Technical Q & A

Plywood vs. OSB Truss Repairs

by Jim Vogt, P.E.

The terms "plywood" and "OSB" are often used interchangeably, but it's important to know the difference when making a truss repair.

The building codes prohibit the cutting, notching drilling, or otherwise altering of truss members or components without written approval from a registered design professional. When specifying the material in a repair detail, the Building Designer or Truss Designer has a number of options including plywood or oriented strand board (OSB) gussets, metal nail-on plates, lumber scabs or repair frames. The following question examines two commonly-used products.

Question

Which is better to use for truss repairs, plywood or OSB?

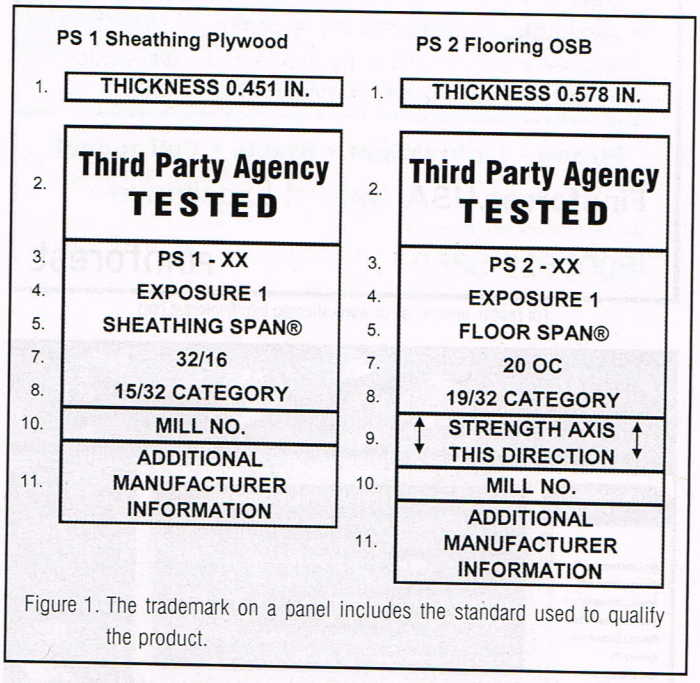

Figure 1. The trademark on a panel includes the standard used to qualify the product.

Answer

Plywood and OSB are two types of wood structural panel products commonly specified and used to repair damaged joints in metal plate connected wood trusses. There are several factors to consider before deciding which product to use.

First, everyone involved in the repair process needs to understand the difference between the two products. The 2009 International Building Code® (IBC®) defines plywood as:

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

Similarly, the IBC defines OSB as:

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

It's not uncommon to hear people refer to a wood structural panel as "plywood," but after further discussion it's clear they're actually talking about OSB. Make sure there is a clear understanding of the differences between the two, especially if the repair requires a specific product.

Second, Section 2303.1.4 of the 2009 IBC requires that wood structural panels used in structural applications, such as truss repairs, must conform to the requirements provided in the U.S. Department of Commerce/National Institute of Standards and Technology standards (DOC), PS 1 or PS 2. More specifically, Section 2303.1.4 states:

> **2303.1.4 Wood structural panels.** Wood structural panels, when used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1 or PS 2. Each panel or member shall be identified for grade and glue-type by the trademarks of and approved testing and grading agency...

Structural plywood may be qualified using the requirements of PS 1, Structural Plywood, or PS 2, Performance Standard for Wood-based Structural-use Panels, whereas structural OSB is qualified under PS 2. The standard used to qualify a product is included as part of the trademark on the panel (see Figure 1). Only panels conforming to PS 1 or PS 2 should be used.

at a glance

- ❑ Plywood and OSB design values are given; those that are doing repairs in your office should have a good feel for the similarities and differences.
- ❑ Plywood and OSB generally have similar design properties with a key exception of fastener strength where plywood will require more fasteners to be used.
- ❑ If a truss repair specifies only OSB, plywood should not be substituted without written permission from the registered design professional who prepared the truss repair design drawing.

The building codes provide allowable span and load information for wood structural panels used in typical floor, roof and wall sheathing applications. For truss repairs, specific design capacities, such as allowable tensile strength and shear through-the-thickness, are required. Design capacities for various panel grades and span ratings are available from qualified panel testing and grading agencies (e.g., APA–The Engineered Wood Association, TECO, etc.) and are also provided in Chapter M9 of the *ASD/LRFD Manual for Engineered Wood Construction* (2005), published by the American Wood Council (AWC) and the American Wood Council of the American Forest & Paper Association (AF&PA). The design capacities in these documents are based on tests of panels manufactured in accordance with PS 1 and PS 2, which bear the trademark of a qualified inspection and testing agency (see Table 1 and 2 for examples).

These tables show there are generally only slight differences between the design capacities for structural plywood and OSB for a given span rating. An exception, however, occurs with shear through-the-thickness capacities, where OSB provides considerably higher values. Based on this difference, if a truss repair specifies only OSB, plywood should not be substituted without written permission from the registered design professional who prepared the truss design repair drawing.

Another design capacity to consider is dowel bearing strength, which determines the allowable lateral resistance provided by the nails, screws or bolts that attach the wood structural panel to the truss. Table 11.3.2B of the *National Design Specification® for Wood Construction* (NDS®) lists the dowel bearing strengths for various wood structural panels (see Table 3). All grades of OSB, Structural 1 and Marine plywood are assigned the same dowel bearing strength, whereas all "other grades" of plywood have a lower dowel bearing strength. Since the majority of plywood used for construction applications in the U.S. is NOT Structural 1 or Marine, lower lateral resistance values (i.e., more fasteners) typically must be used for a repair using plywood than for one using OSB. **SBC**

To pose a question for this column, call the SBCA technical department at 608/274-4849 or email technicalqa@sbcmag.info.

Table A
Wood Structural Panel Design Capacities Based on Span Ratings[a]

Span Rating		Strength: Bending $F_b S$ (lb-in/ft of width)		Strength: Axial Tension $F_t A$ (lb/ft of width)		Strength: Axial Compression $F_c A$ (lb/ft of width)		Strength: Shear through the thickness [b,c] $F_v t_v$ (lb/in of shear-resisting panel length)	Planar Shear: Planar Shear F_s (lb/Q) (lb/ft of width)		Stiffness and Rigidity: Bending EI (lb-in²/ft of width)		Stiffness and Rigidity: Axial EA (lb/ft of width x 10^6)		Rigidity through the thickness $G_v t_v$ (lb/in of panel depth)
		Capacities relative to strength axis [d]													
		0°	90°	0°	90°	0°	90°	0° / 90°	0°	90°	0°	90°	0°	90°	0° / 90°
Sheathing Span[e]															
24/0	3-ply	250	54	2,300	600	2,850	2,500	53	156	273	66,000	3,600	3.35	2.90	25,000
32/16	3-ply	370	92	2,800	1,250	3,550	3,100	62	198	347	126,500	8,100	4.15	3.60	27,000
	4-ply	407	110	2,800	1,250	5,325	4,650	81	198	479	126,500	17,820	4.15	3.60	35,100
	5-ply	444	166	3,640	1,625	5,325	4,650	93	215	165	126,500	25,110	4.15	3.60	40,500
40/20	3-ply	625	150	2,900	1,600	4,200	4,000	68	246	431	247,500	18,000	5.00	4.50	28,500
	4-ply	688	180	2,900	1,600	6,300	6,000	88	246	595	247,500	39,600	5.00	4.50	37,050
	5-ply	750	270	3,770	2,080	6,300	6,000	102	267	205	247,500	55,800	5.00	4.50	42,750
48/24	4-ply	930	270	4,000	1,950	7,500	7,200	98	300	725	440,000	64,900	5.85	5.00	40,300
	5-ply	1,014	405	5,200	2,535	7,500	7,200	113	325	250	440,000	91,450	5.85	5.00	46,500
Floor Span[e]															
20 oc	4-ply	528	168	2,900	1,600	6,300	6,000	87	246	595	231,000	28,600	5.00	4.50	36,400
	5-ply	576	252	3,770	2,080	6,300	6,000	101	267	205	231,000	40,300	5.00	4.50	42,000
24 oc	4-ply	704	258	3,350	1,950	7,500	7,200	96	300	725	330,000	57,200	5.85	5.00	39,000
	5-ply	768	387	4,355	2,535	7,500	7,200	111	325	250	330,000	80,600	5.85	5.00	45,000
32 oc	5-ply	1,044	684	5,200	3,250	9,450	9,300	120	390	300	715,000	232,500	7.50	7.30	54,000
48 oc	5-ply	1,920	1,224	7,280	4,745	12,150	10,800	158	501	385	1,265,000	496,000	8.20	7.30	75,750

(a) The design values in this table correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Allowable Stress Deign (ASD)/LRFD Manual for Engineered Wood Construction* Tables M9.2.1- M9.2.4, which are available from the AF&PA American Wood Council. The appropriate panel grade and construction adjustment factor, C_c, has already been incorporated into these design values—do not apply the C_c factor a second time. These values do not apply to Structural I panels. See Tables M9.2.1 – M9.2.4 for the appropriate multipliers for Structural I panels.
(b) Shear through the thickness design capacities are limited to sections two feet or less in width; wider sections may require further reductions.
(c) 5-ply applies to plywood with 5 or more layers; for 5-ply/3-layer plywood, use values for 4-ply plywood.
(d) Strength axis is defined as the axis parallel to the face and back orientation of the grain (veneer), which is generally the long panel direction, unless otherwise marked.

Table 1. Design capacities for structural plywood, provided by TECO.

Table A
Wood Structural Panel Design Capacities Based on Span Ratings[a]

Span Rating	Strength: Bending $F_b S$ (lb-in/ft of width)		Strength: Axial Tension $F_t A$ (lb/ft of width)		Strength: Axial Compression $F_c A$ (lb/ft of width)		Strength: Shear through the thickness [b] $F_v t_v$ (lb/in of shear-resisting panel length)	Planar Shear: Planar Shear F_s (lb/Q) (lb/ft of width)	Stiffness and Rigidity: Bending EI (lb-in²/ft of width)		Stiffness and Rigidity: Axial[a1] EA (lb/ft of width x 10^6)		Rigidity through the thickness $G_v t_v$ (lb/in of panel depth)
	Capacities relative to strength axis [c]												
	0°	90°	0°	90°	0°	90°	0° / 90°	0° / 90°	0°	90°	0°	90°	0° / 90°
Sheathing Span[e]													
24/0	300	97	2,300	780	2,850	2,500	155	130	60,000	11,000	3.35	2.50	77,500
24/16	385	115	2,600	1,300	3,250	2,500	165	150	78,000	16,000	3.80	2.70	83,500
32/16	445	165	2,800	1,650	3,550	3,100	180	165	115,000	25,000	4.15	2.70	83,500
40/20	750	270	2,900	2,100	4,200	4,000	195	205	225,000	56,000	5.00	2.90	88,500
48/24	1,000	405	4,000	2,550	5,000	4,300	220	250	400,000	91,500	5.85	3.30	96,000
Floor Span[e]													
16 oc	500	180	2,600	1,900	4,000	3,600	170	205	150,000	34,000	4.50	2.70	83,500
20 oc	575	250	2,900	2,100	4,200	4,000	195	205	210,000	40,500	5.00	2.90	87,000
24 oc	770	385	3,350	2,550	5,000	4,300	215	250	300,000	80,500	5.85	3.30	93,000
32 oc	1,050	685	4,000	3,250	6,300	6,200	230	300	650,000	235,000	7.50	4.20	110,000
48 oc	1,900	1,200	5,600	4,750	8,100	6,750	305	385	1,150,000	495,000	8.20	4.60	155,000

(a) The design values in this table correspond with those published in the 2005 edition of the AF&PA American Wood Council's *Allowable Stress Deign (ASD)/LRFD Manual for Engineered Wood Construction* Tables M9.2.1- M9.2.4, which are available from the AF&PA American Wood Council.
(a1) In late January 2008, revised Axial EA 90° (perpendicular) values were submitted for modification to AF&PA based on an industry-wide consensus. The appropriate panel grade and construction adjustment factor, C_c, has already been incorporated into these design values—do not apply the C_c factor a second time. These values do not apply to Structural I panels. See Tables M9.2.1 – M9.2.4 for the appropriate multipliers for Structural I panels.
(b) Shear through the thickness design capacities are limited to sections two feet or less in width; wider sections may require further reductions.
(c) Strength axis is defined as the axis parallel to the face and back orientation of the flakes, which is generally the long panel direction, unless otherwise marked.

Table 2. Design capacities for OSB, provided by TECO.

Table 11.3.2B Dowel Bearing Strengths for Wood Structural Panels

Wood Structural Panel	Specific[1] Gravity G	Dowel Bearing Strength, F_e, in pounds per square inch (psi)
Plywood		
Structural 1, Marine	0.50	4650
Other Grades[1]	0.42	3350
Oriented Strand Board		
All Grades	0.50	4650

1. Use G = 0.42 when species of the plies is not known. When species of the plies is known, specific gravity listed for the actual species and the corresponding dowel bearing strength may be used, or the weighted average may be used for mixed species.

Table 3. NDS® Table 11.3.2B lists the dowel bearing strengths for various wood structural panels.