

## Session 6. Conference Synthesis

### Durability in Housing: Where Do We Go From Here? Summary of Conference Participant Viewpoints at Close-Out Session

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#### Overview of Session

The final session of the conference was provided as a forum for conference participants to discuss issues deemed critical to advancing the conference premise. As the moderator/facilitator, I sought audience participation to identify opportunities for cooperative action, to seek input on issues not addressed during the conference, to provide opportunity for opposing views on major strategies for advancing durability in housing, and to share individual action plans in the hope of identifying others with resources to contribute toward those goals. These ideas can be used to evaluate the R&D needs for this area and help establish a prioritized program to meet those needs.

The topical viewpoints were gathered and consolidated in this summary for ease of assimilation by the reader. This summary presentation of ideas and concerns was not intended to change the original intent of the speakers. The comments are categorized according to the session/topics presented in the conference. In many cases, I needed to expand and extrapolate beyond the speaker's comments to provide a holistic viewpoint of an R&D suggestion or implementation activity.

#### Summary of Viewpoints

##### *General Topics*

**Longevity of housing:** What is our expectation of how long houses should last? Some do-it-yourself folks build so that their "improvements" last until the house is sold to someone else. Bankers and the lending community expect the structure to last 30 years from the time that they initiate a mortgage on the structure. We also know that there is a service-life expectation after which the structure is functionally obsolete. Serviceability could mark the end of a house's useful function. Catastrophic failure of a home's structure caused by wind or earthquake may mark the end of its safe use. (One presenter lives in a 240-year-old house.) We need to think this through so that we can have a defensible target for our materials, systems, and designs.

**Life cycle costs:** Life cycle assessment (LCA) or life cycle inventory (LCI) tools are needed by designers. These methods of costing the entire system over its entire span of existence (i.e., costs of materials, energy of production, energy consumption during lifetime, maintenance, and disposal) will allow comparisons to be made among different systems, components, or materials. Progress in Europe on this topic is significant,

with Switzerland and Sweden leading the trend. LCI and LCA require much data on system performance, including durability, to provide accurate predictions.

**Environmental impact of materials and systems:** Green building systems are on the rise and will have consumer recognition within the next few years. Consumers are becoming aware of the impact of their purchasing decisions (a natural result of “thinking globally and acting locally”). This requires that we pay attention to the renewability, sustainability, and environmental impact of the materials and systems we advocate.

**Research needs and priorities:** A comprehensive research needs assessment is critical to undertaking the appropriate research in housing durability. We should target our research efforts according to a prioritization of the issues and problems. This is particularly true in the areas of building practices and design of housing systems.

### *Codes and Standards*

**Natural disaster mitigation:** We need to do a critical assessment of engineering requirements to mitigate the effects of natural disasters. Although the United States has a very good system of construction and insurance to handle the effects of major hurricanes, there are many tropical parts of the world that don’t recover quickly from these events. Homelessness can last for years when such an event occurs. We need to take a critical look at these situations and gather engineering ideas for solving these disaster management problems.

**ISO timber and lumber standards:** The secretariat for the Technical Committee on Timber and Lumber within the International Standards Organization (ISO) had been chaired by Russia and will soon be chaired by AF&PA; Bob Glowinsky or Ken Bland are contacts. Although this committee had been very quiet, this change in leadership promises to advance the type of standards needed to mitigate natural disasters.

**Caribbean housing initiative:** A conference was held in Puerto Rico in the aftermath of Hurricane George. The Caribbean is subject to not only hurricanes but also earthquakes. The 2-day forum, which was held in September 1998, was organized to discuss building codes, standards, and economic development. Conference sponsors included the U.S. Agency for International Development (USAID), NIST, World Bank, and Organization of American States. The conference was attended by representatives from more than 125 organizations. One of the key themes was natural disasters. There is significant interest in improving and enhancing the quality of construction in the Caribbean for economic reasons as well as human interests.

**Review of building codes for impact on durability:** An area of concern is that we assess building code requirements to make sure that we are all working toward the same objective. We should review our codes, in areas such as crawl space ventilation requirements, for their actual impact on durability. Could some parts of our codes be causing harm when used with new products or materials?

**Minimum property standards:** A clear way to assist the building industry would be to establish minimum property standards for housing by which we could quantify loads and develop a rationale for peak storm/load frequency. This is the type of information that is needed to develop the so-called global building code. These standard building codes would be useful in providing equivalent safety margins for short-term loading situations (earthquake, wind, or snow) regardless of location. A building code that would provide for enhanced structure depending upon local loading expectations would be quite sophisticated.

### *Building Practices*

**Lessons from existing housing systems:** Given the massive housing stock in place, we have much information to gain by making a connection between existing housing systems and new housing. We should be able to make inferences from problems witnessed and to quantify the behavior of existing structures. Shortcomings include a lack of tools for assessing the performance of existing structures, poorly

organized databases on housing problem areas, and inadequate documentation on appropriate retrofits for structures. These assessments should be the basis for improvements in new designs in wood construction.

**Improving environmental performance of existing housing stock:** Given the sizeable investment we have in existing housing and the inherent durability of housing (e.g., 50- to 100-year-old housing versus 5- to 15-year-old automobiles), we need to consider the rather slow pace at which we can make changes to our housing stock overall. If we only develop solutions for new construction, our impact will be limited. The PATH initiative targets reduction of greenhouse gases from our housing systems. It seems clear that we need to place much emphasis on improvements in our existing housing stock. A conscious decision must be made to wisely allocate resources and efforts between existing and new housing systems.

**Effect of do-it-yourself market:** Some of the do-it-yourself centers seem to be telling people that they can do most projects by themselves. Jobs such as painting the house or building an addition are seen as weekend work. Professional support for such projects will almost always result in a better job. We need to be more cautious about what we tell people they can tackle. Real estate professionals often see that projects done by homeowners lower the value of a house compared to not making any “improvement” at all. These types of improvements are also common in the industrial/commercial sector.

**Field testing of installed materials:** Testing of new materials and systems in the field should be undertaken prior to their introduction in the marketplace. We should be able to evaluate the builder’s real use of the product and find the most economical methods for installation. Affordable implementation of new systems could also be optimized through such field testing. We should be able to have new products evaluated by all homebuilding professionals, mechanical systems installers, and homeowners/maintenance personnel to assure that the new products can perform in the system.

### *Design/Systems*

**Categorizing housing system concerns:** Housing problems with wood durability can be categorized in three areas for R&D needs: decay, fire, and strength. Decay or aging resulting from exposure is related to designing a system adequately protected from the elements of nature. Fire becomes an issue of safety when building with this inherently combustible carbon-based material. Perhaps the most R&D has been done to quantify the strength of the materials and housing systems to resist short- and long-term load applications.

**Keeping systems simple:** Simplicity of design is critical to the success of wood housing as a “low-tech” system—perhaps not as simple as “two screws and a screwdriver,” but with quality as an integral part of the system. The systems approach requires significantly more attention to the interaction of materials, components, and all other systems.

**Integrating housing systems:** Systems integration in home building is typically done by the builder, not by an architect. This is the pre-build environment, where important system-wide components or changes in how materials interface can effect cost-savings and service life. These improvements are often incremental and rely upon a continuous feedback system in regard to system integrity and utility concerns. Labor turnover is a significant impediment to the continuous or life-long learning process that would make system integration successful.

**Developing expert systems:** The organization of information in the form of expert systems has been pursued by NIST for some years. Efforts have been focused on concrete for developing a computer integrated knowledge system (CIKS). This type of system should be developed for all major construction materials, with great care given to making the system consistent and uniform to allow direct comparisons with other systems. Work has been progressing in cooperation with the Steel Structures Painting Council (now the Society for Protective Coatings) to provide an expert system for disseminating information on protective coatings. Much has been learned from implementing a CIKS for these materials.

**Taking a systems approach to design and construction:** We've begun understand the importance of looking at buildings as a system rather than an amalgamation of assembled parts. Manufacturers need to be encouraged to think of their new products as part of a system, not products or materials in isolation. House wrap materials are a good example of how a material with good properties changes radically and may become a problem for a system when it gets wet. Manufacturers need to consider the combined effects of materials on overall performance.

**Developing strategies for home repair and upgrade:** The huge inventory of housing in the United States merits our attention to that investment. Our mission should be to provide awareness of possible design, building practice, or material durability problems. Work on alternative repair strategies for existing homes (for mundane deterioration problems) can reap vast rewards. Much has been done in this arena, so this might be more of an issue of dissemination of information rather than major new research efforts.

**Recognizing importance of catastrophic events in design and construction:** The sudden end of housing service life resulting from catastrophic events (e.g., hurricanes, tornadoes) compels attention to housing durability. The slow or gradual deterioration of housing systems that results from decay is not of concern if the system has design or construction deficiencies when it encounters severe wind or snow loads.

**Developing alternative and expanded uses for housing:** The adaptive use of buildings hasn't been addressed. Approximately 50% of our construction activity is in the arena of remodeling. Changes in housing stock accompany changes in lifestyle as families evolve and diversify. Our existing codes weren't really written for some uses, such as home-based businesses.

**Designing for maintenance and reuse or recyclability:** We need to address the waste created from activities reconstruction and remodeling. How can we design for removal, demolition, reuse, or recycling of buildings, components, and materials? We should provide accessibility for homeowners who attempt *to* maintain structures.

### *Materials and Products*

**Materials—a minor problem?** Approximately 15 years ago, the British Building Research Establishment evaluated repairs being performed on housing owned by municipal housing authorities (i.e., public housing). That study found that only 18% of repairs were the result of faulty materials. Most of the repairs were needed because of faulty design or construction. Although it may be difficult to translate this information into U.S. housing systems, this study clearly indicates that materials are the least of our worries.

**Green (undried) lumber:** The use of green framing lumber is seen as a limitation on the quality of construction in our housing stock. To reduce callbacks resulting from dimensional changes in green lumber, only dried materials should be used. Otherwise, builders will shift to alternative materials that don't generate consumer complaints.

**Finger-joint durability:** The inherent design of finger-jointed exterior trim dooms it for failure. The mismatch of grain causes the paint film to fail, creating a localized zone of deterioration. In a similar vein, siding manufacturers have tried to improve quality and performance by back-priming and/or prefinishing wood siding, which has caused some installers to eliminate all priming in the field. Building site end-cuts need to be primed or an inherent weakness is built into the siding protection system.

**Decline in lumber quality:** In a letter to the editor of a homebuilder's journal, a contractor commented on the continuing decline of lumber quality and suggested that the contributing cause was the grading rules. A grading agency responded that since grading rules haven't changed, lumber quality hasn't changed. Overall lumber quality has clearly declined. Although grading rules haven't changed significantly, for any given grade, a greater number of pieces have more of the allowed defects. If we don't put quality back into these

commodity grades, we're going to continue to see substitution of alternative materials in commodity markets.

**Increasing demand for wood products:** A large problem that we've all been working around is the impact of increasing demand on wood resources. Wood continues to enjoy good markets worldwide. This pressure on the supply nearly guarantees that quality of our raw materials will decline in the face of expectations that products will improve.

### *Technology Transfer and Education*

**New product training for builders and carpenters:** Training of the building community is an ongoing challenge. Introduction of new materials/systems is difficult because of the changing nature of the workforce (a result of the cyclical housing market). On-site design changes are typical for many wood-frame structures, and new systems may not be as robust and forgiving as traditional structural or exterior cladding systems. The AF&PA once published a book called *Designing Buildings for Permanence* (or something close to that). If this publication is still available, it might be worthwhile to update or supplement it. For approximately 20 years, the Extension Service of Minnesota has been sponsoring a 2-week training class for sales staffs of building material suppliers. This training provides somewhat unbiased information on products and systems to be passed on to homeowners and do-it-yourself folks.

**Quality construction for consumer investment in housing:** Homeowner and builder education efforts need to be implemented to reinforce the importance of quality construction. Builders with reputations and a commitment to quality and durability have a competitive edge in the marketplace. Consumers are especially keyed into the past performance of a builder since most referrals are from former clients or homeowners.

**National system for construction technology.** Development of appropriate vehicles for disseminating information on construction materials is a question that should be dealt with in this forum. The USDA has done this type of work in its Extension Program. NIST's Manufacturing Extension Partnership (MEP) Program is now precluded from working in the construction arena, but it could probably do a good job in this subject area. More than 100 MEPs nationwide disseminating information on manufacturing. The Civil Engineering Research Foundation (CERF) conducted a study to extend the mandate of the NIST's MEPs to include construction technology. CERF has produced two reports on the feasibility of forming Construction Technology Extension Partnerships (CTEPs). These reports could provide a basis improving the infrastructure related to housing durability.

**Education on paints and finishes:** A significant impediment to improved durability is relevant information on paints and finishes for builders or consumers. This area should not be such a mystery for most consumers. Sales staffs in retail outlets are typically not trained for disseminating the right information. A simpler, self-education vehicle for consumers is needed. Books on exterior finishes are good (e.g., *Finishes for Exterior Wood* published by the Forest Products Society), but they don't provide the level of information needed by consumers. FPL has developed short consumer-friendly *Finish Lines* to meet this need (see [www.fpl.fs.fed.us](http://www.fpl.fs.fed.us)).

**Market expectations and consumer education on wood finishes:** A problem for paints and finishes in the consumer marketplace is the wholly unrealistic expectation for how long finishes will perform. Consumers need to be told that exterior coatings for wood are sacrificial materials that erode away. These coatings need to be renewed or maintained on a regular basis to protect the underlying material.

### **Closing Comments**

We have many opportunities to achieve the overall objective of improving the durability of our housing stock. This discussion clearly indicates that there is much good work already underway, the potential to build new collaborative partnerships, and good reasons to be optimistic that we can implement new

approaches to improving housing systems. We need to improve housing system resistance to catastrophic events and ensure continued good performance through resistance to deterioration and timely maintenance.

Our efforts at this conference have laid the basic groundwork for a common understanding of the problems we face on the issue of durability in housing. Although it is premature to set research needs in priority at this time, we can identify some broad areas for further discourse. For next year's conference, we propose the following six topics:

1. Material performance in housing—Identify the problems that manifest themselves as shortcomings in our traditional materials and look for opportunities to improve the entire system.
2. Interactions between wood and nonwood materials—Develop a common understanding of properties and characteristics for successful and failed marriages between different materials in components as well as the housing system.
3. Systems integration—Explore expert systems (or other cross-discipline dialogue techniques) for optimizing housing systems across such functional areas as structural, HVAC, and water- and weather-proofing.
4. Emerging technologies—Explore new techniques, materials, components, and systems that promise to improve durability while reducing life-cycle costs.
5. Testing and evaluation—Develop methods for accelerated assessment of materials, components, and systems that reflect in-place builder-installed performance
6. Review of codes and standards—Develop performance expectations for housing as reflected in building codes and standards (both prescriptive and performance) along with approaches for streamlining the building regulatory environment for injecting new technology.



# A Forum on Durability Issues in Housing

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