

Title Block Line 1
 You can change this area
 using the "Settings" menu item
 and then using the "Printing &
 Title Block" selection.
 Title Block Line 6

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Printed: 8 SEP 2021, 5:02PM

Wood Beam

Lic. #: KW-06009356

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 Engineering & Technical Services, Inc

DESCRIPTION: Hammer Truss Rafer -Bents B&C

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
+D+0.750Lr		1.334	1.291	0.893	
+D+0.750S		2.108	2.039	1.411	
+D+0.60W		1.118	1.081	0.748	
+D+0.750Lr+0.450W		1.752	1.695	1.172	
+D+0.750S+0.450W		2.526	2.443	1.690	
+0.60D+0.60W		0.893	0.864	0.598	
+0.60D		0.336	0.325	0.225	
Lr Only		1.032	0.998	0.690	
S Only		2.063	1.996	1.381	
W Only		0.928	0.898	0.621	

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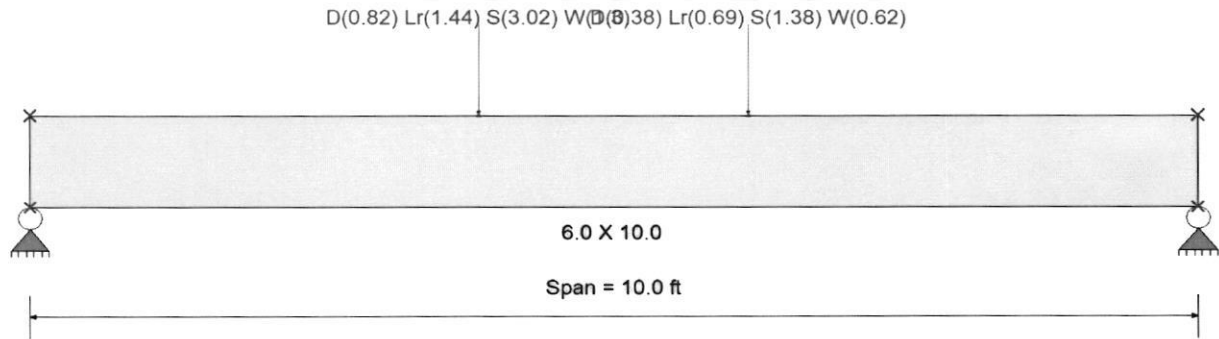
DESCRIPTION: Hammer Truss Collar Tie - Bents B&C

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
 Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1,350.0 psi	E : Modulus of Elasticity
Load Combination IBC 2018	Fb -	1,350.0 psi	Ebend- xx
	Fc - Prll	925.0 psi	Eminbend - xx
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi	
Wood Grade : No.1	Fv	170.0 psi	
	Ft	675.0 psi	Density
Beam Bracing : Completely Unbraced			31.210pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
 Point Load : D = 0.820, Lr = 1.440, S = 3.020, W = 1.30 k @ 3.849 ft
 Point Load : D = 0.380, Lr = 0.690, S = 1.380, W = 0.620 k @ 6.151 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.922	1	Maximum Shear Stress Ratio	=	0.396	: 1
Section used for this span	=	6.0 X 10.0		Section used for this span	=	6.0 X 10.0	
	=	1,420.47psi			=	77.35 psi	
	=	1,540.10psi			=	195.50 psi	
Load Combination	=	+D+S		Load Combination	=	+D+S	
Location of maximum on span	=	3.869ft		Location of maximum on span	=	0.000ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.185 in	Ratio =	649	>=360		
Max Upward Transient Deflection		0.000 in	Ratio =	0	<360		
Max Downward Total Deflection		0.239 in	Ratio =	502	>=240		
Max Upward Total Deflection		0.000 in	Ratio =	0	<240		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Max Stress Ratios									Moment Values			Shear Values						
		Span #	M	V	C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v			
D Only	Length = 10.0 ft	1	0.264	0.115	0.90	1.000	1.00	1.00	1.00	1.00	0.99	2.66	318.63	1207.63	0.00	0.00	0.00	0.00	0.00	153.00
+D+Lr	Length = 10.0 ft	1	0.508	0.218	1.25	1.000	1.00	1.00	1.00	1.00	0.99	7.08	849.72	1672.67	0.00	0.00	0.00	1.86	46.41	212.50
+D+S	Length = 10.0 ft	1	0.922	0.396	1.15	1.000	1.00	1.00	1.00	1.00	0.99	11.84	1,420.47	1540.10	0.00	0.00	0.00	3.09	77.35	195.50
+D+0.750Lr	Length = 10.0 ft	1	0.429	0.185	1.25	1.000	1.00	1.00	1.00	1.00	0.99	5.97	716.95	1672.67	0.00	0.00	0.00	1.57	39.22	212.50
+D+0.750S	Length = 10.0 ft	1	0.743	0.319	1.15	1.000	1.00	1.00	1.00	1.00	0.99	9.54	1,145.01	1540.10	0.00	0.00	0.00	2.50	62.42	195.50
+D+0.60W	Length = 10.0 ft	1	0.284	0.122	1.60	1.000	1.00	1.00	1.00	1.00	0.99	5.05	605.99	2134.61	0.00	0.00	0.00	1.33	33.20	272.00

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Wood Beam

Lic. #: KW-06009356

Engineering & Technical Services, Inc

DESCRIPTION: Hammer Truss Collar Tie - Bents B&C

Load Combination	Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values					
			M	V								M	fb	F'b	V	fv	F'v			
+D+0.750Lr+0.450W	Length = 10.0 ft	1	0.437	0.187	1.60	1.000	1.00	1.00	1.00	1.00	0.99	7.77	932.47	2134.61	0.00	0.00	0.00	2.04	50.90	272.00
+D+0.750S+0.450W	Length = 10.0 ft	1	0.637	0.272	1.60	1.000	1.00	1.00	1.00	1.00	0.99	11.34	1,360.53	2134.61	0.00	0.00	0.00	2.96	74.10	272.00
+0.60D+0.60W	Length = 10.0 ft	1	0.224	0.096	1.60	1.000	1.00	1.00	1.00	1.00	0.99	3.99	478.54	2134.61	0.00	0.00	0.00	1.05	26.15	272.00
+0.60D	Length = 10.0 ft	1	0.090	0.039	1.60	1.000	1.00	1.00	1.00	1.00	0.99	1.59	191.18	2134.61	0.00	0.00	0.00	0.42	10.58	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.2387	4.891		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.104	2.626
Overall MINimum	1.038	0.882
D Only	0.716	0.614
+D+Lr	1.867	1.593
+D+S	3.104	2.626
+D+0.750Lr	1.579	1.348
+D+0.750S	2.507	2.123
+D+0.60W	1.339	1.143
+D+0.750Lr+0.450W	2.046	1.745
+D+0.750S+0.450W	2.974	2.520
+0.60D+0.60W	1.052	0.898
+0.60D	0.429	0.369
Lr Only	1.151	0.979
S Only	2.389	2.011
W Only	1.038	0.882

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 Engineering & Technical Services, Inc

DESCRIPTION: South Side Hammer Beam - Bents B&C

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
 Load Combination Set : IBC 2018

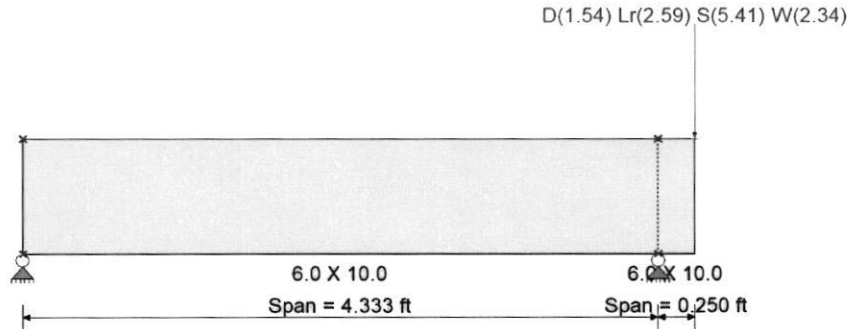
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination IBC 2018

Wood Species : Douglas Fir-Larch
 Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1,350.0 psi	E : Modulus of Elasticity	
Fb -	1,350.0 psi	Ebend-xx	1,600.0ksi
Fc - Prll	925.0 psi	Eminbend - xx	580.0ksi
Fc - Perp	625.0 psi		
Fv	170.0 psi	Density	31.210pcf
Ft	675.0 psi		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
 Load for Span Number 2

Point Load : D = 1.540, Lr = 2.590, S = 5.410, W = 2.340 k @ 0.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.135	1	Maximum Shear Stress Ratio	=	0.889	: 1
Section used for this span	=	6.0 X 10.0		Section used for this span	=	6.0 X 10.0	
	=	208.55psi			=	173.83 psi	
	=	1,547.02psi			=	195.50 psi	
Load Combination	=	+D+S		Load Combination	=	+D+S	
Location of maximum on span	=	4.333ft		Location of maximum on span	=	4.333ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.001 in	Ratio =	5378	>=	360	
Max Upward Transient Deflection		-0.004 in	Ratio =	14671	>=	360	
Max Downward Total Deflection		0.001 in	Ratio =	4256	>=	240	
Max Upward Total Deflection		-0.004 in	Ratio =	11743	>=	240	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values						
			M	V	C _d	C _{F/N}	C _i	C _r	C _m	C _t	C _L	M	f _b	F'b	V	f _v	F'v			
D Only																				
	Length = 4.333 ft	1	0.038	0.252	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.39	46.25	1211.69	0.00	0.00	0.00	1.54	38.58	153.00
	Length = 0.250 ft	2	0.038	0.252	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.39	46.25	1214.82	0.00	0.00	0.00	1.54	38.58	153.00
+D+Lr																				
	Length = 4.333 ft	1	0.074	0.486	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.03	123.95	1680.99	0.00	0.00	0.00	4.13	103.33	212.50
	Length = 0.250 ft	2	0.073	0.486	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.03	123.95	1687.15	0.00	0.00	0.00	4.13	103.33	212.50
+D+S																				
	Length = 4.333 ft	1	0.135	0.889	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.74	208.55	1547.02	0.00	0.00	0.00	6.95	173.83	195.50
	Length = 0.250 ft	2	0.134	0.889	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.74	208.55	1552.20	0.00	0.00	0.00	6.95	173.83	195.50
+D+0.750Lr																				
	Length = 4.333 ft	1	0.062	0.410	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.87	104.52	1680.99	0.00	0.00	0.00	3.49	87.14	212.50
	Length = 0.250 ft	2	0.062	0.410	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.87	104.52	1687.15	0.00	0.00	0.00	3.49	87.14	212.50

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Engineering & Technical Services, Inc

DESCRIPTION: South Side Hammer Beam - Bents B&C

Load Combination	Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values		
			M	V								M	fb	F'b	V	fv	F'v
+D+0.750S						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.109	0.716	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.40	167.97	1547.02	5.60	140.02	195.50
Length = 0.250 ft	2		0.108	0.716	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.40	167.97	1552.20	5.60	140.02	195.50
+D+0.60W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.041	0.271	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.74	88.37	2149.13	2.95	73.68	272.00
Length = 0.250 ft	2		0.041	0.271	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.74	88.37	2159.42	2.95	73.68	272.00
+D+0.750Lr+0.450W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.063	0.417	1.60	1.000	1.00	1.00	1.00	1.00	0.99	1.13	136.11	2149.13	4.54	113.47	272.00
Length = 0.250 ft	2		0.063	0.417	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.13	136.11	2159.42	4.54	113.47	272.00
+D+0.750S+0.450W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.093	0.612	1.60	1.000	1.00	1.00	1.00	1.00	0.99	1.66	199.56	2149.13	6.65	166.34	272.00
Length = 0.250 ft	2		0.092	0.612	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.66	199.56	2159.42	6.65	166.34	272.00
+0.60D+0.60W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.033	0.214	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.58	69.87	2149.13	2.33	58.25	272.00
Length = 0.250 ft	2		0.032	0.214	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.58	69.87	2159.42	2.33	58.25	272.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.013	0.085	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.23	27.75	2149.13	0.93	23.15	272.00
Length = 0.250 ft	2		0.013	0.085	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.23	27.75	2159.42	0.93	23.15	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0000	0.000	+D+S	-0.0044	2.517
	2	0.0014	0.250		0.0000	2.517

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	-0.373	7.383	
Overall MINimum	-0.061	2.475	
D Only	-0.061	1.660	
+D+Lr	-0.210	4.400	
+D+S	-0.373	7.383	
+D+0.750Lr	-0.173	3.715	
+D+0.750S	-0.295	5.952	
+D+0.60W	-0.142	3.145	
+D+0.750Lr+0.450W	-0.234	4.829	
+D+0.750S+0.450W	-0.356	7.066	
+0.60D+0.60W	-0.117	2.481	
+0.60D	-0.036	0.996	
Lr Only	-0.149	2.739	
S Only	-0.312	5.722	
W Only	-0.135	2.475	

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DESCRIPTION: North Side Hammer Beam - Bents B&C

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
 Load Combination Set : IBC 2018

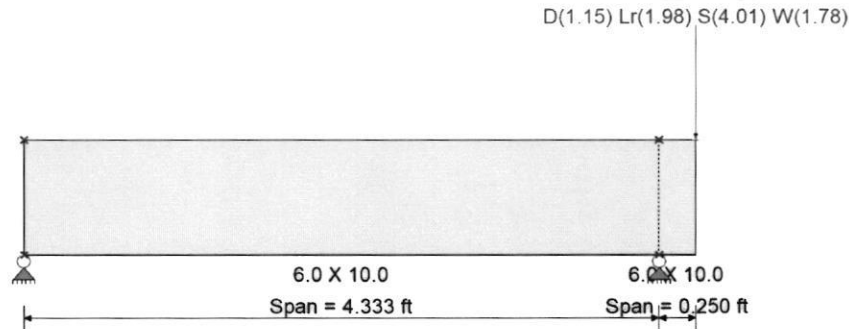
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination IBC 2018

Wood Species : Douglas Fir-Larch
 Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1,350.0 psi	E : Modulus of Elasticity	
Fb -	1,350.0 psi	Ebend- xx	1,600.0ksi
Fc - Prll	925.0 psi	Eminbend - xx	580.0ksi
Fc - Perp	625.0 psi		
Fv	170.0 psi	Density	31.210pcf
Ft	675.0 psi		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads
 Load for Span Number 2
 Point Load : D = 1.150, Lr = 1.980, S = 4.010, W = 1.780 k @ 0.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.100	1	Maximum Shear Stress Ratio	=	0.660	: 1
Section used for this span	=	6.0 X 10.0		Section used for this span	=	6.0 X 10.0	
	=	154.85psi			=	129.08 psi	
	=	1,547.02psi			=	195.50 psi	
Load Combination	=	+D+S		Load Combination	=	+D+S	
Location of maximum on span	=	4.333ft		Location of maximum on span	=	4.333ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.000 in	Ratio = 0 < 360				
Max Upward Transient Deflection		-0.003 in	Ratio = 19793 >= 360				
Max Downward Total Deflection		0.001 in	Ratio = 5766 >= 240				
Max Upward Total Deflection		-0.003 in	Ratio = 15973 >= 240				

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v	
D Only																		
	Length = 4.333 ft	1	0.029	0.188	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.29	34.55	1211.69	0.00	0.00	0.00	0.00
	Length = 0.250 ft	2	0.028	0.188	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.29	34.55	1214.82	1.15	28.83	153.00	153.00
+D+Lr																		
	Length = 4.333 ft	1	0.056	0.369	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.78	93.95	1680.99	0.00	0.00	0.00	0.00
	Length = 0.250 ft	2	0.056	0.369	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.78	93.95	1687.15	3.13	78.33	212.50	212.50
+D+S																		
	Length = 4.333 ft	1	0.100	0.660	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.29	154.85	1547.02	0.00	0.00	0.00	0.00
	Length = 0.250 ft	2	0.100	0.660	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.29	154.85	1552.20	5.16	129.08	195.50	195.50
+D+0.750Lr																		
	Length = 4.333 ft	1	0.047	0.310	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.66	79.10	1680.99	0.00	0.00	0.00	0.00
	Length = 0.250 ft	2	0.047	0.310	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.66	79.10	1687.15	2.64	65.96	212.50	212.50

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DESCRIPTION: North Side Hammer Beam - Bents B&C

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v
+D+0.750S						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.081	0.532	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.04	124.77	1547.02	4.16	104.02	195.50
Length = 0.250 ft	2		0.080	0.532	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.04	124.77	1552.20	4.16	104.02	195.50
+D+0.60W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.031	0.204	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.55	66.59	2149.13	2.22	55.53	272.00
Length = 0.250 ft	2		0.031	0.204	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.55	66.59	2159.42	2.22	55.53	272.00
+D+0.750Lr+0.450W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.048	0.316	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.86	103.13	2149.13	3.44	85.98	272.00
Length = 0.250 ft	2		0.048	0.316	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.86	103.13	2159.42	3.44	85.98	272.00
+D+0.750S+0.450W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.069	0.456	1.60	1.000	1.00	1.00	1.00	1.00	0.99	1.24	148.80	2149.13	4.96	124.04	272.00
Length = 0.250 ft	2		0.069	0.456	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.24	148.80	2159.42	4.96	124.04	272.00
+0.60D+0.60W						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.025	0.162	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.44	52.77	2149.13	1.76	44.00	272.00
Length = 0.250 ft	2		0.024	0.162	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.44	52.77	2159.42	1.76	44.00	272.00
+0.60D						1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.333 ft	1		0.010	0.064	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.17	20.73	2149.13	0.69	17.30	272.00
Length = 0.250 ft	2		0.010	0.064	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.17	20.73	2159.42	0.69	17.30	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000		-0.0033	2.517
+D+S	2	0.0010	0.250	+D+S	0.0000	2.517

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	-0.270	5.489	
Overall MINimum	-0.038	1.883	
D Only	-0.038	1.248	
+D+Lr	-0.153	3.342	
+D+S	-0.270	5.489	
+D+0.750Lr	-0.124	2.819	
+D+0.750S	-0.212	4.429	
+D+0.60W	-0.100	2.377	
+D+0.750Lr+0.450W	-0.170	3.666	
+D+0.750S+0.450W	-0.258	5.276	
+0.60D+0.60W	-0.085	1.878	
+0.60D	-0.023	0.749	
Lr Only	-0.114	2.094	
S Only	-0.231	4.241	
W Only	-0.103	1.883	

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 Title Block Line 6

Project Title:
 Engineer:
 Project ID:
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40

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Wood Beam

File: cahill.ec6

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Engineering & Technical Services, Inc

Lic. #: KW-06009356

DESCRIPTION: Tie Beam - Bents A&D

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10

Load Combination Set : IBC 2018

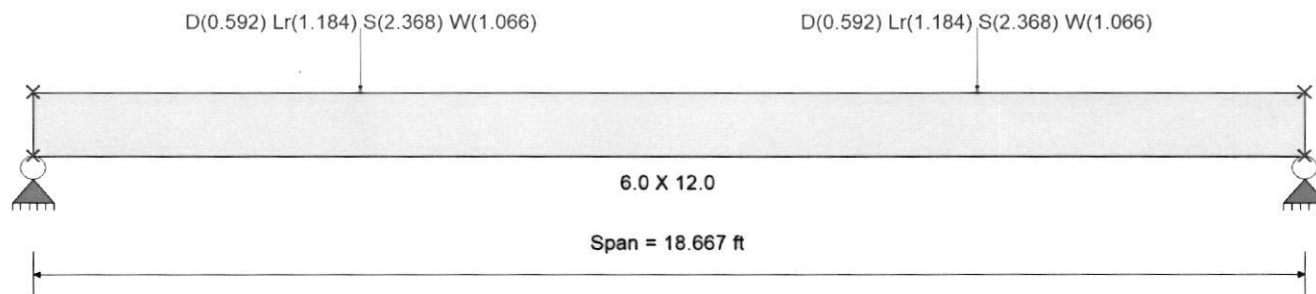
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination IBC 2018

Wood Species : Douglas Fir-Larch
 Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1350 psi	E : Modulus of Elasticity	
Fb -	1350 psi	Ebend-xx	1600ksi
Fc - Prll	925 psi	Eminbend - xx	580ksi
Fc - Perp	625 psi		
Fv	170 psi		
Ft	675 psi	Density	31.21 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads

Point Load : D = 0.5920, Lr = 1.184, S = 2.368, W = 1.066 k @ 4.802 ft

Point Load : D = 0.5920, Lr = 1.184, S = 2.368, W = 1.066 k @ 13.870 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.816	1	Maximum Shear Stress Ratio	=	0.329	: 1
Section used for this span	=	6.0 X 12.0		Section used for this span	=	6.0 X 12.0	
	=	1,240.52psi			=	64.41 psi	
	=	1,519.93psi			=	195.50 psi	
Load Combination	=	+D+S		Load Combination	=	+D+S	
Location of maximum on span	=	9.265ft		Location of maximum on span	=	17.713ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.568 in	Ratio =	394	>=	360	
Max Upward Transient Deflection		0.000 in	Ratio =	0	<	360	
Max Downward Total Deflection		0.741 in	Ratio =	302	>=	240	
Max Upward Total Deflection		0.000 in	Ratio =	0	<	240	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values					
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	f _b	F' _b	V	f _v	F' _v			
D Only	Length = 18.667 ft	1	0.245	0.098	0.90	1.000	1.00	1.00	1.00	1.00	0.98	3.52	293.42	1196.50	0.00	0.00	0.00	0.72	15.06	153.00
+D+Lr	Length = 18.667 ft	1	0.465	0.187	1.25	1.000	1.00	1.00	1.00	1.00	0.98	9.20	766.97	1647.78	0.00	0.00	0.00	1.91	39.73	212.50
+D+S	Length = 18.667 ft	1	0.816	0.329	1.15	1.000	1.00	1.00	1.00	1.00	0.98	14.89	1,240.52	1519.93	0.00	0.00	0.00	3.09	64.41	195.50
+D+0.750Lr	Length = 18.667 ft	1	0.394	0.158	1.25	1.000	1.00	1.00	1.00	1.00	0.98	7.78	648.58	1647.78	0.00	0.00	0.00	1.61	33.57	212.50
+D+0.750S	Length = 18.667 ft	1	0.660	0.266	1.15	1.000	1.00	1.00	1.00	1.00	0.98	12.04	1,003.74	1519.93	0.00	0.00	0.00	2.50	52.07	195.50
+D+0.60W	Length = 18.667 ft	1	0.263	0.104	1.60	1.000	1.00	1.00	1.00	1.00	0.98	6.59	549.23	2086.90	0.00	0.00	0.00	1.36	28.39	272.00

Title Block Line 1
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 Title Block Line 6

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Beam

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Engineering & Technical Services, Inc

DESCRIPTION: Tie Beam - Bents A&D

Load Combination Segment Length	Span #	Max Stress Ratios		C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	Moment Values			Shear Values			
		M	V								M	fb	F'b	V	fv	Fv	
+D+0.750Lr+0.450W Length = 18.667 ft	1	0.403	0.160	1.60	1.000	1.00	1.00	1.00	1.00	0.97	10.09	840.44	2086.90	0.00	2.09	43.56	272.00
+D+0.750S+0.450W Length = 18.667 ft	1	0.573	0.228	1.60	1.000	1.00	1.00	1.00	1.00	0.97	14.35	1,195.60	2086.90	0.00	2.98	62.07	272.00
+0.60D+0.60W Length = 18.667 ft	1	0.207	0.082	1.60	1.000	1.00	1.00	1.00	1.00	0.97	5.18	431.86	2086.90	0.00	1.07	22.37	272.00
+0.60D Length = 18.667 ft	1	0.084	0.033	1.60	1.000	1.00	1.00	1.00	1.00	0.97	2.11	176.05	2086.90	0.00	0.43	9.04	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.7405	9.333		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.105	3.106
Overall MINimum	1.066	1.066
D Only	0.737	0.738
+D+Lr	1.921	1.922
+D+S	3.105	3.106
+D+0.750Lr	1.625	1.626
+D+0.750S	2.513	2.514
+D+0.60W	1.377	1.378
+D+0.750Lr+0.450W	2.105	2.106
+D+0.750S+0.450W	2.993	2.994
+0.60D+0.60W	1.082	1.082
+0.60D	0.442	0.443
Lr Only	1.184	1.184
S Only	2.367	2.369
W Only	1.066	1.066

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Wood Beam

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Engineering & Technical Services, Inc

DESCRIPTION: Purlins

Load Combination	Segment Length	Span #	Max Stress Ratios		Moment Values							Shear Values					
			M	V	C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	M	f _b	F'b	V	f _v	F'v
+D+0.750S+0.450W	Length = 12.0 ft	1	0.231	0.092	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.30	649.91	2808.00	0.40	24.91	272.00
														0.00	0.00	0.00	0.00
+0.60D+0.60W	Length = 12.0 ft	1	0.328	0.130	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.84	919.91	2808.00	0.56	35.25	272.00
														0.00	0.00	0.00	0.00
+0.60D	Length = 12.0 ft	1	0.121	0.048	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.68	340.21	2808.00	0.21	13.04	272.00
														0.00	0.00	0.00	0.00
	Length = 12.0 ft	1	0.048	0.019	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.27	136.09	2808.00	0.08	5.22	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.4286	6.044		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.631	0.631
Overall MINimum	0.227	0.227
D Only	0.151	0.151
+D+Lr	0.391	0.391
+D+S	0.631	0.631
+D+0.750Lr	0.331	0.331
+D+0.750S	0.511	0.511
+D+0.60W	0.287	0.287
+D+0.750Lr+0.450W	0.433	0.433
+D+0.750S+0.450W	0.613	0.613
+0.60D+0.60W	0.227	0.227
+0.60D	0.091	0.091
Lr Only	0.240	0.240
S Only	0.480	0.480
W Only	0.227	0.227

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 Engineer:
 Project ID:
 Project Descr:

Wood Beam

File: cahill.ec6

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Engineering & Technical Services, Inc

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DESCRIPTION: Gable Purlins

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
 Load Combination Set : IBC 2018

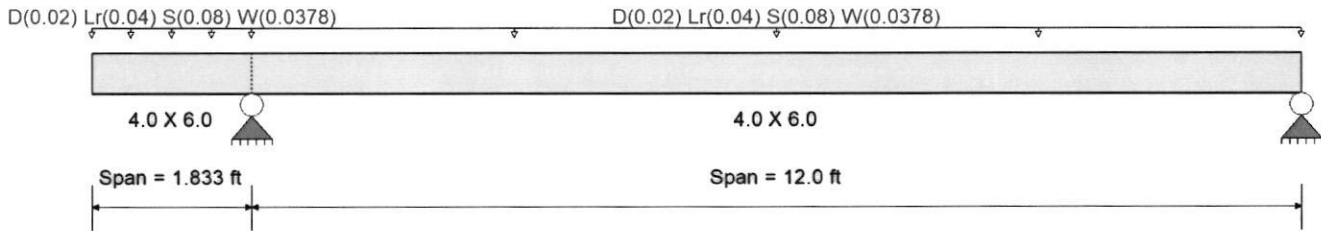
Material Properties

Analysis Method : Allowable Stress Design
 Load Combination IBC 2018

Wood Species : Douglas Fir-Larch
 Wood Grade : No.1

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	1,350.0 psi	E : Modulus of Elasticity	
Fb -	1,350.0 psi	Ebend-xx	1,600.0ksi
Fc - Prll	925.0 psi	Eminbend - xx	580.0ksi
Fc - Perp	625.0 psi		
Fv	170.0 psi		
Ft	675.0 psi	Density	31.210pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loads

Load for Span Number 1

Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.01890 ksf, Tributary Width = 2.0 ft

Load for Span Number 2

Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.01890 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design N.G.

Maximum Bending Stress Ratio	=	0.447	1	Maximum Shear Stress Ratio	=	0.191	1
Section used for this span	=	4.0 X 6.0		Section used for this span	=	4.0 X 6.0	
	=	903.11 psi			=	37.29 psi	
	=	2,018.25 psi			=	195.50 psi	
Load Combination	=	+D+S		Load Combination	=	+D+S	
Location of maximum on span	=	6.168 ft		Location of maximum on span	=	1.833 ft	
Span # where maximum occurs	=	Span # 2		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.309 in	Ratio =	466	>=	360	
Max Upward Transient Deflection		-0.142 in	Ratio =	310	<	360	
Max Downward Total Deflection		0.406 in	Ratio =	354	>=	240	
Max Upward Total Deflection		-0.187 in	Ratio =	234	<	240	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values				
			M	V	C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v	
D Only																		
	Length = 1.833 ft	1	0.013	0.058	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.04	21.18	1579.50	0.00	0.00	0.00	0.00
	Length = 12.0 ft	2	0.137	0.058	0.90	1.300	1.00	1.00	1.00	1.00	1.00	0.43	216.35	1579.50	0.14	8.93	153.00	153.00
+D+Lr																		
	Length = 1.833 ft	1	0.025	0.109	1.25	1.300	1.00	1.00	1.00	1.00	1.00	0.11	54.79	2193.75	0.37	23.11	212.50	0.00
	Length = 12.0 ft	2	0.255	0.109	1.25	1.300	1.00	1.00	1.00	1.00	1.00	1.12	559.73	2193.75	0.37	23.11	212.50	0.00
+D+S																		
	Length = 1.833 ft	1	0.044	0.191	1.15	1.300	1.00	1.00	1.00	1.00	1.00	0.18	88.40	2018.25	0.60	37.29	195.50	0.00
	Length = 12.0 ft	2	0.447	0.191	1.15	1.300	1.00	1.00	1.00	1.00	1.00	1.81	903.11	2018.25	0.60	37.29	195.50	0.00
+D+0.750Lr																		
						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00

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 Title Block Line 6

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Beam

File: cahill.ec6

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Engineering & Technical Services, Inc

DESCRIPTION: Gable Purlins

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values			
			M	V	C _d	C _{FV}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v
	Length = 1.833 ft	1	0.021	0.092	1.25	1.300	1.00	1.00	1.00	1.00	1.00	0.09	46.38	2193.75	0.31	19.56	212.50
	Length = 12.0 ft	2	0.216	0.092	1.25	1.300	1.00	1.00	1.00	1.00	1.00	0.95	473.88	2193.75	0.31	19.56	212.50
+D+0.750S						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.035	0.154	1.15	1.300	1.00	1.00	1.00	1.00	1.00	0.14	71.59	2018.25	0.48	30.20	195.50
	Length = 12.0 ft	2	0.362	0.154	1.15	1.300	1.00	1.00	1.00	1.00	1.00	1.46	731.42	2018.25	0.48	30.20	195.50
+D+0.60W						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.014	0.062	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.08	40.23	2808.00	0.27	16.97	272.00
	Length = 12.0 ft	2	0.146	0.062	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.82	411.04	2808.00	0.27	16.97	272.00
+D+0.750Lr+0.450W						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.022	0.094	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.12	60.68	2808.00	0.41	25.59	272.00
	Length = 12.0 ft	2	0.221	0.094	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.24	619.91	2808.00	0.41	25.59	272.00
+D+0.750S+0.450W						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.031	0.133	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.17	85.88	2808.00	0.58	36.23	272.00
	Length = 12.0 ft	2	0.312	0.133	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.75	877.45	2808.00	0.58	36.23	272.00
+0.60D+0.60W						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.011	0.049	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.06	31.76	2808.00	0.21	13.40	272.00
	Length = 12.0 ft	2	0.116	0.049	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.65	324.51	2808.00	0.21	13.40	272.00
+0.60D						1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
	Length = 1.833 ft	1	0.005	0.020	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.03	12.71	2808.00	0.09	5.36	272.00
	Length = 12.0 ft	2	0.046	0.020	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.26	129.81	2808.00	0.09	5.36	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0000	0.000	+D+S	-0.1866	0.000
	2	0.4057	6.101		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum		0.839	0.616
Overall MINimum		0.301	0.222
D Only		0.201	0.148
+D+Lr		0.520	0.382
+D+S		0.839	0.616
+D+0.750Lr		0.440	0.323
+D+0.750S		0.679	0.499
+D+0.60W		0.382	0.281
+D+0.750Lr+0.450W		0.576	0.423
+D+0.750S+0.450W		0.815	0.599
+0.60D+0.60W		0.301	0.222
+0.60D		0.121	0.089
Lr Only		0.319	0.234
S Only		0.638	0.469
W Only		0.301	0.222

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 Project ID:
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Wood Beam

Lic. #: KW-06009356

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Engineering & Technical Services, Inc

DESCRIPTION: Purlins at Bents B&C w/ Drift

Load Combination	Segment Length	Span #	Max Stress Ratios								Moment Values			Shear Values		
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	f _v
Length = 12.0 ft	1	0.153	0.061	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.86	430.94	2808.00	0.26	16.51	272.00
+D+0.750Lr+0.450W					1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.231	0.092	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.30	649.91	2808.00	0.40	24.91	272.00
+D+0.750S+0.450W					1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.337	0.141	1.60	1.300	1.00	1.00	1.00	1.00	1.00	1.89	947.07	2808.00	0.61	38.29	272.00
+0.60D+0.60W					1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.121	0.048	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.68	340.21	2808.00	0.21	13.04	272.00
+0.60D					1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 12.0 ft	1	0.048	0.019	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.27	136.09	2808.00	0.08	5.22	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.4471	6.000		0.0000	0.000

Vertical Reactions

Load Combination	Support notation : Far left is #1	
	Support 1	Support 2
Overall MAXimum	0.716	0.643
Overall MINimum	0.227	0.227
D Only	0.151	0.151
+D+Lr	0.391	0.391
+D+S	0.716	0.643
+D+0.750Lr	0.331	0.331
+D+0.750S	0.574	0.520
+D+0.60W	0.287	0.287
+D+0.750Lr+0.450W	0.433	0.433
+D+0.750S+0.450W	0.677	0.622
+0.60D+0.60W	0.227	0.227
+0.60D	0.091	0.091
Lr Only	0.240	0.240
S Only	0.564	0.492
W Only	0.227	0.227

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Wood Beam

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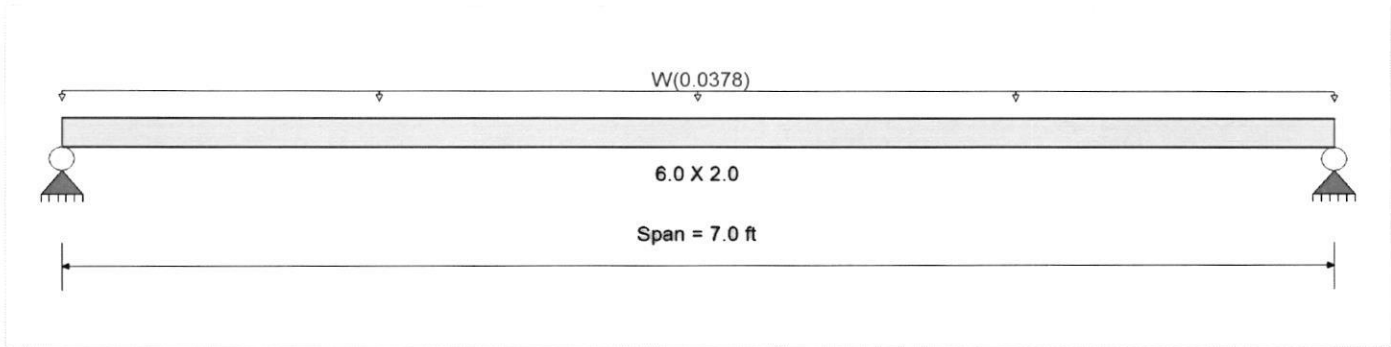
DESCRIPTION: Girts

CODE REFERENCES

Calculations per NDS 2012, IBC 2012, CBC 2013, ASCE 7-10
 Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1000 psi	E : Modulus of Elasticity	
Load Combination IBC 2018	Fb -	1000 psi	Ebend- xx	1700 ksi
Wood Species : Douglas Fir-Larch	Fc - Prll	1500 psi	Eminbend - xx	620 ksi
Wood Grade : No.1	Fc - Perp	625 psi		
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	Fv	180 psi		
	Ft	675 psi	Density	31.21 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : W = 0.01890 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.200	1	Maximum Shear Stress Ratio	=	0.033	: 1
Section used for this span	=	6.0 X 2.0		Section used for this span	=	6.0 X 2.0	
	=	416.75 psi			=	9.49 psi	
	=	2,080.00 psi			=	288.00 psi	
Load Combination	=	+0.60W		Load Combination	=	+0.60W	
Location of maximum on span	=	3.500 ft		Location of maximum on span	=	6.847 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	
Maximum Deflection							
Max Downward Transient Deflection		0.302 in	Ratio =	278	>=	240	
Max Upward Transient Deflection		0.000 in	Ratio =	0	<	240	
Max Downward Total Deflection		0.181 in	Ratio =	463	>=	240	
Max Upward Total Deflection		0.000 in	Ratio =	0	<	240	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios									Moment Values			Shear Values				
			M	V	C _d	C _{F/V}	C _i	C _r	C _m	C _t	C _L	M	fb	F'b	V	fv	F'v		
+0.60W	Length = 7.0 ft	1			0.90	1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	162.00
	Length = 7.0 ft	1	0.200	0.033	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.14	416.75	2080.00	0.08	9.49	288.00	0.00	0.00
+0.450W	Length = 7.0 ft	1			1.60	1.300	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00	0.00	0.00
	Length = 7.0 ft	1	0.150	0.025	1.60	1.300	1.00	1.00	1.00	1.00	1.00	0.10	312.56	2080.00	0.06	7.12	288.00	0.00	0.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.3021	3.526		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.132	0.132

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Wood Beam

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DESCRIPTION: Girts

Vertical Reactions	Support notation : Far left is #1		Values in KIPS
	Support 1	Support 2	
Load Combination			
Overall MINimum	0.132	0.132	
+0.60W	0.079	0.079	
+0.450W	0.060	0.060	
W Only	0.132	0.132	

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Wood Column

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Engineering & Technical Services, Inc

DESCRIPTION: SW Column - Bents A&D

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x8
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	13.5 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Douglas Fir-Larch			Exact Width	6 in Allow Stress Modification Factors
Wood Grade	No. 1			Exact Depth	8 in Cf or Cv for Bending 1.0
Fb +	1200 psi	Fv	170 psi	Area	48.0 in^2 Cf or Cv for Compression 1.0
Fb -	1200 psi	Ft	825 psi	Ix	256.0 in^4 Cf or Cv for Tension 1.0
Fc - Prll	1000 psi	Density	31.21 pcf	Iy	144.0 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	625 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1600	1600	1600 ksi	Kf : Built-up columns 1.0 <i>NDS 15.3.2</i>
	Minimum	580	580		Use Cr : Repetitive ? No

Brace condition for deflection (buckling) along columns :
 X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 13.5 ft, K = 1
 Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 13.5 ft, K = 1

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 140.445 lbs * Dead Load Factor

AXIAL LOADS . . .

Rafter: Axial Load at 13.50 ft, D = 0.3520, Lr = 0.7040, S = 1.408, W = 0.6340 k

Tie Beam: Axial Load at 13.50 ft, D = 0.740, Lr = 1.180, S = 2.370, W = 1.070 k

BENDING LOADS . . .

Lat. Uniform Load creating My-y, W = 0.1130 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2231 : 1**
 Load Combination +D+0.60W
 Governing NDS Formula **Comp + Myy, NDS Eq. 3.9-3**
 Location of max. above base **6.795 ft**
 At maximum location values are . . .
 Applied Axial **2.255 k**
 Applied Mx **0.0 k-ft**
 Applied My **1.545 k-ft**
 Fc : Allowable **586.20 psi**

Maximum SERVICE Lateral Load Reactions . .
 Top along Y-Y **0.0 k** Bottom along Y-Y **0.0 k**
 Top along X-X **0.7628 k** Bottom along X-X **0.7628 k**

Maximum SERVICE Load Lateral Deflections . . .
 Along Y-Y **0.0 in** at **0.0 ft** above base
 for load combination : n/a
 Along X-X **0.3705 in** at **6.795 ft** above base
 for load combination : W Only

Other Factors used to calculate allowable stresses . . .
 Bending Compression Tension

PASS Maximum Shear Stress Ratio = **0.05258 : 1**
 Load Combination +D+0.60W
 Location of max. above base **0.0 ft**
 Applied Design Shear **14.302 psi**
 Allowable Shear **272.0 psi**

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.573	0.04979	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+Lr	1.250	0.450	0.1155	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+S	1.150	0.480	0.1891	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750Lr	1.250	0.450	0.09805	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750S	1.150	0.480	0.1534	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.60W	1.600	0.366	0.2231	PASS	6.795 ft	0.05258	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.366	0.1839	PASS	6.705 ft	0.03943	PASS	0.0 ft
+D+0.750S+0.450W	1.600	0.366	0.2078	PASS	6.705 ft	0.03943	PASS	0.0 ft

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 Title Block Line 6

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Wood Column

Lic. #: KW-06009356

DESCRIPTION: SW Column - Bents A&D

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+0.60D+0.60W	1.600	0.366	0.2170	PASS	6.795 ft	0.05258	PASS	0.0 ft
+0.60D	1.600	0.366	0.02628	PASS	0.0 ft	0.0	PASS	13.50 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only						1.232				
+D+Lr						3.116				
+D+S						5.010				
+D+0.750Lr						2.645				
+D+0.750S						4.066				
+D+0.60W	0.458	0.458				2.255				
+D+0.750Lr+0.450W	0.343	0.343				3.412				
+D+0.750S+0.450W	0.343	0.343				4.833				
+0.60D+0.60W	0.458	0.458				1.762				
+0.60D						0.739				
Lr Only						1.884				
S Only						3.778				
W Only	0.763	0.763				1.704				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Max. Y-Y Deflection	
	Distance	Distance	Distance	Distance
D Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750S	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W	0.2223 in	6.795 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.450W	0.1667 in	6.795 ft	0.0000 in	0.000 ft
+D+0.750S+0.450W	0.1667 in	6.795 ft	0.0000 in	0.000 ft
+0.60D+0.60W	0.2223 in	6.795 ft	0.0000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.0000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
S Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
W Only	0.3705 in	6.795 ft	0.0000 in	0.000 ft

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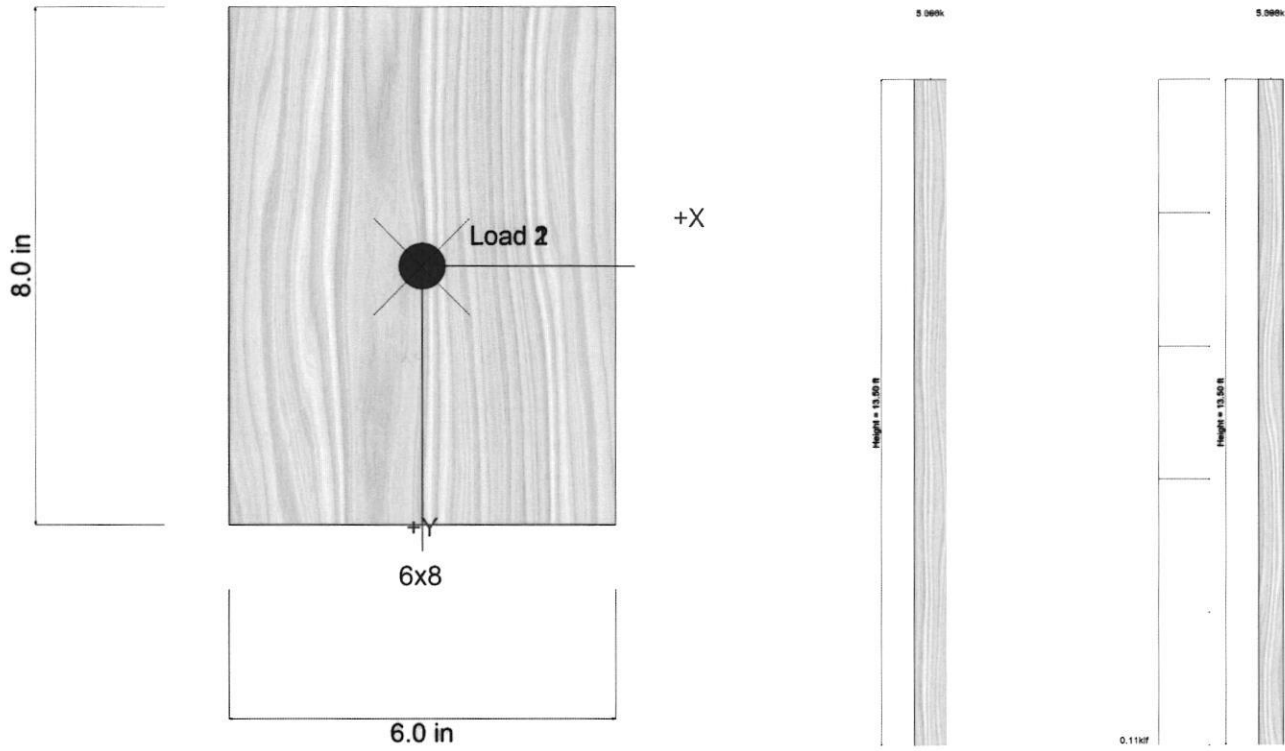
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Engineer:
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Project Descr:

Wood Column

Lic. #: KW-06009356

DESCRIPTION: SW Column - Bents A&D

Sketches



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Wood Column

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DESCRIPTION: SW Column w/ Dormer - Bents B&C

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x8
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	13.5 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Douglas Fir-Larch			Exact Width	6.0 in Allow Stress Modification Factors
Wood Grade	No.1			Exact Depth	8.0 in Cf or Cv for Bending 1.0
Fb +	1,200.0 psi	Fv	170.0 psi	Area	48.0 in^2 Cf or Cv for Compression 1.0
Fb -	1,200.0 psi	Ft	825.0 psi	lx	256.0 in^4 Cf or Cv for Tension 1.0
Fc - Prll	1,000.0 psi	Density	31.210 pcf	ly	144.0 in^4 Cm : Wet Use Factor 1.0
Fc - Perp	625.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1,600.0	1,600.0	1,600.0 ksi	Kf : Built-up columns 1.0 <i>NDS 15.3.2</i>
	Minimum	580.0	580.0		Use Cr : Repetitive ? No

Brace condition for deflection (buckling) along columns :
 X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 13.5 ft, K = 1
 Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 13.5 ft, K = 1

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 140.445 lbs * Dead Load Factor

AXIAL LOADS . . .

Hammer Truss Rafter: Axial Load at 13.50 ft, D = 0.490, Lr = 0.880, S = 1.830, W = 0.790 k
 Hammer Beam: Axial Load at 13.50 ft, D = 1.660, Lr = 2.740, S = 5.720, W = 2.480 k
 Dormer Rafter: Axial Load at 13.50 ft, D = 0.450, Lr = 0.80, S = 1.60, W = 0.720 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.1130 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.4487 : 1	Maximum SERVICE Lateral Load Reactions . .
Load Combination	+D+S	Top along Y-Y 0.7628 k Bottom along Y-Y 0.7628 k
Governing NDS Formula	Comp Only, fc/Fc'	Top along X-X 0.0 k Bottom along X-X 0.0 k
Location of max.above base	0.0 ft	Maximum SERVICE Load Lateral Deflections . . .
At maximum location values are . . .		Along Y-Y 0.2084 in at 6.795 ft above base
Applied Axial	11.890 k	for load combination : W Only
Applied Mx	0.0 k-ft	Along X-X 0.0 in at 0.0 ft above base
Applied My	0.0 k-ft	for load combination : n/a
Fc : Allowable	552.05 psi	Other Factors used to calculate allowable stresses . . .
		Bending Compression Tension
PASS Maximum Shear Stress Ratio =	0.05258 : 1	
Load Combination	+D+0.60W	
Location of max.above base	0.0 ft	
Applied Design Shear	14.302 psi	
Allowable Shear	272.0 psi	

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.573	0.1107	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+Lr	1.250	0.450	0.2654	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+S	1.150	0.480	0.4487	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750Lr	1.250	0.450	0.2244	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750S	1.150	0.480	0.3624	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.60W	1.600	0.366	0.2012	PASS	6.795 ft	0.05258	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.366	0.2794	PASS	6.705 ft	0.03943	PASS	0.0 ft

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Wood Column

Lic. #: KW-06009356

Engineering & Technical Services, Inc

DESCRIPTION: SW Column w/ Dormer - Bents B&C

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+D+0.750S+0.450W	1.600	0.366	0.4055	PASS	6.705 ft	0.03943	PASS	0.0 ft
+0.60D+0.60W	1.600	0.366	0.1850	PASS	6.705 ft	0.05258	PASS	0.0 ft
+0.60D	1.600	0.366	0.05844	PASS	0.0 ft	0.0	PASS	13.50 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top	@ Base	@ Top
D Only						2.740				
+D+Lr						7.160				
+D+S						11.890				
+D+0.750Lr						6.055				
+D+0.750S						9.603				
+D+0.60W				0.458	0.458	5.134				
+D+0.750Lr+0.450W				0.343	0.343	7.851				
+D+0.750S+0.450W				0.343	0.343	11.398				
+0.60D+0.60W				0.458	0.458	4.038				
+0.60D						1.644				
Lr Only						4.420				
S Only						9.150				
W Only				0.763	0.763	3.990				

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Distance	Max. Y-Y Deflection		Distance
	in	ft		in	ft	
D Only	0.0000	0.000	0.000	0.0000	0.000	0.000
+D+Lr	0.0000	0.000	0.000	0.0000	0.000	0.000
+D+S	0.0000	0.000	0.000	0.0000	0.000	0.000
+D+0.750Lr	0.0000	0.000	0.000	0.0000	0.000	0.000
+D+0.750S	0.0000	0.000	0.000	0.0000	0.000	0.000
+D+0.60W	0.0000	0.000	0.000	0.1250	0.000	6.795
+D+0.750Lr+0.450W	0.0000	0.000	0.000	0.0938	0.000	6.795
+D+0.750S+0.450W	0.0000	0.000	0.000	0.0938	0.000	6.795
+0.60D+0.60W	0.0000	0.000	0.000	0.1250	0.000	6.795
+0.60D	0.0000	0.000	0.000	0.0000	0.000	0.000
Lr Only	0.0000	0.000	0.000	0.0000	0.000	0.000
S Only	0.0000	0.000	0.000	0.0000	0.000	0.000
W Only	0.0000	0.000	0.000	0.2084	0.000	6.795

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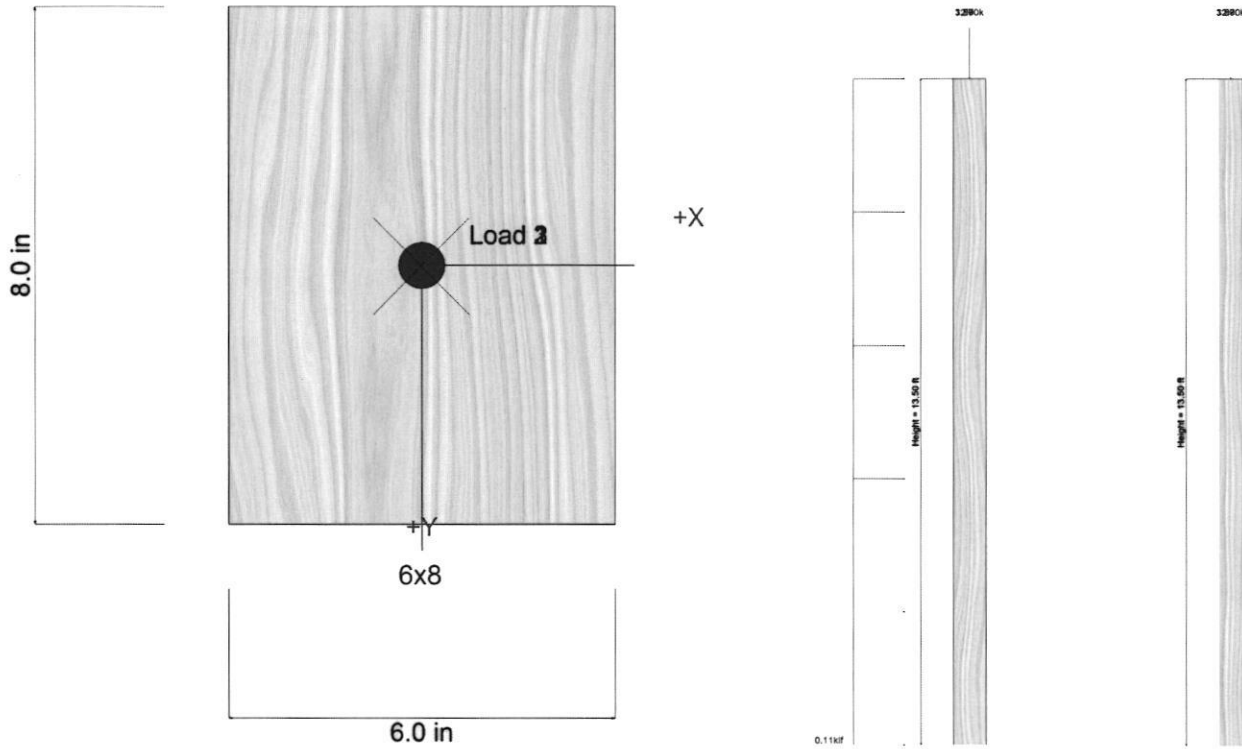
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Engineering & Technical Services, Inc

Wood Column

Lic. #: KW-06009356

DESCRIPTION: SW Column w/ Dormer - Bents B&C

Sketches



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 Project ID:
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Engineering & Technical Services, Inc

Wood Column

Lic. #: KW-06009356

DESCRIPTION: SW Column - Bents B&C

Code References

Calculations per 2012 NDS, IBC 2012, CBC 2013, ASCE 7-10
 Load Combinations Used : IBC 2018

General Information

Analysis Method :	Allowable Stress Design			Wood Section Name	6x8
End Fixities	Top & Bottom Pinned			Wood Grading/Manuf.	Graded Lumber
Overall Column Height	13.5 ft			Wood Member Type	Sawn
<i>(Used for non-slender calculations)</i>					
Wood Species	Douglas Fir-Larch			Exact Width	6.0 in Allow Stress Modification Factors
Wood Grade	No.1			Exact Depth	8.0 in Cf or Cv for Bending 1.0
Fb +	1,200.0 psi	Fv	170.0 psi	Area	48.0 in ² Cf or Cv for Compression 1.0
Fb -	1,200.0 psi	Ft	825.0 psi	Ix	256.0 in ⁴ Cf or Cv for Tension 1.0
Fc - Prll	1,000.0 psi	Density	31.210 pcf	Iy	144.0 in ⁴ Cm : Wet Use Factor 1.0
Fc - Perp	625.0 psi				Ct : Temperature Factor 1.0
E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial		Cfu : Flat Use Factor 1.0
	Basic	1,600.0	1,600.0	1,600.0 ksi	Kf : Built-up columns 1.0 <i>NDS 15.3.2</i>
	Minimum	580.0	580.0		Use Cr : Repetitive ? No
Brace condition for deflection (buckling) along columns :					
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 13.5 ft, K = 1					
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 13.5 ft, K = 1					

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 140.445 lbs * Dead Load Factor

AXIAL LOADS . . .

Hammer Truss Rafter: Axial Load at 13.50 ft, D = 0.560, Lr = 1.030, S = 2.060, W = 0.930 k

Hammer Beam: Axial Load at 13.50 ft, D = 1.250, Lr = 2.090, S = 4.240, W = 1.880 k

BENDING LOADS . . .

Lat. Uniform Load creating Mx-x, W = 0.1130 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio =	0.3114 : 1	Maximum SERVICE Lateral Load Reactions . .
Load Combination	+D+S	Top along Y-Y 0.7628 k Bottom along Y-Y 0.7628 k
Governing NDS Formula	Comp Only, fc/Fc'	Top along X-X 0.0 k Bottom along X-X 0.0 k
Location of max. above base	0.0 ft	Maximum SERVICE Load Lateral Deflections . . .
At maximum location values are . . .		Along Y-Y 0.2084 in at 6.795 ft above base
Applied Axial	8.250 k	for load combination : W Only
Applied Mx	0.0 k-ft	Along X-X 0.0 in at 0.0 ft above base
Applied My	0.0 k-ft	for load combination : n/a
Fc : Allowable	552.05 psi	Other Factors used to calculate allowable stresses . . .
		<u>Bending</u> <u>Compression</u> <u>Tension</u>
PASS Maximum Shear Stress Ratio =	0.05258 : 1	
Load Combination	+D+0.60W	
Location of max. above base	0.0 ft	
Applied Design Shear	14.302 psi	
Allowable Shear	272.0 psi	

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
D Only	0.900	0.573	0.07880	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+Lr	1.250	0.450	0.1879	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+S	1.150	0.480	0.3114	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750Lr	1.250	0.450	0.1590	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.750S	1.150	0.480	0.2519	PASS	0.0 ft	0.0	PASS	13.50 ft
+D+0.60W	1.600	0.366	0.1798	PASS	6.795 ft	0.05258	PASS	0.0 ft
+D+0.750Lr+0.450W	1.600	0.366	0.1978	PASS	6.705 ft	0.03943	PASS	0.0 ft
+D+0.750S+0.450W	1.600	0.366	0.2826	PASS	6.705 ft	0.03943	PASS	0.0 ft

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Wood Column

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 Engineering & Technical Services, Inc

DESCRIPTION: SW Column - Bents B&C

Load Combination Results

Load Combination	C _D	C _P	Maximum Axial + Bending Stress Ratios			Maximum Shear Ratios		
			Stress Ratio	Status	Location	Stress Ratio	Status	Location
+0.60D+0.60W	1.600	0.366	0.1710	PASS	6.795 ft	0.05258	PASS	0.0 ft
+0.60D	1.600	0.366	0.04159	PASS	0.0 ft	0.0	PASS	13.50 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction		k	Y-Y Axis Reaction		Axial Reaction	My - End Moments		k-ft	Mx - End Moments	
	@ Base	@ Top		@ Base	@ Top		@ Base	@ Top		@ Base	@ Top
D Only						1.950					
+D+Lr						5.070					
+D+S						8.250					
+D+0.750Lr						4.290					
+D+0.750S						6.675					
+D+0.60W				0.458	0.458	3.636					
+D+0.750Lr+0.450W				0.343	0.343	5.555					
+D+0.750S+0.450W				0.343	0.343	7.940					
+0.60D+0.60W				0.458	0.458	2.856					
+0.60D						1.170					
Lr Only						3.120					
S Only						6.300					
W Only				0.763	0.763	2.810					

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection		Max. Y-Y Deflection	
	Distance	Distance	Distance	Distance
D Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750S	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W	0.0000 in	0.000 ft	0.1250 in	6.795 ft
+D+0.750Lr+0.450W	0.0000 in	0.000 ft	0.0938 in	6.795 ft
+D+0.750S+0.450W	0.0000 in	0.000 ft	0.0938 in	6.795 ft
+0.60D+0.60W	0.0000 in	0.000 ft	0.1250 in	6.795 ft
+0.60D	0.0000 in	0.000 ft	0.0000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
S Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
W Only	0.0000 in	0.000 ft	0.2084 in	6.795 ft

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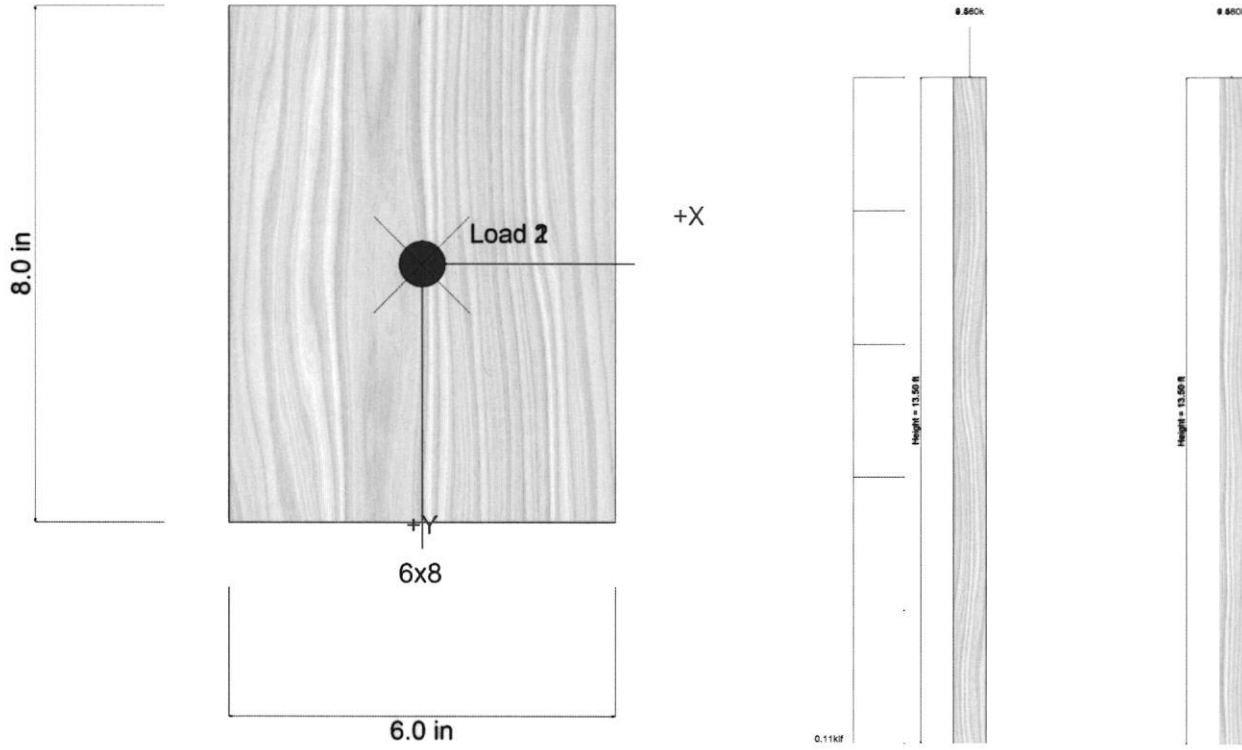
Wood Column

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DESCRIPTION: SW Column - Bents B&C

Sketches



Engineering & Technical Services, Inc. 27121 469th Ave / PO Box 308 Tea, SD 57064-8100 Phone: (605) 498-1290 Fax: (605) 498-1299	Client:	Legacy Post & Beam	Job #:	CCA0621	59
	Job Name:	Lawson Entertaining Barn	Date:	9/30/2021	
	Location:	Glenelg, MD	Designed by:	CMN	

Footing Design

Frostwall @ Column B&C w/ Dormer (P value from P. 54)

P = 11890 #
 11890 # / 1500 psf = 7.927 ft
 Frost Wall = 4 ft x 2 ft x 2 = 16.00 sqft → Okay

Frostwall @ Column A (P value from P. 51)

P = 5010 #
 5010 # / 1500 psf = 3.34 ft
 Frost Wall = 4 ft x 2 ft x 2 = 16.00 sqft → Okay

Frostwall @ Column B&C (P value from P. 57)

P = 8250 #
 8250 # / 1500 psf = 5.5 ft
 Frost Wall = 4 ft x 2 ft x 2 = 16.00 sqft → Okay

shall be permitted to be used to resist seismic and wind forces. The size and spacing of fasteners at shear wall boundaries, panel edges, and intermediate supports shall be as provided in Table 4.3A. The shear wall shall be constructed as follows:

1. Panels shall not be less than 4' x 8', except at boundaries and changes in framing. Framing members or blocking shall be provided at the edges of all panels.
2. Nails located at least 3/8" from edges and ends of panels. Maximum nail spacing of 6" on center at panel edges. Maximum nail spacing of 6" on center along intermediate framing members for 3/8" and 7/16" panels installed on studs spaced 24" on center. Maximum nail spacing along intermediate framing of 12" for thicker panels or closer stud spacings.
3. 2" nominal or wider framing thickness at adjoining panel edges except that 3" nominal or wider framing thickness and staggered nailing are required where:
 - a. Nails are spaced 2" on center or less at adjoining panel edges, or
 - b. 10d nails having penetration into framing of more than 1-1/2" are spaced 3" on center, or less at adjoining panel edges, or
 - c. Required nominal unit shear capacity exceeds 700 plf in seismic Design Category D, E, or F.
4. Maximum stud spacing of 24" on center.
5. Wood structural panels shall conform to the requirements for its type in DOC PS 1 or PS 2.

4.3.7.2 Particleboard Shear Walls: Shear walls sheathed with particleboard sheathing shall be permitted to be used to resist wind forces and seismic forces in Seismic Design Categories A, B, and C. The size and spacing of fasteners at shear wall boundaries, panel edges, and intermediate supports shall be as provided in Table 4.3A. The shear wall shall be constructed as follows:

1. Panels shall not be less than 4' x 8', except at boundaries and changes in framing. Framing members or blocking shall be provided at the edges of all panels.
2. Nails located at least 3/8" from edges and ends of panels. Maximum nail spacing of 6" on center along intermediate framing members for 3/8" panels installed on studs spaced 24" on center. Maximum nail spacing along intermediate framing of 12" on center for thicker panels or closer stud spacings.

3. 2" nominal or wider framing thickness at adjoining panel edges except that 3" nominal or wider framing thickness and staggered nailing are required where:
 - a. Nails are spaced 2" on center or less at adjoining panel edges, or
 - b. 10d nails having penetration into framing of more than 1-1/2" are spaced 3" on center, or less at adjoining panel edges.
4. Maximum stud spacing of 24" on center.
5. Particleboard shall conform to ANSI A208.1.

4.3.7.3 Fiberboard Shear Walls: Shear walls sheathed with fiberboard sheathing shall be permitted to be used to resist wind forces and seismic forces in Seismic Design Categories A, B, and C. The size and spacing of fasteners at shear wall boundaries, panel edges, and intermediate supports shall be as provided in Table 4.3A. The shear wall shall be constructed as follows:

1. Panels shall not be less than 4' x 8', except at boundaries and changes in framing. Framing members or blocking shall be provided at the edges of all panels.
2. Nails located at least 3/8" from edges and ends of panels. Maximum nail spacing of 6" on center along intermediate framing members.
3. 2" nominal or wider framing at adjoining panel edges.
4. Maximum stud spacing of 16" on center.
5. Minimum length of galvanized roofing nails is 1-1/2" for 1/2" thick sheathing and 1-3/4" for 25/32" thick sheathing.
6. Fiberboard sheathing shall conform to either AHA 194.1 or ASTM C 208.

4.3.7.4 Gypsum Wallboard, Gypsum Veneer Base, Water-Resistant Backing Board, Gypsum Sheathing, Gypsum Lath and Plaster, or Portland Cement Plaster Shear Walls: Shear walls sheathed with gypsum wallboard, gypsum veneer base, water-resistant backing board, gypsum sheathing, gypsum lath and plaster, or portland cement plaster shall be permitted to be used to resist wind forces and seismic forces in Seismic Design Categories A through D. End joints of adjacent courses of gypsum wallboard or sheathing shall not occur over the same stud. The size and spacing of fasteners at shear wall boundaries, panel edges, and intermediate supports shall be as provided in Table 4.3B. Nails shall be spaced not less than 3/8" from edges and ends of panels. Wood framing shall be 2" nominal or wider.

4.3.7.4.1 Gypsum Wallboard, Gypsum Veneer Base, Water-Resistant Gypsum Backing Board: Gyp-

G_{a2} = apparent shear wall shear stiffness for side 2, kips/in. (from Column A, Tables 4.3A, 4.3B, or 4.3C)

K_{min} = minimum ratio of v_{s1}/G_{a1} or v_{s2}/G_{a2}

v_{s1} = nominal unit shear capacity for side 1, lbs/ft (from Column A, Tables 4.3A, 4.3B, or 4.3C)

v_{s2} = nominal unit shear capacity for side 2, lbs/ft (from Column A, Tables 4.3A, 4.3B, or 4.3C)

v_{sc} = Combined nominal unit shear capacity of two-sided shear wall for seismic design, lbs/ft

4.3.3.2.2 Nominal unit shear capacities for shear walls sheathed with dissimilar materials on the same side of the wall are not cumulative. For shear walls sheathed with dissimilar materials on opposite sides, the combined nominal unit shear capacity, v_{sc} or v_{wc} , shall be either two times the smaller nominal unit shear capacity or the larger nominal unit shear capacity, whichever is greater.

Exception: For wind design, the combined nominal unit shear capacity, v_{wc} , of shear walls sheathed with a combination of wood structural panels, hardboard panel siding, or structural fiberboard on one side and gypsum wallboard on the opposite side shall equal the sum of the sheathing capacities of each side separately.

4.3.3.3 Summing Shear Wall Lines: The nominal shear capacity for shear walls in a line, utilizing shear walls sheathed with the same materials and construction, shall be permitted to be combined if the induced shear load is distributed so as to provide the same deflection, δ_{sw} , in each shear wall. Summing nominal unit shear capacities of dissimilar materials applied to the same wall line is not allowed.

4.3.3.4 Shear Capacity of Perforated Shear Walls: The nominal shear capacity of a perforated shear wall shall be taken as the nominal unit shear capacity multiplied by the sum of the shear wall segment lengths, ΣL_i , and the appropriate shear capacity adjustment factor, C_o , from Table 4.3.3.4.

4 LATERAL FORCE-RESISTING SYSTEMS

Table 4.3.3.4 Shear Capacity Adjustment Factor, C_o

Wall Height, h	Maximum Opening Height ¹				
	h/3	h/2	2h/3	5h/6	h
8' Wall	2' - 8"	4' - 0"	5' - 4"	6' - 8"	8' - 0"
10' Wall	3' - 4"	5' - 0"	6' - 8"	8' - 4"	10' - 0"
Percent Full-Height Sheathing ²	Effective Shear Capacity Ratio				
10%	1.00	0.69	0.53	0.43	0.36
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

1. The maximum opening height shall be taken as the maximum opening clear height in a perforated shear wall. Where areas above and/or below an opening remain unshathed, the height of each opening shall be defined as the clear height of the opening plus the unshathed areas.
 2. The sum of the lengths of the perforated shear wall segments divided by the total length of the perforated shear wall.

Table 4.3A Nominal Unit Shear Capacities for Wood-Frame Shear Walls^{1,3}**Wood-based Panels (Excluding Plywood for G_a)⁴**

Sheathing Material	Minimum Nominal Panel Thickness (in.)	Minimum Fastener Penetration in Framing (in.)	Fastener Type & Size	A SEISMIC								B WIND			
				Panel Edge Fastener Spacing (in.)								Panel Edge Fastener Spacing (in.)			
				6		4		3		2		6	4	3	2
v_s (plf)	G_a (kips/in.)	v_s (plf)	G_a (kips/in.)	v_s (plf)	G_a (kips/in.)	v_s (plf)	G_a (kips/in.)	v_w (plf)	v_w (plf)	v_w (plf)	v_w (plf)				
Wood Structural Panels - Structural I ^{4,5}	5/16	1-1/4	Nail (common or galvanized box) 6d	400	13.0	600	18.0	780	23.0	1020	35.0	560	840	1090	1430
	3/8 ²	1-3/8	8d	460	19.0	720	24.0	920	30.0	1220	43.0	645	1010	1290	1710
	7/16 ²			510	16.0	790	21.0	1010	27.0	1340	40.0	715	1105	1415	1875
	15/32	1-1/2	10d	560	14.0	860	18.0	1100	24.0	1460	37.0	785	1205	1540	2045
15/32	680			22.0	1020	29.0	1330	36.0	1740	51.0	950	1430	1860	2435	
Wood Structural Panels - Sheathing ^{4,5}	5/16	1-1/4	6d	360	13.0	540	18.0	700	24.0	900	37.0	505	755	980	1260
	3/8	1-3/8	8d	400	11.0	600	15.0	780	20.0	1020	32.0	560	840	1090	1430
	3/8 ²			440	17.0	640	25.0	820	31.0	1060	45.0	615	895	1150	1485
	7/16 ²	1-1/2	10d	480	15.0	700	22.0	900	28.0	1170	42.0	670	980	1260	1640
	15/32			520	13.0	760	19.0	980	25.0	1280	39.0	730	1065	1370	1790
	Plywood Siding	5/16	1-1/4	Nail (galvanized casing) 6d	280	13.0	420	16.0	550	17.0	720	21.0	390	590	770
3/8		1-3/8	8d	320	16.0	480	18.0	620	20.0	820	22.0	450	670	870	1150
Particleboard Sheathing - (M-S "Exterior Glue" and M-2 "Exterior Glue")	3/8		Nail (common or galvanized box) 6d	240	15.0	360	17.0	460	19.0	600	22.0	335	505	645	840
	3/8		8d	260	18.0	380	20.0	480	21.0	630	23.0	365	530	670	880
	1/2		10d	280	18.0	420	20.0	540	22.0	700	24.0	390	590	755	980
	1/2			370	21.0	550	23.0	720	24.0	920	25.0	520	770	1010	1290
	5/8			400	21.0	610	23.0	790	24.0	1040	26.0	560	855	1105	1455
Fiberboard Sheathing - Structural	1/2		Nail (common or galvanized roofing) 8d common or 11 ga. galv. roofing nail (0.120" x 1-1/2" long x 7/16" head)			340	4.0	460	5.0	520	5.5	475	645	730	
	25/32		8d common or 11 ga. galv. roofing nail (0.120" x 1-3/4" long x 7/16" head)			360	4.0	480	5.0	540	5.5	505	670	755	

- Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls.
- Shears are permitted to be increased to values shown for 15/32 inch sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
- For framing grades other than Douglas Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Specific Gravity of the framing lumber from the *NDS*. The Specific Gravity Adjustment Factor shall not be greater than 1.
- Apparent shear stiffness values, G_a , are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for shear walls constructed with OSB panels. When plywood panels are used, G_a values shall be determined in accordance with Appendix A.
- Where moisture content of the framing is greater than 19% at time of fabrication, G_a values shall be multiplied by 0.5.

Table 4.3B Nominal Unit Shear Capacities for Wood-Frame Shear Walls¹**Gypsum and Portland Cement Plaster**

Sheathing Material	Material Thickness	Fastener Type & Size ²	Max. Fastener Edge Spacing ³	Max. Stud Spacing		A		B
						SEISMIC		WIND
						v_s (plf)	G_s (kips/in.)	v_w (plf)
Gypsum wallboard, gypsum veneer base, or water-resistant gypsum backing board	1/2"	5d cooler (0.086" x 1-5/8" long, 15/64" head) or wallboard nail (0.086" x 1-5/8" long, 9/32" head) or 0.120" nail x 1-1/2" long, min. 3/8" head	7"	24"	unblocked	150	4.0	150
			4"	24"	unblocked	220	6.0	220
			7"	16"	unblocked	200	5.5	200
			4"	16"	unblocked	250	6.5	250
			7"	16"	blocked	250	6.5	250
			4"	16"	blocked	300	7.5	300
	No. 6 Type S or W drywall screws 1-1/4" long	8/12"	16"	unblocked	120	3.5	120	
		4/16"	16"	blocked	320	8.0	320	
		4/12"	24"	blocked	310	8.0	310	
		8/12"	16"	blocked	140	4.0	140	
		6/12"	16"	blocked	180	5.0	180	
	5/8"	6d cooler (0.092" x 1-7/8" long, 1/4" head) or wallboard nail (0.0915" x 1-7/8" long, 19/64" head) or 0.120" nail x 1-3/4" long, min. 3/8" head	7"	24"	unblocked	230	6.0	230
			4"	24"	unblocked	290	7.5	290
			7"	16"	blocked	290	7.5	290
			4"	16"	blocked	350	8.5	350
		No. 6 Type S or W drywall screws 1-1/4" long	8/12"	16"	unblocked	140	4.0	140
			8/12"	16"	blocked	180	5.0	180
5/8" (Two-Ply)	Base ply—6d cooler (0.092" x 1-7/8" long, 1/4" head) or wallboard nail (0.0915" x 1-7/8" long, 19/64" head) or 0.120" nail x 1-3/4" long, min. 3/8" head Face ply—8d cooler (0.113" x 2-3/8" long, 0.281" head) or wallboard nail (0.113" x 2-3/8" long, 3/8" head) or 0.120" nail x 2-3/8" long, min. 3/8" head	Base: 9"	16"	blocked	500	11.0	500	
		Face: 7"						
Gypsum sheathing	1/2" x 2' x 8'	0.120" nail x 1-3/4" long, 7/16" head, diamond-point, galvanized	4"	16"	unblocked	150	4.0	150
	1/2" x 4'		4"	24"	blocked	350	8.5	350
			7"	16"	unblocked	200	5.5	200
	5/8" x 4'	6d galvanized cooler (0.092" x 1-7/8" long, 1/4" head) or wallboard nail (0.0915" x 1-7/8" long, 19/64" head) or 0.120" nail x 1-3/4" long, min. 3/8" head	4/7"	16"	blocked	400	9.5	400
Gypsum lath, plain or perforated	3/8" lath and 1/2" plaster	0.092" x 1-1/8" long, 19/64" head, gypsum wallboard blued nail or 0.120" nail x 1-1/4" long, min 3/8" head	5"	16"	unblocked	200	5.5	200
Expanded metal or woven wire lath and Portland cement plaster	7/8"	0.120" nail x 1-1/2" long, 7/16" head	6"	16"	unblocked	360	9.0	360

1. Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.4.

2. Type S or W drywall screws shall conform to requirements of ASTM C 1002.

3. Where two numbers are given for maximum fastener edge spacing, the first number denotes fastener spacing at the edges and the second number denotes fastener spacing in the field.

Table 4.3C Nominal Unit Shear Capacities for Wood-Frame Shear Walls¹**Lumber Shear Walls**

Sheathing Material	Sheathing Nominal Dimensions	Type, Size, and Number of Nails per Board		A SEISMIC		B WIND
		Nailing at Intermediate Studs (nails/board/support)	Nailing at Shear Wall Boundary Members (nails/board/end)	v_s	G_a	v_w
				(plf)	(kips/in.)	(plf)
Horizontal Lumber Sheathing	1x6 & smaller	2-8d common nails (3-8d box nails)	3-8d common nails (5-8d box nails)	100	1.5	140
	1x8 & larger	3-8d common nails (4-8d box nails)	4-8d common nails (6-8d box nails)			
Diagonal Lumber Sheathing	1x6 & smaller	2-8d common nails (3-8d box nails)	3-8d common nails (5-8d box nails)	600	6.0	840
	1x8 & larger	3-8d common nails (4-8d box nails)	4-8d common nails (6-8d box nails)			
Double Diagonal Lumber Sheathing	1x6 & smaller	2-8d common nails (3-8d box nails)	3-8d common nails (5-8d box nails)	1200	10.0	1680
	1x8 & larger	3-8d common nails (4-8d box nails)	4-8d common nails (6-8d box nails)			
Vertical Lumber Siding	1x6 & smaller	2-8d common nails (3-8d box nails)	3-8d common nails (5-8d box nails)	90	1.0	125
	1x8 & larger	3-8d common nails (4-8d box nails)	4-8d common nails (6-8d box nails)			

1. Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.5 through 4.3.7.8.

CS/CMST/CMSTC/CSHP

Coiled Straps (cont.)

These products are available with additional corrosion protection. For more information, see p. 14.

SS For stainless-steel fasteners, see p. 21.

SD Many of these products are approved for installation with Strong-Drive® SD Connector screws. See pp. 348-352 for more information.

Model No.	Total L	Ga.	DF/SP		SPF/HF		Allowable Tension Loads (160)	Code Ref.
			Fasteners (in.)	End Length (in.)	Fasteners (in.)	End Length (in.)		
CMST12	40'	12	(74) 0.162 x 2½	33	(84) 0.162 x 2½	38	9,215	IBC, FL, LA
			(86) 0.148 x 2½	39	(98) 0.148 x 2½	44	9,215	
CMST14	52½'	14	(56) 0.162 x 2½	26	(66) 0.162 x 2½	30	6,475	
			(66) 0.148 x 2½	30	(76) 0.148 x 2½	34	6,475	
CMSTC16	54'	16	(50) 0.148 x 3¼	20	(58) 0.148 x 3¼	25	4,690	
CS14	100'	14	(26) 0.148 x 2½	15	(30) 0.148 x 2½	16	2,490	
			(30) 0.131 x 2½	16	(36) 0.131 x 2½	19	2,490	
SS CS16	150'	16	(20) 0.148 x 2½	11	(22) 0.148 x 2½	13	1,705	
			(22) 0.131 x 2½	13	(26) 0.131 x 2½	15	1,705	
CS20	250'	20	(12) 0.148 x 2½	7	(14) 0.148 x 2½	9	1,030	
			(14) 0.131 x 2½	9	(16) 0.131 x 2½	9	1,030	
CSHP18	75'	18	(14) 0.148 x 2½	9	(16) 0.148 x 2½	10	1,540	
			(16) 0.131 x 2½	10	(18) 0.131 x 2½	11	1,540	
CSHP20	75'	20	(12) 0.148 x 2½	8	(12) 0.148 x 2½	8	1,160	
			(12) 0.131 x 2½	8	(14) 0.131 x 2½	9	1,160	

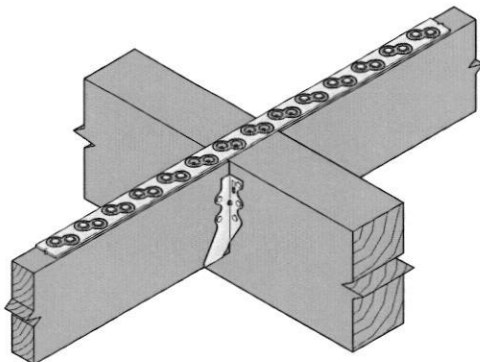
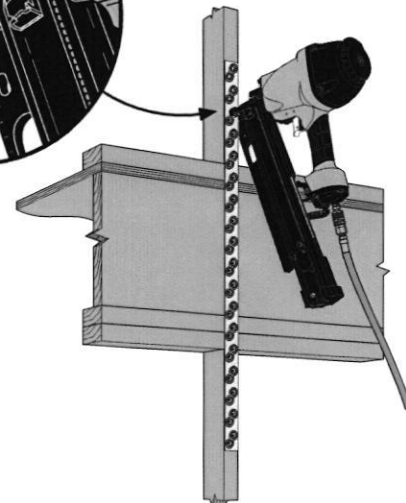
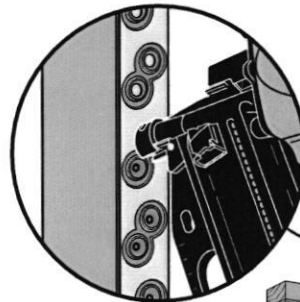
- See pp. 266-267 for Straps and Ties General Notes.
- Calculate the connector value for a reduced number of nails as follows:

$$\text{Allowable Load} = \frac{\text{No. of Nails Used}}{\text{No. of Nails in Table}} \times \text{Table Load}$$

Example: CMSTC16 in DF/SP with 40 nails total.
(Half of the nails in each member being connected)

$$\text{Allowable Load} = \frac{40 \text{ Nails (Used)}}{50 \text{ Nails (Table)}} \times 4,690 \text{ lb.} = 3,752 \text{ lb.}$$

- See p. 274 for alternate nailing and lap splice information.
- Fasteners:** Nail dimensions are listed diameter by length. See pp. 21-22 for fastener information.



Typical CSHP Installation
(CS/CMST similar)

Typical CSHP Installation