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Building for the Future

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by Barb McHatton

When a tornado ripped through their Greensburg, Kansas, home on May 4, 2007, probably the last thing on Scott and Jill Eller's minds was the thought of rebuilding. Most likely, their only thought was whether or not they would survive at all as their home was reduced to a pile of rubble around them.

It took the enhanced F-5 tornado a mere 12 minutes to destroy an estimated 95 percent of the Greensburg's buildings and infrastructure. Sadly, the rural town of 1,500 was virtually wiped off the map. Faced with the daunting task of rebuilding, the town is using this adversity as an opportunity to set a whole new standard in green building and living.

Although in consideration prior to the devastating storm, the aftermath prompted the Greensburg city council to approve an unprecedented resolution—that all new city building in excess of 4,000 square feet be built to LEED Platinum standards. To complement this initiative with a residential rebuild that was just as green, the city started Greensburg GreenTown (www.greensburggreentown.org), a nonprofit organization of passionate green-building advocates that would provide the resources, information, and support that the town would need to rebuild Greensburg as a model green community.

It was through this education the Ellers discovered that SIP homes were not only green, but better equipped to withstand hurricane-force winds and earthquakes. "Initially, we were looking for something that was more structurally sound than what we had," says Scott Eller, "when we became more involved with the green aspects, SIPs seemed like the ideal choice."

Eller adds that SIPs made more sense economically as well. "A lot of people were using insulated concrete forms (ICFs)," he says, "we found that SIPs were less expensive to build with and offered many of the same green and energy benefi ts as ICFs."

In their quest to build their new, more-tornado-resistant home, the Ellers enlisted an expert in SIP technology—Michael Morley, president of SIPsmart Building Systems, Inc. in nearby Lawrence, Kan. He literally wrote the book on SIP technology: Building with Structural Insulated Panels (Taunton Press, 2000), the definitive manual of SIP technology that is used by builders across the country.

A Different Way to Build

When Morley was first introduced to SIPs in the early 1990s, he encountered a new and improved way to build using a system-built technology that created straighter walls, and added energy efficiency and strength to the structure. In fact, Morley says manufacturers' testing and load tables show that a SIP building is three times as strong as a conventional stick-built structure. He also discovered that these buildings were easier and faster to erect at the jobsite.

"Basically, we begin the process by designing a building with a CAD system," claims Morley. "We then deliver the design to our SIP

supplier who uses Computer Numeric Control (CNC) automated processing machinery to cut the pieces from the 8 x 24-foot blank SIP panels." Within three or four weeks, the SIP fabricator delivers a complete building "kit" to the building site. This SIP kit includes installation instructions, detailed shop drawings, precut and labeled panels, and all accessories to complete the installation.

By designing the panels ahead of time, Morely works out many of the common problems that occur during the construction process including dimensioning errors, connection details, and optimization of panels. Additionally, the strength and consistency of the wall panels is assured through the SIP manufacturer's quality control processes before they are delivered to the jobsite.

"Using Building Information Modeling (BIM), we can make changes and advancements from a computer-aided 3-D model," he claims. SIPsmart uses Autodesk's Autocad ADT design software. This is converted into the machine language used by the processor to program the CNC machines.

Time Is on Your Side The ready-to-assemble SIP components can be manufactured in up to 8 x 24-foot sizes and arrive at the jobsite ready to erect. Morley claims that a properly trained SIP construction crew can save significant time—as much as 50 percent—associated with standard construction methods because all framing, insulating, and sheathing is performed in one step. Because SIPs are factory built, all window openings can be pre-cut to specifications and all electrical chases drilled into the foam core, eliminating the need to drill through studs for wiring. Other industry estimates support Morley's figures. A study conducted for BASF by the RS Means unit of Reed Construction Data shows that residential builders can save as much as 55 percent of their framing labor needs by building with SIPs instead of conventional lumber and batt insulation.

The SIP system is compatible with a variety of foundation materials— including poured concrete, blocks, or ICFs. Builders can also configure SIP walls with a conventional truss roof. The assembly of SIP walls using standard construction methods—they are fastened using conventional staples, nails, or screws—may reduce the learning curve for construction crews. Cost savings are realized by reduced labor costs and shortened cycle times for the project. Jobsite waste is reduced because each panel arrives pre-cut and ready to assemble without having to modify on site.

After the walls are erected, all joints are sealed with specially designed SIP sealing mastic or low-expanding foam sealant, creating an airtight, thermally efficient structure.

On-Site Challenges

One big drawback to building with SIPs in Greensburg is the lack of qualified contractors. Greensburg is a relatively isolated, rural community and most contractors must come from Wichita, Kan., about 100 miles away. The homeowners have a limited number of general contractors to choose from. One of the biggest impediments to the growth of the SIP industry is the resistance of some builders to try a new building material or system. "If the crew doesn't want to learn something new," says Morley, "it can actually make the project take longer to complete and cause cost overruns."

The standard 8 x 24-foot SIP panels are heavy and require the use of boom trucks or forklifts to unload trucks and erect the structure. It would be difficult and dangerous to try to install these jumbo panels manually. If access is difficult or lifting equipment is not available, 4-foot-wide panels can be more easily installed by hand.

Green Benefits

SIPs also offer many advantages for the environment. For instance, the OSB used can be an engineered wood product that is made from small, sustainably harvested, plantation-grown trees. They are manufactured using wood more effi ciently than traditional sawn lumber. The insulating foam core (usually polystyrene or polyiso) is made of 98 percent air, needs only a small amount of petroleum byproduct to produce and is manufactured using non-CFC blowing agents. Because fabrication and modifications are done in the factory, the minimal panel waste generated within the factory can be recycled.

But the true value of the SIP home is best realized after completion. SIP homes boast 60 to 70 percent energy

cost savings versus standard stick-built, fi berglass-insulated homes. Morley says that a typical 1,500 sq. ft. SIP-built home averages about $30 per month to heat and cool. Morley's confidence in the energy savings that come with SIPs is such that his company offers cost guarantees with many of his home designs. The numbers are on his side: testing done by the Oak Ridge National Laboratory showed signifi cant increases in whole-wall R-value of SIP walls versus standard stick-built walls with fiberglass batt insulation.[1] The thermally efficient design enables smaller HVAC systems to be used—which, in turn, use less energy—because the airflow into the home is so controlled. The objective is to build a home that is more comfortable and delivers more even temperatures with no drafts. Plus, the inner foam core also reduces noise passing through the walls from outside the home and inside between rooms.

SIP homes also provide an extremely airtight building envelope.As such, these buildings require mechanical ventilation systems to be incorporated into the design. This allows the structure to take in only controlled amounts of fresh air that can also be filtered for allergens and dehumidifi ed to reduce mold growth for improved indoor air quality (IAQ). Stale, moist air can then be exhausted to the outside. According the Morely, a SIP home's supercontrolled airflow, tight envelope, and low infiltration rates improve IAQ, as well as control humidity and temperature, producing a healthful, comfortable indoor environment.

From a code standpoint, SIP buildings are classified as wood buildings and have the same requirements as stick buildings. SIP buildings feature a Class A fire rating; testing reveals SIPs show good performance in fire situations because there are no wall cavities in which flames spread.

Geometric Possibilities

When the Ellers looked at SIPsmart's Web site, it was the geodesic dome that sold them on Morley's designs. There are other SIP houses being built in Greensburg, but the dome design makes their home uniquely appropriate to this geographic region. The dome's round shape deflects winds more easily and the SIPs increase the home's strength.

The geodesic dome design is a patent pending technology called Architecture Resistant to Climatic eXtremes (ARCX). Morley says the domes use 22 percent less materials than standard rectilinear structures to enclose the same amount of space. The ARCX combines intelligent geometry with versatility of the SIP materials to create structures that resist high winds.

At one time, Morley used standard windows to add natural light to these domed spaces. Due to the relative difficulty he encountered when trying to fit the square windows into the triangular shapes, he has since contracted window manufacturer Sunglo Skylight Products, Kansas City, Mo., to make triangular-shaped skylights that fit the ARCX's geometric surfaces.

Morley initially created the ARCX design to provide storm-resistant buildings for disaster areas that could be constructed quickly and easily. He's currently in talks with FEMA to send a team to investigate the ARCX building for similar applications.

Life After the Storm

The headlines that a year ago brought national attention to this small midwest town has evolved into a deeper narrative about living with the challenge of a second chance. After the journalists and politicians came the film crews—notably from the Discovery Channel's Planet Green network. Their documentary of the town's resurrection— and resurgence—is titled Greensburg; the first of the 13-part series aired in June. Dig deeper still, and you see families like the Ellers making the best of a bad situation and discovering help along the way.

[1] Visit www.sips.org for more information on SIPs' thermal performance.