



Building America Case Study

Advanced Extended Plate and Beam Wall System in a Cold-Climate House

Mount Joy, Pennsylvania

PROJECT INFORMATION

Construction: New home

Type: Single-family

Partner: Home Innovation Research Labs,
homeinnovation.com

Builder: LCCTC, Mount Joy, PA

Size: 2,660 ft² above grade, 3,990 ft² conditioned area

Price Range: \$300,000

Date Completed: June 2015

Climate Zone: Cold (IECC 5A)

PERFORMANCE DATA

HERS index score: 45
(DOE ZERH target index: 48)

Projected annual energy cost savings:
\$1,163

Incremental cost of energy-efficiency
measures: \$14,309

Incremental annual mortgage: \$828

Annual cash flow: \$335

Billing data: Not available

A zero energy ready home (ZERH) was recently completed that features an innovative wall system. This highly insulated (high-R) light-frame wall system, called the extended plate and beam (EP&B), is for use above grade in residential buildings. The U.S. Department of Energy (DOE) Building America research team Home Innovation Research Labs featured this system in a new construction test house (NCTH).

The EP&B wall design significantly increases insulation value, reduces framing factors, and effectively manages moisture. It relies on common methods and materials for framing, air sealing, insulation, drainage plane, and siding attachment. The EP&B wall design combines optimized framing that features insulated structural rim headers with integrated rigid foam sheathing to increase R-value and reduce thermal bridging. The foam sheathing is installed between the wall studs and structural wood sheathing. The wood sheathing is attached directly to a framing extension that is formed by the extended top and bottom plates. The target nominal insulation values are R-25 for 2×4 walls and R-30 for 2×6 walls.

Home Innovation Research Labs partnered with Lancaster County Career and Technology Center (LCCTC) to build this NCTH. This vocational high school has a Construction Technology program in which students gain practical experience building real houses that incorporate state-of-the-art, energy-efficiency, and green technologies. The homes are listed for sale upon completion. This NCTH features an EP&B wall system with 2×6 stud framing and 2 in. of extruded polystyrene insulation for a total nominal insulation value of R-31 (R-10 foam plus R-21 blown cellulose in wall cavities).

Key Features

TEST HOUSE

- High-efficiency, two-stage, air-source heat pump system (16 SEER, 9.8 HSPF)
- R-31 EP&B wall assembly
- R-29 foundation wall insulation
- R-49 insulation in vented attic
- U-0.30/SHGC-0.28 windows
- 100% high-efficacy lighting
- Solar thermal preheat domestic hot water system

EP&B WALL SYSTEM



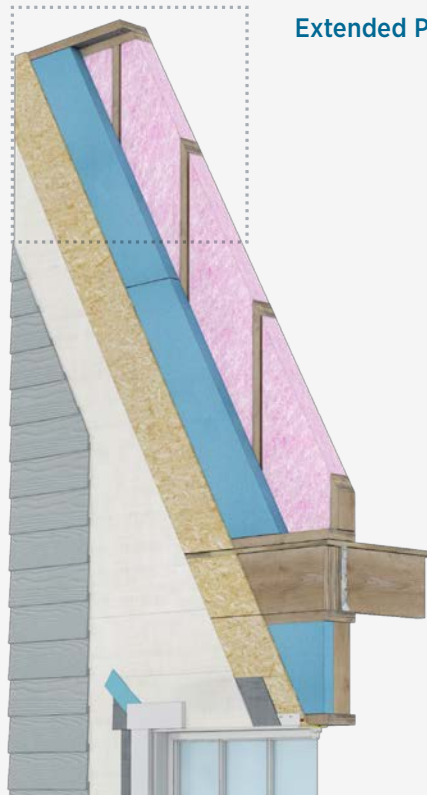
Sheathing over foam wall assembly



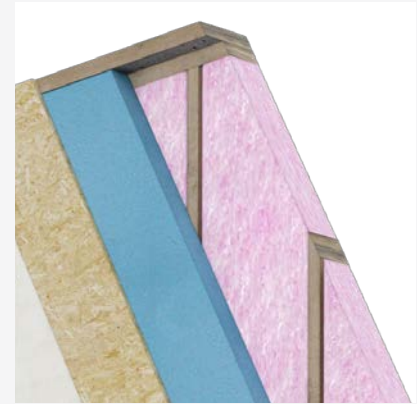
Typical wall section installation

For more Information see the Building America report *Advanced Extended Plate and Beam Wall System in a Cold-Climate House* at buildingamerica.gov.

Image credit: All images were created by the Partnership for Home Innovation team.



Extended Plate and Beam



- Plates and studs are different width
- R25 (2 × 4 studs and 2 × 6 plates)
- R30 (2 × 6 studs and 2 × 8 plates)

Lessons Learned

- This first field demonstration of the EP&B system was successfully completed with positive feedback from the design team and the construction crew.
- The evaluation confirmed the premise for introducing the system—it provides a practical way for the building industry to achieve a high-R wall system.
- The wall system is expected to minimize transition risks and costs to builders that are interested in adopting a high-R enclosure.
- EP&B offers design flexibility in the selection of framing and insulation combinations to optimize the overall R-value as needed to meet the specific energy savings targets.
- The wall system was integrated with the air barrier without requiring special air-sealing measures. Conventional air-sealing methods resulted in a tight building envelope (1.9 air change per hour at 50 Pascals).
- The exterior wood sheathing can dry to the exterior, provides a clear drainage plane and flashing surface for window and door openings, and provides a nailing surface for siding attachment.
- This project outlined a cost-effective 44% energy savings solution package over the Building America benchmark for a cold climate and earned DOE ZERH certification.