 Created with	
<b>Company Name</b>	<b>KLE Technological University</b>	<b>Project Title</b>	<b>Problem Set 2 - Cleat Angle Beam to Beam</b>
<b>Group/Team Name</b>	<b>Civil Engineering Department</b>	<b>Subtitle</b>	
<b>Designer</b>	<b>Satish Annigeri</b>	<b>Job Number</b>	
<b>Date</b>	<b>05 /06 /2016</b>	<b>Method</b>	<b>Limit State Design (No Earthquake Load)</b>


<b>Design Conclusion</b>	
<b>Cleat Angle</b>	<b>Pass</b>
<b>Cleat Angle</b>	
<b>Connection Properties</b>	
<b>Connection</b>	
Connection Title	Double Angle Web Cleat
Connection Type	Shear Connection
<b>Connection Category</b>	
Connectivity	Beam-Beam
Beam Connection	Bolted
Column Connection	Bolted
<b>Loading (Factored Load)</b>	
Shear Force (kN)	100.0
<b>Components</b>	
<b>Column Section</b>	ISMB 450
Material	Fe 410
<b>Beam Section</b>	ISMB 300
Material	Fe 410
Hole	STD
<b>Cleat Section</b>	ISA 90X90X8
Thickness (mm)	8
Cleat Leg Size B (mm)	90
Cleat Leg Size A (mm)	90
Hole	STD
<b>Bolts on Beam</b>	
Type	Black Bolt
Grade	4.8
Diameter (mm)	16
Bolt Numbers	5
Columns (Vertical Lines)	1
Bolts Per Column	5

Gauge (mm)	0
Pitch (mm)	40
End Distance (mm)	30
Edge Distance (mm)	30
<b>Bolts on Column</b>	
Type	Black Bolt
Grade	4.8
Diameter (mm)	16
Bolt Numbers	8
Columns (Vertical Lines)	1
Bolts Per Column	4
Gauge (mm)	0
Pitch (mm)	40
End Distance (mm)	50
Edge Distance (mm)	30
<b>Assembly</b>	
Column-Beam Clearance (mm)	20

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<b>Design Check: Secondary Beam Connectivity</b>			
<b>Check</b>	<b>Required</b>	<b>Provided</b>	<b>Remark</b>
<b>Bolt shear capacity (kN)</b>		$V_{dsb} = ((2*400*0.6126*16*16)/(\sqrt{3}*1.25*1000)) = 58.012$ [cl. 10.3.3]	
<b>Bolt bearing capacity (kN)</b>		$V_{dpb} = (2.5*0.491*16*7.7*400)/(1.25*1000) = 48.393$ [cl. 10.3.4]	
<b>Bearing capacity of beam web (kN)</b>		$V_{dpb} = (2.5*0.491*16*7.7*410)/(1.25*1000) = 49.603$ [cl. 10.3.4]	
<b>Bearing capacity of cleat (kN)</b>		$V_{dpb} = (2.5*0.491*16*8*410)/(1.25*1000) = 51.535$ [cl. 10.3.4]	
<b>Bearing capacity (kN)</b>		Min (48.393, 49.603, 51.535) = 48.393	
<b>Bolt capacity (kN)</b>		Min (58.012, 48.393) = 48.393	
<b>Critical bolt shear (kN)</b>	$\leq 48.393$	18.028	<b>Pass</b>
<b>No. of bolts</b>		5	
<b>No. of column(s)</b>	$\leq 2$	1	
<b>No. of bolts per column</b>		5	
<b>Bolt pitch (mm)</b>	$\geq 2.5*16 = 40, \leq \text{Min}(32*7.7, 300) = 247$ [cl. 10.2.2]	40	<b>Pass</b>
<b>Bolt gauge (mm)</b>	$\geq 2.5*16 = 40, \leq \text{Min}(32*7.7, 300) = 247$ [cl. 10.2.2]	0	
	$\geq 1.7*18.0 = 30.6, \leq 12*7.7 =$		

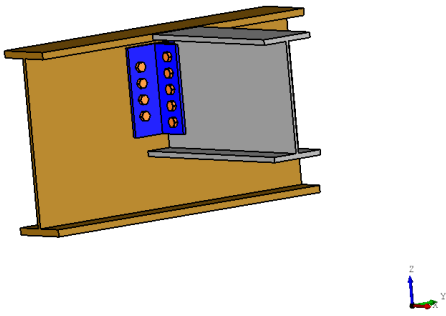
<b>End distance (mm)</b>	92.4 [cl. 10.2.4]	30	<b>Pass</b>
<b>Edge distance (mm)</b>	$\geq 1.7 \cdot 18.0 = 30.6, \leq 12 \cdot 7.7 = 92.4$ [cl. 10.2.4]	30	<b>Pass</b>
<b>Block shear capacity (kN)</b>	$\geq 100.0$	$V_{db} = 203.164$ [cl. 6.4.1]	<b>Pass</b>
<b>Cleat height (mm)</b>	$\geq 0.6 \cdot 300.0 = 180.0, \leq 300.0 - 13.1 - 14.0 - 17.4 - 15.0 - 5 = 235.5$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	220	<b>Pass</b>
<b>Cleat moment capacity (kNm)</b>	$(2 \cdot 58.012 \cdot 40^2) / (40 \cdot 1000) = 3.0$	$M_d = (1.2 \cdot 250 \cdot Z) / (1000 \cdot 1.1) = 116.16$ [cl. 8.2.1.2]	<b>Pass</b>


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Design Check: Primary Beam Connectivity			
Check	Required	Provided	Remark
Bolt shear capacity (kN)		$V_{dsb} = ((400 \times 0.6126 \times 16 \times 16) / (\sqrt{3} \times 1.25 \times 1000)) = 29.006$ [cl. 10.3.3]	
Bolt bearing capacity (kN)		$V_{dpb} = (2.5 \times 0.491 \times 16 \times 8.0 \times 400) / (1.25 \times 1000) = 50.278$ [cl. 10.3.4]	
Bearing capacity of beam web (kN)		$V_{dpb} = (2.5 \times 0.491 \times 16 \times 9.4 \times 410) / (1.25 \times 1000) = 60.554$ [cl. 10.3.4]	
Bearing capacity of cleat (kN)		$V_{dpb} = (2.5 \times 0.491 \times 16 \times 8 \times 410) / (1.25 \times 1000) = 51.535$ [cl. 10.3.4]	
Bearing capacity (kN)		Min (50.278, 60.554, 51.535) = 51.535	
Bolt capacity (kN)		Min (29.006, 51.535) = 29.006	
Critical bolt shear (kN)	$\leq 29.006$	27.01	Pass
No. of bolts		8	
No. of column(s) per angle	$\leq 2$	1	
No. of bolts per column per angle		4	
Bolt pitch (mm)	$\geq 2.5 \times 16 = 40, \leq \text{Min}(32 \times 8.0, 300) = 256$ [cl. 10.2.2]	40	Pass
Bolt gauge (mm)	$\geq 2.5 \times 16 = 40, \leq \text{Min}(32 \times 8.0, 300) = 256$ [cl. 10.2.2]	0	

<b>End distance (mm)</b>	$\geq 1.7 \cdot 18.0 = 30.6, \leq 12 \cdot 8.0 = 96.0$ [cl. 10.2.4]	50	<b>Pass</b>
<b>Edge distance (mm)</b>	$\geq 1.7 \cdot 18.0 = 30.6, \leq 12 \cdot 8.0 = 96.0$ [cl. 10.2.4]	30	<b>Pass</b>
<b>Block shear capacity (kN)</b>	$\geq 100.0$	$V_{db} = 200.437$ [cl. 6.4.1]	<b>Pass</b>
<b>Cleat height (mm)</b>	$\geq 0.6 \cdot 300.0 = 180.0, \leq 300.0 - 13.1 - 14.0 - 17.4 - 15.0 - 5 = 235.5$ [cl. 10.2.4, Insdag Detailing Manual, 2002]	220	<b>Pass</b>
<b>Cleat moment capacity (kNm)</b>	$(2 \cdot 29.006 \cdot 40^2) / (40 \cdot 1000) = 3.192$	$M_d = (1.2 \cdot 250 \cdot Z) / (1000 \cdot 1.1) = 116.16$ [cl. 8.2.1.2]	<b>Pass</b>

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<b>Additional Comments</b>			