



**CERAMIC TILE INSTITUTE OF AMERICA, INC.**  
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## **CTIOA FIELD REPORT 79-3-2 (R-96)**

### **SUBJECT: BLENDING CERAMIC TILE WITH SHADE RANGE**

#### **Introduction**

1. There is a strong trend for the construction industry to use various kinds of ceramic tile on floors. When properly installed there is no material to compare with ceramic tile. This is because of its beauty, wearing ability, immunity to cigarette burns, ease of removal of chewing gum, overall ease of cleaning and sanitizing, and thermal absorption properties.
2. CTI has previously issued field reports related to this subject, CTI 66-2-4 (see page 340), Bonding to Concrete Surfaces and CTI 72-2-1 (see page 406), Removal of Dead Cement From Concrete Surfaces. Neither of those reports cover all of the methods and equipment in this report.

#### **Choice Of Installation Method**

1. We recommend and refer architects to the Handbook For Ceramic Tile Installation, in order to have them select the method needed for their project. The three basic methods are shown on page 186 of the Handbook.
2. Method F111 isolates the tile installation from the concrete slab (see page 186). Results:
  - Experience has proven such methods when properly installed do not fail when the concrete slab bends, deflects, creeps or cracks.
  - The ceramic tile in a wire reinforced mortar bed, isolated with cleavage membrane, can survive intact because it does not inherit the problems of the concrete.
3. Method F112 and F113 use methods of bonding to the concrete (see page 186). Results:
  - Experience has proven such methods often fail when bonded to the concrete slab. If the concrete bends or deflects the tile is loosened or buckled loose.
  - All slabs will move and deflect. The ceramic tile bonded to the concrete slab in either a mortar bed or thinset system inherits the problems of the concrete slab. If the ceramic tile is bonded to the concrete slab and the slab cracks the tile will also crack and often be loosened.
4. Advice from CTI is to use the cleavage membrane and wire reinforced mortar method for all slab-abovegrade construction. Bonding direct to the concrete is to be considered only for slab-on-grade construction.

#### **Concrete Slab Preparation-New Construction**

1. When a mortar bed is to be used, and bonded to the concrete slab, the requirements are for the slab depression to be accurate with a screeded finish and free of cracks, waxy or oily films, and curing compounds. Slope, when required, is to be in the slab. The maximum variation in the slab shall not exceed 1/4 inch in 10 feet from the required plane.
2. The preparation of the concrete slab for bonding with dry-set portland cement mortar or latex-portland cement mortar is more exacting. The slab is to have a steel trowel and fine broom finish with no curing compounds used. Any slope required is to be in the concrete slab. The maximum variation in the slab shall not exceed 1/2 inch in 10' from the required plane.

- Experience and tests have proven that concrete slabs given the steel trowel and fine broom finish, gives the best overall base for the bonded to concrete.
- In past years the tile industry reference documents called for concrete slabs to have a wood float finish. This provides a good surface for a bond. However, concrete contractors do a more accurate finish job with the steel trowel and fine broom finish. They are prone to finish the concrete with a large wood bull-float, and leave it, when a wood float finish is specified. This does not provide a straight enough surface for the tile application.
- An article in the Concrete Construction Magazine outlines an interesting and economical way to produce flat, slightly sanded, concrete finishes . . . "The method has been in use in Europe for sometime. The proprietary method involves placing, screeding and bullfloating the concrete, curing it for two to five days, and finally using a machine which is a grinder-finisher. The resulting surface is flat and slightly porous with a sanded appearance. It is free of ridges, trowel marks and other protrusions, and surfaces have closer tolerances than trowel finished floors. Finishing is usually done at the rate of 4,000 square feet per man per day. No weak surface film remains. The method produces an excellent base for tile."

### **Concrete Slabs In Need Of Scarifying Or Surface Treatment**

1. When it is found necessary to scarify or treat a concrete slab to provide a good bondable surface there are a number of choices to consider. Too often tile contractors consider only one method, instead of all the options available to them.
2. There is uncertainty in the minds of many tile contractors on what is needed. There is also a lack of knowledge about the equipment to use and where to obtain it.
3. There is also the need to determine what surface treatment is to be used, depending upon the limitations of the particular project under consideration.
  - Large extensive areas may be best done by equipment not practical in a small area and vice versa.
  - Acid etching may not be practical in closed and confined areas or where acid fumes will do damage to surrounding surfaces.
    - a. When there are doubts whether the person to do acid etching is experienced enough to handle the job and to know the proper techniques, extreme care should be exercised, since personal injury and permanent damage can occur if this hazardous material is improperly handled.
    - b. There are different acids to use to scarify concrete. Hydrofloric and muriatic were used in a test made by the Ceramic Tile Institute.
  - Projects with equipment in them, especially for the preparation of foods, cannot be done in a way that results in cement dust or chips of concrete getting into the food preparation equipment.

### **Concrete Scarifying**

1. In preparation for this field report, CTI tried a number of ways to scarify concrete and treat concrete to provide a bondable surface for ceramic tile. Tile was bonded to these surfaces, cured, and test sheared to failure and comparative results recorded.
2. The results indicate that clean, properly prepared, broom finished concrete needs no treatment and gives some of the best overall results.
3. The tests also indicate that there are a number of satisfactory ways to scarify or treat the concrete.
4. Blastrac
  - Blastrac is a complete, self-contained, patented cleaning system. As the metallic abrasive, propelled by the rapidly rotating blast wheel, scours the concrete surface, it rebounds, using pure kinetic energy along with removed contaminants-into a high efficiency recovery system.
  - Abrasives and contaminants pass through an airwash separator. Pulverized abrasive, dust and contaminants are removed by a separate dust collector.
  - Usable abrasive is returned to the storage hopper for recirculation by the blast wheel. There is little or no abrasive loss in the Blastrac operation because of the newly designed, exclusive magnetic floor seals.
5. Tenant Concrete Scarifiers

Equipment is now available to scarify the surface of concrete in a comparatively rapid and economical way. Most of this equipment was developed for use in scarifying airport runways to make them more non-slip for the aircrafts. These same machines have been found to be useful in the scarifying of concrete to provide a bondable surface for ceramic tile. They are best used where

extensive areas of concrete are to be prepared. The scarifying is done by bundles of case-hardened washers with teeth, hitting the concrete from a rotating open drum with rods across it to hold the washers. Adjustments can be made by use of a fourth, a half, three fourths or full bundles of washers. The bonding results were good.

6. Terrazzo Grinders

These grinders, with a coarse stone, are also easily available. They were found to do a good job and the bonding results were good.

7. Sandblasting

A very good surface is produced if a heavy sandblast is used. Sandblasting must expose particles of some of the fine aggregate in the concrete.

8. Bushhammering

This was not included in the CTI testing. It is known to do an adequate job of concrete surface preparation. It is not a stand-up method of scarifying, like the above listed equipment, but will provide a way to handle small jobs.

9. Acid Etching

This provides a suitable surface, but it cannot be used on all concrete surfaces. Oil and grease are used to protect metals and other adjoining surfaces when acid cleaning is done. Therefore, acid will have little effect where there is oily or grease film on the concrete. Much knowledge is needed to remove various residues on floors before the acid is applied.

### **Resilient Materials On Concrete**

1. One of the most often asked questions at CTI is . . . "Can I bond ceramic tile to an existing resilient floor?" No!
2. Seemingly successful installations have been reported but there is also known to be a number of failures.
3. The question has also been asked, if after the resilient material is taken up, can tile be bonded to the emulsion left on the concrete? No! Again, there has been reported many failures where this has been done.
4. What kind of gamble are we willing to take? Let's estimate the cost of removal of the resilient material and emulsion on a 1,000 square foot installation at \$400 \$2,000. If it fails, removal and replacement would no doubt be \$12,000 to \$15,000. This does not include costs involved in inconvenience to the occupant nor the cost of removal of the occupants equipment and furnishing.
5. Test results showed very low value where tile was bonded to the emulsion.

### **Removal Of Resilient Tile and Emulsion**

1. There is equipment for removing the resilient tile. The two we used were Palmer Senior and Junior Floor Stripper.
2. Efforts to remove the emulsion and scarify the concrete at the same time, by using the Tennant Machine, did not work well. The emulsion gums up the area being cleaned and the equipment.
3. Emulsion removers worked well and do a quick efficient job. The area can then be scarified without the emulsion interfering with the work. Paint varnish and epoxy removers are available for this stripping. But many times it is less costly to the contractor to subcontract out this work to speciality firms qualified to do this type of concrete scarifying.

### **Conclusions**

1. Properly finished clean concrete, with a steel trowel and light broom finish, provides the best surface for bonding ceramic tile.
2. If such a surface is not provided, a surface treatment is required.
3. There are a number of different scarifying and treatments that can be used.
4. The treatment method used might be dictated by the size, requirements and limitations of the projects.
5. The effectiveness of the treatment is best evaluated by the installation of a small test area. These tests should be cover cured and then removed with hammer and chisel. A clean failure, where the bonding mortar is in contact with the concrete, indicates a weak bond.
6. Testing laboratories can be hired to test bond strengths if needed.