



Product Durability and Maintenance

Introduction

This fact sheet provides building owners, designers, and builders of affordable, multifamily housing with criteria for evaluating the durability of building materials and systems. It examines the categories of criteria for evaluating durability and its relationship with maintenance issues. It then sets out criteria for evaluating the durability of material systems for a given project. Durability is dependent on building type, design, use, installation, and maintenance. Therefore, it is not possible to simply list the products that have been found to be durable in some projects and expect them to be the best selections for every project.

Product durability continues to be one of the most difficult aspects for most designers, developers and builders of Green or sustainable buildings to grasp. There is no standard or widely accepted methodology for evaluating durability of building materials. Comparisons across product lines are difficult because aesthetics, cost, and architectural appropriateness are usually considered to be at least as important to material selection as durability.

Despite this lack of an accepted evaluation system, there are criteria that building owners, designers and builders can use to ensure that the materials selected for a project will be the most durable and cost effective systems appropriate for a given project.

Durability Criteria

Disposal Frequency. Disposal frequency is the anticipated useful life of a system or product before it must be removed and replaced. Disposal frequency can be based on manufacturers warranty period, historic data, or a building owner or builder's experience with a product or system. Disposal frequency is easiest of the criteria to establish but, unless other factors are included in the evaluation, it can be one of the most unreliable.

Manufacturer's warranties are usually based on specific installation instructions which may or may not be typically followed by contractors or may not

be compatible with the other systems used in the building. They also often include an exception to the warranty for unspecified "unusual climate conditions". Therefore, warranties should be considered as good indicators of a product's durability only when there is local experience using the product or good research has been done to ensure that the product is appropriate to the local climate, the anticipated application, and the compatibility of the product with the other building components. This type of research is done by specification writers or by independent groups such as Building Green, publishers of *Environmental Building News* and the *GreenSpec Directory*.

Durability based on maintenance. The durability of many products will depend on regular maintenance. This class of products may have a short life span if not maintained or may have a very long life if properly maintained. A good example of this is wood products, which require repainting or refinishing at regular intervals to prevent moisture or ultraviolet damage and wear. In the Bay Area there are numerous examples of small single-family and multi-family, wood clad buildings where the siding remains functional after decades of exposure to the elements because the siding was back primed when it was installed and has been well maintained. Also included in this group would be equipment like HVAC or heating systems that require regular maintenance to ensure not only that the system lasts as long as expected but that it performs at or near rated efficiencies. Maintenance guidelines can be obtained from product manufacturers, trade associations that represent manufacturers or installers of products and from the Building Owners and Managers Association.

Durability based on interdependency of systems. The durability category that has the most impact on overall building durability is interdependency. Interdependency describes the relationship between the various parts of a system to make the whole system function as designed. For example, one can install an expensive, very durable exterior cladding system like stone but neglect to install a proper drainage plane behind it or to properly flash windows and seal other openings. Moisture may then penetrate

the exterior around the windows or other openings and be trapped behind the stone to damage the building framing and sheathing. Interdependency is an issue that must be addressed at all stages of the design and construction process. An excellent source for information about interdependency of structural systems is the *Energy Efficient Builder's Guide to Hot-Dry/Mixed Dry Climate*. The Builders Guide's target audience is single family designers and contractors but most information is applicable to multi-family projects.

Commissioning is another aspect that must be covered in any discussion of durability and maintenance. Commissioning is the process of verifying that building systems are:

- 1) Appropriate to the design of the building. Verifying that the systems have been sized properly and are the most appropriate systems for the type and design of the particular building. This stage of commissioning is done during design.
- 2) Operating at design efficiencies. This includes the efficiency of mechanical systems as well as the ability of structural and finish systems to perform the functions they were designed for, i.e. window flashing not allowing water penetration or gutters and downspouts directing water away from foundations. This stage is ongoing during construction with final audits at completion.
- 3) Continuing to operate as planned after the building is occupied. This stage of commissioning involves regular maintenance and testing to verify that the systems continue to operate effectively.

For more information on commissioning see the Green Affordable Housing Coalition Residential Commissioning fact sheet.

Green Building Benefits

Selecting materials and systems that will be long lasting and maintain their effectiveness throughout their life spans can provide many benefits to a building, its owners, occupants, and the community.

- Less frequent replacement needs mean cost savings to the building owners and reduced waste going into landfills.
- Long lasting systems that maintain their operating efficiency will reduce energy and

water consumption over the lifecycle of the building. This not only reduces utility costs but also reduces the negative impacts of the building on the local and global environment.

- Durable systems and materials can also make the building more attractive to occupants, since they will not have to endure the discomfort and inconvenience of major repairs or replacement of systems that fail.

Implementation

There is no list of materials and systems that will always be the most durable. For each project and building type different products will need to be evaluated and decisions made regarding initial cost, operating costs, maintenance requirements, and compatibility with other systems in the building.

In keeping with good project management practice, the project management team should perform a lessons learned analysis at the closing of each project. The results from this effort should be maintained in a historical database that the firm can use in designing future projects. This database can then be used to evaluate the problems, issues and constraints that arise with the different systems used and will become an important resource determining durability issues on future projects. The lessons learned should, at a minimum, contain the following information regarding materials and systems used in the project.

- Types of systems and materials used
- Variances from project budget and schedule directly related to systems or materials
- Change requests required to meet installation requirements of any system or material
- Training of installation crews to speed learning curve for specific systems or materials

The following matrix provides an example of how two different materials would be compared to determine the balance between first cost and durability and maintenance costs for a project. The inputs and criteria will vary depending on the type of system and the project drivers but the premise that decisions must be made based on the best information available remains the same.

Product to be evaluated	Expected Life span in years (warranty or historic apps.)	Installation requirements for full durability	Initial Cost (\$ per unit)	Operating Costs (\$ per M,BTU for energy consuming products, \$ per year for others)	Maintenance Requirements	Availability of Maintenance Resources
Cementitious siding (Hardie)	50+	Drainage plane, proper flashing	2.05 sq. ft.	Painting .09 per sq ft based on .90 per sq ft every 10 years	Repaint every 10-12 yrs	Available, contract
Composite siding Collins True Wood	30+	Drainage plane, proper flashing	2.05 sq. ft.	Painting, .1125 per sq ft based on .90 per sq ft every 8 yrs	Repaint every 6-8 yrs	Available, contract

For more information

DOE Building Technologies program, commissioning information
<http://www.eere.energy.gov/buildings/info/multifamily/maintain.html>

Environmental Building News
www.buildinggreen.com
 Current and past articles about building materials and systems that may have a positive impact on green buildings. Membership required to access articles. EBN 14:11 contains an excellent article on durability.

HUD/PATH (Partnership for Advanced Technology in Housing)
www.pathnet.org/sp.asp?id=985
 Improving Durability in Housing Background Paper Paper sponsored by NAHB and NIST discussing various aspects of durability in construction materials. Directed at single family but very applicable to most multifamily projects.

Building Science Corp.
www.buildingscience.com
 Building Science Corp. is a DOE Building America partner. The website contains many articles related to durability and moisture control.

Energy Efficient Building Association
Builder's Guide to Hot-Dry & Mixed-Dry Climates
 Hard copy field guide to construction details to increase durability, comfort, energy efficiency, and health in residential construction. Written for the single family market but applicable to single and multifamily construction. Available on-line at www.eeba.org.

Disclaimer

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