tecinstruct LLC
4111 164th St SW
Unit 51
Lynnwood, WA 98087

Phone (206) 553 9076
rheimisch@yahoo.com

Engineering

STRUCTURAL DESIGN

Owner:	James & Brooke Aldrich
Project:	7448 W Mercer Way Mercer Island, WA 98040
Description:	Addition and Alteration
Building Codes:	IBC/IRC 2021 ASCE 7-16
Structural Design/ EOR:	Roland Heimisch, P. E. Lic # 42479
Date	04/28/2025

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1. LATERAL DESIGN

Project: 7448 W Mercer Way, Mercer Island, 98040

1.1 Seismic Design

Criteria	Basic Seismic-Force-Resisting System			Diaphragms / Shear Walls
	Medium Building Height	H	=	15 ft
	Seismic Use Group			II
	Importance Factor	I_e	=	1.0
	Site Class			D
	Seismic Design Category			D
	Response Factor	R	=	6.5 (light frame wood building)
	Mapped Acceleration	S_s	=	1.65
		S_1	=	0.63
	Design Acceleration	SD_s	=	1.16
		SD_1	=	NA
	Seismic Response Coefficient	C_s	=	SDs / (R/I)
			=	1.16 / (6.5/1.0) = 0.18

Building Weight

W = 15 psf x 2,600 sqft = 39,000 lbs

Base Shear V_{Base} = C_s x W = 0.18 x 39,000 = 7,000 lbs

Design Shear: To convert from strength level to ASD, Base Shear is multiplied by 0.7

V_{Design} = 0.7 x 7,000 = 4,900, say 5,000 lbs

Seismic Load per Grid:

Grids 6 & B	0.25 x 5,000	=	1,250 lbs
Grids 2 & C	0.50 x 5,000	=	2,500 lbs

REPORT SUMMARY

Site Information

Address:	*7448 W Mercer Way, Mercer Island, Washington, 98040*
Elevation:	241 ft (NAVD 88)
Lat:	47.535985
Long:	-122.238503
Standard:	ASCE/SEI 7-22
Risk Category:	II
Soil Class:	D - Stiff Soil

Seismic Data

S_S	1.65
S_1	0.63
S_{MS}	1.74
S_{M1}	1.29
S_{DS}	1.16
S_{D1}	0.86
T_L	6
PGA_M	0.74
V_{S30}	260
Seismic Design Category	D
Note	Where values of the multi-period 5%-damped MCER response spectrum are not available from the USGS Seismic Design Geodatabase, the design response spectrum shall be permitted to be determined in accordance with Section 11.4.5.2

Project: 7448 W Mercer Way, Mercer Island, 98040

1.2 Wind Design

Directional Procedure, Part 2 (simplified method) per ASCE 7-22

Design Criteria:

Enclosed Simple Diaphragm Building	
Risk Category II	
Basic Wind Speed per Table 26.5-1A	110 MpH
Directionality Factor K_d	0.85
Exposure Category	B
Wind Speed up factor K_{zt}	1.0
Enclosure Classification	enclosed
Net pressure at top of wall p_h , Table 27.6-1 (conservatively also used for bottom of wall)	17.5 psf

As the shear wall design is performed for ASD, the load is multiplied with 0.7

Applied wind pressure	0.7 x 17.5	12.25, say 13 psf

Uniform wind load on diaphagms

w/ trib h 10 ft	w =	10 x 13	=	130 plf

Wind loads per grid:	Grid 6	0.5 x 20 x 130	=	1,300 lbs
	Grid 2	0.5 x 65 x 130	=	4,225 lbs
	Grid A & C	0.5 x 68 x 130	=	4,420 lbs
	Grid B	0.5 x 28 x 130	=	1,820 lbs

Grids A and 5 are existing to remain

Shear Wall Types

SW type	OSB	Nails	Nails edge @ (in o.c.)	Nails field @ (in o.c.)	Boundary Member	Seismic list x .94 (to adjust for HF)	Wind x 1.4 plf	Anchor Bolt 5/8" @ (in o.c.)
P1-6	7/16"	8d	6"	12"	2x	225	315	48"
P1-3	7/16"	8d	3"	12"	3x	425	590	30"
Roof	7/16"	8d	6"	12"	2x	226	316	
Floor	3/4" CDX	10d	6"	12"	2x	300	420	

Holdowns

Callout	HD	All T (lbs)	Wood Member	Bolt dia	Embedment w/ Epoxy SET-G3
1	HDU2	2215	(2) 2x	5/8"	7"
2	HDU4	3285	(2) 2x	5/8"	9"

Wind loads

	Shear design				Overturning									
Grid	**Shear**	**Length** total	**Shear** uniform	**SW** Type	**Panel**	**L**	**h**	**Aspect Ratio**	**M ot**	**Wall** trib.H	**R/Fl** trib.L	**M res** Restr.	**M tot**	**Uplift** T	**HW**
	V (lbs)	L (ft)	v (plf)			(ft)	(ft)	k/L	(lb-ft)	(ft)	(ft)	(lb-ft)	(lb-ft)	(lbs	
6	1300	28.0	46	P1-6	6-1 p	28.00	8	0.29	10400	8	2	23100	-12700	**-454**	**not rqd**
2	4225	17.5	**241**	**P1-6**	2-1	4.00	8	2	7726	8	6	588	7138	**1784**	**HDU2**
					2-2	8.00	8	1	15451	8	6	2520	12931	**1616**	**HDU2**
					2-3	5.50	8	1.45	10623	8	6	1155	9468	**1721**	**HDU2**
			Sheathing, nailing pattern, and holdowns in Grid 2 to be verified												
A	4420	35.0	**126**	**P1-6**	A-1	2.50	8	3.2	2526	8	14	330	2196	**878**	**HDU2**
				Existing grid, to be verified											
B	1820	5.0	**364**	**P1-3**	B-1	2.50	8	3.2	7280	8	14	330	6950	**2780**	**HDU4**
					B-2	2.50	8	3.2	7280	8	14	330	6950	**2780**	**HDU4**
C	4420	20.0	**221**	**P1-6**	C-1	20.00	8	0.4	35360	8	14	25740	9620	**481**	**HDU2**

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear**	**h op / h total**	**Σ Li**	**L total**	**Sheathing ΣLi / L**	**Co**	**q'**	**Nailing**
	v (plf)	%	**(ft)**	(ft)	%		(plf)	
6-1	46	5h/6	16	28	57	0.61	132	P1-6

Wind loads

	Shear design				Overturning										
Grid	**Shear**	**Length** total	**Shear** uniform	**SW** Type	**Panel**	**L**	**h**	**Aspect Ratio**	**M ot**	**Wall** trib.H	**R/Fl** trib.L	**M res** Restr.	**M tot**	**Uplift** T	**HW**
	V (lbs)	L (ft)	v (plf)			(ft)	(ft)	k/L	(lb-ft)	(ft)	(ft)	(lb-ft)	(lb-ft)	(lbs	
6	1250	28.0	**45**	**P1-6**	6-1 p	28.00	8	0.29	10000	8	2	23100	-13100	-468	not rqd
2	2500	17.5	143	P1-6	2-1	4.00	8	2	4571	8	6	588	3983	996	HDU2
					2-2	8.00	8	1	9143	8	6	2520	6623	828	HDU2
					2-3	5.50	8	1.45	6286	8	6	1155	5131	933	HDU2
			Sheathing, nailing pattern, and holdowns in Grid 2 to be verified												
A	2500	35.0	71	P1-6	A-1	2.50	8	3.2	1429	8	14	330	1099	439	HDU2
				Existing grid, to be verified											
B	1250	5.0	250	P1-3	B-1	2.50	8	3.2	5000	8	14	330	4670	1868	HDU2
					B-2	2.50	8	3.2	5000	8	14	330	4670	1868	HDU2
C	2500	20.0	125	P1-6	C-1	20.00	8	0.4	20000	8	14	25740	-5740	-287	not rqd

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear**	**h op / h total**	**Σ Li**	**L total**	**Sheathing ΣLi / L**	**Co**	**q'**	**Nailing**
	v (plf)	%	**(ft)**	(ft)	%		(plf)	
6-1	63	5h/6	16	28	57	0.61	181	P1-6

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2. GRAVITY DESIGN

2.1 Design Criteria

Dead Loads	**Roof**	Coating/Waterproofing	2.0
		Sheathing OSB/Plywood 15/32“	2.0
		Trusses / Framing	3.0
		Insulation R-38	1.2
		Gypsum Board 5/8“	2.8
		Miscellaneous (Sprinkler, HVAC etc)	1.5
		Total	12.5, say **15 psf**
	Floors Living	Finished Floor (carpet)	1.0
		Sheathing OSB/Plywood 3/4“	2.5
		Floor Joists / TJIs	2.5
		Insulation R-11	1.0
		Gypsum Board 5/8“	2.8
		Miscellaneous (Sprinkler, HVAC etc)	1.5
		Total	11.3, say **15 psf**
	Decks/Balconies	Decking	3.0
		Floor Joists / TJIs	2.5
		Miscellaneous (Railing/Waterproofing)	1.5
		Total	7.0 say **10 psf**
	Ext. Walls	Siding	3.0
		Sheathing 15/32“ OSB/Plywood	2.0
		2x6“ Studs @ 16“ o.c.	1.5
		Insulation R-21	0.6
		Gypsum Board 5/8“	2.8
		Total	9.9, say **10 psf**
	Int. Walls	2x4“ Studs @ 16“ o.c.	1.5
		Gypsum Board (2 sides) 5/8“	5.6
		Total	7.1, say **8 psf**
Live Loads		Roof	**25 psf**
		Living areas	**40 psf**
		Decks/Balconies	**60 psf**
Snow Load		Snow Ground Load	25 psf
		Snow Roof Load (no reduction applied)	**25 psf**

2.2 Key List

Roof Level

Key No. 1.1 **Manufactured Scissored Trusses, @ 24” o.c.**

Key No. 1.2 **Manufactured Common Trusses, @ 24” o.c.**

Key No. 1.3 **Glulam WS, 24F-1.8E, 5-1/2x9-1/2”**

Key No. 1.4 **Post, HF No. 2, 6x6”, P.T.**

Key No. 1.5 **Glulam WS, 24F-1.8E, 5-1/2x13-1/2”**

Key No. 1.6 **Header, DF No. 2, 4x6”**

Floor Level

Key No. 2.1 **Floor Joist, F No. 2, 2x10”, @ 16” o.c.**

Key No. 2.2 **Beam, DF No. 2, 6x10”**

Key No. 2.3 **Continuous Footing, fc = 2,500 psi, 16x8”**

Key No. 2.4 **Spread Footing, fc = 2,500 psi, 24x24x8”**

2.3 Roof

Key No. 1.1 Manufactured Scissored Trusses, @ 24" o.c.

Span:	max L		=	28 ft
Load:	DL		=	15 psf
	SL		=	25 psf

Per manufacturer

Key No. 1.2 Manufactured Common Trusses, @ 24" o.c.

Span:	max L		=	16 ft
Load:	DL		=	15 psf
	SL		=	25 psf

Per manufacturer

Key No. 1.3 Glulam WS, 24F-1.8E, 5-1/2x9-1/2"

Span:	L		=	16 ft
Load:	roof w/ trib 8 ft			
	DL	8 x 15	=	120 plf
	SL	8 x 25	=	200 plf

For calculation see design sheets

Key No. 1.4 Post, HF No. 2, 6x6", P.T.

height:	H		=	8 ft
Load:	reaction from beam 1.3			
	PDL		=	965 lbs
	PSL		=	1,610 lbs

Per inspection

Key No. 1.5 Glulam WS, 24F-1.8E, 5-1/2x13-1/2"

Span:	L		=	16 ft
Load:	roof w/ trib 22 ft			
	DL	22 x 15	=	330 plf
	SL	22 x 25	=	550 plf

For calculation see design sheets

Key No. 1.6 Header, DF No. 2, 4x6"

Span:	L		=	6 ft
Load:	roof w/ trib 2 ft			
	DL	2 x 15	=	30 plf
	SL	2 x 25	=	50 plf

For calculation see design sheets

2.4 Floor Level and Foundation

Key No. 2.1 Floor Joist, F No. 2, 2x10", @ 16" o.c.

Span:	L		=	10 ft
Loads:	DL		=	15 psf
	LL		=	40 psf

For calculation see design sheets

Key No. 2.2 Beam, DF No. 2, 6x10"

Span:	L		=	9 ft
Load:	floor w/ trib 10 ft			
	DL	10 x 15	=	150 plf
	LL	10 x 40	=	400 plf

For calculation see design sheets

Key No. 2.3 Continuous Footing, fc = 2,500 psi, 16x8"

Dimensions per prescriptive requirements

Reinforcement: (2) rebars # 4 longitudinal
Transverse #3 @ 18" o.c.

Key No. 2.4 Spread Footing, fc = 2,500 psi, 24x24x8"

Load	reaction from (2x) beam 2.2 (governs over post 1.4)			
	P	2 x 2,500	=	5,000 lbs
Soil pressure		5,000 / 4	=	1,250 psf < 1,500
Rebars	# 4 @ 6" o.c. both directions			

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
1_3 Beam
Apr. 23, 2025 14:54

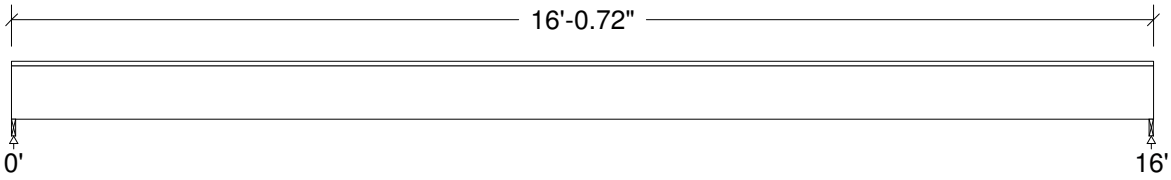
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				120.0		plf
SL	Snow	Full UDL				200.0		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	964		964
Snow	1606		1606
Factored:			
Total	2570		2570
Bearing:			
Capacity			
Beam	2570		2570
Support	2639		2639
Des ratio			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	0.72		0.72
Min req'd	0.72		0.72
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Glulam-Unbalan., West Species, 24F-1.8E WS, 5-1/2"x9"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2

Total length: 16'-0.75"; Clear span: 15'-11.25"; Volume = 5.5 cu.ft.; 6 laminations, 5-1/2" maximum width,

Lateral support: top = continuous, bottom = at supports;

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 70	Fv' = 305	psi	fv/Fv' = 0.23
Bending(+)	fb = 1655	Fb' = 2760	psi	fb/Fb' = 0.60
Live Defl'n	0.49 = L/391	0.53 = L/360	in	0.92
Total Defl'n	0.78 = L/244	1.07 = L/180	in	0.74

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.15	1.00	1.00	1.000	1.000	-	-	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + S
 Bending(+): LC #2  = D + S
 Deflection: LC #2  = D + S  (live)
             LC #2  = D + S  (total)
 Bearing   : Support 1 - LC #2 = D + S
             Support 2 - LC #2 = D + S
 D=dead S=snow
 All LC's are listed in the Analysis output
 Load Patterns: s=S/2,  X=L+S or L+Lr,  _=no pattern load in this span
 Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
 V max = 2560, V design = 2310 (NDS 3.4.3.1(a)) lbs; M(+) = 10240 lbs-ft
 EI = 601.42e06 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.00 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
1_5 GLB
Apr. 23, 2025 15:30

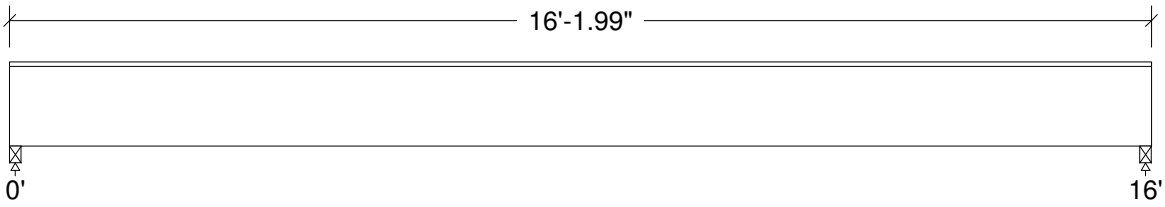
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				330.0		plf
SL	Snow	Full UDL				550.0		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	2667		2667
Snow	4446		4446
Factored:			
Total	7113		7113
Bearing:			
Capacity			
Beam	7113		7113
Support	7306		7306
Des ratio			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#2		#2
Length	1.99		1.99
Min req'd	1.99		1.99
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Glulam-Unbalan., West Species, 24F-1.8E WS, 5-1/2"x13-1/2"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2

Total length: 16'-2.0"; Clear span: 15'-10"; Volume = 8.3 cu.ft.; 9 laminations, 5-1/2" maximum width,

Lateral support: top = continuous, bottom = at supports;

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 121	Fv' = 305	psi	fv/Fv' = 0.40
Bending(+)	fb = 2023	Fb' = 2760	psi	fb/Fb' = 0.73
Live Defl'n	0.40 = L/480	0.53 = L/360	in	0.75
Total Defl'n	0.64 = L/300	1.07 = L/180	in	0.60

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.15	1.00	1.00	1.000	1.000	-	-	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	2
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + S
 Bending(+): LC #2  = D + S
 Deflection: LC #2  = D + S  (live)
             LC #2  = D + S  (total)
 Bearing   : Support 1 - LC #2 = D + S
             Support 2 - LC #2 = D + S
 D=dead S=snow
 All LC's are listed in the Analysis output
 Load Patterns: s=S/2,  X=L+S or L+Lr,  _=no pattern load in this span
 Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
 V max = 7040, V design = 5977 (NDS 3.4.3.1(a)) lbs; M(+) = 28160 lbs-ft
 EI = 2029.78e06 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.00 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
1_6 Header
Apr. 23, 2025 15:32

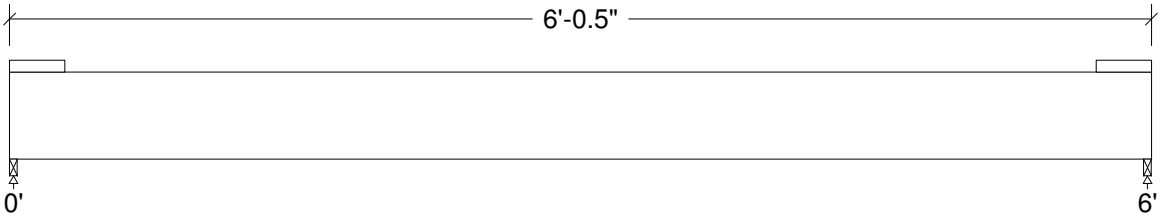
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				30.0		plf
SL	Snow	Full UDL				50.0		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	91		91
Snow	151		151
Factored:			
Total	242		242
Bearing:			
Capacity			
Beam	1094		1094
Support	1211		1211
Des ratio			
Beam	0.22		0.22
Support	0.20		0.20
Load comb	#2		#2
Length	0.50*		0.50*
Min req'd	0.50*		0.50*
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

*Minimum bearing length setting used: 1/2" for end supports

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x6 (3-1/2"x5-1/2")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 6'-0.5"; Clear span: 5'-11.5"; Volume = 0.8 cu.ft.
Lateral support: top = at supports, bottom = at supports;
This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 16	Fv' = 207	psi	fv/Fv' = 0.08
Bending(+)	fb = 245	Fb' = 1271	psi	fb/Fb' = 0.19
Live Defl'n	0.02 = < L/999	0.20 = L/360	in	0.09
Total Defl'n	0.03 = < L/999	0.40 = L/180	in	0.08

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.15	1.00	1.00	1.000	1.300	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + S
 Bending(+): LC #2  = D + S
 Deflection: LC #2  = D + S  (live)
             LC #2  = D + S  (total)
 Bearing   : Support 1 - LC #2 = D + S
             Support 2 - LC #2 = D + S
 D=dead S=snow
 All LC's are listed in the Analysis output
 Load Patterns: s=S/2,  X=L+S or L+Lr,  _=no pattern load in this span
 Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
 V max = 240, V design = 202 (NDS 3.4.3.1(a)) lbs; M(+) = 360 lbs-ft
 EI = 77.64e06 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.00 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
1_6 Header
Apr. 23, 2025 15:44

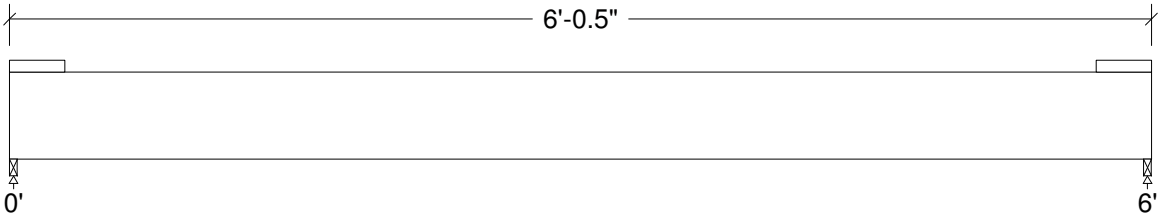
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				30.0		plf
SL	Snow	Full UDL				50.0		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	91		91
Snow	151		151
Factored:			
Total	242		242
Bearing:			
Capacity			
Beam	1094		1094
Support	1211		1211
Des ratio			
Beam	0.22		0.22
Support	0.20		0.20
Load comb	#2		#2
Length	0.50*		0.50*
Min req'd	0.50*		0.50*
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

*Minimum bearing length setting used: 1/2" for end supports

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x6 (3-1/2"x5-1/2")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 6'-0.5"; Clear span: 5'-11.5"; Volume = 0.8 cu.ft.
Lateral support: top = at supports, bottom = at supports;
This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 16	Fv' = 207	psi	fv/Fv' = 0.08
Bending(+)	fb = 245	Fb' = 1271	psi	fb/Fb' = 0.19
Live Defl'n	0.02 = < L/999	0.20 = L/360	in	0.09
Total Defl'n	0.03 = < L/999	0.40 = L/180	in	0.08

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.15	1.00	1.00	1.000	1.300	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + S
 Bending(+): LC #2  = D + S
 Deflection: LC #2  = D + S  (live)
             LC #2  = D + S  (total)
 Bearing   : Support 1 - LC #2 = D + S
             Support 2 - LC #2 = D + S
 D=dead S=snow
 All LC's are listed in the Analysis output
 Load Patterns: s=S/2,  X=L+S or L+Lr,  _=no pattern load in this span
 Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
 V max = 240, V design = 202 (NDS 3.4.3.1(a)) lbs; M(+) = 360 lbs-ft
 EI = 77.64e06 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.00 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
2_1 Floor Joist
Apr. 23, 2025 15:44

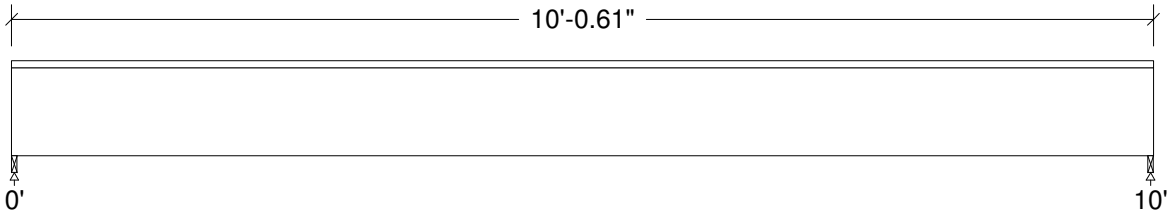
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full Area				15.00(16.0")		psf
LL	Live	Full Area				40.00(16.0")		psf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	101		101
Live	268		268
Factored:			
Total	369		369
Bearing:			
Capacity			
Joist	369		369
Support	711		711
Des ratio			
Joist	1.00		1.00
Support	0.52		0.52
Load comb	#2		#2
Length	0.61		0.61
Min req'd	0.61		0.61
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.25		1.25
Fcp sup	625		625

Lumber-soft, Hem-Fir (N), No.1/No.2, 2x10 (1-1/2"x9-1/4")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2

Floor joist spaced at 16.0" c/c; Total length: 10'-0.63"; Clear span: 9'-11.38"; Volume = 1.0 cu.ft.

Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 33	Fv' = 145	psi	fv/Fv' = 0.23
Bending(+)	fb = 514	Fb' = 1265	psi	fb/Fb' = 0.41
Live Defl'n	0.08 = < L/999	0.33 = L/360	in	0.23
Total Defl'n	0.09 = < L/999	0.50 = L/240	in	0.18

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	145	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	1000	1.00	1.00	1.00	1.000	1.100	-	1.15	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	2
Emin'	0.58 million		1.00	1.00	-	-	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #2  = D + L
Bending(+): LC #2  = D + L
Deflection: LC #2  = 0.5D + L  (live)
            LC #2  = 0.5D + L  (total)
Bearing   : Support 1 - LC #2 = D + L
            Support 2 - LC #2 = D + L
D=dead L=live
All LC's are listed in the Analysis output
Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
V max = 367, V design = 308 (NDS 3.4.3.1(a)) lbs; M(+) = 917 lbs-ft
EI = 158.29e06 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 0.50 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

WoodWorks® SOFTWARE FOR WOOD DESIGN

7448 W Mercer Island
Mercer Island, WA 98040
2_2 Beam
Apr. 23, 2025 15:48

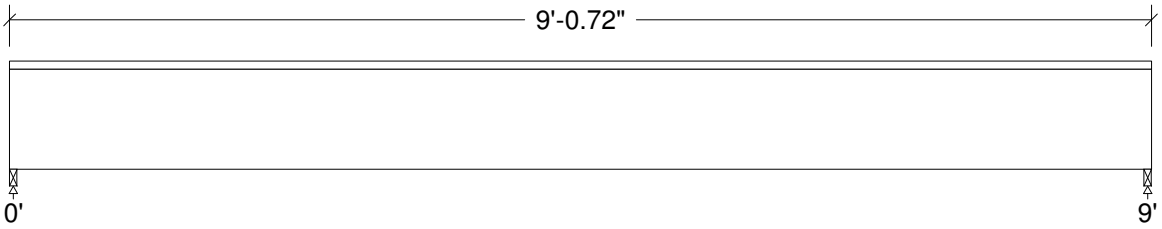
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				150.0		plf
LL	Live	Full UDL				400.0		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	680		680
Live	1812		1812
Factored:			
Total	2492		2492
Bearing:			
Capacity			
Beam	2492		2492
Support	2661		2661
Des ratio			
Beam	1.00		1.00
Support	0.94		0.94
Load comb	#2		#2
Length	0.72		0.72
Min req'd	0.72		0.72
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

Timber-soft, D.Fir-L (N), No.2, 6x10 (5-1/2"x9-1/2")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 9'-0.75"; Clear span: 8'-11.25"; Volume = 3.3 cu.ft.; Beam or stringer
Lateral support: top = continuous, bottom = at supports;
This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 58	Fv' = 170	psi	fv/Fv' = 0.34
Bending(+)	fb = 808	Fb' = 875	psi	fb/Fb' = 0.92
Live Defl'n	0.12 = L/934	0.30 = L/360	in	0.39
Total Defl'n	0.14 = L/786	0.60 = L/180	in	0.23

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	170	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	875	1.00	1.00	1.00	1.000	1.000	-	1.00	1.00	1.00	2
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million	1.00	1.00	-	-	-	-	1.00	1.00	2	

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #2  = D + L
 Deflection: LC #2  = 0.5D + L  (live)
             LC #2  = 0.5D + L  (total)
 Bearing   : Support 1 - LC #2 = D + L
             Support 2 - LC #2 = D + L
 D=dead L=live
 All LC's are listed in the Analysis output
 Load Patterns: s=S/2,  X=L+S or L+Lr,  _=no pattern load in this span
 Load combinations: ASD Basic from ASCE 7-16 2.4
```

CALCULATIONS:

```
 V max = 2475, V design = 2023 (NDS 3.4.3.1(a)) lbs; M(+) = 5569 lbs-ft
 EI = 510.84e06 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.50 permanent + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2021) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.