



## CERAMIC TILE INSTITUTE OF AMERICA, INC.

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

# CTIOA Field Report 86-2-1

## SUBJECT: THE EVOLUTION OF PANELIZATION

### I. INTRODUCTION

A. Prefabrication, exterior ceramic tile panels, are red hot. There are more ceramic tile panels now being designed and specified for future construction than the total built in all past years. It seems as though every major architectural office has a few buildings under plan using ceramic tile. When an architect wants to give the owners the most durable, beautiful and cost effective finish, they turn to ceramic tile.

B. Panelization of ceramic tile is not new. The first building ever to receive ceramic tile panelization was the world famous "Wil-Flower Building" located at 615 Flower in Los Angeles, California. Pictures of this landmark tile exterior were printed in the July/August, 1983 Tile Industry News. The two pictures, one taken at the completion and the other over 25 years later. The building is well constructed and shows as excellent today as it did upon completion.

C. The new market is in: prefabricated, exterior tile panels framed with lightweight steel studs. Although the basic concept is not truly new, this system has now become economically feasible due to recent, cost-reducing production line methods of making lightweight steel studs and other elements in the system. Thirty years ago, the concept was first used on a Tishman high-rise office building in Los Angeles. Although a highly publicized and successful project steel studs and other elements were then custom-formed which priced the system out of the market for that time. Today, the situation is reversed. Prefab panels are now more competitive (often by a big margin) than glass or aluminum curtain wall, precast concrete, masonry, etc.

D. Advantages of Prefab

Prefabricated panels, framed with lightweight steel studs, comprise a new system for high-rise exterior walls where permanent architectural beauty, surprising economy and most efficient scheduling are desirable or necessary.

2. Although steel stud prefabricated buildings have a long and successful history, this marks the first time systems have been available nationally using exterior facing of the most prestigious and permanent material .....ceramic tile. The lightweight panels are assembled and finished indoors then transported to the job-site for erection with rooftop rigging or other lightweight lifting gear. Costly scaffolding is eliminated except on lower floors when hand-setting of tiles may be advantageous.

3. In brief, prefabricated ceramic tile panels on steel stud framing offer the following advantages:

a. Eliminates tons of costly deadload in design and requires less structural mass since panels weigh approximately 800 less than brick or pre-cast concrete;

b. Significantly less expensive than glass or aluminum curtain walls ..... superior insulation capability, more energy efficient;

c. Eliminates costly scaffolding ..... panels are hoisted by lightweight lifting gear such as rooftop rigging and welded into position from the inside of the structure;

d. Panel cavities provide a chase for pipes and wiring along exterior walls, for faster, easier and more economical installation;

e. Exterior ceramic surface is virtually maintenancefree; requires no painting, acid-cleaning, or renovation;

f. Factory supervision and quality control assures utmost accuracy, closer tolerances and more consistent results;

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g. Rain, snow and freezing temperatures do not delay completion schedules since panels are constructed in enclosed building;

h. Superior resistance to wet weather compared to other prefabricated panels;

i. Tile exteriors are permanent and non-fading and frostproof..... aesthetic additions to any community, forever.

#### E. The Market Potential

1. According to some respected construction industry executives, prefab tile panels represent one of the most exciting and explosive growth potentials for ceramic tile in the next decade. It's a concept, they believe, whose time has come.

2. Obviously, prefab tile exteriors are not for every office building, hospital, school or other building. However, many, many contracts now going to curtainwall, concrete or masonry, would be excellent prospects for the prefab tile system for economy reasons alone. Block and brick, for example, do about 10 times the sales of tile according to the U. S. Department of Commerce. Glass and aluminum curtainwall (now on a downhill trend due to poor insulation qualities) cost at least 30% more than installed prefab tile panels.

## F. Readily Available Materials

1. The basic elements of the newstyle walls are light gauge steel studding and joists. These are practically off-the-shelf items available throughout the country from many manufacturers -- such as Bostwick, Inryco/Milcor, U. S. Gypsum, U. S. Steel and others. Assembling and erecting of the steel framing can best be done by journeymen lathers rather than iron-workers or carpenters. The remaining materials: asphalt impregnated gypsum sheathing, self-furring lath, cement, gypsum wallboard and tile are also available everywhere.
2. Different methods of anchoring the panels to the building may be devised according to need, as long as the whole affair conforms to local building codes. In addition to code requirements, it is advisable to ascertain allowable spans from the supplier of the steel framing as protection against wind and seismic overloading.

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3. It cannot be emphasized too strongly that fabrication and fastenings must be of top quality for permanent reliability. Also, the tile selected must be of a frostproof type that resists local weather conditions.
  4. The very nature of tile panel construction helps induce the highest standards of quality control. Since panels are made under shelter, they can be fabricated with extreme accuracy, closer tolerances and more consistent results. For the same reason, completion schedules are not delayed by rain, snow and freezing.
- S. At the construction site, this type of framing facilitates rapid formation of window and door headers. It also tends to distribute and dissipate strains throughout the entire structure. It is, however, recommended that the architect and design engineer consult with the panel prefabricator right from the start.

## G. Fire Resistance

1. The various components of prefabricated exterior tile panels are made of non-combustible materials and generally carry a flame spread and smoke density rating of zero. After fire rated gypsum wallboard is attached to the interior flange of the steel stud framing, most building codes qualify the wall as a one-hour fire-rated system.

II. This author has knowledge of six different basic methods of panelizing tile.

### A. Pre-Cast Concrete

1. Pre-cast concrete units may have been the oldest since there is evidence of this method dating back more than a century. The size of the panels, however, were very small for the same reasons as today - the panels are heavy. Lifting and anchoring was a problem. The panels were apparently constructed in two methods. Finished surface side up - the concrete was poured into a frame and while the concrete was still in a plastic state, and after finished, the tile were set into pure portland cement. This method was difficult to work due to the size limitations, time restraints and control of the materials. The second variation was to place the tile face down on a smooth surface into an easily removable adhesive. Then place the powdered grout into the grout joints, moisten just enough to create complete hydration, after a light mist carefully pump a pea gravel or

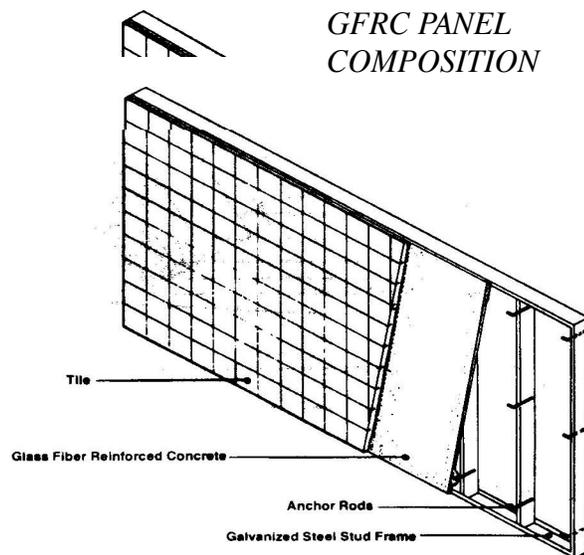
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larger aggregate concrete over proper wire reinforcing. Some aggitation is usually required. Even with the limitations, this pre-cast method is still being used today. The pre-cast concrete panels will usually weigh between 60 to 100 pounds per square foot. They usually will cost about double of those manufactured with the steel studs and the wire reinforced mortar beds.

## B. Glass Fiber Reinforced Concrete

1. A variation to the pre-cast concrete method is the GFRC (Glass Fiber Reinforced Concrete System). The advantage of the GFRC is its weight of 30 to 50 pounds per square foot.

2. The GFRC panels not only are lighter weight but are more easily made by pumping the fiber reinforced concrete. Because of the lighter weight, lower cost for transportation and erection is obvious. Many estimators figure \$1,000 - \$1,500 savings for every 1,000 pounds reduced from the total weight of steel and concrete.

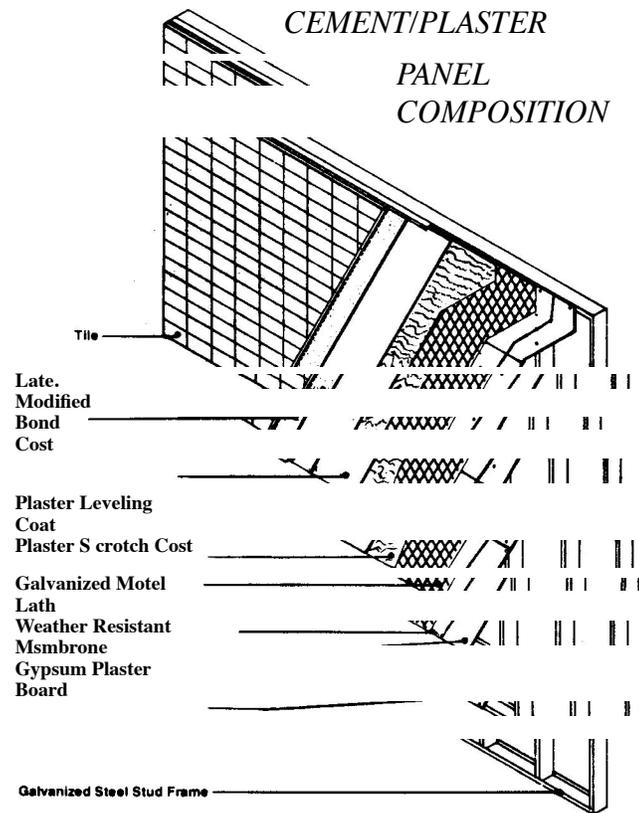


## C. Wire Reinforced Mortar Beds

1. The most popular method is the wire reinforced mortar bed. The mortar bed is usually  $\frac{3}{4}$ " -  $1\frac{1}{4}$ " thick which puts the system at 15 to 30 pounds per square

feet depending upon materials selected. With the invention of thin-set bonding mortar, productivity was greatly increased. The quality of this method is its lighter weight but yet very durable strength. The finished tile surface was easier to control and quality tolerances were obtainable. This method is similar to the method W221 in the Tile Council of America Handbook for Ceramic Tile Installation with the following requirements:

Metal lath shall be 3.4 galvanized self-furred, fasteners be non-corrosive, non-oxidizing with washers or head greater than  $\frac{3}{4}$ " in diameter and strong enough to carry the live and dead loads. Over a steel stud frame, gypsum impregnated with asphalt is usually the solid backing most commonly used. The installation specification to be used is ANSI A108.1 and A108.5.



#### D. Portland Cement Insulation Panels

Another system is the use of two of the same wire reinforced mortar beds separated by insulation and reinforced with crosswire to add lateral strength. The walls do not use the conventional steel studs due to the strength of the two wire reinforced portland cement mortar beds. This system has not seen a large amount of use. The weight will vary between 35 to 50 pounds per square foot.

#### E. Cementitious Backer Units

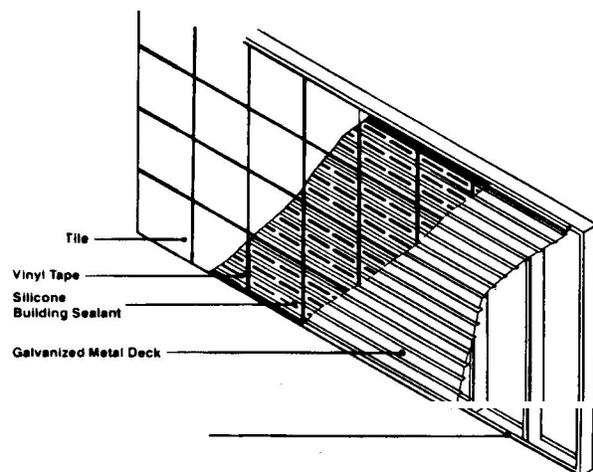
1. One of the newest systems is with the use of cementitious backer units or as we have known for a couple of decades as Wonderboard. This system is partly described within method W244, (Glass Mesh Mortar Unit) in the TCA Handbook. A membrane is needed to resist water penetration through the system since most tile cementitious backer units are not water proof. This system will weigh approximately 7 pounds per square foot, plus the steel studs, if the more common weight tile are used.

#### F. Silicone Bonding Systems

1. With the invention of high strength silicones, the adhesion of ceramic tile directly to metal decking, properly supported, brought another light-weight system.

2. Silicone adhesive/sealants are semi-organic, they show little degradation even after decades of exposure to weather, heat, temperature fluctuations, moisture and airborne chemicals and contaminants. Additionally, they are rubbery and flexible and adhere well to ceramics and galvanized steel. Silicone adhesive/ sealants have been proven as structural components for glass curtain walls and approved by codes. In addition to the steel studs and metal decking, the only weight is the silicone and the tile.

#### *SILICONE PANEL COMPOSITION*



**III. A final word: All reasonable clearance between panels and structural members for adjustments in vertical, horizontal and rotational positioning. The use of metal shims or other adjusting devices to align panels is recommended.**

**While details may differ from one locality to another, these easy-to-erect prefabricated tile panel walls offer the multiple advantages of lightweight, economy and maintenance-free permanent beauty.**

#### **IV. CONCLUSION**

**A The tile industry is on the threshold of a major breakthrough for growth. Not every contractor is geared for this work: it is for the medium and big operations. But, the potential looks very bright. Aggressiveness in learning sales, training and risk-taking can pay big dividends for these firms.**

**B. Whatever system is used, Ceramic Tile Institute recommends an entire battery of tests be conducted at independent testing laboratories to ensure proper performance. Some of these systems have already completed their tests through CTI and are being used throughout the world on various projects using ceramic tile. Be concerned about fastening the materials plus a multitude of other results from necessary tests which can be arranged through the Ceramic Tile Institute.**

**C. Cost alone is no judge for the system to be selected. A sign hanging in my office says it clearly, "The bitterness of poor quality remains long after the sweetness of low price is forgotten".**