

## STONE

Expert restoration of stone surfaces is critical for aesthetics as well as to prevent costly replacement of the stone. Our time-tested methods, coupled with technologically advanced solutions, can reverse the signs of aging and damage to protect, seal and enhance the beauty of natural stone surfaces.

### Architectural Elements:

- Banisters
- Countertops and vanities
- Floors
- Statues
- Walls and façade panels

### Types of Stone:

- Granite
- Limestone
- Marble
- Onyx
- Sandstone
- Slate
- Terrazzo
- Travertine

### Methods:

- Cleaning
- Crystalizing
- Lippage Removal
- Honing
- Maintaining
- Polishing
- Restoring

### Myths and Realities

RSG believes our customers should be aware of the science behind our marble restoration methods. We think it's important for them to understand what is involved in maintaining their floors so that they can make informed decisions regarding the value of the service. We are confident that the more our customers know, the better our chances of maintaining a mutually beneficial relationship. To help achieve this goal, we've written this article explaining our methods for restoring marble and granite floors. We hope you find it helpful and informative.

## Renewing a worn-out lobby floor

mopping and waxing procedures are used to maintain most marble and granite floors. Floors that are maintained this way have usually completely lost their polish (by 'polish,' we mean the highly reflective finish that one associates with a newly installed marble floor.) Marble floors with these heavy wax coats often look more like faux marble tile in that they have none of the brilliant polish that is inherent to high quality architectural stone. Dissatisfaction with this dull appearance is what keeps us in business. Customers yearn for that 'like new' appearance the floor had when it was first installed and they could see their reflections in the polished finish.

Marble floors that lack a polish appear that way for very straightforward reasons. The friction created by foot traffic and dirt has worn down the marble surface. If one were to look through a microscope at the surface of an old worn marble floor and compare it to the finish on a newly polished floor, one would be struck by how rough and cratered the former looked compared to the latter. It is the roughness of the surface, along with dirt and wax buildup in its nooks, that prevent the floor from appearing polished. Remember that for something to appear polished it must reflect light very effectively. In order to reflect light, it must be very smooth. A rough finish by definition reflects light poorly since it defracts, rather than reflects, the light waves which strike it. This, in a nutshell, is the reason an unpolished or worn floor appears as it does.

In achieving a highly polished floor is to make it very smooth. With both marble and granite, the only effective means of smoothing the surface is honing. 'Honing' is an industry term that refers to abrasively smoothing a surface. For all intents and purposes honing a stone floor is synonymous with sanding a piece of wood. The honing method used is usually either stone grinding or machine honing with diamond pads. Diamond pads are circular pads with industrial diamonds attached to the bottom. These pads are a relatively new innovation that enables the honing process to be done more efficiently and quietly. They are the material of choice for nearly all marble restoration companies.

Typically, the marble restorer will employ a rotary floor machine with a diamond pad affixed to the bottom. Several different grades of pads are used to restore the surface, beginning with a rougher grade (perhaps 60 grit) and working toward finer grades (1000 grit or higher). The process of using progressively finer grits of diamond pad is necessary because the pre-restored stone surface is usually very rough and cratered. The low grit pads (which have a rough feel to them) are necessary to smooth the deeper scratches that usually are found on floors which have not been restored for some time. These rougher grits by themselves are not enough to smooth the floor. Successions of grits are necessary to gradually smooth the surface to a point that is required to recreate the desired high polish. This is a time-consuming process.

Marble and granite differ substantially in their degree of hardness. Granite is far more dense and hard than marble. It is also true that different types of marble and granite within their respective categories vary in their degree of hardness. Because of these varying degrees of hardness, different types of stone require different honing procedures to produce a highly polished finish. For example, Negro Marquina marble typically requires much less aggressive honing than White Carrera. This usually means that less time is required to hone Negro Marquina than White Carrera both because the very low grits may be unnecessary for Negro, and because less time may be required for each level of grit (60, 120, 220, 400, 800, etcetera).

There are literally dozens of gradations of hardness among the various types of marble and granite that are typically used in commercial and institutional buildings. Knowing precisely

how much to hone and when to stop is the stone mechanic's craft, and it usually takes years for a person to develop the depth of knowledge to effectively and economically polish a floor.

Finally in achieving high quality sheen is to polish the honed finish with an acid ('acid polishing'). The typical method is to use oxalic acid with a buffering agent of aluminum oxide. The acid, which is relatively mild, nevertheless serves to melt the very top layer of the stone, while the rotary action of the buffing machine smoothes the surface. The result is an extremely smooth finish.

While there are some other ways to polish, the acid method is the method of choice if the desired outcome is a truly brilliant polish. For this reason, it is the most common method used in factory application. After polishing the floor, the residue of the acid is then thoroughly rinsed and neutralized.

## How 'new' will a restored floor look?

A floor that has been polished by an expert stone mechanic employing the general methodology described above should look dramatically superior compared with its former appearance. Just how dramatic the difference is will depend on how poorly the floor looked to begin with. Floors that have not been polished in years should strike the observer as appearing as if they had been replaced. A floor that had been polished three months prior to a just-completed restoration will look substantially better, but the contrast will not be as great.

It is important to note that the floor will almost never look exactly as it did when it was first installed. This is particularly true of granite floors. Newly installed floors were polished in a factory. The general procedure used to polish in the factory is the same, but the equipment is different. The factory machines used to hone the surface of the stone are gigantic devices that are capable of generating thousands of foot-pounds of pressure. With that much pressure, these machines can hone the surface to a point where it is far smoother than anything that can be achieved in the field. Recall that reflectivity is a function of smoothness: the smoother the surface can be made, the more brilliant the polished finish. Unfortunately, until new technologies are developed, the spectacular finish of a new floor can only be approximated with onsite restoration services. Fortunately, technology is improving, and we are coming closer and closer to this ideal.

## How to maintain a newly polished floor

Precisely how a floor is to be maintained depends upon many factors. The type of stone, traffic patterns and degrees of traffic, the quality of the desired finish and the resources available to pay for the desired end product are all key elements. We will describe in a general way our methods, occasionally contrasting them with other methods being sold in the marketplace. Precisely which is best for the customer is the customer's subjective opinion.

When a customer hires RSG to maintain their marble or granite floor on a contractual basis, we follow a practice of completely restoring the finish as a first step. The method is usually identical to that described above, with one additional crucial step called vitrification (also sometimes referred to as crystallization).

After having acid polished the floor, RSG applies a small amount of vitrifying chemical to the surface of the stone and then uses a rotary floor machine with a steel wool pad affixed to the bottom to burnish the surface of the stone. The combination of the spinning of the steel wool

pad and the weight of the floor machine create friction at the point where the steel wool meets the stone. The heat created by this friction serves to catalyze a chemical reaction between the vitrifying chemical (fluorosilicates, mixing and accelerating agents) and the stone itself. The result of this chemical reaction is that the hardness and durability of the polish on the surface of the stone is actually enhanced. This step is crucial because the vitrifying process dramatically enhances the hardness of the floor, making the new polish far more durable and long lasting than it otherwise would be.

## The Science of Vitrification

on the Moh's scale, which ranks the relative hardness of stone on a logarithmic scale of one to ten, with one being the softest (talcum powder) and ten the hardest (diamond), marble rates at three. Please recall this is a logarithmic scale (each unit increase represents a tenfold increase: a stone rated at two is ten times as hard as a stone rated at one). Marble, with a rating of three, is relatively soft. Granite is rated at seven, making it an extremely hard stone, far harder than marble.

Our vitrifying process actually serves to enhance the hardness of the surface of the stones on which it is polished. Let us use marble as an example. Marble, which is fundamentally calcium carbonate, has a Moh's rating of three. The vitrifying liquid is polished onto the surface of the marble and actually reacts with the calcium carbonate to form a thin layer of calcium fluoride. This calcium fluoride (quartz) has a Moh's rating of between 3.5 and 3.7, which is a dramatic increase in the hardness of the surface layer of the stone and therefore increases its durability. Recall that the scale is logarithmic: an increase on this scale of between .5 and .7 means the surface is between four and six times as hard as it is without the vitrifying process.

This dramatic enhancement of the hardness of the surface layer is why the vitrifying step is considered so crucial in the RSG maintenance program. Because of this step, floors that would ordinarily wear out (lose most of their polish) in a week can last a month, or depending on the amount of foot traffic, several months. Because our service is typically calibrated around a monthly cycle, we are able to maintain the floor to a very high polish virtually all the time.

Maintaining a floor to a very high polish is not possible without vitrifying unless the floor is constantly re-honed and polished. Constant re-honing of the entire wear area of a busy floor is usually prohibitively expensive. Some companies prefer instead to re-polish small areas each evening. Unfortunately, if the floor in question is relatively large, area re-polishing can result in a 'patchwork quilt' effect, with some areas of the floor looking outstanding and others quite poor.

An additional beneficial feature of the vitrification process is that in most instances it will reduce the slipperiness of the surface of the stone. The tendency for a person to slip on the surface of polished granite or marble is a function of the coefficient of friction of the surface. The higher this friction number, the less likely the person will be to slip. When the vitrifying chemical is burnished into the surface of the marble or granite, it raises the coefficient of friction, thereby making the likelihood of someone slipping and falling lower than would be the case if the stone were polished and had no such protection.

The typical maintenance program will have RSG returning to the site one month after the initial restoration (honing, acid polishing and application of the vitrifying process). Certain high-wear areas will have become so worn that the calcium fluoride layer and the polish on the marble itself will have partially worn away. These high-wear areas will thus need to be re-honed, polished and re-vitrified. Fortunately, large sections of the floor will still be in

excellent condition thanks in part to the extra protection provided by the crystallizing process. These areas can simply be polished, allowing us to concentrate primarily on restoring the worn areas so that the entire floor once again looks outstanding. In the future, as other areas gradually deteriorate and lose their polish, they too will be re-honed, acid polished and re-vitrified. Employing the vitrifying process as part of ongoing maintenance saves substantial time and money over the long term.

The method for maintenance described above is not always applied uniformly to every customer, but it is the method used to obtain the best result. As stated at the outset of this section, the frequency of service is a function of the degree of wear and tear the floor is subjected to, and the extent to which the customer desires a very high quality appearance at all times. For those customers who demand very high quality, our monthly service, which includes monthly honing and acid polishing, is usually necessary.

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