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CMHA

ARE RILEM TUBES AN EFFECTIVE METHOD OF EVALUATING THE WATER REPELLENT CHARACTERISTICS OF CMU?

No. The "RILEM" Tube Test was originally developed to provide an indication of the initial absorptive characteristics of stone masonry. These values could be correlated to the deterioration rates of stones in various areas of a stone masonry structure and to evaluate the effectiveness of remediation techniques. Today the RILEM Tube Test is often used (or misused) to assess the water repellent characteristics of a concrete masonry assembly, usually after a report of water penetration. There can be several reasons why a masonry wall leaks, but using the RILEM Tube Test to assess absorptive characteristics of individual units to determine the cause of the water penetration is largely ineffective and the results often misinterpreted. This misinterpretation can detract from the effort to determine and fix the actual root cause(s) of the masonry wall leaks.

RILEM TUBE AND TEST METHOD DESCRIPTION

The RILEM Tube Test was developed in the late 1970's by RILEM (a European group similar to ASTM) for quantifying the amount water absorbed and forced into the surface of masonry stone.

The test utilizes a straight or L-shaped hollow tube (see Figures 1 and 2). The straight tube is for horizontal surfaces while the L-shaped tube is for vertical surfaces. The large opening of the tube is adhered to the stone's surface using putty or rope caulk. Water is then added to the tube and monitored over time. As the water drops an absorption rate (volume of water absorbed over time) can be determined.

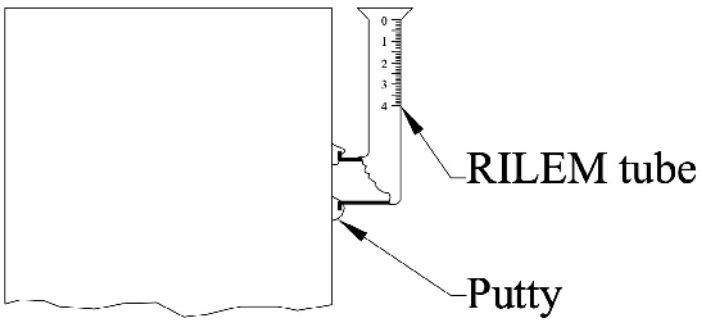

Figure 1— RILEM Tube on Vertical Surface

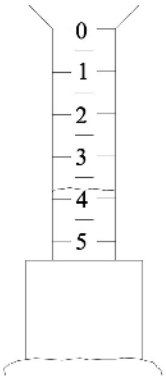

Figure 2— RILEM Tube on Horizontal Surface

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RILEM TUBE LIMITATIONS

While the RILEM tube can be visually impactful, the method only quantifies water absorbed and adsorbed by a stone or masonry unit's surface and not the volume of water penetrating through a masonry assembly.

One of the greatest drawbacks to using a RILEM tube is that the area in contact with the surface measures only 0.88 $in.^2$ (5.7 cm^2), which is quite small. Due to the small area there is inherent variability in the test. A study conducted at the University of Wyoming concluded that 1,665 tests would need to be conducted for every 12 ft^2 (1.11 m^2) of wall surface being evaluated in order to achieve a sample error of 10% or less [8]. Hence, drawing any conclusions about the water penetration characteristics of an entire wall assembly based on 50, 100, or even 500 tests can be speculative at best.

The RILEM Tube Test can be useful when evaluating the effectiveness of a remediation procedure, such as the application of a surface coating, by measuring the surface absorption characteristics before and after the treatment. However, care and insight must be used when interpreting the results.

RECOMMENDED METHODS FOR EVALUATING WATER REPELLENCY

When CMU are specified to have water repellent characteristics, the industry recommends following CMHA TEK 19-07, which contains requirements for this type of CMU [1]. These requirements are based on the use of three test methods, and CMHA TEK 19-07 contains performance requirements for each:

- Water Droplet or Water Stream Test [2] – this is a quick field method where water beads are placed on a unit in a horizontal position, or a stream of water is sprayed onto a constructed wall. If the bead stays on the surface (or if the water stream visibly runs down the wall) the unit is considered to have water repellent characteristics. It is important to note that exposure can degrade the repellency characteristics at the surface of the unit, so if the units do not pass this test they should be taken to the laboratory for further evaluation.
- Spray Bar Test [3] – in this test, a unit is subjected to a constant stream of water over the surface of the face shell for four hours. After that time, the inside of the exposed face shell is observed and the amount of dampness is measured. This test is effective in evaluating overall water repellency, as well as detecting the presence of interconnected voids in the concrete matrix.
- Water Uptake Test [4] – in this test, a coupon sample is taken from a CMU and partially submerged in water. The amount of water the coupon absorbs over time is measured. This test evaluates the capillary suction of a CMU.

These tests were developed for evaluating the characteristics of the CMU independent of the rest of the concrete masonry assembly. Several laboratory and field methods ([5], [6], [7]) have been developed by ASTM for evaluating the water penetration characteristics of masonry wall assemblies. The CMHA methods are effective in evaluating the water repellency characteristics of the CMU, and the ASTM methods listed can evaluate either the performance of the assembly overall or the drainage system within a masonry assembly. In many cases, however, these methods may not uncover the underlying problem of why a building is leaking. Such issues many times are tied to causes unrelated to the masonry assembly (such as unprotected masonry during construction, connections at a roof, or improper detailing of flashing).

REFERENCES

1. *Characteristics of Concrete Masonry Units with Integral Water Repellent,* TEK 19-07, CMHA, 2008.
2. CMU-WR1, *Standard Test Methods for Water Stream and Water Droplet Tests of Concrete Masonry Units,* CMHA, 2009.
3. CMU-WR2, *Standard Test Method for Spray Bar Test of Concrete Masonry Units*, CMHA, 2009.
4. CMU-WR3, *Standard Test Method for Assessing Water Uptake Potential of Concrete Masonry Units*, CMHA, 2009.
5. ASTM C1601-14a, *Standard Test Method for Field Determination of Water Penetration of Masonry Wall Surfaces*, ASTM International, West Conshohocken, PA, 2014, www.astm.org.
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8. Effects of Pressure on Water Penetration in Brick Masonry, S. Roller, M.S. Thesis, Department of Civil and Architectural Engineering, University of Wyoming, Laramie, WY, 1994.

ABOUT CMHA

The Concrete Masonry & Hardscapes Association (CMHA) represents a unification of the Interlocking Concrete Pavement Institute (ICPI) and National Concrete Masonry Association (NCMA). CMHA is a trade association representing US and Canadian producers and suppliers in the concrete masonry and hardscape industry, as well as contractors of interlocking concrete pavement and segmental retaining walls. CMHA is the authority for segmental concrete products and systems, which are the best value and preferred choice for resilient pavement, structures, and living spaces. CMHA is dedicated to the advancement of these building systems through research, promotion, education, and the development of manufacturing guides, design codes and resources, testing standards, and construction practices.