

Attachment B: Geotechnical Explorations Minimum Requirements

The primary Geotechnical Exploration Consultant is expected to maintain a truck-mounted drill rig, necessary support vehicles, and a geotechnical testing laboratory with the appropriate staffing and personnel for each. Electronic Cone Penetration Testing (ECPT) and land surveying requirements may be satisfied using subconsultants as necessary. All boring spacing will be in accordance with the LRFD Bridge Design manual unless otherwise instructed by the Project Manager.

Deep Borings

Deep soil borings vary from 30-120 ft deep and shall be made by the wet rotary drilling method. In each deep boring undisturbed samples of cohesive or semi-cohesive material shall be obtained from each distinct soil stratum that is penetrated or at 5 ft (1.5m) intervals, whichever is less, using a 3 in. (76mm) diameter Shelby tube sampling tube. When cohesionless soils are encountered at any depth, a split spoon sampler shall be used in conjunction with Standard Penetration Tests (SPT) at 3 foot (1m) intervals. In the case of dense materials ($N > 30$) encountered greater than 10 ft (3m) thick, the Project Manager should be contacted to review the sampling interval requirement on a case-by-case basis. If requested by DOTD, continuous sampling of a boring will be obtained at < 3 foot (1m) intervals to a pre-determined depth. Boring samples shall be retained for a minimum period of 90 days. **Boring logs which show evidence of persistent SPTs in cohesive soils will not be accepted.** The hammer efficiency as determined by ASTM D4633 shall be reported with all SPT results.

Samples may not be extruded at the worksite. Transport of samples from the field to the laboratory shall conform to ASTM D4220, Group C. Sample tubes shall be transported vertically in the same orientation as they were sampled with care taken to avoid excessive temperature variation, vibration, storage time, or any other source of possible sample disturbance. Samples shall be extruded at the primary geotechnical laboratory in accordance by means of a continuous pressure hydraulic ram. Extrusion by any other method, such as water pressure, is prohibited. Samples shall be extruded directly onto a sample trough and shall not be caught with the hands.

The Consultant's primary geotechnical laboratory shall maintain accreditation by AMRL for each of the following AASHTO (ASTM) standards/test methods; R18, T88 (D422), T89 (D4318), T90 (D4318), T100 (D854), T216 (D2435), T265 (D2216), T296 (D2850), & (D1140). Accreditation for the analogous ASTM standard/test methods will be accepted in lieu of the AASHTO method.

Deep boring samples shall be classified by using the USCS soil classification system. Soil index properties and moisture content shall be determined for at least 75 percent of all samples obtained from each boring. UU Triaxial compression testing shall be performed on at least 75 percent of the extruded cohesive samples.

If designated as necessary for the boring location, consolidation tests shall be performed and the results shall be reported as graphs of "Void Ratio vs. Log of Pressure" and "Coefficient of Consolidation vs. Log of Pressure". Both plots may be shown on the same graph, if adequately labeled. Any sample from a clay layer that shows signs of being overconsolidated must be

Table 1: Minimum AMRL Geotechnical Testing with ASTM equivalents

AASHTO	ASTM	Description
R 18		Standard Recommended Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
T 88	D 422	Standard Method of Test for Particle Size Analysis of Soils
T 89	D 4318	Standard Method of Test for Determining the Liquid Limit of Soils
T 90	D 4318	Standard Method of Test for Determining the Plastic Limit and Plasticity Index of Soils
T 100	D 854	Standard Method of Test for Specific Gravity of Soils
T 216	D 2435	Standard Method of Test for One-Dimensional Consolidation Properties of Soils
T 265	D 2216	Standard Method of Test for Laboratory Determination of Moisture Content of Soils
T 296	D 2850	Standard Method of Test for Unconsolidated, Undrained Compressive Strength of Cohesive Soils in Triaxial Compression
	D 1140	Standard Test Methods for Determining the Amount of Material Finer than 75- μ m (No. 200) Sieve in Soils by Washing

subjected to a load/rebound/re-load cycle during the consolidation testing as per AASHTO T 216. Any sample selected for consolidation testing shall also have the specific gravity determined according to AASHTO T 100 and the Atterberg Limits determined with supporting results reported.

Shallow Borings

Shallow soil borings for subgrade soil surveys vary in depth to 4 feet below the existing roadway and no less than 2 feet below the bottom of the base course for overlays. For new construction, the depth of each boring should be at least 8 feet below the finished roadway elevation or natural ground, whichever is greater, with additional testing requirements for areas of cut/fill greater than 10 feet. These borings can be made utilizing hollow-stem augers, continuous-flight augers, pneumatic- or direct-push sampling. Any other method shall be approved by the project manager prior to it being implemented. Soil strata shall be identified every foot or strata break at the discretion of the lab engineer of record using the AASHTO classification system.

Settlement/Slope Stability Study

In cut areas, the material to be removed shall be tested and sampled with an emphasis on silt content, with the boring terminating at least 8 feet below the proposed cut depth. In fill areas, the boring should be continuously sampled to at least two and up to three times the maximum fill height, with consolidation testing being necessary as the fill heights approach 10 feet.

Electronic Cone Penetrometer Testing (ECPT)

ECPT rigs shall be capable of a minimum of 100 ft of penetration in clayey soils. Calibration certificates for ECPT probes and equipment utilized shall be made available upon request by the project manager. The final CPT sounding results shall conform to an input format readable by LTRC's CPT-Pile or Dataforensic's RapidCPT software.

Location and Elevation Determination

The horizontal location of each borehole shall be determined to within 10 ft (3m). The natural ground elevation at the location of each borehole shall be determined to within 6 in. (0.15m). Elevations of existing structures or benchmarks should be available on the preliminary plans.

Rights of Entry

It will be the responsibility of the Consultant to obtain consent from landowners in order to enter onto any private property. In the case that consent is not granted, the Consultant shall contact the project manager to execute a Forced Entry, as per Louisiana Revised Statute 48:217. Forced entry access will be granted via written notice from the project manager.

Deliverables

Upon request, the DOTD Pavement & Geotechnical Design Section will provide to the Consultant an example of each subsurface log format. The lettering used on the logs shall be of such size and clarity that the legibility of data can be maintained when reduced to fifty (50) percent of its original size. A digital log that can be imported into the DOTD's pLog Enterprise geotechnical software for the electronic storage and retrieval of the soil boring and CPT logs shall be submitted. DOTD has worked with Dataforensics (www.dataforensics.net) to develop a standardized gINT template for this purpose, and they should be contacted to obtain the most current version. All project deliverables shall become the property of DOTD upon successful completion of each Task Order.

All reported test results, including each profile sheet, shall be sealed and manually signed and dated by the Professional Engineer in responsible charge of testing. The DOTD Pavement and Geotechnical Design Section will review the completed boring logs for completeness and accuracy prior to final acceptance.