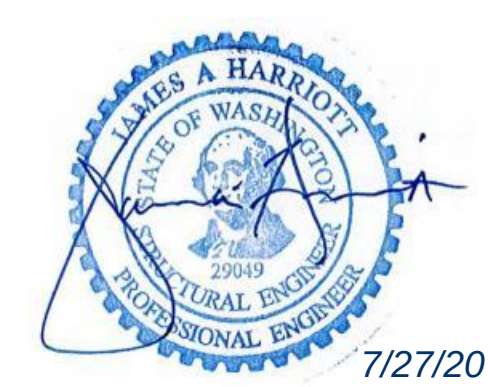
STRUCTURAL CALCULATIONS

Project:
Nader Residence
5472 West Mercer Way
Mercer Island, WA 98040

Architect:
Patricia Brennan Architects
224 Pontius Avenue North, Suite 117
Seattle, WA 98109

Structural Engineer:
Harriott Valentine Engineers, Inc.
1932 First Avenue, Suite 720
Seattle, WA 98101
tel. 206-624-4760



7/27/20

SECTION 1: FRAMING

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CRITERIA

FRAMING

roof	dead	asphalt shingles	2.5	live snow	25.0 psf
		1/2" plywood	1.5		
		2x12 @ 16"oc	3.3		
		R38 insulation	1.4		
		5/8" gyp. wallboard	2.8		
		slope factor	0.6		
		miscellaneous	0.9 7%		
			13.0 psf		
	total	dead + live	38.0 psf		
upper floor	dead	3/4" hardwood	3.0	live residential	40.0 psf
		3/4" plywood	2.3		
		11-7/8" TJI 110 @ 16"oc	1.9		
		R21 insulation	0.8		
		5/8" gyp. wallboard	2.8		
		miscellaneous	1.2 10%		
			12.0 psf		
	total	dead + live	52.0 psf		
deck	dead	5/4 deck boards	2.6	live deck	60.0 psf
		2x12 @ 16"oc	3.3		
		miscellaneous	1.1 16%		
			7.0 psf		
	total	dead + live	67.0 psf		
walls		3/4" cedar bevel siding	1.4		
		1/2" plywood	1.5		
		2x6 @ 16"oc	1.7		
		R21 insulation	0.8		
		1/2" gyp. wallboard	2.2		
		miscellaneous	1.4 16%		
			9.0 psf		

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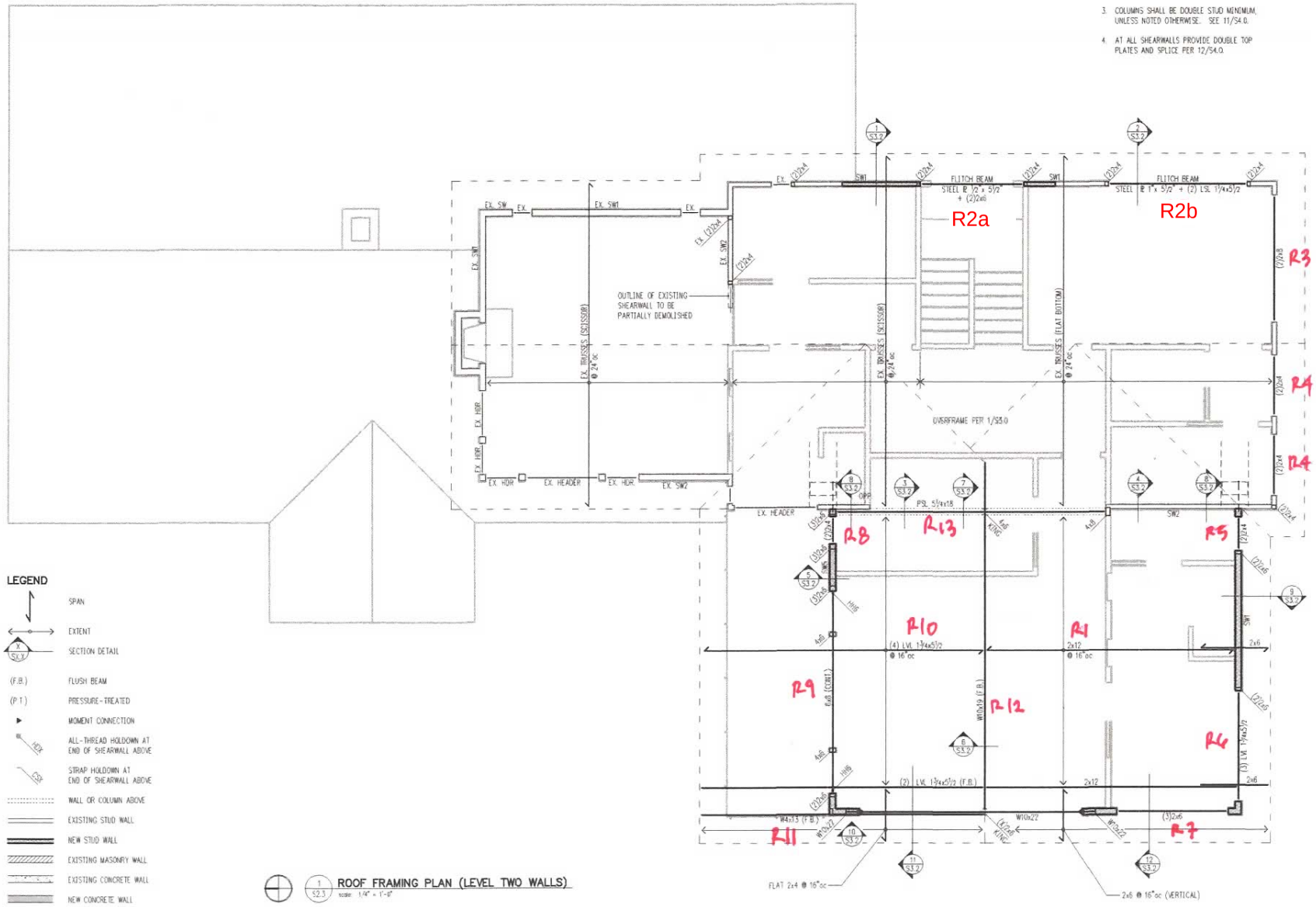
PLAN NOTES

1. SW__ INDICATES SHEARWALL TYPE PER SCHEDULE 8/S4.0. REFER TO DETAILS FOR TYPICAL SHEARWALL CONSTRUCTION. SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL WALL INFORMATION.
2. REFER TO GENERAL STRUCTURAL NOTES FOR FLOOR OR ROOF SHEATHING TYPE, THICKNESS, AND NAILING.
3. COLUMNS SHALL BE DOUBLE STUD MINIMUM, UNLESS NOTED OTHERWISE. SEE 11/S4.0.
4. AT ALL SHEARWALLS PROVIDE DOUBLE TOP PLATES AND SPLICE PER 12/S4.0.



LEGEND

- SPAN
- EXTENT
- SECTION DETAIL
- (F.B.) FLUSH BEAM
- (P.T.) PRESSURE-TREATED
- MOMENT CONNECTION
- ATH ALL-THREAD HOLDOWN AT END OF SHEARWALL ABOVE
- STRAP HOLDOWN AT END OF SHEARWALL ABOVE
- WALL OR COLUMN ABOVE
- EXISTING STUD WALL
- NEW STUD WALL
- EXISTING MASONRY WALL
- EXISTING CONCRETE WALL
- NEW CONCRETE WALL

1 S2.3 ROOF FRAMING PLAN (LEVEL TWO WALLS)
scale: 1/4" = 1'-0"

BEAMS (SIMPLE SPAN UNIFORM LOAD)

R1 SLOPED

(snow)

total load =	38	psf
live load =	25	psf
pitch =	4	:12
horiz. length =	18.46	ft
trib. width =	1.33	ft

vertical

w (total) =	51	plf
w (live) =	33	plf
W (total) =	935	lb
W (live) =	615	lb

sloped		demand		capacity			
W (total) =	887 lb	V =	0.44 k	Vr =	1.94 k		
W (live) =	584 lb	M =	2.16 k-ft	Mr =	2.58 k-ft		
w (total) =	46 plf	EI (total) =	1.51E+08 lb-in2	EI =	2.31E+08 lb-in2		
w (live) =	30 plf	EI (live) =	1.49E+08 lb-in2	d (total) =	0.64 in = L/	367	
length =	19.46 ft			d (live) =	0.42 in = L/	558	

use **2x12**

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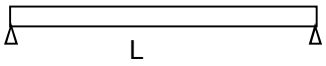
BEAMS (SIMPLE SPAN UNIFORM LOAD)

ROOF



(snow)
total load = 38 psf
live load = 25 psf

location	criteria		demand		capacity		
				1.93 k			
east	w (total) =	539 plf	V =	~~2.09~~ k	Vr =	39.60 k	
(stair)	w (live) =	355 plf	M =	4.06 k-ft	Mr =	4.54 k-ft	
R2a	L =	7.76 ft	EI (total) =	1.13E+08 lb-in2	EI =	2.01E+08 lb-in2	
	trib. =	14.18 ft	EI (live) =	1.12E+08 lb-in2	d (total) =	0.22 in = L/	426
					d (live) =	0.14 in = L/	647
					use	**steel plate 1/2"x 5-1/2"**	

location	criteria		demand		capacity		
				2.63 k			
east	w (total) =	539 plf	V =	~~2.78~~ k	Vr =	79.20 k	
(bedrm)	w (live) =	355 plf	M =	7.19 k-ft	Mr =	9.08 k-ft	
R2b	L =	10.33 ft	EI (total) =	2.68E+08 lb-in2	EI =	4.02E+08 lb-in2	
	trib. =	14.18 ft	EI (live) =	2.64E+08 lb-in2	d (total) =	0.34 in = L/	360
					d (live) =	0.23 in = L/	548
					use	**steel plate 1"x 5-1/2"**	

location	criteria		demand		capacity		
				0.76 k			
south	w (total) =	169 plf	V =	~~0.81~~ k	Vr =	2.50 k	
(bedrm)	w (live) =	112 plf	M =	1.95 k-ft	Mr =	2.95 k-ft	
R3	L =	9.58 ft	EI (total) =	6.71E+07 lb-in2	EI =	1.24E+08 lb-in2	
	trib. =	4.46 ft	EI (live) =	6.62E+07 lb-in2	d (total) =	0.26 in = L/	443
					d (live) =	0.17 in = L/	673
					use	**(2)2x8**	

location	criteria		demand		capacity		
				0.35 k			
south	w (total) =	169 plf	V =	~~0.40~~ k	Vr =	1.21 k	
(bedrm)	w (live) =	112 plf	M =	0.48 k-ft	Mr =	0.86 k-ft	
R4	L =	4.75 ft	EI (total) =	8.17E+06 lb-in2	EI =	1.39E+07 lb-in2	
	trib. =	4.46 ft	EI (live) =	8.07E+06 lb-in2	d (total) =	0.14 in = L/	408
					d (live) =	0.09 in = L/	620
					use	**(2)2x4**	

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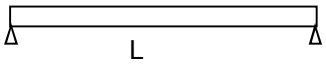
BEAMS (SIMPLE SPAN UNIFORM LOAD)

ROOF



(snow)
total load = 38 psf
live load = 25 psf

location	criteria		demand		capacity		
				0.48 k			
master	w (total) =	444 plf	V =	~~0.61~~ k	Vr =	1.21 k	
potty	w (live) =	292 plf	M =	0.42 k-ft	Mr =	0.86 k-ft	
R5	L =	2.75 ft	EI (total) =	4.16E+06 lb-in2	EI =	1.39E+07 lb-in2	
	trib. =	11.68 ft	EI (live) =	4.10E+06 lb-in2	d (total) =	0.04 in = L/	803
					d (live) =	0.03 in = L/	1220
					use	**(2)2x4**	

location	criteria		demand		capacity		
				1.72 k			
master	w (total) =	444 plf	V =	~~1.85~~ k	Vr =	6.31 k	
bathtub	w (live) =	292 plf	M =	3.85 k-ft	Mr =	7.33 k-ft	
south	L =	8.33 ft	EI (total) =	1.16E+08 lb-in2	EI =	1.37E+08 lb-in2	
R6	trib. =	11.68 ft	EI (live) =	1.14E+08 lb-in2	d (total) =	0.35 in = L/	284
					d (live) =	0.23 in = L/	432
					use	**(3) LVL 1-3/4x5-1/2**	

location	criteria		demand		capacity		
				0.68 k			
master	w (total) =	176 plf	V =	~~0.73~~ k	Vr =	2.85 k	
bathtub	w (live) =	116 plf	M =	1.52 k-ft	Mr =	2.76 k-ft	
west	L =	8.33 ft	EI (total) =	4.57E+07 lb-in2	EI =	8.25E+07 lb-in2	
R7	trib. =	4.62 ft	EI (live) =	4.51E+07 lb-in2	d (total) =	0.23 in = L/	433
					d (live) =	0.15 in = L/	658
					use	**(3)2x6**	

location	criteria		demand		capacity		
				0.62 k			
master	w (total) =	740 plf	V =	~~0.83~~ k	Vr =	1.21 k	
closet	w (live) =	487 plf	M =	0.47 k-ft	Mr =	0.86 k-ft	
north	L =	2.25 ft	EI (total) =	3.79E+06 lb-in2	EI =	1.39E+07 lb-in2	
R8	trib. =	19.47 ft	EI (live) =	3.74E+06 lb-in2	d (total) =	0.03 in = L/	879
					d (live) =	0.02 in = L/	1337
					use	**(2)2x4**	

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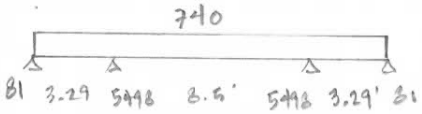
ROOF

R9 MBR

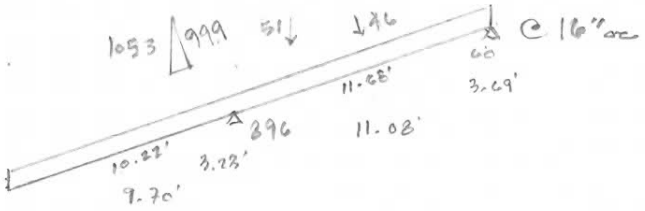


$V = 3.15$ $V_R = 5.20$ USE 6×8

$M = -3.74$ $M_R = 6.67$

$\Delta_{TL} = 0.09" = \frac{L}{1137}$

R10 DECK RAFTERS

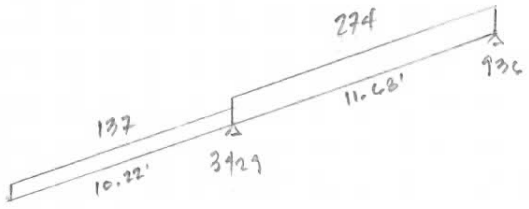


$V = 0.47$ $V_R = 8.42$ USE (4) LVL 1¾ × 5½ @ 16" oc

$M = -2.10$ $M_R = 9.78$

$\Delta_{SL} = 0.79" = \frac{L}{154}$ vs. $\frac{L}{120}$

R11 NW SUPPORT



$V = 2.21$ $L_b = 122"$; $L_p = 42$; $L_r = 230$ USE W4×13

$M = -7.15$ $M_n/\Omega = 13.06$

$\Delta_{SL} = 0.99" = \frac{L}{124}$ vs. $\frac{L}{120}$

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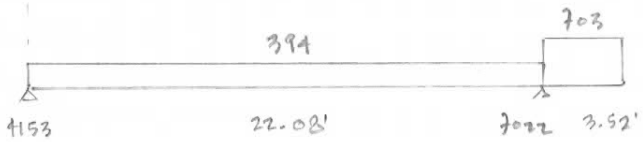
ROOF

R12 RIDGE

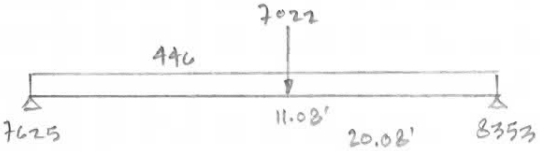


$V =$ $\quad$ $\ell = 16"$; $F_b = 30.00$ $\quad$ USE W10×19

$M = +21.83, -4.36$ $\quad$ $M_R = 47.00$

$\Delta_{TL} = 0.67" = \frac{L}{395}$

R13 RIDGE SUPPORT EAST



$V = 8.35$ $\quad$ $V_R = 21.01$ $\quad$ USE PSL $5\frac{1}{4}$×18

$M = 57.01$ $\quad$ $M_R = 75.32$

$\Delta_{TL} = 0.71" = \frac{L}{338}$

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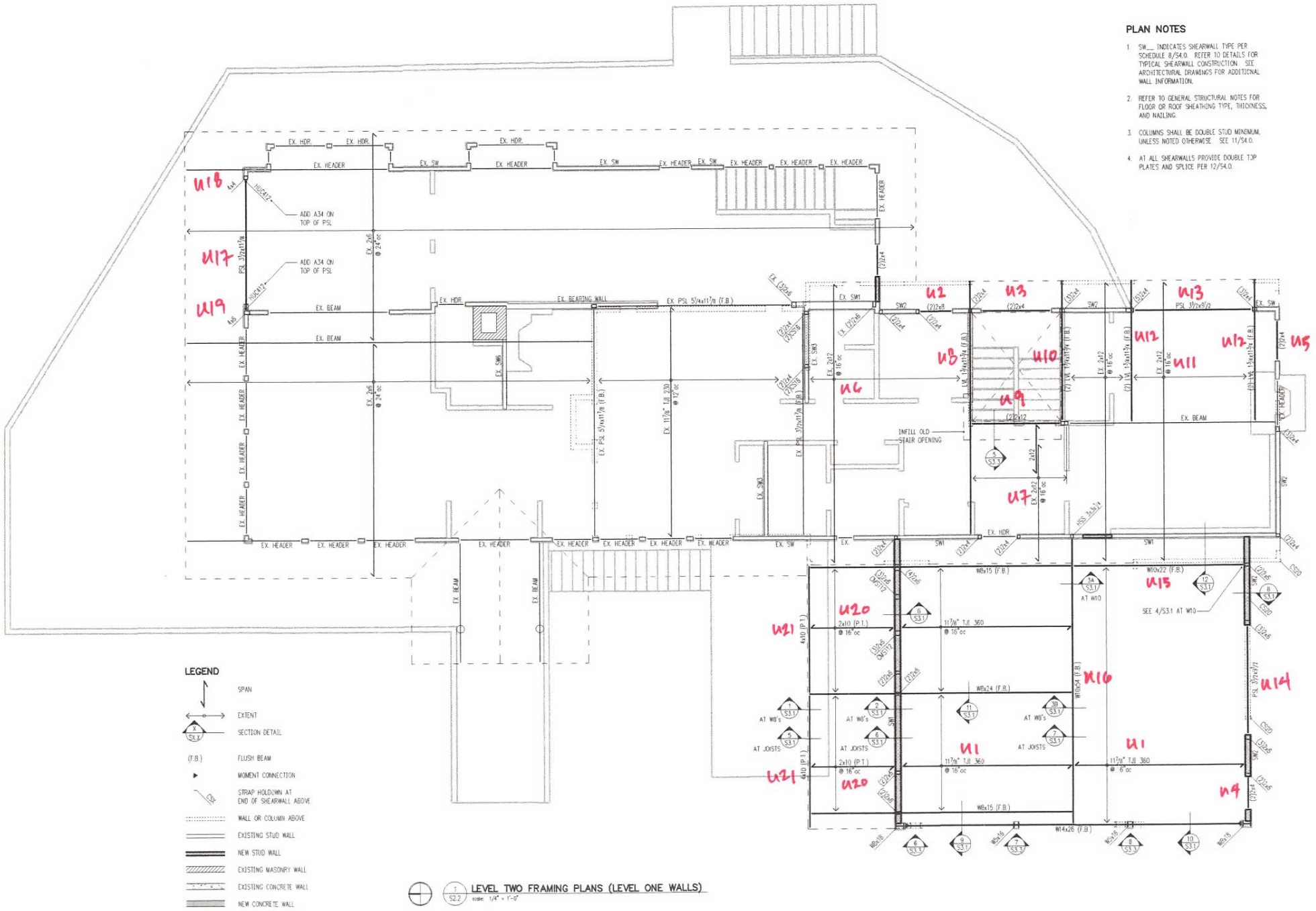
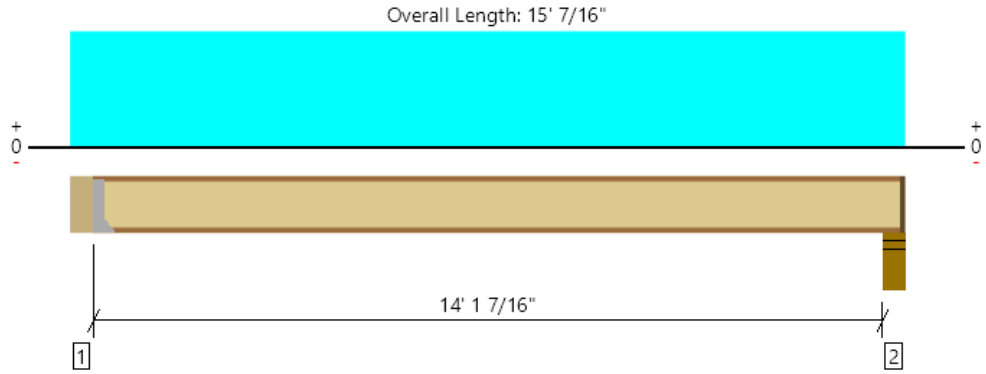

PLAN NOTES
1. SW__ INDICATES SHEARWALL TYPE PER SCHEDULE 8/S4.0. REFER TO DETAILS FOR TYPICAL SHEARWALL CONSTRUCTION. SEE ARCHITECTURAL DRAWINGS FOR ADDITIONAL WALL INFORMATION.
2. REFER TO GENERAL STRUCTURAL NOTES FOR FLOOR OR ROOF SHEATHING TYPE, THICKNESS, AND NAILING.
3. COLUMNS SHALL BE DOUBLE STUD MINIMUM, UNLESS NOTED OTHERWISE. SEE 11/S4.0.
4. AT ALL SHEARWALLS PROVIDE DOUBLE TOP PLATES AND SPLICE PER 12/S4.0.
LEGEND
SPAN
EXTENT
SECTION DETAIL
(F.B.) FLUSH BEAM
MOMENT CONNECTION
STRAP HOLDOWN AT END OF SHEARWALL ABOVE
WALL OR COLUMN ABOVE
EXISTING STUD WALL
NEW STUD WALL
EXISTING MASONRY WALL
EXISTING CONCRETE WALL
NEW CONCRETE WALL
LEVEL TWO FRAMING PLANS (LEVEL ONE WALLS)
scale: 1/4" = 1'-0"

U1

Level, Floor: Joist

1 piece(s) 11 7/8" TJI® 360 @ 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)	492 @ 5 1/2"	1080 (1.75")	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	492 @ 5 1/2"	1705	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1748 @ 7' 6 3/4"	6180	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.122 @ 7' 6 3/4"	0.355	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.159 @ 7' 6 3/4"	0.710	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	50	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 7' 3" o/c based on loads applied, unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 14' 6" 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" 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 11 7/8" SPF beam	5.50"	Hanger[1]	1.75" / - [2]	121	403	524	See note [1]
2 - Stud wall - SPF	5.50"	4.25"	1.75"	120	399	519	1 1/4" Rim Board

- 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

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	IUS2.37/11.88	2.00"	N/A	10-10d	2-Strong-Grip	

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 15' 7/16"	16"	12.0	40.0	Default Load

Weyerhaeuser Notes

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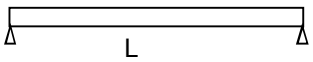
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
James A. Harriott Harriott Valentine Engineers Inc. (206) 624-4760 jharriott@harriottvalentine.com	

Weyerhaeuser

BEAMS (SIMPLE SPAN UNIFORM LOAD)

LEVEL TWO + ROOF



(residential)
total load = 52 psf
live load = 40 psf

(snow)
total load = 38 psf
live load = 25 psf

location	criteria		demand		capacity		
				1.54 k			
laundry	w (total) =	1232 plf	V =	~~1.90~~ k	Vr =	2.18 k	
U2	w (live) =	841 plf	M =	1.46 k-ft	Mr =	2.23 k-ft	
	L =	3.08 ft	EI (total) =	1.62E+07 lb-in2	EI =	1.24E+08 lb-in2	
	floor =	11.65 ft	EI (live) =	1.66E+07 lb-in2	d (total) =	0.02 in = L/	1836
	roof =	15.00 ft			d (live) =	0.01 in = L/	2689
	wall =	7.00 ft					
					use	**(2)2x8**	

location	criteria		demand		capacity		
				0.18 k			
stair	w (total) =	62 plf	V =	~~0.19~~ k	Vr =	1.05 k	
(east)	w (live) =	48 plf	M =	0.30 k-ft	Mr =	0.65 k-ft	
U3	L =	6.25 ft	EI (total) =	6.80E+06 lb-in2	EI =	1.39E+07 lb-in2	
	floor =	1.19 ft	EI (live) =	7.84E+06 lb-in2	d (total) =	0.15 in = L/	491
	roof =	0.00 ft			d (live) =	0.12 in = L/	638
	wall =	0.00 ft					
					use	**(2)2x4**	

location	criteria		demand		capacity		
				0.52 k			
garage	w (total) =	420 plf	V =	~~0.65~~ k	Vr =	1.05 k	
(south)	w (live) =	295 plf	M =	0.50 k-ft	Mr =	0.65 k-ft	
U4	L =	3.08 ft	EI (total) =	5.52E+06 lb-in2	EI =	1.39E+07 lb-in2	
	floor =	7.39 ft	EI (live) =	5.83E+06 lb-in2	d (total) =	0.06 in = L/	604
	roof =	0.00 ft			d (live) =	0.04 in = L/	859
	wall =	4.00 ft					
					use	**(2)2x4**	

location	criteria		demand		capacity		
				0.17 k			
guest	w (total) =	107 plf	V =	~~0.20~~ k	Vr =	1.05 k	
(south)	w (live) =	27 plf	M =	0.19 k-ft	Mr =	0.65 k-ft	
U5	L =	3.75 ft	EI (total) =	2.53E+06 lb-in2	EI =	1.39E+07 lb-in2	
	floor =	0.67 ft	EI (live) =	9.49E+05 lb-in2	d (total) =	0.03 in = L/	1318
	roof =	0.00 ft			d (live) =	0.01 in = L/	5272
	wall =	8.00 ft					
					use	**(2)2x4**	

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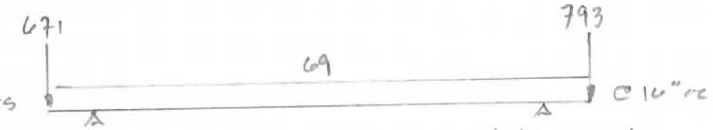
LEVEL TWO

U6 EX. JOISTS D+S+L



ROOF 447 539
WALL 56 56
503 595
plf plf

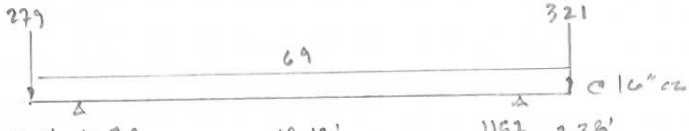
$V = 0.96$ $V_R = 2.33$

$M = -2.08, +1.33$ $M_R = 3.03$

$\Delta_{TL} = 0.21'' = \frac{L}{1095}$

USE EX. 2x12 @ 16" oc

U6 EX. JOISTS NO SNOW



ROOF 153 184
WALL 56 56
209 240
plf plf

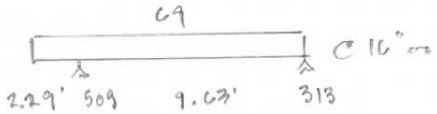
$V = 0.67$ $V_R = 2.33$

$M = -0.96, +2.31$ $M_R = 3.03$

$\Delta_{TL} = 0.47'' = \frac{L}{439}$

USE EX. 2x12 @ 16" oc

U7 STAIR JOISTS



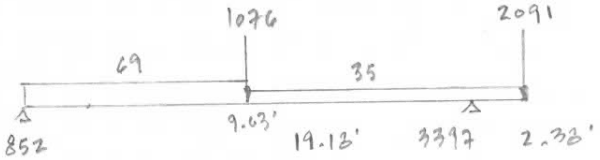
$V = 0.35$ $V_R = 2.33$

$M = 0.71$ $M_R = 3.03$

$\Delta_{TL} = 0.05'' = \frac{L}{2311}$

USE EX. 2x12 @ 16" oc

U8 NORTH SIDE OF STAIR



$V = 2.17$ $V_R = 4.30$

$M = +5.00, -5.03$ $M_R = 9.28$

$\Delta_{TL} = 0.59'' = \frac{L}{390}$

USE LVL $1\frac{3}{4} \times 11\frac{1}{4}$

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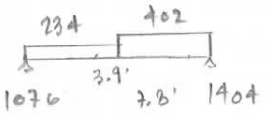
LEVEL TWO

U9 STAIR HEAD



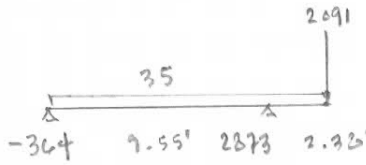
V = 1.40 V_R = 3.38

M = 2.45 M_R = 4.48

Δ_{TL} = 0.06" = $\frac{L}{1700}$

USE (2) 2x12

U10 SOUTH SIDE OF STAIR



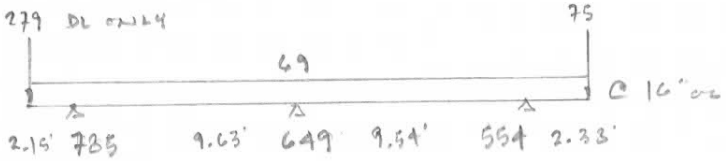
V = 2.17 V_R = 7.30

M = -5.08 M_R = 9.28

Δ_{TL} = 0.20" = $\frac{L}{143}$ vs. $\frac{L}{120}$

USE LVL 1 3/4 x 11 1/4

U11 EX. JOISTS GUEST



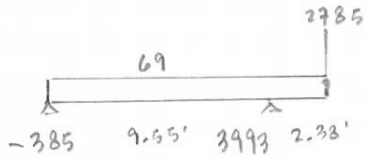
V = 0.36 V_R = 2.33

M = -0.76 M_R = 3.03

Δ_{TL} = 0.02"

USE EX. 2x12 @ 16" o.c.

U12 SIDES OF GUEST



V = 2.95 V_R = 8.60

M = -6.82 M_R = 18.56

Δ_{TL} = 0.13" = $\frac{L}{220}$ vs. $\frac{L}{120}$

USE (2) LVL 1 3/4 x 11 1/4

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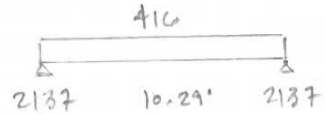
LEVEL TWO

U13 GUEST

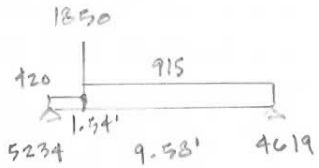


$V = 2.14$ $V_R = 6.43$ USE PSL $3\frac{1}{2} \times 9\frac{1}{2}$

$M = 5.51$ $M_R = 13.06$

$\Delta_{PL} = 0.21" = \frac{L}{588}$

U14 GARAGE (SOUTH)



ROOF	0	444
WALL	36	87
FLOOR	384	384
	420	915

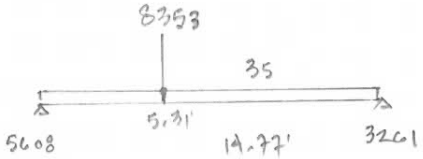
$V = 5.23$ $V_R = 6.43$ USE PSL $3\frac{1}{2} \times 9\frac{1}{2}$

$M = 11.64$ $M_R = 13.06$

$\Delta_{TL} = 0.39" = \frac{L}{295}$

$\Delta_{LL} = 0.11" = \frac{L}{1.028}$

U15 GARAGE (EAST)

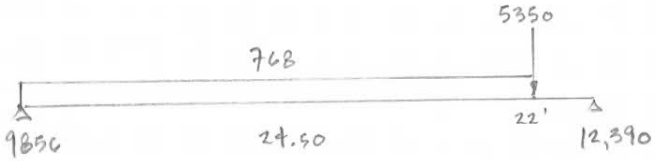


$V = 5.61$ $\ell = 32"$; $F_b = 30.00$ USE W10x22

$M = 28.53$ $M_R = 58.00$

$\Delta_{TL} = 0.26" = \frac{L}{682}$

U16 GARAGE (MIDDLE)



$V = 12.39$ $\ell = 16"$; $F_b = 30.00$ USE W10x54

$M = 63.11$ $M_R = 150.00$

$\Delta_{TL} = 0.79" = \frac{L}{374}$

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LEVEL TWO

WIND BEAM

$q_z = 0.00256\, K_z\, k_{zt}\, K_d\, V^2$

$V = 110$

$K_d = 0.85$

$k_{zt} = 1.222$

$K_z = 0.94$ (25' EXP. C)

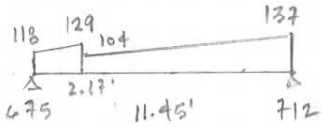
$q_z = 30.24$ psf

$GC_p = 1.40$ (WITHIN $a = 3'$); 1.10

$GC_{pi} = 0.18 \pm$

$p = q_h(GC_p - GC_{pi}) = 47.8$ psf / 38.7 psf (1.0W)

U17 BEAM



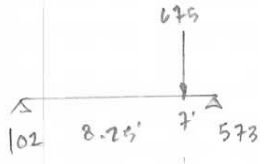
0.6W

$V = 0.71$ $\quad V_R = 12.86$ $\quad$ USE PSL $3\frac{1}{2} \times 11\frac{7}{8}$

$M = 1.94$ $\quad M_R = 9.38$

$\Delta_W = 0.54'' = \frac{L}{241}$ vs. $\frac{L}{240}$

U18 EAST POST

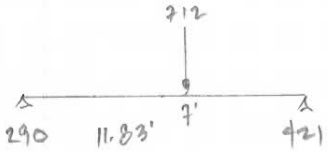


$V = 0.57$ $\quad V_R = 2.35$ $\quad$ USE 4x4

$M = 0.71$ $\quad M_R = 1.42$

$\Delta_W = 0.29'' = \frac{L}{341}$ vs. $\frac{L}{240}$

U19 WEST POST



$V = 0.42$ $\quad V_R = 3.70$ $\quad$ USE 4x6

$M = 1.99$ $\quad M_R = 3.06$

$\Delta_W = 0.49'' = \frac{L}{290}$ vs. $\frac{L}{240}$

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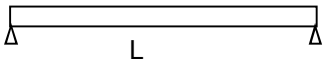
BEAMS (SIMPLE SPAN UNIFORM LOAD)

DECK



(deck)
total load = 67 psf
live load = 60 psf

location	criteria		demand		capacity		
				0.30 k			
joist	w (total) =	89 plf	V =	~~0.32~~ k	Vr =	1.39 k	
U20	w (live) =	80 plf	M =	0.59 k-ft	Mr =	1.92 k-ft	
	L =	7.24 ft	EI (total) =	1.53E+07 lb-in2	EI =	1.29E+08 lb-in2	
	trib. =	1.33 ft	EI (live) =	2.05E+07 lb-in2	d (total) =	0.04 in = L/	2023
					d (live) =	0.04 in = L/	2259
					use	**2x10 @ 16"oc Hem-Fir No. 2**	

location	criteria		demand		capacity		
				1.24 k			
rim	w (total) =	243 plf	V =	~~1.31~~ k	Vr =	3.24 k	
U21	w (live) =	217 plf	M =	3.52 k-ft	Mr =	4.24 k-ft	
	L =	10.77 ft	EI (total) =	1.36E+08 lb-in2	EI =	3.00E+08 lb-in2	
	trib. =	3.62 ft	EI (live) =	1.83E+08 lb-in2	d (total) =	0.24 in = L/	528
					d (live) =	0.22 in = L/	590
					use	**4x10 Hem-Fir No. 2**	

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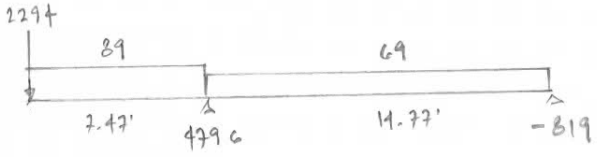
DECK

U22 MIDDLE

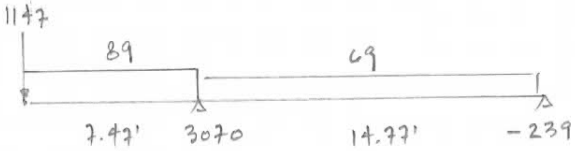


$V = 2.96$ $\quad \ell = 90'' ; \ F_b = 29.0C$ $\quad$ USE W8×24

$M = -19.62$ $\quad M_R = 50.61$

$\Delta_{TL} = 0.72'' = \frac{L}{124}$ VS $\frac{L}{120}$ CANT.

U23 EDGES



$V = 1.81$ $\quad \ell = 90'' ; \ F_b = 20.8C$ $\quad$ USE W8×15

$M = -11.05$ $\quad M_R = 20.51$

$\Delta_{TL} = 0.66'' = \frac{L}{136}$ VS $\frac{L}{120}$ CANT.

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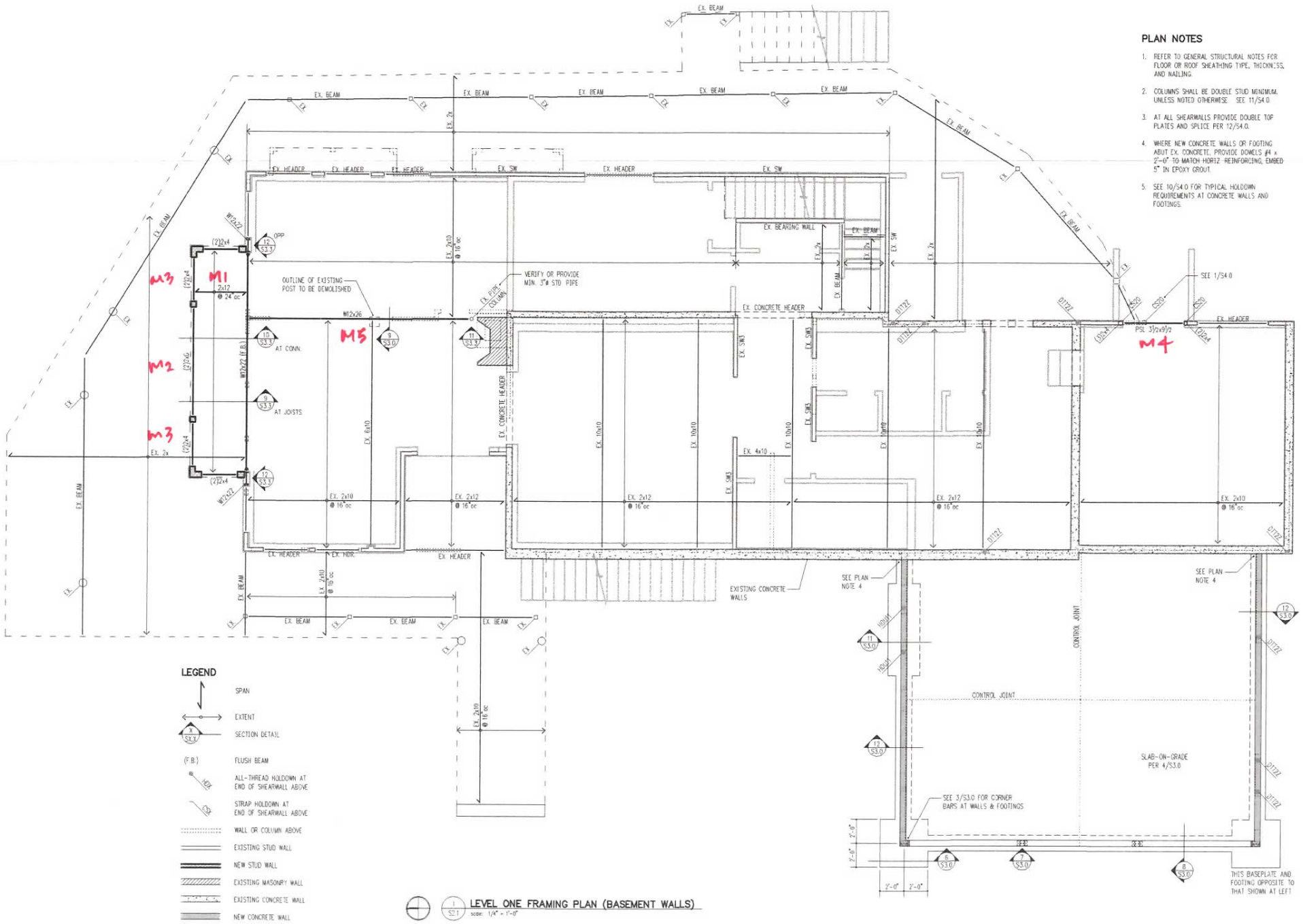
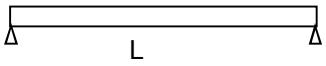

PLAN NOTES
1. REFER TO GENERAL STRUCTURAL NOTES FOR FLOOR OR ROOF SHEATHING TYPE, THICKNESS, AND NAILING.
2. COLUMNS SHALL BE DOUBLE STUD MINIMUM, UNLESS NOTED OTHERWISE. SEE 11/S4.0.
3. AT ALL SHEARWALLS PROVIDE DOUBLE TOP PLATES AND SPLICE PER 12/S4.0.
4. WHERE NEW CONCRETE WALLS OR FOOTING ABUT EX. CONCRETE, PROVIDE DOWELS #4 x 2'-0" TO MATCH HOR12 REINFORCING, EMBED 5" IN EPOXY GROUT.
5. SEE 10/S4.0 FOR TYPICAL HOLDOWN REQUIREMENTS AT CONCRETE WALLS AND FOOTINGS.
M1
M2
M3
M4
M5
EX. BEAM
EX. HEADER
EX. SW
EX. BEARING WALL
EX. CONCRETE HEADER
OUTLINE OF EXISTING POST TO BE DEMOLISHED
VERIFY OR PROVIDE MIN. 3"ø STD PIPE
EX. PIPE COLUMN
AT CONN.
AT JOISTS
EX. 2x10 @ 16" oc
EX. 2x12 @ 16" oc
EX. 10x10
EX. 4x10
EX. 6x10
EX. HDR.
EXISTING CONCRETE WALLS
SEE PLAN NOTE 4
CONTROL JOINT
SLAB-ON-GRADE PER 4/S3.0
SEE 3/S3.0 FOR CORNER BARS AT WALLS & FOOTINGS
THIS BASEPLATE AND FOOTING OPPOSITE TO THAT SHOWN AT LEFT
SEE 1/S4.0
PSL 3½x9½
LEGEND
SPAN
EXTENT
SECTION DETAIL
(F.B.) FLUSH BEAM
ALL-THREAD HOLDOWN AT END OF SHEARWALL ABOVE
STRAP HOLDOWN AT END OF SHEARWALL ABOVE
WALL OR COLUMN ABOVE
EXISTING STUD WALL
NEW STUD WALL
EXISTING MASONRY WALL
EXISTING CONCRETE WALL
NEW CONCRETE WALL
LEVEL ONE FRAMING PLAN (BASEMENT WALLS)
scale: 1/4" = 1'-0"

BEAMS (SIMPLE SPAN UNIFORM LOAD)

LOW ROOF



(snow)
total load = 38 psf
live load = 25 psf

location	criteria		demand		capacity		
				0.15 k			
rec. rm.	w (total) =	76 plf	V =	~~0.17~~ k	Vr =	1.21 k	
joist	w (live) =	50 plf	M =	0.19 k-ft	Mr =	0.86 k-ft	
M1	L =	4.52 ft	EI (total) =	3.16E+06 lb-in2	EI =	1.39E+07 lb-in2	
	trib. =	2.00 ft	EI (live) =	3.12E+06 lb-in2	d (total) =	0.05 in = L/	1056
					d (live) =	0.03 in = L/	1606
					use	**(2)2x4**	

location	criteria		demand		capacity		
				0.38 k			
rec. rm	w (total) =	86 plf	V =	~~0.40~~ k	Vr =	1.90 k	
longer	w (live) =	57 plf	M =	0.95 k-ft	Mr =	1.84 k-ft	
M2	L =	9.42 ft	EI (total) =	3.23E+07 lb-in2	EI =	5.41E+07 lb-in2	
	trib. =	2.26 ft	EI (live) =	3.19E+07 lb-in2	d (total) =	0.28 in = L/	402
					d (live) =	0.19 in = L/	611
					use	**(2)2x6**	

location	criteria		demand		capacity		
				0.15 k			
rec. rm.	w (total) =	86 plf	V =	~~0.17~~ k	Vr =	1.21 k	
shorter	w (live) =	57 plf	M =	0.17 k-ft	Mr =	0.86 k-ft	
M3	L =	3.97 ft	EI (total) =	2.42E+06 lb-in2	EI =	1.39E+07 lb-in2	
	trib. =	2.26 ft	EI (live) =	2.39E+06 lb-in2	d (total) =	0.03 in = L/	1380
					d (live) =	0.02 in = L/	2097
					use	**(2)2x4**	

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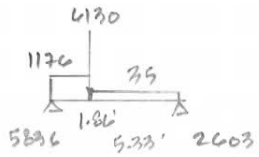
LEVEL ONE

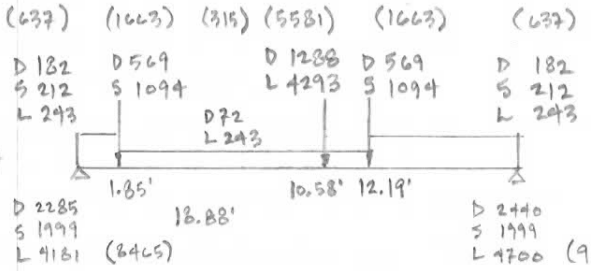
M4 STORAGE



$V = 5.34$ $V_R = 6.43$ USE PSL $3\frac{1}{2} \times 9\frac{1}{2}$

$M = 8.81$ $M_R = 13.06$ $\Delta_{TL} = 0.07''$

M5 REPLACE EX. 4×14



$V = 9.14$ $\ell = 16''$; $F_b = 30.00$ USE W12×26

$M = 51.09$ $M_R = 83.50$

$\Delta_{TL} = 0.50'' = \frac{L}{452}$

$\Delta_{LL} = 0.29'' = \frac{L}{781}$

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WOOD COLUMN

4x OR 6x

Species: DF #2
Size: 4x

Fc* = 1300 psi Fc ⊥ = 405 psi << sill plate is
E = 1.60E+06 psi Hem-Fir
c' = 0.8
d = 3.5 in
KcE = 0.3

le (ft)	le (in)	FcE (psi)	F'c (psi)	4x4 Pa (lb)	4x6 Pa (lb)	
Pa (perp)				4961	7796	
8.00	96.00	638	555	6802	10688	<< crushing governs
8.50	102.00	565	502	6150	9664	up to a height of
9.00	108.00	504	455	5575	8760	9'-7" w/ Hem-Fir
9.50	114.00	452	414	5069	7966	(7'-5" if Doug-Fir)
10.00	120.00	408	377	4624	7266	
10.50	126.00	370	345	4231	6649	
11.00	132.00	337	317	3883	6103	
11.50	138.00	309	292	3575	5618	
12.00	144.00	284	269	3301	5187	

Species: DF #1
Size: 6x

Fc* = 925 psi Fc ⊥ = 405 psi << sill plate is
E = 1.60E+06 psi Hem-Fir
c' = 0.8
d = 5.5 in
KcE = 0.3

le (ft)	le (in)	FcE (psi)	F'c (psi)	6x6 Pa (lb)	4x6 Pa (lb)	
Pa (perp)				12251	7796	
8.00	96.00	1576	775	23443	14918	<< crushing governs
8.50	102.00	1396	750	22701	14446	up to a height of
9.00	108.00	1245	724	21897	13934	14'-8" w/ Hem-Fir
9.50	114.00	1117	696	21041	13389	(10'-8" if Doug-Fir)
10.00	120.00	1008	666	20145	12819	
10.50	126.00	915	636	19225	12234	
11.00	132.00	833	605	18296	11643	
11.50	138.00	762	574	17373	11056	
12.00	144.00	700	544	16470	10481	

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WOOD COLUMN

MULTI-STUD

Species: HF stand.
Size: 2x4

Fc* = 1300 psi Fc ⊥ = 405 psi << sill plate is Hem-Fir
E = 1.20E+06 psi
c' = 0.8
d = 3.5 in
KcE = 0.3

le (ft)	le (in)	FcE (psi)	F'c (psi)	(2)2x4 Pa (lb)	(3)2x4 Pa (lb)	(4)2x4 Pa (lb)	(5)2x4 Pa (lb)	
Pa (perp)				4253	6379	8505	10631	
8.00	96.00	479	435	4566	6848	9131	11414	<< crushing governs
8.50	102.00	424	390	4099	6148	8198	10247	up to a height of
9.00	108.00	378	352	3696	5543	7391	9239	8'-4" w/ Hem-Fir
9.50	114.00	339	319	3346	5019	6691	8364	(6'-5" if Doug-Fir)
10.00	120.00	306	290	3041	4562	6083	7603	
10.50	126.00	278	264	2775	4163	5550	6938	
11.00	132.00	253	242	2541	3812	5083	6353	
11.50	138.00	232	222	2335	3503	4670	5838	
12.00	144.00	213	205	2152	3229	4305	5381	

Species: HF stud
Size: 2x6

Fc* = 800 psi Fc ⊥ = 405 psi << sill plate is Hem-Fir
E = 1.20E+06 psi
c' = 0.8
d = 5.5 in
KcE = 0.3

le (ft)	le (in)	FcE (psi)	F'c (psi)	(2)2x6 Pa (lb)	(3)2x6 Pa (lb)	(4)2x6 Pa (lb)	(5)2x6 Pa (lb)	
Pa (perp)				6683	10024	13365	16706	
8.00	96.00	1182	645	10642	15963	21284	26605	<< crushing governs
8.50	102.00	1047	620	10229	15343	20457	25572	up to a height of
9.00	108.00	934	593	9788	14683	19577	24471	12'-5" w/ Hem-Fir
9.50	114.00	838	565	9329	13994	18658	23323	(8'-5" if Doug-Fir)
10.00	120.00	756	537	8860	13290	17720	22151	
10.50	126.00	686	509	8390	12586	16781	20976	
11.00	132.00	625	480	7928	11892	15856	19820	
11.50	138.00	572	453	7479	11219	14959	18699	
12.00	144.00	525	427	7049	10574	14099	17624	

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SECTION 2: LATERAL

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CRITERIA

LATERAL

wind	wind importance factor	1.0		
	basic wind speed	110	mph	
	wind exposure	C		
	topographical factor (Kzt)	1.22		
seismic	seismic importance factor	1.0		
	latitude	47.553	°	
	longitude	-122.228	°	
	accel. at short periods (Ss)	1.457	g	(from SEAOC Design Tool)
	accel. at 1-sec period (S1)	0.505	g	
	seismic design category	D		
	response modification factor (R)	6.5		

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.h = 1254 ft
H = 320 ft
x = 1322 ft
z = 209 ft

H / Lh = 0.255
K1 = 0.215

x / Lh = 1.054
K2 = 0.737

z / Lh = 0.167
K3 = 0.666

$Kzt = (1+K1\ K2\ K3)^2$

Kzt = 1.222

This site is 1186 east of the water.

This site is exposure C because it is not B or D.

It is not B because roughness B does not prevail at least 1500 ft upwind.

It is not D because the site is not within 600 ft of an exposure D condition.

SEISMIC DESIGN

this distribution is for the new addition and south part of house

ASCE 7-10
Equivalent Lateral Force Procedure

Occupancy Category	II		Table 1-1
Seismic Design Category	D		Table 11.6-1
Importance Factor	1.00		Table 11.5-1
Site Class	D		Table 20.3-1
S_S	145.70	%g	(from USGS Seismic Hazard Curves, 2002 data)
S_1	50.50	%g	(from USGS Seismic Hazard Curves, 2002 data)
F_a	1.00		Table 11.4-1
F_v	1.50		Table 11.4-2
C_t	0.02		Table 12.8-2
x	0.75		Table 12.8-2
h_n	20.00	feet	(height to highest level)
$S_{MS} = Fa*Ss$	1.4570		Eq. 11.4-1
$S_{M1} = Fv*S1$	0.7575		Eq. 11.4-2
$S_{DS} = (2/3)*S_{MS}$	0.9713	g	Eq. 11.4-3
$S_{D1} = (2/3)*S_{M1}$	0.5050	g	Eq. 11.4-4
Period $T_a = C_t*h_n\text{^}x$	0.1891	s	Eq. 12.8-7
T_o	0.1040	s	per section 11.4.5
T_S	0.5199	s	per section 11.4.5
S_a	0.9713	g	per section 11.4.5
R	6.5		Table 12.2-1
Ωo	3		Table 12.2-1
C_d	4		Table 12.2-1
Section 9.5.5 ok?	Yes		Table 12.6-1

Equivalent Lateral Force Procedure (section 12.8)

Cs	0.1494		Eq. 12.8-2
W, weight	122,304	lb	per table below
Q_E	18,277	lb	Eq. 12.8-1

Vertical Force Distribution (section 12.8.3)
k = 1.00

Level	Hx	Floor Area	Floor Wt.	Floor Wt.	Wall Length	Wall Wt.	Total Wt.	WxHx	Cvx	(LRFD) Q_E	(ASD) $0.7Q_E$
	(ft)	(ft2)	(psf)	(k)	(ft)	(k)	(k)	(k-ft)	(%)	(k)	(k)
ex. roof	17.00	1587	13	20.6	164	5.9	26.5	451.1	28.5	5.22	3.653
new roof	20.00	1027	13	13.4	105	3.8	17.1	342.6	21.7	3.96	2.774
ex. low roof	11.50	1882	13	24.5	172	7.0	31.4	361.5	22.9	4.18	2.927
ex. level two	9.00	1235	12	14.8	160	12.2	27.1	243.5	15.4	2.82	1.972
new level two	9.00	759	12	9.1	129	9.9	19.0	170.8	10.8	1.98	1.383
new deck	9.00	167	7	1.2	0	0.0	1.2	10.5	0.7	0.12	0.085
							122.3	1580.0	100.0	18.28	12.79

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SEISMIC DESIGN

this distribution is for the existing lower north part

ASCE 7-10
Equivalent Lateral Force Procedure

Occupancy Category	II		Table 1-1
Seismic Design Category	D		Table 11.6-1
Importance Factor	1.00		Table 11.5-1
Site Class	D		Table 20.3-1
S_S	145.70	%g	(from USGS Seismic Hazard Curves, 2002 data)
S_1	50.50	%g	(from USGS Seismic Hazard Curves, 2002 data)
F_a	1.00		Table 11.4-1
F_v	1.50		Table 11.4-2
C_t	0.02		Table 12.8-2
x	0.75		Table 12.8-2
h_n	20.00	feet	(height to highest level)

$S_{MS} = Fa*Ss$	1.4570		Eq. 11.4-1
$S_{M1} = Fv*S1$	0.7575		Eq. 11.4-2
$S_{DS} = (2/3)*S_{MS}$	0.9713	g	Eq. 11.4-3
$S_{D1} = (2/3)*S_{M1}$	0.5050	g	Eq. 11.4-4
Period $T_a = C_t*h_n\text{^}x$	0.1891	s	Eq. 12.8-7
T_o	0.1040	s	per section 11.4.5
T_S	0.5199	s	per section 11.4.5
S_a	0.9713	g	per section 11.4.5

R	6.5	Table 12.2-1
Ωo	3	Table 12.2-1
C_d	4	Table 12.2-1
Section 9.5.5 ok?	Yes	Table 12.6-1

Equivalent Lateral Force Procedure (section 12.8)

Cs	0.1494		Eq. 12.8-2
W, weight	31,790	lb	per table below
Q_E	4,751	lb	Eq. 12.8-1

Vertical Force Distribution (section 12.8.3)
k = 1.00

Level	Hx	Floor Area	Floor Wt.	Floor Wt.	Wall Length	Wall Wt.	Total Wt.	WxHx	Cvx	(LRFD) Q_E	(ASD) $0.7Q_E$
	(ft)	(ft2)	(psf)	(k)	(ft)	(k)	(k)	(k-ft)	(%)	(k)	(k)
ex. low roof	23.25	612	13	8.0	54	2.4	10.4	241.5	49.6	2.35	1.648
ex. level two	11.75	351	12	4.2	54	5.1	9.3	109.5	22.5	1.07	0.747
ex. deck	11.75	827	12	9.9	35	0.0	9.9	116.6	23.9	1.14	0.796
new sub-roof	9.13	89	13	1.2	28	1.0	2.2	19.8	4.1	0.19	0.135
							31.8	487.3	100.0	4.75	3.325

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WIND

$q_z = 0.00256\, K_z K_{zT} K_d V^2$

EXP. C

K_z		q_z	
0.94	25'	30.2	
0.916	22' (=h)	29.5	($= q_h$)
0.90	20'	29.0	
0.85	15'	27.3	

$K_{zT} = 1.222$

$K_d = 0.85$

$V = 110$

N-S WIND

WALLS

WINDW. $C_p = 0.8$ $\quad q_z G C_p = \begin{cases} 20.5 & 25' \\ 19.7 & 20' \\ 18.6 & 15' \end{cases}$

$L/B = 30/50 < 1$

LEEW. $C_p = 0.5$ $\quad q_h G C_p = -12.5$

ROOFS

$A:12 = 18.4°$

$h/L = 20.5/30 = 0.68$ (ADDITION)

WINDW. $C_p = -0.10$ $\quad q_h G C_p = -2.5$

LEEW. $C_p = -0.58$ $\quad q_h G C_p = -14.5$

$h/L = 23.5/58.5 = 0.40$ (OLD PART)

PARALLEL $C_p = -0.9$ $\quad q_h G C_p = -22.6$

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WIND

E-W WIND

WALLS

WINDW. $C_p = 0.8$ $\quad q_z G_f C_p = \begin{cases} 20.5 & 25' \\ 19.7 & 20' \\ 18.6 & 15' \end{cases}$

$L/B = 46/58 < 1$

LEEW. $C_p = 0.5$ $\quad q_h G_f C_p = -12.5$

ROOFS

$4:12 = 18.4°$

$h/L = 23.5/46.5 = 0.50$

WINDW. $C_p = -0.06$ $\quad q_h G_f C_p = -1.5$

LEEW. $C_p = -0.57$ $\quad q_h G_f C_p = -14.3$

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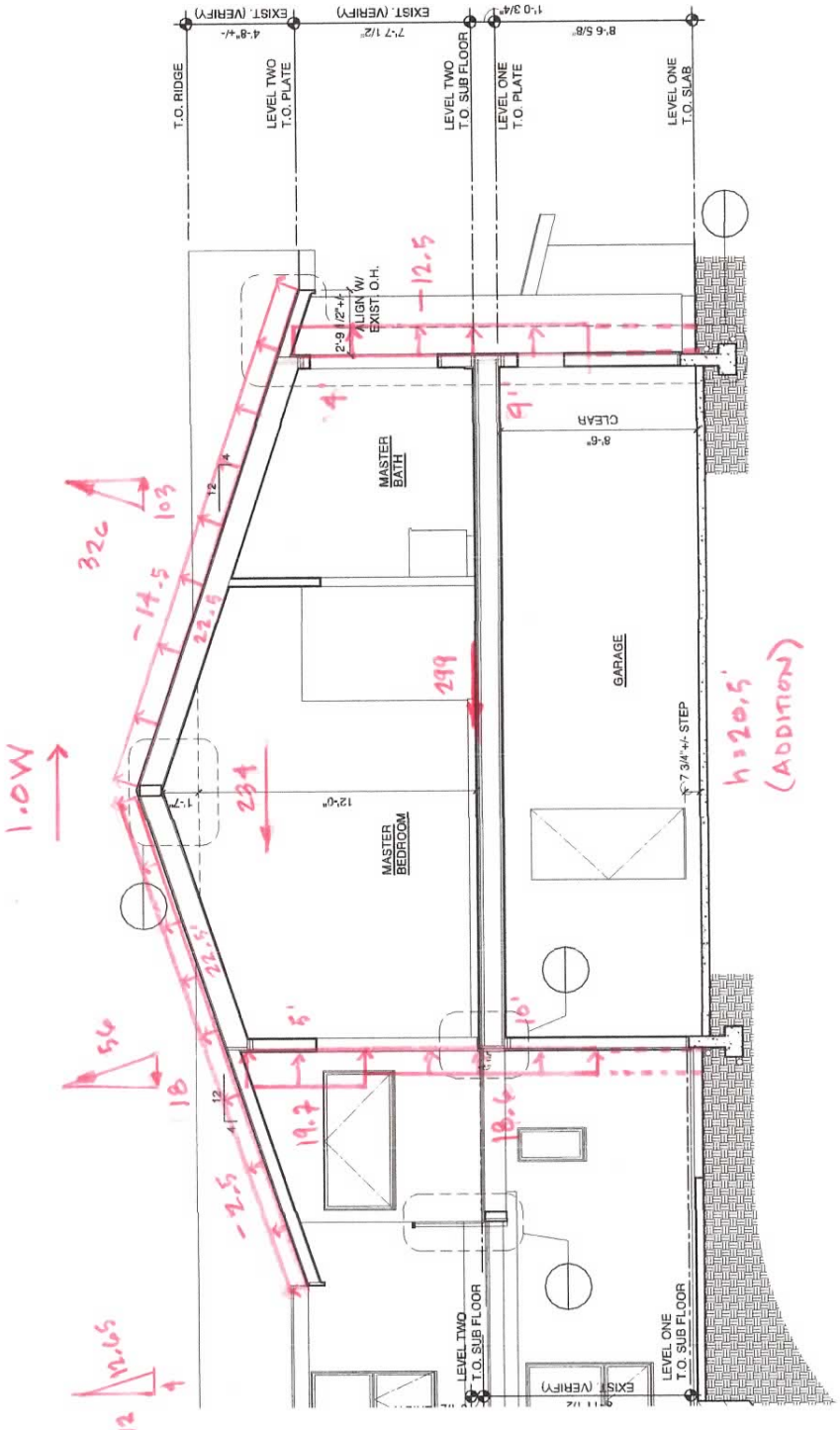
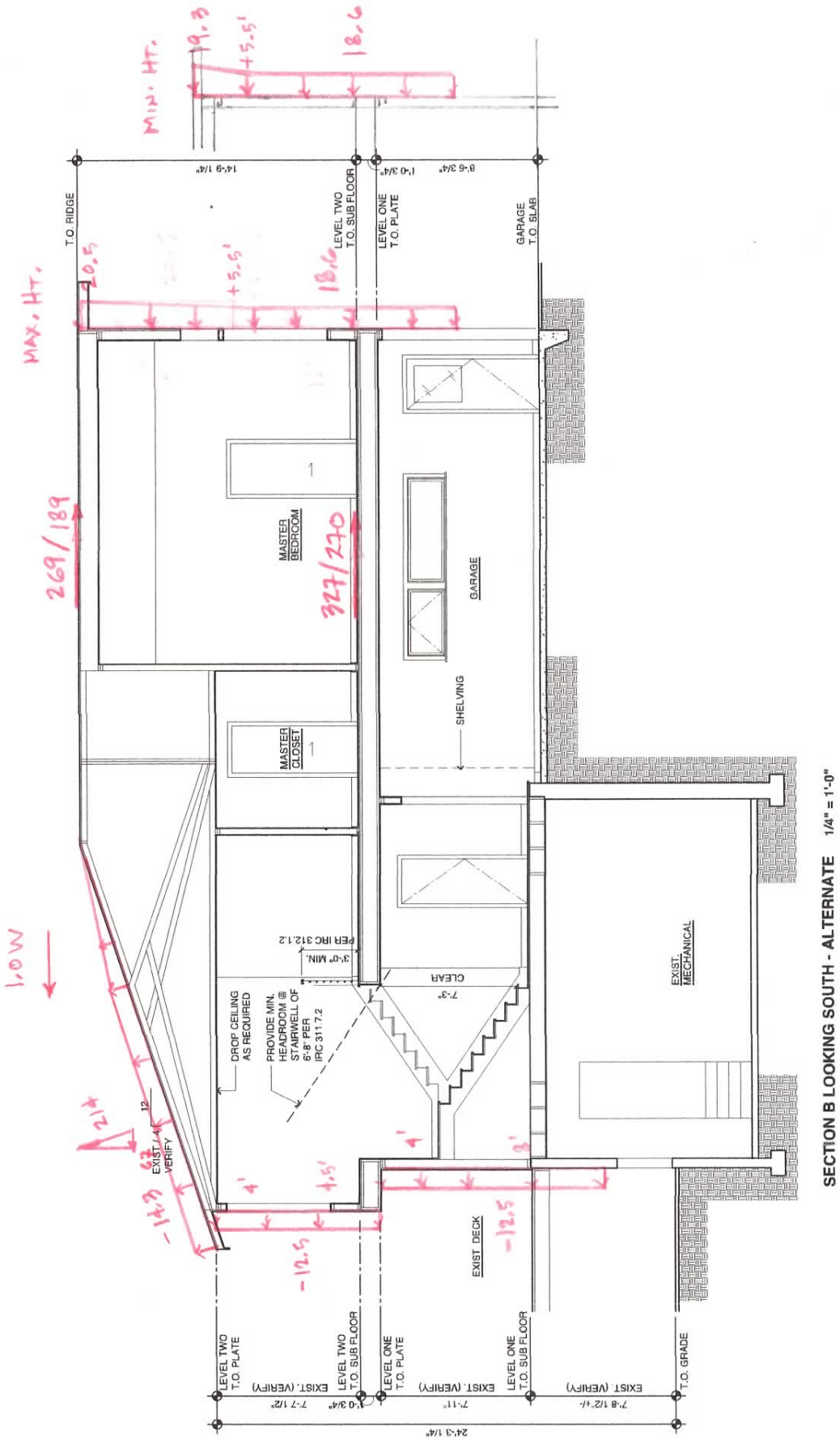
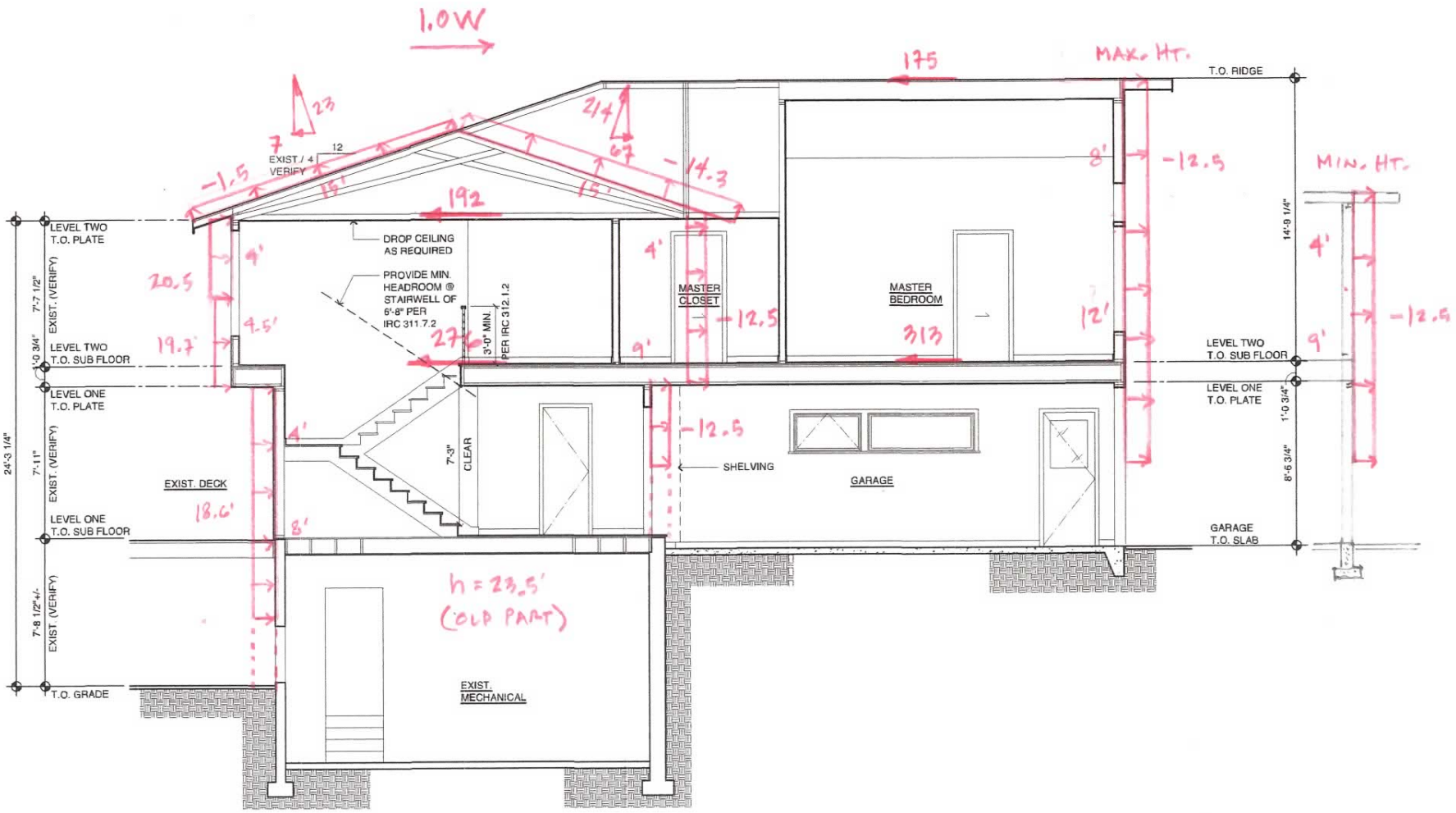
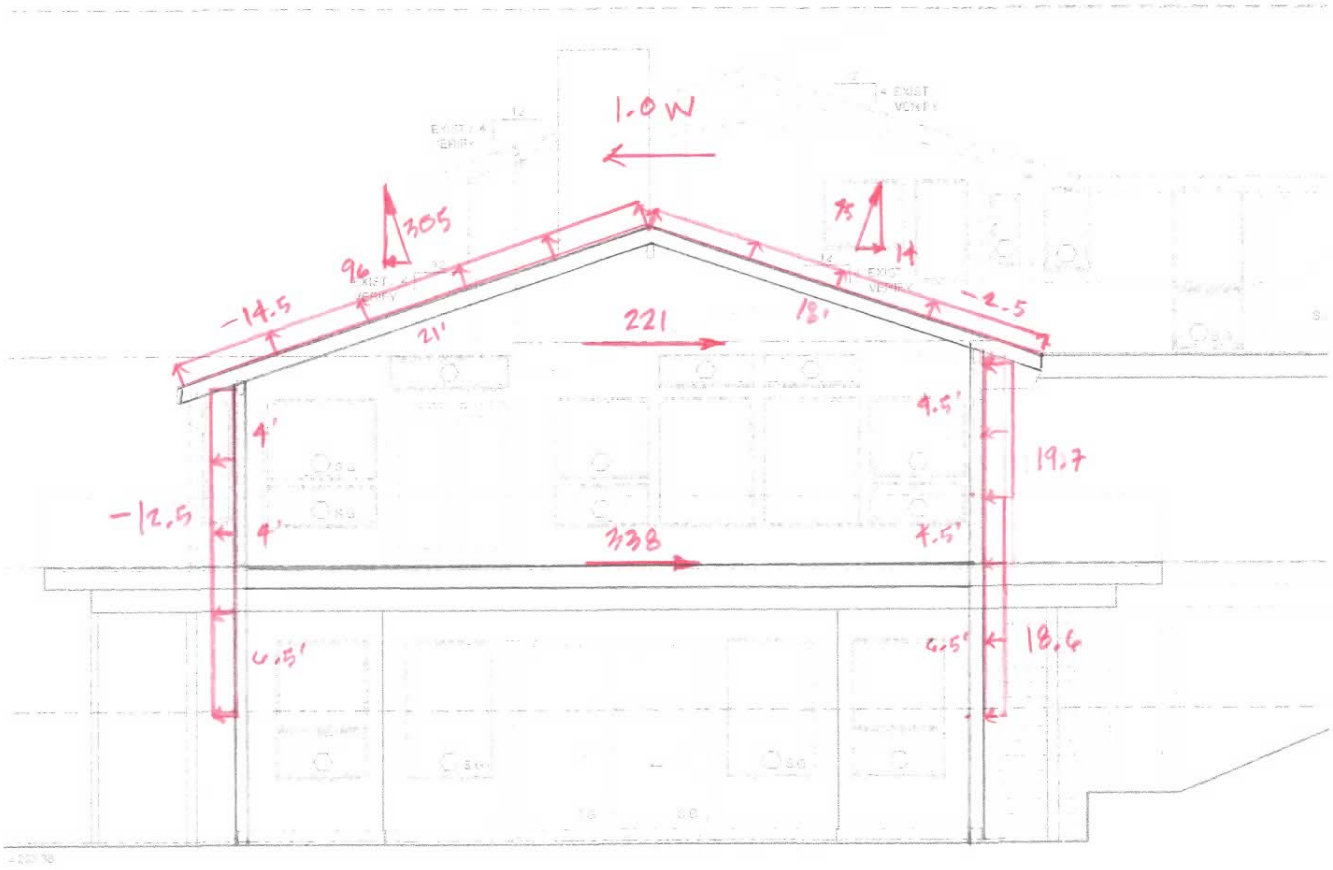

T.O. RIDGE
LEVEL TWO T.O. PLATE
LEVEL TWO T.O. SUB FLOOR
LEVEL ONE T.O. PLATE
LEVEL ONE T.O. SLAB
EXIST. (VERIFY)
EXIST. (VERIFY)
1'-0 3/4"
4'-8"+/-
7'-7 1/2"
8'-6 5/8"
ALIGN W/ EXIST. O.H.
2'-9 1/2"+/-
12.5
4'
9'
CLEAR
8'-6"
MASTER BATH
MASTER BEDROOM
GARAGE
7 3/4"+/- STEP
12'-0"
1'-7"
1.0W
23.4
19.9
h=20.5' (ADDITION)
32c
103
12
14.5
22.6
22.5'
5c
10
19.2
18.6
5'
10'
12.5
12.65
LEVEL TWO T.O. SUB FLOOR
LEVEL ONE T.O. SUB FLOOR
EXIST. (VERIFY)



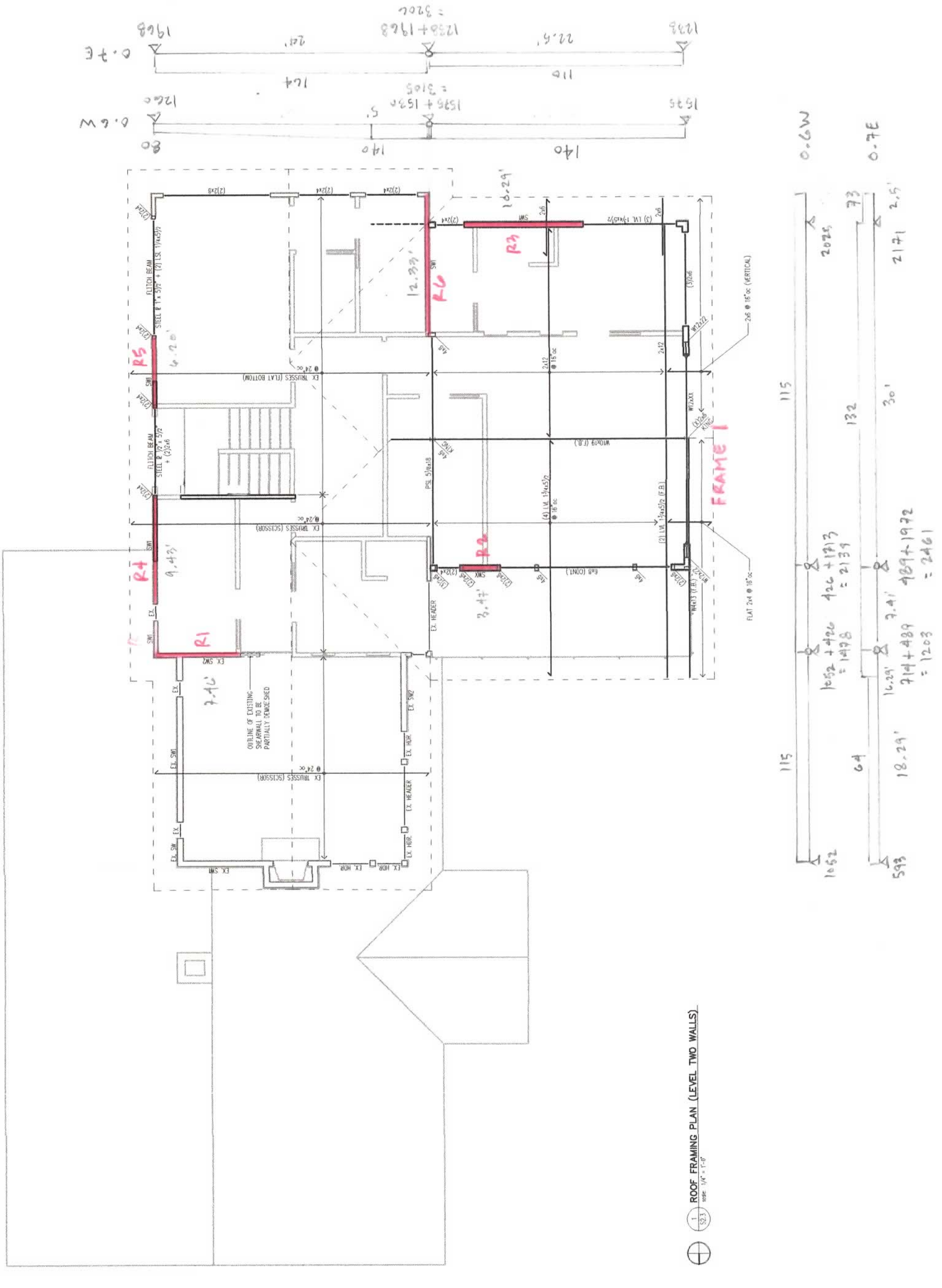
SECTION B LOOKING SOUTH - ALTERNATE 1/4" = 1'-0"



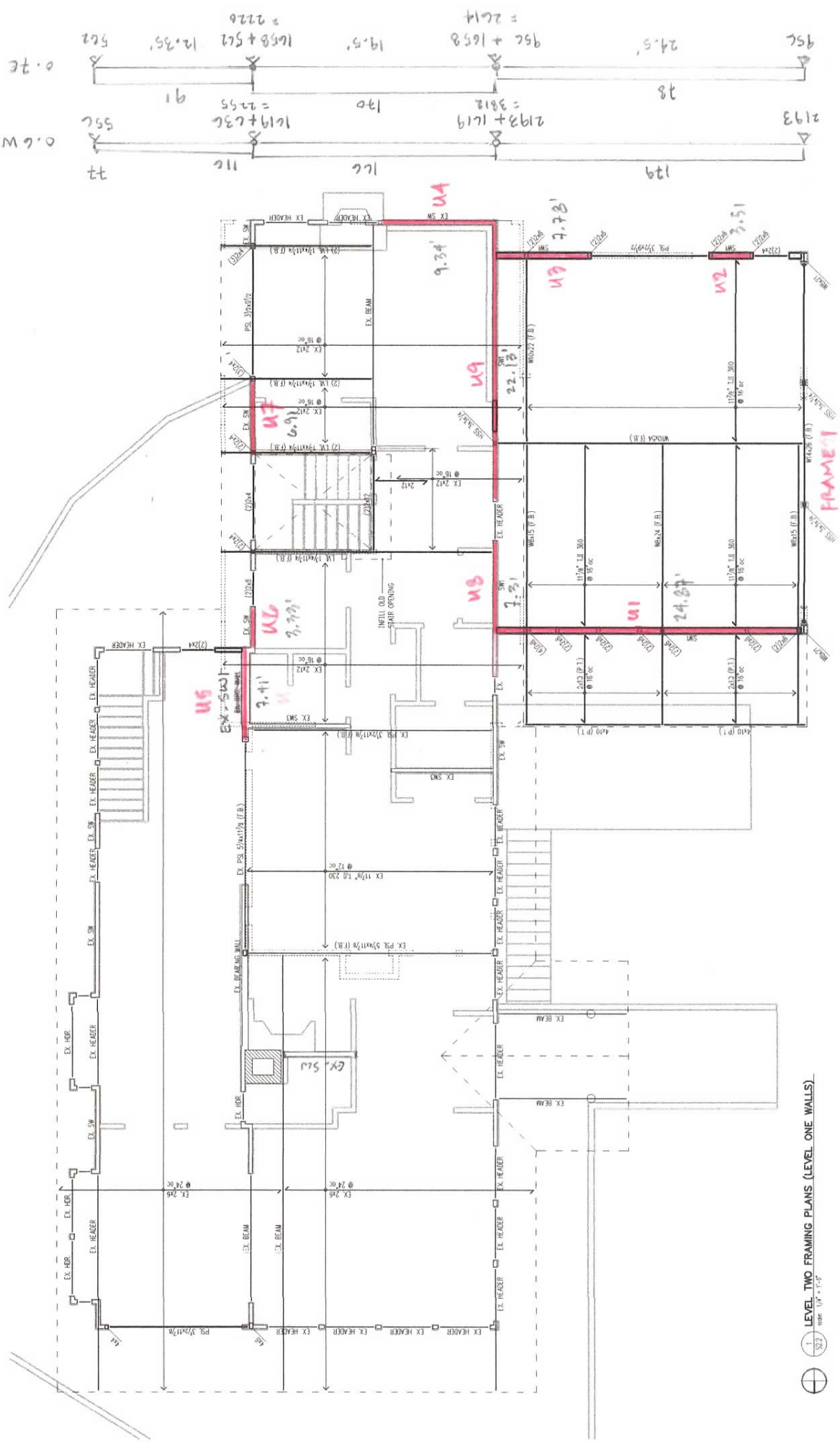
SECTION B LOOKING SOUTH - ALTERNATE 1/4" = 1'-0"



NORTH ELEVATION 1/4" = 1'-0"



ROOF FRAMING PLAN (LEVEL TWO WALLS)
scale: 1/4" = 1'-0"


U1
U2
U3
U4
U5
U6
U7
U8
U9
FRAME 1
EX. HEADER
EX. BEAM
EX. SW
EX. HDR
EX. BEARING WALL
EX. SLD
INFILL OLD STAIR OPENING
LEVEL TWO FRAMING PLANS (LEVEL ONE WALLS)

LATERAL FORCE DISTRIBUTION (SEISMIC)

WALLS BELOW ROOF

East-West

va' = allowable shear values multiplied by 1.25-0.125 h / L
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
R1	1203	0	1203	5.03	239	SW2	8.46	1.68	N/A	10175	2023	0	2023	420	1603	(2)CS16	538	2561	(2)2x4
											2023	0	2023	458	1565	(2)CS16	169	2192	(2)2x4 (EX)
R2	2461	0	2461	3.47	709	SW5	10.00	2.88	810	24610	7092	0	7092	583	6509	CMST12	81	7173	(3)2x6
											7092	0	7092	583	6509	CMST12	833	7925	(3)2x6
R3	2171	0	2171	10.29	211	SW1	7.61	0.74	N/A	16531	1607	0	1607	1216	391	CS20	1850	3457	(2)2x6
											1607	0	1607	846	761	CS20	611	2218	2x6

rho = 1.00

North-South

va' = allowable shear values multiplied by 2w/h
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
R4	1187	0	1187	9.43	126	SW1	7.61	0.81	N/A	9041	959	0	959	1004	-45	none	458	1417	(2)2x4
											959	0	959	1284	-326	none	2091	3050	(2)2x4
R5	781	0	781	6.20	126	SW1	7.61	1.23	N/A	5944	959	0	959	1039	-81	none	2091	3050	(2)2x4
											959	0	959	1229	-270	none	2785	3744	(2)2x4
R6	3206	0	3206	12.33	260	SW2	7.61	0.62	N/A	24412	1980	0	1980	2534	-554	none	8353	10333	4x8
											1980	0	1980	1000	980	CS20	756	2736	(2)2x4

rho = 1.00

LATERAL FORCE DISTRIBUTION (SEISMIC)

WALLS BELOW LEVEL TWO

East-West

va' = allowable shear values multiplied by 1.25-0.125 h / L
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
U1	1603	2461	4064	24.87	163	SW1	7.91	0.32	N/A	32146	1293	990	2282	3928	-1646	none	3070	5352	(2)2x6
											1293	990	2282	3928	-1646	none	0	2282	2x6
U2	231	369	600	3.51	171	SW2	7.91	2.25	881	4747	1352	0	1352	720	632	DTT2Z	647	1999	(2)2x6
											1352	0	1352	1311	41	DTT1Z	5234	6586	(3)2x6
U3	511	819	1330	7.78	171	SW2	7.91	1.02	N/A	10521	1352	465	1817	1796	21	DTT1Z	4619	6436	(3)2x6
											1352	-1142	211	2306	-2095	none	0	1817	2x6
U4	676	1083	1759	10.29	171	SW2	7.91	0.77	N/A	13915	1352	0	1352	1005	347	DTT2Z	1317	2669	(2)2x4
											1352	0	1352	1483	-131	none	4209	5561	(3)2x4

rho = 1.00

North-South

va' = allowable shear values multiplied by 2w/h
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
U5	932	826	1758	7.41	237	SW1	7.91	1.07	N/A	13908	1877	0	1877	2824	-947	none	6358	8235	(3)2x6 (EX)
											1877	0	1877	458	1418	PHD2 (EX)	1643	3520	(2)2x6 (EX)
U6	419	371	790	3.33	237	SW2	7.91	2.38	336	6250	1877	0	1877	997	880	DTT2Z	1643	3520	(2)2x4
											1877	0	1877	837	1039	DTT2Z	1897	3774	(2)2x4
U7	869	770	1640	6.91	237	SW2	7.91	1.14	N/A	12969	1877	1198	3075	1755	1319	DTT2Z	2873	5948	(3)2x4
											1877	1198	3075	2299	776	CS20	6130	9205	(5)2x4
U8	649	796	1445	7.31	198	SW1	7.91	1.08	N/A	11431	1564	0	1564	2586	-1022	none	1455	3019	(2)2x4
											1564	0	1564	1421	143	DTT1Z	586	2150	(2)2x4
U9	1965	2410	4375	22.13	198	SW1	7.91	0.36	N/A	34605	1564	0	1564	3175	-1612	none	586	2150	(2)2x4
											1564	1980	3544	3037	507	DTT1Z	1317	2881	(2)2x4

rho = 1.00

LATERAL FORCE DISTRIBUTION (WIND)

WALLS BELOW ROOF

East-West

va' = allowable shear values multiplied by 1.25-0.125 h / L
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
R1	1478	0	1478	5.03	294	SW2	8.46	1.68	N/A	12501	2485	0	2485	420	2066	(2)CS16	538	3023	(2)2x4
											2485	0	2485	458	2027	(2)CS16	169	2654	(2)2x4 (EX)
R2	2139	0	2139	3.47	616	SW5	10.00	2.88	810	21390	6164	0	6164	583	5581	CMST12	81	6245	(3)2x6
											6164	0	6164	583	5581	CMST12	833	6997	(3)2x6
R3	2025	0	2025	10.29	197	SW1	7.61	0.74	N/A	15420	1498	0	1498	1216	283	CS20	1850	3348	(2)2x6
											1498	0	1498	846	653	CS20	611	2109	2x6

rho = 1.00

North-South

va' = allowable shear values multiplied by 2w/h
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
R4	760	0	760	9.43	81	SW1	7.61	0.81	N/A	5789	614	0	614	1004	-390	none	458	1072	(2)2x4
											614	0	614	1284	-670	none	2091	2705	(2)2x4
R5	500	0	500	6.20	81	SW1	7.61	1.23	N/A	3806	614	0	614	1039	-425	none	2091	2705	(2)2x4
											614	0	614	1229	-615	none	2785	3399	(2)2x4
R6	3105	0	3105	12.33	252	SW2	7.61	0.62	N/A	23643	1918	0	1918	2534	-616	none	8353	10271	4x8
											1918	0	1918	1000	917	CS20	756	2674	(2)2x4

rho = 1.00

LATERAL FORCE DISTRIBUTION (WIND)

WALLS BELOW LEVEL TWO

East-West

va' = allowable shear values multiplied by 1.25-0.125 h / L
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
U1	3814	2139	5953	24.87	239	SW1	7.91	0.32	N/A	47088	1893	860	2753	3928	-1175	none	3070	5823	(2)2x6
											1893	860	2753	3928	-1175	none	0	2753	2x6
U2	587	345	932	3.51	265	SW2	7.91	2.25	881	7368	2099	0	2099	720	1379	DTT2Z	647	2746	(2)2x6
											2099	0	2099	1311	788	DTT1Z	5234	7333	(3)2x6
U3	1301	764	2065	7.78	265	SW2	7.91	1.02	N/A	16332	2099	434	2533	1796	736	DTT1Z	4619	7152	(3)2x6
											2099	-1065	1034	2306	-1272	none	0	2533	2x6
U4	1721	1010	2731	10.29	265	SW2	7.91	0.77	N/A	21601	2099	0	2099	1005	1094	DTT2Z	1317	3416	(2)2x4
											2099	0	2099	1483	616	none	4209	6308	(3)2x4

rho = 1.00

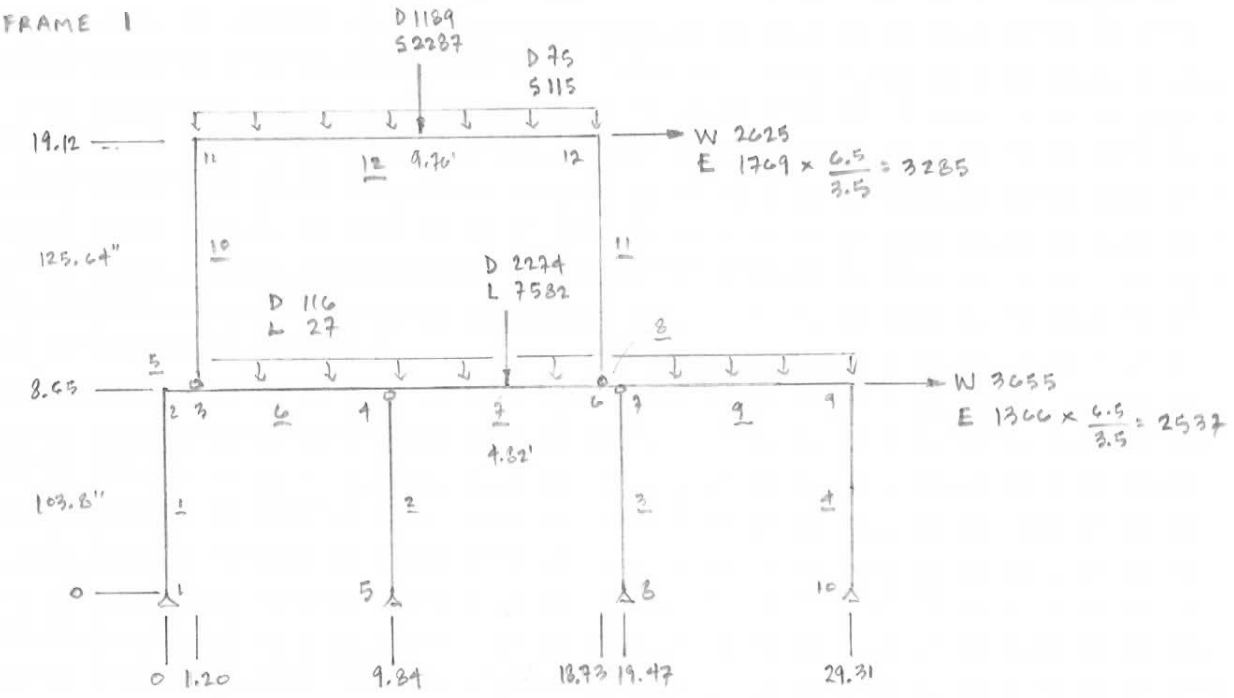
North-South

va' = allowable shear values multiplied by 2w/h
for wall aspect ratios greater than 2:1

WALL	F (lb)	V (abv)	V (total)	L (ft)	v (plf)	SW	h (ft)	h/l	va'	M ot (lbft)	OT (lb)	OT (abv)	OT (total)	DL max (lb)	T (lb)	HD	TL (lb)	C (lb)	POST
U5	947	529	1476	7.41	199	SW1	7.91	1.07	N/A	11673	1575	0	1575	2824	-1249	none	6358	7933	(3)2x6 (EX)
											1575	0	1575	458	1117	PHD2 (EX)	1643	3218	(2)2x6 (EX)
U6	425	238	663	3.33	199	SW2	7.91	2.38	336	5246	1575	0	1575	997	579	DTT2Z	1643	3218	(2)2x4
											1575	0	1575	837	738	DTT2Z	1897	3472	(2)2x4
U7	883	493	1376	6.91	199	SW2	7.91	1.14	N/A	10885	1575	767	2342	1755	587	DTT2Z	2873	5215	(3)2x4
											1575	767	2342	2299	43	CS20	6130	8472	(5)2x4
U8	947	771	1718	7.31	235	SW1	7.91	1.08	N/A	13585	1858	0	1858	2586	-727	none	1455	3313	(2)2x4
											1858	0	1858	1421	438	DTT1Z	586	2444	(2)2x4
U9	2865	2334	5199	22.13	235	SW1	7.91	0.36	N/A	41128	1858	0	1858	3175	-1317	none	586	2444	(2)2x4
											1858	1918	3776	3037	739	DTT1Z	1317	3175	(2)2x4

rho = 1.00

FRAME 1



WIND DRIFT

USE 10-YR MRI 70 mph WIND VS. H/400
ASCE 7-16 COMMENTARY CC.2.2

$\delta_9 = 0.235"$ VS. $\frac{H}{400} = 0.26"$ ✓

$\delta_{12} - \delta_9 = 0.193"$ VS. $0.31"$ ✓

SEISMIC DRIFT

$\Delta_{MAX} = 0.02H$; $C_d = 3$

$\delta_9 = 0.535" \times C_d = 1.61"$ VS. $0.02H = 2.08"$ ✓

$\delta_{12} - \delta_9 = 0.600" \times C_d = 1.80"$ VS. $2.51"$ ✓

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FRAME 1

ROOF BEAM W10X22

$P = 1.33$ $\quad M = 16.41$

$f_a = 0.20$ $\quad f_b = 8.49$

$l = 210''$ $\quad l = 210''$

$F_a = 6.06$ $\quad C_b = 1.75 + 1.05\left(\frac{1.64}{16.41}\right) + 0.3\left(\frac{1.64}{16.41}\right)^2 = 1.86$

$F_b = 16.35$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.03 + 0.52 = 0.55 < 1.00 \checkmark$$

UPPER COL. W10X22

$P = 1.06$ $\quad M = 16.41$

$f_a = 0.62$ $\quad f_b = 8.49$

$l = 125''$ $\quad l = 125''$

$F_a = 16.06$ $\quad C_b = 1.75 + 1.05\left(\frac{0}{16.41}\right) + 0.3\left(\frac{0}{16.41}\right)^2 = 1.75$

$F_b = 26.93$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.04 + 0.32 = 0.36 < 1.00 \checkmark$$

UPPER BEAM W14X26

$P = 1.45$ $\quad M = 12.57$

$f_a = 0.19$ $\quad f_b = 1.27$

$l = 48''$ $\quad l = 48''$

$F_a = 25.26$ $\quad C_b = 1.75$

$C_b = 1.75 + 1.05\left(\frac{6.25}{12.10}\right) + 0.3\left(\frac{6.25}{12.10}\right)^2 = 2.37 \leq 2.30$

$F_b = 30.00$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.01 + 0.14 = 0.15 < 1.00 \checkmark$$

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FRAME 1

LOWER COL. W8×18

$P = 3.75$ $\quad M = 12.57$

$f_a = 0.71$ $\quad f_b = 9.92$

$l = 103''$ $\quad l = 103''$

$F_a = 18.20$ $\quad C_b = 1.75 + 1.05\left(\frac{0}{12.57}\right) + 0.3\left(\frac{0}{12.57}\right) = 1.75$

$F_b = 28.21$

$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.04 + 0.35 = 0.39 < 1.00$ ✓

LOWER COL. W5×19

$P = 3.38$ $\quad M = 5.54$

$f_a = 0.61$ $\quad f_b = 6.52$

$l = 103$ $\quad l = 103$

$F_a = 19.01$ $\quad C_b = 1.75 + 1.05\left(\frac{0}{5.54}\right) + 0.3\left(\frac{0}{5.54}\right)^2 = 1.75$

$F_b = 28.13$

$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.03 + 0.23 = 0.26 < 1.00$ ✓

BASEPLATES

MAX. TENSION & SHEAR $\quad 0.9D \pm E \quad$ (LRFD)

W8×18's

$T_u = 3027$, $V_u = 2026$

W5×19's

$T_u = 0$, $V_u = 902$

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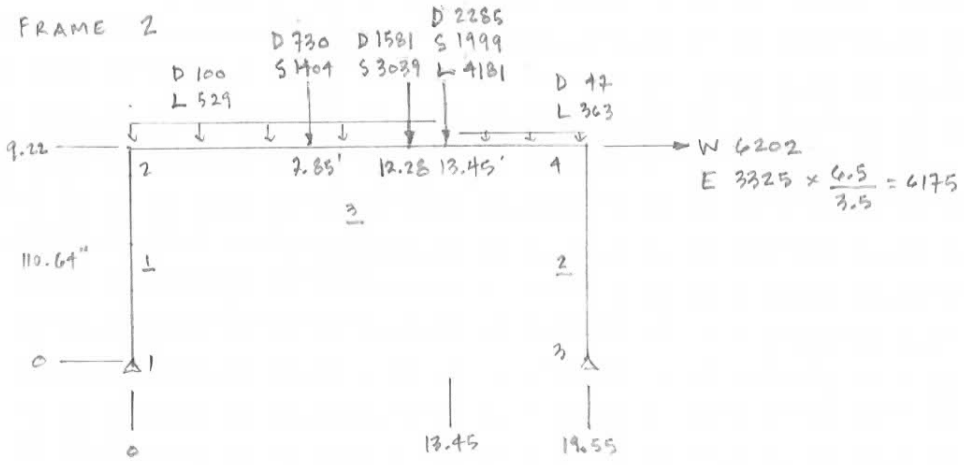
FRAME 2



WIND DRIFT

USE 10-YR MRI 70 mph WIND VS. $H/400$

ASCE 7-16 COMMENTARY CC.2.2

$\delta_1 = 0.268"$ VS. $\frac{H}{400} = 0.277"$ ✓

SEISMIC DRIFT

$\Delta_{MAX} = 0.02H$; $C_d = 3$

$\delta_1 = 0.658" \times C_d = 1.97"$ VS. $0.02H = 2.21"$ ✓

GRAVITY DEFLECTION $D + 0.75L + 0.75S$

$\Delta = 0.312" = \frac{L}{752}$

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FRAME 2

BEAM W12X22

$P = 2.79$ $\quad M = 39.33$

$f_a = 0.43$ $\quad f_b = 18.58$

$l_y = 24''$ $\quad l = 24''$

$l_x = 235''$ ← $\quad C_b = 1.00$

$F_a = 24.66$ $\quad F_b = 30.00$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.02 + 0.62 = 0.64 < 1.00 \checkmark$$

COL. W12X22

$P = 3.64$ $\quad M = 25.73$

$f_a = 0.56$ $\quad f_b = 12.16$

$l = 111''$ $\quad l = 111''$

$F_a = 8.70$ $\quad C_b = 1.75 + 1.05\left(\frac{0}{25.73}\right) + 0.3\left(\frac{0}{25.73}\right)^2 = 1.75$

$F_b = 22.28$

$$\frac{f_a}{F_a} + \frac{f_b}{F_b} = 0.06 + 0.55 = 0.61 < 1.00 \checkmark$$

BASEPLATES

MAX. TENSION & SHEAR $0.9D \pm E$ (LRFD)

$T_u = 514$, $V_u = 2133$ OR $T_u = 0$, $V_u = 4042$

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SECTION 3: FOUNDATION

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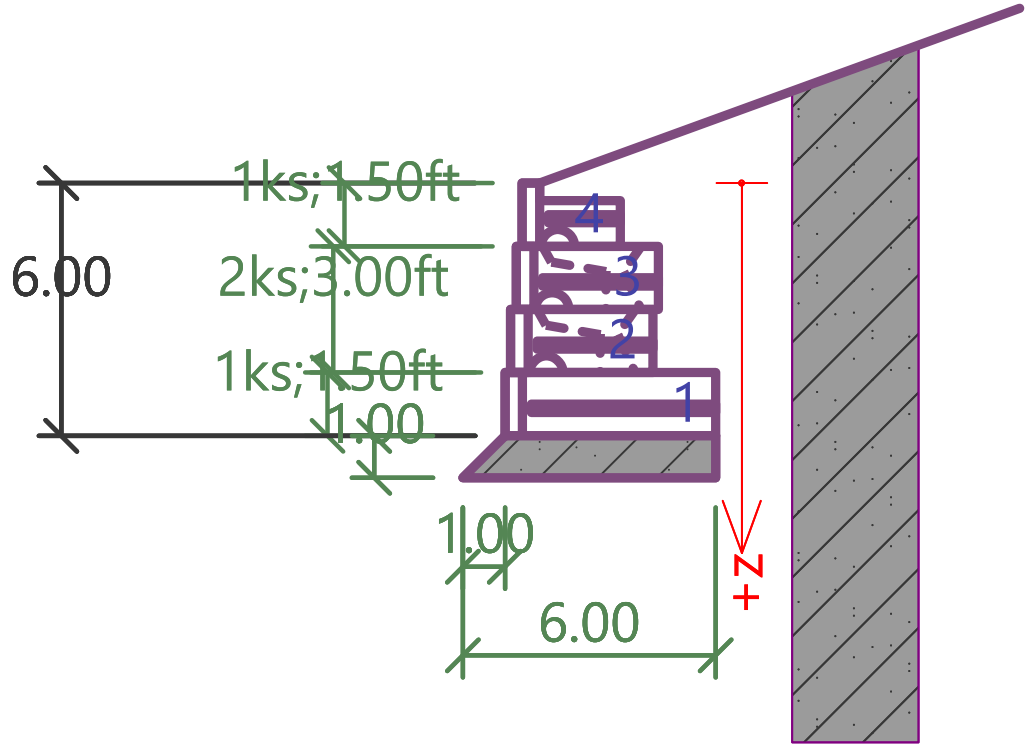
Name : Profile and assignment	Stage : 1



Analysis of Redi Rock wall

Input data

Project

Task : Nader site wall
Customer : Patricia Brennan Architects
Author : Conrad Beymer
Date : 7/16/2020

Settings

USA - Safety factor

Wall analysis

Active earth pressure calculation :	Coulomb
Passive earth pressure calculation :	Mazindrani (Rankine)
Earthquake analysis :	Mononobe-Okabe
Shape of earth wedge :	Calculate as skew
Allowable eccentricity :	0.333
Internal stability :	Standard - straight slip surface
Reduction coeff. of contact first block - base :	1.00
Verification methodology :	Safety factors (ASD)

Safety factors			
Permanent design situation			
Safety factor for overturning :	SF_o =	1.50	[–]
Safety factor for sliding resistance :	SF_s =	1.50	[–]
Safety factor for bearing capacity :	SF_b =	2.00	[–]
Safety factor for sliding along geo-reinforcement :	SF_{sr} =	1.50	[–]
Safety factor for geo-reinforcement strength :	SF_{st} =	1.50	[–]
Safety factor for pull out resistance of geo-reinf. :	SF_{po} =	1.50	[–]
Safety factor for connection strength :	SF_{con} =	1.50	[–]

Blocks

No.	Description	Height h [in]	Width w [in]	Unit weight γ [pcf]
1	Block 28	18.00	28.00	120.00
2	Block 41	18.00	40.50	120.00
3	Block 60	18.00	60.00	130.00
4	Top block 24 straight	18.00	24.00	108.00
5	Planter 41	18.00	40.50	120.00
6	Planter 60	18.00	60.00	112.00
7	Top block 28	18.00	28.00	120.00
8	Top block 41	18.00	40.50	120.00
9	Top block 24 straight garden	18.00	24.00	80.00
10	Block R-5236 HC	36.00	52.00	110.00
11	Block R-7236 HC	36.00	72.00	110.00
12	Block R-9636 HC	36.00	96.00	110.00
13	Block R-41 HC	18.00	40.50	110.00

No.	Description	Min. shear strength F_{min} [lbf/ft]	Max. shear strength F_{max} [lbf/ft]	Friction f [°]
1	Block 28	6061.00	11276.00	44.00
2	Block 41	6061.00	11276.00	44.00
3	Block 60	6061.00	11276.00	44.00
4	Top block 24 straight	6061.00	11276.00	44.00
5	Planter 41	6061.00	11276.00	44.00
6	Planter 60	6061.00	11276.00	44.00
7	Top block 28	6061.00	11276.00	44.00
8	Top block 41	6061.00	11276.00	44.00
9	Top block 24 straight garden	6061.00	11276.00	44.00
10	Block R-5236 HC	4550.00	12000.00	44.00
11	Block R-7236 HC	4550.00	12000.00	44.00
12	Block R-9636 HC	4550.00	12000.00	44.00
13	Block R-41 HC	5358.00	12906.00	37.00

Setbacks

No.	Setback s [in]
1	0.010
2	0.375
3	1.625
4	9.375
5	16.625

Geometry

No. group	Description	Count	Setback s [in]
1	Block 60	1	1.62
2	Block R-41 HC	2	1.62
3	Top block 28	1	-

Base

Geometry

Upper setback a_1 = 0.00 ft
Lower setback a_2 = 1.00 ft
Height h = 1.00 ft
Width b = 6.00 ft

Material

Soil creating foundation - Seattle Area

Basic soil parameters

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]	γ_{su} [pcf]	δ [°]
1	Seattle Area		30.00	35.0	110.00	77.50	20.00

All soils are considered as cohesionless for at rest pressure analysis.

Soil parameters

Seattle Area

Unit weight :	γ =	110.0 pcf
Stress-state :		effective
Angle of internal friction :	φ_{ef} =	30.00 °
Cohesion of soil :	c_{ef} =	35.0 psf
Angle of friction struc.-soil :	δ =	20.00 °
Saturated unit weight :	γ_{sat} =	140.0 pcf

Backfill

Backfill is not considered.

Geological profile and assigned soils

No.	Thickness of layer t [ft]	Depth z [ft]	Assigned soil	Pattern
1	-	0.00 .. ∞	Seattle Area	

Terrain profile

Terrain behind construction has the slope 1: 2.75 (slope angle is 20.00 °).

Water influence

Ground water table is located below the structure.

Resistance on front face of the structure

Resistance on front face of the structure is not considered.

Verification No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.78	3076.9	3.07	1.000
Weight - earth wedge	0.0	-5.37	687.2	4.30	1.000
Active pressure	1277.1	-2.70	966.9	5.58	1.000

Verification of complete wall

Check for overturning stability

Resisting moment M_{res} = 17802.0 lbfft/ft
Overturning moment M_{ovr} = 3447.0 lbfft/ft

Safety factor = 5.16 > 1.50
Wall for overturning is SATISFACTORY

Check for slip

Resisting horizontal force H_{res} = 2941.40 lbf/ft
Active horizontal force H_{act} = 1277.12 lbf/ft

Safety factor = 2.30 > 1.50

Wall for slip is SATISFACTORY

Overall check - WALL is SATISFACTORY

Dimensioning No. 1

Forces acting on construction

Name	F_{hor} [lbf/ft]	App.Pt. z [ft]	F_{vert} [lbf/ft]	App.Pt. x [ft]	Design coefficient
Weight - wall	0.0	-2.40	2416.9	2.09	1.000
Weight - earth wedge	0.0	-4.37	687.2	3.30	1.000
Active pressure	997.3	-2.32	865.0	4.53	1.000

Verification of block No. 1

Check for overturning stability
Resisting moment M_{res} = 11241.8 lbfft/ft
Overturning moment M_{ovr} = 2313.4 lbfft/ft

Safety factor = 4.86 > 1.50
Joint for overturning stability is SATISFACTORY

Check for slip
Resisting horizontal force H_{res} = 2449.01 lbf/ft
Active horizontal force H_{act} = 997.29 lbf/ft

Safety factor = 2.46 > 1.50
Joint for verification is SATISFACTORY

Bearing capacity of foundation soil

Design load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]	Eccentricity [–]	Stress [psf]
1	-162.2	4730.92	1277.12	0.000	788.5

Service load acting at the center of footing bottom

No.	Moment [lbfft/ft]	Norm. force [lbf/ft]	Shear Force [lbf/ft]
1	-162.2	4730.92	1277.12

Verification of foundation soil

Stress in the footing bottom : rectangle

Eccentricity verification
Max. eccentricity of normal force e = 0.000
Maximum allowable eccentricity e_{alw} = 0.333

Eccentricity of the normal force is SATISFACTORY

Verification of bearing capacity
Max. stress at footing bottom σ = 788.5 psf
Bearing capacity of foundation soil R_d = 2000.0 psf

Safety factor = 2.54 > 2.00
Bearing capacity of foundation soil is SATISFACTORY

Overall verification - bearing capacity of found. soil is SATISFACTORY

Slope stability analysis

Input data

Project

Settings

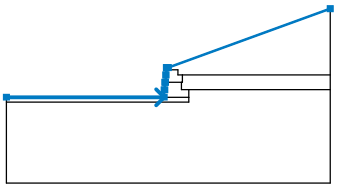
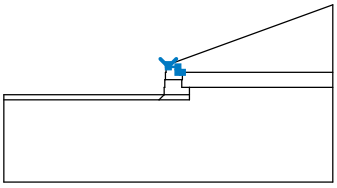
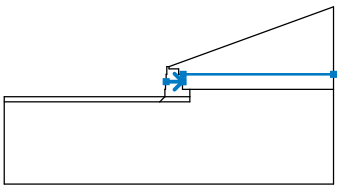
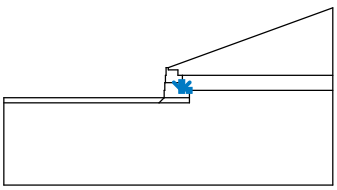
USA - Safety factor

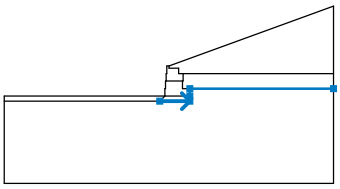
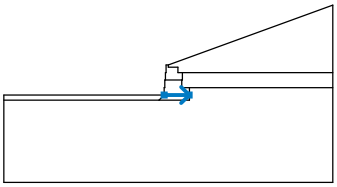
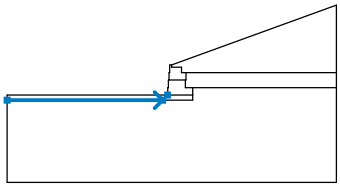
Stability analysis

Earthquake analysis : Standard
Verification methodology : Safety factors (ASD)

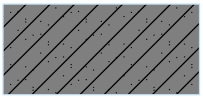
Safety factors			
Permanent design situation			
Safety factor :	SF_s =	1.50	[–]

Interface

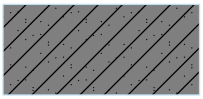
No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
1		-32.80	-6.00	-0.82	-6.00	-0.82	-4.50
		-0.69	-4.50	-0.69	-3.00	-0.55	-3.00
		-0.55	-1.50	-0.42	-1.50	-0.42	0.00
		0.00	0.00	32.80	11.94		
2		0.00	0.00	0.00	-0.42	1.92	-0.42
		1.92	-1.50	2.82	-1.50		
3		-0.55	-3.00	2.69	-3.00	2.82	-3.00
		2.82	-1.50	32.80	-1.50		
4		2.69	-3.00	2.69	-4.50	4.18	-4.50

No.	Interface location	Coordinates of interface points [ft]					
		x	z	x	z	x	z
5		-1.82	-7.00	4.18	-7.00	4.18	-6.00
		4.18	-4.50	32.80	-4.50		
6		-0.82	-6.00	4.18	-6.00		
7		-32.80	-7.00	-1.82	-7.00	-0.82	-6.00

Soil parameters - effective stress state

No.	Name	Pattern	φ_{ef} [°]	c_{ef} [psf]	γ [pcf]
1	Seattle Area		30.00	35.0	110.0

Soil parameters - uplift

No.	Name	Pattern	γ_{sat} [pcf]	γ_s [pcf]	n [–]
1	Seattle Area		140.0		

Soil parameters

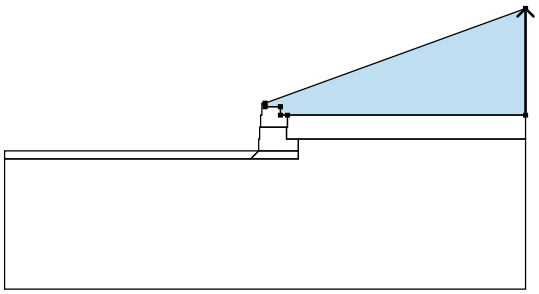
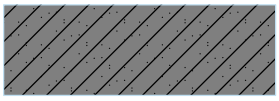
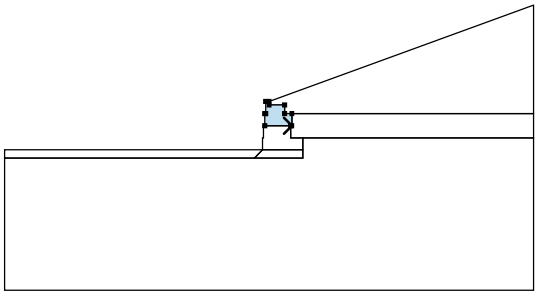
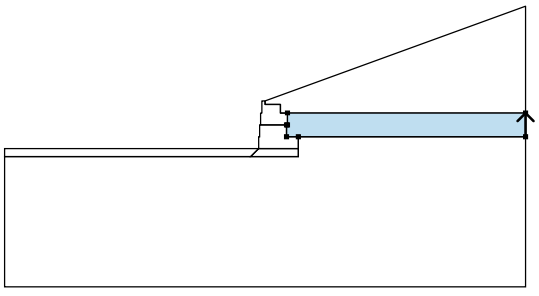
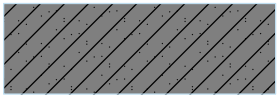
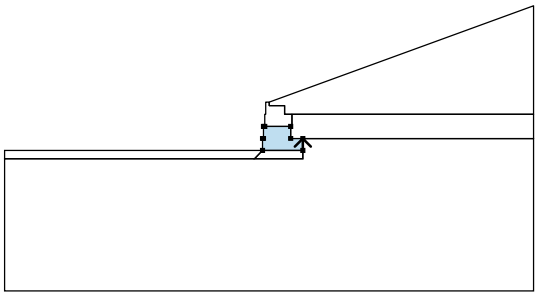
Seattle Area

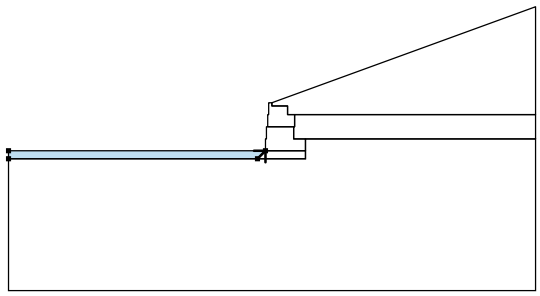
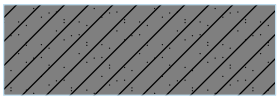
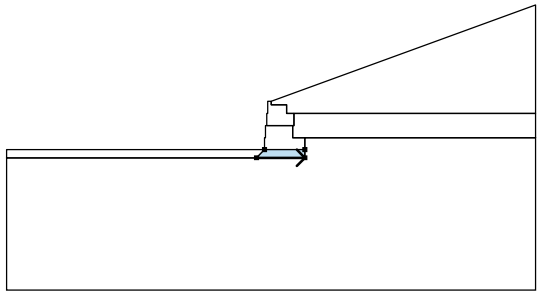
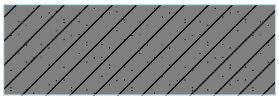
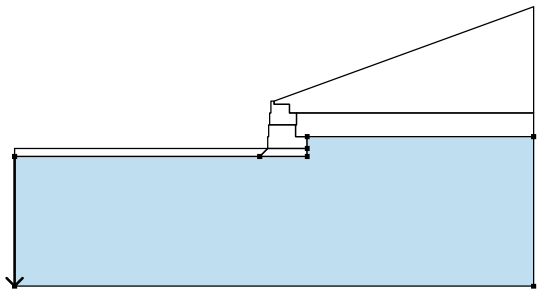
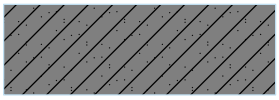
Unit weight : γ = 110.0 pcf
Stress-state : effective
Angle of internal friction : φ_{ef} = 30.00 °
Cohesion of soil : c_{ef} = 35.0 psf
Saturated unit weight : γ_{sat} = 140.0 pcf

Rigid bodies

No.	Name	Sample	γ [pcf]
1	Material of structure		120.0

Assigning and surfaces

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
1		32.80	-1.50	32.80	11.94	Seattle Area
		0.00	0.00	0.00	-0.42	
		1.92	-0.42	1.92	-1.50	
		2.82	-1.50			
2		2.69	-3.00	2.82	-3.00	Material of structure
		2.82	-1.50	1.92	-1.50	
		1.92	-0.42	0.00	-0.42	
		0.00	0.00	-0.42	0.00	
		-0.42	-1.50	-0.55	-1.50	
		-0.55	-3.00			
3		32.80	-4.50	32.80	-1.50	Seattle Area
		2.82	-1.50	2.82	-3.00	
		2.69	-3.00	2.69	-4.50	
		4.18	-4.50			
4		4.18	-6.00	4.18	-4.50	Material of structure
		2.69	-4.50	2.69	-3.00	
		-0.55	-3.00	-0.69	-3.00	
		-0.69	-4.50	-0.82	-4.50	
		-0.82	-6.00			

No.	Surface position	Coordinates of surface points [ft]				Assigned soil
		x	z	x	z	
5		-1.82	-7.00	-0.82	-6.00	Seattle Area
		-32.80	-6.00	-32.80	-7.00	
6		-1.82	-7.00	4.18	-7.00	Seattle Area
		4.18	-6.00	-0.82	-6.00	
7		-32.80	-7.00	-32.80	-23.40	Seattle Area
		32.80	-23.40	32.80	-4.50	
		4.18	-4.50	4.18	-6.00	
		4.18	-7.00	-1.82	-7.00	

Water

Water type : No water

Tensile crack

Tensile crack not input.

Earthquake

Earthquake not included.

Settings of the stage of construction

Design situation : permanent

Results (Stage of construction 1)

Analysis 1

Circular slip surface

Slip surface parameters							
Center :	x =	-1.79	[ft]	Angles :	α_1 =	-22.55	[°]
	z =	8.25	[ft]		α_2 =	77.18	[°]
Radius :	R =	15.43	[ft]				
The slip surface after optimization.							

Slope stability verification (Bishop)

Sum of active forces : F_a = 4302.2 lbf/ft

Sum of passive forces : F_p = 6658.2 lbf/ft

Sliding moment : M_a = 66382.3 lbfft/ft

Resisting moment : M_p = 102735.5 lbfft/ft

Factor of safety = 1.55 > 1.50

Slope stability ACCEPTABLE