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Choosing Between Oriented Strand board and Plywood

Manufacturers of oriented strandboard and plywood claim both products work well. But using panels made of wood chips makes some builders nervous. Like it or not, osb will define the future of the structural sheathing market.

By Paul Fisette – © 2005

The issue for most builders who choose between plywood and osb is durability. Osb looks like, and is, a bunch of wood chips glued together. Detractors of osb are quick to say: “osb falls apart”. This opinion has a familiar tone. 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. Not many builders share that view today.

Portland Manufacturing Company made the first structural plywood from western woods in 1905. This plywood, like all structural plywood made until the mid 1930’s, was bonded with non-waterproof blood and soybean glue. Delamination were routine until waterproof synthetic resins were developed during world war II. The technical fix for delamination was inspired by the 1950’s housing boom. In the late 1960’s advances in adhesive technology brought southern pine plywood to residential builders. Today, southern pine plywood accounts for about half of all structural plywood sold.

MacMillan Bloedel opened the first viable waferboard facility at Hudson Bay, Saskatchewan in 1963. Aspenite, the first generation waferboard (called chipboard by many builders), was manufactured from the abundant supply of aspen found in the region (credit julio). Technology involving the random alignment of wood-fiber in waferboard soon gave way to the development of structurally superior oriented strandboard. Elmendorf Manufacturing Company made the first osb in Clairmont, NH just 14 years ago.

Technical Merits

Model building codes typically use the phrase “wood structural panel” to describe the use of plywood and osb. Codes recognize these two materials as the same. Likewise, APA the Engineered Wood Association, the agency responsible for approving more than 75% of the structural panels used in residential construction, treat osb and plywood as equals in their published performance guidelines. And wood scientists agree that the structural performance of osb and plywood are equivalent.

Osb and plywood share the same exposure durability classifications: Interior, Exposure 1 (95% of all structural panels), Exposure 2 and Exterior. They share the same set of performance standards and span ratings. Both materials are installed on roofs, walls and floors using one set of recommendations. Installation requirements prescribing the use of H-clips on roofs, blocking on floors and allowance of single-layer floor systems 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. However, 3/4-inch Sturd-I-Floor plywood weighs 70 pounds, 10 pounds less than its osb counterpart. Even the storage recommendations are the same: keep panels off of the ground and protected from weather.

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 6-cycle aged tests: osb and waferboard performed equal to or better than CD-grade plywood. The results of another independent study conducted by Raymond LaTona at the Weyerhauser Technology Center in Tacoma also showed that withdrawal strengths in osb and plywood are the same. But, while the two products may perform the same structurally, they are undeniably different materials.

To begin with, the composition of each material is different. Plywood is made from thin sheets of veneer that are cross-laminated and glued together with a hot-press. Imagine the raw log as a pencil being sharpened in a big pencil sharpener. The wood veneer is literally peeled from the log as it is spun. 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.

Logs are ground into thin wood strands to produce oriented strandboard. Dried strands are mixed with wax and adhesive, formed into thick mats, and then hot-pressed into panels. Don’t mistake osb for chipboard or waferboard. Osb is different. The strands in osb are aligned. “Strand plies” are positioned as alternating layers that run perpendicular to each other. This structure mimics plywood. Waferboard, a weaker and less-stiff cousin of osb, is a homogeneous, random composition. Osb is engineered to have strength and stiffness equivalent to plywood.

Performance is similar in many ways, but there are differences in the service provided by osb and plywood. 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. Swollen edges of osb panels can telegraph through thin coverings like asphalt roof shingles.

The term ghost lines or roof ridging was coined to describe the effect of osb edge swelling under thin roof shingles. The Structural Board Association (SBA), a trade association that represents osb manufacturers 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 knock on 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, like over an improperly vented attic or over a poorly constructed crawlspace, you are asking for trouble.

Osb responds more slowly to changes in relative humidity and exposure to liquid water. It takes longer 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. Wood species has a significant impact. If osb is made from aspen or poplar, it gets a big fat zero with regard to natural decay resistance. Many of the western woods used to manufacture plywood at least have moderate decay resistance.

In the past we've heard that walls in many South eastern homes covered with the Exterior Finish and Insulation System (EIFS) were rotting. Rigid foam insulation was applied over osb and coated with a stucco-like covering. When the exterior foam boards were removed, wet, rotted, crumbling osb was exposed. Osb was slammed in the press. The problem really isn't osb's fault. All cases I'm familiar with were caused by improper installation of flashing or protective coverings.

Louisiana-Pacific's osb inner-seal siding also made the news. LP settled a class action suit in 1995 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 are very moist climates. LP said the problems were caused by improper installation. But builders and consultants involved in this case think the material doesn't work in permanently exposed applications. To my knowledge, there has not been a problem of similar scale associated with plywood siding. Osb, in its current state of development, is more sensitive to moist conditions. Plywood, although not immune, is somewhat forgiving. Plywood actually gets saturated much faster than osb, but it is not prone to edge swelling and it dries out much more quickly.

On the plus side, osb is a more consistent product. It is truly an engineered material. You never have a soft spot in the panel because 2 knot holes overlap. You don't have to worry about knot holes at the edge of a panel where you are nailing. Delamination are virtually non-existent.

Osb is perhaps 50 strands thick, so its characteristics are averaged out over many more "layers" than plywood. Osb is consistently stiff. Plywood has a broader range of variability. During the manufacturing process, plywood veneers are randomly selected and stacked up into panels. You may get 4 veneers of earlywood stacked above 1 veneer of latewood. Who knows? Most plywood panels are overbuilt to cover the statistical range that guarantees each sheet of plywood meets the minimum standard. Osb, on average, is 7% less stiff because it stays closer to its target spec. However, osb feels stiffer when you walk across a floor covered with it because there are no occasional weak panels like plywood. Smaller trees can be used to make osb. Wood fiber is used more efficiently in osb.

Osb is stronger than plywood in shear. Shear values, through its thickness, are about 2 times greater than plywood. This is one of the reasons osb is used for webs of wooden I-joists. However, nail-holding ability controls performance in shear wall applications. So both products perform equally well as shear-wall components.

Approved Use

It is human nature to be afraid of a new product. A builder's reputation often hangs on the ability of new technology to deliver on its promise. Homeowners expect builders to select materials and systems that perform well. Builders need assurance from manufacturers that new products will work. Manufacturers are not always right. But right or wrong, a manufacturer's support is often where the rubber meets the road.

Subfloors and underlayment's serve as structural platforms and as a base for flooring products. Osb and plywood are equals structurally, but flooring manufacturers make different recommendations regarding their use as a substrate.

The National Oak Flooring Association (NOFA) in Memphis recommends either 5/8-inch and thicker plywood, 3/4-inch osb or 1-x6-inch dense, group1 softwood boards installed at a diagonal under hardwood flooring. The NOFA recommendation is based on research conducted by Joe Loferski at Virginia Tech, Blacksburg, VA. In his study, Loferski simulated what happens on a real construction site. He built several full-sized floors out of boards, plywood and osb and weathered them for 5 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 solid boards installed at a diagonal were far and away the best system. Statistically, 5/8-inch plywood and 3/4-inch osb worked 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 floor of all was the control specimen, which had been protected from any weathering. This speaks volumes for the importance of protecting materials during transport, storage and early stages of construction.

If you are planning to use osb as a subfloor OR underlayment for your next tile floor, you may want to think again. Joe Tarver, Executive Director of the National Tile Contractors Association, Jackson, MS says, " Osb is not an acceptable substrate to receive ceramic tile, period!" NTCA lists osb, along with pressboard and luan plywood, as "not acceptable" in its reference manual. It has to do with thickness swell. They feel that if osb gets wet, it transfers stress and causes the tile to fail.

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

Wall sheathing: No news is good news. All manufacturers of siding products I contacted agree that osb and plywood are equals. Kevin Chung, Engineer with Western Wood Products Association in Seattle 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 nailbase.”

Roof sheathing is a mixed bag. The National Roofing Contractors Association (NRCA) in Rosemont, IL 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 2 roofing manufacturers, Cellotex and TAMKO, prefer plywood roof decks. Warranties on shingles are extended to both substrates, but manufactures feel more comfortable with plywood. Mark Graham, NRCA’s associate director of technical services says, “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.” Grahm 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 were 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 have 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.

Market Rap

Osb has earned its reputation as a low-cost substitute for plywood. In fact, recent price quotes from Denver, Boston and Atlanta put 7/16-inch osb $3.00 to as much as $5.00 per sheet lower than 1/2-inch cdx plywood. This price spread means that a builder can save $700.00 on a 2,500 square foot house if osb is substituted for plywood sheathing on floors, walls, and roofs. A substantial savings to be sure. 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.

A bumper crop of news stories highlighting contractor rip offs 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 it with something cheap, like osb. When it comes to structural integrity, cost is less of an issue among consumers than structural performance.

“It looks like a bunch of junk pounded together.”, is how one homeowner described osb to me. Another homeowner asked, ” What the hell is going on? Aren’t there any more trees?” Public perception is that we are getting stuck with scraps. The uninitiated don’t appreciate the high-level of science and technology used to produce engineered wood products. They think that “glued-together” is not as good as “nailed-together”. And oddly, plywood is perceived as solid wood to a lay person.

Customers don’t want technical explanations about many things. For example: Most do not want to know how blown-in fiberglass insulation performs differently than batt insulation. They typically don’t want to know what weight roof shingle you are using; or even what depth floor joist you have speced. However, customers are nervous about engineered wood because all they see are little pieces of wood stuck together. Osb is so visually striking that customers need a technical explanation about this material from their builders.

Future Watch

Osb is unceremoniously pushing plywood aside as the structural panel of choice. Market data show that conversion from plywood to osb among builders is irregular, but clearly moving toward osb and away from plywood. One thing is certain: osb is in our future. Osb products will improve. Products like AdvanTech by Huber Engineered Woods (http://huberwood.com/) is an example of a premium osb product line. It is costlier than the garden variety osb product. However, AdvanTech and products like it have greatly improved performance qualities. Production in the future will reflect market needs. Perhaps thickness-swell will be included in future performance standards. It should. 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 and we will dictate the final product.

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