

# ICC-ES Evaluation Report


ESR-4805

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<p><b>DIVISION: 32 00 00— EXTERIOR IMPROVEMENTS</b></p> <p><b>Section: 32 32 00— Retaining Walls</b></p> <p><b>Section: 32 32 23— Segmental Retaining Walls</b></p>	<p><b>REPORT HOLDER:</b>  <b>CORNERSTONE WALL SOLUTIONS INC.</b></p>	<p><b>EVALUATION SUBJECT:</b>  <b>MAGNUMSTONE</b></p>	
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## 1.0 EVALUATION SCOPE

**Compliance with the following code:**

- 2021, 2018 and 2015 [International Building Code® \(IBC\)](#)

**Properties evaluated:**

- Physical properties

## 2.0 USES

The MagnumStone segmental retaining wall (SRW), system consists of precast modular concrete blocks for the construction of conventional gravity retaining walls or a reinforced masonry retaining wall system.

## 3.0 DESCRIPTION

### 3.1 General:

The MagnumStone segmental concrete block face units are available in standard units, half high units, corner/end units and cap units. Short and long extender units using a tongue-and-groove concrete system to lock into the back of the standard MagnumStone units may also be used to increase the mass of the system. See [Figure 1](#) for configurations, dimensions and weights. Cap units or a top block may be used for surfacing with the MagnumStone concrete blocks as shown in [Figures 2](#) and [3](#).

All units comply with ASTM C1776, are made from normal-weight concrete using normal-weight aggregates, and have a minimum 28-day compressive strength of 4000 psi (21 MPA) on the net area.

## 4.0 DESIGN AND INSTALLATION

### 4.1 Design:

**4.1.1 General:** Structural calculations must be submitted to the code official for each wall system installation. The system must depend on the weight and geometry of the concrete blocks and soil to resist lateral earth pressures and other lateral forces. For masonry retaining wall systems, refer to Section 4.1.4 of this report. Lateral earth pressures are determined using either Coulomb or Rankine earth pressure theory. The design must include evaluation of both external and internal stability of the structure and include consideration of external loads such as surcharges and seismic forces, as applicable.

External stability analysis must be similar to that required for conventional retaining walls, and must consider base (lateral) sliding, overturning, bearing capacity (and excessive settlement), and overall (deep-seated) slope stability. Internal stability analysis of MagnumStone SRWs must consider movement between courses.

Minimum safety factors used in design (for external stability check) for SRWs, must be 1.5 for deep-seated (global) stability and 2.0 for bearing capacity. The minimum safety factors against lateral sliding and overturning must be 1.5 (IBC Section 1807.2.3, as applicable). Minimum safety factors used in design (for internal stability) must be 1.5 for peak shear strength between SRW units. The registered design professional must prepare wall design such that the minimum safety factors prescribed in this section for all other failure modes are maintained. Seismic safety factors for all limit states related to SRW design may be 75 percent of the corresponding minimum allowable static safety factors.

A site-specific soils investigation report in accordance with IBC Section 1803, is required. The soils investigation report must provide a global slope stability analysis that considers the influence of site geometry, subsoil properties, groundwater conditions, and existing (or proposed) slopes above and below the proposed retaining wall. Where the wall is assigned to Seismic Design Category (SDC) C, D, E or F, the site-specific soils report must include the information as required by IBC Section 1803.5.11. Where the wall is assigned to Seismic Design Category (SDC) D, E or F, the site-specific soils report must include the information as required by IBC Section 1803.5.12.

The design of the MagnumStone Block wall may be based on the National Concrete Masonry Association report, "Design Manual for Segmental Retaining Walls", NCMA Report No. TR 127A/ISBN 1-881384-07-1, dated 2009, the LFRD Bridge Design Specifications, Section 11.11 Prefabricated Modular Walls, AASHTO 9<sup>th</sup> Edition, 2020, or other accepted geotechnical principles for gravity structures, as determined by the design professional and approved by the building code official.

**4.1.2 Conventional Gravity Retaining Walls:** The gravity wall system depends on its weight and geometry to counteract the lateral earth pressures and other lateral forces. Gravity wall design must be based on standard engineering principles. The maximum practical height above the wall base is approximately 50 feet (15 m).

Structural analysis must be based on accepted engineering principles, and the IBC. All contact surfaces of the units must be maintained in compression. Sliding along each respective layer must be checked, including shearing through the connection and the wall face. Gravity wall details are shown in [Figures 2](#) and [3](#) of this report and inter-unit shear capacity equations between face units are provided in [Table 1](#). The shear interaction of mass extenders in conjunction with face units has not been evaluated under this report and must be designed by a registered design professional.

**4.1.3 Backfill and Drainage:** Backfill material placed behind the MagnumStone Block concrete units consist of approved suitable fine grain or coarse grain materials as specified by the soils registered design professional. Provisions for drainage shall also be determined by the soils registered design professional.

**4.1.4 Reinforced Masonry Retaining Walls:** The design of reinforced masonry retaining wall systems must comply with Section 1807.2 and Chapter 21 of the IBC.

## 4.2 Installation:

- a) When required by the statutes of the jurisdiction in which the project is to be constructed, a registered design professional must design and analyze the retaining wall project. Review of local jurisdiction codes and regulations in addition to IBC must be considered by the registered design professional.
- b) Excavate the appropriate depth zone removing any organic materials that are not competent back fill materials such as topsoil. Dig a base trench a minimum of 36 inches (915 mm) wide, or 6 inches (152 mm) wider than the block system depth on both the front and back face if using extenders, and a minimum of 6 inches (152 mm) deep. Remove all vegetation and unsuitable organic soils. (Do not use these for structural backfill.) Compact soil base properly.
- c) Base stabilization fabrics may be used on the base leveling pad trench.
- d) Prepare base leveling pad trench with 6 inches (152 mm) of well graded gravel and compact firmly with vibrating compaction equipment.
- e) Level the base levelling pad gravel from front to back and side to side. This procedure will ensure a straight and stable wall.
- f) Lay your first base course using a string line to align the first row of units. Place each unit front edge to edge, lining up the back of the units. Ensure each block is level front to back and side to side.

- g) For gravity walls that incorporate extender units, place the extenders behind the standard units using the tongue-and-groove connection.
- h) Sweep the top of each course units to clear debris. Lay the following courses in a running bond pattern so each unit is centered on two units below. Pull each unit forward to lock connecting SecureLugs in place to the blocks below.
- i) Place perforated drainage pipe behind or inside the channel of the horizontal hollow core. Day light the drainpipe when required. Drainpipe may be sock wrapped.
- j) Fill the hollow core of the MagnumStone wall units with a draining angular stone or approved equivalent materials.
- k) Place the approved backfill materials in layers of no more than 8 inches (203 mm) deep. Compact each layer well to 98 percent Standard Proctor Density or as specified by the registered design professional.
- l) Repeat the steps of backfill, courses, and extenders per the approved design. The top course may use either MagnumStone top blocks or standard blocks with caps.
- m) Sweep off the top course of units. If caps are used, secure caps to the top of the wall using an approved concrete adhesive.
- n) Place soil separation fabric on top of the backfill and drainage materials as well as the back side of the wall caps. Cover with topsoil.
- o) MagnumStone retaining wall system may also be installed using inside and outside 90-degree corners when applicable.
- p) MagnumStone retaining wall system may also be installed using inside and outside curves with a minimum radius of 8 feet (2400 mm).

**4.3 Special Inspections:** Special inspection must be provided in accordance with IBC Sections 1705.1.1, 1705.4 and 1705.6. The inspector's responsibilities include verifying the following:

- 1. The modular concrete unit type and dimensions.
- 2. MagnumStone Block unit identification in compliance with ASTM C1776, including compressive strength, as described in Section 3.1 of this report.
- 3. Product identification, including evaluation report number (ESR-4805).
- 4. Foundation preparation.
- 5. MagnumStone Block unit and extender, if applicable, placement, including proper alignment and inclination.
- 6. Backfill placement and compaction.
- 7. Drainage provisions and water management

## 5.0 CONDITIONS OF USE:

The MagnumStone Block Retaining Wall System described in this report complies with, or is a suitable alternative to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1** The systems are designed and installed in accordance with this report; the manufacturer's published installation instructions; and accepted engineering principles. If there is a conflict between this report and the manufacturer's published installation instructions, this report governs.
- 5.2** The wall design calculations are submitted to, and approved by, the code official. The calculations must be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.3** A site-specific soils investigation in accordance with IBC Section 1803, as noted in Section 4.1.1 of this report, must be provided for each project site.
- 5.4** In areas where repeated freezing and thawing under saturated conditions occur, evidence of compliance with freeze-thaw durability requirements of ASTM C1776 must be furnished to the code official prior to construction.
- 5.5** Special inspection must be provided for backfill placement and compaction, and block installation, in accordance with Section 4.3 of this report.

- 5.6 Details in this report are limited to areas outside of groundwater. For applications where free-flowing groundwater is encountered, or where wall systems are submerged, the installation and design of systems must comply with the recommendations of the soils engineer and the appropriate sections of the NCMA Design Manual for Segmental Retaining Walls, and must be approved by the code official.
- 5.7 Under the 2021 IBC, project specifications for soil and water conditions that include sulfate concentrations identified in ACI 318-19 Table 19.3.1.1 as severe (S2) or very severe (S3), must include mix designs for the concrete, masonry and grout that comply with the intent of ACI 318-19 Table 19.3.1.1.
- 5.8 Under the 2018 and 2015 IBC, project specifications for soil and water conditions that include sulfate concentrations identified in ACI 318-14 Table 19.3.1.1 as severe (S2) or very severe (S3), must include mix designs for the concrete, masonry and grout that comply with the intent of ACI 318-14 Table 19.3.1.1.

## 6.0 EVIDENCE SUBMITTED

Data in accordance with the [ICC-ES Acceptance Criteria for Segmental Retaining Walls \(AC276\)](#), dated April 2021.

## 7.0 IDENTIFICATION

- 7.1 Each concrete block is identified with the manufacturer’s name (Cornerstone Wall Solutions, Inc.) and address, the name of the product (MagnumStone), batch number, and the evaluation report number (ESR-4805).
- 7.2 The report holder’s contact information is the following:

**CORNERSTONE WALL SOLUTIONS INC.**  
**370, 5222 – 130<sup>TH</sup> AVE SE**  
**SUITE 349**  
**CALGARY, ALBERTA T2Z 0G4**  
**CANADA**  
**(800) 939-9193**  
[info@cornerstonewallsolutions.com](mailto:info@cornerstonewallsolutions.com)  
[www.cornerstonewallsolutions.com](http://www.cornerstonewallsolutions.com)

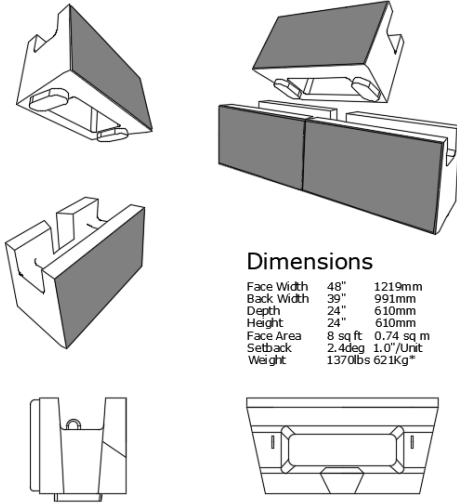
**TABLE 1—INTER-UNIT SHEAR RESISTANCE BETWEEN FACE UNITS EQUATIONS<sup>1</sup>**

Wall Systems	Serviceability Shear Strength <sup>2</sup> (lbs/ft)		Peak Shear Strength (lbs/ft)	
	Equation	Maximum	Equation	Maximum
<b>MagnumStone Block</b>	$F = 742 + N.tan\ 38.7$	3372	$F = 3155 + N.tan\ 35.0$	5454

For SI: 1 lb/linear foot = 14.6N/m

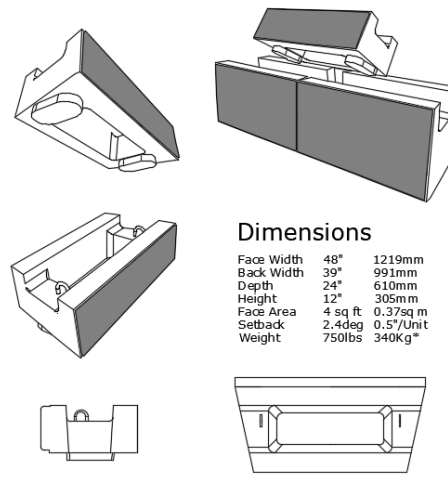
<sup>1</sup>The inter-unit shear resistance F [lb/linear foot (N/m)] of the System at any depth is a function of superimposed normal (applied) load, N [lb/linear foot N/m].

<sup>2</sup>The serviceability shear strength is based on prescribed deformation criterion, which is either ¼ inch (19 mm) or a value equal to 2 percent of the unit height, whichever is less.



**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	2.4deg	1.0°/Unit
Weight	1370lbs	621kg*

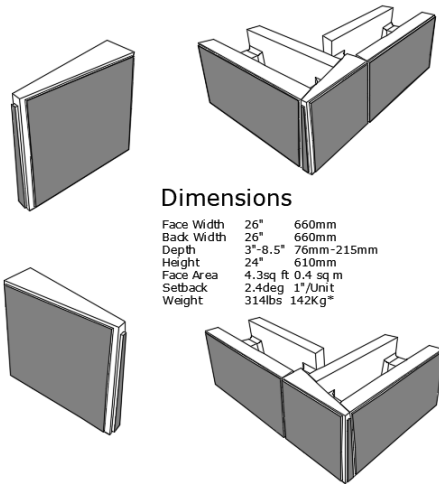


**Dimensions**

Face Width	48"	1219mm
Back Width	39"	991mm
Depth	24"	610mm
Height	12"	305mm
Face Area	4 sq ft	0.37sq m
Setback	2.4deg	0.5°/Unit
Weight	750lbs	340Kg*

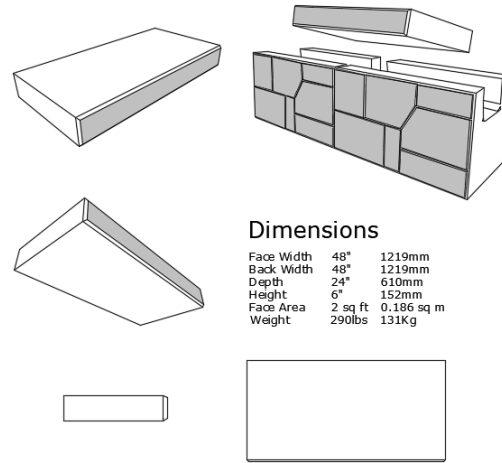
**STANDARD UNIT**

**HALF HIGH UNIT**



**Dimensions**

Face Width	26"	660mm
Back Width	26"	660mm
Depth	3"-8.5"	76mm-215mm
Height	24"	610mm
Face Area	4.3sq ft	0.4 sq m
Setback	2.4deg	1°/Unit
Weight	314lbs	142Kg*

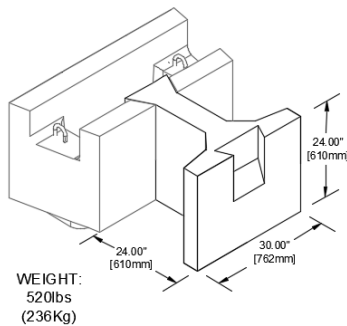


**Dimensions**

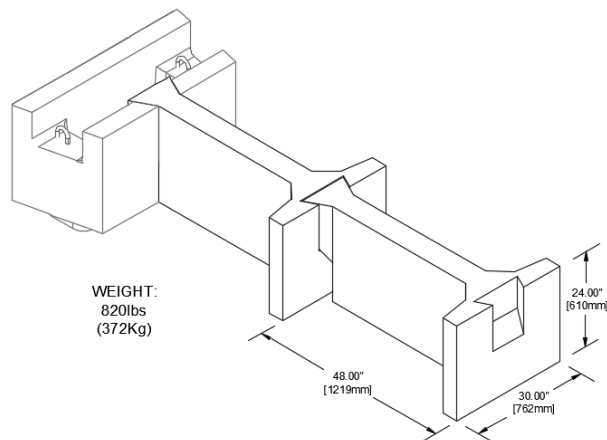
Face Width	48"	1219mm
Back Width	48"	1219mm
Depth	24"	610mm
Height	6"	152mm
Face Area	2 sq ft	0.186 sq m
Weight	290lbs	131Kg

**CORNER/END UNIT**

**CAP UNIT**



**SHORT EXTENDER**



**LONG EXTENDER**

**FIGURE 1—MAGNUMSTONE BLOCK DETAILS**

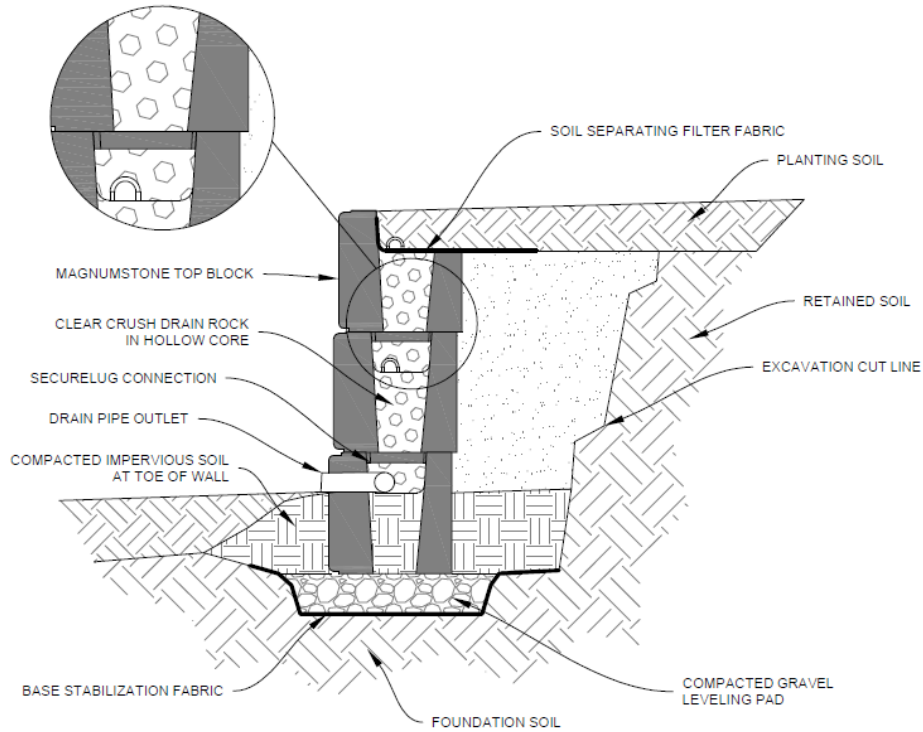


FIGURE 2—GRAVITY RETAINING WALL

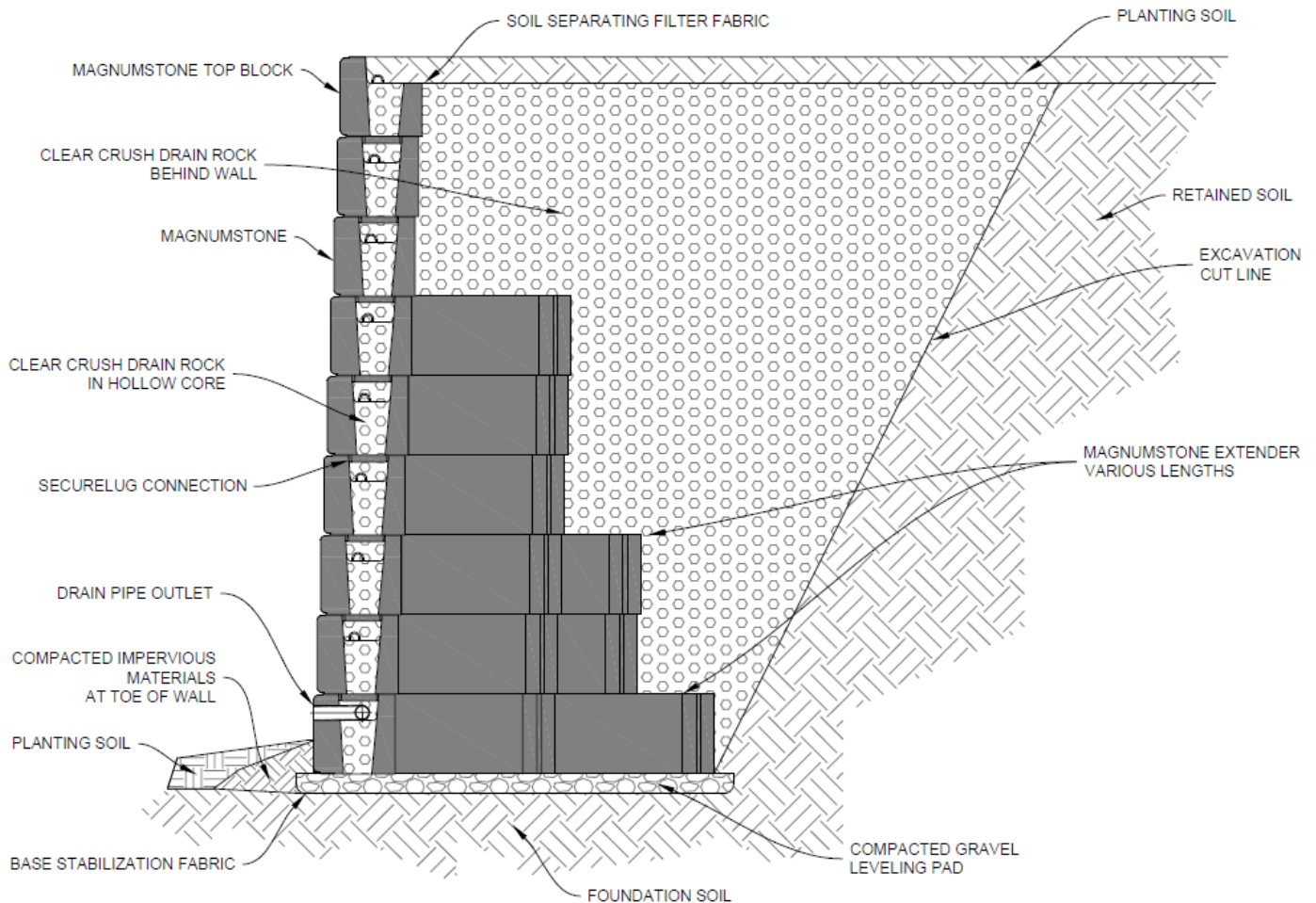


FIGURE 3—GRAVITY RETAINING WALL WITH EXTENDERS