We are committed to always providing you with up-to-date information and cutting-edge engineering. By registering your manual, you will ensure your access to the newest technical updates as they become available.

Register at redi-rock.com/register
Hello!

When Redi-Rock launched in 2000, the introduction of large, wetcast blocks changed the retaining wall industry. Nineteen years later as we publish our latest version of the Design Resource Manual, we’re aiming to change more than an industry—we’re aiming to reinforce the ways that we, together, are changing the world in concrete ways.

We know that the work you do makes an impact in your community, and we’re honored each time you choose Redi-Rock to solve problems and improve people’s lives. In recognition of that, we’ll continue to strive to be a leader in the industry, providing the design tools and engineering resources you need to do that valuable work.

Within this manual, you’ll see the latest innovation of the Redi-Rock system in Redi-Rock XL Hollow-Core Retaining blocks. Standing 914 millimeters tall and available in 1320, 1830, and 2440-millimeter widths, Redi-Rock XL blocks integrate with the rest of the proven system—including Positive Connection, Freestanding, Hollow-core, and our standard Gravity blocks—helping you optimize taller walls in tighter spaces.

Also within these pages, you’ll find answers to frequently asked questions, a detailed library of products, detailed design information, specifications, installation instructions, typical details, and much more. The information in this publication is intended to supplement even more information available anytime on our website at redi-rock.com.

If you’re not finding what you’re looking for or if there is anything we can do for you, please let us know how we can help.

Sincerely,

Jamie Johnson, PE
Director of Engineering
Redi-Rock International
engineering@redi-rock.com
+1 866-222-8400 ext. 3010

Visit us at Redi-Rock.com!

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Changing the World in Concrete Ways

At Redi-Rock, we believe in helping you change the world in concrete ways by unleashing the possibility of people, products, and technology to create large block retaining wall solutions you can trust for a lifetime. We do that by:

- leading the way with comprehensive, expert-level support and resources,
- never giving up on expanding the solutions possible with our integrated system, and
- making time to care about local communities by partnering with manufacturers, empowering people to contribute to their communities in meaningful ways.

On www.redi-rock.com you’ll find hundreds of case studies that illustrate Redi-Rock solutions and these values coming to life in real world applications. We hope they provide the confidence and context you need to design and install Redi-Rock.

We also hope they provide a spark of inspiration about how the work you do can change the lives around you.

View Case Studies
redi-rock.com/changetheworld
Redi-Rock revolutionized the retaining wall industry in 2000 when they introduced large, wetcast, gravity blocks with interlocking knob and groove technology—think giant, one-ton Lego blocks.

Not only did the walls look better with the texture of natural stone, but the machine-set blocks sped up installation compared to the existing offerings on the market. Since then, the scope of Redi-Rock’s product line has evolved into one integrated system of wall solutions.

Whether you’re looking for a tall gravity wall, an even taller reinforced wall, a freestanding solution, accessories to polish off your project, or a combination of all of the above, the solution you’re after is available with Redi-Rock.

**TALL GRAVITY WALLS**

It’s where it all started. The sheer size and weight of each block utilizes the power of gravity to create strong, beautiful walls. Available in solid or hollow core options, these blocks minimize excavation and feature multiple batter options to allow for taller walls in tighter spaces.

**EVEN TALLER REINFORCED WALLS**

There’s virtually no chance of a connection failure with Positive Connection (PC) blocks because the geogrid wraps through a vertical core slot is cast in each block. Not only does this allow for really tall walls, but it also means massive live loads have met their match.

**FREESTANDING WALLS**

Textured on two or more sides, freestanding blocks help create great looking above-grade finishes or stand alone walls. Whether solid or hollow-core, these blocks are great for solving a number of frequent design challenges like attaching a fence to the top of a wall or cantilever solutions.

**COORDINATING ACCESSORIES**

One of the best things about Redi-Rock is that all of the different products work together to form seamless solutions. Plus, with accessories like columns, steps, and caps to coordinate perfectly with the rest of the system, so your seamless solution is also a great looking solution.

**Optimize Your Solution for Any Market**

- ARCHITECTURAL
- DEVELOPMENTS
- RESIDENTIAL
- GOVERNMENT
- TRANSPORTATION
- RAIL
- PORTS & HARBORS
- FLOOD & STORMWATER
- EROSION CONTROL
- SHORELINE RESTORATION
- UTILITIES
- MINING

Mix and match blocks from the various families of products to optimize your solution for any market.

**Natural Stone Textures**

With the ability to get any block in the Redi-Rock arsenal in four natural stone textures, it means that technical agility comes with just the right aesthetic touch.
Frequently Asked Questions

WHAT IS REDI-ROCK?
Redi-Rock is a line of precast products made from durable, first-purpose, air-entrained, wetcast concrete. The most common Redi-Rock products are large retaining wall blocks. Often referred to as one-ton Lego blocks, Redi-Rock blocks vary in width from 710 millimeters to 2.44 meters and in weight from 544 kilograms to 1588 kilograms. In many instances, the Redi-Rock retaining wall blocks are big enough that they can be simply stacked on top of each other to construct a “gravity” wall. For even taller and/or more heavily loaded retaining walls, the Redi-Rock Positive Connection (PC) System can be used to construct a Mechanically Stabilized Earth (MSE) wall.

However, Redi-Rock is much more than simply large retaining wall blocks. Redi-Rock freestanding blocks have the same great look as the retaining blocks, with texture on two or more sides. These freestanding blocks are perfect for perimeter walls, entrance monuments, or parapet walls. Redi-Rock accessory products include column blocks, steps, and caps. These accessories are perfect for completing your project. We even have products like Pole Base® concrete foundations for light poles, driveway monuments, and signs.

WHO MAKES REDI-ROCK PRODUCTS?
Redi-Rock products are produced by over 130 independently-owned manufacturers located all over the globe. Contact information for the Redi-Rock manufacturer in your area is available anytime at redi-rock.com.

WHO DESIGNS REDI-ROCK RETAINING WALLS?
The answer to this question depends on what you are trying to accomplish. If you want to get a good idea of how Redi-Rock products can work for your project, the preliminary height guides in this Design Resource Manual are a great place to start. These guides show Redi-Rock wall sections in different assumed soil and loading conditions, and they can quickly help you determine what sections will likely work for your particular project.

When you want to build a wall, there simply is no substitute for detailed plans prepared by a licensed engineer who routinely designs retaining walls. Licensed professionals have proven themselves with years of study and practice, and they are uniquely qualified to create an optimal design for the specific conditions of your project. In addition, a seal of the calculations and design drawings by a “Design Professional of Responsible Charge” is generally required by the International Building Code (Section 105.2) for all walls over four feet (1219 millimeters) in height.

WHO INSTALLS REDI-ROCK RETAINING WALLS?
Redi-Rock walls are typically constructed by earth excavating contractors or landscaping contractors using large pieces of earth-moving equipment. General contractors that have experience building Redi-Rock walls can be excellent resources for your project. Your local Redi-Rock manufacturer will often have close working relationships with the wall installers in your area and can be a great source of information.

Wondering how to install Redi-Rock? We can help there, too. Redi-Rock has a detailed Installation Manual that covers the basic installation steps. We also have several typical construction details showing how to build common things like 90-degree corners, curves, barriers, or other features in your wall. These resources are available in this Design Resource Manual and online at redi-rock.com.

HOW MUCH DO REDI-ROCK WALLS COST?
Since every project is different, there is no single price for a Redi-Rock wall. Several things must be accounted for, including material, labor, and shipping costs. Materials include Redi-Rock blocks, drainage aggregates, geotextiles, drain pipes, and possibly even select fill; however, project costs are much more than just the sum of material costs. Although Redi-Rock blocks may have a higher price per unit than smaller, dry-cast retaining wall products or blocks made from inferior materials like return concrete, they provide significant savings due to installation speed and product longevity.

The true cost of a Redi-Rock wall must be evaluated on the cost per area of wall face (dollars per square foot or square meter) of the completed structure over the full life of the structure. For taller mechanically stabilized earth walls, part of the cost per square unit area of the retaining wall includes the factory cut geogrid strips that are used with the PC blocks. These strips are specifically manufactured and certified for width and strength, providing construction efficiencies and design reliability that add value to your project.

The real value in Redi-Rock retaining walls comes from superior engineering, high-quality products, and unbeatable face textures that lead to extremely robust and attractive structures that will last for a lifetime. It is because of the intricacies and complexities of each unique project that the very best source for pricing is typically from the Redi-Rock manufacturer located closest to your project site. Find the closest manufacturer at redi-rock.com.

WILL REDI-ROCK WORK FOR MY PROJECT?
Redi-Rock has been used with outstanding success on a myriad of different retaining wall applications. Some examples are retaining walls in water applications (seawalls, bank stabilization, channelization, and detention ponds), bridge abutments, parks, residential projects, commercial projects, highway walls, GRS-IBS structures, and even rail applications. Chances are, someone has already figured out a way to use Redi-Rock on a project just like yours. There are hundreds of case studies available at redi-rock.com that will help you visualize how Redi-Rock can be used to make your project a reality.

I HAVE MORE QUESTIONS...WHAT SHOULD I DO?
Quite simply, ask. Your local Redi-Rock manufacturer is a great place to start. Often they have working relationships with wall design engineers and local installers. You can also contact Redi-Rock International, either through your local manufacturer or directly by calling (866) 222-8400 or by email at engineering@redi-rock.com. We have engineers on staff who can help answer general design questions, provide specific information about our products, and point you in the right direction to successfully design and install your own outstanding Redi-Rock retaining wall.

redi-rock.com
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redi-rock.com
© 2020 Redi-Rock International, LLC
### Retaining Blocks

**FINISHED TEXTURE ON ONE FACE**

The Redi-Rock Retaining wall blocks come in multiple widths and configurations. The defining characteristic is that Retaining blocks have an aesthetic texture cast into only ONE face, and the textured face is the only side exposed to view in the finished wall. These blocks are machine-placed, wet-cast, precast modular block units manufactured from first purpose, non-reconstituted concrete and intended for constructing dry-stacked modular retaining wall systems. The block units are manufactured from structural-grade concrete mixes in accordance with ASTM C94 or ASTM C685 that produce a finished unit with excellent resistance to freeze-thaw, deicing chemical exposure, and submerged conditions in both fresh water and salt water applications. All Redi-Rock blocks are manufactured and distributed through an international network of individually-owned, licensed precast concrete manufacturers.

### Concrete Mix Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Minimum 28 Day Compressive Strength</th>
<th>Maximum Water-Cement Ratio</th>
<th>Nominal Maximum Aggregate Size</th>
<th>Aggregate Class Designation</th>
<th>Air Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>27.6 MPa</td>
<td>0.45</td>
<td>25</td>
<td>3M</td>
<td>4.5% ± 1.5%</td>
</tr>
<tr>
<td>Severe</td>
<td>27.6 MPa</td>
<td>0.45</td>
<td>25</td>
<td>3M</td>
<td>6.0% ± 1.5%</td>
</tr>
<tr>
<td>Very Severe</td>
<td>30.0 MPa</td>
<td>0.40</td>
<td>25</td>
<td>45</td>
<td>6.0% ± 1.5%</td>
</tr>
</tbody>
</table>

**FREEZE THAW EXPOSURE CLASS**

- Moderate
- Severe
- Very Severe

**MAXIMUM WATER-SOLUBLE CHLORIDE ION (Cl-) CONTENT IN CONCRETE, PERCENT BY WEIGHT OF CEMENT**

0.15

**MAXIMUM CHLORIDE AS Cl- CONCENTRATION IN MIXING WATER, PARTS PER MILLION**

1000

**MAXIMUM PERCENTAGE OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT**

0.15 (Very Severe Exposure Class Only)

**Fly Ash or Other Pozzolans Per ASTM C618**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Total Ash, Pozzolans, and Silica Fume</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>50</td>
</tr>
</tbody>
</table>

**Slag Conforming to ASTM C699**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Total Ash, Pozzolans, and Silica Fume</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>35</td>
</tr>
</tbody>
</table>

**Silica Fume Conforming to ASTM C1240**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Alkali-Aggregate Reactivity Mitigation Per ACI 207</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
</tr>
</tbody>
</table>

### Reference Dimensions:

- **Height** = Vertical Dimension of Textured Face
- **Length** = Horizontal Dimension Parallel to Textured Face
- **Width** = Horizontal Dimension Perpendicular to Textured Face

### Dimensional Tolerances

<table>
<thead>
<tr>
<th>All Blocks</th>
<th>Full Blocks</th>
<th>Half Blocks</th>
<th>710mm Blocks</th>
<th>1030mm Blocks</th>
<th>1520mm Blocks</th>
<th>1380mm XL Blocks</th>
<th>1630mm XL Blocks</th>
<th>2440mm XL Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>457 ± 5</td>
<td>712 ± 13</td>
<td>579 ± 13</td>
<td>575 ± 13</td>
<td>892 ± 13</td>
<td>1387 ± 13</td>
<td>1184 ± 13</td>
<td>1692 ± 13</td>
<td>2302 ± 13</td>
</tr>
</tbody>
</table>

### Retaining Blocks: Block Library

#### R-28T 710mm Top

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Textured Face varies
- **Center of Gravity:** 378 mm
- **Block Weight:** 557 kg
- **Block Volume:** 0.243 m³

#### R-28HT 710mm Half Top

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Textured Face varies
- **Center of Gravity:** 389 mm
- **Block Weight:** 260 kg
- **Block Volume:** 0.113 m³

#### R-28M 710mm Middle

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Center of Gravity:** 354 mm
- **Block Weight:** 730 kg
- **Block Volume:** 0.319 m³

#### R-28HM 710mm Half Middle

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Textured Face varies
- **Center of Gravity:** 364 mm
- **Block Weight:** 340 kg
- **Block Volume:** 0.148 m³

#### R-28B 710mm Bottom

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Textured Face varies
- **Center of Gravity:** 355 mm
- **Block Weight:** 790 kg
- **Block Volume:** 0.345 m³

#### R-28HB 710mm Half Bottom

- **Material:** Cobble / Limestone, Kingstone / Ledgestone
- **Face Texture:** Textured Face varies
- **Center of Gravity:** 364 mm
- **Block Weight:** 370 kg
- **Block Volume:** 0.160 m³

### Notes:

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Interface shear knobs are typically 254 mm diameter by 102 mm tall. Smaller knob diameters are available.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. Half blocks contain a fork slot on only one side of the block.

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# Block Library

## RETAINING BLOCKS

### Speciality Block

<table>
<thead>
<tr>
<th>Block</th>
<th>Dimension</th>
<th>Weight</th>
<th>Volume</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-41T</td>
<td>1030mm Top</td>
<td>790 kg</td>
<td>0.346 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-41M</td>
<td>1030mm Middle</td>
<td>1050 kg</td>
<td>0.457 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-41B</td>
<td>1030mm Bottom</td>
<td>1110 kg</td>
<td>0.483 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-41HT</td>
<td>1030mm Half Top</td>
<td>350 kg</td>
<td>0.15 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-41HM</td>
<td>1030mm Half Middle</td>
<td>460 kg</td>
<td>0.20 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-41HB</td>
<td>1030mm Half Bottom</td>
<td>490 kg</td>
<td>0.21 m³</td>
<td>Cobble / Limestone</td>
</tr>
</tbody>
</table>

### Kingstone / Ledgestone

<table>
<thead>
<tr>
<th>Block</th>
<th>Dimension</th>
<th>Weight</th>
<th>Volume</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>R-60M</td>
<td>1520mm Middle</td>
<td>1490 kg</td>
<td>0.651 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-60HM</td>
<td>1520mm Half Middle</td>
<td>610 kg</td>
<td>0.264 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-60B</td>
<td>1520mm Bottom</td>
<td>1550 kg</td>
<td>0.877 m³</td>
<td>Cobble / Limestone</td>
</tr>
<tr>
<td>R-60HB</td>
<td>1520mm Half Bottom</td>
<td>630 kg</td>
<td>0.277 m³</td>
<td>Cobble / Limestone</td>
</tr>
</tbody>
</table>

### Other Blocks

<table>
<thead>
<tr>
<th>Block</th>
<th>Dimension</th>
<th>Weight</th>
<th>Volume</th>
<th>Texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speciality Block</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### RETAINING BLOCKS

#### Block Library

**R-5236HC** 1320 mm XL Hollow-Core
- **Face Texture:** Ledgestone
- **Block Weight:** 1510 kg
- **Block Volume:** 0.660 m³
- **Infill Volume:** 0.648 m³
- **Center of Gravity:** 737 mm

**R-7236HC** 1830 mm XL Hollow-Core
- **Face Texture:** Ledgestone
- **Block Weight:** 1890 kg
- **Block Volume:** 0.824 m³
- **Infill Volume:** 1.028 m³
- **Center of Gravity:** 1013 mm

**R-9636HC** 2440 mm XL Hollow-Core
- **Face Texture:** Ledgestone
- **Block Weight:** 2190 kg
- **Block Volume:** 0.958 m³
- **Infill Volume:** 2.190 m³

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Actual block volumes and weights may vary.
5. Center of Gravity is measured from the back of block, excluding stone infill.

---

### RETAINING BLOCKS

#### Block Library

**R-419M** 1030mm MIDDLE 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1050 kg
- **Block Volume:** 0.46 m³
- **Center of Gravity:** 514 mm

**R-419HM** 1030mm MIDDLE 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1020 kg
- **Block Volume:** 0.44 m³
- **Center of Gravity:** 500 mm

**R-419B** 1030mm BOTTOM 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1110 kg
- **Block Volume:** 0.48 m³
- **Center of Gravity:** 523 mm

**R-419HB** 1030mm BOTTOM 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1080 kg
- **Block Volume:** 0.47 m³
- **Center of Gravity:** 510 mm

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. Interface Shear knobs are nominally 254 mm diameter by 102 mm tall.

---

### RETAINING BLOCKS

#### Block Library

**R-419B** 1030mm BOTTOM 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1110 kg
- **Block Volume:** 0.48 m³
- **Center of Gravity:** 523 mm

**R-419HM** 1030mm BOTTOM 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1080 kg
- **Block Volume:** 0.47 m³
- **Center of Gravity:** 510 mm

**R-419HB** 1030mm BOTTOM 230mm SETBACK
- **Face Texture:** Cobble / Limestone
- **Block Weight:** 1050 kg
- **Block Volume:** 0.46 m³
- **Center of Gravity:** 500 mm

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. Half blocks contain a fork slot on only one side of the block.
7. Interface Shear knobs are typically 254 mm diameter by 102 mm tall.
RETAINING BLOCKS

Block Library

R-409M 1520mm MIDDLE 230mm SETBACK

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 1500 kg 1460 kg |
| Block Volume:  | 0.85 m³ 0.64 m³ |
| Center of Gravity: | 785 mm 770 mm |

R-409M 1520mm BOTTOM 230mm SETBACK

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 1550 kg 1520 kg |
| Block Volume:  | 0.88 m³ 0.66 m³ |
| Center of Gravity: | 850 mm 785 mm |

R-409M 1520mm TOP 230mm SETBACK

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 1500 kg 1460 kg |
| Block Volume:  | 0.85 m³ 0.64 m³ |
| Center of Gravity: | 785 mm 770 mm |

R-409M 1520mm PC TOP

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 740 kg 710 kg |
| Block Volume:  | 0.321 m³ 0.27 m³ |
| Center of Gravity: | 362 mm 349 mm |

R-409M 1520mm PC BOTTOM

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 740 kg 700 kg |
| Block Volume:  | 0.321 m³ 0.207 m³ |
| Center of Gravity: | 362 mm 349 mm |

R-409M 1520mm PC MIDDLE

| Face Texture: | Cobble / Limestone Kingstone / Ledgestone |
| Block Weight:  | 740 kg 700 kg |
| Block Volume:  | 0.321 m³ 0.207 m³ |
| Center of Gravity: | 362 mm 349 mm |

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Center of Gravity is measured from the back of block.
4. Actual block volumes and weights may vary.

Full Middle

Half Middle

Full Bottom

Half Bottom

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Center of Gravity is measured from the back of block.
5. Actual block volumes and weights may vary.

Full Middle

Half Middle

Full Bottom

Half Bottom

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Center of Gravity is measured from the back of block.
5. Actual block volumes and weights may vary.

Full Middle

Half Middle

Full Bottom

Half Bottom

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Center of Gravity is measured from the back of block.
5. Actual block volumes and weights may vary.

Full Middle

Half Middle

Full Bottom

Half Bottom

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer.
3. Confirm availability before specifying or ordering.
4. Center of Gravity is measured from the back of block.
5. Actual block volumes and weights may vary.
### RETAINING BLOCKS

#### R-41PL 1030mm PLANTER

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 910 kg
- **Block Volume:** 0.40 m³
- **Center of Gravity:** 480 mm
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 400 kg
- **Block Volume:** 0.17 m³
- **Center of Gravity:** 513 mm

#### R-41HPL 1030mm HALF PLANTER

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 910 kg
- **Block Volume:** 0.40 m³
- **Center of Gravity:** 480 mm
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 400 kg
- **Block Volume:** 0.17 m³
- **Center of Gravity:** 513 mm

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Center of Gravity is measured from the back of block.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. Half blocks contain a fork slot on only one side of the block.
7. Interface Shear knobs are typically 254 mm diameter by 102 mm tall.

---

### RETAINING BLOCKS

#### R-AB ANCHOR BOTTOM

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 1070 kg
- **Block Volume:** 0.47 m³
- **Center of Gravity:** 533 mm

#### R-AM ANCHOR MIDDLE

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 1010 kg
- **Block Volume:** 0.44 m³
- **Center of Gravity:** 523 mm

#### R-MT MODIFIED TOP

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 540 kg
- **Block Volume:** 0.24 m³
- **Center of Gravity:** 455 mm

#### R-MHT MODIFIED HALF TOP

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 320 kg
- **Block Volume:** 0.14 m³
- **Center of Gravity:** 527 mm

---

### RETAINING BLOCKS

#### R-SM SHORT MIDDLE

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 580 kg
- **Block Volume:** 0.25 m³
- **Center of Gravity:** 507 mm

#### R-ST SHORT TOP

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 500 kg
- **Block Volume:** 0.22 m³
- **Center of Gravity:** 509 mm

#### R-419SM 230mm SETBACK SHORT MID

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 580 kg
- **Block Volume:** 0.24 m³
- **Center of Gravity:** 507 mm

#### R-419ST 230mm SETBACK SHORT TOP

- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 500 kg
- **Block Volume:** 0.13 m³
- **Center of Gravity:** 509 mm

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Center of Gravity is measured from the back of block.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. 695mm wide blocks contain a fork slot on only one side of the block. These are specialty blocks and may have limited availability and is only used in double 90-degree corner applications.
7. Interface Shear knobs are typically 254 mm diameter by 102 mm tall. Smaller knob diameters are available.
The Redi-Rock Freestanding blocks come in one width and stack in a vertical manner. The defining characteristic is that freestanding blocks have an aesthetic texture cast into multiple faces; the textured face is on at least the two longitudinal vertical faces, and also as required on one end or the top of the blocks. These blocks are machine-placed, wet-cast, precast modular block units manufactured from first purpose, non-reconstituted concrete and intended for constructing dry-stacked modular retaining wall systems. The block units are manufactured from structural-grade concrete mixes in accordance with ASTM C304 or ASTM C685 that produce a finished unit with excellent resistance to freeze-thaw, deicing chemical exposure, and submerged conditions in both fresh water and salt water applications. All Redi-Rock blocks are manufactured and distributed through an international network of individually-owned, licensed precast concrete manufacturers.

**CONCRETE MIX PROPERTIES**

- **FREEZE-THAW EXPOSURE CLASS**
- **MAXIMUM WATER CEMENT RATIO**
- **MINIMUM 28 DAY COMPRESSIVE STRENGTH**
- **AGGREGATE CLASS DESIGNATION**
- **AIR CONTENT**

**REFERENCE DIMENSIONS:**

- **HEIGHT** = VERTICAL DIMENSION OF TEXTURED FACE
- **LENGTH** = LONGER HORIZONTAL DIMENSION PARALLEL TO TEXTURED FACES
- **WIDTH** = HORIZONTAL DIMENSION PERPENDICULAR TO LONGER TEXTURED FACES

**DIMENSIONAL TOLERANCES**

- **HEIGHT**
- **LENGTH**
- **WIDTH**

*Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstrates good durability and performance. When these requirements are followed, specific freeze-thaw testing of the concrete is typically NOT required.*

*Exposure class is as described in ACI 318.*

*Test method ASTM C304.*

*Defined in ASTM C31 Table 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete.*

*Test method ASTM C221.*

*Test method ASTM C1218 at age between 28 and 42 days.*

*Where used in high sulfide environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents).*

*The total cementitious material also includes ASTM C150, C595, C845, and C1157 cement. The maximum percentages shall include: (a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157. (b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157. (c) Silica fume, ASTM C1240, present in a blended cement.*

*Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze-thaw durability in a detailed and current testing program.*

*All dimensions are shown in units of mm.*

*Permissible defects: Chips smaller than 38mm in its largest dimension and cracks not wider than 0.38mm and not longer than 25% of the nominal height of the block; bug holes in the architectural face smaller than 19mm; and bug holes, water marks, and color variation on non-architectural faces.*

---

**Redi-Rock Freestanding blocks come in one width and stack in a vertical manner.**

**Concrete mixes in accordance with ASTM C304 or ASTM C685 produce a finished unit with excellent resistance to freeze-thaw, deicing chemical exposure, and submerged conditions in both fresh water and salt water applications.**

**All Redi-Rock blocks are manufactured and distributed through an international network of individually-owned, licensed precast concrete manufacturers.**

**Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstrates good durability and performance. When these requirements are followed, specific freeze-thaw testing of the concrete is typically NOT required.**

**Exposure class is as described in ACI 318.**

**Test method ASTM C304.**

**Defined in ASTM C31 Table 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete.**

**Test method ASTM C221.**

**Test method ASTM C1218 at age between 28 and 42 days.**

**Where used in high sulfide environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents).**

**The total cementitious material also includes ASTM C150, C595, C845, and C1157 cement. The maximum percentages shall include: (a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157. (b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157. (c) Silica fume, ASTM C1240, present in a blended cement.**

**Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze-thaw durability in a detailed and current testing program.**

**All dimensions are shown in units of mm.**

**Permissible defects: Chips smaller than 38mm in its largest dimension and cracks not wider than 0.38mm and not longer than 25% of the nominal height of the block; bug holes in the architectural face smaller than 19mm; and bug holes, water marks, and color variation on non-architectural faces.**

---

**Redi-Rock International Design Resource Manual V20**

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## Block Library

### FREESTANDING BLOCKS

#### Block Library

**F-SM STRAIGHT MIDDLE**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 640 kg
- **Block Volume:** 0.279 m³

**F-SG STRAIGHT GARDEN TOP**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 480 kg
- **Block Volume:** 0.208 m³

**F-SB STRAIGHT BOTTOM**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 690 kg
- **Block Volume:** 0.302 m³

**F-ST STRAIGHT TOP**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 620 kg
- **Block Volume:** 0.272 m³

**F-VB VARIABLE RADIUS BOTTOM**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 630 kg
- **Block Volume:** 0.273 m³

**F-VT VARIABLE RADIUS TOP**
- **Face Texture:** Cobble / Limestone
- **Kingstone / Ledgestone**
- **Block Weight:** 560 kg
- **Block Volume:** 0.234 m³

---

1. Units for dimensions are mm typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Architectural faces on the blocks have varying texture.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. 152 mm diameter vertical semi-cylindrical voids at the ends of the block for mechanical tie-down are available, refer to Force Protection blocks for additional information.
7. Knobs are typically 254mm diameter by 102 mm tall. Smaller knobs are available.
8. Architectural faces on the blocks have varying texture.
9. Actual block volumes and weights may vary.
10. Knobs are typically 254 mm diameter by 102 mm tall. Smaller knobs are available.
### Block Library

#### Freestanding Blocks

**F-FM**  **Force Protection Middle**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 610 kg, 550 kg
- **Block Volume:** 0.267 m³, 0.238 m³

**F-FT**  **Force Protection Top**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 600 kg, 530 kg
- **Block Volume:** 0.260 m³, 0.232 m³

**F-FB**  **Force Protection Bottom**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 660 kg, 600 kg
- **Block Volume:** 0.290 m³, 0.261 m³

**F-BB**  **Barrier Block**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 4,240 kg
- **Block Volume:** 1.85 m³

**F-CM**  **Corner Middle**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 620 kg
- **Block Volume:** 0.27 m³

**F-CG**  **Corner Garden Top**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 480 kg
- **Block Volume:** 0.21 m³

**F-CB**  **Corner Bottom**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 680 kg
- **Block Volume:** 0.30 m³

**F-CT**  **Corner Top**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 610 kg
- **Block Volume:** 0.26 m³

**F-CG**  **Corner Garden Top**

- **Face Texture:** Cobble / Limestone, Kingstone / Ledgestone
- **Block Weight:** 480 kg
- **Block Volume:** 0.21 m³

### Notes:

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Architectural faces on the blocks have varying texture.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.
6. Knobs are typically 254mm diameter by 102 mm tall. Smaller knobs are available.

---

<table>
<thead>
<tr>
<th>Block Type</th>
<th>Face Texture</th>
<th>Block Weight</th>
<th>Block Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-FM</td>
<td>Cobble / Limestone</td>
<td>610 kg, 550 kg</td>
<td>0.267 m³, 0.238 m³</td>
</tr>
<tr>
<td>F-FT</td>
<td>Cobble / Limestone</td>
<td>600 kg, 530 kg</td>
<td>0.260 m³, 0.232 m³</td>
</tr>
<tr>
<td>F-FB</td>
<td>Cobble / Limestone</td>
<td>660 kg, 600 kg</td>
<td>0.290 m³, 0.261 m³</td>
</tr>
<tr>
<td>F-BB</td>
<td>Cobble / Limestone</td>
<td>4,240 kg</td>
<td>1.85 m³</td>
</tr>
<tr>
<td>F-CM</td>
<td>Cobble / Limestone</td>
<td>620 kg</td>
<td>0.27 m³</td>
</tr>
<tr>
<td>F-CG</td>
<td>Cobble / Limestone</td>
<td>480 kg</td>
<td>0.21 m³</td>
</tr>
<tr>
<td>F-CB</td>
<td>Cobble / Limestone</td>
<td>680 kg</td>
<td>0.30 m³</td>
</tr>
<tr>
<td>F-CT</td>
<td>Cobble / Limestone</td>
<td>610 kg</td>
<td>0.26 m³</td>
</tr>
</tbody>
</table>

---

**Cobble / Limestone**

- **Face Texture:** Variates
- **Block Weight:** 610 ± kg
- **Block Volume:** 0.27 m³

**Limestone**

- **Face Texture:** Variates
- **Block Weight:** 610 ± kg
- **Block Volume:** 0.27 m³

**Lifting Insert or Textured Top Surface, Optional**

- **Face Texture:** Variates
- **Block Weight:** 610 ± kg
- **Block Volume:** 0.27 m³

---

**单位**

1. 块的尺寸单位为毫米，除非另有说明。
2. 块的生产随各自授权的Redi-Rock制造商而异。需确认在使用前。
3. 块的表面纹理各不相同。
4. 实际的块体尺寸和重量可能有所不同。
5. 重量基于混凝土密度为2291 kg/m³。
6. 旋钮直径通常为254mm，高为102 mm。较小的旋钮也有。
**FREESTANDING BLOCKS**

**Block Library**

<table>
<thead>
<tr>
<th>BLOCK LIBRARY</th>
<th>BLOCK LIBRARY</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F-HCM</strong></td>
<td><strong>F-HCG</strong></td>
</tr>
<tr>
<td><strong>HALF CORNER MIDDLE</strong></td>
<td><strong>HALF CORNER GARDEN TOP</strong></td>
</tr>
<tr>
<td>Face Texture: Cobble / Limestone</td>
<td>Face Texture: Cobble / Limestone</td>
</tr>
<tr>
<td>Kingstone / Ledgestone</td>
<td>Kingstone / Ledgestone</td>
</tr>
<tr>
<td>Block Weight: 300 kg</td>
<td>Block Weight: 240 kg</td>
</tr>
<tr>
<td>Block Volume: 0.13m³</td>
<td>Block Volume: 0.11m³</td>
</tr>
</tbody>
</table>

**F-HCB**

**HALF CORNER BOTTOM**

| Face Texture: Cobble / Limestone | Block Weight: 320 kg |
| Kingstone / Ledgestone | Block Volume: 0.14m³ |

**F-HCT**

**HALF CORNER TOP**

| Face Texture: Cobble / Limestone | Block Weight: 290 kg |
| Kingstone / Ledgestone | Block Volume: 0.13m³ |

**F-HHC**

**HOLLOW-CORE**

| Face Texture: Cobble / Limestone | Block Weight: 210 kg |
| Kingstone / Ledgestone | Block Volume: 0.090m³ |

**F-HCHC**

**CORNER HOLLOW-CORE**

| Face Texture: Cobble / Limestone | Block Weight: 250 kg |
| Kingstone / Ledgestone | Block Volume: 0.108m³ |

---

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Architectural faces on the blocks have varying texture.
4. Actual block volumes and weights may vary.
5. Weights are based upon a concrete density of 2291 kg/m³.

---

**FACE TEXTURE VARIES**

610 ± LEDGESTONE
COBBLESTONE
584 ± LIMESTONE
FREESTANDING BLOCKS

**Block Library**

**F-9SC 230 mm STEPDOWN CORNER**
- **Face Texture:** Cobble / Limestone Kingstone / Ledgestone
- **Block Weight:** 340 kg 300 kg
- **Block Volume:** 0.146 m³ 0.130 m³

**F-9SG 230 mm STEPDOWN GARDEN**
- **Face Texture:** Cobble / Limestone Kingstone / Ledgestone
- **Block Weight:** 250 kg 210 kg
- **Block Volume:** 0.109 m³ 0.093 m³

**Face Texture:**
- Block Volume:
- Block Weight:

**F-90C 90 DEGREE CORNER**
- **Face Texture:** Cobble / Limestone Kingstone / Ledgestone
- **Block Weight:** 600 kg 600 kg
- **Block Volume:** 0.26 m³ 0.26 m³

**LIFTING INSERT, OPTIONAL**

**REFERENCE DIMENSIONS:**

- **HEIGHT** = VERTICAL DIMENSION OF TEXTURED FACE
- **LENGTH** = LONGER HORIZONTAL DIMENSION OF TEXTURED FACE
- **WIDTH** = SHORTER HORIZONTAL DIMENSION

**COLUMN BLOCK**

- **HEIGHT**
  - 457 ± 5
- **LENGTH**
  - 610 ± 13
- **WIDTH**
  - 610 ± 13

**CAP/STEP BLOCK**

- **HEIGHT**
  - 152 ± 5
- **LENGTH**
  - VARES ± 13
- **WIDTH**
  - 724 ± 13

**CONCRETE MIX PROPERTIES**

<table>
<thead>
<tr>
<th>EXPOSURE CLASS</th>
<th>MINIMUM 28 DAY COMPR. STRENGTH (MPa)</th>
<th>MAXIMUM WATER CEMENT RATIO</th>
<th>NOMINAL MAXIMUM AGGREGATE SIZE (mm)</th>
<th>AGGREGATE CLASS DESIGNATION (14)</th>
<th>AIR CONTENT (11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MODERATE</td>
<td>27.6</td>
<td>0.45</td>
<td>25</td>
<td>3M</td>
<td>4.5% ± 1.5%</td>
</tr>
<tr>
<td>SEVERE</td>
<td>27.6</td>
<td>0.45</td>
<td>25</td>
<td>35</td>
<td>6.0% ± 1.5%</td>
</tr>
<tr>
<td>VERY SEVERE</td>
<td>30.0</td>
<td>0.40</td>
<td>45</td>
<td>50</td>
<td>0.6% ± 1.5%</td>
</tr>
</tbody>
</table>

**MAXIMUM CHLORIDE AS CONCENTRATION IN MIXING WATER PARTS PER MILLION**
- 1000

**MAXIMUM PERCENTAGE OF TOTAL CEMENTITIOUS MATERIALS BY WEIGHT**
- (VERY SEVERE EXPOSURE CLASS ONLY)

- FLY ASH OR OTHER POZZOLANS PER ASTM C618
  - TOTAL ASH, POZZOLANS, SLAG, AND SILICA FUME: 50

- SLAG CONFORMING TO ASTM C989
  - TOTAL ASH, POZZOLANS, AND SILICA FUME: 35

- SILICA FUME CONFORMING TO ASTM C1240
  - ALKALI-AGGREGATE REACTIVITY MITIGATION PER ACI 201

**ACCESSORY BLOCKS**

- (COLUMNS, STEPS, AND CAPS)

The Redi-Rock Column and Accessory blocks come in multiple widths and configurations. The defining characteristic is that these blocks have an aesthetic texture cast into two or more faces, and create columns, caps, and steps that complement both Retaining and Freestanding blocks. These blocks are machine-placed, wet-cast, precast modular block units manufactured from first purpose, non-reconstituted concrete and intended for constructing dry-stack modular features that coordinate with retaining walls. The block units are manufactured from structural-grade concrete mixes in accordance with ASTM C94 or ASTM C689 that produce a finished unit with excellent resistance to freeze-thaw, deicing chemical exposure, and submerged conditions in both fresh water and salt water applications. All Redi-Rock blocks are manufactured and distributed through an international network of individually-owned, licensed precast concrete manufacturers.

**CONCRETE MIX PROPERTIES**

- **FLY ASH OR OTHER POZZOLANS** (1-4)
  - Type IP, blended cement, ASTM C595, or ASTM C1157

- **SLAG** (5-6)
  - Used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157

- **SILICA FUME** (7-9)
  - Present in a blended cement

1. Concrete mix properties are in general accordance with ACI 318 durability requirements. Research has shown that concrete manufactured to these standards demonstrates good durability and performance. When these requirements are followed, specific freeze-thaw testing of the concrete is typically NOT required.
2. Exposure class is as described in ACI 318.
4. Test method ASTM C33 Table 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregate for Concrete.
5. Test method ASTM C231.
6. Test method ASTM C1218 at age between 28 and 42 days.
7. Where used in high sulfate environments or where alkali-silica reactivity is of issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)
8. The total cementitious material also includes ASTM C150, C855, C864, and C1157 cement. The maximum percentages shall include:
   - Fly ash or other pozzolans in type IP, blended cement, ASTM C695, or ASTM C1157.
   - Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
9. The total cementitious material also includes ASTM C150, C855, C864, and C1157 cement. The maximum percentages shall include:
   - Fly ash or other pozzolans in type IP, blended cement, ASTM C695, or ASTM C1157.
   - Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
10. Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
11. Alkali-aggregate reactivity mitigation per ACI 201
12. All dimensions are shown in units of mm.
13. Permissible defects: Chips smaller than 38mm in its largest dimension and cracks not wider than 0.305mm and not longer than 25% of the nominal height of the block, bug holes in the architectural face smaller than 10mm, and bug holes, water marks, and color variation on non-architectural face.
14. Column blocks have a smooth troweled finish on horizontal faces.
### BLOCK LIBRARY

**ACCESSORIES (CAP AND STEP BLOCKS)**

<table>
<thead>
<tr>
<th>A-2SC</th>
<th>TWO-SIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>290 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.125 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A-4SC</th>
<th>FOUR-SIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>300 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.132 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A-3SC72</th>
<th>THREE-SIDED 1830mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>470 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.21 m³</td>
</tr>
</tbody>
</table>

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Actual block volumes and weights may vary.
4. Weights are based upon a concrete density of 2291 kg/m³.

---

**ACCESSORIES (COLUMN BLOCKS)**

<table>
<thead>
<tr>
<th>A-COL8</th>
<th>COLUMN - 203mm CORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>330 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.14 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A-COL4</th>
<th>COLUMN - 102mm CORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>370 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.16 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A-COLS</th>
<th>COLUMN - SOLID CORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>380 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.08 m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A-CC</th>
<th>COLUMN CAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Block Weight:</td>
<td>180 kg</td>
</tr>
<tr>
<td>Block Volume:</td>
<td>0.08 m³</td>
</tr>
</tbody>
</table>

1. Units for dimensions are mm, typical unless noted otherwise.
2. Block production varies with each licensed Redi-Rock manufacturer. Confirm availability before specifying or ordering.
3. Actual block volumes and weights may vary.
4. Weights are based upon a concrete density of 2291 kg/m³.
5. Weight and volume ranges represent the blocks with the maximum hole size shown and with no hole.
6. Optional fence rail pockets available upon request. Typical pocket size is: 50 wide x 130 deep x 230 tall.
PROVEN, ENGINEERED SOLUTIONS

Designing critical wall structures is important work—and Redi-Rock has the best resources available to make your job easier. These include:

• Wall Analysis Software
• Preliminary Height Guides
• MSE Design Details

And so much more...

EASY INSTALLATION

Remember how fun it was to play with Lego blocks as a kid? Well installing Redi-Rock retaining walls is like that ... on a much larger scale. And to make it even easier, Redi-Rock has a ton of resources available to help you out:

• The Installation Guide
• Typical Construction Details
• The Block Library

And multiple other resources...

On Demand Resources Available at Redi-Rock.com

On Demand Resources Available at Redi-Rock.com

Thousandsof engineers download the freeware every year. Get your copy today at redi-rock.com/freeware.

REDI-ROCK WALL FREEWARE

This free software program is used to design and analyze cross sections of Redi-Rock gravity walls. Developed in partnership with FINE Software, the experts behind the GEO5 geotechnical suite of software, this robust engineering tool allows users to:

• select specific design standards like ASD or LRFD
• model various site conditions including soil layers, load types & locations, and water conditions
• analyze for slope stability and bearing capacity

We prefer to install a Redi-Rock wall due to the size of the block. There’s more machine work involved, they go quicker, and in a given day you can install more square footage as compared to a smaller, more labor-intensive block.”

Matt Guigli
Vice President of Guigli & Sons, Inc.
Watch the video at redi-rock.com/worcester

REDI-ROCK WALL PROFESSIONAL

This bundle of software modules from the GEO5 suite of software has a specific module to make designing and analyzing gravity and MSE walls using the Redi-Rock Positive Connection system easy. This not only allows for extremely accurate modeling of Redi-Rock walls, but the GEO5 programs can also be used to design and analyze any MSE or precast modular block gravity wall. The GEO5 modules included in the package are:

• Redi-Rock Wall (Pro)
• Slope Stability
• Spread Footing
• Spread Footing CPT
• Prefab Wall
• MSE Wall

Upgrade to Redi-Rock Wall Professional to take your designs to new heights. Lease, buy, or demo the software at redi-rock.com/pro.

The Worcester State site was sloping with a pretty good drop off, and they chose to build the wall with terraces of about 10 feet each. For aesthetic reasons, they used the Ledgestone product—it looks really nice.”

Eric Merluzzi, PE
Project Engineer
Watch the video at redi-rock.com/worcester

Remember how fun it was to play with Lego blocks as a kid? Well installing Redi-Rock retaining walls is like that ... on a much larger scale. And to make it even easier, Redi-Rock has a ton of resources available to help you out:

• The Installation Guide
• Typical Construction Details
• The Block Library

And multiple other resources...

On Demand Resources Available at Redi-Rock.com
**Design Information**

**Concrete**
- **Design Unit Weight:** 143pcf (2291 kg/m³)

**Limestone and Cobblestone Face Texture**
- **Average Volume (Vc):** 0.319 m³ (From CAD Model)
- **Concrete Block Weight (Wc):**
  \[ Wc = 0.319 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 731 \text{ kg} \]

**Kingstone and Ledgestone Face Texture**
- **Average Volume (Vc):** 0.305 m³ (From CAD Model)
- **Concrete Block Weight (Wc):**
  \[ Wc = 0.305 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 699 \text{ kg} \]
  - **Average Center of Gravity (COGc):** 353 mm (From CAD Model)

**Infill Soil**
- **Design Unit Weight:** 1602 kg/m³
  - **Volume (Vs):** 0.0297 m³ (From CAD Model)
  - **Infill Soil Weight (Ws):**
    \[ Ws = 0.0297 \text{ m}^3 \times 1602 \text{ kg/m}^3 = 47.6 \text{ kg} \]
  - **Center of Gravity (COGs):** 345 mm (Data from CAD Model)

**Infilled Unit Weight Calculations**

### Design Volume
- **R-28M 710 mm Middle Block with Soil Infill**
  - **Dimensions:** 1172 mm x 711 mm x 576 mm ± 711 mm

### Infilled Unit Weight Calculations
- **Concrete**
  - **Design Unit Weight:** 143pcf (2291 kg/m³)

**Limestone and Cobblestone Face Texture**
- **Concrete Block Weight (Wc):**
  \[ Wc = 0.319 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 731 \text{ kg} \]
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  - **Infill Soil Weight (Ws):**
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- **Concrete Block Weight (Wc):**
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  - **Volume (Vs):** 0.0297 m³ (From CAD Model)
  - **Infill Soil Weight (Ws):**
    \[ Ws = 0.0297 \text{ m}^3 \times 1602 \text{ kg/m}^3 = 47.6 \text{ kg} \]
  - **Center of Gravity (COGs):** 345 mm (Data from CAD Model)

**NOTE:** The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

### Infilled Unit Weight Calculations

#### Design Volume
- **R-28PCM 710 mm Positive Connection (PC) Middle Block with Soil Infill**
  - **Dimensions:** 1172 mm x 711 mm x 575 mm ± 711 mm

#### Infilled Unit Weight Calculations
- **Concrete**
  - **Design Unit Weight:** 143pcf (2291 kg/m³)

**Limestone and Cobblestone Face Texture**
- **Concrete Block Weight (Wc):**
  \[ Wc = 0.319 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 731 \text{ kg} \]
  - **Volume (Vs):** 0.0297 m³ (From CAD Model)
  - **Infill Soil Weight (Ws):**
    \[ Ws = 0.0297 \text{ m}^3 \times 1602 \text{ kg/m}^3 = 47.6 \text{ kg} \]
  - **Center of Gravity (COGs):** 345 mm (Data from CAD Model)

**Kingstone and Ledgestone Face Texture**
- **Concrete Block Weight (Wc):**
  \[ Wc = 0.305 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 699 \text{ kg} \]
  - **Volume (Vs):** 0.0297 m³ (From CAD Model)
  - **Infill Soil Weight (Ws):**
    \[ Ws = 0.0297 \text{ m}^3 \times 1602 \text{ kg/m}^3 = 47.6 \text{ kg} \]
  - **Center of Gravity (COGs):** 345 mm (Data from CAD Model)

**NOTE:** The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

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**Design Information**

**Concrete**
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**Limestone and Cobblestone Face Texture**
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  - **Infill Soil Weight (Ws):**
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**Infilled Unit Weight Calculations**

#### Design Volume
- **R-28M 710 mm Middle Block with Soil Infill**
  - **Dimensions:** 1172 mm x 711 mm x 576 mm ± 711 mm

#### Infilled Unit Weight Calculations
- **Concrete**
  - **Design Unit Weight:** 143pcf (2291 kg/m³)

**Limestone and Cobblestone Face Texture**
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**Kingstone and Ledgestone Face Texture**
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  \[ Wc = 0.305 \text{ m}^3 \times 2291 \text{ kg/m}^3 = 699 \text{ kg} \]
  - **Volume (Vs):** 0.0297 m³ (From CAD Model)
  - **Infill Soil Weight (Ws):**
    \[ Ws = 0.0297 \text{ m}^3 \times 1602 \text{ kg/m}^3 = 47.6 \text{ kg} \]
  - **Center of Gravity (COGs):** 345 mm (Data from CAD Model)

**NOTE:** The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.
DESIGN INFORMATION

INFLLED UNIT WEIGHT CALCULATIONS

CONCRETE
Design Unit Weight = 2291 kg/m³
LIMESTONE AND COBBLESTONE FACE TEXTURE
Average Volume (Vc) = 0.457 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.457 m³ x 2291 kg/m³ = 1047 kg
KINGSTONE AND LEDGESTONE FACE TEXTURE
Average Volume (Vc) = 0.443 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.443 m³ x 2291 kg/m³ = 1015 kg
Average Center of Gravity (COGc) = 521 mm (From CAD Model)

INFILL SOIL
Design Unit Weight = 1602 kg/m³
Soil considered as infill includes the soil between adjacent blocks and at the ends of the bottom groove in the block.
Volume (Vs) = 0.0617 m³ (From CAD Model)
Infill Soil Weight (Ws) = 0.0617 m³ x 1602 kg/m³ = 98.8 kg
Center of Gravity (COGs) = 342 mm (Data from CAD Model)

NOTE: The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

DESIGN VOLUME
1.03 m x 1.172 m x 0.457 m = 0.552 m³

INFILLED UNIT WEIGHT
LIMESTONE AND COBBLESTONE FACE TEXTURE
\[ \text{INFILL} = \frac{1047 \text{ kg} + 98 \text{ kg}}{0.552 \text{ m}^3} = 2076 \text{ kg/m}^3 \]
KINGSTONE AND LEDGESTONE FACE TEXTURE
\[ \text{INFILL} = \frac{1015 \text{ kg} + 98 \text{ kg}}{0.552 \text{ m}^3} = 2018 \text{ kg/m}^3 \]

NOTE: The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

INFILLED UNIT WEIGHT CALCULATIONS

CONCRETE
Design Unit Weight = 2291 kg/m³
LIMESTONE AND COBBLESTONE FACE TEXTURE
Average Volume (Vc) = 0.430 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.430 m³ x 2291 kg/m³ = 985 kg
KINGSTONE AND LEDGESTONE FACE TEXTURE
Average Volume (Vc) = 0.416 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.416 m³ x 2291 kg/m³ = 953 kg
Average Center of Gravity (COGc) = 518 mm (From CAD Model)

INFILL SOIL
Design Unit Weight = 1602 kg/m³
Soil considered as infill includes the soil between adjacent blocks, in the geogrid slot, and at the ends of the bottom groove in the block.
Volume (Vs) = 0.0827 m³ (From CAD Model)
Infill Soil Weight (Ws) = 0.0827 m³ x 1602 kg/m³ = 132 kg
Center of Gravity (COGs) = 396 mm (Data from CAD Model)

NOTE: The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

DESIGN VOLUME
1.03 m x 1.172 m x 0.457 m = 0.552 m³

INFILLED UNIT WEIGHT
LIMESTONE AND COBBLESTONE FACE TEXTURE
\[ \text{INFILL} = \frac{985 \text{ kg} + 132 \text{ kg}}{0.552 \text{ m}^3} = 2024 \text{ kg/m}^3 \]
KINGSTONE AND LEDGESTONE FACE TEXTURE
\[ \text{INFILL} = \frac{953 \text{ kg} + 132 \text{ kg}}{0.552 \text{ m}^3} = 1966 \text{ kg/m}^3 \]

NOTE: The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.
**DESIGN INFORMATION**

**CONCRETE**
- Design Unit Weight = 2291 kg/m³

**LIMESTONE AND COBBLESTONE FACE TEXTURE**
- Average Volume (Vc) = 0.651 m³ (From CAD Model)
- Concrete Block Weight (Wc) = 0.651 m³ * 2291 kg/m³ = 1,491 kg

**KINGSTONE AND LEDGESTONE FACE TEXTURE**
- Average Volume (Vc) = 0.637 m³ (From CAD Model)
- Concrete Block Weight (Wc) = 0.637 m³ * 2291 kg/m³ = 1,463 kg
- Average Center of Gravity (COGc) = 790 mm (From CAD Model)

**INFILL SOIL**
- Design Unit Weight = 1602 kg/m³
- Soil considered as infill includes the soil between adjacent blocks and at the ends of the bottom groove in the block.
- Volume (Vs) = 0.130 m³ (From CAD Model)
- Infill Soil Weight (Ws) = 0.130 m³ * 1602 kg/m³ = 208 kg
- Center of Gravity (COGs) = 495 mm (From CAD Model)

**DESIGN VOLUME**
- 1.524 m x 1.172 m x 0.457 m = 0.816 m³

**INFILLED UNIT WEIGHT**
- **LIMESTONE AND COBBLESTONE FACE TEXTURE**
  - INFILL = (1491 kg + 208 kg) / 0.816 m³ = 2088 kg/m³

- **KINGSTONE AND LEDGESTONE FACE TEXTURE**
  - INFILL = (1463 kg + 208 kg) / 0.816 m³ = 2054 kg/m³

**NOTE:** The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.

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**INFILLED UNIT WEIGHT CALCULATIONS**

**R-60M 1520 mm MIDDLE BLOCK WITH SOIL INFILL**

**INLAY**
- Design Unit Weight = 2291 kg/m³

**LIMESTONE AND COBBLESTONE FACE TEXTURE**
- Average Volume (Vc) = 0.677 m³ (From CAD Model)
- Concrete Block Weight (Wc) = 0.677 m³ * 2291 kg/m³ = 1,551 kg

**KINGSTONE AND LEDGESTONE FACE TEXTURE**
- Average Volume (Vc) = 0.663 m³ (From CAD Model)
- Concrete Block Weight (Wc) = 0.663 m³ * 2291 kg/m³ = 1,519 lbs
- Average Center of Gravity (COGc) = 803 mm (From CAD Model)

**INFILL SOIL**
- Design Unit Weight = 1602 kg/m³
- Soil considered as infill includes the soil between adjacent blocks and at the ends of the bottom groove in the block.
- Volume (Vs) = 0.130 m³ (From CAD Model)
- Infill Soil Weight (Ws) = 0.130 m³ * 1602 kg/m³ = 208 kg
- Center of Gravity (COGs) = 495 mm (From CAD Model)

**DESIGN VOLUME**
- 1.524 m x 1.172 m x 0.457 m = 0.816 m³

**INFILLED UNIT WEIGHT**
- **LIMESTONE AND COBBLESTONE FACE TEXTURE**
  - INFILL = (1551 kg + 208 kg) / 0.816 m³ = 2156 kg/m³

- **KINGSTONE AND LEDGESTONE FACE TEXTURE**
  - INFILL = (1519 kg + 208 kg) / 0.816 m³ = 2116 kg/m³

**NOTE:** The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis.
**HOLLOW CORE RETAINING BLOCKS**

**Infill Weight Calculations**

**R-5236HC 1320 mm XL HOLLOW-CORE RETAINING BLOCK WITH SOIL INFILL**

**Concrete**
Design Unit Weight = 2291 kg/m³

LEDGESTONE FACE TEXTURE
Average Volume (Vc) = 0.659 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.659 m³ x 2291 kg/m³ = 1,510 kg
Average Center of Gravity (COGc) = 737 mm (From CAD Model)

**Infill**
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.

Volume (Vs) = 0.648 m³ (From CAD Model)
Infill Soil Weight (Ws) = 0.648 m³ x 1602 kg/m³ = 1,038 kg
Center of Gravity (COGs) = 507 mm (From CAD Model)

**Design Volume & Center of Gravity**

1.321 m x 1.172 m x 0.914 m = 1.415 m³

COG = (737 mm (1510 kg) + 507 mm (1038 kg)) / (1510 kg + 1038 kg) = 643 mm

**Infilled Unit Weight**

LEDGESTONE FACE TEXTURE

Average Volume (Vc) = 0.824 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.824 m³ x 2291 kg/m³ = 1888 kg
Average Center of Gravity (COGc) = 1013 mm (From CAD Model)

**Infill**
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.

Volume (Vs) = 1.028 m³ (From CAD Model)
Infill Soil Weight (Ws) = 1.028 m³ x 1602 kg/m³ = 1647 kg
Center of Gravity (COGs) = 762 mm (From CAD Model)

**Design Volume & Center of Gravity**

1.829 m x 1.172 m x 0.914 m = 1.959 m³

COG = (1013 mm (1888 kg) + 762 mm (1647 kg)) / (1888kg + 1647 kg) = 896 mm

**Infilled Unit Weight**

LEDGESTONE FACE TEXTURE

Average Volume (Vc) = 1.028 m³ (From CAD Model)
Concrete Block Weight (Wc) = 1.028 m³ x 2291 kg/m³ = 1888 kg
Average Center of Gravity (COGc) = 1013 mm (From CAD Model)

**Infill**
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.

Volume (Vs) = 1.028 m³ (From CAD Model)
Infill Soil Weight (Ws) = 1.028 m³ x 1602 kg/m³ = 1647 kg
Center of Gravity (COGs) = 762 mm (From CAD Model)

**Design Volume & Center of Gravity**

1.829 m x 1.172 m x 0.914 m = 1.959 m³

COG = (1013 mm (1888 kg) + 762 mm (1647 kg)) / (1888kg + 1647 kg) = 896 mm

**Infilled Unit Weight**

LEDGESTONE FACE TEXTURE

Average Volume (Vc) = 1.028 m³ (From CAD Model)
Concrete Block Weight (Wc) = 1.028 m³ x 2291 kg/m³ = 1888 kg
Average Center of Gravity (COGc) = 1013 mm (From CAD Model)

**Infill**
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.

Volume (Vs) = 1.028 m³ (From CAD Model)
Infill Soil Weight (Ws) = 1.028 m³ x 1602 kg/m³ = 1647 kg
Center of Gravity (COGs) = 762 mm (From CAD Model)

**Design Volume & Center of Gravity**

1.829 m x 1.172 m x 0.914 m = 1.959 m³

COG = (1013 mm (1888 kg) + 762 mm (1647 kg)) / (1888kg + 1647 kg) = 896 mm

**Infilled Unit Weight**

LEDGESTONE FACE TEXTURE

Average Volume (Vc) = 1.028 m³ (From CAD Model)
Concrete Block Weight (Wc) = 1.028 m³ x 2291 kg/m³ = 1888 kg
Average Center of Gravity (COGc) = 1013 mm (From CAD Model)

**Infill**
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.

Volume (Vs) = 1.028 m³ (From CAD Model)
Infill Soil Weight (Ws) = 1.028 m³ x 1602 kg/m³ = 1647 kg
Center of Gravity (COGs) = 762 mm (From CAD Model)
CONCRETE
Design Unit Weight = 2291 kg/m³

LEDGESTONE FACE TEXTURE
Average Volume (Vc) = 0.958 m³ (From CAD Model)
Concrete Block Weight (Wc) = 0.958 m³ x 2291 kg/m³ = 2195 kg
Average Center of Gravity (COGc) = 1405 mm (From CAD Model)

INFILL
Design Unit Weight = 1602 kg/m³
Material considered as infill includes the crushed stone between adjacent blocks and in the hollow cores within the blocks.
Volume (Vs) = 1.547 m³ (From CAD Model)
Infill Soil Weight (Ws) = 1.547 m³ x 1602 kg/m³ = 2478 kg
Center of Gravity (COGs) = 1034 mm (From CAD Model)

DESIGN VOLUME
2.438 m x 1.172 m x 0.914 m = 2.612 m³
COG = (1405 mm x 2195 kg + 1034 mm x 2478 kg) / (2195 kg + 2478 kg) = 1208 mm

INFILLED UNIT WEIGHT CALCULATIONS

Five degree (5°) setback (Standard)
Setback = 41 mm (5° batter angle on wall)
Move blocks forward during installation to engage shear knobs (Typical)
Available with:
- 710 mm blocks, 1030 mm blocks, and 1520 mm blocks
- 710 mm PC blocks (shown here) and 1030 mm PC blocks

One degree (1°) setback (Specialty)
Setback = 10 mm (1° batter angle on wall)
Move blocks forward during installation to engage shear knobs (Typical)
Available with:
- 710 mm blocks, 1030 mm blocks, and 1520 mm blocks
- 710 mm PC blocks (shown here) and 1030 mm PC blocks

Zero (0°) setback (Specialty)
Setback = 0 mm (0° batter angle on wall)
Move blocks forward during installation to engage shear knobs (Typical)
Available with:
- 710 mm blocks, 1030 mm blocks, and 1520 mm blocks
- 710 mm PC blocks (shown here) and 1030 mm PC blocks

NOTE: The infilled unit weights shown here are reference values. Several factors can cause the unit weights of both concrete and infill soil to vary. The designer should use sound engineering judgement when assigning an infilled unit weight value for analysis. For overturning analyses, AASHTO recommends limiting the infill soil weight to 80% of its theoretical maximum for units without a solid bottom (11.11.4.4).
Redi-Rock has two options for large batter retaining walls. Both options are created by relocating the knob so that it is further back in the Redi-Rock blocks compared to our smaller batter walls (5° and less). There are two knob locations further back in the block which create the 230 mm setback block and the planter block. Blocks made with knobs in either of these locations almost exclusively use 254 mm diameter knobs.

**230 mm Setback Blocks**

Setback = 238 mm (27.5° batter angle on wall)

Available with:
- 1030 mm blocks (shown here) and 1520 mm blocks
- Not available in PC blocks

**Planter Blocks**

Setback = 422 mm

Available with:
- 1030 mm blocks (shown here) and 1520 mm blocks
- Not available in PC blocks

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**914 mm HIGH RETAINING BLOCKS**

The block-to-block setback available with 914 mm high Redi-Rock XL hollow-core retaining blocks is controlled by the location of the shear knobs cast into the blocks. The 83 mm setback between courses creates a 5° batter angle on the back of the wall which is consistent with the batter angle created by 457 mm high Redi-Rock blocks with 254 mm shear knobs.

**914 mm High XL Hollow-Core Retaining Blocks**

The relative knob and groove configuration, and resulting setback, are consistent between the 1320 mm, 1830 mm, and 2440 mm XL hollow-core retaining blocks.
Interface Shear Report 171 mm

Test Methods: ASTM D6916 & NCMA SRWU-2
Test Facility: Bathurst, Clarabut Geotechnical Testing, Inc.
Block Type: 710 mm Positive Connection (PC) Block
Test Dates: 2011-10-21 - 171 mm Shear Knob Test

171 mm KNOB INTERFACE SHEAR DATA(a, b, c, d)

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Normal Load, kN/m</th>
<th>Service State Shear, kN/m</th>
<th>Peak Shear, kN/m</th>
<th>Observed Failure</th>
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</tbody>
</table>

Peak Shear: \( S_p = 88.45 + N \tan 44° \), \( S_{peak} = 164.8 \text{ kN/m} \)
Service State Shear: \( S_{ss} = 14.59 + N \tan 50° \), \( S_{sspeak} = 160.5 \text{ kN/m} \)

171 mm KNOB INTERFACE SHEAR CAPACITY

![Graph showing shear capacity vs. normal load for 171 mm knob interface shear test](image)

(a) Minimum 28-day compressive strength of the concrete blocks tested in the 171 mm knob interface shear test exceeded 30.3 MPa.
(b) Service State Shear is measured at a horizontal displacement equal to 2% of the block height. For Redi-Rock blocks, displacement = 9 mm.
(c) In several test cases, the test was stopped before failure of the block occurred to prevent damage to the test apparatus. The shear capacities recorded reflect the limits of the maximum loading that could be safely exerted on the blocks tested.
(d) The recommended design shear capacity at a given normal load for a critical wall structure is the lesser of the peak capacity divided by a minimum factor of safety (not less than 1.5) or the capacity based upon the 9 mm service state displacement criterion. Nevertheless, the design shear capacity of the concrete is less than that of the blocks used in this test.

The information contained in this report has been compiled by Redi-Rock International, LLC as a recommendation of peak interface shear capacity. It is accurate to the best of our knowledge as of the date of its issue. However, final determination of the suitability of any design information and the appropriateness of the data for a given design purpose is the sole responsibility of the user. No warranty of performance is expressed or implied by the publishing of the foregoing laboratory test results. Issue date: 2011-10-14.

Interface Shear Report 254 mm

Test Methods: ASTM D6916 & NCMA SRWU-2
Test Facility: Bathurst, Clarabut Geotechnical Testing, Inc.
Block Type: 710 mm Positive Connection (PC) Block
2011-10-14 - 254 mm Shear Knob Test

254 mm KNOB INTERFACE SHEAR DATA(a, b, c, d)

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Normal Load, kN/m</th>
<th>Service State Shear, kN/m</th>
<th>Peak Shear, kN/m</th>
<th>Observed Failure</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>286.318</td>
<td>164.911</td>
<td>164.911</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>2</td>
<td>233.605</td>
<td>164.911</td>
<td>164.911</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>3</td>
<td>197.899</td>
<td>165.947</td>
<td>165.947</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>4</td>
<td>161.146</td>
<td>165.947</td>
<td>165.947</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>5</td>
<td>122.599</td>
<td>163.510</td>
<td>163.510</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>6</td>
<td>160.518</td>
<td>164.211</td>
<td>164.211</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>7</td>
<td>159.395</td>
<td>164.211</td>
<td>164.211</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>8</td>
<td>84.440</td>
<td>151.981</td>
<td>162.810</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>9</td>
<td>45.781</td>
<td>109.002</td>
<td>148.478</td>
<td>Test Stopped</td>
</tr>
<tr>
<td>10</td>
<td>7.618</td>
<td>57.296</td>
<td>88.045</td>
<td>Test Stopped</td>
</tr>
</tbody>
</table>

Peak Shear: \( S_p = 88.45 + N \tan 44° \), \( S_{peak} = 164.8 \text{ kN/m} \)
Service State Shear: \( S_{ss} = 49.47 + N \tan 51° \), \( S_{sspeak} = 160.5 \text{ kN/m} \)

254 mm KNOB INTERFACE SHEAR CAPACITY

![Graph showing shear capacity vs. normal load for 254 mm knob interface shear test](image)

(a) Minimum 28-day compressive strength of the concrete blocks tested in the 254 mm knob interface shear test exceeded 30.3 MPa.
(b) Service State Shear is measured at a horizontal displacement equal to 2% of the block height. For Redi-Rock blocks, displacement = 9 mm.
(c) In several test cases, the test was stopped before failure of the block occurred to prevent damage to the test apparatus. The shear capacities recorded reflect the limits of the maximum loading that could be safely exerted on the blocks tested.
(d) The recommended design shear capacity at a given normal load for a critical wall structure is the lesser of the peak capacity divided by a minimum factor of safety (not less than 1.5) or the capacity based upon the 9 mm service state displacement criterion. Nevertheless, the design shear capacity of the concrete is less than that of the blocks used in this test.

The information contained in this report has been compiled by Redi-Rock International, LLC as a recommendation of peak interface shear capacity. It is accurate to the best of our knowledge as of the date of its issue. However, final determination of the suitability of any design information and the appropriateness of the data for a given design purpose is the sole responsibility of the user. No warranty of performance is expressed or implied by the publishing of the foregoing laboratory test results. Issue date: 2011-10-14.
Interface Shear Report XL Hollow-Core Retaining Block

Test Methods: ASTM D6916 & NCMA SRWU-2  Block Type: R-5236 1320 mm Hollow-Core Retaining Block

INTERFACE SHEAR DATA(a)

Tested By: TRI Environmental | Dec. 10-21, 2017  Tested By: Redi-Rock International | Mar. 14-23, 2018

Block Type: R-5236 1,320 mm Hollow-Core Retaining Block  Test Methods: ASTM D6916 & NCMA SRWU-2

1 Test stopped - back cracked  11 Test stopped - back cracked  10 Test stopped - uplift  10 Test stopped - back cracked  9 Test stopped - back cracked  9 Test stopped - back cracked  7 Knob/face shear  7 Knob/face shear  3 Test stopped - uplift  3 Knob/face shear

Normal Load

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Normal Load kN/m</th>
<th>Peak Shear kN/m</th>
<th>Observed Failure(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12.7</td>
<td>55.6</td>
<td>Test stopped - uplift</td>
</tr>
<tr>
<td>2</td>
<td>73.4</td>
<td>167.9</td>
<td>Knob/face shear</td>
</tr>
<tr>
<td>3</td>
<td>12.7</td>
<td>49.4</td>
<td>Test stopped - uplift</td>
</tr>
<tr>
<td>4</td>
<td>241.7</td>
<td>247.5</td>
<td>Test stopped - capacity</td>
</tr>
<tr>
<td>5</td>
<td>30.1</td>
<td>101.7</td>
<td>Test stopped - uplift</td>
</tr>
<tr>
<td>6</td>
<td>51.6</td>
<td>143.8</td>
<td>Test stopped - uplift</td>
</tr>
<tr>
<td>7</td>
<td>113.4</td>
<td>163.6</td>
<td>Knob/face shear</td>
</tr>
<tr>
<td>8</td>
<td>113.3</td>
<td>154.7</td>
<td>Test stopped - back cracked</td>
</tr>
<tr>
<td>9</td>
<td>111.7</td>
<td>181.0</td>
<td>Test stopped - back cracked</td>
</tr>
<tr>
<td>10</td>
<td>95.5</td>
<td>176.8</td>
<td>Test stopped - up lift</td>
</tr>
<tr>
<td>11</td>
<td>182.4</td>
<td>203.8</td>
<td>Test stopped - back cracked</td>
</tr>
</tbody>
</table>

Peak Shear Envelope:

\[ S_{I_{min}} = 66.4 + N \tan 44° \quad (N < 102.4 \text{ kN/m}) \]
\[ S_{I_{min}} = 123.9 + N \tan 22° \quad (102.4 \text{ kN/m} \leq N < 235.2 \text{ kN/m}) \]
\[ S_{I_{min}} = 218.9 \text{ kN/m} \quad (N \geq 235.2 \text{ kN/m}) \]

Inflection Points:

\[ S_I = 66.4 \text{ kN/m} \]
\[ N_0 = 0 \text{ kN/m} \]
\[ S_I = 165.2 \text{ kN/m} \]
\[ N_2 = 102.4 \text{ kN/m} \]
\[ S_I = 219.9 \text{ kN/m} \]
\[ N_3 = 235.2 \text{ kN/m} \]

INTERFACE SHEAR CAPACITY

![Graph showing interface shear capacity]

(a) The average compressive strength at the time of testing of all concrete blocks tested in the XL hollow-core retaining block test series was 27.6 MPa.

(b) In many cases, the test was stopped before peak shear load occurred because of significant uplift or block failure. Damage to the back of upper block where horizontal load was applied when test failure occurred is expressed or implied by the publishing of the foregoing laboratory test results.

(c) Design shear capacity inferred from the test data reported herein should be lowered when test failure results from block rupture. When test failure results from block rupture, the blocks used in this test. The data reported represents the actual laboratory strength equal to 27.6 MPa. No further modifications to the test data have been made. The information contained in this report has been compiled by Redi-Rock International, LLC as a recommendation of peak interface shear performance of concrete and concrete blocks tested this report. The test data reported herein should be lowered when test failure occurs at a lower interface shear performance of concrete than the blocks used in this test. The data reported represents the actual laboratory test results. The equations for peak shear strength have been modified to reflect the interface shear performance of concrete with a minimum 50% compressive strength equal to 27.6 MPa. No further modifications to the equations have been made. Appropriate factors of safety for design should be added.

The information contained in this report has been compiled by Redi-Rock International, LLC as a recommendation of peak interface shear performance of concrete and concrete blocks tested this report. The test data reported represents the actual laboratory test results. The equations for peak shear strength have been modified to reflect the interface shear performance of concrete with a minimum 50% compressive strength equal to 27.6 MPa. No further modifications to the equations have been made. Appropriate factors of safety for design should be added.

Minimum Turning Radius

Convex curves can easily be incorporated into a Redi-Rock wall. Redi-Rock blocks are tapered 7½° on each side. The smallest radius that can be made with Redi-Rock blocks (without cutting the blocks) occurs when the blocks are placed together with their sides touching. This minimum radius for full size blocks is 4.42 m from the face of the blocks.

Block to block setback will cause the radius for each succeeding row to be smaller than the row below. To ensure the minimum radius for the top row of blocks in a wall, start with the minimum radius and then add 51 mm per course for each standard setback block 457-mm high block, 254 mm per course for each 230 mm setback block, and 432 mm per course for each planter block in the wall below the top row of blocks. For 914-mm high XL blocks, add 102 mm per row.

MINIMUM RADIUS FOR BOTTOM ROW OF BLOCKS

<table>
<thead>
<tr>
<th>HEIGHT OF WALL</th>
<th>RADIUS FROM FACE OF BLOCK</th>
<th>RADIUS FROM FACE OF BLOCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>457 mm High Blocks</td>
<td>(0.46 m)</td>
<td>(6.4 m)</td>
</tr>
<tr>
<td>914 mm High Blocks</td>
<td>(4.42 m)</td>
<td>(95.08 m)</td>
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</tbody>
</table>

Concave curves may be installed at varying radii. The blocks should be placed tight together to make a smooth curve. Although there is no fixed minimum radius, smaller radii lengths of less than 4.42 m will result in excessive protrusion of the backing surface of the blocks in the underlying layer.

Exposed Untextured Block Surface

Top Blocks Tight Together

Block to block setback will cause the radius for each succeeding row to be smaller than the row below. To ensure the minimum radius for the top row of blocks in a wall, start with the minimum radius and then add 51 mm per course for each standard setback block 457-mm high block, 254 mm per course for each 230 mm setback block, and 432 mm per course for each planter block in the wall below the top row of blocks. For 914-mm high XL blocks, add 102 mm per row.

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The following specification addresses precast modular block walls designed as unreinforced gravity structures or reinforced with geosynthetic reinforcement. This document is a guide specification and should be modified as necessary for your particular project. An editable version of this document is available for download at redi-rock.com.
PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) retaining wall with or without geosynthetic reinforcement. Precast modular block retaining wall blocks under this section shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 450 kg per unit.

B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.

C. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 31, Division 32 and Division 33 also apply to this Section.

1.02 PRICE AND PAYMENT PROCEDURES

A. Allowances. No allowance shall be made in the price of the retaining wall for excavation beyond the limits required for retaining wall construction as shown on the project plans. The cost of excavation for the purposes of site access shall be the responsibility of the General Contractor. Removal of unsuitable soils and replacement with select fill shall be as directed and approved in writing by the Owner or Owner’s representative and shall be paid under separate pay items.

B. Unit Prices. In addition to a lump sum price pursuant to completion of the scope of work described in Part 1.01 of this Section, the General Contractor shall provide a unit price per square meter of vertical wall face that shall be the basis of compensation for up to a ten (10) percent increase or reduction in the overall scope of the retaining wall work.

C. Measurement and Payment.

1. The unit of measurement for furnishing the precast modular block retaining wall system shall be the vertical area of the wall face surface as measured from the top of the leveling pad to the top of the wall including coping. The final measured quantity shall include supply of all material components and the installation of the precast modular block system.

2. The final accepted quantities of the precast modular block retaining wall system will be compensated per the vertical face area as described above. The quantities of the precast modular block retaining wall as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per square meter of vertical wall face.

D. Measurement and Payment.

1. The final acceptable quantities of the precast modular block retaining wall system will be compensated per the vertical face area as described above. The quantities of the precast modular block retaining wall as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per square meter of vertical wall face.

E. Measurement and Payment.

1. The final accepted quantities of the precast modular block retaining wall system shall be the basis of compensation for up to a ten (10) percent increase or reduction in the overall scope of the retaining wall work.

F. Measurement and Payment.

1. The final measured quantity shall include supply of all material components and the installation of the precast modular block system.

2. The final accepted quantities of the precast modular block retaining wall system will be compensated per the vertical face area as described above. The quantities of the precast modular block retaining wall as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per square meter of vertical wall face.

1.03 REFERENCES

A. Where the specification and reference documents conflict, the Owner’s designated representative will make the final determination of the applicable document.

B. Definitions:


2. Geotextile – a geosynthetic fabric manufactured for use as a separation and filtration medium between dissimilar soil materials.

3. Geogrid – a geosynthetic material comprised of a regular network of tensile elements manufactured in a mesh-like configuration of consistent aperture openings. When connected to the PMB facing units and placed in horizontal layers in compacted fill, the geogrid prevents lateral deformation of the retaining wall face and provides effective tensile reinforcement to the contiguous reinforced fill material.

4. Drainage Aggregate – clean, crushed stone placed within and immediately behind the precast modular block units to facilitate drainage and reduce compaction requirements immediately adjacent to and behind the precast modular block units.

5. Unit Core Fill – clean, crushed stone placed within the hollow vertical core of a precast modular block unit. Typically, the same material used for drainage aggregate as defined above.

6. Foundation Zone – soil zone immediately beneath the leveling pad and the reinforced zone.

7. Retained Zone – soil zone immediately behind the drainage aggregate and wall infill for wall sections designed as modular gravity structures. Alternatively, in the case of wall sections designed with geosynthetic soil reinforcement, the retained zone is the soil zone immediately behind the reinforced zone.

8. Reinforced Zone – structural fill zone within which successive horizontal layers of geogrid soil reinforcement have been placed to provide stability for the retaining wall face. The reinforced zone exists only for retaining wall sections that utilize geosynthetic soil reinforcement for stability.

9. Reinforced Fill – structural fill placed within the reinforced zone.

10. Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks are placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.

11. Wall Infill – the fill material placed and compacted between the drainage aggregate and the excavated soil face in retaining wall sections designed as modular gravity structures.

C. Reference Standards

1. Design


d. FHWA-NHI-10-024 Volume I and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.

e. FHWA-NHI-10-025 Volume II and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.

2. Precast Modular Block Units

a. ACI 201 – Guide to Durable Concrete
3. Geosynthetics

b. ACI 318 – Building Code Requirements for Structural Concrete

c. ASTM C33 – Standard Specification for Concrete Aggregates

d. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens


h. ASTM C150 – Standard Specification for Portland Cement

i. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.


m. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.


r. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.


t. ASTM C1218 – Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.


w. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.

x. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).

y. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).

3. Geosynthetics


n. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.

o. ASTM D5818 – Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics.


4. Soils

a. AASHTO M 145 – AASHTO Soil Classification System.

b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.


f. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.

g. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 lb/ft (2,700 kN/m)).


i. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

j. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).

k. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).


r. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).

5. Drainage Pipe
b. ASTM F2646 – Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Meeting. As directed by the Owner, the General Contractor shall schedule a preconstruction meeting at the project site prior to commencement of retaining wall construction. Participation in the preconstruction meeting shall be required of the General Contractor, Retaining Wall Design Engineer, Retaining Wall Installation Contractor, Grading Contractor and Inspection Engineer. The General Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.

1. Preconstruction Meeting Agenda:
   a. The Retaining Wall Design Engineer shall explain all aspects of the retaining wall construction drawings.
   b. The Retaining Wall Design Engineer shall explain the required bearing capacity of soil below the retaining wall structure and the shear strength of in-situ soils assumed in the retaining wall design to the Inspection Engineer.
   c. The Retaining Wall Design Engineer shall explain the required shear strength of fill soil in the reinforced, retained and foundation zones of the retaining wall to the Inspection Engineer.
   d. The Retaining Wall Design Engineer shall explain any measures required for coordination of the installation of utilities or other obstructions in the reinforced or retained fill zones of the retaining wall.
   e. The Retaining Wall Installation Contractor shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Grading Contractor.

1.05 SUBMITTALS

A. Product Data. At least 14 days prior to construction, the General Contractor shall submit a minimum of six (6) copies of the retaining wall product submittal package to the Owner’s Representative for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:
   1. Precast Modular Block System brochure
   2. Precast Modular Block concrete test results specified in paragraph 2.01, subparagraph B of this section as follows:
      a. 28-day compressive strength
      b. Air content
      c. Slump or Slump Flow (as applicable)
   3. Drainage Pipe

B.Installer Qualification Data. At least 14 days prior to construction, the General Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the Retaining Wall Installation Contractor, per paragraph 1.07, subparagraph A of this section.

C. Retaining Wall Design Calculations and Construction Shop Drawings. At least 14 days prior to construction, the General Contractor shall furnish six (6) sets of construction shop drawings and six (6) copies of the supporting structural calculations report to the Owner for review and approval. This submittal shall include the following:
   1. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.
   2. Qualifications Statement of Experience of the Retaining Wall Design Engineer as specified in paragraph 1.07, subparagraph B of this section.
   3. Certificate of Insurance of the Retaining Wall Design Engineer as specified in paragraph 1.06, subparagraph B of this section.

1.06 CONSTRUCTION SHOP DRAWING PREPARATION

A. The Retaining Wall Design Engineer shall coordinate the retaining wall construction shop drawing preparation with the project Civil Engineer, project Geotechnical Engineer and Owner’s Representatives. The General Contractor shall furnish the Retaining Wall Design Engineer the following project information required to prepare the construction shop drawings. This information shall include, but is not limited to, the following:
   1. Current versions of the site, grading, drainage, utility, erosion control, landscape, and irrigation plans;
   2. electronic CAD file of the civil site plans listed in (1);
   3. report of geotechnical investigation and all addenda and supplemental reports;
   4. recommendations of the project Geotechnical Engineer regarding effective stress shear strength and total stress shear strength (when applicable) parameters for in-situ soils in the vicinity of the proposed retaining wall(s) and for any fill soil that may potentially be used as backfill in retained and/or foundation zones of the retaining wall.

B. The Retaining Wall Design Engineer shall provide the Owner with a certificate of professional liability insurance verifying the minimum coverage limits of $1 million USD per claim and $1 million USD aggregate.

C. Design of the precast modular block retaining wall shall satisfy the requirements of this section. Where local design or building code requirements exceed these specifications, the local requirements shall also be satisfied.

D. The Retaining Wall Design Engineer shall note any exceptions to the requirements of this section by listing them at the bottom right corner of the first page of the construction shop drawings.
1.07 QUALITY ASSURANCE

E. Approval or rejection of the exceptions taken by the Retaining Wall Engineer will be made in writing as directed by the Owner.

F. The precast modular block design, except as noted herein, shall be based upon AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.03, subparagraph C.1.

G. In the event that a conflict is discovered between these specifications and a reasonable interpretation of the design specifications and methods referenced in paragraph F above, these specifications shall prevail. If a reasonable interpretation is not possible, the conflict shall be resolved per the requirements in paragraph 1.03, subparagraph A of this section.

H. Soil Shear Parameters. The Retaining Wall Design Engineer shall prepare the construction shop drawings based upon soil shear strength parameters from the available project data and the recommendations of the project Geotechnical Engineer. If insufficient data exists to develop the retaining wall design, the Retaining Wall Design Engineer shall communicate the specific deficiency of the project information or data to the Owner in writing.

I. Allowable bearing pressure requirements for each retaining wall shall be clearly shown on the construction drawings.

J. Global Stability. Overall (global) stability shall be evaluated in accordance with the principals of limit equilibrium analysis as set forth in FHWA-NHI-10-024 Volume I and FHWA-NHI-10-025 Volume II GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes as referenced in paragraph 1.03, subparagraph C.1. The minimum factors of safety shall be as follows:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Service (Static)</td>
<td>1.4</td>
</tr>
<tr>
<td>Seismic</td>
<td>1.1</td>
</tr>
<tr>
<td>Rapid Drawdown (if applicable)</td>
<td>1.2</td>
</tr>
</tbody>
</table>

K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.03, subparagraph C.1.

1.08 QUALITY CONTROL

A. Retaining Wall Installation Contractor Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the Retaining Wall Installation Contractor shall document compliance with the following:

1. Experience.
   a. Construction experience with a minimum of 2,800 square meters of the proposed precast modular block retaining wall system.
   b. Construction of at least ten (10) precast modular block (large block) retaining wall structures within the past three (3) years.
   c. Construction of at least 4,650 square meters of precast modular block (large block) retaining walls within the past three (3) years.

2. Retaining Wall Installation Contractor experience documentation for each qualifying project shall include:
   a. Project name and location

B. Retaining Wall Design Engineer Qualifications and Statement of Experience. The Retaining Wall Design Engineer shall submit a written statement affirming that he or she has the following minimum qualifications and experience.

1. The Retaining Wall Design Engineer shall be licensed to practice in the jurisdiction of the project engineer of record for the retaining walls constructed on the project.

2. The Retaining Wall Design Engineer shall be independently capable of performing all internal and external stability analyses, including those for seismic loading, compound stability, rapid draw-down and deep-seated, global modes of failure.

3. The Retaining Wall Design Engineer shall submit a written statement affirming that he or she has personally supervised the design of the retaining walls for the project, that the design considers all the requirements listed in paragraph 1.06 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.

4. The Retaining Wall Design Engineer shall submit a written statement affirming that he or she has personally supervised the design of the retaining walls for the project, that the design considers all the requirements listed in paragraph 1.06 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.

C. The Owner reserves the right to reject the design services of any engineer or engineering firm who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.
3. Verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate.

4. Inspect and document soil compaction in accordance with these specifications:
   a. Required dry unit weight
   b. Actual dry unit weight
   c. Allowable moisture content
   d. Actual moisture content
   e. Pass/fail assessment
   f. Test location – wall station number
   g. Test elevation
   h. Distance of test location behind the wall face

5. Verify that all excavated slopes in the vicinity of the retaining wall are bench-cut as directed by the project Geotechnical Engineer.

6. Notify the Retaining Wall Installation Contractor of any deficiencies in the retaining wall construction and provide the Retaining Wall Installation Contractor a reasonable opportunity to correct the deficiency.

7. Notify the General Contractor, Owner and Retaining Wall Design Engineer of any construction deficiencies that have not been corrected timely.

8. Document all inspection results.

9. Test compacted density and moisture content of the retained backfill with the following frequency:
   a. At least once every 90 square meters (in plan) per 230 mm vertical lift, and
   b. At least once per every 460 mm of vertical wall construction.

D. The General Contractor’s engagement of the Inspection Engineer does not relieve the Retaining Wall Installation Contractor of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.

E. The Retaining Wall Installation Contractor shall inspect the on-site grades and excavations prior to construction and notify the Retaining Wall Design Engineer and General Contractor if on-site conditions differ from the elevations and grading conditions depicted in the retaining wall construction shop drawings.

1.09 DELIVERY, STORAGE AND HANDLING

A. The Retaining Wall Installation Contractor shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

B. The Retaining Wall Installation Contractor shall store and handle all materials in accordance with the manufacturer’s recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.

C. Geosynthetics
   1. All geosynthetic materials shall be handled in accordance with ASTM D4873. The materials should be stored off the ground and protected from precipitation, sunlight, dirt and physical damage.

D. Precast Modular Blocks
Concrete Mix Properties

<table>
<thead>
<tr>
<th>Exposure Class(1)</th>
<th>Minimum 28-Day Compressive Strength(2)</th>
<th>Maximum Water Ratio</th>
<th>Nominal Maximum Aggregate Size</th>
<th>Aggregate Class Designation(2)</th>
<th>Air Content(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>27.6 MPa</td>
<td>0.45</td>
<td>25 mm</td>
<td>3M</td>
<td>4.5% +/- 1.5%</td>
</tr>
<tr>
<td>Severe</td>
<td>27.6 MPa</td>
<td>0.45</td>
<td>25 mm</td>
<td>3S</td>
<td>6.0% +/- 1.5%</td>
</tr>
<tr>
<td>Very Severe</td>
<td>30.0 MPa</td>
<td>0.40</td>
<td>25 mm</td>
<td>4S</td>
<td>6.0% +/- 1.5%</td>
</tr>
</tbody>
</table>

Maximum Water-Soluble Chloride Ion (Cl-) Content in Concrete, Percent by Weight of Cement(3,4):

- Moderate
- Severe
- Very Severe

Maximum Chloride as Cl- Concentration in Mixing Water, Parts Per Million:

- Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume(5):
- Silica Fume Conforming to ASTM C1240:
- Silica Fume Conforming to ASTM C1240:

Maximum Water-Soluble Chloride Ion (Cl-) Content in Concrete, Percent by Weight of Cement:

- Moderate
- Severe
- Very Severe

Alkali Aggregate Reactivity Mitigation per ACI 201:

- (a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
- (b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
- (c) Silica fume, ASTM C1240, present in a blended cement.

Slump (Conventional Concrete) per ASTM C143:

- 125 mm +/- 40 mm

Slump Flow (Self-Consolidating Concrete) per ASTM C1611:

- 450 mm – 800 mm

**Notes:**
- (1) Exposure class is as described in ACI 318. “Moderate” describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. “Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. “Very Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.
- (2) Test method ASTM C39.
- (3) Defined in ASTM C33 Table 3 Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete.
- (4) Test method ASTM C231.
- (5) Test method ASTM C1218 at age between 28 and 42 days.
- Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)
- (6) The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:
  - (a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
  - (b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
  - (c) Silica fume, ASTM C1240, present in a blended cement.
- (7) Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.
- (8) Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.
- (9) Slump may be increased by a high-range water-reducing admixture.

D. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

<table>
<thead>
<tr>
<th>Block Type</th>
<th>Dimension</th>
<th>Nominal Value</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>710 mm Block</td>
<td>Height 457 mm</td>
<td>+/- 5 mm</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Length 1172 mm</td>
<td>+/- 13 mm</td>
<td>0.15</td>
</tr>
<tr>
<td>1030 mm Block</td>
<td>Width* 710 mm</td>
<td>+/- 13 mm</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Height 457 mm</td>
<td>+/- 5 mm</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>Length 1172 mm</td>
<td>+/- 13 mm</td>
<td>0.15</td>
</tr>
<tr>
<td>1520 mm Block</td>
<td>Width* 1520 mm</td>
<td>+/- 13 mm</td>
<td>0.15</td>
</tr>
</tbody>
</table>

* Block tolerance measurements shall exclude variable face texture

E. Individual block units shall have a nominal height of 457 mm.

F. With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 254 mm, 190 mm, or 171 mm in diameter and 102 mm or 51 mm in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 254 mm diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 95 kN/m at a minimum normal load of 7 kN/m. as well as an ultimate peak interface shear capacity in excess of 160 kN/m. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 190 mm or 171 mm diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 27 kN/m at a minimum normal load of 7 kN/m as well as an ultimate peak interface shear capacity in excess of 146 kN/m. Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 27.6 MPa concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

G. When used as a mechanically-stabilized earth system, the 710 mm and 1030 mm precast modular block units shall be cast with a 330 mm wide, continuous vertical core slot that will permit the insertion of a 305 mm wide strip of geogrid reinforcement to pass completely through the block. When installed in this manner, the geogrid reinforcement shall form a non-normal load dependent, positive connection between the block unit and the reinforcement strip. The use of steel for the purposes of creating the geogrid to block connection is not acceptable.

H. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 4.42 m.

I. The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the four (4) standard horizontal set-back facing batter options listed below:
N. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner’s Representative reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.


N. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner’s Representative reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.

O. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

J. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 0.54 square meters with a unique texture pattern that repeats with a maximum frequency of once in any 1.4 square meters of wall face.

K. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.

L. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 38 mm in its largest dimension and cracks not wider than 0.3 mm and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 19 mm in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.

2.02 GEOGRID REINFORCEMENT

A. Geogrid reinforcement shall be a woven or knitted PVC coated geogrid manufactured from high-tenacity PET polyester fiber with an average molecular weight greater than 25,000 (Mₜ > 25,0000) and a carboxyl end group less than 30 (CEG < 30). The geogrid shall be furnished in prefabricated roll widths of certified tensile strength by the manufacturer. The prefabricated roll width of the geogrid shall be 300 mm +/- 13 mm. No cutting of geogrid reinforcement down to the 300 mm roll width from a larger commercial roll width will be allowed under any circumstances.

B. The ultimate tensile strength (Tult) of the geogrid reinforcement shall be measured in accordance with ASTM D6637.

C. Geogrid – Soil Friction Properties
   1. Friction factor, F*, shall be equal to 2/3 Tan δ, where δ is the effective angle of internal friction of the reinforced fill soil.
   2. Linear Scale Correction Factor, α, shall equal 0.8.

D. Long-Term Tensile Strength (Tₜₜ) of the geogrid reinforcement shall be calculated in accordance with Section 3.5.2 of FHWA-NHI-10-024 and as provided in this specification.
   1. The creep reduction factor (RFc) shall be determined in accordance with Appendix D of FHWA-NHI-10-025 for a minimum 75 year design life.
   2. Minimum installation damage reduction factor (RFid) shall be 1.25. The value of RFid shall be based upon documented full-scale tests in a soil that is comparable to the material proposed for use as reinforced backfill in accordance with ASTM D5818.
   3. Minimum durability reduction factor (RFd) shall be 1.3 for a soil pH range of 3 to 9.

E. Connection between the PMB retaining wall unit and the geogrid reinforcement shall be determined from short-term testing per the requirements of FHWA-NHI-10-025, Appendix B.4 for a minimum 75-year design life.

F. The minimum value of Tₜₜ for geogrid used in design of a reinforced precast modular block retaining wall shall be 29 kN/m or greater.

G. The minimum length of geogrid reinforcement shall be the greater of the following:
   1. 0.7 times the wall design height, H.
   2. 1.83 m.
   3. The length required by design to meet internal stability requirements, soil bearing pressure requirements and constructability requirements.

H. Constructability Requirements. Geogrid design embedment length shall be measured from the back of the precast modular block facing unit and shall be consistent for the entire height of a given retaining wall section.

I. Geogrid shall be positively connected to every precast modular block unit. Design coverage ratio, Rc, as calculated in accordance with AASHTO LRFD Bridge Design Specifications Figure 11.10.6.4.1-2 shall not exceed 0.50.

J. Preapproved Geogrid Reinforcement Products.
1. Miragrid XT Geogrids as manufactured by TenCate Geosynthetics of Pendergrass, Georgia USA and distributed by Manufacturers of the Redi-Rock Retaining Wall System.

K. Substitutions. No substitutions of geogrid reinforcement products shall be allowed.

2.03 GEOTEXTILE

A. Nonwoven geotextile fabric shall be placed as indicated on the retaining wall construction shop drawings. Additionally, the nonwoven geotextile fabric shall be placed in the v-shaped joint between adjacent block units on the same course. The nonwoven geotextile fabric shall meet the requirements Class 3 construction survivability in accordance with AASHTO M 288.

B. Preapproved Nonwoven Geotextile Products
1. Mirafi 140N
2. Propex Geotex 451
3. Skaps GT-140EX
4. Thrace-Linq 140EX
5. Carthage Mills FX-40HS
6. Stratatex ST 142

2.04 DRAINAGE AGGREGATE AND WALL INFILL

A. Drainage aggregate (and wall infill for retaining walls designed as modular gravity structures) shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D422:

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>38 mm</td>
<td>100</td>
</tr>
<tr>
<td>25 mm</td>
<td>95-100</td>
</tr>
<tr>
<td>13 mm</td>
<td>25-60</td>
</tr>
<tr>
<td>4.76 mm</td>
<td>0-10</td>
</tr>
<tr>
<td>2.38 mm</td>
<td>0-5</td>
</tr>
</tbody>
</table>

B. The reinforced backfill material shall be free of sod, peat, roots or other organic or deleterious matter including, but not limited to, ice, snow or frozen soils. Materials passing the 0.42 mm sieve shall have a liquid limit less than 25 and plasticity index less than 6 per ASTM D4318. Organic content in the backfill material shall be less than 1% per AASHTO T-267 and the pH of the backfill material shall be between 5 and 8.

C. Soundness. The reinforced backfill material shall exhibit a magnesium sulfate soundness loss of less than 30% after four (4) cycles, or sodium sulfate soundness loss of less than 15% after five (5) cycles as measured in accordance with AASHTO T-104.

D. Reinforced backfill shall not be comprised of crushed or recycled concrete, recycled asphalt, bottom ash, shale or any other material that may degrade, creep or experience a loss in shear strength or a change in pH over time.

2.05 REINFORCED FILL

A. Material used as reinforced backfill material in the reinforced zone (if applicable) shall be a granular fill material meeting the requirements of USCS soil type GW, GP, SW or SP per ASTM D2487 or alternatively by AASHTO Group Classification A-1-a or A-3 per AASHTO M 145. The backfill shall exhibit a minimum effective internal angle of friction, $\phi = 34$ degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D422:

<table>
<thead>
<tr>
<th>U.S. Standard Sieve Size</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 mm</td>
<td>100</td>
</tr>
<tr>
<td>4.76 mm</td>
<td>0-100</td>
</tr>
<tr>
<td>0.42 mm</td>
<td>0-60</td>
</tr>
<tr>
<td>0.15 mm</td>
<td>0-10</td>
</tr>
<tr>
<td>0.075 mm</td>
<td>0-15</td>
</tr>
</tbody>
</table>

B. The reinforced backfill material shall be free of sod, peat, roots or other organic or deleterious matter including, but not limited to, ice, snow or frozen soils. Materials passing the 0.42 mm sieve shall have a liquid limit less than 25 and plasticity index less than 6 per ASTM D4318. Organic content in the backfill material shall be less than 1% per AASHTO T-267 and the pH of the backfill material shall be between 5 and 8.

C. Soundness. The reinforced backfill material shall exhibit a magnesium sulfate soundness loss of less than 30% after four (4) cycles, or sodium sulfate soundness loss of less than 15% after five (5) cycles as measured in accordance with AASHTO T-104.

D. Reinforced backfill shall not be comprised of crushed or recycled concrete, recycled asphalt, bottom ash, shale or any other material that may degrade, creep or experience a loss in shear strength or a change in pH over time.

2.06 LEVELING PAD

A. The precast modular block units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the Retaining Wall Design Engineer.

B. Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in section 2.04 or a preapproved alternate material.

C. Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of 17.2 MPa.

2.07 DRAINAGE

A. Drainage Pipe
1. Drainage collection pipe shall be a 100 mm diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 152 kPa per ASTM D2412.
2. The drainage pipe shall be manufactured in accordance with ASTM D1248 for HDPE pipe and fittings.

B. Preapproved Drainage Pipe Products
1. ADS 3000 Triple Wall pipe as manufactured by Advanced Drainage Systems.

PART 3 – EXECUTION

3.01 GENERAL

A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer’s requirements.
3.02 EXAMINATION

A. Prior to construction, the General Contractor, Grading Contractor, Retaining Wall Installation Contractor and Inspection Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

A. Fill Soil.
   1. The Inspection Engineer shall verify that reinforced backfill placed in the reinforced soil zone satisfies the criteria of this section.
   2. The Inspection Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the Retaining Wall Design Engineer as shown on the construction drawings.

B. Excavation.
   1. The Grading Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Grading Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Grading Contractor.
   2. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the Retaining Wall Design Engineer and “Division 31, Section 31 20 00 – Earthmoving” of these project specifications.
   3. Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.

C. Foundation Preparation.
   1. Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted according project specifications. The Inspection Engineer shall document the volume of undercut and replacement.

   2. Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.
      a. The Inspection Engineer shall verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate. The Inspection Engineer shall immediately stop work and notify the Owner if the in-situ shear strength is found to be inconsistent with the retaining wall design assumptions.
      b. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings per paragraph 1.08 i of this section.

D. Leveling Pad.
   1. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.
   2. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6” (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 8.9 kN of centrifugal force and to the satisfaction of the Inspection Engineer.
   3. Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The Retaining Wall Installation Contractor shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

3.04 PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

A. The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer’s recommendations and these specifications, these specifications shall prevail.

B. Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.

C. Precast Modular Block Installation
   1. The first course of block units shall be placed with the front face edges tightly abutted together on the prepared leveling pad at the locations and elevations shown on the construction drawings. The Retaining Wall Installation Contractor shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.
   2. Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks to a minimum distance of 300 mm behind the block unit.
   3. Drainage aggregate shall be placed in 230-mm maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 8.9 kN of centrifugal force.
D. Geogrid Reinforcement Installation (if required)

1. Geogrid reinforcement shall be installed at the locations and elevations shown on the construction drawings on level fill compacted to the requirements of this specification.

2. Continuous 300 mm wide strips of geogrid reinforcement shall be passed completely through the vertical core slot of the precast modular block unit and extended to the embedment length shown on the construction plans. The strips shall be staked or anchored as necessary to maintain a taut condition.

3. Reinforcement length (L) of the geogrid reinforcement is measured from the back of the precast modular block unit. The cut length (Lc) is two times the reinforcement length plus additional length through the block facing unit. The cut length is calculated as follows:

\[ L_c = 2L + 0.9 \text{ m} \text{ (710 mm block unit)} \]

\[ L_c = 2L + 1.5 \text{ m} \text{ (1030 mm block unit)} \]

4. The geogrid strip shall be continuous throughout its entire length and may not be spliced. The geogrid shall be furnished in nominal, prefabricated roll widths of 300 mm +/- 13 mm. No field modification of the geogrid roll width shall be permitted.

5. Neither rubber tire nor track vehicles may operate directly on the geogrid. Construction vehicles traffic in the reinforced zone shall be limited to speeds of less than 8 km/hr once a minimum of 230 mm of compacted fill has been placed over the geogrid reinforcement. Sudden braking and turning of construction vehicles in the reinforced zone shall be avoided.

E. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:

1. Deviation from the design batter and horizontal alignment, when measured along a 3 m straight wall section, shall not exceed 19 mm.

2. Deviation from the overall design batter shall not exceed 13 mm per 3 m of wall height.

3. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 13 mm.

4. The base of the precast modular block wall excavation shall be within 50 mm of the staked elevations, unless otherwise approved by the Inspection Engineer.

5. Differential vertical settlement of the face shall not exceed 300 mm along any 61 m of wall length.

6. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 13 mm.

7. The wall face shall be placed within 50 mm of the horizontal location staked.

3.05 WALL INFILL AND REINFORCED BACKFILL PLACEMENT

A. Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:

1. 98% of maximum dry density at ± 2% optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.

B. Compactive effort within 0.9 m of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 0.9 m of the back of the precast modular blocks.

C. Backfill material shall be installed in lifts that do not exceed a compacted thickness of 230 mm.

D. At the end of each work day, the Retaining Wall Installation Contractor shall grade the surface of the last lift of the granular wall infill to a 3% ± 1% slope away from the precast modular block wall face and compact it.

E. The General Contractor shall direct the Grading Contractor to protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

3.06 OBSTRUCTIONS IN THE INFILL AND REINFORCED FILL ZONE

A. The Retaining Wall Installation Contractor shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.

B. Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the Retaining Wall Design Engineer can appropriately address the required procedures for construction of the wall section in question.

3.07 COMPLETION

A. For walls supporting unpaved areas, a minimum of 300 mm of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.
B. For retaining walls with crest slopes of 5H:1V or steeper, silt fence shall be installed along the wall crest immediately following construction. The silt fence shall be located 0.9 m to 1.2 m behind the uppermost precast modular block unit. The crest slope above the wall shall be immediately seeded to establish vegetation. The General Contractor shall ensure that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.

C. The General Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The General Contractor shall notify the Owner of any deviations.

END OF SECTION 32 32 16
1. PURPOSE

This manual is intended to serve as a guide for the proper installation and construction of a Redi-Rock retaining wall. The recommendations and guidelines presented here are intended to supplement detailed construction documents, plans, and specifications for the project.

2. RESPONSIBILITIES

Redi-Rock supports a Total Quality Management approach to Quality Assurance and Quality Control (QA/QC) in the planning, design, manufacture, installation, and final acceptance of a Redi-Rock wall. This approach requires the responsible party at each stage of the project ensure that proper procedures are followed for their portion of the work. The responsible parties during the construction phase of a Redi-Rock wall include the Contractor, Engineer or Owner’s Representative, and Redi-Rock licensed manufacturer. Their specific responsibilities for compliance are as follows:

CONTRACTOR

The Contractor is responsible for providing construction according to the contract documents, plans, and specifications for the project. The Contractor shall ensure that employees engaged in construction of the Redi-Rock wall understand and follow the project plans and specifications, are familiar with construction methods required, and have adequate safety training.

ENGINEER OR OWNER’S REPRESENTATIVE

The Engineer or Owner’s Representative is responsible for construction review to assure that the project is being constructed according to the contract documents (plans and specifications). The representative shall fully understand the project plans and specifications and shall perform adequate field verification checks to ensure construction is in conformance with the project requirements. The presence of the Engineer or Owner’s representative does not relieve the Contractor of their responsibilities for compliance with the project plans and specifications.

REDI-ROCK LICENSED MANUFACTURER

Redi-Rock blocks are produced by independently-owned licensed manufacturers. The manufacturer is responsible for the production and delivery of Redi-Rock units to the job site in accordance with published material quality, size tolerances, construction documents, plans, and specifications. The licensed manufacturer is responsible for adherence to any project specific QA/QC requirements for the production of precast concrete retaining wall units. Often, additional services—such as installation training classes—are available through the Redi-Rock manufacturer.

3. PRE-CONSTRUCTION CHECKLIST

Before you start construction of a Redi-Rock wall, take the time to complete necessary planning and preparation. This process will help ensure a safe, efficient, and quality installation. It will also help avoid costly mistakes.

SAFETY

Safety is of primary concern to Redi-Rock International. Redi-Rock walls must be installed in a safe manner. All local, state, and federal safety regulations must be followed. In addition, Redi-Rock International greatly encourages installers to set up company programs to help their people stay safe at work. These programs should address items such as: personal protective equipment, maintaining safe slopes and excavations, fall protection, rigging and lifting, and other safety precautions. Safety-training materials specific to your company can be found at www.osha.gov, by calling 1-800-321-OSHA (6742), or from your local government safety office.

ENGINEERING AND PERMITS

Obtain necessary engineering and permits for your project. Your local building department is an excellent resource to help determine the requirements for your project.

REVIEW THE PROJECT PLANS

Take the time to review and understand the project plans and specifications. Make sure that the plans take into account current site, soil, and water conditions. Pay close attention to silty or clayey soils and ground water or surface water on the site as these can significantly increase the forces on the wall. A pre-construction meeting with the wall design engineer, construction inspector, wall contractor, and owner or representative is recommended.

CONSTRUCTION PLANNING

Develop a plan to coordinate construction activities on your site. Make sure your plan specifically addresses how to control surface water during construction.

UTILITY LOCATION

Make sure to have underground utilities located and marked on the ground before starting any construction. Call 8-1-1, go online to www.call811.com, or contact your local utility company to schedule utility marking for your project site.
MATERIAL STAGING

Store Redi-Rock blocks in a location close to the proposed wall. Blocks should be kept clean and mud free. Blocks should also be stored in a location which will minimize the amount of handling on the project site.

Store geogrid in a clean, dry location close to the proposed wall. Keep the geogrid covered and avoid exposure to direct sunlight.

Be careful where you stockpile excavation and backfill material. Do not stockpile material over buried utility pipes, cables, or near basement walls which could be damaged by the extra weight.

MATERIAL VERIFICATION

Material planned for use as drainage aggregate between and behind Redi-Rock blocks and structural backfill material proposed for use in the reinforced soil zone of mechanically stabilized earth walls must be inspected and verified to comply with requirements of the construction documents, plans, and specifications.

EQUIPMENT

Make sure you have the proper equipment to handle Redi-Rock blocks and install the wall. Redi-Rock blocks are quite large and heavy. Make sure excavators and other construction equipment are properly sized to handle the blocks safely. (Figure 1)

Hand-operated equipment should include, at a minimum: shovels, 0.6-meter level, 1.2-meter level, broom, hammer, tape measure, string, spray paint, laser level, pry or Burke bar, walk-behind vibratory plate compactor (capable of delivering a minimum of 8.9 kN centrifugal force), and a 406-millimeter concrete cut-off saw. (Figure 2)

Personal protective equipment should include, at a minimum: appropriate clothing, steel toe boots with metatarsal protection, eye protection, hard hat, gloves, hearing protection, fall protection rigging, and other items as necessary to ensure a safe working environment.

4. SUBGRADE SOILS

Proper base preparation is a critical element in the construction of your retaining wall. Not only is it important to provide a stable foundation for the wall, but a properly prepared base will greatly increase the speed and efficiency of your wall installation. Proper base preparation starts with the subgrade soils.

Existing soils must be removed to the bottom of the leveling pad elevation for the retaining wall. The base and back of excavation should expose fresh, undisturbed soil or rock. Remove all organic, unsuitable, and disturbed soils that “fall-in” along the base of the wall or the back of the excavation. Always provide safe excavations in accordance with OSHA requirements.

The subgrade soil (below the leveling pad) should be evaluated by the Engineer or Owner’s Representative to verify that it meets the design requirements and to determine its adequacy to support the retaining wall. Any unsuitable material shall be excavated and replaced as directed by the on-site representative and per the requirements of the contract drawings, plans, and specifications.

Subgrade soils must be compacted to a density as specified in the contract documents, plans, and specifications but not less than 90% maximum density at ± 2% optimum moisture content as determined by a modified proctor test (ASTM D698). (Figures 3 and 4)
5. LEVELING PAD

Base preparation continues with proper leveling pad construction. Redi-Rock retaining walls can be
designed with an open-graded crushed stone, dense-graded crushed stone (GAB), or concrete leveling
pad which supports the bottom row of blocks. The choice of which type of leveling pad to use is made by
the wall design engineer and depends on several factors including the bearing capacity of the native soil,
location of the drain outlet, and conditions at the base of the wall.

Open-graded crushed stone is typically used in cases where the wall drain can outlet to daylight (by
gravity) somewhere below the elevation of the bottom of the leveling pad. (Figure 6A) The material
should be 25-millimeter diameter and smaller stone. A crushed stone meeting the gradation requirements
of ASTM No. 57 with no material passing the 0.075-millimeter sieve is preferred. The leveling pad
thickness shall be as designed by the wall design engineer. A minimum thickness of 150 millimeters
or 300 millimeters is common. The leveling pad should extend at least 150 millimeters in front and 300
millimeters behind the bottom block. Make sure to check your construction documents for details.

Dense-graded crushed stone or graded aggregate base (GAB) material is typically used in cases where
the wall drain can only outlet to daylight somewhere above the bottom of the leveling pad. (Figure 6B)
The material should be dense-graded crushed stone with between 8 and 20% “fines” which will pass
through a 0.075 millimeter sieve. The leveling pad thickness shall be as designed by the wall design
engineer. Minimum dimensions are the same as those for an open-graded crushed stone leveling pad.

The leveling pad material should be placed and compacted to provide a uniform, level pad on which to
construct the retaining wall. (Figure 5) Proper elevation can be established with a laser level or transit.

Place the stone leveling pad in uniform loose lifts a maximum of 150 millimeters thick. Consolidate
the stone with a minimum of three passes with a 610-millimeter wide walk-behind vibrating plate
compactor capable of delivering at least 8.9 kN of centrifugal force. This should achieve 90% relative
density of the stone determined in accordance with ASTM D-4253 and D-4254. In place density of the stone
fill should be confirmed using ASTM D-6938. If you don’t achieve a minimum of 90% relative density, place
the stone in smaller lifts or apply more compaction effort until you do achieve desired density of the stone.

Unless specifically included in the design calculations, do NOT place a thin layer of sand between the leveling
pad and bottom block. This layer will reduce the sliding resistance between the leveling pad and bottom block.

In some cases, the wall design requires the construction of a concrete leveling pad. (Figures 6C
and 6D) Construct the leveling pad according to the detailed plans for your project.

Some designs require a shear key in the bottom of the footing and/or a lip in front of the Redi-Rock blocks.
These items would be shown in the project plans.

If steel rebar is to be placed in the footing, secure the bars together with wire ties in the pattern shown in the
construction documents. Use rebar supports to hold the rebar structure in the proper position in the footing.

Place wood formwork at the front and back of the concrete leveling pad or footing. The top of the
formwork should be placed at the elevation of the top of the concrete footing so you can screed the top smooth
in preparation for block placement. It is important that the top surface be smooth and level for full contact of
the retaining wall blocks. Place concrete as specified to cure to the minimum specified strength, place
the bottom blocks and continue construction of the retaining wall.
6. SETTING THE BOTTOM ROW OF WALL BLOCKS

Redi-Rock blocks are typically delivered to the construction site using a flatbed trailer or boom truck. (Figure 7) Rubber-tired backhoes, loaders, skid steers, or excavators are used to set the retaining wall blocks. (Figure 8) Make sure to use the proper sized equipment to handle the large blocks. All lifting chains, rigging, or slings must be OSHA compliant and safety rated for proper working loads.

Properly mark the location of the retaining wall. A string line or offset stakes are typically used to establish horizontal and vertical alignment. If offset stakes are used, the stakes should be placed at least 1.5 meters but no more than 3 meters in front of the face of the retaining wall. A stake should be provided at every elevation change and at a maximum of 15 meters apart.

**Wall construction should start at a fixed point such as a building wall, 90° corner, or at the lowest elevation of the wall.**

Place the blocks on the prepared leveling pad. Blocks shall be placed in full contact with the leveling pad and other immediately adjacent block units. (Figure 9) Block alignment should be established by lining up the “form line” where the face texture meets the steel form finished area at the top of the block, approximately 130 millimeters back from the front face. (Figure 10)

Check all blocks for level and alignment as they are placed. Small adjustments to the block location can be made with a large pry or Burke bar. Proper installation of the bottom block course is critical to maintaining the proper installation of all subsequent block courses within acceptable construction tolerance. It also makes installation of the upper rows of blocks much easier and more efficient.

Place and compact backfill in front of the bottom block course prior to placement of subsequent block courses or backfill. This will keep the blocks in place as drainage aggregate and backfill are placed and compacted.

Place a 457 millimeter x 305 millimeter piece of non-woven geotextile fabric in the vertical joint between the blocks to prevent the drainage aggregate and backfill material from migrating through the vertical joints between blocks. (Figure 11)

Place washed drainstone or open-graded crushed stone backfill between blocks and at least 300 millimeters behind the wall. A stone meeting the gradation requirements of ASTM No. 57 with no material passing the 0.075-millimeter sieve is preferred. Place the stone in uniform loose lifts a maximum of 150 millimeters thick. Consolidate the stone with a minimum of three passes with a 610 millimeters wide, walk-behind, vibrating plate compactor capable of delivering at least 8.9 kN of centrifugal force. (Figure 12) This should achieve 90% relative density of the stone determined in accordance with ASTM D-4253 and D-4254. In place density of the stone fill should be confirmed using ASTM D-6938. If you don’t achieve a minimum of 90% relative density, place the stone in smaller lifts or apply more compaction effort until you do achieve desired density of the stone.

Place non-woven geotextile fabric between the drainstone and the remaining backfill material if specified.

Backfill behind the drainage aggregate with material as specified in the project construction documents. Place the lifts as specified, but not to exceed 230 millimeters maximum. Granular backfill shall be compacted to a minimum of 95% maximum density as determined by a standard proctor test (ASTM D698). Use proper equipment to insure complete compaction of the backfill material. It may be necessary to wet or dry the backfill material, place the material in smaller lifts, and/or apply more compaction effort to reach 95% maximum density. Do not use any organic, topsoil, frozen, soft, wet, or loose soils when backfilling the wall.

Re-check all units for level and alignment and sweep the top of each course of blocks clean before starting construction of the next course.
7. INSTALLING THE WALL DRAIN

A drain is placed behind the Redi-Rock wall blocks at the lowest elevation where the pipe can safely outlet to daylight. Drainage aggregate should be placed to the bottom of the drain as shown in the construction documents. A 100 millimeter perforated sock drain is commonly used for the drain pipe. Often the drain is encapsulated with drainage aggregate and wrapped with a non-woven geotextile fabric. The drain should run the entire length of the wall and needs to have proper outlets on the ends and at regularly spaced points along the wall. (Figure 13)

Care needs to be taken during installation to avoid crushing or damaging the drain pipe or outlets.

8. SETTING UPPER ROWS OF WALL BLOCKS

Once the backfill is fully placed and compacted for the block course below, place the next row of blocks in a running bond configuration with the vertical joint of the lower block units centered under the mid-point of the block units above. If needed, a half block can be used at the end of every other row to maintain a running bond. (Figure 14)

Push the Redi-Rock blocks forward until the groove on the bottom of the block comes in full contact with the knobs on the blocks below. Adjacent blocks shall be placed with their front edges tightly abutted together.

Place non-woven geotextile fabric in the vertical joint between the blocks, and place and compact the drainage aggregate and backfill material the same way you did for the bottom row.

Never install more than one course of blocks without placing and compacting drainage aggregate and backfill to the full height of the block units. Placing multiple courses of blocks without backfill will prevent the proper placement and consolidation of the drainage aggregate between the blocks.

9. INSTALLING GEOGRID FOR MECHANICALLY STABILIZED EARTH WALLS

Redi-Rock blocks are designed to allow you to build relatively tall non-reinforced (or gravity) walls which use the weight of the blocks to provide stability. However, for some projects you may need to build even taller walls. In these cases, mechanically stabilized earth (MSE) retaining walls can be built with the Redi-Rock Positive Connection (PC) System.

The geogrid used in Redi-Rock PC System walls are 300-millimeter wide strips of PVC coated polyester geogrid that wrap through a vertical core slot cast into the block and extend full length into the reinforced soil zone on both the top and bottom of the block.

It is critical that you only use factory cut strips of Mirafi geogrid that are certified by TenCate Mirafi for width and strength. Field cutting strips of geogrid from larger rolls can significantly degrade the capacity of the wall system and is not allowed. Geogrid strips are only available through a Redi-Rock Manufacturer. (Figure 15)

Verify that you have the correct geogrid material and then cut the individual strips to the required length. The distance a geogrid strip must extend into the reinforced soil zone (design length) is measured from the back of the block to the end of the geogrid. Since the geogrid wraps through the block, the actual cut length of a given geogrid strip is two (2) times the design length plus enough additional geogrid to wrap though the block. For the Redi-Rock 710-millimeter PC blocks, the cut length is two (2) times the design length plus 0.9 meters.

Inspect the Redi-Rock PC blocks for any concrete flashing or sharp edges in the slot and groove through the block. Remove any flashing and grind smooth any sharp edges which could damage the geogrid reinforcement.

Place the geogrid strip in the vertical core slot from the bottom of the block and pull approximately half of the length of the strip up through the core slot. Measure from the back of the block unit to the required design length and pin the bottom leg of the geogrid strip with staples, stakes, or other appropriate methods. Pull the geogrid strip tight to remove any slack, wrinkles, or folds. Secure the geogrid firmly in place by putting a pin through the geogrid and the steel lifting insert which is located in the recessed area on the top of the PC block (Figure 16) or placing drainage aggregate in the vertical core slot.
INSTALLATION GUIDE

Place drainage aggregate between and behind the blocks. (Figure 17) Place the stone in uniform loose lifts as required in the project plans and specifications. Consolidate the stone between the blocks by hand tamping. Make sure to tamp stone into the ends of the groove on the bottom of the Redi-Rock PC blocks. Consolidate the stone behind the blocks with a minimum of three passes with a 610-millimeter wide walk-behind vibrating plate compactor capable of delivering at least 8.9 kN of centrifugal force.

Provide further compaction if needed to meet the density specified in the contract documents, but not less than 90% relative density of the stone determined in accordance with ASTM D-4253 and D-4254.

Figure 17

Figure 18

Place a strip of non-woven geotextile fabric between the drainage aggregate and the reinforced soil zone if specified.

Place the reinforced soil zone material in uniform loose lifts as required in the project plans and specifications. Reinforced soil zone material must be compacted to a density as specified in the contract documents, plans, and specifications but not less than 95% maximum density as determined by a modified proctor test (ASTM D1557).

Begin compaction at the back of the wall blocks and proceed to the embedded end of the geogrid strip using care to maintain the reinforcement strip in a level, taut condition oriented perpendicular to the back of the block unit to which it is attached.

Use hand operated compaction equipment within 1 meter of the back of the PC blocks. Heavier equipment can be used beyond 1 meter away from the PC blocks. Tracked construction equipment must not be operated directly on the geogrid strip reinforcement. A minimum fill thickness of 150 millimeters is required for the operation of tracked vehicles over the geogrid strips. Turning of tracked vehicles should be kept to a minimum to prevent displacement of the fill and the geogrid strips. Rubber-tired vehicles may pass over the geogrid strips at a slow speed of less than 8 km/hr. Sudden breaking and sharp turning should be avoided.

After placing and properly compacting backfill to the elevation of the geogrid strip at the top of the block, extend the top leg of the geogrid strip to the design length required. Pull the geogrid strip tight to remove any slack, wrinkles, or folds. (Figure 18) Pin the top leg of the geogrid strip with staples, stakes, or other appropriate methods to hold it in place and keep the geogrid strip taut.

Fill the center slot in the PC blocks with drainage aggregate. Be careful to keep the grid flat against the back of the slot in the PC block and prevent any stone from lodging between the geogrid and the concrete block. Fill the vertical core slot completely with drainage aggregate. Consolidate the drainage aggregate by hand tamping. Use a broom to sweep clean the top of the blocks. Do not operate a walk behind vibratory plate compactor on top of the Redi-Rock PC blocks.

Place retained soil immediately between the end of the reinforced soil zone (identified as the embedded end of the geogrid reinforcement strips) and the back of the excavation. Compact retained soil to a density as specified in the contract documents, plans, and specifications but not less than 95% maximum density as determined by a standard proctor test (ASTM D698). Maximum differential elevation between the reinforced fill and the retained soil fill should never exceed 450 millimeters.

Continue construction in a similar fashion to the top of the wall. (Figure 19)
10. XL HOLLOW-CORE RETAINING BLOCKS

The greater width of XL blocks allows gravity walls to be built to greater height, while the greater individual block heights means that each block creates more area of wall face. XL block retaining wall installation generally follows the procedures of other Redi-Rock products, with a few differences.

Following the general procedures of sections 1 to 9, prepare the subgrade soils and place the leveling pad. The required leveling pad thickness will depend on the design by the wall design engineer, but will generally be a minimum of 305 millimeters thick.

Use appropriately-rated rigging fastened to the three lift hooks (one in the middle and two in the back of the blocks) and suitable heavy equipment to lift blocks into place. Place the first row of blocks to the correct line and grade. Just as with other Redi-Rock products, extra attention to ensure the first row of blocks is level and installed to the correct line and grade will save effort later as the installation proceeds.

Place two 457 millimeter by 457 millimeter pieces of non-woven geotextile fabric in each vertical joint between blocks – one on the upper half of the joint and one in the lower, wedge-shaped portion of the joint - to prevent the drainage aggregate and backfill material from migrating through the vertical joints at the blocks’ face. Place washed drainstone or open-graded crushed stone backfill into the hollow cores of the blocks and between blocks in lifts of no more than 230 millimeters deep. Compact each lift by tamping until no further consolidation occurs with a soil tamper or other similar method. Strike off the top and sweep the upper surface of the blocks so the next row will sit cleanly on the lower row.

Due to the high percentage of open-graded stone within and between blocks, a drainage course behind the blocks is not required, but may be desirable to ease compaction of backfill and improve drainage. Place a layer of nonwoven geotextile fabric between the back of blocks (or drainstone layer, if used) and retained backfill.

Place and compact backfill as described above and repeat as necessary to reach the required height. Finish the top of wall with one or more rows of 457 millimeter high retaining blocks or freestanding blocks.
11. SPECIAL FEATURES

Some walls require special features such as curves, corners, top of wall details, details for elevated groundwater applications, and other details. Refer to the construction documents, plans, and specifications for details to construct these features. Additional general reference construction details are available on the Redi-Rock website, redi-rock.com.

12. IMPORTANT NOTES

Best practice dictates that wall construction should continue without interruption or delays. This will help expedite construction and minimize the time the excavation is open.

The construction site should be graded and maintained to direct surface water runoff away from the retaining wall throughout the entire construction process.

Do not exceed the allowable construction tolerances specified in the contract documents, plans, and specifications. At no time should tolerances at the wall face exceed 1° vertically and 25 millimeters 3 meter (1:120) horizontally.

Immediately report the following site conditions, if encountered, to the Engineer or Owner’s representative to determine the corrective action needed:

- Any observed groundwater seepage.
- Surface water run-off directed toward the retaining wall during construction.
- Erosion or scour of material near the wall.
- Ponded water near the wall.
- Wet, soft, or easily compressible soils in the foundation zone.
- Existing rock that differs in location from that shown on the project plans or rock located above the elevation of the bottom of the leveling pad.
- Existing or proposed toe or crest slopes that differ from typical cross-sections shown in the project plans.
- Any other items not specifically mentioned which raise questions or cause concerns during wall construction.

Immediately implement any corrective action before resuming wall construction.
13. FREESTANDING WALLS

Redi-Rock freestanding wall blocks have facing texture on two or three sides. They are used in applications where two or three sides of the wall are visible. Freestanding blocks can be installed as “stand alone” walls, such as perimeter walls or fences. They can also be designed and installed as the finishing top courses on a Redi-Rock retaining wall.

Freestanding wall installation is similar to that for Redi-Rock retaining walls. The main exception is that there is typically no backfill material behind the freestanding walls. Even though there is no backfill acting on the walls, freestanding walls need to be properly engineered. They require adequate stability at the base of the wall and they need to resist any applied forces such as wind loads or forces from railings or fences.

If you are building a “stand alone” freestanding wall, prepare the subgrade soils and leveling pad as described previously. Place bottom blocks on the leveling pad. A 150 millimeter minimum bury on the bottom block is typical. Extra bury may be required for some projects. Middle and top blocks are placed directly on top of the bottom blocks with no batter.

If you are building a freestanding wall on the top of a Redi-Rock retaining wall, end the last row of retaining wall blocks with a middle block. The size of the knob on top of the last row of retaining wall blocks will establish the setback for the first row of freestanding blocks. Retaining blocks with a 254-millimeter diameter knob will produce a 73 millimeter setback between the retaining block and the first freestanding block. If the retaining blocks have a 190 millimeter diameter knob, the setback between the retaining block and the first freestanding block will be 41 millimeters. Be sure to contact your local Redi-Rock manufacturer to determine availability of blocks with different knob sizes.

Begin and end freestanding walls with full or half Corner blocks.

Freestanding walls are installed plumb with no batter.

Variable radius freestanding blocks with a 100 millimeter x 305 millimeter pocket in one or two ends of the block are used to make curved walls. Field cut the relatively thin face texture on the ends of the variable radius blocks as needed to make the desired radius for your wall. (Figure 24)

14. FREESTANDING HOLLOW-CORE WALLS

Redi-Rock Freestanding Hollow-Core units are stacked, similar to other Redi-Rock freestanding blocks, but then filled with concrete. Freestanding Hollow-Core Blocks work well for freestanding barriers, and can also be utilized for cantilever retaining walls.

CANTILEVERED WALLS

For many applications, the Freestanding Hollow-Core Blocks will be supported by a reinforced concrete footing. Prior to placing the footing, layout the wall to determine the locations of the open cores in the staggered rows of hollow-core units. This will help determine where rebar should be placed in the footing. When determining vertical rebar placement, consider the equipment that will be used to set the block to help avoid conflicts. Number and size of rebar will depend upon the engineer’s structural design.

Construct the footing on a competent subgrade per the design drawings. Once the footing has cured, use a stringline to mark the alignment of the blocks (usually the inside of the block). Begin setting blocks. A scissors-type clamp works well. (Figure 25) Alternatively, straps looped around the interior ribs can be used, as well.
Corners can be constructed in the wall using hollow-core corner blocks. These blocks have texture on three sides. For a tight fit between blocks, the texture on the corner block can be trimmed by 50 to 75 millimeters where it abuts the adjacent block. If the design requires continuous rebar, cut a section out of the side of the corner block aligned with the hollow core of the adjacent block. **(Figure 26)**

Place horizontal rebar in the blocks, supported in the grooves on the interior structural ribs. Place the vertical rebar, lapping and tying, as required.

Stack the next row of block, making sure to carefully align the blocks and staggering the joints to create a running bond. We recommend stacking no more than three courses of block without filling the core.

Prior to infilling the wall, we suggest grouting the joints between blocks with non-shrink standard grout. This helps prevent leakage during infilling, and provides an aesthetic element.

Infill the hollow core of the wall with ready-mix concrete meeting the requirements of the design. Place the concrete carefully to prevent misalignment of the rebar. While filling, use an internal concrete vibrator to ensure consolidation and eliminate voids.

**COPING**

Freestanding Hollow-Core Blocks can be placed on Redi-Rock PC-series walls to create a freestanding coping. The connection uses a No. 3 rebar hook to tie the coping to the upper PC blocks.

Install a No. 3 rebar hook through the lifting hook in each PC block and let the hook lay on the shear knob.

Install PC geogrid strips, if required. Fill the PC core with stone to the recess area. Place plastic sheeting over the geogrid exposed in the PC core.

Set the Freestanding Hollow-Core Blocks in place on the PC blocks.

Install the horizontal and vertical reinforcing steel, as required by the design. Pull the rebar hooks up into the Freestanding Hollow-Core Blocks core and engage with the horizontal rebar. Fill the hollow cores with concrete. **(Figures 27 & 28)**
WATER CONTROL APPLICATIONS
A few additional details can be incorporated into Freestanding Hollow-Core walls to improve their water-tightness for flood control and other water-related applications. (Figure 29)

Prior to constructing the footing, perform any subgrade preparation, soil improvements, and/or drainage installation as required by the design.

Install an appropriate waterstop at the joint between the footing and the bottom of the wall, following the waterstop manufacturer’s recommendations.

When using a ribbed center bulb strip, install it prior to pouring concrete for the footing such that it will be half embedded in the footing. Commonly, it will require attaching to the footing rebar with wire ties.

A bentonite/butyl rubber expandable waterstop can be installed on top of the footing prior to installing the first row of blocks. Be sure to protect the strip from damage and keep it clean.

A keyway can be cast into the footing if required by the design.

Avoid block-to-block joints where structural ribs from adjacent blocks will be in contact, as this will result in a joint with little, if any, cast-in-place concrete available to resist water flow. If necessary, remove one of the offending ribs with a concrete saw.

When placing concrete, extra care should be taken to fully consolidate the concrete to eliminate voids which could become conduits for water. Integral crystalline waterproofing admixtures are available that can reduce permeability and seal small cracks. Additional measures, such as sealing exposed joints with non-shrink grout and/or mastic and casting a slab against the wall can also be used to reduce water penetration. Foundation waterproofing experts should be consulted to select and assist with the installation of any performance improvement measures.

15. CAP INSTALLATION

Cap or step blocks are commonly used on top of freestanding walls to provide a finished look. (Figure 30)

Mark the center of the freestanding blocks to monitor the correct running bond spacing.

Secure the cap with construction adhesive, polyurethane sealant, or mortar. If construction adhesive is used, it should meet the requirements of ASTM D3498 and C557 and HUD/FHA Use of Materials Bulletin #60. Two examples are Titebond Heavy Duty Construction Adhesive by Franklin International or PL Premium Construction Adhesive. If polyurethane sealant is used, it should be one-component, highly-flexible, non-priming, gun-grade, high-performance elastomeric polyurethane sealant with movement of ± 25% per ASTM C719, tensile strength greater than 1.4 MPa per ASTM D412, and adhesion to peel on concrete greater than 3.5 N/mm per ASTM C794.

Adhesive or sealants should be applied in 40 millimeter diameter round “Hershey Kiss” shaped dollops located in two rows at the top of the freestanding blocks at 200 millimeters on center.

Caps can be cut as needed for proper alignment. If desired, grout the joints between cap blocks after installation with a non-shrink grout.
16. FORCE PROTECTION WALLS

Install a threaded termination end on the end of the cable. Electroline M Series terminations manufactured by Esmet, Inc. work well.

Thread cable with a termination end through all the blocks. It is important that the cable is placed in each course of blocks prior to placing the next course.

Pull the cable through the block on the far end of the wall until approximately 50 millimeters of threads protrude beyond the end of the blocks. The exposed threads will provide room to place for a 16 millimeter x 150 millimeter x 230 millimeter steel plate over the exposed threads and start the nut.

Mark and cut the cable at the starting end of the wall so that 100 millimeters of cable protrudes beyond the block, providing room a 16 millimeter x 150 millimeter x 230 millimeter steel plate and ferrule termination fitting.

After the cable has been cut, slide the entire cable several feet (meters) towards the ferrule end so that you will have room to work. Install a steel plate and ferrule termination end on the cable.

Pull the cable snug so that the ferrule is against the steel plate. There will be 51 millimeters of thread exposed at the far end of the wall which has the termination end on the cable.

Place the steel plate over the threads and start the nut. The nut can be tightened to the desired tension.

Force Protection Coping With J-Bolts and Post-Tensioned Cable

- This drawing is for reference only.
- Final designs for construction must be prepared by a registered Professional Engineer, using the actual conditions of the proposed site.
- Final wall design must address both internal and external drainage and shall be evaluated by the Professional Engineer who is responsible for the final design.
**17. REDI-ROCK COLUMNS**

Redi-Rock column blocks are available to complement Redi-Rock walls. Columns can be installed by themselves or with fences or gates.

Column blocks can be placed on properly prepared aggregate or concrete leveling pads or directly on Redi-Rock retaining wall blocks, depending on the specific design for your project.

Column blocks can be manufactured with pockets for concrete or split wood fence rails.

Concrete adhesive or polyurethane sealant can be used between stacked column blocks.

Install a cap on the top of a column. Adjust the cap position until all sides are equidistant and square to the column. Secure the column cap with construction adhesive or polyurethane sealant.

Special inserts are available for mounting gates or similar features to Redi-Rock columns.

Column blocks are available with 100 millimeter or tapered 200 millimeter diameter cores which can be filled with stone or concrete and steel rebar reinforcement.

A conduit can be left through the core if needed for lighting or other features.

---

**J-BOLT INSTALLATION**

J-Bolts can be used to secure force protection walls to the top row of retaining wall blocks (when used on the top of a Redi-Rock wall) or to concrete anchors set in the ground (for a stand alone wall).

Set force protection blocks with the ends centered on ground anchors or the center of Redi-Rock middle retaining wall blocks immediately below.

Place a clip between blocks in hooks provided in the middle of the block on each end.

Place a J-bolt through center of the clip, thread a nut on the J-bolt, and tighten.

Repeat for all remaining courses of force protection blocks.
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**Large Batter Wall Section**

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**Alternating Planter & Standard Batter Wall Section**

The Redi-Rock retaining blocks are available with multiple shear knob size and location options, to permit wall batter design flexibility. This detail depicts alternating 422 mm Planter and 41 mm Standard setback blocks, however designs are possible using more than one Standard setback block between Planter blocks. The regular repetition of combinations of different setback blocks within a wall profile can have structural and aesthetic significance. Abrupt changes in wall batter that carry over multiple blocks are not recommended.

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**Typical Reinforced Wall Section**

- **Drainage aggregate**
- **Leveling pad (As specified by Engineer)**
- **305 mm wide strip of geogrid wrapped through block and extending full length (L) back into reinforced fill zone (Typical)**
- **Move blocks forward during installation to engage shear knobs (Typical)**
- **Fill vertical core slot and wedge between adjacent blocks with drainage aggregate (Typical)**
- **Drain (As specified by Engineer)**
- **Non-woven geotextile fabric (If specified by Engineer)**
- **710 mm PC Middle block (Typical)**
- **710 mm PC Bottom block**
- **Reinforced Soil**
- **Setback = 41 mm (5° batter angle on wall)**

**Note:**
One degree or zero degree batter angle walls are available using blocks with 190 mm or 171 mm knobs (Specialty items)

**Setback** = 41 mm

**Exposed wall** (Height varies with design)

**Bury depth**

**Water surface** (Elevation varies)

---

**Typical Seawall Detail**

- **Drainstone (ASTM No. 57 or Equivalent)**
- **Non-woven geotextile fabric**
- **Armor stone as specified by local Professional Engineer**
- **Grade to drain surface water away from wall**
- **Optional Concrete Footing**
- **Steel Reinforcement As Required per Footing Design**
- **Shear Curb (Lip on Top of Footing) for Bottom Block Sliding Resistance**
- **Footing Size and Dimensions per Site Specific Design**

**Notes:**
- Use ASTM No. 57 stone (or as specified by local Professional Engineer) to infill between blocks.
- Preliminary wall height charts do not apply and should not be used for walls in water applications due to the variety of site-specific variables.
- Contact your local Professional Engineer for specific details and final design.
- Walls may require geogrid reinforcement.
- Refer to final engineering plans.
**NOTES:**
- Use ASTM No. 57 stone (or as specified by local Professional Engineer) to infill between blocks.
- Maximum wall height charts are not provided for walls in water applications due to the variety of site-specific variables. Contact your local Professional Engineer for specific details and final design.
- Walls may require geogrid reinforcement. Refer to final engineering plans.
- Seawalls could be constructed with filled trough Planter Blocks using a 422 mm setback per course.

**Conceptual Sheetpile Protected Seawall Detail**

**Wall Drainage Options**

**Typical Section - Option 1**
- Drain pipe (As specified)
- Drainage aggregate (In wedge between blocks, in vertical core slot, and 305 mm behind blocks)

**Typical Section - Option 2**
- Drain pipe (As specified)
- Drainage aggregate (In wedge between blocks and in vertical core slot)

**Blanket and Chimney Drain Section**
- Drain pipe (As specified)
- Coarse drainage aggregate (AASHTO No. 57 or equivalent)

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TYPICAL CONSTRUCTION DETAILS

Typical Drainage Detail - Cross Section

- Grade to drain surface water away from wall
- Drainage (AASHTO No. 57 or equivalent) to extend at least 305 mm behind 457 mm high Redi-Rock blocks
- Non-woven geotextile fabric at back of XL blocks and between drainstone and retained soil (if specified by Engineer based on site soil conditions)
- Non-woven geotextile fabric between adjacent blocks at face (required)
- Fill all void spaces in and between blocks with drainstone (AASHTO No. 57 or equivalent)

Alternate Detail for Concrete or Impervious Leveling Pad

- Perforated pipe, gravity drain to outlet (as specified by Engineer)
- Crushed stone leveling pad

Typical Drainage Detail - Isometric View

- Grade to drain surface water away from wall
- Extend geotextile over drainstone and below surface materials
- Drainage (AASHTO No. 57 or equivalent) to extend at least 305 mm behind 457 mm high Redi-Rock blocks
- Non-woven geotextile fabric at back of XL blocks and between drainstone and retained soil (if specified by Engineer based on site soil conditions. Shown cut away.)
- Fill all void spaces in and between blocks with drainstone (AASHTO No. 57 or equivalent)

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Steps Through Wall

Freestand Blocks or Retaining Blocks (Per Design)

Retaining Wall Blocks (Per Design)

Step Blocks Placed Tight Against Wall Return Wall. Field Cut Step Blocks to Fit When Return Wall Has Batter

Approach Grade

Slope 1%-2% for Drainage

300 mm min

152 mm TYP

150 mm Compacted Granular Base Below Steps

90° Battered Corner - Flush End

Notes:

- Wall is flush with building.
- Rows 2, 4, 6, and 8 require approximately 3 mm gaps between blocks for length of wall shown.
- Solution shown based on a 610 mm wide corner block.

Stair Section

90° Battered Corner - Flush End

Short Block (Typical)

Corner Block (Typical)

Row | Short Blocks Required
--- | ---
1 | 0
2 and 3 | 1 per Row
4 and 5 | 2 per Row
6 and 7 | 3 per Row
8 | 4 per Row

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Double 90° Outside Corner - Short Block Solution

Alternate long and short face of Freestanding Corner block on either end of row for proper spacing (Typical)

Short Block Requirements
1. Short Block on the 2nd Row
2. Short Blocks on the 3rd Row
3. Short Blocks on the 4th Row
4. Additional Short Block For Every Additional Row to the Top of the Wall

Retaining block (Typical)

Transitions Into Planters

One knob on each block must be removed from the planter blocks at the transition into and out of planters. Planter transitions will alter the bond (vertical joint) alignment from course to course.

Full and Half Corner Blocks

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This drawing shows typical installation details required for setback walls with the bottom of the wall aligned. Specific block placement will vary depending on site grades.

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**Freestanding Blocks with Cap at Top Wall**

- Setback = 0 mm on Freestanding blocks
- Setback = 73 mm when 254 mm knob used
- Setback = 41 mm when 190 mm knob used
- Setback = 41 mm when 254 mm knob used

To secure the cap block to the freestanding block, use polyurethane sealant. Optional shear lugs cast into the cap block or rebar ties that can be embedded in site-cast concrete (with garden block) are also available.

**Section View**

- Freestanding blocks used where block is exposed and textured surface is required on both sides of the wall.
- One-component, highly flexible, non-priming, gun grade, high performance elastomeric polyurethane sealant shall have movement of plus or minus 25% per ASTM C719, tensile strength greater than 1.4 MPa per ASTM D412, and adhesion to peel on concrete greater than 3.5 N/mm per ASTM C794. Apply sealant in 38 mm diameter round “hersey kiss”-shaped dollops located in two rows at the top of the Freestanding blocks at 200 mm on center.

**Front View**

- Freestanding blocks used where block is exposed and textured surface is required on both sides of the wall.

**Back View**

- Freestanding blocks used where block is exposed and textured surface is required on both sides of the wall.

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**Drainage Swale Options**

- **Grass Swale**
  - 0.75 mm PVC or EPDM geomembrane (Textured on both sides)
  - Non-woven geotextile fabric (AASHTO M288 Survivability Class 2) between geomembrane and soil

- **Concrete Swale**
  - Non-woven geotextile fabric (AASHTO M288 Survivability Class 2)

- **Drainage Swale Behind Wall**
  - Grade swale cross-slope to provide 1% to 2% (minimum) fall parallel to wall
  - Grade swale around blocks in step down areas
  - Rock check dams as required

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TYPICAL CONSTRUCTION DETAILS

Top of Wall Step Options

Stack bricks under back corner of Corner Garden block to keep block supported prior to backfilling

Grade drops along back and end of Corner Garden block

Alternate Garden Block Placement

Sawcut and remove inside edge of Corner Garden block and fill with topsoil (Recommended)

Grade drops along side of Corner Garden block

Top of Wall 230 mm Stepdown Blocks

Freestanding block or Top Retaining block (Typical)

Freestanding Corner block (Typical)

230 mm Stepdown block (Garden insert optional)

Sawcut and remove inside edge of Corner Garden block and fill with topsoil (Optional)

Field cut stepdown block to length (if needed)

Middle Block with no knobs (Typical)
(Specialty block / Non-inventory item)

Retaining blocks (Typical)

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TYPICAL CONSTRUCTION DETAILS

**Geogrid Layout for Convex Curves and Radial Corners**

- Geogrid strips may be overlapped directly.
- Reinforcement effective unit perimeter for pullout calculations, \( C = 1.5 \) (1 side full contact with soil, 1 side partial contact with soil).

### Minimum radius for bottom row

<table>
<thead>
<tr>
<th>Number of courses</th>
<th>Height of wall</th>
<th>Radius from face of block</th>
<th>Distance between blocks*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.46 m</td>
<td>4.42 m</td>
<td>3 mm</td>
</tr>
<tr>
<td>2</td>
<td>0.91 m</td>
<td>4.47 m</td>
<td>5 mm</td>
</tr>
<tr>
<td>3</td>
<td>1.37 m</td>
<td>4.52 m</td>
<td>7 mm</td>
</tr>
<tr>
<td>4</td>
<td>1.83 m</td>
<td>4.57 m</td>
<td>9 mm</td>
</tr>
<tr>
<td>5</td>
<td>2.29 m</td>
<td>4.62 m</td>
<td>11 mm</td>
</tr>
<tr>
<td>6</td>
<td>2.74 m</td>
<td>4.67 m</td>
<td>13 mm</td>
</tr>
<tr>
<td>7</td>
<td>3.20 m</td>
<td>4.72 m</td>
<td>15 mm</td>
</tr>
<tr>
<td>8</td>
<td>3.66 m</td>
<td>4.76 m</td>
<td>16 mm</td>
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<td>4.11 m</td>
<td>4.83 m</td>
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<td>10</td>
<td>4.57 m</td>
<td>4.88 m</td>
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<tr>
<td>11</td>
<td>5.03 m</td>
<td>4.93 m</td>
<td>21 mm</td>
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<tr>
<td>12</td>
<td>5.49 m</td>
<td>4.98 m</td>
<td>22 mm</td>
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<tr>
<td>13</td>
<td>5.94 m</td>
<td>5.03 m</td>
<td>24 mm</td>
</tr>
<tr>
<td>14</td>
<td>6.40 m</td>
<td>5.08 m</td>
<td>26 mm</td>
</tr>
</tbody>
</table>

*Distance between blocks is measured at the back of 110 mm blocks and 610 mm behind the face parting (back edge of face texture) for 1030 mm blocks. This distance is intended to be a guide only. Minimum radius is controlling.

4.42 m is the minimum radius for Redi-Rock blocks. It occurs when all the blocks are placed tight together. A larger radius is required on the bottom row of a Redi-Rock wall to account for the batter between courses of blocks and still provide enough space to construct the top row of blocks.

- Place 457 mm high piece of non-woven geotextile fabric (AASHTO M288 Survivability Class 3) in joint between blocks (Typical).
- Place stone in joint between adjacent blocks.

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**Geogrid Layout for Concave Curves and Radial Corners**

- Geogrid strips (for blocks on current layer)
- Geogrid strips (for blocks on current layer)
- Geogrid strips (for blocks one layer down)

- Place stone in joint between adjacent blocks.

- When blocks become too closely spaced, place fabric across joint at back of blocks.

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Utilities in the Reinforced Soil Zone

- Storm or Sanitary Sewer Pipe:
  - Keep sufficient separation to meet max geogrid slope and clearance requirements.
  - Maintain 75 mm minimum between geogrid and pipe.
  - Wrap pipe joints with non-woven geotextile fabric (AASHTO M288 Survivability Class 2).
  - Storm drain or sanitary sewer pipe installed parallel to wall.
  - AASHTO No. 57 stone (or equivalent) 150 mm minimum around pipe.
  - Wrap pipe with non-woven geotextile fabric (AASHTO M288 Survivability Class 2).
  - Install geogrid strips above and below pipe.

- "Dry" Utilities (Electric, Gas, Telecommunications):
  - Keep sufficient separation to meet max geogrid slope and clearance requirements.
  - Maintain 75 mm minimum between geogrid and pipe.
  - "Dry" Utilities installed parallel to wall.
  - Install geogrid strips above and below pipe.

Redi-Rock International follows the recommendations of FHWA GEC 011 and discourages placing pipes or other horizontal obstructions behind the wall in the reinforced soil zone. Placing pipes in this zone could lead to maintenance problems and potential wall failure.

Pipes Installed Perpendicular Through Wall

- Storm or Sanitary Sewer Pipe:
  - Pipe protruding through wall (1.22 m diameter concrete pipe shown).
  - Use adequate measures to address scour, runoff, and other issues at base of wall.
  - Concrete collar (Cast-in-place around pipe).
  - Non-woven geotextile fabric (AASHTO M288 Survivability Class 1) 360° around pipe and behind collar.

- Control joint (if needed).
  - Plan View
  - Section View
  - Remove only the minimum number of blocks required to fit pipe through wall.
  - Use adequate measures to address scour, runoff, and other issues at base of wall.
  - Use adequate measures to address scour, runoff, and other issues at base of wall.
  - Use adequate measures to address scour, runoff, and other issues at base of wall.

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These generic pedestrian guard and fence details show a few potential options for their installation on the top of a Redi-Rock retaining wall. It is the design engineer's responsibility to fully design and detail the connection of the guard posts to the retaining wall blocks and assure acceptable resistance to the applied forces. Redi-Rock blocks are plain concrete, without steel reinforcement.

**Grouted Connection (1 Block)**
- Flange base plate attached to top block with adhesive set anchor bolts
- Grout fence or railing post in place
- Field core into block in second course

**Grouted Connection (2 Blocks)**
- Fence or railing post
- Core and grout or connect with flanged base plate
- Reinforced concrete sidewalk
- Field core into top block with adhesive

**Flange Bolted Connection**
- Grout fence or railing post in place

**Moment Slab Connection**
- Grout fence or railing post in place
- Field core into block in second course

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Freestanding Bond Beam at Top of Wall

Cap Block, Secure to Freestanding Block with Polyurethane Sealant, or Optional Rebar Embedded in Concrete

Freestanding Garden Block with Two (2) Continuous Reinforcing Bars, Filled with Cast-in-Place Concrete, as Designed by Wall Design Engineer

Freestanding Wall Blocks

Retaining Wall Blocks

Section View

Typical Cantilever Wall Section

Redi-Rock Freestanding Hollow Core Block (F-HC)

Exposed wall (Height varies with design)

Concrete Infill (As specified by Engineer)

Non-woven geotextile fabric (If specified by Engineer based on site soil conditions)

Drain stone (No. 57 or equivalent) Stone to extend at least 12" (305 mm) behind blocks.

Drain (As specified by Engineer)

Backfill per design requirements. Install in lifts and compact per project specifications.

Grade to drain surface water away from wall

Redi-Rock Cap (if desired)

Footing Width

Footing thickness

Footing rebar and wall ties (As specified by Engineer)

Reinforced concrete footing (As specified by Engineer)

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Sealant Adhesive: One-component, highly flexible, non-priming, gun grade, high performance elastomeric polyurethane sealant shall have movement of plus or minus 25% per ASTM C719, tensile strength greater than 1.4 MPa per ASTM D412, and adhesion to peel on concrete greater than 3.5 N/mm per ASTM C794. Apply sealant in 38 mm diameter round “hersey kiss”-shaped dollops located in two rows at the top of the Freestanding blocks at 200 mm on center.
**F-HC Freestanding Block Continuous Corner Detail**

- **TRIM TEXTURE AS REQUIRED FOR GOOD FIT BETWEEN BLOCKS**
- **CUT CORNER BLOCK TO ALLOW FOR CONTINUATION OF REBAR**

**F-HC Freestanding Block Coping with Fence Attachment**

- **ATTACH FLANGE MOUNTED FENCE POSTS TO GAP UNIT WITH CONCRETE ANCHOR BOLTS (RED HED TRU-BOLT WEDGE ANCHORS OR EQUAL)**
- **SET CAP BLOCK ON TOP F-HC UNIT AND EMBED STEEL REINFORCEMENT IMMEDIATELY AFTER PLACEMENT OF CAST-IN-PLACE CONCRETE**

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TYPICAL CONSTRUCTION DETAILS

F-HC Freestanding Block Coping with Fence Attachment

- All reinforcing steel to conform to ASTM A706 or AASHTO M31 420 MPa.
- 14.0 mm bars, 1016 mm long (tie to embedded hooks)
- (2) REDI-ROCK R-ANCHORS (292 mm from each end)
- Cover top of retaining blocks and all exposed geogrid with 6 mil Visqueen plastic layer
- No. 57 stone infill in vertical core slot, between adjacent blocks, and 300 mm behind back of blocks
- Fill bottom half of vertical core slot for PC blocks immediately below freestanding blocks

End View

Bend Detail

10.0 mm rebar hooks

Cap block cast with R-anchors (specialty block)

Attach flange mounted fence posts to cap unit with concrete anchor bolts (Redi-Hed Tri-Bolt Wedge Anchors or equal)

Set cap block on top F-HC unit and embed steel reinforcement immediately after placement of cast-in-place concrete

Cast-in-place concrete in hollow core of F-HC units and in top half of vertical core slot in PC blocks immediately below F-HC blocks. Minimum 28 day compressive strength = 27.6 MPa

20.0 mm vertical bars, 292 mm O.C.

Typical, both sides of center core

20.0 mm horizontal bars, continuous, 610 mm overlap on ends. Typical, both sides of center core

10.0 mm bar hook - wrap around lifting insert in top of block and extend into hollow core area of F-HC block

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Post and Beam Guardrail

- Post and beam guardrail
- Install 300 mm diameter corrugated HDPE sleeve during wall construction. Install guardrail posts in sleeve and grout (min. 27.6 MPa compressive strength) in place after wall construction.
- Wrap geogrid strips around sleeve as needed

Section View

Upper leg of strip (installed at top of block elevation)

Lower leg of strip (installed at bottom of block elevation)

Guardrail beam

Post

Geogrid strips

Top View

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TYPICAL CONSTRUCTION DETAILS

**Cast-in-Place Moment Slab Traffic Barrier - Flat Grade Installation**

- **Steel ties per traffic barrier design**: 14.0 mm bars at 152 mm O.C. minimum
- **Cast-in-place moment slab**: 9.1 m Sections
- **2440 mm Minimum**
- **51 mm cover**
- **76 mm cover**
- **533 mm minimum**
- **76 mm cover**
- **Cast-in-place traffic barrier (Texas T501 railing shown)**
- **Concrete for cast-in-place barrier and moment slab**: dot standard structure mix
- **Minimum 28-day compressive strength**: shall be 24.1 MPa or higher as specified
- **Reinforcing steel**: shall conform to ASTM A706 or AASHTO M31 Grade 60 (420 MPa)
- **Formed joint with low modulus, hot-poured, rubber-asphalt joint sealing compound**: along expansion joint
- **Expansion cap**: 38 mm dia. x 457 mm ASTM A36 galvanized or epoxy coated smooth dowel bar centered vertically in slab at 305 mm O.C. along expansion joint
- **Sawed joint with hot-poured, rubber-asphalt sealant**: along contraction joint
- **Provide grease or sleeve bond breaker on one side**: along contraction joint

**Final Design Must Address Site Drainage**

- **Pavement**

**Materials**

Concrete for cast-in-place barrier and moment slab shall be dot standard structure mix. Minimum 28-day compressive strength shall be 27.4 MPa or higher as specified. Reinforcing steel shall conform to ASTM A706 or AASHTO M31 Grade 60 (420 MPa).

**Design**

Moment slab shown is dimensioned based on an equivalent static load of 44.5 kN per NCHRP Report 663. Moment slab reinforcement shown is based on AASHTO LRFD Bridge Design Specifications, 5th edition, 2010, TL-4 loading detailed in Table A13.2.1.

The selection and use of this detail, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the registered professional engineer in charge of the project.

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**Cast-in-Place Moment Slab Traffic Barrier - Sloping Installation**

- **Steel ties per traffic barrier design**: 14.0 mm bars at 152 mm O.C. minimum
- **Cast-in-place moment slab**: 9.1 m Sections
- **2440 mm Minimum**
- **51 mm cover**
- **76 mm cover**
- **864 mm minimum**
- **864 mm minimum**
- **Cast-in-place traffic barrier (Texas T501 railing shown)**
- **Concrete for cast-in-place barrier and moment slab**: dot standard structure mix
- **Minimum 28-day compressive strength**: shall be 27.6 MPa or higher as specified
- **Reinforcing steel**: shall conform to ASTM A706 or AASHTO M31 Grade 60 (420 MPa)
- **Formed joint with low modulus, hot-poured, rubber-asphalt joint sealing compound**: along expansion joint
- **Expansion cap**: 38 mm dia. x 457 mm ASTM A36 galvanized or epoxy coated smooth dowel bar centered vertically in slab at 305 mm O.C. along expansion joint
- **Sawed joint with hot-poured, rubber-asphalt sealant**: along contraction joint
- **Provide grease or sleeve bond breaker on one side**: along contraction joint

**Final Design Must Address Site Drainage**

- **Pavement**

**Materials**

Concrete for cast-in-place barrier and moment slab shall be dot standard structure mix. Minimum 28-day compressive strength shall be 27.4 MPa or higher as specified. Cast-In-Place level-up concrete shall be manufactured in accordance with ASTM C94. Minimum 28-day compressive strength shall be 24.1 MPa or higher as specified. Reinforcing steel shall conform to ASTM A706 or AASHTO M31 Grade 60 (420 MPa).

**Design**

Moment slab shown is dimensioned based on an equivalent static load of 44.5 kN per NCHRP Report 663. Moment slab reinforcement shown is based on AASHTO LRFD Bridge Design Specifications, 5th edition, 2010, TL-4 loading detailed in Table A13.2.1.

The selection and use of this detail, while designed in accordance with generally accepted engineering principles and practices, is the sole responsibility of the registered professional engineer in charge of the project.

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TYPICAL CONSTRUCTION DETAILS

Precast Barrier Block

Design of reinforced concrete moment slab by local engineer to meet project requirements

Rebar shown in barrier block meets AASHTO TL-3 loading requirements. Rebar design in barrier block is intended to be modified as necessary to meet other loading conditions. All reinforcing steel shall be 420 MPa deformed rebar. All concrete shall have a minimum 28-day compressive strength of 27.6 MPa.

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