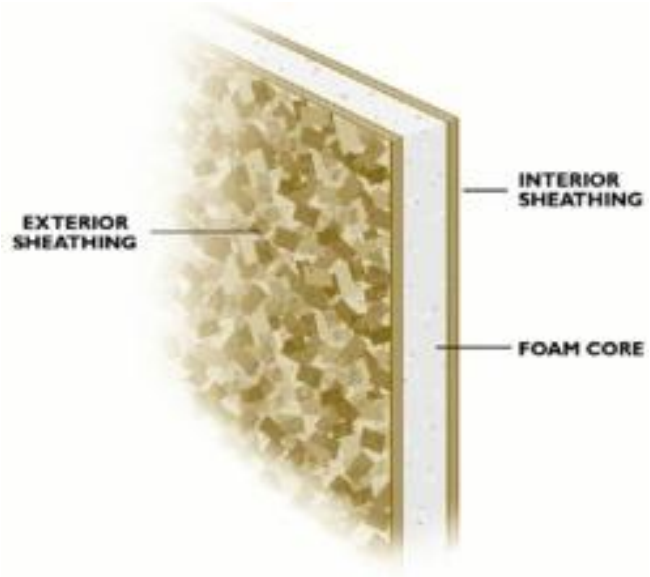
BORNHOFT GLOBAL TECHNOLOGIES LLC

A Universal Look at:

Structural Insulated Panels



SIP's vs. Conventional Built Systems

ENERGY STAR

PATH Partnership for Advancing Technology in Housing PARTNER

SIPA

What are SIPs

SIPs are structural insulated panels consisting of a solid core of polystyrene or polyurethane foam insulation sheathed with oriented strand board (OSB) as standard. The foam core provides high insulation values (4 per inch for polystyrene - 6.5 per inch for polyurethane), while the OSB contributes to the system's overall strength and stability.

Why Build with SIPs?

*** Save up to 60% Cooling & Heating Coasts*
*** Structurally Superior Strength and Straighter Walls*
*** Reduced Labor Costs*
*** Speed of Construction*
*** Environmentally Responsible*
*** Finished Building will be Quieter*

Save up to 60% in Heating and Cooling Costs

A typical 6" Polystyrene Wall Panel has an R-Value of "24" and an 8" Roof Panel has an R-Value of "32". A 6" polyurethane Wall Panel has an R-Value of "39" With the Heating and Cooling Loads being lower it translates into lower energy costs, saving you money immediately.

SIPs Qualify for Energy Star Mortgages

Higher Appraised Values
Better Qualifying Values
Tax Incentives

Table of Contents

Structural Insulated Building Panels

Overview

The advances in structural framing provide alternatives to traditional stud-framed homes. The traditional, time-consuming to build, stud-framed homes are harder to air seal, more labor-intensive and more expensive to heat or cool over time due to large amounts of lumber that occupy space for insulation.

Is there a better alternative to old-fashioned stud framing? Structural insulated panels, also known as "SIPs," are typically made by sandwiching a polyurethane layer of foam between two structural skins of oriented strand board, or "OSB." Frames built with SIPs are stronger than conventional stud frames and a SIP framed home takes less time to erect, saving you money on labor. The airtight, draft-free nature of SIP frames also saves homeowners money on their energy bills.

There are several ways to analyze the different associated costs of construction in conventional stick-built dwellings vs. Structural Insulated Panels (SIP's). In order to glean a better understanding we need to break down the different aspects. Only by a complete systems analysis can a contractor, developer, home or building owner understand the complete cost savings.

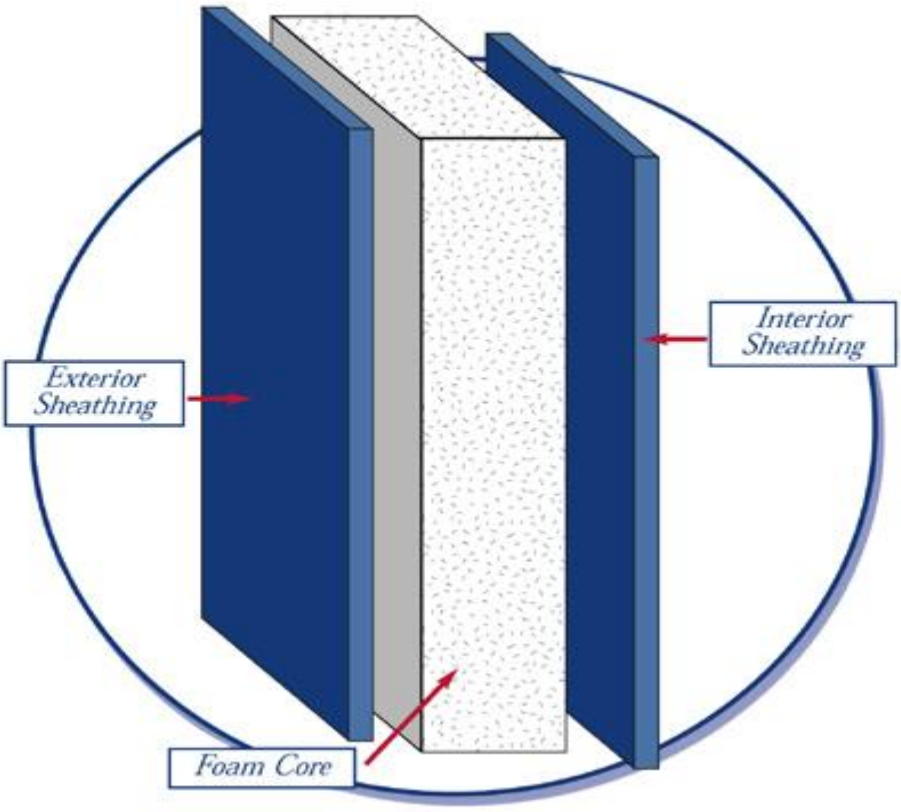
History of SIP's

The US Forest Products Laboratory built the first Structural Insulated Panel structure in 1935; however, energy efficiency concerns didn't exist until fuel prices increased. The first increase, in 1974, saw the cost of crude oil rise from $11.45 per barrel to $18.21, a jump of over $6.75 per barrel; in 2006 we have seen the cost of crude oil skyrocket to over $70.00 per barrel.

Product performance and affordability were impacted by the introduction of oriented strand board in 1981, which eliminated the use of plywood.

SIPs are high-performance building panels for floors, walls and roofs in residential and commercial buildings. Each panel is typically made using polyurethane foam insulation sandwiched between two structural skins of oriented strand board (OSB), but other surfaces are also available to meet your needs. The result is a building system that is very strong, predictable, energy efficient, and cost effective.

Standard Structural Insulated Panel



Benefits To The Builder

SIP builders establish a specialty market that separates their business from other builders because they provide the community with a final product that has superior energy efficiency and structural performance.

SIPs combine structural framing, insulation, and sheathing into one step, therefore providing the opportunity for more projects per year. SIPs are easier to work with during the cold winter months. After quickly installing the panels, the rest of the project can be spent completing the work on the interior

The pre-built nature of the SIP system requires fewer framers. In the United States, fewer people are choosing building as a career. Less than 30% of these construction positions are being filled. SIPs can help lessen this manpower shortage because it's much easier to learn how to build with SIP panels than with traditional framing. In addition *Bornhoft Construction Service, LLC* can provide on-site technical training to contractors and builders.

SIPs reduce job site waste by reducing the cost of waste disposal. According to statistics, the average builder pays $511 per 2,000 sq. ft. home for waste disposal. Wood products account for 35% of this waste. The typical exterior framing waste of a SIP home can be hauled off in a 55 gal container. Also, every builder experiences job site material theft. It's much more difficult for SIP panels to be stolen than it is with standard lumber.

Bornhoft Construction Services SIPs reduce the margin for framing errors. Each panel is numbered to correspond with a blueprint. Panels are built to specifications, taking the guesswork out of design and quality control on-site.

Maintaining a consistent profit margin becomes easier with SIPs, since the builder knows upfront exactly what the exterior framing cost will be. Stick framing relies on the integrity of a multitude of connection points between 2x's and sheathing. With SIPs, loads are distributed across the entire panel due to the continuous bond between the sheathing and rigid insulation. A SIP panel can be compared to an I-beam, with the sheathing acting as flanges and the insulation as the web. Because of this, a SIP structure is many times stronger than a conventional structure.

Benefits To The Homeowner

The biggest benefit of the SIP system is energy efficiency. The home or building is wrapped in insulation without the thermal breaks experienced in 2x framing at each stud and around the electrical work. Also, the insulation in SIPs maintains its integrity over time, whereas batt insulation settles and absorbs moisture.

The US Department Of Energy compared 5 different building systems for clear-wall R-value (measures the R-value of an uninterrupted insulation cavity section of a wall) vs. whole-wall R-value (takes into account the areas where most thermal performance is lost, such as corners, studs, wall to roof, window, and door areas). The test concluded that SIPs maintain 88% of their clear-wall performance after whole-wall R-value is measured. This is 58% better than 2 x 6 stick framing. SIP Panels provide a quieter and healthier living environment.

SIP panels are an excellent sound barrier, and the naturally tight construction of a SIP shell helps prevent dust and allergens from penetrating the home. The installation of air exchangers is recommended to promote healthier air quality and control humidity.

A SIP home or building provides flexibility and freedom of interior design. There is no need for a stud-finder. The entire inside is sheathed with oriented strand board. Finding a place to support a nail for pictures, curtains, or cabinets isn't a problem. There is time and money to be saved when it comes to applying sheet rock! It should be noticeably faster since you don't have to worry about hitting the studs.

Structural Insulated Panels are typically composed of two materials- OSB and polyurethane or OSB and Polystyrene, and are environmentally safe. The OSB is derived from short growth, or “Replaceable” tree crops. The polyurethane insulation does not contain any CFCs, (chlorofluorocarbons) or formaldehyde.

SIPs vs. Conventional Framing

The cost of SIPs is always compared to stick-frame construction, but is not an "Apples-to-apples" comparison, since 2x construction cannot compete with the thermal efficiency or strength of SIPs. To build a house out of conventional materials that would perform with the same thermal efficiency and strength as a SIP house or building would cost 40 to 50% more. Although the material cost of SIPs is higher than 2x construction, you are actually paying for some of your framing labor when you purchase panels. The finished home cost difference is only 3%-5% more than a stick-framed home. The difference depends on labor and materials costs in your area. The minimum 50% energy savings quickly recoups any additional initial investment over the cost of conventional framing. The savings continue even when you sell your home. A study released by the EPA revealed that energy efficiency increases the resale value of homes by $20 for every $1 in annual energy cost savings.

The results of yet another construction process analysis was written in a 1998 report to the U.S. DOE, Department of Industrial Engineering and Management Systems, University of Central Florida, Orlando, FL. The study focuses on the construction of two similar single-family homes, one SIP and one stick-built, built by Habitat for Humanity during the fall of 1997. The data indicated that the SIP home saved 65% of the site labor when compared to the stick-built home. Cycle time savings are of similar magnitude. Volunteers were interviewed after framing the SIP house to gauge their perception of SIP construction. The results suggest that both construction professionals and other volunteers believed that SIPs reduced construction effort significantly, averaging about one-half the effort of conventional construction.

The EPA has developed a program called Energy Star Homes to help homebuyers offset the up-front cost of building a better home. Some incentives include Energy Efficient Mortgages. The perks of Energy Efficient Mortgages include debt-to-income ratio loans, closing cost rebates, and lower interest rates. Also, congress is debating a tax credit of 1% of the purchase price with a maximum of $2,000 for newly built homes, which use at least 50% less energy than the Model Energy Code

Today some builders are still resistant to change their construction methods, but this is only temporary because customer demand will dictate acceptance. In the future, all builders will give customers the option of building with panels. After all, why would anyone build with anything else?

Labor Savings

Labor today is the one single component of the construction costs that if properly controlled will benefit the contractor the most. SIP's can help to manage and better control those costs in several ways.

Because of the superior structural strength of SIP's over conventional stick-built construction, the erection of the building shell does not require the workforce to understand all aspects of construction. This is achieved by the manufacturer in their planning and design stage. For example, door and window openings of less than 48" wide do not require the normal building components as in conventional construction. This allows for the journeyman carpenters to plan and construct other aspects of the job.

The erection of SIP panels on the job site is much faster than the stick-built construction of those same walls. Once again the design and layout is the responsibility of the manufacturer and builder long before construction begins. Once the panels arrive on the site, the job of the contractor is to set them in place according to a detailed drawing showing their placement.

Once the SIP panels are in place and secured, the construction of the shell is complete and ready for windows and doors to be installed. The openings for these items will have already been done in the manufacturer's facility leaving any structural concerns to the manufacturer and their structural engineers and not to the contractor.

The last and most important time saving advantage of SIP construction is the insulating of the shell. With SIP's this has already been done.

What the experts say about Precision Engineered Framing:

"It's fabulous... a proven technology that deserves much greater application in the building industry."

- **Bob Vila**,
" Home Again"

"For new construction, I don't think there's any reason to use anything but the panels."

- **Norm Abram**,
" This Old House" and "New Yankee Workshop"

"I was really impressed with how easy and quick the panels went together. This type of construction is the wave of the future!"

- **Ben Mandell**,
" New Home Show"

"... goes up incredibly fast..."

- **Steve Thomas**,
" This Old House"

"Every once in a while a new technology comes along that makes its predecessors obsolete. John Henry couldn't compete with the steam drill, power saws replaced hand saws, and drywall replaced plaster and lath. There is no going backward. Today, structural insulated panels (SIPs) are in the process of replacing the postwar norm of stick-framed, fiberglass-insulated houses"

- **Michael Morley**,
author of "Building With Structural Insulated Panels"

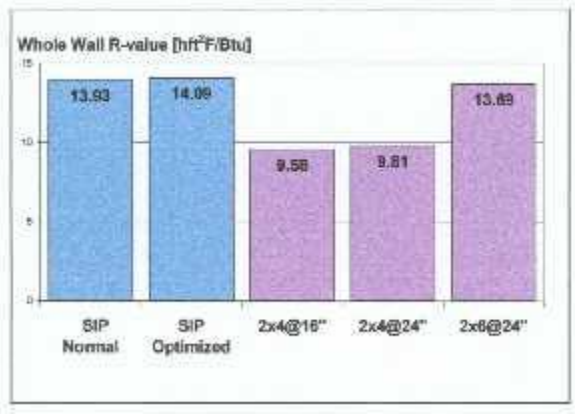
"I was a firm believer in stick framing for years, but I'll never go back."

-- **Rick Thompson**

SIPs Outperform Stick & Batt:

Oak Ridge National Laboratory - R-Value Test

When someone says "R-value", what they're really talking about is resistance to heat flow in a given medium, such as fiberglass insulation. The higher the number the greater the resistance. So when a builder is asked "What's the R-value of this wall?", the natural inclination is to think of the material that most commonly specifies its rating. More often than not, it's the insulation, and the response is something along the lines of "Oh, that wall has an R-value of 24" - fairly impressive, but also strikingly inaccurate.
It's not that the builder is intentionally misleading his client or associate, but that he's just following common practice. In reality, this reasoning doesn't take into account all the other components that go into making a wall: wood or steel studs every 16" or 24", bracing, nails or screws, wiring and switch boxes - any number of things that are not insulation, and in all likelihood, have R-values that fall well short of the stated R-24.



A new study by the Oak Ridge National Labs (ORNL) proves that a 4-inch SIP wall outperforms 2"x4" stick and batt construction, and even edges out 2"x6" construction in terms of thermal performance. Because SIPs are the structural elements, there are no studs or braces to cause breaks in the insulative action. The end result is a more comfortable, energy efficient structure that performs up to spec in real-world conditions. Unlike stick and batt construction, which can be subject to poorly installed - even missing - insulation, the nature of SIPs is such that the structural and insulative elements are joined as one. There are no hidden gaps, because a solid layer of foam insulation is integral to panel construction.

By contrast, state-of-the-art technical analysis of whole wall performance indicates that the losses in a stud wall are much greater than you might think: on average, the other standard components in stick and batt construction can reduce R-values in as much as 30% of the wall area. Fortunately, that's not the case with structural insulated panels. The ORNL study found that SIPs perform at approximately 97% of their stated R-value overall, losing only 3% to nail holes, seams, splines, and the like. Wiring chases are precut or preformed into the foam core, providing a continuous layer of insulation keeping the elements at bay and the interior free of drafts and cold spots.

A SIP wall also outperforms stick and batt when it comes to maintaining consistent interior temperatures, and that translates to improved occupant comfort. The interior surface temperature of frame construction drops

precipitously at every stud, while the SIP wall remains consistent across its entire surface. No temperature dips mean improved occupant comfort, regardless of where you are in the room. That's a big part of what people are talking about when they say they can immediately "feel the difference" in a SIP-built residential or commercial space. With SIPs, thermal efficiency and comfort are built in at the factory, and now the lab results prove it.

Tests Verify SIP Performance Advantage

Oak Ridge National Laboratory Test Room with Four-Inch SIPs Blows Away 2x6 Fiberglass Construction in Controlled Side-By-Side Lab Test

"SIP room 15 times less leaky" - Oak Ridge report

A SIP test room has significantly outperformed a 2x6 stick-framed and fiberglass-insulated wall in controlled testing under identical laboratory conditions at the government's Oak Ridge National Laboratories (ORNL). Results from a carefully monitored and instrumented study in Oak Ridge's climate simulation laboratory showed that SIP construction can be far more airtight than stick-frame construction. "We can put a number on it," says SIPA Executive Director Bill Wachtler. "When it comes to stopping air infiltration and exfiltration, a properly sealed SIP building is almost 15 times better than the competition."

Systems Approach to Savings

In order to completely understand and appreciate the savings in implementing a structural insulated panel building we need to look at it in a complete system approach. Looking at the building materials, labor savings, interest savings and energy savings that can be realized a clearer picture begins to develop. All of these figures can be obtained by working with Innovative Building Technologies, your contractor, your lending institution and utility company, you will be surprised with the findings.

Taking the Plunge:

How and Why Builders Decide to Use Panelized Housing Technology

By: Michael J. Crosbie, Ph D. R.A. Steven Winter Associates, Inc.

How do builders decide whether to use panelized house systems? What factors come into play when a builder is contemplating making a move to panelized construction? And for what reasons would builders who are inclined to try a new building technology choose not to use panelized construction?

These are some of the questions asked in a recent survey conducted for the U.S. Department of Housing and Urban Development's PATH (Partnership for Advancing Technology in Housing) program in an effort to understand how builders decide to use panel systems. We interviewed 24 builders across the U.S., mostly from the Southwest and Southeast part of the country, where the lion's share new housing starts are taking place (according to the latest U.S. Census data). We selected builders in a wide range of sizes (from 2 employees to more than 100) and the number of houses produced annually (from 2 to more than 200). The builders surveyed serve all kinds of markets, from first-time homebuyers and affordable housing for lower-income buyers, to high-end custom homebuyers.

What was learned in the survey might surprise some builders, especially when in comes to the motivating factors that serve as "tipping points," propelling builders to take the plunge in using panelized housing technology. Comparing one's own experience to what was learned in the survey might help a builder to decide whether to use panelized construction. The matrix at the end of the article presents a variety of factors that builders identified as being crucial in making their decision, what the elements of success where in using panels, and what some of the drawbacks were.

Popular Panel Technologies

Builders using all kinds of panelized systems were represented in the survey: simple open-wall panel technology (where panels are delivered to the site with exterior sheathing and open stud walls inside, to receive utilities, insulation, and finishes); sophisticated structural insulated panels (SIPs, with two pieces of OSB sandwiching a core of rigid foam insulation); precast concrete panels (delivered to the site with exterior finishes already applied); and SIPs with cement board exterior surfaces. By far, the most popular panel systems used were open wall systems and SIPs—five of the builders surveyed used open wall panels, while 13 chose some form of SIP.

Builders who have never used a panel system were also surveyed to understand their reasons for choosing not to use panels. These builders were selected from PATH's Technology Evaluation projects—which tracks builders' experiences on-site with using innovative building technologies—so they were at least open to the idea of trying something new. These builders almost uniformly cited higher costs for panelized systems as the reason they have not used them. Also mentioned was the lack of a panelized dealer close by, and the fact that no other builders in their region were using panelized systems. Generally, they admitted to not knowing enough about the benefits of the technology or how panelized systems are used.

The Cost Factor

Ironically enough, the cost of panelized systems was not a negative factor for the builders who chose to use them. The reason for this is that panelized builders, at least in the survey, tended to view costs on a more long-term basis. For example, builders who used SIPs technology admitted to higher first-costs for materials when compared to stick framing. But there were cost advantages further along the construction timeline. By using SIPs, builders could use fewer on-site laborers, at a lower skill level, which cost less. The construction time was also shortened, which meant that labor costs could be kept lower. Builders also mentioned the cost of construction waste—hauling it away and paying to dispose of it. With panelized technology the builders surveyed reported that there was less construction site waste—which was ultimately a cost savings.

Builders surveyed in the Southeastern U.S. predominately used open-wall panel systems. Many of these builders cited less on-site labor as a way of reducing costs—and a reason to use panel systems. Avoiding costly material theft was also a factor in the decision to use panel systems for some builders.

Construction Quality and Efficiency

While higher costs for panelized systems did not appear to deter the builders surveyed, construction quality and efficiency were cited as the biggest factors in deciding to use panels by builders all over the U.S., large and small. Construction quality appeared to be a bigger factor for smaller builders versus larger builders. Many of the builders surveyed who produced 15 or fewer houses a year noted that a drop in the number of callbacks was the result of better material quality and a higher quality finished product in using panel systems (particularly SIPs).

For larger builders in the survey (constructing between 50 to more than 200 houses a year) open-wall panel systems were the technology of choice. For these builders, construction efficiency (faster construction times with less on-

site labor) was a bigger factor than construction quality (although many of the builders said that they believed that construction quality was better with panel systems versus stick or masonry building).

Many of the builders surveyed said that construction efficiency was enhanced with an experienced on-site crew, whether subcontractor labor well-versed in the panel system used, or the builder's own employees who have used the panel system before. In fact, many of the builders surveyed said that the on-site crew experience was the biggest factor in determining construction efficiency. Builders noted that construction efficiency was greater with fewer subs (which means less management necessary by the builder) and that fully fabricated panel systems—pre-designed with window and door locations and cut-outs—further enhanced construction efficiency. House designs that were simple and repeatable on a variety of sites also added to construction efficiency in using panels.

Energy Savings

The promise of better energy efficiency due to higher quality construction and boosted levels of insulation (particularly in SIPs) was a deciding factor for only certain builders surveyed. Builders who operated in parts of the country with extreme climates (either hot or cold) preferred the higher energy efficiency of SIPs technology. All of the builders surveyed in the Southwest cited energy efficiency as an important factor in deciding to use panelized construction, and all but one chose SIPs. By contrast, only one builder out of the six surveyed in the Southeast cited energy efficiency as a deciding factor (that one builder was in Florida). Most of the builders in the Southeast opted for open-wall panel systems.

The bigger the builder (in terms of the number of units produced) the less of a factor energy efficiency played in the choice of using panels. For builders serving the affordable housing market, and those building high-end custom homes, energy efficiency was a factor. For builders who produced spec or tract houses, energy efficiency was less of a factor in deciding to use panels.

Competing with Other Builders

The general consensus among the builders surveyed was that the choice of panels was not made in an effort to compete with other builders in a market or region. Several builders mentioned that homebuyers do not discern a visual difference in a stick-built or masonry home versus a panelized home—they essentially appear the same. However, several builders surveyed mentioned that better energy performance (particularly with SIPs) helped them to

compete by being able to serve a niche market of homebuyers were interested in energy savings and lower utility bills. Other builders mentioned that the savings in construction time and labor costs helped them to compete with builders who did not use panels. This was particularly true for the builders in the survey who constructed 100 or more houses a year.

The Code Factor

Some resistance (or at least begrudging acceptance) of panelized systems by local code officials and building inspectors was experience by about half the builders in the survey who use panels. Among these builders, the negative reaction from the local officials was not enough to change their minds about using the technology. In fact, a number of builders reported such resistance as a challenge they were happy to meet by educating building inspectors, either on their own or with the assistance of the panel manufacturer or trade groups.

Builders who use panels for the first time in a locale where the technology has not made a big impact on the market should expect to spend some time educating the building inspector about panelized systems. However, builders report that once familiar with the systems, building inspectors are not a barrier to the technology's use. In fact, one builder noted that local building inspectors now prefer the panel systems because they are easier to inspect, and construction quality is higher.

Common Problems and Success Factors

Fabrication errors, miscommunications with the panel manufacturer, late delivery, resistance from subs such as electricians and plumbers, and the training of installation crews were the most common problems mentioned by builder in using panel systems. Fabrication errors in open wall and SIPs can usually be corrected on-site, or the manufacturer will supply a new panel. Good communication with the fabricator—particularly changes in the house's design—is essential in heading off problem on site, many panel builders reported. Resistance from other subs is common in those who have never worked with the technology. Several builders mentioned that once familiar with panelized technology (even one house) resistance on the part of the sub dissipates.

Many builders reported that having experienced crews, either on staff or as subbed labor, is a key factor in making a panelized project a success. This can usually be attained simply by experience (learning onsite in the process of building a panelized house for the first time) or through crew training by the panel manufacturer. Some suppliers will send a representative to the site to help a crew through the building process—several builders noted that this was

a big factor in using panel successfully. Technical support by the supplier was cited by several builders as an important factor for continued use of a particular system.

Other factors for success with panel systems mentioned by builders included close coordination and scheduling with the manufacturer/supplier and good shop drawings that are carefully checked. Some builders mentioned that repeatable home designs also helped in the success of projects (both from the standpoint of getting the bugs worked out in the factory and on-site).

Conclusions

Higher first costs and an inadequate understanding of panelized housing technology appear to be the most common barriers cited by builders who have not used the technology. Among those who have taken the plunge, cost savings in the long-term, shorter construction time, and better overall quality are the major deciding factors. Some builders have carved out niche markets in building energy-efficient homes, and the energy efficiency of SIPs construction in particular has helped them to serve this market. Competition with other builders does not appear to be a major factor in choosing to use panels. Code officials continue to remain behind the curve of understanding how panel systems work, but appear to be accepting of the technology once educated on the technology (thanks to enlightenment from builders using panels). One of the major factors for the successful use of panels is trained crews experienced with the technology, along with good communication and coordination between the builder and panel supplier.

R- Values

What is an R-Value?

R-Value is: a measure of the resistance of a substance (in our case insulation) to heat flow.

This is what the dictionary says about R-value. But does that mean that every thing we see printed is giving us a clear picture of that product? No! This is where things get confusing. Labels printed on bags, or other literature does not necessarily reflect the performance in the field, or rather, in your home, office, or warehouse. Why is that? Before I explain that, here are a few more terms to understand.

Advertised R-value:

This is the stated manufacturers R-value as it was tested. Usually by it's self, under laboratory conditions.

Whole R- value:

This is the resistance value of a whole wall system, ie: what R-value does to the wall in your home, office or warehouse, operate at. This is the true test of what your product offers.

This is why a 2x6 wall that is advertised at an R 19 only operates at a R-13.69, or a 2x4 wall advertised at R-13 only operates at an R-9.58.

So when you are choosing methods to insulate, please take time to examine all the facts. The product you choose should not only be high in R-value, but it needs to act in your wall as it is advertised.

Insulation Information.™

Subscriptions for Professionals See page 10.

The Cellulose
INSULATION
J·O·U·R·N·A·L

The Journal Of Information For The Professional Builder, Architect, Supplier and Insulation Contractor

R-19 Batts Actually Deliver R-11

New Oak Ridge Research Confirms True Performance of Batts in 2" x 6" Walls

New research from Oak Ridge National Laboratory (ORNL) confirms that fiberglass batts in 2" x 6" (and 2" x 4") walls provide much less than their labeled R-value. Many builders and homeowners are considering other insulation systems that deliver substantially better performance.

Energy Design Update notes that "at this point, researchers have a good understanding of the . . . performance of stick-built, fiberglass-insulated walls".[1] This understanding is based on countless tests and field studies over decades. The results have consistently shown that fiberglass batts do not deliver their labeled R-value.

Even Perfect Installations Suffer

The research team at ORNL's Buildings Technology Center first tested "perfectly installed"[2] batts. The batts were "precisely cut and perfectly fit"[3] to

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R-19 Batts Actually Deliver R-11

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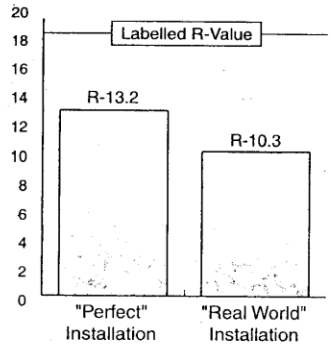
"R-19" Batt Actual Performance



Source: Oak Ridge National Laboratory, 1999

create an ideal situation. Even when installed in this manner, the R-19 batts mustered only an R-13.2![4]

The Real World

When the research team installed the batts according to common building practices, the performance was even more disastrous. The tests show that in real homes, an R-19 batt only provides an R-10.3.[5]

We Knew This 20 Years Ago?

Yes, since at least 1979 when Johns-Manville conducted tests of batt insulated walls. Their results were nearly identical to those from Oak Ridge 20 years later. Wall assemblies built to simulate real-world construction and installation revealed that R-19 batts in 2" x 6" walls lost from 24% to 49% of their R-value.[6]

Better Choices

More builders and homeowners are insisting on insulation products that deliver the performance they expect. Cellulose wall-spray insulation, for instance, eliminates voids and gaps and provides dependable R-value. It provides other benefits, too, by reducing drafts and sound transmission and increasing fire resistance.

For more information about real world insulation performance or for additional copies of this article, please call: 517-521-3545 or email: CIJOURNAL@AOL.COM

Sources

[1-5] Energy Design Update, "How Thermal Shorts and Insulation Flaws Can Degrade an 'R-19' Stud Wall to a Measly 'R-11'", Sept. 1999.

[6] Johns-Manville Research and Development Center, "Effects of Insulation Gaps", Nov. 1979.