Questions and Answers about SIPs

SIPA
Structural Insulated Panel Association

Q: What are structural insulated panels?

A: Structural insulated panels (SIPs) are high performance building panels used in floors, walls, and roofs for residential and light commercial buildings. The panels are typically made by sandwiching a core of rigid foam plastic insulation between two structural skins of oriented strand board (OSB). Other skin material can be used for specific purposes. SIPs are manufactured under factory controlled conditions and can be custom designed for each home. The result is a building system that is extremely strong, energy efficient and cost effective. Building with SIPs will save you time, money and labor.

Q: I want to build a structural insulated panel home. What is the first step?

A: For homeowners, the first step is to identify a quality builder who has experience with SIP construction. An experienced SIP builder will manage the plan conversion and review process. Search the SIPA Membership Directory to find an experienced SIP builder in your area.

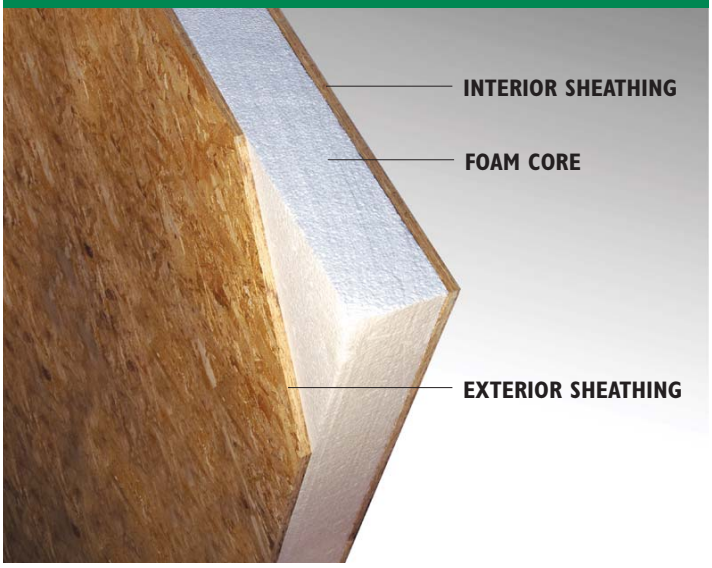
For a builder looking to start their first SIP project, the first step is to find a manufacturer or dealer/distributor to work with. These companies typically handle the plan conversions and engineering services necessary to get the project underway. Search the SIPA Membership Directory to find a Manufacturer or Dealer/Distributor Member in your area.

Q: How does the structural insulated panel design and fabrication process work?

A: The construction of a SIP home or commercial building begins with the construction documents. Once the construction documents are in the hands of a SIP manufacturer, dealer/distributor, or design professional, they are converted to SIP shop drawings that give the dimensions of each individual panel.

The shop drawings are reviewed by the builder, engineer, the building owner, and other involved parties. Once the shop drawings are finalized, the SIPs are fabricated and shipped to the jobsite for installation.

Typical SIP Construction



Q: What is the R-value of structural insulated panels?

A: R-values for SIPs depend on the thickness of the SIP and the type of core material that is used. See SIPA's R-value chart for the minimum R-values of commonly available SIPs.

Static R-values, like those included in the chart, rate the effectiveness of insulating material. However, they do not accurately describe how products perform in a real world setting. When fiberglass or other types of insulation are installed, they are installed around structural members made of wood or metal that have very poor insulating value. Field-installed insulation materials are also prone to installation imperfections.

The Department of Energy's Oak Ridge National Laboratory has studied and tested the performance of entire wall assemblies in large sections. The resulting whole-wall R-value data reveals that a 4.5" SIP wall rated at R-14 outperformed a 2"x6" wall with R-19 fiberglass insulation.

Q: Where can I learn more about structural insulated panels?

A: There are a number of resources on structural insulated panels:

Browse the publications on the SIPA Online Store. Building with Structural Insulated Panels, by Michael Morley, and the Builder's Guide to Structural Insulated Panels (SIPs), by Joe Lstiburek, are two popular books that contain a wealth of information.

Attend the SIPA Annual Meeting & Conference or stop by SIPA's exhibit at the International Builders' Show.

Call the SIPA Help Desk at 253-620-7400, Mon - Fri, 8am-5pm PT. Or Email your questions to *help@sips.org*.

Q: How much faster can I build with structural insulated panels?

A: SIP homes go up faster than traditionally framed buildings. A properly trained SIP installation crew can save a significant amount of time in a build cycle[1]. Panels can be manufactured as big as 8- by 24-ft., so entire walls can be put up quickly, reducing dry-in time. SIPs can be supplied as ready to install building components when they arrive at the jobsite, eliminating the time needed to perform individual jobsite operations of framing, insulating and sheathing 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. Electrical chases are typically provided in the core of panels, so there is no need to drill through studs for wiring.

[1] Edminster, Ann and Yassa, Sami. Efficient Wood Use in Residential Construction: A Practical Guild to Saving Wood, Money, and Forests. Natural Resource Defense Council, 1998.

Q: How much labor can I save with structural insulated panels?

A: Because SIPs are prefabricated, the amount of additional framing required is minimal. SIPs are always straight and true, there are far fewer callbacks, no culling studs, or need to straighten walls. SIPs also provide a uniform nailing surface for both interior and exterior finishing.

Q: How much money can I save with structural insulated panels?

A: Builders can save money through decreased construction and labor costs. The superior whole wall R-values and building

tightness capable with SIPs allow HVAC equipment to be downsized and ductwork to be minimized. Builders can also significantly reduce jobsite waste disposal and temporary heat during construction. Homeowners that incorporate other energy efficient features with SIP construction can benefit from the energy efficiency of a SIP home with reductions in heating and cooling costs of 50 percent or more possible and may, qualify for Energy Efficient Mortgages, and enjoy higher appraised value.

Q: How much do structural insulated panels cost?

A: Pricing information can be obtained by contacting any of SIPA's Manufacturer or Dealer/Distributor members. However, the material price does not reflect the labor savings capable with SIP construction.

A recent study conducted by the R.S. Means unit of Reed Construction Data shows that building with SIPs can reduce framing labor needs by as much as 55 percent over conventional wood framing. Builders can also expect decreased jobsite waste disposal costs and savings on HVAC equipment. Energy-efficient SIP buildings demand a higher market price because of the utility savings they offer to home buyers. When all these factors are considered, building with SIPs is often less expensive than other building systems.

Q: How green are structural insulated panels?

A: Energy efficiency—Structural insulated panels are one of the most environmentally responsible building systems available. A SIP building envelope provides high levels of insulation and is extremely airtight, meaning the amount of energy used to heat and cool a home can be cut by up to 50 percent. The energy that powers homes and commercial buildings is responsible for a large portion of greenhouse gasses emitted into the atmosphere. By reducing the amount of energy used in buildings, architects, builders, and homeowners can contribute to a clean environment for the future.

Resource use—The insulation used in SIPs is a lightweight rigid foam plastic composed of 98% air, and requires only a small amount of petroleum to produce. The foam insulation used in panel cores is made using a non-CFC blowing agent that does not threaten the earth's ozone layer.

Waste minimization—Since SIPs are prefabricated in the factory, there is less jobsite waste that needs to be landfilled. Factory fabrication is often done using optimization software and many manufacturers recycle factory scrap to make other foam products.

Q: How strong are structural insulated panels?

A: The structural characteristics of SIPs are similar to that of a steel I-Beam. The OSB skins act as the flange of the I-beam, while the rigid foam core provides the web. This design gives SIPs an advantage at handling in plane compressive loads.

SIPs can be engineered for most applications. Detailed information on the structural performance of SIPs is available from SIPA member manufacturers.

Q: How are structural insulated panels supported? Are there studs in the panels?

A: For most applications, SIPs are structurally self-sufficient. The structural characteristics of SIPs are similar to that of a steel I-Beam. The OSB skins act as the flange of the I-beam, while the rigid foam core provides the web. This design is extremely strong and eliminates the need for additional framing.

In cases where a point load from a beam or header requires additional support, a double dimensional lumber spline or engineered wood spline is field installed at in-plane panel connections.

SIPs are also used as curtain walls for steel frame or timber frame structures. In large commercial applications SIPs can minimize the amount of structural support needed and reduce material costs.

In roof applications, SIPs rely on beams and purlins for support. SIPs can span long distances, allowing a minimal amount of structural supports to be used.

Q: How do I properly size HVAC equipment?

A: The high insulating properties of SIPs allow smaller HVAC equipment to be used. When working with an HVAC contractor, make sure their calculations take into account an accurate estimation of typically low levels of air infiltration in a SIP home. Proper HVAC sizing is crucial because an oversized HVAC system will fail to reach the steady operating rate the equipment was designed for. Short cycling HVAC equipment will be less energy efficient and require more maintenance than properly sized HVAC equipment.

Q: How important is ventilation?

A: SIP buildings are extremely airtight and require mechanical ventilation. Ventilation systems bring fresh air into the building in controlled amounts and exhaust moisture laden and stale air to the outside. By limiting air exchange to controlled ventilation systems, SIP homes allow for all incoming air to be filtered for allergens and dehumidified, amounting to better indoor air quality. Proper ventilation is important in all homes to preserve indoor air quality.

Q: Are vapor barriers required in structural insulated panel buildings?

A: Air barriers or vapor barriers are not required in SIP buildings because properly sealed SIPs create a code compliant air barrier with a permeability rating of less than 1.0 perm. In addition, the foam core of SIPs is solid and continuous throughout the wall, eliminating the convection and condensation issues that can occur in cavity walls.

Q: How do structural insulated panels improve indoor air quality?

A: The tightness of the SIP building envelope prevents air from gaining access to the interior of the home except in controlled amounts. A controlled indoor environment is both healthy and comfortable. Humidity can be controlled more easily in a SIP home resulting in a home that is more comfortable for occupants and less prone to mold growth and dust mites.

Q: How do structural insulated panels react to fire?

A: Residential building code requires 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. . Structural insulated panels faced with 0.5" 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.

Q: Do structural insulated panels block sound transmission?

A: The sound resistance of a SIP wall depends on the thickness of the gypsum drywall applied, the exterior finish applied and the thickness of the insulating foam core that is used.

SIPs are especially effective at blocking high frequency noise and most homeowners notice the quiet comfort of a SIP home. However, low frequency sounds are not as effectively stopped by a SIP building envelope.

For multifamily and commercial buildings, a universal sound transmission coefficient (STC) is used to specify the sound resistance of wall assemblies. Assemblies with a range of STC ratings are available, including options with a STC rating greater than 50 for party walls in multifamily buildings. Contact a SIPA Manufacturer Member for more information on these assemblies.

Q: Are structural insulated panels compatible with other building systems?

A: SIPs are compatible with other building systems. Wall panels can sit on a variety of foundation materials, including poured concrete, blocks, or insulated concrete forms. SIPs are sized to accept dimensional lumber and are seamlessly compatible with stick framing. Builders may choose to build with SIP walls and a conventional truss roof, or stick walls and a SIP roof with little difficulty. SIPs are also popular as a method of providing a well-insulated building envelope for timber frame structures.

Q: What considerations do you need to take into account when building with structural insulated panels vs. conventional framing?

A: The majority of construction with SIPs is very similar to conventional framing. SIPs accept dimensional lumber and are fastened together using staples, nails or screws. Proper sealing is especially crucial in a SIP structure. All joints need to be sealed with specially designed SIP sealing mastic or low expanding foam sealant, and/or SIP tape. Voids between panels and unused electrical chases need to be filled with low expanding foam. In addition to sealing, planning and consideration needs to be applied to material handling. Although smaller 8- by 4-ft. panels can be set by hand, larger 8- by 24-ft. panels require the use of equipment to unload and set.

Q: What is the learning curve for structural insulated panel installation?

A: For construction professionals competent in standard wood framing techniques, the task of learning SIPs is not difficult. Many SIP manufacturers and dealer/distributors offer onsite technical assistance for builders that are new to SIP construction. Builders can also learn installation techniques from The SIP School.

Q: Can structural insulated panels be modified on site?

A: On-site modification can easily be done using a few additional SIP specific tools. Panels can be cut using a beam saw or a beam cutting attachment to a circular saw. The foam core can then be recessed for splines or dimensional lumber using a hot wire foam scoop or specialized angle grinder attachment to recess the core.

Q: How are electrical wiring and fixtures installed?

A: Electrical wires are pulled through precut channels inside the core of the panels called "chases." Manufacturers cut chases during the manufacturing process according to the electrical design of the home. Electricians can then use fish tape to feed wires through panel chases without compressing the insulation or having to drill through studs. Wiring can also be run through baseboard raceways and in the cavity behind the beveled spacer on SIP roof-to-wall connections.

Q: Can plumbing be installed in structural insulated panels?

A: Plumbing should not be located in exterior SIP walls because of the possibility of condensation or supply lines freezing in cold climates. During the design phase of the project, all plumbing should be relocated to interior walls.

If plumbing must be located on an exterior wall, it is recommended that a surface chase be installed on the interior of the wall to conceal plumbing. Another option is to construct a small section of the wall using conventional wood framing that can be used to run plumbing.

Plumbing penetrations such as DWV can be placed through SIPs if they are thoroughly sealed to prevent air infiltration.

Q: How do I attach siding or other exterior claddings to structural insulated panels?

A: Builders should consult the siding manufacturer's installation instructions for how to attach their product to SIPs. Because SIPs use very little solid lumber, an increased fastener schedule is often required when attaching exterior cladding.

If the siding manufacturer does not offer recommendations for attaching their product to SIPs, a licensed architect or engineer can calculate the appropriate fastener frequency by obtaining fastener pullout capacities from the SIP manufacturer.

It is also important that proper moisture management procedures be followed when applying any type of cladding to SIPs. The Builder's Guide to Structural Insulated Panels (SIPs) [link to store] provides details for attaching various types of cladding materials. With the exception of metal and vinyl siding,

the Builder's Guide recommends that all claddings be installed with a drainage gap between the cladding and the weather resistant barrier in climates that average more than 20 inches of annual rainfall.

Q: Can kitchen cabinets be attached to structural insulated panels?

A: It is recommended that the cabinet manufacturer provide instructions on how to attach their product to SIPs. Typically, an increased fastener schedule is required. Another option is to install plywood strips behind the cabinets to provide additional holding strength for fasteners.

If the cabinet manufacturer does not offer recommendations for attaching their product to SIPs, a licensed architect or engineer can calculate the appropriate fastener frequency by obtaining fastener pullout capacities from a SIP manufacturer.

Q: Are structural insulated panels susceptible to insects?

A: Although termites do not feed on the foam panel cores, there have been instances in which panel cores have been hollowed out by these insects and used as a nesting ground. Many manufacturers offer SIPs with borate treated foam to provide termite resistance. Termites may also be deterred through the use of a specifically designed steel mesh. Both these treatments are highly effective, but they are not a substitute for careful termite prevention and maintenance, as with any other wood structure.

Q: Are structural insulated panels susceptible to mold and mildew?

A: An airtight SIP building envelope forms the basis of a successful mold control strategy. The extremely low levels of air infiltration in SIP buildings allow for incoming air to be provided in controlled amounts by air handling equipment. Proper dehumidification of incoming air following ASHRAE standards will create an environment where mold physically cannot grow.

In addition to creating an airtight structure, SIPs are solid and free of any cavities in the wall where moisture can condense and cause unseen mold growth.

Q: Can structural insulated panels be replaced or repaired if damaged?

A: If panels are damaged, a structural engineer needs to assess the damage to determine what is cosmetic and what is structural. If the damage is only cosmetic then the source of moisture must be determined and fixed, whether it is from inside or outside. If the damage is structural, then the source of the problem must be identified and a structural solution to the problem must be found. That can be done by either a site modification of the panels or replacement of the panels, depending on the extent of the damage. In the event that panels are damaged, the manufacturer and installer of the panels should be notified. There are SIPA members who can act as a consultant to assess the damage and recommend repair or replacement strategies.

Q: What about roofing? Does a building with a structural insulated panel roof need to be ventilated?

A: The area inside a SIP building envelope is considered conditioned space and will be ventilated by the building's HVAC system. There is no need to provide a vented attic beneath a SIP roof, and doing so would compromise the conditioned space of the building. Most roofing manufacturers specify how to attach their product to SIPs. Please contact the roofing manufacturer for application instructions.

Q: Do roofing manufacturer's warranty asphalt shingles over structural insulated panel roofs?

A: Some roofing manufacturer's warranty asphalt shingles over unvented SIP roofs, while others void their warranty because of higher shingle temperatures. Research conducted by Building Science Corporation reveals that although asphalt shingle temperatures increase slightly (2 - 3 degrees F) in an unvented roof assembly, the color of the shingles and the roof orientation have a much more profound impact on the durability of shingles. According to the Builder's Guide to Structural Insulated Panels (SIPs) published by Building Science Corporation, the typical reduction of shingle life over an unvented SIP roof assembly is between one and two years. Builders seeking to comply with roofing manufacturer warranties can choose from a variety of more durable, non-asphalt roofing materials or provide a venting space between the SIP roof panels and the roofing material (known as a "cold roof").

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Research conducted by Building Science Corporation on test homes in hot climates demonstrates that including the attic in the conditioned space allowed for more energy-efficient space conditioning and less probability of moisture related issues. [Rudd, Armin and Joseph Lstiburek. Vented and Sealed Attics in Hot Climates. Building Science Press, 1998]

Some building science experts, such as Building Science Corporation Principal Joe Lstiburek, have advocated venting the roof by providing an air space between the SIP roof panels and the roofing material (known as a "cold roof"). This practice is not a requirement for SIP buildings, but an extra measure to improve the durability and moisture resistance of the building.

What is shingle ridging? Does shingle ridging occur in structural insulated panel buildings?

A: Shingle ridging is a bulging of asphalt roofing material that occurs along the joints of engineered wood panels used in roof applications. This rare phenomenon is caused by changing moisture content in the roof sheathing and occurs in traditional truss-framed roof assemblies as well as SIP roof assemblies.

The ridges caused by the expansion of SIP roof panels may be an aesthetic blemish, but it does not affect the performance of the roofing or the SIP roof panels.

Several assemblies that prevent shingle ridging are described in the Builder's Guide to Structural Insulated Panels (SIPs). Specifying a cold roof, or simply over-sheathing the roof with an additional layer of OSB staggered over the panel joints, will eliminate the possibility of shingle ridging. Alternately, wood shingles, wood shakes, or a standing seam metal roof can be used in place of asphalt shingles.

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