



In our last newsletter, we discussed the execution of good site preparation for proper drainage and provided a simplified, easy foundation design.

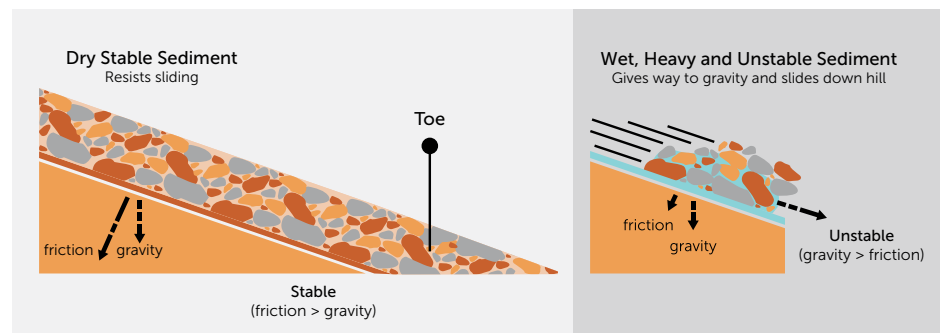
This edition is dedicated to best practices when building on or near a slope and how to prevent landslides.

Unreinforced Slopes

By Tom Rehrig

Many homeowners choose to place their home on lots with steep slopes. Generally, a contractor removes the "toe" by cutting a shelf into the side of the hill. The "toe" plays a critical role in keeping the upper portion stable. Removing the "toe" without reinforcement should be avoided. **An unreinforced slope can erode and collapse**, which can result in the home being pushed off its foundation.

Rainwater and runoff adds tremendous weight and pressure within the soil and acts like a lubricant. This combination reduces the frictional forces that hold the hill in place, causing the slope to become unstable resulting in potential failure (landslide).



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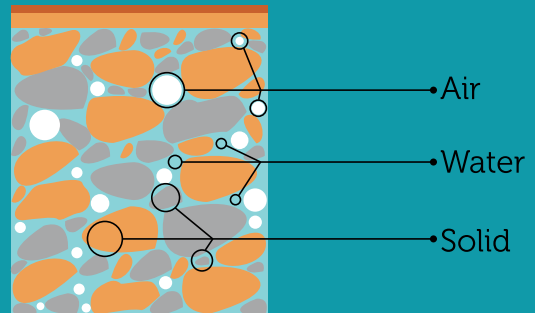
SLOPE PROXIMITY

When the home is located adjacent to a slope steeper than 1:3 (1' vertical and 3' horizontal), special setbacks (D) are required between the building and the base of the slope. This setback is to protect the home from damage caused by drainage, erosion, and failures of the slope (landslide). You should consult with the local building official or the state residential building code to determine these minimum setback distances (D).

If a building official or state building regulation is not available, then contacting an engineer to determine proper setbacks is also an option. The tables below can be used as a general reference for the minimum recommended setback for slopes from 1:3(18.5°) to 1:1(45°). Building sites with slopes greater than 45° or where the minimum setbacks can't be met should be referred to a professional engineer or registered architect.

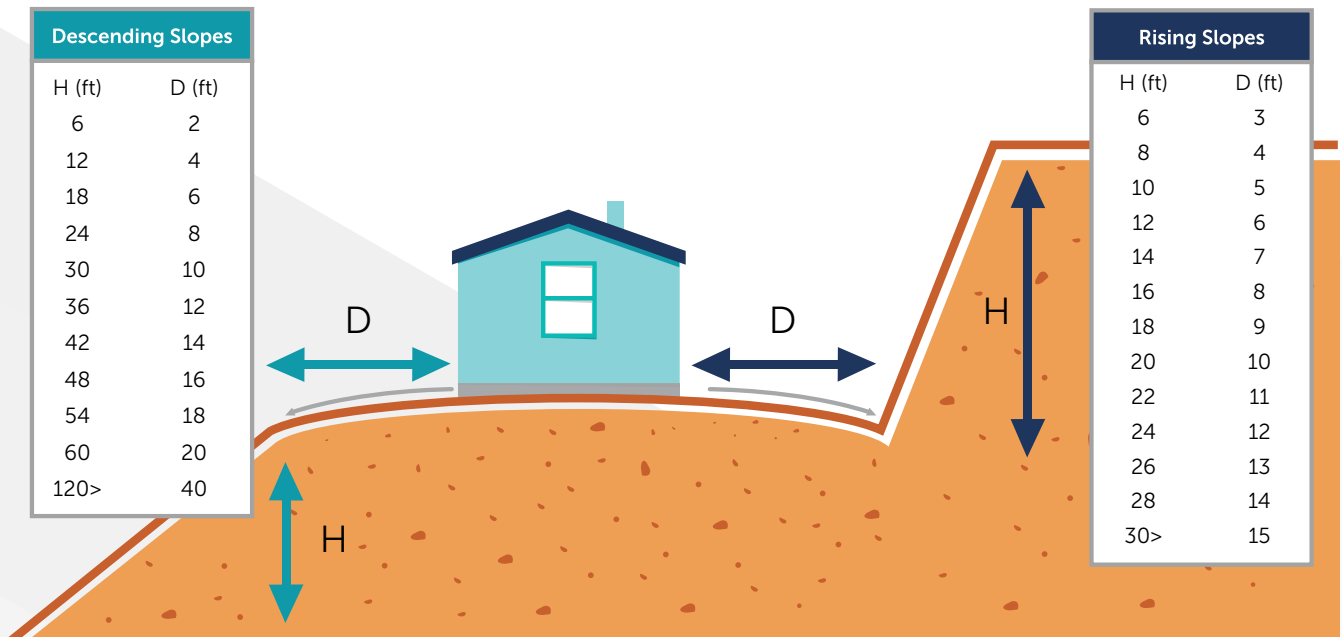
The Makeup of Soil

Soil is made up of soil particles, air, and water. Soils like clay are weaker (unless properly compacted and drained) because they contain more air. Excess water saturates the soil particles replacing the air, increasing the weight, and pushing the particles apart which reduces the friction and weakens the soil.



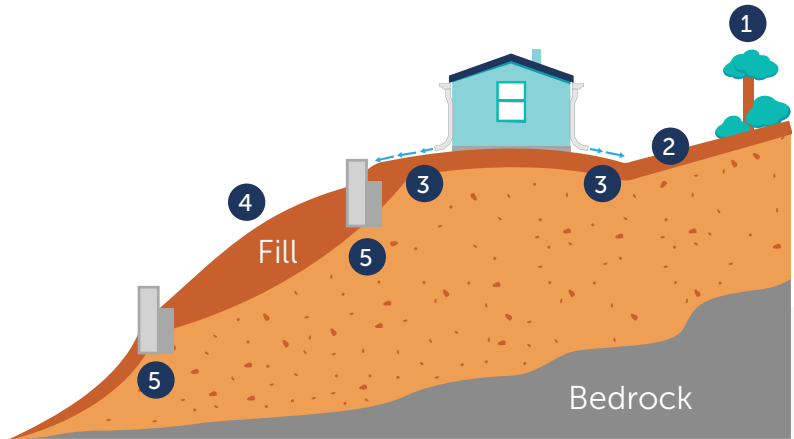
Descending Slopes	
H (ft)	D (ft)
6	2
12	4
18	6
24	8
30	10
36	12
42	14
48	16
54	18
60	20
120>	40

Rising Slopes	
H (ft)	D (ft)
6	3
8	4
10	5
12	6
14	7
16	8
18	9
20	10
22	11
24	12
26	13
28	14
30>	15



How to Prevent Landslides

1. Keep vegetation in place to reinforce soil.
2. Address the steepness by re-grading the slope.
3. Divert roof water and slope runoff away from home.
4. Properly compact fill to avoid pooling, uneven settling, and landslides.
5. Stabilize slope with retaining walls. A retaining wall is recommended for slopes that exceed 1:1.5 (1' vertical to 1.5' horizontal or 34-degrees).



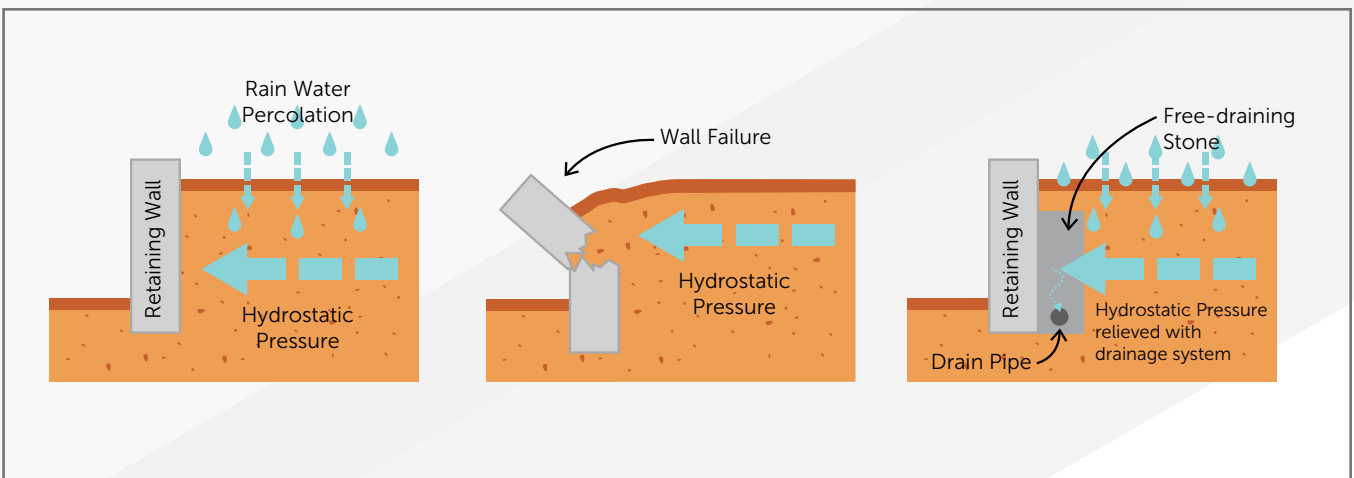
Retaining Walls

By Chuck Morgan

A retaining wall is a vertical structure designed to contain soil and prevent erosion. The most common retaining walls used in residential construction are Gravity and Anchored walls. Gravity walls use the weight of the wall to hold back the soil. They are best suited to small slopes requiring walls of less than 3-4 feet in height. Anchored walls use tension supports, that are anchored to the soil or rock to support the wall and resist pressure.

A retaining wall is constantly fighting gravity to prevent erosion. To be successful, the wall requires careful planning and sound construction practices. Factors such as soil type, slope angle, height, and drainage impact the stability of a retaining wall. Local building codes and ordinances vary between communities. Check with your local building authority for requirements and necessary zoning or building permits.

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Best Practices in Retaining Wall Construction

FOUNDATION

For walls 4 feet or less, a compacted gravel footer is usually sufficient. Taller walls require a poured footer below the frost line (check with the local authority for requirements).

BACKFILL

The space directly behind a retaining wall should be filled with clean $\frac{3}{4}$ " gravel, not dirt. Dirt absorbs water and swells, which puts additional pressure on the back of the wall. Gravel will allow water to drain which reduces the pressure. Backfill a minimum of 12"-18" immediately behind the wall with clean $\frac{3}{4}$ " gravel. Any additional backfill should be clean native soil. Add the backfill after each course of block is laid and compact using a vibrating plate compactor. Make a minimum of 3-5 passes. Never try to compact more than one course of backfill at a time.

DRAINAGE

Shorter walls using precast retaining wall blocks will usually drain fine with just the gravel backfill. Larger walls and solid walls need proper drain pipes installed behind the wall along the footer. This will help carry water safely away from the wall and home.

CONSTRUCTION

(Always follow the block manufacturer's and/or engineer's instructions.)

Most gravity and anchored retaining walls are constructed so that they lean slightly toward the soil they're containing. This design, known as "step-back construction," creates a sturdy wall structure that pushes back against the lateral pressure of the soil behind it. Solid precast retaining wall blocks are designed to lock mechanically. Hollow blocks must be filled with compacted gravel after each course is laid to lock them in place. The first course of block must be installed below grade. For walls over 4 feet, the base of the wall should be 2" below grade for every foot of wall height.

REINFORCEMENT

Many precast systems require reinforcement such as geotextile mesh layered between courses at certain intervals, based on the overall height. When building a terraced retaining wall, specific spacing and reinforcement is required based on the height of the walls and the soil type. Refer to the manufacturer or engineer design for these requirements.

NEXT EDITION: CROSSMOD HOMES