



Water, water everywhere

Flood testing is appropriate only for waterproofing systems

by Joan P. Crowe, AIA



There are various occasions when roof system specifications call for flood testing, such as to determine quality assurance of a newly installed roof system or locate a leak source.

But sometimes, flood testing is recommended when it isn't appropriate. Following is a discussion about NRCA's guidelines for flood testing.

Not recommended

NRCA does not recommend conducting flood tests as part of a routine quality-control or quality-assurance program for a new roof system. One reason is flood tests sometimes are solely and incorrectly relied on to determine roof system quality. Flood testing alone does not forecast a properly designed or installed roof system. For example, a flood test will not provide information about service life or evaluate a roof system's ability to resist wind or impact loads.

Flood testing also is not appropriate for identifying potential leak sources. Roof systems are designed to be weatherproof, not waterproof. A weatherproof roof resists the passage of water with a minimal amount of hydrostatic pressure (flowing water); waterproofing systems prevent the passage of water under hydrostatic pressure (standing water). For example, water leakage may occur at roof drain flashings with flood testing. Flood testing exposes roof drains to hydrostatic pressure, and roof drains are not designed to be leak-free under such unrealistic imposed conditions.

And imagine this worst-case scenario: There is a significant breach in a roof system during a flood test. As a result, a serious leak would materialize and there would be no way to stop the large quantities of water from entering the building, resulting in substantial interior damage.

Safety is another important reason NRCA does not recommend flood testing. Water weighs 62.4 pounds per cubic foot (1000 kg/m³), or 5.2 pounds per square foot (psf) (83 kg/m²) for every inch of water. If a flood test calls for a depth of 4 inches (102 mm), this converts to a dead load of more than 20 psf (100 kg/m²). However, to achieve a minimum of 4 inches (102 mm) of water over the roof surface, many areas will be deeper, particularly roof drain locations, because of the roof slope. This extra loading may exceed a roof deck's structural capacity.

In addition, safety is an issue once flood testing is terminated. When a drain plug is removed, the whirlpooling water

potentially may suck a worker's hand or arm into a drain. Also, if a drain plug is not removed slowly, the volume of uncontrolled water discharge might damage the drainage system.

Quality-control guidelines

Instead of using flood testing as a measure of quality control and quality assurance, NRCA recommends roofing professionals follow NRCA quality-control guidelines for evaluating roof systems. Guidelines for built-up, polymer-modified bitumen and thermoset roof systems are in *The NRCA Roofing and Waterproofing Manual, Fifth Edition*. The guidelines for built-up and polymer-modified bitumen roof systems were updated in 2004 and issued as stand-alone documents. They include checklists for visual examination and criteria regarding how to evaluate roof covering materials, vapor retarders, insulation, fasteners, flashings and surfacings.

The guidelines clearly define who is responsible for quality control and quality assurance. Quality control is performed by roofing contractors. A roofing contractor should designate another person, who may be a member of a work crew, to perform on-site quality control during the entire application process. This person should be knowledgeable of the roof system being installed and have the authority to bring work into compliance if noncomplying work is observed.

Quality assurance is the same as quality control but is performed by the building owner's representative, such as an architect, engineer, roof consultant or manufacturer representative. The quality-assurance person should be qualified and knowledgeable of the system being installed, as well as methods of application. The quality-assurance person must notify the roofing contractor immediately if noncomplying work is observed so necessary corrective action can be taken.

The quality-control guidelines also discuss test cuts and seam samples. NRCA recommends test cuts and seam samples not be considered part of a routine quality-control or quality-assurance

program. Test cuts for built-up roof systems should not be substituted for in-process quality control or quality assurance provided by continuous visual examination. A test cut generally is not considered a reliable measure of quality control or quality assurance because the findings of one or several small test cuts may not accurately represent the entire roof area. Also, focusing solely on test cuts may give undue emphasis to the quantitative measurements while ignoring other critical aspects of a roof, such as proper drainage and flashing. Roofing professionals acknowledge limited application variations do not adversely affect a roof system's overall quality and performance.

In addition, test cuts are destructive to a roof system. Each test cut creates a breach in a roof system that must be patched.

Waterproofing systems

Although NRCA does not recommend flood testing roof systems, it strongly recommends waterproofing systems be flood-tested to assess their integrity. NRCA also recommends having results witnessed and confirmed in writing in case a problem arises after job completion.

To evaluate whether a waterproofing system is leak-free under hydrostatic pressure, a test can be conducted in one of two ways:

- **Flood test:** To conduct a flood test, temporarily close any deck drains and erect temporary dams where required to retain water on the surface of the waterproofing material. Then, flood the surface to a maximum of 2 inches (51 mm) at the high point and retain the water for a minimum of 24 hours or as required by the manufacturer.
- **Flowing-water test:** To conduct a flowing-water test, apply continuously flowing water over the waterproofing membrane's surface for a minimum of 24 hours or as required by the manufacturer without closing the drains or erecting dams.

Selecting the appropriate test depends on the structural capacity of the deck/substrate and slope of the deck/



waterproofing system. Decks without significant slope (such as plaza decks) can be tested with a flood test or a flowing-water test. Decks with significant slope (such as parking garage ramps) can be tested using a flowing-water test. Determining a deck's structural capacity is a designer's responsibility.

Care must be taken so the weight of the water does not exceed the load-carrying capacity of the structural deck and height of the water does not exceed the height of the lowest flashing. During a flood test, water should remain on the waterproofing membrane for a minimum of 24 hours or as recommended by the manufacturer. The areas beneath the membrane should be inspected for leaks. If leaks are detected, they should be repaired and the area should be retested. A flood test documents the performance of a waterproofing membrane before placement of overburden or topping material. Following a flood test, NRCA recommends you execute a verification form. A sample form can be found in *The NRCA Waterproofing Manual, 2005 Edition*.

For guidance, ASTM International issued ASTM D5957-98, "Standard Guide for Flood Testing Horizontal Waterproofing Installations." This standard provides a method to test the watertightness of a waterproofing system installed on a slope no greater than ¼-in-12 (1.2 degrees). This test method can be used on fully adhered liquid- or fluid-applied membranes or loose-laid sheet membranes.

Summing it up

NRCA maintains a quality roof system installation can be achieved with proper design and quality materials and by having the work performed by a professional roofing contractor. And the most effective way to evaluate a quality roof system is by thorough, continuous examination at the time of application. If these recommendations are followed, the expense and potential drawbacks of flood testing a roof system need not be incurred. 🌀🌧️❄️

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Following a flood test, NRCA recommends you execute a verification form. A sample form can be found in *The NRCA Waterproofing Manual, 2005 Edition*. Photos courtesy of Structural Research Inc., Middleton, Wis.