

FIELD REPORT # 0707

RE: Concrete Slabs That Move

The vast majority of precast concrete tile installations are on poured concrete substrates with a high percentage of these *slab-on-grade*. This means the concrete slab is at ground level, subject to all the stresses and movements that specific geographic areas are impacted with from *mother nature*. Movement of the earthen substrate comes in many forms due to earthquakes, unstable soil, expansive soil, moisture, moisture vapor emission induced contraction and expansion. Great strides have been made in the last several decades in designing concrete slabs to withstand these pressures through; soil compaction, thicker slabs, higher psi concrete, steel mesh reinforcing, movement control joints, etc.; however, for a variety of reasons there are still concrete slabs that can cause problems.

THE A - B - C'S OF PRE-INSPECTING CONCRETE SLABS BEFORE INSTALLING TILE:

- A- **Inspect the concrete substrate looking for expansion, control and cold joints**, as none of these can be ignored by just tiling over them. **Very important**, look also for irregular cracks in the slab that were not planned, indicating excessive slab movement. When there is movement along any of these broken planes, tile obviously will not hold these points together and these will travel through the tile assembly and become visible on the floor's surface as cracked tile. Everyone is quick to blame the tile, but fault begins with the crack that was already in the concrete slab.
- B- **Check the concrete slab's surface condition**, as *bond failure* is the #-1 consumer complaint. *Excessive Lippage* and *Cracked tiles* run second and third. Ideally, concrete slabs should have a 'broomed finish,' however, that seldom ever occurs even when it is stated clearly in the commercial specifications. The typical machine finished concrete surface potentially can be a problem surface to bond tile. There are several methods of checking the surface to ensure bond.
- C- **Verify how true the slab is to the required plane (level or sloped)**. According to ANSI* and the TCNA Handbook+, "*Maximum permissible variation in the plane or slope, 1/4" in 10 feet (6 mm in 3 m) from the required plane; nor more 1/16-inch in 12 inches (2 mm in 305 mm) when measured from the high points in the surface.*"

NOTE: If the concrete slab that is about to receive tile does not meet all of the above requirements, **DO NOT INSTALL TILE** without notifying the G/C or owner in writing of your concerns. If ordered to proceed anyway, obtain a written release prior to installation. If you proceed without a written release, you have in effect **bought the slab** as acceptable, and all future problems are yours and not caused by the slab.

* ANSI = *American National Standard Specifications for the Installation of Ceramic Tile*.

+ TCNA = *Handbook for Ceramic Tile Installation*

TILE INDUSTRY RECOMMENDATIONS FOR MOVEMENT JOINTS:

With the understanding that concrete substrates move, the tile industry (TCNA+) has recommended maximum spans between expansion joints: **Interior - 20' to 25' in both directions** — **Exterior - 8' to 12' in both directions**.

Equally

important is also allowing for movement around the perimeter of all tile installations.

Concrete Slabs That Move – II

SELECTING THE RIGHT TYPE OF MOVEMENT JOINT:

Movement joints are essential for the success of most tile installations. There are six different types of ‘Movement Joints’ for the tile assembly specifically designed to offset different potential problems inherent in concrete slabs. Four of the six ‘Movement Joints’ originate in the concrete slab substrate and must continue through the tile assembly. For complete details regarding ‘**Movement Joints-Vertical & Horizontal**, consult TCNA’s 2008 Handbook, pages 79 & 80 where all six are reviewed in depth with both technical data and illustrations.

EXPANSION JOINTS:

Permits free movement both vertically and horizontally with complete separation for the full depth of the slab. Depending on their span, joint width varies from 3/8" to 1/2" or 4 times expected movement. The recommended flexible filler is *urethane sealants* for both exterior and interior applications.

CONSTRUCTION JOINTS: (Cold Joints)

Construction joints occur between where two sections of concrete slabs that are poured at different times meet. The time difference of these pours may be less than one hour or years apart. Also, the reinforcing steel may be continuous.

ISOLATION/EXPANSION JOINTS:

A separation provided between two adjoining parts of a slab to allow movement where expansion is likely to exceed contraction. Also acting as an Isolation Joint, they allow adjoining slabs on grade to have independent movement to each other and the reinforcing steel is not continuous between them.

CONTRACTION JOINTS: (Control Joints)

A formed, sawed or tooled groove into a poured concrete slab to create a weaken plane designed to control and accommodate the inherent random cracking attributable to the initial drying shrinkage, thermal and moisture changes and load stresses. The most common example of the use of ‘contraction joints’ is in freeway construction that permits a continuous rather than sectional pouring of concrete.

PERIMETER JOINTS: (Only in the tile assembly)

The most overlooked movement joint, particularly on residential tiled floors. When building a group of homes to sell, the selection of the floor tiles is usually deferred until it is sold. This means the baseboard is already in place when the floor tile is installed. This usually is the only place the owner will accept a movement joint. ‘Perimeter Joints’ occur only in the tile assembly, not into the substrate.

GENERIC MOVEMENT JOINTS: (Only in the tile assembly)

Similar to perimeter joints, these ‘generic joints’ are not placed over movement in the concrete substrate. They are placed where deemed necessary as the tile cladding is being installed.

IF THE EXISTING MOVEMENT JOINT IN THE SUBSTRATE DOES NOT ALIGN WITH TILE JOINT:

Because this is such a frequent problem, the TCNA Handbook has provided two excellent options allowing the tile installer to continue his installation without cutting tiles. Entitled ‘**Crack Isolation Membranes**’ on page 25, refer to F125-07 ‘Partial Coverage’ and F125A-07 ‘Full Coverage.’

NOTE: For additional information on membranes, see CTMA’s Field Report # 0708, ‘Membranes, Crack Isolation,’ available free upon request.

IMPORTANT CONCLUSIONS:

- 1-- Even though concrete slabs move (shrink & expand), they are **not a flexible material** and can crack.
- 2- Do not install tile over an obvious problem floor. If you do, you have bought the floor & it’s problems.