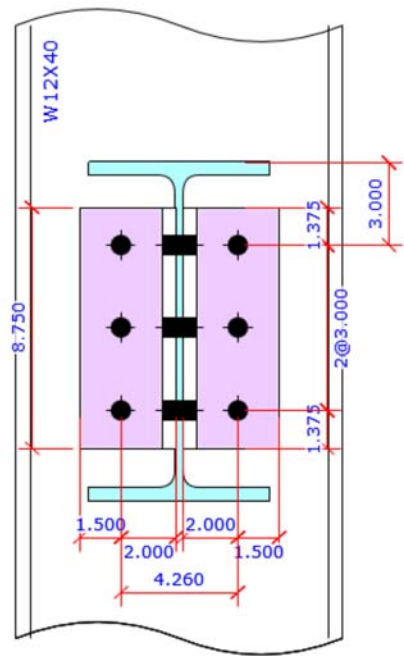
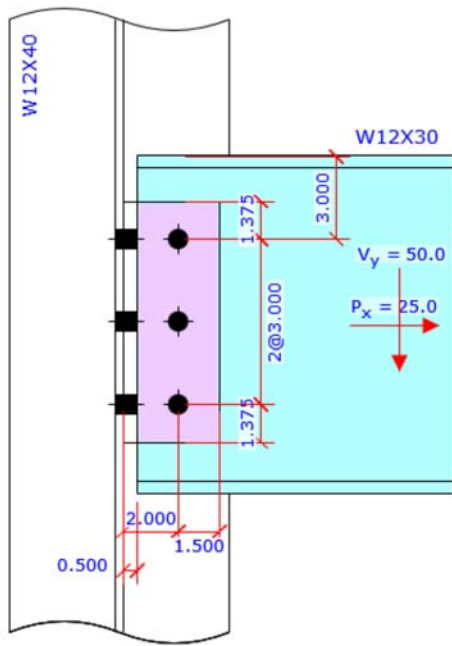


Beam to Column	Clip Angle Shear Connection	Code=AISC 360-10 LRFD
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Result Summary	geometries & weld limitations = PASS	limit states max ratio = 0.68 PASS
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Sketch	Shear Connection	Code=AISC 360-10 LRFD
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Members & Components Summary		
Member	Shear Connection	Code=AISC 360-10 LRFD

Geometry Restriction Checks - Clip Angle to Beam			PASS
Min Bolt Edge Distance - Clip Angle to Beam			
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 Clip Angle to Beam	$L_e =$	= 1.375 [in]	
		> L_{e-min}	OK
Min Bolt Spacing - Clip Angle to Beam			
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 Clip Angle to Beam	$L_s =$	= 3.000 [in]	
		> L_{s-min}	OK

Geometry Restriction Checks - Clip Angle to Column Web			PASS
Min Bolt Edge Distance - Clip Angle to Column Web			
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 Clip Angle to Column Web	$L_e =$	= 1.375 [in]	
		> L_{e-min}	OK
Min Bolt Spacing - Clip Angle to Column Web			
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 Clip Angle to Column Web	$L_s =$	= 3.000 [in]	
		> L_{s-min}	OK

W Shape Beam - Tensile Yield		ratio = 25.00 / 395.55 = 0.06	PASS
Gross area subject to tension	$A_g =$	= 8.790 [in ²]	
Steel yield strength	$F_y =$	= 50.0 [ksi]	
Tensile force required	$P_u =$	= 25.00 [kips]	
Tensile yielding strength	$R_n = F_y A_g$	= 439.50 [kips]	AISC 14 th Eq D2-1
Resistance factor-LRFD	$\phi = 0.90$		AISC 14 th D2 (a)
	$\phi R_n =$	= 395.55 [kips]	AISC 14 th Eq D2-1
	ratio = 0.06	> P_u	OK

W Shape Beam - Tensile Rupture		ratio = 25.00 / 133.51	= 0.19	PASS
W beam section	= W12X30			
	d = 12.300 [in]	b _f = 6.520 [in]		
	t _f = 0.440 [in]	t _w = 0.260 [in]		
	A _g = 8.790 [in ²]			
Bolt hole diameter	bolt dia d _b = 3/4 [in]	bolt hole dia d _n = 7/8 [in]		AISC 14 th B4.3b
Number of bolt row	n = 3			
W section net area	A _n = A _g - n d _h t _w	= 8.108 [in ²]		
Shear lag factor	U = [(d - 2 t _f) t _w] / A _g	= 0.338		AISC 14 th D3
Tensile force required	P _u =	= 25.00 [kips]		
Tensile effective net area	A _e = A _n U	= 2.739 [in ²]		
Plate tensile strength	F _u =	= 65.0 [ksi]		
Tensile rupture strength	R _n = F _u A _e	= 178.01 [kips]		AISC 14 th Eq D2-2
Resistance factor-LRFD	φ = 0.75			AISC 14 th D2 (b)
	φ R _n =	= 133.51 [kips]		AISC 14 th Eq D2-2
	ratio = 0.19	> P _u	OK	

Beam Web - Shear Yielding		ratio = 50.00 / 95.94	= 0.52	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 =	= 50.00 [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	φ = 1.00			AISC 14 th Eq J4-3
	φ R _n =	= 95.94 [kips]		
	ratio = 0.52	> V _u	OK	

Beam Web - Shear Rupture		ratio = 50.00 / 73.58	= 0.68	PASS
Plate Shear Rupture Check				
Bolt hole diameter	bolt dia d _b = 3/4 [in]	bolt hole dia d _n = 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 _n) t _p	= 2.516 [in ²]		
Shear force required	V _u =	= 50.00 [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	φ = 0.75			AISC 14 th Eq J4-4
	φ R _n =	= 73.58 [kips]		
	ratio = 0.68	> V _u	OK	

Beam Web - Bolt Bearing on Beam Web		ratio = 55.90 / 85.56	= 0.65	PASS
The bolt group is oriented so that the shear force V is in ver. direction and the axial force P is in hor. direction				
Bolt group forces	shear V = 50.00 [kips]		axial P = -25.00 [kips]	
Bolt group resultant force	$R = (V^2 + P^2)^{0.5}$		= 55.90 [kips]	
Resultant force/hor line load angle	$\theta = \tan^{-1}(V/P)$		= 63.43 [°]	
<hr/>				
Bolt hole diameter	bolt dia $d_b = 0.750$ [in]		bolt hole dia $d_{bh} = 0.813$ [in]	AISC 14 th B4.3b
Bolt hole ver. dimension	$d_v =$		= 0.813 [in]	
Bolt hole hor. dimension	$d_h =$		= 0.813 [in]	
Bolt center to bolt hole edge dist	$d_c = 0.5 d_{bh}$		= 0.406 [in]	
<hr/>				
Bolt no in ver & hor direction	Bolt Row $n_v = 3$		Bolt Col $n_h = 1$	
Bolt spacing	ver $s_v = 3.000$ [in]			
Bolt edge distance	ver $e_v = 3.000$ [in]		hor $e_h = 1.500$ [in]	
<hr/>				
Bolt clear dist - bot right corner bolt	$L_{cA} = \min\left(\frac{e_v}{\sin \theta}, \frac{e_h}{\cos \theta}\right) - d_c$		= 2.948 [in]	
Bolt clear dist - right side edge bolt	$L_{cB} = \min\left(\frac{s_v - 0.5d_v}{\sin \theta}, \frac{e_h}{\cos \theta}\right) - d_c$		= 2.494 [in]	
<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	$R_{n-bolt} = 2 \times F_{nv} A_b$		= 47.71 [kips]	AISC 14 th Eq J3-1
<hr/>				
Bolt bearing on plate	thick $t = 0.260$ [in]		tensile $F_u = 65.0$ [ksi]	
Bolt bearing strength	$R_{n-br} = 3.0 d_b t F_u$		= 38.03 [kips]	AISC 14 th Eq J3-6b
<hr/>				
Type A - Bolt Group Bottom Right Corner Bolt				
Number of bolt	$n_A = 1$			
Bolt tear out strength	$R_{n-tA} = 1.5 L_{cA} t F_u$		= 74.73 [kips]	AISC 14 th Eq J3-6b
Bolt bearing strength	$R_{nA} = \min(R_{n-tA}, R_{n-br}, R_{n-bolt})$		= 38.03 [kips]	
<hr/>				
Type B - Bolt Group Right Side Edge Bolt				
Number of bolt	$n_B = 2$			
Bolt tear out strength	$R_{n-tB} = 1.5 L_{cB} t F_u$		= 63.21 [kips]	AISC 14 th Eq J3-6b
Bolt bearing strength	$R_{nB} = \min(R_{n-tB}, R_{n-br}, R_{n-bolt})$		= 38.03 [kips]	
<hr/>				
Bolt bearing strength for all bolts	$R_n = n_A R_{nA} + n_B R_{nB} + n_C R_{nC} + n_D R_{nD}$		= 114.08 [kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$		= 85.56 [kips]	
	ratio = 0.65		> R	OK

Beam Web - Axial Tearout - Block Shear - Center Strip		ratio = 25.00 / 70.03	= 0.36	PASS
Plate Block Shear - Center 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	$t_p = 0.260$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 3$	$n_h = 1$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 1.750$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 3.000$ [in]	$e_h = 1.500$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 0.780 [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 0.553 [in ²]		
Net area subject to tension when sheared out by center strip	$A_{nt} = (n_v - 1) (s_v - d_h) t_p$	= 1.105 [in ²]		
Block shear strength required	$V_u =$	= 25.00 [kips]		
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min(0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 93.37 [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 70.03 [kips]		
	ratio = 0.36	> V_u	OK	

Clip Angle - Beam Side - Shear Yielding		ratio = 25.00 / 131.25	= 0.19	PASS
Plate Shear Yielding Check				
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.500$ [in]		
Plate yield strength	$F_y = 50.0$ [ksi]			
Plate gross area in shear	$A_{gv} = b_p t_p$	= 4.375 [in ²]		
Shear force required	$V_u =$	= 25.00 [kips]		
Plate shear yielding strength	$R_n = 0.6 F_y A_{gv}$	= 131.25 [kips]		AISC 14 th Eq J4-3
Resistance factor-LRFD	$\phi = 1.00$			AISC 14 th Eq J4-3
	$\phi R_n =$	= 131.25 [kips]		
	ratio = 0.19	> V_u	OK	

Clip Angle - Beam Side - Shear Rupture		ratio = 25.00 / 89.58	= 0.28	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 $t_p = 0.500$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$	= 3.063 [in ²]		
Shear force required	$V_u =$	= 25.00 [kips]		
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$	= 119.44 [kips]		AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$	= 89.58 [kips]		
	ratio = 0.28	> V_u	OK	

Clip Angle - Beam Side - Axial Tensile Yield		ratio = 12.50 / 196.88	= 0.06	PASS
Plate Tensile Yielding Check				
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.500$ [in]		
Plate yield strength	$F_y = 50.0$ [ksi]			
Plate gross area in shear	$A_g = b_p t_p$	= 4.375 [in ²]		
Tensile force required	$P_u =$	= 12.50 [kips]		
Plate tensile yielding strength	$R_n = F_y A_g$	= 218.75 [kips]		AISC 14 th Eq J4-1
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th Eq J4-1
	$\phi R_n =$	= 196.88 [kips]		
	ratio = 0.06	> P_u		OK

Clip Angle - Beam Side - Axial Tensile Rupture		ratio = 12.50 / 149.30	= 0.08	PASS
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	$n = 3$			
Plate size	width $b_p = 8.750$ [in]	thickness $t_p = 0.500$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in tension	$A_{nt} = (b_p - n d_h) t_p$	= 3.063 [in ²]		
Tensile force required	$P_u =$	= 12.50 [kips]		
Plate tensile rupture strength	$R_n = F_u A_{nt}$	= 199.06 [kips]		AISC 14 th Eq J4-2
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-2
	$\phi R_n =$	= 149.30 [kips]		AISC 14 th Eq J4-2
	ratio = 0.08	> P_u		OK

Clip Angle - Beam Side - Bolt Bearing on Clip Angle		ratio = 27.95 / 53.68	= 0.52	PASS
The bolt group is oriented so that the shear force V is in ver. direction and the axial force P is in hor. direction				
Bolt group forces	shear V = 50.00 [kips]		axial P = -25.00 [kips]	
Bolt group resultant force	$R = (V^2 + P^2)^{0.5}$		= 55.90 [kips]	
Each angle or plate takes	R = 0.50 x R		= 27.95 [kips]	
Resultant force/hor line load angle	$\theta = \tan^{-1}(V/P)$		= 63.43 [°]	
<hr/>				
Bolt hole diameter	bolt dia $d_b = 0.750$ [in]		bolt hole dia $d_{bh} = 0.813$ [in]	AISC 14 th B4.3b
Bolt hole ver. dimension	$d_v =$		= 0.813 [in]	
Bolt hole hor. dimension	$d_h =$		= 0.813 [in]	
Bolt center to bolt hole edge dist	$d_c = 0.5 d_{bh}$		= 0.406 [in]	
<hr/>				
Bolt no in ver & hor direction	Bolt Row $n_v = 3$		Bolt Col $n_h = 1$	
Bolt spacing	ver $s_v = 3.000$ [in]			
Bolt edge distance	ver $e_v = 1.375$ [in]		hor $e_h = 1.500$ [in]	
<hr/>				
Bolt clear dist - bot right corner bolt	$L_{CA} = \min\left(\frac{e_v}{\sin \theta}, \frac{e_h}{\cos \theta}\right) - d_c$		= 1.131 [in]	
Bolt clear dist - right side edge bolt	$L_{CB} = \min\left(\frac{s_v - 0.5d_v}{\sin \theta}, \frac{e_h}{\cos \theta}\right) - d_c$		= 2.494 [in]	
<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
<hr/>				
Bolt bearing on plate	thick t = 0.500 [in]		tensile $F_u = 65.0$ [ksi]	
Bolt bearing strength	$R_{n-br} = 3.0 d_b t F_u$		= 73.13 [kips]	AISC 14 th Eq J3-6b
<hr/>				
Type A - Bolt Group Bottom Right Corner Bolt				
Number of bolt	$n_A = 1$			
Bolt tear out strength	$R_{n-tA} = 1.5 L_{CA} t F_u$		= 55.14 [kips]	AISC 14 th Eq J3-6b
Bolt bearing strength	$R_{nA} = \min(R_{n-tA}, R_{n-br}, R_{n-bolt})$		= 23.86 [kips]	
<hr/>				
Type B - Bolt Group Right Side Edge Bolt				
Number of bolt	$n_B = 2$			
Bolt tear out strength	$R_{n-tB} = 1.5 L_{CB} t F_u$		= 121.57 [kips]	AISC 14 th Eq J3-6b
Bolt bearing strength	$R_{nB} = \min(R_{n-tB}, R_{n-br}, R_{n-bolt})$		= 23.86 [kips]	
<hr/>				
Bolt bearing strength for all bolts	$R_n = n_A R_{nA} + n_B R_{nB} + n_C R_{nC} + n_D R_{nD}$		= 71.57 [kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$		= 53.68 [kips]	
	ratio = 0.52		> R	OK

Clip Angle - Beam Side - Block Shear - 1-Side Strip		ratio = 25.00 / 101.77	= 0.25	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	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 1$	$n_h = 3$		
Bolt spacing in hor dir	$s_h = 3.000$ [in]			
Bolt edge dist in ver & hor dir	$e_v = 1.500$ [in]	$e_h = 1.375$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	= 3.688 [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	= 2.594 [in ²]		
Net area subject to tension	$A_{nt} = (e_v - 0.5 d_h) t_p$	= 0.531 [in ²]		
Block shear strength required	$V_u =$	= 25.00 [kips]		
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min (0.6F_u A_{nv} , 0.6F_y A_{gv}) +$ $U_{bs} F_u A_{nt}$	= 135.69 [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 101.77 [kips]		
	ratio = 0.25	> V_u	OK	

Clip Angle - Beam Side-Axial Tearout - Block Shear - Center Strip		ratio = 12.50 / 134.67	= 0.09	PASS
Plate Block Shear - Center 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	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 3$	$n_h = 1$		
Bolt spacing in ver & hor dir	$s_v = 3.000$ [in]	$s_h = 1.750$ [in]		
Bolt edge dist in ver & hor dir	$e_v = 1.375$ [in]	$e_h = 1.500$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p \times 2$	= 1.500 [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p \times 2$	= 1.063 [in ²]		
Net area subject to tension when sheared out by center strip	$A_{nt} = (n_v - 1) (s_v - d_h) t_p$	= 2.125 [in ²]		
Block shear strength required	$V_u =$	= 12.50 [kips]		
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min (0.6F_u A_{nv} , 0.6F_y A_{gv}) +$ $U_{bs} F_u A_{nt}$	= 179.56 [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 134.67 [kips]		
	ratio = 0.09	> V_u	OK	

Clip Angle - Beam Side - Block Shear - Shear/Tensile Interact		ratio =	= 0.07	PASS
Shear block shear strength required	$V_u =$		= 25.00 [kips]	
Axial block shear strength required	$P_u =$		= 12.50 [kips]	
Shear block shear strength available	$\phi R_{nv} =$ from calc shown above		= 101.77 [kips]	
Axial block shear strength available	$\phi R_{nt} =$ from calc shown above		= 134.67 [kips]	
Block shear shear/tensile interaction	ratio = $\left(\frac{V_u}{\phi R_{nv}}\right)^2 + \left(\frac{P_u}{\phi R_{nt}}\right)^2$		= 0.07	AISC 14 th Eq 10-5
			< 1.0	OK

Clip Angle - Column Side - Shear Rupture		ratio = 25.00 / 89.58	= 0.28	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 $t_p = 0.500$ [in]		
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate net area in shear	$A_{nv} = (b_p - n d_h) t_p$		= 3.063 [in ²]	
Shear force required	$V_u =$		= 25.00 [kips]	
Plate shear rupture strength	$R_n = 0.6 F_u A_{nv}$		= 119.44 [kips]	AISC 14 th Eq J4-4
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-4
	$\phi R_n =$		= 89.58 [kips]	
	ratio = 0.28		> V_u	OK

Clip Angle - Column Side - Bolt Bearing on Clip Angle		ratio = 25.00 / 53.68	= 0.47	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	$t = 0.500$		[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 $n_{in} = 2$	edge $n_{ed} = 1$		
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in} + n_{ed} R_{n-ed}$	= 71.57	[kips]	
Required shear strength	$V_u =$	= 25.00	[kips]	
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	= 53.68	[kips]	
	ratio = 0.47	> V_u	OK	

Clip Angle - Column Side - Block Shear - 1-Side Strip		ratio = 25.00 / 101.77	= 0.25	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	$t_p = 0.500$ [in]			
Plate strength	$F_y = 50.0$ [ksi]	$F_u = 65.0$ [ksi]		
Bolt no in ver & hor dir	$n_v = 1$	$n_h = 3$		
Bolt spacing in hor dir	$s_h = 3.000$ [in]			
Bolt edge dist in ver & hor dir	$e_v = 1.500$ [in]	$e_h = 1.375$ [in]		
Gross area subject to shear	$A_{gv} = [(n_h - 1) s_h + e_h] t_p$	= 3.688 [in ²]		
Net area subject to shear	$A_{nv} = A_{gv} - [(n_h - 1) + 0.5] d_h t_p$	= 2.594 [in ²]		
Net area subject to tension	$A_{nt} = (e_v - 0.5 d_h) t_p$	= 0.531 [in ²]		
Block shear strength required	$V_u =$	= 25.00 [kips]		
Uniform tension stress factor	$U_{bs} = 1.00$			AISC 14 th Fig C-J4.2
Bolt shear resistance provided	$R_n = \min (0.6F_u A_{nv}, 0.6F_y A_{gv}) + U_{bs} F_u A_{nt}$	= 135.69 [kips]		AISC 14 th Eq J4-5
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J4-5
	$\phi R_n =$	= 101.77 [kips]		
	ratio = 0.25	> V_u	OK	

Clip Angle / Beam Web - Bolt Shear		ratio = 55.90 / 107.35	= 0.52	PASS
Bolt group forces	shear $V = 50.00$ [kips]	axial $P = -25.00$ [kips]		
Bolt group resultant force	$R = (V^2 + P^2)^{0.5}$	= 55.90 [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	$n_s = 3.0$	shear plane $m = 2$		
Beam Side Bolt Group Eccentricity				
Eccentricity in double angle connection can be neglected when bolt group has single vertical row of bolt and the distance from face of angle OSL to bolt group CG is less than 3 inch				AISC 14 th Page 10-8
Bolt group eccentricity coefficient	$C_{ec} =$	= 1.000		AISC 14 th Page 10-8
Required shear strength	$V_u =$	= 55.90 [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 = 0.52	> V_u	OK	

Clip Angle / Column - Bolt Shear		ratio = 25.00 / 53.68	= 0.47	PASS
Bolt group forces	shear $V = 25.00$ [kips]	axial $P = 12.50$ [kips]		
Bolt shear stress	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	$n_s = 3.0$	shear plane $m = 1$		
Bolt group eccentricity coefficient	$C_{ec} =$	$= 1.000$		
Required shear strength	$V_u =$	$= 25.00$ [kips]		
Bolt shear strength	$R_n = F_{nv} A_b n_s m C_{ec}$	$= 71.57$ [kips]		AISC 14 th Eq J3-1
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th Eq J3-1
	$\phi R_n =$	$= 53.68$ [kips]		
	ratio = 0.47	$> V_u$	OK	

Clip Angle / Column - Bolt Bearing on Column		ratio = 50.00 / 107.35	= 0.47	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	spacing $L_s = 3.000$ [in]			
Plate tensile strength	$F_u = 65.0$ [ksi]			
Plate thickness	$t = 0.295$ [in]			
Interior Bolt				
Bolt hole edge clear distance	$L_c = L_s - d_h$	$= 2.188$ [in]		
Bolt tear out/bearing strength	$R_{n-t\&b-in} = 1.5 L_c t F_u \leq 3.0 d_b t m F_u$	$= 43.14$ [kips]		AISC 14 th Eq J3-6b
	$= 62.92 \leq 43.14$			
Bolt strength at interior	$R_{n-in} = \min (R_{n-t\&b-in}, R_{n-bolt})$	$= 23.86$ [kips]		
Number of bolt				
Number of bolt	interior $n_{in} = 6$			
Bolt bearing strength for all bolts	$R_n = n_{in} R_{n-in}$	$= 143.14$ [kips]		
Required shear strength	$V_u =$	$= 50.00$ [kips]		
Bolt resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3-10
	$\phi R_n =$	$= 107.35$ [kips]		
	ratio = 0.47	$> V_u$	OK	

Clip Angle / Column - Angle Leg Bending		ratio = 1.11 / 2.67	= 0.42	PASS
Angle leg on beam	width $b = 8.750$ [in]	thickness $t = 0.500$ [in]		
	tensile $F_u = 65.0$ [ksi]	bolt gage $g = 2.000$ [in]		
Beam web thickness	$t_p = 0.260$ [in]			
The angle leg bending moment is derived based on the assumption that the 2L legs to form a single span $L=2d$ beam with both ends fixed and tensile point load $2P$ imposed at mid span of this beam, so the moment $M=(1/8) \times 2P \times 2d = 0.5 P d$				
1/2 beam span - distance from bolt center to gusset plate center	$d = g + 0.5 t_p$	= 2.130 [in]		
Axial tensile load on single angle	$P =$	= 12.50 [kips]		
Moment in demand	$M_r = 0.5 P d$	= 1.11 [kip-ft]		
Moment capacity	$M_n = (t^2 b) / 4 \times F_u$	= 2.96 [kip-ft]		AISC 14 th Eq 15-21
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th Eq 15-21
	$\phi M_n =$	= 2.67 [kip-ft]		
	ratio = 0.42	> M_r	OK	

Bolt Tensile Prying Action on Clip Angle		ratio = 4.17 / 13.35	= 0.31	PASS
For 2L clip angle, all loads to be x 0.5 for single angle				
Bolt group forces	shear V = 25.00 [kips]		axial P = -12.50 [kips]	
Single Bolt Tensile Capacity Without Considering Prying				
Bolt grade	grade = A325-N			
Nominal tensile/shear stress	$F_{nt} = 90.0$ [ksi]		$F_{nv} = 54.0$ [ksi]	AISC 14 th Table J3.2
	bolt dia $d_b = 0.750$ [in]		bolt area $A_b = 0.442$ [in ²]	
Bolt group shear force	shear V = 25.00 [kips]		no of bolt n = 3	
Shear stress required	$f_{rv} = V / (n A_b)$		= 18.86 [ksi]	
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3.7
Modified nominal tensile stress	$F'_{nt} = 1.3 F_{nt} - \frac{F_{nt}}{\phi F_{nv}} f_{rv} \leq F_{nt}$		= 75.08 [ksi]	AISC 14 th Eq J3-3a
Bolt nominal tensile strength	$r_n = F'_{nt} A_b$		= 33.17 [kips]	AISC 14 th Eq J3-1
Resistance factor-LRFD	$\phi = 0.75$			AISC 14 th J3.6
Single bolt tensile capacity	$\phi r_n =$		= 24.88 [kips]	
Single Bolt Tensile Capacity After Considering Prying				
Clip angle	leg width L = 3.500 [in]		bolt gage g = 2.000 [in]	
	leg t = 0.500 [in]			
Dist from bolt center to leg edge	a = L - g		= 1.500 [in]	
	$a' = a + 0.5 d_b \leq (1.25 b + 0.5 d_b)$		= 1.875 [in]	AISC 14 th Eq 9-27
Bolt hole diameter	bolt dia $d_b = 0.750$ [in]		bolt hole dia $d_h = 0.813$ [in]	AISC 14 th B4.3b
Dist from bolt center to centerline of angle leg	b = g - 0.5 t		= 1.750 [in]	
	b' = b - 0.5 d_b		= 1.375 [in]	AISC 14 th Eq 9-21
Angle length	L = 8.750 [in]		Bolt Col $n_v = 3$	
Bolt spacing			$s_v = 3.000$	
Bolt tributary length	$p = L / n_v$ $p \leq 2b$ and $p \leq s_v$		= 2.917 [in]	AISC 14 th Page 9-11
	$\rho = b' / a'$		= 0.733	AISC 14 th Eq 9-26
	$\delta = 1 - d_h / p$		= 0.721	AISC 14 th Eq 9-24
Tensile capacity per bolt before considering prying	B = from calc shown in above section		= 24.88 [kips]	
Resistance factor-LRFD	$\phi = 0.90$			AISC 14 th Page 9-10
Clip angle leg thickness	t = 0.500 [in]		tensile $F_u = 65.0$ [ksi]	
Plate thickness req'd to develop bolt tensile capacity without prying	$t_c = \left(\frac{4 B b'}{\phi p F_u} \right)^{0.5}$		= 0.896 [in]	AISC 14 th Eq 9-30a
	$\alpha' = \frac{1}{\delta (1 + \rho)} \left[\left(\frac{t_c}{t} \right)^2 - 1 \right]$		= 1.765	AISC 14 th Eq 9-35
when $\alpha' > 1$	$Q = \left(\frac{t}{t_c} \right)^2 (1 + \delta)$		= 0.537	AISC 14 th Eq 9-34
Bolt tensile force per bolt in demand	T = from calc shown below		= 4.17 [kips]	
Tensile strength per bolt after considering prying	$\phi r_n = B \times Q$		= 13.35 [kips]	AISC 14 th Eq 9-31
	ratio = 0.31		> T	OK
Calculate Max Single Bolt Tensile Load				
For 2L clip angle, all loads to be x 0.5 for single angle				
Bolt group force	axial P = 12.50 [kips]			

