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WHITE PAPER

The Most Violated Standard in Tile and Stone Installation: Movement Joints, TCNA EJ171, and the Failures They Prevent

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Abstract

Of all the requirements in the tile and stone installation industry, movement joints are simultaneously the most clearly mandated and one of the most routinely ignored. TCNA Detail EJ171 and ANSI A108.01-3.7 establish explicit, non-negotiable requirements for the placement, sizing, and construction of movement joints in every tile and stone installation. Yet across commercial and luxury hospitality projects, these joints are omitted from field areas, grouted over at perimeters, undersized where they do exist, and systematically absent above concrete control joints in the substrate. The result is a failure pattern that is entirely predictable: cracked tiles, tented sections where the assembly debonds and rises off the substrate, and progressive deterioration that compounds over time. This white paper examines why movement joints are required, what the governing standards actually mandate, how and where failures occur when those requirements are not followed, and what design professionals, general contractors, and owners can do to ensure compliance before the floor is installed.

Introduction

Every tile and stone installation exists within a building that moves. Concrete slabs shrink as they cure. Steel frames deflect under load. Temperature swings cause materials to expand and contract at different rates. Moisture comes and goes, and with it, dimensional changes in both the substrate and the finish material above. Tile and stone are rigid. Grout is rigid. The adhesive mortar beneath them is rigid. A tile assembly installed without any provision for movement is, in the most literal sense, a system under accumulating stress with no designed relief point. When that stress exceeds the tensile capacity of the assembly, it will find its own relief point—through the tile, through the grout joint, or at the bond line.

Movement joints are the designed relief points. They are the intentional interruptions in the rigid tile field where a compressible, elastomeric sealant replaces hard grout, allowing the assembly to accommodate the movement that will occur without transferring that stress into the tile or the bond. They are not a cosmetic feature, not an upgrade, and not optional. The Tile Council of North America (TCNA) states plainly in Detail EJ171 that perimeter and field movement joints within a tile installation are "essential and required." ANSI A108.02-4.4.2 is equally direct: "Movement joints are a requirement for tilework."

Despite this clarity, movement joint deficiencies are among the most common findings in forensic tile investigations. In my experience reviewing failed luxury hospitality installations, the absence or inadequacy of movement joints is a contributing factor in the majority of cases. Cracked tiles in hotel lobbies, tented porcelain panels in sunlit corridors, debonded stone at building perimeters—virtually all of these failures share a root cause that could have been addressed during installation at a fraction of the cost of subsequent remediation.

This paper is intended to explain the physics of why movement joints are required, to clarify what EJ171 and the ANSI A108 series actually mandate, to describe the specific failure modes that result when those requirements are not followed, and to provide practical guidance on how to ensure compliance.

Why Movement Joints Are Required: The Physics of a Rigid System

To understand why movement joints matter, it helps to understand what tile is not. Tile and stone are not flexible materials. They do not stretch, bend, or yield in response to movement in the substrate beneath them. When the concrete slab beneath a tile floor expands slightly on a warm afternoon—or contracts on a cool night, or shrinks gradually over years as it dries—that dimensional change must go somewhere. In a properly designed installation with adequate movement joints, it goes into the sealant-filled joints, which compress and expand as needed. In an installation without adequate movement joints, it goes into the tile itself, typically as a crack, or into the bond line, typically as debonding.

The mathematics of this are instructive. Research and industry documentation have demonstrated that small horizontal movements in a tile assembly translate into substantially larger vertical displacements. When a 48-inch span of tile is restrained at its perimeter and subjected to only 1/8 inch of horizontal compression, the resulting upward displacement at the apex of the buckled assembly can reach approximately 2 inches.[1] This is the phenomenon known as tenting—sections of tile that have debonded from the substrate and risen measurably, sometimes dramatically, off the floor. In an occupied hotel lobby, a tented tile is both a safety hazard and a visible failure of the installation.

The forces driving this movement are multiple and cumulative. Thermal expansion is the most intuitive: all materials expand when heated and contract when cooled, and they do so at different rates. Concrete, ceramic tile, porcelain tile, and natural stone all have distinct coefficients of thermal expansion, and where they are bonded together, differential expansion creates shear stress at the bond line. Moisture also contributes, as porous materials absorb and release water vapor throughout their service life. Concrete slabs undergo long-term drying shrinkage after curing—a process that continues for months or years after placement and that produces cumulative dimensional change across the slab. Finally, structural loading and building movement introduce deflection and dynamic stress into the slab and, through it, into the tile assembly bonded to its surface.

In areas classified as "interior but exposed to direct sunlight"—a common condition in hotel lobbies with full-height storefront glazing on two or three sides—the thermal forces are particularly concentrated. A tile floor behind floor-to-ceiling glass can reach surface temperatures far exceeding the ambient room temperature, cycling through significant expansion-contraction cycles on a daily basis. TCNA EJ171 specifically identifies this condition and reduces the permitted movement joint spacing accordingly.

The Governing Standards

TCNA EJ171 – Movement Joint Guidelines for Ceramic, Glass, and Stone

TCNA Detail EJ171, published in the TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, is the primary industry reference governing movement joint design in the United States.[2] The detail is explicit and comprehensive, addressing field joint spacing, perimeter joint requirements, sealant specifications, joint sizing, and the treatment of structural joints in the substrate.

The field joint spacing requirements under EJ171 establish clear maximum intervals:

1. Interior areas not exposed to direct sunlight: maximum 25 feet in each direction.
2. Interior areas exposed to direct sunlight or moisture, or above-ground concrete slabs: maximum 12 feet in each direction.
3. Exterior tile assemblies: 8 to 12 feet in each direction.

Perimeter joint requirements under EJ171 are equally specific. Movement joints are required wherever tilework abuts any restraining surface: perimeter walls, columns, curbs, pipes, dissimilar floor finishes, and anywhere the backing material changes or changes direction. These perimeter joints must be filled with a compressible elastomeric sealant, not grout. Grout is a rigid material and does not provide the movement relief that a perimeter joint is designed to deliver.

EJ171 also addresses the treatment of structural joints in the substrate. All expansion joints, control joints, construction joints, cold joints, and saw-cut contraction joints in the concrete slab must be carried through the tile assembly. Tiling over these joints—covering a concrete control joint with a continuous field of tile and grout—is a documented violation of EJ171. When a concrete control joint is intended to control where the slab cracks as it shrinks, installing rigid tile over it simply transfers the crack upward into the tile. The remedy, prescribed by EJ171 and TCNA method F125, is either to honor the joint directly in the tile work with a movement joint at the same location, or to install an anti-fracture membrane specifically rated for bridging control joints, according to the membrane manufacturer's guidelines.

EJ171 also specifies minimum joint widths. Regardless of calculated movement, movement joints must never be less than 1/8 inch wide.[3] For perimeter joints at walls, the preferred minimum is 1/4 inch. Joints sized below these minimums—even joints filled with sealant rather than grout—do not provide adequate movement capacity and should not be treated as compliant.

ANSI A108.01-3.7 – Soft Joints and Movement Accommodation

ANSI A108.01, General Requirements: Structures, Substrates, and Preparation for Tile, addresses movement joints in Section 3.7.[4] This section establishes that movement joints are a required element in all bonded tile systems. Key provisions include:

4. **Section 3.7.3.1:** Interior areas exposed to direct sunlight must have expansion joints spaced at 8 to 12 feet in both the north/south and east/west directions.
5. **Section 3.7.4.1:** Sealants used in movement joints must comply with ASTM C920, Standard Specification for Elastomeric Joint Sealants. Suitable products include silicone, urethane, and polysulfide sealants. Acrylic latex, siliconized latex, and similar low-performance products do not meet this requirement.
6. **Section 3.7.4.1.1:** Backup material (backer rod) must be a flexible, compressible polyurethane material sized to fit the joint without compressing, and shaped to contact only the sides—not the base—of the joint. A sealant that bonds to three sides of a joint cannot function as a movement joint.
7. **Section 3.7.5:** Generic movement joints in the tile field not located over an existing substrate joint may be installed in a non-linear configuration (sawtooth, zipper) to accommodate tile patterns. This provision—added to address designer resistance to straight-line joint interruptions in complex layouts—eliminates the most commonly cited aesthetic argument against proper movement joint placement.

ANSI A108.02-4.4 reinforces these requirements with mandatory language: "Movement joints are required over all construction, control, and expansion joints in the backing and where backing materials change or change direction including terminations of tilework where it abuts restraining or dissimilar surfaces."[4] Section 4.4.3 further requires that movement joints be kept free and clear of all setting and grouting materials. A joint that has been partially filled with mortar or grout during installation cannot function as a movement joint regardless of what is applied on top.

Natural Stone Institute – Dimension Stone Design Manual

For natural stone tile specifically, the Natural Stone Institute publishes the Dimension Stone Design Manual (DSDM), which reinforces TCNA and ANSI movement joint requirements and adds stone-specific guidance.[5] The DSDM addresses movement joints in the context of horizontal stone flooring and notes that stone tile installations must comply with TCNA EJ171 for joint placement and sizing. The manual further addresses the specific vulnerability of natural stone to movement-induced failure: natural stone, unlike ceramic or porcelain tile, often has veining, fissures, and planes of weakness that make it more susceptible to cracking when subjected to unrelieved stress. A porcelain tile under movement pressure may crack cleanly; a travertine or marble panel under the same stress may fracture unpredictably.

The DSDM also highlights the importance of movement joints at all structural column locations. Columns transmit load concentration points into the slab, creating areas of differential movement relative to the surrounding field. This differential must be accommodated in the tile assembly through perimeter joints around the column base. The absence of these joints is a particularly predictable source of tile cracking in hotel lobbies and public spaces where columns interrupt the floor tile field.

Responsibility: Design, Specification, and Installation

A significant source of movement joint failures in commercial construction is the ambiguity—often deliberate—around who is responsible for designing and detailing movement joint layouts. EJ171 is direct on this point: because of the limitless conditions and structural systems on which tile can be installed, the design professional or engineer shall show the specific locations and details of movement joints on project drawings. The responsibility belongs to the architect or design professional, not to the tile installer.

In practice, this requirement is frequently not followed. Tile sections in project specifications reference EJ171 by name without providing the movement joint layout drawings that the standard requires the design professional to produce. The tile installer is then left to determine joint locations in the field, often without adequate knowledge of the slab geometry, the structural joint locations, or the solar exposure conditions that govern spacing requirements. When tile installers omit or misplace joints under these circumstances, the failure is partially attributable to a specification that did not fulfill its own obligations.

This does not absolve the installer of responsibility for joints that are expressly required—perimeter joints at walls, joints above known saw-cut control joints, and joints at structural columns are not discretionary and should be provided regardless of whether the drawings show them. An experienced tile installer should identify these conditions in the field and raise them formally before proceeding, not proceed without them and leave the failure to manifest later.

The practical recommendation for project owners and general contractors is to require, at the pre-installation meeting, that the tile installer submit shop drawings showing the proposed movement joint layout for review and approval by the architect before work begins. This single step—required by most well-drafted specifications but rarely enforced in practice—catches the majority of movement joint omissions before a single tile is set.

How Movement Joint Failures Present in the Field

Failure Mode 1: Tile Cracking Over Concrete Control Joints

One of the most direct and predictable movement joint failures occurs when a tile assembly is installed continuously over a saw-cut control joint in the concrete slab. Concrete slabs are intentionally weakened at control joint locations so that drying shrinkage cracking occurs there rather than randomly across the slab surface. When tile is installed over these joints without a corresponding movement joint in the tile assembly, the crack that forms in the concrete telegraphs upward through the setting material and into the tile.[6] The resulting tile crack typically appears directly above the substrate joint, running the full length of whatever tile or tiles span it. In large-format thin tile panels, these cracks can extend the entire length of a panel.

Installer-supplied in-progress photos from installations where this failure has occurred frequently show the tell-tale evidence: self-leveling underlayment poured continuously over the entire slab surface, including over the saw-cut joints, before tile installation begins. Once the self-leveler covers a joint, there is no visual indicator of its location for the installer, making it nearly impossible to honor the joint in the tile work above unless the joint locations were marked or documented beforehand.

Failure Mode 2: Tenting and Debonding at Perimeters

When perimeter joints are filled with grout rather than elastomeric sealant, the tile field at the perimeter of the room is effectively locked against the walls or storefront framing. As thermal expansion drives the tile field to grow, it has no relief at its edges. The stress accumulates across the installation until the weakest point—often a tile near the perimeter where the compressive load is greatest—cracks or debonds. In well-bonded assemblies, the tile cracks to relieve the stress. In assemblies where the bond is marginal, the tile debonds and tents, with measurable uplift that creates a trip hazard and an obvious visible failure.

In hotel lobbies and commercial spaces with floor-to-ceiling storefront glazing, this failure mode is especially common because the solar exposure condition reduces the permitted movement joint spacing to 12 feet—significantly less than the 25-foot maximum for standard interior areas—while simultaneously concentrating thermal stress at the perimeter of the installation directly adjacent to the glass. A grouted perimeter joint at a storefront window in a sun-exposed lobby is subjected to exactly the kind of daily thermal cycling that EJ171's reduced spacing requirement is designed to address.

Failure Mode 3: Cracking at Structural Columns

Structural columns present a specific movement challenge that EJ171 addresses through its perimeter joint requirements. Columns are rigid load-bearing elements that transfer concentrated forces into the slab, creating stress concentration points at their bases. The slab in the immediate vicinity of a column behaves differently from the slab in the open field, and tile installed continuously across a column base without a perimeter isolation joint cannot accommodate the differential movement between the two zones. The result is cracking at or near the column, often in an arc or curved pattern consistent with the stress field emanating from the column base.

In large column-free lobby areas where structural columns interrupt a continuous tile field, the absence of column perimeter joints is a consistent finding in forensic investigations. These joints are often omitted entirely, or replaced with a standard grout joint of the same width as the field joints, which provides no movement relief whatsoever. Where joints are present, they are frequently undersized—less than 1/8 inch wide—or filled with a low-performance acrylic caulk rather than an ASTM C920 sealant.

Failure Mode 4: Progressive Failure Over Time

A critical and often underappreciated characteristic of movement joint failures is that they are progressive. An installation that appears intact at project closeout may begin to show isolated cracks within months of opening, and those cracks may multiply substantially over the following years as the cumulative effects of thermal cycling, building movement, and long-term concrete shrinkage accumulate. This progression is not random—it follows the map of movement joint deficiencies documented at the time of initial investigation. Tiles that were found to sound hollow in early inspections become visibly cracked later. Perimeter grout joints that showed hairline cracking at the first inspection exhibit measurable tenting at follow-up visits.

This progressive nature has important implications for project owners and their attorneys. A failure that is documented in its early stages may be far less costly to remediate than one that has been allowed to develop for years. Early engagement of a qualified third-party consultant—at the first sign of tile cracking or hollow sounding—provides the best opportunity to document causation before additional failures mask the original deficiency, and to establish a remediation scope before the problem compounds.

What a Compliant Movement Joint Installation Requires

A movement joint program that complies with ANSI A108.01-3.7, ANSI A108.02-4.4, and TCNA EJ171 is not complicated to execute, but it requires planning before the tile is set:

8. **Design professional provides movement joint layout drawings.** Specific joint locations, types, and details must be shown on project drawings. The tile installer is not responsible for designing the joint layout.
9. **All concrete substrate joints are identified and marked before self-leveler or setting materials are applied.** Control joints, cold joints, and expansion joints in the slab must be located, documented, and either honored in the tile work directly above them or addressed with a code-compliant anti-fracture membrane per TCNA F125.

10. **Field joints are provided at maximum intervals per EJ171.** For sun-exposed interior areas, this means no more than 12 feet in each direction. For standard interior areas, no more than 25 feet. For exterior, 8 to 12 feet.
11. **Perimeter joints are provided at all restraining surfaces.** At every wall, column, curb, pipe penetration, dissimilar floor finish transition, and change of backing material, the grout is replaced with a compressible sealant joint. This is not optional and is not satisfied by a narrow caulk line applied over an otherwise grouted joint.
12. **Joints are properly constructed.** Movement joints must be clear of all setting and grouting materials, filled with backer rod sized to contact only the sides of the joint, and sealed with an ASTM C920-compliant elastomeric sealant applied after the tile and grout are dry. The sealant must be allowed to cure before the area is opened to traffic.
13. **Minimum joint width is maintained.** No movement joint may be less than 1/8 inch wide. Perimeter joints at walls are preferred at 1/4 inch minimum.

Conclusion

Movement joints are, in the language of TCNA EJ171, “essential and required.” The failure to provide them is not a minor workmanship variation; it is a fundamental deficiency that compromises the long-term performance of every square foot of tile around the omission. The cracking, tenting, and debonding that result are not warranty issues in the conventional sense—they are the direct, mechanical consequence of a tile assembly that was never designed to accommodate the movement that would inevitably occur.

What makes movement joint failures particularly frustrating from an investigative standpoint is how preventable they are. The standards are clear. The requirements are well-documented. The failure modes are entirely predictable. An installation that omits perimeter joints at storefront framing in a sun-exposed lobby will crack. An installation that tiles over concrete control joints will crack directly above them. An installation without field joints across a 60-foot lobby will tent. These outcomes are not surprises; they are the expected behavior of a rigid material system placed under unrelieved stress.

For architects and design professionals: provide movement joint layout drawings. The standard requires it, and the installations you specify will perform better for it. For general contractors: enforce the requirement for installer shop drawings showing joint locations, and require a pre-installation meeting where joint placement is reviewed against the substrate conditions. For project owners: if you are already seeing isolated tile cracks in a recently completed installation, engage a qualified consultant before the problem progresses. The cost of early documentation and targeted remediation is a fraction of the cost of full floor replacement after the failure has run its course.

Movement joints do not fail installations. The absence of movement joints fails installations. EJ171 exists to prevent exactly the failures described in this paper. Following it is not optional—and treating it as such has consequences that project owners, general contractors, and installers will eventually be asked to explain.

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