



Created with



Company Name	IIT Bombay	Project Title	Connection Design Examples
Group/Team Name	Osdag	Subtitle	Cleat Angle shear connection
Designer	Engineer #1	Job Number	1.1.3.3.1
Date	19 /06 /2017	Client	Manas M. Ghosh, INSDAG, Kolkata

Design Conclusion	
Cleat Angle	Pass
Cleat Angle	
Connection Properties	
Connection	
Connection Title	Double Angle Web Cleat
Connection Type	Shear Connection
Connection Category	
Connectivity	Beam-Beam
Beam Connection	Bolted
Column Connection	Bolted
Loading (Factored Load)	
Shear Force (kN)	100
Components	
Column Section	WPB 280x280x61.2
Material	Fe 410
Beam Section	NPB 220x110x29.4
Material	Fe 410
Hole	STD
Cleat Section	100 100 x 8
Thickness (mm)	8
Cleat Leg Size B (mm)	100
Cleat Leg Size A (mm)	100
Hole	STD
Bolts on Beam	
Type	HSFG
Grade	10.9
Diameter (mm)	20
Bolt Numbers	3
Columns (Vertical Lines)	1
Bolts Per Column	3
Gauge (mm)	0
Pitch (mm)	50
End Distance (mm)	40

Edge Distance (mm)	40
Bolts on Column	
Type	HSFG
Grade	10.9
Diameter (mm)	20
Bolt Numbers	6
Columns (Vertical Lines)	1
Bolts Per Column	3
Gauge (mm)	0
Pitch (mm)	50
End Distance (mm)	40
Edge Distance (mm)	40
Assembly	
Column-Beam Clearance (mm)	15.0



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Design Preferences

Bolt

Hole Type	Over-sized
Material Grade (MPa) (overwrite)	1040.0
Slip factor	0.52

Detailing

Type of Edges	Rolled, machine-flame cut, sawn and planed
Minimum Edge-End Distance	1.5 times the hole diameter
Gap between beam & support (mm)	15.0
Are members exposed to corrosive influences?	No

Design

Design Method	Limit State Design
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Design Check: Secondary Beam Connectivity

Check	Required	Provided	Remark
Bolt shear capacity (kN)		$V_{dsf} = ((0.52 \times 2 \times 0.85 \times 178.36) / (1.25)) = 121.285$ [cl. 10.4.3]	
Bolt bearing capacity (kN)		N/A	
Bearing capacity of beam web (kN)		N/A	
Bearing capacity of cleat (kN)		N/A	
Bearing capacity (kN)		N/A	
Bolt capacity (kN)		121.285	
Critical bolt shear (kN)	≤ 121.285	34.319	Pass
No. of bolts		3	
No. of column(s)	≤ 2	1	
No. of bolts per column		3	
Bolt pitch (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 6.6, 300) = 212$ [cl. 10.2.2]	50	Pass
Bolt gauge (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 6.6, 300) = 212$ [cl. 10.2.2]	0	
End distance (mm)	$\geq 1.5 \times 24.0 = 36, \leq 12 \times 6.6 = 79.2$ [cl. 10.2.4]	40	Pass
Edge distance (mm)	$\geq 1.5 \times 24.0 = 36, \leq 12 \times 6.6 = 79.2$ [cl. 10.2.4]	40	Pass
Block shear capacity (kN)	≥ 100	$V_{db} = 108.114$ [cl. 6.4.1]	Pass
Cleat height (mm)	$\geq 0.6 \times 222.0 = 133.2, \leq 222.0 - 10.2 - 1.2 - 10.0 - 2.4 - 5 = 193.2$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	180	Pass
Cleat moment		$M_d = (1.2 \times 250 \times Z) / (1000 \times 1.1)$	Pass

capacity (kNm)	$(2 \cdot 121.285 \cdot 50^2) / (50 \cdot 1000) = 3.0$	= 77.76 [cl. 8.2.1.2]	pass
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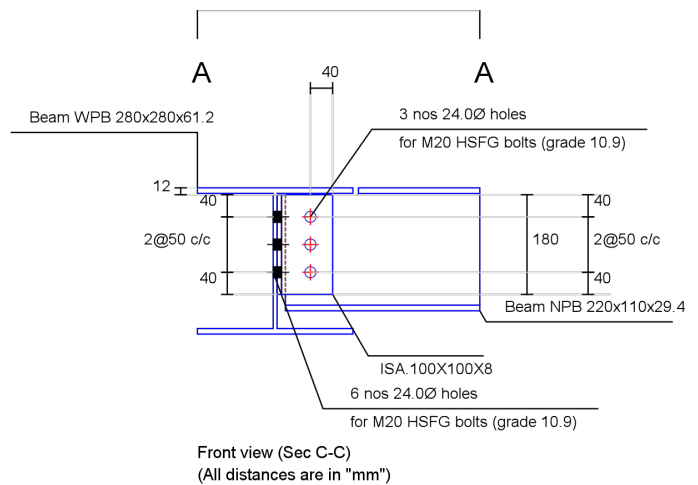
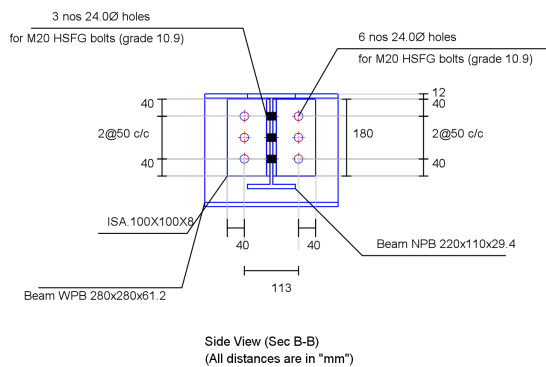
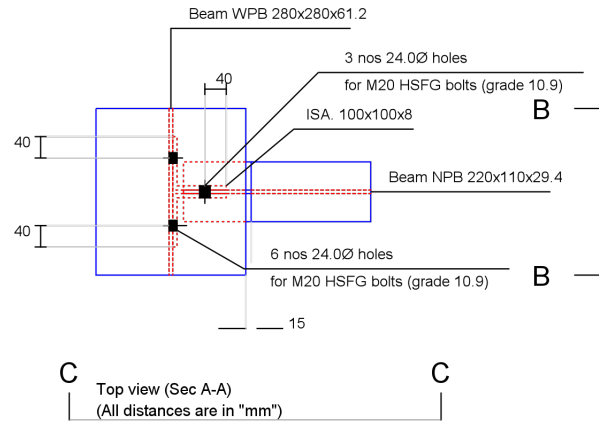
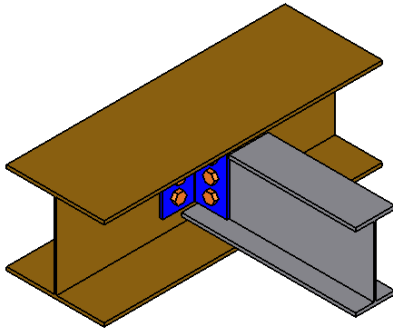
Design Check: Primary Beam Connectivity			
Check	Required	Provided	Remark
Bolt shear capacity (kN)		$V_{dsf} = ((0.52 \times 1 \times 0.85 \times 178.36) / (1.25)) = 60.642$ [cl. 10.4.3]	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt bearing capacity (kN)		N/A	
Bolt capacity (kN)		60.642	
Critical bolt shear (kN)	≤ 60.642	35.77	Pass
No. of bolts		6	
No. of column(s) per angle	≤ 2	1	
No. of bolts per column per angle		3	
Bolt pitch (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 7.0, 300) = 224$ [cl. 10.2.2]	50	Pass
Bolt gauge (mm)	$\geq 2.5 \times 20 = 50, \leq \text{Min}(32 \times 7.0, 300) = 224$ [cl. 10.2.2]	0	
End distance (mm)	$\geq 1.5 \times 24.0 = 36, \leq 12 \times 7.0 = 84.0$ [cl. 10.2.4]	40	Pass
Edge distance (mm)	$\geq 1.5 \times 24.0 = 36, \leq 12 \times 7.0 = 84.0$ [cl. 10.2.4]	40	Pass
Block shear capacity (kN)	≥ 100	$V_{db} = 108.114$ [cl. 6.4.1]	Pass
Cleat height (mm)	$\geq 0.6 \times 222.0 = 133.2, \leq 222.0 - 10.2 - 1.2 - 10.0 - 2.4 - 5 = 193.2$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	180	Pass

Cleat moment capacity (kNm)	$(2 \cdot 60.642 \cdot 50^2) / (50 \cdot 1000) = 3.165$	$M_d = (1.2 \cdot 250 \cdot Z) / (1000 \cdot 1.1)$ $= 77.76$ [cl. 8.2.1.2]	Pass
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Additional Comments	
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