

Testing Flexural Tension Strength of Masonry with Low-Pressure Vacuum

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Abstract:

A test of flexural tension strength has been developed and continuously improved by the authors as part of an instructional module on masonry in materials and structural design courses at Cornell University. For over 20 years students have annually gained an appreciation for masonry materials and the critical influence of workmanship by building clay- or concrete brick walls that are approximately 24 inches (610 mm) wide and 36 inches (914 mm) high. Working in teams of 4-5 persons, the students break bricks, mix mortar, lay bricks, level and align the wall, trim and clean the joints, and protect the wall in plastic sheeting. One week later the students return to uniformly load the wall with air pressure by means of a standard shop-type vacuum cleaner to induce flexural failure near mid-height. From measurements of geometry, end conditions, and the recorded air pressure at failure the net tension stress at failure is computed. Seven-day results when converted to estimate 28-day values compare favorably with the values indicated in the TMS 402 Code (TMS, 2005) for allowable tension stress in unreinforced masonry. The test not only provides an exciting introduction to masonry and an opportunity for team building at the beginning of the semester, but the realistic and reliable results obtained effectively augment lectures and design projects. Given the simple logistical requirements, the test can readily be conducted as part of an educational program at any level, and given the influence of workmanship on flexural strength, the test would be a valuable addition in apprentice-training programs.

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