SIPs and SSPs Are Not the Same
by David Carradine, Frank Woeste and Scott M. Kent

Timber framers commonly call stressed-skin panels the composites of wood, glue and plastic foam that sheathe the roofs and walls of many modern American timber frame buildings. But, properly defined, the term is a misnomer since, with very few exceptions, these panels lack the lumber core essential to the definition as promulgated by the American Plywood Association and accepted by code agencies in the 1960s (1).

A stressed-skin panel is understood to comprise one or two skins firmly bonded by adhesives of specified structural performance to timber members of certain sizes and on-center spacing. The presence or absence of thermal insulation is irrelevant to the definition.

The panels that do generally surround modern American timber frames, and which comprise one or two (usually two) engineered-wood sheet skins chemically bonded to a simple plastic foam core, were originally described by the American Plywood Association as sandwich panels (2). Today, by agreement of the people who build them, such panels are generally called structural insulated panels because they have both insulating and load-bearing abilities.

Both forms of panel rely on composite action, which requires the core and skin or skins to act as a unit, forbidding slippage between them. The adhesives or fastenings must be effective in transferring shear forces and cannot deteriorate over time because of moisture or creep.

While many stressed-skin panels have skins attached to both edges of the framing lumber, a panel can meet the definition with one skin (Figure 2a, below). Since the strength and stiffness of the stressed-skin panel are based on the composite action of the core and skin, an important requirement is that the adhesive be rigid, with known structural performance in both the short and long term.

If for some reason the adhesive between the skin and the lumber core failed to function as intended, the components of the stressed-skin panel acting individually would still safely carry some substantial percentage of the design load. While this scenario is not desirable, it demonstrates that stressed-skin panels (as we define them) are inherently robust with respect to manufacturing deficiencies in the type and application of adhesives used to connect the skin to the core. This virtue is not shared by structural insulated panels.

What are SIPS?
Structural insulated panels (SIPs) consist of a layer of rigid insulating foam, varying from 3 1/2 to 11 1/4 in. thick, sandwiched between layers of 7/16-in.

oriented-strand board (OSB), with possibly an interior finish, such as gypsum board or tongue-and-groove paneling, added to one side.

The insulating foam for SIPs can be polyurethane (including polyisocyanurate) or polystyrene (expanded or extruded). Figure 3a shows a cross-section of a common SIP configuration. SIPs, without a core of framing lumber spaced 24 in. or less on center, are substantially different from stressed-skin panels in that 100 percent of a bending moment is assumed for design purposes to be resisted by the tension and compression capacity of the skins.

In addition to relying on the adhesive bond between the two skins and the core for the needed bending strength, the core material must also transfer the shear produced by the bending loads, both in the short and long term. If the adhesive bond between the skins and core fails to function or the core material fails to function, the SIP fails.

Since the structural integrity of the SIP depends entirely upon the glue bonds between the skins and the core and the durability and structural reliability of the core material, it's obviously important for SIPs to be manufactured under accepted standards and that manufacturing procedures and quality control be subjected to third-party inspection by an approved agency. Typically, such inspections involve unannounced, regular visits to the manufacturing facility by representatives of a testing agency such as Product Fabrication Service (Madison, Wisc.), to scrutinize fabrication methods and test random samples of SIPs to ensure that the foam, OSB and the adhesion between the foam and the OSB are adequate. These third-party inspections are required in order to maintain code approval by the International Conference of Building Officials (ICBO).

Determining if SIPs meet industry standards:
How can you determine if a SIP meets recognized industry The existence of a full code report for a product and its manufacturer is a reliable indication that third-party inspections have been conducted at the SIP plant and that the governing agency, such as the ICBO or the National Evaluation Service, has embraced the product as acceptable. Additionally, code-approved SIN should display a stamp on the OSB that indicates the panel type, the code report number, the manufacturer's trademark or name and the third-party inspection agency's logo and report number.

If SIPs are designed properly for their intended application, manufactured using establish quality procedures and verified by third-party inspection (3), builders can be assured of structural performance similar to the solid-sawn timber and board sheathing constructions that have been used for centuries.

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*Plywood Design Specification Supplement 3, Design and Fabrication of Plywood Stressed-Skin Panels (updated August 1990), document available in PDF format at **www.apawood.org**.*

*Plywood Design Specification Supplement 4, Design and Fabrication of Plywood Sandwich Panels (March 1990), available at **www.apawood.org**.*

*ICBO Evaluation Service (ES) documents AC04 and AC05, acceptance criteria, respectively, for Sandwich Panels and Sandwich Panel Adhesives, are available at **www.icbo.org**.*

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