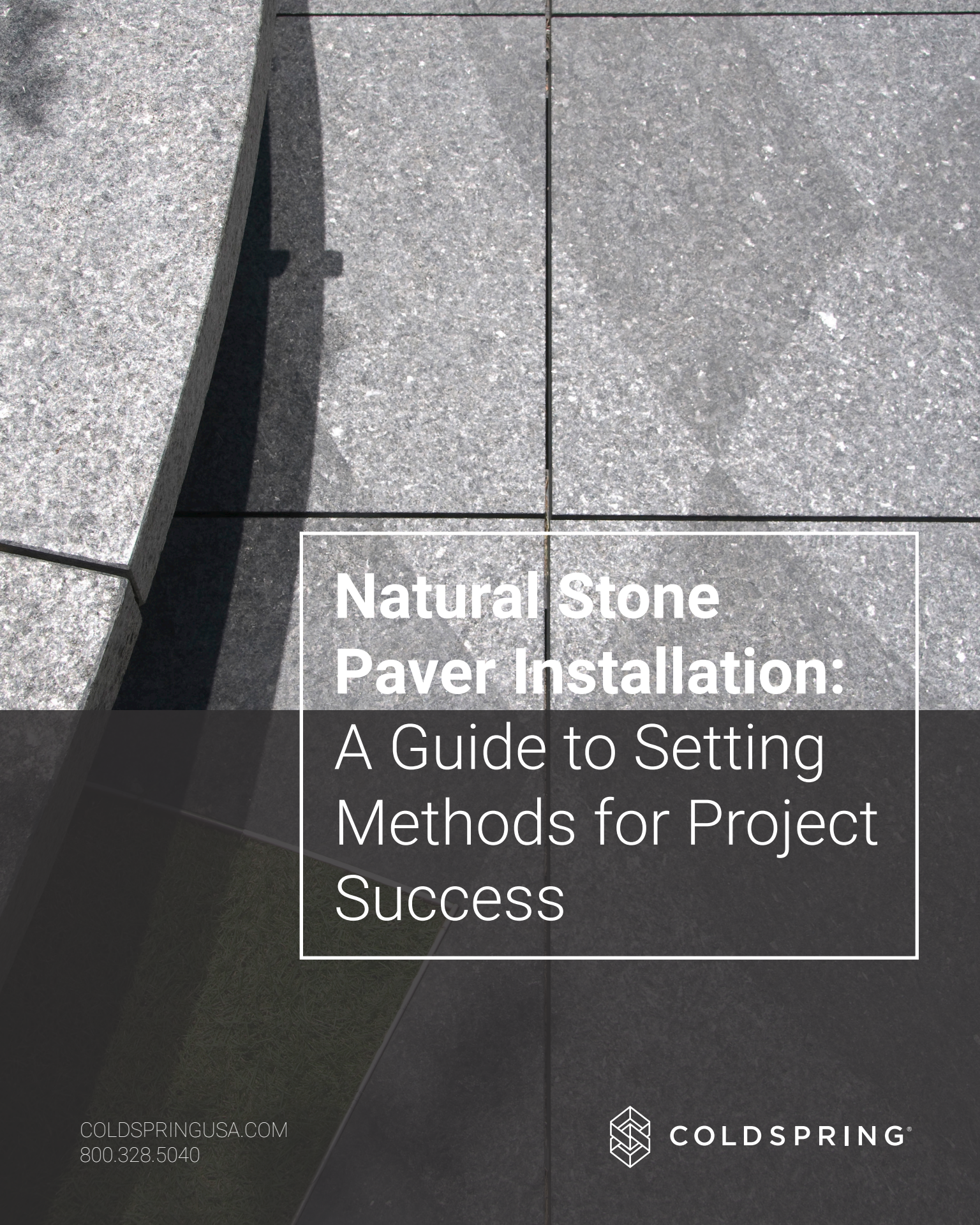

Natural Stone Paver Installation: A Guide to Setting Methods for Project Success

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Natural stone is a perennial favorite among the many options for landscape paving. Nothing compares to natural stone's inherent beauty, with each stone possessing a unique fingerprint from Mother Nature. What's more, natural stone makes an ideal choice for exterior paving because it offers versatility in design, longevity, durability, and is a sustainably sourced building material.

A successful paving project with natural stone depends on a proper installation, which includes the correct installation method for the project's conditions. With an understanding of the various setting methods and their differences, landscape architects will be able to specify the appropriate application for the project's conditions and goals.

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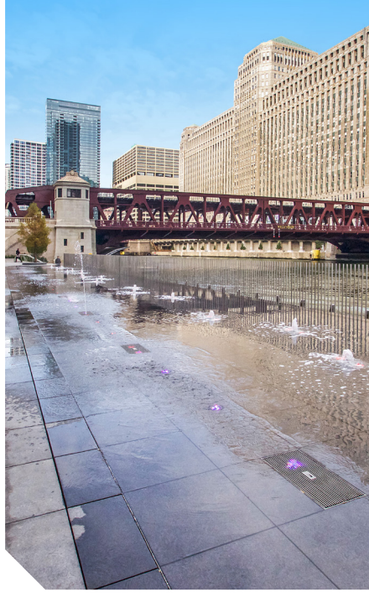


Attractive public places for leisure time and city identification are becoming increasingly important in today's city planning and design. For thousands of years, natural stone has provided one of the best materials for creating beautiful, long-lasting spaces in cities because of its many benefits.

For gathering places such as parks with fountains, memorial sites and plazas, natural stone is an ideal material. It's timeless and durable. Plazas and other hardscapes built from natural stone pavers more than half a century ago remain standing today as a record of stone's durability.

Capable of withstanding the elements of weather and human interaction, natural stone performs well in metropolitan hardscapes when specified correctly and set with the appropriate installation method.

In addition to providing longevity and durability, designs incorporating natural stone create interesting frameworks for open and enticing spaces that create a city's identity. Natural stone helps projects:

- **Create a sense of place**
- **Express the cultural and natural environment**
- **Create settings where crowds can gather**
- **Make aesthetically appealing and low maintenance surfaces**
- **Offer flexibility and entice visitors to return**

What's more, certain natural stones such as granite require very minimal upkeep and maintenance, making them ideal for outdoor settings with high traffic. With the correct installation method, no other material compares to the performance and beauty of natural stone paving.

02: WHAT IS THE BEST MATERIAL TO PUT UNDER PAVERS?

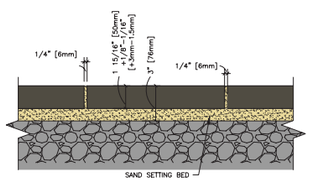
The best material to put under pavers depends on many considerations, including the method of installation. When the appropriate installation is selected, natural stone pavers can provide a long-lasting, durable and beautiful material for landscape designs in public spaces. A strong foundation is crucial to ensuring long-lasting pavers. Uneven or cracked pavers typically occur when the wrong paver base was used or was improperly installed.

Understanding the differences in installation methods, the best applications for each and what base to use in landscape paving when laying pavers is essential for a successful project. Ultimately, discussing your paving project with an experienced natural stone supplier will help ensure its successful completion and maintain its beauty and performance for many years.

SAND SET

A sand set installation method may be best if a concrete slab is not an option for the base. This system offers both permeability and some flexibility. What kind of sand goes under pavers? Instead of mortar, polymeric sand may be used to fill the joints between the stones. Polymeric sand is a fine sand that's combined with additives to form a binding agent when exposed to water. As the sand particles fuse, the joint between two pavers are locked in place.

Sand set systems can be installed faster and cheaper than other methods due to the speed in preparing the setting bed and the lack of added expense for concrete and mortar in the base material. If repairs are needed, the pavers in a sand set system can simply be lifted, the base repaired, and the pavers can then be reset. By contrast, pavers in a mortar set system may be

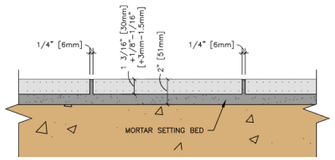


damaged or broken during removal for repair.

How thick should the sand be under the pavers? Key considerations for sand set pavers are that they should be thicker in depth and smaller in overall piece size, allowing them to shift and rock in place without breaking the paver if the overall system begins to fail. As the pavers get thicker, they lock together better.

Like any system, uniform support of the paver is critical. If the water can't properly drain from a sand set system and gets underneath the stone pavers, the water will eventually move the sand and create a rocking scenario which will ultimately compromise the pavers' durability.

MORTAR SET



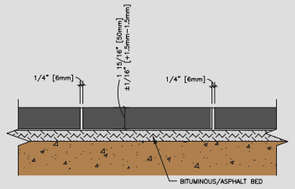
The most widely used installation for stone paving is the mortar set method. Typically used in pedestrian or vehicular spaces, the mortar set method excels when a rigid system is required to handle high-traffic areas. In a mortar system, joints are grouted.

Mortar also provides a degree of flexibility to the setting bed, which allows for larger and irregularly shaped pieces to be effectively set.

In many areas of the country, mortar systems provide a high-performing setting system that can last for a very long time. Evacuating surface water is important in a mortar set installation, so proper drainage is key.

BITUMINOUS SET

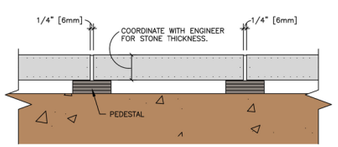
The bituminous set installation method is growing in popularity. The oil-based bituminous setting bed includes a 1-inch layer of asphalt with a thin mastic. As such, the bituminous setting bed isn't prone to absorbing water. With proper drainage, water infiltration and freeze-thaw action are less impactful factors with bituminous setting beds.



Bituminous set systems, similar to mortar set and other setting systems, require water to be drained at the paver surface. Standing or pooling water is a recipe for failure in climates that experience a high frequency of freeze-thaw cycles in a year. The benefit of a bituminous system versus a mortar set in the same environment, however, is that bituminous setting is oil based, meaning the substance holding the stone in place is hydrophobic (does not absorb water) unlike mortar which is hydrophilic (absorbs water). If the surface drainage isn't perfect with a bituminous system, the setting bed is a bit of an insurance policy for long-term durability. Similar to sand set method, the joints in bituminous are filled with polymeric sand – typically around 1/8th inch wide which makes this setting system to be considered flexible compared to a rigid mortar bed.

With a bituminous set, the paver's thickness tolerance is critical, as a bituminous system doesn't allow for paver height adjustment like mortar or sand systems. Therefore, smaller piece sizes are a common way to accommodate this requirement.

PEDESTAL SET



Pedestal systems can work well in many environments because they don't rely on a mortar, sand or a bituminous setting bed. A pedestal set system provides drainage beneath the surface of the paving.

Depending on the pavers' size, pedestal set systems may require thicker pieces of stone than other methods, such as a mortar or bituminous set system. Paving sizes typically start at 2ft by 2ft. Pedestal set systems are often used in rooftop settings and fountain applications as well as plazas at the street level – anywhere draining or eliminating water is a concern.

03: VERSATILITY WITH PEDESTAL SET

PEAVEY PLAZA | MINNEAPOLIS, MN

Another example of paving success – Peavey Plaza in Minneapolis -- demonstrates the creative possibilities with granite in a hardscape. Originally designed by renowned landscape architect M. Paul Friedberg as the "living room" of Minneapolis, Peavey Plaza opened to the public in 1975. The one-acre respite in the midst of busy downtown life included signature elements such as a large central reflecting pool with a cascading concrete fountain.

Over the years, the plaza had become badly deteriorated and difficult to maintain. In 2017, a revitalization of Peavey Plaza began with landscape architecture firm Coen+Partners of Minneapolis leading the design effort.

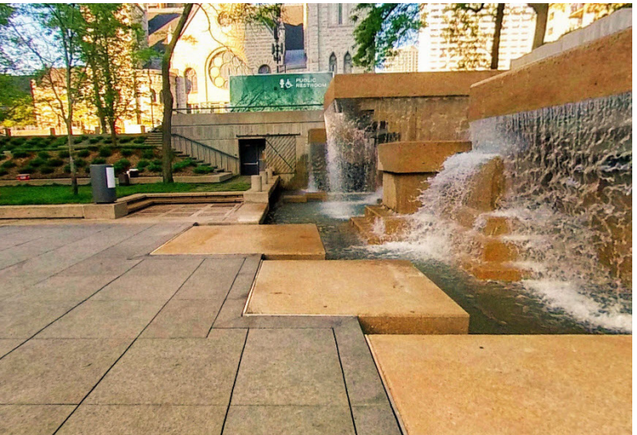
Because Peavey Plaza had been named to the National Register of Historic Places, preserving the original design intent was an important consideration.

Other design goals included:

- increase accessibility and safety
- improve long-term sustainability and maintenance
- rehabilitate character-defining features

The new design plan met these goals and maintained the plaza's iconic cascading fountain and reflecting pool – but with a different material as the backdrop. According to Laura Kamin-Lyndgaard, Senior Associate at Coen+Partners, granite was the material of choice in the initial stages of design

As a civic space with a range of programming needs, the reflecting pool's ability to drain quickly and often was an important factor. Since granite has a very low absorption rate, it provided an ideal choice for the paving materials – unlike concrete or brick which absorb water and would disintegrate quickly in numerous cycles of drying off and rewetting.



"Very early on, we determined the granite needed to be a dark color, to maintain a sense of depth and create a highly reflective water surface," says Kamin-Lyndgaard. "The color of the granite would have a huge impact on what the water would look like."

MESABI BLACK® DIAMOND® 10

Because the original material for the reflecting pool was a warm-toned brown brick, the team began looking for brown shades of granite sourced from locations around the world. But when the client and design team considered the difficulties of maintaining the plaza with a foreign stone source, Kamin-Lyndgaard says they prioritized finding a supplier closer to the project.

Meeting the need for a local source, Coldspring provided more than 10,000 square feet Mesabi Black® granite pavers for the reflecting pool's surface and surrounding area. A Diamond® 10 finish throughout highlights the stone's reflective crystals, enhancing and contrasting with the depth of the Mesabi Black's darker tones.

"One of our points of interest with the granite selection was how the granite looked when it was under water and how it made the water look," says Kamin-Lyndgaard. "We wanted to ensure the granite supported the character of the water."

- **A pedestal set system, ideal for fountains and reflecting pools, feeds water through the paver joints. Although the water is constantly circulating, the frequency of the open joints in a pedestal system enable water to flow at a rate that makes the surface appear still.**

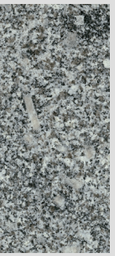
Custom-milled perimeter weir stones are grouted in place, which hold a pristine level edge and drain water to a collection trough for recirculation. With only a ¼ inch of water, the tolerances in this system were critical. The pedestal system enabled the contractors to meet the specified 1/16-inch tolerance.

What's more, the pedestal set system allows a unique functionality for the plaza. Water can quickly be completely drained from the reflecting pool so the plaza can host outdoor concerts and events. The plaza can be transformed within mere hours to become a functional space.

Peavey Plaza re-opened on July 18, 2019 with a design that enhances sustainability and makes the plaza accessible to all, with wheelchair and stroller ramps to access all levels of the plaza. A popular gathering spot, Peavey Plaza provides an oasis of tranquility for city dwellers. And now that its major revitalization is complete, the plaza has reclaimed its place as one of Minneapolis' most dynamic and vibrant public spaces.

04: COLD CLIMATE SUCCESS

CARNELIAN®



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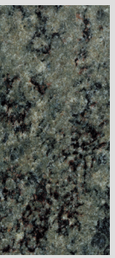

MOUNTAIN GREEN®

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STATE STREET | MADISON, WI

Climates with abundant freeze-thaw cycles have special considerations for natural stone paving due to the expansion, contraction and possible infiltration of water. When a project has stood for decades and remains in excellent condition, a successful installation has likely played a key role.

For example, State Street in Madison, Wisconsin, provides a beautiful of natural stone's durability when installed with an appropriate setting bed for the conditions. Granite-paved State Street is a thriving pedestrian zone linking the State Capitol Square with the University of Wisconsin-Madison's campus. The pulse of downtown Madison, State Street is closed to regular traffic and has well-marked bicycle lanes and extra-wide sidewalks for strolling and outdoor seating at restaurants and cafés.

In the early 2000s, Saiki Design of Madison carried out the vision for State Street's renovation, which was completed in four phases over a 10-year period. The design team worked to preserve the cherished elements of the existing streetscape and Library Mall while placing equal emphasis on restoring views to many of the city's iconic features.

State Street's renovation included the addition of granite pavers from Coldspring in four colors: Carnelian®, Iridian®, Charcoal Black® and Mountain Green®. The materials were selected based on their durability, permanence and ease of maintenance. All pavers were finished with a non-slip Diamond® 100 finish, which provides a semi-rough surface that's textured to reveal vibrant colors in a deep, rich background.

State Street's pavers were installed with a bituminous setting bed, which offers an ideal solution in cold-weather climates since it's not prone to water infiltration, with proper drainage.

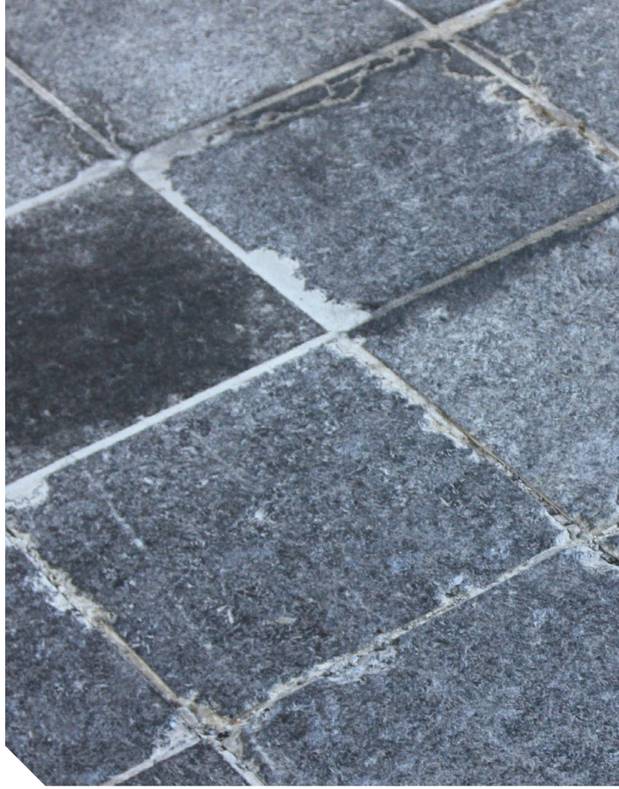
Today, nearly 20 years since the first granite pavers were installed at State Street, the pavers look nearly the same as they did when first installed. State Street, with its shopping, dining, entertainment and events, is a major attraction in Madison and has become a true reflection of the city's diversity and vibrant lifestyle.

05: WHY DID MY PAVER PROJECT FAIL?

Unfortunately, from time to time, projects don't perform as well as intended. It's important to learn from these projects to avoid similar challenges on future projects. Paving systems can fail for a variety of reasons if not properly designed or installed. It could be due to the physical properties of the material itself if a stone not suitable to the environment is selected, but more often than not, it is due to a failure of the system below grade.

In a major metropolitan area in the Midwest, a large area of paving began failing 10 to 15 years after installation. The failing section was located along a multi-block portion running through the city's downtown corridor that is well known for its shopping, dining and pedestrian experience. Typically, an application like this should perform for 30 to 50 years with minimal maintenance. However, the combination of a rigid system combined with harsh environmental conditions, accelerated the aging and subsequent break down of the paving system on this project.

This project utilized a mortar bed for its setting system. Mortar systems can last a very long time when properly set and maintained. That said, it is important to note that in environments with heavy freeze-thaw cycles, the presence of moisture in the joints and base can break down the bond between the mortar and the stone more rapidly than in other environments. This factor, amongst others, ultimately contributed to a precipitous breakdown of the entire system on this project.



It is important to consider the environmental conditions that will impact each element of a paving system. Each setting system has conditions in which they shine. It is possible that if a less rigid and hydrophobic setting system – such as a bituminous setting bed – had been used in this environment, bonding with the pavers could have remained sufficient to sustain the system. It is always best to consult with stone experts and setting specialists when designing the most durable system for your specific project.

Granite paving is arguably the most durable surface material for standing the test of time. It is important to keep in mind that of equal importance is the design and performance of the sub-grade base for the long term durability of the entire system.

FINISHING THE JOB

Once the setting bed method is selected, the best finish for the paving surface must be considered – especially when preventing slips and falls in icy or wet conditions. Just like setting bed methods, there are a number of finish options for natural stone pavers, but thermal is the most traditional. It gives the stone a nice texture and holds up very well over time. It also meets many slip-resistance testing requirements.

Depending on the stone used, the environment in which it's placed and the volume of foot traffic it receives, the aggressiveness of the finish may need to be adjusted. Knowing the environment both during and after installation will make for a natural stone landscape that will not only be functional, but beautiful as well.

NATURAL STONE: THE DURABLE, VERSATILE, LONG-TERM SOLUTION

When the appropriate method of installation is selected, natural stone pavers can provide a long-lasting, durable and beautiful material for public use. An experienced stone supplier can offer guidance and contribute to a successful project that will leave a lasting legacy.

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