Administering the Intricacies of Brickwork

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Value for builders, owners, and the environment

by Frank Kiesecker
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STRUCTURAL INSULATED PANELS (SIPS)
HAVE BECOME A POPULAR ENERGY-
SAVING BUILDING MATERIAL. SINCE THEY
ARE MANUFACTURED TO SPEC, THERE IS
NEARLY ZERO WASTE ON THE JOBSITE AND
LABOR IS SIGNIFICANTLY REDUCED, WITH
TIME SAVINGS FROM 30 TO 40 PERCENT. SIPS
ALSO MAKE INSIDE FINISH WORK EASIER TO
COMPLETE—DRYWALL GOES UP FASTER AND
CABINETS ARE QUICKLY ATTACHED DIRECTLY
INTO THE FACING.

A structure built with SIPS can reduce enough energy consumption to eliminate two to three tons of carbon dioxide (CO₂) emissions into the atmosphere annually when compared to those built with 2x dimensional lumber.¹ In other words, over a 30-year timespan, a building constructed with SIPS can reduce carbon dioxide emissions by 60 to 90 tons.

Some SIPS are also approved for seismic zones D, E, and F construction by NTA Inc., furthering the panels’ appeal to those located in California, Oregon, Washington, and Nevada. Only a few SIP manufacturers are approved for seismic construction.²

SIPS 101
SIPS are a strong structural system consisting of expanded polystyrene (EPS) insulation laminated to oriented strandboard (OSB), forming a structural panel. They can be custom fabricated to virtually any architectural design. EPS—the core product for SIPS systems—has excellent insulating qualities as it is lightweight, strong, resilient, non-corrosive, and dimensionally stable.³

SIPS are pre-fabricated to specifications for the project and ready to install. They complete roof, wall, or floor sections in the building design and can be placed on foundations or conventionally framed structural systems.
SIPs may be erected by hand or by using a crane or lift truck. Panel weight and contractor preference dictate the erection method used.

SIPs are connected by plates, splines, nails, staples, and/or adhesive. All interior surfaces of the SIP must be finished with a code approved 15-minute thermal barrier, such as 12.7-mm (½-in.) gypsum board or 1x wood paneling. The entire SIP assembly for wall, roof, and floor applications is fire-rated through International Code Council-Evaluation Service Report (ICC-ESR) 2233.

Tests that are sponsored by the Structural Insulated Panel Association (SIPA) demonstrated that SIP connections did not create thermal bridging as in stick framing because the spline connection areas perform equally with the field area of the SIPs.

**SIP tips**

There are some important tips one should know when building with structural insulated panels, based on the most common errors made by builders.

**Pre-plan electrical and equipment needs**

Builders familiar with SIPs stress the importance of pre-planning for electrical chases early in the design phase. Since SIPs are manufactured to meet the project’s specifications, it is important to plan for electrical chases in advance to prevent time-consuming and costly changes for modifications during installation.

For example, SIP facings should never be cut horizontally for the installation of electrical wiring. Doing so results in compromising structural performance. Also important at the front end of the project is to determine whether there are any equipment needs for installing the panels. If the project specifies roof panels or wall and floor panels larger than 2.4 x 2.4 m (8 x 8 ft) in size, equipment such as a forklift or crane may be needed to install the SIPs.

**Organize the panels for installation**

After the SIPs are delivered to the jobsite, proper storage, weather protection, and handling help make the installation process more efficient. First, one must set aside a level spot to store panels, separating them for each floor. Essentially, the panels should be organized by the sequence in which they are installed. The panels should be laid flat, no closer than 76 mm (3 in.) to the ground, and given plenty of support. Panels should be stacked so identifying marks can be easily read. They must also be kept dry when stored onsite; one strategy involves covering them with a breathable protective covering.

**Installation and sealing**

Panels need to be fully supported during the installation process. The panel slips over a wall plate, which needs to be set 12.7 mm (½ in.) from the building edge to ensure the panels are supported. Next, the panels are set in place, starting with the corners or valleys and then outward. Once the panels are installed, one should always follow the manufacturer’s joint sealing recommendations. Panel joints and voids must be properly sealed using adhesive or SIP tape to minimize air leakage and to maintain the structure’s long-term durability.

**Protect the panels from weather penetration**

Once the SIPs have been installed and sealed, weather protection such as housewrap can prevent moisture deterioration. Windows, openings, and penetrations require proper flashing and sealants. Improperly installed flashings can result in trapped moisture. The housewrap manufacturer’s
<table>
<thead>
<tr>
<th>SIP Thickness</th>
<th>R-value at 23.9 C (75 F)</th>
<th>R-value at 4.4 C (40 F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>114 mm (4 ½ in.)</td>
<td>14.9</td>
<td>16.0</td>
</tr>
<tr>
<td>165 mm (6 ½ in.)</td>
<td>22.6</td>
<td>24.3</td>
</tr>
<tr>
<td>210 mm (8 ¼ in.)</td>
<td>29.3</td>
<td>31.6</td>
</tr>
<tr>
<td>260 mm (10 ¼ in.)</td>
<td>37.0</td>
<td>39.9</td>
</tr>
</tbody>
</table>

Proper storage, weather protection, and handling make the installation of structural insulated panels more efficient. All penetrations must be flashed as windows will eventually leak some water at the sill. Installing flashing under and around windows and doors will direct water away from the wall structure.

**Sizing up the HVAC**

One common mistake involves underestimating the high insulating and air-sealing properties of SIPs when selecting a mechanical system. Structural insulated panels allow for smaller HVAC equipment. When working with an installer, it is important he or she takes into account an estimate for low levels of air infiltration. Proper HVAC sizing is critical because an underused system will fail to reach a steady operating rate, resulting in short cycling—which is less energy-efficient and requires more maintenance.

Factors used to determine HVAC sizing include:
- building size (each floor analyzed individually);
- orientation of building;
- type of wall construction (and associated R-value);
- window information (number, location, insulation value, and fenestration rating);
- door information (number, location, insulation value, and fenestration rating);
- duct location (in heated space, unheated space, attic, and crawl space);
- fireplaces (number and type); and
- air infiltration.

**Framing and insulating the Sundance Conference Center**

Structural insulated roof panels were chosen to frame and insulate the Redford Conference Center in Sundance, Utah (pictured on page 32). The facility, designed by Bill Salerno of Salerno Architects, is the latest addition to Robert Redford’s Sundance Resort, near Mount Timpanogos—a place that integrates artistic expression, environmental responsibility, and successful commerce.

In the spring of 2010, Redford worked closely with Salerno Architects to select environmentally responsible and energy-efficient products for the new conference center. SIPs were selected for the roofing because of their inherent energy efficiency and structural performance. The exceptional strength of SIPs provide the ability to resist snow loads while spanning over custom-built timber-frame trusses. SIPs were also selected for the project because of their reputation for efficient installation and the resulting savings in labor time.
SIPs were specified to frame unique architectural features at Severance Middle School.

SIPs offered ample nailing surface for the installation of beetle-kill pine decking used for the ceiling.

According to Shawn Pollard, project superintendent at R & O Construction, the SIPs were exceptionally quick and efficient to install on the roof areas of the conference center. This allowed them to move forward on the interior work.

A total of 1408 m² (15,152 sf) of 210- and 311-mm (8 ¼- and 12 ¼-in.) SIPs were used to frame the center’s three roof areas.

This sustainable building provides nearly 325.2 m² (3500 sf) of meeting space featuring reception areas that wrap the building and transition the outdoors with the interiors.

School's rotunda roof designed with SIPs

Structural insulated panels were RB + B Architects’ solution to some unique design elements at the Weld County Middle School in Severance, Colorado. SIPs were specified to frame unique architectural features on roof sections because of their design flexibility and material cost savings.

SIPs were custom-manufactured in order to meet the specifications for the roof’s rotunda.

“We chose SIPs for the rotunda roof and two-story gable roofs at the school because of some special design challenges,” explained architect Rebecca Spears. “First, there were large vaulted areas and we wanted to cut down on the number of bar joist supports where there is exposed structure. The SIPs provided the long spans we needed. Secondly, SIPs offered ample nailing surface for the installation of the beetle-kill pine decking used for the ceiling in each of these areas.”

General contractor Roche Construction was impressed with how quickly and tightly the SIPs laid in place as more than 140 m² (1500 sf) of roof panels were installed in approximately 45 minutes.

The panels are energy-efficient and provide a continuous wood surface without thermal breaks. In total, about 1045 m² (11,236 sf) of structural insulated panels were used in the project.

SIPs rebuild TV station destroyed by fire

In December 2008, a fire at KREX-TV studio in Grand Junction, Colorado, broke out as a result of an electrical problem. The building was damaged beyond repair.

Ron Tillery, studio manager, seized the opportunity to build a new studio that would be more energy-efficient and correct a longstanding problem with noise coming from a helicopter pad on the roof of the neighboring St. Mary’s Hospital.

“Our studio was right in the line of flight for the hospital helicopter pad, and the noise was a problem for us for years,” said Tillery. “We set out to build an entirely new studio for the television station that would improve our facility in every aspect.”
Tillery was interested in insulating the studio for heat as well as acoustics.

“We told the architect, Design Specialists, we wanted to have the best possible acoustics and energy efficiency in our new building. They suggested we use SIPs for the roof. The panels are already sandwiched with R-38 EPS insulation and ready to put in place, and our architects felt the SIPs would give us the best thermal insulation available.”

SIPs also offered acoustical benefits because of the airtightness of a SIPs-built building. They work well for blocking out mid- to high-range frequencies that are airborne.

Low-frequency noise can be best handled by a heavy, dense material such as concrete. However, concrete roofs require a difficult, more complex construction. In the case of KREX, the helicopter noise was of a higher frequency, so the SIPs were able to block out some of the noise from the sheer airtightness of the SIPs connections.

Although none of the construction crew had worked with SIPs before, Tillery said there were no problems with the installation.

“We broke ground in late November of 2008, gradually moved into parts of the building throughout the winter, installed our new set and the technical equipment in the spring, and did our first high-definition broadcast in August 2009,” he said.

**SIPs save money for Colorado townhouses**

SIPs were specified to increase energy efficiency and cost savings for a 2009 townhouse complex remodeling project in Colorado.

Tennis Townhomes voted to remodel its 14 buildings to increase their energy efficiency and property value. The project included replacing the roofs, siding, and windows to save energy. The original roof insulation provided only an R-19 insulation value, which was increased to an R-38 by using SIPs.

The old roofing material was scraped off, exposing the original decking. New felt paper was installed, then the SIPs were screwed into place. The perimeter and overhang edges of the buildings had 165-mm (6 ½-in.) SIPs installed, while the inner area of the roof received 165-mm nailbase roof panels. These differ from SIPs in that OSB is laminated to only one side of the EPS with nailbase, whereas SIPs are laminated on both sides.

Although original installation time was projected to be 10 weeks, installation was completed in half
**SIP DOS AND DON’TS**

**Do:**
1. Provide adequate support for structural insulated panels (SIPs) when storing them. Store SIPs lying flat and covered.
2. Study installation drawings before setting panels.
3. Remove debris from plate area before panel placement.
4. Provide level and square foundations or floors that support SIP walls.
5. Provide adequate bracing of panels during erection.
6. Hold sill plate back from edge of floor system 12.7 mm (½ in.) to allow full bearing of SIP oriented strandboard (OSB) facings.
7. Provide 25.4 to 38.1 mm (1 to 1.5 in.) diameter access holes in plating to align with electrical wire chases in SIPs.
8. Store sealant and SIP tape in a warm area for best application results in cold weather.
9. Follow manufacturer’s recommended joint sealing techniques.
10. Place sealant along the leading edge of wood being inset into panel.
11. Use sealant on wood-to-wood, wood-to-expanded polystyrene (EPS), and EPS-to-EPS connections.
12. Use SIP tape or equivalent vapor retarder on roof panel joints.
13. Install proper flashing and sealants around all rough openings and penetrations as required.
14. Use only continuous 2xs, I-beams, and insulated I-beams for spline connections.
15. Use proper underlayments for roofing and siding. SIP walls are airtight without housewrap, but they do need a drainage plane material.
16. Install plumbing in interior walls. Furr out interior sections for pipes if necessary.
17. Provide adequate ventilation to maintain indoor air quality.
18. Use termite- and mold-resistant materials when required such as a termite-resistant EPS SIP core or mold-resistant OSB treatment.

**Don’t:**
1. Leave panels exposed to the elements for long periods.
2. Lift SIPs by top OSB facing or drop SIPs on corners.
3. Install SIPs directly on concrete.
4. Cut wall panel skins horizontally for installation of electrical wiring or overcut the OSB facings for field-cut openings. Use factory-provided chases in SIP core.
5. Be afraid to field trim panels for an exact fit.
6. Install recessed lighting inside the panels.
7. Put plumbing in SIPs.
8. Install or use unvented combustion equipment such as vent-free gas logs, fireplaces, or heaters in an airtight SIP house.

For the Keystone Tennis Townhomes, SIPs provided a continuous 304.8-mm (12-in.) overhang along the roof's edge. That time. About 4860 m² (52,300 sf) of both structural insulated and nailbase panels were installed in five weeks, saving the remodel substantial time and money.

“When our company was contacted to help design a more efficient roof, nailbase was the most cost-effective way to go,” explained Travis Construction’s Blake Nudell, senior project manager. “We were able to leave the existing framing and increase their insulation from an R-19 to an R-38. By using SIPs at the perimeter of the roof, we were able to give our client a continuous 304.8-mm (12-in.) overhang, which is something the association did not have before. Ice dams had also been an ongoing problem. With the new insulated roof, we are anticipating this will no longer be an issue.”

**Conclusion**

Structural insulated panels have been used for more than 30 years in residential and commercial projects for their high R-value, superior strength, and easy installation. SIPs popularity has increased with added interest in environmental efficiencies, concerns for energy efficiency, and installation cost reduction. Proper installation is critical to ensure maximum benefit to all stakeholders.

Pre-planning for electrical chases, careful organization of panels before installation, proper support for panels, appropriate joint sealing per manufacturer’s instructions, moisture protection such as housewrap, and adequate consideration of HVAC size are some key issues for builders to consider at the front end of the project.
Author
Frank Kiesecker is the senior vice president of sales and marketing at ACH Foam Technologies. He has 35 years of experience with the structural insulated panel (SIP) industry. Kiesecker served as a board member and the first vice president of the Structural Insulated Panel Association (SIPA) from 1999 to 2005, and is currently a board member of the Associated Foam Manufacturers (AFM) Corporation. He can be reached via e-mail at fkiesecker@achfoam.com.

Abstract
Structural insulated panels (SIPs) are becoming a popular energy-saving building material with many advantages to builders and building owners. They can be manufactured to virtually any architectural design, reducing waste and labor significantly. This article examines some important tips one should know when building with the products, based on the most common errors made by builders.

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Oriented strandboard
Structural insulated panels

Notes
1 The Expanded Polystyrene Molders Association (EPSMA) commissioned Franklin Associates to conduct a lifecycle assessment of SIPs with EPS insulation.
2 Construction details are specific to the panel manufacturer as there are variances in each system. The Structural Insulated Panel Association (SIPA) provides generic information at www.sips.org/content/technical/index.cfm?pageId=20, but it is highly recommended to reference the individual manufacturers’ installation instructions.

SIPs were installed along the perimeter of the townhomes while nail-base panels filled the center of the roof.