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SUBJECT: GLASS TILE REPORT

By: CTIOA Specialty Tile Committee

Glass Tile

Glass tile has become more than trend in the world of tile and design and is now a significant percentage of the tile market. With this growth has come the need for a better understanding of how to select and install glass tile. Glass tile formats include a full range of mosaic, large format, liners, trim and decos. The variety of sizes, thicknesses, backings, surface finishes, manufacturing methods and performance characteristics allow glass tile to be specified for many different tile applications.

Description

A basic knowledge of how glass tile is produced is helpful for understanding glass tile's performance characteristics and determining glass tile's appropriate application. From ASTM Designation C162-94C, glass is defined as an inorganic product of fusion that has cooled to a rigid condition without crystallizing. The inorganic products that make up the most common type of glass, soda-lime glass, are: silicon dioxide (silica), sodium, and calcium oxides (carbonates). These raw materials are heated to a viscous molten state and then rapidly cooled without sufficient time for a regular crystal lattice to form. A simpler definition designated by the tile industry for referring to tile made of glass is: a ceramic tile having an overall non-crystalline microstructure. The non-crystalline microstructure is what delineates glass tile from other ceramic tile that has a crystalline microstructure.

Manufacturing

Glass tile can be categorized into three basic types: Cast, Fused, and Cold. These categories refer to the temperature at which the glass tile is produced and will help the design professional, installer and consumer begin to understand some of the basic performance characteristics of glass tile.

- Cast: pressed in a liquid state, at 1600 °F or higher.
- Fused: sheet & sintered glass altered with heat at temperature range from 1200 °F to 1599 °F.
- Cold: sheet glass altered between room temperature and 1199 °F.

Cast glass tile manufacturing, through the use of molds and presses, forms the liquefied raw materials into the tile format. Casting a homogenous mix of molten raw materials produces thru body color which is an integral part of the glass tile. The cast glass

manufacturing process provides an almost limitless range of color, size and shape options and the front and back surface's of the glass tile can be altered with secondary processes to further enhance the glass tile's appearance, scratch and slip resistance. Cast glass tile has high breaking strength, chemical and freeze-thaw resistance, is impervious and has some scratch resistance. Successfully installed in wet locations, exterior applications, pools and domes for many years, cast glass tile is generally the most durable and versatile glass tile type.

Fused glass tile manufacturing bonds pre-manufactured sheet glass with paints, foils, frits and/or additional layers of glass with enough heat to permanently fuse the products together. Fused glass tile also has high breaking strength, chemical resistance and freeze-thaw resistance and is impervious, but generally does not resist scratching. Low scratch and slip resistance generally excludes fused glass tile from being recommended for floor applications.

Sintered glass tile is also considered a fused glass tile, which utilizes various pre-colored fines, mixed with organic mediums that are pressed into molds and fired. The firing reaches a temperature, which promotes binding, yet does not liquefy the entire mass. This usually produces a glass tile with a lower breaking strength and higher absorption rate yet allows for a simpler method of manufacturing.

Cold glass tile manufacturing generally employs the same sheet glass as fused glass tile, but the cold process uses little or no heat to bond or laminate the decorative finishes to the glass tile. This type of glass tile manufacturing often produces glass tile too sensitive to be installed in exterior applications, intermittent moisture areas (showers & tubs with shower heads) and submerged applications (pools, spas and fountains). The lack of durability and low bond strengths of the decorative finishes generally limits cold glass tile installation to dry, wall applications unless recommended for wet areas by the glass tile manufacturer.

The American National Standard for manufacturing ceramic tile is ANSI A137.1. Currently there is no standard for manufacturing glass tile. While certain ASTM tests such as C1026 Freeze-Thaw Resistance, C373 Water Absorption or C650 Chemical Resistance can be applied to glass tile, a more comprehensive manufacturing standard to address the unique qualities and performance characteristics of glass tile is needed. ANSI A137.2 is the proposed designation for a glass tile manufacturing standard and is being developed.

Formats

Using one of the manufacturing methods listed above glass tile can be cast, shaped, and cut into many different sizes. The facial dimension, thickness, and mounting style will impact where the glass tile should be installed as well as the installation recommendations. In general, glass tile is described as either a mosaic glass tile or a large format glass tile.

- Mosaic glass tile is usually mounted and has a facial dimension of 9 square inches or less.
- Large format glass tile is un-mounted and has a facial dimension range from 4 square inches to 576 square inches.

If the trend toward larger tile continues further defining any glass tile larger than 576 square inches (24" x 24") as a glass panel may be necessary. Glass tiles of this size may need to be installed with different installation techniques.

Specifying

The numerous types and varieties of glass tiles currently on the market provide architects, design professionals, and homeowners with creative options that were previously unavailable. In addition to glass tile's inherent beauty, many glass tiles are freeze/thaw stable, non-absorptive, as well as chemically resistant, so they can be specified for a wide range of tile applications. However, as previously mentioned, not all glass tiles are suitable for all applications. When selecting and specifying glass tile consult the glass tile manufacturer for the glass tile's test results and recommended applications.

Substrate

The performance of a glass tile installation is dependent upon the durability and dimensional stability of the underlying framing structure and the substrate to which it is bonded. Not all substrate preparation methods are suitable for glass tile installation. Glass tile can have high breaking strengths, but by nature may be slightly less flexible than other tile types. This requires the specification of the most stable substrates for the installation of glass tile.

Two substrates commonly used in the tile industry, which are **unacceptable** for glass tile installations are wood products and one-coat (single float) mortar bed methods. These substrates do not provide the dimensional stability required for successful glass tile installations.

The following substrate recommendations for glass tile installation are from the "2007 TCA Handbook for Ceramic Tile Installation"

- Wet-set method, with portland cement mortar—ANSI A108.1A (to be used only in conjunction with A108.14)
- Well cured mortar beds—ANSI A108.1B (cured a minimum of 7 days)
- Cementitious backer units (CBU)—ANSI A118.9 (Note: an ANSI A108.02-3.8 membrane is required behind all CBU installations in wet areas.)
- Concrete slabs (on grade) cured for 28 days minimum
- Gypsum board (dry areas only)—ASTM C1396 or ASTM C1396M-04

In vertical applications, when installing tile over a substrate that is attached to wood or metal framing, the TCA Handbook wall installation methods specify: "dry, well-braced wood studs" or "well-braced metal studs". The minimum requirement for steel studs is 20 gauge, 3-1/2" deep with the stud spacing not to exceed 16" on center. The steel must meet ASTM C645-04 for nonstructural framing and C955-03 for load bearing studs, runner and bracing or bridging and have a minimum G60 (galvanized) coating per ASTM A653/A653M.

Blocking and bracing is often overlooked in substrate preparation, but is an important component of the stable substrate for a tile assembly. Based on the need to provide the most stable substrate, glass tile installations require additional blocking, particularly as the glass tile format size increases. A good recommendation for large format glass tile

installations is to install solid blocking between the framing, horizontally every 18" and at all CBU transitions.

Setting Materials

Significant progress has been made in the development of setting materials for installing glass tile. Generally, a flexible setting system with high bond strength will be recommended for glass tile installation. However, due to the different types of glass tile, setting material recommendations will vary by manufacturer. To determine what setting material to use, follow the glass tile manufacturer's recommendations, which should align with the recommendations made by the setting material manufacturer. In the absence of installation instructions, a setting material listing "Glass Tile" under "Acceptable Uses" on the bag or container would be recommended.

Grout

As with setting materials, grout recommendations for glass tile also vary by manufacturer. Grout type is generally dictated by the grout joint size, the scratch resistance/surface hardness of the glass tile face and the glass tile type. There is currently a wide range of grout products being recommended for glass tile, which include un-sanded and sanded cement-based grout, epoxy, modified epoxy, silicone and urethane grout.

Based on glass tile's thermal rate of expansion, the grout material must be flexible enough to allow for some movement of the glass tile. Generally, grouts with high compressive strength, such as epoxy-based grouts do not perform well with glass tile, particularly as the tile size increases. The greater the glass tile's mass (size and thickness) the greater the consideration needs to be for expansion. Epoxy grouts may perform well with smaller mosaics, less than 3/16" thick and smaller than 1" x 1", but as the glass tile format size increases, epoxy grout may be problematic.

Cement-based grouts allow for some movement of the glass tile. The standard industry recommendation is to use un-sanded grout for joints up to 1/8" and sanded grout for joints greater than 1/8". This is a good guideline for glass tile, but there are exceptions. Some mosaic tile is manufactured with a beveled edge where the facial dimension of the back of the tile is smaller than the front. When this type of tile is mounted the joint size on the face may be less than 1/8", but grow to 1/4" at the back of the tile. For this type of glass tile sanded grout would be recommended due to the overall joint width being greater than 1/8".

In addition to joint size, scratch resistance/surface hardness of the glass tile often will often determine which grout performs best. The belief that glass tile should always be grouted with un-sanded grout is not accurate. Most cast glass tile and some fused glass tile can be successfully grouted with sanded grout due to this type of glass tile's durable, scratch resistant surface. Some glass tile has a less durable surface and un-sanded grout would be more appropriate. Confirm with the glass tile manufacturer the best grout to use with their product.

In the absence of a grout recommendation from the glass tile manufacturer, select a grout based on the previously mentioned factors. Test the grout in an inconspicuous area or on a sample board prior to installation to determine the grouts compatibility with the glass tile.

Installation Techniques

The recent public demand for new and different tile materials has pushed the production of specialty tiles such as glass tile. As a result of the increased presence of these specialty tiles the need has grown for new and updated manufacturing and installation standards. Glass mosaic tile has been successfully installed for hundreds of years, but until recently there had never been installation standards. An exciting step in the evolution of glass tile occurred when three new standards for the installation of mounted glass tile mosaics were published in the American National Standard Specifications for the Installation of Ceramic Tile (ANSI). By incorporating modern setting materials with traditional installation techniques and applying scientific testing to understand the performance of the various installation techniques, glass tile experts, with the help of their industry peers were able to develop these new standards. The new standards are:

- Installation of Paper-Faced Glass Mosaic Tile ANSI A108.14 – 2005 [New]
- Alternate Method: Installation of Paper-Faced Glass Mosaic Tile ANSI A108.15 – 2005 [New]
- Installation of Paper-Faced, Back-Mounted, Edge-Mounted, or Clear Film Face-Mounted Glass Mosaic Tile ANSI A108.16 – 2005 [New]

In the absence of installation instructions from the glass tile manufacturer, the decision to use one of these methods over the other will be determined by the type of glass tile specified and the location the glass tile will be installed.

Currently, there is no standard for the installation of large format glass tile. This standard is also under development and will be available in the future. In the absence of an industry standard the best practice is to refer to the glass tile manufacturer's recommendations for installation. An additional resource for information about large format glass tile installation is the Ceramic Tile Institute of America Inc. (CTIOA) Field Report "2002-12-12 Installation Specification for Directly Bonding Large Module Glass Tile to Portland Cement Mortar Beds (cured 7 days) and Cementitious Backer Units (CBU)".

Movement Joints

Movement joints are essential for the success of most tile installations and glass tile is no exception. Glass tile may have a higher rate of thermal expansion and contraction than other tile types. The importance of incorporating movement joints in a glass tile installation cannot be overemphasized. Follow the recommendations found in Movement Joints EJ171 in the "TCA Handbook for Ceramic Tile Installation". An architect or engineer should be consulted when specifying the number, location and type of movement joint for the tile installation.