

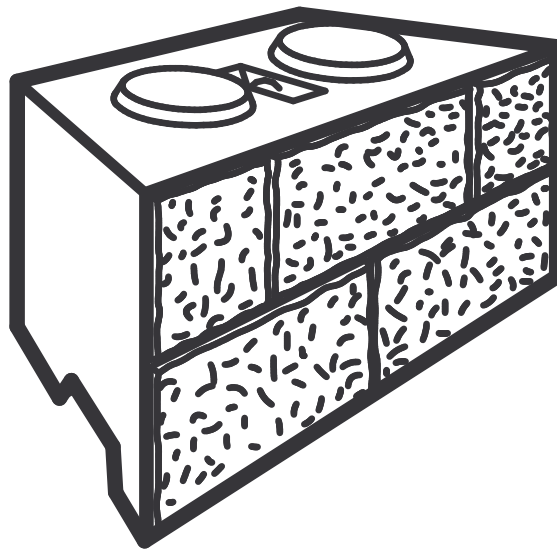
# **WOODARD'S**

CONCRETE PRODUCTS, INC.

## **Precast Retaining Wall Blocks Installation Guidelines**

**based on the**

**National Concrete Masonry Association's  
*Design Manual For Segmental Retaining Walls*  
Second Edition**

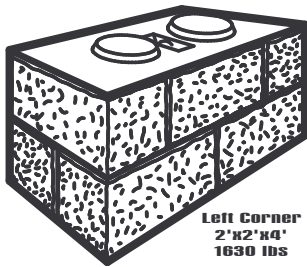


**Phone 845-361-3471  
Fax 845-361-1050  
629 Lybolt Road / PO Box 8  
Bullville, NY 10915  
[www.woodardsconcrete.com](http://www.woodardsconcrete.com)**

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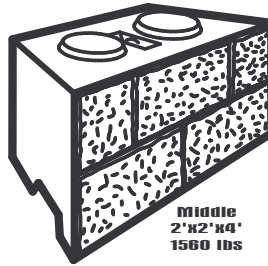
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## Standard Block Sizes



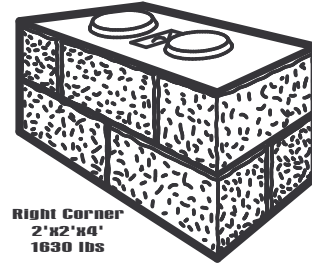
Left Corner  
2'x2'x4'  
1630 lbs

**RWB-2X2X4LC**



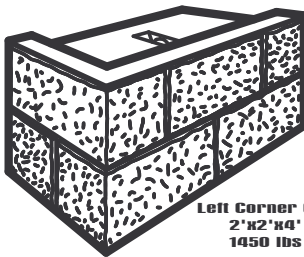
Middle  
2'x2'x4'  
1560 lbs

**RWB-2X2X4M**



Right Corner  
2'x2'x4'  
1630 lbs

**RWB-2X2X4RC**



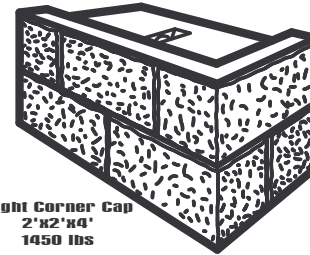
Left Corner Cap  
2'x2'x4'  
1450 lbs

**RWB-2X2X4LCC**



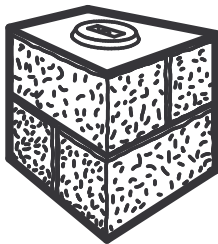
Middle Cap Block  
2'x2'x4'  
1360 lbs

**RWB-2X2X4MC**



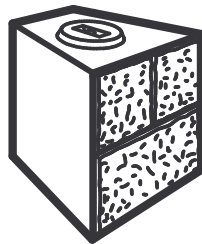
Right Corner Cap  
2'x2'x4'  
1450 lbs

**RWB-2X2X4RCC**



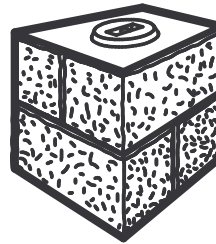
Left Corner Half Block  
2'x2'x2'  
800 lbs

**RWB-2X2X2LC**



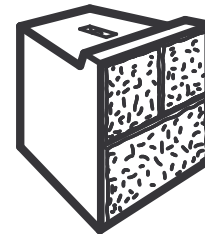
Half Block Middle  
2'x2'x2'  
700 lbs

**RWB-2X2X2M**



Right Corner Half Block  
2'x2'x2'  
800 lbs

**RWB-2X2X2RC**



Half Block Cap  
2'x2'x2'  
620 lbs

**RWB-2X2X2MC**

## **Standard Soil & Aggregate Characteristics**

### **Reinforced Backfill Soil:**

**Soils used with installing the geotextile reinforcing grid shall be free of debris and consist of one of the following USCS soil types: GP, GW, SW, SP or SM and meeting gradation in accordance with ASTM D 422.**

<b>Sieve Size</b>	<b>Percent Passing</b>
<b>4"</b>	<b>100</b>
<b>#4</b>	<b>100-20</b>
<b>#40</b>	<b>0-60</b>
<b>#200</b>	<b>0-35</b>

**The maximum size should be limited to 3/4 inch.**

**The pH should be between 3 and 9.**

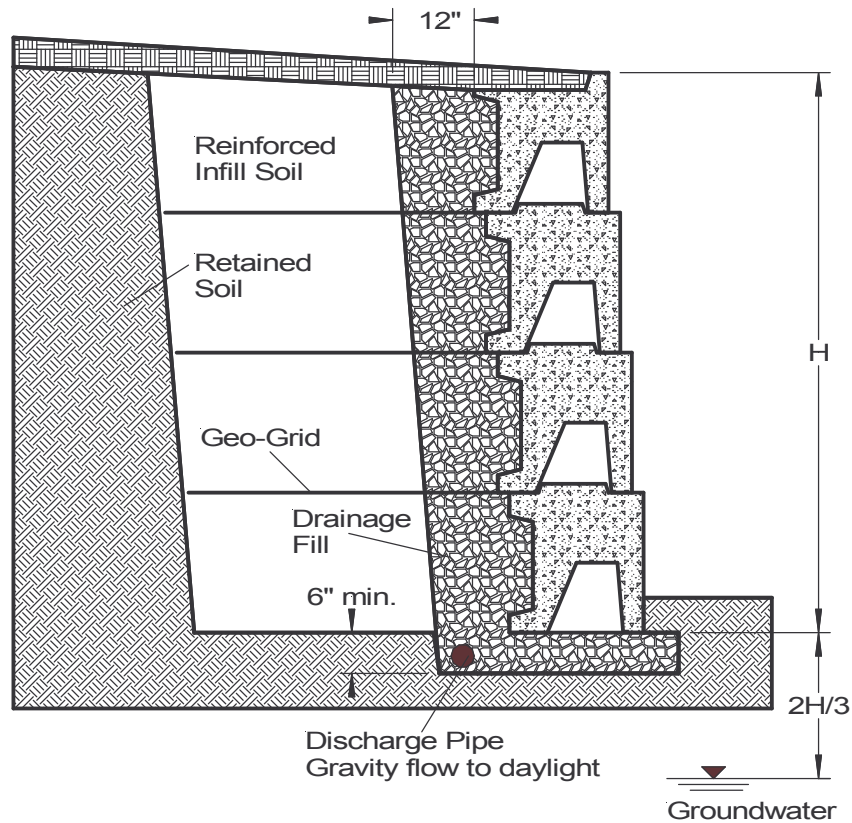
### **Drainage Aggregate:**

**1" or less clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D 422:**

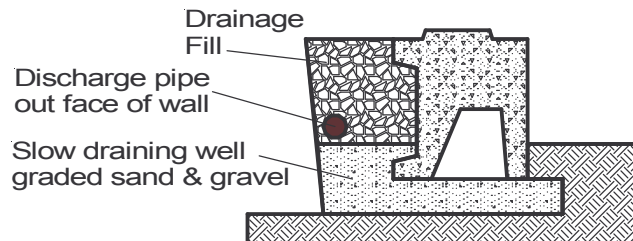
<b>Sieve Size</b>	<b>Percent Passing</b>
<b>1"</b>	<b>100</b>
<b>3/4"</b>	<b>75-100</b>
<b>#4</b>	<b>0-60</b>
<b>#40</b>	<b>0-50</b>
<b>#200</b>	<b>0-5</b>

## Footing Design - Case 1

**Case 1: Groundwater is equal to or greater than  $2H/3$  below bottom of wall and there is negligible lateral groundwater flow into infill and retained soils.**

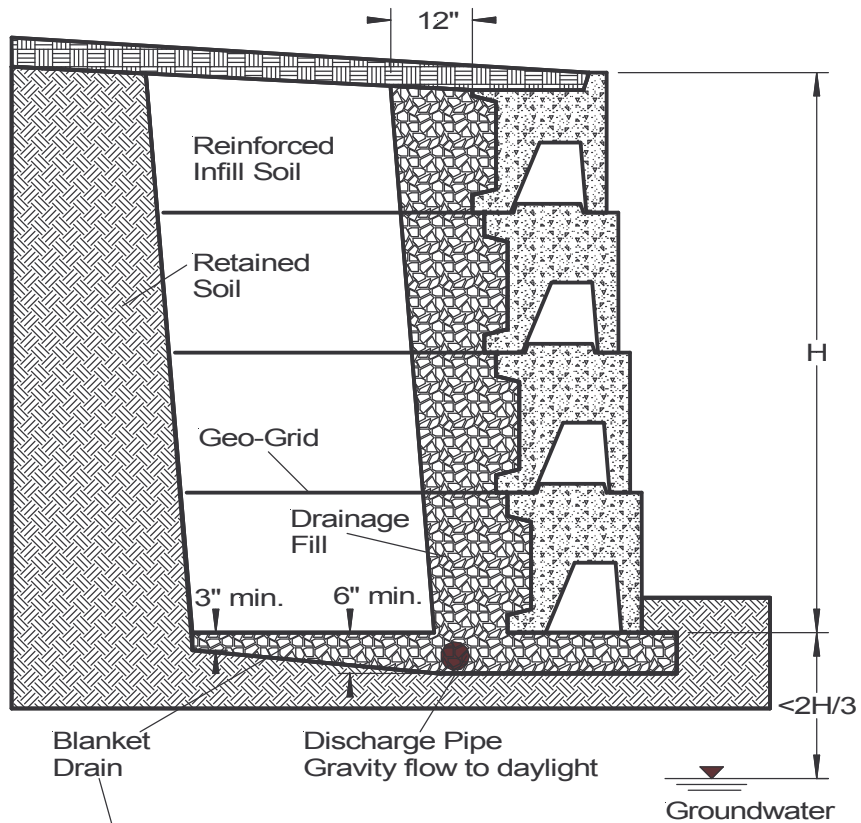


### Optional Drain Detail

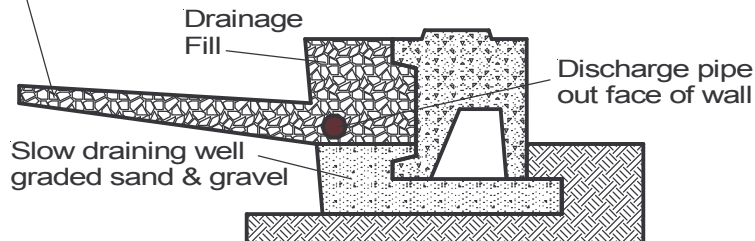


## Footing Design - Case 2

**Case 2: Groundwater table near bottom of bearing pad or could rise to base of reinforced infill soil on a seasonal basis. Negligible lateral groundwater flow into infill and retained soils.**



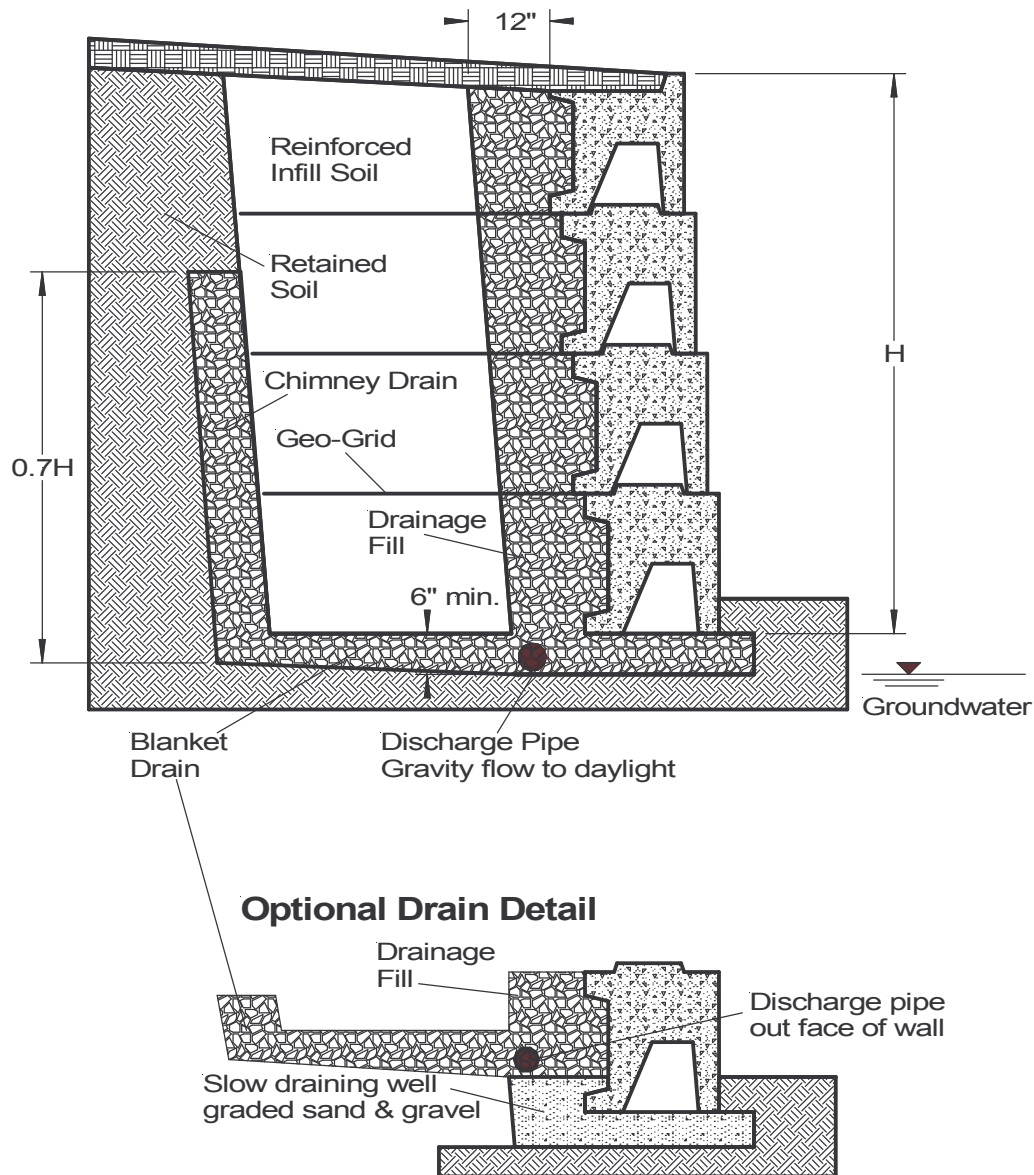
### **Optional Drain Detail**



## Footing Design - Case 3

**Case 3: Groundwater table near bottom of wall or possible lateral flow into reinforced infill soil and retained soil on a seasonal basis.**

**This drainage system provides maximum protection and should be used where there is uncertainty in actual site conditions.**



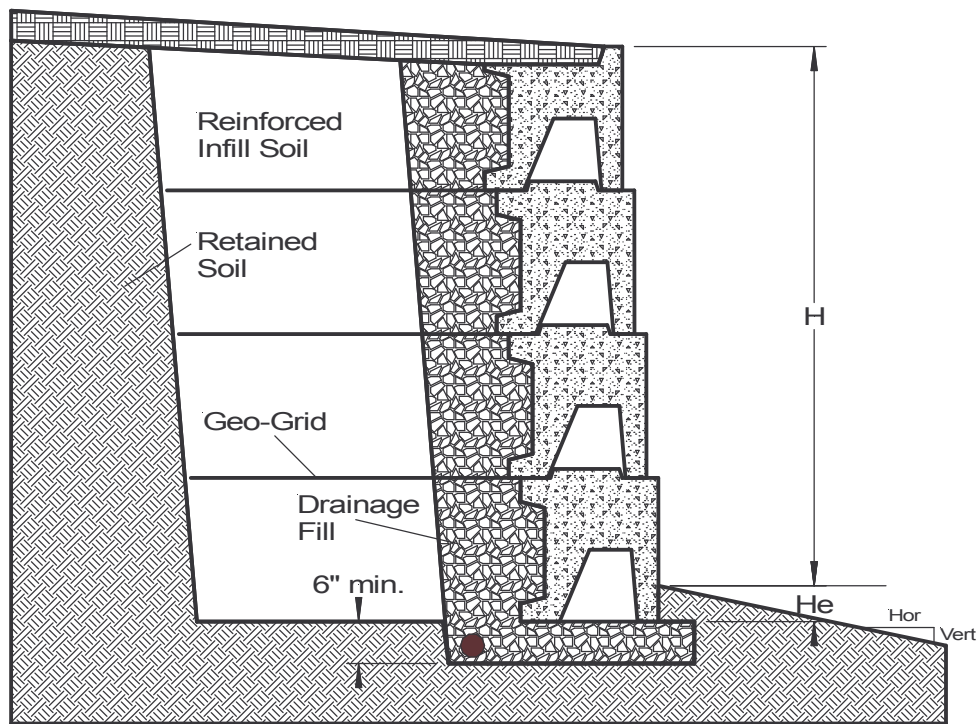
## **Footing Embedment Depth**

**The embedment depth is dependent on the lower slope of the wall.**

**Level lower slope:  $H_e = H/20$  or 6" minimum**

**3Hor. : 1Vert. slope:  $H_e = H/10$  or 6" minimum**

**2Hor. : 1Vert. slope:  $H_e = H/7$  or 6" minimum**

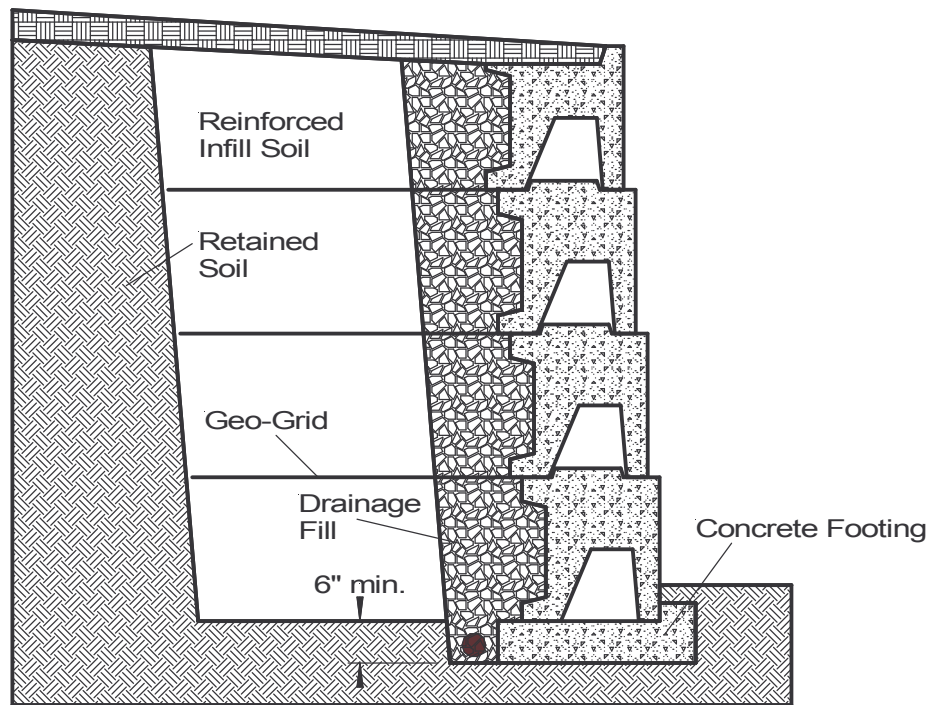




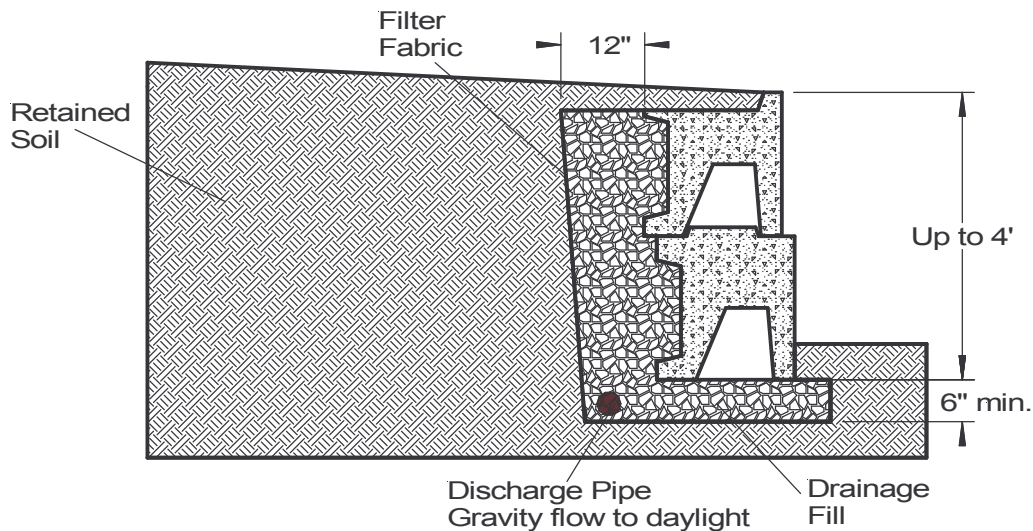
## Concrete Wall Footing

**In cases where there is very poor bearing soil or the weight of the retaining wall blocks exceeds the bearing capacity of the drainage material, a concrete footing may be used. This can be poured in place or precast concrete. The site engineer will have to determine the final dimensions.**

**For our blocks, a compacted stone base with a design for 2,000 psf will allow up to an 8' high wall. Above this, a concrete base pad should be used.**



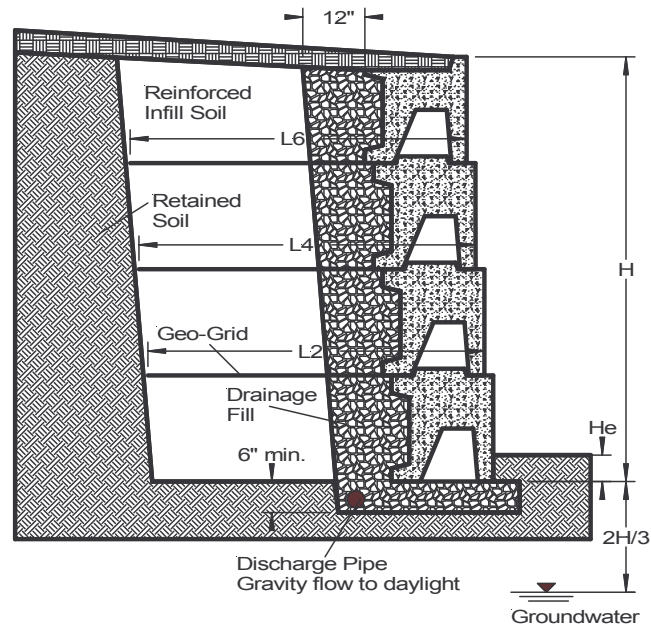
## Un-reinforced Wall Design up to 4' high



### **Installation:**

- 1. Install leveling pad with drain pipe. Compact to 95% of Maximum Standard Proctor Density (ASTM D698).**
- 2. Install first row of blocks level. For a straight run, use a string line on the inside face. Getting this first course level is critical to making the rest of the job easier.**
- 3. Install drainage stone in 8" lifts, compacting to 95%.**
- 4. Clean the tops of the blocks completely.**
- 5. Set the next course of blocks making sure that they are hitting the back of the knobs on the blocks below. This ensures that ground pressure cannot push them forward any more. The standard offset is two inches but if you want the front face flush, you will need to cut 1-3/4" off the backs of the knobs. To do this, snap a chalk line across the knobs and cut them with a demolition saw equipped with a diamond blade.**

## Reinforced Wall Design over 4' high



**Miragrid 5XT Geogrid Length Chart\***

H(ft)	# Blocks High	L2(ft)	L4	L6	L8	L10	L12	L14	L16	L18	He(in)
2	1	--	--	--	--	--	--	--	--	--	6
4	2	--	--	--	--	--	--	--	--	--	6
6	3	6	6	--	--	--	--	--	--	--	6
8	4	6	6	7	--	--	--	--	--	--	6
10	5	6	6	7	9	--	--	--	--	--	6
12	6	8	8	8	9	10	--	--	--	--	7
14	7	9	9	9	9	10	11	--	--	--	8
16	8	10	10	10	10	10	11	12	--	--	9
18	9	11	11	11	11	11	11	12	14	--	10
20	10	12	12	12	12	12	12	12	14	15	12

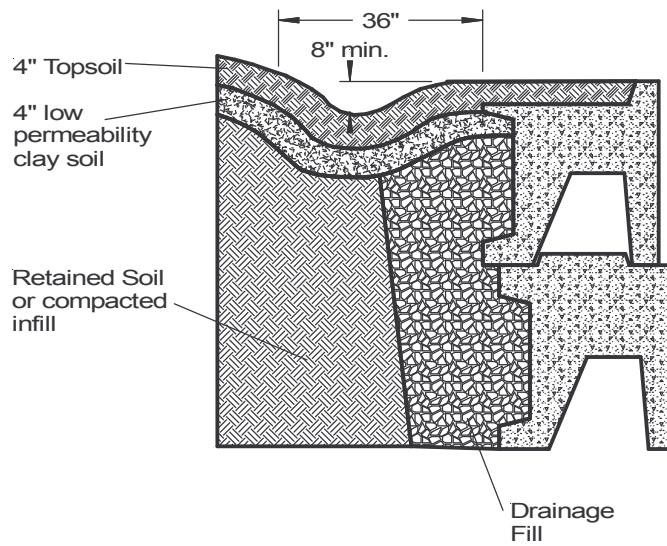
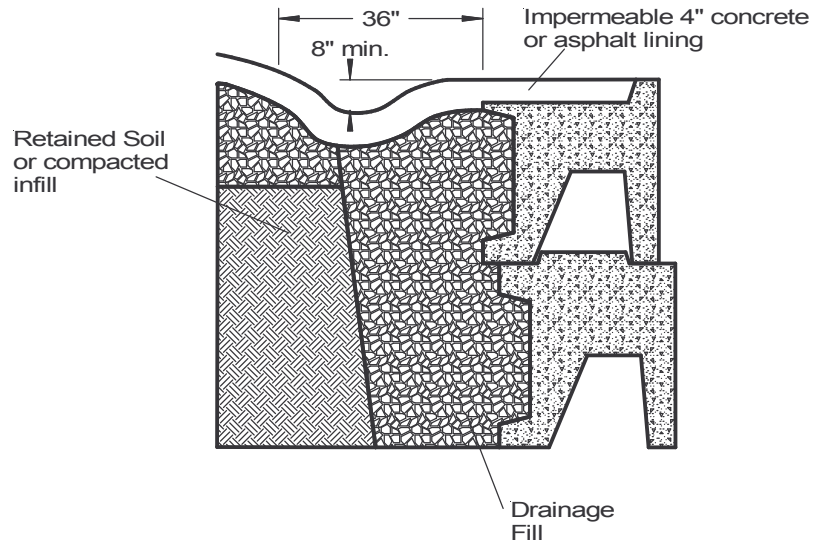
(Example: L4 = Length of geogrid in feet at 4' high level off base)

### **\*Site Conditions required for the above chart:**

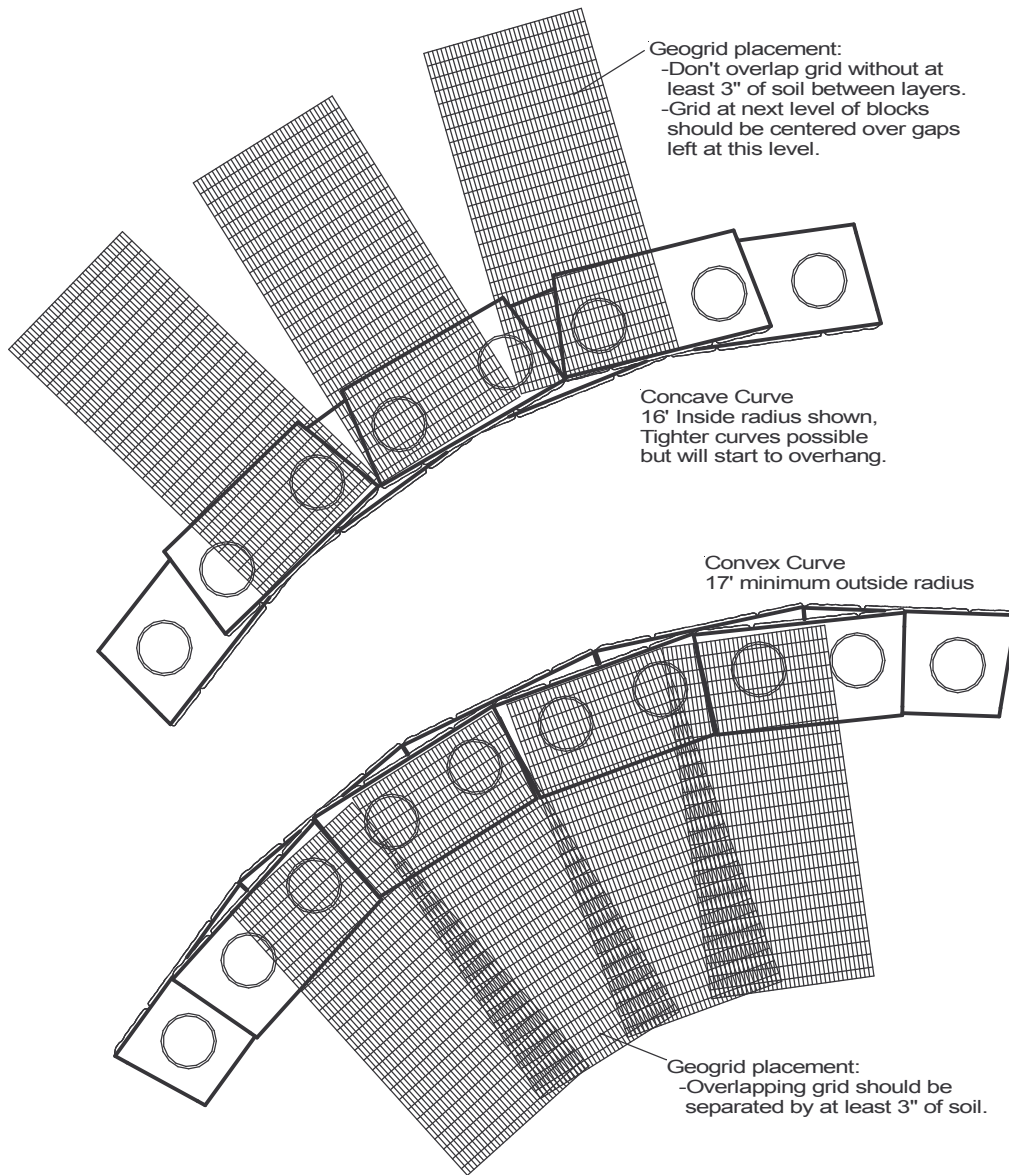
1. Reinforced, retained, and foundation soils all are sandy type with friction angle of 30 degrees and a unit weight of 120 lb/square foot. The leveling pad is gravel with a friction angle of 40 degrees and a unit weight of 125 lb/square foot.
2. Slopes at the top and bottom of the wall are level and there is no surcharge on top.
3. Groundwater is at least 2H/3 below bottom of wall.
4. All retaining wall designs should be reviewed by the site engineer to assure conformity with existing conditions. There are too many factors involved with each site to guarantee that one design will work every time.
5. Many projects require a separate soil investigation and geotechnical assessment before wall design can begin. This is critical where there are significant structures, wall heights greater than 15 feet, steep slopes in the vicinity, cohesive soils proposed for the infill, high groundwater elevations and or seismic activity in the area.

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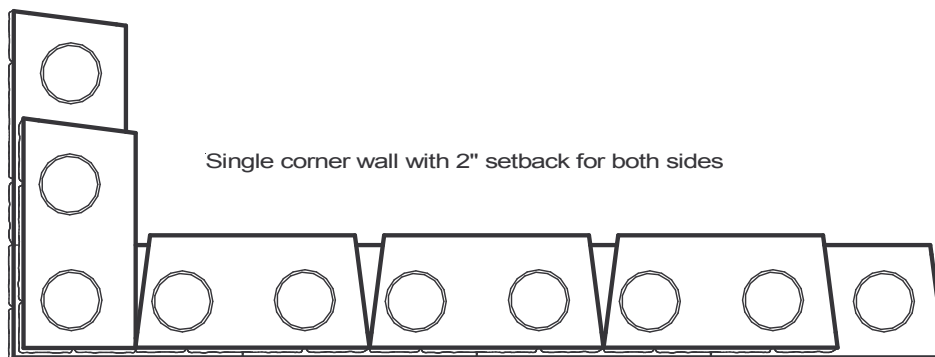
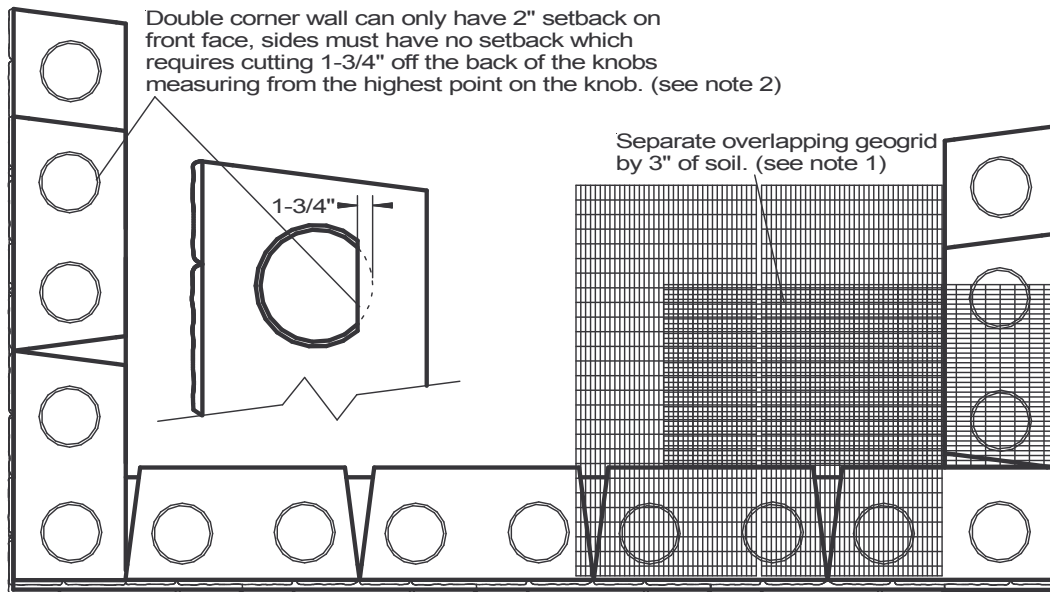
## Drainage Swale Details



## Installing Curved Walls



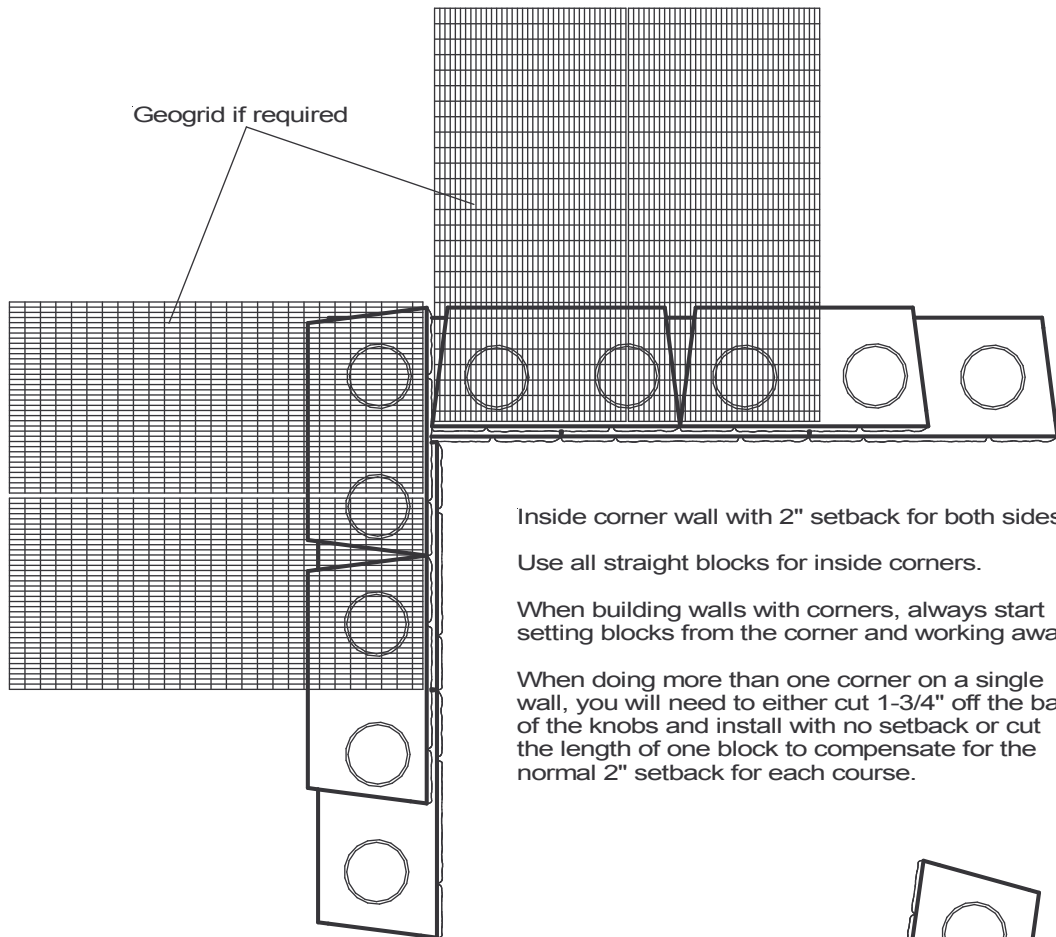
## Installing Outside Corners



### Notes:

1. An alternative geogrid placement for corners is to alternate the direction of the grid for successive rows rather than trying to get a 3" layer between two grids.
2. If a 2" setback is required for all three sides then 4" will have to be cut off the length of one of the blocks on the front face for each row you go up. (4" off second row, 8" off third row, etc.)
3. If the end of the wall is abutting a foundation or other vertical wall, then 2" will have to be cut off the length of one block for each row you go up.
4. If a 2" setback is required and the location of the top row is critical, then plan carefully where the bottom row is located.
5. The notch on the bottom of half blocks does not go all the way through the sides as on the full blocks. If a half block is not centered over the knob below, you will have to break off the leftover web of concrete.

## Installing Inside Corners

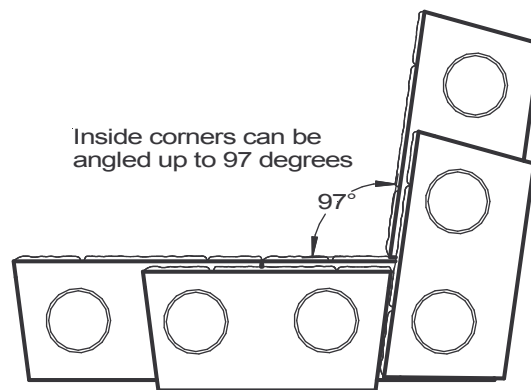


Inside corner wall with 2" setback for both sides.

Use all straight blocks for inside corners.

When building walls with corners, always start setting blocks from the corner and working away.

When doing more than one corner on a single wall, you will need to either cut 1-3/4" off the back of the knobs and install with no setback or cut the length of one block to compensate for the normal 2" setback for each course.





## **General Installation Procedure**

- 1. Install leveling pad with drain pipe. Compact to 95% of Maximum Standard Proctor Density (ASTM D698).**
- 2. Install first row of blocks level. For straight runs, use a string line on the inside face. Getting this first row straight and level is critical to making the whole job easier and faster.**
- 3. Install drainage stone and fill material to top of block in 8" lifts, compacting each layer. Install secondary drains through the face of the wall at this time if needed.**
- 4. Clean all debris off the top of the blocks (very important) and install geogrid reinforcing (if required) to length as needed. Grid should extend to the front of the blocks.**
- 5. Set next course of blocks.**
- 6. Tension geogrid and secure. Grid must be flat and free from wrinkles.**
- 7. Backfill next 8" layer over grid. Compact fill then remove tension on grid.**
- 8. Continue with successive courses in the same manner.**



## **Surcharge Loading & Sloped Backfills**

Often there are added surcharge loads behind the wall which will add to the design loading calculations. There are four main types:

**1. Sloped Backfill:** If the grade above the wall is not flat, this slope will contribute an additional load on the wall. The amount will increase with steeper slopes.

**2. Broken Back Slope:** This is a case where the angled slope above the wall is less than 2 times the height of the wall before it levels off.

**3. Uniform Surcharge:** A uniform surcharge loading is used to model routine loads applied to the top of the wall. Dead loads will come from tiered retaining walls, buildings, storage tanks, etc. Live loads will come from vehicle traffic. Common loads are:

**100 psf for cars and light truck traffic**

**250 psf for tractor trailers or highway loading**

**4. Line or Point Loads:** These may result from heavy insulated footings or continuous footings installed in close proximity to the wall.

## **Resources**

- 1. NCMA - The National Concrete Masonry Association has publications retaining to segmental walls including a design manual, installation guide and a retaining wall design program. They are found at [www.ncma.org](http://www.ncma.org) or by calling 703-713-1900.**
- 2. Geogrid - Detailed specifications for geogrids used and installation guidelines can be found at the Tencate website at [www.tencate.com](http://www.tencate.com) or on our website.**
- 3. Test Results - All Woodard's test results for block interface shear and block to geogrid connections can be found at our website [www.woodardsconcrete.com](http://www.woodardsconcrete.com) or by calling our office at 845-361-3471.**
- 4. NPCA - Woodard's Concrete is a National Precast Concrete Association Certified Plant. This process insures that we are doing everything that we can to provide a quality product. For more information visit [www.precast.org](http://www.precast.org).**