DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

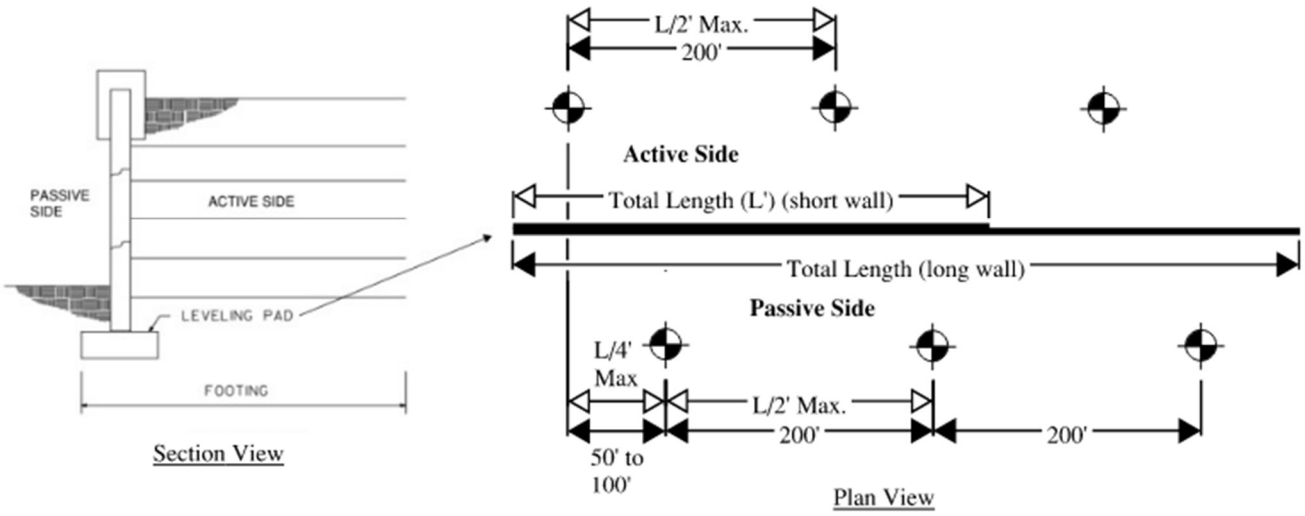
GEOTECHNICAL ENGINEERING BUREAU
FOUNDATION DRILLING AND SAMPLING GUIDELINES

Retaining Wall Foundation Investigations - Drilling and Sampling

A. Drilling Criteria

1. Borings for retaining walls should generally be made at 200-foot intervals for long walls (walls longer than 300 feet) unless erratic foundation conditions are found. In this case, enough borings should be made to sufficiently define the subsurface conditions. Shorter walls (walls shorter than 300 feet) and walls used in bridge abutments should have at least 2 borings per wall with the borings spaced no more than half the wall length. If the borings made for the bridge are relatively close to the proposed wall, these may be used in lieu of new boring(s). For Mechanically Stabilized Earth (MSE) walls, a pair of borings shall be done every 200 feet along the wall alignment, one on the active side and another on the passive side for long walls. For short MSE walls, a pair of borings shall be done no more than half the wall length along the wall alignment; one on the active side and another on the passive side. Depending on site variability and conditions, borings should be staggered such that they are spaced 50 to 100 feet apart for long walls, and no more than a quarter of the wall length for short walls.

   See illustration below:



Boring Spacing for Short MSE Walls are those with "L" and white arrows.
Boring Spacing for Long MSE Walls are those with numerical values and black arrows; the number of borings for Long MSE Walls is not limited to the six shown in the example above, but should be increased to adequately sample the full length of the wall

MSE Walls (LRFD) Boring Layout

2. Borings should be drilled as closely as possible to the location of the proposed footing or special backfill area. Borings should be offset only when site or traffic conditions prevent this. If a lane or shoulder closure is required to perform borings, prior approval must be obtained from the District Engineer's office. All lane or shoulder closures must be set up in accordance with MUTCD standards, and within the hours set by the District Engineer's office.

3. Borings should be drilled to a depth of 1½ times the wall height as measured from the bottom of the wall footing. At longer walls, one boring every 600 feet (with at least one boring per wall) should be drilled slightly deeper, to 2 to 2½ times the wall height to check for groundwater or varying foundation conditions. If voids or other erratic subsurface conditions are encountered, notify the geotechnical engineer in charge of the project as soon as possible.

4. For load and resistance factor design (LRFD) wall foundation investigations, borings should be performed at both the active (beneath and behind wall) and passive (in front of wall) sides of the proposed wall. The boring depth and frequency along the wall should follow item number 1 and 3 above. In addition, any critical sections of the wall should be identified and borings should be taken at these locations. These will facilitate more accurate global stability analyses.

   If the borings have not encountered 15-blow count or better material within a boring depth of 1½ times the height of the wall as measured from the bottom of the wall

footing, then use the following Standard Penetration Test (SPT) criteria as a guideline to terminate the borings:

Thickness of Strata	SPT Greater Than
5 feet	31 blows
10 feet	21 blows
15 feet	11 blows

Note that these guidelines are minimum requirements and the geotechnical engineer in charge of the project is responsible for performing adequate borings to depths sufficient to aid the design of a deep foundation system should very loose/soft soils be encountered before the criteria above is met. If any of the SPT sampling criteria have not been met after approximately 50 feet, contact the geotechnical engineer in charge of the project.

B. Sampling Guidelines

1. If the proposed footing is more than 5 feet below the existing ground, perform SPT tests at 5-foot intervals from the ground line to the proposed wall footing, beginning at a depth of 5 feet. At the footing elevation, perform SPT tests at 2½- foot intervals for the next 10 feet and at 5-foot intervals thereafter. Save all samples in a clean sample jar and mark all jar boxes with the project number and county, boring number, bridge location and date. Sample jars must be a minimum of 16 oz (500 ml) in size. Fill up the jar so the lab has sufficient material for testing. CPT (Cone Penetration Test) and DMT (Flat Dilatometer Test) tests are acceptable however they must be accompanied by SPT tests so samples are collected and tested in the lab. SPTs should comprise of no less than 40% of the drilling plan when CPT and/or DMT are being considered.

2. Note the type of bit(s) used throughout the boring. When drilling hard rock layers or boulders, also note the time to drill through these materials.

3. Obtain 24-hour groundwater elevations on at least one of the borings at each wall site. If the borings are dry, indicate this on the boring logs.

4. If soft layers of clay or plastic silt are found at the borings, push at least two 3 inch diameter Shelby tubes at or near the center of the soft layer(s) (N<10) so that consolidation tests can be performed on the samples. The total number of Shelby tubes obtained should depend on the extent of the soft layers encountered. Mark the tube with the project number and county, the boring number, the depth of the sample, and the date.

5. If rock coring is performed, either 5 ft or 10 ft rock core runs will be acceptable.

C. Special Notes

1. Obtain the ground elevations at each boring by using a benchmark from the survey control package for that project. This can be obtained from the GDOT Statewide Location Bureau in the Office of Design Policy and Support. If it is not available, have a Georgia registered land surveyor create a benchmark from which ground elevations at each boring can be determined.

2. In addition to all drilling and sampling data, each boring log should contain the project number and county, the date, the wall location, the driller's name, the type of drill used (truck-mounted Failing 250, CME 550 on ATV, etc.), the drilling method used (auger, rotary, etc.), the groundwater elevation, GPS coordinates and all other notes relevant to the subsurface conditions. The GPS coordinates should be in decimal degrees to the precision of at least 5 decimal places and to the accuracy of 10 ft +/-. The driller should also include energy rating data for the hammer.

   Note: SPT hammers must be calibrated once every 2 years and calibration data must be submitted as part of the deliverables on every project.

   Note: Please refer to Chapter 1.1 of the GDOT Automated Survey Manual for project coordinate datum guidance.

3. Provide for each project an individual PDF file per boring location for the SPT boring logs and CPT sounding Logs. This should be considered a separate deliverable from any logs included in the appendices of any WFI report. The consultant report review request may be rejected if this deliverable is not included in the submittal package.

4. After groundwater checks are made, all boring holes should be filled in (and patched if made in a travel lane or paved shoulder) and the site left in good condition. Drill cuttings and all other spoils should be cleaned off any paved areas.

D. Laboratory Testing

1. Laboratory testing for most soil samples for WFI's normally consists of a Unified classification test, which includes an Atterberg limits test, moisture content test, and sieve analysis.

2. The sieve sizes used for the sieve analysis are Nos. 4, 10, 40, 60 and 200, which is one more than the minimum required by AASHTO or ASTM standards.

3. Laboratory testing for rock samples normally consists of unconfined compressive strength tests, and on occasion, split tensile tests.

4. Undisturbed tests such as Triaxial - Consolidated Undrained (CU) (other types of triaxial tests (CD or UU) may be run in addition to the CU test based on the discretion of the geotechnical engineer in charge of the project) and Consolidation should be run if Shelby tube samples are collected.

5. The latest editions of the following ASTMs should be followed for any lab tests performed:

Test	ASTM Designation
Unified Soil Classification System (USCS)	D2487
Moisture Content	D2216
Atterberg Limits	D4318
Unconfined Compressive Strength of Rock	D7012
Split Tensile Strength of Rock	D3967
Triaxial - Consolidated Undrained (CU)	D4767
Triaxial – Consolidated Drained (CD)	D7181
Triaxial – Unconsolidated Undrained (UU)	D2850
Consolidation	D2435

The geotechnical engineer in charge of the project is the professional geotechnical engineer who will sign the WFI report.