



CERAMIC TILE INSTITUTE OF AMERICA, INC.

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CTIOA REPORT 2006-5-23

SUBJECT: CONCRETE TILES

By: CTIOA Specialty Tile Products Committee:

Next to water, concrete is the most used material in the world. Concrete could also be classified as one of the most versatile materials as it is cast, formed, molded, colored and textured into every conceivable use man can think of. Believed by many to be a product of the modern world, the fact is that the ancient Egyptians actually employed a primitive concrete in their pyramids and the Roman's built the Coliseum with it. Today, perhaps because it is so widely used, it is taken for granted; however, without concrete our world would be considerably different.

Concrete comes in many forms; however, we wish to focus this report on one: **pre-cast concrete tiles**. These tiles are available today in myriads of shapes, sizes, thicknesses, textures and colors. Annually in the United States, millions of square feet of concrete tiles are installed on interior and exterior floors and walls of both commercial and residential structures. Concrete tiles can duplicate any texture or color developed by man or nature. Their surfaces can be left natural, polished like stone, colored and textured like tiles, shot blasted to expose a variety of different aggregates, inlaid with fossils and semiprecious stone or different mementos. With the use of sealers, the finished appearance can be either matte, semi-gloss or high gloss.

MANUFACTURING / TYPES

Concrete tiles are usually cast, extruded or ram pressed during their manufacturing process. Manufacturing plants vary from hand-casting to the most modern automated production, where the tiles are not touched by humans from the raw material stage, through manufacturing and curing, until they are inspected prior to packaging. Available sizes run through the spectrum from panelized 4"x 4" units up to 30"x 30" units. All the standard shapes available in other types of tiles are also available in the various types of concrete tiles. In addition, custom shapes, sizes and colors tend to be very competitive with other materials.

SPECIFICATIONS

The CTMA (Concrete Tile Manufacturers Association) has compiled a complete set of concrete tile performance specifications in a twelve page Handbook for Concrete Tiles. It has six sections that cover concrete tile specifications for raw materials, product and tile assembly performance, installation instructions for both thin-set and mortar-set, spread and bag grouting, sealers and maintenance. The installation instructions conform to both ANSI and the TCA Handbook recommendations. These specifications were developed based on the results of a series of tests that were performed by the Smith Emery Laboratories located in Los Angeles, CA. Complete details of all these test procedures are covered in CTMA's newsletter *Concrete Tile Tales*, Vol. II, Issue #3. Both the CTMA Handbook and newsletter are available upon request from the CTIOA.

“ Q-TILE” TESTING PROGRAM

To assure the construction industry and the ultimate consumer that the rigid standards of the CTMA's 'Product Performance' specifications are maintained by all member manufacturers, the CTMA has instituted a "Q-Tile" (Quality-Tile) ongoing testing program. Cartons of member manufacturer's tiles are picked up by Smith-Emery at random from job sites, dealer or plant inventory. These tiles are then tested in five different ASTM categories.

I.	Absorption	12%	ASTM C-67	(Section 8)
II.	Density	140 lbs cubic/ft	ASTM C-642	
III.	Length Change (+/-)	0.1% max.	ASTM C-157	(CTMA Modified)
IV.	Bond Strength (shear)	50 psi	ASTM C-482	
V.	Breaking Strength (max. load)	300 lbs	ASTM C-67	(Section 21)

SUBSTRATES

Any substrate that can accept ceramic or natural stone tiles is considered an acceptable substrate for concrete tiles. Like all tile products, concrete tiles must be installed to meet both industry and the manufacturer's recommendations.

When membranes are part of the tile assembly, they must be an industry approved "direct bond, load bearing, anti-fracture" membrane, or an approved "cleavage" membrane that is placed under a reinforced mortar-bed. Concrete tiles can be installed in the interior and/or exterior in both horizontal and vertical applications.

MOVEMENT JOINTS

Movement joints must conform to the recommendations in the current TCA *Handbook for the Installation of Ceramic Tile*. Concrete tiles are affected, like many other products, to changes in temperature and excessive moisture, similar to Quarry and Saltillo tiles.

INSTALLATION TECHNIQUES

Consult the CTMA *Handbook for Concrete Tiles* for complete details which are in concert with the TCA

Handbook. The CTMA also recommends that exterior applications be backbuttered according to ANSI A108.5 A-4.3.3.3.3.

GROUTING

Concrete tiles are normally installed with a wide grout joint and the CTMA recommends a Quarry (or Saltillo) grade of sanded grout. The larger aggregate in these grouts will prevent shrinkage cracks in the grout joints. Like all grouting materials, carefully follow the grout manufacturer's instructions and do not add too much water to the mix.

SPECIAL CONSIDERATIONS

1. Like other ceramic tile products (Quarry tile, Saltillo, etc.), excessive heat or moisture will cause concrete tiles to slightly expand and/or shrink depending how they were cured, installed and sealed. The CTMA further developed additional ASTM testing procedures to duplicate extreme field conditions. These tests subjected bonded concrete tiles to a 41-day moisture and drying cycle before shear testing according to ASTM C-482. The results of these tests established three basic facts: When concrete tiles are **(1)** - properly cured according to CTMA specifications, **(2)** - installed according to the CTMA and ANSI specifications, **(3)** - appropriate Movement Joints are in place as recommended by the TCA Handbook, **normal movements will not compromise the concrete tile's bond to the substrate.**

NOTE: The substrate and/or the membrane must be an approved system as per the CTIOA and ANSI.

2. **CURING:** The proper curing of any concrete product is extremely important. When a concrete tile is initially cast, it is saturated with moisture and as it goes through the hydration process it will shrink until it has an initial cure. **The curing time varies due to a number of factors** such as: the cement water mix ratio, cement aggregate mix ratio, type of aggregate, type of admixtures, presence of accelerators, vibration during casting, method of curing (atmospheric, curing chambers), etc. Through extensive research, Smith-Emery and the CTMA have established that if **in seven days** (or less) a concrete tile meets CTMA's requirements for three different ASTM test procedures, it is sufficiently cured enough to be sold and installed. These three tests are: **(1) - Compression Strength** (4000 psi), **(2) - Moisture Content** (7%) and **(3) - Length Change** (0.1% maximum). The Smith-Emery tests established that any amount of additional shrinkage that may occur after these three benchmarks are reached is very insignificant and will not affect the installation of these tiles.

NOTE: CTMA concrete tile member manufacturers stamp the production date on their tile cartons.

3. **CURLING:** The curling phenomena is usually the result of: (1) - Improper mix or procedure in manufacturing the concrete tile, (2) - The concrete tiles were not properly cured and/or, (3) - Industry standards were not followed in installing the concrete tiles. It is also true that a loose thin piece of pre-cast concrete, such as a concrete tile before it is installed, can curl when subjected over a period of time to excessive moisture and heat. However, tests performed by Smith-Emery have proven that when these same tiles are properly installed by the procedures outlined in the CTMA's Handbook, this tendency is offset by the proper bonding of the concrete tiles to the substrate. **Like ceramic and natural stone tiles, proper installation will provide a trouble free**

concrete tile installation!

To obtain free copies of the *Handbook for Concrete Tiles* and/or the newsletter *Concrete Tile Tales*, Vol. II, Issue #3 or any additional information on concrete tiles, contact the CTIOA.