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Subject: **Learning from Forensics – Tips**

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Stone as tile installations:

The largest number of complaints for request for independent inspections relate to natural stone tiles installations. When homeowners, attorneys, property managers, contractors, distributors or manufacturer's call us to perform an independent inspection we ask,

“Well, what are the problems?”

Common responses are:

“The floor is not flat!”

“There is excess lippage and the contractor says this is normal!”

“The stone is stained or discolored!”

“The stone is hollow!”

“The stone is cracked!”

“The stone is fractured!”

“The stone surface is spalling or falling apart!”

“The polish is not uniform!”

“This is not what we bought or expected to have installed!”

“The stone is different in color or has a larger shade range in color and we bought one color of stone”

“The stone assembly is leaking!”

Issues/Categories

In review of inspections and reports we have written on these site inspections, we have divided the assemblies into issues/categories to assist for successful stone tile installations:

Stone Management;

Know your stone and the stone characteristics;

Cost Cutting or Value Engineering;

Poor Workmanship;

Expansion Joints;

Incorrect Backer Board Installations;

Attachment of Wire to Wood Floor Assembly;

Sound Rated Floors Where Required;

Countertops;
Veneer Installations

Stone Management

Stone management is a term we use that defines what the owner expects to receive. The defect or failure occurs and is claimed by the owner when the stone is not what the owner expected.

Examples include:

An unacceptable shade range;

The blending or lack of blending of the stone, which has shade variation;

The finish of the stone;

An unexpected finish or color;

Imperfections in the stone;

Quality of the stone;

Performance of the stone;

The emphasis here with the failure and defect, is on what the seller sold and what the buyer expected.

Communication between the parties, seller and buyer, is essential to eliminate stone management failures and defects.

Importers, distributors, fabricators of the stone materials have a duty to educate variations that are inherent in stone.

When stone is selected and approved with known variations of that stone, then the importers, distributors, fabricators have a duty to supply what was ordered, or verify the difference in the product delivered is acceptable by the buyer.

The distributors and importers have a duty to state if the product is suitable for its intended usage.

The distributors and importers are the experts in our industry.

They are liable for supplying inferior stone when the quality or performance is not what was expected or representative of the samples the stone was chosen from.

An example, a large custom home in Palm Springs had stone selected, and the range installed as to what the owner was told the range would be within. The stone delivered to the site was not within this range that was approved. \$1,000,000 worth of stone had to be modified to work with the existing site conditions and owner.

Stone management includes changes in fabrication.

Adding of polyester and epoxy coatings with fiberglass mats on the back of the stone is a change in fabrication.

You are liable for changes in fabrication in products you accept as delivered.

Importer and tile distributors are responsible to educate installers of altered stone surfaces which have occurred from changes in fabrication as to what workmanship requirements are necessary in order to make the installation last and perform.

The best tip for importers and distributors: do not accept stone with modified backs.

Instead of bonding the setting adhesives to the stone directly, the setting materials are now bonding to other than the stone surface.

Portland cement including modified mortars will bond to stone surfaces.

Portland cement will not bond to polyester.

Portland cement will not bond to epoxy.

Portland cement will not bond to resins.

Portland cement will not bond to mastic.

Entire projects have failed due to lack of communication of changes in fabrication.

Epoxy will bond to polyester.

Epoxy will bond to epoxy.

Epoxy will bond to Portland cement.

Epoxy will bond to resins.

Epoxy will bond to mastic.

The theme here is Portland cement will not bond to epoxy or polyester resins, and epoxy will bond to Portland cement.

Broadcasting sand into resins or epoxy does not make the backside of the stone compatible with Portland cement mortar.

If in doubt as to what will effectively bond to changes in fabrication, we encourage you to work with your favorite adhesive manufacturer.

Send the stone to the adhesive manufacturer for testing in their laboratory.

The adhesive manufacturer will confirm to you what setting material will work best with altered natural stone surfaces.

The best tip for tile and stone installers is to refuse to install stone tiles with modified backs.

These rules apply to moisture sensitive stone tiles including agglomerates.

Stones subject to curling and crowning require special attention to setting materials that will not contribute to/or aggravate the moisture sensitive stone.

Un-bonded floor assembly will contribute to curling and crowning of moisture sensitive stone tiles.

As example, if mastic is used as any part of the installation assembly, the curling and crowning of the stone tiles are stronger than the mastic. If adding a sound rated floor, the mat should not be installed with mastic.

Changes in fabrication includes: enhanced stone slabs, enhanced stone slabs are a problem if any fabrication is necessary. The distributor should have knowledge of what was used to enhance the stone in order to notify fabricators as to how to enhance fabricated edges of the enhanced stone.

Know your stone and the stone characteristics:

Know the stone and the correct application. Some stones are oversold.

All slates and sandstones are not equal.

We caution against installing slate and sandstone where there is constant wetting and drying occurring. Slate installed in areas that are dry and stay dry, or wet and stay wet may perform without deterioration. Slate exposed to wet and dry cycling is subject to

deterioration. A swimming pool in Rancho Santa Fe has slate literally shaling, spalling apart in pieces and falling into the swimming pool.

A flamed or honed finish typically has better coefficient of friction than a polished surface.

Polished surfaces do not belong installed on floors in wet areas due to slip, trip and fall liability and reduced coefficient of friction.

Avoid using polished stone at building entry pivot points where the stone could get wet.

Prevent the slip trip and fall liability by requesting the design be changed.

Type C and Type D Marbles do not belong in areas subjected to moisture.

Avoid the mixing of different stones with different finishes together. Mixing of stones that cannot be polished in between polished stone creates a long-term maintenance problem.

Volcanic tuft also called canterra and Adoquin stone have been oversold and these stones do not perform well in swimming pool surrounds and in vehicular traffic areas.

Flagstone does not belong in vehicular traffic areas especially without adequate expansion joints.

Natural stones should not be installed over moisture sensitive slip-sheet assemblies used strictly for anti-fracture capabilities on concrete slabs subject to moisture/vapor emission, migration, wicking, percolating and transmitting through concrete slabs.

A proper application would be to install an anti-fracture waterproof membrane to prevent the moisture/vapor emission migration through the substrate from affecting the natural stone floor or wall assembly. We recommend using products meeting ANSI A118.10 requirements like Composeal Gold, Noble-Seal TS, and Dal-Seal TS, directly bonded to the concrete slab with a rapid setting mortar. The rapid setting mortar will heat hydrate and cure quickly. When a membrane is placed on concrete, the membrane will draw moisture to the underside of the membrane.

Normal latex will not cure when subjected to moisture for a long period of time.

The rapid setting mortar has alumite, which is high pH friendly. A 9.3 pH alkalinity can cause loss of bond to Portland cement setting materials but not to rapid setting mortars in the high alkalinity condition.

One caution is not all ANSI A118.10 membranes are equal and perform equally in compression and in tension. Peel and stick membranes are not suitable for thick or medium bed mortars installed on the top side of the peel and stick membrane.

Cost Cutting or Value Engineering:

Cost cutting is taking and substituting materials or assembly methods in order to reduce costs. Cost cutting contributes to failures when the long-term effect is not analyzed. Let me use an example. A hotel was built on the waterfront in San Diego. Granite was the specified material for countertops, floors and veneer. The owner cut costs and changed the granite to a marble. I had three meetings with three different head of maintenance personnel who tried to blame the marble for citric acid etching of the polish surface. In each case, I began by stating the history of the changes that occurred and why.

The maintenance personnel became friendly to the high cost of maintenance associated with the cost cutting changes once they understood the history of the project.

Value engineering is a true process that accounts and documents the changes that do or do not affect the long-term performance of the changes created.

Value engineering may or may not work depending if the interrelationships with other components are compatible with reasons the original choices were dependent on.

An example: A hospital was built in San Diego. The general contractor value engineered and deleted the cement backer board to be used in the shower from the tile contractor's contract. The cement backer board was assigned to the drywall contractor. The drywall contractor installed the cement backerboard. The tile contractor was then asked to install the weather resistive barrier paper behind the cement backer board. The tile contractor related the weather resistive barrier paper was no longer part of the contract with the tile contractor as the installation was eliminated when the backer board installation was deleted. After discussion, the tile contractor was paid a cost to install a waterproof membrane over the backer board for direct bond of tile to the membrane in these showers. This value-engineering example is one where value engineering was not fully performed as the coordination was omitted for the installation of weather resistive barrier papers or waterproof membranes with the change in assignment to contracts.

Be cautious when an exterior area is reduced in size to save money.

An example: Ribbons of tile and stone in concrete require drainage for moisture to exit from the ribbon; Expansion joints on both sides of the tile and stone abutting the concrete;

Expansion joints to divide up the length of the concrete; and where a waterproof membrane is used, the waterproof membrane must be presloped at least $\frac{1}{4}$ inch per foot. Remember standing water or ponding water will contribute to failure of the installation.

Another example is a 6-story veneer project in San Diego. The original tile contractor attended a meeting by the general contractor. The general contractor related they were going to save the client a lot of money by changing to direct bond over concrete instead of installing over a wire reinforced mortar bed. The tile contractor refused to proceed with the contract and warned the exterior veneer would fail. Another tile contractor was contracted with the general contractor for the installation of veneer with direct bond to concrete. Six years later, as predicted, the veneer started falling off of the building structure. Litigation proceeded by the owner. The general contractor (and sub contractors) paid for the complete removal and replacement of the entire veneer assembly and installed the new veneer to the specifications that were originally assigned to the original contract.

Tip: Documenting in writing the failure will occur prevented the original tile contractor from being named in the lawsuit. And/or "Never save your clients money on your own back!"

Poor Workmanship

Poor workmanship is the sole responsibility of the installing contractor.

I could give hundreds of examples.

The primary problem is from employees not adequately trained, not informed, or not implementing and following industry standards or manufacturer's installations explicitly. Use ANSI A108 and the Annual Handbook for Ceramic Tile Installation.

Use the Marble Institute of America Design Manual.

We recommend avoiding designs and installations that require tightly butted joints.

Where contractors are required to proceed to install tightly butted joints, obtain a waiver of liability.

Washing the backs of all stone tiles is required to remove the dust prior to installation.

The best tip for tile and stone installers is to refuse to install stone tiles with modified backs.

Expansion Joints

Expansion joints! Expansion Joints! Expansion Joints!

Expansion joints are mandatory to allow the stone assembly including the stone, setting materials, grout and adjacent restricting materials to accommodate moisture and thermal expansion.

Requirements for expansion joint width are: Prior to 2005

Minimum ½ inch joint with maximum spacing at 16 feet apart in all directions;

Minimum 3/8 inch joint with maximum spacing at 12 feet apart in all directions;

Minimum ¼ inch joint with maximum spacing of 8 feet apart in all directions;

Minimum 1/8 inch joint with maximum spacing of 4 feet apart in all directions;

The above dimensions were modified in the 2005/2006 Handbook For Ceramic Tile Installation Minimum ½ inch joint with maximum spacing at 12 feet apart in all directions;

Minimum 3/8 inch joint with maximum spacing at 8 feet apart in all directions;

These rules include all installations on exteriors of buildings, all installations exposed to sunlight or temperature changes, and all installations exposed to moisture.

We recommend doubling the rule for interior applications and caution exceeding these rules.

In addition, expansion joints are required where tile and stonework abut restraining surfaces, such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, handrails, doorframes, and where changes in backing material occur.

Expansion joint through tile and stone installations over structural expansion joints must never be narrower than the structural expansion joint.

All expansion, control, construction, cold and seismic joints in the structure should continue through the tile and stonework including all horizontal and vertical assemblies.

For additional information consult the Handbook for Ceramic Tile Installation, Published by the Tile Council of America, Assembly Method EJ171.

The failure of the installing tile and stone contractor to coordinate and install or have installed by other contractors the correct expansion joints to these requirements and the specifications, contributes to the most failures that occur in California on commercial and institutional projects.

In addition, we are observing large custom homes with no expansion joints and resultant loss of bond of flooring assemblies. The lack of expansion joints is exacerbated by the lack of scarifying the concrete slab prior to installation.

Incorrect Backer Board Installations

Backer board installations not taped and properly installed will cause indent fracturing of the stone directly installed over the untapped joints between the backer board sheets. Fastening of the backer board is required to follow the manufacturer's installation instructions explicitly.

Failures including indent fracturing of tile, limestone, marble and granite installed over backer board installations without tape are occurring. One contractor I talked with after he removed and replaced, at his cost, an entire limestone floor over backer board installation, admitted he was in a hurry and left the tape off. This was an expensive lesson to learn.

I testified in trial in Colorado where the backer board was sold by a large home supply store to a builder. The home supply store did not sell the tape, and did not offer the manufacturers installation instructions. The builder asked the limestone distributor if the limestone would crack. The limestone distributor said no. The builder installed the backer board, no tape, and used liquid nails to adhere the backer board to the wood floor. The limestone cracked and was fractured directly above each seam between each sheet of the backer board. The judge ruled in favor of the limestone distributor and the installer of the backer board failed to install the backer board correctly.

Backer board installation used in showers is in lieu of a wire reinforced mortar bed. The installation still requires a weather resistive barrier paper on all vertical wall assemblies and waterproof membranes over all horizontal wood framing. If the shower will be used by multiple occupants, the weather resistive barrier paper is required to be changed to a waterproof membrane.

Installation of backer board in showers directly to water resistant gypsum board is not an approved assembly and will contribute to water damage of the water resistant gypsum board backing in the shower assembly.

The 2006 International Residential Code has eliminated water resistant gypsum board as a suitable backing for direct bond of tile and stone in a shower assembly.

Type II mastic is not a waterproof membrane.

Recent investigations include backer board installations on countertops.

The backer board is not adequately installed with the wrong side up.

One recent project, we went into the kitchen and easily lifted the stone right off of the backer board.

The Ceramic Tile Institute of Northern California is currently cautioning against veneer installations utilizing backer board due to investigation of many veneer failures where installations were promoted and specified by the backer board sales representative.

Distributors selling the backer board should sell the tape and give manufacturers installation requirements or verify the contractor and employees have the manufacturer's recommendations.

Contractors should inspect the backer board before installation of stone over the backer board. If you are a contractor installing backer board, follow manufacturer's installation directions explicitly. Remember the Marble Institute of America requires L/720 for suitable substrate to receive stone installation on horizontal surfaces.

Attachment of Wire to Wood Floor Assembly

There is no requirement in ANSI A108 or in Assembly Method F141 in the Handbook for Ceramic Tile Installation to mechanically fasten the 2-inch by 2-inch 16/16 gage reinforcing wire fabric, or equal, to the wood floor assembly.

Mechanically fastening the wire transfers the stress that occurs with moisture and thermal expansion and point load stresses occurring with weight transfer from the top of the tile or stone assembly.

Indent fracturing of the tile and stone floors are the first indication the wire was improperly attached to the wood framed floor assembly.

The failure is prominent in radiant heat floor systems when the wire is attached to the wood floor assembly. The correct method is to install the radiant heat tubing, fill the spaces between the tubes in with mortar, install an anti-fracture membrane or a waterproof membrane, and install a wire reinforced mortar bed, and stone or tile. We had one home in Rancho Santa Fe where the marble contractor installed stucco mesh underneath the radiant heat tubing and mechanically fastened the stucco mesh into the wood floor. The red travertine stone from Spain was installed. I was called in when the red travertine stone from Spain started indent fracturing. The fracturing was occurring in 3-foot grids initially. A lawsuit was filed. The Builder blamed the wood floor assembly for excessive deflection.

Destructive testing proved the wire was in the wrong location and was fastened improperly to the wood floor. By the time the lawsuit was settled, the indent fracturing was occurring as close as 8 inches apart. The radiant heat tubing creates a weakened plane joint causing cracking of the mortar and resultant indent cracking and fracturing of the stone. The floor was replaced at a cost exceeding \$250,000. An expensive lesson to learn not to mechanically fasten the wire to the mortar bed and not to listen to the radiant heating engineer who said to place the wire underneath the tubing, instead of using a cleavage membrane and place the wire in the mortar bed above the radiant heat tubing. Since this time, the Marble Institute of America has published the requirements for the wood floor assembly to achieve L/720 instead of L/360 as published in Assembly Method F141 in the Handbook for Ceramic Tile Installation.

We are in complete disagreement with assembly method F145 introduced in 1997 into the Handbook for Ceramic Tile Installation. We have investigated failures upon failures of wood floor assemblies where wire, expanded metal lath, and stucco mesh are mechanically fastened to the wood floor assembly. Bob Stanaland, CTA with the Ceramic Tile Institute of Northern California has been investigating similar failures for years. I have had correspondence with Robert Daniels of the Tile Council of America, Inc. and with Gray LaFortune, CTC with the Ceramic Tile Institute of America, Inc.

Robert Daniels response was the assembly is only for less than 100 square feet and contractors in the northeast portion of the United States claim they have been installing this method successfully for years. I question if the contractors have had the opportunity to go back and look to see if the installations are performing or failing.

When I served as a representative to the Tile Council of America Bi-Annual Handbook for Ceramic Tile Installation Conference in the 1980's, I documented the bonding to wood failures investigated by myself, while investigating at the Ceramic Tile and Marble Institute of San Diego, the Ceramic Tile Institute, and the Ceramic Tile Institute of America. The purpose was to oppose Bob Moore proposing modified epoxy emulsion mortars as suitable for bonding to all wood assemblies. I have had lawsuits with failures of stone installed on floors and decks due to the mechanical fastening of the wire reinforcing to the wood framing. The installing contractors who mechanically fastened the wire to the wood floor are now claiming the sole fault is the wood floor was not built to L/720 as now required by the Marble Institute of America.

I had discussions during attendance at a Ceramic Tile Distributors of America Convention in Texas with a concrete tile manufacturer sales representative. He stated their product is installed successfully with direct bond to plywood floors. I related I was traveling to Boston to attend the American Society of Association Executives Annual Convention. He related the bar in the hotel I was staying at had this installation. In Boston, I visited the bar with concrete tile directly bonded to the wood floor. The entire floor was failing with fractured tiles and grout. I followed up with a courtesy letter to the sales representative advising him of the failure observed.

Note: the ANSI A108-2005 no longer requires L/360 or L/720 for stone installations over wood floor. New language:

“2.3 Deflection

Floor systems, including the framing system and subfloor panels, over which tile will be installed shall be in conformance with the IRC for residential applications, the IBC for commercial applications, or applicable building codes.”

“Note: The owner should communicate in writing to the project design professional and general contractor the intended use of the tile installation, in order to enable the project design professional and general contractor to make necessary allowances for the expected live load, concentrated loads, impact loads, and dead loads including weight of the tile and setting bed. The tile installer shall not be responsible for any floor framing or subfloor installation not compliant with applicable building codes, unless the tile contractor designs and installs the framing or subfloor.”

Sound Rated Floors Where Required

The building codes have appendices that are adopted by building department jurisdictions.

The sound rated floor assemblies are required to achieve a 50 IIC and STC rating. All residences above other residences in the same building structure are required to have sound rated floors. This includes an exterior deck of one residence over inhabitable space of another residence. Condominium CC&R's include requirement to use approved sound

rated floor assemblies for all remodeling and new floor covering installation for the project included in each homeowner's residence.

The major failures are where no sound rated floor is installed and the owner claims excess noise transfer is occurring.

The second most common failure is not following the manufacturer's installation instructions explicitly.

Perimeter isolation is mandatory.

Follow manufacturer's installation instructions explicitly.

One residence on Wilshire Boulevard in Los Angeles was in litigation because sound rated floor installation requirements were not followed explicitly. Estimated cost was at \$165,000 plus homeowner move out costs for 1-2 months during reconstruction.

The Sea Lodge in La Jolla was a sound rated floor which failed when the owner had door stops anchored through the sound rated floor assembly.

Countertops

The Residential Stone Countertop Installation published by the Marble Institute of America is wonderful. Thank you to the Marble Institute of America for publishing this document. I have shared the document with the Woodwork Institute of California and Nevada for the purpose of coordinating proper rough tops required for stone slab countertop installations. I had asked the Ceramic Tile Institute of America, Inc. to supply the proper rough top requirements for ceramic tile and thin stone assemblies.

The Woodwork Institute of California and Nevada does not have requirements in their manual for rough tops for ceramic tile and stone countertops.

The Woodwork Institute of California and Nevada requires mechanical fastening of cabinets to studs in walls using 3-inch long number 14 sheet pan screws or truss screws. As contractors, you should verify the cabinets are adequately anchored to the wall. A minimum $\frac{3}{4}$ inch penetration into wood studs and a minimum $\frac{3}{8}$ -inch penetration into metal studs are required. Where the proper anchorage is not provided, the splash joint will crack at the intersection of the cabinet deck to the vertical splash on the wall. In addition, sinks and overhangs or cantilevered countertops require adequate support. We currently have failures on countertops with fractured countertops with stone slabs where the stone slab is not properly supported. One project utilized particleboard for the rough top. Then the stone top was leveled using screws through the particleboard. The particleboard has sagged since original installation and the stone slab has fractured directly above the screw support used to level the countertop.

A sink installed with slab countertop is required to support 300 pound load.

We have investigated slab countertops where the slab was installed cracked.

We have investigated slab countertops where fill was not uniform and where bullnose edges were poorly fabricated. I recently investigated a granite slab countertop where oil or fat had been uniformly wiped into the horizontal slab countertop and the owners wanted new granite slab countertops from the fabricator at no charge.

The successful countertop installation method with stone tile is following Assembly Method C511 in the Handbook for Ceramic Tile Installation.

We sincerely caution against direct bond of stone tile to plywood, oriented strand board called OSB, or particleboard.

Veneer Installations

Veneer installations are classified as adhered veneer and anchored veneer.

All veneer weighing more than 15 pounds per square foot is required to be anchored veneer.

Failures occur with anchored veneer when adhesives used, fail and when mechanical anchoring systems are not in conformance with minimum industry standards.

Failures have occurred with adhered veneer assemblies due to lack of coordination with the lath and plastering contractor installing the scratch and brown coat for the tile and stone veneer assemblies. Soaps and surfactants used in plastic cement used by a lath and plastering contractor will bleed through and discolor limestone and marble. Plastic cement is a weaker mix than our ANSI A108.1 requirements. The purpose claimed by the lath and plastering contractor is to facilitate blowing the mortar on the wall instead of using trowel applied method to be installed through ANSI 108.1.

Lath and plastering contractors want to install #15-screeds which serve to control shrinkage cracking of the scratch and brown coat. The correct screed should be double casing beads over double studs or #40 expansion joint screeds when the screed is installed by the lath and plastering contractor. The tile industry ANSI A108.1 does not address screeds and assumes the tile and stone contractor is using wood float strips, and removing the wood float strips and filling with caulking/sealants to work at the expansion joint locations. Spacing for expansion joints are the same for veneer as for horizontal assemblies. Expansion joints are even more critical on south and west facing sides of the building followed by the east side. The building code requires veneer to allow for differential movement on building exteriors.

The lath & plastering contractor wants to install stucco mesh or paper backed wire instead of 3.4 pounds per square yard expanded metal lath attached directly to studs or 2.5 pounds per square yard attached to studs with solid backing in between the stud and the wire reinforcement. The wire installation cannot bridge over the expansion joint location. Where full stone pattern is being installed, the expansion joints must be coordinated with the lath and plastering contractor for location to accommodate the full stone tile design.

Installation of stone as adhered veneer includes washing the back of the stone to remove dust and changing the water being used frequently.

Where a shade range occurs with the stone selected, the installer should pre-blend the stone prior to delivery to the site for installation.

All veneer installations require grout, except at expansion joint locations.

There is no building code approval for an ungrouted installation.

If sealers are used as grout release prior to installation of tile, brick and stone, verification is required if the painter will be installing sealers, and if the grout release is compatible with these other sealers.

In California Title 24 prohibits veneer to be installed above entrance and exit doors to schools and hospitals ½ inches and thicker in dimension. All materials ½ inch and thicker above door installations in schools and hospitals are required to be anchored veneer.

The International Building Code Chapter 14 requires full bond adhesion of veneer and even states back buttering of the tile as part of the approved requirements. References to the word “tile” in the code includes thin-brick and stones that are installed by adhesion. Spot mounting adhered veneer is not approved.

Stone and tile installed on horizontal windowsills adjacent to reflective glass require expansion joints more often due to the thermal heat buildup from the reflective glass. Again the reminder waterproofing of the windowsill and positive slope for drainage is required.

Masonry and concrete walls are required to be heavily scarified to remove contaminants such as curing compounds and form releases prior to direct bond installation.

Accent stone used on concrete insets require expansion joints at all locations where the accent stone abut the concrete.

In some parts of the United States, acid rain is a concern and the selection of the stone should consider the acid rain environment.

In some parts of the United States, freeze-thaw conditions are a concern and the selection of the stone should consider the freeze thaw conditions.

I defended a tile and stone contractor on a city hall project in the San Diego area. The first issue was installing glazed wall tile on a dome that was subject to 15 freeze thaw conditions a year. The tile spalled and was shaling due to moisture freezing underneath the glaze of the tile. A second issue was polished granite was specified on exterior walkways. The contractor obtained a release of liability from the City after warning of the dangers of polished surfaces on exterior walking conditions. I woman slipped and broke her hip. A lawsuit was filed. The tile and stone contractor was released from the lawsuit. The polished granite tile has since been sand blasted to remove the polish.

The third issue was citrus fluids etching the sealer on the granite on the interior lobby from drinks served by open bar during grand opening of the city hall.

The project was correctly designed with proper expansion joints as I had met with the architect during the design of the building and assisted in expansion joint layout.

Please work toward successful installations without failures.