

University of Minnesota – 2010 Annual Report

Overview

Much of the current University of Minnesota housing research is focused on building technology and environmental issues specific to the north central region of the United States. An informal network of approximately a dozen researchers from a wide range of disciplines are concerned with solving problems associated with the design, construction, renovation, and operation of buildings in cold climates. There are several new initiatives at the University to increase research efforts in the housing arena. The Affordable Housing Initiative, led by the Center for Sustainable Building Research, has been funded by a non-profit foundation to support the Minnesota Housing Authority's Green Communities efforts. The newly formed Bioproducts and Biosystems Engineering department has proposed an "advanced building systems center" built around the existing Cold Climate Housing and Bioproducts Marketing and Management programs. The Institute for Renewable Energy and the Environment and the newly created university-wide Institute on the Environment have both announced support for programs focused on building efficiency. The University of Minnesota Extension has a full-time Regional Extension Educator in Housing Technology and the Cold Climate Housing (CCH) program has created a new position focused on affordable housing technologies. CCH and CSBR continue to serve as a focal point for regional research, technology transfer, and outreach to the home design and building industry.

Part 1: Current Activities in Research

Industry support has dropped significantly in 2010 due to the housing downturn. However, an industry funded project to evaluate various insulation and moisture management strategies for stucco and fiber cement board siding was conducted at the Cloquet Residential Research Facility this past year. Unfortunately, the Foundation Test Facility at Rosemount has been closed. The CCH staff continues to be active with the home building industry on both mandatory and voluntary building standards. The primary issues of concern are moisture management, foundation insulation, and green building. Below are three highlighted research initiatives – both ongoing and new—for 2010.

A. SEP/ETMMS (Structural Engineered Panel / Exterior Thermal and Moisture Management System)

We refer to this as a "studless" building system. It is essentially a monocoque construction methodology using 1-1/8" OSB (or in some cases a laminated 2-ply system). The structural system is then wrapped completely by a robust, self-healing moisture membrane (controls both liquid and vapor) from bottom to top, including the roof system. This is covered by XPS foam (1 to 2 inches under the slab, 2 inches on the foundation, 3 inches on the walls, and 5 to 6 inches on the roof). Furring strips are used on the walls to carry the siding and sleepers are used on the roof to accommodate venting, sheathing, and roofing. These houses have had blower door readings of 209 to 380 cfm at 50 Pascals. Obviously, we combine this aggressive envelope system with a carefully engineered, high efficiency HVAC system, including make-up air for exhaust devices. Our demonstration houses have been built with affordable housing groups. Additional product testing and hygrothermal evaluation that has been supported with a cooperative agreement with the US Forest Products Laboratory was completed in 2010.

B. NorthernSTAR Building America Team

The University of Minnesota is one of fifteen project teams nationwide chosen by the U.S. Department of Energy to help develop cost-effective solutions to reduce the average energy use of housing, while improving comfort, durability, and indoor air quality. Building America works with research teams made up of key members from the building industry in the production of advanced residential buildings. The NorthernSTAR Team will conduct systems engineering research to develop technologies and strategies to achieve the following goals:

- Develop retrofit strategies for existing homes that achieve significant energy savings while ensuring the safety and quality of the home
- Produce new homes on a community scale that use on average 40% to 60% less energy
- Improve indoor air quality and comfort
- Help home builders reduce construction time and waste

- Implement innovative energy-saving and material efficient technologies
- Improve builder profitability
- Provide new product opportunities to manufacturers and suppliers

Successful technology packages are chosen based on overall, whole-house cost and performance assessments, allowing the BA teams to achieve performance goals with little or no increase in builder or homeowner costs.

Part 2: Current Activities in Teaching

The Residential Building Science and Technology degree program continues to attract new students, but is considering a move to the engineering side of our department. Students would graduate with an engineering degree under our joint program with the College of Science and Engineering. This might require us to refocus the RBST minor to attract more students from non-engineering disciplines such as architecture, housing, and construction management. Also, programs in architecture, housing, and construction management have seen large increases in student enrollment over the past few years. A new Masters in Sustainable Design in the College of design has been very successful and some of those students are enrolling in the RBST courses.

Part 3: Current Activities in Outreach

Requests for outreach continue to be strong. While most requests for training are connected to green building initiatives, there is still strong interest in Best Practices for Moisture Control. The CCH and CSBR staffs continue to be involved in a variety of affordable housing technical assistance projects. CCH faculty remain highly engaged in national technology transfer activities including Building America, Healthy Homes and a variety of conferences including EEBA, Affordable Comfort, Better Buildings; Better Business, and the Energy Design Conference. Bill Angell, Director of the Midwest Universities Radon Consortium, continues to offer a solid slate of radon measurement and mitigation courses, including a newly developed online course designed for builders on Radon Resistant New Construction.

A. High-Performance Homes for Cold Climates This initiative is focused on high end training needs of the building industry to design and construct highly efficient, durable, and safe new homes. This year a full day course was developed on foundation insulation and moisture management.

B. Smart Green Remodeling: A Systems-Guided, Performance-Based Approach: As communities try to improve their housing stock, especially the vacant and boarded foreclosed homes, there is a need for a holistic approach that can address both current deficiencies and the long-term desired outcomes of a healthier, more durable and efficient home. Green remodeling programs are expanding opportunities to produce these outcomes and have less impact on the environment. *Yet home remodeling, no matter what “color”, can be a risky proposition.* Changes and upgrades can either make things better or worse, especially in homes that have existing performance (air quality, moisture, durability, energy-efficiency) issues. A “system’s-guided” approach helps to ensure that the remodel will enhance the performance of the home and diminish the risks to both the homeowner and the contractor. This workshop helps designers and remodelers apply building performance approaches to home renovations that can increase your profits and marketability, reduce call-backs and liability concerns, and result in homes that are far better for their inhabitants and the planet.

Major Plans for 2011

We will continue to develop the new “advanced building systems research and resource center” design and research agenda within the new departmental and collegiate structure. We believe next year will be a good year for housing research activities, especially in the areas of energy improvements and moisture transport relating to durability and indoor air quality concerns. We look forward to rebuilding some of our capacity and strength in our interdisciplinary research and technology transfer efforts.

Contacts

Patrick H. Huelman, Cold Climate Housing Coordinator
 Department of Bioproducts and Biosystems Engineering
 203 Kaufert Lab, 2004 Folwell Avenue, St. Paul, MN 55108
 Phone: (612)624-1286 email: phuelman@umn.edu