



Proper Trowel Selection and Back Buttering TDS 196

In past few years, the tile industry has seen a shift in the size of tile that is used to clad a wall or tile a floor. Historically, a tile was labeled as large format if it was larger than 8"x8" (200mm x 200mm). Improvements in manufacturing technology have made it possible to manufacture tile which is as large as 48" x 48" (1,220mm x 1,220mm), not taking into account thin porcelain veneer panel, which can weigh as much as 100 lb. (45.5 kg). In comparison today, it would be difficult to consider an 8" x 8" (200mm x 200mm) tile as being large, but proper installation methods and materials can help to ensure that any size tile, stone, adhered masonry veneer, or thin brick is installed in such a way as to meet the industry requirements for mortar coverage.

While a suitable substrate that falls into the industry requirements for surface tolerances is critical to the success of the application, having proper coverage on the tile is as critical to the finished installation as the flatness of the substrate. As stated in ANSI A108.5 2.3.4, for installation of tile on walls or ceilings; "Average contact area shall not be less than 80% except on exterior or wet area installations where contact shall be 95% when not less than three tiles or tile assemblies are removed for inspection. The 80% to 95% coverage shall be sufficiently distributed to give full support of the tile."

As stated in ANSI A108.5 3.3.2 for installation of tile on floors; "Average uniform contact area shall not be less than 80% except on exterior or shower installations where contact area shall be 95% when no less than three tiles or tile assemblies are removed for inspection. The 80% or 95% coverage shall be sufficiently distributed to give full support to the tile with particular attention to this support under all corners of the tile."

So exactly how do you achieve these coverage requirements when installing ceramic tile and stone? If you're installing a tile that is 6"x6" (150mm x 150mm) or less, the answer is easy! Typically, the 80% to 95% coverage on a 6"x6" (150mm x 150mm) can be met with proper troweling techniques and most likely a ¼" x ¼" (6mm x 6mm) square notch trowel. However, when tile or stone starts to become larger, it becomes necessary to take extra steps to achieve the coverage that is acceptable according to industry standards. Thus the importance of properly back buttering (thin coat of thin set placed on the back of the tile to help assist in the proper transfer of thin set), as well as choosing a trowel size that is proper to the application to achieve the proper coverage.



Figure 1: A properly back buttered large format tile.

ANSI A 108.5 2.4.3 for installation of tile on walls and ceilings, and, ANSI A108.5 3.3.3 state; if 95% coverage is specified in the project specifications, back butter each tile with bond coat; or select a notched trowel sized to facilitate the proper coverage, key the mortar into the substrate with the flat side of the trowel, and comb with the notched side of the trowel in one direction. Embed the tile in the mortar by beating-in, pushing in a direction perpendicular to the combed ridges, or other means to achieve specified coverage. The method used should produce maximum coverage with the corners and edges fully supported. Periodically remove and check a tile to assure that proper coverage is being attained."

No installation of tile, stone adhered masonry veneer, or thin brick is ever exactly the same, much like the fact that substrates and jobsite conditions will vary. With this said, there is no universal rule on the proper size notched trowel required that will fit every application based simply on tile size. The guidelines for trowel sizes, as stated in National Tile Contractors Association (NTCA) Reference Manual E-23 “Trowel Guidelines” are guidelines and cannot address every installation circumstance. The substrate, type & size of tile, intended service level of the installation, climatic conditions, interior or exterior use, and individual manufacturer’s recommendations are all factors the installer should consider in selecting the proper trowel. For example, for installation of tile or stone which is 6”x6” (150mm x 150mm) or smaller, a ¼” x ¼” (6mm x 6mm) square notch trowel may be adequate. Installation of an 18” x 18” (450mm x 450mm) tile will probably require a ½” x ½” (12mm x 12mm) or ¾” (19mm) loop notch trowel. The picture below is a 6” x 6” (150mm x 150mm) tile set using a ¼” x ¼” (6mm x 6mm) square notched trowel.



Figure 2: 6” x 6” (150mm x 150mm) quarry tile installed using a ¼” x ¼” (6mm x 6mm) square notch trowel – sufficient coverage has been achieved.

As you can see, the 6” x 6” (150mm x 150mm) tile in Figure 2 falls into the range of proper coverage without back buttering the tile. However, in the tile industry some the large jobsite failures have been due to the lack of mortar coverage on the back of the tile or stone. The most common cause for this type of failure is improper sized notch trowel selection while failing to check coverage on a regular basis.



Figure 3: 18” x 18” (450mm x 450mm) tile installed using a ¼” x ¼” (6mm x 6mm) square notch trowel – insufficient coverage has been achieved.

It is clear, as shown in Figure 3, that the minimum of 80% coverage is not being met. Insufficient coverage may lead to potential failures, such as loss of bond, cracking/breaking under load (due to lack of support), hollow sounding tile, etc... Based on Figure 3, it is clear that a ¼” x ¼” trowel may not be the proper size for an 18” x 18” (450mm x 450mm) tile. A more proper trowel size for a 18” x 18” (450mm x 450mm) tile would be a ¼” x 3/8” (6mm x 9mm) trowel. Keep in mind that the larger size trowel does not always guarantee sufficient coverage. The NTCA has stated some factors in E-23 which may alter the recommended size of the notch trowel, but they are not the only factors which may cause poor mortar coverage. Warpage of the tile or stone (refer to ANSI A137.1 “American National Standard Specifications for Ceramic Tile” for more information), the angle at which the notch trowel is held during installation, wear (age and use) of the trowel, swirling of the adhesive mortar during application, and other factors all play roles in mortar coverage.



Figure 4: Two 18" x 18" (450mm x 450mm) tile showing coverage when using a 1/4" x 3/8" (6mm x 9mm) trowel – the tile on the left was installed using just the square notched trowel while the tile on the right was installed with the same trowel but was back buttered.

Figure 4 shows that using a larger towel alone will not necessarily mean that you will get the required coverage. However, when the same piece of tile is properly back buttered the coverage is much more consistent and even while helping to ensure that the industry standards for coverage rates are met.

Professional tile contractors and do-it-yourselfers are now faced with tile sizes from mosaics to large, heavy tiles of varying sizes, so becoming familiar with the proper tools and techniques to help make sure that the tile or stone is properly bedded is important. Conduct test areas, check coverage during installation, be consistent when mixing batches of mortar, back butter large format tile, clean tools frequently, make sure the substrate is flat prior to installing the tile or stone, make adjustments as necessary to achieve maximum coverage, and make sure the mortar is of suitable consistency to "wet out" the back of the tile/stone and the substrate.



Figure 5: The tile on the left was installed using a 1/4" x 1/4" (6mm x 6mm) trowel and has approximately 30 – 35% coverage; the tile in the middle was installed using a 1/4" x 3/8" (6mm x 9mm) trowel and achieved approximately 55 – 60% coverage; while the tile on the right was installed using a 1/4" x 3/8" (6mm x 9mm) trowel with back buttered tile achieves 75 - 80% contact between the tile and the substrate.

The pictures in Figure 5 tell a tale all of their own. Keep in mind that the requirement states 80 – 95% contact of the adhesive to the tile/stone through to the substrate for the best possible support and adhesion. Just making sure that the mortar is in 100% contact with the tile and with the substrate may not be enough to ensure the best possible coverage. The best practice is to make sure that the mortar is in full contact with the substrate by using the flat side of the trowel to key the mortar in, use the flat side of the trowel to back butter the tile/stone and use the proper size notch trowel to ensure that the tile is fully supported by the mortar over the required surface area.



Figure 6: This tile was installed using a ½” x ½” (12mm x 12mm) trowel, the tile was back-buttered and the mortar was keyed into the substrate. The coverage easily meets the minimum requirements set forth in ANSI A108.5.

From the pictures shown, a great lesson can be learned regarding proper trowel selection, while properly back buttering the tile may go a long way in making for a successful tile installation. Keep in mind that these are only guidelines and they provide a great place to start. Proper methods should be followed throughout the installation and tiles should be checked periodically to ensure that the tile is consistently achieving the appropriate coverage rates.

For more information, please refer to TDS 193 “Installation of Large Format Tile” which can be found at <https://laticrete.com>.

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