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CTIOA FIELD REPORT 80-12-10 (R-85)

SUBJECT: PREFABRICATED EXTERIOR WALL PANELS WITH CERAMIC TILE

INTRODUCTION:

Within the past year, there has been a surge of interest in prefabricated steel stud panels with ceramic tile exterior surfaces, The Ceramic Tile Institute believes this subject to be significant to,CTI members and,have obtained permission from TILE & DECORATIVE SURFACES MAGAZINE to pre-print a feature story on this topic which appears below:

NEW $100 MILLION MARKET FOR TILE

PRE-FAB PANELS FOR EXTERIOR WALLS

Every so often, perhaps once every 50 years, an opportunity appears for an industry to surge ahead at a pace which boosts sales at a surprising, unexpected rate.

There are very positive signs around today that the ceramic tile industry is moving into such an opportunity. It has been gradually building up for several years and ready to become a reality ... an explosive opportunity for growth to those who are prepared and aggressive.

Tile contractors, distributors and manufacturers of tile and related products should commence research, training and marketing plans if they plan to profit from this new frontier.

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 con cept 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

customformed 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.

ADVANTAGES OF PREFAB

Prefabricated panels installed over gypsum sheathing, 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.

Although steel stud prefabricated buildings have a long and successful history, this marks the first time that a system has 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 j ob-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.

From initial design stages through final installation, technical services are available without obligation to architects and contractors for consultation, drawings and specifications.

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

- Eliminates tons of costly deadload in design and requires less structural mass since panels weigh approximately 80% less than brick or pre-cast concrete.
- Significantly less expensive than glass or aluminum curtain walls ... superior insulation capability, more energy efficient.
- Eliminates costly scaffolding ... panels are hoisted by lightweight lifting gear such as rooftop rigging and welded into position from the inside of the structure.
- Panel cavities provide a chase for pipes and wiring along exterior walls, for faster, easier and more economical installation.
- Exterior ceramic surface is virtually maintenance-free; requires no painting, acid-cleaning, or renovation.
- Factory supervision and quality control assures utmost accuracy, closer tolerances and more consistent results.
- Rain, snow and freezing temperatures do not delay completion schedules since panels are constructed in enclosed building; Superior resistance to wet weather compared to other prefabricated panels.
- Tile exteriors are permanent and non-fading and frostproof ... aesthetic additions to any community, forever.
- Exclusive keyback ridges on some ceramic tiles permanently lock tiles into portland cement mortar in panels for superior margin of safety.

THE MARKET POTENTIAL

According to some respected construction industry executives, prefab the 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. According to latest F. W. Dodge Statistics,

non-residential construction (office buildings, commercial stores, schools, hospitals and manufacturing) construction in 1979 was almost $50 billion dollars. Exterior walls for these buildings consume 3-11% of the total construction costs (for brick, block, stucco, curtain wall glass or aluminum, etc.) which boils down to a conservative $2.5 billion dollar market each year. Up to now, ceramic tile has captured an insignificant share of this potential due to various reasons (scaffolding costs, weather limitations, etc.) but now the situation has changed 180 degrees.

If tile can capture 5% of this exterior market, the potential is $250 million per year. Even at a conservative 2%, the volume will be $100 million per year which is more than 10% of the total tile market in the1979 year for the United States.

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 the panels.

PIONEER PROJECT DENVER, COLORADO

In September, 1980, the first modern-day high-rise with prefabricated ceramic tile panels was completed in Denver, Colorado ... the stunning 12-story Lincoln Court Building. The Lincoln Court office building was designed by McMorran Obermeier Goss Bershof Architects (better known as "McOG") and erected by Turner Construction Co., general contractor. Tile was laid by Ace Tile & Terrazzo Company in lightweight steel stud panels made by John Burke, Inc. The tile is Gail Unglazed Red Range Brickplate with brown and black flashing to provide iridescent blending of colors within each panel. The keyback ridge design in Gail Brickplate locks the tile permanently into the mortar bed for an extra margin of safety.

FABRICATION AND ATTACHMENT OF PANELS

All panels were assembled and finished indoors, a great convenience in Denver's winter weather, then transported to the job site. While other projects may require different arrangements of steel, backing and attachments, the Denver panels demonstrate the basic idea.

They were framed by 16-gauge punched steel Cee studs 6" wide, on 24" centers, and rest on tracks of unpunched 18-gauge steel. Each roughly-two-inch-thick panel is backed by 1/2" asphalt impregnated gypsum sheathing (core treated) on which is placed self-furring expanded metal lath with asphalt treated paper back. These are screwed to the studs with self-tapping screws over washers. This is followed by two 3/e" coats of portland cement plaster, latex modified portland cement bond coat and then the tile.

Crucial to the success of this new system is the method of affixing the panels to the structure of the building, which has a steel frame and poured-in-place concrete floors.

Three-foot-long 2" x 2" x $^{3}/_{16}$" clip angles were welded vertically to the spandrel beams all the

way around the building, including corners. The steel studs of the tile panels are welded to these angles, making a sturdy and permanent installation. Glass fiber insulating batts, 6" thick, are placed between the studs.

READILY AVAILABLE MATERIALS

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 the are also available everywhere.

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.

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.

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.

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.

FIRE RESISTANCE

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.

TEMPERATURE CYCLING TESTS

To prove that the Gail Brickplate panels used on the Lincoln Court Building were durable under adverse conditions, tests were conducted by an independent testing construction research laboratory in 1980, which subjected a panel to severe temperature changes and freeze-thaw conditions to simulate extreme weather conditions.

The test panel was constructed identically to the prefabricated wall panels used on the Lincoln Court Building in Denver, Colorado. The exterior surface of the panel was subjected to 150 heating and cooling cycles alternating from 25 degrees F to 145 degrees F with each

temperature extreme held for 15 minutes.

The panel was also subjected to twelve freeze-thaw cycles in which the panel was covered with 1/4 inch of water and frozen to -20 degrees R The average cycle time was four hours with complete thawing after each freezing phase.

The laboratory reported that there was no evidence of any, damage or cracking resulting from these tests.

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-toerect prefabricated tile panel walls offer the multiple advantages of lightweight, economy and maintenance-free permanent beauty.

SOURCES OF INFORMATION
Already some of the more aggressive major companies have been planning and preparing for the future growth of prefab tile panels. Probably the most experienced is Gail Ceramics, Orange, California, which supplied the tile for the Lincoln Court Building in Denver and worked closely with the architects. Gail has prepared excellent technical information, brochures and slide presentations on the system and also has an architectural consultant on staff to answer questions and assist in problem solving, estimating and detailing. Since Gail was the first to be involved in a major prefab job, their experience is also advantageous to a firm anxious to learn and expand. Moreover, Gail has a special "keyback ridge" on the backside of their tile which serves as a sales lock-in advantage when an architect or engineer is worried about the tiles falling five floors from the surface of the structure.

Huntington-Pacific has also been active in this market and has produced a slide presentation on the system which has been shown at industry meetings in recent months.

For counsel on the installation of tile over the sheathing, the Lathing Bureau has information available.

In one year, dozens of companies will be jumping on the bandwagon but only a few of the better financed firms are prepared right now to help without obligation.

SUMMARY
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.

FURRING & LATHING INFORMATION BUREAU

"FLIB"

PANELIZING EXTERIOR WALLS WITH STEEL STUDS, LATH, PORTLAND CEMENT PLASTER AND CERAMIC TILE

INTRODUCTION

Architects and builders, wanting to reduce dead load, construction time and costs, are more frequently utilizing light gauge steel stud framed panels with any of several different finish materials to construct exterior walls on their building. Tile and masonry veneer are two of the most desirable finish materials designers would like to use on their buildings; however, they are concerned with the cost.

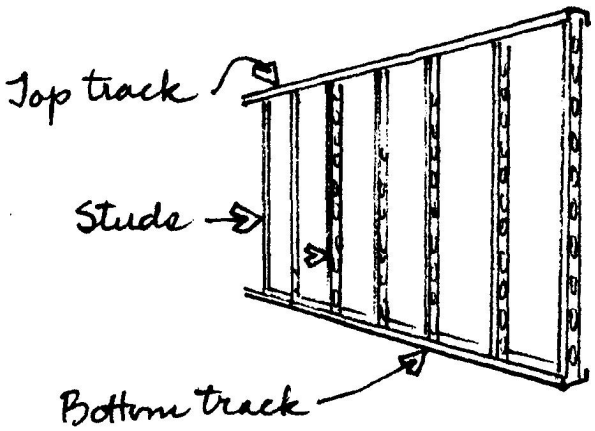
Remarkable cost savings are possible when the steel stud panels with a tile finish are fabricated off the job site, then shipped to the job and hoisted in place. The panels are simply but securely welded to the structural frame of the building.

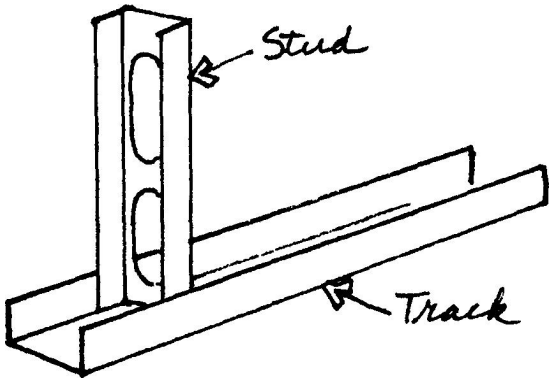
TERMINOLOGY

There are a few terms and definitions which should be understood to be familiar with prefabricated tile panel construction.

1. STEEL STUDS AND TRACKS

   Steel studs and tracks are roll formed sections usually fabricated from metal in thicknesses of 16, 18, 20 or 25 gauge. They may be fabricated from galvanized steel or are available painted with rust inhibitive paint. Steel studs and tracks are available in widths of 2-1/2", 3-1/4", 3-1/2", 3-5/8", 4" and 6" and in lengths cut to order, up to 20' - 30'.





A. STUDS
There are over a half a hundred different types, sizes and gauges of steel studs, so care should be taken to select the most appropriate one for any particular application.

The webs of steel studs typically contain punchouts through which electrical and mechanical lines can be run. The punchouts also serve to reduce the weight of the sections.

B. RUNNER TRACKS
Runner tracks, which secure the studs at the top and bottoms of panels, do not have punched webs. They are fabricated slightly larger than the stud width in order to provide secure attachment top and bottom.

2. GYPSUM SHEATHING

In order to assure flattest panels with adequate racking strength, 1/2" thick fire resistant gypsum sheathing is screwed to the steel stud framing with self tapping screws prior to lath and plaster application.

Gypsum sheathing has a water resistant gypsum core encased in specially treated brown water repellent paper on both sides and long edges. It is not a vapor barrier!

Available 24" wide with V-shaped T & G long edges, normally applied horizontally with tongue up. Also available 48" wide with square edges for vertical application.

3. CASING BEADS (Plaster stops)

Fabricated from 26 gauge galvanized steel, casing beads are available in 1/2", 3/4", 7/8", 1" and 1-1/4" sizes to accomodate different thicknesses of plaster and finish materials. Best quality panels are produced when 1-1/4" casing beads are installed to the framework first, then the sheathing, lath and plaster is installed. Casing beads are also available on special order in zinc alloy and stainless steel.

4. PAPER BACKED, SELF-FURRED METAL LATH

Lath for Portland cement plaster can be expanded metal, woven wire (chicken wire) or welded wire fabric. All three are available with a self-furring feature and with factory applied paper backing.

The building codes allow for the elimination of paper backing when lath is installed over a solid backing like gypsum sheathing but best results are achieved when the weather resistant paper is included.

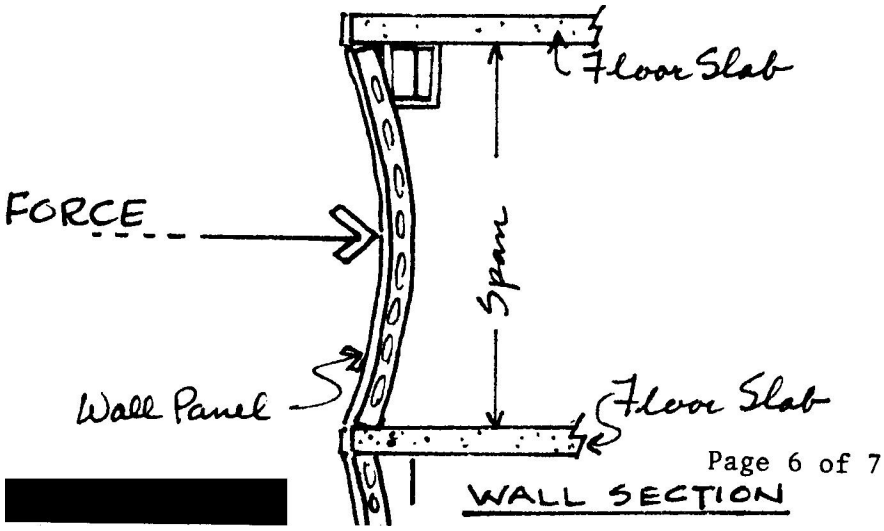
There are two grades of building paper approved for use as a weather resistant underlayment for exterior plaster. Both are covered by Federal Specification UU-B-790, Type I, Grade B or Grade D. The difference between the two grades is in the allowable moisture permeability.

5. FORCES AND STRESSES

The exterior skin of any building is subject to many different forces, from wind, earthquakes, framing movement, thermal fluctuations and vibrations. Whenever a force acts on a body, there is an accompanying change in size or shape of the body. These forces cause the wall materials to bend, deflect, deform or compress, sometimes to the point of failure. Any material's ability to withstand these forces depends on the strength, stiffness and method of installation.

A. DEFLECTION

Deflection is a typical physical action. It is that deformation which occurs from bending forces perpendicular to the panel face. Brittle materials like plaster and tile may crack or delaminate when the matrix deflects as much as 1/360 of the overall span.

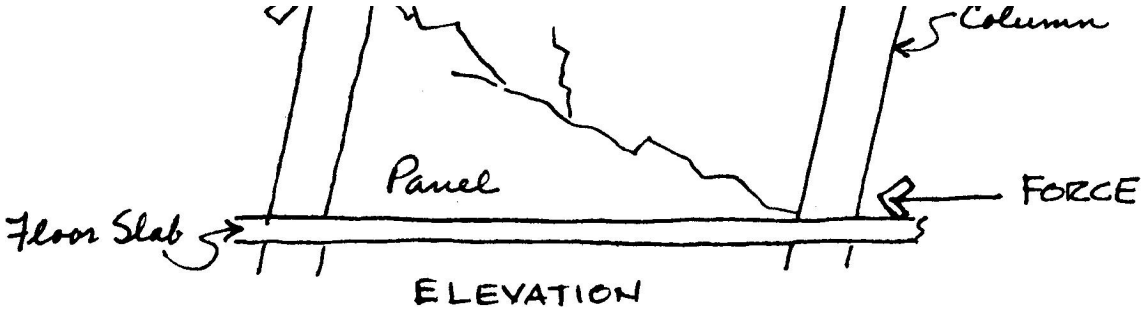


Deflection ,in steel stud framed panels can be reduced several different ways;
1. Use larger stud. (6" stud instead of 4")
2. Use stud of heavier gauge. (16 gauge instead of 18 gauge)
3. Decrease stud spacing. (24" to 16" or 16" to 12")

4. Reduce the height of the panel.

B. RACKING

Racking is a physical action resulting from earthquakes, framing movement or forces in the direction of the plane of the panel.



Sheathing, lath, wallboard, and other collateral materials properly attached to studs afford a small degree of racking ,resistance, Diagonal bracing welded to every intersecting stud provides the best values.