

## Wood Structural Panel and Foam Insulation Systems

### Background

The latest International Energy Conservation Code (IECC) and building science recommendations have driven up demand for foam insulation in most climate zones. Installation of wood structural panel (WSP) sheathing over foam insulation creates the need for wall cladding, such as lap siding or vinyl siding, to be installed over WSP as nailable sheathing. On the other hand, many builders have elected to install foam insulation over WSP sheathing.

Structurally speaking, installing WSP sheathing directly to studs (i.e., foam over WSP) is better. However, this method may create a risk of moisture problems in some climate zones because low permeability of foam insulation could reduce the drying potential of wood-frame walls. In addition, installation of wall cladding over foam insulation is a major concern because of the lack of fastener holding capacities on foam insulation. Therefore, a joint venture agreement between the USDA Forest Products Laboratory (FPL) and APA—The Engineered Wood Association was initiated in May 2011 to investigate hygrothermal performance of wood-frame walls installed with foam insulation over WSP sheathing. Use of WSP as nailable sheathing for WSP over foam applications will also be investigated.

### Objective

The objective of this project is to evaluate the possibility of combining WSP sheathing and foam insulation in wood-frame wall applications to satisfy both structural and energy conservation code requirements.



WSU Natural Exposure Test facility.

### Approach

This project will be implemented in two independent tracks:

*Track 1: Hygrothermal Study*—Moisture movement through wall assemblies when foam insulation is installed over WSP sheathing will be studied. We will investigate both the potential for moisture accumulation and the drying capability of the walls. APA and FPL researchers will collaborate to evaluate the moisture performance of this wall configuration using a one-dimensional computer hygrothermal model (WUFI Pro 5.2) and the new Chamber for Analytic Research on Wall Assemblies exposed to Simulated weather (CARWASH) at FPL. In addition, full-scale walls will be constructed in the field using the Washington State University (WSU) facility at Puyallup, Washington, to monitor (1) moisture movement through the wall in response to natural outdoor environmental hygrothermal loads and (2) drying potential in response to controlled wetting of the WSP.

Four wall assemblies will be constructed to study the effect of wall orientation (south and north) and exterior insulation type (low-permeance extruded polystyrene and high-permeance rigid mineral wool).

*Track 2: Structural Performance*—Two sub-tasks will be conducted:

- Racking resistance—Racking resistance of wall assemblies when WSP sheathing is installed over foam insulation will be evaluated through full-scale shear wall tests conducted at the APA Research Center in Tacoma, Washington, using the ASTM E 72 monotonic test method.
- WSP sheathing as nailable sheathing—Collaborative research with the Institute for Business and Home Safety (IBHS) will evaluate WSP as nailable sheathing through full-scale wind tunnel tests. These tests may not include the foam insulation, because the main purpose of the tests is to evaluate withdrawal and nail-head pull-through resistance of the connection.

The IBHS Research Center (<http://ofb.ibhs.org/research>) is a unique, state-of-the-art, multi-risk applied research and training facility on a 90-acre parcel of land in Chester County, South Carolina, approximately 45 minutes south of the Charlotte Airport. This facility is designed to advance building science by enabling researchers to more fully and accurately evaluate various residential and commercial construction materials and systems.

### Expected Outcomes

This project is expected to provide information that will advance the use of WSP sheathing and foam insulation in wood-frame wall applications:

- Hygrothermal performance data for foam-over-sheathing applications in Marine 4 Climate Zone
- Bracing-wall performance data for sheathing-over-foam applications
- Test data for using wood structural panels as nailable sheathing

### Timeline

Track 2 of this project will be completed by September 30, 2013; Track 1 will be completed by September 30, 2014.



IBHS Research Center's wind tunnel test facility.

### Cooperators

APA—The Engineered Wood Association  
 USDA Forest Service, Forest Products Laboratory  
 Washington State University  
 Insurance Institute for Business & Home Safety

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