SIPs Provide Green Building Benefits in Traditional and Cutting-Edge Designs

By Joe Pasma, P.E.

In the 1970s, geodesic domes were the vision of efficient, futuristic buildings. It seems that every community had a least one of these Buckminster Fuller-inspired creations – whether a home, restaurant, office, church or motel.

Today, green buildings typically look no different than conventional buildings. The unseen systems and materials are often more important than the outward appearance. A case in point is structural insulated panels (SIPs). SIPs contribute to a range of environmentally responsible design goals, while meeting the structural and aesthetic needs of a host of building types and architectural styles.

SIPs provide a strong and stiff base for a living roof at the Bend, Oregon, Metro Parks and Recreation District headquarters.

Structural Attributes

Structural insulated panels are high-performance, engineered wall, roof, and floor components for use in single- and multi-family homes, as well as schools, worship facilities, offices, retail, and other light commercial buildings. The panels are made of two outer sheathing layers (typically oriented strand board – OSB) laminated to a rigid insulating foam core (such as expanded polystyrene – EPS). The skins and foam core work together to achieve high strength in a manner comparable to other engineered structural components, such as I-joists.

In wall applications, SIPs provide exceptional strength in racking and diaphragm shear capacities, making them suitable as shear walls and structural diaphragms to resist high winds and earthquakes. They have been proven for use in seismic design categories D, E and F.

For walls, SIPs provide exceptional strength in racking capacities.

In roof applications, SIPs perform well under gravity and snow loads. Designers can specify SIPs to create vaulted, open interior spaces. Since they have long clear span capability – typically up to 20 feet – SIPs can reduce the need for intermediate structural supports. They can also be employed in roof structures without an engineered truss system. The results are large, soaring rooflines, open and vaulted ceilings, and overall extra indoor space for applications otherwise very difficult to achieve with stick-built construction.

Most SIP manufacturers work with designers and specifiers to ensure their panels are accepted by local building code officials and are in compliance with the building codes, including the *International Building Code* (IBC) and *International Residential Code* (IRC). This process includes providing alternative material evaluation or listing reports for SIPs showing evidence of compliance with code requirements as an alternate method of construction.

Green Building Advantages

In addition to their ability to meet a range of structural needs, SIPs support green building goals, including improved energy efficiency and indoor air quality.

The key environmental advantage of designing and building with SIPs is their ability to create a tight, high-performance building envelope. The rigid foam core offers continuous insulation across the panels' width and length, reducing the thermal bridging created by lumber. Additionally, the large-size panels have significantly fewer joints that require sealing.

The U.S. Department of Energy's (DOE) Oak Ridge National Laboratory (ORNL) evaluated the energy performance of SIPs versus stick-built framing. Their analysis of complete wall assemblies found that SIPs had an approximately 47 percent higher whole-wall R-value than a comparably sized stud wall (i.e., 3.5-inch-thick core SIP versus 2 by 4 studs at 16 inches on center).

Because of SIPs' capabilities, more design professionals are using them in net zero-energy buildings. The panels can help reduce annual heating and cooling demands by 50 to 60 percent compared to stick framing, going a long way toward reducing overall energy needs. This is particularly important in states such as California, where energy efficiency is mandated. California's Title 24 *Energy Efficiency Standards for Residential and Nonresidential Buildings* require net-zero energy construction by 2020 for homes and 2030 for commercial buildings. All across the country, the American Institute of Architects (AIA) has put forth its *AIA 2030 Commitment*, calling for all new buildings to be carbon neutral by 2030.

The tightness of the SIPs' envelope also makes buildings less prone to infiltration by

Helping speed construction, SIPs arrive at the jobsite in large, ready-to-install sections.

SIPs meet a wide range of structural needs in roof, wall and floor systems.

common pollutants such as radon, molds, pollen, volatile organic compounds (VOCs), lead dust and asbestos. As such, SIPs can be an important part of creating a healthier indoor environment, which is especially important in homes, schools and healthcare facilities.

For these and other green building advantages, including reduced construction waste, SIPs can help design professionals earn up to 36 or more points in the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program for homes, and up to 23 points for commercial construction.

Design Flexibility

Design teams are using SIPs in a range of architectural styles, from traditional to ultra-modern. SIP buildings look no different than other construction materials, and can also enable innovative designs.

For example, architects working for Brad Pitt's Make It Right Foundation to help rebuild New Orleans, developed a "Float House" that uses SIP walls and roofs as part of a modular structure built on a chassis designed to float. In Bend, Oregon, the Bend Metro Parks and Recreation District opened a new headquarters with a green "living" roof placed on top of structural insulated panels. Pushing the design envelope even further, a commercial building in Seattle used six cargo shipping containers with a roof made of SIPs. Each of these projects incorporated a host of other green features; the design teams selected the SIPs as a key part of that, as well as for their ability to meet aesthetic and structural needs.

Conclusion

SIP technology is not new, having been around for several decades. What has changed is a growing recognition of their contribution to green building and ability to work well with a range of building designs. For structural engineers and other design team members who have not yet designed a structure with SIPs, to get started, contact a panel manufacturer or dealer for detailed information on load capacities, panel sizes, code acceptance and other related factors.▪

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