

**REDI\*ROCK**

The Leader In Precast Modular Block Retaining Walls

POSITIVE CONNECTION SYSTEM

**RETAINING WALLS**

In 2000, Redi-Rock International pioneered the precast modular block (PMB) retaining wall solution utilizing massive, machine-placed concrete blocks to build tall, gravity retaining walls.



Weight: 1540 lbs.  
46" x 28" x 18" High  
5.75 sq. ft. of face

Since then, Redi-Rock’s engineering and R&D departments have continued to push the envelope by combining proven engineering principals with innovative new product technology to advance the precast modular block (PMB) industry. Among many, these advances have included development of the industry-leading “Essence of Natural Rock” look through the detailed stone texture options of Limestone, Cobblestone, and Ledgestone.

Today, Redi-Rock is proud to offer not only a gravity retaining wall system, but also an unparalleled geosynthetic reinforced system—the Positive Connection (PC) System. The heart and soul of the PC System is its superior connection strength. Unlike friction connections featured in other geosynthetic reinforced wall systems, there is virtually no chance of a pullout connection failure with the PC System because the grid wraps through the block. The resulting connection does not have a weight dependent (friction) component, so it provides as much strength at the top of the wall as at the bottom. Also, unlike many other wall systems, there are no extra parts such as clips, bars, or mechanical fasteners required to assemble the connection.

What sets the PC System apart from other reinforced wall products on the market today? We’ll dig into that in the following pages, but in short, the PC System:

- Addresses the long-term connection requirements in the AASHTO LRFD specifications
- Provides superior seismic performance over other geosynthetic reinforced wall systems
- Utilizes a corrosion-free reinforcement system without special connection components
- Increases wall height with efficient use of geogrid soil reinforcement
- Incorporates a massive, ¾ ton, precast concrete block facing unit
- Offers the incomparable durability of “wet cast”, air-entrained concrete
- Simplifies the wall construction sequence resulting in faster installation
- Improves the overall project aesthetic with a variety of standard face texture and color options
- Delivers an attractive, cost-effective, high-performance retaining wall structure

Rigorous testing, comprehensive engineering analysis, and successful project experience has proven the PC System as an economical and aesthetic structural solution for reinforced retaining walls. Suitable for a broad range of applications, including roadways, railroads, bridge and harbor projects, the PC System has already been approved by numerous state Departments of Transportation with more approvals pending.



**Introduction.....1**

**PC System Key Features.....3**

**Performance Characteristics.....7**

**Components.....9**

**Manufacturing Network.....9**

**Case Studies.....10**

Introducing the

# POSITIVE CONNECTION SYSTEM

**REDI\*ROCK**

*This 41 ft. tall vertical PC System wall is part of a back-to-back tiered wall structure that allowed a roadway to be built through a park. See page 10 for more on this project.*

# KEY FEATURES



*The Canadian National Railway used PC System walls in Montreal to elevate a rail line. These walls are engineered to withstand extreme live loads. See page 10 for more on this project.*

## OUTSTANDING PERFORMANCE

Heavy live loads, including Cooper E-80 loading, are no problem for the PC System. The unique, high-capacity positive connection also delivers exceptional structural performance in areas with high seismic loading requirements.

Whether you're designing standard 5 degree walls, vertical walls, or tiered walls, the facing connection capacity is independent of wall height. PC walls can be easily built in excess of 60 feet tall.



**Ledgestone**



**Cobblestone**



**Limestone**

## NEXT GENERATION AESTHETICS

Redi-Rock blocks are made of structural precast concrete, but they feature the look of natural stone, giving reinforced retaining walls a beautiful appearance. A variety of standard wall textures and colors are available, including Cobblestone, Limestone, and Ledgestone. These blocks are cast in molds taken from real stone, giving them a depth of texture of up to 5 inches. To accent the natural texture, Redi-Rock blocks are often colored to match local landscapes with integral color, surface shake on color hardeners, or post-applied stains. Translucent sealers and anti-graffiti sealers are also available. Contact your local Redi-Rock manufacturer for recommended coloring and sealer options.

The mold fabrication department at Redi-Rock International can create custom cast graphics to satisfy the requirements of virtually any specification. Contact your local Redi-Rock manufacturer for more information.



*Reduced geosynthetic reinforcement coverage ratios and fast installation make the PC System a cost effective solution for projects in many applications.*

## **A COST EFFECTIVE SOLUTION**

The PC System combines superior installation efficiency and reduced reinforcement material costs to deliver a very cost-effective retaining wall solution.

Curious how the PC System compares to mechanically stabilized earth (MSE) panels or dry-cast segmental retaining wall (SRW) systems? Redi-Rock PC walls are typically installed with small crews of 3 to 4 men and a hydraulic excavator sufficient in size to lift the blocks into place. Redi-Rock block units can be placed in direct contact without shims, spacers or bearing pads, and the knob and groove design automatically aligns blocks with the correct face batter. No bracing or strutting is required and no clips, connectors or fasteners are needed to secure the reinforcement to the wall face. All of these factors combine to deliver fast, reliable installations that are very price-competitive when bid against other MSE wall systems designed in accordance with AASHTO LRFD methodology.



# KEY FEATURES



*Each Redi-Rock block installs like a massive Lego block using a piece of heavy machinery and a small crew. This efficient installation process results in saved time and money.*

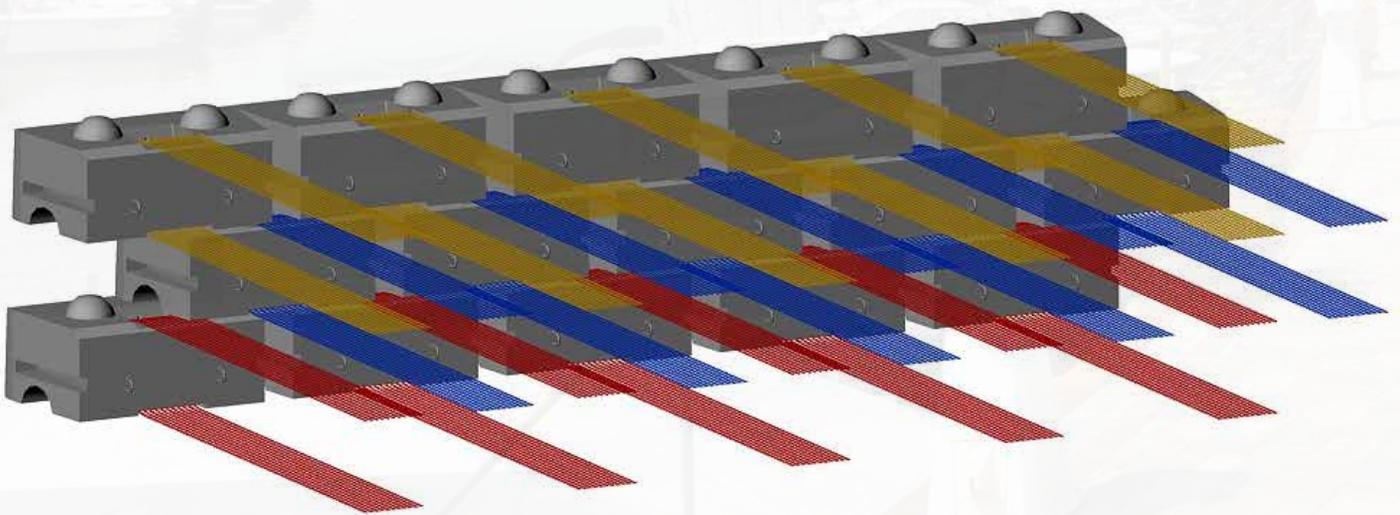
## EFFICIENT INSTALLATION

The PC System features a quick, simple and repeatable reinforcement installation method that delivers a highly reliable connection configuration with proper reinforcement orientation every time.

Let's dig into how the PC System delivers maximum installation efficiency:

- Large facing units (5.75 square feet) yield faster installation with fewer units to handle
- There are no mechanical connectors to place—just the block and the geogrid strip
- The geogrid strips cannot be oriented incorrectly, eliminating this common error in SRW construction
- 25% or 50% coverage reinforcement strips speeds installation by providing tensile reinforcement only where it is actually needed in the retaining wall
- Heavy, interlocking concrete block facing units provide a very stable facing against which backfill compaction can be easily achieved

Large block facing units also provide easy access to a very stable element to which workers can affix temporary fall protection apparatus and equipment.





*All Redi-Rock products coordinate beautifully—allowing designers to accent a PC System wall with gravity walls, freestanding walls, columns, caps, or steps to create a unique and aesthetic solution for projects.*

## FULLY COORDINATED PRODUCT LINE

Designing a project with Redi-Rock allows flexibility that isn't always possible with other systems. Redi-Rock offers complete retaining wall solutions that include gravity walls, freestanding walls, columns, caps, steps, corner units, and coping—all with the unparalleled "Essence of Natural Rock". The many Redi-Rock products can be combined to create a perfectly coordinated custom solution for any site.

The shape of each Redi-Rock block permits the construction of inside and outside curves as well as inside and outside corners without cutting blocks. The Redi-Rock system is easy to install and rarely requires field fabrication of blocks or the casting of special concrete elements to provide the required transition or termination of the wall system.



*When this busy roadway required a pedestrian bridge, engineers chose the PC System for the portions of the wing walls closest to the arch. As the wing walls transitioned away from the bridge, the design transitioned to gravity walls—saving installation time and material costs.*

## HYBRID RETAINING WALL DESIGN

Because Redi-Rock specializes in both reinforced and gravity retaining walls, a unique "hybrid retaining wall" solution is possible. Hybrid walls utilize reinforced wall sections only when absolutely necessary and transition to gravity (un-reinforced) wall sections to minimize excavation, save installation time and reduce overall material cost. Hybrid walls can also incorporate gravity sections at the top of reinforced walls to allow access for buried utilities that would otherwise be located within the reinforced backfill zone.



# PERFORMANCE CHARACTERISTICS

## Wet Cast Precast Modular Block



### DURABILITY

To ensure maximum durability, Redi-Rock blocks are made of fresh, structural grade, high compressive strength precast concrete. Returned, reconstituted, or waste concrete is never used. PC blocks are cast in a single, uninterrupted pour, yielding consistent block unit integrity and consistent physical performance properties—translating into a finished retaining wall that will stand the test of time.

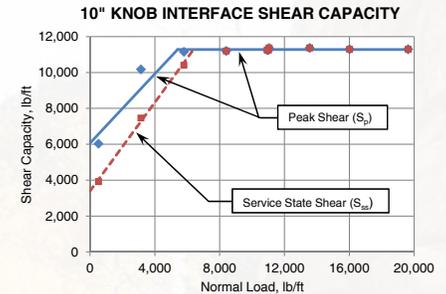
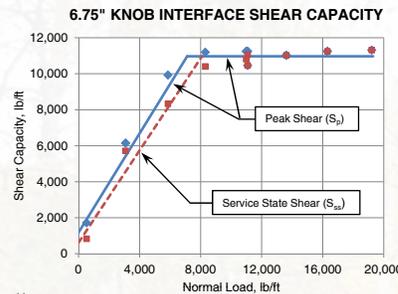
Because Redi-Rock blocks are manufactured using wet-cast concrete, they offer excellent resistance to freeze-thaw cycles, road de-icing salt, and erosion/scour. Because of the low absorption rate and air entrainment of wet-cast concrete, Redi-Rock blocks are also a superior option for submerged water applications.

Regardless of the application, Redi-Rock PC System blocks contain no polymeric or steel reinforcement connectors that can deform or corrode over time. This results in a superior maintenance-free service life even in extreme environments. The massive 5.75 sq. ft. block facing unit also offers greater wall facing thickness than dry cast SRWs and MSE panels, resulting in greater survivability in vehicle impact collisions.

If durability is important for your next reinforced wall project, choose the PC System.

### FACING SHEAR CAPACITY

The shear resistance of a concrete modular block retaining wall is a measure of the unit's ability to resist displacement or shear of one unit relative to another. The PC System units offer a minimum block interface shear of 6,000 lbs./ft. at zero normal load which is roughly 3 to 10 times the capacity of most hand-placed dry-cast SRWs.



The  $\frac{3}{4}$  ton nominal block facing unit weight has a peak block interface shear in excess of 11,000 lbs./ft. which offers a redundant structural feature that helps limit horizontal facing deformation under design loads.



### CONTINUOUS VERTICAL CORE SLOT

Perhaps the most innovative aspect of the PC System is its simplicity. While many reinforced retaining wall systems require a pin or other mechanical connector, the PC System requires none. There are no mechanical connectors or fasteners to be installed improperly or left out during construction. The PC System connection utilizes a vertical core slot in the block through which a continuous strip of geosynthetic reinforcement is installed. This quick and simple process of assembly maximizes consistency in the construction as well as the overall reliability of the retaining wall system.

# Geosynthetic Soil Reinforcement



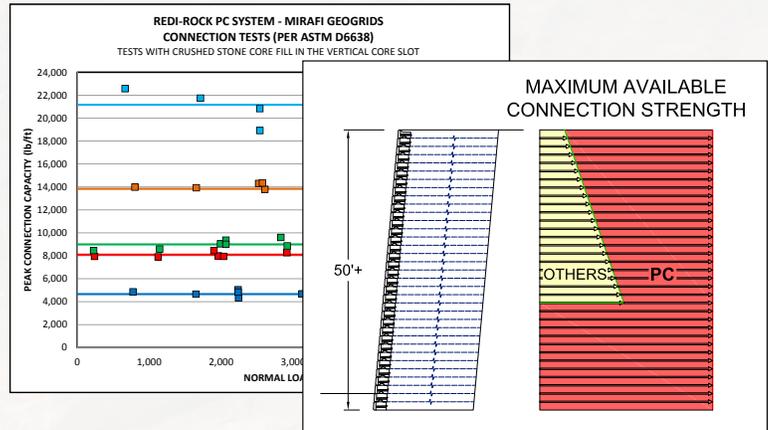
## PVC COATED POLYESTER (PET) GEOGRID REINFORCEMENT STRIPS

The PC System utilizes PVC coated polyester geogrid reinforcement strips that have completed the rigorous AASHTO National Transportation Product Evaluation Program (NTPEP). These factory-cut and -certified custom 12" wide strips of Mirafi XT geogrids are specifically manufactured for use with the PC System and are available in a broad range of tensile strengths from 4,700 lbs./ft. up to 27,000 lbs./ft. This geogrid reinforcement is manufactured in the USA by TenCate Geosynthetics and may be purchased from any local Redi-Rock manufacturer.

## Highly Efficient Long-Term Connection

### WEIGHT-INDEPENDENT CONNECTION

Controlled by the tensile strength of the reinforcement, the PC System's weight-independent, long-term connection design is unique among geogrid reinforced MSE retaining wall structures. This exceptional connection capacity allows the PC System to perform under extreme loading conditions, including Cooper E-80 live loads.

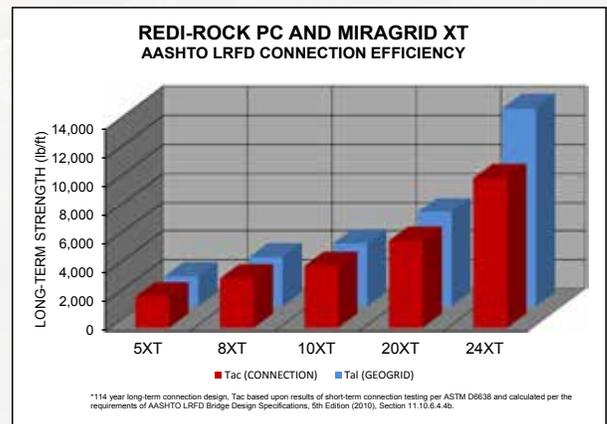


Unlike almost every other segmental block / geogrid reinforced MSE wall, the PC System connection is completely weight independent. As you move closer to the top of the wall and the weight on the block/geogrid connection decreases, the PC system does not lose any connection capacity. The PC system opens up possibilities for projects that are simply not available with other systems.

## LRFD Design

### AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

Superior connection efficiency between the blocks and geosynthetic soil reinforcement allows very cost effective designs under AASHTO LRFD methodology at extreme wall heights and/or loading conditions.



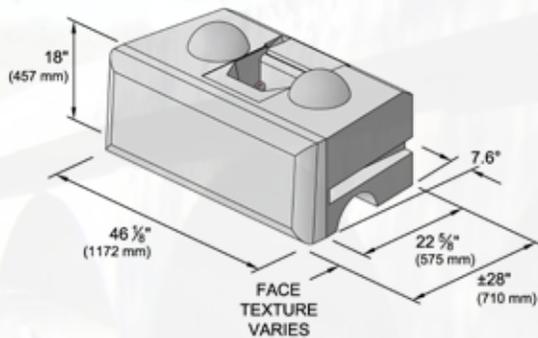
\*114 year long-term connection design. Tac based upon results of short-term connection testing per ASTM D6638 and calculated per the requirements of AASHTO LRFD Bridge Design Specifications, 9th Edition (2010), Section 11.10.6.4.4b.

# POSITIVE CONNECTION COMPONENTS

## Positive Connection Blocks

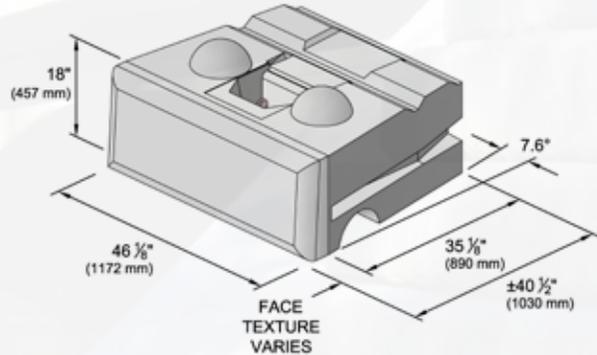
### Middle - 28" (710 mm) PC Block

Average Volume = 10.6 ft<sup>3</sup> (0.30 m<sup>3</sup>)  
Average Weight = 1,520 lb (690 kg)



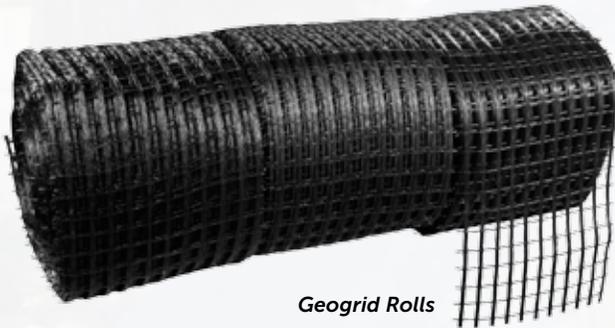
### Middle - 41" (1030 mm) PC Block

Average Volume = 15.2 ft<sup>3</sup> (0.43 m<sup>3</sup>)  
Average Weight = 2,170 lb (984 kg)



## Manufacturer Certified Geogrid

- Custom 12" roll width
- Certified Manufacturer Tensile Test Reports



### THE REDI-ROCK MANUFACTURING NETWORK

Redi-Rock is proud to maintain the largest licensed manufacturing network of any proprietary concrete modular retaining wall product. Through this extensive manufacturing network, Redi-Rock offers cost-effective retaining wall solutions within reach of nearly every major market throughout the United States and Canada. In addition, manufacturers in England, Northern Ireland, Spain, and the Republic of Korea give Redi-Rock a truly global reach.

## CASE STUDIES



### 44,000 Sq. Ft. Walls Help Elevate CN Rail Line

**REDI-ROCK PRODUCER:** Graymont Materials

**THE CHALLENGE:** In 2011, the Canadian National (CN) Railway and the Montreal Metro began construction on a major renovation project that would eliminate an at-grade crossing where the CN Rail line crossed over a light commuter Metro line. To elevate the CN Rail line, designers needed to build a gradual, walled slope leading up to a massive concrete bridge structure and then down the other side.

**THE SOLUTION:** For a solution, designers turned to Redi-Rock. **“The PC system is the only block with this type of connection which allowed it to handle the loads,”** explained David Chartier, junior engineer with V. Fournier & Associés. “When you have massive loads so near the block facing, it’s hard to make a wall that will work. The walls are very high and the load is very close, but the civil engineering of this block made it a good fit.”

Mirafi Miragrid 24XT geogrid strips were used to provide soil reinforcement in these walls. In total, the project required 6,100 Redi-Rock retaining blocks and 1,500 freestanding blocks. The first trains are expected to run on the lines late in 2013.

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### 41’ Tall Walls Create Access to Park

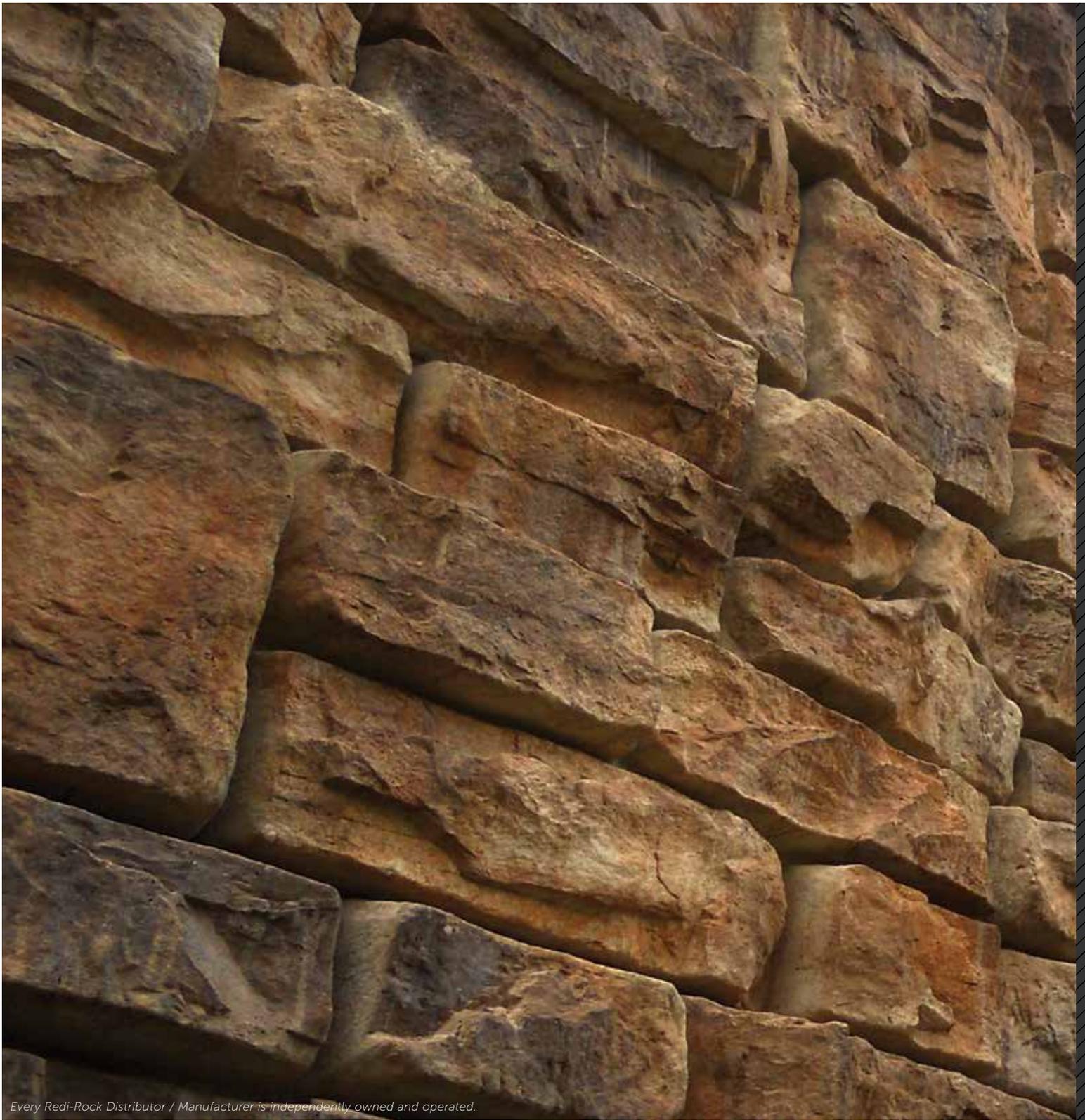
**REDI-ROCK PRODUCER:** Redi-Rock of Kentuckiana

**THE CHALLENGE:** Significant grade changes presented a challenge when 21st Century Parks set out to link 4 major parks in the Louisville area. Creating new roads to access the system was a major priority; one notable phase of the project required 3 separate retaining walls to get the job done, one of them 41 ft. tall.

**THE SOLUTION:** “The high efficiency of the PC System really made it possible to design tiered walls with those loads at that height,” said Clint Hines, P.E. of J.C. Hines and Associates. “It was AASHTO design and tall tiered walls; it would be hard to make it work with anything else.”



This project required vertical walls and included several pipe penetrations which posed a challenge. **“This project really showcases the flexibility and the range that Redi-Rock has,”** Hines explained. The owners of this project are so pleased with this phase of the project that plans are in the works to use Redi-Rock on additional phases.



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