



CERAMIC TILE INSTITUTE OF AMERICA, INC.

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

CTIOA Field Report 81-1-4 (R-89)

SUBJECT: GLASS MOSAIC MURAL INSTALLATION

- INTRODUCTION

1. The purpose of this report is to offer some insight into the challenges and peculiarities of installing glass mosaics, especially murals.
2. This report will outline procedures for installing glass mosaic murals.
3. The types of murals that will be discussed are those made of both Smalti, Byzantine glass and Venetian glass.
4. Murals made of glass mosaic, especially the Smalti type glass, are very costly and can easily be ruined unless they are properly handled and installed. For this reason, many specifications require the mural be installed by: "Professional Journeyman tile setters experienced in setting tile of this type under similar conditions". This field report, therefore, is as much a not-to-do warning for those inexperienced in mural installations as it is a review of procedure for those who are experienced.

- DISCUSSION

1. Both types of glass are installed basically the same way.

2. As stated in a prior issued CTI Field Report, No. 66-2-9, "Backbuttering Glass Mosaics", a successful glass mosaic installation cannot be obtained by combing thinset material over a hardened surface, such as a prefloat mortar bed, and placing the glass mosaic sheets directly on the thinset mortar. This procedure most surely will result in a failure. The major factors Contributing to the failure are:
 - a. Insufficient contact of the thinset bonding mortar to the glass., resulting in little or no bond.
 - b. An inability to beat the Byzantine glass in on a hard wall because all tesserae are not of equal thickness.
 - c. Both kinds of glass must be back grouted, they cannot be face grouted.
 - d. Not locking each individual tessera of glass into place by back-buttering the bondable side of the sheets of glass.

- MATERIAL AND MIXING RATIOS

1. Glass mosaics are best set in the mortar method of tile installation.
2. The mortar method referred to is in the ANSI A108.1 specification.
3. The materials are as follows:
 - a. Portland Cement:Conforming to ASTM CISO, Type 1.
 - b. Hydrated Lime:For masonry purposes and to conform to ASTM C-207 types, plus the added requirement limiting the unhydrated oxides to 8% maximum.
 - c. Sand: ASTM designation C-144 washed plaster sand and specification for aggregate for masonry mortar ASTM C-144.
 - d. Water:Free from impurity that is injurious to the construction and shall be fit for human consumption.
 - e. Grout and Buttering Mix:Shall be a grout mix with up to one part sand to two parts portland cement. Sand to

comply with CTI 70-6 Standard for Graded Extra Fine Sand Aggregate (See CTI Field Report 73-1-3 for further information on fine sand aggregate.) White sand complying with CTI 70-6 is available from Crystal Silica Sand Company in Oceanside, California. It is called Tile 70 Sand. The only way to get grey graded sand is to screen washed plaster sand using a 16 mesh screen (window screen).

f. Mortar Setting Bed: Shall be mixed in the proportions of one part portland cement, one part hydrated lime, six parts washed plaster sand.

- LOFTING

1. Lofting is a procedure whereby the mural is laid out on a clean, dry surface, paper side down.
2. The sheets are placed so that they fit tightly together.
3. Measurements are then taken to make certain that the mural fits properly into the space it is designed for.
4. Special care should be taken when lofting, to protect the sheets from moisture such as a damp concrete slab. Also, it must be protected from the direct heat of the sun. Moisture will begin to release the tile from its paper face. Excessive heat will cause the paper to curl and the glue to become brittle. Either condition could cause the tile to come loose from the paper face.

- INSTALLATION - FOR VENETIAN AND BYZANTINE GLASS

1. Mortar bed should not exceed 1/2" in thickness. A plumb scratch can be applied to obtain desired thickness, or compensate for irregularities in the wall or floor.
2. Setting the mosaic in fresh mortar provides the most favorable installation.
3. An area not to exceed a days installation should be floated. An experienced journeyman can expect to set fifty square feet per day. This estimate is of course dependent upon job and weather conditions.

4. The mortar bed must be firm before setting sheets. A wet or heavy bed could precipitate slipping, air pockets, and difficulty in working the sheets together. Mosaic sheets are one-of-a-kind units. If it falls apart or is ruined by putting it on too wet a bed, an expensive work of art may very well be irreparably damaged.
5. Mosaicist draw a center line and also draw squiggle lines all over the back of the cartoon paper prior to cutting it into sections and mounting the Tessarae. These lines are used to plumb and level and keep details such as hand and faces straight and true.
6. Constant care must be taken to make sure the mural is level and plumb. If it begins to drift out of level, it is difficult or impossible to correct the mistake.
7. The backbuttering of the mosaic is of great importance for several reasons: One, it locks the individual pieces into place so that they do not move independently after the sheet is set. Two, it provides a 100% bond between tile and mortar bed. Three, it removes any foreign substance such as dirt or dust from the back of the tile that could act as a bond breaker. Four, the backbuttering process is also back-grouting the tile. Beveled Venetian glass cannot effectively be face-grouted.
8. Extreme care should be taken not to butter the glass too far in advance of setting the sheet. Depending on the weather, consistency of the backbutter and the experience of the setter, that sheet has between 30 and 60 seconds before the water in the backbutter effects the glue on the paper holding the glass together. If the water is allowed to dissolve the glue, the sheet could tear, fall apart, or become difficult or impossible to handle.
9. The placing of the sheets is critical. Care should be taken to fit the sheets together as tightly and smoothly as possible. A few extra minutes fitting the sheets initially, will save hours of tedious work after the paper has been pulled from the face of the glass. This careful fitting of the sheets is to prevent sheet marks from showing where two sheets come together.
10. Sheets should be tapped into place and joint lines smoothed before pulling the paper.

11. Wetting the sheets is a variable. In hotter weather, fewer sheets would be set before wetting. The opposite, of course, is true in colder weather. Generally, between 20 and 30 square feet could be set before wetting the sheets and pulling the paper.

- WORKING THE GLASS

1. The glass must be rubbed into place, using a block of wood or comparable implement. The face of the glass must be rubbed flat and smooth.
2. When a mural is so large that it takes more than one day to install, the mortar extending past the edges of the sheets in place must be cut clean back to the scratch coat. This procedure is done so that the next days work can be fit nicely into place.

- DISCUSSION OF ALTERNATIVE METHOD OF SETTING SMALTI BYZANTINE GLASS

1. This method has been related to us by workmen who have used it successfully in the field.
2. The materials are the same as those specified in C.3 a-d. The mixing ratio for the backbutter is different. The backbutter mix is 3 parts sand 1 part portland cement and 1 part hydrated lime.
3. This procedure is for setting Smalti Byzantine over a pre-floated setting bed.

- PROCEDURE

1. Mural is lofted and its actual dimensions are taken.
2. The area is prefloated using the mortar mix detailed in C.3 f. The prefloating is done to accommodate the thickness of the glass plus 1/2".
3. The mortar bed is then cover-cured until dimensionally stable. It is recommended that it be cured for seven days.
4. A box screed is then made so that each sheet will have exactly 1/2" of backbutter on it in addition to the glass.
5. A skim coat of thinset is then applied on a small section of the wall. Care should be taken that the thinset does not skim over

before the sheets are applied to the mortar bed.

6. Make certain that there is a good bond between the prefloated mortar bed and the backbutter. The shear strength of one coat of mortar applied to another coat of mortar without an effective bonding ingredient, such as a cement slurry or thinset, is very low.
7. All other procedures are the same as those outlined in the previous sections.

- GROUTING

1. Refer to backbutter mix in section C.3 e. This same material is used to grout the glass.
2. All cement and glue scum must be cleaned from the face of the tile prior to grouting.

- CONCLUSION

1. Glass mosaics are fragile works of art. Each step of the procedure must be taken with care by those experienced in doing this work.
2. Lofting for dimension, backbuttering for maximum bond and careful placement and working in of the sheets are the most important aspects of a good installation.
3. The installation of glass mosaic murals is perhaps the most difficult procedure in tile setting. It is for that reason that we recommended only professional journeymen with experience in dealing with this material under many circumstances be called upon for an installation of this kind. There can be no short cuts when installing glass mosaics. The glass dictates its own speed, therefore, control of all of the materials is absolutely critical. Glass is most unforgiving. One simple mistake could ruin an expensive work of art and be very costly to the installer.