Because what is under the ground on which a project is to be built is often more important than the condition of the surface itself, Froehling & Robertson, Inc. offers our clients a comprehensive suite of geotechnical drilling services that utilize the latest technological tools and procedures. Whether a client needs F&R to evaluate the strength and composition of the subsurface or test to determine whether there may be soil or groundwater contamination, we have the field and laboratory testing capabilities to support our clients' specific needs.

F&R maintains a fleet of drilling equipment as well as accredited geotechnical engineers that offer a comprehensive scope of geotechnical drilling services utilizing diversified drilling equipment with standard testing techniques that include penetration tests and rock coring. F&R's drilling staff is trained in applicable ASTM testing procedures and participates in our in-house quality control programs. As part of our geotechnical services, we perform a wide range of geotechnical laboratory testing services in support of our subsurface exploration. These tests include, but are not limited to: classification indices, consolidation studies, triaxial and direct shear, unconfined compression, and permeability. Once the analysis is completed, our professional staff of geotechnical engineers compiles the field and laboratory data into a detailed report of our findings and recommendations which can then be utilized by the project design team and/or owner.

Our geotechnical studies may be further assisted by the following in-situ testing methods:

Pressuremeter

The fundamental principle of a pressuremeter test is to expand a vertical cylindrical probe within an undisturbed mass of soil or soft rock using either equal volume increments or equal stress increments. An advantage of the pressuremeter test is that it involves loading a relatively large volume of soil in-situ at discrete points in the soil profile. Soil design parameters that can be derived from pressuremeter test data include bearing capacity and settlement of shallow foundations, end-bearing, and frictional capacity for piles, settlement of piles, lateral load capacity of piles, shear strength of clay soils, and friction angle of granular soils. Since the pressuremeter is used within a pre-drilled hole, it can be used to obtain data within soft soils up to partially weathered rock.

Dilatometer

Correlated soil parameters obtainable from the dilatometer test data include material index, horizontal stress index, dilatometer modulus, coefficient of earth pressure in situ, over-consolidation ratio, undrained shear strength, friction angle, coefficient of consolidation, coefficient of permeability, and constrained modulus. Predicting settlements of shallow foundations is perhaps the primary application of the dilatometer test, especially in sandy soils and soft clay soils. An advantage of the dilatometer is that it can be used to obtain in-place data at short, equally spaced depth intervals, thereby providing a profile of the subsurface. Moreover, since pre-drilling is not required, profile data can be obtained relatively quickly.

Vane Shear

Soil parameters obtainable from the vane shear test data include in-situ undrained shear strength. The vane shear is extremely useful to quickly determine undrained shear strength with depth and establish a reasonable pattern. Undrained shear strength can assist in shallow foundation design and parameters for slope stability.

Field Resistivity

Resistivity defines the characteristic of a material to limit or resist the flow of an electrical current. Resistivity surveys are conducted by inducing a low voltage current into the ground between two electrodes and measuring the potential at other electrodes. Rocks and soils have different resistivity that often is dependent on their level of water saturation and differences in lithology. Higher water saturation results in greater current flow (low resistivity) because of dissolved ions in the water. Dry soils and rocks usually have higher resistivity, and void spaces are completely resistant.

Terrain Conductivity

Terrain Conductivity, also called electromagnetic (EM) induction, is a measure of how well the subsurface materials conduct electric current. The conductivity of these materials is a function of their physical properties, namely porosity, permeability, and the nature of the fluid within the pores. Unlike electrical resistivity, EM instruments do not require ground contact. Therefore, data can sometimes be obtained very rapidly. EM generally has lower resolution than electrical resistivity because of the configuration of the transmitter and receiver coils.

Inclinometer

The primary function of an inclinometer device is to record relative deflection of the surrounding soil mass over time. These measurements provide a baseline orientation of the encapsulated casing within the ground. During ground shifting and/or movement the casing is allowed to travel along with the soil mass and relative movement of the casing is displayed within the inclinometer measurements. This measurement of ground movement can be applied to measure lateral earth movements of unstable slopes, land slide areas, dams and roadway embankments. Inclinometers are also used to measure deflections of geostructural elements including retaining walls, sheeting and shoring, walls of excavations, caissons, piles, sheet piling, tunnels, and shafts.

ReMi Shear Wave Velocity

The Refraction Seismograph can be used to perform Refraction Microtremor (ReMi) Shear Wave Surveys that provide one-dimensional shear wave velocity profiles, downhole refraction (p-wave) testing, and shear wave profile testing. The ReMi Shear Wave Survey can provide depth to rock and rock ripability studies, shear wave velocities for site specific Seismic Design Category determination per the International Building Code (IBC), and also liquefaction potential of subsurface soils. An advantage of the ReMi Shear Wave Velocity is that it can provide the Seismic Site Classification without drilling a required 100 foot boring and/or possibly improving the Seismic Site Classification per Table 1613.5.2 of the IBC.