RESEARCH in Progress

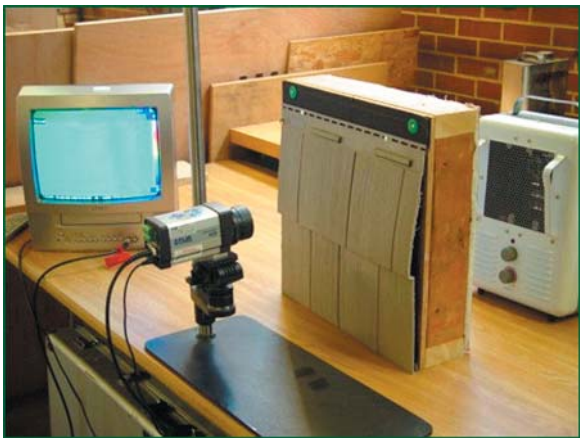
Forest Products Laboratory

Advanced Imaging Techniques to Detect Moisture and Leaks Inside Wooden Walls

Significant economic losses occur every year in the United States from severe decay damage in walls of wood-frame housing. Decay is found in high-moisture-content areas, which often result from leaks around windows, chimneys, ice dams, and pipes. Health risks are also associated with some molds that grow in these moist areas. Detecting incipient moisture problems inside the walls of wood-frame housing is crucial to appropriate maintenance and repair of the structure.

Background

Previous work has shown that x-ray imaging can detect defects in wood and is sensitive to the presence of moisture. Preliminary work has shown that new digital x-ray imaging techniques and portable x-ray sources have the potential for quickly and economically detecting high moisture levels inside residential walls. In addition, preliminary work has shown that thermographic imaging may serve as a competitive, or at least complementary, technique to x-ray imaging for quickly locating areas of high moisture. Compared with thermographic techniques, x-ray imaging techniques provide greater resolution but are more expensive and require more training. Traditional thermographic techniques are more difficult to implement because they rely on passive heating (ambient temperature), which is often difficult to control and interpret.



Experimental setup of thermographic camera and stud wall model.

Objectives

The ultimate goal of this research is to develop a technique to detect incipent moisture problems inside walls and roofs of wood-frame housing. The immediate objective is to evaluate the capabilities of digital x-ray photography and digital thermography to detect moisture and leaks in walls of wood-frame housing.

Approach

The research will be conducted in two phases. In the first phase (this current research program), sample walls will be fabricated and tested in the laboratory. Four types of wall construction will be tested under four moisture conditions. Parameters to be evaluated for x-ray imaging include spot size of the x-ray source and pixel size of the detector; for thermographic imaging, duration and types of active heat source (including through-wall and same-side heating). In the second phase (a future research program), the most effective configurations of both x-ray and thermographic imaging will be used in field trials on houses undergoing home inspections that expose the interior of walls for visual inspection. Results from the imaging techniques will be compared with results of visual inspections.

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Expected Outcomes

The results of this research will provide a better understanding of the potential and limitations of x-ray and thermographic imaging techniques to detect incipient moisture problems inside the walls of wood-frame housing.

Timeline

The first phase of this research program is expected to begin August 2005 and be completed in 12 months. If results of the first phase are promising, the second phase will begin August 2006 and be completed by July 2008.

Cooperators

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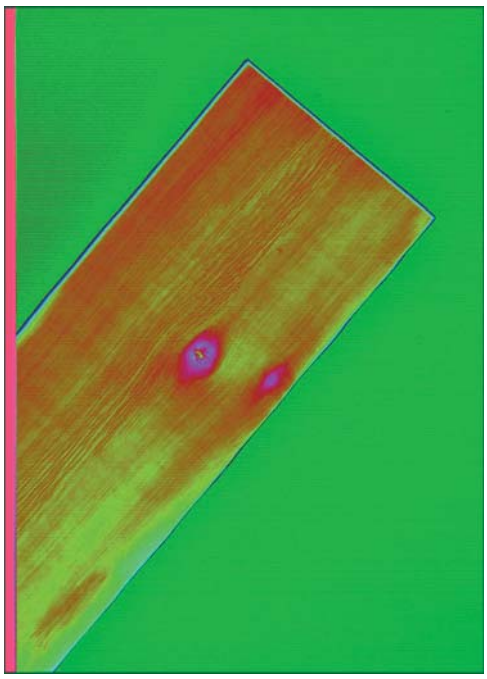
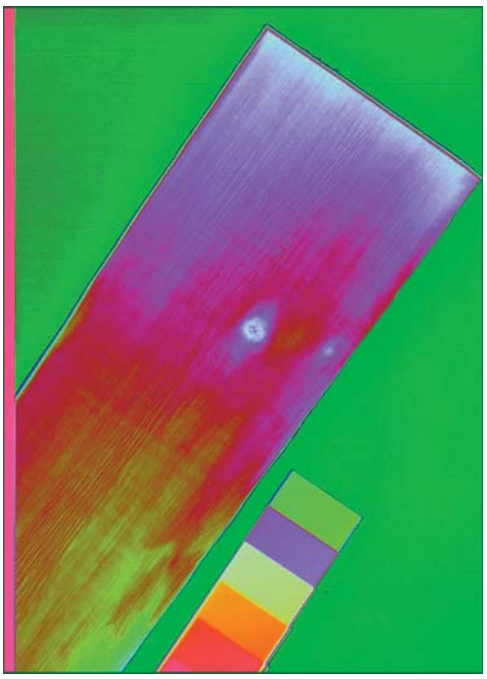


X-ray image of knots on oak specimen.



X-ray image of knots on oak specimen after soaking in water for 48 hours.