SIPs Wall Construction

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- OSB interior and exterior panels
- EPS insulation core typical
- Housewrap
- Furring creating a minimum $^{3}/_{8}$" ventilation gap/drainage gap behind cladding

Photo: SIPA

References

1 Lstiburek, J. W. (2008). *Builder's Guide to Structural Insulated Panels (SIPs) for all Climates.* Westford: Building Science Press Inc.

2 Lstiburek, J. W. (2006). *Water Management Guide.* Westford: Building Science Press Inc.

3 SIPA (n.d.). *Report on the Juneau, Alaska Roof Issue.* Retrieved May 2009 from Structural Insulated panel Association: http://www.sips.org/content/technical/index.cfm?PageId=161.

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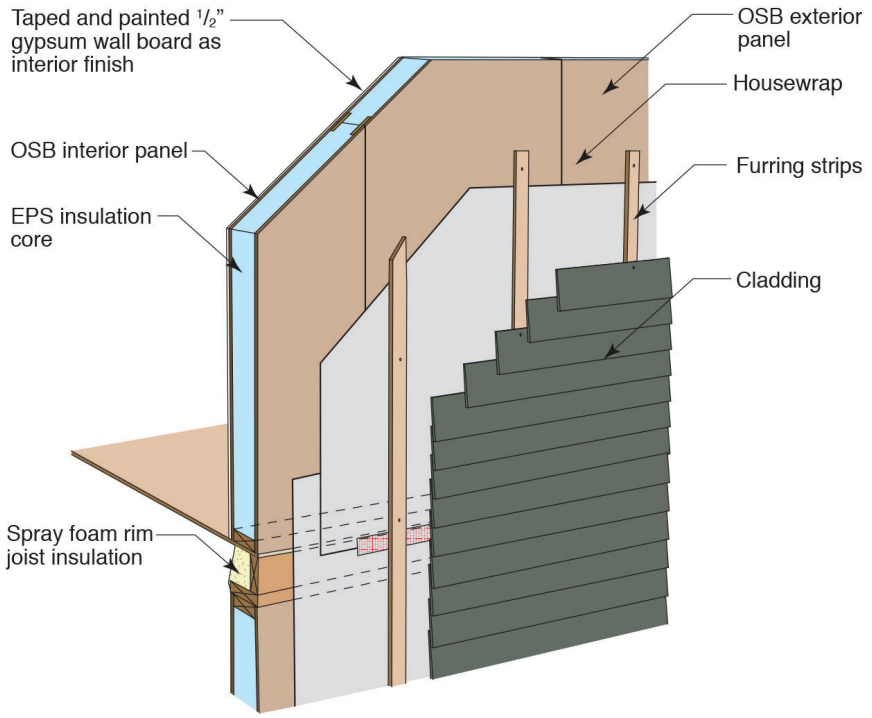

Introduction

This overview summarizes SIPs wall construction including the advantages and disadvantages of this construction strategy. A more detailed analysis and direct comparison to several other walls can be found online. Complex two dimensional heat flow analysis and one dimensional hygrothermal modeling were used to determine moisture related durability risks for analysis.

For a more complete analysis of this and other wall constructions, go to www.buildingscience.com.

Thermal Control

Installed Insulation R-value: Structural Insulated Panels (SIPs) are typically constructed using OSB panels adhered to both sides of an expanded polystyrene (EPS) foam insulation core. The most common SIP insulation thicknesses are $3^{1}/_{2}$" and $5^{1}/_{2}$" and are equivalent to R-14 and R-22. It is possible, although not as common, to use different insulation types, and thicker panels to achieve high R wall values.

Whole-wall R-value: Using two dimensional heat flow analysis with thermal bridging effects and average framing factors, the clear wall R-value with the OSB layers, drywall, cladding, and surface films often has an R-value higher than the installed insulation R-value because of fewer thermal bridges in the wall system. The whole-wall R-value depends on thermal bridging through vertical stiffeners, top and bottom plate, as well as the wood bucks for windows and doors.

Air Leakage Control: Both OSB and EPS foam are air impermeable so there is no air leakage through the center of the SIPS panels; however it is important to address the air tightness of joints between the panels as well as interfaces with other structural elements (i.e. foundation walls or roofs) and penetrations such as windows, doors and services.[1] It is relatively

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easy to achieve a high level of airtightness on a SIPs enclosure.

Typical Insulation Products: EPS foam is the most common, but SIPs have also been constructed with XPS and polyisocyanurate foam cores.

Durability

Rain Control: Rain leakage into the enclosure is the leading cause of premature building enclosure failure. Rain control is typically addressed using a shingle lapped and/or taped water control layer such as building paper or a synthetic WRB (i.e. housewrap). Intersections, windows, doors and other penetrations must be drained and/or detailed to prevent the penetration of rainwater beyond the water control layer.[2]

Air Leakage Control: There is no air leakage through the center of the panel but there is risk of air leakage at the joints between panels if not detailed correctly. Historically, there were design detail issues with the air tightness of the joints between the panels allowing warm moist interior air to condense on the exterior cold OSB layer.[3] Standards of SIPs construction have improved and following the recommended construction guidelines mitigates nearly all of the risk of moisture related durability issues from air leakage.

Vapor Control: A SIPs panel controls vapor well. There is very minimal risk to vapor related moisture damage in SIPs construction.

Drying: Water on either the interior or exterior of the SIPs will dry easily to the interior or exterior in most climates. In very humid or wet climates with minimal drying potential, the OSB may remain wet for an extended period and could result in moisture related durability issues. Ventilated claddings are recommended and required for this reason.

Built- in Moisture: Water on the surfaces of the panel during construction should dry easily following completion if ventilation claddings are used; any water trapped in the panel joints will dry much more slowly.

Durability Summary: If the SIPs are installed according to best practice, with proper air seals and flashed penetrations, the system is very durable in all climates.

Buildability

Using SIPs is relatively easy and quick once the training has been completed. Panels are ordered and shipped to site and assembled with a crane. More specific info can be found at www.sips.org. Generally, most of the services are run on interior partition walls, but there are methods of installing services on the interior of a SIPs panel. A SIPs house can be assembled and dried in more quickly than a wood framed house once the panels are on site.

Cost

SIPs panels range considerably in price depending on the project details and the required thickness of wall panels. It is more expensive than standard construction and can generally only be used on simple geometries.

Material Use

SIPs panels require minimal framing lumber but an increase in structural sheathing panels.

Summary

SIPs wall panels are generally not constructed with enough insulation to be considered a high R enclosure system on its own in heating climates. It is possible to use thicker insulation panels or to combine SIPs with another insulation strategy in cold climates. It is relatively quick and easy to build with SIPs following training, and refined standard practice techniques have removed nearly all of the historical risks of air leakage condensation. The cost and simple geometries of SIPs houses are two of the main reasons why this technology is not used more often.