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CTI FIELD REPORT 75-2-1 (R-85)

SUBJECT: FLOOR MORTAR

Foreword:

The study of floor mortar for ceramic tile floors is not a new subject. There are unresolved needed changes in floor mortars that should be agreed upon and then these changes be written into ANSI Standards.

1. Introduction
    1. 1.1 Efflorescence is a constantly lurking problem in tile installations, especially on exterior floors and exterior paved tile areas.
    2. 1.2 Interior tile floors, in areas that are subjected to constant flooding with water, are also found to be saturated with water where dry pack sand-cement mortar is used. This occurs in showers and in many kitchen areas such as US. Navy galleys.
    3. 1.3 The challenge now faced is how to make floor mortar dense enough to prevent it from soaking in water.
2. Background Information
    1. 2.1 Efflorescence is caused by water being drawn to the surface of the tile and upon evaporation leaving behind white salts which the water carries to the surface. The heat of the sun acts like a pump to draw the water to thesurface and sand-cement floor mortar allows the water to soak in and then be easily drawn through it.
    2. 2.2 Efflorescence can also be a problem on interior floors; but a bigger worry is the saturation of the mortar with liquids in galleys, restaurants and food processing areas.
    3. 2.3 Saturation of floor mortar with water will not easily deteriorate the mortar, as would happen with gypsum products, but it can contribute to the efflorescence.
    4. 2.4 Saturation with liquids from food handling and food processing can deteriorate floor mortar and also cause offensive odors in such establishments.
    5. 2.5 Ceramic Tile Institute current studies include several items which are believed will make the floor mortar dense and less prone to absorbing water and liquids.
        A. The gradation of the aggregate which is used in floor mortar.
        B. The addition of cementitious material to the sand.
        C. The compaction of floor mortar when it is placed.
3. Discussion
    1. 3.1 The gradation of sand is most important and information is available on this in CTI Field Report No. 73-2-7, Section 3, Aggregates (see page 335). Sand as required in ASTM C144 is properly graded.
    2. 3.2 The US. Navy has taken the stand that 2500 psi compressive values are to be in the floor mortar for quarry tile installations. These values cannot be reached with mortar made from the sand complying with ASTM C 144. Aggregate, at least as large as pea gravel, has to be used and made into concrete to reach the 2500 psi.

3. 3.3 Keeping jurisdiction over the placement of prefloated floor mortar is a challenge to the ceramic tile trade. The use of concrete for the setting bed further encourages concrete workers to lay claim to the prefloating.
4. 3.4 Studies are not complete to establish the proportions or kinds of cementitious material, which will fill up the voids in the sand used for floor mortar. ANSI Standard Specifications call for "The mortar setting bed mix shall consist of 1-part portland cement, 5parts dry sand or 6-parts damp sand and 1/2-part hydrated lime by volume. Add water to obtain stiff mix, approximately five gallons per sack of cement:"
5. 3.5 In some geographical areas, however, the practice is to not add any lime. Floor mix in these areas is portland cement and sand only.
6. 3.6 Although some compressive strength tests have been run on floor mortars CTI has not established how high values can be obtained with an ideal sand and cementitious materials.
7. 3.7 The final item being studied is the possible higher compressive strength value that might be reached if floor mortar were tightly compacted.
8. 3.8 Hand compaction, with a wood float and trowel as the floor mortar is placed and floated, the traditional method which has been used in the trade. It is questioned if this method provides the ultimate in compaction of the mortar.
9. 3.9 The Drehman method of installing quarry tile floors. They use a stand-up wooden tamper weighing 35 pounds. Recently this type of installation procedure was observed. The men using the 35-pound stand-up tamper quickly tire as they try to tamp-in a floor.
10. 3.10 CTI has been studying electric and motordriven tamper/levelers, which apparently would be the way to obtain the maximum values in compaction of floor mortars.

4. Conclusion
    1. 4.1 Considerable improvement is needed in the dry pack floor mortar and can be accomplished by:
        A. Using the proper gradation of the aggregate.
        B. Filling all the voids in the aggregate.
        C. Tightly compacting the mortar when it is placed and floated.
        D. Use of pea gravel concrete for the mortar bed.