

SECTION 02011
SUBSURFACE INVESTIGATION

02011.01 GENERAL

A. Description

Subsurface investigation shall include, but not necessarily be limited to, drilling test holes (in rock), auguring holes, digging test pits or driving rods (where drilling or auguring is impractical) as a means of verifying the character and suitability of existing material for foundation purposes, for use as embankment or backfill material, and/or for determining the means and methods for grading operations.

B. Related Work Included Elsewhere

1. Protection of the environment; Section 01500.
2. Clearing and grubbing; Section 02110.
3. General Excavation; Section 02210.

C. Quality Assurance

The Engineer will inspect the work to ensure compliance with the Contract Documents.

D. Submittals

1. Submit finished reproducible reports with copies in triplicate within one (1) week after boring, indicating neatly and clearly the information for each boring including the depths of stratum by elevations, classification of materials, length of cores, driving records, and any other pertinent information and construction recommendations.
2. Submit log of all rods driven including number, size, length, and location of all rods.
3. Submit a report recommending construction methods, foundation preparation requirements, quantities and types of borrow and/or selected fill required, optimum moisture contents, gradation, permeability, binders in the soil, reasonable compaction limits using native soils, and any recommendations on further tests needed.
4. Submit rock cores and soil samples to the Engineer for retention for future reference.

02011.02 MATERIALS**A. Materials Furnished by the County**

The Contractor will be furnished with the locations and the designated points of exploration, marked with suitable stakes and with the ground elevation indicated clearly thereon.

B. Contractor's Options

Not applicable.

C. Detailed Material Requirements

Not applicable.

02011.03 EXECUTION**A. General**

1. Test holes shall be drilled or augured as indicated on the Plans or in the "Special Provisions", or as directed by the Engineer. The Engineer will be the final authority concerning the location, depth, direction, and number of holes to be drilled or augured.
2. The size and length of rods to be driven will be designated by the Engineer. The Contractor shall mark rods as directed by the Engineer and maintain the blow count as a written record.
3. This work shall be considered a minor construction item, and the Proposal quantities may be increased or decreased or the item eliminated at the Engineer's discretion, without otherwise altering the Contract.

B. Site

1. When the Engineer considers the conditions at the site unsuitable for the prosecution of the work, he may order the Contractor, in writing, to suspend work until suitable conditions exist. Should work be thus suspended, on written order, additional time will be allowed for completion equal to the period during which the work was suspended. In accordance with Section GP-8.07, no additional compensation shall be paid the Contractor on account of such suspension.
2. It is the Contractor's responsibility to satisfy himself as to the location of underground utilities in the immediate vicinity of the subsurface investigation so as to prevent damage to them. Should any damage to such utilities occur, the Contractor shall be required to bear the full cost of repairs and/or replacement of the utilities.

3. The Contractor shall be required to do all necessary clearing and any other work necessary to move his equipment to, around and from the site. Each test hole drilled by the Contractor shall be suitably backfilled and leveled upon its completion and acceptance by the Engineer. At the completion of the work, the Contractor shall remove his equipment and leave the site in a clean condition acceptable to the Engineer.

C. Soil Sampling

1. The soil sampling shall be performed in accordance with ASTM D 1586 which shall be consulted for description of equipment required, preparation for and method of boring, care of samples, logging and data required, and groundwater determination. Soil sampling shall be carried to the proposed depths shown on the Plans unless otherwise directed by the Engineer. Auguring between samples will be permitted if, in the opinion of the Engineer, subsurface conditions allow.
2. Samples recovered from wash water commonly called "wash samples" will be unacceptable.
3. In general, the use of water for cleaning out the casing will be permitted; however, if the moisture content of the material below the casing might be altered by water in the casing, such water shall be removed by an approved method.
4. Test holes drilled through overburden shall be suitably cased to permit obtaining "dry samples" of the sizes specified or directed by the Engineer.
5. Blasting with small charges to remove small boulders or other obstructions which cannot be conveniently removed will not be permitted unless otherwise authorized by the Engineer.
6. A continuous record shall be kept of the number of hammer blow per foot of penetration on a comparative basis. The same weight and fall of casing hammer shall be used for drilling casings of the same size by all drilling rigs used by the Contractor on this work.
7. During the sinking of the casing, observations shall be made to determine the elevation of the water surface in the hole. On any day in which a boring is not completed, the hole shall be pumped as nearly dry as practicable and permitted to stand overnight. Before resuming work the next day the elevation of the water surface in the hole shall be determined.

D. Core Borings

1. Core borings shall be made using a rotary drilling machine having a hydraulically actuated feed or thrust with size NX or NWM diamond double tube swivel type core barrel. Core borings shall be begun at refusal, which shall be considered to have been reached when the rate of advance is less than one (1) inch for 50 blows.

2. Casing shall be firmly seated upon the hard formation to prevent loose material from entering the hole and to prevent loss of drilling fluid. If soil seams, fissures, cavities or broken rock prevents the advance of the boring, auxiliary casing shall be used inside the borehole and the coring shall continue using the next smaller series WM or WX core barrel and bit.
3. When soft materials are encountered, a split-spoon sample or other type sample as specified by the Engineer shall be taken. Resume diamond core drilling when hard materials are again encountered. Casing shall be extended through the soft layer if necessary in the opinion of the Engineer.
4. Maximum effort shall be exercised to obtain 100 percent recovery in rock coring. Drill fluid pressure and rate of flow, speed of bit rotation, and pressure on the bit shall at all times be carefully controlled. The initial coring run below the top of rock shall not exceed five (5) feet. Coring runs in very badly broken or shattered rock shall not exceed five (5) feet. Coring runs in rock established as being firm, may be increased to a maximum of ten (10) feet.
5. The Contractor shall provide core boxes of wood or other durable material for protection and storage of the cores. The boxes shall be provided with hinged covers and with longitudinal spacers that will form separate compartments for each core run. Small blocks fit between the spacers shall be provided to mark the beginning and end of each run or pull of core barrel. The cores shall be placed from left to right beginning at the top hinged side of the core box. The wood block shall be securely fastened and the depth clearly marked at the top and bottom of the core and at each noticeable gap in the formation.
6. The Contractor shall deliver the core boxes, complete with all recovered cores, to the Engineer at the project site for permanent storage. The Contractor shall be responsible for temporary weather protected storage of cores until delivery to the Engineer.
7. Throughout the boring operations, the Contractor shall keep a continuous and accurate log of the material encountered during the drilling of each hole. He shall also keep a complete record of the operations of sinking the casing, recording the size and weight of the casing, weight and fall of the hammer and number of blows per foot required to drive the casing. A copy of the field drillers report shall be delivered to the Engineer along with the rock cores within 24-hours after completion of the boring.

02011.04 METHOD OF MEASUREMENT

Except as otherwise provided, measurement for subsurface investigation shall be started at normal ground line. At water locations, measurement shall be started at the streambed

elevation. False starts will not be measured or allowed unless the boring has penetrated at least five (5) feet before being abandoned in which case five (5) feet will be measured and allowed.

Measurement for subfoundation investigation will be made of the total length of holes drilled, augured, or rods driven as directed by the Engineer.

02011.05 BASIS OF PAYMENT

Payment for subfoundation investigation will be made at the price bid per linear foot irrespective of whether carried out from land or water locations. The price bid shall include furnishing all labor, material, equipment, keeping of records, the restoring of the terrain to its condition prior to the beginning of the work, all necessary insurance and incidentals required to satisfactorily complete the work as specified including mobilization of drilling equipment, final soils reports, including recommendations, analysis of data and delivery of soil samples and/or rock cores to the Engineer.