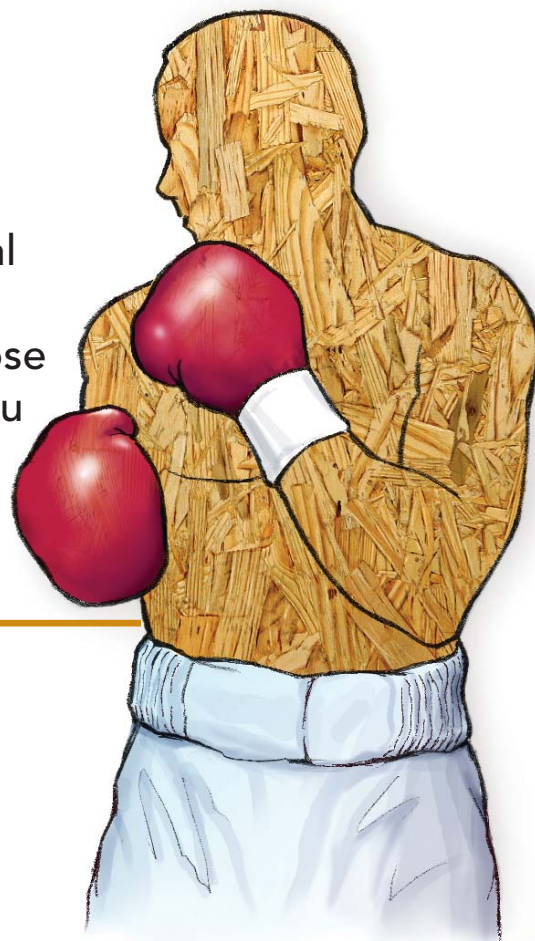


# Plywood VS. OSB

New-generation structural panels mean decade-old notions are no way to choose sheathing. Here's what you need to know.

BY SEAN GROOM



## Price

- Basic OSB panels are generally several dollars cheaper than CDX plywood.

## Moisture resistance

- Plywood absorbs water faster and dries out faster than OSB. Both types of panels swell around the edges as they get wet, but plywood returns nearly to its original thickness as it dries, while OSB swelling is irreversible.

## Job-site handling

- OSB panels lie flat and are engineered for consistent quality without knots or voids. Plywood, on the other hand, resists edge damage better and weighs less than OSB.

## Performance

- As structural panels, plywood and OSB are designed to meet the same load and span ratings. However, tile and resilient-flooring associations generally do not recommend installing their products directly over OSB.

## Environmental concerns

- OSB can be manufactured from lesser-quality trees and with less glue than plywood.

**L**ike the old latex- versus oil-paint debate, people hold strong feelings about oriented strand board (OSB) and plywood. Because there seems to be some truth on each side of the argument, it's not easy to figure out which type of structural panel you should be using.

From a cost-saving perspective, the appeal of OSB is easy to understand. Sheathing a 2500-sq.-ft. house with OSB can save about \$900 compared to the cost of plywood sheathing. OSB advocates also point out that these panels are more uniform than plywood and that OSB has a higher "green building" value because it can be manufactured from lower-grade logs rather than veneer-grade timber. Many wood species can be used for OSB, not just softwoods, as is the case with plywood sheathing. Plywood advocates counter that it's tough to argue with a 50-year durability record and claim that plywood is a stronger panel that holds up better to water.

Despite the strong opinions, contractors and homeowners have been adopting OSB steadily since its commercial introduction around 1980.



## Cost comparison

A survey of lumberyards around the country revealed that despite rising prices, you generally can save a few bucks on commodity-grade structural panels buying OSB instead of plywood. Structural-panel prices fluctuate daily, so these prices capture a snapshot in time. The price difference narrows for 3/4-in. panels.

Seattle, WA				
1/2-in.	CDX	\$18.49	OSB	\$13.49
3/4-in.	CDX	\$25.99	OSB	\$24.99

Des Moines, IA				
1/2-in.	CDX	\$19.96	OSB	\$16.25
3/4-in.	CDX	\$28.40	OSB	\$23.98

Santa Fe, NM				
1/2-in.	CDX	\$19.98	OSB	\$15.38
3/4-in.	CDX	\$29.48	OSB	\$29.12

Waterford, CT				
1/2-in.	CDX	\$23.34	OSB	\$16.74
3/4-in.	CDX	\$34.49	OSB	\$29.80

Atlanta, GA				
1/2-in.	CDX	\$15.06	OSB	\$15.63
3/4-in.	CDX	\$23.50	OSB	\$22.26



2500-sq.-ft. house



**\$909.45 savings to your bottom line by sheathing a typical 2500-sq.-ft. house exclusively with OSB instead of plywood (costs based on an average of survey prices)**

Within 10 years, it had snagged one-third of the market from plywood, and by 1999, OSB production had surpassed plywood. Mills now produce about 1.5 times more OSB than plywood, and APA—The Engineered Wood Association forecasts that OSB will continue to gain market share.

### Rocky starts for plywood and OSB

Carpenters were quick to find flaws in both plywood and OSB when they were introduced to the market. The first plywood panels were produced 100 years ago, but it took 30 years of glue development and the post-World War II building boom for plywood to become a widely used sheathing product. Still, many older builders refused to give up on the solid-pine planks they had used for years. Over time, the skeptics either retired or were won over by improved panel quality and price.

Plywood was the dominant sheathing material 20 years ago when OSB became widely available. The hefty price difference was an incentive for builders to try OSB. Unfortunately, the new product had a tendency to swell permanently when it became wet. And when it was soaked, some carpenters reported, it fell apart. The similarity in appearance to early waferboard, a panel with no structural rating and little water resistance, also created confusion over OSB's performance capabilities.

OSB manufacturers have addressed many of the swelling problems, and contractors have found the latest generation of OSB greatly improved at a time when many of them complain about the quality

of plywood, citing more frequent delaminations, core voids, and out-of-square panels.

Joseph Lstiburek of Building Science Corporation, who lectures extensively on mold and building practices, best sums up the prevailing view: "I would not hesitate a heartbeat to use OSB despite the fact that it is both more water sensitive and more mold sensitive than plywood. The cost benefits, the versatility benefits, and the stiffness and structural benefits outweigh the associated risks if the product is used intelligently."

### Water can ruin any panel

The knock against the first generation of OSB was that the edges swelled when the panels became wet. Contractors may have saved a few bucks buying OSB, but part of that savings disappeared with the added labor cost of sanding down swollen edges to restore flatness to a subfloor. Homeowners noticed the problem every time they pulled into their driveways and saw the edges of OSB sheathing panels outlined in their roof shingles.

To limit swelling, manufacturers have adjusted the mix of resins and wax content used to manufacture OSB. They've also sealed panel edges to improve water resistance (sidebar p. 98). These steps haven't made OSB waterproof, but plywood isn't waterproof, either. Both types of panels will experience problems if water is allowed to puddle on the sheathing or if panels are left exposed to the elements for an extended time.

Plywood and OSB are wood products, and the veneers or flakes in a panel react with water the same way that any other form of wood



**Grain orientation provides strength.** Peels from a log are laid up by alternating the grain direction of each ply at 90° to the one below it.



## Panel manufacturing: ply vs. strand

It's not unusual for a homeowner to complain that OSB is just a bunch of woodchips that are glued together and ask for plywood because it's "real" wood. In fact, plywood advertisements encourage this perception of OSB.

Although OSB is indeed made from thousands of wood flakes that are glued together, it relies on layers of alternating grain orientation for

strength just as plywood does.

OSB and plywood both start with debarked trees. A plywood mill peels the veneer from a spinning log with a giant knife. The veneers are coated with glue and laid up with the grain orientation at 90° to the sheet below.

OSB mills chip the logs into flakes roughly 1.5 in. wide, 3 in. to 6 in. long, and 0.028 in. thick. Compared to the trees that

are used for plywood, OSB can use much smaller-diameter trees, and the quality isn't as important. Because OSB panels don't need a continuous peeled veneer, the log doesn't have to be as straight, and the number of knots doesn't matter.

The wood strands are dried and then fed into a blender that coats them with wax and resins. The flakes then pass through giant "combs" that orient

them into thin layers with the grain of the flakes running in one direction. Additional strand layers are added with the grain of each layer in an alternating direction, creating a thick mat of cross-laminated strands.

Once plywood panels or OSB mats are assembled, they are pressed under intense heat and pressure to activate the resins, and the finished panels then are trimmed to size.



**Strength in numbers.** Each layer of thin, narrow wax-and-resin-coated wood strands is arranged with its grain direction oriented 90° to the layer below, just like plywood. The cross-lamination of thousands of strands provides strength in both directions without knots or voids in the panel. Spray nozzles maintain proper moisture content until the mat reaches the press.



responds: by absorbing moisture and swelling. If a wood panel remains wet long enough, it will decay.

If you think you've noticed that OSB and plywood get wet at different rates, you're right. This is what Lstiburek means when he says OSB is more water sensitive than plywood. Because plywood is made out of peeled layers of a log, the wood fibers are intact across the entire panel and wick water relatively quickly across the panel. On the other hand, thousands of wood flakes make up an OSB panel, so the wicking action is interrupted continuously. Consequently, OSB takes a lot longer than plywood to get wet. But wet OSB takes a lot longer to dry out, something you need to account for before you install roofing, siding, or flooring.

The differences between veneers and flakes affect not only how panels get wet, but also what happens when they get wet. Both types of panels swell when they absorb moisture; however, because flakes don't transfer moisture well, OSB is more likely to swell around the edges and in isolated spots. A greater area of a plywood panel will swell, but once it dries out, the panel returns nearly to its original thickness. A well-made plywood sheet with good gluelines and limited core defects can withstand several wetting and swelling cycles because peeling veneer from a log doesn't alter

## The wet test

the structure of wood fibers. When a tree is flaked to make OSB, however, the wood fibers are severed, and they expand. The unpressed mats of oriented flakes in an OSB panel contain many times their volume in airspace. A ½-in. panel is many times thicker before it enters the press. Because wood has a memory, the flakes return to this fibrous state when water is able to loosen the bonds between strands.

### Ratings ensure that panels do the same job

Whether you use plywood or OSB, be sure to use Exposure 1 panels. Panels with this rating must pass wet/dry tests in the lab that duplicate the normal wetting that takes place during construction.

The trouble is that “normal” wetting can vary significantly. To a builder in Seattle, normal wetting might mean 25 consecutive days of misting rain. In New England, it could mean three major soaking rainstorms. The advice that emerges from this discussion is simple: Dry-in a new building as soon as possible.

Structural panels are engineered to meet performance criteria. The tests are material blind, so the panel stamp guarantees a panel’s stiffness, span rating, and nail-holding ability whether it’s plywood or OSB. Ed Keith, a senior APA engineer, says, “Plywood was here first, and two generations of builders knew how to use plywood. So when OSB came along, it was engineered and tested to be just like plywood for a specific end use.” Any plywood panel bearing an APA stamp with a 40/20 span rating will perform the same as an OSB panel with a 40/20 span rating.

Just because a plywood panel is ½ in. thick and an OSB sheet with the same rating is ¾ in. doesn’t mean that one of the panels is inherently stronger than the other. Many builders tend to purchase sheathing by material thickness, but the key factor is span rating.

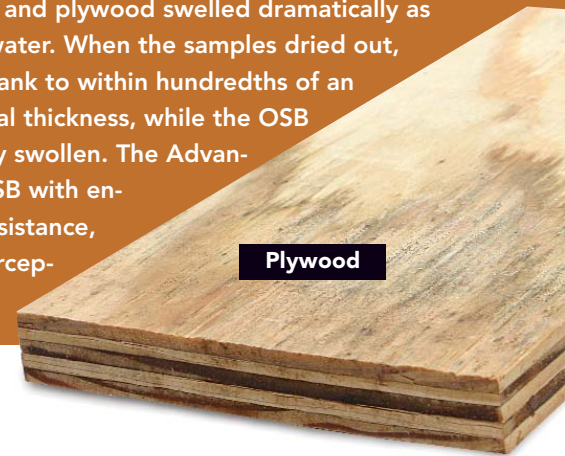
Small differences in nominal thickness can increase panel strength dramatically. For example, a panel rated 32/16 may be only ½ in.



OSB

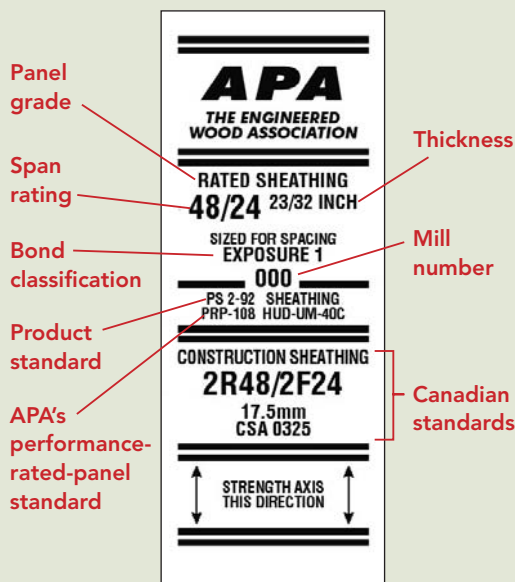
AdvanTech

Builders often complain that when structural panels get wet, problems begin. Curious about water’s effects, we created conditions that exceeded job-site weathering by suspending samples of OSB, plywood, and AdvanTech (sidebar p. 98) in water for several weeks. The OSB and plywood swelled dramatically as they absorbed water. When the samples dried out, the plywood shrank to within hundredths of an inch of its original thickness, while the OSB was permanently swollen. The AdvanTech, an über-OSB with enhanced water resistance, had nearly imperceptible swelling.



Plywood

## Decoding a panel stamp



The APA stamp on plywood and OSB does much more than tell you which side faces down. (The stamp should face down so that an inspector can read it.) It dictates how a panel may be used. The panel grade indicates three possible end uses: sheathing for roofs, walls, and floors (rated Sheathing); single-layer flooring

(rated Sturd-I-Floor); and exterior siding (rated Siding). Panels that also are marked Structural I have improved racking and cross-panel strength characteristics used in applications such as structural insulated panels (SIPs).

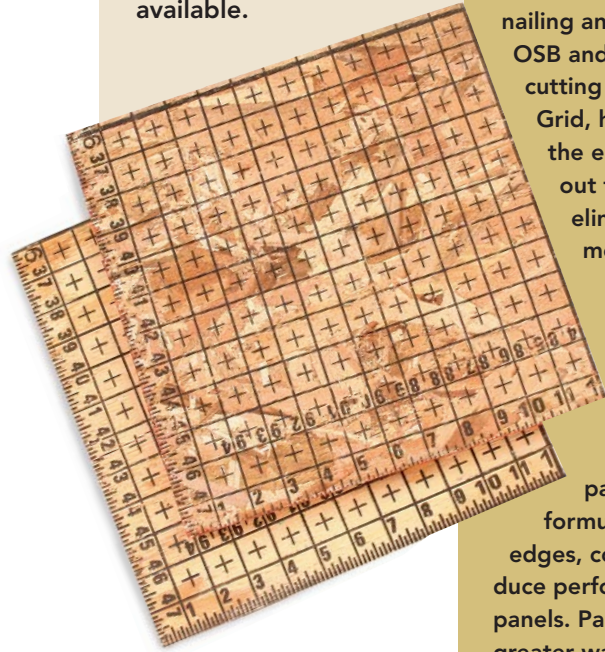
Under the rating designation are two sets of numbers that resemble fractions. The span rating on the

left, 48/24, contains two pieces of information: The sheet must have supports at least every 48 in. on a roof and at least every 24 in. on a floor. The right-hand number, in this case 23/32 INCH, is the nominal thickness of the panel.

Sheathing panels are rated for durability with generally either an Exposure 1 or Exterior rating.

## Not all OSB is the same

Responding to complaints from builders and homeowners about OSB's tendency to swell when wet, manufacturers have continued to refine OSB technology. As a result, different types of OSB panels are now available.



**Retire your tape?** Printed cutting and measuring guides supposedly let you make any cut, including diagonals, without marking an OSB or plywood panel.

### • COMMODITY PANELS

Basic OSB is still fine in applications such as wall or roof sheathing that shed water before the building is dried in.

### • TIME-SAVING PANELS

One of the latest trends is to print nailing and cutting aids directly on OSB and plywood panels. The cutting aids, such as Martco's Grid, have rules printed along the edges and marks throughout the field and claim to eliminate the need for tape measures and chalklines.

### • SUPERIOR WATER-RESISTANT PANELS

By increasing the amount of wax in the panel, varying the resin formulation, and sealing panel edges, companies now can produce performance-enhanced OSB panels. Panels engineered for greater water resistance cost more but are worth the investment for floor sheathing. Huber's AdvanTech line is designed to stay flat even under extreme wetting conditions. Huber also sells AdvanTech for walls and roofs, but it's not available in many parts of the country.

Louisiana-Pacific's Top Notch flooring panels are self-draining and are also available in improved water-resistant formulations and with heavy-duty edge sealing.

### • MOLD-RESISTANT PANELS

Manufacturers like Martco and Potlatch have added mold inhibitors to OSB panels because builders worry about mold-related lawsuits. Without consistent moisture, you can't have mold, so some experts believe that if the roofing and siding are installed properly, there's no reason you'd need this feature.

### • RADIANT BARRIERS

Numerous manufacturers have incorporated a radiant barrier on OSB and plywood roof sheathing. Studies claim that reducing radiant heat in the attic lowers cooling costs in warm climates by up to 20%.



**Scuppers for floor sheathing.** Cutouts in some brands of Louisiana-Pacific's tongue-and-groove floor sheathing drain water. Notches on the underside of the 4-ft. ends also prevent water from pooling on the joists.



**Foil-faced sheathing is cool.** Aluminum foil laminated to roof sheathing reduces air-conditioning costs by preventing 97% of the radiant energy absorbed by the panels from entering the attic.

thicker than one rated 24/16, but as roof sheathing, its allowable live load is 75% greater.

### Plywood can be stiffer, but OSB is more consistent

Tests have shown that on average, a plywood sheet is 7% stiffer than OSB of the same thickness and span rating. However, OSB will seem stiffer because you never step on soft panels. "The bell-shaped curve for plywood stiffness is about as wide as it is tall," Keith explains. "But the curve for OSB looks like a pencil."

A sheet of plywood can vary from its target stiffness because random veneer sheets are stacked with alternating grain directions. Core voids, which are created by overlapping knot holes in veneer layers, can create soft spots in plywood. Softer panels also result from plantation-grown trees that have weaker strength and stiffness char-

acteristics than naturally grown trees. OSB panels, on the other hand, never have core voids, and they can be engineered and manufactured more precisely.

### Bad practices can give panels a bad name

When Hurricane Andrew devastated southern Florida in 1992, people immediately blamed OSB for the failure of so many houses. Although Dade County, in a break with Florida's state code, subsequently prohibited the use of OSB as roof sheathing, many observers viewed the decision as politically motivated. Engineers and wood scientists pored over the wreckage, and the nearly unanimous consensus was that building practices, not materials, were responsible for much of the damage. Nailing schedules were ignored, and flashing details were skipped. In some cases, roof sheathing was tacked in place

with only a fastener at each corner. The storm flattened houses in one development, while an adjacent development (also in the path of the storm) suffered only minor damage. Both groups of houses were built with OSB.

The tendency among builders and consumers is to discover a problem and to blame the problem on the type of panel used in the building. That is hardly ever the case, according to Jerry Winandy, head of the composites group at the Forest Products Laboratory. “The products are similar enough that if one product failed, the other product will almost always fail in the same situation. It’s just a matter of time. If water is getting into the system, both products will eventually have problems and fail.” More important than the choice of structural panel, he argues, is the decisions about the design; the type of siding and roofing and the way they are applied; and interior moisture con-

trol. Says Winandy, “I think the critical thing is that we have to come up with a systems approach to moisture exclusion outside the structure and moisture control inside the structure.”

He’s not alone. Everyone interviewed for this article said that the performance of structural panels depends on building and installation details rather than on the panels themselves. Jeff Outten, technical marketing manager for plywood at Weyerhaeuser, reports that 99% of the problem calls they receive are related to installation mistakes. Paying attention to common trouble spots (sidebar below) allows plywood and OSB to perform as they are designed to and allows you to base sheathing choices on cost, ease of use, and product availability. □

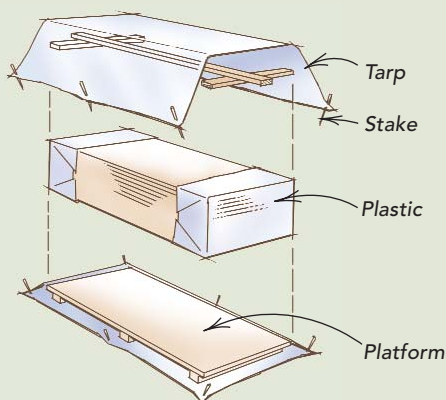
Sean Groom is an associate editor at *Fine Homebuilding*. Photos by the author, except where noted.

## Take six steps to protect yourself from sheathing problems

The delivery guy just handed you an invoice for \$4,800, so why are you going to let him dump your sheathing materials on wet, muddy ground? It takes only a few minutes to store plywood and OSB properly, and to make sure your panels stay dry and undamaged until it’s time to nail them up.

### 1. MINIMIZE STORAGE TIME

Scheduling delivery as close as possible to when you’ll use the panels means fewer opportunities for the sheathing to be rained on or manhandled.



Store panels on a level platform, wrap the ends with plastic, and cover with a tarp, staking the ends out from the stack to promote air circulation.

### 2. PLAN THE LAYOUT

Most OSB panels rely on edge-sealing to prevent thickness swelling. Giving a little thought to panel layout can limit the number of cut ends and make sure they fall where they will have less impact. Sheath a roof from left to right, putting the cut edges of the starting panels on the left side of the roof, and you can seal the edges quickly with a roller. If you’re not going to

paint the edges, the cut edges will be under the drip edge where any swelling won’t telegraph through the shingles.

### 3. MIND THE GAP

Butting panels together is the most common source of complaints lodged with manufacturers. When panels expand—something that is inevitable—they need somewhere to go, or they will buckle. A 1/8-in. gap between panels—the diameter of a 10d nail—is recommended between all edges. Many roof-panel clips (also known as H-clips) are designed to maintain this spacing.

Tongue-and-groove OSB panels never should be hammered together. A small



shoulder on the tongue edge provides the expansion space, and compressing this edge pretty much guarantees the panel will buckle.

### 4. FOLLOW NAILING SPECS

Maximum nail spacing is 6 in. along the edges and 12 in. in the interior, but check with your building department because local codes may require tighter spacing. Fasteners shouldn’t be driven within 3/8 in. of the edge.

Sinking the head of a nail or staple below the surface may seem like extra insurance, but you’re really weakening the holding strength.

### 5. DRY-IN A HOUSE QUICKLY

Floors have the potential for the greatest moisture-related problems during construction and must be protected from standing water. Use a tarp before the roof goes on, and sweep the floor deck immediately after a storm. If this can’t be done, drill drainage holes.

To keep out water, install the house-wrap as the walls go up. Likewise, tacking down tar paper as soon as the roof is sheathed not only protects the roof deck but also goes a long way toward keeping the floors dry as well.

### 6. PAY ATTENTION TO THE FLASHING

Mold requires a continuous source of moisture, and if a panel is getting that much water, it’s going to fail regardless of type. Common sources include poor chimney or window flashing, improper siding attachment, incorrect attic and crawlspace venting, and inappropriate insulation strategies. One common oversight is leaky bathroom-ceiling penetrations that allow humid air into the attic to condense on the roof sheathing.