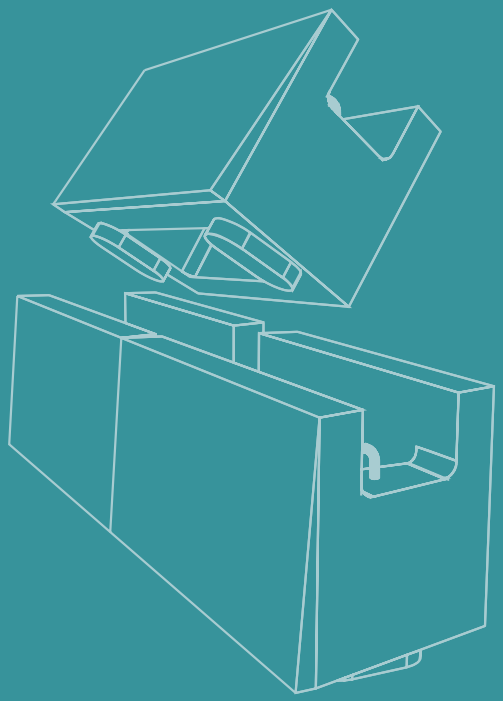
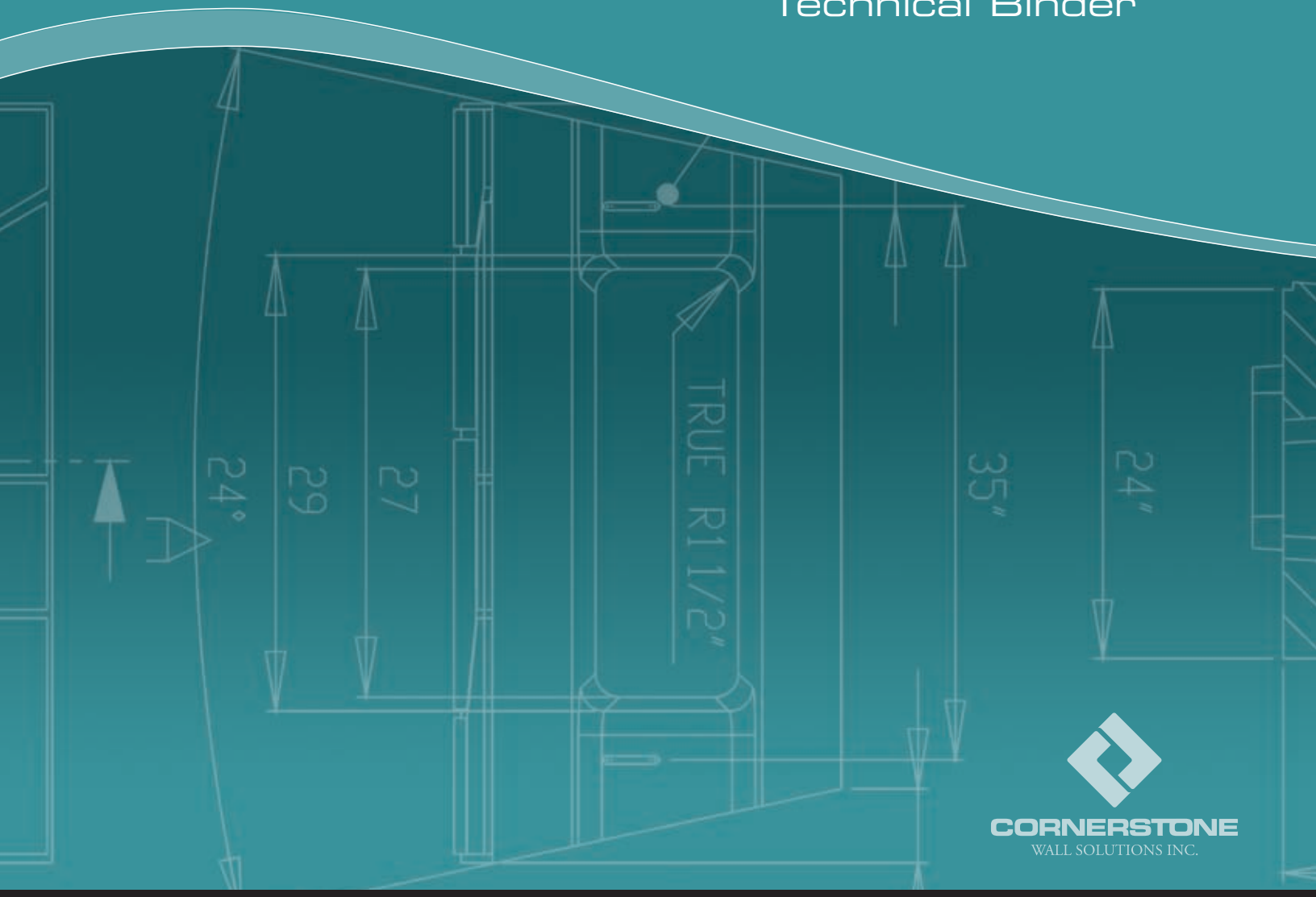


MagnumStone™

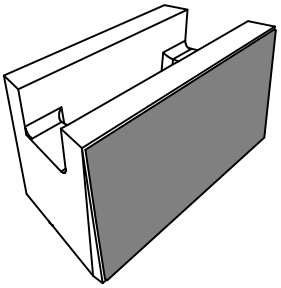
Technical Binder

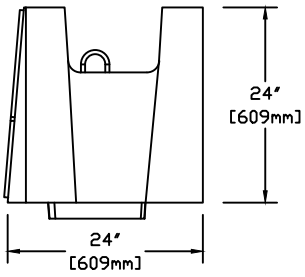


CORNERSTONE
WALL SOLUTIONS INC.

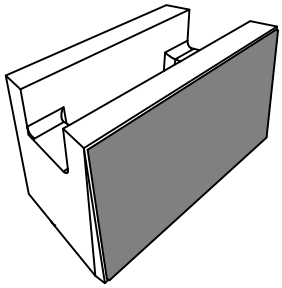
MagnumStone

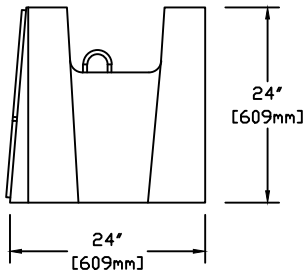
>>>THE UNITS



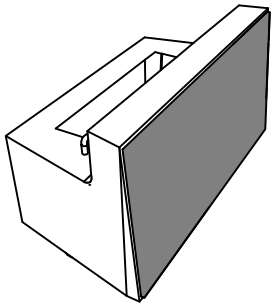


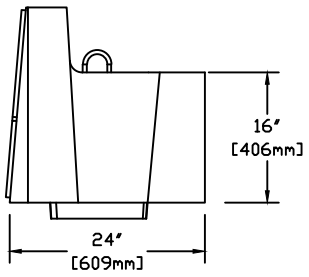
>>>STANDARD



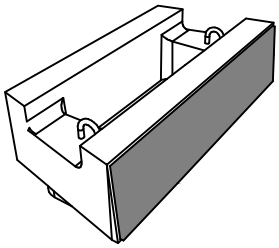


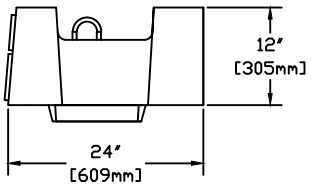
>>>STANDARD BASE



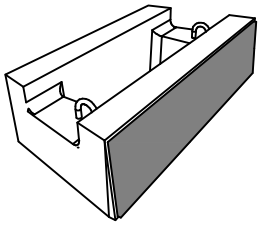


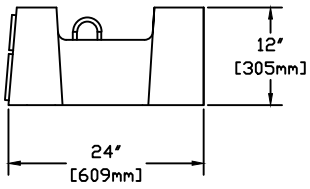
>>>STANDARD TOP



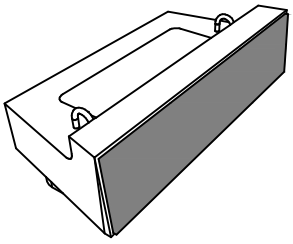


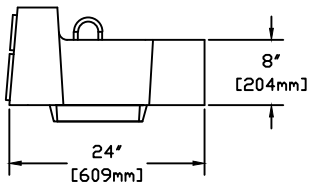
>>>HALF HIGH



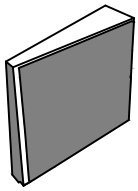


>>>HALF HIGH BASE

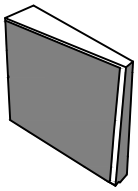




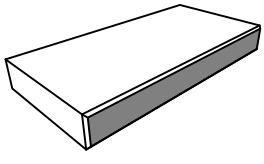
>>>HALF HIGH TOP



>>>LEFT END CAP



>>>RIGHT END CAP

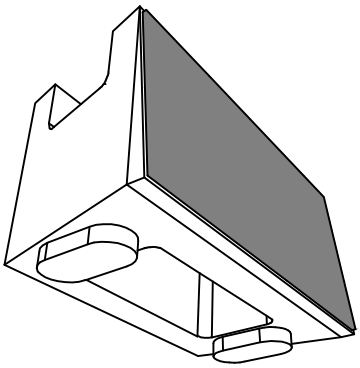


>>>STEP/CAP

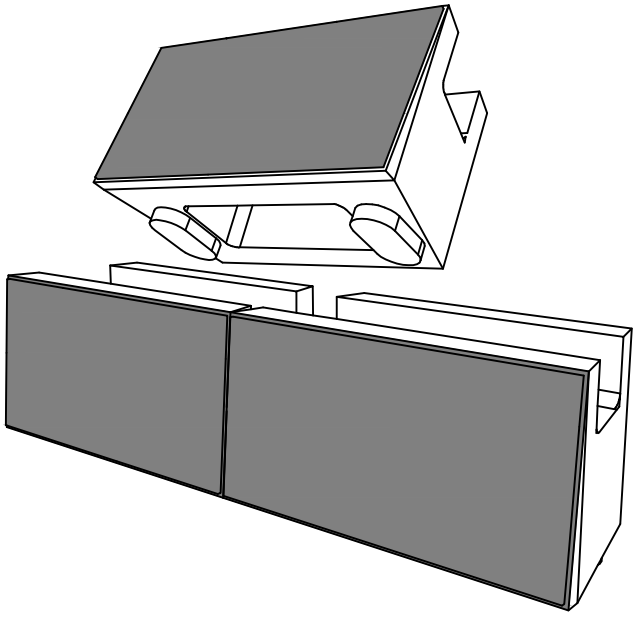
CORNERSTONE
WALL SOLUTIONS INC.

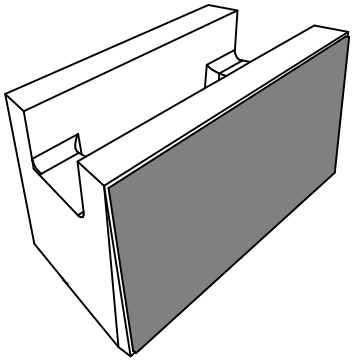
MagnumStone

>>>STANDARD UNIT



>>>ISOMETRIC BOTTOM VIEW

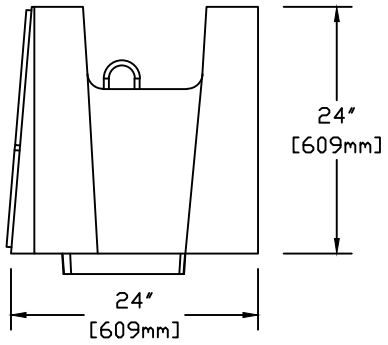




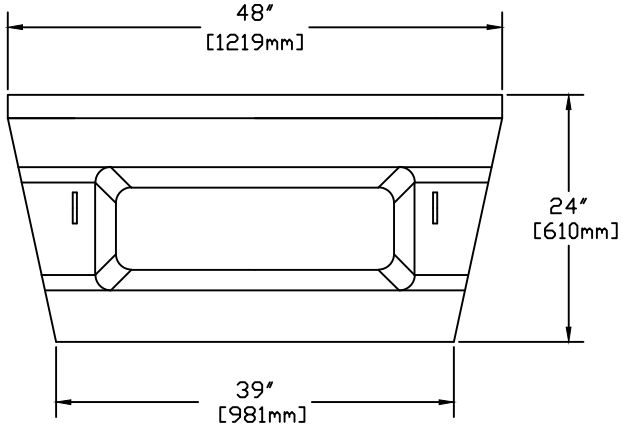
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	24"	610mm
Face Area	8 sq ft	0.74 sq m
Setback	4.5deg	2.0"/Unit
Weight	1370lbs	621Kg*



>>>SIDE VIEW



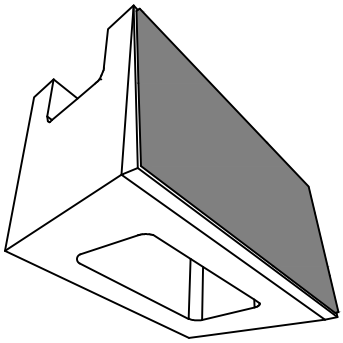
>>> TOP VIEW

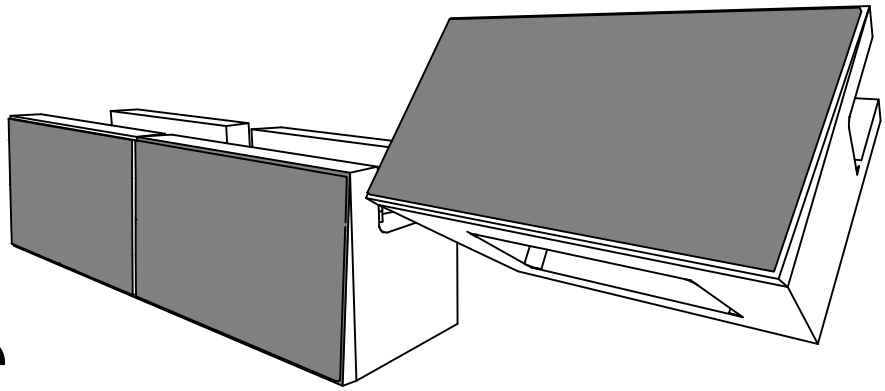
*Weights may vary betweem producers

CORNERSTONE
WALL SOLUTIONS INC.

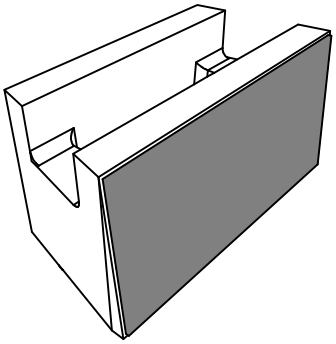
MagnumStone

>>>STANDARD BASE UNIT





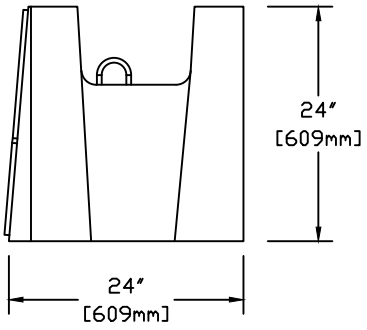
>>>ISOMETRIC BOTTOM VIEW

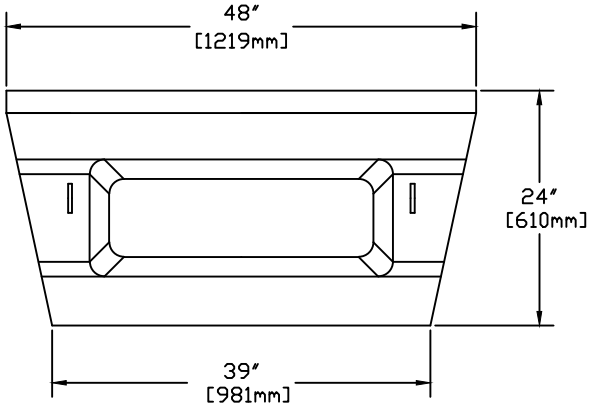


Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	24"	610mm
Face Area	8 sq ft	0.74 sq m
Setback	4.5deg	2.0"/Unit
Weight	1345lbs	621Kg*

>>>ISOMETRIC TOP VIEW





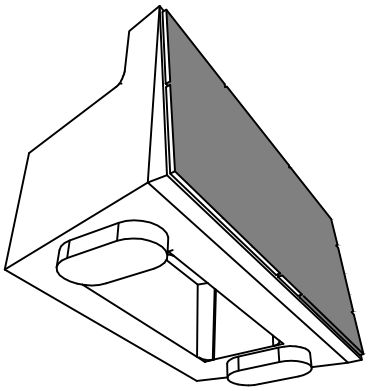
>>>SIDE VIEW >>> TOP VIEW

*Weights may vary betweem producers

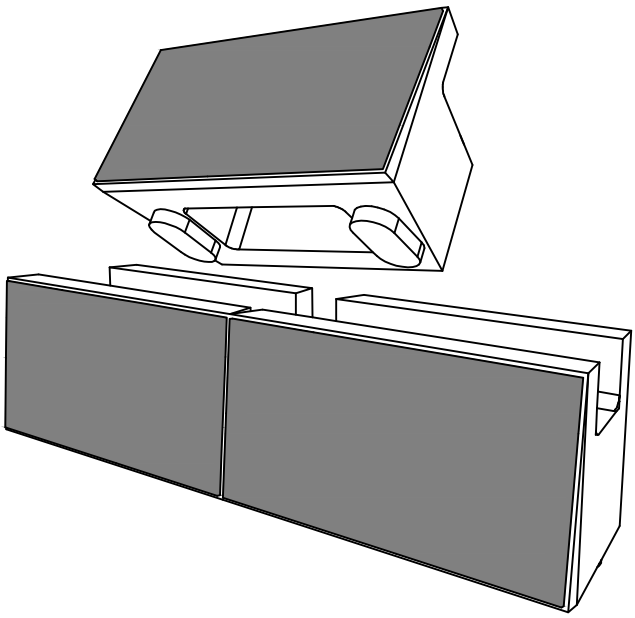
CORNERSTONE
WALL SOLUTIONS INC.

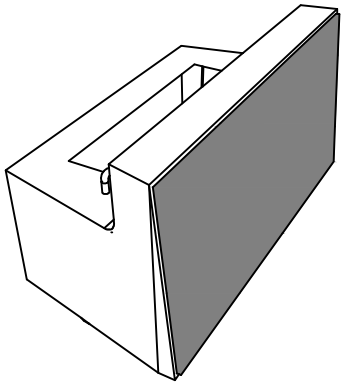
MagnumStone

>>>STANDARD TOP UNIT



>>>ISOMETRIC BOTTOM VIEW

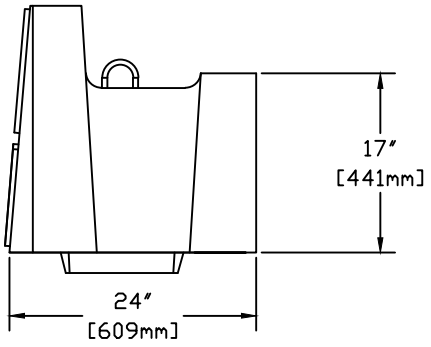




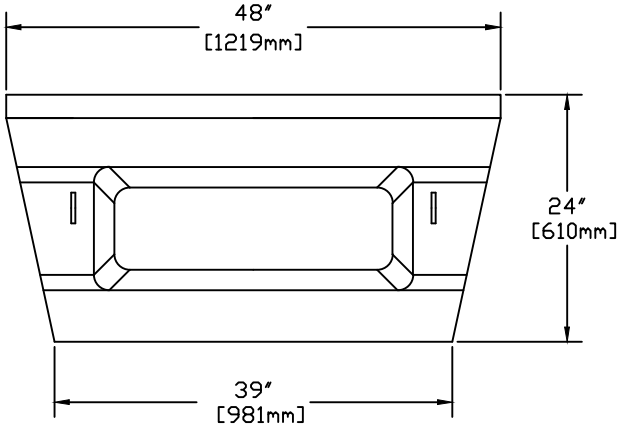
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	24"	610mm
Face Area	8 sq ft	0.74 sq m
Setback	4.5deg	2.0"/Unit
Weight	1220lbs	553Kg*



>>>SIDE VIEW



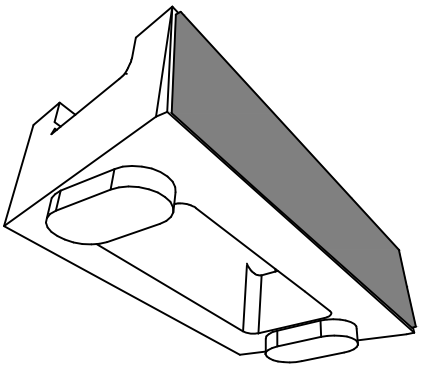
>>> TOP VIEW

*Weights may vary betweem producers

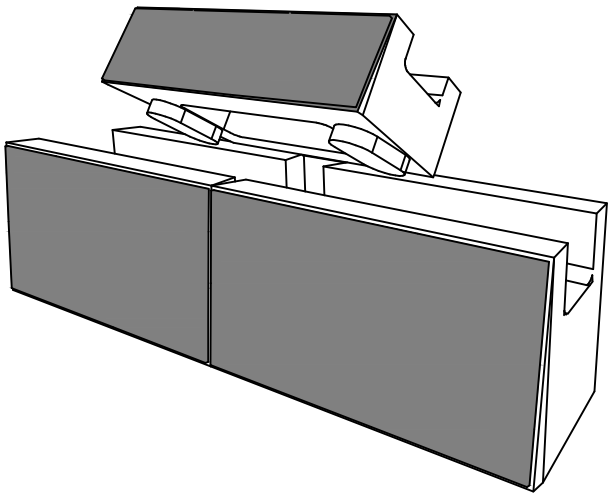
CORNERSTONE
WALL SOLUTIONS INC.

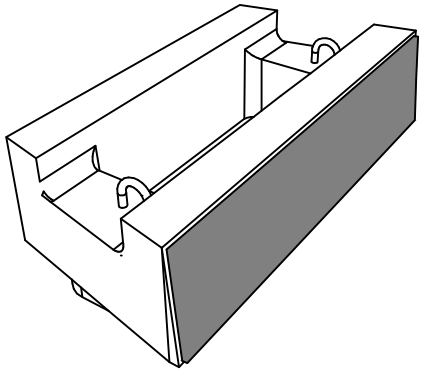
MagnumStone

>>>HALF HIGH UNIT



>>>ISOMETRIC BOTTOM VIEW

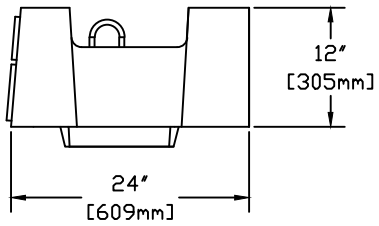




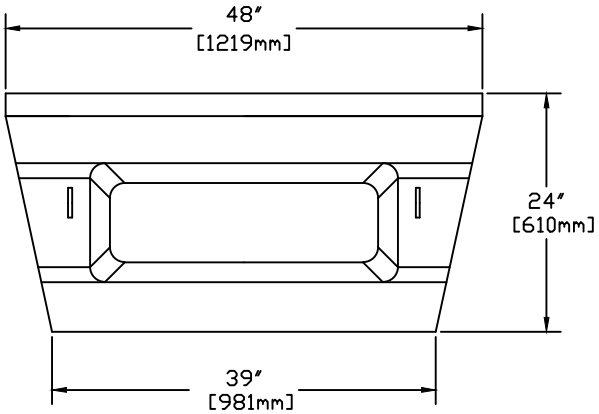
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	12"	305mm
Face Area	4 sq ft	0.37sq m
Setback	4.5deg	1.0"/Unit
Weight	750lbs	340Kg*



>>>SIDE VIEW



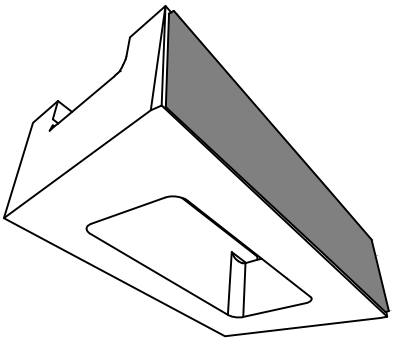
>>> TOP VIEW

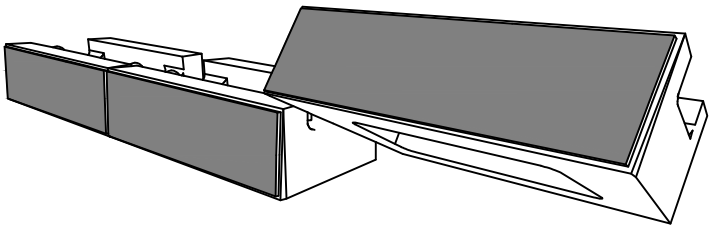
*Weights may vary betweem producers

CORNERSTONE
WALL SOLUTIONS INC.

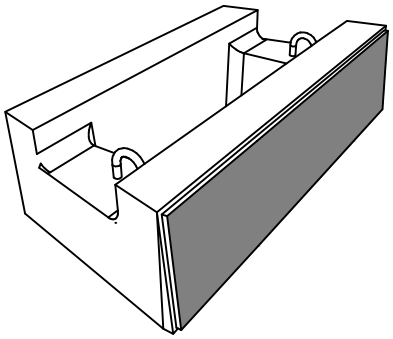
MagnumStone

>>>HALF HIGH BASE UNIT





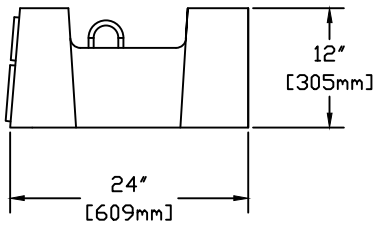
>>>ISOMETRIC BOTTOM VIEW



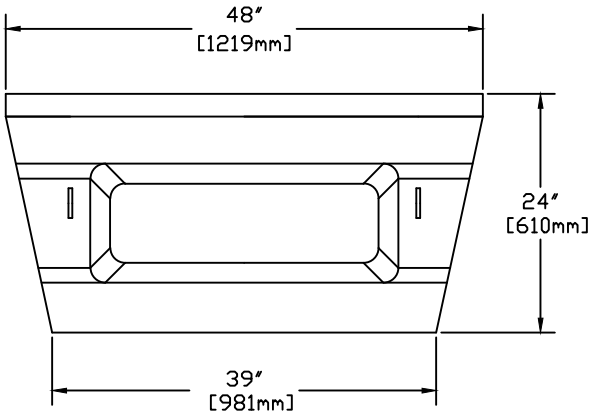
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	12"	305mm
Face Area	4 sq ft	0.37sq m
Setback	4.5deg	1.0"/Unit
Weight	725lbs	328Kg*



>>>SIDE VIEW



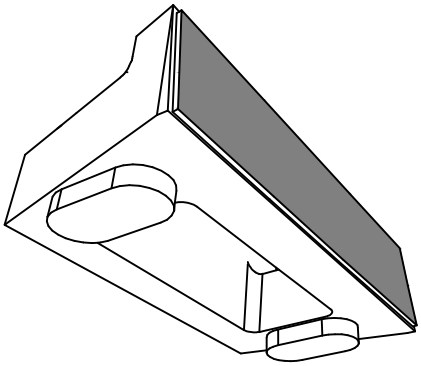
>>> TOP VIEW

*Weights may vary betweem producers

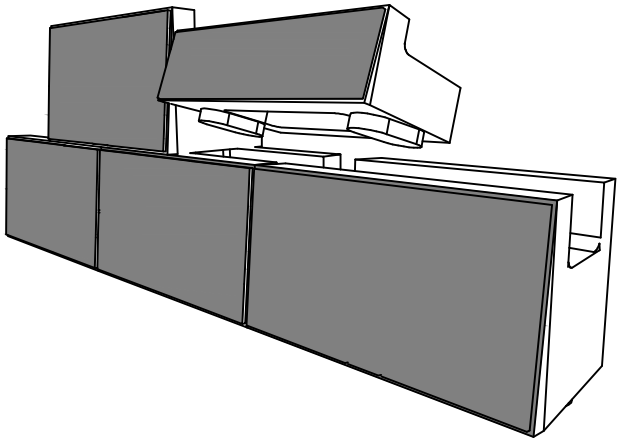
CORNERSTONE
WALL SOLUTIONS INC.

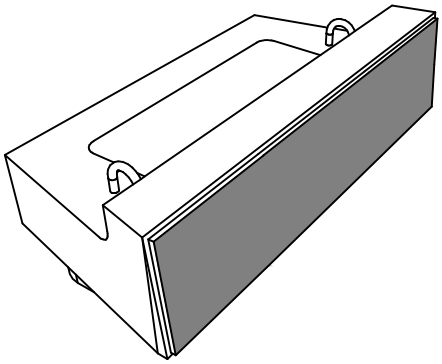
MagnumStone

>>>HALF HIGH TOP UNIT



>>>ISOMETRIC BOTTOM VIEW

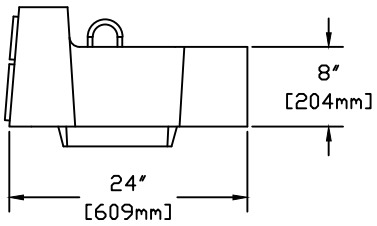




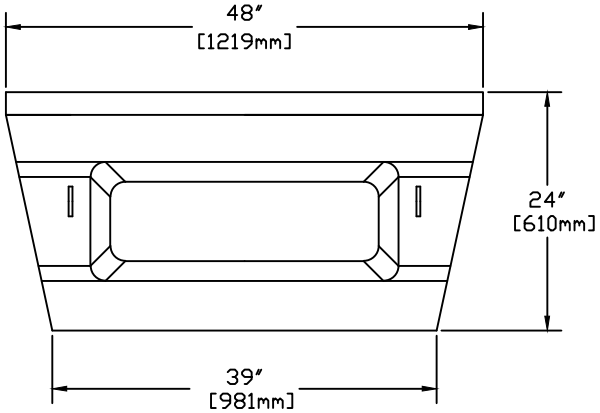
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	305mm
Height	12"	610mm
Face Area	4 sq ft	0.37sq m
Setback	4.5deg	1.0"/Unit
Weight	680lbs	308Kg*



>>>SIDE VIEW



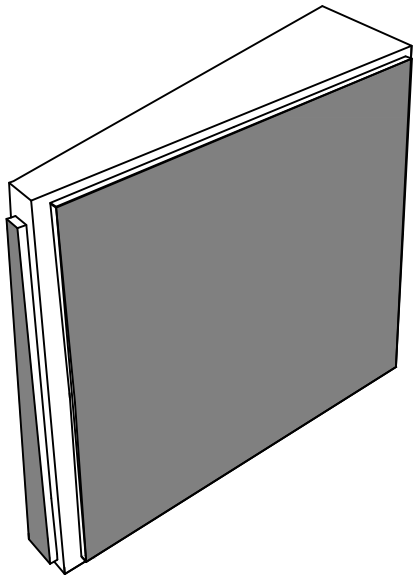
>>> TOP VIEW

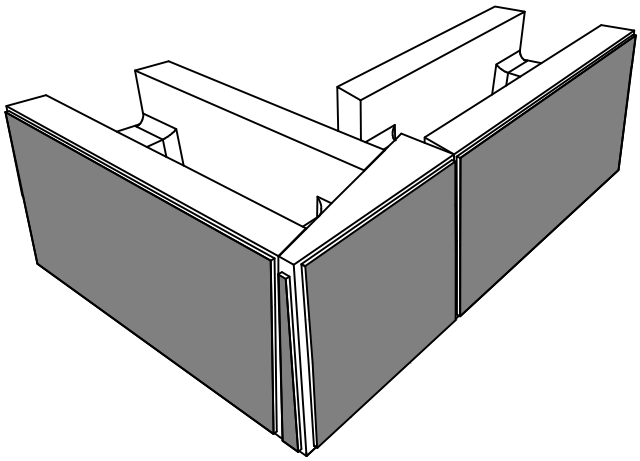
*Weights may vary betweem producers

CORNERSTONE
WALL SOLUTIONS INC.

MagnumStone

>>>STANDARD CORNER/END UNIT

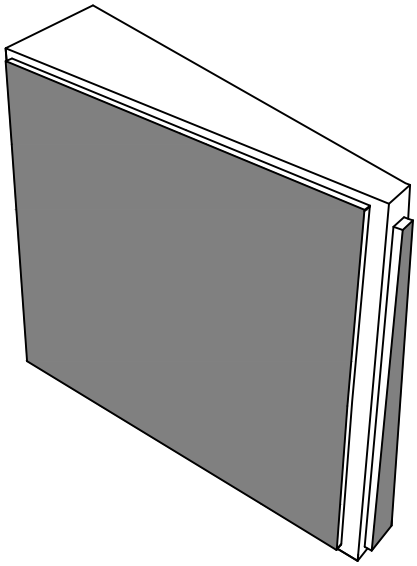


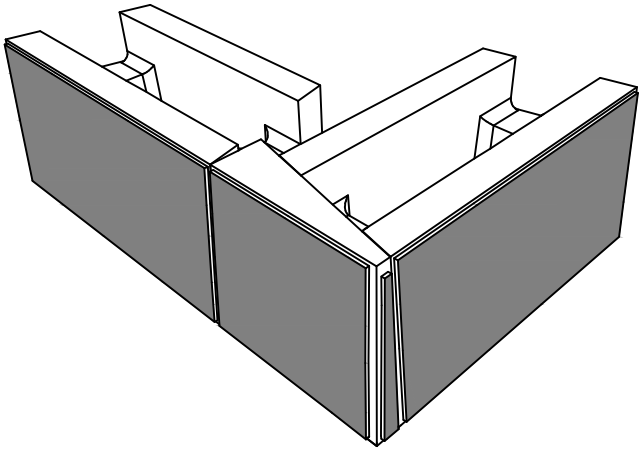


Dimensions

Face Width	26"	660mm
Back Width	26"	660mm
Depth	3/8.5"	76/215mm
Height	24"	610mm
Face Area	4.3sq ft	0.4 sq m
Setback	4.5deg	2"/Unit
Weight	314lbs	142Kg*

>>>RIGHT END CAP





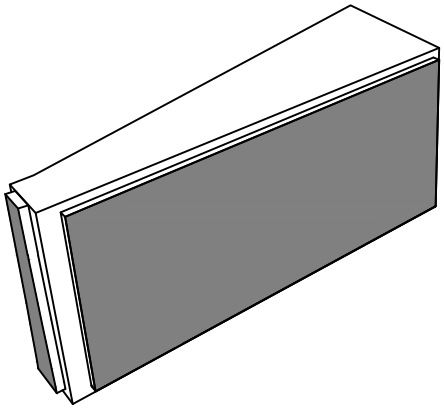
>>>LEFT END CAP

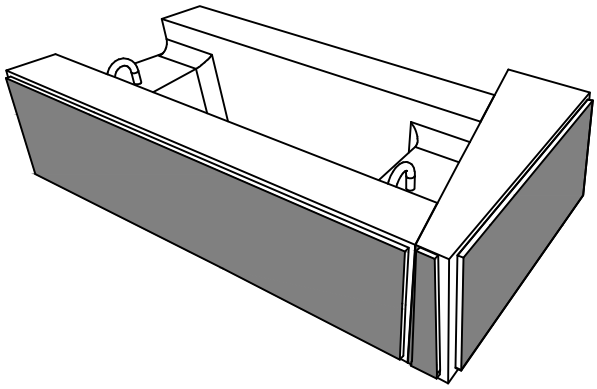
*Weights may vary betweem producers

CORNERSTONE
WALL SOLUTIONS INC.

MagnumStone

>>>HALF HIGH CORNER/END UNIT

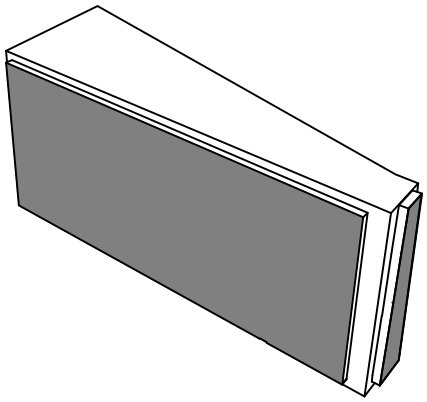


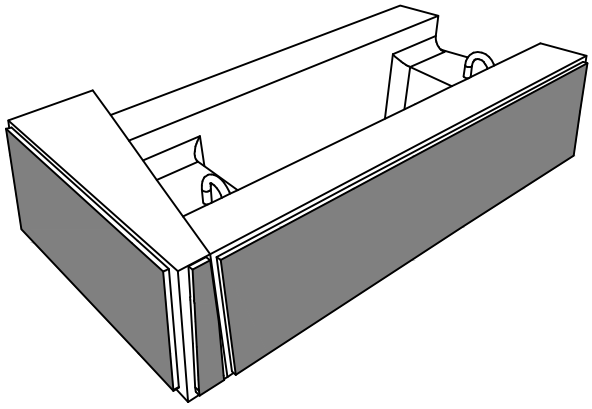


Dimensions

Face Width	26"	660mm
Back Width	26"	660mm
Depth	8/9"	203/229mm
Height	12"	305mm
Face Area	4 sq ft	0.37 sq m
Setback	4.5deg	1"/Unit
Weight	150lbs	68Kg*

>>>RIGHT END CAP



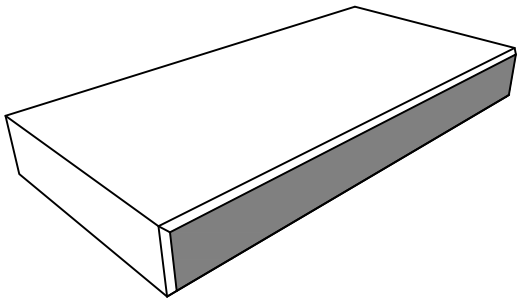


>>>LEFT END CAP

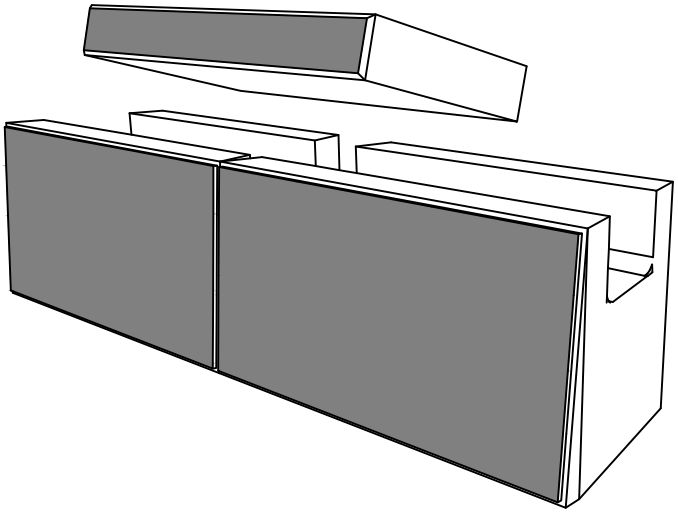
*Weights may vary betweem producers

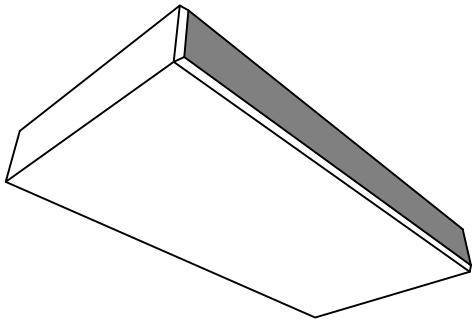
MagnumStone

>>>STEP/CAP



>>>ISOMETRIC BOTTOM VIEW

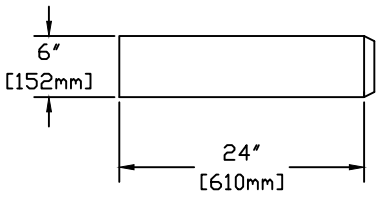




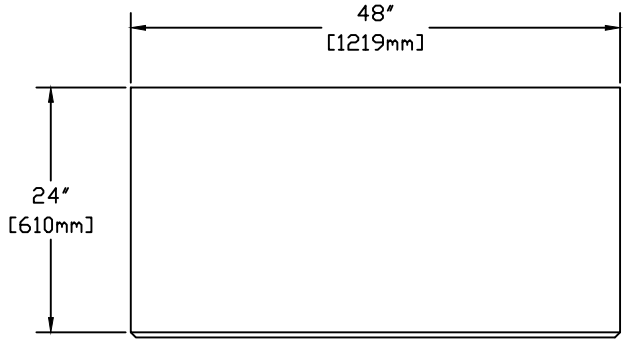
>>>ISOMETRIC TOP VIEW

Dimensions

Face Width	48"	1219mm
Back Width	48"	1219mm
Depth	24"	610mm
Height	6"	152mm
Face Area	2 sq ft	0.186 sq m
Weight	290lbs	131Kg*



>>>SIDE VIEW



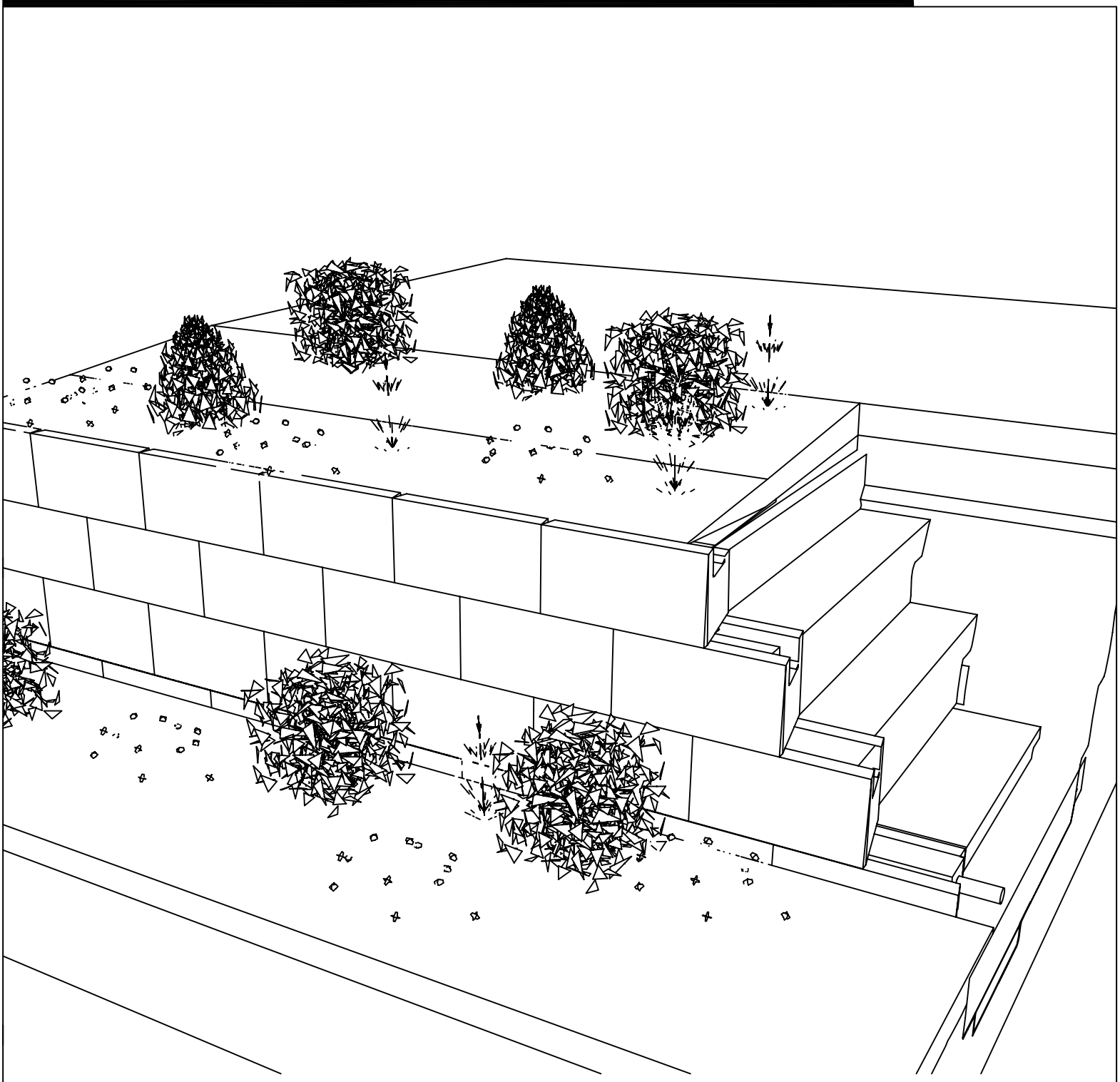
>>> TOP VIEW

*Weights may vary betweem producers

CORNERSTONE
WALL SOLUTIONS INC.

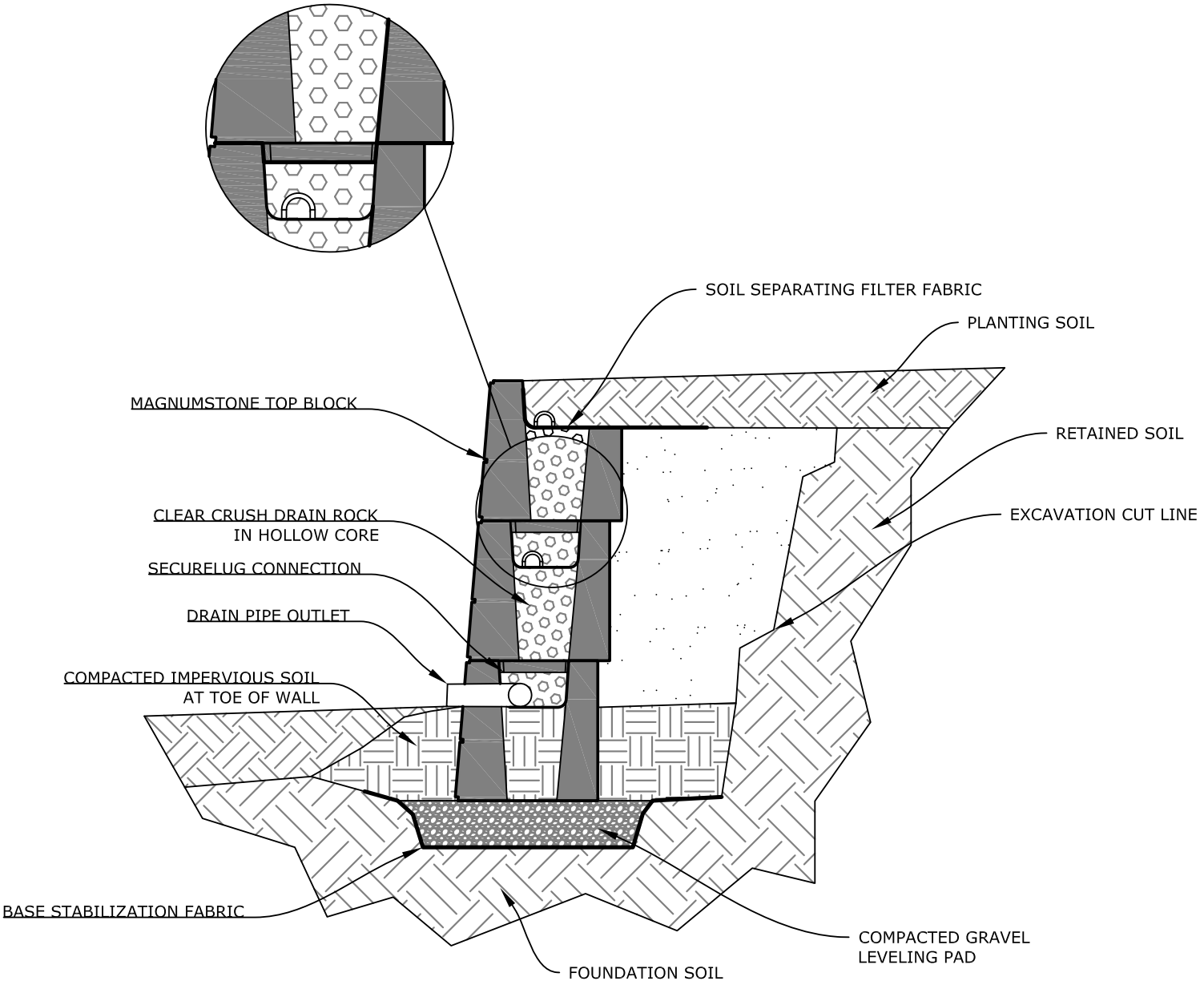
MagnumStone

>>>GRAVITY

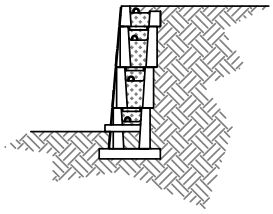


These preliminary details are intended solely to act as an aid when designing a wall. This drawing should not be used for final design or construction. Each site–specific wall should be certified and signed by a registered geotechnical engineer in the State or Province that it is being built. The accuracy and use of the details in this document are the sole responsibility of the user.

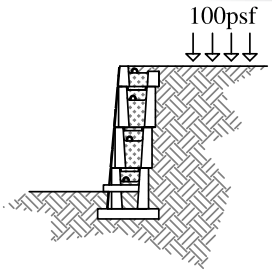
CORNERSTONE
WALL SOLUTIONS INC.


SOIL SEPARATING FILTER FABRIC
PLANTING SOIL
MAGNUMSTONE TOP BLOCK
RETAINED SOIL
CLEAR CRUSH DRAIN ROCK
IN HOLLOW CORE
EXCAVATION CUT LINE
SECURELUG CONNECTION
DRAIN PIPE OUTLET
COMPACTED IMPERVIOUS SOIL
AT TOE OF WALL
BASE STABILIZATION FABRIC
COMPACTED GRAVEL
LEVELING PAD
FOUNDATION SOIL

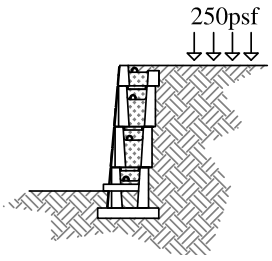
> > > MagnumStone™ Gravity Wall Charts



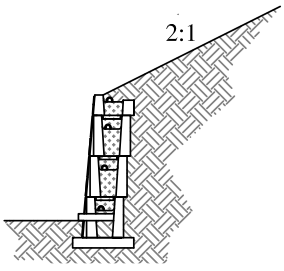
Soil Type	Height Exposed	Height Embedded	Total
AASHTO #57	8.1' (2469mm)	0.5' (152mm)	8.6' (2621mm)
34° Soil	6.6' (2012mm)	0.5' (152mm)	7.1' (2164mm)
30° Soil	5.9' (1798mm)	0.5' (152mm)	6.4' (1951mm)
26° Soil	4.9' (1494mm)	0.5' (152mm)	5.4' (1646mm)



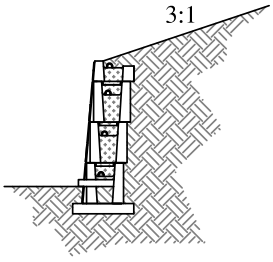
Soil Type	Height Exposed	Height Embedded	Total
AASHTO #57	6.6' (2012mm)	0.5' (152mm)	7.1' (2164mm)
34° Soil	5.4' (1646mm)	0.5' (152mm)	5.9' (1798mm)
30° Soil	4.4' (1341mm)	0.5' (152mm)	4.9' (1494mm)
26° Soil	3.3' (1006mm)	0.5' (152mm)	3.8' (1158mm)



Soil Type	Height Exposed	Height Embedded	Total
AASHTO #57	4.9' (1494mm)	0.5' (152mm)	5.4' (1646mm)
34° Soil	3.3' (1006mm)	0.5' (152mm)	3.8' (1158mm)
30° Soil	2.0' (610mm)	0.5' (152mm)	2.5' (762mm)
26° Soil	0.9' (274mm)	0.5' (152mm)	1.4' (427mm)



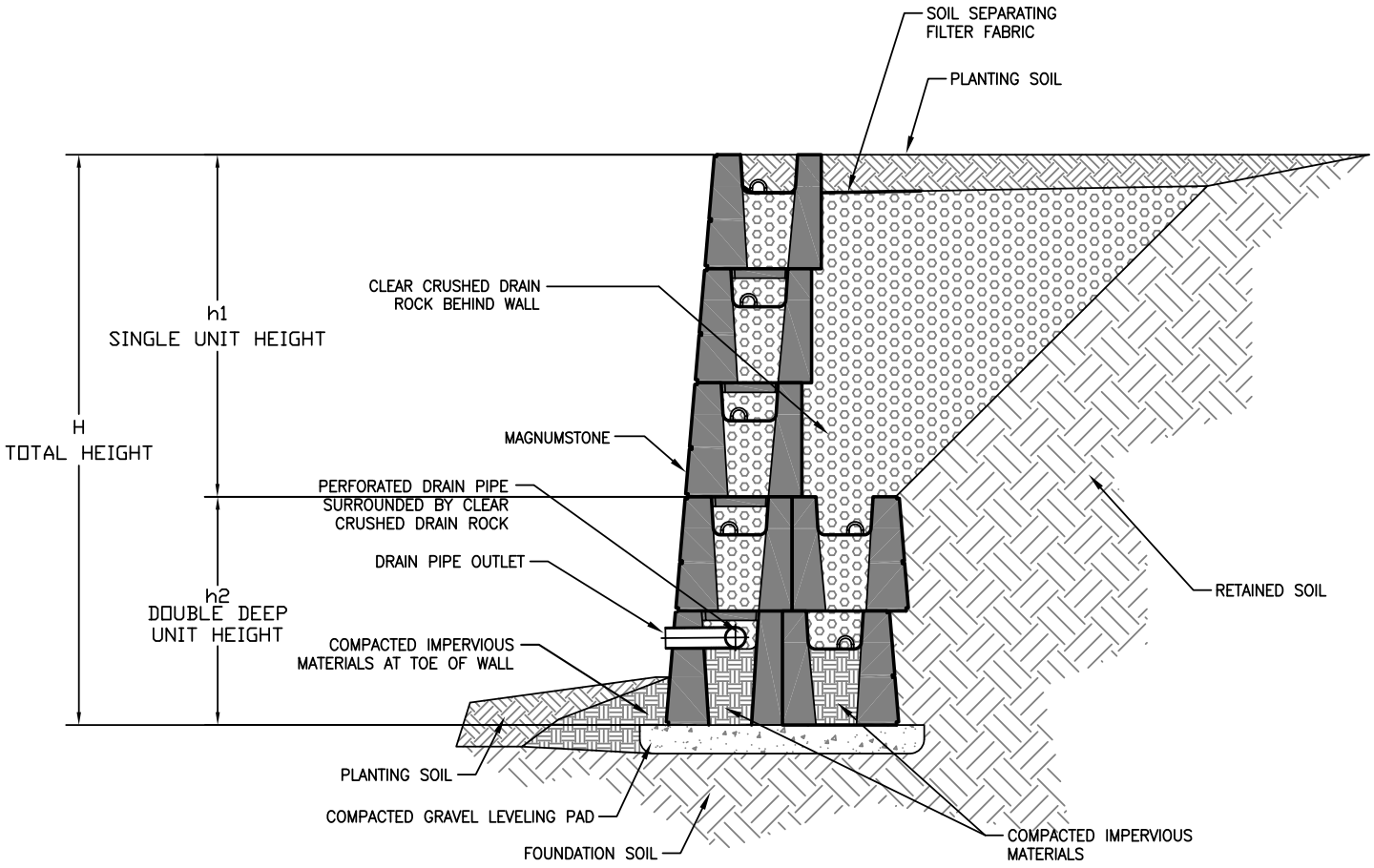
Soil Type	Height Exposed	Height Embedded	Total
AASHTO #57	6.5' (1981mm)	0.5' (152mm)	7.0' (2134mm)
34° Soil	4.5' (1372mm)	0.5' (152mm)	5.0' (1524mm)
30° Soil	3.2' (975mm)	0.5' (152mm)	3.7' (1128mm)
26° Soil			



Soil Type	Height Exposed	Height Embedded	Total
AASHTO #57	7.1' (2164mm)	0.5' (152mm)	7.6' (2316mm)
34° Soil	5.6' (1707mm)	0.5' (152mm)	6.1' (1859mm)
30° Soil	4.4' (1341mm)	0.5' (152mm)	4.9' (1494mm)
26° Soil	3.3' (1006mm)	0.5' (152mm)	3.8' (1158mm)

DISCLAIMER. This chart is for initial estimation purposes only. Do not use for final design or construction. Retain a licensed professional engineer to design every wall on a case-by-case basis using site specific criteria. The accuracy and use of this document are the sole responsibility of the user. All calculations were performed based on NCMA methodology using factors of safety of 1.5 for sliding and overturning. The bearing capacity of base soils will be no less than 3,000 pounds per square foot (psf). All soils have been assumed to be less than 125 pounds per cubic foot (pcf). Global Stability Analysis has not been performed.

> > > MagnumStone™ Double Deep Gravity Wall



DISCLAIMER. This chart is for initial estimation purposes only. Do not use for final design or construction. Retain a licensed professional engineer to design every wall on a case-by-case basis using site specific criteria. The accuracy and use of this document are the sole responsibility of the user. All calculations were performed based on NCMA methodology using factors of safety of 1.5 for sliding and overturning. The bearing capacity of base soils will be no less than 3,000 pounds per square foot (psf). All soils have been assumed to be less than 125 pounds per cubic foot (pcf). Global Stability Analysis has not been performed.

> > > MagnumStone™ Double Deep Gravity Wall Charts

Lower Tier (AASHTO #57)
φ_{soil} = 38° (min.)
γ_{soil} = 110pcf (max.)

Upper Tier (AASHTO #57)
φ_{soil} = 38° (min.)
γ_{soil} = 110pcf (max.)

No Slope, No Load

H	h1	h2
16' (4877mm)	0' (0mm)	16' (4877mm)
14' (4267mm)	2' (610mm)	12' (3658mm)
12' (3658mm)	5' (1524mm)	7' (2134mm)
10' (3048mm)	8' (2438mm)	3' (914mm)
9' (2134mm)	9' (2134mm)	0' (0mm)

2:1 Slope, No Load

H	h1	h2
14' (4267mm)	0' (0mm)	14' (4267mm)
12' (3658mm)	1' (305mm)	11' (3353mm)
10' (3048mm)	4' (1219mm)	6' (1829mm)
8' (2438mm)	6' (1829mm)	2' (610mm)
7' (2134mm)	7' (2134mm)	0' (0mm)

3:1 Slope, No Load

H	h1	h2
15' (4572mm)	0' (0mm)	15' (4572mm)
14' (4267mm)	0' (0mm)	14' (4267mm)
12' (3658mm)	3' (914mm)	9' (2743mm)
10' (3048mm)	5' (1524mm)	5' (1524mm)
8' (2438mm)	7' (2134mm)	1' (305mm)
8' (2438mm)	8' (2438mm)	0' (0mm)

No Slope, 100psf Load

H	h1	h2
16' (4877mm)	0' (0mm)	16' (4877mm)
14' (4267mm)	1' (305mm)	13' (3962mm)
12' (3658mm)	3' (914mm)	9' (2743mm)
10' (3048mm)	6' (1829mm)	5' (1524mm)
8' (2438mm)	7' (2134mm)	1' (305mm)
7' (2134mm)	7' (2134mm)	0' (0mm)

No Slope, 250psf Load

H	h1	h2
14' (4267mm)	0' (0mm)	14' (4267mm)
12' (3658mm)	1' (305mm)	11' (3353mm)
10' (3048mm)	3' (914mm)	7' (2134mm)
8' (2438mm)	5' (1524mm)	3' (914mm)
6' (1829mm)	6' (1829mm)	0' (0mm)
5' (1524mm)	5' (1524mm)	0' (0mm)

Lower Tier
φ_{soil} = 30° (min.)
γ_{soil} = 125pcf (max.)

Upper Tier (AASHTO #57)
φ_{soil} = 38° (min.)
γ_{soil} = 110pcf (max.)

No Slope, No Load

H	h1	h2
13' (3962mm)	0' (0mm)	13' (3962mm)
12' (3658mm)	2' (610mm)	10' (3048mm)
10' (3048mm)	4' (1219mm)	6' (1829mm)
8' (2438mm)	6' (1829mm)	3' (914mm)
6' (1829mm)	6' (1829mm)	0' (0mm)

2:1 Slope, No Load

H	h1	h2
7' (2134mm)	0' (0mm)	7' (2134mm)
7' (2134mm)	3' (914mm)	4' (1219mm)
6' (1829mm)	4' (1219mm)	2' (610mm)
4' (1219mm)	4' (1219mm)	1' (305mm)
4' (1219mm)	4' (1219mm)	0' (mm)

3:1 Slope, No Load

H	h1	h2
10' (3048mm)	0' (0mm)	10' (3048mm)
8' (2438mm)	4' (1219mm)	4' (1219mm)
6' (1829mm)	5' (1524mm)	1' (305mm)
5' (1524mm)	5' (1524mm)	0' (0mm)

No Slope, 100psf Load

H	h1	h2
11' (3353mm)	0' (0mm)	11' (3353mm)
10' (3048mm)	1' (305mm)	9' (2743mm)
8' (2438mm)	4' (1219mm)	4' (1219mm)
6' (1829mm)	5' (1524mm)	1' (305mm)
5' (1524mm)	5' (1524mm)	0 (0mm)

No Slope, 250psf Load

H	h1	h2
9' (2743mm)	0' (0mm)	9' (2743mm)
8' (2438mm)	3' (914mm)	5' (1524mm)
6' (1829mm)	4' (1219mm)	2' (610mm)
4' (1219mm)	3' (914mm)	1' (305mm)
3' (914mm)	3' (914mm)	0' (0mm)

> > > GRAVITY MAGNUMSTONE™ WALL

Gravity (SRW) segmental retaining wall systems are structures lower in height that use the MagnumStone™ unit weight combined with gravel core infill to resist earth pressures behind and on top of the wall. The 2"/ unit (4.5 degree or 1"/vertical foot) batter or setback of the MagnumStone™ 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.

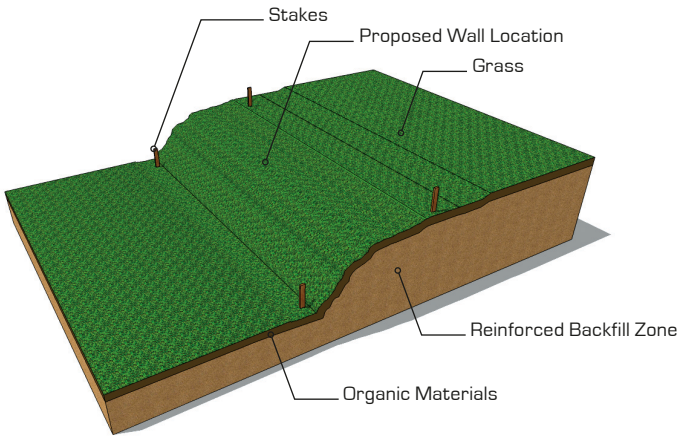
> > > STEP 1
PLANNING

· 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 **Reinforced Backfill Zone**

· Store and protect **Reinforced Backfill Materials** from inclement weather during construction



> > > STEP 2
EXCAVATION

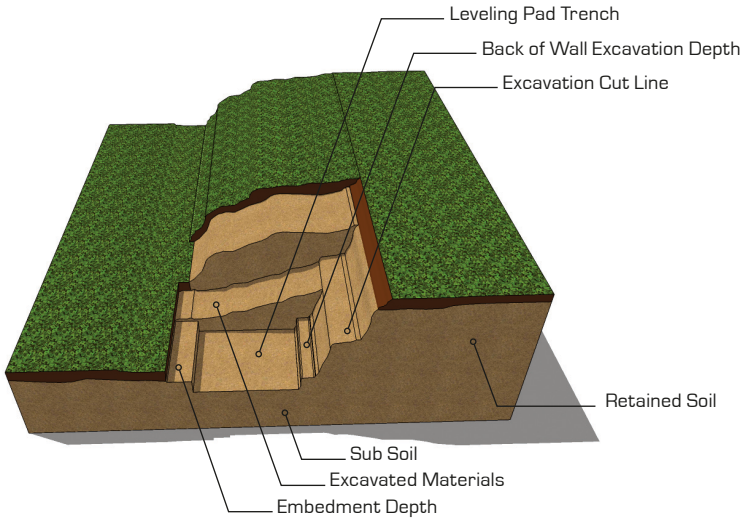
· Excavate and prepare **Sub Base Leveling Trench** 6" below first course

· **Leveling Pad Trench** is approximately 3.5' to 4' wide

· Normal wall **Burial Depth** or **Embedment Depth** is 6" to 12"

· Excavate cut line to a 2 to 1 slope or greater

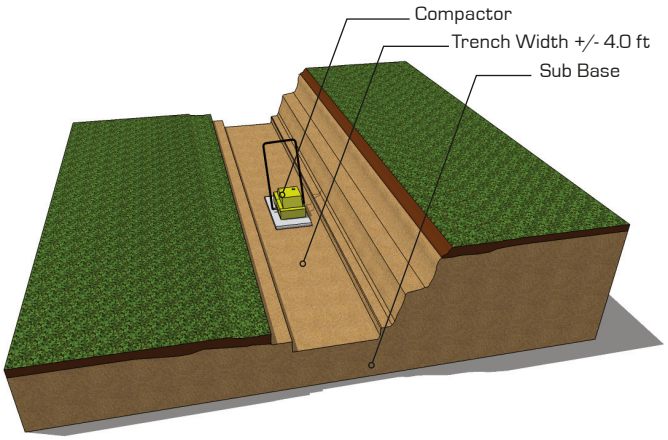
· Back of wall excavation depth into the bank should be 12" beyond the back of the **Sub Base Leveling Trench**



> > > STEP 3
SUB BASE COMPACTION

· Compact **Sub Base** to **95% Standard Proctor Density** or greater

· Remove any **Organic** or poor soils in the **Sub Base** and replace with proper **Reinforced Fill Materials** before compacting

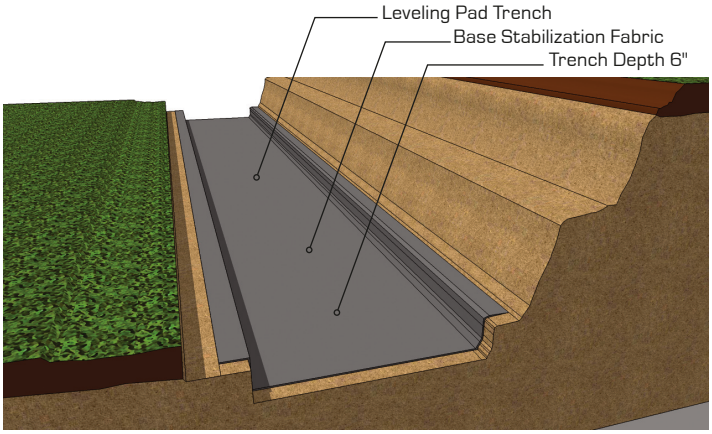


> > > STEP 4
BASE STABILIZATION

· (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

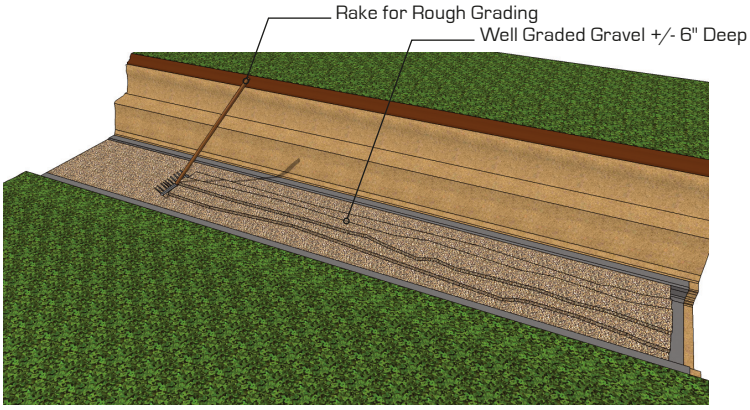
· Fabric also provides extra **Structural Bearing Stability** to the base leveling pad



> > > STEP 5
ROUGH LEVELING PAD

· Place well graded gravel on top of fabric in the leveling pad trench approximately 6" deep

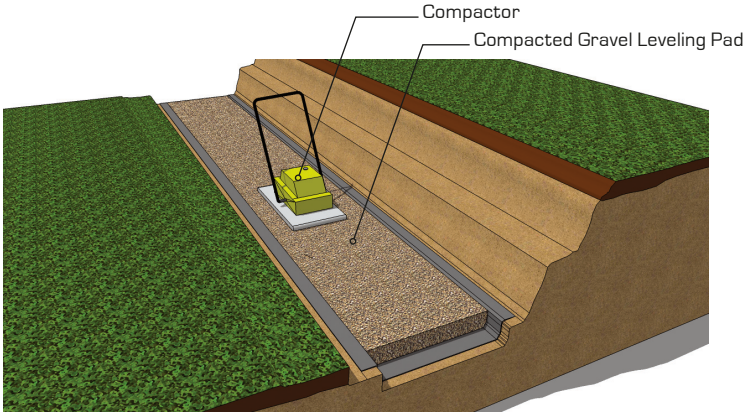
· Rough grade gravel with a rake close to finish base elevation



> > > STEP 6
COMPACT LEVELING PAD

· **Compact Gravel Leveling Pad** to **95% Standard Proctor Density** or greater

· Correct **Moisture Content** in the gravel will help in reaching proper compaction



> > > STEP 7
LEVEL SCREED PIPES

· Place first 4' 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

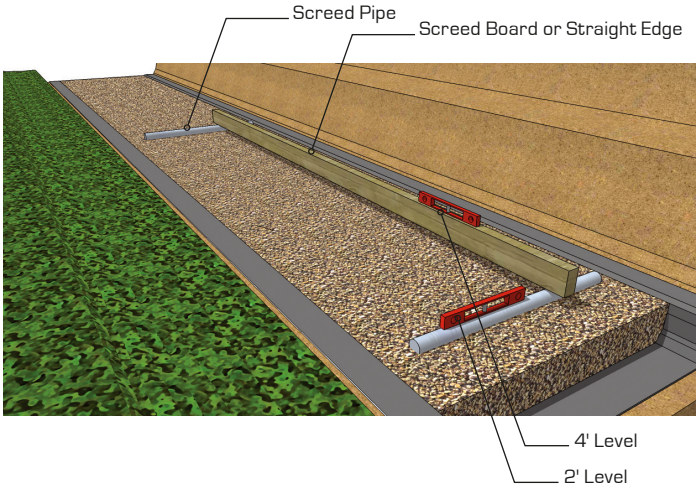
· Use a 2' level or **Laser Level** to set the **Screed Pipe** to the proper level

· Gravel is added underneath and around the **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**

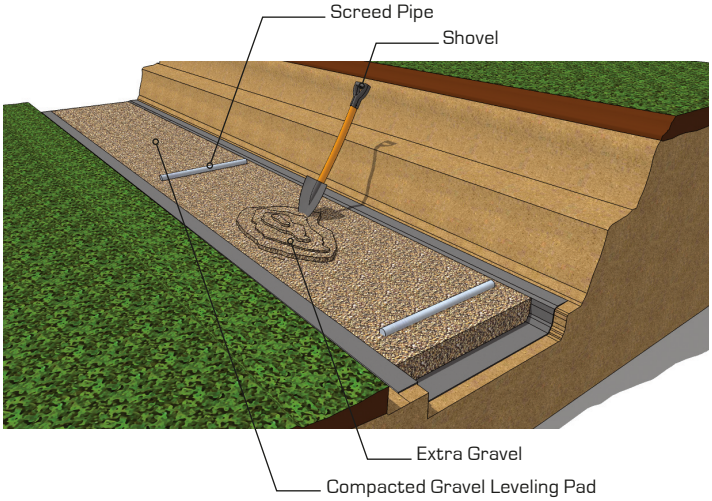
· Continue to place and level **Screed Pipes** the full length of the trench leveling pad or until reaching a base elevation change



> > > STEP 8
EXTRA GRAVEL

· Place or remove extra **Well Graded Gravel** 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

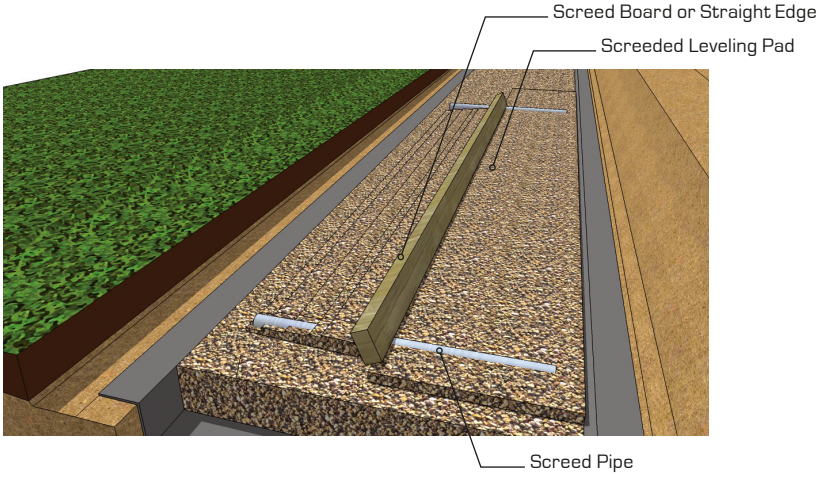
· **Screed** the gravel leveling pad with a **Screed Board** or **Straight Edge** across the trench on top of two **Screed Pipes**

· 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

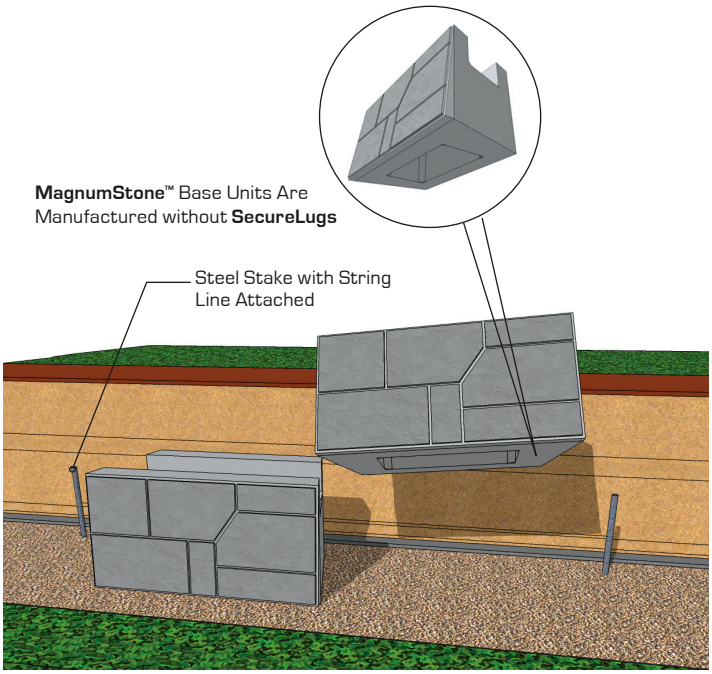
· Continue to screed the leveling pad until completing the full length of the trench or up to the first elevation change



> > > STEP 10
REMOVED SECURELUGS

· **MagnumStone**™ base units, placed on the leveling pad, are manufactured without **SecureLugs**

· 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 at either end of the leveling pad to establish the back of the first course of units

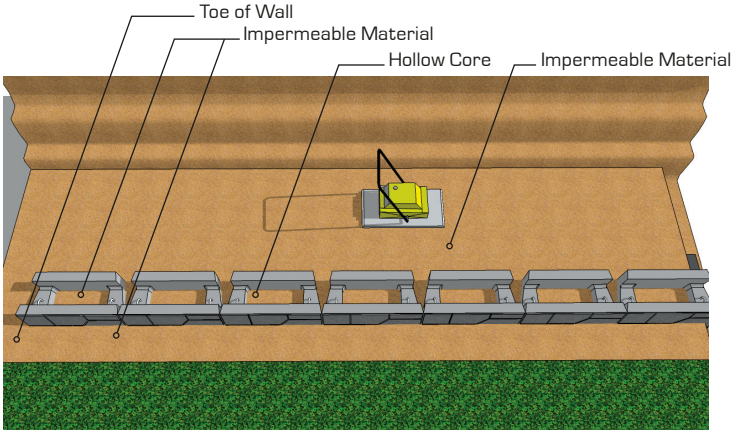
· Secure tightly a string line to the stakes at either end which will provide the guide to line up the back of each **MagnumStone**™ base unit

· The distance of the string line between the steel stakes may vary due to heavy winds

> > > STEP 12
IMPERMEABLE FILL

· 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**

· Compact the impermeable materials behind, in front and in the hollow cores of the units



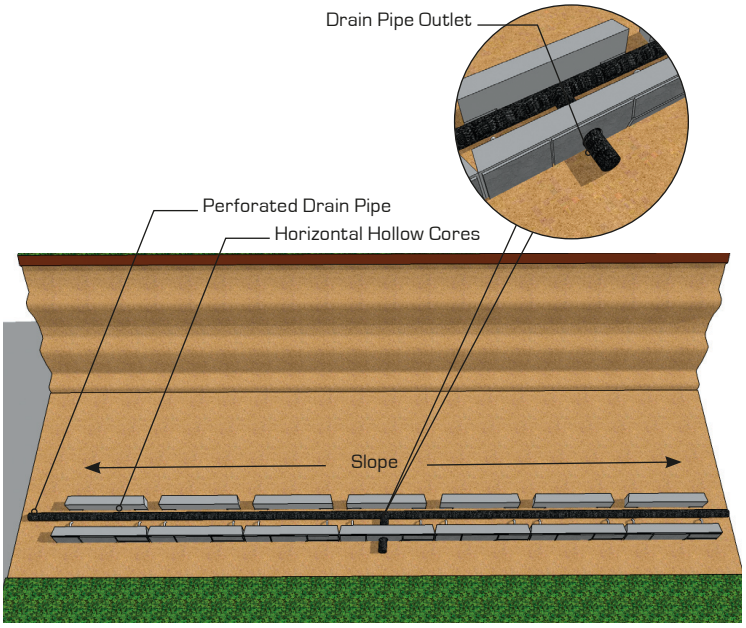
> > > STEP 13

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**, laid in the **Horizontal Cores**, can be a **Sock Wrapped** system to help prevent fines from migrating into the pipe



> > > STEP 14

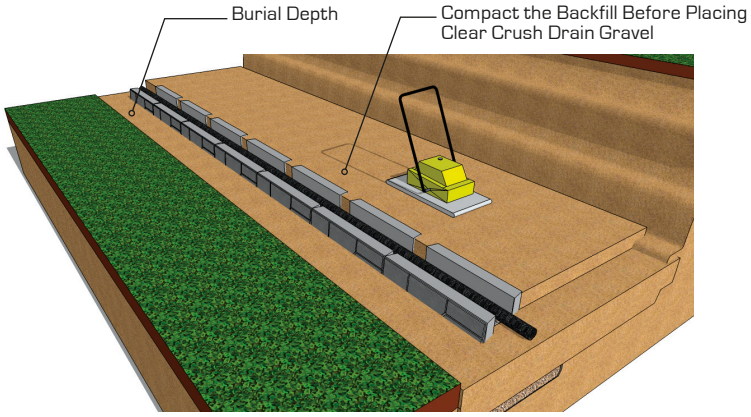
BACKFILL

· Place and compact **Backfill Materials** in maximum **Lifts** of 8"

· **Lifts** may be less than 8" depending on the type of soil or size of equipment

· 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**



> > > STEP 15

DRAINAGE GRAVEL

· **Clear Crush Drain Gravel** is placed in the vertical and horizontal hollow cores after placing and compaction of the backfill materials

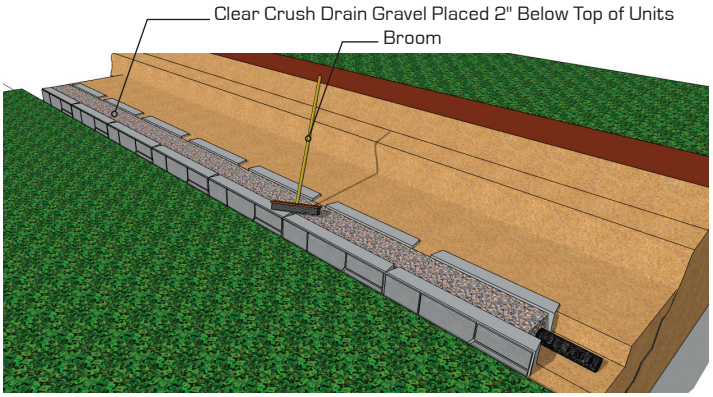
· The **Clear Crush Drain Gravel** should be 2" below the top of units to allow for **SecureLug** connection

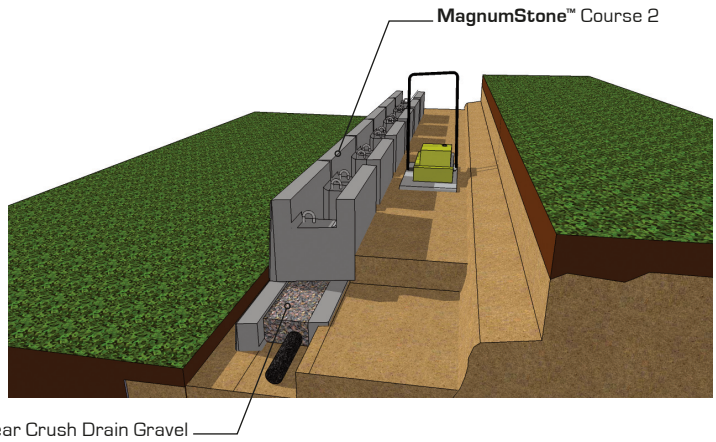
· **Clear Crush Drain Gravel** does not need to be compacted

· Sweep the top of the **MagnumStone**™ units clean of all rock and dirt before placing second course of **MagnumStone**™ units

· Make sure the **Backfill Materials** directly behind the wall are placed flush to the top of the units

· Make sure the **Backfill Materials** are well compacted and level as possible



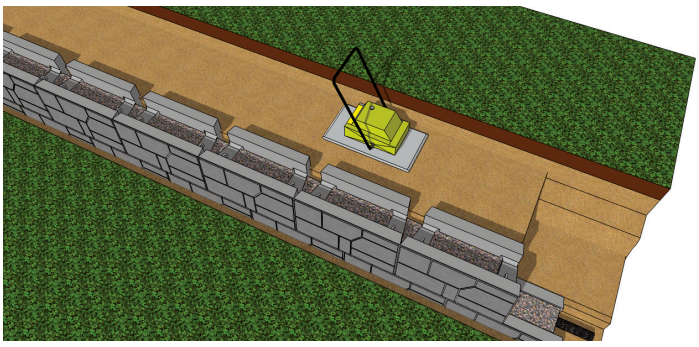


> > > STEP 16

CONTINUE INSTALLATION

· Continue to install each course of units following the same steps as above

· Install and compact **Backfill Materials** in 8" **Lifts** until wall is complete

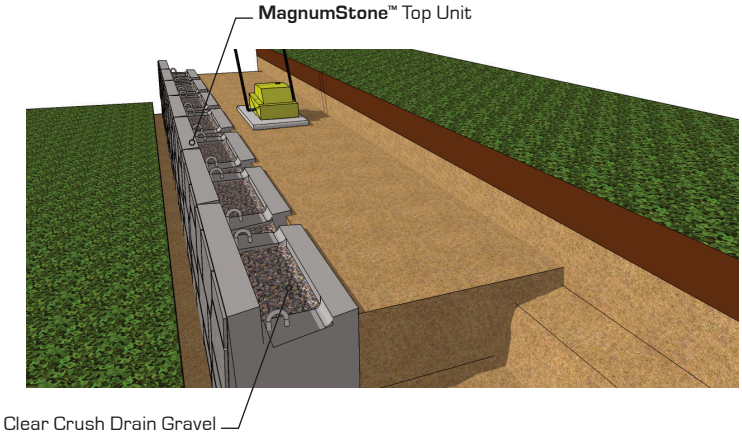


> > > STEP 17
TOP OF WALL UNITS

· Complete the top of the wall with **MagnumStone™ Top Units**

· **MagnumStone™ Top Units** are manufactured with the back panel 8" lower than the front face panel

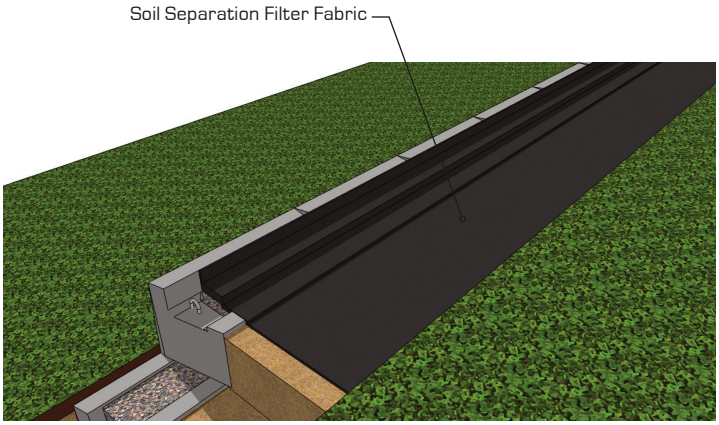
· The **Clear Crush Drain Gravel** and backfill materials will be placed flush to the top of lowered back panel. There are times when more than 8" of top soils may be required



> > > STEP 18
SOIL SEPARATION 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

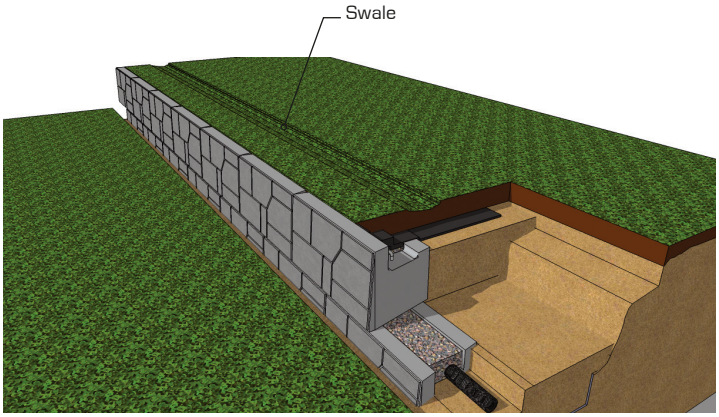
· The fabric will prevent planting soil fines from staining the face of the wall and migrating into the **Clear Crush Drain Gravel** (Angular Aggregate free of fines)



> > > STEP 19
FINAL GRADING

· 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



*Final determination of the suitability of the contemplated use, and its manner of use are the sole responsibility of the user

CORNERSTONE

WALL SOLUTIONS, INC.

MagnumStone™ Specifications
Gravity

SPECIFICATION FOR **MAGNUMSTONE™ GRAVITY**

SEGMENTAL RETAINING WALL SYSTEM

PART 1: GENERAL

1.01 Description

The work consists of supplying and installing all aspects of the MagnumStone™ Precast Concrete Segmental Retaining Wall (SRW) units as specified in the construction drawings or as established by the Owner, Architect or Engineer.

1.02 Related Work

A. Section 02100 Site Preparation
B. Section 02200 Earthwork
C. Section 02832 Interlocking Block Retaining Walls
D. Section 01270 Unit Prices

1.03 Reference Standards

A. Engineering Design

- AASHTO M288 Geotextile Specification for Highway Applications
- AASHTO Standard Specifications for Highway Bridges
- NCMA Design Manual for Segmental Retaining Walls (SRW)
- NCMA SRWU-1 Determination of Connection Strength between Geosynthetics and SRW units
- NCMA SRWU-2 Determination of Shear Strength between Concrete Segmental Retaining Wall (SRW) units

B. Segmental Retaining Wall (SRW) units

- ASTM C 140 Sample & Testing Concrete Masonry Units
- ASTM C 1262 Evaluation the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
- ASTM C 1372 Standard Specification for Segmental Retaining Wall (SRW) Units

C. Soils

- ASTM D 698 Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort
- ASTM D 422 Gradation Analysis of Soil Particles
- ASTM D 4318 Test Methods for Liquid Limit, Plastic Limit
- and Plasticity Index of Soils
- ASTM D 51 Testing Methods for Measuring pH of Soil
- ASTM D 2487 Standard Classification of Soils (Unified Soil
- Classification System)

D. Drainage Pipe

- ASTM D 3034 Specification for Type PSM Polyvinyl Chloride (PVC) pipe
- ASTM D 1248 Corrugated Plastic Pipe

E. The Owner or Owner's Representative shall determine the final application if the specifications and reference documents conflict.

1.04 Design Submittals

A. Material installation and description data should be submitted for each product specified
B. The SRW designs and drawings should include, bottom and top of wall elevation, drainage details and any other unique applications.
C. Design Method and Calculations should be in accordance with the NCMA Design Guidelines or the AASHTO Standard Specifications for Highways. Global stability analysis should be calculated as part of the final design.
D. Samples of the SRW units, color and texture should be submitted as per design specifications.
E. All test reports should be in accordance with ASTM C 140 and performed by an independent laboratory.
    a. Delivery, Storage and Handling
F. The Contractor shall inspect all materials delivered to the site to ensure proper type and grade of materials have been received as per the project specifications.
G. The Contractor shall ensure proper storage, handling and protection from damage of the materials. Damaged materials shall not be used in the construction of the Segmental Retaining Wall.
H. The Contractor shall prevent excessive mud, wet concrete, and like materials from coming in contact with the wall materials.

PART 2: MATERIALS

2.01 Concrete Segmental Retaining Wall (SRW) units

a. SRW concrete units shall be MagnumStone™ units as manufactured by licensed _____ producer in accordance with NCMA, ASTM or AASHTO standards and conform to the NCMA Tek 2-4 or as per project engineer specifications.
b. MagnumStone™ units shall have a minimum 28 days compressive of equal to 25 MPA (or greater if specified) and a maximum absorption of 5 pcf (or less if specified) (ASTM C 140). Final compressive strength shall be 40 MPA min average for 3 units. (Suggested air content of 5 +_ 1 % with slump 50 +- 20 mm)
c. Color for the MagnumStone™ units shall be _____
d. ASTM C 1262 shall be standard for areas subject to many freeze-thaw cycles.
e. The maximum water absorption shall be less than 5% and the height dimensions from front to back plus or minus 1/8th of an inch and end to end will not vary more than plus or minus 1/4 of an inch over 4 feet. All other specifications must meet the ASTM C 1372.
f. The MagnumStone™ 2-4 units shall have a face area of 8 sq ft (.75 sq m) and MagnumStone™ 1-4 units shall have a face area of 4 sq ft (.37.5 sq m)
g. The MagnumStone™ unit weight shall be approximately +-1400 lbs with a combined unit/gravel infill of +-800 lbs.
h. The MagnumStone™ units shall be sound and free of cracks, chips or other defects that may prevent the contractor from properly installing the wall units or reduce the long term strength of the wall structure.
i. MagnumStone™ capping units shall be a regular unit with 8 inches of the back of the unit removed to allow for soil materials placed over the hollow units and up against the back of the front face.

j. Concrete sample in accordance with AASHTO T-141, Compression test in accordance with AASHTO T-23 and AASHTO T-22, Air content testing in accordance with AASHTO T-152 or AASHTO T-196, Slump test in accordance with AASHTO T-119, 28 day testing in accordance with AASHTO T-23 and AASHTO T-22 or as specified by the project engineer.
k. Reinforcing Mesh – Reinforcing mesh (if required) shall be shop-fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A-82 (AASHTO M-32) and shall be welded into the finished mesh fabric in accordance with ASTM A-185 (ASSHTO M-55). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of ASTM A-123 (AASHTO M-111). Connector bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A-82 (AASHTO M-32) and galvanized in accordance with ASTM A-123 (AASHTO M-111).
l. Electrochemical Requirements if applicable will follow the AASHTO specifications.

2.02 Foundation Soil

A. The foundation soils shall be undisturbed native site soils.
B. The foundation soils shall be inspected and tested by an engineer before installing base leveling gravel.
C. Disturbed or unsuitable foundation soils shall be properly compacted or replaced with expectable soils as specified by the engineer.

2.03 Backfill Soil

A. Backfill soils shall be free of organic materials and other unsuitable materials.
B. Soils classified as GP, GW, SP, SW, or SM types and accordance with ASTM D 2487 are suitable. All soils shall be approved by the engineer.
C. The plasticity of the backfill soils shall have fine fraction of less than 20.

2.04 Base Leveling Materials

A. The base leveling gravel shall be well graded compacted gravel (GW)
B. Unreinforced concrete base leveling pad can also be used if specified.
C. AASHTO specifications will be followed when constructing concrete footing for DOT projects.

2.05 Drainage and Unit Infill Aggregate

A. Drainage Aggregate shall be clean crushed gravel meeting the gradation in accordance with ASTM D 448.
B. Drainage Aggregates shall be placed in all unit voids and 6” to 12” behind the wall units with uniform particle size less than 1” (25mm) and not more than 5% passing through the No. 200 sieve.

2.06 Drainage Pipe

A. Drainage pipe shall be perforated PVC or corrugated HDPE pipe with a minimum size of 4” in diameter.
B. Geotextiles wrap around the drainage pipe shall be used as specified by the engineer if required.
C. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.07 Geotextile Fabric

A. The Geotextiles shall be non-woven as specified by the specifications and construction drawings.
B. The Geotextiles when used as a soil separator shall be permeable allowing water to effectively pass through the fabric openings.

2.08 AASHTO

When constructing DOT projects all AASHTO and ASTM specifications should be followed unless otherwise specified by the engineer.

PART 3 WALL DESIGN

3.01 Design Standard

A. The wall design engineer and/or geotechnical engineer shall consider the internal, local stability, external stability, bearing capacity and global stability of the soil mass above, behind and below the wall structure.
B. The MagnumStone™ wall system shall be designed in accordance to the NCMA Design Manual for Segmental Retaining Walls, Second Edition or in accordance to AASHTO. The minimum factors of safety shall be (or greater if specified by engineer)

External Stability; Base Sliding = 1.5, Overturning = 2.0, Bearing Capacity = 2.0, Global Stability = 1.3
Internal Stability; Tensile Overstress = 1.0, Pullout = 1.5, Internal Sliding = 1.5
Local Stability; Facing Shear = 1.5, Connection = 1.5

3.02 Soil Standards

A. The following soil design parameters shall be used (or specified by engineer)
B. **Drainage/Unit Fill;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lbs/sq ft (0 kPa)
C. **Reinforced Backfill;** Soil Unit Weight = _____ lb/cub ft (KN/cub m), Friction Angle = ___degree, Cohesion = _____lbs/sq ft (0 kPa)
D. **Base Leveling Pad;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lb/sq ft (0 kPa)

3.03 Project Design

A. The site grades and information will determine the length, height and overall elevations for the MagnumStone™ retaining wall requirements.
B. The design height (H) shall be measured from the top of the base leveling pad to the top of the wall cap units.
C. The above and below slopes of the wall details will be on the site construction drawings.
D. The minimum embedment depth of the wall shall be no less than 1/2 unit (12”) or H/10 or as specified by the site construction drawings.

PART 4 CONSTRUCTION

4.01 Qualifications

Contractor and site supervisor shall have proven qualified experience to complete the installation of the segmental retaining wall system.

4.02 Excavation

A. The contractor shall excavate to the lines and grades shown on the project grading plans.
B. Back excavated cut shall be notched benches of 5 feet vertical for every 2 feet horizontal bench or as per the engineers specifications.
C. Over excavated or filled areas shall be well compacted and inspected by an engineer.
D. Excavated materials that are used for backfilling reinforcement zone shall be protected from the weather.
E. All organic or other non gravel materials shall not be used in the backfilled reinforcement zone.

4.03 Foundation Preparation

A. Foundation trench shall be excavated to the dimensions indicated on the construction drawings.
B. The reinforced zone and leveling pad foundation soil shall be examined by the on site engineer to ensure proper bearing strength.
C. Soils not meeting required strength shall be removed and replaced with proper materials.

D. Foundation materials shall be compacted to a minimum of 95% Standard Proctor dry density or greater, before placing leveling pad. (ASTM D 698)

4.04 Base Leveling Pad

A. Granular aggregate materials, minimum 6 inches thick and 2 (48") times the width of the wall unit, shall be placed and compacted to a minimum of 95% Standard Proctor dry density or greater. (a un-reinforced concrete pad may be used)
B. The base leveling pad shall be level horizontally and back to front to ensure the first course of units are level.
C. Top of base leveling pad elevation and installation of granular materials shall be in accordance of the specifications and construction drawings. The toe of the wall burial depth shall be constructed as shown on the construction drawings.
D. A concrete reinforced footing should be placed below the frost level and constructed in accordance to the specification and construction drawings.

4.05 Units Installation

A. The first course of MagnumStone™ units shall be carefully placed on a well graded gravel or concrete leveling pad.
B. The first row of units shall be level form unit to unit and from back to front.
C. A string line can be used to align a straight wall or PVC flex pipes can be used to establish smooth convex or concave curved walls.
D. Use the smooth back of the units for alignment and measuring to ensure smooth curves and straight walls.
E. The second course of units shall have the concrete connecting lugs in the unit voids of the first course below and pulled forward resting the lugs against the front edge of the 2 lower unit voids.
F. All units shall be laid snugly together and parallel to the straight or curved lines.
G. The MagnumStone™ units shall be swept clean of all dirt or rocks before installing the next layer of units or placing the geosynthetics.

H. After laying each course, perform a visual or string line straightness check.

Drainage Gravel

A. MagnumStone™ unit voids and the drainage chimney 6 to 12 inches behind the wall shall be filled with a free-draining granular material, such as ¾" clear rock (clean gravel).
B. Clear gravel (clean gravel) shall be placed into the unit voids and behind the wall each course.
C. Clear gravel (clean gravel) does not need any mechanical compaction.

4.06 Backfill

A. The reinforced backfill materials shall be placed in maximum lifts of 12" and shall be compacted to a minimum 95% Standard Proctor density or greater, in accordance with ASTM D 698
B. Only hand-operated compaction equipment shall be used within 2 feet of the back of the wall.
C. Soil density testing shall not be taken within the 2 foot area.
D. The toe of the wall shall be filled and compacted as the wall is being constructed.

4.07 Cap Installation

A. The MagnumStone™ full size cap units should be placed in the same installation procedures as the regular MagnumStone™ units.

B. Geotextiles should be used as a soil separator between the final layer of backfill and drainage materials and the top soil materials to prevent fines from migrating into the drainage gravel or through the wall face.
C. A special MagnumStone™ 6" high cap can be used to complete the top of the wall. Concrete adhesive should be used to glue the cap units to the regular units.

PART 5 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

5.01 Construction Quality Control

A. The wall project installer is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.
B. A qualified independent party will be responsible to verify that installation procedures have been installed in accordance with the specifications and construction drawings.
C. All site construction tolerances for vertical alignment, horizontal locations for elevations, corner and radius locations, wall batter and minimum bulging will be with in NCMA or AASHTO specifications.

5.02 Quality Assurance

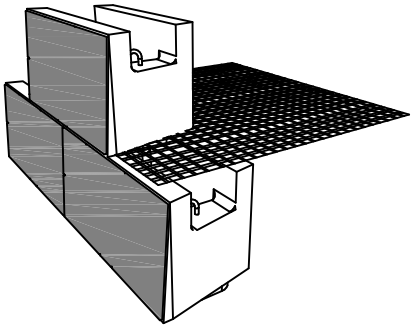
A. The owner is responsible to engage testing and inspection services to provide independent quality construction assurance.
B. Compaction testing of the reinforcement backfill soils shall be performed every 2 vertical feet of material installation.
C. The tests shall be done a minimum of every 50 lineal feet along the wall at each level of testing.
D. Testing shall not be closer than 3 feet from the back of the wall and done at a variety of locations to cover the entire reinforced soil zone.
E. Independent inspection professionals shall ensure all parameters and construction specifications have been followed in accordance to the design drawings and specifications.

PART 6 PAYMENT

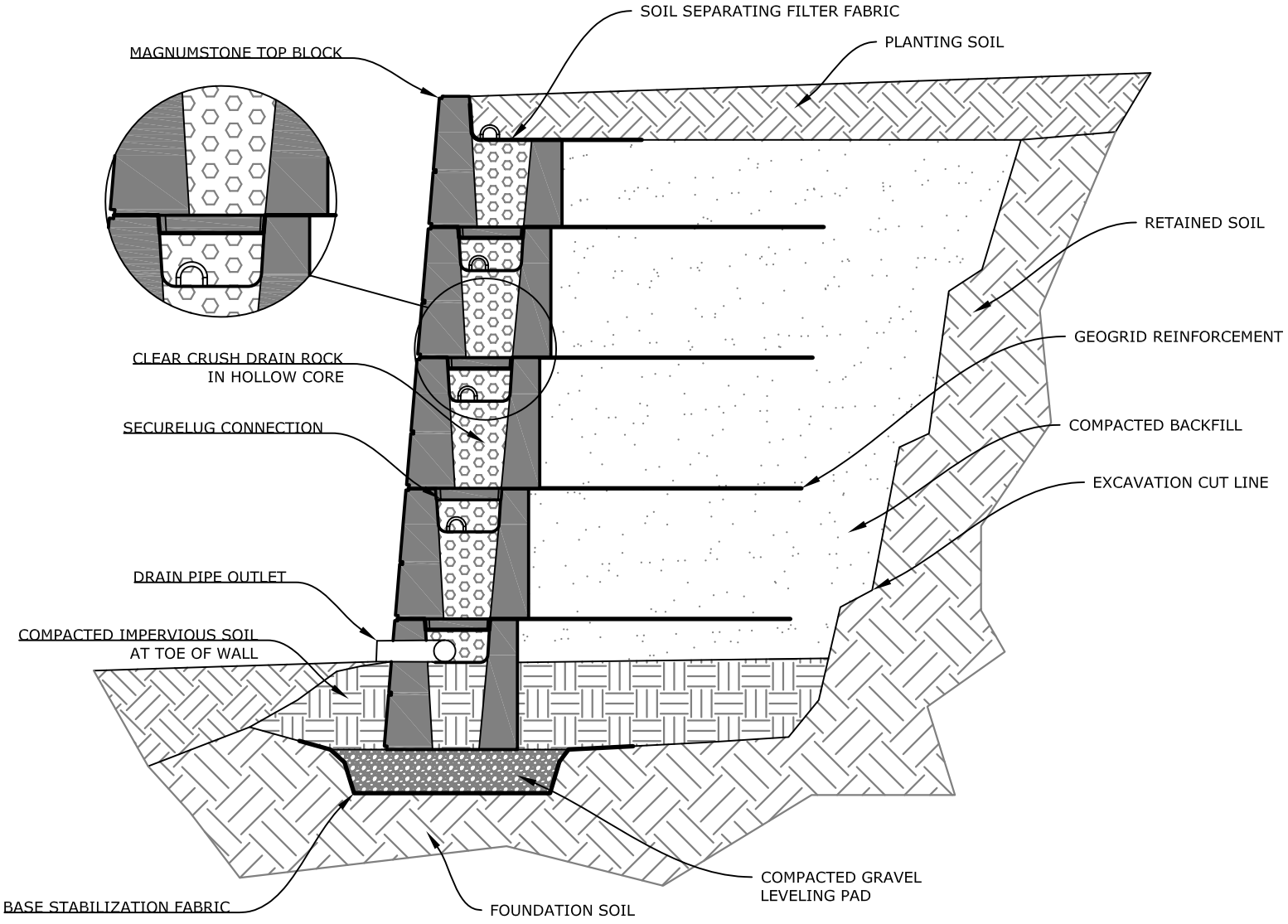
6.01 Payment for the installation of the MagnumStone™ wall shall be based on the unit price per square face foot (square face meter) of wall product installed. The shipping and delivery slips shall be verified by both Contractor and Owner or Owner representative at the time of product delivery to the site and this will be the bases of the final count or product used.

MagnumStone

>>>GEOGRID REINFORCED



GEOGRID PLACED FLAT
AND TAUGHT FOR MAXIMUM
SECURE LUG CONNECTION



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www.cornerstonewallsolutions.com

> > > GEOGRID REINFORCED MAGNUMSTONE™ WALL

Creating a MagnumStone™ reinforced wall system, involves the use of geogrids for reinforcement. MagnumStone™ 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.

> > > STEP 1
PLANNING

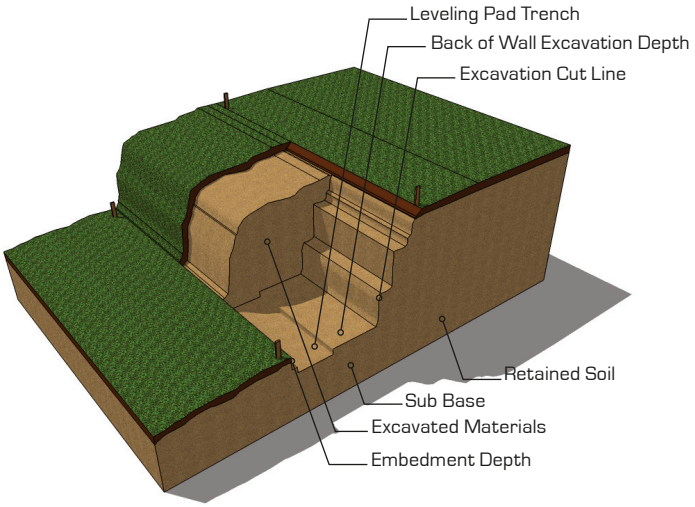
· Excavate and prepare **Sub Base Leveling Trench** 6" below first course

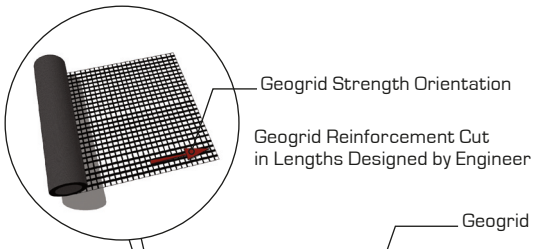
· **Leveling Pad Trench** is approximately 3.5' to 4' wide

· 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**





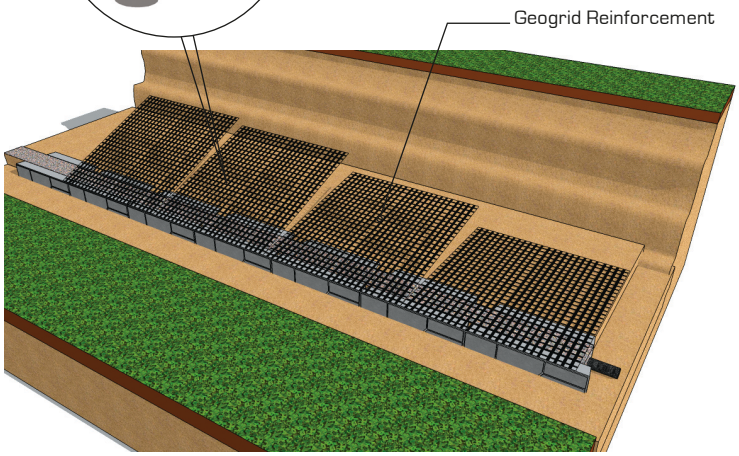
> > > STEP 2
CUT GEOGRID

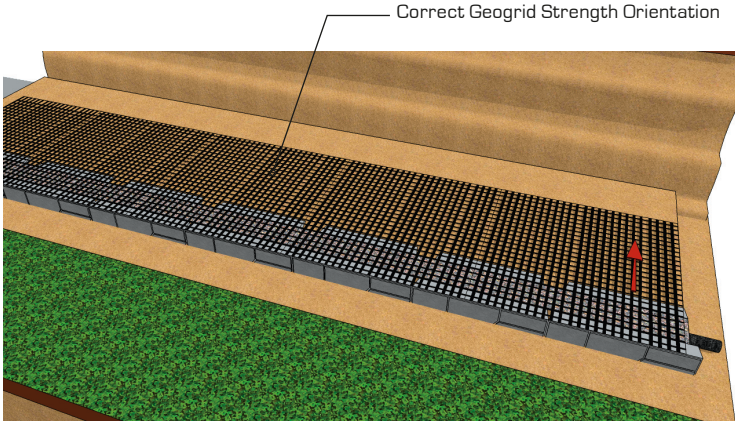
· Cut **Geogrid Reinforcement** to the length specified in the design

· **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





> > > STEP 3

LAY GEOGRID

· Place the **Geogrid** as far forward on the **MagnumStone**™ units as possible without revealing it on the face

· Place the next course of **MagnumStone**™ units on top of the lower units and **Geogrid** at a half bond to the lower units

· The two **SecureLugs** will fit securely into the hollow cores of the two units below and lock the **Geogrid** into the gravel core

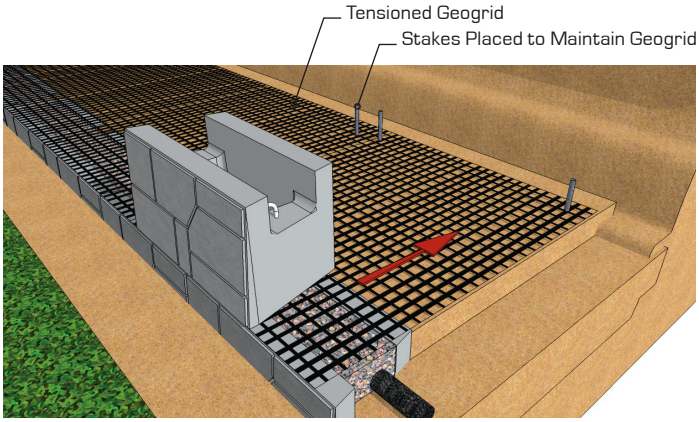
· The gravel in the lower units will be recessed 2" or more to allow for the **SecureLugs** connection

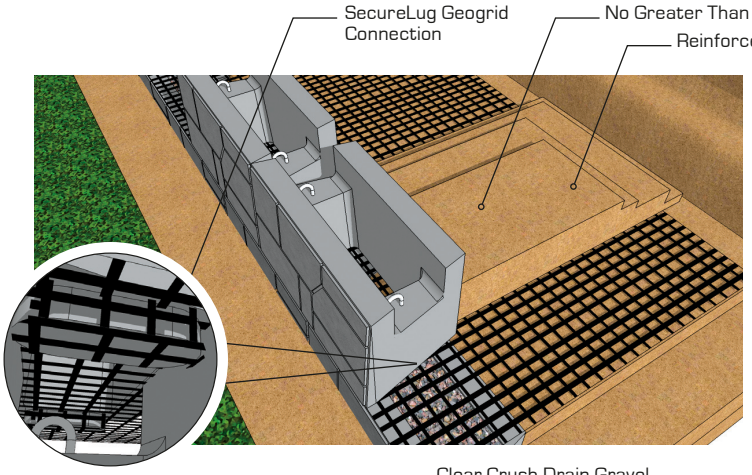
· Complete the installation of units on the **Geogrid Reinforced** courses

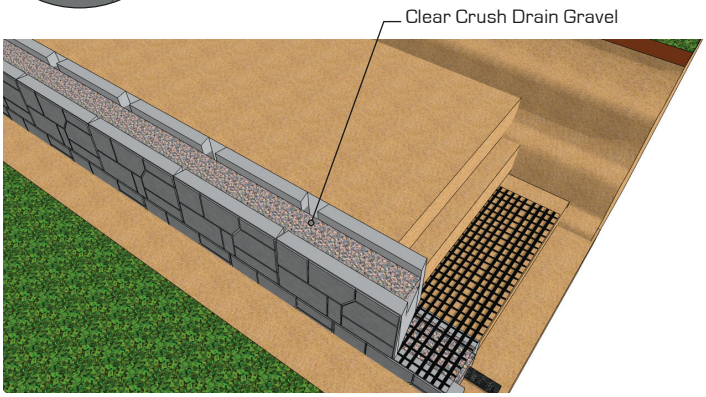
· Make sure each unit is installed against the unit next to it leaving no gaps between unit joints

· Use stakes or backfill materials to maintain the tension of the **Geogrid** during backfilling

· Do not drive equipment directly on top of **Geogrid**







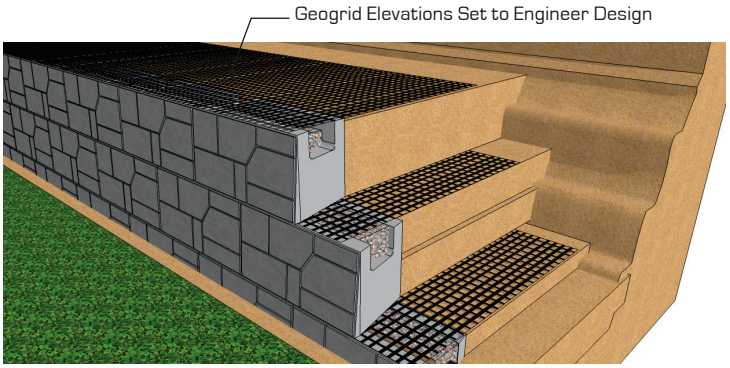
> > > STEP 4

REINFORCED BACKFILL

· **Backfill** the **Reinforced Zone** by placing materials from the back of the wall towards the end of the **Geogrid**

· Install drainage gravel in the cores after placing and compacting backfill materials

· Install and compact backfill materials in **Lifts** no greater than 8" until wall is complete



CORNERSTONE
WALL SOLUTIONS, INC.

MagnumStone™ Specifications
Geogrid Reinforced

SPECIFICATION FOR **MAGNUMSTONE™**
GEOGRID REINFORCED
SEGMENTAL RETAINING WALL SYSTEM

PART 1: GENERAL

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B. Section 02200 Earthwork
C. Section 02070 Geosynthetic Reinforcement Walls
D. Section 02832 Interlocking Block Retaining Walls
E. Section 01270 Unit Prices

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B. Segmental Retaining Wall (SRW) units

- ASTM C 140 Sample & Testing Concrete Masonry Units
- ASTM C 1262 Evaluation the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
- ASTM C 1372 Standard Specification for Segmental Retaining Wall (SRW) Units

C. Geosynthetic Reinforcement

- ASTM D 4595 Tensile Properties of Geosynthetics by the Wide Width Strip Method
- ASTM D 5262 Evaluating the Unconfined Creep of Geosynthetics
- ASTM D 6638 Grid Connection Strength (NCMA SRWU-1)
- ASTM D 6916 Grid Shear Strength (NCMA SRWU-2)
- GRI GG 1 Single Rib Geogrid Tensile Strength
- GRI GG 4 Determination of Long Term Design Strength of
- Geogrids
- GRI GG 5 Determination of Geogrid (soil) Pullout
- GRI GG 6 Determination of Geotextile (soil) Pullout

D. Soils

- ASTM D 698 Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort
- ASTM D 422 Gradation Analysis of Soil Particles
- ASTM D 4318 Test Methods for Liquid Limit, Plastic Limit
- and Plasticity Index of Soils

- ASTM D 51 Testing Methods for Measuring pH of Soil
- ASTM D 2487 Standard Classification of Soils (Unified Soil
- Classification System)

E. Drainage Pipe
- ASTM D 3034 Specification for Type PSM Polyvinyl Chloride (PVC) pipe
- ASTM D 1248 Corrugated Plastic Pipe

F. The Owner or Owner's Representative shall determine the final application if the specifications and reference documents conflict.

1.04 Design Submittals

A. Material installation and description data should be submitted for each product specified
B. The SRW designs and drawings should include geosynthetic layout, bottom and top of wall elevation, drainage details and any other unique applications.
C. Design Method and Calculations should be in accordance with the NCMA Design Guidelines or the AASHTO Standard Specifications for Highways. Global stability analysis should be calculated as part of the final design.
D. Samples of the SRW units, color and texture should be submitted as per design specifications. Geosynthetic sample should also be furnished as per design.
E. All test reports should be in accordance with ASTM C 140 and performed by an independent laboratory.
    a. Delivery, Storage and Handling
F. The Contractor shall inspect all materials delivered to the site to ensure proper type and grade of materials have been received as per the project specifications.
G. The Contractor shall ensure proper storage, handling and protection from damage of the materials. Damaged materials shall not be used in the construction of the Segmental Retaining Wall.
H. The Contractor shall prevent excessive mud, wet concrete, and like materials from coming in contact with the wall materials.

PART 2: MATERIALS

2.01 Concrete Segmental Retaining Wall (SRW) units

a. SRW concrete units shall be MagnumStone™ units as manufactured by licensed _____ ___ producer in accordance with NCMA, ASTM or AASHTO standards and conform to the NCMA Tek 2-4 or as per project engineer specifications.
b. MagnumStone™ units shall have a minimum 28 days compressive of equal to 25 MPA (or greater if specified) and a maximum absorption of 5 pcf (or less if specified) (ASTM C 140). Final compressive strength shall be 40 MPA min average for 3 units. (Suggested air content of 5 +_ 1 % with slump 50 +- 20 mm)
c. Color for the MagnumStone™ units shall be _____
d. ASTM C 1262 shall be standard for areas subject to many freeze-thaw cycles.
e. The maximum water absorption shall be less than 5% and the height dimensions from front to back plus or minus 1/8th of an inch and end to end will not vary more than plus or minus 1/4 of an inch over 4 feet. All other specifications must meet the ASTM C 1372.
f. The MagnumStone™ 2-4 units shall have a face area of 8 sq ft (.75 sq m) and MagnumStone™ 1-4 units shall have a face area of 4 sq ft (.37.5 sq m)
g. The MagnumStone™ unit weight shall be approximately +-1400 lbs with a combined unit/gravel infill of +-800 lbs.
h. The MagnumStone™ units shall be sound and free of cracks, chips or other defects that may prevent the contractor from properly installing the wall units or reduce the long term strength of the wall structure.
i. MagnumStone™ capping units shall be a regular unit with 8 inches of the back of the unit removed to allow for soil materials placed over the hollow units and up against the back of the front face.

j. Concrete sample in accordance with AASHTO T-141, Compression test in accordance with AASHTO T-23 and AASHTO T-22, Air content testing in accordance with AASHTO T-152 or AASHTO T-196, Slump test in accordance with AASHTO T-119, 28 day testing in accordance with AASHTO T-23 and AASHTO T-22 or as specified by the project engineer.

k. Reinforcing Mesh – Reinforcing mesh (if required) shall be shop-fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A-82 (AASHTO M-32) and shall be welded into the finished mesh fabric in accordance with ASTM A-185 (ASSHTO M-55). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of ASTM A-123 (AASHTO M-111). Connector bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A-82 (AASHTO M-32) and galvanized in accordance with ASTM A-123 (AASHTO M-111).

l. Electrochemical Requirements if applicable will follow the AASHTO specifications.

2.02 Geosynthetic Reinforcements

A. Geosynthetic reinforcements shall be high tensile Geogrid or Geotextile manufactured for soil reinforcement applications.

B. The construction design and drawings shall show the type, strength and location of the geosynthetics. Manufactures specifications shall be used for test data and installation procedures.

C. Geosynthetics shall be evaluated in accordance with the NCMA and or AASHTO specifications.

2.03 Foundation Soil

A. The foundation soils shall be undisturbed native site soils.

B. The foundation soils shall be inspected and tested by an engineer before installing base leveling gravel.

C. Disturbed or unsuitable foundation soils shall be properly compacted or replaced with expectable soils as specified by the engineer.

2.04 Backfill Soil

A. Backfill soils shall be free of organic materials and other unsuitable materials.

B. Soils classified as GP, GW, SP, SW, or SM types and accordance with ASTM D 2487 are suitable. All soils shall be approved by the engineer.

C. The plasticity of the backfill soils shall have fine fraction of less than 20.

2.05 Base Leveling Materials

A. The base leveling gravel shall be well graded compacted gravel (GW)

B. Unreinforced concrete base leveling pad can also be used if specified.

C. AASHTO specifications will be followed when constructing concrete footing for DOT projects.

2.06 Drainage and Unit Infill Aggregate

A. Drainage Aggregate shall be clean crushed gravel meeting the gradation in accordance with ASTM D 448.

B. Drainage Aggregates shall be placed in all unit voids and 6” to 12” behind the wall units with uniform particle size less than 1” (25mm) and not more than 5% passing through the No. 200 sieve.

2.07 Drainage Pipe

A. Drainage pipe shall be perforated PVC or corrugated HDPE pipe with a minimum size of 4” in diameter.

B. Geotextiles wrap around the drainage pipe shall be used as specified by the engineer if required.
C. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.08 Geotextile Fabric

A. The Geotextiles shall be non-woven as specified by the specifications and construction drawings.
B. The Geotextiles when used as a soil separator shall be permeable allowing water to effectively pass through the fabric openings.

2.09 AASHTO

When constructing DOT projects all AASHTO and ASTM specifications should be followed unless otherwise specified by the engineer.

PART 3 WALL DESIGN

3.01 Design Standard

A. The wall design engineer and/or geotechnical engineer shall consider the internal, local stability, external stability, bearing capacity and global stability of the soil mass above, behind and below the wall structure.
B. Geosynthetic reinforcement vertical spacing shall not exceed 4 feet or 2 units.
C. Geosynthetic reinforcement shall be 100% horizontal coverage parallel to the length of the wall unless specified by the engineer.
D. The MagnumStone™ wall system shall be designed in accordance to the NCMA Design Manual for Segmental Retaining Walls, Second Edition or in accordance to AASHTO. The minimum factors of safety shall be (or greater if specified by engineer)

External Stability; Base Sliding = 1.5, Overturning = 2.0, Bearing Capacity = 2.0, Global Stability = 1.3
Internal Stability; Tensile Overstress = 1.0, Pullout = 1.5, Internal Sliding = 1.5
Local Stability; Facing Shear = 1.5, Connection = 1.5

3.02 Soil Standards

A. The following soil design parameters shall be used (or specified by engineer)
B. **Drainage/Unit Fill;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lbs/sq ft (0 kPa)
C. **Reinforced Backfill;** Soil Unit Weight = _____ lb/cub ft (KN/cub m), Friction Angle = ___degree, Cohesion = _____lbs/sq ft (0 kPa)
D. **Base Leveling Pad;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lb/sq ft (0 kPa)

3.03 Project Design

A. The site grades and information will determine the length, height and overall elevations for the MagnumStone™ retaining wall requirements.
B. The design height (H) shall be measured from the top of the base leveling pad to the top of the wall cap units.
C. The above and below slopes of the wall details will be on the site construction drawings.
D. The minimum embedment depth of the wall shall be no less than 1/2 unit (12”) or H/10 or as specified by the site construction drawings.
E. Geosynthetic minimum length shall not be less than 60% of the height of the wall (H/.6).

PART 4 CONSTRUCTION

4.01 Qualifications

Contractor and site supervisor shall have proven qualified experience to complete the installation of the segmental retaining wall system.

4.02 Excavation

A. The contractor shall excavate to the lines and grades shown on the project grading plans.
B. Back excavated cut shall be notched benches of 5 feet vertical for every 2 feet horizontal bench or as per the engineers specifications.
C. Over excavated or filled areas shall be well compacted and inspected by an engineer.
D. Excavated materials that are used for backfilling reinforcement zone shall be protected from the weather.
E. All organic or other non gravel materials shall not be used in the backfilled reinforcement zone.

4.03 Foundation Preparation

A. Foundation trench shall be excavated to the dimensions indicated on the construction drawings.
B. The reinforced zone and leveling pad foundation soil shall be examined by the on site engineer to ensure proper bearing strength.
C. Soils not meeting required strength shall be removed and replaced with proper materials.
D. Foundation materials shall be compacted to a minimum of 95% Standard Proctor dry density or greater, before placing leveling pad. (ASTM D 698)

4.04 Base Leveling Pad

A. Granular aggregate materials, minimum 6 inches thick and 2 (48”) times the width of the wall unit, shall be placed and compacted to a minimum of 95% Standard Proctor dry density or greater. (a un-reinforced concrete pad may be used)
B. The base leveling pad shall be level horizontally and back to front to ensure the first course of units are level.
C. Top of base leveling pad elevation and installation of granular materials shall be in accordance of the specifications and construction drawings. The toe of the wall burial depth shall be constructed as shown on the construction drawings.
D. A concrete reinforced footing should be placed below the frost level and constructed in accordance to the specification and construction drawings.

4.05 Units Installation

A. The first course of MagnumStone™ units shall be carefully placed on a well graded gravel or concrete leveling pad.
B. The first row of units shall be level form unit to unit and from back to front.
C. A string line can be used to align a straight wall or PVC flex pipes can be used to establish smooth convex or concave curved walls.
D. Use the smooth back of the units for alignment and measuring to ensure smooth curves and straight walls.
E. The second course of units shall have the concrete connecting lugs in the unit voids of the first course below and pulled forward resting the lugs against the front edge of the 2 lower unit voids.
F. All units shall be laid snugly together and parallel to the straight or curved lines.

G. The MagnumStone™ units shall be swept clean of all dirt or rocks before installing the next layer of units or placing the geosynthetics.

H. After laying each course, perform a visual or string line straightness check.

Drainage Gravel

A. MagnumStone™ unit voids and the drainage chimney 6 to 12 inches behind the wall shall be filled with a free-draining granular material, such as ¾" clear rock (clean gravel).
B. Clear gravel (clean gravel) shall be placed into the unit voids and behind the wall each course before placing the geosynthetic reinforcement layer.
C. Clear gravel (clean gravel) does not need any mechanical compaction.

4.06 Backfill

A. The reinforced backfill materials shall be placed in maximum lifts of 12" and shall be compacted to a minimum 95% Standard Proctor density or greater, in accordance with ASTM D 698
B. Only hand-operated compaction equipment shall be used within 2 feet of the back of the wall.
C. Soil density testing shall not be taken within the 2 foot area.
D. The backfill shall be smooth and level so that the geosynthetic lays flat with no dips or bumps.
E. The toe of the wall shall be filled and compacted as the wall is being constructed.

4.07 Cap Installation

A. The MagnumStone™ full size cap units should be placed in the same installation procedures as the regular MagnumStone™ units.
B. Geotextiles should be used as a soil separator between the final layer of backfill and drainage materials and the top soil materials to prevent fines from migrating into the drainage gravel or through the wall face.
C. A special MagnumStone™ 6" high cap can be used to complete the top of the wall. Concrete adhesive should be used to glue the cap units to the regular units.

PART 5 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

5.01 Construction Quality Control

A. The wall project installer is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.
B. A qualified independent party will be responsible to verify that installation procedures have been installed in accordance with the specifications and construction drawings.
C. All site construction tolerances for vertical alignment, horizontal locations for elevations, corner and radius locations, wall batter and minimum bulging will be with in NCMA or AASHTO specifications.

5.02 Quality Assurance

A. The owner is responsible to engage testing and inspection services to provide independent quality construction assurance.
B. Compaction testing of the reinforcement backfill soils shall be performed every 2 vertical feet of material installation.
C. The tests shall be done a minimum of every 50 lineal feet along the wall at each level of testing.
D. Testing shall not be closer than 3 feet from the back of the wall and done at a variety of locations to cover the entire reinforced soil zone.

E. Independent inspection professionals shall ensure all parameters and construction specifications have been followed in accordance to the design drawings and specifications.

PART 6 PAYMENT

6.01 Payment for the installation of the MagnumStone™ wall shall be based on the unit price per square face foot (square face meter) of wall product installed. The shipping and delivery slips shall be verified by both Contractor and Owner or Owner representative at the time of product delivery to the site and this will be the bases of the final count or product used.

GEOSYNTHETIC SOIL REINFORCEMENT

PART 1 GENERAL

1.01 Description

The work consists of supplying and installing geosynthetic reinforcements and the reinforcement backfill zone as specified in the construction drawings or as established by the Owner, Architect or Engineer.

1.02 Related Work

A. Section 02832 Modular Block Retaining Wall
B. Section 02200 Site Preparation
C. Section 02300 Earthwork
D. Section 02070 Geosynthetic Reinforcement Walls

1.03 Reference Standard Geosynthetic Reinforcement

A. ASTM D 4595 Tensile Properties of Geosynthetics
B. ASTM D 5262 Evaluating the Unconfined Creep of the Geosynthetics
C. GGI GG -1 Single Rib Geosynthetic Tensile Strength
D. GGI GG -5 Geogrid Pullout
E. GGI GG -6 Geotextile Pullout

1.04 Reference Standards for Soils

A. ASTM D 698 Moisture Density Relationship for Soils
B. ASTM D 422 Gradation of Soils
C. ASTM D 424 Atterberg limits of Soils
D. ASTM D G51 Soil Ph

1.05 Delivery, Storage and Handling

A. The Contractor shall inspect all geosynthetic products delivered to the site to ensure for the proper type and strength.

B. Geosynthetics shall be stored in accordance with the manufactures specifications.
C. Geosynthetics shall be protected from the weather and any other conditions that could damage the material.

PART 2 MATERIALS

2.01 Geosynthetic Products

A. Geogrid products specifically produced for the use of soil reinforcement and consisting of high-density polyethylene or polypropylene.

B. Geotextiles are woven fabrics produced for the use of soil reinforcement.

C. The manufactured specifications shall be used for test data and installation procedures.
D. Approved Geosynthetics as per MagnumStone™ specification and approved testing.
E. All products shall be approved by the site Engineer.

PART 3 CONSTRUCTION

3.01 Qualification
Refer to Section 02832 Modular Block Retaining Wall
3.02 Excavation
Refer to Section 02832 Modular Block Retaining Wall
3.03 Foundation Preparation
Refer to Section 02832 Modular Block Retaining Wall
3.04 Leveling Pad
Refer to Section 02832 Modular Block Retaining Wall
3.05 Unit Installation
Refer to Section 02832 Modular Block Retaining Wall

3.06 Installation of Geosynthetics Reinforcement

A. The construction plans shall show the type, strength and location of the geosynthetics.
B. Manufacturer's specifications shall be used for test data and installation procedures.
C. The geosynthetics shall be cut to the correct length and laid in the orientation as specified by the manufacturer.
D. The MagnumStone™ unit voids, drainage chimney and backfill zone are filled, compacted and leveled correctly before placing the geosynthetics.
E. Ensure that the drainage materials directly behind the wall units are flush or slightly higher than the top of the units so that the geosynthetics will not be sheared on the back of the unit's sharp edge.
F. The units shall be swept clean of all dirt or rocks before placing the geosynthetics.
G. Shimming of units shall not be allowed on the geosynthetic layers.
H. The geosynthetics shall be placed as far forward on the MagnumStone™ units as possible without revealing materials on the face of the wall.
I. Loosely lay geosynthetics toward the back of the compacted backfill zone.
J. Gently pull the geosynthetics toward the back of the compacted backfill zone after placing the next row of MagnumStone™ units on top of the geosynthetics and on top of the lower units.
K. Use stakes or gravel materials to maintain tension on the geosynthetics. Excessive tension may alter the alignment of the wall units.

3.07 Backfill

A. Contractor shall not drive equipment directly on the exposed geosynthetics.
B. Backfill the reinforced zone by placing materials from the back of the wall towards the end of the geosynthetics in order to maintain tension on the reinforcement.
C. Contractor shall leave 12" trench between the back of the wall and backfill materials to allow for drainage clean gravel drainage materials. This process will prevent undue soil pressures that could rotate the MagnumStone™ units forward and reduce the set back of the wall while compacting the backfill materials.
D. Once the MagnumStone™ units, geosynthetics and backfill materials have been placed, fill the unit voids and the drainage chimney with clear rock.
E. Continue the construction of the wall based on the previously outlined steps placing and compacting soils as specified.
F. When completing the final layer of backfill materials and drainage gravel, and before placing the planting soil, place a layer of geosynthetic soil separation fabric. The fabric shall be placed no less than 4 feet behind the wall and up the back side of the wall up to the cap unit. The fabric will prevent the planting soil fines from migrating into the drainage gravel and from staining the wall face.

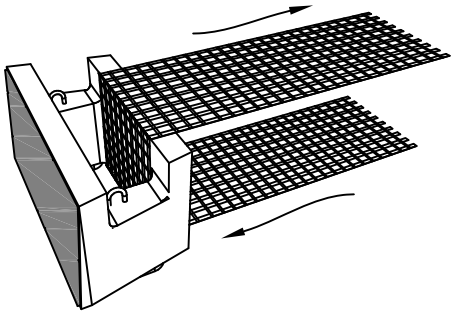
3.08 Cap Installation
Refer to Section 02832 Modular Block Retaining Wall

PART 4 PAYMENT

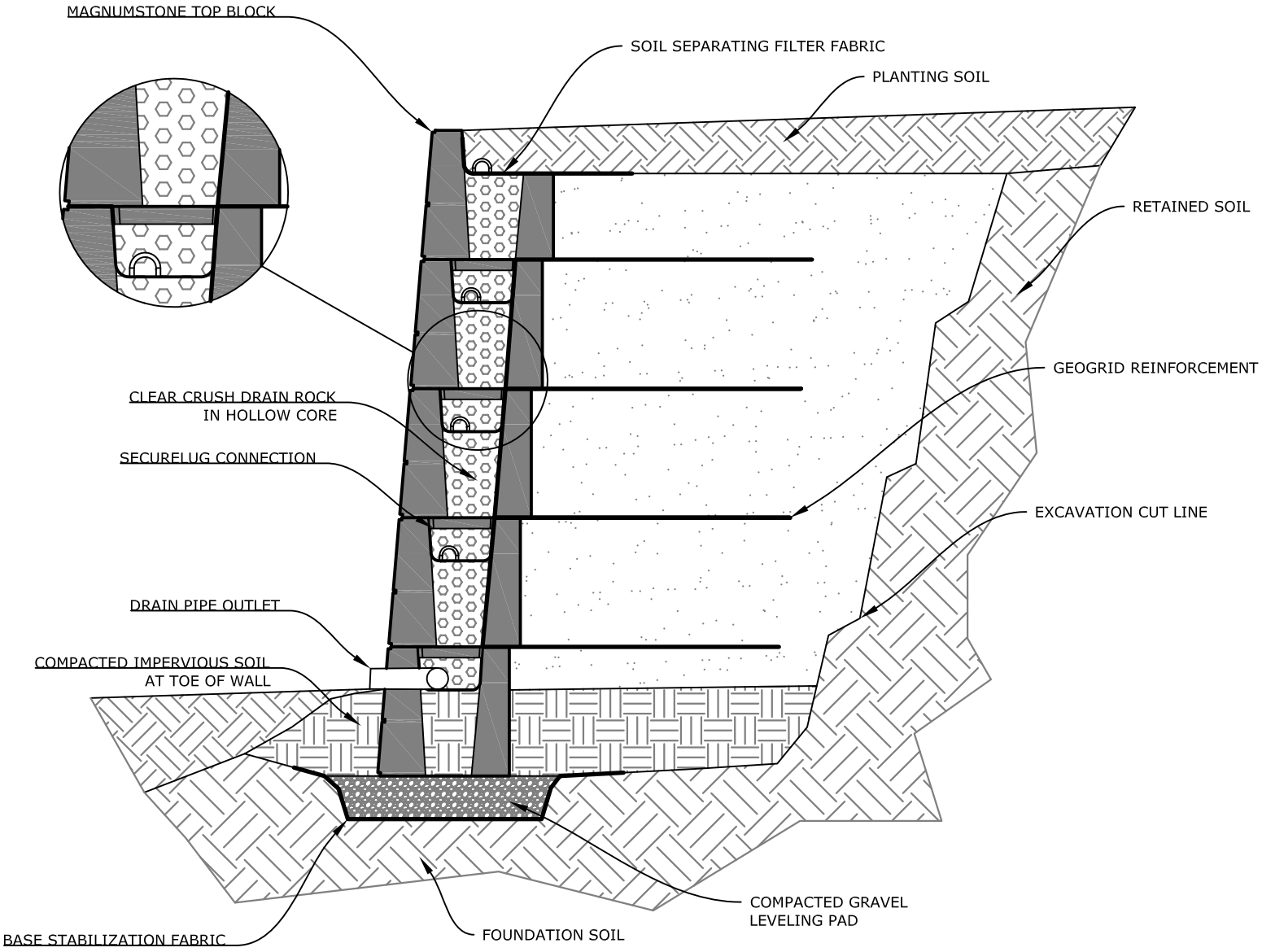
4.01 Payment for the placement of the geosynthetics shall be based on the unit price per square yard (square meter) installed or as per contract agreement.

MagnumStone Batter

>>>POSITIVE CONNECTION



WRAP GEOGRID THOUGH
HOLLOW CORE FOR
POSITIVE CONNECTION



CORNERSTONE
WALL SOLUTIONS INC.

www.cornerstonewallsolutions.com

> > > MAGNUMSTONE™ POSITIVE CONNECTION

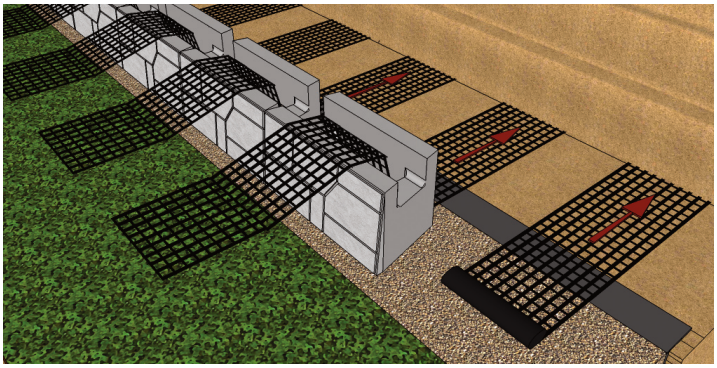
One single length of geogrid is wrapped through the hollow core providing equal length reinforcement at the bottom and top of a single MagnumStone™ unit. The geogrid wrapped hollow core is then filled with gravel making this the ultimate geogrid positive connection.

> > > STEP 1

LAY FIRST COURSE

· **Geogrid** positive reinforcement will be cut in 24" wide strips and twice the length specified in the design plus 2' for the unit height. (if specified **Geogrid** length is 10' the length will be 22' long)

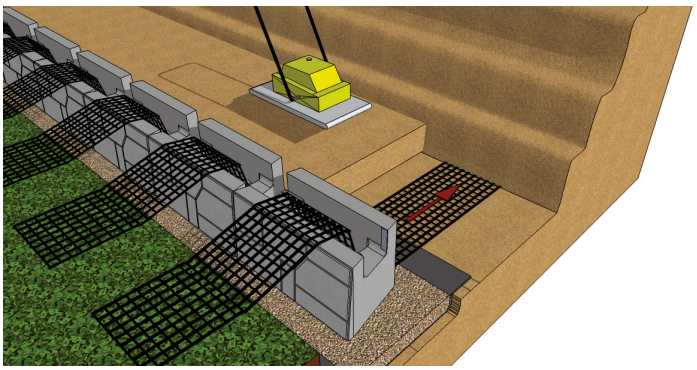
· Place the base units vertical open core over the half rolled length of **Geogrid**. Make sure the **Geogrid** is placed to the correct design length, perpendicular and centered to the unit before placing **MagnumStone™**



> > > STEP 2

COMPACT BACKFILL

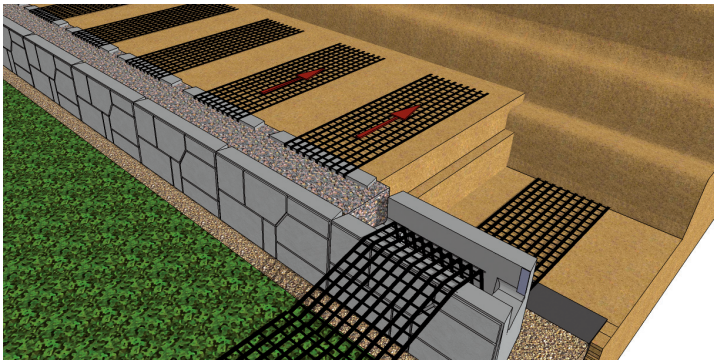
· Backfill and compact the **Reinforced Zone** by placing materials from the back of the wall towards the end of the **Geogrid**. Install and compact **Backfill Materials** in 8" **Lifts**



> > > STEP 3

WRAP GEOGRID

· Pull rolled **Geogrid** out of the vertical core and place perpendicular to top of first unit on top of compacted backfill. Tension **Geogrid** before installing drainage gravel. Install the **Clear Crush Drain Gravel** 2" below the top of units to allow for **Securelug** connection

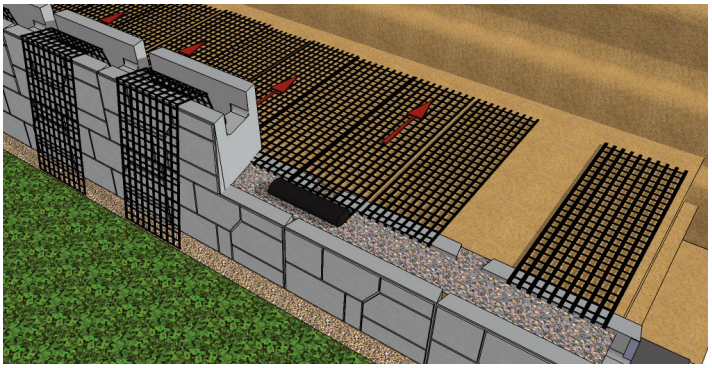


> > > STEP 4

LAY SECOND COURSE

· Place the second **MagnumStone™** units vertical open core over the second layer of half rolled **Geogrid**. Make sure **Geogrid** is placed to the correct design length perpendicular to the unit and centered to the two adjacent **Geogrid** strips before placing the unit

· Repeat above steps for each course of **MagnumStone™** Positive Reinforced Wall



CORNERSTONE

WALL SOLUTIONS, INC.

MagnumStone™ Specifications

Positive Connection

SPECIFICATION FOR **MAGNUMSTONE™ POSITIVE**

SEGMENTAL RETAINING WALL SYSTEM

PART 1: GENERAL

1.01 Description

The work consists of supplying and installing all aspects of the MagnumStone™ Precast Concrete Segmental Retaining Wall (SRW) units as specified in the construction drawings or as established by the Owner, Architect or Engineer.

1.02 Related Work

A. Section 02100 Site Preparation
B. Section 02200 Earthwork
C. Section 02070 Geosynthetic Reinforcement Walls
D. Section 02832 Interlocking Block Retaining Walls
E. Section 01270 Unit Prices

1.03 Reference Standards

A. Engineering Design

- AASHTO M288 Geotextile Specification for Highway Applications
- AASHTO Standard Specifications for Highway Bridges
- NCMA Design Manual for Segmental Retaining Walls (SRW)
- NCMA SRWU-1 Determination of Connection Strength between Geosynthetics and SRW units
- NCMA SRWU-2 Determination of Shear Strength between Concrete Segmental Retaining Wall (SRW) units

B. Segmental Retaining Wall (SRW) units

- ASTM C 140 Sample & Testing Concrete Masonry Units
- ASTM C 1262 Evaluation the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
- ASTM C 1372 Standard Specification for Segmental Retaining Wall (SRW) Units

C. Geosynthetic Reinforcement

- ASTM D 4595 Tensile Properties of Geosynthetics by the Wide Width Strip Method
- ASTM D 5262 Evaluating the Unconfined Creep of Geosynthetics
- ASTM D 6638 Grid Connection Strength (NCMA SRWU-1)
- ASTM D 6916 Grid Shear Strength (NCMA SRWU-2)
- GRI GG 1 Single Rib Geogrid Tensile Strength
- GRI GG 4 Determination of Long Term Design Strength of
- Geogrids
- GRI GG 5 Determination of Geogrid (soil) Pullout
- GRI GG 6 Determination of Geotextile (soil) Pullout

D. Soils

- ASTM D 698 Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort
- ASTM D 422 Gradation Analysis of Soil Particles
- ASTM D 4318 Test Methods for Liquid Limit, Plastic Limit
- and Plasticity Index of Soils

- ASTM D 51 Testing Methods for Measuring pH of Soil
- ASTM D 2487 Standard Classification of Soils (Unified Soil
- Classification System)

E. Drainage Pipe
- ASTM D 3034 Specification for Type PSM Polyvinyl Chloride (PVC) pipe
- ASTM D 1248 Corrugated Plastic Pipe

F. The Owner or Owner's Representative shall determine the final application if the specifications and reference documents conflict.

1.04 Design Submittals

A. Material installation and description data should be submitted for each product specified
B. The SRW designs and drawings should include geosynthetic layout, bottom and top of wall elevation, drainage details and any other unique applications.
C. Design Method and Calculations should be in accordance with the NCMA Design Guidelines or the AASHTO Standard Specifications for Highways. Global stability analysis should be calculated as part of the final design.
D. Samples of the SRW units, color and texture should be submitted as per design specifications. Geosynthetic sample should also be furnished as per design.
E. All test reports should be in accordance with ASTM C 140 and performed by an independent laboratory.
    a. Delivery, Storage and Handling
F. The Contractor shall inspect all materials delivered to the site to ensure proper type and grade of materials have been received as per the project specifications.
G. The Contractor shall ensure proper storage, handling and protection from damage of the materials. Damaged materials shall not be used in the construction of the Segmental Retaining Wall.
H. The Contractor shall prevent excessive mud, wet concrete, and like materials from coming in contact with the wall materials.

PART 2: MATERIALS

2.01 Concrete Segmental Retaining Wall (SRW) units

a. SRW concrete units shall be MagnumStone™ units as manufactured by licensed _____ ___ producer in accordance with NCMA, ASTM or AASHTO standards and conform to the NCMA Tek 2-4 or as per project engineer specifications.
b. MagnumStone™ units shall have a minimum 28 days compressive of equal to 25 MPA (or greater if specified) and a maximum absorption of 5 pcf (or less if specified) (ASTM C 140). Final compressive strength shall be 40 MPA min average for 3 units. (Suggested air content of 5 +_ 1 % with slump 50 +- 20 mm)
c. Color for the MagnumStone™ units shall be _____
d. ASTM C 1262 shall be standard for areas subject to many freeze-thaw cycles.
e. The maximum water absorption shall be less than 5% and the height dimensions from front to back plus or minus 1/8th of an inch and end to end will not vary more than plus or minus 1/4 of an inch over 4 feet. All other specifications must meet the ASTM C 1372.
f. The MagnumStone™ 2-4 units shall have a face area of 8 sq ft (.75 sq m) and MagnumStone™ 1-4 units shall have a face area of 4 sq ft (.37.5 sq m)
g. The MagnumStone™ unit weight shall be approximately +-1400 lbs with a combined unit/gravel infill of +-800 lbs.
h. The MagnumStone™ units shall be sound and free of cracks, chips or other defects that may prevent the contractor from properly installing the wall units or reduce the long term strength of the wall structure.
i. MagnumStone™ capping units shall be a regular unit with 8 inches of the back of the unit removed to allow for soil materials placed over the hollow units and up against the back of the front face.

j. Concrete sample in accordance with AASHTO T-141, Compression test in accordance with AASHTO T-23 and AASHTO T-22, Air content testing in accordance with AASHTO T-152 or AASHTO T-196, Slump test in accordance with AASHTO T-119, 28 day testing in accordance with AASHTO T-23 and AASHTO T-22 or as specified by the project engineer.

k. Reinforcing Mesh – Reinforcing mesh (if required) shall be shop-fabricated of cold drawn steel wire conforming to the minimum requirements of ASTM A-82 (AASHTO M-32) and shall be welded into the finished mesh fabric in accordance with ASTM A-185 (ASSHTO M-55). Galvanization shall be applied after the mesh is fabricated and conform to the minimum requirements of ASTM A-123 (AASHTO M-111). Connector bars shall be fabricated of cold drawn steel wire conforming to the requirements of ASTM A-82 (AASHTO M-32) and galvanized in accordance with ASTM A-123 (AASHTO M-111).

l. Electrochemical Requirements if applicable will follow the AASHTO specifications.

2.02 Geosynthetic Reinforcements & positive connection

A. Geosynthetic reinforcements shall be high tensile Geogrid or Geotextile manufactured for soil reinforcement applications.

B. The construction design and drawings shall show the type, strength and location of the geosynthetics. Manufactures specifications shall be used for test data and installation procedures.

C. Geosynthetics shall be evaluated in accordance with the NCMA and or AASHTO specifications.

D. MagnumStone™ Positive Mechanical Connection shall be installed in accordance to MagnumStone™ specifications.

2.03 Foundation Soil

A. The foundation soils shall be undisturbed native site soils.

B. The foundation soils shall be inspected and tested by an engineer before installing base leveling gravel.

C. Disturbed or unsuitable foundation soils shall be properly compacted or replaced with expectable soils as specified by the engineer.

2.04 Backfill Soil

A. Backfill soils shall be free of organic materials and other unsuitable materials.

B. Soils classified as GP, GW, SP, SW, or SM types and accordance with ASTM D 2487 are suitable. All soils shall be approved by the engineer.

C. The plasticity of the backfill soils shall have fine fraction of less than 20.

2.05 Base Leveling Materials

A. The base leveling gravel shall be well graded compacted gravel (GW)

B. Unreinforced concrete base leveling pad can also be used if specified.

C. AASHTO specifications will be followed when constructing concrete footing for DOT projects.

2.06 Drainage and Unit Infill Aggregate

A. Drainage Aggregate shall be clean crushed gravel meeting the gradation in accordance with ASTM D 448.

B. Drainage Aggregates shall be placed in all unit voids and 6” to 12” behind the wall units with uniform particle size less than 1” (25mm) and not more than 5% passing through the No. 200 sieve.

2.07 Drainage Pipe

A. Drainage pipe shall be perforated PVC or corrugated HDPE pipe with a minimum size of 4" in diameter.
B. Geotextiles wrap around the drainage pipe shall be used as specified by the engineer if required.
C. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248.

2.08 Geotextile Fabric

A. The Geotextiles shall be non-woven as specified by the specifications and construction drawings.
B. The Geotextiles when used as a soil separator shall be permeable allowing water to effectively pass through the fabric openings.

2.09 AASHTO

When constructing DOT projects all AASHTO and ASTM specifications should be followed unless otherwise specified by the engineer.

PART 3 WALL DESIGN

3.01 Design Standard

A. The wall design engineer and/or geotechnical engineer shall consider the internal, local stability, external stability, bearing capacity and global stability of the soil mass above, behind and below the wall structure.
B. Geosynthetic reinforcement vertical spacing shall not exceed 4 feet or 2 units.
C. Geosynthetic reinforcement shall be 100% horizontal coverage parallel to the length of the wall unless specified by the engineer.
D. The MagnumStone™ wall system shall be designed in accordance to the NCMA Design Manual for Segmental Retaining Walls, Second Edition or in accordance to AASHTO. The minimum factors of safety shall be (or greater if specified by engineer)

External Stability; Base Sliding = 1.5, Overturning = 2.0, Bearing Capacity = 2.0, Global Stability = 1.3
Internal Stability; Tensile Overstress = 1.0, Pullout = 1.5, Internal Sliding = 1.5
Local Stability; Facing Shear = 1.5, Connection = 1.5

3.02 Soil Standards

A. The following soil design parameters shall be used (or specified by engineer)
B. **Drainage/Unit Fill;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lbs/sq ft (0 kPa)
C. **Reinforced Backfill;** Soil Unit Weight = _____ lb/cub ft (KN/cub m), Friction Angle = ___degree, Cohesion = _____lbs/sq ft (0 kPa)
D. **Base Leveling Pad;** Soil Unit Weight = _____lb/cub ft (KN/cub m), Friction Angle = ____degree, Cohesion = lb/sq ft (0 kPa)

3.03 Project Design

A. The site grades and information will determine the length, height and overall elevations for the MagnumStone™ retaining wall requirements.
B. The design height (H) shall be measured from the top of the base leveling pad to the top of the wall cap units.
C. The above and below slopes of the wall details will be on the site construction drawings.

D. The minimum embedment depth of the wall shall be no less than 1/2 unit (12”) or H/10 or as specified by the site construction drawings.
E. Geosynthetic minimum length shall not be less than 60% of the height of the wall (H/.6).

PART 4 CONSTRUCTION

4.01 Qualifications

Contractor and site supervisor shall have proven qualified experience to complete the installation of the segmental retaining wall system.

4.02 Excavation

A. The contractor shall excavate to the lines and grades shown on the project grading plans.
B. Back excavated cut shall be notched benches of 5 feet vertical for every 2 feet horizontal bench or as per the engineers specifications.
C. Over excavated or filled areas shall be well compacted and inspected by an engineer.
D. Excavated materials that are used for backfilling reinforcement zone shall be protected from the weather.
E. All organic or other non gravel materials shall not be used in the backfilled reinforcement zone.

4.03 Foundation Preparation

A. Foundation trench shall be excavated to the dimensions indicated on the construction drawings.
B. The reinforced zone and leveling pad foundation soil shall be examined by the on site engineer to ensure proper bearing strength.
C. Soils not meeting required strength shall be removed and replaced with proper materials.
D. Foundation materials shall be compacted to a minimum of 95% Standard Proctor dry density or greater, before placing leveling pad. (ASTM D 698)

4.04 Base Leveling Pad

A. Granular aggregate materials, minimum 6 inches thick and 2 (48”) times the width of the wall unit, shall be placed and compacted to a minimum of 95% Standard Proctor dry density or greater. (a un-reinforced concrete pad may be used)
B. The base leveling pad shall be level horizontally and back to front to ensure the first course of units are level.
C. Top of base leveling pad elevation and installation of granular materials shall be in accordance of the specifications and construction drawings. The toe of the wall burial depth shall be constructed as shown on the construction drawings.
D. A concrete reinforced footing should be placed below the frost level and constructed in accordance to the specification and construction drawings.

4.05 Units Installation

A. The first course of MagnumStone™ units shall be carefully placed on a well graded gravel or concrete leveling pad.
B. The first row of units shall be level form unit to unit and from back to front.
C. A string line can be used to align a straight wall or PVC flex pipes can be used to establish smooth convex or concave curved walls.
D. Use the smooth back of the units for alignment and measuring to ensure smooth curves and straight walls.

E. The second course of units shall have the concrete connecting lugs in the unit voids of the first course below and pulled forward resting the lugs against the front edge of the 2 lower unit voids.
F. All units shall be laid snugly together and parallel to the straight or curved lines.
G. The MagnumStone™ units shall be swept clean of all dirt or rocks before installing the next layer of units or placing the geosynthetics.

H. After laying each course, perform a visual or string line straightness check.

Drainage Gravel

A. MagnumStone™ unit voids and the drainage chimney 6 to 12 inches behind the wall shall be filled with a free-draining granular material, such as ¾" clear rock (clean gravel).
B. Clear gravel (clean gravel) shall be placed into the unit voids and behind the wall each course before placing the geosynthetic reinforcement layer.
C. Clear gravel (clean gravel) does not need any mechanical compaction.

4.06 Backfill

A. The reinforced backfill materials shall be placed in maximum lifts of 12" and shall be compacted to a minimum 95% Standard Proctor density or greater, in accordance with ASTM D 698
B. Only hand-operated compaction equipment shall be used within 2 feet of the back of the wall.
C. Soil density testing shall not be taken within the 2 foot area.
D. The backfill shall be smooth and level so that the geosynthetic lays flat with no dips or bumps.
E. The toe of the wall shall be filled and compacted as the wall is being constructed.

4.07 Cap Installation

A. The MagnumStone™ full size cap units should be placed in the same installation procedures as the regular MagnumStone™ units.
B. Geotextiles should be used as a soil separator between the final layer of backfill and drainage materials and the top soil materials to prevent fines from migrating into the drainage gravel or through the wall face.
C. A special MagnumStone™ 6" high cap can be used to complete the top of the wall. Concrete adhesive should be used to glue the cap units to the regular units.

PART 5 CONSTRUCTION QUALITY CONTROL AND ASSURANCE

5.01 Construction Quality Control

A. The wall project installer is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.
B. A qualified independent party will be responsible to verify that installation procedures have been installed in accordance with the specifications and construction drawings.
C. All site construction tolerances for vertical alignment, horizontal locations for elevations, corner and radius locations, wall batter and minimum bulging will be with in NCMA or AASHTO specifications.

5.02 Quality Assurance

A. The owner is responsible to engage testing and inspection services to provide independent quality construction assurance.
B. Compaction testing of the reinforcement backfill soils shall be performed every 2 vertical feet of material installation.

C. The tests shall be done a minimum of every 50 lineal feet along the wall at each level of testing.
D. Testing shall not be closer than 3 feet from the back of the wall and done at a variety of locations to cover the entire reinforced soil zone.
E. Independent inspection professionals shall ensure all parameters and construction specifications have been followed in accordance to the design drawings and specifications.

PART 6 PAYMENT

6.01 Payment for the installation of the MagnumStone™ wall shall be based on the unit price per square face foot (square face meter) of wall product installed. The shipping and delivery slips shall be verified by both Contractor and Owner or Owner representative at the time of product delivery to the site and this will be the bases of the final count or product used.

GEOSYNTHETIC SOIL REINFORCEMENT

PART 1 GENERAL

1.01 Description

The work consists of supplying and installing geosynthetic reinforcements and the reinforcement backfill zone as specified in the construction drawings or as established by the Owner, Architect or Engineer.

1.02 Related Work
A. Section 02832 Modular Block Retaining Wall
B. Section 02200 Site Preparation
C. Section 02300 Earthwork
D. Section 02070 Geosynthetic Reinforcement Walls

1.03 Reference Standard Geosynthetic Reinforcement
A. ASTM D 4595 Tensile Properties of Geosynthetics
B. ASTM D 5262 Evaluating the Unconfined Creep of the Geosynthetics
C. GGI GG -1 Single Rib Geosynthetic Tensile Strength
D. GGI GG -5 Geogrid Pullout
E. GGI GG -6 Geotextile Pullout

1.04 Reference Standards for Soils
A. ASTM D 698 Moisture Density Relationship for Soils
B. ASTM D 422 Gradation of Soils
C. ASTM D 424 Atterberg limits of Soils
D. ASTM D G51 Soil Ph

1.05 Delivery, Storage and Handling

A. The Contractor shall inspect all geosynthetic products delivered to the site to ensure for the proper type and strength.

B. Geosynthetics shall be stored in accordance with the manufactures specifications.
C. Geosynthetics shall be protected from the weather and any other conditions that could damage the material.

PART 2 MATERIALS

2.01 Geosynthetic Products

A. Geogrid products specifically produced for the use of soil reinforcement and consisting of high-density polyethylene or polypropylene.

B. Geotextiles are woven fabrics produced for the use of soil reinforcement.
C. The manufactured specifications shall be used for test data and installation procedures.
D. Approved Geosynthetics as per MagnumStone™ specification and approved testing.
E. All products shall be approved by the site Engineer.

PART 3 CONSTRUCTION

3.01 Qualification
Refer to Section 02832 Modular Block Retaining Wall
3.02 Excavation
Refer to Section 02832 Modular Block Retaining Wall
3.03 Foundation Preparation
Refer to Section 02832 Modular Block Retaining Wall
3.04 Leveling Pad
Refer to Section 02832 Modular Block Retaining Wall
3.05 Unit Installation
Refer to Section 02832 Modular Block Retaining Wall

3.06 Installation of Geosynthetics Reinforcement

A. The construction plans shall show the type, strength and location of the geosynthetics.
B. Manufacturer's specifications shall be used for test data and installation procedures.
C. The geosynthetics shall be cut to the correct length and laid in the orientation as specified by the manufacturer.
D. The MagnumStone™ unit voids, drainage chimney and backfill zone are filled, compacted and leveled correctly before placing the geosynthetics.
E. Ensure that the drainage materials directly behind the wall units are flush or slightly higher than the top of the units so that the geosynthetics will not be sheared on the back of the unit's sharp edge.
F. The units shall be swept clean of all dirt or rocks before placing the geosynthetics.
G. Shimming of units shall not be allowed on the geosynthetic layers.
H. The geosynthetics shall be placed as far forward on the MagnumStone™ units as possible without revealing materials on the face of the wall.
I. Loosely lay geosynthetics toward the back of the compacted backfill zone.
J. Gently pull the geosynthetics toward the back of the compacted backfill zone after placing the next row of MagnumStone™ units on top of the geosynthetics and on top of the lower units.
K. Use stakes or gravel materials to maintain tension on the geosynthetics. Excessive tension may alter the alignment of the wall units.

3.07 Backfill

A. Contractor shall not drive equipment directly on the exposed geosynthetics.
B. Backfill the reinforced zone by placing materials from the back of the wall towards the end of the geosynthetics in order to maintain tension on the reinforcement.
C. Contractor shall leave 12" trench between the back of the wall and backfill materials to allow for drainage clean gravel drainage materials. This process will prevent undue soil pressures that could rotate the MagnumStone™ units forward and reduce the set back of the wall while compacting the backfill materials.
D. Once the MagnumStone™ units, geosynthetics and backfill materials have been placed, fill the unit voids and the drainage chimney with clear rock.
E. Continue the construction of the wall based on the previously outlined steps placing and compacting soils as specified.

F. When completing the final layer of backfill materials and drainage gravel, and before placing the planting soil, place a layer of geosynthetic soil separation fabric. The fabric shall be placed no less than 4 feet behind the wall and up the back side of the wall up to the cap unit. The fabric will prevent the planting soil fines from migrating into the drainage gravel and from staining the wall face.

3.08 Positive Connection

A. When a higher geosynthetic to block connection strength is required to meet the higher safety requirements, a positive MagnumStone™ connection system can be used.
B. When building a Positive MagnumStone™ wall system, follow the same basic construction procedures as when building MagnumStone™ gravity or geosynthetic reinforced or steel concrete walls.
C. Cut the 2 foot wide geosynthetic reinforcement to twice the length plus 2 feet of the design of a single geosynthetic length specified by the engineer designs. Roll one end of the geosynthetic into a tight roll to the point where the length of a single length is still left. Place the roll into the horizontal core centered on the joint of the two units and making sure that the correct length of geosynthetic is placed at right angles to the wall on top of the well compacted backfill.
D. Place the second row MagnumStone™ unit centered on top of the two units below and over the roll of geosynthetic sitting inside the horizontal core. Continue to cut and place the 2 foot wide rolls of geosynthetics in the same steps as above and then place all the MagnumStone™ units on the second row along the full length of the wall.
E. Backfill and compact the gravel materials and 12 inches of drainage gravel behind the wall typical of basic wall construction procedures. Make sure the gravel backfill is flush with the top of the second row of units and that the fabric soil barrier is tight and secure.
F. Reach down into the hollow core of the second row unit and roll out the second length of the 2 foot wide geosynthetic up the inside back unit and then back at right angle to the wall on top of the compacted backfill materials. This creates the incredible 100% positive connection system. Insure that the second end of the geosynthetic reinforcement is tensioned to remove any slack and then secure by staking the end into the gravel.
G. Place the third row MagnumStone™ unit on top of the second row of units centered to the two units below and centered to the 2 foot geosynthetic reinforcement.
H. Repeat the above steps until the full length of the wall geosynthetics and wall units have been properly installed. Do not drive equipment on top of the exposed geosynthetic reinforcement.
I. Repeat the above step by step installation when installing the next row of MagnumStone™ wall units. Each double row of geosynthetic reinforcements is placed in such away that there is 100% coverage of reinforcements on each row and each MagnumStone™ unit has two lengths of reinforcements attached to them to create a total positive reinforcement/unit connection.

3.09 Cap Installation

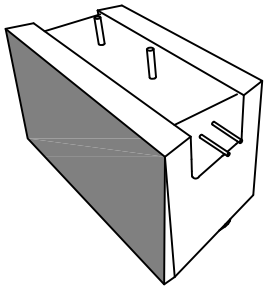
Refer to Section 02832 Modular Block Retaining Wall

PART 4 PAYMENT

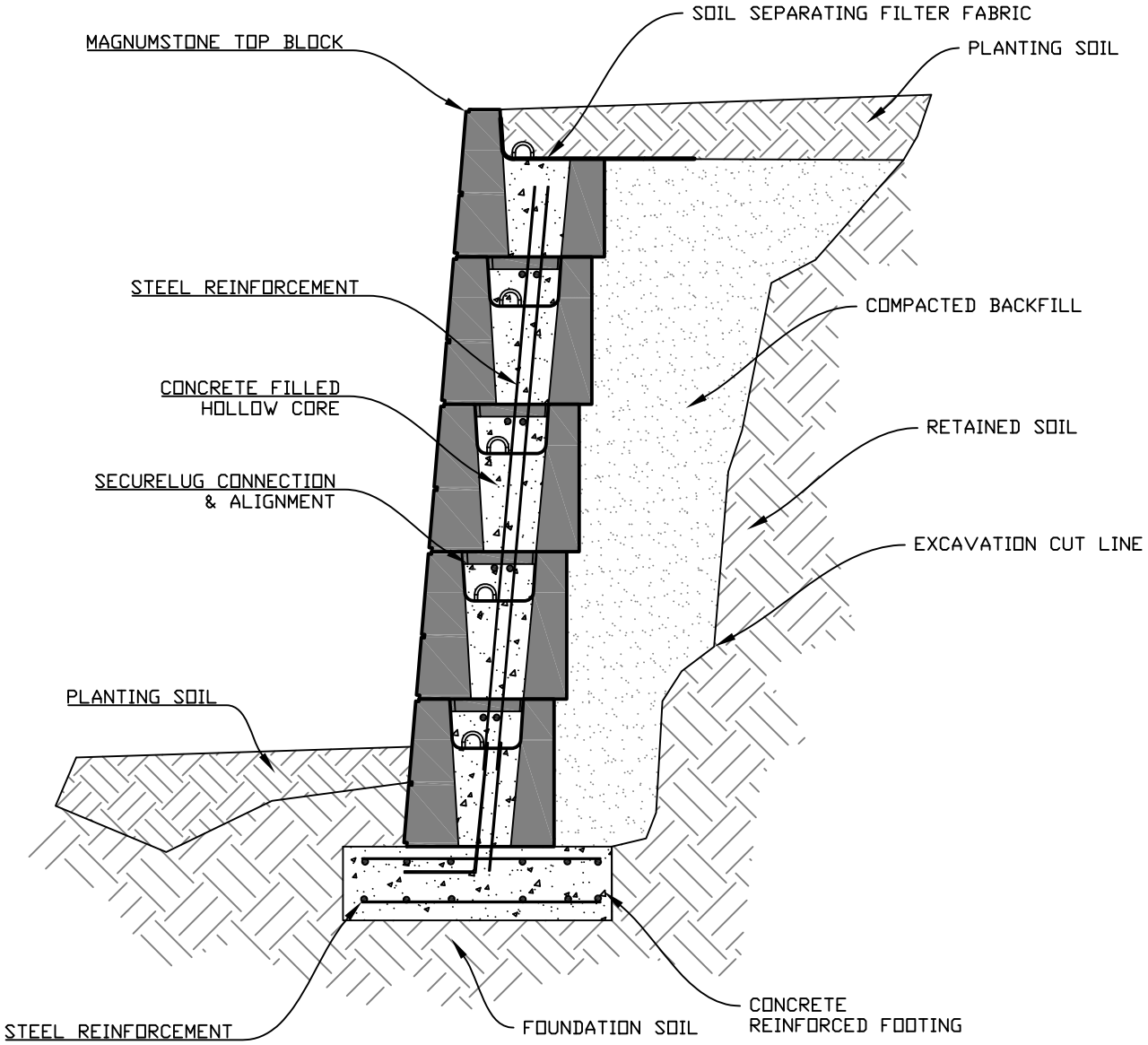
4.01 Payment for the placement of the geosynthetics shall be based on the unit price per square yard (square meter) installed or as per contract agreement.

MagnumStone

>>>STEEL/CONCRETE WALL

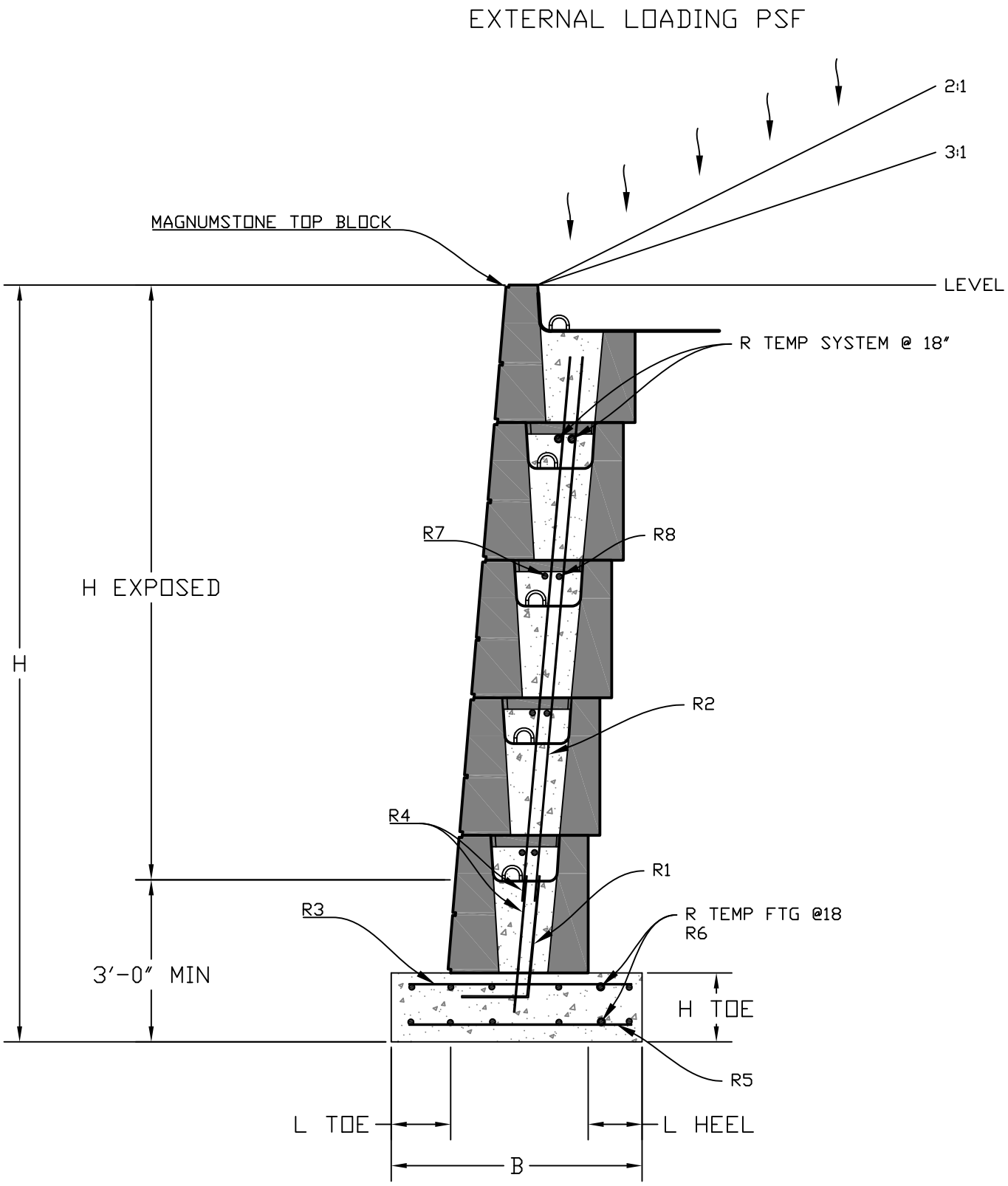


STEEL REINFORCED
THROUGH HOLLOW
CORE IN CONCRETE



MagnumStone

>>>STEEL/CONCRETE WALL



CORNERSTONE
WALL SOLUTIONS INC.

MAGNUM STONE REINFORCED WALL SECTIONS

Estimate worksheet.

NO SLOPE, NO SURCHARGE ABOVE

H total	h exposed	Slope above	Loading	Bearing Pressure (max - KSF)	B	L toe	L heal	h toe	R1	R2	R3	R4	R5	R6	R7	R8
11	8.00	level	none	2.28	5.83	1.50	2.50	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
13	10.00	level	none	2.67	6.83	1.75	3.25	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
15	12.00	level	none	2.82	8.08	2.25	4.00	1.00	Use #7 @ 12" back	Use #6 @ 12" splice	Use #7 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
17	14.00	level	none	3.33	9.08	2.25	5.00	1.33	Use #8 @ 12" back	Use #7 @ 12" splice	Use #7 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
19	16.00	level	none	3.61	10.33	2.50	6.00	1.50	Use 2#7 @ 12" back or #10	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
21	18.00	level	none	3.86	11.33	3.00	6.50	1.75	Use 2#7 @ 12" back or #11	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #5@24" front	Use #4@24" back
23	20.00	level	none	4.01	12.58	3.50	7.25	2.00	Use 2#9 @ 12" back	Use #9 @ 12" splice	Use #10 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #5@24" front	Use #4@24" back

2:1 SLOPE, NO SURCHARGE ABOVE

H total	h exposed	Slope above	Loading	Bearing Pressure (max - KSF)	B	L toe	L heal	h toe	R1	R2	R3	R4	R5	R6	R7	R8
11	8.00	2:1	none	2.25	6.83	2.00	3.00	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
13	10.00	2:1	none	2.61	7.83	2.50	3.50	1.00	Use #7 @ 12" back	Use #7 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
15	12.00	2:1	none	2.91	9.08	3.00	4.25	1.00	Use #8 @ 12" back	Use #7 @ 12" splice	Use #7 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
17	14.00	2:1	none	3.86	9.83	2.75	5.25	1.25	Use #10 @ 12" back or 2#7	Use #7 @ 12" splice	Use #8 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
19	16.00	2:1	none	3.91	11.33	3.50	6.00	1.50	Use 2#9 @ 12" back	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
21	18.00	2:1	none	4.64	12.33	3.50	7.00	1.83	Use 3#8 @ 12" back or #14	Use #10 @ 12" splice	Use #10 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back
23	20.00	2:1	none	4.78	14.33	4.00	8.50	2.40	Use 3#9 @ 12" back or 2 # 11	Use #11 @ 12" splice	Use #10@ 12" Top foot	Use #6 @ 12" front	Use #6 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back

3:1 SLOPE, NO SURCHARGE ABOVE

H total	h exposed	Slope above	Loading	Bearing Pressure (max - KSF)	B	L toe	L heal	h toe	R1	R2	R3	R4	R5	R6	R7	R8
11	8.00	3:1	none	2.40	6.08	1.75	2.50	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
13	10.00	3:1	none	2.89	7.08	2.00	3.25	1.00	Use #7 @ 12" back	Use #7 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
15	12.00	3:1	none	3.13	8.33	2.50	4.00	1.00	Use #8 @ 12" back	Use #7 @ 12" splice	Use #7 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
17	14.00	3:1	none	3.54	9.58	2.75	5.00	1.25	Use #9 @ 12" back	Use #7 @ 12" splice	Use #8 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
19	16.00	3:1	none	3.95	10.83	3.00	6.00	1.50	Use 2#8 @ 12" back or #11	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
21	18.00	3:1	none	4.44	11.83	3.25	6.75	1.83	Use 2#9 @ 12" back	Use #9 @ 12" splice	Use #9 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back
23	20.00	3:1	none	4.85	13.08	3.50	7.75	2.25	Use 3#9 @ 12" back or 2 # 10	Use 2#8 @ 12" splice or #11	Use 2#8@ 12" Top foot or #10	Use #6 @ 12" front	Use #6 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back

NO SLOPE, 100 PSF SURCHARGE ABOVE

H total	h exposed	Slope above	Loading	Bearing Pressure (max - KSF)	B	L toe	L heal	h toe	R1	R2	R3	R4	R5	R6	R7	R8
11	8.00	level	100 psf	2.42	6.08	1.75	2.50	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
13	10.00	level	100 psf	2.80	7.08	2.00	3.25	1.00	Use #7 @ 12" back	Use #7 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
15	12.00	level	100 psf	2.94	8.33	2.50	4.00	1.10	Use #7 @ 12" back	Use #7 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
17	14.00	level	100 psf	3.21	9.58	2.75	5.00	1.25	Use #9 @ 12" back	Use #7 @ 12" splice	Use #8 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
19	16.00	level	100 psf	3.49	10.83	3.00	6.00	1.50	Use #10 @ 12" back or 2#7	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
21	18.00	level	100 psf	3.86	11.83	3.25	6.75	1.83	Use 2#8 @ 12" back or #11	Use #8 @ 12" splice	Use #9 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back
23	20.00	level	100 psf	4.57	12.33	3.25	7.25	2.25	Use 2#9 @ 12" back	Use #10 @ 12" splice or 2#7	Use #9@ 12" Top foot	Use #6 @ 12" front	Use #6 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back

NO SLOPE, 250 PSF SURCHARGE ABOVE

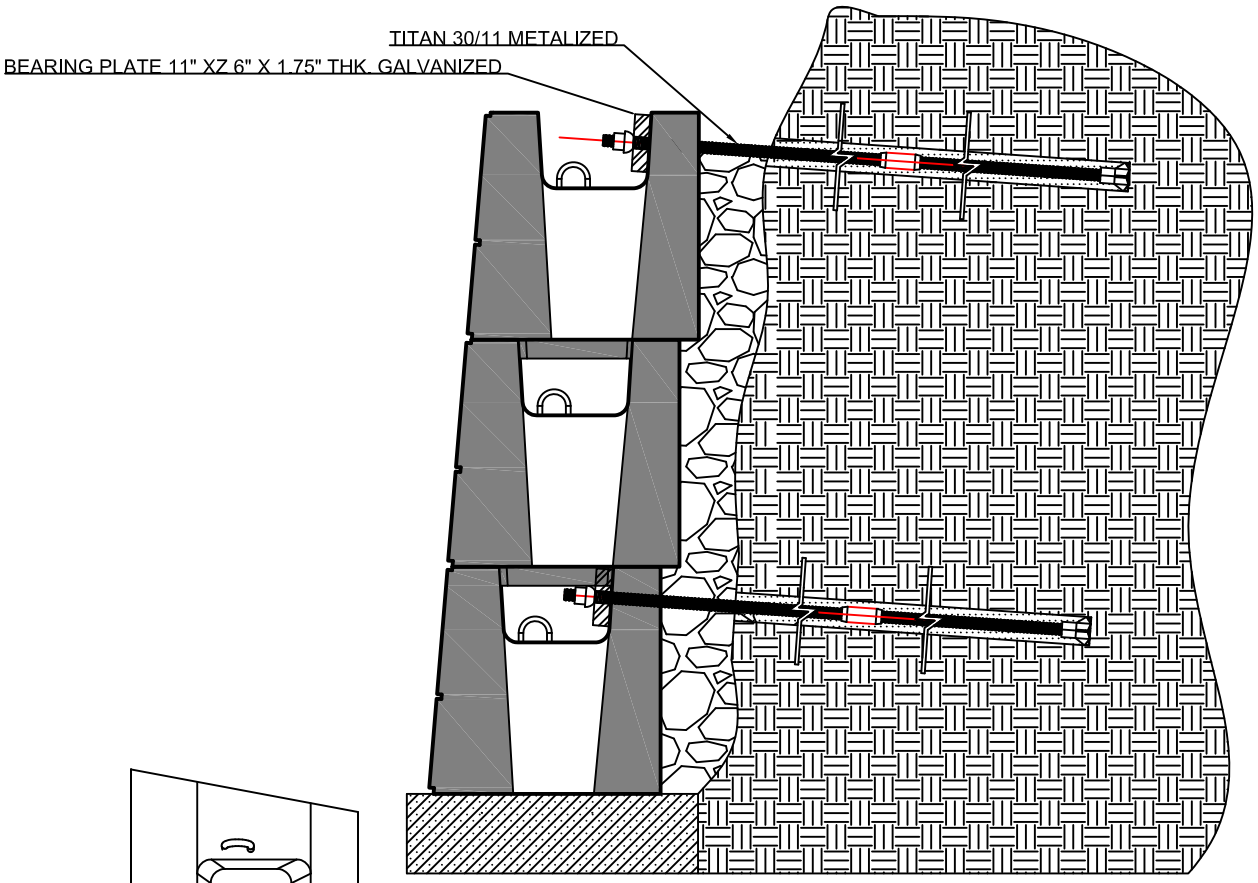
H total	h exposed	Slope above	Loading	Bearing Pressure (max - KSF)	B	L toe	L heal	h toe	R1	R2	R3	R4	R5	R6	R7	R8
11	8.00	level	250 psf	2.56	6.83	2.00	3.00	1.00	Use #6 @ 12" back	Use #6 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
13	10.00	level	250 psf	2.93	7.83	2.25	3.75	1.00	Use #7 @ 12" back	Use #7 @ 12" splice	Use #6 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
15	12.00	level	250 psf	3.30	8.83	2.50	4.50	1.10	Use #8 @ 12" back	Use #7 @ 12" splice	Use #7 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #4@18" temp foot T&B	Use #5@24" front	Use #4@24" back
17	14.00	level	250 psf	3.68	9.83	2.75	5.25	1.25	Use #10 @ 12" back or 2#7	Use #7 @ 12" splice	Use #8 @ 12" Top foot or 2#6	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
19	16.00	level	250 psf	3.94	11.08	3.00	6.25	1.50	Use 2#8 @ 12" back or #11	Use #8 @ 12" splice	Use #9 @ 12" Top foot	Use #5 @ 12" front	Use #5 @ 12	Use #5@18" temp foot T&B	Use #5@24" front	Use #4@24" back
21	18.00	level	250 psf	4.32	12.08	3.25	7.00	1.90	Use 2#9 @ 12" back	Use #9 @ 12" splice	Use #9 @ 12" Top foot or 2#7	Use #5 @ 12" front	Use #5 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back
23	20.00	level	250 psf	4.59	13.33	3.50	8.00	2.25	Use 2#10 @ 12" back or 3 # 8	Use 2#8 @ 12" splice or #11	Use #10@ 12" Top foot or 2#7	Use #6 @ 12" front	Use #6 @ 12	Use #6@18" temp foot T&B	Use #6@24" front	Use #4@24" back

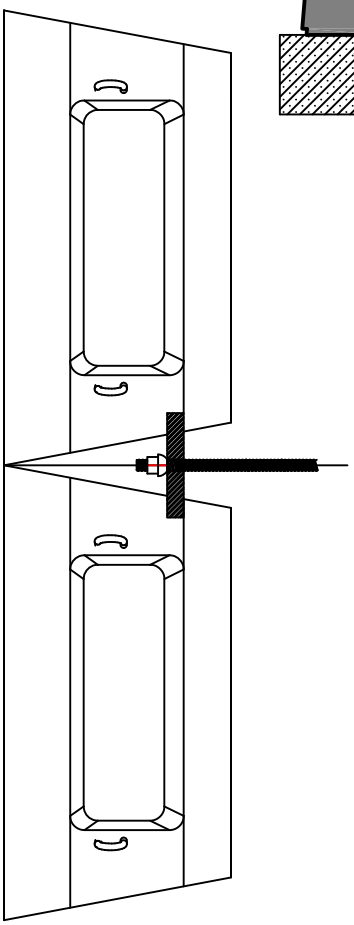
This chart is for estimation purposes only and should not be used for construction. There are many assumptions that were incorporated into these analyses and by changing any one or combination of, could result in significantly different results. The contractor, project owner or distributor of Magnum Stone **must** contact a locally licensed professional engineer to design every wall on a case-by-case basis utilizing site specific criteria.

All Concrete 4,000 psi compressive strength, all steel 60 ksi tensile strength

MagnumStone

>>>SOIL ANCHOR





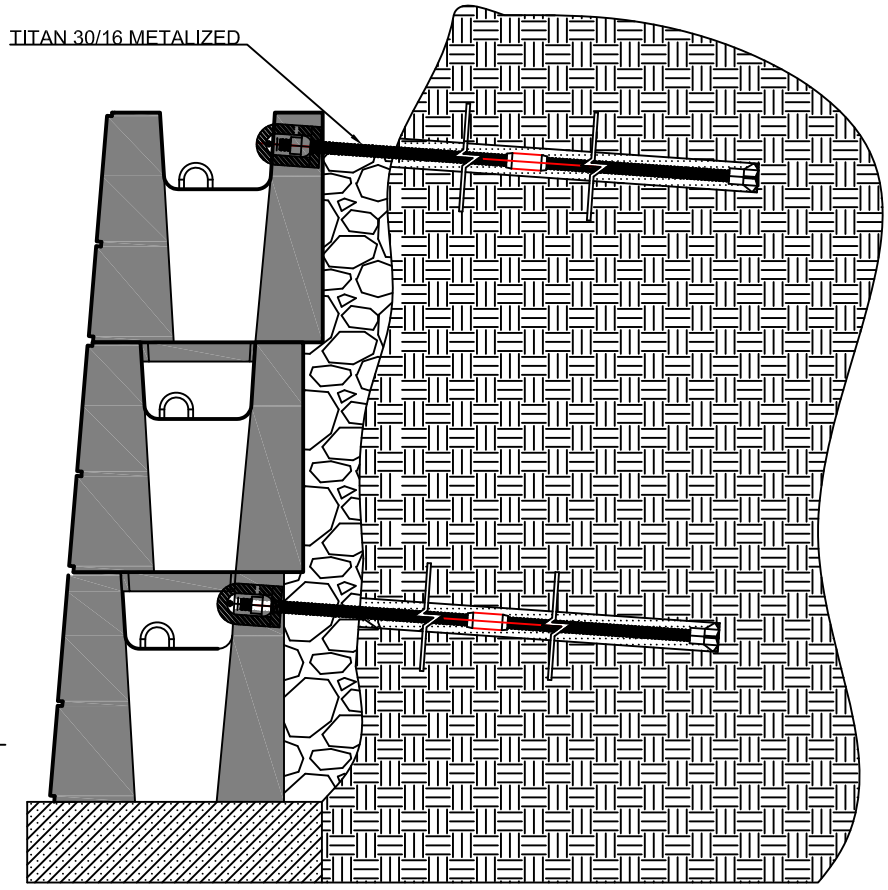
DESIGN LOAD (KIPS)	fc(28 days) (psi)	BEARING PLATE SIZE (in)	BEARING PLATE THICKNESS (in)
29.7	4,000	10 X 5.5	1.5
25.0	4,000	9.5 X 5.25	1.5
20.0	4,000	9.25 X 4.75	1.5
15.0	4,000	9.0 X 4.25	1.25
10.0	4,000	8.75 X 3.5	1.25
5.0	4,000	8.0 X 3.0	1.0

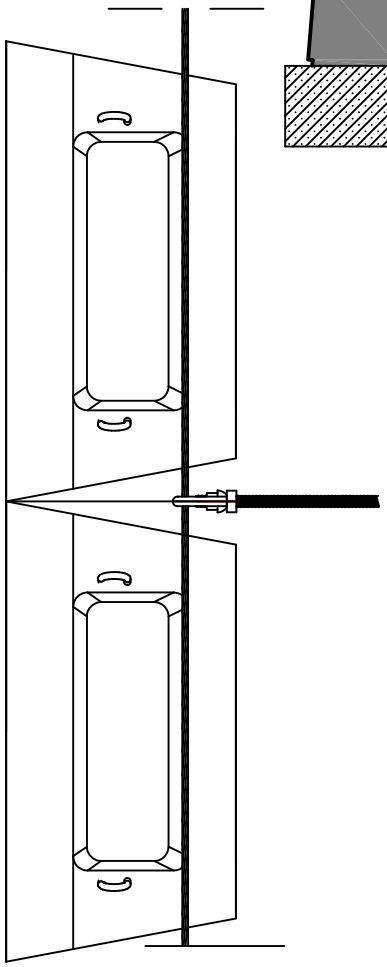
NOTE:
- TITAN 30/16 ROD HAVE TO BE METALIZED
- BEARING PLATE GRADE 50 KSI, GALVANIZED AFTER FABRICATION.
- VERTICAL/HORIZONTAL NAILS SPACING BASED ON REQUIRED CAPACITY.

CON-TECH SYSTEMS LTD	CORNERSTONE
SCALE:	DRAWN BY: TOM
DATE: DEC.04.09.	REVISED
TITAN 30/16 & MAGNUMSTONE WALL, OPTION #1	
SOIL NAIL C/W BEARING PLATE	DRAWING NUMBER SAMPLE #1

MagnumStone

>>>SOIL ANCHOR



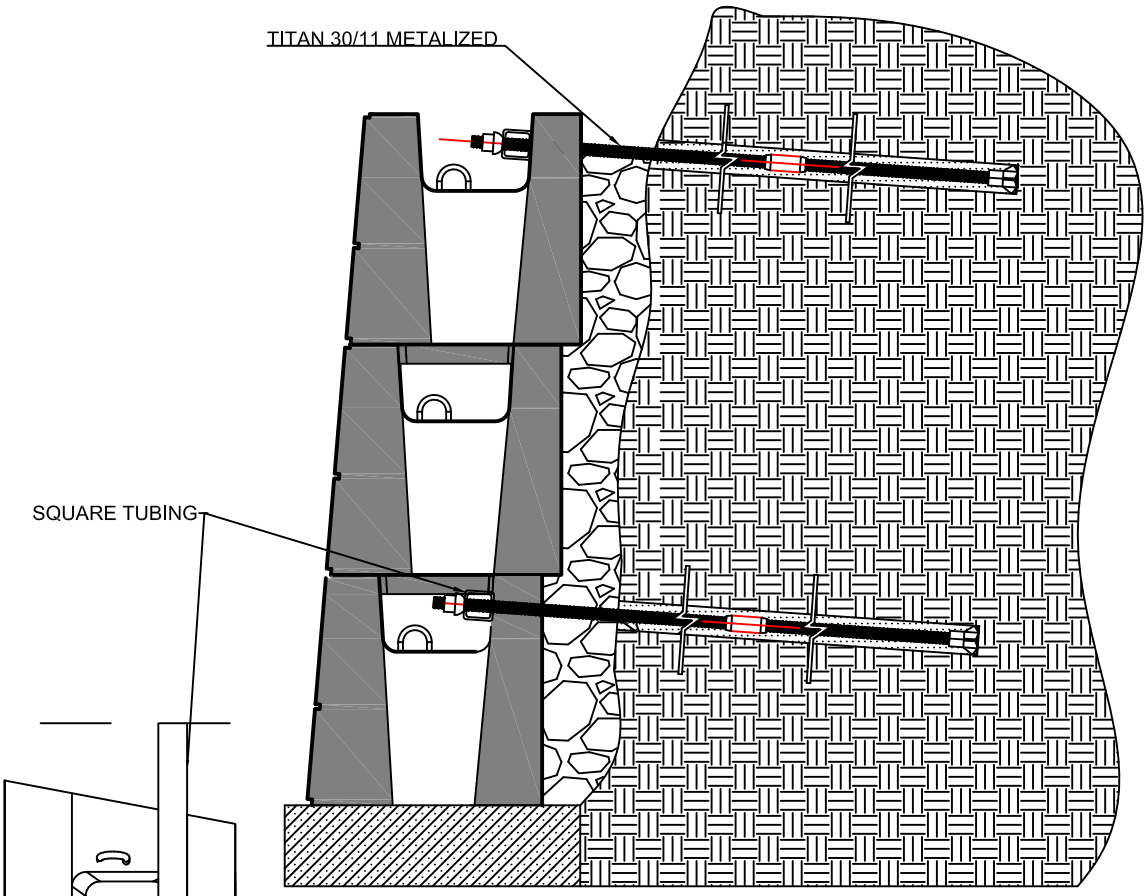


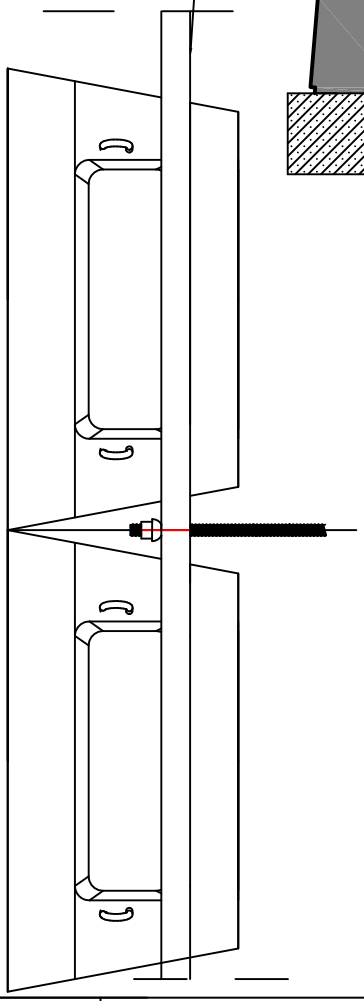
NOTE:
- TITAN 30/16 ROD HAVE TO BE METALIZED
-0.6" STRAND 270 KSI, HAVE TO BE GALVANIZED.
-EYE HAVE TO BE METALIZED
- VERTICAL/HORIZONTAL NAILS SPACING BASED ON REQUIRED CAPACITY.

CON-TECH SYSTEMS LTD	CORNERSTONE
SCALE:	DRAWN BY: TOM
DATE: DEC.04.09.	REVISED
TITAN 30/16 & MAGNUMSTONE WALL, OPTION #2	
SOIL NAIL C/W 0.6" STRAND	DRAWING NUMBER SAMPLE #2

MagnumStone

>>>SOIL ANCHOR





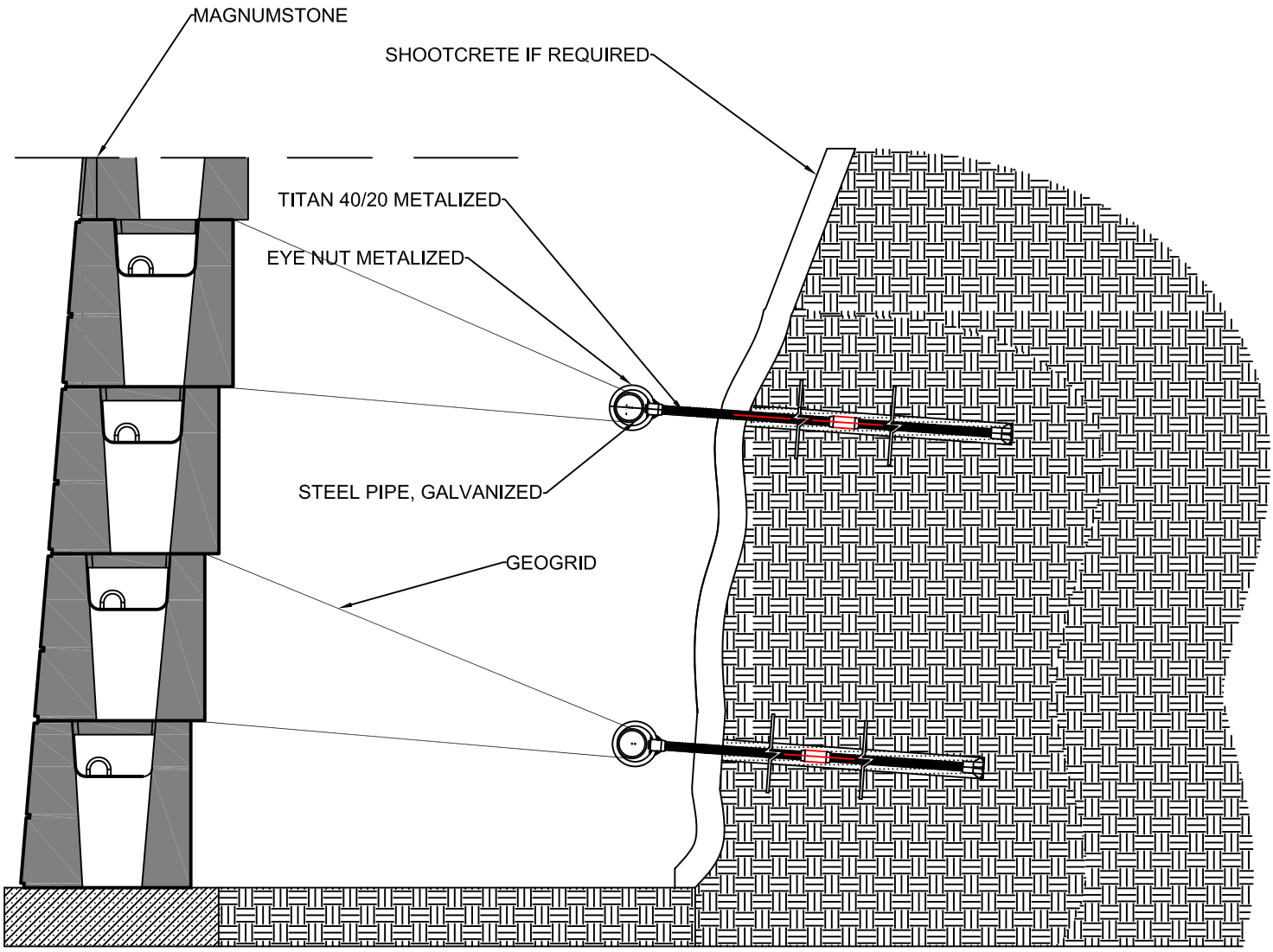
DESIGN LOAD (KIPS)	fc(28 days) (psi)	min.SECTION MODULUS(in^3)*	STEEL SQUARE TUBING SIZE (in)	STEEL PIPE (In)
29.7	4,000	1.258	3 X 3 X 0.25	3.5" SCH 40
25.0	4,000	1.058	2.75 X 2.75 X 0.25	3.5" SCH 40
20.0	4,000	0.847	2.63 X 2.63 X 0.25	3" SCH 40
15.0	4,000	0.635	2.38 X 2.38 X 0.20	3" SCH 40
10.0	4,000	0.423	2.25 X 2.25 X 0.188	2.5" SCH 40
5.0	4,000	0.212	2.0 X 2.0 X 0.188	2.0" SCH 40

NOTE:
- TITAN 30/16 ROD HAVE TO BE METALIZED
- STRUCTURAL STEEL SHAPE, GALVANIZED.
- VERTICAL/HORIZONTAL NAILS SPACING BASED ON REQUIRED CAPACITY.

CON-TECH SYSTEMS LTD		CORNERSTONE
SCALE:		DRAWN BY: TOM
DATE: DEC.04.09.		REVISED
TITAN 30/16 & MAGNUMSTONE WALL, OPTION #3		
SOIL NAIL C/W STRUCTURAL SHAPE		DRAWING NUMBER SAMPLE #3

MagnumStone

>>>SOIL ANCHOR



NOTE:

- TITAN 40/20 ROD HAVE TO BE METALIZED
- STEEL PIPE, GALVANIZED.
- VERTICAL/HORIZONTAL NAILS SPACING BASED ON REQUIRED CAPACITY.

CON–TECH SYSTEMS LTD		CORNERSTONE
SCALE:		DRAWN BY: TOM
DATE: DEC.04.09.		REVISED
TITAN 40/20 & MAGNUMSTONE WALL, OPTION #4		
SOIL NAIL C/W GEOGRID		DRAWING NUMBER SAMPLE #4

MagnumStone

>>>SOIL ANCHOR

BAR SIZE	AREA (In^2)	GUTS(klps)	YIELD(klps)	Max.TEST (klps)	Max.DESIGN LOAD (klps)	BAR LENGTH (ft)
TITAN 30/16	0.59	49.5	40.5	39.6	29.7	10

AVERAGE ULTIMATE BOND STRESS-ROCK/GROUT	psi	CARBIDE DRILL BIT SIZE (In)	FACTOR OF SAFETY	min. BOND LENGTH (ft)
GRANITE & BASALT	250 - 450	2	1.5	2.4
DOLOMOTIC LIMESTONE	200 - 300	2	1.5	2.9
SOFT LIMESTONE	150 - 200	2	1.5	4.0
SLATES & HARD SHALES	120 - 200	2	1.5	4.9
SOFT SHALES	30 - 120	2	1.5	19.7
SAND STONES	120 - 250	2	1.5	4.9
WEATHERED SANDSTONES	100 - 120	2	1.5	5.9
CHALK	30 - 155	2	1.5	19.7
WEATHERED MARL	25 - 35	2	1.5	29.5
CONCRETE	200 - 400	2	1.5	2.9

AVERAGE ULTIMATE BOND STRESS-COHESIVE SOILS/GROUT	psi	CLAY DRILL BIT SIZE (in)	FACTOR OF SAFETY	min. BOND LENGTH (ft)
SOFT SILTY CLAY	5 - 10	3.75	1.5	45.2
SILTY CLAY	5 - 10	3.75	1.5	45.2
STIFF CLAY, MED. TO HIGH PLASTICITY	5 - 15	3.75	1.5	45.2
VERY STIFF CLAY, MED. TO HIGH PLASTICITY	10 - 25	3.75	1.5	22.6
STIFF CLAY, MED. PLASTICITY	15 - 35	3.75	1.5	15.1
VERY STIFF CLAY, MED. PLASTICITY	20 - 50	3.75	1.5	11.3
VERY STIFF SANDY SILT, MED. PLASTICITY	40 - 55	3.75	1.5	5.6

AVERAGE ULTIMATE BOND STRESS-COHESIONLESS SOILS /GROUT	psi	DRILL BIT SIZE (in)	FACTOR OF SAFETY	min. BOND LENGTH (ft)
FINE-MED. SAND, MED. DENSE - DENSE	12 - 55	3.5	1.5	18.5
MED.-COARSE SAND (W/GRAVEL), MED.-DENSE	16 - 95	3.5	1.5	13.9
MED.-COARSE SAND (W/GRAVEL), DENSE-VERY DENSE	35 - 140	3.5	1.5	6.4
SILTY SAND	25 - 60	3.5	1.5	8.9
DENSE GLACIAL TILL	43 - 75	3.5	1.5	5.2
SANDY GRAVEL, MED. DENSE - DENSE	31 - 200	3.5	1.5	7.2
SANDY GRAVEL, DENSE - VERY DENSE	40 - 200	3.5	1.5	5.6

NOTE:
BOND LENGTH CALCULATED WITHMAX. DESIGN LOAD OF 29.7 kips PER ROD.
IF CORNERSTONE REQUIRE LOWER DESIGN LOAD, DIFFERENT IN LOAD (%) WILL APPLY ON THE BOND LENGTH TOO.

CON-TECH SYSTEMS LTD	CORNERSTONE	
SCALE:		DRAWN BY: TOM
DATE: DEC.04.09.		REVISED
BOND LENGTH FOR TITAN 30/16 APPLICATION		
SOIL NAIL C/W BEARING PLATE		DRAWING NUMBER BOND – #1

MagnumStone

>>>SOIL ANCHOR

BAR SIZE	AREA (in²)	GUTS(kips)	YIELD(kips)	Max.TEST (kips)	Max.DESIGN LOAD (kips)	BAR LENGTH (ft)
TITAN 40/20	1.13	121.2	96.7	95.6	72.7	10

AVERAGE ULTIMATE BOND STRESS-ROCK/GROUT	psi	CARBIDE DRILL BIT SIZE (in)	FACTOR OF SAFETY	min. BOND LENGTH (ft)
GRANITE & BASALT	250 - 450	3.5	1.5	3.3
DOLOMOTIC LIMESTONE	200 - 300	3.5	1.5	4.1
SOFT LIMESTONE	150 - 200	3.5	1.5	5.5
SLATES & HARD SHALES	120 - 200	3.5	1.5	6.9
SOFT SHALES	30 - 120	3.5	1.5	27.5
SAND STONES	120 - 250	3.5	1.5	6.9
WEATHERED SANDSTONES	100 - 120	3.5	1.5	8.3
CHALK	30 - 155	3.5	1.5	27.5
WEATHERED MARL	25 - 35	3.5	1.5	33.0
CONCRETE	200 - 400	3.5	1.5	4.1

AVERAGE ULTIMATE BOND STRESS-COHESIVE SOILS/GROUT	psi	CLAY DRILL BIT SIZE (in)	FACTOR OF SAFETY	min. BOND LENGTH (ft)
SOFT SILTY CLAY	5 - 10	5.90	1.5	70.0
SILTY CLAY	5 - 10	5.90	1.5	70.0
STIFF CLAY, MED. TO HIGH PLASTICITY	5 - 15	5.90	1.5	70.0
VERY STIFF CLAY, MED. TO HIGH PLASTICITY	10 - 25	5.90	1.5	35.0
STIFF CLAY, MED. PLASTICITY	15 - 35	5.90	1.5	23.3
VERY STIFF CLAY, MED. PLASTICITY	20 - 50	5.90	1.5	17.5
VERY STIFF SANDY SILT, MED. PLASTICITY	40 - 55	5.90	1.5	8.8

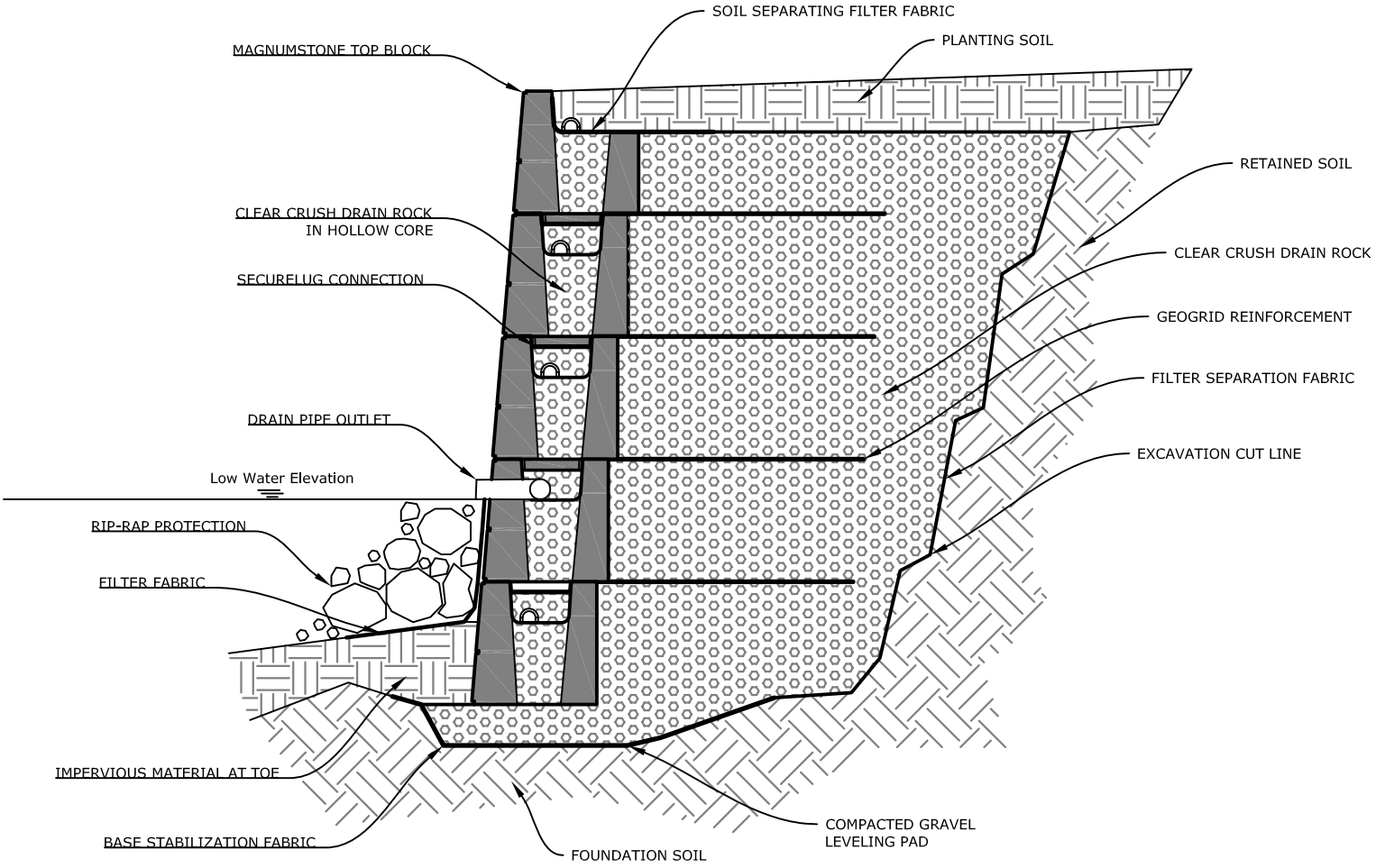
AVERAGE ULTIMATE BOND STRESS-COHESIONLESS SOILS /GROUT	psi	DRILL BIT SIZE (In)	FACTOR OF SAFETY	mIn. BOND LENGTH (ft)
FINE-MED. SAND, MED. DENSE - DENSE	12 - 55	4.5	1.5	35.5
MED.-COARSE SAND (W/GRAVEL), MED.-DENSE	16 - 95	4.5	1.5	26.6
MED.-COARSE SAND (W/GRAVEL), DENSE-VERY DENSE	35 - 140	4.5	1.5	12.2
SILTY SAND	25 - 60	4.5	1.5	17.0
DENSE GLACIAL TILL	43 - 75	4.5	1.5	9.9
SANDY GRAVEL, MED. DENSE - DENSE	31 - 200	4.5	1.5	13.7
SANDY GRAVEL, DENSE - VERY DENSE	40 - 200	4.5	1.5	10.7

NOTE:
BOND LENGTH CALCULATED WITHMAX. DESIGN LOAD OF 29.7 kips PER ROD.
IF CORNERSTONE REQUIRE LOWER DESIGN LOAD, DIFFERENT IN LOAD (%) WILL APPLY ONTHE BOND LENGTH TOO.

CON-TECH SYSTEMS LTD	CORNERSTONE	
SCALE:		DRAWN BY: TOM
DATE: DEC.04.09.		REVISED
BOND LENGTH FOR TITAN 40/20 APPLICATION		
SOIL NAIL C/W BEARING PLATE		DRAWING NUMBER BOND – #2

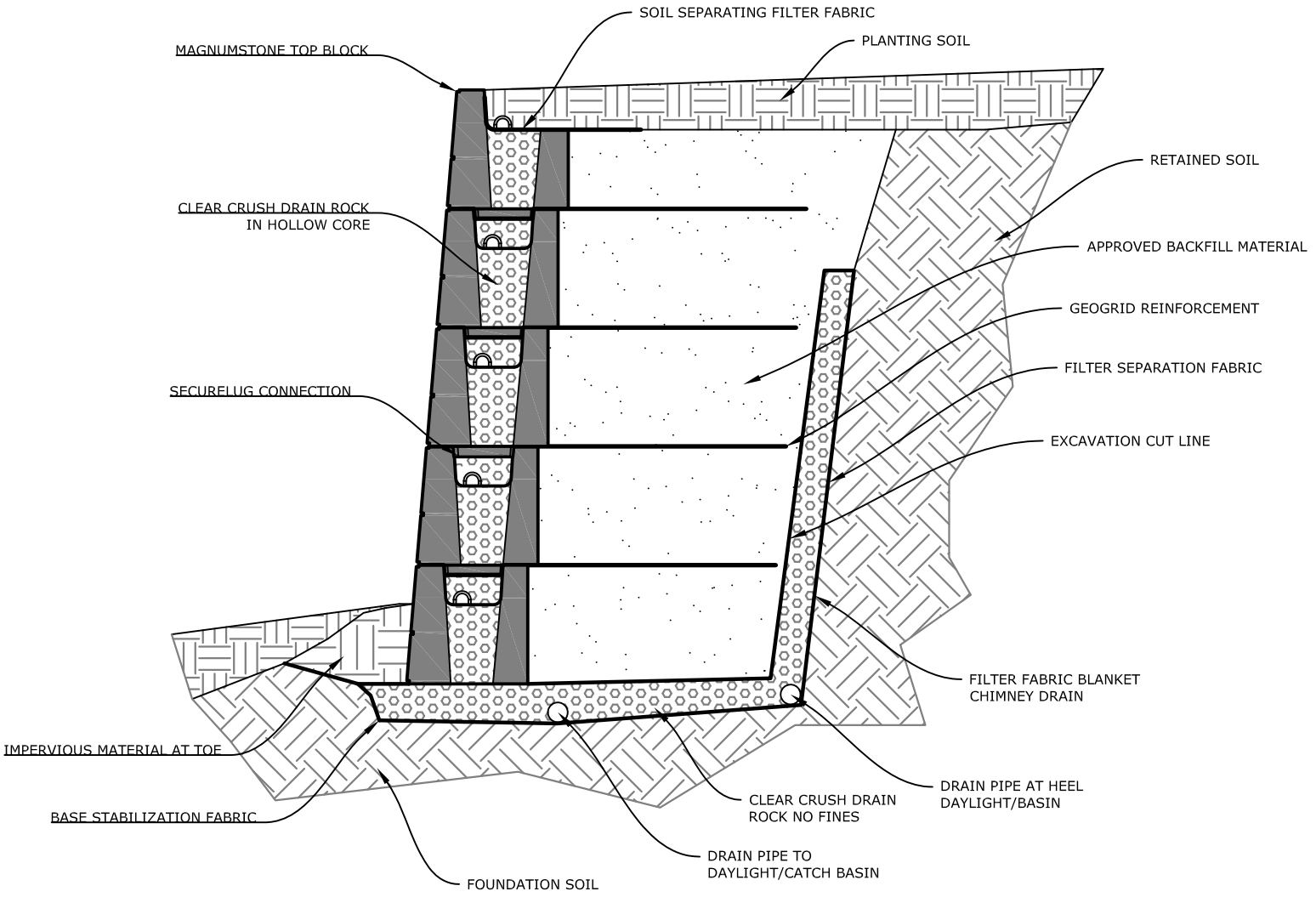
MagnumStone Batter

>>>WATER



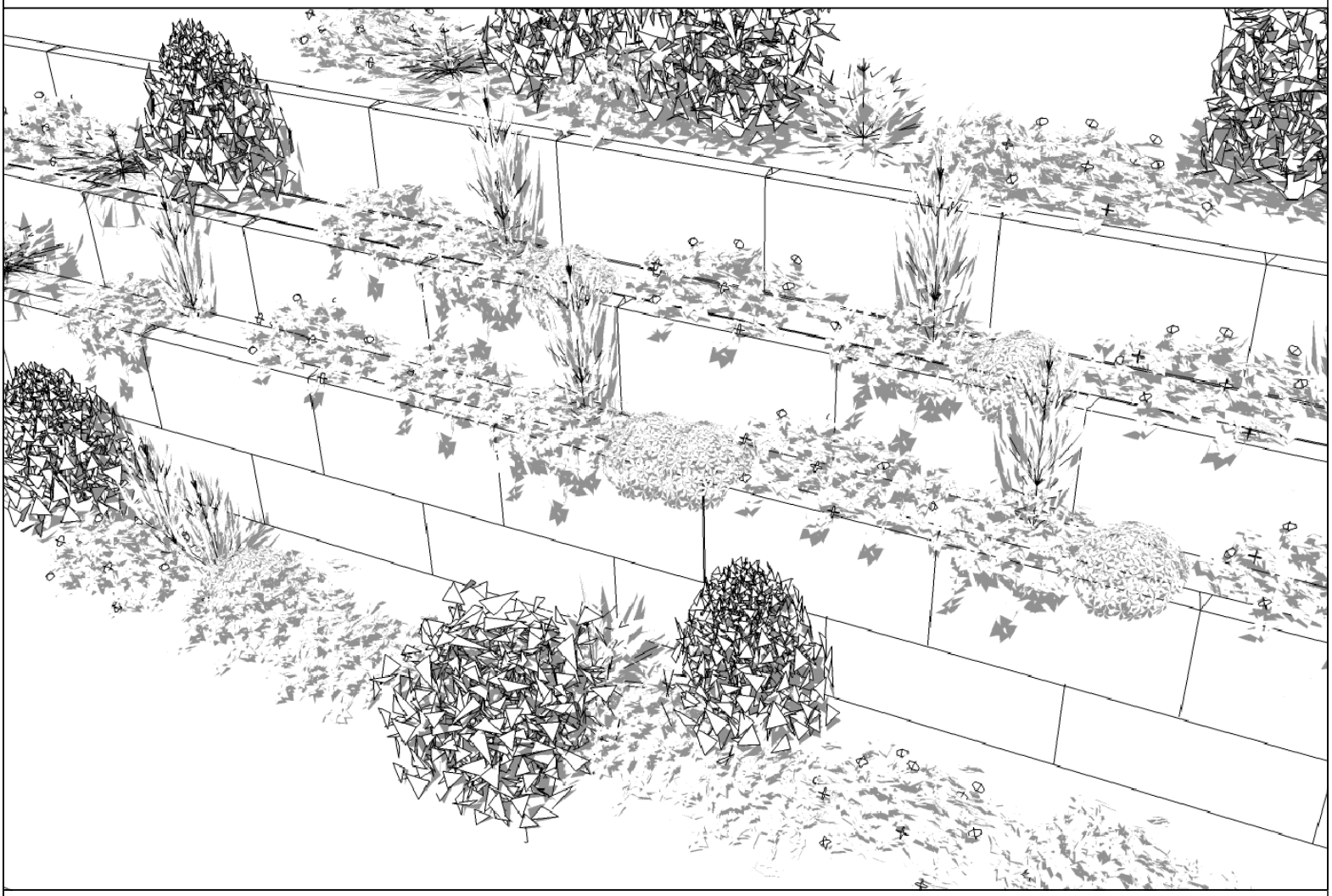
MagnumStone Batter

>>>CHIMNEY DRAIN



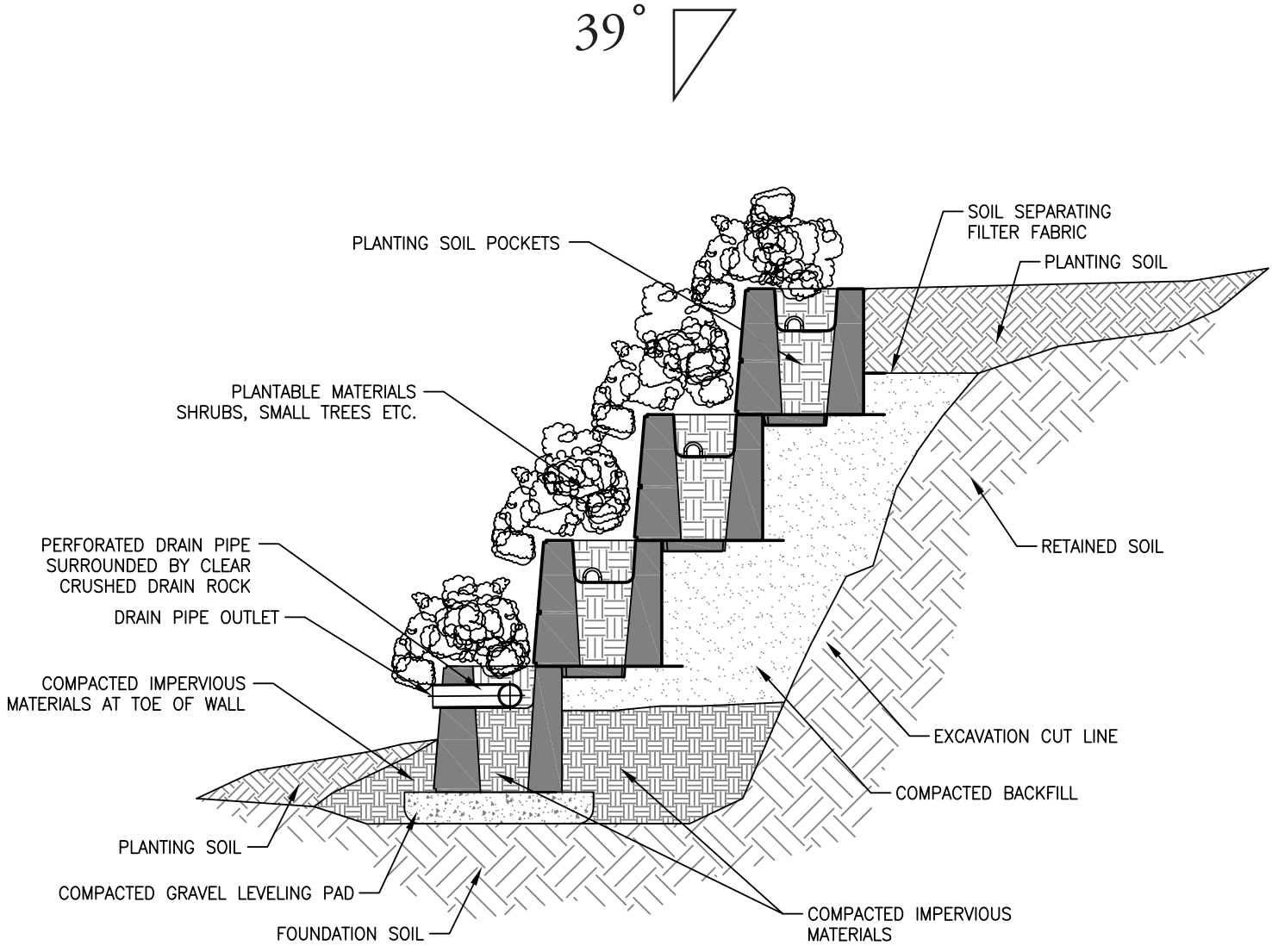
MagnumStone

>>>GREEN / PLANTABLE

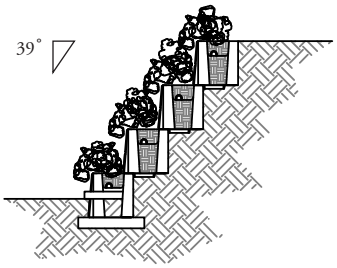


CORNERSTONE
WALL SOLUTIONS INC.

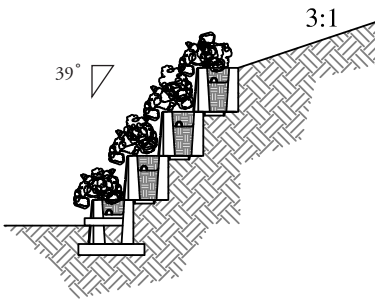
> > > MagnumStone™ 2.0 Ft Plantable Wall



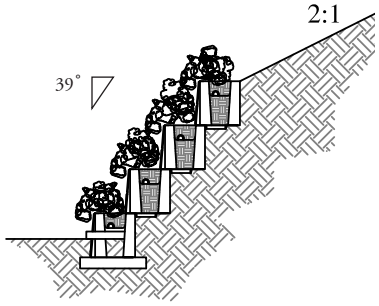
> > > MagnumStone™ 2.0 Ft Plantable Wall Charts



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	20.9’ (6370mm)	1.1’ (335mm)	22.0’ (6706mm)
30° Soil	20.9’ (6370mm)	1.1’ (335mm)	22.2’ (6767mm)
26° Soil	14.5’ (4420mm)	0.8’ (244mm)	15.3’ (4663mm)



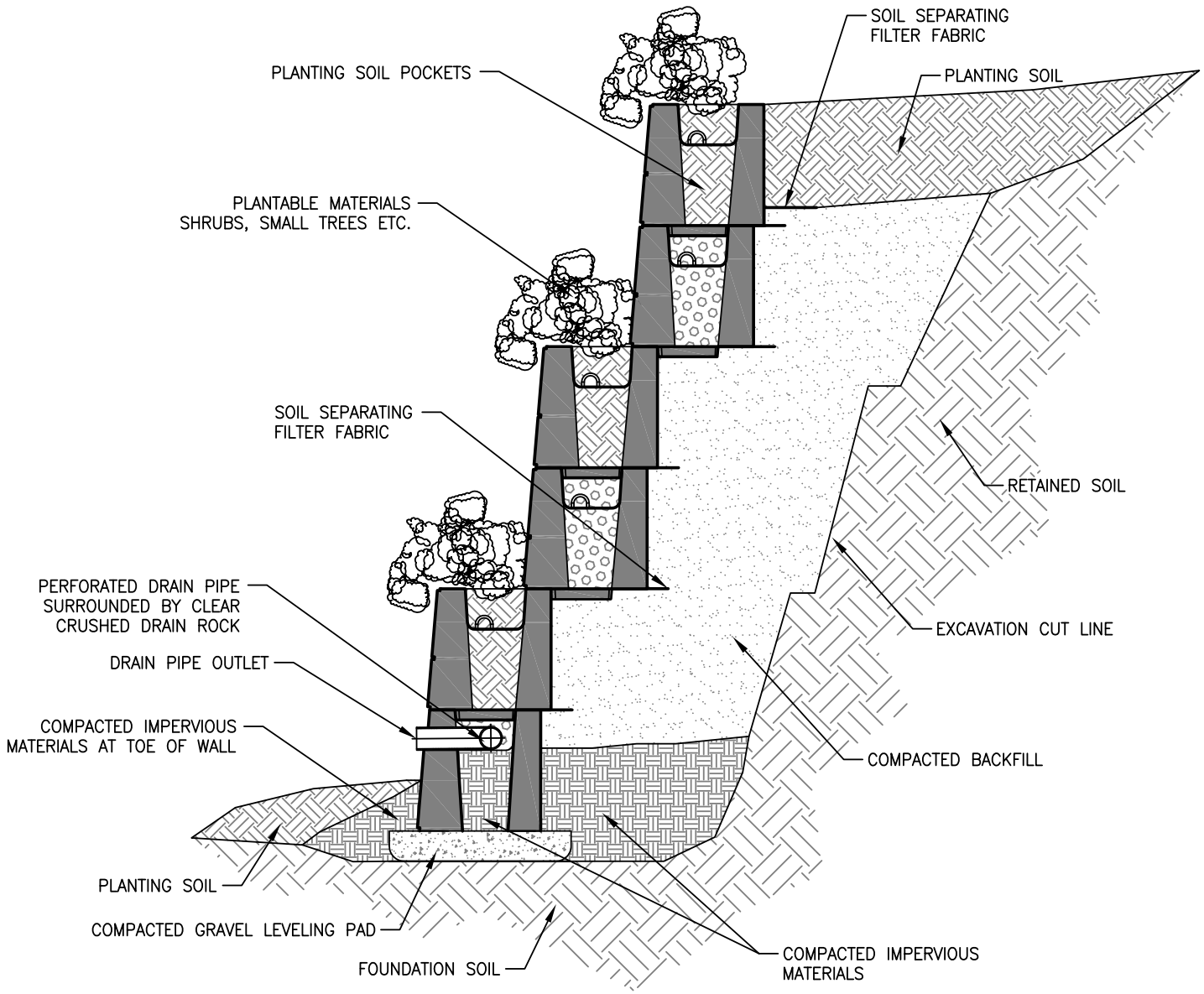
Soil Type	Height Exposed	Height Embedded	Total
34° Soil	20.9’ (6370mm)	1.1’ (335mm)	22.0’ (6706mm)
30° Soil	17.8’ (5425mm)	1.0’ (305mm)	18.8’ (5730mm)
26° Soil	10.8’ (3292mm)	0.6’ (183mm)	11.4’ (3475mm)



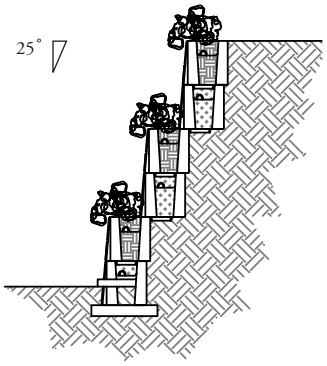
Soil Type	Height Exposed	Height Embedded	Total
34° Soil	20.9’ (6370mm)	1.1’ (335mm)	22.0’ (6706mm)
30° Soil	13.4’ (4084mm)	0.8’ (244mm)	14.2’ (4328mm)
26° Soil	N/A	N/A	N/A

DISCLAIMER. This chart is for initial estimation purposes only. Do not use for final design or construction. Retain a licensed professional engineer to design every wall on a case-by-case basis using site specific criteria. The accuracy and use of this document are the sole responsibility of the user. All calculations were performed based on NCMA methodology using factors of safety of 1.5 for sliding and overturning. The bearing capacity of base soils will be no less than 3,000 pounds per square foot (psf). All soils have been assumed to be less than 125 pounds per cubic foot (pcf). Global Stability Analysis has not been performed.

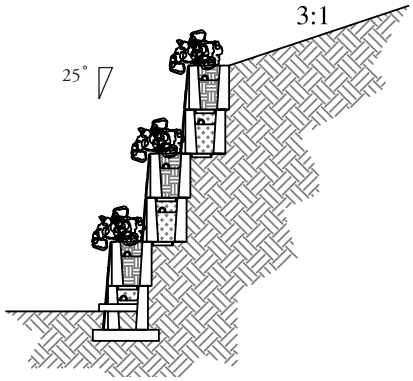
25°


SOIL SEPARATING FILTER FABRIC
PLANTING SOIL POCKETS
PLANTING SOIL
PLANTABLE MATERIALS SHRUBS, SMALL TREES ETC.
SOIL SEPARATING FILTER FABRIC
RETAINED SOIL
PERFORATED DRAIN PIPE SURROUNDED BY CLEAR CRUSHED DRAIN ROCK
EXCAVATION CUT LINE
DRAIN PIPE OUTLET
COMPACTED IMPERVIOUS MATERIALS AT TOE OF WALL
COMPACTED BACKFILL
PLANTING SOIL
COMPACTED GRAVEL LEVELING PAD
FOUNDATION SOIL
COMPACTED IMPERVIOUS MATERIALS

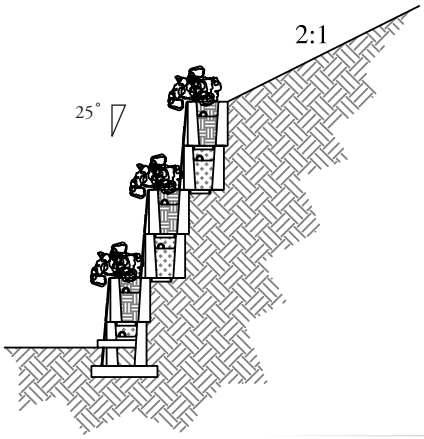
> > > MagnumStone™ 4.0 Ft Plantable Wall Charts



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	14.5' (4420mm)	0.8' (244mm)	15.3' (4663mm)
30° Soil	10.8' (3292mm)	0.6' (183mm)	11.4' (3475mm)
26° Soil	8.1' (2469mm)	0.5' (152mm)	8.6' (2621mm)



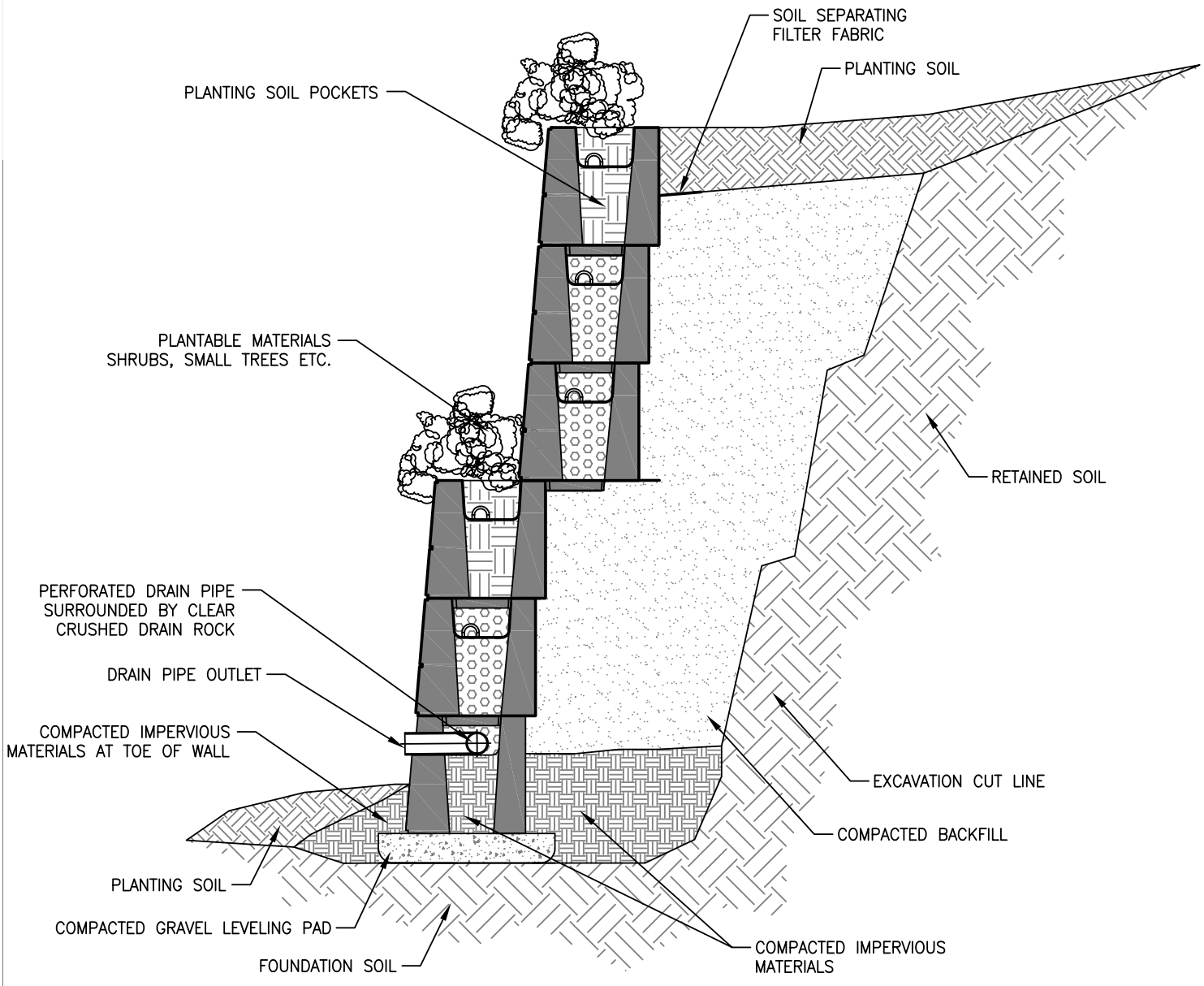
Soil Type	Height Exposed	Height Embedded	Total
34° Soil	11.8' (3597mm)	0.7' (213mm)	12.5' (3810mm)
30° Soil	8.4' (2560mm)	0.5' (152mm)	8.9' (2713mm)
26° Soil	5.8' (1768mm)	0.5' (152mm)	6.3' (1920mm)



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	9.8' (2987mm)	0.6' (183mm)	10.4' (3170mm)
30° Soil	6.2' (1890mm)	0.5' (152mm)	6.7' (2042mm)
26° Soil	N/A	N/A	N/A

DISCLAIMER. This chart is for initial estimation purposes only. Do not use for final design or construction. Retain a licensed professional engineer to design every wall on a case-by-case basis using site specific criteria. The accuracy and use of this document are the sole responsibility of the user. All calculations were performed based on NCMA methodology using factors of safety of 1.5 for sliding and overturning. The bearing capacity of base soils will be no less than 3,000 pounds per square foot (psf). All soils have been assumed to be less than 125 pounds per cubic foot (pcf). Global Stability Analysis has not been performed.

18°


SOIL SEPARATING FILTER FABRIC
PLANTING SOIL
PLANTING SOIL POCKETS
PLANTABLE MATERIALS SHRUBS, SMALL TREES ETC.
RETAINED SOIL
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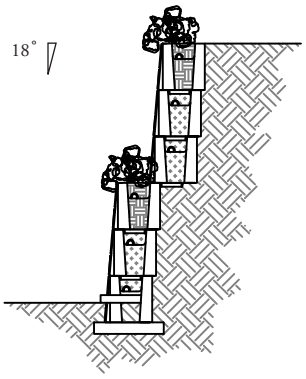
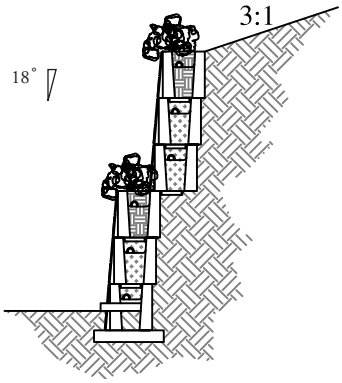
COMPACTED GRAVEL LEVELING PAD
FOUNDATION SOIL
COMPACTED IMPERVIOUS MATERIALS

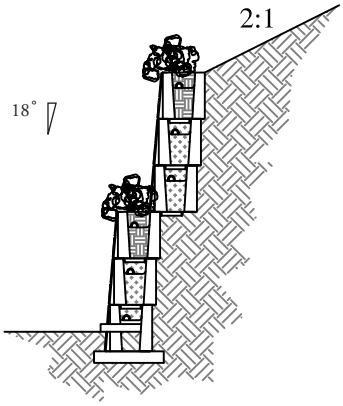
> > > MagnumStone™ 6.0 Ft Plantable Wall Charts



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	10.9' (3322mm)	0.6' (183mm)	11.5' (3505mm)
30° Soil	8.5' (2591mm)	0.5' (152mm)	9.0' (2743mm)
26° Soil	6.6' (2012mm)	0.5' (152mm)	7.1' (2164mm)



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	8.8' (2682mm)	0.5' (152mm)	9.3' (2835mm)
30° Soil	6.4' (1951mm)	0.5' (152mm)	6.9' (2103mm)
26° Soil	4.7' (1433mm)	0.5' (152mm)	5.2 (1586mm)



Soil Type	Height Exposed	Height Embedded	Total
34° Soil	7.2' (2195mm)	0.5' (152mm)	7.7' (2347mm)
30° Soil	4.8' (1463mm)	0.5' (152mm)	5.3' (1615mm)
26° Soil	N/A	N/A	N/A

DISCLAIMER. This chart is for initial estimation purposes only. Do not use for final design or construction. Retain a licensed professional engineer to design every wall on a case-by-case basis using site specific criteria. The accuracy and use of this document are the sole responsibility of the user. All calculations were performed based on NCMA methodology using factors of safety of 1.5 for sliding and overturning. The bearing capacity of base soils will be no less than 3,000 pounds per square foot (psf). All soils have been assumed to be less than 125 pounds per cubic foot (pcf). Global Stability Analysis has not been performed.

THE ENVIRONMENTAL ADVANTAGE

MangumStone™ is a large wet-cast retaining wall system, cleverly engineered with a hollow core. Its hollow design uses nearly half the concrete of a solid system while maintaining all of its strength and durability. The environmental and economical advantages of the MagnumStone™ system are unprecedented in our industry.

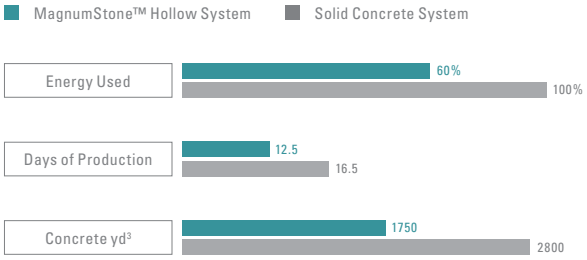
Raw materials use energy which can cause water pollution and air emission problems which are leading factors that make concrete unfriendly to our environment. We cannot avoid using concrete but we must find complementary variations and more earth friendly solutions in its uses.

V V V Engineered for strength... designed for beauty

MAGNUMSTONE™

> > > Production

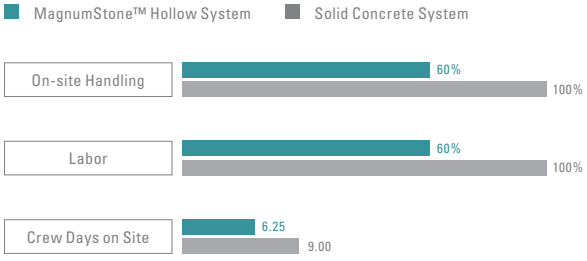
MagnumStone's hollow core allows production facilities to maximize their output and reduce their carbon footprint. Its unique hollow core design means less concrete to pour, making the units lighter for handling purposes and reducing the amount of cement required per block. Both of these factors translate into cost savings and a significant reduction in harmful greenhouse gas emissions (nearly 40%) when compared to solid concrete systems.



Graph is based on a 5000 square foot retaining wall project.

> > > Installation

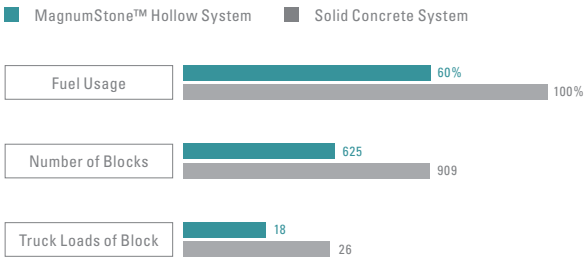
The MagnumStone™ 8 sq face ft is light enough to be moved on site in pairs of 16 sq ft with a standard bobcat. The large light weight hollow core MagnumStone™ units can be installed quickly, to create curves and turn corners, with smaller equipment and less labor. MagnumStone™ was designed for the end user by providing many options for solving nearly any contractor wall problem.



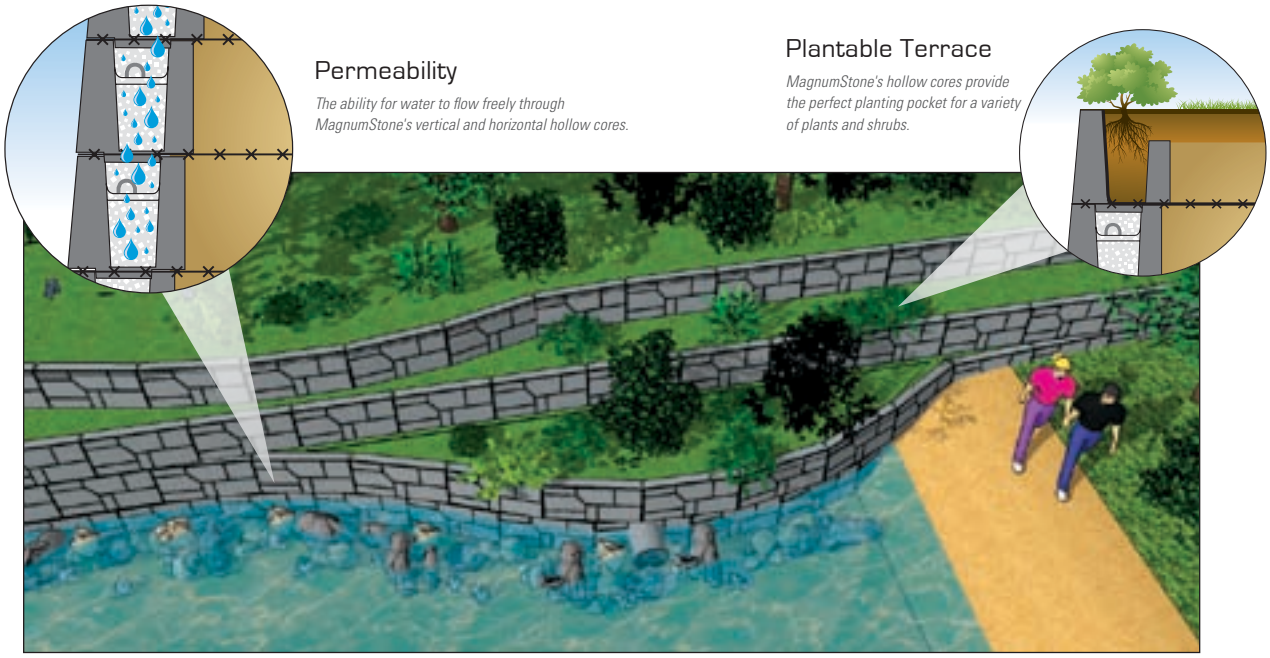
Graph is based on a 5000 square foot retaining wall project.

> > > Transportation

MagnumStone's light weight design maximizes each truck load to the site, reducing the number of trucks on the road, and their carbon footprint. A typical 48,000 lb truck can transport nearly 300 sq ft of MagnumStone™ units, reducing the number of loads to ship to each job. Plus, each unit can be loaded and unloaded quickly and easily two at a time, reducing time and labor on the job site.



Graph is based on a 5000 square foot retaining wall project.



Permeability

The ability for water to flow freely through MagnumStone's vertical and horizontal hollow cores.

Plantable Terrace

MagnumStone's hollow cores provide the perfect planting pocket for a variety of plants and shrubs.

> > > Design

The MagnumStone's large vertical and horizontal cores allow wall designers the flexibility of creating many solutions without environmentally costly side-effects. The aesthetically pleasing plantable terraces maximize green area, which reduce the "heat island" effect common among concrete surfaces. MagnumStone™ works in harmony with the environment. Its unique internal drainage system, and ease of incorporating both through wall, and top of wall details makes it the prime choice for environmentally friendly wall solutions.

All graphs and charts used in this brochure are estimations, and should be used only for comparisons.

WHAT IS LEED?

The LEED™ (Leadership in Energy and Environmental Design) Green Building Rating System is a voluntary, consensus-based program for developing high-performance, sustainable buildings. These LEED standards have been developed by the U.S. Green Building Council (www.usgbc.org). Based on well-founded scientific standards, LEED emphasizes state-of-the-art strategies for sustainable site development, water savings, energy efficiency , materials selection and indoor environmental quality. Using MagnumStone™ in a building project may help one achieve LEED Credits.

Credit Code	Name and Description	Points
SS Credit 5.2	Maximize Open Space: *Provide a high ratio of open space to development footprint to promote biodiversity.*	1
SS Credit 6.1	Stormwater Design, Rate and Quantity Control: *Limit distribution of natural water flows by managing stormwater runoff.*	1
SS Credit 6.2	Stormwater Design, Treatment: *Implement a stormwater management plan that reduces impervious cover, promotes on-site filtration and eliminates contaminants.*	1
SS Credit 7.1	Heat Island Effect, Non-Roof: *Reduce heat islands.*	1
SS Credit 5.1	Site Development: *Protect or Restore Habitat*	1
MR Credit 2.1	Construction Waste Management: *Divert 50% from Disposal.*	1
MR Credit 2.2	Construction Waste Management: *Divert 75% from Disposal.*	1
MR Credit 3.1	Materials Reuse: *5% of Materials Reused.*	1
MR Credit 3.2	Materials Reuse: *10% of Materials Reused.*	1
MR Credit 4.1	Recycled Content: *10% (Post-Consumer + 1/2 Pre-Consumer)*	1
MR Credit 4.2	Recycled Content: *20% (Post-Consumer + 1/2 Pre-Consumer)*	1
MR Credit 5.1	Regional Materials: *10% Extracted, Processed, and Manufactured Regionally.*	1
MR Credit 5.2	Regional Materials: *20% Extracted, Processed, and Manufactured Regionally.*	1
SS = Sustainable Sites MR = Materials & Resources	*Sourced from: LEED For New Construction Rating System v 2.2, October 2005*	

MAGNUMSTONE™ MARKETING MATERIALS

If you require more information on MagnumStone™ please visit our website at cornerstonewallsolutions.com.

CornerStone® Website

Installation Guide

Sustainability Brochure

General Brochure

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> > > MAGNUMSTONE™ WALL DETAILS

This section provides detailed, illustrated step-by-step instructions for using MagnumStone™ 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.

> > > STEP 1

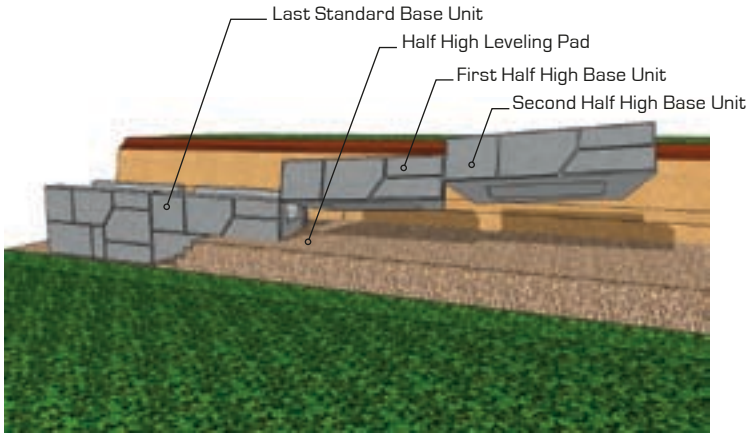
BASE ELEVATION CHANGES

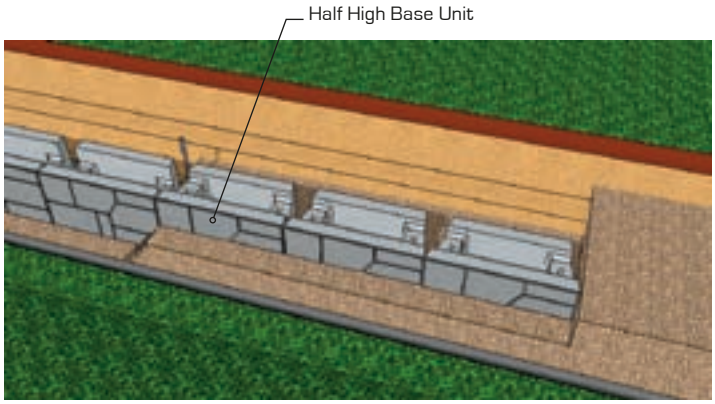
· The top of the last **Standard Base Unit** will be used to establish the **Half High Base Units** gravel leveling pad elevation

· Make sure to backfill and compact the gravel in and around the last **Standard Base Unit**

· Finished grade of the leveling pad should be 1/8" to 1/4" above half the height of the last **Standard Base Unit** to allow for a small amount of settlement to the first **Half High Base Unit**

· Repeat steps 5 through 9 in the gravity section on preparing the step up gravel leveling pad





> > > STEP 2

LAY ELEVATION CHANGES

· Place the first **Standard Unit**, (with **SecureLugs**), on the second course at a half bond on top of last & second last **Half High Base Units**

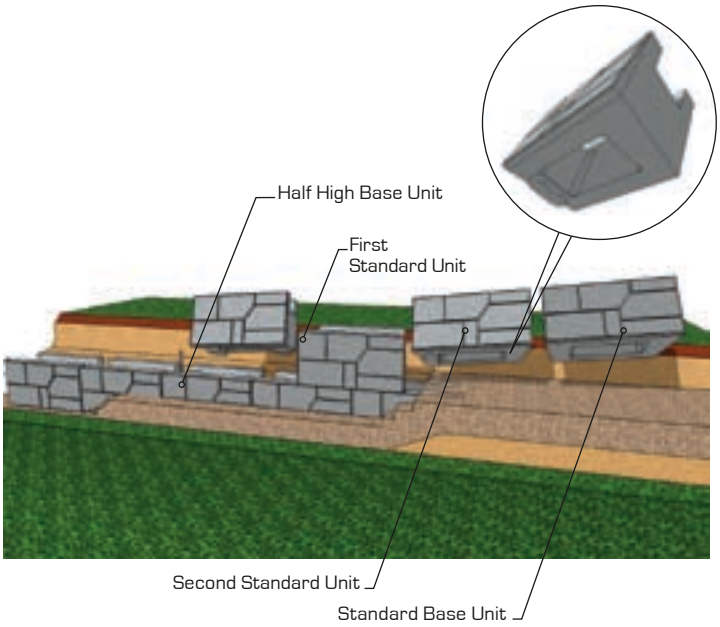
· The two **SecureLugs** will fit into the hollow cores of the two **Half High Units** below. To align the wall, place a string line at the back of the units for a straight wall or place a **PVC Flex Pipe** for a curved wall

· The batter or set back will be 2"/unit (4.5 degree or 1"/vertical foot)

· Place the second **Standard Unit** half on the last **Half High Unit** and half on the gravel leveling pad. Ensure that the **SecureLug** is removed on the leveling pad side of the unit

· Complete the installation of the **MagnumStone**™ units in either direction of the elevation change

· Make sure each unit is in line and laid tight to each other



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

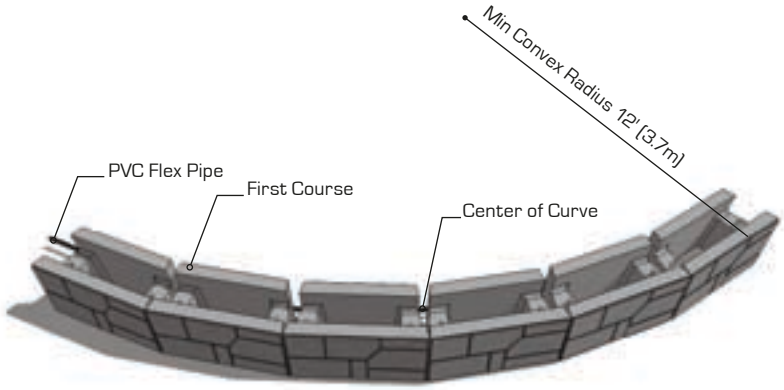
· Use the back of the unit for alignment

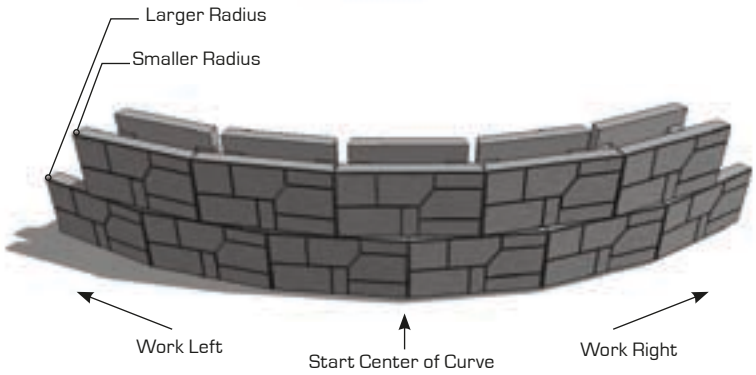
· Build each course of units by starting at the same place and the same bond as the last course

· **Convex** curves have a slight increase in batter or setback to the standard 1"/foot

· 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

· **MagnumStone™** minimum **Convex** curve is approximately 12 foot radius





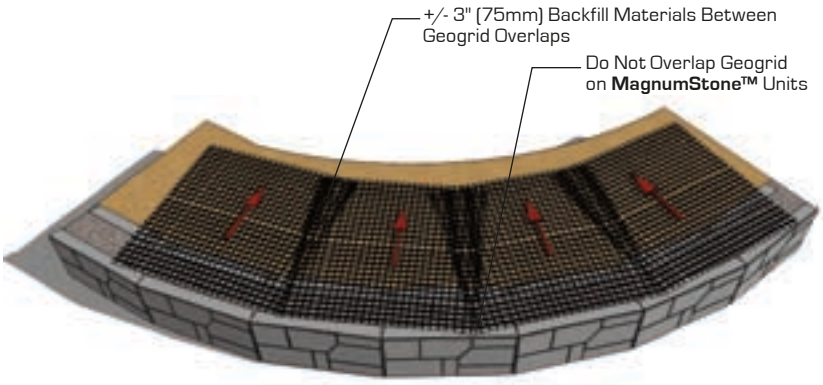
> > > STEP 2

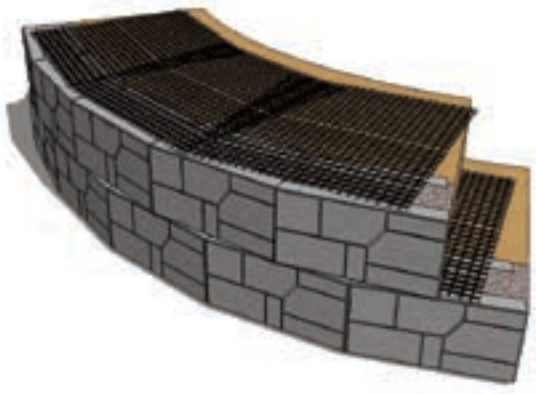
CONVEX GEOGRID CURVE

· Each **Geogrid** length should be laid perpendicularly to the wall face

· **Geogrid** should not overlap on the **MagnumStone™** 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

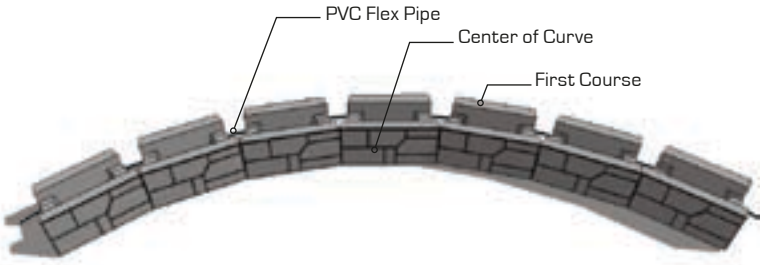
· Use **PVC Flex Pipes** to create smooth and accurate **Concave** curves

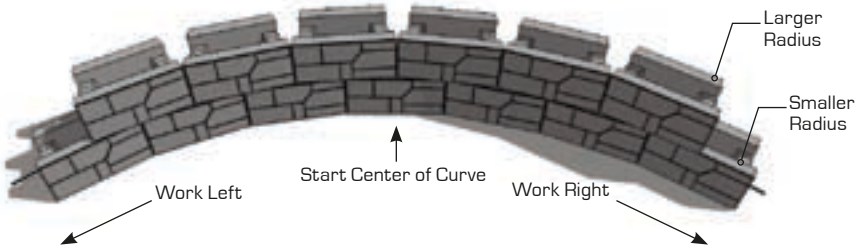
· Use the back of the unit for alignment

· Build each course of units by starting at the same place and the same bond as the last course

· **Concave** curves have a slight decrease in batter or setback to the standard 1"/foot

· 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





> > > STEP 2

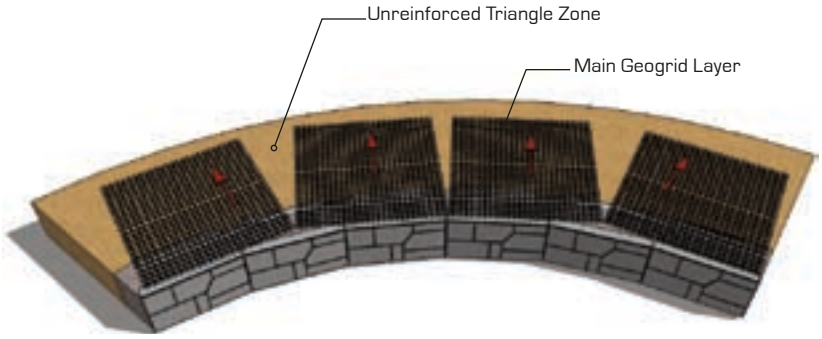
CONCAVE GEOGRID CURVE

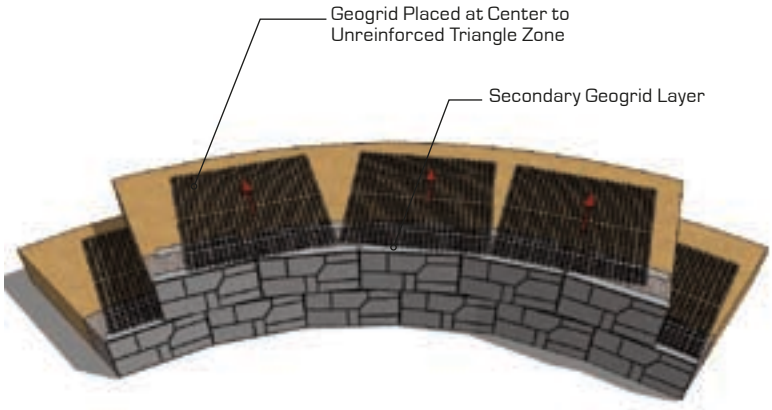
· Each **Geogrid** length should be laid perpendicularly to the wall face

· **Geogrid** should not overlap on the **MagnumStone™** 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 Corners

> > > STEP 1
OUTSIDE FIRST COURSE

· Use a **Corner/End Unit** to build an outside corner

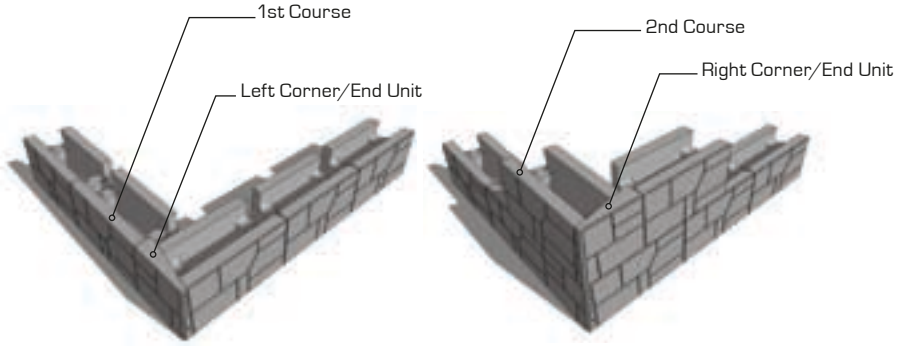
· Attach a **Left Corner/End Unit** to the first **MagnumStone™** base unit and place assembled corner unit on base leveling pad to start the outside corner

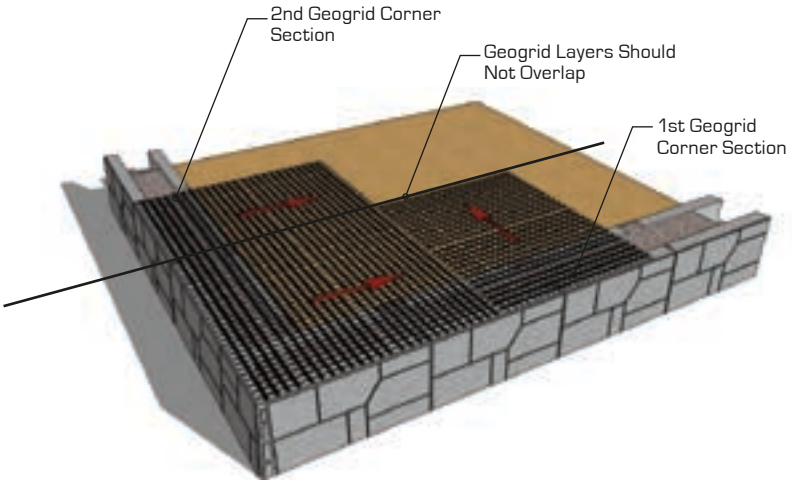
· Place a **MagnumStone™** unit on either side against the **Corner/End Unit**

· Continue to lay the **MagnumStone™** base course on either side of the corner until first course is completed

· Attach a **Right Corner/End Unit** to a **MagnumStone™** standard unit (with **SecureLugs**) and place on second course overlapping lower corner unit. Align the second course corner unit with lower corner unit to achieve proper setback

· Continue to lay the **MagnumStone™** second course on either side of the corner until second course is completed





> > > STEP 2
OUTSIDE GEOGRID CORNER

· Each **Geogrid** length should be laid perpendicularly to the wall face

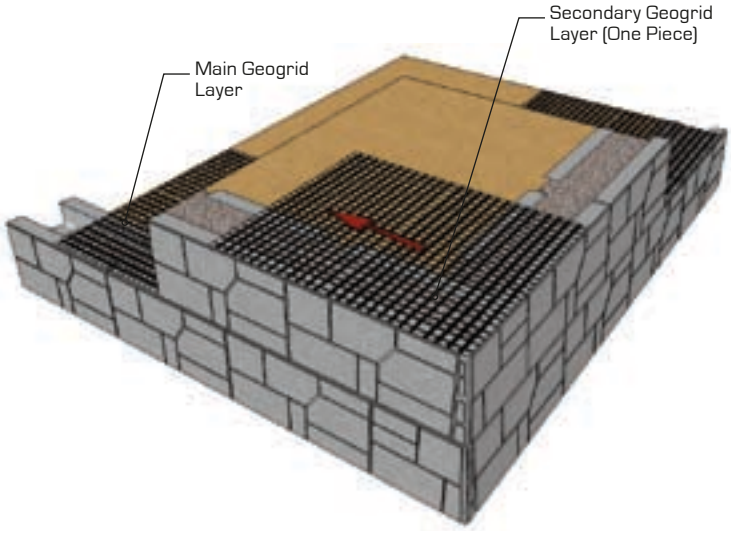
· **Geogrid** should not overlap on the **MagnumStone™** units

· Lay the 1st **Geogrid** corner section perpendicularly to one side of the corner

· Lay the 2nd **Geogrid** section perpendicularly 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 Corners

> > > STEP 1

INSIDE FIRST COURSE

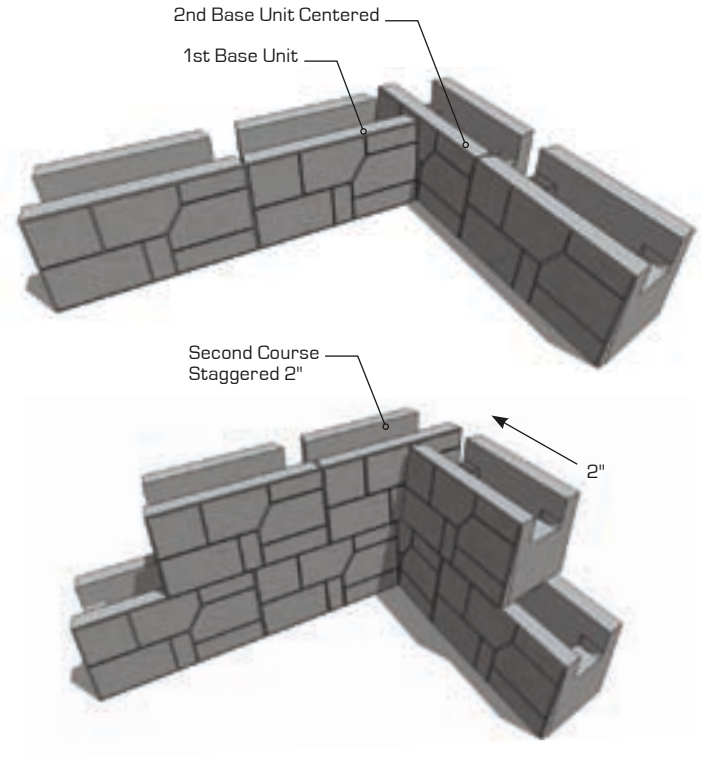
· Place the second unit at right angle and centered to the first **MagnumStone™** base unit. Continue to install the **MagnumStone™** base units right and left of the first inside corner units

· 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 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 **MagnumStone™** units

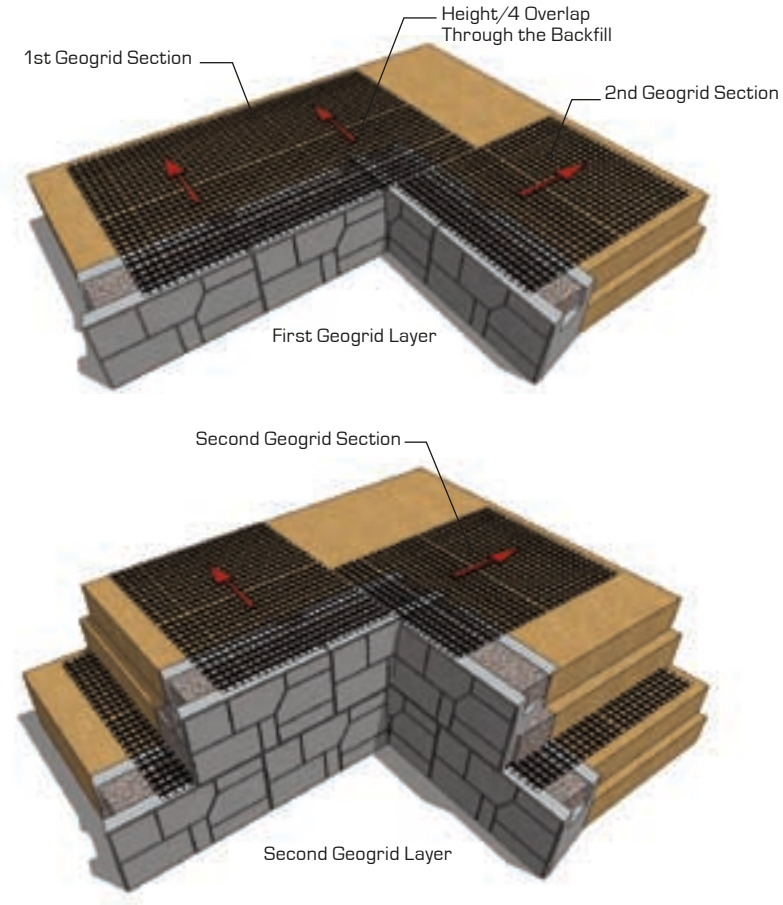
· Lay the 1st **Geogrid** corner section perpendicularly to one side of the corner and overlap h/4 through the backfill (Height of Wall ÷ 4)

· 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**

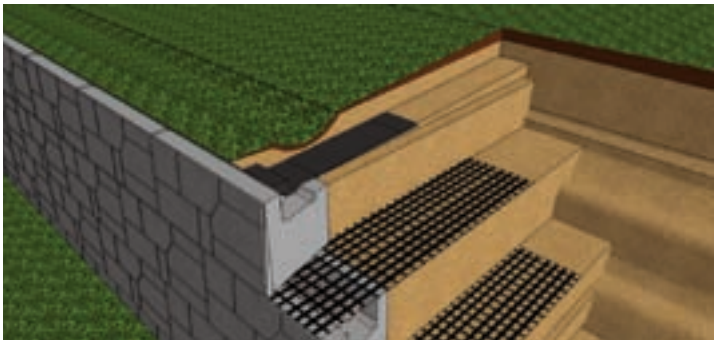


> > > MAGNUMSTONE™ TOP OF WALL DETAILS

Once again the large hollow cores provide yet another solution. This time it facilitates the easy embedment of traffic barriers, railings, fences or even large “Jersey” barriers that projects require for top of wall safety. The top of wall details can be secured by infilling the vertical and horizontal cores with concrete. Another benefit is the embedment system near the front of the wall face. This provides the designer and owner maximum usage of the land above the wall without sacrificing any structural integrity.

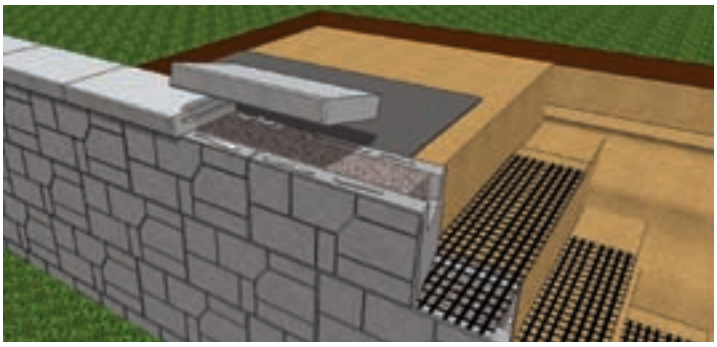
> > > GRASS SWALES

· An impermeable soil **Swale** can be created on top of the wall to take care of any water that may cascade over the wall face



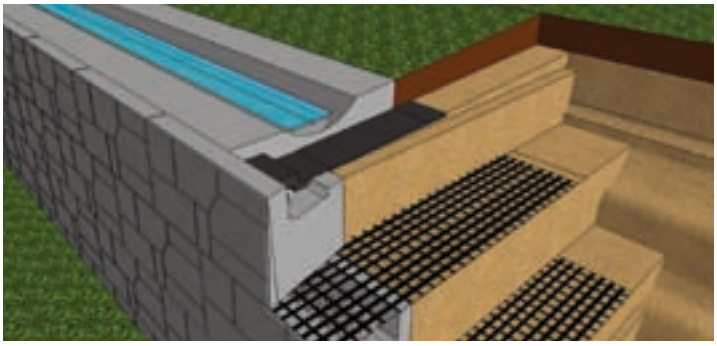
> > > STEP/CAPS

· Complete the top of wall with **MagnumStone™ Step/Caps**. Make sure all units are free of dirt and stones before installing the caps



> > > CONCRETE SWALES

· Concrete **Swales** can be placed on top of the **MagnumStone™** wall to take care of any possible surface water problems that may damage the backfill soils

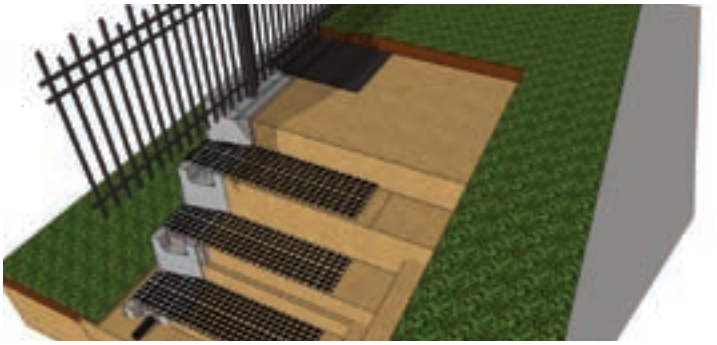


> > > FENCE POSTS

· Fence posts, railings or guard rails can be placed into the large vertical hollow cores

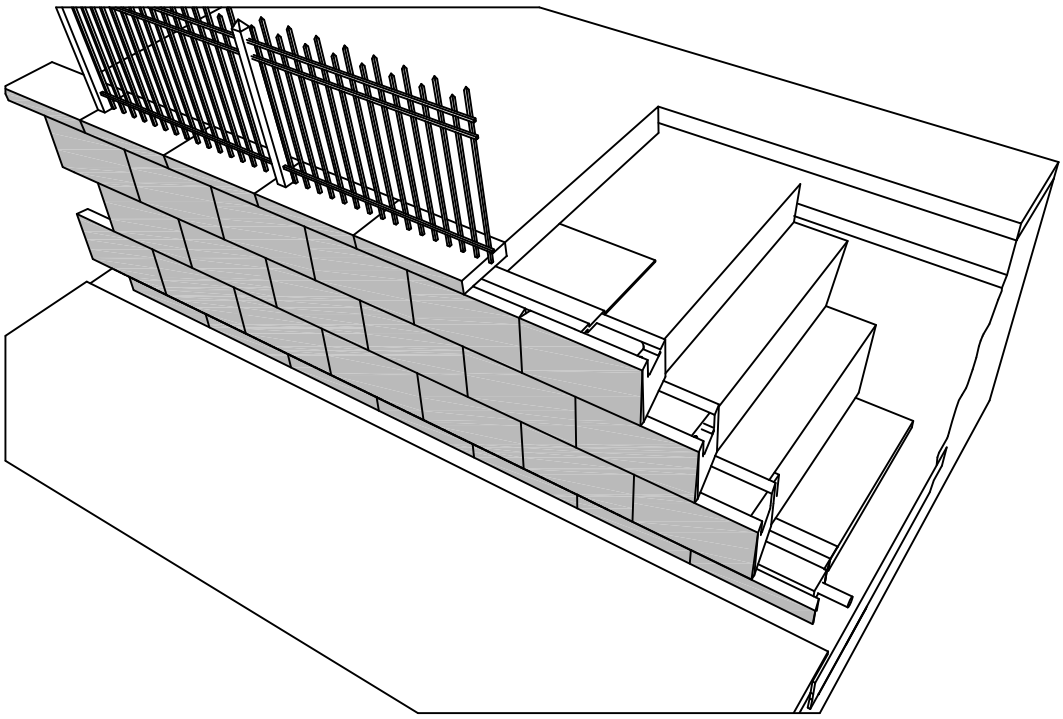
· Fill the vertical and hollow cores with concrete to the depth and length around each post that will resist lateral force

· Check with a qualified engineer



MagnumStone

>>>FENCE POST IN HOLLOW CORE



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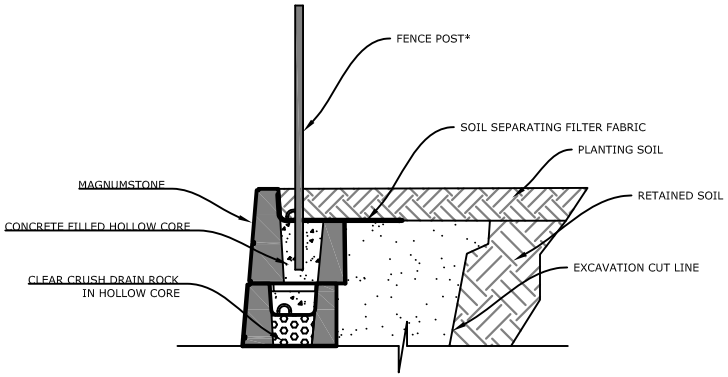

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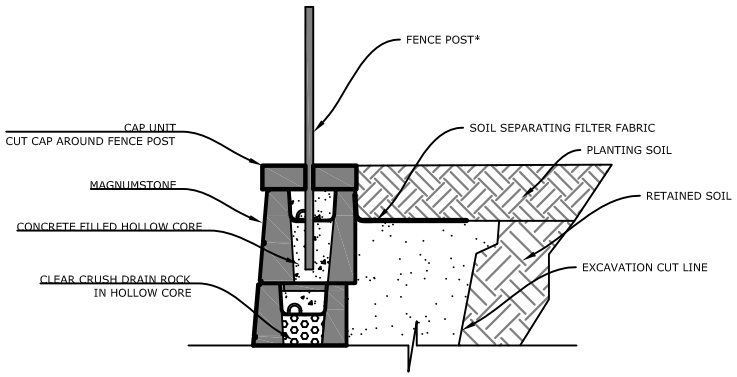

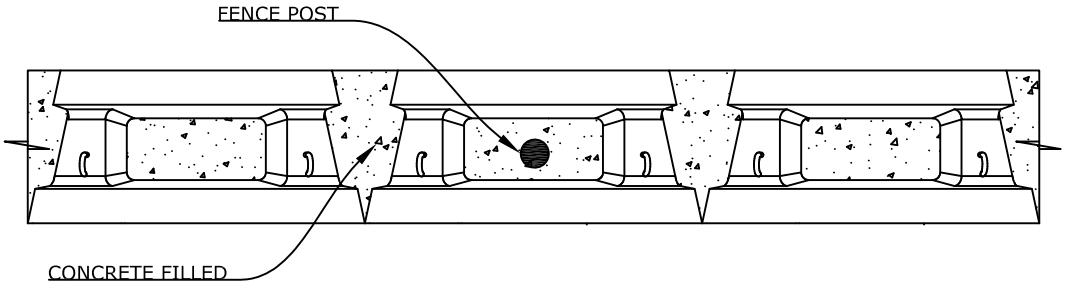

CORNERSTONE
WALL SOLUTIONS INC.

*LATERAL WIND LOADS NEED TO BE VERIFIED BY ENGINEER.