Schnabel ENGINEERING

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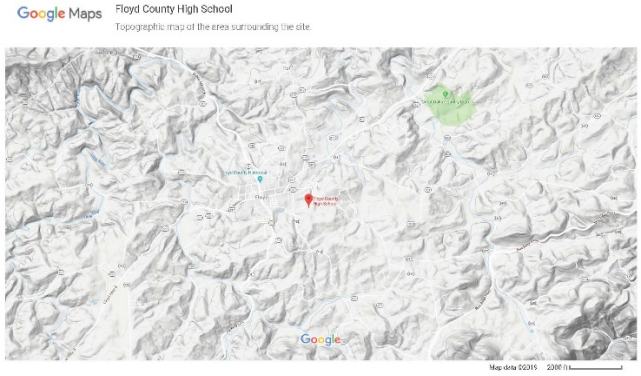
Geotechnical Engineering

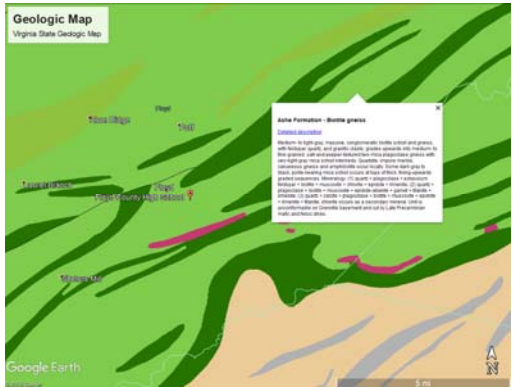
Geotechnical Engineering is a part of Civil Engineering that focuses on soil and rock. Geotechnical engineers explore subsurface (below ground) conditions using various methods. The exploration typically begins in the office by reviewing aerial (e.g., satellite) images, geological maps, and topographic maps. This office review is typically referred to as a "desk study". Examples of each are shown below:

Aerial Image

Topographic Map



Geologic Map



The next phase of exploration is typically performed at the project site. One method of field investigation is performing soil test borings; soil test borings evaluate the soil and / or rock conditions at a specific location. The locations of the soil test borings are chosen using the information from the "desk study" as well as the proposed construction (e.g., how, what, where, when). Soil test borings are typically performed using a drilling rig equipped with hollow stem augers and a drilling head (tip of augers). Below is a picture of a drilling rig, hollow stem augers, and a drilling head:

Drilling Rig

Hollow Stem Augers

Drilling Head

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Geotechnical Engineering Overview

Drilling rigs come in all sorts of configurations and sizes. The pictured drilling rig is mounted on tracks (opposed to tires) to allow for increased mobility on soft ground conditions. The drilling rig rotates the augers to move the soil test boring downwards into the soil. At selected depths, advancement of the augers is stopped and a test called the “SPT” is performed. The SPT involves taking a 2-inch diameter hollow metal sampler and striking it with a 140-pound hammer. The number of blows it takes to move the sampler a certain length is used as a relative measure of soil strength, with higher the N-values suggesting higher soil strength. The SPT also allows for a soil sample to be retrieved after performing the hammer blows. The SPT soil sample is classified and then placed into a jar for later observation and / or laboratory testing. The soil test borings and SPT tests are continued until a planned depth is reached. The depth of boring depends on the construction and soil conditions. Below are photos of an SPT Split-Spoon Sampler both closed and split open.

SPT Split-Spoon Sampler (Closed)

SPT Split-Spoon Sampler (Split Open with Soil Inside)

The geotechnical engineer’s role is to select methods and locations to evaluate the subsurface (below ground) conditions and adjust those plans as needed. During drilling, geotechnical engineers also record data and observations, manage the drillers, and relay information back to the others in the office. In addition to SPT test, there are numerous observations during drilling that can help us understand the subsurface (below ground) conditions. The observations can include the presence of groundwater and behavior the drilling rig during advancement of the augers. For instance, wobbling of the augers along with “chatter” (noise) can suggest a layer of material that will be difficult to excavate through during construction. At the end of the field investigation, soil test boring logs are created to document the observed soil conditions and field test results (such as SPT data).

After the field exploration, the collected soil samples are brought back to the office to perform additional observations and laboratory testing. Laboratory testing is used to classify the soil types and estimate soil engineering properties. Finally, the results of the “desk study”, field investigation, and laboratory testing are combined to create an understanding of the subsurface (below ground) conditions. Geotechnical engineers then perform many calculations (math) to help design the proposed construction. The subsurface (below ground) understanding and calculations are then used to provide recommendations including earthwork (filling or excavating soil), foundations (structure that supports buildings), pavement (roads and parking lots), as well as many other construction aspects.