



Amber Fox
NTCA Five Star Program Director



Ceramic Tile Lippage: Unsightly and, on Floors, Unsafe... and Perfectly Allowable When Tile Industry Substrate Flatness Requirements are Disregarded (e.g., “Quarter in Ten”)

Presented by the National Tile Contractors Association (NTCA), with thanks to the Tile Council of North America (TCNA) for permitting the editing and republishing herein by NTCA* of [this TCNA-authored article](#).

GCs, you know the drill, it’s crunch time—budgets are depleted, schedules are in jeopardy, and the tile contractor is agitating for extra time and money to fix the concrete. It isn’t flat enough for tile and flattening it wasn’t included in the bid, says the email with a change order attached.

Really? It *looks* flat, and often there’s documentation that the slab meets the flatness tolerance specified for the concrete. But before you refuse that change order, know that by doing so you’re ok-ing what would normally qualify as installation flaws. That’s because ceramic tile industry guidelines nullify the relevant workmanship standards—installation flatness and lippage—when substrate tolerances are disregarded. Here’s how it’s stated in the TCNA Handbook, published by Tile Council of North America:

“Including a separate requirement [in project specifications, to flatten the substrate] helps avoid change orders. If such substrate preparation is not separately and specifically required and included in bid proposals, the tile contractor assumes a suitably flat substrate will be provided. Industry standards for tile finish flatness and lippage do not apply if the project owner does not provide a substrate that meets required ANSI A108.02 substrate flatness tolerances and chooses not to correct substrate flatness issues.”



For thin-bed installations, installers check for variations in concrete with a straightedge. Although a slab may meet the flatness tolerances called out in the concrete portion of the specification, it may not be flat enough for a ceramic tile installation, particularly if large tiles are chosen.

Why “Flat” Concrete Usually Isn’t Good Enough for Tile

Many tile contractors and GCs can still (fondly) remember when this was never an issue. Until roughly the ‘60s (give or take, depending on the region), ceramic tile installers “mudded” floors before tiling them, erasing any slab flatness issues with a ¾” to 3” mortar bed. When the advent of thin-set revolutionized tile setting by enabling tile to be bonded directly to concrete, slab flatness suddenly became more relevant.

But tiles were much smaller when thin-set installations started to take over, and the smaller tiles cooperated by conforming to substrate undulations. Installers weren’t “fighting the floor” then as they are today with tiles getting ever larger and grout joints narrowing, exacerbating substrate flatness issues. “As tile size increases, the negative effect of substrate irregularities is compounded,” says the TCNA Handbook.

Preserve Workmanship Quality Standards and Eliminate Eleventh-Hour Substrate Dilemmas that Can Derail Project Progress

One key point that tends to be overlooked in specifications is that concrete industry requirements for slab flatness differ from tile industry requirements and if this difference is not addressed early in the bidding process it can create an adversarial finger pointing situation that unnecessarily slows your project down. After all, when additional work, and the cost that goes with it, comes up on a project many times our first instinct is to place blame on one of the two parties involved. But oftentimes the concrete contractor and the tile installer are in the right, with nobody but mother nature at fault, and I don't think you will get her to cover the costs. The importance of concrete substrate tolerances as required by individual flooring trades is so great that The American Society of Concrete Contractors (ASCC) highlighted the issue by publishing [this position statement on Division 3 versus Division 9 Floor Flatness Tolerances](#), which is vigorously endorsed by the National Tile Contractors Association and its membership.

The TCNA Handbook offers a few possibilities for addressing the issue in specifications: “If specifying a thin-bed method, project specifications should include a separate specification and requirement (such as a pourable underlayment) to bring the substrate into compliance if the substrate does not meet the required flatness tolerance. Alternatively, when specifying tile with any edge longer than 15" consider specifying a recessed installation substrate and a mortar bed (thick-set) method to produce a tile substrate that meets the more stringent flatness requirement for large format tiles.”

Unfortunately, the above is often ignored. For whatever reason, tile specifications in this regard do not seem to have kept pace with tile industry advancements and design preferences. Assuming no GC would ever want to throw out tile workmanship standards, until project specifications do better at addressing substrate flatness where tile will be installed, it’s an issue GCs must address. The National Tile Contractors Association (NTCA) recommends that GCs implement protocols to square away substrate flatness issues as early as a project will allow, as the options become more limited over time, and because last-minute negotiations and decisions generally don’t produce the best results.

More Specifically

One strategy GCs could employ would be to ask bidding tile contractors to include a specific monetary amount for floor prep in their bids as a separate line item, with the work to be paid on a time and materials basis. This “allowance” would be determined by the GC and, ideally, more than what is actually needed so that the actual amount does not result in the very thing the allowance aims to avoid, i.e., the need to “find money” near the end of a project. The tile contractor would of course have to turn in time and material tickets to facilitate GC oversight and tracking of the depletion of the allowance.

Rather than a monetary amount, a material quantity could be specified by the GC, for example, sixty 25-pound bags of floor patch, or 1/2” of self-leveler. This approach is a bit trickier, but some contractors prefer it. The concept is the same in that what is specified is ideally more than what is required. Of note, it affords greater competitiveness among bidding tile contractors by requiring each to arrive at a cost for providing the specified quantity.



Substrate Flatness: A Closer Look at Tile Vs. Concrete Specs and Methods of Measuring

Specifications for concrete generally call for flatness to be measured per ASTM E1155, a test method by which many points of a slab are measured, with the values indicating how much higher or lower each individual point is from an established reference point. Each measurement is plugged into a formula to determine the slab’s overall floor flatness or its FF. Because FF number is an average, individual areas of the concrete may not be flat at all, as long as the high spots balance out the low spots enough to achieve the required FF, which is specified based on the intended use of the area. Typically, an FF of 35 is specified where ceramic tile will be directly bonded to the slab. For the tile contractor, the high and low spots on a slab meeting the FF 35 are the problem areas, the severity of which is directly proportionate to the size of the tile. The required FF applies only to individual sections of a slab, and per the test method, measurements for a given section are taken on one side of construction and isolation joints only. That is to say, the measurements and resulting FF for a slab section on one side of a construction or isolation joint are not compared to nor required to bear any particular relationship with the adjacent section of the slab. Yet ceramic tile is often expected to continue across such joints seamlessly, an obvious issue if slab sections finish at different heights. Now factor in two additional issues: Measurements are not taken in the very places where the most curling of the slab will occur: at column block-outs, the perimeter, and at construction and isolation joints. And, the measurements are taken within a few days of concrete placement, when the slab is at its flattest, a very different slab than that which the tile contractor inherits. To be fair, many of these issues, although they manifest as problems for the tile contractor, make sense when looked at in context. The shrinkage and curling of a slab has little if anything to do with the workers who placed it. The raw materials used, the concrete mix and

Mother Nature are the true culprits. So, it makes sense, when measuring concrete flatness, to eliminate what is outside the concrete contractor's sphere of influence.

Now fast forward a few months. The tile contractor arrives on the jobsite, checking the floor by placing a 10-foot straightedge on randomly chosen spots. This is not so much an assessment of the concrete installer's workmanship, but rather an evaluation of whether the floor is suitably flat to receive tile. If large tiles are in order, the tile contractor is likely to check more areas and more carefully. Knowing where the worst offenders lie, the seasoned contractor will thoroughly evaluate flatness at construction and isolation joints, column block-outs and the perimeter. For larger tiles, the floor is allowed 1/8 inch of variation in 10 feet; for smaller tiles, 1/4 inch is allowed in 10 feet. Anyplace with more than that is out of tolerance for the tile contractor and something must be done to bring the floor into tolerance, so the tile can be installed flat and without excessive lippage.

The concrete contractor could come back to grind down high spots. The tile contractor could grind and patch individual areas, or pour self-leveler over the whole area. But neither contractor is likely to be planning on doing so if their scope of work, and as such their bids, didn't include it—hence the need for tile specifications and/or the bid process to clarify expectations of the tile contractor.

In Summary

With ceramic tiles getting ever larger and larger, substrate flattening is becoming a necessity on nearly every job. GCs can manage jobsites more efficiently and effectively by acknowledging this and initiating protocols that eliminate ambiguity early on over the extent of a tile contractor's obligations with regard to flattening a substrate. One method is to provide an adequate allowance. Tile contractors generally like this approach, as it compensates for the fact that they often do not have the access to a substrate that would be required to accurately assess and bid on the amount of floor prep needed, such as when a tile contractor bids on a job but the concrete has not yet been placed. For GCs, it eliminates the apples-to-oranges bid comparisons required when a standardized approach for accommodating the unknowns is not provided.

To learn more, visit our NTCA website at: <http://www.tile-assn.com/> and Tile Council at: www.TCNAtile.com

*This edited version has not been reviewed by TCNA.