The wind resistance of shingles

Revisions are necessary to accommodate new standards and codes for asphalt shingle wind resistance

by Mark S. Graham

Unlike membrane roof systems, which are designed for wind uplift based on uplift-resistance pressures, asphalt shingle roof systems are classified based on wind speeds. Following is a brief overview of the wind-resistance methodologies applicable to asphalt shingle roof systems.

ASTM D3161

ASTM D3161, "Standard Test Method for Wind-Resistance of Asphalt Shingles (Fan-Induced Method)," evaluates the wind resistances of discontinuous, air-permeable, steep-slope roofing products, including asphalt shingles, by delivering a stream of air across test deck specimens. A minimum of two test specimens are subjected to test velocities of 60-, 90- or 110-mph winds for two hours. During the tests, the test specimens are observed for any damage, including disengagement of a sealed tab. Test specimens exhibiting damage are considered to have failed the test.

Asphalt shingle test specimens passing the two-hour test duration at 60 mph are classified as Class A; those passing at 90 mph are

classified as Class D; and those passing at 110 mph are classified as Class F.

A statement in ASTM D3161 indicates: "... The results of this test do not directly correlate to wind speeds experienced in service ... ." Also, ASTM D3161 makes no accommodation for building height or mean roof height, building exposure, building importance factor or risk category.

ASTM D3161 originally was published in 1972 and based on methodology developed by the National Bureau of Standards (now the National Institute for Standards and Technology) in the 1950s. Since its original development and publication, ASTM D3161 has been revised several times. The original version only provided testing at a 60-mph test velocity. The addition of testing at 90 mph and 110 mph and classifications are notable revisions.

Historically, asphalt shingles that have passed this wind-resistance test have performed well.

ASTM D7158

ASTM D7158, "Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method)," provides a method for calculating the uplift force exerted by wind on a specific shingle and comparing that to the shingle's mechanical uplift resistance. A shingle's mechanical uplift resistance is dictated by a number of factors, including the shingle's rigidity and bond strength of its self-seal strip.

ASTM D7158 is based on extensive research conducted during the early 2000s by wind engineering consultants Cermak Peterka Petersen Inc., Fort Collins, Colo., for the Asphalt Roofing Manufacturers Association.

When ASTM D7158 first was published in 2005 (designated as ASTM D7158-05), its methodology was based on ASCE 7-02, "Minimum Design Loads for Buildings and Other Structures." It resulted in classifying asphalt shingles that passed a basic wind speed of 90 mph as Class D; Class G were those that passed a basic wind speed of 120 mph; and Class H were those that passed a basic wind speed of 150 mph.

ASTM D7158-05's classifications were limited to specific parameters from ASCE 7-02, including Category I or II buildings for all slopes, Ground Roughness B or C, and building heights of 60 feet or less. For buildings outside of these parameters, such as Category III or IV, Ground Roughness D or building heights greater than 60 feet, additional engineering calculations were required. Shingle manufacturers had to be consulted for the additional shingle-specific data necessary to perform these calculations.

ASTM D7158 has been revised several times, and the 2016 version references ASCE 7-10 instead of ASCE 7-02. This resulted in a change to ASTM D7158's wind-speed classifications from being based on ASCE 7-02's nominal design wind speeds (V_{asd}) to ASCE 7-10's ultimate design wind speeds (V_{ult}). Now, ASTM D7158's Class D indicates having passed a V_{ult} up to 115 mph, Class G having passed a V_{ult} up to 150 mph and Class H having passed a V_{ult} up to 190 mph.

ASTM D7158-16's classifications are limited to specific parameters from ASCE 7-10, including Category I through IV buildings for all slopes, Ground Roughness B or C, and building heights of 60 feet or less. For building conditions outside of these parameters, additional engineering calculations are required.

Additional changes necessary

The publication of ASCE 7-16, "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," and its incorporation into the *International Building Code,® 2018 Edition* (IBC® 2018) appears to necessitate additional revisions to ASTM D7158.

ASCE 7-16's procedure for determining design wind loads for steep-slope roof assemblies differs from that of ASCE 7-10 (and ASCE 7-05 and ASCE 7-02). ASCE 7-16's pressure coefficients are notably higher than those of its previous editions, which will result in greater design wind loads for many steep-slope roof assemblies. As a result, it appears ASTM D7158 needs to be revised to accommodate these higher design wind loads.

Also, because IBC 2018 permits the use of either V_{asd} or V_{ult}, ASTM D7158's classifications should be revised to accommodate the use of either wind speed methodology.

Until ASTM D7158 is appropriately revised to accommodate ASCE 7-16 and IBC 2018, NRCA recommends designers use ASTM D7158 cautiously when either ASCE 7-16 or IBC 2018 is applicable.

MARK S. GRAHAM is NRCA's vice president of technical services.

@MarkGrahamNRCA

Construction technology investments surpass 2017

A July report from Jones Lang LaSalle Inc., Chicago, shows during the first half of 2018, investments in construction technology surpassed the previous year's total by 30 percent, according to www.constructiondive.com.

Spending in the construction technology segment reportedly is outpacing overall tech startup investment growth in the U.S. The report states: "It's no mere accident that this uptick in [construction technology] investing coincides with an industry plagued by cost fluctuations, labor shortage issues and overall lack of productivity improvements—creating what many venture capitalists view as a prime opportunity for disruption."

Jones Lang LaSalle estimates construction technology-focused startups will receive funding through about 120 deals by the end of the year.

The report also indicates collaboration software and project management purveyors account for about 112 construction technology startups, followed by about 50 firms focused on off-site techniques and nearly 40 mobile-centric startups.

Three startups valued at more than $1 billion—Katerra, Menlo Park, Calif.; Uptake Technologies, Chicago; and Procore Technologies, Carpinteria, Calif.—are in the top five construction technology startups in terms of amount of funding received, at $1.1 billion, $287 million and $180 million, respectively.

The report states: "Off-site construction, cloud-based software and new, tech-focused hardware are capturing the largest investor dollars and customer bases. Artificial intelligence and big data solutions are a close second but are positioned to make even larger impacts."

To view lists of the seven major construction technologies and the top 10 construction technology trends to watch in 2018, go to www.professionalroofing.net.

NIBS, ASTM International and RCI Inc. announce collaboration

The National Institute of Building Sciences (NIBS), ASTM International and RCI Inc. issued a joint statement July 11 announcing their intent to avoid duplicating efforts relating to their respective building enclosure commissioning (BECx) programs.

NIBS has begun launching a series of new BECx certification modules as part of an agreement with ASTM International to create a joint certificate in BECx. NIBS unveiled three two-hour pilot modules during the BEST Building Enclosure Science & Technology Conference™ in Philadelphia in April. Additional modules will be unveiled during a workshop at NIBS' Building Innovation 2019 Conference & Expo Jan. 7-10 in Washington, D.C. ASTM International will work with NIBS to develop e-learning versions of each module to provide users online access through ASTM International's learning management system.

> "NIBS has begun a series of new BECx certification modules to create a joint certificate"

In partnership with Professional Testing Inc., an Orlando, Fla.-based certification and examination company, RCI is developing certifications for various BECx roles as defined by ASTM International. RCI's goal is to develop full-scope certifications for each area to advance the level of quality and standards in the U.S. BECx industry. The certifications are being developed in accordance with ISO/IEC 17024:2012 requirements. To ensure all stakeholders' needs have been taken into consideration, industry experts are invited to serve on job task analysis working groups to be hosted at the University of Wisconsin—Madison in October.

ASTM International committees present merit awards

ASTM International has announced Randall Ober, product development consultant for Carlisle Construction Materials, Carlisle, Pa., has received an Award of Merit from ASTM International's Committee D08 on Roofing and Waterproofing, and Christopher White, research chemist for the National Institute of Standards and Technology, Gaithersburg, Md., has received an Award of Merit from ASTM International's Committee C24 on Building Seals and Sealants. Established in 1949, the Award of Merit is ASTM International's highest recognition for individual contributions to developing standards and includes an accompanying title of fellow.

Ober was honored for his outstanding leadership, distinguished service and personal dedication to developing and promoting Committee D08's voluntary standards, particularly his contribution to the group regarding organic roof coverings. A member of ASTM International since 1990, Ober previously received Committee D08's Award of Appreciation in 2005 and 2014, Distinguished Leadership Award in 2010 and 25 Year Service Award in 2015.

White was honored for his dedicated service to Committee C24, particularly his commitment to standards development and his respected technical expertise and leadership. A member of ASTM International since 2002, White previously received Committee C24's Award of Appreciation in 2008 and Lou Toporcer Hall of Fame Award in 2013. White also is active in the American Chemical Society, American Physical Society and Society of Plastics Engineers.