

Structural Calculations for:

Rader Residence

7310 86th Ave SE, Mercer Island, WA 98040

Client: H2D Architecture

Code: 2018 International Building Code

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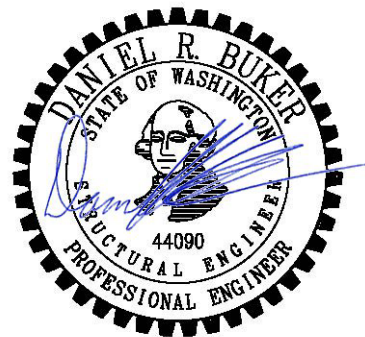
- C1 – Design Criteria
- L1 – L12 – Lateral Calculations
- F1 – F41 – Framing Calculations

Scope: Single Family Residence Addition

December 9, 2022

Revised: February 13, 2023

Revised: May 31, 2023



Seismic Design Loads (ASCE 7-16)

for a Wood Framed Structure

RISK CATEGORY II

OCCUPANCY CAT. II Table 1.5-1

IMP. FACTOR 1 Table 1.5-2

SITE CLASS D Table 20.3-1

R = 6.5 Table 12.2-1

SEISMIC

DESIGN CATEGORY D 11.6

$S_s = 1.461$

$S_1 = 0.505$

$F_a = 1.20$ Table 11.4-1

$F_v = 1.80$ Table 11.4-2

$S_{DS} = 1.169$

$S_{D1} = 0.606$

$T_0 = 0.10$

$T_s = 0.52$

$T_L = 6$ Fig 22-14

$T = 0.21$

Seismic Dead Load: 15^{psf} Roof

15^{psf} Floor

20^{psf} Walls

$C_{sULT} = 0.180$ Eqn. 12.8-2

$C_{sASD} = 0.128$

$W_{roof} = 15 + 10 = 25^{psf}$

$W_{floor} = 10 + 10 + 10 = 30^{psf}$

Vertical Design Loads

Criteria

ASCE 7-16

IBC 2018

Dead Loads

Roof (Composit) 2.5 psf

1/2" Ply 1.5 psf

Rafter/Truss 2 psf

Insulation 1 psf

5/8" GWB 3.1 psf

Misc./Mech. 2 psf

12.1 psf

Use 15 psf

Flooring 1 psf

Sheathing 2.3 psf

Joist 2.6 psf

5/8" GWB 3.1 psf

Misc. Mech 1 psf

10 psf

Use 15 psf

Live Loads

Snow 25 psf

floor 40 psf

Soil Bearing

1500
~~2000~~ psf



Project: Rader Residence
7310 86th Ave SE
Mercer Island, WA 98040

Date: 11/7/2022

Design: CRB

⚠ This is a beta release of the new ATC Hazards by Location website. Please [contact us](#) with feedback.

ℹ The ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

ATC Hazards by Location

Search Information

Address: 7310 86th Ave SE, Mercer Island, WA 98040, USA

Coordinates: 47.5373417, -122.2236198

Elevation: 325 ft

Timestamp: 2022-11-07T20:43:00.418Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: II

Site Class: D-default



Basic Parameters

Name	Value	Description
S_S	1.461	MCE_R ground motion (period=0.2s)
S_1	0.505	MCE_R ground motion (period=1.0s)
S_{MS}	1.754	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.169	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	1.2	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	0.898	Coefficient of risk (1.0s)
PGA	0.625	MCE_{peak} peak ground acceleration

PGA	0.020	MCEG peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.75	Site modified peak ground acceleration
T _L	6	Long-period transition period (s)
SsRT	1.461	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.62	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	4.296	Factored deterministic acceleration value (0.2s)
S1RT	0.505	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.562	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.639	Factored deterministic acceleration value (1.0s)
PGAd	1.422	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.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. [Find out why.](#)

Disclaimer

Hazard loads are provided by the U.S. Geological Survey [Seismic Design Web Services](#).

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Wind Design Loads (ASCE 7-16)

Directional Procedure - Part 1

Exposure B
 V= 97 mph
 K_d= 0.85 Table 26.6-1
 I= 1
 G= 0.85 26.11.1
 K_e= 1.00 Table 26.9-1

Roof Angle = 21.4 degrees
 Ground to top of roof 22.8 ft
 Bottom of roof to top of roof 6.31 ft
 (mean roof height) h= 19.6 ft

Pressure Coefficients
 from Figure 27.4-1:

Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.5
Windward Roof	0.3
Leeward Roof	-0.6

*Note= C_p values are conservative
 worst case values

K_{zt}= 1.00

Pressures: Calculated using ASCE7-16 Ch. 27 (Directional Procedure)						
Ht	K _z	q _z	P _{ww walls}	P _{lw walls}	Ultimate P _{walls} (psf)	Allowable P _{walls} (psf)
0-15	0.57	11.67	7.94	5.39	13.33	8.00
15-20	0.62	12.69	8.63	5.39	14.03	8.42
20-25	0.66	13.51	9.19	5.39	14.58	8.75
25-30	0.7	14.33	9.75	5.39	15.14	9.08
30-40	0.76	15.56	10.58	5.39	15.98	9.59

P _{ww roof}	P _{lw roof}	P _{roof} (psf)	P _{roof} (psf)
3.24	6.47	9.71	5.83



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Coordinates: 47.5373417, -122.2236198
Elevation: 325 ft
Timestamp: 2022-11-07T20:42:02.369Z
Hazard Type: Wind



ASCE 7-16

MRI 10-Year ----- 67 mph
MRI 25-Year ----- 73 mph
MRI 50-Year ----- 78 mph
MRI 100-Year ----- 83 mph
Risk Category I ----- 92 mph
Risk Category II ----- 97 mph
Risk Category III ----- 104 mph
Risk Category IV ----- 108 mph

ASCE 7-10

MRI 10-Year ----- 72 mph
MRI 25-Year ----- 79 mph
MRI 50-Year ----- 85 mph
MRI 100-Year ----- 91 mph
Risk Category I ----- 100 mph
Risk Category II ----- 110 mph
Risk Category III-IV ----- 115 mph

ASCE 7-05

ASCE 7-05 Wind Speed ----- 85 mph

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Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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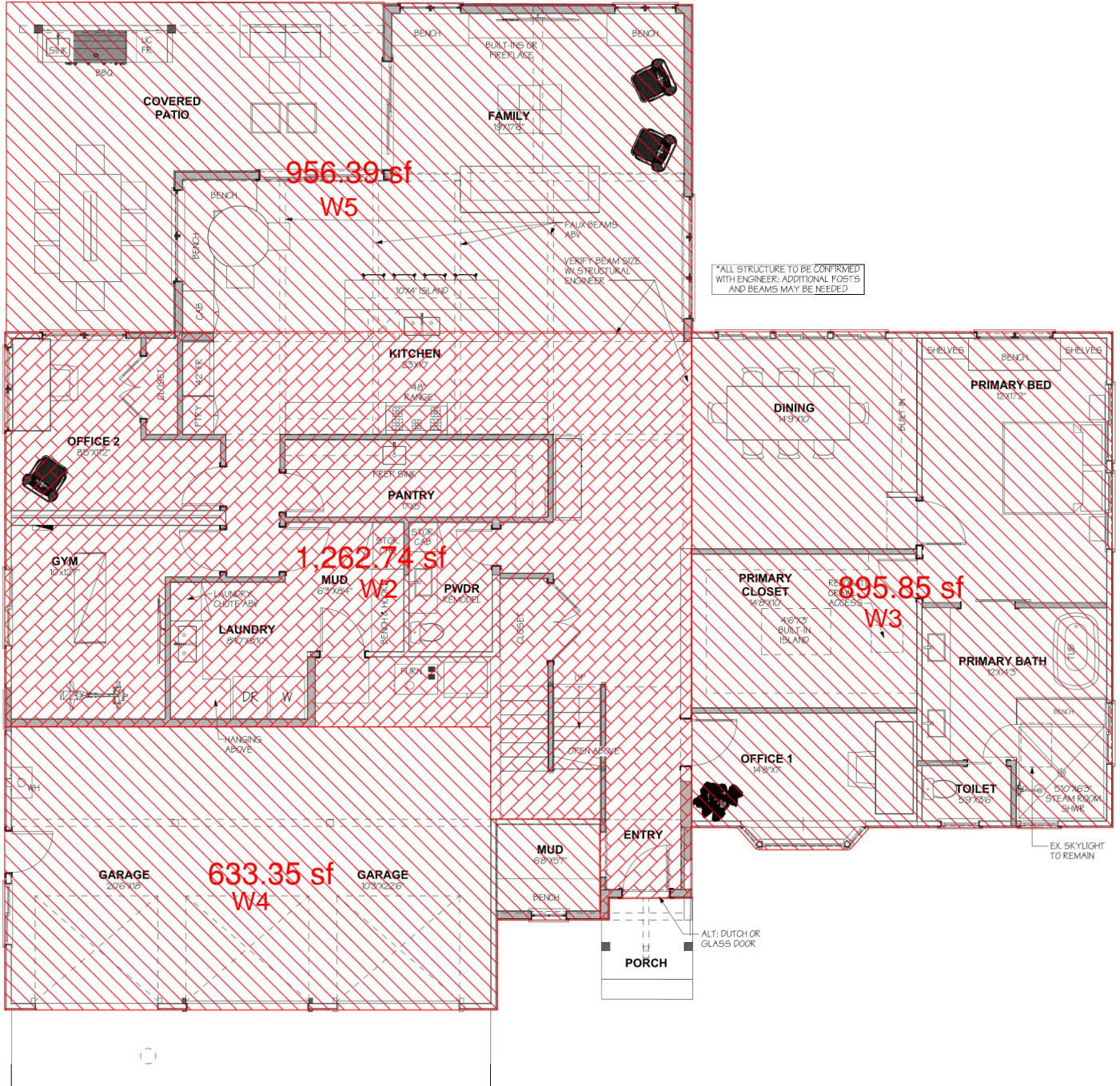
Upper Roof Mass Calculation

$$W1 = 1813.34 \times 25 = 45.33 \text{ kip}$$



Low Roof/Second Floor Mass Calculations

$W2 = 1262.74 \times 30 = 37.88 \text{ kips (E)}$
 $W3 = 895.85 \times 25 = 22.4 \text{ kips (E)}$
 $W4 = 633.35 \times 25 = 15.83 \text{ kips (E)}$
 $W5 = 956.39 \times 25 = 23.91 \text{ kips (New)}$
 $W_{total} = 76.11 \text{ kips (Existing)}$
 $W_{total} = 23.91 \text{ (New)}$



(E) Structure

Seismic Analysis (ASCE 7-10)

$S_s =$	1.461	$F_a =$	1.20	$S_{ms} =$	1.75	$S_{Ds} =$	1.17
$S_1 =$	0.51	$F_v =$	1.80	$S_{m1} =$	0.909	$S_{D1} =$	0.61

Site Class =	D	
Mean Roof Height =	19.6	ft
T =	0.19	sec
R =	6.5	
I =	1.0	
rho =	1.0	
Cs =	0.180	
W =	121.44	K
Allowable Base Shear V =	15.29	K

House

Level	Wx (K)	hx (ft)	Wxhx	Cvx	Fx (K)
Roof	45.33	16.5	748	0.53	8.1
Second	76.11	8.75	666	0.47	7.2
Sum	121.44		1414	1.0	15.3

Wind analysis

wroof = $(6.31 + 8.25/2) \times 12$ psf = 126 plf
wsecond = $(8.25/2 + 8.25/2) \times 12$ psf = 99 plf

Windload N/S: Froof = 126plf x 44.69ft = 5.6k
 Fsecond = 99plf x 72.21ft = 7.1k

Total = 12.7k/15.3k = 0.83% of seismic therefore Seismic controls N/S design.

Windload E/W: Froof = 126plf x 35.4ft = 4.46k
 Fsecond = 99plf x 65.7ft = 6.5k

Total = 10.96k/15.3k = 0.72% of seismic therefore Seismic controls E/W design.



Seismic Analysis (ASCE 7-10)

$S_s =$	1.461	$F_a =$	1.20	$S_{ms} =$	1.75	$S_{Ds} =$	1.17
$S_1 =$	0.51	$F_v =$	1.80	$S_{m1} =$	0.909	$S_{D1} =$	0.61

Site Class =	D	
Mean Roof Height =	11	ft
T =	0.12	sec
R =	6.5	
I =	1.0	
rho =	1.0	
Cs =	0.180	
W =	23.91	K
Allowable Base Shear V =	3.01	K

House

Level	Wx (K)	hx (ft)	Wxhx	Cvx	Fx (K)
Roof	23.91	7.75	185	1.00	3.0
Sum	23.91		185	1.0	3.0

Wind analysis

$w_{roof} = (4.67 + 7.75/2) \times 12 \text{ psf} = 103 \text{ plf}$
 $A_{awning} = (4.67) \times 12 \text{ psf} = 56 \text{ plf}$

Windload N/S: $\text{Roof} = 103 \text{ plf} \times 33.73 \text{ ft} = 3.5\text{k}$
 $\text{Awning} = 56 \text{ plf} \times 11 = 0.6 \text{ k}$

Total = $4.1\text{k}/3.0\text{k} = 1.37\%$ of seismic therefore Wind controls N/S design.

Windload E/W: $\text{Roof} = 103\text{plf} \times 21.3\text{ft} = 2.2\text{k}$

Total = $2.2\text{k}/3\text{k} = 0.73\%$ of seismic therefore Seismic controls E/W design.



(E) Roof Diaphragm
2nd floor shearwalls

East/West Direction (Existing)

Grid	D	E
Vwind (kips)	2	1.24
Vseismic (kips)	4.1	2.5
Length of wall (ft)	12.75	9.25
v_wind (p/f)	157	231
v_siesmic (p/l)**	322	465
h (ft)	7.75	7.75
OTF_Wind (lbs)*	1216	1039
OTF_Seismic (lbs)*	2492	2095
Length of shortest wall pier (ft)	12.75	2.25
Apect Ratio Reduction for Lateral Loads	0.61	3.44
Aspect Ratio Penalty	1.0	0.58
Shearwall	W4	W3
Holdown	MSTC66	MSTC66

*OTF does not take into account dead load and weight of the wall uno

**v_siesmic includes penalty

Existing Second Floor Diaphragm
First Floor Walls

North/South Direction (Existing)

Grid	1	2	3
Vwind (kips)	5	6.4	1.4
Vseismic (kips)	7.3	9.2	1.9
Length of wall (ft)	24.25	29.5	16.75
v_wind (p/f)	206	217	84
v_siesmic (p/l)**	301	312	113
h (ft)	7.75	7.75	7.75
OTF_Wind (lbs)*	1598	1681	648
OTF_Seismic (lbs)*	2333	2417	879
Length of shortest wall pier (ft)	4	8	4
Apect Ratio Reduction for Lateral Loads	1.94	0.97	1.94
Aspect Ratio Penalty	1.0	1.0	1.0
Shearwall	W3	W4	W6
Holdown	HDU4	HDU5	HDU2

*OTF does not take into account dead load and weight of the wall uno

**v_siesmic includes penalty

East/West Direction (Existing)

Grid	C	D	E
Vwind (kips)	2.47	3.6	2.5
Vseismic (kips)	3.9	7.7	6.1
Length of wall (ft)	14.5	12.75	16.75
v_wind (p/f)	293	282	257
v_siesmic (p/l)**	463	604	627
h (ft)	7.75	7.75	7.75
OTF_Wind (lbs)*	1320	2188	1157
OTF_Seismic (lbs)*	2084	4680	2822
Length of shortest wall pier (ft)	2.25	12.75	2.25
Apect Ratio Reduction for Lateral Loads	3.44	0.61	3.44
Aspect Ratio Penalty	0.58	1.0	0.58
Shearwall	W3	W2	W2
Holdown	MSTC66	HDU4	MSTC66

*OTF does not take into account dead load and weight of the wall uno

**v_siesmic includes penalty

Addition Roof Diaphragm
First Floor Shearwalls

North/South Direction (Existing)

Grid	2	3	4
Vwind (kips)	1.3	1.7	1
Vseismic (kips)	1.2	1.1	1.3
Length of wall (ft)	3.25	3.5	12
v_wind (p/f)	477	538	83
v_siesmic (p/l)**	440	348	108
h (ft)	7.75	7.75	7.75
OTF_Wind (lbs)*	3100	3764	646
OTF_Seismic (lbs)*	2862	2436	840
Length of shortest wall pier (ft)	3.25	3.5	12
Apect Ratio Reduction for Lateral Loads	2.38	2.21	0.65
Aspect Ratio Penalty	0.84	0.90	1.0
Shearwall	W3	W4	W6
Holdown	HDU4	HDU4	HDU2

*OTF does not take into account dead load and weight of the wall uno

**v_siesmic includes penalty

This is added
to C on the
(E) House

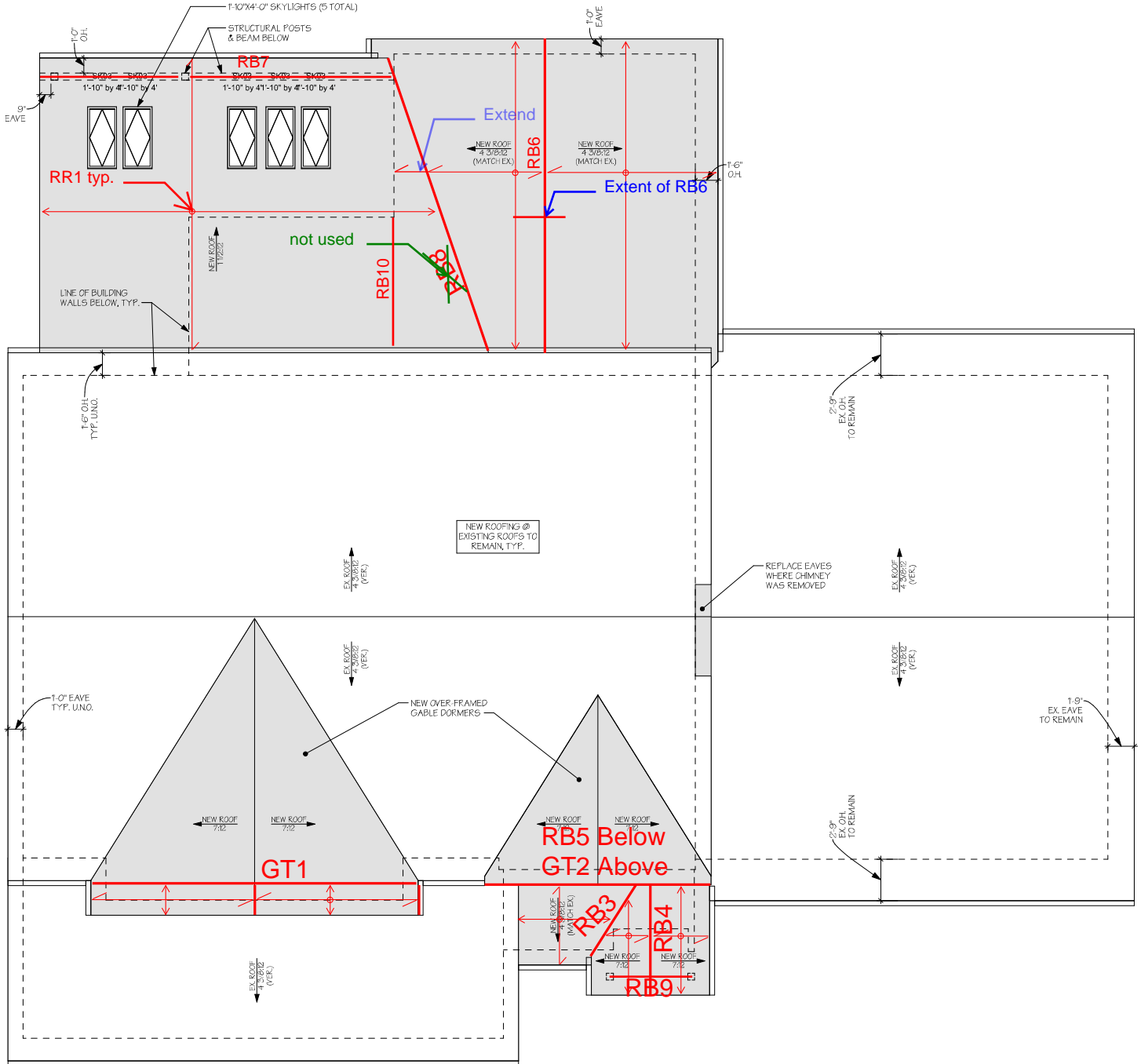
East/West Direction (Existing)

Grid	A	B	C
Vwind (kips)	0.56	1.1	1.1
Vseismic (kips)	0.79	1.5	0.73
Length of wall (ft)	10	5.5	See
v_wind (p/f)	56	200	Existing
v_siesmic (p/l)**	79	273	House
h (ft)	7.75	7.75	7.75
OTF_Wind (lbs)*	434	1550	Lateral
OTF_Seismic (lbs)*	612	2114	Analysis
Length of shortest wall pier (ft)	10	5.5	3
Apect Ratio Reduction for Lateral Loads	0.78	1.41	2.58
Aspect Ratio Penalty	1.0	1.0	0.77
Shearwall	W6	W6	See (E)
Holdown	HDU2	HDU2	House

*OTF does not take into account dead load and weight of the wall uno

**v_siesmic includes penalty

Roof Framing Keyplan



Section Properties & Capacities of Sawn Lumber

	b (in)	d (in)	Sx (in ³)	Ix (in ⁴)
2x4	1.5	3.5	3.06	5.36
2x6	1.5	5.5	7.56	20.80
2x8	1.5	7.25	13.14	47.63
2x10	1.5	9.25	21.39	98.93
2x12	1.5	11.25	31.64	177.98
2x14	1.5	13.25	43.89	290.78
3x4	2.5	3.5	5.10	8.93
3x6	2.5	5.5	12.60	34.66
3x8	2.5	7.25	21.90	79.39
3x10	2.5	9.25	35.65	164.89
3x12	2.5	11.25	52.73	296.63
3x14	2.5	13.25	73.15	484.63
4x4	3.5	3.5	7.15	12.51
4x6	3.5	5.5	17.65	48.53
4x8	3.5	7.25	30.66	111.15
4x10	3.5	9.25	49.91	230.84
4x12	3.5	11.25	73.83	415.28
4x14	3.5	13.25	102.41	678.48
6x6	5.5	5.5	27.73	76.26
6x8	5.5	7.5	51.56	193.36
6x10	5.5	9.5	82.73	392.96
6x12	5.5	11.5	121.23	697.07
6x14	5.5	13.5	167.06	1127.67
6x16	5.5	15.5	220.23	1706.78

Hem-Fir No. 2			
M(#-ft)	Cd=1.0	Cd=1.15	Cd=1.6
(2)2x4	651	748	1,041
(2)2x6	1,393	1,602	2,228
(2)2x8	2,234	2,569	3,574
(2)2x10	3,333	3,833	5,333
(2)2x12	4,482	5,155	7,172
(2)2x14	5,596	6,435	8,954
DF-L No. 2			
3x4	574	660	919
3x6	1,229	1,413	1,966
3x8	1,971	2,267	3,154
3x10	2,941	3,382	4,706
3x12	3,955	4,548	6,328
3x14	4,938	5,678	7,900
DF-L No. 2			
4x4	804	924	1,286
4x6	1,720	1,979	2,753
4x8	2,989	3,438	4,783
4x10	4,492	5,166	7,187
4x12	6,091	7,004	9,745
4x14	7,681	8,833	12,289
DF-L No. 1			
6x6	3,120	3,587	4,991
6x8	5,801	6,671	9,281
6x10	9,307	10,703	14,891
6x12	13,638	15,684	21,821
6x14	18,550	21,333	29,680
6x16	24,081	27,693	38,530

DESIGN PROPERTIES

Allowable Design Properties⁽¹⁾ (100% Load Duration)

Grade	Width	Design Property	Depth												
			4¾"	5½"	5½" Plank Orientation	7¼"	8⅝"	9¼"	9½"	11¼"	11⅞"	14"	16"	18"	20"
TimberStrand® LSL															
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550	6,335	7,240		10,520					
		Shear (lbs)	4,340	5,455	1,925	7,190	8,555	9,175		11,155					
		Moment of Inertia (in. ⁴)	24	49	20	111	187	231		415					
		Weight (plf)	4.5	5.6	5.6	7.4	8.8	9.4		11.5					
1.55E	1¾"	Moment (ft-lbs)						4,950	5,210	7,195	7,975	10,920	14,090		
		Shear (lbs)						3,345	3,435	4,070	4,295	5,065	5,785		
		Moment of Inertia (in. ⁴)						115	125	208	244	400	597		
		Weight (plf)						5.1	5.2	6.2	6.5	7.7	8.8		
	3½"	Moment (ft-lbs)						9,905	10,420	14,390	15,955	21,840	28,180		
		Shear (lbs)						6,690	6,870	8,140	8,590	10,125	11,575		
		Moment of Inertia (in. ⁴)						231	250	415	488	800	1,195		
		Weight (plf)						10.1	10.4	12.3	13	15.3	17.5		
Microllam® LVL															
2.0E	1¾"	Moment (ft-lbs)		2,125		3,555		5,600	5,885	8,070	8,925	12,130	15,555	19,375	23,580
		Shear (lbs)		1,830		2,410		3,075	3,160	3,740	3,950	4,655	5,320	5,985	6,650
		Moment of Inertia (in. ⁴)		24		56		115	125	208	244	400	597	851	1,167
		Weight (plf)		2.8		3.7		4.7	4.8	5.7	6.1	7.1	8.2	9.2	10.2
Parallam® PSL															
2.0E	3½"	Moment (ft-lbs)						12,415	13,055	17,970	19,900	27,160	34,955	43,665	
		Shear (lbs)						6,260	6,430	7,615	8,035	9,475	10,825	12,180	
		Moment of Inertia (in. ⁴)						231	250	415	488	800	1,195	1,701	
		Weight (plf)						10.1	10.4	12.3	13.0	15.3	17.5	19.7	
	5¼"	Moment (ft-lbs)						18,625	19,585	26,955	29,855	40,740	52,430	65,495	
		Shear (lbs)						9,390	9,645	11,420	12,055	14,210	16,240	18,270	
		Moment of Inertia (in. ⁴)						346	375	623	733	1,201	1,792	2,552	
	7"	Weight (plf)						15.2	15.6	18.5	19.5	23.0	26.3	29.5	
		Moment (ft-lbs)						24,830	26,115	35,940	39,805	54,325	69,905	87,325	
		Shear (lbs)						12,520	12,855	15,225	16,070	18,945	21,655	24,360	
		Moment of Inertia (in. ⁴)						462	500	831	977	1,601	2,389	3,402	
		Weight (plf)						20.2	20.8	24.6	26.0	30.6	35.0	39.4	

(1) For product in beam orientation, unless otherwise noted.

Some sizes may not be available in your region.

PRODUCT STORAGE



Protect product from sun and water

CAUTION:
Wrap is slippery when wet or icy

Align stickers (2x3 or larger)
directly over support blocks

Use support blocks (6x6 or larger)
at 10' on-center to keep bundles
out of mud and water

DESIGN PROPERTIES

Design Stresses⁽¹⁾ (100% Load Duration)

Grade	Orientation	G Shear Modulus of Elasticity (psi)	E Modulus of Elasticity (psi)	E _{min} Adjusted Modulus of Elasticity ⁽²⁾ (psi)	F _b Flexural Stress ⁽³⁾ (psi)	F _t Tension Stress ⁽⁴⁾ (psi)	F _{c⊥} Compression Perpendicular to Grain ⁽⁵⁾ (psi)	F _c Compression Parallel to Grain (psi)	F _v Horizontal Shear Parallel to Grain (psi)	SG Equivalent Specific Gravity ⁽⁶⁾
TimberStrand® LSL										
1.3E	Beam/Column	81,250	1.3 x 10 ⁶	660,750	1,700	1,075	710	1,835	425	0.50 ⁽⁷⁾
	Plank	81,250	1.3 x 10 ⁶	660,750	1,900 ⁽⁸⁾	1,075	635 ⁽⁹⁾	1,835	150	0.50 ⁽⁷⁾
1.55E	Beam	96,875	1.55 x 10 ⁶	787,815	2,325	1,070 ⁽¹⁰⁾	900	2,170	310 ⁽¹⁰⁾	0.50 ⁽⁷⁾
Microllam® LVL										
2.0E	Beam	125,000	2.0 x 10 ⁶	1,016,535	2,600	1,555	750	2,510	285	0.50
Parallam® PSL										
1.8E	Column	112,500	1.8 x 10 ⁶	914,880	2,400 ⁽¹¹⁾	1,755	545 ⁽¹¹⁾	2,500	190 ⁽¹¹⁾	0.50
2.0E	Beam	125,000	2.0 x 10 ⁶	1,016,535	2,900	2,025	625 ⁽¹²⁾	2,900 ⁽¹³⁾	290	0.50

(1) Unless otherwise noted, adjustment to the design stresses for duration of load are permitted in accordance with the applicable code.

(2) Reference modulus of elasticity for beam and column stability calculations, per NDS®.

(3) For 12" depth. For other depths, multiply F_b by the appropriate factor as follows:

– For TimberStrand® LSL, multiply by $\left[\frac{12}{d}\right]^{0.092}$

– For Microllam® LVL, multiply by $\left[\frac{12}{d}\right]^{0.136}$

– For Parallam® PSL, multiply by $\left[\frac{12}{d}\right]^{0.111}$

(4) F_t has been adjusted to reflect the volume effects for most standard applications.

(5) F_{c⊥} may not be increased for duration of load.

(6) For lateral connection design only.

(7) Specific gravity of 0.58 may be used for bolts installed perpendicular to face and loaded perpendicular to grain.

(8) Values are for thickness up to 3½".

(9) For members less than 1¾" thick and in plank orientation, use F_{c⊥} of 670 psi.

(10) Value accounts for large hole capabilities. See **Allowable Holes** on page 26.

(11) Value shown is for plank orientation.

(12) Use 750 psi for Parallam® PSL identified with plant number 0579.

(13) For column applications, use F_{c||} of 500 psi. Alternatively, refer to ESR-1387, Table 1, footnote 15.

General Assumptions for Trus Joist® Beams

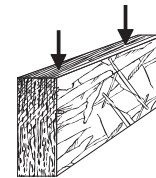
- Lateral support is required at bearing and along the span at 24" on-center, maximum.
- Bearing lengths are based on each product's bearing stress for applicable grade and orientation.
- All members 7¼" and less in depth are restricted to a maximum deflection of 5/16".
- Beams that are 1¾" x 16" and deeper require multiple plies.
- No camber.
- Beams and columns must remain straight to within 5L/4608 (in.) of true alignment. L is the unrestrained length of the member in feet.

For applications not covered in this brochure, contact your Weyerhaeuser representative.

See pages 28 and 29 for multiple-member beam connections.

TimberStrand® LSL, Microllam® LVL, and untreated Parallam® PSL are intended for dry-use applications

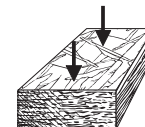
Beam Orientation



Column Orientation



Plank Orientation



Roof Framing RR1

Rafters			
L =	10 ft 10 in	Lumber Type =	Hem-Fir #2
w _{DL} =	15 psf	F _b =	850 psi
w _{LL} =	25 psf	F _v =	150 psi
Spacing =	16 in o.c.	E =	1,300,000 psi
Joist Size	2x6	C _D =	1.15
S =	7.56 in ³	C _r =	1.15
I =	20.80 in ⁴	C _F =	1.3
A =	8.25 in ²	incised	no
M =	785 #-ft		
R1 = R2 =	289 #	E' =	1300000 psi
f _b =	1245 psi	F _b ' =	1461 psi OK
f _v =	52.6 psi	F _v ' =	173 psi OK
Δ _{DL} =	0.231 in =	L/	564
Δ _{LL} =	0.384 in =	L/	339
Δ _{TL} =	0.615 in =	L/	212

Roof Framing RR2

Rafters			
L =	7 ft 9 in	Lumber Type =	Hem-Fir #2
w _{DL} =	15 psf	F _b =	850 psi
w _{LL} =	25 psf	F _v =	150 psi
Spacing =	24 in o.c.	E =	1,300,000 psi
Joist Size	2x6	C _D =	1.15
S =	7.56 in ³	C _r =	1.15
I =	20.80 in ⁴	C _F =	1.3
A =	8.25 in ²	incised	no
M =	601 #-ft		
R1 = R2 =	310 #	E' =	1300000 psi
f _b =	953 psi	F _b ' =	1461 psi OK
f _v =	56.4 psi	F _v ' =	173 psi OK
Δ _{DL} =	0.090 in =	L/	1033
Δ _{LL} =	0.150 in =	L/	620
Δ _{TL} =	0.240 in =	L/	387

Roof Framing RR3

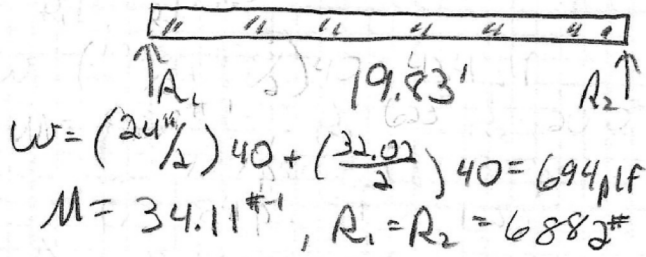
Rafters			
L =	19 ft 3 in	Lumber Type =	Hem-Fir #2
w _{DL} =	15 psf	F _b =	850 psi
w _{LL} =	25 psf	F _v =	150 psi
Spacing =	16 in o.c.	E =	1,300,000 psi
Joist Size	2x12	C _D =	1.15
S =	31.64 in ³	C _r =	1.15
I =	177.98 in ⁴	C _F =	1
A =	16.88 in ²	incised	no
M =	2470 #-ft		
R1 = R2 =	513 #	E' =	1300000 psi
f _b =	937 psi	F _b ' =	1124 psi OK
f _v =	45.6 psi	F _v ' =	173 psi OK
Δ _{DL} =	0.267 in =	L/	865
Δ _{LL} =	0.445 in =	L/	519
Δ _{TL} =	0.712 in =	L/	324

Roof Framing

DL = 15 psf
SL = 25 psf

GT1

$l = 19.83'$

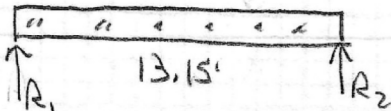


$W = (24 \frac{1}{2}) 40 + (\frac{32.02}{2}) 40 = 694 \text{ plf}$
 $M = 34.11 \text{ k-ft}, R_1 = R_2 = 6882 \#$

See FB3

GT2

$l = 13.15'$



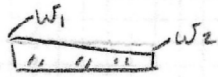
$W = 694 \text{ plf}$
 $M = 15.0 \text{ k-ft}, R_1 = R_2 = 4563 \#$

Post height = 7.35'

5/8" Ø Thru Bolts $V_{all} = 700 \#$
 $\# \text{ Req'd } \frac{4563 \#}{700} = 8 \text{ Bolts @ } 12" \text{ o.c.}$
 Vertical Post to Post

RB3

$l = 5.75'$

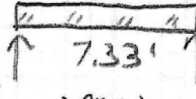


$W_1 = (7.8 \frac{1}{2} + 0.9 \frac{1}{2}) 40 = 176 \text{ plf}$
 $W_2 = (4.85 \frac{1}{2} + 3.9 \frac{1}{2}) 40 = 176 \text{ plf}$
 $M = 728 \text{ k-ft}, R_1 = R_2 = 506 \#$
 $f_b = 578 \text{ psi} \leq F_b = 977 \text{ psi}$
 $f_v = 46 \text{ psi} \leq F_v = 172 \text{ psi}$
 $\Delta_{TL} = 0.080" = \frac{l}{861}$

(2) 2x6

RB4

$l = 7.33'$



$W = (3.9 \frac{1}{2} + 3.9 \frac{1}{2}) 40 = 160 \text{ plf}$
 $M = 1075 \text{ k-ft}, R_1 = R_2 = 587 \#$
 $f_b = 732 \text{ psi} \leq F_b = 1035 \text{ psi}$
 $f_v = 46 \text{ psi} \leq F_v = 207 \text{ psi}$
 $\Delta_{TL} = 0.134" = \frac{l}{657}$

4x6

5/8" x 13/8" JWFH
GLB

RB5

$l = 14'$

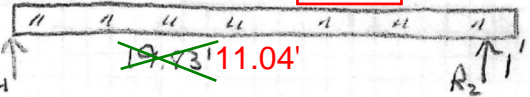


$R_1 = 506 \#, R_2 = 587 \#$
 $W = 694 \text{ plf} + 80 \text{ plf} = 774 \text{ plf}$
 $M = 5520 \text{ k-ft}, R_1 = 1790 \#, R_2 = 7670 \#, 2460 \#$
 $f_b = 839 \text{ psi} \leq F_b = 2909 \text{ psi}$
 $f_v = 231 \text{ psi} \leq F_v = 240 \text{ psi}$
 $\Delta_{TL} = 0.0409" = \frac{l}{227} \text{ see DS calc}$

5/8" x 9 1/2" PSL

RB6

~~$l = 12.04'$~~



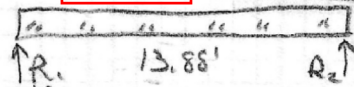
~~$W = (10 \frac{1}{2} + 10 \frac{1}{2}) 40 = 400 \text{ plf}$~~
 ~~$M = 19.6 \text{ k-ft}, R_1 = 3760 \#, R_2 = 4180 \#$~~
 ~~$f_b = 1410 \text{ psi} \leq F_b = 2190 \#, 2610 \#$~~
 ~~$f_v = 870 \text{ psi} \leq F_v = 1550 \text{ psi}$~~
 ~~$f_v = 75 \text{ psi} \leq F_v = 195 \text{ psi}$~~
 ~~$\Delta_{TL} = 0.681" = \frac{l}{633}$~~

6X10 GLB

W8x24

RB7

$l = 13.88'$



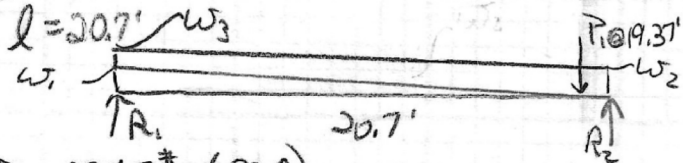
$W = (\frac{4.8 + 1.58}{18(2)}) 40 = 426 \text{ plf}$
 $M = 10.3 \text{ k-ft}, R_1 = R_2 = 2957 \#$
 $f_b = 1224 \text{ psi} \leq F_b = 2400 \text{ psi}$
 $f_v = 77 \text{ psi} \leq F_v = 265 \text{ psi}$
 $\Delta_{TL} = 0.273" = \frac{l}{447}$
 $Ma = 36.5 \text{ k-ft}$
 $Va = 38.9 \text{ k}$
 $0.148" = L/1122$

~~5/8" x 10 1/2" x 24" V4 GLB~~

ROOF FRAMING (cont)

RB8

$5\frac{1}{2} \times 13\frac{1}{2}$ 24F-V4
GLB



$P = 2957^*$ (RB7)

$w_1 = (19.23/2) 40 = 385 \text{ plf}$

$w_2 = (10.4/2) 40 = 209 \text{ plf}$

$w_3 = (3.7/2) 40 = 75 \text{ plf}$

$M = 19.9 \text{ k-ft}, R_1 = 4090^*, R_2 = 5800^*$

$f_b = 1430 \text{ psi} \leq F'_b = 2400 \text{ psi}$

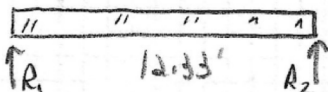
$f_v = 118 \text{ psi} \leq F'_v = 265 \text{ psi}$

$\Delta_{TL} = 0.77" = L/322$

RB9

$3\frac{1}{2} \times 9\frac{1}{2}$ LSL

$l = 12.33'$



$w = 90 \text{ plf} + 80 \text{ plf} = 170 \text{ plf}$

$M = 3231 \text{ ft-lb}, R_1 = R_2 = 1050^*$

$f_b = 740 \text{ psi} \leq F'_b = 2325 \text{ psi}$

$f_v = 50 \text{ psi} \leq F'_v = 310 \text{ psi}$

$\Delta_{TL} = 0.228" = L/648$

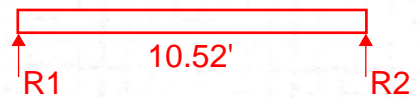
Footings @ Garage

$d = \sqrt{\frac{6304 + 456}{2000}} = 2.3 \therefore \text{use } 2'-6" \square \text{ ftg}$

RB10

6x8

$l = 10.52'$

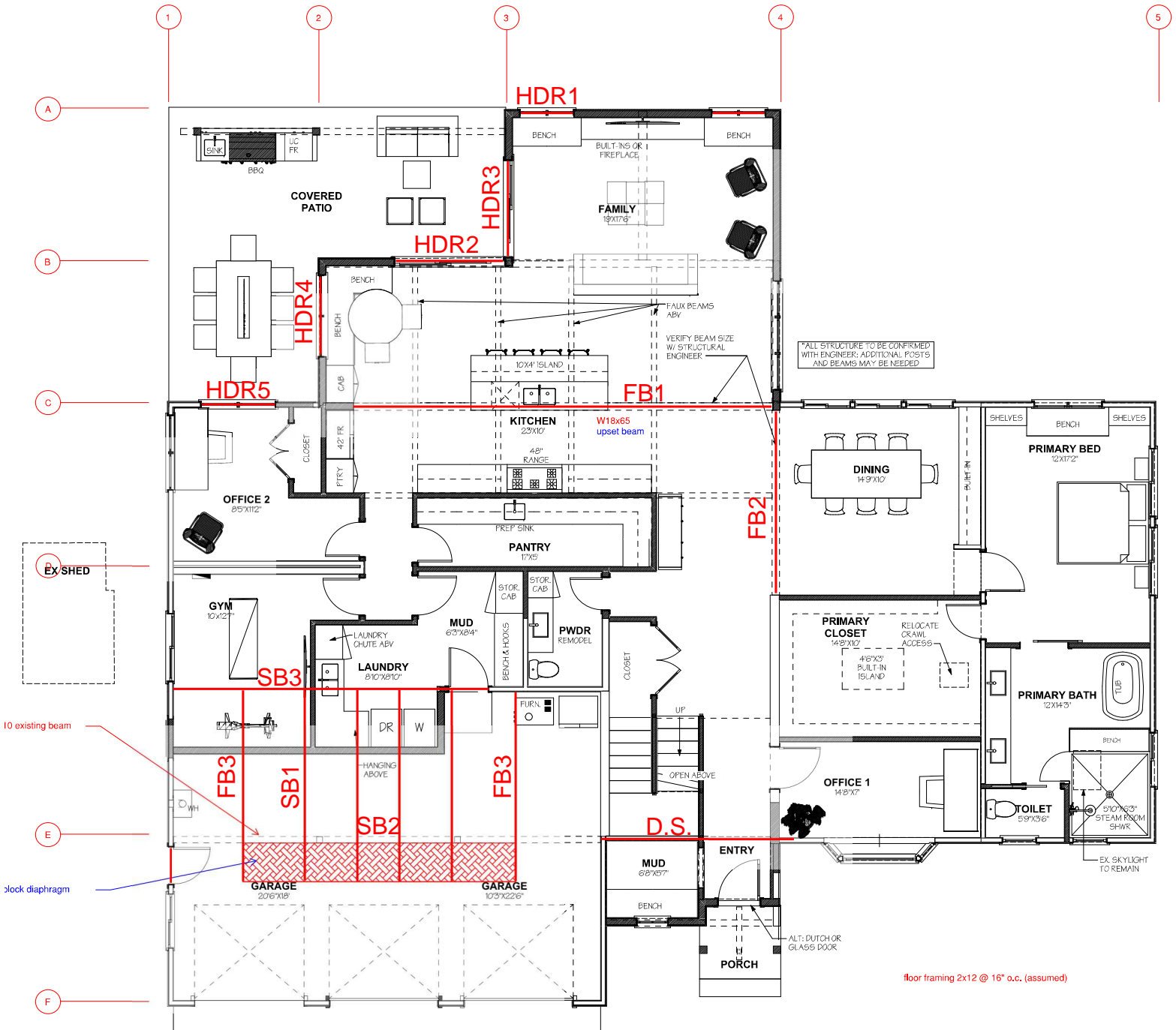


$w = \frac{(19.58 + .5)^2}{(2 \times 19.58)} \times 40 = 300 \text{ plf}$

$M = 4200 \text{ lb-ft}, R_1 = R_2 = 1587 \text{ lb}$
 $f_b = 980 \text{ psi} \leq F'_b = 1550 \text{ psi}$
 $f_v = 60 \text{ psi} \leq F'_v = 195 \text{ psi}$

Total Deflection = $0.2672" = L/472$

Second Floor Framing Keyplan

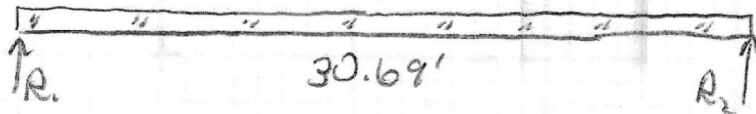


Floor Joist FJ1 (2x8 Hem-Fir #2)			
L =	11 ft 7 in	Lumber Type =	Hem-Fir #2
w _{DL} =	15 psf	F _b =	850 psi
w _{LL} =	40 psf	F _v =	150 psi
Spacing =	12 in o.c.	E =	1,300,000 psi
Joist Size	2x10	C _D =	1.15
S =	21.39 in ³	C _r =	1.15
I =	98.93 in ⁴	C _F =	1.1
A =	13.88 in ²	incised	no
M =	926 #-ft		
R1 = R2 =	319 #	E' =	1300000 psi
f _b =	519 psi	F _b ' =	1237 psi
f _v =	34.5 psi	F _v ' =	173 psi
Δ _{DL} =	0.048 in	L/	2926
Δ _{LL} =	0.127 in	L/	1097
Δ _{TL} =	0.174 in	L/	798

OK
OK

FB1

$l = 30.69'$



$W_{\text{load}} = (10.375/2 + 30.67/2) 40 = 825 \text{ plf}$

$W_{\text{floor}} = (12/2)(55 \text{ psf}) = 330 \text{ plf}$

$W_{\text{total}} = 825 \text{ plf} + 330 \text{ plf} = 1155 \text{ plf}$

$M = 136 \text{ k-ft}, R_1 = R_2 = 17.7 \text{ k}$

for wood $l/360 = 1.02''$

keep deflection to no more

than $3/4'' \Rightarrow I = 17,077 \text{ in}^4$

try $8\frac{3}{4} \times 30 \text{ GLB}$

or $10\frac{3}{4} \times 27 \text{ GLB}$

$f_b = 1243 \text{ psi}$

$f_b = 1250 \text{ psi}$

$f_{u1} = 101 \text{ psi} \setminus F'_v = 265 \text{ psi}$
 $f_{v2} = 92 \text{ psi}$

$\Delta_{TL1} = 0.65'' = l/5626$

$\Delta_{TL2} = 0.73'' = l/504$

$F'_b = 2760 \text{ psi}$

okay

for steel $I_{\text{req}} = 1060 \text{ in}^4$

W18x65 ($I_{\text{prov}} = 1070 \text{ in}^4$)

$\frac{M_r}{\phi_b} = 204 \text{ k-ft} \geq M_R = 136 \text{ k-ft}$

$\frac{V_r}{\phi_v} = 165 \text{ k} \geq V_R = 17.7 \text{ k}$

$\Delta_{TL} = 0.74'' = l/497 \text{ (okay)}$

\therefore use $8\frac{3}{4} \times 30 \text{ 24F-V4}$

or $10\frac{3}{4} \times 27 \text{ 24F-V4}$

or W18x65 ← Client's choice

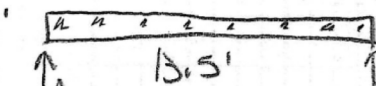
$d = \text{sqrt}(17700/1500) = 3.4'$ therefore use 3'-6" square x 12" w/ (4) #5 each way top and bottom at base of each post for beam.

FLOOR FRAMING (cont)

FBI

16x10

$l = 13.5'$



$$W = \frac{(2\frac{1}{2} + 2)^2}{2(2)} 40 + 100 \text{ pIF} + \frac{1}{2}(55) = 334 \text{ pIF}$$

$$M = 7609 \text{ #}\cdot\text{ft}, R_1 = R_2 = 2255 \text{ #}$$

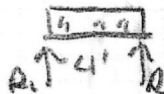
$$f_b = 1104 \text{ psi} \leq F'_b = 1550 \text{ psi}$$

$$f_v = 65 \text{ psi} \leq F'_v = 195 \text{ psi}$$

$$\Delta_{TL} = 0.397 \text{ " } = l/408$$

HDR1
 $l = 4'$

(2) 2x8



$$W = \frac{(2+2)^2}{4} 40 + 50 = 210 \text{ pIF}$$

$$M = 420 \text{ #}\cdot\text{ft}, R_1 = R_2 = 420 \text{ #}$$

$$f_b = 192 \text{ psi} \leq F'_b = 977 \text{ psi}$$

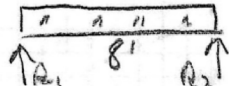
$$f_v = 30 \text{ psi} \leq F'_v = 172 \text{ psi}$$

$$\Delta_{TL} = 0.0195 \text{ " } = l/257$$

HDR2

$l = 8'$

(2) 2x10



$$W = (10.33/2 + 9.5/2) 40 = 400 \text{ pIF}$$

$$M = 3200 \text{ #}\cdot\text{ft}, R_1 = R_2 = 1600 \text{ #}$$

$$f_b = 898 \text{ psi} \leq F'_b = 977 \text{ psi}$$

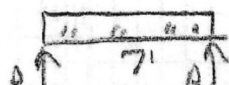
$$f_v = 87 \text{ psi} \leq F'_v = 172 \text{ psi}$$

$$\Delta_{TL} = 0.1433 \text{ " } = l/669$$

HDR3

$l = 7'$

(2) 2x10



$$W = (2\frac{1}{2} + 19\frac{1}{2}) 40 + 20 \text{ pIF} = 440 \text{ pIF}$$

$$M = 2695 \text{ #}\cdot\text{ft}, R_1 = R_2 = 1540 \text{ #}$$

$$f_b = 756 \text{ psi} \leq F'_b = 977 \text{ psi}$$

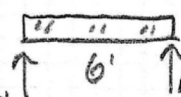
$$f_v = 84 \text{ psi} \leq F'_v = 172 \text{ psi}$$

$$\Delta_{TL} = 0.092 \text{ " } = l/908$$

HDR4

$l = 6'$

(2) 2x8



$$W = 80 \text{ pIF} + 30 \text{ pIF} = 110 \text{ pIF}$$

$$M = 495 \text{ #}\cdot\text{ft}, R_1 = R_2 = 350 \text{ #}$$

$$f_b = 227 \text{ psi} \leq F'_b = 977 \text{ psi}$$

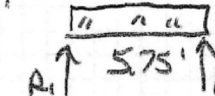
$$f_v = 23 \text{ psi} \leq F'_v = 172 \text{ psi}$$

$$\Delta_{TL} = 0.026 \text{ " } = l/2780$$

HDR5

$l = 5.75'$

(2) 2x12



$$W = (25.25/2 + 29/2) 40 + 20 \text{ pIF} = 925 \text{ pIF}$$

$$M = 3823 \text{ #}\cdot\text{ft}, R_1 = R_2 = 2660 \text{ #}$$

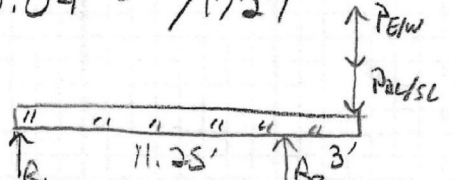
$$f_b = 725 \text{ psi} \leq F'_b = 977 \text{ psi}$$

$$f_v = 119 \text{ psi} \leq F'_v = 172 \text{ psi}$$

$$\Delta_{TL} = 0.04 \text{ " } = l/1727$$

SB1

$l = 14.25'$



$$W_{DL} = 20 \text{ pIF}$$

$$W_{LL} = 55 \text{ pIF}$$

$$P_{SL} = 146 \text{ #}$$

$$P_{DL} = 465 \text{ #}$$

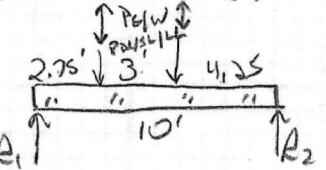
$$P_E = 2095 \text{ #} \Rightarrow 2993 \text{ #}$$

$$P_W = 1039 \text{ #} \Rightarrow 1732 \text{ #}$$

See Visual Analysis
Use $5\frac{1}{4} \times 11\frac{1}{4}$ PSL

SB2

$l = 10'$



$$W_{PL} = 135 \text{ pIF}$$

$$W_{WL} = 357 \text{ pIF}$$

$$P_{DL} = 1.0 \text{ k}$$

$$P_{SL} = 0.2 \text{ k}$$

$$P_{LL} = 0.5 \text{ k}$$

$$P_E = 3.8 \text{ k}$$

$$P_W = 2.2 \text{ k}$$

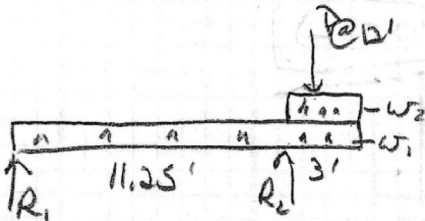
See Visual Analysis
Use (2) C9x20 Sister Jo (E) Beam

FLOOR FRAMING (Cont)

FB3

$l = 14.25'$

$P = 6882\#$



$W_1 = (1\frac{1}{2}) 55 = 73.3 \text{ plf}$

$W_2 = (\frac{(10+2)^2}{20}) 40 + 90 \text{ plf} = 378 \text{ plf}$

$M = 7190\#-'$, $R_1 = 227\#$, $R_2 = 9290\#$

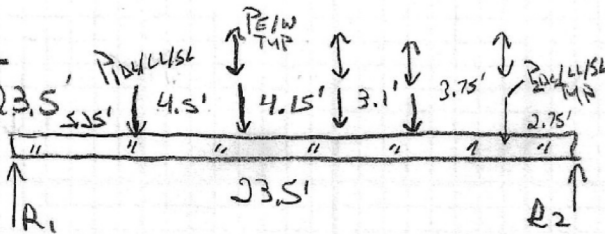
$f_b = 779 \text{ psi} \leq F'_b = 2900 \text{ psi}$

$f_v = 236 \text{ psi} \leq F'_v = 290 \text{ psi}$

$\Delta_{TL} = 0.108" = l/667$

SB3

$l = 23.5'$



$W_{AL} = 188 \text{ plf}$

$W_{LL} = 500 \text{ plf}$

$P_{DL} = 80\#$

$P_{LL} = 278\#$

$P_{SL} = -40\#$

$P_E = 798\#$

$P_W = 462\#$

$P_{DL} = 218\#$

$P_{LL} = 287\#$

$P_{SL} = -40\#$

See Visual Analysis
W10x45

DS

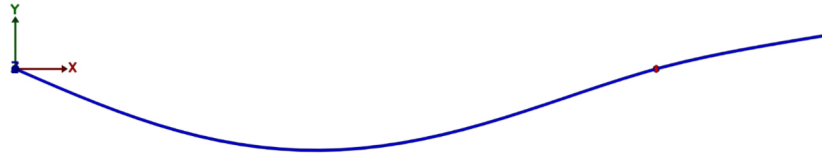
$l = 14'$

$P_E = 2500\#$

$P_W = 1240\#$

∴ use 5/8 x 9 1/2 PL Beam for DS
W/MSTC 66 STRAP Each
End of Beam to
Beam or Beam to
TOP plate

SB1 15
L = 14.25'



Mr = 20.68 K-ft \leq Ma = 26.95 K-ft
Vr = 6.96 K \leq Va = 12.055 K
Total Deflection = 0.3947" \Rightarrow L/342

Front

Okay, therefore use, 5 1/4 x 11 1/2 PSL for SB1

Project Settings

<p>Building Code Load Combinations: Deflection Checks IBC 2012 ASD</p> <p>General Settings: Vertical Direction: Y North Axis: Plus Z Ground Elevation: 0 ft Occupancy Risk Category: II</p> <p>Seismic Data: Seismic Design Category: D Spectral Acceleration SDs: 1.169 Overstrength (Omega) X: 3, Y: 3, Z: 3 Redundancy (Rho) X: 1, Y: 1, Z: 1</p> <p>Wind Data: Wind Speed (mph): 110 Mean Roof Height: 0 ft Ground Elevation: 0 ft Gust Factor: 0.85</p> <p>Analysis Data: Analysis Method: PDelta Performance: Auto Force Tolerance: 0.1 Absolute Force Tolerance: 0.5 K Displacement Tolerance: 0.01 Load Stepping Points: 31</p>

Bill of Materials: Members

Material	Section	Count	Total Length ft	Total Volume in ³	Total Weight K
Parallam PSL 2.0E (Beam)	PSL-B 5.25x11.25	1	14.2500	10099.6875	0.2630

Total Member Weight = 0.26301 K

Member Loads, Uniform

Member	Service Case	Direction	Magnitude	Full Length?	Start Offset ft	End Offset ft	Projected?	Predefined Load
BmX003	D	Shear y	-0.0200 K/ft	Yes	0.0000	14.2500	No	N.A.
BmX003	L	Shear y	-0.0550 K/ft	Yes	0.0000	14.2500	No	N.A.

Member Loads, Concentrated

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	D	Shear y	-0.4650 K	14.2500
BmX003	E+X	Shear y	-2.9930 K	14.2500
BmX003	E-X	Shear y	2.9930 K	14.2500
BmX003	S	Shear y	-0.1460 K	14.2500
BmX003	W+X	Shear y	-1.7320 K	14.2500
BmX003	W-X	Shear y	1.7320 K	14.2500

Factored Load Combinations

Name	Code	Effective Equation	Design	Deflection
16-8	IBC 2012 ASD	D	Allowable	Other

Factored Load Combinations (continued)

Name	Code	Effective Equation	Design	Deflection
16-9	IBC 2012 ASD	D + L	Allowable	Dead Plus Live
16-10S	IBC 2012 ASD	D + S	Allowable	Other
16-11Lr	IBC 2012 ASD	D + 0.75L	Allowable	Dead Plus Live
16-11S	IBC 2012 ASD	D + 0.75L + 0.75S	Allowable	Other
16-12E »+X	IBC 2012 ASD	1.16366D + 0.7E+X	Allowable	Other
16-12E »+X:Ω	IBC 2012 ASD	1.16366D + 2.1E+X	Allowable	Other
16-12E »-X	IBC 2012 ASD	1.16366D + 0.7E-X	Allowable	Other
16-12E »-X:Ω	IBC 2012 ASD	1.16366D + 2.1E-X	Allowable	Other
16-12W »+X	IBC 2012 ASD	D + 0.6W+X	Allowable	Other
16-12W »-X	IBC 2012 ASD	D + 0.6W-X	Allowable	Other
16-13Lr »+X	IBC 2012 ASD	D + 0.75L + 0.45W+X	Allowable	Other
16-13Lr »-X	IBC 2012 ASD	D + 0.75L + 0.45W-X	Allowable	Other
16-13S »+X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W+X	Allowable	Other
16-13S »-X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W-X	Allowable	Other
16-14 »+X	IBC 2012 ASD	1.122745D + 0.525E+X + 0.75L + 0.75S	Allowable	Other
16-14 »+X:Ω	IBC 2012 ASD	1.122745D + 1.575E+X + 0.75L + 0.75S	Allowable	Other
16-14 »-X	IBC 2012 ASD	1.122745D + 0.525E-X + 0.75L + 0.75S	Allowable	Other
16-14 »-X:Ω	IBC 2012 ASD	1.122745D + 1.575E-X + 0.75L + 0.75S	Allowable	Other
16-15 »+X	IBC 2012 ASD	0.6D + 0.6W+X	Allowable	Other
16-15 »-X	IBC 2012 ASD	0.6D + 0.6W-X	Allowable	Other
16-15Di	IBC 2012 ASD	0.6D	Allowable	Other
16-16 »+X	IBC 2012 ASD	0.43634D + 0.7E+X	Allowable	Other
16-16 »+X:Ω	IBC 2012 ASD	0.43634D + 2.1E+X	Allowable	Other
16-16 »-X	IBC 2012 ASD	0.43634D + 0.7E-X	Allowable	Other
16-16 »-X:Ω	IBC 2012 ASD	0.43634D + 2.1E-X	Allowable	Other
D+0.75(L+W) »+X	Deflection Checks	D + 0.75L + 0.75W+X	Deflections	Other
D+0.75(L+W) »-X	Deflection Checks	D + 0.75L + 0.75W-X	Deflections	Other
D+L	Deflection Checks	D + L	Deflections	Dead Plus Live
D+Lr	Deflection Checks	D	Deflections	Other
D+S	Deflection Checks	D + S	Deflections	Other
Live	Deflection Checks	L	Deflections	Live Only
Seismic »+X	Deflection Checks	E+X	Deflections	Other
Seismic »-X	Deflection Checks	E-X	Deflections	Other
Snow	Deflection Checks	S	Deflections	Wind Or Snow
Wind »+X	Deflection Checks	W+X	Deflections	Wind Or Snow
Wind »-X	Deflection Checks	W-X	Deflections	Wind Or Snow

Result Cases

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-8	8	Allowable (ASD)	Static	No	N.A.
16-8 Second Order	52	Allowable (ASD)	Static	Yes	N.A.

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-9	9	Allowable (ASD)	Static	No	N.A.
16-9 Second Order	53	Allowable (ASD)	Static	Yes	N.A.
16-10S	10	Allowable (ASD)	Static	No	N.A.
16-10S Second Order	54	Allowable (ASD)	Static	Yes	N.A.
16-11Lr	11	Allowable (ASD)	Static	No	N.A.
16-11Lr Second Order	55	Allowable (ASD)	Static	Yes	N.A.
16-11S	12	Allowable (ASD)	Static	No	N.A.
16-11S Second Order	56	Allowable (ASD)	Static	Yes	N.A.
16-12E »+X	15	Allowable (ASD)	Static	No	Normal
16-12E »+X Second Order	59	Allowable (ASD)	Static	Yes	Normal
16-12E »+X:Ω	16	Allowable (ASD)	Static	No	Over-Strength
16-12E »+X:Ω Second Order	60	Allowable (ASD)	Static	Yes	Over-Strength
16-12E »-X	17	Allowable (ASD)	Static	No	Normal
16-12E »-X Second Order	61	Allowable (ASD)	Static	Yes	Normal
16-12E »-X:Ω	18	Allowable (ASD)	Static	No	Over-Strength
16-12E »-X:Ω Second Order	62	Allowable (ASD)	Static	Yes	Over-Strength
16-12W »+X	13	Allowable (ASD)	Static	No	N.A.
16-12W »+X Second Order	57	Allowable (ASD)	Static	Yes	N.A.
16-12W »-X	14	Allowable (ASD)	Static	No	N.A.
16-12W »-X Second Order	58	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »+X	19	Allowable (ASD)	Static	No	N.A.
16-13Lr »+X Second Order	63	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »-X	20	Allowable (ASD)	Static	No	N.A.
16-13Lr »-X Second Order	64	Allowable (ASD)	Static	Yes	N.A.
16-13S »+X	21	Allowable (ASD)	Static	No	N.A.
16-13S »+X Second Order	65	Allowable (ASD)	Static	Yes	N.A.
16-13S »-X	22	Allowable (ASD)	Static	No	N.A.
16-13S »-X Second Order	66	Allowable (ASD)	Static	Yes	N.A.
16-14 »+X	23	Allowable (ASD)	Static	No	Normal
16-14 »+X Second Order	67	Allowable (ASD)	Static	Yes	Normal
16-14 »+X:Ω	24	Allowable (ASD)	Static	No	Over-Strength
16-14 »+X:Ω Second Order	68	Allowable (ASD)	Static	Yes	Over-Strength
16-14 »-X	25	Allowable (ASD)	Static	No	Normal
16-14 »-X Second Order	69	Allowable (ASD)	Static	Yes	Normal
16-14 »-X:Ω	26	Allowable (ASD)	Static	No	Over-Strength
16-14 »-X:Ω Second Order	70	Allowable (ASD)	Static	Yes	Over-Strength
16-15 »+X	27	Allowable (ASD)	Static	No	N.A.
16-15 »+X Second Order	71	Allowable (ASD)	Static	Yes	N.A.
16-15 »-X	28	Allowable (ASD)	Static	No	N.A.
16-15 »-X Second Order	72	Allowable (ASD)	Static	Yes	N.A.
16-15Di	29	Allowable (ASD)	Static	No	N.A.

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-15Di Second Order	73	Allowable (ASD)	Static	Yes	N.A.
16-16 »+X	30	Allowable (ASD)	Static	No	Normal
16-16 »+X Second Order	74	Allowable (ASD)	Static	Yes	Normal
16-16 »+X:Ω	31	Allowable (ASD)	Static	No	Over-Strength
16-16 »+X:Ω Second Order	75	Allowable (ASD)	Static	Yes	Over-Strength
16-16 »-X	32	Allowable (ASD)	Static	No	Normal
16-16 »-X Second Order	76	Allowable (ASD)	Static	Yes	Normal
16-16 »-X:Ω	33	Allowable (ASD)	Static	No	Over-Strength
16-16 »-X:Ω Second Order	77	Allowable (ASD)	Static	Yes	Over-Strength
D	1	No Design	Static	No	N.A.
D Second Order	45	No Design	Static	Yes	N.A.
D+0.75(L+W) »+X	35	Deflections	Static	No	N.A.
D+0.75(L+W) »+X Second Order	79	Deflections	Static	Yes	N.A.
D+0.75(L+W) »-X	36	Deflections	Static	No	N.A.
D+0.75(L+W) »-X Second Order	80	Deflections	Static	Yes	N.A.
D+L	34	Deflections	Static	No	N.A.
D+L Second Order	78	Deflections	Static	Yes	N.A.
D+Lr	38	Deflections	Static	No	N.A.
D+Lr Second Order	82	Deflections	Static	Yes	N.A.
D+S	37	Deflections	Static	No	N.A.
D+S Second Order	81	Deflections	Static	Yes	N.A.
E+X	2	No Design	Static	No	Normal
E+X Second Order	46	No Design	Static	Yes	Normal
E-X	3	No Design	Static	No	Normal
E-X Second Order	47	No Design	Static	Yes	Normal
L	4	No Design	Static	No	N.A.
L Second Order	48	No Design	Static	Yes	N.A.
Live	39	Deflections	Static	No	N.A.
Live Second Order	83	Deflections	Static	Yes	N.A.
S	5	No Design	Static	No	N.A.
S Second Order	49	No Design	Static	Yes	N.A.
Seismic »+X	43	Deflections	Static	No	Normal
Seismic »+X Second Order	87	Deflections	Static	Yes	Normal
Seismic »-X	44	Deflections	Static	No	Normal
Seismic »-X Second Order	88	Deflections	Static	Yes	Normal
Snow	40	Deflections	Static	No	N.A.
Snow Second Order	84	Deflections	Static	Yes	N.A.
W+X	6	No Design	Static	No	N.A.
W+X Second Order	50	No Design	Static	Yes	N.A.
W-X	7	No Design	Static	No	N.A.

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
W-X Second Order	51	No Design	Static	Yes	N.A.
Wind »+X	41	Deflections	Static	No	N.A.
Wind »+X Second Order	85	Deflections	Static	Yes	N.A.
Wind »-X	42	Deflections	Static	No	N.A.
Wind »-X Second Order	86	Deflections	Static	Yes	N.A.

Node Reactions

(extreme rows: max and min)

Node	Result Case	FX K	FY K	FZ K	MX K-ft	MY K-ft	MZ K-ft
N003	16-12E »+X:Ω	0.0000	9.0507	0.0000	0.0000	0.0000	0.0000
N003	16-12E »+X:Ω Second Order	0.0000	9.0507	0.0000	0.0000	0.0000	0.0000
N003	16-16 »-X:Ω	0.0000	-7.5529	0.0000	0.0000	0.0000	0.0000
N003	16-16 »-X:Ω Second Order	0.0000	-7.5529	0.0000	0.0000	0.0000	0.0000

Member Forces

(extreme rows: max and min)

Member	Fx Min K	Fx Max K	Vy K	Mz Min K-ft	Mz Max K-ft
BmX003	0.0000 (88)	0.0000 (88)	6.9600 (16)	-20.6806 (60)	18.1717 (77)

Member Relative Deflections

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-8	0.0000	0.0201	8509.5642
BmX003	16-8 Second Order	0.0000	0.0201	8509.5642
BmX003	16-9	-0.0046	0.0099	17224.0902
BmX003	16-9 Second Order	-0.0046	0.0099	17224.0902
BmX003	16-10S	0.0000	0.0292	5850.4011
BmX003	16-10S Second Order	0.0000	0.0292	5850.4011
BmX003	16-11Lr	-0.0016	0.0121	14177.7263
BmX003	16-11Lr Second Order	-0.0016	0.0121	14177.7263
BmX003	16-11S	0.0000	0.0182	9409.0154
BmX003	16-11S Second Order	0.0000	0.0182	9409.0154
BmX003	16-12E »+X	0.0000	0.1570	1089.1837
BmX003	16-12E »+X Second Order	0.0000	0.1570	1089.1837
BmX003	16-12E »+X:Ω	0.0000	0.4257	401.6807
BmX003	16-12E »+X:Ω Second Order	0.0000	0.4257	401.6807
BmX003	16-12E »-X	-0.1121	0.0000	1525.9782
BmX003	16-12E »-X Second Order	-0.1121	0.0000	1525.9782
BmX003	16-12E »-X:Ω	-0.3807	0.0000	449.2184
BmX003	16-12E »-X:Ω Second Order	-0.3807	0.0000	449.2184
BmX003	16-12W »+X	0.0000	0.0862	1984.2219
BmX003	16-12W »+X Second Order	0.0000	0.0862	1984.2219

Member Relative Deflections (continued)

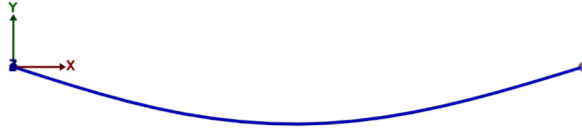
Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-12W »-X	-0.0477	0.0000	3587.3685
BmX003	16-12W »-X Second Order	-0.0477	0.0000	3587.3685
BmX003	16-13Lr »+X	0.0000	0.0592	2888.5061
BmX003	16-13Lr »+X Second Order	0.0000	0.0592	2888.5061
BmX003	16-13Lr »-X	-0.0435	0.0000	3931.4768
BmX003	16-13Lr »-X Second Order	-0.0435	0.0000	3931.4768
BmX003	16-13S »+X	0.0000	0.0661	2586.1037
BmX003	16-13S »+X Second Order	0.0000	0.0661	2586.1037
BmX003	16-13S »-X	-0.0367	0.0000	4655.1823
BmX003	16-13S »-X Second Order	-0.0367	0.0000	4655.1823
BmX003	16-14 »+X	0.0000	0.1189	1437.9602
BmX003	16-14 »+X Second Order	0.0000	0.1189	1437.9602
BmX003	16-14 »+X:Ω	0.0000	0.3200	534.3485
BmX003	16-14 »+X:Ω Second Order	0.0000	0.3200	534.3485
BmX003	16-14 »-X	-0.0842	0.0000	2029.7878
BmX003	16-14 »-X Second Order	-0.0842	0.0000	2029.7878
BmX003	16-14 »-X:Ω	-0.2852	0.0000	599.6444
BmX003	16-14 »-X:Ω Second Order	-0.2852	0.0000	599.6444
BmX003	16-15 »+X	0.0000	0.0783	2183.3081
BmX003	16-15 »+X Second Order	0.0000	0.0783	2183.3081
BmX003	16-15 »-X	-0.0552	0.0000	3100.4356
BmX003	16-15 »-X Second Order	-0.0552	0.0000	3100.4356
BmX003	16-15Di	0.0000	0.0121	14182.6071
BmX003	16-15Di Second Order	0.0000	0.0121	14182.6071
BmX003	16-16 »+X	0.0000	0.1428	1197.1113
BmX003	16-16 »+X Second Order	0.0000	0.1428	1197.1113
BmX003	16-16 »+X:Ω	0.0000	0.4116	415.4522
BmX003	16-16 »+X:Ω Second Order	0.0000	0.4116	415.4522
BmX003	16-16 »-X	-0.1260	0.0000	1357.5638
BmX003	16-16 »-X Second Order	-0.1260	0.0000	1357.5638
BmX003	16-16 »-X:Ω	-0.3947	0.0000	433.2757
BmX003	16-16 »-X:Ω Second Order	-0.3947	0.0000	433.2757
BmX003	D	0.0000	0.0201	8509.5642
BmX003	D Second Order	0.0000	0.0201	8509.5642
BmX003	D+0.75(L+W) »+X	0.0000	0.0921	1855.8632
BmX003	D+0.75(L+W) »+X Second Order	0.0000	0.0921	1855.8632
BmX003	D+0.75(L+W) »-X	-0.0762	0.0000	2245.5208
BmX003	D+0.75(L+W) »-X Second Order	-0.0762	0.0000	2245.5208
BmX003	D+L	-0.0046	0.0099	17224.0902
BmX003	D+L Second Order	-0.0046	0.0099	17224.0902

Member Relative Deflections (continued)

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	D+Lr	0.0000	0.0201	8509.5642
BmX003	D+Lr Second Order	0.0000	0.0201	8509.5642
BmX003	D+S	0.0000	0.0292	5850.4011
BmX003	D+S Second Order	0.0000	0.0292	5850.4011
BmX003	E+X	0.0000	0.1919	891.2819
BmX003	E+X Second Order	0.0000	0.1919	891.2819
BmX003	E-X	-0.1919	0.0000	891.2819
BmX003	E-X Second Order	-0.1919	0.0000	891.2819
BmX003	L	-0.0168	0.0000	10159.7552
BmX003	L Second Order	-0.0168	0.0000	10159.7552
BmX003	Live	-0.0168	0.0000	10159.7552
BmX003	Live Second Order	-0.0168	0.0000	10159.7552
BmX003	S	0.0000	0.0094	18271.2797
BmX003	S Second Order	0.0000	0.0094	18271.2797
BmX003	Seismic »+X	0.0000	0.1919	891.2819
BmX003	Seismic »+X Second Order	0.0000	0.1919	891.2819
BmX003	Seismic »-X	-0.1919	0.0000	891.2819
BmX003	Seismic »-X Second Order	-0.1919	0.0000	891.2819
BmX003	Snow	0.0000	0.0094	18271.2797
BmX003	Snow Second Order	0.0000	0.0094	18271.2797
BmX003	W+X	0.0000	0.1110	1540.1887
BmX003	W+X Second Order	0.0000	0.1110	1540.1887
BmX003	W-X	-0.1110	0.0000	1540.1887
BmX003	W-X Second Order	-0.1110	0.0000	1540.1887
BmX003	Wind »+X	0.0000	0.1110	1540.1887
BmX003	Wind »+X Second Order	0.0000	0.1110	1540.1887
BmX003	Wind »-X	-0.1110	0.0000	1540.1887
BmX003	Wind »-X Second Order	-0.1110	0.0000	1540.1887

SB2
L = 10'

23



$M_r = 19.97 \text{ K-ft} \leq M_a = 30.4 \text{ K-ft}$
 $V_r = 6.30 \text{ K} \leq V_a = 52.2 \text{ K}$
Total Deflection = 0.1531" $\Rightarrow L/783$

Front

Okay, therefore use, (2) C9x20 for SB2

Project Settings

Building Code Load Combinations: Deflection Checks IBC 2012 ASD General Settings: Vertical Direction: Y North Axis: Plus Z Ground Elevation: 0 ft Occupancy Risk Category: II Seismic Data: Seismic Design Category: D Spectral Acceleration SDs: 1.169 Overstrength (Omega) X: 3, Y: 3, Z: 3 Redundancy (Rho) X: 1, Y: 1, Z: 1 Wind Data: Wind Speed (mph): 110 Mean Roof Height: 0 ft Ground Elevation: 0 ft Gust Factor: 0.85 Analysis Data: Analysis Method: PDelta Performance: Auto Force Tolerance: 0.1 Absolute Force Tolerance: 0.5 K Displacement Tolerance: 0.01 Load Stepping Points: 31
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Bill of Materials: Members

Material	Section	Count	Total Length ft	Total Volume in ³	Total Weight K
ASTM A36	C9X20	1	10.0000	704.4000	0.2000

Total Member Weight = 0.20005 K

Member Loads, Uniform

Member	Service Case	Direction	Magnitude	Full Length?	Start Offset ft	End Offset ft	Projected?	Predefined Load
BmX003	D	Shear y	-0.1350 K/ft	Yes	0.0000	10.0000	No	N.A.
BmX003	L	Shear y	-0.4650 K/ft	Yes	0.0000	10.0000	No	N.A.

Member Loads, Concentrated

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	D	Shear y	-1.0000 K	2.7500
BmX003	D	Shear y	-1.0000 K	5.7500
BmX003	E+X	Shear y	-3.8000 K	2.7500
BmX003	E+X	Shear y	3.8000 K	5.7500
BmX003	E-X	Shear y	-3.8000 K	5.7500
BmX003	E-X	Shear y	3.8000 K	2.7500
BmX003	L	Shear y	-0.5000 K	2.7500
BmX003	L	Shear y	-0.5000 K	5.7500
BmX003	S	Shear y	-0.2000 K	2.7500
BmX003	S	Shear y	-0.2000 K	5.7500

Member Loads, Concentrated (continued)

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	W+X	Shear y	-2.2000 K	2.7500
BmX003	W+X	Shear y	2.2000 K	5.7500
BmX003	W-X	Shear y	-2.2000 K	5.7500
BmX003	W-X	Shear y	2.2000 K	2.7500

Factored Load Combinations

Name	Code	Effective Equation	Design	Deflection
16-8	IBC 2012 ASD	D	Allowable	Other
16-9	IBC 2012 ASD	D + L	Allowable	Dead Plus Live
16-10S	IBC 2012 ASD	D + S	Allowable	Other
16-11Lr	IBC 2012 ASD	D + 0.75L	Allowable	Dead Plus Live
16-11S	IBC 2012 ASD	D + 0.75L + 0.75S	Allowable	Other
16-12E »+X	IBC 2012 ASD	1.16366D + 0.7E+X	Allowable	Other
16-12E »+X:Ω	IBC 2012 ASD	1.16366D + 2.1E+X	Allowable	Other
16-12E »-X	IBC 2012 ASD	1.16366D + 0.7E-X	Allowable	Other
16-12E »-X:Ω	IBC 2012 ASD	1.16366D + 2.1E-X	Allowable	Other
16-12W »+X	IBC 2012 ASD	D + 0.6W+X	Allowable	Other
16-12W »-X	IBC 2012 ASD	D + 0.6W-X	Allowable	Other
16-13Lr »+X	IBC 2012 ASD	D + 0.75L + 0.45W+X	Allowable	Other
16-13Lr »-X	IBC 2012 ASD	D + 0.75L + 0.45W-X	Allowable	Other
16-13S »+X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W+X	Allowable	Other
16-13S »-X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W-X	Allowable	Other
16-14 »+X	IBC 2012 ASD	1.122745D + 0.525E+X + 0.75L + 0.75S	Allowable	Other
16-14 »+X:Ω	IBC 2012 ASD	1.122745D + 1.575E+X + 0.75L + 0.75S	Allowable	Other
16-14 »-X	IBC 2012 ASD	1.122745D + 0.525E-X + 0.75L + 0.75S	Allowable	Other
16-14 »-X:Ω	IBC 2012 ASD	1.122745D + 1.575E-X + 0.75L + 0.75S	Allowable	Other
16-15 »+X	IBC 2012 ASD	0.6D + 0.6W+X	Allowable	Other
16-15 »-X	IBC 2012 ASD	0.6D + 0.6W-X	Allowable	Other
16-15Di	IBC 2012 ASD	0.6D	Allowable	Other
16-16 »+X	IBC 2012 ASD	0.43634D + 0.7E+X	Allowable	Other
16-16 »+X:Ω	IBC 2012 ASD	0.43634D + 2.1E+X	Allowable	Other
16-16 »-X	IBC 2012 ASD	0.43634D + 0.7E-X	Allowable	Other
16-16 »-X:Ω	IBC 2012 ASD	0.43634D + 2.1E-X	Allowable	Other
D+0.75(L+W) »+X	Deflection Checks	D + 0.75L + 0.75W+X	Deflections	Other
D+0.75(L+W) »-X	Deflection Checks	D + 0.75L + 0.75W-X	Deflections	Other
D+L	Deflection Checks	D + L	Deflections	Dead Plus Live
D+Lr	Deflection Checks	D	Deflections	Other
D+S	Deflection Checks	D + S	Deflections	Other
Live	Deflection Checks	L	Deflections	Live Only
Seismic »+X	Deflection Checks	E+X	Deflections	Other

Factored Load Combinations (continued)

Name	Code	Effective Equation	Design	Deflection
Seismic »-X	Deflection Checks	E-X	Deflections	Other
Snow	Deflection Checks	S	Deflections	Wind Or Snow
Wind »+X	Deflection Checks	W+X	Deflections	Wind Or Snow
Wind »-X	Deflection Checks	W-X	Deflections	Wind Or Snow

Result Cases

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-8	8	Allowable (ASD)	Static	No	N.A.
16-8 Second Order	52	Allowable (ASD)	Static	Yes	N.A.
16-9	9	Allowable (ASD)	Static	No	N.A.
16-9 Second Order	53	Allowable (ASD)	Static	Yes	N.A.
16-10S	10	Allowable (ASD)	Static	No	N.A.
16-10S Second Order	54	Allowable (ASD)	Static	Yes	N.A.
16-11Lr	11	Allowable (ASD)	Static	No	N.A.
16-11Lr Second Order	55	Allowable (ASD)	Static	Yes	N.A.
16-11S	12	Allowable (ASD)	Static	No	N.A.
16-11S Second Order	56	Allowable (ASD)	Static	Yes	N.A.
16-12E »+X	15	Allowable (ASD)	Static	No	Normal
16-12E »+X Second Order	59	Allowable (ASD)	Static	Yes	Normal
16-12E »+X:Ω	16	Allowable (ASD)	Static	No	Over-Strength
16-12E »+X:Ω Second Order	60	Allowable (ASD)	Static	Yes	Over-Strength
16-12E »-X	17	Allowable (ASD)	Static	No	Normal
16-12E »-X Second Order	61	Allowable (ASD)	Static	Yes	Normal
16-12E »-X:Ω	18	Allowable (ASD)	Static	No	Over-Strength
16-12E »-X:Ω Second Order	62	Allowable (ASD)	Static	Yes	Over-Strength
16-12W »+X	13	Allowable (ASD)	Static	No	N.A.
16-12W »+X Second Order	57	Allowable (ASD)	Static	Yes	N.A.
16-12W »-X	14	Allowable (ASD)	Static	No	N.A.
16-12W »-X Second Order	58	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »+X	19	Allowable (ASD)	Static	No	N.A.
16-13Lr »+X Second Order	63	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »-X	20	Allowable (ASD)	Static	No	N.A.
16-13Lr »-X Second Order	64	Allowable (ASD)	Static	Yes	N.A.
16-13S »+X	21	Allowable (ASD)	Static	No	N.A.
16-13S »+X Second Order	65	Allowable (ASD)	Static	Yes	N.A.
16-13S »-X	22	Allowable (ASD)	Static	No	N.A.
16-13S »-X Second Order	66	Allowable (ASD)	Static	Yes	N.A.
16-14 »+X	23	Allowable (ASD)	Static	No	Normal
16-14 »+X Second Order	67	Allowable (ASD)	Static	Yes	Normal
16-14 »+X:Ω	24	Allowable (ASD)	Static	No	Over-Strength
16-14 »+X:Ω Second Order	68	Allowable (ASD)	Static	Yes	Over-Strength

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-14 »-X	25	Allowable (ASD)	Static	No	Normal
16-14 »-X Second Order	69	Allowable (ASD)	Static	Yes	Normal
16-14 »-X:Ω	26	Allowable (ASD)	Static	No	Over-Strength
16-14 »-X:Ω Second Order	70	Allowable (ASD)	Static	Yes	Over-Strength
16-15 »+X	27	Allowable (ASD)	Static	No	N.A.
16-15 »+X Second Order	71	Allowable (ASD)	Static	Yes	N.A.
16-15 »-X	28	Allowable (ASD)	Static	No	N.A.
16-15 »-X Second Order	72	Allowable (ASD)	Static	Yes	N.A.
16-15Di	29	Allowable (ASD)	Static	No	N.A.
16-15Di Second Order	73	Allowable (ASD)	Static	Yes	N.A.
16-16 »+X	30	Allowable (ASD)	Static	No	Normal
16-16 »+X Second Order	74	Allowable (ASD)	Static	Yes	Normal
16-16 »+X:Ω	31	Allowable (ASD)	Static	No	Over-Strength
16-16 »+X:Ω Second Order	75	Allowable (ASD)	Static	Yes	Over-Strength
16-16 »-X	32	Allowable (ASD)	Static	No	Normal
16-16 »-X Second Order	76	Allowable (ASD)	Static	Yes	Normal
16-16 »-X:Ω	33	Allowable (ASD)	Static	No	Over-Strength
16-16 »-X:Ω Second Order	77	Allowable (ASD)	Static	Yes	Over-Strength
D	1	No Design	Static	No	N.A.
D Second Order	45	No Design	Static	Yes	N.A.
D+0.75(L+W) »+X	35	Deflections	Static	No	N.A.
D+0.75(L+W) »+X Second Order	79	Deflections	Static	Yes	N.A.
D+0.75(L+W) »-X	36	Deflections	Static	No	N.A.
D+0.75(L+W) »-X Second Order	80	Deflections	Static	Yes	N.A.
D+L	34	Deflections	Static	No	N.A.
D+L Second Order	78	Deflections	Static	Yes	N.A.
D+Lr	38	Deflections	Static	No	N.A.
D+Lr Second Order	82	Deflections	Static	Yes	N.A.
D+S	37	Deflections	Static	No	N.A.
D+S Second Order	81	Deflections	Static	Yes	N.A.
E+X	2	No Design	Static	No	Normal
E+X Second Order	46	No Design	Static	Yes	Normal
E-X	3	No Design	Static	No	Normal
E-X Second Order	47	No Design	Static	Yes	Normal
L	4	No Design	Static	No	N.A.
L Second Order	48	No Design	Static	Yes	N.A.
Live	39	Deflections	Static	No	N.A.
Live Second Order	83	Deflections	Static	Yes	N.A.
S	5	No Design	Static	No	N.A.
S Second Order	49	No Design	Static	Yes	N.A.

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
Seismic »+X	43	Deflections	Static	No	Normal
Seismic »+X Second Order	87	Deflections	Static	Yes	Normal
Seismic »-X	44	Deflections	Static	No	Normal
Seismic »-X Second Order	88	Deflections	Static	Yes	Normal
Snow	40	Deflections	Static	No	N.A.
Snow Second Order	84	Deflections	Static	Yes	N.A.
W+X	6	No Design	Static	No	N.A.
W+X Second Order	50	No Design	Static	Yes	N.A.
W-X	7	No Design	Static	No	N.A.
W-X Second Order	51	No Design	Static	Yes	N.A.
Wind »+X	41	Deflections	Static	No	N.A.
Wind »+X Second Order	85	Deflections	Static	Yes	N.A.
Wind »-X	42	Deflections	Static	No	N.A.
Wind »-X Second Order	86	Deflections	Static	Yes	N.A.

Node Reactions

(extreme rows: max and min)

Node	Result Case	FX K	FY K	FZ K	MX K-ft	MY K-ft	MZ K-ft
N001	16-14 »+X:Ω	0.0000	6.3043	0.0000	0.0000	0.0000	0.0000
N001	16-14 »+X:Ω Second Order	0.0000	6.3043	0.0000	0.0000	0.0000	0.0000
N002	16-16 »+X:Ω	0.0000	-1.6849	0.0000	0.0000	0.0000	0.0000
N002	16-16 »+X:Ω Second Order	0.0000	-1.6849	0.0000	0.0000	0.0000	0.0000

Member Forces

(extreme rows: max and min)

Member	Fx Min K	Fx Max K	Vy K	Mz Min K-ft	Mz Max K-ft
BmX003	0.0000 (88)	0.0000 (88)	6.3043 (68)	-7.7718 (75)	19.9711 (70)

Member Relative Deflections

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-8	-0.0546	0.0000	2197.5080
BmX003	16-8 Second Order	-0.0546	0.0000	2197.5080
BmX003	16-9	-0.1313	0.0000	914.1327
BmX003	16-9 Second Order	-0.1313	0.0000	914.1327
BmX003	16-10S	-0.0616	0.0000	1948.6929
BmX003	16-10S Second Order	-0.0616	0.0000	1948.6929
BmX003	16-11Lr	-0.1121	0.0000	1070.4173
BmX003	16-11Lr Second Order	-0.1121	0.0000	1070.4173
BmX003	16-11S	-0.1173	0.0000	1022.7116
BmX003	16-11S Second Order	-0.1173	0.0000	1022.7116
BmX003	16-12E »+X	-0.0527	0.0000	2274.8855

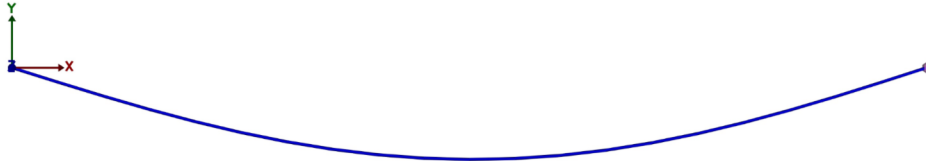
Member Relative Deflections (continued)

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-12E »+X Second Order	-0.0527	0.0000	2274.8855
BmX003	16-12E »+X:Ω	-0.0400	0.0000	2999.1150
BmX003	16-12E »+X:Ω Second Order	-0.0400	0.0000	2999.1150
BmX003	16-12E »-X	-0.0763	0.0000	1572.0094
BmX003	16-12E »-X Second Order	-0.0763	0.0000	1572.0094
BmX003	16-12E »-X:Ω	-0.1039	0.0000	1155.4739
BmX003	16-12E »-X:Ω Second Order	-0.1039	0.0000	1155.4739
BmX003	16-12W »+X	-0.0489	0.0000	2451.5618
BmX003	16-12W »+X Second Order	-0.0489	0.0000	2451.5618
BmX003	16-12W »-X	-0.0608	0.0000	1972.7381
BmX003	16-12W »-X Second Order	-0.0608	0.0000	1972.7381
BmX003	16-13Lr »+X	-0.1077	0.0000	1114.5089
BmX003	16-13Lr »+X Second Order	-0.1077	0.0000	1114.5089
BmX003	16-13Lr »-X	-0.1167	0.0000	1028.3729
BmX003	16-13Lr »-X Second Order	-0.1167	0.0000	1028.3729
BmX003	16-13S »+X	-0.1129	0.0000	1062.8926
BmX003	16-13S »+X Second Order	-0.1129	0.0000	1062.8926
BmX003	16-13S »-X	-0.1219	0.0000	984.3004
BmX003	16-13S »-X Second Order	-0.1219	0.0000	984.3004
BmX003	16-14 »+X	-0.1153	0.0000	1041.1555
BmX003	16-14 »+X Second Order	-0.1153	0.0000	1041.1555
BmX003	16-14 »+X:Ω	-0.1001	0.0000	1198.2979
BmX003	16-14 »+X:Ω Second Order	-0.1001	0.0000	1198.2979
BmX003	16-14 »-X	-0.1334	0.0000	899.7230
BmX003	16-14 »-X Second Order	-0.1334	0.0000	899.7230
BmX003	16-14 »-X:Ω	-0.1531	0.0000	783.9068
BmX003	16-14 »-X:Ω Second Order	-0.1531	0.0000	783.9068
BmX003	16-15 »+X	-0.0274	0.0000	4382.8899
BmX003	16-15 »+X Second Order	-0.0274	0.0000	4382.8899
BmX003	16-15 »-X	-0.0391	0.0000	3068.9042
BmX003	16-15 »-X Second Order	-0.0391	0.0000	3068.9042
BmX003	16-15Di	-0.0328	0.0000	3662.5133
BmX003	16-15Di Second Order	-0.0328	0.0000	3662.5133
BmX003	16-16 »+X	-0.0156	0.0000	7708.3748
BmX003	16-16 »+X Second Order	-0.0156	0.0000	7708.3748
BmX003	16-16 »+X:Ω	-0.0101	0.0218	5498.6426
BmX003	16-16 »+X:Ω Second Order	-0.0101	0.0218	5498.6426
BmX003	16-16 »-X	-0.0372	0.0000	3226.3446
BmX003	16-16 »-X Second Order	-0.0372	0.0000	3226.3446
BmX003	16-16 »-X:Ω	-0.0656	0.0000	1829.6215

Member Relative Deflections (continued)

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-16 »-X:Ω Second Order	-0.0656	0.0000	1829.6215
BmX003	D	-0.0546	0.0000	2197.5080
BmX003	D Second Order	-0.0546	0.0000	2197.5080
BmX003	D+0.75(L+W) »+X	-0.1048	0.0000	1144.8899
BmX003	D+0.75(L+W) »+X Second Order	-0.1048	0.0000	1144.8899
BmX003	D+0.75(L+W) »-X	-0.1198	0.0000	1001.5205
BmX003	D+0.75(L+W) »-X Second Order	-0.1198	0.0000	1001.5205
BmX003	D+L	-0.1313	0.0000	914.1327
BmX003	D+L Second Order	-0.1313	0.0000	914.1327
BmX003	D+Lr	-0.0546	0.0000	2197.5080
BmX003	D+Lr Second Order	-0.0546	0.0000	2197.5080
BmX003	D+S	-0.0616	0.0000	1948.6929
BmX003	D+S Second Order	-0.0616	0.0000	1948.6929
BmX003	E+X	0.0000	0.0206	5832.9324
BmX003	E+X Second Order	0.0000	0.0206	5832.9324
BmX003	E-X	-0.0206	0.0000	5832.9324
BmX003	E-X Second Order	-0.0206	0.0000	5832.9324
BmX003	L	-0.0767	0.0000	1565.2232
BmX003	L Second Order	-0.0767	0.0000	1565.2232
BmX003	Live	-0.0767	0.0000	1565.2232
BmX003	Live Second Order	-0.0767	0.0000	1565.2232
BmX003	S	-0.0070	0.0000	17209.5384
BmX003	S Second Order	-0.0070	0.0000	17209.5384
BmX003	Seismic »+X	0.0000	0.0206	5832.9324
BmX003	Seismic »+X Second Order	0.0000	0.0206	5832.9324
BmX003	Seismic »-X	-0.0206	0.0000	5832.9324
BmX003	Seismic »-X Second Order	-0.0206	0.0000	5832.9324
BmX003	Snow	-0.0070	0.0000	17209.5384
BmX003	Snow Second Order	-0.0070	0.0000	17209.5384
BmX003	W+X	0.0000	0.0119	10075.0651
BmX003	W+X Second Order	0.0000	0.0119	10075.0651
BmX003	W-X	-0.0119	0.0000	10075.0651
BmX003	W-X Second Order	-0.0119	0.0000	10075.0651
BmX003	Wind »+X	0.0000	0.0119	10075.0651
BmX003	Wind »+X Second Order	0.0000	0.0119	10075.0651
BmX003	Wind »-X	-0.0119	0.0000	10075.0651
BmX003	Wind »-X Second Order	-0.0119	0.0000	10075.0651

SB3
L = 23.5' 31



Front

$M_r = 55.02 \text{ K-ft} \leq M_a = 85.8 \text{ K-ft}$
 $V_r = 9.02 \text{ K} \leq V_a = 70.7 \text{ K}$
Total Deflection = 0.7330" $\Rightarrow L/384$

Okay, therefore use, W10x45 for SB3

Project Settings

Building Code Load Combinations: Deflection Checks IBC 2012 ASD General Settings: Vertical Direction: Y North Axis: Plus Z Ground Elevation: 0 ft Occupancy Risk Category: II Seismic Data: Seismic Design Category: D Spectral Acceleration SDs: 1.169 Overstrength (Omega) X: 3, Y: 3, Z: 3 Redundancy (Rho) X: 1, Y: 1, Z: 1 Wind Data: Wind Speed (mph): 110 Mean Roof Height: 0 ft Ground Elevation: 0 ft Gust Factor: 0.85 Analysis Data: Analysis Method: PDelta Performance: Auto Force Tolerance: 0.1 Absolute Force Tolerance: 0.5 K Displacement Tolerance: 0.01 Load Stepping Points: 31
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Bill of Materials: Members

Material	Section	Count	Total Length ft	Total Volume in ³	Total Weight K
ASTM A992 Grade 50	W10X45	1	23.5000	3750.6000	1.0652

Total Member Weight = 1.0652 K

Member Loads, Uniform

Member	Service Case	Direction	Magnitude	Full Length?	Start Offset ft	End Offset ft	Projected?	Predefined Load
BmX003	D	Shear y	-0.1350 K/ft	Yes	0.0000	23.5000	No	N.A.
BmX003	L	Shear y	-0.5000 K/ft	Yes	0.0000	23.5000	No	N.A.

Member Loads, Concentrated

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	D	Shear y	-0.0800 K	9.7500
BmX003	D	Shear y	-0.0800 K	13.9000
BmX003	D	Shear y	-0.0800 K	17.0000
BmX003	D	Shear y	-0.0800 K	20.7500
BmX003	D	Shear y	-0.0250 K	5.2500
BmX003	E+X	Shear y	-2.3620 K	9.7500
BmX003	E+X	Shear y	-2.3620 K	17.0000
BmX003	E+X	Shear y	2.3620 K	13.9000
BmX003	E+X	Shear y	2.3620 K	20.7500
BmX003	E-X	Shear y	-0.7980 K	13.9000

Member Loads, Concentrated (continued)

Member	Service Case	Direction	Magnitude	Offset ft
BmX003	E-X	Shear y	-0.7980 K	20.7500
BmX003	E-X	Shear y	0.7980 K	9.7500
BmX003	E-X	Shear y	0.7980 K	17.0000
BmX003	L	Shear y	-0.2870 K	9.7500
BmX003	L	Shear y	-0.2870 K	13.9000
BmX003	L	Shear y	-0.2870 K	17.0000
BmX003	L	Shear y	-0.2870 K	20.7500
BmX003	L	Shear y	-0.2780 K	5.2500
BmX003	S	Shear y	0.0400 K	9.7500
BmX003	S	Shear y	0.0400 K	13.9000
BmX003	S	Shear y	0.0400 K	17.0000
BmX003	S	Shear y	0.0400 K	20.7500
BmX003	S	Shear y	0.0610 K	5.2500
BmX003	W+X	Shear y	-0.4620 K	9.7500
BmX003	W+X	Shear y	-0.4620 K	17.0000
BmX003	W+X	Shear y	0.4620 K	13.9000
BmX003	W+X	Shear y	0.4620 K	20.7500
BmX003	W-X	Shear y	-0.4630 K	20.7500
BmX003	W-X	Shear y	-0.4620 K	13.9000
BmX003	W-X	Shear y	0.4620 K	9.7500
BmX003	W-X	Shear y	0.4620 K	17.0000

Factored Load Combinations

Name	Code	Effective Equation	Design	Deflection
16-8	IBC 2012 ASD	D	Allowable	Other
16-9	IBC 2012 ASD	D + L	Allowable	Dead Plus Live
16-10S	IBC 2012 ASD	D + S	Allowable	Other
16-11Lr	IBC 2012 ASD	D + 0.75L	Allowable	Dead Plus Live
16-11S	IBC 2012 ASD	D + 0.75L + 0.75S	Allowable	Other
16-12E »+X	IBC 2012 ASD	1.16366D + 0.7E+X	Allowable	Other
16-12E »+X:Ω	IBC 2012 ASD	1.16366D + 2.1E+X	Allowable	Other
16-12E »-X	IBC 2012 ASD	1.16366D + 0.7E-X	Allowable	Other
16-12E »-X:Ω	IBC 2012 ASD	1.16366D + 2.1E-X	Allowable	Other
16-12W »+X	IBC 2012 ASD	D + 0.6W+X	Allowable	Other
16-12W »-X	IBC 2012 ASD	D + 0.6W-X	Allowable	Other
16-13Lr »+X	IBC 2012 ASD	D + 0.75L + 0.45W+X	Allowable	Other
16-13Lr »-X	IBC 2012 ASD	D + 0.75L + 0.45W-X	Allowable	Other
16-13S »+X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W+X	Allowable	Other
16-13S »-X	IBC 2012 ASD	D + 0.75L + 0.75S + 0.45W-X	Allowable	Other
16-14 »+X	IBC 2012 ASD	1.122745D + 0.525E+X + 0.75L + 0.75S	Allowable	Other

Factored Load Combinations (continued)

Name	Code	Effective Equation	Design	Deflection
16-14 »+X:Ω	IBC 2012 ASD	$1.122745D + 1.575E+X + 0.75L + 0.75S$	Allowable	Other
16-14 »-X	IBC 2012 ASD	$1.122745D + 0.525E-X + 0.75L + 0.75S$	Allowable	Other
16-14 »-X:Ω	IBC 2012 ASD	$1.122745D + 1.575E-X + 0.75L + 0.75S$	Allowable	Other
16-15 »+X	IBC 2012 ASD	$0.6D + 0.6W+X$	Allowable	Other
16-15 »-X	IBC 2012 ASD	$0.6D + 0.6W-X$	Allowable	Other
16-15Di	IBC 2012 ASD	0.6D	Allowable	Other
16-16 »+X	IBC 2012 ASD	$0.43634D + 0.7E+X$	Allowable	Other
16-16 »+X:Ω	IBC 2012 ASD	$0.43634D + 2.1E+X$	Allowable	Other
16-16 »-X	IBC 2012 ASD	$0.43634D + 0.7E-X$	Allowable	Other
16-16 »-X:Ω	IBC 2012 ASD	$0.43634D + 2.1E-X$	Allowable	Other
D+0.75(L+W) »+X	Deflection Checks	$D + 0.75L + 0.75W+X$	Deflections	Other
D+0.75(L+W) »-X	Deflection Checks	$D + 0.75L + 0.75W-X$	Deflections	Other
D+L	Deflection Checks	D + L	Deflections	Dead Plus Live
D+Lr	Deflection Checks	D	Deflections	Other
D+S	Deflection Checks	D + S	Deflections	Other
Live	Deflection Checks	L	Deflections	Live Only
Seismic »+X	Deflection Checks	E+X	Deflections	Other
Seismic »-X	Deflection Checks	E-X	Deflections	Other
Snow	Deflection Checks	S	Deflections	Wind Or Snow
Wind »+X	Deflection Checks	W+X	Deflections	Wind Or Snow
Wind »-X	Deflection Checks	W-X	Deflections	Wind Or Snow

Result Cases

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-8	8	Allowable (ASD)	Static	No	N.A.
16-8 Second Order	52	Allowable (ASD)	Static	Yes	N.A.
16-9	9	Allowable (ASD)	Static	No	N.A.
16-9 Second Order	53	Allowable (ASD)	Static	Yes	N.A.
16-10S	10	Allowable (ASD)	Static	No	N.A.
16-10S Second Order	54	Allowable (ASD)	Static	Yes	N.A.
16-11Lr	11	Allowable (ASD)	Static	No	N.A.
16-11Lr Second Order	55	Allowable (ASD)	Static	Yes	N.A.
16-11S	12	Allowable (ASD)	Static	No	N.A.
16-11S Second Order	56	Allowable (ASD)	Static	Yes	N.A.
16-12E »+X	15	Allowable (ASD)	Static	No	Normal
16-12E »+X Second Order	59	Allowable (ASD)	Static	Yes	Normal
16-12E »+X:Ω	16	Allowable (ASD)	Static	No	Over-Strength
16-12E »+X:Ω Second Order	60	Allowable (ASD)	Static	Yes	Over-Strength
16-12E »-X	17	Allowable (ASD)	Static	No	Normal
16-12E »-X Second Order	61	Allowable (ASD)	Static	Yes	Normal
16-12E »-X:Ω	18	Allowable (ASD)	Static	No	Over-Strength

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
16-12E »-X:Ω Second Order	62	Allowable (ASD)	Static	Yes	Over-Strength
16-12W »+X	13	Allowable (ASD)	Static	No	N.A.
16-12W »+X Second Order	57	Allowable (ASD)	Static	Yes	N.A.
16-12W »-X	14	Allowable (ASD)	Static	No	N.A.
16-12W »-X Second Order	58	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »+X	19	Allowable (ASD)	Static	No	N.A.
16-13Lr »+X Second Order	63	Allowable (ASD)	Static	Yes	N.A.
16-13Lr »-X	20	Allowable (ASD)	Static	No	N.A.
16-13Lr »-X Second Order	64	Allowable (ASD)	Static	Yes	N.A.
16-13S »+X	21	Allowable (ASD)	Static	No	N.A.
16-13S »+X Second Order	65	Allowable (ASD)	Static	Yes	N.A.
16-13S »-X	22	Allowable (ASD)	Static	No	N.A.
16-13S »-X Second Order	66	Allowable (ASD)	Static	Yes	N.A.
16-14 »+X	23	Allowable (ASD)	Static	No	Normal
16-14 »+X Second Order	67	Allowable (ASD)	Static	Yes	Normal
16-14 »+X:Ω	24	Allowable (ASD)	Static	No	Over-Strength
16-14 »+X:Ω Second Order	68	Allowable (ASD)	Static	Yes	Over-Strength
16-14 »-X	25	Allowable (ASD)	Static	No	Normal
16-14 »-X Second Order	69	Allowable (ASD)	Static	Yes	Normal
16-14 »-X:Ω	26	Allowable (ASD)	Static	No	Over-Strength
16-14 »-X:Ω Second Order	70	Allowable (ASD)	Static	Yes	Over-Strength
16-15 »+X	27	Allowable (ASD)	Static	No	N.A.
16-15 »+X Second Order	71	Allowable (ASD)	Static	Yes	N.A.
16-15 »-X	28	Allowable (ASD)	Static	No	N.A.
16-15 »-X Second Order	72	Allowable (ASD)	Static	Yes	N.A.
16-15Di	29	Allowable (ASD)	Static	No	N.A.
16-15Di Second Order	73	Allowable (ASD)	Static	Yes	N.A.
16-16 »+X	30	Allowable (ASD)	Static	No	Normal
16-16 »+X Second Order	74	Allowable (ASD)	Static	Yes	Normal
16-16 »+X:Ω	31	Allowable (ASD)	Static	No	Over-Strength
16-16 »+X:Ω Second Order	75	Allowable (ASD)	Static	Yes	Over-Strength
16-16 »-X	32	Allowable (ASD)	Static	No	Normal
16-16 »-X Second Order	76	Allowable (ASD)	Static	Yes	Normal
16-16 »-X:Ω	33	Allowable (ASD)	Static	No	Over-Strength
16-16 »-X:Ω Second Order	77	Allowable (ASD)	Static	Yes	Over-Strength
D	1	No Design	Static	No	N.A.
D Second Order	45	No Design	Static	Yes	N.A.
D+0.75(L+W) »+X	35	Deflections	Static	No	N.A.
D+0.75(L+W) »+X Second Order	79	Deflections	Static	Yes	N.A.
D+0.75(L+W) »-X	36	Deflections	Static	No	N.A.

Result Cases (continued)

Name	ID	Design Checks	Result Type	P-Delta?	Seismic Type
D+0.75(L+W) »-X Second Order	80	Deflections	Static	Yes	N.A.
D+L	34	Deflections	Static	No	N.A.
D+L Second Order	78	Deflections	Static	Yes	N.A.
D+Lr	38	Deflections	Static	No	N.A.
D+Lr Second Order	82	Deflections	Static	Yes	N.A.
D+S	37	Deflections	Static	No	N.A.
D+S Second Order	81	Deflections	Static	Yes	N.A.
E+X	2	No Design	Static	No	Normal
E+X Second Order	46	No Design	Static	Yes	Normal
E-X	3	No Design	Static	No	Normal
E-X Second Order	47	No Design	Static	Yes	Normal
L	4	No Design	Static	No	N.A.
L Second Order	48	No Design	Static	Yes	N.A.
Live	39	Deflections	Static	No	N.A.
Live Second Order	83	Deflections	Static	Yes	N.A.
S	5	No Design	Static	No	N.A.
S Second Order	49	No Design	Static	Yes	N.A.
Seismic »+X	43	Deflections	Static	No	Normal
Seismic »+X Second Order	87	Deflections	Static	Yes	Normal
Seismic »-X	44	Deflections	Static	No	Normal
Seismic »-X Second Order	88	Deflections	Static	Yes	Normal
Snow	40	Deflections	Static	No	N.A.
Snow Second Order	84	Deflections	Static	Yes	N.A.
W+X	6	No Design	Static	No	N.A.
W+X Second Order	50	No Design	Static	Yes	N.A.
W-X	7	No Design	Static	No	N.A.
W-X Second Order	51	No Design	Static	Yes	N.A.
Wind »+X	41	Deflections	Static	No	N.A.
Wind »+X Second Order	85	Deflections	Static	Yes	N.A.
Wind »-X	42	Deflections	Static	No	N.A.
Wind »-X Second Order	86	Deflections	Static	Yes	N.A.

Node Reactions

(extreme rows: max and min)

Node	Result Case	FX K	FY K	FZ K	MX K-ft	MY K-ft	MZ K-ft
N002	16-9	0.0000	9.0204	0.0000	0.0000	0.0000	0.0000
N002	16-9 Second Order	0.0000	9.0204	0.0000	0.0000	0.0000	0.0000
N002	D+L	0.0000	9.0204	0.0000	0.0000	0.0000	0.0000
N002	D+L Second Order	0.0000	9.0204	0.0000	0.0000	0.0000	0.0000
N002	E+X	0.0000	-0.7940	0.0000	0.0000	0.0000	0.0000
N002	E+X Second Order	0.0000	-0.7940	0.0000	0.0000	0.0000	0.0000

Node Reactions (continued)

(extreme rows: max and min)

Node	Result Case	FX K	FY K	FZ K	MX K-ft	MY K-ft	MZ K-ft
N002	Seismic »+X	0.0000	-0.7940	0.0000	0.0000	0.0000	0.0000
N002	Seismic »+X Second Order	0.0000	-0.7940	0.0000	0.0000	0.0000	0.0000

Member Forces

(extreme rows: max and min)

Member	Fx Min K	Fx Max K	Vy K	Mz Min K-ft	Mz Max K-ft
BmX003	0.0000 (88)	0.0000 (88)	-9.0204 (34)	-2.6142 (88)	55.2048 (24)

Member Relative Deflections

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-8	-0.1887	0.0000	1494.6821
BmX003	16-8 Second Order	-0.1887	0.0000	1494.6821
BmX003	16-9	-0.7330	0.0000	384.7251
BmX003	16-9 Second Order	-0.7330	0.0000	384.7251
BmX003	16-10S	-0.1784	0.0000	1580.8050
BmX003	16-10S Second Order	-0.1784	0.0000	1580.8050
BmX003	16-11Lr	-0.5969	0.0000	472.4327
BmX003	16-11Lr Second Order	-0.5969	0.0000	472.4327
BmX003	16-11S	-0.5892	0.0000	478.6139
BmX003	16-11S Second Order	-0.5892	0.0000	478.6139
BmX003	16-12E »+X	-0.2635	0.0000	1070.2779
BmX003	16-12E »+X Second Order	-0.2635	0.0000	1070.2779
BmX003	16-12E »+X:Ω	-0.3525	0.0000	800.0734
BmX003	16-12E »+X:Ω Second Order	-0.3525	0.0000	800.0734
BmX003	16-12E »-X	-0.2049	0.0000	1376.5804
BmX003	16-12E »-X Second Order	-0.2049	0.0000	1376.5804
BmX003	16-12E »-X:Ω	-0.1758	0.0000	1603.9053
BmX003	16-12E »-X:Ω Second Order	-0.1758	0.0000	1603.9053
BmX003	16-12W »+X	-0.1960	0.0000	1438.8368
BmX003	16-12W »+X Second Order	-0.1960	0.0000	1438.8368
BmX003	16-12W »-X	-0.1814	0.0000	1554.7123
BmX003	16-12W »-X Second Order	-0.1814	0.0000	1554.7123
BmX003	16-13Lr »+X	-0.6024	0.0000	468.1255
BmX003	16-13Lr »+X Second Order	-0.6024	0.0000	468.1255
BmX003	16-13Lr »-X	-0.5914	0.0000	476.8117
BmX003	16-13Lr »-X Second Order	-0.5914	0.0000	476.8117
BmX003	16-13S »+X	-0.5947	0.0000	474.1939
BmX003	16-13S »+X Second Order	-0.5947	0.0000	474.1939
BmX003	16-13S »-X	-0.5837	0.0000	483.1088
BmX003	16-13S »-X Second Order	-0.5837	0.0000	483.1088

Member Relative Deflections (continued)

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	16-14 »+X	-0.6452	0.0000	437.1041
BmX003	16-14 »+X Second Order	-0.6452	0.0000	437.1041
BmX003	16-14 »+X:Ω	-0.7111	0.0000	396.5614
BmX003	16-14 »+X:Ω Second Order	-0.7111	0.0000	396.5614
BmX003	16-14 »-X	-0.6013	0.0000	468.9814
BmX003	16-14 »-X Second Order	-0.6013	0.0000	468.9814
BmX003	16-14 »-X:Ω	-0.5793	0.0000	486.8188
BmX003	16-14 »-X:Ω Second Order	-0.5793	0.0000	486.8188
BmX003	16-15 »+X	-0.1205	0.0000	2339.5736
BmX003	16-15 »+X Second Order	-0.1205	0.0000	2339.5736
BmX003	16-15 »-X	-0.1059	0.0000	2662.3079
BmX003	16-15 »-X Second Order	-0.1059	0.0000	2662.3079
BmX003	16-15Di	-0.1132	0.0000	2491.1369
BmX003	16-15Di Second Order	-0.1132	0.0000	2491.1369
BmX003	16-16 »+X	-0.1266	0.0000	2227.7073
BmX003	16-16 »+X Second Order	-0.1266	0.0000	2227.7073
BmX003	16-16 »+X:Ω	-0.2164	0.0000	1303.0548
BmX003	16-16 »+X:Ω Second Order	-0.2164	0.0000	1303.0548
BmX003	16-16 »-X	-0.0677	0.0000	4163.8311
BmX003	16-16 »-X Second Order	-0.0677	0.0000	4163.8311
BmX003	16-16 »-X:Ω	-0.0399	0.0000	7064.9572
BmX003	16-16 »-X:Ω Second Order	-0.0399	0.0000	7064.9572
BmX003	D	-0.1887	0.0000	1494.6821
BmX003	D Second Order	-0.1887	0.0000	1494.6821
BmX003	D+0.75(L+W) »+X	-0.6061	0.0000	465.2974
BmX003	D+0.75(L+W) »+X Second Order	-0.6061	0.0000	465.2974
BmX003	D+0.75(L+W) »-X	-0.5878	0.0000	479.7739
BmX003	D+0.75(L+W) »-X Second Order	-0.5878	0.0000	479.7739
BmX003	D+L	-0.7330	0.0000	384.7251
BmX003	D+L Second Order	-0.7330	0.0000	384.7251
BmX003	D+Lr	-0.1887	0.0000	1494.6821
BmX003	D+Lr Second Order	-0.1887	0.0000	1494.6821
BmX003	D+S	-0.1784	0.0000	1580.8050
BmX003	D+S Second Order	-0.1784	0.0000	1580.8050
BmX003	E+X	-0.0646	0.0000	4367.6125
BmX003	E+X Second Order	-0.0646	0.0000	4367.6125
BmX003	E-X	0.0000	0.0218	12927.6950
BmX003	E-X Second Order	0.0000	0.0218	12927.6950
BmX003	L	-0.5443	0.0000	518.0756
BmX003	L Second Order	-0.5443	0.0000	518.0756

Member Relative Deflections (continued)

Member	Result Case	Min Dy in	Max Dy in	L/Dy
BmX003	Live	-0.5443	0.0000	518.0756
BmX003	Live Second Order	-0.5443	0.0000	518.0756
BmX003	S	0.0000	0.0103	27435.2486
BmX003	S Second Order	0.0000	0.0103	27435.2486
BmX003	Seismic »+X	-0.0646	0.0000	4367.6125
BmX003	Seismic »+X Second Order	-0.0646	0.0000	4367.6125
BmX003	Seismic »-X	0.0000	0.0218	12927.6950
BmX003	Seismic »-X Second Order	0.0000	0.0218	12927.6950
BmX003	Snow	0.0000	0.0103	27435.2486
BmX003	Snow Second Order	0.0000	0.0103	27435.2486
BmX003	W+X	-0.0126	0.0000	22329.6550
BmX003	W+X Second Order	-0.0126	0.0000	22329.6550
BmX003	W-X	0.0000	0.0126	22366.7716
BmX003	W-X Second Order	0.0000	0.0126	22366.7716
BmX003	Wind »+X	-0.0126	0.0000	22329.6550
BmX003	Wind »+X Second Order	-0.0126	0.0000	22329.6550
BmX003	Wind »-X	0.0000	0.0126	22366.7716
BmX003	Wind »-X Second Order	0.0000	0.0126	22366.7716

Column Buckling Calculations

Column Geometry Data

d ₂ or b	1.5	in
d ₁	5.5	in
Le ₁	14.0	ft
Le ₂	1.0	ft

Column Design Values

F _b	2900	psi
F _c	2900	psi
E _{min'}	1016	ksi
F _{cperp} (Hem Fir Plt)	625	psi
cb	1.25	

Column Loading

P	6100	lbs
W ₁	774	plf
M ₁		ft-lbs
W ₂	0	plf
M ₂	0	ft-lbs

Flexural Stress Adjustment Factors

Roof/EQ / Wind - C _D	1.60
Size Factor - C _F	1.00
Repetitive - C _r	1.15

Compressive Stress Adjustment Factors

Roof/EQ / Wind - C _D	1.15
Size Factor - C _F	1.00

Other Factors

c	0.8
K _f	1
K _e	1
R _{B1}	20.26
R _{B2}	0.77

Bracing

81

Bearing

Area
Increase
no

Column Stability Factor Calculation

Strong Axis

F _{ce1}	895	psi
F _{c*1}	3335	psi
F _{ce1} /F _{c*1}	0.268	
C _{p1}	0.251	

Weak Axis

F _{ce2}	13049	psi
F _{c*2}	3335	psi
F _{ce2} /F _{c*2}	3.913	
C _{p2}	0.940	

Beam Stability Factor Calculation

Strong Axis

F _{be1}	2969	psi
F _{b*1}	5336	psi
F _{be1} /F _{b*1}	0.6	
CL ₁	0.53	

Weak Axis

F _{be2}	2048933	psi
F _{b*2}	5336	psi
F _{be2} /F _{b*2}	384	
CL ₂	1.00	

Adjusted Allowable Stresses

Strong Axis

F _{c'1}	839	psi
F _{b'1}	2812	psi

Weak Axis

F _{c'2}	3137	psi
F _{b'2}	5335	psi

Imposed Column Stresses

Strong Axis

f _{c1}	739	psi
f _{b1}	0	psi

Weak Axis

f _{c2}	739	psi
f _{b2}	0	psi

Perpendicular to Grain Stress Check

F _{cperp}	781	psi
f _{cperp}	739	psi

OK

Allowable Stress Interaction Formula

0.78 OK

$$\left(\frac{f_c}{F_c'}\right)^2 + \frac{f_{b1}}{F_{b1}'[1-f_c/F_{cB}]} + \frac{f_{b2}}{F_{b2}'[1-f_c/F_{cB2}-(f_{b1}/F_{bB})]} \leq 1.0$$

Slenderness Check le/d

31 OK

Slenderness Check le/b

8 OK

Date: 11/29/2022
 Project #: Rader Residence
 Design: CRB
 Sheet: Mercer Island, WA

JOIST SPAN (P.S.F.)



Floor and Roof Applications

6" Members													10" Members																		
Member		Spans											Member		Spans																
M/W Type (SSMA)	O.C.	11'-0"		12'-0"		13'-0"		14'-0"		15'-0"		16'-0"		17'-0"		M/W Type (SSMA)	O.C.	18'-0"		19'-0"		20'-0"		21'-0"		22'-0"		23'-0"		24'-0"	
		T	L	T	L	T	L	T	L	T	L	T	L	T	L			T	L	T	L	T	L	T	L	T	L	T	L	T	L
6SW18 (600S162-43)	12"	92	76	77	59	66	46	55	37	45	30	37	25	31	21	10SW18* (1000S162-43)	12"	58	58	52	51	47	44	42	38	39	33	35	29	32	25
	16"	69	57	58	44	49	35	41	28	34	22	28	19	23	15		16"	43	43	39	38	35	33	32	28	29	25	26	22	24	19
	24"	46	38	39	29	33	23	28	18	22	15	19	12	15	10		24"	29	29	26	26	23	22	21	19	19	16	18	14	16	13
6SW16 (600S162-54)	12"	141	94	109	72	85	57	68	46	56	37	46	31	38	25	10SW16 (1000S162-54)	12"	105	75	95	63	82	54	70	47	61	41	53	35	46	31
	16"	106	70	81	54	64	43	51	34	42	28	34	23	29	19		16"	79	56	71	48	61	41	53	35	46	31	40	27	35	24
	24"	70	47	54	36	43	28	34	23	28	19	23	15	19	13		24"	53	37	47	32	41	27	35	23	31	20	27	18	24	16
8SW18 (800S162-43)	12"	126	126	106	106	90	90	78	74	68	60	60	49	53	41	12SW16* (1200S162-54)	12"	124	118	111	100	101	86	91	74	83	65	76	56	70	50
	16"	95	95	79	79	68	68	58	55	51	45	45	37	40	31		16"	93	88	84	75	75	64	68	56	62	48	57	42	52	37
	24"	63	63	53	53	45	45	39	37	34	30	30	25	26	21		24"	62	59	56	50	50	43	46	37	42	32	48	28	45	25

NOTES:

Refer to page 21 for table notes.

* = Exceeds the H/T ratio of 200

T = Total Load

L = Live Load