3.2 GeoLock® Wall Anchor System

3.2.1 Summary Description

The GeoLock Wall Anchor System designed and manufactured by Foundation Supportworks is a proven method to laterally support bowed, leaning and sheared foundation walls and retaining walls subject to unbalanced earth pressures. Similar-type "plate anchor" systems have been used successfully since the late 1970s to stabilize foundation walls and retaining walls against further appreciable lateral movement. The system consists of an earth anchor buried in the ground an adequate distance from the structure, an interior wall plate set against the wall face being supported, and an anchor rod to connect the two (*Figure 3.14*). The passive resistance of the soil in front of the earth anchor resists lateral forces on the wall and further inward movement. Technical specifications for the GeoLock Wall Anchor System are included in *Appendix 3A*.

3.2.1.1 Advantages

Some of the advantages to installing GeoLock wall anchors over other wall bracing systems may include:

- Can be installed year-round
- Most jobs completed in one day
- Minimal disturbance to home, lawn and landscaping
- Can straighten walls over time (in many cases)
- Will not damage interior flooring
- Easily hidden within framing of walls

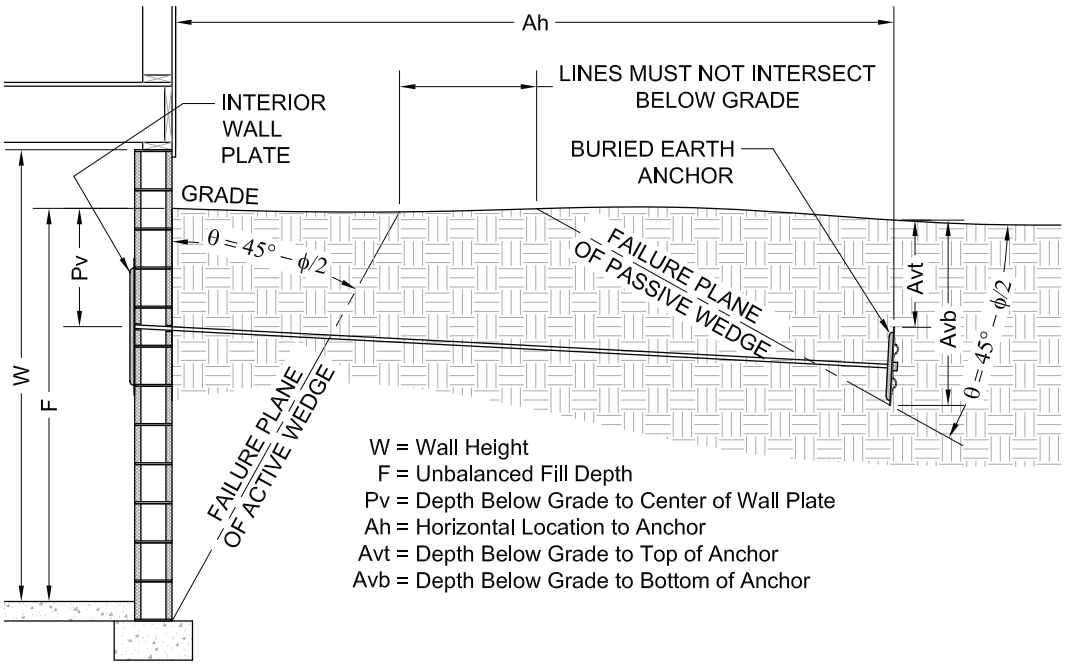


Figure 3.14 General arrangement of GeoLock® Wall Anchor System

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3.2.2 Installation Guidelines

In the following subsections, we offer general installation guidelines for spacing, tightening, and depth and location of the earth anchor. Literally thousands of basement walls have been stabilized with these guidelines and with great results. Deviations to these guidelines may be considered by a qualified design professional based on project-specific conditions.

3.2.2.1 Spacing

The designer will consider several factors when providing recommendations for anchor spacing. These factors include the wall height and thickness, the retained height of the backfill, and the general condition and position of the wall. One of the most common situations is for an 8-inch-thick concrete block residential basement wall that is 8 feet tall with 8 feet of unbalanced fill. This scenario most commonly results in a spacing recommendation of 5 feet between anchors and 3 feet from corners. Another common situation would be for an 8-inch-thick poured concrete residential basement wall that is also 9 feet tall with 8 feet of unbalanced fill. This scenario most commonly results in a spacing recommendation of 6 feet between anchors and 3.5 feet from corners.

3.2.2.2 Torque Recommendations

Torque applied to the nuts during the tightening process of the wall anchor system correlates directly to tension in the anchor rod and force applied to the wall. Foundation Supportworks engineering recommends that applied torque not exceed 80 foot-pounds (ft-lb) for block walls and 90 ft-lb for poured concrete walls. These torque values assume that Foundation Supportworks Anchor Wax is applied to the threads on the rod, which significantly reduces friction between the rod and nut and results in a higher applied force than nuts tightened to similar torque in a dry condition. The average applied force noted in *Figure 3.15* was generated from dozens of test samples with testing completed at an independent test facility. Due to product variations, these values should only be considered applicable to products supplied by Foundation Supportworks.

Applied Torque (ft-lb)	Average Applied Force (lb)	
	Waxed Condition	Dry Condition
80	11,900	6,100
90	12,900	6,900

Figure 3.15 Average applied force on the anchor rod versus applied torque on the anchor rod nut

The GeoLock system utilizes a hemispherical washer which allows the thread rod to be installed at angles up to 10 degrees in any direction. The adjustable washer prevents edge-loading of the nut and bending of the all thread rod, and allows for a more accurate torque reading during the tightening process *(Figure 3.16)*. Installers shall closely monitor the tightening process of the wall anchor installation and reduce the applied torque as necessary for atypical conditions.



Figure 3.16 Hemispherical washer

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3.2.2.3 Depth & Location of Earth Anchor

The GeoLock Wall Anchor System is designed with two (2) ¾-inch diameter, 80-inch long all-thread rods coupled together. This total rod length of 13 feet 4 inches allows the earth anchor to be approximately 12 feet from the stabilized wall, far enough to prevent load from the anchor being transferred back to the wall. Considering the backfill height, the vertical placement of the earth anchor, and a range of soil types and strengths, the coupled rod length of 13 feet 4 inches would be adequate for typical applications with backfill heights up to about 8 feet. Additional all-thread rod sections can easily be added as necessary for backfill heights greater than 8 feet.

The following tables provide the horizontal location of the earth anchor from the exterior face of the foundation wall (Ah) and the earth anchor depths (Avt and Avb) considering a variety of soil conditions. Refer to *Figure 3.14* when using these tables. One quickly observes that soil type has little effect and changes Ah and Avb only slightly. Rather, values of Ah and Avb are driven more by minimum depth criteria and geometry. The anchor plate should also be buried deep enough to be below the depth of soil affected by frost, and below any "active zone," i.e., the depth of clayey soils that may shrink or swell with seasonal moisture variations.

Soil Description: Medium Dense Sand and Gravel

Internal angle of friction (Φ) = 34 degrees

"Ah" Minimum Required Horizontal Location to Anchor (ft)											
"Pv" Depth Below Grade to Center of Wall Plate (ft)		1		2		3		4		5	
		Anchor Size		Anchor Size		Anchor Size		Anchor Size		Anchor Size	
		Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg
"F" Unbalanced Fill Depth (ft)	**10**	12.2	13.0	12.2	13.0	13.0	13.8	14.9	15.7	16.8	17.5
	9	11.7	12.5	11.7	12.5	12.5	13.2	14.4	15.1		
	8	11.2	11.9	11.2	11.9	11.9	12.7	13.8	14.6		
	7	10.6	11.4	10.6	11.4	11.4	12.2				
	6	10.1	10.9	10.1	10.9	10.9	11.7				
	5	9.6	10.3	9.6	10.3						
	4	9.0	9.8	9.0	9.8						
	3	8.5	9.3								

"Avb & Avt" Minimum Required Depths Below Grade to Anchor (ft)										
Bottom - Avb:	3.7	4.1	3.7	4.1	4.1	4.5	5.1	5.5	6.1	6.5
Top - Avt:	Depth as needed to prevent frost effects									

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Soil Description: Loose Sand and Gravel

Internal angle of friction (Φ) = 30 degrees

"Ah" Minimum Required Horizontal Location to Anchor (ft)											
"Pv" Depth Below Grade to Center of Wall Plate (ft)		1		2		3		4		5	
		Anchor Size		Anchor Size		Anchor Size		Anchor Size		Anchor Size	
		Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg
"F" Unbalanced Fill Depth (ft)	10	12.1	12.8	12.1	12.8	12.9	13.6	14.6	15.3	16.3	17.0
	9	11.6	12.3	11.6	12.3	12.3	13.0	14.0	14.7		
	8	11.0	11.7	11.0	11.7	11.7	12.4	13.4	14.1		
	7	10.4	11.1	10.4	11.1	11.1	11.8				
	6	9.8	10.5	9.8	10.5	10.5	11.3				
	5	9.2	10.0	9.2	10.0						
	4	8.7	9.4	8.7	9.4						
	3	8.1	8.8								

"Avb & Avt" Minimum Required Depths Below Grade to Anchor (ft)										
Bottom - Avb:	3.7	4.1	3.7	4.1	4.1	4.5	5.1	5.5	6.1	6.5
Top - Avt:	Depth as needed to prevent frost effects									

Soil Description: Silt, Silty/Clayey Sand and Gravel

Internal angle of friction (Φ) = 26 degrees

"Ah" Minimum Required Horizontal Location to Anchor (ft)											
"Pv" Depth Below Grade to Center of Wall Plate (ft)		1		2		3		4		5	
		Anchor Size		Anchor Size		Anchor Size		Anchor Size		Anchor Size	
		Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg
"F" Unbalanced Fill Depth (ft)	10	12.1	12.8	12.1	12.8	12.8	13.5	14.4	15.1	16.0	16.7
	9	11.5	12.2	11.5	12.2	12.2	12.8	13.8	14.4		
	8	10.9	11.5	10.9	11.5	11.5	12.2	13.1	13.8		
	7	10.2	10.9	10.2	10.9	10.9	11.6				
	6	9.6	10.3	9.6	10.3	10.3	11.0				
	5	9.0	9.7	9.0	9.7						
	4	8.4	9.0	8.4	9.0						
	3	7.7	8.4								

"Avb & Avt" Minimum Required Depths Below Grade to Anchor (ft)										
Bottom - Avb:	3.7	4.1	3.7	4.1	4.1	4.5	5.1	5.5	6.1	6.5
Top - Avt:	Depth as needed to prevent frost effects									

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Soil Description: Silty Clay, Clay with Sand

Internal angle of friction (Φ) = 18 degrees

"Ah" Minimum Required Horizontal Location to Anchor (ft)											
"Pv" Depth Below Grade to Center of Wall Plate (ft)		1		2		3		4		5	
		Anchor Size		Anchor Size		Anchor Size		Anchor Size		Anchor Size	
		Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg
"F" Unbalanced Fill Depth (ft)	10	12.3	12.9	12.3	12.9	12.9	13.5	14.3	14.8	15.6	16.2
	9	11.6	12.2	11.6	12.2	12.2	12.7	13.5	14.1		
	8	10.9	11.4	10.9	11.4	11.4	12.0	12.8	13.4		
	7	10.1	10.7	10.1	10.7	10.7	11.3				
	6	9.4	10.0	9.4	10.0	10.0	10.6				
	5	8.7	9.2	8.7	9.2						
	4	8.0	8.5	8.0	8.5						
	3	7.2	7.8								

"Avb & Avt" Minimum Required Depths Below Grade to Anchor (ft)										
Bottom - Avb:	3.7	4.1	3.7	4.1	4.1	4.5	5.1	5.5	6.1	6.5
Top - Avt:	Depth as needed to prevent frost effects									

Soil Description: Saturated Clay Soils

Internal angle of friction (Φ) = 0 degrees

"Ah" Minimum Required Horizontal Location to Anchor (ft)											
"Pv" Depth Below Grade to Center of Wall Plate (ft)		1		2		3		4		5	
		Anchor Size		Anchor Size		Anchor Size		Anchor Size		Anchor Size	
		Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg	Small	Med/Lrg
"F" Unbalanced Fill Depth (ft)	10	13.7	14.1	13.7	14.1	14.1	14.7	15.1	15.5	16.1	16.5
	9	12.7	13.1	12.7	13.1	13.1	13.7	14.1	14.5		
	8	11.7	12.1	11.7	12.1	12.1	12.7	13.1	13.5		
	7	10.7	11.1	10.7	11.1	11.1	11.7				
	6	9.7	10.1	9.7	10.1	10.1	10.7				
	5	8.7	9.1	8.7	9.1						
	4	7.7	8.1	7.7	8.1						
	3	6.7	7.1								

"Avb & Avt" Minimum Required Depths Below Grade to Anchor (ft)										
Bottom - Avb:	3.7	4.1	3.7	4.1	4.1	4.5	5.1	5.5	6.1	6.5
Top - Avt:	Depth as needed to prevent frost effects									

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3.2.3 Installation Steps

The following steps provide a broad overview of a typical GeoLock Wall Anchor System installation. Intermediate steps, installation equipment and tools used, and considerations for unusual conditions or applications are not addressed.

Step 1

Sod is carefully removed and a hole is excavated or augered (*Figure 3.17*). The front face of the hole (toward structure) is cut flat to accept the earth anchor plate.



Figure 3.17

Step 2

A small 1⅛-inch hole is drilled through the basement wall and the anchor rod is driven out to penetrate the augered hole (*Figure 3.18*).



Figure 3.18

Step 3

Earth anchor plate is placed in the augered hole and attached to the anchor rod (*Figure 3.19*).



Figure 3.19

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Step 4

Interior wall plate is positioned over the anchor rod and tightened to the specified torque, seating the earth anchor plate and engaging the passive resistance of the soils (*Figure 3.20*).



Figure 3.20

Step 5

Augered hole is backfilled and compacted and the sod is replaced (*Figure 3.21*).



Figure 3.21

Step 6

Anchors can be tightened at specified intervals to straighten wall over time, if desired (*Figure 3.22*). Tightening of the anchors generally occurs during drier seasons of the year when there is less pressure on the wall and shrinkage gaps may have formed between the wall and the soil.



Figure 3.22

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