EPS Molders Association

Newsline

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Students Build Ecosmart ICF & SIPS House

at Montana State University

Construction began in April 2010 on an energy efficient home at Montana State University in Bozeman, MT. The project is a collaboration between MSU graduates Bill Hoy, an architect in Washington, D.C., and Kitty Saylor, president and CEO of REHAU North America. REHAU is a German firm that deals with innovation and manufacturing of polymer-based products and systems. "We see this as a pilot project for many more to come," Kitty Saylor said, "We'd like to replicate the project with lessons learned."

The project, dubbed the REHAU MONTANA Ecosmart House, will specifically focus on sustainability, low energy usage and disability design. The residence will serve as a real-world learning and teaching tool for MSU students and as a source of valuable data for those in the construction industry looking for the best ways to meet the latest LEED, NAHB and IBEC certification standards. In its entirety, the three-year project includes research, design, and construction followed by an additional two-year period when the house will be monitored for system performance and research. A key objective of the research is to determine how the various building systems can best be integrated to optimize energy consumption, comfort and life-cycle costing. Findings will be posted to the web as they become available.

The house will feature a number of sustainable building technologies, including:

- Insulating Concrete Forms
- Structural Insulated Panels
- Ground-Air Heat Exchange
- Vinyl Door and Window Frames
- Solar Thermal Energy for Hot Water
- Geothermal Ground Loop Heat Exchange

The Ecosmart House was designed and is being built with the help of 20-30 students from MSU. For example, mechanical engineering students have used computers to model air exchanges and the effectiveness of various building materials. Film students are also shooting a documentary of the construction of the house with a focus on the energy efficient techniques being used. ■

Study Reveals Best Choices

for Efficiency & Waste Prevention

Structural Insulated Panels and Insulating Concrete Forms garnered very high marks in the final installment of an extensive two phase life cycle assessment of residential building practices, *A Life Cycle Approach to Prioritizing Methods of Preventing Waste from the Residential Construction Sector*, recently released by the State of Oregon Department of Environmental Quality. The Oregon DEQ report, prepared with the assistance of the Oregon Home Builders Association, Quantis and Earth Advantage Institute, analyzed the best ways to reduce greenhouse gasses and waste generation from the residential construction sector. The report presents a thorough study of various construction methods to measure and quantify the overall environmental benefit of design and construction practices available to residential builders.

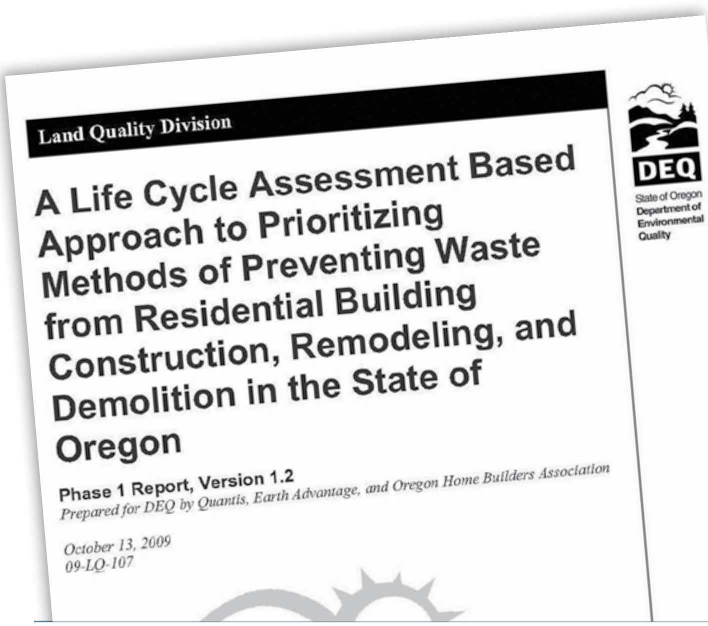
The report identifies 25 construction techniques, analyzes the broad environmental impact and ranks the techniques for overall resource efficiency. In other words, the study provides an indication as to how to create the most efficient living quarters considering all phases of the life of the structure. The life cycle study considers resource harvesting, transportation, milling and fabrication of materials as well as the construction, remodeling and demolition along with energy consumed during occupancy.

The study examined energy use and waste at all stages of a home's life. Interestingly, use and occupancy contribute in excess of 80% of the total climate change impact over the projected 70 year life of the home. The materials production stages (including original and replacement materials) contributed only 12% overall, followed by transportation of materials and workers to and from the construction site at a miniscule 4%.

The Oregon Department of Environmental Quality found that insulating concrete forms and structural insulated panels were among the best building practices to reduce greenhouse gasses and waste generation. The stated goal of the project was to identify and characterize building practices that are likely to prevent waste and to determine which of those practices provide the greatest net environmental benefit.

Of the 25 practices evaluated, ICFs and SIPs were ranked 3rd and 6th overall in net climate change. The number 1 and 2 spots were claimed by multi-family housing and building a smaller home. Although there are efficiencies gained by housing people in multi-family structures or 1,100 square foot houses, comparing those options to alternate building material used in single family houses does not provide any useful information to builders. The efficiency gains of SIPs and ICFs could also be realized by smaller home and the multi-family structure resulting in even greater net environmental benefit.

DEQ's comprehensive life cycle analysis was broken down into four stages: construction, occupancy, re-model and demolition. To illustrate just how comprehensive the study was, the energy and resource use at the construction stage included energy used harvesting and manufacturing of building materials, transporting materials to the site, energy consumed building the home and even energy consumed by laborers commuting to the construction site. Obviously the study is an expansive assessment



Land Quality Division

A Life Cycle Assessment Based Approach to Prioritizing Methods of Preventing Waste from Residential Building Construction, Remodeling, and Demolition in the State of Oregon

DEQ
State of Oregon Department of Environmental Quality

Phase 1 Report, Version 1.2
Prepared for DEQ by Quantis, Earth Advantage, and Oregon Home Builders Association

October 13, 2009
09-LQ-107

of the universal impact of providing shelter. It is not simply focused on cut plans, tight design, quality control and reduction of scraps at the job site, but a thorough assessment of the most efficient method for providing living spaces.

Life cycle research is still considered to be a relatively new environmental assessment tool representing sophisticated data modeling for a variety of impact categories. Climate change or global warming potential is a measure of CO2 generated. Nonrenewable primary energy use is the consumption of fossil and nuclear resources through all stages of the life cycle. Human health impact is an attempt to quantify the generation and release of toxins and other factors that affect human health and is measured in units of disability-adjusted life years which combines estimations of morbidity (illness) and mortality. Ecosystem quality measures the activity's impact on an ecosystem by assessing the acidification, eutrophication, toxicity to wildlife, land occupation and unspecified other mechanisms. Resource depletion is caused when nonrenewable resources are consumed or when renewable resources are consumed at a rate greater than the rate of renewal.

Even with the comprehensive consideration of energy use in the acquisition and fabrication of the materials to build the house and the energy use in construction, it was the use of the home as a dwelling that consumed the vast majority of energy throughout the home's projected life. Therefore, the efficiency gains in heating and cooling afforded by SIPs and ICFs resulted in a significant advantage over other construction practices. In addition to the overall ranking, SIPs and ICFs also did well in the individual categories: waste generation, climate change impact, non-renewable energy use, human health impact, ecosystem quality impact and resource depletion impact.

SIPs and ICFs had a significantly lower climate change impact and non-renewable energy use impact than wood, plywood and fiberglass. SIPs and ICFs also trumped wood, plywood and fiberglass in measure of human health impact, ecosystem impact and resource depletion. By comparison, SIPs performed better than intermediate framing, advance floor framing, advance framing with drywall clips, double wall, and staggered stud. The report stated that, "many of the limitations of wood-frame construction are overcome with structural insulated panels." Additionally, the report found that because of the radical reduction or elimination of wood framing and the associated thermal bridges, the overall performance of SIPs "exceeded the base case by a considerable margin." Regarding ICFs the report states, "as with SIPs, ICF does not have thermal bridges so this insulation is continuous across the entire wall surface."

This study will have far reaching benefits for the state of Oregon and will likely provide key information in future policy development. In summarizing the key implications, conclusions and recommendations, particular emphasis was given to:

- Future policies that reverse the trend in increasing house size and even modest decreases in home size that would likely improve environmental outcomes;
- Material reuse and environmentally preferable materials selection should require thorough analysis of individual materials and components; and
- Wall framing practices should be selected based on their overall environmental profile rather than specific environmental attributes.

For more information see www.oregon.gov/DEQ.

Lifecyle Benefits of SIPS

A life cycle analysis conducted by Franklin Associates for the EPS Molders Association SIPs Work Group shows SIPs yield exponential environmental benefits compared to traditional stick framing. The SIPS LCA Study presents a powerful case for the significant contributions SIPs provide in making homes more efficient, comfortable and environmentally sustainable. U.S. results demonstrate an average savings of 9.9 times the amount of energy expended when using SIPs compared to traditional stick framing and a reduction in global warming potential by 13.2 times the CO_2 equivalent of the emissions produced. This represents an energy payback period of 5.1 years and a recapture of greenhouse gas emissions in 3.8 years for using SIPs. Results are even more impressive for Canada, returning the energy invested in 2.7 years, and the emissions in 2.7 years.

Meeting Passive House Standards with SIPS

by James Hodgson

Developed in Germany during the mid 1990s, Passive House (or Passivhaus) design criteria target an aggressive 90% reduction in a building's heating energy consumption compared to typical building methods. This includes commercial and institutional buildings, as well as homes. Structural Insulated Panels (SIPs) made of expanded polystyrene (EPS) and Oriented Strand Board (OSB) can provide the tight building envelope and superior insulation required by the Passive House criteria, as well as meet the design needs of other highly energy-efficient buildings.

Under the Passive House standards, designers approach the building's heating and ventilation needs in a comprehensive, systematic fashion that minimizes energy losses and maximizes energy gains. They achieve this by boosting the insulation, sealing air leaks and eliminating thermal bridging, while using passive solar heat and captured heat from people and equipment. As a result, a Passive House may not even need a furnace.

While other green building rating systems include energy efficiency elements, what sets Passive House apart is a zealous attention to virtually every building component, system and siting decision that influences energy consumption. A Passive House Planning Package (PHPP) – an energy modeling program – evaluates a building's materials and type of construction, orientation and local weather conditions, among other factors.

While Passive House buildings are still rare in the United States, more than 15,000 single-family homes, multifamily residences, schools, offices, and other buildings have been built or remodeled in Europe.

Passive House performance characteristics, as called for by the Passive House Institute U.S. (PHIUS), are:

- An airtight building shell with less than 0.6 air changes per hour at 50 pascal pressure, measured by a blower-door test
- Annual heating requirements less than 15 kWh/sq m/year (4.75 kBtu/sf/year)
- Primary energy use less than 120 kWh/sq m/year (38.1 kBtu/sf/year)

Depending on the climate additional recommendations include low U-value windows, energy-efficient ventilation systems with heat recovery, and construction free of thermal bridges.

Although Passive House standards do not require SIPs, the panels support the design goals and performance characteristics very well. The large size panels have fewer gaps needing sealing than other construction methods (especially compared to stick framing) and reduce thermal bridging. Because the insulation is integrated directly with the structural elements, it is continuous throughout the panels, and is produced within a controlled setting, it tends to perform much better than is possible with components built and installed separately on the job site.

Research on EPS core SIPs conducted by the USDOE's Oak Ridge National Laboratory underscores these points.

In blower door tests, the lab found that a SIP room was 15 times more airtight than one built with conventional wood framing (leakage rate of 8 cubic feet per minute at 50 pascals compared to 121 CFM50).

The lab's research also showed that SIPs outperform stick construction in whole-wall R-values, taking into account the entire wall assembly, including heat transfer through the structural members, at corners and other joints, and around windows. For walls of similar thickness, SIPs had approximately 47% greater resistance to heat flow (R-value of 14.09 for a 3.5-inch-thick foam core SIP compared to an R-value of 9.58 for 2x4 stud framing at 16 inches on center with fiberglass insulation).

Real-world applications of SIPs in a wide range of climates over several decades also support the lab's findings. Among such projects, Premier Building Systems has been working with several project teams that are designing and building Passive Houses with SIPs.

In a high-end custom home in Park City, Utah, 12-inch-thick SIP walls provide an insulating R-value of 48 compared to an R-value of about 19 for a typical wall built with 2X6 studs with fiberglass batt insulation. The SIP roof is also 12-inches-thick, with four additional inches of EPS attached, for an R-value of 68.

A more modest Hood River, Oregon, home meets the Passive House criteria in part with R-value 42 SIP walls and an R-value 60 SIP roof. The architect estimates that the total annual energy costs (not just heating and cooling) will be only about $185 per year – much lower than typical for that part of Oregon.

In Menlo Park, California, plans are underway for what is believed to be the Bay Area's first Passive House. The project team anticipates that the SIP home will be so well insulated that its heat exchange unit will require a filament only about the size of that found in a common hair dryer.

Whether Passive House standards will take-off in a big way remains to be seen, but building codes and homeowner/building owner preferences are increasingly driving demand for energy-efficient buildings. As a result, more design professionals are looking to advanced building methods such as SIPs to create high-performance building envelopes.

James Hodgson is the general manager for Premier Building Systems. ■

Additional Resources

Passive House Institute
http://www.passivehouse.us/passiveHouse/PHIUSHome.html

Our Passive House
http://www.ourpassivehouse.org

Passivhaus Institut
http://www.passivehouse.com

Cost Efficient Passive Houses as European Standards
http://cepheus.de/eng/index.html

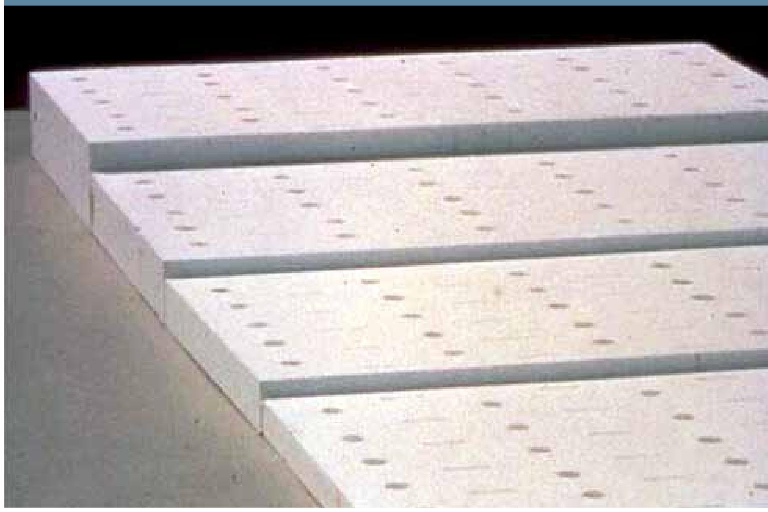
THE CUTTING EDGE

Insulation materials have long been recognized for their energy efficiency. After all, that's their primary function. Now, a new era of energy policy is driving the demand for increased efficiency. Incentives from all levels of government, as well as local utilities, are raising the awareness, desirability and affordability of energy-efficient homes and buildings. The U.S. Department of Energy (DOE) has introduced its Weatherization and Intergovernmental Program that provides grants, technical assistance and informational tools to states, local governments and utilities for their energy programs. These programs coordinate with national goals to increase the energy efficiency of the economy and aim to increase the adoption of cost-effective and efficiency technologies that will result in lower energy bills, improved air quality and greenhouse gas reduction.

Expanded polystyrene (EPS) meets these new energy policy demands, whether used to increase the efficiency of the average home, multifamily structure or commercial building. This issue of *EPS Newsline* presents several insulation related studies that show EPS products can help reduce energy consumption and contribute toward a sustainable future. One feature explores how EPS meets stringent Passive House criteria, while another examines an Oregon life cycle analysis that determines how EPS provides superior energy efficiency gains. Finally, another piece examines how students at Montana State University are utilizing EPS in an Ecosmart house that will serve as a real world source of data to help meet green building certification standards.

To find out more about EPS insulation products visit our website at www.epsmolders.org. ■

Betsy Steiner
Executive Director



Insulated Concrete Roof Decks

Engineered for Strength & Versatility

When structural concrete roofing applications demand high value insulation, EPS is the ideal choice for insulated concrete roof decks. EPS has a proven track record in roofing applications and is engineered to endure the life of the roof. It meets the needs of the most demanding building requirements and is capable of providing cost effective and consistent thermal performance.

EPS insulated concrete roof deck panels combine the strength, security, and structural integrity of concrete with the flexibility of lightweight expanded polystyrene forms. The result is a self-supporting joist-and-deck forming system that provides the maximum strength of a reinforced concrete deck with minimal materials and labor. This powerful system can be used in place of traditional floors, roofs, ceilings and tilt-up wall construction, and can be used on new and existing roof projects.

Strategically placed and sized holes penetrate the panels, allowing for monolithic bonding of the slurry coat and top pour. The panel holes keep the cement particles in suspension until they cure into a honeycomb matrix, providing superb structural adherence to the concrete slurry beneath the panels and the lightweight concrete above. No deck penetrations weaken the system and stress-causing joints directly under the roofing membrane are eliminated. Available in a variety of standard and custom sizes and thicknesses, the EPS panels can be easily sloped to ensure maximum drainage.

EPS insulated concrete roof deck can be fabricated during manufacture to meet specific design dimensions. Because of its light weight EPS insulated concrete roof deck panels have excellent workability, one person can easily handle, shape and install the panels. They can be cut to shape with ordinary tools to ensure tight joints, thus eliminating heat loss.

EPS is non-hygroscopic and does not readily absorb moisture. Its closed-cell structure reduces the absorption and migration of moisture into the insulation material, which prevents warping, cracking, and buckling. In addition, EPS insulated roof deck saves heating and cooling costs by supplying consistent R-value over the life of the roofing system.

Advantages:

- Easily slopes to ensure drainage
- Long term thermal value
- Durable over the life of the roof
- Low moisture absorption
- Lightweight, reduces roof weight and is easily handled onsite
- Avoid tear off

Expanded polystyrene insulation meets extensive building requirements, including ASTM C578-04, Standard and Specifications for Rigid, Cellular Polystyrene Thermal Insulation and CAN/ULC-S701-01, Standard for Thermal Insulation, Polystyrene Boards and Pipe. More than 48 EPS manufacturers with hundreds of locations in the U.S. and Canada maintain numerous listings at Factory Mutual (FM), Underwriters Laboratory (UL), Underwriters Laboratory of Canada (ULC), International Code Council (ICC) and other test facilities representing various roof construction types.

EPS Rebuilds High School

The final chapter in the story of Hurricane Katrina for Salmen High School in Slidell, LA is now complete. Located on the shores of Lake Pontchartrain, Slidell was hit particularly hard by Katrina's wind and storm surge, which pushed over eight feet of water through the area. Salmen High School was all but demolished by the storm. When FEMA's assessment was complete, it showed more than 51% of the facility was destroyed beyond repair. Constructed in 1965, the 20 buildings damaged by the hurricane encompassed a combined area of 153,984 square feet and contained multiple classrooms, administrative offices, cafeteria, and a gymnasium.

The vow to rebuild the school included a pledge to build a sustainable structure that could endure the harsh potential of the Gulf Coast weather. The scope of the project was even more amazing based on the fact that they had to have the school ready for occupancy by fall 2010. An EPS insulating concrete floor deck and roof system offered the perfect solution for the fast paced construction schedule, and offered insulation and performance benefits that resulted in a durable, sustainable "safe haven" for over 500 students and 50 teachers at Salmen High School.

The twelve inch insulating floor and roof system was built on concrete piers with an additional 3" of EPS on top to increase the beam depths for added load and span capacity. EPS was also chosen for its exceptional insulation benefits as well as the additional sound reduction to the parking garages located under some of the classrooms.

At the ribbon cutting ceremony, U.S. Senator Mary Landrieu said the rebuilding of Salmen High School was crucial to the recovery of the community. Recounting efforts to rebuild the school, Senator Landrieu said, "Our delegation worked hard to get this job done, and it was a big job... the result was more green space, more parking, a beautiful campus and the best technology. Children are our heart and 100 percent of our future. We felt our first dollars and efforts should go to them." ■

Idaho Uses Geofoam for Major Bridge Project

Construction of a new Topaz Bridge over the Union Pacific Railroad and Portneuf Marsh Valley Canal east of McCammon, Idaho incorporates geofoam for the bridge approaches, the first project of its kind in Idaho. The four-lane structure will be 613 feet long and include the state's longest center span – 320 feet.

Due to high water content in the soil under the west approach, engineers turned to EPS geofoam for its high compressive strength and low weight ratio. Conversely, conventional materials would make the fill easily susceptible to settlement and therefore compromise the highway. Engineers turned to EPS geofoam as an alternative. The use of geofoam in bridge approaches avoids the problem of excessive settlements and affords savings in construction time.

Geofoam was installed in perpendicular layers on the west bridge approach and will be covered with shotcrete before completion of the highway segment. When finished the approach will be about 30 feet high, 500 feet long and contain the equivalent of 22,000 cubic yards of foam blocks. Construction began in April 2009, the estimated construction completion date is August 2011. ■

EPS Member Companies

ADLAM Films, Inc
AFM Corporation
Alamo Foam
Arvron, Inc.
Atlas EPS
BASF Corporation
Beaver Plastics Ltd.
Cellofoam North America, Inc.
Comel S.N.C.
Concrete Block Insulating Systems, Inc.
Createc Corporation
DiversiFoam Products
Drew Foam Companies, Inc.
Epsilon Holdings, LLC
Flint Hills Resources, LP
FMI-EPS, LLC
Free Form Factory LTD
Georgia Foam, Inc.
Groupe Isolofoam
Harbor Foam
HIRSCH Americas, LTD
Houston Foam Plastics
Insulation Corporation of America
Insulation Technology, Inc.
Insulfoam LLC
Intertek
KBM ApS
Kurtz North America
Lanxess Corporation
Le Groupe LegerLite, Inc.
Loyal Group/Foam Products NA, LLC
Mansonville Plastics(BC) Ltd.
Mid-Atlantic Foam
Nexkemia Petrochemicals, Inc.
Northwest Foam Products, Inc.
NOVA Chemicals, Inc.
OPCO, Inc.
Plasti-Fab Ltd.
Plymouth Foam Inc.
Polar Industries, Inc.
Powerfoam Insulation, Div. of MetlSpan LLC
Produits Pour Toiture Fransyl Limite
Progressive Foam Technologies, Inc.
Promass SRL
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