SLATE GROUTING

By Remo Capolino, RRC, PE

In the last hundred years, there have been few advancements in slate technology that have improved the life expectancy of slate roofing. The use of slate hooks as a supplemental method of securement for high-wind slate installations is one notable exception. A relatively new procedure called slate grouting has been developed and has been improving/extending the performance of slate for more than 15 years. Such a track record is only "new" when compared to the hundreds of years slate has been used as a roofing material. When compared to the track record of other technologies that have been widely accepted by the roofing industry (i.e., single-ply reformulations, changes in insulation blowing agents, cold adhesives, "green" materials, etc.), 15 years does offer a significant time period upon which the merits and abilities of the system can be judged.

Slate grouting is the process of injecting breathable polymer material in between the individual slates, creating a monolithic sheathing comprised of individual slates that are connected (one might go so far as to say "sealed") to all of the surrounding slates. The grout material effectively acts to glue the individual slates together, so that any individual location of distress that occurs after grouting and would otherwise result in a slipped or missing slate, is rendered moot as the slate is retained in place due to the adhesive properties of the grout. The shedding of individual slates due to cracked slates or fastener problems (missing, overdriven, substrate void, etc.) can thereby be prevented, abating a potential serious safety hazard of slates falling from above. Slates that have been grouted are also less likely to break than those that have not been grouted because the grout fills in the voids between slates that allow slates to move/chatter. This support reduces the bending stresses placed upon the slates when heavy snow or roof traffic is applied and, therefore, reduces the number of slates that break.

Please note that serious and endemic problems cannot be remedied by slate grouting. If most or all areas of slate have a particular problem that causes them to be shed from the roof, the process of slate grouting will only serve to hold slate in place until a large area of slate fails, resulting in it falling from place and likely causing much more serious damage than if the individual slates were allowed to fail.

After grouting, the slate roof can expect to continue to perform for a minimum of 15 years. The additional life provided varies greatly on what the original problem was and how close to the end of its life the slate roof was at the time of grouting. Significantly longer life extension is conceivable; however, a proven track record can only be as long as a technology has existed, which in the case of slate grouting is approaching 15 years. As will be discussed below, the actual additional life a slate roof can achieve is likely to be significantly greater than 15 years.

The cost of slate grouting will, of course, vary and will be dependent upon the condition of the slate, access requirements, size of individual slates, and roof slope. When compared to the cost of reroofing the area with new slate of commensurate size and quality, grouting is typically half the price of new slate. As such, the cost of slate grouting is typically more expensive than installing new asphalt composition roofing; however, most owners who have slate roofs would rather keep them as slate and do not want asphalt composition roofing.

The slate grout material is, naturally, proprietary, and the exact formulation is a closely guarded secret. Typically, the grout is a vapor-permeable polymer that contains specialty components to assist with color matching and allows them to closely control the viscosity of the product. For slate roofs of uniform color, the grout is custom tinted

to match the color of the slate. For multi-colored slate roofs, a color matching the more predominant slate color is typically selected.

The process of slate grouting involves the following steps:

1. Assess the roof to determine if the slates are candidates for grouting. In general, if the slate roof is nearing its life expectancy and is showing the classic signs of an aging slate roof (i.e., an increased frequency of missing or slipped slates due to cracks within the slates), then it is ideal for grouting. If the deterioration of the roof is the widespread softening of the slate due to moisture absorption, corrosion of iron nails, or any other issue that compromises the securement of all the slates on the roof, then the roof is not likely to be a candidate for grouting.
2. Once determined to be an acceptable candidate for grouting, the roof is carefully cleaned with low-pressure water. This cleaning process allows the grouting technician to visually inspect each slate on the roof and determine if any slates in place are damaged.
3. After cleaning, all missing and damaged slates must be replaced. The intent of slate grouting is not to glue together a damaged slate roof; rather, it is to hold damaged slates in place as they occur and prevent them from falling out of place to the ground below.
4. At the same time as slate repairs are implemented, it may be advisable to repair or upgrade metal flashings, such as open valleys and ridge caps. If the slate roof performs but the flashings leak, the owner has not received any appreciable improvement from slate grouting. Repairs and upgrades to flashings can include removal and replacement; however, it is more common to apply coatings that can be expected to prolong the life of these components 10 or 20 years and that can be reapplied after this time period if the grouted slate roof is still performing well.
5. Once cleaning and repairs are completed, a clear penetrant sealer should be applied to the slate surfaces. This sealer prevents the grout from adhering to the exposed slate surface. This is particularly important when multiple colors of slate are installed and the grout cannot match all the pieces of slate. If a sealer is not applied to the slate, it can be expected that the grout will remain adhered to the exposed portions of the slate for a longer period of time than if a sealer had been installed.
6. Next, shims are installed at the butt ends of each slate to create a thin gap into which the grout will be injected. Shims vary and can consist of tile grout shims if a constant height or thickness is required, or of cedar shims, if variable-thickness shims are needed.
7. After shimming, the grout is injected with an airless pump and specialized application nozzle. The nozzle forces the grout between the slates, penetrating the gap between ½ to 3 in. The variation in penetration is due mostly to the conditions of the existing slate roofing. Cupped slates and other variations in the slate roofing will make it easier or more difficult to inject the grout, thereby impacting the depth to which the grout penetrates.
8. During grouting, a significant amount of grout material is placed on the weathering surfaces of the slate. This material is spread thinly over the entire slate surface, with the bulk of the excess material being removed. The grout does not have UV stabilizers, and the material on the weathering surfaces will rapidly deteriorate and wash away. The time period for this to occur varies, depending upon if the sealer discussed above was installed, and on UV exposure, which is dependent upon roof facet orientation and shading/protection by surrounding trees or other buildings. Typically, when the sealer is installed, the exposed grout material is no longer discernable from the ground after six months to two years.
9. Though rarely done, after the grout has cured, the roof can be washed

Figure 2 – Areas of slate requiring repair (photo courtesy of SlateSavers).

Figure 1 – Overview of varied-color slate roof.

Figure 3 – Installation of reinforced liquid flashings (photo courtesy of SlateSavers).

Figure 4 – Installation of reinforced liquid flashings.

again with low-pressure water. This will greatly accelerate the removal of grout from weather-exposed areas. Despite this cleaning procedure, it can be expected that some grout will remain. Typically, the removal of grout from exposed areas is only considered when varied-colored slates are installed and the aesthetics of the building cannot be temporarily altered.

Two slate roofs—on Long Island, NY, and in Westchester County, NY—were grouted circa 2004 and will be discussed to show what the technology of slate grouting can do and how it performs over a decade. The author would like to acknowledge the cooperation and assistance of SlateSavers, who provided access to the grouted slate roofs, both during and after grouting.

LONG ISLAND COMMERCIAL MANSARD ROOF

A one-story commercial building in Mattituck, NY, has a multicolored slate mansard roof with uneven coursing (*Figure 1*). In 2004, the building owner complained of significant and frequent loss of slates and was investigating the removal and replacement of the slate roof with asphalt shingles. In lieu of removal and replacement with asphalt shingles, the alternative of slate grouting was accepted. Slate repairs were made (*Figure 2*); ridges, open valleys, and other flashings were coated with a UV-stable reinforced liquid membrane (*Figures 3* and *4*); and the slate was grouted.

A recent visit to the site to inspect the condition and performance of the grouting revealed the assembly to be performing very well. The owner stated that there have been no leaks and, more importantly, not a single slate has fallen since grouting. This is a drastic change from the average of 15 or 20 falling slates per year prior to grouting. As can be seen from the photos, falling slates anywhere from the roof land on public access sidewalks, presenting an imminent danger to the public and a serious liability to the building owner.

From the ground, which is only approx-

Figure 5 – Slate shim installed low becomes exposed.

Figure 6 – Overview of freeze/thaw-damaged slate after grouting.

Figure 7 – Close-up of freeze/thaw-damaged slate after grouting.

imately 20 feet away, there was no discernable sign of grout on the weathering surfaces of the slate. Hands-on inspection of the slate was provided and revealed that in some areas of the roof, small amounts of the grout were still in place on the weathering surface. It should be noted that this roof did not receive the clear penetrant sealer prior to grouting. In one location, a shim used to facilitate grout injection was installed somewhat lower than normal, and as a result, was observed due to the deterioration of the exposed grout material (*Figure 5*). Several slates that have deteriorated significantly due to freeze/thaw since grouting were noted; however, these have not fallen from the roof and remain in place (*Figures 6* and *7*). The flashings that were coated were performing well, and overall, the roof looked very good and was performing well.

Slates from a grouted roof were removed to determine the depth of penetration of the grout injection. At the observed slates, the penetration of the grout was almost two inches past the edge of the overlying slate (*Figure 8*). A vertically orientated crack in one slate that effectively left two skinny slates—each attached with a single nail—was observed to have slate grout in the crack and between this slate and the underlying slate. This had effectively glued the broken slate in place, making its removal and replacement unnecessary.

Figure 8 – Depth of penetration of grout injection.

Figure 9 – Airless grout pump.

Figure 11 – Exposed slate grout limited to within two inches of slate edges.

Figure 10 – Grout-injection nozzle.

WESTCHESTER COUNTY PRIVATE RESIDENCE

A residence in Westchester County, a suburb of New York City, also has an aging slate roof. The author was able to observe the installation of the grout in 2006 and has returned to the site as recently as September of 2014 to observe its performance. The uniform black slates were aged to the point where the owners stated slate loss and leakage caused them to contemplate removal and replacement of the roof with asphalt shingles. Instead, the roof was grouted to provide additional life to the existing slates.

The flashings at this roof were also coated with a reinforced, UV-stabilized liquid membrane to provide an additional 10 to 20 years of useful service life. Slate grouting was done with the airless pump (*Figure 9*) and specialized grout-injection nozzle (*Figure 10*).

Grout injection resulted in excess material on the weathering surfaces of the slates; however, careful installation and diligent cleanup by the grout technician limited the excess grout to only the areas within two inches or so of the edges of the slates (*Figure 11*).

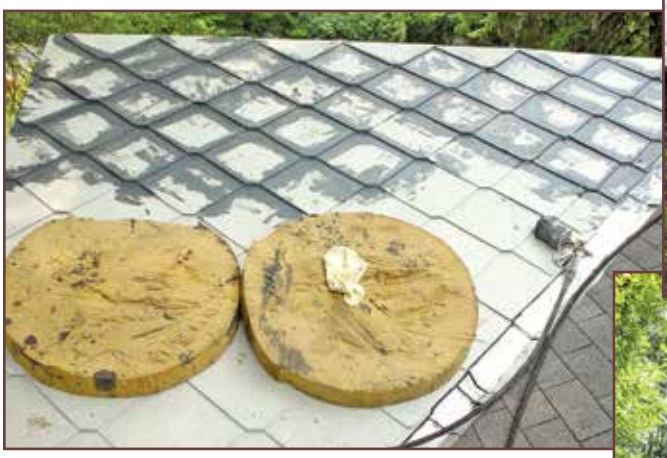
Figure 12 – Overview prior to slate grouting (photo courtesy of SlateSavers).

Figure 14 – Overview eight years after grouting.

Figure 13 – Overview two years after grouting (photo courtesy of SlateSavers).

Figure 16 – Overview before tile grouting (photo courtesy of SlateSavers).

Figure 15 – Grouting of tile roof (photo courtesy of SlateSavers).



The building was revisited in September of 2014 and was found to be performing well. Again, the owner indicated that not a single slate has fallen/slipped and that there have been no leaks since the roof was grouted. The overall aesthetics of the slate roof have not been changed, and the grouting material cannot be detected from the ground. Photos of a single elevation before, two years after, and ten years after (*Figures 12, 13,* and *14*) show that to the general public, the installation of the slate grouting is invisible. However, the serious problems of leakage and falling slates have stopped.

Figure 17 – Overview after tile grouting (photo courtesy of SlateSavers).

CONCLUSION

Slate grouting is "new," and as with all new things related to slate roofing technology—which has remained relatively unchanged for hundreds of years—the first question is, "Why fix something that isn't broken?" That being said, looking to improve something that works perfectly well is the American way. The grouting of slate can be utilized to preserve the essential fabric of historically significant buildings, stabilize aging buildings, and—with a proven track record of almost 15 years—can likely extend the life of almost any slate roof at least 20 years and possibly significantly longer (30, 40, or even 50 years?).

The use of this technology is not limited to slate. Tile and asbestos shingles can be grouted with the same/similar benefits being achieved (*Figures 15, 16,* and *17*). After close-up viewing and hands-on examination of the grouted roof after a decade of service, no deterioration of the concealed grout was observed. Since most roof deterioration results from the same three conditions (physical abuse, UV degradation, and thermal shock), slate grout is likely to perform well, as it is not likely to receive physical abuse from roof traffic, nor will it be exposed to UV degradation. Only thermal shock remains as a threat to its life expectancy. After personally reviewing the performance of slate grout after ten years of service, I found no discernible deterioration to the grout. While I can't determine an actual life expectancy for the grout, I would expect it will perform without problems for 20 years and would not be surprised if it allowed the slate roof to remain in place and functioning for much longer than that.

These two roofs will continue to be monitored, and any significant changes in their condition or performance will be documented and presented in a future article—an article that both the slate grouting industry and I do not expect to be written any time soon.

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Remo R. Capolino, RRC, PE, a principal with Wiss, Janney, Elstner & Associates, grew up in a family-owned specialty roofing contracting business and graduated from the University of Connecticut with a BS in civil engineering. After more than 15 years in contracting and leadership roles with the Association of General Contractors (AGC), Northeast Roofing Contractors Association (NERCA), and the National Roofing Contractors Association (NRCA), he turned to consulting. Capolino has used his expertise in copper, zinc, slate, and other specialty roofing assemblies on a number of internationally recognized projects.