

"MOISTURE EXCHANGE" Performance of OSB and Plywood Structural Panels

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ABSTRACT

Currently, most code authorities accept the functional equivalence of plywood and OSB structural panels. This position is promoted strongly by trade groups within the "engineered wood" industry. At the same time, most construction professionals who work with the two products assert exterior plywood tends to better survive extended moisture exposure than does a comparable OSB panel.

Testing confirms that OSB has a somewhat greater resistance to moisture infiltration and a somewhat greater resistance to exfiltration of moisture within the panel, and it is this tendency of OSB to retain excess moisture that can foster mold growth and wood decay.

Such differences in "moisture exchange" performance should not be considered a deficiency in the OSB product. When properly installed, neither OSB nor plywood should be exposed to moisture extremes; however, design/construction teams must look beyond the industry's existing structural performance rating system to evaluate project-specific risk factors that may favor the specification of plywood.

INTRODUCTION

Structural wood panels, primarily consisting of engineered plywood and oriented strandboard ("OSB") products, dominate the exterior sheathing market. The most common panel size is 4x8 feet, with typical thicknesses ranging from 3/8-inch to more than 1 inch.

Plywood structural panels may be performance-rated according to the provisions of voluntary product standard PS-1-95¹, published by the National Institute of Standards and Technology (NIST). OSB structural panels may be rated according to the provisions of NIST voluntary product standard PS-2-92². However, similar rating standards are also published by governmental agencies in Canada and Japan and by APA – The Engineered Wood Association, and other structural panel trademarking organizations.

Plywood

Plywood is manufactured from thin veneer sheets that have been peeled from logs and bonded together with resin in alternating cross-grained plies using a hot press.³ To maximize strength and stability, the resulting plywood panels always have an odd number of layers so that each panel is balanced around a central axis.

Structural plywood has been manufactured since 1905⁴; however, delamination resulting from exterior exposure was a common problem until the first synthetic "waterproof glue" was developed in 1934.⁵

- "Since layers can consist of a single ply or of two or more plies laminated such that their grain is parallel, a panel can contain an odd or even number of plies, but always an odd number of layers. ...To distinguish the number of plies (individual sheets of veneer in a panel) from the number of layers (number of times the grain orientation changes), panels are sometimes described as three-ply, three-layer or four-ply, three-layer."⁶

- "Plywood must have a minimum number of plies and layers for each thickness range. For example, 15/32 inch Structural 1 plywood must have at least 4 plies and 3 layers. Non-Structural 1 plywood of the same thickness can have 3 plies."⁷

Oriented strandboard

Oriented strandboard structural panels are manufactured from thin wood strands⁸ sliced from logs (in the direction of the wood grain) that are then dried, mixed with wax and adhesive, placed into a form in multiple layers (usually four or five), and hot-pressed into panels. While the homogeneous or non-oriented

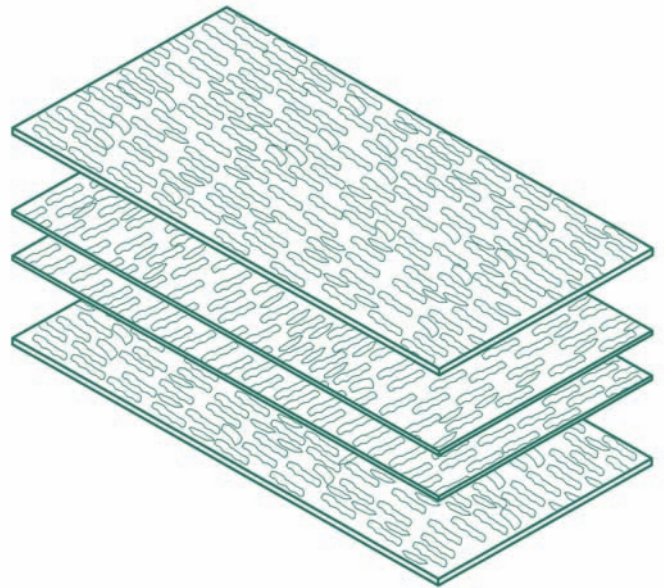


Figure 1 - OSB consists of inner and outer orthogonal layers of "oriented" (Typically $\pm 40^\circ$) strands that have been hot-pressed into continuous mats of wood fiber.

“chipboard” predecessors of OSB date back to 1963, the first oriented strandboard panels were manufactured in 1983.

The strands in the outer layers are *oriented* (typically $\pm 40^\circ$) along the length of the panel, thus giving the panel its primary strength along this axis. The strands of the inner layers are oriented perpendicular to the outer layers.

- “...OSB and waferboard are engineered, mat-formed structural panels made of strands, flakes, or wafers sliced from small diameter, round, wood logs and bonded with exterior-type binder under heat and pressure. Strand dimensions are predetermined and have a uniform thickness. The majority of Structural Board Association (SBA) member mills use a combination of strands up to 6" (150mm) long and 1" (25mm) wide.
- OSB panels consist of layered mats. Exterior or surface layers consist of strands aligned in the long panel direction; inner layers consist of cross- or randomly-aligned strands. These large mats are then subjected to intense heat and pressure to become a “master” panel, then cut to size.
- OSB’s strength comes mainly from the uninterrupted wood fiber, interweaving of the long strands or wafers, and degree of orientation of strands in the surface layers. Waterproof and boil-proof resin binders are combined with the strands to provide internal strength, rigidity, and moisture resistance.”⁹

Many tree species are used to manufacture plywood and OSB panels; however, the commonly used species are: **OSB** – southern pine, lodgepole pine, and “aspen/poplar”¹⁰; and **Plywood** – Douglas fir, western larch and hem-fir¹¹ (“western plywood” manufactured west of the Rocky Mountains) and southern pine (“southern pine plywood” manufactured in southern states).

- “Plywood can be manufactured from over 70 species of wood. ...These species are divided according to species strength and stiffness into five groups. ...Group 1 species are the strongest and stiffest.”¹² (Note that Douglas fir, western larch, and southern pine are Group 1 species, while aspen and poplar are in Groups 4 and 5.)
- Canadian softwood plywood allows 13 species for face veneer and 20 species for the inner plies.”¹³
- “The raw material for the original waferboard product, which was made from square wafers, was aspen. As this industry expanded and OSB became the predominant product manufactured, other species, such as southern pine, white birch, red maple, sweetgum, and yellow-poplar were found to be suitable raw materials as well. Small amounts of some other hardwoods can also be used for OSB.”¹⁴

None of the major “Model Building Codes” in North America differentiates between plywood and OSB structural sheathing, both of which must meet minimum voluntary performance standards when tested for three basic performance qualities: strength and stiffness, dimensional stability, and bond durability. Provided these structural and exposure performance minimums are met, the two products are considered equivalent by the code authorities.

Head-to-head performance comparisons of the two products

indicate specific testing variables (e.g., relative humidity, thickness, or fastener types and spacing) may produce results favoring one material over the other;¹⁵ however, in general terms, it is reasonable to use the voluntary performance standards as a mechanism for evaluating the “real world” equivalency of the two products. If either material will significantly exceed the desired minimum level of service and structural performance, then it appears the project designer and specifier need only evaluate non-performance factors (e.g., cost and availability) before specifying the sheathing system.

It is important to recognize, though, that the *moisture exchange* performance of the two products has not been a factor in such evaluations by the code authorities or by local building departments. These entities must assume that the sheathing will be installed under roofing, cladding, and weather barrier systems designed and installed to minimize moisture infiltration of the underlying structural panels; however, out in the workplace, construction professionals see numerous instances of design and/or construction failures resulting in extended periods of moisture entry and ensuing severe deterioration of the underlying plywood and OSB sheathing.

We also observe some conditions in which the plywood sheathing has better survived the moisture onslaught. What factors help explain plywood’s superior performance?

MOISTURE EXCHANGE

Both plywood and OSB are porous and strongly *hygroscopic* building materials; i.e., samples will adsorb¹⁶ or desorb moisture as necessary to reach a moisture exchange equilibrium with surrounding ambient moisture. The two sheathing products continually are undergoing *hygrothermal* interactions with their surroundings. The amount and direction of the energy exchange (gain or loss) depend on the temperature and moisture content levels of the panels and the surrounding air.

- “Like other hygroscopic materials, wood placed in an environment with stable temperature and relative humidity will eventually reach a moisture content that yields no vapor pressure difference between the wood and the surrounding air. In other words, its moisture content will stabilize at a point called the **equilibrium moisture content (EMC)**.”¹⁷

The primary mechanisms for this continual moisture exchange process¹⁸ are:

- **Vapor diffusion** - Vapor pressures increase as relative humidity (RH) and temperatures rise. The greater the vapor pressure differential through the sheathing, the greater the tendency for water vapor to migrate from the high-pressure side to the low-pressure side. Vapor diffusion generally occurs from warm to cold.
- **Surface diffusion** - At the molecular level, the thickness and mobility of water molecules adsorbed at the external and internal surfaces (e.g., at the internal pore walls) and within the sheathing pores increase as RH increases, resulting in moisture movement from regions with higher concentrations of adsorbed water to regions with lower concentrations. Surface diffusion occurs from moist to dry.
- **Capillary conduction** - If moisture levels are sufficient, the capillaries within the sheathing material begin to fill, resulting in moisture movement by capillary tension (due

to “hydrogen bonding” of the water molecules to the wood substrate) at the interface between the water and air. The capillary conduction process also occurs from moist to dry, is generally independent of temperature, and is the most efficient mechanism for moisture exchange.

Water (like all carriers of energy) always moves from areas of high energy potential to areas of low. Fundamentally, every condition that we experience with water is due to energy flowing from an area of greater concentration to an area of lesser. If there is an accessible route, no matter how small, wet always moves toward *dry* and *warm* always moves toward *cold*.¹⁹

During typical winter months, *vapor diffusion* to the exterior is the main mode of moisture exchange in a “dry” wall, while in a “moist” wall, the forces of *surface diffusion* are simultaneously working to move moisture to the interior. The “wet” wall is dominated by forces of *capillary conduction* moving excess moisture to drier areas and components. The directions of moisture movement for these exchange mechanisms may be opposed, depending on variables such as RH, pressure/temperature differentials, and the amounts and sources of moisture and vapor.

Fiber saturation

Fiber saturation is the level of moisture content (MC) at which the cell walls are holding as much water as possible; any additional water will accumulate within the cell cavities. This transitional zone is critically important for consideration of structural (e.g., swelling or linear expansion) and biodeterioration issues:

- “Water held in the cell walls is called *bound* water, while

water in the cell cavities is called *free* water. As the name implies, the free water is relatively accessible, and an accessible source of water is necessary for decay fungi to start growing. Therefore, decay can generally only commence if the moisture content of the wood is above fiber saturation. The fiber saturation point is also the limit for wood shrinkage. Wood shrinks or swells as its moisture content changes, but only when water is taken up or given off from the cell walls. Any change in water content in the cell cavity will have no effect on the dimension of the wood. Therefore, wood...shrinks and swells (only) when it changes (to) moisture content below the point of fiber saturation.”²⁰

- “While some moulds (sic) can colonize wood at moisture contents between 15 and 20%, little or no sporulation occurs. Most moulds (sic) require moisture contents above 20% for growth and sporulation. Infection by spores of “wood-rotting basidiomycetes” [WRB] probably does not occur at wood moisture contents below about 29% ...The mycelium and mycelial cords of WRB can colonize wood below the fibre (sic) saturation point, possibly down to 20% mc, provided they are growing from a substrate at a higher moisture content.”²¹
- “Once WRB are established, the minimum moisture content for decay to proceed is around 22 - 24%, so 20% is frequently quoted as a maximum safe moisture content for wood. ...WRB can survive for up to nine years in wood at moisture contents around 12%. If the wood wets up again, the decay process can restart.”²²
- “...keeping wood below the threshold moisture content of 20 to 25% is the primary means of preventing decay fungi from growing in wood.”²³

In general terms, industry research²⁴ identifies three critical moisture content “thresholds” describing the exponential acceleration of the biodeterioration process:

- 20-24% MC = slow growth of previously established rot and mold spores;
- 25-29% MC = moderate growth of rot and mold spores; and
- ≥ 30% MC = fast growth of rot and mold spores.

Clearly, these threshold levels confirm that even a 10% increase in moisture content may result, over an extended period, in significantly increased mold and rot growth. Considering such potentially acute effects of even small increases in moisture con-



tent, a comparative evaluation of the moisture exchange performance of OSB and plywood is warranted to determine if one of the products tends to experience somewhat higher moisture content levels during extended “wet” conditions.

Moisture Exchange Properties – OSB and Plywood

At typical ambient levels of RH and moisture content, published vapor permeance values for both plywood and OSB are roughly comparable. At increasing RH, the permeability of both plywood and OSB increase exponentially as moisture content approaches fiber saturation; however, the vapor permeance for the plywood panel increases at a significantly faster rate than for a similar OSB panel. In other words, during higher RH conditions, the moisture vapor transport mechanisms within plywood operate more efficiently than OSB.

- “In a dry state ...the plywood has a permeance (permeability divided by thickness) less than 5.7×10^{-11} [kg/Pa x s x m²] (1.0 perm), and therefore functions as a vapor retarder. When the relative humidity approaches a saturated state, the plywood becomes very permeable. From a dry to a moist state, the permeability of this plywood increases by a factor of 30.”²⁵
- “The difference in behavior for the plywood and OSB sheathing was attributed to a difference in the permeability functions for the two materials. ...the permeability of plywood becomes large as the moisture content approaches fiber saturation. On the other hand, the permeability of OSB is considerably smaller. As a result, moisture at the surface of the OSB is not readily transferred to its interior.”²⁶

A computer model called MOIST, developed at NIST, is used to predict moisture content versus time for components of a building envelope. MOIST testing of exterior-grade plywood and OSB conducted by NIST researcher Douglas M. Burch reveals:

- **Plywood** – “The moisture content of the thin surface layer is seen to follow closely that of the interior bulk layer, thereby indicating a small gradient in moisture content across the sheathing thickness.”²⁷
- **OSB** – “...the thin surface layer has a considerably higher moisture content than the bulk layer... a significant gradient in moisture content exists across the thickness of the OSB sheathing, thereby providing a potential for buckling and warping.”²⁸

In other words, Burch reports that while the surface and interior components of exterior grade plywood sheathing work in general concert to store and/or move water, depending on conditions, the surface and interior layers of OSB sheathing have significantly differing performance characteristics.

At the Oak Ridge National Laboratory (ORNL), Achilles Karagiozis has developed an “advanced hygrothermal model”²⁹ called MOISTURE-EXPERT that allows two-dimensional simulations of building envelope performance. Dr. Karagiozis has used this computer model to evaluate hygrothermal performance of wall systems in the greater Seattle area.

Included in the “Phase 1” report³⁰ for this ORNL research are limited comparisons of the *moisture diffusivity*³¹ performance of OSB and plywood. The report reveals:

- Unlike plywood, for OSB panels, the wetting and drying rates for the moisture diffusivity process differ greatly; and
- For OSB, both the wetting and drying rates for moisture diffusivity improve exponentially for the orthogonal “y-direction” (i.e., laterally within the OSB panel) when compared with the “x-direction” (i.e., through the OSB panel).
- “Another important material property consideration in advanced hygrothermal models is that many materials exhibit very different behavior in the x, y, and z Cartesian directions. For example, moisture transport in wood is directionally dependent.”³²

In other words, unlike plywood, but in a similar fashion to wood (e.g., sawn lumber), Dr. Karagiozis concludes it is easier for moisture to move *within* an OSB panel than to *exit through* the panel.

In lumber, the directionally dependent nature of the moisture transport results from the vertical orientation of the tree’s internal capillary structure. Similarly for OSB, the *strand orientation* process required to produce the panel’s structural properties results in a relatively uniform direction of the internal capillary complex of the two outer layers and a generally opposite capillary orientation for the inner layers. In contrast, the testing and analyses reported by Dr. Karagiozis indicate such moisture exchange orientation is not produced during press manufacture of the thinner peeled layers that comprise a plywood panel.

The stratification of these wood strand layers is exacerbated by the use of wax in the OSB manufacturing process.

- “OSB is composed of many layers of interleaved strands that are compacted to a panel density that is up to 50% greater than that of the wood furnished. A small amount of wax is also added to make it more moisture tolerant. Moisture takes longer to penetrate through this denser material.”³³
- “Wax is used in the OSB manufacturing process for several reasons:
 - Wax is a water repellent that provides the finished product with resistance to aqueous penetration. This provides protection against weather-related wetting during construction.
 - Wax functions as a sticking agent for powdered resin and promotes resin fluidity.
 - Wax acts as a solid lubricant providing slip characteristics to the strand surface, reducing the plugging tendency at the forming station.”³⁴
- “...it has been shown in some studies that as wax level is increased above 1.5 percent solids addition, some bond degradation begins to occur.”³⁵
- “A small amount of wax (usually less than 1.5% by weight) is added in the OSB manufacturing process to improve the board’s resistance to moisture and water absorption. Most OSB manufacturers use slack wax, which is obtained as a byproduct of lube oil refining...”³⁶
- “The wood strands are then coated with powdered or liquid resins and a small amount of wax. These resin binders together with the wax will contribute to OSB’s moisture resistant qualities. However, like all wood products, OSB will react to changes in moisture and humidity.”³⁷

The wax increases the panel's resistance (at the exterior and interior layers) to moisture exchange by interfering with the adhesive attraction ("hydrogen bonding") of water molecules to the wood substrate.

In brief, water molecules are "polar" (the oxygen atom at one end of the molecule has a slightly negative charge, while the two hydrogen atoms at the opposite ends of the molecule are slightly positive). Similar to the attracting bond between opposite magnetic poles, the attracting forces between the hydrogen atoms of water molecules and open oxygen atoms at the external or internal (pore) surfaces of hygroscopic construction materials are relatively strong, resulting in the potential for significant moisture movement (e.g., the "capillary action" or "wicking" that occurs when wood sheathing is installed tight to basewall flashings).

On the other hand, there is no similar attraction between water molecules and non-polar molecules such as oil or wax (i.e., "oil and water don't mix"), which explains why asphaltic roofing materials are so common. Therefore, diminished bonding performance of water molecules resulting from the infusion of wax during OSB manufacture will affect the moisture sorption processes (adsorption and surface diffusion) typically experienced at the external and internal (pore) surfaces. Further, during "wet" periods of fiber saturation, the presence of wax will significantly diminish capillary conduction performance.

A further significant OSB vs. plywood difference in material properties is the high *density gradient* found in OSB. Typically, as a result of its hot-press manufacture, the outer layers of OSB panels are denser than the inner, creating a density gradient that will impact the moisture/vapor exchange processes. In comparison, the "density profile" of pressed veneers comprising a plywood panel is much flatter.

- "The density of wood-based composite panels is not uniform in the thickness direction. A characteristic vertical density profile is formed...The density profile of wood-based composites has a direct influence on all the relevant physical and mechanical properties of the finished panel."³⁸
- "Many factors influence the consolidation of the OSB panel in the press: press temperature, mat moisture content and its distribution, wood species, strand geometry, adhesive type, the profile of thickness change during hot pressing, mat temperature, press time, press closing speed, and press pressure. The manipulation of the above factors can change the density profile of the board, the heat transfer rate, and thus the board properties and production rate." "The density profile of OSB is also governed by the consolidation rate of the mat which in turn is affected by the press closing time. Fast press closing times cause higher surface-layer density and higher moduli of elasticity and rupture, but lower internal bonding."³⁹

In summary, the research conducted at NIST and ORNL indicates that, in comparison with plywood panels, OSB panels have:

- A somewhat greater resistance to moisture infiltration;
- A somewhat decreased ability to exfiltrate moisture from the panel; and
- A significantly increased tendency for excess moisture to move laterally within the panel, to the upper limit of the panel's moisture storage capacity.

It is reasonable to attribute a significant degree of these performance differences to the relatively uniform orientation of the capillary structures in the OSB panels and the flatter density profile of the plywood panels. A further significant contributing factor certainly is the addition of wax (approximately 0.5 pounds per 4'x8'x1/2" sheet) during the strand-blending process. The wax infusion impairs moisture and vapor movement, whether by infiltration or exfiltration. In other words, the wax works to both initially protect the OSB panels from excess moisture conditions and to diminish the release rate of interior moisture if the panel does become "wet."

During "wet" conditions of intermittent or cyclic water infiltration, the OSB panel will have a significant disadvantage compared to plywood because both the duration and the extent of its period of "excess" moisture can be expected to be somewhat greater.

OSB vs. Plywood Testing

This conclusion can be evaluated by further review of the results of the "Phase 1" report⁴⁰ published by Dr. Karagiozis for two-dimensional simulations of hygrothermal performance of stucco-clad wall systems in Seattle. Among the advanced aspects of the MOISTURE-EXPERT program is the researcher's ability to assume conditions of exterior water penetration, simulating the "real world" effects of building envelope deficiencies. The analyses reported by Dr. Karagiozis in Graphs 1 and 2 assume that 2% of the wind-driven rain striking the exterior wall will penetrate the building envelope.

Graph 1 evaluates a stucco-clad wall assembly with 60-minute building paper installed over OSB or plywood sheathing atop unfaced fiberglass batt insulation. The interior air/vapor barrier is provided by a coat of interior PVA paint and a coat of latex paint applied to gypsum wallboard.

Graph 2 evaluates the same stucco-clad wall assemblies except the interior vapor retarder consists of a coat of latex primer and a coat of latex paint. (Note the use of latex primer instead of PVA paint results, in this case, in reduced moisture content within the wall assemblies.)

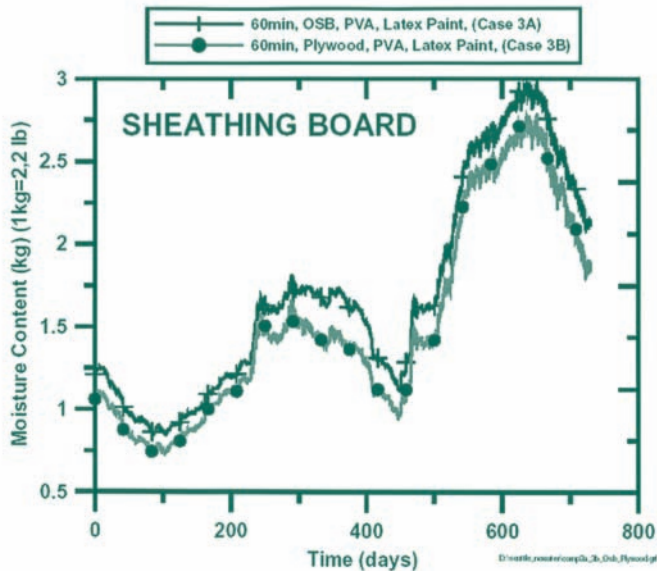
Both graphs demonstrate that during the course of the two-year analyses, the moisture content⁴¹ of the plywood tends to increase at a faster rate than the OSB during the periods of moisture increase.

Conversely, during periods of moisture decrease, the plywood more rapidly releases its moisture, resulting in some extended periods (> three months) during which the moisture content of the OSB is significantly greater than the plywood.

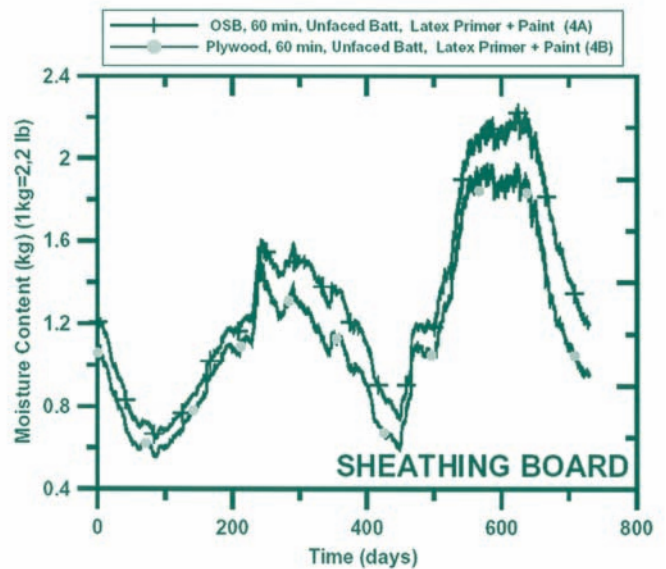
CONCLUSIONS

Analysis conducted by NIST and ORNL clearly indicates a significant difference in moisture exchange performance of OSB and plywood in wet conditions. The extended periods of increased moisture content observed in the OSB panels can be expected to result in significantly exacerbated conditions of mold growth and wood rot. In wet conditions, the OSB will experience, over time, a much greater potential for severe structural deterioration.

The inner and outer layers comprising the OSB panels do not work well together when moving excess moisture to the exterior surface, resulting in a product that is more susceptible than plywood to the deleterious effects of cyclic moisture exposure. This



Graph 1 - (2% Water Penetration and Initial 85% RH) - Moisture content of OSB and plywood during two-year evaluation of Test Case #3. Note extended periods during which the OSB tends to hold onto excess moisture.



Graph 2 - (2% Water Penetration and Initial 85% RH) - Moisture content of OSB and plywood during two-year evaluation of Test Case #4. Note extended periods during which the OSB tends to hold onto excess moisture.

conclusion is consistent with test results reported by Okkonen and River⁴² at the USFS Forest Products Laboratory comparing the results of “one year of outdoor exposure” and “accelerated laboratory-aging treatments” on plywood panels⁴³ and “wood-based panels”⁴⁴ consisting of OSB performance rated sheathing:

- “Performance of the wood-based panels was severely decreased by accelerated-aging treatment, including the cyclic boil-dry treatment and the ASTM D 1037 accelerated-aging treatment. ...The MOR [modulus of rupture] and MOE [modulus of elasticity] of wood-based panels decreased to 28 to 49 percent of initial values after 1 cycle of BD [boil-dry] treatment and 9 to 39 percent after 40 cycles. ...Plywoods retained about 90 percent of the initial MOR or MOE after 1 BD cycle and about 40 to 70 percent after 40 BD cycles...”
- For the tested OSB panels: “One year of outdoor exposure reduced MOR and MOE to about 40 to 60 percent of the initial values.”
- For the tested plywood panels: “One year of outdoor exposure reduced MOR and MOE in all plywoods to about 70 to 90 percent of the initial values.”

In summary, the testing indicates OSB and plywood performance-rated sheathing products do not provide equivalent long-term structural performance in response to high levels of moisture resulting from deficient design or construction.

The differences in moisture exchange performance of the two materials is attributable to their unique structural compositions, and key factors certainly are the differing density profiles, the wax infusion in OSB manufacture, and the oriented nature of OSB’s wood strands, which produces generally directional properties for the product’s inner and outer capillary systems.

Such conclusions are general, of course. Panel performance

may be affected by many environmental and product variables, including the natural resistance to decay of the differing wood species used to manufacture the engineered sheathing; however, it is clear that pre-construction evaluation of the differing moisture exchange properties of OSB and plywood should be conducted by a project’s designer, specifier, and installers.

- “When exposed to direct wetting, the moisture content is influenced by wetting time and by panel variables such as veneer species of plywood and wax additives of OSB.”⁴⁵

Various risk factors (e.g., expected high levels of interior humidity and/or rainfall and/or wind-driven moisture) may lead the design team to specify plywood instead of OSB, or to specify a different cladding or roof covering over the OSB, or to upgrade the specifications and details for installation of the “weather resistive barrier” and related flashing assemblies. These combined factors of increased risk might lead the general contractor to more closely supervise and coordinate the subcontractors’ work or to upgrade the tarping system used to protect exposed construction.

While it is a truism that construction techniques commonly accepted in Phoenix may be a recipe for lawsuits and potential structural collapse in rainy Seattle or Portland, it also must be recognized that on a project-by-project basis, OSB’s moisture exchange limitations may be a more significant risk factor (depending on the integrity of the design and installation of the roofing/cladding, weather resistive barrier and sheathing systems) than the local annual rainfall.

- “Oriented strand board (OSB) or other composite wood product panels may not be equivalent to plywood for a particular location (i.e., “wet” climates). While recent code changes have caused OSB to be deemed “equivalent” to plywood in most instances, OSB may not be appropriate in environments where there is substantial moisture in the

air, such as locations near major bodies of water.”⁴⁶

This conclusion should not be construed as a blanket condemnation of the use of OSB structural sheathing in roof, wall, or floor assemblies, even in the wettest and most humid climates. OSB is a well-engineered product that provides significant economic, structural, and environmental (through the use of lower quality and more easily farmed trees) benefits. For many uses, OSB provides performance and/or service values that are superior to plywood; however, for other uses the opposite may be true, particularly during extended conditions of excessive moisture.

Industry groups correctly note that, “When properly installed, neither OSB nor plywood should be exposed to those extreme conditions...”; however, they are incorrect when they conclude this assertion by stating, “...and both have performed equally well.”⁴⁷ ■

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