

**DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA**

**GEOTECHNICAL ENGINEERING BUREAU
FOUNDATION DRILLING AND SAMPLING GUIDELINES**

Bridge Foundation Investigations- Drilling, Sampling and Special Notes

A. Drilling Criteria

1. As a general rule, one boring should be made at each bent of the new or widened bridge. For bridges with short spans (approximately 40 feet or less) in the Coastal Plain Region, begin by drilling every other intermediate bent, and if the subsurface conditions between borings are very similar, the bents that were skipped may not need to be drilled. This decision should have prior approval from an engineer from the Geotechnical Engineering Bureau, however. Coastal Plain bridges with short spans with more than 25-30 spans may be drilled every third bent.

This guideline may not apply for bridges in southwest Georgia where limerock is encountered. Bridges in the Piedmont or Valley and Ridge Regions may require two borings at each bent if erratic foundation conditions are found between bents. Discuss this with the engineer in charge of the project.

2. Borings should be drilled as closely as possible to the location of the proposed footing or column. 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. The depth of the borings should be according to the following criteria:
 - a. Piedmont and Valley and Ridge Regions:

- i. Grade Separation Bridges: Borings at the endbents should be drilled to rock refusal. However, if no rock is found within approximately 100 feet of the ground surface, contact the engineer for instructions. Borings at the intermediate bents may be terminated if 25-blow count or better material is found throughout the first 20 feet of material below the proposed footing elevation. The reason for this is that a spread footing design may be used at these bents. However, one boring every 300 feet (with a minimum of one boring at one of the intermediate bents) should be drilled to rock refusal to check for groundwater or varying subsurface conditions. (Again, if no rock is found within 100 feet of the ground surface, contact the engineer.) If the borings have not encountered 25-blow count or better material within the first 25 feet of the ground surface, then continue the boring to rock refusal. If rock is found at shallow elevations (within 15 feet of the ground surface), the rock should be cored (with 10-foot runs until the percent recovery is at least 75%) to ensure that spread footings or drilled shafts can be founded on or in competent rock.
 - ii. Stream Crossings: Borings at the endbents should be drilled in the same manner as for grade separation bridges. At the intermediate bents the depth of borings will be dependent on the theoretical scour line shown on the bridge layout. If rock is found above the scour line, or within about 10 feet below the scour line with loose to medium dense soils above the rock, core the rock (with 10-foot runs until the percent recovery is at least 75%), assuming the design will be spread footings or drilled shafts. If there is at least 15 feet of soil with blow counts of 20 or greater above the rock, and the scour line is above the dense soil, drill down to rock refusal without taking rock cores.
- b. Coastal Plain Region:
- i. Grade Separation Bridges: Borings at the intermediate bents may be terminated if 25-blow count or better material is found throughout the first 20 feet of drilling below the proposed footing elevation. However, one boring every 300 feet (with a minimum of one boring at one of the intermediate bents) should be drilled at least 40 feet deep to check for soft layers or erratic conditions, and may be terminated once the STP numbers are greater than those indicated throughout the corresponding depths indicated below.

If the borings have not encountered 25-blow count or better material within the first 25 feet of the ground surface, then use the following Standard Penetration Test (SPT) criteria as a guideline to terminate the borings. Also use this criteria for borings at the endbents once the boring is drilled below original ground:

<u>Thickness of Strata</u>	<u>SPT Greater Than</u>
15 feet	50 blows
20 feet	40 blows
25 feet	35 blows
30 feet	30 blows
35 feet	25 blows
45 feet	20 blows

If any of the SPT sampling criteria have not been met after approximately 80 feet, contact the engineer.

- ii. Stream Crossings: Borings at the endbents should be drilled in the same manner as for grade separation bridges. At the intermediate bents the depth of borings will be dependent on the theoretical scour line shown on the bridge layout. The SPT criteria should be used once the boring is drilled below the scour line.

If voids or other erratic foundation conditions are encountered, notify the engineer in charge of the project as soon as possible.

B. Sampling Guidelines

1. At bridge endbents, perform SPT tests at 5-foot intervals, beginning at a depth of 5 feet. At grade separation bridges, perform SPT tests at intermediate bents at 2½-foot intervals from 5 to 10 feet, and then at 5-foot intervals thereafter. At stream crossings, perform SPT tests at 5-foot intervals, beginning at a depth of 5 feet. 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.
2. Note the type of drill rig and bit(s) used throughout the boring. When drilling hard rock layers or boulders, also note the time to drill through these materials.
3. When coring rock as noted in Item A-3 above, obtain a 10-foot core run unless otherwise directed by the engineer. If the rock is very poor quality, and is fractured and weathered, an additional core run may be required. Note the time spent on coring each run. Save all core runs and label the boxes with the project number and county, boring number, depths and date. Label the top and bottom of the core runs with the beginning and ending depths. It is strongly recommended not to break core runs to fit into boxes. However, if long boxes are not readily available and cores must be broken to fit into shorter boxes, note the locations of the breaks on the cores and on the drilling logs.
4. Obtain 24-hour groundwater elevations on at least two of the borings at grade separation bridges if the borings indicate that spread footings are likely to be used.

5. If soft layers of clay or plastic silt are found at the endbent borings, push at least two Shelby tubes at or near the center of the soft layer(s) so that consolidation tests can be performed on the samples. Mark the tube with the project number and county, the boring number, the depth of the sample, and the date.

C. Special Notes

1. Obtain the ground elevations at each boring by using the TBM shown on the preliminary layout. If there is no TBM shown, use an assumed elevation shot from the centerline of the beginning or end of the bridge.
2. In addition to all drilling and sampling data, each boring log should contain the project number and county, the date, the bridge 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 and all other notes relevant to the subsurface conditions.
3. 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.
4. If the project is an existing bridge to be widened or replaced, note the existing foundation type and condition. If the bridge has spread footings, contact the engineer to see if washboring to locate the top of footings will be required.
5. Note any other additional information or problems, such as old foundations, rock outcrops, erosion problems, stream channel migration, etc. that would be helpful in the foundation design or construction of the bridge.
6. Remember that these guidelines may be modified based on the site conditions and the engineer's requirements.

D. Laboratory Testing

Laboratory testing for most soil samples for BFI's normally consists of only a Unified classification test, which includes an Atterberg limits test and sieve analysis. The sieve sizes used are Nos. 4, 10, 40, 60 and 200, which is one more than the minimum required by AASHTO or ASTM standards. Laboratory testing for rock samples normally consists of compressive strength tests, and on occasion, split tensile tests.