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Great Expectations: Realistic Performance of Windows and Doors

Given numerous well-publicized issues and events over recent years–the 2004-2005 hurricanes, mold from building envelope leakage, high energy costs and terrorist bomb threats–state and international building codes, industry standards and a variety of other rating programs have been steadily raising the performance bar for windows and doors. The primary focus has been on energy efficiency, impact resistance and water penetration; while the basics of structural performance, safety, security, durability, and other performance factors remain as important as ever. The increased requirements and improved product performance have combined to raise the expectations of the public in both the residential and commercial markets.

Such higher expectations are typically manifest in unrealistic assumptions of eliminated risk. This trend, by the way, is not confined to fenestration products, and seems to be rife in many other products sold today. Given such a climate, it might be useful to interject some perspective on what constitutes realistic expectations and what the buying public should understand.

STRINGENT STANDARDS AND TESTING

There is no question that the steady march of technology and evolving code philosophy have produced products that perform far better than their ancestors. This is a good thing, and the increased stringency of standards and performance tests reflect that progress. The most recent incarnation of the omnibus window, door and skylight standard, AAMA/WDMA/CSA 101/I.S. 2/A440-08–recently adopted for referencing by the I-codes and the basis for third-party product certification–is a case in point, addressing a record number of operator types and requiring more stringent performance test hurdles.

For example, the U.S requirements dictate testing for water penetration that subjects the exterior surfaces of fenestration products to 5 gal/ft2/hr of water–roughly equivalent to 8 inches of rain per hour–driven by a static pressure equivalent to a wind speed of up to 70 mph-plus. In terms of impact resistance, some local codes are tougher yet, such as those of Florida's Miami-Dade and Broward Counties, located in the defined High Velocity Hurricane Zone. Here, windows must withstand impacts simulated by impelling up to an eight-foot long, nine-pound 2 x 4 stud into the product at up to 34 mph.

Consider also the ever tightening energy efficiency requirements for emerging green building programs, as well as for mainstays such as the Department of Energy's Energy Star labeling system.

And there are philosophical changes in how the industry views its products and their roles in the completed building. Looking at the entire building as a system and integrating fenestration products into a cohesive weather resistant barrier from roof to ground is one example. Flashing and sealants are at the front line of this interface. Recognizing this, the industry has developed or upgraded new standards for these formerly unsung components. The tenets of green building practices represent another paradigm shift. Such changes in perspective have generated yet more performance standards and rating systems.

The list goes on and on. Higher expectations are resulting in better products. But at what point do the expectations become unrealistic?

The practicality of designing a product that can completely eliminate the possibility of failure requires some important considerations. Would such a product make sense from an engineering and economic perspective? For one thing, all performance factors cannot be maximized; there are tradeoffs to be considered in the design, as maximizing one benefit can undo another. For example, will maximizing energy efficiency or fall prevention restrict operation or emergency access?

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When the best engineering balance is struck, will the end result be aesthetically appealing? Will it cost more than can be justified in the context of the building's location, purpose and price point? What maintenance will be required? To balance these considerations, the industry must take the approach of maintaining aesthetic and financial satisfaction while minimizing (not eliminating) the risk of performance failure.

Another important consideration is that laboratory testing is conducted under ideal conditions–a carefully handled sample product installed exactly as directed by the manufacturer. Try as we might, we simply cannot duplicate the vagaries of nature and conditions at all ultimate job sites. And, for obvious economic reasons, product testing must be done on a sample unit basis rather than as 100 percent screening.

End users should understand the basics of this cost-benefit balance as well as the realities of real-world product handling and installation and their impact on realized product performance.

INSTALLATION IS PARAMOUNT

Even more to the point is the fact that installation is the determining factor in whether or not the performance designed into the product is realized in the field. Meeting high standards and passing rigorous testing to verify conformance do not ensure the intended performance after installation. Even the best-designed and thoroughly tested product can fail if improperly installed.

We have not left even this aspect to chance. Examples of industry efforts to ensure proper installation include ASTM E 2112 Standard Practice for Installation of Exterior Windows, Doors and Skylights, and the InstallationMasters Program to qualify installers and methods, as well as AAMA 504, Voluntary Laboratory Test Method to Qualify Fenestration Installation Procedures, for verifying manufacturer-prescribed installation methods. If providing ironclad installation instructions and using tested and certified materials do not make the grade, performance after installation can be checked according to the methods of relatively new installation test protocols, such as those of AAMA 502, Voluntary Specification for Field Testing of Windows and Sliding Glass Doors.

Today, it is imperative that all participants in the supply and installation chain work together to maximize the likelihood that the intended performance of the installed fenestration products will be realized. But this may not always happen.

THE END USER PLAYS A MAJOR ROLE

It is incumbent upon our industry to educate the buyer on the importance of installation and the qualifications of the installer. But the buyer's role is just beginning after the installation. The importance of that role is clear once we understand that, despite cutting edge design, top-quality fabrication, eagle-eyed certification, by-the-book professional installation and high marks from any rating system you can name, time takes its toll. The end user cannot expect the product to deliver like-new performance over multiple decades. As