TCC MATERIALS®
SPEC BLENDED CONSTRUCTION PRODUCTS®

Technical Notes

FIELD TESTING OF MASONRY MORTARS

TCC Materials® Spec Mix® masonry mortars are preblended to meet the property requirements of ASTM C 270, *The Standard Specification for Mortar for Unit Masonry*. Section 3 of ASTM C 270 states, "this not a specification to determine mortar strengths through field testing". Furthermore, the document states "the compressive strength values resulting from field tested mortars do not represent the compressive strength of mortar as tested in the laboratory nor that of the mortar in the wall."

Physical properties of the field sampled mortar shall not be used to determine the compliance to this specification and are not intended as criteria to determine the acceptance or rejection of the mortar. ASTM C 780, *Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry* states, "The test results obtained under this test method are not required to meet the minimum compressive strength values in accordance with the property specification in C270."

Also, ACI 530.1-99 *Specification for Masonry Structures Commentary* states, "Field sampling and testing of mortar is conducted under Test Method C780 and is used to verify consistency of materials and procedures, not mortar strength."

Excerpts from *Inspection of Concrete Masonry Construction-Testing and Quality Assurance* (National Concrete Masonry Association,1996) state, "The property specifications of ASTM C270 allow flexibility in proportions of mortar materials, but tests must be performed to demonstrate that that the combination of materials selected meets established requirements for compressive strength, air content and water retention. It is important to note that these requirements apply only to mortar mixed in the laboratory under very controlled environments, not mortar mixed in the field. Tests performed on field prepared mortar are not expected to exceed these property values and frequently will not because these requirements were based on expected properties of laboratory mixed mortar."

"When fresh mortar is placed in contact with masonry units, its characteristics immediately begin to change due to the loss of water into the masonry units. However, nearly all of the mortar test methods are performed on mortar sampled from the mixer, before it has come into contact with the masonry units. Therefore, the properties of the sampled and tested mortar can be expected to differ significantly from the mortar in contact with the masonry units. Because the condition of the units and the environments can vary greatly from job to job, the properties of the plastic mortar may need to vary significantly as well to ensure quality construction. For this reason, no pass/fail values exist for field test methods of mortar."

ASTM C780-96, Annex 7 Test 3.8 *Compressive Strength Test* is a commonly used test of field mortars because of the ease of the test method and because it is frequently used for other cementitious materials and products.

From *Inspection of Concrete Masonry Construction -Testing and Quality Assurance* , "The results from these tests are not representative of the actual strength of the mortar in the wall. The tested compressive strength of field-mixed mortar may be significantly less than hardened mortar joints for the following reasons: (1) Mortar specimens are cast in non-absorbent forms. By contrast, the mortar in the wall is exposed to suction from absorbent masonry units, reducing the water-to-cement ratio. Field mortar test specimens, with their higher mortar-to-cement ratio can not develop the same strength as the mortar place in contact with the masonry units. (2) The aspect ratio of mortar specimens is greater than that of mortar joints. Typical mortar joints have a height of ⅜" and a depth of not less than 1". This results in a very broad, stable configuration that is naturally able to carry more load than the comparatively taller and more slender mortar

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specimen...Remember that those values in ASTM C270 were developed for laboratory prepared mortar only. Tests performed on properly mixed field mortar will often fall well below these values in C270."

The measured strength is dependent upon the water content at the time of set, along with other factors, and reflects the general strength that would be attained by the mortar in the masonry. The measured value shall not, however, be construed as being representative of the actual strength of the mortar in the masonry.

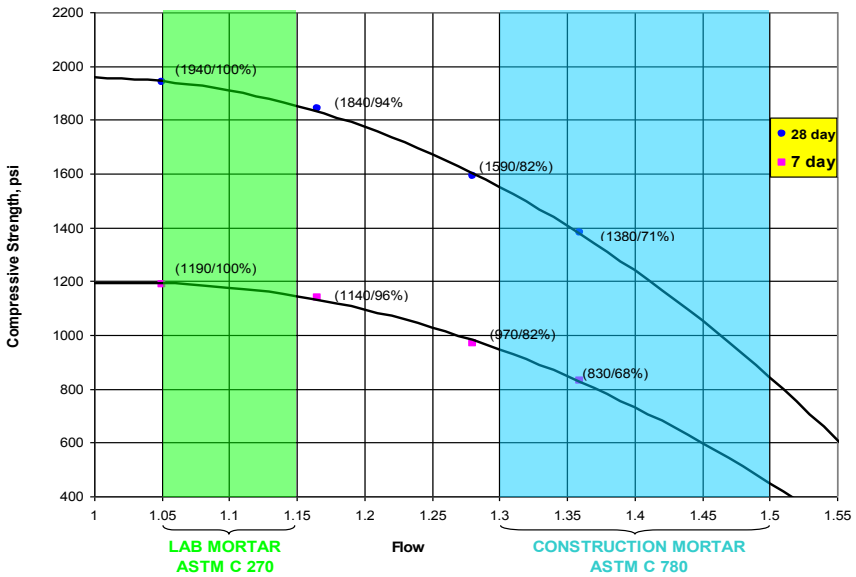
Workability is the most important property of plastic mortar. Workable mortar can be spread easily with a trowel into the separations and crevices of the masonry unit. Workable mortar also supports the weight of masonry units when placed and facilitates alignment. The mason can best assess workability by observing the response of the mortar to the trowel.

The compressive strength of a mortar depends largely upon the cement content and the water to cement ratio. For lab testing evaluations, Mortar standards commonly require a minimum water retention of 75% based on an initial flow of only 105 to 115%. Construction mortars normally have an initial flow in the range of 130 to 150% in order to produce a workability satisfactory to the mason. The lower initial flow requirements for the laboratory mortars were arbitrarily set because the low flow mortars more closely indicated the mortar compressive strength in the masonry. This is because most masonry units will remove some of the water once contact is made.

Because construction mortars are mixed with a higher water to cement ratio compared to lab mortars, the compressive strength of mortars made in the field will be lower than those produced in the lab. To demonstrate the Flow to Compressive Strength Relationship, tests of a Type S Masonry mortar were conducted in the laboratory. This is intended to highlight the impact the Flow to water/ cement ratio can have on a masonry mortar per below table.

Flow-Strength* Relationship: Lab vs. Construction Mortar

(Type S Masonry Mortar)



*All test specimens 2"x4" cylinders. When cube and cylinder test specimens from like mixtures are to be compared, the cylinder compressive strength may be considered to be equal to 85% of the cube compressive strength.
Cemston Companies Laboritories, May 2000.