

Good-quality specifications result in good-quality tile and stone installations

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Ceramic tile, natural and manufactured stone, and glass tile have shown continued innovation in production process, use, and popularity despite reduced consumption due to the soft economy. As the products and the usage of these products evolve, it is critical to be current and accurate when specifying tile and stone.

Not all products are suitable for all applications. New installation products for these materials are changing rapidly, so it isn't a simple process to determine what should be used, or what it should be used with, or where it should be used, or how it should be installed. The labor factor is also of vital concern, since most failures are generally related to installer error.

The solution to all of these potential challenges has not changed. It is still as important as ever to have good quality specifications with detailed, thorough and clear quality-control and quality-assurance sections to achieve good quality tile and stone installations.

Quality control begins with the selection process and a thorough understanding of the application. Determine the recommended usage and limitations of the intended products that you want to use. As a finish material, aesthetics will play a major part in the selection process, but only those products suitable for the intended use should be considered. Utilize qualified consultants and reliable manufacturers at this stage not just for information, but to help qualify and substantiate that the products are suitable for the intended application.

Next, write a thorough and clear specification to avoid the all-too-common ambiguities found in many tile and stone specifications. Refrain from only referencing industry standards; though they are vitally important, it is necessary to have a performance specification to ensure the selected products are suitable for the intended application and will perform as intended. Many standards are very broad and result in products that can

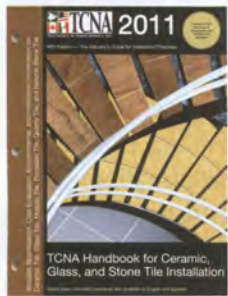
vary substantially in performance, but still meet the standard. For the same reason, it's important to have a detailed, clear and thorough quality-assurance section and field quality-control plan to be implemented by someone other than the installer him or herself.

The architectural Construction Specification Institute (CSI) MasterFormat and SectionFormat provide the structure for good-quality specifications, which if used correctly and thoroughly will produce good-quality tile and stone installations. The following are some key steps in preparing the three-part specification:

Part 1, general section

In the part 1, general section, it is important to reference the key and relevant standards for the tile industry. In all ceramic tile, glass, or stone tile adhered applications, the *TCNA Handbook for Ceramic, Glass, and Stone Tile Installation* (www.tile-assn.com) should be referenced.

The current *TCNA Handbook* now has a special glass tile section as a selection and installation guide and a very large stone tile selection and installation guide with specific installation details for stone in all of the various applications.



The TCNA Handbook for Ceramic, Glass and Stone Tile Installation is a critical set of standards for specification of tile and stone.

Also reference ANSI A108, A118, & A136, *The American National Standards Specifications for the Installation of Ceramic Tile* (www.tile-assn.com) in all adhered-tile applications. This set of standards defines the installation of ceramic tile as well as

the test methods and physical properties for ceramic-tile installation materials. Many of these methods and materials also apply to the installation of glass tile and stone tile. ANSI A108 provides standards for sub-surfaces and preparations by other trades, standards for materials and workmanship, and details the installation of various methods and materials. For ceramic-tile applications, reference ANSI A137.1 Specifications for Ceramic Tile to establish and qualify that the ceramic tile provided is standard grade material. The



ANSI committee is currently working on a separate stan-

ANSI standards are important to reference as part of your specification.

dard for glass tile that will be called ANSI-A137.2 once completed.

The ANSI committee has also created and approved a new ANSI A138.1 specification for sustainable ceramic tiles, glass tiles, and tile installation materials. This standard is the basis for the Green SquaredSM certification program, managed by the Tile Council of North America (TCNA) and independently verified by SCS, UL and NSF. Ceramic tile, glass tile and stone all have huge features and benefits in terms of environmental



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sustainability, their material makeup, how they are produced, and their long life cycle. All of these products earn large LEED points, substantially contributing to the project's sustainability rating.

When specifying stone, reference the *MIA Dimension Stone Design Manual* (www.marble-institute.com), whether it is an adhered application or a mechanical stone application. MIA references the key ASTM standards that apply to the various geological classifications of stone defining their benchmark for standard grade material.



MIA Dimension Stone Design Manual is used in specifying stone.

ASTM C1528 Standard Guide for the Selection of Dimension Stone (www.astm.org) should also be referenced for any type of a stone application. This guide presents a cursory review of the different stone types commonly used in construction, common applications, available finishes, and factors affecting product costs.

Submittals as a part of the quality-assurance specification section are very important. This is not a cut-and-paste section. These sections need to be project-, product-, and application-specific. The physical properties and suitability of products need to be verified. Too often products like natural stone are imported without

verifying physical properties and suitability, and are sold based on price and not on standard-grade requirements. Aesthetics are important, but suitability is critical.

Samples representative of what will be supplied for the project need to be submitted and verified before they are delivered to the project site. Too often owners are forced to live with something different from what was intended. By the time a product is delivered to the job site, the delays and costs to replace it are prohibitive, especially if the product gets installed before a deficiency is noticed. Require field mock-ups as the quality-control standard for color range and visual requirements such as tile lippage, layout, and other workmanship requirements. Required warranties should be specified, provided in writing, and clearly stated. Warranties are never "no-fault insurance"; there are always conditions and limitations.

Part of the quality assurance is to specify that a quality-control plan is established and implemented by someone other than the installer. A qualified third party representing the owner is preferable, but even having someone provided by the general contractor is better than relying on the installer to provide their own quality control.

A very important quality-assurance requirement that is often left off is requiring and verifying that installers understand the industry standards that they are expected to follow. Often installers learn on the job and don't have any type of formal training.

Specify that installers must verify they completed a training session to review industry standards

and the quality-control plan for the project. The *2012 TCNA Handbook* now contains language that recommends using qualified labor in your specification (see related news item on page 38 of this issue).

Compounding the lack of experience and understanding of industry standards is lack of qualified supervision that tile subcontractors often supply to manage their workforce. Tile foremen should not only manage the work, but they should supervise the installers to ensure they are following the specifications and industry standards.

Part 2, products section

Part 2, the products section, is important for the architect to specify products that will not only perform as required, but can be competitively priced. Performance-based specifications allow quality and performance to be specified without being locked into a high-priced proprietary product. Reference standards allow the lowest acceptable-performing product to be used, which is normally the cheapest and least-performing product.

TCNA has recently added ISO 13007 Standards for Adhesives and Grouts to its *Handbook*. ISO C-Cementitious

APPENDIX A. ISO 13007 STANDARDS FOR ADHESIVES AND GROUTS

Chart 1—Standard Codes for Adhesives for Tile & Stone

Code			Description
Type	Class	Optional Characteristics	
C	-	-	Cementitious Mortar
C	1	-	Cementitious mortar with normal tensile bond strength <ul style="list-style-type: none"> • Tensile adhesion bond strength of ≥ 2.5 N/mm² (72.5 psi) when tested per 13007 curing parameters • 28-day tensile adhesion bond strength of ≥ 0.5 N/mm² (72.5 psi) after 28 months open time
C	2	-	Cementitious mortar with improved tensile bond strength <ul style="list-style-type: none"> • Tensile adhesion bond strength of ≥ 1 N/mm² (145 psi) when tested per 13007 curing parameters • Baseline "C1" open time characteristics
C	1 or 2	E	Cementitious mortar with extended open time <ul style="list-style-type: none"> • 28-day tensile adhesion bond strength of ≥ 0.5 N/mm² (72.5 psi) after 30 minutes open time
C	1 or 2	F	Cementitious mortar, fast-setting <ul style="list-style-type: none"> • 24-hour tensile adhesion bond strength of ≥ 0.5 N/mm² (72.5 psi) • 28-day tensile adhesion bond strength of ≥ 0.5 N/mm² (72.5 psi) after 10 months open time
C	1 or 2	T	Cementitious mortar with slip resistance <ul style="list-style-type: none"> • Will not allow a tile applied on a vertical surface to slip more than 0.5 mm (0.0196")
C	1 or 2	S1	Cementitious mortar with normal deformability <ul style="list-style-type: none"> • Deformability ≤ 2 mm (0.125 in.) \times 1 mm (0.039 in.) when tested per 13007
C	1 or 2	S2	Cementitious mortar with improved deformability <ul style="list-style-type: none"> • Deformability ≤ 1 mm (0.039 in.) when tested per 13007
C	1 or 2	P1	Cementitious mortar with normal adhesion to EGP (Exterior Grade Plywood) <ul style="list-style-type: none"> • 28-day tensile adhesion bond strength of ≥ 0.5 N/mm² (72.5 psi)
C	1 or 2	P2	Cementitious mortar with improved adhesion to EGP (Exterior Grade Plywood) <ul style="list-style-type: none"> • 28-day tensile adhesion bond strength of ≥ 1 N/mm² (145 psi) <p><i>Note: It is recommended with EGP installations over 18" O.C. that the "S2" code also be specified in addition to the "P2" code.</i></p>

TCNA recently added ISO 13007 Standards for Adhesives and Grouts to its Handbook.

Mortars can be designated and specified to clearly show the level of performance and type of performance required for a particular project, including level of bond strength, faster setting, extended open time, slip resistance (non-sag), level of deformability, and suitability and level of performance for adhering to plywood.

Part 3, execution section

This section is not only important, but critical. This is not a cut-and-paste section either. Here the architect needs to clearly specify the appropriate details and steps for each type of tile or stone application.

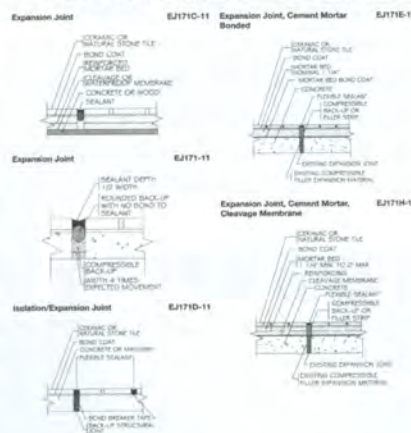
Consistent with the ANSI A108 standards, the substrates to which the tile is attached need to meet requirements and tolerances in order for the tile installer to be able to provide a satisfactory installation. For proper preparation of substrate, it needs to be clarified that the substrate will *always* require cleaning. Substrates may also require scarifying the surface to remove any contaminants and to open the concrete pores to allow for an adequate attachment.

Tiling over cracks is never acceptable. Structural cracks must be repaired by the general contractor and shrinkage cracks need to be isolated with a membrane per TCNA detail F125. Expansion joints and control joints must continue through the tile assembly unless a cleavage membrane is used. Specific TCNA installation method details need to be specified for each application, taking into consideration the type of substrate: whether it is on-ground or a suspended floor, a wall over solid or framed backing, interior or exterior, and whether a wet or dry application. Workmanship standards need to be specified in terms of proper tile layout, tolerances such as lippage, acceptable clean-up, and safe

and proper protection of work and adjacent areas.

Don't forget movement joints, which are often left out of tile installations and are always considered a contributing factor in many failures. The *TCNA Handbook* detail EJ171 states "because of the limitless conditions and structural systems on which tile can be installed, the architect or designer shall show the specific locations and details of movement joints on project drawings." TCNA EJ171 provides plenty of details and information as a guideline for architects to follow in their specification.

EJ171 MOVEMENT JOINT GUIDELINES FOR CERAMIC, GLASS, AND STONE



Movement joints are a critical consideration in writing your spec. Reference the TCNA Handbook for these details.

Field quality-control plan

This critical section is also not cut-and-paste. A quality-control plan is project-specific and thoroughly specifies in detail the quality-control process, steps and testing that are required on the project during the tile installation process. The objective is to avoid costly delays and problems, and to catch problems before they become contributing defects in a costly failure.

Generally speaking, failures are due to many compounding deficiencies, so the goal of a quality-control plan is to

make sure the tile is installed according to industry standards and product manufacturers' directions. This should include ensuring the correct products are being used, that materials and the installation areas don't exceed temperature minimums or maximums. Products must be stored under the conditions established by their manufacturer. Provisions must be made to protect installation areas from adverse climatic conditions, products must be mixed and used according to the manufacturers' instructions, and the resultant tile installation must meet performance and workmanship requirements.

First you need a good quality-control plan, but second – and more importantly – you need to have a qualified inspector implementing the quality-control plan. A good, qualified inspector should have tile installation experience and be very knowledgeable with the tile-industry standards.

The quality-control process is actually a great training program for the tile installers working on the project. As the quality-control inspector implements the quality-control plan, installers benefit by learning industry standards and the correct methods for installing tile. The installers also benefit from the inspector's experience and knowledge gained from the inspector's input. At the end of a job with a good quality-control plan, the tile installers are more knowledgeable and proficient at their work, which benefits them in future projects.

In the past, tile installers were not able to easily and affordably learn industry standards and acceptable installation methods. In addition, there was no standardized way to rate the tile installer to determine his or her skill level. Now the tile industry has certification programs that validate the installer's skills and knowledge for performing tile installations.

Two such programs are the Certified Tile Installer (CTI) program offered by the Ceramic Tile Education Foundation (CTEF) and the Tile Installer Thin-set Standards (ITS) verification course offered in Spanish and English by The University of Ceramic Tile and Stone (UofCTS). Learn more about what these



Selecting installers who have passed CTEF's Certified Tile Installer program or the Tile Installer Thin-set Standards verification course by UofCTS are ways one can help find quality tile contractors and installers.

courses verify at www.tilecareer.com and www.CTaSC.com respectively.

Summary

When there is a problem, it doesn't matter who is at fault: everyone will pay in one way or the other in terms of time, money, or reputation. That's why it's important to avoid cut-and-paste tile specifications and to always thoroughly review the intended applications, the suitability and limitations of products, and the relevant industry standards. Quality-assurance and field quality-control plans are essential to ensuring a successful tile installation. Be sure to consult with qualified experts for high-risk applications such as exterior veneers, exterior decks over occupied space, high-traffic or heavy-duty applications, showers, swimming pools, and other wet applications.

With over 30 years experience in various aspects of the tile and stone industry, Donato Pompo CTC CSI CDT MBA is the founder of Ceramic Tile and Stone Consultants (CTaSC), a professional consulting company of expert consultants comprised of accomplished ceramic tile consultants, stone consultants, ceramic tile and stone installers, architects, engineers, general contractors, construction scientists and other industry specialists conveniently located throughout the US and Canada. CTaSC provides tile, stone, terrazzo and brick services in forensic investigations, quality-control services for products and installation methods, including specification writing, as well as training programs, testing, and on-site quality-control inspection services. Reach Donato at www.CTaSC.com, Donato@CTaSC.com or call 866-669-1550.

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