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# STRUCTURAL INSULATED PANELS (SIP)

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# STRUCTURAL INSULATED PANELS (SIP)

## Part I: General Overview of SIP Product.

- What are SIPs?
- Example SIP Buildings.
- SIPs and Wind.
- SIPs and Seismic.
- SIPs and Fire.
- SIPs and Energy Performance.
- SIPs Contractor Benefits.

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# What are SIPs?

SIPs are high performance building panels that can be used to build, walls, roofs and floors in residential and commercial buildings.

•Used in place of wood framed walls for greater energy efficiency.

•Fabricated from 24’ long pieces of Structural Grade OSB and an Expanded
Polystyrene Foam Core (R-4 per inch of foam)

•Similar to panelized construction in that SIPs are manufactured offsite, labeled, and shipped to the jobsite.

# What are SIPs: History of SIPs.

SIPs were invented by the US forest service in the late thirties. The use of panelized construction in general became more widespread, as a reaction to deforestation in the Pacific Northwest during WWI.

The first SIP homes were built in the late 30's, in Madison Wisconsin to test the material. The homes passed inspection during the late 50's and SIP homes have been in production since that time.

The use of SIP panels became more popular during the 90's, due to increased interest in environmentalism and/or rising power bills, due to conflicts in the Middle East.

-"Integrating Panels into the Production Homebuilding Process"
September 2005
U.S. Department of Housing and Urban Development
PATH (Partnership for Advancing Technology in Housing)
Washington, DC 20410-6000

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# What are SIPs?

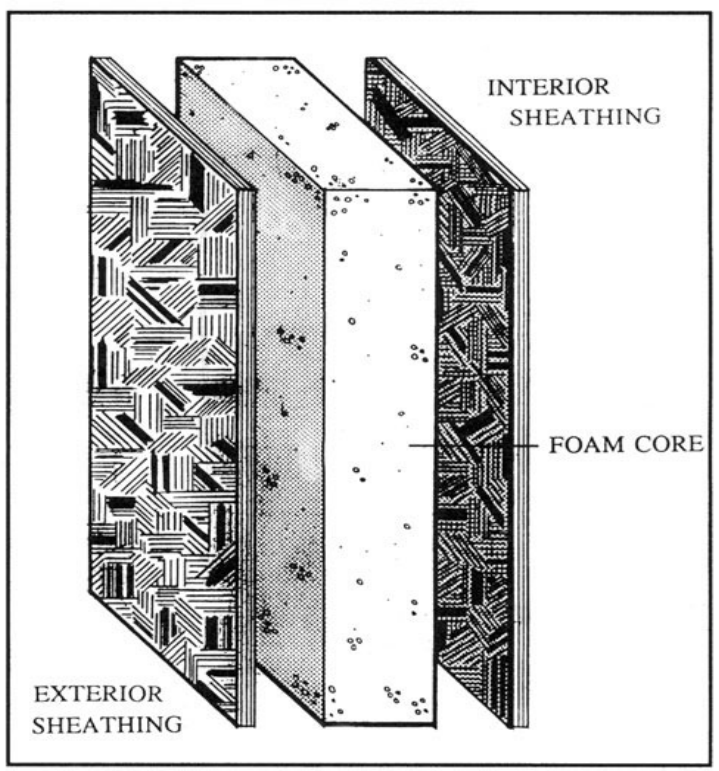


Fig. 2: SIPs have two exterior skins bound to a rigid plastic foam core

**Structural OSB**

**Industrial Adhesive**

**Expanded Polystyrene**

**Industrial Adhesive**

**Structural OSB**

Oriented Strand Board (OSB)

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- SIP Panels are at least 2 times stronger than conventional stick framed walls.
- SIP Panels use design values with a higher Factor of Safety of (typically 3) compared to wood framing (F. O. S. around 1.5)
- SIP Panels provide greater shear, compression, and tensile strengths as a result of their higher factor of safety.

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# Example SIP Buildings

## Habitat for Humanity
## Build 26
## 3907 East Deloy Drive
## Idaho Falls, ID

**sPANELS** donated and delivered the Structural Insulated Panels (SIPs) for the construction of the exterior walls for Build 26 of Habitat for Humanities Idaho Falls Affiliate.

On June 23, 2012 three of **sPANELS** staff provided on, site technical assistance to guide and help the Habitat volunteer work crew lay out the panels and put them in place.







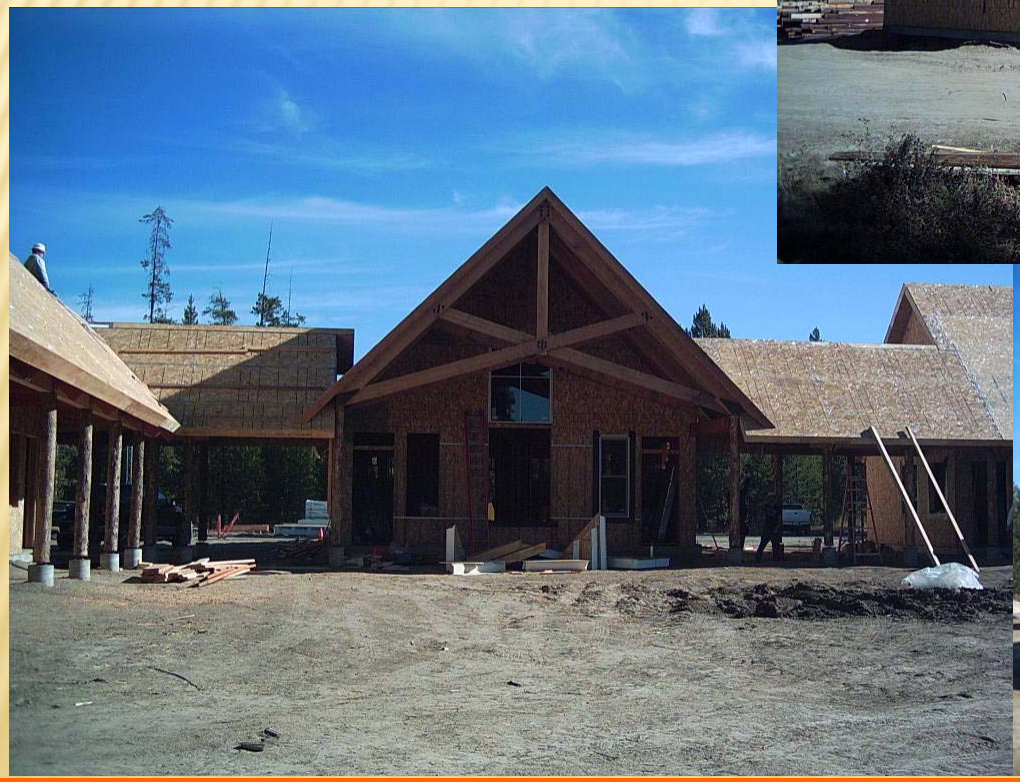
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# Example SIP Buildings

**Rental Cabins**

Harriman State Park, ID.







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# Example SIP Buildings

**Residential**
**Complex**
**Studio**
**Building**
San Diego, CA







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# Example SIP Buildings

**Monticello Assisted Living Center,**
Idaho Falls, ID.





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# Example SIP Buildings

**Hermannsson Home**

Terrebonne, OR.

(Bend metro area)







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# Example SIP Buildings

**Tamarack Ski**
**Resort Home**
McCall, ID.





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# Example SIP Buildings

**Tamarack Ski Resort Home**
McCall, ID.

(120 lb snow load)



# SIPS and Wind:

## Severe Wind Resistance







This home built with **sPANELS** Structural Insulated Panels near McCall ID, around the Tamarack resort area, performed as expected, after a wind microburst dropped trees on it's roof. Not even any gypsum wall or roof seams were damaged as a result of the impact. One piece of wood soffit underneath the porch had aesthetic damage, and was replaced.

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# SIPS and Wind:
## Severe Wind Resistance

Photo Courtesy Michael Morley and AFM Team Industries



This Clermont, Georgia SIP house survived a 1998 tornado with superficial damage while 27 conventional houses around it were destroyed.

Photo Courtesy Team Industries



The concrete foundation of this Sumner County, Tennessee SIP house crumbled and the porch was swept away, but the SIP walls and roof are still there. The contents of the house were only slightly damaged.

# SIPs and Seismic Forces:

## Earthquake Resistance

1995 7.2 magnitude earthquake,  Kobe Japan:

A total of 6 SIP homes were built within a few miles of the quake epicenter.

All 6 homes stood solidly after the force of the quake.

http://www.r-control.com/downloads/projects/kobe-earthquake.pdf

# SIPs and Seismic Forces:

## Earthquake Resistance

Whole house SIP “shake table tests” The following video:

http://www.fas.org/programs/energy/btech/advanced%20technologies/sip_testing.html
http://www.youtube.com/watch?v=P4p_wDk-fcQ&feature=player_embedded

This video shows a SIP structure withstanding 40 inches of displacement in 5 seconds, on a platform designed to simulate earthquake conditions.

This test was performed by Professor Khalid Mosalam, at Berkeley’s Department of Civil and Environmental Engineering, Pacific Earthquake Engineering Research (PEER).

This video is courtesy of the Federation of American Scientists www.fas.org.

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# SIPs and Fire:

Our EPS core has a Flash Point (When combustion would occur with the aid of a nearby open flame) of 610 Degrees Farenheit. 675 Degrees Farenheit is roughly the operating temperature of a commercial pizza oven. This home in Afton WY, (seen in other slides) was built half in SIP, and half in conventional construction.

**The SIP half of this home withstood the heat of the fire**, the conventional construction did not.





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# SIPs and Energy Efficiency

• SIP homes are more efficient than conventional wood framing due to fewer air changes and overall less “leaky” construction.

• SIP homes use less fuel during winter heating and summer cooling due to increased R values.

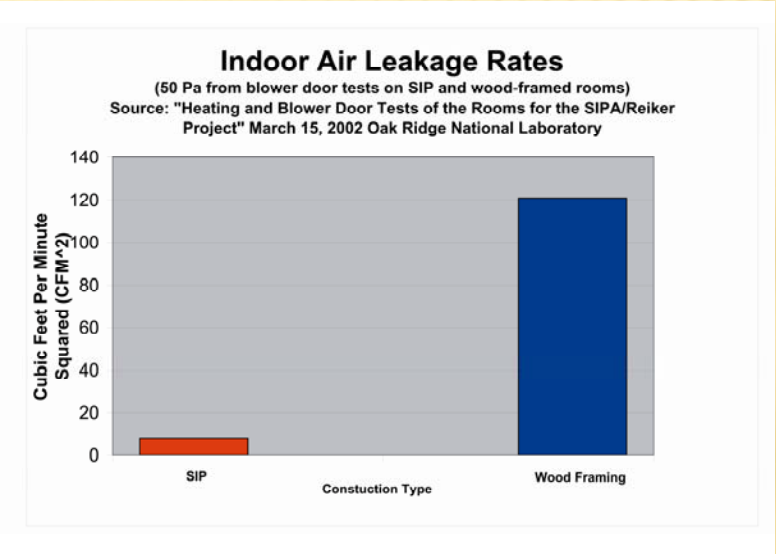
• SIP homes conduct outdoor temperatures less, due to decreased thermal bridging.

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# STRUCTURAL INSULATED PANELS

## Energy Performance: Oak Ridge National Laboratories

**(Study on Whole Wall Insulation Performance)**

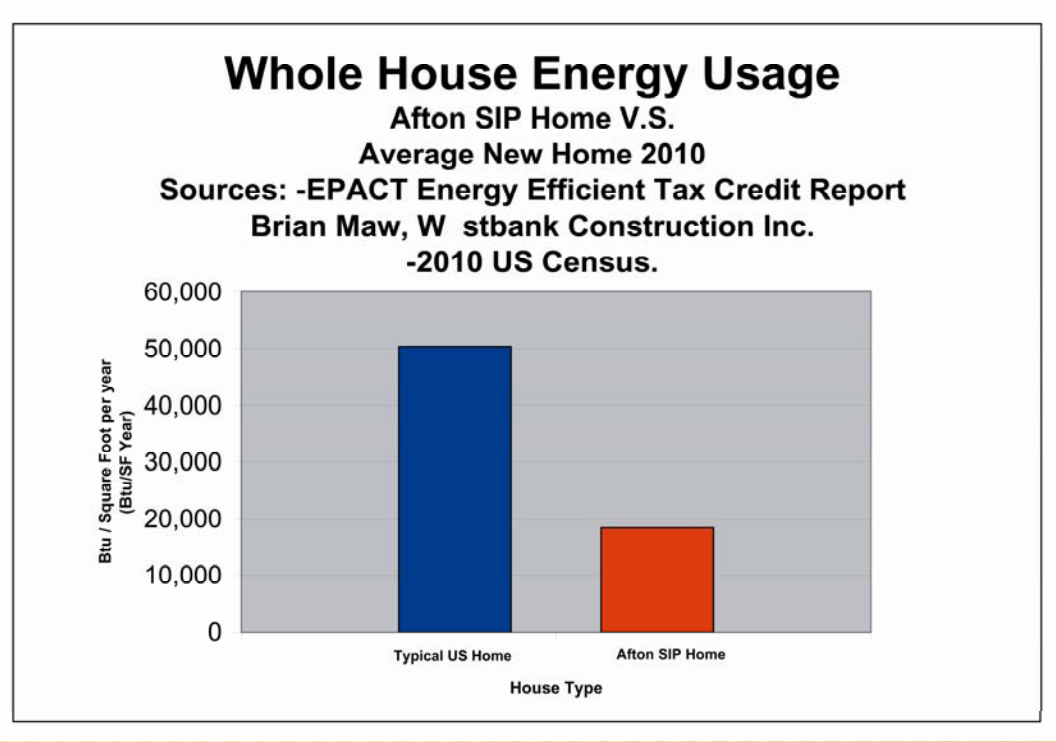



The conclusion of the study was that a 4" SIP wall was found to be more effective at blocking heat transfer than a 6" conventional stud-framed wall and with 15 times less air infiltration.

*(http://www.ornl.gov/sci/roofs+walls/articles/wallratings/index.html)*

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# Energy Performance: sPANELS SIP Home, Afton, WY




Data collected from blower tests on a 4044 square foot SIP home.

Put in perspective, this 4044 square foot home is projected to use 74.5 Million Btus of energy in a year (18,400 Btu/sf year) the average 2143 square foot house annually uses 108 Million Btu of energy (50,400 Btu/sf year). 18,400 / 50,400 = spends 37% of what a typical house would on power bills.

**• In layman's terms, this homeowner saves around 63% more on power bills then they would with a conventionally framed home.**

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# Energy Performance: sPANELS SIP Home, Afton, WY





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# Energy Performance: sPANELS SIP Home, Afton, WY.





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# Energy Performance:

## Brock University Side By Side Study

Alberta, CAN

### Side By Side Study

• Test setup: Two identical rental housing units were built adjacent to each other, oriented East West. Both have natural gas heating and forced air. Both were built by the same construction crews, who were unaware that thermal testing was to be conducted. Both were built to Ontario Building Code. With few exceptions, both were occupied throughout the study. One was constructed using 2x6 Stud Walls, and the other was constructed using 4 1/2" SIP walls.



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# Energy Performance:

## Brock University
## Side By Side Study
Alberta, CAN

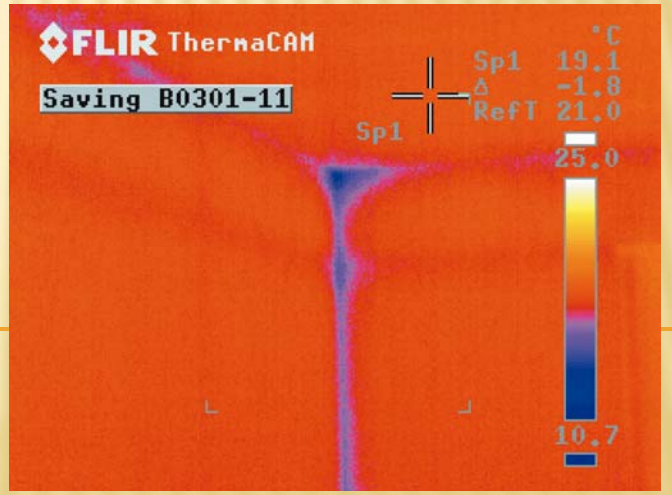
## Side By Side Study

• The R 17 rated—4.5” SIP wall performed at an R17 equivalent.
• The R20 rated—2x6 stud wal performed at R-4 equilvalent.
• The SIP house experienced 1.55 air changes per hour.
• The 2x6 house experienced 2.68 air changes per hour, 68% more air leakage.
• Air leaks are not accounted for in R value figures.
• Thermal Imaging shows the 2x6 wall conducting more heat loss through thermal bridging:

2x6 Stud Wall




SIP Wall




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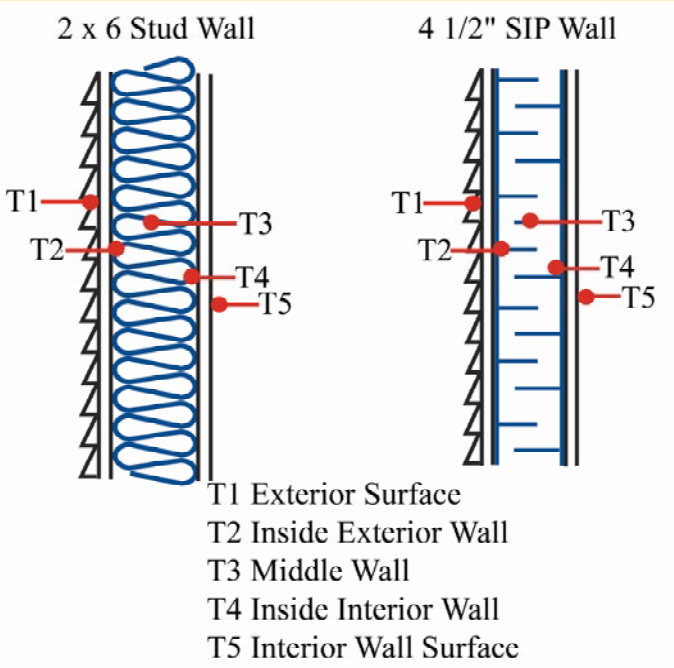
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# Energy Performance:

## Brock University Side By Side Study

Alberta, CAN

**Temperature Sensor Positioning:**



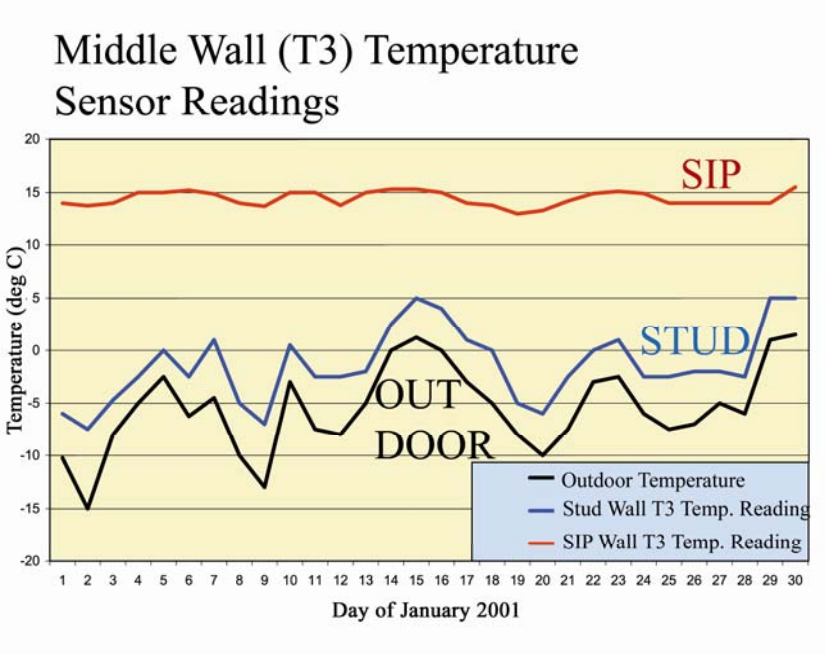

## Side By Side Study

• Differential between T2 and T4 readings:
4.5” SIP wall - 43.7 deg F.
2x6 stud wall - 54.2 deg F.

Conclusion: These results demonstrate more heat loss through the 2x6 stud wall than a 4.5” SIP wall.

Midwall (T3) Sensor Findings:
Average for January:
2x6 stud wall - 35.5 deg F
4.5” SIP wall - 60.1 deg F

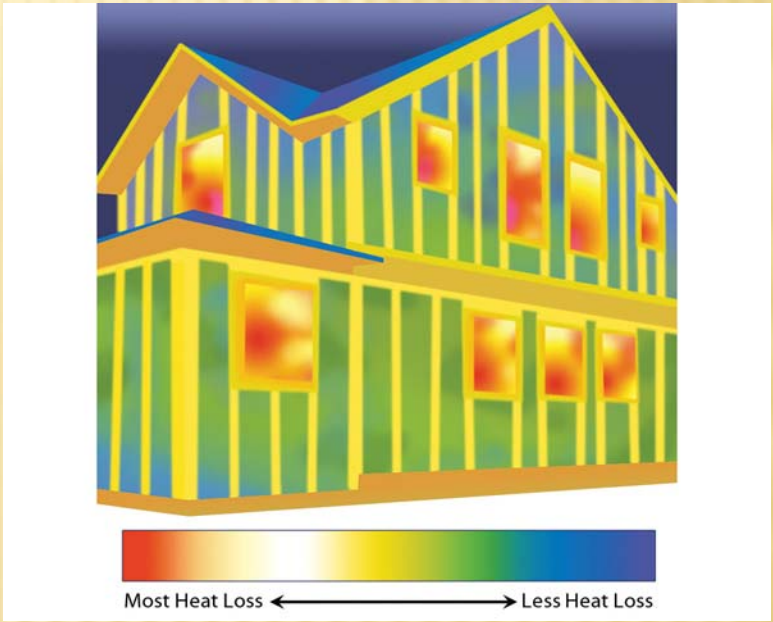
Conclusion: These results demonstrate that SIP walls experience less heat loss:



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# STRUCTURAL INSULATED PANELS

| | Conventional Framing | Structural Insulated Panels |
|---|---|---|
| 4” | R13 | R19 |
| 6” | R19 | R25 |
| 8” | R26 | R33 |
| 10” | R32 | R42 |
| 12” | R39 | R51 |




## Thermal Bridging

-Thermal bridging occurs in the building envelope when structural members allow heat conduction to occur. Wood framing, seen on the right, allows thermal bridging and poor energy performance.

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# STRUCTURAL INSULATED PANELS




Wood Frame




SIP

Thermal imaging comparing a wood framed home on the left
And a SIP home, on the right

## Thermal Bridging

Reference:
http://www.offgridcon.com/apps/photos/photo?photoid=29414816

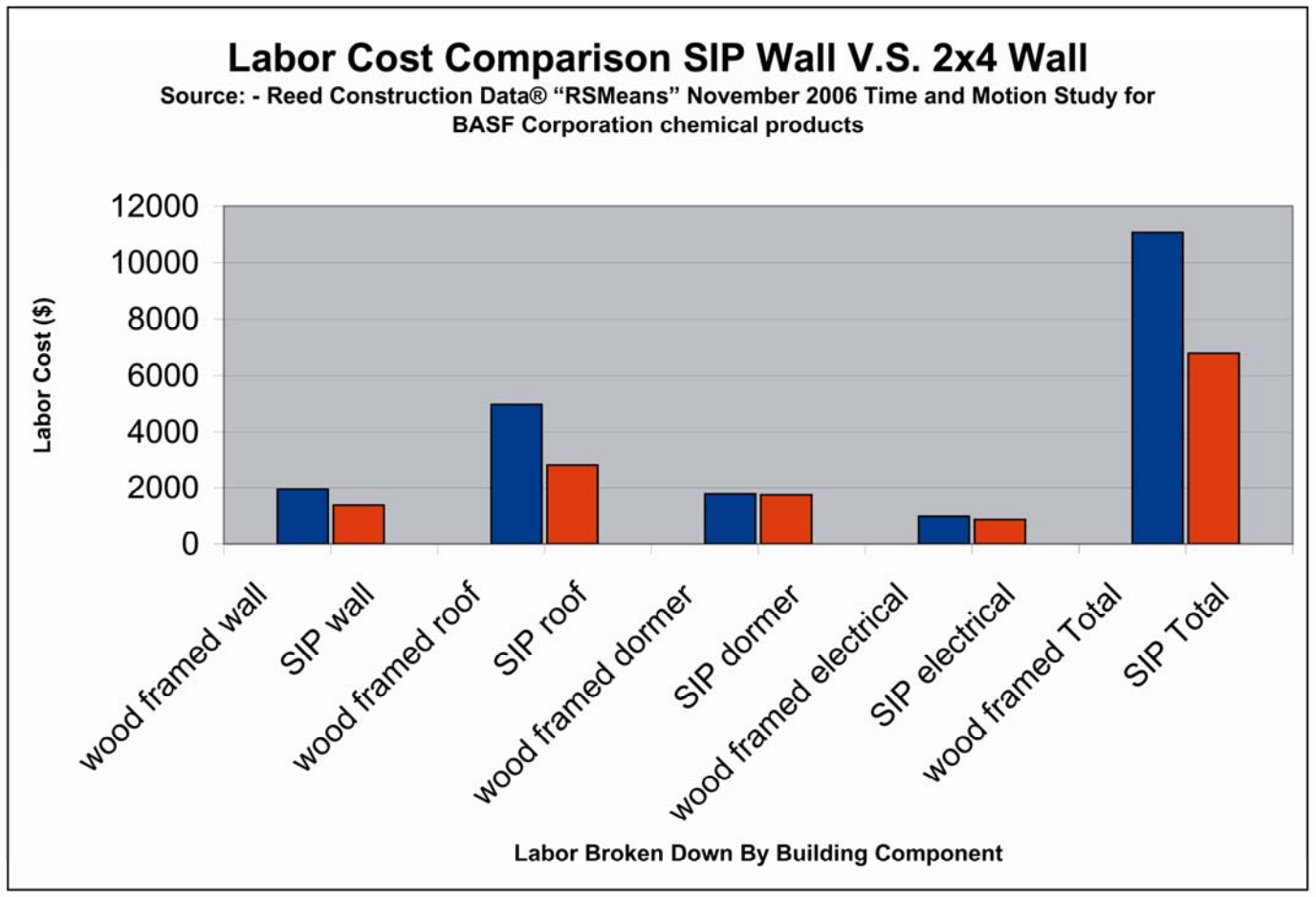
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# SIPs Contractor Benefits.

- SIPs are easy to assemble.
- Jobsite waste is reduced
- Build time is reduced
- Electrical Chases are Pre-installed, Electrician's time is reduced.
- SIPs fill a Niche market sought after by home owners and businesses.
- SIPs fulfill the demands of energy conservation codes, such as IECC 2012

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# SIPs Contractor Benefits:



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## SIPs Contractor Benefits:

- **sPANELS** product features a **20 YR** Limited Warranty on workmanship and materials.

- **sPANELS** Limited warranty includes accessory materials supplied as part of sPanels specifications.

# WARRANTY

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# STRUCTURAL INSULATED PANELS (SIP)

## Part II: Inspection Criteria and Code Reports.

Construction Inspection Criteria.

NTA Seismic zones D,E,F Listing Report.

ICC-ES Product Listing Report.

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# SIPs Construction Inspection Criteria… What to look for:

✓ Tight joints, not more than 1/8” of spline material can be seen between panel joints.

✓ Make sure the manufacturer’s or structural engineer’s fastener placement schedule is being followed at: 1. wall panel joints, 2. at roof panel joints, 3. and in the spacing of screws which go through the roof panels into beams and/or the wall panel top plates.

✓Make sure the SIP manufacturer has a Code Evaluation Report Listing, with an industry recognized evaluation service. ( ICC-ES, and NTA being the most common) **OR, LACKING THAT,** a structural engineer willing to denote code equivalency in writing.

# SIPs Construction Inspection Criteria … What to look for

✓ Make sure that panel joints have been sprayed with manufacturer recommended sealant.

✓ Plumbing in SIP walls can cause condensation if plumbing is run inside the panels. This happens because standing water in a plumbing pipe is usually colder than the indoor air temperature. (somewhat like a lavatory tank) Water vapor can get trapped in the panel, due to the tightness of the construction. Make sure plumbing is not being run through SIP walls.

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# sPANELS Code Reports: NTA Seismic D,E,F

Seismic tests on SIP panels are meant to prove equivalency to the rigidity of a wood framed, plywood sheeted wall of the same size.

NTA®

CSI 06 12 00

Assembly Report: **SPH111411-7**

**Assembly No. SPH111411-7**
**sPanels Structural Insulated Wall Panels**
**for use in Seismic Design.**

**Report Holder**
**sPanels Holdings, LLC**
**2420 Heyrend Way**
**Idaho Falls, Idaho 83402**

**Manufacturing Location**
**sPanels Holdings, LLC**
**2420 Heyrend Way**
**Idaho Falls, Idaho 83402**

**SUBJECT**
***sPanels Structural Insulated Wall Panels for use in Seismic Design.***

To obtain the most current NTA Certification Report Visit www.ntainc.com/product-certification/.

**DESIGN**

1. **Design Approval.** Where required by the authority having jurisdiction, structures using *sPanels Structural Insulated Panels* (SIPs) shall be designed by a registered design professional. Construction documents, including engineering calculations and drawings providing floor plans, window details, door details and connector details, shall be submitted to the code official when application is made for a permit. The individual preparing such documents shall possess the necessary qualifications as required by the applicable code and the professional registration laws of the state where the construction is undertaken. Approved construction documents shall be available at all times on the jobsite during installation.
2. **Connection to Structure.** Designed in accordance with accepted engineering practice to transfer racking forces into the wall at the top and out of the wall at the base.
3. **Design Loads.** Design loads to be resisted by the SIPs shall be as required under the applicable building code. Loads on the SIPs shall not exceed the loads noted in ESR-2182.
4. **In-Plane Shear Design.** Shear walls shall be sized to resist all code required wind and seismic loads without exceeding the allowable loads provided in Table 1. Shear wall chords, hold-downs and connections to transfer shear forces between the wall and surrounding structure shall be designed in accordance with accepted engineering practice.
5. **Seismic Design.** The shear wall configurations in Table 1 are permitted in Seismic Design Categories A, B, C, D, E and F. Such walls shall be designed using the seismic design coefficients and limitations provided in ASCE 7-05 for light-framed walls sheathed with wood structural panels rated for shear resistance (SFRS A13). The assembly shall use the following factors for design: Response Modification Coefficient, $R = 6.5$; System Overstrength Factor, $\Omega_0 = 3.0$; Deflection Amplification Factor, $C_d = 4.0$. The maximum assembly height-to-width ratio is 1:1.
6. **Adhesives and Sealants.** Adhesives and sealants shall not be applied at wood-to-wood or spline-to-facing interfaces in shear walls in Seismic Design Categories D, E and F. Adhesives and sealants may be applied to wood-to-foam or facing-to-foam interfaces. Flexible SIP tape may be applied over panel joints.
7. **Conditions of Use.** Installation complies with this report and the approved construction documents.

*This assembly listing is intended to indicate that NTA, Inc. has evaluated data pertaining to the described assembly and has found that when constructed in accordance with this listing the data herein applies. NTA Inc. makes no warranty, either expressed or implied, regarding the product covered by this report.*

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WEB: WWW.NTAINC.COM
PHONE: 574-773-7975
FAX: 574-773-2260

SPH111411-7 Construction Listing 2011-12-14
Issue/Revision Date: 12/14/2011
Expiration Date: 12/14/2012
Page 1 of 3

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**sPANELS Code Reports:**
**NTA Seismic D,E,F**

Equivalency to the rigidity of a wood framed, plywood sheeted wall is achieved with a monatonic “weight loaded” seismic racking shear test, to achieve a “backbone arch” result. This result must be reached without using sealants or adhesives (which are a typical part of SIP construction) These components would actually make the assembly behave in a more rigid and acceptable manner.

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CSI 06 12 00

Assembly Report: **SPH111411-7**

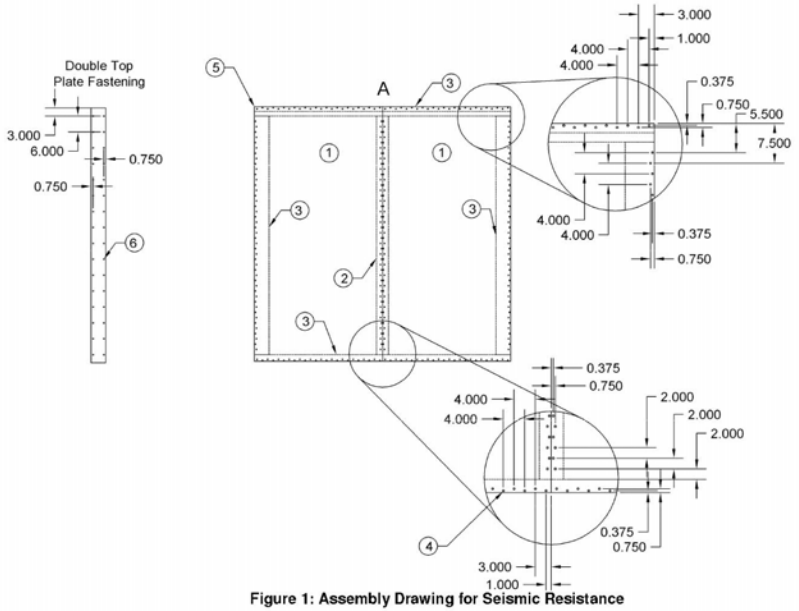



**Figure 1: Assembly Drawing for Seismic Resistance**

**Components:**

1. **Structural Insulated Panels.** *sPanel Structural Insulated Panels* consisting of nominal 5-½ in. thick EPS core laminated between two sheets of minimum 7/16 in. thick oriented strand board (OSB). SIP Panels shall bear the ESR-2182 listing mark.
2. **Splines.** *sPanel Structural Insulated Panels* for use in seismic construction are interconnected with OSB (Surface) Splines, 4 in. wide, 7/16 in. thick and the full length of the spline connection.
3. **Chords and Top and Bottom Plates.** *sPanel Structural Insulated Panels* for use in seismic construction shall use #1 Douglas Fir 6x6 Chords, #1 Douglas Fir Double 2x6 Top Plates and a single #1 Douglas Fir 3x6 Bottom Plate.

**Note:** *sPanel Structural Insulated Panels* shall be fastened in accordance with Figure 1.

4. **8d Nails, 0.131 in. x 2-3/8 in.** applied 4 in. on center around the panel perimeter and on both sides of the spline connection in two staggered rows.
5. **(2) 10d Nails, 0.148 in. x 3 in.** used to end nail the top and bottom plates at each chord.
6. **10d Nails, 0.148 in. x 3 in.** used for double plate 6 in. on center in two rows.
7. **Hold-downs.** (not shown) Designed in accordance with accepted engineering practice to resist design chord forces

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## sPANELS Code Reports: NTA Seismic D,E,F

A“backbone arch” result indicates the time and magnitude of shaking during testing when the fasteners (nails) in a SIP wall system begin to unseat. If this result is reasonably close to the “backbone arch” result in a wood framed wall, and the result can be repeated, then NTA’s test criteria has been passed.

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Assembly Report: **SPH111411-7**

**Table 1: Allowable In-Plane Shear Strength (Pounds per Foot) for SIP Shear Walls (Seismic Loads in Seismic Design)[1,2]**

| Spline Type | Framing Minimum SG[3] | Minimum Facing Connections[2] | | | Shear Strength (plf) |
|---|---|---|---|---|---|
| | | Chord[2] | Plate[2] | Spline | |
| 7/16 in. OSB Surface Spline | 0.50 | 0.113" x 2-3/8" nails, Two rows staggered 4 in. o.c., 3/4 in. and 3/8 in. edge distance | 0.113" x 2-3/8" nails, Two rows staggered 4 in. o.c., 3/4 in. and 3/8 in. edge distance | 0.113" x 2-3/8" nails, Two rows staggered 4 in. o.c., 3/4 in. and 3/8 in. edge distance | 1340 |

[1] Allowable seismic design coefficients are defined in Section 5.
[2] Chords, hold-downs, and connections to other structural elements must be designed by a registered design professional in accordance with accepted engineering practice.
[3] Required connections must be made on each side of the panel. Dimensional or engineered lumber shall have an equivalent specific gravity not less than specified.

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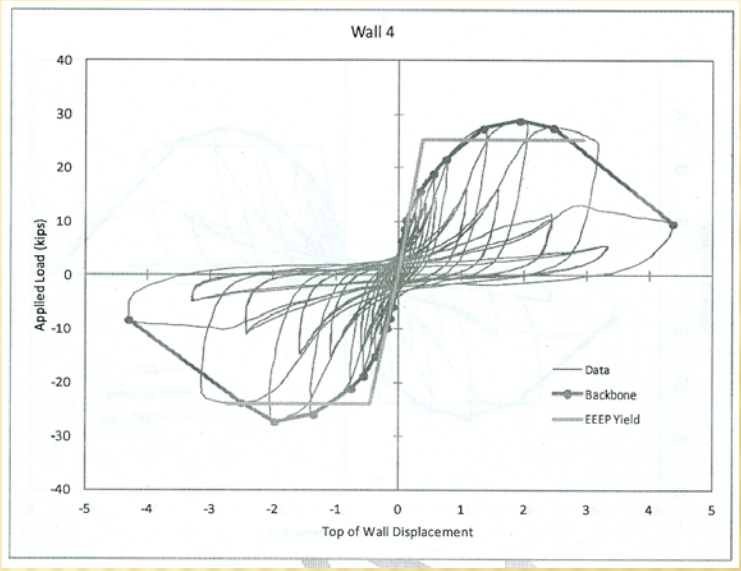
SPH111411-7 Construction Listing 2011-12-14

Issue/Revision Date: 12/14/2011
Expiration Date: 12/14/2012
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## sPANELS Code Reports: NTA Seismic D,E,F

An APA (American Plywood Association) testing facility in Seattle tested our panels, from those tests NTA wrote sPanel's seismic zone D, E, and F report, and sPANELS seismic zone D, E and F product listing.




**"Backbone Arch" graph.**



**Monatonic Racking Shear Test Setup**

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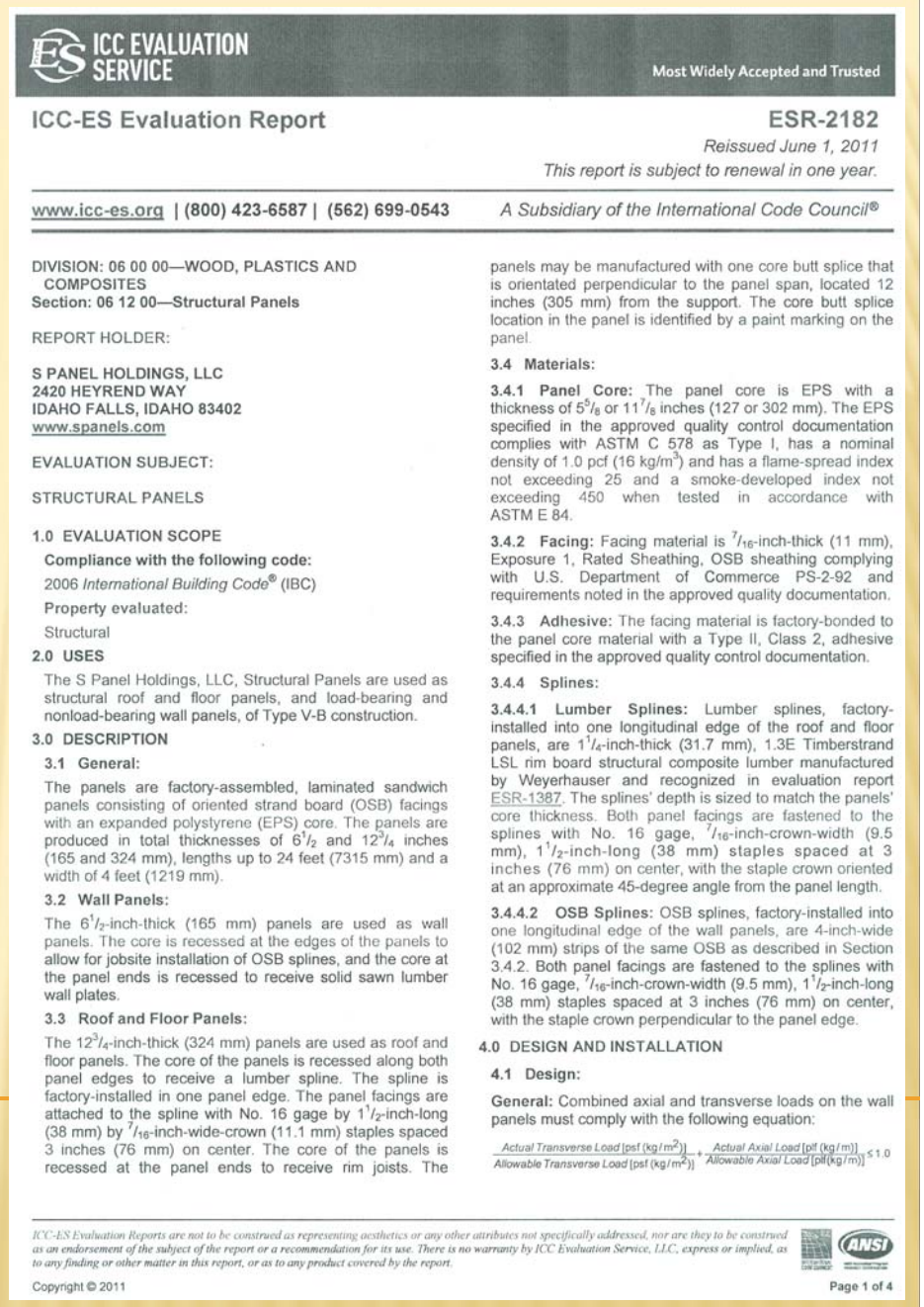
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## sPANELS Code Reports: ICC-ES

sPANELS currently uses the ICC-ES To provide product listing services.

An advantage of the ICC-ES ESR report is that it is widely known, so much so that it is often mistaken for a requirement of the ICC codes.

Several other companies, such as NTA provide product listing services which satisfy code requirements.



ICC EVALUATION SERVICE — Most Widely Accepted and Trusted

**ICC-ES Evaluation Report** — **ESR-2182**

*Reissued June 1, 2011*

*This report is subject to renewal in one year.*

www.icc-es.org | (800) 423-6587 | (562) 699-0543 — *A Subsidiary of the International Code Council®*

DIVISION: 06 00 00—WOOD, PLASTICS AND COMPOSITES
Section: 06 12 00—Structural Panels

REPORT HOLDER:

S PANEL HOLDINGS, LLC
2420 HEYREND WAY
IDAHO FALLS, IDAHO 83402
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EVALUATION SUBJECT:

STRUCTURAL PANELS

**1.0 EVALUATION SCOPE**

**Compliance with the following code:**

2006 *International Building Code®* (IBC)

**Property evaluated:**

Structural

**2.0 USES**

The S Panel Holdings, LLC, Structural Panels are used as structural roof and floor panels, and load-bearing and nonload-bearing wall panels, of Type V-B construction.

**3.0 DESCRIPTION**

**3.1 General:**

The panels are factory-assembled, laminated sandwich panels consisting of oriented strand board (OSB) facings with an expanded polystyrene (EPS) core. The panels are produced in total thicknesses of $6^{1}/_{2}$ and $12^{3}/_{4}$ inches (165 and 324 mm), lengths up to 24 feet (7315 mm) and a width of 4 feet (1219 mm).

**3.2 Wall Panels:**

The $6^{1}/_{2}$-inch-thick (165 mm) panels are used as wall panels. The core is recessed at the edges of the panels to allow for jobsite installation of OSB splines, and the core at the panel ends is recessed to receive solid sawn lumber wall plates.

**3.3 Roof and Floor Panels:**

The $12^{3}/_{4}$-inch-thick (324 mm) panels are used as roof and floor panels. The core of the panels is recessed along both panel edges to receive a lumber spline. The spline is factory-installed in one panel edge. The panel facings are attached to the spline with No. 16 gage by $1^{1}/_{2}$-inch-long (38 mm) by $^{7}/_{16}$-inch-wide-crown (11.1 mm) staples spaced 3 inches (76 mm) on center. The core of the panels is recessed at the panel ends to receive rim joists. The panels may be manufactured with one core butt splice that is orientated perpendicular to the panel span, located 12 inches (305 mm) from the support. The core butt splice location in the panel is identified by a paint marking on the panel.

**3.4 Materials:**

**3.4.1 Panel Core:** The panel core is EPS with a thickness of $5^{5}/_{8}$ or $11^{7}/_{8}$ inches (127 or 302 mm). The EPS specified in the approved quality control documentation complies with ASTM C 578 as Type I, has a nominal density of 1.0 pcf (16 kg/m$^3$) and has a flame-spread index not exceeding 25 and a smoke-developed index not exceeding 450 when tested in accordance with ASTM E 84.

**3.4.2 Facing:** Facing material is $^{7}/_{16}$-inch-thick (11 mm), Exposure 1, Rated Sheathing, OSB sheathing complying with U.S. Department of Commerce PS-2-92 and requirements noted in the approved quality documentation.

**3.4.3 Adhesive:** The facing material is factory-bonded to the panel core material with a Type II, Class 2, adhesive specified in the approved quality control documentation.

**3.4.4 Splines:**

**3.4.4.1 Lumber Splines:** Lumber splines, factory-installed into one longitudinal edge of the roof and floor panels, are $1^{1}/_{4}$-inch-thick (31.7 mm), 1.3E Timberstrand LSL rim board structural composite lumber manufactured by Weyerhauser and recognized in evaluation report ESR-1387. The splines' depth is sized to match the panels' core thickness. Both panel facings are fastened to the splines with No. 16 gage, $^{7}/_{16}$-inch-crown-width (9.5 mm), $1^{1}/_{2}$-inch-long (38 mm) staples spaced at 3 inches (76 mm) on center, with the staple crown oriented at an approximate 45-degree angle from the panel length.

**3.4.4.2 OSB Splines:** OSB splines, factory-installed into one longitudinal edge of the wall panels, are 4-inch-wide (102 mm) strips of the same OSB as described in Section 3.4.2. Both panel facings are fastened to the splines with No. 16 gage, $^{7}/_{16}$-inch-crown-width (9.5 mm), $1^{1}/_{2}$-inch-long (38 mm) staples spaced at 3 inches (76 mm) on center, with the staple crown perpendicular to the panel edge.

**4.0 DESIGN AND INSTALLATION**

**4.1 Design:**

**General:** Combined axial and transverse loads on the wall panels must comply with the following equation:

$$\frac{\text{Actual Transverse Load [psf (kg/m}^2\text{)]}}{\text{Allowable Transverse Load [psf (kg/m}^2\text{)]}} + \frac{\text{Actual Axial Load [plf (kg/m)]}}{\text{Allowable Axial Load [plf (kg/m)]}} \le 1.0$$

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The allowable transverse loads for the panels are shown in Table 1. The use of the floor or roof panels to resist any other load conditions (such as a roof diaphragm resisting seismic or horizontal-wind loads) is outside the scope of this report. The allowable uniform axial compression loads on the 6 1/2-inch-thick (165 mm) panels used as bearing walls with an 18-foot (5486 mm) maximum wall height is 2,028 plf (296 kN/m). The allowable racking shear loads for the 6 1/2-inch-thick (165 mm) wall panels installed in accordance with this report with a maximum shearwall height-to-length ratio of 1-to-1 is 93 plf (1358 N/m).

**4.2 Installation:**

**4.2.1 General:** The panels must be installed in accordance with the manufacturer's published installation instructions and this evaluation report. A copy of the instructions must be available at all times on the jobsite during installation.

The longitudinal edges of the panels must be connected to each other with the factory-installed splines. The roof and floor panels are installed with the timber splines and the wall panels are installed with the OSB splines. Both panel facings must be fastened to the splines with No. 16 gage, 7/16-inch-crown (9.5 mm), 1 1/2-inch-long (38 mm) staples spaced 3 inches (76 mm) on center, with the staple crown oriented at an approximate 45-degree angle from the panel length and with an edge distance of 3/16 inch (4.8 mm). Both panel facers must also be attached to solid sawn lumber framing at each side of wall openings, at wall corners and at each end of shearwalls with the same staples and staple spacing as noted for attachment at panel splines.

Top and bottom plates installed into the recessed core of the wall panels must be nominally 2-inch Douglas fir–larch solid sawn lumber, sized to match the panel's core thickness. Both the panel facings of the wall panels must be fastened to the top and bottom plates with the same fasteners, fastener orientation (crown width perpendicular to the panel end) and fastener spacing as described above for attachment of the splines to the panel facing. Figure 1 shows typical installation details. The wall panels must be installed in a manner such that the panel facers are in full contact and sufficiently supported by the underlying structure; and the loads applied at the top of the panel are uniform loads applied to both panel facers.

**4.2.2 Wall Openings:** Wall openings for doors and windows must be framed with conventional materials, and designed in accordance with the IBC, to the satisfaction of the code official.

**4.2.3 Thermal Barrier:**

**4.2.3.1 Wall, Floor and Roof:** A layer of 1/2-inch-thick (12.7 mm) gypsum wallboard, complying with ASTM C 36 or ASTM C 1396, must be installed on the interior surface of wall and roof panels and the bottom side of floor panels with occupied space below the floor panel. The gypsum wallboard must be fastened with No. 6 by 1 1/4-inch-long (31.7 mm) Type W wallboard screws spaced at 16 inches (406 mm) on center at the perimeter of each gypsum wallboard and at 12 inches (305 mm) on center in rows spaced at 24 inches (610 mm) on center, in the field of the gypsum wallboard. The gypsum wallboard is also attached to the panels with OSI Formula No. 38 Drywall Adhesive, applied in 3/8-inch-diameter (9.5mm) beads spaced at 4 1/2 inches (114mm) on center. Wallboard joints must be taped and filled with joint compound in accordance with GA-216 or ASTM C 840.

**4.2.3.2 Floor Panels:** An approved thermal barrier, such as 3/4-inch-thick (19.1 mm) plywood, must be installed on the top of floor panels to separate the panels from the interior of the building. The thermal barrier must be attached to the OSB facings of the sandwich panels in accordance with the code.

**4.2.4 Exterior Wall Covering:** The exterior face of the wall panels must be covered with an approved exterior wall covering, and a water-resistive barrier as required by IBC Section 1404.2. Where portland cement plaster is used, compliance with IBC Sections 2510 and 2512 is required. Flashing must be installed in accordance with the code.

**4.2.5 Roof Covering:** The roof panels must be covered with a roof covering complying with the code, including IBC Section 2603.6. Roofs with hot-asphalt or hot coal-tar pitch require mechanical attachment of a base ply prior to the application of the roof covering materials. Fasteners must have sufficient length to penetrate through the top panel skin. Underlayments and flashing must be installed in accordance with the code or a current evaluation report.

**5.0 CONDITIONS OF USE**

The panels described in this report comply with, or are suitable alternatives to what is specified in, the code indicated in Section 1.0 of this report, subject to the following conditions:

**5.1** The panels must be fabricated, identified and erected in accordance with this report and the manufacturer's published installation instructions. If there is a conflict between the manufacturer's instructions and this report, this report governs.

**5.2** Design loads to be resisted by the panels must be determined in accordance with the code, and must be less than the allowable panel loads noted in this report.

**5.3** Construction documents, including engineering calculations and drawings providing floor plans, window opening details, door opening details, and connection details, must be submitted to the code official when application is made for a permit, to verify compliance with this report and the code. The design calculations and details must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

**5.4** All roof-to-wall and wall-to-floor construction joint details must be designed such that gravity loads are applied to the wall panels as a uniform concentric axial load over the entire wall panel thickness.

**5.5** When used as shear walls (racking shear), the panels are recognized for use in Seismic Design Categories A, B and C.

**5.6** The panels are limited to use in structures of Type V-B construction.

**5.7** The floor panels are limited to use in Group R occupancies.

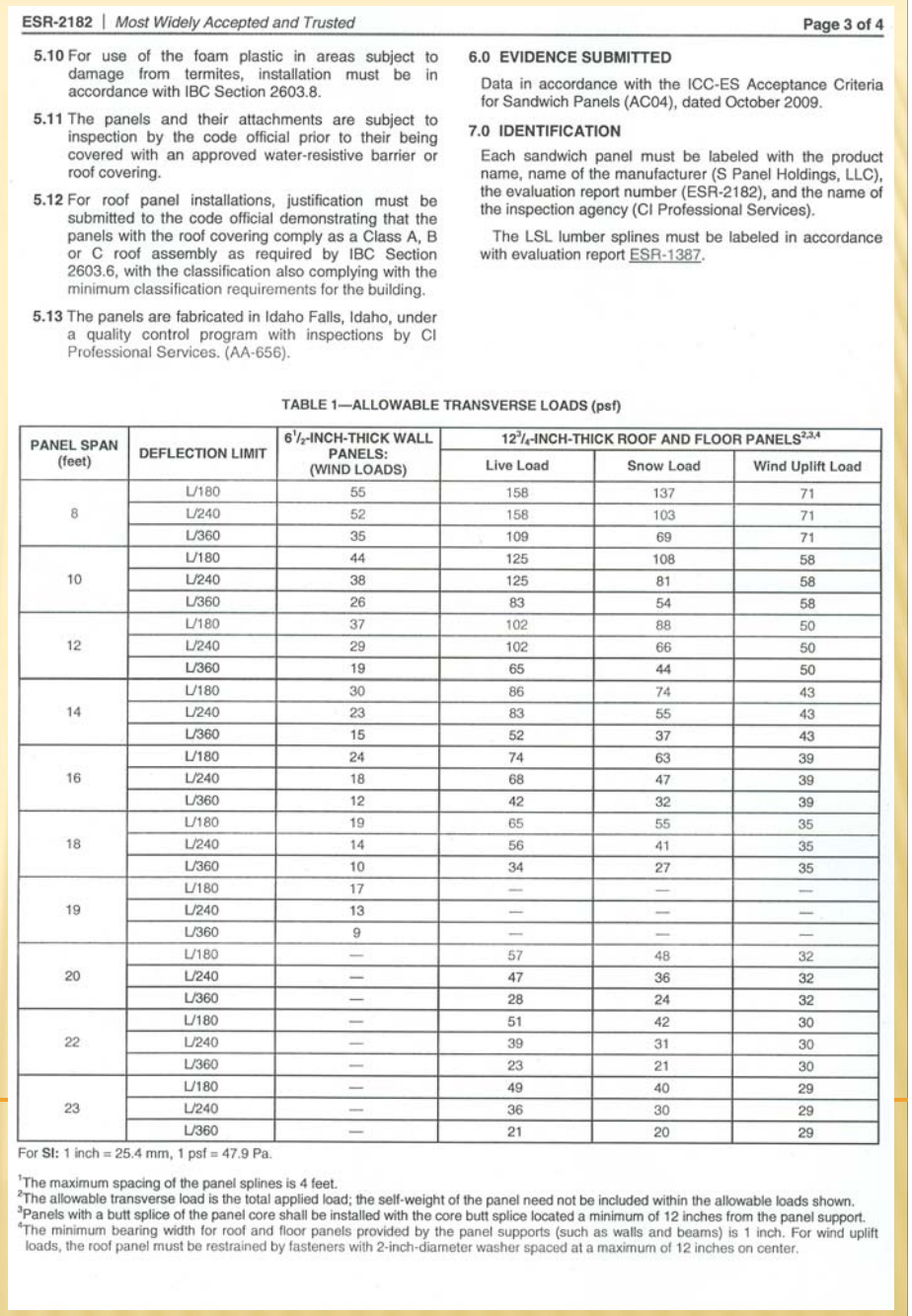
**5.8** The foam plastic core must be separated from the building interior by a thermal barrier installed in accordance with Section 4.2.3 of this report.

**5.9** The panels must be installed a minimum of 6 inches (152 mm) above finish grade.

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Load charts for SIP roofs are highly dependent on deflection criteria, which is usually determined by support structure (beam) spacing, roof loads, and ceiling finish material choice.





**5.10** For use of the foam plastic in areas subject to damage from termites, installation must be in accordance with IBC Section 2603.8.

**5.11** The panels and their attachments are subject to inspection by the code official prior to their being covered with an approved water-resistive barrier or roof covering.

**5.12** For roof panel installations, justification must be submitted to the code official demonstrating that the panels with the roof covering comply as a Class A, B or C roof assembly as required by IBC Section 2603.6, with the classification also complying with the minimum classification requirements for the building.

**5.13** The panels are fabricated in Idaho Falls, Idaho, under a quality control program with inspections by CI Professional Services. (AA-656).

**6.0 EVIDENCE SUBMITTED**

Data in accordance with the ICC-ES Acceptance Criteria for Sandwich Panels (AC04), dated October 2009.

**7.0 IDENTIFICATION**

Each sandwich panel must be labeled with the product name, name of the manufacturer (S Panel Holdings, LLC), the evaluation report number (ESR-2182), and the name of the inspection agency (CI Professional Services).

The LSL lumber splines must be labeled in accordance with evaluation report ESR-1387.

**TABLE 1—ALLOWABLE TRANSVERSE LOADS (psf)**

| PANEL SPAN (feet) | DEFLECTION LIMIT | 6½-INCH-THICK WALL PANELS: (WIND LOADS) | 12¾-INCH-THICK ROOF AND FLOOR PANELS[2,3,4] | | |
|---|---|---|---|---|---|
| | | | Live Load | Snow Load | Wind Uplift Load |
| 8 | L/180 | 55 | 158 | 137 | 71 |
| | L/240 | 52 | 158 | 103 | 71 |
| | L/360 | 35 | 109 | 69 | 71 |
| 10 | L/180 | 44 | 125 | 108 | 58 |
| | L/240 | 38 | 125 | 81 | 58 |
| | L/360 | 26 | 83 | 54 | 58 |
| 12 | L/180 | 37 | 102 | 88 | 50 |
| | L/240 | 29 | 102 | 66 | 50 |
| | L/360 | 19 | 65 | 44 | 50 |
| 14 | L/180 | 30 | 86 | 74 | 43 |
| | L/240 | 23 | 83 | 55 | 43 |
| | L/360 | 15 | 52 | 37 | 43 |
| 16 | L/180 | 24 | 74 | 63 | 39 |
| | L/240 | 18 | 68 | 47 | 39 |
| | L/360 | 12 | 42 | 32 | 39 |
| 18 | L/180 | 19 | 65 | 55 | 35 |
| | L/240 | 14 | 56 | 41 | 35 |
| | L/360 | 10 | 34 | 27 | 35 |
| 19 | L/180 | 17 | — | — | — |
| | L/240 | 13 | — | — | — |
| | L/360 | 9 | — | — | — |
| 20 | L/180 | — | 57 | 48 | 32 |
| | L/240 | — | 47 | 36 | 32 |
| | L/360 | — | 28 | 24 | 32 |
| 22 | L/180 | — | 51 | 42 | 30 |
| | L/240 | — | 39 | 31 | 30 |
| | L/360 | — | 23 | 21 | 30 |
| 23 | L/180 | — | 49 | 40 | 29 |
| | L/240 | — | 36 | 30 | 29 |
| | L/360 | — | 21 | 20 | 29 |

For **SI:** 1 inch = 25.4 mm, 1 psf = 47.9 Pa.

[1]The maximum spacing of the panel splines is 4 feet.
[2]The allowable transverse load is the total applied load; the self-weight of the panel need not be included within the allowable loads shown.
[3]Panels with a butt splice of the panel core shall be installed with the core butt splice located a minimum of 12 inches from the panel support.
[4]The minimum bearing width for roof and floor panels provided by the panel supports (such as walls and beams) is 1 inch. For wind uplift loads, the roof panel must be restrained by fasteners with 2-inch-diameter washer spaced at a maximum of 12 inches on center.

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Many detail decisions such as those noted here as sPANELS typical installation details are often modified by the personal preferences of a project's structural engineer.

