



CERAMIC TILE INSTITUTE OF AMERICA, INC.

12061 Jefferson Blvd., Culver City, CA 90230-6219

CTIOA REPORT 83-1-1 (R-96)

SUBJECT: TILE TYPES, USES AND STANDARDS COVERING THEIR MANUFACTURED PHYSICAL QUALITIES

INTRODUCTION

Due to the ever increasing variety of tile, there is a certain amount of confusion as to what the different categories of tile are, their specific qualities and standards.

The purpose of this field report is to clarify the qualities, characteristics and uses for the various tile types.

There are a number of types of tile which do not fall within the ANSI A137.1 Standard Specifications for Ceramic Tile. These special purpose tiles will be discussed in a separate section of this report.

DISCUSSION

1. The American National Standard Specifications for Ceramic Tile (ANSI A137.1) divides ceramic tile into the following categories:

- a. Unglazed ceramic mosaic
- b. Unglazed quarry paver tile
- c. Unglazed paver tile
- d. Glazed wall tile
- e. Glazed ceramic mosaic

- f. Glazed quarry tile
 - g. Glazed paver tile
 - h. Decorative thin wall tile
 - i. Special purpose tile
2. To more fully understand the differences between the various types of tile, each type will be discussed on the basis of how the tile is manufactured, its performance characteristics and special considerations.
 3. The nine types of ceramic tile listed previously are all covered under the American National Specifications for Ceramic Tile (ANSI A137.1). The tile is evaluated with a uniform testing criteria. The tests are composed of both nondestructive and destructive procedures.
 4. The nondestructive tests are basically designed to determine the dimensional qualities of the tile types. There is also a color uniformity test for glazed ceramic products.
 5. The destructive tests require that the tile be tested for water absorption, crazing, thermal shock, bond strength, breaking strength and abrasive hardness.
 6. The tile sample is taken from one lot of tile. Eighty pieces of loose quarry, paver and glazed wall tile or 20 sheets of mounted ceramic mosaic are required for the test procedure.

TILE TYPES

1. Unglazed Ceramic Mosaic

- a. Ceramic mosaic tile is formed by either the dustpressed or plastic method, usually 1/4 to 3/8 inch thick, and having a facial area of less than six square inches. Ceramic mosaic tile may be of either porcelain or natural clay composition and either plain or with an abrasive mixture throughout.
- b. Ceramic mosaic tile is required by the Standards to be either impervious, if porcelain body; or impervious or vitreous, if natural clay body. Impervious requires water absorption of not more than 0.5 percent; vitreous designates a water absorption between .5 percent and 3 percent. Water absorption of all tile discussed in this report is calculated in accordance with ASTM test method C373.
- c. If conductive tile is required for hospital or laboratory installation,

ceramic mosaic tile can be manufactured to meet the conductive requirements of ASTM C483.

d. Where frostproof tile is required, manufacturers should be consulted as to whether their tile meets frostproof requirements.

e. Where abrasive hardness values are required, porcelain body ceramic mosaic tile must achieve a rating of 100. If it has a body formed of natural clay, a rating of 50 is required. Test method is ASTM C501.

f. Ceramic mosaic is a very durable tile type, with above average slip resistant characteristics, and is suitable for most exterior and interior horizontal and vertical applications. It may not be suitable for heavy commercial installations where maximum durability is required.

2. Unglazed Quarry Tile

a. Unglazed tile is made by the extrusion process from natural clay or shale usually having six square inches (39 cm²) or more of facial area.

b. Inasmuch as quarry tile is an extruded product and thus presents unique manufacturing and firing requirements; its water absorption is set at five percent or less. Due to manufacturing procedures it has been determined not to classify quarry tile in vitreous or semivitreous categories.

c. Unglazed quarry tile is also a very durable tile type with a wide range of users.

d. Quarry tile can be manufactured with an abrasive grit embedded into the surface if increased slip resistance is required.

e. If frostproof tile is necessary a certificate stating its frost resistance should be required from the manufacturer.

f. As the standard calls for thickness of 1/2" to 3/4", quarry tile may be suitable in very heavy wear areas or commercial installations where durability and resistance to chemicals is of paramount importance.

3. Unglazed Paver Tile

a. Paver tile is unglazed porcelain or natural clay tile formed by the dust pressed method having six square inches or more of facial area.

- b. Paver tile has much the same characteristics and requirements as ceramic mosaic tile.
- c. Breaking strength, abrasive hardness, water absorption and virtually all destructive and nondestructive tests have the same requirements for both glazed and unglazed tile.
- d. Again, unglazed paver tile is a dense, durable material which can be used in many different applications.

4. Glazed Ceramic Mosaic-Quarry-Paver Tile

- a. The glazed version of these tile types must meet the same criteria that the unglazed units do. The only difference is that glazed tile must be subjected to a crazing and thermal shock test. The tile body must not show any evidence of disintegration and the glaze no evidence of shivering spalling, or crazing. Standard tests for thermal shock and crazing are ASTM C484 and C424, respectively.
- b. When specifying or installing glazed tile for flooring use, several requirements should be considered.
 - 1. If it is to go in a high traffic or exterior area, is it slip resistant? There is a test to determine the slip resistance of tile. This test should be made prior to installing the tile, if slip resistance is required.
 - 2. Will the glazed tile withstand the wear? Some glazes are more durable than others. Glazed tile will be more prone to pattern wear than will an unglazed product.
 - 3. Consider maintenance constraints. Light colored tile may not be suitable for high traffic areas, where they would be subject to dirt, grease, or other types of staining, thus requiring constant maintenance.

5, Glazed Wall Tile

- a. Glazed wall tile is a tile with a body that is suitable for interior use; which is usually nonvitreous; and is not required nor expected to withstand excessive impact or be subject to freezing and thawing condition.
- b. This type of tile varies dramatically with the tile types discussed in

the previous sections of this report. This tile is generally made of a soft whiteware bisque with an impervious glaze. With regard to water absorption, the standard states it may have up to an 18 percent absorption factor. As this tile is intended for wall and countertop use, its performance characteristics are not as high as previously discussed tile. This tile must, however, achieve a 90 psi rating for breaking strength. Also, when tested for thermal shock and crazing, there must be no evidence of disintegration of the body nor peeling, slivering, spalling, or crazing of the glaze.

c. As this type of tile is not as durable as paver or quarry tile, it would not be recommended for floor use.

d. When used for countertop installations, several factors should be considered:

1. Durability - does it meet the standards for breaking strength and absorption resistance?
2. Type of Glaze - high gloss glazes will tend to show scratch and wear marks more quickly than will glazed tile with a mat or semi-mat finish.
3. Is the tile recommended by the manufacturer for countertop use? - Most manufacturers will have a list of those tile and glaze types most suitable for countertop use.
4. Acid Resistance - if tile is to be used on a countertop it must be capable of withstanding food acids such as orange, lemon, and vegetable acids. It has been found through empirical testing that the very durable crystalline glazes are in some cases quite susceptible to acid etching.
5. Water Penetration - the glazed surface should be a fused impervious surface. No water or moisture should be able to penetrate through the glaze.
6. Cleanability - when common household items such as mustard, ketchup, animal fat, cooking oil, etc., are placed on the surface of the tile their stains must be easily removable with neutral household cleaners.

6. Decorative Thin Wall Tile

- a. This type of glazed tile is designed primarily for decorative interior residential walls.
- b. Although thin wall tile is a product designed for a very specific use, it must conform to requirements of glazed wall tile with exception of the breaking strength criteria.
- c. It is required by the standards that boxes containing such tile shall be marked with an orange label and "Decorative Thin Wall Tile" be typed conspicuously on the label.
- d. This tile is usually found to be less than 3/8" in thickness.

7. Special Purpose or Faience Type Tile

- a. Special Purpose Tile: Tile, either glazed or unglazed, made to meet or to have special physical design or appearance characteristics such as size, thickness, shape, color, or decoration; keys or lugs on backs or sides; pregrouted assemblies or sheets; special resistance to staining, frost, alkalis, acids, thermal shock, physical impact or high coefficient of friction.
- b. In addition to the ANSI definition this glazed or unglazed tile is generally made by the dust pressed or plastic process, showing characteristic variations in the face, edges and glaze that give a handcrafted nonmechanical, decorative effect.
- c. There is no standard test method or criteria for evaluating special purpose tile in the ANSI A137.1 Standards.
- d. The tile should be either vitreous or semivitreous. It is believed that tile with a water absorption over seven percent may not have suitable durability characteristics for floor use.
- e. With regard to abrasive wear the minimum requirements is 35. If a tile is specified for use in a high traffic area, values between 60 and 90 may be necessary to withstand performance requirements.
- f. This standard requires the average breaking strength to be not less than 250 psi. This requirement is somewhat severe. However, if maximum performance is required this value should be maintained.
- g. If slip resistance tile is required for exteriors, wet areas, ramps and similar areas, then a higher coefficient of friction is recommended. There is now an ASTM test procedure C1028 that can evaluate slip

resistance either at the jobsite or in the laboratory.

h. Evaluating of Special Purpose Tile

1. When a specific tile is chosen for a specific installation, certain criteria must be established against which the chosen tile can be evaluated.
2. The tile must be evaluated on the basis of the performance requirements it must have to insure that the installation will retain its beauty and functionality.
3. If there is a question with regard to the suitability of a tile either, consult the manufacturer for its recommendation or test the tile in accordance with recognized methods and procedures.

8. Packing House Tile

- a. These are unglazed tile units which are formed in the extrusion process. These units are manufactured generally in a 4" x 8" x 1 3/16" - 1 1/2".
- b. Various surface textures are available, such as smooth surface, diamond tread, abrasive surface and vertical fibre. These units can be used where chemical resistance, heavy commercial or industrial or extraordinarily severe wearing conditions require maximum performance characteristics of a ceramic tile unit..

GLAZES

1. There are many different types of glazes. Section 2 below lists the major types. Each glaze has been developed for a special purpose. Whether it be for aesthetics, performance or a combination of characteristics the glaze of an individual tile must be evaluated for the area and performance needs required of it.
2. Glaze types with brief description:
 - * Bright glaze. A high gloss coating with or without color (ASTM C242)
 - * Clear glaze. A transparent glaze with or without color (ASTM C242).
 - * Crystalline glaze. A glaze that contains microscopic crystals (ASTM

C242).

* Fritted glaze. A glaze in which a part or all of the fluxing constituents are prefused (ASTM C242).

* Mat glaze. A low gloss ceramic glaze with or without color (ASTM C242).

* Opaque glaze. A nontransparent glaze with or without color (ASTM C242).

* Raw glaze. A glaze compound primarily from raw constituents. It contains no prefused materials (ASTM C242).

* Semi-mat glaze. A medium gloss ceramic glaze with or without color (ASTM C242).

* Speckled glaze. A glaze containing granules of oxides or ceramic stains that are of contrasting colors.

3. Manufacturers can be consulted as to which glazes are more suitable to specific performance requirements.

CONCLUSION

1. As was alluded to under paragraph C8, there is a vast array of tile on today's market.

2. Unglazed tile is, by and large, the most durable general tile type. Quarry, paver and ceramic mosaic tile have physical characteristics which give them unique applications. Performance requirements must be determined prior to selecting a tile. In this fashion tile can be matched to the need and produce a lasting installation.

3. No one tile or group of tile can be effectively utilized in every circumstance. Tile is a most versatile material with wide application possibilities. Care, however, must be given to choosing the appropriate tile for a given set of requirements.

4. When the full range of considerations beyond color are taken into account, tile can play an effective role in not only beautifying an area, but also becoming an integral and durable part of a residential or commercial project with the lowest net cost to the consumer.