Soils Support Buildings/Infrastructure

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Soil Supports Us

Access to good soil is very important for building a modern infrastructure. Soil is directly used to make building materials, such as cement and brick, as well as indirectly used to grow the plants used to make building materials such as wood boards and insulation fibers. Historically, many homes and other structures were made from soil or soil that was caked and dried into blocks. These included earthen homes cut into hillsides, homes where mud was "plastered" onto the walls, and adobe homes.

Since soil is everywhere, all structures are also built on soil. Selection of sites with the best soil is an important engineering decision in the building process. Soil maps are a great tool to help engineers determine the best location for their design. Soil maps are created by soil scientists and present information such as:

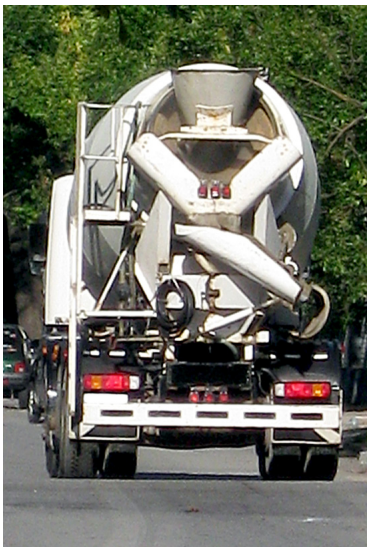
- the slope of the land surface;
- soil biological, chemical, and physical properties; and,
- potential for water runoff, drainage, or storage.

Soil maps are available for public access from the USDA Natural Resource Conservation Service at the **Web Soil Survey** site at websoilsurvey.sc.egov.usda.gov

Making Smart Engineering Decisions

There are many important engineering decisions that go into developing safe buildings, bridges, and other structures (known as the infrastructure of a community). One of these is determining the best soil to build on. A good soil for infrastructure has the following properties:

- balanced chemistry and neutral pH, so that building materials are not corroded;
- stability through wetting and drying cycles, so that expanding soil does not crack roads or foundations;
- strength under pressure, so that the weight of the building does not cause it to sink into the ground; and,
- ability to capture precipitation, so that runoff and erosion do not damage structures.



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Strength and stability of soil are related to its physical properties. Soil with good structure is more stable. Clay textures are often more stable than sand textures because they have better structure; however, a mix of particle sizes (and pore sizes) is best for engineering (just as it is best for growing crops). Not all soil minerals are equal. Some clay minerals, from a family called smectite, are more likely to shrink and expand during wetting and drying cycles than minerals from other families, such as kaolinite.

When soil properties are not ideal for building, there are ways to change the landscape and practices to provide for better building sites. For example, drainage can be added or land surfaces reshaped to direct water away from the site. It is important to know what the soil properties are for a site so any corrective measures can be incorporated into the design and future failures avoided. There are some well-known examples in history of builders not understanding their soil properly, resulting in structural failures. One of the most famous is the Leaning Tower of Pisa. The land underneath seemed stable during the dry season when building began, but the soil became unstable during the wet season and sank under the weight of the building. Even worse, it sank unevenly, resulting in a leaning tower. In addition to managing drainage, compacting and stabilizing the soil before construction may have reduced settling problems.

While a leaning building or a cracked foundation seems inconvenient, lack of soils knowledge can also result in catastrophic structural failures. One example is that eroded soil particles floating in a water body can be abrasive to bridges, eventually damaging the structural support and resulting in collapse. Another example is mudslides. Homes built on steep land surfaces with soil that loses stability when wet can be swept away with the eroding hillside during times of high soil moisture.

Recap

There is soil underneath all structures, from roads to homes to skyscrapers. Selecting sites with the best soil will lead to more stable and safe structures. Managing for long-term success requires understanding the soil properties and managing the movement of water at the building site.

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Homes built on steep land surfaces with soil that loses stability when wet can be swept away.

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