POWELL VILLA
PORTLAND, OR

STRUCTURAL CALCULATIONS

DESIGN CRITERIA: DC1-DC2
PARAPET FRAMING: PF1-PF10

(13 PAGES TOTAL INCLUDING COVER SHEET)

July 10, 2017

PROJECT NUMBER: 170103.01

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DC I

USGS Design Maps Summary Report

Exposure B
120 mph

User-Specified Input

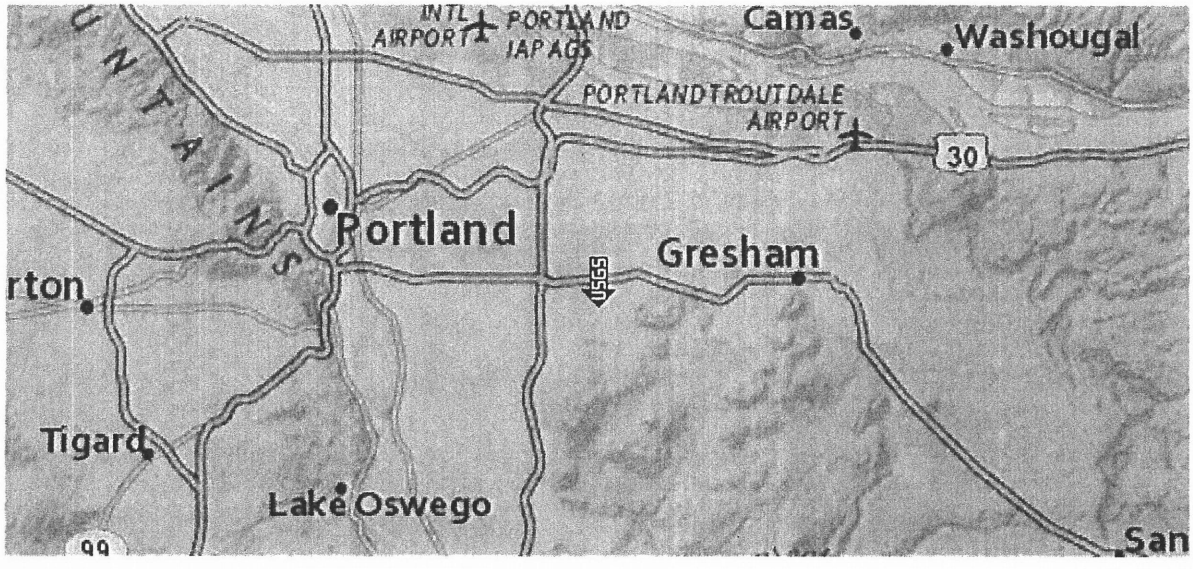
Report Title Powell Villa
Mon June 5, 2017 18:48:56 UTC

Building Code Reference Document 2012/2015 International Building Code
(which utilizes USGS hazard data available in 2008)

Site Coordinates 45.49606°N, 122.53622°W

Site Soil Classification Site Class D – "Stiff Soil"

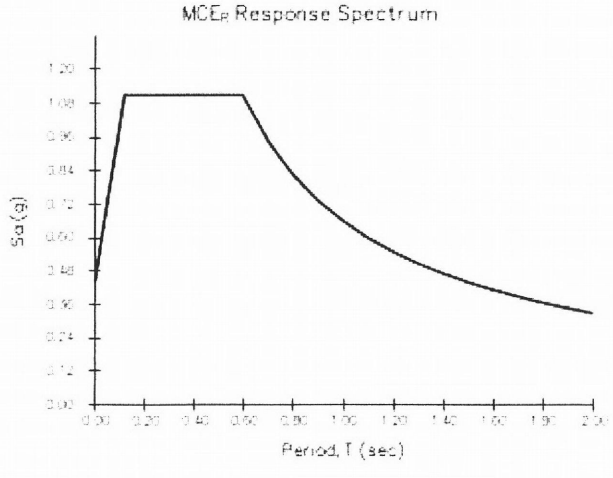
Risk Category I/II/III

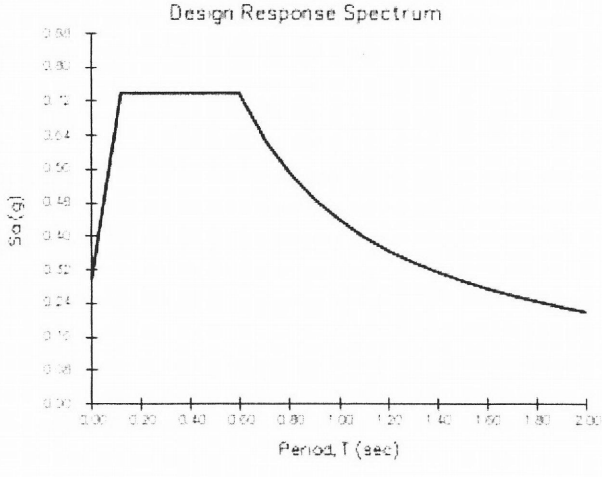


USGS-Provided Output

S_S =	1.014 g	S_{MS} =	1.110 g	S_{DS} =	0.740 g
S_1 =	0.417 g	S_{M1} =	0.661 g	S_{D1} =	0.440 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





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DC2
RNH
170103.01
6/13/2017

WIND LOAD: BASED ON ASCE 7-10

$V_{3s} := 120$

Exposure B

$I_w := 1.0$ $K_d := 0.85$

$K_h := 0.7$ $GC_{pw} := 1.1 + 1.5$ $GC_{pL} := 1.1 + 1.0$ component and cladding parapet 200ft^2

$K_{zt} := 1.0$ $C_f := 1.3$

$q_z := 0.00256 \cdot K_h \cdot K_{zt} \cdot K_d \cdot I_w \cdot V_{3s}^2 \cdot psf$ $q_z = 21.93\,psf$

$F_w := GC_{pw} \cdot q_z \cdot I_w$ $F_w = 57.03\,psf$ $F_L := GC_{pL} \cdot q_z \cdot I_w$ $F_L = 46.06\,psf$

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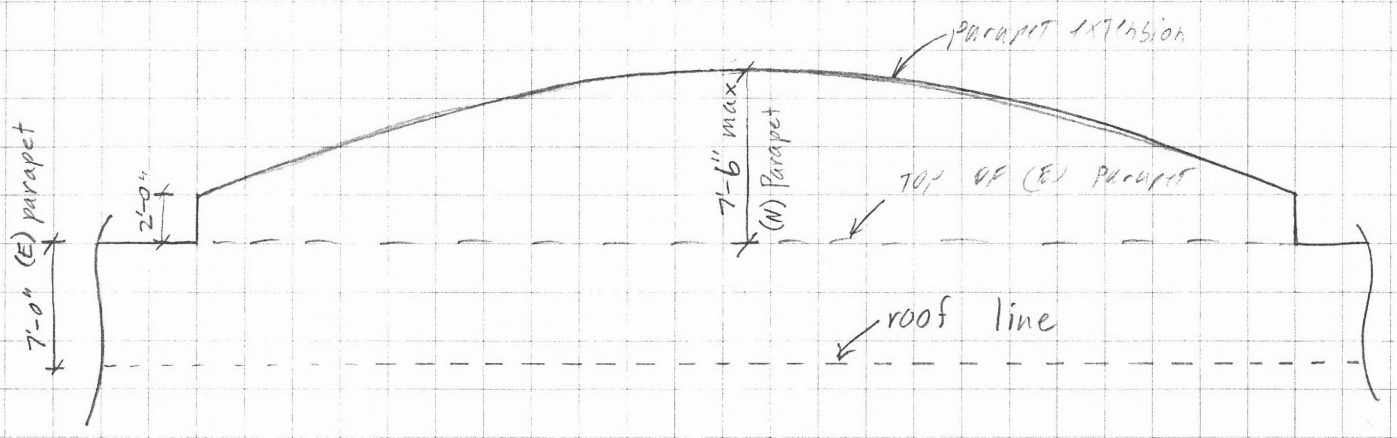
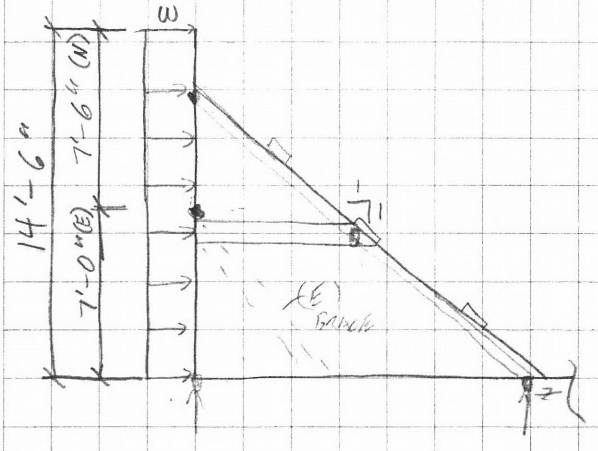
PROJECT NAME: Powell Villa | PROJ. NO. 170103.01 | SHEET P1
TITLE: | BY: RNH | DATE: 6/8/17

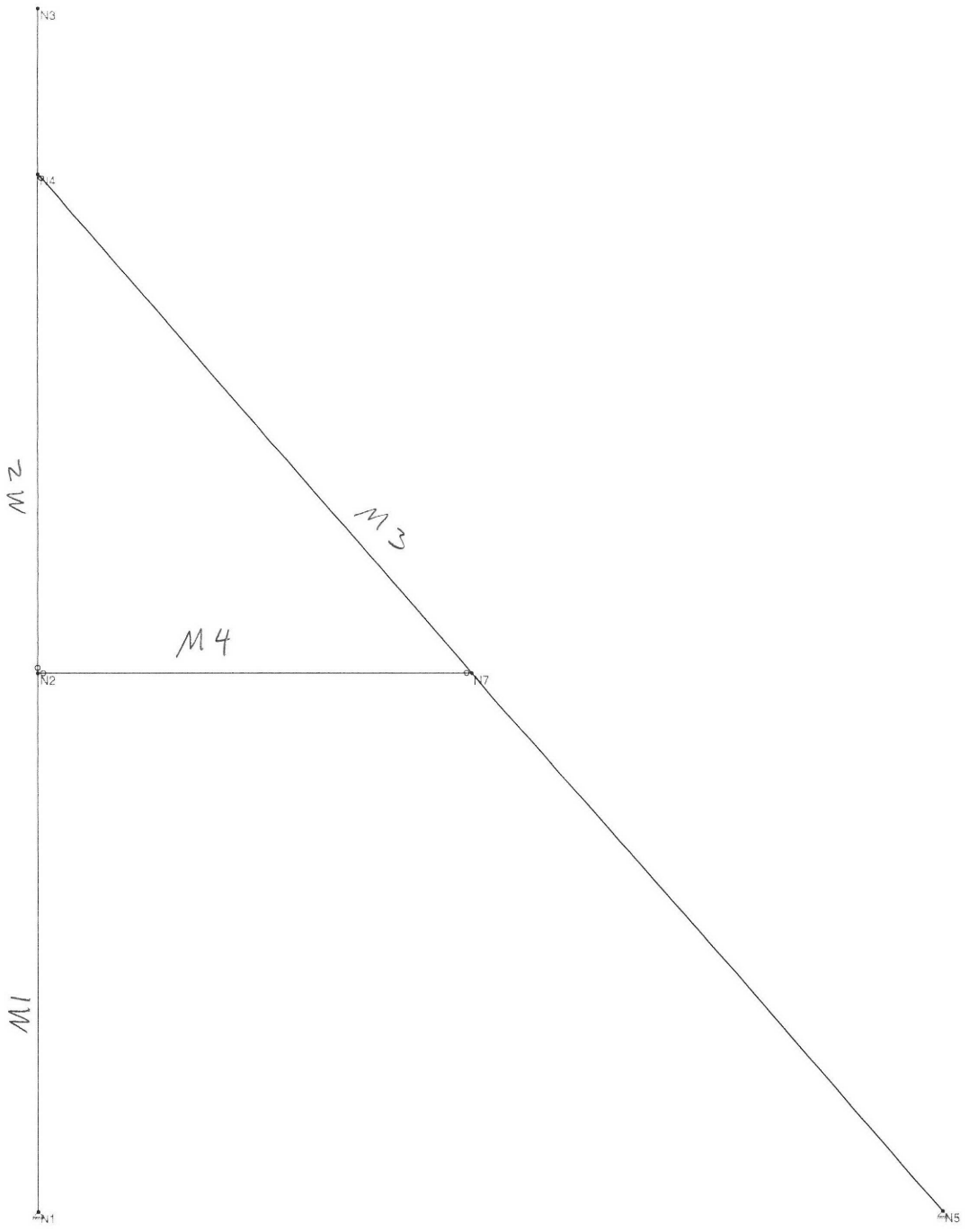
New Parapet



$F = 57.03$ psf $(1.0W)$ (windward) $F_p = 0.4 S_{DS} I W_t = 0.296 W_t$
$F = 46.06$ psf $(1.0W)$ (LEEWARD)



PF2



Envelope Only Solution

		SK - 1
RNH		June 9, 2017 at 10:26 AM
170103.01		NEW PARAPET.r2d

Load Combination Design

	Description	ASIF	CD	ABIF	Service	Hot Rolled	Cold Form...	Wood	Concrete	Masonry	Footings	Aluminum
1	ASD					Yes	Yes	Yes	Yes	Yes	Yes	Yes
2	DL+SL					Yes	Yes	Yes	Yes	Yes	Yes	Yes
3	DL+0.75SL+...					Yes	Yes	Yes	Yes	Yes	Yes	Yes
4	DL+0.6W					Yes	Yes	Yes	Yes	Yes	Yes	Yes
5	0.6DL+0.6W					Yes	Yes	Yes	Yes	Yes	Yes	Yes
6	DL+0.75SL+...					Yes	Yes	Yes	Yes	Yes	Yes	Yes
7	DL+0.6W					Yes	Yes	Yes	Yes	Yes	Yes	Yes
8	0.6DL+0.6W					Yes	Yes	Yes	Yes	Yes	Yes	Yes
9	DL+0.75SL+...					Yes	Yes	Yes	Yes	Yes	Yes	Yes
10	DL+0.7E					Yes	Yes	Yes	Yes	Yes	Yes	Yes
11	0.6DL+0.7E					Yes	Yes	Yes	Yes	Yes	Yes	Yes

Envelope Joint Reactions

	Joint		X [k]	LC	Y [k]	LC	Moment [k-ft]	LC
1	N1	max	.178	8	1.062	6	0	2
2		min	-.223	5	-.409	5	0	2
3	N5	max	.595	7	.772	3	0	2
4		min	-.734	4	-.471	7	0	2
5	Totals:	max	.774	8	1.295	2		
6		min	-.958	4	.174	5		

Envelope Member Section Forces

	Member	Sec		Axial[k]	LC	Shear[k]	LC	Moment[k-ft]	LC
1	M1	1	max	1.062	6	.222	5	0	2
2			min	-.409	5	-.18	7	0	2
3		2	max	1.062	6	.111	5	.219	8
4			min	-.409	5	-.09	7	-.271	5
5		3	max	1.062	6	0	2	.292	7
6			min	-.409	5	0	2	-.361	5
7		4	max	.922	6	.09	8	.219	8
8			min	-.493	5	-.111	4	-.271	5
9		5	max	.922	6	.18	8	0	2
10			min	-.493	5	-.222	4	0	2
11	M2	1	max	.921	6	.192	4	0	2
12			min	-.494	5	-.155	8	0	2
13		2	max	.921	6	.056	4	.2	8
14			min	-.494	5	-.045	8	-.248	4
15		3	max	.771	6	.066	7	.18	8
16			min	-.584	4	-.081	4	-.222	4
17		4	max	.771	6	.176	7	.077	5
18			min	-.584	4	-.218	4	-.062	7
19		5	max	0	2	0	2	0	2
20			min	0	2	0	2	0	2
21	M3	1	max	.648	4	.38	6	0	2
22			min	-.697	6	-.16	4	0	2
23		2	max	.648	4	.207	6	.68	4
24			min	-.521	7	-.16	4	-1.228	6
25		3	max	.926	4	.148	4	1.255	4
26			min	-.75	7	-.118	7	-1.77	6
27		4	max	.926	4	.148	4	.627	4
28			min	-.75	7	-.208	6	-1.114	6
29		5	max	.942	3	.148	4	0	2
30			min	-.75	7	-.316	6	0	2
31	M4	1	max	.413	4	0	2	0	2
32			min	-.337	7	0	2	0	2
33		2	max	.413	4	0	2	0	2
34			min	-.337	7	0	2	0	2
35		3	max	.413	4	0	2	0	2
36			min	-.337	7	0	2	0	2
37		4	max	.413	4	0	2	0	2
38			min	-.337	7	0	2	0	2
39		5	max	.413	4	0	2	0	2
40			min	-.337	7	0	2	0	2

Cold Formed Steel Section Sets

	Label	Shape	Type	Design List	Material	Design Rules	A [in2]	I (90,270) [i...	I (0,180) [in4]
1	EP	600S250-68	Column	CU	A570 Gr.33	Typical	.836	.688	4.73
2	NP	600S162-43	Beam	CS	A607 C1 Gr.55	Typical	.447	.148	2.32
3	Brace1	2-800S200-5...	VBrace	CS	A607 C1 Gr.55	Typical	1.452	1.061	13.14
4	brace2	400S162-43	HBrace	CU	A607 C1 Gr.55	Typical	.357	.131	.892

Envelope AISI S100-12: ASD Cold Formed Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear C...	Loc[ft]	LC	Pn/Om[k]	Tn/Om[k]	Mn/Om[...	Cb	Cm	Eqn
1	M1	600S162-43	.575	3.25	6	.157	6.5	4	2.611	14.722	1.128	1.136	.85	C5.2.1-1
2	M2	600S162-43	.684	2.833	6	.154	6	4	1.863	14.722	.886	1.331	1	C5.2.1-1
3	M3	2-800S200-54-BB	.817	8.139	4	.091	0	6	22.304	47.82	1.655	1	.6	C5.2.1-2
4	M4	400S162-43	.135	0	4	.000	0	2	3.048	11.757	.809	1	.6	C5.2.1-1

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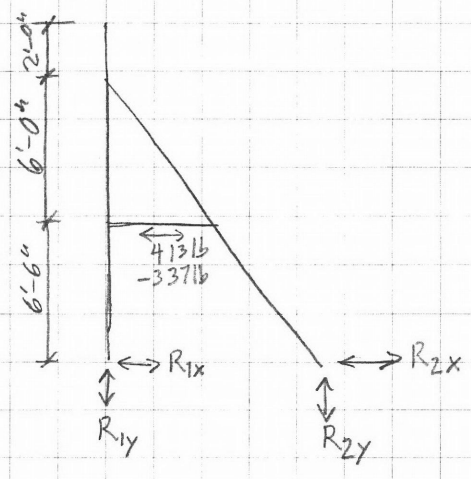
PROJECT NAME: Powell Villa PROJ. NO. 170103.01 SHEET PF6

TITLE: BY: RNH DATE: 6/9/17

Parapet Extension



$R_{1x} = -223lb^{(5)} / 178lb^{(8)}$

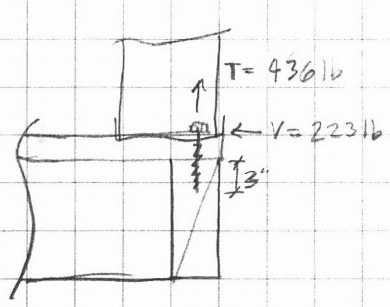
$R_{1y} = -436lb^{(5)} / 1,103lb^{(6)}$

$R_{2x} = -734lb^{(4)} / 596lb^{(7)}$

$R_{2y} = -493lb^{(7)} / 804lb^{(3)}$

} Simpson H6 okay for 950lb up
Simpson LS70 okay for 915lb Lateral

Steel stud to roof stucture



#10 wood screw okay for $V_a = 115lb$

$T_a = (3" \times 135^{lb}/_{in}) = 405lb$

$\sqrt{(436lb)^2 + (223)^2} = 490lb$

$\lambda = \tan^{-1}\left(\frac{436lb}{223lb}\right) = 63°$

$Z' = \frac{(405lb)(115lb)}{(405lb)\cos^2(63) + (115lb)\sin^2(63)} = 266lb$

#10 wood screws @ 12" o.c.

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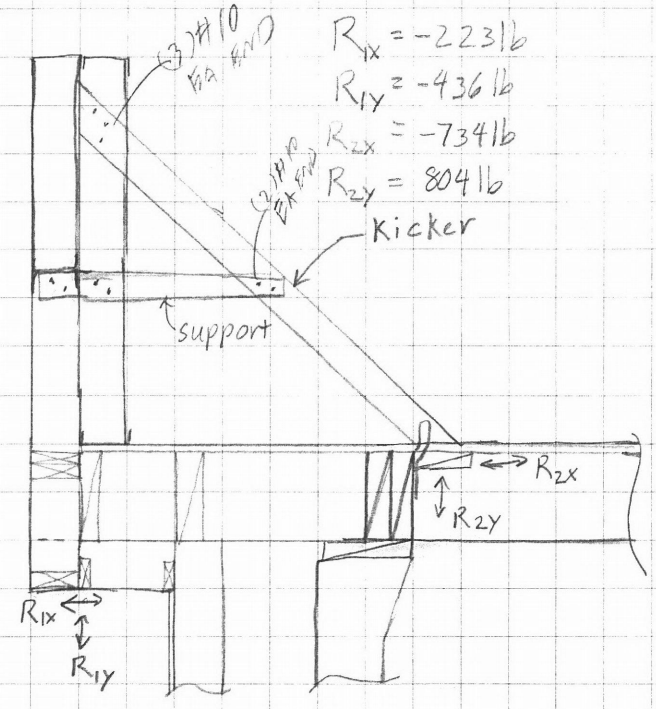
PROJECT NAME: Powell Villa | PROJ. NO. 170103.01 | SHEET PF7

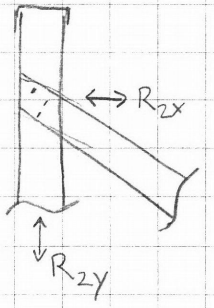
TITLE: | BY: RNH | DATE: 6/12/17

Parapet connections



$R_{1x} = -223$lb
$R_{1y} = -436$lb
$R_{2x} = -734$lb
$R_{2y} = 804$lb

Top of Kicker to Studs



$\sqrt{R_{2x}^2 + R_{2y}^2} = 1.09$k

$\tan^{-1}\left(\frac{R_{2y}}{R_{2x}}\right) = 47.6°$

#10 screws okay for $V = \frac{1.11\text{k}}{3} = 370$lb

$n = 1.09\text{k} / 370\text{lb} = 2.95 \Rightarrow 3$ screws

Support to Studs and Kicker

load is support = 413lb

$n = (413\text{lb})/(370\text{lb}) = 1.12 \Rightarrow 2$

(2) #10 screws

PF8

POWELL VILLA
IN ACCORDANCE WITH 2012 IBC IN ACCORDANCE W/ ASCE SECTION 7.7

PROJECT NAME: POWELL VILLA PROJECT NO.: 170103.01 DATE:6/8/17

ELEMENT ID: NEW PARAPET DESIGNER: RNH

$P_g := 10 \cdot psf$	Basic ground snow load
$P_{min} := 25 \cdot psf$	Minimum snow load.
$I := 1.0$	Importance factor (Table No. 1.5-2, p. 5)
$C_e := 1.0$	Snow exposure factor (Table No. 7-2, p. 30)
$C_t := 1.0$	Thermal factor (Table No. 7-3, p. 30)

Density of Snow:

$D_1 := \frac{0.13}{ft} \cdot P_g + 14.0 \cdot pcf$ $D_1 = 15.3\,pcf$

$D := if\left(D_1 \le 30 \cdot pcf, D_1, 30 \cdot pcf\right)$ $D = 15.3\,pcf$

Calculated Minimum Roof Snow Load:

$P_f := 0.7 C_e \cdot C_t \cdot I \cdot P_g$ $P_f = 7\,psf$

Required Minimum Roof Snow Load:

$P_r := if\left(P_{min} > P_f, P_{min}, P_f\right)$ $P_r = 25\,psf$

Height of Calculated Minimum Snow Load on Lower Roof or Deck:

$h_b := \frac{P_f}{D}$ $h_b = 0.46\,ft$

CASE III-B: DRIFT LOAD FOR PARAPET OR PERIMETER PROJECTION.
(Sec. 7.7.1 and Figure 7-9)

$W_b := 159 \cdot ft$ Maximum horizontal distance from parapet to edge of roof

$h_r := 14.5 \cdot ft$ Difference in height between top of parapet or projection and roof

$h_c := h_r - h_b$ Difference in height between top of parapet or projection and uniform snow

$h_c = 14.042\,ft$

Basic Height of Drift Surcharge:

$W_b := if(W_b < 25 \cdot ft, 25ft, W_b)$ $W_b = 159\,ft$

$h_d := \left[0.43 \cdot \left(\frac{W_b}{ft}\right)^{\frac{1}{3}} \cdot \left(\frac{P_g}{psf} + 10\right)^{\frac{1}{4}} - 1.5\right] \cdot ft$ $h_d = 3.43\,ft$

Reduced Height of Drift Surcharge at Face of Parapet:

$h_n := 0.75 \cdot h_d$ $h_n = 2.57\,ft$

Width of Drift in Relation to Minimum Snow Load, P_f:

$W_{d1} := 4 \cdot h_d$ $W_{d1} = 13.7\,ft$

$W_{d2} := 4 \cdot \frac{h_d^{\,2}}{(h_r - h_b)}$ $W_{d2} = 3.3\,ft$

$W_{d3} := if(W_{d2} < 8h_c, W_{d2}, 8 \cdot h_c)$ $W_{d3} = 3.3\,ft$

$W_d := if(h_n < h_c, W_{d1}, W_{d3})$ $W_d = 13.7\,ft$

Maximum Intensity of Snow Load at Height Change:

$P_{m1} := D \cdot (h_n + h_b)$ $P_{m1} = 46.32\,psf$

$P_{m2} := D \cdot h_r$ $P_{m2} = 221.85\,psf$

$P_{m3} := if(P_{m1} < P_{m2}, P_{m1}, P_{m2})$ $P_{m3} = 46.32\,psf$

$P_{m4} := if(P_{m3} > P_r, P_{m3}, P_r)$ $P_{m4} = 46.32\,psf$

$P_m := if\left(\frac{h_r - h_b}{h_b} > 0.2, P_{m4}, P_r\right)$ $P_m = 46.32\,psf$

Maximum Surcharge Intensity in Addition to Required Minimum Snow Load, P_r:

$P_s := P_m - P_r$ $P_s = 21.32\,psf$

Width of Drift in Relation to Required Minimum Snow Load, P_r:

$W_{dr} := W_d \cdot \frac{P_m - P_r}{P_m - P_f}$ $W_{dr} = 7.4\,ft$

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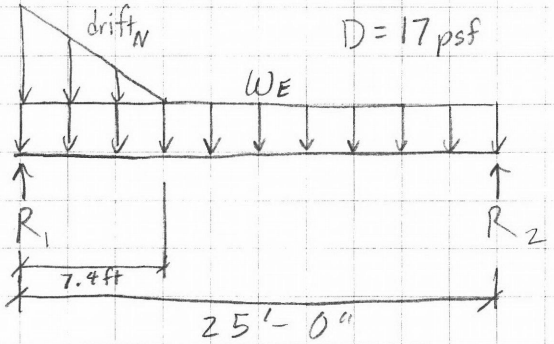
PROJECT NAME: Powell Villa | PROJ. NO. 170103.01 | SHEET PF10

TITLE: ROOF CHECK FOR NEW DRIFT | BY: RNH | DATE: 6/12/17

Load on Existing Joist



w_E = (136 plf / 200 plf / 336 plf) existing
(D / S / Total)

drift$_N$ = 21.32 psf @ 7.4 ft new load

Existing condition

$R_1 = R_2$ = (1.7K / 2.5K / 4.2K)
(D / S / Total)

$M_E = \frac{w_E (25)^2}{8} = 26.25\ k \cdot ft$

New condition

(D / S / Total)

R_1 = (1.7K / 3.07K / 4.77K)

R_2 = (1.7K / 2.56K / 4.26K)

$M_N = 27.03\ k \cdot ft$

% dif. $= \left(\frac{27.03\ k \cdot ft - 26.25\ k \cdot ft}{26.25\ k \cdot ft}\right)(100) = 2.97\% < 5\%$ ok