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# How Soils Can Work For You

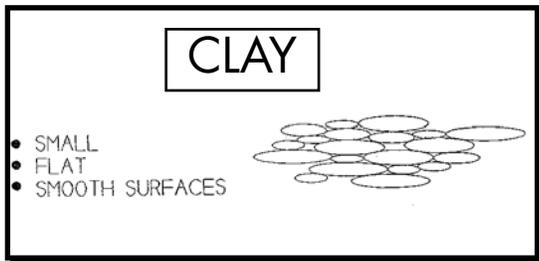
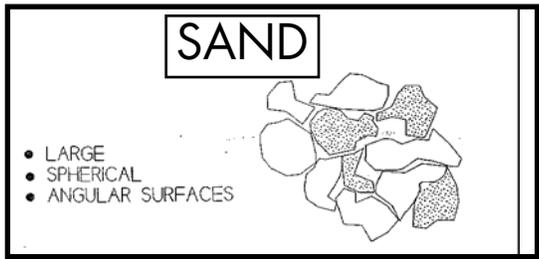
## Q Why does the type of soil being retained make a difference?

Soil has two main properties that are used to determine how much reinforcement is required to stabilize a soil mass. The internal strength, *soil*

TYPICAL SOIL PROPERTIES			
Soil Groups	Cohesion (as compacted) PSF	Cohesion (saturated) PFS	Soil Friction Angle (degree)
Clean Gravel - Sand Mix	0	0	36
Sand - Silt Clay Mix	1050	300	32
Inorganic Clays	1800	270	27

*friction angle or Phi angle*, of different soils plays a major role in determining how well soils hold themselves up. This internal strength of the soil, not the retaining wall, performs most of the work of holding up any hillside. The friction angle of the soil is an indicator on how well the soil will support its own weight.

Soils also possess a second property which allows the soil to stick together, *cohesion*. Clay soils have lower internal strengths but higher cohesion values. Soils with high percentages of sand and gravel have higher internal strengths and lower cohesion values.



## Q How does water affect the soil?

The major cause of landslides is moisture. Water changes the characteristics of soil in the same way that heat affects ice. As any soil becomes saturated, two things happen:

- The weight of the mass of soil increases. Once the weight of the soil increases beyond the internal strength of the soil, the mass slumps.
- The ability of soil particles to stick together is reduced.

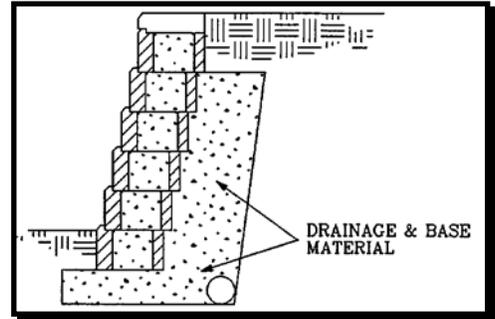
Clay soils are comprised of small flat particles that drain away water very slowly. Once a clay soil mass becomes saturated, cohesive properties become negligible.

Soils with high percentages of sand and gravel are comprised of larger more angular particles. This type of soil has lower cohesive properties but drains away water very rapidly. The ability of the soil to drain provides a more stable soil mass and reduces hydrostatic pressure present in saturated soil. The internal strength of sandy soil is also higher.

**Q What type of aggregate should be used when preparing the base, building the drain field behind the wall and in the cores of the block?**

A well graded compatible aggregate provides the best base and drain field material. *Well graded* may be defined as having a wide range in grain sizes and substantial amounts of all intermediate particle sizes. Fines should be minimized as sufficient compaction can be obtained with the proper gradation of aggregates. It is not necessary to use different types of material for the base and drain field.

Crushed stone has several positive features as a backfill material for retaining walls. High internal shear strength, good compaction characteristics and excellent drainage and freeze/thaw resistance capabilities provide the key ingredients needed for trouble free retaining wall construction.

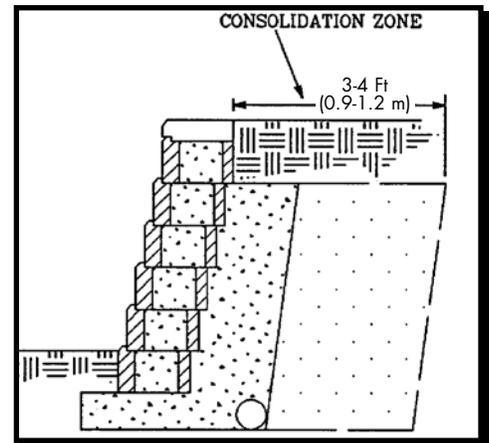


**Q Can soil behind the wall be over compacted?**

**Yes!** Excess compaction may result in the following situations:

- Forward rotation of the wall facing.
- Localized bulging of the wall facing.
- Damage to the reinforcement when sharp angular aggregate is used.

Retaining wall construction requires a certain amount of compaction to consolidate the soil and minimize settlement that occurs after walls have been constructed. Excessive compaction can cause forward rotation of the wall facing. Soil compaction within 3-4 ft (0.9-1.2 m) of the wall must be accomplished with hand operated equipment. Plate compactors provide the compaction required while minimizing the potential for pushing the wall forward. Large equipment operating too close to the wall is a common problem on commercial construction sites. Concentrated loading from heavy equipment may cause over compaction and result in a rotation of the wall facing or localized bulging. Over compaction may also damage geogrid reinforcement materials.



**More compaction is not always better. Contact the AB Engineering Department for more information on the correct backfill material to use for the job and guidelines on proper compaction.**

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