - (2T_{\rm b}) - (2R_{1b}) - 20$ $= 1008.1 - (2 \times 40.0) - (2 \times 30.0) - 20$ $= 848$	**OK**
Width (mm)		$W_{st} = D_c - (2T_c) - (2R_{1c}) - 20$ $= 150.0 - (2 \times 9) - (2 \times 8.0) - 20$ $= 96$	**OK**
Thickness (mm)	$t_{\rm st} = \dfrac{t_{wc} - t_c}{2}$ $= \dfrac{10.8 - 5.4}{2}$ $= 2.7$	8	**Pass**
Weld Size (mm)	3	4	**Pass**

		Created with	
Company Name		Project Title	beam to column end plate connection
Group/Team Name		Subtitle	
Designer		Job Number	
Date	21 /01 /2025	Client	

3 3D Views

`C:3-env-packages.png` (a) 3D View	`C:3-env-packages.png` (b) Top View
`C:3-env-packages.png` (c) Side View	`C:3-env-packages.png` (d) Front View

4 Design Log

2025-01-21 20:10:49 - Osdag - ERROR - : The selected supporting column HB 150 cannot accommodate the selected supported beam UB 1016 x 305 x 349

2025-01-21 20:10:49 - Osdag - WARNING - : Width of the supported beam by considering the maximum end plate width (B + 25 mm), is more than the width available at the supporting column

2025-01-21 20:10:49 - Osdag - WARNING - : Width of the supported beam should be less than or equal to 150.0 mm

2025-01-21 20:10:49 - Osdag - INFO - : Define a beam or a column of suitable compatibility and re-design

2025-01-21 20:10:49 - Osdag - WARNING - The Load(s) defined is/are less than the minimum recommended value [Ref. IS 800:2007, Cl.10.7].

2025-01-21 20:10:49 - Osdag - WARNING - [Minimum Factored Load] The external factored bending moment (23.0 kNm) is less than 0.5 times the plastic moment capacity of the beam (2488.8 kNm)

2025-01-21 20:10:49 - Osdag - INFO - The minimum factored bending moment should be at least 0.5 times the plastic moment capacity of the beam to qualify the connection as rigid connection (Annex. F-4.3.1, IS 800:2007)

2025-01-21 20:10:49 - Osdag - INFO - The value of load(s) is/are set at minimum recommended value as per Cl.10.7 and Annex. F, IS 800:2007

2025-01-21 20:10:49 - Osdag - INFO - Designing the connection for a factored moment of 1244.4 kNm

2025-01-21 20:10:49 - Osdag - WARNING - [Beam-Column Compatibility] The design factored bending moment (1244.4 kNm) being transferred from the beam to the column exceeds the maximum capacity of the column section (29.1 kNm) (acting along the major (z-z) axis)

2025-01-21 20:10:49 - Osdag - INFO - Note: The maximum moment check is based on full capacity of the column section classified as Semi-compact, as per Table 2 of IS 800:2007

2025-01-21 20:10:49 - Osdag - INFO - The value of design bending moment is set to be equal to the maximum capacity of the column, i.e. 29.1 kNm

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 8.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 10.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 12.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 14.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 16.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 18.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 20.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 22.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 25.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 28.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 32.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick

2025-01-21 20:10:49 - Osdag - WARNING - [End Plate] The end plate of 36.0 mm is thinner than the thickest of the elements being connected

2025-01-21 20:10:49 - Osdag - INFO - Selecting a plate of higher thickness which is at least 40 mm thick
2025-01-21 20:10:49 - Osdag - INFO - [Bolt Design] Bolt diameter and grade combination ready to perform bolt design
2025-01-21 20:10:49 - Osdag - INFO - The solver has selected 210.0 combinations of bolt diameter and grade to perform optimum bolt design in an iterative manner
2025-01-21 20:10:49 - Osdag - WARNING - [Column Web] The web of the column is susceptible to shear bucking due to the reaction transferred by the beam to the column
2025-01-21 20:10:49 - Osdag - INFO - The minimum required thickness of the web is 10.8 mm
2025-01-21 20:10:49 - Osdag - INFO - Providing stiffening to the column web
2025-01-21 20:10:49 - Osdag - INFO - [Optimisation] Performing the design by optimising the plate thickness, using the most optimum plate and a suitable bolt diameter approach
2025-01-21 20:10:49 - Osdag - INFO - If you wish to optimise the bolt diameter-grade combination, pass a higher value of plate thickness using the Input Dock
2025-01-21 20:10:49 - Osdag - INFO - [Flange Strength] The reaction at the compression flange of the beam 221.92 kN is less than the flange capacity 1812.0 kN. The flange strength requirement is satisfied.
2025-01-21 20:10:49 - Osdag - INFO - [End Plate] The end plate of 40.0 mm passes the moment capacity check. The end plate is checked for yielding due tension caused by bending moment and prying force
2025-01-21 20:10:49 - Osdag - INFO - [Bolt Design] The bolt of 8.0 mm diameter and 3.6 grade passes the tension check
2025-01-21 20:10:49 - Osdag - INFO - Total tension demand on bolt (due to direct tension + prying action) is nan kN and the bolt tension capacity is (8.64 kN)
2025-01-21 20:10:49 - Osdag - INFO - [Bolt Design] The bolt of 8.0 mm diameter and 3.6 grade passes the combined shear + tension check
2025-01-21 20:10:49 - Osdag - INFO - The Interaction Ratio (IR) of the critical bolt is nan
2025-01-21 20:10:49 - Osdag - INFO - : ========== Design Status ============
2025-01-21 20:10:49 - Osdag - INFO - : Overall beam to column end plate connection design is UNSAFE
2025-01-21 20:10:49 - Osdag - INFO - : ========== End Of Design ============