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PRESS RELEASE
ARDEX - PLANT EXPANSION
LATICRETE - PROMOTIONS
LATICRETE - GRAND OPENING

LUXURY VINYL AND RIGID CORE PLANKS - DON ZIMMERMAN
WELLMADE PERFORMANCE FLOORING
AFTER A BUILDING FLOOD: INSPECTION AND ASSESSMENT
OF TRAVERTINE FLOOR TILES - PATRIC J. MOFFETT

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After a Building Flood: Inspection and Assessment of Travertin Floor Tiles



Patrick J. Moffett

Moffett is an IICRC instructor who teaches fire and water damage restoration courses across the U.S., Canada, Europe and Australia. Patrick's 30 years of experience in mitigating thousands

of fire and water damage losses, they required the assessment of: wood finishes, built-in cabinets, kitchen and bathroom cabinets, moldings, trim, flooring and building framing. Patrick is an AIHA registered industrial hygienist and a licensed general contractor. Patrick is the owner of Blue Sky Environmental Consulting, Inc., in Southern California

About Travertin:

Travertin (Lapis tiburtinus), is the rock that took its name from Tivoli, Italy, near Rome. Travertin is a sedimentary carbonated stone, which refers to stone being formed by deposits of minerals and sediment; this is in contrast to igneous metamorphic stone, such as marble. Travertin is a terrestrial sedimentary rock, which is usually found in geothermally heated hot springs and geysers, and limestone caves. When heated carbon dioxide rich water percolates through rocks, carbon dioxide saturates the pores and crevasse of rock; partially dissolving what becomes Travertin rock. As water cools, there is a pressure drop, resulting in carbonated rock to recrystallize.

Travertin is a dense, banded sedimentary rock (limestone) composed of calcium: calcite and aragonite; and detritic minerals, including clay, quartz, manganese and iron oxides. Traces of iron oxides are sufficient to impart an ochraceous tint to Travertin but color is usually associated with clay minerals and siliceous sinter. (Pentecost, A., Ph.D. "Travertin". 2005. Springer Publishing)

The creation of Travertin goes through an extra earthy evolution process, where hot and mineral-rich water flows through limestone, resulting in the release of carbon dioxide, helping Travertin to create its distinctive look and porosity. Limestone is composed of more than 50% carbonate minerals, generally the minerals calcite (pure CaCO_3) or dolomite (calcium-magnesium carbonate, $\text{CaMg}[\text{CO}_3]_2$) or both.

Most carbonate rocks begin as sedimentary deposits in seawater. Sedimentary carbonate rocks are common on every continent and have formed through most of geologic history; they are still forming today in the tropics as coral reefs and at the bottoms of shallow seas. Marine limestone forms because seawater has high concentrations of two key dissolved chemicals—calcium (Ca^{++}) and bicarbonate (HCO_3) ions, and at the near-surface layer of most ocean bottoms, there are corals, clams and shells, micas, quartz, pyrite, iron oxides and graphite. The forming of sediment into rock is called "metamorphism", where heat and pressure causes recrystallization of sediment. Sea-dwelling creatures once used the ocean's floor as their home, where they too eventually became part of the sediment (see Moffett's kitchen picture next page). When pure, Travertin is white, but as impurities set into the sediment layer, over thousands of years, Travertin rock turns grey, brown, yellow, blue and red.

During mining operations, sedimentary limestone deposits can be extensive, covering hundreds of square miles, where Travertin limestone can be relatively uniform in thickness and quality. Therefore, quarries can be large and long lived, mining Travertin stone that can be hundreds of feet thick over areas of several square miles.



(Picture above by CEGA SRL, who over the past 30 years, processes Travertin into residential floor tiles in Tivoli, Italy. Picture shows layers of Travertin that will eventually become floor tiles; notice cells and porosity.)

Continue on Next Page



(Picture above is the author’s honed and sealed Travertin kitchen floor showing beautiful crustaceans and shells.)

Because Travertin is plentiful, it weighs less than marble and granite, and it’s relatively easy to quarry. In ancient times, Travertin was often the stone of choice in construction, such as the Colosseum and Roman aqueducts. In the 1600s, Bernini used Travertin columns to shape the colonnade at St. Peter’s Basilica. Today, the Lincoln Center in New York, the ABC Entertainment Center and the Getty Museum in Los Angeles are made from or lined with Travertin. In addition, the tallest building in America, the Willis Tower in Chicago, has its lobby lined with Travertin, while the Shell-Haus in Berlin uses the stone throughout the building, where it’s often called a masterpiece of design. The UCLA Medical Building in Los Angeles has an entire ground floor made of Travertin, which is designed to withstand an 8.0 Richter scale earthquake.

About Travertin Floor Fills:

Travertin has natural fissures and bubbles which exist throughout the stone, which again, is the byproduct of the release of carbon dioxide passing through it. The fissures and surface pits are from broken bubbles that contribute to the stone’s porosity. At the factory, Travertin floor tiles are often “floor filled” with colored cement or resins; and during tile installation and pit maintenance, floor fills consist of resins that fill voids and cracks. Floor filled Travertin tile becomes a more durable floor tile product than non-floor fill tiles.

There are a few unofficial tile-grade classification systems from stone producers, suppliers and distributors, such as: Premium “first-grade”; Standard “second-grade”, also known as Mid-grade; and Commercial “third-grade”. Depending on grade, use and appearance, Travertin floor tiles require different levels of maintenance and care. Due to store price and selection, a lot of Travertin tiles sold in the U.S., are third-grade products.

First grade “Premium” Travertin, are tiles that are usually double-filled (first by machine, then by hand). They are selected to have consistent coloring throughout the crates, and the only limitation about holes varies by producer. For example, there are “no large holes”, and in many cases “no holes”, because tiles are fill all the way through. (Note: Premium-grade tiles are selected because, they have few holes and pits, and only a minimal amount of filler is required.) The producer cutting and filling Premium tiles will also specify the quality of their tiles, such as: there are no chipped or cracked edges; tiles are the same color and thickness throughout crates; tiles are smooth to the hand on the face; Travertin is evenly cut with true 90 degree angles; edges are smooth or beveled.

Tom McNail, who sat on the board of the Marble Institute of America (MIA) said: “If you are going to walk on your floors, you’re going to wear them”. Meaning, Travertin, limestone and marble stone floors will require maintenance.



Continue on Next Page

Since hardened resin is a foreign substance, its ability to expand and contract at the same rate of porous limestone is different. Further, as the floor ages, is repeatedly cleaned, and foot traffic scuffs and wears the floor, micro abrasion and chipping of the tile's surface and floor fills develop. From the high use of the floor by foot traffic, resin-based floor fills wear down at a slower rate than limestone, a softer material – resulting in an uneven floor. Resin floor fills become higher than softer limestone, because it is hard, it doesn't wear easily, and it is insoluble in water. Depending on the quality/grade of Travertin, a combination of grinding, honing and floor-fill repair may be required to increase the life of the floor.

In another situation, over time and use, some factory floor fill cement-based floor fills can chip or pop out, sometimes because it had little surface area to bond with during manufacturing. Once they appear, holes, chipping and pitting no longer protects Travertin by the floor sealer; and if the floor is protected by a polish and it has a patina, the floor will pick-up light differently, where the tile becomes dirtier faster, and begins to look unsightly.

General Inspection and Evaluation: In evaluating wear or damage to Travertin flooring, it's recommended to first clean the floor with a mild alkaline detergent followed by rinsing and drying. (One must also remove grime and grease from cracks, pits and grout). Then, evaluate the condition of the floor and grout, and then determine how much or how bad the floor is damaged by analyzing scratching, etching, spills, stains, pitting, hair-line cracks/fractures, loss of floor fills, etc. In other words, how healthy is the floor?

Several Potential Installation Issues: When the floor appears to be installed improperly, such as when cracks, fissures, high and low spots at corners, or over time the floor appears to have settled or raised areas, consultation with all materially interested parties is required to come up with the best solution to restore the floor by any or a combination of the following: removing high spots, chips, loss of floor fill, filling in low spots, and overall, increase its appearance and life expectancy.

Often, what's appearing at the top of the tile as cracks, means the tile is damaged all the way through.

Sometimes it's not the tile's fault, but it's an installation issue, underlayment or subfloor issue. In more complicated situations, the foundation may have cracked or settled, the framing may have swelled, resulting in expansion and contraction, that can transfer in cracking of tiles. This situation will often result in floor tiles being removed to thoroughly investigate and correct underlayment and subfloor problems.

Debonding: Natural stone floor tiles may have a hollow sound under them, which indicates either the mortar or adhesive (e.g., Thinset) has released (debonded) from the substrate or from the tile. Sometimes this condition is a result of internal stresses caused by the installation, use or maintenance. Sometimes, a larger the tiles' footprint, such as tiles that are larger than 12-inch x 12-inch, become more difficult to install correctly. Working with mortar and Thinset is an art unto itself.

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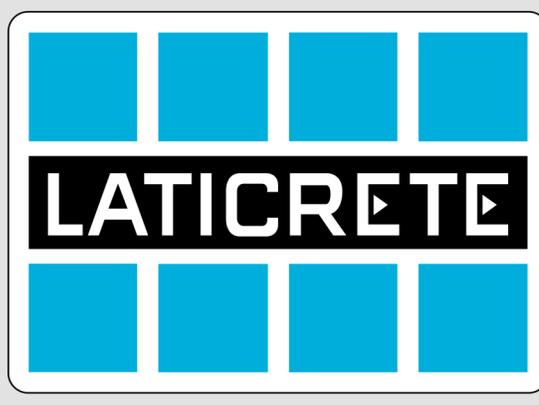
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The Importance of Training Your Installation Managers



Don Zimmerman
*Wellmade Performance
Flooring*

Zimmerman is technical and claims manager at Wellmade Performance Flooring based in Wilsonville, Ore. He has more than 35 years in the floor covering industry, 27 years as an installer of many types of floor coverings, he holds inspector certifications from the NWFPA, NALFA, and IFCI, and is always trying to assist the floor covering industry to get better educated to have a better end result and reduce callbacks.

substrate should be as smooth and flat as possible to eliminate any issues of separating due to irregular flatness in the substrate, or to prevent telegraphing from seams or debris that might be under the flooring; this is especially true for click vinyl products. If your substrate is flat and smooth, you will have nothing to worry about with inspectors accusing the installer for issues due to improper floor prep.

I am not saying these products perform less than other products because every type of flooring has its pros and cons, quite the reverse; what I am saying is that education to the salesperson and the installer is the right preparation for sales to the public, and are the keys to the performance and durability of these excellent floors. Knowledge is the key.

While Luxury and Rigid Core Vinyl products are the new generation of flooring materials due to their sustainability, looks, and durability, there are some realities both consumers and installers need to know about this fabulous flooring before purchasing.

For consumers:

The consumer should be more educated by the sales person that even though these floors are durable and state they are scratch resistant, all hard surface floor coverings will scratch. Luxury vinyl is a product which is softer under foot than other floor coverings like laminate and wood floors, this is why luxury vinyl flooring is more in demand, although let's not forget about being water proof also; with these benefits vinyl floors will require some care. Also concerning scratches in Luxury Vinyl flooring is that darker colors tend to show scratches more than lighter colors, and darker colors are more the trend right now, so be cautious of what is underfoot or dragged across your floor as floors can't scratch themselves.

For installers:

The substrates for these vinyl floors need more attention to detail and should be prepared as if you were installing sheet vinyl; even though the new LVT, LVP, and EVP's are thicker than most sheet vinyl, they will telegraph and settle into uneven areas of your substrate more than other floor-coverings in the marketplace like laminate. This means that the

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