Ballast stays put in high winds

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Stone-ballasted membranes constitute about 10% of all new built-up and single-ply roofing systems, and many older systems continue to perform well in the low-slope roofing market.

Unfortunately, in their zeal, some structural engineers have confused the smaller and lighter pea gravel used on built-up roofs (BURs) for fire and weather protection with the large size stones used as ballast on some single-ply roofing membranes.

Because these engineers can cite window damage from pea gravel, they have developed restrictive requirements—based on no science—for all stones used in roofing applications. These mandates are found in Section 1504.8 of the 2006 International Building Code (IBC).

For contractors evaluating ballasted single-ply roof systems, the most detailed guidance referenced in the IBC is "ANSI/SPRI Standard RP-4 2002, "Wind Design Standard for Ballasted Single-Ply Roofing Systems." It can be downloaded free at the Single Ply Roofing Industry's (SPRI's) Web site, www.spri.org.

RP-4 defines a ballasted roof as a membrane roofing system that is usually loose laid on the roof deck and held in place by the weight of stone aggregate or precast concrete pavers. The weight of the stone or pavers employs the force of gravity to hold the roof membrane in place and counter the uplift forces of wind.

Minimum requirements in the RP-4 standard call for stone not smaller than ASTM D448 #4, and/or 18 psf pavers or interlocking pavers.

Code requirements limit the use of stone ballast to buildings less than 110 feet high in cities and 35 feet high in open country. Ironically, as the code stands, a pea-graveled BUR could be installed on a 110-foot-tall building with no gravel stop or parapet wall. A ballasted single ply using *larger* stone would be limited to a 45-foot-tall structure under the same conditions.

Parapets over 24" are effective in reducing uplift in all roof types, but are particularly effective on roofs with stone or gravel ballast: The stone has to jump over the parapet, creating a downstream effect. In several cases examined in the RICOWI Wind Investigation Program where high parapets existed, no pea gravel left the roof; it was piled against the parapet.

"RP-4 is based on wind science, but the code is based on a structural engineer's lack of understanding of wind science," says one industry expert.

The design criteria for RP-4 are based on actual wind tunnel testing and confirmed by wind studies. Actual field performance data was used—and confirmed by independent organizations—using small-and large-scale wind tests. This was augmented by extensive collaboration from the country's leading wind experts, followed by industry and peer review.

"RP-4 was originally developed in 1985 based on wind tunnel tests that generated more data than new airplane testing at that time," says David Roodvoets, technical director of SPRI. "The code limitations developed in 2004 and included in the 2006 code do not consider any factors that wind engineers would consider important."

RICOWI has released data from inspections of 93 low-slope and 91 steep-sloped roofs in Florida in the immediate aftermath of Hurricane Charley in August 2004 and Hurricane Ivan in September 2004.

"From the ballasted roofs observed in the Charlie and Ivan investigations, I would conclude that stone ballasted

roofs did not contribute to the debris stream from these hurricanes," said Roodvoets, RICOWI's wind event coordinator. "Worst case, after Katrina, we saw a few stones lying around near a building."

In the meantime, SPRI and the National Roofing Contractors Association are working to clarify the stone ballast issue in the 2007-2009 edition of the IBC.

"We may not have this corrected in this year's hearings, but we are working to separate out the requirements for adhered pea gravel and the larger stones required by RP-4," reports Roodvoets.

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