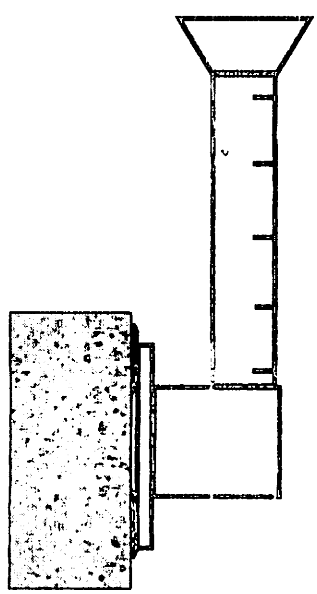
USE OF "BLOCK" RILEM TUBE FOR EVALUATING WATER REPELLENCY AND WARRANTY REQUIREMENTS FOR CONCRETE MASONRY UNITS

Introduction

It has become increasingly apparent that Custom Masonry Units present some unique challenges with respect to water intrusion. The high porosities and the large capillaries in these units render many traditional water-repellent technologies ineffective. Not only has water-repellent technology evolved to address these challenges, but also field-testing procedures have now been revised to incorporate techniques suitable for these materials.

Procedure

The traditional RILEM tube has been the mainstay of field testing procedures for many manufacturers of water-repellent products. It allows for the only practical, rapid, nondestructive evaluation of comparative water-repellency in the field. Properly conducted, the test procedure allows for a quantitative evaluation of water repellency of both the masonry unit and the unit/mortar interfaces.



Traditional test procedures have consisted of:

1. The masonry surface should be clean, dry and free from poorly adhered coatings and/or partially spalled masonry fragments.

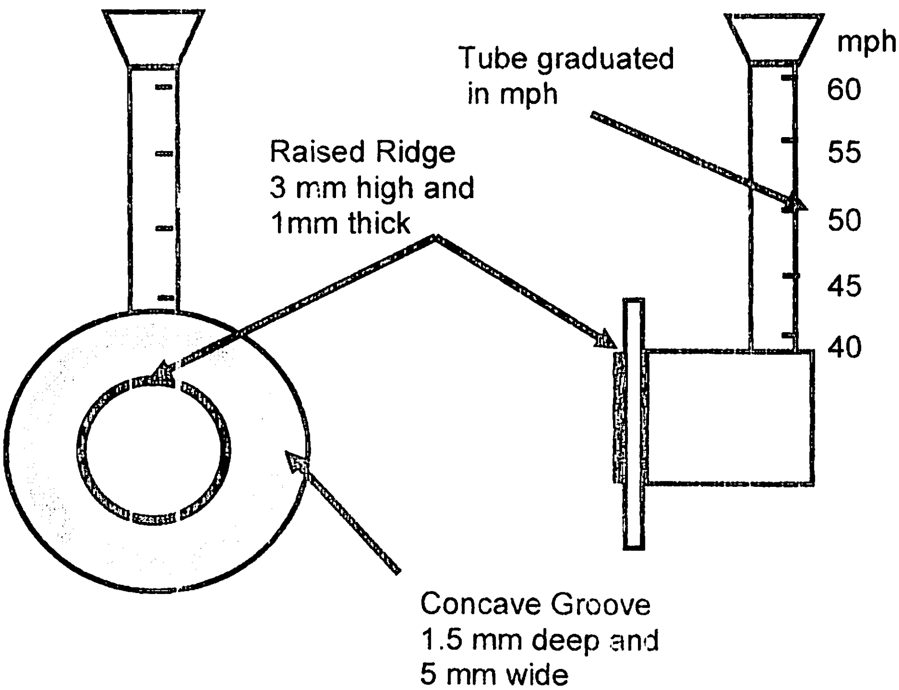
2. Roll out a bead of the putty to approximately 1/4" diameter and 6" length. Attach the putty to the flat brim of the tube.

3. Firmly press the tube with the attached putty to the surface. Press in any putty that extrudes to form a tight seal.

4. Fill the tube with water to the appropriate level, ensuring no air is trapped inside the body. If air is trapped inside, remove the tube and repeat the procedure in a new area.

5. Wait for 20 minutes and then record the amount of water absorbed by the substrate.

After extensive laboratory testing, the traditional tube assembly has been redesign in an effort to generate more reproducible results and to minimize the influence of the operator on the test results. To this end, a new design has emerged that is easier to use and is now available in a unit specifically for testing custom masonry units.



Highlights of the new design are:

- A wider flange for easier sealing to rough surfaces
- A guide groove on the flange to aid in placement of the putty
- A raised ridge on the underside to prevent putty "filling in" the opening and reducing the area under test
- Graduations in miles per hour wind driven rain
- A less severe range of wind driven rain simulations that accurately reflect "normal" weather conditions.

This new design produces a tube that is easier to use and allows for reproducible results with minimal training. The new design does require some minor modifications in the technique used when conducting field evaluations and has prompted a review of its impact on warranty qualification. Traditional test procedures that utilized an assembly which simulated 97-mph wind-driven rain conditions were, in essence, exposing the masonry to the effects of a Category 2 hurricane. In reality, these conditions are just short of the force necessary to begin creating structural failures in some curtainwall systems!

The redesigned tube produces a maximum test condition of a simulated 60-mph wind-driven rain. These conditions are typical of those experienced by structures during strong thunderstorms in many parts of the United States and fall slightly short of hurricane conditions which begin at 74 mph.

The new recommended testing procedure is:

1. The masonry surface should be clean, dry and free from poorly adhered coatings and/or partially spalled masonry fragments.

2. Roll out a bead of the putty to approximately 1/2" diameter and 6" length.

3. Place the putty in the concave groove on the flat brim of the tube.

4. Firmly press the tube with the attached putty to the surface. Press in any putty that extrudes to form a tight seal.

NOTE: The presence of the raised ridge on the underside of the flange makes this step especially important. Compression of the putty will not be as great as with the traditional assembly and therefore a complete seal may not be achieved if this step is omitted.

5. Evaluate the assembly to ensure the putty has not extruded into the "bowl" area of the tube and is not interfering with the test area.

6. Fill the tube with water to the 60-mph level, making sure no air is trapped inside the body. If air is trapped inside, remove the tube and repeat the procedure in a new area.

7. Wait for 20 minutes and then record the maximum wind-driven rain speed that the treated masonry can withstand.

Revised April 1999

Technical Bulletin

SUBJECT

RILEM Tube Evaluations

PURPOSE

1. To provide a summary of how to utilize the RILEM tube for field water-repellency evaluations.

2. To provide guidelines for interpreting the data generated from using the RILEM tube.

3. To provide a correlation between the water level in the tube in milliliters and a velocity of wind-driven rain.

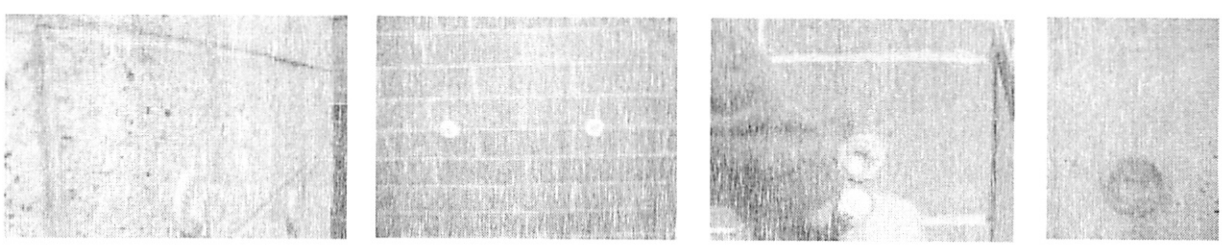
REFERENCE

RILEM Test No. II.4, water absorption under low pressure (pipe method)

DISCUSSION

RILEM is an acronym for Reunion Internationale des Laboratoires d'Essals et de Recherches sur les Materiaux et des Constructions (International Union of Testing and Research Laboratories for Materials and Structures) located in Paris, France. Their function and purpose are similar to the American organization ASTM (American Society for Testing and Materials) in that technical committees are formed to develop standard testing methods, RILEM works specifically with measuring properties, performance and durability of various building fabrics.

One technical committee, Commission 25-PEM developed a method to assess deterioration of natural building stone utilizing what has become known as a RILEM tube (Figure 1). These tubes are now commonly used to evaluate water absorption rates on many types of new, existing, man-made and naturally occurring building materials. This evaluation may be used to determine a substrate's need for a water-repellent, it may be used to compare the water absorption of treated vs. untreated substrates or it may be used to compare the performance of different treatments.

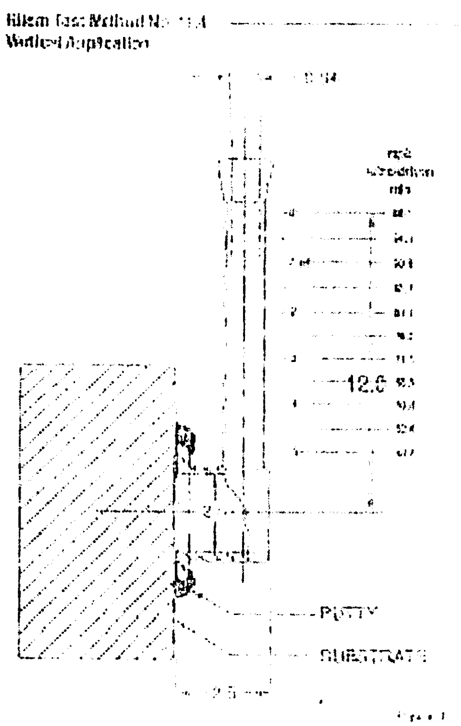


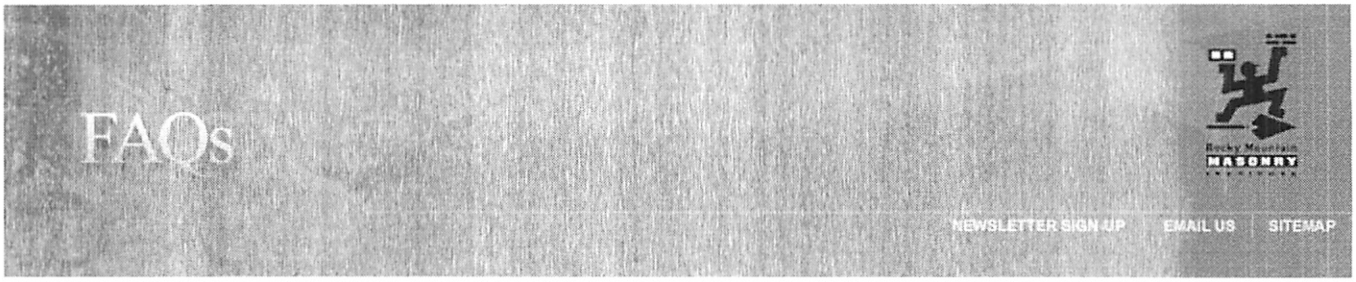
The tube is temporarily affixed to the substrate with a water impermeable putty, such as Bostik's BluTack®. The tube is then slowly filled with water to the appropriate level (the tube is graduated in milliliters), taking care to avoid trapping air bubbles. Most substrates are evaluated with the tube filled to the "0.0 mL" graduation, which is the topmost graduation. Experience with many concrete masonry units (CMU) indicates that this poses conditions that are too severe for many CMU, even following treatment with a water-repellent. Because of this, for CMU only, it is recommended that the tube be filled to the "2.5 mL" graduation when evaluating water-repellent treatments. If a performance differentiation is not observed when the tube is filled to this level, e.g. when an elastomeric is evaluated on CMU, the tube may be filled to the "0.0 mL' graduation.

Typically the volume of water absorbed is recorded after 20-minutes of contact, however, longer time frames may be used. If a 20-minute dwell is not providing data which allows for differentiation between areas (treated vs. Untreated, one treatment vs. another), the tube can be left on the substrate for time periods longer than 20 minutes. If this technique is utilized record the time at which performance differentiation could be determined.

In general, acceptable performance is achieved if the level of water drops no more than 20% of the original height during the 20-minute test period. For example, if a clay brick wall is evaluated, the tube would be filled to the "0.0 mL" graduation at the beginning of the test. After 20 minutes, the water level should be no lower than the "1.0 mL" graduation. If CMU is evaluated, the original water level would be "2.5 mL" and the final height should be no lower than "3.0 mL"

The height of the column of water, as measured from the center of the bowl to the meniscus in the tube, determines the hydrostatic pressure applied to the test area. This pressure can subsequently be converted into a velocity, or wind-driven rain speed. As an example, if the tube is filled to the "0.0 mL" graduation, this exerts a pressure of 1139.36 Pa, which correlates to a 98.1-mph wind-driven rain. Filling the tube to the "2.5 mL" graduation correlates to a 78.2-mph wind-driven rain. The attached chart illustrates the range of pressures/velocities and water levels.





Frequently Asked Questions

Answers provided by Atkinson-Noland & Associates, Inc. and RMMI Technical Director Diane Travis, dianet@rmmi.org

- I am building a structure with Single Wythe CMU walls. Do I need flashing and a water repellent coating?
- I am planning to build an anchored stone veneer wall with 4" deep rough, natural stones stacked in a random ashlar pattern. Should I leave an air space behind the stone or should I fill the gap solidly with mortar and grout?
- Do I need weep holes or dampproofing for a retaining wall?
- When do I need to install relieving angles in a tall, brick-veneered building?
- How big should the air gap be in a cavity wall?
- How do I calculate the fire rating of my structural brick or brick veneer wall?
- How do I calculate the fire rating of my concrete block wall?
- Which flashing is best?
- The inspector didn't show up on time but I built the wall anyway. Now they want me to tear down the wall because they can't verify proper construction. What do I do?
- I have an old historic building that needs some joints repointed. What mortar should I use?
- I am bidding a project that appears to have too much steel and grout in the wall. Is there any way to find out if this design is correct?
- The testing agency reported that one batch of their mortar samples from my job site did not meet the specified compressive strength. Do I have to take down this area of masonry and rebuild it?
- My wall has a crack in it. Should I be concerned?
- Which masonry tie is best for veneer construction?
- What is the proper way to judge a masonry wall?
- How do I know when my building needs repair?

Q. I am building a structure with Single Wythe CMU walls. Do I need flashing and a water repellent coating?

A. Concrete block, particularly lightweight concrete block, is not weather tight if you do not apply a water repellent coating to it. Water repellent coatings usually last between 2 and 10 years, depending upon the exposure of the building and the competence of the applicator. As a rule of thumb, penetrating water repellents last longer because they are not as prone to ultraviolet degradation as surface coatings are. I recommend Silane and Siloxane-based coatings because of this longevity.

If you want to read more about water repellent coatings for concrete block, go to the web site for the National Concrete Masonry Association at HYPERLINK "http://www.ncma.org/" www.ncma.org. Look for an icon labeled "E-Tek". Click on this heading and it will take you to another web site where you can download technical articles. I suggest you download:

- Tek Note 8-1A - Maintenance of Concrete Masonry Walls
- Tek Note 19-1 - Water Repellents for Concrete Masonry Walls

My favorite flashing/weep system for single wythe walls is called Cavity Vent. It is a strip