Company Name	**Vasudev Raghunath Upadhye**	**Project Title**	**Numerical 3**
Group/Team Name	**MIT**	**Subtitle**	
Designer	**VRU**	**Job Number**	**Numerical 3**
Date	**05 /06 /2016**	**Method**	**Limit State Design (No Earthquake Load)**

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)	100.0
Components	
Column Section	ISMB 450
Material	Fe 410
Beam Section	ISMB 300
Material	Fe 410
Hole	STD
Cleat Section	ISA 100X100X8
Thickness (mm)	8
Cleat Leg Size B (mm)	100
Cleat Leg Size A (mm)	100
Hole	STD
Bolts on Beam	
Type	Black Bolt

Grade	4.8
Diameter (mm)	8
Bolt Numbers	18
Columns (Vertical Lines)	2
Bolts Per Column	9
Gauge (mm)	20
Pitch (mm)	20
End Distance (mm)	18
Edge Distance (mm)	18
Bolts on Column	
Type	Black Bolt
Grade	4.8
Diameter (mm)	8
Bolt Numbers	36
Columns (Vertical Lines)	2
Bolts Per Column	9
Gauge (mm)	20
Pitch (mm)	20
End Distance (mm)	18
Edge Distance (mm)	18
Assembly	
Column-Beam Clearance (mm)	20

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Design Check: Secondary Beam Connectivity			
Check	**Required**	**Provided**	**Remark**
Bolt shear capacity (kN)		V_{dsb} = ((2*400*0.6126*8*8)/(√3*1.25*1000) = 14.477 [cl. 10.3.3]	
Bolt bearing capacity (kN)		V_{dpb} = (2.5*0.356*8*7.7*400)/(1.25*1000) = 17.544 [cl. 10.3.4]	
Bearing capacity of beam web (kN)		V_{dpb} = (2.5*0.356*8*7.7*410)/(1.25*1000) = 17.982 [cl. 10.3.4]	
Bearing capacity of cleat (kN)		V_{dpb} = (2.5*0.356*8*8*410)/(1.25*1000) = 18.683 [cl. 10.3.4]	
Bearing capacity (kN)		Min (17.544, 17.982, 18.683) = 17.544	
Bolt capacity (kN)		Min (14.477, 17.544) = 14.477	
Critical bolt shear (kN)	≤ 14.477	6.782	**Pass**
No. of bolts		18	
No.of column(s)	≤ 2	2	
No. of bolts per column		9	

Bolt pitch (mm)	≥ 2.5* 8 = 20, ≤ Min(32*7.7, 300) = 247 [cl. 10.2.2]	20	**Pass**
Bolt gauge (mm)	≥ ;2.5*8 = 20, ≤ Min(32*7.7, 300) = 247 [cl. 10.2.2]	20	
End distance (mm)	≥ 1.7*11.0 = 18.7, ≤ 12*7.7 = 92.4 [cl. 10.2.4]	18	**Pass**
Edge distance (mm)	≥ 1.7*11.0 = 18.7, ≤ 12*7.7 = 92.4 [cl. 10.2.4]	18	**Pass**
Block shear capacity (kN)	≥ 100.0	V_{db} = 184.304 [cl. 6.4.1]	**Pass**
Cleat height (mm)	≥ 0.6*300.0=180.0, ≤ 300.0-13.1-14.0-17.4-15.0-5=235.5 [cl. 10.2.4, Insdag Detailing Manual, 2002]	196	**Pass**
Cleat moment capacity (kNm)	$(2*14.477*20^2)/(20*1000)$ = 3.6	M_d = (1.2*250*Z)/(1000*1.1) = 92.198 [cl. 8.2.1.2]	**Pass**

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Date	**05 /06 /2016**	**Method**	**Limit State Design (No Earthquake Load)**

Design Check: Primary Beam Connectivity			
Check	**Required**	**Provided**	**Remark**
Bolt shear capacity (kN)		V_{dsb} = ((400*0.6126*8*8)/(√3*1.25*1000) = 7.239 [cl. 10.3.3]	
Bolt bearing capacity (kN)		V_{dpb} = (2.5*0.356*8*8.0*400)/(1.25*1000) = 18.227 [cl. 10.3.4]	
Bearing capacity of beam web (kN)		V_{dpb} = (2.5*0.356*8*9.4*410)/(1.25*1000) = 21.952 [cl. 10.3.4]	
Bearing capacity of cleat (kN)		V_{dpb} = (2.5*0.356*8*8*410)/(1.25*1000) = 18.683 [cl. 10.3.4]	
Bearing capacity (kN)		Min (18.227, 21.952, 18.683) = 18.683	
Bolt capacity (kN)		Min (7.239, 18.683) = 7.239	
Critical bolt shear (kN)	≤ 7.239	7.069	**Pass**
No. of bolts		36	
No.of column(s) per angle	≤ 2	2	
No. of bolts			

per column per angle		9	
Bolt pitch (mm)	≥ 2.5* 8 = 20, ≤ Min(32*8.0, 300) = 256 [cl. 10.2.2]	20	**Pass**
Bolt gauge (mm)	≥ 2.5*8 = 20, ≤ Min(32*8.0, 300) = 256 [cl. 10.2.2]	20	
End distance (mm)	≥ 1.7*11.0 = 18.7, ≤ 12*8.0 = 96.0 [cl. 10.2.4]	18	**Pass**
Edge distance (mm)	≥1.7*11.0 = 18.7, ≤12*8.0 = 96.0 [cl. 10.2.4]	18	**Pass**
Block shear capacity (kN)	≥100.0	V_{db} = 184.304 [cl. 6.4.1]	**Pass**
Cleat height (mm)	≥ 0.6*300.0=180.0, ≤ 300.0-13.1-14.0-17.4-15.0-5=235.5 [cl. 10.2.4, Insdag Detailing Manual, 2002]	196	**Pass**
Cleat moment capacity (kNm)	$(2*7.239*20^2)/(20*1000)$ = 3.792	$M_d = (1.2*250*Z)/(1000*1.1)$ = 92.198 [cl. 8.2.1.2]	**Pass**

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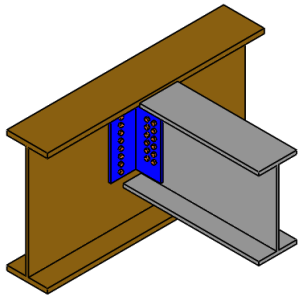
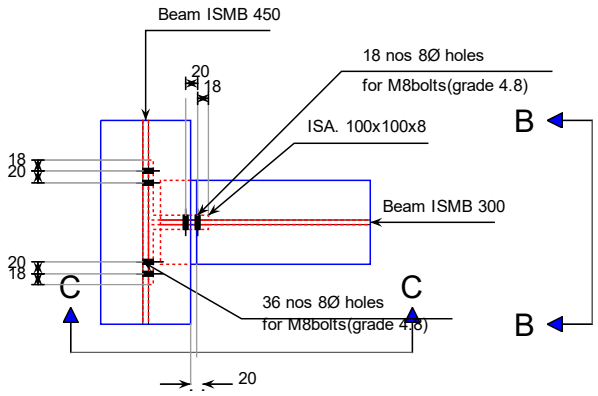
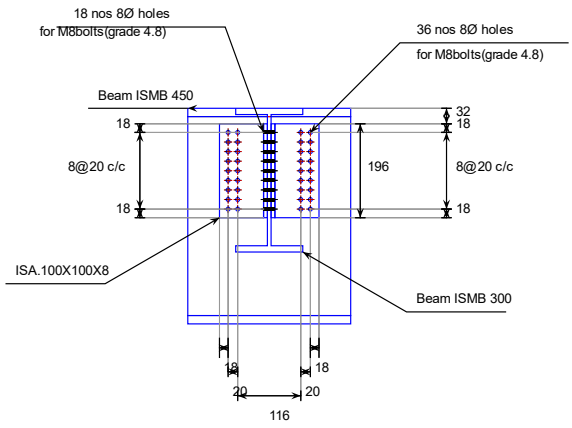
Views

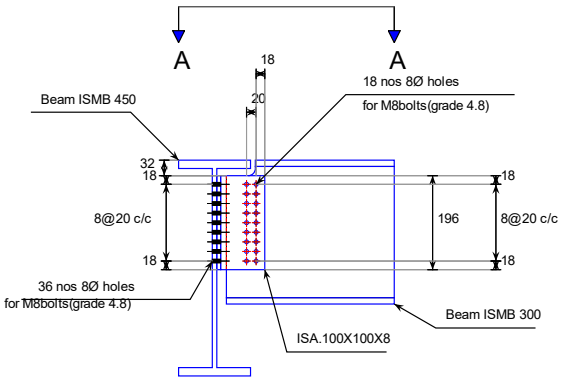




Top view (Sec A-A) (All distances are in "mm")



Side View (Sec B-B) (All distances are in "mm")



Front view (Sec C-C) (All distances are in "mm")

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Additional Comments	Ok. The connection is checked for various combinations of bolt diameter and cleat section dimensions and current combination is found satisfactory.