Structural Calculations for:

Feldmann Residence

8059 West Mercer Way, Mercer Island, WA, 98040

Client: Living Shelter Architects

Code: 2015 International Building Code

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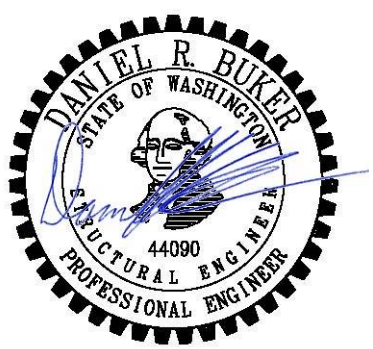
Scope: Partial Second Story Addition for Single-Family Residence

May 13th, 2020



Buker Engineering, llc
PO Box 55124
Seattle, WA 98155
Ph: 206.258.6333

Seismic Design Loads (ASCE 7-10)

for a Wood Framed Structure

RISK CATEGORY	II	
OCCUPANCY CAT.	II	Table 1-1
IMP. FACTOR	1	Table 11.5-1
SITE CLASS	D	Table 20.3-1
R =	6.5	Table 12.2-1

SEISMIC DESIGN CATEGORY D 11.6.1.1

S_s =	1.469	
S_1 =	0.559	
F_a =	1.00	Table 11.4-1
F_v =	1.50	Table 11.4-2
S_{DS}=	0.979	
S_{D1}=	0.559	
Cs_{ULT}=	0.151	Eqn. 12.8-2
Cs_{ASD}=	0.108	

Seismic Dead Load: 15 psf Roof
15 psf Floor
20psf Walls

W_{roof}=15 + 10= 25 psf

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

Vertical Design Loads

Criteria
ASCE 7-10
IBC 2015

Dead Loads

Roof (Composit)	2.5	psf	Flooring	1	psf
1/2" Ply	1.5	psf	Sheathing	2.3	psf
Rafter/Truss	2	psf	Joist	2.6	psf
Insulation	1	psf	5/8" GWB	3.1	psf
5/8" GWB	3.1	psf	Misc. Mech	1	psf
Misc./Mech.	2	psf		10	psf
	12.1	psf			
Use	15	psf	Use	15	psf

Live Loads

Snow	25	psf
floor	40	psf

Soil Bearing

2000 psf

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Project:	Feldmann Residence 8059 W Mercer Way Mercer Island, WA	Date:	9/2/2019
		Design:	CRD

C1

Wind Design Loads (ASCE 7-10)

Directional Procedure - Part 1

Exposure	C		
V=	110	mph	
K_d=	0.85		Table 26.6-1
I=	1		
G=	0.85		26.9

Roof Angle =	39.81	degrees
Ground to top of roof	22.92	ft
Bottom of roof to top of roof	9.25	ft
(mean roof height) h=	18.3	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= Cp values are conservative worst case values

K_{zt}= 1.00

Pressures:

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	Ultimate P_{walls} (psf)	**Allowable P_{walls} (psf)**
0-15	0.85	22.38	15.22	10.07	25.29	**15.17**
15-20	0.9	23.70	16.11	10.07	26.18	**15.71**
20-25	0.94	24.75	16.83	10.07	26.90	**16.14**
25-30	0.98	25.80	17.55	10.07	27.62	**16.57**
30-40	1.04	27.38	18.62	10.07	28.69	**17.21**

$P_{ww\ roof}$	$P_{lw\ roof}$	P_{roof} (psf)	**P_{roof} (psf)**
6.04	12.09	18.13	**10.88**

Use 16.25 psf on projected wind surfaces

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Project: Feldmann Residence
8059 W Mercer Way
Mercer Island, WA

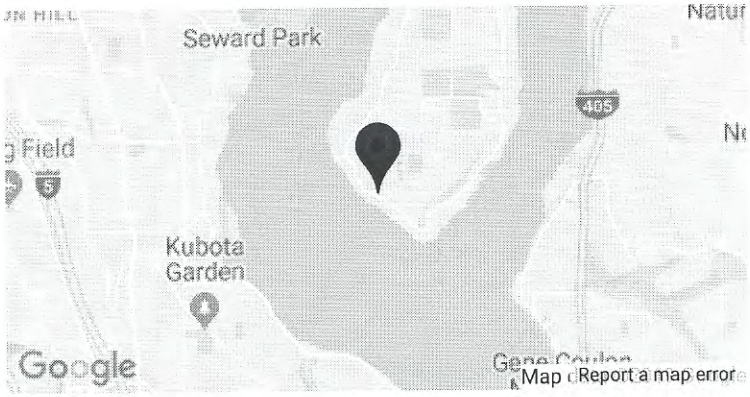
Date: 9/2/2019

Design: CRD

L1

ATC Hazards by Location

Search Information



Address: 8059 W Mercer Way, Mercer Island, WA 98040, USA

Coordinates: 47.529889, -122.23538380000002

Elevation: ft

Timestamp: 2019-09-02T23:37:25.746Z

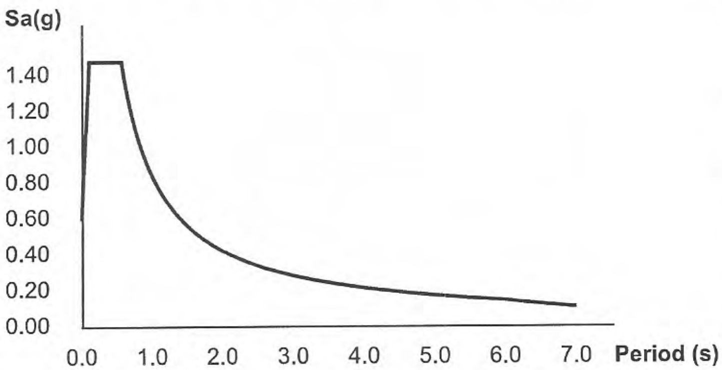
Hazard Type: Seismic

Reference Document: IBC-2015

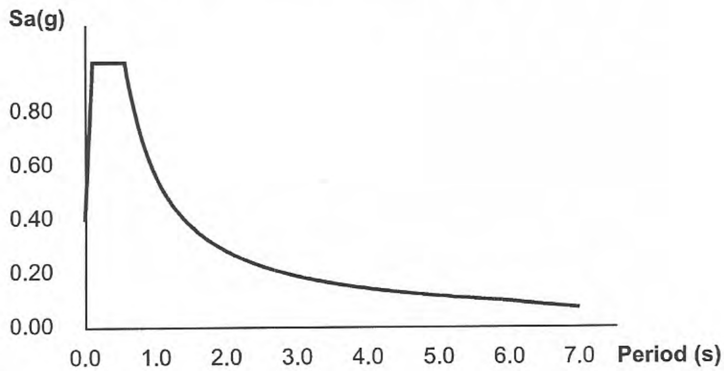
Risk Category: II

Site Class: D

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	1.469	MCE_R ground motion (period=0.2s)
S_1	0.559	MCE_R ground motion (period=1.0s)
S_{MS}	1.469	Site-modified spectral acceleration value
S_{M1}	0.838	Site-modified spectral acceleration value
S_{DS}	0.979	Numeric seismic design value at 0.2s SA
S_{D1}	0.559	Numeric seismic design value at 1.0s SA

▾Additional Information

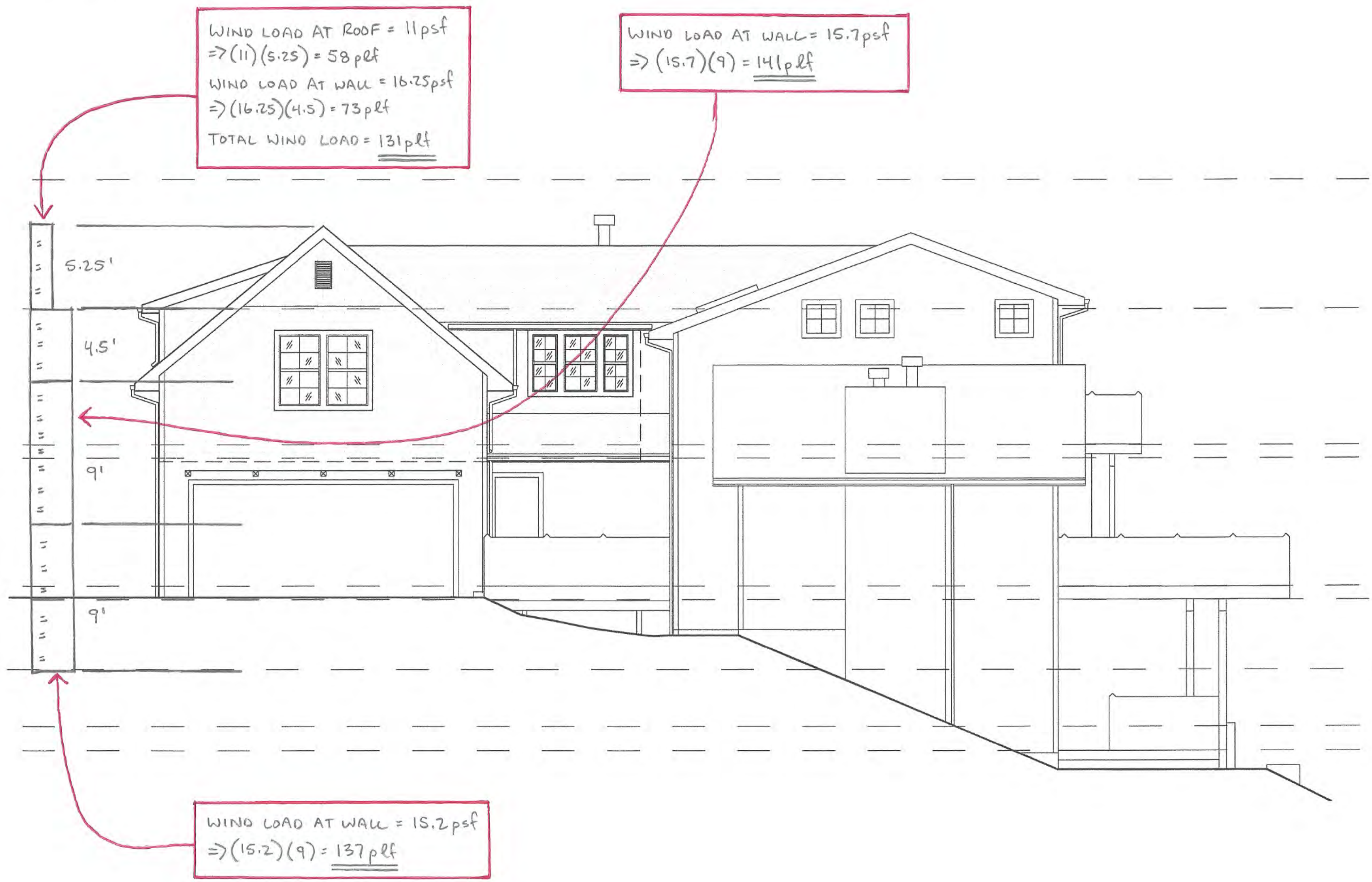
Name	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2s
F_v	1.5	Site amplification factor at 1.0s

L2

WIND ANALYSIS

SCALE: 1/8" = 1'-0"

* REPRESENTS CONSERVATIVE WIND LOADS IN ALL DIRECTIONS



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SEISMIC ANALYSIS - FULL HOUSE

$A_{ROOF} = (23.25)(25.25) + (26.75)(33.5) + (8.25)(20.25) = 1650\ ft^2$

$W_{ROOF} = (1650)(25) = 41.25^k$

$A_{2ND\ (FLOOR)} = 486 + 731 + 349 = 1566\ ft^2$

$A_{2ND\ (ROOF)} = 410 + 57 = 467 ft^2$

$W_{2ND} = (1566)(30) + (467)(25) = 58.7^k$

$A_{1ST} = 900 + 191 + 314 = 1405\ ft^2$

$W_{1ST} = (1405)(30) = 42.15^k$ (NOT PART OF SCOPE, USED FOR VERTICAL DISTRIBUTION ONLY)

$V_{ASD} = (142.1^k)(0.108) = \underline{\underline{15.35^k}}$

LEVEL	W_x	h_x	$W_x h_x$	C_{vx}	F_x
ROOF	41.25^k	27'	1114.0	0.44	6.75^k
2ND	58.7^k	18'	1057.0	0.41	6.30^k
1ST	42.15^k	9'	380.0	0.15	2.3^k
TOTAL	142.1^k		2551.0	1.0	15.35^k

SEISMIC ANALYSIS - ADDITION

$A_{ROOF} = (23.25)(25.25) + (8.25)(20.25) = 754\ ft^2$

$W_{ROOF} = (754)(25) = 18.9^k$

$A_{2ND} = 486 + 275 = 761\ ft^2$

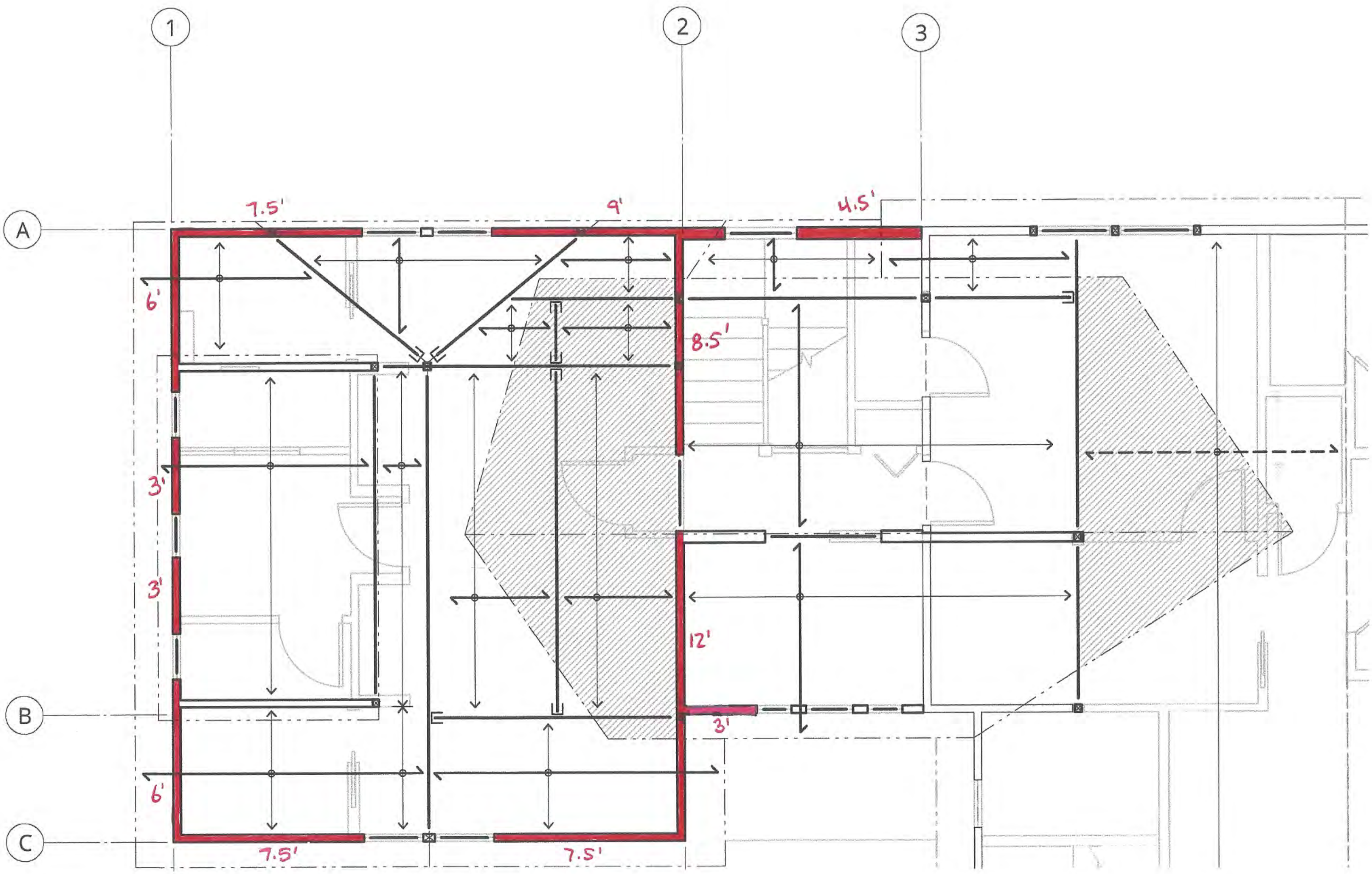
$W_{2ND} = (761)(30) = 22.8^k$

$V_{ASD} = (41.7)(0.108) = 4.5^k$

LEVEL	Wx	hx	Wxhx	Cvx	Fx
ROOF	18.9^k	18'	340.2	0.62	2.79^k
2ND	22.8^k	9'	205.2	0.38	1.71^k
TOTAL	41.7^k		545.4	1.0	4.5^k

SHEARWALL KEYPLAN - UPPER ROOF FRAMING

SCALE: 3/16" = 1'-0"



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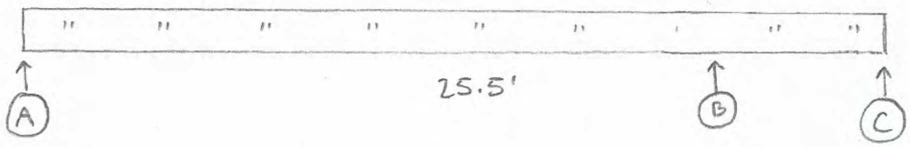
ROOF DIAPHRAGM/2ND FLOOR WALLS NORTH/SOUTH DIRECTION

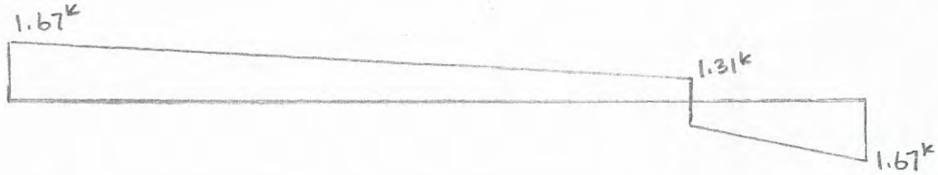
WIND LOAD = 131 plf

SEISMIC LOAD = $2790^{\#}/25.5' = 109$ plf

GRID:



WIND:



SEISMIC:

North/South Direction

Grid	A	B	C
Vwind (kips)	1.67	1.31	1.67
Vseismic (kips)	1.39	1.09	1.39
Length of wall (ft)	21	3	15
v_wind (p/f)**	80	582	111
v_siesmic (p/l)**	66	484	93
h (ft)	8	8	8
OTF_Wind (lbs)*	636	4658	891
OTF_Seismic (lbs)*	530	2907	741
Length of shortest wall pier (ft)	4.5	3	7.5
Apect Ratio Reduction for Seismic Loads	1.78	2.67	1.07
Siesmic Penalty	1.0	0.75	1.0
Shearwall	W6	W2	W6
Holdown	N/A	MSTC66	CS16

***OTF does not take into account dead load and weight of the wall uno**
****v_siesmic/wind includes penalty**

ROOF DIAPHRAGM / 2ND FLOOR WALLS EAST/WEST DIRECTION

WIND LOAD = 131 plf

SEISMIC LOAD = 2790/31' = 90 plf

GRID:

WIND:

SEISMIC:

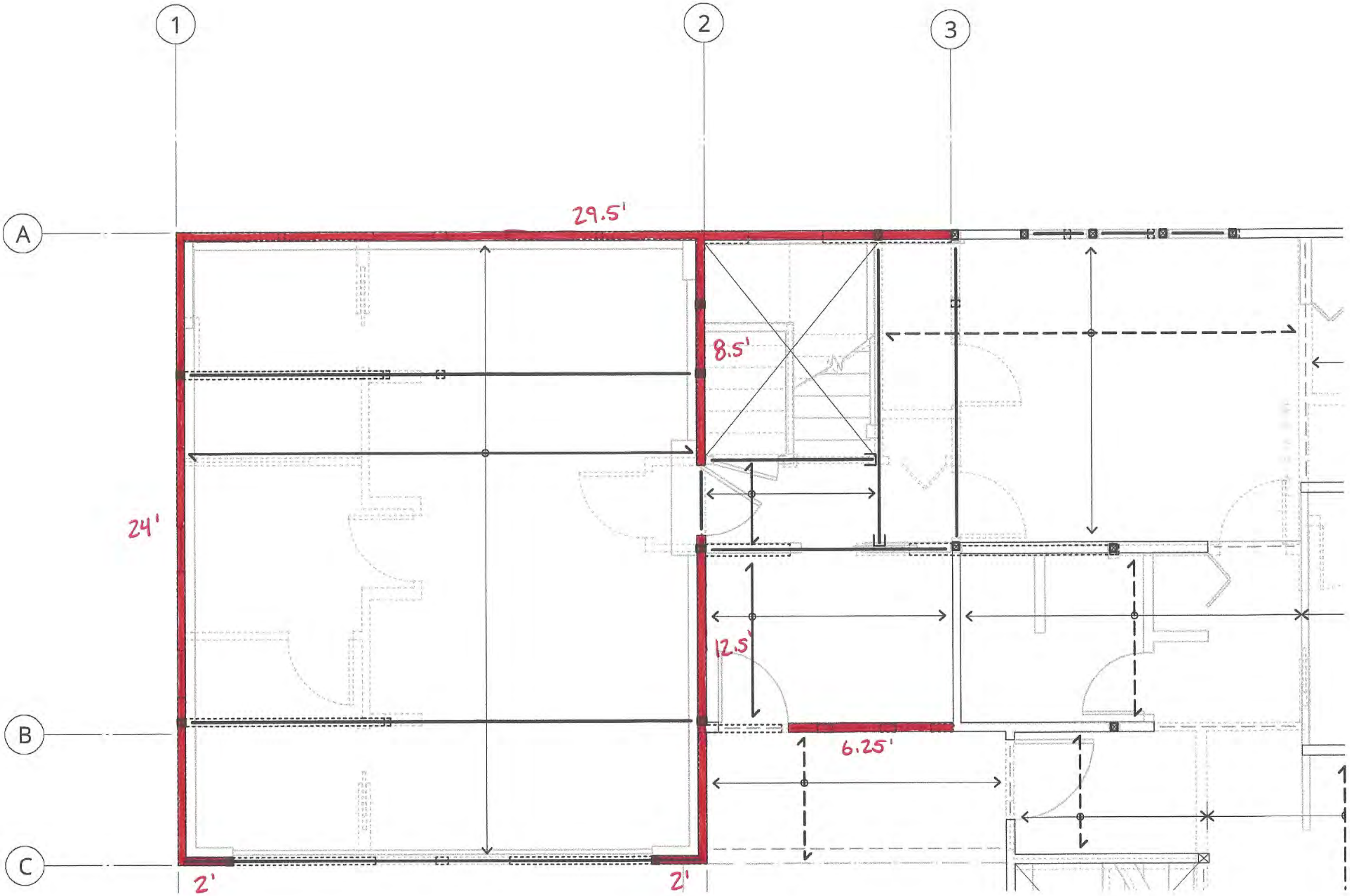
East/West Direction

Grid	1	2
Vwind (kips)	1.41	2.65
Vseismic (kips)	0.97	1.83
Length of wall (ft)	18	20.5
v_wind (p/f)**	104	129
v_siesmic (p/l)**	72	89
h (ft)	8	8
OTF_Wind (lbs)*	836	1034
OTF_Seismic (lbs)*	431	714
Length of shortest wall pier (ft)	3	8.5
Apect Ratio Reduction for Seismic Loads	2.67	0.94
Siesmic Penalty	0.75	1.0
Shearwall	W6	W6
Holdown	N/A	CS16

***OTF does not take into account dead load and weight of the wall uno**
****v_siesmic/wind includes penalty**

SHEARWALL KEYPLAN - 2ND FLOOR FRAMING

SCALE: 3/16" = 1'-0"



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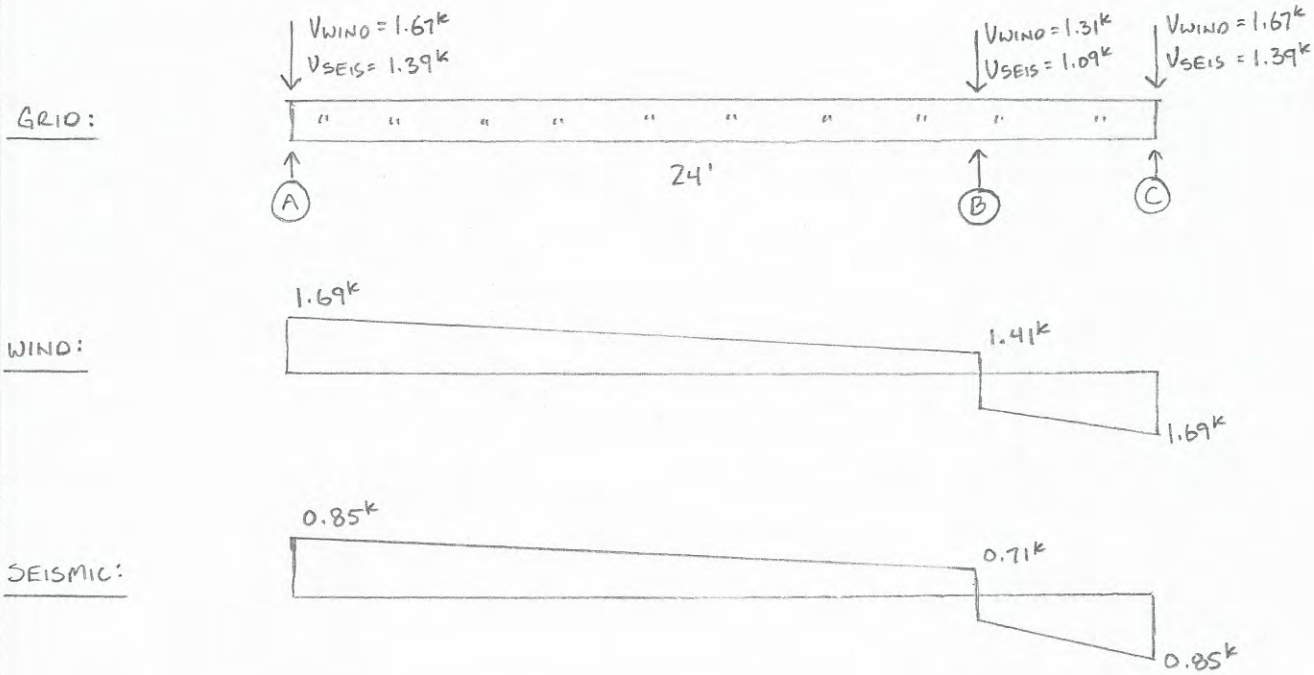
2ND FLOOR DIAPHRAGM / 1ST FLOOR WALLS — NORTH/SOUTH DIRECTION

WIND LOAD = 141 plf

SEISMIC LOAD = $1710^{\#}/24' = 71$ plf



North/South Direction

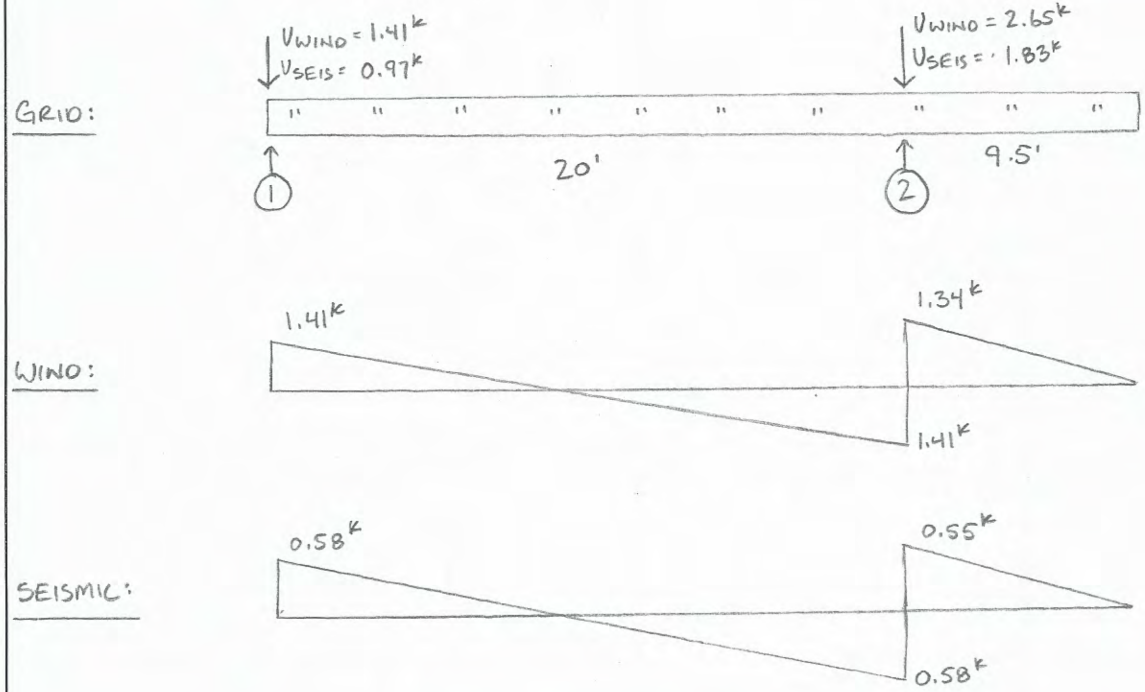
Grid	A	B	C
Vwind (kips)	3.34	2.79	3.36
Vseismic (kips)	2.24	1.8	2.24
Length of wall (ft)	29.5	6.25	4
v_wind (p/f)**	113	446	945
v_siesmic (p/l)**	76	288	630
h (ft)	9	9	4.5
OTF_Wind (lbs)*	1019	4018	4253
OTF_Seismic (lbs)*	683	2592	2520
Length of shortest wall pier (ft)	29.5	6.25	2
Apect Ratio Reduction for Seismic Loads	0.31	1.44	2.25
Siesmic Penalty	1.0	1.0	0.89
Shearwall	W6	W2	See Portal Frame Sheets
Holdown	N/A	HDU4	

***OTF does not take into account dead load and weight of the wall uno**
****v_siesmic/wind includes penalty**

2ND FLOOR DIAPHRAGM / 1ST FLOOR WALLS — EAST/WEST DIRECTION

WIND LOAD = 141 plf

SEISMIC LOAD = $1710^{\#} / 29.5' = 58$ plf



East/West Direction

Grid	1	2
Vwind (kips)	2.82	5.4
Vseismic (kips)	1.55	2.96
Length of wall (ft)	18	20.5
v_wind (p/f)**	235	263
v_siesmic (p/l)**	129	144
h (ft)	9	9
OTF_Wind (lbs)*	2115	2371
OTF_Seismic (lbs)*	775	1300
Length of shortest wall pier (ft)	3	8.5
Apect Ratio Reduction for Seismic Loads	3.00	1.06
Siesmic Penalty	0.67	1.0
Shearwall	W6	W6
Holdown	HDU2	HDU4

***OTF does not take into account dead load and weight of the wall uno**
****v_siesmic/wind includes penalty**

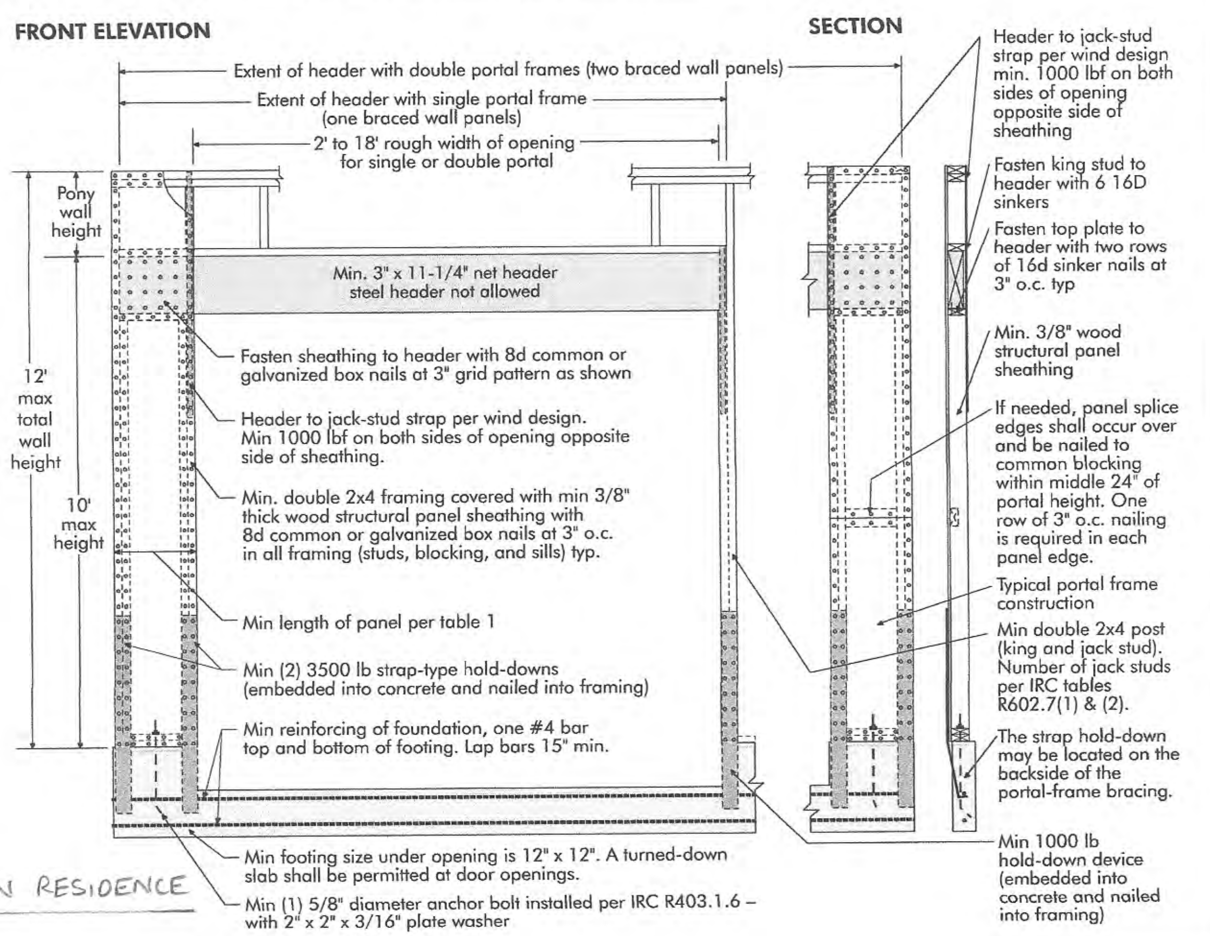
APA Technical Topics
TT-100G APRIL 2020

A Portal Frame with Hold Downs for Engineered Applications

The APA portal-frame design, as shown in Figure 1, was envisioned primarily for use as bracing in conventional light-frame construction. However, it can also be used in engineered applications, as described in this technical topic. The portal frame is not actually a narrow shear wall because it transfers shear by means of a semi-rigid, moment-resisting frame. The extended header is integral in the function of the portal frame, thus, the effective frame width is more than just the wall segment, but includes the header length that extends beyond the wall segment. For this shear transfer mechanism, the wall aspect ratio requirements of the code do not apply to the wall segment of the APA portal frame.

FIGURE 1

CONSTRUCTION DETAILS FOR APA PORTAL-FRAME DESIGN WITH HOLD DOWNS



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L12

TABLE 1

RECOMMENDED ALLOWABLE DESIGN VALUES FOR APA PORTAL FRAME USED ON A RIGID-BASE FOUNDATION FOR WIND OR SEISMIC LOADING[a,b,c,d]

Minimum Portal Width (in.)	Maximum Portal Height (ft)	Allowable Design (ASD) Values per Frame Segment		Load Factor
		Shear[e,f] (lbf)	Deflection (in.)	
16	8	850	0.33	3.09
	10	625	0.44	2.97
24	8	1,675	0.38	2.88
	10	1,125 *	0.51	3.42

a. Design values are based on the use of Douglas-fir or Southern pine framing. For other species of framing, multiply the above shear design value by the specific gravity adjustment factor = (1 – (0.5 – SG)), where SG = specific gravity of the actual framing. This adjustment shall not be greater than 1.0.

b. For construction as shown in Figure 1.

c. Values are for a single portal-frame segment (one vertical leg and a portion of the header). For multiple portal-frame segments, the allowable shear design values are permitted to be multiplied by the number of frame segments (e.g., two = 2x, three = 3x, etc.).

d. Interpolation of design values for heights between 8 and 10 feet, and for portal widths between 16 and 24 inches, is permitted.

e. The allowable shear design value is permitted to be multiplied by a factor of 1.4 for wind design.

f. If story drift is not a design consideration, the tabulated design shear values are permitted to be multiplied by a factor of 1.15. This factor is permitted to be used cumulatively with the wind-design adjustment factor in Footnote (e) above.

Recommended design values for engineered use of the portal frames are provided in Table 1 considering both strength and stiffness. The Table 1 values were developed using the CUREE cyclic test protocol (ASTM E2126) with a flexible load head to ensure that the code (IBC) drift limit, ductility and safety factor are maintained. For seismic design, APA recommends using the design coefficients and factors for light-frame (wood) walls sheathed with wood structural panels rated for shear resistance (Item 15 of Table 12.2-1 of ASCE 7-16). See APA Report T2004-59 for more details.

Since cyclic testing was conducted with the portal frame attached to a rigid test frame using embedded strap-type hold downs, design values provided in Table 1 of this document should be limited to portal frames constructed on similar rigid-base foundations, such as a concrete foundation, stem wall or slab, and using a similar embedded strap-type hold down.

* ADJUSTED ALLOWABLE SHEAR DESIGN FOR ASSUMED HEM-FIR LUMBER:

GRAVITY OF HEM-FIR = 0.43

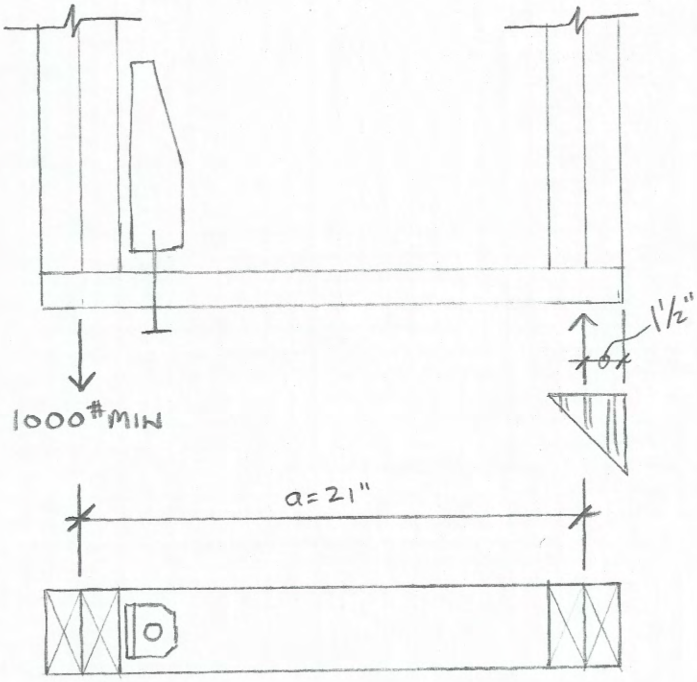
$\Rightarrow (1-(0.5-0.43)) = 0.93$

$\Rightarrow (1125)(0.93) =$ 1046plf PER PANEL

FELDMANN RESIDENCE

L13

ADJUSTED HOLDOWN REQUIREMENT FOR NARROWER PANEL



MOMENT = 1000 (21")
= 21,000 #-"

a = 24 - 1½ - 3" - 1½"
= 18"

HD REQ'D = 21,000/18" = 1170#

CAPACITY OF A DISCONTINUED PHD6 = 4225#

*PROVIDED FOR REFERENCE ONLY

LIST- 1 APPROVED ANCHOR CONNECTORS FOR NEW CONSTRUCTION OF TILT-UP WALL AND MASONRY WALL BUILDINGS 1,2,3

Simpson Strong-Tie Co. (RR 25300) Date: January 15, 2002

Model * No.	Material (ga.)		Dimensions (in.)			Anchor Bolt Diameter (in.)	Stud Fastener	Max. Allowable Tension Load (lbs.)
	Strap	Washer	Width	Height	CL			
PHD2	14	3	2.875	9.3125	1.375	5/8	(10) - SDS¼ x 3	2420b
							(10) - SDS¼ x 2 ½	2420b
							(10) - SDS¼ x 1 ½	2420b
PHD5	14	3	2.875	11.5625	1.375	5/8	(14) - SDS¼ x 3	2420b
							(14) - SDS¼ x 2 ½	2420b
							(14) - SDS¼ x 1 ½	2420b
PHD6	12	3	2.9375	13.8125	1.375	7/8	(18) - SDS¼ x 3	4070b
							(18) - SDS¼ x 2 ½	4070b
							(18) - SDS¼ x 1 ½	3550d
PHD8	10	10	3.000	17.1875	1.375	7/8	(24) - SDS¼ x 3	5420a
							(24) - SDS¼ x 2 ½	5420a
							(24) - SDS¼ x 1 ½	4225d

Notes:
1. The wood member must be sized for the load carrying capacity.
2. Loads listed include an increase for short-term duration and shall be reduced where required by code for load combinations.
3. Anchor bolt type, length, and embedment to be specified by the designer.

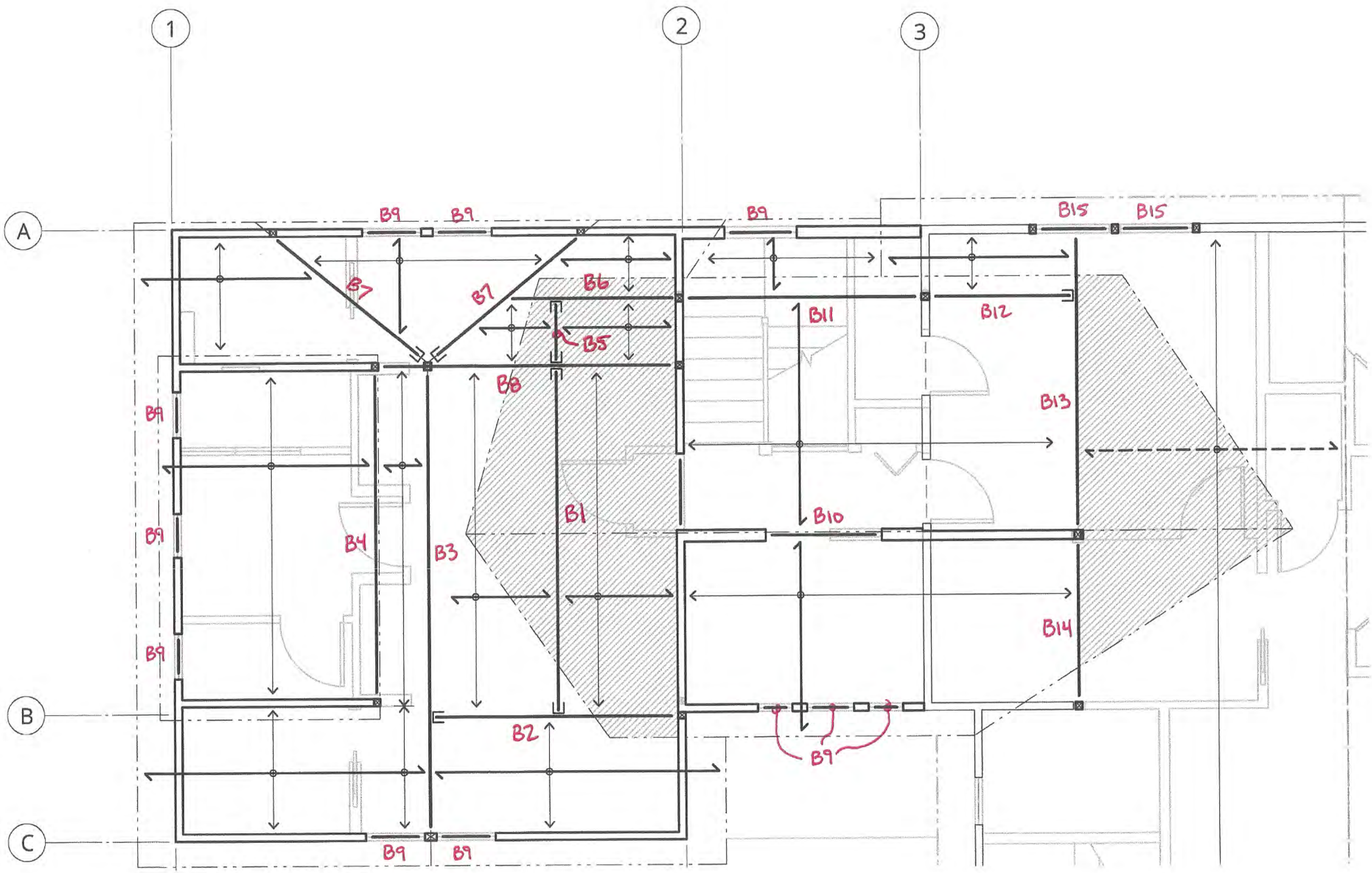
*These are for wall anchor connectors only. See 91.2315.5.6 of the 1999 Los Angeles Building Code for hold-down connectors.

LEGEND OF GOVERNING CRITERIA:

a = mean ultimate load value on a steel jig / (3 x 1.4)
b = mean 1/8" deflection load value on a steel jig / 3
c = the fastener value in accordance with 1999 Los Angeles City Building Code
d = max. value on RR

ROOF FRAMING KEYPLAN

SCALE: 3/16" = 1'-0"



FELDMANN RESIDENCE

F1

	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

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

Grade	Width	Design Property	Depth 4⅜"	5½"	5½" Plank Orientation	7¼"	8⅝"	9½"	11⅞"	14"	16"	18"
TimberStrand® LSL												
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550	6,335					
		Shear (lbs)	4,340	5,455	1,925	7,190	8,555					
		Moment of Inertia (in.4)	24	49	20	111	187					
		Weight (plf)	4.5	5.6	5.6	7.4	8.8					
1.55E	1¾"	Moment (ft-lbs)						5,210	7,975	10,920	14,090	
		Shear (lbs)						3,435	4,295	5,065	5,785	
		Moment of Inertia (in.4)						125	244	400	597	
		Weight (plf)						5.2	6.5	7.7	8.8	
	3½"	Moment (ft-lbs)						10,420	15,955	21,840	28,180	
		Shear (lbs)						6,870	8,590	10,125	11,575	
		Moment of Inertia (in.4)						250	488	800	1,195	
		Weight (plf)						10.4	13	15.3	17.5	
Microllam® LVL												
2.0E	1¾"	Moment (ft-lbs)		2,125		3,555		5,885	8,925	12,130	15,555	19,375
		Shear (lbs)		1,830		2,410		3,160	3,950	4,655	5,320	5,985
		Moment of Inertia (in.4)		24		56		125	244	400	597	851
		Weight (plf)		2.8		3.7		4.8	6.1	7.1	8.2	9.2
Parallam® PSL												
2.2E	3½"	Moment (ft-lbs)						13,055	19,900	27,160	34,955	43,665
		Shear (lbs)						6,430	8,035	9,475	10,825	12,180
		Moment of Inertia (in.4)						250	488	800	1,195	1,701
		Weight (plf)						10.4	13.0	15.3	17.5	19.7
	5¼"	Moment (ft-lbs)						19,585	29,855	40,740	52,430	65,495
		Shear (lbs)						9,645	12,055	14,210	16,240	18,270
		Moment of Inertia (in.4)						375	733	1,201	1,792	2,552
		Weight (plf)						15.6	19.5	23.0	26.3	29.5
	7"	Moment (ft-lbs)						26,115	39,805	54,325	69,905	87,325
		Shear (lbs)						12,855	16,070	18,945	21,655	24,360
		Moment of Inertia (in.4)						500	977	1,601	2,389	3,402
		Weight (plf)						20.8	26.0	30.6	35.0	39.4

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

FELDMANN RESIDENCE

F3

PRODUCT STORAGE

Protect product from sun and water

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)	$F_{c\perp}$ Compression Perpendicular to Grain[5] (psi)	$F_{c\parallel}$ 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	2,900[12]	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) $F_{c\perp}$ 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 $F_{c\perp}$ of 670 psi. NDS® bearing area factor $C_b = 1.0$.
(10) Value accounts for large hole capabilities. See **Allowable Holes** on page 26.
(11) Value shown is for plank orientation.
(12) For column applications, use $F_{c\parallel}$ of 500 psi. Alternatively, refer to ESR-1387, Table 1, footnote 15.

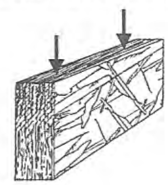
General Assumptions for Trus Joist® Beams

- 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 $\frac{5L^2}{4608}$ (in.) of true alignment. L is the unrestrained length of the member in feet.

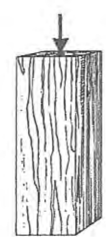
For applications not covered in this brochure, contact your Weyerhaeuser representative.

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

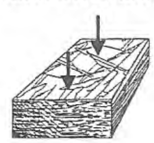
Beam Orientation



Column Orientation



Plank Orientation



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

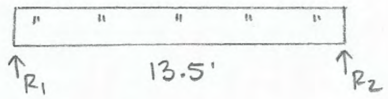
FELDMANN RESIDENCE

F4

UPPER ROOF FRAMING DESIGN

$D_L = 15\,psf$, $S_L = 25\,psf$

B1 — 6x8



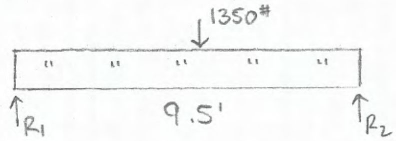
$W = (10/2)(40) = 200\,plf$

$R_1 = R_2 = 1350^{\#}$ $M = 4.56^{k\text{-}1}$

$f_b = 1060\,psi$ $f_v = 50\,psi$

$\Delta_{TL} = 0.48'' = l/338$

B2 — 6x8



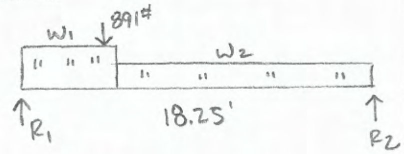
$W = (16/12)(40) = 53\,plf$

$R_1 = 891^{\#}$ $R_2 = 962^{\#}$ $M = 3.79^{k\text{-}1}$

$f_b = 883\,psi$ $f_v = 35\,psi$

$\Delta_{TL} = 0.17'' = l/671$

B3 — 5¼" x 11⅞" PSL



$W_1 = (19.5/2)(40) = 390\,plf$

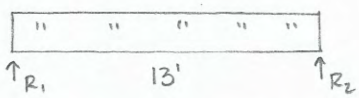
$W_2 = (7/2)(40) = 140\,plf$

$R_1 = 3030^{\#}$ $R_2 = 1670^{\#}$ $M = 9.94^{k\text{-}1}$

$f_b = 967\,psi$ $f_v = 73\,psi$

$\Delta_{TL} = 0.4'' = l/547$

B4 — 4x10



$W = (10/2)(40) = 200\,plf$

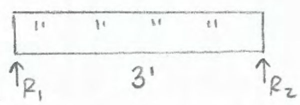
$R_1 = R_2 = 1300^{\#}$ $M = 4.23^{k\text{-}1}$

$f_b = 1020\,psi \le F'_b = 1035\,psi$

$f_v = 60\,psi$

$\Delta_{TL} = 0.35'' = l/446$

B5 — (2) 2x8



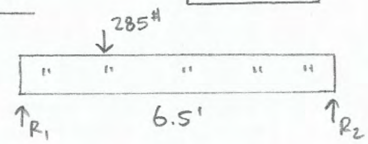
$W = (9.5/2)(40) = 190\,plf$

$R_1 = R_2 = 285^{\#}$ $M = 0.24^{k\text{-}1}$

$f_b = 109\,psi$ $f_v = 20\,psi$

$\Delta_{TL} = 0.01'' = l/3600$

B6 — (2) 2x8



$W = (16/12)(40) = 53\,plf$

$R_1 = 370^{\#}$ $R_2 = 260^{\#}$ $M = 0.63^{k\text{-}1}$

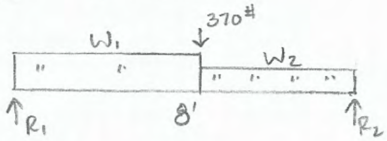
$f_b = 290\,psi$ $f_v = 26\,psi$

$\Delta_{TL} = 0.04'' = l/1950$

UPPER ROOF FRAMING DESIGN (CON'T)

$D_L = 15\,psf$ $S_L = 25\,psf$

B7 — (2) 2x8



$W_1 = (7.5/2)(40) = 150\,plf$

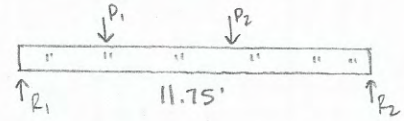
$W_2 = (5/2)(40) = 100\,plf$

$R_1 = 735^{\#}$ $R_2 = 635^{\#}$ $M = 1.74^{k\text{-}1}$

$f_b = 794\,psi$ $f_v = 51\,psi$

$\Delta_{TL} = 0.15'' = l/640$

B8 — 6x10



$P_1 = (2)(635) + 1670 = 2940^{\#}$

$P_2 = 1350 + 285 = 1635^{\#}$

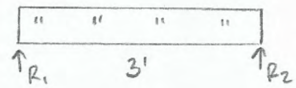
$W = (16/12)(40) = 53\,plf$

$R_1 = 3410^{\#}$ $R_2 = 1790^{\#}$ $M = 7.88^{k\text{-}1}$

$f_b = 1140\,psi$ $f_v = 98\,psi$

$\Delta_{TL} = 0.32'' = l/440$

B9 — (2) 2x8



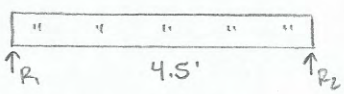
$W = (10/2)(40) = 200\,plf$

$R_1 = R_2 = 300^{\#}$ $M = 0.23^{k\text{-}1}$

$f_b = 105\,psi$ $f_v = 21\,psi$

$\Delta_{TL} = 0.01'' = l/3600$

B10 — (2) 2x8



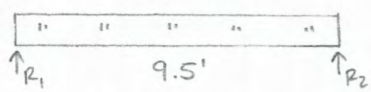
$W = (16/2)(40) = 320\,plf$

$R_1 = R_2 = 720^{\#}$ $M = 0.81^{k\text{-}1}$

$f_b = 370\,psi$ $f_v = 50\,psi$

$\Delta_{TL} = 0.03'' = l/1800$

B11 — (2) 2x10



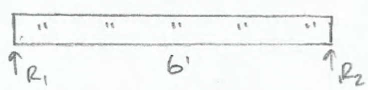
$W = (11.5/2)(40) + 20 = 250\,plf$

$R_1 = R_2 = 1188^{\#}$ $M = 2.82^{k\text{-}1}$

$f_b = 791\,psi$ $f_v = 64\,psi$

$\Delta_{TL} = 0.18'' = l/633$

B12 — (2) 2x8



$W = (11.5/2)(40) + 20 = 250\,plf$

$R_1 = R_2 = 750^{\#}$ $M = 1.12^{k\text{-}1}$

$f_b = 514\,psi$ $f_v = 52\,psi$

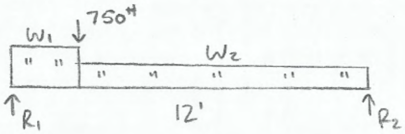
$\Delta_{TL} = 0.06'' = l/1200$

UPPER ROOF FRAMING DESIGN (CON'T)

$D_L = 15psf$, $S_L = 25psf$

B13

3½" x 9½" LSL



$W_1 = (17/2)(40) = 340plf$

$W_2 = (14/2)(40) = 280plf$

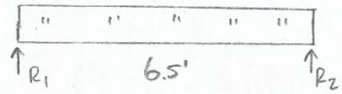
$R_1 = 2410^{\#}$ $R_2 = 1850^{\#}$ $M = 6.12^{k\text{-}1}$

$f_b = 1400psi$ $f_v = 109psi$

$\Delta_{TL} = 0.32" = \ell/450$

B14

4x10



$W = (14/2)(40) = 280plf$

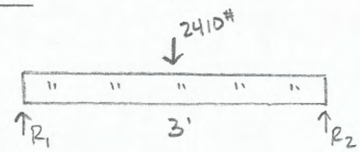
$R_1 = R_2 = 910^{\#}$ $M = 1.48^{k\text{-}1}$

$f_b = 356psi$ $f_v = 42psi$

$\Delta_{TL} = 0.03" = \ell/2600$

B15

(2) 1¾" x 5½" LVL



$W = (13/2)(40) = 260plf$

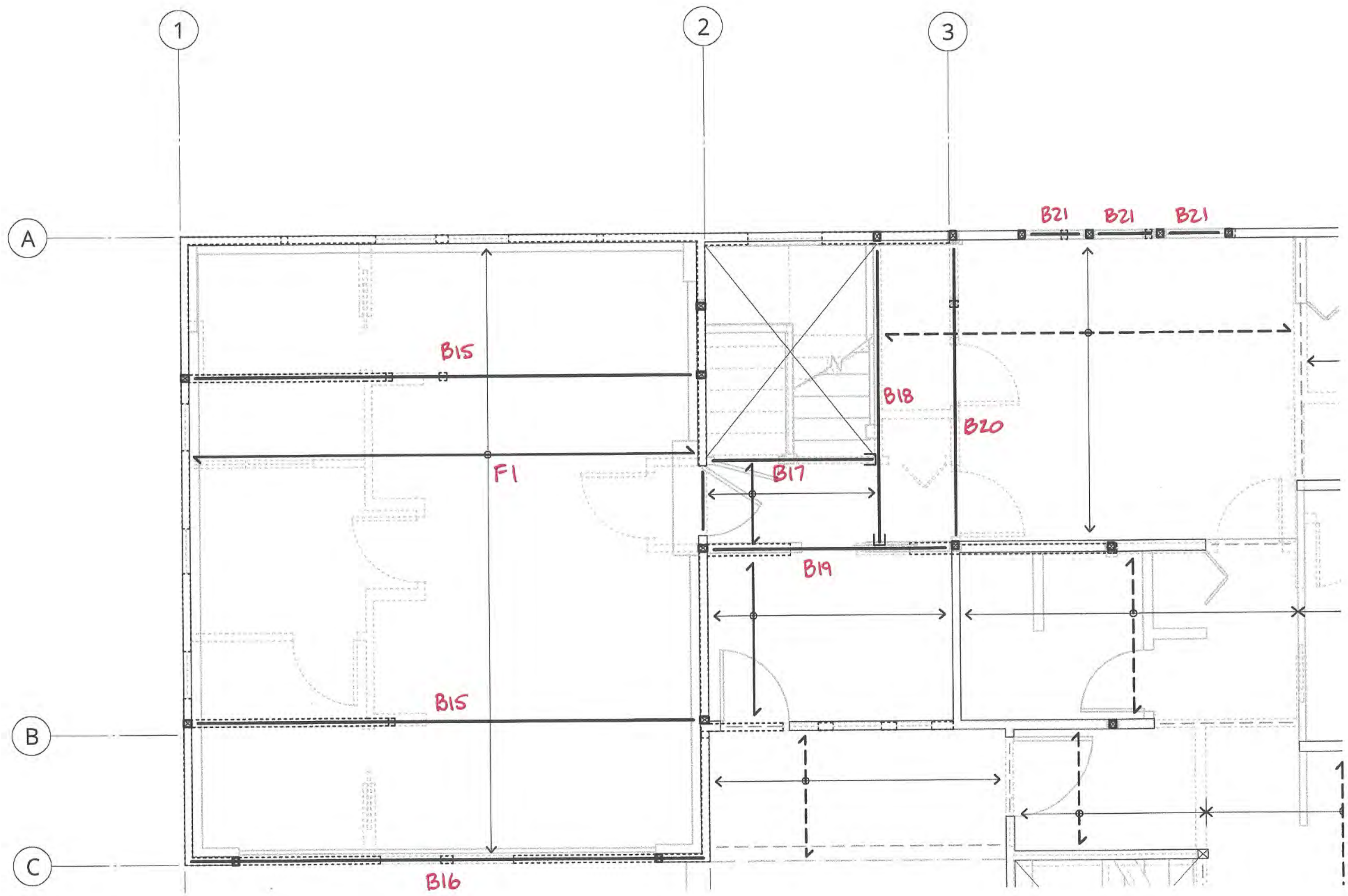
$R_1 = R_2 = 1600^{\#}$ $M = 2.1^{k\text{-}1}$

$f_b = 1430psi$ $f_v = 125psi$

$\Delta_{TL} = 0.03" = \ell/1200$

2ND FLOOR FRAMING KEYPLAN

SCALE: 3/16" = 1'-0"

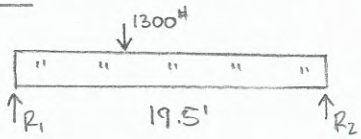


FELDMANN RESIDENCE

2ND FLOOR FRAMING DESIGN

$D_L = 15$ psf, $L_L = 40$ psf, $S_L = 25$ psf

B15 — (2) 1¾" x 14" LVL



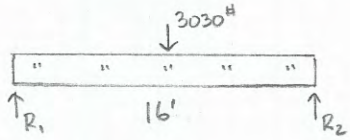
$W = (16/12)(55) = 73$ plf

$R_1 = 1510\#$ $R_2 = 1210\#$ $M = 9.28^{k\text{-}1}$

$f_b = 974$ psi $f_v = 47$ psi

$\Delta_{TL} = 0.35'' = \ell/670$

B16 — 3½" x 14" PSL



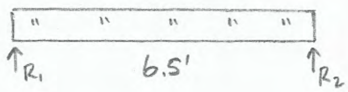
$W = (16/12)(55) + 100 = 173$ plf

$R_1 = R_2 = 2900\#$ $M = 17.7^{k\text{-}1}$

$f_b = 1850$ psi $f_v = 89$ psi

$\Delta_{TL} = 0.44'' = \ell/436$

B17 — (2) 2x8



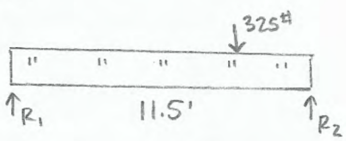
$W = (3.5/2)(55) = 100$ plf

$R_1 = R_2 = 325\#$ $M = 0.53^{k\text{-}1}$

$f_b = 242$ psi $f_v = 23$ psi

$\Delta_{TL} = 0.04'' = \ell/1950$

B18 — 6x8



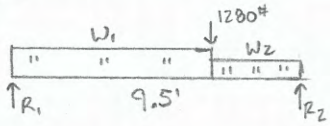
$W = (3/2)(55) + 100 = 183$ plf

$R_1 = 1150\#$ $R_2 = 1280\#$ $M = 3.62^{k\text{-}1}$

$f_b = 843$ psi $f_v = 47$ psi

$\Delta_{TL} = 0.28'' = \ell/493$

B19 — 3½" x 9½" LSL



$W_1 = (10/2)(55) + (16/2)(40) + 80$
$= 675$ plf

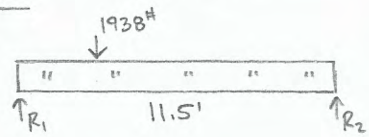
$W_2 = (6.5/2)(55) + (16/2)(40) + 80$
$= 580$ plf

$R_1 = 3570\#$ $R_2 = 3840\#$ $M = 9.42^{k\text{-}1}$

$f_b = 2150$ psi $f_v = 173$ psi

$\Delta_{TL} = 0.4'' = \ell/285$

B20 — 6x8



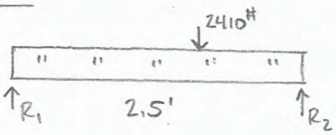
$W = (4/2)(55) = 110$ plf

$R_1 = 2150\#$ $R_2 = 1050\#$ $M = 5.03^{k\text{-}1}$

$f_b = 1170$ psi $f_v = 78$ psi

$\Delta_{TL} = 0.35'' = \ell/394$

B21 — (2) 2x8



$W = (16/12)(55) + (16/12)(40) + 100 = 227$ plf

$R_1 = 1250\#$ $R_2 = 1730\#$ $M = 1.62^{k\text{-}1}$

$f_b = 738$ psi $f_v = 120$ psi

$\Delta_{TL} = 0.02'' = \ell/1500$

FORTE WEB

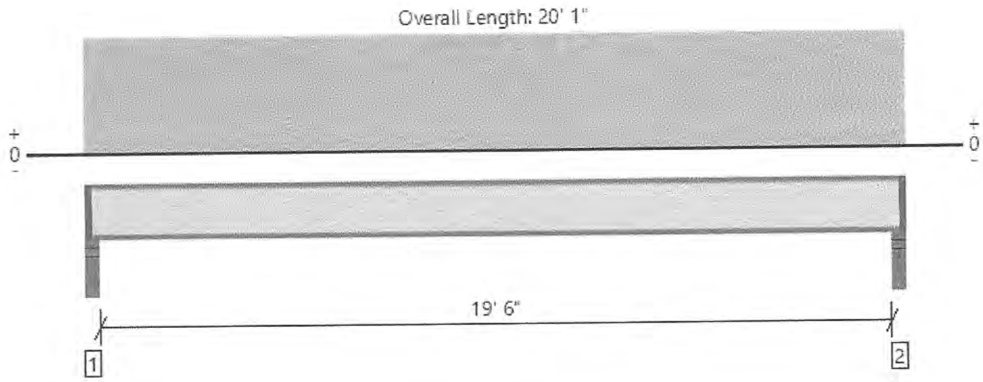
MEMBER REPORT

PASSED

2nd Floor, Floor Over Garage

1 piece(s) 14" TJI® 360 @ 24" OC

F1



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	544 @ 2 1/2"	1080 (1.75")	Passed (50%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	536 @ 3 1/2"	1955	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2659 @ 10' 1/2"	7335	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.208 @ 10' 1/2"	0.492	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.286 @ 10' 1/2"	0.983	Passed (L/825)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	39	38	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 5" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 19' 10" o/c based on loads applied, unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - LSL	3.50"	1.75"	1.75"	151	402	553	1 3/4" Rim Board
2 - Stud wall - LSL	3.50"	1.75"	1.75"	151	402	553	1 3/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PLF)	0 to 20' 1"	N/A	15.0	40.0	Default Load

Weyerhaeuser Notes

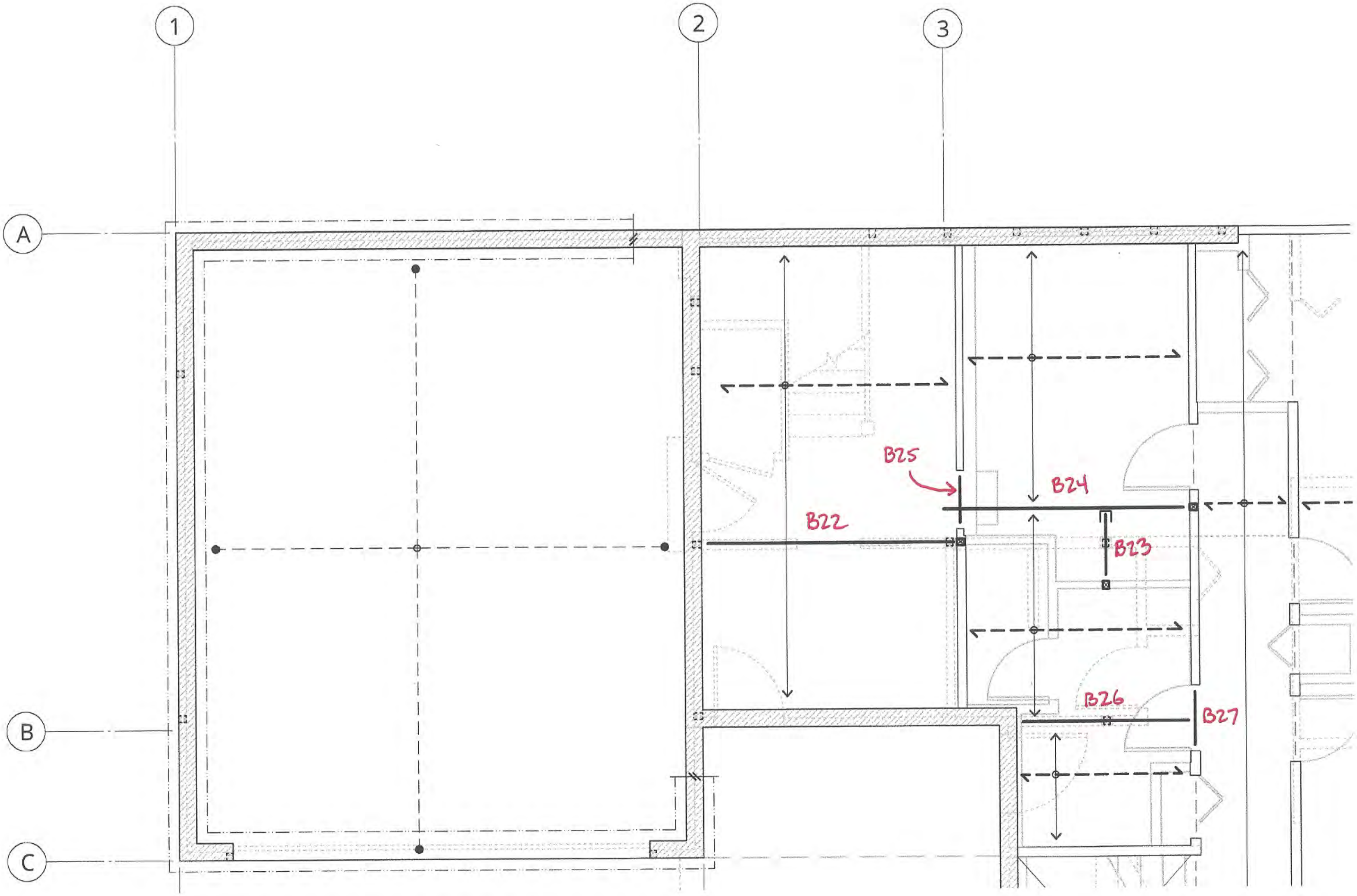
F10

ForteWEB Software Operator	Job Notes
Craig Donison Buker Engineering (206) 258-6333 craig@bukerengineering.com	FELDMANN RESIDENCE

Weyerhaeuser

MAIN FLOOR FRAMING KEYPLAN

SCALE: 3/16" = 1'-0"



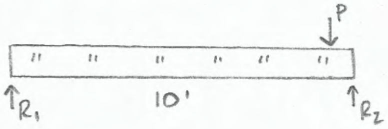
FELDMANN RESIDENCE

F11

MAIN FLOOR FRAMING DESIGN

$D_L = 15psf$, $L_L = 40psf$, $S_L = 25psf$

B22 — (3) 1¾" x 7¼" LVL



P = 3840 + 1280 = 5120#

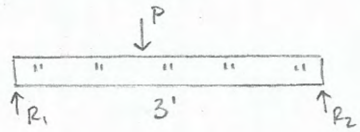
W = (16/12)(55) = 73plf

R_1 = 621# R_2 = 5230# M = 2.64^{k-1}

f_b = 690psi f_v = 206psi

Δ_{TL} = 0.13" = ℓ/923

B23 — 4x8



P = 1850 + 910 = 2760#

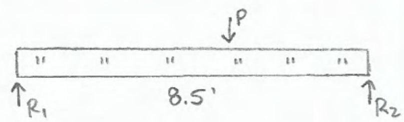
W = (8.5/2)(55) = 234plf

R_1 = 1960# R_2 = 1500# M = 2.27^{k-1}

f_b = 888psi f_v = 116psi

Δ_{TL} = 0.03" = ℓ/1200

B24 — (2) 1¾" x 7¼" LVL



P = 1960#

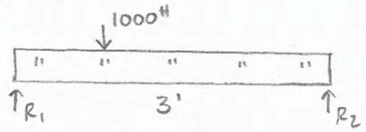
W = (16/12)(55) = 73plf

R_1 = 1000# R_2 = 1580# M = 4.41^{k-1}

f_b = 1720psi f_v = 94psi

Δ_{TL} = 0.21" = ℓ/485

B25 — 4x8



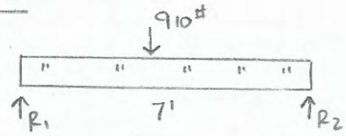
W = (19/2)(55) = 523plf

R_1 = 1530# R_2 = 1030# M = 1.02^{k-1}

f_b = 400psi f_v = 90psi

Δ_{TL} = 0.01" = ℓ/3600

B26 — 4x8



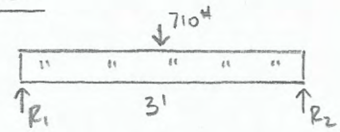
W = (16/12)(55) = 73plf

$R_1 = R_2$ = 710# M = 2.04^{k-1}

f_b = 800psi f_v = 42psi

Δ_{TL} = 0.09" = ℓ/933

B27 — (2) 2x8



W = (22.5/2)(55) = 619plf

$R_1 = R_2$ = 1280# M = 1.23^{k-1}

f_b = 561psi f_v = 88psi

Δ_{TL} = 0.02" = ℓ/1800