STRUCTURAL CALCULATIONS FOR:

DAY RESIDENCE

9843 MERCERWOOD DR
MERCER ISLAND, WA

CLIENT: RICHARD + LESLIE DAY

SEPTEMBER 27, 2021

MARC J. MALSAM
41206

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122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

DESIGN CRITERIA IBC 2018

DEAD LOADS

ROOF		FLOOR	
Composition	2.5 psf	3/4" Plywood	2.4 psf
3/4" Plywood	2.4 psf	TJI @ 16" o.c.	2.3 psf
TJI @ 24" o.c.	1.5 psf	Flooring	1.0 psf
Insulation	1.0 psf	Gyp Board (5/8")	2.8 psf
Gyp Board (5/8")	2.8 psf	MEP	1.5 psf
MEP	1.5 psf		
Solar Panels	5.0 psf		
Total	16.7 psf	Total	10.0 psf
Use	20.0 psf	Use	15.0 psf

LIVE LOADS/OCCUPANCY

Risk Category II

Roof Deck No

Common Access No

ROOF LIVE

Snow = 25 psf

FLOOR LIVE

Occupancy = 40 psf

Stair/Corridor = 40 psf

DECK LIVE

Occupancy = 60 psf

SEISMIC CRITERIA ASCE 7-16 Ch. 11 & Ch. 12

Imp. Factor = 1.00

Site Class = D(Geo)

R Value = 6.5

Seismic Ht, hn= 16 ft

T, Building= 0.2

Ts= 0.7

Geo. Ground Hazard? **No w/ASCE 11.4.8 Excep's**

S_s =	1.4		F_a =	1.000	Table 11.4-1
S_1 =	0.54		F_v =	NULL	Table 11.4-2
S_{ms} =	1.400	x 2/3 =	$\mathbf{S_{ds}}$ =	**0.933**	Eqn. 11.4-3
S_{m1} =	NULL	x 2/3 =	$\mathbf{S_{d1}}$ =	**NULL**	Eqn. 11.4-4

C_{SULT} = **0.144**

C_{SALL} = **0.101**

T/Ts= 0.236 ≤ 1.5

Okay, Cs Eqn. 12.8-2

SEISMIC WEIGHT ASCE 7-16 12.7.2

Partitions = 15 psf

***Roof weight = 1/2 Partition + Roof DL**

***Floor weight = Full Partition + Floor DL**

ROOF 27.5 psf 0 psf

FLOOR 30.0 psf

SEISMIC DESIGN CATEGORY IBC 1613.2.5 1.3

Seismic DC= D

WIND CRITERIA ASCE 7-16 Ch. 27 Directional Procedure

V = 110 mph

Exposure = B

h = 16 ft

K_d = 0.85

G = 0.85

K_{zt} = 1.33 ***See Kzt Worksheet**

Roof Slope = FLAT : 12 = 0 °

PRESSURE COEFFICIENTS (Cp)

Windward Wall = 0.8

Leeward Wall = -0.5

Windward Roof = N/A

Leeward Roof = N/A

PRESSURE (PSF) $q = 0.00256K_zK_{zt}K_dV^2$

Ht	K_z	q_z	$0.6xq_z{}^1$	q_h	P_{WW}	P_{LW}	P_{WALL}	P_{ROOF}
0-15	0.57	20.0	12.0		8.1	5.5	**13.7**	
15-20	0.62	21.7	13.0	13.0	8.9	5.5	**14.4**	**N/A**
20-25	0.66	23.1	13.9		9.4	5.5	**15.0**	
25-30	0.70	24.5	14.7		10.0	5.5	**15.5**	
30-35	0.73	25.6	15.3		10.4	5.5	**16.0**	
35-40	0.76	26.6	16.0		10.9	5.5	**16.4**	
40-45	0.79	27.7	16.6		11.3	5.5	**16.8**	
45-50	0.81	28.4	17.0		11.6	5.5	**17.1**	

[1] Per IBC 2018 1605.3.1 Basic Load Combinations

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Project: 9843 Mercerwood Dr (Day)
Mercer Island, WA

Date: 8/12/2021

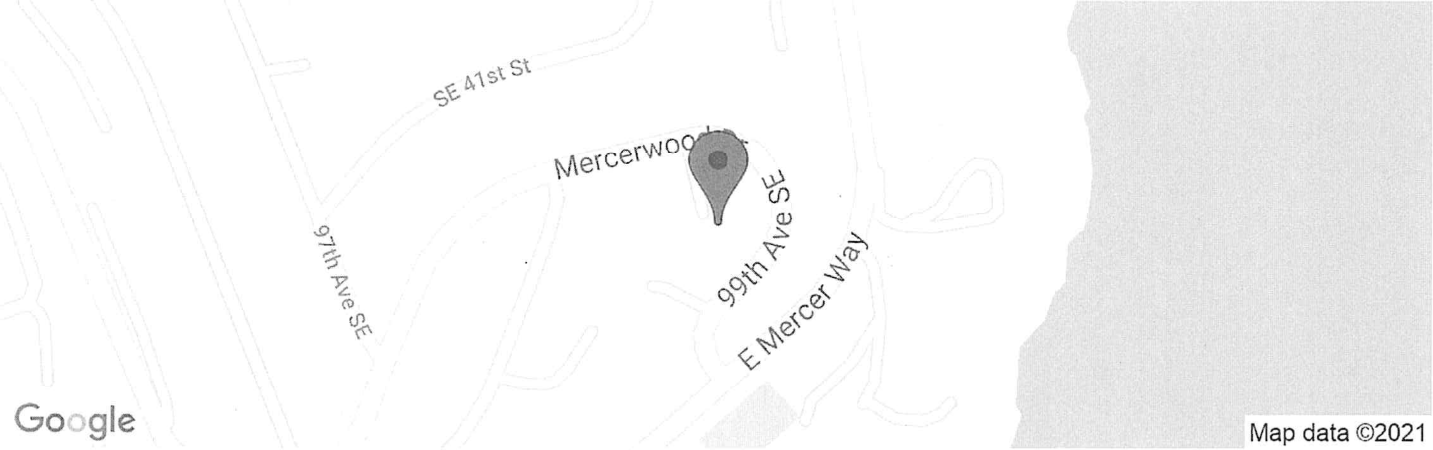
Proj. No. 0139-2021-02-01

Design: DLS

Sheet: DC1

OSHPD

Latitude, Longitude: 47.57288812919959, -122.20697195275675



Date	8/9/2021, 1:00:25 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.404	MCE_R ground motion. (for 0.2 second period)
S_1	0.488	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.685	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.124	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

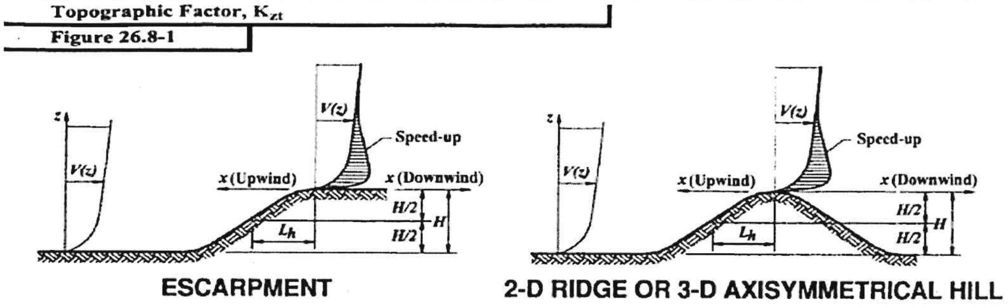
Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.601	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.721	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.404	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.556	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.671	Factored deterministic acceleration value. (0.2 second)
S1RT	0.488	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.544	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.463	Factored deterministic acceleration value. (1.0 second)
PGAd	1.249	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.903	Mapped value of the risk coefficient at short periods
C_{R1}	0.898	Mapped value of the risk coefficient at a period of 1 s

DC2

Kzt WORKSHEET

ASCE 7-10 26.8.1

Exposure = D
Bldg Height = 16 ft
Site Elev = 161 ft



	PROFILE 1	PROFILE 2	PROFILE 3	PROFILE 4
Shape =	2-D Escarp	2-D Escarp	2-D Escarp	2-D Escarp
H =	305 ft	167 ft	131 ft	318 ft
H/2 =	153 ft	84 ft	66 ft	159 ft
L_h =	2006 ft	739 ft	686 ft	1742 ft
x =	2112 ft	264 ft	106 ft	1954 ft
z =	16 ft	16 ft	16 ft	16 ft
Unobstructed[1]	Yes	Yes	Yes	Yes
Above Terrain[2]	Yes	Yes	Yes	Yes
Upper Half[3]	Yes	Yes	Yes	Yes
Site to Crest	Upwind	Upwind	Upwind	Upwind
H/Lh[4]	0.152	0.22592	0.190851	0.1825069
Calc Kzt ?	NO	YES	NO	NO
K_1:	$(K_1/H/L_h)$	$(K_1/H/L_h)$	$(K_1/H/L_h)$	$(K_1/H/L_h)$
Coefficient =	0.95	0.95	0.95	0.95
K_1 =	N/A	0.21462	N/A	N/A
K_2:	$(1 - \lvert x\rvert/\mu L_h)$	$(1 - \lvert x\rvert/\mu L_h)$	$(1 - \lvert x\rvert/\mu L_h)$	$(1 - \lvert x\rvert/\mu L_h)$
μ =	1.5 (Figure 26.8-1)	1.5 (Figure 26.8-1)	1.5 (Figure 26.8-1)	1.5 (Figure 26.8-1)
K_2 =	N/A	0.7619	N/A	N/A
K_3:	$e^{-\gamma z/Lh}$	$e^{-\gamma z/Lh}$	$e^{-\gamma z/Lh}$	$e^{-\gamma z/Lh}$
γ =	2.5 (Figure 26.8-1)	2.5 (Figure 26.8-1)	2.5 (Figure 26.8-1)	2.5 (Figure 26.8-1)
K_3 =	N/A	0.94733	N/A	N/A
K_{zt} =	$(1 + K_1 K_2 K_3)^2$	$(1 + K_1 K_2 K_3)^2$	$(1 + K_1 K_2 K_3)^2$	$(1 + K_1 K_2 K_3)^2$
K_{zt} =	1.00	1.33	1.00	1.00

[1] *Hill, ridge, or escarpment is isolated and unobstructed upwind by other similar topographic features of comparable height for 100H or 2 miles (whichever is less) ASCE 7-10 26.8.1*

[2] *The hill, ridge, or escarpment protrudes above the height of the upwind terrain features within a 2-mi radlus in any quadrant by a factor of two or more. ASCE 7-10 26.8.1*

[3] *The structure is located as shown in Fig. 26.8-1 in the upper one-half of a hill or ridge or near the crest of an escarpment. ASCE 7-10 26.8.1*

[4] *For $H/L_h > 0.5$, assume $H/L_h = 0.5$ for K_1 and $L_h = 2H$ for K_2 and K_3*

Kzt = 1.33

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Date: 8/12/2021
Proj. No.: 0139-2021-02-01
Design: DLS
Sheet: DC3

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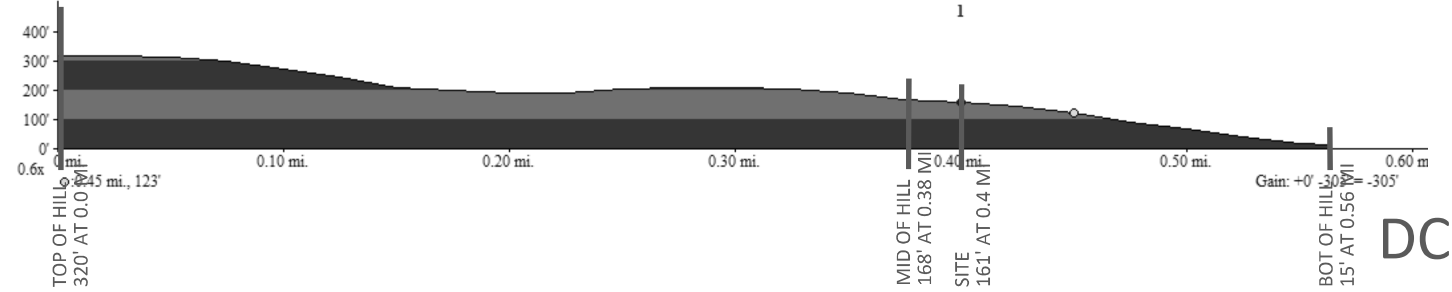

DC4

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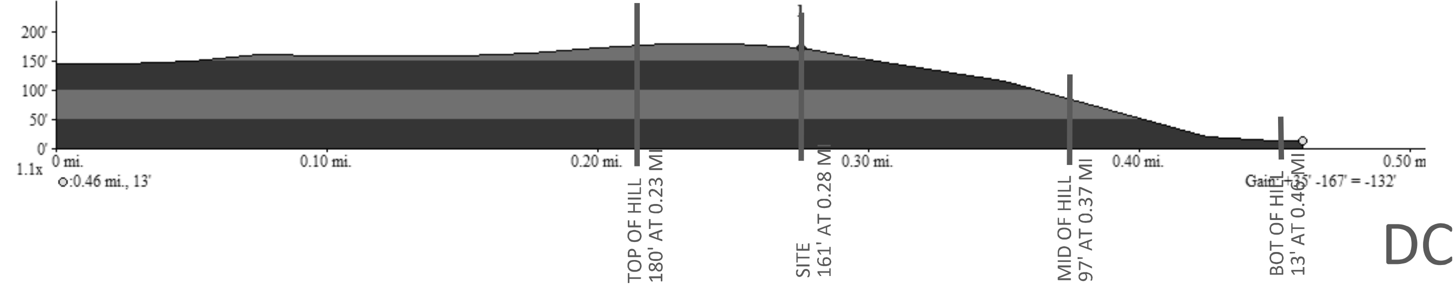

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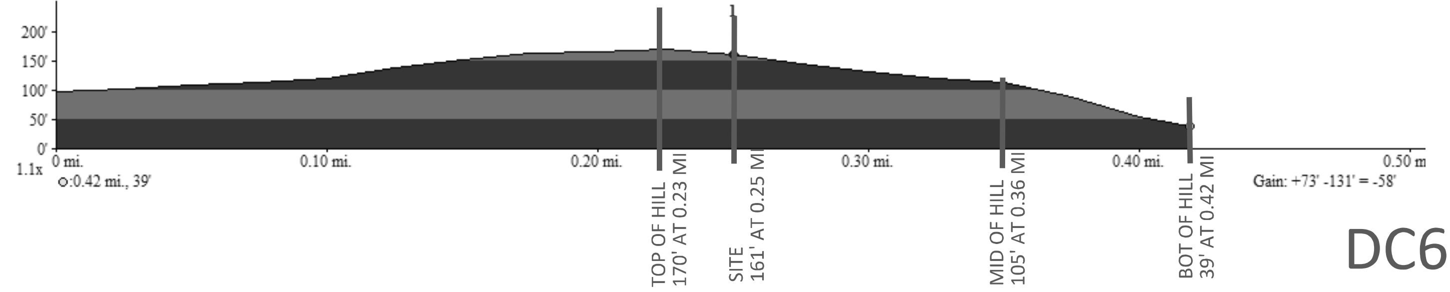

DC6

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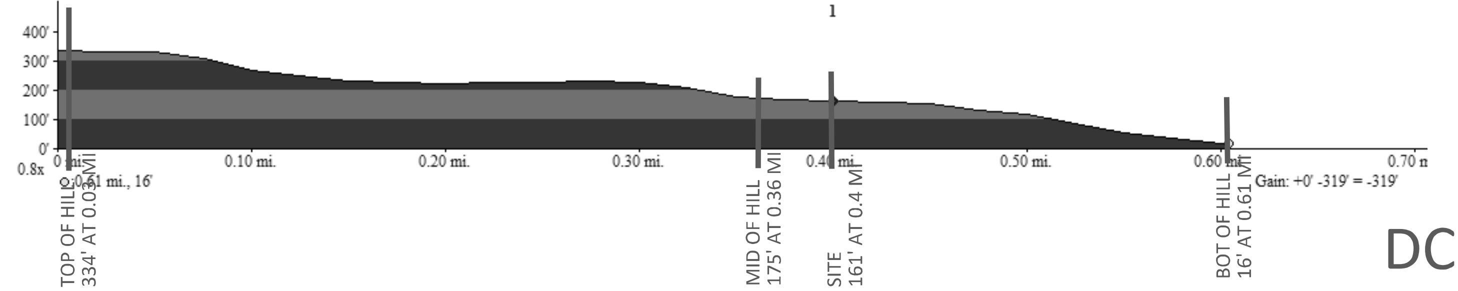
1

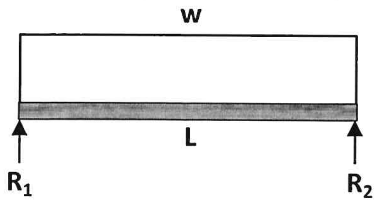


DC7

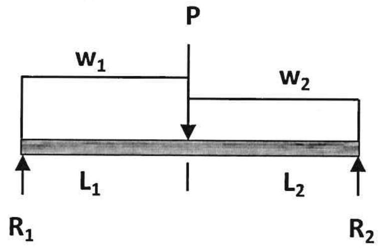
TYPICAL BEAM CASES

***ASSUME CASE 1 FOR ALL BEAMS U.N.O.**

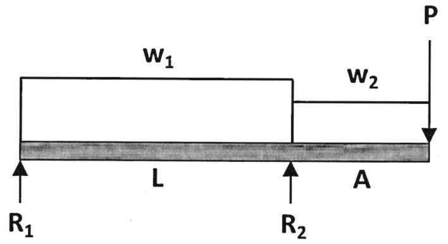
CASE #1: (C1)



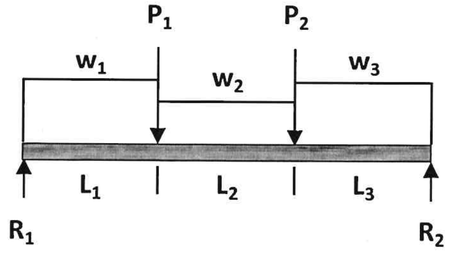
CASE #2: (C2)



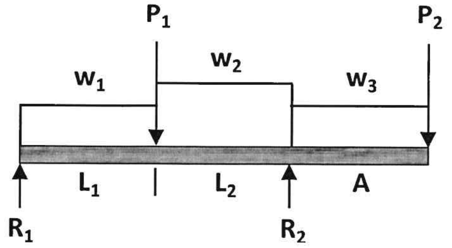
CASE #3: (C3)



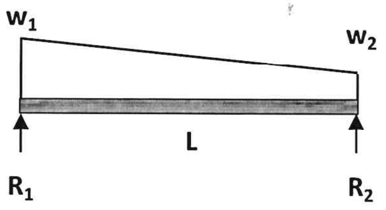
CASE #4: (C4)



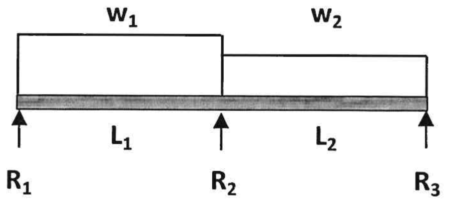
CASE #5: (C5)



CASE #6: (C6)



CASE #7: (C7)



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Project
Mercer Island, WA

8/12/2021
Date
0139-2021-02-01
Proj. No.
DLS
Design
DC8
Sheet

Lateral Analysis East Wing

Seismic Design

Level	Area	#/SF	WT	HT	Wi Hi	% Dist.	V
Roof	1554	27.5	44.5 *	12	534	100	4.5

$$V_{ult} = 0.144\ (44.5) = 6.41$$

$$V_{ALL} = 0.101\ (44.5) = 4.5$$

Wind Design Loads

Level	Trib Height	#/ft	N-S Exposure L	N-S Exposure V	E-W Exposure L	E-W Exposure V
Roof	8.5	13.7(8.5) = 116.5	25.5	2.97	60	6.99
				Σ = 2.97		Σ = 6.99

* Exterior Stucco

Perimeter = 181ft
Stucco Weight = 10psf
= 1.8k

Day Residence
PROJECT

21.8.9
DATE

0139.2021.02.01
PROJECT NO

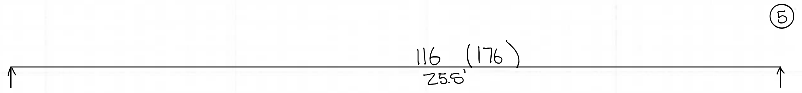
DLS
DESIGN

E-L1
SHEET

N-S Exposure

Roof

h= 10

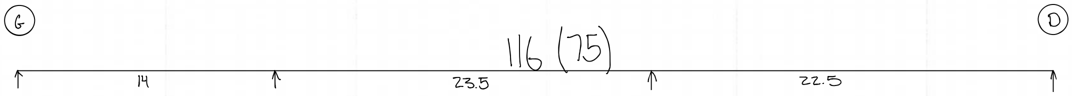


R	1.48 (2.24)	1.48 (2.24)
L	4+4.5+14+26 = 48.5	14+ 43.5 = 57.5
V	31 (46)	26 (39)
SW	SW6	SW6
OT	—	—
HD	—	—
2W/H	$\frac{2(4)}{10}(230) = 184$ ✓	>1.0

E-W Exposure

Roof

h= 10



R	0.81 (0.53)	2.17 (1.41)	2.67 (1.73)	1.31 (0.84)
L	5.5+4.5=10	10.5	14.75	2+2+2 = 6
V	81 (53)	207 (134)	181 (117)	218 (140)
SW	SW6	SW6	SW6	SW3
OT	—	2.07 (1.34)	1.81 (1.17)	2.18 (1.4)
HD		HDU2	HDU2	HDU2
2W/H	$\frac{(2)4.5}{10}(335, 230) = 301, 207$ ✓	>1.0	>1.0	$\frac{2(2)}{10}(630, 450) = 252, 180$ ✓

PROJECT: Day Residence

DATE: 21.8.10

PROJECT NO: 0139.2021.02.01

DESIGN: DLS

SHEET: E-L2

Lateral Analysis West Wing

Seismic Design

Level	Area	#/SF	WT	HT	Wi Hi	% Dist.	V
Roof	1525	27.5	41.9	18	755	67	6.0
Main	1525	30	47.3 *	8	378	33	3.0
			Σ = 89.2		Σ = 1133		Σ = 9.0

$V_{ult} = 0.144\ (89.2) = 12.8$

$V_{ALL} = 0.101(89.2) = 9.0$

Wind Design Loads

			NE-SE Exposure		NW-SW Exposure	
Level	Trib Height	#/ft	L	V	L	V
Roof	8	14.4(3)+13.7(5) = 111.7	31	3.46	46	5.14
Main	10	13.7(10) = 137	31	4.25	46	6.30
				Σ = 7.71		Σ = 11.44

*** Exterior Stucco**

Perimeter = 145ft
Stucco Weight = 10psf
= 1.5k

PROJECT: Day Residence

DATE: 21.8.10

PROJECT NO: 0139.2021.02.01

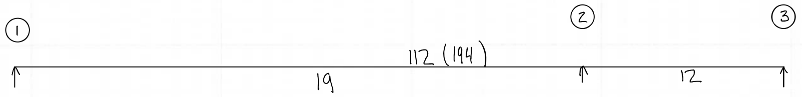
DESIGN: DLS

SHEET: W-L1

NE-SE Exposure

Roof

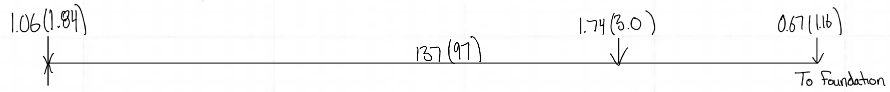
h=10



	①	②	③
R	1.06 (1.84)	1.74 (3.0)	0.67 (1.16)
L	24+4+11 = 39	10.5	2+5.5+2 = 9.5
V	27 (47)	166 (286)	71 (122)
SU	SW6	SW4	SW3
OT	—	1.66 (2.86)	0.71 (1.22)
HD	—	HDU4 / (2) CS16	HDU2 / CS16
2W/H	$\frac{2(4)}{10}$ (335, 230) = 268, 184 ✓	>1.0	$\frac{2(2)}{10}$ (630, 450) = 252, 180 ✓

Main

h= 9

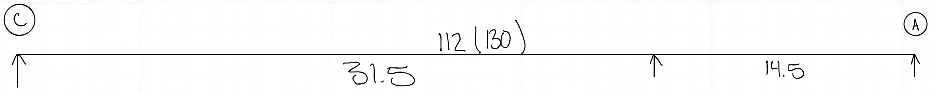


R	3.85 (3.87)
L	35.5
V	108 (109)
SU	SW6
OT	0.97 (0.98)
HD	HDU2
2W/H	>1.0

NW-SW Exposure

Roof

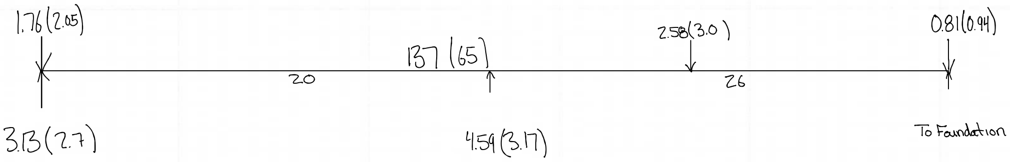
h=10



	Ⓒ		Ⓐ
R	1.76 (2.05)	2.58 (3.0)	0.81 (0.94)
L	4+4+4 = 12	12.5	6.25+6.25 = 12.5
V	147 (170)	206 (232)	64 (75)
SU	SW6	SW4	SW6
OT	1.47 (1.7)	2.06 (2.32)	—
HD	CS16 / HDU2	(2) CS16	—
2W/H	$\frac{2(4)}{10}$ (335, 230) = 268, 184 ✓	>1.0	>1.0

Main

h= 9



R	3.13 (2.7)	4.59 (3.17)
L	3.25+4.25+6.75 = 14.25	10.5
V	220 (189)	437 (302)
SU	SW4	SW4
OT	Partial Stk 1.98 (1.7) 1.47 (1.7) 3.45 (3.4)	3.93 (2.72)
HD	HDU2 / HDU5	HDU5
2W/H	$\frac{(2)3.5}{9}$ (490, 350) = 381, 272 ✓	>1.0

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PROJECT: Day Residence

DATE: 21.8.10

PROJECT NO: 0139.2021.02.01

DESIGN: DLS

SHEET: W-L2

Vertical Analysis

Roof

14" TJI 210'S AT 16" o.c. (See V4)

Typ Rim

$L=6$
$W=0.045(\frac{20.5}{2}+0.66)=0.49$
$R=1.47$
$M=2.2$
$F_b=0.65$
$F_v=77$
$\Delta=0.04$
$=\ell/1{,}872$

1¼ x 14 LSL Rim Typ

#201 Garage Beam

$L=7.75$
$W=0.045(0.66)+0.015(4)=0.09$
$R=0.35$
$M=0.67$
$F_b=0.07$
$F_v=7.4$
$\Delta=0.006$
$=\ell/15{,}845$

3½ x 14 LSL

#202

$L=5.5$
$W=0.045(\frac{20.5}{2}+0.66)=0.49$
$R=1.35$
$M=1.85$
$F_b=0.39$
$F_v=47.5$
$\Delta=0.016$
$=\ell/4058$

1¾ x 14 LSL

#203 C2

$L_1=2.5$
$L_2=0.5$
$W_1=0.045(\frac{19}{2}+0.66)=0.457$
$W_2=0.457$
$P=1.35$ (from #202)
$R_1=0.91$
$R_2=1.81$
$M=0.91$
$F_b=0.19$
$F_v=78$
$\Delta=0.002$
$=\ell/15{,}245$

1¾ x 14 LSL

#204

$L=6.75$
$W=0.045(1.33)=0.06$
$R=0.2$
$M=0.34$
$F_b=0.07$
$F_v=8.09$
$\Delta=0.005$
$=\ell/17{,}971$

1¾ x 14 LSL → use 3½ x 14 LSL

#205

$L=12.5$
$W=0.045(1.33)=0.06$
$R=0.37$
$M=1.16$
$F_b=0.25$
$F_v=18.6$
$\Delta=0.05$
$=\ell/2{,}830$

1¾ x 14 LSL

Office Header

$L=10.25$
$W=0.63$ (From TJI Rxn)
$R=3.22$
$M=8.27$
$F_b=1.54$
$F_v=109$
$\Delta=0.23$
$=\ell/531$

3½ x 10½ PSL

*3½" bearing required for TJI

#206

$L=12$
$W=0.045(\frac{30}{2})=0.675$
$R=4.05$
$M=12.15$
$F_b=1.27$
$F_v=100$
$\Delta=0.25$
$=\ell/567$

3½ x 14 LSL

#207 (Stair Side) C2

$L_1=5$
$L_2=11$
$W_1=0.045(\frac{19}{2}+0.66)=0.46$
$W_2=0.46$
$P=4.05$
$R_1=6.44$
$R_2=4.92$
$M=26.5$
$F_b=1.85$
$F_v=121$
$\Delta=0.48$
$=\ell/397$

5¼ x 14 PSL

#207

$L=12.5$
$W=0.46$
$R=2.86$
$M=8.9$
$F_b=0.6$
$F_v=47$
$\Delta=0.1$
$=\ell/1{,}434$

5¼ x 14 PSL ok

#208

$L=12.5$
$W=0.045(\frac{19}{2})=0.43$
$R=2.67$
$M=8.34$
$F_b=1.75$
$F_v=133$
$\Delta=0.38$
$=\ell/396$

1¾ x 14 LSL

#209

$L=18$
$W=0.045(1.33)+0.015(4)=0.12$
$R=1.08$
$M=4.9$
$F_b=1.02$
$F_v=58$
$\Delta=0.46$
$=\ell/472$

1¾ x 14 LSL

#210

$L=7$
$W=0.43$
$R=1.5$
$M=2.6$
$F_b=0.55$
$F_v=61$
$\Delta=0.04$
$=\ell/2{,}242$

1¾ x 14 LSL

PROJECT: Day Residence

DATE: 21.8.11

PROJECT NO: 0139.2021.02.01

DESIGN: DLS

Vertical Analysis

(....) seismic loading

Main

Floor: 14" TJI 230's AT 16" oc. (See V5)

Crawlspace: 11-7/8" TJI 210's AT 16" oc (See V6)

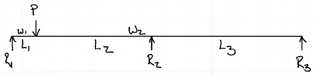
#101 C2

$L_1=5.5$
$L_2=3.5$
$W_1=0.055(\frac{21}{2}+0.66)=0.61$
$W_2=0.61+0.015(9)=0.75$
$P=0$
$R_1=2.85$
$R_2=3.14$

$M=6.6$
$F_b=1.9$
$F_v=173$
$\Delta=0.26$
$=\ell/421$

1¾ x 11⅞ LSL

#102



$L_1=2.5$
$L_2=9$
$L_3=11.5$
$U_1=0.055(\frac{19}{2}+0.66)=0.56$
$W_2=0.055(1.33)+0.015(9)=0.21$
$P=2.85$

$R_1=3.74$
$R_2=4.05$
$R_3=0.73$
$M=7.6$
$F_b=1.1$
$F_v=90$
$\Delta=-0.16$
$=\ell/1725$

3½x11⅞ LSL

#103 C6

$L=8.5$
$W_1=0.055(\frac{10}{2}+0.66)=0.31$
$W_2=0.055(.66)=0.036$
$R_1=0.93$
$R_2=0.54$

$M=1.6$
$F_b=0.33$
$F_v=36$
$\Delta=0.03$
$=\ell/3118$

1¾x14 LSL

#104 C4

$L_1=0$
$L_2=12.75$
$L_3=5$
$W_1=0.055(1.33)+0.015(10)=0.22$
$W_2=0.055(1.33)+0.015(10)=0.22$
$W_3=0.055(1.33)=0.073$
$P_1=0$
$P_2=0$

$R_1=1.85$
$R_2=1.32$
$M=7.8$
$F_b=0.8$
$F_v=49$
$\Delta=0.35$
$=\ell/611$

Overturning

$P_1=\Omega(2.87)=7.18,-7.18$
$P_2=7.18,-7.18$
$R_1=-3.3,7$

$R_2=6.48,-3.8$
$F_b=2.6$
$F_v=196$

3½x14 LSL

*HGU required

#105 C4

$L_1=4.25$
$L_2=3$
$L_3=5$
$W_1=0.055(\frac{26}{2})+0.015(10)=0.87$
$W_2=0.87$
$W_3=0.87$
$P_1=0.54\ (8.45)$
$P_2=1.32\ (6.51)$

$R_1=6.22\ (13.5)$
$R_2=6.3\ (12.1)$
$M=21$
$F_b=1.45\ (3.5)$
$F_v=108\ (255)$
$\Delta=0.23$
$=\ell/635$

5¼x14 PSL

#106

$L=6.5$
$W=0.055(\frac{25}{2})=0.69$
$R=2.23$
$M=3.6$

$F_b=0.76$
$F_v=88$
$\Delta=0.04$
$=\ell/1752$

1¾ x 14 LSL

#107 C2

$L_1=17.5$
$L_2=0.5$
$W_1=0.055(1.33)=0.073$
$W_2=0.073$
$P=8.4\ (13.5)$
$R_1=0.89\ (1.0)$
$R_2=8.8\ (13.7)$

$M=5.4$
$F_b=0.57\ (0.82)$
$F_v=268\ (452)$
$\Delta=0.26$
$=\ell/839$

3½x14 LSL Use 5¼x14 PSL

#108 C2

$L_1=17.5$
$L_2=0.5$
$W_1=0.055(1.33)=0.073$
$W_2=0.073$
$P=10.3$
$R_1=0.94$
$R_2=10.7$

$M=6.1$
$F_b=0.43$
$F_v=216$
$\Delta=0.15$
$=\ell/1471$

5¼x14 PSL

#109 C2

$L_1=12.5$
$L_2=4.25$
$W_1=0.073$
$W_2=0.073$
$P=9.3$
$R_1=2.97$
$R_2=7.55$

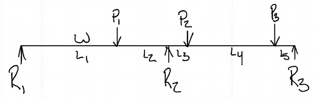
$M=31.4$
$F_b=2.19$
$F_v=152$
$\Delta=0.51$
$=\ell/394$

5¼x14 PSL

Vertical Analysis

Main Cont.

#110



$L_1 = 6.75$
$L_2 = 4.75$
$L_3 = 0.5$
$L_4 = 6.5$
$L_5 = 1.5$
$W = 0.055(\frac{29.5}{2}) = 0.81$
$P_1 = 0.33$
$P_2 = 0.33$
$P_3 = 7.55$

$R_1 = 3.61$
$R_2 = 12.7$
$R_3 = 8.08$
$M = 13.6$
$Fb = 0.95$
$Fv = 110$
$\Delta = 0.061$
$= L/3947$

5¼ x 14 PSL

#111/112 C3

$L = 12.25$
$A = 1$
$W_1 = 0.073$
$W_2 = 0.055(0.66)+0.015(10) = 0.19$
$P = 1.3$
$R_1 = 0.33$
$R_2 = 2.05$

$M = 1.39$
$Fb = 0.29$
$F_V = 78$
$\Delta = 0.002$
$= \ell/15,330$

1¾x14 LSL

#113

$L = 5$
$W = 0.055(\frac{13.5}{2})+0.015(10) = 0.52$
$R = 1.3$
$M = 1.6$

$Fb = 0.34$
$F_V = 43$
$\Delta = 0.012$
$= \ell/5089$

1¾x14 LSL

Overturning

$R_1 =$
$R_2 =$

$Fb =$
$F_V =$

Main Support Header C2

$L_1 = 0.75$
$L_2 = 2$
$W_1 = 0$
$W_2 = 0$
$P = 12.7$
$R_1 = 9.23$
$R_2 = 3.46$

$M = 6.9$
$Fb = 0.67$
$F_V = 225$
$\Delta = 0.005$
$= \ell/6255$

5½x12 GL

Daylight Doors C2

$L_1 = 1$
$L_2 = 5$
$W_1 = 0.036$
$W_2 = 0.036$
$P = 3.61$
$R_1 = 3.11$
$R_2 = 0.7$

$M = 3.1$
$Fb = 0.65$
$F_V = 188$
$\Delta = 0.02$
$= \ell/3066$

1¾x14 LSL

Crawlspace Header

$L = 4.5$
$W = 1.09/1.33 = 0.82$ (Forte Rxn)
$R = 1.85$
$M = 2.07$

$Fb = 0.5$
$F_V = 56$
$\Delta = 0.02$
$= \ell/2,636$

4x10 header Typ

MALSAM
TSANG
STRUCTURAL
ENGINEERING

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SUITE 210
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PROJECT: Day Residence

DATE: 21.8.11

PROJECT NO: 0139.2021.02.01

DESIGN: DLS

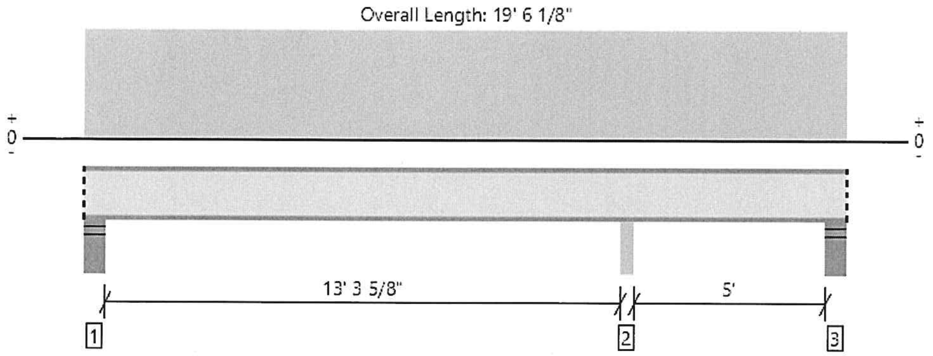
SHEET: V3

MEMBER REPORT

PASSED

Level, Roof: Joist (Office)

1 piece(s) 14" TJI® 210 @ 16" OC



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)	840 @ 13' 10 7/8"	2467 (3.50")	Passed (34%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	457 @ 13' 9 1/8"	2237	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	-1047 @ 13' 10 7/8"	5164	Passed (20%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.042 @ 6' 6"	0.451	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.075 @ 6' 5 7/8"	0.676	Passed (L/999+)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD
Member Pitch : 0/12

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - HF	5.50"	5.50"	1.75"	156	196	352	Blocking
2 - Beam - HF	3.50"	3.50"	3.50"	374	467	841	None
3 - Stud wall - HF	5.50"	5.50"	1.75"	-9	41/-58	41/-67	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 7" o/c	
Bottom Edge (Lu)	8' o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 19' 6 1/8"	16"	20.0	25.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Dylan Steele Malsam-Tsang (707) 496-3698 dylan1steele@gmail.com	

Weyerhaeuser

8/11/2021 4:33:07 PM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: 9843 Mercerwood

V4

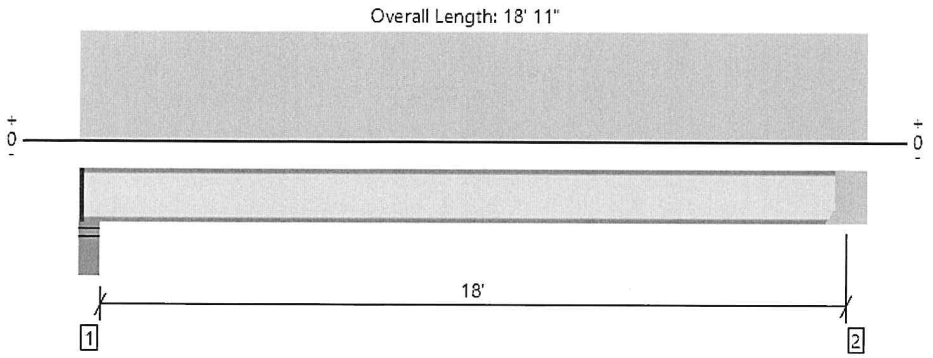
FORTE WEB

MEMBER REPORT

PASSED

Level, Floor: Joist(West Wing)

1 piece(s) 14" TJI® 230 @ 16" OC



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)	663 @ 18' 5 1/2"	1060 (1.75")	Passed (63%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	663 @ 18' 5 1/2"	1945	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2998 @ 9' 5"	4990	Passed (60%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.243 @ 9' 5"	0.452	Passed (L/893)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.334 @ 9' 5"	0.904	Passed (L/649)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	46	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

	Bearing Length			Loads to Supports (lbs)			
Supports	**Total**	**Available**	**Required**	**Dead**	**Floor Live**	**Total**	**Accessories**
1 - Stud wall - HF	5.50"	4.25"	1.75"	188	502	690	1 1/4" Rim Board
2 - Hanger on 14" HF beam	5.50"	Hanger[1]	1.75" / - [2]	190	507	697	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	**Bracing Intervals**	**Comments**
Top Edge (Lu)	5' 5" o/c	
Bottom Edge (Lu)	18' 4" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	**Model**	**Seat Length**	**Top Fasteners**	**Face Fasteners**	**Member Fasteners**	**Accessories**
2 - Face Mount Hanger	IUS2.37/14	2.00"	N/A	12-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	**Location**	**Spacing**	**Dead (0.90)**	**Floor Live (1.00)**	**Comments**
1 - Uniform (PSF)	0 to 18' 11"	16"	15.0	40.0	Default Load

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	**Job Notes**
Dylan Steele Malsam-Tsang (707) 496-3698 dylan1steele@gmail.com	

Weyerhaeuser

8/11/2021 2:31:11 PM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: 9843 Mercerwood

V5

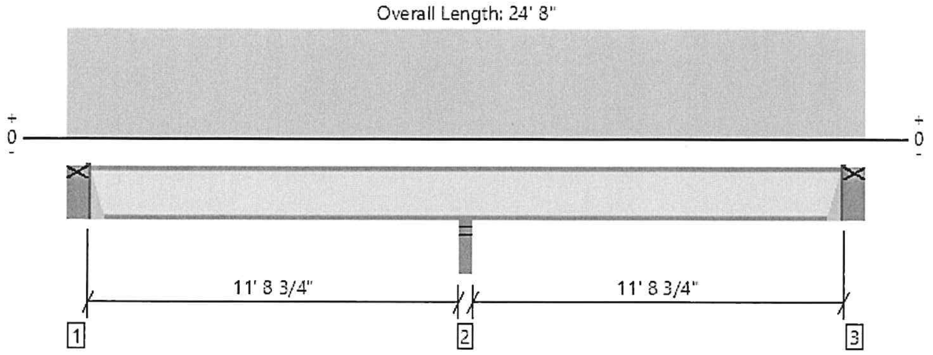
FORTE WEB

MEMBER REPORT

PASSED

Level, Floor: Joist (East Wing)

1 piece(s) 11 7/8" TJI® 210 @ 16" OC



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)	1089 @ 12' 4"	2145 (3.50")	Passed (51%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	510 @ 12' 5 3/4"	1821	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-1293 @ 12' 4"	3795	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.060 @ 18' 7"	0.297	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.076 @ 18' 8 1/2"	0.594	Passed (L/999+)	--	1.0 D + 1.0 L (Alt Spans)
TJ-Pro™ Rating	59	40	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Hanger on Single 2X HF plate	5.50"	Hanger[1]	1.75" / - [2]	98	302/-15	400/-15	See note [1]
2 - Stud wall - HF	3.50"	3.50"	3.50"	297	792	1089	None
3 - Hanger on Single 2X HF plate	5.50"	Hanger[1]	1.75" / - [2]	98	302/-15	400/-15	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.
- [2] Required Bearing Length / Required Bearing Length with Web Stiffeners

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 10" o/c	
Bottom Edge (Lu)	6' 6" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Top Mount Hanger	ITS2.06/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	
3 - Top Mount Hanger	ITS2.06/11.88	2.00"	4-10dx1.5	2-10dx1.5	2-Strong-Grip	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 24' 8"	16"	15.0	40.0	Default Load

ForteWEB Software Operator	Job Notes
Dylan Steele Malsam-Tsang (707) 496-3698 dylan1steele@gmail.com	

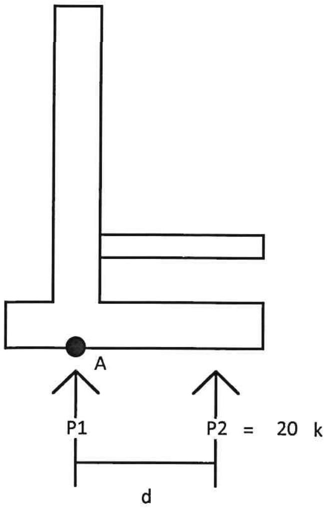
Weyerhaeuser

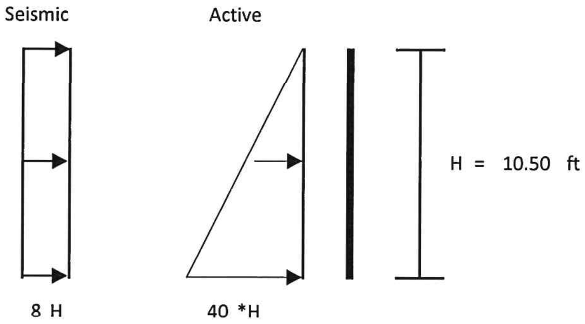
8/10/2021 9:52:38 PM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: 9843 Mercerwood

V6

PIN PILE DESIGN

Basement Retaining Wall Pile Calculations





$$M_{base} = \frac{(0.5)(35)(H^3)}{3} + \frac{(8)(H^2)}{2} = 8.2 \text{ k-ft/ft}$$

P1 spacing: 4.50 ft

$$M_{pile} = 8.2 \times 4.50 = 36.7 \text{ k-ft}$$

$$\sum M_A = -36.7 + (20)(d) \Rightarrow d = 1.8 \text{ ft} \Rightarrow \text{Use } 3.0 \text{ ft}$$

Project

8/16/2021
Date

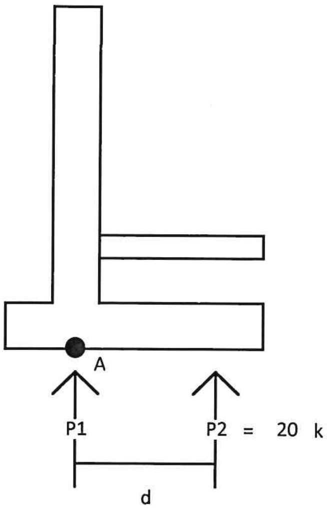
0139.2021.02.01
Proj. No.

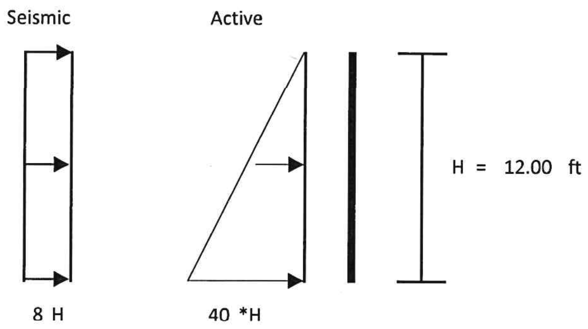
DLS
Design

U7
Sheet

PIN PILE DESIGN

Terrace Retaining Wall Pile Calculations





$M_{base} = \dfrac{(0.5)(35)(H^3)}{3} + \dfrac{(8)(H^2)}{2} = 12.1$ k-ft/ft

P1 spacing: 4.00 ft

$M_{pile} = 12.1 \times 4.00 = 48.4$ k-ft

$\sum M_A = -48.4 + (20)(d) \Rightarrow d = 2.4$ ft $\Rightarrow$ Use 3.0 ft

VERTICAL ANALYSIS

Pin Pile Design:

Pile Capacities: 2"Ø = 6k & 3"Ø = 12k

Typical Footing:

fy = 60 ksi
F'c = 2.5 ksi
As = 0.59 sq in
B = 8 in
d = 26.75 in

ØMn = 68.15 k-ft
ØVc/2 = 9 k

Footing Spans:

Grid 1

W = 0.68 LL + 1.38 DL = 2.06 klf
W(ult) = 2.74 klf
Spacing: 4"Ø → 2.9' oc
3"Ø → 5.8' oc
Design Length: 4' d = 77.75"
Mu = 5.48 k-ft ≤ ØMn = 203.33 k-ft OK
Vu = 0 k ≤ ØVc/2 = 24.3 k OK

Grid 3 (Existing)

W = 0.57 LL + 1.7 DL = 2.27 klf
W(ult) = 2.95 klf
Spacing: 4"Ø → 2.6' oc
3"Ø → 5.2' oc
Design Length: 2' d = 134.75"
Mu = 1.47 k-ft ≤ ØMn = 354.42 k-ft OK
Vu = 0 k ≤ ØVc/2 = 41.4 k OK

Grid 3 (New)

W = 0.57 LL + 1.75 DL = 2.32 klf
W(ult) = 3.01 klf
Spacing: 4"Ø → 2.5' oc
3"Ø → 5.1' oc
Design Length: 4.5' d = 137.75"
Mu = 7.63 k-ft ≤ ØMn = 362.38 k-ft OK
Vu = 0 k ≤ ØVc/2 = 42.3 k OK

East Wing

W = 0.7 LL + 1.09 DL = 1.79 klf
W(ult) = 2.43 klf
Spacing: 4"Ø → 3.3' oc
3"Ø → 6.7' oc
Design Length: 6.5' B = 6" d = 68.75"
Mu = 12.82 k-ft ≤ ØMn = 178.56 k-ft OK
Vu = 0 k ≤ ØVc/2 = 16.2 k OK

Grid C

W = 0.2 LL + 0.77 DL = 0.97 klf
W(ult) = 1.24 klf
Spacing: 6.1' oc
3"Ø → 12.3' oc
Design Length: 10' B = 6" d = 68.75"
Mu = 15.55 k-ft ≤ ØMn = 178.56 k-ft OK
Vu = 0 k ≤ ØVc/2 = 16.2 k OK

Footing Spans: (Cont...)

Entry Way

W = 0.64 LL + 0.79 DL = 1.43 klf
W(ult) = 1.97 klf
Spacing: 4"Ø → 4.2' oc
3"Ø → 8.4' oc
Design Length: 7.5' B = 6" d = 32.75"
Mu = 13.82 k-ft ≤ ØMn = 83.13 k-ft OK
Vu = 1.47 k ≤ ØVc/2 = 8.1 k OK

Retaining Wall (Terrace)

W = 0 LL + 2.75 DL = 2.75 klf
W(ult) = 3.3 klf
Spacing: 4"Ø → 2.1' oc
3"Ø → 4.3' oc
Design Length: 4' d = 155.75"
Mu = 6.59 k-ft ≤ ØMn = 410.09 k-ft OK
Vu = 0 k ≤ ØVc/2 = 55.68 k OK

Stone Wall

W = 0 LL + 0.75 DL = 0.75 klf
W(ult) = 0.9 klf
Spacing: 4"Ø → 8' oc
3"Ø → 16' oc
Design Length: 8' d = 76.75"
Mu = 7.2 k-ft ≤ ØMn = 200.68 k-ft OK
Vu = 0 k ≤ ØVc/2 = 24 k OK

MALSAM
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122 South Jackson
Suite 210
Seattle, WA 98104
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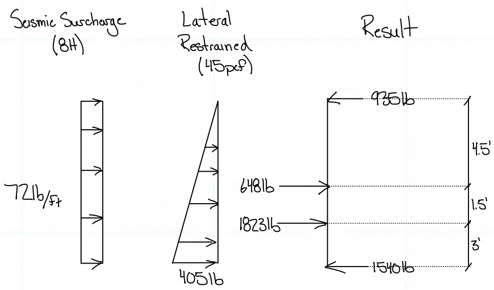
9843 Mercerwood Dr (Day)
Project
Mercer Island, WA

9/3/2021
Date
0139-2021-02-01
Proj. No.
DLS
Design
V9
Sheet

Restraint of existing FDN



Floor Diaphragm
TJI 230 blk capacity = 480

$$\text{Blk req} = \frac{935(24''\text{oc})}{480} = 3.89 \therefore 4 \text{ blks Req @ Perpendicular}$$

*See Anchor design for attachment to (E) Wall

Day Residence
PROJECT

21.9.24
DATE

0139.2021.02.01
PROJECT NO

DLS
DESIGN

V10
SHEET

1.Project information

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

Project description:
Location:
Fastening description:

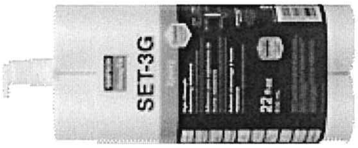
2. Input Data & Anchor Parameters

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

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 5.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 6.38
c_{ac} (inch): 7.58
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 108.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 5/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057



V11

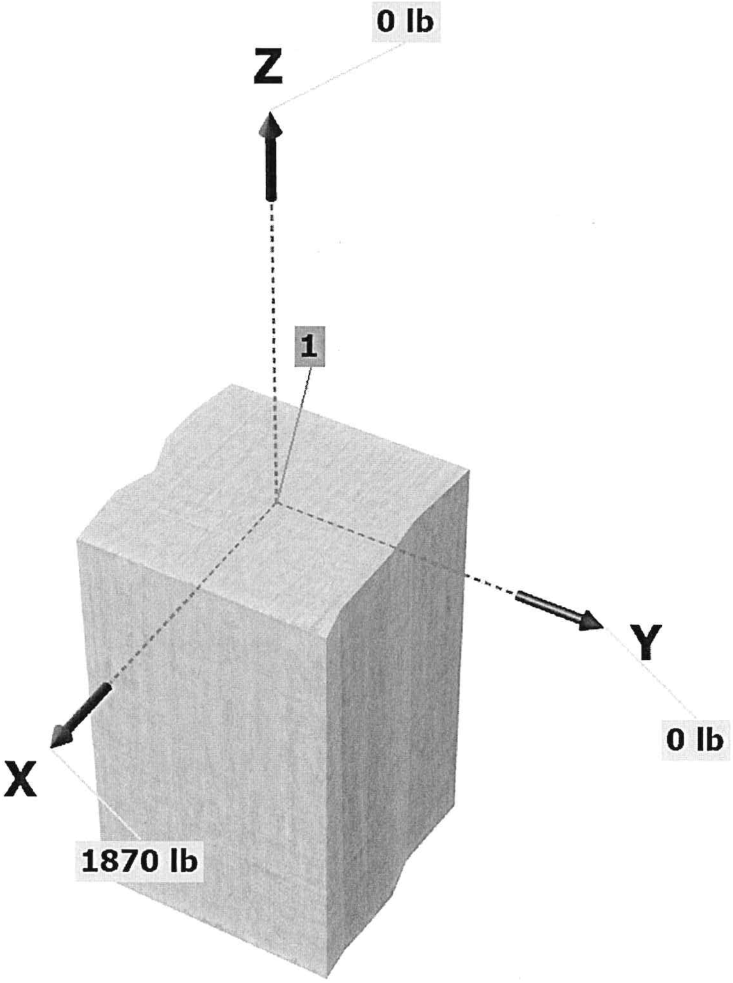
Company:		Date:	9/24/2021
Engineer:		Page:	2/5
Project:			
Address:			
Phone:			
E-mail:			

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

Strength level loads:

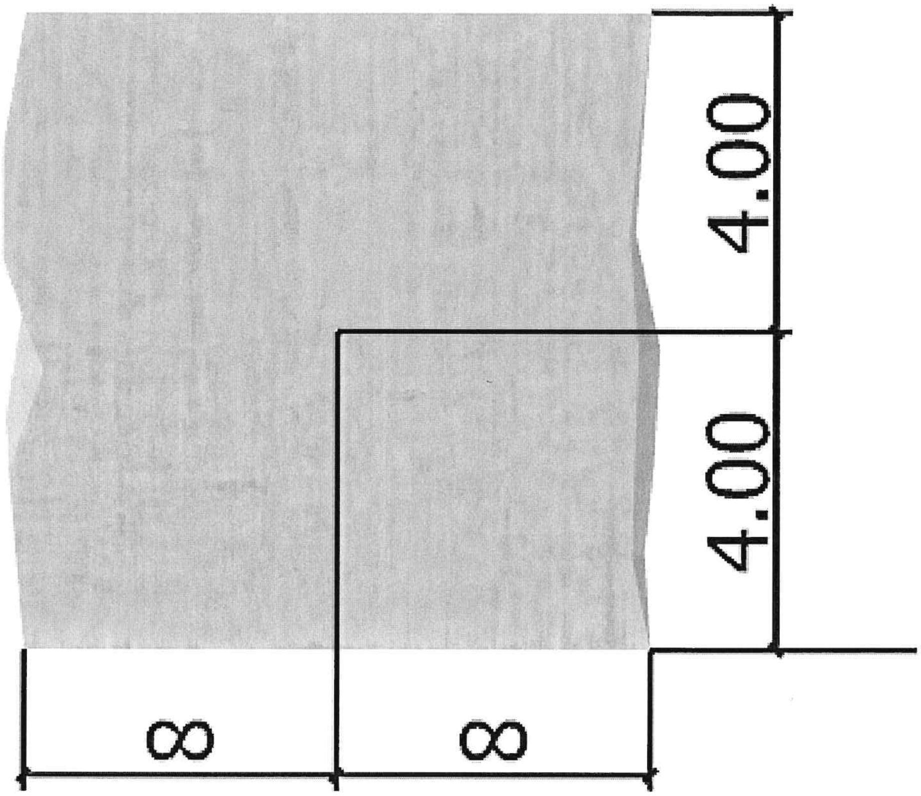
N_{ua} [lb]: 0
V_{uax} [lb]: 1870
V_{uay} [lb]: 0

<Figure 1>



V12

<Figure 2>



V13

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	1870.0	0.0	1870.0
Sum	0.0	1870.0	0.0	1870.0

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

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

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

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

Shear perpendicular to edge in x-direction:

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

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
5.00	0.625	1.00	2500	4.00	3355

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

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbx} (lb)
72.00	72.00	1.000	1.000	1.000	3355	0.70	2349

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

$\phi V_{cp} = \phi \min|k_{cp}N_a ; k_{cp}N_{cb}| = \phi \min|k_{cp}(A_{Na} / A_{Na0})\,\Psi_{ed,Na}\Psi_{cp,Na}N_{ba} ; k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1a)

k_{cp}	A_{Na} (in²)	A_{Na0} (in²)	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	140.19	307.10	0.837	1.000	13312	5086

A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ	ϕV_{cp} (lb)
120.00	225.00	0.860	1.000	1.000	9503	4359	0.70	6102

11. Results

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

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	1870	5112	0.37	Pass
T Concrete breakout x+	**1870**	**2349**	**0.80**	**Pass (Governs)**
Pryout	1870	6102	0.31	Pass

SET-3G w/ 5/8"Ø F1554 Gr. 36 with hef = 5.000 inch meets the selected design criteria.

12. Warnings

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

- Refer to manufacturer’s product literature for hole cleaning and installation instructions.

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