



Structural Calculations For:

Kaempf Residence

8238 Southeast 72nd Street

Mercer Island, Washington 98040



Prepared for: HERE architecture + interiors

Job #: 13021-2022-03

Date: February 22, 2022

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 8238 SE 72nd St
 City: Mercer Island State: WA
 ZIP: 98040
 Latitude: 47.5387 N
 Longitude: -122.2280 W
 Ground Elevation 321 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 $V = 20$ kips $\Omega_o = 2.5$
 $S_s = 1.465$ $S_1 = 0.506$
 $S_{DS} = 1.17$ $S_{D1} = 0.57$
 $C_s = 0.180$ $I_e = 1.0$



Story Information

Stories Above Grade (Including Mezzanine Levels) 3

Horizontal and Vertical Irregularities:

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

Wind Load Summary:

$V = 110$ $K_{z1} = 1.30$
 Exposure = B

Dead Loads:

Roof		Floor	
Roofing	2.5 psf	Finish Floor	1 psf
1/2" Sheathing	1.5 psf	3/4" Sheathing	2.3 psf
Rafters/Trusses	2 psf	Joists	2.6 psf
Insulation	1 psf	5/8" GWB	3.1 psf
5/8" GWB	3.1 psf	Misc./Mech.	1 psf
Solar Panels	5 psf		10 psf
	15 psf	Use	10 psf
Use	15 psf		

Live Loads:

Roof	20 psf
Floor	40 psf
Deck	60 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	1.00		

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	0.45	Seismic Surcharge	8H
Passive	350 pcf		



Kaempff Residence
 Mercer Island, Washington

DATE 2/9/2023

PROJ. #

DESIGN JDT

SHEET CR1

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD
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Wind Coefficients

Exposure	B	
V=	110	mph
K_d =	0.85	Table 26.6-1
K_{zt} =	0.67	Table 26.10-1
K_e =	0.99	Table 26.9-1
G=	0.85	26.9.4

Transverse Wind Pressures

L/B = 0.42 h/L = 0.84

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-1.17 / -0.18
Leeward Roof	-0.63

Location and Building Dimensions

Calculate K_{zt} ?	No	
K_{zt}	1.30	
Roof Type	Gable	
Roof Slope - Transverse Dir	0	degrees
Roof Slope - Long Dir	15	degrees
Ground to top of roof	27.25	ft
Bot of roof to top of roof	3.5	ft
Mean Roof Height, h	25.5	ft
Short Plan Dimension	30.5	ft
Long Plan Dimension	72.5	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft

Velocity Pressure at Mean Roof Height, q_n =	22.6	psf
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Wall Pressures (Unfactored):

ASD

Ht	K_z	q_z	$P_{ww \text{ walls}}$	$P_{lw \text{ walls}}$	$P_{\text{walls (psf)}}$
0-15	0.57	19.28	13.11	9.62	13.6
15-20	0.62	20.98	14.26	9.62	14.3
20-25	0.66	22.33	15.18	9.62	14.9
25-30	0.7	23.68	16.10	9.62	15.4
30-40	0.76	25.71	17.48	9.62	16.3
41-50	0.81	27.40	18.64	9.62	17.0
51-60	0.85	28.76	19.56	9.62	17.5
61-70	0.89	30.11	20.48	9.62	18.1
71-80	0.93	31.46	21.40	9.62	18.6
81-90	0.96	32.48	22.09	9.62	19.0
91-100	0.99	33.49	22.78	9.62	19.4

Roof Pressures (Unfactored)

ASD

Windward		Leeward	Horiz Proj (psf)
Max	Min		
-3.5	-22.5	-12.2	5.24

Longitudinal Wind Pressures

L/B = 2.38 h/L = 0.35

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.28
Windward Roof	-0.58 / -0.07
Leeward Roof	-0.50

Wall Pressures (Unfactored):

ASD

Ht	K_z	q_z	$P_{ww \text{ walls}}$	$P_{lw \text{ walls}}$	$P_{\text{walls (psf)}}$
0-15	0.57	19.28	13.11	5.41	11.11
15-20	0.62	20.98	14.26	5.41	11.80
20-25	0.66	22.33	15.18	5.41	12.35
25-30	0.7	23.68	16.10	5.41	12.91
30-40	0.76	25.71	17.48	5.41	13.74
41-50	0.81	27.40	18.64	5.41	14.43
51-60	0.85	28.76	19.56	5.41	14.98
61-70	0.89	30.11	20.48	5.41	15.53
71-80	0.93	31.46	21.40	5.41	16.08
81-90	0.96	32.48	22.09	5.41	16.50
91-100	0.99	33.49	22.78	5.41	16.91

Roof Pressures (Unfactored)

ASD

Windward		Leeward	Horiz Proj (psf)
Max	Min		
-1.4	-11.2	-9.6	4.92



Kaempf Residence
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 SHEET CR3

LATERAL ANALYSIS

SEISMIC DESIGN

ROOF DIA.: 15 PSF x 1,115 SQ.FT. + 5 PSF x 909 SQ. FT. = 21.3 K

SECOND FLOOR & LOW ROOF DIA.: 20 PSF x 909 SQ. FT. + 15 PSF x 1,577 SQ. FT.
+ 5 PSF x 1,125 SQ. FT. + 10 PSF x 342 SQ, FT, = 50.9 K

FIRST FLOOR DIA.: 15 PSF x 2,034 SQ. FT. + 10 PSF x 648 SQ. FT. = 37.0 K

BASE SHEAR = 17.9 KIPS

WIND DESIGN

ROOF DIA.: 15.40 PSF x 3.5 FT. x 0.5 FT. + 14.90 PSF x 3.5 FT. = 79 PLF

SECOND FLOOR DIA.: 14.90 PSF x 0.25 FT. 14.30 PSF x 5 FT. + 13.60 PSF x 2.5 FT. = 109 PLF

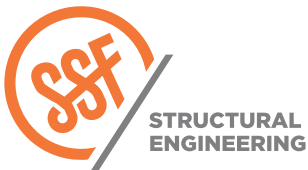
LOW ROOF DIA.: 5.24 PSF x 3.5 FT. + 14.30 PSF x 1 FT. + 13.60 PSF x 2.875 FT. = 72 PLF

FIRST FLOOR DIA.: 13.60 PSF x 8.375 FT. = 114 PLF

DIRECTION	LEVEL	PLF	WIDTH	FORCE
N/S	ROOF DIA.	79 PLF	48 FT.	3.8 KIPS
N/S	SECOND FLOOR DIA.	109 PLF	48 FT.	5.2 KIPS
N/S	LOW ROOF DIA.	72 PLF	25.5 FT.	1.8 KIPS
N/S	FIRST FLOOR DIA.	114 PLF	72.5 FT.	8.3 KIPS
E/W	ROOF DIA.	79 PLF	22 FT.	1.7 KIPS
E/W	SECOND FLOOR DIA.	109 PLF	22 FT.	2.4 KIPS
E/W	LOW ROOF DIA.	72 PLF	8.5 FT.	0.6 KIPS
E/W	FIRST FLOOR DIA.	114 PLF	30.5 FT.	3.5 KIPS

N/S BASE SHEAR = 19.1 KIPS

E/W BASE SHEAR = 8.2 KIPS



KAEMPF RESIDENCE

PROJECT
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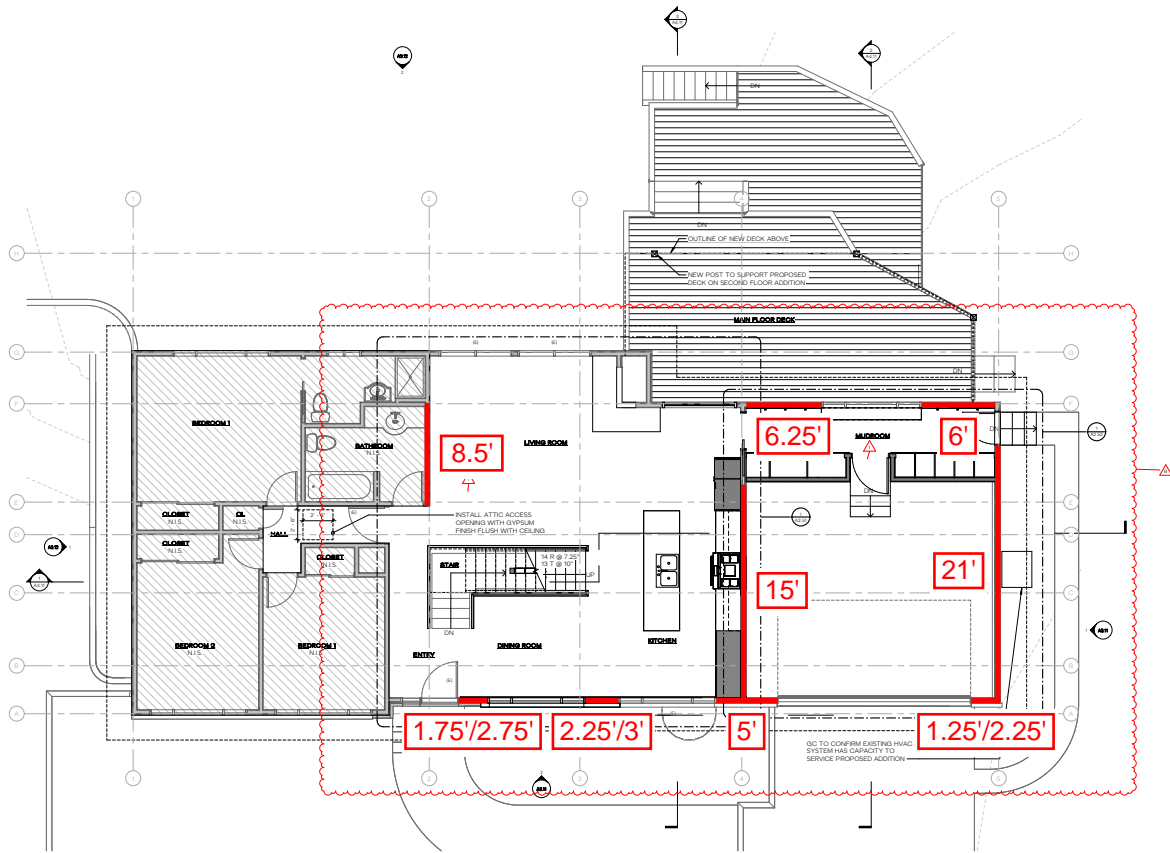
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PROJ. # JDT

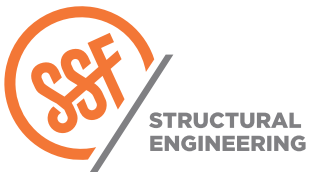
DESIGN L1

SHEET

LATERAL DESIGN KEY PLAN



FIRST FLOOR PLAN



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DATE	
PROJ. #	JDT
DESIGN	L3
SHEET	

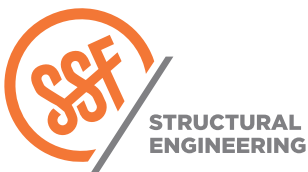
LATERAL DESIGN

N/S DIRECTION - SEISMIC DESIGN

ROOF DIA.:	(W)	26.5 FT.	(E)
FORCE (KIPS)	1.4 K	2.9 K	1.4 K
SHEARWALL LENGTH (FT.)	2 FT./2.75 FT.	12.5 FT.	6.25 FT.
SHEAR (PLF)	700 PLF	232 PLF	224 PLF
SHEARWALL TYPE	2W3	W6	W6
OVERTURNING (KIPS)	3.6 K - 0.6 DL	1.6 K - 0.6 DL	1.6 K - 0.6 DL
HOLDOWN TYPE	(2)CS16	CS16	CS16

N/S DIRECTION - SEISMIC DESIGN

SECOND FLOOR & LOW ROOF DIA.:	(W)	26.5 FT.	(E)
FORCE (KIPS)	4.7 K	5.5 K	2.9 K
SHEARWALL LENGTH (FT.)	8.5 FT.	15 FT.	21 FT.
SHEAR (PLF)	553 PLF	367 PLF	138 PLF
SHEARWALL TYPE	W2	W3	W6
OVERTURNING (KIPS)	4.4 K - 0.6 DL	2.9 K - 0.6 DL	1.1 K - 0.6 DL
HOLDOWN TYPE	(3)CS16	HDU2	NONE



KAEMPF RESIDENCE

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MERCER ISLAND, WASHINGTON

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PROJ. # **JDT**

DESIGN **L4**

SHEET

LATERAL DESIGN

E/W DIRECTION - SEISMIC DESIGN

ROOF DIA.:

FORCE (KIPS)

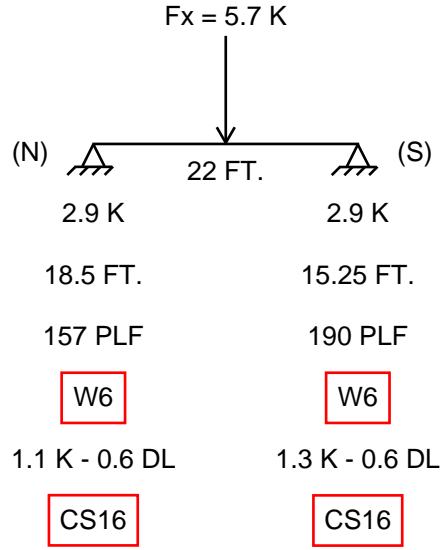
SHEARWALL LENGTH (FT.)

SHEAR (PLF)

SHEARWALL TYPE

OVERTURNING (KIPS)

HOLDOWN TYPE



E/W DIRECTION - SEISMIC DESIGN

SECOND FLOOR & LOW ROOF DIA.:

FORCE (KIPS)

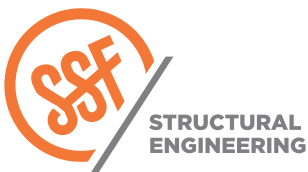
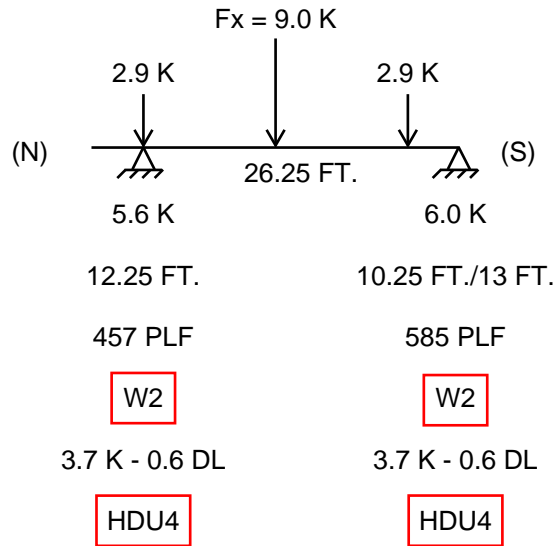
SHEARWALL LENGTH (FT.)

SHEAR (PLF)

SHEARWALL TYPE

OVERTURNING (KIPS)

HOLDOWN TYPE



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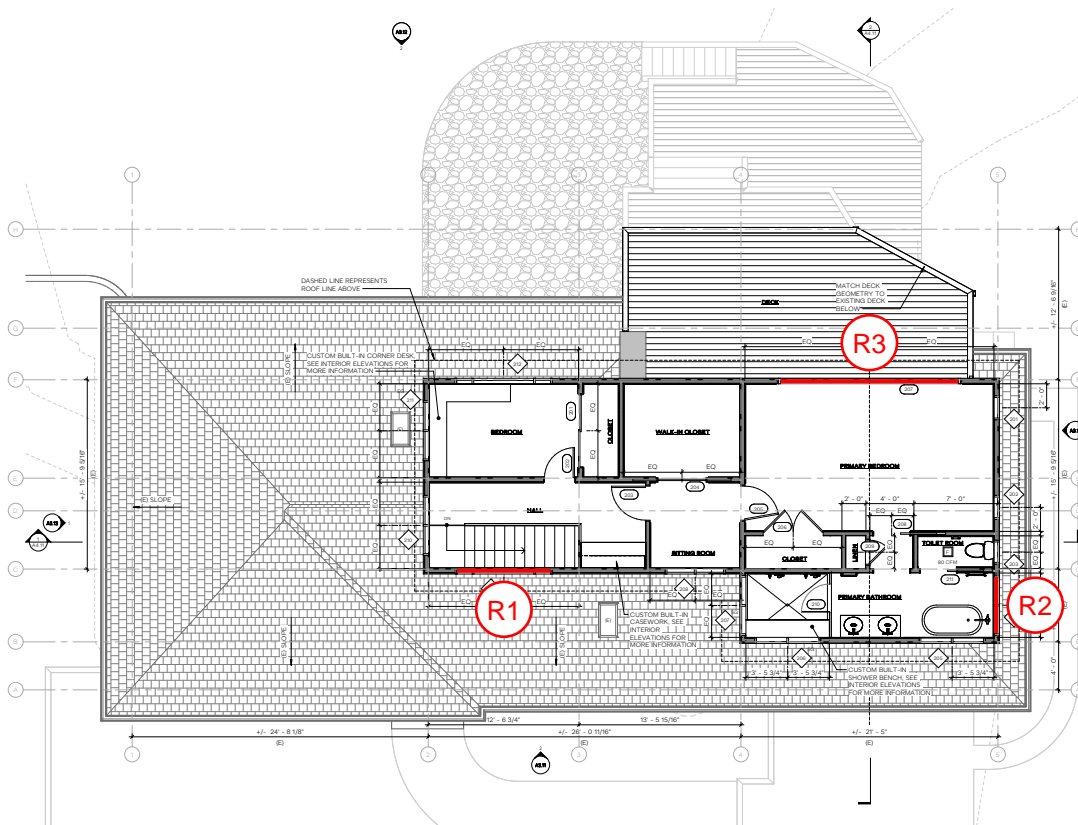
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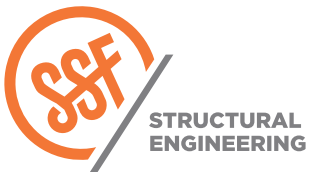
DESIGN L5

SHEET

GRAVITY DESIGN KEY PLAN



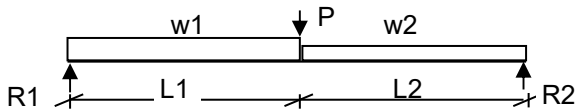
ROOF FRAMING PLAN



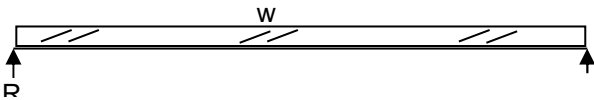
KAEMPF RESIDENCE
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MERCER ISLAND, WASHINGTON

DATE	
PROJ. #	JDT
DESIGN	G1
SHEET	

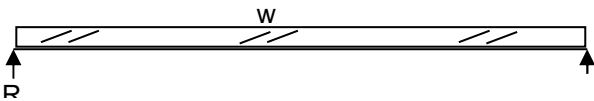
Header		R1		GL 3 1/2x9
w1=	120	plf		R1 = 1,223 lbs
w2=	400	plf		R2 = 2,237 lbs
L1=	6	ft		M = 4,911 lb-ft
L2=	3	ft		Fb = 1,247 psi
X=	4.5	ft		Fv = 92 psi
P=	1,600	lbs		Δ = 0.14 in
b=	3.50	in		I/
d=	9.00	in		Cv = 1.00
E=	1,800	ksi		



Header		R2		(2)2x8
w=	520	plf		R= 1,365 lbs
L=	5.25	ft		M= 1,792 ft-lbs
b=	3.00	in		Fb= 818 psi
d=	7.25	in		Fv= 72 psi
E=	1300	ksi		Δ = 0.07 in
Cv=	1.00	≤ 1.0		I/



Header		R3		GL 5 1/2x9
w=	120	plf		R= 930 lbs
L=	15.5	ft		M= 3,604 ft-lbs
b=	5.50	in		Fb= 582 psi
d=	9.00	in		Fv= 25 psi
E=	1800	ksi		Δ = 0.26 in
Cv=	1.00	≤ 1.0		I/

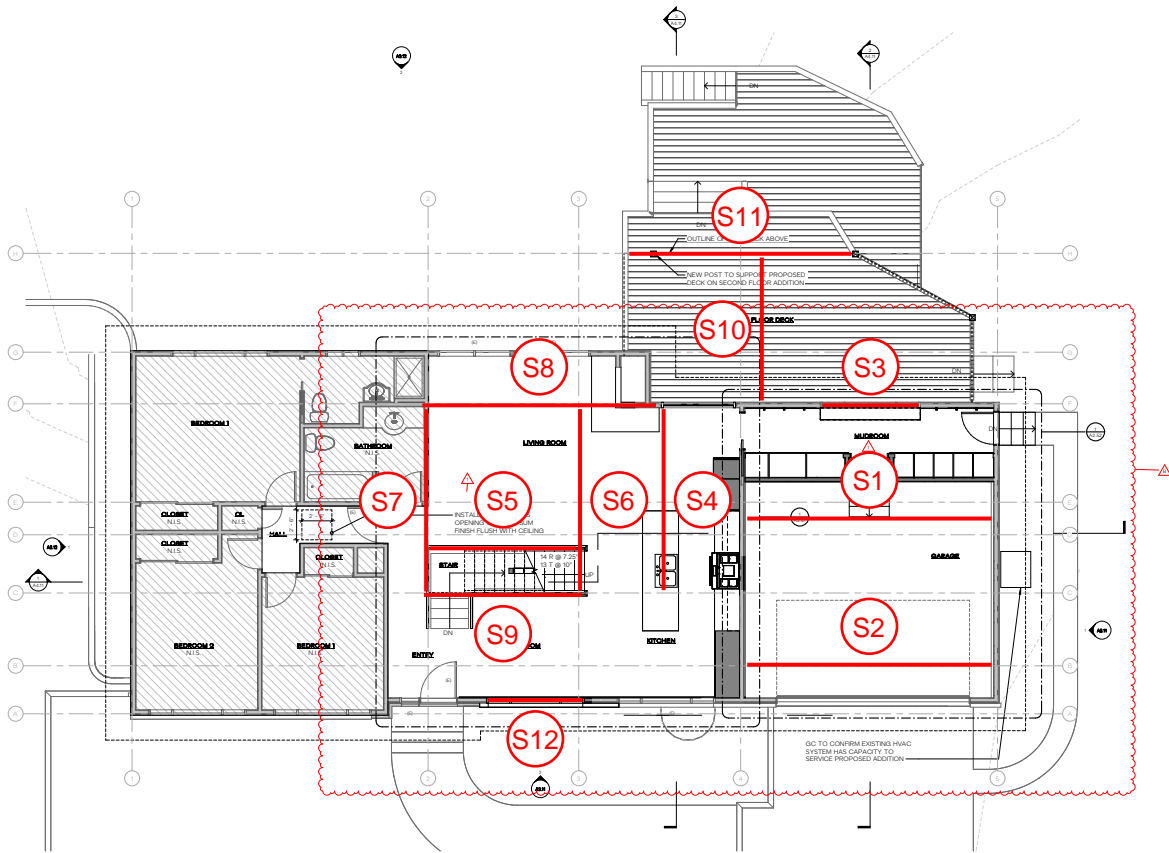


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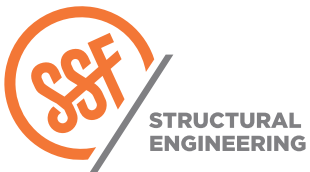
Project: Kaempf Residence Date: 01/26/23
Mercer Island, Washington Project #: _____
Roof Framing Design: JDT
 Sheet: G2

GRAVITY DESIGN KEY PLAN



SECOND FLOOR & LOW ROOF FRAMING PLAN

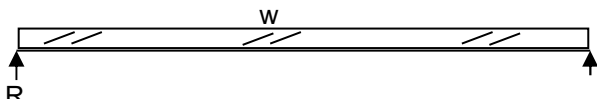
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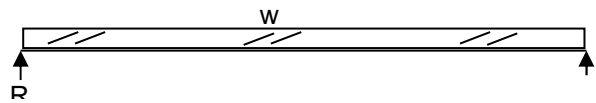
KAEMPF RESIDENCE
 PROJECT
 MERCER ISLAND, WASHINGTON

DATE _____
 PROJ. # JDT
 DESIGN G3
 SHEET _____

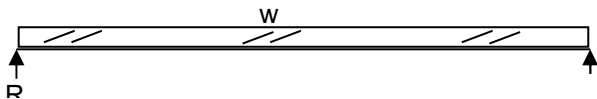
Joist		S1	11 7/8" TJI 360 @ 16" oc	
w=	67	plf	R=	712 lbs
L=	21.25	ft	M=	3,782 ft-lbs
b=	12.00	in	Mn/Ω =	6,180 ft-lbs
d=	1.00	in	Vn/Ω =	1,705 lbs
E=	419000	ksi	Δ=	0.73 in
Cv=	1.00	≤1.0	I/	348



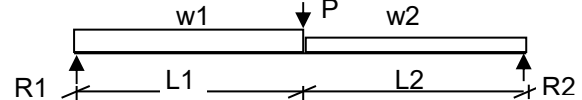
Beam		S5	PSL 5 1/4x11 7/8	
w=	300	plf	R=	2,025 lbs
L=	13.5	ft	M=	6,834 ft-lbs
b=	5.25	in	Fb=	665 psi
d=	11.88	in	Fv=	42 psi
E=	2200	ksi	Δ=	0.14 in
Cv=	1.00	≤1.0	I/	1165



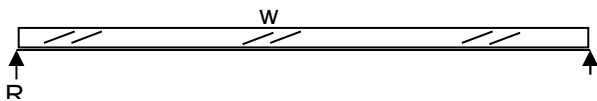
Beam		S2	PSL 7x11 7/8	
w=	327	plf	R=	3,474 lbs
L=	21.25	ft	M=	18,458 ft-lbs
b=	7.00	in	Fb=	1,346 psi
d=	11.88	in	Fv=	57 psi
E=	2200	ksi	Δ=	0.70 in
Cv=	0.97	≤1.0	I/	365



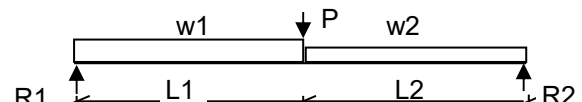
Beam		S6	PSL 5 1/4x11 7/8	
w1=	67	plf	R1 =	1,042 lbs
w2=	67	plf	R2 =	2,055 lbs
L1=	12	ft	M =	7,683 lb-ft
L2=	4	ft	Fb =	747 psi
X=	8.5	ft	Fv =	48 psi
P=	2,025	lbs	Δ=	0.19 in
b=	5.25	in	I/	1,011
d=	11.88	in	Cv=	1.00
E=	2,200	ksi		



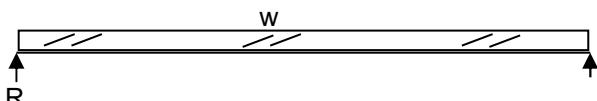
Beam		S3	LSL 1 3/4x11 7/8	
w=	722	plf	R=	3,159 lbs
L=	8.75	ft	M=	6,910 ft-lbs
b=	1.75	in	Fb=	1,450 psi
d=	14.00	in	Fv=	142 psi
E=	1500	ksi	Δ=	0.16 in
Cv=	1.00	≤1.0	I/	662



Beam		S7	PSL 5 1/4x11 7/8	
w1=	427	plf	R1 =	4,064 lbs
w2=	710	plf	R2 =	5,925 lbs
L1=	12	ft	M =	18,469 lb-ft
L2=	4	ft	Fb =	1,796 psi
X=	8.3	ft	Fv =	126 psi
P=	2,025	lbs	Δ=	0.56 in
b=	5.25	in	I/	345
d=	11.88	in	Cv=	1.00
E=	2,200	ksi		



Joist		S4	11 7/8" TJI 230 @ 16" oc	
w=	67	plf	R=	536 lbs
L=	16	ft	M=	2,144 ft-lbs
b=	12.00	in	Mn/Ω =	4,215 ft-lbs
d=	1.00	in	Vn/Ω =	1,655 lbs
E=	347000	ksi	Δ=	0.28 in
Cv=	1.00	≤1.0	I/	674



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Project: Kaempf Residence Date: 07/22/24
Mercer Island, Washington Project #: _____
Second Floor and Low Roof Framing Design: JDT
 Sheet: G4

GRAVITY DESIGN

SECOND FLOOR AND LOW ROOF FRAMING

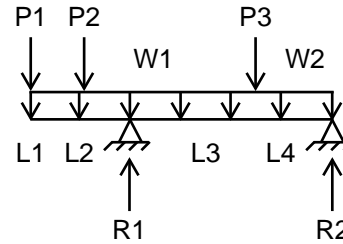
S9:

W1 = 380 PLF
W2 = 660 PLF
P1 = 5,925#
P2 = 1,223#
P3 = 2,237#
L1 = 2.25 FT.
L2 = 1.75 FT.
L3 = 6.75 FT.
L4 = 2.25 FT.

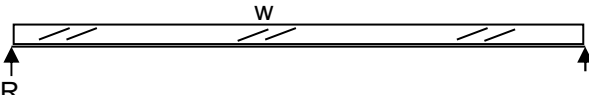
R1 = 14,471#
R2 = 825#
M = 29,090 FT.-#

fb = 1,558 psi
fv = 157 psi
 Δ total = 0.20" = 2L/480

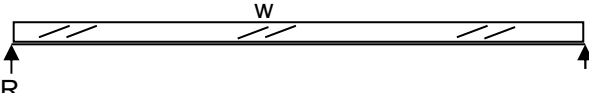
USE PSL 5 1/4x16



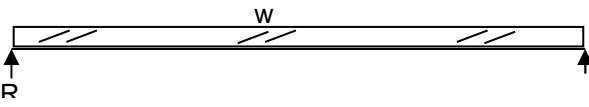
Joist		S10	P.T. 2x12 @ 16" oc	
w=	94	plf	R=	611 lbs
L=	13	ft	M=	1,986 ft-lbs
b=	1.50	in	Fb=	753 psi
d=	11.25	in	Fv=	46 psi
E=	1300	ksi	Δ =	0.26 in
Cv=	1.00	≤ 1.0	I/I	598



Beam		S11	GL 5 1/2x15	
w=	455	plf	R=	4,379 lbs
L=	19.25	ft	M=	21,076 ft-lbs
b=	5.50	in	Fb=	1,226 psi
d=	15.00	in	Fv=	69 psi
E=	1800	ksi	Δ =	0.50 in
Cv=	0.98	≤ 1.0	I/I	458



Header		S12	4x8	
w=	280	plf	R=	1,050 lbs
L=	7.5	ft	M=	1,969 ft-lbs
b=	3.50	in	Fb=	771 psi
d=	7.25	in	Fv=	52 psi
E=	1700	ksi	Δ =	0.11 in
Cv=	1.00	≤ 1.0	I/I	853



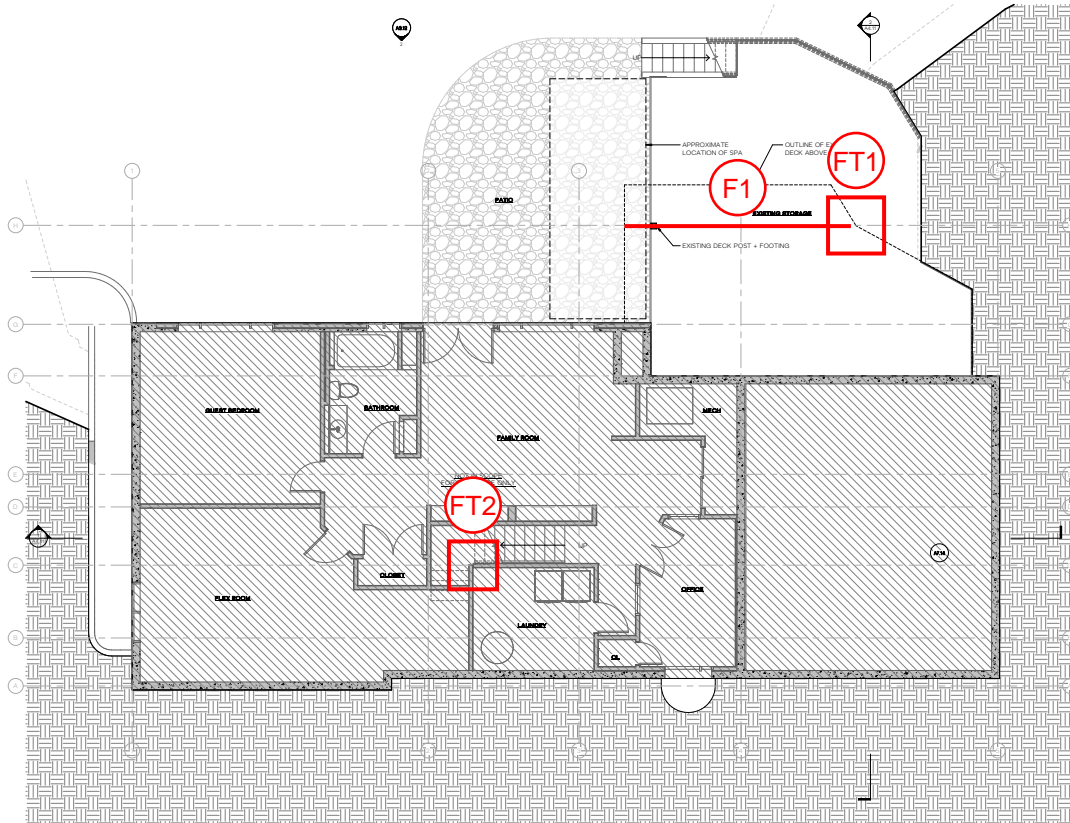

**STRUCTURAL
ENGINEERING**

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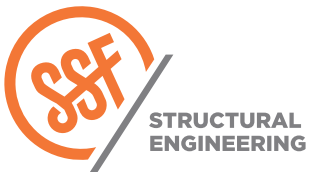
Office: 206.443.6212
Fax: 206.443.4870

Project: Kaempf Residence Date: 08/08/24
Mercer Island, Washington Project #: _____
Second Floor and Low Roof Framing Design: JDT
 _____ Sheet: G7

GRAVITY DESIGN KEY PLAN



FIRST FLOOR FRAMING & FOUNDATION PLAN



KAEMPF RESIDENCE

PROJECT
MERCER ISLAND, WASHINGTON

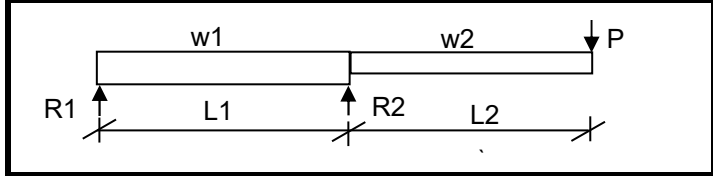
DATE

PROJ. # **JDT**

DESIGN **G8**

SHEET

Beam		F1	GL 5 1/2x15
w1=	700	plf	R1= 5078 lbs
w2=	700	plf	R2= 12,776 lbs
L1=	17	ft	M+= 18,421 lb-ft
L2=	3	ft	M-= 13,135 lb-ft
X=	8.38	ft	Fb= 1,072 psi
P=	4,379	lbs	Fv= 105 psi
b=	5.50	in	Δ span= 0.302 in
d=	15.00	in	l span/ 665
E=	1,800	ksi	Δ cant= (0.08) in
Cv=	0.99		l cant/ (726)



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Project: Kaempf Residence Date: 08/08/24
Mercer Island, Washington Project #: _____
First Floor Framing Design: JDT
 Sheet: G9

GRAVITY DESIGN

FOUNDATION DESIGN

FT1:

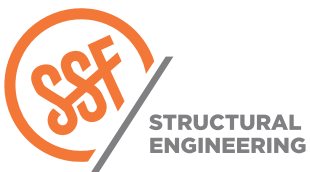
P = 13,821#
qallow = 1,500 psf
Areq = 9.2 square feet

USE 3'-6"x3'-6"x14" DEEP CONCRETE PAD FOOTING WITH (5)#4's EACH WAY BOTTOM

FT2:

P = 14,471#
qallow = 1,500 psf
Areq = 9.6 square feet

USE 3'-0"x3'-0"x12" DEEP CONCRETE PAD FOOTING WITH (4)#4's EACH WAY BOTTOM



KAEMPF RESIDENCE

PROJECT
MERCER ISLAND, WASHINGTON

DATE

PROJ. # JDT

DESIGN G10

SHEET