RESEARCH in Progress

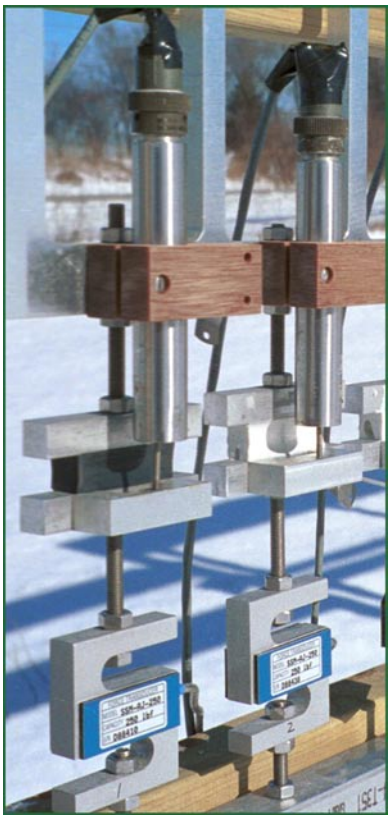
Advanced Housing Research Center
Forest Products Laboratory
Madison, Wisconsin

Predicting the Life Span of Sealants Used in Home Construction Applications

In the United States, numerous types of sealants are available for home construction. Consumers expect that these sealants will work properly and last a long time. However, manufacturers may not have completed lengthy outdoor exposure testing, currently the only reliable method to determine the service life of sealant formulations.

Accelerated test methods of sealant formulations have not yielded reliable predictions of service life. One problem is the lack of broad agreement on or fundamental understanding of the failure mechanisms in sealant formulations. In addition, the relationship between accelerated exposure and service-life results has inspired little confidence. This is because current accelerated test methods do not

- adequately consider the four major outdoor stress components—temperature, moisture, ultraviolet (UV) radiation, and joint movement;
- address the sealant interactions with the materials to which they are bonded; and
- account for the inherent cyclical nature of the stresses and strains that are placed on sealants.



Specimens exposed to cyclical loading outdoors. Apparatus includes attached force transducer and linear variable differential transducers (LVDTs).

Background

Sealants are used extensively in construction to protect the exterior shell of the structure against intrusion of moisture. Sealants are used on a variety of materials (including glass, metal, masonry, and wood) and are available in a wide range of formulations that provide various levels of adhesive strength, flexibility, resistance to heat and moisture, and service life. Other than the manufacturers' literature, little information is available on the life span of these sealants, particularly for those used in residential construction.

Objective

The objective of this research is to develop a reliability-based protocol that incorporates both accelerated and outdoor exposures for predicting the service life of various sealants used in construction. This protocol will then be used to develop standards, in cooperation with industry and standard-setting organizations, which in turn will improve industry confidence in accelerated testing.

Approach

Research will focus on exposure of sealants to cyclic fatigue in an outdoor environment and measure the response (load and deflection) and weather parameters (such as temperature and relative humidity) causing the material response. Two types of apparatus are used to produce cyclical loading by (1) moisture-driven dimensional changes of wood and (2) temperature-driven dimensional changes of aluminum.

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Samples will also be exposed to controlled cyclic humidity, cyclic temperature, and cyclic load in the laboratory. Data from outdoor and laboratory experiments will be used to construct a model for predicting service life of various sealant formulations.

Expected Outcomes

Outdoor and laboratory test protocols will be developed for reliably testing sealant formulation. Data will be used to develop standards in cooperation with industry and standard-setting organizations, such as the American Society for Testing and Materials (ASTM).

Timeline

Cyclic fatigue tests started in December 2001 using the wood-driven apparatus and in April 2004 using the thermally driven apparatus. The outdoor exposure will take three years. Laboratory tests are planned for late 2004 and early 2005.

Cooperators

We are receiving support through a Cooperative Research and Development Agreement between industry and the National Institute of Standards and Technology.

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