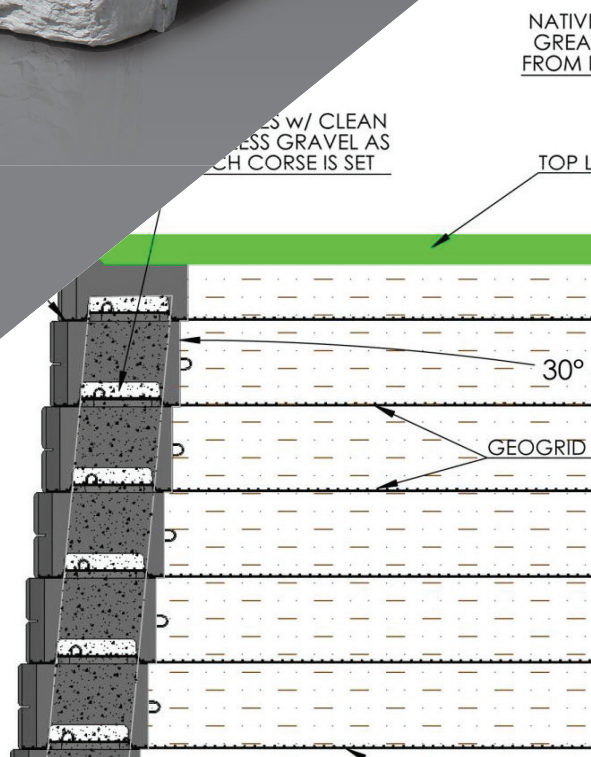


Design Manual: Reinforced Wall

Section 3



www.verti-block.com





Design Manual: Reinforced Wall

General Information

Company Information

Verti-Block™ is the latest innovative forming system from Verti-Crete, LLC. Recognized worldwide for outstanding aesthetics and performance, Verti-Crete's proprietary and patented forming systems produce the most durable, cost effective and attractive precast elements anywhere. Verti-Crete continues to help precasters around the world provide contractors, developers, and property owners with smart precast solutions.

Verti-Crete's heritage in the precast, concrete, and aggregate industries reaches back decades. From Window Wells to Battery Molds, each innovation has been fueled by our passion for bringing out the beauty of precast concrete. Concrete has been known for centuries for its durability. Through innovative research and design and the application of custom molding technology, Verti-Crete is making concrete known for its low cost and beauty.

Verti-Block Unique Features

- Versatility
- Project Compatibility
- Less Concrete Required
- Engineered Hollow Core
- Lower Transportation Costs
- Faster Return on Investment

Verti-Block was created with landscaping in mind -- we've made it easy to transport and install, even in tight access spots. Blocks can be moved and put into place with smaller equipment; there's no need for heavy machines like a telehandler or crane. The male and female connection eliminates placement error, ensuring strength and an exact installation every time. Also, the engineered hollow cavities allow for more flexibility with drainage and less concrete required for each block which will save time and money.

Verti-Block is ideal for a variety of landscaping projects including residential communities, commercial campuses, schools, parks, back yards, and more. Able to accommodate winding landscapes and even tight curves, Verti-Block is designed to add interest to any landscape while securely retaining earth. For projects also requiring a privacy wall, Verti-Block allows fencing or guard rails to be constructed directly on top of the Verti-Block structure. Fencing can be placed right on the edge of the wall for an attractive, continuous space.

Disclosure

It is important to note that the design parameters for a Verti-Block™ installation come with a suggested maximum height under assumed conditions. Verti-Block wall specifications are calculated using assumed loading conditions and material properties and may fluctuate from location depending on varying soil properties and terrain. In addition to the information included in this manual, please consult with your engineer to determine the specific design requirements for your site as soil and terrain vary by location.

Verti-Crete, LLC provides forming systems to independent Licensed Producers and does not build the actual precast concrete elements themselves. Therefore, Verti-Crete, LLC does not assume any responsibility regarding structural stability of any particular blocks or wall system. Verti-Crete, LLC also assumes no responsibility in connection with any property damage, injury or death claim whatsoever whether asserted against a Lessee, Lessor, Purchaser or others arising out of or attributable to the operation of or products produced with Verti-Crete, LLC equipment.



Design Manual: Reinforced Wall

Specifications for Verti-Block Reinforced Wall

PART 1 GENERAL

1.1 GENERAL INFORMATION

- A. When wall heights exceed those listed in the gravity wall chart, geogrid can be added to provide a stable wall condition. Layers of geogrid inserted between the blocks and extending behind the wall interlock with the surrounding soil to create a cohesive soil mass. This mass uses its own weight and internal shear strength to resist both the sliding and the overturning pressures from the soil being retained. The crushed stone in the Verti-Block hollow core provides a connection between the layers of geogrid and the Verti-Block wall, locking the two systems together. The reinforced soil mass becomes the structure and the Vert-Block wall becomes the facing. The specific location and embedment length of the grid layers depends upon the site conditions, wall heights and Long-Term Allowable Design Strength of the grid being used. Consult with your design engineer for specifics on installation of reinforced walls.
- B. Geogrids are flexible, synthetic meshes which are manufactured specifically for slope stabilization and earth retention. These "grids" are available in a variety of materials, sizes and strengths. They can be made of high tensile strength plastics or woven polyester yarns and are typically packaged at the factory in rolls. The grids are rated by Long-Term Allowable Design Strength (LTADS) with values ranging from 500 to 4,000 pounds per linear foot (7.3 kN/m to 58.4 kN/m).
- C. Work includes supplying and installing precast concrete retaining wall blocks to the lines and grades assigned within the specified construction drawings herein.
- D. The contractor is solely responsible for the means and methods of construction as well as safety of workers and of the public.

1.2 REFERENCE STANDARDS

- A. ASTM C39: Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- B. ASTM C94: Standard Test Method for Ready-Mixed Concrete.
- C. ASTM C136: Standard Test Method for Sieve Analysis of Fine and Coarse Aggregate.
- D. ASTM C1372: Standard Test Method for Segmental Retaining Wall Units.
- E. ASTM D698: Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard effort.
- F. ASTM D1557: Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified effort.
- G. ASTM D6916: Standard Test Method for Determining the Shear Strength between Segmental Concrete units.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Contractor shall check the materials upon delivery to assure proper material has been received.
- B. Contractor shall prevent excessive mud, wet concrete and like substances from adhering to the Verti-Block units.
- C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the wall or surrounding reinforced soil embankments.

- D. Exposed faces of precast concrete retaining wall blocks shall be reasonably free of large chips, cracks, or stains when viewed from a distance of 10 feet.

PART 2 MATERIALS

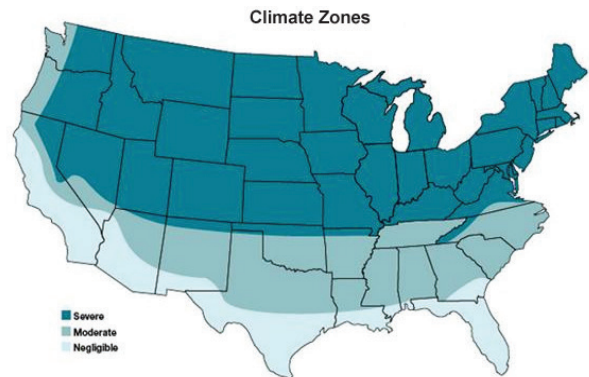
2.1 WALL UNITS

- A. Precast concrete retaining wall blocks shall be Verti-Block units as produced by a licensed Verti-Block manufacturer.
- B. Exterior precast concrete block dimensions shall be uniform and consistent. Maximum dimensional tolerances shall be within 1 percent excluding the architectural surface. Maximum width (face to back) dimensional deviation including the architectural surface shall be 1 inch.
- C. Exposed face shall be finished as specified. Other surfaces to be smooth form type. Small bug holes on the block face may be patched to blend into the remainder of the block face.
- D. Concrete for precast blocks shall have a minimum of 28-day compressive strength of 4,000 psi (pounds per square inch).
- E. Wall units shall be made with Ready-Mixed concrete in accordance with ASTM C94, latest revision, and per the following chart:

Climate	Air Content	28 Day Compressive Strength, MPa	Slump*, mm
Severe	4 1/2 % - 7 1/2 %	27.6	127 ± 38
Moderate	3% - 6%	27.6	127 ± 38
Negligible	1 1/2 % - 4 1/2 %	27.6	127 ± 38

*Higher slumps are allowed if achieved by use of appropriate admixtures. Nevertheless, all material used in the wall units must meet applicable ASTM and local requirements for exterior concrete.

- F. Typical applications do not require reinforcing steel. However, if an application outside the scope of this design manual calls for it, reinforcing steel (if used shall be Grade 60. Minimum clear cover to reinforcement shall be 1.5 inches.
- G. The face pattern shall be selected from the manufacturer's standard molds. The color of each block unit shall be natural gray (precast concrete). A concrete stain may be field applied to color the block units if specified by the Owner.



2.2 LEVELING PAD AND DRAINAGE PIPE

- A. Leveling Pad shall consist of (1 inch minus) crushed stone base.
- B. Drainage infill material shall be stone and be poured into the hollow core of each Verti-Block as each row of blocks is installed. Ensure that all voids are filled and no air pockets are detected.



Design Manual: Reinforced Wall

Specifications for Verti-Block Reinforced Wall

2.2 LEVELING PAD AND DRAINAGE PIPE (CONTINUED)

- C. Backfill material shall be approved by the geotechnical engineer. Native site excavated soils may be compacted in place if approved unless otherwise specified in the drawings. Unsuitable soils with a PL greater than 6, organic soils, and frost susceptible soils shall not be used within a 1 to 1 influence area.
- D. Non-woven geotextile cloth shall be placed between the native retained soil and the block wall.
- E. Where additional fill is needed, Contractor shall submit sample and specification to Engineer for approval.

2.3 DRAINAGE

- A. Internal and external drainage shall be a perforated 4 inch drain pipe but must be evaluated by a professional engineer who is responsible for the final wall design for exact requirements.

2.4 GEOTEXTILE FABRIC

- A. Provide a geotextile filter for separation from backfill at the tails of the blocks. The geotextile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds (Reference ASTM D4632). The geotextile may cover the entire back face of the blocks or may be cut into strips to cover the gaps between tail units with a minimum of 6 inches of overlap over the concrete tail on both sides.

PART 3 CONSTRUCTION

3.1 EXCAVATION

- A. Excavate as required to the lines and grades shown on construction drawings for installation of the retaining wall. Excavate to the base level for a sufficient distance behind the face to permit installation of the base.
- B. Slope or shore excavation as necessary for safety and for conformance with applicable OSHA requirements.

3.2 FOUNDATION AND SOIL PREPARATION

- A. On-site foundation soil shall be examined by the Geotechnical Engineer to ensure that the bearing foundation soil strength meets or exceeds assumed design conditions and strength. Soil not meeting the required strength shall be removed and replaced with acceptable, compacted material.
- B. Level the gravel base to lines and grades demonstrated on the construction plans. Native foundation soil shall be compacted to 95 percent of the maximum dry density (ASTM D698, Standard Proctor) or 90 percent of modified proctor to ensure a hard and level surface on which the first set of blocks may be suitable replacement fill.

3.2 FOUNDATION AND SOIL PREPARATION (CONTINUED)

- C. Prepare and smooth the granular material to ensure complete contact of the first course with the base. The surface of granular base may be dressed with finer aggregate to aid leveling, provided that the thickness of dressing layer should not exceed 3 times the maximum particle size used. Native soil compacted in place as each course is set.
- D. Contractor may substitute concrete for granular base material. Concrete may be placed full thickness or as a topping to level the base. If used as a topping, the concrete shall have a minimum thickness of 3 inches.

3.3 UNIT INSTALLATION

- A. Place the first course of standard wall block units directly on the compacted (1 inch minus) fractured gravel base. Ensure full contact between adjacent blocks so they fit tightly together. Check all blocks for uniform alignment and level placement.
- B. Fill and compact the unity core and all voids between and within the blocks with clean (1 inch minus) gravel to lock firmly into place. Continue to check for level and alignment between all blocks.
- C. Place clean native soil behind the units in maximum loose lifts of 8 inches and compact. Compact all backfill to a minimum of 95 percent of the maximum dry density (ASTM D698, Standard Proctor). For cohesive soils, the moisture content at the time of compaction should be adjusted to within -2 and +3 percent of optimum. Place backfill in successive lifts until level with the top of the facing unit.
- D. Remove and sweep off all excess aggregate and other materials from the top of the blocks before continuing on the next block course.
- E. Install next course of precast concrete retaining wall blocks to bond on top of the base row. Position blocks to be offset from seams of blocks on lower course. Blocks shall be placed at a 2 3/16 inch setback and recessed over the alignment hoop. Check each block for proper alignment and level. Continue to unit fill and backfill behind each course of units. Hand-operated place and compaction equipment shall be used around the block and within 3 feet of the wall to achieve consolidation.
- F. Continue to install subsequent courses of blocks in a like manner to elevations shown on the construction plans. Construct wall in level stages, placing the units at each course for the entire length of the wall, if possible. Unit fill and backfill shall be placed to the level of the top of the facing block unit before placing the next course.
- G. Final grade above and below the retaining wall shall provide for positive drainage and prevent ponding. Protect completed wall from other construction. Do not operate large equipment or store materials above the wall that exceed the design surcharge loads. All walls shall be installed in accordance with local building codes and requirements.



Specifications for Verti-Block Reinforced Wall

PART 4 GEOGRID INSTALLATION

4.1 GEOGRID - GENERAL

- A. This information has been carefully compiled by Strata Systems, Inc. and to the best of our knowledge is accurate. Final determination of the suitability of any information or material is the sole responsibility of the user. Structural design shall be performed by a licensed design professional.

4.2 KEY POINTS TO FOLLOW

- A. Sweep tops of Verti-Block units clean of all debris before installing the next course of units or placing geogrid materials.
- B. Unroll geogrid and cut to length indicated in the approved shop drawings.
- C. Primary strength direction of the geogrid shall be placed perpendicular to the wall.
- D. Place the geogrid on the facing unit and locate as detailed in the approved shop drawings.
- E. Pull the geogrid taut to remove slack in the geogrid. Stake or pin the geogrid near the end to maintain alignment and to prevent development of slack during backfill placement.
- F. Preferred method of fill placement and compaction is starting at the wall face and moving towards the rear of the geogrid embedment length.
- G. All soil is to be compacted to project specifications. This includes materials placed directly behind the wall units, along the geogrid embedment length and any retained fill behind the geogrid zone and in-situ soils.
- H. Excavation at back of geogrid zone should be stepped and fill keyed into in-situ soils.
- I. Compaction should be limited to 6" minimum lift in combination with vibratory roller having maximum weight of 25,000 lbs. Thinner lift thickness at the wall face may be necessary when considering light-weight walk-behind compaction equipment. Lift thickness and equipment should be selected to ensure full compaction throughout the full depth of the of each lift.
- J. Adjacent embedment lengths of geogrid shall abut to provide 100% coverage at elevations requiring geogrid reinforcement, as indicated in the approved shop drawings.
- K. Place a minimum of 3 inches (75 mm) of fill between overlapping layers of geogrid where overlapping occurs behind curves and corners of a wall.
- L. Construction vehicles shall not be operated directly on the geogrid. A minimum of 6 inches (150 mm) of fill cover over the geogrid is required for operation of construction vehicles in the reinforced zone.
- M. Turning of vehicles should be avoided to prevent dislocation or damage to the geogrid and the wall facing units.
- N. Primary geogrid may not be overlapped or connected mechanically to form splices in the primary strength direction.

4.3 GEOGRID INSTALLATION RESTRICTIONS

- A. Use only small, walk-behind compaction equipment for compacting of any fill within a 3 foot zone from the wall face
- B. Do not allow any tracked construction equipment to travel directly on the Geogrid material
- C. For necessary travel on the geogrid, use only lightweight rubber tired equipment operated at slow speed (less than 10 mph); do not allow abrupt braking or sharp turning
- D. Do not leave heavy equipment, parked adjacent to the top of the wall at any time
- E. Do not stockpile any construction materials adjacent to the top of the wall

4.4 Geogrid Installation Verification

- A. Check construction plans and horizontal alignments of wall and segmental units
- B. Check batter and setback of segmental units
- C. Confirm specifications for Geogrid, segmental units, drainage stone and reinforced backfill
- D. Confirm elevations of footing and top of wall
- E. Elevations of Geogrid layers

PART 5 QUALITY ASSURANCE

5.1 Construction Quality Control

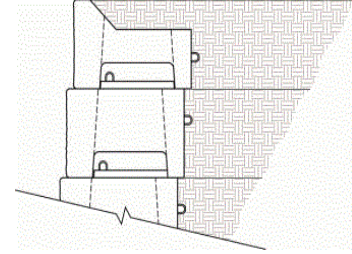
- A. The contractor is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.
- B. The contractor shall verify that installation is in accordance with the specifications and construction drawings.

5.2 Quality Assurance

- A. The Owner is responsible to engage testing and inspection service to provide quality construction assurance.
- B. Compaction testing shall be done a minimum of every 1 foot of vertical fill and every 100 lineal feet along the wall.
- C. Testing shall be done at a variety of locations to cover the entire backfill zone.
- D. The inspection professional should perform sufficient testing and observation to verify that wall installation substantially conforms to the design drawings and specifications and complies to all ASTM standards.

Reinforced Wall Matrix

Soil Type	Silty Soil
Load Condition	Level Backfill / No Surcharge
Internal Angle of Friction	$\geq 30^\circ$
Suggested Geogrid	Stratagrid®



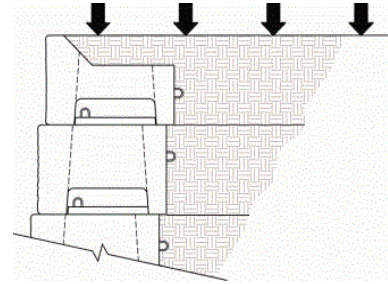
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L	None									
8'	0.5'	0.5'	VP	GT	L	None									
10'	0.5'	0.5'	VP	GT	L	None									
12'	0.57'	0.5'	VP	GT	L	2	4	6							
						200	200	200							
						8.5	8.5	8.5							
14'	0.67'	0.5'	VP	GT	L	2	4	6	8						
						500	500	500	500						
						9.8	9.8	9.8	9.8						
16'	0.76'	0.5'	VP	GT	L	2	4	6	8	10					
						500	500	500	500	500					
						11.1	11.1	11.1	11.1	11.1					
18'	0.86'	0.5'	VP	GT	L	2	4	6	8	10	12				
						500	500	500	500	500	500				
						12.3	12.3	12.3	12.3	12.3	12.3				
20'	0.95'	0.5'	VP	GT	L	2	4	6	8	10	12	14			
						500	500	500	500	500	500	500			
						13.6	13.6	13.6	13.6	13.6	13.6	13.6			
22'	1'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16		
						600	600	600	600	600	600	600	600		
						14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9		
24'	1.14'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	18	
						600	600	600	600	600	600	600	600	600	
						16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	
26'	1.24'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	18	20
						600	600	600	600	600	600	600	600	600	600
						17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
28'	1.33'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	18	20
						600	600	600	600	600	600	600	600	600	600
						18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
30'	1.43'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	18	20
						600	600	600	600	600	600	600	600	600	600
						20	20	20	20	20	20	20	20	20	20

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Notes: Unit weight of soil is 120 pcf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Silty Soil
Load Condition	Level Backfill / 250 psf Surcharge
Internal Angle of Friction	$\geq 30^\circ$
Suggested Geogrid	Stratagrid®



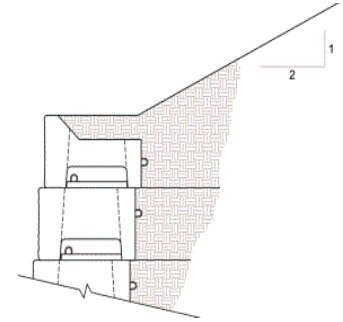
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
6'	0.5'	0.5'	VP GT L	None											
8'	0.5'	0.5'	VP GT L	2 200 7.9	4 200 7.9										
10'	0.5'	0.5'	VP GT L	2 200 9.2	4 200 9.2	6 200 9.2									
12'	0.57'	0.5'	VP GT L	2 500 9.5	4 500 9.5	6 500 9.5									
14'	0.67'	0.5'	VP GT L	2 500 10.8	4 500 10.8	6 500 10.8	8 500 10.8								
16'	0.76'	0.5'	VP GT L	2 500 12.1	4 500 12.1	6 500 12.1	8 500 12.1	10 500 12.1							
18'	0.86'	0.5'	VP GT L	2 500 13.3	4 500 13.3	6 500 13.3	8 500 13.3	10 500 13.3	12 500 13.3						
20'	0.95'	0.5'	VP GT L	2 600 14.6	4 600 14.6	6 600 14.6	8 600 14.6	10 600 14.6	12 600 14.6	14 600 14.6					
22'	1.05'	0.5'	VP GT L	2 600 15.9	4 600 15.9	6 600 15.9	8 600 15.9	10 600 15.9	12 600 15.9	14 600 15.9	16 600 15.9				
24'	1.14'	0.5'	VP GT L	2 600 17.1	4 600 17.1	6 600 17.1	8 600 17.1	10 600 17.1	12 600 17.1	14 600 17.1	16 600 17.1	18 600 17.1			
26'	1.24'	0.5'	VP GT L	2 600 18.4	4 600 18.4	6 600 18.4	8 600 18.4	10 600 18.4	12 600 18.4	14 600 18.4	16 600 18.4	18 600 18.4	20 600 18.4		
28'	1.33'	0.5'	VP GT L	2 600 19.7	4 600 19.7	6 600 19.7	8 600 19.7	10 600 19.7	12 600 19.7	14 600 19.7	16 600 19.7	18 600 19.7	20 600 19.7	22 600 19.7	

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Silty Soil
Load Condition	2:1 Sloping Backfill / No Surcharge
Internal Angle of Friction	$\geq 30^\circ$
Suggested Geogrid	Stratagrid®



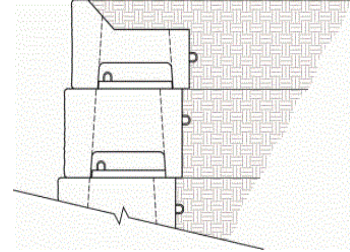
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block											
			VP	GT	L	None								
6'	0.5'	0.5'	VP	GT	L	None								
8'	0.5'	0.5'	VP	GT	L	2	4							
						200	200							
						8.6	8.6							
10'	0.5'	0.5'	VP	GT	L	2	4							
						500	500							
						9.5	9.5							
12'	0.6'	0.5'	VP	GT	L	2	4	6						
						500	500	500						
						11.1	11.1	11.1						
14'	0.6'	0.5'	VP	GT	L	2	4	6	8					
						500	500	500	500					
						13.0	13.0	13.0	13.0					
16'	0.6'	0.5'	VP	GT	L	2	4	6	8	10				
						500	500	500	500	500				
						15.0	15.0	15.0	15.0	15.0				
18'	0.6'	0.5'	VP	GT	L	2	4	6	8	10	12			
						500	500	500	500	500	500			
						17.0	17.0	17.0	17.0	17.0	17.0			
20'	0.6'	0.5'	VP	GT	L	2	4	6	8	10	12	14		
						600	600	600	600	600	600	600		
						19.0	19.0	19.0	19.0	19.0	19.0	19.0		
22'	0.6'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	
						600	600	600	600	600	600	600	600	
						21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	
24'	0.6'	0.5'	VP	GT	L	2	4	6	8	10	12	14	16	18
						600	600	600	600	600	600	600	600	600
						23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Sandy Soil
Load Condition	Level Backfill / No Surcharge
Internal Angle of Friction	$\geq 35^\circ$
Suggested Geogrid	Stratagrid®



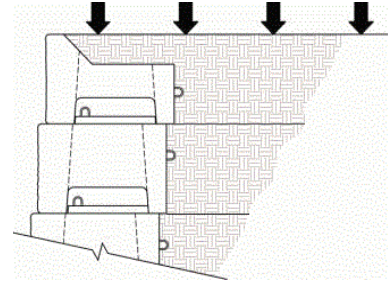
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
10'	0.5'	0.5'	VP	None											
12'	0.5'	0.5'	VP	None											
14'	0.67'	0.5'	VP	2	4	6									
			GT	200	200	200									
			L	8.4	8.4	8.4									
16'	0.76'	0.5'	VP	2	4	6									
			GT	500	500	500									
			L	9.8	9.8	9.8									
18'	0.86'	0.5'	VP	2	4	6	8								
			GT	500	500	500	500								
			L	10.8	10.8	10.8	10.8								
20'	0.95'	0.5'	VP	2	4	6	8	10							
			GT	500	500	500	500	500							
			L	12	12	12	12	12							
22'	1.05'	0.5'	VP	2	4	6	8	10	12						
			GT	500	500	500	500	500	500						
			L	13.2	13.2	13.2	13.2	13.2	13.2						
24'	1.14'	0.5'	VP	2	4	6	8	10	12	14					
			GT	500	500	500	500	500	500	500					
			L	14.5	14.5	14.5	14.5	14.5	14.5	14.5					
26'	1.24'	0.5'	VP	2	4	6	8	10	12	14	16				
			GT	500	500	500	500	500	500	500	500				
			L	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6				
28'	1.33'	0.5'	VP	2	4	6	8	10	12	14	16	18			
			GT	500	500	500	500	500	500	500	500	500			
			L	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8			
30'	1.4'	0.5'	VP	2	4	6	8	10	12	14	16	18	20		
			GT	600	600	600	600	600	600	600	600	600	600		
			L	18	18	18	18	18	18	18	18	18	18		
30' +			VP	Heights above 30 feet are achievable. Please contact your Verti-Block dealer for more details											
			GT												
			L												

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Sandy Soil
Load Condition	Level Backfill / 250 psf Surcharge
Internal Angle of Friction	$\geq 35^\circ$
Suggested Geogrid	Stratagrid®



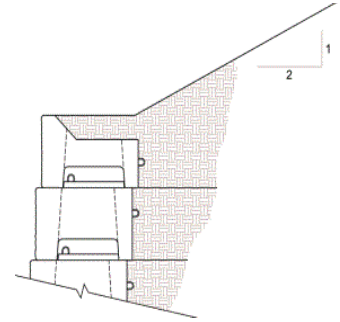
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
8'	0.5'	0.5'	VP	None											
10'	0.5'	0.5'	VP	2	4										
			GT	200	200										
			L	6.8	6.8										
12'	0.57'	0.5'	VP	2	4	6									
			GT	200	200	200									
			L	7.9	7.9	7.9									
14'	0.67'	0.5'	VP	2	4	6	8								
			GT	500	500	500	500								
			L	9	9	9	9								
16'	0.76'	0.5'	VP	2	4	6	8								
			GT	500	500	500	500								
			L	9.6	9.6	9.6	9.6								
18'	0.86'	0.5'	VP	2	4	6	8	10							
			GT	500	500	500	500	500							
			L	10.8	10.8	10.8	10.8	10.8							
20'	0.95'	0.5'	VP	2	4	6	8	10	12						
			GT	500	500	500	500	500	500						
			L	12	12	12	12	12	12						
22'	1.05'	0.5'	VP	2	4	6	8	10	12	14					
			GT	500	500	500	500	500	500	500					
			L	13.2	13.2	13.2	13.2	13.2	13.2	13.2					
24'	1.14'	0.5'	VP	2	4	6	8	10	12	14	16				
			GT	500	500	500	500	500	500	500	500				
			L	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4				
26'	1.25'	0.5'	VP	2	4	6	8	10	12	14	16	18			
			GT	500	500	500	500	500	500	500	500	500			
			L	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6			
28'	1.33'	0.5'	VP	2	4	6	8	10	12	14	16	18	20		
			GT	600	600	600	600	600	600	600	600	600	600		
			L	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8		
30' +			VP	Heights above 30 feet are achievable. Please contact your Verti-Block dealer for more details											
			GT												
			L												

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Sandy Soil
Load Condition	2:1 Sloping Backfill / No Surcharge
Internal Angle of Friction	$\geq 35^\circ$
Suggested Geogrid	Stratagrid®



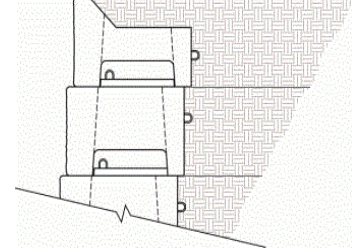
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP – Geogrid Verticle Placement			GT – Geogrid Type (Strata 200, 500, 600)				L – Geogrid Length in Feet					
8'	0.5'	0.5'	VP GT L	None											
10'	0.5'	0.5'	VP GT L	None											
10'	0.5'	0.5'	VP GT L	2 200 7.4	4 200 7.4										
12'	0.57'	0.5'	VP GT L	2 500 7.8	4 500 7.8										
14'	0.67'	0.5'	VP GT L	2 500 9.2	4 500 9.2	6 500 9.2									
16'	0.76'	0.5'	VP GT L	2 500 10.6	4 500 10.6	6 500 10.6	8 500 10.6								
18'	0.86'	0.5'	VP GT L	2 500 12	4 500 12	6 500 12	8 500 12	10 500 12							
20'	0.95'	0.5'	VP GT L	2 600 13.5	4 600 13.5	6 600 13.5	8 600 13.5	10 600 13.5	12 600 13.5						
22'	1.05'	0.5'	VP GT L	2 600 14.9	4 600 14.9	6 600 14.9	8 600 14.9	10 600 14.9	12 600 14.9	14 600 14.9					
24'	1.14'	0.5'	VP GT L	2 600 16.4	4 600 16.4	6 600 16.4	8 600 16.4	10 600 16.4	12 600 16.4	14 600 16.4	16 600 16.4				

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Gravelly Soil
Load Condition	Level Backfill / No Surcharge
Internal Angle of Friction	$\geq 40^\circ$
Suggested Geogrid	Stratagrid®



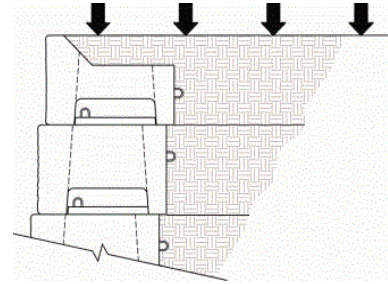
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
14'	0.5'	0.5'	VP	None											
16'	0.76'	0.5'	VP	2	4	6	8								
			GT	200	200	200	200								
			L	9.6	9.6	9.6	9.6								
18'	0.86'	0.5'	VP	2	4	6	8	10							
			GT	200	200	200	200	200							
			L	10.8	10.8	10.8	10.8	10.8							
20'	0.95'	0.5'	VP	2	4	6	8	10	12						
			GT	200	200	200	200	200	200						
			L	12	12	12	12	12	12						
22'	1.05'	0.5'	VP	2	4	6	8	10							
			GT	500	500	500	500	500							
			L	13.2	13.2	13.2	13.2	13.2							
24'	1.14'	0.5'	VP	2	4	6	8	10	12						
			GT	500	500	500	500	500	500						
			L	14.4	14.4	14.4	14.4	14.4	14.4						
26'	1.24'	0.5'	VP	2	4	6	8	10	12	14					
			GT	500	500	500	500	500	500	500					
			L	15.6	15.6	15.6	15.6	15.6	15.6	15.6					
28'	1.33'	0.5'	VP	2	4	6	8	10	12	14	16				
			GT	500	500	500	500	500	500	500	500				
			L	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8				
30'	1.43'	0.5'	VP	2	4	6	8	10	12	14	16	18			
			GT	500	500	500	500	500	500	500	500	500			
			L	18	18	18	18	18	18	18	18	18			
32'	1.52'	0.5'	VP	2	4	6	8	10	12	14	16	18	20		
			GT	500	500	500	500	500	500	500	500	500	500		
			L	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2		
34'	1.62'	0.5'	VP	2	4	6	8	10	12	14	16	18	20	22	
			GT	500	500	500	500	500	500	500	500	500	500	500	
			L	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	
34' +			VP	Heights above 34 feet are achievable. Please contact your Verti-Block dealer for more details											
			GT												
			L												

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Notes: Unit weight of soil is 120 pcf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

Soil Type	Gravelly Soil
Load Condition	Level Backfill / 250 psf Surcharge
Internal Angle of Friction	$\geq 40^\circ$
Suggested Geogrid	Stratagrid®



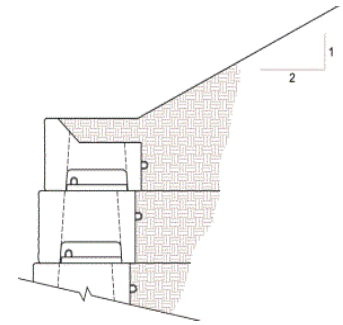
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
10'	0.5'	0.5'	VP GT L	None											
12'	0.57'	0.5'	VP GT L	2 200 7.2	4 200 7.2	6 200 7.2									
14'	0.67'	0.5'	VP GT L	2 200 8.4	4 200 8.4	6 200 8.4	8 200 8.4								
16'	0.76'	0.5'	VP GT L	2 200 9.6	4 200 9.6	6 200 9.6	8 200 9.6	10 200 9.6							
18'	0.86'	0.5'	VP GT L	2 200 10.8	4 200 10.8	6 200 10.8	8 200 10.8	10 200 10.8	12 200 10.8						
20'	0.95'	0.5'	VP GT L	2 500 12	4 500 12	6 500 12	8 500 12	10 500 12	12 500 12						
22'	1.05'	0.5'	VP GT L	2 500 13.2	4 500 13.2	6 500 13.2	8 500 13.2	10 500 13.2	12 500 13.2	14 500 13.2					
24'	1.14'	0.5'	VP GT L	2 500 14.4	4 500 14.4	6 500 14.4	8 500 14.4	10 500 14.4	12 500 14.4	14 500 14.4	16 500 14.4				
26'	1.24'	0.5'	VP GT L	2 500 15.6	4 500 15.6	6 500 15.6	8 500 15.6	10 500 15.6	12 500 15.6	14 500 15.6	16 500 15.6	18 500 15.6			
28'	1.33'	0.5'	VP GT L	2 500 16.8	4 500 16.8	6 500 16.8	8 500 16.8	10 500 16.8	12 500 16.8	14 500 16.8	16 500 16.8	18 500 16.8	20 500 16.8		
30'	1.43'	0.5'	VP GT L	2 500 18	4 500 18	6 500 18	8 500 18	10 500 18	12 500 18	14 500 18	16 500 18	18 500 18	20 500 20.4	22 500 20.4	
30' +			VP GT L	Heights above 30 feet are achievable. Please contact your Verti-Block dealer for more details											

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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.

Reinforced Wall Matrix

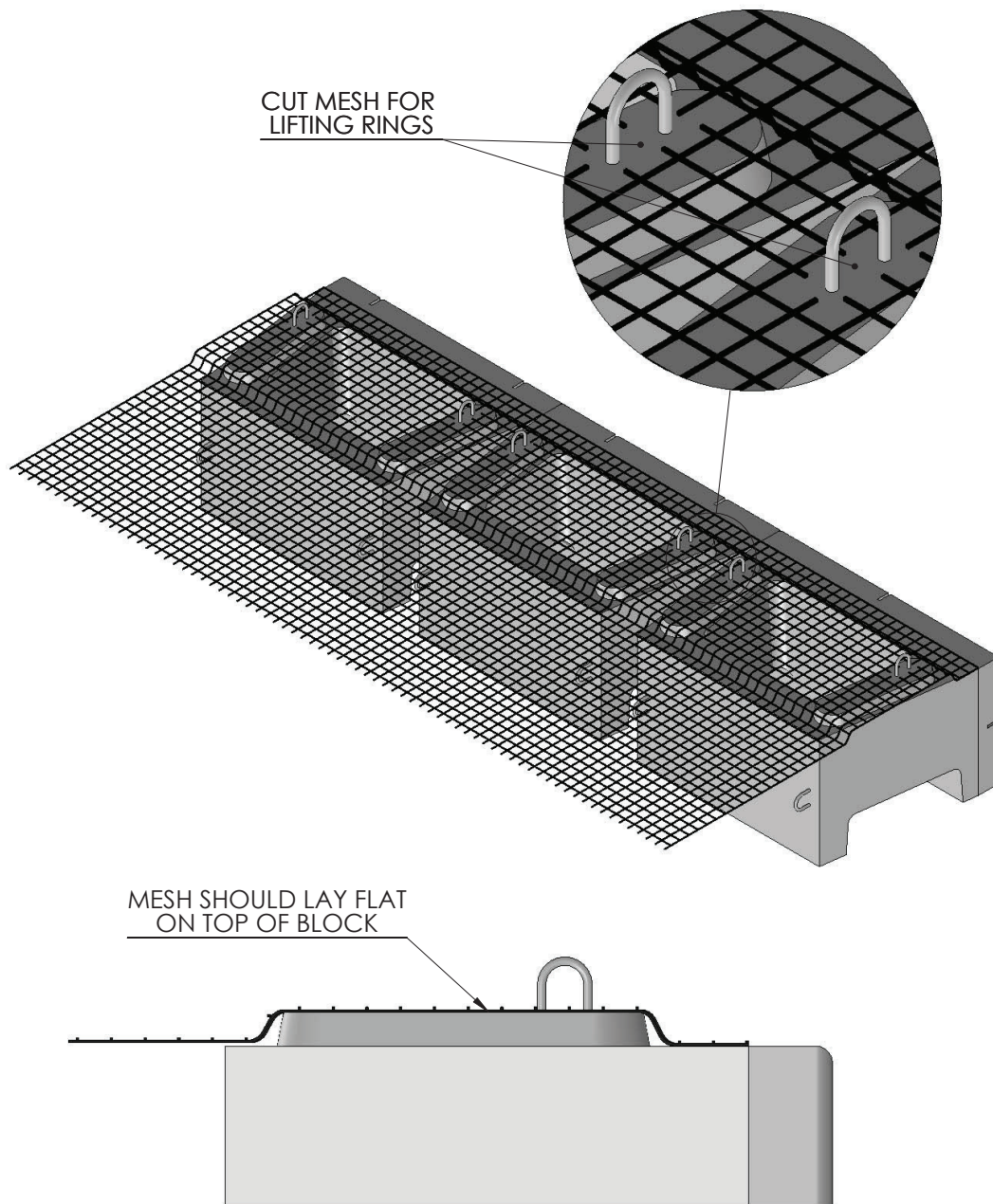
Soil Type	Gravelly Soil
Load Condition	2:1 Sloping Backfill / No Surcharge
Internal Angle of Friction	$\geq 40^\circ$
Suggested Geogrid	Stratagrid®



Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
12'	0.5'	0.5'	VP	None											
14'	0.67'	0.5'	VP	2	4	6	8								
			GT	200	200	200	200								
			L	8.9	8.9	8.9	8.9								
16'	0.76'	0.5'	VP	2	4	6									
			GT	500	500	500									
			L	9.6	9.6	9.6									
18'	0.86'	0.5'	VP	2	4	6	8								
			GT	500	500	500	500								
			L	10.8	10.8	10.8	10.8								
20'	0.95'	0.5'	VP	2	4	6	8	10							
			GT	200	200	200	200	200							
			L	12	12	12	12	12							
22'	1.05'	0.5'	VP	2	4	6	8	10	12						
			GT	500	500	500	500	500	500						
			L	13.2	13.2	13.2	13.2	13.2	13.2						
24'	1.14'	0.5'	VP	2	4	6	8	10	12	14					
			GT	500	500	500	500	500	500	500					
			L	14.4	14.4	14.4	14.4	14.4	14.4	14.4					
26'	1.25'	0.5'	VP	2	4	6	8	10	12	14	16				
			GT	500	500	500	500	500	500	500	500				
			L	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6				
28'	1.33'	0.5'	VP	2	4	6	8	10	12	14	16	18			
			GT	600	600	600	600	600	600	600	600	600			
			L	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8			
30'	1.43'	0.5'	VP	2	4	6	8	10	12	14	16	18	20		
			GT	600	600	600	600	600	600	600	600	600	600		
			L	18	18	18	18	18	18	18	18	18	20.4		
32'	1.52'	0.5'	VP	2	4	6	8	10	12	14	16	18	20	22	
			GT	600	600	600	600	600	600	600	600	600	600	600	
			L	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	
34'	1.62'	0.5'	VP	2	4	6	8	10	12	14	16	18	20	22	24
			GT	600	600	600	600	600	600	600	600	600	600	600	600
			L	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4

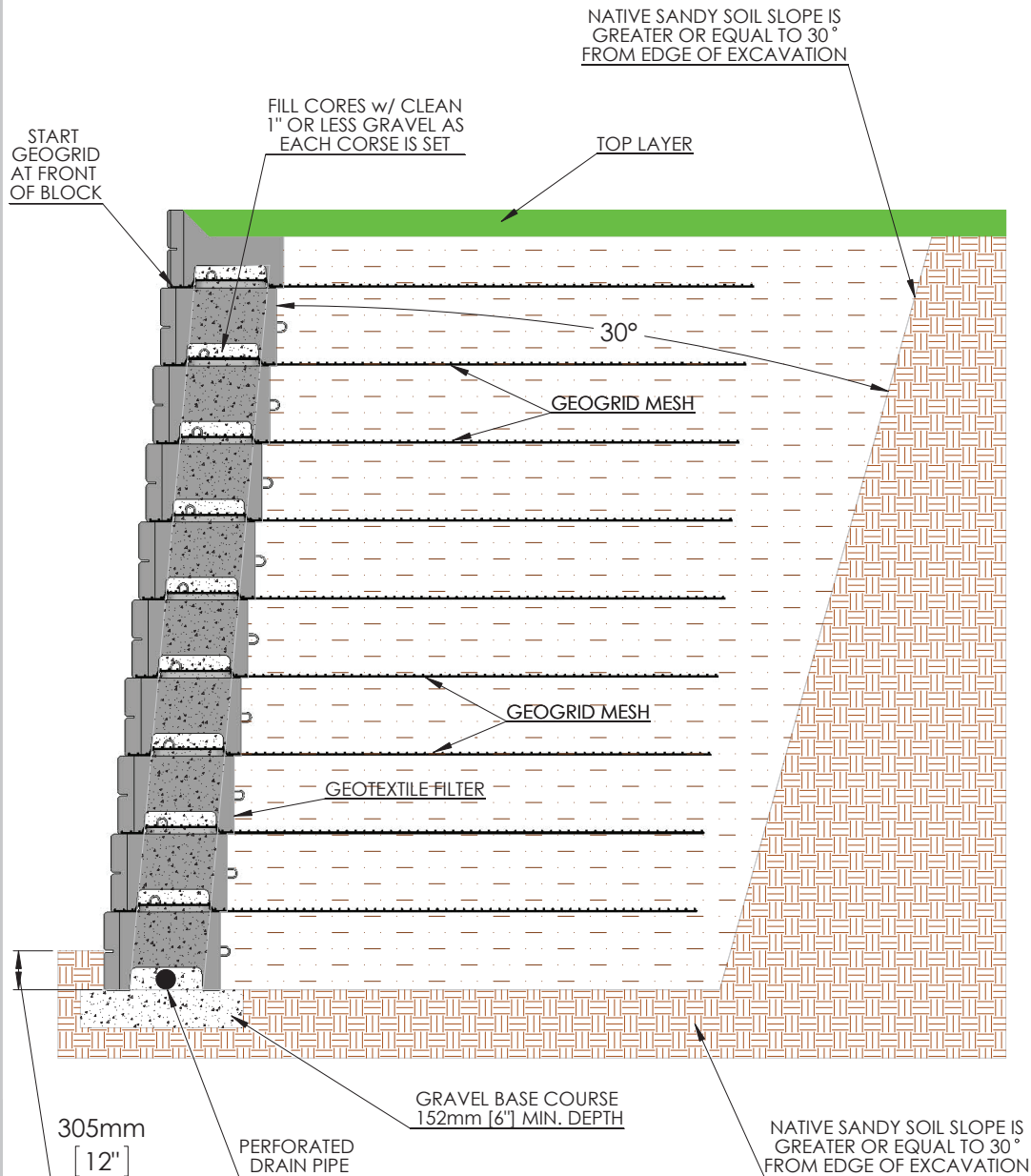
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Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density. Designs are in general accordance with NCMA guidelines.



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	FRICITION CONNECTION
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	DWG NO.	M-01
SCALE: 1: 7	SHEET 1 OF 1	

6m GEOGRID FRICTION CONNECTION



DRAWN BY
R FONTANESI

DATE
5/8/2015

16500 SOUTH 500 WEST
BLUFFDALE, UTAH 84065
PHONE: (801) 571-2028

TITLE:

6m FRICTION DETAIL

DWG NO.

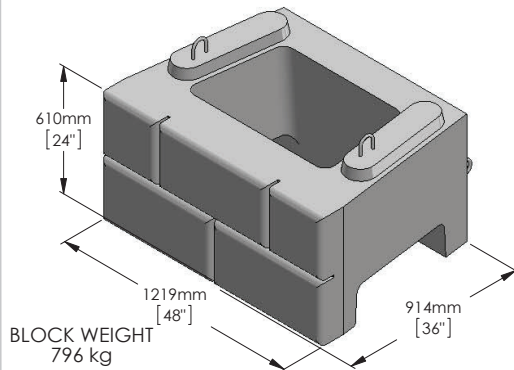
M-03M

SCALE: 1: 42

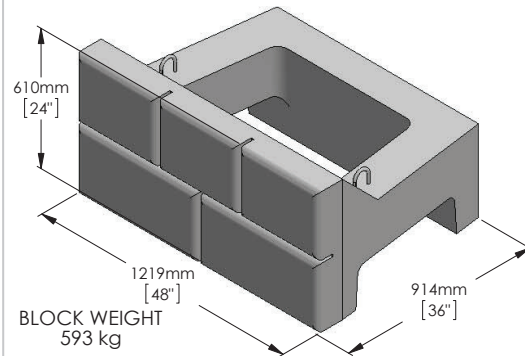
SHEET 1 OF 1

900 BLOCK SERIES

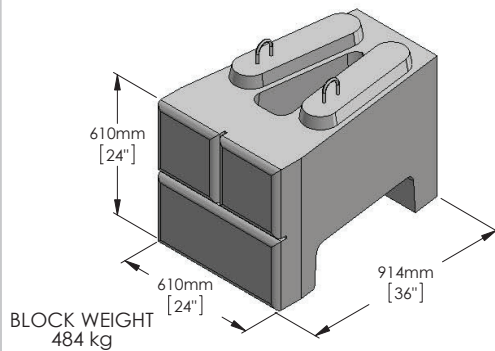
STANDARD BLOCK



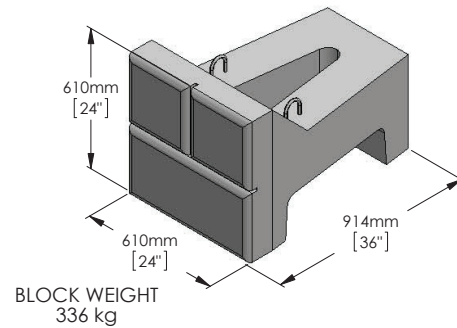
STANDARD TOP BLOCK



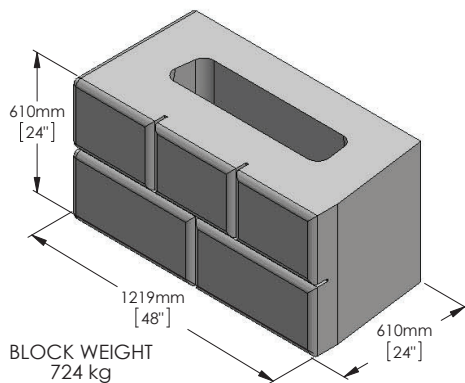
HALF BLOCK



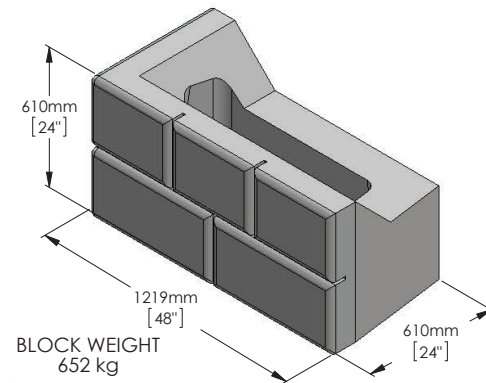
HALF TOP BLOCK



CORNER BLOCK



CORNER TOP BLOCK



DRAWN BY
R FONTANESI

DATE
4/13/2015

16500 SOUTH 500 WEST
BLUFFDALE, UTAH 84065
PHONE: (801) 571-2028

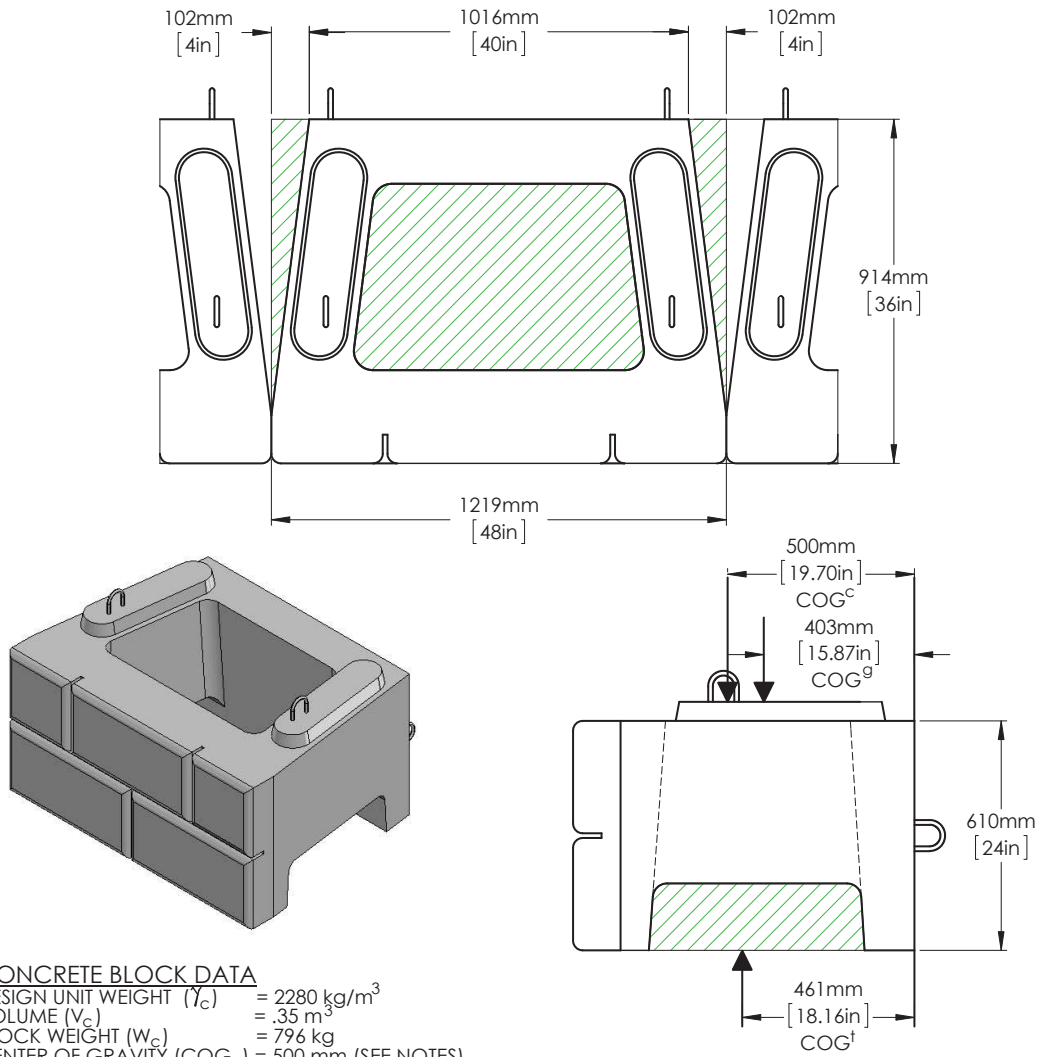
TITLE:
900 BLOCK SERIES

DWG NO.
BD-01M

SCALE: 1: 20

SHEET 1 OF 1

600 STANDARD BLOCK & GRAVEL INFILL



CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT (γ_c) = 2280 kg/m³
 VOLUME (V_c) = .35 m³
 BLOCK WEIGHT (W_c) = 796 kg
 CENTER OF GRAVITY (COG_c) = 500 mm (SEE NOTES)

GRAVEL INFILL DATA

DESIGN UNIT WEIGHT (γ_g) = 1760 kg/m³
 VOLUME (V_g) = .33 m³
 GRAVEL INFILL WEIGHT (W_g) = 580 kg
 CENTER OF GRAVITY (COG_g) = 406 mm (SEE NOTES)

NOTES:

- VOLUME, WEIGHT AND COG CALCULATIONS WERE DONE USING CAD SOFTWARE.
- COG MEASUREMENTS ARE FROM BACK OF BLOCK

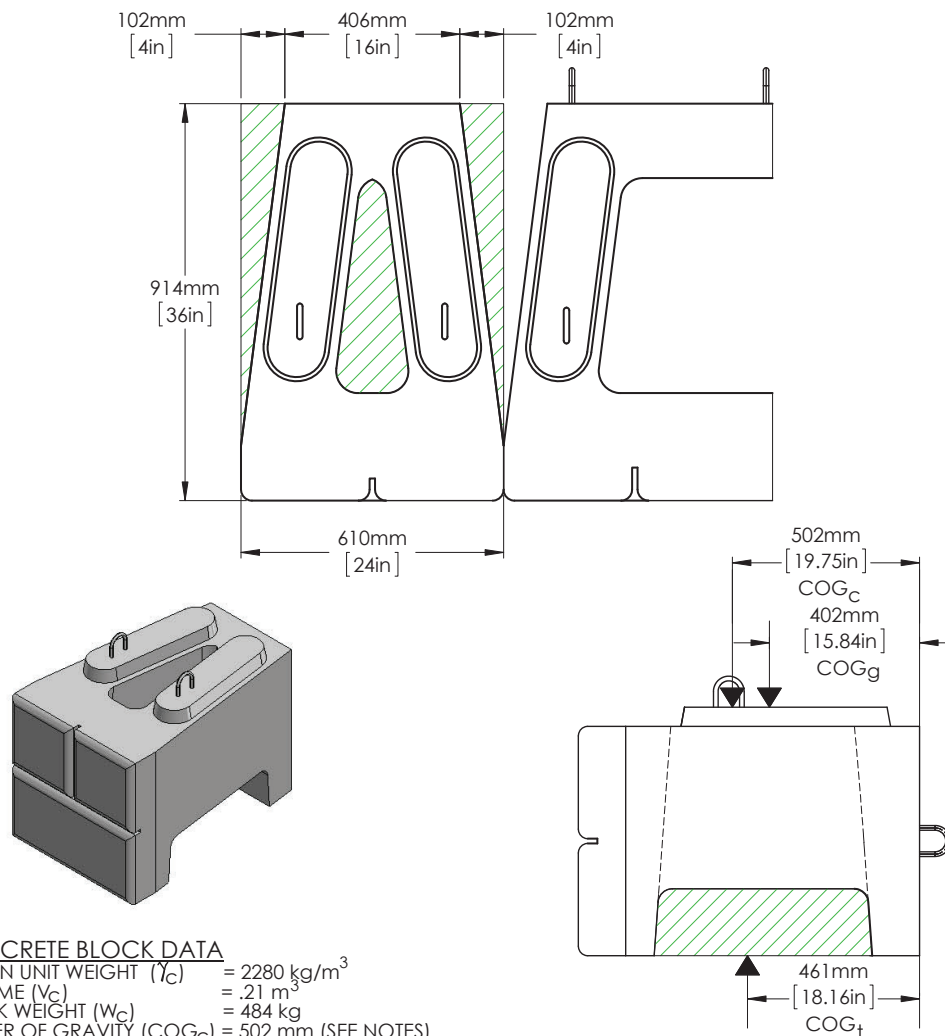
COMBINED UNIT DATA

DESIGN UNIT WEIGHT (γ_t) = (796 lbs + 580 lbs) / .68 m³ = 2020 kg/m³
 VOLUME (V_t) = .35 m³ + .33 m³ = .68 m³
 TOTAL UNIT WEIGHT (W_t) = 1376 kg
 CENTER OF GRAVITY (COG_t) = 461 mm (SEE NOTES)



DRAWN BY	DATE	TITLE:
R FONTANESI	4/30/2015	STANDARD BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-02M
SCALE: 1: 15		SHEET 1 OF 1

900 HALF BLOCK & GRAVEL INFILL



CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT (γ_c) = 2280 kg/m³
 VOLUME (V_c) = .21 m³
 BLOCK WEIGHT (W_c) = 484 kg
 CENTER OF GRAVITY (COG_c) = 502 mm (SEE NOTES)

GRAVEL INFILL DATA

DESIGN UNIT WEIGHT (γ_g) = 1760 kg/m³
 VOLUME (V_g) = .13 m³
 GRAVEL INFILL WEIGHT (W_g) = 224 kg
 CENTER OF GRAVITY (COG_g) = 402 mm (SEE NOTES)

NOTES:

- VOLUME, WEIGHT AND COG CALCULATIONS WERE DONE USING CAD SOFTWARE.
- COG MEASUREMENTS ARE FROM BACK OF BLOCK

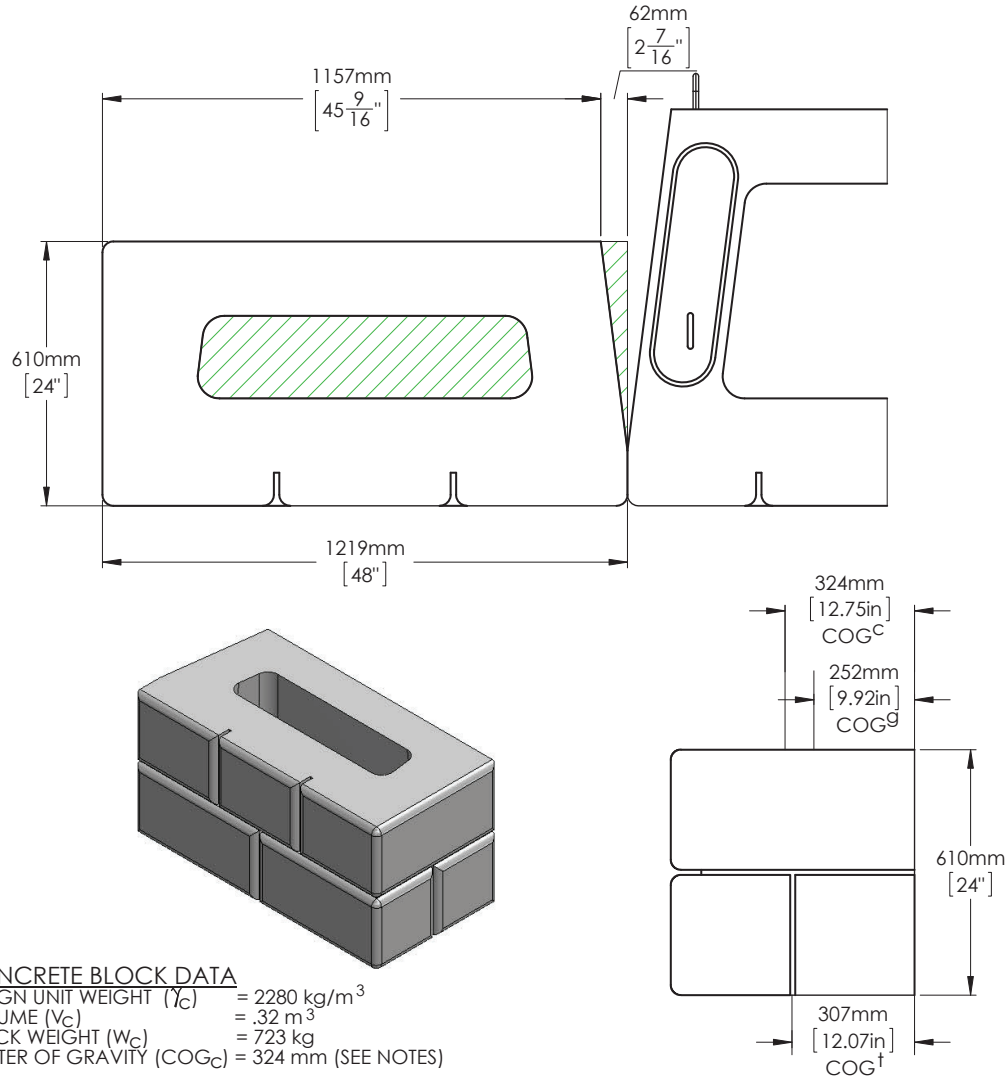
COMBINED UNIT DATA

DESIGN UNIT WEIGHT (γ_t) = (484 kg + 224 kg) / .34 m = 2080 kg/m³
 VOLUME (V_t) = .21 m³ + .13 m³ = .34 m³
 TOTAL UNIT WEIGHT (W_t) = 708 kg
 CENTER OF GRAVITY (COG_t) = 461 mm (SEE NOTES)



DRAWN BY	DATE	TITLE:
R FONTANESI	5/1/2015	HALF BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-03M
SCALE: 1: 15		SHEET 1 OF 1

600" CORNER BLOCK & GRAVEL INFILL



DRAWN BY
R FONTANESI

DATE
5/1/2015

16500 SOUTH 500 WEST
BLUFFDALE, UTAH 84065
PHONE: (801) 571-2028

TITLE:
CORNER BLOCK

DWG NO.
BD-04M

SCALE: 1: 15

SHEET 1 OF 1