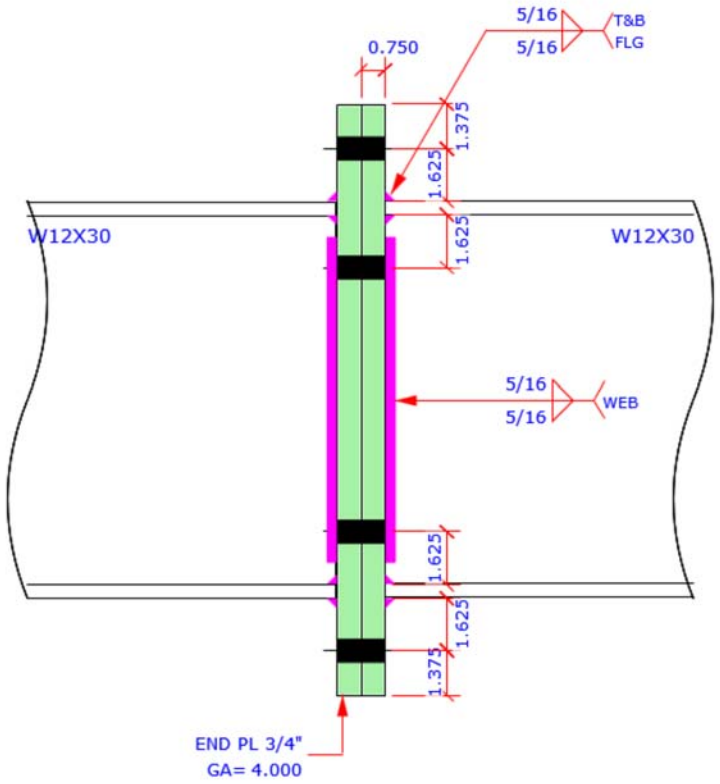
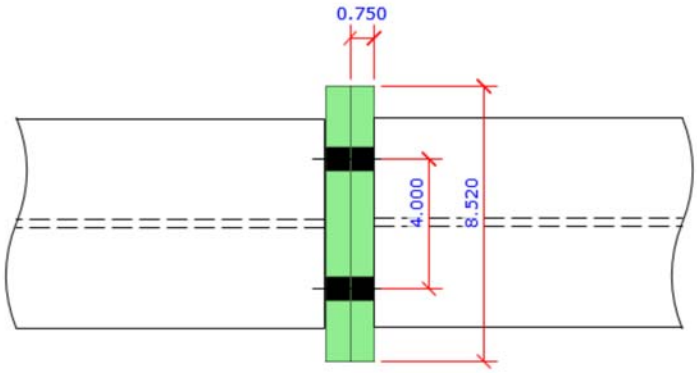
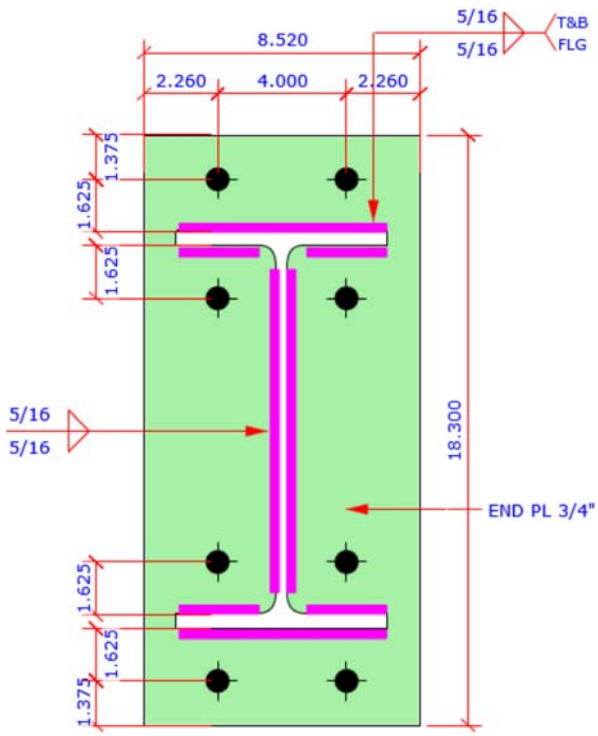
Result Summary - Overall	Moment Connection - Beam Splice	Code=AISC 360-10 LRFD

Result Summary - Overall	geometries & weld limitations = **PASS**	limit states max ratio = **0.61**	**PASS**
Right Beam	geometries & weld limitations = **PASS**	limit states max ratio = **0.61**	**PASS**
Left Beam	geometries & weld limitations = **PASS**	limit states max ratio = **0.61**	**PASS**

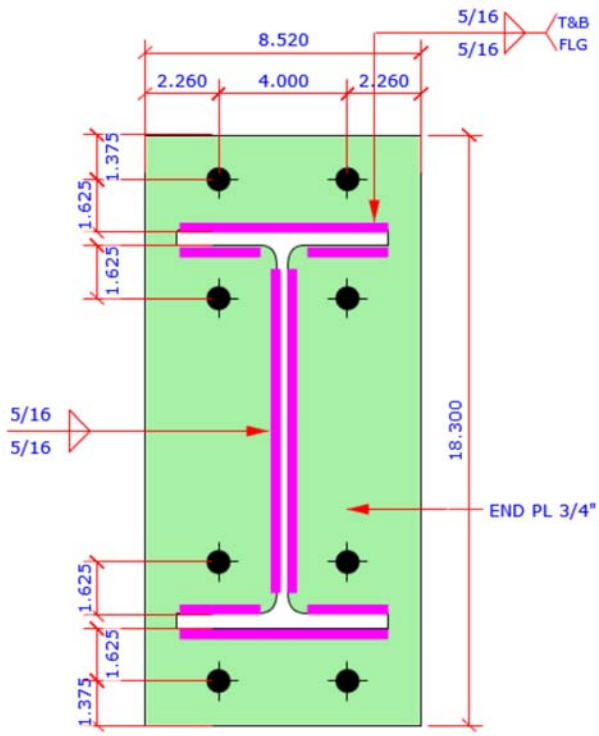
Sketch	Moment Connection - Beam Splice	Code=AISC 360-10 LRFD



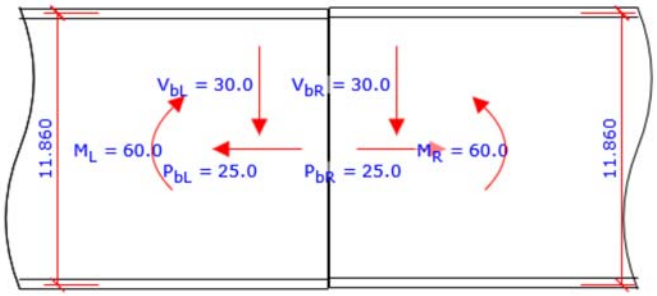




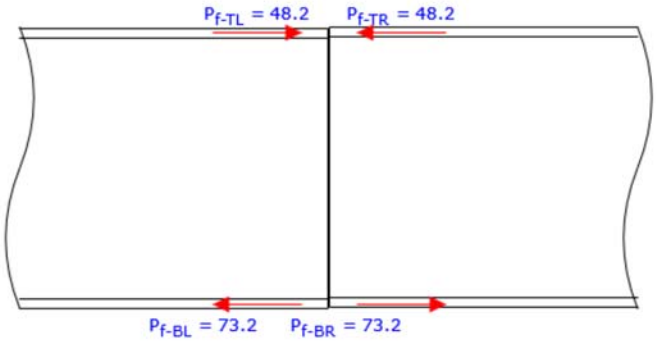
Left Side Beam



Right Side Beam



Design Load



Beam Flange Force

Members & Components Summary

Member	Moment Connection				Code=AISC 360-10 LRFD
Right Side Beam Section					
W12X30	$d = 12.300$	[in]	$b_f = 6.520$	[in]	
	$t_f = 0.440$	[in]	$t_w = 0.260$	[in]	
	$k_{des} = 0.740$	[in]	$k_{det} = 1.125$	[in]	
	$k_1 = 0.750$	[in]	$A = 8.790$	[in^2]	
	$S_x = 38.60$	[in^3]	$Z_x = 43.10$	[in^3]	
Steel Grade A992	$F_y = 50.0$	[ksi]	$F_u = 65.0$	[ksi]	
Left Side Beam Section					
W12X30	$d = 12.300$	[in]	$b_f = 6.520$	[in]	
	$t_f = 0.440$	[in]	$t_w = 0.260$	[in]	
	$k_{des} = 0.740$	[in]	$k_{det} = 1.125$	[in]	
	$k_1 = 0.750$	[in]	$A = 8.790$	[in^2]	
	$S_x = 38.60$	[in^3]	$Z_x = 43.10$	[in^3]	
Steel Grade A992	$F_y = 50.0$	[ksi]	$F_u = 65.0$	[ksi]	

Beam Flange Force Calc

Beam Flange Force

Beam section	$d_b = 12.300$	[in]	$t_{fb} = 0.440$	[in]
Flange force moment arm	$d_m = d_b - t_{fb}$		$= 11.860$	[in]
User input load	axial $P_{bR} = -25.00$	[kips]	moment $M_R = 60.00$	[kip-ft]
	in tension			
Beam flange force - top	$P_{f\text{-}TR} = P_{bR} / 2 + M_R / d_m$		$=$ **48.21**	[kips]
Beam flange force - bottom	$P_{f\text{-}BR} = P_{bR} / 2 - M_R / d_m$		$=$ **-73.21**	[kips]

Right Beam	Splice MC Connection	Code=AISC 360-10 LRFD

Result Summary	geometries & weld limitations = **PASS**	limit states max ratio = **0.61** **PASS**

Geometry Restriction Checks				**PASS**
Min Bolt Spacing - End Plate				
Bolt diameter	d_b =	= 0.750	[in]	
Min bolt spacing allowed	$L_{s\text{-}min} = 2.667\ d_b$	= **2.000**	[in]	AISC 14th J3.3
Min Bolt spacing in End Plate	L_s =	= **3.690**	[in]	
		> $L_{s\text{-}min}$	OK	
Min Bolt Edge Distance - End Plate				
Bolt diameter	d_b =	= 0.750	[in]	
Min edge distance allowed	$L_{e\text{-}min}$ =	= **1.000**	[in]	AISC 14th Table J3.4
Min edge distance in End Plate	L_e =	= **1.375**	[in]	
		> $L_{e\text{-}min}$	OK	
Max Bolt Edge Distance - End Plate				
Connecting plate thickness	t_p =	= 0.750	[in]	
Max edge distance allowed	$L_{e\text{-}max}$ = min (12t , 6")	= **6.000**	[in]	AISC 14th J3.5
Max edge distance in End Plate	L_e =	= **2.260**	[in]	
		< $L_{e\text{-}max}$	OK	

Beam Flange Fillet Weld Limitation				**PASS**
Min Fillet Weld Size				
Thinner part joined thickness	t =	= 0.440	[in]	
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4
Fillet weld size provided	w =	= **0.313**	[in]	
		> w_{min}	OK	
Min Fillet Weld Length				
Fillet weld size provided	w =	= 0.313	[in]	
Min fillet weld length allowed	$L_{min} = 4 \times w$	= **1.250**	[in]	AISC 14th J2.2b
Min fillet weld length	$L = 0.5\ b_{fb} - k_{1b}$	= **2.510**	[in]	
		> L_{min}	OK	

Beam Web Fillet Weld Limitation				**PASS**
Min Fillet Weld Size				
Thinner part joined thickness	t =	= 0.260	[in]	
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4
Fillet weld size provided	w =	= **0.313**	[in]	
		> w_{min}	OK	
Min Fillet Weld Length				
Fillet weld size provided	w =	= 0.313	[in]	
Min fillet weld length allowed	$L_{min} = 4 \times w$	= **1.250**	[in]	AISC 14th J2.2b
Min fillet weld length	$L = 0.5\ d_b - k_b$	= **5.025**	[in]	
		> L_{min}	OK	

Verify AISC DG4 Bolt No Prying Assumption — **AISC DG4 Is Used**

Bolt Moment Strength (No Prying)

	bolt grade = A325-N	F_t = 90.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]	bolt area A_b = 0.442	[in^2]	
Bolt norminal tensile strength	$P_t = F_t A_b$	= 39.76	[kips]	AISC 14th Eq J3-1
Tension bolt moment arm	h_0 = 13.705 [in]	h_1 = 10.015	[in]	
Bolt moment strength (no prying)	$M_{np} = 2 P_t (h_0 + h_1)$	= 157.19	[kip-ft]	AISC DG4 Eq 3.7
Bolt resistance factor-LRFD	ϕ_v = 0.75			AISC 14th Eq J3-1
	$\phi^{np}_{v\,M}$ =	= **117.89**	[kip-ft]	

End Plate Bending Strength

End plate width	b_{plate} = 8.520 [in]	thickness t_p = 0.750	[in]	
Beam flange width	b_{fb} = 6.520 [in]			
Effective end plate width	$b_p = \min (b_{plate}, b_{fb} + 1")$	= 7.520	[in]	AISC DG4 Page 9 item 5
End plate yield strength	F_{yp} = 50.0 [ksi]			
See AISC DG4 Table 3.1 for all formulas to derive the following parameters				AISC DG4 Table 3.1
Tension bolt moment arm	h_0 = 13.705 [in]	h_1 = 10.015	[in]	
	g = 4.000 [in]			
	p_{fi} = 1.625 [in]	p_{fo} = 1.625	[in]	
	s = 2.742 [in]	Y_p = 88.61	[in]	
Flexure resistance factor-LRFD	ϕ^b_v = 0.90			AISC 14th F1 (1)
End plate bending strength	$\phi^b_v M_{pl} = \phi^b_v F_{yp} t_p^2 Y_p$	= **186.90**	[kip-ft]	AISC DG4 Table 3.1
Check thick end plate condition	$\phi^b_v M_{pl} >= 1.11 X \phi_v M_{np}$			AISC DG4 Eq 3.33
	ratio = **0.70** thick plate			
The thick end plate conditions are met. AISG DG4 is used and no bolt prying is considered				AISC DG4 Eq 3.33 & 3.35

Bolt Moment Strength (No Prying) — ratio = 73.21 / 119.28 = **0.61** **PASS**

	bolt grade = A325-N	F_t = 90.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]	bolt area A_b = 0.442	[in^2]	
Bolt norminal tensile strength	$P_t = F_t A_b$	= 39.76	[kips]	AISC 14th Eq J3-1
Tension bolt moment arm	h_0 = 13.705 [in]	h_1 = 10.015	[in]	
Flange force moment arm	$d_m = d_b - t_{fb}$	= 11.860	[in]	
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$	= **73.21**	[kips]	
Flange force resistance by bolt	$F_n = 2 P_t (h_0 + h_1) / d_m$	= 159.04	[kips]	AISC DG4 Eq 3.7
Bolt resistance factor-LRFD	ϕ_v = 0.75			AISC 14th Eq J3-1
	$\phi^n_{v\,F}$ =	= **119.28**	[kips]	AISC DG4 Eq 3.7
	ratio = **0.61**	> P_{uf_t}	OK	

Bolt Shear Strength			ratio = 30.00 / 71.57	= **0.42**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]		bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 4.0		shear plane m = 1		
Required shear strength	V_u =		= **30.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ_v = 0.75				AISC 14th Eq J3-1
	$\phi^n_{v\,R}$ =		= **71.57**	[kips]	
	ratio = **0.42**		> V_u	OK	

Bolt Bearing / TearOut Strength on End Plate			ratio = 30.00 / 71.57	= **0.42**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750 [in]		bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = 3/4 [in]		bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.690 [in]		edge distance L_e = 1.375	[in]	
Plate tensile strength	F_u = 65.0 [ksi]				
Plate thickness	t = 0.750 [in]				
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.878	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 210.42 ≤ 109.69		= 109.69	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Edge Bolt					
Bolt hole edge clear distance	$L_c = L_e - d_h / 2$		= 0.969	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 70.84 ≤ 109.69		= 70.84	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Number of bolt	interior n_{in} = 2		edge n_{ed} = 2		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$		= 95.43	[kips]	
Required shear strength	V_u =		= **30.00**	[kips]	
Bolt resistance factor-LRFD	ϕ_v = 0.75				AISC 14th J3-10
	$\phi^n_{v\,R}$ =		= **71.57**	[kips]	
	ratio = **0.42**		> V_u	OK	

End Plate Flexural Yielding			ratio = 73.21 / 189.11	= **0.39**	**PASS**
End Plate Bending Strength					
End plate width	b_{plate} = 8.520 [in]		thickness t_p = 0.750 [in]		
Beam flange width	b_{fb} = 6.520 [in]				
Effective end plate width	b_p = min (b_{plate} , b_{fb} + 1")		= 7.520 [in]		AISC DG4 Page 9 item 5
End plate yield strength	F_{yp} = 50.0 [ksi]				
See AISC DG4 Table 3.1 for all formulas to derive the following parameters					AISC DG4 Table 3.1
Tension bolt moment arm	h_0 = 13.705 [in]		h_1 = 10.015 [in]		
	g = 4.000 [in]				
	p_{fi} = 1.625 [in]		p_{fo} = 1.625 [in]		
	s = 2.742 [in]		Y_p = 88.61 [in]		
Flexure resistance factor-LRFD	ϕ_v^b = 0.90				AISC 14th F1 (1)
End plate bending strength	$\phi_v^b M_{pl} = \phi_v^b F_{yp} t_p^2 Y_p$		= **186.90** [kip-ft]		AISC DG4 Table 3.1
Flange force moment arm	$d_m = d_b - t_{fb}$		= 11.860 [in]		
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$		= **73.21** [kips]		
Flange force provided by end plate bending	$\phi_{v\,R}^{pl} = \phi_v M_{pl} / d_m$		= **189.11** [kips]		AISC DG4 Eq 3.10
	ratio = **0.39**		> P_{uf_t}	OK	

End Plate Shear Yielding			ratio = 36.61 / 169.20	= **0.22**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$		= **36.61** [kips]		
End plate width	b_{plate} = 8.520 [in]		thickness t_p = 0.750 [in]		
Beam flange width	b_{fb} = 6.520 [in]				
Effective end plate width	b_p = min (b_{plate} , b_{fb} + 1")		= 7.520 [in]		AISC DG4 Page 9 item 5
Plate Shear Yielding Check					
Plate size	width b_p = 7.520 [in]		thickness t_p = 0.750 [in]		
Plate yield strength	F_y = 50.0 [ksi]				
Plate gross area in shear	$A_{gv} = b_p t_p$		= 5.640 [in^2]		
Shear force required	0.5 P_{uf_t} =		= **36.61** [kips]		
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$		= 169.20 [kips]		AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ_v = 1.00				AISC 14th Eq J4-3
	$\phi_{v\,R}^n$ =		= **169.20** [kips]		
	ratio = **0.22**		> 0.5 P_{uf_t}	OK	

End Plate Shear Rupture				ratio = 36.61 / 126.58	= **0.29**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$			= **36.61**	[kips]	
End plate width	b_{plate} = 8.520	[in]	thickness t_p = 0.750		[in]	
Beam flange width	b_{fb} = 6.520	[in]				
Effective end plate width	$b_p = \min (b_{plate}, b_{fb} + 1")$			= 7.520	[in]	AISC DG4 Page 9 item 5
Plate Shear Rupture Check						
Bolt hole diameter	bolt dia d_b = $^3/_4$	[in]	bolt hole dia d_h = $^7/_8$		[in]	AISC 14th B4.3b
Number of bolt	n = 2					
Plate size	width b_p = 7.520	[in]	thickness t_p = 0.750		[in]	
Plate tensile strength	F_u = 65.0	[ksi]				
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$			= 4.328	[in^2]	
Shear force required	0.5 P_{uf_t} =			= **36.61**	[kips]	
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$			= 168.77	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ_v = 0.75					AISC 14th Eq J4-4
	$\phi^n_{v\,R}$ =			= **126.58**	[kips]	
	ratio = **0.29**			> 0.5 P_{uf_t}	OK	

Beam Flange Weld Strength				ratio = 73.21 / 120.47	= **0.61**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$			= **73.21**	[kips]	
Fillet weld length - double fillet	$L = [b_{fb} + (b_{fb} - 2k_{1b})] / 2$ as dbl fillet			= 5.770	[in]	
Fillet Weld Strength Check						
Fillet weld leg size	w = $^5/_{16}$	[in]	load angle θ = 90.0		[°]	
Electrode strength	F_{EXX} = 70.0	[ksi]	strength coeff C_1 = 1.00			AISC 14th Table 8-3
Number of weld line	n = 2 for double fillet					
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$			= 1.50		AISC 14th Page 8-9
Fillet weld shear strength	R_{n-w} = 0.6 (C_1 x 70 ksi) 0.707 w n C_2			= 27.838	[kip/in]	AISC 14th Eq 8-1
Base metal - beam flange	thickness t = 0.440	[in]	tensile F_u = 65.0		[ksi]	
Base metal - beam flange is in tension, tensile rupture as per AISC 14th Eq J4-2 is checked						AISC 14th J2.4
Base metal tensile rupture	$R_{n-b} = F_u t$			= 28.600	[kip/in]	AISC 14th Eq J4-2
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$			= **27.838**	[kip/in]	AISC 14th Eq 9-2
Resistance factor-LRFD	ϕ_v = 0.75					AISC 14th Eq 8-1
	$\phi^n_{v\,R}$ =			= **20.879**	[kip/in]	
Shear resistance required	P_{uf_t} =			= **73.21**	[kips]	
Fillet weld length - double fillet	L =			= 5.770	[in]	
Shear resistance provided	$\phi^n_{v\,F} = \phi_v R_n$ x L			= **120.47**	[kips]	
	ratio = **0.61**			> P_{uf_t}	OK	

Left Beam | Splice MC Connection | Code=AISC 360-10 LRFD

Result Summary	geometries & weld limitations = **PASS**	limit states max ratio = **0.61**	**PASS**

Geometry Restriction Checks					**PASS**
Min Bolt Spacing - End Plate					
Bolt diameter	d_b =	= 0.750	[in]		
Min bolt spacing allowed	$L_{s\text{-}min} = 2.667\ d_b$	= **2.000**	[in]	AISC 14th J3.3	
Min Bolt spacing in End Plate	L_s =	= **3.690**	[in]		
		> $L_{s\text{-}min}$	OK		
Min Bolt Edge Distance - End Plate					
Bolt diameter	d_b =	= 0.750	[in]		
Min edge distance allowed	$L_{e\text{-}min}$ =	= **1.000**	[in]	AISC 14th Table J3.4	
Min edge distance in End Plate	L_e =	= **1.375**	[in]		
		> $L_{e\text{-}min}$	OK		
Max Bolt Edge Distance - End Plate					
Connecting plate thickness	t_p =	= 0.750	[in]		
Max edge distance allowed	$L_{e\text{-}max}$ = min (12t , 6")	= **6.000**	[in]	AISC 14th J3.5	
Max edge distance in End Plate	L_e =	= **2.260**	[in]		
		< $L_{e\text{-}max}$	OK		

Beam Flange Fillet Weld Limitation					**PASS**
Min Fillet Weld Size					
Thinner part joined thickness	t =	= 0.440	[in]		
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4	
Fillet weld size provided	w =	= **0.313**	[in]		
		> w_{min}	OK		
Min Fillet Weld Length					
Fillet weld size provided	w =	= 0.313	[in]		
Min fillet weld length allowed	$L_{min} = 4 \times w$	= **1.250**	[in]	AISC 14th J2.2b	
Min fillet weld length	$L = 0.5\ b_{fb} - k_{1b}$	= **2.510**	[in]		
		> L_{min}	OK		

Beam Web Fillet Weld Limitation				**PASS**
Min Fillet Weld Size				
Thinner part joined thickness	t =	= 0.260	[in]	
Min fillet weld size allowed	w_{min} =	= **0.188**	[in]	AISC 14th Table J2.4
Fillet weld size provided	w =	= **0.313**	[in]	
		> w_{min}	OK	
Min Fillet Weld Length				
Fillet weld size provided	w =	= 0.313	[in]	
Min fillet weld length allowed	L_{min} = 4 x w	= **1.250**	[in]	AISC 14th J2.2b
Min fillet weld length	L = 0.5 d_b - k_b	= **5.025**	[in]	
		> L_{min}	OK	

Verify AISC DG4 Bolt No Prying Assumption						**AISC DG4 Is Used**
Bolt Moment Strength (No Prying)						
	bolt grade = A325-N			F_t = 90.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]		bolt area A_b = 0.442	[in^2]	
Bolt norminal tensile strength	$P_t = F_t A_b$			= 39.76	[kips]	AISC 14th Eq J3-1
Tension bolt moment arm	h_0 = 13.705	[in]		h_1 = 10.015	[in]	
Bolt moment strength (no prying)	$M_{np} = 2 P_t (h_0 + h_1)$			= 157.19	[kip-ft]	AISC DG4 Eq 3.7
Bolt resistance factor-LRFD	ϕ_v^v = 0.75					AISC 14th Eq J3-1
	ϕ_v =			= **117.89**	[kip-ft]	
End Plate Bending Strength						
End plate width	b_{plate} = 8.520	[in]		thickness t_p = 0.750	[in]	
Beam flange width	b_{fb} = 6.520	[in]				
Effective end plate width	$b_p = \min (b_{plate}, b_{fb} + 1")$			= 7.520	[in]	AISC DG4 Page 9 item 5
End plate yield strength	F_{yp} = 50.0	[ksi]				
See AISC DG4 Table 3.1 for all formulas to derive the following parameters						AISC DG4 Table 3.1
Tension bolt moment arm	h_0 = 13.705	[in]		h_1 = 10.015	[in]	
	g = 4.000	[in]				
	p_{fi} = 1.625	[in]		p_{fo} = 1.625	[in]	
	s = 2.742	[in]		Y_p = 88.61	[in]	
Flexure resistance factor-LRFD	ϕ_v = 0.90					AISC 14th F1 (1)
End plate bending strength	$\phi_v M_{pl} = \phi_v F_{yp} t_p^2 Y_p$			= **186.90**	[kip-ft]	AISC DG4 Table 3.1
Check thick end plate condition	$\phi_v M_{pl}$ >= 1.11 X $\phi_v^v M_{np}$					AISC DG4 Eq 3.33
	ratio = **0.70** thick plate					
The thick end plate conditions are met. AISG DG4 is used and no bolt prying is considered						AISC DG4 Eq 3.33 & 3.35

Bolt Moment Strength (No Prying)			ratio = 73.21 / 119.28	= **0.61**	**PASS**
	bolt grade = A325-N		F_t = 90.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Bolt norminal tensile strength	$P_t = F_t A_b$		= 39.76	[kips]	AISC 14th Eq J3-1
Tension bolt moment arm	h_0 = 13.705	[in]	h_1 = 10.015	[in]	
Flange force moment arm	$d_m = d_b - t_{fb}$		= 11.860	[in]	
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$		= **73.21**	[kips]	
Flange force resistance by bolt	$F_n = 2 P_t (h_0 + h_1) / d_m$		= 159.04	[kips]	AISC DG4 Eq 3.7
Bolt resistance factor-LRFD	ϕ_v^v = 0.75				AISC 14th Eq J3-1
	ϕ_v =		= **119.28**	[kips]	AISC DG4 Eq 3.7
	ratio = **0.61**		> P_{uf_t}	OK	

Bolt Shear Strength			ratio = 30.00 / 71.57	= **0.42**	**PASS**
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Number of bolt carried shear	n_s = 4.0		shear plane m = 1		
Required shear strength	V_u =		= **30.00**	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$		= 95.43	[kips]	AISC 14th Eq J3-1
Bolt resistance factor-LRFD	ϕ_v^v = 0.75				AISC 14th Eq J3-1
	ϕ_v =		= **71.57**	[kips]	
	ratio = **0.42**		> V_u	OK	

Bolt Bearing / TearOut Strength on End Plate			ratio = 30.00 / 71.57	= **0.42**	**PASS**
Single Bolt Shear Strength					
Bolt shear stress	bolt grade = A325-N		F_{nv} = 54.0	[ksi]	AISC 14th Table J3.2
	bolt dia d_b = 0.750	[in]	bolt area A_b = 0.442	[in^2]	
Single bolt shear strength	$R_{n\text{-}bolt} = F_{nv} A_b$		= 23.86	[kips]	AISC 14th Eq J3-1
Bolt Bearing / TearOut Strength on Plate					
Bolt hole diameter	bolt dia d_b = 3/4	[in]	bolt hole dia d_h = 13/16	[in]	AISC 14th Table J3.3
Bolt spacing & edge distance	spacing L_s = 3.690	[in]	edge distance L_e = 1.375	[in]	
Plate tensile strength	F_u = 65.0	[ksi]			
Plate thickness	t = 0.750	[in]			
Interior Bolt					
Bolt hole edge clear distance	$L_c = L_s - d_h$		= 2.878	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}in} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 210.42 ≤ 109.69		= 109.69	[kips]	
Bolt strength at interior	$R_{n\text{-}in} = \min(R_{n\text{-}t\&b\text{-}in}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Edge Bolt					
Bolt hole edge clear distance	$L_c = L_e - d_h / 2$		= 0.969	[in]	
Bolt tear out/bearing strength	$R_{n\text{-}t\&b\text{-}ed} = 1.5\, L_c\, t\, F_u \le 3.0\, d_b\, t\, F_u$				AISC 14th Eq J3-6b
	= 70.84 ≤ 109.69		= 70.84	[kips]	
Bolt strength at edge	$R_{n\text{-}ed} = \min(R_{n\text{-}t\&b\text{-}ed}, R_{n\text{-}bolt})$		= 23.86	[kips]	
Number of bolt	interior n_{in} = 2		edge n_{ed} = 2		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n\text{-}in} + n_{ed} R_{n\text{-}ed}$		= 95.43	[kips]	
Required shear strength	V_u =		= **30.00**	[kips]	
Bolt resistance factor-LRFD	ϕ_v^v = 0.75				AISC 14th J3-10
	ϕ_v =		= **71.57**	[kips]	
	ratio = **0.42**		> V_u	OK	

End Plate Flexural Yielding			ratio = 73.21 / 189.11	= **0.39**	**PASS**
End Plate Bending Strength					
End plate width	b_{plate} = 8.520	[in]	thickness t_p = 0.750	[in]	
Beam flange width	b_{fb} = 6.520	[in]			
Effective end plate width	b_p = min (b_{plate} , b_{fb} + 1")		= 7.520	[in]	AISC DG4 Page 9 item 5
End plate yield strength	F_{yp} = 50.0	[ksi]			
See AISC DG4 Table 3.1 for all formulas to derive the following parameters					AISC DG4 Table 3.1
Tension bolt moment arm	h_0 = 13.705	[in]	h_1 = 10.015	[in]	
	g = 4.000	[in]			
	p_{fi} = 1.625	[in]	p_{fo} = 1.625	[in]	
	s = 2.742	[in]	Y_p = 88.61	[in]	
Flexure resistance factor-LRFD	ϕ_v = 0.90				AISC 14th F1 (1)
End plate bending strength	$\phi_v M_{pl} = \phi_v F_{yp} t_p^2 Y_p$		= **186.90**	[kip-ft]	AISC DG4 Table 3.1
Flange force moment arm	$d_m = d_b - t_{fb}$		= 11.860	[in]	
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$		= **73.21**	[kips]	
Flange force provided by end plate bending	$\phi_v = \phi_v^v M_{pl} / d_m$		= **189.11**	[kips]	AISC DG4 Eq 3.10
	ratio = **0.39**		> P_{uf_t}	OK	

End Plate Shear Yielding			ratio = 36.61 / 169.20	= **0.22**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$		= **36.61**	[kips]	
End plate width	b_{plate} = 8.520	[in]	thickness t_p = 0.750	[in]	
Beam flange width	b_{fb} = 6.520	[in]			
Effective end plate width	b_p = min (b_{plate} , b_{fb} + 1")		= 7.520	[in]	AISC DG4 Page 9 item 5
Plate Shear Yielding Check					
Plate size	width b_p = 7.520	[in]	thickness t_p = 0.750	[in]	
Plate yield strength	F_y = 50.0	[ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$		= 5.640	[in^2]	
Shear force required	0.5 P_{uf_t} =		= **36.61**	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$		= 169.20	[kips]	AISC 14th Eq J4-3
Resistance factor-LRFD	ϕ_v^v = 1.00				AISC 14th Eq J4-3
	ϕ_v =		= **169.20**	[kips]	
	ratio = **0.22**		> 0.5 P_{uf_t}	OK	

End Plate Shear Rupture				ratio = 36.61 / 126.58	= **0.29**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$			= **36.61**	[kips]	
End plate width	b_{plate} = 8.520	[in]	thickness t_p = 0.750		[in]	
Beam flange width	b_{fb} = 6.520	[in]				
Effective end plate width	$b_p = \min (b_{plate}, b_{fb} + 1")$			= 7.520	[in]	AISC DG4 Page 9 item 5
Plate Shear Rupture Check						
Bolt hole diameter	bolt dia d_b = $^3/_4$	[in]	bolt hole dia d_h = $^7/_8$		[in]	AISC 14th B4.3b
Number of bolt	n = 2					
Plate size	width b_p = 7.520	[in]	thickness t_p = 0.750		[in]	
Plate tensile strength	F_u = 65.0	[ksi]				
Plate net area in shear	$A_{nv} = (b_p - n\, d_h)\, t_p$			= 4.328	[in^2]	
Shear force required	0.5 P_{uf_t} =			= **36.61**	[kips]	
Plate shear rupture strength	$R_n = 0.6\, F_u\, A_{nv}$			= 168.77	[kips]	AISC 14th Eq J4-4
Resistance factor-LRFD	ϕ_v^v = 0.75					AISC 14th Eq J4-4
	ϕ_v =			= **126.58**	[kips]	
	ratio = **0.29**			> 0.5 P_{uf_t}	OK	

Beam Flange Weld Strength				ratio = 73.21 / 120.47	= **0.61**	**PASS**
Flange force required in tension	$P_{uf\_t} = P_u / 2 - M_u / d_m$			= **73.21**	[kips]	
Fillet weld length - double fillet	$L = [b_{fb} + (b_{fb} - 2k_{1b})] / 2$ as dbl fillet			= 5.770	[in]	
Fillet Weld Strength Check						
Fillet weld leg size	w = $^5/_{16}$	[in]	load angle θ = 90.0		[°]	
Electrode strength	F_{EXX} = 70.0	[ksi]	strength coeff C_1 = 1.00			AISC 14th Table 8-3
Number of weld line	n = 2 for double fillet					
Load angle coefficient	$C_2 = (1 + 0.5 \sin^{1.5} \theta)$			= 1.50		AISC 14th Page 8-9
Fillet weld shear strength	R_{n-w} = 0.6 (C_1 x 70 ksi) 0.707 w n C_2			= 27.838	[kip/in]	AISC 14th Eq 8-1
Base metal - beam flange	thickness t = 0.440	[in]	tensile F_u = 65.0		[ksi]	
Base metal - beam flange is in tension, tensile rupture as per AISC 14th Eq J4-2 is checked						AISC 14th J2.4
Base metal tensile rupture	$R_{n-b} = F_u t$			= 28.600	[kip/in]	AISC 14th Eq J4-2
Double fillet linear shear strength	$R_n = \min (R_{n-w}, R_{n-b})$			= **27.838**	[kip/in]	AISC 14th Eq 9-2
Resistance factor-LRFD	ϕ_v^v = 0.75					AISC 14th Eq 8-1
	ϕ_v =			= **20.879**	[kip/in]	
Shear resistance required	P_{uf_t} =			= **73.21**	[kips]	
Fillet weld length - double fillet	L =			= 5.770	[in]	
Shear resistance provided	$\phi_v = \phi_v^v R_n$ x L			= **120.47**	[kips]	
	ratio = **0.61**			> P_{uf_t}	OK	