



MiraStone™

by CORNERSTONE®

Engineered for strength...designed for beauty

Installation Guide

Use this Installation Guide for step-by-step instructions on how to create your easy-to-install MiraStone™ segmental retaining wall system.

» [cornerstonewallsolutions.com](https://www.cornerstonewallsolutions.com)

The MiraStone™ retaining wall system was developed with the installer in mind. MiraStone's durable, high shear strength concrete SecureLugs fit into lower units' hollow cores, allowing significant lateral movement without losing unit to unit interlock. Tapered sides with removable wings make it easy to build tight curves and straight walls with complete accuracy. MiraStone's large hollow core, filled with gravel, provides a superb geogrid to block connection.

MiraStone® is committed to providing complete technical and construction information to installers and engineers to ensure the successful completion of any retaining wall project. Your best choice is MiraStone™ for value, beauty, durability, ease of construction, and complete retaining wall excellence.

Design Advantage

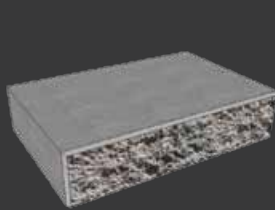
- Units are made from high compression and low-absorption concrete, that provides durability and resistance to weathering.
- Large hollow core reduces efflorescence problems and the use of costly pigments.
- Units provide excellent solutions for gravity, geogrid reinforced, steel/concrete, plantable and other types of wall structures.
- Provides superior environmental advantages both by using less concrete in manufacturing and by the resulting efficiency of transportation.
- Provides superior flexibility in creating curves, corners, steps and terraced walls.

Installation Advantage

- A small crew can easily install 200 to 600 square feet of wall units a day.
- One person can easily handle the light weight hollow core MiraStone™ unit.
- The one-step SecureLug system outperforms the pins or clip method, speeding up installation time considerably.
- The hollow core makes it easy to saw cut, add special lighting or place fence posts into when adding creative details.

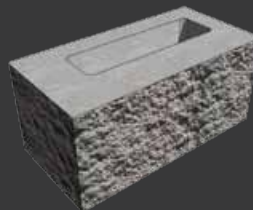
Economic Advantage

- MiraStone™ system will save time, labor, and material costs.
- MiraStone™ walls can cost considerably less than conventional cast in place concrete walls or traditional masonry systems.
- MiraStone™ light-weight, hollow core units are less expensive to ship and handle.
- MiraStone™ labor and equipment costs are low because no special equipment is required and semi-skilled workers will find the units easy to assemble.



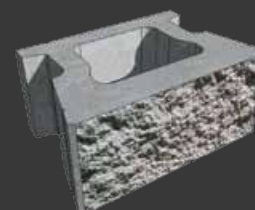
CAP

3" Height x 18" Width x 12" Depth
(76 H x 457 W x 305 mm D)
Weight: 46 lbs (21 kgs)



90 DEGREE CORNER

6" Height x 18" Width x 9" Depth
(152 H x 457 W x 229 mm D)
Weight: 35 lbs (16 kgs)



STRAIGHT FACE

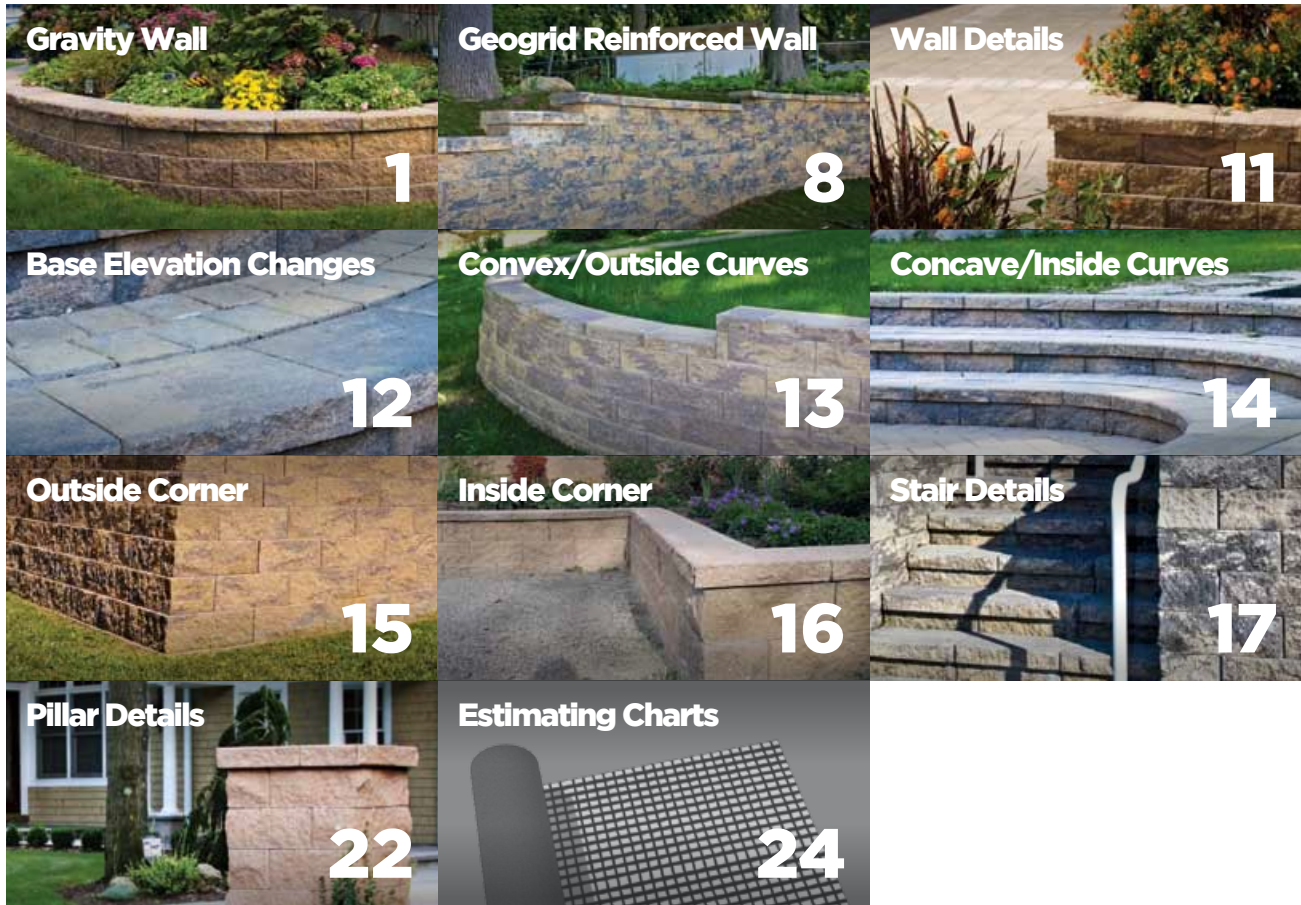
6" Height x 18" Width x 12" Depth
(152 H x 457 W x 305 mm D)
Weight: 57 lbs (26 kgs)
Face Area = .75 sq. ft.

**All dimensions vary between manufacturers. Verify with local producer for correct measurements.*

DIMENSIONS	6" HEIGHT x 18" WIDTH x 12" DEPTH (152 H x 457 W x 305 MM D)		FACES	VARIES	
FACE AREA	.75 SQ FT	(0.07 M2)	GRAVEL FILLED WEIGHT	94 LBS	(43 KGS)
VOLUME OF VOIDS	.296 FT3	(.008 M3)	CONCRETE FILLED WEIGHT	101 LBS	(46 KGS)
WEIGHT	57 LBS	(26 KGS)	BATTER/SETBACK	4.5°	1/2"/UNIT

MiraStone™

by CORNERSTONE®



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AFFILIATIONS:

Cornerstone® Wall Solutions is a proud member of the *National Concrete Masonry Association*, the *Interlocking Concrete Pavement Institute* and the *National Precast Concrete Association*.

LICENSING:

Cornerstone® Wall Solutions licences products to manufacturers. Opportunities are still available. Contact us for more information.

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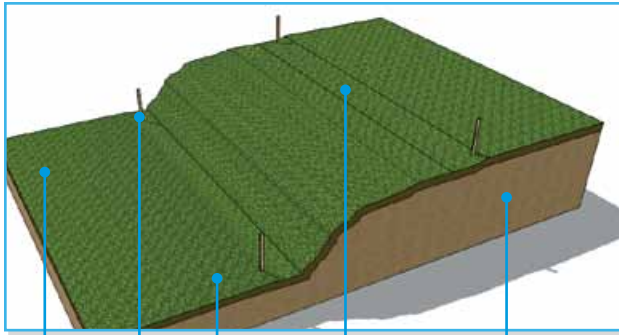
MiraStone™ Gravity Wall

Gravity (SRW) segmental retaining wall systems are structures lower in height that use the MiraStone™ unit weight combined with gravel core infill to resist earth pressures behind and on top of the wall. The 1/2"/unit (4.5 degree or 1"/vertical foot) batter or setback of the MiraStone™ wall along with proper soil conditions below and behind the wall provide the stability of the structure. For walls 4.0ft (1.2m) and taller a qualified engineer should be consulted.

NOTE: **Bolded** installation terms are defined in our online glossary at: www.cornerstonewallsolutions.com

Gravity Wall

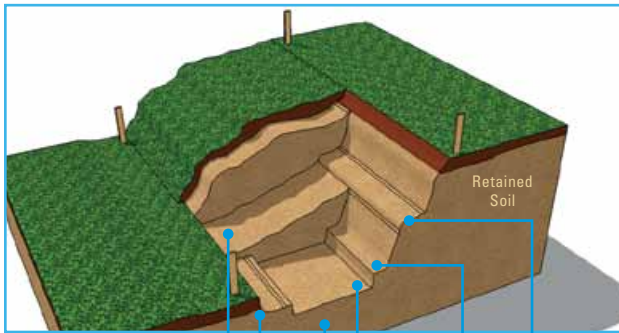
Step 1: Planning



Grass Stakes Organic Materials Proposed Wall Location Reinforced Backfill Zone

- Mark the bottom and top of the wall excavation location with spray paint or stakes;
- Establish proper elevation bottom and top of wall before excavating;
- **Organic Materials** should not be used in **Structural Backfill Zone**;
- Store and protect **Structural Backfill Materials** from inclement weather during construction.

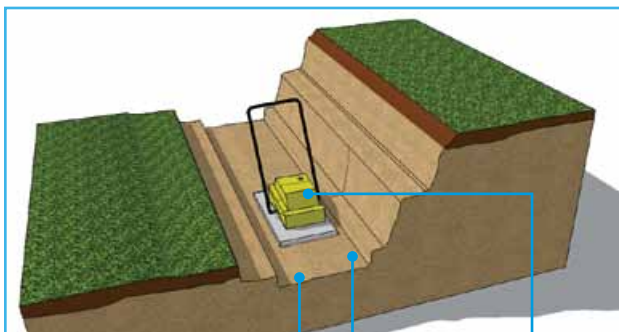
Step 2: Excavation



Excavated Materials Embedment Depth Sub Base Leveling Pad Trench Back of Wall Excavation Depth Retained Soil Excavation Cut Line

- Excavate and prepare **Sub Base Leveling Pad Trench** 6" below first course;
- **Leveling Pad** trench is approximately 2.5' to 3' wide;
- Normal wall **Burial Depth** or **Embedment Depth** is 6" to 12" or one block;
- Excavate cut line to a 2 to 1 slope or greater;
- Back of wall excavation depth into the bank should be 12" beyond the back of the **Sub Base Leveling Trench**.

Step 3: Sub Base Compaction

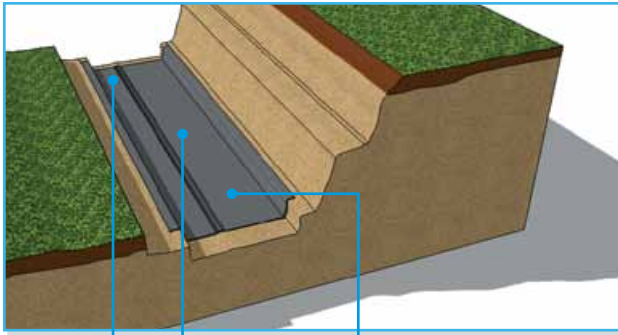


Trench Width +/- 3.0 ft Sub Base Compactor

- Compact **Sub Base** to 95% **Standard Proctor Density** or greater;
- Remove any **Organic** or poor soils in the **Sub Base** and replace with proper **Structural Fill Materials** before compacting.

Gravity Wall

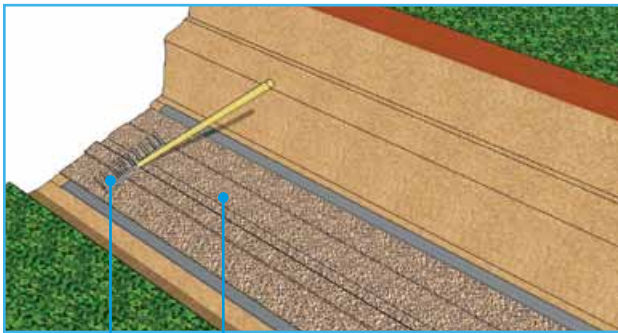
Step 4: Base Stabilization



Leveling Pad Trench Base Stabilization Fabric Trench Depth 6"

- (Optional) place 5' to 6' wide **Base Stabilization Fabric** on top of leveling pad trench;
- **Base Stabilization Fabrics** will help prevent sub base materials from mixing with the gravel base leveling pad during compaction;
- Fabric also provides extra **Structural Bearing Stability** to the base leveling pad.

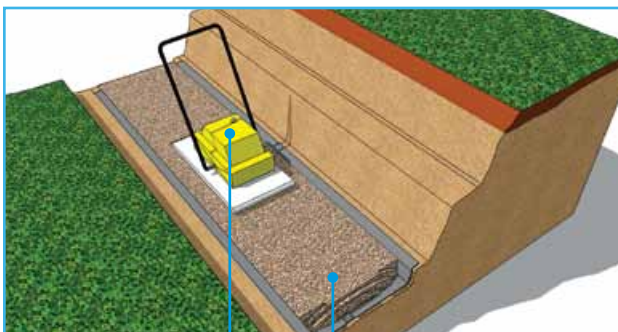
Step 5: Rough Leveling Pad



Rake for Rough Grading Well Graded Gravel Approx +/- 6" Deep

- Place **Well Graded Gravel** (also known as Road Base Aggregates) on top of fabric in the leveling pad trench approximately 6" deep;
- Rough grade gravel with a rake close to finish base elevation.

Step 6: Compact Leveling Pad

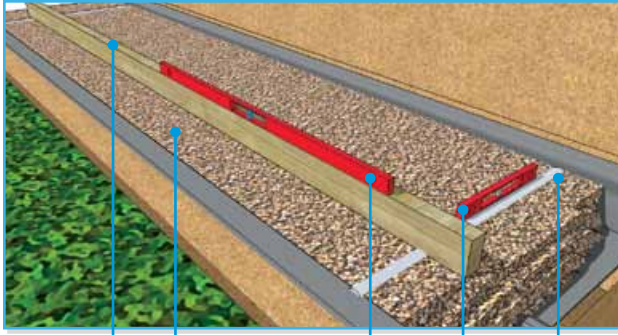


Compacted Gravel Leveling Pad Compacted Gravel Leveling Pad

- Compact the **Gravel Leveling Pad** to 95% **Standard Proctor Density** or greater;
- **Correct Moisture Content** in the gravel will help in reaching proper compaction.

Gravity Wall

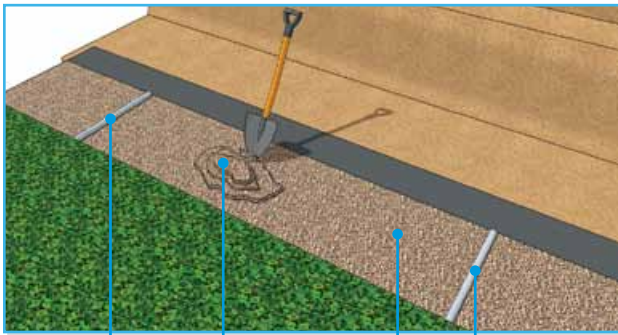
Step 7: Level Screed Pipes



Screed Board or Straight Edge
Compacted Gravel Leveling Pad
4" Level
2" Level
Screed Pipe

- Place first 3' long **Screed Pipe** across the trench at one end of the wall or at the lowest elevation;
- Scratch a trench for the pipe in the compacted gravel with a chipping hammer;
- Use a 2' level or **Laser Level** to set the screed pipe to the proper level. Add gravel underneath and around screed pipe to support while leveling;
- Place the second screed pipe across the trench approximately 9' from the first screed pipe. Level the second screed pipe to the same elevation as the first screed pipe by using a 4' level on top of a **Screed Board, Straight Edge** or with a **Laser Level**;

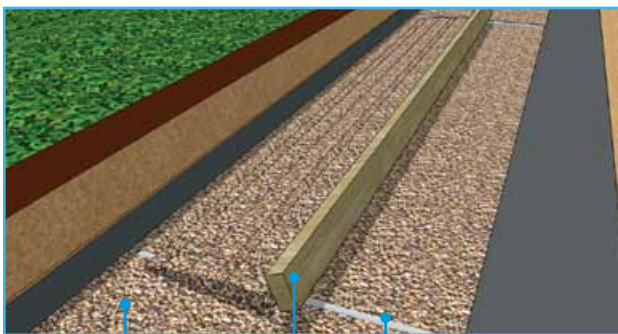
Step 8: Extra Gravel



Screed Pipe
Extra Gravel
Compacted Gravel Leveling Pad
Screed Pipe

- Continuing on from the previous step, place and level screed pipes the full length of the trench leveling pad or until reaching a base elevation change.
- Place or remove extra **Well Graded Gravel** (also known as Road Base Aggregates) level to the top of the screed pipes as needed;
- (If more than 1 ½ inches of loose gravel is added, repeat the compaction steps again before screeding).

Step 9: Screeding Leveling Pad

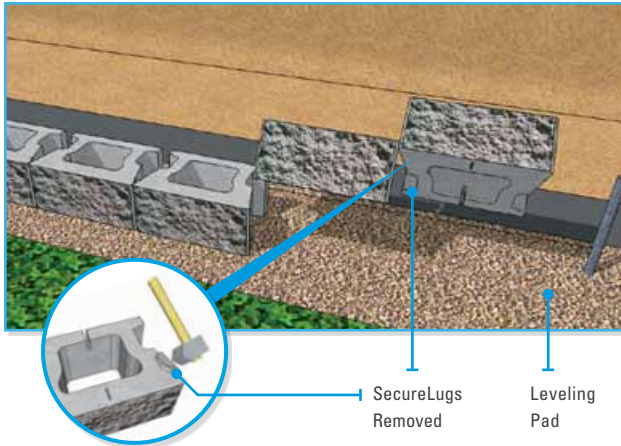


Compacted Gravel Leveling Pad
Screed Board or Straight Edge
Screed Pipe

- Screed the gravel leveling pad with a **Screed Board** or **Straight Edge** across the trench on top of two screed pipes;
- The coarser the gravel the more back and forth the screeding action when drawing the **Screed** across the leveling pad;
- Too much pressure on the screed straight edge may dislodge the level of the screed pipes while screeding;
- A second screed pass may be needed to insure an accurate level has been achieved;
- Continue to screed the leveling pad until completing the full length of the trench or up to the first elevation change.

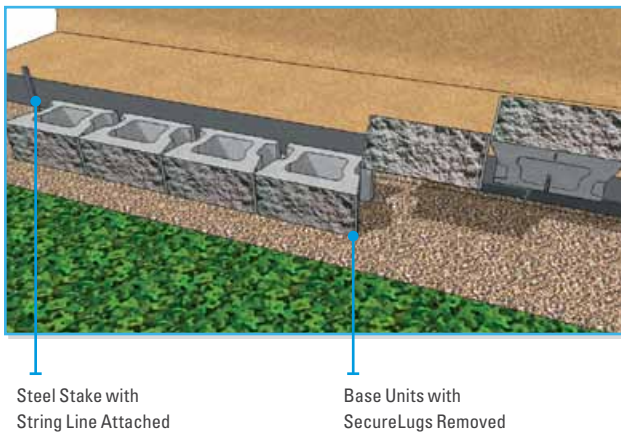
Gravity Wall

Step 10: Remove Securelugs



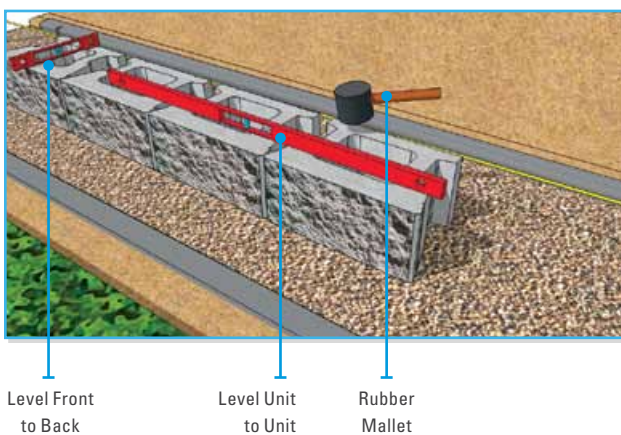
- **MiraStone™** base units will have the **SecureLugs** removed before placing on the leveling pad;
- Place each unit on top of the leveling pad in such a way as not to disturb the level gravel.

Step 11: Lay First Course



- Remove the screed pipes from the leveling pad;
- Place a steel stake or **MiraStone™** unit at either end of the leveling pad to establish the back of the first course of units;
- Secure tightly a string line to the stakes or **MiraStone™** units at either end which will provide the guide to line up the back of each base unit;
- The distance of the string line between the steel stakes or **MiraStone™** units may vary due to heavy winds .

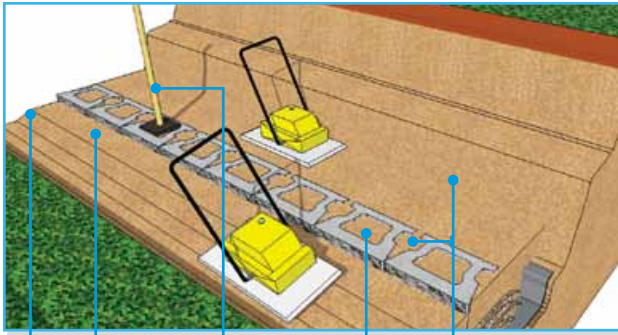
Step 12: Level Units



- Units are laid snug together and parallel to the straight or curved line;
- A rubber mallet should be used if unit height and alignment adjustment is needed;
- Use a short 2' level to make sure the units are level front to back;
- Use a 4' level to make sure the units are level unit to unit along the length of the wall;
- Correct batter and straight horizontal lines in the completed **MiraStone™** wall depend on the accuracy of the base leveling pad and units.

Gravity Wall

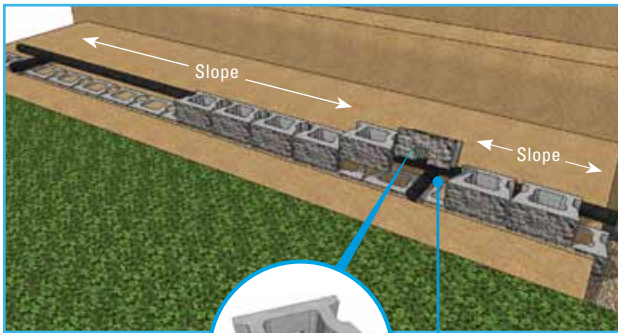
Step 13: Impermeable Fill



Toe of Wall
Impermeable Material
Hand Compactor
Hollow Core
Impermeable Material

- Backfill behind, in front (**toe of wall**) and in the hollow cores of the units with **Impermeable Materials** up to the desired level of the **Perforated Drain Pipe** or to the top of the first course;
- Compact the impermeable materials behind, in front and in the hollow cores of the units;
- Sweep the top of the units clean of all rock and dirt before placing the next course of units;
- Sweeping should create a 1/2" void in the core to accommodate the **SecureLug's** interlock.

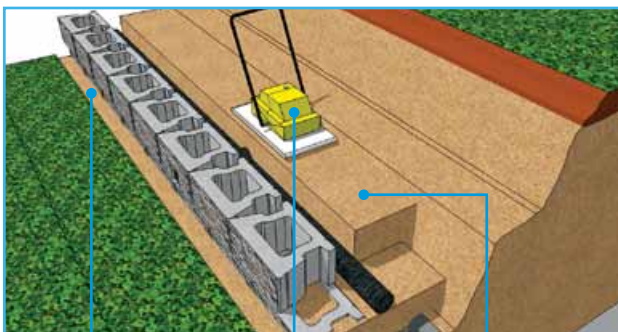
Step 14: Drain Pipe Outlet



Cut 4" Square Out of Bottom – CornerStone™
Drain Pipe Outlet

- **Perforated Drain Pipe** should have adequate slope to drain water in the right direction towards each **Drain Pipe Outlet**;
- **Drain Pipe Outlet** can be every 30 or 50 feet;
- **Perforated Drain Pipe** can be a **Sock Wrapped** system to help prevent fines from migrating into the pipe.

Step 15: Backfill

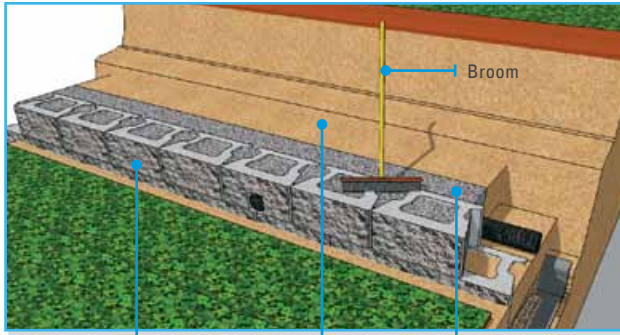


Burial Depth
Compact the Backfill Materials Before Inserting Drainage Gravel
6" Lifts

- Place and compact **Backfill Materials** in maximum **Lifts** of 6".
- Lifts may be less in height than 6", depending on the type of soil or size of equipment;
- Backfill materials will be placed 6" to 12" behind the units allowing for **Clear Crush Drain Gravel** (Angular Aggregates free of fines) between the **MiraStone™** units and compacted backfill materials;
- By adding **Clear Crush Drain Gravel** (Angular Aggregate free of fines) after compaction of **Backfill Materials**, this will prevent undue pressure against the wall which can cause the units to move out of alignment;
- Each lift should be compacted to 95% **Standard Proctor** or greater;
- The correct **Moisture Content** in the **Backfill Materials** will help in reaching proper **Compaction Density**.

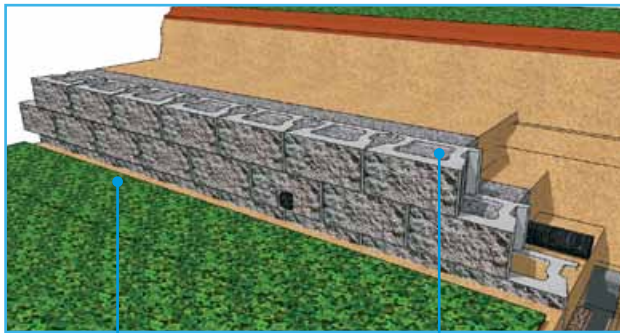
Gravity Wall

Step 16: Drainage Gravel



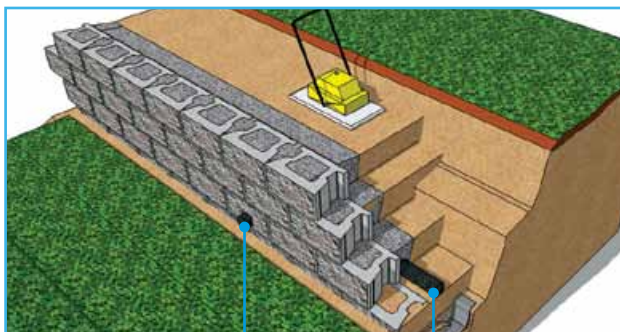
Course 3
Reinforced Backfill Materials
Clear Crush Drain Gravel Placed Flush to Top of Units

- **Clear Crush Drain Gravel** (Angular Aggregates free of fines) is placed in the hollow cores and 6" to 12" behind the wall units after compaction of the **Backfill Materials**. This will prevent undue pressure against the wall which can cause the units to move out of alignment;
- **Clear Crush Drain Gravel** does not need to be compacted;
- Sweep the top of the **MiraStone™** units clean of all rock and dirt before placing the next courses;
- Make sure the **Clear Crush Drain Gravel** directly behind the wall units is placed flush to the top of the units;
- Make sure the **Backfill Materials** are as well compacted and level as possible.



Course 3
Clear Crush Drain Gravel

Step 17: Continue Installation

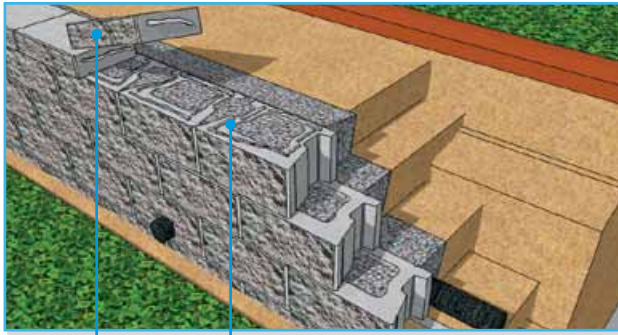


Grout Around Drain Pipe Outlet
Perforated Drain Pipe

- Continue to install each course of units following the same steps as above;
- Install and compact **Backfill Materials** in 6" lifts until wall is complete;
- Grout around **Drain Pipe Outlet** to prevent **Clear Crush Drain Gravel** or **Drainage Aggregates** (Angular Aggregates free of fines) from migrating.

Gravity Wall

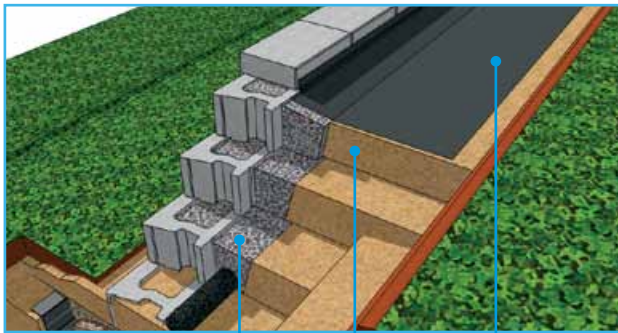
Step 18: Capping



Cap Unit
Concrete Adhesive

- Complete the top of the wall with **MiraStone™** cap units;
- Properly secure the cap units using a **Concrete Adhesive**;
- Make sure all units are free of dirt and stones before installing the caps;
- Place a solid bead of **Concrete Adhesive** around the top of each **MiraStone™** unit.
- Place a bead of adhesive between each joint of the cap units.

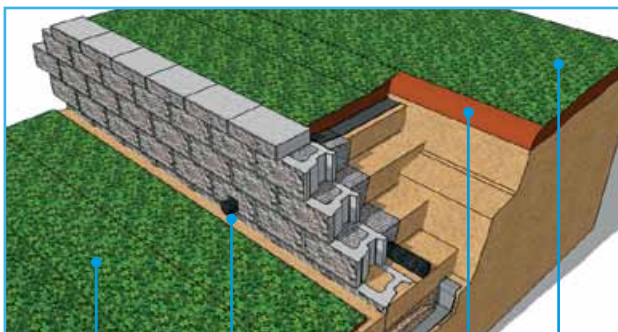
Step 19: Soil Separation Fabric



Drainage Gravel
Backfill Material
Soil Separating Filter Fabric

- Place a 6 ft wide **Soil Separating Filter Fabric** on top of the backfill and drainage gravel and against the back of the last units before placing the planting soils;
- The fabric will prevent planting soil fines from staining the face of the wall and migrating into the **Clear Crush Drain Gravel** (Angular Aggregate free of fines).

Step 20: Final Grading



Grass
Drain Pipe Outlet
Planting Soil
Grass

- Insure that final grading is done on top and bottom of the wall;
- Make sure to protect newly placed planting soil from erosion during heavy rains or surface runoff;
- Please Note: Final determination of the suitability of the contemplated use, and its manner of use are the sole responsibility of the user.



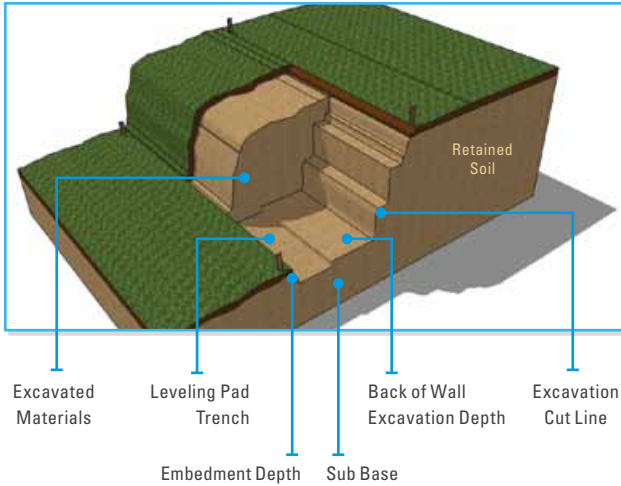
Geogrid Reinforced Wall

Creating a MiraStone™ reinforced wall system involves the use of geogrids for reinforcement. MiraStone™ walls 4.0ft (1.2m) and taller will automatically have active pressures because of their height. Walls smaller than 4.0ft (1.2m) may also require geogrid reinforcement depending on other related factors. Parking lots, roadways, or positive slopes above walls for example, require the use of reinforcement to help resist the increased pressure behind the wall. Geogrid used with the appropriate lengths, layers, and compacted backfill materials will resist these active forces above and behind the wall. For walls 4.0 ft and taller a qualified engineer should be consulted.

NOTE: **Bolded** installation terms are defined in our online glossary at: www.cornerstonewallsolutions.com

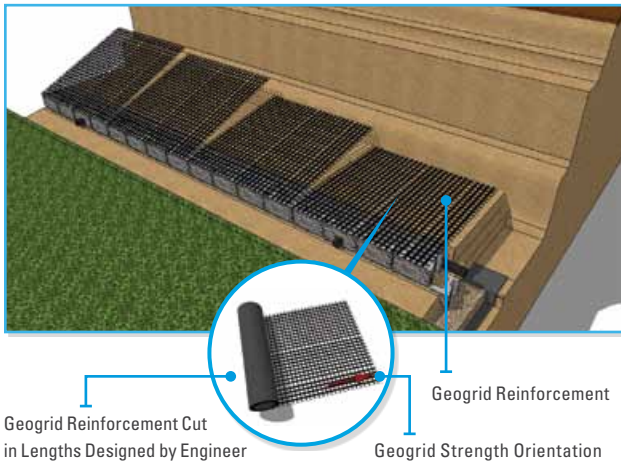
Geogrid Reinforced Wall

Step 1: Planning

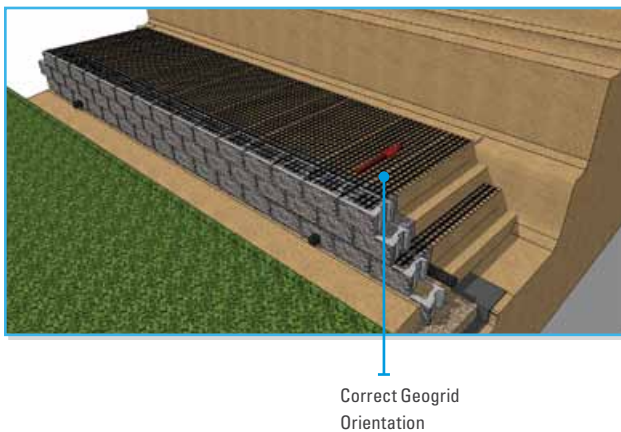


- Excavate and prepare **Sub Base Leveling Trench** 6" below first course;
- **Leveling Pad Trench** is approximately 2.5' to 3' wide;
- Normal wall **Burial Depth** or **Embedment Depth** is 6" to 12" or one block (for more information refer to design manual);
- Excavate cut line to a 2 to 1 slope or greater;
- Back of wall excavation depth into the bank at the base of the wall should be from the face of wall to the designed length of **Geogrid**.

Step 2: Cut Geogrid

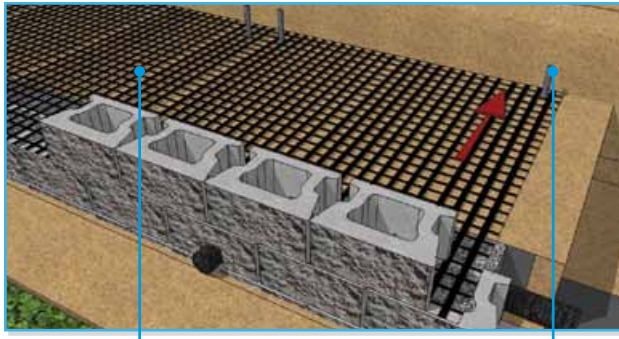


- Cut **Geogrid Reinforcement** to length specified in design;
- Geogrids are manufactured in two directions Uni-axial or Bi-axial. Uni-axial grid has one direction of strength and that direction has to be oriented perpendicularly to the face of the wall during installation. Bi-axial grid can be laid in two directions, perpendicular and lengthwise to the face of wall (ensure that the lengthwise direction is still in accordance to the length specified by the Engineer's design);
- **Correct geogrid orientation, strength and length is crucial to the success of the wall project;**
- Each geogrid length should be laid parallel and adjacent to each other but never overlapping.



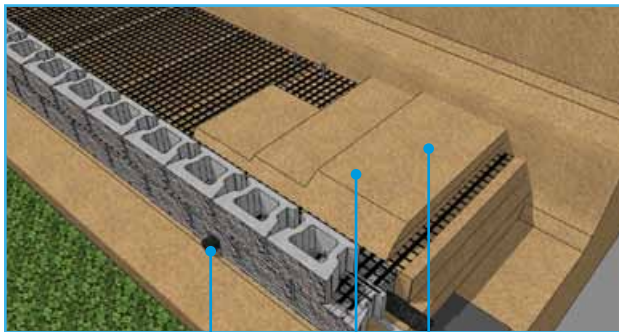
Geogrid Reinforced Wall

Step 3: Lay Geogrid



Tensioned Geogrid

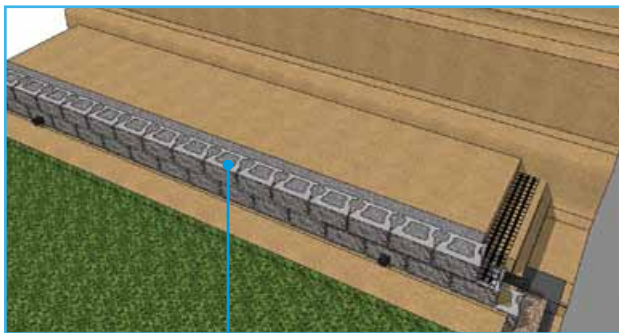
Stakes Placed to Maintain Geogrid Tension



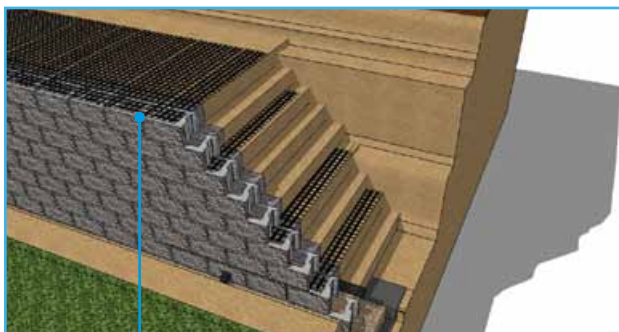
Drain Pipe Outlet

6" Lifts

Reinforced Zone



Clear Crush Drain Gravel



Geogrid Elevations Set to Engineer Design

- Place the geogrid as far forward on the **MiraStone™** units as possible without revealing it on the face;
- Place the next course of **MiraStone™** units on top of the lower units and geogrid at a half bond;
- The two **SecureLugs** will fit securely into the hollow cores of the two units below and lock the geogrid into the gravel core;
- Pull the unit forward to engage and align the **SecureLugs**;
- Complete the installation of units on the **Geogrid Reinforced** courses;
- Make sure each unit is installed against the next unit, leaving no gaps between unit joints;
- Tension the geogrid in such a way as **NOT** to disturb the alignment of the upper units;
- Use stakes or backfill materials to maintain the tension during backfilling;
- Do not drive equipment directly on top of geogrid.

Step 4: Reinforced Backfill

- **Backfill** and **Compact** the **Reinforced Zone** by placing materials from the back of the wall towards the end of the geogrid;
- Install drainage gravel in the cores and 6" to 12" behind the units after placing and compacting backfill materials;
- Install and compact **Backfill Materials** in 6" lifts until wall is complete.



MiraStone™ Wall Details

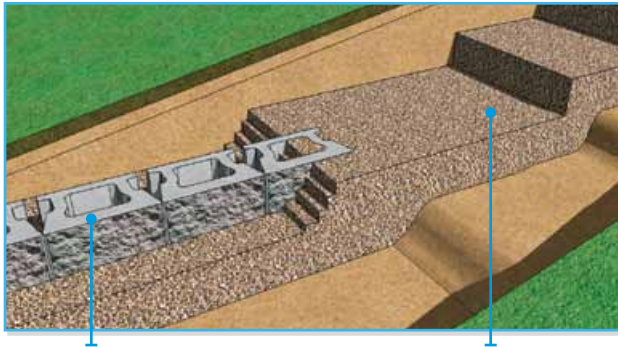
This section provides detailed, illustrated step-by-step instructions for using MiraStone™ to construct wall details including: inside curves, outside curves, elevation changes, and both inside and outside corners.

Curves, corners and elevation changes are the portions of a wall project that adapt to the specifics of the site and the needs of its users. Correct construction and professional completion of these wall details greatly enhances the visual appeal of the finished project and avoids the time and costs associated with improper installation.

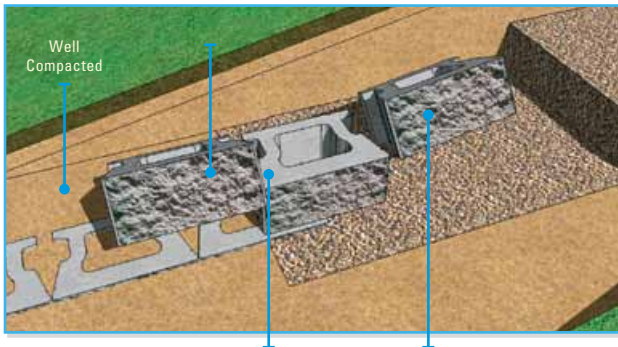
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Base Elevation Changes

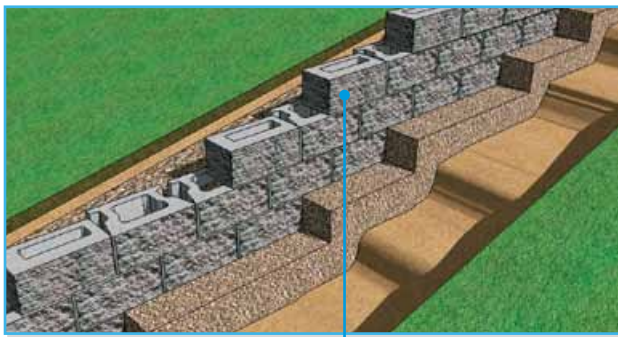
Step 1: Base Elevation Changes



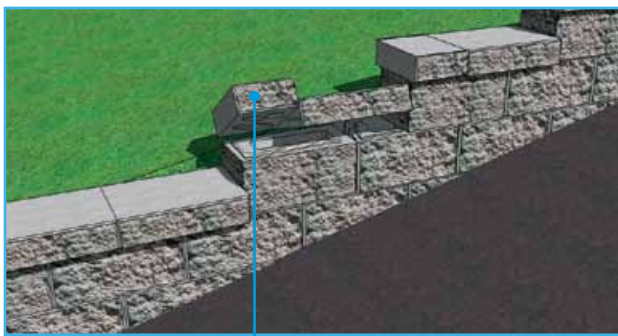
Top of Base Unit First Unit Second Course Base Leveling Pad



Second Unit One ~ SecureLug Removed Third Unit ~ Both SecureLugs Removed



Corner Unit

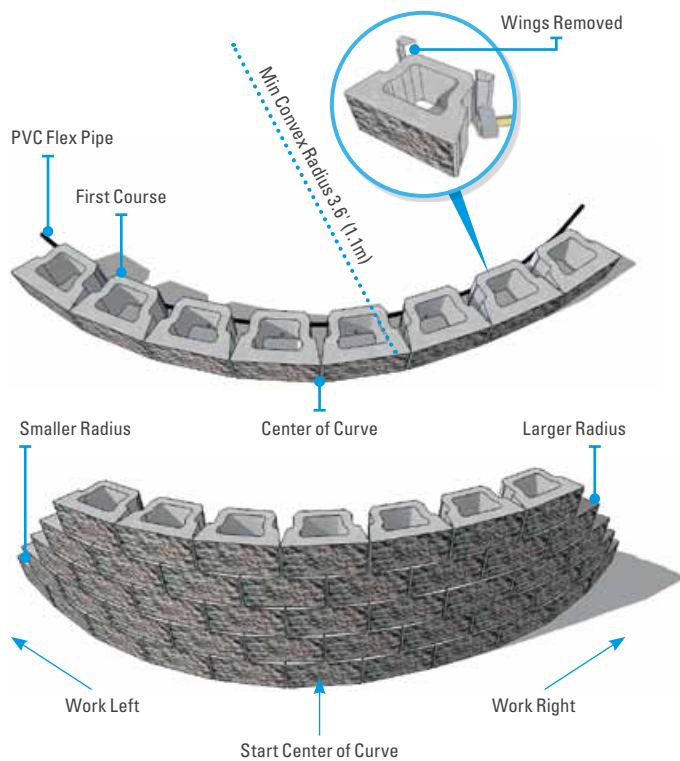


Capping Units Attached with Concrete Adhesive

- The top of the installed base unit will be used to establish the step up gravel leveling pad elevation;
- Make sure to backfill and compact the gravel in and around the last unit of the first course;
- Finished grade of the leveling pad should be an 1/8" to 1/4" above top of first course units to allow for a small amount of settlement;
- Repeat the above screeding steps on the second elevation gravel leveling pad;
- Place the first unit on the second course at a half bond on top of last & second last of the first course units;
- The two **SecureLugs** will fit into the hollow cores of the two units below. To align the wall, place a string line at the back of the units for a straight wall or place a PVC pipe for a curved wall;
- Pull upper unit forward to engage and align units;
- The batter or set back will be 1/2"/unit (4.5 degree or 1"/vertical foot) for **MiraStone™**;
- Place the second unit half on the last unit and half on the second gravel leveling pad. Ensure that the **SecureLug** is removed on the leveling pad side of the unit.

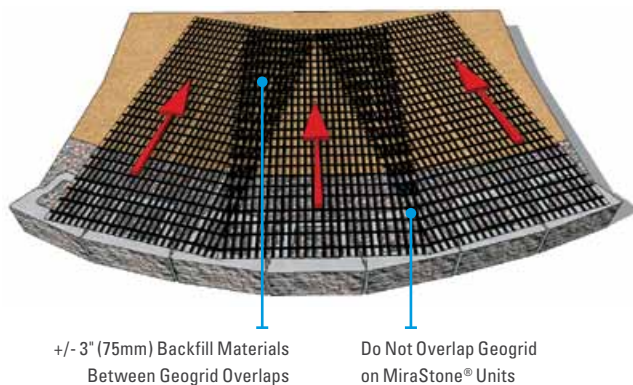
Convex/Outside Curves

Step 1: Convex First Course



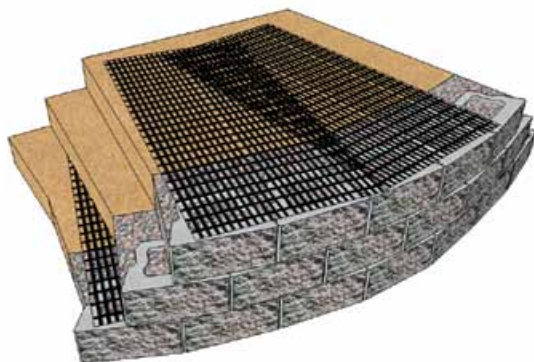
- If possible, start building a curve from the center and work left and right through the curve;
- Use **PVC Flex Pipes** to create smooth and accurate **Convex** curves;
- Use the back of the unit for alignment ;
- Remove one or both **MiraStone™** wings when building a **Convex** curve;
- Build each course of units by starting at the same place and the same bond as the last course;
- Convex curves have a slight increase in batter or setback to the standard 1/2" for **MiraStone™**;
- The taller the wall the larger the **Convex** first course needs to be. The radius of each additional course will be slightly smaller than the lower course ;
- **MiraStone™** minimum **Concave** curve is approximately 3.6 foot radius.

Step 2: Convex Geogrid Curve



+/- 3" (75mm) Backfill Materials Between Geogrid Overlaps

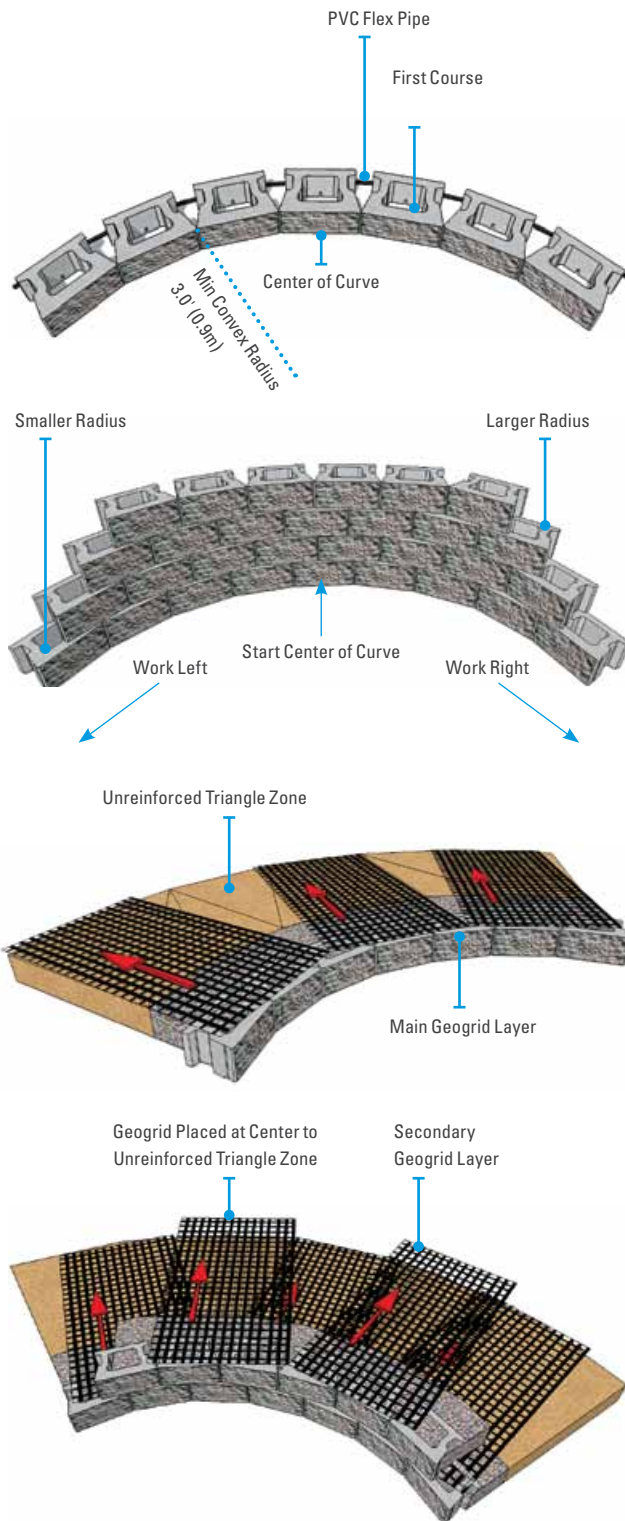
Do Not Overlap Geogrid on MiraStone® Units



- Each geogrid length should be laid perpendicularly to the wall face;
- Geogrid should not overlap on the **MiraStone™** units;
- **Correct geogrid orientation, strength and length is crucial to the success of the wall project.**

Concave/Inside Curves

Step 1: Concave First Course



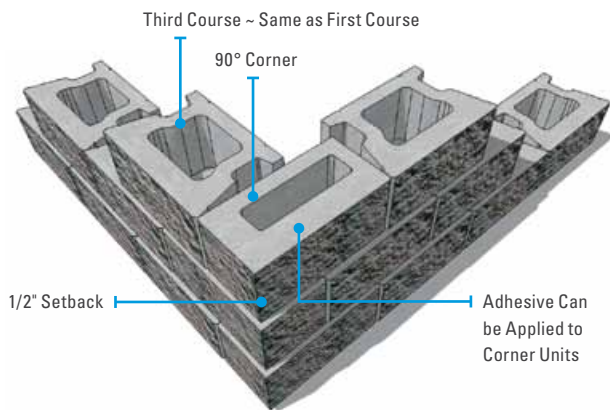
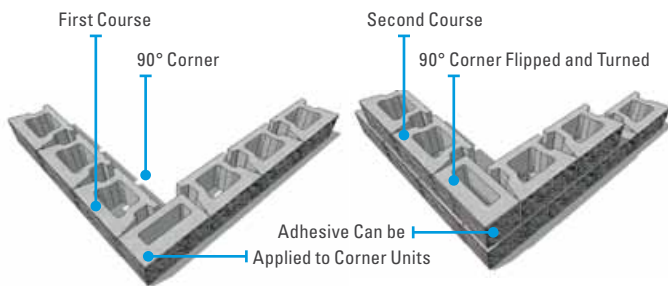
- If possible, start building a curve from the center and work left and right through the curve;
- Use **PVC Flex Pipes** to create smooth and accurate **Concave** curves;
- Use the back of the unit for alignment;
- Build each course of units by starting at the same place and the same bond as the last course;
- **Concave** curves have a slight increase in batter or setback to the standard 5/8";
- The taller the wall the smaller the **Concave** first course needs to be. The radius of each additional course will be slightly larger than the lower course;
- **MiraStone™** minimum **Concave** curve is approximately 3.6 foot radius.

Step 2: Concave Geogrid Curve

- Each geogrid length should be laid perpendicularly to the wall face;
- Geogrid should not overlap on the **MiraStone™** units;
- To ensure 100% coverage, place a second layer of geogrid centered to the unreinforced triangle zone one course above the main geogrid layer;
- **Correct geogrid orientation, strength and length is crucial to the success of the wall project.**

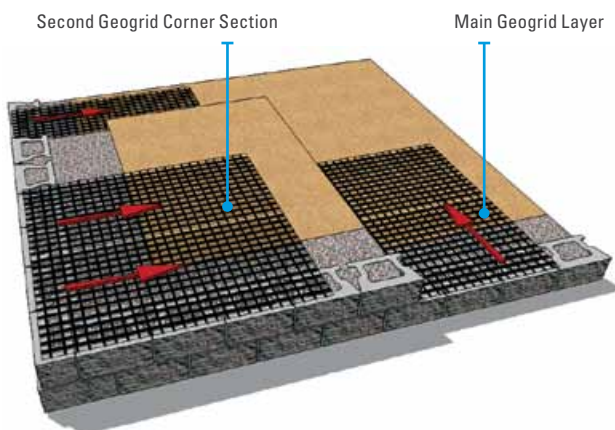
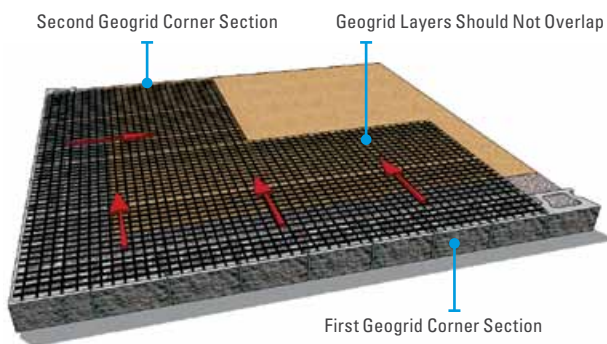
Outside Corner

Step 1: Outside First Course



- Use a **90° Corner** unit to build an outside corner;
- Place the first **90° Corner** unit on the base leveling pad to start the outside corner;
- Place a unit on either side against the 90° Corner unit;
- Continue to lay the **CornerStone®** base course on either side of the corner until first course is completed;
- Flip and turn the second course **90° Corner** overlapping the short side and half of the base unit. This unit should be pushed back 1/2" to achieve proper setback;
- Continue to lay the second **MiraStone™** course on either side of the corner until second course is completed;
- The **90° Corners** can be glued or concrete core filled to ensure a proper course to course outside corner interlock.

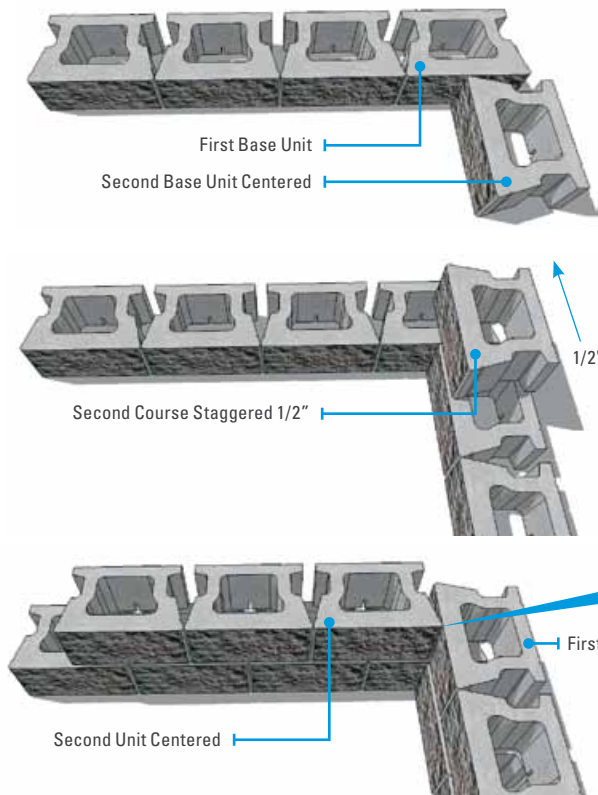
Step 2: Convex Geogrid Curve



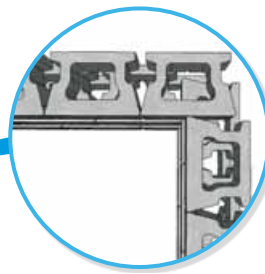
- Each geogrid length should be laid perpendicular to the wall face;
- Geogrid should not overlap on the **MiraStone™** units;
- Lay the 1st geogrid corner section perpendicular to one side of the corner;
- Lay the 2nd geogrid section perpendicular to the other side of the corner but not overlapping the 1st geogrid section;
- Lay the secondary geogrid layer one course above and perpendicular to the lower main geogrid layer directional strength;
- **Correct geogrid orientation, strength and length is crucial to the success of the wall project.**

Inside Corner

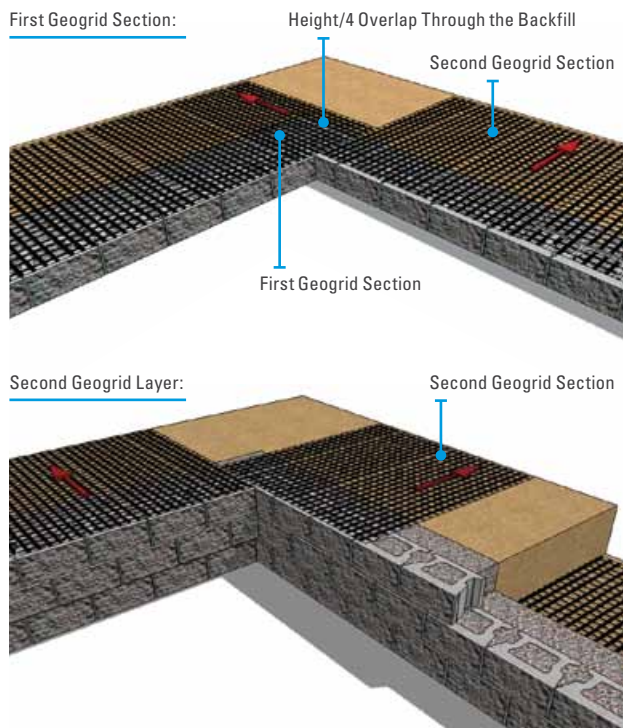
Step 1: Inside First Course



- Place the second unit at right angle and centered to the first **MiraStone™** base unit. Continue to install the base units right and left of the first inside corner units;
- Place the second unit at right angle and centered to the 1st unit on the second course;
- Make sure second course units are placed at a 1/2" setback to the lower inside corner;
- Continue to install the units left and right of the inside corner to complete the second course of the wall;
- Repeat the above step by step installation until the wall height is completed or until reaching the first geogrid layer.



Step 2: Inside Geogrid Corner



- Each geogrid length should be laid perpendicularly to the wall face;
- Geogrid should not overlap on the **MiraStone™** units;
- Lay the 1st geogrid corner section perpendicularly to one side of the corner and overlap $h/4$ through the backfill ($\text{Height of Wall} \div 4$);
- Lay the 2nd geogrid section perpendicularly to the 1st geogrid;
- Lay the second geogrid layer perpendicularly and overlap $h/4$ through the backfill opposite to the first geogrid layer;
- The $h/4$ overlap will alternate layer to layer to properly secure the inside corner;
- **Correct geogrid orientation, strength and length is crucial to the success of the wall project.**



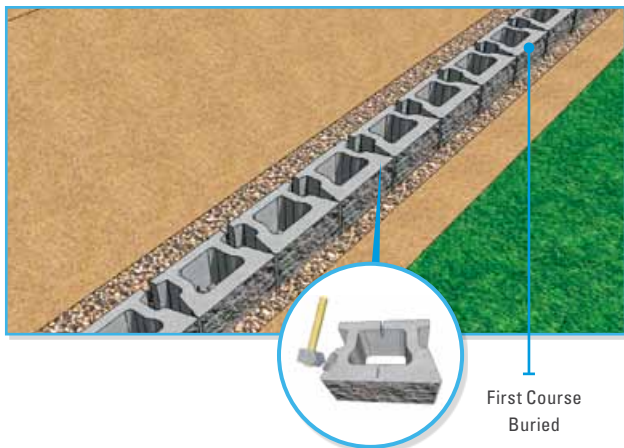
MiraStone™ Stair Details

Proper installation of stairs in a wall project requires the same care and thoroughness as the creation of the wall itself. MiraStone's design features, including the hollow core and SecureLug, simplify the process and provide installers with a range of options to create stairs that are striking and unique. This section provides illustrated step-by-step instructions for using MiraStone™ to construct stair details.

NOTE: **Bolded** installation terms are defined in our online glossary at: www.cornerstonewallsolutions.com

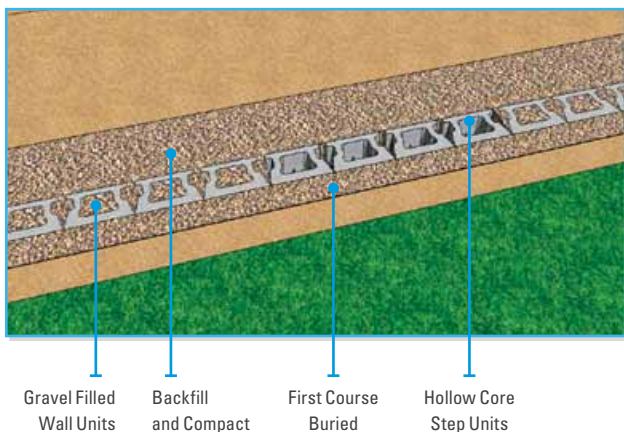
Stair Details

Step 1: Base Leveling Pad



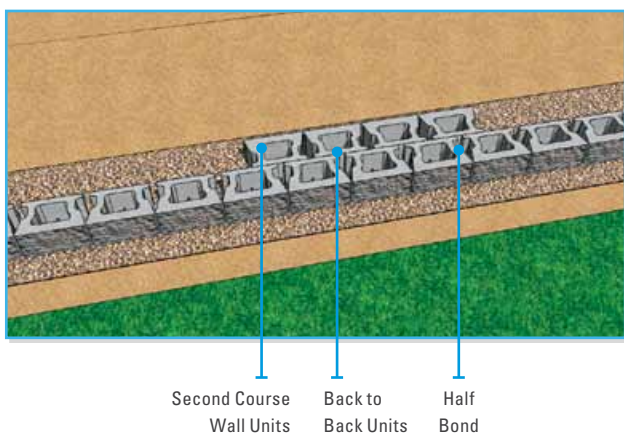
- When building steps, exercise the same care used in typical wall construction;
- Prepare the sub-base and base leveling pad by following **MiraStone™** Gravity Wall Installation Steps 1 to 9;
- Build each step in sequence with each course of the regular wall units for best results of wall to step interlock.

Step 2: Lay First Course



- **MiraStone™** first base units will have the **SecureLugs** removed before placing on the leveling pad;
- First course of step units will be totally buried;
- Backfill behind the first course units with gravel, then compact and level flush to the top of the first course;
- Do not fill the step units' hollow cores with gravel if you plan to use concrete.

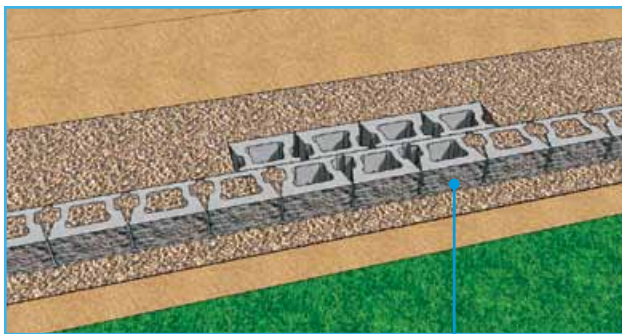
Step 3: Lay Second Course



- Place the second course of units on top of the base units;
- Place a second row of units back behind the second course of units on half bond;
- Backfill behind the second course of units with gravel, then compact and level flush to the top of the second course;
- Do not fill the step units' hollow cores with gravel if you plan to use concrete.

Stair Details

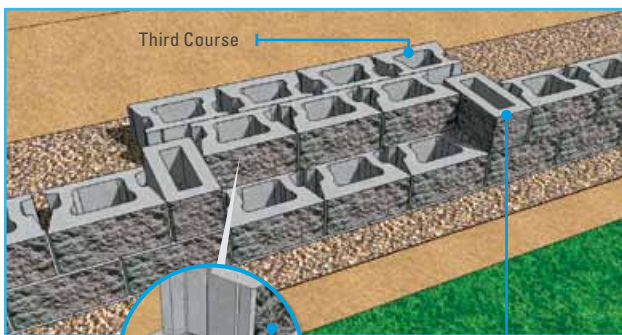
Step 4: Lay Third Course



Backfill and Compact Behind Units

- Place the third course of units on the lower backward facing units with the **SecureLugs** placed into the 2 hollow cores of the lower units on half bond;
- Pull the units forward to lock the **SecureLugs** into the lower backward units;
- The third course units will be in a forward batter approximately 1.5 inch leaving 10.5 inches exposed on the front first step;
- Place a second row of units back to back behind the third course of units on half bond.

Step 5: Continue Installation

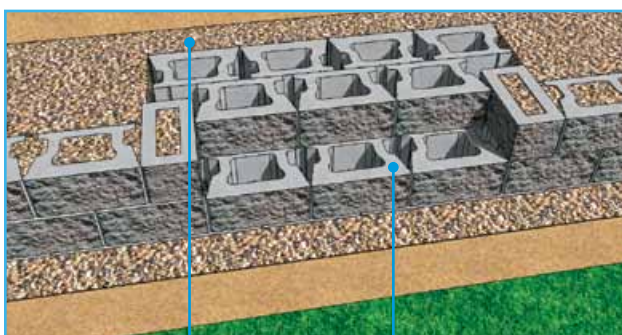


SecureLug Interlock

1.5" Forward Batter

90° Corner

- Continue to install each course of step units following the same steps as above;
- The top and final step does not need backward units.

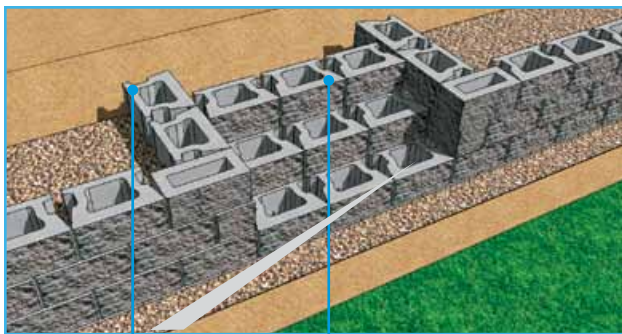


Backfill and Compact

Stair Tread

Stair Details

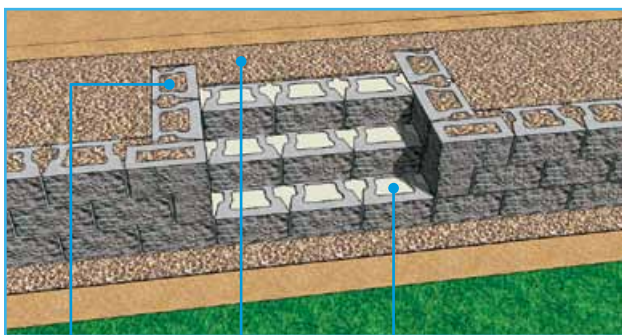
Step 6: Concrete Core Steps



Typical Wall Construction

Fourth Course

- Concrete filling the cores of all the step units will provide for greater stair stability;
- Concrete core fill flush to the top of the units;
- Use a steel bar to hand vibrate the cores to insure proper filling;
- Option: Unit cores can be filled with gravel but must be well compacted.

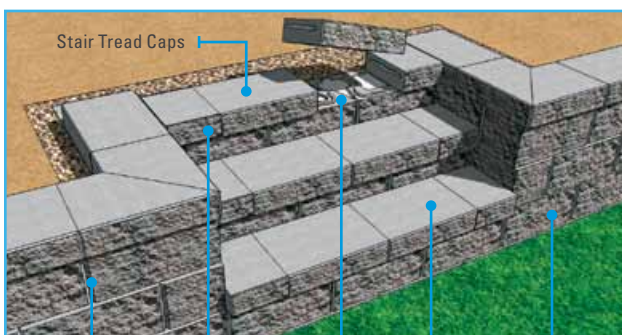


Gravel Filled Wall Units

Backfill and Compact Behind Units

Concrete Core Fill All Step Units

Step 7: Stair Treads



Stair Returns Walls Near Vertical

1.5" Overhang

Concrete Adhesive

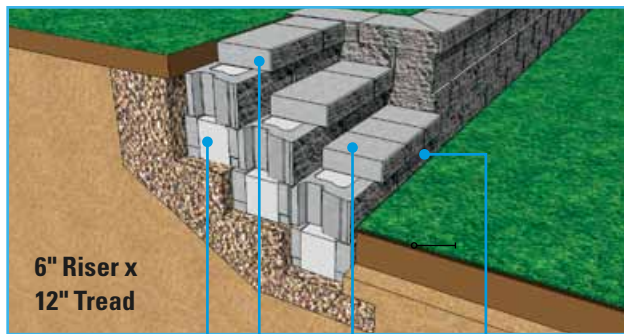
12" (300mm) Tread

6" (150mm) Riser

- **MiraStone™** 12 inch deep cap units can be used as a stair tread;
- Option: Pavers, Patio Slabs or Natural Stone can also be used as a stair tread.

Stair Details

Step 8: 8" Riser Cross Section



Concrete Core Fill
All Step Units

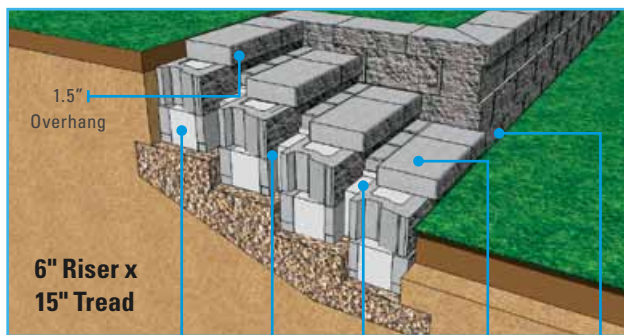
3" (76mm)
Cap

12" (300mm)
Tread

6" (150mm)
Riser

- The 12 inch cap will overhang the step units by approximately 1.5 inch on each step;
- The riser will be a full 6 inches using the above installation;
- Properly secure the cap units using a concrete adhesive;
- Make sure all units are free of dirt and stones before installing;
- Place a bead of adhesive between each joint of the caps.

Step 9: Lower Step Risers



1.5"
Overhang

Concrete Core Fill
All Step Units

Backwards
Buried Units

Concrete
Between Units

15" (380mm)
Tread

6" (150mm)
Riser

- Lower risers can be made such as 6" or 7" by lowering the buried units 1 to 2 inches below the top of the backward buried unit;
- Larger treads can be created by moving the buried units back off the forward step course 3 to 4 inches to create a 15 to 16 inch tread;
- A variety of riser heights and tread lengths can be created to suit your project.



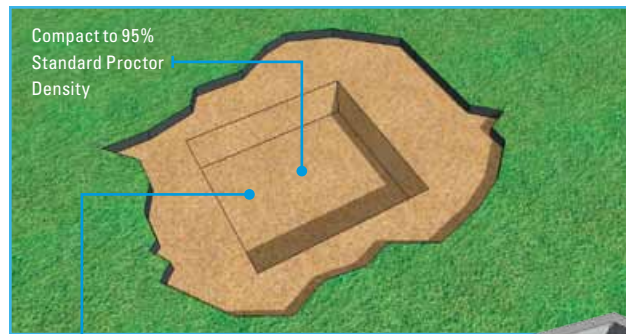
MiraStone™ Pillar Details

Pillars add a finishing touch of elegance to any MiraStone™ wall project. They can be used to create distinguished entranceways to any residence or business and the unit's hollow cores greatly simplify the placement of lighting in the pillars. This section provides simple instructions for the creation of a 27" pillar.

NOTE: **Bolded** installation terms are defined in our online glossary at: www.cornerstonewallsolutions.com

27" Pillar

Step 1: Leveling Pad



Sub Base Leveling Pad
14" Below Finished Grade



- Excavate and prepare your **Sub Base Leveling Pad**;
- Install leveling pad of well graded gravel (also known as road base aggregates) a minimum of 8" (200 mm) thick and 40" (1000 mm) square. Compact to 95% standard proctor density
- Install the first 4 corner units perpendicular and square to each other;
- Ensure first base course is level and square to center of pad;
- Bury the first course completely for stability.

MiraStone™ 8" 90° Corner Unit:

6" Height x 18" Width x 9" Depth (152 H x 457 W x 229 mm D)

Weight: 65 lbs (29 kgs)

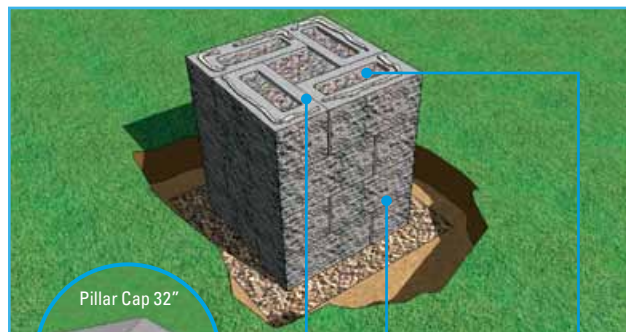
Step 2: Second Course



Concrete Adhesive Leveling Pad Base Stabilization Fabric

- Place second course of the **MiraStone™ 90° Corner** units directly on top of the first course;
- Flip and turn the second course corner units upside down to create an overlapping bond;
- **Clear Crush Drain Gravel** (Angular Aggregates free of fines) should be placed in the cores and middle of pillar (concrete core filling optional) use a dry concrete mix to prevent leaching of cement;
- **Concrete Adhesive** should be applied to all units to ensure course to course interlock.

Step 3: Additional Course



Flip and Turn Overlapping Bonds on Each Course Gravel Filled Cores

- Repeat Step 1 and Step 2 until desired height of pillar has been reached.

Step 4: Completion

- Complete the pillar with a **Pillar Cap**;
- Secure the Pillar Cap with a concrete adhesive ***Pillar cap approximately 32" (508mm)**.

The soil friction angle in these charts is used to calculate the pressure soil will have on a MiraStone™ Geogrid reinforced wall. This guide outlines 26, 30 & 34 degree friction angle soil types. Additionally, three different top-of-wall load conditions are used in each of the soil types i.e. no surcharge load, 100 psf load and a 4 to 1 slope.

The assumed weight for the three soil types is approximately 120 lb/ft³ (19kN/m³). A well graded gravel leveling pad with a minimum of 1 (6") unit of burial is assumed for base sliding resistance. All sub base, leveling pad and backfill materials should be compacted to a minimum of 95% Standard Proctor.

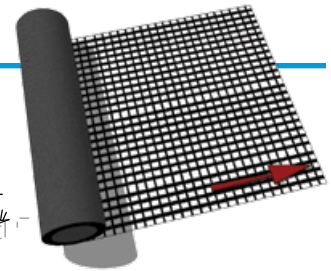
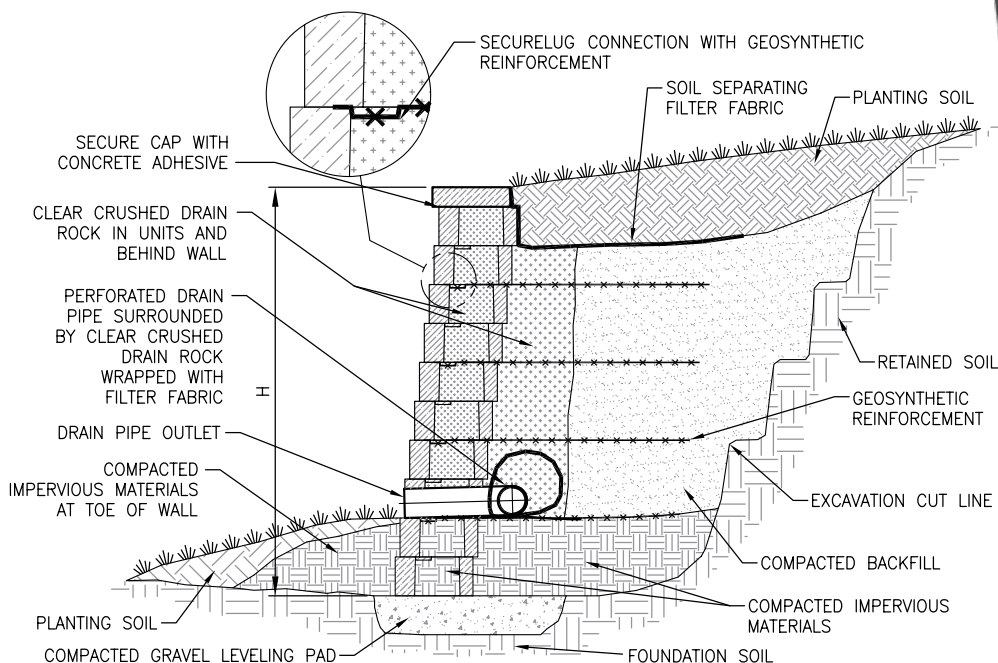
The MiraStone™ concrete SecureLug has a built in batter or set back of 4.5 degrees or 1"/vertical foot of wall. For more specific soil analysis refer to our website, or consult a qualified engineer.

These preliminary design charts are used by owner, designer, architect and installer to calculate construction cost only and are not for construction purposes. A qualified engineer should be consulted for a final construction design.



Geogrids are meshes typically made of a regular pattern of tensile elements usually made of a fairly rigid type of plastic. These are used to strengthen fill materials in geotechnical applications. They provide increased shear strength between soil strata interfaces. Their tensile strength can prevent or decrease the degree of differential settlement in some applications such as beneath structures or roads by transmitting the load over a broader area of soil, thereby diminishing the vertical stress — and subsequent compression — in the soil.

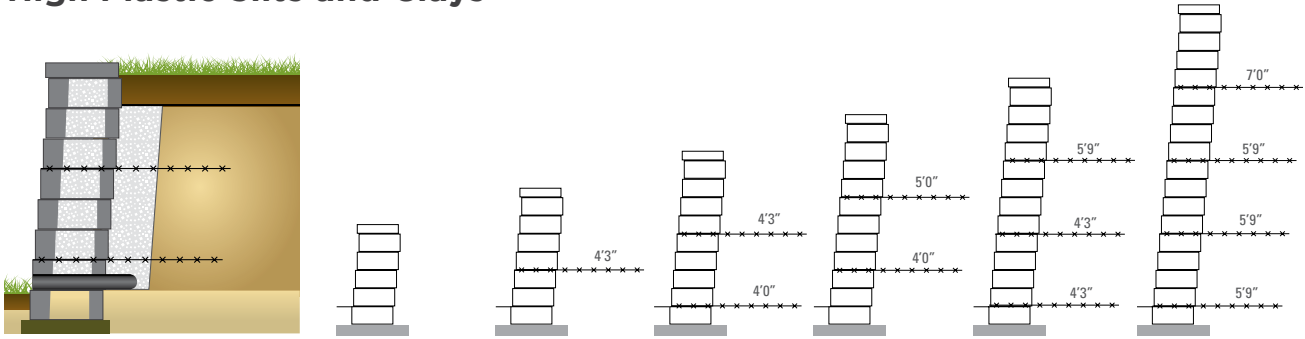
Geogrid Reinforced Cross Section



26° Soil

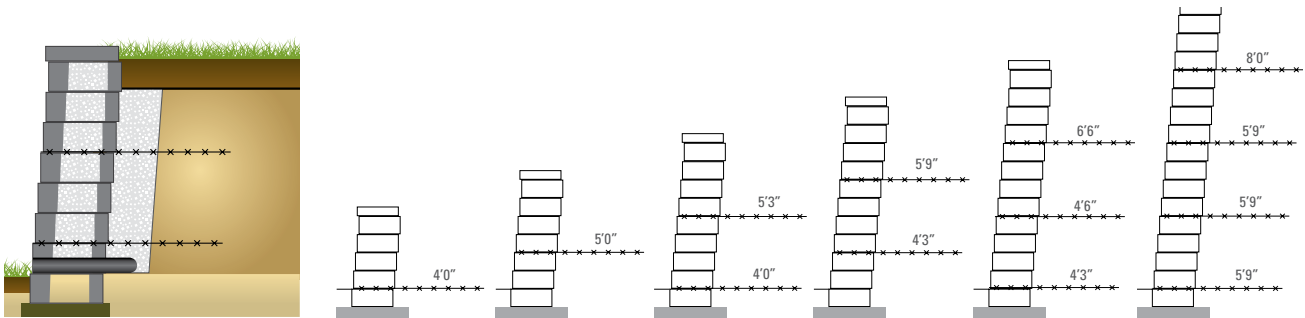
Case A: Flat At Top & Bottom Of Wall - No Surcharge

High Plastic Silts and Clays



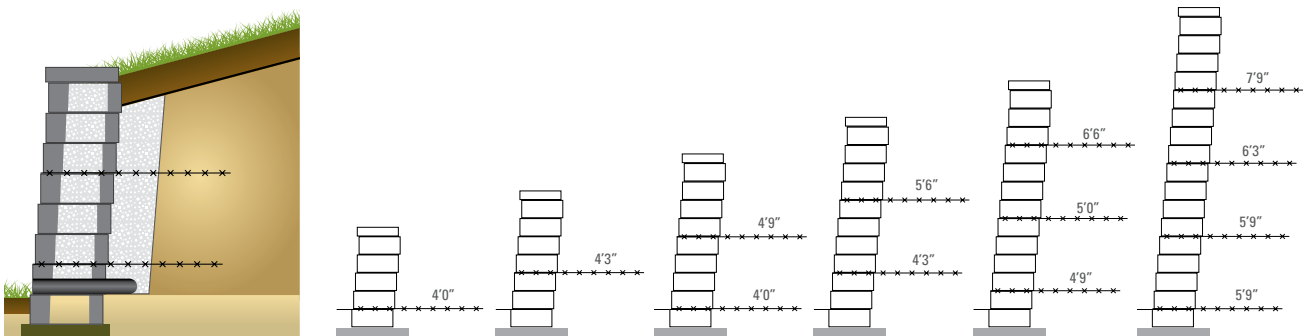
Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.000	0.472	0.917	1.000	1.583	2.694
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case B: Flat At Top & Bottom Of Wall - 100 PSF Surcharge



Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.444	0.556	1.028	1.111	1.694	2.806
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case C: 4/1 Slope at Top - Flat Bottom



Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.444	0.472	0.972	1.083	1.806	2.833
# Block per Ln Ft	3.75	5.25	6.75	8.25	10.50	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Approximate Equivalent Geogrids: SRW: 3 Series, Strata: SG150, Synteen: SF20, Mirafi: 2XT, Tensar: BX1200, Luckenhaus/Raugrid: 3/3-20, Huesker/Fortrac: 35/20-20

DO NOT USE FOR CONSTRUCTION • FOR PRELIMINARY ESTIMATION ONLY

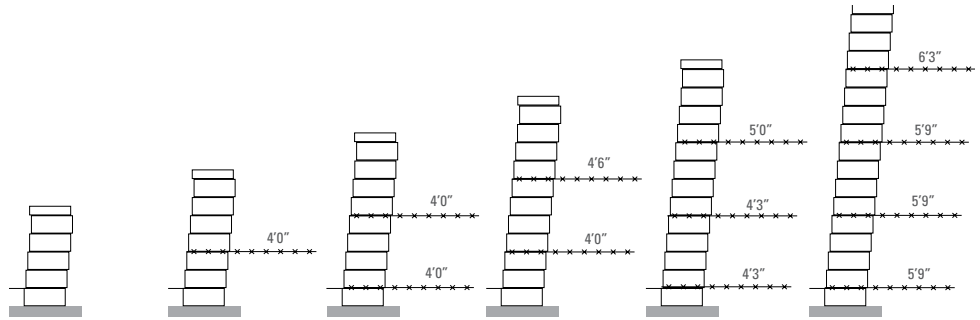
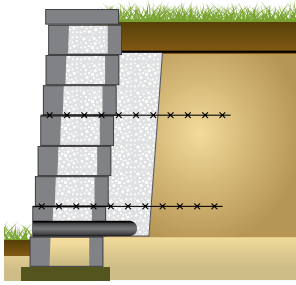
The above charts are intended for preliminary estimation only and all designs must be reviewed by a professional engineer.

Use of the charts are the sole responsibility of the user. CornerStone Wall Solutions Inc. assumes no liability for improper use of the charts.

30° Soil

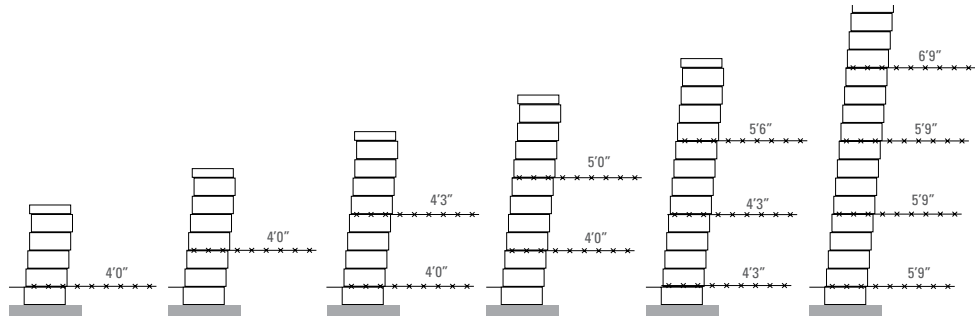
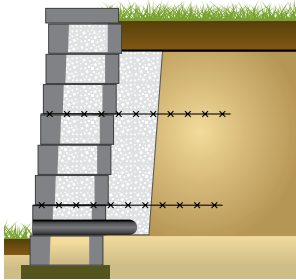
Case A: Flat At Top & Bottom Of Wall - No Surcharge

Sandy Silts and Clays



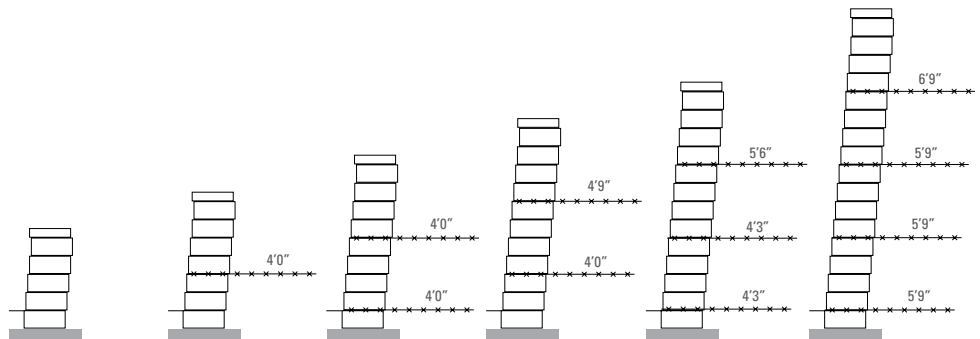
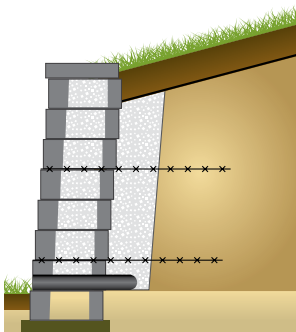
Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.000	0.444	0.889	0.944	1.500	2.611
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case B: Flat At Top & Bottom Of Wall - 100 PSF Surcharge



Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.444	0.444	0.917	1.000	1.556	2.667
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case C: 4/1 Slope at Top - Flat Bottom



Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.000	0.444	0.889	0.972	1.556	2.667
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Approximate Equivalent Geogrids: SRW: 3 Series, Strata: SG150, Synteen: SF20, Mirafi: 2XT, Tensar: BX1200, Luckenhaus/Raugrid: 3/3-20, Huesker/Fortrac: 35/20-20

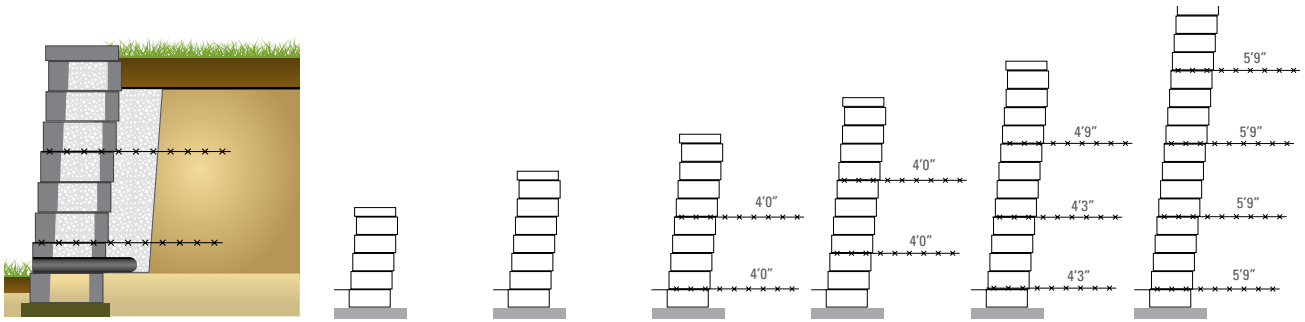
DO NOT USE FOR CONSTRUCTION • FOR PRELIMINARY ESTIMATION ONLY

The above charts are intended for preliminary estimation only and all designs must be reviewed by a professional engineer. Use of the charts are the sole responsibility of the user. CornerStone Wall Solutions Inc. assumes no liability for improper use of the charts.

34° Soil

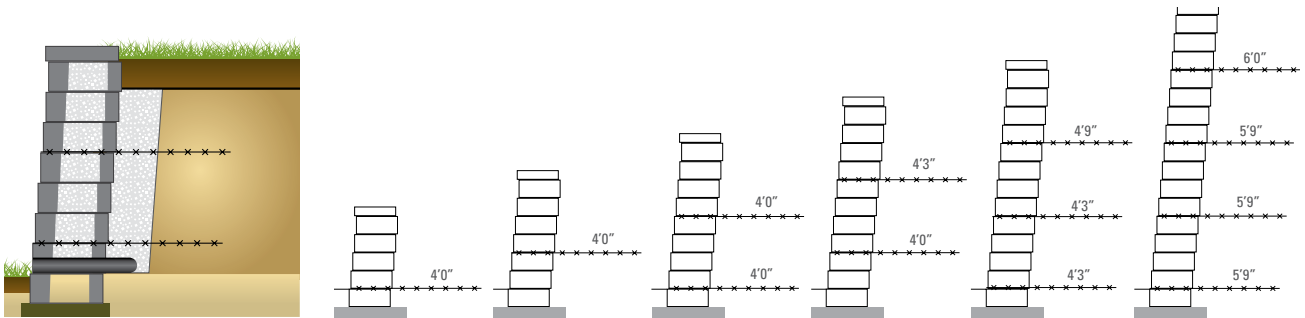
Case A: Flat At Top & Bottom Of Wall - No Surcharge

Sandy Gravel



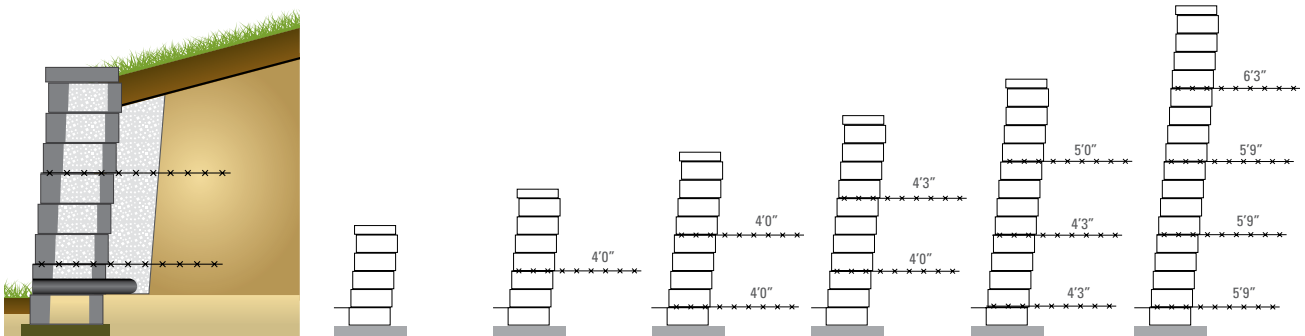
Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.000	0.000	0.889	0.889	1.472	2.556
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case B: Flat At Top & Bottom Of Wall - 100 PSF Surcharge



Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.444	0.444	0.889	0.917	1.472	2.583
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Case C: 4/1 Slope at Top - Flat Bottom



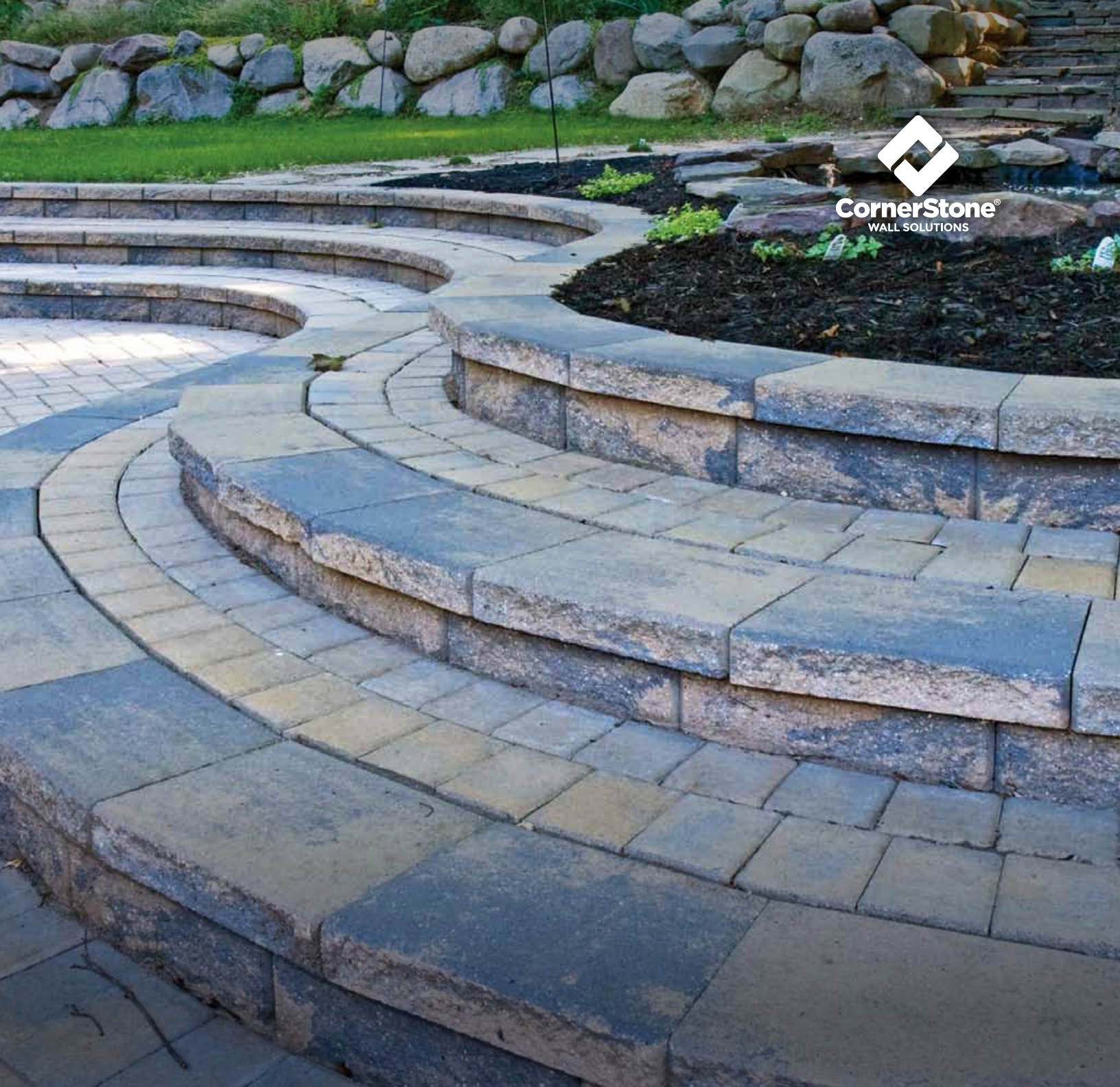
Exposed Hgt wo/cap	2'0"	3'0"	4'0"	5'0"	6'0"	8'0"
Grid Sq Yd per Ln Ft	0.000	0.444	0.889	0.917	1.500	2.611
# Block per Ln Ft	3.75	5.25	6.75	8.25	9.75	12.75
# Cap per Ln Ft	.75	.75	.75	.75	.75	.75

Approximate Equivalent Geogrids: SRW: 3 Series, Strata: SG150, Synteen: SF20, Mirafi: 2XT, Tensar: BX1200, Luckenhaus/Raugrid: 3/3-20, Huesker/Fortrac: 35/20-20

DO NOT USE FOR CONSTRUCTION • FOR PRELIMINARY ESTIMATION ONLY

The above charts are intended for preliminary estimation only and all designs must be reviewed by a professional engineer.

Use of the charts are the sole responsibility of the user. CornerStone Wall Solutions Inc. assumes no liability for improper use of the charts.



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