RESEARCH in Progress

Forest Products Laboratory

Innovative Technologies for Affordable Housing—Phase 2

Energy efficiency, durability, and good indoor air quality are essential in affordable housing. Although widely recognized, these desirable attributes are frequently compromised or poorly executed, leaving future homeowners with high utility, maintenance, repair, and replacement costs and poor air quality that could affect health and productivity.

Field testing in research house.

Background

Research on innovative technologies that can be applied to low-income and affordable housing is limited, and for the most part, these technologies remain untested. New technology is often rejected because of high first costs and unknown maintenance and operation costs. Important to the acceptance of new technology in the construction of affordable housing are minimizing first costs and providing clear information on potential costs related to energy use, moisture management, and durability.

Researchers at the University of Minnesota are testing a new and innovative structural engineered panel (SEP) wall system. The flat-panel system consists of a 1-1/8-in.-thick oriented strandboard (OSB) panel with an exterior vapor–moisture–air barrier and exterior insulation (the exterior thermal moisture management system, or ETMMS). Initial testing on three houses built using the SEP–ETMMS wall panel system indicates that they are extremely tight structures. Researchers now are testing moisture resistance of the *in situ* panels and ambient air quality inside the houses.

Objectives

The overall objective of this project is to investigate innovative building materials and systems that have the potential to enhance building performance while maintaining or reducing construction costs. This second phase of the project consists of testing several aspects of the performance of SEP structures. Based on phase 1 analysis and this phase 2 testing, the primary objective of this phase is to optimize a SEP-2 panel design for energy efficiency, moisture management, and indoor air quality.

Approach

Although ETMMS can be used with different wall systems (such as a traditional 2 by 4 framed wall), the SEP must be combined with ETMMS to be effective. In phase 2, the SEP–ETMMS design will be evaluated using alternative materials and results compared with conventionally insulated cavity construction. Phase 2 research is structured into three tasks: (1) Panel evaluation will focus on design, engineering, evaluation, and optimization of SEP-2, a rib-stiffened version of SEP coupled with the ETMMS wall system. The ribbed design will reduce weight, simplify panel connections, facilitate window and door installation, provide space

Advanced Housing Research Center
Forest Products Laboratory
Madison, Wisconsin

USDA Forest Service

U.S. Department of Agriculture
Forest Service • Forest Products Laboratory

Forest Products Laboratory

University of Minnesota

Using vertical SEP panels in construction of research house.

Completing the ETMMS and exterior finishes.

for utility services, and offer a variety of interior finishes. (2) Energy and moisture evaluation will focus on the hygrothermal behavior of the SEP–ETMMS design. Energy use in two houses will be monitored and compared with energy use models. Common sources of moisture and transport mechanisms involved in building mold and decay will be evaluated. Research will include moisture modeling and qualitative laboratory testing. (3) VOC evaluation will be conducted in an environmental chamber using panels with and without interior finishes. Indoor air in the existing structures will also be evaluated for VOCs, radon, relative humidity, temperature, and carbon dioxide.

Expected Outcomes

The primary outcome of this phase of the project will be documentation of a thorough evaluation and optimization of the SEP-2 and ETMMS wall system, information critical for adoption of SEP–ETMMS technology by the home-building industry.

Timeline

System evaluation and laboratory testing will begin in fall 2005. Field testing will commence in winter 2005. Final reporting should be complete by December 2006.

Cooperators

University of Minnesota, College of Natural Resources and College of Architecture and Landscape Architecture
Amherst H. Wilder Foundation
Greater Frogtown Community Development Corporation

Contact Information

Patrick H. Huelman
College of Natural Resources
University of Minnesota
St. Paul, Minnesota
(612) 624-1286, phuelman@umn.edu