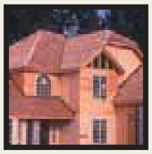
Structural Insulated Panels

PRODUCT GUIDE

Structural Insulated Panel Association

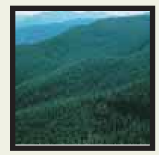
APA

WOOD
The Natural Choice



Engineered wood products are a good choice for the environment. They are manufactured for years of trouble-free, dependable use. They help reduce waste by decreasing disposal costs and product damage. Wood is a renewable, recyclable, biodegradable resource that is easily manufactured into a variety of viable products.

A few facts about wood.

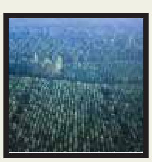


- ***We're growing more wood every day.*** Forests fully cover one-third of the United States' and one-half of Canada's land mass. American landowners plant more than two billion trees every year. In addition, millions of trees seed naturally. The forest products industry, which comprises about 15 percent of forestland ownership, is responsible for 41 percent of replanted forest acreage. That works out to more than one billion trees a year, or about three million trees planted every day. This high rate of replanting accounts for the fact that each year, 27 percent more timber is grown than is harvested. Canada's replanting record shows a fourfold increase in the number of trees planted between 1975 and 1990.

- ***Life Cycle Assessment shows wood is the greenest building product.*** A 2004 Consortium for Research on Renewable Industrial Materials (CORRIM) study gave scientific validation to the strength of wood as a green building product. In examining building products' life cycles – from extraction of the raw material to demolition of the building at the end of its long lifespan – CORRIM found that wood was better for the environment than steel or concrete in terms of embodied energy, global warming potential, air emissions, water emissions and solid waste production. For the complete details of the report, visit www.CORRIM.org.

- ***Manufacturing wood is energy efficient.*** Wood products made up 47 percent of all industrial raw materials manufactured in the United States, yet consumed only 4 percent of the energy needed to manufacture all industrial raw materials, according to a 1987 study.

Material	Percent of Production	Percent of Energy Use
Wood	47	4
Steel	23	48
Aluminum	2	8



- ***Good news for a healthy planet.*** For every ton of wood grown, a young forest produces 1.07 tons of oxygen and absorbs 1.47 tons of carbon dioxide.

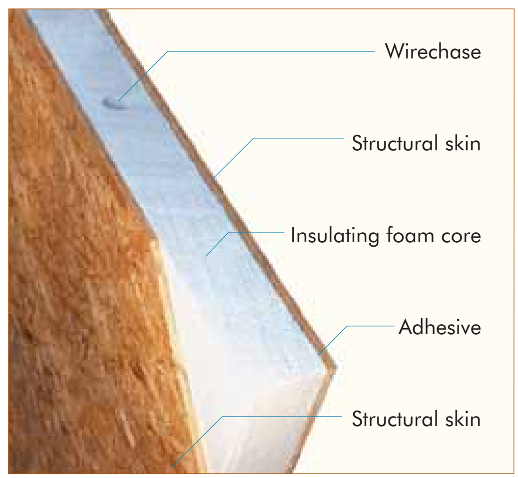
Wood: It's the natural choice for the environment, for design and for strong, lasting construction.

Structural Insulated Panels

Advanced emerging building materials, such as structural insulated panels (SIPs), are engineered to provide more durable, energy efficient homes and commercial buildings. Using SIPs to create a high performance building envelope is the first step to producing a "green" building that is strong, energy efficient, and cost effective.

WHAT ARE SIPS?

Structural insulated panels are high-performance building panels used in exterior walls, roofs, and floors for residential and light commercial construction. The panels are made by sandwiching a core of rigid foam insulation between two skins of wood structural panels, typically oriented strand board (OSB).



The foam core of the panel is typically composed of expanded polystyrene (EPS), polyurethane, extruded polystyrene (XPS) or polyisocyanurate. Where required by the manufacturing process, structural adhesive is used to adhere the foam cores to the skins of the panel in the lamination process. Once laminated, panels can be fabricated either onsite or in the manufacturing plant to meet the design specifications of a home and shipped to the site for a quick and easy installation.

The SIP fabrication process usually begins with a CAD drawing of the building. Panel manufacturers convert the CAD drawings into shop drawings that can be plugged directly into CNC fabrication machines or used to measure and cut panels by hand. "Chases" or channels for electrical wiring are cut or formed into the foam core, and the core is recessed around the edges to accept connection splines or dimensional lumber. By fabricating SIPs under factory-controlled conditions, SIPs achieve tolerances far more precise than wood framing.

From the manufacturing plant, panels are shipped to the jobsite. Panels are available in a standard 4'x8' size and range in size up to jumbo 8'x24' panels. Panels range in thickness from 4-1/2 to 12-1/4 inches, providing a range of R-values that comply with insulation requirements in different climate zones.

Structural insulated panels are used in single and multifamily residential buildings as well as light commercial structures. SIPs are most commonly used in walls and roofs, but they can also be used in floors and foundations.

WHY SIPS?

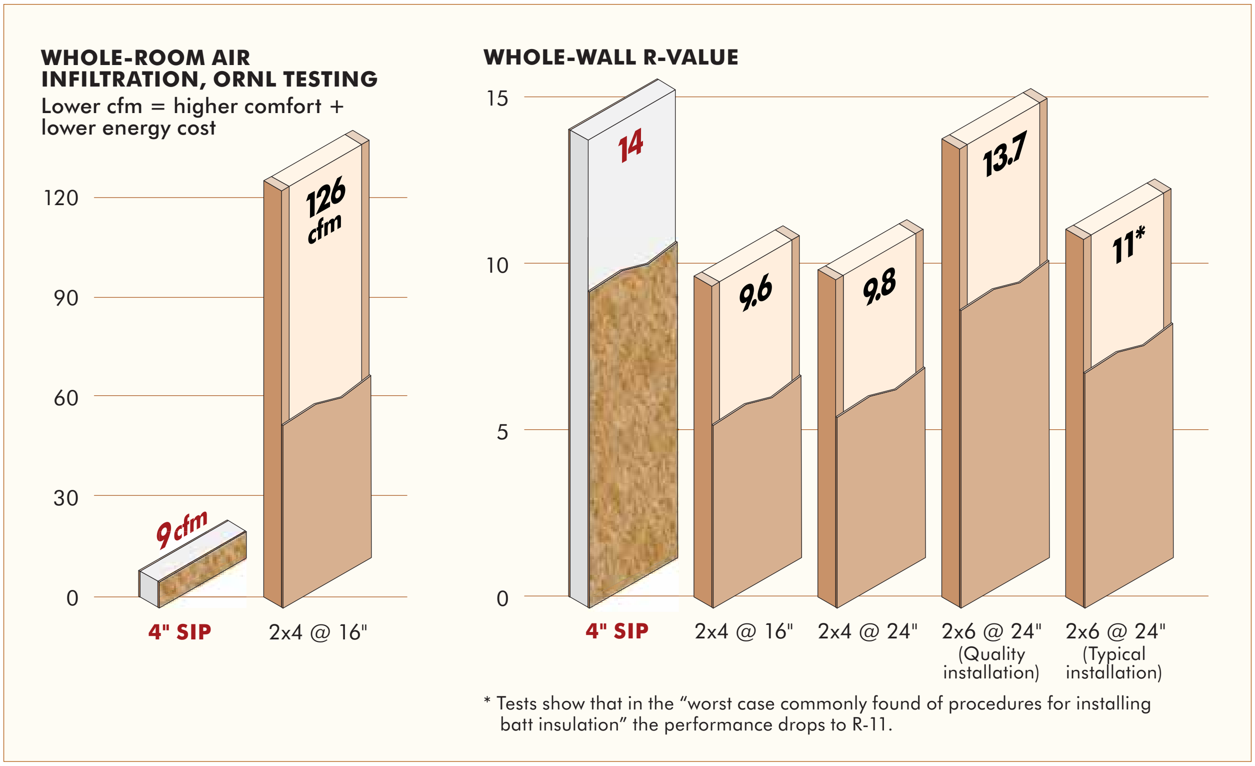
SIPs are a building system that can save builders time, money and labor while producing high-performance, green buildings.

SIPs Save Energy

Energy use and thermal efficiency are two of the anchor points of a green building. Buildings that use less energy and generate less carbon dioxide emissions have a smaller impact on the environment.

The insulating core of a structural insulated panel provides high-density continuous insulation. SIPs enable structures to be assembled with minimal framing. The percentage of area in a wall assembly composed of sawn lumber is classified as a wall's "framing factor." The framing factor is a measure of thermal bridging. The more framing, the higher the framing factor and the more energy is lost due to thermal bridging. A typical stick-framed home averages a framing factor ranging from 15 to 25 percent, while a SIP home averages a framing factor of only 3 percent. When the whole-wall R-value is measured, SIP walls outperform stick-framed walls because studs placed 16 or 24 inches on center cause thermal bridging and result in energy loss. Additionally, fiberglass and other insulating materials are subject to gaps, voids, or compression leading to further degradation in thermal performance.

When working with panels as large as 8'x24' there are significantly fewer joints that require sealing. SIPs make establishing a whole house air barrier simple and effective. Studies at the U.S. Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) have shown a SIP room to have 90 percent less leakage than its stick-framed counterpart.[1]



(1) Christian, Jeff and T.W. Petrie, *Heating and Blower Door Tests of the Rooms for the SIPA/Reiker Project*. ORNL March 15, 2002.

Air leakage in homes is measured by using a blower door test. Using a specially designed fan to pressurize the structure, Home Energy Rating System (HERS) technicians can measure the amount of air leakage in the home and use this information to size HVAC equipment or apply for an ENERGY STAR qualification. SIP research homes built by ORNL were measured to have infiltration rates as low as 0.03 natural air changes per hour (ACH). Stick-framed homes of similar size in the same subdivision averaged blower door test results ranging from 0.2 to 0.25.[(2)] SIP homes have proven to reach these levels of air tightness consistently enough for the EPA to waive the required blower door test for homes with a complete SIP envelope to receive an ENERGY STAR rating.

When combined with other high-performance systems, SIP homes can reduce annual energy use by 50 percent or more over the Model Energy Code. SIPs have been instrumental in the creation of many zero-energy buildings that produce as much energy as they consume through photovoltaic cells and a high performance SIP building envelope.[(2)]

NEAR-ZERO-ENERGY HOUSES

House	Sq. Ft.	% Savings of Model Energy Code (MEC)	Annual Utility Costs
SIPA ZEH1	1060	51.0%	$343
SIPA ZEH2	1060	57.0%	$484
SIPA ZEH3	1060	57.5%	$413
SIPA ZEH4	1200	62.5%	$275
SIPA ZEH5	1232	69.5%	$242

In 2002, ORNL teamed up with the Structural Insulated Panel Association (SIPA) and the Department of Energy (DOE) to create five innovative net-zero energy buildings. These high-performance homes featured structural insulated panel walls and roofs, rooftop solar photovoltaic systems, and other energy efficient technologies that helped these homes approach DOE's goal of net-zero energy use.

The small single-family homes were built in Habitat for Humanity's Harmony Heights subdivision in Lenoir, Tennessee. ORNL performed extensive testing on the performance of these homes and monitored energy usage for the first year of habitation. The air tightness and insulating properties of a SIP building envelope helped cut the annual heating and cooling cost for the first zero-energy home to $0.45 a day. By using SIPs in conjunction with other energy-efficient and affordable features, builders are able to offer net-zero energy homes to North American homebuyers.

(2) *Energy Savings from Small Near-Zero-Energy Houses*, ORNL, 2002.

SIPs Save the Environment

With rising concerns over global climate change, designers and builders have focused on reducing the environmental impact of homes and commercial buildings. SIPs help achieve this mission by saving energy and valuable natural resources, and by providing a healthy indoor environment for building occupants. Builders using SIPs often find it easier and more cost effective to meet the qualification standards under many green building rating systems, such as the Leadership in Energy Efficient Design (LEED), Green Globes, and National Association of Homebuilders (NAHB) green building programs.

SIPs are both energy efficient and an efficient use of resources, making them an ideal choice for a high-performance green building. The OSB used in SIP skins is made from trees that are harvested from sustainably managed forests.

The insulating core used in SIPs is a lightweight structural foam composed of 98 percent air, and requires a relatively small amount of petroleum to produce. Both EPS and polyurethane-based foam insulations are made using a non-chlorofluorocarbon (CFC) blowing agent that does not threaten the earth's ozone layer.

SIPs are often cut using optimization software that minimizes the amount of waste. EPS waste generated in the SIP manufacturing and fabricating process is recycled into other EPS products. Jobsite waste is also reduced.

By using less energy than most buildings, SIPs cut down on carbon dioxide emissions. According to the EPA, when the emissions generated during energy production are included, the average home emits 22,000 lbs of carbon dioxide annually, roughly twice as much as the average car. Homes built with SIPs and other high-performance systems can reduce a home's carbon dioxide emissions by as much as 50 percent.

SIPs are inert and stable, and do not off-gas any chemicals. An airtight SIP building envelope allows for fresh air to be provided in controlled amounts, filtered to remove allergens and dehumidified, amounting to healthy indoor air quality. SIPs are uniformly insulated, without the voids, cold spots, or thermal bypasses of conventional insulation that can cause condensation leading to potentially hazardous mold growth.

SIPs Save Time and Labor

Prefabricated SIPs can save builders a significant amount of onsite labor. SIPs are ready to install when they arrive at the jobsite, eliminating the need to perform the individual operations of framing, sheathing, and insulating stick-framed walls. Window openings may be precut in the panels, and depending on the size, a separate header may not need to be installed. Working with jumbo panels means entire walls and roof sections can be put up quickly.

Since SIPs are an entirely engineered product, they are inherently flat, straight, and true. With SIPs, there is no need to spend time culling studs or straightening stick-framed walls. Siding, interior finishes, and trim will go up faster because SIPs provide a uniform nailing surface. Interior framing can be done after SIPs are set, meaning a house can be dried-in quickly. A recent R.S. Means study shows building with SIPs saves 41 percent on labor.[3] Quicker dry-in time leads to a more stable structure with fewer problems involving drywall cracks, nail pops, and subfloor movement.

SIPs Save Money

In addition to trimming time off the build cycle of a structure, SIPs can be installed with less skilled labor than traditional stick framing. Early completion translates to lower loan cost overhead and additional opportunity for profit by building more homes in the same amount of time. Jobsite waste-disposal costs will be reduced because SIPs are primarily fabricated off site. The energy efficiency of a SIP structure allows smaller HVAC equipment to be used, duct runs to be minimized, and heating costs during the construction process to be lowered. Builders who build energy efficient homes may qualify for federal or state tax credits.

DESIGN ADVANTAGES

SIPs offer several inherent advantages due to their engineered fabrication and structural abilities. SIPs are an integrated system. The manufacturing process is fully integrated with the CAD design process. This introduces the flexibility and accuracy of CAD design into the actual construction of the home. The entire building process from design to finished construction takes less time and is closer to the design specifications with a SIP structure.

Building with an engineered product means that SIP components will always be straight, true, and cut with close tolerances. Designers can use complexity to their advantage with CAD/CAM fabrication technology. CNC cutting machines are capable of cutting just about any shape and size of panel, taking complex measuring and mathematics out of onsite construction. Complex roofs, rounded roofs, and rounded or arched windows are only a few examples of design elements easily achieved with SIPs.

SIPs can dramatically simplify the construction process. Jumbo panels with large spanning capabilities can close space with fewer structural members than traditional stick framing. Transverse and racking load tests confirm the strength and transverse load resistance of SIPs, meaning less additional supports will be needed to add stability in high seismic or wind areas.

(3) *BASF Corporation Time and Motion Study,* R.S. Means, 2006.

Custom Homes

For the custom-home market, SIPs offer a cutting edge product that can deliver a variety of custom designed elements. In any design, SIPs create a solid and energy efficient structure with trim and interior finishes that match the accurate, engineered construction of the exterior panels.

Timber Frames

SIPs owe a portion of their emerging popularity to the renewed interest in timber framing. SIPs are a perfect fit to provide exceptional insulation for the large spans and voluminous interior spaces of timber-framed structures.

Affordable Housing

SIPs make housing affordable for low-income residents. Low-income families spend an average of 19.5 percent of household income on home energy costs.[4] When SIPs are used in single unit or multifamily low-income housing, this number can be drastically reduced. SIPs also cater to volunteer housing programs, such as Habitat for Humanity, because less skilled labor is needed to erect a SIP building than a conventional stick-framed home.

(4) Phillips, Judith. *Housing Strategies for Mississippi.* John C. Stennis Institute of Government, Mississippi State University, 2006.

Nonresidential, Industrial and Commercial

SIPs are frequently used in light commercial construction. Crews working with 8'x24' jumbo panels can close in a large building very quickly. SIPs are commonly used in conjunction with engineered lumber products because they can cover large spans without additional structural support. SIPs are also a widely used choice for schools wishing to cut energy costs and create a healthy indoor environment for students.

DESIGN AND CONSTRUCTION CONSIDERATIONS

Building with SIPs involves several unique design and construction considerations.

Foundations

Working with SIPs requires attention to foundation tolerances. Although SIPs can be modified on site to fit an out-of-square or non-level foundation, this process is laborious and can affect the air sealing capabilities of the panels. Make sure the foundation contractor is aware of the tolerance required when building with SIPs.

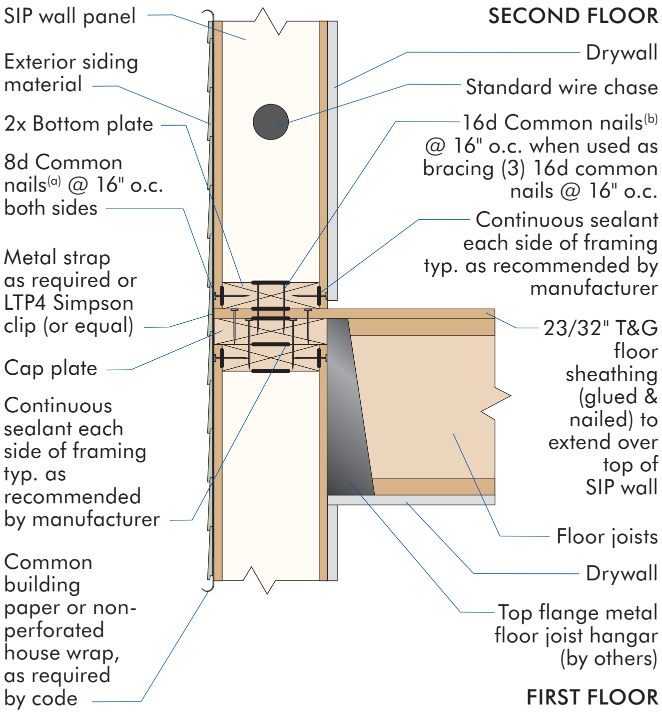
Window and Door Openings

When drywall is applied to SIPs the total wall thickness may be slightly different than a stick-framed wall because SIPs have wood structural panels on both sides. Window and door openings need to be sized accordingly.

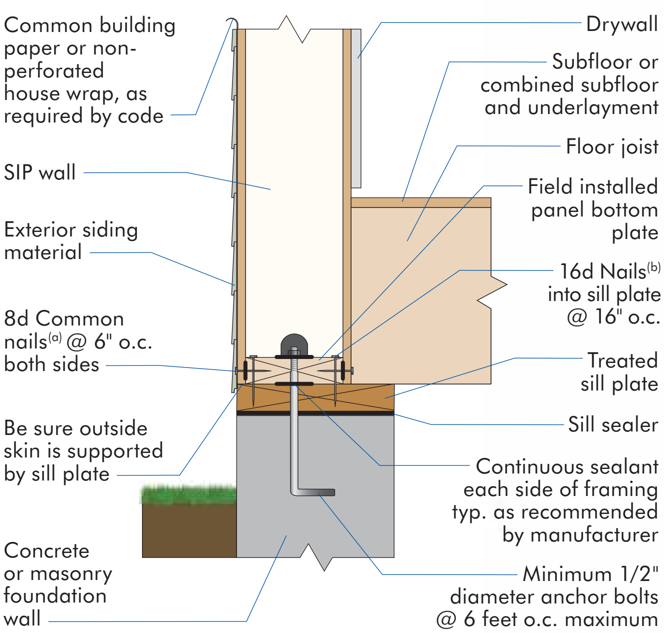
Site Conditions and Material Handling

Although 4'x8' panels can often be unloaded and set by hand, jumbo 8'x24' panels weigh up to 700 lbs and require the use of equipment to unload and install. To set jumbo wall and roof panels, an extending boom fork lift, boom truck, or crane is used. Site conditions need to be taken into consideration when dealing with large equipment. High-wind conditions also pose a problem for setting large roof panels.

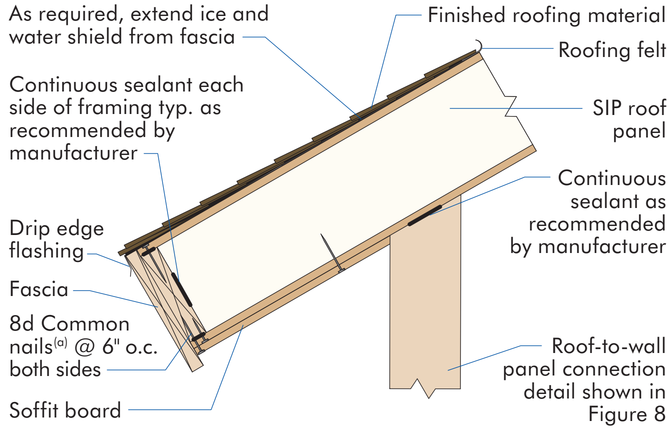
1 SECOND FLOOR CONNECTION DETAIL – HANGING FLOOR *(See page 12 for alternate detail)*



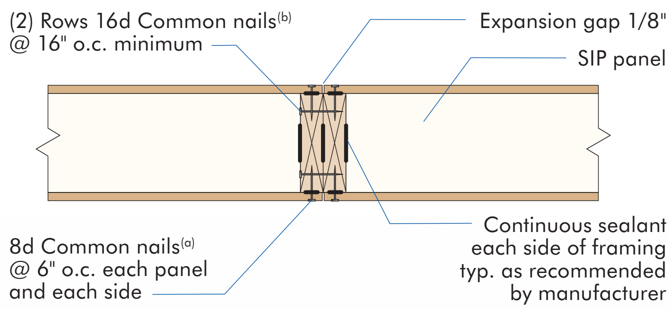
2 FOUNDATION CONNECTION – ELEVATED FLOOR



3 EAVES CONNECTION DETAIL

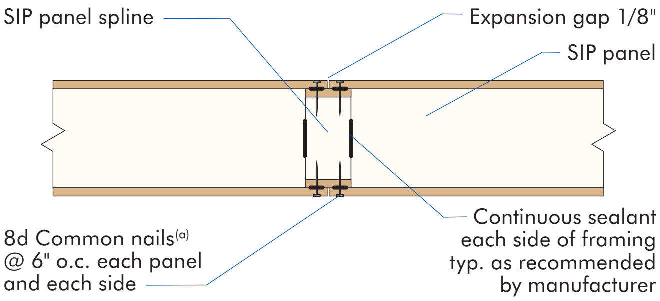


4 WALL-TO-WALL VERTICAL PANEL CONNECTION – DIMENSIONAL LUMBER SPLINE

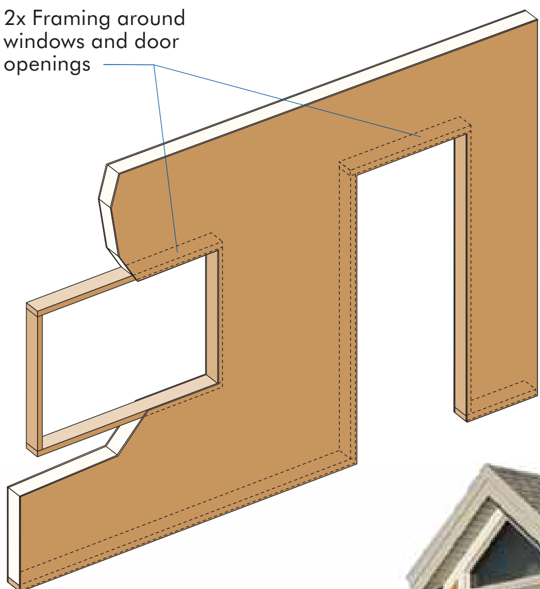


(a) 8d Common nail – 0.131" x 2 1/2" x full head
(b) 16d Common nail – 0162" x 3 1/2" x full head

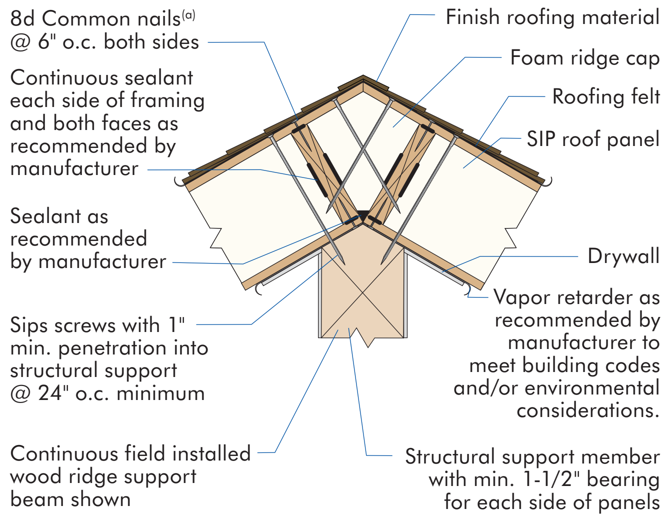
5 WALL-TO-WALL VERTICAL PANEL CONNECTION – BLOCK SPLINE



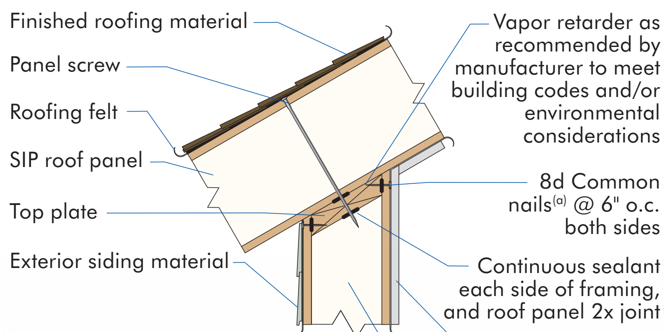
6 DOOR AND WINDOW FRAMING



7 ROOF-TO-ROOF PANEL CONNECTION – FOAM RIDGE CAP DETAIL

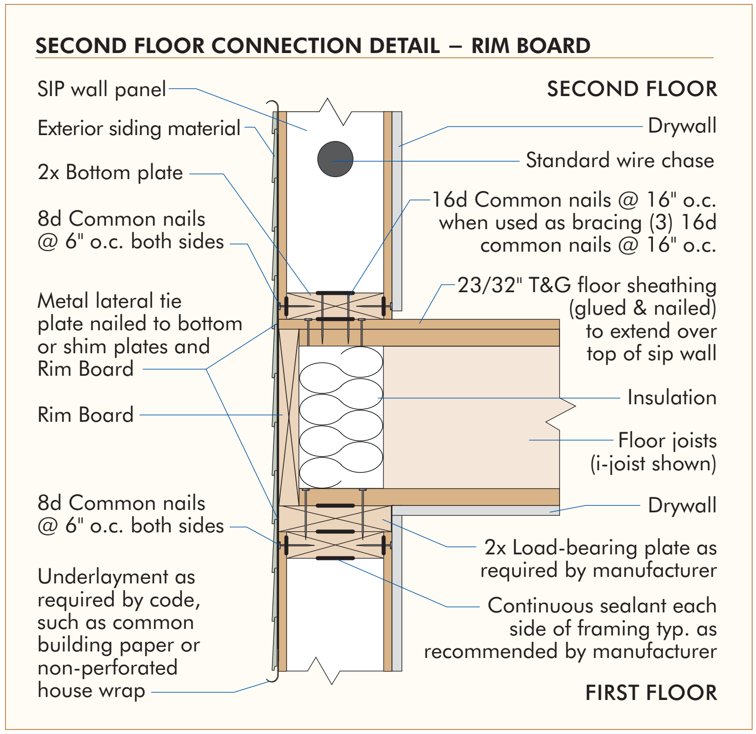


8 ROOF-TO-WALL PANEL CONNECTION – BEVELED SIP WALL



Floor Systems

Builders have two options for floor systems when constructing a home with SIPs. In a hanging floor system, high-efficiency SIPs are used in place of Rim Boards® and floor joists are attached using metal hangers. In a platform floor design, builders use traditional floor construction design, using a Rim Board to connect wall panels to the foundation. Insulated SIP Rim Boards are available from many SIP manufacturers.



PRESCRIPTIVE METHOD FOR BUILDING WITH SIPS

The Prescriptive Method for SIPs used in wall systems in residential construction provides a set of thoroughly tested provisions for panel construction and assembly. The method is endorsed by HUD, PATH, the NAHB Research Center, and *APA – The Engineered Wood Association,* and is now permitted in Section R614 of the 2007 supplement to the 2006 International Residential Code (IRC). The Prescriptive Method allows design and building professionals to specify SIPs using common load tables that document the performance of a standardized SIP.

The Prescriptive Method for SIPs used in wall systems in residential construction is limited to certain applications and wind and seismic zones. The complete limitations are discussed on pages 16-18.

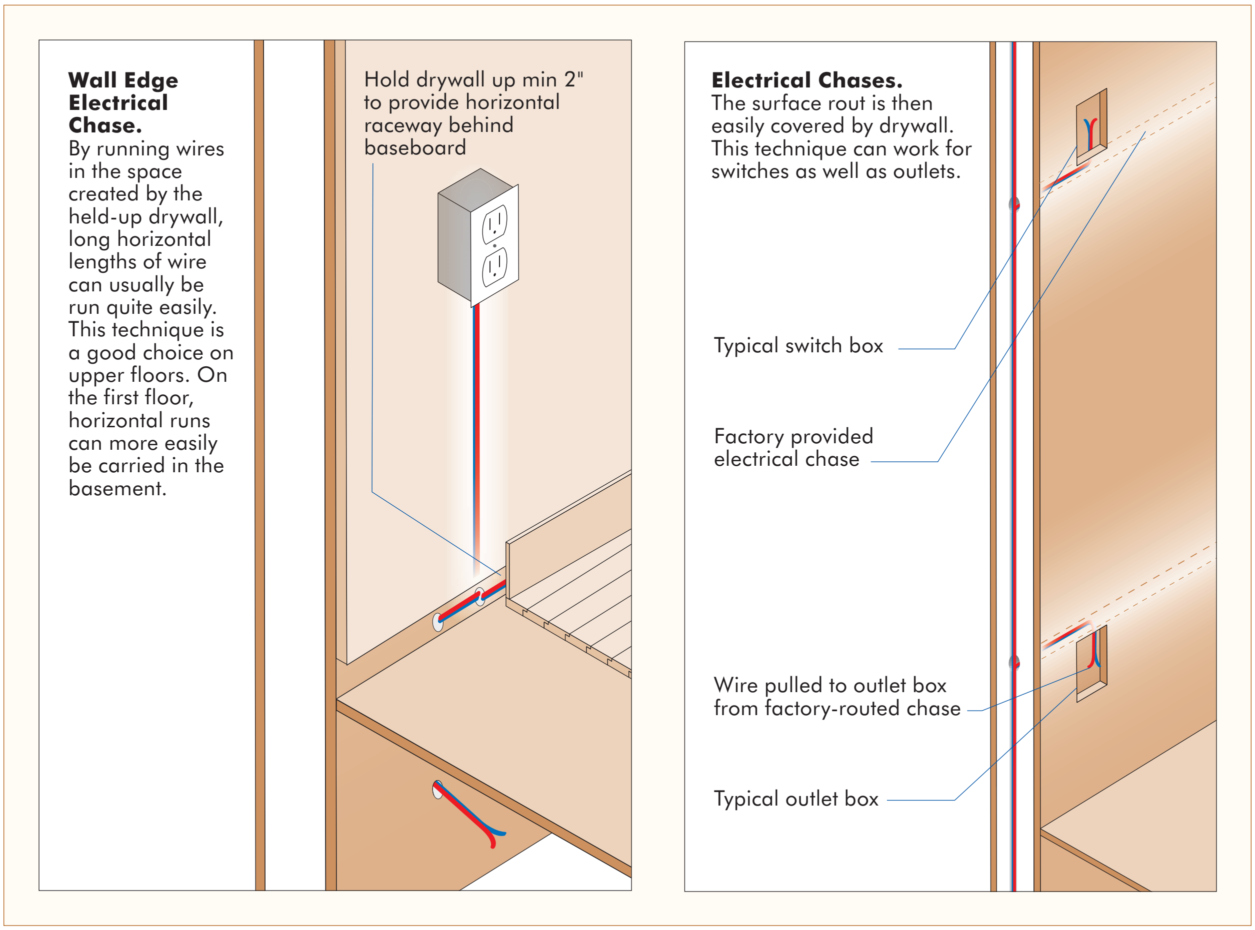
To obtain a copy of the Prescriptive Method for SIPs used in wall systems in residential construction, visit www.sips.org, www.pathnet.org or www.apawood.org.

Electrical

Electrical wires are pulled through precut channels inside the core of the panels called "chases." Manufacturers cut or form chases both horizontally and vertically during the fabrication process according to the electrical design of the home.

Chases enable wires to be run through walls without compressing insulation or having to drill through studs. Electricians can access chases by drilling or cutting small access holes in the interior skin of the panel.

Another commonly used technique is running wires through baseboard raceways and in the cavity behind the beveled spacer on SIP roof-to-wall connections. Raceways can be created by using manufactured surface mount wiring mold, furring strips behind baseboards, or holding back drywall and the flooring to create space for wiring.



Wall Edge Electrical Chase. By running wires in the space created by the held-up drywall, long horizontal lengths of wire can usually be run quite easily. This technique is a good choice on upper floors. On the first floor, horizontal runs can more easily be carried in the basement.

Electrical Chases. The surface rout is then easily covered by drywall. This technique can work for switches as well as outlets.

Plumbing

Plumbing should never be run horizontally or vertically in SIP walls. Penetrations through SIPs must be well sealed to prevent air leakage and moisture penetration.

HVAC

SIP buildings are extremely tight structures with levels of air infiltration lower than the average stick-built structure. When working with an HVAC contractor, make sure their calculations take into account the low air infiltration and higher R-values of a SIP home. Proper HVAC sizing is crucial because an oversized HVAC system will fail to reach the steady operating rate for which the equipment was designed. Short cycling HVAC equipment will be less energy efficient and require more maintenance than properly sized HVAC equipment. Short cycling HVAC equipment also leads to excessive humidity in structures during cooling seasons.

SIP construction typically requires mechanical ventilation. Ventilation systems bring fresh air into the building in controlled amounts and exhaust moisture laden and stale air to the outside. Ventilation systems can be designed to incorporate heat recovery ventilators (HRVs) or energy recovery ventilators (ERVs). These advanced systems harness heat being exhausted from the home and utilize it to heat the fresh air coming into the home for an even more efficient use of energy. Proper ventilation is crucial in structures with low air infiltration to prevent condensation that can lead to mold growth.

ASSEMBLY

Sealing

All joints between panels need to be sealed according to manufacturer specifications. Sealing is typically done with specially designed SIP sealing mastic, expanding foam, and/or SIP sealing tape.

Sealing is crucial to achieve the potential envelope tightness capable with structural insulated panels. An improperly sealed home is not only prone to thermal bridging and energy inefficient, but subject to humidity problems and potential mold growth.

Proper sealing is especially important when installing SIP roofs. The ridge of a SIP roof can use either bevel-cut SIPs for a flush joint, or use a beveled foam block insert. The ridge detail is a critical construction detail that requires attention to sealing using methods as noted above. Manufacturer specifications will provide specific sealing details designed to prevent moisture movement.

Exterior Finishes

Exterior finishing materials can be applied easily to SIPs. SIPs provide a uniform nailing surface for exterior finishes. A continuous drainage plane must be established between SIPs and siding. This may be either building paper or non-perforated house wrap. Siding should be attached to SIPs according to the siding manufacturer's specifications.

Roofing

As with siding, roofing needs to be attached to SIP roof panels according to the roofing manufacturer's recommendations. Roofing paper needs to be placed beneath the finish roofing as with a lumber-framed roof. Roofing materials need to be specified as over a conventionally framed roof.

Fire

Residential building codes require that foam insulation be separated from the interior of the building by a material that remains in place for at least 15 minutes of fire exposure. SIPs faced with 1/2-inch gypsum drywall meet this requirement.

Commercial builders may need a one-hour fire-rated wall or roof, which is achieved by testing and listing a specific wall or roof assembly to ASTM E119 with an accredited certification agency. Individual SIPA member manufacturers should be contacted to confirm listed assemblies they can provide.

For buildings requiring a two-hour fire-rated assembly, specialty fire resistant panels are applied to the inside of the SIP. More information on the availability of special fire and sound resistance systems is available from SIPA member manufacturers. Check the SIPA website, www.sips.org for listings.

IRC AND PRESCRIPTIVE METHOD SUPPLEMENT

Prescriptive SIP wall systems were adopted into the International Residential Code (IRC) in 2007. The 2007 IRC supplement and subsequent editions of the code include prescriptive standards for SIP wall construction in Section R614. Code adoption of SIP construction was the result of advocacy efforts by APA and SIPA.

Builders and design professionals using SIP walls in residential projects will no longer be required to conduct or supply additional engineering to show equivalency to the IRC. Inclusion in the IRC recognizes structural insulated panels as equal to other code-approved building systems.

Section R614 of the IRC only covers SIP wall construction for residential buildings in the applicability limits listed in Table 1.

The results of structural testing conducted by APA is available in the U.S. Department of Housing and Urban Development's Prescriptive Method for Structural Insulated Panels (SIPs) Used in Wall Systems in Residential Construction. Table 2 from the Prescriptive Method illustrates the maximum allowable transverse loads for wall panel applications.

Depending on the size of the window and other structural considerations, openings can be cut into a SIP wall without the addition of a separate header. Table 3 shows the maximum allowable axial loads for SIP headers.

TABLE 1

APPLICABILITY LIMITS

Building Dimension	Maximum building width is 40 feet (12.2 m)
	Maximum building length is 60 feet (18.3 m)
Number of Stories	2 story (above basement)
Basic Wind Speed	Up to 130 mph (209 km/h)
Wind Exposure	Exposures B[a] (suburban/wooded)
	Exposures C[a] (open terrain)
Ground Snow Load	70 psf (3.35 kN/m2) maximum ground snow load
Seismic Zone	A, B and C
Building Height	Maximum 35 feet (10.7 m)
Load-Bearing Wall Height	10 feet (3 m) maximum

[a]As defined by the provisions in ASCE 7-05.

TABLE 2

ALLOWABLE TRANSVERSE LOAD FOR DEFLECTION LIMITS

Panel Height	Panel Nominal Thickness	Allowable Transverse Load for Deflection Limits (psf)			
		L/360	L/240	L/180	L/120
8-foot	4-1/2"	30	38	38	38
10-foot	4-1/2"	18	27	27	27
8-foot	6-1/2"	38	38	38	38
10-foot	6-1/2"	29	29	29	29

TABLE 3

ALLOWABLE SIP HEADER DESIGN VALUES

Header Span (Feet)	Allowable Load (plf)
2	1060
4	540
6	300
8	175

TABLE 4

ALLOWABLE DESIGN VALUES FOR SIP WALL PANELS

Load Type	Nominal Wall Thickness			
	4-1/2 in. Wall Height		6-1/2 in. Wall Height	
	96 in.	120 in.	96 in.	120 in.
Shear (plf)	315	315	315	315
Axial (plf)	3,200	3,200	3,100	3,100

TABLE 5

NOMINAL THICKNESS (INCHES) FOR SIP WALLS SUPPORTING SIP OR LIGHT-FRAME ROOFS ONLY

Wind Speed (3-sec gust)		Snow Load (psf)	Building Width (ft)														
			24			28			32			36			40		
			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)			Wall Height (ft)		
Exp. A/B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10
85		20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
110	100	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
120	110	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5
130	120	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	6.5
		70	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	4.5	6.5	N/A
	130	20	4.5	4.5	6.5	4.5	4.5	N/A	4.5	4.5	N/A	4.5	4.5	N/A	4.5	6.5	N/A
		30	4.5	4.5	N/A	4.5	4.5	N/A	4.5	4.5	N/A	4.5	6.5	N/A	4.5	6.5	N/A
		50	4.5	6.5	N/A	4.5	6.5	N/A	4.5	N/A	N/A	6.5	N/A	N/A	6.5	N/A	N/A
		70	4.5	N/A	N/A	6.5	N/A	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mph = 1.61 km/hr
Deflection criteria: L/240
Roof dead load: 10 psf maximum
Roof live load: 70 psf maximum
Ceiling dead load: 5 psf maximum
Ceiling live load: 20 psf maximum
N/A indicates not applicable (design required)

TABLE 6

NOMINAL THICKNESS (INCHES) OF SIP WALLS SUPPORTING SIP OR LIGHT-FRAME STORY AND ROOF

Wind Speed (3-sec gust) Exp. A/B	Wind Speed (3-sec gust) Exp. C	Snow Load (psf)	Building Width (ft) 24 Wall Height (ft) 8	24 / 9	24 / 10	28 Wall Height (ft) 8	28 / 9	28 / 10	32 Wall Height (ft) 8	32 / 9	32 / 10	36 Wall Height (ft) 8	36 / 9	36 / 10	40 Wall Height (ft) 8	40 / 9	40 / 10
85		20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5
100	85	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5	6.5	N/A	N/A
110	100	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	6.5	6.5
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	6.5	N/A
		70	4.5	4.5	4.5	4.5	4.5	6.5	6.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A
120	110	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A
		30	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	6.5	6.5	N/A
		50	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A
		70	4.5	4.5	6.5	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
130	120	20	4.5	4.5	6.5	4.5	4.5	6.5	4.5	6.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A
		30	4.5	4.5	6.5	4.5	4.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A	6.5	N/A	N/A
		50	4.5	6.5	N/A	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		70	4.5	6.5	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	130	20	6.5	N/A	N/A	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		30	6.5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		50	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		70	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mph = 1.61 km/hr
Deflection criteria: L/240
Roof dead load: 10 psf maximum
Roof live load: 70 psf maximum
Ceiling load: 5 psf maximum
Ceiling live load: 20 psf maximum
Second floor live load: 30 psf maximum
Second floor dead load: 10 psf
Second floor wall dead load: 10 psf
N/A indicates not applicable (design required)

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APA – The Engineered Wood Association is a nonprofit trade association of and for structural wood panel, glulam timber, wood I-joist, laminated veneer lumber and other engineered wood product manufacturers. Based in Tacoma, Washington, APA represents approximately 150 mills throughout North America, ranging from small, independently owned and operated companies to large integrated corporations.

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