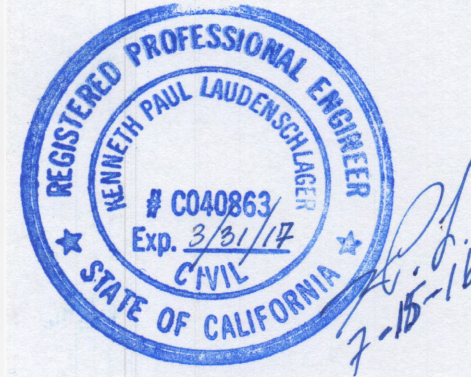


ALPEN ENGINEERING, INC.
Paul Laudenschlager, P.E.
P.O. Box 6, Truckee, California 96160
ph (530)582-9593 E-mail: paul@alpenengineering.com

TECHNICAL BULLETIN
FOR UNBLOCKED SHEARWALLS OVER RAYCORE PANELS

July 15, 2016

By: K. Paul Laudenschlager, P. E.



Background & Reasons for Bulletin

Standard practice for shearwalls constructed under the International Building Code (IBC) or Wood Structural Panel (WSP) Braced wall panels constructed under the International Residential Code (IRC) require shearwalls or braced wall panels to be blocked; that is to have all a panel edges edge nailed to framing members or blocking. This blocking is normally accomplished by edge nailing full 8 ft. panels to the top and bottom plates for buildings with 8 ft. ceilings or by using 10 ft. wood structural panels similarly for walls with 9 ft. or 10 ft. ceiling heights. However, in some parts of the United States, 10 ft. wood structural panels are not readily available. Alternately, for walls taller than the wood structural panels size, another option is to edge nail the unsupported transverse panel edges to flat 2x4 blocks. With RAYCORE panel walls, although this can be done, it is an additional time consuming step since it requires routing out the foam and also decreases the insulation capacity of the wall.

Alternate Unblocked Shearwalls with Tighter Fastener Spacing

An alternate to using standard blocked shearwalls (or WSP braced wall panels) is to use unblocked shearwalls with tighter fastener spacing. The alternate fastener spacings in Table 1 below may be used for unblocked shearwalls or WSP braced wall panels in lieu of standard blocked shearwalls over Raycore panels. These have been calculated using reduction factors the AWC Special Provisions for Wind and Seismic-2015 Addition (SDPWS), Section 4.3.3.2 and applied to shearwall capacities for nails in SDPWS table 4.3A and for staples in ESR-1559, 7/2016 by the ICC Evaluation Service. Using these tighter fastener spacings will allow construction of unblocked shearwalls taller than 8 ft. using standard 4x8 wood structural panels. These have been calculated for 7/16" wood structural panels with 16" o.c. stud spacing. Fasteners for other panel thicknesses may be calculated upon request.

TABLE 1: FASTENERS REQUIRED FOR UNBLOCKED 7/16-inch WOOD STRUCTURAL PANEL SHEARWALLS OR WSP (BRACED WALL PANELS) FOR 16 inches O.C. STUD SPACING.

Fastener	Edge Studs/Top & Bottom Plates	Intermediate Studs (field)
8d com Nail (0.131 in. x 2.5 in.)	4.5 in. o.c.	4.5 in. o.c.
16 gauge x 1-3/4 in. Staple *	3 in. o.c.	3 in o.c.

*Staples must have a minimum 7/16 in. crown width & be installed with their crown parallel to the long dimension of the framing and be driven flush with the surface of the sheathing.

Attachments:

1. Calculations
2. SDPWS Table 4.3A
3. ESR 1539 Table 8

CIVIL * STRUCTURAL * LOG * TIMBER FRAME
P.O. BOX 6 TRUCKEE, CALIFORNIA 96160
ph. (530) 582-9593
E-mail: paul@alpenengineering.com

PROJECT UNBLOCKED SHEARWALLS
JOB NUMBER _____
BY KPL
DATE 7-15-16
REVISION DATE _____

STANDARD ATTACHMENT (PER IRC TABLE R602.3)	WOOD STRUCTURAL PANEL SHEATHING (7/16")		(ASD) $V_6 = V_{allowable}$ 255 PLF*
	EDGE	INTERMEDIATE	
Ed com	6"	12"	
16 GA x 1 3/4" STAPLE	3"	6"	310 PLF**

* PER NDS 2015, TABLE 4.3A. ** PER ESR-1539 7/2016 TABLE 8

REDUCTION FOR UNBLOCKED SHEARWALLS (PER "NDS 2015 SPECIAL PROVISIONS FOR WIND & SEISMIC" SECTION 4.3.3.2)

$$V_{ub} = V_c C_{ub}$$

For Ed com @ 6/6 & 16" STUD SPACING
 $C_{ub} = 0.8$

*** OR EQUIVALENT STAPLES
16 GA @ 3"/3"

For Ed com NAILS IN 7/16" WOOD STRUCT. PANELS
NAILED AT 6"/6"

$$V_{ub} = (255)(0.8) = 204$$

REDUCTION IN SPACING FOR EQUIVALENT CAPACITY.
EDGE & FIELD NAIL SPACING = $(6)(0.8) = 4.8$ IN O.C.

USE Ed com @ 4.5" EDGE / 4.5" FIELD
FOR UNBLOCKED 7/16" SHEARWALLS
WITH STUDS @ 16" O.C.

For 16 GA x 1 1/2" OR 1 3/4" STAPLES @ 3" EDGE / 3" FIELD
 $V_{ub} = (310)(0.8) = 248$ PLF THIS APPROXIMATELY
 EQUAL TO STANDARD CONDITION WITH Ed com @
 6"/12" WITH $V_6 = 255$ PLF.

USE 16 GA x 1 3/4" STAPLES @ 3" EDGE / 3" FIELD
 FOR UNBLOCKED 7/16" SHEARWALLS WITH STUDS
 @ 16" O.C.

Table 4.3A Nominal Unit Shear Capacities for Wood-Frame Shear Walls^{1,3,6,7}

Wood-based Panels⁴ *LRFD Moments Divide By 2 (ASD)*

Sheathing Material	Minimum Nominal Panel Thickness (in.)	Minimum Fastener Penetration in Framing Member or Blocking (in.)	Fastener Type & Size	A SEISMIC												B WIND					
				Panel Edge Fastener Spacing (in.)						Panel Edge Fastener Spacing (in.)						Panel Edge Fastener Spacing (in.)					
				6	4	3	2	6	4	3	2	6	4	3	2						
Wood Structural Panels - Structural ^{4,5}	5/16	1-1/4	Nail (common or galvanized box) 6d	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	3/8 ²	1-3/8		400	13	10	600	18	13	780	23	16	1020	35	22	560	840	1090	1430		
	7/16 ²	1-3/8		460	19	14	720	24	17	920	30	20	1220	43	24	645	1010	1280	1710		
	15/32	1-3/8		510	16	13	790	21	16	1010	27	19	1340	40	24	715	1105	1415	1875		
Wood Structural Panels - Sheathing ^{4,5}	15/32	1-1/2	Nail (common or galvanized box) 10d	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	19/32	1-1/2		680	22	16	1020	29	20	1330	36	22	1740	51	28	950	1430	1860	2435		
	5/16	1-1/4		360	13	9.5	540	18	12	700	24	14	900	37	18	505	755	980	1260		
	3/8	1-1/4		400	11	8.5	600	15	11	780	20	13	1020	32	17	560	840	1090	1430		
Plywood Siding	5/16	1-1/4	Nail (galvanized casing) 6d	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	3/8	1-3/8		440	17	12	640	25	15	820	31	17	1060	45	20	615	895	1150	1485		
	3/8	1-3/8		480	15	11	700	22	14	900	28	17	1170	42	21	670	980	1260	1640		
	15/32	1-1/2		520	13	10	760	19	13	980	25	15	1280	39	20	730	1065	1370	1790		
Particleboard Sheathing - (M-S "Exterior Glue" and M-2 "Exterior Glue")	5/16	1-1/4	Nail (galvanized casing) 8d	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	3/8	1-3/8		280	13	10	420	16	11	550	17	12	720	21	12	390	590	770	1010		
	3/8	1-3/8		320	16	11	480	18	12	620	20	13	820	22	12	450	670	870	1150		
	3/8	1-3/8		240	15	10	360	17	11	460	19	12	600	22	12	335	505	645	840		
Structural Fiberboard Sheathing	1/2	1-1/2	Nail (common or galvanized box) 6d	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	5/8	1-1/2		260	18	12	380	20	13	480	21	13	630	23	13	385	530	670	880		
	1/2	1-1/2		280	18	12	420	20	13	540	22	13	700	24	13	390	590	755	980		
	5/8	1-1/2		370	21	13	550	23	14	720	24	14	920	25	14	520	770	1010	1290		
Structural Fiberboard Sheathing	1/2	1-1/2	Nail (galvanized roofing) 11 ga. galv. roofing nail (0.120" x 1-1/2" long x 7/16" head)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	25/32	1-1/2		400	21	13	610	23	14	790	24	14	1040	26	14	560	855	1105	1455		
Structural Fiberboard Sheathing	1/2	1-1/2	Nail (galvanized roofing) 11 ga. galv. roofing nail (0.120" x 1-1/2" long x 7/16" head)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)	V _s (plf)	G _s (kips/in.)		
	25/32	1-1/2		340	4.0	4.0	460	5.0	5.0	520	5.5	5.5	520	5.5	5.5	475	645	730	730		

1. Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls. See Appendix A for common and box nail dimensions.
 2. Shears are permitted to be increased to values shown for 1.5/32 inch (nominal) sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.
 3. For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G_s)]$, where G_s = Specific Gravity of the framing lumber from the NDS (Table 12.3.3.A). The Specific Gravity Adjustment Factor shall not be greater than 1.
 4. Apparent shear stiffness values G_s are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for shear walls constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, G_s values shall be permitted to be multiplied by 1.2.
 5. Where moisture content of the framing is greater than 19% at time of fabrication, G_s values shall be multiplied by 0.5.
 6. Where panels are applied on both faces of a shear wall and nail spacing is less than 6" on center on either side, panel joints shall be offset to fall on different framing members as shown below. Alternatively, the width of the nailed face of framing members shall be 3" nominal or greater at adjoining panel edges and nails at all panel edges shall be staggered.
 7. Galvanized nails shall be hot-dipped or tumbled.

TABLE 8—ALLOWABLE SHEAR FOR WIND OR SEISMIC LOADING FOR WOOD STRUCTURAL PANEL SHEAR WALLS WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE AND RATED SHEATHING (plf)^{1,2,3,4,5,6,7,8,9,10,11}

NOMINAL NAIL DIAMETER (inch) OR STAPLE GAGE	MINIMUM NOMINAL FASTENER LENGTH (inches)		SEISMIC				WIND			
	Panels Applied Directly to Framing	Panels Applied Over 1/2 inch or 5/8 inch Gypsum Sheathing	Fastener Spacing at Panel Edges (inches)				Fastener Spacing at Panel Edges (inches)			
			6	4	3	2	6	4	3	2
3/8-inch Nominal Panel Thickness										
0.148 smooth	2	—	220	320	410	530	305	445	575	740
	—	2 1/2	260	380	490	640	365	530	685	895
0.131 smooth or deformed	1 3/4	—	220	320	410	530	305	445	575	740
	—	2 1/4	200	300	390	510	280	420	545	715
0.120 smooth or deformed	1 3/4	—	160	230	295	380	220	320	410	530
	—	2 1/2	170	255	330	430	235	355	460	600
0.113 smooth or deformed	1 3/4	—	200	300	390	510	280	420	545	715
	—	2 1/4	150	225	295	380	210	315	410	535
14, 15, 16 Gage	1 1/2	—	140	210	280	360	195	295	390	505
14, 15, 16 Gage	—	2	140	210	280	360	195	295	390	505
7/16-inch Nominal Panel Thickness										
0.148 smooth	2 1/2	—	240	350	450	585	335	490	630	820
	—	2 1/2	260	380	490	640	365	530	685	895
0.131 smooth or deformed	2	—	240	350	450	585	335	490	630	820
	—	2 1/2	215	315	405	530	305	440	570	740
0.120 smooth or deformed	2	—	205	295	380	495	285	415	530	690
	—	2 1/2	185	265	340	445	255	370	475	625
0.113 smooth or deformed	2	—	180	265	335	440	250	365	470	615
	—	2 1/2	160	235	305	395	225	330	425	550
14, 15, 16 Gage	1 1/2	—	155	230	310	395	215	320	435	555
14, 15, 16 Gage	—	2	140	210	280	360	195	295	390	505
1 1/32-inch Nominal Panel Thickness										
0.148 smooth	2	—	310	460	600	770	435	645	840	1075
	—	2 1/2	260	380	490	640	365	530	685	895
0.131 smooth or deformed	2	—	260	380	490	640	365	530	685	895
	—	2 1/2	215	315	405	530	305	440	570	740
0.120 smooth or deformed	2	—	220	320	415	540	310	445	575	755
	—	2 1/2	185	265	340	445	255	370	475	625
0.113 smooth or deformed	2	—	195	285	365	480	275	395	510	670
	—	2 1/2	160	235	305	395	225	330	425	550
14, 15, 16 Gage	1 1/2	—	170	255	335	430	240	355	470	600
14, 15, 16 Gage	—	2	140	210	280	360	195	295	390	505
1 9/32-inch Nominal Panel Thickness										
0.148 smooth	2 1/4	—	340	510	665	870	475	715	930	1215
0.131 smooth or deformed	2 1/4	—	285	425	550	720	395	595	770	1005
0.120 smooth or deformed	2 1/4	—	240	355	465	605	330	500	645	845
0.113 smooth or deformed	2 1/4	—	210	315	410	535	295	440	575	750
14, 15, 16 Gage	1 3/4	—	185	280	375	475	260	390	525	665

See pages 12 for footnote explanations.

FOOTNOTE EXPLANATIONS FOR SHEAR WALL TABLES 7 AND 8

¹For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m.

²Shear wall construction using nails must be in accordance with Section 4.3.6 and 4.3.7 of the 2015 and 2008 AF&PA Special Design Provisions for Wind and Seismic (SPDWS), and shear wall construction using staples must be in accordance with 2015 IBC Table 2306.3(1) (similar for earlier codes), as applicable.

³Tabulated values are for short-time loading due to wind or seismic. The tabulated seismic values must be reduced by 37 percent and 44 percent for normal and permanent load duration, respectively.

⁴The tabulated values are for fasteners installed in Douglas Fir-larch or Southern Pine. For framing of other species: (1) Find the assigned specific gravity for species of lumber (see Section A1.2) (2) For staples find shear value from the Table 7 (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species. (3) For nails find shear value from the applicable table and multiply by the following Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Assigned Specific Gravity of the framing lumber. This adjustment factor must not be greater than 1.

⁵Shear wall deflection must be determined in accordance with Section A3.0.

⁶Structural I and Rated Sheathing panels must comply with DOC PS1 or PS2. Install panels either horizontally or vertically. All panel edges must be backed by framing members.

⁷In structures assigned to Seismic Design category D, E, or F, where the allowable shear design value exceeds 350 plf, all framing members receiving edge nailing from abutting panels must not be less than a single 3-inch nominal member. Panel joint and sill plate nailing must be staggered in all cases. See Section 4.3.6.4 of SPDWS, or 2006 IBC Section 2305.3.11 for sill plate size and anchorage requirements, as applicable.

⁸Space fasteners maximum 6 inches on center along intermediate framing members - Exception: When panel thickness is greater than $\frac{7}{16}$ -inch or studs are spaced less than 24 inches on center, space fasteners maximum 12 inches on center.

⁹Nails must be flat head nails denoted in Appendix B as meeting the head area ratio requirements for lateral force resisting assemblies. A deformed shank nail must have either a helical (screw) shank or an annular (ring) shank.

¹⁰Staples must have a $\frac{7}{16}$ -inch minimum crown width and must be installed with their crown parallel to the long dimension of the framing members, and must be driven flush with the surface of the sheathing.

¹¹The values for $\frac{3}{8}$ -inch and $\frac{7}{16}$ -inch panels applied directly to framing using nails may be increased to values shown for $\frac{15}{32}$ -inch-thick panels of the same panel grade, provided studs are spaced a maximum of 16 inches on center or panels are applied with long dimension across studs.