

## ***Selection & Maintenance of Natural Stone Tile Floors***

by

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For years, retail developers and architects had favored use of porcelain ceramic tile as a floor finish in retail facilities, primarily due to cost effectiveness and ease of maintenance, compared to other high-traffic commercial floor finishes such as natural stone. Recently, there has been resurgence in the use of natural stone as a floor finish, resulting from design trends towards upscale retail environments and natural floor finish materials, decreased cost, and the globalization of the natural stone market.

Many of the problems associated with maintenance of natural stone, such as staining and cracking, have now been minimized with new installation and maintenance technologies such as water-based penetrating sealers, crack-isolation membranes and adhesive mortars. Similarly, the poor durability and difficulty in maintenance of polished stone finishes popular in the past has given way to design trends towards more natural honed or textured stone surface finishes. These finishes are more durable and easy to maintain in high-traffic commercial environments. The trend towards honed and matte stone finishes is further driven by practical consideration of building and insurance regulations which require slip resistant floor surfaces.



Figure 1 – honed limestone tile sealed with penetrating sealer provides a soft, natural look that is safe and easy to maintain in a retail food court environment

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Choice of stone varieties has historically been limited by project budgets and availability. Today, the globalization of stone markets, driven by economic and technological advances, has resulted in virtually unlimited choices of natural stone varieties, configurations, and finishes at reasonably competitive costs. The cost of natural stone has in fact decreased over 10% since 2002, due primarily to the large supply of imported stone from countries with low labor costs such as China, India, Brazil, and Turkey. Industry analysts recently forecast a 10% compound annual growth rate of stone consumption in the U.S. through 2011.

Retail developers and architects have embraced this trend, and natural stone has again become the retail floor finish material of choice in up-scale retail environments. However, with the positive attributes offered by natural stone floor finishes, there remain certain limitations and precautions in the selection and maintenance of stone tile floor finishes in retail environments.

### **Selection of Natural Stone Floor Materials**

The availability of stone from emerging market suppliers around the world has made selection of stone variety and quality a critical design decision. The most important consideration is determining the suitability of the stone for the intended design application as well as the anticipated construction conditions. Compliance with ASTM Standards for generic stone varieties such as granite, marble, or limestone is the fundamental criteria used by architects to assess quality and suitability of stone. It is important to note, however, that many emerging market suppliers do not test their material; these suppliers rely on the developer, architect or building contractor to conduct testing. Unfortunately, most users are unwilling to bear the cost burden for testing, and as a result, stone is often selected based on variety and color / texture only, without any consideration of physical characteristics such as compressive strength, density or water absorption. For example, there are hundreds of varieties of limestone, with tremendous variations in quality and physical characteristics, and even variations within the same stone quarried by the same supplier, based on extraction location within the stone quarry, or fabricated tile size and thickness.

There are also physical attributes of stone, such as moisture sensitivity, for which there are no established industry test protocols. However, many industry manufacturers and consultants have devised accurate tests to evaluate this phenomenon. Certain varieties of limestone, prized for color or texture from certain mineral or organic content, are notorious for becoming dimensionally unstable or subject to deterioration as a result of prolonged moisture exposure. Moisture sources can be obvious (water leaks from food tenants or unprotected fountains / planters), or more subtle sources (residual construction / installation moisture or daily maintenance water absorption). In some cases, a particular stone variety may not be problematic until the stone is fabricated into thin 3/8 inch (10 mm) tiles with large area dimensions (12 x 24 or 18 x 18 inches).

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Figure 2 – honed limestone tile with reactive organic content damaged from excessive moisture exposure resulting from failure to install vapor retarder

To insure a successful stone floor finish installation, criteria for stone selection should include the following basic functional considerations:

- Request test data from stone supplier or test in compliance with ASTM test standards
- Conduct specialized testing or mock-ups to assess suitability of stone for intended application
- Assess proposed installation methods / materials and anticipated construction conditions to insure compatibility

### **Maintenance of Natural Stone Floor Materials**

Successful maintenance of natural stone tile floor finishes is primarily achieved by limiting abrasion and staining. As described above, selection of stone that is suitable for the intended application is the first step in insuring durability and ease of maintenance. For example, selection of a soft, polished marble in a high-traffic retail area would be a maintenance nightmare, while a honed finish, Class III high density limestone would be durable, slip-resistant, and wear evenly in high-traffic areas, blending with the stone's natural patina.

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Figure 3 – discoloration of honed Pietro di Cardoza sandstone caused by prolonged exposure to residual adhesive moisture after installation over an impermeable crack-isolation membrane; note the “halo” at the perimeter where moisture escapes through grout joints

Control of abrasion in high-traffic areas is a matter of developing a daily maintenance regimen of sweeping, collecting contamination, and washing / damp-mopping with mild neutral pH detergents and water. An important consideration in washing stone is to use non-abrasive cleaning equipment that deposits minimal residual water. Excess residual water will infiltrate beneath the stone, where it will accumulate daily, and possibly cause staining, deterioration or dimensional instability of the stone as described above.

The development of deep-penetrating, water-based silane sealers has revolutionized control of staining and ease of cleaning more absorptive natural stone materials. Silane, a derivative of silicon, has a very small molecular size, and can penetrate deeply into stone pores, where it chemically reacts and develops a strong bond, repelling water, oils or other contaminating liquids. This strong chemical bond, together with deep penetration beneath the stone surface, creates durable, long-lasting protection from daily stone surface maintenance or abrasion, as well as protection from weather or damaging sun exposure. There typically is no change in stone appearance or texture, although these types of products can also be formulated to enhance and darken natural stone, or to increase slip resistance. We’ve come a long way since the Roman’s use of olive oil to protect and enhance stone !

While penetrating-type sealers do not form a protective film over the surface and allow the stone to “breathe” or transpire moisture vapor, these sealers do not protect against topical dirt deposits in the stone surface texture or damage from prolonged exposure to acidic liquids, such as juice or soda. The maintenance concept employed by penetrating

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sealers is to allow increased "reaction time" by holding a stain or contamination at the stone surface where it can be cleaned in a reasonable time.

The trend towards more natural-look matte or textured stone surface finishes such as a honed finish, has gone a long way to solve the traditional problems of noticeable wear from high-traffic, as well as poor slip resistance of polished surfaces. In situations where varieties of stone such as granite provide appropriate durability for a polished finish, penetrating sealers may be used for ease of maintenance, as well as for improving slip resistance.



Figure 4 – polished finish granite is durable in high-traffic airport retail area, but even hard, dense stones will eventually show wear

Eventually, natural stone tile will show wear in high-traffic areas; but one of the advantages of natural stone is that the surface can be re-finished to repair normal wear and tear or minor damage. However, any re-finishing of natural stone must be done by physical grinding of the stone surface with diamond pads or other abrasive compounds; there are no "quick-fix" methods without risks, despite many commercial claims. It is strongly recommended to avoid any type of re-finishing methods for marble or limestone commonly known as vitrification or re-crystallization. This re-finishing method actually changes the physical composition of the stone, as acid chemicals are used to break down the calcium carbonate surface of the stone and combine the calcium with other compounds to form a new, impervious, enamel-like film over the surface of the stone. Once the pores of the stone surface are blocked, moisture vapor can become encapsulated and cause deterioration or dimensional instability of the stone.

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## **Stone – A Natural Choice for Retail Environments**

While natural stone has become more available, affordable and durable for retail environments, technological and economic advances have made it increasingly important for retail developers and architects to give careful consideration to the functional selection and maintenance of natural stone flooring. Diligence and understanding of current stone industry technology will result in a beautiful, durable and profitable retail project.

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