



Engineering

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STRUCTURAL DESIGN
Revision 10_2024

Owner:	Renee Lund
Project:	8520 SE 82nd St Mercer Island, WA 98040
Description:	Remodel and Addition
Building Codes:	IBC/IRC 2018 ASCE 7-16
Structural Design/ EOR:	Roland Heimisch, P. E. Lic # 42479
Date	10/28/2024





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Engineering

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1. LATERAL DESIGN

Project: 8520 SE 82nd St, Mercer Island, WA 98040

1.1 Seismic Design

Criteria	Basic Seismic-Force-Resisting System			Diaphragms / Shear Walls
	Medium Building Height	H	=	30 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	=	1.64
		S ₁	=	0.62
	Design Acceleration	SD _s	=	1.15
		SD ₁	=	NA
	Seismic Response Coefficient	C _s	=	SD _s / (R/I)
			=	1.15 / (6.5/1.0) = 0.18

Building Weight

3rd level	W	15 x 1,500 sqft	=	22,500 lbs
2nd level	W	20 x 2,200 sqft	=	44,000 lbs
1st level	W	20 x 2,200 sqft	=	44,000 lbs
Total Building Weight	W		=	110,500 lbs

Base Shear V_{Base} = C_s x W = 0.18 x 110,500 = 19,900 lbs

Design Shear: To convert from strength level to ASD, Base Shear is multiplied by 0.7
 V_{Design} = 0.7 x 19,900 = 14,000 lbs

Vertical Distribution: F_x = C_{vx} x V = C_{vx} x 14,000
 C_{vx} = (w_x x h_x^k) / ∑ (w_i x h_i^k) with k = 1.0 for T < 0.5 sec

Level	w _x (lb)	h _x (ft)	w _x h _x (lb-ft)	w _x h _x /∑w _i h _i (%)	F _x (lbs)	L _{E/W} (ft)	v _{xNS} (plf)	L _{NS} (ft)	v _{xEW} (plf)
3rd	22,500	33	742,500	35	4,900	24	205	58	85
2nd	44,000	22	968,000	46	6,440	55	120	50	130
1st	44,000	9	396,000	19	2,660	55	50	50	55
∑	110,500	---	2,106,500	100	14,000				

REPORT SUMMARY

Site

Information

Address:	8520 SE 82nd St, Mercer Island, Washington, 98040
Elevation:	323 ft (NAVD 88)
Lat:	47.530593
Long:	-122.225147
Standard:	ASCE/SEI 7-22
Risk Category:	II
Soil Class:	D - Stiff Soil

Seismic Data

S_s	1.64
S_1	0.62
S_{Ms}	1.73
S_{M1}	1.27
S_{Ds}	1.15
S_{D1}	0.85
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: 8520 SE 82nd St, Mercer Island, WA 98040

1.2 Wind Design

Directional Procedure, Part 2 (simplified method) per ASCE 7-16, Chapter 27.5

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	C
	Wind Speed up factor K_{zt}	1.9
	Enclosure Classification	enclosed
	Net pressure at top of wall p_h , Table 27.6-1 (conservatively also used for bottom of wall)	28.5 psf
	Total pressure	1.9×28.5 54 psf

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

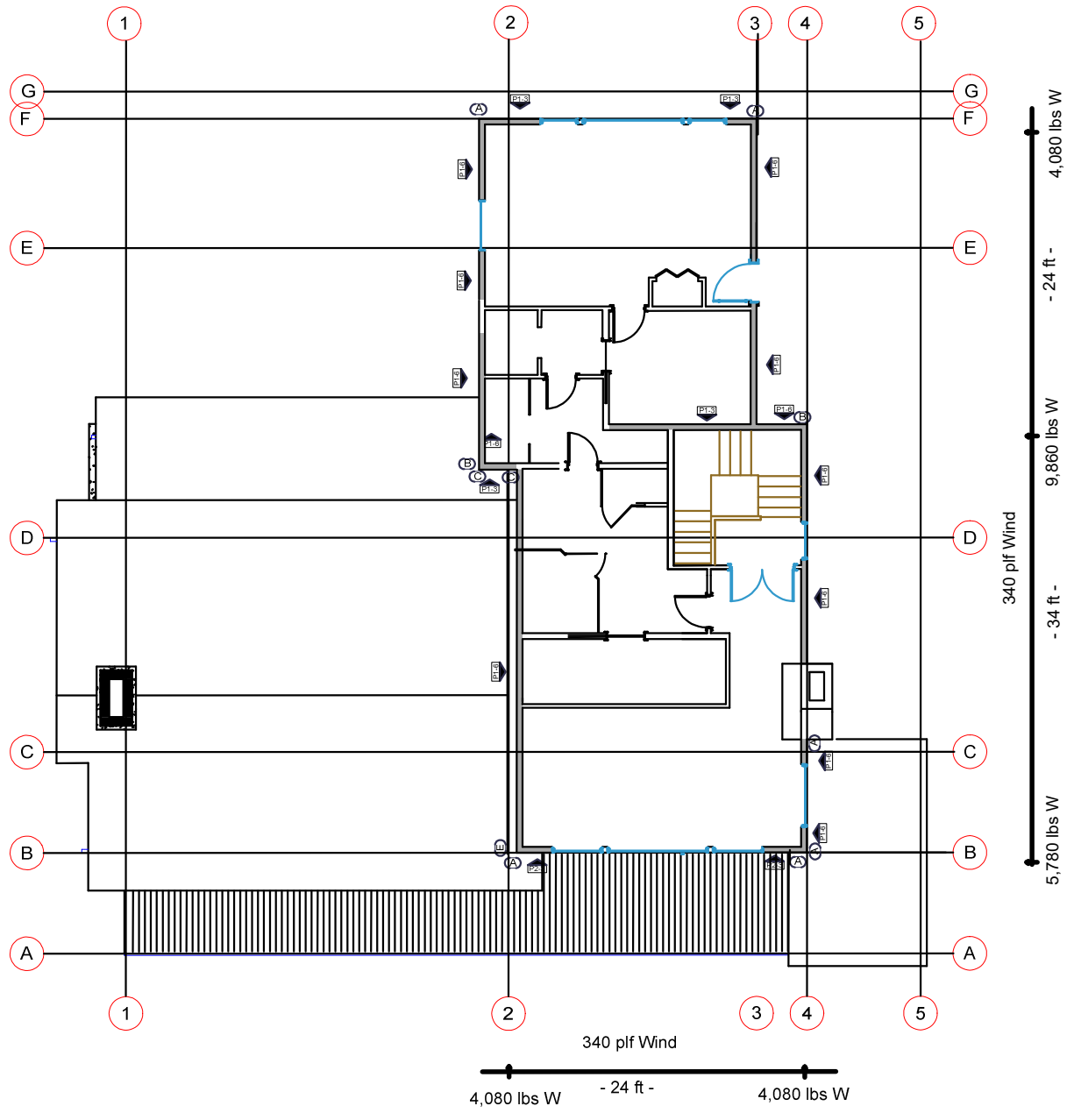
Applied wind pressure	0.7×54	38 psf
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Uniform wind load on diaphragms

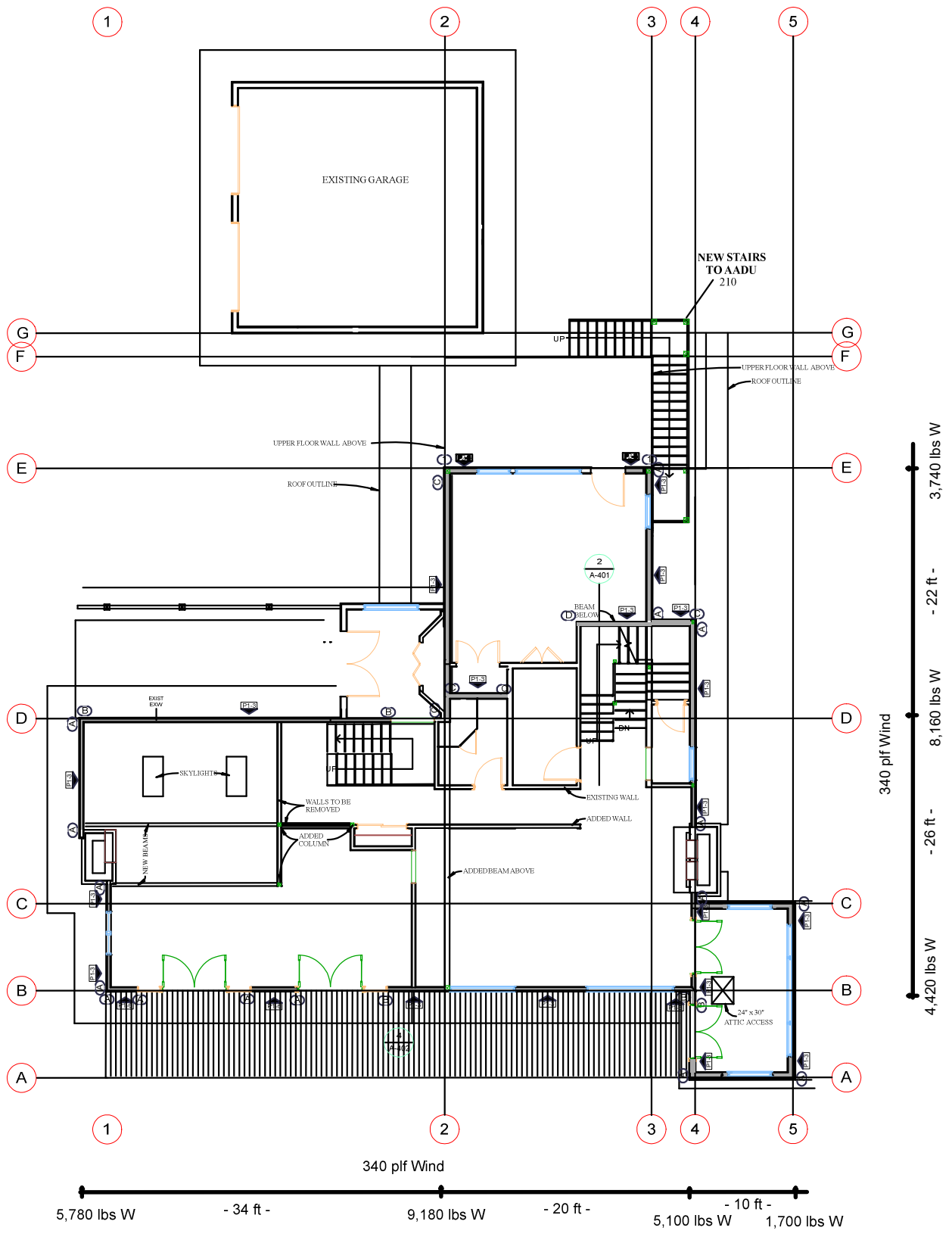
$$w / \text{trib h } 9 \text{ ft} \quad w = \quad 9 \times 38 \quad = \quad 340 \text{ plf}$$

With wind load more than 40% (= capacity increase for shear panels) greater than seismic load, wind governs for all conditions. Consequently, no further seismic evaluation was performed.

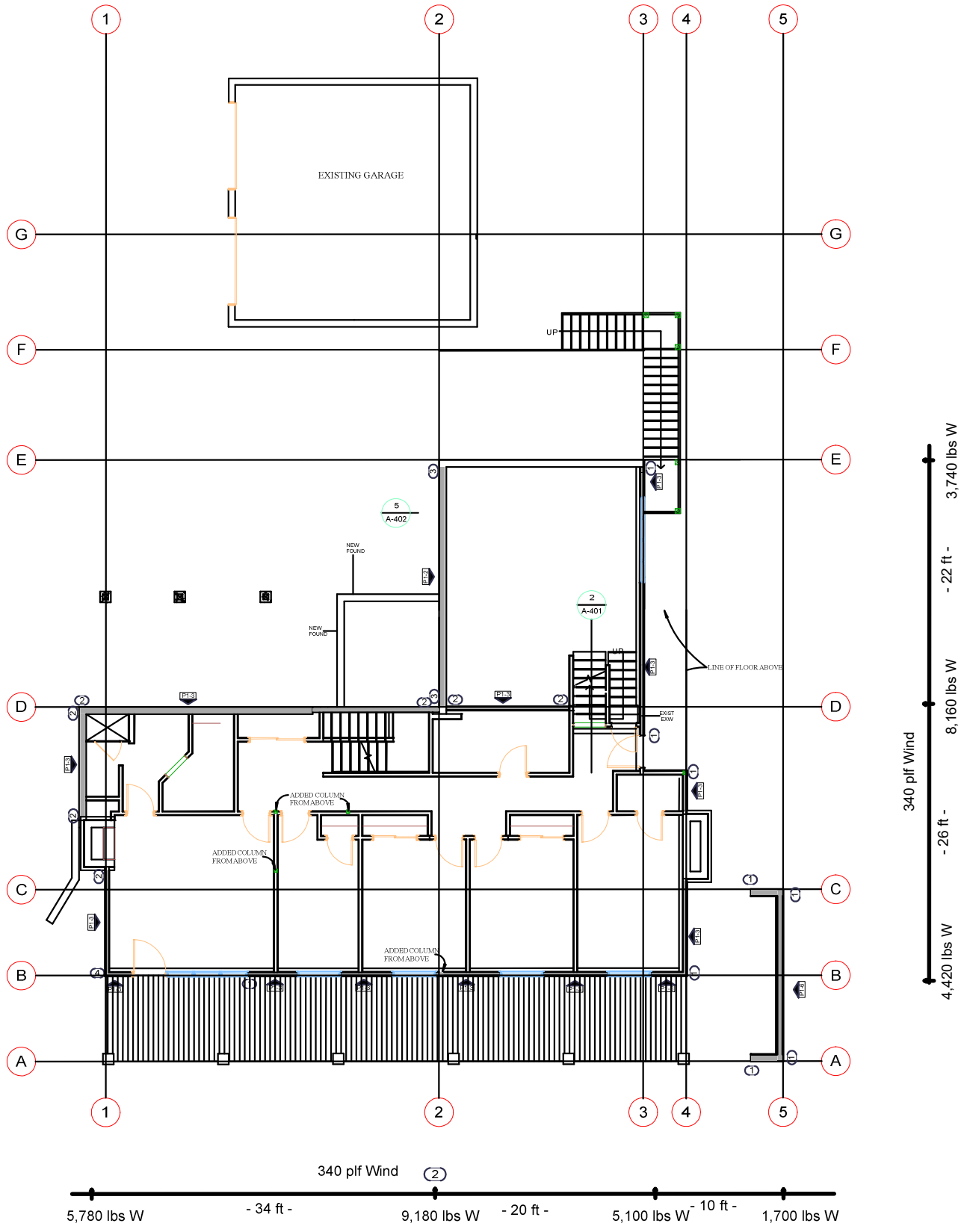
Shear Wall Layout Upper Level



Shear Wall Layout Main Level



Shear Wall Layout Lower Level



Shear Wall Types

SW type	OSB	Nails edge @ (in o.c.)	Nails field @ (in o.c.)	Boundary Member	Seismic list x .94 (to adjust for HF)	Wind Anchor x 1.4 Bolt 5/8" @ (in o.c.)
P1-6	7/16"	8d	12"	2x	225	315 48"
P1-3	15/32"	10d	12"	3x	565	790 36"
P1-2	15/32"	10d	12"	3x	725	1015 24"
P2-3	15/32"	10d	12"	3x	1130	1580 18"
Roof	7/16"	8d	12"	2x	226	316
Floor	3/4" CDX	10d	12"	2x	300	420
Straps	Callout	Strap	All T (lbs)	Member (in)	Nails	
	A	MST37	2345	(2) 2x	22-16d	
	B	MST48	3640	(2) 2x	34-16d	
	C	MST60	5405	(2) 2x	46-16d	
	D	MSTC48B3	3330	(2) 2x	38-10d	
	E	H6	1065	(2) 2x	8-16d	
Holdowns	Callout	HD	All T (lbs)	Wood Member	Bolt dia.	Embedment w/ Epoxy SET-XP
	1	HDU2	2215	(2) 2x	5/8"	7"
	2	HDU5	4340	(2) 2x	5/8"	11"
	3	HDU8	7870	(2) 2x	7/8"	15"

Grid 1 Wind

Shear design Overturning

Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Panel Type	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	No shear panels in grid 1 at 3rd level															
based on perf design																
2	5780	5780	20.0	289	P1-3	10.0	8	0.8	23120	8	2	2850	20270	20270	2027	MST37
					P1-6	10.0	8	0.8	23120	8	2	2850	20270	20270	2027	MST37
1	5780	11560	20.0	578	P1-3	10.0	4	0.4	23120	4	2	1710	21410	41680	4168	HDU5
					1-2	10.0	4	0.4	23120	4	2	1710	21410	41680	4168	HDU5

p perforated panel

Panel	Unit Shear v (plf)	h op total	Σ Li (ft)	L total (ft)	Sheathing Σ Li / L %	Co from SDPWS 4.3.3.5	q' (plf)	Nailing
1-1 2nd	289	2h/3	6	10	60	0.71	678	P1-3

Grid 2 Wind

Shear design										Overturning							
Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Type	Panel	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	4080	4080	58.0	70	P1-6	2-1	30.0	9	0.3	18993	9	10	50445	-31452	-31452	-1048	not reqd
						2-2 p	28.0	9	0.32	17727	9	10	43890	-26163	-26163	-934	not reqd
2	9180	13260	23.0	577	P1-3	2-1	23.0	12	0.52	159120	12	10	34155	124965	93513	4066	MST60
1	9180	22440	23.0	976	P1-2	2-1	23.0	4	0.17	89760	4	2	9315	80445	173958	7563	HDU8

p perforated panel

Panel	Unit Shear v (plf)	h op 2h/3	ΣLi	L total	Sheathing $\Sigma Li / L$ %	Co from SDPWS 4.3.3.5	q' (plf)	Nailing
2-2-3rd	70	22	22	28	79	0.82	109	P1-6



Grid 3/4 Wind

Shear design Overturning

Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Type	Panel	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res Restr. (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	4080	4080	51.0	80	P1-6	34-1 p	9.0	9	1	6480	9	10	4361	2120	2120	236	MST37
						34-2 p	18.0	9	0.5	12960	9	10	17955	-4995	-4995	-278	not req
						34-3 p	24.0	9	0.38	17280	9	10	32148	-14868	-14868	-620	not req
based on perf design																	
2	6120	10200	50.0	204	P1-3	34-1 p	17.0	9	0.53	31212	9	10	15989	15224	17343	1020	MST37
						P1-6	34-2 p	19.0	0.47	34884	9	10	20036	14849	16968	893	MST37
						P1-6	34-3 p	14.0	0.64	25704	9	10	10773	14931	9936	710	MST37
1	6120	16320	44.0	371	P1-3	34-1	19.0	4	0.21	28189	4	2	6327	21862	39205	2063	HDU2
						34-2 p	25.0	4	0.16	37091	4	2	11025	26066	43409	1736	HDU2

p perforated panel

Panel	Unit Shear v (plf)	h op / h total	ΣLi (ft)	L total (ft)	Sheathing $\Sigma Li / L$ %	Co from SDPWS 4.3.3.5	q' (plf)	Nailing
34-1 3rd	80	2h/3	4	9	44	0.64	281	P1-6
34-2 3rd	80	2h/3	15	18	83	0.85	113	P1-6
34-3 3rd	80	5h/6	21	24	88	0.8	114	P1-6
34-1 2nd	204	5h/6	10	17	59	0.62	559	P1-3
34-2 2nd	204	2h/3	16	19	84	0.85	285	P1-6
34-3 2nd	204	2h/3	11	14	79	0.82	317	P1-6
34-3 1st	371	h/2	17	25	68	0.86	634	P1-3

Grid 5 Wind

Shear design		Overturning															
Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Panel Type	Panel L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW	
3	No shear panels in grid 4 at 3rd level																
2	1700	1700	16.0	106	P1-3	5-1 p	16.0	8	0.5	13600	10	5	11160	2440	2440	153	MST37
Based on perf design																	
1	1700	3400	16.0	213	P1-6	5-1	16.0	10	0.63	34000	10	5	11160	22840	25280	1580	HJU2

p perforated panel

Panel	Unit Shear v (plf)	h op	Σ Li (ft)	L total (ft)	Sheathing Σ Li / L %	Co from SDPWS 4.3.3.5	q' (plf)	Nailing
5-1 2nd	106	2h/3	4	16	25	0.57	744	P1-3

Grids A and C

These grids are not considered part of the main force resisting system

Called out on the drawings as P1-6, with straps MST37 between the floors and holdown HDU2, per inspection

p perforated panel

Panel	Unit Shear	h op / h total	ΣL_i	L total	Sheathing	Co from	q'	Nailing
5-1 2nd	v (plf)	106	2h/3	4	(ft)	25	SDPWS	(plf)
				16	%	4.3.3.5		
						0.57	744	P1-3

Grid B Wind

Shear design		Overturning															
Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Type	Panel	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	5780	5780	24.0	241	P2-3	B-1	24.0	9	0.38	52020	9	2	18612	33408	33408	1392	MST37
Based on perf design																	
2	4420	10200	35.0	291	P1-6	B-1	3.0	8	2.67	6994	8	5	293	6702	6702	2234	MST37
						B-2	4.0	8	2	9326	8	5	546	8780	8780	2195	MST37
						P1-3	28.0	8	0.29	65280	8	5	30030	35250	68658	2452	MST48
1	4420	14620	43.5	336	P1-3	B-1	2.5	8	3.2	6722	8	5	195	6527	13229	5291	H DU8
						B-2	41.0	8	0.2	110238	8	5	64760	45479	52180	1273	H DU2

p perforated panel

Panel	Unit Shear v (plf)	h op 2h/3	h total	Σ Li (ft)	L total (ft)	Sheathing %	Co from SDPWS	q' (plf)	Nailing
A-1 3rd	251	2h/3	7	24	24	29	0.59	1459	P2-3
A-3 2nd	291	h/2	22	28	28	79	0.9	412	P1-3
A-2 1st	336	h/2	27	41	41	66	0.85	600	P1-3

Grid D Wind

Shear design

Overturning

Level	Shear story V (lbs)	Shear acc V (lbs)	Length L (ft)	Shear total uniform v (plf)	SW Type	Panel	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res Restr. (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	9860	9860	19.0	519	P1-3	D-1	3.0	9	3	14012	9	2	248	13764	13764	4588	MST60
						D-2	16.0	9	0.56	74728	9	2	8184	66544	66544	4159	MST60
2	8160	18020	44.0	410	P1-3	D-1	28.0	8	0.29	91738	8	10	41580	50158	50158	1791	MST48
						D-2	5.0	9	1.8	18430	9	10	1283	17147	17147	3429	MST60
						D-3	11.0	9	0.82	40545	9	10	6584	33962	33962	3087	MST60
1	8160	26180	43.0	609	P1-3	D-1	32.0	4	0.13	77931	4	10	42336	35595	85753	2680	HDU5
						D-2	11.0	4	0.36	26789	4	10	4851	21938	39085	3553	HDU5

Grid F Wind

Shear design		Overturning															
Level	Shear story V (lbs)	Shear acc V (lbs)	Length total L (ft)	Shear uniform v (plf)	SW Type	Panel	L (ft)	h (ft)	Aspect Ratio k/L	M ot (lb-ft)	Wall trib.H (ft)	R/FI trib.L (ft)	M res (lb-ft)	M tot (lb-ft)	M tot acc (lb-ft)	Uplift T (lbs)	HW
3	4080	4080	24.0	170	P1-3	F-1 p	24.0	9	0.38	36720	9	2	18612	18108	18108	755	MST37
based on perf design																	
2	3740	9574	* 24.0	399	P2-3	F-1 p	24.0	8	0.33	76595	8	10	30456	46139	46139	1922	MST37
based on perf design																	
* with floor above cantilevered, load (4,080) was factored by 33/23, = distance between grids D&F/distance between grids D&E																	

1 Concrete Level

Bold indicates that wind governs

p perforated panel

Panel	Unit	h op	h total	Σ Li	L total	Sheathing Co	q'	Nailing
		Shear v (plf)	h total	Σ Li	L total	from	SDPWS (plf)	
				(ft)	(ft)	%	4.3-3.5	
F-1 3rd	170	2h/3	10	24	24	42	0.6	638
F-1 2nd	399	2h/3	10	24	24	42	0.6	1496
								P1-3
								P2-3



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2. GRAVITY DESIGN

Project: 8520 SE 82nd St, Mercer Island, WA 98040

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 / TJs	2.5	
	Insulation R-11	1.0	
	Gypsum Board 5/8"	2.8	
	Miscellaneous (Sprinkler, HVAC etc)	1.5	
	Non bearing partitions	8.0	
	Total	19.3, say 20 psf	
Decks/Balconies	Decking	3.0	
	Floor Joists / TJs	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	

Project: 8520 SE 82nd St, Mercer Island, WA 98040

2.2 Key List

Main Floor Alterations

- Key No. 1.1 Rafters, HF No. 2, 2x12", @ 24" o.c.
- Key No. 1.2 Glulam WS, 24F-1.8E, 3-1/8x12"
- Key No. 1.3 Post, PSL, 1.8E, 3-1/2x3-1/2"
- Key No. 1.4 Header, DF No. 2, 4x6"
- Key No. 1.5 Continuous Footing, fc = 2,500 psi, 12x8"
- Key No. 1.6 Spread Footing, fc = 2,500 psi, 24x24x8"

New Sunroom

- Key No. 2.1 Manufactured Trusses @ 24" o.c.
- Key No. 2.2 Header, DF No. 2, 4x8"
- Key No. 2.3 TJI 110, 1-3/4x11-7/8", @ 16" o.c.
- Key No. 2.4 Beam, DF No. 2, 4x8"
- Key No. 2.5 Dbl Joists, HF No. 2, (2) 2x8", P.T.
- Key No. 2.6 Continuous Footing, fc = 2,500 psi, 16x8"

Second Story Addition

- Key No. 3.1 Manufactured Trusses, @ 24" o.c.
- Key No. 3.2 Header, DF No. 2, 4x10"
- Key No. 3.3 Header, DF No. 2, 4x6"
- Key No. 3.4 Beam, PSL, 2.2E, 2900Fb, 3-1/2x11-7/8"
- Key No. 3.5 Post, HF No. 2, 6x6", P.T.
- Key No. 3.6 TJI 210, 2-1/16x16", @ 16" o.c.
- Key No. 3.7 Beam, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"
- Key No. 3.8 Beam, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"
- Key No. 3.9 Post, HF No. 2, 6x6", P.T.
- Key No. 3.10 Glulam WS, 24F-1.8E, 5-1/2x21"
- Key No. 3.11 Post within Wall, DF No. 2, 6x6"
- Key No. 3.12 TJI 230, 2-5/16x11-7/8", @ 16" o.c.
- Key No. 3.13 Header, DF No. 2, 4x12"
- Key No. 3.14 Stair Stringers, HF No. 2, 2x12", @ 12" o.c., P.T.
- Key No. 3.15 Landing Joists, HF No. 2, 2x6", @ 16" o.c., P.T.
- Key No. 3.16 Beam, flush, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"
- Key No. 3.17 Spread Footing, fc = 2,500 psi, 42x42x8"

Project: 8520 SE 82nd St, Mercer Island, WA 98040

2.3 Main Floor Alterations

Key No. 1.1 Rafters, HF No. 2, 2x12", @ 24" o.c.

Span:	L	cantilevered	=	10 + 2.5 ft
Load:	DL		=	15 psf
	SL		=	25 psf

For calculation see design sheets. Depth per insulation requirements.
Also used for new rafters above foyer.

Key No. 1.2 Glulam WS, 24F-1.8E, 3-1/8x12"

Span:	L	cantilevered	=	18 + 3.5 ft
Load:	reaction from joists 1.1			
	DL	0.5 x 250	=	125 plf
	SL	0.5 x 390	=	195 plf

For calculation see design sheets

Key No. 1.3 Post, PSL, 1.8E, 3-1/2x3-1/2"

Height:	L		=	12 ft
Load:	max P = reaction from (2x) beam 1.2			
	PDL	2 x 1,010	=	2,020 lbs
	PSL	2 x 1,700	=	3,400 lbs

For calculation see design sheets
Continued in basement

Key No. 1.4 Header, DF No. 2, 4x6"

Span:	L		=	5 ft
Load:	roof w/ trib 6 ft			
	DL	6 x 15	=	90 plf
	SL	6 x 25	=	150 plf

For calculation see design sheets

Key No. 1.5 Continuous Footing, $f_c = 2,500$ psi, 12x8"

Dimensions per prescriptive requirements for 1-story buildings

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

Key No. 1.6 Spread Footing, $f_c = 2,500$ psi, 24x24x8"

Load	from post 1.3			
	P		=	5,460 lbs
Soil pressure		5,460 / 4	=	1,365 psf < 1,500
Rebars	# 4 @ 6" o.c. both directions			

Project: 8520 SE 82nd St, Mercer Island, WA 98040

2.4 New Sunroom

Key No. 2.1 Manufactured Trusses @ 24" o.c.

Span:	L	=	16 ft
Loads:	DL	=	20 psf
	SL	=	25 psf
Design per manufacturer			

Key No. 2.2 Header, DF No. 2, 4x8"

a) North and south walls

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

b) East wall

Span:	L	=	12 ft
Load:	roof w/ trib 3 ft		
	DL 3 x 15	=	45 plf
	SL 3 x 25	=	75 plf

c) Existing exterior wall

Span:	L	=	5 ft
Load:	roof w/ trib 3 ft, floor w/ trib 11 ft		
	DL 3 x 15 + 11 x 20	=	265 plf
	LL 11 x 40	=	440 plf
	SL 3 x 25	=	75 plf

For calculation see design sheets

Key No. 2.3 TJI 110, 1-3/4x11-7/8", @ 16" o.c.

Span:	L	=	14 ft
Loads:	DL	=	20 psf
	LL	=	40 psf

Per iLevel span tables for deflection L/480

Key No. 2.4 Beam, DF No. 2, 4x8"

Span:	L	=	6 ft
Load:	roof w/ trib 8 ft, floor w/ trib 1 ft, wall w/ h 8 ft		
	DL 8 x 15 + 1 x 20 + 8 x 10	=	220 plf
	LL 1 x 40	=	40 plf
	SL 8 x 25	=	200 plf

For calculation see design sheets

Project: 8520 SE 82nd St, Mercer Island, WA 98040

Key No. 2.5 Dbl Joists, HF No. 2, (2) 2x8", P.T.

Span:	L	=	8 ft
Load:	roof w/ trib 3 ft		
	DL	3 x 15	= 45 plf
	SL	3 x 25	= 75 plf

For calculation see design sheets

Depth to match existing deck

Key No. 2.6 Continuous Footing, $f_c = 2,500$ psi, 16x8"

Dimensions per prescriptive requirements for 2-story buildings

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

Project: 8520 SE 82nd St, Mercer Island, WA 98040

2.5 Second Story Addition

Key No. 3.1 Manufactured Trusses, @ 24" o.c.

Span:	L	=	23 ft
Loads:	DL	=	15 psf
	SL	=	25 psf
Design per manufacturer			

Key No. 3.2 Header, DF No. 2, 4x10"

Span:	L	=	8 ft
Load:	roof w/ trib 13 ft		
	DL	13 x 15	= 195 plf
	SL	13 x 25	= 325 plf
For calculation see design sheets			

Key No. 3.3 Header, DF No. 2, 4x6"

Span:	L	=	5 ft
Load:	roof w/ trib 13 ft		
	DL	13 x 15	= 195 plf
	SL	13 x 25	= 325 plf
For calculation see design sheets			

Key No. 3.4 Beam, PSL, 2.2E, 2900Fb, 3-1/2x11-7/8"

Span:	L	=	18 ft
Load:	floor with w/ trib 2 ft, nb wall w/ h 8 ft (partial), point load from lateral design		
	DL1	2 x 20	= 40 plf
	DL2	x = 12 to 18 ft	8 x 10 = 80 plf
	P Lat	at x = 8 ft	= 4,160 lbs
For calculation see design sheets			

Key No. 3.5 Post, HF No. 2, 6x6", P.T.

Height:	H	=	9 ft
Load:	stairs with trib 10 sqft		
Per inspection			

Key No. 3.6 TJI 210, 2-1/16x16", @ 16" o.c.

Span:	L	cantilevered	=	19 + 3 ft
Loads:	typical fool loads + point load from upper floor w/ roof trib 12 ft, wall h 9 ft			
	DL		=	20 psf
	LL		=	40 psf
	PDL	1.33 x (12 x 15 + 9 x 10)	=	360 lbs
	PSL	1.33 x 12 x 25	=	400 lbs
For calculation see design sheets				

Project: 8520 SE 82nd St, Mercer Island, WA 98040

Key No. 3.7 Beam, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"

Span:	L	=	8 ft
Loads:	reaction from TJI 3.6		
	DL	760 x 0.75 (factor to adjust for spacing)	= 570 plf
	LL	855 x 0.75	= 640 plf

For calculation see design sheets

Key No. 3.8 Beam, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"

Span:	L	=	19 + 3 ft
Loads:	roof w/ trib 3 ft, wall w/ h 9 ft		
	DL	3 x 15 + 9 x 10\	= 135 plf
	SL	3 x 25	= 75 plf

For calculation see design sheets

Key No. 3.9 Post, HF No. 2, 6x6", P.T.

Height:	H	=	10 ft
Loads:	reaction from beams 3.7 and 3.8		
	PDL	2,230 + 1,720	= 3,950 lbs
	PLL	2,615 + 955	= 3,570 lbs

For calculation see design sheets

Key No. 3.10 Glulam WS, 24F-1.8E, 5-1/2x21"

Span:	L	=	24 ft
Loads:	roof w/ trib 12 ft, floor w/ trib 12 ft, wall w/ h 8 ft		
	DL	12 x 15 + 12 x 20 + 8 x 10	= 500 plf
	LL	12 x 40	= 480 plf
	SL	12 x 25	= 300 plf

For calculation see design sheets

Key No. 3.11 Post within Wall, DF No. 2, 6x6"

Height:	H	=	12 ft
Loads:	reaction from beam 3.8 (governs over 3.9 and 3.10)		
	PDL		= 6,070 lbs
	PLL		= 6,820 lbs

For calculation see design sheets

Key No. 3.12 TJI 230, 2-5/16x11-7/8", @ 16" o.c.

Span:	L	=	18 ft
Loads:	DL	=	20 psf
	LL	=	40 psf

Per iLevel span tables for deflection L/480

Project: 8520 SE 82nd St, Mercer Island, WA 98040

Key No. 3.13 Header, DF No. 2, 4x12"

Span:	L	=	8 ft
Load:	floor w/ trib 9 ft, wall w/ h 12 ft		
	DL	9 x 20 + 12 x 10	= 300 plf
	LL	9 x 40	= 360 plf
For calculation see design sheets			

Key No. 3.14 Stair Stringers, HF No. 2, 2x12", @ 12" o.c., P.T.

Span:	L	=	11 ft
Loads:	DL	=	10 psf
	LL	=	40 psf
Per tables			

Key No. 3.15 Landing Joists, HF No. 2, 2x6", @ 16" o.c., P.T.

Span:	L	=	3 ft
Loads:	DL	=	10 psf
	LL	=	40 psf
Per tables			

Key No. 3.16 Beam, flush, LSL, 1.55E, 2325Fb, 3-1/2x11-7/8"

Span:	L	=	15 ft
Load:	floor w/ trib 3 ft, wall w/ h 10 ft		
	DL	3 x 20 + 10 x 10	= 160 plf
	LL	3 x 40	= 120 plf
For calculation see design sheets			

Key No. 3.17 Spread Footing, $f_c = 2,500$ psi, 42x42x8"

Load	reaction from beam 3.10 (governs over post 3.8)		
	P	=	13,190 lbs
Soil pressure	13,190 / 12.25	=	1,077 psf < 1,500
Rebars	# 4 @ 6" o.c. both directions		



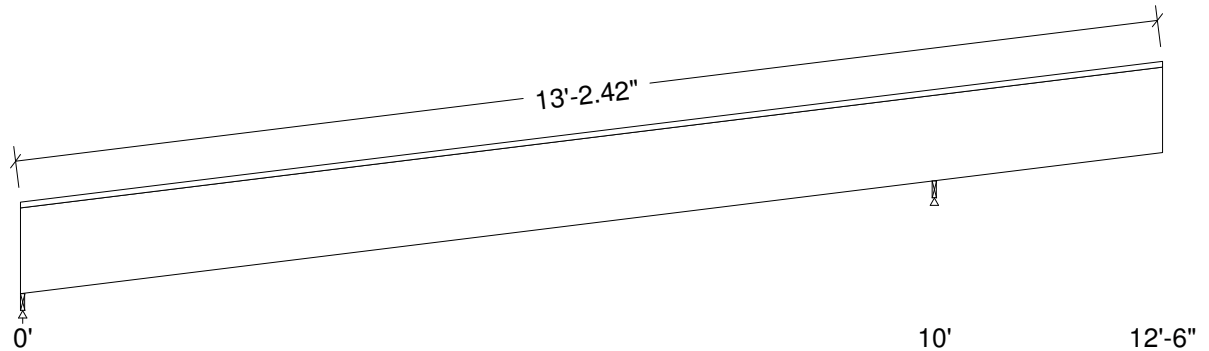
8520 SE 82nd St
Mercer Island, WA 98040
1_1 Roof Joist
Oct. 27, 2024 13:57

Design Check Calculation Sheet
WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full Area	No			15.00	(24.0")	psf
SL	Snow	Full Area	No			25.00	(24.0")	psf

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



Unfactored:					
Dead	150		246		
Snow	237		389		
Factored:					
Total	387		635		
Bearing:					
F' θ	438		438		
Capacity					
Joist	387		635		
Support	690		693		
Des ratio					
Joist	1.00		1.00		
Support	0.56		0.92		
Load comb	#2		#2		
Length	0.59		0.59		
Min req'd	0.59		0.59		
Cb	1.00		1.63		
Cb min	1.00		1.63		
Cb support	1.25		1.25		
F _{cp sup}	625		625		

Lumber-soft, Hem-Fir (N), No.1/No.2, 2x12 (1-1/2"x11-1/4")

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

Roof joist spaced at 24.0" c/c; Total length: 13'-6.19"; Clear span(horz): 9'-11.44", 2'-5.69"; Volume = 1.6 cu.ft.; Pitch: 4/12

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 = 30	Fv' = 167	psi	fv/Fv' = 0.18
Bending(+)	fb = 340	Fb' = 1322	psi	fb/Fb' = 0.26
Bending(-)	fb = 97	Fb' = 618	psi	fb/Fb' = 0.16
Live Defl'n	0.04 = < L/999	0.53 = L/240	in	0.07
Total Defl'n	0.06 = < L/999	0.70 = L/180	in	0.09

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfirt	Ci	LC#
Fv'	145	1.15	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	1000	1.15	1.00	1.00	1.000	1.000	-	1.15	1.00	1.00	2
Fb'-	1000	1.15	1.00	1.00	0.467	1.000	-	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	1.00	2
Emin'	0.58 million	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = D + S
 Bending(+): 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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 411, V design = 341 (NDS 3.4.3.1(a)) lbs; M(+) = 897 lbs-ft; M(-) = 255 lbs-ft
 EI = 284.76e06 lb-in²

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 1.00 permanent + "live"

Bearing: Allowable bearing at an angle F'_{theta} calculated for each support
 as per NDS 3.10.3

Lateral stability(-): Lu = 10'-6.50" Le = 17'-11.88" RB = 32.9; Lu based on full span

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. Continuous or Cantilevered Beams: NDS Clause 4.2.5.5 requires that normal grading provisions be extended to the middle 2/3 of 2 span beams and to the full length of cantilevers and other spans.
4. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.
5. SLOPED BEAMS: level bearing is required for all sloped beams.
6. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.



8520 SE 82nd St
Mercer Island, WA 98040
1_2 Beam
Oct. 27, 2024 14:00

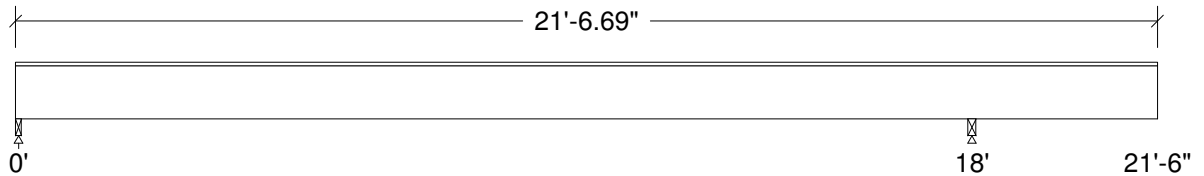
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL	No			125.0		plf
SL	Snow	Full UDL	No			195.0		plf

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



Unfactored:					
Dead	1090		1605		
Snow	1700		2504		
Factored:					
Total	2789		4109		
Bearing:					
Capacity					
Beam	2789		4577		
Support	3004		4109		
Des ratio					
Beam	1.00		0.90		
Support	0.93		1.00		
Load comb	#2		#2		
Length	1.37		1.88		
Min req'd	1.37		1.88**		
Cb	1.00		1.20		
Cb min	1.00		1.20		
Cb support	1.12		1.12		
Fcp sup	625		625		

**Minimum bearing length governed by the required width of the supporting member.

Glulam-Unbalan., West Species, 24F-1.8E WS, 3-1/8"x12"

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

Total length: 21'-6.69"; Clear span: 17'-10.38", 3'-5.06"; Volume = 5.6 cu.ft.; 8 laminations, 3-1/8" 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	$f_v = 106$	$F_v' = 305$	psi	$f_v/F_v' = 0.35$
Bending (+)	$f_b = 1920$	$F_b' = 2760$	psi	$f_b/F_b' = 0.70$
Bending (-)	$f_b = 314$	$F_b' = 1531$	psi	$f_b/F_b' = 0.20$
Live Defl'n	$0.52 = L/417$	$0.60 = L/360$	in	0.86
Total Defl'n	$0.85 = L/254$	$0.90 = L/240$	in	0.94

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
Fb'-	1450	1.15	1.00	1.00	0.918	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
E _{miny} '	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	2

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = D + S
 Bending (+): 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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 2989, V design = 2644 (NDS 3.4.3.1(a)) lbs; M(+) = 11999 lbs-ft; M(-) = 1960 lbs-ft
 EI = 809.99e06 lb-in²
 "Live" deflection is due to all non-dead loads (live, wind, snow...)
 Total deflection = 1.00 permanent + "live"
 Lateral stability(-): Lu = 18' Le = 28'-11.06" RB = 20.7; Lu based on full span

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. Grades with equal bending capacity in the top and bottom edges of the beam cross-section are recommended for continuous beams.
5. GLULAM: bxd = actual breadth x actual depth.
6. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
7. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).
8. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.



1_3 Post
Oct. 27, 2024 14:03

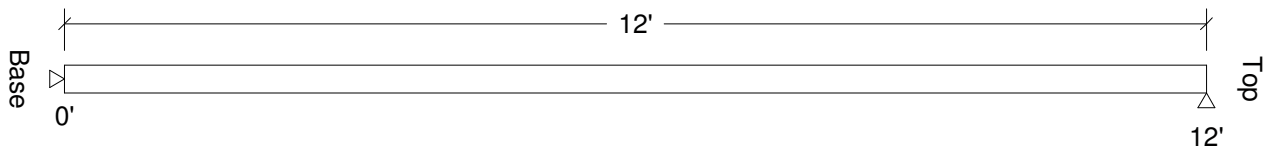
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Location [ft]		Magnitude		Unit
			Start	End	Start	End	
PDL	Dead	Axial	(Ecc. = 0.00")		2020		lbs
PSL	Snow	Axial	(Ecc. = 0.00")		3400		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Snow			
Axial:			
Dead	2020		2020
Snow	3400		3400
Factored:			
L->R			
Load comb	#1		#1

PSL, 1.8E, 2400Fb, 3-1/2"x3-1/2"

Support: Non-wood

Total length: 12'; Volume = 1.0 cu.ft.

Pinned base; $K_e \times L_b: 1.0 \times 12.0 = 12.0$ ft; $K_e \times L_d: 1.0 \times 12.0 = 12.0$ ft;

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	$f_c = 442$	$F_c' = 1708$	psi	$f_c/F_c' = 0.26$
Axial Bearing	$f_c = 442$	$F_c^* = 2886$	psi	$f_c/F_c^* = 0.15$

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL/CP	CV	Cfu	Cr	Cfrt	CF	LC#
Fc'	2510	1.15	-	1.00	0.592	-	-	-	1.00	-	2
Fc*	2510	1.15	-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

Axial : LC #2 = D + S

D=dead S=snow

All LC's are listed in the Analysis output

Load combinations: ASD Basic from ASCE 7-16 2.4

Axial b used, $l/b = 41.1$, $l/d = 41.1$

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. FIRE RATING: LVL, PSL and LSL are not rated for fire endurance.
4. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
5. SCL: Shear deflection is calculated using true modulus of elasticity E and shear modulus $G = E/16$.



8520 SE 82nd St
Mercer Island, WA 98040
1_4 Header
Oct. 27, 2024 14:01

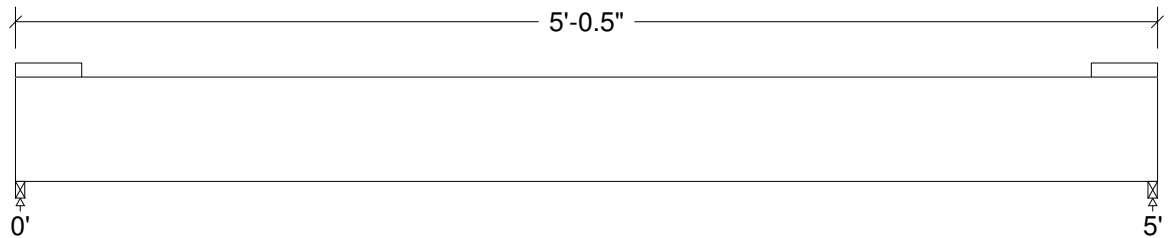
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				90.0		plf
SL	Snow	Full UDL				150.0		plf

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



Unfactored:			
Dead	227		227
Snow	378		378
Factored:			
Total	605		605
Bearing:			
Capacity			
Beam	1094		1094
Support	1211		1211
Des ratio			
Beam	0.55		0.55
Support	0.50		0.50
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: 5'-0.5"; Clear span: 4'-11.5"; Volume = 0.7 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	$f_v = 38$	$F_v' = 207$	psi	$f_v/F_v' = 0.18$
Bending (+)	$f_b = 510$	$F_b' = 1271$	psi	$f_b/F_b' = 0.40$
Live Defl'n	$0.03 = < L/999$	$0.17 = L/360$	in	0.16
Total Defl'n	$0.04 = < L/999$	$0.25 = L/240$	in	0.17

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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 600, V design = 485 (NDS 3.4.3.1(a)) lbs; M(+) = 750 lbs-ft

EI = 77.64e06 lb-in²

"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.



8520 SE 82nd St
Mercer Island, WA 98040
2_2a Header
Oct. 27, 2024 14:05

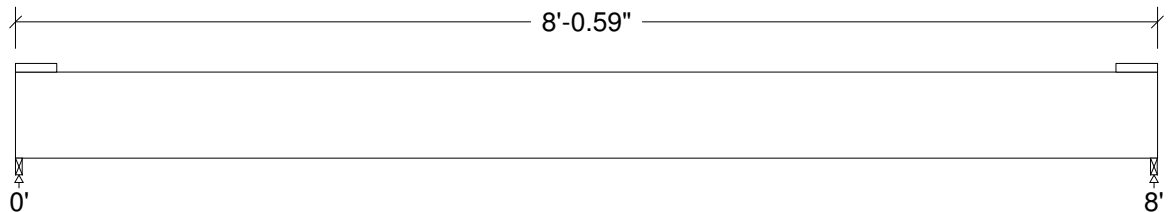
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
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	483		483
Snow	805		805
Factored:			
Total	1288		1288
Bearing:			
Capacity			
Beam	1288		1288
Support	1426		1426
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	0.59		0.59
Min req'd	0.59		0.59
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x8 (3-1/2"x7-1/4")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 8'-0.56"; Clear span: 7'-11.44"; Volume = 1.4 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	$f_v = 64$	$F_v' = 207$	psi	$f_v/F_v' = 0.31$
Bending(+)	$f_b = 1002$	$F_b' = 1256$	psi	$f_b/F_b' = 0.80$
Live Defl'n	$0.10 = L/926$	$0.27 = L/360$	in	0.39
Total Defl'n	$0.17 = L/578$	$0.40 = L/240$	in	0.41

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	0.988	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
Emin'	0.58 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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 1280, V design = 1079 (NDS 3.4.3.1(a)) lbs; M(+) = 2560 lbs-ft

EI = 177.83e06 lb-in²

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 1.00 permanent + "live"

Lateral stability(+): Lu = 8' Le = 14'-10.25" RB = 10.3

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.



8520 SE 82nd St
Mercer Island, WA 98040
2_2b Header
Oct. 27, 2024 14:05

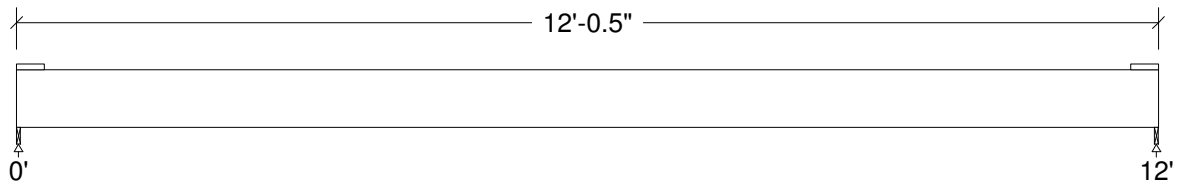
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				45.0		plf
SL	Snow	Full UDL				75.0		plf

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



Unfactored:			
Dead	271		271
Snow	452		452
Factored:			
Total	722		722
Bearing:			
Capacity			
Beam	1094		1094
Support	1211		1211
Des ratio			
Beam	0.66		0.66
Support	0.60		0.60
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, 4x8 (3-1/2"x7-1/4")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 12'-0.5"; Clear span: 11'-11.5"; Volume = 2.1 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	$f_v = 38$	$F_v' = 207$	psi	$f_v/F_v' = 0.18$
Bending (+)	$f_b = 845$	$F_b' = 1246$	psi	$f_b/F_b' = 0.68$
Live Defl'n	$0.20 = L/731$	$0.40 = L/360$	in	0.49
Total Defl'n	$0.31 = L/457$	$0.60 = L/240$	in	0.52

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	0.981	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
Emin'	0.58 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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 720, V design = 645 (NDS 3.4.3.1(a)) lbs; M(+) = 2160 lbs-ft

EI = 177.83e06 lb-in²

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 1.00 permanent + "live"

Lateral stability(+): Lu = 12' Le = 22'-0.94" RB = 12.5

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.



8520 SE 82nd St
Mercer Island, WA 98040
2_2c Header
Oct. 27, 2024 14:06

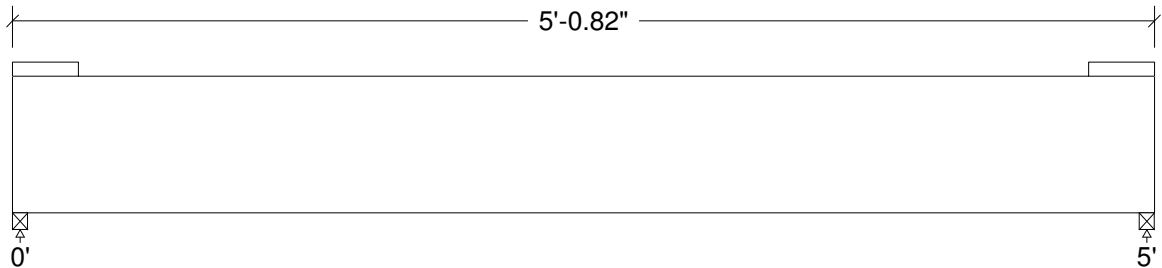
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat- tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				265.0		plf
LL	Live	Full UDL				440.0		plf
SL	Snow	Full UDL				75.0		plf

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



Unfactored:			
Dead	672		672
Live	1115		1115
Snow	190		190
Factored:			
Total	1787		1787
Bearing:			
Capacity			
Beam	1787		1787
Support	1978		1978
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	0.82		0.82
Min req'd	0.82		0.82
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x8 (3-1/2"x7-1/4")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 5'-0.81"; Clear span: 4'-11.19"; Volume = 0.9 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	$f_v = 78$	$F_v' = 180$	psi	$f_v/F_v' = 0.43$
Bending(+)	$f_b = 862$	$F_b' = 1098$	psi	$f_b/F_b' = 0.79$
Live Defl'n	$0.03 = < L/999$	$0.17 = L/360$	in	0.21
Total Defl'n	$0.05 = < L/999$	$0.25 = L/240$	in	0.21

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	180	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.00	1.00	1.00	0.994	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	1.00	2
Emin'	0.58 million	1.00	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 #3 = D + 0.75(L + S) (total)
 Bearing : Support 1 - LC #2 = D + L
 Support 2 - LC #2 = D + L

D=dead L=live S=snow

All LC's are listed in the Analysis output

Load combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 1762, V design = 1313 (NDS 3.4.3.1(a)) lbs; M(+) = 2203 lbs-ft

EI = 177.83e06 lb-in²

"Live" deflection is due to all non-dead loads (live, wind, snow...)

Total deflection = 0.50 permanent + "live"

Lateral stability(+): Lu = 5' Le = 9'-11.56" RB = 8.4

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.



8520 SE 82nd St
Mercer Island, WA 98040
2_4 Beam
Oct. 27, 2024 14:08

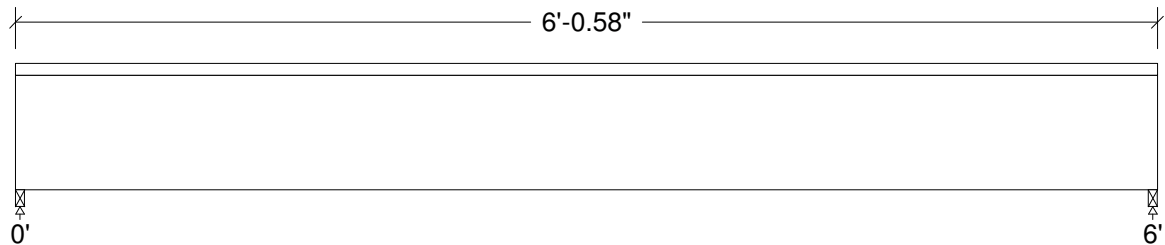
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				220.0		plf
LL	Live	Full UDL				40.0		plf
SL	Snow	Full UDL				200.0		plf

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



Unfactored:			
Dead	665		665
Live	121		121
Snow	605		605
Factored:			
Total	1270		1270
Bearing:			
Capacity			
Beam	1270		1270
Support	1406		1406
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#4		#4
Length	0.58		0.58
Min req'd	0.58		0.58
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x8 (3-1/2"x7-1/4")

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 6'-0.56"; Clear span: 5'-11.44"; Volume = 1.1 cu.ft.
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	$f_v = 59$	$F_v' = 207$	psi	$f_v/F_v' = 0.28$
Bending(+)	$f_b = 740$	$F_b' = 1271$	psi	$f_b/F_b' = 0.58$
Live Defl'n	$0.03 = < L/999$	$0.20 = L/360$	in	0.16
Total Defl'n	$0.07 = < L/999$	$0.30 = L/240$	in	0.23

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cf _{rt}	Ci	LC#
F _v '	180	1.15	1.00	1.00	-	-	-	-	1.00	1.00	4
F _b ' ⁺	850	1.15	1.00	1.00	1.000	1.300	-	1.00	1.00	1.00	4
F _{cp} '	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million	1.00	1.00	1.00	-	-	-	-	1.00	1.00	4
E _{min} '	0.58 million	1.00	1.00	1.00	-	-	-	-	1.00	1.00	4

CRITICAL LOAD COMBINATIONS:

Shear : LC #4 = D + S
 Bending(+): LC #4 = D + S
 Deflection: LC #4 = D + S (live)
 LC #4 = D + S (total)
 Bearing : Support 1 - LC #4 = D + S
 Support 2 - LC #4 = D + S

D=dead L=live S=snow

All LC's are listed in the Analysis output

Load combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 1260, V design = 996 (NDS 3.4.3.1(a)) lbs; M(+) = 1890 lbs-ft

EI = 177.83e06 lb-in²

"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.



8520 SE 82nd St
Mercer Island, WA 98040
2_5 Dbl Joist
Oct. 27, 2024 14:10

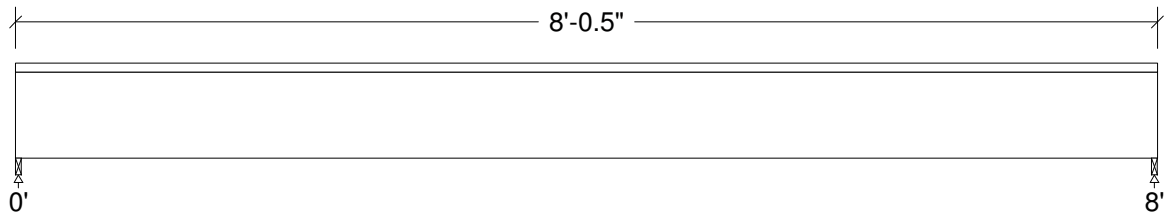
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				45.0		plf
SL	Snow	Full UDL				75.0		plf

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



Unfactored:			
Dead	181		181
Snow	302		302
Factored:			
Total	482		482
Bearing:			
Capacity			
Beam	607		607
Support	1055		1055
Des ratio			
Beam	0.79		0.79
Support	0.46		0.46
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	1.12		1.12
Fcp sup	625		625

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

Lumber n-ply, Hem-Fir (N), No.1/No.2, 2x8, 2-ply (3"x7-1/4")

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

Total length: 8'-0.5"; Clear span: 7'-11.5"; Volume = 1.2 cu.ft.

Incised; 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	$f_v = 28$	$F_v' = 133$	psi	$f_v/F_v' = 0.21$
Bending (+)	$f_b = 438$	$F_b' = 1104$	psi	$f_b/F_b' = 0.40$
Live Defl'n	$0.05 = < L/999$	$0.27 = L/360$	in	0.18
Total Defl'n	$0.08 = < L/999$	$0.40 = L/240$	in	0.19

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	145	1.15	1.00	1.00	-	-	-	-	1.00	0.80	2
Fb'+	1000	1.15	1.00	1.00	1.000	1.200	-	1.00	1.00	0.80	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million	1.00	1.00	1.00	-	-	-	-	1.00	0.95	2
Emin'	0.58 million	1.00	1.00	1.00	-	-	-	-	1.00	0.95	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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 480, V design = 405 (NDS 3.4.3.1(a)) lbs; M(+) = 960 lbs-ft

EI = 76.21e06 lb-in²/ply

"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.
4. BUILT-UP BEAMS: it is assumed that each ply is a single continuous member (that is, no butt joints are present) and that each ply is equally top-loaded. Where beams are side-loaded, special fastening details may be required.



8520 SE 82nd St
Mercer Island, WA 98040
3_2 Header
Oct. 27, 2024 14:17

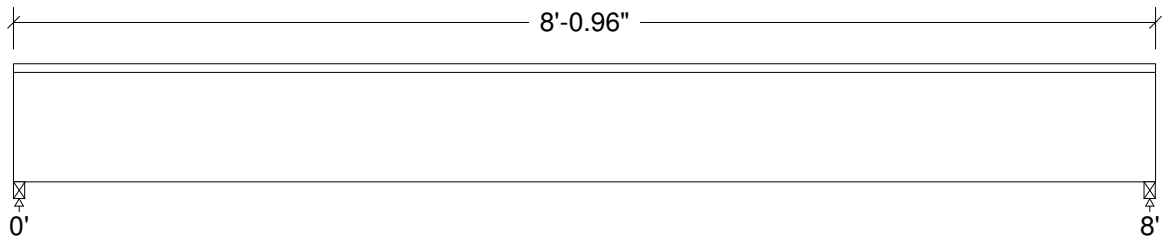
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				195.0		plf
SL	Snow	Full UDL				325.0		plf

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



Unfactored:			
Dead	788		788
Snow	1313		1313
Factored:			
Total	2101		2101
Bearing:			
Capacity			
Beam	2101		2101
Support	2326		2326
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	0.96		0.96
Min req'd	0.96		0.96
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Lumber-soft, D.Fir-L (N), No.1/No.2, 4x10 (3-1/2"x9-1/4")

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

Total length: 8'-0.94"; Clear span: 7'-11.06"; Volume = 1.8 cu.ft.

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	$f_v = 77$	$F_v' = 207$	psi	$f_v/F_v' = 0.37$
Bending (+)	$f_b = 1000$	$F_b' = 1173$	psi	$f_b/F_b' = 0.85$
Live Defl'n	$0.08 = < L/999$	$0.27 = L/360$	in	0.30
Total Defl'n	$0.13 = L/739$	$0.40 = L/240$	in	0.32

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	1.200	-	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
Emin'	0.58 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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 2080, V design = 1658 (NDS 3.4.3.1(a)) lbs; M(+) = 4160 lbs-ft

EI = 369.34e06 lb-in²

"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.



8520 SE 82nd St
Mercer Island, WA 98040
3_3 Header
Oct. 27, 2024 14:18

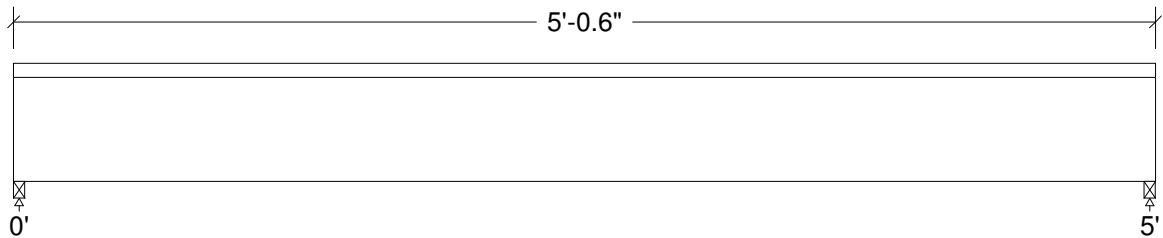
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				195.0		plf
SL	Snow	Full UDL				325.0		plf

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



Unfactored:			
Dead	492		492
Snow	821		821
Factored:			
Total	1313		1313
Bearing:			
Capacity			
Beam	1313		1313
Support	1454		1454
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	0.60		0.60
Min req'd	0.60		0.60
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

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: 5'-0.63"; Clear span: 4'-11.38"; Volume = 0.7 cu.ft.
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	$f_v = 82$	$F_v' = 207$	psi	$f_v/F_v' = 0.39$
Bending (+)	$f_b = 1105$	$F_b' = 1271$	psi	$f_b/F_b' = 0.87$
Live Defl'n	$0.06 = < L/999$	$0.17 = L/360$	in	0.35
Total Defl'n	$0.09 = L/637$	$0.25 = L/240$	in	0.38

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 combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 1300, V design = 1049 (NDS 3.4.3.1(a)) lbs; M(+) = 1625 lbs-ft

EI = 77.64e06 lb-in²

"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.



8520 SE 82nd St
Mercer Island, WA 98040
3_4 Beam
Oct. 27, 2024 14:54

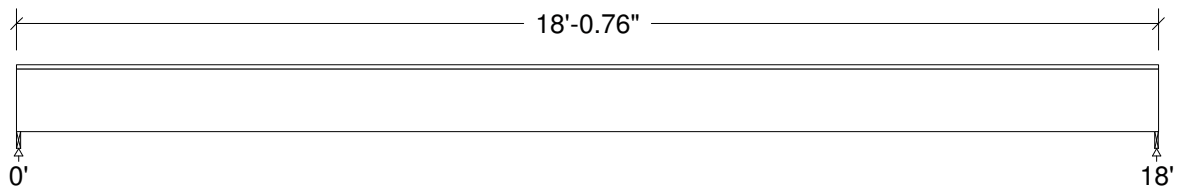
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat- tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				40.0		plf
LL	Live	Full UDL				80.0		plf
P Wind	Wind	Point		8.03		4160		lbs

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



Unfactored:			
Dead	361		361
Live	723		722
Wind	2311		1849
Factored:			
Total	1943		1735
Bearing:			
Capacity			
Beam	2106		1881
Support	1943		1735
Des ratio			
Beam	0.92		0.92
Support	1.00		1.00
Load comb	#3		#3
Length	0.80		0.72
Min req'd	0.80**		0.72**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

PSL, 2.2E, 2900Fb, 3-1/2"x11-7/8"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 18'-0.75"; Clear span: 17'-11.25"; Volume = 5.2 cu.ft.
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	$f_v = 66$	$F_v' = 464$	psi	$f_v/F_v' = 0.14$
Bending (+)	$f_b = 1852$	$F_b' = 4640$	psi	$f_b/F_b' = 0.40$
Live Defl'n	$0.52 = L/418$	$0.60 = L/360$	in	0.86
Total Defl'n	$0.61 = L/355$	$0.90 = L/240$	in	0.68

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	290	1.60	-	1.00	-	-	-	-	1.00	-	3
Fb'+	2900	1.60	-	1.00	1.000	1.000	-	1.00	1.00	-	5
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.2 million	-	-	1.00	-	-	-	-	1.00	-	3
E _{miny} '	1.11 million	-	-	1.00	-	-	-	-	1.00	-	3

CRITICAL LOAD COMBINATIONS:

Shear : LC #3 = D + 0.75(L + 0.6W)
 Bending (+): LC #5 = D + 0.6W
 Deflection: LC #3 = D + 0.75(L + 0.6W) (live)
 LC #3 = D + 0.75(L + 0.6W) (total)
 Bearing : Support 1 - LC #3 = D + 0.75(L + 0.6W)
 Support 2 - LC #3 = D + 0.75(L + 0.6W)

D=dead L=live W=wind

All LC's are listed in the Analysis output

Load combinations: ASD Basic from ASCE 7-16 2.4

CALCULATIONS:

V max = 1940, V design = 1838 (NDS 3.4.3.1(a)) lbs; M(+) = 12693 lbs-ft

EI = 1074.51e06 lb-in² GA = 5.71e06 lb

"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. FIRE RATING: LVL, PSL and LSL are not rated for fire endurance.
4. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
5. SCL: Shear deflection is calculated using true modulus of elasticity E and shear modulus G = E/16.



8520 SE 82nd St
Mercer Island, WA 98040
3_6 TJI
Oct. 27, 2024 14:56

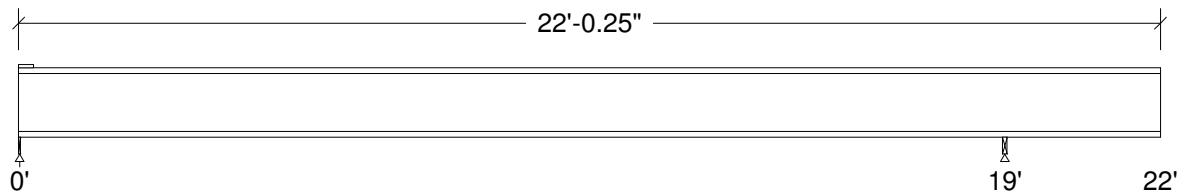
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full Area	No			20.00		psf
LL	Live	Full Area	Yes			40.00		psf
PDL	Dead	Point	No	22.02		360		lbs
PSL	Snow	Point	Yes	22.02		400		lbs

Maximum Reactions (lbs) and Support Bearing (in):



Unfactored:								
Dead	191					756		
Live	508					679		
Snow	-63					463		
Factored:								
Total	699					1613		
Bearing:								
Capacity								
Joist	Reaction resistance of I-joist from 086 15.2.3.5 is not considered							
Support	761					1613		
Des ratio								
Support	0.92					1.00		
Load comb	#5					#3		
Length	0.50*					1.06		
Min req'd	0.50*					1.06**		
Cb support	1.18					1.18		
Fcp sup	625					625		

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

**Minimum bearing length governed by the required width of the supporting member.

I-Joist, TJI, 210, 2-1/16"x16"

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

Floor joist spaced at 16" c/c; Total length: 22'-0.25"; Clear span: 18'-11.25", 2'-11.5"

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	V = 836	Vr = 2190	lbs	V/Vr = 0.38
Bending (+)	M = 3035	Mr = 4895	lbs-ft	M/Mr = 0.62
Bending (-)	M = 2400	Mr = 5629	lbs-ft	M/Mr = 0.43
Live Defl'n	0.37 = L/608	0.47 = L/480	in	0.79
Total Defl'n	0.49 = L/468	0.95 = L/240	in	0.51

Additional Data:

FACTORS:	F/E	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Vr	2190	1.00	-	-	-	-	-	-	-	-	2
M+'	5759	1.00	-	-	-	-	-	1.00	-	-	5
M-'	5759	1.15	-	-	-	-	-	1.00	-	-	4
EI	566.0 million	-	-	-	-	-	-	-	-	-	5

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = D + L
 Bending(+): LC #5 = D + L (pattern: L_)
 Bending(-): LC #4 = D + S
 Deflection: LC #5 = (live)
 LC #5 = (total)
 Bearing : Support 1 - LC #5 = D + L (pattern: L_)
 Support 2 - LC #3 = D + 0.75(L + S)

D=dead L=live 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 = 836 lbs; M(+) = 3035 lbs-ft; M(-) = 2400 lbs-ft

EI = 622.60e06 lb-in² (inc. 10% comp. action) K = 1.87e06 lbs GA = 0.23e06 lb

"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. WoodWorks Sizer provides preliminary estimates for I-joist design. Each wood I-joist producer develops its own proprietary design values. Please contact the manufacturer for a custom I-joist version of Sizer or other I-joist design software.
4. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.



8520 SE 82nd St
Mercer Island, WA 98040
3_7 Beam
Oct. 27, 2024 15:18

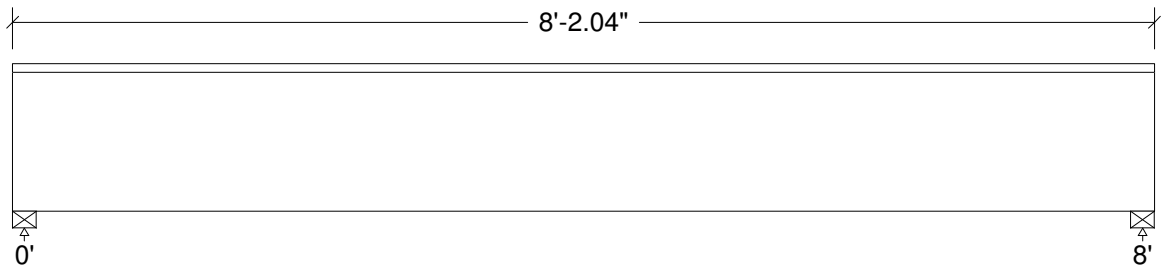
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL				570.0		plf
LL	Live	Full UDL				640.0		plf

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



Unfactored:			
Dead	2329		2329
Live	2614		2614
Factored:			
Total	4943		4943
Bearing:			
Capacity			
Beam	5715		5715
Support	4943		4943
Des ratio			
Beam	0.86		0.86
Support	1.00		1.00
Load comb	#2		#2
Length	2.04		2.04
Min req'd	2.04**		2.04**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

LSL, 1.55E, 2325Fb, 3-1/2"x11-7/8"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 8'-2.06"; Clear span: 7'-9.94"; Volume = 2.4 cu.ft.
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	$f_v = 128$	$F_v' = 310$	psi	$f_v/F_v' = 0.41$
Bending(+)	$f_b = 1412$	$F_b' = 2325$	psi	$f_b/F_b' = 0.61$
Live Defl'n	$0.08 = < L/999$	$0.27 = L/360$	in	0.29
Total Defl'n	$0.11 = L/852$	$0.40 = L/240$	in	0.28

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
F_v'	310	1.00	-	1.00	-	-	-	-	1.00	-	2
$F_b'+$	2325	1.00	-	1.00	1.000	1.000	-	1.00	1.00	-	2
F_{cp}'	800	-	-	1.00	-	-	-	-	1.00	-	-
E'	1.5 million	-	-	1.00	-	-	-	-	1.00	-	2
E_{miny}'	0.80 million	-	-	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:

$V_{max} = 4840$, $V_{design} = 3540$ (NDS 3.4.3.1(a)) lbs; $M(+)$ = 9680 lbs-ft

$EI = 757.04e06$ lb-in² Apparent E approximates the effect of shear deflection.

"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. FIRE RATING: LVL, PSL and LSL are not rated for fire endurance.
4. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
5. SCL: Deflection is calculated using an apparent modulus of elasticity E that incorporates the effect of shear deflection.



8520 SE 82nd St
Mercer Island, WA 98040
3_8 Beam
Oct. 27, 2024 15:07

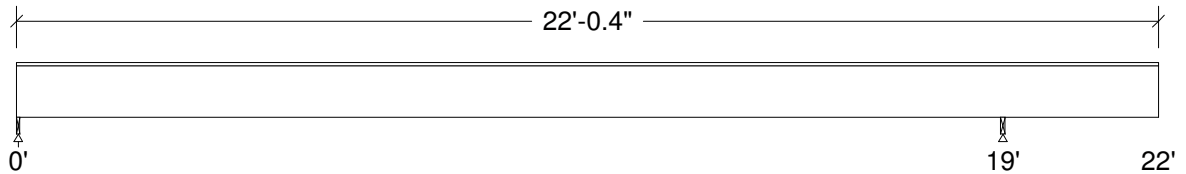
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Pat-tern	Location [ft]		Magnitude		Unit
				Start	End	Start	End	
DL	Dead	Full UDL	No			135.0		plf
SL	Snow	Full UDL	Yes			75.0		plf

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



Unfactored:					
Dead	1255			1719	
Snow	706			955	
Factored:					
Total	1961			2675	
Bearing:					
Capacity					
Beam	2267			4142	
Support	1961			2675	
Des ratio					
Beam	0.86			0.65	
Support	1.00			1.00	
Load comb	#3			#2	
Length	0.81			1.10	
Min req'd	0.81**			1.10**	
Cb	1.00			1.34	
Cb min	1.00			1.34	
Cb support	1.11			1.11	
Fcp sup	625			625	

**Minimum bearing length governed by the required width of the supporting member.

LSL, 1.55E, 2325Fb, 3-1/2"x11-7/8"

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

Total length: 22'-0.38"; Clear span: 18'-11.06", 2'-11.44"; Volume = 6.4 cu.ft.

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	$f_v = 66$	$F_v' = 356$	psi	$f_v/F_v' = 0.18$
Bending (+)	$f_b = 1326$	$F_b' = 2674$	psi	$f_b/F_b' = 0.50$
Bending (-)	$f_b = 138$	$F_b' = 2209$	psi	$f_b/F_b' = 0.06$
Live Defl'n	$0.28 = L/809$	$0.63 = L/360$	in	0.44
Total Defl'n	$0.77 = L/294$	$0.95 = L/240$	in	0.81

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	310	1.15	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2325	1.15	-	1.00	1.000	1.000	-	1.00	1.00	-	3
Fb'-	2325	1.15	-	1.00	0.826	1.000	-	1.00	1.00	-	2
Fcp'	800	-	-	1.00	-	-	-	-	1.00	-	-
E'	1.5 million	-	-	1.00	-	-	-	-	1.00	-	3
Eminy'	0.80 million	-	-	1.00	-	-	-	-	1.00	-	3

CRITICAL LOAD COMBINATIONS:

Shear : LC #2 = D + S
 Bending(+): LC #3 = D + S (pattern: Ss)
 Bending(-): LC #2 = D + S
 Deflection: LC #3 = (live)
 LC #3 = (total)
 Bearing : Support 1 - LC #3 = D + S (pattern: Ss)
 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 = 2045, V design = 1827 (NDS 3.4.3.1(a)) lbs; M(+) = 9092 lbs-ft; M(-) = 945 lbs-ft
 EI = 757.04e06 lb-in² Apparent E approximates the effect of shear deflection.
 "Live" deflection is due to all non-dead loads (live, wind, snow...)
 Total deflection = 1.00 permanent + "live"
 Lateral stability(-): Lu = 19' Le = 30'-3.94" RB = 18.8; Lu based on full span

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. FIRE RATING: LVL, PSL and LSL are not rated for fire endurance.
4. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.
5. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
6. SCL: Deflection is calculated using an apparent modulus of elasticity E that incorporates the effect of shear deflection.



3_9 Post
Oct. 27, 2024 15:24

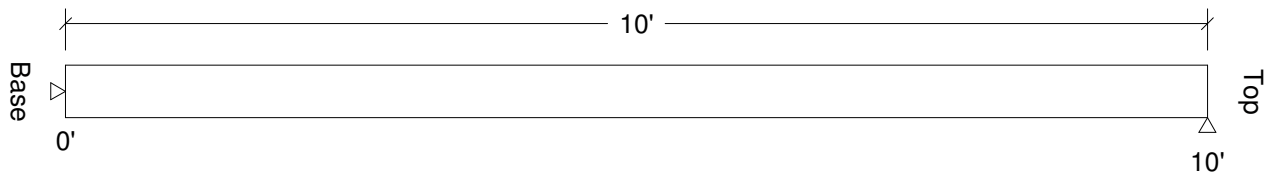
Design Check Calculation Sheet

WoodWorks Sizer 2023

Loads:

Load	Type	Distribution	Location [ft]		Magnitude		Unit
			Start	End	Start	End	
PDL	Dead	Axial	(Ecc. = 0.00")		3950		lbs
PLL	Live	Axial	(Ecc. = 0.00")		3570		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Live			
Axial:			
Dead	3950		3950
Live	3570		3570
Factored:			
L->R			
Load comb	#1		#1

Timber-soft, Hem-Fir (N), No.2, 6x6 (5-1/2"x5-1/2")

Support: Non-wood

Total length: 10'; Volume = 2.1 cu.ft.; Post or timber

Pinned base; Incised; Ke x Lb: 1.0 x 10.0 = 10.0 ft; Ke x Ld: 1.0 x 10.0 = 10.0 ft;

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Axial	$f_c = 249$	$F_c' = 345$	psi	$f_c/F_c' = 0.72$
Axial Bearing	$f_c = 249$	$F_c^* = 460$	psi	$f_c/F_c^* = 0.54$

Additional Data:

FACTORS:	F/E (psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
F_c'	575	1.00	1.00	1.00	0.750	1.000	-	-	1.00	0.80	2
F_c^*	575	1.00	1.00	1.00	-	1.000	-	-	1.00	0.80	2

CRITICAL LOAD COMBINATIONS:

Axial : 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

Axial b used, $l/b = 21.8$, $l/d = 21.8$

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.