www.rcenggstudion.com	**Design of Beam to Beam End Plate Connection**	Date:	
		Rev:	

Bolt Strength

High Strength Bolt Grade	8.8 Grade			
Nominal Shear stress		Fnv	= 372	N/mm^2
Nominal Tensile stress		Fnt	= 620	N/mm^2

Steel Details

Structural Steel Grade	A36			
Specified minimum Yeild stress		Fy	= 250	N/mm^2
Specified minimum Tensile stress		Fu	= 400	N/mm^2

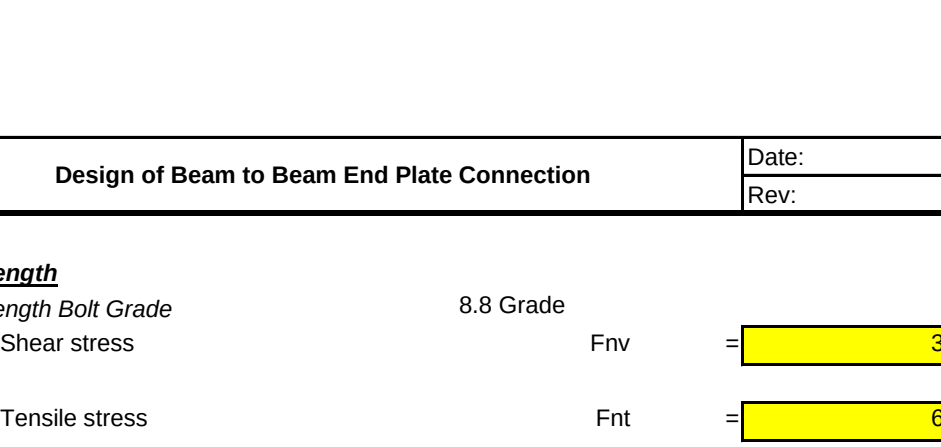
Weld Strength

Welding Electrode Grade	E70 XX			
Electrode classification number		F_{EXX}	= 70 ksi	
			480	N/mm^2

FORCES FROM STAAD ANALYSIS

Max. Axial Load	A_{fw}	= 710	kN
Max. Vertical Shear	F_{vw}	= 44	kN
Max. Horizontal Shear	F_{hw}	= 6	kN
Max Torsion	Mt	= 1.00	kN-m

Shear force due to torsion	=	0.01 kN
Shear force vector sum	=	sqrt(44^2 + 6^2) + 0.01
Ftw = (Fvw2+Fhw2)0.5 + (Nb × S_{tor})	=	44.01 kN



S.No	Check	Ratio	Remarks
1.0	**Bolt Check**		
1.1	Tension Check	0.84	Checked ok
1.2	Shear Check	0.08	Checked ok
1.3	Bearing Check	0.04	Checked ok
2.0	**Check for Gusset and End Plate**		
2.1	Check for Web Weld	0.000	Checked ok
2.2	Check for Flange Weld	0.002	Checked ok

Beam profile BEAM			**UC305x305x97**
Depth of Beam	D_b	=	307.9 mm
Flange Width of Beam	W_b	=	305.3 mm
Web Thickness of Beam	twb	=	9.9 mm
Flange Thickness of Beam	F_{tb}	=	15.4 mm
Root Radius of Beam	R_{tb}	=	15.2 mm

End plate profile

Depth of plate	D_p	=	307	mm
Width of plate	W_p	=	325	mm
Thickness of Flange plate	tg	=	15	mm
Thickness of Web Plate	F_p	=	10	mm

Bolt detail

Nominal diameter of the bolt	B_d	=	24	mm
Area bolt shank	Ab	=	452	mm^2
Net area of the bolt	Anb	=	353	mm^2
Diameter of the hole	Dh	=	26	mm
Total number of the bolts	N_b	=	6	
Distance between Column flange end & end	R	=	500	
Number of bolt rows	N	=	3	
Bolt Edge distance	A	=	75	mm
End Projection of Plates	Proj.	=	10	mm
Plate width	C	=	325	mm
Plate Height	J	=	307	mm
Plate thickness	K	=	15	mm
Bolt spacing (Horizontal)	B	=	175	mm
Edge Distance (Bottom)	G	=	63.5	mm
Edge Distance (top)	I	=	63.5	mm
Bolt Spacing (Vertical)	M	=	180	mm

1. Check for BOLTS

Stress due to axial force

Total tensile Force per Bolt	$T_{af} = A_f / (N_b)$	=	118	kN
Dist between bolt center to center of bolt group	r	=	Sqrt (87.5^2 + 90^2)	
		=	125.52	mm
Shear in a bolt due to torsion	$Stor = (Mt \times r) / \Sigma r^2$	=	5.52) / (4 x 125.52^2)	
			0.00	kN
Vertical shear force on a bolt	Stv = Fv / Nb	=	44 / 6	
		=	7	kN
Horizontal shear force on a bolt	Sth = Fh / Nb	=	6 / 6	
		=	1	kN
Resultant shear force on a bolt	$Sr = (Stv^2+Sth^2)^{0.5}$	=	SQRT(7^2 + 1^2)	
			7	kN
Total shear force on a bolt	St = Sr+Stor	=	7+0	
		=	7.00	kN

1.1) Check for Tension capacity (AISC ASD 360 -16 par J3.6)

Required Tension force for one bolt	Tt	=	118	kN
Allowable Tensile capacity of one bolt	= Rn /Ω = Fnt·Ab / Ω	=	620 x 452 / 2	
Ω = 2.00		=	140.12	kN
check for tension capacity of the bolt	Tt < Rn /Ω	=	118.33 < 140.12	
	Ratio		0.84	
			Checked ok	

1.2) Check for Shear capacity (AISC ASD 360 -16 par J3.6)

Required Shear force for one bolt	St	=	7.00	kN
Allowable Shear capacity of one bolt	= Rn /Ω = Fnv·Ab / Ω	=	372 x 452 / 2	
Ω = 2.00		=	84	kN
(check for shear)	St < Rn /Ω	=	7 < 84.072	
	Ratio	=	0.08	

				Checked ok

1.3) check for Bearing capacity (AISC ASD 360 -16 par J3.10)

Required Shear force for one bolt		St	=	7.00 kN
Allowable Bearing Force of one Bolt		Rn=2.4·d·t·Fu	=	2.4 x 24 x 15 x 400
	Ω = 2.00		=	346 kN
		Rn/Ω	=	173 kN
Allowable bearing capacity		Rn/Ω > St	=	172.8 > 7
		Ratio	=	0.04
				Checked ok

2) CHECK FOR GUSSET & END PLATE WELDING TO BEAM

General data

Gusset Depth		Hp	=	307.9 -(2 x 15.4 + 2 x 15.2)
			=	246.7 mm
Number of flanges		Nf	=	2
Weld Thickness of Web		w_w	=	6 mm
Weld Thickness of Flange		w_f	=	6 mm
Lever arm		$l_a = (D_b - F_{tb})$	=	292.5 mm
Vertical Weld Length		$l_v = (2 \cdot H_p)$	=	493.4 mm
Total horiz. weld length on flanges		l_h	=	(2x 325) - (2x 10)
				630 mm

2.2)CHECK FOR WEB WELD (AISC ASD 360 -16 par J2.4)

Due to Shear force

Allowable Weld strength at throat		$\sqrt{}_s = 0.707 \cdot w_w \cdot 0.6Fw / \Omega$	=	.707 x 6 x 0.6 x 480/2
	Ω = 2.00		=	610.85 N/mm
Unit shear force on the weld		$U_s = F_{tw} / l_v$	=	44.01 / 493.4
			=	0.10 N/mm
Check for unit force		$U_s < W_s$	=	0.1 < 610.85
		Ratio	=	0.000
				Checked ok

2.3) CHECK FOR FLANGE WELD (AISC ASD 360 -16 par J2.4)

Due to Axial force

Unit Axial force on the weld		$Uaf = A_{fw} / l_h$	=	710 / 630
			=	1.10 N/mm
Allowable Weld strength at throat		$Wr = 0{,}707 \cdot w_f \cdot Fw / \Omega$	=	)7 x 6 x 0.6 x 480 / 2
	Ω = 2.00			611 N/mm
		Uaf< Wr	=	1.1 < 611
		Ratio	=	0.002
				Checked ok

SUMMARY TABLE	
BOLT GRADE	8.8 Grade
BOLT DIA (mm)	24
NUMBER OF BOLTS (Nos.)	6
GUSSET PLATE THICKNESS (mm)	15