

February 21, 2025

House with attached garage & laundry
22136 Pine Court
Timber Cove, Jenner, CA 95450
unit 1 lot 15 apn 109-380-015
Sonoma County, California

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STRUCTURAL CALCULATIONS

references:

CBC California Building Code, 2022

California Code of Regulations Title 24, part 2

CRC California Residential building Code, 2022 ← consulted, but CBC governs our structural design

ASCE Hazard tool on line report dated 10/05/2024

ASCE Minimum Design Loads for Buildings & other Structures, ASCE/SEI Standard 7-10,

updated 2013 American Society of Civil Engineers

NDS National Design Specification for Wood Construction, 2012 ed

and **WSDD** Wood Structural Design Data, 1973 ed, both from American Wood Council

Simpson Catalog C 2020

drawings by Gauthier & Hallett architects October 4, 2024

soils investigation by PJC & Associates November 18 2021 job No 10506.01

by **Michael Hallett, architect, California license C 9346, renewal date 9-30-2025**

General Dimensions and Notes:

A free standing house with a partial second story inside the main form
and covered deck and covered entry deck and link and garage and laundry
all of wood frame and shear wall construction

on a foundation of spread footings and stem wall
with framed floors over ventilated underfloor space

No concrete slabs on grade

no over excavation and compaction so as to minimize disruption of tree roots

The underfloor space well ventilated and containing no exposed insulation

which might be subject insect or rodent infestation

Dimensions of main house 40 ft wide 24 feet deep plus roofed deck 40 ft wide 15 ft deep
under a single shed roof sloped at 1:12. This roof extends in the same plane to cover the
entry deck and garage and laundry. All rainwater drained to buffer tanks and metered outfall
maximum height above grade 25 ft.

A schematic plan is shown on p 3 of these calculations

Design parameter summary - more detail overleaf

Wind speed 110, exposure C, height 20, adjusted **P = 28 psf**

Seismic Site Class C **S_s 2.335 g** (N Latitude 38.5454)

S₁ 0.987 g (Longitude -123.2880)

Z = 0.25 x W



Structural design parameters summary, copy on drawings.

- 1 Floor live load (1607.9) & T 1607.1 Residential 40 psf
 entry porch and stair 100 psf
- roof live load (1607.11) & T 1607.1 residential 20 psf
- 2 ground snow load 0
- 3 basic wind speed (ASCE fig 26.5-1A) V 110 mph P 28 psf
- 4 seismic design category II, factor 1.0 base shear $Z = 0.25 \times W$
 site class "C"
- 5 flood design: not in a flood hazard area

Wind Loads:

3 basic wind speed (figure 26.5-1A) V 110 mph
 we will use simplified procedure of ASCE ch 28 part 2
 for enclosed simple diaphragm low rise buildings with gable roof
 basic wind speed for importance category II, V = 110
 wind exposure category (ASCE 26.7) ... "C"
 topographic factor K_{zt} (section 26.8) = 1.0
 enclosure classification (ASCE 26.10) = enclosed
 Design wind loads for MWFRS Main Wind Force Resisting System (ASCE fig 28.6-1)

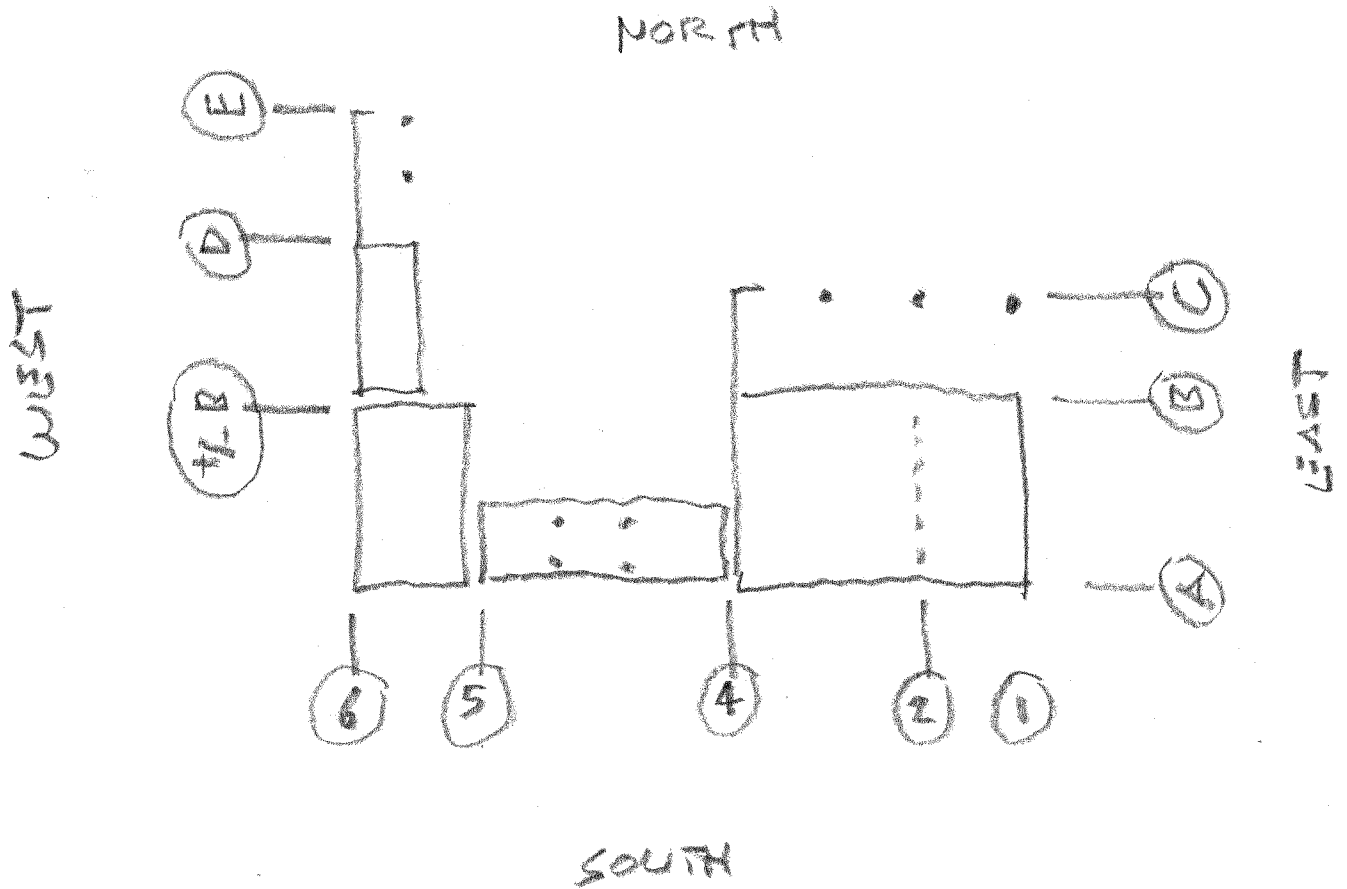
$p_s = \text{Lambda} \times K_{zt} \times I \times P_{s30}$ (ASCE equation 28.6-1)
 Lambda = adjustment factor mean for roof height
 for exposure C, mean roof height 20 ft = 1.29
 K_{zt} = topographic factor = 1.0
 I importance factor ... = 1.0
 P_{s30} = tabulated value for exposure B, h 30, roof pitch 30 degrees

building surface zone:	Ps30 value from table	(Lambda)	Ps
horizontal on wall	A + 21.6	1.29	28
horizontal on roof projected area	B + 14.8		19
vertical on roof windward slope	E + 8.3		11
vertical on roof leeward slope	F - 13.0		-17
overhang	Eoh - 8.7		-11

(C,D,G,H not used on this compact building)
 internal pressure coefficients are incorporated in the values found here
 in this location no provision is made for wind borne debris

continued

Schematic plan



calculations continued over leaf

We analyze the building as four rectangular elements

House Entry link Garage Laundry

House

I Wind Loads applied and overturning check		WEST – EAST → /		xP = load
wall face to west, total projected area A:		20 h x 42 w	= 840 sf	28 23,520 # in
roof horizontally projected area	B → /	4 h x 42 w	= 168	19 3,192 in
roof windward slope plan area down E	∨ /	42 w x 40 L	= 1680	11 18,480 down
roof underside of overhang	Eoh \ ^	0	= 0	-11 0 up

II Wind Loads applied and overturning check		EAST- WEST / <-		xP = load
wall face to east, total projected area A:		20 h x 42 w	= 840 sf	28 23,520 # in
roof horizontally projected area at oh	B \	4h x 15 w	= 60	19 1,140 in
		.33 x 40 w	= 13.2	19 251 in
roof leeward sloped plan area	F \ ^	42 w x 40 L	= 1680	-13 -21,840 up
roof underside of overhang	Eoh \ ^	15 w x 40 L	= 600	-11 6,600 up
		40 w x 4	= 160	-11 1,769 up

III Wind Loads applied and overturning check		NORTH – SOUTH		xP = load
wall face to north , total projected area A:		28 ave h x 40 w	= 1,120 sf	28 31,360 # in
roof horiz projected area face of oh included at A		1 x 40	40	19 760 # in
roof underside of overhang	Eoh \ ^	40 w x 15 d	= 600	-11 6,600 up

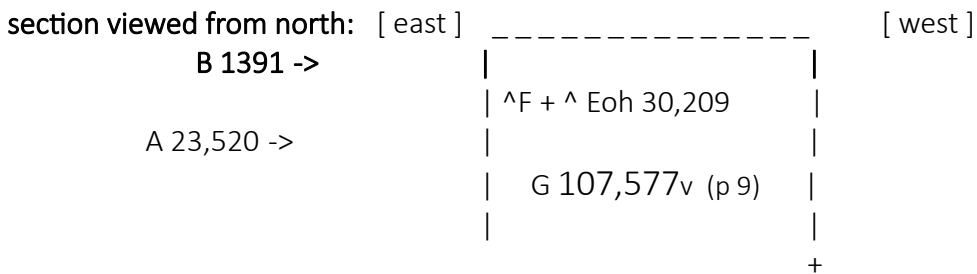
IV SOUTH – NORTH will be similar

continued over

OVERTURNING CHECK CASE II GOVERNS

THIS TABLE REPEATED FROM ABOVE

wall face to east, total projected area A:		20 h x 42 w	= 840 sf	28	23,520 # in
roof horizontally projected area at oh B	\	4h x 15 w	= 60	19	1,140 in
		.33 x 40 w	= 13.2	19	251 T:1391
roof leeward sloped plan area	F \ /	42 w x 40 L	= 1680	-13	-21,840 up
roof underside of overhang	Eoh \ /	15 w x 40 L	= 600	-11	6,600 up
		40 w x 4	= 160	-11	1,769 up
					T: 30,209 up

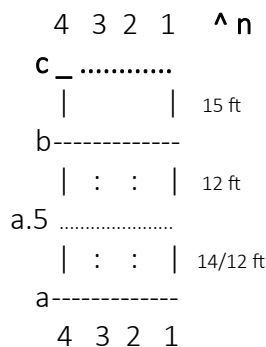


moments about +

F+Eoh	30,209	x	20	=	604 ft-k	clockwise
B->	1391	x	20	=	28 ft-k	clockwise
A->	23,520	x	10	=	235 ft-k	clockwise
Net otm:					867 ft-k	clockwise

dIrm: $G \sqrt{107,577} \times 20 \text{ ft} = \underline{-2152} \text{ ft-k}$
 $\times 2/3 = \underline{-1442} \text{ ft-k}$ before we account for foundation
 net total- 575 ft-k ok

Wind Load distributed to walls



W-E <-> West facing wall on line 4

840 sf, upper half 420 sf x 28 = 11,760 #

distribute to lines c 7/40 15% = 1764 # b 20/40 50% = 5880 a 14/40 35% = 4116 #

N ^\ S (Low slope roof w deep overhang)

1120 sf uper half 560 sf x 28 psf = 15680 to ln 4 50% = 7840 ln 1 50% = 7840

These are larger than the seismic numbers Wind will govern top plate down to the heavy main floor

Seismic Loads:

Simplified procedure will be used, per ASCE 12.14

The building will be analyzed as one unit which meets the requirements of 12.14.1.1 including having 2 well spaced lines of resistance for each direction considered.

Seismic design category per ASCE T 11.6-1 C
[1613.1 exceptions n. a. for this site]

seismic importance factor I = 1.0
(occupancy category "II")

mapped spectral response accelerations (ASCE Hazard tool)

S_s 2.355 g (N Lat 38.5454)

S₁ 0.997 g (W Long -123.2828)

spectral response coefficients (confirmed below)

S_{DS} 1.868 g

S_{D1} not used in simplified method

basic seismic force resisting system: ASCE 12.14.4.1 & T 12.14-1

Diaphragms constructed of wood structural panels

item A 13 light frame walls... R = 6-1/2

design base shear per ASCE 12.14.8.8:

$$V = (F_{SDS} / R) \times W \quad \text{ASCE eq 12.14-12}$$

$$S_{DS} = 2/3 \times (F_a S_s)$$

F_a site not "rock" per this section

ref ASCE 11.4.3, table 11.4-1

site class D; S_s 2.357 which is > 1.25

F_a = 1.0

S_s from data above = 2.2357 g

$$S_{DS} = 2/3 \times (1.0 \times 2.2357) = 1.579$$

$$V = (F_{SDS} / R) \times W$$

"F" per list ASCE paragraph 12.14.8.1, one story = 1.0

S_{DS} is found above at 1.579

R from ASCE table 12.14.1 = 6-1/2 for shear wall LFRS

Base shear: $V = (1.0 \times 1.579 / 6.5) \times W$ $V = 0.243 W$ we will use 0.25

Seismic loads continued $V = 0.25 W$ (from work above)

Vertical distribution: ASCE 12.14.8.2
 $F_x = (w_x / W) V$ ASCE eq 12.14-13
 w_x effective weight assigned at each story

Distribution within stories: ACES 12.14.8.3
For flexible diaphragm structures
use tributary area rules
diaphragms taken as flexible

Load Combinations

Allowable stress design- Loads & combinations considered
ASCE 7-10 2.4.1

notations: D dead load, E earthquake h horizontal v vertical
L live load, W wind Load
[F, F_a H, R, S, T zero or negligible]

for wind resistance use only $(2/3)D$ for sliding, overturning, foundation sliding
not using reductions of ASCE 12.13.4

Increases of allowable stress & reductions of load per CBC materials chapters
& reference standards may be used

D+L

D+L+W $(2/3)D$ for o.t. check

D+E

$(0.6)D+(0.6)W$ | will not represent a worse condition for this

$(0.6)D+(0.7)E$ | simple flexible diaphragm & shear wall building

continued

Weights of components, for seismic and vertical loads

Roof over main space and deck

roofing, standing seam metal 26 ga	2 psf
ice n water	.5
ply "nailer"	2.5
mineral insulation board 2-3/4	2
sheathing, 1/2"	2
2x10 at 16	3.6
girders	2
insulation in rafter space	1.5
ceiling- 2x6 t&g decking	6
total	22 psf

Roof overhangs: net the same 22 psf

Roof over entry

roofing, standing seam metal 26 ga	2 psf
ice n water	.5
mineral insulation board 2-3/4	2
sheathing, 1/2"	2
2x10 rafters + 2x4 cj at 16	5
girders	1
insulation in rafter space	0
ceiling- 2x6 t&g decking	6
total	29 psf

Roof at garage

roofing, standing seam metal 26 ga	2 psf
ice n water	.5
sheathing, 1/2"	2
2x10 rafters at 24	2.5
gyp board ceiling	5
total at garage	12 psf

Roof at Laundry

roofing, standing seam metal 26 ga	2 psf
ice n water	.5
sheathing, 1/2"	2
2x6 rafters at 24	1.5
gyp board ceiling	5
total at garage	11 psf

Roof at tank shelter

roofing, standing seam metal 26 ga	2 psf
ice n water	.5
sheathing, 1/2"	2
2x6 t&g decking	6
4x6 rafters at 24	3
total	14

Raised floor at Loft

joists 2x10 at 24	3
sheathing 5/8 t&g ply	3
insulation	1
ceiling	5
underlayment	2
finish floor	3
total:	17 psf

Raised floor at Main

joists 1-3/4 x 9-1/4 LVL at 16	4.5
sheathing 5/8 t&g ply	3
insulation	2
normal weight concrete	50
ceiling	5
underlayment	2
finish floor wood or tile	3
total:	70 psf

Main deck floor if redwood

redwood decking	6
4x6 at 16	7
girders 6x10 at 5 ave	4
total	17 psf

Main deck floor if tiled

	wt	load
tile	5 psf	-
thin set on wp	1	60 LL (40 x 1.5 = 60 including cantilevered areas)
ply sheathing 3/4	3	
joists 4x6 at 16	7	
girders 6x10 at 5 ave	4	
"ceiling" at oh s framing	2	
fiber cement	3	
total	20 + 5 = 25	+ 60 = 85 psf

Walls exterior

roofing, standing seam metal 26 ga	2 psf
stripping	.5
mineral insulation board 2-3/4	2
moisture barrier	.5
sheathing, 1/2"	2
2x6 at 16	2.25
insulation between studs	0.5
gyp bd or panels	5
exterior wall total	15 psf

Wall exterior w fiber cement 19 psf

Walls at underfloor perimeter 19 psf

walls at underfloor interior 15 psf

walls at finished space interior 15 psf

Areas x weights for seismic load: House rectangle:

roof area main: $(40 \times 41 = 1640 + 4 \times 26 = 104) = 1744 \times 22 \text{ psf } W = 38,368 \# \text{ E} = 9592$

walls and then allocate load assignments

loft level, all exterior

north wall 8 ave h, 40 w $8 \times 40 = 320 \text{ sf} \times 19 \text{ psf} = w = 6080 \# \text{ E } 1520$

east wall 9 h x 24 w $= 216 \text{ sf} \times 19 \text{ psf} = w = 4104 \#$

south w jog $40 + 2 = 42 \text{ ft w} \times 8 \text{ ave} = 336 \times 19 \text{ mostly} = 6384 \#$

west 7 h x 42+wings, 50 $= 350 \times 19^* = w = 6650 \#$

* part metal, part cement, part has 2 exterior sides

main level exterior

north wall 9 h x 40 w $= 360 \text{ sf} \times 19 \text{ psf} = w = 6840 \# \text{ E } 912$

east wall 9 h x 24 w $= 216 \text{ sf} \times 19 \text{ psf} = w = 4104 \#$

south w jog $40 + 2 = 42 \text{ ft w} \times 9 = 378 \times 19 \text{ mostly} = 7182 \#$

west 9 h x 42+wings, 50 $= 450 \times 19^* = w = 8550 \#$

* part metal, part cement, part has 2 exterior sides

main level interior

grid line 2 24 ft long 8 h $192 \times 15 = w = 2,880 \#$

below floor exterior

north wall In C deck ave 7 h x 40 w $= 280 \text{ f} \times 19 \text{ psf} = w = 5320 \# \text{ E } 1330$

east wall inc at deck 9 h x 39 w $= 351 \text{ sf} \times 19 \text{ psf} = w = 6669 \# \text{ E } 1667$

south w jog $40 + 2 = 42 \text{ ft w} \times 2 = 84 \times 19 \text{ mostly} = 1596 \# \text{ E } 399$

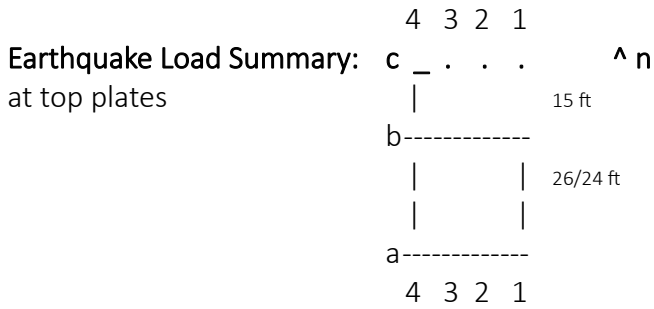
west 3 ave h x 42+wings, 50 $= 150 \times 19 = w = 2850 \# \text{ E } 712$

House module sub total W: $107,577 \# < \text{ send back to ot check p 4}$

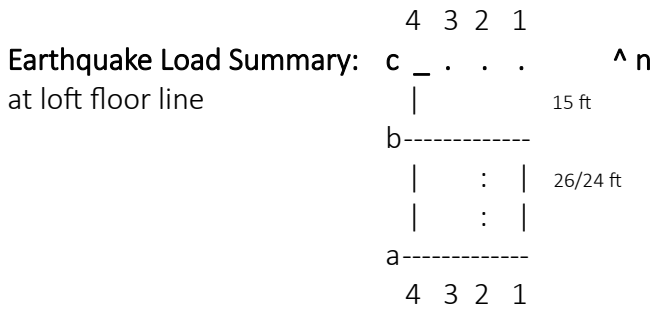
House Loft floor 364 sf at 17 psf = 6154 # E = 1539

House main floor 976 sf at 70! = 68320 # E = 17,080

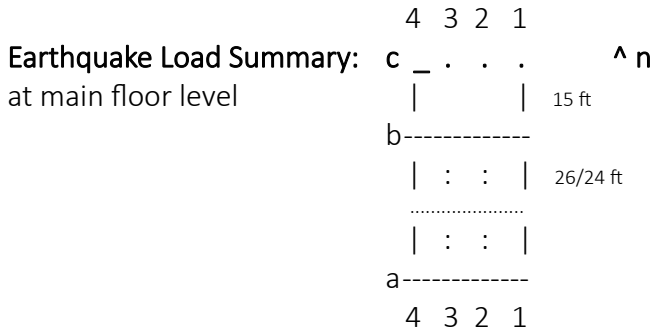
House Main Deck $43 \times 19 = 817 \times 17 = 13889 \# \text{ E} =$
includes part of stair



W <-> E roof E = 9592 c 7/40 15% = 1439 b 20/40 50% = 4796 a 14/40 35% = 3357
 N ^ \ S roof 4 50% = 4796 1 50% = 4796
 W <-> E walls on line c upper half of = 5x17x19=1615/2=808 E=202
 line b 14 ft has loft floor use upper half of 8x14x19=2128/2=1064 E=266
 26 ft has high space upper half of 17x26x19=8398/2=4199 E=1050
 line a 14 ft has loft floor use upper half of 8x14x19=2128/2=1064 E=266
 26 ft has high space upper half of 17x26x19=8398/2=4199 E=1050
 wall on line 4 distributed via roof shear
 a-b panel: using upper half of 26x15x19=7410 / 2 =3705 E = 926
 b-c panel: using upper half of 15x15x19=4275 / 2 =2138 E = 534
 wall on line 1 distributed via roof shear
 a-b panel: using upper half of 24x9x19=4104 / 2 =2052 E = 513
 b-c panel does not exist



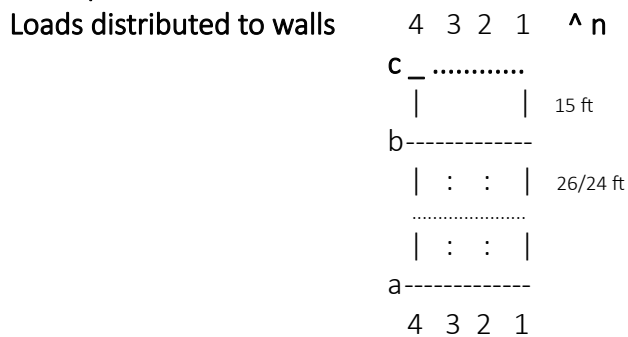
W <-> E loft floor E = 1539 b 50% = E = 385 a 50% 385
 N ^ \ S 2 50% 1 50% E = 385
 walls on line c- no contribution at this level
 line b 14 ft has loft floor use lower half of 8x14x19=2128/2=1064 E=266
 and upper half of lower- - - E = 266
 line a 14 ft has loft floor use lower half of 8x14x19=2128/2=1064 E=266
 and upper half of wall below- - - E = 266
 wall on line 4- no contribution at this level
 wall on line 2 upper half of 24x8x15 = 2880 / 2 = 1440 E = 360
 wall on line 1 upper half of 24 x 8 x 19 = 3648 / 2 = 1824 E = 456



W <-> E Main floor E = 17,080 c- b 25% = E 4270 A.5 50% E = 8540 a/a.1 25% E 4270
 N ^ V S Main floor ln4 15% = 2562 ln 3 33% = 5636 ln 2 35% = 5978 ln 1 17% = 2904
 Main deck E = 3472 for W-E note overhangs c 61% = E = 2118 B 39% e = 1354
 deck for N- S (not used per planned details)
 W <-> E walls on line c- half of = $7 \times 40 \times 19 = 5320 / 2 = 2660$ E = 665
 line b 14 ft has loft floor use lower half of $8 \times 14 \times 19 = 2128 / 2 = 1064$ E = 266
 26 ft has high space use lower half of $17 \times 26 \times 19 = 8398 / 2 = 4199$ E = 1050
 line a 14 ft has loft floor use lower half of $8 \times 14 \times 19 = 2128 / 2 = 1064$ E = 266
 26 ft has high space use lower half of $17 \times 26 \times 19 = 8398 / 2 = 4199$ E = 1050
 wall on line 4 distributed via floor shear
 a-b panel: using lower half of $26 \times 15 \times 19 = 7410 / 2 = 3705$ E = 926
 b-c panel: using lower half of $15 \times 15 \times 19 = 4275 / 2 = 2138$ E = 534
 wall on line 1 distributed via floor shear
 a-b panel: using lower half of $24 \times 9 \times 19 = 4104 / 2 = 2052$ E = 513
 and upper half of basement wall $24 \times 9 \times 19 = 4104 / 2 = 2052$ E = 513
 b-c panel upper half of basement wall $15 \times 9 \times 19 = 2565 / 2 = 1283$ E = 321
 no wall above, deck rail is not heavy

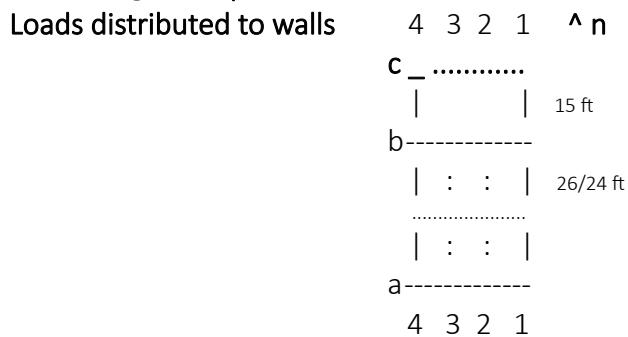
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Earthquake Load



- wall on line c: <-> from roof: E=1439
 from upper wall itself E = 202
 from upper walls on line 4 via roof $534/2 = E = 267$
 total at top plate: E = 1908 <<
- at main floor lvl from wall on ln 4 lower upper E 267
 wall its self lower upper and upper lower E 404
 from extended lower wall 34 ft x 9 x 19 = $5814/2=2907$, E = 727
 from deck E 2118 (40 ft long wall below deck)
 total load added at main 3516 total sliding at deck: 5424 <<
- wall on line b: <-> from roof: E = 4796
 from upper half of whole wall E = $266 + 266 + 1050 = 1582$
 from upper walls on ln 4 via roof a-b $926/2 = 463$ b-c $534/2 = 267$
 from upper wall on line 1 via roof $513 \times 2 / 2 = 513$
 total at top plate E = 7158
 from loft floor E = 385 + lh of wall 1582, walls 4 & 1 750 total added 2417
- at main floor <-> from main floor E = 4270
 from deck E = 1354
 from lower part of wall on b E = 1582
 from lns 4 & 1 via floor $267 + 513 E = 780$
 from upper self wall b $40 \times 8 \times 19 = 6080/2 = 3040$, E = 760
 total added E = 8746 total sliding at main floor E = 16,289 <<
- wall on line a & a.1 from roof: E = 3357
 from upper half of whole wall E = $266 + 266 + 1050 = 1582$
 from upper walls on ln 4 via roof a-b $926/2 = 463$ b-c $534/2 = 267$
 from upper wall on line 1 via roof $513 \times 2 / 2 = 513$
 total at top plate E = 7158
 from loft floor E = 385
- at main floor <-> from main floor E = 4270
 from lower part of this wall on line a E = 760
 from lns 4 & 1 via floor $267 + 513 E = 780$
 from upper self wall below low and tapered E = 600
 total added at floor line E = 6410 total sliding at main 13,953 <<

continuing Earthquake Load

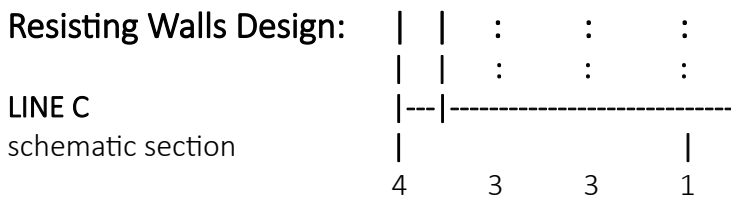


- wall on line 4: ^V from roof: E= 4796
 - from upper wall itself E = 926
 - from upper wall on line c via roof & corner E = 202
 - from upper wall on b via roof E 525
 - from upper wall on a via roof E 525
 - total at line 4 top plate: E = 6974
- at main floor line from main floor E 2562
 - from wall on ln 4 lower upper E 926
 - wall its self upper lower E 500
 - total load added at main 3988 total sliding at main 10,962
- wall on line 3 ^V from roof: 0 this wall only in basement
 - from, main floor: E = 5636
 - from upper half of whole wall 8 x 14 x 15 = 1680 # E = 420
- wall on line 2 ^V from roof: 0
 - from loft floor E = 384
 - from, main floor: E = 5978
 - from whole wall above floor 8 x 24 x 15 = 2880 # E = 720
 - from upper half of wall below floor E = 720
 - line 2 total at main floor line E = 7802
- wall on line 1 ^V from roof: 4796 with overhang 5753
 - from upper part of self wall 9x24x19 = 4104/2=2052 E 513
 - via roof diaphragm from upper walls a & b 650
 - line 1 total at top plate E = 6916
 - from loft floor E = 385
 - at loft floor line half walls above n below 8x24x19=3648 E = 912
 - total added at loft floor line: E = 1297
- at main floor <-> from main floor E = 2904
 - from lower part of this wall above floor 3648/2 = 1824 E = 456
 - from lns a & b via floor 267 + 513 E = 780
 - from upper self wall below floor 40 x 8 x 19 = 6080/2 = 3040, E = 760
 - total added at main floor E = 4900 total sliding at main 13113 <<

Governing Loads Check: at top plates total at main floor level

4 3 2 1 ^ n		
c_.....	<-> W 1764 # E 1908	W 3816 E 5424
	15 ft	
b-----	<-> W 5880 # E 7158	W 14316 E 16,928
: :	12 ft	
a.5		
: :	14/12 ft	
a-----	<-> W 4116 # E 7158	W 14316 E 13,953
4 3 2 1		
^ ^		
	_____ W 7840 # E 6974	W 13948 E 13,113
	_____ W 7840 # E 6974	W 13948 E 10,962

WIND from page ___ W-E <-> West facing wall on line 4
 840 sf, upper half 420 sf x 28 = 11,760 #
distribute to lines c 7/40 15% = 1764 # b 20/40 50% = 5880 a 14/40 35% = 4116 #
 N ^\ S (Low slope roof w deep overhang)
 1120 sf upper half 560 sf x 28 psf = 15680 to ln 4 50% = 7840 ln 1 50% = 7840



W-E Wall Line C: Load at top plate e 1908 / wall Length 5.33 ft = 360 plf
 otm (for HD force) one panel h 16 ft Load 1908 SW__6__
 otm 1908 # x 16 ft = 30528 ft-#
 dlrn: roof tributary length corner to c-c of adjacent openings: 9 ft
 roof tributary area, 9 x 1 = 9 sf x weight 22 psf = 198 #
 wall 5.33 x 16 x 19 psf = 1620 #
 T: 1818 #
 dlrn: 2.67 x 1818 = 4845 ft-#
 net otm 30,528 - 4845 = 25683
 HD spacing 4.5 => T = 5705 # HD __H DU8__

continuing

W-E Wall Line C: Load at Main floor & deck line 5424

wall panels A 17 w 1908 from above + $5424/2 = 2712 = 4620 / 17 = 272$ plf
 and B 17 w $2712 / 17 = 160$ plf

at A otm 9 ft x Load 4620 = 41580 ft-#

dlrm: deck- not used

roof post- not used

wall 17 x 7 ave x 19 psf = 2261 #

dlrm: $8.5 \times 2261 = 19218$ ft-#

net otm $41,580 - 19218 = 22,362$ fr-#

HD spacing 12 => T = 1863 at east end HD_HDU5_

at west end combine w load from e end T= 5705* HD_HDU8_

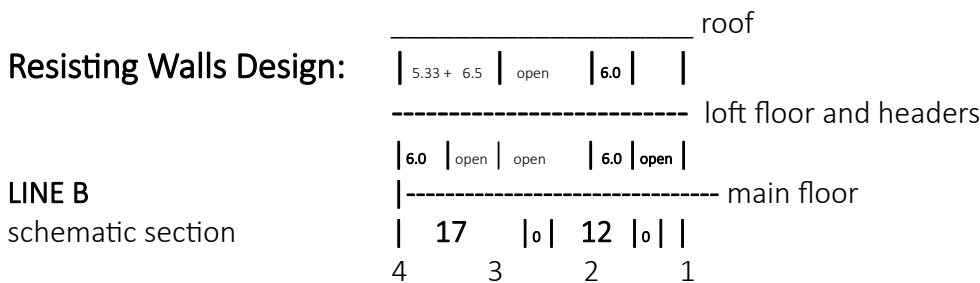
* the larger only as they are in tension one at a time)

at wall part B otm = $2712 \times 9 = 24,408$ ft-#

wall wt 17 x 9 x 19 = 2907

dlrm: $8.5 \times 2907 = 24,709$ ft-#

net otm $24,408 - 24,709 > 0$ ht not required



B upper, load 7158

panels between 3 & 4 11 ft near line 2: 6 ft total 17
 $7158 / 17 = 421$ plf SW_4_

panel a between 3 & 4, otm $421 \times 11 = 4632$ x 7.5 h = 35737 ft-#

dlrm, roof tributary area $12 \times (12+6=18) = 216 \times 22$ psf = 4752 #

dlrm from roof $4752 \times 5.5 = 26136$ ft-#

wall weight $7.5 \times 11 \times 19 = 1568$ #

dlrm from wall $1568 \times 5.5 = 8621$ total dlrms: 34757 ft #

net otm: $35737 - 34757 = 1000$ ft-#

practical hd spacing 5 ft $1000/5 = 200$ # use HD_HDU2_

Panel b across grid line 2 otm $421 \times 6 = 2526 \times 8h = 22734 \text{ ft-}\#$
dlrm, roof tributary area $12 \times (12+6=18) = 216 \times 22 \text{ psf} = 4752 \#$
dlrm from roof $4752 \times 5.5 = 26136 \text{ ft-}\#$
wall weight $8 \times 6 \times 19 = 912 \#$
dlrm from wall $912 \times 3 = 2736$ total dlrms: 28,872 ft #
net otm: $22734 - 28872 < 0$ ok no hd

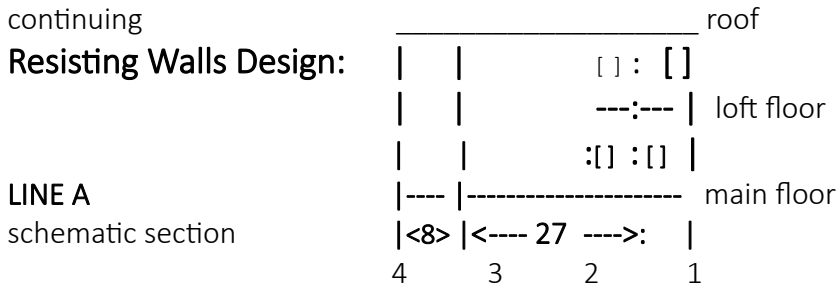
Line B lower portion of main level 2 story wall

sliding load from above 7158 #
additional load from loft and wall weights 2417 total 9575 #
panel a nr line 4 Load $9575/2 = 4788 / 6 = 798 \text{ plf} !$
panel b across line 2 Load $9575/2 = 4788 / 6 = 798 \text{ plf} !$
otm $4788 \times 8 = 38,304 \text{ ft-}\#$ (for each)
dlrm from above is used above
dlrm from wall: $6 \times 8 \times 19 = 912 \times 3 = 2736 \text{ ft-}\#$ (for each)
net otm for each $38,304 - 2736 = 35,568$
 $35568 / \text{hd space} = 5.17 = 6880 \text{ HD force HD_HDU8_}$

Line B wall below main floor level

sliding from above: $3579 \times 2 = 7158 + 2417 = 9575 \#$
load added at floor line 8746 total: 16,289
panel a between lines 3 & 4 17 ft
panel b nr line 2 12 ft total 29 $16,289/29 = 562 \text{ plf SW_3-10_}$
panel a 17 ft $\times 562 \text{ plf} = 9554 \#$
otm $9554 \times 8 = 76,432 \text{ ft-}\#$
dlrm from floor - negligible, spans w-east, supported on walls
dlrm from wall $17 \times 8 \times 15 = 2040 \# \times 7.5 = 15,300 \text{ ft-}\#$
net otm $76,432 - 15,300 = 61,132 \text{ ft-}\#$
hd space 16 $61,132/16 = 3821 = \text{hd force req'd HD_HDU5_}$
panel b load $12 \times 562 = 6744 \#$
otm $6744 \times 8 = 53,954 \text{ ft-}\#$
dlrm from wall $12 \times 8 \times 15 = 1440 \# \times 6 = 8640 \text{ ft-}\#$
net otm $53,954 - 8640 = 45,314 \text{ ft-}\#$
hd spacing 11 ft $45,314 / 11 = 4119 \# \text{ hd force HD_HDU5_}$

continued

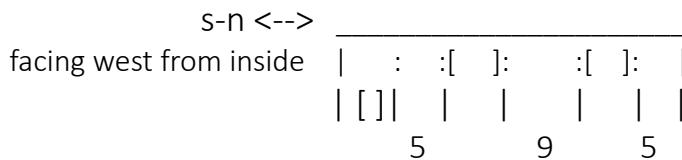


Loft level panel a between 3+ & 4 8 ft wide 17 high
 B 27 ft wide 18 h, reinforce around two small windows
 (Load (E) $7158 / (8+27=35) = 206$ plf)
 OR Load $7158 / (8+18)=26 = 275$ plf and avoid special detailing SW__6__

for a Load share $275 \times 8 = 2200$ #
 otm: $2200 \# \times (h = 15 \text{ ft}) = 33000 \text{ ft-}\#$
 dlrn from roof will be neglected
 dlrn fom wall $8 \times 15 \times 25\text{psf} = 1800$ #
 dlrn $1800 \times 4 = 7200$
 net otm $33000 - 7200 = 25,800 \text{ ft-}\#$
 hd spacing 7 ft $25\ 800/7 = \text{hd force} = 3686 \text{ HD_HDU5_}$

for panel b load share is $275 \times 18 = 4400$ #
 otm $4400 \times 16 = 70,400$
 dlrn: load from roof: tributary area $12 \times 18 \text{ ft} \times 22 \text{ plf} = 4752$ #
 from wall $18 \times 16 \times 19 = 2572$, total = 10224
 dlrn = $10224 \times 9 = 92016$
 net otm, < 0 no hd required

Wall on line 4 main level treating as 2 story wall



Load (Wind) 7840 #
 panels a b c: $5 + 9 + 5 = 19 \text{ ft}$
 $7840 / 19 = 413 \text{ plf}$
 panel A 5 ft Load $5 \times 413 = 2065$ #
 otm = 2065×15 (on high step in foundation) = $30975 \text{ ft-}\#$
 dlrn roof tributary area, $(5+3) \times 6 = 48 \times 22 \text{ psf} = 1056$ #
 wall $5 \times 15 \times 15\text{psf} = 1125$
 dlrn $1124 + 1056 = 2181 \times 2.5 \text{ ft} = 5453 \text{ ft-}\#$

House with covered decks & attached garage 22136 Pine Ct Timber Cove Structural p 20

Gauthier & Hallett, Michael Hallett, architect (707) 847-3468

continuing line 4 wall panel a 5 ft

net otm $30975 - 5453 \text{ ft-}\# = 25522 \text{ ft-}\#$

hd spacing 5 ft hd force req = 5104 # HD_HDU5_

Line 4 panel b 9 ft, load $9 \times 413 = 3737 \text{ \#}$

$3717 \times h = 17$ (foundationm stepped down) = 63189 ft#

drrm from roof: roof tributary $6 \times (9+3+3 = 15) \times 22 = 1980 \text{ \#}$

from wall: $9 \times 17 \times 19 \text{ psf} = 2907 \text{ \#}$ total 4887

dltm $4887 \times 4.5 = 21992 \text{ ft-}\#$

net otm $63189 - 21992 = 41198 \text{ ft-}\#$

hd spacing 9 ft $41198 / 9 = 4578 \text{ \#}$ HD_HDU5_

Line 4 panel c 5 ft, (taller than a) load $5 \times 413 = 2065 \text{ \#}$

otm: $2065 \times h = 19$ (foundationm stepped down) = 39235 ft-#

drrm from roof: roof tributary $6 \times (5+3=8) \times 22 = 1056 \text{ \#}$

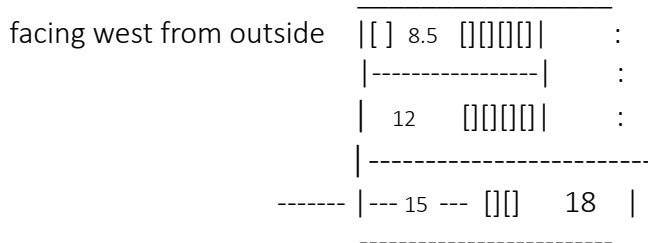
from wall: $5 \times 17 \times 19 \text{ psf} = 1615 \text{ \#}$ total 2671

dltm $2671 \times 2.5 = 6678 \text{ ft-}\#$

net otm $39253 - 6678 = 32576 \text{ ft-}\#$

hd spacing 5 ft $32576 / 5 = 6516 \text{ \#}$ HD_HDU8_

Wall on line 1 <->:



Load (Wind) at top plate 7840 #

panel a loft level 8.5 ft wide $7840 / 8.5 = 922 \text{ plf}$ SW_3-10_TWO SIDES_

otm $7840 \times 9 \text{ ft } h = 70560 \text{ ft-}\#$

dltm from roof tributary area $(7+4=11) \times (8.5+1.25+1.25=11) = 121 \times 22=2662\#$

from wall $8.5 \times 9 \times 19 = 1454$ total 4116 #

dltm = $4116 \times 4.25 = 17491 \text{ ft-}\#$

net otm: $70560 - 17491 = 53069 \text{ ft-}\#$

hd spacing 8.5 (both hds NORTH SIDE of their studs)

hd force req'd $53069 / 8.5 = 6243 \text{ \#}$ at this level HD_HDU8_

continuing Wall on Line 1:

panel b at story below loft HD loads from above T = 6243 #

sliding load from above: 7840 #

sliding Load added this level 1297 # sliding total: 9137

panel B Load $9137 / 12 = 761$ plf continue from above SW_3-10_TWO SIDES_

otm: $9137 \times 8 = 73096$ ft-#

dlrm from floor at loft $7 \times 12 = 84 \times 17 = 1428$ #

from wall $8 \times 12 \times 19 = 1824$ total: 3252

dlrm $3252 \times 6 = 19512$ ft-#

net otm $73096 - 19512 = 53584$ ft-#

hd spacing 8.5 to align w above $53584 / 8.5 = 6304$ #

Will be combined with above so total is $6304 + 6243 = 12547$ # HD_HDU14_
in 6x6 stud

Line 1 panels c & d below main floor sliding from above: 9137

sliding added (from p 15) 4900

total sliding 14037

c 15 + d 18 = 33 $14037/33 = 425$ plf continue SW_3-10_ outside only

Panel c $15 \times 425 =$ sliding load share 6376 #

otm = $6376 \times h=4 = 25504$ ft-#

dlrm from floor $15 \times 7 \times 70 = 7350$ #

from wall $15 \times 4 \times 19 = 1140$ # total: 8490 #

dlrm = $8490 \times 7.5 = 63675$ no more HD required

Line 1 panel d:

$18 \times 425 = 7650$ #

otm $7650 \times 8 = 61200$ ft-#

dlrm, not relying on the deck

from wall only $8 \times 18 \times 19 = 2736$ #

dlrm = $2736 \times 9 = 24624$ ft-#

net otm: $61200 - 24624 = 36576$ ft-#

use hd spacing 17 hd force $36576 / 17 = 2152$ HD_HDU2_

[we have not considered roof load via corner and post

but we think we will need that for uplift resistance

at this open edge...]

Vertical loads:

House roof:

DL 22 psf Live load 20 psf total 42 psf

typical rafter span 14 ft for 2x10 at 16" w = $42 \times 1.33 = 56$ plf W = 784 #

R-1 = R 2 = 392# Use Simpson LU210 hangers

And 2x4x14" nailing blocks for shear transfer sheathing to PSL Beam

w/ 3 8d into beam and 3 8d through ply into each block

Roof girders concealed in roof:

L = 24 ft for grid line 2

rafter reactions 392# at 16 inches $392/1.33 = 295$ plf x two sides = 590 plf

weight of beam if PSL 11-7/8 x 7, similar if laminated LVL + 30 t: 620 plf

Mmax at mid span $w \times l^2 / 8 = 620 \times 24 \times 24 / 8 = 44,640$ ft=# required

L = 24 ft for grid line 3

rafter reactions at 14 ft rafter span 392# at 16 inches $392/1.33 = 295$ plf

at 12 ft 336 253

weight of beam if PSL 11-7/8 x 7 similar if laminated LVL 30 plf t: 578 plf

Mmax at mid span $w \times l^2 / 8 = 578 \times 24 \times 24 / 8 = 41,616$ ft=# required

PSL 2.0e 11-7/8 x 5-1/4 allowable moment 29,855 and wt 29 plf ng

PSL 2.0e 11-7/8 x 7 allowable moment 39,806 ft=# ng

PSL 2.0e 14 x 7 allowable moment 54,325 ft=# ok <- revise on drawings

== or use alternate LVL

Alternate LVL 1.9e 1-3/4 x 11-7/8 at 8925 ft=# x 5 = 44,625 close enough

x 6 = 53,550 ft=# alternate ok

bearing length required: less than 3-1/2"

one 24 ft length weighs about 150# ok for lifting up without a crane

roof beams continued overleaf

At roof over deck, L = 15 ft, cantilever 4.5 ft
rafter reactions at 14 ft rafter span 392# at 16 inches $392/1.33 = 295$ plf
at 12 ft on 2nd side 255
weight of beam if LVL 1-3/4 x 11-7/8 x 2 + 15 t: 565 plf
Mmax at mid span $w \times L^2 / 8 = 565 \times 15 \times 15 / 8 = 15,890$ ft-# required
Alternate LVL 1.9e 1-3/4 x 11-7/8 at 8925 ft-# x 2 = 17,850 ok

At steel column cap, 1-3/4 x 2 = 3.5 + 5/8 + = hole c-c gage 4-1/4
Largest reaction on steel post $565 \times (8 + 4.5 = 12.5) = 7063$ #
required bearing length < 3-1/2"

Loft floor joists
L = 14 ft with minor cantilever
DL 17 psf Live load 40 psf total 57 psf for 16" spacing $w = 57 \times 1.33 = 76$ plf
2x10 at 16" ok

Main floor
Maximum L = 24 DL = 70 psf LL = 40 tl 110 psf
M = $w \times L^2 / 8 = 110 \times 14 \times 14 / 8 = 2695$ ft-# ok
reactions R-1 = R-2 = $110 \times 7 = 770$ # ok
horizontal shear in LVL $F_v = 3V / 2bd = 3 \times 110 / 2 \times 1.75 \times 11.88 = 79$ psi ok

Main deck has tile over wp so framing stays dry
and we have a noncombustible floor surface
under the outdoor kitchen

Typical joist longest span (continuous at each support) 7 feet
and cantilever 4.5 ft
Load DL 25 LL 60 TL 85
for 7 ft $w = 85$ plf $W = 595$ R1 at interior support = 595
D Fir 4x6 ok for bending and deflection

Main deck girders max L = 16 cantilever at east 5 ft
Load $595 / 1.33 = 447$ plf
M max: $w \times L^2 / 8 = 447 \times 16 \times 16 / 8 = 14,316$ ft-#
lvl 1.93 1-3/4 x 11-7/8 allowable M 8,925 x 2 = 17,850 ok

Areas and weights for Garage & Laundry wing (seismic will govern s-n) (wind w-e)

Roof over entry porch 8 x 32 = 256 sf

29 psf x 256 = 7424 # 7424 x 0.25 = E = 1856
 pipe columns 20#/ft x 13=260 x 4 = 1040 # upper 1/2 = 520 130
total at tpl 1856
 1/2 to House line 4 928 & ln 5 928

roof over garage 22 x 18 = 396 sf

12 psf x 396 = 4752 4752 x 0.25 = E = 1181
 walls metal on w 12 hi x 22 = 264 x 15 = 3960 x 1/2 = 1980 495
 s 12 hi x 18 = 216 x 15 = 3240 1620 405
 f-c n 12 hi x 10 = 120 x 17 = 2040 1020 255
 int n 12 hi x 8 = 96 x 12 = 1152 576 144
 f-c e 14 hi x 22 = 308 x 17 = 6236 3118 778
total: 3259
 1/2 to line 6: 1630 1/2 to ln 5 1630

roof over laundry 18 x 8 = 144 sf

11 psf x 144 = 1584 # E: 396
 walls metal on w 12 h x 18 = 216 x 15 = 3240 x 1/2 1620 405
 f-c on n 12 h x 8 = 96 x 17 = 1632 816 204
 f-c e 12 h x 18 = 216 x 17 = 3672 1836 459
total: 1464
 1/2 to ln 6 732 half to 5.7 732

roof at tank shelter w open side 20 x 14 = 280

14 psf x 280 = 3920 # E: 976
 wall on w met + f-c w 12 h x 20 = 240 sf x 22 psf = 5280 # 1/2; 2640 660
1/2 to ln 6 330 ln 5.7 330

roof at writer's studio 12 x 14 = 168 sf

12 psf x 168 = 2016 # E: 504
 walls metal 4 side 10 hi x 8 x 4 = 320 sf x 15 = 4800 x 1/2" 2400 600 T: 1104
wall h 552 j 552

Wind Loads for garage and Laundry wing

Roof over entry porch 8 x 32 = 256 sf

roof projected area facing west, B: = 3x8=24 sf x 19 psf-> 456->
 plan area windward slope E: 256 sf x 11 psf down 2816 dn if w fr w
 Eoh 11 psf up 2816 up if w fr e
 pipe columns A" 2dxh = 1 x13=13 x4 = 52 sf x28 psf-> = 1456 #

roof over garage 22 x 18 = 396 sf

projected area facing west, B = 22 x 1.5 = 33 x 19 627-> 627
 plan area windward slope E: 396 x 11 psf down 4356 dn
 wall metal on w 12 hi x 22, A: 264 x 28 = 7392-> upper half-> 3696
 total w- e at t pl 4323
 to ln A 2162 to ln +/-B 2162

roof over laundry 18 x 8 = 144 sf

projected area facing west, B: 18 x 1 = 18 x 19 342 # -> 342
 plan area windward slope E: 144 x 11 psf down 1584 dn
 wall metal on w 12 hi x 18, A: 216 x 28 = 6048 -> upper half 3024
 total w- e at t Pl 3666
 to ln +/-B 1683 to ln D 1683

roof at tank shelter w open side 20 x 14 = 280

projected area facing west, B: 20 x 1.25 = 25 sf x 19 475 # -> 475
 wall on w met 12 h x 20 A: 240 sf x 28 6720 upper 1/2 3360
 total w- e at t pl 3835
 to ln D 1918 to ln E 1918

roof at writer's studio 12 x 14 = 168 sf

projected area facing west, B: 12 x 3 = 36 x 19 684 # -> 684
 wall metal facing w 10 hi x 8 = 80 sf x 28 = 2240 -> upper 1/2 1120
 total w-e at tpl 1804
 to ln F 902 to ln G 902

Garage Laundry Resisting walls West- East <-->

A	L 8.5 ft	wind load 2162 #	/8.5 =	254 plf	_SW6_
+/- B	L 6.5 ft	2162 + 1683 = 3845	/6.5 =	592plf	_SW3-10_
D	L 8 ft	1683 + 1918 = 3601	/8 =	450plf	_SW3-10_
E	braced posts 1918				
F	L 4 ft	902	/4 =	226 plf	_SW6_
G	L 4 ft	902			_SW6_

Resisting walls S-N seismic governs

Line 6 at garage load s-n 1630 #

Line 6 at laundry load s-n 732

line 6 at tank shelter 330 T: 2692

Wall panels $22 + 5 + 4 + 20 = 51$ $2692 / 51 = 53$ plf _SW6_ no hd's

line 5.7 330 + 732 T: 1062

Wall panels at main level $6 + 6 = 12$ $1062 / 12 = 89$ plf

upper part has $3 + 3 = 6$ $1062 / 6 = 177$ plf Use _SW6_

line 5 at garage 928

+ 1630 T: 2558

Wall panel 18 ft $2558 / 18 = 142$ _SW6_

continued

Typical exterior wall & SW 6:

1/2" panels, **D Fir exterior ply "STR I"**, 8d (0.131" diameter) @ 6" 340 plf
2x studs & plates, double top plates, 2-2x
clips where sheathing does not lap: A35 (450#) @ 16"
blocking at horizontal panel joints, use 2x6 or 2x4
sill plate, 2x; sill nailing 16d (@141) 2 per ft, use 16d @ 6"
Anchor bolts at concrete foundation 5/8" @ 32"

SW 4: 1/2" (15/32) **D Fir exterior ply "STR I"**, 8d @ 4" 430 plf
2x studs & plates, double top plates, 2-2x
clips where sheathing does not lap: A35 (450#) @ 12"
blocking at horizontal panel joints, use 3x6
sill plate, 2x; sill nailing 16d (@141) = < 3 per ft, use 16d @ 4"
Anchor bolts at concrete foundation 5/8" @ 32"
Reference: SDPWS table 4.3A – for seismic

SW 4 TWO SIDES: 860 plf

4x6 stud / block at panel joints, stagger nails on same stud at panel joints
Reference: SDPWS section 4.3.3.3 – same construction 2 sides => 2x capacity
Sheathing and nailing must be symmetrical on two sides to achieve full load

SW 3-10: 1/2" **D Fir ply "STR I"**, 10d @ 3" **4x6 studs at boundaries and panel joints** 665 plf

double top plates, 2-2x6
nail double plates with 16d at 4" (typ is 16d @ 16")
Stagger panel edge nailing on 2 doubled plates
clips where sheathing does not lap: A35 (450#) @ 9"
Sill plate, 3x6
Lap sheathing on rim joist with p.e.n. into sill & rim OR sill nailing 20d @ 3"
Anchor bolts at concrete foundation 5/8" @ 32"
Reference: SDPWS table 4.3A – for seismic

SW 3-10 TWO SIDES: 1330 plf

4x6 stud / block at panel joints, stagger nails on same stud at panel joints
Reference: SDPWS section 4.3.3.3 – same construction 2 sides => 2x capacity
Sheathing and nailing must be symmetrical on two sides to achieve full load

Hold Down Notes:

DTT2Z w/ 8 SDS 1/4x1-1/2 screws (included) in 2x4 stud **rated 1825 #**
anchor 1/2"

HDU2-SDS2.5 in 2,2x4 studs laminated with 4 SDS-2.5 **rated 3075 #**
anchor 5/8, at new concrete w/ SSTB24; at existing concrete as detailed
Anchor center location from far face of 4x4 stud, 5 inches

HDU5-SDS2.5 in 2,2x4 studs laminate studs w 7 additional SDS-2.5 **rated 5645 #**
OR a single 4x4 or 4x6 stud
anchor 5/8 at new concrete SB 5/8 x 24 18" into stem wall, corner/end ok
At existing drill and epoxy w required inspection

HDU8-SDS2.5 in 4x6 DF STUD **rated 7,870**
anchor 7/8

HDU14-SDS2.5 IN 6X6 DF STUD **rated 14,445**
anchor 1 inch

ANCHOR BOLTS FOR SLIDING LOADS

Rule from CBC sec 1905 embedded bolts & drilled-in non expansion type may use
values for wood single shear at NDS & 1-1/2" ptdf sill 1/2" 650, 5/8 930 (ASD)

For 3x sill 2-1/2 ptdf & 5/8 _1050_

if redwood 3x sill: 5/8 bolt _810_

embedded 7 in, side clearance 1-3/4, end distance 15d (1/2: 8 in 5/8: 9-1/2)

end of document