Minimum Wall Sheathing CRC - First Floor **SECTION [0201] - 1**

The residence is sheathed in exterior 1/2" 5-ply plywood nailed with 8d common nails at 12" oc at edges and field. The boundary nailing capacity is half of the maximum spacing tabulated in the building codes. The residence is checked against the CRC prescriptive wall opening limits, assuming 6" oc (which is not the case) to assess the degree of wall continuity. A CBC analysis is performed in calculation 0301 which estimates the DC ratios for the 12" oc nailing.

Figure 1 Existing shear wall nailing - 8d at 12" OC 01 - F01

Figure 2 Existing shear wall nailing - 8d - 2-1/2" penetration 01 - F02

The minimum solid wall percent is given in the following CRC table.

R606.12.2.1 MINIMUM EXTERIOR SOLID WALL LENGTH (%)			
Seismic Design	One story or	Wall supporting	Wall supporting

...continued on next page

R606.12.2.1 MINIMUM EXTERIOR SOLID WALL LENGTH (%)			
Category	top story of two story	light-framed second story and roof	masonry second story and roof
Townhouses in C	20	25	35
D0 or D1	25	Not Permitted	Not Permitted
D2	30	Not Permitted	Not Permitted

The percent solid wall for each shear wall is:

Percent Solid Shearwall			
Wall No.	Length (ft)	Openings (ft)	Solid (%)
SW1	30.0	12.6	58
SW2	13.7	4.5	67
SW3	5.8	0.0	100
SW4	14.4	6.5	55
SW5	5.8	0.0	100
SW6	13.6	3.1	77
SW7	30.0	8.0	73
SW8	42.0	22.7	46

Therefore, if edge nailing requirements are met the residence meets the prescriptive opening requirements of the CRC.

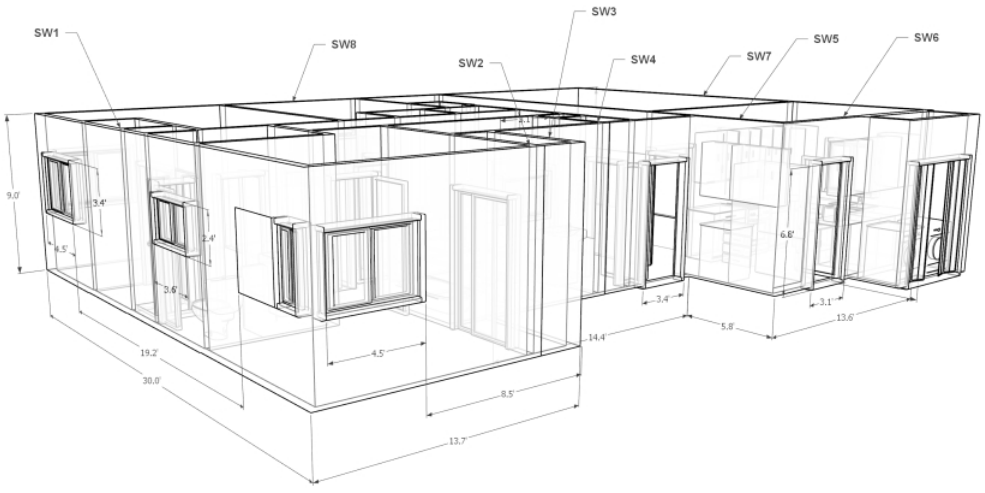

Figure 3 First floor shear walls - north and west sides 01 - F03

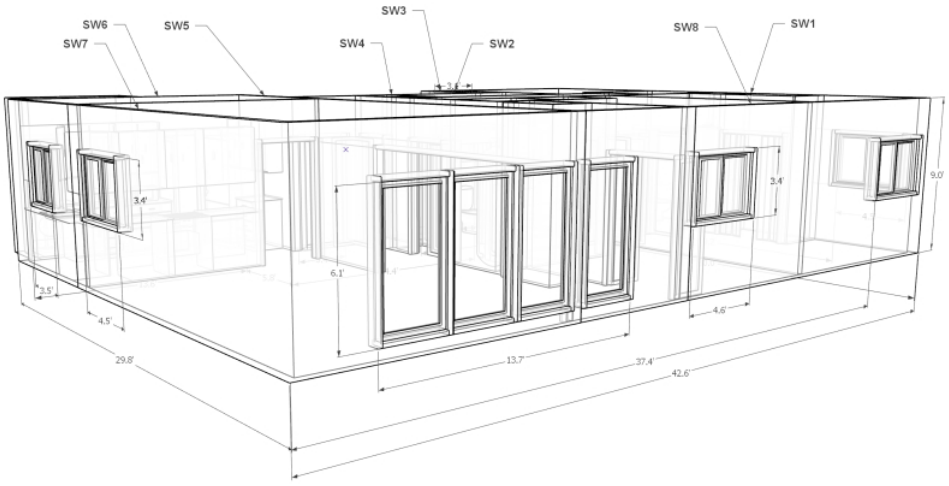

Figure 4 First floor shear walls - south and east sides 01 - F04

Check required basic fastener spacing:

R602.3(1) FASTENING SCHEDULE			
Panel thickness	Number and Type of Fastener [a][b][c]	Edge Spacing	Intermediate Spacing
3/8 in.- 1/2 in.	6d common (2 in. x 0.11 in) nail (subfloor, wall); 8d common (2 1/2 in. x 0.131 in.) nail (roof); or RSRS- 01 (2 7/8 in. x 0.113 in.) nail (roof)	6 in.	12 in.
19/32 in.- 1 in.	8d common nail (2 1/2 in. x 0.131 in.); or RSRS-01; (2 1/8 in. x 0.113 in.) nail (roof)	6 in.	12 in.
1/8 in.-1 1/4 in.	10d common (3 in. x 0.148 in.) nail; or 8d (2 1/2 in. x 0.131 in.) deformed nail	6 in.	12 in.

```
Note: Table applies to wood structural panels, subfloor, roof
and interior wall sheathing to framing and particleboard wall
sheathing to framing [see Table FI602.3(3) for wood structural
panel exterior wall sheathing to wall framing

[a] Nails are smooth-common box or deformed shanks except where
otherwise stated. Nails used for framing and sheathing connections
shall have minimum average bending yield strengths as shown:
80 ksi for shank diameter of 0.192 inch (20d common nail);
90 ksi for shank diameters larger than 0.142 inch but not larger
than 0.177 inch and 100 ksi for shank diameters of 0.142 inch or less.
```

[b] Staples are l6 gage wire and have a minimum 7/16-inch diameter crown width.

[c] Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

Check code required wind governed fastener spacing:

R602.3(3) WOOD WALL SHEATHING WIND PRESSURE REQUIREMENTS[a,b,c]			
Minimum Nail Size	6d commonn(2.0 x 0.113)	8d Com-monn(2.5 x 0.131)	8d Com-monn(2.5 x 0.131)
Minimum Nail Penetration (in)	1.5	1.75	1.75
Minimum Panel Span Rating	24/0	24/16	24/16
Minimum Nominal Thickness (in)	3/8	7/16	7/16
Minimum Stud Spacing (in)	16	16	24
Edge Nail Spacing (in)	6	6	6
Field Nail Spacing (in)	12	12	12
Exposure B Vult (mph)	140	170	140
Exposure C Vult (mph)	115	140	115
Exposure D Vult (mph)	110	135	110

[1] Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

[2] Table is based on wind pressures acting toward and away from building surfaces in accordance with Section R301.2. Lateral bracing requirements shall be in accordance with Section 8602.10.

[3] Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternate to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 o.c. shall be used with studs spaced not more than 16 inches on center.

In order to meet the code prescriptive wind and seismic requirements the number of nails at the exterior sheathing panel boundaries need to be doubled - from 12" oc to 6" oc. Refer to CBC analysis in calculation 0301 for an analysis of DC ratios with reduced capacity

Foundation - CRC Requirements **SECTION [0201] - 2**

The existing foundation on the north and west side of the residence is a concrete strip footing directly supporting the floor joists. On the south side the floor joists are supported on 2x4 framed walls varying in height, up to 6 feet. The framing is clad on the outside with 1x10 planks, spaced 1" apart for ventilation.

The foundation has two significant seismic deficiency. The first is a significant torsional irregularity arising from lack of shear stiffness and strength on the south and east walls. The existing structure has only one compression brace along each wall and the spaced planks do not provide meaningful strength or stiffness. This irregularity is a deficiency whether the floor diaphragm is considered semi-rigid or flexible. The second is the lack of adequate anchorage of the sill plates to the foundation. Existing anchorage typically consists of only a single 1/2" anchor bolt and small washer every 3 or 4 feet.

The torsional irregularities disqualify the foundation structure from following a CRC design process.

Seismic Model Inputs - CBC Requirements SECTION [0201] - 3

Seismic demands on the residence were analyzed using a 3D FEM model. The model includes the full relevant geometry, loads and stiffness of the walls, roof, floors and foundation.

The in-plane stiffness of the T&G roof is taken as 300 pounds/inch/inch using test data from [USDA1972]. The in-plane stiffness of the plywood shear walls and subfloor is estimated at 1000 pounds/inch/inch after supplementary nailing, using values from CBC tables.

[USDA1972] USDA Forest Products Laboratory. 1972. "Shear Stiffness Of Two-Inch Wood Decks For Roof Systems", U.S.D.A. Forest Service RESEARCH PAPER, FPL 155 1972

system-message

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Malformed table. Column span alignment problem in table line 8.

```
=============================================================  ==========  =======  =====
AWC4.3A Unit Shear Capacity Wood-Frame Shear Walls [1-7]
=============================================================  ==========  =======  =====
component                                                      property    --       --
panel                                                          thick(in)   5/16     3/8
nail                                                           depth(in)   1-1/4    1-1/4
nail                                                           size        6d       6d
---------                                                      -------     -------  -----
edge nail                                                      value
---------                                                      -------     -------  -----
6-in                                                           vs(plf)     360      400
OSB 6-in                                                       Ga(kip/in)  13       11
PLY 6-in                                                       Ga(kip/in)  9.5      6.5
4-in                                                           vs(plf)     540      600
OSB 4-in                                                       Ga(kip/in)  18       15
PLY 4-in                                                       Ga(kip/in)  12       11
3-in                                                           vs(plf)     700      780
OSB 3-in                                                       Ga(kip/in)  24       20
PLY 3-in                                                       Ga(kip/in)  14       13
2-in                                                           vs(plf)     900      1020
OSB 2-in                                                       Ga(kip/in)  37       32
PLY 2-in                                                       Ga(kip/in)  18       17
=============================================================  ==========  =======  =====
```

backrefs:

The shear capacity adjustments for shear wall openings is taken from the AWC table below:

Table 4.3.3.5 Shear CapacitynAdjustment Factor, Co					
Wall Hght - h	Max Opening Hght [1]				
h	h/3	h/2	2h/3	5h/6	h
8’ Wall	2’-8in	4’-0in	5’-4in	6’-8in	8’-0in
9’ Wall	3’-0in	4’-6in	6’-0in	7’-6in	9’-0in
10’ Wall	3’-4in	6’-0in	6’-8in	8’-4in	10’-0in
Percent Full-Hght	Effective Shear				
Sheathing [2]	Capacity Ratio				
10%	1.00	0.69	0.53	0.43	0.36

...continued on next page

Table 4.3.3.5 Shear CapacitynAdjustment Factor, Co					
20%	1.00	0.71	0.56	0.45	0.38
30%	1.00	0.74	0.59	0.49	0.42
40%	1.00	0.77	0.63	0.53	0.45
50%	1.00	0.80	0.67	0.57	0.50
60%	1.00	0.83	0.71	0.63	0.56
70%	1.00	0.87	0.77	0.69	0.63
80%	1.00	0.91	0.83	0.77	0.71
90%	1.00	0.95	0.91	0.87	0.83
100%	1.00	1.00	1.00	1.00	1.00

	ASCE7-16; Risk II; Site D
Parameter	Value
SS	1.512
S1	0.685
FA	1
FV	1.5
SMS	1.512
SM1	1.027
SDS	1.008
SD1	0.685
TL	12
PGA	0.603
PGAM	0.603
FPGA	1
LE	1

Table 01 Base shear coefficient 03 - T01

variable	**value**	**[value]**	**description**
SDS	1	1	short period design
R1	6.5	6.5	reduction factor
omega	3	3	overstrength factor

Seismic coefficent **[e]_**

$$C_s = \frac{SDS}{R_1}$$

$$0.15 = \frac{0.15}{0.15}$$

variable	value	[value]	description [eq. number]
C_s	0.153846	0.153846	Base shear coefficient [00]

Docutils System Messages

system-message

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Unknown target name: "e".