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

Phone (206) 553 9076
rheimisch@yahoo.com
www.tecinstruct.com

Engineering

STRUCTURAL DESIGN

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	11/15/2023

tecinstruct LLC
6830 NE Bothell Way
Suite C, PMB 181
Kenmore, WA 98028

Phone (206) 553 9076
rheimisch@yahoo.com

Engineering

Table of Contents

Engineering

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

Phone (206) 553 9076
rheimisch@yahoo.com

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
	Seimic 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	=	SDs / (R/I)
			=	1.15 / (6.5/1.0) = 0.18

Building Weight

3rd level	W	15 x 2,000 sqft		=	30,000 lbs
2nd level	W	20 x 3,000 sqft		=	60,000 lbs
1st level	W	20 x 2,600 sqft		=	52,000 lbs
Total Building Weight			**W**	**=**	**142,000 lbs**

Base Shear V_{Base} = C_s x W = 0.18 x 142,000 = 25,560 lbs

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

V_{Design} = 0.7 x 25,560 = 17,900 lbs

Vertical Distribution: $F_x = C_{vx} \times V = C_{vx} \times 17{,}900$

$C_{vx} = (w_x \times h_x^k) / \sum (w_i \times h_i^k)$ with k = 1.0 for T < 0.5 sec

Level	**w_x**	**h_x**	**$w_x h_x$**	**$w_x h_x / \sum w_i h_i$**	**F_x**	**$L_{E/W}$**	**v_{xNS}**	**$L_{N/S}$**	**v_{xEW}**
	(lb)	(ft)	(lb-ft)	(%)	(lbs)	(ft)	(plf)	(ft)	(plf)
3rd	30,000	33	990,000	35	6,270	20	315	70	90
2nd	60,000	22	1,320,000	48	8,590	70	125	70	125
1st	52,000	9	468,000	17	3,040	70	45	50	60
∑	142,000	---	2,778,000	100	8,780				

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 x 28.5	54 psf

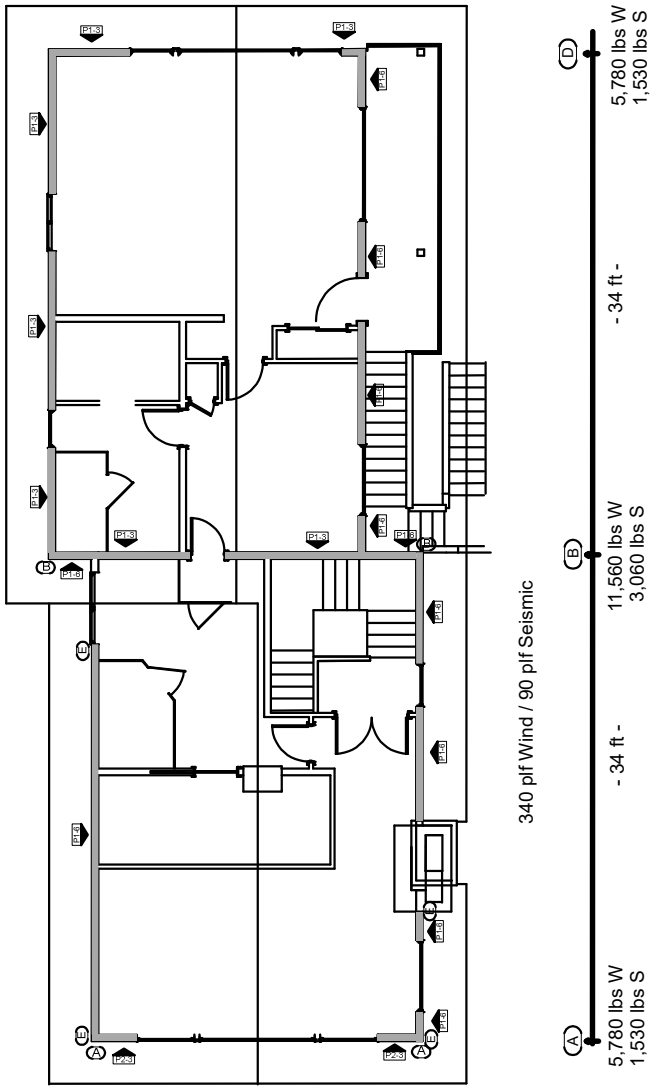
As the shear wall design is performed for ASD, the load is multiplied with 0.7

Applied wind pressure	0.7 x 54	38 psf

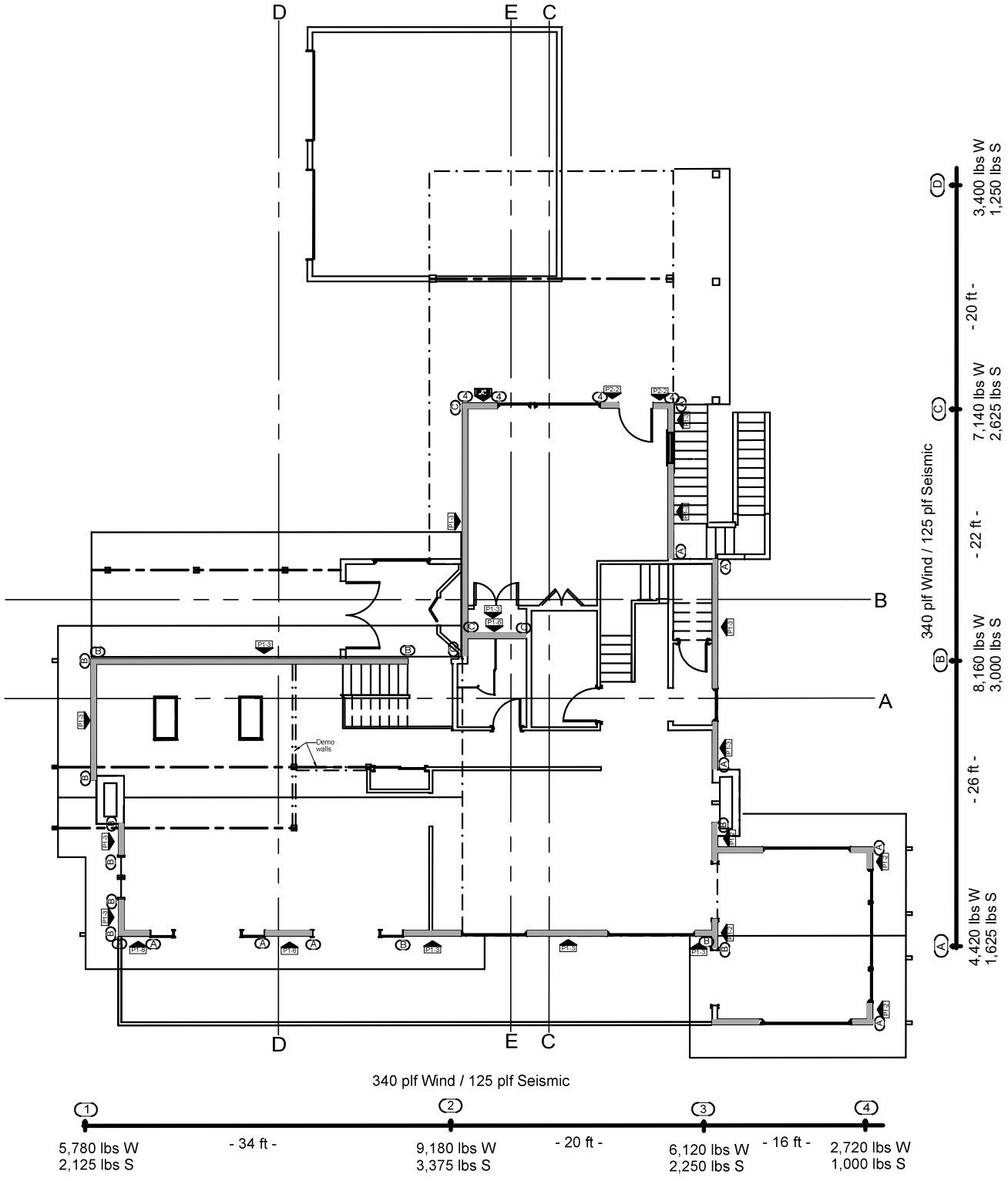
Uniform wind load on diaphagms

w/ trib h 9 ft	w =	9 x 38	=	340 plf	

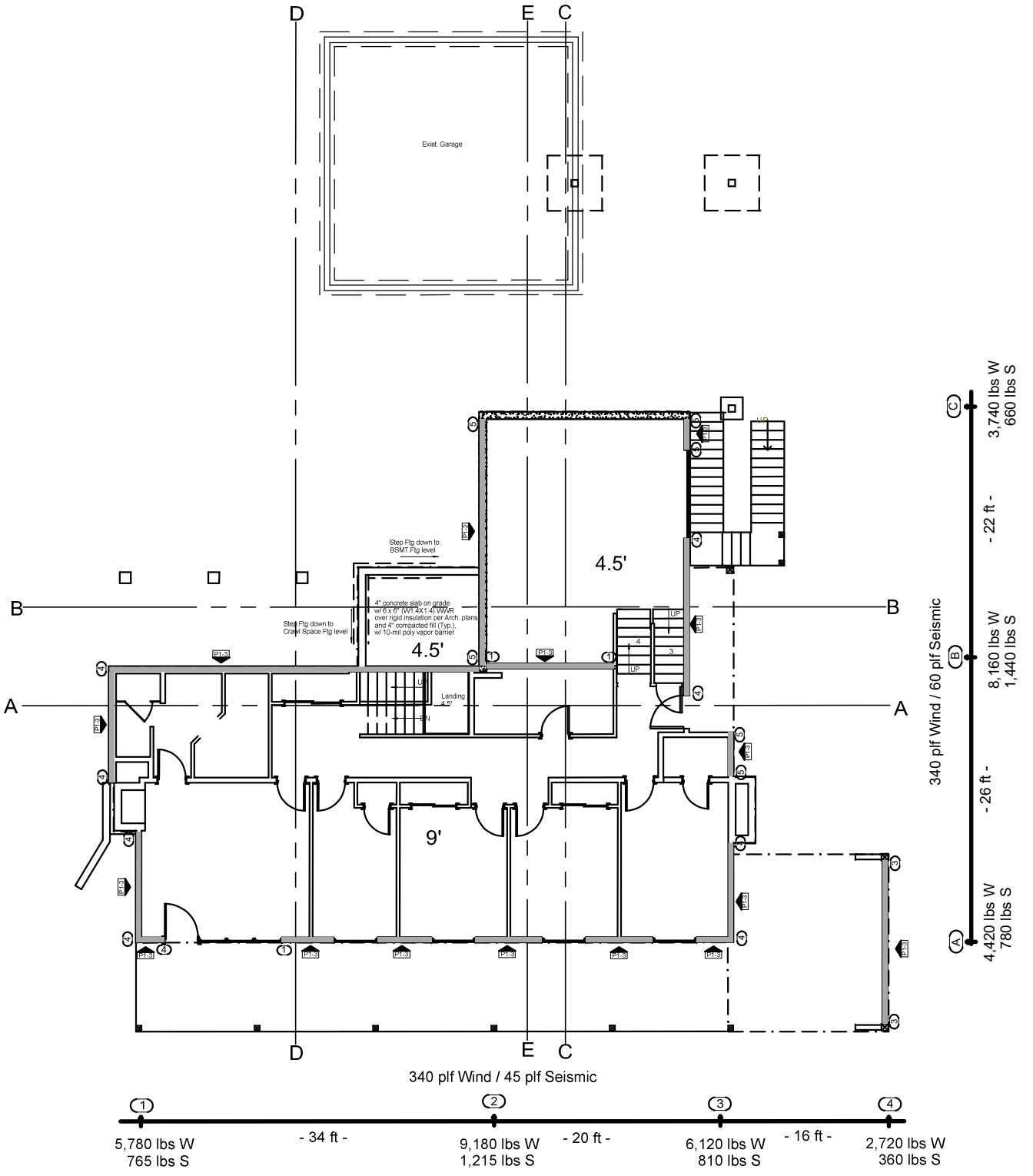
Shear Wall Layout Upper



Shear Wall Layout Main



Shear Wall Layout Lower



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	36"
P1-2	15/32"	10d	2"	12"	3x	725	1015	24"
P2-3	15/32"	10d	3"	12"	3x	1130	1580	18"
P2-2	19/32"	10d	2"	12"	3x	1635	2290	12"
Roof	7/16"	8d	6"	12"	2x	226	316	
Floor	3/4" CDX	10d	6"	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	HDU4	3285	(2) 2x	5/8"	9"
3	HDU5	4340	(2) 2x	5/8"	11"
4	HDU8	7870	(2) 2x	7/8"	15"
5	HDU14	14445	6x6"	1"	18"

Grid 1 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/Fl** trib.L (ft)	**M res** Restr. (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																
2	5780	5780	17.0	**340**	**P1-3**	1-1	3.0	10	3.33	10200	10	2	270	9930	9930	**3310**	**MST48**
						1-2	3.0	10	3.33	10200	10	2	270	9930	9930	**3310**	**MST48**
						1-3	11.0	10	0.91	37400	10	2	4158	33242	33242	**3022**	**MST48**
1	5780	11560	20.0	**578**	**P1-3**	1-1	10.0	8	0.8	46240	8	2	2850	43390	53320	**5332**	**HDU8**
						1-2	10.0	4	0.4	23120	4	2	1710	21410	54652	**5465**	**HDU8**

Bold indicates that wind governs

Grid 1 Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (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																
2	2125	2125	17.0	125	P1-6	1-1	3.0	10	3.33	3750	10	2	270	3480	3480	1160	MST37
						1-2	3.0	10	3.33	3750	10	2	270	3480	3480	1160	MST37
						1-3	11.0	10	0.91	13750	10	2	4158	9592	9592	872	MST37
1	765	2890	20.0	145	P1-6	1-1	10.0	8	0.8	11560	8	2	2850	8710	8710	871	HDU2
						1-2	10.0	4	0.4	5780	4	2	1710	4070	4070	407	HDU2

Bold indicates that seismic governs

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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW** to beam
3	4080	4080	23.0	177	P1-6	2-1	27.0	9	0.33	43106	9	10	40784	2323	2323	86	H6
						2-2 p	34.0	9	0.26	54282	9	10	64923	-10641	-10641	-313	not rqd
2	9180	13260	24.0	**553**	**P1-3**	2-1	24.0	12	0.5	159120	12	10	37224	121896	124219	**5176**	**MST60**
1	9180	22440	23.0	**976**	**P1-2**	2-1	23.0	4	0.17	89760	4	2	9315	80445	204664	**8898**	**HDU14**

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
2-2 3rd	177	2h/3	27	34	79	0.82	272	P1-6

Grid 2 Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW** to beam
3	4200	4200	23.0	**183**	**P1-6**	2-1	27.0	9	0.33	44374	9	10	40784	3590	3590	**133**	**H6**
					P1-3	2-2 p	34.0	9	0.26	55878	9	10	64923	-9045	-9045	**-266**	**not rqd**
					based on perf design												
2	3375	7575	24.0	316	P1-3	2-1	24.0	12	0.5	90900	12	10	37224	53676	57266	2386	MST48
1	1215	8790	23.0	382	P1-3	2-1	23.0	4	0.17	35160	4	2	9315	25845	83111	3614	HDU5

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
2-2 3rd	183	2h/3	27	34	79	0.82	**281**	**P1-3**

Grid 3 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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	4080	4080	59.0	69	P1-6	3-1 p	9.0	9	1	5601	9	10	4361	1241	1241	138	MST37
						3-2 p	18.0	9	0.5	11203	9	10	17955	-6752	-6752	-375	not req
						3-3 p	16.0	9	0.56	9958	9	10	14136	-4178	-4178	-261	not rqd
						3-4 p	16.0	9	0.56	9958	9	10	14136	-4178	-4178	-261	not rqd
2	6120	10200	32.0	**319**	**P1-2**	3-1 p	10.0	9	0.9	28688	9	10	5415	23273	24513	**2451**	**MST48**
					P1-3	3-2 p	19.0	9	0.47	54506	9	10	20036	34471	35712	**1880**	**MST37**
					P1-3	3-3 p	13.0	9	0.69	37294	9	10	9263	28031	21279	**1637**	**MST37**
1	6120	16320	31.0	**526**	**P1-3**	3-1	9.0	9	1	42643	9	10	4361	38282	62795	**6977**	**HDU8**
						3-2	4.0	8	2	16846	8	5	546	16300	40814	**10203**	**HDU14**
						3-3	14.0	8	0.57	58963	8	5	7371	51592	87303	**6236**	**HDU8**
						3-4	4.0	8	2	16846	8	5	546	16300	37579	**9395**	**HDU14**

p perforated panel **Bold indicates that wind governs**

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
3-1 3rd	69	2h/3	4.5	9	50	0.67	206	P1-6
3-2 3rd	69	2h/3	15	18	83	0.85	97	P1-6
3-3 3rd	69	2h/3	11	16	69	0.76	132	P1-6
3-4 3rd	69	2h/3	8	16	50	0.67	206	P1-6
3-1 2nd	319	2h/3	5	10	50	0.67	**952**	**P1-2**
3-2 2nd	319	2h/3	16	19	84	0.79	**480**	**P1-3**
3-3 3rd	319	2h/3	10	13	77	0.81	**512**	**P1-3**

Grid 3 Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW** to beam
3	4200	4200	59.0	**71**	**P1-6**	3-1 p	9.0	9	1	5766	9	10	4361	1406	1406	**156**	**H6**
						3-2 p	18.0	9	0.5	11532	9	10	17955	-6423	-6423	**-357**	**not req**
						3-3 p	16.0	9	0.56	10251	9	10	14136	-3885	-3885	**-243**	**not rqd**
						3-4 p	16.0	9	0.56	10251	9	10	14136	-3885	-3885	**-243**	**not rqd**
2	2250	6450	32.0	202	P1-2	3-1 p	10.0	9	0.9	18141	9	10	5415	12726	14131	1413	MST37
					P1-3	3-2 p	19.0	9	0.47	34467	9	10	20036	14432	15837	834	MST37
					P1-3	3-3 p	13.0	9	0.69	23583	9	10	9263	14320	7898	608	MST37
					based on perf design												
1	810	7260	31.0	234	P1-6	3-1	9.0	9	1	18970	9	10	4361	14609	28740	3193	HDU4
						3-2	4.0	8	2	7494	8	5	546	6948	21079	5270	HDU8
						3-3	14.0	8	0.57	26230	8	5	7371	18859	34696	2478	HDU4
						3-4	4.0	8	2	7494	8	5	546	6948	14846	3711	HDU5

p perforated panel **Bold indicates that seismic governs**

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
3-1 3rd	71	2h/3	4.5	9	50	0.67	**212**	P1-6
3-2 3rd	71	2h/3	15	18	83	0.85	**100**	P1-6
3-3 3rd	71	2h/3	11	16	69	0.76	**136**	P1-6
3-4 3rd	71	2h/3	8	16	50	0.67	**212**	P1-6
3-1 2nd	202	2h/3	5	10	50	0.67	**603**	P1-2
3-2 2nd	202	2h/3	16	19	84	0.79	**304**	P1-3
3-3 3rd	202	2h/3	10	13	77	0.81	**324**	P1-3

Grid 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/Fl** trib.L (ft)	**M res** Restr. (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	2720	2720	16.0	**170**	**P1-2** **Based on perf design**	4-1 p	16.0	8	0.5	21760	10	5	11160	10600	10600	**663**	**MST37**
1	2720	5440	16.0	**340**	**P1-3**	4-1	16.0	10	0.63	54400	10	5	11160	43240	53840	**3365**	**HDU5**

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing** **ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
4-1 2nd	170	2h/3	4	16	25	0.57	**1193**	**P1-2**

Grid 4 Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (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	1000	1000	16.0	63	P1-3 Based on perf design	4-1 p	16.0	8	0.5	8000	10	5	11160	-3160	-3160	-198	not rqd
1	360	1360	16.0	85	P1-6	4-1	16.0	10	0.63	13600	10	5	11160	2440	-720	-45	not rqd

Bold indicates that seismic governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing** **ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
4-1 2nd	63	2h/3	4	16	25	0.57	442	P1-3

Grid A 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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	5780	5780	23.0	**251**	**P2-3**	A-1	23.0	9	0.39	52020	9	2	17078	34943	34943	**1519**	**MST37**
					Based on perf design												
2	4420	10200	35.0	**291**	**P1-6**	A-1	3.0	8	2.67	6994	8	5	293	6702	6702	**2234**	**MST37**
						A-2	4.0	8	2	9326	8	5	546	8780	8780	**2195**	**MST37**
					P1-3	A-3 p	28.0	8	0.29	65280	8	5	30030	35250	70193	**2507**	**MST48**
1	4420	14620	43.5	**336**	**P1-3**	A-1	2.5	8	3.2	6722	8	5	195	6527	13229	**5291**	**HDU8**
						A-2	41.0 p	8	0.2	110238	8	5	64760	45479	52180	**1273**	**HDU2**

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing** **ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
A-1 3rd	251	2h/3	7	23	30	0.59	**1398**	**P2-3**
A-3 2nd	291	h/2	22	28	79	0.9	**412**	**P1-3**

Grid A Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	1530	1530	23.0	67	P1-3	A-1 p	23.0	9	0.39	13770	9	2	17078	-3308	-3308	-144	not rqd
					Based on perf design												
2	1625	3155	35.0	90	P1-6	A-1	3.0	8	2.67	2163	8	5	293	1871	-1437	-479	not rqd
						A-2	4.0	8	2	2885	8	5	546	2339	-969	-242	not rqd
						A-3 p	28.0	8	0.29	20192	8	5	30030	-9838	-9838	-351	not rqd
1	780	3935	43.5	90	P1-6	A-1	2.5	8	3.2	1809	8	5	195	1614	178	71	HDU2
						A-2	41.0 p	8	0.2	29671	8	5	64760	-35089	-36525	-891	not rqd

Bold indicates that seismic governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing** **ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
A-1 3rd	67	2h/3	7	23	30	0.59	373	P1-3
A-3 2nd	90	h/2	22	28	79	0.9	127	P1-6

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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	11560	11560	26.0	**445**	**P1-3**	B-1 p	26.0	9	0.35	104040	9	2	21879	82161	82161	**3160**	**MST48**
2	8160	19720	33.0	**598**	**P1-3**	B-1	28.0	8	0.29	133857	8	10	41580	92277	92277	**3296**	**MST48**
						B-2	5.0	9	1.8	26891	9	10	1283	25608	25608	**5122**	**MST60**
1	8160	27880	43.0	**648**	**P1-3**	B-1	32.0	4	0.13	82992	4	10	42336	40656	132933	**4154**	**HDU5**
						B-2	11.0	4	0.36	28528	4	10	4851	23677	49286	**4481**	**HDU5**

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear**	**h op / h total**	**Σ Li**	**L total**	**Sheathing**	**Co from**	**q'**	**Nailing**
					ΣLi / L	**SDPWS**	(plf)	
	v (plf)		(ft)	(ft)	%	4.3.3.5		
B-1 3rd	445	5h/6	23	26	88	1	**592**	**P1-3**

Grid B Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	3060	3060	26.0	118	P1-6	B-1 p	26.0	9	0.35	27540	9	2	21879	5661	5661	218	MST37
2	3000	6060	33.0	184	P1-6	B-1	28.0	8	0.29	41135	8	10	41580	-445	-445	-16	not rqd
						B-2	5.0	10	2	9182	10	10	1350	7832	7832	1566	MST37
1	1440	7500	43.0	174	P1-6	B-1	32.0	4	0.13	22326	4	10	42336	-20010	-20456	-639	not rqd
						B-2	11.0	4	0.36	7674	4	10	4851	2823	10655	969	HDU2

Bold indicates that seismic governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing** **ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
B-1 3rd	118	5h/6	23	26	88	1	157	P1-6

Grid C 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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	No shear panels in grid C at 3rd level																
2	7140	7140	10.0	**714**	**P2-3**	C-1	3.5	9	2.57	22491	9	2	347	22145	22145	**6327**	**HDU8**
					P2-2	C-2 p	6.5	9	1.38	41769	9	2	1287	40482	40482	**6228**	**HDU8**
					based on perf design												
1	Concrete level																

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
C-2 2nd	714	5h/6	3.5	6.5	54	0.6	**2210**	**P2-2**

Grid C Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	No shear panels in grid C at 3rd level																
2	2625	2625	10.0	**263**	**P2-3**	C-1	3.5	9	2.57	8269	9	2	347	7922	7922	2264	HDU2
					P2-3	C-2 p	6.5	9	1.38	15356	9	2	1287	14069	14069	2165	HDU2
					based on perf design												
1	Concrete level																

Bold indicates that seismic governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
C-2 2nd	300	5h/6	3.5	6.5	54	0.6	**929**	**P2-3**

Grid D 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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	5780	5780	22.0	**263**	**P2-3 based on perf design**	D-1 p	22.0	9	0.41	52020	9	2	15609	36411	36411	**1655**	**MSTC48B3 to MF nailer**
2	3400	9180	Steel Moment Frame														
1	Foundation level																

Bold indicates that wind governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
D-1 3rd	263	2h/3	7	22	32	0.6	**1378**	**P2-3**

Grid D Seismic

	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/Fl** trib.L (ft)	**M res** Restr. (lb-ft)	**M tot** (lb-ft)	**M tot** acc (lb-ft)	**Uplift** T (lbs	**HW**
3	1530	1530	22.0	70	P1-3 based on perf design	D-1 p	22.0	9	0.41	13770	9	2	15609	-1839	-1839	-84	not rqd
2	1250	2780	Steel Moment Frame														
1	Foundation level																

Bold indicates that seismic governs

p perforated panel

Panel	**Unit Shear** v (plf)	**h op / h total**	**Σ Li** (ft)	**L total** (ft)	**Sheathing ΣLi / L** %	**Co from SDPWS** 4.3.3.5	**q'** (plf)	**Nailing**
D-1 3rd	70	2h/3	7	22	32	0.6	367	P1-3

Engineering

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

Phone (206) 553 9076
rheimisch@yahoo.com

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 / TJIs	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 / 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	**20 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

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, 4x12”**

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, DF No. 2, 6x10”**

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 **Deck Joists, HF No. 2, 2x12”, @ 16” o.c., P.T.**

Key No. 3.8 **Beam, PSL, 2.2E, 2900Fb, 5-1/4x18”**

Key No. 3.9 **Beam, PSL, 2.2E, 2900Fb, 5-1/4x18”**

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, 72x72x16”**

Key No. 3.18 **Spread Footing, fc = 2,500 psi, 42x42x8”**

Key No. 3.19 **Steel Moment Frame, Columns HSS8x8x0.5, Beam W12x50, Grade 50**

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, fc = 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, fc = 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, 4x12"

Span:	L		=	11 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, fc = 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, DF No. 2, 6x10"

Span:	L		=	20 ft
Load:	roof w/ trib 3 ft			
	DL	3 x 15	=	45 plf
	SL	3 x 25	=	75 plf

For calculation see design sheets

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

Span:	L		=	20 ft
Load:	reaction from beam 3.4			
	PDL		=	450 plf
	PSL		=	750 plf

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 Deck Joists, HF No. 2, 2x12", @ 16" o.c., P.T.

Span:	L	cantilevered	=	8 + 5 ft
Loads:	on cantilever only, rear span = joists 3.6			
	DL		=	10 psf
	LL		=	60 psf

For calculation see design sheets

Key No. 3.8 Beam, PSL, 2.2E, 2900Fb, 5-1/4x18"

Span:	L		=	21 ft
Loads:	reaction from joists 3.6, factor 0.75 to adjust for spacing			
	DL	0.75 x 760	=	570 plf
	LL	0.75 x 855	=	640 plf

For calculation see design sheets

Key No. 3.9 Beam, PSL, 2.2E, 2900Fb, 5-1/4x18"

Span:	L		=	21 ft
Loads:	reaction from joists 3.6 and deck joists 3.7, factor 0.75 to adjust for spacing			
	DL	0.75 x (200 + 90)	=	220 plf
	LL	0.75 x (500 + 525)	=	770 plf

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, fc = 2,500 psi, 72x72x16”

Under moment frame 3.19
Loads are directly imported from the MF design software into the footing software
Western column (within garage wall) governs, eastern footing same size for consistency
For calculation see design sheets
Allowable soil pressure increased by 1/3 for transient loads, 1,500 x 1.33 = 2,000 psf

Key No. 3.18 Spread Footing, fc = 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		

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

Key No. 3.19 Steel Moment Frame, Columns HSS8x8x0.5, Beam W12x50, Grade 50

Loads: uniform loads from roof w/ trib 3 ft, floor w/ trib 2 ft, wall w/ h 10 ft

Point loads: reactions from post 3.5, beam 3.8, & beam 3.9.

DL	3 x 15 + 2 x 20 + 10 x 10	=	170 plf
LL	0.75 x (2 x 40 + 3 x 25)	=	120 plf
PDL35	at x = 0 ft	=	450 lbs
PLL35		=	750 lbs
PDL38	at x = 18.5 ft	=	6,100 lbs
PLL38		=	6,800 lbs
PDL39	at x = 3.5 (above eastern column)	=	2,400 lbs
PLL39		=	8,200 lbs

Point loads from lateral design

H wind (from grid D)		=	+/- 9,180 lbs
P wind uplift /downforce	at x = 3.5 and 22 ft	=	+/- 1,655 lbs
H seismic (from grid D)		=	+/- 2,780 lbs
P seismic	at x = 3.5 and 22 ft 3.0 (Omega) x 90	=	+/- 270 lbs

For calculation see design sheets

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
1_1 Roof Joist
July 9, 2023 10:54

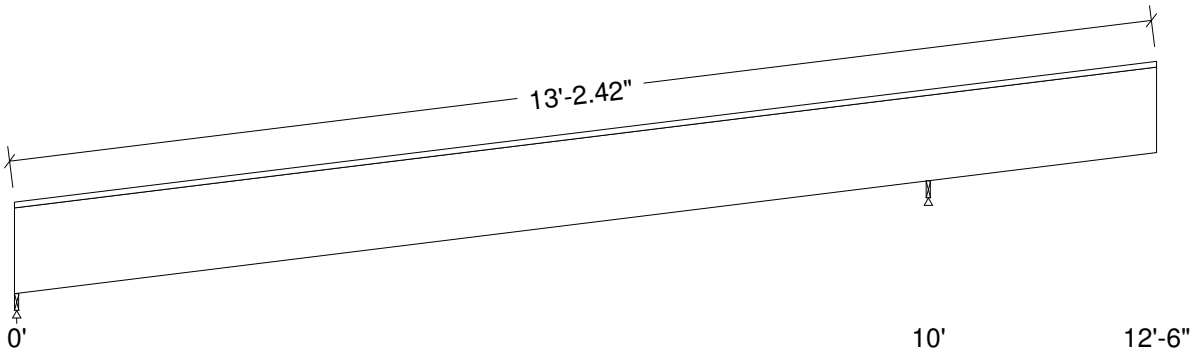
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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'theta	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		
Fcp 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
Deflection:				
Interior Dead	0.02 = < L/999			
Live	0.04 = < L/999	0.53 = L/240	in	0.07
Total	0.06 = < L/999	0.70 = L/180	in	0.09
Cantil. Dead	-0.02 = < L/999			
Live	-0.02 = < L/999	0.26 = L/120	in	0.09
Total	-0.04 = L/784	0.35 = L/90	in	0.11

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	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	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
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
V max = 411, V design = 341 lbs; M(+) = 897 lbs-ft; M(-) = 255 lbs-ft
  EIy = 284.76 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.0 dead + "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 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

1_3 Post
July 9, 2023 11:03

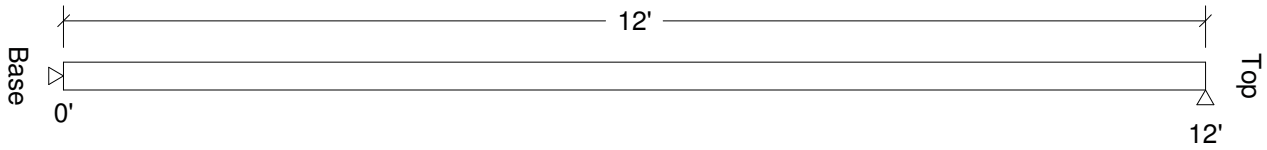
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
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; Ke x Lb: 1.0 x 12.0 = 12.0 ft; Ke x Ld: 1.0 x 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	fc = 442	Fc' = 1708	psi	fc/Fc' = 0.26
Axial Bearing	fc = 442	Fc* = 2887	psi	fc/Fc* = 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 / IBC 2018 1605.3.1

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
1_4 Header
July 9, 2023 11:05

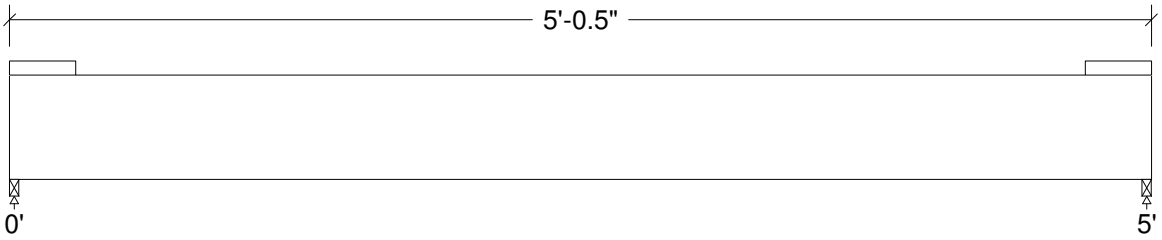
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	fv = 38	Fv' = 207	psi	fv/Fv' = 0.18
Bending(+)	fb = 510	Fb' = 1271	psi	fb/Fb' = 0.40
Dead Defl'n	0.02 = < L/999			
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 600, V design = 485 lbs; M(+) = 750 lbs-ft
   EIy = 77.64 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
2_2a Header
July 9, 2023 11:13

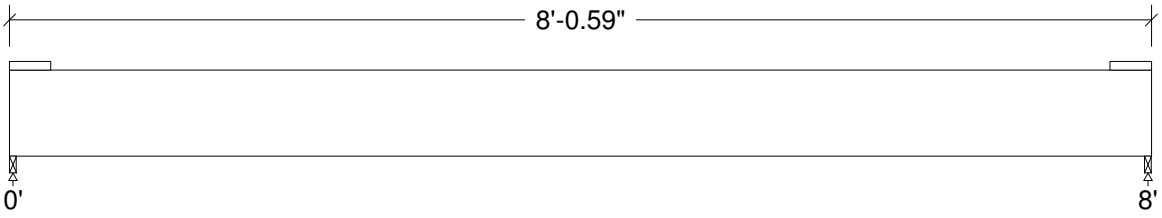
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

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	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	fv = 64	Fv' = 207	psi	fv/Fv' = 0.31
Bending(+)	fb = 1002	Fb' = 1256	psi	fb/Fb' = 0.80
Dead Defl'n	0.06 = < L/999			
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 1280, V design = 1079 lbs; M(+) = 2560 lbs-ft
   EIy = 177.83 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "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 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
2_2b Header
July 9, 2023 11:14

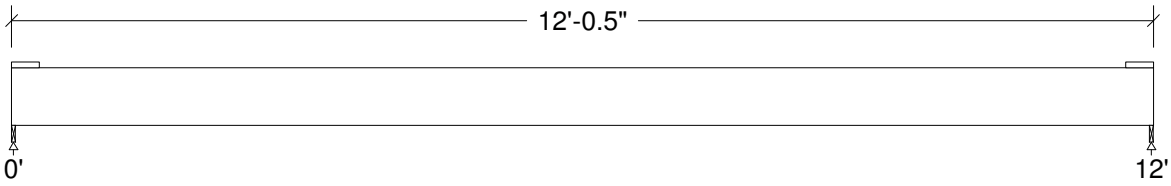
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	723		723
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	fv = 38	Fv' = 207	psi	fv/Fv' = 0.18
Bending(+)	fb = 845	Fb' = 1246	psi	fb/Fb' = 0.68
Dead Defl'n	0.12 = < L/999			
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 720, V design = 645 lbs; M(+) = 2160 lbs-ft
   EIy = 177.83 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "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 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
2_2c Header
July 9, 2023 11:21

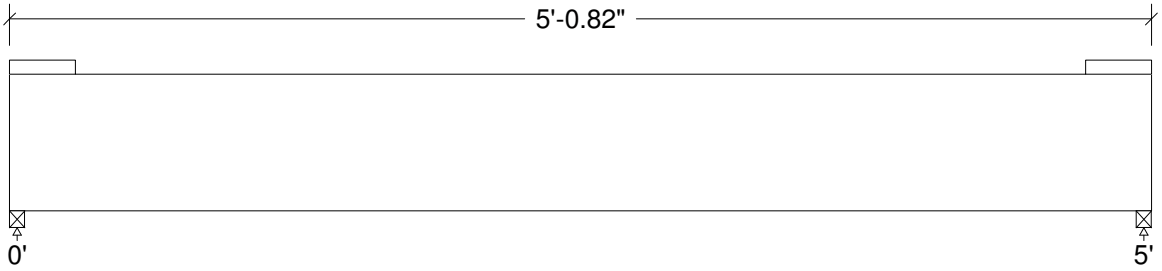
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	fv = 78	Fv' = 180	psi	fv/Fv' = 0.43
Bending(+)	fb = 862	Fb' = 1098	psi	fb/Fb' = 0.79
Dead Defl'n	0.02 = < L/999			
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  = D + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 1763, V design = 1313 lbs; M(+) = 2203 lbs-ft
   EIy = 177.83 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "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 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
2_4 Beam
July 9, 2023 11:27

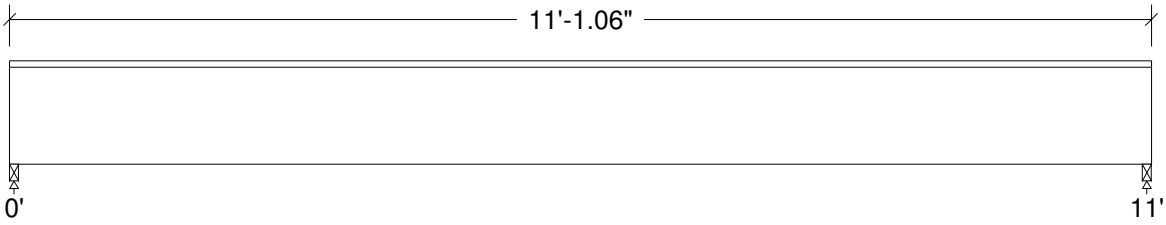
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	1220		1220
Live	222		222
Snow	1109		1109
Factored:			
Total	2329		2329
Bearing:			
Capacity			
Beam	2329		2329
Support	2578		2578
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#4		#4
Length	1.06		1.06
Min req'd	1.06		1.06
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, 4x12 (3-1/2"x11-1/4")

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

Total length: 11'-1.06"; Clear span: 10'-10.94"; Volume = 3.0 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	fv = 72	Fv' = 207	psi	fv/Fv' = 0.35
Bending(+)	fb = 1033	Fb' = 1075	psi	fb/Fb' = 0.96
Dead Defl'n	0.11 = < L/999			
Live Defl'n	0.10 = < L/999	0.37 = L/360	in	0.27
Total Defl'n	0.21 = L/633	0.55 = 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	4
Fb'+	850	1.15	1.00	1.00	1.000	1.100	-	1.00	1.00	1.00	4
Fcp'	625	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.6 million		1.00	1.00	-	-	-	-	1.00	1.00	4
Emin'	0.58 million		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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 2310, V design = 1898 lbs; M(+) = 6353 lbs-ft
   EIy = 664.44 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
2_5 Dbl Joist
July 9, 2023 11:41

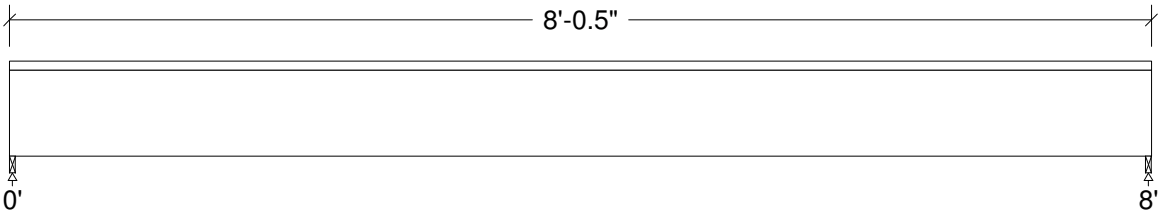
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	483		483
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	1.13		1.13
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	fv = 28	Fv' = 133	psi	fv/Fv' = 0.21
Bending(+)	fb = 438	Fb' = 1104	psi	fb/Fb' = 0.40
Dead Defl'n	0.03 = < L/999			
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	0.95	2
Emin'	0.58 million		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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 480, V design = 405 lbs; M(+) = 960 lbs-ft
   EIy = 76.21 lb-in^2/ply
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.
5. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_2 Header
July 9, 2023 11:51

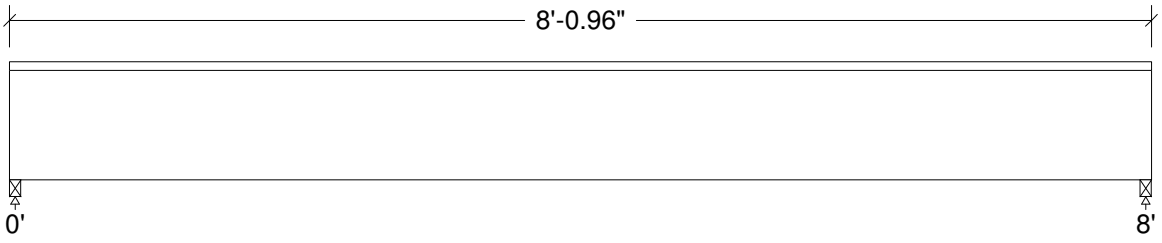
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	fv = 77	Fv' = 207	psi	fv/Fv' = 0.37
Bending(+)	fb = 1000	Fb' = 1173	psi	fb/Fb' = 0.85
Dead Defl'n	0.05 = < L/999			
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 2080, V design = 1658 lbs; M(+) = 4160 lbs-ft
   EIy = 369.34 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
3_3 Header
July 9, 2023 11:52

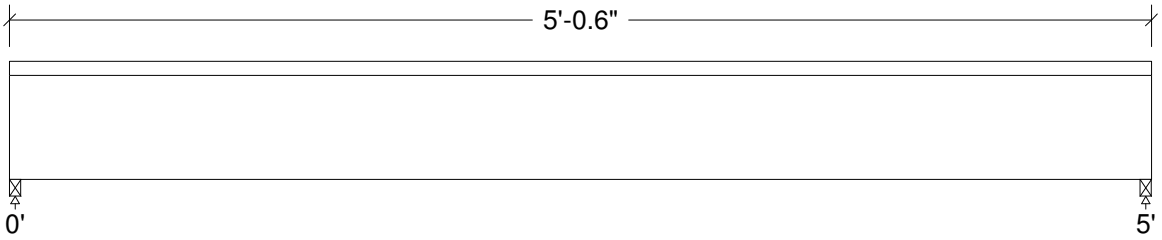
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	fv = 82	Fv' = 207	psi	fv/Fv' = 0.39
Bending(+)	fb = 1105	Fb' = 1271	psi	fb/Fb' = 0.87
Dead Defl'n	0.04 = < L/999			
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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 1300, V design = 1049 lbs; M(+) = 1625 lbs-ft
   EIy = 77.64 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
3_4 Beam
July 9, 2023 12:01

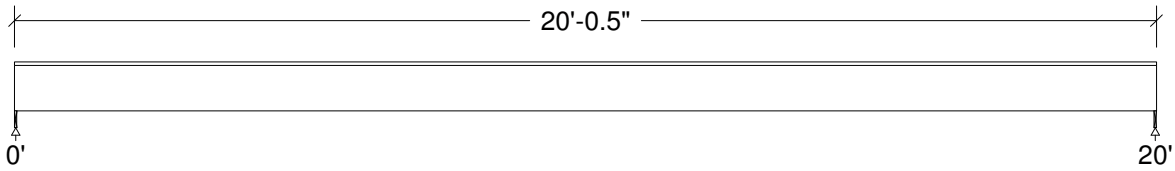
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	451		451
Snow	752		752
Factored:			
Total	1203		1203
Bearing:			
Capacity			
Beam	1719		1719
Support	1836		1836
Des ratio			
Beam	0.70		0.70
Support	0.65		0.65
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	1.07		1.07
Fcp sup	625		625

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

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: 20'-0.5"; Clear span: 19'-11.5"; Volume = 7.3 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 = 32	Fv' = 195	psi	fv/Fv' = 0.16
Bending(+)	fb = 870	Fb' = 1006	psi	fb/Fb' = 0.86
Dead Defl'n	0.32 = L/756			
Live Defl'n	0.53 = L/454	0.67 = L/360	in	0.79
Total Defl'n	0.85 = L/283	1.00 = L/240	in	0.85

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	170	1.15	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	875	1.15	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 + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 1200, V design = 1103 lbs; M(+) = 6000 lbs-ft
   EIy = 510.84 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
3_6 TJI
July 9, 2023 12:06

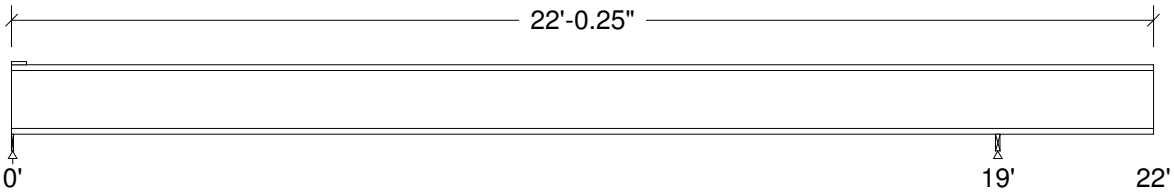
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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 O86 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
Deflection:				
Interior Dead	0.11 = < L/999			
Live	0.37 = L/608	0.47 = L/480	in	0.79
Total	0.49 = L/468	0.95 = L/240	in	0.51
Cantil. Dead	0.08 = L/445			
Live	0.14 = L/248	0.15 = L/240	in	0.96
Total	0.23 = L/159	0.30 = L/120	in	0.75

Additional Data:

FACTORS:	F/E	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Vr	2190	1.00	-	-	-	-	-	-	1.00	-	2
Mr+	4895	1.00	-	-	-	-	-	1.00	1.00	-	5
Mr-	4895	1.15	-	-	-	-	-	1.00	1.00	-	4
EI	566.0 million	-	-	-	-	-	-	-	1.00	-	5

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #5  = D + L (pattern: L_)
 Bending(-): LC #4  = D + S
 Deflection: LC #5  = D + L (pattern: L_)  (live)
             LC #5  = D + L (pattern: L_)  (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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 836 lbs; M(+) = 3035 lbs-ft; M(-) = 2400 lbs-ft
 EI = 622.60e06 lb-in^2 (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 = 0.5 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_7 Deck Joist
July 9, 2023 12:14

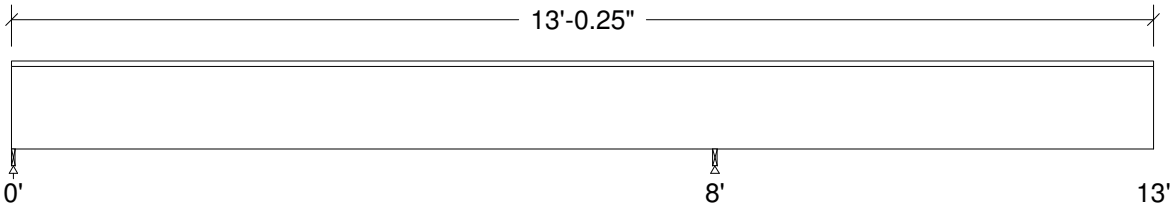
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Partial Area	No	8.02	13.02	10.00(16.0")		psf
LL	Live	Partial Area	No	8.02	13.02	60.00(16.0")		psf

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



Unfactored:					
Dead	-21		88		
Live	-125		525		
Factored:					
Uplift	-146				
Total			613		
Bearing:					
Capacity					
Joist	304		613		
Support	586		742		
Des ratio					
Joist	0.00		1.00		
Support	0.00		0.83		
Load comb	#1		#2		
Length	0.50*		0.63		
Min req'd	0.50*		0.63		
Cb	1.00		1.59		
Cb min	1.00		1.59		
Cb support	1.25		1.25		
Fcp sup	625		625		

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

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

Floor joist spaced at 16.0" c/c; Total length: 13'-0.25"; Clear span: 7'-11.44", 4'-11.69"; Volume = 1.5 cu.ft.

Incised; 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 = 34	Fv' = 116	psi	fv/Fv' = 0.30
Bending(-)	fb = 442	Fb' = 594	psi	fb/Fb' = 0.75
Deflection:				
Interior Dead	-0.00 = < L/999			
Live	-0.03 = < L/999	0.27 = L/360	in	0.10
Total	-0.03 = < L/999	0.40 = L/240	in	0.07
Cantil. Dead	0.01 = < L/999			
Live	0.13 = L/479	0.33 = L/180	in	0.38
Total	0.14 = L/442	0.50 = L/120	in	0.27

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	0.80	2
Fb'-	1000	1.00	1.00	1.00	0.645	1.000	-	1.15	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 + L
 Bending(-): LC #2  = D + L
 Deflection: LC #2  = D + L  (live)
             LC #2  = D + L  (total)
 Bearing   : Support 1 - LC #1 = D only
             Support 2 - LC #2 = D + L
 Uplift    : Support 1 - 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 467, V design = 385 lbs; M(-) = 1167 lbs-ft
   EIy = 284.76 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
 Lateral stability(-):  Lu = 8'  Le = 14'-4.00"  RB = 29.3
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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. The critical deflection value has been determined using maximum back-span deflection. Cantilever deflections do not govern design.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_8 Beam
July 9, 2023 12:35

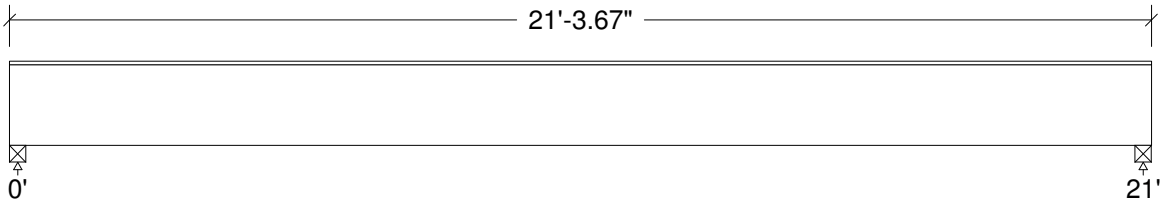
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
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	6072		6072
Live	6818		6818
Factored:			
Total	12890		12890
Bearing:			
Capacity			
Beam	14437		14437
Support	12890		12890
Des ratio			
Beam	0.89		0.89
Support	1.00		1.00
Load comb	#2		#2
Length	3.67		3.67
Min req'd	3.67**		3.67**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

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

PSL, 2.2E, 2900Fb, 5-1/4"x18"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 21'-3.69"; Clear span: 20'-8.31"; Volume = 14.0 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	fv = 170	Fv' = 290	psi	fv/Fv' = 0.59
Bending(+)	fb = 2823	Fb' = 2900	psi	fb/Fb' = 0.97
Dead Defl'n	0.24 = < L/999			
Live Defl'n	0.54 = L/468	0.70 = L/360	in	0.77
Total Defl'n	0.78 = L/324	1.05 = L/240	in	0.74

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	290	1.00	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2900	1.00	-	1.00	1.000	1.000	-	1.00	1.00	-	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.2 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	1.11 million		-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #2  = D + L
 Deflection: LC #2  = D + L  (live)
             LC #2  = D + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 12705, V design = 10705 lbs; M(+) = 66701 lbs-ft
   EIy = 5613.30 lb-in^2  GA = 12.99e06 lb
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_9 Beam
July 9, 2023 12:33

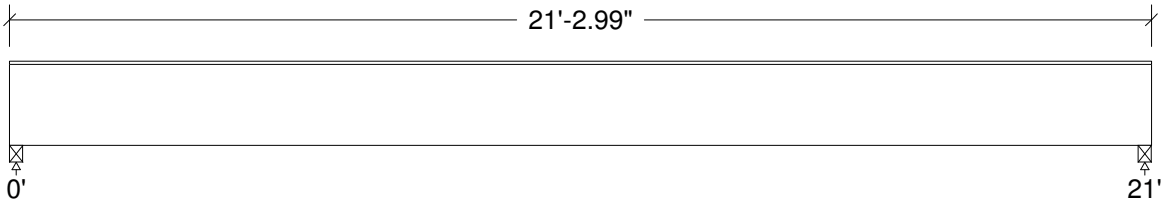
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				220.0		plf
LL	Live	Full UDL				770.0		plf

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



Unfactored:			
Dead	2337		2337
Live	8181		8181
Factored:			
Total	10518		10518
Bearing:			
Capacity			
Beam	11781		11781
Support	10518		10518
Des ratio			
Beam	0.89		0.89
Support	1.00		1.00
Load comb	#2		#2
Length	2.99		2.99
Min req'd	2.99**		2.99**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

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

PSL, 2.2E, 2900Fb, 5-1/4"x18"

Supports: All - Timber-soft Beam, D.Fir-L (N) No.2
Total length: 21'-3.0"; Clear span: 20'-9"; Volume = 13.9 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	fv = 139	Fv' = 290	psi	fv/Fv' = 0.48
Bending(+)	fb = 2310	Fb' = 2900	psi	fb/Fb' = 0.80
Dead Defl'n	0.09 = < L/999			
Live Defl'n	0.65 = L/389	0.70 = L/360	in	0.92
Total Defl'n	0.74 = L/340	1.05 = L/240	in	0.70

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	290	1.00	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2900	1.00	-	1.00	1.000	1.000	-	1.00	1.00	-	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.2 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	1.11 million		-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #2  = D + L
 Deflection: LC #2  = D + L  (live)
             LC #2  = D + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 10395, V design = 8787 lbs; M(+) = 54574 lbs-ft
   EIy = 5613.30 lb-in^2  GA = 12.99e06 lb
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_10 Beam
July 9, 2023 12:47

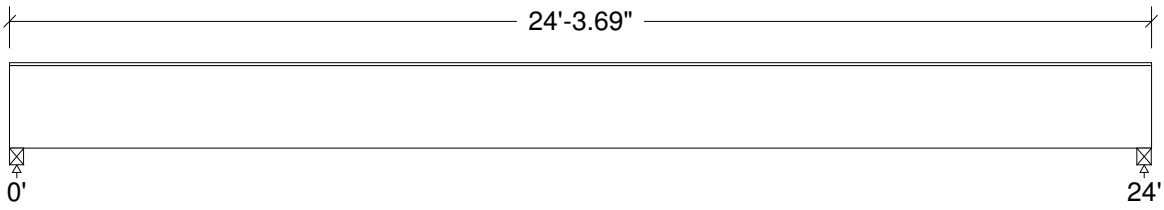
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				500.0		plf
LL	Live	Full UDL				480.0		plf
SL	Snow	Full UDL				300.0		plf

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



Unfactored:			
Dead	6077		6077
Live	5834		5834
Snow	3646		3646
Factored:			
Total	13187		13187
Bearing:			
Capacity			
Beam	13187		13187
Support	13544		13544
Des ratio			
Beam	1.00		1.00
Support	0.97		0.97
Load comb	#3		#3
Length	3.69		3.69
Min req'd	3.69		3.69
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"x21"

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

Total length: 24'-3.69"; Clear span: 23'-8.31"; Volume = 19.5 cu.ft.; 14 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 = 128	Fv' = 265	psi	fv/Fv' = 0.48
Bending(+)	fb = 2095	Fb' = 2223	psi	fb/Fb' = 0.94
Dead Defl'n	0.49 = L/589			
Live Defl'n	0.57 = L/503	0.80 = L/360	in	0.71
Total Defl'n	1.06 = L/271	1.20 = L/240	in	0.88

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cvr	LC#
Fv'	265	1.00	1.00	1.00	-	-	-	-	1.00	1.00	1.00	2
Fb'+	2400	1.00	1.00	1.00	1.000	0.926	-	-	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	3
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	3

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #2  = D + L
 Deflection: LC #3  = D + 0.75(L + S)  (live)
             LC #3  = D + 0.75(L + S)  (total)
 Bearing   : Support 1 - LC #3 = D + 0.75(L + S)
             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 combinations: ASD Basic from ASCE 7-16 2.4 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 11760, V design = 9894 lbs; M(+) = 70560 lbs-ft
   EIy = 7640.21 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

3_11 Post
July 10, 2023 13:37

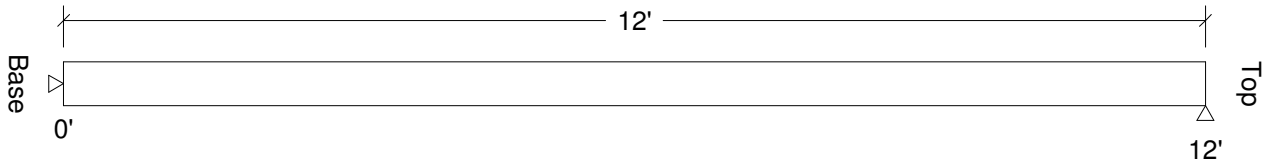
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
PDL	Dead	Axial	(Ecc. = 0.00")		6070		lbs
PLL	Live	Axial	(Ecc. = 0.00")		6820		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Live			
Axial:			
Dead	6070		6070
Live	6820		6820
Factored:			
L->R			
Load comb	#1		#1

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

Support: Non-wood

Total length: 12'; Volume = 2.5 cu.ft.; Post or timber

Pinned base; Ke x Lb: 1.0 x 12.0 = 12.0 ft; Ke x Ld: 1.0 x 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	fc = 426	Fc' = 428	psi	fc/Fc' = 0.99
Axial Bearing	fc = 426	Fc* = 700	psi	fc/Fc* = 0.61

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fc'	700	1.00	1.00	1.00	0.612	1.000	-	-	1.00	1.00	2
Fc*	700	1.00	1.00	1.00	-	1.000	-	-	1.00	1.00	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 / IBC 2018 1605.3.1

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

8520 SE 82nd St
Mercer Island, WA 98040
3_13 Header
July 10, 2023 13:35

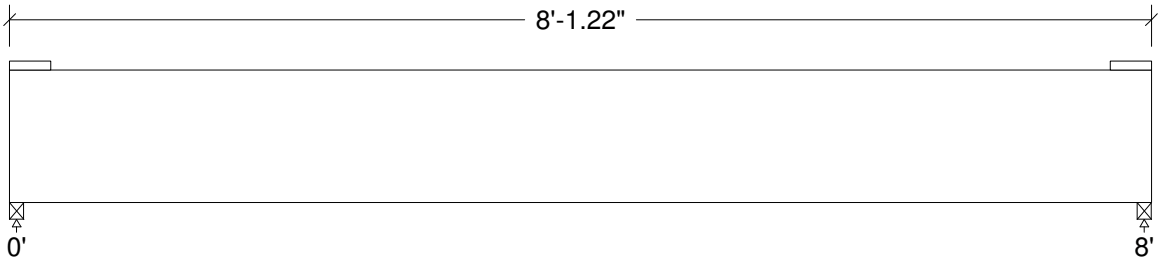
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				300.0		plf
LL	Live	Full UDL				360.0		plf

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



Unfactored:			
Dead	1215		1215
Live	1458		1458
Factored:			
Total	2674		2674
Bearing:			
Capacity			
Beam	2674		2674
Support	2960		2960
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	1.22		1.22
Min req'd	1.22		1.22
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, 4x12 (3-1/2"x11-1/4")

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

Total length: 8'-1.25"; Clear span: 7'-10.75"; Volume = 2.2 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 = 76	Fv' = 180	psi	fv/Fv' = 0.42
Bending(+)	fb = 858	Fb' = 921	psi	fb/Fb' = 0.93
Dead Defl'n	0.02 = < L/999			
Live Defl'n	0.05 = < L/999	0.27 = L/360	in	0.19
Total Defl'n	0.07 = < L/999	0.40 = L/240	in	0.18

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	0.985	1.100	-	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 + L
 Bending(+): LC #2  = D + L
 Deflection: LC #2  = D + L  (live)
             LC #2  = D + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 2640, V design = 1988 lbs; M(+) = 5280 lbs-ft
   EIy = 664.44 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
 Lateral stability(+):  Lu = 8'  Le = 15'-10.25"  RB = 13.2
```

Design Notes:

1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) 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

8520 SE 82nd St
Mercer Island, WA 98040
3_16 Beam
July 19, 2023 13:34

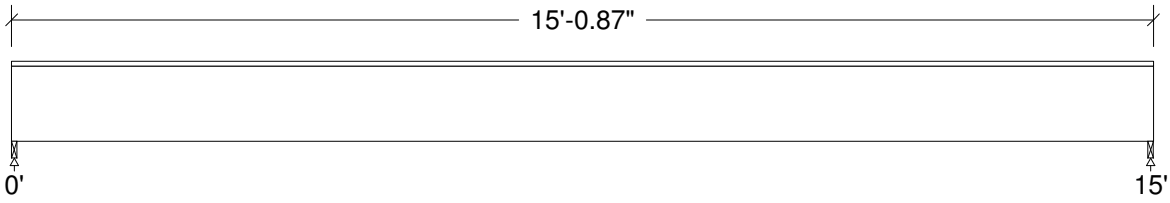
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
DL	Dead	Full UDL				160.0		plf
LL	Live	Full UDL				120.0		plf

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



Unfactored:			
Dead	1206		1206
Live	904		904
Factored:			
Total	2110		2110
Bearing:			
Capacity			
Beam	6252		6252
Support	2110		2110
Des ratio			
Beam	0.34		0.34
Support	1.00		1.00
Load comb	#2		#2
Length	0.87		0.87
Min req'd	0.87**		0.87**
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: 15'-0.88"; Clear span: 14'-11.13"; Volume = 4.4 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	fv = 65	Fv' = 310	psi	fv/Fv' = 0.21
Bending(+)	fb = 1149	Fb' = 2325	psi	fb/Fb' = 0.49
Dead Defl'n	0.12 = < L/999			
Live Defl'n	0.18 = L/996	0.50 = L/360	in	0.36
Total Defl'n	0.30 = L/598	0.75 = L/240	in	0.40

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	310	1.00	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2325	1.00	-	1.00	1.000	1.000	-	1.00	1.00	-	2
Fcp'	2050	-	-	1.00	-	-	-	-	1.00	-	-
E'	1.5 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	0.80 million		-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = D + L
 Bending(+): LC #2  = D + L
 Deflection: LC #2  = D + L  (live)
             LC #2  = D + 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 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V max = 2100, V design = 1813 lbs; M(+) = 7875 lbs-ft
   EIy = 757.04 lb-in^2 Apparent E approximates the effect of shear deflection.
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 0.5 dead + "live"
```

Design Notes:

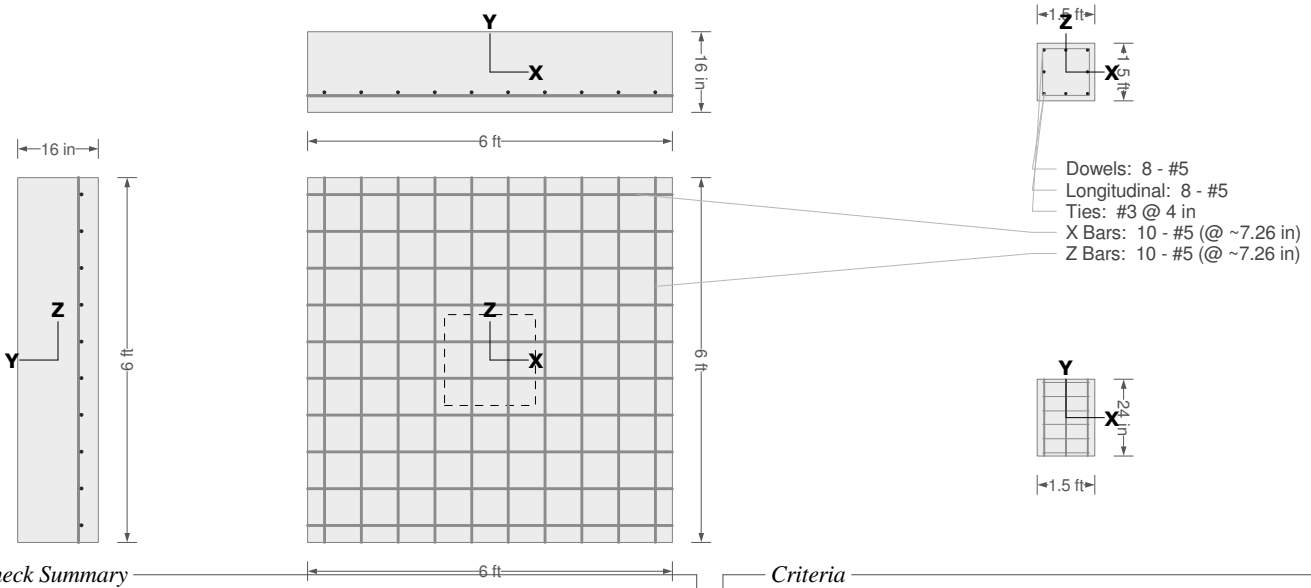
1. Analysis and design are in accordance with the ICC International Building Code (IBC 2018) and the National Design Specification (NDS 2018), using Allowable Stress Design (ASD). Design values are from the NDS Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
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.

ROLAND HEIMISCH
TECINSTRUCT LLC

8520 MF Rev 111523

Key 3.17 Pad Footing under Moment Frame Column 002 (governs over Col 001), used for both columns for consistency

Design Detail



Check Summary

Ratio	Check	Provided	Required	Combination
----- Footing -----				
✓ 0.147	X Flexure (-Z)	1918 in·k	282.5 in·k	1.2D + 1.6L
✓ 0.147	X Flexure (+Z)	1918 in·k	282.5 in·k	1.2D + 1.6L
✓ 0.168	Z Flexure (-X)	2022 in·k	339.3 in·k	1.2D + 0.5L + 1.0Wpx
✓ 0.150	Z Flexure (+X)	2022 in·k	303.1 in·k	1.2D + 1.6L
✓ 0.178	Shear (-Z)	65.14 k	11.58 k	1.2D + 1.6L
✓ 0.178	Shear (+Z)	65.14 k	11.58 k	1.2D + 1.6L
✓ 0.197	Shear (-X)	68.51 k	13.49 k	1.2D + 0.5L + 1.0Wpx
✓ 0.175	Shear (+X)	68.51 k	11.96 k	1.2D + 1.6L
✓ 0.669	Min Steel Z	3.1 in²	2.07 in²	1.4D
✓ 0.669	Min Steel X	3.1 in²	2.07 in²	1.4D
✓ 0.179	Min Strain Z	0.0223	0.0040	1.4D
✓ 0.169	Min Strain X	0.0236	0.0040	1.4D
✓ 0.161	Punching Shear	150 psi	24.08 psi	1.2D + 0.5L + 1.0Wpx
----- Pedestal -----				
✓ 0.098	Axial	432.7 k	42.3 k	1.2D + 1.6L
✓ 0.151	Biaxial Bending	0.151	1.000	0.9D + 1.0Wnx
✓ 0.109	Shear X	60.86 k	6.65 k	1.2D + 0.5L + 1.0Wnx
✓ 0.000	Shear Z	61.22 k	0 k	1.4D
----- Interface -----				
✓ 0.043	Bearing (footing)	991.8 k	42.3 k	1.2D + 1.6L
✓ 0.078	Bearing (pedestal)	544.2 k	42.3 k	1.2D + 1.6L
✓ 0.005	Tension	133.9 k	0.71 k	0.9D + 1.0Wnx
✓ 0.006	Dowel Dev (ftg)	13 in	0.08 in	0.9D + 1.0Wnx
✓ 0.006	Dowel Dev (ped)	22.5 in	0.13 in	0.9D + 1.0Wnx
✓ 0.653	Min Steel	2.48 in²	1.62 in²	1.4D
----- Stability -----				
✓ 0.835	Bearing Pressure	1500 psf	1252 psf	1.0D + 1.0L
✓ 0.000	Overturning-X	Infinite	1.500	1.0D + 1.0L
✓ 0.861	Overturning-Z	1.743	1.500	0.6D + 0.6Wnx
✓ 0.618	Sliding-X	2.429	1.500	0.6D + 0.6Wnx
✓ 0.000	Sliding-Z	Infinite	1.500	1.0D + 1.0L
✓ 0.000	Uplift	Infinite	1.500	1.0D + 1.0L

Criteria

Use basic criteria from common project settings	Yes
Building Code	IBC 2018
Strength Load Combinations	IBC 2018 (Strength)
Stability Load Combinations	ASCE 7-16 (ASD)
Apply Sds Factor to Seismic Combinations for Ev	No
Factor of Safety: Overturning	1.50
Factor of Safety: Sliding	1.50
Factor of Safety: Uplift	1.50
Perimeter Skin Friction	0 psf
Additional Uplift Resistance	0 k
Allowable Bearing Pressure	1500 psf
Separate Allowable Pressure for Dead Only	No
Separate Allowable Pressure for Dead+Live Only	No
Separate Allowable Pressure for Wind/Seismic	Yes
Allowable Bearing (W/E)	2000 psf
Gross / Net (Allowable Bearing)	Gross
Friction Coefficient	0.40
Cohesion (@ soil interface)	0 psf
Passive Soil Resistance (Fixed)	0 lb
Calculate Depth-Dependent Passive Pressure	Yes
Passive Pressure / Depth	300 lb/ft³
Soil Depth To Pressure Top	0 ft
Soil Depth To Footing Bottom	3 ft
Additional Sliding Resistance	0 k
Concrete Weight	150 lb/ft³
Parme beta (for biaxial)	0.65
Include footing weight in strength bearing pressure	Yes
Include overburden in strength bearing pressure	Yes

Loads Summary (Service Loads)

Load Set	Name	Source	P	Mx	Mz	Vx	Vz	Overburden
N003	D	Dead	15.35 k	0 in·k	-0 in·k	0.51 k	0 k	0 psf
N003	L	Live	14.42 k	0 in·k	-0 in·k	0.55 k	0 k	0 psf
N003	W+X	Wind (+X)	15.13 k	0 in·k	-0 in·k	-5.76 k	0 k	0 psf
N003	W-X	Wind (-X)	-15.13 k	0 in·k	-0 in·k	5.76 k	0 k	0 psf
N003	E+X	Earthquake (+X)	4.21 k	0 in·k	-0 in·k	-1.77 k	0 k	0 psf
N003	E-X	Earthquake (-X)	-4.21 k	0 in·k	-0 in·k	1.77 k	0 k	0 psf
N003	Overburden	Dead	0 k	0 in·k	0 in·k	0 k	0 k	120 psf

ROLAND HEIMISCH
TECINSTRUCT LLC

8520 MF Rev 111523

Strength Check Results Summary

Load Combination	Factored Axial (k)	Factored Moment-X (in·k)	Factored Moment-Z (in·k)	Factored Shear-X (k)	Factored Shear-Z (k)	Factored Overburden (psf)	Factored Footing Weight (k)	Factored Pedestal Weight (k)	Mu +X Cantilever (in·k)
Set: N003 : 1.4D	21.49	0	0	0.72	0	168	10.08	0.94	203.4
Set: N003 : 1.2D + 1.6L	41.49	0	0	1.5	0	144	8.64	0.81	303.1
Set: N003 : 1.2D + 0.5Wpx	25.99	0	0	-2.26	0	144	8.64	0.81	176.5
Set: N003 : 1.2D + 0.5Wnx	10.86	0	0	3.49	0	144	8.64	0.81	171.5
Set: N003 : 1.2D + 0.5L + 1.0Wpx	40.76	0	0	-4.87	0	144	8.64	0.81	218.3
Set: N003 : 1.2D + 0.5L + 1.0Wnx	10.5	0	0	6.65	0	144	8.64	0.81	209.4
Set: N003 : 1.2D + 1.0Wpx	33.55	0	0	-5.14	0	144	8.64	0.81	177.1
Set: N003 : 1.2D + 1.0Wnx	3.29	0	0	6.37	0	144	8.64	0.81	171.7
Set: N003 : 1.2D + 0.5L + 1.0Epx	29.84	0	0	-0.88	0	144	8.64	0.81	211.9
Set: N003 : 1.2D + 0.5L + 1.0Enx	21.42	0	0	2.66	0	144	8.64	0.81	214.9
Set: N003 : 1.2D + 0.5L	25.63	0	0	0.89	0	144	8.64	0.81	212.7
Set: N003 : 1.2D + 1.0Epx	22.63	0	0	-1.15	0	144	8.64	0.81	173.3
Set: N003 : 1.2D + 1.0Enx	14.21	0	0	2.38	0	144	8.64	0.81	174.6
Set: N003 : 1.2D	18.42	0	0	0.61	0	144	8.64	0.81	174.3
Set: N003 : 0.9D + 1.0Wpx	28.95	0	0	-5.3	0	108	6.48	0.61	133.6
Set: N003 : 0.9D + 1.0Wnx	-1.32	0	0	6.22	0	108	6.48	0.61	164.2
Set: N003 : 0.9D + 1.0Epx	18.03	0	0	-1.31	0	108	6.48	0.61	129.1
Set: N003 : 0.9D + 1.0Enx	9.61	0	0	2.23	0	108	6.48	0.61	130.7
Set: N003 : 0.9D	13.82	0	0	0.46	0	108	6.48	0.61	130.8

Load Combination	Mu -X Cantilever (in·k)	Mu +Z Cantilever (in·k)	Mu -Z Cantilever (in·k)	Vu +X Cantilever (k)	Vu -X Cantilever (k)	Vu +Z Cantilever (k)	Vu -Z Cantilever (k)	Vu Punching (k)	vu Punching (psi)
Set: N003 : 1.4D	183.3	193.3	193.3	8.01	7.17	7.92	7.92	15.64	10.84
Set: N003 : 1.2D + 1.6L	261.8	282.5	282.5	11.96	10.22	11.58	11.58	32.37	22.44
Set: N003 : 1.2D + 0.5Wpx	231.5	204	204	6.86	9.17	8.36	8.36	19.63	14.42
Set: N003 : 1.2D + 0.5Wnx	83.35	127.4	127.4	6.85	3.15	5.22	5.22	7.19	6.9
Set: N003 : 1.2D + 0.5L + 1.0Wpx	339.3	278.8	278.8	8.41	13.49	11.43	11.43	31.77	24.08
Set: N003 : 1.2D + 0.5L + 1.0Wnx	41.79	125.6	125.6	8.45	1.42	5.15	5.15	6.89	8.61
Set: N003 : 1.2D + 1.0Wpx	307.5	242.3	242.3	6.78	12.25	9.93	9.93	25.85	20.3
Set: N003 : 1.2D + 1.0Wnx	10.16	89.1	89.1	6.97	0.18	3.65	3.65	1.01	4.53
Set: N003 : 1.2D + 0.5L + 1.0Epx	235.2	223.5	223.5	8.29	9.26	9.16	9.16	22.79	15.69
Set: N003 : 1.2D + 0.5L + 1.0Enx	146.9	180.9	180.9	8.53	5.68	7.41	7.41	15.87	12.17
Set: N003 : 1.2D + 0.5L	191.7	202.2	202.2	8.38	7.5	8.29	8.29	19.33	13.4
Set: N003 : 1.2D + 1.0Epx	200.7	187	187	6.77	7.92	7.66	7.66	16.87	11.92
Set: N003 : 1.2D + 1.0Enx	114.2	144.4	144.4	6.94	4.4	5.92	5.92	9.95	8.06
Set: N003 : 1.2D	157.1	165.7	165.7	6.87	6.14	6.79	6.79	13.41	9.29
Set: N003 : 0.9D + 1.0Wpx	268.2	200.9	200.9	5.07	10.71	8.23	8.23	22.49	18.17
Set: N003 : 0.9D + 1.0Wnx	0	47.67	47.67	7.05	0	1.95	1.95	1.01	4.44
Set: N003 : 0.9D + 1.0Epx	162.1	145.6	145.6	5.02	6.41	5.97	5.97	13.51	9.78
Set: N003 : 0.9D + 1.0Enx	75.23	103	103	5.21	2.88	4.22	4.22	6.59	5.74
Set: N003 : 0.9D	117.8	124.3	124.3	5.15	4.61	5.09	5.09	10.06	6.97

Load Combination	Pu Pedestal (k)	Mu-X Pedestal (in·k)	Mu-Z Pedestal (in·k)	Vu-X Pedestal (k)	Vu-Z Pedestal (k)	Reqd dowel dev (footing) (in)	Reqd dowel dev (pedestal) (in)
Set: N003 : 1.4D	21.49	0	17.2	0.72	0	15	15
Set: N003 : 1.2D + 1.6L	41.49	0	36.02	1.5	0	15	15
Set: N003 : 1.2D + 0.5Wpx	25.99	0	54.34	2.26	0	15	15
Set: N003 : 1.2D + 0.5Wnx	10.86	0	83.85	3.49	0	15	15
Set: N003 : 1.2D + 0.5L + 1.0Wpx	40.76	0	116.8	4.87	0	15	15
Set: N003 : 1.2D + 0.5L + 1.0Wnx	10.5	0	159.6	6.65	0	15	15
Set: N003 : 1.2D + 1.0Wpx	33.55	0	123.4	5.14	0	15	15
Set: N003 : 1.2D + 1.0Wnx	3.29	0	153	6.37	0	15	15
Set: N003 : 1.2D + 0.5L + 1.0Epx	29.84	0	21.04	0.88	0	15	15
Set: N003 : 1.2D + 0.5L + 1.0Enx	21.42	0	63.83	2.66	0	15	15
Set: N003 : 1.2D + 0.5L	25.63	0	21.39	0.89	0	15	15
Set: N003 : 1.2D + 1.0Epx	22.63	0	27.69	1.15	0	15	15
Set: N003 : 1.2D + 1.0Enx	14.21	0	57.18	2.38	0	15	15
Set: N003 : 1.2D	18.42	0	14.75	0.61	0	15	15
Set: N003 : 0.9D + 1.0Wpx	28.95	0	127.1	5.3	0	15	15
Set: N003 : 0.9D + 1.0Wnx	-1.32	0	149.3	6.22	0	10.5	18
Set: N003 : 0.9D + 1.0Epx	18.03	0	31.37	1.31	0	15	15
Set: N003 : 0.9D + 1.0Enx	9.61	0	53.49	2.23	0	15	15
Set: N003 : 0.9D	13.82	0	11.06	0.46	0	15	15

Stability Check Results Summary

Load Combination	Factored Axial (k)	Factored Moment-X (in·k)	Factored Moment-Z (in·k)	Factored Shear-X (k)	Factored Shear-Z (k)	Factored Overburden (psf)	Factored Footing Weight (k)	Factored Pedestal Weight (k)	Max Applied Bearing (psf)
Set: N003 : 1.0D + 1.0L	29.77	0	0	1.07	0	120	7.2	0.68	1252
Set: N003 : 1.0D + 0.6Wpx	24.43	0	0	-2.94	0	120	7.2	0.68	1281
Set: N003 : 1.0D + 0.6Wnx	6.27	0	0	3.97	0	120	7.2	0.68	871
Set: N003 : 1.0D + 0.7Epx	18.3	0	0	-0.73	0	120	7.2	0.68	907.7
Set: N003 : 1.0D + 0.7Enx	12.41	0	0	1.75	0	120	7.2	0.68	834.9
Set: N003 : 1.0D	15.35	0	0	0.51	0	120	7.2	0.68	810.3
Set: N003 : 1.0D + 0.75L + 0.45Wpx	32.97	0	0	-1.66	0	120	7.2	0.68	1400
Set: N003 : 1.0D + 0.75L + 0.45Wnx	19.35	0	0	3.52	0	120	7.2	0.68	1197
Set: N003 : 1.0D + 0.75L + 0.525Epx	28.37	0	0	-0	0	120	7.2	0.68	1119
Set: N003 : 1.0D + 0.75L + 0.525Enx	23.95	0	0	1.86	0	120	7.2	0.68	1161
Set: N003 : 1.0D + 0.75L	26.16	0	0	0.93	0	120	7.2	0.68	1144
Set: N003 : 0.6D + 0.6Wpx	18.29	0	0	-3.15	0	72	4.32	0.41	1004
Set: N003 : 0.6D + 0.6Wnx	0.13	0	0	3.76	0	72	4.32	0.41	629.7
Set: N003 : 0.6D + 0.7Epx	12.16	0	0	-0.93	0	72	4.32	0.41	624.6
Set: N003 : 0.6D + 0.7Enx	6.26	0	0	1.54	0	72	4.32	0.41	513.5
Set: N003 : 0.6D	9.21	0	0	0.31	0	72	4.32	0.41	486.2

ROLAND HEIMISCH
TECINSTRUCT LLC

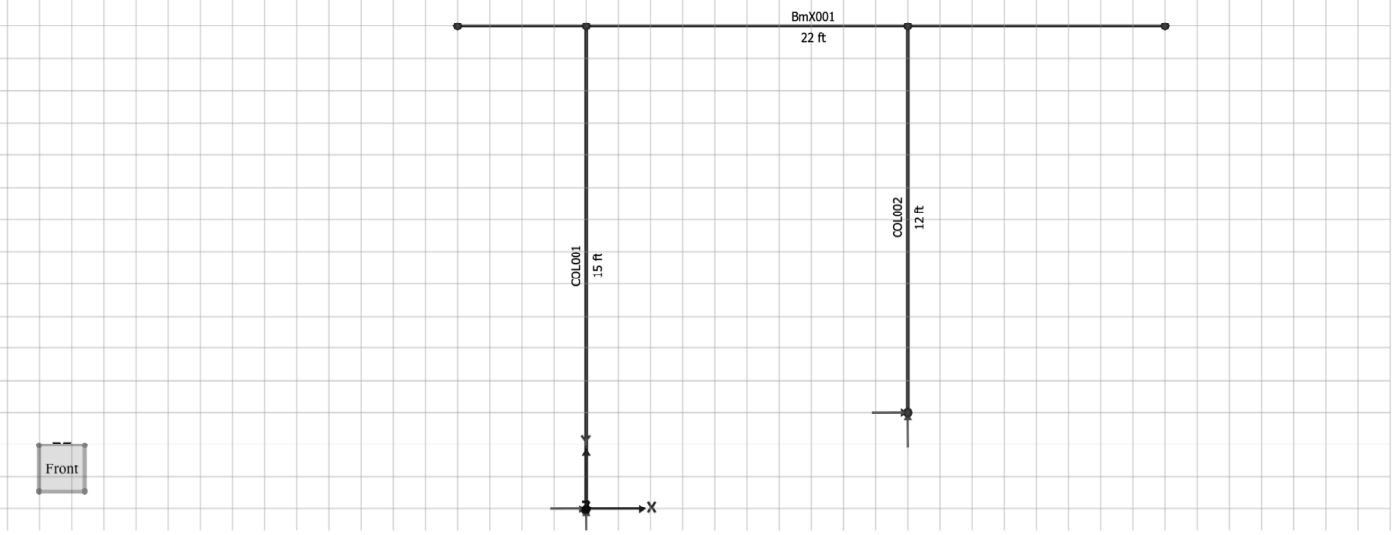
8520 MF Rev 111523

Stability Check Results Summary (continued)

Load Combination	Allowable Bearing (psf)	Actual F.S. Overturning-X	Actual F.S. Overturning-Z	Required F.S. Overturning	Actual F.S. Sliding-X	Actual F.S. Sliding-Z	Required F.S. Sliding	Actual F.S. Uplift	Required F.S. Uplift
Set: N003 : 1.0D + 1.0L	1500	1.#IO	35.200	1.500	21.484	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.6Wpx	2000	1.#IO	11.121	1.500	7.058	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.6Wnx	2000	1.#IO	4.128	1.500	3.404	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.7Epx	2000	1.#IO	37.488	1.500	25.240	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.7Enx	2000	1.#IO	12.515	1.500	9.120	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D	1500	1.#IO	47.948	1.500	33.468	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.75L + 0.45Wpx	2000	1.#IO	24.296	1.500	14.541	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.75L + 0.45Wnx	2000	1.#IO	8.000	1.500	5.324	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.75L + 0.525Epx	2000	1.#IO	51812.646	1.500	31920.700	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.75L + 0.525Enx	2000	1.#IO	17.401	1.500	11.088	1.#IO	1.500	1.#IO	1.500
Set: N003 : 1.0D + 0.75L	1500	1.#IO	36.960	1.500	23.138	1.#IO	1.500	1.#IO	1.500
Set: N003 : 0.6D + 0.6Wpx	2000	1.#IO	7.277	1.500	5.212	1.#IO	1.500	1.#IO	1.500
Set: N003 : 0.6D + 0.6Wnx	2000	1.#IO	1.743	1.500	2.429	1.#IO	1.500	1.#IO	1.500
Set: N003 : 0.6D + 0.7Epx	2000	1.#IO	18.681	1.500	14.994	1.#IO	1.500	1.#IO	1.500
Set: N003 : 0.6D + 0.7Enx	2000	1.#IO	7.818	1.500	7.504	1.#IO	1.500	1.#IO	1.500
Set: N003 : 0.6D	1500	1.#IO	47.948	1.500	41.574	1.#IO	1.500	1.#IO	1.500

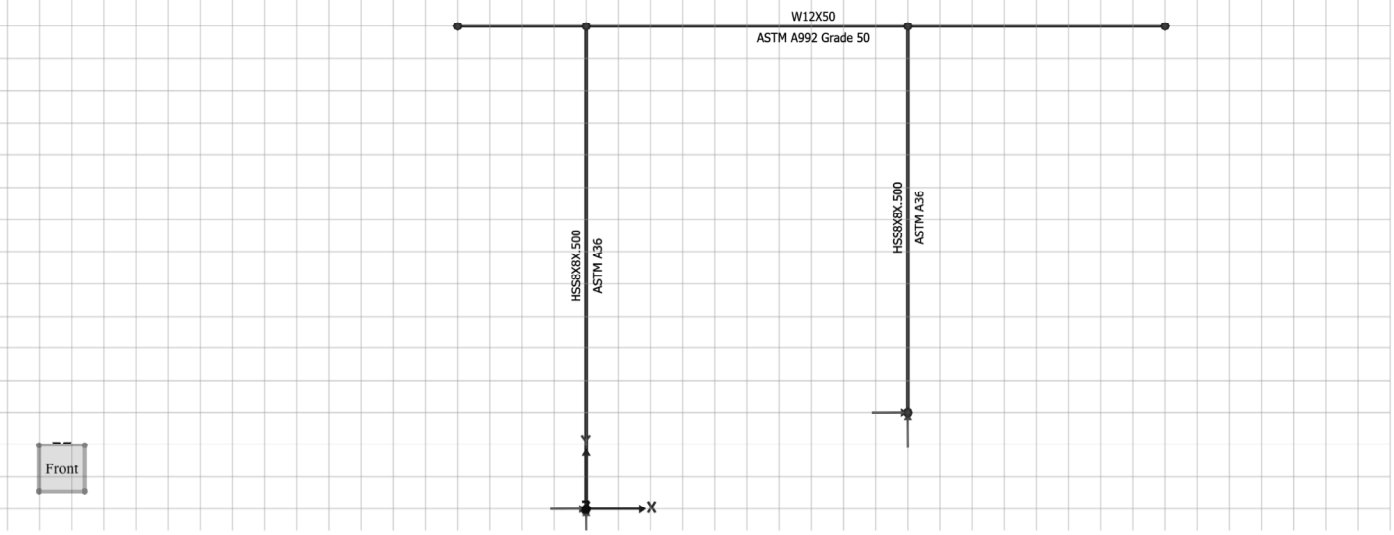
Key 3.19 Moment Frame

System and Dimensions



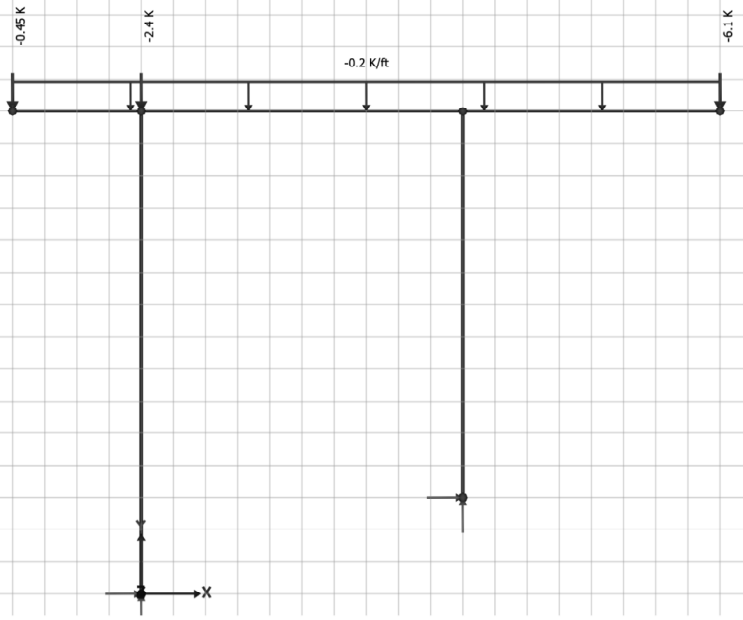
Key 3.19 Moment Frame

Shapes and Material



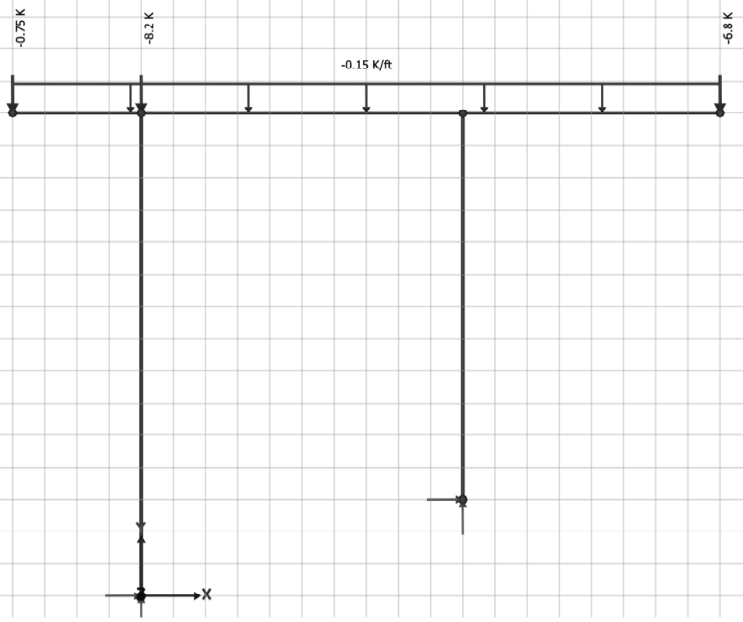
Key 3.19 Moment Frame

Dead Load



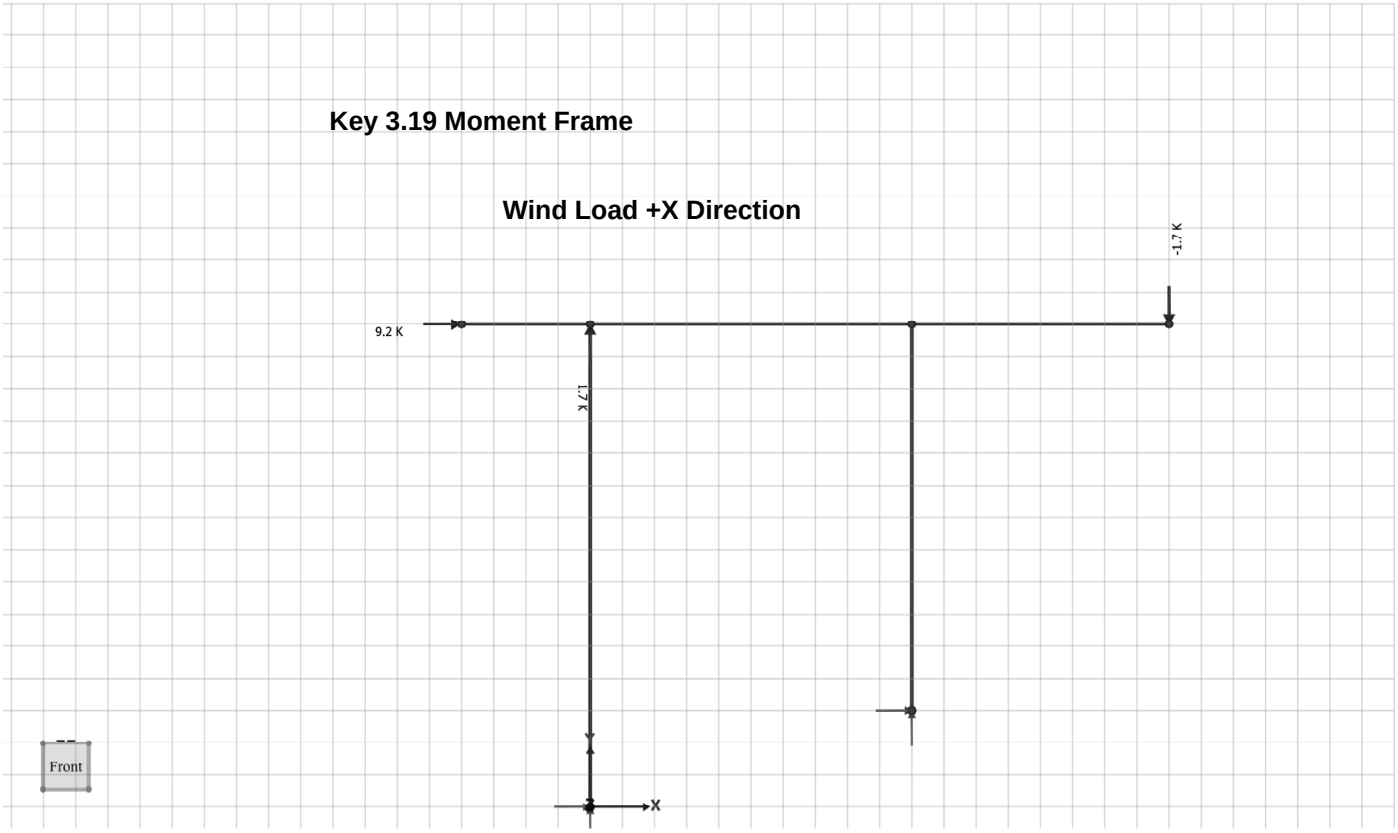
Key 3.19 Moment Frame

Live Load



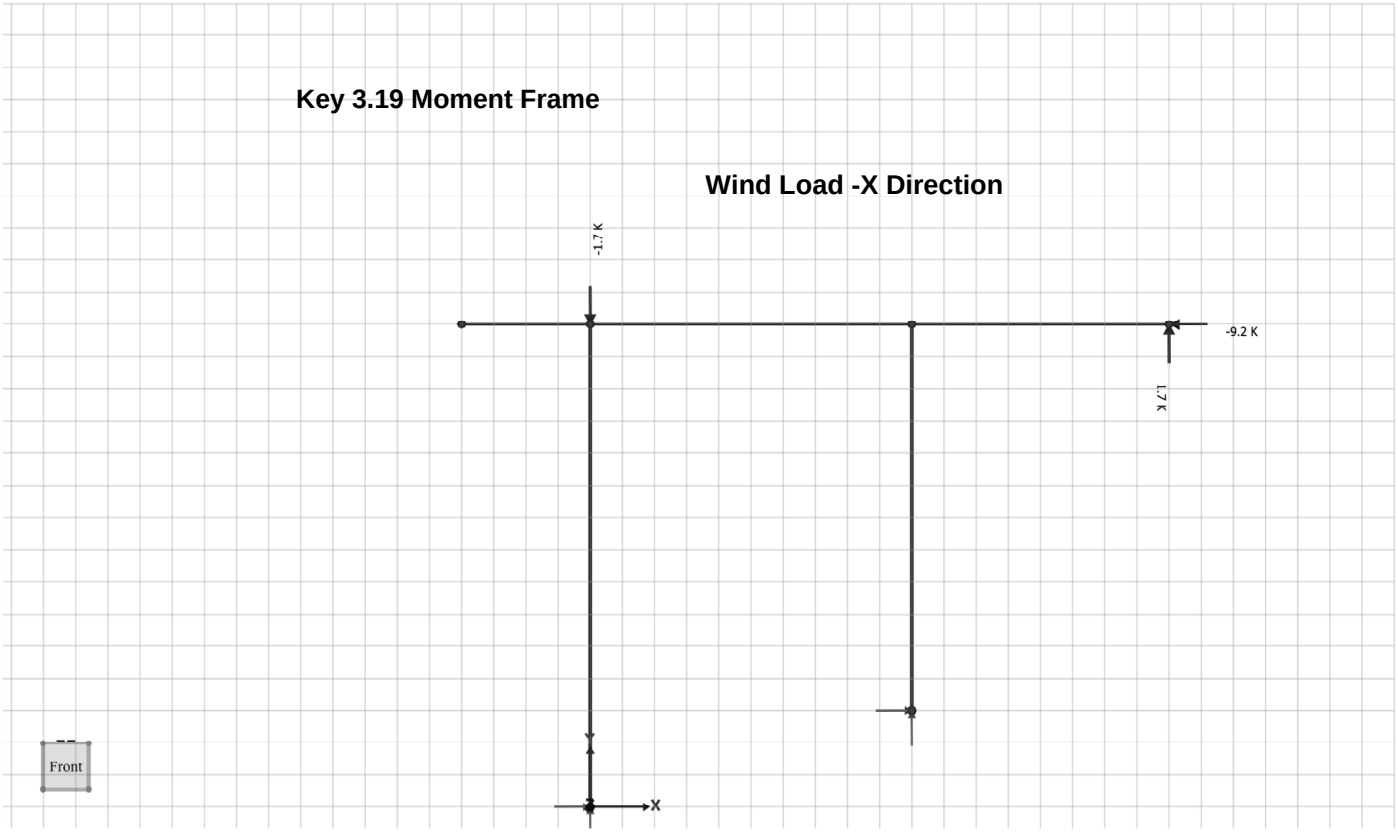
Key 3.19 Moment Frame

Wind Load +X Direction



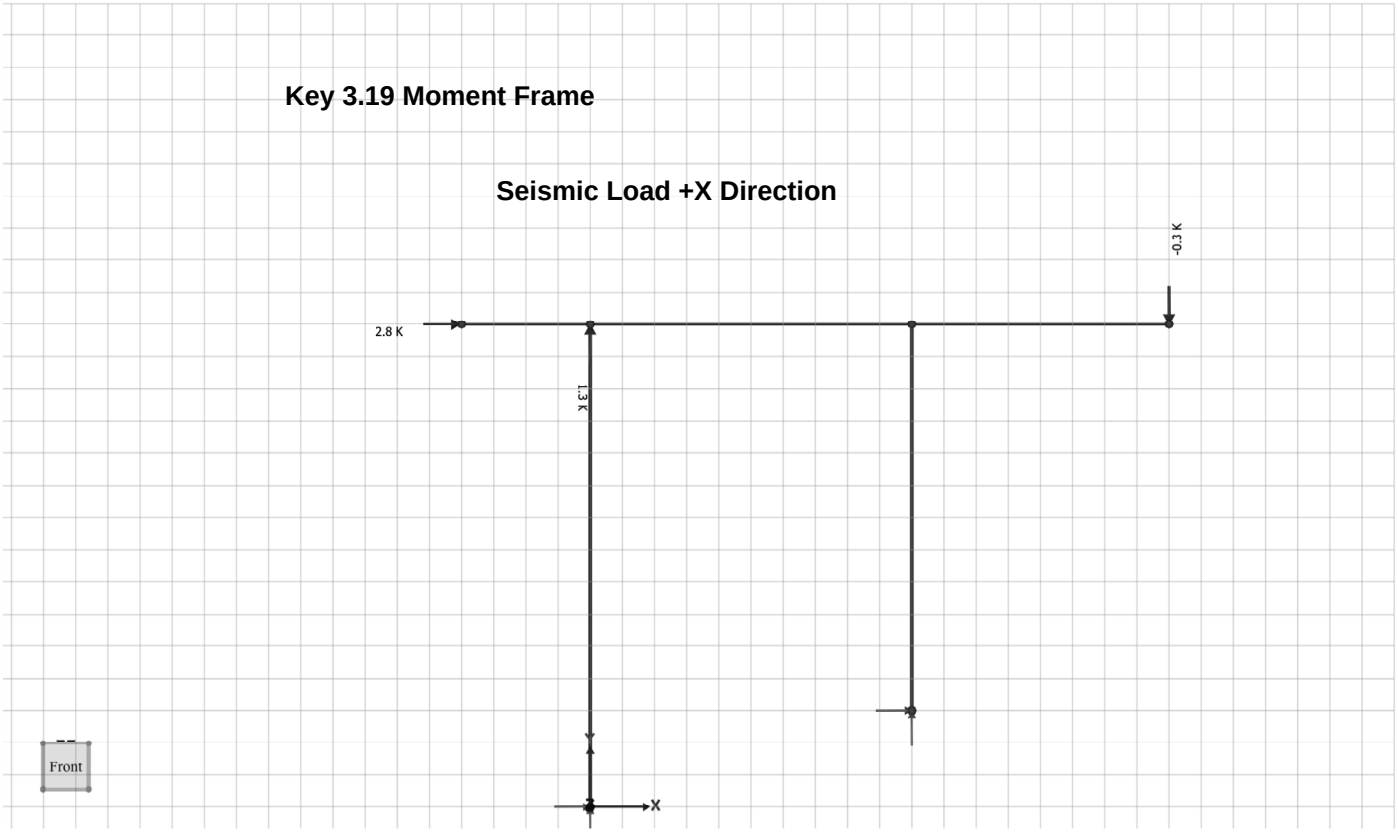
Key 3.19 Moment Frame

Wind Load -X Direction



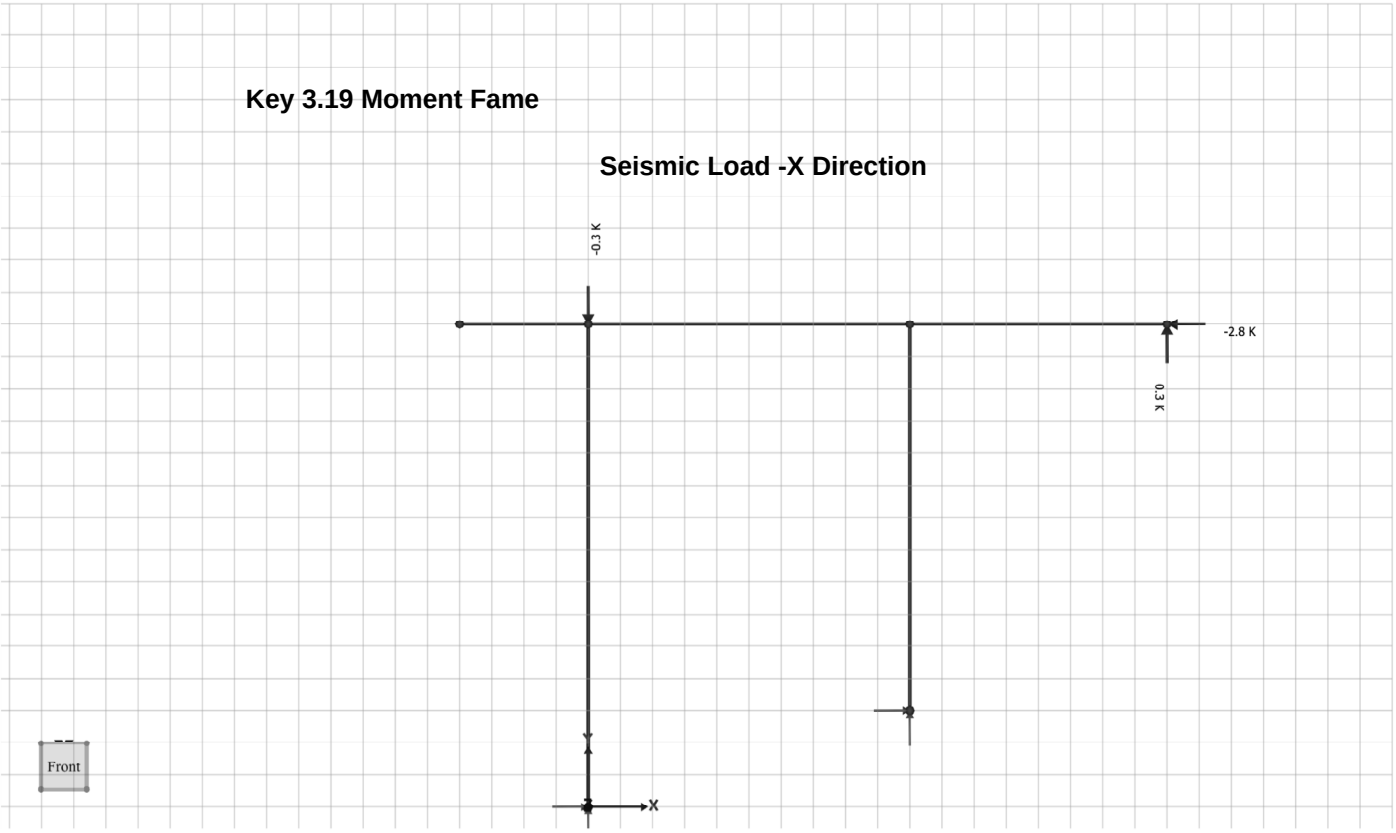
Key 3.19 Moment Frame

Seismic Load +X Direction



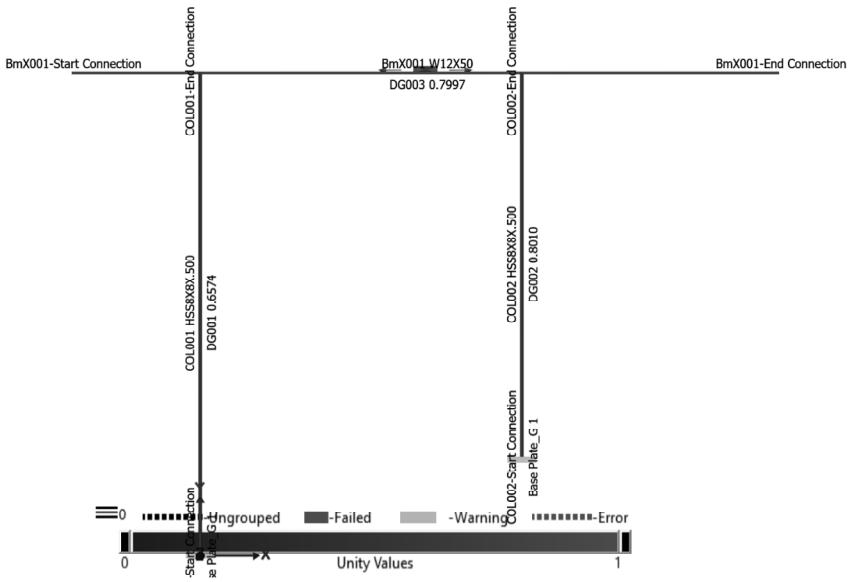
Key 3.19 Moment Fame

Seismic Load -X Direction



Key 3.19 Moment Frame

Unity Checks



Front

With all unities < 1.0, all members are adequate

Key 3.19 Moment Frame

TECINSTRUCT LLC
ROLAND HEIMISCH
E:\Projects 2023\Rich 2023\...\8520 structural\8520 MF Rev 111523.vap
Wednesday, November 15, 2023 12:41 PM

Story Drift

Column Global Drift

Member	Result Case	Total DX in	Drift X in	(Drift X)/L	Total DZ in	Drift Z in	(Drift Z)/L
COL001	1. 1.4D	0.2011	0.2011	0.0011	0.0000	0.0000	0.0000
COL001	2. 1.2D+1.6L+0.5Lr	0.4086	0.4086	0.0023	0.0000	0.0000	0.0000
COL001	3. 1.2D+1.6Lr+0.5W »+X	1.1443	1.1443	0.0064	0.0000	0.0000	0.0000
COL001	3. 1.2D+1.6Lr+0.5W »-X	-0.7988	0.7988	0.0044	0.0000	0.0000	0.0000
COL001	3. 1.2D+1.6Lr+L	0.2462	0.2462	0.0014	0.0000	0.0000	0.0000
COL001	4. 1.2D+0.5W+L+0.5Lr+Fa »+X	1.2181	1.2181	0.0068	0.0000	0.0000	0.0000
COL001	4. 1.2D+0.5W+L+0.5Lr+Fa »-X	-0.7249	0.7249	0.0040	0.0000	0.0000	0.0000
COL001	4. 1.2D+Di	0.1724	0.1724	0.0010	0.0000	0.0000	0.0000
COL001	4. 1.2D+W+L+0.5Lr »+X	2.1901	2.1901	0.0122	0.0000	0.0000	0.0000
COL001	4. 1.2D+W+L+0.5Lr »-X	-1.6960	1.6960	0.0094	0.0000	0.0000	0.0000
COL001	5. 0.9D+0.5W+Fa »+X	1.1012	1.1012	0.0061	0.0000	0.0000	0.0000
COL001	5. 0.9D+0.5W+Fa »-X	-0.8418	0.8418	0.0047	0.0000	0.0000	0.0000
COL001	5. 0.9D+Di+Wi	0.1293	0.1293	0.0007	0.0000	0.0000	0.0000
COL001	5. 0.9D+W »+X	2.0731	2.0731	0.0115	0.0000	0.0000	0.0000
COL001	5. 0.9D+W »-X	-1.8130	1.8130	0.0101	0.0000	0.0000	0.0000
COL001	6. 1.2D+E+L+0.2S »+X	0.8336	0.8336	0.0046	0.0000	0.0000	0.0000
COL001	6. 1.2D+E+L+0.2S »-X	-0.3401	0.3401	0.0019	0.0000	0.0000	0.0000
COL001	7. 0.9D+E »+X	0.7167	0.7167	0.0040	0.0000	0.0000	0.0000
COL001	7. 0.9D+E »-X	-0.4570	0.4570	0.0025	0.0000	0.0000	0.0000
COL001	D	0.1436	0.1436	0.0008	0.0000	0.0000	0.0000
COL001	D+0.75L+0.45W »+X	1.1291	1.1291	0.0063	0.0000	0.0000	0.0000
COL001	D+0.75L+0.45W »-X	-0.6196	0.6196	0.0034	0.0000	0.0000	0.0000
COL001	D+L	0.2913	0.2913	0.0016	0.0000	0.0000	0.0000
COL001	D+S	0.1436	0.1436	0.0008	0.0000	0.0000	0.0000
COL001	E+X	0.5874	0.5874	0.0033	0.0000	0.0000	0.0000
COL001	E-X	-0.5863	0.5863	0.0033	0.0000	0.0000	0.0000
COL001	L	0.1477	0.1477	0.0008	0.0000	0.0000	0.0000
COL001	Live	0.1477	0.1477	0.0008	0.0000	0.0000	0.0000
COL001	Seismic »+X	0.5874	0.5874	0.0033	0.0000	0.0000	0.0000
COL001	Seismic »-X	-0.5863	0.5863	0.0033	0.0000	0.0000	0.0000
COL001	W+X	1.9439	1.9439	0.0108	0.0000	0.0000	0.0000
COL001	W-X	-1.9422	1.9422	0.0108	0.0000	0.0000	0.0000
COL001	Wind »+X	1.1663	1.1663	0.0065	0.0000	0.0000	0.0000
COL001	Wind »-X	-1.1653	1.1653	0.0065	0.0000	0.0000	0.0000
COL002	1. 1.4D	0.2013	0.2013	0.0014	0.0000	0.0000	0.0000
COL002	2. 1.2D+1.6L+0.5Lr	0.4091	0.4091	0.0028	0.0000	0.0000	0.0000
COL002	3. 1.2D+1.6Lr+0.5W »+X	1.1437	1.1437	0.0079	0.0000	0.0000	0.0000
COL002	3. 1.2D+1.6Lr+0.5W »-X	-0.7991	0.7991	0.0055	0.0000	0.0000	0.0000
COL002	3. 1.2D+1.6Lr+L	0.2464	0.2464	0.0017	0.0000	0.0000	0.0000

Column Global Drift (continued)

Member	Result Case	Total DX in	Drift X in	(Drift X)/L	Total DZ in	Drift Z in	(Drift Z)/L
COL002	4. 1.2D+0.5W+L+0.5Lr+Fa »+X	1.2176	1.2176	0.0085	0.0000	0.0000	0.0000
COL002	4. 1.2D+0.5W+L+0.5Lr+Fa »-X	-0.7252	0.7252	0.0050	0.0000	0.0000	0.0000
COL002	4. 1.2D+Di	0.1725	0.1725	0.0012	0.0000	0.0000	0.0000
COL002	4. 1.2D+W+L+0.5Lr »+X	2.1887	2.1887	0.0152	0.0000	0.0000	0.0000
COL002	4. 1.2D+W+L+0.5Lr »-X	-1.6967	1.6967	0.0118	0.0000	0.0000	0.0000
COL002	5. 0.9D+0.5W+Fa »+X	1.1005	1.1005	0.0076	0.0000	0.0000	0.0000
COL002	5. 0.9D+0.5W+Fa »-X	-0.8422	0.8422	0.0058	0.0000	0.0000	0.0000
COL002	5. 0.9D+Di+Wi	0.1294	0.1294	0.0009	0.0000	0.0000	0.0000
COL002	5. 0.9D+W »+X	2.0716	2.0716	0.0144	0.0000	0.0000	0.0000
COL002	5. 0.9D+W »-X	-1.8138	1.8138	0.0126	0.0000	0.0000	0.0000
COL002	6. 1.2D+E+L+0.2S »+X	0.8334	0.8334	0.0058	0.0000	0.0000	0.0000
COL002	6. 1.2D+E+L+0.2S »-X	-0.3401	0.3401	0.0024	0.0000	0.0000	0.0000
COL002	7. 0.9D+E »+X	0.7163	0.7163	0.0050	0.0000	0.0000	0.0000
COL002	7. 0.9D+E »-X	-0.4572	0.4572	0.0032	0.0000	0.0000	0.0000
COL002	D	0.1438	0.1438	0.0010	0.0000	0.0000	0.0000
COL002	D+0.75L+0.45W »+X	1.1287	1.1287	0.0078	0.0000	0.0000	0.0000
COL002	D+0.75L+0.45W »-X	-0.6198	0.6198	0.0043	0.0000	0.0000	0.0000
COL002	D+L	0.2916	0.2916	0.0020	0.0000	0.0000	0.0000
COL002	D+S	0.1438	0.1438	0.0010	0.0000	0.0000	0.0000
COL002	E+X	0.5869	0.5869	0.0041	0.0000	0.0000	0.0000
COL002	E-X	-0.5866	0.5866	0.0041	0.0000	0.0000	0.0000
COL002	L	0.1478	0.1478	0.0010	0.0000	0.0000	0.0000
COL002	Live	0.1478	0.1478	0.0010	0.0000	0.0000	0.0000
COL002	Seismic »+X	0.5869	0.5869	0.0041	0.0000	0.0000	0.0000
COL002	Seismic »-X	-0.5866	0.5866	0.0041	0.0000	0.0000	0.0000
COL002	W+X	1.9423	1.9423	0.0135	0.0000	0.0000	0.0000
COL002	W-X	-1.9432	1.9432	0.0135	0.0000	0.0000	0.0000
COL002	Wind »+X	1.1654	1.1654	0.0081	0.0000	0.0000	0.0000
COL002	Wind »-X	-1.1659	1.1659	0.0081	0.0000	0.0000	0.0000

Max Drift = 2.2 inches

Allowable Drift = 0.025 x 12 ft x 12 in/ft = 3.6 inches > 2.2 >> OK

Key 3.19 Moment Frame, Base Plate under Column 001

Design Summary: Base Plate_G 1

Base Plate Design:
Thickness = 0.5 in
Fy = 36 Ksi

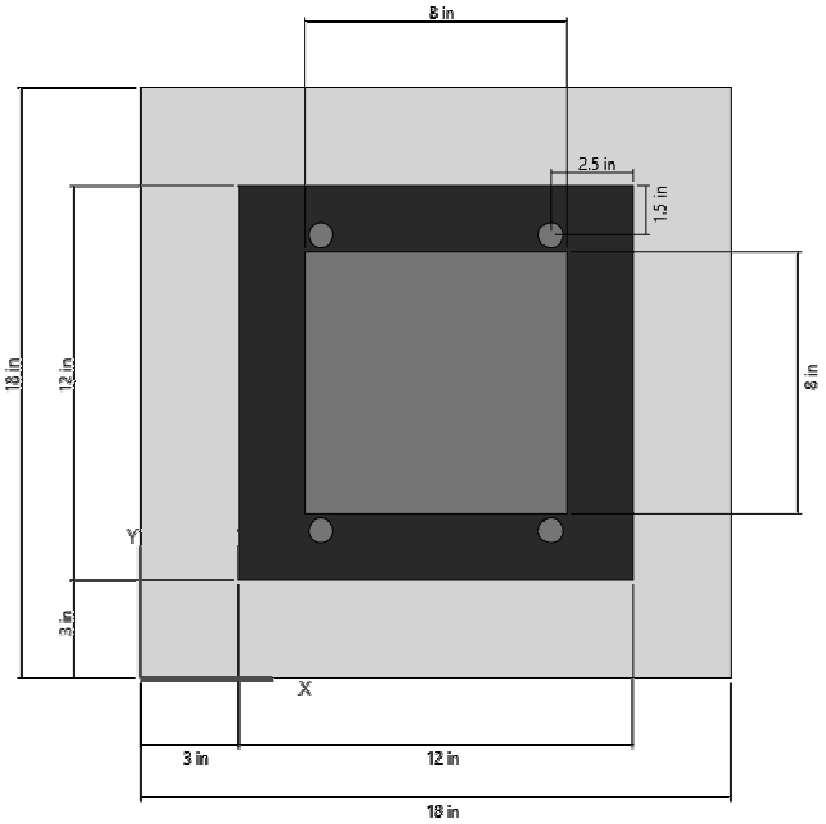
Anchorage Design:
Diameter = 0.75 in
Type = Headed Bolt
Embed = 12 in
Fy = 36 Ksi
Fu = 58 Ksi

Concrete Design:
F'c = 2.5 Ksi
Cracking = Yes

Steel Specification:
AISC 360-16

Concrete Specification:
ACI 318-14

Analysis Method:
AISC Design Guide One



Limit State	Load Key	Demand	Capacity	Unity Value
Concrete Bearing	18	0.28812 Ksi	1.3813 Ksi	0.209
Plate Bending	9	0.1545 K-ft	0.16875 K-ft	0.916
AnchorageTension	9			
Steel Strength		14.832 K	58.116 K	0.255
Concrete Breakout		14.832 K	>1.0E20	0.000
Concrete Pullout		14.832 K	59.46 K	0.249
Concrete Blowout		3.7079 K	14.932 K	0.248
Anchorage Shear	23			
Steel Strength		-6.6514 K	12.088 K	0.550
Concrete Breakout		6.6514 K	6.9774 K	0.953
Concrete Pryout		6.6514 K	31.995 K	0.208
Anchorage Interaction	23	-	-	0.953
Anchorage Detailing	-	-	-	OK
Plate Detailing	-	-	-	OK

Key 3.19 Moment Frame, Base Plate under Column 002

Design Summary: Base Plate_G 1

Base Plate Design:
Thickness = 0.5 in
Fy = 36 Ksi

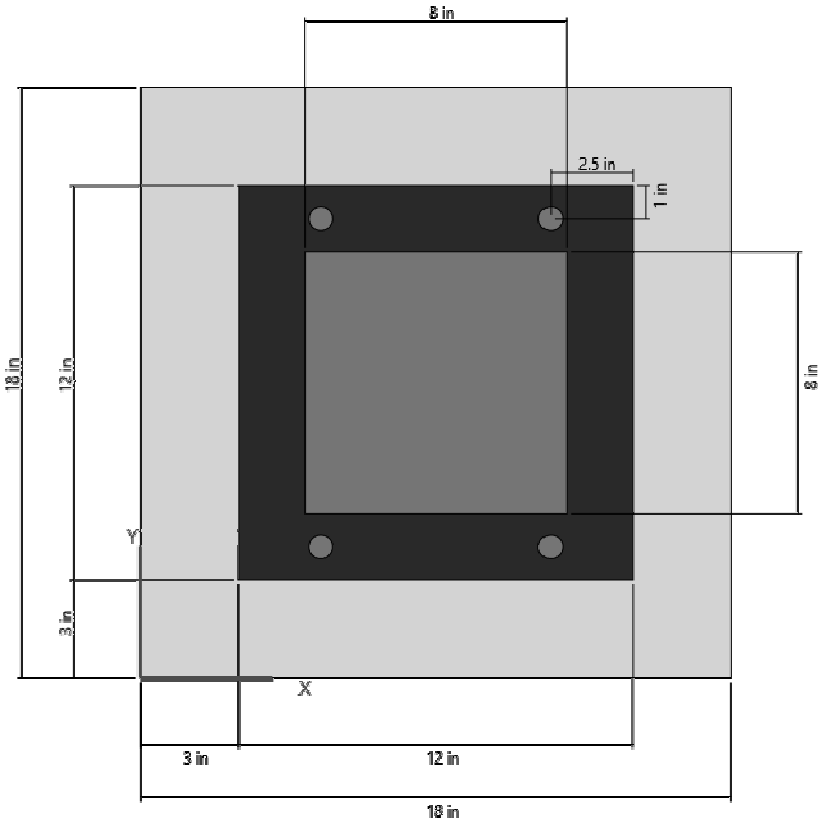
Anchorage Design:
Diameter = 0.75 in
Type = Headed Bolt
Embed = 12 in
Fy = 36 Ksi
Fu = 58 Ksi

Concrete Design:
F'c = 2.5 Ksi
Cracking = Yes

Steel Specification:
AISC 360-16

Concrete Specification:
ACI 318-14

Analysis Method:
AISC Design Guide One



Limit State	Load Key	Demand	Capacity	Unity Value
Concrete Bearing	18	0.28812 Ksi	2.0719 Ksi	0.139
Plate Bending	9	0.1545 K-ft	0.16875 K-ft	0.916
AnchorageTension	9			
Steel Strength		14.832 K	58.116 K	0.255
Concrete Breakout		14.832 K	>1.0E20	0.000
Concrete Pullout		14.832 K	59.46 K	0.249
Concrete Blowout		3.7079 K	14.186 K	0.261
Anchorage Shear	23			
Steel Strength		-6.6514 K	15.11 K	0.440
Concrete Breakout		6.6514 K	7.0789 K	0.940
Concrete Pryout		6.6514 K	31.072 K	0.214
Anchorage Interaction	23	-	-	0.940
Anchorage Detailing	-	-	-	OK
Plate Detailing	-	-	-	OK