Supplement 4 – Soil Sampling

The pictures below represent typical soil sampling procedures used for most projects in our area. Figures 1 through 9 are of the standard penetration test (SPT).

Standard Penetration Test (disturbed sample):

Figure 1. Off-road drill rig.

Figure 2. Operator prepares to use 3- to 4-inch diameter continuous-flight auger.

Figure 3. The operators uses the auger to drill down to the first sampling depth. Soil pulled out of the hole is noted so that the driller can approximate the depth for each change of soil type.

Figure 4. The SPT split-spoon sampler is placed at the bottom of the augered hole. A 140-pound automatic-trip hammer, falling freely approximately 30 inches, drives the sampler a depth of 18 inches. The driller records how many "blows" it takes to drive the sampler each 6-inch increment.

Figure 5. The endcap is removed from the sampler tube...

Figure 6. ...and the split-spoon sampler splits into its two halves.

Figure 7. Representative portions of each sample are placed in one or more jars for each sampling depth for lab testing. For some projects (e.g. roads and bridges) a field unconfined compression (Rimac) strength test is performed on an intact portion (cohesive soil, only) of the sample.

Figure 8. The sample jar lid (center) is marked with the boring number (B1), depth of sample (1 to 2.5 feet) and the blows (3-4-6).

Shelby (Thin-Walled) Tube (Relatively undisturbed sample)

Figure 9. The Shelby tube sampler being removed has already been pushed 24 inches into undisturbed soil.

Figure 10. The driller estimates how much of the soil was recovered in the tube. This type of sampling is useful for getting relatively undisturbed soils in cohesive (silty and clayey) soil. It is very difficult to get samples in very rocky (too hard) or sandy (non-cohesive) soils.

Figure 11. End-view of the deepest face of the soil sample extracted.

Miscellaneous

Figure 12. Augers of different configurations. The top four augers are hollow stem. The center-top auger has a plug with cutting teeth.

Figure 13. Rock tooth bit for an auger.

Figure 14. A diamond-tooth bit is used to advance rock core sampling. The bit grinds an annular ring allowing a sample recovery tube to slip around the rock core. Rock coring is several times the lineal foot cost of soil sampling.

Shear Vane *In Situ* Test

Figure 15. The vane shear test is used to attempt to get the shear strength of the soil in its natural, undisturbed test. This can be useful especially in soils where recovery is poor or there is concern that conventional sampling would disturb the soil excessively and make shear strength measurements in the lab unreliable.

Figure 16. The shear vane is inserted into the hole and carefully pushed about 1 foot into undisturbed soil at the bottom.

Figure 17. After allowing the shear vane to sit in the soil for a few minutes, the driller uses a torque-wrench to apply torque to the shear vane shaft. When the shear vane reaches maximum torque (indicated when shaft begins to rotate), the torque is recorded.