

PLYWOOD OR OSB?

USED AS INTENDED, THE TWO PRODUCTS ARE INTERCHANGEABLE

Since its introduction 25 years ago, oriented strand board (OSB) has played an increasingly important role as a structural panel for all kinds of construction applications. OSB production in the United States and Canada totaled 25.4 billion square feet (3/8-inch basis), or 59 percent of the total combined production of structural plywood and OSB in 2004.

Some design and construction professionals have come to swear by oriented strand board. Others, however, prefer to stick with plywood. So which product is really better?

The answer, for most routine construction applications, is *both*. That's because both products, although different in composition and appearance, are manufactured according to a set of standards that assure very similar performance when used in applications for which they are intended: sheathing, single-layer flooring, and exterior siding.

Manufacturing Process

Plywood is composed of thin sheets of veneer or plies, peeled from a log as it is turned on a lathe against a knife blade. The veneer is clipped to suitable width, dried, and graded. Growth characteristics in the veneer, such as knots and knotholes, can be repaired or plugged to improve the grade. Adhesive is applied to the plies, which are then laid up in cross-laminated layers.

Plywood has an odd number of layers with each layer consisting of one or more plies. Face layers normally have the grain oriented parallel to the long dimension of the panel. The glued veneer assembly is placed in a hot press where they are bonded together under heat and pressure. Wood is strongest along the grain, and shrinks and expands most across the grain. By cross laminating adjacent layers, optimal strength, stiffness and resistance to shrinking and expansion are achieved. Cross lamination also minimizes wood's potential for splitting.

Instead of sheets of veneer, oriented strand board is made of thousands of pressed, thin wood strands that overlap and interlock. These strands, typically measuring three to four inches long, are mixed with resin and applied in layers on a forming line. Like plywood, the layers are oriented at right angles to one another, thereby achieving the strength, stiffness and dimensional stability advantages that result from cross lamination. The layers of strands, or mat, are then bonded with exterior glue under heat and pressure.

APA performance rated plywood and OSB panels are made with resin adhesives that provide a waterproof bond. Such panels are identified as EXTERIOR or EXPOSURE 1.

Because other factors may affect bond performance, however, only EXTERIOR panels are recommended for applications subject to long-term exposure to weather or moisture, such as siding. EXPOSURE 1 panels are designed to temporarily withstand exposure to the weather or moisture during construction, but are intended to eventually be protected from such exposure. Such applications include subflooring, wall, and roof sheathing, for example. Approximately 95 percent of performance rated panels are manufactured with an EXPOSURE 1 designation.

Performance versus Prescriptive Standards

In the past, plywood mills worked with a limited number of species, manufacturing products according to one product standard that contained a set of “recipes” for acceptable ways to make plywood. Properly manufactured plywood, made according to the standard, qualified to be stamped as meeting that standard.

A performance standard, on the other hand, is based on the intended end use of the product and does not prescribe how the product must be manufactured. The performance standards, under which OSB and some plywood panels are qualified, were developed to assure reliable performance in service, to address a changing wood-fiber supply, and to remove obstacles to innovative manufacturing technology.

The overall objective was to assure that a product satisfied the requirements of the application for which it was intended. To do this, the performance criteria in the standard must address the critical attributes of the product that affected its successful performance in actual service. This led to the development of innovative test methods that linked attributes of the product with field performance and marketplace needs.

Performance standards for wood structural panels were developed in the late 1970s and early 1980s by the American Plywood Association (now APA – The Engineered Wood Association). APA today represents the manufacturers of about 65 percent of the structural plywood and OSB panels made in North America. In addition to quality auditing, APA performs product and systems research, develops and maintains industry standards, and conducts marketing activities worldwide.

Advantages of Performance Standards

Wood structural panel performance standards provide several advantages to manufacturers, users and specifiers alike. Among them:

- By expanding the range of panel composition and manufacturing methods, performance standards permit more efficient use of limited wood fiber supplies. Wood species, which do not lend themselves to use under traditional prescriptive standards, are made available for use.
- By freeing manufacturers from narrow, prescriptive requirements, performance standards encourage manufacturing and product innovations, which translate into cost savings and improved performance for consumers.
- Performance standards establish baseline criteria for qualifying new products and provide a means for their recognition in building codes.
- Performance standards, together with descriptive panel trademark stamps, simplify the specification, identification, and use of wood structural panels.

Product Qualification and Performance Testing

There are three basic criteria for qualifying wood-based panel products under performance standards--structural adequacy, dimensional stability and glue bond durability. Wood-based products qualifying as exterior siding are also evaluated for surface characteristics, including ability to accept different kinds of finishes.

Performance criteria in these categories were established by building code requirements and through tests of panel products with known acceptance in the marketplace. The tests evaluate a panel's ability to perform to the expected and necessary level for the intended end use. Not all performance tests apply to all panels and their applications, but a partial list of typical tests includes:

- Racking. A cyclic load is applied to a panel-and-lumber wall assembly. Deflection and ultimate load sustained by the wall are measured.
- Uniform load. A panel is fastened to joists and a uniform load is applied (similar to heavy winds or snow) while deflection between joists is measured.
- Concentrated static load. Load is applied through a one- or three-inch-diameter disc mid-span between joists and near an unsupported edge. Deflection and ultimate load are measured.
- Impact resistance. A bag of steel shot weighing 30 or 60 pounds, depending on span, is dropped on the panel mid-span between joists to determine impact load performance. A concentrated load is then applied.
- Direct fastener withdrawal. Nails are driven into the panel and the force needed to pull them straight out is measured.
- Lateral fastener strength. A nail is driven through the panel, and through a hole in a steel block behind the panel. The nail is clamped and the force required to move the panel laterally is recorded.
- Linear expansion. Measurements are taken to determine the change in length caused by moisture.

Today, three standards apply to the manufacture of APA wood structural panels: APA RATED SHEATHING, APA RATED STURD-I-FLOOR, and APA RATED SIDING. These standards are: *U.S. Voluntary Product Standard PS 1-95, Construction and Industrial Plywood* (a prescriptive standard), *U.S. Voluntary Product Standard PS 2-04 (formerly PS 2-92)* (a performance standard), and *APA Performance Standard for Wood-Based Structural-Use Panels PRP-108* (also a performance standard). All three grades of panels can be manufactured as plywood, OSB, or other wood-based panel products. APA RATED SHEATHING is rated for use as subflooring, wall sheathing and roof sheathing. APA STRUCTURAL I RATED SHEATHING is a special sheathing grade designed for use where shear and/or cross-panel strength properties are of maximum importance.

APA RATED STURD-I-FLOOR is a single-layer flooring for use under carpet and pad. It can be used in place of separate subfloor and underlayment layers. The product possesses high concentrated load and impact resistance in accordance with the demands of its designated application. APA RATED STURD-I-FLOOR is available with square or tongue-and-groove edges.

APA RATED SIDING is available as both panel and lap siding and in a variety of surface textures and patterns. Panel siding is rated to perform when applied directly to studs (single-wall construction), or it may also be installed over sheathing.

Quality Auditing and Code Recognition

Once a mill's panels have qualified for APA Performance Rated panel trademarking, APA quality auditors check the mill's quality control program by selecting panels at random for testing at one of APA's four quality laboratories around the country. Quality assurance tests are run frequently to help assure that panels leaving the mill continue to meet the performance criteria as demonstrated during product qualification. Under an alternative Quality Management System developed by APA, a mill's entire quality-management system and process are subject to qualification and routine audit by APA.

APA's program of qualification performance tests and routine quality assurance testing has led to recognition of APA performance standards by the ICC Evaluation Service, Inc. under the ICC-ES Legacy Report NER-108. A consensus version of APA performance standards is recognized in U.S. International Building Code. In Canada, similar performance standards are recognized in the National Building Code of Canada (NBCC).

Engineered Applications

APA Performance Rated Panels, whether plywood or OSB, can also be used for engineered applications such as shear walls, diaphragms, and materials handling applications using design capacities and specifications published by APA.

Engineering design capacities for plywood and OSB APA RATED SHEATHING and APA RATED STURD-I-FLOOR, and other plywood grades for example, are given in APA Panel Design Specification, Form No. D510. Design stresses and section properties for plywood conforming to *U.S. Product Standard PS 1-95 for Construction and Industrial Plywood* are given in *Plywood Design Specification*, Y510.

Performance Issues

Where skepticism about OSB exists, it usually involves concern about the product's performance after exposure to moisture. While thickness swelling caused by exposure to moisture has long been known to be greater in OSB than in plywood, such swelling does not affect panel structural performance in the applications for which it is intended. Fastener withdrawal and other structural performance tests which plywood and OSB must pass in order to qualify for APA trademarking are conducted under both dry and wet conditions. Because panel thickness swelling or other surface smoothness factors can affect the performance of resilient floor coverings, however, APA recommends that a separate plywood underlayment be installed if resilient flooring is used, regardless of whether the subfloor is OSB or plywood.

Questions sometimes arise about long-term deflection characteristics of OSB. All wood products have a tendency to increase deflection over time under a long-term application of maximum load -- a characteristic called creep. In normally prescribed applications, however, creep is not an issue. A snow load on a roof, for example, is typically of too short a duration to cause creep. Even under permanent, full-design-load conditions, OSB and other wood products can be used by incorporating appropriate design adjustments.

Additional Information

Additional information about performance rated plywood and OSB panels is available from APA, which maintains a comprehensive inventory of product guides, design/construction literature, and research reports. These publications are available free of charge from the APA web site at <http://www.apawood.org/publications>. To order a hard copy (fees may apply), contact APA's Publications Department at 253-565-6600, Ext. 407. Publication titles of special interest to readers of this article include:

- *Performance Standards and Policies for Structural Use Panels*, Form E445
- *Performance Rated Panels*, Form F405
- *Engineered Wood Construction Guide*, Form E30
- *Oriented Strand Board*, Form W410
- *Performance Rated Siding*, Form E300
- *Panel Design Specification*, Form D510
- *Roof Sheathing Fastening Schedules for Wind Uplift*, Form T325

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