Company Name	IIT B	Project Title	Moment Connection Design Example
Group/Team Name	Osdag	Subtitle	End Plate Moment Connection
Designer	Engineer #2	Job Number	1.2.1.2.2.2
Date	13 /06 /2019	Client	Pratip Bhattacharya

Design Conclusion	
Beam to Beam Extended One Way End Plate Splice Connection	Fail
Connection Properties	
Connection	
Connection Title	Beam to Beam Extended One Way End Plate Splice
Connection Type	Moment Connection
Connection Category	
Connectivity	Beam - Beam
Beam to End Plate Connection	Welded
End Plate to End Plate Connection	Bolted
End plate type	Extended one way
Loading (Factored Loads)	
Bending Moment (kNm)	75.0
Shear Force (kN)	12.0
Axial Force (kN)	0.0
Components	
Beam Section	MB 400
Grade of Steel	Fe 410.0
Plate Section	505.0 X 180.9 X 14.0
Thickness (mm)	14.0
Width (mm)	180.9
Height (mm)	505.0
Clearance Holes for Fasteners	Over-sized
Grade of Steel	Fe 410.0
Weld	
Type	Groove Weld (CJP)
Size of Weld (mm)	16.0
Bolts	
Type	Bearing Bolt
Property Class	3.6
Diameter (d) (mm)	20
Hole Diameter (d_o) (mm)	24
Number of Bolts (n)	8
End Distance (e) (mm)	41

Edge Distance (e') (mm)	45
Gauge Distance (g) (mm)	50
Cross-centre gauge (g') (mm)	90.9
Pitch Distance (p) (mm)	
Pitch 2-3	50.0
Pitch 3-4	218.0

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Design Preferences	
Bolt	
Hole Type	Over-sized
Hole Clearance (mm)	4.0
Ultimate Strength (f_u) (MPa)	300.0
Slip factor	N/A
Beta (β)(non pre-tensioned)	2
Weld	
Type of Weld	Shop weld
Detailing	
Type of Edges	Sheared or hand flame cut
Minimum Edge and 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			
Tension capacity of critical bolt (kN)	Tension in bolt due to external factored moment & external factored axial load + Prying force = 48.456+31.818 = 80.274 [cl. 10.4.7]	Tension capacity = (0.9*300*245) / (1.25*1000) = 52.92 [cl. 10.4.5]	**Fail**
Bolt shear capacity (kN)	Factored shear force / Number of bolts = 12.0 / 8 = 1.5	V_{dsb} = (300*1*0.6126*20*20)/(√3*1.25*1000) = 33.9 [cl. 10.3.3]	**Pass**
Bolt bearing capacity (kN)		V_{dpb} = (2.5*0.444*20*32.0*410.0) / (1.25*1000) = 233.2 [cl. 10.3.4]	
Bolt capacity (kN)	min (33.9, 233.2)	33.9	
Combined shear and tension capacity of bolt	≤ 1.0	(V_{sb}/V_{db})^2 + (T_b/T_{db})^2 = (1.5/33.9)^2 + (80.274/52.92)^2 = 2.303 [cl. 10.3.6]	**Fail**
No. of bolts		8.0	
No. of column(s)		2	
No. of row(s)		4	
Bolt gauge (mm)	≥ 2.5 * d = 50.0, ≤ min(32 * t, 300) = 300.0 [cl. 10.2.2 & cl. 10.2.3]	50	**Pass**
Bolt pitch (mm)	≥ 2.5 * d = 50.0, ≤ min(32 * t, 300) = 300.0 [cl. 10.2.2 & cl. 10.2.3]	50	**Pass**
End distance (mm)	≥ 1.7 d_o = 40.8,≤ 12*t*ε = 170.0 [cl. 10.2.4]	41	**Pass**
Edge distance (mm)	≥ 1.7 d_o = 40.8,≤ 12*t*ε = 170.0 [cl. 10.2.4]	41	**Pass**
Plate Checks			
Plate thickness (mm)	((4*1.10*958.328*1000)/(250.0*70.0)) ^ 0.5 = 13.656 [Design of Steel Structures - N. Subramanian, 2014]	14.0	**Pass**

Plate height (mm)	Based on detailing requirements	505.0	
Plate width (mm)		180.9	
Plate moment capacity (kNm)	Moment demand (M_d) = ((13.656^2*250.0*70.0)/(4.4)) * 10^ -3 = 958.328 [Design of Steel Structures - N. Subramanian, 2014]	Moment capacity (M_c) = ((14.0^2*250.0*70.0)/(4.4)) * 10^ -3 = 1007.284 [Design of Steel Structures - N. Subramanian, 2014]	**Pass**
Weld Checks			
Size of Butt Weld (mm)		16.0	
Stiffener Checks			
Height (mm)		95.0	
Thickness (mm)		10.0	
WeldSize (mm)		10.0	
MomentCapacity (KN-m)	≥ 5.233	12.278	**Pass**

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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	