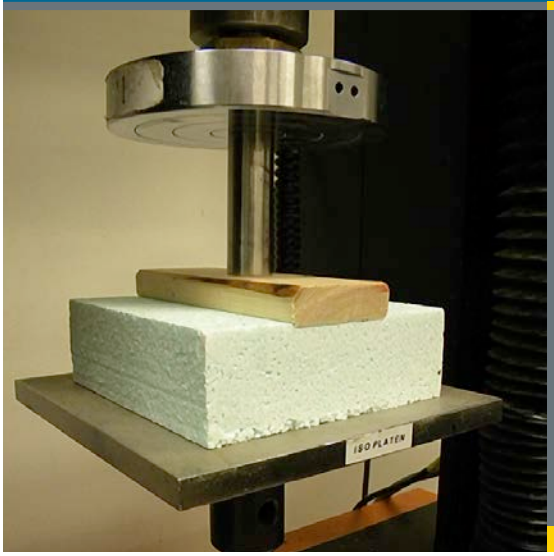

Building America Case Study

Technology Solutions for New and Existing Homes

Cladding Attachment Over Thick Exterior Insulating Sheathing

PROJECT INFORMATION:

Project Name: Cladding Attachment Over Thick Exterior Insulating Sheathing

Partners:

Building Science Corporation
www.buildingscience.com

The Dow Chemical Company
www.dow.com

James Hardie Building Products
www.jameshardie.com

Building Component: Building envelope component

Application: New and/or retrofit; Single and/or multifamily

Year Research Conducted: 2011 through 2012

Applicable Climate Zone(s): All

The addition of insulation to the exterior of buildings is an effective means of increasing the thermal resistance of wood-framed walls and mass masonry wall assemblies. The location of the insulation on the exterior of the structure has many direct benefits, including better effective R-value from reduced thermal bridging, better condensation resistance, reduced thermal stress on the structure, as well as other commonly associated improvements such as increased airtightness and improved water management. For thick layers of exterior insulation (more than 1.5 in.), the use of wood furring strips attached through the insulation back to the structure has been used by many contractors and designers as a means to provide a convenient cladding attachment location.

Although the approach has proven effective, there is significant resistance to its widespread implementation due to a lack of research and understanding of the mechanisms involved in the development of the vertical displacement resistance capacity. In addition, the long-term in-service performance of the system has been questioned due to potential creep effects of the assembly under the sustained dead load of the cladding and effects of varying environmental conditions. In addition, the current International Building Code (IBC) and International Residential Code (IRC) do not have a provision that specifically allows this assembly.

Researchers from Building Science Corporation, a U.S. Department of Energy Building America team, investigated these issues to better understand the mechanics behind this method of cladding attachment. They examined the impacts on the vertical movement potential of cladding systems resulting from gravity dead loads as well as environmental exposure. The research was critical in developing a better understanding of how to design the cladding attachment system and what some of its limitations may be.

Building America SM
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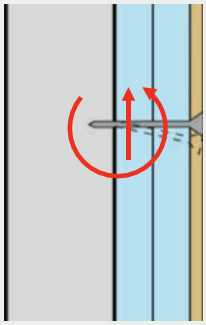
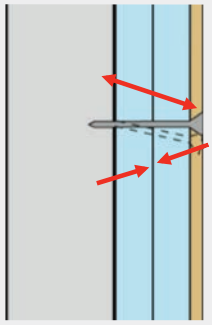
Load Components

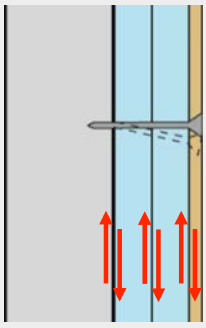
Shear and rotational resistance provided by fastener to wood connections.



Rotational resistance provided by tension in fastener and compression of the insulation.



Vertical movement resistance provided by friction between layers.



For more Information, see the Building America report, *Cladding Attachment Over Thick Exterior Insulating Sheathing,* at: *www.buildings.energy.gov*

Image credit: All images were created by the BSC team.

Exterior environmental exposure testing examined four types of insulation materials. Each test panel was constructed with two layers of 2-in. thick insulation and loaded to three different load magnitudes (8 pounds [lbs], 15 lbs, and 30 lbs per fastener). Researchers recorded the downward and upward vertical movement of the furring strips over a period of about 70 days. Daily movements were on the order of ±1/32 of an inch.

Lessons Learned

- Assemblies with lightweight claddings, such as vinyl, wood, and fiber cement, typically result in a small loads (less than 8 lbs/fastener), and demonstrated very good initial as well as long-term performance in an exposed environment. These results are consistent with current construction experience.
- Heavier claddings, such as stucco and adhered stone veneer, may result in larger loads (15 lbs/ fastener up to 30 lbs/fastener), and demonstrated more potential for long-term creep movement. Additional research is required.
- The bending capacity of the screw fastener varies greatly with the length of the cantilever, and may not play a significant role in the total system capacity for thicker layers of exterior insulation.
- The compression strut formed by the insulation resisting the inward movement of the furring was a measurable effect. Other unanticipated factors affected the test results, however, so a clear measure of the magnitude of the effect was not achieved.
- Friction between layers can play a significant role in the total system capacity, although the forces that affect the amount of friction can be highly variable in the initial installation and during long-term use due to expansion and contraction of materials.

Looking Ahead

The work completed to date provides much of the background necessary to allow for more widespread adoption of this approach. More research is needed, and the final goal is to provide support for the development of prescriptive design tables to be incorporated into the IBC and IRC.

U.S. DEPARTMENT OF ENERGY
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