Reviewed for
Code Compliance

07/12/2022

Duane Boice P.E.
President

Engineering & Technical Services Inc.
STRUCTURAL CALCULATIONS

COVER SHEET

Date: July 12, 2022

Project: Sand Creek Post & Beam / Keelin Regan-Reed

Project Location: 34130 Whiffle Tree Trail
Oak Creek, CO 80467

E.T.S. Designer: Alex Smith/Colin Nelson

Contact: Brad Longe

Building Sizes: 24'-0" x 60'-0"
Building Style: Ponderosa Country Barn
Sand Creek Post & Beam Job #: KRE121-1

COLORADO LICENSED
DUANE D. BOICE
25031
7/12/2022
PROFESSIONAL ENGINEER

Comments:
DEISGN LOAD INFORMATION:

- 2018 International Building Code
- Roof Live/Snow Load: 116 PSF
- Ground Snow Load: 150 PSF
- Wind Load (Ultimate) = 115 MPH EXP. 'C' (3 Second Gust)
- Risk Category – II
- Seismic Design Category – C

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

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Client:	**Sand Creek Post & Beam**	Job #:	KRE121-1	1
Job Name:	**Keelin Regan-Reed**	Date:	4/22/2021	
Location:	**Oak Creek, CO**	Designed by:	**ARS**	

Design Criteria

Code Authority:	2018	International Building Code	
Roof Dead Load:	10	PSF	
Roof Snow/Live Load:	116	PSF	= 150 PSF x 1.1 x 1.0 x 0.7
Ground Snow Load:	150	PSF	
Wind Load:	115	MPH - (Ult) (3 Second Gust)	
Exposure:	C		
Seismic Category:	C		
Imp. Cat. :	II		
Structure Type:	Fully Enclosed		

Basic Wind Parameters

Wind Load Standard	= ASCE 7-16	Exposure Category	= C
Wind Design Speed	= 115.0 mph	Risk Category	= II
Structure Type	= Building	Building Type	= Enclosed

General Wind Settings

	= ASCE 7-16 Wind Parameters	=
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
NF	= Natural Frequency of Structure	= 1.000 Hz
Zg	= Altitude (Ground Elevation) above Sea Level	= 0.000 ft
Bdist	= Base Elevation of Structure	= 0.000 ft
GenElev	= Specify the Elevations For Wind Pressures	= Mean Roof Ht
SDB	= Simple Diaphragm Building	= True
MWFRS	= Analysis Procedure being used for MWFRS	= Ch 28 Pt 1
C&C	= Analysis Procedure being used for C&C	= Ch 30 Pt 1
Reacs	= Show the Base Reactions in the output	= False
MWFRSType	= MWFRS Method Selected	= Ch 27 Pt 1

Building Inputs

RoofType	: Building Roof Type = Gabled	: Gabled	=		
W	: Width Perp to Ridge = 24.000 ft	L	: Length Along Ridge	= 60.000 ft	
EHt	: Eave Height = 11.500 ft	RE	: Roof Entry Method	= Slope	
Slope	: Slope of Roof = 10.0 :12	OH	: Specify Roof to Wall intersections and Overhangs	= Overhang	
Parapet	: Type of Parapet = None	Theta	: Roof Slope	= 39.81 Deg	
Par	: Is there a Parapet = False	OH_ALL	: Overhang	= 1.500 ft	
OH_ALL	: Overhang = 1.500 ft	OH_ALL	: Overhang	= 1.500 ft	

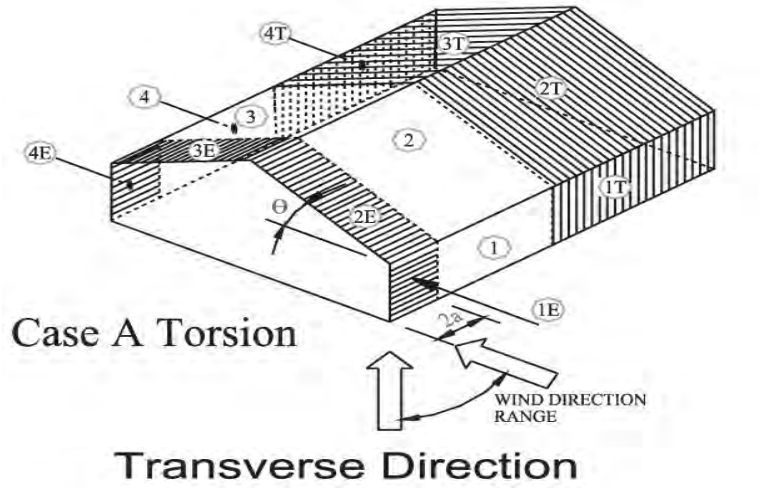
Wind Pressures for Transverse Direction per Fig 28.3-1
All wind pressures include a load factor of 0.6

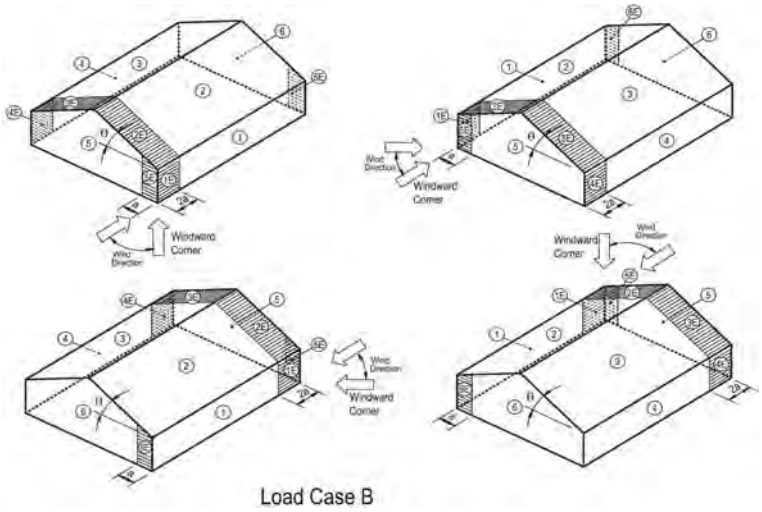
Building Surface	GCpf	GCpi	p +GCPi psf	p -GCPi psf
1	0.560	+/-0.18	5.68	11.07
2	0.210	+/-0.18	0.45	5.83
3	-0.430	+/-0.18	-9.12	-3.74
4	-0.370	+/-0.18	-8.22	-2.84
1E	0.690	+/-0.18	7.63	13.01
2E	0.270	+/-0.18	1.35	6.73
3E	-0.530	+/-0.18	-10.62	-5.23
4E	-0.480	+/-0.18	-9.87	-4.49
1T	0.140	+/-0.18	-0.60	4.79
2T	0.052	+/-0.18	-1.91	3.48
3T	-0.108	+/-0.18	-4.30	1.08
4T	-0.093	+/-0.18	-4.08	1.31
2_OHx	0.210	+/-0.00	3.14	3.14
2_OHy	0.210	+/-0.00	3.14	3.14
3_OHx	-0.430	+/-0.00	-6.43	-6.43
3_OHy	-0.430	+/-0.00	-6.43	-6.43
2E_OHx	0.270	+/-0.00	4.04	4.04
2E_OHy	0.270	+/-0.00	4.04	4.04
3E_OHx	-0.530	+/-0.00	-7.93	-7.93
3E_OHy	-0.530	+/-0.00	-7.93	-7.93
2T_OHx	0.052	+/-0.00	0.79	0.79
2T_OHy	0.052	+/-0.00	0.79	0.79
3T_OHx	-0.108	+/-0.00	-1.61	-1.61
3T_OHy	-0.108	+/-0.00	-1.61	-1.61

p = [Walls and Roof] qh*[GCpf - (+/-GCpi)] {Eqn 28.3-1}
[Parapet] qp * GCPf {Eqn 28.3-2}
GCpf = External Pressure coefficient from Fig 28.3-1

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

LHD	= Least Horizontal Dimension: Min(B, L)	= 24.000 ft
a1	= Min(0.1 * LHD, 0.4 * h	= 2.400 ft
a	= Max(a1, 0.04 * LHD, 3 ft [0.9 m])	= 3.000 ft





Wind Pressures for Longitudinal Direction per Pifg 28.3-1
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	-9.42	-4.04
2	-0.690	+/-0.18	-13.01	-7.63
3	-0.370	+/-0.18	-8.22	-2.84
4	-0.450	+/-0.18	-9.42	-4.04
5	0.400	+/-0.18	3.29	8.67
6	-0.290	+/-0.18	-7.03	-1.64
1E	-0.480	+/-0.18	-9.87	-4.49
2E	-1.070	+/-0.18	-18.69	-13.31
3E	-0.530	+/-0.18	-10.62	-5.23
4E	-0.480	+/-0.18	-9.87	-4.49
5E	0.610	+/-0.18	6.43	11.81
6E	-0.430	+/-0.18	-9.12	-3.74
1T	-0.113	+/-0.18	-4.37	1.01
2T	-0.173	+/-0.18	-5.27	0.11
3T	-0.093	+/-0.18	-4.08	1.31
4T	-0.113	+/-0.18	-4.37	1.01
5T	0.100	+/-0.18	-1.20	4.19
6T	-0.073	+/-0.18	-3.78	1.61
2_OHx	-0.690	+/-0.00	-10.32	-10.32
2_OHy	-0.690	+/-0.00	-10.32	-10.32
3_OHx	-0.370	+/-0.00	-5.53	-5.53
3_OHy	-0.370	+/-0.00	-5.53	-5.53
2E_OHx	-1.070	+/-0.00	-16.00	-16.00
2E_OHy	-1.070	+/-0.00	-16.00	-16.00
3E_OHx	-0.530	+/-0.00	-7.93	-7.93
3E_OHy	-0.530	+/-0.00	-7.93	-7.93

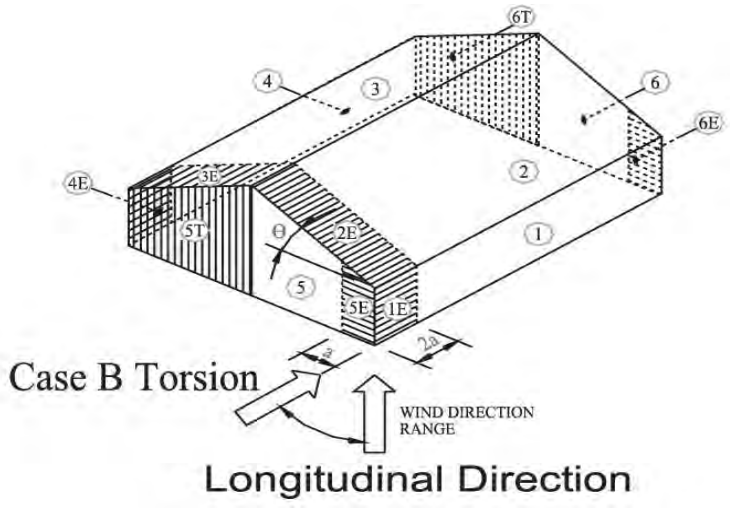
2T_OHx	-0.173	+/-0.00	-2.58	-2.58
2T_OHy	-0.173	+/-0.00	-2.58	-2.58
3T_OHx	-0.093	+/-0.00	-1.38	-1.38
3T_OHy	-0.093	+/-0.00	-1.38	-1.38

p = [Walls and Roof] qh*[GCpf - (+/-GCpi)] {Eqn 28.3-1}
[Parapet] qp * GCPf {Eqn 28.3-2}
GCpf = External Pressure coefficient from Fig 28.3-1

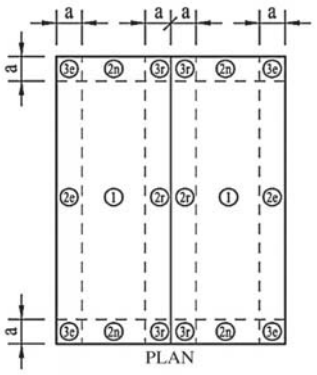
OHx & OHy are the Overhang in the X (Along ridge) & Y (Normal to Ridge) directions

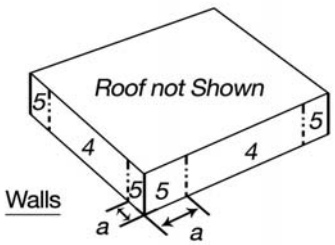
Torsional load cases with 'T' need not be considered if Either of the following are met:
* One Story buildings with h <= 30 ft [9.1 m]
* 2 stories or less framed with light frame construction and Flexible Diaphragm

LHD	= Least Horizontal Dimension: Min(B, L)	= 24.000 ft
a1	= Min(0.1 * LHD, 0.4 * h	= 2.400 ft
a	= Max(a1, 0.04 * LHD, 3 ft [0.9 m])	= 3.000 ft



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





h	= Mean Roof Height above grade	= 16.500 ft
Kh	= 15 ft [4.572 m]< Z <Zg -->(2.01*(Z/zg)^(2/Alpha) {Table 26.10-1}	= 0.866
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 26.13-1 for Enclosed Building	= +/-0.18
LF	= Load Factor based upon ASD Design	= 0.60
qh	= (0.00256 * Kh * Kzt * Kd * Ke * V^2) * LF	= 14.95 psf
LHD	= Least Horizontal Dimension: Min(B, L)	= 24.000 ft
a1	= Min(0.1 * LHD, 0.4 * h	= 2.400 ft
a	= Max(a1, 0.04 * LHD, 3 ft [0.9 m])	= 3.000 ft
h/B	= Ratio of mean roof height to least hor dim: h / B	= 0.688

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

Description	Zone	Width	Span	Area	1/3 Rule	Ref Fig	GCp Max	GCp Min	p Max psf	p Min psf
		ft	ft	sq ft						
Purlins	2e	2.000	12.000	48.00	Yes	30.3-2D	0.628	-1.119	12.08	-19.42
Rafters	2e	12.000	24.000	288.00	No	30.3-2D	0.500	-0.800	10.17	-14.66
Studs	4	1.333	12.000	48.00	Yes	30.3-1	0.880	-0.980	15.85	-17.34
Columns	4	4.000	12.000	48.00	No	30.3-1	0.880	-0.980	15.85	-17.34

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 30.3-1 through 30.3-7
p = Wind Pressure: qh*(GCp - GCpi) [Eqn 30.3-1]*
*Per Para 30.2.2 the Minimum Pressure for C&C is 9.60 psf [0.460 kPa] {Includes LF}

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Client:	**Sand Creek Post & Beam**	Job #:	KRE121-1
Job Name:	**Keelin Regan-Reed**	Date:	4/22/2021
Location:	**Oak Creek, CO**	Designed by:	**ARS**

Lateral Anaylsis

Longitudinal Main Level — End Zone = 3.0 ft

19.74	psf	x	3.00	ft	x	5.75	ft		=		340.52	lb	(end zone wall)
19.74	psf	x	3.00	ft	x	2.50	ft	x	0.5	=	74.03	lb	(end zone wall)
18.84	psf	x	9.00	ft	x	8.25	ft		=		1,398.87	lb	(interior zone wall)
18.84	psf	x	9.00	ft	x	7.50	ft	x	0.5	=	635.85	lb	(interior zone wall)
											2,449	lb	

Total Shear = 2,449 lb

Seismic Shear > Wind Shear, Design for Seismic Shear

Seismic Shear = 2851 #

Left Wall

Openings = 33.7 ft — Largest Opening Height = 7.5 ft

V_w = 2,851 lb / 26.3 ft = 108 plf — Wall Height = 11.5 ft

Shear capacity of 1/2" osb sheating w/ 8d nails @ 6" o.c.= 365 plf

365 plf > 108 plf -> Okay

Uplift = 2,851 lb - 7 psf x 26.3 ft x 11.50 ft = 734 # net

Uplift = 734 # x 11.50 ft / 26.3 = 321 # uplift per corner & openings

Uplift w/ opening = 321 / 0.65 = 498 # -> Okay

Right Wall

Openings = 21.7 ft — Largest Opening Height = 7 ft

V_w = 2,851 lb / 38.3 ft = 74 plf — Wall Height = 11.5 ft

Shear capacity of 1/2" osb sheating w/ 8d nails @ 6" o.c.= 365 plf

365 plf > 74 plf -> Okay

Uplift = 2,851 lb - 7 psf x 38 ft x 11.50 ft = 0 # net

Uplift = 0 # x 11.50 ft / 38.3 = 0 # uplift per corner & openings

Uplift w/ opening = 0 / 0.73 = 0 # -> Okay

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Location:	**Oak Creek, CO**	Designed by:	**ARS**

Transverse Anaylsis

Transverse Main Level

10.00 ft (roof height) End Zone = 6.0 ft

18.76	psf	x	6.00	ft	x	10.00	ft	=	1,125.83 lb	(end zone roof)
13.59	psf	x	24.00	ft	x	10.00	ft	=	3,261.87 lb	(interior zone roof)
19.74	psf	x	6.00	ft	x	5.75	ft	=	681.03 lb	(end zone wall)
18.84	psf	x	24.00	ft	x	5.75	ft	=	2,599.92 lb	(interior zone wall)
									7,668.65 lb	

Total Shear = 7,669 lb

Seismic Shear < Wind Shear, Design for Wind Shear

Seismic Shear = 2851 #

Front Wall — Largest Opening Height = 6.2 ft

Openings = 12.2 ft — Wall Height = 11.5 ft

V_w = 7,669 lb / 11.8 ft = 648 plf

Shear capacity of 1/2" osb sheating w/ 8d nails @ 3" o.c.= 685 plf

685 plf > 648 plf -> Okay

Uplift = 7,669 lb - 7 psf x 11.8 ft x 11.50 ft = 6,716 # net

Uplift = 6,716 # x 11.50 ft / 11.8 = 6529 # uplift per corner & openings

Uplift w/ opening = 6529 / 0.67 = 9786 # -> Okay

Uplift Capacity of Simpson HDU14-SDS2.5 w/ 1" x12" AB w/ 7.25" Wood 12375# > 9786# -> Okay

Rear Wall — Largest Opening Height = 2.2 ft

Openings = 12.0 ft — Wall Height = 11.5 ft

V_w = 7,669 lb / 12.0 ft = 639 plf

Shear capacity of 1/2" osb sheating w/ 8d nails @ 3" o.c.= 685 plf

685 plf > 639 plf -> Okay

Uplift = 7,669 lb - 7 psf x 12 ft x 11.50 ft = 6,703 # net

Uplift = 6,703 # x 11.50 ft / 12.0 = 6423 # uplift per corner & openings

Uplift w/ opening = 6423 / 1.00 = 6423 # -> Okay

Uplift Capacity of Simpson HDU8-SDS2.5 w/ 0.875" x12" AB w/ 4.5" Wood 6580# > 6423# -> Okay

Hazards by Location

Search Information

Address: 34130 Whiffle Tree Trail, Oak Creek, CO 80467, USA

Coordinates: 40.2179159, -106.7913239

Elevation: 8001 ft

Timestamp: 2021-04-22T12:41:26.618Z

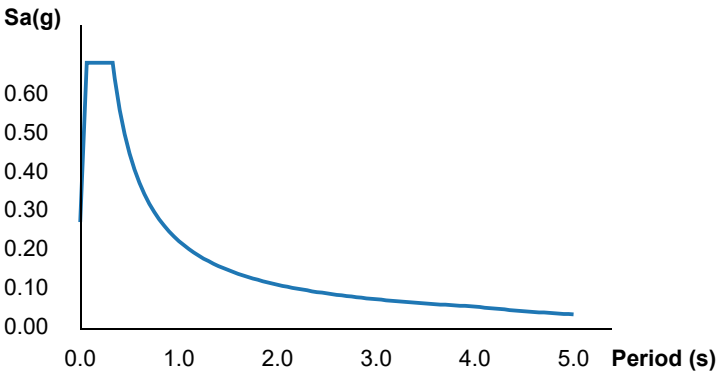
Hazard Type: Seismic

Reference Document: ASCE7-16

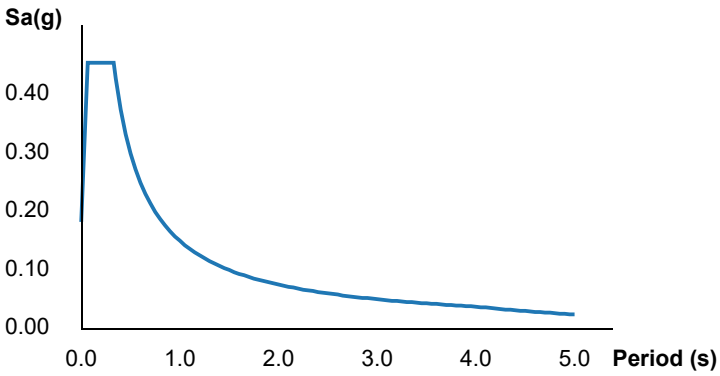
Risk Category: II

Site Class: D-default

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.482	MCE_R ground motion (period=0.2s)
S_1	0.093	MCE_R ground motion (period=1.0s)
S_{MS}	0.682	Site-modified spectral acceleration value
S_{M1}	0.224	Site-modified spectral acceleration value
S_{DS}	0.454	Numeric seismic design value at 0.2s SA
S_{D1}	0.15	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	C	Seismic design category
F_a	1.414	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s

CR_S	0.92	Coefficient of risk (0.2s)
CR_1	0.938	Coefficient of risk (1.0s)
PGA	0.319	MCE_G peak ground acceleration
F_{PGA}	1.281	Site amplification factor at PGA
PGA_M	0.409	Site modified peak ground acceleration
T_L	4	Long-period transition period (s)
SsRT	0.482	Probabilistic risk-targeted ground motion (0.2s)
SsUH	0.524	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.093	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.1	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

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Location:	**Oak Creek, CO**	Designed by:	**ARS**

Seismic Anaylsis - Sheathing

Seismic - Sheathing V = 1 x SDS x W / R SDS= 0.454 R= 6.5

10	psf	x	63	ft	x	35	ft		=	22,050	lb	Roof
116	psf	x	63	ft	x	35	ft	x 0.2	=	51,156	lb	Snow
7	psf	x	60	ft	x	5.75	ft	x 2	=	4,830	lb	Side Wall
7	psf	x	24	ft	x	5.75	ft	x 2	=	1,932	lb	End Wall
7	psf	x	12	ft	x	10	ft	x 2	=	1,680	lb	End Wall
										81,648	lb	

1 x 0.454 x 81,648 / 6.5 = 5703 #/direction = 2851 #/ Wall

Seismic Shear < Wind Shear, Design for Wind Shear

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Roof Members - Purlins

Design Loads

DL =	10	PSF
LL =	116	PSF
W1 =	12.1	PSF
W2 =	-19.4	PSF

Load Combinations

1) D + L =	125.5	PSF
2) D + 0.75L + 0.75W1 =	105.7	PSF
3) D + 0.75L + 0.75W2 =	82.1	PSF
4) D + W1 =	22.1	PSF
5) D + W2 =	-9.4	PSF
6) 0.6D +0 W1 =	18.1	PSF
7) 0.6D + W2 =	-13.4	PSF

Roof Members - Rafters

Design Loads

DL =	10	PSF
LL =	116	PSF
W1 =	10.2	PSF
W2 =	-14.7	PSF

Load Combinations

1) D + L =	125.5	PSF
2) D + 0.75L + 0.75W1 =	104.3	PSF
3) D + 0.75L + 0.75W2 =	85.6	PSF
4) D + W1 =	20.2	PSF
5) D + W2 =	-4.7	PSF
6) 0.6D +0 W1 =	16.2	PSF
7) 0.6D + W2 =	-8.7	PSF

Floor / Loft Members

Design Loads

DL =	0	PSF
LL =	0	PSF

Load Combinations

1) D + L =	0.0	PSF

Wall Members - Studs

Design Loads

DL =	N/A	PSF
LL =	N/A	PSF
W1 =	15.9	PSF
W2 =	-17.3	PSF

Load Combinations

4) D + W1 =	15.9	PSF
5) D + W2 =	-17.3	PSF

Wall Members - Columns

Design Loads

DL =	N/A	PSF
LL =	N/A	PSF
W1 =	15.9	PSF
W2 =	-17.3	PSF

Load Combinations

4) D + W1 =	15.9	PSF
5) D + W2 =	-17.3	PSF

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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

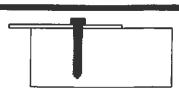
$Z_{\perp}$ = 361# x 1.15 LDF = 415#
361# x 1.25 LDF = 451#
361# x 1.6 LDF = 578#

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" Lag per bracket into sill plate + (1) 1/2" x 6" Titen HD anchor
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]



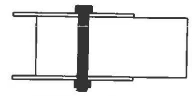
for sawn lumber or SCL with ASTM A653, Grade 33 steel side plate (for t_s<1/4") or ASTM A 36 steel side plate (for t_s=1/4")
(tabulated lateral design values are calculated based on an assumed length of lag screw penetration, p, into the main member equal to 8D)

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]

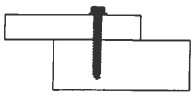
for sawn lumber or SCL main member with 1/4" ASTM A 36 steel side plates



Thickness: Main Member t_m in.	Thickness: Side Member t_s in.	Bolt Diameter D in.	G=0.67 Red Oak $Z_{\parallel}$ lbs.	G=0.67 Red Oak $Z_{\perp}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\parallel}$ lbs.	G=0.55 Mixed Maple Southern Pine $Z_{\perp}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\parallel}$ lbs.	G=0.50 Douglas Fir-Larch $Z_{\perp}$ lbs.	G=0.49 Douglas Fir-Larch (N) $Z_{\parallel}$ lbs.	G=0.49 Douglas Fir-Larch (N) $Z_{\perp}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\parallel}$ lbs.	G=0.46 Douglas Fir(S) Hem-Fir(N) $Z_{\perp}$ lbs.	G=0.43 Hem-Fir $Z_{\parallel}$ lbs.	G=0.43 Hem-Fir $Z_{\perp}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\parallel}$ lbs.	G=0.42 Spruce-Pine-Fir $Z_{\perp}$ lbs.	G=0.37 Redwood (open grain) $Z_{\parallel}$ lbs.	G=0.37 Redwood (open grain) $Z_{\perp}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\parallel}$ lbs.	G=0.36 Eastern Softwoods Spruce-Pine-Fir(S) Western Cedars Western Woods $Z_{\perp}$ lbs.	G=0.35 Northern Species $Z_{\parallel}$ lbs.	G=0.35 Northern Species $Z_{\perp}$ 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 (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}.

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Lap Shear Force Data Sheet

Customer Name: Western Builders Supply
File No: 09-33459
Measurements Are N/A

Test Date: 10/23/09 to 10/30/09
Tested By: Ron Pienkowski

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**

Wood Beam

Lic. # : KW-06009356 — Engineering & Technical Services, Inc

DESCRIPTION: Purlins

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

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

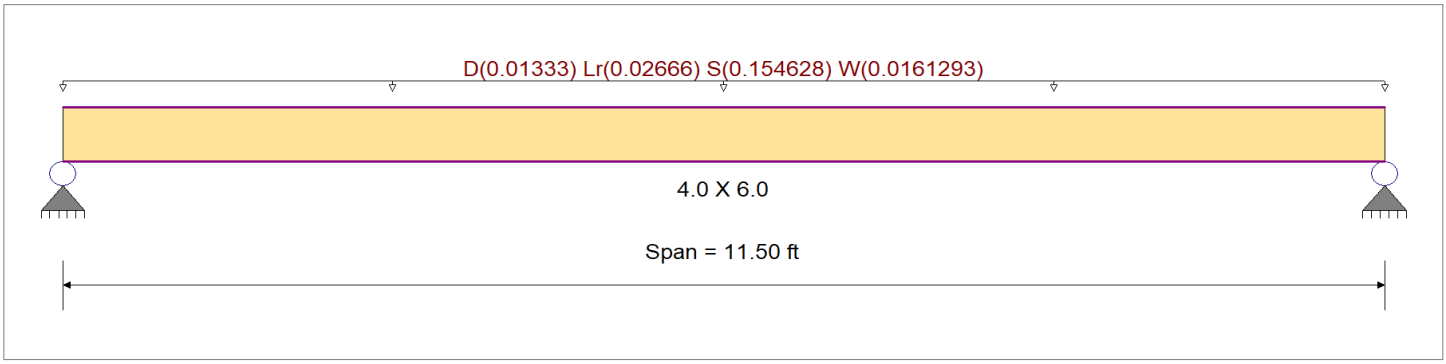
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

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

Repetitive Member Stress Increase



Applied Loads

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

Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.01210 ksf, Tributary Width = 1.333 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.598 : 1	Maximum Shear Stress Ratio	=	0.284 : 1
Section used for this span		4.0 X 6.0	Section used for this span		4.0 X 6.0
	=	1,388.28 psi		=	55.51 psi
	=	2,320.99 psi		=	195.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	5.750 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.531 in	Ratio =	259 >=240
Max Upward Transient Deflection	0.000 in	Ratio =	0 <240
Max Downward Total Deflection	0.577 in	Ratio =	239 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

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+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.061	0.029	0.90	1.300	1.00	1.15	1.00	1.00	1.00	0.22	110.18	1816.43	0.07	4.41	153.00
+D+L+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.055	0.026	1.00	1.300	1.00	1.15	1.00	1.00	1.00	0.22	110.18	2018.25	0.07	4.41	170.00
+D+Lr+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.131	0.062	1.25	1.300	1.00	1.15	1.00	1.00	1.00	0.66	330.54	2522.81	0.21	13.22	212.50
+D+S+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.598	0.284	1.15	1.300	1.00	1.15	1.00	1.00	1.00	2.78	1,388.28	2320.99	0.89	55.51	195.50
+D+0.750Lr+0.750L+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.109	0.052	1.25	1.300	1.00	1.15	1.00	1.00	1.00	0.55	275.45	2522.81	0.18	11.01	212.50
+D+0.750L+0.750S+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.460	0.219	1.15	1.300	1.00	1.15	1.00	1.00	1.00	2.14	1,068.75	2320.99	0.68	42.74	195.50
+D+0.60W+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.059	0.028	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.38	190.17	3229.20	0.12	7.60	272.00

Wood Beam

DESCRIPTION: Purlins

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+0.750Lr+0.750L+0.450W+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.104	0.049	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.67	335.45	3229.20	0.21	13.41	272.00
+D+0.750L+0.750S+0.450W+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.350	0.166	1.60	1.300	1.00	1.15	1.00	1.00	1.00	2.26	1,128.75	3229.20	0.72	45.14	272.00
+0.60D+0.60W+0.60H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.045	0.021	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.29	146.10	3229.20	0.09	5.84	272.00
+D+0.70E+0.60H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.034	0.016	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.22	110.18	3229.20	0.07	4.41	272.00
+D+0.750L+0.750S+0.5250E+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.331	0.157	1.60	1.300	1.00	1.15	1.00	1.00	1.00	2.14	1,068.75	3229.20	0.68	42.74	272.00
+0.60D+0.70E+H					1.300	1.00	1.15	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 11.50 ft	1	0.020	0.010	1.60	1.300	1.00	1.15	1.00	1.00	1.00	0.13	66.11	3229.20	0.04	2.64	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.5771	5.792		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.966	0.966
Overall MINimum	0.093	0.093
+D+H	0.077	0.077
+D+L+H	0.077	0.077
+D+Lr+H	0.230	0.230
+D+S+H	0.966	0.966
+D+0.750Lr+0.750L+H	0.192	0.192
+D+0.750L+0.750S+H	0.743	0.743
+D+0.60W+H	0.132	0.132
+D+0.750Lr+0.750L+0.450W+H	0.233	0.233
+D+0.750L+0.750S+0.450W+H	0.785	0.785
+0.60D+0.60W+0.60H	0.102	0.102
+D+0.70E+0.60H	0.077	0.077
+D+0.750L+0.750S+0.5250E+H	0.743	0.743
+0.60D+0.70E+H	0.046	0.046
D Only	0.077	0.077
Lr Only	0.153	0.153
S Only	0.889	0.889
W Only	0.093	0.093
H Only		

Wood Column

DESCRIPTION: 18' Studs

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design
End Fixities : Top & Bottom Pinned
Overall Column Height : 18 ft
(Used for non-slender calculations)

Wood Species : iLevel Truss Joist
Wood Grade : MicroLam LVL 2.0 E

Fb +	2600 psi	Fv	285 psi
Fb -	2600 psi	Ft	1555 psi
Fc - Prll	2510 psi	Density	42.01 pcf
Fc - Perp	750 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	2000	2000	2000 ksi
Minimum	1016.535	1016.535	

Wood Section Name : **1.75x5.5**
Wood Grading/Manuf. : Trus Joist
Wood Member Type : Microllam LVL

Exact Width	**1.750**	in
Exact Depth	**5.50**	in
Area	9.625	in^2
Ix	24.263	in^4
Iy	2.456	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis

Applied Loads

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

Column self weight included : 50.543 lbs * Dead Load Factor
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, W = 0.01730 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.1374** : 1
Load Combination : +D+0.60W+H
Governing NDS Forumla : 1Comp + Mxx, NDS Eq. 3.9-3
Location of max.above base : 9.060 ft
At maximum location values are . . .
Applied Axial : 0.05054 k
Applied Mx : 0.4204 k-ft
Applied My : 0.0 k-ft
Fc : Allowable : 4,016.0 psi

PASS Maximum Shear Stress Ratio = **0.03193** : 1
Load Combination : +D+0.60W+H
Location of max.above base : 18.0 ft
Applied Design Shear : 14.559 psi
Allowable Shear : 456.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.1557 k	Bottom along Y-Y	0.1557 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Lateral Deflections . . .
Along Y-Y : 0.8512 in at 9.060 ft above base
for load combination : W Only
Along X-X : 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	1.000	0.002325	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+L+H	1.000	1.000	0.002092	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+Lr+H	1.250	1.000	0.001674	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+S+H	1.150	1.000	0.001819	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+0.750Lr+0.750L+H	1.250	1.000	0.001674	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+0.750L+0.750S+H	1.150	1.000	0.001819	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+0.60W+H	1.600	1.000	0.1374	PASS	9.060 ft	0.03193	PASS	18.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	1.000	0.1031	PASS	8.940 ft	0.02395	PASS	18.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	1.000	0.1031	PASS	8.940 ft	0.02395	PASS	18.0 ft
+0.60D+0.60W+0.60H	1.600	1.000	0.1374	PASS	9.060 ft	0.03193	PASS	18.0 ft
+D+0.70E+0.60H	1.600	1.000	0.001308	PASS	0.0 ft	0.0	PASS	18.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	1.000	0.001308	PASS	0.0 ft	0.0	PASS	18.0 ft

Wood Column

DESCRIPTION: 18' Studs

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.70E+H	1.600	1.000	0.000785	PASS	0.0 ft	0.0	PASS	18.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	k-ft	My - End Moments @ Base	My - End Moments @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top
+D+H						0.051					
+D+L+H						0.051					
+D+Lr+H						0.051					
+D+S+H						0.051					
+D+0.750Lr+0.750L+H						0.051					
+D+0.750L+0.750S+H						0.051					
+D+0.60W+H				0.093	0.093	0.051					
+D+0.750Lr+0.750L+0.450W+H				0.070	0.070	0.051					
+D+0.750L+0.750S+0.450W+H				0.070	0.070	0.051					
+0.60D+0.60W+0.60H				0.093	0.093	0.030					
+D+0.70E+0.60H						0.051					
+D+0.750L+0.750S+0.5250E+H						0.051					
+0.60D+0.70E+H						0.030					
D Only						0.051					
Lr Only											
L Only											
S Only											
W Only				0.156	0.156						
E Only											
H Only											

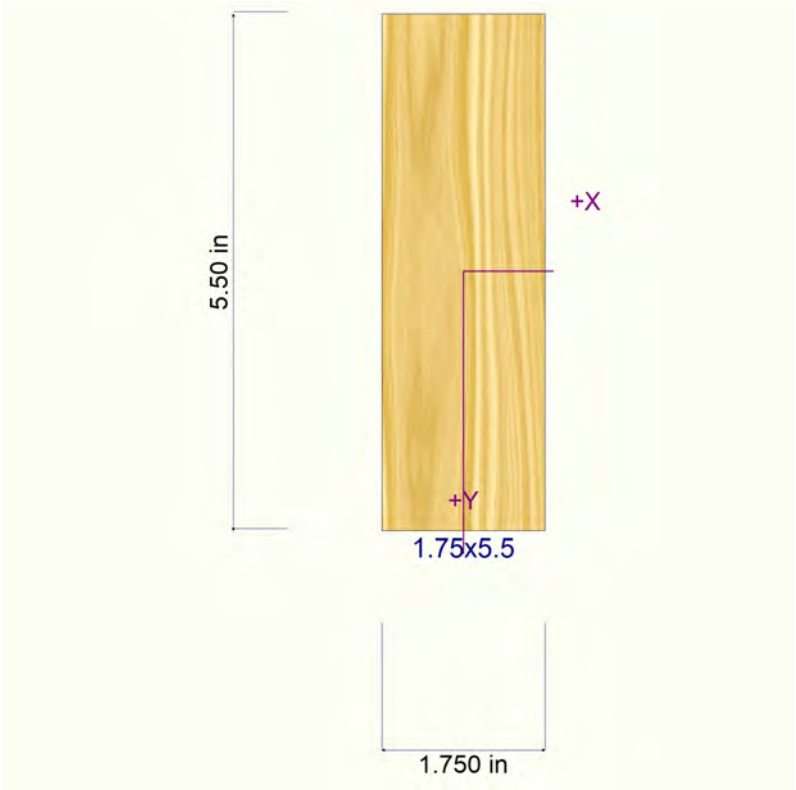
Maximum Deflections for Load Combinations

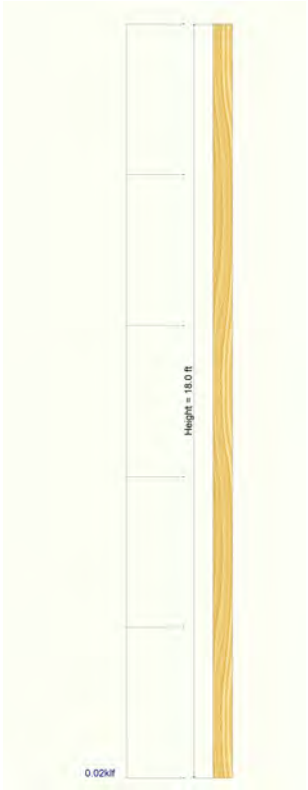
Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.5107 in	9.060 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.3830 in	9.060 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.3830 in	9.060 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.5107 in	9.060 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	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
L 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	0.8511 in	9.060 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

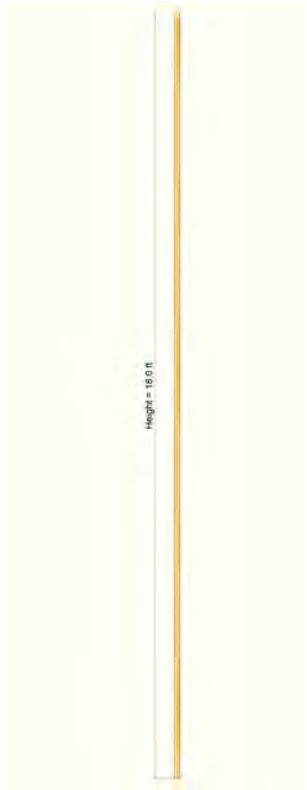
Wood Column

DESCRIPTION: 18' Studs

Sketches







Wood Column

DESCRIPTION: Studs

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design
End Fixities : Top & Bottom Pinned
Overall Column Height : 12 ft
(Used for non-slender calculations)

Wood Species : Spruce-Pine-Fir
Wood Grade : No. 1/No. 2

Fb +	875 psi	Fv	135 psi
Fb -	875 psi	Ft	450 psi
Fc - Prll	1150 psi	Density	26.22 pcf
Fc - Perp	425 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1400	1400	1400 ksi
Minimum	510	510	

Wood Section Name : **2x6**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**1.50**	in
Exact Depth	**5.50**	in
Area	8.250	in^2
Ix	20.797	in^4
Iy	1.547	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
Cf or Cv for Compression	1.10
Cf or Cv for Tension	1.30
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis

Applied Loads

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

Column self weight included : 18.026 lbs * Dead Load Factor
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, W = 0.0230 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.2166** : 1
Load Combination +D+0.60W+H
Governing NDS Forumla 1/Comp + Mxx, NDS Eq. 3.9-3
Location of max.above base 5.960 ft
At maximum location values are . . .
Applied Axial 0.01803 k
Applied Mx 0.2484 k-ft
Applied My 0.0 k-ft
Fc : Allowable 2,024.0 psi

PASS Maximum Shear Stress Ratio = **0.06970** : 1
Load Combination +D+0.60W+H
Location of max.above base 12.0 ft
Applied Design Shear 15.055 psi
Allowable Shear 216.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.1380 k	Bottom along Y-Y	0.1380 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Lateral Deflections . . .
Along Y-Y 0.3725 in at 6.040 ft above base
for load combination : W Only
Along X-X 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	1.000	0.001919	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+L+H	1.000	1.000	0.001727	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+Lr+H	1.250	1.000	0.001382	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+S+H	1.150	1.000	0.001502	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750Lr+0.750L+H	1.250	1.000	0.001382	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750L+0.750S+H	1.150	1.000	0.001502	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.60W+H	1.600	1.000	0.2166	PASS	5.960 ft	0.06970	PASS	12.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	1.000	0.1624	PASS	5.960 ft	0.05227	PASS	12.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	1.000	0.1624	PASS	5.960 ft	0.05227	PASS	12.0 ft
+0.60D+0.60W+0.60H	1.600	1.000	0.2166	PASS	5.960 ft	0.06970	PASS	12.0 ft
+D+0.70E+0.60H	1.600	1.000	0.001080	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	1.000	0.001080	PASS	0.0 ft	0.0	PASS	12.0 ft

Wood Column

DESCRIPTION: Studs

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.70E+H	1.600	1.000	0.000648	PASS	0.0 ft	0.0	PASS	12.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	k-ft	My - End Moments @ Base	My - End Moments @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top
+D+H						0.018					
+D+L+H						0.018					
+D+Lr+H						0.018					
+D+S+H						0.018					
+D+0.750Lr+0.750L+H						0.018					
+D+0.750L+0.750S+H						0.018					
+D+0.60W+H				0.083	0.083	0.018					
+D+0.750Lr+0.750L+0.450W+H				0.062	0.062	0.018					
+D+0.750L+0.750S+0.450W+H				0.062	0.062	0.018					
+0.60D+0.60W+0.60H				0.083	0.083	0.011					
+D+0.70E+0.60H						0.018					
+D+0.750L+0.750S+0.5250E+H						0.018					
+0.60D+0.70E+H						0.011					
D Only						0.018					
Lr Only											
L Only											
S Only											
W Only				0.138	0.138						
E Only											
H Only											

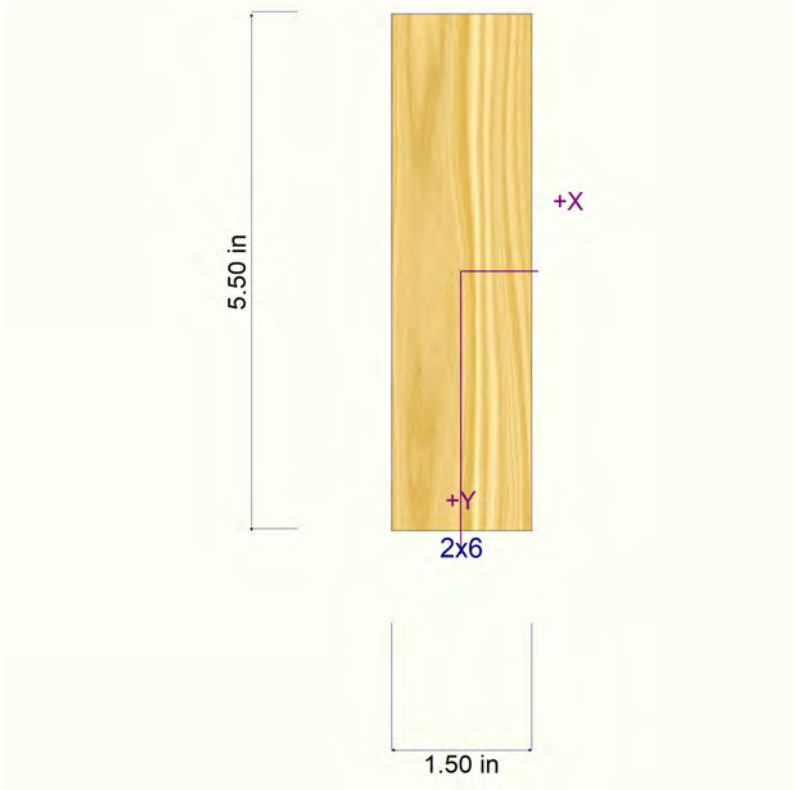
Maximum Deflections for Load Combinations

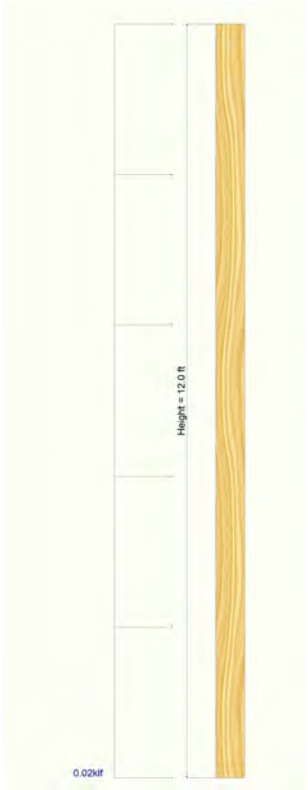
Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.2235 in	6.040 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.1676 in	6.040 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.1676 in	6.040 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.2235 in	6.040 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	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
L 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	0.3725 in	6.040 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

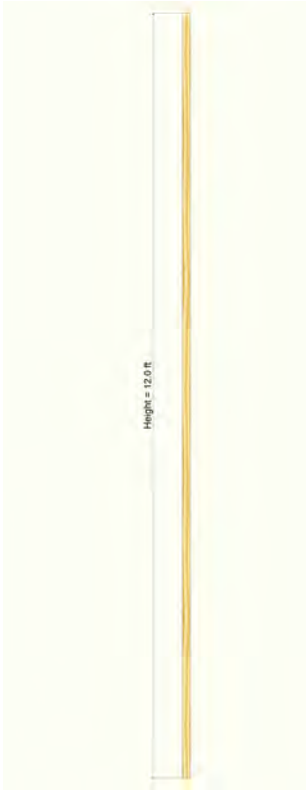
Wood Column

DESCRIPTION: Studs

Sketches







Wood Beam

DESCRIPTION: Roof Beam Collar Tie

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

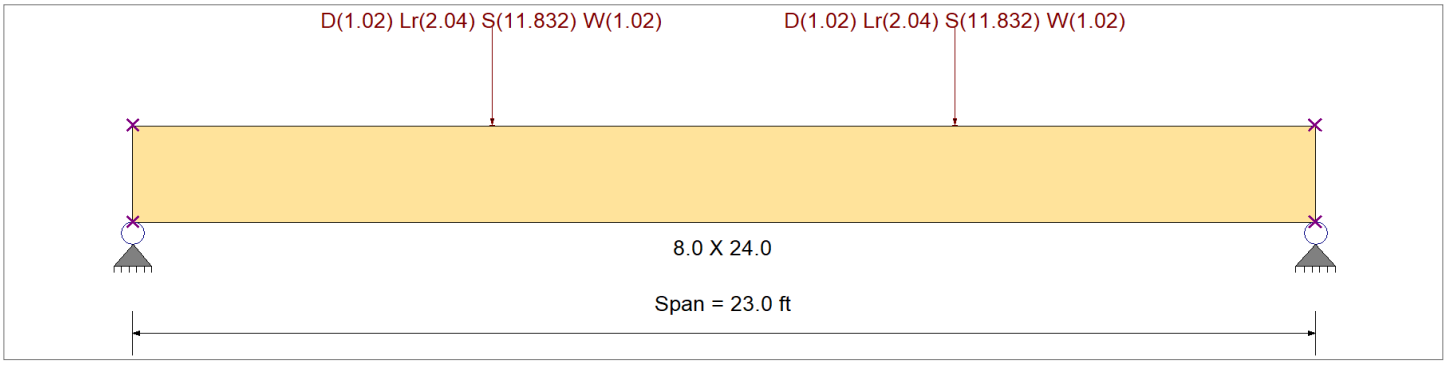
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb +	1350 psi
Fb -	1350 psi
Fc - Prll	925 psi
Fc - Perp	625 psi
Fv	170 psi
Ft	675 psi

E : Modulus of Elasticity

Ebend- xx	1600 ksi
Eminbend - xx	580 ksi
Density	31.21 pcf



Applied Loads

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

Point Load : D = 1.020, Lr = 2.040, S = 11.832, W = 1.020 k @ 7.0 ft
Point Load : D = 1.020, Lr = 2.040, S = 11.832, W = 1.020 k @ 16.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.938 : 1	Maximum Shear Stress Ratio	=	0.514 : 1
Section used for this span		8.0 X 24.0	Section used for this span		8.0 X 24.0
	=	1,405.69 psi		=	100.41 psi
	=	1,497.99 psi		=	195.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	13.934 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.566 in	Ratio =	487 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.615 in	Ratio =	449 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

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+H													0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.094	0.052	0.90	0.972	1.00	1.00	1.00	1.00	0.98	7.14	111.56	1185.37	1.02	7.97	153.00
+D+L+H					0.972	1.00	1.00	1.00	1.00	0.98			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.085	0.047	1.00	0.972	1.00	1.00	1.00	1.00	0.97	7.14	111.56	1311.68	1.02	7.97	170.00
+D+Lr+H					0.972	1.00	1.00	1.00	1.00	0.97			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.207	0.113	1.25	0.972	1.00	1.00	1.00	1.00	0.96	21.42	334.69	1619.76	3.06	23.91	212.50
+D+S+H					0.972	1.00	1.00	1.00	1.00	0.96			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.938	0.514	1.15	0.972	1.00	1.00	1.00	1.00	0.96	89.96	1,405.69	1497.99	12.85	100.41	195.50
+D+0.750Lr+0.750L+H					0.972	1.00	1.00	1.00	1.00	0.96			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.172	0.094	1.25	0.972	1.00	1.00	1.00	1.00	0.96	17.85	278.91	1619.76	2.55	19.92	212.50
+D+0.750L+0.750S+H					0.972	1.00	1.00	1.00	1.00	0.96			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.722	0.395	1.15	0.972	1.00	1.00	1.00	1.00	0.96	69.26	1,082.16	1497.99	9.89	77.30	195.50
+D+0.60W+H					0.972	1.00	1.00	1.00	1.00	0.96			0.00	0.00	0.00	0.00

Wood Beam

DESCRIPTION: Roof Beam Collar Tie

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
Length = 23.0 ft	1	0.088	0.047	1.60	0.972	1.00	1.00	1.00	1.00	0.94	11.42	178.50	2025.91	1.63	12.75	272.00
+D+0.750Lr+0.750L+0.450W+H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.162	0.086	1.60	0.972	1.00	1.00	1.00	1.00	0.94	21.06	329.11	2025.91	3.01	23.51	272.00
+D+0.750L+0.750S+0.450W+H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.559	0.297	1.60	0.972	1.00	1.00	1.00	1.00	0.94	72.47	1,132.36	2025.91	10.35	80.88	272.00
+0.60D+0.60W+0.60H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.066	0.035	1.60	0.972	1.00	1.00	1.00	1.00	0.94	8.57	133.88	2025.91	1.22	9.56	272.00
+D+0.70E+0.60H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.055	0.029	1.60	0.972	1.00	1.00	1.00	1.00	0.94	7.14	111.56	2025.91	1.02	7.97	272.00
+D+0.750L+0.750S+0.5250E+H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.534	0.284	1.60	0.972	1.00	1.00	1.00	1.00	0.94	69.26	1,082.16	2025.91	9.89	77.30	272.00
+0.60D+0.70E+H					0.972	1.00	1.00	1.00	1.00	0.94			0.00	0.00	0.00	0.00
Length = 23.0 ft	1	0.033	0.018	1.60	0.972	1.00	1.00	1.00	1.00	0.94	4.28	66.94	2025.91	0.61	4.78	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S+H	1	0.6146	11.584		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	12.852	12.852
Overall MINimum	1.020	1.020
+D+H	1.020	1.020
+D+L+H	1.020	1.020
+D+Lr+H	3.060	3.060
+D+S+H	12.852	12.852
+D+0.750Lr+0.750L+H	2.550	2.550
+D+0.750L+0.750S+H	9.894	9.894
+D+0.60W+H	1.632	1.632
+D+0.750Lr+0.750L+0.450W+H	3.009	3.009
+D+0.750L+0.750S+0.450W+H	10.353	10.353
+0.60D+0.60W+0.60H	1.224	1.224
+D+0.70E+0.60H	1.020	1.020
+D+0.750L+0.750S+0.5250E+H	9.894	9.894
+0.60D+0.70E+H	0.612	0.612
D Only	1.020	1.020
Lr Only	2.040	2.040
S Only	11.832	11.832
W Only	1.020	1.020
H Only		

Wood Beam

DESCRIPTION: Dormer Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

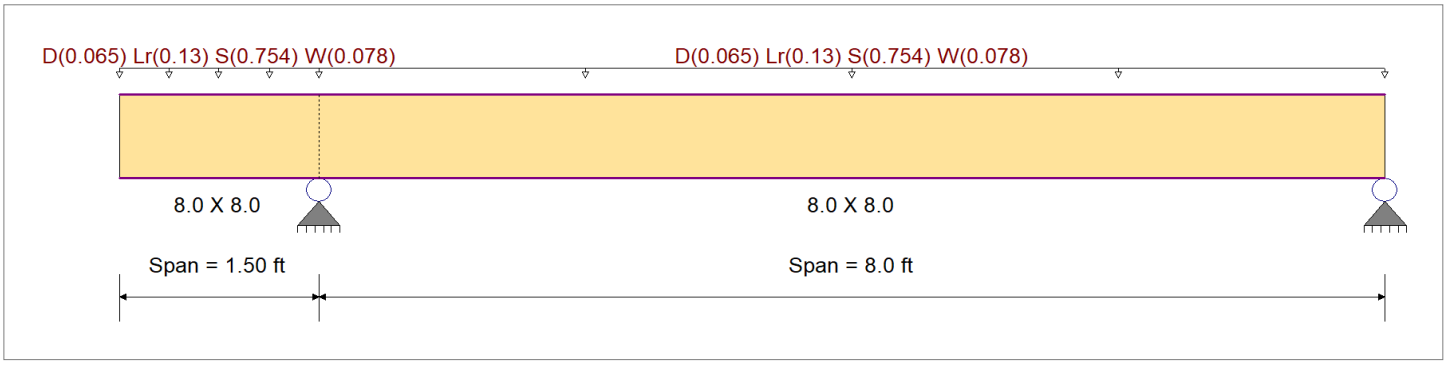
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

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

Fb +	1350 psi
Fb -	1350 psi
Fc - Prll	925 psi
Fc - Perp	625 psi
Fv	170 psi
Ft	675 psi

E : Modulus of Elasticity

Ebend- xx	1600 ksi
Eminbend - xx	580 ksi
Density	31.21 pcf



Applied Loads

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

Load for Span Number 1
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 6.50 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 6.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.552 : 1	Maximum Shear Stress Ratio	=	0.345 : 1
Section used for this span		8.0 X 8.0	Section used for this span		8.0 X 8.0
	=	857.72 psi		=	67.47 psi
	=	1,552.50 psi		=	195.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	4.156 ft	Location of maximum on span	=	1.500 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.118 in	Ratio =	816 >=360
Max Upward Transient Deflection	-0.064 in	Ratio =	560 >=360
Max Downward Total Deflection	0.128 in	Ratio =	752 >=180
Max Upward Total Deflection	-0.070 in	Ratio =	516 >=180

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+H													0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.008	0.035	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.07	10.28	1215.00	0.23	5.35	153.00
Length = 8.0 ft	2	0.056	0.035	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.48	68.07	1215.00	0.23	5.35	153.00
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.008	0.031	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.07	10.28	1350.00	0.23	5.35	170.00
Length = 8.0 ft	2	0.050	0.031	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.48	68.07	1350.00	0.23	5.35	170.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.018	0.076	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.22	30.85	1687.50	0.69	16.06	212.50
Length = 8.0 ft	2	0.121	0.076	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.45	204.22	1687.50	0.69	16.06	212.50
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.083	0.345	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.92	129.57	1552.50	2.88	67.47	195.50

Wood Beam

DESCRIPTION: Dormer Beam

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 = 8.0 ft	2	0.552	0.345	1.15	1.000	1.00	1.00	1.00	1.00	1.00	6.10	857.72	1552.50	2.88	67.47	195.50
+D+0.750Lr+0.750L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.015	0.063	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.18	25.71	1687.50	0.57	13.39	212.50
Length = 8.0 ft	2	0.101	0.063	1.25	1.000	1.00	1.00	1.00	1.00	1.00	1.21	170.18	1687.50	0.57	13.39	212.50
+D+0.750L+0.750S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.064	0.266	1.15	1.000	1.00	1.00	1.00	1.00	1.00	0.71	99.75	1552.50	2.22	51.94	195.50
Length = 8.0 ft	2	0.425	0.266	1.15	1.000	1.00	1.00	1.00	1.00	1.00	4.70	660.30	1552.50	2.22	51.94	195.50
+D+0.60W+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.008	0.034	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.13	17.69	2160.00	0.39	9.21	272.00
Length = 8.0 ft	2	0.054	0.034	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.83	117.08	2160.00	0.39	9.21	272.00
+D+0.750Lr+0.750L+0.450W+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.014	0.060	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.22	31.26	2160.00	0.69	16.28	272.00
Length = 8.0 ft	2	0.096	0.060	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.47	206.94	2160.00	0.69	16.28	272.00
+D+0.750L+0.750S+0.450W+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.049	0.202	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.75	105.30	2160.00	2.34	54.83	272.00
Length = 8.0 ft	2	0.323	0.202	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.96	697.06	2160.00	2.34	54.83	272.00
+0.60D+0.60W+0.60H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.006	0.026	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.10	13.57	2160.00	0.30	7.07	272.00
Length = 8.0 ft	2	0.042	0.026	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.64	89.86	2160.00	0.30	7.07	272.00
+D+0.70E+0.60H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.005	0.020	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.07	10.28	2160.00	0.23	5.35	272.00
Length = 8.0 ft	2	0.032	0.020	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.48	68.07	2160.00	0.23	5.35	272.00
+D+0.750L+0.750S+0.5250E+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.046	0.191	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.71	99.75	2160.00	2.22	51.94	272.00
Length = 8.0 ft	2	0.306	0.191	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.70	660.30	2160.00	2.22	51.94	272.00
+0.60D+0.70E+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 1.50 ft	1	0.003	0.012	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.04	6.17	2160.00	0.14	3.21	272.00
Length = 8.0 ft	2	0.019	0.012	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.29	40.84	2160.00	0.14	3.21	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+H	-0.0696	0.000
+D+S+H	2	0.1276	4.067		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		4.620	3.161
Overall MINimum		0.440	0.301
+D+H		0.367	0.251
+D+L+H		0.367	0.251
+D+Lr+H		1.100	0.753
+D+S+H		4.620	3.161
+D+0.750Lr+0.750L+H		0.917	0.627
+D+0.750L+0.750S+H		3.556	2.433
+D+0.60W+H		0.631	0.431
+D+0.750Lr+0.750L+0.450W+H		1.115	0.763
+D+0.750L+0.750S+0.450W+H		3.754	2.569
+0.60D+0.60W+0.60H		0.484	0.331
+D+0.70E+0.60H		0.367	0.251
+D+0.750L+0.750S+0.5250E+H		3.556	2.433
+0.60D+0.70E+H		0.220	0.151
D Only		0.367	0.251
Lr Only		0.733	0.502
S Only		4.253	2.910
W Only		0.440	0.301
H Only			

Wood Column

DESCRIPTION: Patio Column

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design
End Fixities : Top & Bottom Pinned
Overall Column Height : 8.25 ft
(Used for non-slender calculations)

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

Fb +	1,200.0 psi	Fv	170.0 psi
Fb -	1,200.0 psi	Ft	825.0 psi
Fc - Prll	1,000.0 psi	Density	31.210 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .

	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

Wood Section Name : **8x8**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**8.0** in	Area	60.0 in^2
Exact Depth	**8.0** in	Ix	281.250 in^4
		Iy	320.0 in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Unbraced Length for buckling ABOUT Y-Y Axis = 8.25 ft, K = 1.
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 8.25 ft, K = 1.

Applied Loads

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

Column self weight included : 107.284 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 8.250 ft, D = 0.660, Lr = 1.320, S = 7.656, W = 0.660 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.1260** : 1

Load Combination	+D+S+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	8.423 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	1,044.52 psi

PASS Maximum Shear Stress Ratio = **0.0** : 1

Load Combination	+0.60D+0.70E+H
Location of max.above base	8.250 ft
Applied Design Shear	0.0 psi
Allowable Shear	272.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.0 k	Bottom along Y-Y	0.0 k
Top along X-X	0.0 k	Bottom along X-X	0.0 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 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	0.931	0.01430	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+L+H	1.000	0.922	0.0130	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+Lr+H	1.250	0.899	0.02904	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+S+H	1.150	0.908	0.1260	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.750Lr+0.750L+H	1.250	0.899	0.02445	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.750L+0.750S+H	1.150	0.908	0.09737	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.60W+H	1.600	0.863	0.01317	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.863	0.02326	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.863	0.07705	PASS	0.0 ft	0.0	PASS	8.250 ft
+0.60D+0.60W+0.60H	1.600	0.863	0.009695	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.70E+0.60H	1.600	0.863	0.008686	PASS	0.0 ft	0.0	PASS	8.250 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.863	0.07369	PASS	0.0 ft	0.0	PASS	8.250 ft

Wood Column

DESCRIPTION: Patio Column

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.70E+H	1.600	0.863	0.005212	PASS	0.0 ft	0.0	PASS	8.250 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction k @ Base	@ Top	Y-Y Axis Reaction @ Base	@ Top	Axial Reaction @ Base	My - End Moments k-ft @ Base	@ Top	Mx - End Moments @ Base	@ Top
+D+H					0.767				
+D+L+H					0.767				
+D+Lr+H					2.087				
+D+S+H					8.423				
+D+0.750Lr+0.750L+H					1.757				
+D+0.750L+0.750S+H					6.509				
+D+0.60W+H					1.163				
+D+0.750Lr+0.750L+0.450W+H					2.054				
+D+0.750L+0.750S+0.450W+H					6.806				
+0.60D+0.60W+0.60H					0.856				
+D+0.70E+0.60H					0.767				
+D+0.750L+0.750S+0.5250E+H					6.509				
+0.60D+0.70E+H					0.460				
D Only					0.767				
Lr Only					1.320				
L Only									
S Only					7.656				
W Only					0.660				
E Only									
H Only									

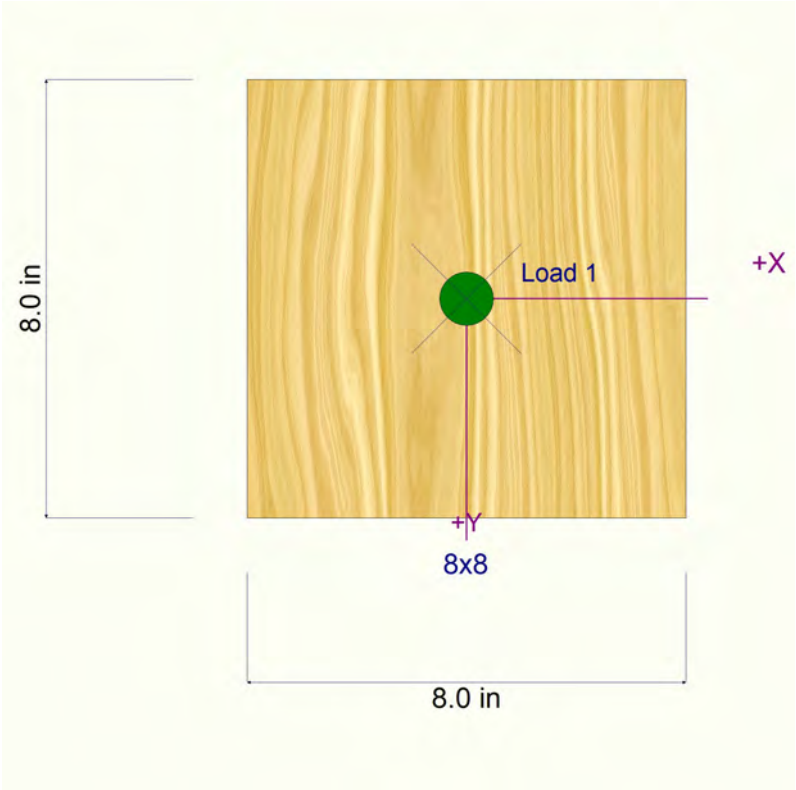
Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	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
L 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	0.0000 in	0.000 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

Wood Column

DESCRIPTION: Patio Column

Sketches



Wood Column

DESCRIPTION: Interior/SW Column

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design
End Fixities : Top & Bottom Pinned
Overall Column Height : 10 ft
(Used for non-slender calculations)

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

Fb +	1,200.0 psi	Fv	170.0 psi
Fb -	1,200.0 psi	Ft	825.0 psi
Fc - Prll	1,000.0 psi	Density	31.210 pcf
Fc - Perp	625.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,600.0	1,600.0	1,600.0 ksi
Minimum	580.0	580.0	

Wood Section Name : **8x8**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**8.0** in	Area	60.0 in^2
Exact Depth	**8.0** in	Ix	281.250 in^4
		Iy	320.0 in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.0
Cf or Cv for Compression	1.0
Cf or Cv for Tension	1.0
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Unbraced Length for buckling ABOUT X-X Axis = 10 ft, K = 1.0

Applied Loads

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

Column self weight included : 130.042 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.0 ft, D = 1.920, Lr = 3.840, S = 22.272, W = 1.920 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, W = 0.03460 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.3874** : 1

Load Combination	+D+S+H
Governing NDS Forumla	Comp Only, fc/Fc'
Location of max.above base	0.0 ft
At maximum location values are . . .	
Applied Axial	24.322 k
Applied Mx	0.0 k-ft
Applied My	0.0 k-ft
Fc : Allowable	980.91 psi

PASS Maximum Shear Stress Ratio = **0.008944** : 1

Load Combination	+D+0.60W+H
Location of max.above base	10.0 ft
Applied Design Shear	2.433 psi
Allowable Shear	272.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.1730 k	Bottom along Y-Y	0.1730 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Lateral Deflections . . .
Along Y-Y 0.01749 in at 5.034 ft above base
for load combination : W Only
Along X-X 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	0.891	0.03993	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+L+H	1.000	0.876	0.03655	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+Lr+H	1.250	0.837	0.08798	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+S+H	1.150	0.853	0.3874	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750Lr+0.750L+H	1.250	0.837	0.07364	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750L+0.750S+H	1.150	0.853	0.2987	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.60W+H	1.600	0.778	0.04018	PASS	0.06711 ft	0.008944	PASS	10.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	0.778	0.07271	PASS	0.06711 ft	0.006708	PASS	10.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	0.778	0.2462	PASS	0.06711 ft	0.006708	PASS	10.0 ft

Wood Column

DESCRIPTION: Interior/SW Column

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.60W+0.60H	1.600	0.778	0.02989	PASS	0.0 ft	0.008944	PASS	10.0 ft
+D+0.70E+0.60H	1.600	0.778	0.02573	PASS	0.0 ft	0.0	PASS	10.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	0.778	0.2353	PASS	0.0 ft	0.0	PASS	10.0 ft
+0.60D+0.70E+H	1.600	0.778	0.01544	PASS	0.0 ft	0.0	PASS	10.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	My - End Moments k-ft @ Base	My - End Moments k-ft @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top
+D+H						2.050				
+D+L+H						2.050				
+D+Lr+H						5.890				
+D+S+H						24.322				
+D+0.750Lr+0.750L+H						4.930				
+D+0.750L+0.750S+H						18.754				
+D+0.60W+H				0.104	0.104	3.202				
+D+0.750Lr+0.750L+0.450W+H				0.078	0.078	5.794				
+D+0.750L+0.750S+0.450W+H				0.078	0.078	19.618				
+0.60D+0.60W+0.60H				0.104	0.104	2.382				
+D+0.70E+0.60H						2.050				
+D+0.750L+0.750S+0.5250E+H						18.754				
+0.60D+0.70E+H						1.230				
D Only						2.050				
Lr Only						3.840				
L Only										
S Only						22.272				
W Only				0.173	0.173	1.920				
E Only										
H Only										

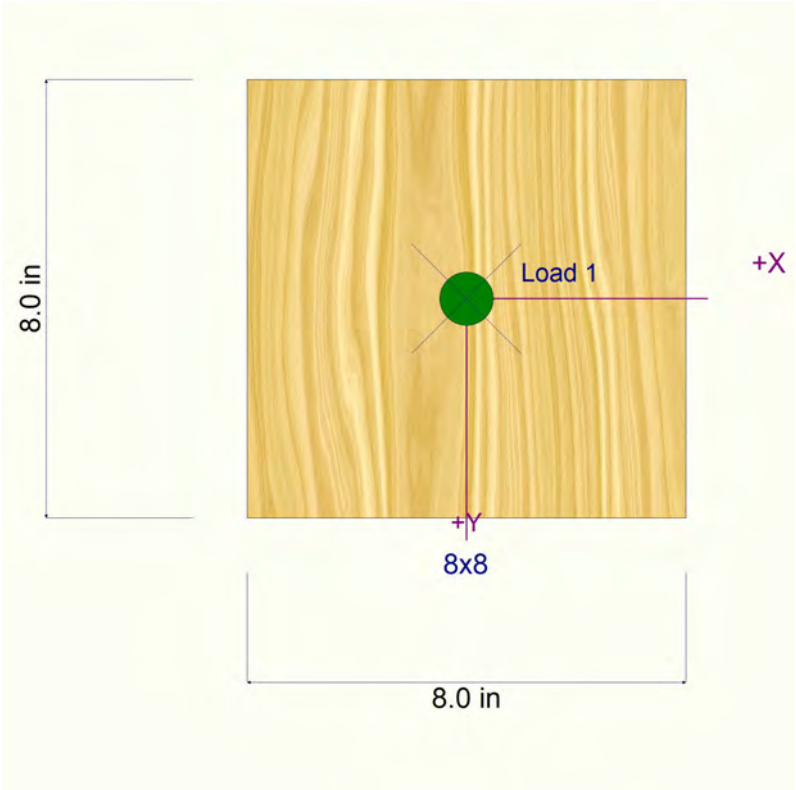
Maximum Deflections for Load Combinations

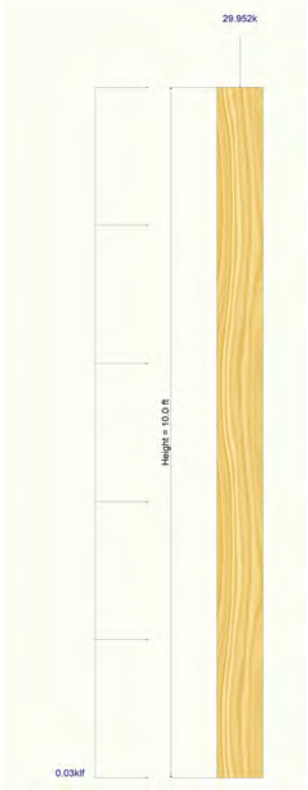
Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.0105 in	5.034 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.0079 in	5.034 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.0079 in	5.034 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.0105 in	5.034 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	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
L 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	0.0175 in	5.034 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

Wood Column

DESCRIPTION: Interior/SW Column

Sketches





Wood Column

DESCRIPTION: King Studs

Code References

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Analysis Method : Allowable Stress Design
End Fixities : Top & Bottom Pinned
Overall Column Height : 12 ft
(Used for non-slender calculations)

Wood Species : Spruce-Pine-Fir
Wood Grade : No. 1/No. 2

Fb +	875.0 psi	Fv	135.0 psi
Fb -	875.0 psi	Ft	450.0 psi
Fc - Prll	1,150.0 psi	Density	26.220 pcf
Fc - Perp	425.0 psi		

E : Modulus of Elasticity . . .	x-x Bending	y-y Bending	Axial
Basic	1,400.0	1,400.0	1,400.0 ksi
Minimum	510.0	510.0	

Wood Section Name : **2-2x6**
Wood Grading/Manuf. : Graded Lumber
Wood Member Type : Sawn

Exact Width	**3.0**	in
Exact Depth	**5.50**	in
Area	16.50	in^2
Ix	41.594	in^4
Iy	12.375	in^4

Allow Stress Modification Factors

Cf or Cv for Bending	1.30
Cf or Cv for Compression	1.10
Cf or Cv for Tension	1.30
Cm : Wet Use Factor	1.0
Ct : Temperature Factor	1.0
Cfu : Flat Use Factor	1.0
Kf : Built-up columns	1.0 *NDS 15.3.2*
Use Cr : Repetitive ?	No

Brace condition for deflection (buckling) along columns :
X-X (width) axis : Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis : Fully braced against buckling ABOUT X-X Axis

Applied Loads

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

Column self weight included : 36.053 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 12.0 ft, W = 0.080 k
BENDING LOADS . . .
Lat. Uniform Load creating Mx-x, W = 0.0230 k/ft

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = **0.1083** : 1
Load Combination +D+0.60W+H
Governing NDS Forumla 1/Comp + Mxx, NDS Eq. 3.9-3
Location of max.above base 5.960 ft
At maximum location values are . . .
Applied Axial 0.08405 k
Applied Mx 0.2484 k-ft
Applied My 0.0 k-ft
Fc : Allowable 2,024.0 psi

PASS Maximum Shear Stress Ratio = **0.03485** : 1
Load Combination +D+0.60W+H
Location of max.above base 0.0 ft
Applied Design Shear 7.527 psi
Allowable Shear 216.0 psi

Maximum SERVICE Lateral Load Reactions . .

Top along Y-Y	0.1380 k	Bottom along Y-Y	0.1380 k
Top along X-X	0.0 k	Bottom along X-X	0.0 k

Maximum SERVICE Load Lateral Deflections . . .
Along Y-Y 0.1863 in at 6.040 ft above base
for load combination : W Only
Along X-X 0.0 in at 0.0 ft above base
for load combination : n/a

Other Factors used to calculate allowable stresses . . .

	Bending	Compression	Tension

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+D+H	0.900	1.000	0.001919	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+L+H	1.000	1.000	0.001727	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+Lr+H	1.250	1.000	0.001382	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+S+H	1.150	1.000	0.001502	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750Lr+0.750L+H	1.250	1.000	0.001382	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750L+0.750S+H	1.150	1.000	0.001502	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.60W+H	1.600	1.000	0.1083	PASS	5.960 ft	0.03485	PASS	0.0 ft
+D+0.750Lr+0.750L+0.450W+H	1.600	1.000	0.08121	PASS	5.960 ft	0.02614	PASS	12.0 ft
+D+0.750L+0.750S+0.450W+H	1.600	1.000	0.08121	PASS	5.960 ft	0.02614	PASS	12.0 ft

Wood Column

DESCRIPTION: King Studs

Load Combination Results

Load Combination	C_D	C_P	Maximum Axial + Bending Stress Ratios: Stress Ratio	Status	Location	Maximum Shear Ratios: Stress Ratio	Status	Location
+0.60D+0.60W+0.60H	1.600	1.000	0.1083	PASS	5.960 ft	0.03485	PASS	0.0 ft
+D+0.70E+0.60H	1.600	1.000	0.001080	PASS	0.0 ft	0.0	PASS	12.0 ft
+D+0.750L+0.750S+0.5250E+H	1.600	1.000	0.001080	PASS	0.0 ft	0.0	PASS	12.0 ft
+0.60D+0.70E+H	1.600	1.000	0.000648	PASS	0.0 ft	0.0	PASS	12.0 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	k	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Axial Reaction @ Base	My - End Moments k-ft @ Base	My - End Moments k-ft @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top
+D+H						0.036				
+D+L+H						0.036				
+D+Lr+H						0.036				
+D+S+H						0.036				
+D+0.750Lr+0.750L+H						0.036				
+D+0.750L+0.750S+H						0.036				
+D+0.60W+H				0.083	0.083	0.084				
+D+0.750Lr+0.750L+0.450W+H				0.062	0.062	0.072				
+D+0.750L+0.750S+0.450W+H				0.062	0.062	0.072				
+0.60D+0.60W+0.60H				0.083	0.083	0.070				
+D+0.70E+0.60H						0.036				
+D+0.750L+0.750S+0.5250E+H						0.036				
+0.60D+0.70E+H						0.022				
D Only						0.036				
Lr Only										
L Only										
S Only										
W Only				0.138	0.138	0.080				
E Only										
H Only										

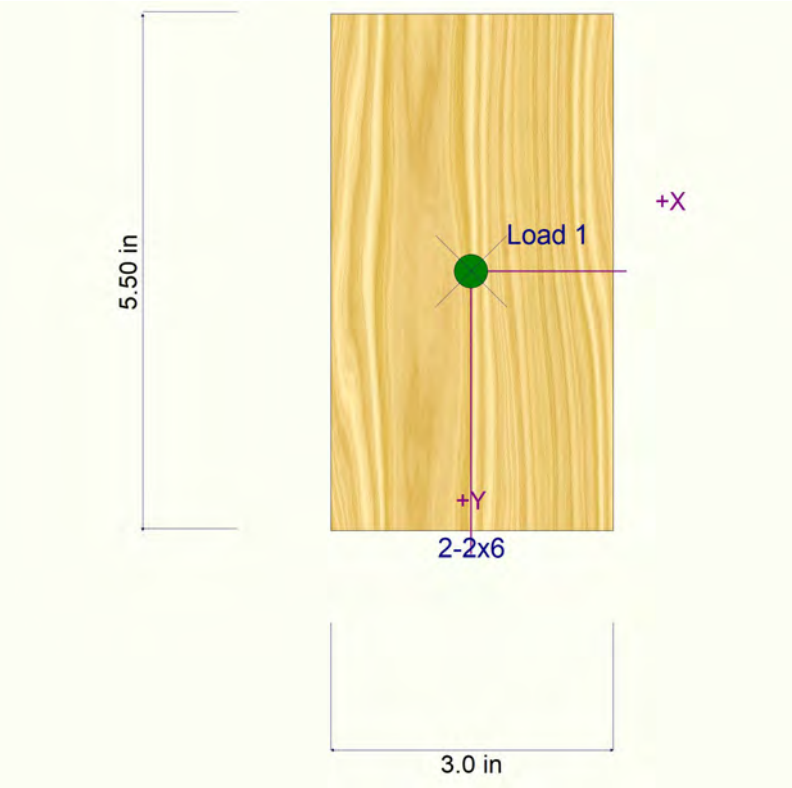
Maximum Deflections for Load Combinations

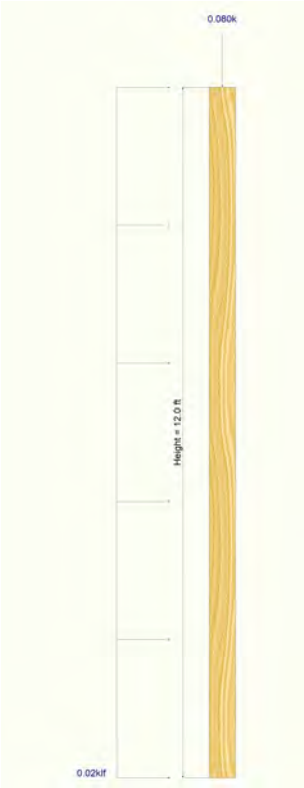
Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
+D+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+Lr+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750Lr+0.750L+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.60W+H	0.0000 in	0.000 ft	0.1118 in	6.040 ft
+D+0.750Lr+0.750L+0.450W+H	0.0000 in	0.000 ft	0.0838 in	6.040 ft
+D+0.750L+0.750S+0.450W+H	0.0000 in	0.000 ft	0.0838 in	6.040 ft
+0.60D+0.60W+0.60H	0.0000 in	0.000 ft	0.1118 in	6.040 ft
+D+0.70E+0.60H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+D+0.750L+0.750S+0.5250E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
+0.60D+0.70E+H	0.0000 in	0.000 ft	0.0000 in	0.000 ft
D Only	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
L 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	0.1863 in	6.040 ft
E Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft
H Only	0.0000 in	0.000 ft	0.0000 in	0.000 ft

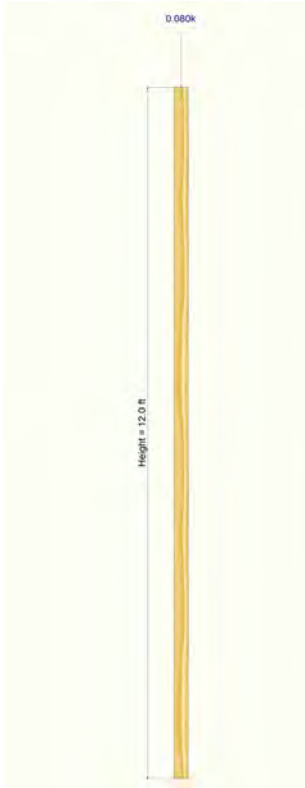
Wood Column

DESCRIPTION: King Studs

Sketches







Wood Beam

DESCRIPTION: Roof Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

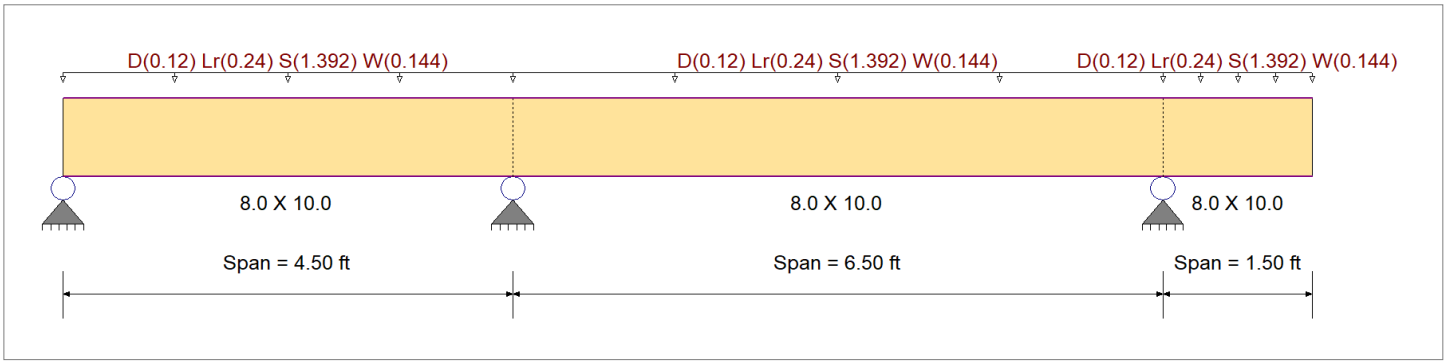
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

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

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.

Load for Span Number 1
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 12.0 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 12.0 ft
Load for Span Number 3
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.335 : 1	Maximum Shear Stress Ratio	=	0.413 : 1
Section used for this span		8.0 X 10.0	Section used for this span		8.0 X 10.0
	=	520.35 psi		=	80.68 psi
	=	1,552.50 psi		=	195.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	4.500 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.023 in	Ratio =	3350 >=360
Max Upward Transient Deflection	-0.015 in	Ratio =	2394 >=360
Max Downward Total Deflection	0.025 in	Ratio =	3084 >=180
Max Upward Total Deflection	-0.016 in	Ratio =	2204 >=180

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+H													0.00	0.00	0.00	0.00
Length = 4.50 ft	1	0.034	0.042	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.46	41.30	1215.00	0.34	6.40	153.00
Length = 6.50 ft	2	0.034	0.042	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.46	41.30	1215.00	0.34	6.40	153.00
Length = 1.50 ft	3	0.010	0.042	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.14	12.15	1215.00	0.08	6.40	153.00
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 4.50 ft	1	0.031	0.038	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.46	41.30	1350.00	0.34	6.40	170.00
Length = 6.50 ft	2	0.031	0.038	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.46	41.30	1350.00	0.34	6.40	170.00
Length = 1.50 ft	3	0.009	0.038	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.14	12.15	1350.00	0.08	6.40	170.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00

Wood Beam

DESCRIPTION: Roof Beam

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
+D+0.60W+H	0.289	1.396	0.895	
+D+0.750Lr+0.750L+0.450W+H	0.511	2.468	1.581	
+D+0.750L+0.750S+0.450W+H	1.721	8.313	5.327	
+0.60D+0.60W+0.60H	0.222	1.072	0.687	
+D+0.70E+0.60H	0.168	0.812	0.520	
+D+0.750L+0.750S+0.5250E+H	1.630	7.874	5.046	
+0.60D+0.70E+H	0.101	0.487	0.312	
D Only	0.168	0.812	0.520	
Lr Only	0.336	1.624	1.040	
S Only	1.949	9.417	6.034	
W Only	0.202	0.974	0.624	
H Only				

Wood Beam

Lic. # : KW-06009356 — Engineering & Technical Services, Inc

DESCRIPTION: Lean-to Roof Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

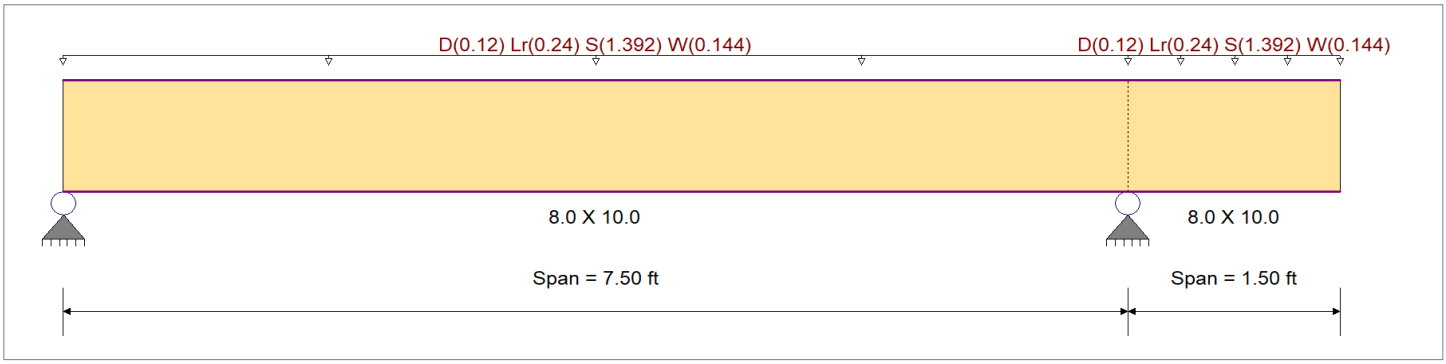
Wood Species : Douglas Fir-Larch
Wood Grade : No.1

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

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.

Load for Span Number 1
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 12.0 ft
Load for Span Number 2
Uniform Load : D = 0.010, Lr = 0.020, S = 0.1160, W = 0.0120 ksf, Tributary Width = 12.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.568 : 1	Maximum Shear Stress Ratio	=	0.450 : 1
Section used for this span		8.0 X 10.0	Section used for this span		8.0 X 10.0
	=	881.80 psi		=	88.00 psi
	=	1,552.50 psi		=	195.50 psi
Load Combination		+D+S+H	Load Combination		+D+S+H
Location of maximum on span	=	3.603 ft	Location of maximum on span	=	6.704 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.085 in	Ratio =	1061 >=360
Max Upward Transient Deflection	-0.049 in	Ratio =	740 >=360
Max Downward Total Deflection	0.092 in	Ratio =	977 >=180
Max Upward Total Deflection	-0.053 in	Ratio =	682 >=180

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+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 7.50 ft	1	0.058	0.046	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.78	69.98	1215.00	0.37	6.98	153.00
Length = 1.50 ft	2	0.010	0.046	0.90	1.000	1.00	1.00	1.00	1.00	1.00	0.14	12.15	1215.00	0.08	6.98	153.00
+D+L+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 7.50 ft	1	0.052	0.041	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.78	69.98	1350.00	0.37	6.98	170.00
Length = 1.50 ft	2	0.009	0.041	1.00	1.000	1.00	1.00	1.00	1.00	1.00	0.14	12.15	1350.00	0.08	6.98	170.00
+D+Lr+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 7.50 ft	1	0.124	0.099	1.25	1.000	1.00	1.00	1.00	1.00	1.00	2.33	209.95	1687.50	1.12	20.95	212.50
Length = 1.50 ft	2	0.022	0.099	1.25	1.000	1.00	1.00	1.00	1.00	1.00	0.41	36.45	1687.50	0.24	20.95	212.50
+D+S+H					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 7.50 ft	1	0.568	0.450	1.15	1.000	1.00	1.00	1.00	1.00	1.00	9.80	881.80	1552.50	4.69	88.00	195.50

Engineering & Technical Services, Inc.
27121 469th Ave / PO Box 308
Tea, SD 57064-8100
Phone:(605) 498-1290 Fax:(605) 498-1299

Client:	**Sand Creek Post & Beam**	Job #:	KRE121-1
Job Name:	**Keelin Regan-Reed**	Date:	7/12/2022
Location:	**Oak Creek, CO**	Designed by:	**ARS**

Footing Design

Frostwall @ A/B (P value from P. 33)

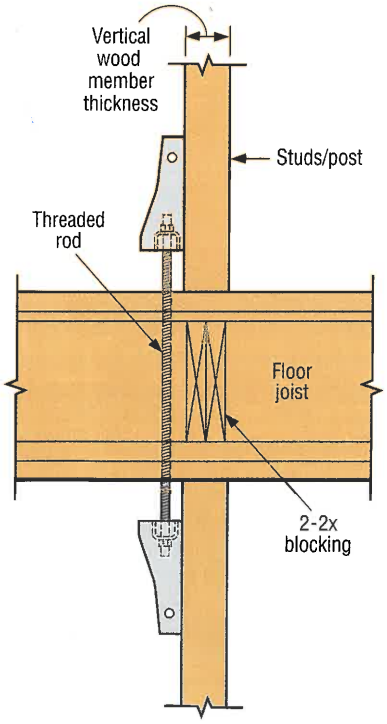
P	=	24332	#								
24332	#	/	1000	psf	=	24.33	ft				
Frost Wall =		4	ft	x	3	ft	x	2	=	24.00	sqft → Okay, soil shear carries remainder

Holdowns (cont.)

These products are available with additional corrosion protection. For more information, see p. 18.

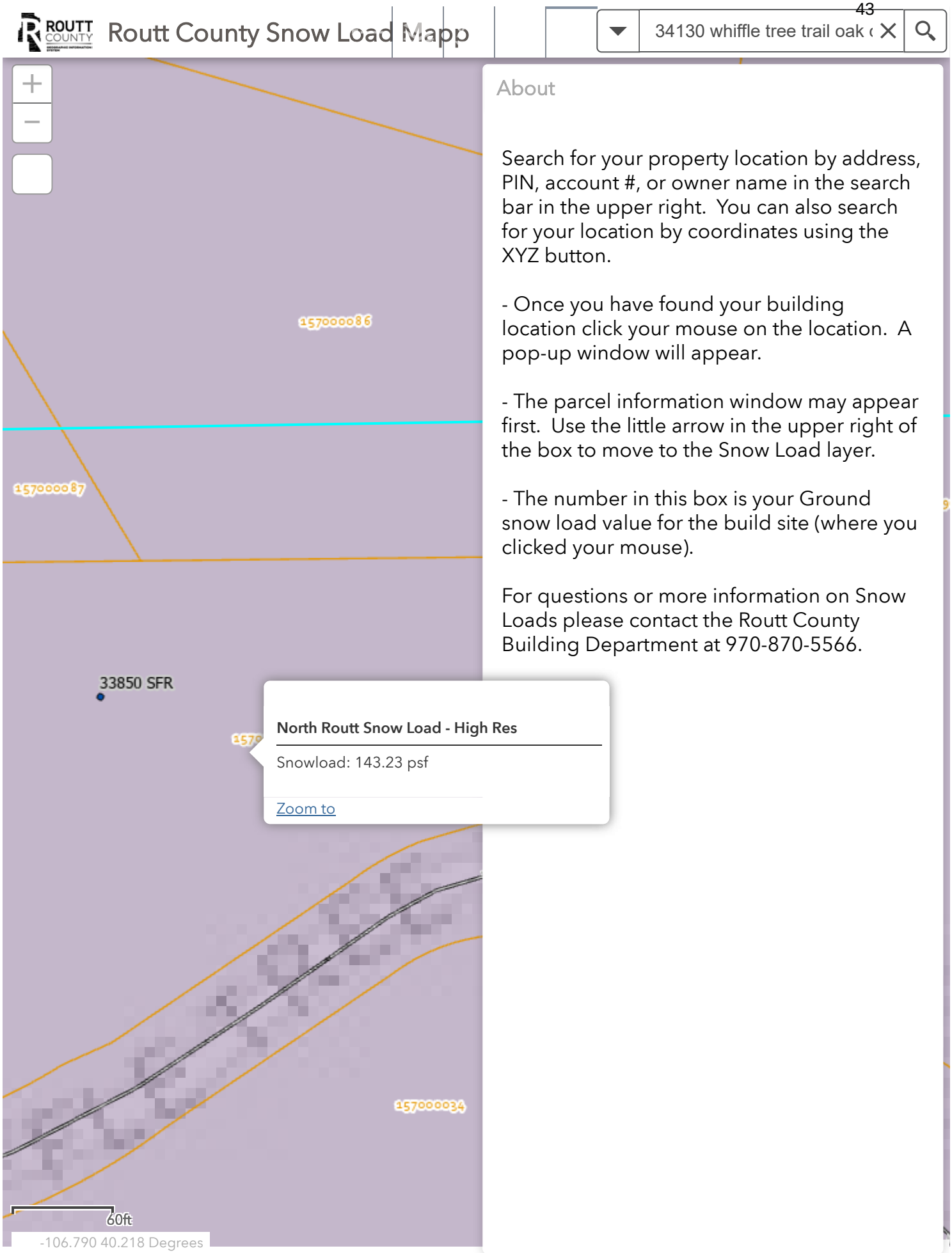
Model No.	Ga.	Dimensions (in.)					Fasteners		Minimum Wood Member Thickness (in.)	Allowable Tension Loads (160)[1]			Code Ref.
		W	H	B	℄	SO	Anchor Bolt Dia. (in.)	Post Fasteners		DF/SP	SPF/HF	Deflection at Allowable Load (in.)	
DTT1Z	14	1½	7⅛	1⅞₁₆	¾	⅜₁₆	⅜	(6) SD #9 x 1½"	1½	840	840	0.170	IP2, L19, FL
								(6) 10d x 1½"		910	640	0.167	
								(8) 10d x 1½"		910	850	0.167	
SS DTT2Z	14	3¼	6¹⁵⁄₁₆	1⅝	1³⁄₁₆	⅜₁₆	½	(8) ¼" x 1½" SDS	1½	1,825	1,800	0.105	I6, L8, FL
								(8) ¼" x 1½" SDS	3	2,145	1,835	0.128	
SS DTT2Z-SDS2.5								(8) ¼" x 2½" SDS	3	2,145	2,105	0.128	
HDU2-SDS2.5	14	3	8¹⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(6) ¼" x 2½" SDS	3	3,075	2,215	0.088	
HDU4-SDS2.5	14	3	10¹⁵⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(10) ¼" x 2½" SDS	3	4,565	3,285	0.114	
HDU5-SDS2.5	14	3	13³⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	(14) ¼" x 2½" SDS	3	5,645	4,065	0.115	
HDU8-SDS2.5	10	3	16⅝	3½	1⅜	1½	⅞	(20) ¼" x 2½" SDS	3	6,765	4,870	0.110	
									3½	6,970	5,020	0.116	
									4½	7,870	5,665	0.113	
HDU11-SDS2.5	10	3	22¼	3½	1⅜	1½	1	(30) ¼" x 2½" SDS	5½	9,335	6,865	0.137	
									7¼	11,175	8,045	0.137	
HDU14-SDS2.5	7	3	25¹¹⁄₁₆	3½	1⁹⁄₁₆	1⁹⁄₁₆	1	(36) ¼" x 2½" SDS	4x6[3,4]	10,770	7,755	0.122	170
									7¼[3]	14,390	10,435	0.177	I6, L8, FL
									5½[2,3]	14,445	10,350	0.172	

1. See pp. 75–76 for Holdown and Tension Tie General Notes.
2. Noted HDU14 allowable loads are based on a 5½" wide post (6x6 min.).
3. HDU14 requires heavy-hex anchor nut to achieve tabulated loads (supplied with holdown).
4. Loads are applicable to installation on either narrow or wide face of post.



Typical HDU Tie Between Floors

C-C-2017 ©2017 SIMPSON STRONG-TIE COMPANY INC.


Routt County Snow Load Mapp
34130 whiffle tree trail oak
About
Search for your property location by address, PIN, account #, or owner name in the search bar in the upper right. You can also search for your location by coordinates using the XYZ button.
- Once you have found your building location click your mouse on the location. A pop-up window will appear.
- The parcel information window may appear first. Use the little arrow in the upper right of the box to move to the Snow Load layer.
- The number in this box is your Ground snow load value for the build site (where you clicked your mouse).
For questions or more information on Snow Loads please contact the Routt County Building Department at 970-870-5566.
157000086
15700087
33850 SFR
North Routt Snow Load - High Res
Snowload: 143.23 psf
Zoom to
157000034
60ft
-106.790 40.218 Degrees

ROUTT COUNTY
REGIONAL BUILDING DEPARTMENT

Proudly Serving Rural Routt County * City of Steamboat Springs * Town of Hayden * Town of Oak Creek * Town of Yampa * Routt County School Districts

Policy: 2018 ICC Building Code Adoption Seismic Category C

Date: 02/23/2021

The Routt County Regional Building Department has composed a Seismic Design Category C Policy to provide our Professionals with clear information on the adoption of the 2018 ICC International Residential Building Code and the 2018 ICC International Building Code respectively.

Through our Code Adoption Processes within each Jurisdiction including; Routt County, Town of Hayden, Town of Yampa, Town of Oak Creek, and City of Steamboat Springs it was voted and approved that all of Routt County will be considered a Seismic Design Category C in respect to both the IRC and IBC Design standards. No Jurisdictions in Routt County have Adopted nor Accepted the Seismic Design Category D designation that is showing in the 2018 IRC in Figure R301.2(2), nor have we adopted or accepted ASCE 7-16 Design Code Reference Document that will display properties as Seismic Category D designation in certain areas. Please note, both the IRC Map and ASCE 7-16 will display certain properties as a Seismic Design Category D, the map in the 2018 IRC has a dark circle displaying this Seismic Category D designation that is centered over the City of Steamboat Springs, and extends outward into Rural Routt County approximately 17 mile total radius. When working within ASCE 7-16 using web link https://seismicmaps.org/ You will find that properties located in the Town of Oak as an example, would be identified as a Seismic Design Category D designation, this would also be the case for any property you pulled up within the City of Steamboat Springs as well as an example. However, the Routt County Regional Building Department and all Jurisdictions we serve voted this down, and we refused to accept the Seismic Design Category D designation throughout all of Routt County.

Routt County Regional Building Department 2018 IBC Policy Amendment to Section 1613:

2018 IBC Section 1613 Earthquake Loads is hereby amended to read as follows:
1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motion and accordance with ASCE 7, excluding Chapter 14 and Appendix 11A. The seismic design category for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.
Exceptions:

1. Detached one- and two-family dwellings, assigned to Seismic Design Category A, B or C, or located where the mapped short-period spectral response acceleration, SS, is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section.

3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.

Routt County Building Department Local Policy Amendment to Section 1613 Earth quake Loads: All properties within Routt County Incorporated and Unincorporated Jurisdictions have been adopted and approved to be a Seismic Design Category C designation through our Building Code Adoption Approval Processes. Structures shall be designed in accordance with our local amendment policy using a Seismic Design Category C designation as the base level design standard. When approved by the Structural Engineer of Record through review of the Geotechnical Soils Report and Soils Site Class, the Seismic Category may be reduced by the Engineer of Record based on the known Soils Site Class and in accordance with ASCE-7 and Chapter 16 of the IBC.

Structural Engineers Acceptable Design Parameters Local Routt County Building Department Policy: The Routt County Building Department has developed these design parameters to align with our Local Code Adoptions that were approved designating all of Routt County a Seismic Design Category C. This Policy has been created to provide maximum values for SDS and SD1 respectively to be used in the mapped areas throughout Routt County that have been designated Seismic Category D in accordance ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/. The parameters below may be used by Structural Engineers based on the Risk Factor of the Building to perform calculations to determine structural designs. The below parameters may be used with Site Class D- Default (See Section 11.4.3) being set on the ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/. Lower values may be used if justified by soil Site Class and resulting site-specific ground motion parameters set forth in ASCE 7-16 and USGS Seismic Design Data Map and approved by the Code Official.

- **Risk Category I, II, and II Building: SDS = 0.333 and SD1 = 0.133**
- **Risk Category IV Building: SDS = 0.499 and SD1 = 0.199**

The intent of setting these parameters and values is to help support Structural Engineers in designing buildings within the spirt of our Locally Approved Code Adoptions designating a standard Seismic Design Category C throughout all of Routt County, to avoid conflicts in what data would otherwise be provided through ASCE 7-16 USGS Seismic Design Data Map found at https://seismicmaps.org/.

Routt County Regional Building Department 2018 IRC Code Adoption

Table R301.2(1) CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA, is completed as follows:

- Ground Snow Load – Case Study Area contact the Building Department for Ground Snow Load Valuations per site.
- Climate Zone 7
- Wind Speed – 115 MPH (ultimate design wind speed)
- Topographic Effects – No
- Seismic Design Category – C Note: When approved by the Structural Engineer of Record through review of the Geotechnical Soils Report and Soils Site Class, the Seismic Category may be reduced

by the Engineer of Record based on the known Soils Site Class and in accordance with ASCE-7 and Chapter 16 of the IBC.

- Subject to Damage by Weathering – Severe
- Subject to Damage by Frost line Depth – 48 inches (1220mm)
- Subject to Damage by Termite – None to slight
- Subject to Damage by Decay – None to slight
- Winter Design:
  - Outdoor Winter Design Dry-Bulb Temperature – -15ºF (-26ºC)
  - Indoor Winter Design Dry-Bulb Temperature: 70° F (21° C)
  - Coincident Wet Bulb: 56° F (13° C)
  - Heating temperature Difference: 85° F (29° C)
- Summer Design:
  - Outdoor Summer Design Dry-Bulb Temperature: 85° F (29° C)
  - Indoor Summer Design Dry-Bulb Temperature: 75° F (24° C)
  - Design Grains: Varies based on weather data Range: -35 to -55
  - Cooling Temperature Difference: 10° F (-12° C)
- Elevation: Varies Elevation by address can be found at: https://elevation.maplogs.com/poi/routt_county_co_usa.12879.html
- Altitude Correction: Varies
  - 7,000’ 0.77
  - 8,000’ 0.75
  - 9,000’ 0.72
  - 10,000’ 0.69
  - 12,000’ 0.63
- Latitude : 40° North
- Ice Shield Underlayment Required – Yes
- Flood Hazards – FIRM, February 4, 2005
- Air Freezing Index – Steamboat 2239
- Mean Annual Temperature – 40-45ºF (4.5-7.2ºC)
- Ground Snow Load Values are Governed by Routt County Regional Building Department based on geographic location. Please visit our home page and click on Ground Snow Load Values for site-specific information.

Sincerely,

Todd Carr

Todd Carr, Building Official
Routt County Building Department

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 1-½" 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 1-½" 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 1-½" for ½" thick sheathing and 1-¾" 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.

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 unsheathed, the height of each opening shall be defined as the clear height of the opening plus the unsheathed 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			560	14.0	860	18.0	1100	24.0	1460	37.0	785	1205	1540	2045
	15/32	1-1/2	10d	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			400	11.0	600	15.0	780	20.0	1020	32.0	560	840	1090	1430
	3/8[2]	1-3/8	8d	440	17.0	640	25.0	820	31.0	1060	45.0	615	895	1150	1485
	7/16[2]			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
	15/32	1-1/2	10d	620	22.0	920	30.0	1200	37.0	1540	52.0	870	1290	1680	2155
	19/32			680	19.0	1020	26.0	1330	33.0	1740	48.0	950	1430	1860	2435
Plywood Siding			Nail (galvanized casing)												
	5/16	1-1/4	6d	280	13.0	420	16.0	550	17.0	720	21.0	390	590	770	1010
	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			280	18.0	420	20.0	540	22.0	700	24.0	390	590	755	980
	1/2		10d	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

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 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls.
2. 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.
3. 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.
4. 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.
5. 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 Walls[1]

Gypsum and Portland Cement Plaster

Sheathing Material	Material Thickness	Fastener Type & Size[2]	Max. Fastener Edge Spacing[3]	Max. Stud Spacing		A SEISMIC v_s (plf)	A SEISMIC G_a (kips/in.)	B WIND 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" Face: 7"	16"	blocked	500	11.0	500
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 Walls[1]

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 (plf)	G_a (kips/in.)	v_w (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.