Plywood vs. OSB

by Paul Fisette

OSB performs as well as or better than plywood in most applications — if you keep it dry

The issue for most builders who choose between plywood and OSB is durability. OSB looks like a bunch of wood chips glued together (that's what it is). Its detractors are quick to say that OSB falls apart. This opinion has a familiar ring — plywood suffered the same criticism not too long ago. Delamination of early plywood sheathings gave plywood a bad name. Many "old-timers" swore by solid board sheathing until the day they hung up their aprons. But not many builders today share that view of plywood.

Similarities of OSB and Plywood

The model building codes all use the phrase "wood structural panel" to describe plywood and OSB, basically recognizing these two materials as equivalents. Likewise, APA — The Engineered Wood Association (the agency responsible for approving more than 75% of the structural panels used in residential construction) treats OSB and plywood as equals in their published performance guidelines. And wood scientists agree that there is no significant difference in structural performance between the two materials.

OSB and plywood share the same exposure durability classifications: Interior, Exposure 1 (95% of all structural panels), Exposure 2, and Exterior. They also share the same set of performance standards and span ratings. Both materials are installed on roofs, walls, and floors using the same installation recommendations. Requirements about the use of H-clips on roofs and blocking on floors are identical.

The weights of OSB and plywood are similar: 7/16-inch OSB and 1/2-inch plywood weigh in at 46 and 48 pounds per sheet, respectively.

Professor Poo Chow, a researcher at the University of Illinois, studied the withdrawal and head pull-through performance of nails and staples in plywood, waferboard, and OSB. Chow found that in both dry and six-cycle aged tests, OSB and waferboard performed equal to or better than C/D-grade plywood. The results of another independent study conducted by Raymond LaTona at the Weyerhauser Technology Center in Tacoma, Wash., also showed that withdrawal strengths in OSB and plywood are the same.

The Differences

But while the two products may perform the same structurally, they are undeniably different materials. Plywood is made by hot-gluing thin sheets of veneer that are peeled from a spinning log. Resulting veneers have pure tangential grain orientation, since the slicing follows the growth rings of the log. Throughout the thickness of the panel, the grain of each layer is positioned in a perpendicular direction to the adjacent layer. There is always an odd number of layers in plywood panels so that the panel is balanced around its central axis. This strategy makes plywood stable and less likely to shrink, swell, cup, or warp.

To make OSB, logs are ground into thin wood strands. The dried strands are mixed with wax and adhesive, formed into thick mats, then hot-pressed into panels. But don't mistake OSB for chipboard or waferboard: The strands in OSB are aligned, or "oriented." Strand plies are positioned as alternating layers that run perpendicular to each other. This structure mimics plywood; OSB is engineered to have strength and stiffness equivalent to plywood. Waferboard, a weaker and less stiff cousin of OSB, is a homogeneous, random composition.

On Site With OSB

Under ideal conditions, the performance of the two materials is similar, but in the real world there are differences in service.

Irreversible swelling. All wood products expand when they get wet. When OSB is exposed to wet conditions, it expands faster around the perimeter of the panel than it does in the middle. The swollen edges of OSB panels can telegraph through thin coverings like asphalt roof shingles — so-called "ghost lines" or "roof ridging." The Structural Board Association (SBA, 45 Sheppard Ave. East, Suite 412 Willowdale, ON M2N 5W9, Canada; 416/730-9090), a trade association that represents OSB manufactur-

ers in North America, has issued a technical bulletin outlining a plan to prevent this phenomenon. SBA correctly indicates that dry storage, proper installation, adequate roof ventilation, and application of a warm-side vapor barrier will help prevent roof ridging.

Irreversible edge swelling has been the biggest problem with OSB. Manufacturers have done a good job of addressing this issue at the manufacturing facility and during transportation by coating panel edges. But the reality is that builders don't limit OSB use to full-sized sheets. The edges of cut sheets are seldom, if ever, treated in the field. Houses under construction get rained on. And if you use OSB in an area of very high humidity, such as above an improperly vented attic or over a poorly constructed crawlspace, you're asking for trouble.

OSB responds slowly to changes in relative humidity and exposure to liquid water. It takes a long time for water to soak OSB, and conversely, once water gets into OSB, it is very slow to leave. The longer that water remains within OSB, the more likely it is to rot. The panel's wood species has a significant impact: OSB made from aspen or poplar has practically no natural decay resistance. Many of the western woods used to manufacture plywood have at least moderate decay resistance.

EIFS problems. Recently, we've heard that walls in many southeastern homes covered with the Exterior Finish and Insulation System (EIFS) were rotting. In these cases, rigid foam insulation was applied over OSB and coated with a stuccolike covering. When the exterior foam boards were removed, wet, rotted, crumbling OSB was exposed. OSB was slammed in the press, but the problem really isn't with OSB. In all the cases I'm familiar with, improper installation of flashing or protective coverings was the culprit.

Louisiana-Pacific's OSB-based Inner-Seal siding also made the news recently when LP settled a class-action suit to the tune of $350 million. The claims were that OSB siding was rotting on the walls of many homes in the South and Pacific Northwest, both moist climates. LP said the problems were caused by improper installation. But builders and consultants involved in this case think the material simply doesn't work in permanently exposed applications. To my knowledge, there has not been a problem of similar scale associated with plywood siding.

Clearly, OSB, in its current state of development, is sensitive to moist conditions. Plywood, although not immune, is somewhat forgiving. Plywood actually gets saturated much faster than OSB but is not prone to edge-swelling and dries out more quickly.

OSB Pluses

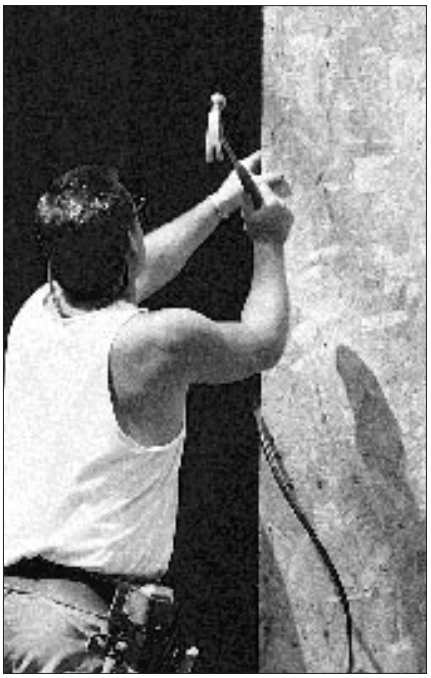
On the positive side, OSB is a more consistent product. It's truly an engineered material. You'll never have a soft spot in an OSB panel because of overlapping knot holes, as you can with plywood. Nor do you have to worry about knot holes at the edge of an OSB panel where you are nailing. Delaminations are virtually nonexistent.

OSB is approximately 50 strands thick, so its characteristics are averaged out over many more "layers" than is the case with plywood. OSB is consistently stiff, whereas plywood has a broader range of variability. During the manufacturing process, plywood veneers are randomly selected and stacked up into panels. You may get four veneers of early-growth wood stacked above one veneer of old-growth wood. Most plywood panels are "overbuilt" to cover the statistical range that guarantees each sheet of plywood will meet the minimum standard. OSB, on average, is 7% less stiff because it stays closer to its target spec. However, OSB sometimes feels stiffer on a floor because there are no occasional weak panels as there are with plywood.

OSB is stronger than plywood in shear. Shear values through its thickness, are about two times greater than those of plywood. This is one of the reasons OSB is often used for the webs of wood I-joists. However, nail-holding ability controls performance in shear wall applications, so plywood and OSB perform equally well as structural sheathing.

Making the Choice

OSB has earned its reputation as a low-cost substitute for plywood: Recent price quotes from Denver, Boston, and Atlanta put 7/16-inch OSB anywhere from $3 to $5 per sheet lower than 1/2-inch C/D Exposure 1 plywood. This means a builder can save $700 on a 2,500-square-foot house if OSB is substituted for plywood sheathing on floors, walls, and roofs. Not surprisingly, the trend among builders is to switch to OSB. APA's market data indicates that more than half the structural panels used in residential construction in 1995 were OSB. But price is not the whole story.



C. BATES

A bumper crop of news stories highlighting contractor ripoffs has left consumers reeling. Reports indicate that some homeowners worry about builders "cheaping out" when they use OSB. Customers become suspicious that builders are trying to put something over on them: charging for an expensive product like plywood and substituting something cheap, like OSB. "It looks like a bunch of junk pounded together," is how one homeowner described OSB to me.

When it comes to structural integrity, cost is less of an issue among consumers than performance.

Given this perception, builders have to be sure the products they use perform as expected, with no surprises. It pays to give some thought to the choice between plywood and OSB. Although the two are broadly touted as "equivalents," the decision should be influenced by the specific application.

Subflooring and Underlayment

While OSB and plywood are equal structurally, flooring manufacturers make

different recommendations regarding their use as a substrate.

Hardwood flooring. The National Oak Flooring Association (NOFA), in Memphis, recommends either 5/8-inch or thicker plywood, 3/4-inch OSB, or 1x6 dense Group 1 softwood boards installed at a diagonal under hardwood flooring. The NOFA recommendation is based on research conducted by Joe Loferski at Virginia Polytechnic Institute in Blacksburg, Va. In his study, Loferski simulated what happens on a real construction site. He built several full-sized floors out of diagonal boards, plywood, and OSB, and weathered them for five weeks before installing hardwood flooring. Finished floor systems were cycled in an environmental chamber to simulate the changes that occur in summer and winter months.

The study showed that diagonal-board subflooring was far and away the best system. Statistically, 5/8-inch plywood and 3/4-inch OSB performed the same. But two significant observations were made during the study: Some of the plywood delaminated during the weathering experiment and new patches had to be spliced into the subfloor system. Also, researchers learned that the best floors of all were the control specimens in each group, which had been protected from any weathering. This speaks volumes for the importance of protecting materials during transport, storage, and the early stages of construction.

Tile. If you are planning to use OSB as subflooring or underlayment for your next tile floor, you may want to think again. According to Joe Tarver, Executive Director of the National Tile Contractors Association (NTCA), in Jackson, Miss., "OSB is not an acceptable substrate to receive ceramic tile, period!" NTCA lists OSB, along with pressboard and lauan plywood, as "not acceptable" in its reference manual's section on substrate materials. This has to do with thickness swelling: If OSB gets wet, it swells, transferring stress and causing the tile to fail.

Resilient flooring. The Resilient Floor Covering Institute (RFCI), a trade association that represents manufacturers of vinyl sheet-flooring and tiles, also favors plywood. RFCI installation specifications recommend plywood as an underlayment material, although OSB is allowed as a subfloor material. While manufacturers have not seen a deluge of failures due to the use of OSB under resilient flooring, they have received complaints of edge swelling that has telegraphed through their flooring products. Manufacturers feel more comfortable guaranteeing their products when they are installed over plywood.

Roof and Wall Sheathing

All the manufacturers of siding products I contacted agree that OSB and plywood are equals when it comes to wall sheathing. Kevin Chung, an engineer with the Western Wood Products Association in Seattle, Wash., assures us, "There have been no problems reported from the field. Nail-holding and racking resistance are the same." Chung has noticed some concern about the use of OSB among builders but is quick to add, "There is no reason for any concern. Both products serve equally well as a nail base."

C. BATES

Roof sheathing is a mixed bag. The National Roofing Contractors Association (NRCA) in Rosemont, Ill., and the Asphalt Roofing Manufacturers Association (ARMA) in Rockville, Md., both recommend the use of APA performance-rated OSB and plywood panels. However, ARMA, NRCA, and representatives from at least two roofing manufacturers, Celotex and TAMKO, prefer plywood roof decks. Warranties on shingles are extended to both substrates, but manufacturers feel more comfortable with plywood. Mark Graham, NRCA's associate director of technical services explains, "We hear a lot of complaints related to dimensional stability. And a disproportionate number are related to OSB. So we are a little bit cautious." Graham also acknowledges that APA, an organization he clearly respects, is standing firmly behind the OSB product.

Florida's Dade County is the only building code district in the country that prohibits the use of OSB as a roof deck. Damage to roofs during Hurricane Andrew was originally blamed on OSB's poor nail-holding power. Dade's banning of OSB spawned several research initiatives to explore the suitability of OSB as a structural sheathing. Research conducted by APA, Chow, LaTona, and others has conclusively proven OSB seaworthy. Many experts think the ban makes no sense. Dade's position is perceived by many industry insiders to be a political maneuver to satisfy public concern.

Future Watch

OSB is unceremoniously pushing plywood aside as the structural panel of choice. Twenty-one OSB plants are scheduled to open between 1995 and 1997. Nobody is building plywood plants; in fact, they are closing down. Production of structural plywood is forecast to drop by 7% in 1996, while OSB production is projected to increase 25%. But the good news for builders is that the increase in OSB production is expected to depress the price of *all* structural panels. Also, strong supplies help reduce price volatility.

Two things are certain: OSB is in our future, and it will improve. Production will reflect market needs. Perhaps thickness swelling will be included in future performance standards (it should be). OSB manufacturers can formulate their process to provide virtually any property they want. They can build panels to resist high relative humidity, deliver more strength, or provide a harder surface. It becomes a question of cost vs. performance; builders will dictate the performance of the final product. ■

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