



# Avoiding Construction Defects

## Performing Quality Control and Quality Assurance

By Donato Pompo

Photos courtesy Ceramic Tile and Stone Consultants Inc.

**CONSTRUCTION DEFECT LITIGATION IS NOT ONLY DOING WELL, BUT IT IS ALSO THRIVING.** THERE IS NO SHORTAGE OF DEFECTIVE CONSTRUCTION WORK AND FAILED PROJECTS. WHETHER IT IS CERAMIC TILE OR NATURAL STONE, OR ANY OTHER CONSTRUCTION MATERIAL, CONSTRUCTION DEFECTS UNFORTUNATELY ARE RELATIVELY COMMON IN PROJECTS.

So, what is the problem or problems? Generally, a failure is not due to a single deficiency, but rather due to multiple compounding deficiencies. In the author's experience, it seems about 95 percent of the time the deficiencies are installer error.

Although there are normally compounding contributing deficiencies, some of them could be the architectural specification due to inaccurate, incomplete, and/or ambiguous specifications. The tile installer relies on the specification to direct

them on their scope of their work, on what products to use, and on what methods to use in the installation.

Installers are not architects or engineers, so they should not be expected to make decisions such as the placement and design of movement joints. The installer is expected to follow the manufacturer's directions and industry standards. The general contractor has oversight responsibilities in not only selecting the subcontractors and orchestrating the sequence of work, but also monitoring the on-site conditions and the subcontractor's work to some degree relative to the scope of work. Both the subcontractor and general contractor should be submitting requests for information (RFIs) for clarification when there is doubt.

### **The role of the installer and subcontractor**

The focus of deflecting construction defects can be narrowed down to the subcontractor, which could significantly reduce problems and failures. Some

examples of common defects could be the installer's work not meeting the standards or specification for properly adhering the tile and achieving adhesive contact between the back of the tile and its substrate. Another example can be not installing or honoring existing movement joints as per the specifications, standards, or manufacturer's directions. Another instance can be the waterproofing not being installed correctly or the formation of an inadequate slope on the tile surface or on the underlying membrane in a wet environment. Avoiding excessive tile lippage and other workmanship requirements when tiles are installed is also a common defect.

Tile and stone installers often learn on the job and do not have any substantial training on the industry installation standards. There are unions and industry organizations who provide some training, but even then, most installers lack knowledge of the standards and tend to pick up and apply bad habits.

### The role of the foreman on-site

Installers do not make mistakes intentionally, but due to the lack of knowledge, the pressure to be more productive, and the lack of adequate supervision, mistakes happen. Sharing his own experience, the author started as a tile installer many years ago, then was a proactive on-the-job system of training and oversight. There was a foreman who closely oversaw the work of others and coached the installer on how to perform their work correctly and was there to catch mistakes before they became an issue. This was the way installers got trained and developed skills which elevated them to more prominent roles. However nowadays, too often, installers with limited skills are thrown on a job and given limited instructions and no oversight, or, the foreman on the job is actually one of the installers and not performing any oversight. In some cases, there is a roaming foreman who jumps from one job to another giving commands and putting out fires, but does not perform any proactive quality control (QC) or training.

### Finding the solution in parts

The solution is to prepare specifications which fully utilize the Part 1: General and Part 3: Execution sections of *Master Specifications* as they are not often utilized enough. The Part 2: Products section



It should be required for a crew of installers to train and demonstrate their knowledge with the current installation standards.

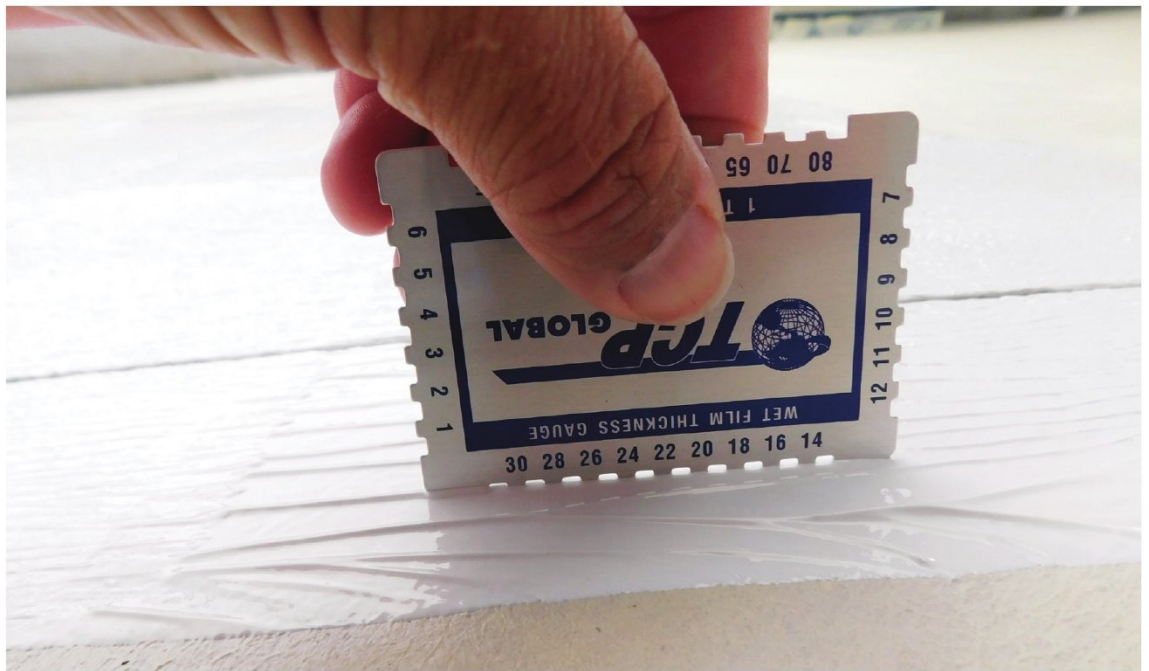
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is also important for calling out the right products and accessories in a clear and complete manner without any ambiguities.

### Part 1: General

Most master specifications do not fully utilize the Part 1 general section. Reference standards in Part 1 is where all relevant applicable standards within the body of the specification are included.

It is up to the specifier to vet and select the right products for the intended application and required performance.



A laser thermometer can be used to document the temperature of the substrate or materials not exceeding 32 C (90 F).

This section should thoroughly and correctly reference the relevant standards that apply to the descriptive work. Any relevant American National Standards (ANSI), International Organization for Standardization (ISO), and ASTM standards should be listed in a specific way. For Division 9 Finishes or Division 4 Masonry, the standard for the physical properties of the finish material should be referenced, as well as the standards which reference

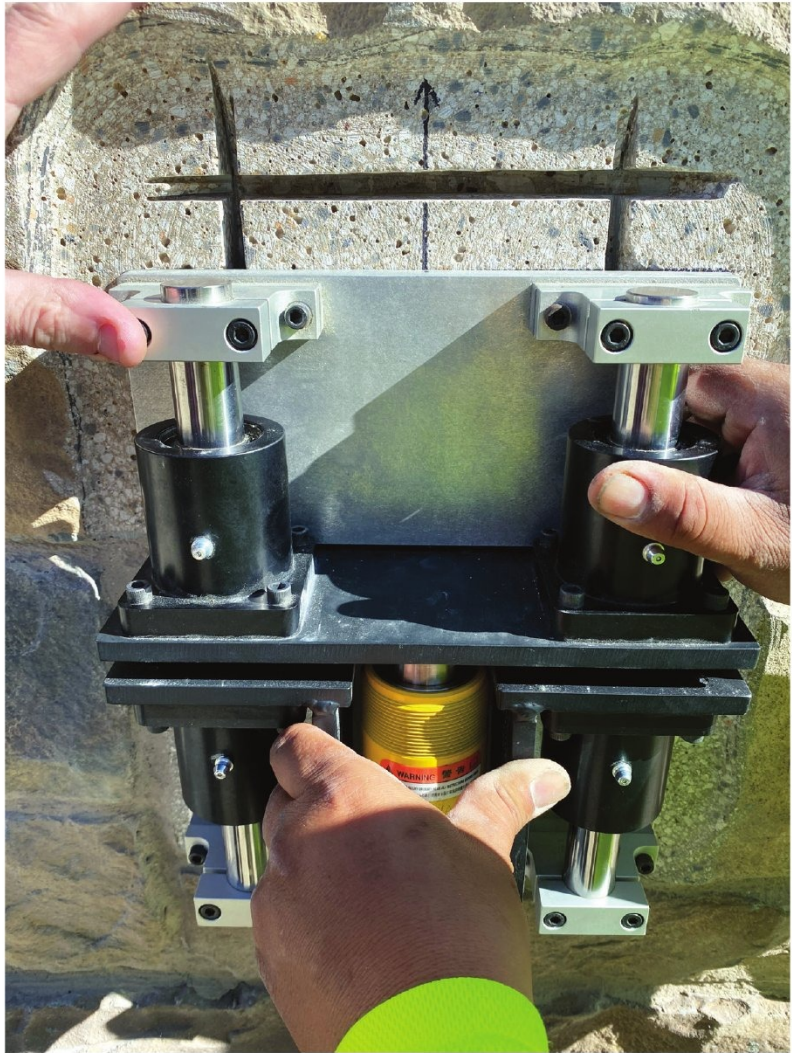
the performance requirements of the installation products. In particular, the specifications for more critical applications, such as industrial, high traffic, wet, and veneer, should be a performance or prescriptive specification to help ensure the right products and methods are being employed for a successful installation of the intended application. It is up to the specifier to vet and select the right products for the intended application and required performance, while ensuring it meets the aesthetic requirements as well.

An important section of Part 1 is quality assurance (QA). This is where professionals can stipulate the quality of work, in terms of the installers and manufacturer requirements and training. This is where it should be specified that mockups are required and produced for approval, and there will be a QC plan which will be created and implemented during the installation process.

This is also where appropriate ASTM materials and test protocols are called out and require the specified materials to meet the minimum/maximum performance requirements for the intended application. For larger projects, third-party laboratory testing should be required to verify not only the submitted samples of what is specified, tested, and meets the requirements, but also to test the actual material being supplied and installed on the job. This requires the specifier to be qualified on what are the appropriate products and performance criteria for the intended



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application, further verifying their suitability for the intended use. If the specifier does not have the knowledge to determine what is appropriate and suitable, they should retain an expert to consult along the way and only rely on the manufacturer's recommendations which are in writing.

Also in Part 1, installer qualifications and experience with installing similar products in similar applications are established and required. It should state installers should have a minimum of five years of experience, and they also need to comply with the specified *Tile Council of North America (TCNA) Handbook for Ceramic, Glass, and Stone Installation* requirements. Doing so will help ensure quality installations. Specifications are used to stipulate quality and subcontractor qualifications in Part 1.

It should be required for the installers to demonstrate their crew of installers had training and have demonstrated their knowledge with the current installation standards. It should also be required for a non-working project foreman to be on the job-site full time, overseeing the work and implementing their own QC plan. The installation company should be required to verify all of these requirements with certificates of completion of training and with specific project references. A mock-up should be required as well, to further demonstrate execution and performance of the specified application, and to verify the aesthetic value as well.



The quality control (QC) plan should verify relevant industry standards are being met, for example, achieving 95 percent thin-set contact between the tile and the substrate in a wet application.

A very important requirement in the QA section is to require a QC plan, which will be implemented during the installation by a third-party inspector. There should also be a requirement for specific QA testing of installation materials to verify they are meeting the intended performance requirements. For instance, the *International Building Code (IBC)* requires exterior tile veneers to achieve a 344 kPa (50 psi) shear bond strength requirement for each applied unit. This should be tested early on during the actual installation, if not on the mockup. Further testing should also be considered periodically during the entire installation process. The reasoning behind this, is to identify a problem early on to avoid serious issues or delays; if it goes unnoticed, it can be a costly issue to resolve.

### Part 3: Execution

This section is important in specifying the scope of work, quantitative installation methods and requirements, and the sequence of work relative to the respective installation products. Protection of materials should be pointed out, indicating the requirements and limitations in terms of material storage, environmental conditions for

material storage and during installation, and protection of the completed work.

Often, what is missing from this section is the QC plan. The QC plan should be written to outline the sequence of work and the requirements of the respective products being used. The plan should require the QC inspector to verify the material's manufacturer's directions are met in terms of storage, its use during application, and during curing.

The QC plan should verify relevant industry standards are being met, for example, achieving 95 percent thin-set contact between the tile and the substrate in a wet application, or ensuring movement joints are installed every 2.4 to 3.6 m (8 to 12 ft) in an exterior application. It should be required for freshly installed tiles to be pulled-up, to verify and document the thin-set mortar coverage, and then immediately re-install them. This takes little time and effort by the installer and is what the standards say the installer should do periodically. The QC inspection should be done quantitatively when possible. For instance, for every 4.6 m<sup>2</sup> (50 sf) tile installed, three tiles shall be removed to verify they substantially achieved the required 95 percent thin-set mortar coverage. A laser thermometer can also be used to document the temperature of the substrate or materials not exceeding 32 C (90 F). The movement joints being placed every 2.4 to 3.6 m (8 to 12 ft) should also be documented, as well as the closed-cell polyethylene foam backer rod being used and installed correctly with the appropriate ASTM C920 traffic grade sealant.

The lack of installer supervision and QC adds to the construction industry's shortage of qualified labor. Without the supervision and oversight, the labor continues to do things wrong, which perpetuates the same mistakes and problems. A QC plan that is not only written clearly and comprehensively,

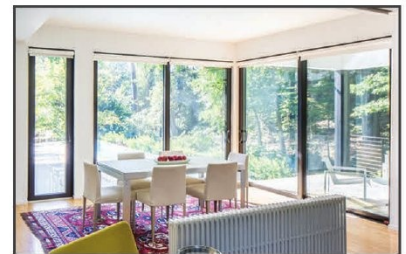


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The key to a successful tile and stone installation is to write good specifications fully utilizing the QA and QC sections of the Master Specification.

Photo courtesy Hearst Castle

but also implemented by a qualified inspector with installation experience and knowledge, becomes the best remedy to ensure a successful installation. The installers end up being trained on how to properly perform the work as per the industry standards and per the manufacturer's directions, which follows them to their next job.

### Conclusion

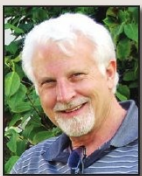
Construction problems and failures can be avoided when *Master Specification* Part 1: General and QA

is fully utilized, alongside Part 3: Execution, which includes a detailed QC plan to be implemented by a qualified inspector. Ensuring manufacturer directions are being followed and industry installation standards are being adhered to is key to training the installer and crews, avoiding deficiencies, or catching and correcting them in a timely manner, and avoiding costly failures.

In the author's experience, they have never found a tile or stone failure fully following industry standards and manufacturer's instructions—it is always the opposite. The failure is never due to one deficiency but due to many compounding deficiencies. The industry standards represent years of experience and scientific testing from a consensus group of industry professionals who volunteer their time and efforts to help architects, installers, and owners have successful tile and stone installations. The key to a successful tile and stone installation is to write good specifications fully utilizing the QA and QC sections of the *Master Specification*. This will help ensure there is adequate oversight to oversee and verify that industry installation standards, manufacturers' directions, and the specifications are followed correctly. **CS**

## ADDITIONAL INFORMATION

### Author



Donato Pompo, CTC, CSI, CDT, ITS, CTS, CSS, MBA, is the founder of Ceramic Tile and Stone Consultants (CTaSC), and of the University of Ceramic Tile and Stone (U of CTS). He has more than 35 years of experience in the ceramic tile and stone industry, from

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### Key Takeaways

Generally, when there is a problem during construction, it is not due to a single deficiency, but rather due to multiple compounding deficiencies. Poorly written architectural specifications and the lack of oversight by the general

contractor can be contributing factors to failures. The solution is utilizing the quality assurance section of the *Master Specification* Part 1: General and require a QC plan to be specified and implemented by a qualified QC tile inspector, as described in Part: 3 Execution.

### MasterFormat No.

01 43 00 – Quality Assurance Requirements  
 01 45 00 – Quality Control Requirements  
 04 40 00 – Stone Assemblies  
 07 90 00 – Joint Protection  
 09 30 00 – Tiling

### UniFormat No.

Z1020 – Quality Assurance and Control

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 Construction defects      Quality control  
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