



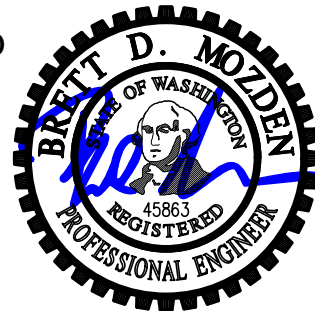
Structural Calculations For:

Lurie

4859 90th PI SE

Mercer Island, WA, 98040

Prepared for: Brandt Design Group
Job #: 01519-2023-02
Date: March 31, 2023



Criteria Sheet

Codes

Structural IBC 2018
 Loading ASCE 7-16
 Wood: NDS 2018
 Steel: AISC 360-16
 Concrete: ACI 318-14
 Masonry: TMS 402/602-16

Project Location

Street & Number 4859 90th Place SE
 City: Mercer Island State: WA
 ZIP: 98040
 Latitude: 47.5593 N
 Longitude: -122.2186 W
 Ground Elevation 367 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure
 Lateral System: Light-frame (wood) Walls Sheathed with Wood
 Structural Panels Rated for Shear Resistance
 R: 6.50 $C_d = 4$
 Base Shear $V = 12$ kips $\Omega_o = 2.5$
 $S_s = 1.437$ $S_r = 0.499$
 $S_{DS} = 1.15$ $S_{DI} = 0.60$
 $C_s = 0.177$ $I_E = 1.0$



Story Information

Stories Above Grade (Including Mezzanine Levels) 1

Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities) No

Wind Load Summary:

$V = 98$ $K_{ZT} = 1.60$
 Exposure = B

Dead Loads:

Roof		Floor	
Roofing	1 psf	Finish Floor	2 psf
1/2" Sheathing	1.8 psf	3/4" Sheathing	2.7 psf
Trusses @ 24" oc	2.5 psf	Joists @ 16" oc	2.2 psf
Misc./Mech.	1.5 psf	Misc./Mech.	2 psf
Ceiling Finish	2.8 psf	Ceiling Finish	2.8
Solar Panels	5 psf		11.7 psf
	15 psf	Use	12 psf
Use	15 psf		

Live Loads:

Floor 40 psf

Snow Loading Criteria:

Ground Snow, p_g	20 psf	Flat Roof Snow Load, p_f	25.0 psf
Exposure Factor, C_e	1.00	Sloped Roof Snow Load, p_s	25.0 psf
Thermal Factor, C_t	1.00		
Importance Factor, I_s	1.00		
Slope Factor, C_s	0.61		

Soils:

Soils Report Provided? No To be approved by the authority having jurisdiction, per 11.8.2 exception.

Allowable Bearing	1500 psf	Active	55/35 pcf (Restrained/Unrestrained)
Sliding, μ	0.3	Seismic Surcharge	8H
Passive	250 pcf		



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SHEET 1

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD
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Wind Coefficients

Exposure	B	
V=	98	mph
K _d =	0.85	Table 26.6-1
K _r =	0.57	Table 26.10-1
K _e =	0.99	Table 26.9-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.87 h/L = 0.20

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-0.38 / 0.12
Leeward Roof	-0.56

Location and Building Dimensions

Calculate K _{zt} ?	No	
K _{zt}	1.60	
Roof Type	Gable	
Roof Slope - Transverse Dir	18	degrees
Roof Slope - Long Dir	0	degrees
Ground to top of roof	14.92	ft
Bot of roof to top of roof	7.50	ft
Mean Roof Height, h	11.17	ft
Short Plan Dimension	56.5	ft
Long Plan Dimension	65.25	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Velocity Pressure at Mean Roof Height, q _h =	19.0	psf
---------------------------------------------------------	------	-----

Wall Pressures (Unfactored):

Ht	K _z	q _z	ASD		
			P _{ww walls}	P _{lw walls}	P _{walls (psf)}
0-15	0.57	18.81	12.79	8.06	12.5
15-20	0.62	20.46	13.91	8.06	13.2
20-25	0.66	21.78	14.81	8.06	13.7
25-30	0.7	23.10	15.71	8.06	14.3
30-40	0.76	25.08	17.05	8.06	15.1
41-50	0.81	26.73	18.17	8.06	15.7
51-60	0.85	28.05	19.07	8.06	16.3
61-70	0.89	29.37	19.97	8.06	16.8
71-80	0.93	30.69	20.87	8.06	17.4
81-90	0.96	31.68	21.54	8.06	17.8
91-100	0.99	32.67	22.21	8.06	18.2

Roof Pressures (Unfactored)

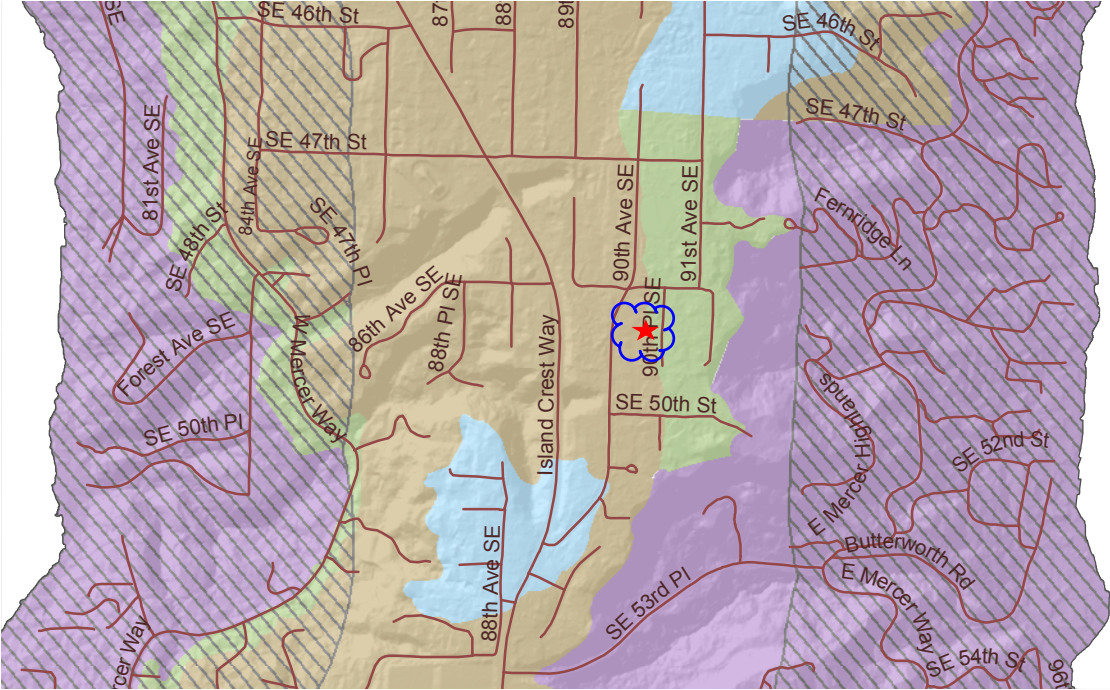
Windward		Leeward	Horiz Proj (psf)
Max	Min		
1.9	-6.1	-9.0	6.58



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 SHEET 3





Kzt = 1.60

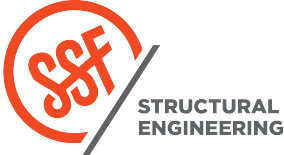


WIND EXPOSURE CATEGORIES:

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

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

Kzt Factor		Kzt = 1.0
		Kzt = 1.3
		Kzt = 1.6
		Kzt = 1.9

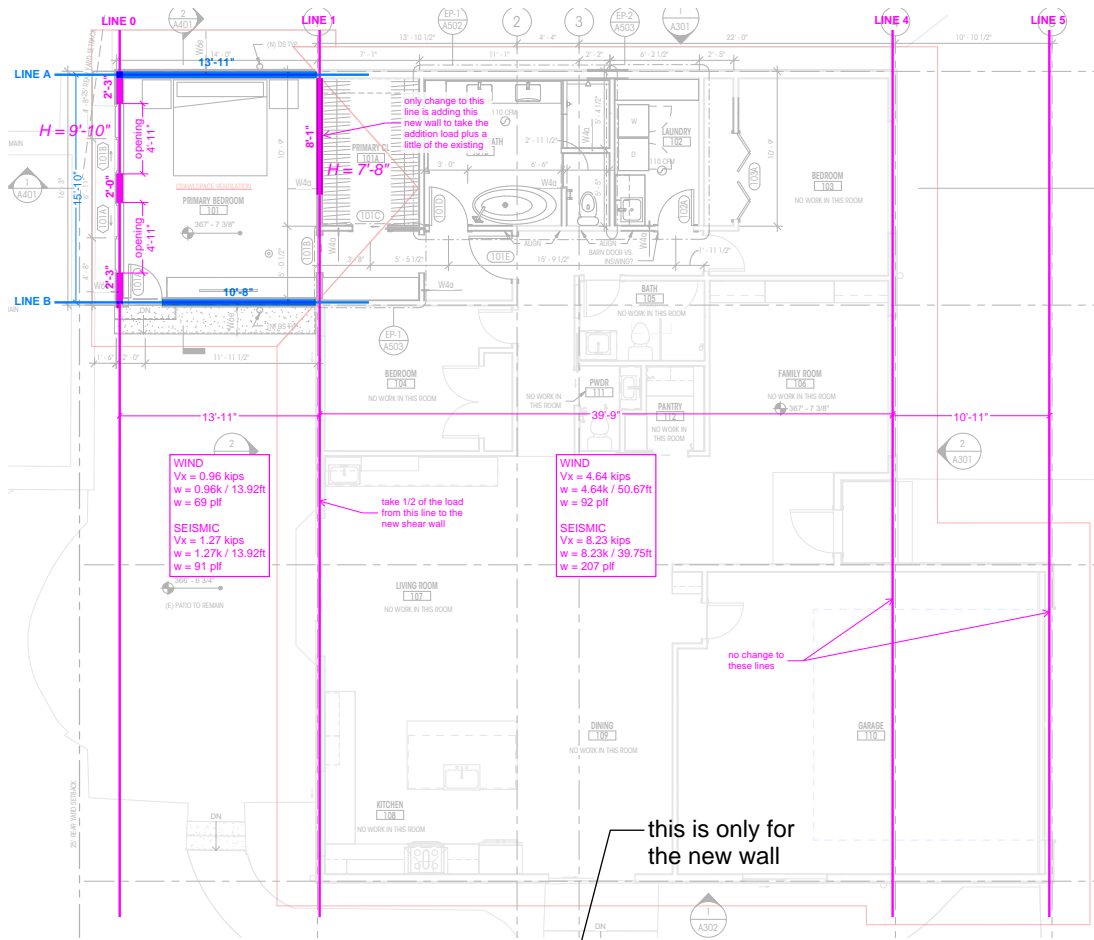


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SHEET 4

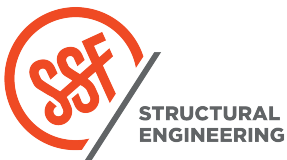
Lateral Design - N/S Direction

ROOF



	Line 0	Line 1	Line 4	Line 5
V (k) W/EQ	0.48 / 0.64	1.40 / 2.70	no change	no change
V cum (k) W/EQ	0.48 / 0.64	1.40 / 2.70	to this line	to this line
L (ft) W/EQ	FTAO	8.08 / 8.08	-	-
V (plf) W/EQ	103 / 138	173 / 334	-	-
SW type	W6	W4	-	-
OT (k)	0.39	2.56	-	-
0.6DL (k)	-	0.47	-	-
OT cum (k)	-	2.09	-	-
HD	-	HDU2	-	-

see FTAO on next page



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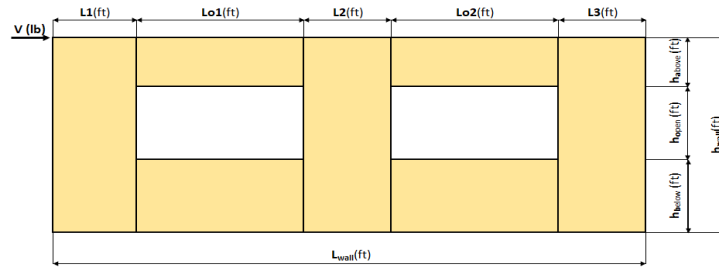
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DESIGN

SHEET 5

Lateral Design - N/S Direction

ROOF - LINE 0 FTAO



Shear Wall Calculation Variables

V	640 lbf	Opening 1		Opening 2		Adj. Factor Method = 2bs/h	
L1	2.25 ft	h _{o1}	2.25 ft	h _{o2}	2.25 ft	Wall Pier Aspect Ratio	Adj. Factor
L2	2.00 ft	h _{o1}	4.25 ft	h _{o2}	4.25 ft	P1=h _{o1} /L1=	1.89
L3	2.25 ft	h _{o1}	2.50 ft	h _{o2}	2.50 ft	P2=h _{o1} /L2=	2.13
h _{wall}	9.00 ft	Lo1	4.92 ft	Lo2	4.92 ft	P3=h _{o1} /L3=	1.89
L _{wall}	16.33 ft						N/A

1. Hold-down forces: $H = Vh_{wall}/L_{wall}$ = 353 lbf

2. Unit shear above + below opening
 First opening: $va1 = vb1 = H/(h_{o1}+h_{o2}) = 74$ plf
 Second opening: $va2 = vb2 = H/(h_{o2}+h_{o2}) = 74$ plf

3. Total boundary force above + below openings
 First opening: $O1 = va1 \times (L1) = 365$ lbf
 Second opening: $O2 = va2 \times (L2) = 365$ lbf

4. Corner forces
 $F1 = O1(L1)/(L1+L2) = 193$ lbf
 $F2 = O1(L2)/(L1+L2) = 172$ lbf
 $F3 = O2(L2)/(L2+L3) = 172$ lbf
 $F4 = O2(L3)/(L2+L3) = 193$ lbf

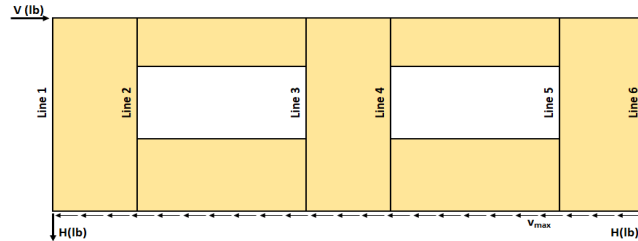
5. Tributary length of openings
 $T1 = (L1 \times Lo1)/(L1+L2) = 2.60$ ft
 $T2 = (L2 \times Lo1)/(L1+L2) = 2.31$ ft
 $T3 = (L2 \times Lo2)/(L2+L3) = 2.31$ ft
 $T4 = (L3 \times Lo2)/(L2+L3) = 2.60$ ft

6. Unit shear beside opening
 $v1 = (V/L)(L1+T1)/L1 = 85$ plf
 $v2 = (V/L)(T2+L2+T3)/L2 = 130$ plf
 $v3 = (V/L)(T4+L3)/L3 = 85$ plf
 Check $v1 \times L1 + v2 \times L2 + v3 \times L3 = V?$ = 640 lbf OK

7. Resistance to corner forces
 $R1 = v1 \times L1 = 190$ lbf
 $R2 = v2 \times L2 = 260$ lbf
 $R3 = v3 \times L3 = 190$ lbf

8. Difference corner force + resistance
 $R1-F1 = -3$ lbf
 $R2-F2-F3 = -84$ lbf
 $R3-F4 = -3$ lbf

9. Unit shear in corner zones
 $vc1 = (R1-F1)/L1 = -1$ plf
 $vc2 = (R2-F2-F3)/L2 = -42$ plf
 $vc3 = (R3-F4)/L3 = -1$ plf



Check Summary of Shear Values for Two Openings

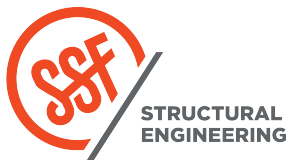
Line 1: $vc1(h_{o1}+h_{o2})+v1(h_{o1})=H?$		-7	359	353 lbf
Line 2: $va1(h_{o1}+h_{o2})-vc1(h_{o1}+h_{o2})-v1(h_{o1})=0?$	353	-7	359	0
Line 3: $vc2(h_{o1}+h_{o2})+v2(h_{o2})-va1(h_{o1}+h_{o2})=0?$	-199	552	353	0
Line 4: $va2(h_{o2}+h_{o2})-v2(h_{o2})-vc2(h_{o2}+h_{o2})=0?$	353	552	-199	0
Line 5: $va2(h_{o2}+h_{o2})-vc3(h_{o2}+h_{o2})-v3(h_{o2})=0?$	353	-7	359	0
Line 6: $vc3(h_{o2}+h_{o2})+v3(h_{o2})=H?$		-7	359	353 lbf

Design Summary*

Req. Sheathing Capacity	138 plf	**	4-Term Deflection		3-Term Deflection	
Req. Strap Force	193 lbf		4-Term Story Drift %		3-Term Story Drift %	
Req. HD Force	353 lbf					
Req. Shear Wall Anchorage Force	39 plf					

**Req. Sheathing Capacity has been adjusted per the Aspect Ratio Adjustment Factor

*The Design Summary assumes that the shear wall is designed as blocked.



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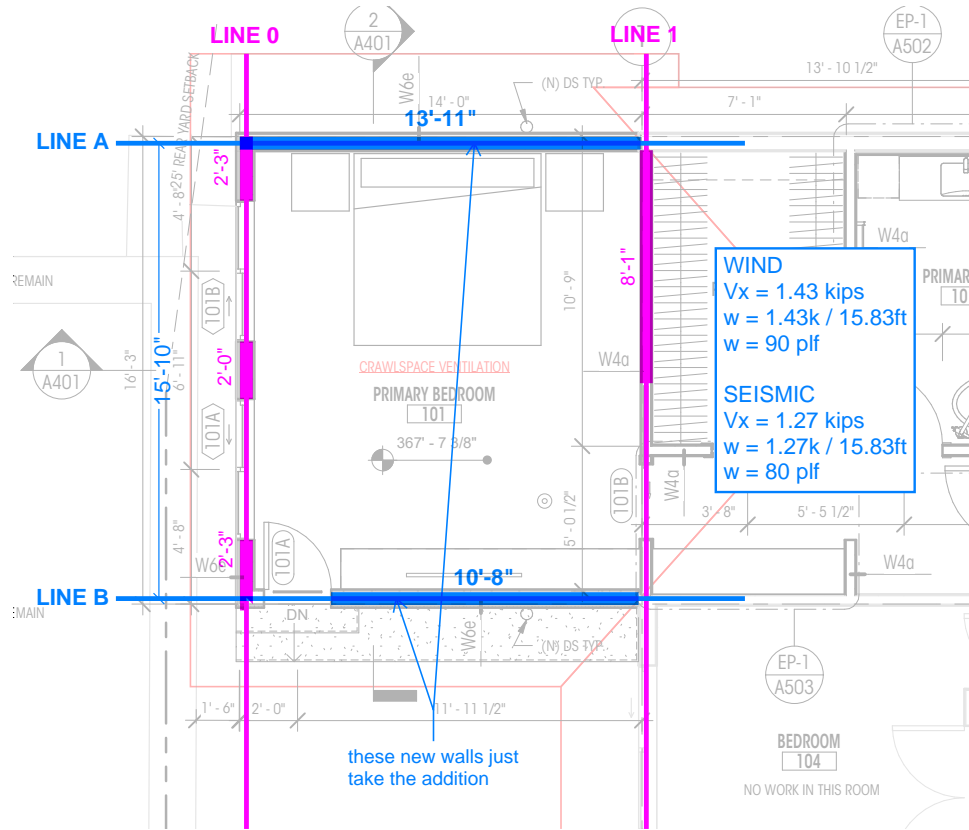
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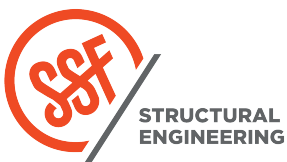
SHEET 6

Lateral Design - E/W Direction

ROOF



	Line B	Line A
V (k) W/EQ	0.72 / 0.64	0.72 / 0.64
V cum (k) W/EQ	0.72 / 0.64	0.72 / 0.64
L (ft) W/EQ	10.67 / 10.67	13.92 / 13.92
V (plf) W/EQ	68 / 60	52 / 46
SW type	W6	W6
OT (k)	-	-
0.6DL (k)	-	-
OT cum (k)	-	-
HD	-	-

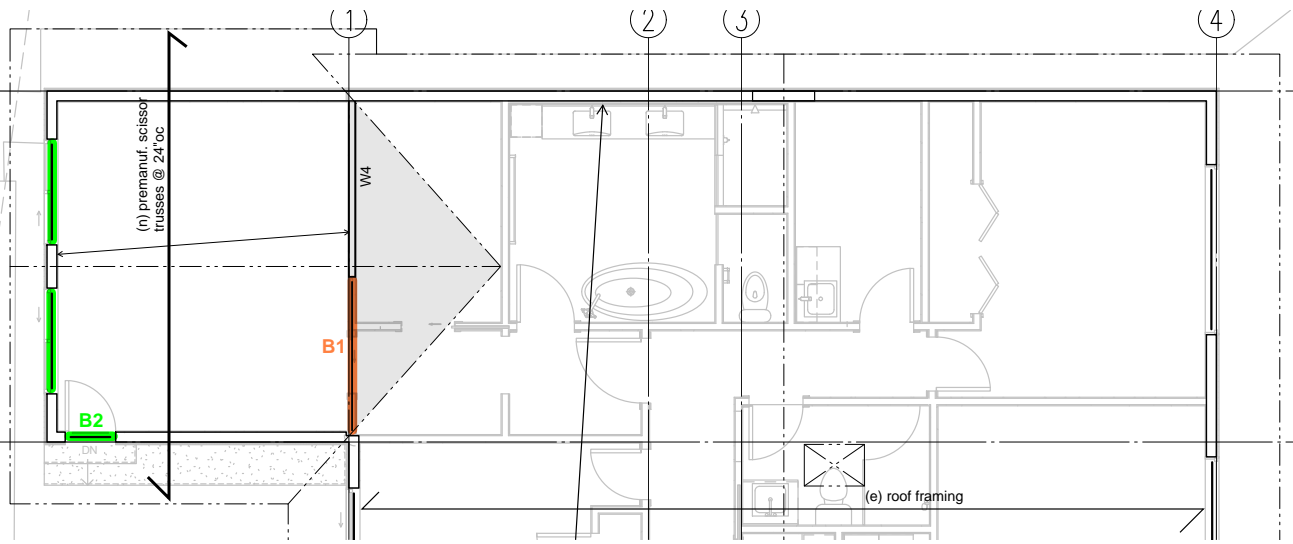


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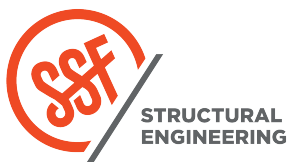
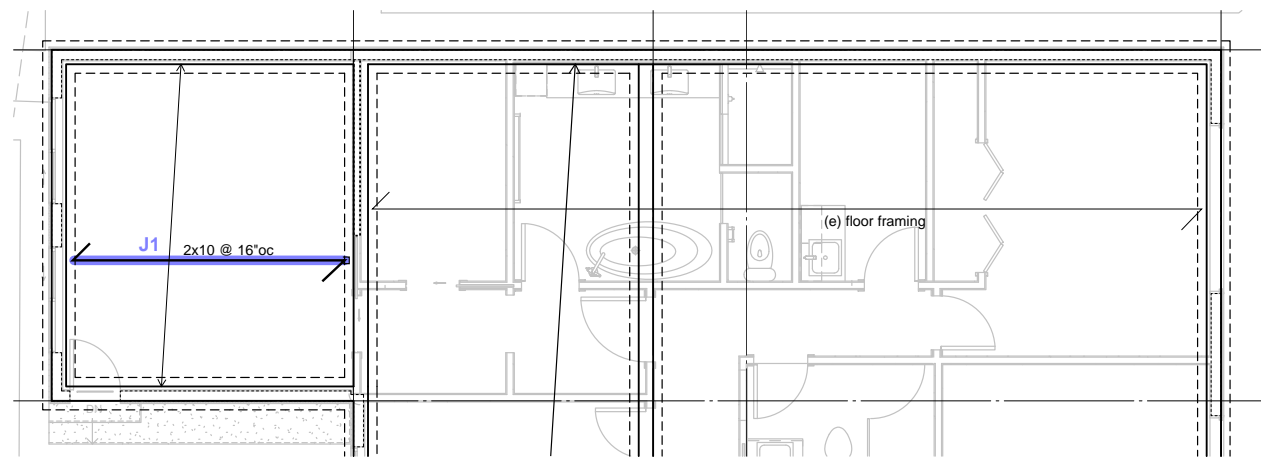
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Gravity Key Plans

ROOF



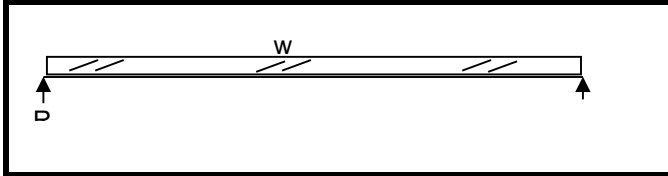
MAIN FLOOR



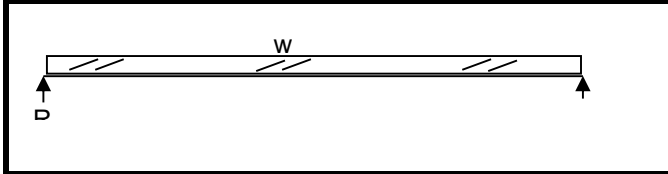
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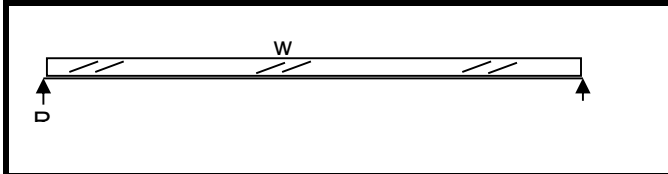
Beam		B1	HF	4	x 12
w=	835	plf	R=	3,236	lbs
L=	7.75	ft	M=	6,269	ft-lbs
b=	3.50	in	Fb=	1,019	psi
d=	11.25	in	Fv=	93	psi
E=	1300	ksi	Δ =	0.13	in
Cv=	1.00	≤ 1.0	I/I	741	



Beam		B2	HF	3	x 6
w=	465	plf	R=	639	lbs
L=	2.75	ft	M=	440	ft-lbs
b=	3.00	in	Fb=	349	psi
d=	5.50	in	Fv=	39	psi
E=	1300	ksi	Δ =	0.01	in
Cv=	1.00	≤ 1.0	I/I	2982	



Beam		J1	HF	2	x 10
w=	69	plf	R=	468	lbs
L=	13.50	ft	M=	1,579	ft-lbs
b=	1.50	in	Fb=	886	psi
d=	9.25	in	Fv=	45	psi
E=	1300	ksi	Δ =	0.40	in
Cv=	1.00	≤ 1.0	I/I	402	



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