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Company Name	**IIT Bombay**	**Project Title**	**Moment Connection Design Example**
Group/Team Name	**Osdag**	**Subtitle**	**Extended both way end plate moment connection**
Designer	**Engineer #1**	**Job Number**	**1.2.1.2.1.2**
Date	**13 /06 /2019**	**Client**	**M M Ghosh**

Design Conclusion

Beam to Beam Extended End Plate Splice Connection	**Pass**

Connection Properties

Connection

Connection Title	Beam to Beam Extended 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 both way

Loading (Factored Loads)

Bending Moment (kNm)	350.0
Shear Force (kN)	120.0
Axial Force (kN)	50.0

Components

Beam Section	UB 406 x 178 x 74
Grade of Steel	Fe 410.0
Plate Section	563.0 X 204.5 X 20.0
Thickness (mm)	20.0
Width (mm)	204.5
Height (mm)	563.0

Clearance Holes for Fasteners	Standard
Grade of Steel	Fe 410.0
Weld	
Type	Groove Weld (CJP)
Size of Weld (mm)	20.0
Bolts	
Type	Friction Grip Bolt
Property Class	8.8
Diameter (d) (mm)	16
Hole Diameter (d_o) (mm)	18
Number of Bolts (n)	12
End Distance (e) (mm)	31
Edge Distance (e') (mm)	57
Gauge Distance (g) (mm)	40
Cross-centre gauge (g') (mm)	90.0
Pitch Distance (p) (mm)	
Pitch 2-3	40.0
Pitch 3-4	221.0
Pitch 4-5	40.0

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Design Preferences	
Bolt	
Hole Type	Standard
Hole Clearance (mm)	2.0
Ultimate Strength (f_u) (MPa)	800.0
Slip factor	0.48
Beta (β) (pre-tensioned bolt)	1
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

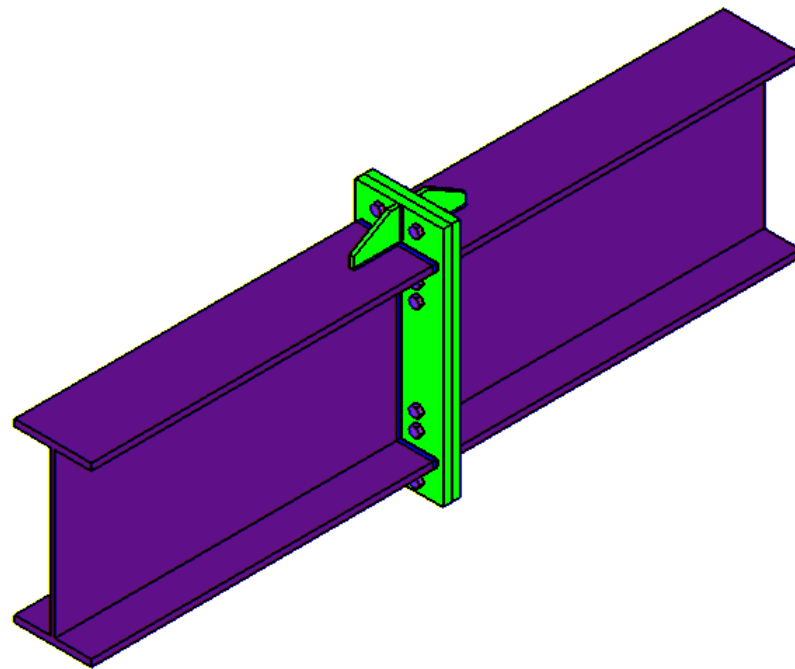| Company Name	IIT Bombay	Project Title	Moment Connection Design Example
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Design Check

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 = 61.814+14.356 = 76.17 [cl. 10.4.7]	Tension capacity = (0.9*800*157) / (1.25*1000) = 90.432 [cl. 10.4.5]	**Pass**
Bolt slip resistance (kN)	Factored shear force / Number of bolts = 120.0 / 12 = 10.0	V_{dsf} = (0.48*1*1.0*87.92) / 1.25 = 33.118 [cl. 10.4.3]	**Pass**
Bolt bearing capacity (kN)	N/A	N/A	
Bolt value (kN)		Bolt Shear Capacity =33.118	
Combined shear and tension capacity of bolt	≤ 1.0	$(V_{sf}/V_{df})^2 + (T_f/T_{df})^2$ = (10.0/33.118)^2 + (76.17/90.432)^2 = 0.801 [cl. 10.4.6]	**Pass**
No. of bolts		12.0	
No. of column(s)		2	
No. of row(s)		6	
Bolt gauge (mm)	≥ 2.5 * d = 40.0, ≤ min(32 * t, 300) = 300.0 [cl. 10.2.2 & cl. 10.2.3]	40	**Pass**
	≥ 2.5 * d = 40.0, ≤ min(32 * t, 300) =		**Pass**

			Pass
Bolt pitch (mm)	300.0	40	
End distance (mm)	[cl. 10.2.2 & cl. 10.2.3] $\geq 1.7\ d_o = 30.6, \leq 12*t*\varepsilon = 240.0$ [cl. 10.2.4]	31	**Pass**
Edge distance (mm)	$\geq 1.7\ d_o = 30.6, \leq 12*t*\varepsilon = 240.0$ [cl. 10.2.4]	31	**Pass**
Plate Checks			
Plate thickness (mm)	((4*1.10*1292.225*1000)/(250.0*89.75)) ^ 0.5 = 14.914 [Design of Steel Structures - N. Subramanian, 2014]	20.0	**Pass**
Plate height (mm)	Based on detailing requirements	563.0	
Plate width (mm)		204.5	
Plate moment capacity (kNm)	Moment demand (M_d) = $((14.914^2*250.0*89.75)/(4.4)) * 10\text{^ }{-3}$ = 1292.225 [Design of Steel Structures - N. Subramanian, 2014]	Moment capacity (M_c) = $((20.0^2*250.0*89.75)/(4.4)) * 10\text{^ }{-3}$ = 1487.273 [Design of Steel Structures - N. Subramanian, 2014]	**Pass**
Weld Checks			
Size of Butt Weld (mm)		20.0	
Stiffener Checks			
Height (mm)		75.0	
Thickness (mm)		10.0	
WeldSize (mm)		10.0	
MomentCapacity (KN-m)	≥ 5.44	7.127	**Pass**

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Fabrication Drawings

3D Cad Model

Top View

End Plate 563x204x20   End Plate 563x204x20

Beam UB 406 x 178 x 74   Beam UB 406 x 178 x 74

z 10
z 10   90
Stiffener 75x112x10

C   C
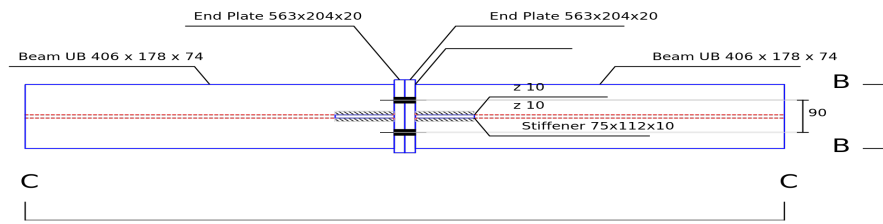
Top view (Sec A-A)
(All dimensions are in "mm")

B

B

Side View

57 90 57

End plate 563x204x20   z 10
                                        z 10

Beam UB 406 x 178 x 74

31
43.0
43.0
40.0
221.0
40.0
43.0
z 10   43.0
z 10   31
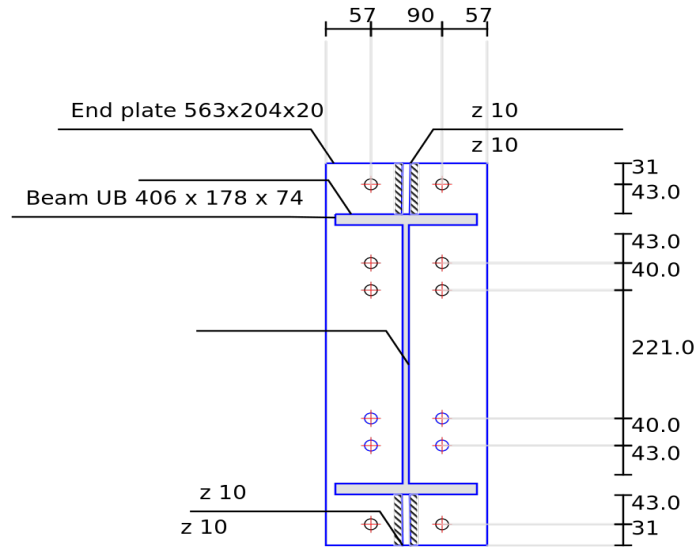
Side view (Sec B-B)
(All dimensions are in "mm")

Front View

A   A

End Plate 563x204x20   End Plate 563x204x20

2 nos 18Ø holes
for M16 Friction Grip Bolt bolts (grade 8.8)
Beam UB 406 x 178 x 74   Beam UB 406 x 178 x 74
4 nos 18Ø holes
for M16 Friction Grip Bolt bolts (grade 8.8)

4 nos 18Ø holes
for M16 Friction Grip Bolt bolts (grade 8.8)
2 nos 18Ø holes   Stiffener 75x112x10
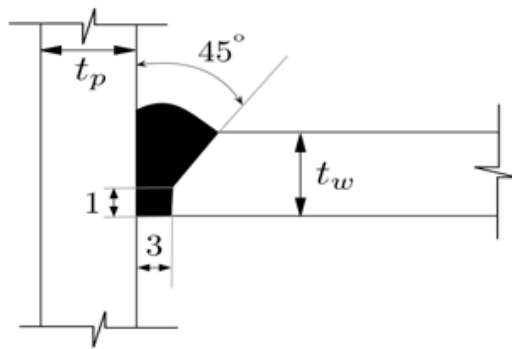for M16 Friction Grip Bolt bolts (grade 8.8)
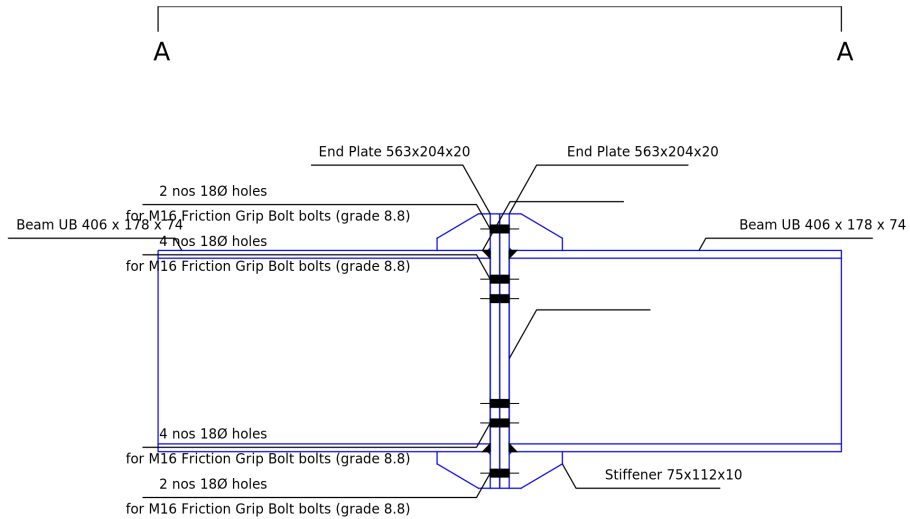
Front view (Sec C-C)
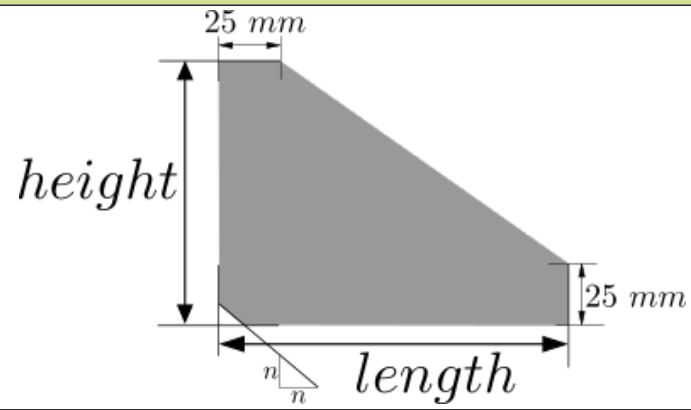(All dimensions are in "mm")
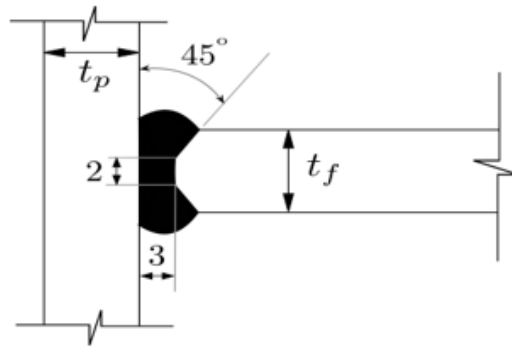
Weld Detailing
Note :- As flange thickness, t_f (16.0mm) >= 12mm, double bevel butt welding is provided [Reference: IS 9595: 1996] (All dimensions are in mm)
Note :- As web thickness, t_w (9.5mm) <= 12mm, single bevel butt welding is provided [Reference: IS 9595: 1996] (All dimensions are in mm)

Stiffener Details

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Additional Comments	