

# Design Manual: Gravity Wall

## Section 1



[www.verti-block.com](http://www.verti-block.com)





# Design Manual: Gravity 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: Gravity Wall with Mass Extenders

## Specifications for Verti-Block Gravity Wall

### PART 1 GENERAL

#### 1.1 General Information

- A. Work includes supplying and installing precast concrete retaining wall blocks to the lines and grades assigned within the specified construction drawings herein.
- B. 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

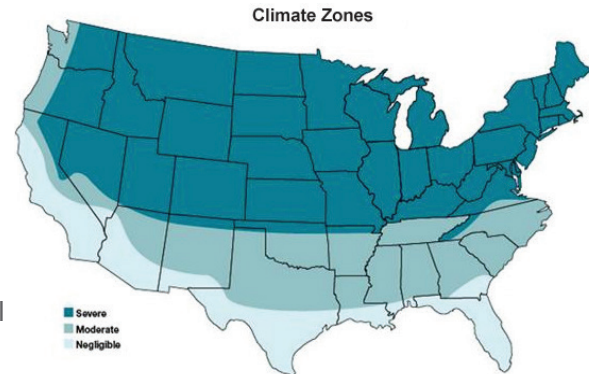
#### 2.1 Wall Units

- 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, psi	Slump*
Severe	4 1/2 % - 7 1/2 %	4000	5" ± 1 1/2"
Moderate	3% - 6%	4000	5" ± 1 1/2"
Negligible	1 1/2% - 4 1/2%	4000	5" ± 1 1/2"

\*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.
- 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.





# Design Manual: Gravity Wall with Mass Extenders

## Specifications for Verti-Block Gravity Wall

### 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.
- 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.

### 3.4 UNIT INSTALLATION - CONTINUED

- A. 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.
- B. Remove and sweep off all excess aggregate and other materials from the top of the blocks before continuing on the next block course.
- C. 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.
- D. 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.
- E. 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.

## PART 4 QUALITY ASSURANCE

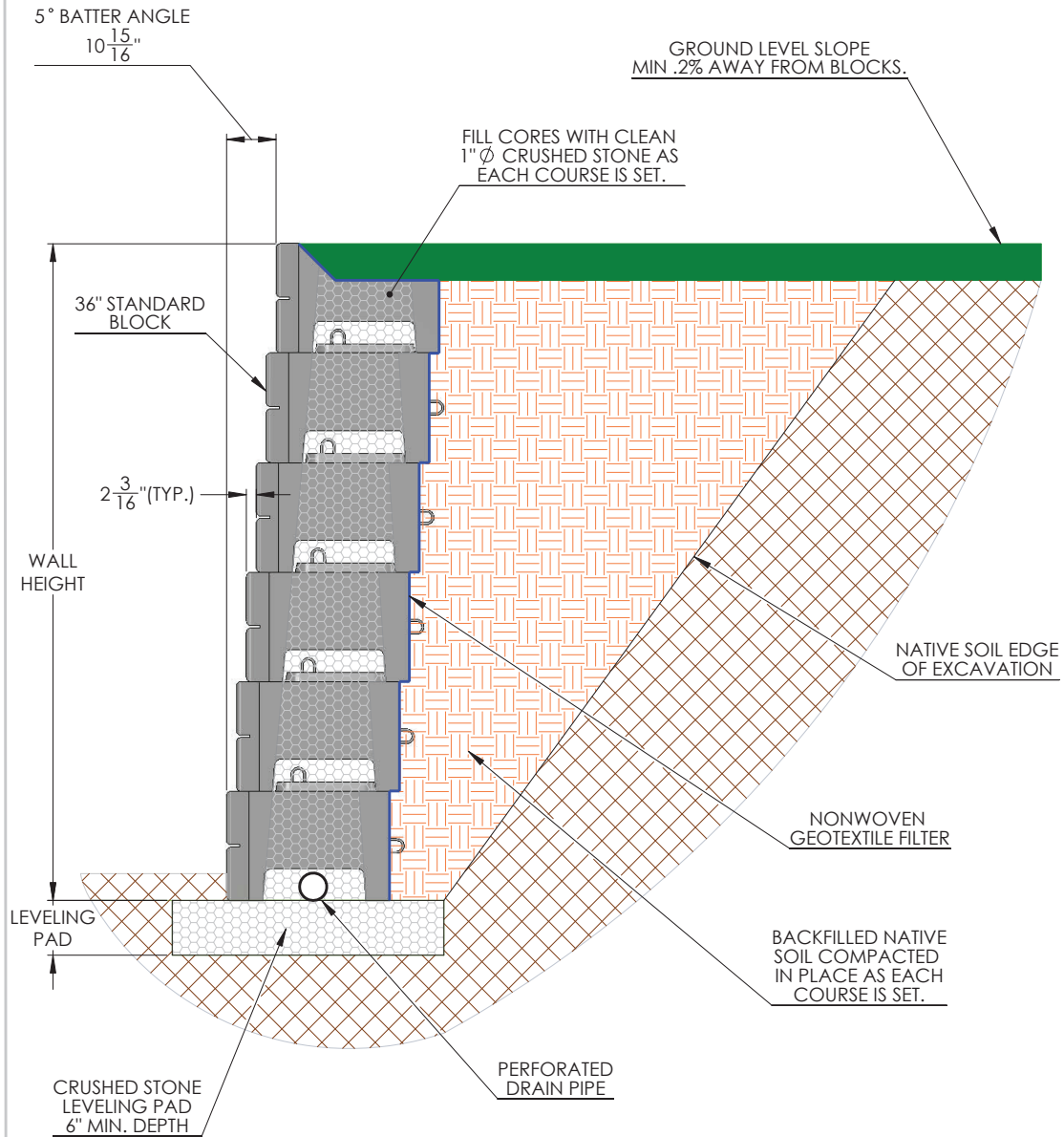
### 4.1 CONSTRUCTION QUALITY CONTROL

- 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.

### 4.2 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.

## TYPICAL GRAVITY WALL WITH 36" VERTI-BLOCK



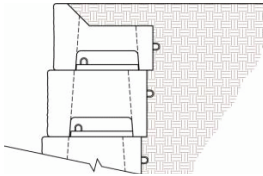
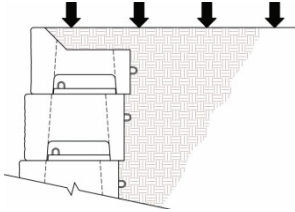
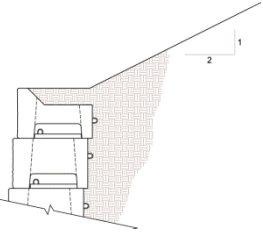
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DAN BALLING	12/30/2013
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	

TITLE:	12' RETAINING SECTION
DWG NO.	WD-14
SCALE: 1: 30	SHEET 1 OF 1



## Gravity Wall Matrix with 36 inch Deep Blocks

Soil Type	Silty Soil <i>Internal Angle of Friction <math>\geq 30^\circ</math></i>	Sandy Soil <i>Internal Angle of Friction <math>\geq 35^\circ</math></i>	Gravelly Soil <i>Internal Angle of Friction <math>\geq 40^\circ</math></i>
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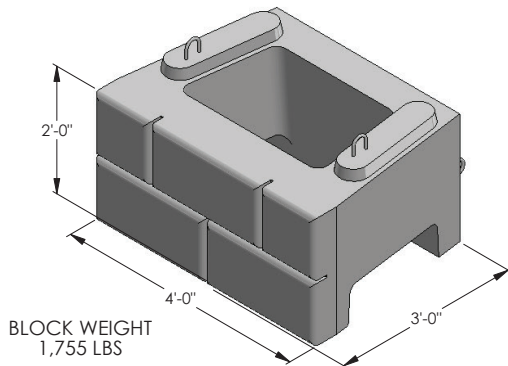
Load Condition	Wall Height	Min. Bury Depth	Leveling Pad	Wall Height	Min. Bury Depth	Leveling Pad	Wall Height	Min. Bury Depth	Leveling Pad
<b>Level Backfill</b> <i>No Surcharge</i> 	3'-6"	6"	6"	3'-6"	6"	6"	3'-6"	6"	6"
	5'-6"	6"	6"	5'-6"	6"	6"	5'-6"	6"	6"
	7'-6"	6"	6"	7'-6"	6"	6"	7'-6"	6"	6"
				9'-6"	6"	6"	9'-6"	6"	6"
							11'-6"	6"	6"
							13'-6"	6"	6"
<b>Level Backfill</b> <i>250 psf Surcharge</i> 	3'-6"	6"	6"	3'-6"	6"	6"	3'-6"	6"	6"
	5'-6"	6"	6"	5'-6"	6"	6"	5'-6"	6"	6"
				7'-6"	6"	6"	7'-6"	6"	6"
							9'-6"	6"	6"
<b>2:1 Sloping Backfill</b> <i>No Surcharge</i> 	3'-6"	6"	6"	3'-6"	6"	6"	3'-6"	6"	6"
	5'-6"	6"	6"	5'-6"	6"	6"	5'-6"	6"	6"
				7'-6"	6"	6"	7'-6"	6"	6"
							9'-6"	6"	6"
							11'-6"	6"	6"

The above chart was prepared by Verti-Crete, LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however Verti-Crete, LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer, using the actual conditions of the proposed site.

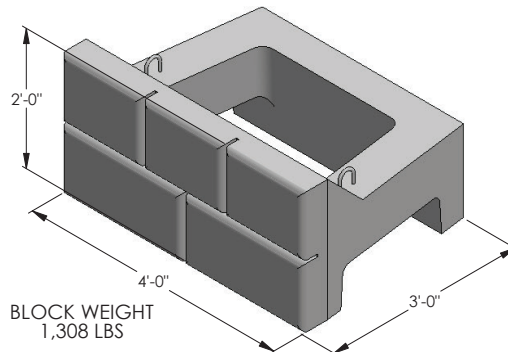
Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95%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

## 36" BLOCK SERIES

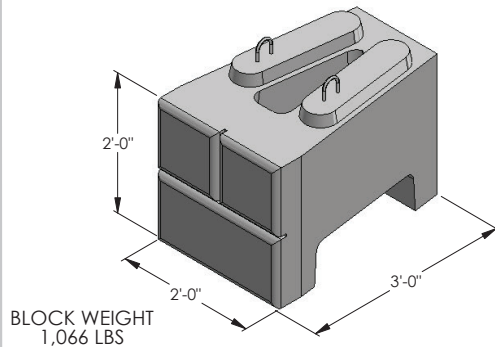
STANDARD BLOCK



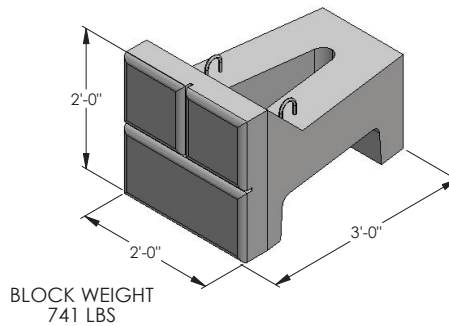
STANDARD TOP BLOCK



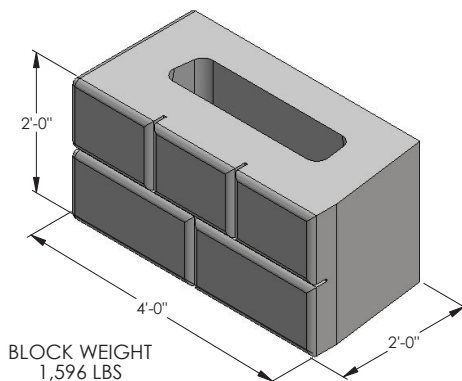
HALF BLOCK



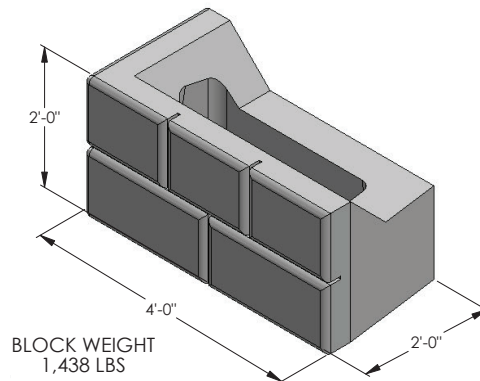
HALF TOP BLOCK



CORNER BLOCK



CORNER TOP BLOCK



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11/25/2013

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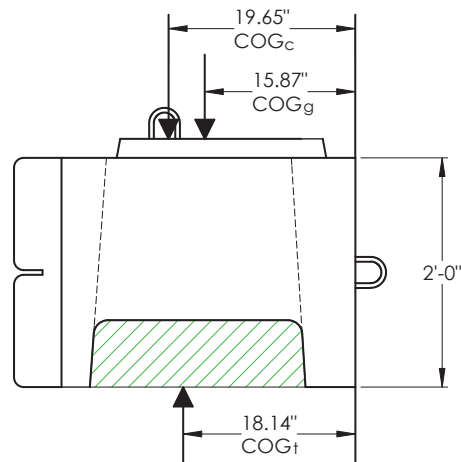
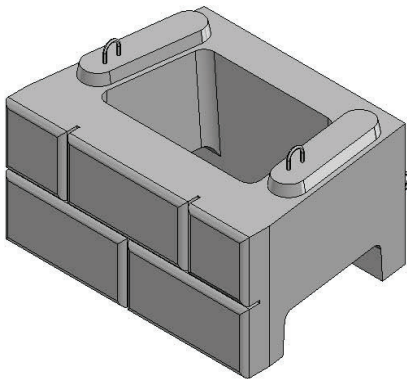
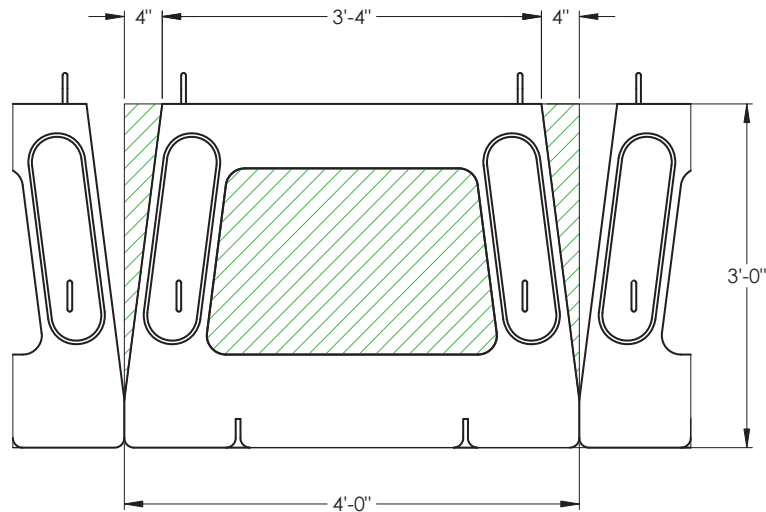
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36" BLOCK SERIES

DWG NO.  
BD-01

SCALE: 1:20

SHEET 1 OF 1

## 36" STANDARD BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
VOLUME ( $V_c$ ) = 12.36 cft  
BLOCK WEIGHT ( $W_c$ ) = 1,755 lbs  
CENTER OF GRAVITY ( $COG_c$ ) = 19.65" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
VOLUME ( $V_g$ ) = 11.64 cft  
GRAVEL INFILL WEIGHT ( $W_g$ ) = 1,280 lbs  
CENTER OF GRAVITY ( $COG_g$ ) = 15.87" (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 ( $\gamma_t$ ) = (1,755 lbs + 1,280 lbs) / 24 cft = 126 pcf  
VOLUME ( $V_t$ ) = 12.36 cft + 11.64 cft = 24.00 cft  
TOTAL UNIT WEIGHT ( $W_t$ ) = 3,035 lbs  
CENTER OF GRAVITY ( $COG_t$ ) = 18.14" (SEE NOTES)



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DAN BALLING

DATE  
11/25/2013

TITLE:

STANDARD BLOCK

DWG NO.

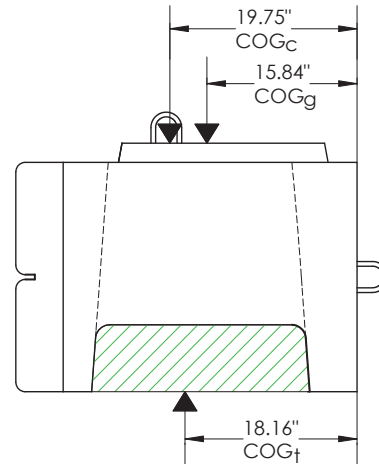
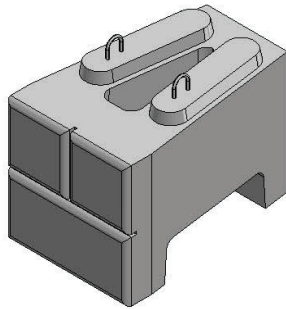
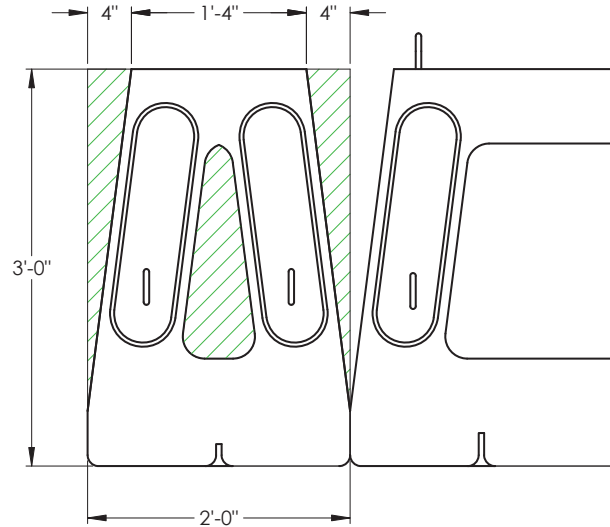
BD-02

SCALE: 1: 15

SHEET 1 OF 1



## 36" HALF BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 7.52 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,068 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 19.75" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 4.48 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 493 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 15.84" (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 ( $\gamma_t$ ) = (1,068 lbs + 493 lbs) / 12 cft = 130 pcf  
 VOLUME ( $V_t$ ) = 7.52 cft + 4.48 cft = 12.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 1,561 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 18.16" (SEE NOTES)



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11/25/2013

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TITLE:

HALF BLOCK

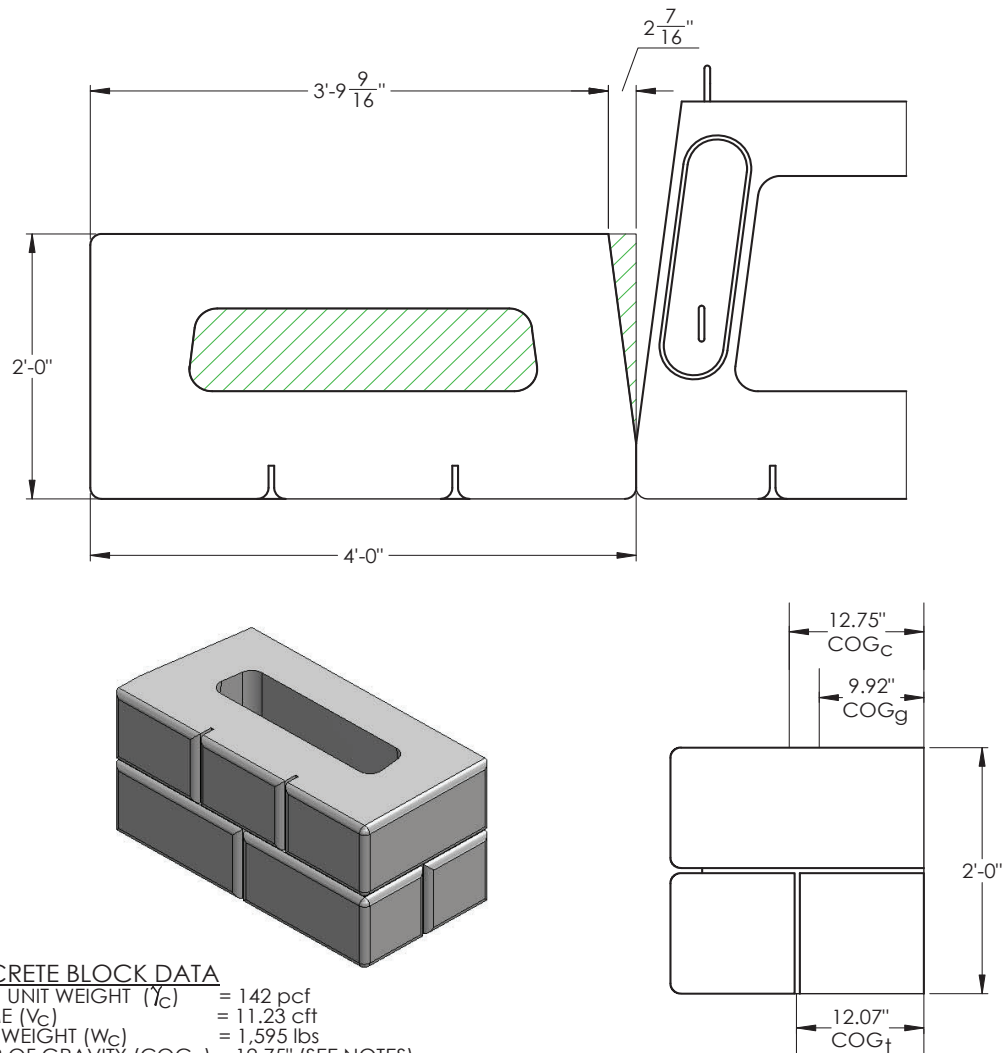
DWG NO.

BD-03

SCALE: 1: 15

SHEET 1 OF 1

## 24" CORNER BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 11.23 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,595 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 12.75" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 4.77 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 508 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 9.92" (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 ( $\gamma_t$ ) = (1,595 lbs + 508 lbs) / 16 cft = 131 pcf  
 VOLUME ( $V_t$ ) = 11.23 cft + 4.77 cft = 16.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 2,103 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 12.07" (SEE NOTES)



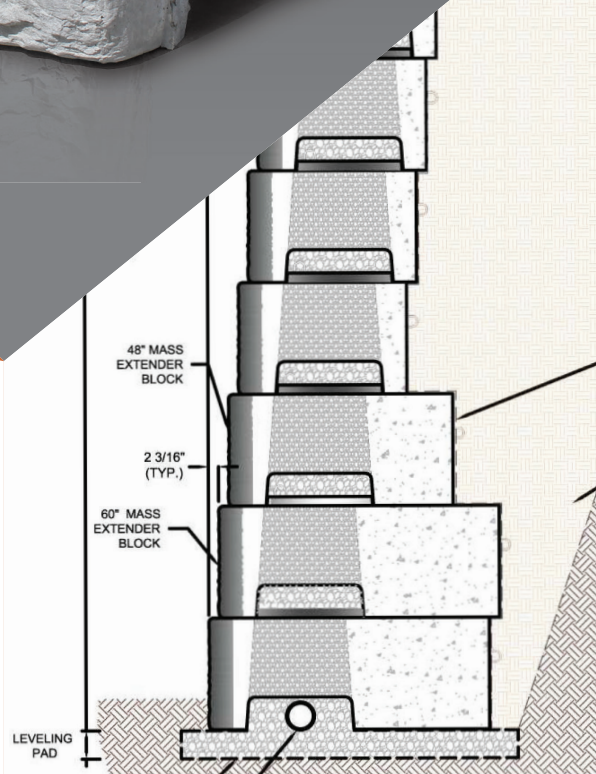
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DAN BALLING	11/25/2013	CORNER BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-04
SCALE: 1: 15		SHEET 1 OF 1

# Design Manual: Gravity Wall with Mass Extender

## Section 2



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## Verti-Block with Mass Extender

There are many projects that can benefit through the use of Verti-Block™ Mass Extenders. When Mass Extenders are used, the height of a gravity wall can be increased without the use of geo-grid for reinforcement. The added leverage and weight on bottom rows provides the needed stability for increased capability.

Please refer to the Gravity Wall Matrix for a representation of what can be accomplished through the use of Verti-Block™ Mass Extenders.



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- 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

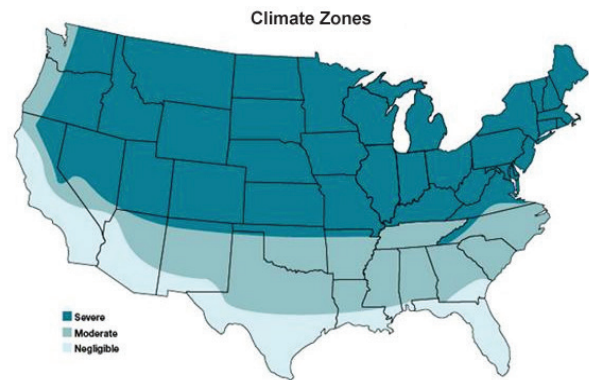
#### 2.1 Wall Units

- 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, psi	Slump*
Severe	4 1/2 % - 7 1/2 %	4000	5" ± 1 1/2"
Moderate	3% - 6%	4000	5" ± 1 1/2"
Negligible	1 1/2% - 4 1/2%	4000	5" ± 1 1/2"

\*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

## 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.
- 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.



# Design Manual: Gravity Wall with Mass Extenders

## Specifications for Verti-Block Gravity Wall

### 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.
- 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.

### 3.4 UNIT INSTALLATION - CONTINUED

- A. 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.
- B. Remove and sweep off all excess aggregate and other materials from the top of the blocks before continuing on the next block course.
- C. 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.
- D. 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.
- E. 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.

## PART 4 QUALITY ASSURANCE

### 4.1 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.

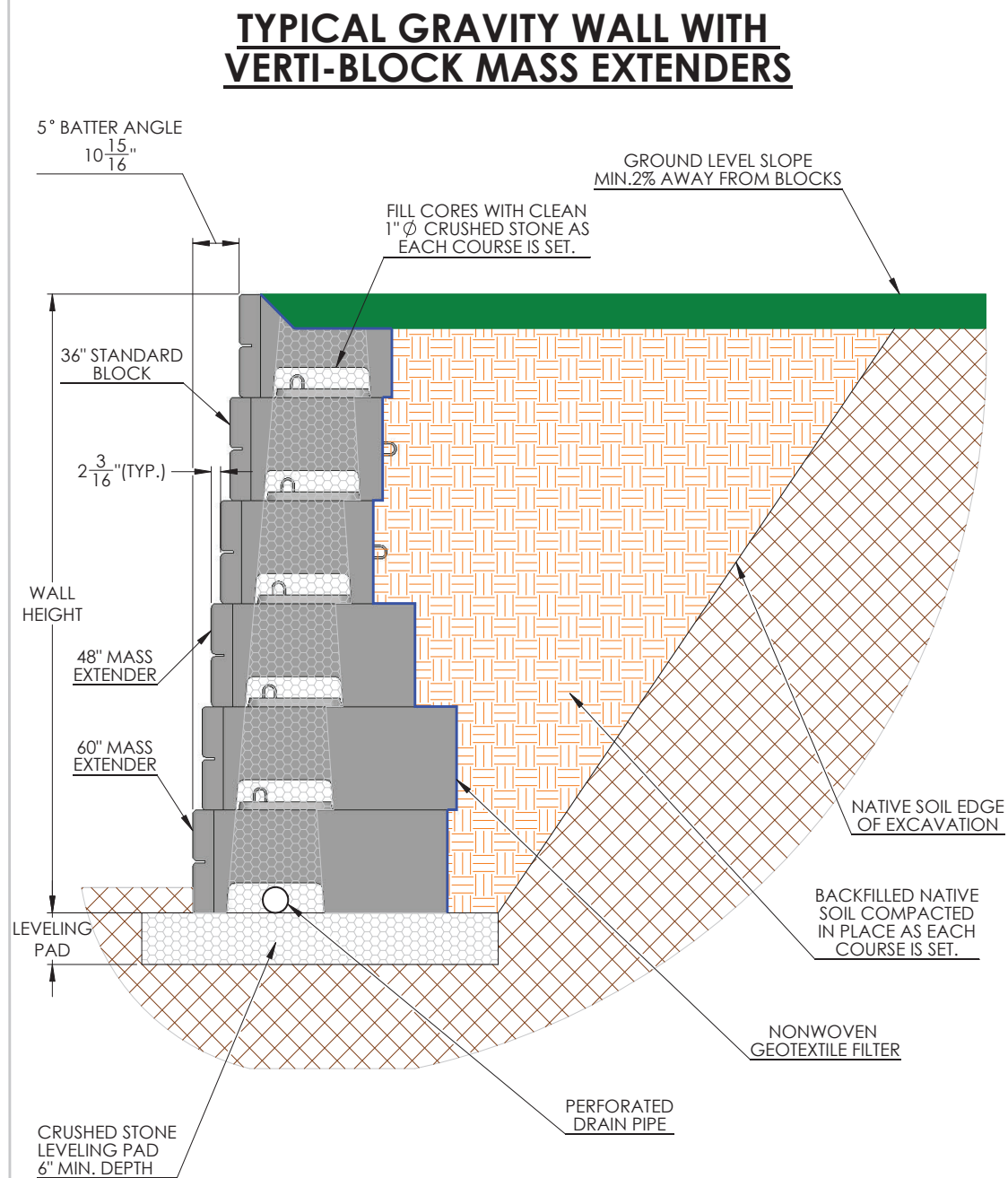
### 4.2 QUALITY ASSURANCE

- 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.





# Design Manual: Gravity Wall with Mass Extenders



DRAWN BY	DATE	TITLE:
DAN BALLING	12/30/2013	12' SECTION W/ MASS EXTENDERS
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-15
SCALE: 1: 30		SHEET 1 OF 1

## Gravity Wall Matrix with Standard and Mass Extender Blocks

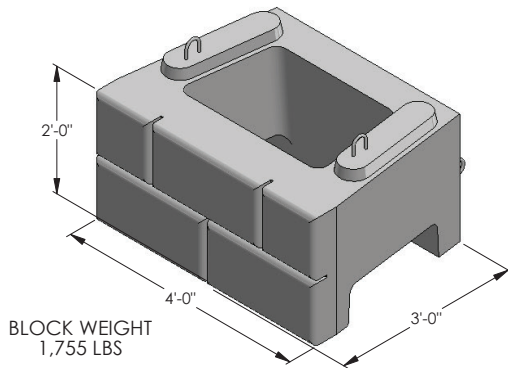
Soil Type	Silty Soil <i>Internal Angle of Friction <math>\geq 30^\circ</math></i>			Sandy Soil <i>Internal Angle of Friction <math>\geq 35^\circ</math></i>			Gravelly Soil <i>Internal Angle of Friction <math>\geq 40^\circ</math></i>		
Load Condition	Wall Height	Min. Bury Depth	Leveling Pad	Wall Height	Min. Bury Depth	Leveling Pad	Wall Height	Min. Bury Depth	Leveling Pad
<b>Level Backfill / No Surcharge</b>									
36" Blocks Only	7.5	0.5	0.5	9.5	0.5	0.5	13.5	0.5	0.5
36" Blocks Only	9.5	0.5	1	11.5	0.5	0.75	--	--	--
36" w/ (1) 48" bottom row	9.5	0.5	0.5	13.5	0.5	0.5	15.5	0.5	0.5
36" w/ (1) 48" bottom row	11.5	0.5	0.75	15.5	0.5	1	--	--	--
36" w/ (2) 48" & (1) 60" bottom row	--	--	--	--	--	--	19.5	0.5	0.75
36" w/ (1) 48" & (1) 60" bottom row	13.5	0.5	0.5	--	--	--	--	--	--
36" w/ (1) 48" & (2) 60" bottom row	15.5	0.5	1.5	17.5	0.5	0.5	--	--	--
36" w/ (4) 48" & (4) 60" bottom row	--	--	--	19.5	0.5	1.25	--	--	--
36" w/ (3) 48" & (5) 60" bottom row	--	--	--	--	--	--	21.5	0.5	0.5
36" w/ (1) 48" & (9) 60" bottom row	--	--	--	--	--	--	23.5	0.5	0.5
<b>Level Backfill / 250 psf Surcharge</b>									
36" Blocks Only	5.5	0.5	0.5	7.5	0.5	0.5	9.5	0.5	0.5
36" w/ (1) 48" bottom row	7.5	0.5	0.5	9.5	0.5	0.5	11.5	0.5	0.5
36" w/ (1) 48" bottom row	9.5	0.5	1	--	--	--	--	--	--
36" w/ (2) 48" bottom rows	--	--	--	11.5	0.5	0.5	13.5	0.5	0.5
36" w/ (2) 48" & (1) 60" bottom rows	--	--	--	--	--	--	15.5	0.5	0.5
36" w/ (1) 48" & (1) 60" bottom rows	11.5	0.5	0.75	--	--	--	--	--	--
36" w/ (2) 48" & (1) 60" bottom rows	--	--	--	13.5	0.5	0.5	--	--	--
36" w/ (3) 48" & (2) 60" bottom rows	--	--	--	15.5	0.5	0.75	--	--	--
36" w/ (2) 48" & (2) 60" bottom rows	--	--	--	--	--	--	17.5	0.5	0.5
36" w/ (1) 48" & (7) 60" bottom rows	--	--	--	--	--	--	19.5	0.5	0.5
<b>2:1 Sloping Backfill / No Surcharge</b>									
36" Blocks Only	5.5	0.5	0.5	7.5	0.5	0.5	11.5	0.5	0.5
36" w/ bottom (1) 48" bottom row	--	--	--	9.5	0.5	1	--	--	--
36" w/ bottom (2) 48" bottom row	7.5	0.5	0.5	11.5	0.5	0.5	13.5	0.5	0.5
36" w/ (1) 48" & (1) 60" bottom rows	--	--	--	--	--	--	15.5	0.5	0.5
36" w/ (1) 48" & (1) 60" bottom rows	9.5	0.5	0.75	--	--	--	--	--	--
36" w/ (3) 48" & (3) 60" bottom rows	--	--	--	15.5	0.5	1.25	--	--	--
36" w/ (1) 48" & (8) 60" bottom rows	--	--	--	--	--	--	19.5	0.5	0.75

The above chart was prepared by Verti-Crete, LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however Verti-Crete, LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer, using the actual conditions of the proposed site.

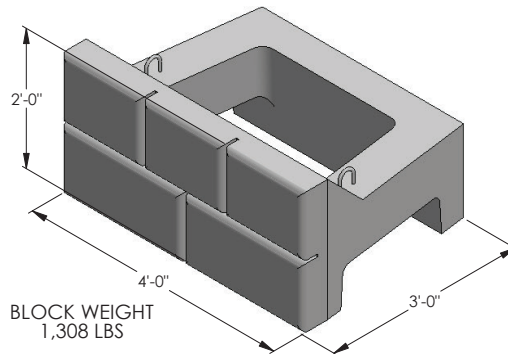
Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Seismic forces have not been considered. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% modified proctor density.

## 36" BLOCK SERIES

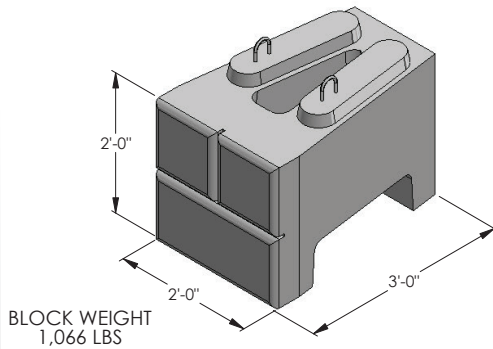
STANDARD BLOCK



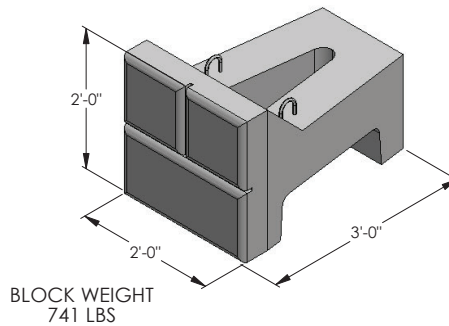
STANDARD TOP BLOCK



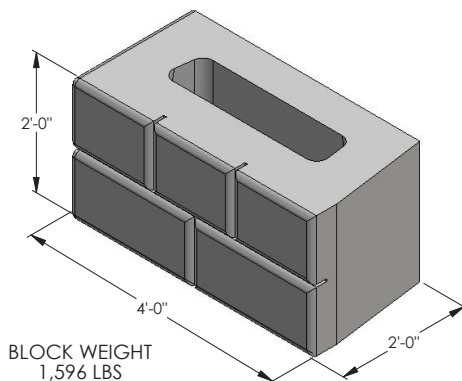
HALF BLOCK



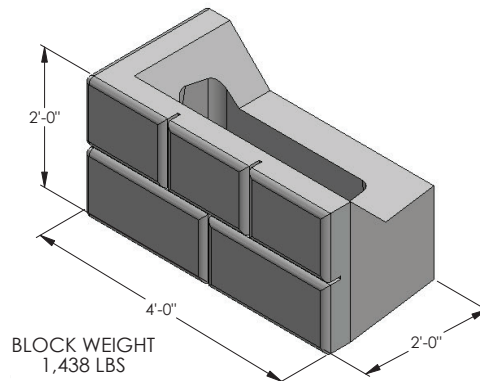
HALF TOP BLOCK



CORNER BLOCK



CORNER TOP BLOCK



DRAWN BY

DAN BALLING

DATE

11/25/2013

TITLE:

36" BLOCK SERIES

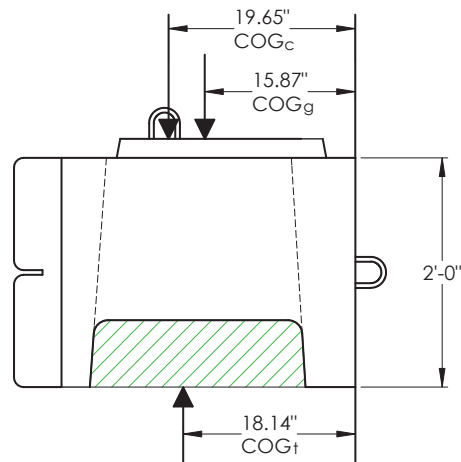
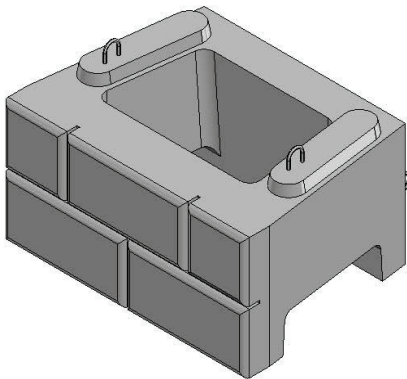
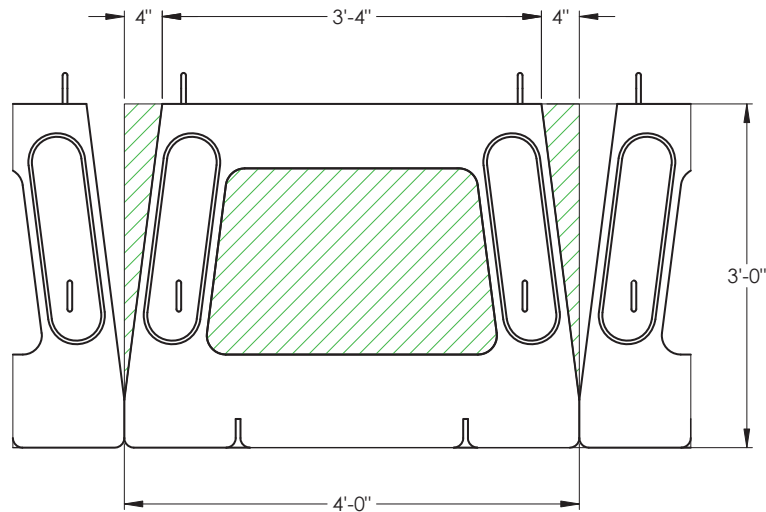
DWG NO.

BD-01

SCALE: 1:20

SHEET 1 OF 1

## 36" STANDARD BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 12.36 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,755 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 19.65" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 11.64 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 1,280 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 15.87" (SEE NOTES)

### NOTES:

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

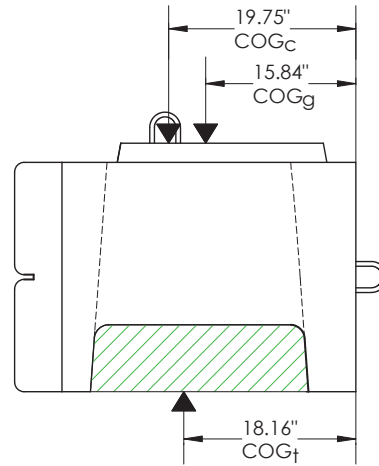
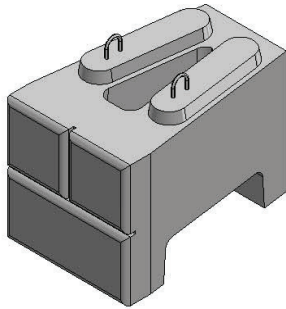
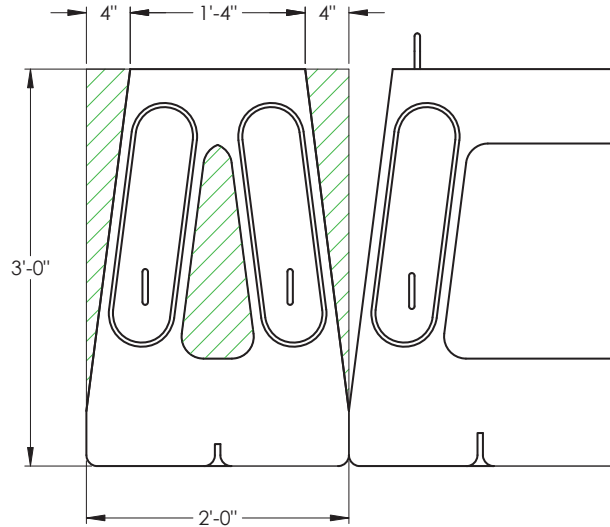
### COMBINED UNIT DATA

DESIGN UNIT WEIGHT ( $\gamma_t$ ) =  $(1,755 \text{ lbs} + 1,280 \text{ lbs}) / 24 \text{ cft} = 126 \text{ pcf}$   
 VOLUME ( $V_t$ ) =  $12.36 \text{ cft} + 11.64 \text{ cft} = 24.00 \text{ cft}$   
 TOTAL UNIT WEIGHT ( $W_t$ ) = 3,035 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 18.14" (SEE NOTES)



DRAWN BY	DATE	TITLE:
DAN BALLING	11/25/2013	STANDARD BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-02
SCALE: 1: 15		SHEET 1 OF 1

## 36" HALF BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 7.52 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,068 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 19.75" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 4.48 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 493 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 15.84" (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 ( $\gamma_t$ ) = (1,068 lbs + 493 lbs) / 12 cft = 130 pcf  
 VOLUME ( $V_t$ ) = 7.52 cft + 4.48 cft = 12.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 1,561 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 18.16" (SEE NOTES)



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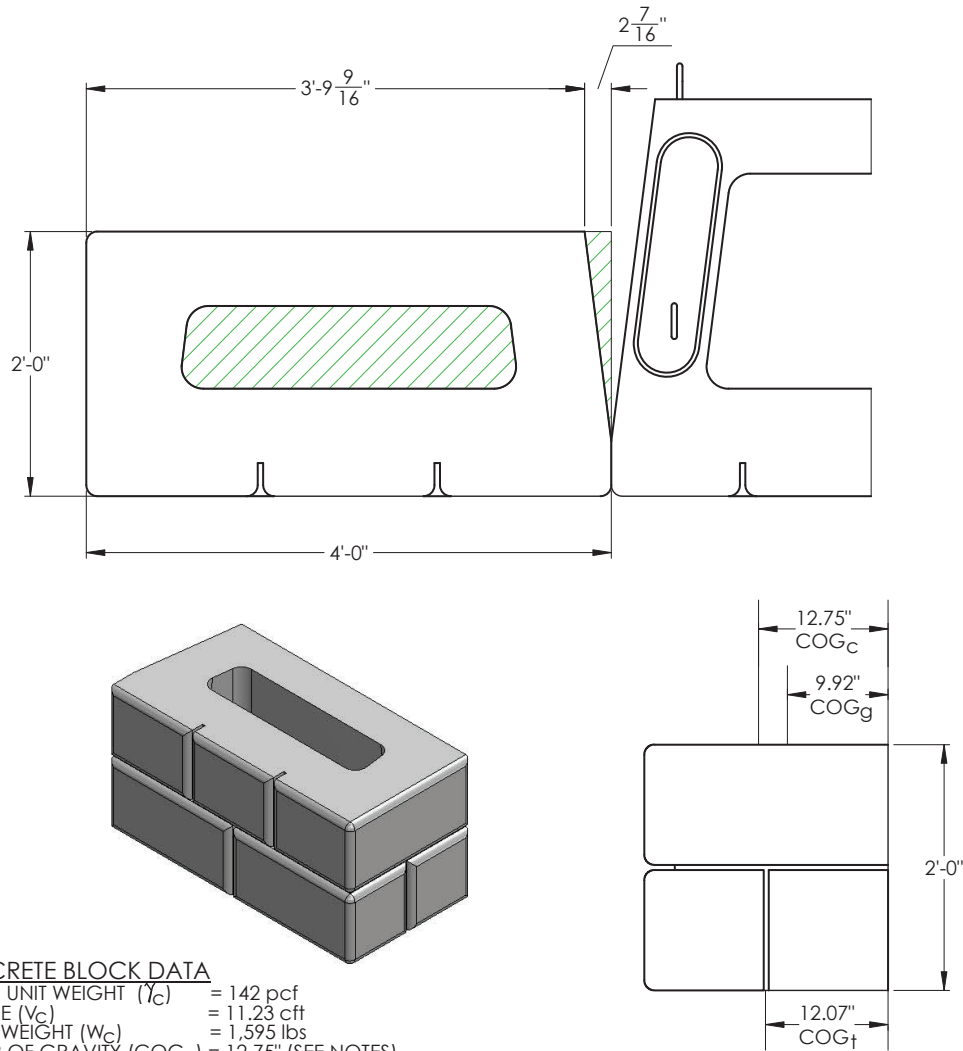
TITLE:  
HALF BLOCK

DWG NO.  
BD-03

SCALE: 1: 15

SHEET 1 OF 1

## 24" CORNER BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 11.23 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,595 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 12.75" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 4.77 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 508 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 9.92" (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 ( $\gamma_t$ ) = (1,595 lbs + 508 lbs) / 16 cft = 131 pcf  
 VOLUME ( $V_t$ ) = 11.23 cft + 4.77 cft = 16.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 2,103 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 12.07" (SEE NOTES)

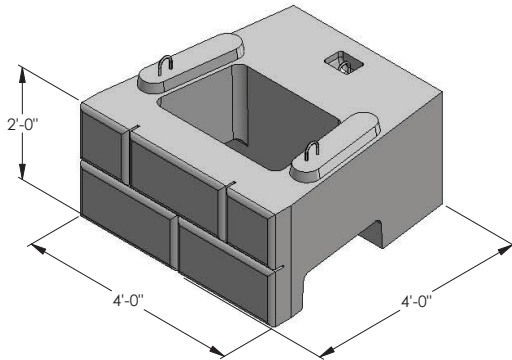


DRAWN BY	DATE	TITLE:
DAN BALLING	11/25/2013	CORNER BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-04
SCALE: 1: 15		SHEET 1 OF 1



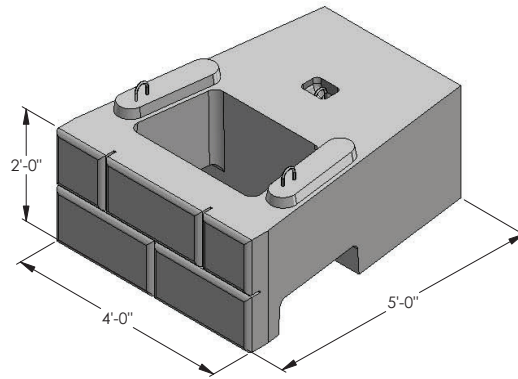
## MASS EXTENDER REGULAR BLOCK SERIES

48" MASS EXTENDER



BLOCK WEIGHT  
2,674 LBS

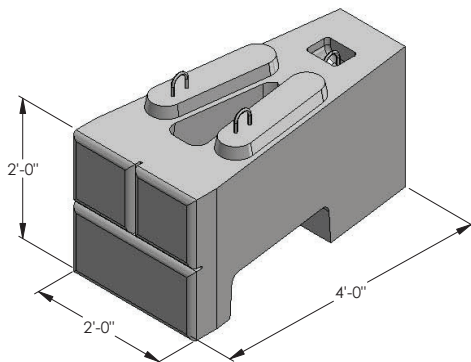
60" MASS EXTENDER



BLOCK WEIGHT  
3,509 LBS

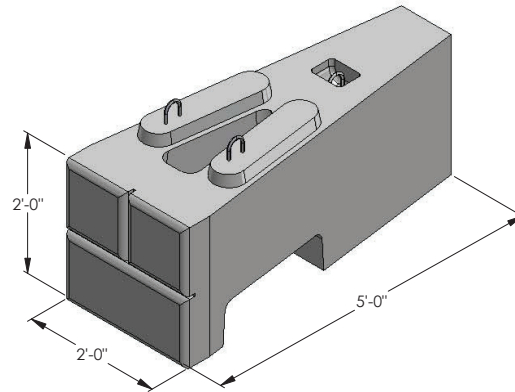
## MASS EXTENDER HALF BLOCK SERIES

48" HALF BLOCK MASS EXTENDER



BLOCK WEIGHT  
1,392 LBS

60" HALF BLOCK MASS EXTENDER



BLOCK WEIGHT  
1,661 LBS



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DAN BALLING

DATE  
11/25/2013

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

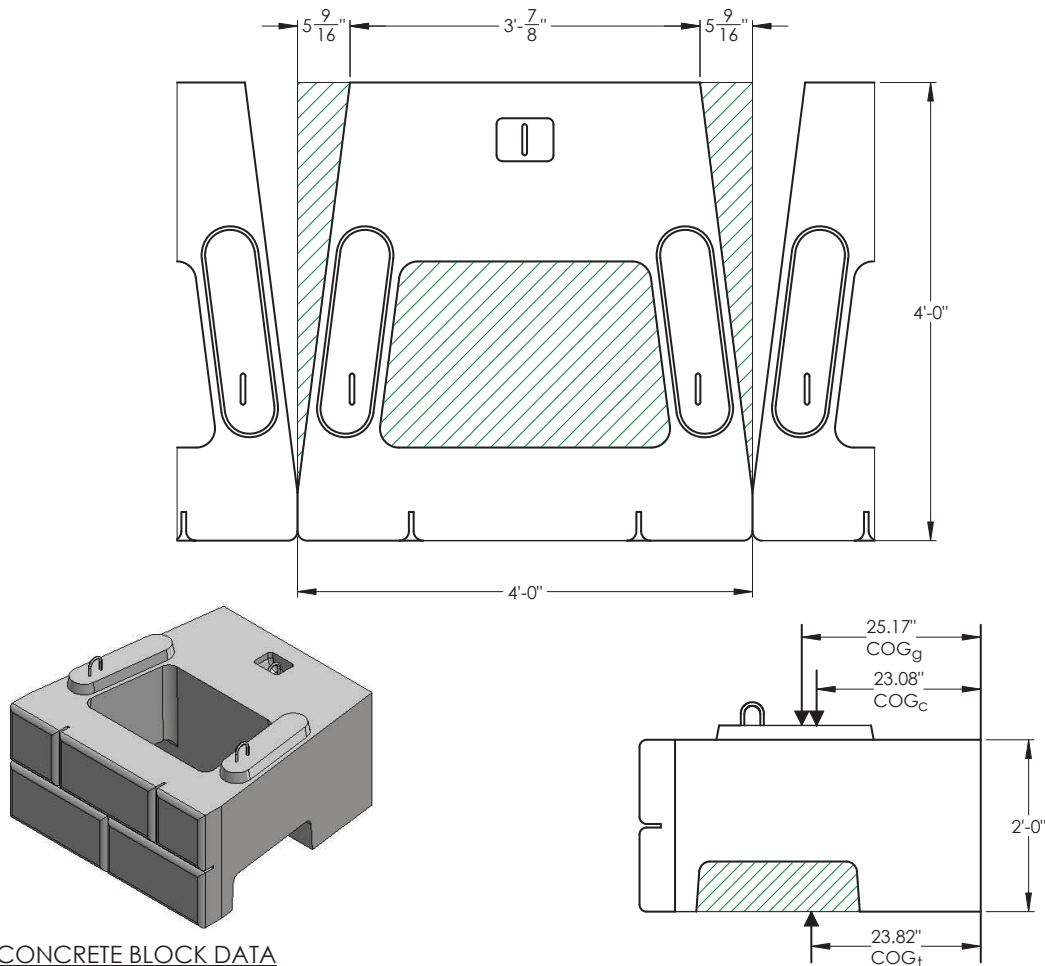
TITLE:  
MASS EXTENDER BLOCK SERIES

DWG NO.  
BD-05

SCALE: 1: 20

SHEET 1 OF 1

## 48" MASS EXTENDER BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 18.83 cft  
 BLOCK WEIGHT ( $W_c$ ) = 2,674 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 23.08" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 13.17 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 1,449 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 25.17" (SEE NOTES)

### NOTES:

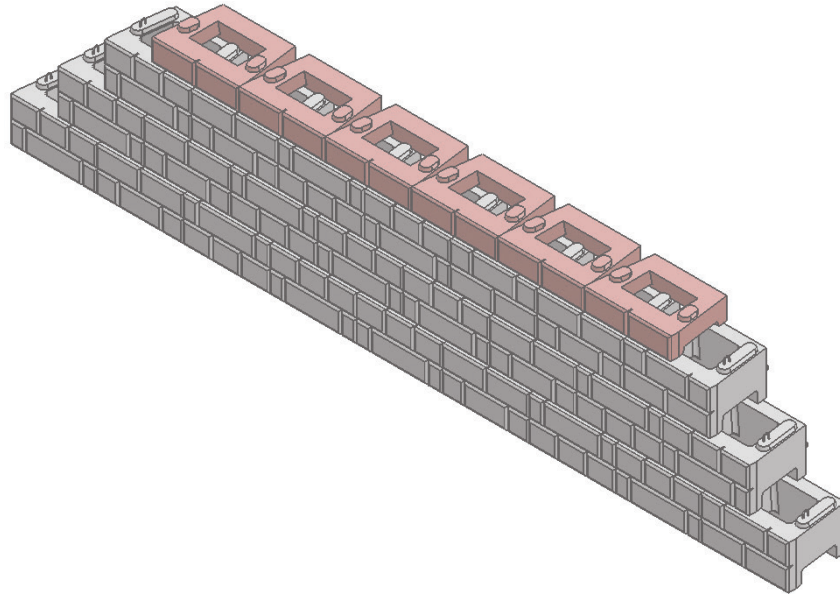
- VOLUME, WEIGHT AND COG CALCULATIONS WERE DONE USING CAD SOFTWARE.
- COG MEASUREMENTS ARE FROM BACK OF BLOCK

### COMBINED UNIT DATA

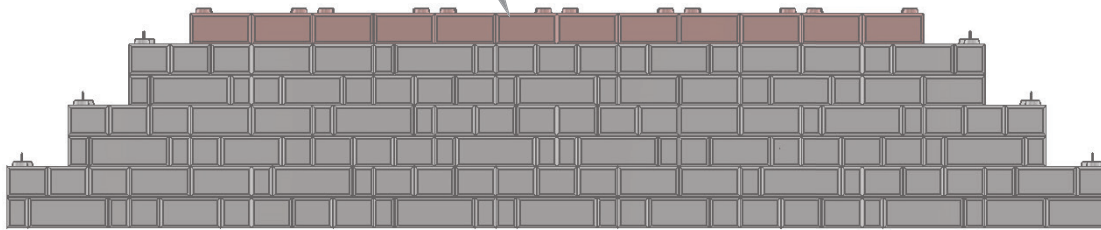
DESIGN UNIT WEIGHT ( $\gamma_t$ ) =  $(2,674 \text{ lbs} + 1,449 \text{ lbs}) / 32 \text{ cft} = 129 \text{ pcf}$   
 VOLUME ( $V_t$ ) =  $18.83 \text{ cft} + 13.17 \text{ cft} = 32.00 \text{ cft}$   
 TOTAL UNIT WEIGHT ( $W_t$ ) = 4,123 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 23.82" (SEE NOTES)



DRAWN BY	DATE	TITLE:
DAN BALLING	11/25/2013	48" MASS EXTENDER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		BD-06
SCALE: 1: 20		SHEET 1 OF 1



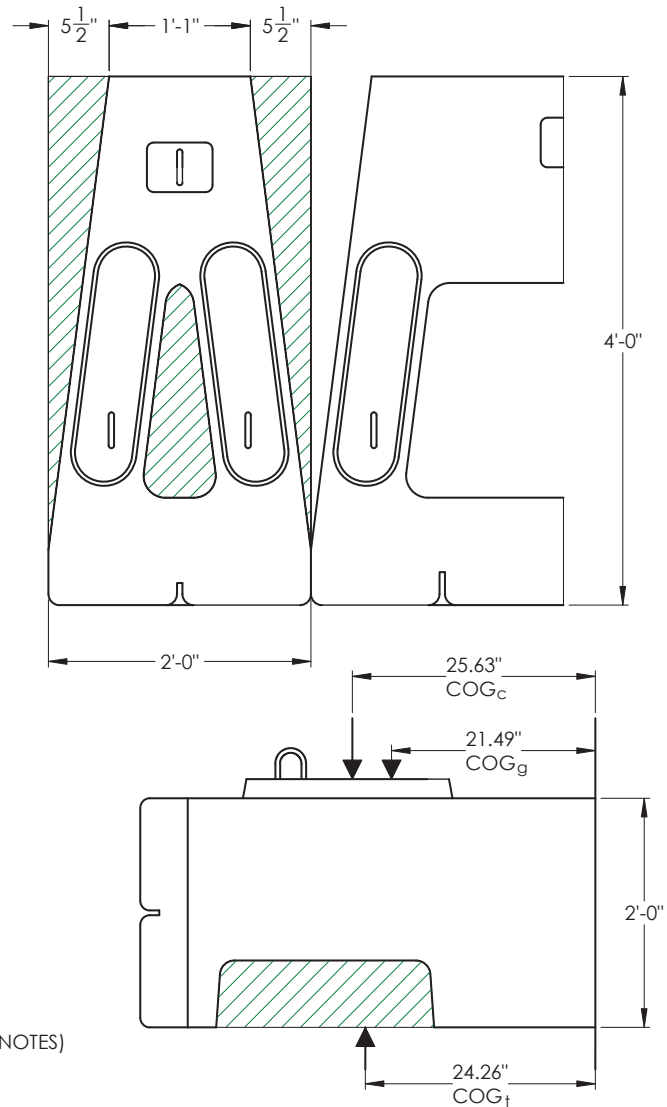
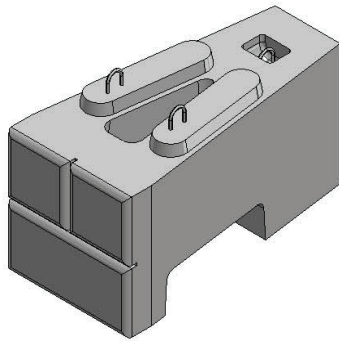
1 ROW OF HALF STEP BLOCKS



DRAWN BY	DATE
R FONTANESI	6/15/2015
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	

TITLE:	HALF STEP TOP ROW
DWG NO.	WD-23
SCALE: 1:30	SHEET 1 OF 1

## 48" HALF BLOCK MASS EXTENDER & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 9.80 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,392 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 25.63" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 6.20 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 682 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 21.49" (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 ( $\gamma_t$ ) = (1,392 lbs + 682 lbs) / 16 cft = 130 pcf  
 VOLUME ( $V_t$ ) = 9.80 cft + 6.20 cft = 16.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 2,074 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 24.26" (SEE NOTES)



DRAWN BY  
DAN BALLING

DATE  
11/25/2013

TITLE:  
48" HALF MASS EXTENDER

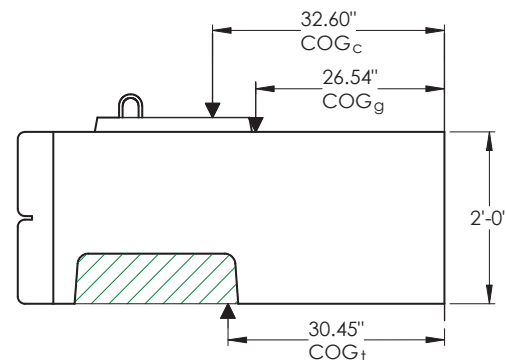
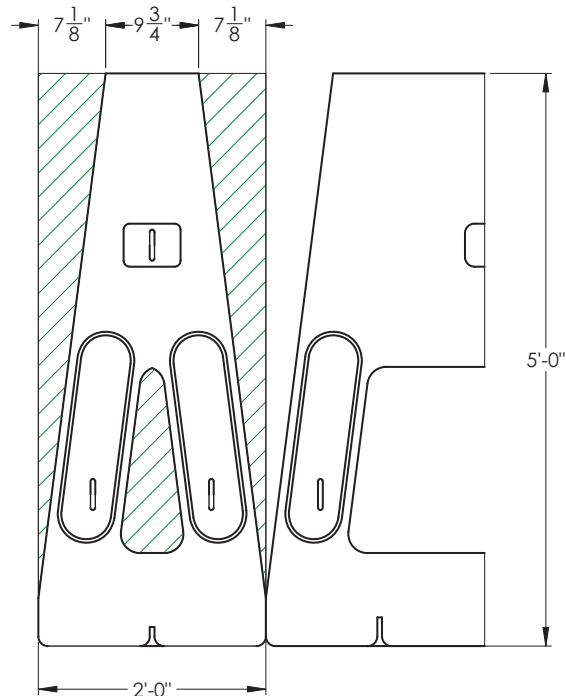
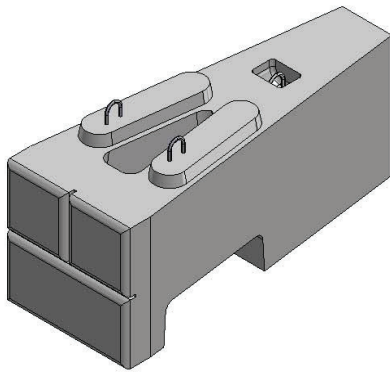
16500 SOUTH 500 WEST  
BLUFFDALE, UTAH 84065  
PHONE: (801) 571-2028

DWG NO.  
BD-08

SCALE: 1: 15

SHEET 1 OF 1

## 60" HALF BLOCK MASS EXTENDER & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 142 pcf  
 VOLUME ( $V_c$ ) = 11.70 cft  
 BLOCK WEIGHT ( $W_c$ ) = 1,661 lbs  
 CENTER OF GRAVITY ( $COG_c$ ) = 32.60" (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 110 pcf  
 VOLUME ( $V_g$ ) = 8.30 cft  
 GRAVEL INFILL WEIGHT ( $W_g$ ) = 913 lbs  
 CENTER OF GRAVITY ( $COG_g$ ) = 26.54" (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 ( $\gamma_t$ ) = (1,661 lbs + 913 lbs) / 20 cft = 129 pcf  
 VOLUME ( $V_t$ ) = 11.70 cft + 8.30 cft = 20.00 cft  
 TOTAL UNIT WEIGHT ( $W_t$ ) = 2,574 lbs  
 CENTER OF GRAVITY ( $COG_t$ ) = 30.45" (SEE NOTES)



DRAWN BY  
DAN BALLING

DATE  
11/25/2013

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

TITLE:  
60" HALF MASS EXTENDER

DWG NO.  
BD-09

SCALE: 1: 20

SHEET 1 OF 1

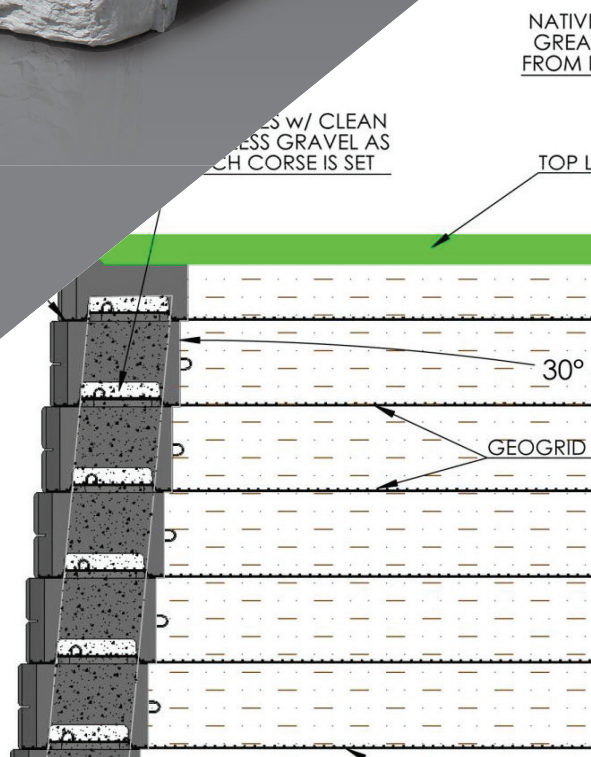


# Design Manual: Reinforced Wall

## Section 3



[www.verti-block.com](http://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

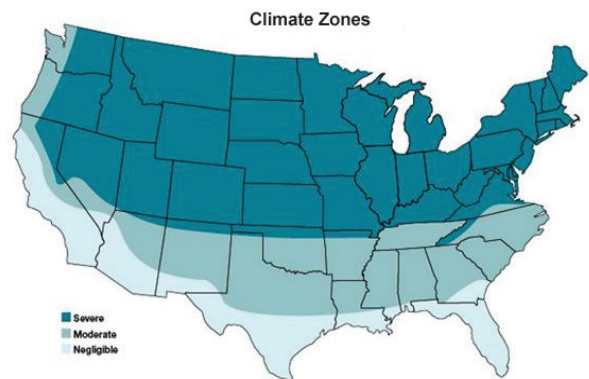
### 2.1 WALL UNITS

- 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

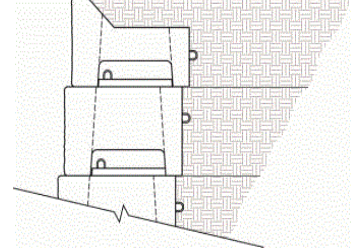
- A. The contractor is responsible to ensure that all installation and materials meet the quality specified in the construction drawings.
- B. The contractor shall verify that installation is in accordance with the specifications and construction drawings.

#### 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

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



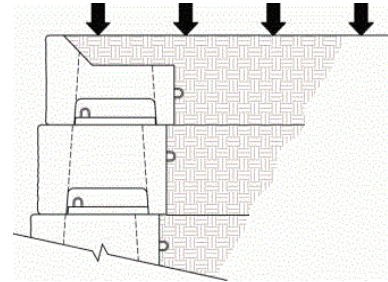
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L	None									
8'	0.5'	0.5'	VP	GT	L	None									
10'	0.5'	0.5'	VP	GT	L	None									
12'	0.57'	0.5'	VP	GT	L	2	4	6							
						200	200	200							
						8.5	8.5	8.5							
14'	0.67'	0.5'	VP	GT	L	2	4	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

The above chart was prepared by Verti-Crete, LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however Verti-Crete, LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer, using the actual conditions of the proposed site.

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

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



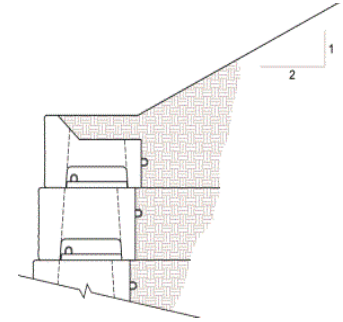
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
6'	0.5'	0.5'	VP GT L	None											
8'	0.5'	0.5'	VP GT L	2 200 7.9	4 200 7.9										
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

<b>Soil Type</b>	Silty Soil
<b>Load Condition</b>	2:1 Sloping Backfill / No Surcharge
<b>Internal Angle of Friction</b>	$\geq 30^\circ$
<b>Suggested Geogrid</b>	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			
6'	0.5'	0.5'	VP GT L	None											
8'	0.5'	0.5'	VP GT L	2 200 8.6	4 200 8.6										
10'	0.5'	0.5'	VP GT L	2 500 9.5	4 500 9.5										
12'	0.6'	0.5'	VP GT L	2 500 11.1	4 500 11.1	6 500 11.1									
14'	0.6'	0.5'	VP GT L	2 500 13.0	4 500 13.0	6 500 13.0	8 500 13.0								
16'	0.6'	0.5'	VP GT L	2 500 15.0	4 500 15.0	6 500 15.0	8 500 15.0	10 500 15.0							
18'	0.6'	0.5'	VP GT L	2 500 17.0	4 500 17.0	6 500 17.0	8 500 17.0	10 500 17.0	12 500 17.0						
20'	0.6'	0.5'	VP GT L	2 600 19.0	4 600 19.0	6 600 19.0	8 600 19.0	10 600 19.0	12 600 19.0	14 600 19.0					
22'	0.6'	0.5'	VP GT L	2 600 21.0	4 600 21.0	6 600 21.0	8 600 21.0	10 600 21.0	12 600 21.0	14 600 21.0	16 600 21.0				
24'	0.6'	0.5'	VP GT L	2 600 23.0	4 600 23.0	6 600 23.0	8 600 23.0	10 600 23.0	12 600 23.0	14 600 23.0	16 600 23.0	18 600 23.0			

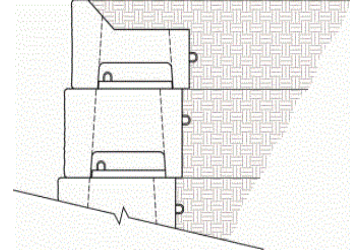
The above chart was prepared by Verti-Crete, LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however Verti-Crete, LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer, using the actual conditions of the proposed site.

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

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



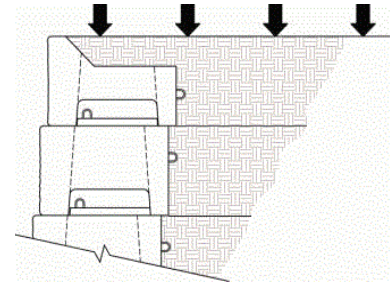
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet													
			VP GT L	None												
10'	0.5'	0.5'	VP GT L	None												
12'	0.5'	0.5'	VP GT L	None												
14'	0.67'	0.5'	VP GT L	2 200 8.4	4 200 8.4	6 200 8.4										
16'	0.76'	0.5'	VP GT L	2 500 9.8	4 500 9.8	6 500 9.8										
18'	0.86'	0.5'	VP GT L	2 500 10.8	4 500 10.8	6 500 10.8	8 500 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								
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							
24'	1.14'	0.5'	VP GT L	2 500 14.5	4 500 14.5	6 500 14.5	8 500 14.5	10 500 14.5	12 500 14.5	14 500 14.5						
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					
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				
30'	1.4'	0.5'	VP GT L	2 600 18	4 600 18	6 600 18	8 600 18	10 600 18	12 600 18	14 600 18	16 600 18	18 600 18	20 600 18			
30' +			VP GT L	Heights above 30 feet are achievable. Please contact your Verti-Block dealer for more details												

The above chart was prepared by Verti-Crete, LLC for estimating and conceptual design purposes only. All information is believed to be true and accurate; however Verti-Crete, LLC assumes no responsibility for the use of these design charts for actual construction. Determination of the suitability of each chart is the sole responsibility of the user. Final designs for construction purposes must be performed by a registered Professional Engineer, using the actual conditions of the proposed site.

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

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



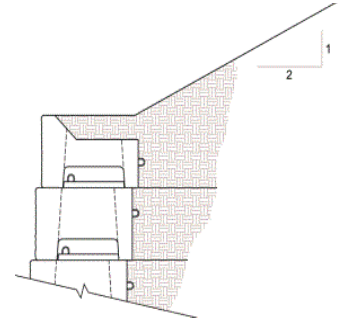
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
8'	0.5'	0.5'	VP GT L	None											
10'	0.5'	0.5'	VP GT L	2 200 6.8	4 200 6.8										
12'	0.57'	0.5'	VP GT L	2 200 7.9	4 200 7.9	6 200 7.9									
14'	0.67'	0.5'	VP GT L	2 500 9	4 500 9	6 500 9	8 500 9								
16'	0.76'	0.5'	VP GT L	2 500 9.6	4 500 9.6	6 500 9.6	8 500 9.6								
18'	0.86'	0.5'	VP GT L	2 500 10.8	4 500 10.8	6 500 10.8	8 500 10.8	10 500 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'	1.25'	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	2 600 16.8	4 600 16.8	6 600 16.8	8 600 16.8	10 600 16.8	12 600 16.8	14 600 16.8	16 600 16.8	18 600 16.8	20 600 16.8		
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

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



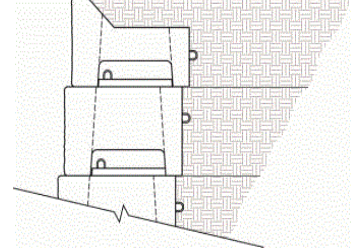
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
8'	0.5'	0.5'	VP GT L	None											
10'	0.5'	0.5'	VP GT L	None											
10'	0.5'	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

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



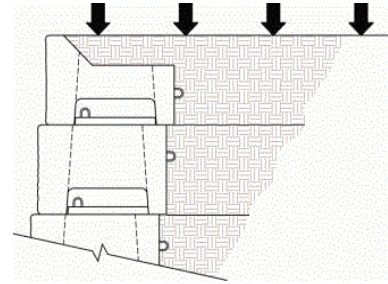
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
14'	0.5'	0.5'	VP	None											
16'	0.76'	0.5'	VP	2	4	6	8								
			GT	200	200	200	200								
			L	9.6	9.6	9.6	9.6								
18'	0.86'	0.5'	VP	2	4	6	8	10							
			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 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

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



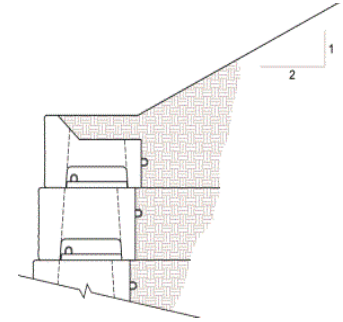
Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block VP – Geogrid Verticle Placement GT – Geogrid Type (Strata 200, 500, 600) L – Geogrid Length in Feet												
			VP GT L	None											
10'	0.5'	0.5'	VP GT L	None											
12'	0.57'	0.5'	VP GT L	2 200 7.2	4 200 7.2	6 200 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

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

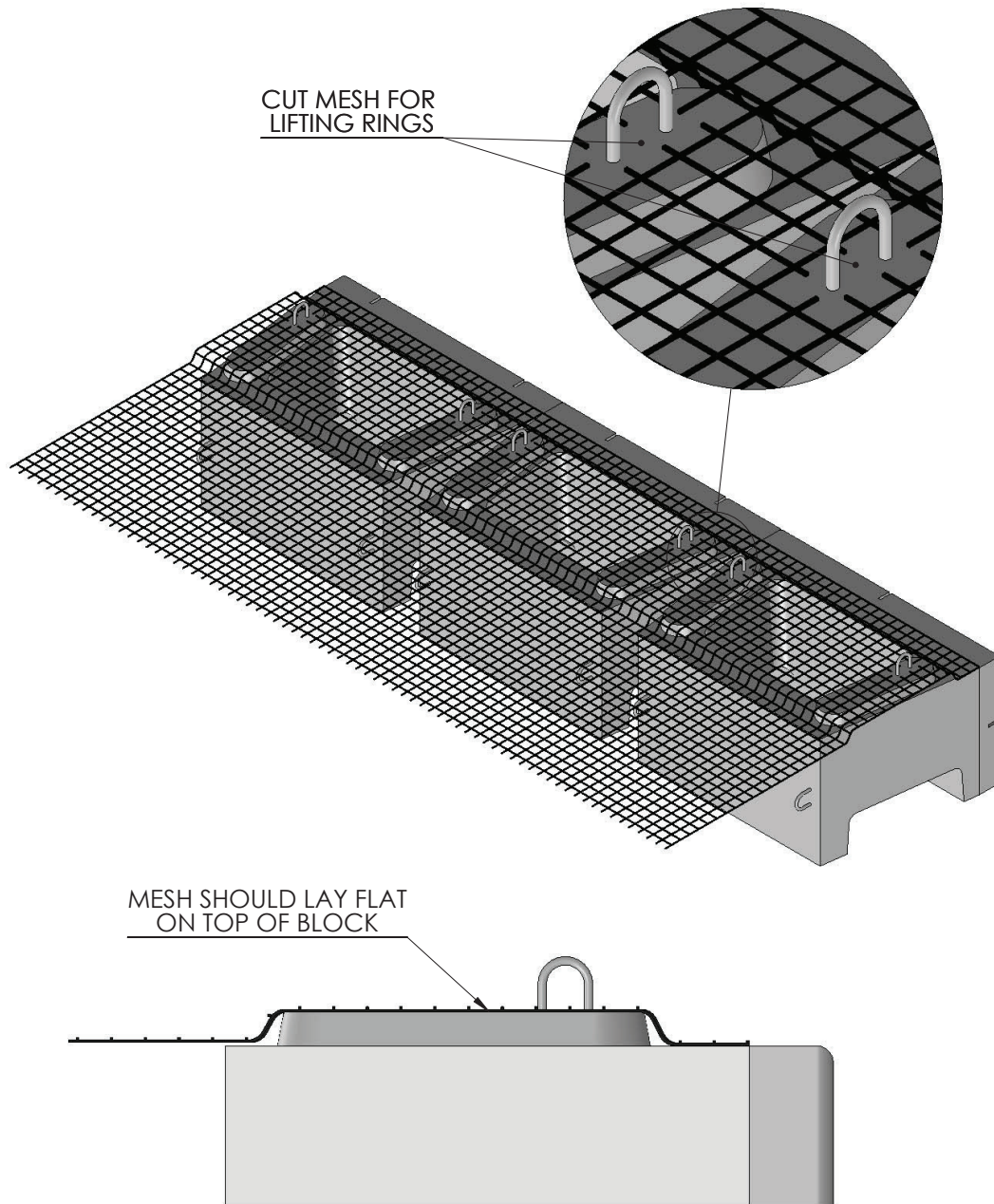


Wall Height	Bury Depth	Level Pad	Dimensions measured in feet from face of block												
			VP	GT	L – Geogrid Length in Feet										
12'	0.5'	0.5'	VP	None											
14'	0.67'	0.5'	VP	2	4	6	8								
			GT	200	200	200	200								
			L	8.9	8.9	8.9	8.9								
16'	0.76'	0.5'	VP	2	4	6									
			GT	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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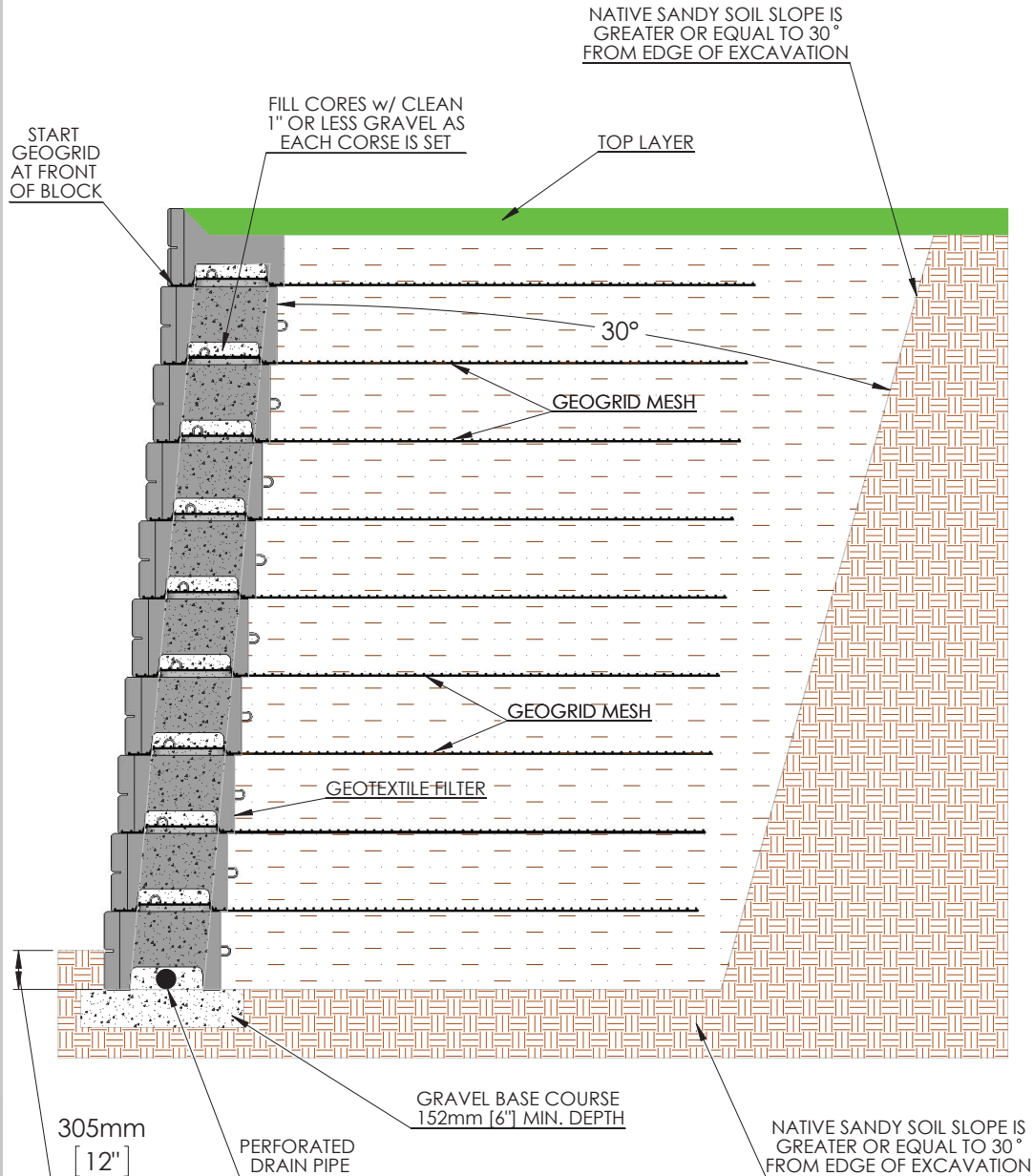
Notes: Unit weight of soil is 120 psf. Minimum factors of safety are sliding: 1.5, overturning: 1.5, and bearing: 2.0. Wall design shall address both internal and external drainage and shall be evaluated by the professional engineer responsible for final design. Backfill material to be compacted to 95% 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.

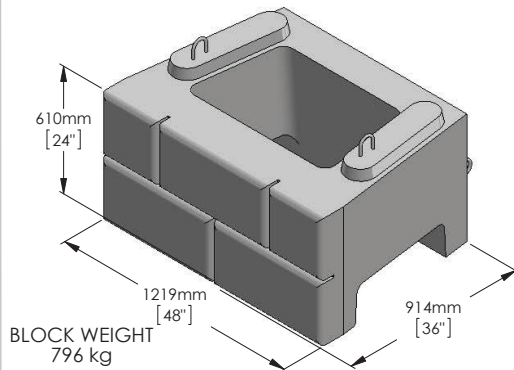
M-03M

SCALE: 1: 42

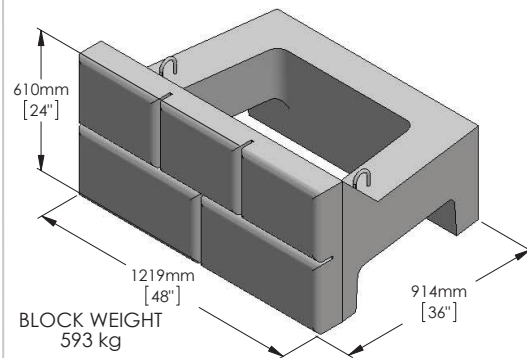
SHEET 1 OF 1

# 900 BLOCK SERIES

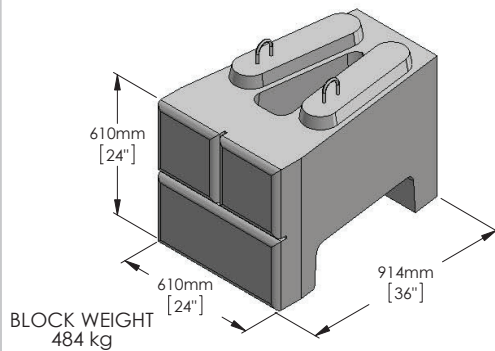
STANDARD BLOCK



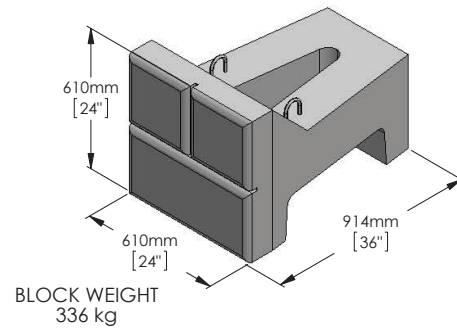
STANDARD TOP BLOCK



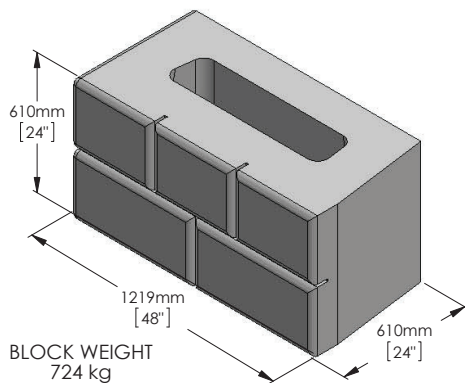
HALF BLOCK



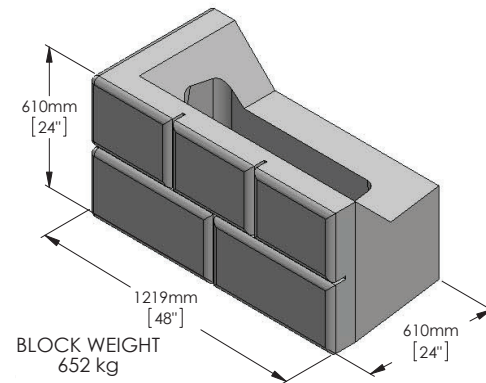
HALF TOP BLOCK



CORNER BLOCK



CORNER TOP BLOCK



DRAWN BY  
R FONTANESI  
DATE  
4/13/2015  
16500 SOUTH 500 WEST  
BLUFFDALE, UTAH 84065  
PHONE: (801) 571-2028

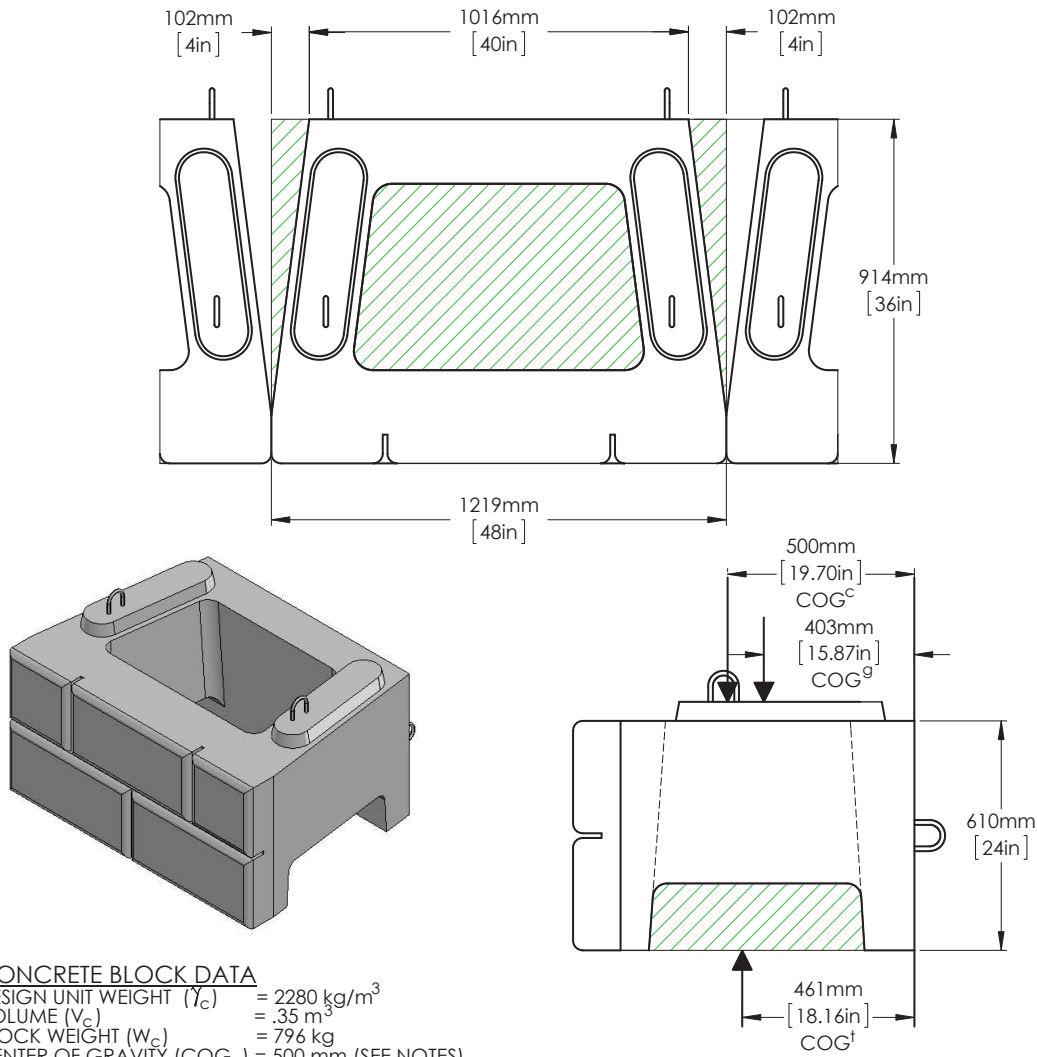
TITLE:  
900 BLOCK SERIES

DWG NO.  
BD-01M

SCALE: 1: 20

SHEET 1 OF 1

## 600 STANDARD BLOCK & GRAVEL INFILL



### CONCRETE BLOCK DATA

DESIGN UNIT WEIGHT ( $\gamma_c$ ) = 2280 kg/m<sup>3</sup>  
 VOLUME ( $V_c$ ) = .35 m<sup>3</sup>  
 BLOCK WEIGHT ( $W_c$ ) = 796 kg  
 CENTER OF GRAVITY ( $COG_c$ ) = 500 mm (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 1760 kg/m<sup>3</sup>  
 VOLUME ( $V_g$ ) = .33 m<sup>3</sup>  
 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

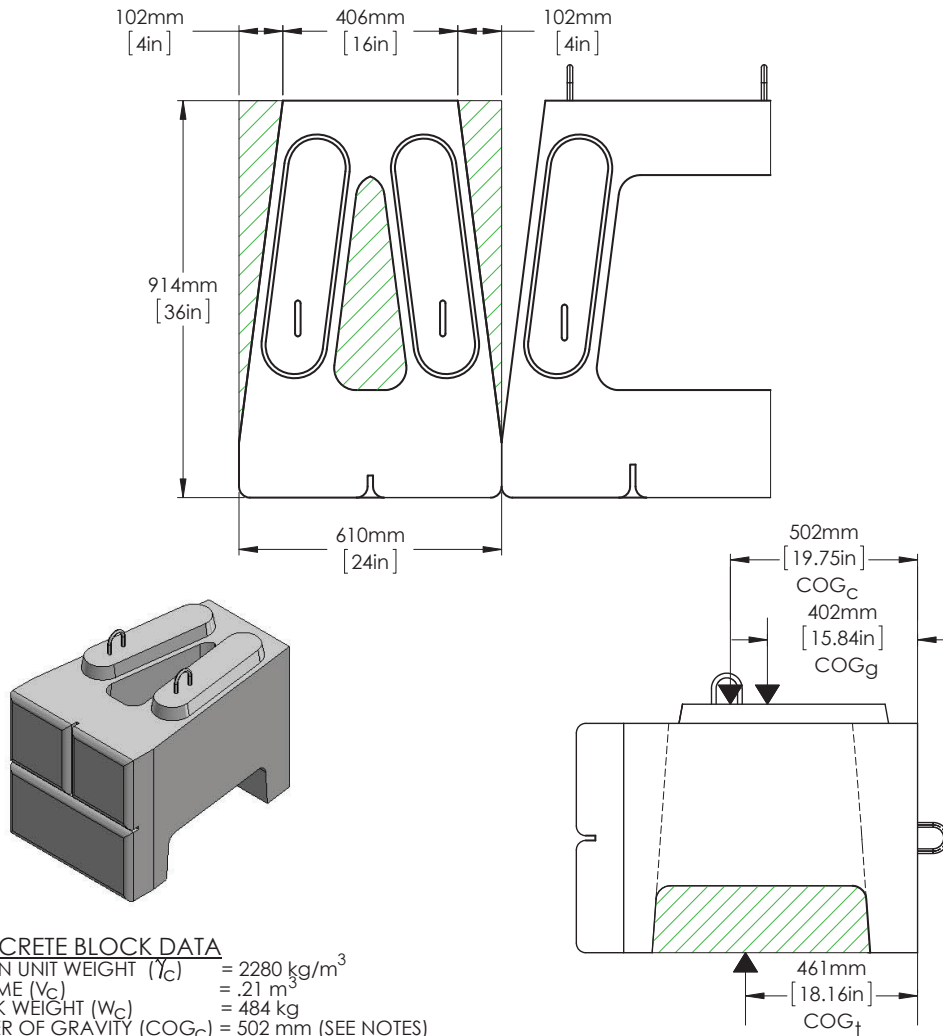
### COMBINED UNIT DATA

DESIGN UNIT WEIGHT ( $\gamma_t$ ) = (796 lbs + 580 lbs) / .68 m<sup>3</sup> = 2020 kg/m<sup>3</sup>  
 VOLUME ( $V_t$ ) = .35 m<sup>3</sup> + .33 m<sup>3</sup> = .68 m<sup>3</sup>  
 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 ( $\gamma_c$ ) = 2280 kg/m<sup>3</sup>  
 VOLUME ( $V_c$ ) = .21 m<sup>3</sup>  
 BLOCK WEIGHT ( $W_c$ ) = 484 kg  
 CENTER OF GRAVITY ( $COG_c$ ) = 502 mm (SEE NOTES)

### GRAVEL INFILL DATA

DESIGN UNIT WEIGHT ( $\gamma_g$ ) = 1760 kg/m<sup>3</sup>  
 VOLUME ( $V_g$ ) = .13 m<sup>3</sup>  
 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

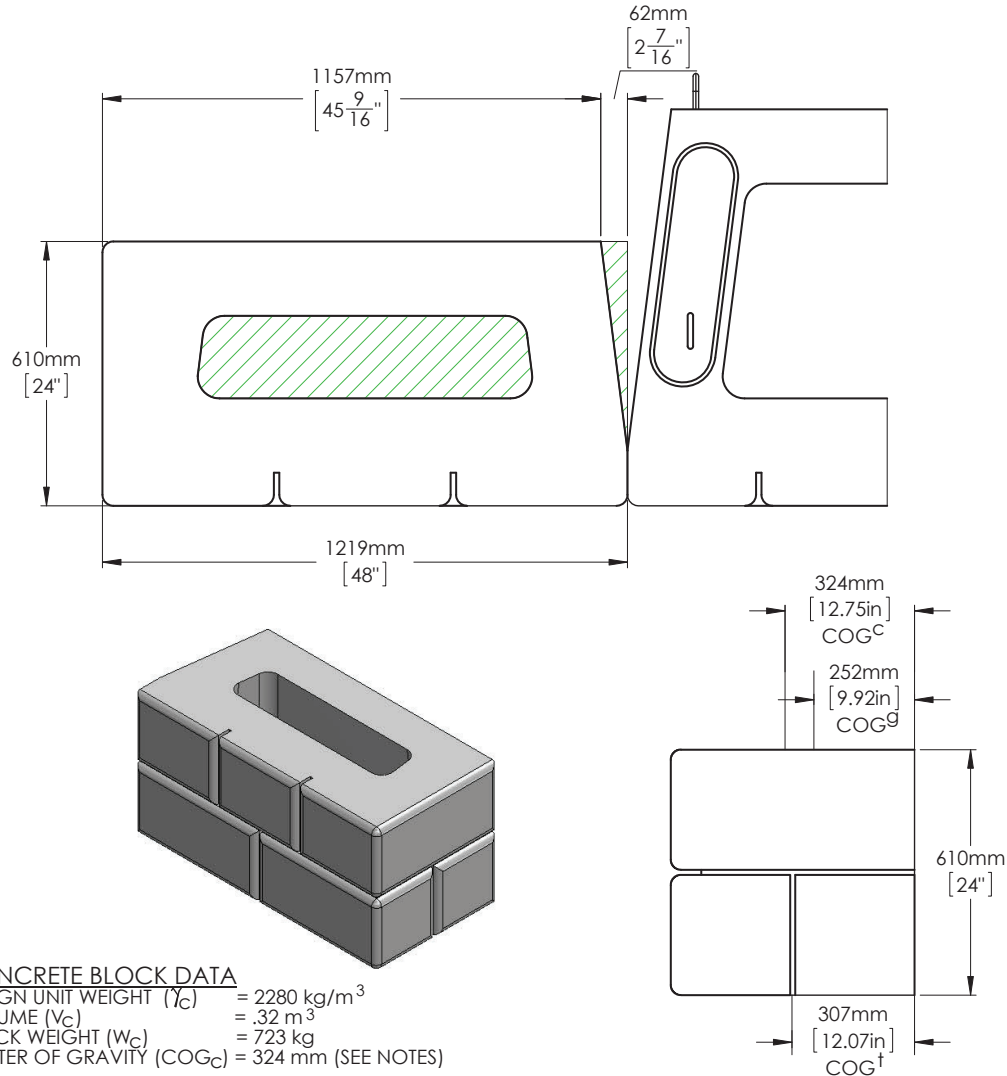
### COMBINED UNIT DATA

DESIGN UNIT WEIGHT ( $\gamma_t$ ) = (484 kg + 224 kg) / .34 m = 2080 kg/m<sup>3</sup>  
 VOLUME ( $V_t$ ) = .21 m<sup>3</sup> + .13 m<sup>3</sup> = .34 m<sup>3</sup>  
 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

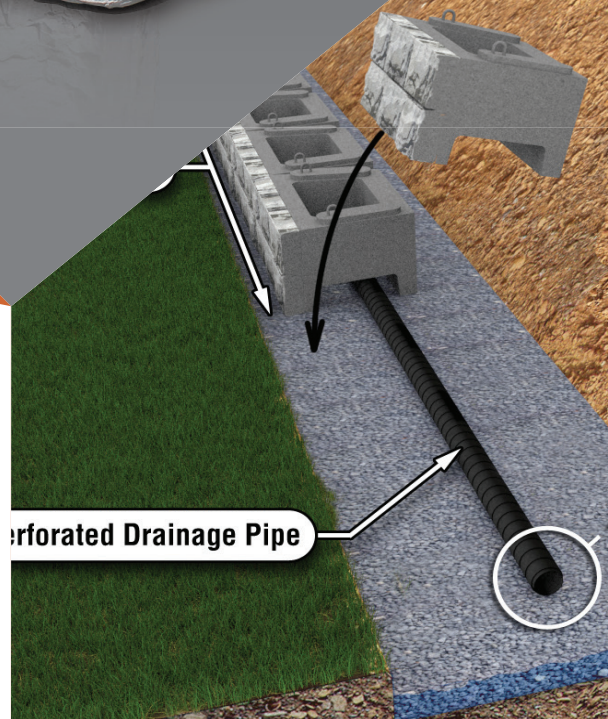


# Design Manual: Installation

## Section 4



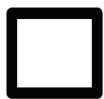
[www.verti-block.com](http://www.verti-block.com)



## Installation Setup

This installation manual is designed to provide general information and assist in the proper techniques required to build Verti-Block™ walls. The manual covers the basics of wall construction and contains many of the details encountered in site work. Before you start construction, take the time to complete necessary planning and preparation. This process will help ensure a safe, efficient, and quality installation. Proper planning will also help avoid costly mistakes.

### Checklist



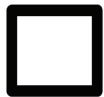
#### **SAFETY**

Safety should always be your primary concern. Verti-Block™ walls must be installed following proper procedures to ensure work site safety and the integrity of the wall. All local, state, and federal safety regulations must be followed.



#### **ENGINEERING AND PERMITS**

Obtain necessary engineering approvals and permits for your project. Your local building department is an excellent resource to help determine the requirements for your project. Note: This installation manual is intended to supplement a detailed, site-specific wall design prepared for your project by a professional engineer. The construction documents for your project will supersede any recommendations presented in this manual.



#### **REVIEW THE PROJECT PLANS**

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



#### **CONSTRUCTION PLANNING**

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



#### **UTILITY LOCATION**

Make sure to have underground utilities located and marked on the ground before starting any construction. In the United States, call 8-1-1 or go online to [www.call811.com](http://www.call811.com) to schedule utility marking for your project site.




#### **MATERIAL STAGING**

Store blocks in a location close to the proposed wall. Blocks should be kept clean and mud free. Blocks should be stored in a location which will minimize the amount of handling on the project site. Store geogrid in a clean, dry location close to the proposed wall. Keep the geogrid covered or in the shade and avoid exposure to direct sunlight. Be careful where you stockpile excavation and backfill material. Do not stockpile soils over buried utility lines which could be damaged by the extra weight.

## Equipment and Supplies

Make sure you have the proper equipment to handle Verti-Blocks and install the wall. Standard Verti-Blocks weigh 1755 lbs (790 Kg.) Mass Extenders can weigh up to 3642 lbs (1639 Kg.) each. Make sure excavators and other construction equipment are properly sized to handle the terrain and each Verti-Block. The following tools are recommended, but should not be limited to this list. Site conditions may require other equipment, tools and materials.

### Earth Handling Equipment







Item	Quantity	Description
	Per Project Requirements	Skid Steer / Excavator / Mini Excavator

### Block Handling Equipment

Item	Quantity	Description
	Per Project Requirements	Skid Steer / Excavator / Mini Excavator
	Per Project Requirements	Telehandler / Crane




\* Always follow safe use and rigging procedures when handling the blocks for Verti-Block forms

## Tools and Equipment

Item	Quantity	Description
	1	Laser Level
	1 of Each	10 Foot Level / 4 Foot Level
	Various	Shovels
	1	Compactor
	Various	Brooms
	2 Sets	Block Lifting Chains



## Tools and Equipment

Item	Quantity	Description
 <p><b>BURKE</b></p> <p>Length 58"</p>	1	Burke Pry Bar
	Various	Marking Paint
	1	Concrete Saw (if required)
	Various	Personal Protective Equipment

## MATERIALS

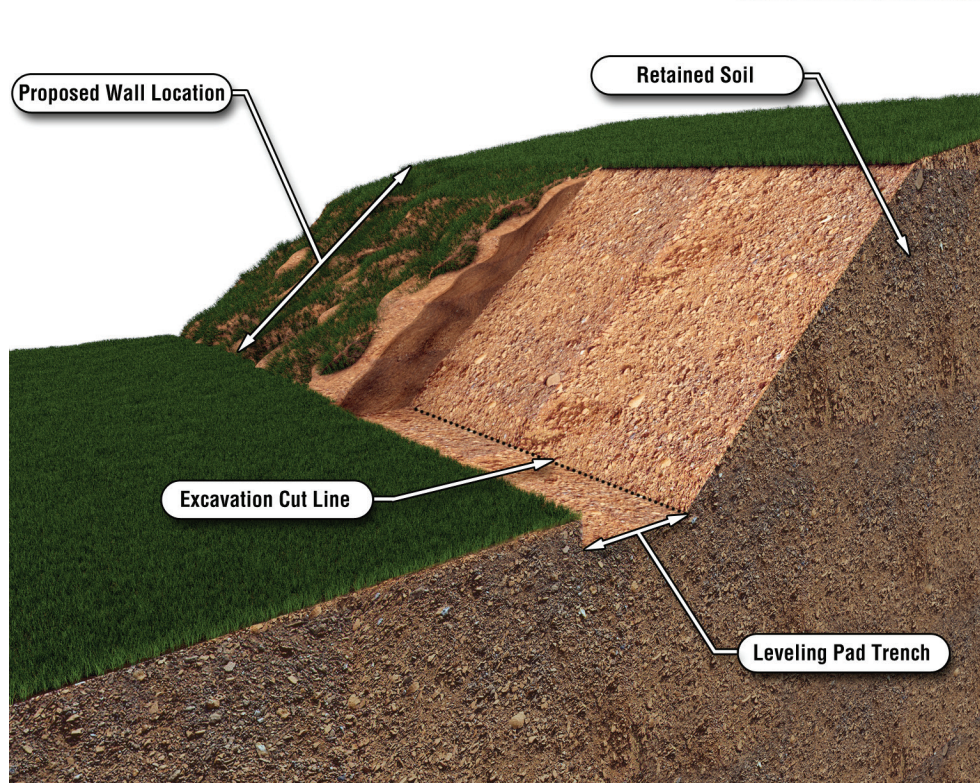
- Wall Base Material (Crushed Stone)
- Unit Fill Material (Crushed Stone)
- Perforated Drain Pipe
- Geotextile Filter Fabric (if required)
- Hand Rail (if required)

## SITE PREPARATION

- Review the approved site plan to confirm lot lines, wall location, length and elevations
- Schedule preconstruction meeting
- Verify the on-site soil conditions
- Call the local utility companies to confirm the location of underground utilities
- Obtain all necessary building permits
- Confirm drainage to avoid erosion or buildup of water behind the wall

## Excavation

### Step 1



- Excavate and prepare leveling pad trench 6" (or 12" if necessary) below the first course
- Normal trench burial depth is 6" to 12"

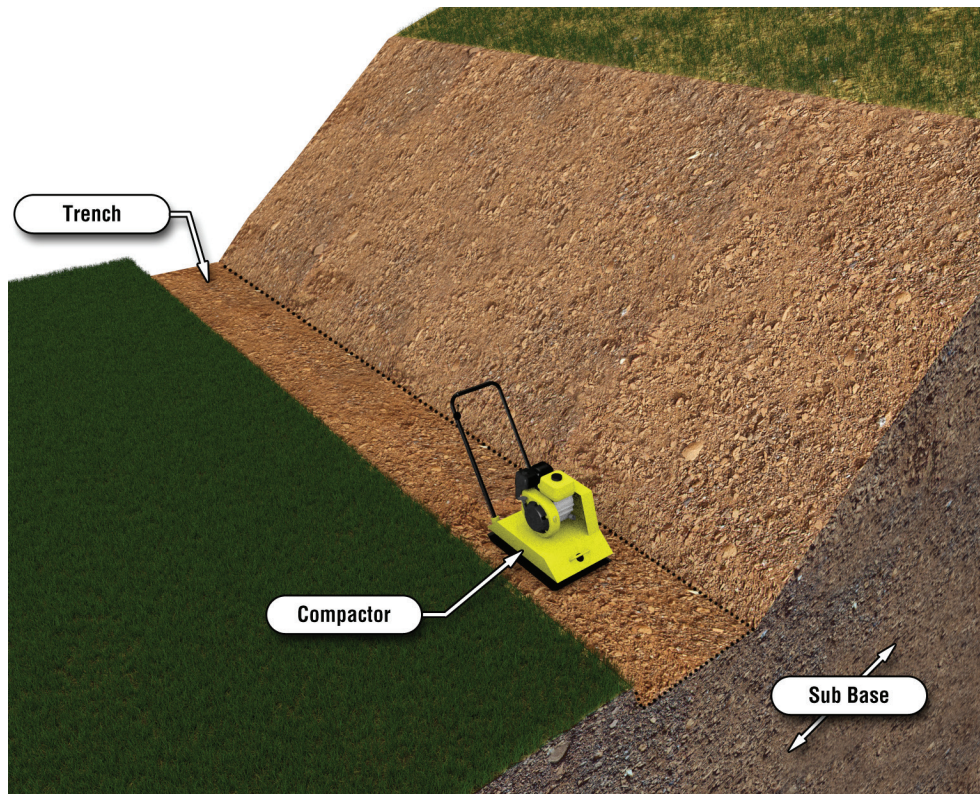
Lay out the location and length of the wall. If possible, always start the wall base at the lowest elevation of the wall. Set wall elevations using a laser level and stakes prior to excavating. Excavate as required for installation of the retaining wall system. Use caution not to over-excavate beyond depth needed for the foundation. Slope or shore excavation as necessary for safety and for conformance with applicable OSHA requirements.





## Foundation Preparation

### Step 2



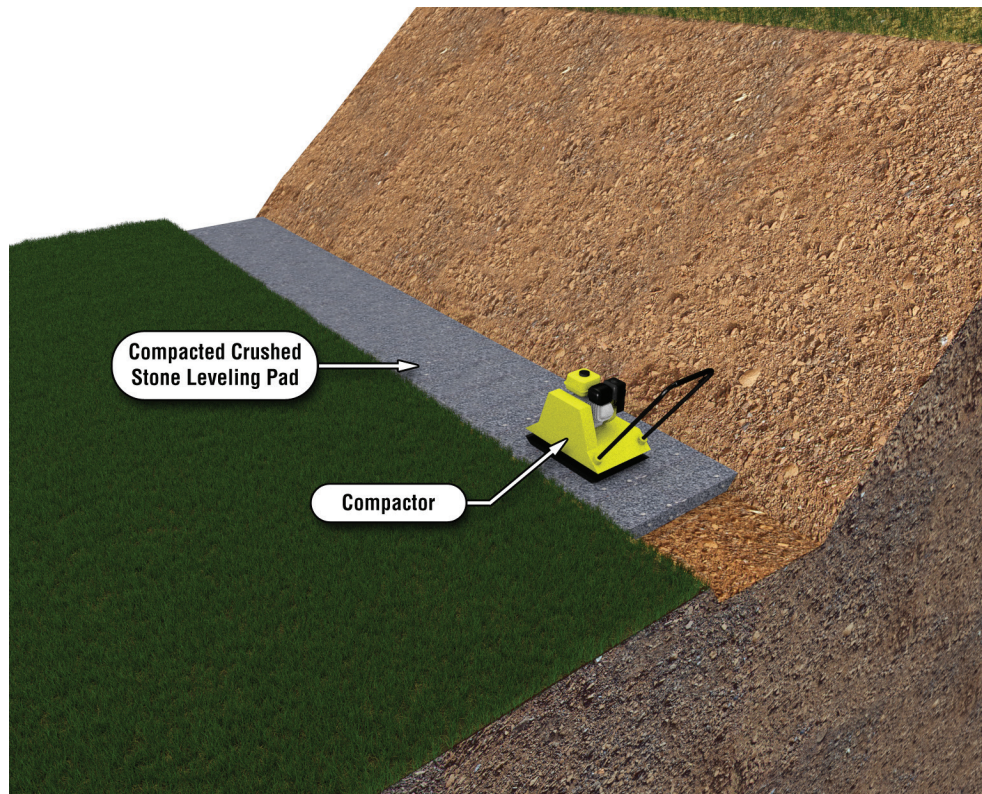
- Compact Sub Base to 95% Standard Proctor Density or greater
- Remove any poor soils in the Sub Base and replace with proper fill materials before compacting

Foundation soils shall be excavated as required by the plan specifications. Foundation soil should be observed by a Geotechnical Engineer to confirm that the bearing soils are similar to the design conditions or assumptions. Foundation soil shall be proof rolled and compacted a minimum of 95 percent of the maximum dry density (ASTM D 698, Standard Proctor) and inspected by the Owner's Engineer prior to placement of leveling pad materials. The contractor shall replace any unsuitable soils discovered during excavation at the direction of the engineer.



## Leveling Pad Construction

### Step 3



- Compact crushed stone leveling pad to 95% Standard Proctor Density or greater
- Ensure pad is level and smooth to allow proper placement of blocks

Construct the wall base to the lines and grades shown on the plans. The base is most often constructed using crushed stone. However, you may construct the base from concrete if desired. The choice of which type of leveling pad to use is made by the wall designer and depends on several factors including the bearing capacity of the native soil, location of the drain outlet and conditions at the base of the wall.

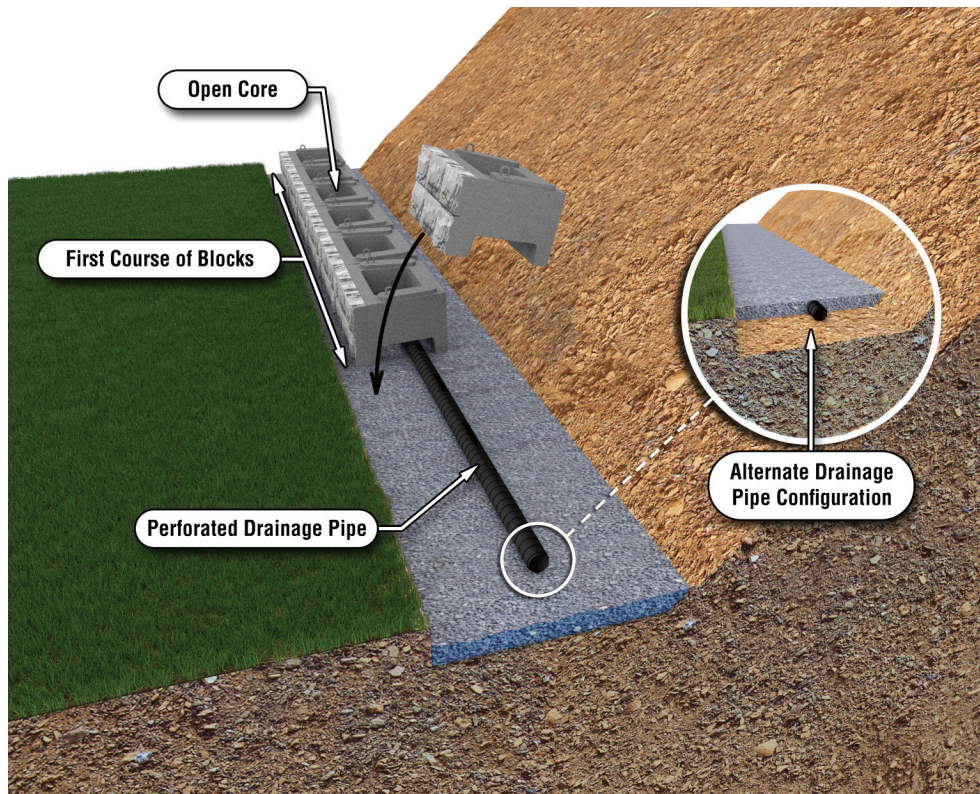
Construct base with the material and to the dimensions shown on the plans. Over excavated areas shall be filled with additional concrete or crushed stone material. Wall base shall consist of concrete with a minimum 28-day compressive strength of 3,000 psi, or a dense graded crushed stone. A minimum of 75% of coarse material shall have 2 or more fractured faces.

Compact the leveling pad to provide a hard and level surface to support the Verti-Block™ unit. Leveling pad material shall be compacted to a minimum of 95 percent of the maximum dry density (ASTM D 698, Standard Proctor). Prepare and smooth the crushed stone to ensure complete contact of the first course with the wall base. The surface of leveling pad 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. It is important to ensure that the wall base has proper drainage. Consult with the engineer if added drainage is needed.



## Wall Unit Installation

### Step 4



#### First Course Procedure

- Lay perforated drain pipe in center of leveling pad
- Place first course of block directly on leveling pad over the drain pipe

Lay the perforated drain pipe in the center of the leveling pad so the blocks can be placed on top of the pipe.

Place the first course of Verti-Block™ units directly on the wall base. If possible, begin placing blocks at the lowest section of the wall. The unit shall be leveled side-to-side, front-to-rear and with adjacent unit. Ensure that each Verti-Block™ units are in full contact with the compacted leveling pad. The first course is the most important to ensure accurate and acceptable results.

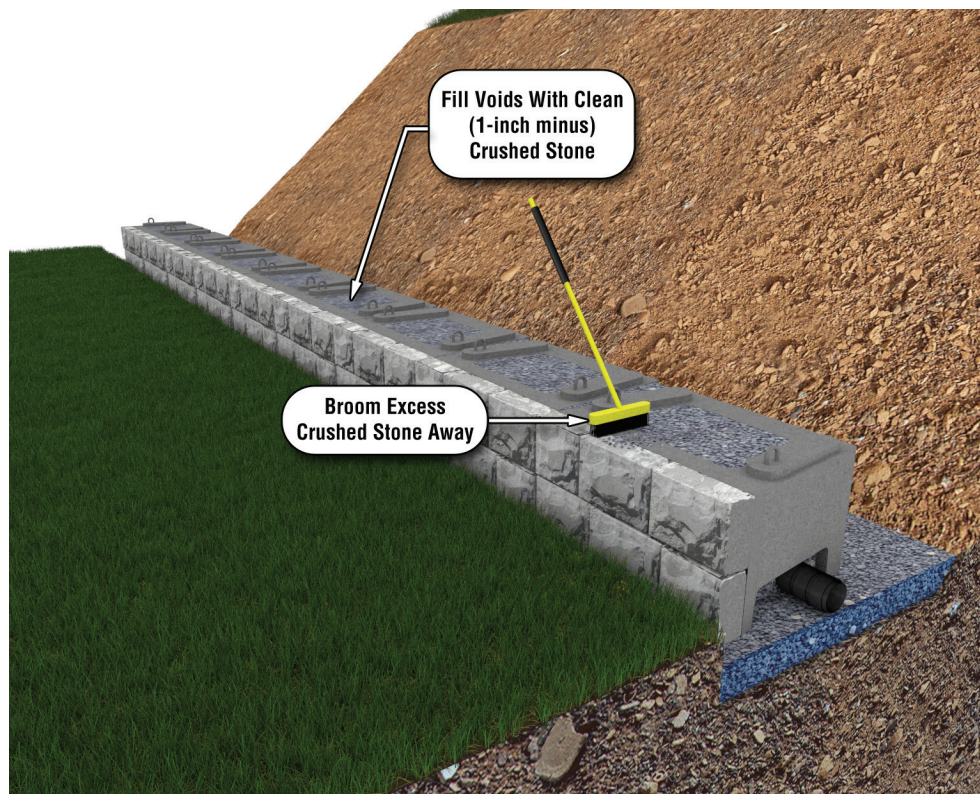
In some cases a mass extender may be used to achieve taller gravity walls. These units shall be installed in accordance with the plans.





## Wall Unit Installation

### Step 5



- Fill all voids with clean crushed stone
- Sweep off excess crushed stone in preparation for next course

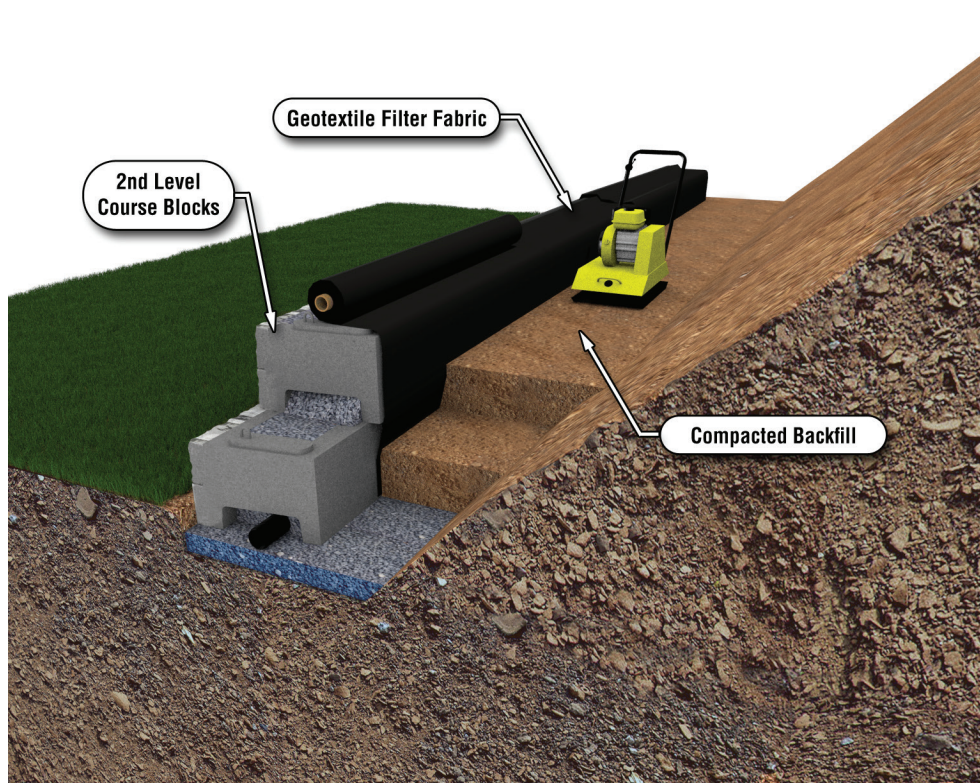
Fill all voids between and within the unit with granular unit fill. Unit fill shall consist of a screened crushed stone. A minimum of 75% of coarse material shall have 2 or more fractured faces.

When required, provide a geotextile filter fabric for separation from backfill at the tails of the unit. The geotextile shall be a needle punched non-woven fabric with a minimum grab tensile strength of 120 pounds according to ASTM D 4632. If used, the geotextile may cover the entire back face of the unit or may be cut in strips to cover the gaps between tail units with a minimum of 6 inches of overlap over the concrete tail on both sides.

**Drain Pipe Alternate Configuration:** Depending on the project, it may be an option to install the perforated drain pipe within the leveling pad. This is acceptable as long as the drain pipe is not damaged or crushed during the compaction process.

## Wall Unit Installation

### Step 6



- As required, place Geotextile filter fabric between blocks and compacted backfill
- Compact backfill behind blocks in lifts no more than 12" high
- Lay 2nd course of blocks on top of the 1st course
- Continue to fill voids with crushed stone for proper drainage

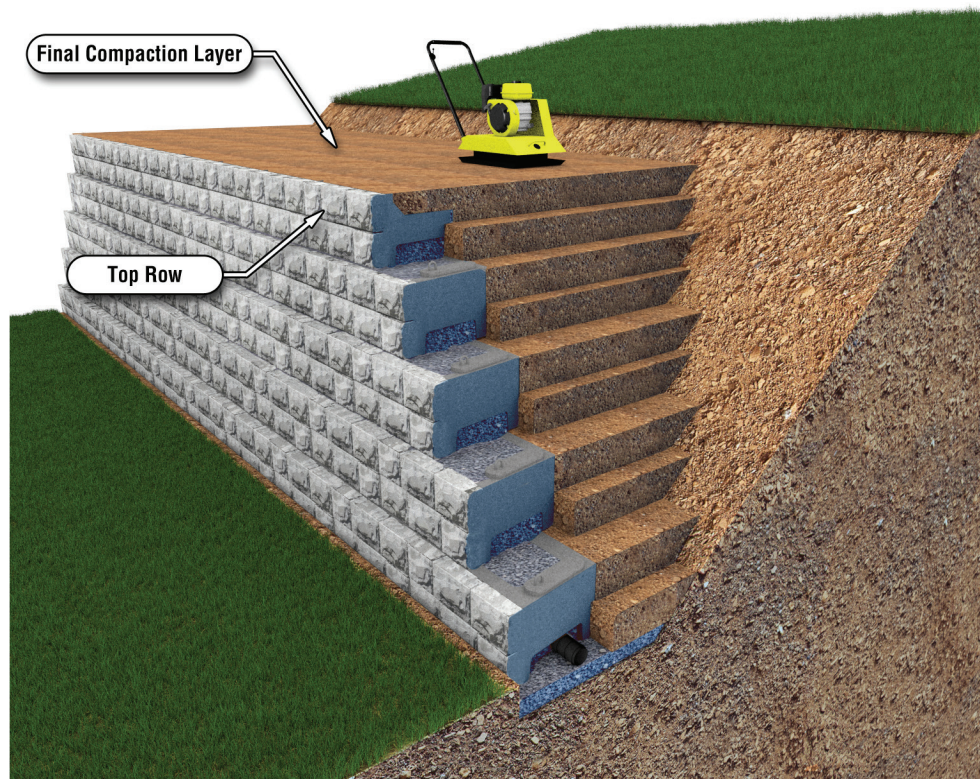
Remove all excess aggregate and other materials from the top of the unit before laying up the next course. Place the next course of blocks in running bond with the previous course. Place the female notch over the male spacing riser from the unit below, and pull the unit forward to contact the male riser. This alignment will produce a batter of 2 3/16 inches for every 24 inches of vertical wall height. Check each Verti-Block™ for level and alignment. The layout of radius and corners shall be installed in accordance with the plans or shop drawings.

Continue placing successive courses to the elevations shown on the plans. Construct wall in level stages, placing the unit at each course for the entire length of the wall, if possible. Unit fill and backfill should be placed to the level of the top of the facing unit before placing the next course. Provide temporary swales to divert runoff away from wall excavation and away from face during the construction phase. Complete the last course by installing the Verti-Block™ top unit. Place unit fill and backfill level with the back face of the unit.



## Backfill Placement and Compaction

### Step 7



- Continue compacting backfill material in lifts every 12" as subsequent block courses are placed
- Continue to lay block courses until the top row is completed

Place native soil backfill behind the unit in maximum loose lifts of 12 inches and compact. Backfill and compact behind the first course before installing other courses.

Compact all backfill to a minimum of 95 percent of the maximum dry density (ASTM D 698, Standard Proctor). For cohesive soils, the moisture content at the time of compaction should be adjusted to within -3 and +4 percent of optimum. Place backfill in successive lifts until level with the top of the facing unit. Additional unit fill is not required behind the unit, but may be placed for the convenience of the contractor.

All other backfill behind and in front of the wall shall consist of suitable on-site soil or imported borrow approved by the Geotechnical Engineer. Backfill shall generally consist of sands, silts, or lean clays with a liquid limit less than 45 and a plasticity index less than 20. Fat clay soils, cobbles, and large rock should generally be avoided unless approved by the Geotechnical Engineer based on local practices. Frozen soils, excessively wet or dry soils, debris, and deleterious materials should not be used.

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.



## Final Grade and Landscape

### Step 8



- Ensure 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

Once the final grade is completed both above and below the wall, landscaping should be installed to complete the aesthetic look to compliment the wall design and appearance. It is important to take precautions to protect planting soils from erosion that may occur during heavy rains or surface run off.

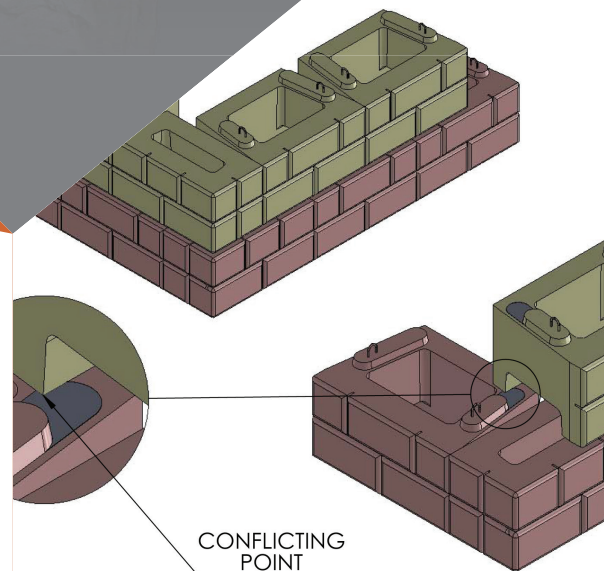


# Design Manual: Construction Drawings

## Section 5

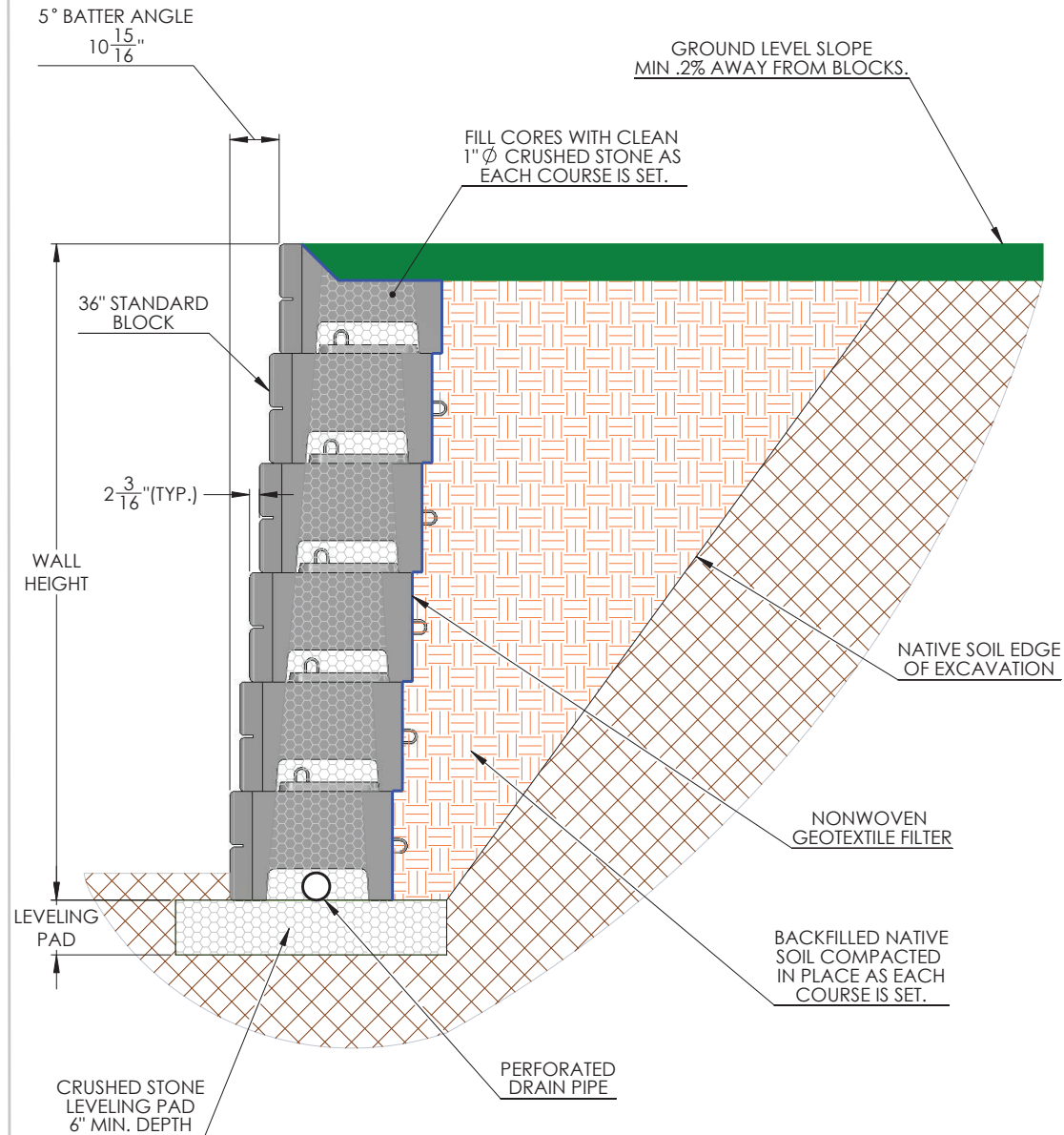


[www.verti-block.com](http://www.verti-block.com)



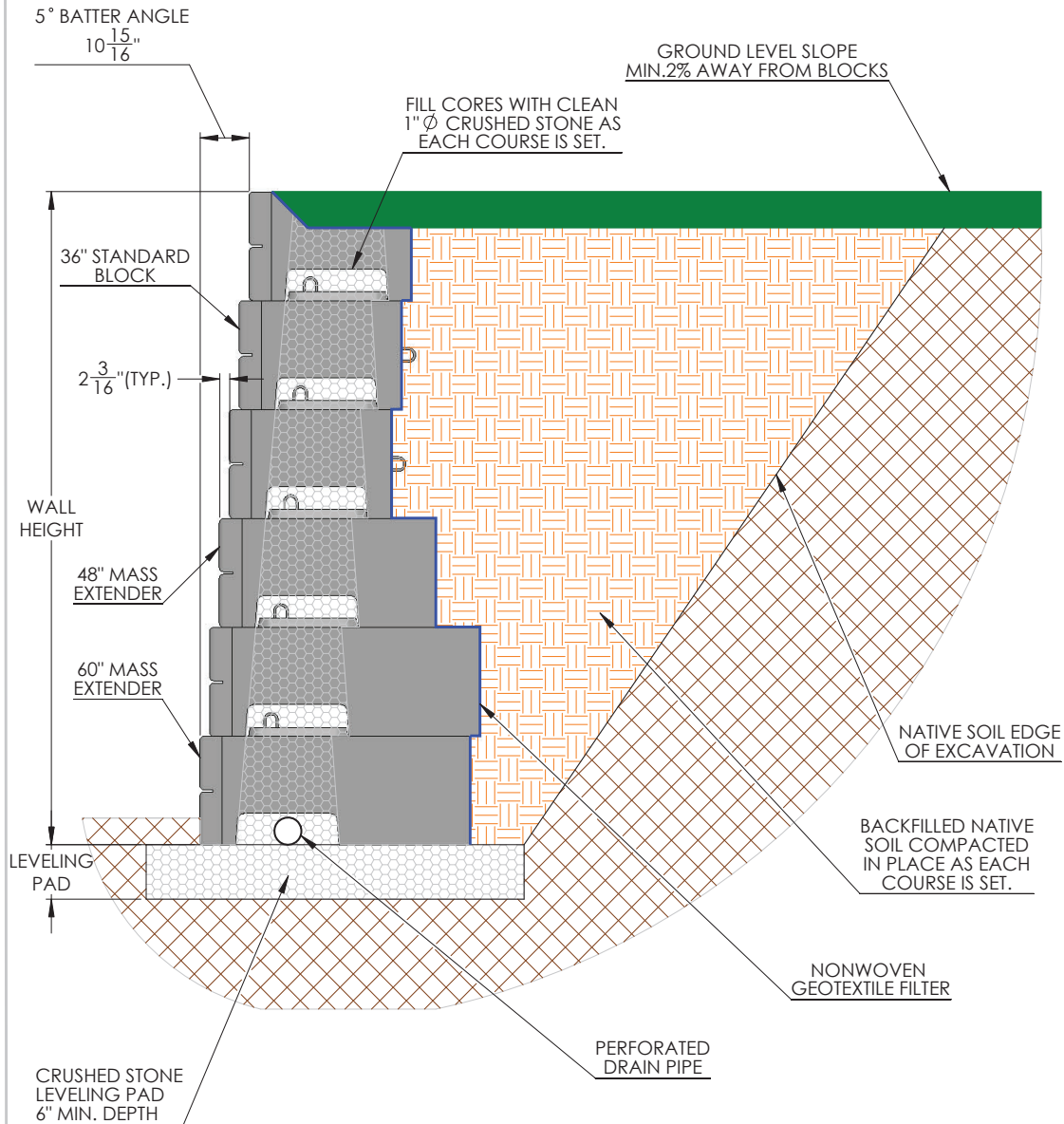


## TYPICAL GRAVITY WALL WITH 36" VERTI-BLOCK



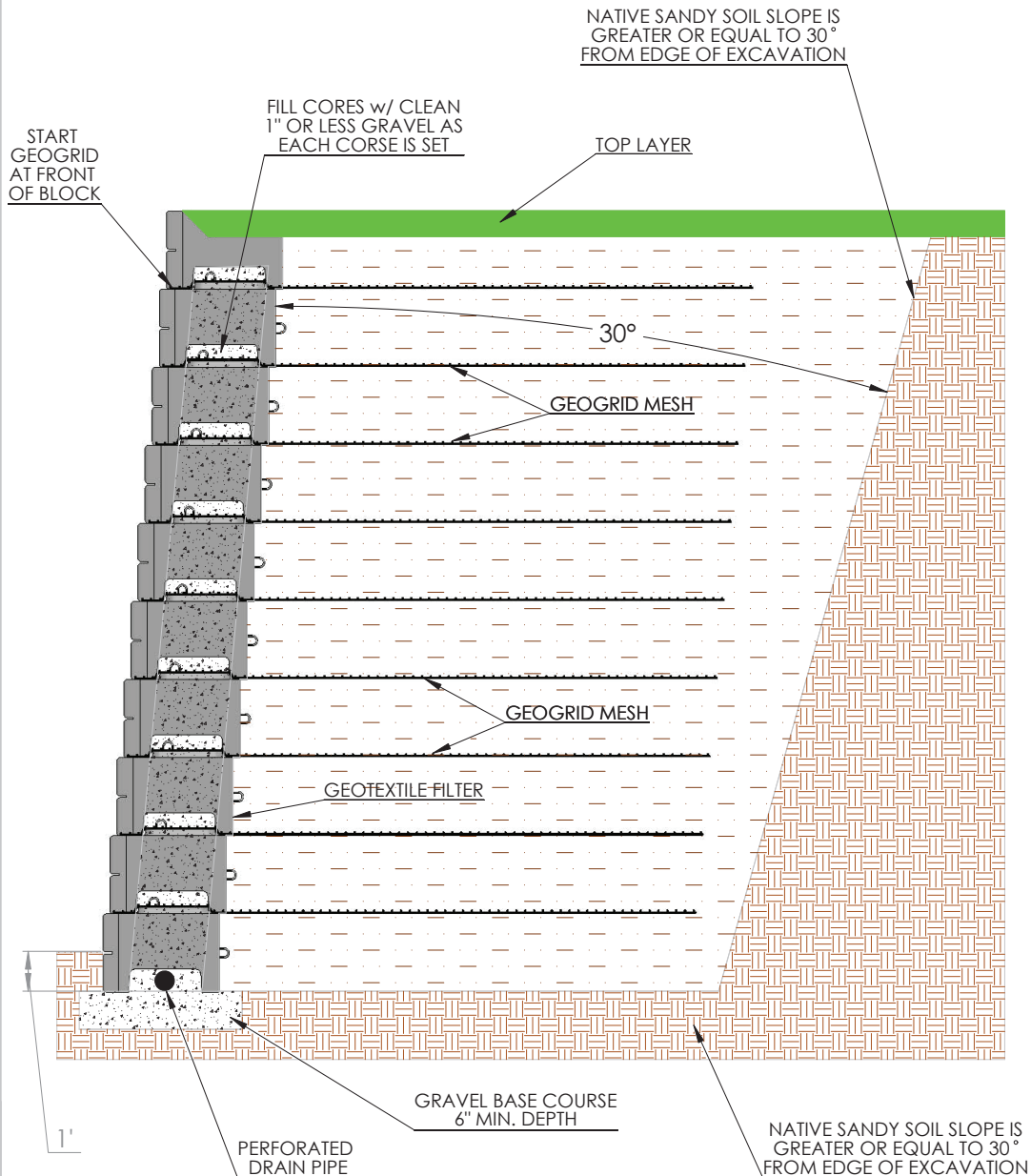
DRAWN BY	DATE	TITLE:
DAN BALLING	12/30/2013	12' RETAINING SECTION
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-14
SCALE: 1: 30		SHEET 1 OF 1

## TYPICAL GRAVITY WALL WITH VERTI-BLOCK MASS EXTENDERS



DRAWN BY	DATE	TITLE:
DAN BALLING	12/30/2013	12' SECTION W/ MASS EXTENDERS
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-15
SCALE: 1: 30		SHEET 1 OF 1

## 20' GEOGRID FRICTION CONNECTION



DRAWN BY	DATE
DAN BALLING	12/12/2013
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	

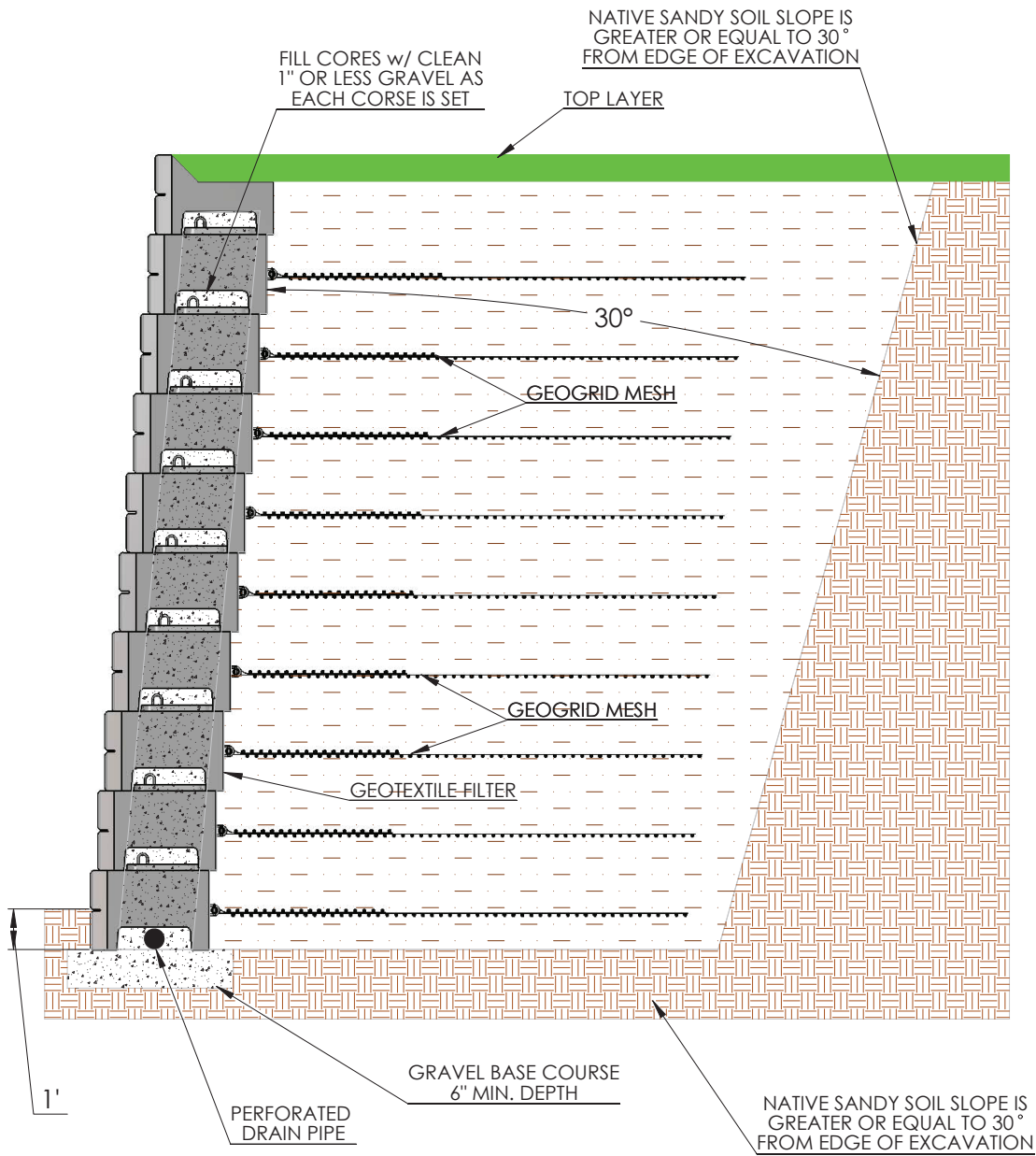
TITLE: 20' FRICTION DETAIL

DWG NO. M-03

SCALE: 1: 42

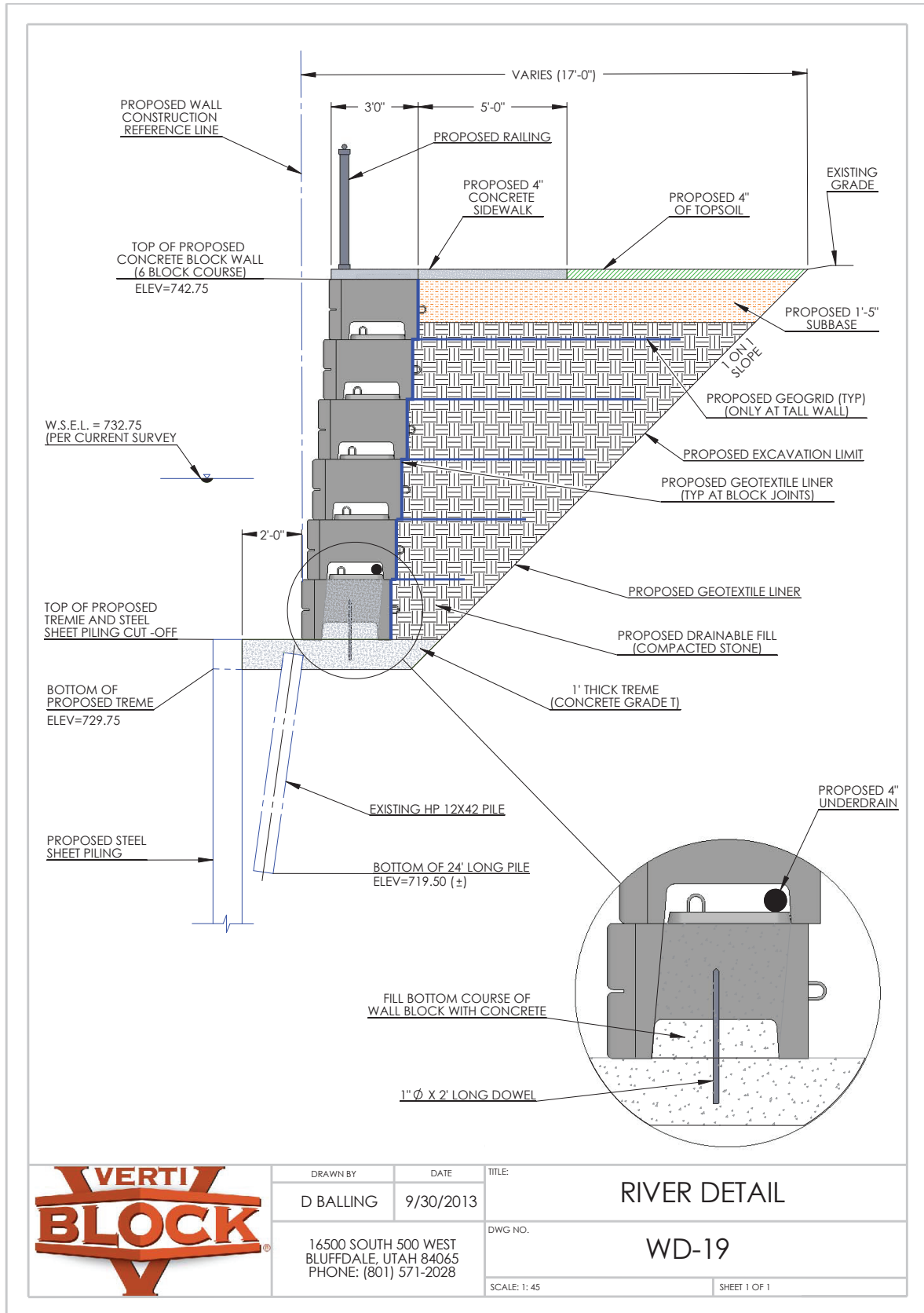
SHEET 1 OF 1

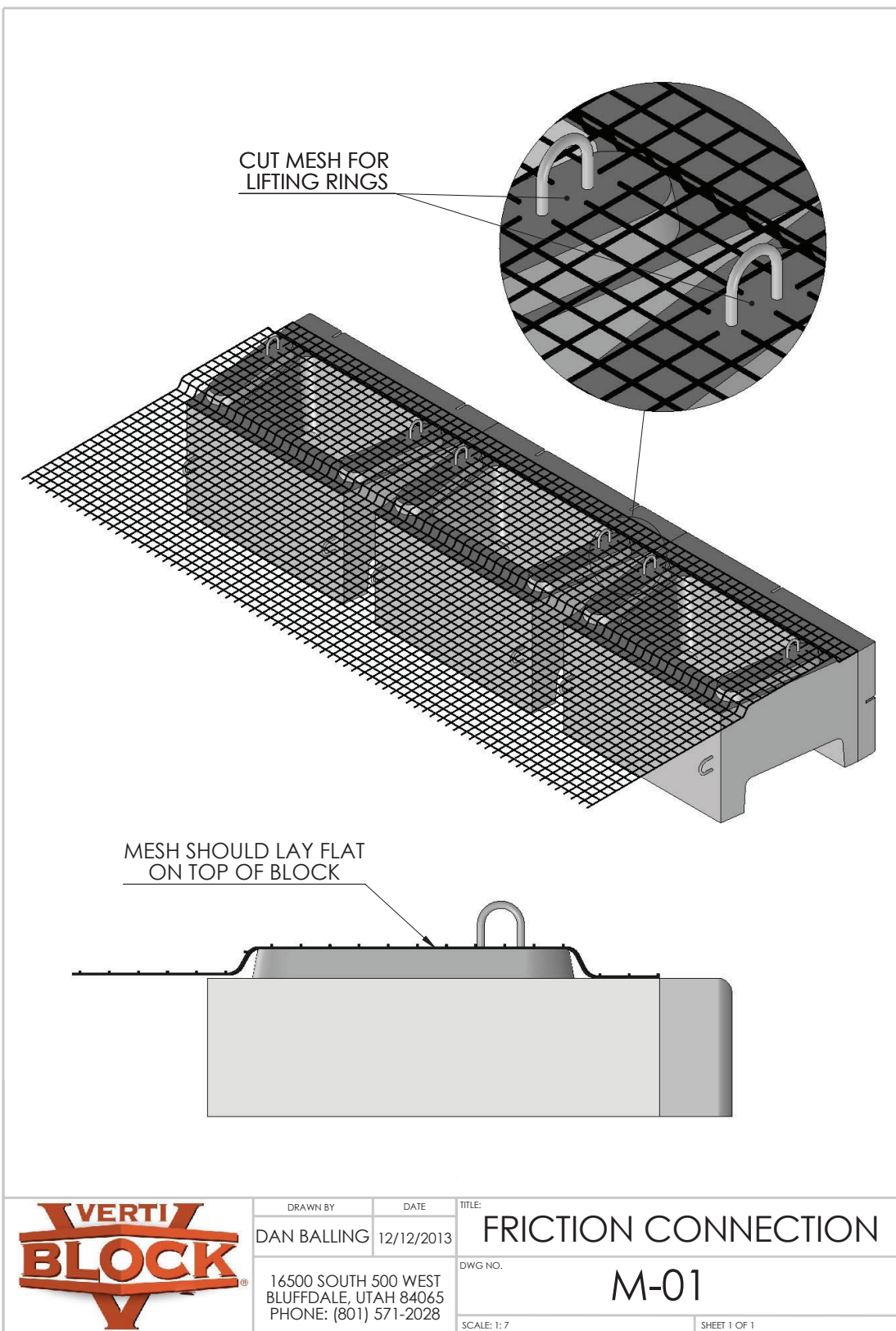
## 20' GEOGRID POSITIVE CONNECTION

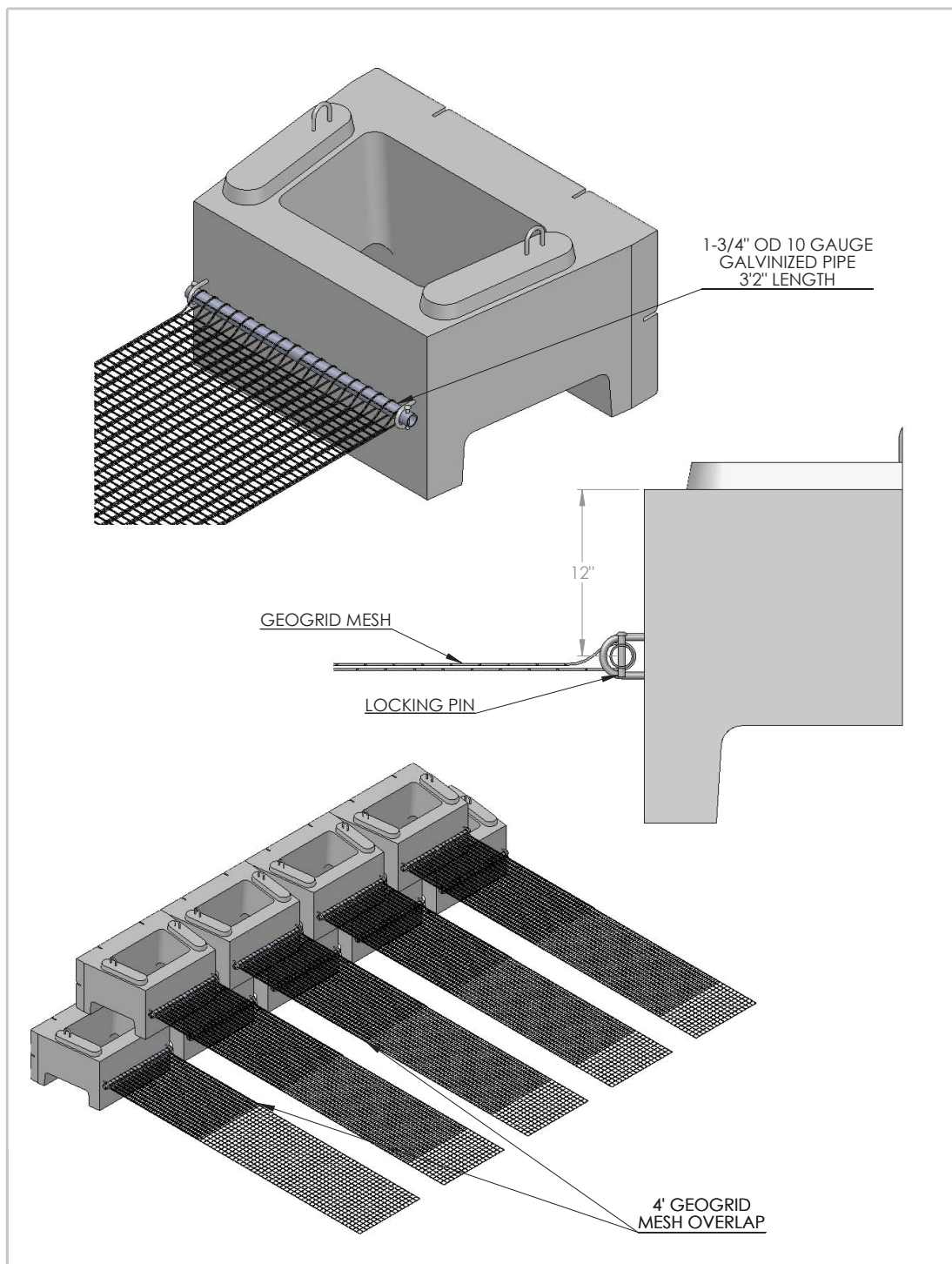


DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	20' POSITIVE CONNECTION
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		M-04
SCALE: 1: 15		SHEET 1 OF 1



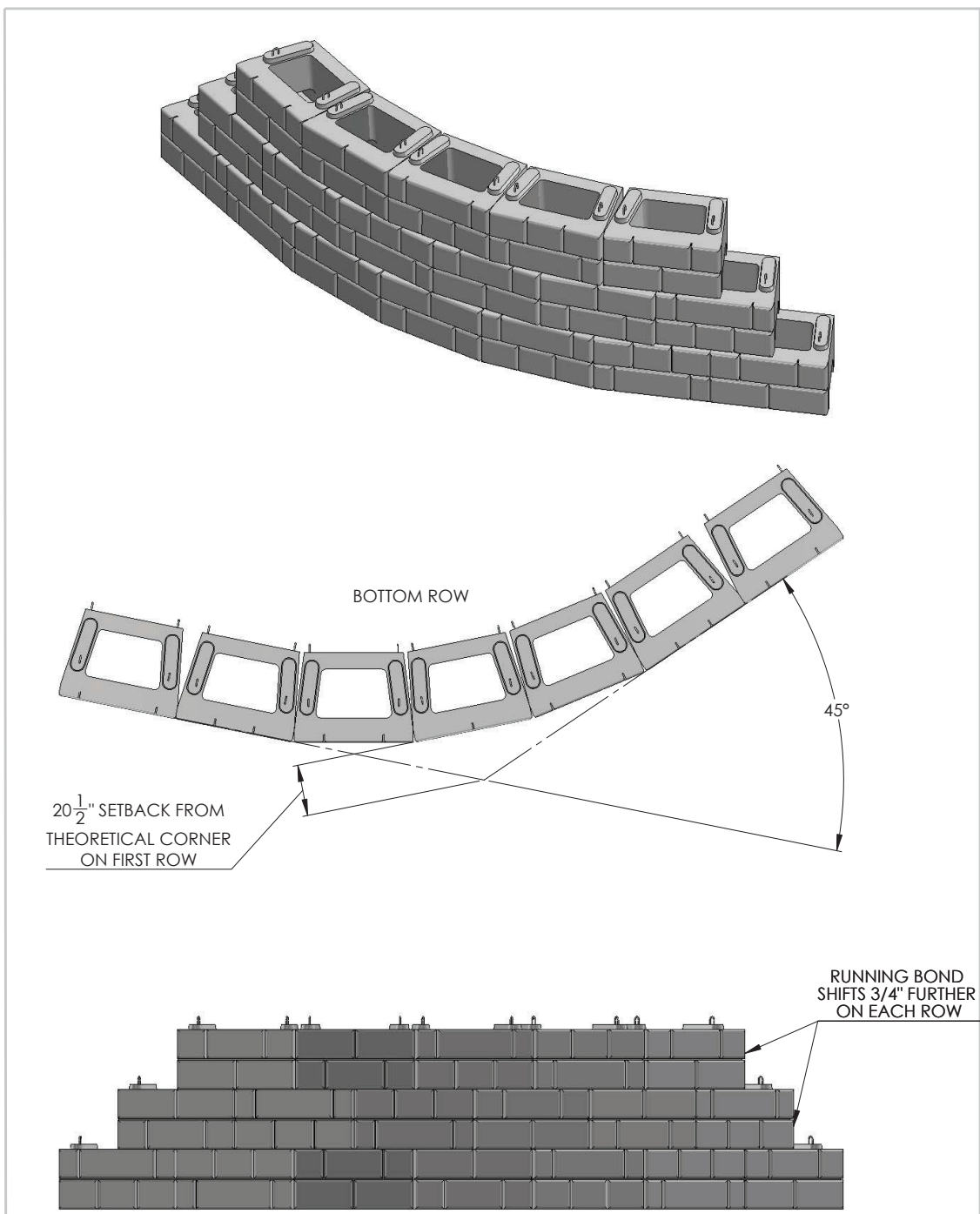







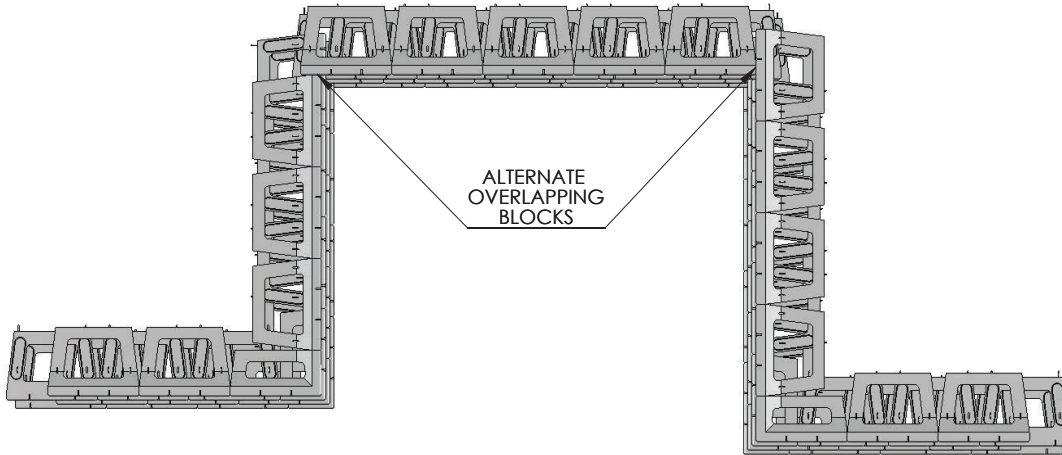
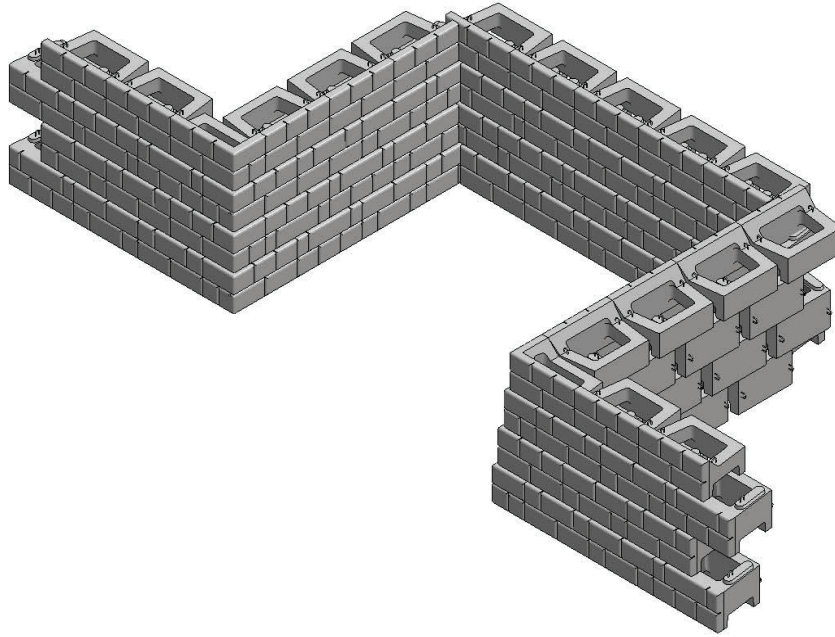
DRAWN BY	DATE
DAN BALLING	12/12/2013
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	

TITLE:	POSITIVE CONNECTION
DWG NO.	M-02
SCALE: 1: 15	SHEET 1 OF 1

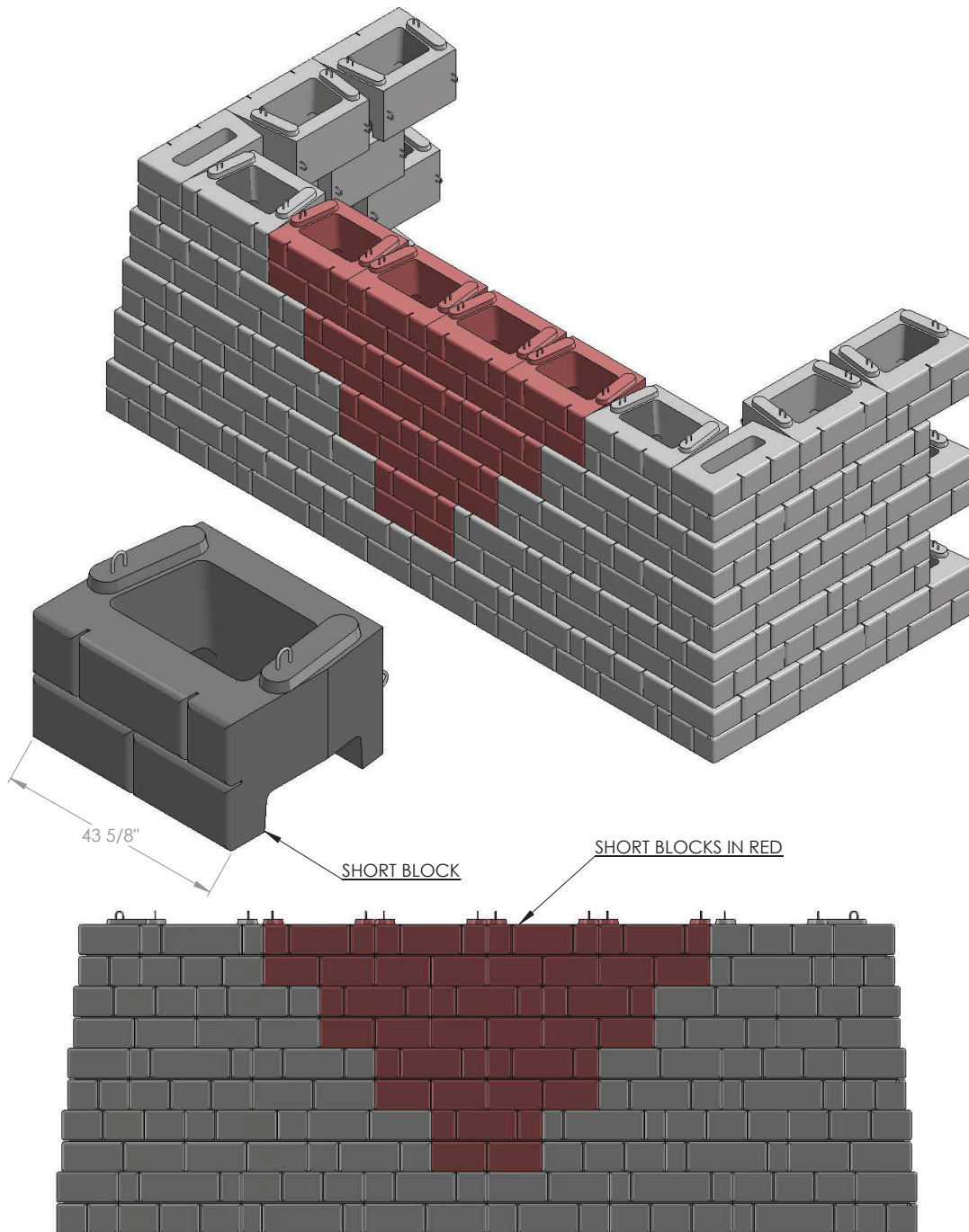


	DRAWN BY	DATE	TITLE:
	DAN BALLING	12/12/2013	45 ° OUTSIDE CORNER
	16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
			C-01
	SCALE: 1: 50	SHEET 1 OF 1	





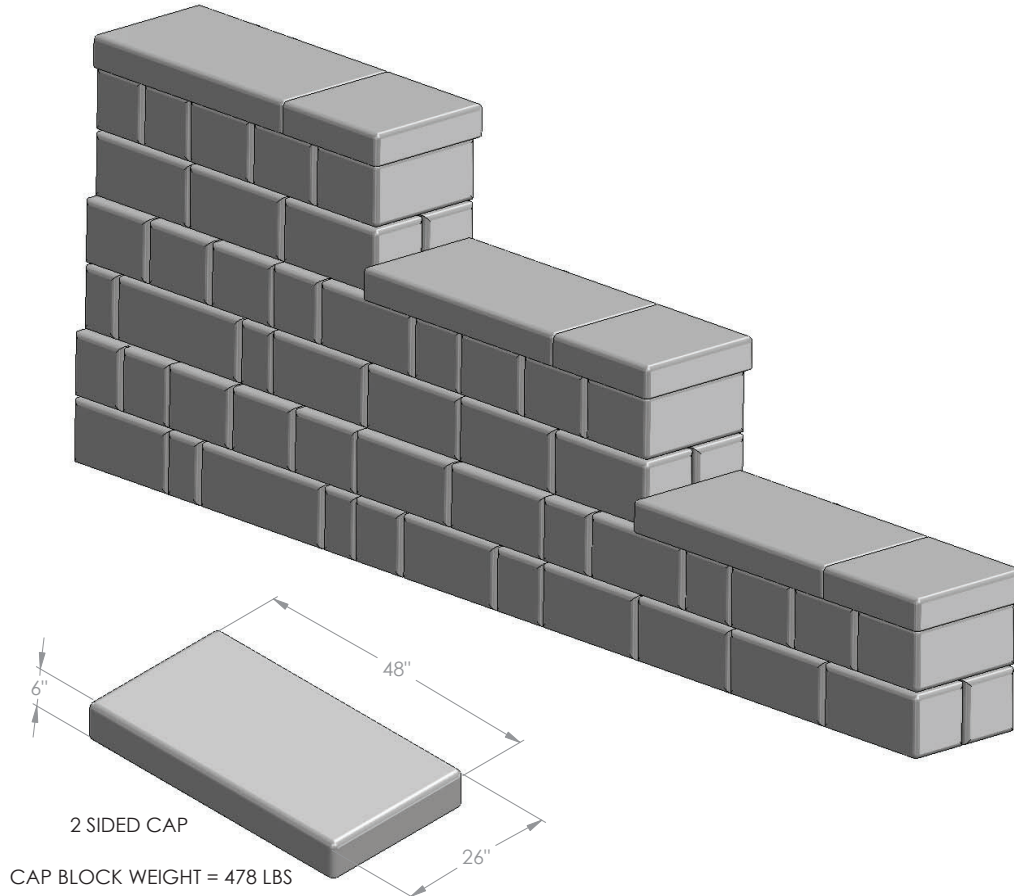
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	DOUBLE 90° INSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		C-02
SCALE: 1: 50		SHEET 1 OF 1



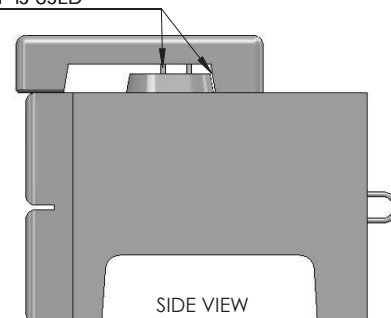
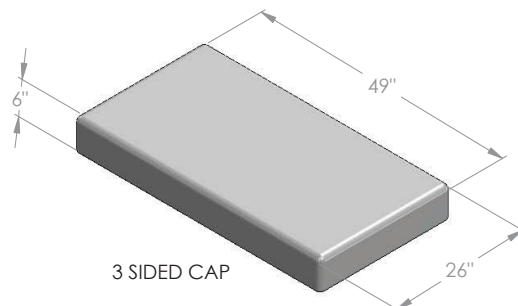
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	DOUBLE 90° OUTSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		C-03
SCALE: 1: 50		SHEET 1 OF 1



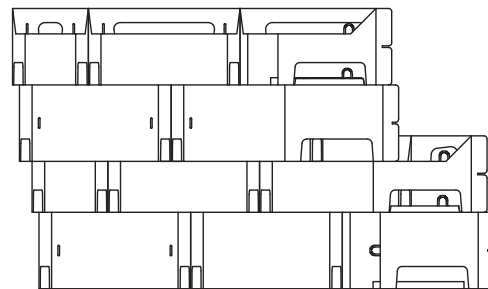
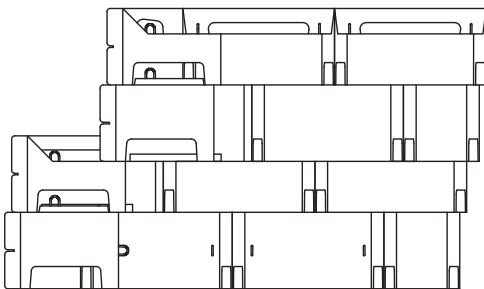
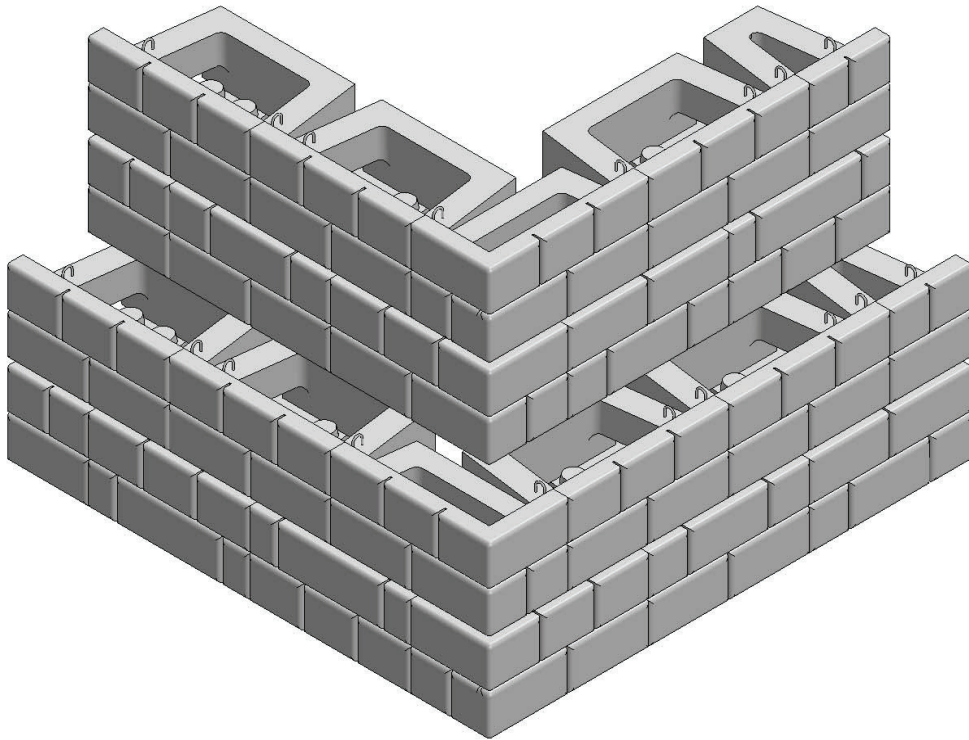
## 6 INCH CAP STEP-DOWN



CONFLICTING AREA WILL REQUIRE THE USE OF  
A 13" NUB BLOCKOUT OR SAW CUT AND REMOVAL  
OF PICK POINT WHEN CAP IS USED



DRAWN BY	DATE	TITLE:
DAN BALLING	12/18/2013	6" CAP BLOCK SCENARIO
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		CB-01
SCALE: 1: 4		SHEET 1 OF 1

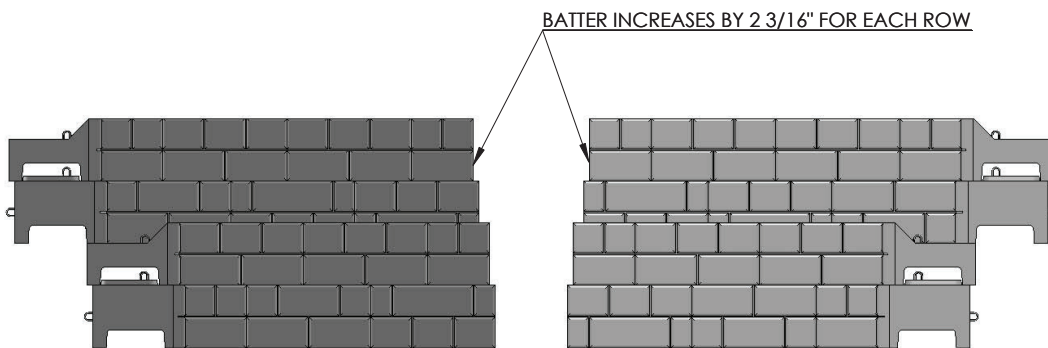
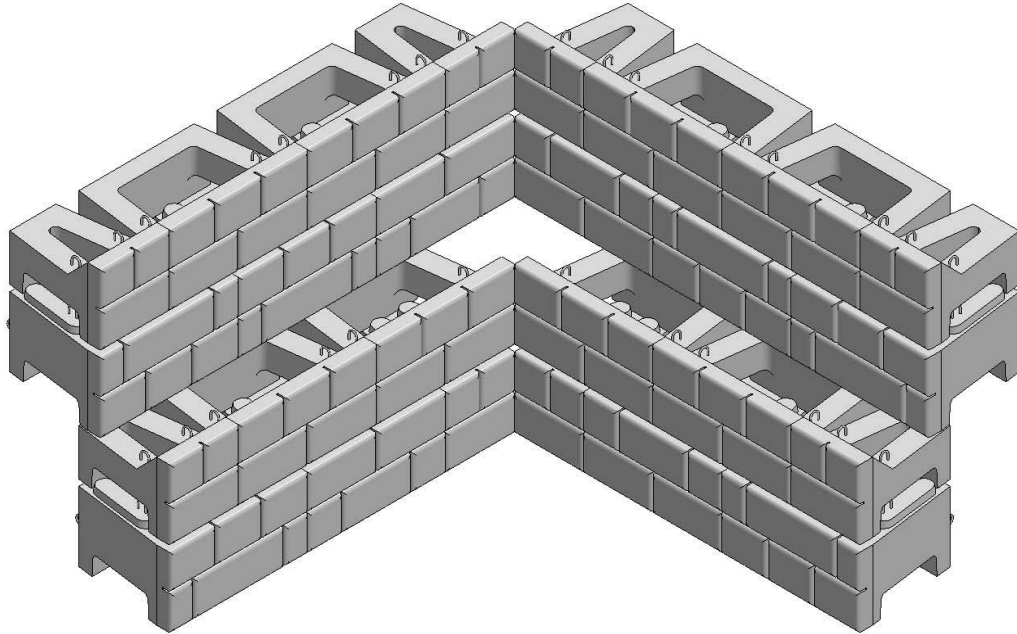


BACK SIDE VIEWS

NOTE:  
REFERENCE OUTSIDE CORNER DETAIL ON NUB BLOCKOUT

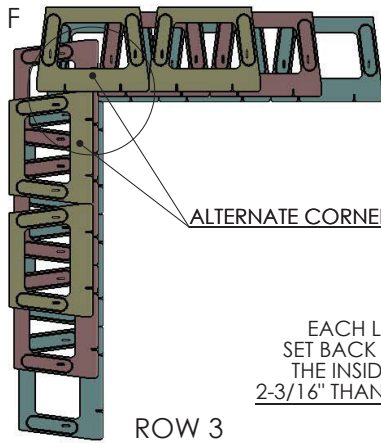
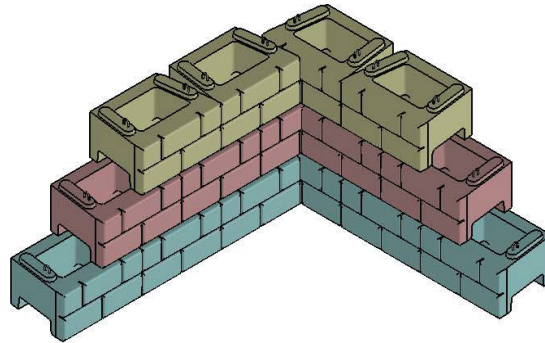


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16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		PR-02
SCALE: 1: 4		SHEET 1 OF 1



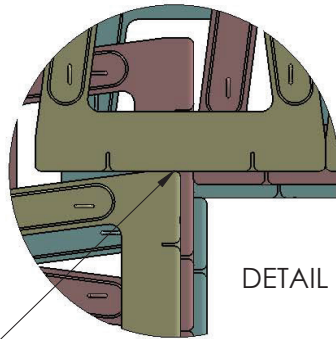
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	PLANTER ROW INSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		PR-03
SCALE: 1: 4		SHEET 1 OF 1

## INTERLACED INSIDE CORNER DETAIL

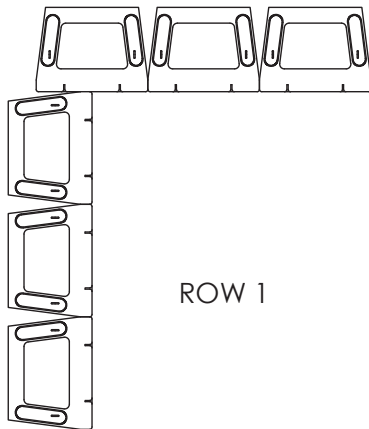


ALTERNATE CORNER OVERLAP

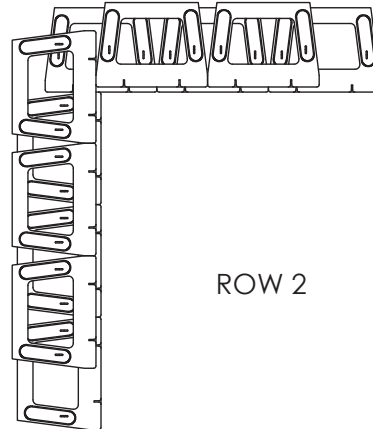
EACH LEVEL WILL BE  
SET BACK AND TOWARD  
THE INSIDE CORNER BY  
2-3/16" THAN THE ONE BELOW



DETAIL F



ROW 1

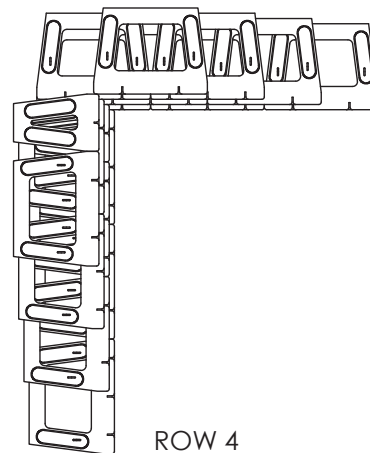
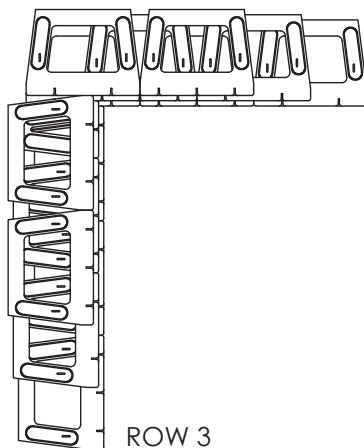
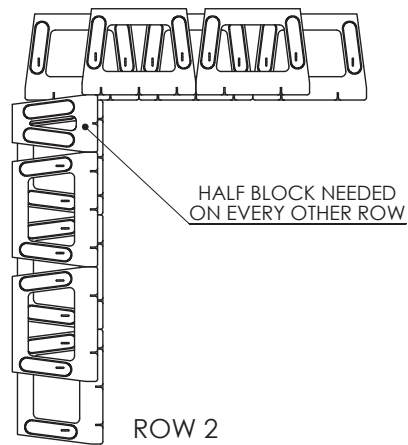
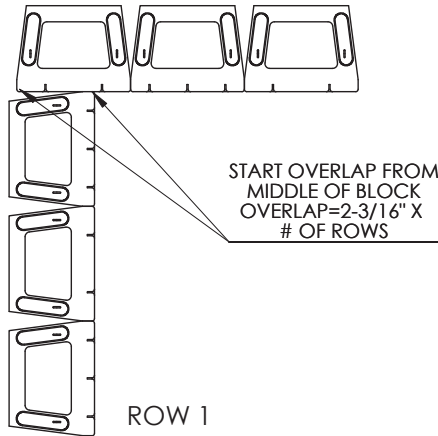
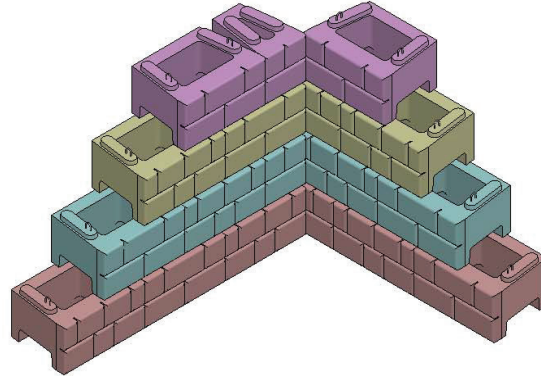


ROW 2



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	INTERLACED INSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-1
SCALE: 1: 60		SHEET 1 OF 1

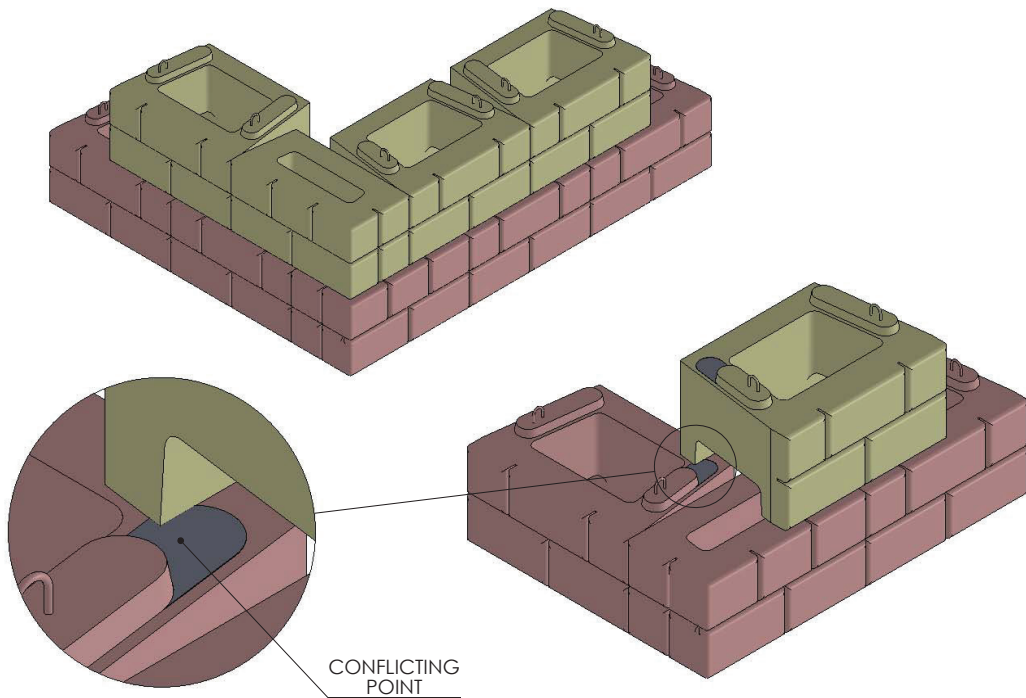
## BUTT-JOINT INSIDE CORNER DETAIL



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	BUTT-JOINT INSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-2
SCALE: 1: 60		SHEET 1 OF 1

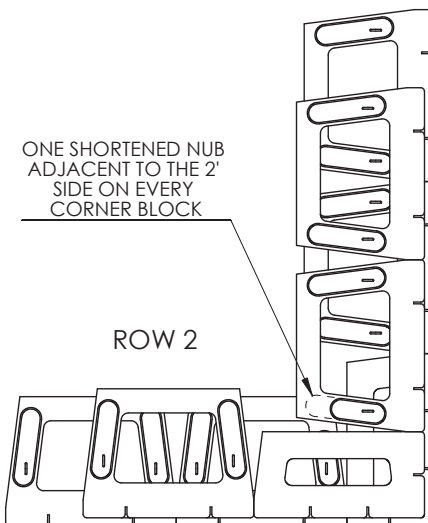


## OUTSIDE CORNER DETAIL



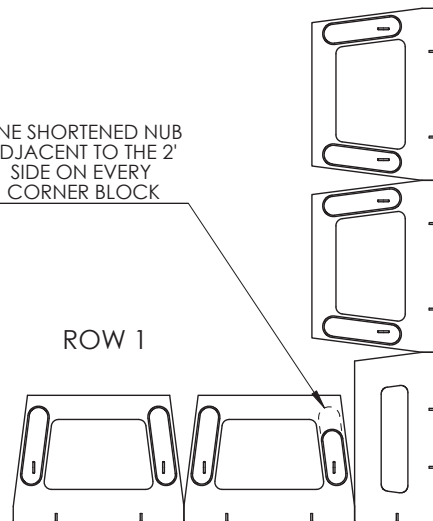
ONE SHORTENED NUB  
ADJACENT TO THE 2'  
SIDE ON EVERY  
CORNER BLOCK

ROW 2



ONE SHORTENED NUB  
ADJACENT TO THE 2'  
SIDE ON EVERY  
CORNER BLOCK

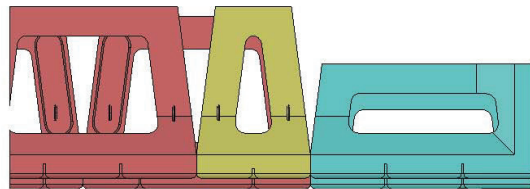
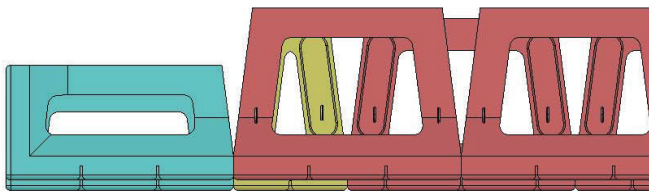
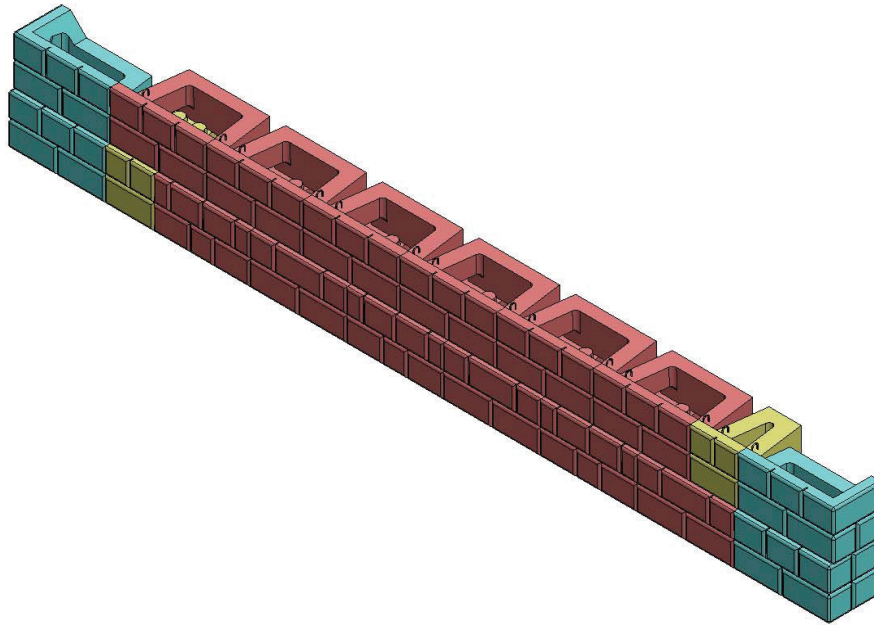
ROW 1



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	OUTSIDE CORNER
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-3
SCALE: 1: 40		SHEET 1 OF 1

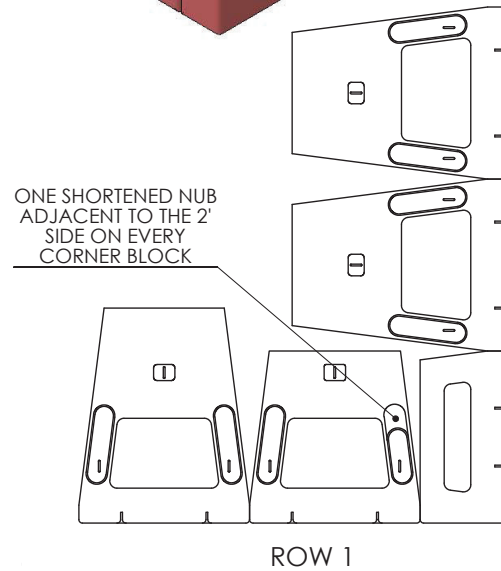
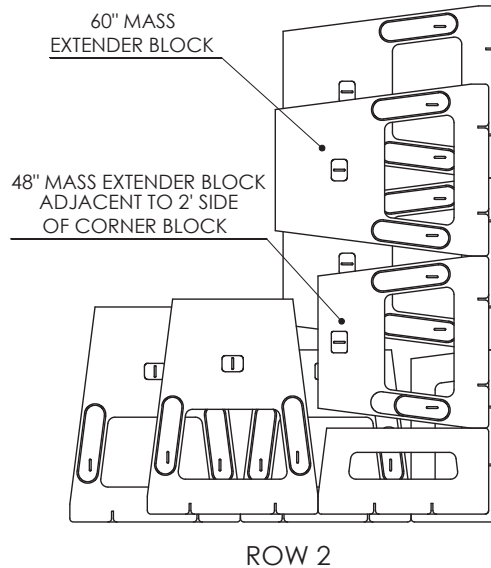
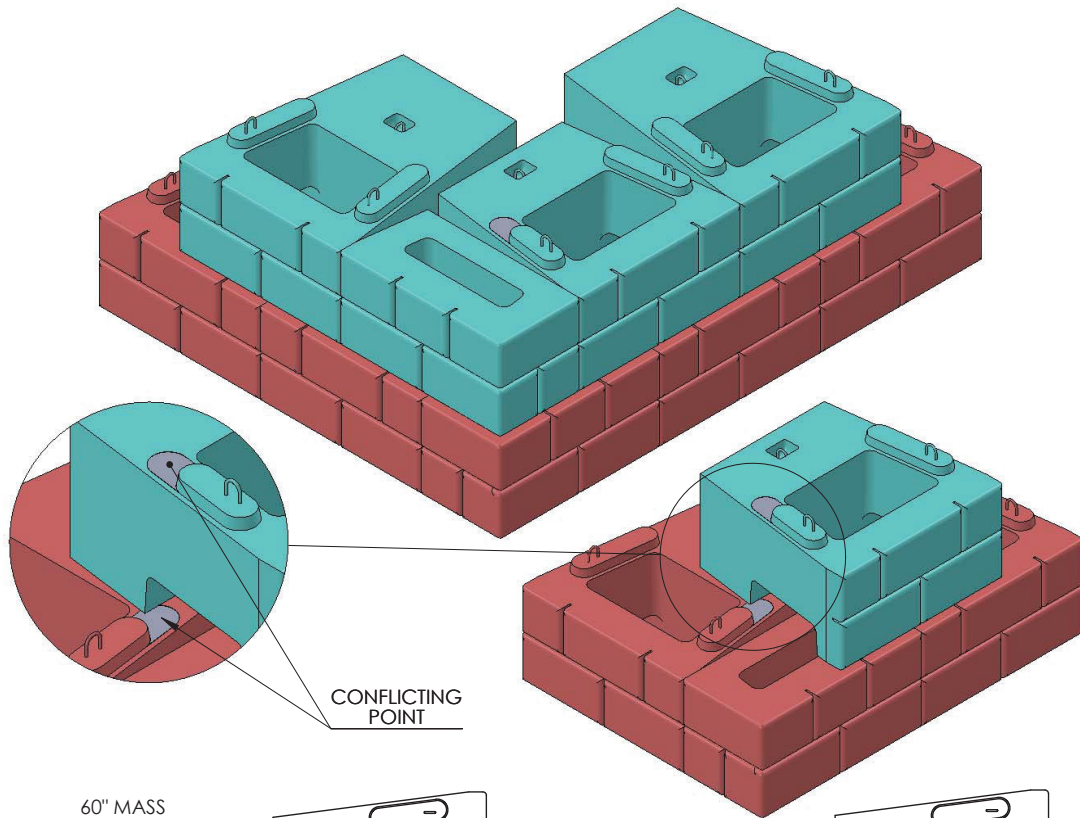


## STRAIGHT FACE WITH SIMPLE 2' RETURNS



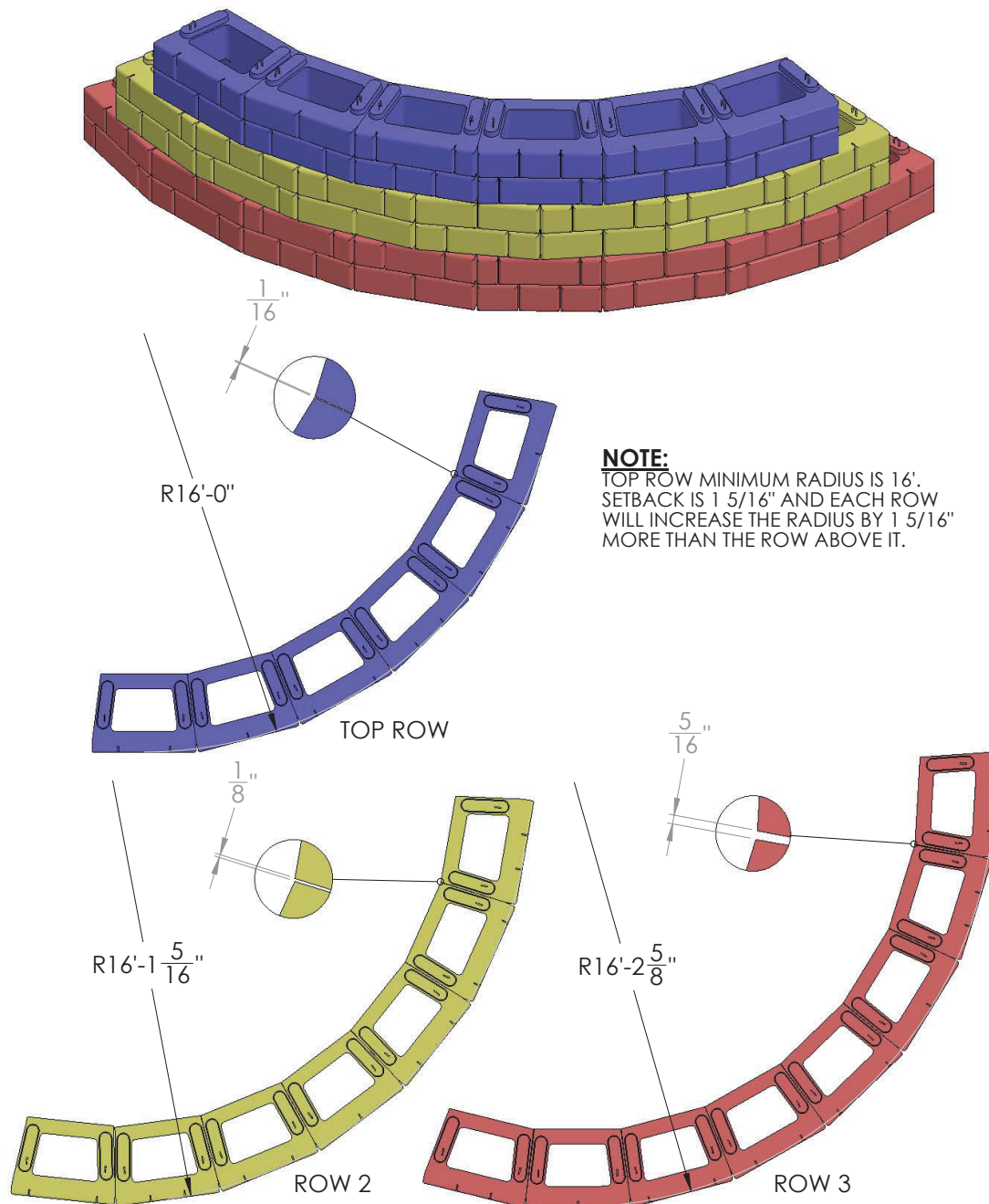
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	2' RETURN
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-4
SCALE: 1: 40		SHEET 1 OF 1

## OUTSIDE CORNER WITH MASS EXTENDERS DETAIL



DRAWN BY	DATE	TITLE
DAN BALLING	12/12/2013	OUTSIDE CORNER w/ ME
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-5
SCALE: 1: 40		SHEET 1 OF 1

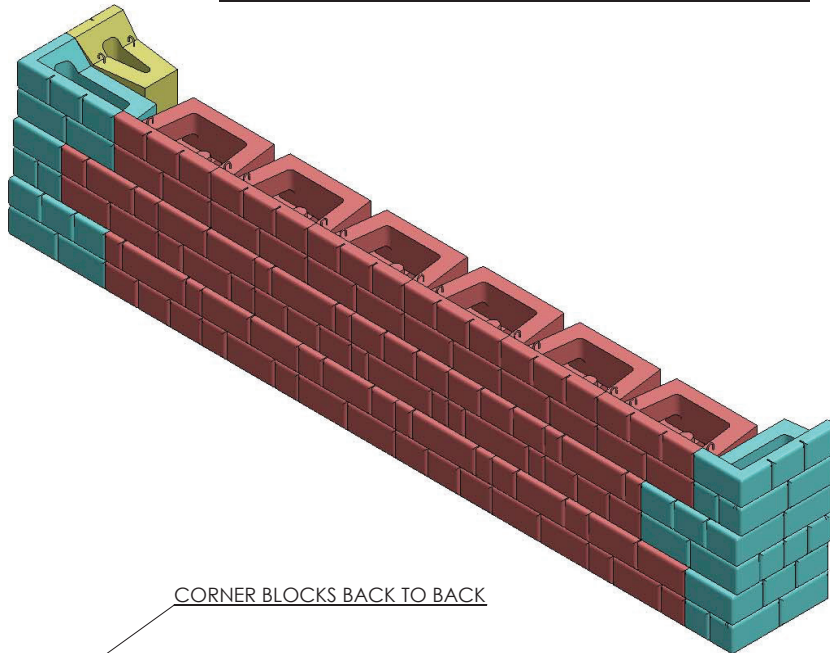
## OUTSIDE CURVE DETAIL



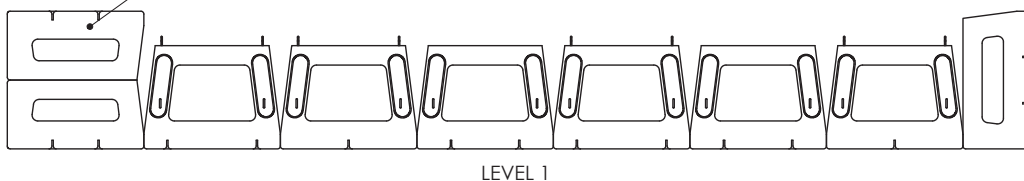
DRAWN BY	DATE
DAN BALLING	12/12/2013
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028	

TITLE:	OUTSIDE CURVE
DWG NO.	WD-6
SCALE: 1: 40	SHEET 1 OF 1

## STRAIGHT FACE WITH SIMPLE 4' RETURNS

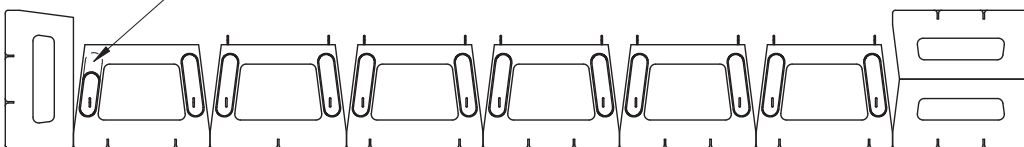


CORNER BLOCKS BACK TO BACK



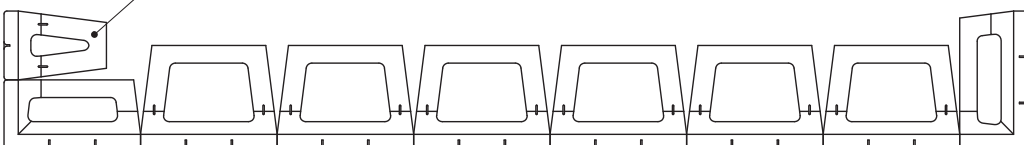
LEVEL 1

6-1/2" NUB BLOCKOUT NEEDED



LEVEL 2

HALF TOP BLOCK REQUIRES  
BLOCKOUT ON BLOCK BELOW

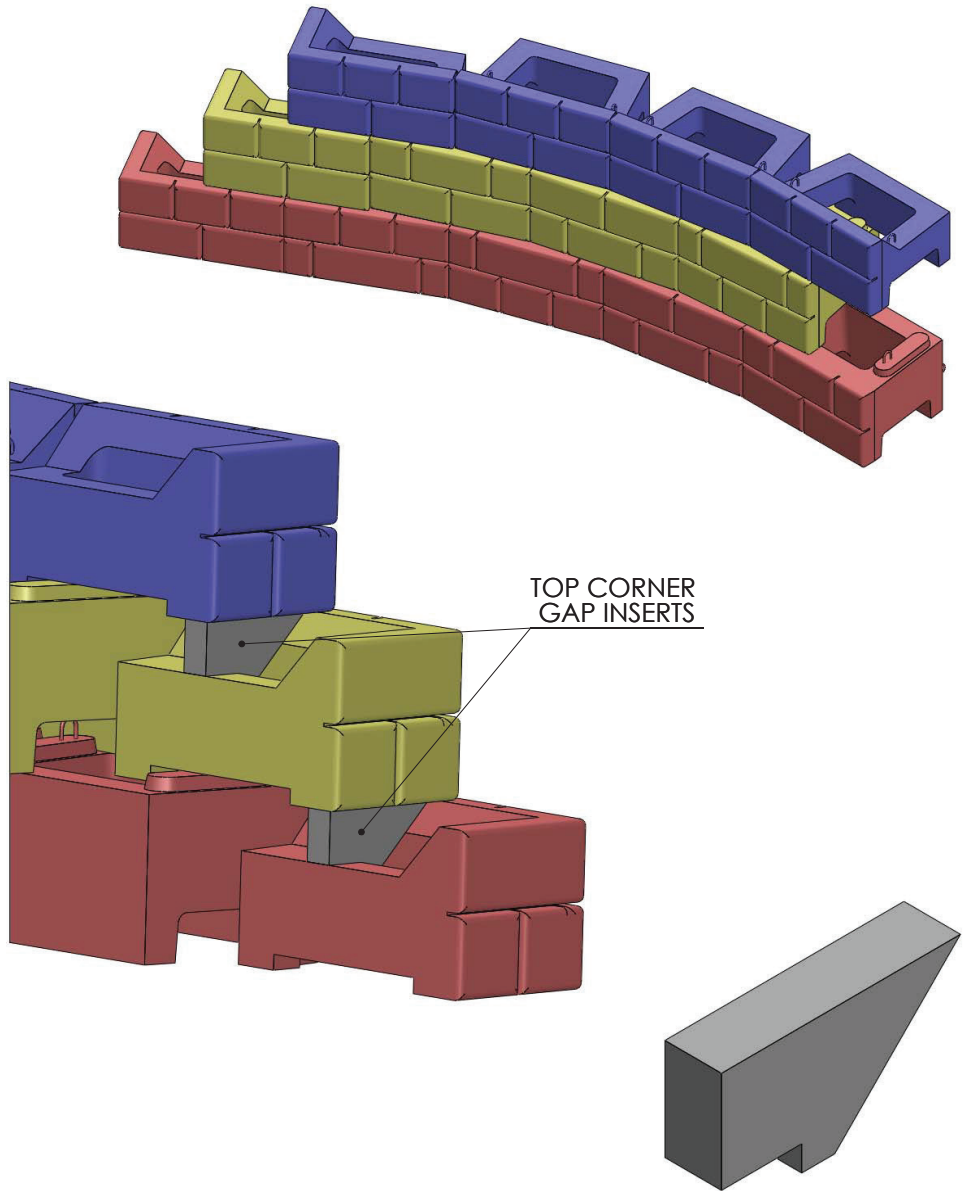


LEVEL 3



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	4' RETURN
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-07
SCALE: 1: 4		SHEET 1 OF 1

## 2' STEP DOWN WITH TOP CORNER GAP INSERTS



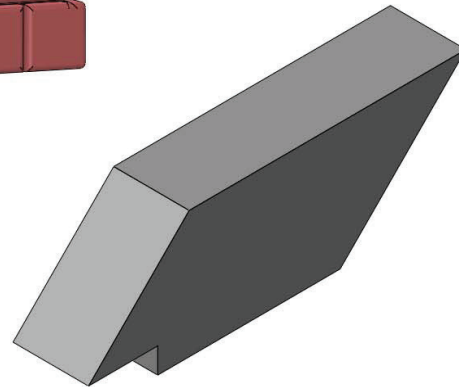
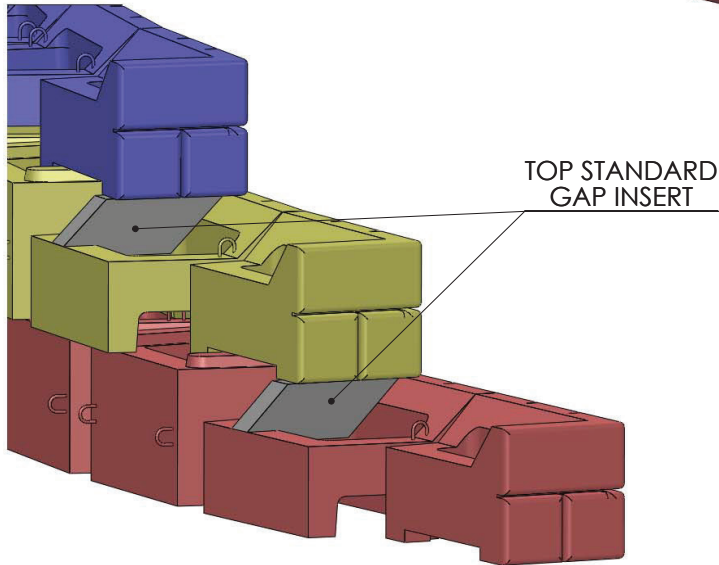
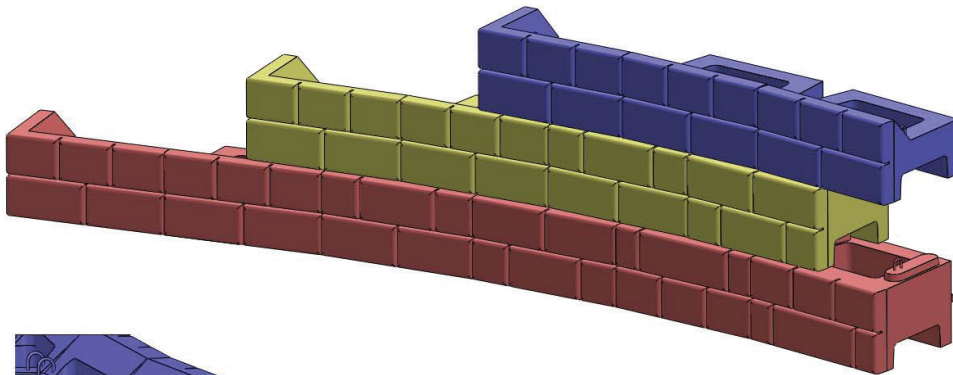
TOP CORNER GAP INSERT



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	2' STEP DOWN
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO. WD-8
SCALE: 1: 40		SHEET 1 OF 1



## 6' STEP DOWN WITH TOP STANDARD GAP INSERT

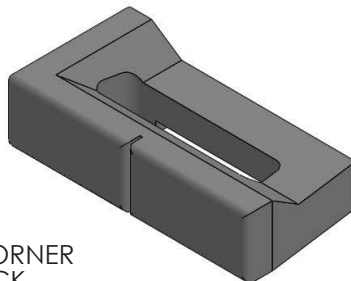
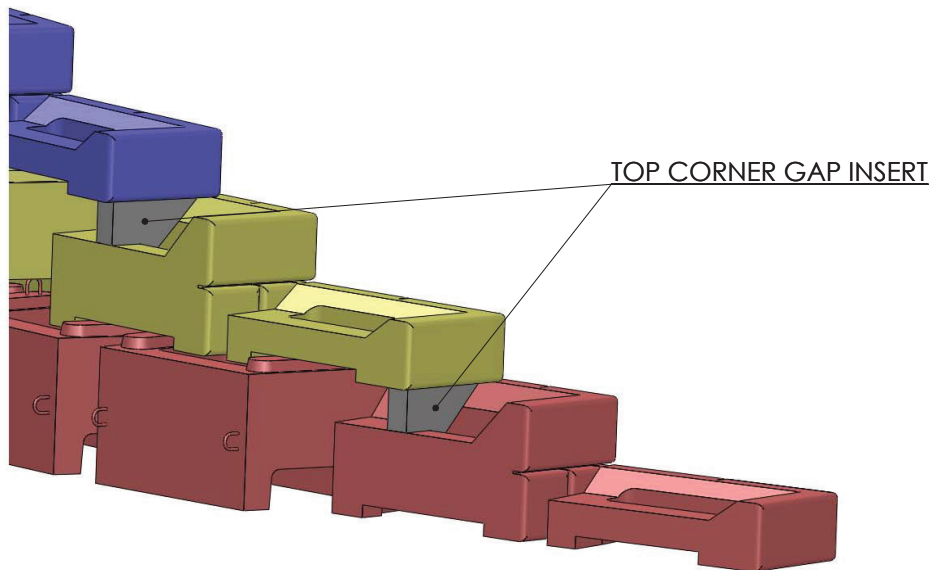
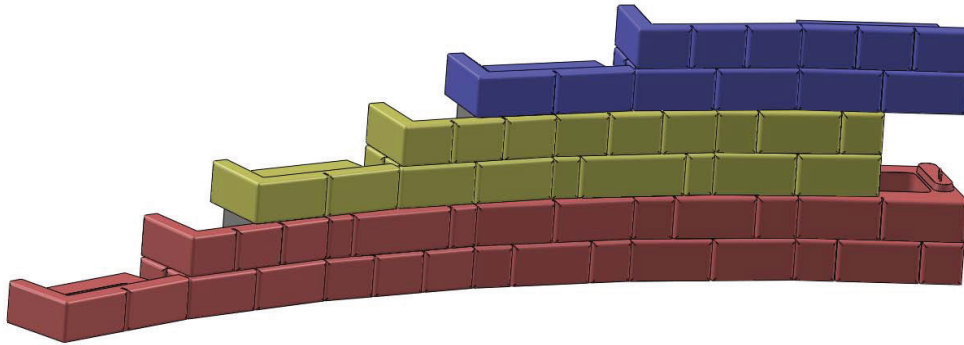


TOP STANDARD GAP INSERT

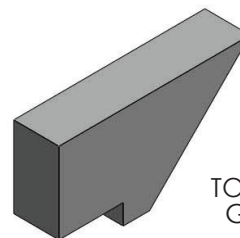


DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	6' STEP DOWN
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-9
SCALE: 1: 40		SHEET 1 OF 1

## 6' STEP DOWN WITH HALF-STEP BLOCK AND TOP CORNER GAP INSERT



HALF-STEP CORNER  
TOP BLOCK

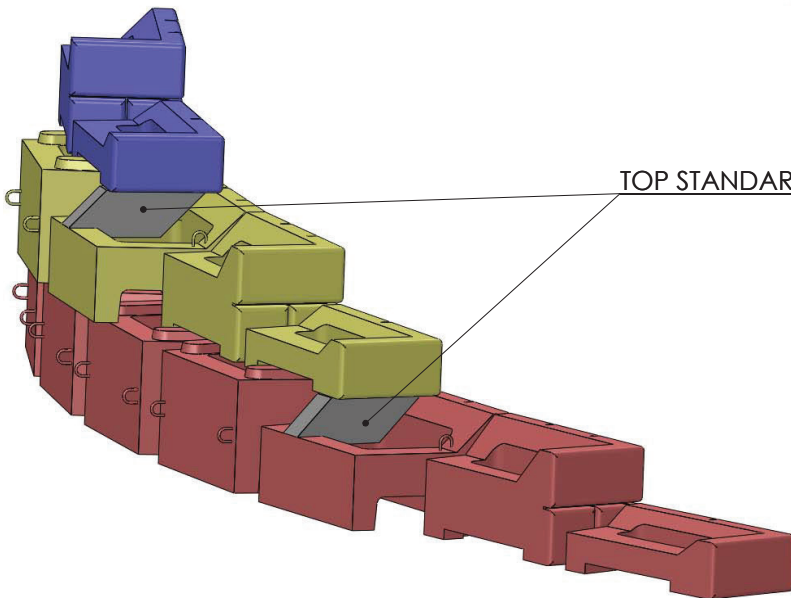
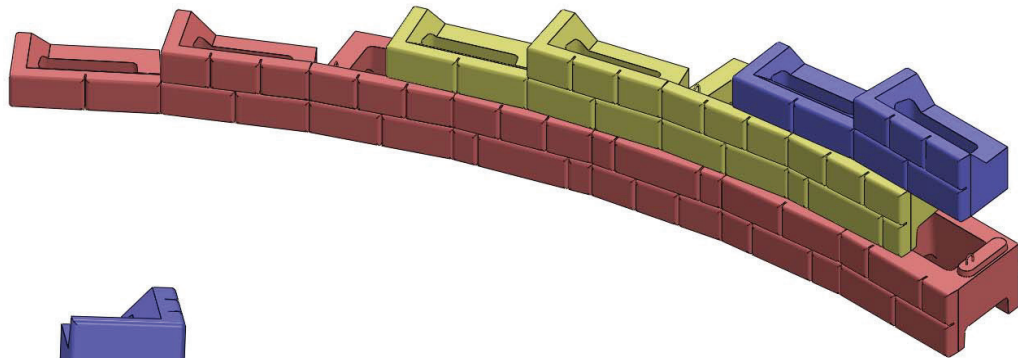


TOP CORNER  
GAP INSERT

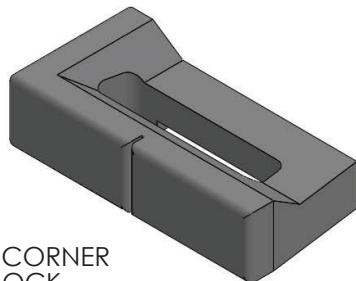


DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	6' STEP W/ HALF STEP BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-10
SCALE: 1: 40		SHEET 1 OF 1

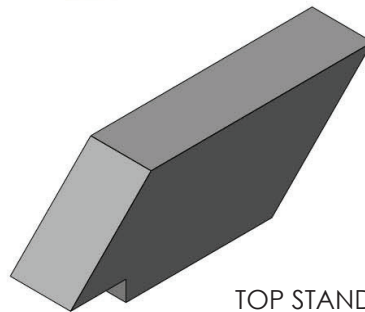
## 10' STEP DOWN WITH HALF-STEP BLOCK AND TOP STANDARD GAP INSERT



TOP STANDARD GAP INSERT



HALF-STEP CORNER  
TOP BLOCK

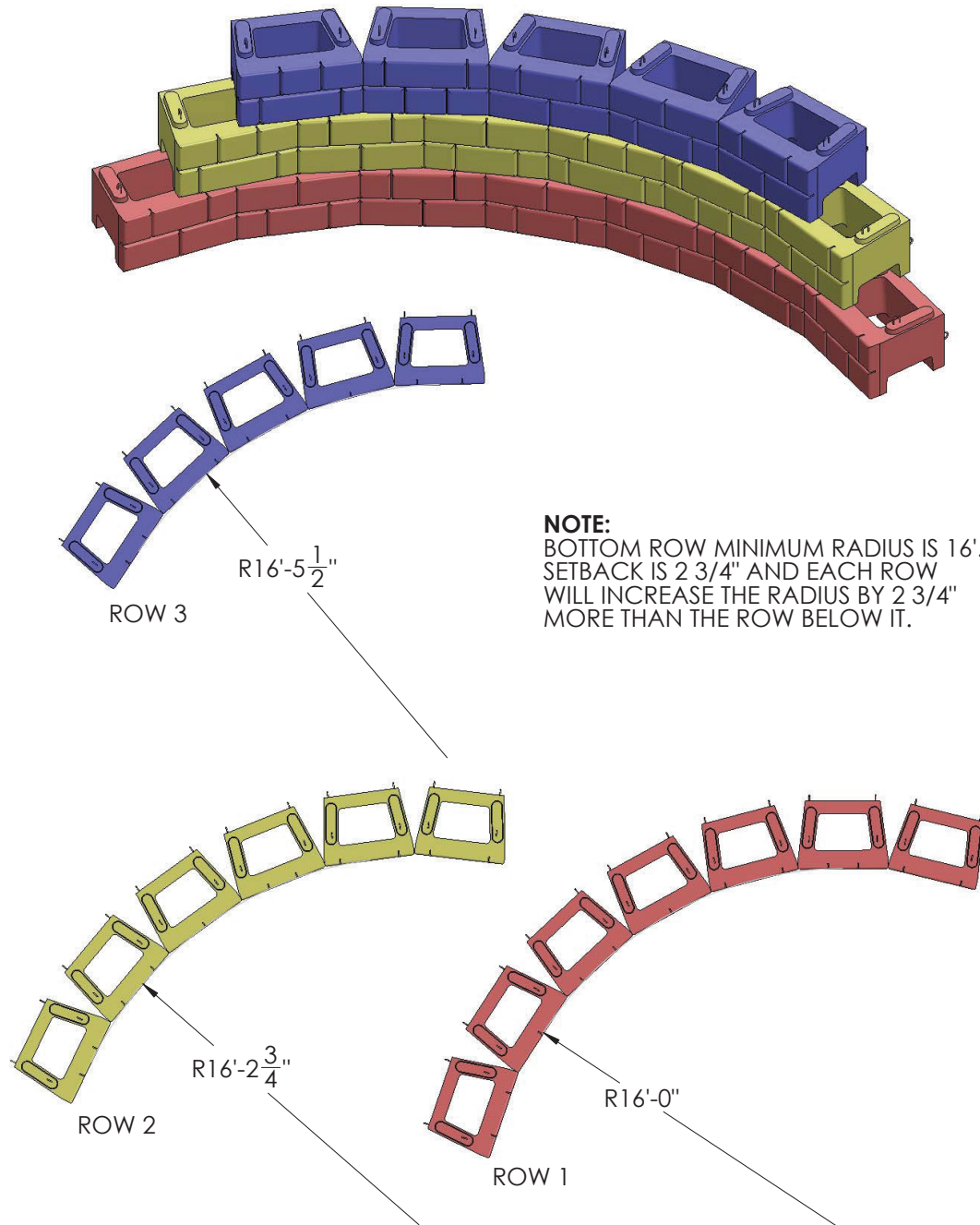


TOP STANDARD  
GAP INSERT

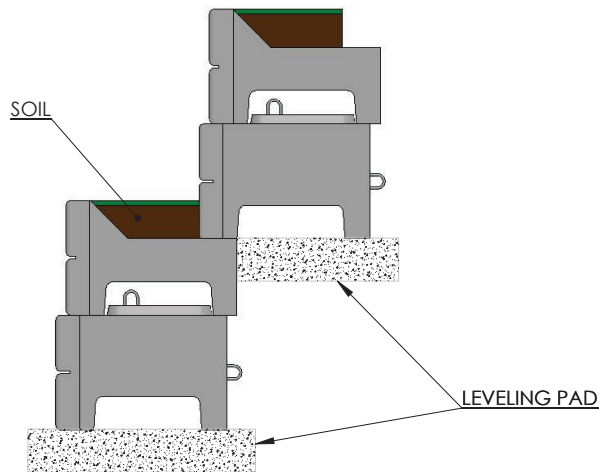
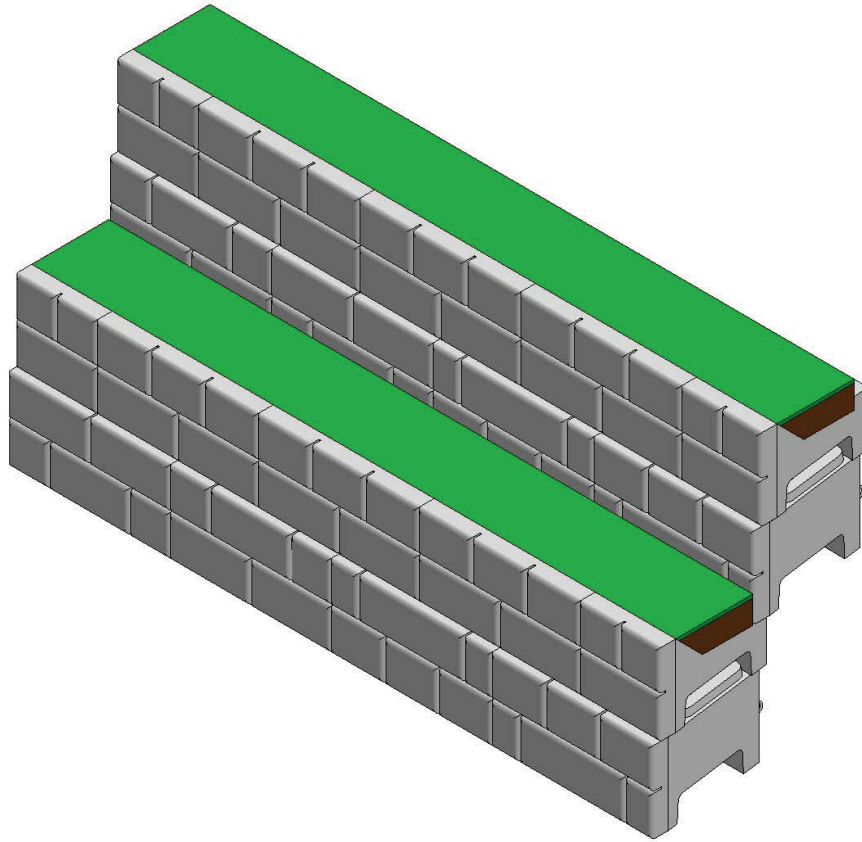


DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	10' STEP W/ HALF STEP BLOCK
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-11
SCALE: 1: 40		SHEET 1 OF 1

## INSIDE CURVE DETAIL



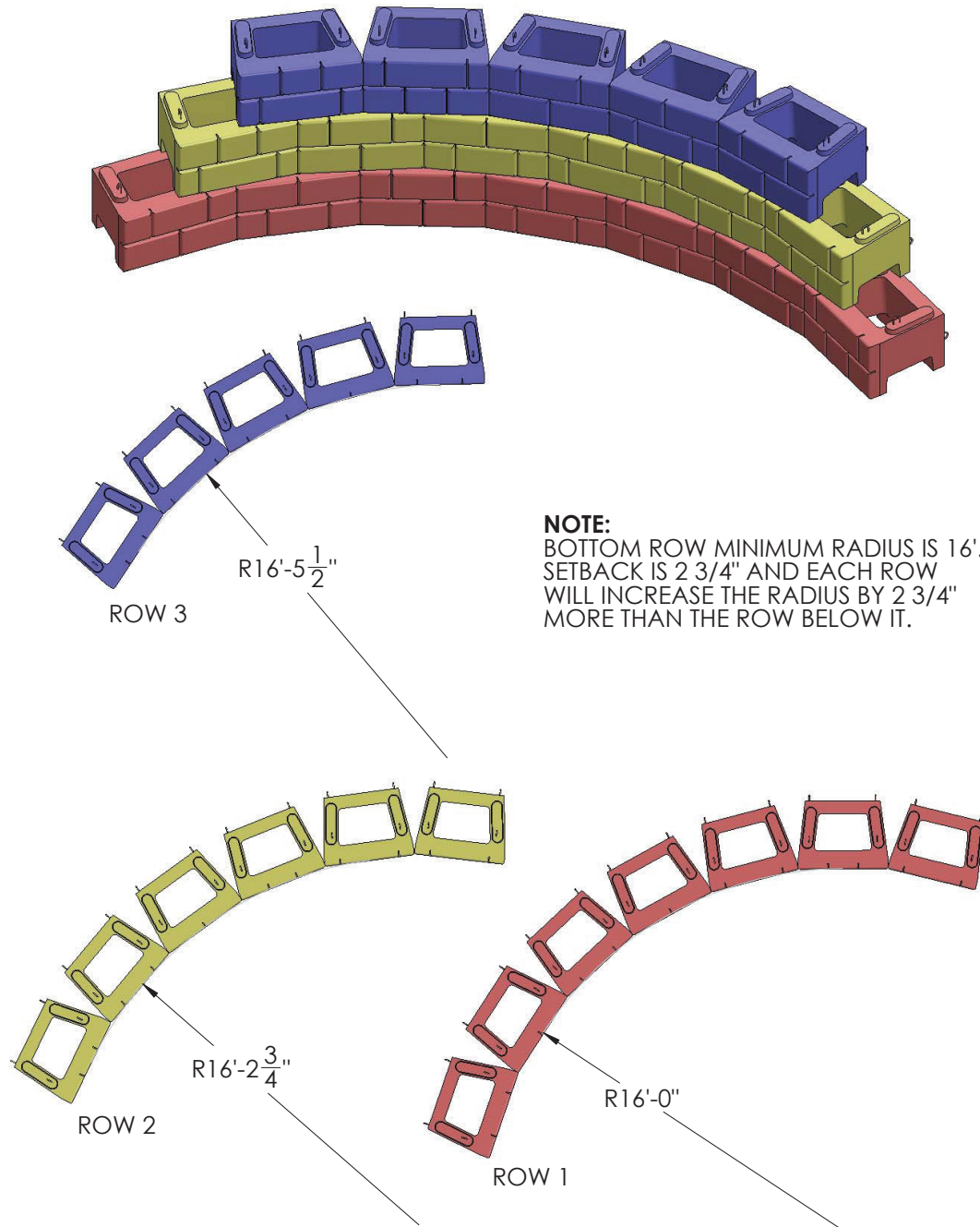
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	INSIDE CURVE
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-12
SCALE: 1: 40		SHEET 1 OF 1



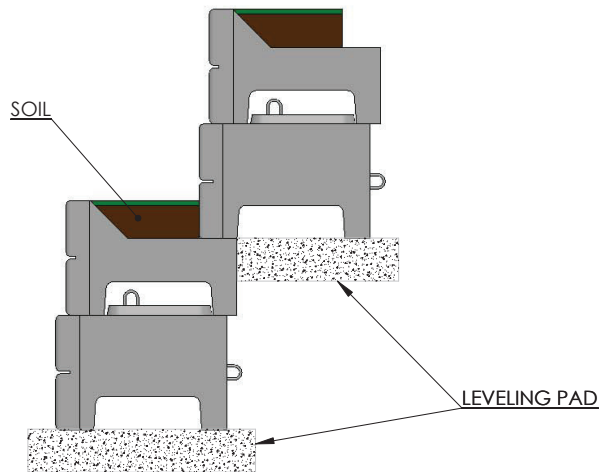
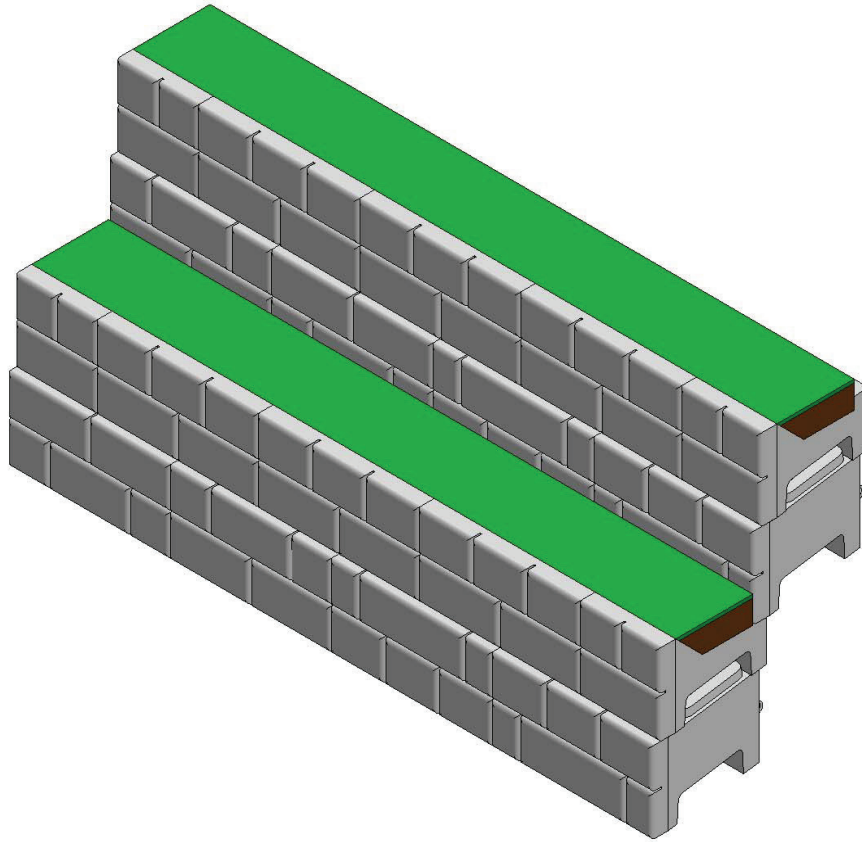
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	PLANTER ROW WALL
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		PR-01
SCALE: 1: 4		SHEET 1 OF 1



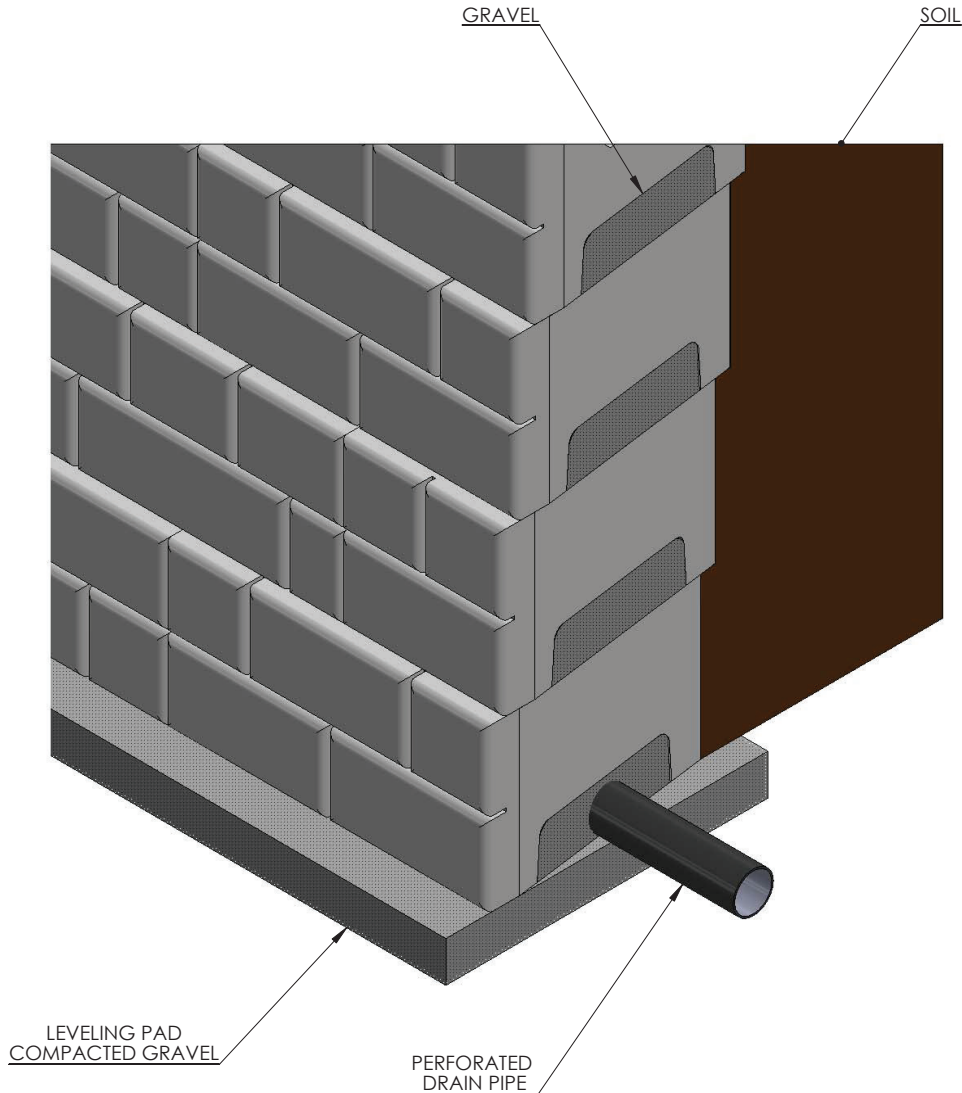
## INSIDE CURVE DETAIL



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	INSIDE CURVE
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-12
SCALE: 1: 40		SHEET 1 OF 1



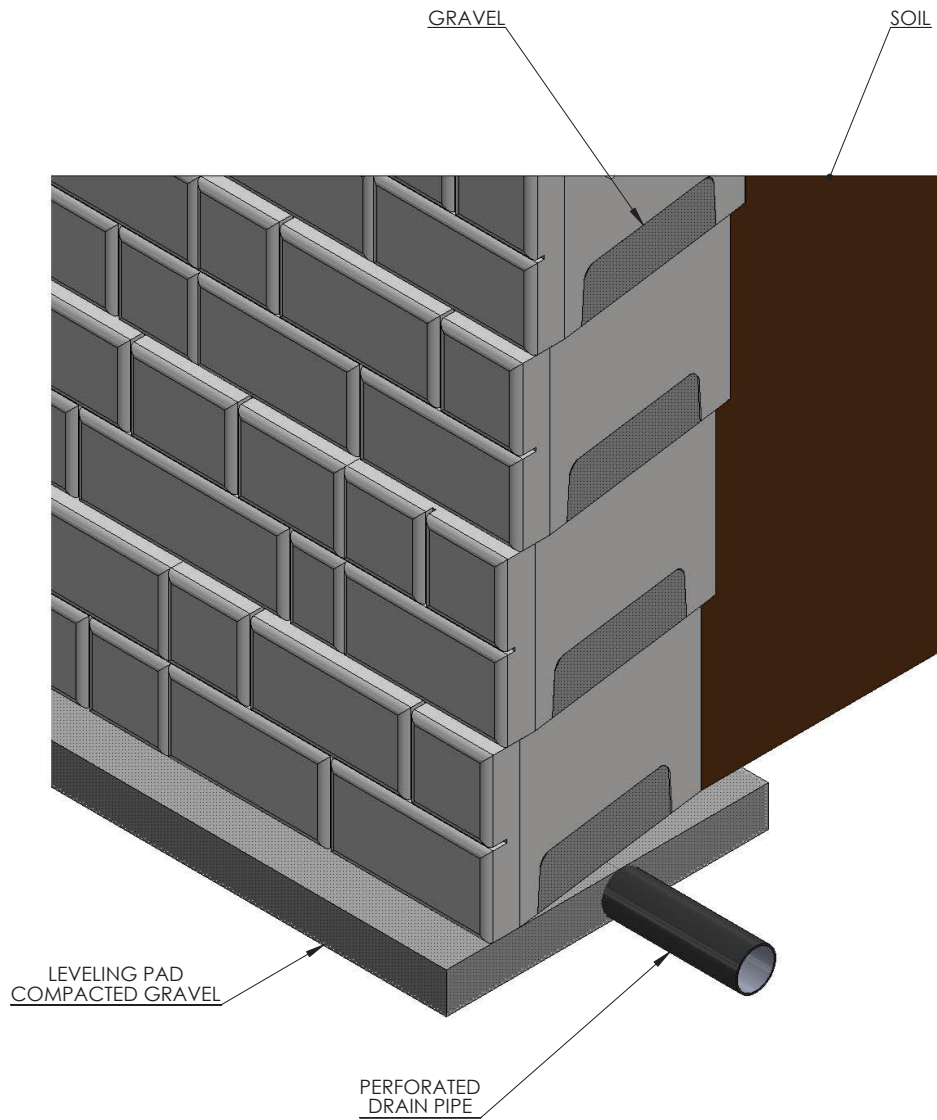
DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	PLANTER ROW WALL
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		PR-01
SCALE: 1: 4		SHEET 1 OF 1



DRAIN PIPE IS PLACED INSIDE GAP AT THE BOTTOM OF THE BLOCK  
AND ON TOP OF THE LEVELING PAD THEN COVERED WITH GRAVEL.



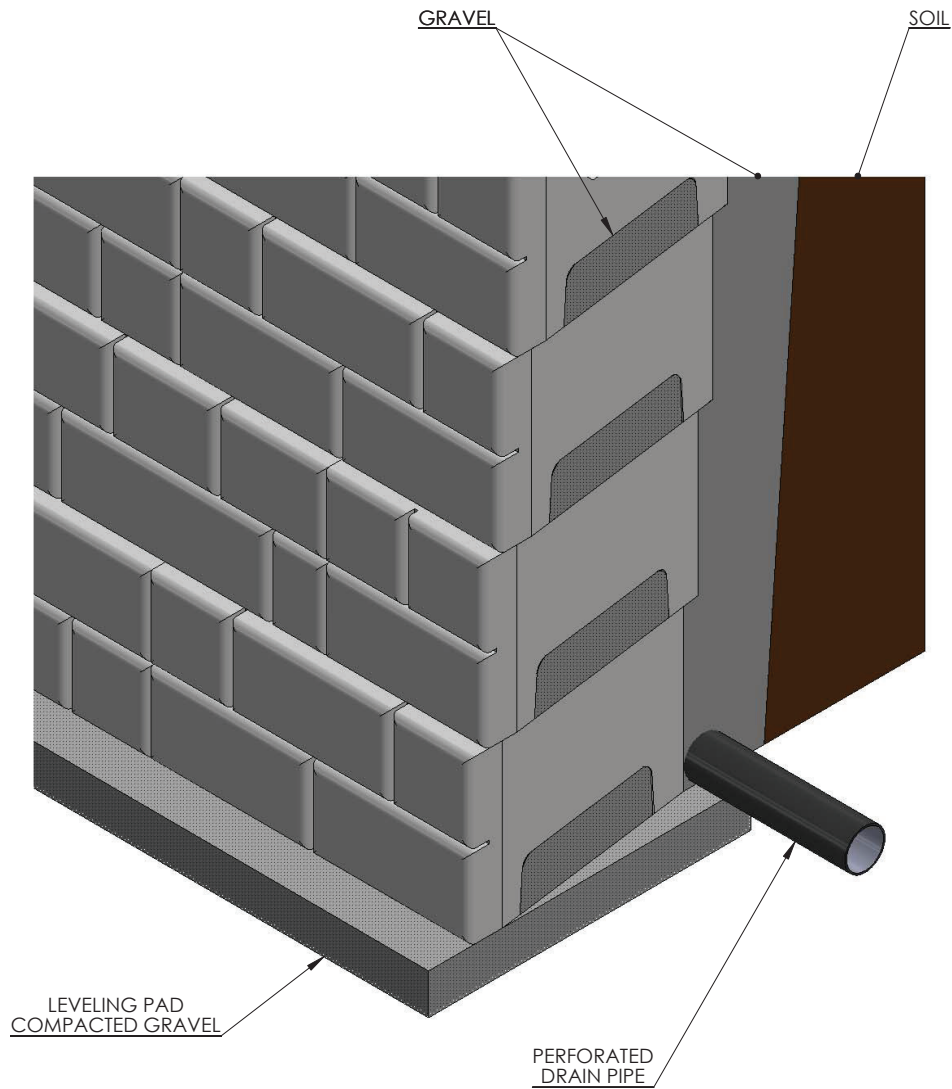
DRAWN BY	DATE	TITLE:
DAN BALLING	12/18/2013	DRAIN PLACEMENT-OPTION #1
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-16
SCALE: 1: 20		SHEET 1 OF 1



DRAIN PIPE IS PLACED INSIDE  
THE COMPACTED GRAVEL  
OF THE LEVELING PAD



DRAWN BY	DATE	TITLE:
DAN BALLING	12/12/2013	DRAIN PLACEMENT-OPTION #2
16500 SOUTH 500 WEST BLUFFDALE, UTAH 84065 PHONE: (801) 571-2028		DWG NO.
		WD-17
SCALE: 1:20		SHEET 1 OF 1



DRAIN PIPE IS PLACED BEHIND THE BLOCK AND ON TOP OF THE LEVELING PAD.  
THIS OPTION REQUIRES 1' OF LOOSE GRAVEL BEHIND THE WALL.  
IF DRAINAGE IS A MAJOR CONCERN FOR AN APPLICATION THIS OPTION  
MAY BE USED ALONG WITH OPTION 1 OR 2