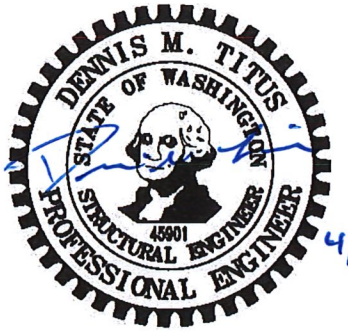
CG ENGINEERING

civil & structural
engineering & planning

STRUCTURAL CALCULATIONS

Brumbaugh Residence

4124 83rd Ave SE
Mercer Island, WA 98040



4/7/22

250 4th Ave S Ste 200
Edmonds, WA 98020
Phone: (425) 778-8500
Fax: (425) 778-5536

CG Project No.: 22032.10

Project Description

An existing house will be demolished and a new single-family home will be built. The house will be mostly a single story with a small second story and roof top deck. The roof will be framed with trusses and the lateral system will be conventional plywood shear walls. New foundations will be required.

Scope of Work

We will provide stamped structural calculations and construction drawings suitable for permit and construction.

Basis of Design

Roof	Dead	15 psf
	Snow	25 psf
Rooftop Deck	Dead	33 psf
	Snow	25 psf
	Live	60 psf
Floor	Dead	15 psf
	Live	40 psf

Wind Parameters

Wind Speed, 3-Sec Gust	98	MPH
Exposure Category	B	
Importance Factor, I_w	1	(Non-Essential Facility)
Mean Height	23	(FT Above Grade Elevation)

Seismic Parameters

V = Wp*[Sds/(R/Ie)] = Sds/(6.5/1) = Cs*Wp

Sds	0.946	
Importance Factor, Ie	1	(Non-Essential Facility)

Wp = Seismic Dead Weight of Stucture

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250 4th Ave South
Suite 200
Edmonds, WA 98020

Description: Project Summary		By: ERH	Date: 3/9/2022
		Checked	Date
		Scale: NTS	Sheet No.
Project: Brumbaugh Residence		Job No.: 22032.10	

Gravity Design Loads

Roof DL

Roofing Material		2.5	psf
3/4 Sheathing		2.3	psf
Insulation		1.0	psf
5/8 Gypsum		2.8	psf
Trusses @ 24" OC		3.0	psf
M/E		1.0	psf
Misc		1.5	psf
		14.1	psf
	USE	15.0	psf

Rooftop Deck DL

Pavers		20.0	psf
Fiberglass		2.0	psf
3/4 Sheathing		2.3	psf
Insulation		1.0	psf
5/8 Gypsum		2.8	psf
2x12 @ 24" OC		2.2	psf
M/E		1.0	psf
Misc		1.5	psf
		32.8	psf
	USE	33.0	psf

Floor DL

Flooring Material		2.0	psf
3/4 Sheathing		2.3	psf
Insulation		1.0	psf
5/8 Gypsum		2.8	psf
2x10 @ 16" OC		2.8	psf
M/E		1.0	psf
Misc		1.5	psf
		13.4	psf
	USE	15.0	psf

Exterior Walls

Siding		2.0	psf
1/2 Sheathing		1.5	psf
Insulation		1.0	psf
5/8 Gypsum		2.8	psf
2x6 @ 16" OC		1.7	psf
Misc		1.0	psf
		10.0	psf
	USE	10.0	psf

Roof LL (Snow)	25.0	psf
Floor LL	40.0	psf
Deck LL	60.0	psf

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250 4th Ave. South
Suite 200
Edmonds, WA 98020

Description: Gravity Design Loads		By: ERH	Date: 03/17/22
		Checked	Date
		Scale	Sheet No.
Project: Brumbaugh Residence		Job No.: 22032.10	

Beam Span Table - Roof Beams

Allowable Uniform Distributed Load in Pounds Per Lineal Foot (PLF)																	
	Span Length in Feet																
Beam	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4x6 HF #2	937	600	417	306	234	185	150	124	104	-	-	-	-	-	-	-	-
3 1/2 x 5 1/2 LSL	1541	986	685	503	369	259	189	142	109	-	-	-	-	-	-	-	-
4x8 HF #2	1461	1038	721	529	405	320	259	214	180	154	132	115	101	-	-	-	-
3 1/2 x 7 1/4 LSL	2616	1674	1163	854	654	517	419	321	247	195	156	127	104	-	-	-	-
6x8 DF #2	2162	1384	961	706	541	427	346	286	240	205	176	154	135	120	107	-	-
2 11/16 x 9 1/4 PSL	2405	1924	1603	1374	1193	942	763	631	530	452	378	307	253	211	178	151	130
4x10 HF #2	1863	1490	1084	796	610	482	390	322	271	231	199	173	152	135	120	108	-
4x12 HF #2	2266	1812	1469	1080	827	653	529	437	367	313	270	235	207	183	163	147	132
5 1/4 x 9 1/4 PSL	5399	4319	3600	3085	2677	2115	1713	1416	1183	931	745	606	499	416	351	298	256
2 11/16 x 9 1/2 PSL	2470	1976	1647	1411	1235	991	802	663	557	475	409	334	275	229	193	164	141
3 1/2 x 9 1/2 LSL	3634	2907	2423	1893	1449	1145	927	766	643	506	405	329	271	226	191	162	139
3 1/2 x 9 1/2 PSL	3700	2960	2467	2114	1850	1482	1201	992	834	674	540	439	362	302	254	216	185
6x10 DF #2	3404	2219	1541	1132	867	685	555	458	385	328	283	247	217	192	171	154	139
5 1/4 x 9 1/2 PSL	5545	4436	3697	3169	2773	2224	1802	1489	1251	1011	810	658	543	452	381	324	278
7 x 9 1/2 PSL	7390	5912	4927	4223	3695	2966	2402	1985	1668	1349	1080	878	723	603	508	432	370
2 11/16 x 11 1/4 PSL	2925	2340	1950	1671	1463	1300	1104	912	767	653	563	491	431	382	325	276	237
3 1/2 x 11 1/4 LSL	4301	3441	2867	2458	2001	1581	1281	1058	889	758	653	547	450	375	316	269	231
3 1/2 x 11 1/4 PSL	4382	3505	2921	2504	2191	1947	1653	1366	1148	978	843	729	600	501	422	359	307
6x12 DF #2	4123	3253	2259	1660	1271	1004	813	672	565	481	415	361	318	281	251	225	203
5 1/4 x 11 1/4 PSL	6567	5253	4378	3752	3283	2918	2480	2050	1722	1468	1265	1097	904	754	635	540	463
2 11/16 x 11 7/8 PSL	3085	2468	2057	1763	1543	1371	1222	1010	849	723	624	543	478	423	377	324	278
3 1/2 x 11 7/8 LSL	4543	3634	3028	2596	2220	1754	1420	1174	986	841	725	631	530	441	372	316	271
3 1/2 x 11 7/8 PSL	4623	3698	3082	2642	2312	2055	1831	1513	1271	1083	934	814	709	591	498	423	363
5 1/4 x 11 7/8 PSL	-	5548	4623	3963	3467	3082	2747	2270	1908	1626	1402	1221	1063	887	747	635	544
7 x 11 7/8 PSL	-	-	6160	5280	4620	4107	3663	3027	2543	2167	1869	1628	1411	1176	991	842	722

Notes:

1. **This table is applicable for Simple Span beams with uniformly distributed loads (no point loads)**
2. **Table values are based on the limiting beam shear & moment capacities, as well as deflection**
3. **The deflection limit used in the above table is (L/180 Total Load) and (L/240 Snow Load)**
4. **This table is applicable for W_{LL}/W_{DL} <= 3.0**
5. **Table values include the Size Factor (C_F) and the Load Duration Factor (C_D)**

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020

Description: Beam Span Table		By: ERH	Date: 03/02/22
		Checked	Date
		Scale	Sheet No.
Project: Brumbaugh Residence		Job No.: 22032.10	

Beam Span Table - Floor Beams

Allowable Uniform Distributed Load in Pounds Per Lineal Foot (PLF)																	
	Span Length in Feet																
Beam	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
4x6 HF #2	815	522	362	266	204	160	117	-	-	-	-	-	-	-	-	-	-
3 1/2 x 5 1/2 LSL	1340	858	546	344	230	162	118	-	-	-	-	-	-	-	-	-	-
4x8 HF #2	1270	902	627	460	353	279	226	186	155	122	-	-	-	-	-	-	-
3 1/2 x 7 1/4 LSL	2275	1456	1011	743	522	367	267	201	155	122	-	-	-	-	-	-	-
6x8 DF #2	1880	1203	836	614	470	371	301	249	209	178	153	134	114	-	-	-	-
2 11/16 x 9 1/4 PSL	2405	1924	1603	1374	1193	889	648	487	375	295	236	192	158	132	111	-	-
4x10 HF #2	1620	1296	942	692	530	419	339	280	236	201	173	151	133	113	-	-	-
3 1/2 x 9 1/4 PSL	3130	2504	2087	1789	1553	1169	852	640	493	388	310	252	208	173	146	124	106
5 1/4 x 9 1/4 PSL	4695	3756	3130	2683	2328	1753	1278	960	739	582	466	379	312	260	219	186	160
2 11/16 x 9 1/2 PSL	2470	1976	1647	1411	1235	965	704	529	407	320	256	209	172	143	121	103	-
3 1/2 x 9 1/2 LSL	3160	2528	2107	1646	1260	953	694	522	402	316	253	206	170	141	119	101	-
3 1/2 x 9 1/2 PSL	3215	2572	2143	1837	1608	1270	926	696	536	421	337	274	226	188	159	135	116
6x10 DF #2	2960	1930	1340	984	754	596	482	399	335	285	246	214	188	167	149	134	118
5 1/4 x 9 1/2 PSL	4825	3860	3217	2757	2413	1905	1389	1043	804	632	506	412	339	283	238	202	174
7 x 9 1/2 PSL	6430	5144	4287	3674	3215	2540	1852	1391	1072	843	675	549	452	377	318	270	231
2 11/16 x 11 1/4 PSL	2925	2340	1950	1671	1463	1300	1104	890	686	539	432	351	289	241	203	173	148
3 1/2 x 11 1/4 LSL	3740	2992	2493	2137	1740	1375	1114	866	667	525	420	342	281	235	198	168	144
3 1/2 x 11 1/4 PSL	3810	3048	2540	2177	1905	1693	1438	1155	889	700	560	455	375	313	264	224	192
6x12 DF #2	3585	2829	1964	1443	1105	873	707	584	491	418	361	314	276	245	218	196	177
5 1/4 x 11 1/4 PSL	5710	4568	3807	3263	2855	2538	2157	1739	1340	1054	844	686	565	471	397	337	289
2 11/16 x 11 7/8 PSL	3085	2468	2057	1763	1543	1371	1222	1010	804	632	506	412	339	283	238	202	174
3 1/2 x 11 7/8 LSL	3950	3160	2633	2257	1930	1525	1235	1018	784	617	494	402	331	276	232	198	169
3 1/2 x 11 7/8 PSL	4020	3216	2680	2297	2010	1787	1592	1316	1050	826	661	538	443	369	311	265	227
5 1/4 x 11 7/8 PSL	-	4824	4020	3446	3015	2680	2389	1974	1575	1239	992	807	665	554	467	397	340
7 x 11 7/8 PSL	-	-	5357	4591	4018	3571	3185	2632	2090	1644	1316	1070	882	735	619	526	451

Notes:

1. **This table is applicable for Simple Span beams with uniformly distributed loads (no point loads)**
2. **Table values are based on the limiting beam shear & moment capacities, as well as deflection**
3. **The deflection limit used in the above table is (L/240 Total Load) and (L/360 Live Load)**
4. **This table is applicable for W_{LL}/W_{DL} <= 4.0**
5. **Table values include the Size Factor (C_F)**

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020

Description: Beam Span Table		By: ERH	Date: 03/02/22
		Checked	Date
		Scale	Sheet No.
Project: Brumbaugh Residence		Job No.: 22032.10	

BEARING WALL TABLE

IBC 2018, NDS 2018

Date modified 10-2-14

	ALLOWABLE LOAD (PLF)									
	8ft			9ft			10ft			
STUD	8" O.C.	12" O.C.	16" O.C.	8" O.C.	12" O.C.	16" O.C.	8" O.C.	12" O.C.	16" O.C.	
2x4 HF Stud Grade	3191	2127	1596	2640	1760	1320	2203	1469	1101	
2x4 HF #2	3704	2469	1852	2991	1994	1496	2458	1639	1229	
2x4 HF #1	***3987***	***2658***	***1993***	3465	2310	1733	2855	1903	1427	
2x4 DF Stud Grade	3620	2413	1810	3014	2010	1507	2525	1683	1263	
2x4 DF #2	4474	2983	2237	3635	2424	1818	2999	1999	1499	
2x4 DF #1	4808	3205	2404	3901	2601	1950	3215	2143	1607	
3x4 HF Stud Grade	5318	3546	2659	4401	2934	2200	3672	2448	1836	
3x4 HF #2	***6113***	***4075***	***3056***	4986	3324	2493	4097	2732	2049	
3x4 HF #1	***6113***	***4075***	***3056***	5775	3850	2888	4758	3172	2379	
3x4 DF Stud Grade	6033	4022	3016	5024	3349	2512	4209	2806	2104	
3x4 DF #2	7457	4971	3728	6059	4039	3030	4998	3332	2499	
3x4 DF #1	8013	5342	4007	6501	4334	3251	5358	3572	2679	
2x6 HF Stud Grade	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	
2x6 HF #2	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	
2x6 HF #1	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	***6265***	***4177***	***3132***	
2x6 DF Stud Grade	8701	5800	4350	8084	5390	4042	7396	4930	3698	
2x6 DF #2	***9668***	***6445***	***4834***	***9668***	***6445***	***4834***	***9668***	***6445***	***4834***	
2x6 DF #1	***9668***	***6445***	***4834***	***9668***	***6445***	***4834***	***9668***	***6445***	***4834***	

Notes:

1. This table assumes that the studs are braced by either sheathing or gypsum wall board.
2. Values shown are in plf and represent 100% bearing capacity based on the February 2018 report by American Wood Council for "Fire-Resistance-Rated Wood-Frame Wall and Floor/Ceiling Assemblies"
3. ***Bold*** and ***italicized*** values are controlled by bottom plate bearing capacity.
4. All DF studs assume a DF bottom plate.
5. All appropriate C_F and C_b factors have been included.
6. Engineer should apply the Ci factor to the allowable loads shown when pressure treated studs are necessary.
7. Engineer should consider out of Plane loads where appropriate.

ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020

Description		By ERH	Date 03/02/22
	Bearing Wall Capacity Table	Checked	Date
		Scale	Sheet No.
Project	Brumbaugh Residence	Job No.	
		22032.10	

HF Column & HF Sill Plate Capacity TABLE

IBC 2018, NDS 2018

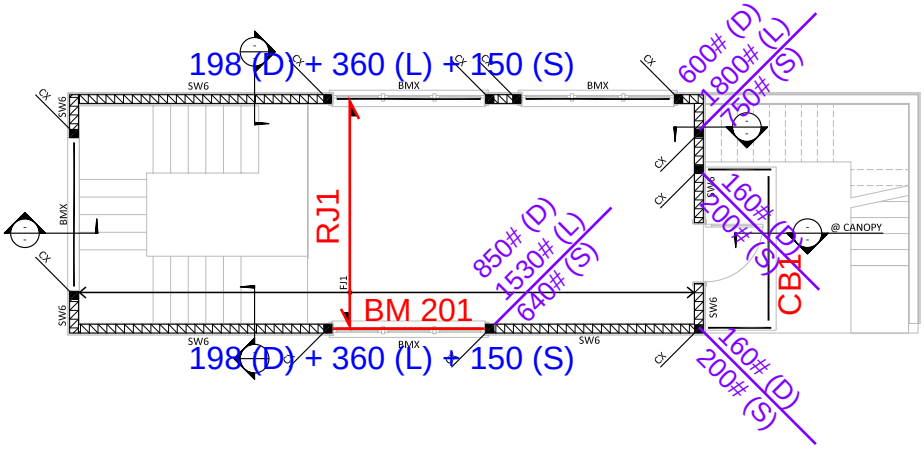
Date modified 10-2-14

	6	7	8	9	10	11	12	13	14	15	16
(2) 2x4 HF Stud	5,149	**4,121**	**3,311**	**2,693**	**2,224**	**1,862**	**1,579**	**1,355**	**1,175**	**1,028**	**906**
P_{SILL}	**4,784**	-	-	-	-	-	-	-	-	-	-
(3) 2x4 HF Stud	9,220	7,723	**6,382**	**5,281**	**4,406**	**3,715**	**3,166**	**2,726**	**2,369**	**2,076**	**1,834**
P_{SILL}	**6,910**	**6,910**	**-**	-	-	-	-	-	-	-	-
(4) 2x4 HF Stud	12,294	10,298	8,510	**7,041**	**5,875**	**4,953**	**4,221**	**3,635**	**3,159**	**2,769**	**2,445**
P_{SILL}	**8,505**	**8,505**	**8,505**	-	-	-	-	-	-	-	-
(2) 3x4 HF Stud	10,245	8,581	**7,091**	**5,868**	**4,896**	**4,128**	**3,518**	**3,029**	**2,632**	**2,307**	**2,038**
P_{SILL}	**7,619**	**7,619**	**-**	-	-	-	-	-	-	-	-
(3) 3x4 HF Stud	15,367	12,872	10,637	**8,802**	**7,343**	**6,191**	**5,277**	**4,543**	**3,948**	**3,461**	**3,057**
P_{SILL}	**10,631**	**10,631**	**10,631**	-	-	-	-	-	-	-	-
(2) 2x6 HF Stud	7,951	**6,405**	**5,164**	**4,210**	**3,481**	**2,917**	**2,476**	**2,125**	**1,843**	**1,613**	**1,423**
P_{SILL}	**7,518**	-	-	-	-	-	-	-	-	-	-
(3) 2x6 HF Stud	16,730	15,297	13,636	11,927	**10,333**	**8,934**	**7,746**	**6,750**	**5,918**	**5,221**	**4,634**
P_{SILL}	**10,859**	**10,859**	**10,859**	**10,859**	**-**	-	-	-	-	-	-
(4) 2x6 HF Stud	23,902	22,755	21,314	19,614	17,764	15,903	14,146	**12,558**	**11,158**	**9,942**	**8,891**
P_{SILL}	**13,365**	**13,365**	**13,365**	**13,365**	**13,365**	**13,365**	**13,365**	-	-	-	-
4x6 HF #2	14,409	11,327	9,009	**7,286**	**5,993**	**5,006**	**4,239**	**3,633**	**3,147**	**2,751**	**2,425**
P_{SILL}	**8,328**	**8,328**	**8,328**	-	-	-	-	-	-	-	-
4x8 HF #2	18,744	14,808	11,809	**9,566**	**7,876**	**6,583**	**5,577**	**4,782**	**4,142**	**3,622**	**3,193**
P_{SILL}	**10,277**	**10,277**	**10,277**	-	-	-	-	-	-	-	-
4x10 HF #2	23,562	18,717	14,972	**12,150**	**10,015**	**8,377**	**7,101**	**6,090**	**5,277**	**4,615**	**4,069**
P_{SILL}	**13,112**	**13,112**	**13,112**	-	-	-	-	-	-	-	-
6x6 DF #2	19,595	18,889	17,995	16,908	15,659	14,315	**12,960**	**11,665**	**10,475**	**9,407**	**8,463**
P_{SILL}	**13,087**	**13,087**	**13,087**	**13,087**	**13,087**	**13,087**	**-**	-	-	-	-
6x8 DF #2	25,830	24,899	23,721	22,288	20,642	18,870	17,083	**15,377**	**13,808**	**12,400**	**11,156**
P_{SILL}	**16,149**	**16,149**	**16,149**	**16,149**	**16,149**	**16,149**	**16,149**	-	-	-	-
6x10 DF #2	28,621	27,790	26,739	25,450	23,929	22,224	**20,420**	**18,614**	**16,885**	**15,285**	**13,835**
P_{SILL}	**20,604**	**20,604**	**20,604**	**20,604**	**20,604**	**20,604**	-	-	-	-	-

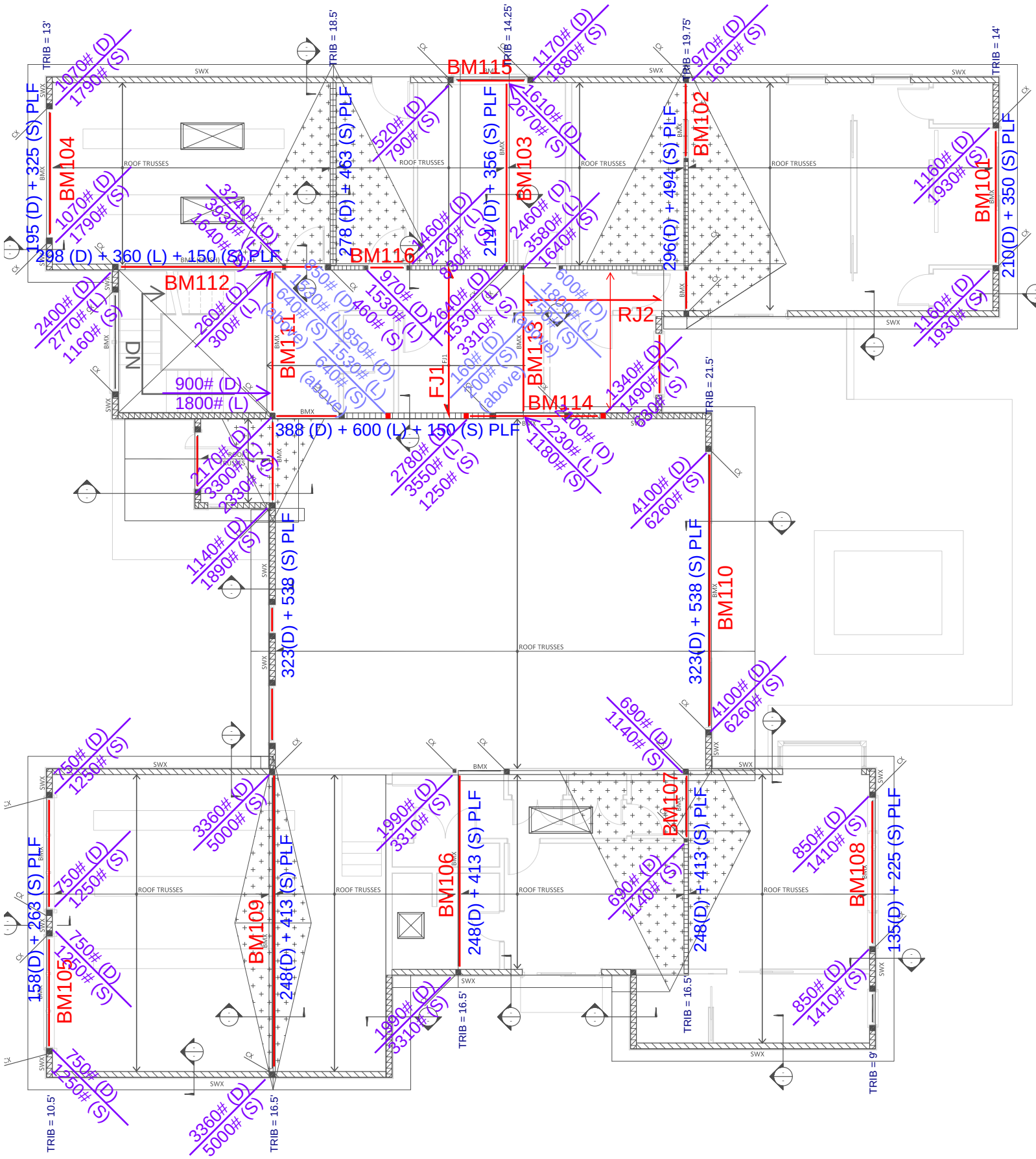
ENGINEERING
250 4th Ave. South
Suite 200

Description		By ERH	Date 03/02/22
Wood Column Capacity Table		Checked	Date
		Scale	Sheet No.
Project Brumbaugh Residence		Job No. 22032.10	

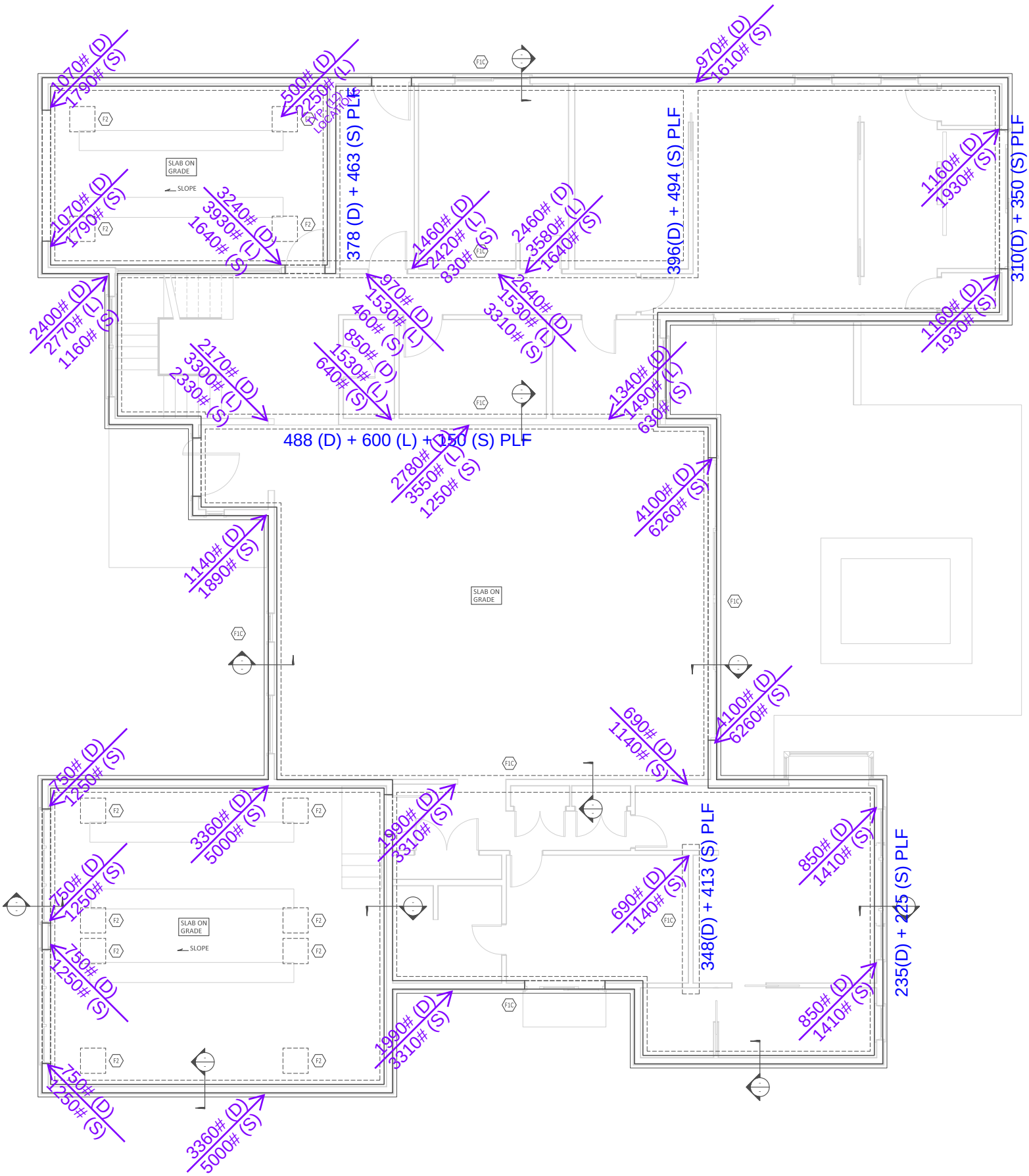
GRAVITY KEY PLAN - ROOFTOP DECK



GRAVITY KEY PLAN - ROOF

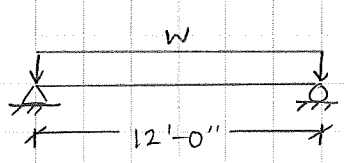


GRAVITY KEY PLAN - FOUNDATION



GRAVITY DESIGN

RJ1



D = 33 PSF
w: L = 60 PSF
S = 25 PSF

PER WOODWORKS:

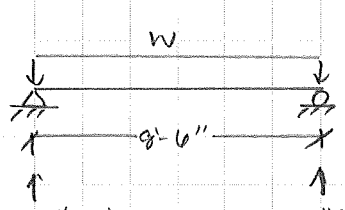
2x12 HF #2 @ 16" O.C.

f_v/F'_v = 37% V_{max} = 744#

f_b/F'_b = 87% M_{max} = 2.2 k-ft

δ_{TOT} = L/553 = 0.26"

BM 201



850#(D)
1530#(L)
640#(S)

850#(D)
1530#(L)
640#(S)

TRIB = 6'

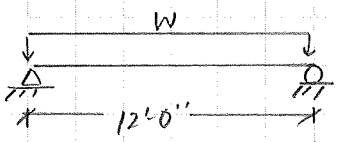
D = 198 PLF
w: L = 360 PLF
S = 150 PLF

PER BEAM SPAN TABLE,

3 1/2 x 9 1/2 PSL

w_{ALLOW} = 1482 PLF OK ✓

FJ1



D = 15 PSF
w: L = 40 PSF

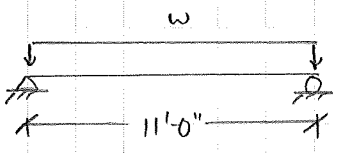
PER WOODWORKS:

2x10 HF #2 @ 16" O.C.

f_v/F'_v = 27% V_{max} = 440#

f_b/F'_b = 69% M_{max} = 1.32 k-ft

RJ2



w = D = 33 PSF
L = 60 PSF
S = 25 PSF

PER WOODWORKS:

1 3/4 x 5 1/2 2.0E LVL @ 16" O.C.

f_v/F'_v = 27%

f_b/F'_b = 61%

δ_{TOT} = L/275 = 0.48"

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: GRAVITY CALCULATIONS	By: ERH	Date: 3/2/22
		Checked	Date
		Scale: NTS	Sheet No.
	Project: BRUMBAUGH RESIDENCE	Job No.: 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 2, 2022 13:24	**PROJECT** RJ1

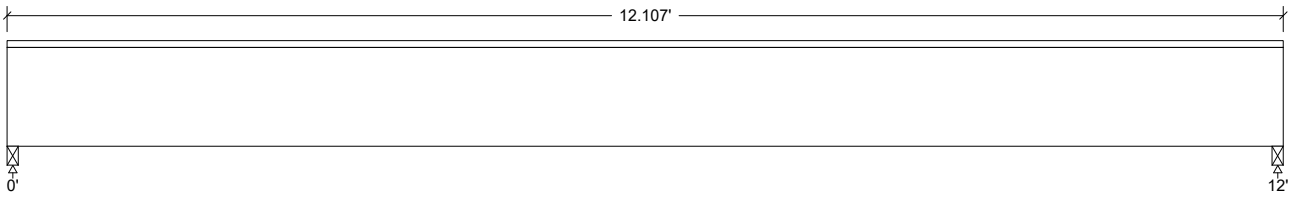
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				33.00(16.0")		psf
Load2	Live	Full Area				60.00(16.0")		psf
Load3	Snow	Full Area				25.00(16.0")		psf

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



Unfactored:			
Dead	266		266
Live	484		484
Snow	202		202
Factored:			
Total	781		781
Bearing:			
Capacity			
Joist	781		781
Support	1506		1506
Des ratio			
Joist	1.00		1.00
Support	0.52		0.52
Load comb	#3		#3
Length	1.29		1.29
Min req'd	1.29		1.29
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.25		1.25
Fcp sup	625		625

RJ1

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

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

Roof joist spaced at 16.0" c/c; Total length: 12.13'; Clear span: 11.875'; Volume = 1.4 cu.ft.

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

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 55	Fv' = 150	psi	fv/Fv' = 0.37
Bending(+)	fb = 847	Fb' = 977	psi	fb/Fb' = 0.87
Live Defl'n	0.17 = L/840	0.60 = L/240	in	0.29
Total Defl'n	0.26 = L/553	0.80 = L/180	in	0.33

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.00	1.00	1.00	1.000	1.000	-	1.15	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.47 million		1.00	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 = 744, V design = 621 lbs; M(+) = 2232 lbs-ft
  EIy = 231.37 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	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 2, 2022 16:15	**PROJECT** FJ1

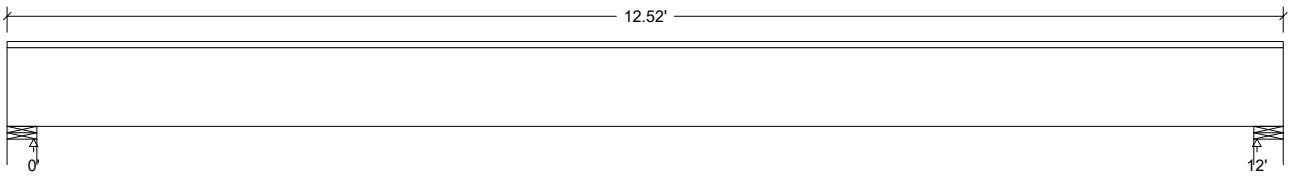
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				15.00(16.0")		psf
Load2	Live	Full Area				40.00(16.0")		psf

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



Unfactored:			
Dead	125		125
Live	334		334
Factored:			
Total	459		459
Bearing:			
Capacity			
Joist	2126		2126
Support	2658		2658
Des ratio			
Joist	0.22		0.22
Support	0.17		0.17
Load comb	#2		#2
Length	3.50		3.50
Min req'd	0.76		0.76
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	-		-
Fcp sup	405		405

Bearing for wall supports is perpendicular-to-grain bearing on top plate. No stud design included.

FJ1

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

Supports: All - Lumber Stud Wall, Hem-Fir Stud

Floor joist spaced at 16.0" c/c; Total length: 12.5'; Clear span: 11.938'; Volume = 1.2 cu.ft.

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

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 41	Fv' = 150	psi	fv/Fv' = 0.27
Bending(+)	fb = 741	Fb' = 1075	psi	fb/Fb' = 0.69
Live Defl'n	0.19 = L/744	0.40 = L/360	in	0.48
Total Defl'n	0.27 = L/541	0.60 = L/240	in	0.44

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.00	1.00	1.00	1.000	1.100	-	1.15	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	2
Emin'	0.47 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 = 440, V design = 381 lbs; M(+) = 1320 lbs-ft
  EIy = 128.61 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	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 13:33	**PROJECT** RJ2

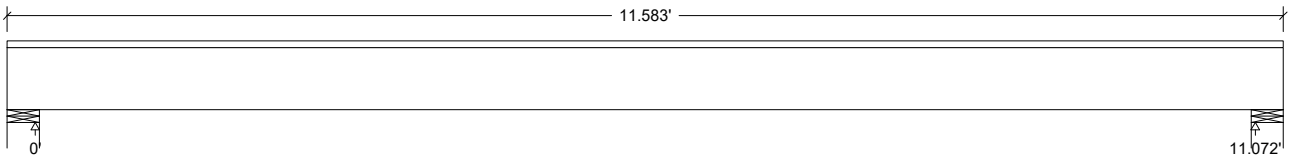
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				33.00(16.0")		psf
Load2	Live	Full Area				60.00(16.0")		psf
Load3	Snow	Full Area				25.00(16.0")		psf

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



Unfactored:			
Dead	255		255
Live	463		463
Snow	193		193
Factored:			
Total	747		747
Bearing:			
Capacity			
Joist	4594		4594
Support	3012		3012
Des ratio			
Joist	0.16		0.16
Support	0.25		0.25
Load comb	#3		#3
Length	3.50		3.50
Min req'd	0.87**		0.87**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	-		-
Fcp sup	405		405

**Minimum bearing length governed by the required width of the supporting member.
Bearing for wall supports is perpendicular-to-grain bearing on top plate. No stud design included.

LVL n-ply, 2.0E, 2500Fb, 1-3/4"x6-3/4", 1-ply
Supports: All - Lumber Stud Wall, Hem-Fir Stud
Floor joist spaced at 16" c/c; Total length: 11.56'; Clear span: 11'; Volume = 1.0 cu.ft.
Lateral support: top = continuous, bottom = at supports; Repetitive factor: applied where permitted (refer to online help);
This section PASSES the design code check.

WARNING: This CUSTOM SIZE is not in the database. Refer to online help.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 78	Fv' = 285	psi	fv/Fv' = 0.27
Bending(+)	fb = 1716	Fb' = 2812	psi	fb/Fb' = 0.61
Live Defl'n	0.32 = L/418	0.37 = L/360	in	0.86
Total Defl'n	0.48 = L/275	0.55 = L/240	in	0.87

Additional Data:

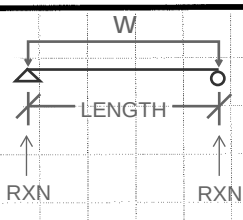
FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	285	1.00	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2500	1.00	-	1.00	1.000	1.081	-	1.04	1.00	-	2
Fcp'	750	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.1 million		-	1.00	-	-	-	-	1.00	-	3
Eminy'	1.06 million		-	1.00	-	-	-	-	1.00	-	3

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 = 686, V design = 612 lbs; M(+) = 1900 lbs-ft
EIy = 94.18 lb-in^2 GA = 1.55e06 lb
"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. System factor KH may not apply to field-assembled multi-ply beams.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.
5. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
6. BUILT-UP SCL: Contact manufacturer for connection details when side-loaded or when loads are not applied equally to all plies.
7. SCL: Shear deflection is calculated using true modulus of elasticity E and shear modulus G = E/16.

BEAM DESIGN



SIMPLY SUPPORTED BEAMS WITH UNIFORMLY DISTRIBUTED LOADS
SIZED USING BEAM SPAN TABLES

BEAM ID	LENGTH	TRIB	W (PLF)	SIZE	RXN (K)
BM 101	11'-0"	14'-0"	210 (D) + 350 (S)	3 1/2 X 9 1/2 PSL	1.16 (D) + 1.93 (S)
BM 102	6'-6"	19'-9"	296 (D) + 494 (S)	4X10 HF #2	0.97 (D) + 1.61 (S)
BM 103	15'-0"	14'-3"	214 (D) + 356 (S)	5 1/4 X 9 1/2 PSL	1.61 (D) + 2.67 (S)
BM 104	11'-0"	13'-0"	195 (D) + 325 (S)	3 1/2 X 9 1/2 PSL	1.07 (D) + 1.79 (S)
BM 105	9'-6"	10'-6"	158 (D) + 263 (S)	4X10 HF #2	0.75 (D) + 1.25 (S)
BM 106	16'-0"	16'-5"	248 (D) + 413 (S)	3 1/2 X 11 7/8 PSL	1.99 (D) + 3.31 (S)
BM 107	5'-6"	16'-5"	248 (D) + 413 (S)	4X8 HF #2	0.69 (D) + 1.14 (S)
BM 108	12'-6"	9'-0"	135 (D) + 225 (S)	3 1/2 X 9 1/2 PSL	0.85 (D) + 1.41 (S)

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250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
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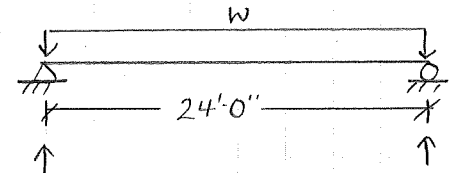
Description		By ERH	Date 03/02/22
GRAVITY - BEAM DESIGN		Checked	Date
		Scale NTS	Sheet No.
Project BRUMBAUGH RESIDENCE		Job No. 22032.10	

GRAVITY DESIGN

BM109

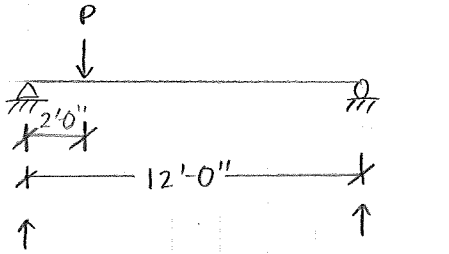


3360# (D)
5000# (S)

TRIB = 16.5'
W: D = 15 PSF (16.5') = 248 PLF
S = 25 PSF (16.5') = 413 PLF

PER WOODWORKS: **5 1/4 x 18" PSL**
f_v/F'_v = 34%
f_b/F'_b = 75%
δ_{TOT} = L/285 = 1.01"

BM111



860#(D)
1500#(L)

260#(D)
300#(L)

STAIR AREA = 90 SF/2 = 45 SF
P: D = 20 PSF (45 SF) = 900#(D)
L = 40 PSF (45 SF) = 1800#(L)

PER WOODWORKS: **5 1/4 x 11 1/4 PSL**
f_v/F'_v = 21%
f_b/F'_b = 18%
δ_{TOT} < L/999

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250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description		By ERH	Date 3/4/22
GRAVITY DESIGN		Checked	Date
		Scale NTS	Sheet No.
Project	BRUMBAUGH RESIDENCE	Job No. 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 4, 2022 17:31	**PROJECT** Beam109

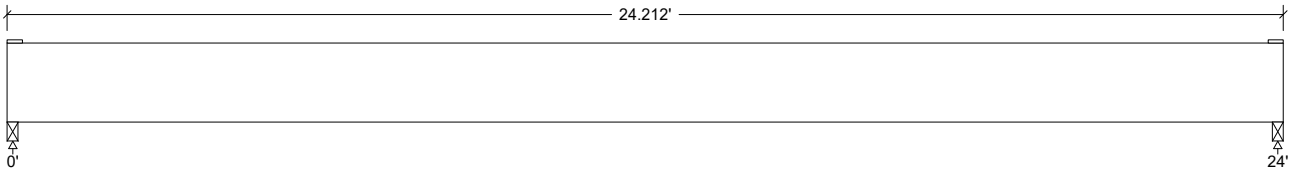
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Dead	Full UDL				248.0		plf
Load2	Snow	Full UDL				413.0		plf
Self-weight	Dead	Full UDL				29.5		plf

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



Unfactored:			
Dead	3357		3357
Snow	5000		5000
Factored:			
Total	8357		8357
Bearing:			
Capacity			
Beam	8357		8357
Support	8953		8953
Des ratio			
Beam	1.00		1.00
Support	0.93		0.93
Load comb	#2		#2
Length	2.55		2.55
Min req'd	2.55		2.55
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

PSL, 2.0E, 2.0E, 5-1/4"x18"
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 24.19'; Clear span: 23.813'; Volume = 15.9 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 = 114	Fv' = 334	psi	fv/Fv' = 0.34
Bending(+)	fb = 2104	Fb' = 2821	psi	fb/Fb' = 0.75
Live Defl'n	0.60 = L/476	1.20 = L/240	in	0.50
Total Defl'n	1.01 = L/285	1.60 = L/180	in	0.63

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	290	1.15	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2900	1.15	-	1.00	0.846	0.956	-	1.00	1.00	-	2
Fcp'	625	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	1.04 million		-	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 = 8286, V design = 7177 lbs; M(+) = 49718 lbs-ft
EIy = 5103.00 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 = 1.0 dead + "live"
Lateral stability(+): Lu = 24.00' Le = 44.19' RB = 18.6

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.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 4, 2022 17:45	**PROJECT** Beam 111

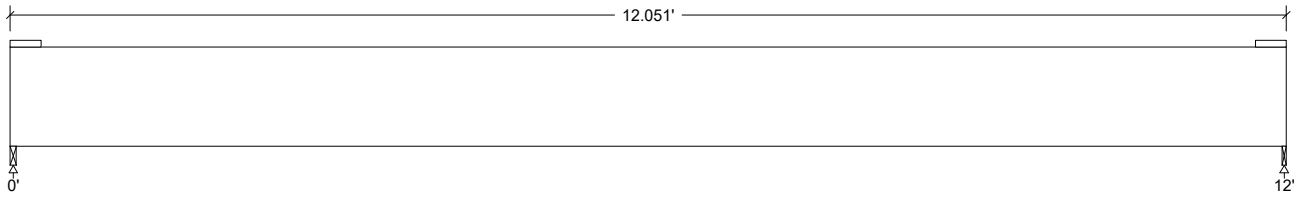
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Dead	Point		2.03		900		lbs
Load2	Live	Point		2.03		1800		lbs
Self-weight	Dead	Full UDL				18.5		plf

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



Unfactored:			
Dead	861		261
Live	1500		300
Factored:			
Total	2361		561
Bearing:			
Capacity			
Beam	2361		1641
Support	2529		1758
Des ratio			
Beam	1.00		0.34
Support	0.93		0.32
Load comb	#2		#2
Length	0.72		0.50*
Min req'd	0.72		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

BEAM 111

PSL, 2.0E, 2.0E, 5-1/4"x11-1/4"

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 12.06'; Clear span: 11.938'; Volume = 4.9 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 = 60	Fv' = 290	psi	fv/Fv' = 0.21
Bending(+)	fb = 508	Fb' = 2872	psi	fb/Fb' = 0.18
Live Defl'n	0.04 = < L/999	0.40 = L/360	in	0.11
Total Defl'n	0.07 = < L/999	0.60 = L/240	in	0.12

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	0.983	1.007	-	1.00	1.00	-	2
Fcp'	625	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	1.04 million		-	1.00	-	-	-	-	1.00	-	2

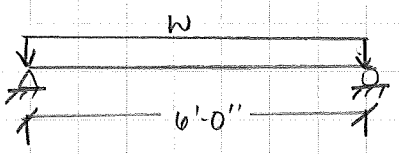
CRITICAL LOAD COMBINATIONS:
Shear : LC #2 = D + L
Bending(+): LC #2 = D + L
Deflection: LC #2 = D + L (live)
LC #2 = D + L (total)
Bearing : Support 1 - LC #2 = D + L
Support 2 - LC #2 = D + L
D=dead L=live
All LC's are listed in the Analysis output
Load combinations: ASD Basic from ASCE 7-16 2.4 / IBC 2018 1605.3.1
CALCULATIONS:
V max = 2361, V design = 2343 lbs; M(+) = 4685 lbs-ft
EIy = 1245.85 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 = 1.0 dead + "live"
Lateral stability(+): Lu = 12.00' Le = 22.38' RB = 10.5

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. 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.

GRAVITY DESIGN

BM 110. - ROOF (BTWN MULLIONS)



TRIB. = 21.5'

w: D = 15 PSF (21.5') = 323 PLF

S = 25 PSF (21.5') = 538 PLF

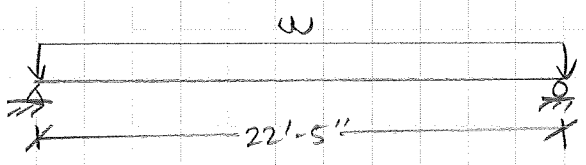
PER WOODWORKS: **6X10 HF #2**

f_v/F'_v = 34%

f_b/F'_b = 76%

$\delta < L/999$

BM 110 - TRANSOM



5.58k (D)
6.02k (S)

5.58k (D)
6.02k (S)

TRIB. = 21.5'

w: 415 (D) + 538 (S) PLF

415 (D): roof load + door load

PER ENERCALC: **W21 x 83**

$\frac{M_a}{M_n/\Omega}$ = 13%

$\frac{V_a}{V_n/\Omega}$ = 5%

δ_D = 0.053"

δ_S = 0.058"

δ_{TOT} = 0.111" < L/360" OK

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: GRAVITY DESIGN	By: ERH	Date: 4/5/22
		Checked	Date
		Scale: NTS	Sheet No.
	Project: BRUMBAUGH RESIDENCE	Job No.	

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Brumbaugh.ec6

LIC# : KW-06015244, Build:20.22.3.16 CG ENGINEERING (c) ENERCALC INC 1983-2022

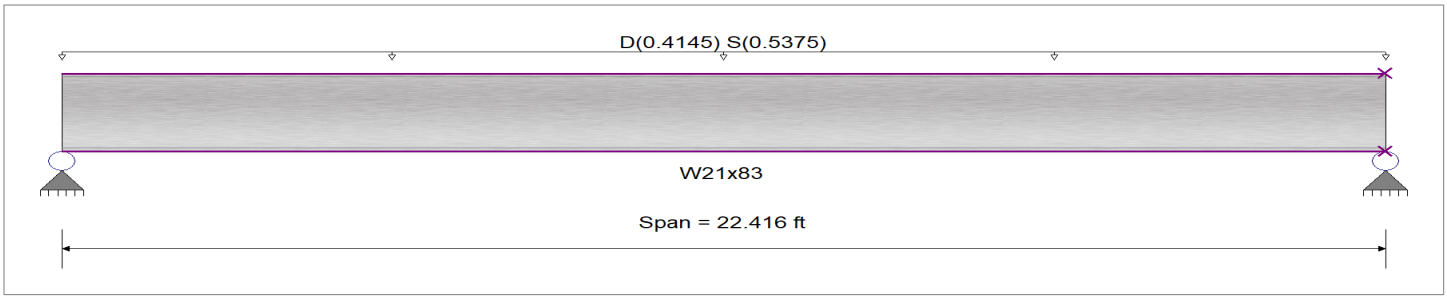
DESCRIPTION: Folding Door Header - all load
BM110 - TRANSOM

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.4145, S = 0.5375 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.133 : 1	Maximum Shear Stress Ratio =	0.053 : 1
Section used for this span	W21x83	Section used for this span	W21x83
Ma : Applied	65.008 k-ft	Va : Applied	11.60 k
Mn / Omega : Allowable	489.022 k-ft	Vn/Omega : Allowable	220.420 k
Load Combination	+D+S	Load Combination	+D+S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.058 in	Ratio =	4,653	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : S Only
Max Downward Total Deflection	0.111 in	Ratio =	2417	>=180	Span: 1 : +D+S
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.1113	11.272		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	11.600	11.600
Overall MINimum	3.346	3.346
D Only	5.576	5.576
+D+S	11.600	11.600
+D+0.750S	10.094	10.094
+0.60D	3.346	3.346
S Only	6.024	6.024

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Apr. 5, 2022 13:37	**PROJECT** Beam 110 - between mullions

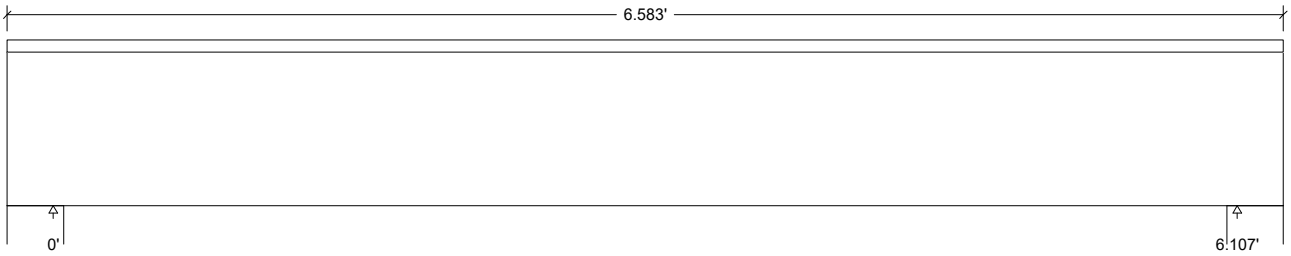
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full UDL				323.0		plf
Load2	Snow	Full UDL				538.0		plf
Self-weight	Dead	Full UDL				10.8		plf

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



Unfactored:			
Dead	1096		1096
Snow	1771		1771
Factored:			
Total	2867		2867
Bearing:			
Capacity			
Beam	7796		7796
Support	32874		32874
Des ratio			
Beam	0.37		0.37
Support	0.09		0.09
Load comb	#2		#2
Length	3.50		3.50
Min req'd	1.29		1.29
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	-		-
Fc sup	1350		1350

BEAM 110

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

Supports: All - Lumber Post Column, D.Fir-L No.2

Total length: 6.56'; Clear span: 6.0'; Volume = 2.4 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 = 55	Fv' = 161	psi	fv/Fv' = 0.34
Bending(+)	fb = 590	Fb' = 776	psi	fb/Fb' = 0.76
Live Defl'n	0.04 = < L/999	0.31 = L/240	in	0.13
Total Defl'n	0.06 = < L/999	0.41 = L/180	in	0.16

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	140	1.15	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	675	1.15	1.00	1.00	1.000	1.000	-	1.00	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.1 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:

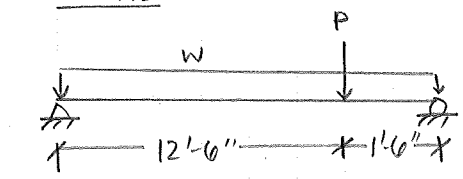
```
 V max = 2662, V design = 1925 lbs; M(+) = 4065 lbs-ft
   EIy = 432.25 lb-in^2
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
```

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.

GRAVITY DESIGN

BM112



2400#(D)
2770#(L)
1160#(S)

3240#(D)
3930#(L)
1640#(S)

ROOF TRIB = 6'

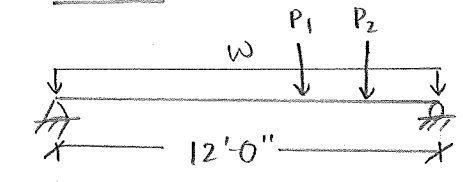
w: D = 33 PSF (6') = 198 PLF
L = 60 PSF (6') = 360 PLF
S = 25 PSF (6') = 150 PLF

WALL LOAD: 10 PSF (10') = 100 PLF (D)

P: D = 850# + 260# = 1110
L = 1530# + 300# = 1830
S = 640#

PER WOODWORKS: **5 1/4 X 11 1/4 PSL**
f_v/F'_v = 56%
f_b/F'_b = 71%
δ_{TOT} = L/299 = 0.56"

BM113



1940#(D)
2280#(L)
980#(S)

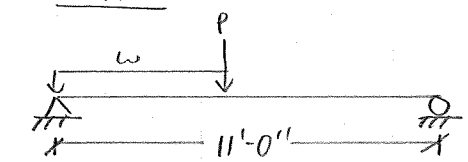
2470#(D)
3580#(L)
1640#(S)

TRIB = 5'-6"

w: D = 100 PLF + 33 PSF (5'-6") = 282 PLF
L = 60 PSF (5'-6") = 330 PLF
S = 25 PSF (5'-6") = 138 PLF

PER WOODWORKS, **5 1/4 X 11 1/4 PSL**
f_v/F'_v = 33%
f_b/F'_b = 29%
δ_{TOT} = L/846 = 0.17"

BM114



w: 388 (D) + 600 (L) + 150 (S) PLF
P: 2100# (D) + 2230# (L) + 1180# (S)

PER WOODWORKS, **5 1/4 X 11 1/4 PSL**
f_v/F'_v = 46%
f_b/F'_b = 68%
δ_{TOT} = L/478

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250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description: GRAVITY DESIGN		By: ERH	Date: 3/8/22
		Checked	Date
		Scale: NTS	Sheet No.
Project: BRUMBAUGH RESIDENCE		Job No.: 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 13:36	**PROJECT** Beam 112

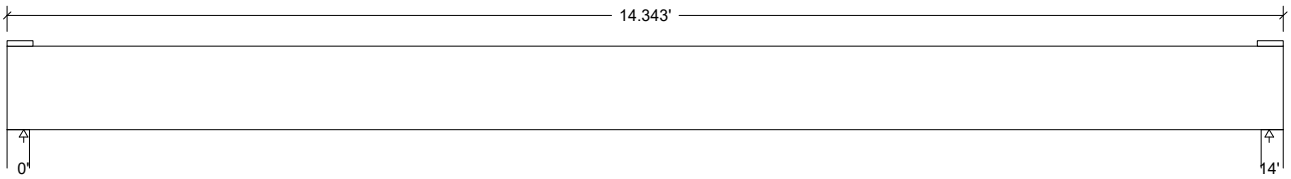
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full UDL				298.0		plf
Load2	Live	Full UDL				360.0		plf
Load3	Snow	Full UDL				150.0		plf
Load4	Dead	Point		12.50		1110		lbs
Load5	Live	Point		12.50		1530		lbs
Load6	Snow	Point		12.50		640		lbs
Self-weight	Dead	Full UDL				18.5		plf

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



Unfactored:			
Dead	2404		3239
Live	2770		3923
Snow	1155		1637
Factored:			
Total	5347		7409
Bearing:			
Capacity			
Beam	9844		9844
Support	12600		12600
Des ratio			
Beam	0.53		0.73
Support	0.41		0.57
Load comb	#3		#3
Length	3.00		3.00
Min req'd	1.58		2.18
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	-		-
Fc sup	800		800

BEAM 112

PSL, 2.0E, 2.0E, 5-1/4"x11-1/4"

Supports: All - Lumber n-ply Column, Hem-Fir Stud
Total length: 14.31'; Clear span: 13.813'; Volume = 5.9 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 = 162	Fv' = 290	psi	fv/Fv' = 0.56
Bending(+)	fb = 2045	Fb' = 2862	psi	fb/Fb' = 0.71
Live Defl'n	0.31 = L/540	0.47 = L/360	in	0.67
Total Defl'n	0.56 = L/299	0.70 = L/240	in	0.80

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	0.980	1.007	-	1.00	1.00	-	2
Fcp'	625	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	3
Eminy'	1.04 million		-	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 = 7058, V design = 6363 lbs; M(+) = 18871 lbs-ft
   EIy = 1245.85 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 = 1.0 dead + "live"
 Lateral stability(+):  Lu = 14.00'  Le = 25.75'  RB = 11.2
```

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. 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
CG Engineering
250 4th Ave S. STE 200
Edmonds, WA 98020
Mar. 8, 2022 13:59

PROJECT

Beam 113

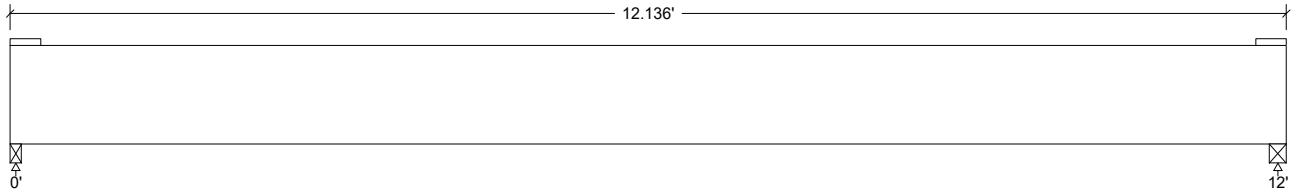
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full UDL				282.0		plf
Load2	Dead	Point		8.81		160		lbs
Load3	Snow	Point		8.81		200		lbs
Load4	Dead	Point		10.56		600		lbs
Load5	Live	Point		10.56		1800		lbs
Load6	Snow	Point		10.56		750		lbs
Load7	Live	Full UDL				330.0		plf
Load8	Snow	Full UDL				138.0		plf
Self-weight	Dead	Full UDL				18.5		plf

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



Unfactored:			
Dead	1937		2467
Live	2223		3582
Snow	984		1641
Factored:			
Total	4342		6385
Bearing:			
Capacity			
Beam	4342		6385
Support	4652		6840
Des ratio			
Beam	1.00		1.00
Support	0.93		0.93
Load comb	#3		#3
Length	1.32		1.95
Min req'd	1.32		1.95
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

BM 113

PSL, 2.0E, 2.0E, 5-1/4"x11-1/4"

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 12.13'; Clear span: 11.875'; Volume = 5.0 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 = 136	Fv' = 290	psi	fv/Fv' = 0.47
Bending(+)	fb = 1463	Fb' = 2872	psi	fb/Fb' = 0.51
Live Defl'n	0.17 = L/837	0.40 = L/360	in	0.43
Total Defl'n	0.30 = L/477	0.60 = L/240	in	0.50

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  0.983  1.007   -    1.00  1.00   -      2
 Fcp'        625    -     -    1.00    -      -     -     -    1.00   -      -
 E'          2.0 million  -    1.00    -      -     -     -    1.00   -      3
 Eminy'    1.04 million   -    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 = 5999, V design = 5359 lbs; M(+) = 13501 lbs-ft
   EIy = 1245.85 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 = 1.0 dead + "live"
 Lateral stability(+):  Lu = 12.00'  Le = 22.38'  RB = 10.5
```

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. 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 14:46	**PROJECT** Beam 114

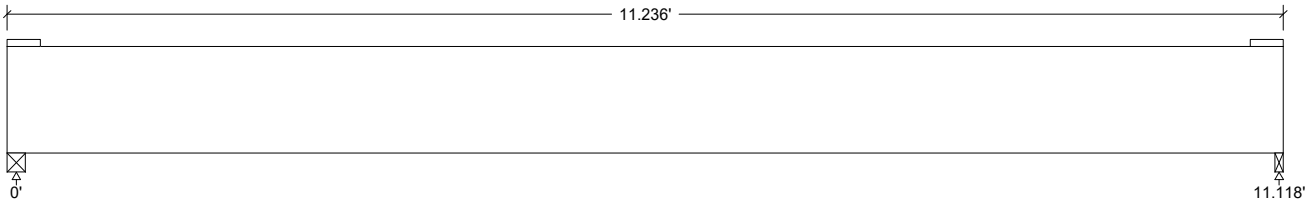
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Partial UDL		0.00	4.67	388.0	388.0	plf
Load2	Live	Partial UDL		0.00	4.67	600.0	600.0	plf
Load3	Snow	Partial UDL		0.00	4.67	150.0	150.0	plf
Load4	Dead	Point		4.67		2100		lbs
Load5	Live	Point		4.67		2230		lbs
Load6	Snow	Point		4.67		1180		lbs
Self-weight	Dead	Full UDL				18.5		plf

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



Unfactored:			
Dead	2781		1336
Live	3544		1488
Snow	1252		629
Factored:			
Total	6378		2923
Bearing:			
Capacity			
Beam	6378		2923
Support	6834		3132
Des ratio			
Beam	1.00		1.00
Support	0.93		0.93
Load comb	#3		#3
Length	1.94		0.89
Min req'd	1.94		0.89
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.07		1.07
Fcp sup	625		625

BM 114

PSL, 2.0E, 2.0E, 5-1/4"x11-1/4"

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 11.25'; Clear span: 11'; Volume = 4.6 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 = 134	Fv' = 290	psi	fv/Fv' = 0.46
Bending(+)	fb = 1956	Fb' = 2876	psi	fb/Fb' = 0.68
Live Defl'n	0.15 = L/864	0.37 = L/360	in	0.42
Total Defl'n	0.28 = L/478	0.56 = L/240	in	0.50

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	0.985	1.007	-	1.00	1.00	-	2
Fcp'	625	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	3
Eminy'	1.04 million		-	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:

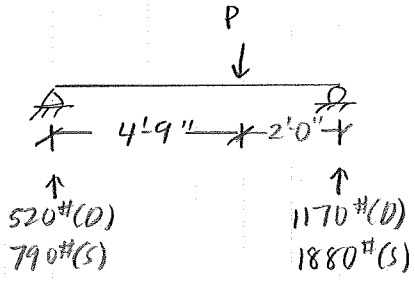
```
 V max = 6243, V design = 5264 lbs; M(+) = 18048 lbs-ft
   EIy = 1245.85 lb-in^2 Apparent E approximates the effect of shear deflection.
 "Live" deflection is due to all non-dead loads (live, wind, snow…)
 Total deflection = 1.0 dead + "live"
 Lateral stability(+):  Lu = 11.13'  Le = 20.94'  RB = 10.1
```

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: Deflection is calculated using an apparent modulus of elasticity E that incorporates the effect of shear deflection.

GRAVITY DESIGN

BM 115



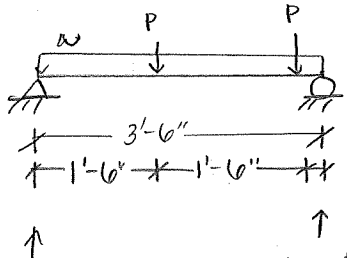
P = 1010#(D) + 2'670#(S) FROM BM 103

PER WOODWORKS · 3½ x 9½ 2.0E PSL

f_v/F'_v = 41%

f_b/F'_b = 41%

BM 116



TRIB = 6'

w : D = 15PSF(6') + 100PLF = 190 PLF

L = 40 PSF(6') = 240 PLF

P : 850#(D) + 1530#(L) + 6410#(S) (BM R1)

PER WOODWORKS · 4x10 HF #2

f_v/F'_v = 75%

f_b/F'_b = 76%

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250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description: GRAVITY DESIGN		By: LRH	Date: 3/8/22
		Checked	Date
		Scale: NTS	Sheet No.
Project: BRUMBAUGH RESIDENCE		Job No.: 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 9, 2022 10:05	**PROJECT** Beam 115

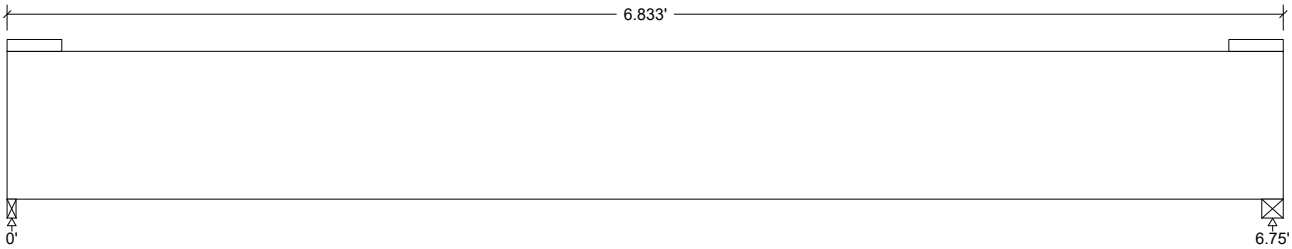
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Point		4.77		1610		lbs
Load2	Snow	Point		4.77		2670		lbs
Self-weight	Dead	Full UDL				10.4		plf

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



Unfactored:			
Dead	512		1168
Snow	791		1879
Factored:			
Total	1303		3047
Bearing:			
Capacity			
Beam	1303		3047
Support	1443		3373
Des ratio			
Beam	1.00		1.00
Support	0.90		0.90
Load comb	#2		#2
Length	0.60		1.39
Min req'd	0.60		1.39
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

BM 115

PSL, 2.0E, 2.0E, 3-1/2"x9-1/2"

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 6.81'; Clear span: 6.688'; Volume = 1.6 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 = 137	Fv' = 334	psi	fv/Fv' = 0.41
Bending(+)	fb = 1384	Fb' = 3338	psi	fb/Fb' = 0.41
Live Defl'n	0.05 = < L/999	0.34 = L/240	in	0.14
Total Defl'n	0.08 = < L/999	0.45 = L/180	in	0.17

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fv'	290	1.15	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2900	1.15	-	1.00	0.976	1.026	-	1.00	1.00	-	2
Fcp'	625	-	-	1.00	-	-	-	-	1.00	-	-
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	1.04 million		-	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: ASCE 7-16 2.4 / IBC 2018 1605.3.1
CALCULATIONS:
V max = 3047, V design = 3038 lbs; M(+) = 6073 lbs-ft
EIy = 500.14 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 = 1.0 dead + "live"
Lateral stability(+): Lu = 6.75' Le = 13.38' RB = 11.2

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. 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY	PROJECT
CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 9, 2022 10:28	Beam 116

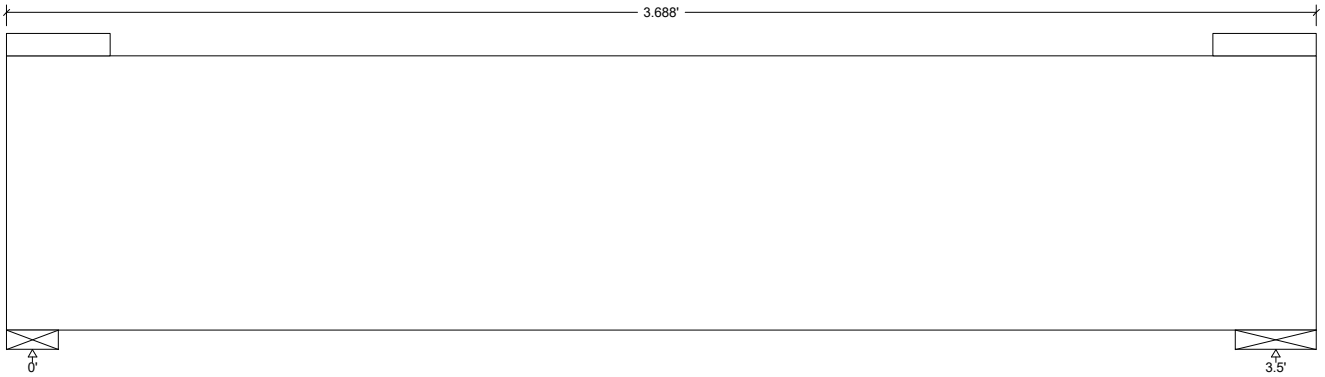
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full UDL				190.0		plf
Load2	Live	Full UDL				240.0		plf
Load3	Dead	Point		1.57		850		lbs
Load4	Live	Point		1.57		1530		lbs
Load5	Snow	Point		1.57		640		lbs
Load6	Dead	Point		3.07		850		lbs
Load7	Live	Point		3.07		1530		lbs
Load8	Snow	Point		3.07		640		lbs
Self-weight	Dead	Full UDL				6.7		plf

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



Unfactored:			
Dead	965		1459
Live	1530		2415
Snow	457		823
Factored:			
Total	2496		3887
Bearing:			
Capacity			
Beam	2496		3887
Support	4264		6641
Des ratio			
Beam	1.00		1.00
Support	0.59		0.59
Load comb	#2		#3
Length	1.76		2.74
Min req'd	1.76		2.74
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

BM 116

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

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 3.69'; Clear span: 3.313'; Volume = 0.8 cu.ft.
Lateral support: top = at supports, bottom = at supports;
This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv* = 112	Fv' = 150	psi	fv*/Fv' = 0.75
Bending(+)	fb = 771	Fb' = 1013	psi	fb/Fb' = 0.76
Live Defl'n	0.01 = < L/999	0.12 = L/360	in	0.12
Total Defl'n	0.03 = < L/999	0.17 = L/240	in	0.15

*The effect of point loads within a distance d of the support has been included as per NDS 3.4.3.1

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.00	1.00	1.00	0.993	1.200	-	1.00	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	3
Emin'	0.47 million		1.00	1.00	-	-	-	-	1.00	1.00	3

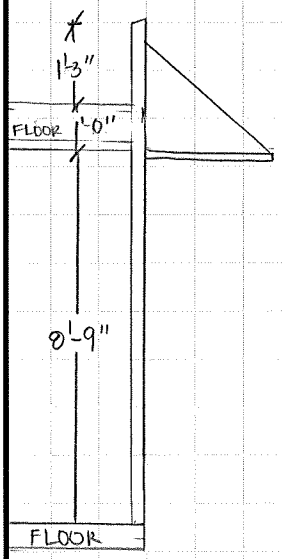
CRITICAL LOAD COMBINATIONS:
Shear : LC #2 = D + L
Bending(+): LC #2 = D + L
Deflection: LC #3 = D + 0.75(L + S) (live)
LC #3 = D + 0.75(L + S) (total)
Bearing : Support 1 - LC #2 = D + L
Support 2 - LC #3 = D + 0.75(L + S)
D=dead L=live S=snow
All LC's are listed in the Analysis output
Load combinations: ASD Basic from ASCE 7-16 2.4 / IBC 2018 1605.3.1

CALCULATIONS:
V max = 3824, V design* = 2423 lbs; M(+) = 3205 lbs-ft
EIy = 300.09 lb-in^2
"Live" deflection is due to all non-dead loads (live, wind, snow…)
Total deflection = 1.5 dead + "live"
Lateral stability(+): Lu = 3.50' Le = 7.19' RB = 8.1

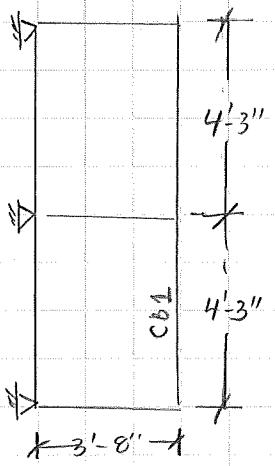
Design Notes:

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. Sawn lumber bending members shall be laterally supported according to the provisions of NDS Clause 4.4.1.

CANOPY



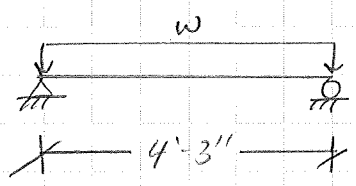
ELEVATION



PLAN

$w = (20 + 25)\ PSF$ (D, S)

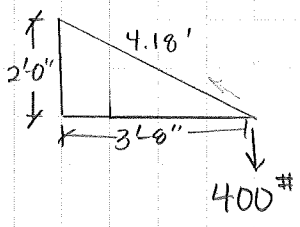
CB #1



$w = \frac{1}{2}(3'-8")(20 + 25)\ PSF = (37 + 46)\ PLF$ (D, S)

PER ENERCALC: C8x10

TIE ROD



Force in Tie Rod = 740#

1/2" ϕ Tie Rod Capacity:

$\pi (1/4")^2 (36\ ksi) = 6.87^k > 0.74^k$ Ok ✓

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: CANOPY DESIGN	By: ERH	Date: 3/8/22
		Checked	Date
		Scale: NTS	Sheet No.
	Project: BRUMBAUGH RESIDENCE	Job No.: 22032.10	

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Brumbaugh.ec6

LIC# : KW-06015244, Build:20.22.2.9 CG ENGINEERING (c) ENERCALC INC 1983-2022

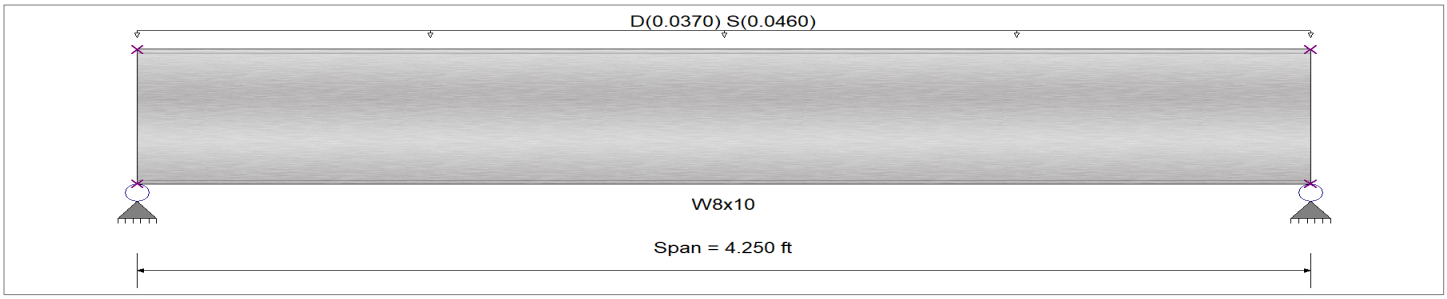
DESCRIPTION: Canopy Beam 1

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
Uniform Load : D = 0.0370, S = 0.0460 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.010 : 1	Maximum Shear Stress Ratio =	0.007 : 1
Section used for this span	W8x10	Section used for this span	W8x10
Ma : Applied	0.210 k-ft	Va : Applied	0.1976 k
Mn / Omega : Allowable	21.870 k-ft	Vn/Omega : Allowable	26.826 k
Load Combination	+D+S	Load Combination	+D+S
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0	<360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : S Only
Max Downward Total Deflection	0.001 in	Ratio =	66423	>=180	Span: 1 : +D+S
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

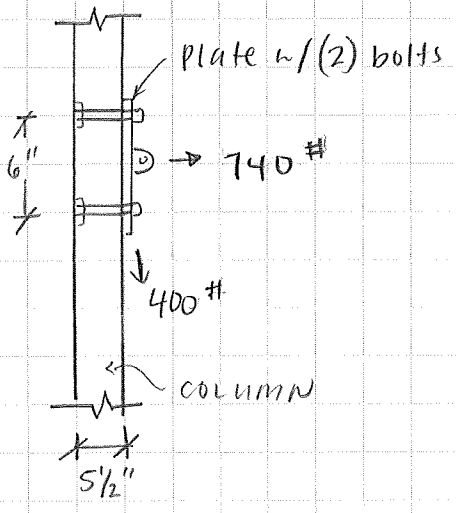
Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.198	0.198
Overall MINimum	0.060	0.060
D Only	0.100	0.100
+D+S	0.198	0.198
+D+0.750S	0.173	0.173
+0.60D	0.060	0.060
S Only	0.098	0.098

CANOPY

Tie Rod / Canopy Connection



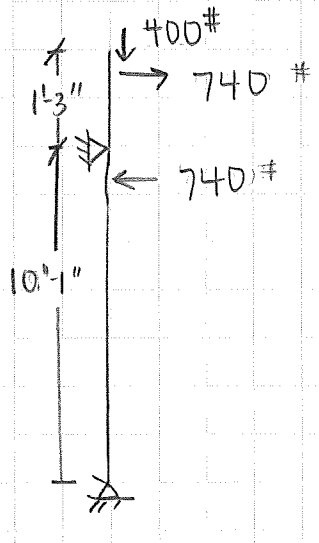
(2) 5/8" ϕ THRU BOLTS

$Z_{11}' = 1130^{\#} \times 1.15 \times 2 \text{ bolts} = 2600^{\#}$

$2600^{\#} > 400^{\#}$ OK

STEEL BOLTS OK BY INSPECTION

Full Height Post



PER WOODWORKS: 4x6 HF #2

AXIAL: $f_c/F_c' = 4\%$

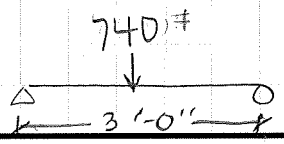
BENDING: $f_b/F_b' = 35\%$

AXIAL + BENDING:

$$\left(\frac{f_c}{F_c'}\right)^2 + \frac{f_b}{F_b'\left(1-\left(f_c/F_{cE}\right)\right)} = (0.64)^2 + \frac{0.35}{1-\frac{23}{933}} = 36\% \text{ ok}\checkmark$$

$$F_{cE} = \frac{0.822(470{,}000)(1.15)}{[10' \times 12''/ft / 5.5'']^2} = 933.3 \text{ psi}$$

DOOR HDR @ Center Tie Rod



PER WOODWORKS: 4x6 HF #2

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: CANOPY DESIGN	By: ERH	Date: 3/8/22
		Checked	Date
		Scale: N TS	Sheet No.
	Project: BRUMBAUGH	Job No.: 22032.10	

AXIAL

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
CG Engineering
250 4th Ave S. STE 200
Edmonds, WA 98020
Mar. 8, 2022 13:11

PROJECT

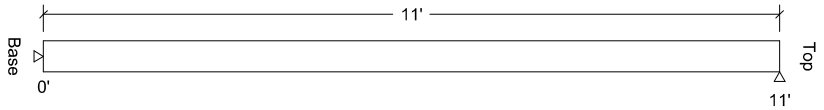
Canopy Column

Design Check Calculation Sheet
WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Live	Axial	(Ecc. = 0.00")		400		lbs
Self-weight	Dead	Axial			44		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Live			
Axial:			
Dead	44		44
Live	400		400
Factored:			
L->R			
Load comb	#1		#1

Lumber Post, Hem-Fir, No.2, 4x6 (3-1/2"x5-1/2")
Support: Non-wood
Total length: 11.0'; Volume = 1.5 cu.ft.
Pinned base; Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 11.0 = 11.0 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 = 23	Fc' = 588	psi	fc/Fc' = 0.04
Axial Bearing	fc = 23	Fc* = 1430	psi	fc/Fc* = 0.02

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fc'	1300	1.00	1.00	1.00	0.412	1.100	-	-	1.00	1.00	2
Fc*	1300	1.00	1.00	1.00	-	1.100	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:
Axial : LC #2 = D + L
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.

BENDING

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
CG Engineering
250 4th Ave S. STE 200
Edmonds, WA 98020
Mar. 8, 2022 13:13

PROJECT

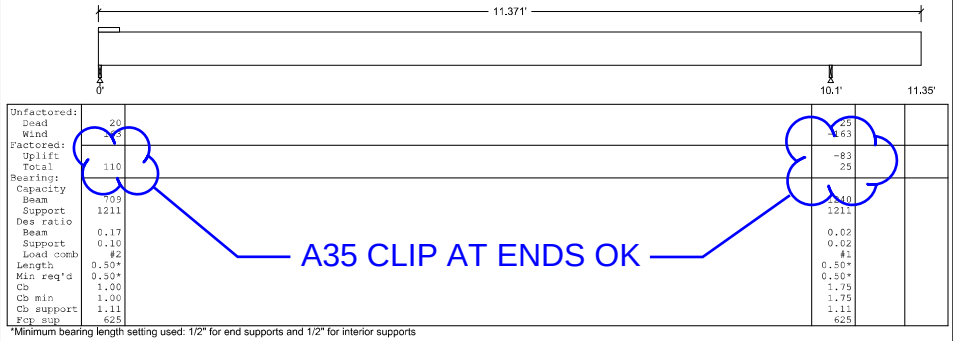
Canopy Column

Design Check Calculation Sheet
WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Wind	Point	No	9.14		740		lbs
Load2	Wind	Point	No	11.37		-740		lbs
Self-weight	Dead	Full UDL	No			4.0		plf

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



Unfactored:		
Dead	20	25
Wind	-93	163
Factored:		
Uplift		-83
Total	110	25
Bearing:		
Capacity		
Beam	709	
Support	1211	1211
Des ratio		
Beam	0.17	
Support	0.10	0.02
Load comb	#2	#1
Length	0.50*	0.50*
Min req'd	0.50*	0.50*
Cb	1.00	1.75
Cb min	1.00	1.75
Cb support	1.11	1.11
Fcp_sup	625	625

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

Lumber-soft, Hem-Fir, No.2, 4x6 (3-1/2"x5-1/2")
Supports: All - Timber-soft Beam, D,Fir-L No.2
Total length: 11.38'; Clear span: 10.063', 1.25'; Volume = 1.5 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 = 35	Fv' = 240	psi	fv/Fv' = 0.14
Bending(+)	fb = 618	Fb' = 1768	psi	fb/Fb' = 0.35
Bending(-)	fb = 2	Fb' = 994	psi	fb/Fb' = 0.00
Deflection:				
Interior Live	0.18 = L/687	1.01 = L/120	in	0.17
Total	0.19 = L/637	1.01 = L/120	in	0.19
Cantil. Live	-0.11 = L/130	0.25 = L/60	in	0.46
Total	-0.12 = L/124	0.25 = L/60	in	0.48

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.60	1.00	1.00	-	-	-	-	1.00	1.00	2
Fb'+	850	1.60	1.00	1.00	1.000	1.300	-	1.00	1.00	1.00	3
Fb'-	850	0.90	1.00	1.00	1.000	1.300	-	1.00	1.00	1.00	1
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	3

CRITICAL LOAD COMBINATIONS:
Shear : LC #2 = 0.6D + 0.6W
Bending(+): LC #3 = D + 0.6W
Bending(-): LC #1 = D only
Deflection: LC #2 = 0.6D + 0.6W (live)
LC #3 = D + 0.6W (total)
Bearing : Support 1 - LC #2 = 0.6D + 0.6W
Support 2 - LC #1 = D only
Support 2 - LC #2 = 0.6D + 0.6W
W=wind
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 = 444, V design = 444 lbs; M(+) = 909 lbs-ft; M(-) = 3 lbs-ft
EIy = 63.08 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. 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 13:19	**PROJECT** Canopy hdr

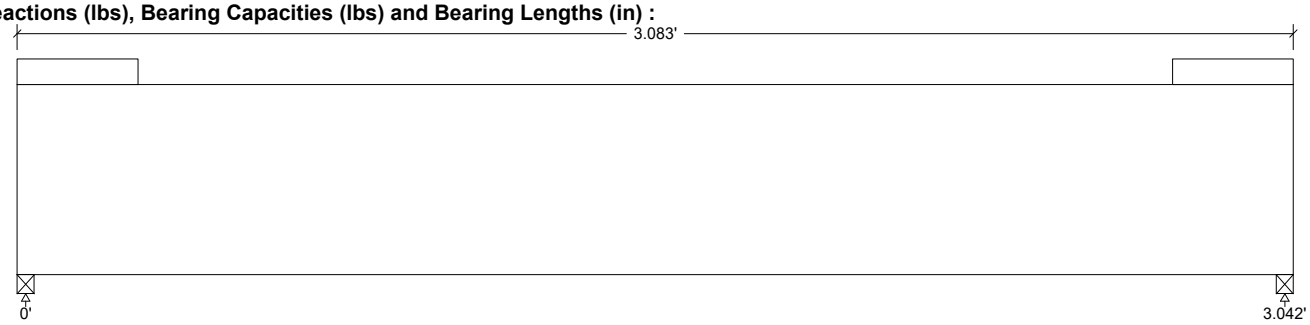
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Live	Point		1.58		740		lbs
Self-weight	Dead	Full UDL				4.0		plf

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



Unfactored:			
Dead	6		6
Live	360		380
Factored:			
Total	366		386
Bearing:			
Capacity			
Beam	1114		1114
Support	1836		1836
Des ratio			
Beam	0.33		0.35
Support	0.20		0.21
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

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

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

Total length: 3.06'; Clear span: 3.0'; Volume = 0.4 cu.ft.

Lateral support: top = at supports, bottom = at supports; Oblique angle: 90.0 deg;

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	x-x	fv = 0	Fv' = 150	psi	fv/Fv' = 0.00
	y-y	fv = 30	Fv' = 150	psi	fv/Fv' = 0.20
Bending(+)	x-x	fb = 0	Fb' = 1105	psi	fb/Fb' = 0.00
	y-y	fb = 606	Fb' = 1160	psi	fb/Fb' = 0.52
Live Defl'n		0.03 = < L/999	0.10 = L/360	in	0.29
Total Defl'n		0.03 = < L/999	0.15 = L/240	in	0.19

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CF	Cfu	Cr	Cfrt	Ci	LC#
Fvy'	150	1.00	1.00	1.00	-	-	-	-	1.00	1.00	2
Fby'	850	1.00	1.00	1.00	1.000	1.300	1.05	1.00	1.00	1.00	2
Fcp'	405	-	1.00	1.00	-	-	-	-	1.00	1.00	-
E'	1.3 million		1.00	1.00	-	-	-	-	1.00	1.00	2
Emin'	0.47 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

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 = 385, V design = 385 lbs; M(+) = 567 lbs-ft

EIy = 25.55 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.

TABLE R301.2(1)
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

ROOF SNOW LOAD[a] (psf)	WIND DESIGN				SEISMIC DESIGN CATEGORY	SUBJECT TO DAMAGE FROM			OUTDOOR DESIGN TEMP (F) - Heat/Cool	ICE BARRIER UNDERLAYMENT REQUIRED	FLOOD HAZARD[e]	AIR FREZING INDEX	MEAN ANNUAL TEMP
	Speed[b] (mph)	Topographic effects[c]	Special wind region	Windborne debris zone		Weathering[d]	Frost line depth	Termite					
25	110	Yes	No	No	D_2	Moderate	12"	Slight to Moderate	83/24	No	N.A.	113	53

MANUAL J DESIGN CRITERIA							
Elevation	Latitude	Winter heating	Summer cooling	Altitude correction factor	Indoor design temperature	Design temperature cooling	Heating temperature difference
338 feet	47°34'39''	72°F max	75°F min	0.99	72°F	75°F	48°F
Cooling temperature difference	Wind velocity heating	Wind velocity cooling	Coincident wet bulb	Daily range	Winter humidity	Summer humidity	
8°F	N.A.	N.A.	66	Medium	75%	68%	

a. This is the minimum roof snow load. When using this snow load it will be left to the engineer's judgment whether to consider drift or sliding snow. However, rain on snow surcharge of 5 psf must be considered for roof slopes less than 5 degrees.

b. The 110 mph Ultimate Design Wind Speed (3-second gust) as adopted by the 2018 IRC/ASCE 7-10 (or if using the IBC for structural design, the 98 mph Basic Design Wind Speed as adopted by the 2018 IBC/ASCE 7-16 may be used).

c. Wind exposure category and Topographic effects (Wind Speed-up Kzt factor) shall be determined on a site-specific basis by the Engineer of Record (components and cladding need not consider topographic effects unless otherwise determined by the engineer of record).

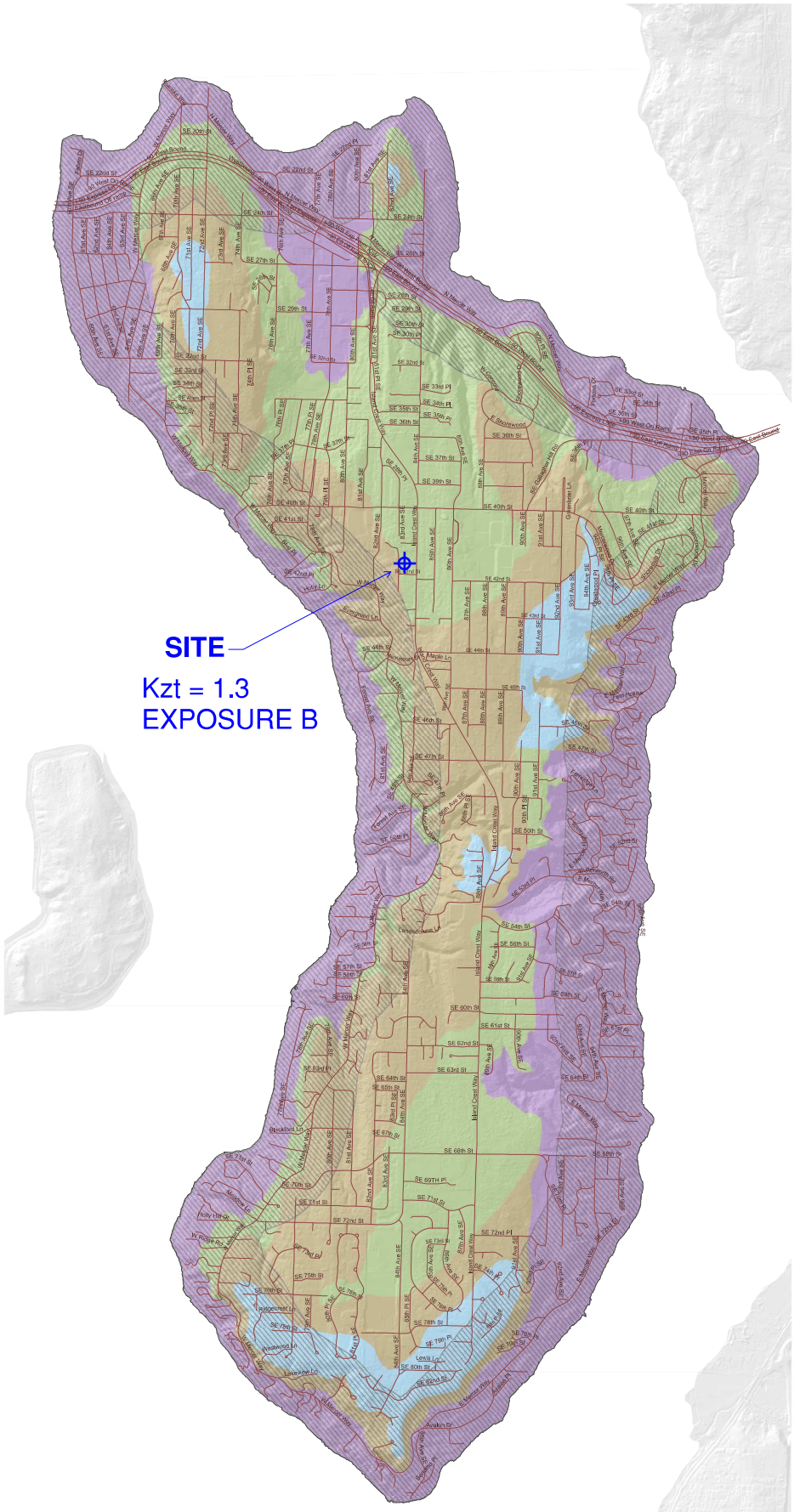
d. Weathering may require a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code. The grade of masonry units shall be determined from ASTM C 34, C 55, C 62, C 73, C 90, C 129, C 145, C 216 or C 652.

e. The City of Mercer Island participates in the National Flood Insurance Program (NFIP); Regular Program (No Special Flood Hazard Area). Further NFIP participation information: CID 530083, Initial FHBM Identified 06/28/74, Initial FIRM Identified 05/16/95, Current Effective Map Date (NSFHA), Reg-Emer Date 06/30/97, 53033C0654G effective 8/19/2020.

Mercer Island Wind Exposure and Wind Speed-Up (Topographic Effect)

by Development Services Group (DSG), City of Mercer Island
April 2009

0 0.5 1 Kilometers 1:12,000
0 0.5 1 Miles
T N



WIND EXPOSURE CATEGORIES & WIND SPEED-UP FACTORS
(ICC Section 1609 & ASCE 7-05 Chapter 6)

It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the Kzt factor to be utilized for each specific project. The Kzt factors and wind exposure categories indicated on this map are the minimum values accepted by the City of Mercer Island without requiring the design professional to submit additional calculations and supporting topographic documentation (to verify the values utilized in their wind load determination).

Please note – The Kzt values indicated on this map are approximations based upon periodic calculations of representative samplings around Mercer Island. These values are intended for City of Mercer Island's plan review purposes only.

WIND EXPOSURE CATEGORIES:

Wind Exposure Category	
	Exposure 'C' (1500 feet from Lake)
	Exposure 'B' (all other areas)

WIND SPEED-UP (TOPOGRAPHIC EFFECT) - K_zt Factor :

K_zt Factor	
	$K_zt = 1.0$
	$K_zt = 1.3$
	$K_zt = 1.6$
	$K_zt = 1.9$

GENERAL NOTES FOR WIND EXPOSURE AND WIND SPEED-UP MAP

This map is the Wind Exposure Category and Wind Speed-up (Topographic Effects) Map for the City of Mercer Island. This map shows the minimum wind exposure category and the minimum wind speed-up, "K_zt" factor, which will be accepted without site specific documentation and calculation.

Other wind speed phenomena may occur on Mercer Island that is not specifically indentified on this map. It is the responsibility of the Owner (or their Design Professional) to review site conditions and determine the appropriate design wind speed and exposure category for their specific project and location.

This map is for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. This map provides DSG staff a general assessment of Wind Exposure Category and Wind Speed-up (Topographic Effects). All areas have not been specifically evaluated and there may be locations that are not correctly represented on this map. It is the responsibility of individual property owners and map users to evaluate risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island with this map.

Information about data used for the map, references, and data limitation are all described the associated 'Read Me' document. The digital version of this map is accompanied by a meta data file containing pertinent information about map construction. This data map is available on the City of Mercer Island website.

The City of Mercer Island is using guidance provided within ICC Section 1609 & ASCE 7-05 Chapter 6 regarding definitions used when creating this map.

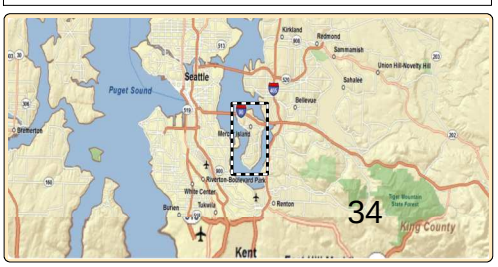
DEFINITIONS:

K_zt factor: The topographic effect of wind speed-up at isolated hills, ridges, and escarpments constituting abrupt changes in the general topography, located in any exposure category, that meet all of the conditions noted in ASCE 7-05 Minimum Design Loads for Buildings and Other Structures, Section 6.5.7.

Exposure B: The wind exposure category that applies where the site in question is located a minimum of 1500 feet from the shoreline and the mean roof height is less than or equal to 30 feet per IBC 2006 section 1609.4.3.

Exposure C: The wind exposure category that applies where the site in question is located within 1500 feet from the shoreline per IBC 2006 section 1609.4.3.

Wind Speed: Minimum 85 mph 3-second gust per IRC Figure R301.2(4)



Hazards by Location

Search Information

Address:	4124 83rd Ave SE, Mercer Island, WA 98040, USA
Coordinates:	47.5717521, -122.2279375
Elevation:	278 ft
Timestamp:	2022-03-01T21:10:29.967Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D

Basic Parameters

Name	Value	Description
S_S	1.419	MCE_R ground motion (period=0.2s)
S_1	0.493	MCE_R ground motion (period=1.0s)
S_{MS}	1.419	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.946	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.902	Coefficient of risk (0.2s)
CR_1	0.897	Coefficient of risk (1.0s)
PGA	0.607	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.668	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.419	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.573	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	3.66	Factored deterministic acceleration value (0.2s)
S1RT	0.493	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.55	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.458	Factored deterministic acceleration value (1.0s)
PGAd	1.245	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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

Disclaimer

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

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Wind Design (ASCE 28.5 Enclosed Simple Diaphragm) **2018 IBC** **ASCE 7-16**

Building Exposure	Exp.= B	Section 1609.4	Section 26.7.3
Basic Wind Speed	V= 98		Per Jurisdiction
Risk Category	I_W= II		Table 1.5-1
Top of Roof Height (feet)	h= 22.75		
Mean Roof Height (feet)	h_{mean}= 18		
Building Length (feet)	L= 80.5		
Building Width (feet)	W= 76.5		
End Zone Width, a (feet)	a= 7.2		Figure 28.6-1
Roof Angle	Angle= 9.5		
Design Wind Pressure, p_{s3}	p_{s30A}= 17.0		Figure 28.6-1
Design Wind Pressure, p_{s3}	p_{s30B}= -7.2		Figure 28.6-1
Design Wind Pressure, p_{s3}	p_{s30C}= 11.3		Figure 28.6-1
Design Wind Pressure, p_{s3}	p_{s30D}= -4.2		Figure 28.6-1
Height/Exposure Adjustm	λ_{max}= 1.00		
Topo. Effect Coeff., K_{zt}	K_{zt}= 1.30		

$V_{asd} = V_{ult}*\sqrt{0.6}$ Section 1609.3.1

	ULT	ASD
	$p_s=\lambda*Kzt*p_{s30}$	$p_s=\lambda*Kzt*ps30*0.6$
p_{s30A}=	22.1	13.2
p_{s30B}=	-9.4	-5.6
p_{s30C}=	14.7	8.8
p_{s30D}=	-5.5	-3.3

ENGINEERING
250 4th Ave South
Suite 200
Edmonds, WA 98020

Description: Wind Summary		By: ERH	Date: 3/17/2022
		Checked	Date
		Scale: NTS	Sheet No.
Project: BRUMBAUGH RESIDENCE		Job No.: 22032.10	

SEISMIC LOAD

ROOFTOP DECK:

DL = 33 PSF + 10 PSF = 43 PSF
AREA = 540 SF
} 23.22 K

MAIN ROOF:

DL = 15 PSF + 5 PSF = 20 PSF
AREA = 4850 SF
} 97.0 K

BASE SHEAR

$F_{EQ} = C_S W = 0.146\,(120.22\text{ K}) = 17.55\text{ K (ULT)}$
12.5 K (ASD)

	TRIB		FEQ
LINE Ⓐ	14'/82'	= 17%	2.1K
LINE Ⓑ	28'/82'	= 34%	4.3K
LINE Ⓒ	27'/82'	= 33%	4.1K
LINE Ⓓ	13'/82'	= 16%	2.0K

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

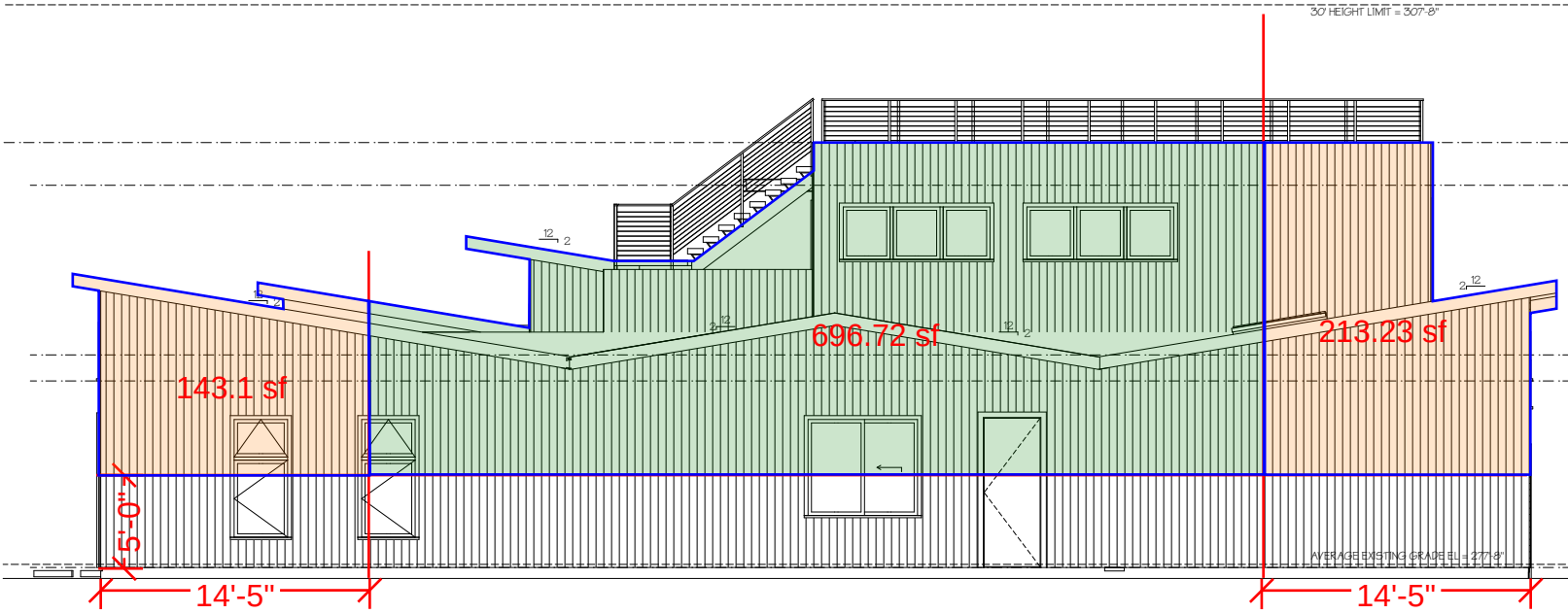
Description	By ERH	Date 3/1/22
	Checked	Date
	Scale NTS	Sheet No.
Project BRUMBAUGH RESIDENCE	Job No. 22032.10	

WIND LOADS

A p = 13.2 psf

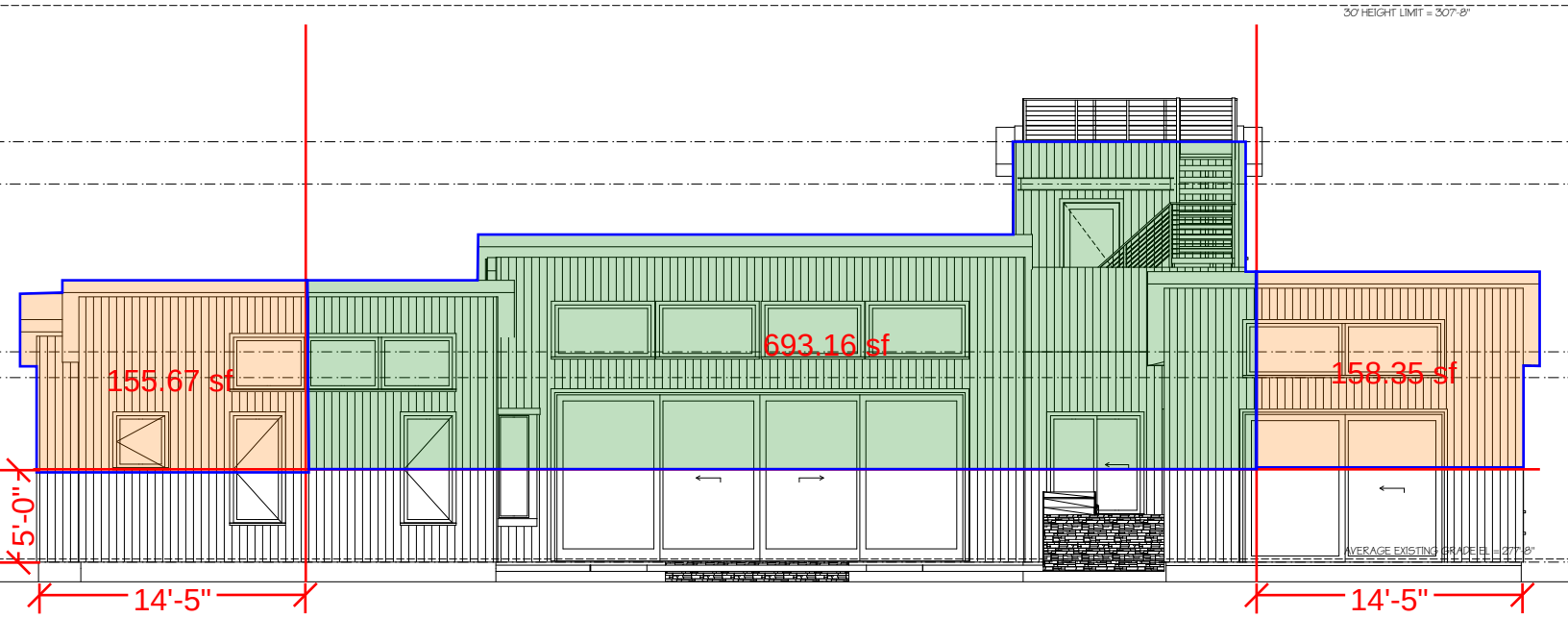
C p = 8.8 psf

ASCE MIN. = 16 PSF (ULT) = 9.6 PSF (ASD)



FW,X =13.2 PSF * (361SF) + 8.8 PSF * (697SF) = **10.9 K** (GOVERNS)

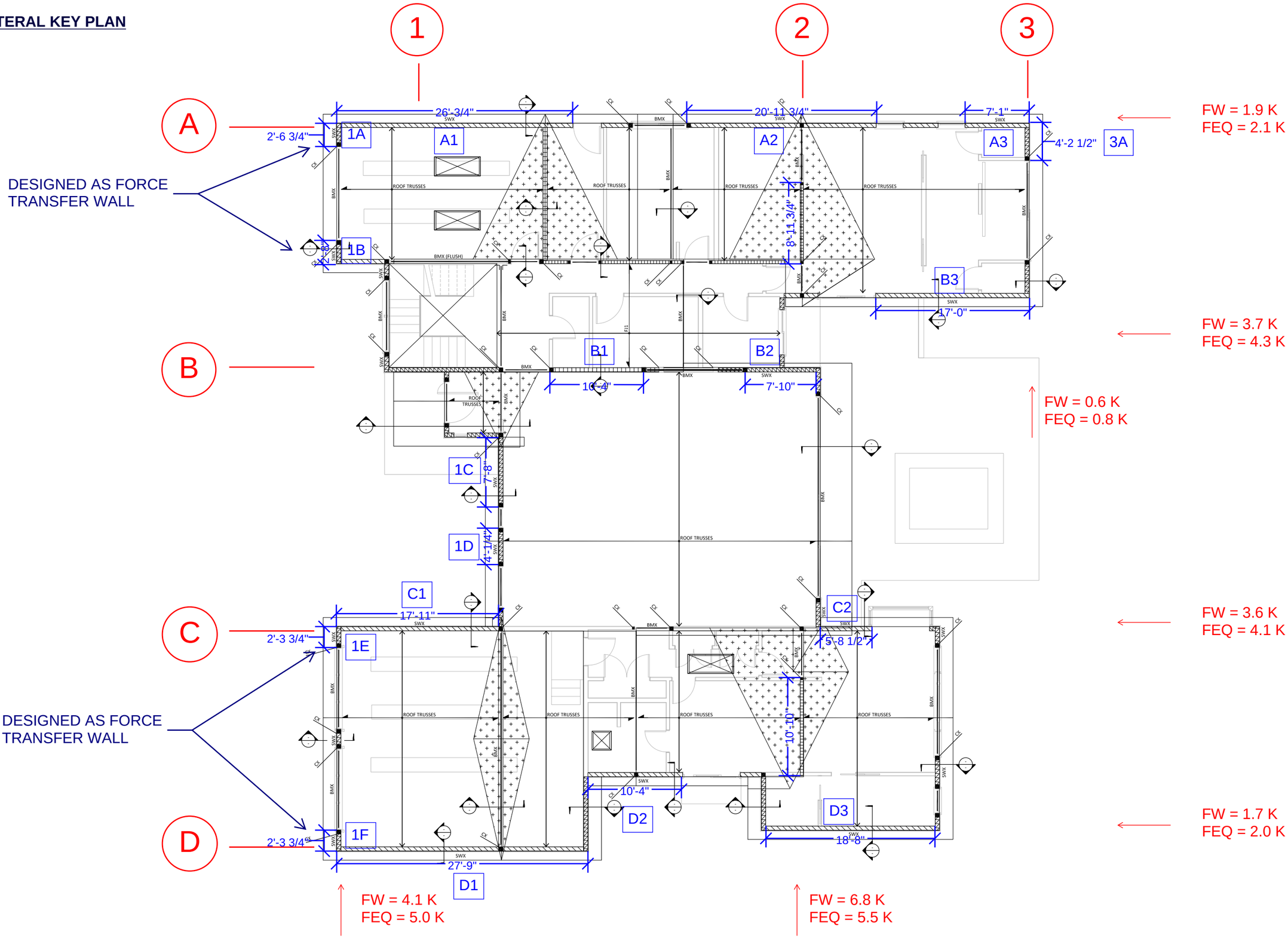
CHECK ASCE MIN:
FW,X = 9.6 PSF * (1058SF) = 10.2 K



FW,Y =13.2 PSF * (314SF) + 8.8 PSF * (693SF) = **10.2 K** (GOVERNS)

CHECK ASCE MIN:
FW,Y = 9.6 PSF * (1007SF) = 9.7 K

LATERAL KEY PLAN



Upper Floor Shear Walls - Walls Below the Roof Framing

X - Direction Walls

Fx (EQ) =	12.5	kips (Story Shear)
Fx (wind) =	10.9	kips (Story Shear)

Story HT =	14
Wall HT =	14
Max h/w	3.5
S_{DS} =	0.95

Wx =	152.4	PLF	seismic
Wx =	132.9	PLF	wind

Wall Line	Wall Mark	SW Length	Trib Width	EQ, WL 2w/h	EQ Shear	Wind Shear	SW Callout	Reduced HD Length	EQ Gross Uplift	Wind Gross Uplift	EQ $(0.6-0.14S_{DS})$DL End i	EQ $(0.6-0.14S_{DS})$DL End j	Wind 0.6 * DL End i	Wind 0.6 * DL End j	Governing Net Uplift End i	Governing Net Uplift End j	Hold-down End i	Hold-down End j	EQ Line Load	Wind Line Load	DL Trib
A	1	26	14	1.0	40	25	SW6	25.5	0.6	0.5	1.0	1.0	1.3	1.3	0.0	0.0	None	None	2.1	1.9	2.0
	2	21	-	1.0	40	25	SW6	20.5	0.6	0.5	0.8	0.8	1.1	1.1	0.0	0.0	None	None	-	-	2.0
	3	7	-	1.0	40	25	SW6	6.5	0.6	0.5	0.3	0.3	0.4	0.4	0.3	0.3	None	None	-	-	2.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
B	1	10.33	28	1.0	121	76	SW6	9.8	1.8	1.6	0.4	0.4	0.5	0.5	1.4	1.4	HDU2	HDU2	4.3	3.7	2.0
	2	7.83	-	1.0	121	76	SW6	7.3	1.8	1.6	0.3	0.3	0.4	0.4	1.5	1.5	HDU2	HDU2	-	-	2.0
	3	17	-	1.0	121	76	SW6	16.5	1.8	1.5	0.7	0.7	0.9	0.9	1.1	1.1	HDU2	HDU2	-	-	2.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
C	1	17.9	27	1.0	174	109	SW6	17.4	2.5	2.2	0.7	0.7	0.9	0.9	1.8	1.8	HDU2	HDU2	4.1	3.6	2.0
	2	5.7	-	0.8	214	133	SW6	5.2	2.7	2.3	0.2	0.2	0.3	0.3	2.4	2.4	HDU4	HDU4	-	-	2.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
D	1	27.75	13	1.0	35	22	SW6	27.3	0.5	0.4	1.1	1.1	1.4	1.4	0.0	0.0	None	None	2.0	1.7	2.0
	2	10	-	1.0	35	22	SW6	9.5	0.5	0.5	0.4	0.4	0.5	0.5	0.1	0.1	None	None	-	-	2.0
	3	18.67	-	1.0	35	22	SW6	18.2	0.5	0.4	0.7	0.7	1.0	1.0	0.0	0.0	None	None	-	-	2.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
		Σ	82.0																12.5	10.9	

Shearwalls: 1/2" sheathing w/ HF studs			
Nil	-	0	plf
SW6	8d@6"o.c.	242	plf
SW4	8d@4"o.c.	350	plf
SW3	8d@3"o.c.	455	plf
SW2	8d@2"o.c.	595	plf
2SW4	8d@4"o.c.	706	plf
2SW3	8d@3"o.c.	910	plf
2SW2	8d@2"o.c.	1190	plf
Re-Calc	-	1200	plf

Holdown Table			
Nil	-	0	kips
None	-	0.5	kips
HDU2	(2)-2x HF	2.215	kips
HDU4	(2)-2x HF	3.3	kips
HDU5	(2)-2x HF	4.1	kips
HDU8	4x DF#2	7.0	kips
HDU11	6x6 DF#1	9.5	kips
HDU14	6x6 DF#1	14.4	kips
			kips
			kips
Re-Calc	-	14.5	kips

Input Cell

Input Cell w/ Formula

C G ENGINEERING

250 4th Ave. South
Suite 200
Edmonds, WA 98020

Description: Upper Floor Shear Walls	By: ERH	Date: 03/17/22
X-Direction	Checked	Date
	Scale: NTS	Sheet No.
Project: Brumbaugh Residence	Job No. 22032.10	

Upper Floor Shear Walls - Walls Below the Roof Framing

Y - Direction Walls

Fy (EQ) =	12.5	kips (Story Shear)
Fy (wind) =	10.2	kips (Story Shear)

Wy =	12500	PLF	seismic
Wy =	10200	PLF	wind

		1A,B	1C,D	1E,F,G	2A,B	3A,B
Story HT =	-	9	10	8	10	13.9
Wall HT =	-	9	10	8	10	13.9
Max h/w	3.5					
S_{DS} =	0.95					

Wall Line	Wall Mark	SW Length	Trib Width	EQ, WL 2w/h	EQ Shear	Wind Shear	SW Callout	Reduced HD Length	EQ Gross Uplift	Wind Gross Uplift	EQ $(0.6-0.14S_{DS})$DL End i	EQ $(0.6-0.14S_{DS})$DL End j	Wind 0.6 * DL End i	Wind 0.6 * DL End j	Governing Net Uplift End i	Governing Net Uplift End j	Hold-down End i	Hold-down End j	EQ Line Load	Wind Line Load	DL Trib
1	~~A~~	~~2.58~~	~~0.4~~	~~0.6~~	~~407~~	~~237~~	~~SW3~~	~~2.1~~	~~2.6~~	~~2.1~~	~~0.2~~	~~0.2~~	~~0.2~~	~~0.2~~	~~2.4~~	~~2.4~~	~~HDU4~~	~~HDU4~~	~~5.0~~	~~4.1~~	~~13.0~~
	~~B~~	~~2.58~~	~~-~~	~~0.6~~	~~407~~	~~237~~	~~SW3~~	~~2.1~~	~~2.6~~	~~2.1~~	~~0.2~~	~~0.2~~	~~0.2~~	~~0.2~~	~~2.4~~	~~2.4~~	~~HDU4~~	~~HDU4~~	~~-~~	~~-~~	~~13.0~~
	C	7.67	-	1.0	233	136	SW6	7.2	2.5	2.0	0.7	0.7	0.9	0.9	1.8	1.8	HDU2	HDU2	-	-	19.0
	D	4	-	0.8	291	170	SW4	3.5	2.7	2.2	0.4	0.4	0.5	0.5	2.3	2.3	HDU4	HDU4	-	-	19.0
	~~E~~	~~2.31~~	~~-~~	~~0.6~~	~~404~~	~~235~~	~~SW3~~	~~1.8~~	~~2.4~~	~~1.9~~	~~0.1~~	~~0.1~~	~~0.2~~	~~0.2~~	~~2.3~~	~~2.3~~	~~HDU4~~	~~HDU4~~	~~-~~	~~-~~	~~10.5~~
	~~F~~	~~2.31~~	~~-~~	~~0.6~~	~~404~~	~~235~~	~~SW3~~	~~1.8~~	~~2.4~~	~~1.9~~	~~0.1~~	~~0.1~~	~~0.2~~	~~0.2~~	~~2.3~~	~~2.3~~	~~HDU4~~	~~HDU4~~	~~-~~	~~-~~	~~10.5~~
																					10.5
																					0.0
																					0.0
								-0.5			####	####	####	####							0.0
2	A	9	0.55	1.0	347	202	SW4	8.5	3.7	3.0	0.8	0.8	1.1	1.1	2.8	2.8	HDU4	HDU4	6.9	5.6	19.8
	B	10.83	-	1.0	347	202	SW4	10.3	3.6	3.0	1.0	1.0	1.3	1.3	2.6	2.6	HDU4	HDU4	-	-	19.8
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
3	A	4.1	0.05	0.6	259	151	SW4	3.6	2.4	2.0	0.3	0.3	0.4	0.4	2.1	2.1	HDU2	HDU2	0.6	0.5	14.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			0.0	0.0	0.0	0.0							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
								-0.5			####	####	####	####							0.0
		Σ	1.0																12.5	10.2	

(1A + 1B), (1E + 1F) DESIGNED AS FORCE TRANSFER WALLS - SEE SPREADSHEET OUTPUT TO FOLLOW

Input Cell

Input Cell w/ Formula

C G ENGINEERING	Description	Upper Floor Shear Walls	By	ERH	Date 03/17/22
250 4th Ave. South, Suite 200, Edmonds, WA 98020		Y-Direction	Checked		Date
			Scale	NTS	Sheet No.
	Project	Brumbaugh Residence	Job No.	22032.10	

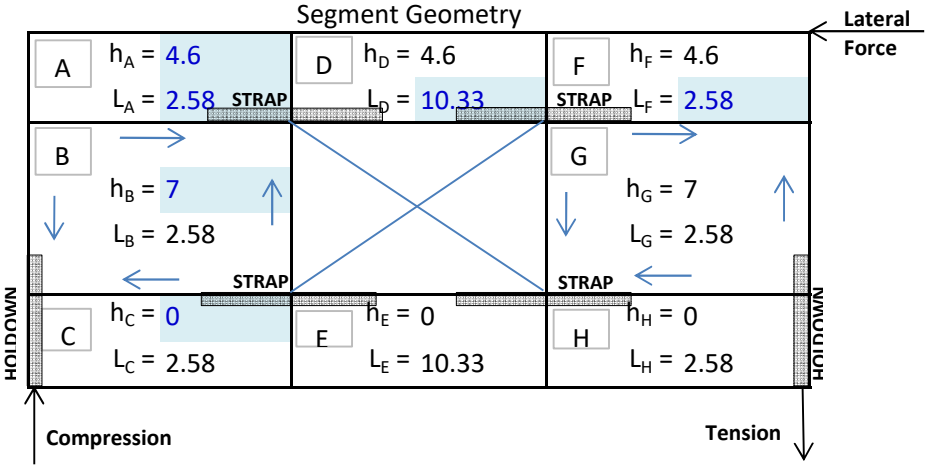
FORCE TRANSFER SHEAR WALL DESIGN

Last Editted 12/12/12

Wall #

Seismic Force = 1260 lbs
Wind Force = 1027 lbs
S_{DS} = 0.95
DL on Wall = 195 plf

Segment Geometry



Wall Geometry

Wall ht = 11.6 ft
Wall l = 15.49 ft
Max H:W = 2.713
Seismic Reduce = 0.737

Uplift

	Seismic	Wind
Gross Uplift =	944	769
Resisting DL =	705	906
Net Uplift =	**238**	**-137**

Holdown Required = **NONE**

Segment Shear Loads

	Seismic	Wind		Seismic	Wind
v_A =	-424	-97	v_E =	278	119
v_B =	331	142	v_F =	-424	-97
v_C =	-424	-97	v_G =	331	142
v_D =	278	119	v_H =	-424	-97

*note wind shear loads are reduced by 40% per IBC 2306.4

*seismic loads are increased based on the aspect ratio factor

Max Shear = **331 plf**
Shear Wall Required = **SW4** Shearwalls: 1/2" sheathing w/ HF studs

Strap Force

	Seismic	Wind	
Strap Force =	**1437**	**864**	lbs

Strap Required = **CS16**

ENGINEERING
250 4th Ave South
Suite 200
Edmonds, WA 98020

Description: Force Transfer Shear Wall Design		By: ERH	Date
		Checked	Date
		Scale	Sheet No.
Project: Brumbaugh		Job No.: 22032.10	

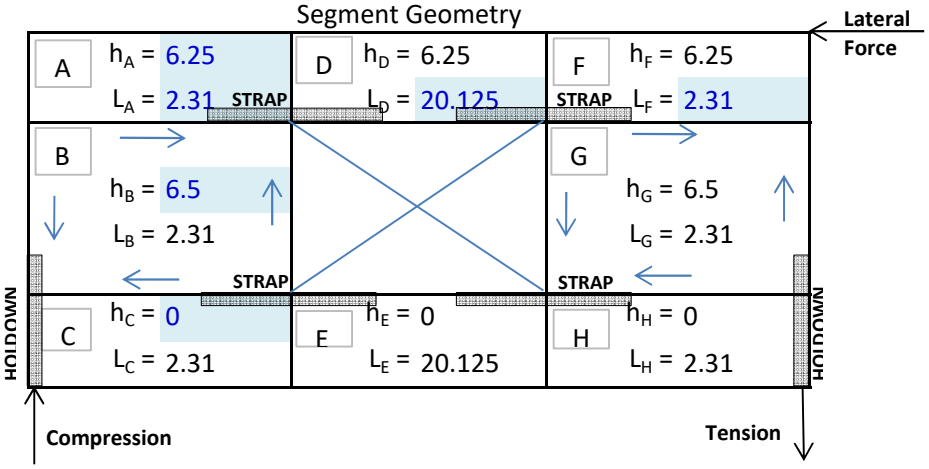
FORCE TRANSFER SHEAR WALL DESIGN

Last Editted 12/12/12

Wall #

Seismic Force = 1120 lbs
Wind Force = 912 lbs
S_{DS} = 0.95
DL on Wall = 158 plf

Segment Geometry



Wall Geometry

Wall ht = 12.75 ft
Wall l = 24.75 ft
Max H:W = 2.814
Seismic Reduce = 0.711

Uplift

	Seismic	Wind
Gross Uplift =	577	470
Resisting DL =	913	1173
Net Uplift =	**-336**	**-703**

Holdown Required = **NONE**

Segment Shear Loads

	Seismic	Wind		Seismic	Wind
v_A =	-455	-93	v_E =	130	54
v_B =	341	141	v_F =	-455	-93
v_C =	-455	-93	v_G =	341	141
v_D =	130	54	v_H =	-455	-93

*note wind shear loads are reduced by 40% per IBC 2306.4

*seismic loads are increased based on the aspect ratio factor

Max Shear = **341 plf**
Shear Wall Required = **SW4** Shearwalls: 1/2" sheathing w/ HF studs

Strap Force

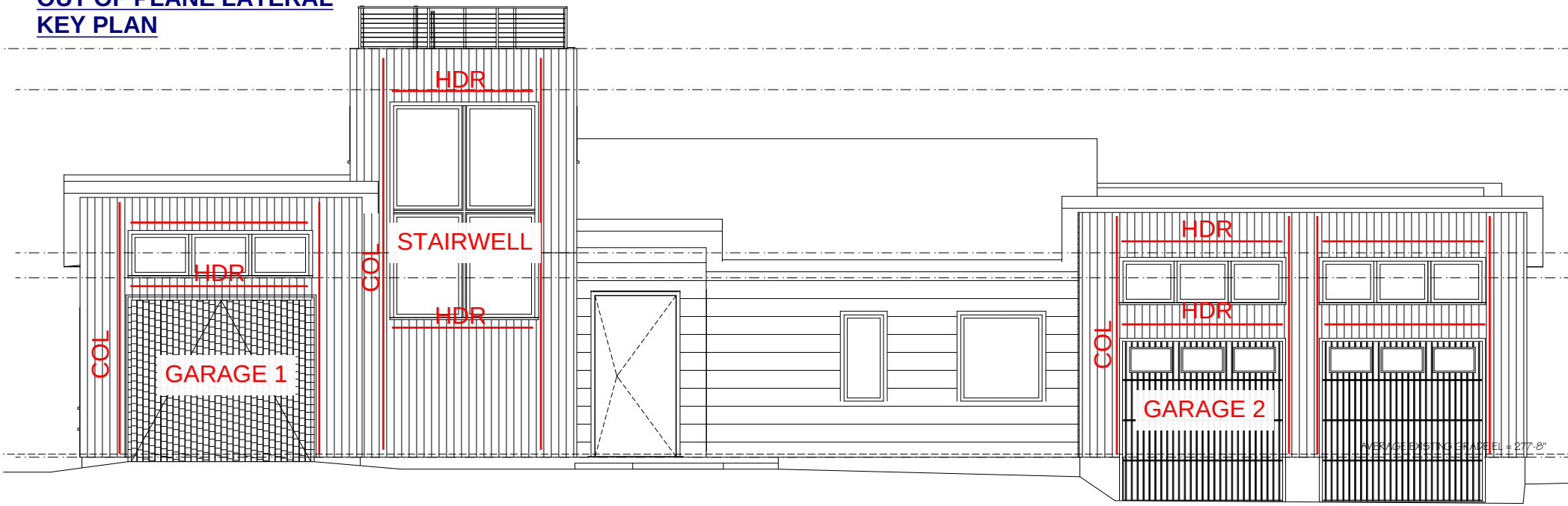
	Seismic	Wind	
Strap Force =	**1307**	**757**	lbs

Strap Required = **CS16**

ENGINEERING
250 4th Ave South
Suite 200
Edmonds, WA 98020

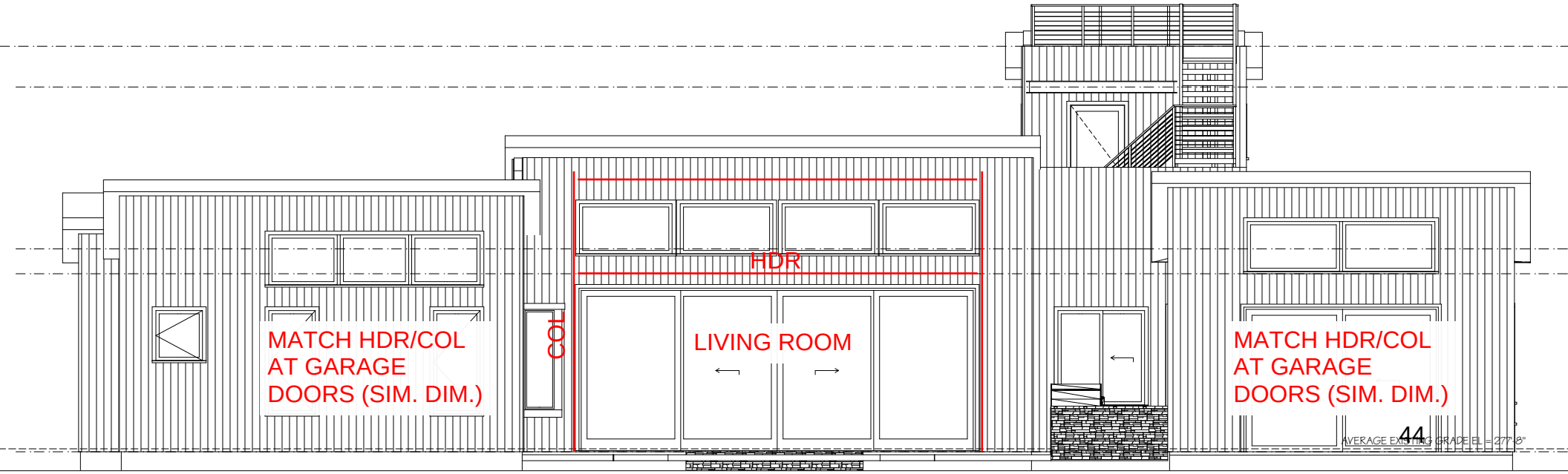
Description: Force Transfer Shear Wall Design		By: ERH	Date
		Checked	Date
		Scale	Sheet No.
Project: Brumbaugh		Job No.: 22032.10	

OUT OF PLANE LATERAL KEY PLAN



WEST ELEVATION

SCALE: 1/4" = 1'-0"



OUT OF PLANE LATERAL - WEST ELEVATION, GARAGE DOORS

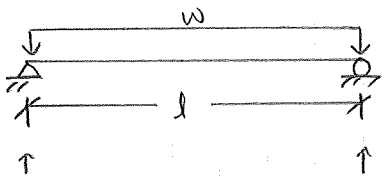
$p_{net} = \lambda K_{zt} p_{net30}$ [ASCE 7-16, EQ 30.4-1]

Wind speed = 98 mph
Exposure (B)
$K_{zt} = 1.3$
Roof Height = 18'
Zone 5

$\lambda = \frac{0.89 - 0.82}{20 - 15}(18 - 15) + 0.82 = 0.862$

EFFECTIVE WIND AREA	p_{net30}	p_{net}
20 SF	21.62 PSF	24.24 PSF
50 SF	19.5 PSF	21.85 PSF
100 SF	17.98 PSF (BY INTERPOLATION)	20.15 PSF

HDR - GARAGE



GARAGE (1)
$l = 10'-4''$
TRIB = 8.1'

$p_{net} = \frac{(21.85 - 20.15)}{50 - 100}(83 - 100) + 20.15$

$p_{net} = 20.73$ PSF

$w = 20.73$ PSF $(8.1') = 167.9$ PLF

PER WOODWORKS, **5¼ x 9½ PSL**
$f_v / F'_v = 5\%$
$f_b / F'_b = 9\%$
$\delta_L = L/941 = 0.13''$
RXN = 890# (W)

GARAGE (2)
$l = 9'-0''$
TRIB = 9'

$p_{net} = \frac{(21.85 - 20.15)}{50 - 100}(81 - 100) + 20.15$

$p_{net} = 20.8$ PSF

$w = 20.8$ PSF $(9') = 187.2$ PLF

PER WOODWORKS, **5¼ x 9½ PSL**
$f_v / F'_v = 5\%$
$f_b / F'_b = 8\%$
$\delta_L < L/999 = 0.08''$
RXN = 850# (W)

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description	By	Date
OUT OF PLANE LATERAL	ERH	3/4/22
	Checked	Date
	Scale NTS	Sheet No.
Project BRUMBAUGH RESIDENCE	Job No. 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN

COMPANY
CG Engineering
250 4th Ave S. STE 200
Edmonds, WA 98020
Mar. 4, 2022 15:30

PROJECT

Garage Door HDR - OOP

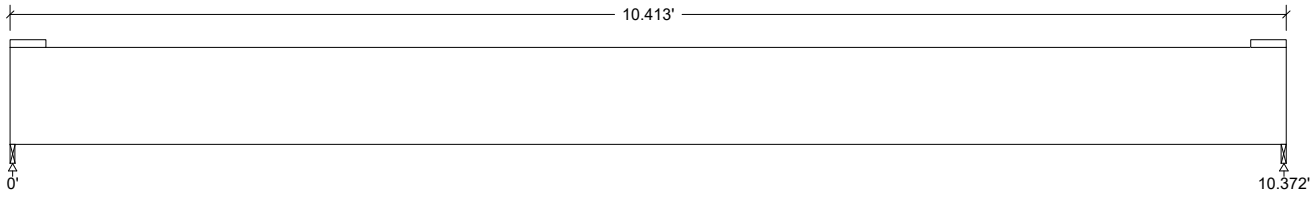
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Wind	Full UDL				168.0		plf
Self-weight	Dead	Full UDL				15.6		plf

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



Unfactored:			
Dead	81		81
Wind	875		875
Factored:			
Total	573		573
Bearing:			
Capacity			
Beam	2256		2256
Support	2969		2969
Des ratio			
Beam	0.27		0.27
Support	0.20		0.20
Load comb	#2		#2
Length	0.50*		0.50*
Min req'd	0.50*		0.50*
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

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

GARAGE 1 HEADER OOP

PSL, 2.0E, 2.0E, 5-1/4"x9-1/2"

Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 10.44'; Clear span: 10.313'; Volume = 3.6 cu.ft.
Lateral support: top = at supports, bottom = at supports; Oblique angle: 90.0 deg;
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	x-x	fv = 0	Fv' = 464	psi	fv/Fv' = 0.00
	y-y	fv = 17	Fv' = 336	psi	fv/Fv' = 0.05
Bending(+)	x-x	fb = 0	Fb' = 4661	psi	fb/Fb' = 0.00
	y-y	fb = 430	Fb' = 4585	psi	fb/Fb' = 0.09
Live Defl'n		0.11 = < L/999	0.35 = L/360	in	0.33
Total Defl'n		0.13 = L/941	0.52 = L/240	in	0.26

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fvy'	210	1.60	-	1.00	-	-	-	-	1.00	-	3
Fby'	2800	1.60	-	1.00	0.997	1.03	-	1.00	1.00	-	3
Fcp'	475	-	-	1.00	-	-	-	-	1.00	-	-
Ey'	2.0 million		-	1.00	-	-	-	-	1.00	-	2
Emin'	1.04 million		-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:
Shear : LC #3 = D + 0.6W
Bending(+): LC #3 = D + 0.6W
Deflection: LC #2 = 0.6D + 0.6W (live)
LC #3 = D + 0.6W (total)
Bearing : Support 1 - LC #2 = 0.6D + 0.6W
Support 2 - LC #2 = 0.6D + 0.6W
W=wind
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 = 604, V design = 550 lbs; M(+) = 1565 lbs-ft
EIy = 229.11 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 = 1.0 dead + "live"
Lateral stability(+): Lu = 10.38' Le = 19.06' RB = 3.6

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.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 4, 2022 15:36	**PROJECT** Garage 2 Door HDR - OOP

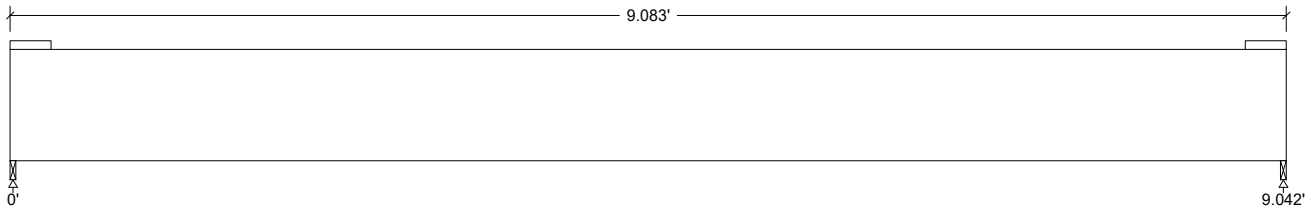
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Wind	Full UDL				187.2		plf
Self-weight	Dead	Full UDL				15.6		plf

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



Unfactored:			
Dead	70		70
Wind	850		850
Factored:			
Total	552		552
Bearing:			
Capacity			
Beam	2256		2256
Support	2969		2969
Des ratio			
Beam	0.26		0.26
Support	0.20		0.20
Load comb	#2		#2
Length	0.50*		0.50*
Min req'd	0.50*		0.50*
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

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

GARAGE 2 HEADER OOP

PSL, 2.0E, 2.0E, 5-1/4"x9-1/2"

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

Total length: 9.06'; Clear span: 9'; Volume = 3.1 cu.ft.

Lateral support: top = at supports, bottom = at supports; Oblique angle: 90.0 deg;

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	x-x	fv = 0	Fv' = 464	psi	fv/Fv' = 0.00
	y-y	fv = 16	Fv' = 336	psi	fv/Fv' = 0.05
Bending(+)	x-x	fb = 0	Fb' = 4676	psi	fb/Fb' = 0.00
	y-y	fb = 359	Fb' = 4586	psi	fb/Fb' = 0.08
Live Defl'n		0.07 = < L/999	0.30 = L/360	in	0.24
Total Defl'n		0.08 = < L/999	0.45 = L/240	in	0.19

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Ci	LC#
Fvy'	210	1.60	-	1.00	-	-	-	-	1.00	-	3
Fby'	2800	1.60	-	1.00	0.998	1.03	-	1.00	1.00	-	3
Fcp'	475	-	-	1.00	-	-	-	-	1.00	-	-
Ey'	2.0 million		-	1.00	-	-	-	-	1.00	-	2
Emin'	1.04 million		-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

Shear : LC #3 = D + 0.6W

Bending(+): LC #3 = D + 0.6W

Deflection: LC #2 = 0.6D + 0.6W (live)

LC #3 = D + 0.6W (total)

Bearing : Support 1 - LC #2 = 0.6D + 0.6W

Support 2 - LC #2 = 0.6D + 0.6W

W=wind

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 = 578, V design = 520 lbs; M(+) = 1307 lbs-ft

EIy = 229.11 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 = 1.0 dead + "live"

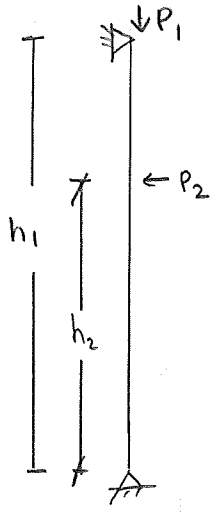
Lateral stability(+): Lu = 9.06' Le = 16.63' RB = 3.4

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. 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.

OUT OF PLANE LATERAL - WEST ELEVATION, GARAGE DOORS

COL - GARAGE



GARAGE ①

h_1 = ~~13'-7"~~ 11'-7"

h_2 = ~~9'-0"~~ 7'-0"

↖ RAISE STEM WALL 2'-0"

P_1 = 1070#(D) + 1790#(S)

P_2 = 880#(W)

PER WOODWORKS, (3) 2x6 HF STUD

Axial + Bending: 69%

δ = L/373 = 0.37"

GPRAGE ②

h_1 = 12'-9"

h_2 = 6'-8"

P_1 = 750#(D) + 1250#(S)

P_2 = 850#(W)

PER WOODWORKS, (3) 2x6 HF STUD

Axial + Bending: 75%

δ = L/301 = 0.51"

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description: OUT OF PLANE LATERAL		By: ERIT	Date: 3/4/22
		Checked	Date
		Scale: NTS	Sheet No.
Project: BRUMBAUGH RESIDENCE		Job No.: 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 4, 2022 15:48	**PROJECT** Garage 1 Door Col - OOP

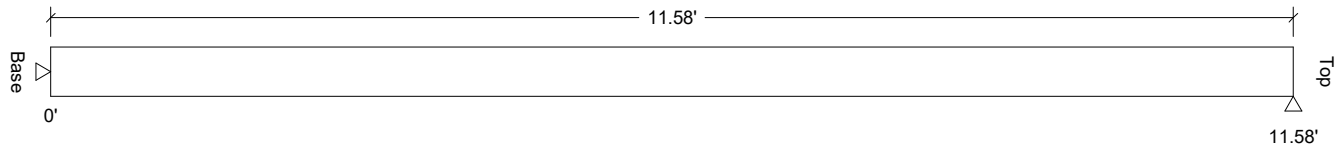
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Axial	(Ecc. = 0.00")		1070		lbs
Load2	Snow	Axial	(Ecc. = 0.00")		1790		lbs
Load3	Wind	Point	7.00		880		lbs
Self-weight	Dead	Axial			59		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Snow			
Wind	348		532
Axial:			
Dead	1129		1129
Snow	1790		1790
Factored:			
L->R	209		319
Load comb	#4		#4

GARAGE 1 DOOR COL OOP

Lumber n-ply, Hem-Fir, Stud, 2x6, 3-ply (4-1/2"x5-1/2")

Support: Non-wood

Total length: 11.56'; Volume = 2.0 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 11.58 = 11.58 ft; 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 = 19	Fv' = 240	psi	fv/Fv' = 0.08
Bending(+)	fb = 773	Fb' = 1242	psi	fb/Fb' = 0.62
Axial	fc = 118	Fc' = 469	psi	fc/Fc' = 0.25
Axial Bearing	fc = 118	Fc* = 920	psi	fc/Fc* = 0.13
Combined	(axial compression + side load bending)			Eq.3.9-3 = 0.69
Live Defl'n	0.37 = L/373	1.16 = L/120	in	0.32
Total Defl'n	0.37 = L/373	1.16 = L/120	in	0.32

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.60	1.00	1.00	-	-	-	-	1.00	1.00	4
Fb'+	675	1.60	1.00	1.00	1.000	1.000	-	1.15	1.00	1.00	4
Fc'	800	1.15	1.00	1.00	0.510	1.000	-	-	1.00	1.00	2
Fc'comb	800	1.60	-	-	0.392	-	-	-	-	-	5
E'	1.2 million		1.00	1.00	-	-	-	-	1.00	1.00	4
Emin'	0.44 million		1.00	1.00	-	-	-	-	1.00	1.00	4
Fc*	800	1.15	1.00	1.00	-	1.000	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #4  = 0.6D + 0.6W
 Bending(+): LC #4  = 0.6D + 0.6W
 Deflection: LC #4  = 0.6D + 0.6W  (live)
             LC #4  = 0.6D + 0.6W  (total)
 Axial     : LC #2  = D + S
 Combined  : LC #5  = D + 0.6W;
 D=dead S=snow W=wind
 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 = 319 lbs; M(+) = 1462 lbs-ft; P = 2919 lbs, Kf = 1.00, (1 - fc/FcE) = 0.92
   EIy = 24.96 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. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 4, 2022 15:48	**PROJECT** Garage 2 Door Col - OOP

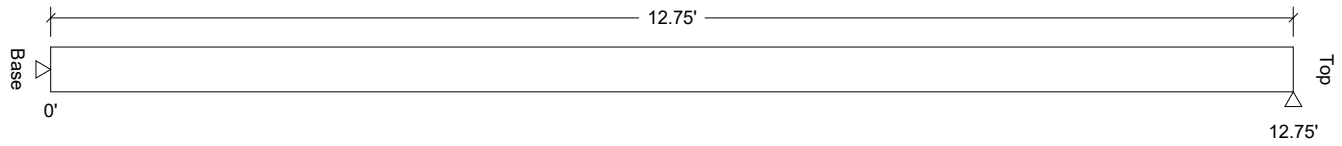
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Dead	Axial	(Ecc. = 0.00")		750		lbs
Load2	Snow	Axial	(Ecc. = 0.00")		1250		lbs
Load3	Wind	Point	6.67		850		lbs
Self-weight	Dead	Axial			65		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Snow			
Wind	405		445
Axial:			
Dead	815		815
Snow	1250		1250
Factored:			
L->R	243		267
Load comb	#4		#4

GARAGE 2 DOOR COL OOP

Lumber n-ply, Hem-Fir, Stud, 2x6, 3-ply (4-1/2"x5-1/2")

Support: Non-wood

Total length: 12.75'; Volume = 2.2 cu.ft.

Pinned base; Load face = width(b); Built-up fastener: nails; Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 12.75 = 12.75 ft; 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 = 16	Fv' = 240	psi	fv/Fv' = 0.07
Bending(+)	fb = 858	Fb' = 1242	psi	fb/Fb' = 0.69
Axial	fc = 83	Fc' = 404	psi	fc/Fc' = 0.21
Axial Bearing	fc = 83	Fc* = 920	psi	fc/Fc* = 0.09
Combined	(axial compression + side load bending)			Eq.3.9-3 = 0.75
Live Defl'n	0.51 = L/301	1.27 = L/120	in	0.40
Total Defl'n	0.51 = L/301	1.27 = L/120	in	0.40

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.60	1.00	1.00	-	-	-	-	1.00	1.00	4
Fb'+	675	1.60	1.00	1.00	1.000	1.000	-	1.15	1.00	1.00	4
Fc'	800	1.15	1.00	1.00	0.439	1.000	-	-	1.00	1.00	2
Fc'comb	800	1.60	-	-	0.332	-	-	-	-	-	5
E'	1.2 million		1.00	1.00	-	-	-	-	1.00	1.00	4
Emin'	0.44 million		1.00	1.00	-	-	-	-	1.00	1.00	4
Fc*	800	1.15	1.00	1.00	-	1.000	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
Shear     : LC #4  = 0.6D + 0.6W
Bending(+): LC #4  = 0.6D + 0.6W
Deflection: LC #4  = 0.6D + 0.6W  (live)
            LC #4  = 0.6D + 0.6W  (total)
Axial     : LC #2  = D + S
Combined  : LC #5  = D + 0.6W;
D=dead S=snow W=wind
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 = 267 lbs; M(+) = 1622 lbs-ft; P = 2065 lbs, Kf = 1.00, (1 - fc/FcE) = 0.93
  EIy = 24.96 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. BUILT-UP COLUMNS: nailed or bolted built-up columns shall conform to the provisions of NDS Clause 15.3.
4. FIRE RATING: Joists, wall studs, and multi-ply members are not rated for fire endurance.

OUT OF PLANE LATERAL - WEST ELEVATION, STAIRWELL

$P_{net} = \lambda K_{zt} P_{net30}$

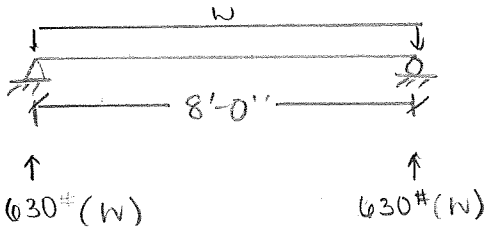
$\lambda = \frac{1.0 - 0.89}{30 - 20}(23 - 20) + 0.89 = 0.923$

Wind Speed = 98 mph
Exposure (B)
$K_{zt} = 1.3$
Roof Height = 23'
Zone 5

EFFECTIVE WIND AREA	P_{net30}	P_{net}
20SF	21.62 PSF	25.94 PSF
50SF	19.5 PSF	23.4 PSF
100 SF	17.98 PSF	21.57 PSF

↑(BY INTERPOLATION)

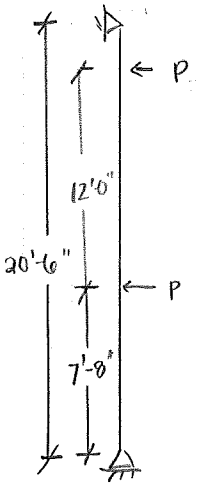
HDR - STAIRWELL WINDOW



TRIB = 6'
w = 25.94 PSF (6.0') = 156 PLF

BASED ON PREVIOUS CALCULATION,
5 1/4 x 9 1/2 PSL OK

COL - STAIRWELL WINDOW



P = 630#

PER WOODWORKS, 5 1/4 x 5 1/4 PSL
$f_b / F'_b = 22\%$
$\delta = L/230 = 1.07"$

$\delta_{ALLOW} = \frac{20.5'(12\,in/ft)}{240} + 1/4" = 1.275" > 1.07"$
OK✓

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: OUT OF PLANE LATERAL	By: ERH	Date: 3/4/22
		Checked	Date
		Scale: NTS	Sheet No.
	Project: BRUMBAUGH RESIDENCE	Job No.: 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 10:27	**PROJECT** Stairwell Post

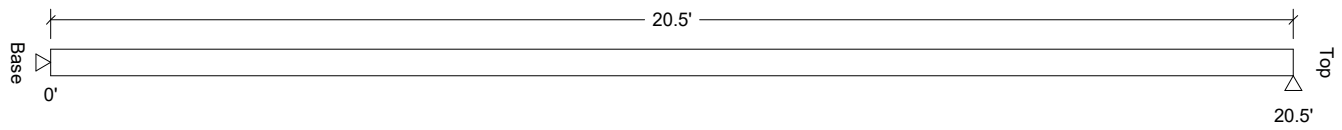
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Wind	Point	7.67		630		lbs
Load2	Wind	Point	19.67		630		lbs
Self-weight	Dead	Axial			177		lbs

Reactions (lbs):



Unfactored:			
Lateral:			
Wind	420		840
Axial:			
Dead	177		177
Factored:			
L->R	252		504
Load comb	#2		#2

Full Height Stairwell Post

PSL, PSL, 1.8E, 5-1/4"x5-1/4"

Support: Non-wood

Total length: 20.5'; Volume = 3.9 cu.ft.

Pinned base; Load face = width(b); Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 20.5 = 20.5 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
Shear	fv = 27	Fv' = 368	psi	fv/Fv' = 0.07
Bending(+)	fb = 961	Fb' = 4384	psi	fb/Fb' = 0.22
Axial	fc = 6	Fc' = 343	psi	fc/Fc' = 0.02
Axial Bearing	fc = 6	Fc* = 2250	psi	fc/Fc* = 0.00
Combined	(axial compression + side load bending)			Eq.3.9-3 = 0.22
Live Defl'n	1.07 = L/230	2.05 = L/120	in	0.52
Total Defl'n	1.07 = L/230	2.05 = L/120	in	0.52

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CV	Cfu	Cr	Cfrt	CF	LC#
Fv'	230	1.60	-	1.00	-	-	-	-	1.00	-	2
Fb'+	2500	1.60	-	1.00	1.000	1.096	-	1.00	1.00	-	2
Fc'	2500	0.90	-	1.00	0.153	-	-	-	1.00	-	1
Fc'comb	2500	1.60	-	-	0.087	-	-	-	-	-	3
E'	1.8 million		-	1.00	-	-	-	-	1.00	-	2
Emin'	0.93 million		-	1.00	-	-	-	-	1.00	-	2
Eminy'	0.93 million		-	1.00	-	-	-	-	1.00	-	2
Fc*	2500	0.90	-	1.00	-	-	-	-	1.00	-	1

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #2  = 0.6D + 0.6W
 Bending(+): LC #2  = 0.6D + 0.6W
 Deflection: LC #2  = 0.6D + 0.6W  (live)
             LC #2  = 0.6D + 0.6W  (total)
 Axial     : LC #1  = D only
 Combined  : LC #3  = D + 0.6W;
 W=wind
 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 = 504 lbs; M(+) = 1932 lbs-ft; P = 177 lbs, (1 - fc/FcE) = 0.98
   EIy = 113.95 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 = 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. 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.

OUT OF PLANE LATERAL - EAST ELEVATION, LIVING ROOM

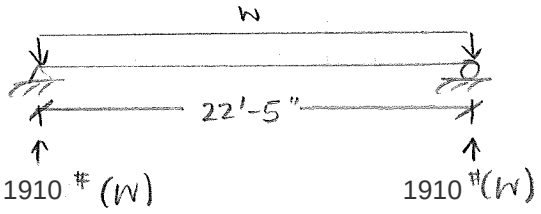
$P_{net} = \lambda K_{zt} P_{net30}$ [ASCE 7-16 EQ 30.4-1]

$\lambda = \frac{0.89 - 0.82}{20 - 15}(18 - 15) + 0.82 = 0.862$

Wind speed = 98
Exposure (B)
$K_{zt} = 1.3$
Roof Height = 18'
Zone 4

EFFECTIVE WIND AREA	P_{net30}	P_{net}
20 SF	17.62 PSF	19.74 PSF
50 SF	16.92 PSF	18.96 PSF
100 SF	16.16 PSF	18.11 PSF

HDR - LIVING ROOM



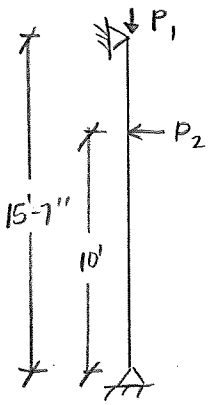
TRIB = (4.75' + 4.67') = 9.42'
w = 18.11 PSF (9.42') = 170.6 PLF

PER ENERCALC: W 21X83
- $\frac{M_a}{M_{n/\Omega}}$ = 8%
- $\frac{V_a}{V_{n/\Omega}}$ = 1%
- δ = 0.247"

PER IBC 2018 1604.3.7 : MEMBERS SUPPORTING GLASS

$\delta_{ALLOW} = \frac{22.42'(12\,in/ft)}{240} + 1/4" = 1.37" > 0.247"$ OK ✓

COL - LIVING ROOM



P_1 (GRAVITY) = 4100 #(D) + 6260 #(S)
P_2 (LATERAL) = 1910 #(W)

PER WOODWORKS, HSS8 X 2 X 1/4
Axial + Bending 19 %
δ_L = 0.29"

$\delta_{ALLOW} = \frac{15.58'(12\,in/ft)}{240} + 1/4" = 1.03" > 0.29"$ OK ✓

CG ENGINEERING 250 4th Ave. South Suite 200 Edmonds, WA 98020 425.778.8500 www.cgengineering.com	Description: OUT OF PLANE LATERAL	By: ERH	Date: 3/4/22
		Checked	Date
		Scale: NTS	Sheet No.
	Project: BRUMBAUGH RESIDENCE	Job No.: 22032.10	

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Brumbaugh.ec6

LIC# : KW-06015244, Build:20.22.3.16 CG ENGINEERING (c) ENERCALC INC 1983-2022

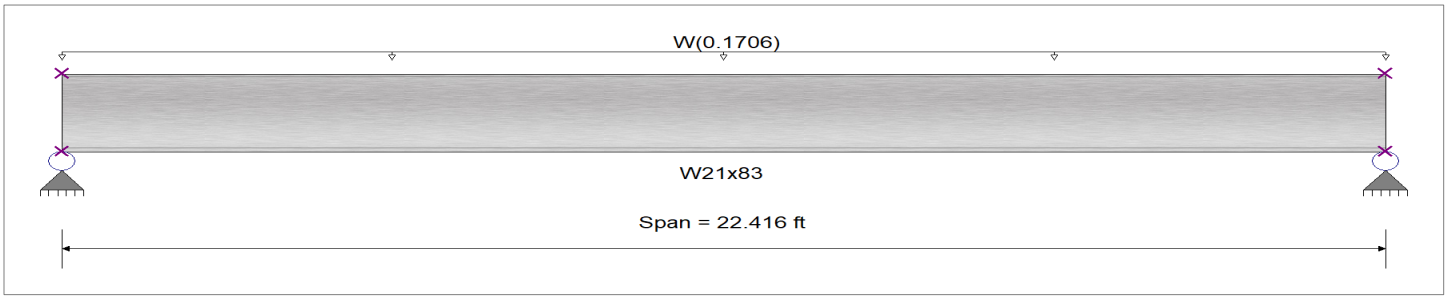
DESCRIPTION: Copy of Folding Door Header - OUT OF PLANE

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Strength Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Minor Axis Bending		



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : W = 0.1706 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.084 : 1	Maximum Shear Stress Ratio =	0.004 : 1
Section used for this span	W21x83	Section used for this span	W21x83
Ma : Applied	6.429 k-ft	Va : Applied	1.147 k
Mn / Omega : Allowable	76.098 k-ft	Vn/Omega : Allowable	279.224 k
Load Combination	+0.60W	Load Combination	+0.60W
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.412 in	Ratio =	652	>=360	
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360	Span: 1 : W Only
Max Downward Total Deflection	0.247 in	Ratio =	1087	>=180	Span: 1 : +0.60W
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.4124	11.272		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.912	1.912
Overall MINimum	0.860	0.860
+0.60W	1.147	1.147
+0.450W	0.860	0.860
W Only	1.912	1.912

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Brumbaugh.ec6

LIC# : KW-06015244, Build:20.22.3.16 CG ENGINEERING (c) ENERCALC INC 1983-2022

DESCRIPTION: STEEL COLUMN

Code References

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Steel Section Name : **HSS8x4x1/4**
Analysis Method : Allowable Strength
Steel Stress Grade
Fy : Steel Yield 50.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 15.670 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition for deflection (buckling) along columns :
X-X (width) axis :
Fully braced against buckling ABOUT Y-Y Axis
Y-Y (depth) axis :
Unbraced Length for buckling ABOUT X-X Axis = 15.670 ft, K = 1.0

Applied Loads

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

Column self weight included : 298.043 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 15.670 ft, D = 5.080, S = 6.020 k
BENDING LOADS . . .
Lat. Point Load at 10.0 ft creating Mx-x, W = 1.910 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS Max. Axial+Bending Stress Ratio = 0.1484 : 1
Load Combination +D+0.60W
Location of max.above base 9.991 ft
At maximum location values are . . .
Pa : Axial 5.378 k
Pn / Omega : Allowable 114.117 k
Ma-x : Applied 4.143 k-ft
Mn-x / Omega : Allowable 33.184 k-ft
Ma-y : Applied 0.0 k-ft
Mn-y / Omega : Allowable 20.459 k-ft

PASS Maximum Shear Stress Ratio 0.01197 : 1
Load Combination +D+0.60W
Location of max.above base 10.096 ft
At maximum location values are . . .
Va : Applied 0.7313 k
Vn / Omega : Allowable 61.119 k

Maximum Load Reactions . .
Top along X-X 0.0 k
Bottom along X-X 0.0 k
Top along Y-Y 1.219 k
Bottom along Y-Y 0.6911 k

Maximum Load Deflections . . .
Along Y-Y 0.1956 in at 8.519 ft above base
for load combination : W Only
Along X-X 0.0 in at 0.0 ft above base
for load combination :

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
D Only	5.378								
+D+S	11.398								
+D+0.750S	9.893								
+D+0.60W	5.378			0.415	0.731				
+D+0.450W	5.378			0.311	0.549				
+D+0.750S+0.450W	9.893			0.311	0.549				
+0.60D+0.60W	3.227			0.415	0.731				
+0.60D	3.227								
S Only	6.020								
W Only				0.691	1.219				

USE FOR ANCHORAGE
DESIGN TO FOLLOW

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
Axial @ Base	Maximum	11.398								
"	Minimum				0.691	1.219				
Reaction, X-X Axis Base	Maximum	5.378								

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Column

Project File: Brumbaugh.ec6

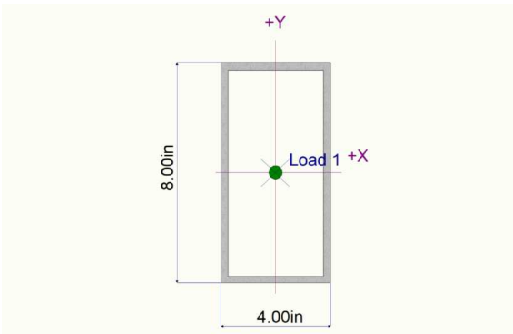
LIC# : KW-06015244, Build:20.22.3.16 CG ENGINEERING (c) ENERCALC INC 1983-2022

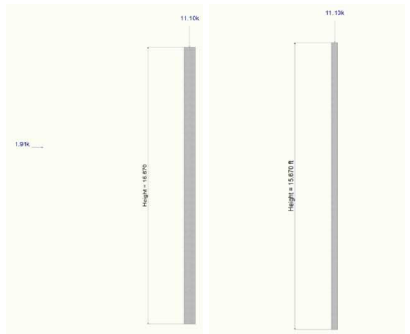
DESCRIPTION: STEEL COLUMN

Extreme Reactions

Item	Extreme Value	Axial Reaction @ Base	X-X Axis Reaction @ Base	X-X Axis Reaction @ Top	Y-Y Axis Reaction @ Base	Y-Y Axis Reaction @ Top	Mx - End Moments @ Base	Mx - End Moments @ Top	My - End Moments @ Base	My - End Moments @ Top
"	Minimum	5.378								
Reaction, Y-Y Axis Base	Maximum				0.691	1.219				
"	Minimum	5.378								
Reaction, X-X Axis Top	Maximum	5.378								
"	Minimum	5.378								
Reaction, Y-Y Axis Top	Maximum	5.378								
"	Minimum	5.378								
Moment, X-X Axis Base	Maximum	5.378								
"	Minimum	5.378								
Moment, Y-Y Axis Base	Maximum	5.378								
"	Minimum	5.378								
Moment, X-X Axis Top	Maximum	5.378								
"	Minimum	5.378								
Moment, Y-Y Axis Top	Maximum	5.378								
"	Minimum	5.378								

Sketches





1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-14
Units: Imperial units

Anchor Information:
Anchor type: Cast-in-place
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 3.500
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 4.88
C_{min} (inch): 3.75
S_{min} (inch): 3.75

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 8.00
State: Uncracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.4
Reinforcement condition: B tension, B shear
Supplemental reinforcement: No
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Ignore 6do requirement: No
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 8.00 x 10.00 x 0.50
Yield stress: 36000 psi

Profile type/size: HSS8X4X1/4

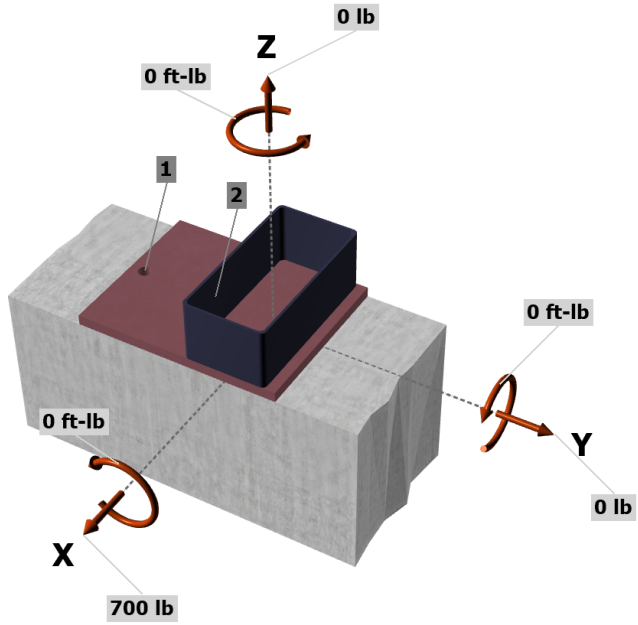
Recommended Anchor
Anchor Name: J- or L-Bolt - 5/8"Ø J- or L-Bolt, F1554 Gr. 36

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: Not applicable
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: Yes

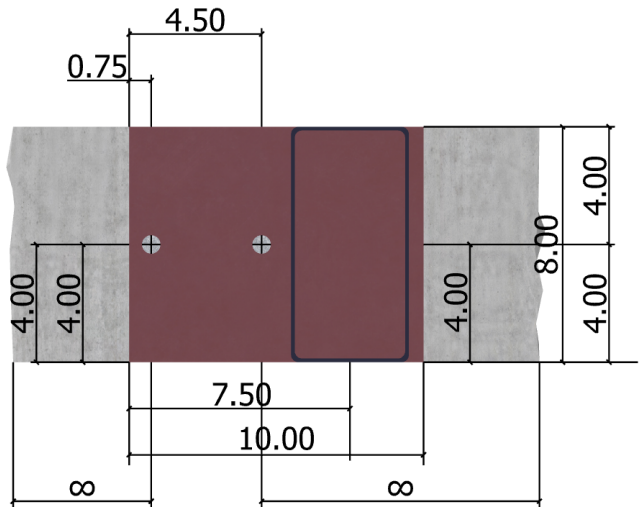
Strength level loads:

N_{ua} [lb]: 0
V_{uax} [lb]: 700
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



<Figure 2>

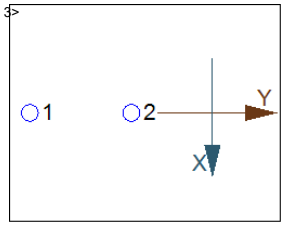


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	-560.0	0.0	560.0
2	0.0	1260.0	0.0	1260.0
Sum	0.0	700.0	0.0	1820.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
7865	1.0	0.65	5112

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in x-direction:

$V_{bx} = \min\left|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}\right|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.50	0.625	1.00	2500	4.00	3124

$\phi V_{cbgx} = \phi\,(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1 & Eq. 17.5.2.1b)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
72.00	72.00	1.000	1.000	1.400	1.000	3124	0.70	3062

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cp} = \phi k_{cp}N_{cb} = \phi k_{cp}(A_{Nc} / A_{Nco})\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.5.3.1a)

k_{cp}	A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	ϕV_{cp} (lb)
2.0	57.00	110.25	0.929	1.250	1.000	7857	0.70	6601

11. Results

11. Interaction of Tensile and Shear Forces (Sec. D.7)?

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	1260	5112	0.25	Pass
T Concrete breakout x+	**1260**	**3062**	**0.41**	**Pass (Governs)**
Pryout	1260	6601	0.19	Pass

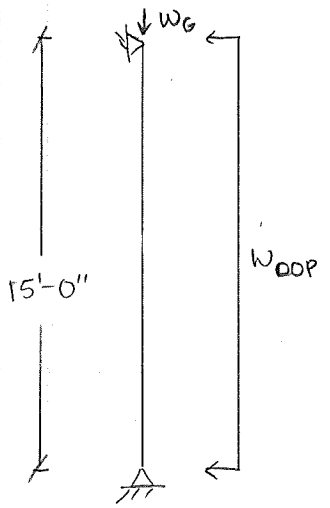
5/8"Ø J- or L-Bolt, F1554 Gr. 36 with hef = 3.500 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

OUT OF PLANE LATERAL - (+ GRAVITY) WALL STUDS

STUD - UP TO 15'-0"



2x6 HF STUD @ 16" O.C.

$W_{OOP} = 26\ PSF\ (\frac{16}{12}) = 34.7\ PLF$

$W_G = 210\ (D) + 350\ (S)\ PLF$

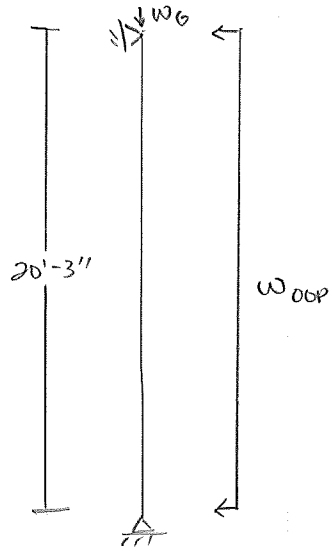
PER WOODWORKS: **2x6 HF STUD @ 16" O.C.**

$f_b/F'_b = 75\%$

Axial + Bending = 85%

$\delta = 4/189$

STUD - OVER 15'-0", UP TO 20'-3"



$1\frac{3}{4} \times 5\frac{1}{2}$ 2.0E LVL @ 16" O.C.

$W_{OOP} = 34.7\ PLF$

$W_G = 323\ (D) + 538\ (S)\ PLF$

PER WOODWORKS: **$1\frac{3}{4} \times 5\frac{1}{2}$ 2.0E LVL @ 16" O.C.**

$f_b/F'_b = 35\%$

Axial + Bending 44%

$\delta = 4/146$

CG ENGINEERING
250 4th Ave. South
Suite 200
Edmonds, WA 98020
425.778.8500
www.cgengineering.com

Description	By	Date
OUT OF PLANE LATERAL	ERH	
WALL STUDS	Checked	Date
	Scale NTS	Sheet No.
Project BRUMBAUGH RESIDENCE	Job No. 22032.10	

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 10:14	**PROJECT** TYP 2X6 STUD

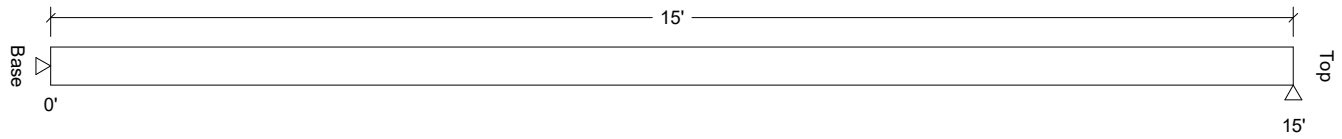
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Dead	Axial UDL	(Ecc. = 0.00")		210		plf
Load2	Live	Axial UDL	(Ecc. = 0.00")		350		plf
Load3	Wind	Full UDL			34.7		plf
Self-weight	Dead	Axial UDL			19		plf

Reactions (lbs):



Unfactored:			
Lateral:			
Dead			
Live			
Wind	260		260
Axial:			
Dead	306		306
Live	467		467
Factored:			
L->R	156		156
Load comb	#4		#4

TYP 2x6 STUD - OOP + GRAVITY

Lumber Stud, Hem-Fir, Stud, 2x6 (1-1/2"x5-1/2")

Support: None

Spaced at 16.0" c/c; Total length: 15.0'; Volume = 0.9 cu.ft.

Pinned base; Load face = width(b); Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 15.0 = 15.0 ft; 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 = 28	Fv' = 240	psi	fv/Fv' = 0.12
Bending(+)	fb = 929	Fb' = 1242	psi	fb/Fb' = 0.75
Axial	fc = 94	Fc' = 301	psi	fc/Fc' = 0.31
Axial Bearing	fc = 94	Fc* = 800	psi	fc/Fc* = 0.12
Combined	(axial compression + side load bending)			Eq.3.9-3 = 0.85
Live Defl'n	0.95 = L/189	1.50 = L/120	in	0.63
Total Defl'n	0.95 = L/189	1.50 = L/120	in	0.63

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CF	Cfu	Cr	Cfrt	Ci	LC#
Fv'	150	1.60	1.00	1.00	-	-	-	-	1.00	1.00	4
Fb'+	675	1.60	1.00	1.00	1.000	1.000	-	1.15	1.00	1.00	4
Fc'	800	1.00	1.00	1.00	0.377	1.000	-	-	1.00	1.00	2
Fc'comb	800	1.60	-	-	0.248	-	-	-	-	-	5
E'	1.2 million	1.00	1.00		-	-	-	-	1.00	1.00	4
Emin'	0.44 million	1.00	1.00		-	-	-	-	1.00	1.00	4
Fc*	800	1.00	1.00	1.00	-	1.000	-	-	1.00	1.00	2

CRITICAL LOAD COMBINATIONS:

```
 Shear     : LC #4  = 0.6D + 0.6W
 Bending(+): LC #4  = 0.6D + 0.6W
 Deflection: LC #4  = 0.6D + 0.6W  (live)
             LC #4  = 0.6D + 0.6W  (total)
 Axial     : LC #2  = D + L
 Combined  : LC #5  = D + 0.6W;
 D=dead L=live W=wind
 All LC's are listed in the Analysis output
 Load combinations: ASD Basic from ASCE 7-16 2.4 / IBC 2018 1605.3.1
```

CALCULATIONS:

```
 V = 156 lbs; M(+) = 586 lbs-ft; P = 772 lbs, (1 - fc/FcE) = 0.89
   EIy = 24.96 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.

WoodWorks® SOFTWARE FOR WOOD DESIGN	**COMPANY** CG Engineering 250 4th Ave S. STE 200 Edmonds, WA 98020 Mar. 8, 2022 10:22	**PROJECT** Full Height Stud

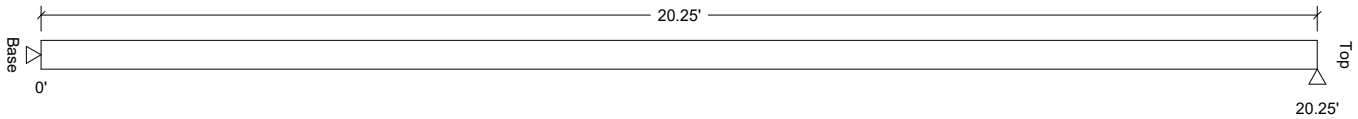
Design Check Calculation Sheet

WoodWorks Sizer 2019 (Update 4)

Loads:

Load	Type	Distribution	Location [ft] Start	Location [ft] End	Magnitude Start	Magnitude End	Unit
Load1	Wind	Full UDL			34.7		plf
Load2	Dead	Axial UDL	(Ecc. = 0.92")		323		plf
Load3	Snow	Axial UDL	(Ecc. = 0.92")		538		plf
Self-weight	Dead	Axial UDL			43		plf

Reactions (lbs):



Unfactored:			
Lateral:			
Dead	2		-2
Snow	3		-3
Wind	351		351
Axial:			
Dead	488		488
Snow	717		717
Factored:			
R->L			-4
Load comb			#2
L->R	212		210
Load comb	#5		#4

Full Height LVL Stud

LVL n-ply, 2.0E, 2600Fb, 1-3/4"x5-1/2"

Support: None

Spaced at 16" c/c; Total length: 20.25'; Volume = 1.4 cu.ft.

Pinned base; Load face = width(b); Ke x Lb: 1.0 x 0.0 = 0.0 ft; Ke x Ld: 1.0 x 20.25 = 20.25 ft; Repetitive factor: applied where permitted (refer to online help);

This section PASSES the design code check.

Analysis vs. Allowable Stress and Deflection using NDS 2018 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 33	Fv' = 456	psi	fv/Fv' = 0.07
Bending(+)	fb = 1474	Fb' = 4160	psi	fb/Fb' = 0.35
Axial	fc = 125	Fc' = 429	psi	fc/Fc' = 0.29
Combined	(axial + eccentric + side load bending)			Eq.15.4-1 = 0.44
Axial Bearing	fc = 125	Fc* = 2887	psi	fc/Fc* = 0.04
Live Defl'n	1.62 = L/149	2.03 = L/120	in	0.80
Total Defl'n	1.65 = L/146	2.03 = L/120	in	0.82

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL/CP	CV	Cfu	Cr	Cfrt	CF	LC#
Fv'	285	1.60	-	1.00	-	-	-	-	1.00	-	4
Fb'+	2600	1.60	-	1.00	1.000	1.000	-	1.00	1.00	-	5
Fc'	2510	1.15	-	1.00	0.149	-	-	-	1.00	-	2
Fc'comb	2510	1.60	-	-	0.107	-	-	-	-	-	3
E'	2.0 million		-	1.00	-	-	-	-	1.00	-	5
Emin'	1.04 million		-	1.00	-	-	-	-	1.00	-	5
Eminy'	1.04 million		-	1.00	-	-	-	-	1.00	-	5
Fc*	2510	1.15	-	1.00	-	-	-	-	1.00	-	2

CRITICAL LOAD COMBINATIONS:

Shear : LC #4 = 0.6D + 0.6W

Bending(+): LC #5 = D + 0.6W

Deflection: LC #4 = 0.6D + 0.6W (live)

LC #5 = D + 0.6W (total)

Axial : LC #2 = D + S

Combined : LC #3 = D + 0.75(S + 0.6W) fb= 1088 Fb'= 4160

FcE= 437 Pxe/S=fc(6xe/d)= 101

D=dead S=snow W=wind

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 = 212 lbs; M(+) = 1084 lbs-ft; P = 1205 lbs

EIy = 48.53 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 = 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. SCL: Structural composite lumber design has assumed: - dry service conditions - no preservative or fire-retardant treatment - no notches
4. SCL: Deflection is calculated using an apparent modulus of elasticity E that incorporates the effect of shear deflection.