

## Research–Demonstration House Development and Evaluation in North Carolina

### Phase II: Performance of Water Management Details for Windows and Doors

An interdepartmental team at Haywood Community College in Clyde, North Carolina, is building a house on campus for research and demonstration. The design and construction of this house is a cooperative undertaking of the Advanced Housing Research Center of the USDA Forest Service, Forest Products Laboratory (FPL), Haywood Community College (HCC), and the Environmental Research Laboratory at the University of Arizona. The purpose of the overall study is to acquire and disseminate knowledge regarding design, construction, and performance of a single-family residential building in the climatic region that includes Haywood County, North Carolina. This phase of the study focuses on evaluating the water management performance of windows and doors.

#### Background

Wind-driven rain usually constitutes the greatest moisture exposure for exterior walls. One key function of exterior walls is to keep bulk water out. If water penetration occurs, it can lead to deterioration of sheathing and framing, typically incurring costly repairs. A common location for water penetration, documented in numerous field investigations, is the interface between windows and walls. Guidance on installation details for windows and doors has changed considerably in recent years. There is a need for documentation of in-service performance of windows and doors installed according to recommended practices.

#### Objective

The objective of this study is to determine whether detectable water intrusion occurs over a period of at least three years where windows and doors are installed according to recommended water management practices.



Figure 1. Research–Demonstration house under construction at Haywood Community College, November 2011. Photo by John Mark Roberts.

#### Approach

Windows and doors will be installed using sill, jamb, and head flashings that are properly overlapped and integrated with the water-resistive barrier according to details outlined in APA's *Build a Better Home* program. A standard method for determining water intrusion by spray testing will be carried out at the house soon after window and door installation and again after approximately three years. Spray testing will be performed with siding installed. Testing will be well documented with regard to spray rate, distance, orientation, movement of spray nozzle, and duration of spray exposure. The first spray testing will be performed without insulation or interior finish installed. Interior trim around windows will be designed to be easily removed to facilitate inspection when spray testing is performed again three years later.



**Figure 2. House foundation was designed to minimize erosion and to include engineered wood products and locally harvested white oak posts.**  
*Photo by John Mark Roberts.*

In addition to spray testing, wood framing and sheathing below windows will be monitored hourly for moisture content and temperature using an automatic data acquisition system. This monitoring will continue for at least three years. Environmental conditions at the house—including indoor temperature and humidity, outdoor temperature and humidity, wind speed and direction, and rainfall—will be recorded on an hourly basis using data loggers and a weather station.

## Expected Outcomes

The project will document water-management performance of window and door installation methods over a period of three years, both under natural in-service conditions and under standard water spray testing. The findings will inform builders, educators and students, homeowners, architects, consultants, and researchers.

## Timeline

Windows, doors, and siding will be installed on the house during winter 2011–2012. Water spray testing will follow. Moisture sensors and the weather station will be installed by spring 2012. A first report is expected by late 2013. Final spray testing is planned for spring 2015, and a final report will be completed by late 2015.

## Cooperators

USDA Forest Service, Forest Products Laboratory  
Haywood Community College  
University of Arizona, Environmental Research Laboratory

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