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Company Name	**IIT B**	**Project Title**	**Connection Designs**
Group/Team Name	**Osdag**	**Subtitle**	**Moment End Plate**
Designer	**Engineer 4**	**Job Number**	**1.2.2.1.3.2.2**
Date	**12 /06 /2019**	**Client**	**Manas M Ghosh**

Design Conclusion	
Beam to Column End Plate Moment Connection	**Fail**
Connection Properties	
Connection	
Connection Type	Moment Connection
Connection Title	Extended End Plate
End plate type	Flush end plate
Connection Category	
Connectivity	Column web-Beam web
Beam to end plate Connection	Welded
Column web to end plate Connection	Bolted
Loading Details	
Bending Moment (kNm)	75.0
Shear Force (kN)	50.0
Axial Force (kN)	25.0
Components	
Beam Section	WPB 240x240x60.3
Grade of Steel	Fe 410.0
Column Section	UC 305 x 305 x 137
Grade of Steel	Fe 410.0
Plate Section	250.0 X 240.0 X 24.0
Thickness (t) (mm)	24.0
Width (mm)	240.0
Depth (mm)	250.0
Clearance holes for fasteners	Standard
Weld	
Type	Fillet Weld
Weld at Flange (mm)	6
Weld at Web (mm)	6
Bolts	
Type	Friction Grip Bolt
Property Class	10.9
Diameter (d) (mm)	20
Hole diameter (d_o) (mm)	22.0

Number of Bolts (n)	8
End Distance (e)(mm)	40
Edge Distance (e') (mm)	75
Cross-centre gauge (g') (mm)	90.0
Pitch Distance (p) (mm)	
Pitch-1,2	50.0
Pitch-2,3	16.0
Pitch-3,4	50.0

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Design Preferences	
Bolt	
Hole Type	Standard
Hole Clearance (mm)	2.0
Ultimate Strength (f_u) (MPa)	1000.0
Slip factor	0.3
Beta (β)(non pre-tensioned)	2
Weld	
Type of Weld	Shop weld
Detailing	
Type of Edges	Sheared or hand flame cut
Minimum Edge-End Distance	1.7 times the hole diameter
Are members exposed to corrosive influences?	No
Design	
Design Method	Limit State Design

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Design Check			
Check	**Required**	**Provided**	**Remark**
Bolt Checks			
Bolt slip resistance (kN)	Factored shear force / Number of bolts = 50.0 / 8 = 6.25	V_{dsf} = (0.3*1*1.0*171.5) / 1.25 = 46.773 [cl. 10.4.3]	**Pass**
Bolt bearing capacity (kN)	N/A	N/A	
Bolt capacity (kN)		Bolt slip resistance =46.773	
Tension capacity of bolt (kN)	≥ Tension in bolt due to external moment + external axial load + prying force =184.869+3.125+39.635=227.629	Tension capacity = (0.9*1000*245) / (1.25*1000) = 176.4 [cl. 10.4.5]	**Fail**
Combined shear and tension capacity of bolt	≤ 1.0	(V_{sf}/V_{df})^2 + (T_f/T_{df})^2 = (6.25/46.773)^2 + (227.629/176.4)^2 = 1.683 [cl. 10.4.6]	**Fail**
No. of bolts	≥ 4 , ≤ 12	8.0	
Pitch distance (mm)	≥ 2.5 * d = 50, ≤ min(32 * t, 300) = 300 [cl. 10.2.2 & cl. 10.2.3]	50	**Pass**
End distance (mm)	≥ 1.7 d_o = 37.4, ≤ 12*t*ε = 165.6 [cl. 10.2.4]	40	**Pass**
Edge distance (mm)	≥ 1.7 d_o = 37.4, ≤ 12*t*ε = 165.6 [cl. 10.2.4]	40	**Pass**
Distance to the centre line of bolt from face of beam flange (mm)	33mm ≤ l_v ≤ 47mm	45	**Pass**
Plate Checks			
Plate thickness (mm)	≥ √ (M *(1.1/fy) *(4/b_e)) = ≥ √ (184.869* (1.1/250.0) * (4/120.0)) =22.019	24.0	**Pass**
Plate height (mm)		250.0	
Plate width (mm)	≥ width of beam flange , ≥240.0	240.0	**Pass**
Weld Checks			
Flange			
Effective weld length			

on top flange (mm)		228.0	
Effective weld length on bottom flange (mm)		102.15	
Weld throat thickness at flange (mm)	< 12.0,> 6.0	6.0	**Pass**
Critical stress in weld at flange (N/mm^2)	≥ $((M/Z_{weld,flange}) + (P/A_{weld}))$ =223.864	$(f_u / \sqrt{3} * \square_{mb})$ = 189.371	**Fail**
Web			
Effective weld length at web (each side) (mm)		189.8	
Weld throat thickness at web (mm)	< 7.5,> 6.0	6.0	**Pass**
Critical stress in weld at web (N/mm^2)	≥ $\sqrt{((M/Z_{weld,web} + P/A_{weld})^2)} + (V/A_{weld,web})^2$ =199.484	$(f_u / \sqrt{3} * \square_{mb})$ = 189.371	**Fail**
Stiffener Checks			
Horizontal Continuity Plate in Tension			
Length (mm)		277.1	
Width (mm)		147.7	
Thickness (mm)	≥15.713	16.0	
Weld (mm)		8.0	
Horizontal Continuity Plate in Compression			
Length (mm)		277.1	
Width (mm)		147.7	
Thickness (mm)	≥15.713	16.0	
Weld (mm)		8.0	
End Plate Stiffeners			
Length (mm)		225.0	
Height (mm)		135.0	
Thickness (mm)		10.0	
Noch at top side of plate (mm)		50.0	
Noch at bottom side of plate (mm)		10.0	
Fillet weld size (mm)		8.0	

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Fabrication Drawings
The fabrication drawings are not been generated due to the failure of the connection.

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Additional Comments	