Wind resistances of aggregate surfacings

by **Mark S. Graham**

In recent years, there has been considerable discussion about various low-slope membrane roof systems' wind resistances. Although much of the industry's attention has been focused on the attachment of roof insulations and membranes to roof decks, relatively little has been done to quantify the wind resistances of aggregate, ballast or pavers on roof membranes' top surfaces.



Test methods

Four industry-recognized test-method standards provide the primary bases for evaluating low-slope membrane roof systems' wind resistances. Factory Mutual Research Corp.'s (FM's) FM 4450 and FM 4470 test standards provide the bases for 1-60, 1-75, 1-90 and 1-105 classifications, and Underwriters Laboratories Inc.'s (UL's) UL 580 and UL 1897 are the bases for Class 15, Class 30, Class 60 and Class 90 classifications.

Although these test-method standards assess the attachment of roof insulations and membranes to roof decks, they do not specifically evaluate adhesion or uplift resistance of roof surfacing materials to underlying surfaces. Therefore, relying on these test methods to determine the wind resistances of aggregate, ballast or pavers is inconclusive.

Code requirements

The model building codes generally require that roof systems be designed to resist wind-uplift pressures based on design wind speeds and other criteria prescribed in each code.

Typically, building code officials rely on FM and UL tests to satisfy wind-uplift resistance requirements for roof coverings. However, in the context of a building code, roof coverings' surfacing materials also typically are considered a portion of a roof system; therefore, surfacing materials are included in wind-uplift resistance requirements.

Although the *Standard Building Code, 1997 Edition,* and *Uniform Building Code, 1997 Edition,* do not provide requirements specific to the wind resistances of roof aggregate, ballast or pavers, the *BOCA* [Building Officials and Code Administrators International Inc.] *National Building Code/ 1996* (BNBC) does. BNBC requires the following: "*1505.2.1 Roofing wind test:* Aggregate, ballast and roof pavers shall be tested and shown by test to stay in place when subjected to the basic wind speeds ... adjusted for building height above grade, building exposure, wind gust effect and wind importance factor."

Although this does not provide significant guidance regarding the actual test method and conditions, BNBC Commentary provides additional information: "This section [*1505.2.1 Roofing wind test*] requires testing of aggregate (such as river rock), ballast and roof pavers, which indicates they will remain in place when subjected to the basic wind speeds of Figure 1609.3, as adjusted for building height, exposure, wind gust and importance factors. The laboratory wind test program that is used to simulate field installation conditions is intended to [help] minimize the hazards of loose roofing materials being blown off the building during a design wind-load condition."

BOCA's primary concern with roof surfacing materials' wind resistances is the ability of aggregate, ballast and pavers to become airborne during high winds and damage adjacent buildings and injure pedestrians. Airborne debris has been considered a significant source of building damage in several recent high-wind events.

Interpretation

Although BNBC specifically requires that aggregate, ballast and paver roof surfacings be wind-tested, it is important for roofing professionals and building officials to realize such a wind test method does not exist in the roofing industry. Also, NRCA is aware of no testing laboratory that currently performs full-scale roofing aggregate, ballast or paver testing.

Based on BNBC's requirement and absence of any testing in the roofing industry to satisfy the code requirement, it can be interpreted that roofing professionals currently cannot design and install roof systems that use aggregate, ballast or paver surfacings in areas where BNBC is applicable.

Interim solution?

Roofing professionals involved in designing and installing roof systems using aggregate, ballast or paver roof surfacings are encouraged to work closely with manufacturers in satisfying minimum wind-uplift resistance requirements.

In some situations, local building officials may waive BNBC's roofing wind test requirement for aggregate, ballast and pavers, provided such a request is made and adequate justification is provided.

Further research

NRCA has undertaken an extensive research project assessing the wind resistances of aggregate and ballast roof surfacings. The research's first phase is analytical modeling and analyses of aggregate and ballast in high-wind conditions; this work is almost completed. The second phase is full-scale testing of various aggregate types at different wind speeds and roof perimeter edge conditions; this research should be completed in mid-1999. PR

Editor's note: *Readers interested in more information about recent changes to the model building codes and general regions of code applicability should call NRCA's Fax-On-Demand at 1-888-455-6722 and request document 1304.*

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