Building America Case Study

Excavationless: Exterior-Side Foundation Insulation for Existing Homes

Minneapolis, Minnesota

PROJECT INFORMATION

Project Name: Excavationless Exterior Foundation Insulation Field Study

Location: Minneapolis, MN

Partners:

Cocoon, *cocoon-solutions.com*

Urban Homeworks, *urbanhomeworks.org/*

BASF, *basf.us*

American Environmental, LLC

Northern*STAR* Building America Partnership

Building Component: Foundation insulation

Application: Retrofit; single-family

Year Tested: 2013

Applicable Climate Zones: All

PERFORMANCE DATA

(of the measure alone, not whole house)

Cost of energy efficiency measure: $3,800 to $5,874 for hydrovac excavation and insulation of 128 linear ft foundation and 768 ft^2 insulation area

Projected energy savings: Minimum 7%–8% whole house energy savings

Installing exterior (soil-side) foundation insulation is the optimal method to enhance a home's hygrothermal performance to promote energy savings, structural integrity, comfort, and occupant health. With an existing home, however, this can be costly and disruptive. It requires: (1) excavating a deep hole by backhoe; (2) stockpiling soil; (3) moving underground utilities; and (4) replacing landscaping and constructed elements. Thus, most existing homes are insulated from the interior at great risk to building durability and occupant health.

The U.S. Department of Energy Northern*STAR* Building America team conducted a field study of an innovative, minimally invasive foundation insulation upgrade technique for existing homes called *excavationless*. It combines two mature systems—hydrovac excavation technology and liquid foam insulation—into a new process. The hydrovac technology uses pressurized water combined with vacuum extraction to dig a precise trench (3–4 in. wide) around the foundation with minimal disruption to landscaping. It exposes buried utilities for inspection and location; thus, it is unlikely to damage nearby utilities. The long, flexible vacuum hose can tunnel under obstacles such as sidewalks and stoops.

> *"To be able to remove soil from around an entire foundation with little or no damage so you can insulate and water proof is a major breakthrough,"*
>
> – Anonymous builder from a CEU class in Minneapolis

BASF provided the liquid hydrophobic closed-cell polyurethane foam insulation, R-5 per in., which is used below grade, in contact with soils and moisture, and adheres to smooth and rough surfaces. The foam used above grade was a combination of the BASF liquid foam against the foundation with rigid extruded polystyrene (XPS) on the outside to provide a smooth surface for the finishing parge coat.

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Description

The liquid foam is easily applied in the trench. It conforms easily to the space below and strongly adheres to rough, uneven surfaces.

XPS foam is used in conjunction with the liquid foam above grade. It holds the foam in place and provides a smooth surface for a parge coat.

Hydrovac trucks have been used for decades. They can move 5,500 cfm of air and remove debris at 220 mph.

For more information, see the Building America report, *Excavationless Exterior Foundation Insulation Field Study,* at: *buildingamerica.gov*

Image credit: All images were created by the Northern*STAR* team.

The excavationless process uses hydrovac technology to cut a precise 3–4 in. wide trench to a desired depth. The pressurized water loosens soil around the foundation while the vacuum extraction process removes the water-soil slurry. Once clean, the trench can be filled with liquid foam insulation.

Lessons Learned

- The hydrovac excavation technology took less than 12 hours to create a 4-in. wide trench, 128 linear ft, to a depth of 4 ½ ft without excavating or stock-piling soil.
- The pressure wand and vacuum are flexible to enable digging under utilities, obstacles, and constructed structures so those elements don't need to be moved, demolished, or replaced.
- A variety of obstacles, including rocks and construction debris, can be encountered when digging around an existing foundation. Large obstacles may need to be manually removed.
- This field study identified ways to improve the next installation. One example is the use of the XPS/liquid foam combination from the rim to the bottom of the trench. The hydrovac contractor estimated that the same foundation would take 50% less time than the first. Together, these improvements could result in an excavationless process that costs 50% less than traditional excavation (not including the extra costs incurred by traditional excavation such as replacing landscaping, structures, and utilities).

Looking Ahead

This measure has a broad market. Homes with uninsulated foundations, including those with full basements, partial basements, crawlspaces, and slabs, number in the tens of millions. Homes with finished basements, expensive landscaping, and barriers such as porches, as well as homes in need of waterproofing, drain tile, or repair can also benefit from this technology.

U.S. DEPARTMENT OF ENERGY
Energy Efficiency & Renewable Energy

For more information, visit:
buildingamerica.gov

The U.S. Department of Energy's Building America program is engineering the American home for energy performance, durability, quality, affordability, and comfort.

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