Duane Boice P.E.
President

Engineering & Technical Services Inc.

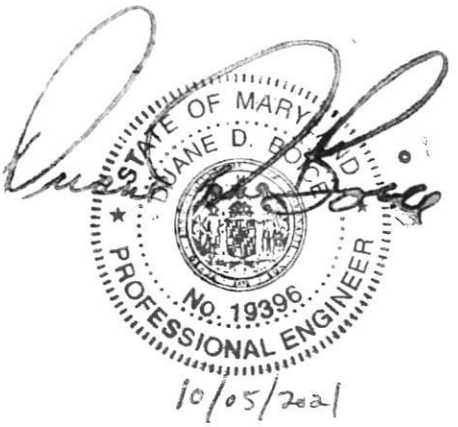
STRUCTURAL CALCULATIONS

COVER SHEET

Date: October 5, 2021

Project: Legacy Post & Beam / Lawson Entertaining Barn

Project Location: 14008 Triadelphia Road
Glenelg, MD 21737



E.T.S. Designer: Colin Nelson

Contact: Brian Wiese

Building Sizes: 20'-0" x 36'-0"

Comments:
DEISGN LOAD INFORMATION:

- **2018 INTERNATIONAL BUILDING CODE**
- **Roof Live/Snow Load: 40 PSF**
- **Ground Snow Load: 40 PSF**
- **Wind Load (Ult.) = 115 MPH EXP. 'C' (3 Second Gust)**
- **Risk Category – II**
- **Seismic Category - B**

Note: THE SEAL AFFIXED TO THIS PAGE APPLIES TO THE COMPLETE SET OF ATTACHED CALCULATIONS.

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Client:	Legacy Post & Beam	Job #:	CCA0621
Job Name:	Lawson Entertaining Barn	Date:	9/30/2021
Location:	Glenelg, MD	Designed by:	CMN

Design Criteria

Code Authority:	2018	International Building Code
Roof Dead Load:	10	PSF
Roof Snow/Live Load:	40	PSF per Howard County, MD CB13-2019
Ground Snow Load:	40	PSF per Howard County, MD CB13-2019
Wind Load:	115	MPH - (Ult) (3 Second Gust)
Exposure :	C	
Seismic Category:	B	
Imp. Cat. :	II	
Structure Type:	Fully Enclosed	

Dormer Drift Load

$$Drift\ Height\ (h_d) = 0.43\sqrt[3]{l_u}\sqrt[4]{p_g + 10} - 1.5$$

$$Drift\ Height\ (h_d) = 0.43\sqrt[3]{12}\sqrt[4]{40 + 10} - 1.5$$

$$Drift\ Height\ (h_d) = 1.12\ ft$$

$$Snow\ Density\ (\gamma) = \ 0.13p_g + 14$$

$$Snow\ Density\ (\gamma) = \ 0.13 * 40 + 14$$

$$Snow\ Density\ (\gamma) = 19.2\ pcf$$
$$\rightarrow not\ to\ exceed\ 30\ pcf$$

$$Drift\ Load = h_d\ x\ \gamma = 1.12ft\ x\ 19.2\ pcf = 21.5\ psf$$

$$Drift\ Width = 4\ x\ h_d$$

$$Drift\ Width = 4\ x\ 1.12ft = 4.48ft$$

MecaWind v2333

Calculations Prepared by:
Date: Sep 08, 2021

FileLocation :

Basic Wind Parameters

Wind Load Standard	= ASCE 7-10	Exposure Category	= C
Wind Design Speed	= 115.0 mph	Risk Category	= II
Structure Type	= Building	Building Type	= Enclosed

General Wind Settings

Incl_LF	= Include ASD Load Factor of 0.6 in Pressures	= True
DynType	= Dynamic Type of Structure	= Rigid
NF	= Natural Frequency of Structure (Mode 1)	= 1.000 Hz
Alt	= Altitude (Ground Elevation) above Sea Level	= 0.000 ft
Bdist	= Base Elevation of Structure	= 0.000 ft
SDB	= Simple Diaphragm Building	= False
Reacs	= Show the Base Reactions in the output	= False
MWFRSType	= MWFRS Method Selected	= Ch 28 Pt 1
Stories	= Number Of Stories	= 3
LFrame	= Is the building framed With Light Frame Construction	= False
FD	= Does the building have a Flexible Diaphragm	= False

Topographic Factor per Fig 26.8-1

Topo	= Topographic Feature	= None
Kzt	= Topographic Factor	= 1.000

Building Inputs

RoofType:	Building Roof Type	= Gabled	W	: Width Perp to Ridge	= 20.000 ft
L	: Length Along Ridge	= 36.000 ft	EHt	: Eave Height	= 13.500 ft
RE	: Roof Entry Method	= Slope	Slope	: Slope of Roof	= 10.0 :12
Theta	: Roof Slope	= 39.81 Deg	Par	: Is there a Parapet	= False

Exposure Constants per Table 26.9-1:

Alpha:	Const from Table 26.9-1= 9.500	Zg:	Const from Table 26.9-1= 900.000 ft
At:	Const from Table 26.9-1= 0.105	Bt:	Const from Table 26.9-1= 1.000
Am:	Const from Table 26.9-1= 0.154	Bm:	Const from Table 26.9-1= 0.650
C:	Const from Table 26.9-1= 0.200	Eps:	Const from Table 26.9-1= 0.200

Overhang Inputs:

Std	= Overhangs on all sides are the same	= True
OHType	= Type of Roof Wall Intersections	= Overhang
OH	= Overhang of Roof Beyond Wall	= 2.000 ft

Main Wind Force Resisting System (MWFRS) Calculations per Ch 28 Part 1:

EHt	= Eave Height	= 13.500 ft
RHt	= Ridge Height	= 21.833 ft
h	= Mean Roof Height: 0.5*(EHt+RHt)	= 17.667 ft
Zh	= Mean Roof Height for Kh: h + Base_Dist	= 17.667 ft
Kh	= Since 15 ft [4.572 m] < Zh < Zg --> 2.01 * (Zh/zg)^(2/Alpha)	= 0.879
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
GCPi	= Ref Table 26.11-1 for Enclosed Building	= +/-0.18
Slope	= Slope of Roof	= 39.81 Deg
LF	= Load Factor based upon ASD Design	= 0.60
qh	= (0.00256 * Kh * Kzt * Kd * V^2) * LF	= 15.17 psf

Wind Pressures for Transverse Direction per Fig 28.4-1
All wind pressures include a load factor of 0.6

Building Surface	GCpf	GCpi	p +GCPi	p -GCPi

			psf	psf
1	0.560	+/-0.18	5.76	11.23
2	0.210	+/-0.18	0.46	5.92
3	-0.430	+/-0.18	-9.25	-3.79
4	-0.370	+/-0.18	-8.34	-2.88
1E	0.690	+/-0.18	7.74	13.20
2E	0.270	+/-0.18	1.37	6.83
3E	-0.530	+/-0.18	-10.77	-5.31
4E	-0.480	+/-0.18	-10.01	-4.55
1T	0.140	+/-0.18	-0.61	4.85
2T	0.052	+/-0.18	-1.93	3.53
3T	-0.108	+/-0.18	-4.36	1.10
4T	-0.093	+/-0.18	-4.13	1.33
2_OHx	0.210	+/-0.00	3.19	3.19
2_OHy	0.210	+/-0.00	3.19	3.19
3_OHx	-0.430	+/-0.00	-6.52	-6.52
3_OHy	-0.430	+/-0.00	-6.52	-6.52
2E_OHx	0.270	+/-0.00	4.10	4.10
2E_OHy	0.270	+/-0.00	4.10	4.10
3E_OHx	-0.530	+/-0.00	-8.04	-8.04
3E_OHy	-0.530	+/-0.00	-8.04	-8.04
2T_OHx	0.052	+/-0.00	0.80	0.80
2T_OHy	0.052	+/-0.00	0.80	0.80
3T_OHx	-0.108	+/-0.00	-1.63	-1.63
3T_OHy	-0.108	+/-0.00	-1.63	-1.63

p = [Walls and Roof] qh*[GCpf - (+/-GCpi)] {Eqn 28.4-1}
[Parapet] qp * GCPf {Eqn 28.4-2}
GCpf = External Pressure coefficient from Fig 28.4-1

OHx & OHy are the Overhang in the X (Along ridge) & Y (Normal to Ridge) directions

Wind Pressures for Longitudinal Direction per Fig 28.4-1
All wind pressures include a load factor of 0.6

Building Surface	GCpf	GCpi	p +GCPi psf	p -GCPi psf
1	-0.450	+/-0.18	-9.56	-4.10
2	-0.690	+/-0.18	-13.20	-7.74
3	-0.370	+/-0.18	-8.34	-2.88
4	-0.450	+/-0.18	-9.56	-4.10
5	0.400	+/-0.18	3.34	8.80
6	-0.290	+/-0.18	-7.13	-1.67
1E	-0.480	+/-0.18	-10.01	-4.55
2E	-1.070	+/-0.18	-18.96	-13.50
3E	-0.530	+/-0.18	-10.77	-5.31
4E	-0.480	+/-0.18	-10.01	-4.55
5E	0.610	+/-0.18	6.52	11.99
6E	-0.430	+/-0.18	-9.25	-3.79
1T	-0.113	+/-0.18	-4.44	1.02
2T	-0.173	+/-0.18	-5.35	0.11
3T	-0.093	+/-0.18	-4.13	1.33
4T	-0.113	+/-0.18	-4.44	1.02
5T	0.100	+/-0.18	-1.21	4.25
6T	-0.073	+/-0.18	-3.83	1.63
2_OHx	-0.690	+/-0.00	-10.47	-10.47
2_OHy	-0.690	+/-0.00	-10.47	-10.47
3_OHx	-0.370	+/-0.00	-5.61	-5.61
3_OHy	-0.370	+/-0.00	-5.61	-5.61
2E_OHx	-1.070	+/-0.00	-16.23	-16.23
2E_OHy	-1.070	+/-0.00	-16.23	-16.23
3E_OHx	-0.530	+/-0.00	-8.04	-8.04
3E_OHy	-0.530	+/-0.00	-8.04	-8.04

2T_OHx	-0.173	+/-0.00	-2.62	-2.62
2T_OHy	-0.173	+/-0.00	-2.62	-2.62
3T_OHx	-0.093	+/-0.00	-1.40	-1.40
3T_OHy	-0.093	+/-0.00	-1.40	-1.40

p = [Walls and Roof] qh*[GCpf - (+/-GCpi)] {Eqn 28.4-1}
[Parapet] qp * GCPf {Eqn 28.4-2}
GCpf = External Pressure coefficient from Fig 28.4-1

OHx & OHy are the Overhang in the X (Along ridge) & Y (Normal to Ridge) directions

Torsional load cases with 'T' need not be considered if Either of the following are met:
* One Story buildings with h <= 30 ft [9.1 m]
* 2 stories or less framed with light frame construction and Flexible Diaphragm

Components And Cladding (C&C) Calculations per Ch 30 Part 1:

EHt	= Eave Height	= 13.500 ft
RHt	= Ridge Height	= 21.833 ft
h	= Mean Roof Height: 0.5*(EHt+RHt)	= 17.667 ft
Zh	= Mean Roof Height for Kh: h + Base_Dist	= 17.667 ft
Kh	= Since 15 ft [4.572 m] < Zh < Zg --> 2.01 * (Zh/zg)^(2/Alpha)	= 0.879
Kzt	= Topographic Factor is 1 since no Topographic feature specified	= 1.000
Kd	= Wind Directionality Factor per Table 26.6-1	= 0.85
GCPi	= Ref Table 26.11-1 for Enclosed Building	= +/-0.18
LF	= Load Factor based upon ASD Design	= 0.60
qh	= (0.00256 * Kh * Kzt * Kd * V^2) * LF	= 15.17 psf
LHD	= Least Horizontal Dimension: Min(B, L)	= 20.000 ft
a1	= Min(0.1 * LHD, 0.4 * h	= 2.000 ft
a	= Max(a1, 0.04 * LHD, 3 ft [0.9 m])	= 3.000 ft

Wind Pressures for C&C Ch 30 Pt 1
All wind pressures include a load factor of 0.6

Description	Zone	Width ft	Span ft	Area sq ft	1/3 Rule	Ref Fig	GCp Max	GCp Min	p Max psf	p Min psf
Pulrins	2	2.000	12.000	48.00	Yes	30.4-2C	0.832	-1.064	15.35	-18.87
Rafters	2	12.000	10.000	120.00	No	30.4-2C	0.800	-1.000	14.87	-17.90
Columns	4	12.000	13.500	162.00	No	30.4-1	0.786	-0.886	14.66	-16.18
Girts	4	2.000	7.000	16.33	Yes	30.4-1	0.962	-1.062	17.33	-18.85

Area = Span Length x Effective Width
1/3 Rule = Effective width need not be less than 1/3 of the span length
GCp = External Pressure Coefficients taken from Figures 30.4-1 through 30.4-7
p = Wind Pressure: qh*(GCp - GCpi) [Eqn 30.4-1]*
*Per Para 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] {Includes LF}

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Job Name:	Lawson Entertaining Barn	Date:	9/30/2021
Location:	Glenelg, MD	Designed by:	CMN

Lateral Anaylsis

Longitudinal Main Level — End Zone = 3.0 ft

20.02	psf	x	3.00	ft	x	8.00	ft	=	480.48	lb	(end zone wall)
19.12	psf	x	7.00	ft	x	9.00	ft	=	1,204.56	lb	(interior zone wall)
									1,685	lb	

Longitudinal Upper Level — Width = 3.0 ft

20.02	psf	x	3.00	ft	x	8.00	ft	=			480.48	lb	(end zone wall)
20.02	psf	x	3.00	ft	x	2.50	ft	x	0.5	=	75.08	lb	(end zone wall)
19.12	psf	x	7.00	ft	x	8.00	ft	=			1,070.72	lb	(interior zone wall)
19.12	psf	x	7.00	ft	x	5.83	ft	x	0.5	=	390.37	lb	(interior zone wall)
											2,017	lb	

Total Shear = 3,702 lb

Seismic Shear < Wind Shear, Design for Wind Shear

Seismic Shear = 234 #

North Wall

Openings = 0.0 ft — Largest Opening Height = 0 ft

V_w = 3,702 lb / 36.0 ft = 103 plf — Wall Height = 8 ft

Shear capacity of 1x10 siding 110 plf

110 plf > 103 plf -> Okay

Uplift = 3,702 lb - 7 psf x 36.0 ft x 8.00 ft = 1,686 # net

Uplift = 1,686 # x 8.00 ft / 36.0 = 375 # uplift per corner & openings

Uplift w/ opening = 375 / 1.00 = 375 # -> Okay

South Wall

Openings = 18.0 ft — Largest Opening Height = 8 ft

V_w = 3,702 lb / 18.0 ft = 206 plf — Wall Height = 8 ft

Shear capacity of 1x10 siding 110 plf

110 plf > 206 plf -> Okay

110 plf X 18 ft = 1980 # - 3702 # = 1,722 # Remaining

Tension Capacity of CS18 = 1705 # x 1 = 1705 # > 1722# -> okay

Uplift = 3,702 lb - 7 psf x 18 ft x 8.00 ft = 2,694 # net

Uplift = 2,694 # x 8.00 ft / 18.0 = 1197 # uplift per corner & openings

Uplift w/ opening = 1197 / 0.50 = 2394 # -> Okay

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Client:	Legacy Post & Beam	Job #:	CCA0621	6
Job Name:	Lawson Entertaining Barn	Date:	9/30/2021	
Location:	Glenelg, MD	Designed by:	CMN	

Transverse Anaylsis

Transverse Upper Level

8.33 ft (roof height) End Zone = 6.0 ft

19.03	psf	x	6.00	ft	x	8.33	ft	=	951.63 lb	(end zone roof)
13.79	psf	x	12.00	ft	x	8.33	ft	=	1,378.96 lb	(interior zone roof)
20.02	psf	x	6.00	ft	x	4.50	ft	=	540.54 lb	(end zone wall)
19.12	psf	x	12.00	ft	x	4.50	ft	=	1,032.48 lb	(interior zone wall)
									3,903.61 lb	

Transverse Main Level

12.50 ft (wall height) End Zone = 6.0 ft

20.02	psf	x	6.00	ft	x	12.50	ft	=	1,501.50 lb	(end zone wall)
19.12	psf	x	12.00	ft	x	12.50	ft	=	2,868.00 lb	(interior zone wall)
									4,369.50 lb	

Total Shear = 8,273 lb

Seismic Shear < Wind Shear, Design for Wind Shear

Seismic Shear = 234 #

East Wall

Largest Opening Height = 0 ft

Openings = 0.0 ft Wall Height = 12.50 ft

V_w = 8,273 lb / 20.0 ft = 414 plf

Shear capacity of 1x10 Siding= 110 plf

110 plf < 414 plf -> Use Straps

110 plf X 20 ft = 2200 # - 8273 # = 6,073 # Remaining

Tension Capacity of CMSTC16 = 4690 # x 2 = 9380 # > 6073# -> okay

Uplift = 8,273 lb - 7 psf x 20 ft x 12.50 ft = 6,523 # net

Uplift = 6,523 # x 12.50 ft / 20.0 = 4077 # uplift per corner & openings

Uplift w/ opening = 4077 / 1.00 = 4077 # -> Okay

West Wall

Largest Opening Height = 11 ft

Openings = 6.0 ft Wall Height = 12.50 ft

V_w = 8,273 lb / 14.0 ft = 591 plf

Shear capacity of 1x10 Siding= 110 plf

110 plf < 591 plf -> Use Straps

110 plf X 14 ft = 1540 # - 8273 # = 6,733 # Remaining

Tension Capacity of CMSTC16 = 4690 # x 2 = 9380 # > 6733# -> okay

Uplift = 8,273 lb - 7 psf x 14 ft x 12.50 ft = 7,048 # net

Uplift = 7,048 # x 12.50 ft / 14.0 = 6293 # uplift per corner & openings

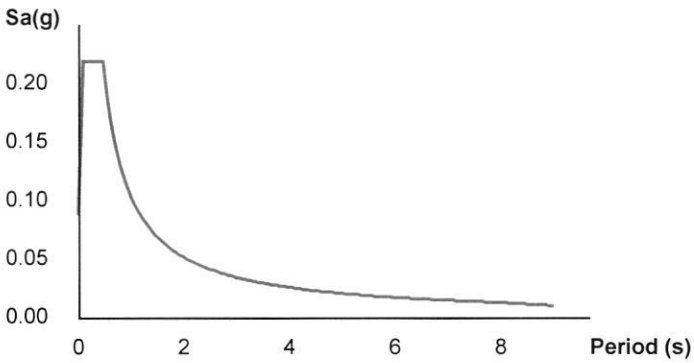
Uplift w/ opening = 6293 / 0.63 = 9989 # -> Okay

ATC Hazards by Location

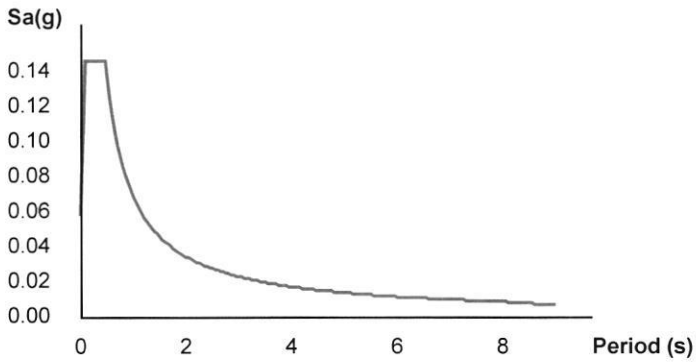
Search Information

Address:	14008 Triadelphia Rd, Glenelg, MD 21737, USA
Coordinates:	39.26450709999999, -76.99995849999999
Elevation:	567 ft
Timestamp:	2021-09-08T18:29:00.547Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D-default

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.137	MCE_R ground motion (period=0.2s)
S_1	0.043	MCE_R ground motion (period=1.0s)
S_{MS}	0.219	Site-modified spectral acceleration value
S_{M1}	0.103	Site-modified spectral acceleration value
S_{DS}	0.146	Numeric seismic design value at 0.2s SA
S_{D1}	0.069	Numeric seismic design value at 1.0s SA

▾Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s

CR_S	0.943	Coefficient of risk (0.2s)
CR_1	0.927	Coefficient of risk (1.0s)
PGA	0.071	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.114	Site modified peak ground acceleration
T_L	8	Long-period transition period (s)
SsRT	0.137	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.145	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.043	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.046	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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Location:	**Glenelg, MD**	Designed by:	**CMN**

Seismic Anaylsis - Sheathing

Seismic - Sheathing V = 1.1 x SDS x W / R SDS= 0.146 R= 6.5

10	psf	x	20	ft	x	36	ft		=	7,200	lb	Roof
7	psf	x	36	ft	x	13.5	ft	x 2	=	6,804	lb	Side Wall
7	psf	x	20	ft	x	13.5	ft	x 2	=	3,780	lb	End Wall
7	psf	x	10	ft	x	8.333	ft	x 2	=	1,167	lb	End Wall
										18,951	lb	

1.1 x 0.146 x 18,951 / 6.5 = 468.2 #/direction = 234 #/ Wall

Seismic Shear < Wind Shear, Design for Wind Shear

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Job Name:	Lawson Entertaining Barn	Date:	9/30/2021	
Location:	Glenelg, MD	Designed by:	CMN	

Roof Members - Purlins

Design Loads

DL =	10	PSF
LL =	40	PSF
W1 =	15.4	PSF
W2 =	-18.9	PSF

Load Combinations

1) D + L =	50.0	PSF
2) D + 0.75L + 0.75W1 =	51.5	PSF
3) D + 0.75L + 0.75W2 =	25.8	PSF
4) D + W1 =	25.4	PSF
5) D + W2 =	-8.9	PSF
6) 0.6D +0 W1 =	21.4	PSF
7) 0.6D + W2 =	-12.9	PSF

Roof Members - Rafters

Design Loads

DL =	10	PSF
LL =	40	PSF
W1 =	14.9	PSF
W2 =	-17.9	PSF

Load Combinations

1) D + L =	50.0	PSF
2) D + 0.75L + 0.75W1 =	51.2	PSF
3) D + 0.75L + 0.75W2 =	26.6	PSF
4) D + W1 =	24.9	PSF
5) D + W2 =	-7.9	PSF
6) 0.6D +0 W1 =	20.9	PSF
7) 0.6D + W2 =	-11.9	PSF

Wall Members - Girts

Design Loads

DL =	N/A	PSF
LL =	N/A	PSF
W1 =	17.3	PSF
W2 =	-18.9	PSF

Load Combinations

4) D + W1 =	17.3	PSF
5) D + W2 =	-18.9	PSF

Wall Members - Columns

Design Loads

DL =	N/A	PSF
LL =	N/A	PSF
W1 =	14.7	PSF
W2 =	-16.2	PSF

Load Combinations

4) D + W1 =	14.7	PSF
5) D + W2 =	-16.2	PSF

1/2" bolts perp. to grain = 1162#
1/2" bolts parallel to grain = 1540#

Hammer Truss

Hammer Post Bents B&C (Reactions from P. 32 (Hammer Rafter))

Support 1:	0 #		
Support 2:	2624 #		
Support 3:	2538 #		
Total:	5162 #	1/2" Bolt paral.	1540
		1/2" Bolt perp.	1162

# of Bolts= 2
Capacity of XL-T Plate 1162 bolt Zperp. = 1162# x 2 bolts x 1.15 LDF = 2673 #
5162 > 2673 therefore 2489# remain

Bearing block shear: 361# x 6 screws x 1.15 LDF= 2491 #
2491# >2489# Therefore okay :: Use PP #2 Bearing block with (6) #17 screws
:: Use PP #2 Bearing block with (6) #17 screws

Hammer Post w/ Dormer Bents B&C (Reactions from P. 29 (Hammer Rafter))

Support 1:	0 #		
Support 2:	2320 #		
Support 3:	424 #		
Support 4:	0 #		
Total:	2744 #	1/2" Bolt paral.	1540
		1/2" Bolt perp.	1162

# of Bolts= 2
Capacity of XL-T Plate 1162 bolt Zperp. = 1162# x 2 bolts x 1.15 LDF = 2673 #
2744 > 2673 therefore 71# remain

Bearing block shear: 361# x 1 screws x 1.15 LDF= 415 #
415# >71# Therefore okay :: Use PP #2 Bearing block with (1) #17 screws
:: Use PP #2 Bearing block with (1) #17 screws

Hammer Tie attachment to Column (T-Plate) (Reactions from P. 37 Hammer Beam)
Reaction: -373 #
Capacity of T Plate: 1162# x 2 bolts x 1.15 LDF = 2672.6 #
2672.6 > 373 -> Okay

Capacity of T Plate: 1540# x 2 bolts x 1.15 LDF = 3542 #
3542 > 373 -> Okay

Knee Brace attachment to post South Side (Reactions from P. 37 Hammer Beam)

Reaction: 7383 #

Shear Capacity of 1/2" lag in 3" wood (Perpendicular): 290 lbs

Connection: 1162# x 6 bolts x 1.15 LDF= 8017.8 #

8017.8>"7383 -> Okay

Reaction: 7383 #

Shear Capacity of 1/2" lag in 3" wood (Perpendicular): 290 lbs

Connection: 1162# x 3 bolts x LDF= 4008.9 #

7383>4008.9 therefore 3374# remain

Therefore use bearing block

Bearing block shear: 361# x 9 screws x 1.15 LDF= 3737 #

3737# >3374.1# Therefore okay

:: Use PP #2 Bearing block with (9) #17 screws

Knee Brace attachment to post North Side (Reactions from P. 39 Hammer Beam)

Reaction: 5489 #

Shear Capacity of 1/2" lag in 3" wood (Perpendicular): 290 lbs

Connection: 1162# x 6 bolts x 1.15 LDF= 8017.8 #

8017.8>"5489 -> Okay

Reaction: 5489 #

Shear Capacity of 1/2" lag in 3" wood (Perpendicular): 290 lbs

Connection: 1162# x 3 bolts x 1.15 LDF= 4008.9 #

5489>4008.9 therefore 1480# remain

Therefore use bearing block

Bearing block shear: 361# x 4 screws x 1.15 LDF= 1661 #

1661# >1480.1# Therefore okay

:: Use PP #2 Bearing block with (4) #17 screws

1/2" bolts perp. to grain = 1162#
1/2" bolts parallel to grain = 1540#

Dormer Rafter to Hammer Rafter Uplift (Reactions from P. 27)
Reaction: 691 # = 691
Withdrawal Capacity of #17 lag in 3" wood: 358 lbs/in
Screw embeddment: 2 in
Connection: 358#/in x 2 in x 2 lags x 1.6 LDF x 0.67= 1536 #
-> 1536# > 691# Therefore Okay

Dormer Rafter to Column Uplift (Bents B-E) (Reactions from P. 27)
Reaction: 1037 # = 1037
Withdrawal Capacity of #17 lag in 3" wood: 358 lbs/in
Screw embeddment: 2 in
Connection: 358#/in x 2 in x 2 lags x 1.6 LDF x 0.67 x 0.75= 1152 #
-> 1152# > 1037# Therefore Okay

Tie Beam to Column (Bents A&D) (Reactions from P. 41)
Reaction: 200 # = 3105 -(1162# x 1.25 LDF x 2 thru bolts) (Capacity of T-Plate)
Therefore use bearing block

Bearing block shear: 361# x 2 screws x 1.25 LDF= 903 #
903# >200# Therefore okay
:: Use Bearing block with (2) screws

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
Job Name:	Lawson Entertaining Barn	Date:	9/30/2021
Location:	Glenelg, MD	Designed by:	CMN

Fastener Design Capacities

1/2" through bolts

$Z_{\parallel}$ = 1540# x 1.15 LDF = 1771#
1540# x 1.25 LDF = 1925#
1540# x 1.6 LDF = 2464#

$Z_{\perp}$ = 1162# x 1.15 LDF = 1336#
1162# x 1.25 LDF = 1453#
1162# x 1.6 LDF = 1859#

1/2" lag bolts with 1/4" side plate

$Z_{\parallel}$ = 480# x 1.15 LDF = 552#
480# x 1.25 LDF = 600#
480# x 1.6 LDF = 768#

$Z_{\perp}$ = 290# x 1.15 LDF = 334#
290# x 1.25 LDF = 363#
290# x 1.6 LDF = 464#

Withdrawal Capacity = 302 # / in x 1.15 LDF = 348#/in
302 # / in x 1.25 LDF = 378#/in
302 # / in x 1.6 LDF = 483#/in

1/2" lag bolts with wood side plate

$Z_{\parallel}$ = 360# x 1.15 LDF = 414#
360# x 1.25 LDF = 450#
360# x 1.6 LDF = 576#

$Z_{\perp}$ = 240# x 1.15 LDF = 276#
240# x 1.25 LDF = 300#
240# x 1.6 LDF = 384#

Withdrawal Capacity = 302 # / in x 1.15 LDF = 348#/in
302 # / in x 1.25 LDF = 378#/in
302 # / in x 1.6 LDF = 483#/in

#15 x 4" girt screws with wood side plates

$Z_{\parallel}$ = 215# x 1.15 LDF = 247#
215# x 1.25 LDF = 269#
215# x 1.6 LDF = 344#

Withdrawal Capacity = 388# x 1.15 LDF = 348#/in
388# x 1.25 LDF = 446#/in
388# x 1.6 LDF = 485#/in

#17 x 7" girt screws with wood side plates

$Z_{\perp}$ = 361# x 1.15 LDF = 415#
361# x 1.25 LDF = 451#
361# x 1.6 LDF = 578#

Withdrawal Capacity = 358# x 1.15 LDF = 412#/in
358# x 1.25 LDF = 448#/in
358# x 1.6 LDF = 573#/in

Post Connection Hold down Capacity - (2 Sill Brackets per conn.)
-(2) 1/2" Lags per bracket into post:
480# shear cap x 1.0 LDF x 4 lags total = 1920#
480# shear cap x 1.15 LDF x 4 lags total = 2208#
480# shear cap x 1.25 LDF x 4 lags total = 2400#
480# shear cap x 1.6 LDF x 4 lags total = 3072#

-(1) 1/2" x 6" Titen HD anchor per bracket
1855# tension cap x 2 anchors = 3710#

Table 12K LAG SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]

for sawn lumber or SCL with ASTM A653, Grade 33 steel side plate (for t_s<1/4") or ASTM A 36 steel side plate (for t_s=1/4")
(tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.5 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_s	D	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
0.075	1/4	170	130	160	120	150	110	150	110	150	100	140	100	140	100	130	90	130	90	130	90
(14 gage)	5/16	220	160	200	140	190	130	190	130	190	130	180	120	180	120	170	110	170	110	160	100
	3/8	220	160	200	140	200	130	190	130	190	120	180	120	180	120	170	110	170	100	170	100
0.105	1/4	180	140	170	130	160	120	160	120	160	110	150	110	150	110	140	100	140	100	140	90
(12 gage)	5/16	230	170	210	150	200	140	200	140	190	130	190	130	190	120	180	110	170	110	170	110
	3/8	230	160	210	140	200	140	200	130	200	130	190	120	190	120	180	110	180	110	170	110
0.120	1/4	190	150	180	130	170	120	170	120	160	120	160	110	160	110	150	100	150	100	140	100
(11 gage)	5/16	230	170	210	150	210	140	200	140	200	140	190	130	190	130	180	120	180	120	180	110
	3/8	240	170	220	150	210	140	210	140	200	130	200	130	190	120	180	110	180	110	180	110
0.134	1/4	200	150	180	140	180	130	170	130	170	120	160	120	160	110	150	110	150	100	150	100
(10 gage)	5/16	240	180	220	160	210	150	210	140	200	140	200	130	200	130	190	120	180	120	180	120
	3/8	240	170	220	150	220	140	210	140	210	140	200	130	200	130	190	120	190	120	180	110
0.179	1/4	220	170	210	150	200	150	200	140	190	140	190	130	190	130	180	120	170	120	170	120
(7 gage)	5/16	260	190	240	170	230	160	230	160	230	150	220	150	220	150	210	130	200	130	200	130
	3/8	270	190	250	170	240	160	240	160	230	150	220	140	220	140	210	130	210	130	200	130
0.239	1/4	240	180	220	160	210	150	210	150	200	140	190	140	190	130	180	120	180	120	180	120
(3 gage)	5/16	300	220	280	190	270	180	260	180	260	170	250	160	250	160	230	150	230	150	230	140
	3/8	310	220	280	190	270	180	270	180	260	170	250	160	250	160	240	140	230	140	230	140
	7/16	420	290	390	260	380	240	370	240	360	230	350	220	350	220	330	200	330	200	320	190
	1/2	510	340	470	300	460	290	450	280	440	270	430	260	420	260	400	240	400	230	390	230
	5/8	770	490	710	430	680	400	680	400	660	380	640	370	630	360	600	330	590	330	580	320
	3/4	1110	670	1020	590	980	560	970	550	950	530	920	500	910	500	860	450	850	450	840	440
	7/8	1510	880	1390	780	1330	730	1320	710	1280	690	1250	650	1230	650	1170	590	1160	590	1140	570
	1	1940	1100	1780	960	1710	910	1700	890	1650	860	1600	820	1590	810	1500	740	1480	730	1460	710
1/4	1/4	240	180	220	160	210	150	210	150	200	140	200	140	190	130	180	120	180	120	180	120
	5/16	310	220	280	200	270	180	270	180	260	170	250	170	250	160	230	150	230	150	230	140
	3/8	320	220	290	190	280	180	270	180	270	170	260	160	250	160	240	150	240	140	230	140
	7/16	480	320	440	280	420	270	420	260	410	250	390	240	390	230	370	220	360	210	360	210
	1/2	580	390	540	340	520	320	510	320	500	310	480	290	480	290	460	270	450	260	440	260
	5/8	850	530	780	470	750	440	740	440	720	420	700	400	690	400	660	370	650	360	640	350
	3/4	1200	730	1100	640	1060	600	1050	590	1020	570	990	540	980	530	930	490	920	480	900	470
	7/8	1600	930	1470	820	1410	770	1400	750	1360	720	1320	690	1310	680	1240	630	1220	620	1200	600
	1	2040	1150	1870	1000	1800	950	1780	930	1730	900	1680	850	1660	840	1570	770	1550	760	1530	740

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; dowel bearing strengths, F_e, of 61,850 psi for ASTM A653, Grade 33 steel and 87,000 psi for ASTM A36 steel and screw bending yield strengths, F_{yb}, of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.

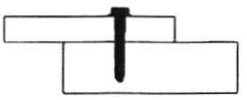
Table 12G **BOLTS: Reference Lateral Design Values, Z, for Double Shear (three member) Connections[1,2]**

for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plates

Thickness: Main Member	Thickness: Side Member	Bolt Diameter	G=0.67 Red Oak		G=0.55 Mixed Maple Southern Pine		G=0.50 Douglas Fir-Larch		G=0.49 Douglas Fir-Larch (N)		G=0.46 Douglas Fir(S) Hem-Fir(N)		G=0.43 Hem-Fir		G=0.42 Spruce-Pine-Fir		G=0.37 Redwood (open grain)		G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods		G=0.35 Northern Species	
t_m in.	t_s in.	D in.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.	$Z_{\parallel}$ lbs.	$Z_{\perp}$ lbs.
1-1/2	1/4	1/2	1410	730	1150	550	1050	470	1030	460	970	420	900	380	880	370	780	310	760	290	730	290
		5/8	1760	810	1440	610	1310	530	1290	520	1210	470	1130	420	1100	410	970	350	950	330	910	320
		3/4	2110	890	1730	660	1580	590	1550	560	1450	520	1350	460	1320	450	1170	370	1140	360	1100	350
		7/8	2460	960	2020	720	1840	630	1800	600	1690	550	1580	500	1540	490	1360	410	1330	390	1280	370
		1	2810	1020	2310	770	2100	680	2060	650	1930	600	1800	540	1760	530	1560	440	1520	420	1460	410
1-3/4	1/4	1/2	1640	850	1350	640	1230	550	1200	530	1130	490	1050	450	1030	430	910	360	890	340	850	330
		5/8	2050	940	1680	710	1530	610	1500	600	1410	550	1310	490	1290	480	1130	400	1110	380	1070	370
		3/4	2460	1040	2020	770	1840	680	1800	660	1690	600	1580	540	1540	530	1360	430	1330	420	1280	410
		7/8	2870	1120	2350	840	2140	740	2110	700	1970	640	1840	580	1800	570	1590	470	1550	460	1490	430
		1	3280	1190	2690	890	2450	790	2410	750	2250	700	2100	630	2060	610	1820	510	1770	490	1710	470
2-1/2	1/4	1/2	1870	1210	1720	910	1650	790	1640	760	1590	700	1500	640	1470	610	1300	510	1270	490	1220	480
		5/8	2740	1340	2400	1020	2190	880	2150	860	2010	780	1880	700	1840	690	1620	580	1580	550	1520	530
		3/4	3520	1480	2880	1110	2630	980	2580	940	2410	860	2250	770	2200	750	1950	620	1900	600	1830	580
		7/8	4100	1600	3360	1200	3060	1050	3010	1010	2820	920	2630	830	2570	810	2270	680	2210	660	2130	610
		1	4690	1700	3840	1280	3500	1130	3440	1080	3220	1000	3000	900	2940	880	2590	730	2530	700	2440	680
3-1/2	1/4	1/2	1870	1240	1720	1100	1650	1030	1640	1010	1590	970	1540	890	1530	860	1450	720	1430	680	1410	670
		5/8	2740	1720	2510	1420	2410	1230	2390	1200	2330	1090	2260	980	2230	960	2110	810	2090	770	2060	740
		3/4	3800	2070	3480	1550	3340	1370	3320	1310	3220	1210	3120	1080	3080	1050	2720	870	2660	840	2560	810
		7/8	5060	2240	4630	1680	4290	1470	4210	1410	3940	1290	3680	1160	3600	1130	3180	950	3100	920	2990	860
		1	6520	2380	5380	1790	4900	1580	4810	1510	4510	1400	4200	1260	4110	1230	3630	1020	3540	980	3410	950
5-1/4	1/4	5/8	2740	1720	2510	1510	2410	1420	2390	1400	2330	1340	2260	1280	2230	1270	2110	1170	2090	1140	2060	1120
		3/4	3800	2290	3480	2000	3340	1890	3320	1850	3220	1780	3120	1610	3090	1580	2920	1300	2890	1260	2840	1220
		7/8	5060	2930	4630	2530	4440	2210	4410	2110	4280	1930	4150	1750	4110	1700	3880	1420	3840	1380	3770	1290
		1	6520	3570	5960	2680	5720	2360	5670	2260	5510	2100	5330	1890	5280	1840	4990	1520	4930	1470	4850	1420
5-1/2	1/4	5/8	2740	1720	2510	1510	2410	1420	2390	1400	2330	1340	2260	1280	2230	1270	2110	1170	2090	1140	2060	1120
		3/4	3800	2290	3480	2000	3340	1890	3320	1850	3220	1780	3120	1690	3090	1650	2920	1360	2890	1320	2840	1280
		7/8	5060	2930	4630	2570	4440	2310	4410	2210	4280	2020	4150	1830	4110	1780	3880	1490	3840	1440	3770	1350
		1	6520	3640	5960	2810	5720	2480	5670	2370	5510	2200	5330	1980	5280	1930	4990	1600	4930	1540	4850	1490
7-1/2	1/4	5/8	2740	1720	2510	1510	2410	1420	2390	1400	2330	1340	2260	1280	2230	1270	2110	1170	2090	1140	2060	1120
		3/4	3800	2290	3480	2000	3340	1890	3320	1850	3220	1780	3120	1690	3090	1670	2920	1530	2890	1500	2840	1480
		7/8	5060	2930	4630	2570	4440	2410	4410	2360	4280	2260	4150	2160	4110	2130	3880	1960	3840	1930	3770	1840
		1	6520	3640	5960	3180	5720	3000	5670	2940	5510	2840	5330	2700	5280	2630	4990	2180	4930	2100	4850	2030
9-1/2	1/4	3/4	3800	2290	3480	2000	3340	1890	3320	1850	3220	1780	3120	1690	3090	1670	2920	1530	2890	1500	2840	1480
		7/8	5060	2930	4630	2570	4440	2410	4410	2360	4280	2260	4150	2160	4110	2130	3880	1960	3840	1930	3770	1870
		1	6520	3640	5960	3180	5720	3000	5670	2940	5510	2840	5330	2700	5280	2660	4990	2440	4930	2400	4850	2350
11-1/2	1/4	7/8	5060	2930	4630	2570	4440	2410	4410	2360	4280	2260	4150	2160	4110	2130	3880	1960	3840	1930	3770	1870
		1	6520	3640	5960	3180	5720	3000	5670	2940	5510	2840	5330	2700	5280	2660	4990	2440	4930	2400	4850	2350
13-1/2	1/4	1	6520	3640	5960	3180	5720	3000	5670	2940	5510	2840	5330	2700	5280	2660	4990	2440	4930	2400	4850	2350

1. Tabulated lateral design values, Z, for bolted connections shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "full-body diameter" bolts (see Appendix Table L1) with bolt bending yield strength, F_{yb}, of 45,000 psi and dowel bearing strength, F_e, of 87,000 psi for ASTM A36 steel.

Table 12J LAG SCREWS: Reference Lateral Design Values, Z, for Single Shear (two member) Connections[1,2,3,4]

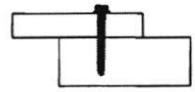


for sawn lumber or SCL with both members of identical specific gravity (tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.67 Red Oak				G=0.55 Mixed Maple Southern Pine				G=0.50 Douglas Fir-Larch				G=0.49 Douglas Fir-Larch(N)				G=0.46 Douglas Fir(S) Hem-Fir(N)			
t_s	D	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1/2	1/4	150	110	110	110	130	90	100	90	120	90	90	80	120	90	90	80	110	80	90	80
	5/16	170	130	130	120	150	110	120	100	150	100	110	100	140	100	110	90	140	100	100	90
	3/8	180	130	130	120	160	110	110	100	150	100	110	90	150	90	110	90	140	90	100	90
5/8	1/4	160	120	130	120	140	100	110	100	130	90	100	90	130	90	100	90	120	90	90	80
	5/16	190	140	140	130	160	110	120	110	150	110	110	100	150	100	110	100	150	100	110	90
	3/8	190	130	140	120	170	110	120	100	160	100	110	100	160	100	110	90	150	100	110	90
3/4	1/4	180	140	140	130	150	110	120	110	140	100	110	100	140	100	110	90	130	90	100	90
	5/16	210	150	160	140	180	120	130	120	170	110	120	100	160	110	120	100	160	100	110	100
	3/8	210	140	160	130	180	120	130	110	170	110	120	100	170	110	120	100	160	100	110	90
1	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	140	150	130	190	130	140	120	190	120	140	120	180	120	130	110
	3/8	230	160	170	160	210	130	150	120	200	120	140	110	190	120	140	110	180	110	130	100
1-1/4	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	130	140	120
	3/8	230	170	170	160	210	150	150	140	200	140	140	130	200	130	140	120	190	120	140	120
1-1/2	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	130
	3/8	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	120
	7/16	360	260	260	240	320	220	230	200	310	200	210	180	310	190	210	180	300	180	200	160
	1/2	460	310	320	280	410	250	290	230	390	220	270	200	390	220	260	200	370	210	250	190
	5/8	700	410	500	370	600	340	420	310	560	310	380	280	550	310	380	270	530	290	360	260
	3/4	950	550	660	490	830	470	560	410	770	440	510	380	760	430	510	370	730	400	480	360
	7/8	1240	720	830	630	1080	560	710	540	1020	490	660	490	1010	470	650	470	970	430	610	430
	1	1550	800	1010	780	1360	600	870	600	1290	530	810	530	1280	500	790	500	1230	470	760	470
1-3/4	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	130
	3/8	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	120
	7/16	360	260	260	240	320	230	230	210	310	210	210	190	310	210	210	190	300	200	200	180
	1/2	460	320	320	290	410	270	290	250	390	240	270	220	390	240	260	220	380	220	250	200
	5/8	740	440	500	400	660	360	440	320	610	330	420	290	600	320	410	290	570	300	390	270
	3/4	1030	580	720	520	890	480	600	430	830	450	550	390	820	440	540	380	780	420	510	360
	7/8	1320	740	890	650	1150	630	750	550	1070	570	700	510	1060	550	680	490	1010	500	650	470
	1	1630	910	1070	790	1420	700	910	670	1340	610	850	610	1320	590	830	590	1270	550	790	550
2-1/2	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	130
	3/8	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	120
	7/16	360	260	260	240	320	230	230	210	310	210	210	190	310	210	210	190	300	200	200	180
	1/2	460	320	320	290	410	290	290	250	390	270	270	240	390	260	260	230	380	250	250	220
	5/8	740	500	500	450	670	430	440	390	640	390	420	350	630	380	410	340	610	360	390	320
	3/4	1110	680	740	610	1010	550	650	490	960	500	610	450	950	490	600	430	920	460	580	410
	7/8	1550	830	1000	740	1370	690	880	600	1280	630	830	550	1260	620	810	530	1190	580	770	500
	1	1940	980	1270	860	1660	830	1080	720	1550	770	990	660	1520	750	970	640	1450	720	920	620
3-1/2	1/4	180	140	140	140	160	120	120	120	150	120	120	110	150	110	110	110	150	110	110	100
	5/16	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	130
	3/8	230	170	170	160	210	150	150	140	200	140	140	130	200	140	140	130	190	140	140	120
	7/16	360	260	260	240	320	230	230	210	310	210	210	190	310	210	210	190	300	200	200	180
	1/2	460	320	320	290	410	290	290	250	390	270	270	240	390	260	260	230	380	250	250	220
	5/8	740	500	500	450	670	440	440	390	640	420	420	360	630	410	410	360	610	390	390	340
	3/4	1110	740	740	650	1010	650	650	560	960	600	610	520	950	580	600	510	920	550	580	490
	7/8	1550	990	1000	860	1400	800	880	710	1340	720	830	640	1320	700	810	620	1280	660	780	570
	1	2020	1140	1270	1010	1830	930	1120	810	1740	850	1060	740	1730	830	1040	720	1670	790	1000	680

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; screw bending yield strengths, F_{yb},of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.

Table 12J (Cont.) **LAG SCREWS: Reference Lateral Design Values (Z) for Single Shear (two member) Connections[1,2,3,4]**



for sawn lumber or SCL with both members of identical specific gravity (tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

Side Member Thickness	Lag Screw Diameter	G=0.43 Hem-Fir				G=0.42 Spruce-Pine-Fir				G=0.37 Redwood (open grain)				G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods				G=0.35 Northern Species			
t_s	D	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$	$Z_{\parallel}$	$Z_{s\perp}$	$Z_{m\perp}$	$Z_{\perp}$
in.	in.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1/2	1/4	110	80	80	70	110	80	80	70	100	70	70	60	100	70	70	60	90	70	70	60
	5/16	130	90	100	80	130	90	90	80	120	80	90	80	120	80	90	70	120	80	80	70
	3/8	140	80	100	80	130	80	90	80	120	60	90	60	120	60	80	60	120	60	80	60
5/8	1/4	120	80	90	80	110	80	90	70	110	70	80	70	100	70	80	60	100	70	70	60
	5/16	140	90	100	90	140	90	100	90	130	80	90	80	130	80	90	80	120	80	90	70
	3/8	140	90	100	80	140	90	100	80	130	80	90	70	130	70	90	70	120	70	90	70
3/4	1/4	130	90	100	80	120	80	90	80	110	80	80	70	110	70	80	70	110	70	80	70
	5/16	150	100	110	90	150	100	110	90	130	90	100	80	130	90	90	80	130	80	90	80
	3/8	150	100	110	90	150	90	110	90	140	90	100	80	130	80	90	70	130	80	90	70
1	1/4	140	100	110	90	140	100	100	90	130	90	100	80	130	80	90	80	130	80	90	70
	5/16	170	110	130	100	170	110	120	100	150	90	110	90	150	90	110	80	150	90	100	80
	3/8	170	100	120	100	170	100	120	90	150	90	110	80	150	90	110	80	150	90	100	80
1-1/4	1/4	140	110	110	100	140	100	100	100	130	100	100	90	130	90	90	90	130	90	90	80
	5/16	180	120	130	110	180	120	130	110	170	100	120	100	170	100	120	90	160	100	110	90
	3/8	190	120	130	110	180	110	130	100	170	100	120	90	170	100	120	90	170	90	110	80
1-1/2	1/4	140	110	110	100	140	100	100	100	130	100	100	90	130	90	90	90	130	90	90	80
	5/16	180	130	130	120	180	130	130	120	170	110	120	110	170	110	120	100	160	110	110	100
	3/8	190	130	130	120	180	130	130	110	170	110	120	100	170	110	120	100	170	100	110	90
	7/16	290	170	190	150	280	160	190	150	260	140	180	130	260	140	170	130	250	140	170	120
	1/2	350	190	240	180	350	190	240	170	310	170	210	150	310	160	210	150	300	160	200	140
	5/8	500	280	340	240	490	270	330	240	450	250	300	210	440	240	290	210	430	240	280	200
	3/4	700	360	450	330	690	350	440	330	630	290	400	290	620	280	390	280	610	270	380	270
	7/8	930	390	580	390	910	380	570	380	850	320	520	320	840	310	510	310	820	290	490	290
	1	1180	420	720	420	1160	410	710	410	1080	340	640	340	1070	330	630	330	1050	320	620	320
1-3/4	1/4	140	110	110	100	140	100	100	100	130	100	100	90	130	90	90	90	130	90	90	80
	5/16	180	130	130	120	180	130	130	120	170	120	120	110	170	120	120	110	160	110	110	100
	3/8	190	130	130	120	180	130	130	110	170	120	120	100	170	120	120	100	170	110	110	100
	7/16	290	180	190	160	280	180	190	160	270	160	180	140	260	150	170	140	260	140	170	130
	1/2	360	210	240	190	360	200	240	180	340	180	220	160	340	170	220	150	330	170	210	150
	5/8	540	290	360	250	530	280	360	250	480	250	320	220	480	250	310	210	460	240	300	210
	3/4	740	400	480	340	730	390	470	340	670	330	420	300	660	320	420	300	640	310	410	290
	7/8	970	450	610	440	950	440	600	440	880	370	540	370	870	360	530	360	850	330	520	330
	1	1210	490	750	490	1200	480	740	480	1110	400	670	400	1090	380	650	380	1070	370	640	370
2-1/2	1/4	140	110	110	100	140	100	100	100	130	100	100	90	130	90	90	90	130	90	90	80
	5/16	180	130	130	120	180	130	130	120	170	120	120	110	170	120	120	110	160	110	110	100
	3/8	190	130	130	120	180	130	130	110	170	120	120	100	170	120	120	100	170	110	110	100
	7/16	290	190	190	170	280	190	190	170	270	180	180	150	260	170	170	150	260	170	170	150
	1/2	360	240	240	210	360	240	240	210	340	220	220	190	340	210	220	190	330	200	210	180
	5/8	590	330	380	290	580	320	370	290	550	290	340	250	540	280	340	240	530	270	330	240
	3/4	890	430	550	380	880	420	540	370	800	380	500	320	780	370	490	320	760	360	480	310
	7/8	1130	550	730	470	1110	540	710	460	1010	490	640	420	990	480	620	410	970	470	600	390
	1	1380	680	870	580	1360	670	850	570	1240	570	760	510	1220	550	750	500	1190	530	730	490
3-1/2	1/4	140	110	110	100	140	100	100	100	130	100	100	90	130	90	90	90	130	90	90	80
	5/16	180	130	130	120	180	130	130	120	170	120	120	110	170	120	120	110	160	110	110	100
	3/8	190	130	130	120	180	130	130	110	170	120	120	100	170	120	120	100	170	110	110	100
	7/16	290	190	190	170	280	190	190	170	270	180	180	150	260	170	170	150	260	170	170	150
	1/2	360	240	240	210	360	240	240	210	340	220	220	190	340	220	220	190	330	210	210	180
	5/8	590	380	380	320	580	370	370	320	550	340	340	290	540	330	340	280	530	320	330	280
	3/4	890	500	550	440	880	490	540	430	830	430	500	370	820	420	490	370	800	410	480	360
	7/8	1240	610	750	530	1220	600	740	520	1150	530	680	460	1140	520	670	450	1110	500	650	430
	1	1610	740	950	630	1600	720	940	620	1480	650	860	550	1450	630	850	540	1410	620	830	520

1. Tabulated lateral design values, Z, shall be multiplied by all applicable adjustment factors (see Table 11.3.1).
2. Tabulated lateral design values, Z, are for "reduced body diameter" lag screws (see Appendix Table L2) inserted in side grain with screw axis perpendicular to wood fibers; screw penetration, p, into the main member equal to 8D; screw bending yield strengths, F_{yb}, of 70,000 psi for D = 1/4", 60,000 psi for D = 5/16", and 45,000 psi for D ≥3/8".
3. Where the lag screw penetration, p, is less than 8D but not less than 4D, tabulated lateral design values, Z, shall be multiplied by p/8D or lateral design values shall be calculated using the provisions of 12.3 for the reduced penetration.
4. The length of lag screw penetration, p, not including the length of the tapered tip, E (see Appendix Table L2), of the lag screw into the main member shall not be less than 4D. See 12.1.4.6 for minimum length of penetration, p_{min}.

TRACE LABORATORIES, INC
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Lap Shear Force Data Sheet

Customer Name: Western Builders Supply
File No: 09-33459
Test Date: 10/23/09 to 10/30/09
Tested By: Ron Pienkowski
Measurements Are N/A

CTX-177-1	Big Timber/ Bronze Star	1722.727	Screw Pulled Out of Wood
CTX-177-2	Big Timber/ Bronze Star	1950.580	Screw Pulled Out of Wood
CTX-177-3	Big Timber/ Bronze Star	1718.008	Screw Pulled Out of Wood
CTX-177-4	Big Timber/ Bronze Star	1938.906	Screw Pulled Out of Wood
CTX-177-5	Big Timber/ Bronze Star	1704.050	Screw Pulled Out of Wood
		Average Force =	**1806.854**
		Standard Deviation =	**126.129**

$\frac{1806\#}{4.0} = 452\#$

CTX-146-1	Big Timber/ Bronze Star	1162.024	Screw Pulled Out of Wood
CTX-146-2	Big Timber/ Bronze Star	943.421	Screw Pulled Out of Wood
CTX-146-3	Big Timber/ Bronze Star	824.708	Screw Pulled Out of Wood
CTX-146-4	Big Timber/ Bronze Star	893.403	Screw Pulled Out of Wood
CTX-146-5	Big Timber/ Bronze Star	865.885	Screw Pulled Out of Wood
		Average Force =	**937.888**
		Standard Deviation =	**132.515**

CTX-156-1	Big Timber/ Bronze Star	1674.444	Screw Pulled Out of Wood
CTX-156-2	Big Timber/ Bronze Star	1777.467	Screw Pulled Out of Wood
CTX-156-3	Big Timber/ Bronze Star	1488.767	Screw Pulled Out of Wood
CTX-156-4	Big Timber/ Bronze Star	1703.751	Screw Pulled Out of Wood
CTX-156-5	Big Timber/ Bronze Star	1399.357	Screw Pulled Out of Wood
		Average Force =	**1608.757**
		Standard Deviation =	**158.152**

STX-93-1	Western Builder/ Silver Star	414.683	Screw Pulled Out of Wood
STX-93-2	Western Builder/ Silver Star	551.374	Screw Pulled Out of Wood
STX-93-3	Western Builder/ Silver Star	687.718	Screw Pulled Out of Wood
STX-93-4	Western Builder/ Silver Star	508.956	Screw Pulled Out of Wood
STX-93-5	Western Builder/ Silver Star	675.002	Screw Pulled Out of Wood
		Average Force =	**567.547**
		Standard Deviation =	**115.162**

STX-103-1	Western Builder/ Silver Star	600.050	Screw Pulled Out of Wood
STX-103-1	Western Builder/ Silver Star	718.910	Screw Pulled Out of Wood
STX-103-1	Western Builder/ Silver Star	699.936	Screw Pulled Out of Wood
STX-103-1	Western Builder/ Silver Star	633.379	Screw Pulled Out of Wood
STX-103-1	Western Builder/ Silver Star	607.352	Screw Pulled Out of Wood
		Average Force =	**651.925**
		Standard Deviation =	**54.346**

CTX-1710-1	Big Timber/ Bronze Star	1422.554	Screw Pulled Out of Wood
CTX-1710-2	Big Timber/ Bronze Star	1671.216	Screw Pulled Out of Wood
CTX-1710-3	Big Timber/ Bronze Star	2396.708	Screw Pulled Out of Wood
CTX-1710-4	Big Timber/ Bronze Star	1181.694	Screw Pulled Out of Wood
CTX-1710-5	Big Timber/ Bronze Star	1226.349	Screw Pulled Out of Wood
		Average Force =	**1579.704**
		Standard Deviation =	**495.943**

Job Information

	Engineer	Checked	Approved
Name:			
Date:	09-09-21		

Project ID	
Project Name	

Structure Type	SPACE FRAME

Number of Nodes	9	Highest Node	9
Number of Elements	9	Highest Beam	9

Number of Basic Load Cases	6
Number of Combination Load Cases	15

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	D
Primary	2	LIVE/SNOW 1
Primary	3	LIVE/SNOW 2
Combination	9	D
Combination	10	D + S1
Combination	13	D + S2
Combination	16	D + W1
Combination	19	D + W2
Combination	22	D + W3
Combination	25	D + 0.75S1 + 0.75W1
Combination	28	D + 0.75S2 + 0.75W1
Combination	31	D + 0.75S1 + 0.75W2
Combination	34	D + 0.75S2 + 0.75W2
Combination	37	D + 0.75S1 + 0.75W3
Combination	40	D + 0.75S2 + 0.75W3
Combination	43	0.6D + W1
Combination	44	0.6D + W2
Combination	45	0.6D + W3

Nodes

Node	X (ft)	Y (ft)	Z (ft)
1	0	0	0
2	2.000	1.667	0
3	7.469	6.224	0
4	8.000	6.667	0
5	12.000	10.000	0
6	16.000	6.667	0
7	16.531	6.224	0
8	22.000	1.667	0
9	24.000	0	0

Beams

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
1	1	2	2.603	1	0
2	2	3	7.119	1	0
3	3	4	0.692	1	0
4	4	5	5.207	1	0
5	5	6	5.207	1	0
6	6	7	0.692	1	0
7	7	8	7.119	1	0
8	8	9	2.603	1	0
9	4	6	8.000	2	0

Section Properties

Prop	Section	Area (in^2)	I_{yy} (in^4)	I_{zz} (in^4)	J (in^4)	Material
1	DFLR_N1_6X8_BM_W	41.250	103.984	193.359	0	DFLR_N1_6X8
2	DFLR_N1_6X10_BM_'	52.250	131.714	392.964	0	DFLR_N1_6X1

Materials

Mat	Name	E (kip/in^2)	ν	Density (kip/in^3)	α (/°F)
1	PRPN	900.000	0.150	0.000	5.5E -6
2	SOPN_N2_6X12_WET	1.2E+3	0.150	0.000	5.5E -6
3	SOPN_N2_6X10_WET	1.2E+3	0.150	0.000	5.5E -6
4	CONCRETE	3.15E+3	0.170	8.68e-05	5.5E -6
5	WSCD_N2_6X6_BM_W	800.000	0.150	0.000	5.5E -6
6	PRPN_N2_6X6_BM	900.000	0.150	0.000	5.5E -6
7	SOPN_N2_6X8_WET	1.2E+3	0.150	0.000	5.5E -6
8	ALUMINUM	10E+3	0.330	9.8e-05	12.8E -6
9	DFLR_N1_6X10_BM_'	1.6E+3	0.150	0.000	5.5E -6
10	STEEL_50_KSI	29E+3	0.300	0.000283	6.5E -6
11	STAINLESSSTEEL	28E+3	0.300	0.000283	9.9E -6
12	DFLR#1	1.6E+3	0.150	0.000	5.5E -6
13	STEEL_36_KSI	29E+3	0.300	0.000283	6.5E -6
14	DFLR#2	1.3E+3	0.150	0.000	5.5E -6
15	WSCD_N2_4X8	1E+3	0.150	0.000	5.5E -6
16	STEEL_275_NMM2	29.7E+3	0.300	0.000	6.67E -6
17	STEEL	29E+3	0.300	0.000283	6.5E -6
18	PRPN_N2_6X8_BM	900.000	0.150	0.000	5.5E -6
19	SOPN_N2_6X6_WET	1.2E+3	0.150	0.000	5.5E -6
20	GLT-16F-V3_DF/DF	1.5E+3	0.150	0.000	5.5E -6
21	PRPN_N2_6X12_BM	900.000	0.150	0.000	5.5E -6
22	PRPN_N2_6X10_BM	900.000	0.150	0.000	5.5E -6
23	GLT-24F-V5_SP/SP	1.5E+3	0.150	0.000	5.5E -6
24	DFLR_N2_6X6_BM_W	1.3E+3	0.150	0.000	5.5E -6
25	WSCD_N2_4X6	1E+3	0.150	0.000	5.5E -6
26	DFLR_N1_6X8_BM_W	1.6E+3	0.150	0.000	5.5E -6
27	STEEL_355_NMM2	29.7E+3	0.300	0.000	6.67E -6

Supports

Node	X (kip/in)	Y (kip/in)	Z (kip/in)	rX (kip·ft/deg)	rY (kip·ft/deg)	rZ (kip·ft/deg)
2	Fixed	Fixed	Fixed	-	-	-
3	Fixed	Fixed	Fixed	-	-	-
7	Fixed	Fixed	Fixed	-	-	-
8	Fixed	Fixed	Fixed	-	-	-

Releases

Beam ends not shown in this table are fixed in all directions.

Beam	Node	x	y	z	rx	ry	rz
1	1	Fixed	Fixed	Fixed	Fixed	Pin	Pin
4	5	Fixed	Fixed	Fixed	Fixed	Pin	Pin
5	5	Fixed	Fixed	Fixed	Fixed	Pin	Pin
8	9	Fixed	Fixed	Fixed	Fixed	Pin	Pin
9	4	Fixed	Fixed	Fixed	Fixed	Pin	Pin
9	6	Fixed	Fixed	Fixed	Fixed	Pin	Pin

Primary Load Cases

Number	Name	Type
1	D	Dead
2	LIVE/SNOW 1	None
3	LIVE/SNOW 2	None
4	WIND 1	Wind
5	WIND 2	Wind
6	WIND 3	Wind

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
9	D	1	D	1.00
10	D + S1	1	D	1.00
		2	LIVE/SNOW 1	1.00
13	D + S2	1	D	1.00
		3	LIVE/SNOW 2	1.00
16	D + W1	1	D	1.00
		4	WIND 1	1.00
19	D + W2	1	D	1.00
		5	WIND 2	1.00
22	D + W3	1	D	1.00
		6	WIND 3	1.00
25	D + 0.75S1 + 0.75W1	1	D	1.00
		2	LIVE/SNOW 1	0.75
		4	WIND 1	0.75
28	D + 0.75S2 + 0.75W1	1	D	1.00
		3	LIVE/SNOW 2	0.75
		4	WIND 1	0.75
31	D + 0.75S1 + 0.75W2	1	D	1.00
		2	LIVE/SNOW 1	0.75
		5	WIND 2	0.75
34	D + 0.75S2 + 0.75W2	1	D	1.00
		3	LIVE/SNOW 2	0.75
		5	WIND 2	0.75
37	D + 0.75S1 + 0.75W3	1	D	1.00
		2	LIVE/SNOW 1	0.75
		6	WIND 3	0.75
40	D + 0.75S2 + 0.75W3	1	D	1.00
		3	LIVE/SNOW 2	0.75
		6	WIND 3	0.75
43	0.6D + W1	1	D	0.60
		4	WIND 1	1.00
44	0.6D + W2	1	D	0.60
		5	WIND 2	1.00
45	0.6D + W3	1	D	0.60
		6	WIND 3	1.00

Load Generators

There is no data of this type.

1 D : Beam Loads

Beam	Type	Direction	Fa	Da (ft)	Fb	Db	Ecc. (ft)
1	UNI lbf/ft	GY	-80.000	-	-	-	-
2	UNI lbf/ft	GY	-80.000	-	-	-	-
3	UNI lbf/ft	GY	-80.000	-	-	-	-
4	UNI lbf/ft	GY	-80.000	-	-	-	-
5	UNI lbf/ft	GY	-80.000	-	-	-	-
6	UNI lbf/ft	GY	-80.000	-	-	-	-
7	UNI lbf/ft	GY	-80.000	-	-	-	-
8	UNI lbf/ft	GY	-80.000	-	-	-	-

1 D : Selfweight

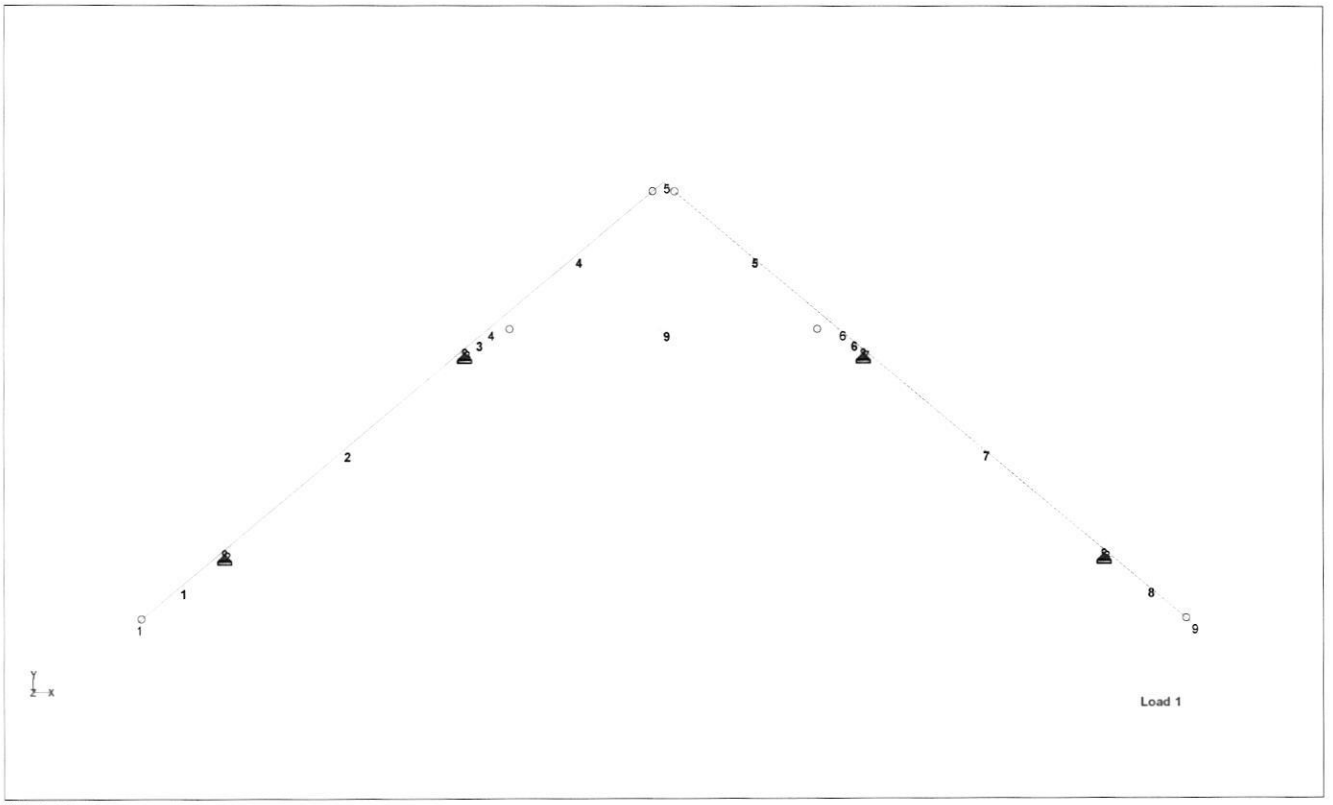
Direction	Factor	Assigned Geometry
Y	-1.000	ALL

2 LIVE/SNOW 1 : Beam Loads

Beam	Type	Direction	Fa	Da (ft)	Fb	Db	Ecc. (ft)
1	UNI lbf/ft	GY	-320.000	-	-	-	-
2	UNI lbf/ft	GY	-320.000	-	-	-	-
3	UNI lbf/ft	GY	-320.000	-	-	-	-
4	UNI lbf/ft	GY	-320.000	-	-	-	-
5	UNI lbf/ft	GY	-320.000	-	-	-	-
6	UNI lbf/ft	GY	-320.000	-	-	-	-
7	UNI lbf/ft	GY	-320.000	-	-	-	-
8	UNI lbf/ft	GY	-320.000	-	-	-	-

3 LIVE/SNOW 2 : Beam Loads

Beam	Type	Direction	Fa	Da (ft)	Fb	Db	Ecc. (ft)
1	UNI lbf/ft	GY	-320.000	-	-	-	-
2	UNI lbf/ft	GY	-320.000	-	-	-	-
3	UNI lbf/ft	GY	-320.000	-	-	-	-
4	UNI lbf/ft	GY	-320.000	-	-	-	-



Whole Structure

Beam End Displacement Summary

Displacements shown in italic indicate the presence of an offset

	Beam	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)
Max X	1	1	28:D + 0.75S2	**0.002**	-0.002	0	0.003
Min X	8	9	10:D + S1	**-0.001**	-0.002	0	0.002
Max Y	8	9	43:0.6D + W1	0.001	**0.001**	0	0.001
Min Y	4	5	10:D + S1	0	**-0.003**	0	0.003
Max Z	1	1	1:D	0.000	-0.000	**0**	0.000
Min Z	1	1	1:D	0.000	-0.000	**0**	0.000
Max Rst	1	1	28:D + 0.75S2	0.002	-0.002	0	**0.003**

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given from beam end A.

				Axial	Shear		Torsion	Bending	
	Beam	L/C	d (ft)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (kip˙in)	My (kip˙in)	Mz (kip˙in)
Max Fx	3	10:D + S1	0	**2.72E+3**	904.974	0	0	0	16.169
Min Fx	2	10:D + S1	7.119	**-927.777**	-1.15E+3	-0	-0	-0	16.169
Max Fy	2	31:D + 0.75S1	0	745.485	**1.23E+3**	0	0	0	14.582
Min Fy	2	28:D + 0.75S2	7.119	-745.485	**-1.33E+3**	-0	-0	-0	19.005
Max Fz	1	1:D	0	0.000	-0.000	**0**	0	0	0
Min Fz	1	1:D	0	0.000	-0.000	**0**	0	0	0
Max Mx	1	1:D	0	0.000	-0.000	0	**0**	0	0
Min Mx	1	1:D	0	0.000	-0.000	0	**0**	0	0
Max My	1	1:D	0	0.000	-0.000	0	0	**0**	0
Min My	1	1:D	0	0.000	-0.000	0	0	**0**	0
Max Mz	2	28:D + 0.75S2	7.119	-745.485	-1.33E+3	-0	-0	-0	**19.005**
Min Mz	2	31:D + 0.75S1	3.559	0	-47.388	0	0	0	**-10.651**

Reaction Summary

	Node	L/C	Horizontal FX (lb)	Vertical FY (lb)	Horizontal FZ (lb)	Moment MX (kip-in)	MY (kip-in)	MZ (kip-in)
Max FX	3	10:D + S1	**1.49E+3**	3.92E+3	0	0	0	0
Min FX	7	25:D + 0.75S1	**-1.86E+3**	2.67E+3	0	0	0	0
Max FY	3	10:D + S1	1.49E+3	**3.92E+3**	0	0	0	0
Min FY	7	45:0.6D + W3	-378.713	**-531.735**	0	0	0	0
Max FZ	2	1:D	5.737	530.272	**0**	0	0	0
Min FZ	2	1:D	5.737	530.272	**0**	0	0	0
Max MX	2	1:D	5.737	530.272	0	**0**	0	0
Min MX	2	1:D	5.737	530.272	0	**0**	0	0
Max MY	2	1:D	5.737	530.272	0	0	**0**	0
Min MY	2	1:D	5.737	530.272	0	0	**0**	0
Max MZ	2	1:D	5.737	530.272	0	0	0	**0**
Min MZ	2	1:D	5.737	530.272	0	0	0	**0**

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
1	DFLR_N1_6	DFLR_N1_6	0.399	1.000	0.399			41.250	193.400	104.000	414.238
2	DFLR_N1_6	DFLR_N1_6	0.568	1.000	0.568			41.250	193.400	104.000	414.238
3	DFLR_N1_6	DFLR_N1_6	0.516	1.000	0.516			41.250	193.400	104.000	414.238
4	DFLR_N1_6	DFLR_N1_6	0.473	1.000	0.473			41.250	193.400	104.000	414.238
5	DFLR_N1_6	DFLR_N1_6	0.414	1.000	0.414			41.250	193.400	104.000	414.238
6	DFLR_N1_6	DFLR_N1_6	0.387	1.000	0.387			41.250	193.400	104.000	414.238
7	DFLR_N1_6	DFLR_N1_6	0.494	1.000	0.494			41.250	193.400	104.000	414.238
8	DFLR_N1_6	DFLR_N1_6	0.348	1.000	0.348			41.250	193.400	104.000	414.238
9	DFLR_N1_6	DFLR_N1_6	0.012	1.000	0.012			52.250	393.000	131.700	995.538

Wood Beam

DESCRIPTION: Dormer Rafter

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

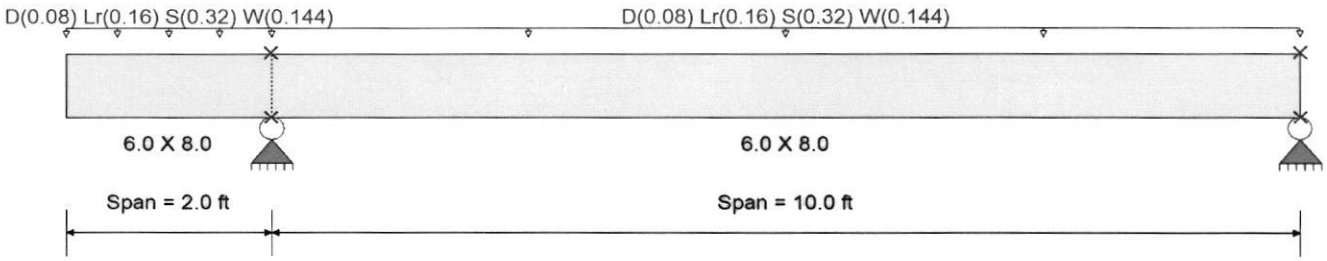
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1,350.0 psi
Fb -	1,350.0 psi
Fc - Prll	925.0 psi
Fc - Perp	625.0 psi
Fv	170.0 psi
Ft	675.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



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 = 0.0180 ksf, Tributary Width = 8.0 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 8.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.574** : 1	Maximum Shear Stress Ratio	=	**0.301** : 1
Section used for this span		**6.0 X 8.0**	Section used for this span		**6.0 X 8.0**
	=	886.47 psi		=	58.81 psi
	=	1,543.08 psi		=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	5.196 ft	Location of maximum on span	=	2.000 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.160 in	Ratio =	748 >=360
Max Upward Transient Deflection	-0.092 in	Ratio =	522 >=360
Max Downward Total Deflection	0.206 in	Ratio =	583 >=240
Max Upward Total Deflection	-0.118 in	Ratio =	406 >=240

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	Moment Values fb	Moment Values F'b	Shear Values V	Shear Values fv	Shear Values F'v
D Only													0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.028	0.085	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.18	33.90	1213.81	0.41	12.95	153.00
Length = 10.0 ft	2	0.161	0.085	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.04	195.27	1209.36	0.41	12.95	153.00
+D+Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.056	0.169	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.50	93.90	1685.20	1.15	35.88	212.50
Length = 10.0 ft	2	0.323	0.169	1.25	1.000	1.00	1.00	1.00	1.00	0.99	2.88	540.87	1676.27	1.15	35.88	212.50
+D+S					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.099	0.301	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.82	153.90	1550.55	1.88	58.81	195.50
Length = 10.0 ft	2	0.574	0.301	1.15	1.000	1.00	1.00	1.00	1.00	0.99	4.73	886.47	1543.08	1.88	58.81	195.50
+D+0.750Lr					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00

Wood Beam

DESCRIPTION: Dormer Rafter

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 2.0 ft	1	0.047	0.142	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.42	78.90	1685.20	0.96	30.15	212.50
Length = 10.0 ft	2	0.271	0.142	1.25	1.000	1.00	1.00	1.00	1.00	0.99	2.42	454.47	1676.27	0.96	30.15	212.50
+D+0.750S					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.080	0.242	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.66	123.90	1550.55	1.52	47.35	195.50
Length = 10.0 ft	2	0.462	0.242	1.15	1.000	1.00	1.00	1.00	1.00	0.99	3.81	713.67	1543.08	1.52	47.35	195.50
+D+0.60W					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.031	0.093	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.35	66.30	2156.20	0.81	25.34	272.00
Length = 10.0 ft	2	0.178	0.093	1.60	1.000	1.00	1.00	1.00	1.00	0.99	2.04	381.89	2140.97	0.81	25.34	272.00
+D+0.750Lr+0.450W					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.048	0.145	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.55	103.20	2156.20	1.26	39.44	272.00
Length = 10.0 ft	2	0.278	0.145	1.60	1.000	1.00	1.00	1.00	1.00	0.99	3.17	594.44	2140.97	1.26	39.44	272.00
+D+0.750S+0.450W					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.069	0.208	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.79	148.20	2156.20	1.81	56.63	272.00
Length = 10.0 ft	2	0.399	0.208	1.60	1.000	1.00	1.00	1.00	1.00	0.99	4.55	853.64	2140.97	1.81	56.63	272.00
+0.60D+0.60W					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.024	0.074	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.28	52.74	2156.20	0.64	20.15	272.00
Length = 10.0 ft	2	0.142	0.074	1.60	1.000	1.00	1.00	1.00	1.00	0.99	1.62	303.79	2140.97	0.64	20.15	272.00
+0.60D					1.000	1.00	1.00	1.00	1.00	0.99			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.009	0.029	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.11	20.34	2156.20	0.25	7.77	272.00
Length = 10.0 ft	2	0.055	0.029	1.60	1.000	1.00	1.00	1.00	1.00	0.99	0.62	117.16	2140.97	0.25	7.77	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	+D+S	-0.1177	0.000
+D+S	2	0.2055	5.084		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		2.955	1.970
Overall MINimum		1.037	0.691
D Only		0.651	0.434
+D+Lr		1.803	1.202
+D+S		2.955	1.970
+D+0.750Lr		1.515	1.010
+D+0.750S		2.379	1.586
+D+0.60W		1.273	0.849
+D+0.750Lr+0.450W		1.981	1.321
+D+0.750S+0.450W		2.845	1.897
+0.60D+0.60W		1.013	0.675
+0.60D		0.391	0.260
Lr Only		1.152	0.768
S Only		2.304	1.536
W Only		1.037	0.691

Wood Beam

DESCRIPTION: Hammer Truss Rafer w/ Dormer -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

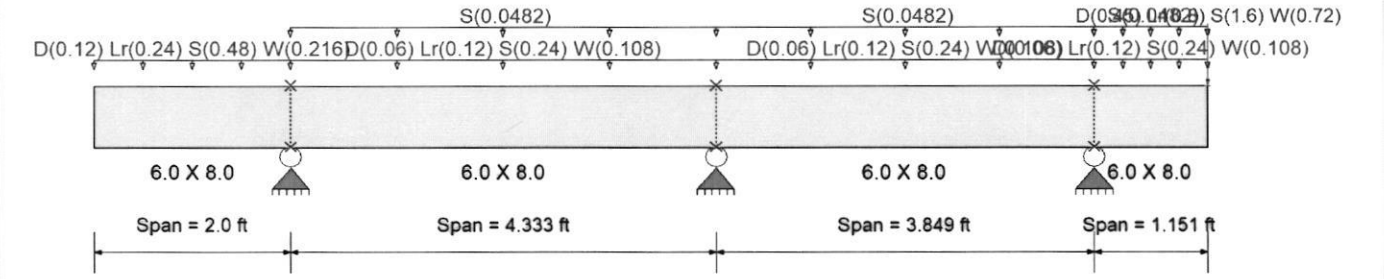
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1,350.0 psi
Fb -	1,350.0 psi
Fc - Prll	925.0 psi
Fc - Perp	625.0 psi
Fv	170.0 psi
Ft	675.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



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 = 0.0180 ksf, Tributary Width = 12.0 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 6.0 ft
Uniform Load : S = 0.04820 , Tributary Width = 1.0 ft, (Drift)
Load for Span Number 3
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 6.0 ft
Uniform Load : S = 0.04820 , Tributary Width = 1.0 ft, (Drift)
Load for Span Number 4
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 6.0 ft
Uniform Load : S = 0.04820 , Tributary Width = 1.0 ft, (Drift)
Point Load : D = 0.450, Lr = 0.80, S = 1.60, W = 0.720 k @ 1.151 ft, (Dormer Rafter)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.314** : 1	Maximum Shear Stress Ratio	=	**0.356** : 1
Section used for this span		**6.0 X 8.0**	Section used for this span		**6.0 X 8.0**
	=	486.95 psi		=	69.61 psi
	=	1,548.68 psi		=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	3.849 ft	Location of maximum on span	=	3.849 ft
Span # where maximum occurs	=	Span # 3	Span # where maximum occurs	=	Span # 3

Maximum Deflection

Max Downward Transient Deflection	0.013 in	Ratio =	2188 >=360
Max Upward Transient Deflection	-0.004 in	Ratio =	10273 >=360
Max Downward Total Deflection	0.016 in	Ratio =	1706 >=240
Max Upward Total Deflection	-0.006 in	Ratio =	7980 >=240

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	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													0.00	0.00	0.00	0.00

Wood Beam

DESCRIPTION: Hammer Truss Rafer w/ Dormer -Bents B&C

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 2.0 ft	1	0.040	0.036	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.26	48.90	1213.81	0.18	5.58	153.00
Length = 4.333 ft	2	0.040	0.036	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.26	48.90	1212.38	0.18	5.58	153.00
Length = 3.849 ft	3	0.087	0.099	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.56	105.86	1212.68	0.48	15.15	153.00
Length = 1.151 ft	4	0.087	0.099	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.56	105.86	1214.32	0.48	15.15	153.00
+D+Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.082	0.073	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.74	138.90	1685.20	0.50	15.53	212.50
Length = 4.333 ft	2	0.083	0.073	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.74	138.90	1682.36	0.50	15.53	212.50
Length = 3.849 ft	3	0.174	0.198	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.56	293.41	1682.97	1.34	42.01	212.50
Length = 1.151 ft	4	0.174	0.198	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.56	293.41	1686.19	1.34	42.01	212.50
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.148	0.138	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.22	228.90	1550.55	0.86	26.98	195.50
Length = 4.333 ft	2	0.148	0.138	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.22	228.90	1548.17	0.86	26.98	195.50
Length = 3.849 ft	3	0.314	0.356	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.60	486.95	1548.68	2.23	69.61	195.50
Length = 1.151 ft	4	0.314	0.356	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.60	486.95	1551.39	2.23	69.61	195.50
+D+0.750Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.069	0.061	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.62	116.40	1685.20	0.42	13.02	212.50
Length = 4.333 ft	2	0.069	0.061	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.62	116.40	1682.36	0.42	13.02	212.50
Length = 3.849 ft	3	0.146	0.166	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.31	246.53	1682.97	1.13	35.30	212.50
Length = 1.151 ft	4	0.146	0.166	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.31	246.53	1686.19	1.13	35.30	212.50
+D+0.750S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.119	0.111	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.98	183.90	1550.55	0.69	21.63	195.50
Length = 4.333 ft	2	0.119	0.111	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.98	183.90	1548.17	0.69	21.63	195.50
Length = 3.849 ft	3	0.253	0.286	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.09	391.68	1548.68	1.79	56.00	195.50
Length = 1.151 ft	4	0.252	0.286	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.09	391.68	1551.39	1.79	56.00	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 = 2.0 ft	1	0.045	0.040	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.52	97.50	2156.20	0.35	10.93	272.00
Length = 4.333 ft	2	0.045	0.040	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.52	97.50	2151.46	0.35	10.93	272.00
Length = 3.849 ft	3	0.096	0.109	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.10	207.14	2152.47	0.95	29.66	272.00
Length = 1.151 ft	4	0.096	0.109	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.10	207.14	2157.84	0.95	29.66	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 = 2.0 ft	1	0.071	0.063	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.82	152.85	2156.20	0.55	17.09	272.00
Length = 4.333 ft	2	0.071	0.063	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.82	152.85	2151.46	0.54	17.09	272.00
Length = 3.849 ft	3	0.150	0.170	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.72	322.48	2152.47	1.48	46.17	272.00
Length = 1.151 ft	4	0.149	0.170	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.72	322.48	2157.84	1.48	46.17	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 = 2.0 ft	1	0.102	0.094	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	220.35	2156.20	0.82	25.64	272.00
Length = 4.333 ft	2	0.102	0.094	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	220.35	2151.46	0.82	25.64	272.00
Length = 3.849 ft	3	0.217	0.246	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.49	467.64	2152.47	2.14	66.88	272.00
Length = 1.151 ft	4	0.217	0.246	1.60	1.000	1.00	1.00	1.00	1.00	1.00	2.49	467.64	2157.84	2.14	66.88	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 = 2.0 ft	1	0.036	0.032	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.42	77.94	2156.20	0.28	8.71	272.00
Length = 4.333 ft	2	0.036	0.032	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.42	77.94	2151.46	0.28	8.71	272.00
Length = 3.849 ft	3	0.077	0.087	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.88	164.80	2152.47	0.76	23.59	272.00
Length = 1.151 ft	4	0.076	0.087	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.88	164.80	2157.84	0.76	23.59	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 = 2.0 ft	1	0.014	0.012	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.16	29.34	2156.20	0.11	3.35	272.00
Length = 4.333 ft	2	0.014	0.012	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.16	29.34	2151.46	0.11	3.35	272.00
Length = 3.849 ft	3	0.030	0.033	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.34	63.52	2152.47	0.29	9.09	272.00
Length = 1.151 ft	4	0.029	0.033	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.34	63.52	2157.84	0.29	9.09	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0087	0.000		0.0000	0.000
+D+S	2	0.0021	2.852	+D+0.750S+0.450W	-0.0004	0.494
	3	0.0000	2.852	+D+S	-0.0058	2.534
+D+S	4	0.0162	1.151		0.0000	2.534

Vertical Reactions

Support notation : Far left is #1 — Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
Overall MAXimum		2.320	0.424	3.873	

Wood Beam

DESCRIPTION: Hammer Truss Rafer w/ Dormer -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
Overall MINimum		0.788	0.060	1.311	
D Only		0.486	0.055	0.827	
+D+Lr		1.362	0.122	2.284	
+D+S		2.320	0.424	3.873	
+D+0.750Lr		1.143	0.105	1.920	
+D+0.750S		1.862	0.332	3.112	
+D+0.60W		0.959	0.091	1.614	
+D+0.750Lr+0.450W		1.497	0.132	2.510	
+D+0.750S+0.450W		2.216	0.359	3.702	
+0.60D+0.60W		0.764	0.069	1.283	
+0.60D		0.291	0.033	0.496	
Lr Only		0.876	0.067	1.457	
S Only		1.834	0.369	3.046	
W Only		0.788	0.060	1.311	

Wood Beam

DESCRIPTION: Hammer Truss Rafer -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

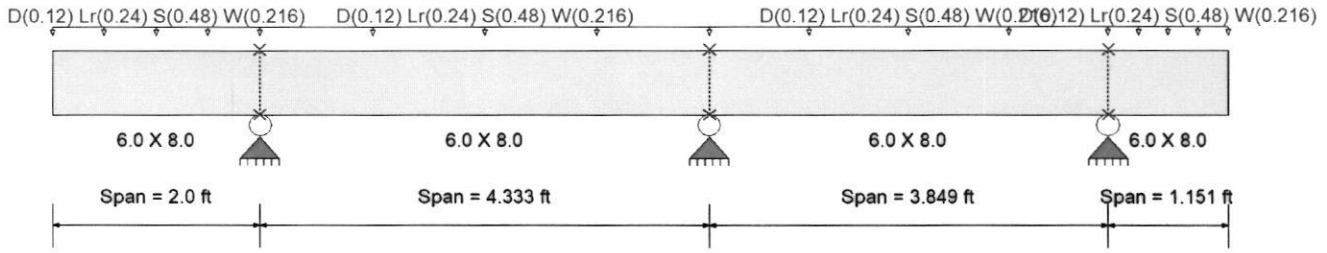
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1,350.0 psi
Fb -	1,350.0 psi
Fc - Prll	925.0 psi
Fc - Perp	625.0 psi
Fv	170.0 psi
Ft	675.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



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 = 0.0180 ksf, Tributary Width = 12.0 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 12.0 ft
Load for Span Number 3
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 12.0 ft
Load for Span Number 4
Uniform Load : D = 0.010, Lr = 0.020, S = 0.040, W = 0.0180 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.148** : 1	Maximum Shear Stress Ratio	=	**0.160** : 1
Section used for this span		**6.0 X 8.0**	Section used for this span		**6.0 X 8.0**
	=	228.90 psi		=	31.29 psi
	=	1,548.17 psi		=	195.50 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	0.000 ft	Location of maximum on span	=	2.000 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.006 in	Ratio =	7700 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.008 in	Ratio =	6054 >=240
Max Upward Total Deflection	-0.001 in	Ratio =	22158 >=240

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.040	0.044	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.26	48.90	1213.81	0.21	6.68	153.00
Length = 4.333 ft	2	0.040	0.044	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.26	48.90	1212.38	0.21	6.68	153.00
Length = 3.849 ft	3	0.029	0.044	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.19	34.93	1212.68	0.19	6.68	153.00
Length = 1.151 ft	4	0.013	0.044	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.09	16.20	1214.32	0.06	6.68	153.00

Wood Beam

DESCRIPTION: Hammer Truss Rafer -Bents B&C

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	Moment Values fb	Moment Values F'b	Shear Values V	Shear Values fv	Shear Values F'v
+D+Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.082	0.089	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.74	138.90	1685.20	0.61	18.99	212.50
Length = 4.333 ft	2	0.083	0.089	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.74	138.90	1682.36	0.61	18.99	212.50
Length = 3.849 ft	3	0.059	0.089	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.53	99.22	1682.97	0.55	18.99	212.50
Length = 1.151 ft	4	0.027	0.089	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.25	46.00	1686.19	0.18	18.99	212.50
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.148	0.160	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.22	228.90	1550.55	1.00	31.29	195.50
Length = 4.333 ft	2	0.148	0.160	1.15	1.000	1.00	1.00	1.00	1.00	1.00	1.22	228.90	1548.17	1.00	31.29	195.50
Length = 3.849 ft	3	0.106	0.160	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.87	163.51	1548.68	0.91	31.29	195.50
Length = 1.151 ft	4	0.049	0.160	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.40	75.81	1551.39	0.30	31.29	195.50
+D+0.750Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.069	0.075	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.62	116.40	1685.20	0.51	15.91	212.50
Length = 4.333 ft	2	0.069	0.075	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.62	116.40	1682.36	0.51	15.91	212.50
Length = 3.849 ft	3	0.049	0.075	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.44	83.15	1682.97	0.46	15.91	212.50
Length = 1.151 ft	4	0.023	0.075	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.21	38.55	1686.19	0.15	15.91	212.50
+D+0.750S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 2.0 ft	1	0.119	0.129	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.98	183.90	1550.55	0.80	25.14	195.50
Length = 4.333 ft	2	0.119	0.129	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.98	183.90	1548.17	0.80	25.14	195.50
Length = 3.849 ft	3	0.085	0.129	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.70	131.36	1548.68	0.73	25.14	195.50
Length = 1.151 ft	4	0.039	0.129	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.32	60.91	1551.39	0.24	25.14	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 = 2.0 ft	1	0.045	0.049	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.52	97.50	2156.20	0.43	13.33	272.00
Length = 4.333 ft	2	0.045	0.049	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.52	97.50	2151.46	0.43	13.33	272.00
Length = 3.849 ft	3	0.032	0.049	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.37	69.65	2152.47	0.39	13.33	272.00
Length = 1.151 ft	4	0.015	0.049	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.17	32.29	2157.84	0.13	13.33	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 = 2.0 ft	1	0.071	0.077	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.82	152.85	2156.20	0.67	20.89	272.00
Length = 4.333 ft	2	0.071	0.077	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.82	152.85	2151.46	0.67	20.89	272.00
Length = 3.849 ft	3	0.051	0.077	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.58	109.18	2152.47	0.61	20.89	272.00
Length = 1.151 ft	4	0.023	0.077	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.27	50.62	2157.84	0.20	20.89	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 = 2.0 ft	1	0.102	0.111	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	220.35	2156.20	0.96	30.12	272.00
Length = 4.333 ft	2	0.102	0.111	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.18	220.35	2151.46	0.96	30.12	272.00
Length = 3.849 ft	3	0.073	0.111	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.84	157.40	2152.47	0.88	30.12	272.00
Length = 1.151 ft	4	0.034	0.111	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.39	72.98	2157.84	0.29	30.12	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 = 2.0 ft	1	0.036	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.42	77.94	2156.20	0.34	10.65	272.00
Length = 4.333 ft	2	0.036	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.42	77.94	2151.46	0.34	10.65	272.00
Length = 3.849 ft	3	0.026	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.30	55.67	2152.47	0.31	10.65	272.00
Length = 1.151 ft	4	0.012	0.039	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.14	25.81	2157.84	0.10	10.65	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 = 2.0 ft	1	0.014	0.015	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.16	29.34	2156.20	0.13	4.01	272.00
Length = 4.333 ft	2	0.014	0.015	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.16	29.34	2151.46	0.13	4.01	272.00
Length = 3.849 ft	3	0.010	0.015	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.11	20.96	2152.47	0.12	4.01	272.00
Length = 1.151 ft	4	0.005	0.015	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.05	9.72	2157.84	0.04	4.01	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.0079	0.000		0.0000	0.000
+D+S	2	0.0014	2.358	+D+S	-0.0002	0.329
+D+S	3	0.0024	2.095		0.0000	0.329
	4	0.0000	2.095	+D+S	-0.0012	1.151

Vertical Reactions

Support notation : Far left is #1 — Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
Overall MAXimum		2.624	2.538	1.756	
Overall MINimum		0.928	0.898	0.621	
D Only		0.561	0.542	0.375	
+D+Lr		1.592	1.540	1.065	
+D+S		2.624	2.538	1.756	