The Building Science Advisor: A Web-Based Tool to Assess the Durability of Building Envelope Components

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Top challenges in envelope energy efficiency

- Moisture performance of energy efficient walls
- Moisture performance of energy efficient attics
- System/whole-house integration when transitioning to more energy efficient homes
- Long-term effectiveness of insulation materials & systems
- Window installation solutions in walls with more insulation
- Details for integration of exterior insulation with other materials
- Moisture performance of energy efficient attics

*Total of 14 issues and challenges presented to respondents*
What builders and homeowners want.....
Approach

Give every building professional instant access to the knowledge of the industry’s best researchers and building scientists.

Distinctive Characteristics:

• Web-based.
• First application of expert system for moisture management.
• Articulates guidance for durable new and retrofit wall systems based on expert consensus, field data, and validated hygrothermal modeling.
The Building Science Advisor

- User defines wall he wants to construct or existing assembly.
- Tool rates its energy and moisture performance.
- Tool makes recommendations regarding improvements.

Building Science Advisor (BSA) is a website that provides expert advice on building envelope system performance from industry’s best researchers and building scientists. This knowledge tool promotes better-informed decisions regarding energy efficient and moisture durable building envelope solutions for new and retrofit constructions. BSA communicates uncertainty associated with moisture durability in a simplified manner. Please refer to the Security & Privacy Notice before using Building Science Advisor.
Pre-assessments

Building Envelope Components

When planning an energy retrofit or replacing damaged and/or deteriorated materials of your building envelope (the components of the house serving as a thermal and weather barrier between the inside and the outside), there are various aspects to consider. Among many things, the main areas are your roof, exterior walls, windows, basements/crawl space, and how air tight your building is. What approach to take depends on the condition of the building and your needs. Click on the items below to view more information on the specified retrofit categories, or select Next to launch the BSA.

- Roofs and Atrics
- Exterior Walls
- Windows and Attachments
- Basements, Crawl Spaces and Foundations
- Building Airtightness

Other than exterior walls, the building science advisor is currently not setup to analyze the moisture durability of other types of retrofits. In addition, it does not account for air leakage which contributes to energy loss and moisture intrusion in the building envelope. The links provide guidance regarding how best to approach these other types of retrofits together with their associated benefits.

To learn more about the details and construction of the building envelope please refer to additional resources:

- Solar Decathlon Building Science Education
- Whole Building Design Guide
- Building Enclosure

Most important, before taking on an exterior retrofit make sure that the demolition and reconstruction follow local, regional and federal code requirements as it pertains to fire hazardous materials and the impact changes will have on the structure’s performance and surrounding property and neighbors. Make sure to check with local code officials regarding permitting requirements prior to the start of construction.

• Provides user with sources of information to consider prior to performing an energy retrofit.
Pre-assessment guidance

Before Starting a Retrofit

Studies have shown that there’s a strong likelihood that some form of moisture damage will be encountered while doing a retrofit. Knowing the condition of the wall will help guide contractors and remodelers with remediation efforts, design, material selection and installation. Before beginning an exterior wall retrofit, it’s important to know the design and condition of the existing wall. Studies by the University of Florida, the Environmental Protection Agency (EPA), the Partnership for Advanced Technology in Housing (PATH) and the U.S. Department of Housing (HUD) revealed that there is a significant fraction of residential buildings that have been exposed to moisture resulting in damage or durability problems. Using data from 17,000 construction defect claims, the abstract of the University of Florida study, Identifying the causes of moisture-related defect litigation in U.S. building construction, determined that 69% were related to moisture penetration in the building envelope. In the PATH report, Building Moisture and Durability, Past, Present and Future Work, there is an extensive literature review section that includes reports, standards and case studies related to moisture durability in residential housing stock. One fifth of the homes surveyed in the HUD study, Assessing Housing Durability, A Pilot Study, documented various types of moisture damage. Though the HUD study was limited to one area, it does reveal the possibility of encountering moisture durability problems in existing homes.
Pre-assessment guidance

Pre-Retrofit Assessment of Walls, Windows, and Doors

- **If active knob and tube wiring or exposed wiring that poses a safety threat is observed**: Then the house must be rewired before work in wall cavities may begin.

- **If any mold is observed**: Then a mold remediation professional should conduct an in-depth inspection and follow up with the proper remediation of the affected areas. No work in wall cavities can proceed until the space has been certified clean by the mold professional. See the EPA Protocols (click here).

- **If the structural integrity of the framing is not adequate and/or any wood shows signs of rot**: Then the framing must be made structurally sound, rot must be remediated, and sources of moisture corrected as part of the project.

- **In homes built before 1978 assume that paint is lead based**: Follow the most current version of EPA’s Lead-Based Paint Renovation, Repair, and Painting Rule.

- **If the house has a natural draft combustion appliance (furnace, water heater)**: Then an assessment of the combustion appliances by a qualified auditor or HVAC contractor will be necessary, including a Combustion Appliance Zone (CAZ) test.

- **If signs of pest-related activity or damage are observed in areas where work will be conducted**: Then inspection and treatment by a certified pest control contractor will be necessary before work can proceed.

- **If the walls have vermiculite insulation or other materials containing asbestos that may be disturbed**: Then professional advice should be obtained. Vermiculite insulation may contain asbestos and must be tested before wall cavity work begins. Contact the state health department. See the EPA Protocols (click here).

- **If the wall, windows, or doors show signs of leaks or moisture damage**: Then repairs should be included in the project. Be sure to pay attention to sources of interior condensation.
Guidance/information sheets

- Guidance sheets on durability issues are available to educate user regarding that topic.
- Additional information is available through links at the bottom of the sheet.
Discussion

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