

Result Summary - Overall

Moment Connection - Beam Splice

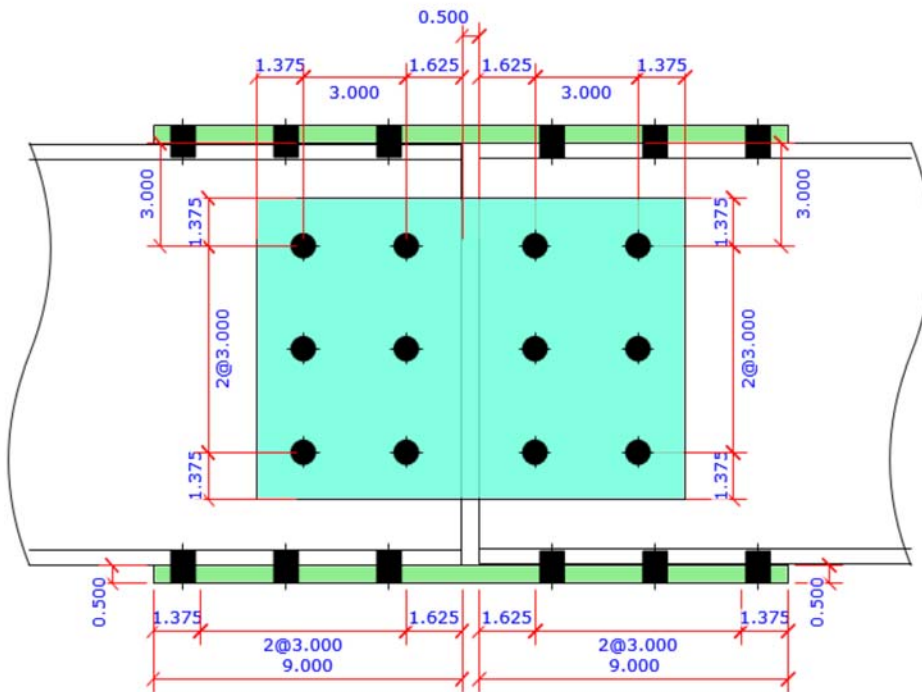
Code=AISC 360-10 LRFD

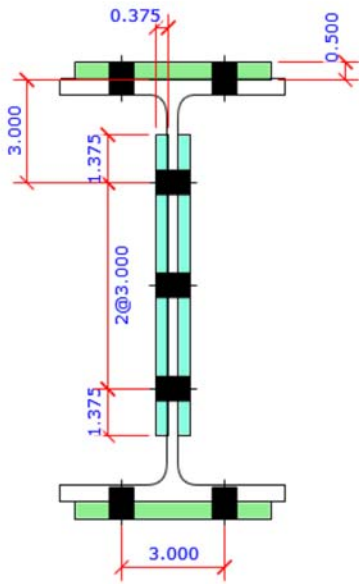
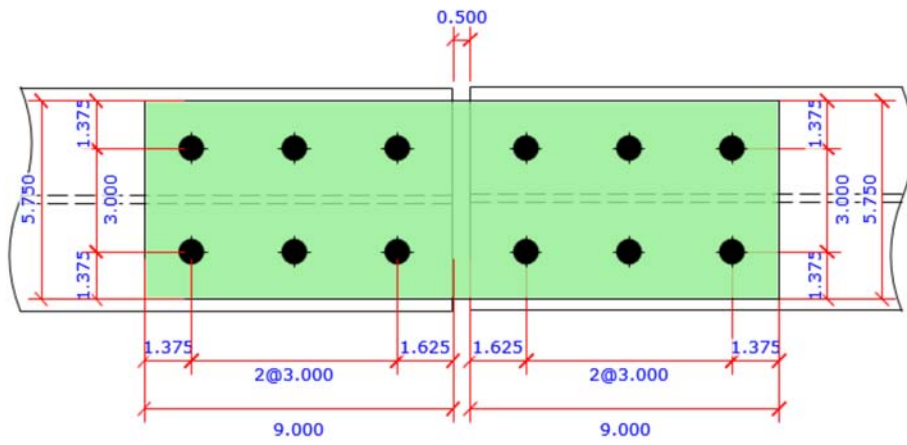
Result Summary - Overall	geometries & weld limitations = PASS	limit states max ratio = 0.85	PASS
Right Beam	geometries & weld limitations = PASS	limit states max ratio = 0.85	PASS
Left Beam	geometries & weld limitations = PASS	limit states max ratio = 0.85	PASS

Sketch

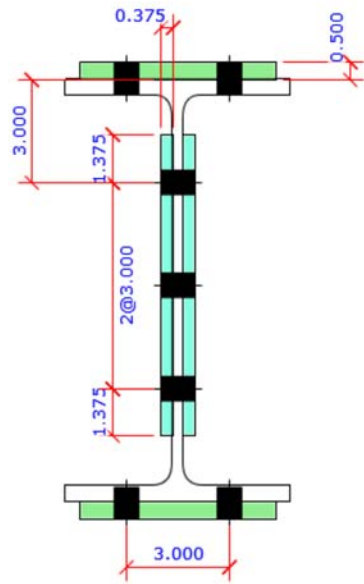
Moment Connection - Beam Splice

Code=AISC 360-10 LRFD

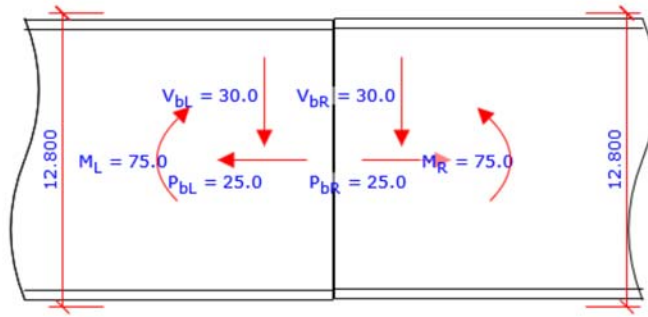




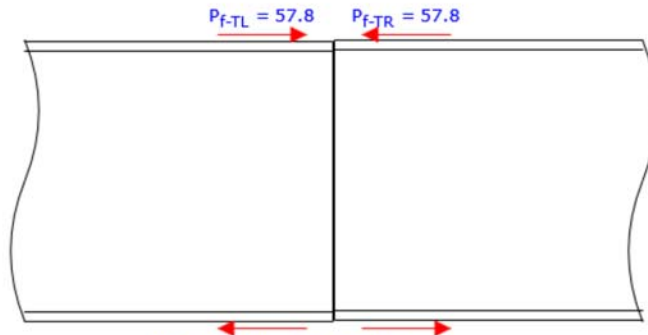
Left Side Beam



Right Side Beam



Design Load



Beam Flange Force & Panel Zone Shear V_p

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	$d_m = d_b - t_{fb}$	$= 12.800$ [in]
User input load	axial $P_{bR} = -25.00$ [kips]	moment $M_R = 75.00$ [kip-ft]
	in tension	
Beam flange force - top	$P_{f-TR} = P_{bR} / 2 + M_R / d_m$	$= 57.81$ [kips]
Beam flange force - bottom	$P_{f-BR} = P_{bR} / 2 - M_R / d_m$	$= -82.81$ [kips]

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

Result Summary geometries & weld limitations = **PASS** limit states max ratio = **0.85** **PASS**

Geometry Restriction Checks - Flange Plate				PASS
Min Bolt Edge Distance - Flange Plate				
Bolt diameter	$d_b =$	$= 0.750$	[in]	
Min edge distance allowed	$L_{e-min} =$	$= 1.000$	[in]	AISC 14 th Table J3.4
Min edge distance in Flange Plate	$L_e =$	$= 1.375$	[in]	
		$> L_{e-min}$		OK
Min Bolt Spacing - Flange Plate				
Bolt diameter	$d_b =$	$= 0.750$	[in]	
Min bolt spacing allowed	$L_{s-min} = 2.667 d_b$	$= 2.000$	[in]	AISC 14 th J3.3
Min Bolt spacing in Flange Plate	$L_s =$	$= 3.000$	[in]	
		$> L_{s-min}$		OK

Geometry Restriction Checks - Web Plate				PASS
Min Bolt Edge Distance - Web Plate				
Bolt diameter	$d_b =$	$= 0.750$	[in]	
Min edge distance allowed	$L_{e-min} =$	$= 1.000$	[in]	AISC 14 th Table J3.4
Min edge distance in Web Plate	$L_e =$	$= 1.375$	[in]	
		$> L_{e-min}$		OK
Min Bolt Spacing - Web Plate				
Bolt diameter	$d_b =$	$= 0.750$	[in]	
Min bolt spacing allowed	$L_{s-min} = 2.667 d_b$	$= 2.000$	[in]	AISC 14 th J3.3
Min Bolt spacing in Web Plate	$L_s =$	$= 3.000$	[in]	
		$> L_{s-min}$		OK

Flange Plate - Bolt Shear				ratio = 85.67 / 107.35 = 0.80	PASS
Flange force moment arm	$d_m = d_b$	$= 12.300$	[in]		
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	$= 85.67$	[kips]		
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2	
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$	[in ²]		
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 1$			
Required shear strength	$V_u =$	$= 85.67$	[kips]		
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	$= 143.14$	[kips]	AISC 14 th Eq J3-1	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1	
	$\phi R_n =$	$= 107.35$	[kips]		
	ratio = 0.80	$> V_u$			OK

Flange Plate - Bolt Bearing		ratio = 82.81 / 107.35	= 0.77	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$	[in]	bolt area $A_b = 0.442$	[in ²]
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86	[kips]	AISC 14 th 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]
Bolt spacing & edge distance	spacing $L_s = 3.000$	[in]	edge distance $L_e = 1.375$	[in]
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate thickness	$t = 0.500$	[in]		
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 73.13	[kips]	AISC 14 th Eq J3-6b
	= 106.64 \leq 73.13			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in} , R_{n-bolt})$	= 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	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 47.23	[kips]	AISC 14 th Eq J3-6b
	= 47.23 \leq 73.13			
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed} , R_{n-bolt})$	= 23.86	[kips]	
Number of bolt	interior $n_{in} = 4$	edge $n_{ed} = 2$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14	[kips]	
Required shear strength	$V_u =$	= 82.81	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.77	> V_u	OK	

Flange Plate - Block Shear - 2 Side Strips		ratio = 82.81 / 197.44	= 0.42	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Block Shear - 2 Side Strips				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]	[in]	AISC 14 th B4.3b
Plate thickness	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]	[ksi]	
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]	[in]	
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]	[in]	
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 7.375	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 5.188	[in ²]	
Net area subject to tension				
when sheared out by 2 side strips	$A_{nt} = (e_v - 0.5 d_h) t_p \times 2$	= 0.938	[in ²]	
Block shear strength required	$V_u =$	= 82.81	[kips]	
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 263.25	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 197.44	[kips]	
	ratio = 0.42	> V_u	OK	

Flange Plate - Block Shear - Center Strip		ratio = 82.81 / 177.63	= 0.47	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Block Shear - Center Strip				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]	[in]	AISC 14 th B4.3b
Plate thickness	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]	[ksi]	
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]	[in]	
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]	[in]	
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 7.375	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 5.188	[in ²]	
Net area subject to tension				
when sheared out by center strip	$A_{nt} = (n_v - 1) (s_v - d_h) t_p$	= 1.063	[in ²]	
Block shear strength required	$V_u =$	= 82.81	[kips]	
Uniform tension stress factor	$U_{bs} = 0.50$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 236.84	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 177.63	[kips]	
	ratio = 0.47	> V_u	OK	

Flange Plate - Tensile Yielding		ratio = 82.81 / 129.38	= 0.64	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Tensile Yielding Check				
Plate size	width $b_p = 5.750$	[in]	thickness $t_p = 0.500$	[in]
Plate yield strength	$F_y = 50.0$	[ksi]		
Plate gross area in shear	$A_g = b_p t_p$	= 2.875	[in ²]	
Tensile force required	$P_u =$	= 82.81	[kips]	
Plate tensile yielding strength	$R_n = F_y A_g$	= 143.75	[kips]	AISC 14 th Eq J4-1
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th Eq J4-1
	$\phi R_n =$	= 129.38	[kips]	
	ratio = 0.64	> P_u	OK	
Flange Plate - Tensile Rupture		ratio = 82.81 / 97.50	= 0.85	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Tensile Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$	[in]	bolt hole dia $d_h = 7/8$	[in] AISC 14 th B4.3b
Number of bolt	$n = 2$			
Plate size	width $b_p = 5.750$	[in]	thickness $t_p = 0.500$	[in]
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate net area in tension	$A_{nt} = (b_p - n d_h) t_p$	= 2.000	[in ²]	
Tensile force required	$P_u =$	= 82.81	[kips]	
Plate tensile rupture strength	$R_n = F_u A_{nt}$	= 130.00	[kips]	AISC 14 th Eq J4-2
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-2
	$\phi R_n =$	= 97.50	[kips]	AISC 14 th Eq J4-2
	ratio = 0.85	> P_u	OK	

Flange Plate - Compression		ratio = 57.81 / 129.38	= 0.45	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - compression	$P_u = P_b / 2 + M / d_m$	= 57.81	[kips]	
Plate Compression Check				
Plate size	width $b_p = 5.750$ [in]	thickness $t_p = 0.500$	[in]	
	$F_y = 50.0$ [ksi]	$E = 29000$	[ksi]	
Plate gross area in compression	$A_g = b_p t_p$	= 2.875	[in ²]	
Plate radius of gyration	$r = t_p / \sqrt{12}$	= 0.144	[in]	
Plate effective length factor	$K =$	= 0.65		
Plate unbraced length	$L_u =$	= 3.750	[in]	
Plate slenderness	$KL/r = 0.65 \times L_u / r$	= 16.89		
Plate compression required	$P_u =$	= 57.81	[kips]	
	when $\frac{KL}{r} \leq 25$			AISC 14 th J4.4 (a)
Plate compression provided	$R_n = F_y \times A_g$	= 143.75	[kips]	AISC 14 th Eq J4-6
Bolt resistance factor-LRFD	$\phi = 0.90$			AISC 14 th J4.4 (a)
	$\phi R_n =$	= 129.38	[kips]	
	ratio = 0.45	> P_u	OK	

Web Plate - Bolt Bearing		ratio = 15.00 / 107.35	= 0.14	PASS
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$ [ksi]		AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$ [in ²]		
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86 [kips]		AISC 14 th 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 14 th Table J3.3
Bolt spacing & edge distance	spacing $L_s = 3.000$ [in]	edge distance $L_e = 1.375$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate thickness	$t = 0.375$ [in]			
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188 [in]		
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 54.84 [kips]		AISC 14 th Eq J3-6b
	= 79.98 ≤ 54.84			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in}, R_{n-bolt})$	= 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	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 35.42 [kips]		AISC 14 th Eq J3-6b
	= 35.42 ≤ 54.84			
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed}, R_{n-bolt})$	= 23.86 [kips]		
Number of bolt	interior $n_{in} = 4$	edge $n_{ed} = 2$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14 [kips]		
Required shear strength	$V_u =$	= 15.00 [kips]		
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35 [kips]		
	ratio = 0.14	> V_u	OK	

Web Plate - Shear Yielding		ratio = 15.00 / 98.44	= 0.15	PASS
Plate Shear Yielding Check				
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.375$ [in]		
Plate yield strength	$F_y = 50.0$ [ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$	= 3.281 [in ²]		
Shear force required	$V_u =$	= 15.00 [kips]		
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 98.44 [kips]		AISC 14 th Eq J4-3
Resistance factor-LRFD	$\phi = 1.00$			AISC 14 th Eq J4-3
	$\phi R_n =$	= 98.44 [kips]		
	ratio = 0.15	> V_u	OK	

Web Plate - Shear Rupture		ratio = 15.00 / 67.18	= 0.22	PASS
Plate Shear Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 3$			
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.375$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$	$= 2.297$ [in ²]		
Shear force required	$V_u =$	$= 15.00$ [kips]		
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	$= 89.58$ [kips]		AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$	$= 67.18$ [kips]		
	ratio = 0.22	$> V_u$	OK	
Web Plate - Block Shear - 1-Side Strip				
		ratio = 15.00 / 84.89	= 0.18	PASS
Plate Block Shear - Side Strip				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Plate thickness	$t_p = 0.375$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	$= 2.766$ [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	$= 1.945$ [in ²]		
Net area subject to tension when sheared out by side strip	$A_{nt} = [(n_v - 1) s_v + e_v - ((n_v - 1) + 0.5) d_h] t_p$	$= 1.148$ [in ²]		
Block shear strength required	$V_u =$	$= 15.00$ [kips]		
Uniform tension stress factor	$U_{bs} = 0.50$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6 F_u A_{nv}, 0.6 F_y A_{gv}) + U_{bs} F_u A_{nt}$	$= 113.19$ [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	$= 84.89$ [kips]		
	ratio = 0.18	$> V_u$	OK	

Beam Flange - Bolt Shear		ratio = 85.67 / 107.35	= 0.80	PASS
Flange force moment arm	$d_m = d_b$	= 12.300	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 85.67	[kips]	
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Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$	[in ²]	
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 1$		
Required shear strength	$V_u =$	= 85.67	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	= 143.14	[kips]	AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.80	> V_u	OK	
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Beam Flange - Bolt Bearing		ratio = 88.39 / 107.35	= 0.82	PASS
Flange force moment arm	$d_m = d_b - t_{fb}$	= 11.860	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 88.39	[kips]	
<hr/>				
Single Bolt Shear Strength				
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Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$	[in ²]	
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86	[kips]	AISC 14 th Eq J3-1
Bolt Bearing/TearOut Strength on Plate				
<hr/>				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 13/16$	[in]	AISC 14 th Table J3.3
Bolt spacing & edge distance	spacing $L_s = 3.000$ [in]	edge distance $L_e = 1.625$	[in]	
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate thickness	$t = 0.440$	[in]		
Interior Bolt				
<hr/>				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 93.84 ≤ 64.35	= 64.35	[kips]	
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in} , R_{n-bolt})$	= 23.86	[kips]	
Edge Bolt				
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Bolt hole edge clear distance	$L_c = L_e - d_h / 2$	= 1.219	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 52.28 ≤ 64.35	= 52.28	[kips]	
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed} , R_{n-bolt})$	= 23.86	[kips]	
<hr/>				
Number of bolt	interior $n_{in} = 4$	edge $n_{ed} = 2$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14	[kips]	
Required shear strength	$V_u =$	= 88.39	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.82	> V_u	OK	

Beam Flange - Block Shear - 2 Side Strips		ratio = 88.39 / 196.70	= 0.45	PASS
Flange force moment arm	$d_m = d_b - t_{fb}$	= 11.860	[in]	
Beam flange force - tension	$V_u = P_b / 2 + M / d_m$	= 88.39	[kips]	
<hr/>				
Plate Block Shear - 2 Side Strips				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Plate thickness	$t_p = 0.440$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 1.760$ [in]	$e_h = 1.625$ [in]		
<hr/>				
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 6.710	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 4.785	[in ²]	
Net area subject to tension				
when sheared out by 2 side strips	$A_{nt} = (e_v - 0.5 d_h) t_p \times 2$	= 1.164	[in ²]	
<hr/>				
Block shear strength required	$V_u =$	= 88.39	[kips]	
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 262.26	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 196.70	[kips]	
	ratio = 0.45	> V_u	OK	

Beam Web - Bolt Shear		ratio = 30.00 / 214.71	= 0.14	PASS
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$ [ksi]		AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$ [in ²]		
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 2$		
Required shear strength	$V_u =$	= 30.00	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	= 286.28	[kips]	AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1
	$\phi R_n =$	= 214.71	[kips]	
	ratio = 0.14	> V_u	OK	

Beam Web - Bolt Bearing		ratio = 30.00 / 171.11	= 0.18	PASS
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$	$A_b = 0.442$	[in] [in ²]	
Single bolt shear strength	$R_{n-bolt} = 2 \times F_{nv} A_b$	= 47.71	[kips]	AISC 14 th Eq J3-1
Bolt Bearing/TearOut Strength on Plate				
Bolt hole diameter	bolt dia $d_b = 3/4$	$d_h = 13/16$	[in] [in]	AISC 14 th Table J3.3
Bolt spacing	spacing $L_s = 3.000$		[in]	
Plate tensile strength	$F_u = 65.0$		[ksi]	
Plate thickness	$t = 0.260$		[in]	
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t m F_u$	= 38.03	[kips]	AISC 14 th Eq J3-6b
	= 55.45 ≤ 38.03			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in}, R_{n-bolt})$	= 38.03	[kips]	
Number of bolt	interior $n_{in} = 6$			
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in}$	= 228.15	[kips]	
Required shear strength	$V_u =$	= 30.00	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 171.11	[kips]	
	ratio = 0.18	> V_u	OK	
Beam Web - Shear Yielding				
		ratio = 30.00 / 95.94	= 0.31	PASS
Plate Shear Yielding Check				
Plate size	width $b_p = 12.300$	thickness $t_p = 0.260$	[in] [in]	
Plate yield strength	$F_y = 50.0$		[ksi]	
Plate gross area in shear	$A_{gv} = b_p t_p$	= 3.198	[in ²]	
Shear force required	$V_u =$	= 30.00	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 95.94	[kips]	AISC 14 th Eq J4-3
Resistance factor-LRFD	$\phi = 1.00$			AISC 14 th Eq J4-3
	$\phi R_n =$	= 95.94	[kips]	
	ratio = 0.31	> V_u	OK	

Beam Web - Shear Rupture		ratio = 30.00 / 73.58	= 0.41	PASS
Plate Shear Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 3$			
Plate size	width $b_p = 12.300$ [in]	thickness $t_p = 0.260$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$	= 2.516 [in ²]		
Shear force required	$V_u =$	= 30.00 [kips]		
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	= 98.10 [kips]		AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$	= 73.58 [kips]		
	ratio = 0.41	> V_u	OK	

Beam Flange With Holes - Beam Flexural Rupture		ratio = 75.00 / 137.67	= 0.54	PASS
Beam sect W12X30	$b_f = 6.520$ [in]	$t_f = 0.440$ [in]		
	$S_x = 38.600$ [in ³]			
	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Gross area of tension flange	$A_{fg} = b_f t_f$	= 2.869 [in ²]		
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 2$			
Net area of tension flange	$A_{fn} = (b_f - n d_h) t_f$	= 2.099 [in ²]		
Moment in demand	$M_u =$	= 75.00 [kips]		
Beam flexural rupture strength	$M_n = \frac{F_u A_{fn}}{A_{fg}} S_x$	= 152.96 [kip-ft]		AISC 14 th Eq F13-1
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th F1
	$\phi M_n =$	= 137.67 [kips]		
	ratio = 0.54	> M_u	OK	

Beam Section Tensile Rupture		ratio = 25.00 / 320.17 = 0.08		PASS
Beam sect W12X30	$t_f = 0.440$ [in] $A_g = 8.790$ [in ²]	$t_w = 0.260$ [in] $F_u = 65.0$ [ksi]		
Beam flange bolt	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n_{flg} = 2$			
Beam web bolt	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n_{web} = 3$			
Net area of beam sect	$A_n = A_g - n_{flg} d_h t_f \times 2 - n_{web} d_h t_w$	$= 6.568$ [in ²]		
Shear lag factor	$U =$ from Table D3.1 case 1	$= 1.00$		AISC 14 th Table D3.1
Tensile force required	$P_u =$	$= 25.00$ [kips]		
Tensile effective net area	$A_e = A_n U$	$= 6.568$ [in ²]		
Plate tensile strength	$F_u =$	$= 65.0$ [ksi]		
Tensile rupture strength	$R_n = F_u A_e$	$= 426.89$ [kips]		AISC 14 th Eq D2-2
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th D2 (b)
	$\phi R_n =$	$= 320.17$ [kips]		AISC 14 th Eq D2-2
	ratio = 0.08	$> P_u$	OK	

Left Beam

Splice MC Connection

Code=AISC 360-10 LRFD

Result Summarygeometries & weld limitations = **PASS**limit states max ratio = **0.85** **PASS****Geometry Restriction Checks - Flange Plate****PASS****Min Bolt Edge Distance - Flange Plate**

Bolt diameter	$d_b =$	= 0.750 [in]	
Min edge distance allowed	$L_{e-min} =$	= 1.000 [in]	AISC 14 th Table J3.4
Min edge distance in Flange Plate	$L_e =$	= 1.375 [in]	
		> L_{e-min}	OK

Min Bolt Spacing - Flange Plate

Bolt diameter	$d_b =$	= 0.750 [in]	
Min bolt spacing allowed	$L_{s-min} = 2.667 d_b$	= 2.000 [in]	AISC 14 th J3.3
Min Bolt spacing in Flange Plate	$L_s =$	= 3.000 [in]	
		> L_{s-min}	OK

Geometry Restriction Checks - Web Plate**PASS****Min Bolt Edge Distance - Web Plate**

Bolt diameter	$d_b =$	= 0.750 [in]	
Min edge distance allowed	$L_{e-min} =$	= 1.000 [in]	AISC 14 th Table J3.4
Min edge distance in Web Plate	$L_e =$	= 1.375 [in]	
		> L_{e-min}	OK

Min Bolt Spacing - Web Plate

Bolt diameter	$d_b =$	= 0.750 [in]	
Min bolt spacing allowed	$L_{s-min} = 2.667 d_b$	= 2.000 [in]	AISC 14 th J3.3
Min Bolt spacing in Web Plate	$L_s =$	= 3.000 [in]	
		> L_{s-min}	OK

Flange Plate - Bolt Shearratio = 85.67 / 107.35 = **0.80** **PASS**

Flange force moment arm	$d_m = d_b$	= 12.300 [in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 85.67 [kips]	
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$ [ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$ [in ²]	
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 1$	
Required shear strength	$V_u =$	= 85.67 [kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	= 143.14 [kips]	AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$		AISC 14 th Eq J3-1
	$\phi R_n =$	= 107.35 [kips]	
	ratio = 0.80	> V_u	OK

Flange Plate - Bolt Bearing		ratio = 82.81 / 107.35	= 0.77	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$	[in]	bolt area $A_b = 0.442$	[in ²]
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86	[kips]	AISC 14 th 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]
Bolt spacing & edge distance	spacing $L_s = 3.000$	[in]	edge distance $L_e = 1.375$	[in]
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate thickness	$t = 0.500$	[in]		
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 106.64 ≤ 73.13	= 73.13	[kips]	
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in} , R_{n-bolt})$	= 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	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 47.23 ≤ 73.13	= 47.23	[kips]	
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed} , R_{n-bolt})$	= 23.86	[kips]	
Number of bolt	interior $n_{in} = 4$		edge $n_{ed} = 2$	
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14	[kips]	
Required shear strength	$V_u =$	= 82.81	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.77	> V_u	OK	

Flange Plate - Block Shear - 2 Side Strips		ratio = 82.81 / 197.44	= 0.42	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Block Shear - 2 Side Strips				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]	[in]	AISC 14 th B4.3b
Plate thickness	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]	[ksi]	
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]	[in]	
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]	[in]	
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 7.375	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 5.188	[in ²]	
Net area subject to tension				
when sheared out by 2 side strips	$A_{nt} = (e_v - 0.5 d_h) t_p \times 2$	= 0.938	[in ²]	
Block shear strength required	$V_u =$	= 82.81	[kips]	
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 263.25	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 197.44	[kips]	
	ratio = 0.42	> V_u	OK	

Flange Plate - Block Shear - Center Strip		ratio = 82.81 / 177.63	= 0.47	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Block Shear - Center Strip				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]	[in]	AISC 14 th B4.3b
Plate thickness	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]	[ksi]	
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]	[in]	
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]	[in]	
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 7.375	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 5.188	[in ²]	
Net area subject to tension				
when sheared out by center strip	$A_{nt} = (n_v - 1) (s_v - d_h) t_p$	= 1.063	[in ²]	
Block shear strength required	$V_u =$	= 82.81	[kips]	
Uniform tension stress factor	$U_{bs} = 0.50$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 236.84	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 177.63	[kips]	
	ratio = 0.47	> V_u	OK	

Flange Plate - Tensile Yielding		ratio = 82.81 / 129.38	= 0.64	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Tensile Yielding Check				
Plate size	width $b_p = 5.750$	[in]	thickness $t_p = 0.500$	[in]
Plate yield strength	$F_y = 50.0$	[ksi]		
Plate gross area in shear	$A_g = b_p t_p$	= 2.875	[in ²]	
Tensile force required	$P_u =$	= 82.81	[kips]	
Plate tensile yielding strength	$R_n = F_y A_g$	= 143.75	[kips]	AISC 14 th Eq J4-1
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th Eq J4-1
	$\phi R_n =$	= 129.38	[kips]	
	ratio = 0.64	> P_u	OK	
Flange Plate - Tensile Rupture		ratio = 82.81 / 97.50	= 0.85	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - tension	$P_u = P_b / 2 + M / d_m$	= 82.81	[kips]	
Plate Tensile Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$	[in]	bolt hole dia $d_h = 7/8$	[in] AISC 14 th B4.3b
Number of bolt	$n = 2$			
Plate size	width $b_p = 5.750$	[in]	thickness $t_p = 0.500$	[in]
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate net area in tension	$A_{nt} = (b_p - n d_h) t_p$	= 2.000	[in ²]	
Tensile force required	$P_u =$	= 82.81	[kips]	
Plate tensile rupture strength	$R_n = F_u A_{nt}$	= 130.00	[kips]	AISC 14 th Eq J4-2
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-2
	$\phi R_n =$	= 97.50	[kips]	AISC 14 th Eq J4-2
	ratio = 0.85	> P_u	OK	

Flange Plate - Compression		ratio = 57.81 / 129.38	= 0.45	PASS
Flange force moment arm	$d_m = d_b + t_p$	= 12.800	[in]	
Flange force - compression	$P_u = P_b / 2 + M / d_m$	= 57.81	[kips]	
Plate Compression Check				
Plate size	width $b_p = 5.750$	[in]	thickness $t_p = 0.500$	[in]
	$F_y = 50.0$	[ksi]	$E = 29000$	[ksi]
Plate gross area in compression	$A_g = b_p t_p$	= 2.875	[in ²]	
Plate radius of gyration	$r = t_p / \sqrt{12}$	= 0.144	[in]	
Plate effective length factor	$K =$	= 0.65		
Plate unbraced length	$L_u =$	= 3.750	[in]	
Plate slenderness	$KL/r = 0.65 \times L_u / r$	= 16.89		
Plate compression required	$P_u =$	= 57.81	[kips]	
	when $\frac{KL}{r} \leq 25$			AISC 14 th J4.4 (a)
Plate compression provided	$R_n = F_y \times A_g$	= 143.75	[kips]	AISC 14 th Eq J4-6
Bolt resistance factor-LRFD	$\phi = 0.90$			AISC 14 th J4.4 (a)
	$\phi R_n =$	= 129.38	[kips]	
	ratio = 0.45	> P_u	OK	

Web Plate - Bolt Bearing		ratio = 15.00 / 107.35	= 0.14	PASS
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$	$A_b = 0.442$	[in ²]	
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86	[kips]	AISC 14 th Eq J3-1
Bolt Bearing/TearOut Strength on Plate				
Bolt hole diameter	bolt dia $d_b = 3/4$	$d_h = 13/16$	[in]	AISC 14 th Table J3.3
Bolt spacing & edge distance	spacing $L_s = 3.000$	edge distance $L_e = 1.375$	[in]	
Plate tensile strength	$F_u = 65.0$		[ksi]	
Plate thickness	$t = 0.375$		[in]	
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 54.84	[kips]	AISC 14 th Eq J3-6b
	= 79.98 ≤ 54.84			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in}, R_{n-bolt})$	= 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	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$	= 35.42	[kips]	AISC 14 th Eq J3-6b
	= 35.42 ≤ 54.84			
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed}, R_{n-bolt})$	= 23.86	[kips]	
Number of bolt	interior $n_{in} = 4$	edge $n_{ed} = 2$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14	[kips]	
Required shear strength	$V_u =$	= 15.00	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.14	> V_u	OK	

Web Plate - Shear Yielding		ratio = 15.00 / 98.44	= 0.15	PASS
Plate Shear Yielding Check				
Plate size	width $b_p = 8.750$	thickness $t_p = 0.375$	[in]	
Plate yield strength	$F_y = 50.0$		[ksi]	
Plate gross area in shear	$A_{gv} = b_p t_p$	= 3.281	[in ²]	
Shear force required	$V_u =$	= 15.00	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 98.44	[kips]	AISC 14 th Eq J4-3
Resistance factor-LRFD	$\phi = 1.00$			AISC 14 th Eq J4-3
	$\phi R_n =$	= 98.44	[kips]	
	ratio = 0.15	> V_u	OK	

Web Plate - Shear Rupture		ratio = 15.00 / 67.18	= 0.22	PASS
Plate Shear Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 3$			
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.375$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$	$= 2.297$ [in ²]		
Shear force required	$V_u =$	$= 15.00$ [kips]		
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	$= 89.58$ [kips]		AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$	$= 67.18$ [kips]		
	ratio = 0.22	$> V_u$	OK	

Web Plate - Block Shear - 1-Side Strip		ratio = 15.00 / 84.89	= 0.18	PASS
Plate Block Shear - Side Strip				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Plate thickness	$t_p = 0.375$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.375$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	$= 2.766$ [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	$= 1.945$ [in ²]		
Net area subject to tension when sheared out by side strip	$A_{nt} = [(n_v - 1) s_v + e_v - ((n_v - 1) + 0.5) d_h] t_p$	$= 1.148$ [in ²]		
Block shear strength required	$V_u =$	$= 15.00$ [kips]		
Uniform tension stress factor	$U_{bs} = 0.50$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6 F_u A_{nv}, 0.6 F_y A_{gv}) + U_{bs} F_u A_{nt}$	$= 113.19$ [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	$= 84.89$ [kips]		
	ratio = 0.18	$> V_u$	OK	

Beam Flange - Bolt Shear		ratio = 85.67 / 107.35	= 0.80	PASS
Flange force moment arm	$d_m = d_b$	= 12.300	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 85.67	[kips]	
<hr/>				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$	[in ²]	
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 1$		
Required shear strength	$V_u =$	= 85.67	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	= 143.14	[kips]	AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.80	> V_u	OK	
<hr/>				
Beam Flange - Bolt Bearing		ratio = 88.39 / 107.35	= 0.82	PASS
Flange force moment arm	$d_m = d_b - t_{fb}$	= 11.860	[in]	
Beam flange force as shear	$V_u = P_b / 2 + M / d_m$	= 88.39	[kips]	
<hr/>				
Single Bolt Shear Strength				
<hr/>				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$	[in ²]	
Single bolt shear strength	$R_{n-bolt} = F_{nv} A_b$	= 23.86	[kips]	AISC 14 th Eq J3-1
Bolt Bearing/TearOut Strength on Plate				
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Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 13/16$	[in]	AISC 14 th Table J3.3
Bolt spacing & edge distance	spacing $L_s = 3.000$ [in]	edge distance $L_e = 1.625$	[in]	
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate thickness	$t = 0.440$	[in]		
Interior Bolt				
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Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 93.84 ≤ 64.35	= 64.35	[kips]	
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in} , R_{n-bolt})$	= 23.86	[kips]	
Edge Bolt				
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Bolt hole edge clear distance	$L_c = L_e - d_h / 2$	= 1.219	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-ed} = 1.5 L_c t F_u \leq 3.0 d_b t F_u$			AISC 14 th Eq J3-6b
	= 52.28 ≤ 64.35	= 52.28	[kips]	
Bolt strength at edge	$R_{n-ed} = \min (R_{n-t\&b-ed} , R_{n-bolt})$	= 23.86	[kips]	
<hr/>				
Number of bolt	interior $n_{in} = 4$	edge $n_{ed} = 2$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 143.14	[kips]	
Required shear strength	$V_u =$	= 88.39	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 107.35	[kips]	
	ratio = 0.82	> V_u	OK	

Beam Flange - Block Shear - 2 Side Strips		ratio = 88.39 / 196.70	= 0.45	PASS
Flange force moment arm	$d_m = d_b - t_{fb}$	= 11.860	[in]	
Beam flange force - tension	$V_u = P_b / 2 + M / d_m$	= 88.39	[kips]	
<hr/>				
Plate Block Shear - 2 Side Strips				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Plate thickness	$t_p = 0.440$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 2$	$n_h = 3$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 3.000$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 1.760$ [in]	$e_h = 1.625$ [in]		
<hr/>				
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 6.710	[in ²]	
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 4.785	[in ²]	
Net area subject to tension				
when sheared out by 2 side strips	$A_{nt} = (e_v - 0.5 d_h) t_p \times 2$	= 1.164	[in ²]	
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Block shear strength required	$V_u =$	= 88.39	[kips]	
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 262.26	[kips]	AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 196.70	[kips]	
	ratio = 0.45	> V_u	OK	

Beam Web - Bolt Shear		ratio = 30.00 / 214.71	= 0.14	PASS
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$ [ksi]		AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]	bolt area $A_b = 0.442$ [in ²]		
Number of bolt carried shear	$n_s = 6.0$	shear plane $m = 2$		
Required shear strength	$V_u =$	= 30.00	[kips]	
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	= 286.28	[kips]	AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1
	$\phi R_n =$	= 214.71	[kips]	
	ratio = 0.14	> V_u	OK	

Beam Web - Bolt Bearing		ratio = 30.00 / 171.11	= 0.18	PASS
Single Bolt Shear Strength				
Bolt shear stress	bolt grade = A325-N	$F_{nv} = 54.0$	[ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$	[in]	bolt area $A_b = 0.442$	[in ²]
Single bolt shear strength	$R_{n-bolt} = 2 \times F_{nv} A_b$	= 47.71	[kips]	AISC 14 th 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 14 th Table J3.3
Bolt spacing	spacing $L_s = 3.000$	[in]		
Plate tensile strength	$F_u = 65.0$	[ksi]		
Plate thickness	$t = 0.260$	[in]		
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	= 2.188	[in]	
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t m F_u$	= 38.03	[kips]	AISC 14 th Eq J3-6b
	= 55.45 ≤ 38.03			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in}, R_{n-bolt})$	= 38.03	[kips]	
Number of bolt	interior $n_{in} = 6$			
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in}$	= 228.15	[kips]	
Required shear strength	$V_u =$	= 30.00	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 171.11	[kips]	
	ratio = 0.18	> V_u	OK	
Beam Web - Shear Yielding				
		ratio = 30.00 / 95.94	= 0.31	PASS
Plate Shear Yielding Check				
Plate size	width $b_p = 12.300$	[in]	thickness $t_p = 0.260$	[in]
Plate yield strength	$F_y = 50.0$	[ksi]		
Plate gross area in shear	$A_{gv} = b_p t_p$	= 3.198	[in ²]	
Shear force required	$V_u =$	= 30.00	[kips]	
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 95.94	[kips]	AISC 14 th Eq J4-3
Resistance factor-LRFD	$\phi = 1.00$			AISC 14 th Eq J4-3
	$\phi R_n =$	= 95.94	[kips]	
	ratio = 0.31	> V_u	OK	

Beam Web - Shear Rupture		ratio = 30.00 / 73.58	= 0.41	PASS
Plate Shear Rupture Check				
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 3$			
Plate size	width $b_p = 12.300$ [in]	thickness $t_p = 0.260$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$	= 2.516 [in ²]		
Shear force required	$V_u =$	= 30.00 [kips]		
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	= 98.10 [kips]		AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$	= 73.58 [kips]		
	ratio = 0.41	> V_u	OK	

Beam Flange With Holes - Beam Flexural Rupture		ratio = 75.00 / 137.67	= 0.54	PASS
Beam sect W12X30	$b_f = 6.520$ [in]	$t_f = 0.440$ [in]		
	$S_x = 38.600$ [in ³]			
	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Gross area of tension flange	$A_{fg} = b_f t_f$	= 2.869 [in ²]		
Bolt hole diameter	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n = 2$			
Net area of tension flange	$A_{fn} = (b_f - n d_h) t_f$	= 2.099 [in ²]		
Moment in demand	$M_u =$	= 75.00 [kips]		
Beam flexural rupture strength	$M_n = \frac{F_u A_{fn}}{A_{fg}} S_x$	= 152.96 [kip-ft]		AISC 14 th Eq F13-1
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th F1
	$\phi M_n =$	= 137.67 [kips]		
	ratio = 0.54	> M_u	OK	

Beam Section Tensile Rupture		ratio = 25.00 / 320.17 = 0.08		PASS
Beam sect W12X30	$t_f = 0.440$ [in] $A_g = 8.790$ [in ²]	$t_w = 0.260$ [in] $F_u = 65.0$ [ksi]		
Beam flange bolt	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n_{flg} = 2$			
Beam web bolt	bolt dia $d_b = 3/4$ [in]	bolt hole dia $d_h = 7/8$ [in]		AISC 14 th B4.3b
Number of bolt	$n_{web} = 3$			
Net area of beam sect	$A_n = A_g - n_{flg} d_h t_f \times 2 - n_{web} d_h t_w$	$= 6.568$ [in ²]		
Shear lag factor	$U =$ from Table D3.1 case 1	$= 1.00$		AISC 14 th Table D3.1
Tensile force required	$P_u =$	$= 25.00$ [kips]		
Tensile effective net area	$A_e = A_n U$	$= 6.568$ [in ²]		
Plate tensile strength	$F_u =$	$= 65.0$ [ksi]		
Tensile rupture strength	$R_n = F_u A_e$	$= 426.89$ [kips]		AISC 14 th Eq D2-2
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th D2 (b)
	$\phi R_n =$	$= 320.17$ [kips]		AISC 14 th Eq D2-2
	ratio = 0.08	$> P_u$	OK	