The Structural Insulated Panel Association (SIPA) is a nonprofit association representing manufacturers, suppliers, distributors, design professionals, and builders committed to providing quality structural insulated panels (SIPs) for all segments of the construction industry.

Course Description

Recent changes to Energy Codes in regard to exterior wall and roof insulation requirements as well as air sealing are forcing builders to look hard at alternate framing and insulating techniques. This course will explain the benefits of building with Structural Insulated Panels (SIPs) for residential applications. The attendee will gain a better understanding of SIP products, construction, assembly and detailing in order to properly utilize SIPs for optimum energy efficiency, labor savings, and durability. The attendee will walk away from the course with a better understanding of how SIPs can be a suitable construction method for current building industry standards.

LEARNING OBJECTIVES

1. Describe and define SIPs and their residential applications
2. Explain energy-efficiency construction strategies utilizing SIPs
3. Illustrate SIP design and engineering methods and standards
4. Illustrate SIP construction methods and applications
COURSE OUTLINE

- SIP basics
- SIP applications – Walls, Roofs, Floors
- Energy efficiency and green building with SIPs
- Designing with SIPs
- Engineering for SIPs
- SIP manufacturing
- SIP construction

WHAT ARE SIPS?

- Originally developed as “stressed-skin” panels in the 1930’s - tested at the Forest Products Laboratory in Madison, WI
- The concept was to minimize and eventually eliminate the framing by using the skins to carry the loads
- Foam cores were introduced in 1969 to form the modern structural insulated panel

WHAT ARE SIPS?

SIP = Structural Insulated Panel
- Composite structural panel
- Rigid foam core - EPS, GPS, or PUR
- Structural facings - usually 7/16” OSB
- Structural adhesive
WHAT ARE SIPS?

Rigid Foam Insulation
Structural Facings
Structural Adhesive
Optional Electrical Chase

WHAT ARE SIPS?

SIP Panel Thickness 4-5/8” 6-1/2” 8-1/4” 10-1/4” 12-1/4”
EPS 15 23 29 37 45
GPS 18 28 36 45 55
Polyurethane 27 41 N/A N/A N/A

Consult panel manufacturer to verify R-values. R-values can vary between manufacturers.

Calculated R-Values include 7/16" OSB on each side. EPS is Type I per ASTM C578-07

R-Values are at mean temperature of 75 degrees F

WHAT ARE SIPS?

- Pre-fabricated, pre-insulated stud wall panels are *not* SIPs
- SIPs replace traditional wall studs to provide a better R-value over the entire wall surface (whole-wall R-value)
- The idea is to use the OSB as the load bearing element, instead of studs. The bearing area provided by a SIP wall is equivalent to 2x10 studs @ 16" oc
WHY SIPS?

Thermal Bridging

SIP WALLS

SIP WALLS
SIP DETAILS

Foam Everything
• Panel joints
• Windows and doors
• Plumbing stacks
• Chimneys

---

SIP DETAILS

---

SIP DETAILS
**SIP DETAILS**

- SIP screws go through the panels into structure
- Thread point for wood
- Light drill point for metal/light gauge
- Heavy drill point for steel/iron

*Wall-to-wall vertical panel connections*

*Dimensional lumber spline*

---

---

---

---
SIP WALLS

- Openings can be cut within panels, at panel edges, etc.
- The foam core is recessed 1½" at the edges of openings to accept 2x framing
- SIP can serve as the header in many cases. Structural headers can also be added when necessary

SIP ROOFS

SIP DETAILS
SIP DETAILS

• Top and bottom plates are drilled during installation to access the vertical electrical chases.

SIP DETAILS

• Wall panels can have 1” to 1 1/2” diameter electrical chases.
• Horizontally at switch & outlet heights
• Vertically, typically 4' OC

SIP DETAILS

SIPs Electrical

39

40

41
CHARACTERISTICS OF SIPS

Thermal Bridging

Wood framing SIPS

A more consistent, symmetric R-value

Framing factor*:
- Optimum value framing: 16%
- Stick framing: 23-25%
- SIPs: 6-8.5%**

SIP with surface spline

Wood frame with fiberglass

** Oak Ridge National Laboratory ZEBRAliance research project

4" SIP wall outperforms 2x6 stud wall with R-19 fiberglass

43

44

45
CHARACTERISTICS OF SIPS

More than 40% of a home’s total envelope loss is due to infiltration!

SIPs have:
- Very few gaps
- Industry standard sealing details
- Superior indoor air quality

CHARACTERISTICS OF SIPS

Air Tightness
SIPs can make homes tight enough to meet the Passive House air tightness standard (0.6 ACH50), which is one of the highest in the industry

ENERGY STAR

SIPs recognized by ENERGY STAR as method to reduce thermal bridging

No blower door test required because of superior air sealing

Makes qualifying easier and more affordable
HERS Index

The HERS Index is a scoring system established by the Residential Energy Services Network (RESNET). The HERS Reference Home is built to the 2006 IECC and has a HERS Index of 100. Net Zero Energy home scores a HERS Index of 0. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home. HERS 85=15% more energy efficient.

GREEN BUILDING

Green Building Program Applications

SIPs can help you achieve the highest levels in all green building programs such as LEED for Homes, the NAHB Green Building Program, EarthCraft, and other state green building programs.

- SIPs cut down on job site waste
- Low HERS index / more energy efficient helps you achieve more points in most green building programs
- Resource efficiency for engineered wood products

LEED v4 FOR HOMES

<table>
<thead>
<tr>
<th>EA - Energy and Atmosphere</th>
<th>Max pts</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA Credit: Annual Energy Use</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MR – Materials and Resources</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MR Credit: Environmentally Preferable Products (sheathing) for FSC certified OSB</td>
<td>1 pt</td>
</tr>
<tr>
<td>MR Credit: Construction Waste Management</td>
<td>Max 3 pts</td>
</tr>
<tr>
<td>MR Credit: Material-Efficient Framing</td>
<td>Max 2 pts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EQ – Environmental Quality</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>EQ Credit: Low-Emitting Products</td>
<td>1.5 pts</td>
</tr>
</tbody>
</table>
SIP Walls have been in the IRC since 2007
Currently Section R610
Basically minimum / prescriptive values but establishes acceptance for Code Officials and standards for manufacturers

Structural code compliance - code reports
SIP DESIGN

Residential energy code compliance
PA - 2015 IECC Chapter 4 (RE)

• Avoid prescriptive requirements for exterior insulation
• Total UA Alternative method using ResCheck
  - OR -
• Performance method (HERS rating in 2015 IECC)

SIP DESIGN

“RIGHT SIZING” of HVAC Equipment - Oversizing equipment jeopardizes building and equipment durability while needlessly increasing costs

Airtightness: A pre-construction estimate of less than 2 ACH is appropriate, and it is common to achieve less than 1 ACH50.

High-performance structures designed and built extremely airtight must have mechanical make-up air via HRV, ERV, or other means

SIP MANUFACTURING

MURUS Virtual Plant Tour.mp4
SIP APPLICATIONS

- SIP walls and roof
- SIP walls with truss roof
- SIPs over timber frame
- SIPs and ICF
- Hybrid construction of any kind

Historic home built in 1872 - 4,467 sqft conditioned space including basement, 1st and 2nd floors. SIPs ready to assemble with all window and door openings precut made for smooth installation.

Beineke Residence, Marion, OH

Affordable, effective renovation applications

Affordable, sustainable, cost-effective housing

South Chicago Work Force housing, Chicago, IL
SIP APPLICATIONS

Affordable, disaster-resistant, LEED Certified housing

Make it Right, New Orleans, LA

SIP APPLICATIONS

Modern, sustainable designs

Evoke Quadrant Model Home, Issaquah, WA
Ellmann Residence, Grand Haven, MI

SIP APPLICATIONS

Timber frame

Christensen Residence, Clarkfield, MN
Twin Mountain Home, Carroll, NH
SIP APPLICATIONS
Craftsman design
Kenworth Bungalow, Minneapolis, MN
Inspiration Home, Olympia, WA

SIP APPLICATIONS
Complex designs made easy

SIP QUESTIONS?