



**MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF MATERIALS TECHNOLOGY
FIELD EXPLORATIONS DIVISION**

**STANDARD SPECIFICATION FOR
SUBSURFACE EXPLORATIONS**

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CONTENTS

GENERAL SPECIFICATIONS	1
GS-1 SCOPE	1
GS-2 GENERAL REQUIREMENTS	1
GS-2.1 Engineer.....	1
GS-2.2 Examination of Specifications, and other Work Requirements	1
GS-2.3 Preparation of Proposal	1
GS-2.4 Consideration of Bids	2
GS-2.5 Award of Contract	2
GS-2.6 Contract Duration	2
GS-2.7 On-Site Equipment And Material Protection.....	2
GS-2.8 Maintenance and Control of Traffic	3
GS-2.9 Project Meeting(s) - Office and/or Field	3
GS-2.10 Delay Time/Standby Time	3
GS-2.11 Control of Work	4
GS-2.12 Cooperation of Contractor.....	4
GS-2.13 Laws to be Observed	4
GS-2.14 Non-Discrimination of Employees	5
GS-2.15 Permits, Utility Clearances and Licenses	5
GS-2.16 Public Convenience	6
GS-2.17 Safety.....	7
GS-2.18 Report of Accidents	7
GS-2.19 Subletting or Assigning this Contract	8
GS-2.20 Annulment of Contract	8
GS-2.21 Eliminated Items.....	8
GS-3 MANNER OF PROSECUTING WORK	8
GS-4 LIQUIDATED DAMAGES	9
GS-5 ACCESS TO PUBLIC AND PRIVATE PROPERTY	9
GS-6 DAMAGE CLAIMS AND INSURANCE.....	10
GS-6.1 Responsibility for Damage Claims, Etc.	10
GS-6.2 Compensation Insurance	10
GS-6.3 Public Liability	10
GS-7 UNDERGROUND PIPES, UTILITIES AND OTHER OBSTRUCTIONS.....	11

GS-8	PROTECTION OF SAMPLES AND RECORDS	11
GS-9	OUT-OF-TOWN ASSIGNMENT.....	11
GS-10	COMMUNICATION	12
GS-11	PAYMENT TO THE CONTRACTOR.....	12
TECHNICAL SPECIFICATIONS.....		13
TS-1	GENERAL	13
TS-2	CONDUCT OF THE WORK	13
TS-2.1	General	13
TS-2.2	Borings in Streets and Paved Areas.....	13
TS-2.3	Refilling of Holes	13
TS-2.4	Cleaning Up	13
TS-3	BORING LOCATIONS AND SAMPLES	14
TS-4	SEQUENCE OF WORK	14
TS-5	ABANDONED BORINGS	14
TS-6	FALSE STARTS	14
TS-7	PROCEDURES FOR MAINTAINING AN OPEN BORE HOLE.....	15
TS-8	RECORDS AND LOGS	15
TS-9	PREPARATION AND DELIVERY OF REPORTS AND RECORD DRAWINGS	16
TS-9.1	Preliminary Driller's Logs.....	16
TS-9.2	Final Test Boring Logs.....	16
T-S 9.3	Electronic Field Data Logging	17
TS-10	DELIVERY OF SAMPLES AND CORES	17
TS-11	MEASUREMENT AND PAYMENT.....	18
TS-12	STANDARD PENETRATION BORINGS	18
TS-12.1	General.....	18
TS-12.2	Driving Casing	18
TS-12.3	Hollow Stem Augers	19
TS-12.4	Frequency of Sampling.....	20
TS-12.5	Sampling Procedure	20
TS-12.6	Sampling Devices	21
TS-12.7	Preservation and Identification of Samples.....	21
TS-12.8	Determination of Running Sand.....	21
TS-12.9	Ground Water	22
TS-12.10	Removal of Casing or Hollow Stem Augers from Ground.....	22
TS-12.11	Record Data	22
TS-12.12	Measurement and Payment	26

TS-13	CORE BORINGS	26
TS-13.1	General.....	26
TS-13.2	Drilling Devices	27
TS-13.3	Maintaining an Open Bore Hole For Casing.....	27
TS-13.4	Coring Procedure.....	27
TS-13.5	Preservation and Identification of Cores	27
TS-13.6	Record Data	28
TS-13.7	Measurement and Payment	29
TS-14	THREE (3) INCH UNDISTURBED SAMPLES.....	29
TS-14.1	General.....	29
TS-14.2	Sampling Devices	29
TS-14.3	Sampling Procedure	30
TS-14.4	Preservation and Identification of Samples.....	30
TS-14.5	Record Data	31
TS-14.6	Measurement and Payment	31
TS-15	DENISON SAMPLES.....	31
TS-15.1	General.....	31
TS-15.2	Sampling Devices	31
TS-15.3	Sampling Procedure	32
TS-15.4	Preservation and Identification of Samples.....	32
TS-15.5	Record Data	33
TS-15.6	Measurement and Payment	33
TS-16	WELLS/PIEZOMETERS	33
TS-16.1	General.....	33
TS-16.2	Wellpoints	34
TS-16.3	Shallow Monitoring Wells Installation	34
TS-16.4	Piezometers Installation.....	34
TS-16.5	Monitoring Ground Water Levels	36
TS-16.6	Measurement and Payment	36
TS-16.7	Piezometers or Shallow Monitoring Wells Abandonment	36
TS-17	INCLINOMETERS.....	37
TS-17.1	General.....	37
TS-17.2	Inclinometer Installation.....	37
TS-17.3	Measurement and Payment	38
TS-18	SOIL PERMEABILITY TESTS	38
TS-18.1	General.....	38

TS-18.2	Testing Procedure	38
TS-18.3	Record Data	40
TS-18.4	Measurement and Payment	41
TS-19	AUGER BORINGS	41
TS-19.1	Boring and Sampling Procedure	41
TS-19.2	Depth of Borings	42
TS-19.3	Frequency of Sampling.....	42
TS-19.4	Preservation, Identification and Quantity of Samples.....	42
TS-19.5	Protection of Samples and Records	44
TS-19.6	Visual Description of Samples.....	44
TS-19.7	Record Data	44
TS-19.8	Measurement and Payment	45
TS-20	SEALING BORE HOLES	45
TS-20.1	Sealing Materials	45
TS-20.2	Sealing Procedures.....	45
TS-20.3	Measurement and Payment	46
TS-21	PATCHING OF BORE HOLES IN BRIDGE DECKS	46
TS-21.1	Patching Procedure	46
TS-21.2	Measurement and Payment	47
TS-22	PAVEMENT CORING	47
TS-22.1	Measurement and Payment	47
TS-23	PATCHING PAVEMENT CORE HOLES.....	47
TS-23.1	Measurement and Payment	47
TS-24	MOBILIZATION AND DEMOBILIZATION OF EQUIPMENT ETC	48
TS-24.1	Specialized Equipment	48
TS-24.2	Measurement and Payment	48
TS-25	EMERGENCY MOBILIZATION	48
TS-26	NIGHT TIME AND HOLIDAY WORK PAYMENT DIFFERENTIAL.....	48
TS-27	EXTRA WORK.....	49
TS-28	SITE RECONNAISSANCE.....	49
TS-28.1	General.....	49
TS-28.2	Measurement and Payment	49
TS-29	SUPPLY OF DRILLING EQUIPMENT AND CREW	50
TS-29.1	Driller Qualifications	50
TS-29.2	Measurement and Payment	50
TS-30	QUASI-STATIC CONE PENETROMETER TEST WITH PORE PRESSURE (CPTU)....	51

TS-30.1	Measurement and Payment	51
TS-31	FLAT PLATE DILATOMETER	51
TS-31.1	Measurement and Payment	52
TS-32	PREBORING PRESSUREMETER (PBPM).....	52
TS-32.1	Measurement and Payment	52
TS-33	VANE SHEAR TESTING	52
TS-33.1	Measurement and Payment	53
TS-34	LABORATORY TESTING OF RECOVERED SOIL SAMPLES	53
TS-34.1	Measurement and Payment	53
TS-35	HYDROGEOLOGICAL TUBE SAMPLING.....	54
TS-35.1	Hydrogeological Tube Samples	54
TS-35.2	Sampling Devices	54
TS-35.3	Sample Procedure	54
TS-35.4	Preservation and Identification of Hydrogeological Tube Samples	54
TS-35.5	Sample Protection.....	55
TS-35.6	Measurement and Payment	55
TS-36	SOFT DIG UTILITY LOCATING.....	55
TS-36.1	Measurement and Payment	55
TS-36.2	Sealing Materials	56
TS-36.3	Sealing Procedures.....	56
TS-36.4	Measurement and Payment	56
TS-37	METAL TRAFFIC BARRIER (GUARDRAIL) REMOVAL AND REPLACEMENT ...	56
TS-37.1	Measurement and Payment	57
TS-38	ACCESS PERMITS	57
TS-38.1	Measurement and Payment	57

GENERAL SPECIFICATIONS

GS-1 SCOPE

The work to be performed under this Contract consists of the exploration of subsurface conditions at various locations throughout the State of Maryland and for providing Drilling Equipment, Certified Drillers, and Driller Helpers. All work, as to be shown on specific project plans, shall be performed by means of earth borings with augers, split barrel soil samples, core borings, in-situ testing, laboratory testing and other work as may be required. The work to be performed by the Contractor consists of the furnishing of all materials, labor, tools, machinery and other equipment, vehicular transportation, and all incidentals necessary and proper for the expeditious completion of these subsurface investigations; all in accordance with these specifications and the Maryland Department Of Transportation/State Highway Administration Specifications entitled "Standard Specifications for Construction & Materials" dated July 2018 and project plans, which will be provided to the Contractor.

GS-2 GENERAL REQUIREMENTS

The following requirements, stipulations and descriptions of Work are hereby defined and described as the "Standard Specification for Subsurface Explorations" and shall apply to the Statewide Drilling Support Contract. Any aspects of the Work not clearly defined by these specifications will be governed by the rules of the best practices of the industry and all applicable AASHTO and ASTM standards, or as otherwise directed by the Maryland Department of Transportation State Highway Administration.

GS-2.1 Engineer

Wherever in these Specifications and/or other Contract Documents the term Engineer or "MDOT SHA" is used without further qualification, it shall mean the Maryland Department of Transportation State Highway Administration or its representative.

GS-2.2 Examination of Specifications, and other Work Requirements

It is assumed that the Bidder, prior to submitting his proposal, has carefully examined the specifications and the requirements of the contract. It is further assumed that the bidder has investigated all other matters, which can affect the work, including the character, quality, and quantities of work to be performed, the materials to be furnished, and the prevailing hourly wage rates for the areas in which the work would be performed. The Contractor shall have no claim for damages, or for any other concession because of any misunderstanding, misinterpretation, or lack of information relative to the contract or to the work, or because of his failure to familiarize himself with the requirements of the contract.

GS-2.3 Preparation of Proposal

Proposals shall be submitted on the standard form provided by the MDOT SHA. In case of incorrect totaling of amounts, or where the unit price and extension do not agree, the unit and lump sum prices shall in all cases govern, and the MDOT SHA is authorized to correct all erroneous extensions and totals.

Proposals must be signed in ink by the Bidder with the signature in full. If the Bidder is a firm, the person signing the proposal must be an authorized agent or officer of the firm who is empowered to sign contracts. If the bidder is a Joint Venture, the person signing the proposal must be an authorized agent or officer of the Joint Venture. A Joint Venture must provide evidence of the Joint Venture's legal standing in the State of Maryland prior to the start of work. Failure to provide such evidence will cause rejection of the Joint Venture.

GS-2.4 Consideration of Bids

The right is reserved by the MDOT SHA to reject any or all bids, to waive technical errors, to request new proposals, to otherwise proceed with the work, or to abandon the work.

Acceptance of a proposal within ninety (90) days after the date of the bid opening shall bind the contractor to execute a contract for the proposed prices, to guarantee the completion of the work within the number of calendar days specified in the proposal, and to guarantee the proposed price for a three-year period from the date of the award. If the proposal has not been accepted within ninety (90) days after the bid opening, then the Contractor may signify to the MDOT SHA in writing that his proposal prices are no longer considered valid.

GS-2.5 Award of Contract

A contract will be awarded based upon the summation of the proposed cost of each item requested in the letter soliciting bids and contained on the Proposal Form. Bidders shall submit prices for all items in the Proposal. Proposals completed in pencil, on other than the prepared forms, or containing changes in phraseology, additions, omissions or limiting provisions will be cause for rejection. The lowest bidders will be selected for the multiple award contract.

GS-2.6 Contract Duration

This Contract will remain in effect for a period of three (3) calendar years beginning with the issuance of the Notice to Proceed by the Administration. Bid prices will apply to all work assigned and carried out during that period. The MDOT SHA reserves the right to extend the term of the Contract for a period of one (1) calendar year, or up to achievement of the full contract value, as agreed upon by all parties. The MDOT SHA also reserves the right to reduce the term of the Contract.

GS-2.7 On-Site Equipment And Material Protection

When borings or in-situ tests are to be drilled on or adjacent to public highways, private entrances, or walkways or other private properties, it shall be the Contractor's responsibility to adequately, and continuously maintain safety on all portions of the project site. No equipment or material shall be left unattended within 30 feet of a traveled roadway, unless an approved protective barrier is used, or an approved work zone traffic control plan is in place.

GS-2.8 Maintenance and Control of Traffic

Maintenance of Traffic will be supplied by the Administration or Contractor when required for a job assignment. Maintenance of Traffic shall be as specified by the Engineer, or the District Traffic Engineer, as required for each individual work site and in accordance with the latest “Manual on Uniform Traffic Control Devices” (MUTCD), the Federal Highway Administration’s “Traffic Control Handbook”, Section 104 of the Specifications, and the SHA Traffic Control plans.

At the direction of the Engineer, work may not be permitted at or near traveled lanes based on traffic volumes and conditions. The traffic conditions will be determined by the Engineer. In some cases, the period for drilling operations or the Contractor’s work hours may be limited between 9:00 am and 3:00 pm as may be directed by the District Traffic Engineer. Whenever MOT will be required on any work assignment which will result in a different than the usual work start time for the Contractor’s personnel, the Contractor shall adjust to the new start time, which is dictated by the MOT time restrictions. There will be no payment for “Delay/Standby Time” resulting from MOT time restrictions if the Contractor was notified about the new starting time in advance.

GS-2.9 Project Meeting(s) - Office and/or Field

The MDOT SHA will provide plans and boring locations to the Contractor for specific assignments during the term of this Contract. For each project assignment, the Contractor shall be required to attend a subsurface exploration meeting in the office and/or in the field for the purpose of identifying and clarifying the field conditions and specific exploratory technique to be employed for the particular job assignment.

One or more additional meetings may be required to discuss the progress of the project assignment. No payment will be made to the Contractor for the purpose of attending office meeting(s). Office meetings include but are not limited to pre-drill, project update or billing meetings. Payment will be made per the bid price for “Site Reconnaissance” as specified in TS-29.

GS-2.10 Delay Time/Standby Time

Delay Time/Standby Time is defined as any delay or Standby one (1) hour or more caused by the MDOT SHA wherein drilling equipment is not in use or the Contractor's normal operation is interrupted. This includes work that is canceled by the SHA once the Contractor’s personnel have reported to the job site or when the Contractor's equipment is being used for any other purpose authorized by the MDOT SHA at the job site.

In the event that the Contractor's normal period of operation is reduced due to Maintenance of Traffic (MOT) restrictions the Contractor would be compensated for the restricted time period only if the MOT restrictions and the work start time were not communicated to the Contractor in advance. Payment will be made as per the bid price for "Delay Time/Standby Time". This item will include crew hourly wages, vehicular transportation, overhead, all fees and profit.

GS-2.11 Control of Work

The MDOT SHA or their designated consultant representative shall determine and decide all questions which may arise as to the quality and acceptability of materials and work performed, the manner of performance and the rate of progress of said work, the interpretation of the specifications relating to the work, the acceptable fulfillment of the contract on the part of the Contractor and the amount and quantity of the several kinds of work performed and materials which are to be paid for under the contract.

The MDOT SHA may appoint such assistance and representatives as they desire, and they will be authorized to inspect work, to give directions pertaining to the work or to the safety and convenience of the public, to approve or reject work, to make measurements of quantities, and to perform such other duties as may be designated by the MDOT SHA.

GS-2.12 Cooperation of Contractor

The Contractor shall give the work the constant attention necessary to facilitate the progress thereof and shall cooperate in every way possible with the MDOT SHA.

The Contractor shall, at all times, have a competent superintendent, capable of reading and understanding the specifications, as his agent on the work, and who shall receive instructions from the MDOT SHA or his authorized representatives. The superintendent shall have full authority to execute the orders and directions of the MDOT SHA and shall execute such orders and directions without delay; and shall promptly supply such materials, tools, equipment, and labor as may be required. The Contractor shall have available, experienced subsurface exploration crews to undertake any of items listed in this contract as part of the exploration assignments from the MDOT SHA. Each subsurface exploration crew shall comprise of a driller who is experienced to conduct all subsurface exploration operations in a manner to satisfy the requirements in this contract the Contractor shall record on the boring log a visual description of all samples, in accordance with TS-12.11 and ASTM D2488. This description shall be in accordance with the TS-12.11 requirements for moisture content, color, grain-size, residual soils, fill soils and other important factors.

GS-2.13 Laws to be Observed

The Contractor warrants that he is familiar with, and at all times shall observe and comply with, all Federal and local laws and by-laws, ordinances, and regulations in any manner affecting the conduct of the work; including without limitation, Workmen's Compensation Laws, minimum and maximum salary and wage statutes and regulations, laws with respect to permits and licenses and fees in connection therewith, laws regarding maximum working hours, and laws and regulations with respect to the use of explosives.

The Contractor shall indemnify and save harmless the MDOT SHA and all his agents and employees against any and all claims or liability arising from, or based on, the violation of such law, regulation, order, or decree, whether the violation was by himself, his employees, or his subcontractors.

GS-2.14 Non-Discrimination of Employees

During the performance of this contract, the Contractor and any of his subcontractors shall provide equal employment opportunities for all qualified persons and shall not discriminate against any employee or applicant for employment because of race, color, creed, sex, age or national origin.

GS-2.15 Permits, Utility Clearances and Licenses

The contractor shall obtain, prior to the start of work, all permits, utility clearances and licenses required by any or all Federal, State, County or local laws or regulatory agency requirements. These may include, but not be limited to, drilling permits, well drilling or piezometer installation permits, utility clearance permits, lane closure permits, or others as required.

Evidence of compliance with all permitting requirements shall be presented to the MDOT SHA prior to the start of any particular assignment. Evidence of Utility Clearance by the “Face-to-Face” meeting will be required for all work assignments under this Contract. The Contractor shall be required to submit documentation that a face to face meeting took place at the project site with all known Utility companies and/or utility owner representative for the purpose of clearing utilities.

The SHA offices in the following table, depending on the District in which the assignment is located, shall be contacted by the Contractor for the purpose of clearing certain Utilities within the MDOT SHA right of way. Additionally the Statewide Communication Center (SCC) must be contacted for all work in the Washington/Baltimore metropolitan area or along Interstate routes to coordinate the location of communication lines within SHA Right of Way through our locator contractor. A faxed copy of the Miss Utility Ticket information must be sent to the SCC to initiate this coordination.

List of SHA Utility Engineers/SCC

SHA District Office	Office Address	Utility Coordinator Contact Numbers	
1	660 West Road Salisbury MD 21802	410-677-4082 800-825-4742	410-430-7464 (Cell) 410-543-6598 (Fax)
2	615 Morganec Road Chestertown MD 21620	410-778-3061 800-637-9740	410-708-4559 (Cell) 410-778-0851 (Fax)
3	9300 Kenilworth Ave. Greenbelt MD 20770	301-513-7310 800-749-0737	240-375-9068 (Cell) 301-513-7415 (Fax)
4	320 West Warren Road Hunt Valley MD 21030	410-229-2340 866-998-0367	410-808-6917 (Cell) 410-527-4691 (Fax)
5	138 Defense Highway Annapolis MD 21401	410-841-1039 800-331-5603	443-829-6549 (Cell) 410-841-5309 (Fax)
6	1251 Vocke Road La Vale MD 21502	301-729-8439 800-760-7138	301-268-3951 (Cell) 301-729-6968 (Fax)
7	5111 Buckeystown Pike Frederick MD 21704	301-624-8116 800-635-5119	301-401-7246 (Cell) 301-624-8225 (Fax)
Statewide Communications Center (SCC)	7491 Connelley Drive Hanover, MD 21076	Jacquelyn O'Leary 410-719-9401 410-744-4716 (Fax)	

Should the contractor fail to obtain all permits, utility clearances or licenses, should any permit or license be revoked or suspended, and/or should the contractor fail to comply with the requirements of any permits, utility clearances and/or licenses, the MDOT SHA may elect to take prosecution of the work out of the hands of the Contractor as described in Article GS-2.19.

Payment under this item will be made at the bid price in the proposal for the item "Permits, Utility Clearances and Licenses within 50 miles" for projects within 50 miles radius from the Contractor's home base; and "Permits, Utility Clearances and Licenses beyond 50 miles" for projects outside 50 miles radius from the Contractor's home base. This price shall include all costs necessary to obtain the required permits and or Utility Clearance, and face to face meeting(s). No additional compensation will be allowed for updating Utility tickets which have been previously cleared and paid for under these Item "Permits, Utility Clearances and Licenses..."

County Well Permits shall be paid for under the bid price in the proposal for the item "County Well Permits. This Price shall include all costs necessary to obtain the required permits.

Access and Property Permits to work on any private or public property shall be obtained by the MDOT SHA.

GS-2.16 Public Convenience

The Contractor shall at all times, conduct the work in such a manner as to cause the least practicable obstruction to traffic. The convenience of the general public and of the residents along and adjacent to the site of work shall be provided in an adequate and satisfactory manner.

Materials stored at the job site shall be so placed as to cause the minimum obstruction to the traveling public. At no time shall materials be stored within 30 feet of a roadway without an approved traffic control barrier or temporary traffic control set up. Fire hydrants on or adjacent to the site of the work shall be kept accessible to fire apparatus at all times, and no material or obstruction shall be placed within fifteen (15) feet of any such hydrant.

Some of the work may occur on a sensitive private property. Drilling fluids and drill cuttings will not be permitted to be discharged on the ground surface on such property. When directed by the MDOT SHA, the Contractor will place all drilling fluids and drill cuttings in 55-gallon steel drums with tightly fitting lids and dispose the material off site at an approved landfill.

Measurement of this item will be on a per drum basis. The drums shall remain with the Contractor at the completion of the work.

Payment under this item will be made at the per drum price bid in the "Bid or Proposal" for the "Removal, Hauling and Disposal of Drill Fluids and Drill Cuttings" which price shall include the placement of the drill fluids and drill cuttings in the 55 gallon drums, removal of the drums from the site of work and the disposal of the drums at an approved landfill.

GS-2.17 Safety

The Contractor shall, at all times, exercise precaution for the protection of all persons, including employees, and property. All provisions of applicable municipal, state and federal laws, ordinances and regulations, including the most recent regulations and standards promulgated under the Occupational Safety and Health Act of 1977 shall be observed in the conduct of the work.

MDOT SHA requires the contractor to wear all necessary and proper personal protective equipment (PPE) while performing work under this contract. PPE shall include, but is not limited to, hard hats, safety vests, eye protection, ear protection, work gloves and safety boots. The contractor shall ensure their employees wear the proper PPE on this contract at no additional cost the MDOT SHA.

The SHA High Visibility Apparel Policy shall be adhered to by the Contractor. The SHA has developed the High Visibility Apparel Policy to make SHA employees and Contractors doing work for the SHA more easily seen as they work on highways and rights-of-way. Full compliance with this policy will be required as of January 1, 2006 and is recommended for operations prior to that date.

The High Visibility Apparel policy adopts the Headwear standard from the American National Standards Institute/International Safety and Equipment Association (ANSI/ISEA 107-2004). This standard provides guidelines for visibility protection for all persons who must perform activities on SHA highways and rights-of-way.

A minimum of a Class 3 ANSI/ISEA 107/2015 will be required for all persons who work on SHA highways and rights-of-way. The apparel will be fluorescent orange-red or fluorescent yellow-green background material color and the outermost garment worn.

If any construction operation, practice, or condition is deemed by the MDOT SHA to be unsafe, the Contractor, when notified in writing by the MDOT SHA, shall take such corrective action as shall be appropriate in the circumstances, or as shall be directed by the MDOT SHA. However, when in the opinion of the MDOT SHA, any operation, practice or condition endangers persons, including employees or property, it shall be summarily discontinued, and adequate remedial action taken by the Contractor before the affected part of the work is resumed. No payment will be made for work stoppage if work is discontinued due to unsafe conditions.

Nothing in the foregoing paragraphs shall be construed as relieving the Contractor from full responsibility for safe performance of the work at all times.

GS-2.18 Report of Accidents

Within twenty-four (24) hours after the occurrence of any accident or other event which results, or might result, in injury to the person or property of any third person, which results from or involves any action or failure to act of the Contractor or any subcontractor, or any employee or agent of either, and which arises in any manner from the performance of the contract, the Contractor shall send a written report of such accident or other event to the MDOT SHA, setting forth a full and precise statement of the facts pertaining thereto.

The Contractor shall also immediately send to the MDOT SHA a copy of any summons, subpoena, notice, or other document served upon or received by the Contractor or any subcontractor, or any agent, employee, or representative of either, in connection with any matter before any court, arising in any manner from the contract or the performance of the work.

GS-2.19 Subletting or Assigning this Contract

No portion of this contract shall be sublet, assigned, or otherwise disposed of, except with the written consent of the MDOT SHA. Requests for permission to sublet, assign, or otherwise dispose of any portion of this contract shall be in writing and accompanied by a statement showing that the organization which will perform the work is appropriately experienced and equipped for such work. The Contractor shall give assurance that the minimum wage for labor shall apply to labor performed on all work sublet, assigned, or otherwise disposed of in any way. Consent to sublet, assign, or otherwise dispose of any portion of this contract shall not be construed to relieve the Contractor of any responsibility for the fulfillment of this contract.

GS-2.20 Annulment of Contract

The Contractor shall perform the work with sufficient labor and equipment or with sufficient materials to promptly complete the work within the time specified for the particular project assignment. If the Contractor fails to perform the work suitably, or neglects or refuses to remove materials or to perform anew such work as may be rejected, or discontinues the prosecution of the work, or if the Contractor becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or allows any final judgement to stand against him unsatisfied for a period of forty-eight (48) hours, or makes an assignment for the benefit of creditors, or fails to carry on the work in an acceptable manner for any cause whatsoever; then the MDOT SHA shall give notice in writing to the Contractor, of the delay, neglect, or default, specifying the same. If the Contractor, within a period of ten (10) days after receipt of such notice, does not proceed in accordance therewith, the MDOT SHA shall have full power and authority, without violating the contract, to take the prosecution of the work out of the hands of the Contractor, appropriate or use any or all materials or equipment on the ground as may be suitable and acceptable, and may enter into an agreement for the completion of the contract, according to the terms and provisions thereof, or may use such other materials as in his opinion shall be required for the completion of the contract in an acceptable manner. All costs and charges incurred by the MDOT SHA, together with cost of completing the work, shall be deducted from any monies due or which may become due the Contractor. In case such expense shall exceed the same which would have been payable under the contract, the Contractor shall be liable and shall pay the MDOT SHA the amount of said excess.

GS-2.21 Eliminated Items

If any item contained in the proposal is found to be unnecessary for the proper completion of the work, the MDOT SHA may eliminate such item from the contract, and such action shall in no way invalidate the contract, and no allowance will be made for items so eliminated in making final payment to the Contractor.

GS-3 MANNER OF PROSECUTING WORK

The work shall be prosecuted in a manner best calculated to promote rapidity and accuracy in execution, to secure safety of life and property, and in accordance with the directions and to the satisfaction of the MDOT

SHA. The Contractor is expected to vigorously and continuously prosecute the work toward prompt completion within the time specified in the proposal. The MDOT SHA reserves the right to request the Contractor to assign additional equipment and personnel to the work if, in the MDOT SHA's opinion, the work at any time does not appear to be approaching completion within the time specified for each drilling or testing assignment.

GS-4 LIQUIDATED DAMAGES

Time is an essential element of the contract. It is important that the fieldwork be completed within the number of calendar days and/or workdays specified for the work. Draft copy of test boring logs shall be submitted within twenty-four hours (24) and final test boring logs shall be submitted within three (3) calendar days after completion of the fieldwork. Any delay in completing the fieldwork will result in delaying the project design and engineering schedule.

For each calendar day that the field work shall remain uncompleted after the contract time specified, counted from the date of the written notice to proceed with the work, the sum per calendar day specified in the Proposal shall be deducted from any money due the Contractor. This sum per calendar day is not a penalty but is liquidated damages for costs incurred because of the Contractor's overrun in time.

An extension of time will be allowed if the total cost of the unit price items actually completed exceeds the total price bid for these items in the Proposal. This extension of time will be based directly upon the proportion of increase in the cost of the unit price items actually completed over the total price bid for these items in the Proposal.

If the Contractor shall be delayed in the completion of his work by reason of unforeseeable causes beyond his control and without his fault or negligence; including but not restricted to acts of God or of the public enemy, acts or neglect of the MDOT SHA, fires, floods, epidemics, quarantine restrictions, strikes, riots, or civil commotion; then the period herein specified for completion of his work shall be extended by such time as shall be fixed by the Engineer. No extension of time will be allowed for inclement weather. However, should weather conditions on a given day indicate that field work would be difficult and should the Contractor inform the MDOT SHA prior to 0800 hrs that the day's (or by 1500 hrs for night's) work is canceled with the SHA's concurrence, then the day (night) will not count toward the number of days specified as "Time of Completion" in the Proposal and Agreement.

GS-5 ACCESS TO PUBLIC AND PRIVATE PROPERTY

The MDOT SHA will obtain permission from the property owners involved to provide access to, and to occupy any public or private property for the purpose of conducting the Contractor's operations under this contract. The Contractor shall not enter upon, or occupy, such property for any purpose until such permission has been granted.

The Contractor shall be responsible for the protection and preservation of all public and private property, including trees, bushes, turf, monuments, highway signs, fences, etc., adjacent to the work site; and shall use every precaution necessary to prevent damage thereto. He shall also be responsible for injury or damage to public or private property resulting directly or indirectly from the execution or non-execution of the work.

He shall also be responsible for remediation of any environmentally sensitive features along access routes or on the job site.

GS-6 DAMAGE CLAIMS AND INSURANCE

GS-6.1 Responsibility for Damage Claims, Etc.

The Contractor shall indemnify and save harmless the MDOT SHA and any representative thereof, from all suits, actions, or claims of any character brought on account of any injuries or damages sustained by any person or property in consequence of any neglect in safeguarding the work, or on account of any act or omission by the said Contractor, or on account of any claims or amounts recovered from any infringement of patent, trademark, or copyright, or from any claims or amounts arising or recovered under the Workmen's Compensation law, or any other law, by-law, ordinances, order or decree. The Contractor shall be responsible for all damage or injury to property of any character during the prosecution of the work resulting from any act, omission, neglect, or misconduct, the manner or method of executing said work satisfactorily, or due to the non-execution of the said work, and said responsibility shall continue until the work under this Contract shall have been completed and accepted.

GS-6.2 Compensation Insurance

The Contractor shall continuously maintain Workmen's Compensation Insurance during the life of this contract for all his employees employed at the site of the project. In case any class of employees engaged in hazardous work under this contract at the site of the project is not protected under the Workmen's Compensation statute, the Contractor shall provide adequate insurance for the protection of his employees not otherwise protected.

GS-6.3 Public Liability

Before any work under this contract is commenced, the Contractor shall, in addition to any other forms of insurance or bonds required under the terms of the contract and specifications, procure and maintain during the life of the contract the following types of insurance in the amounts set forth.

GS-6.3.1 Contractor's Public Liability and Property Damage Liability Insurance

The Contractor shall furnish evidence satisfactory to the MDOT SHA that, with respect to the operations he performs, he carries regular Contractor's Public Liability Insurance providing for a limit of not less than One Million Dollars (\$1,000,000.00) liability for all damages arising out of bodily injuries to or death of one person, and a total (or aggregate) limit of One Million Dollars (\$1,000,000.00) liability for all damages arising out of bodily injuries to or death of two or more persons in any one accident; and regular Contractor's Property Damage Liability Insurance providing for a limit of not less than One Million Dollars (\$1,000,000.00) liability for all damages arising out of injury to or destruction of property in any one accident, and a total (or aggregate) limit of One Million Dollars (\$1,000,000.00) liability for all damages arising out of injury to or destruction of property during the life of the contract.

A copy of the policy for such insurance in the name of the Contractor shall be delivered to the MDOT SHA.

GS-6.3.2 Contractor's Protective Liability and Property Damage Liability Insurance

If any part of the work is to be performed by a subcontractor, the Contractor shall furnish evidence satisfactory to the MDOT SHA that, with respect to the operations performed for him by subcontractors, he carries in his own behalf regular Contractor's Protective Public Liability Insurance providing for a limit of not less than One Million Dollars (\$1,000,000.00) liability for all damages arising out of bodily injuries to or death of one person, and a total (or aggregate) limit of One Million Dollars (\$1,000,000.00) liability for all damages arising out of bodily injuries to or death of two or more persons in any one accident; and regular Contractor's Protective Property Damage Liability Insurance providing for a limit of not less than One Million Dollars (\$1,000,000.00) liability for all damages arising out of injury to or destruction of property in any one accident, and a total (or aggregate) limit of One Million Dollars (\$1,000,000.00) liability for all damages arising out of injury to or destruction of property during the life of the contract.

A copy of the policy for such insurance in the name of the Contractor shall be delivered to the MDOT SHA.

GS-7 UNDERGROUND PIPES, UTILITIES AND OTHER OBSTRUCTIONS

In addition to showing the work to be done under this contract, the plans may also show the locations of various underground pipes, utilities, and other structures in the general work area. This information was obtained from the most reliable sources available; however, the MDOT SHA makes no warranty, expressed or implied, as to the accuracy, type or number of underground pipes, utilities or obstructions within the project site. It shall be the responsibility of the Contractor to verify or determine the locations of all underground pipes, utilities and structures in the immediate vicinity of his operations, and to exercise all due precautions to prevent damage to all underground pipes, utilities and structures. Should any damage to such pipes, utilities or structures occur as a result of the Contractor's operations, the Contractor shall, at his own cost and expense, restore such utilities or structures to a condition equal to that what existed before the damage occurred.

GS-8 PROTECTION OF SAMPLES AND RECORDS

The Contractor shall provide a location for the storage of samples and records so as to protect them against theft, loss, freezing, or damage. Storage and preservation of all samples and records prior to completion of the work, or until such time as they are delivered to the MDOT SHA as hereinafter specified, shall be the responsibility of the Contractor. On certain work assignments, the MDOT SHA may recommend specific sample storage areas to the Contractor.

GS-9 OUT-OF-TOWN ASSIGNMENT

Some assignments under this Contract will require overnight out-of-town stay. Payment will be allowed for an authorized out-of-town stay for a given assignment under this Contract as stated below and for the bid item "Out-Of-Town Stay - Including Meals and Lodging Per Person".

Payment for the costs of meals and lodging would be in accordance with the existing Maryland State Department of Budget and Management (DBM) State Standard Travel Regulations. The cost of three

meals shall not exceed \$47.00 per day for each individual (Breakfast - \$10.00, Lunch - \$12.00, Dinner - \$25.00) and the cost of meals and lodging shall not exceed \$98.00 per day per individual. The cost of meals is subject to adjustment during the Contract period to reflect the prevailing DBM meal rates. The figures quoted above are the fiscal year 2018 DBM meal rates. Lodging receipts are required for reimbursement.

To be eligible for reimbursement for breakfast on the first day of an out of town assignment, work - including commute time- must commence a minimum of two (2) hours before the normal starting time for that day.

To be eligible for reimbursement for dinner on the last day of an out of town assignment, work - including commute time - must conclude a minimum of two (2) hours after the normal quitting time for that day.

For an assignment to be qualified for payment under the bid item "Out-Of-Town Assignment, Including Meals and Lodging Per Person", the assignment should be located at least a distance of fifty (50) miles away from the Contractor's home base, which should be declared by the Contractor prior to receiving notice to proceed on the very first work assignment. The declaration of the Contractor's home base must be made in writing at the time of award of this contract.

GS-10 COMMUNICATION

The contractor is required to have a means to communicate statewide from the job site for emergency contact and for business use by the contractor, SHA or our agent. No payment will be made to the Contractor for costs associated with this on-site communication costs or any other communication between the Contractor and the MDOT SHA by telephone, fax, or e-mail. Long distance telephone calls to the MDOT SHA is encouraged by the use of the Administration's toll-free number (1-866-926-8501).

GS-11 PAYMENT TO THE CONTRACTOR

Payment to the Contractor by the MDOT SHA will be made at the unit prices contained in the letter soliciting bids and as tabulated on the Proposal Form. The amount paid to the contractor will be for the actual work completed for each individual bid item and then summed to reach a total amount for the completed work.

Invoices may be submitted monthly for all work completed during the prior 30-day period. Invoices should be submitted within 30-days from the completion of work and shall be on a form approved by MDOT SHA. Invoices should be sent to The Chief of Field Explorations Division, Maryland State Highway Administration, 7450 Traffic Drive, Hanover Maryland, 21076.

TECHNICAL SPECIFICATIONS

TS-1 GENERAL

The Contractor shall so conduct his work as to accurately determine the nature and depth of each stratum of material encountered and to preserve the natural properties of the materials for future laboratory testing. All methods and equipment shall be as specified herein and shall be subject to the approval of Maryland State Highway Administration and hereinafter referred to as the MDOT SHA.

TS-2 CONDUCT OF THE WORK

TS-2.1 General

The Contractor shall perform such clearing and grubbing as may be necessary to provide access and working space at the site or sites of the work; and do all other work which may be necessary to move his equipment around or between the test boring locations. It shall be the contractor's responsibility to perform any clearing or grubbing in accordance with any local, municipal, state, or federal laws, and property owner(s) requirements. All applicable sediment and erosion control regulations, tree protection regulations and all other environmental rules and regulations, affecting the prosecution of the work, shall be strictly adhered to by the contractor. No direct payment will be made for this work, the costs of which are included in the payment made for "Mobilization and Demobilization of Equipment, etc."

The Contractor should be aware that no additional payment will be made for drilling in the varying geologic regions of the State. Payment for drilling in any part of the State will be as specified in the bid items.

TS-2.2 Borings in Streets and Paved Areas

Where borings are to be drilled in sidewalks, streets or other paved areas, the area of paving damaged shall be kept to the minimum required for satisfactory completion of the work. All damaged paving shall be repaired or replaced in kind as soon as practicable and to the satisfaction of the MDOT SHA.

TS-2.3 Refilling of Holes

Upon the satisfactory completion of each boring, the measurement of the zero hour and 24-hour groundwater level as well as the bottom depth of the hole at each reading, and the acceptance thereof by the MDOT SHA, the Contractor shall immediately refill the hole with the drill cuttings. If required, or as directed by the MDOT SHA, sealing of the hole shall be performed in accordance with the requirements of ARTICLE TS-20 "SEALING BORE HOLES."

TS-2.4 Cleaning Up

Upon completion of the work, the Contractor shall promptly remove all of his equipment, including all markers, ranges, and stakes placed by him, and shall leave the site in a clean and presentable condition, satisfactory to the MDOT SHA and the property owners involved. On some assignments, the work site,

including, but not limited to access routes to and from the drilling site(s) will need to be restored to its undisturbed conditions. Restoration of the work site to its undisturbed conditions may include, but not limited to, spreading, raking, seeding, and mulching. The cost of all site cleanup and site restoration work shall be incidental to and included in the payment for “Mobilization and Demobilization of Equipment, etc.”

TS-3 BORING LOCATIONS AND SAMPLES

The MDOT SHA will designate, by means of stakes or other marks, the locations of all borings and will establish the existing ground elevation at each boring location.

The Contractor shall not proceed with any boring until the location has been marked in the field by the MDOT SHA, nor shall he proceed until he has determined the location of all underground utilities and structures in the vicinity of the boring. Should the Contractor determine that a conflict exists between a proposed boring and an existing utility he shall immediately inform the MDOT SHA, who will then establish a new boring location. The designation of boring locations by the MDOT SHA shall not in any way relieve the Contractor of his responsibility for damage to underground pipes, utilities or structures.

During the progress of the work, the MDOT SHA will specify the criteria to which each boring shall be drilled in order that the character of the material at desired elevations or depths can be determined or verified.

TS-4 SEQUENCE OF WORK

The work shall be performed in the sequence determined by the MDOT SHA.

TS-5 ABANDONED BORINGS

No measurement or payment will be made for borings abandoned or lost before reaching the specified depths except as otherwise provided hereinafter for false starts, or unless and to the extent the MDOT SHA deems that the borings so abandoned are acceptable. Except with the specified permission of the MDOT SHA, the Contractor shall not abandon or complete any boring, or remove any casing or drilling equipment, without first affording the MDOT SHA the opportunity of obtaining the position and depth of the boring prior to abandonment or completion, and any other information which the MDOT SHA may require. No allowance or payment whatsoever will be made for any boring abandoned or completed without compliance with these stipulations. In addition, in order to receive consideration for payment for abandoned borings, the Contractor shall furnish the MDOT SHA with complete records and samples for the depth penetrated in the manner hereinafter prescribed for completed borings.

TS-6 FALSE STARTS

Should the Contractor be unable to complete any boring due to encountering underground utilities or structures, or because obstacles or obstructions are encountered that the MDOT SHA considers are of an unusual nature and that failure to penetrate the obstacles or obstructions is not the fault of the Contractor's methods or equipment, a false start will be allowed. The length of the false start will be measured from

the ground surface to the lowest elevation penetrated, and will be paid for at the unit price bid in the proposal for the particular type of boring being performed; provided, however, that the Contractor shall submit to the MDOT SHA a complete record of all false starts and all samples obtained from the boring before the obstruction was encountered.

TS-7 PROCEDURES FOR MAINTAINING AN OPEN BORE HOLE

An open bore hole shall always be maintained through the use of casing, hollow stem augers or drilling mud. All casing shall be extra-heavy steel or black wrought iron pipe not less than 3-1/2 inch nominal inside diameter. The Contractor may, at his option, utilize flush joint casing instead of conventional pipe casing. Hollow stem augers, of the required diameter, may be utilized in place of driven casing. Solid flight augering shall be performed in accordance with AASHTO T306 and ASTM D1452. Hollow-stem augering shall be performed in accordance with ASTM D6151.

The use of drilling mud may be permitted only with prior approval from MDOT SHA. Before starting work, the Contractor shall seek approval from the MDOT SHA for the procedure to be used to maintain an open hole. If drilling mud is used, the MDOT SHA reserves the right to specify an organic self-destroying drilling fluid additive in place of bentonite or other inorganic clay so that accurate ground water measurements can be made in the bore hole. Mud-rotary drilling shall be performed in accordance with ASTM D5783. If wireline operations are approved, performance shall be in accordance with ASTM D5876. If air-rotary drilling is approved, performance shall be in accordance with ASTM D5782.

It should be noted that in bore holes where soil permeability tests are to be performed only casing will be permitted to maintain an open bore hole. Bore holes in which drilling mud is used shall be bailed to obtain accurate Zero (0) hour and twenty-four (24) hour ground water readings as per TS-12.9. All roadway borings must be backfilled at completion for safety.

TS-8 RECORDS AND LOGS

The Contractor shall record on standardized boring log forms provided by the MDOT SHA, such portions of the several categories of data outlined hereinafter as are deemed by the MDOT SHA to be relevant to the type of boring work accomplished in each case. In addition, each and every boring log shall record the following information:

- (1) Title of project and designation of section thereof.
- (2) Date of starting and completing borings.
- (3) Boring number, (to conform to number assigned on the plans or as furnished by the MDOT SHA).
- (4) Names of the Contractor, Inspector, drillers first initial, last name and rig number.

- (5) Location of site by name, and provide boring locations in Maryland State Plane grid coordinates as measured by a GPS measuring device with an accuracy of 2-inches or less.
- (6) Ground elevation at boring, as furnished by the MDOT SHA.
- (7) Relocated boring's new GPS coordinate locations, or station and offset, and the corresponding elevation and offset and reason for the relocation.
- (8) Type and size of drilling equipment used to drill the hole, including make, model, unique rig identification number and type of hammer.
- (9) Procedure used for maintaining an open bore hole. If drilling mud is used, the type of material used to form the mud.
- (10) Depth to top of ground water if present, measured as provided in Article TS-12.9 "Ground Water."

TS-9 PREPARATION AND DELIVERY OF REPORTS AND RECORD DRAWINGS

Reports and record drawings, all of which shall become the property of the MDOT SHA, for the entire duration of the contract, shall be required as follows:

TS-9.1 Preliminary Driller's Logs

Within twenty-four (24) hours after the completion of each boring, the Contractor shall transmit to the MDOT SHA one (1) electronically formatted copy of the driller's log for the boring, prepared to show all relevant data herein specified. Soil identification and descriptions on the preliminary driller's log shall be made by the driller or contractors' agent at the time drilling is performed in the field. All Boring Log data shall be collected via PDA, Tablet or Tuff Book with software-based program specifically designed for the collection of subsurface drilling data. The software program must be capable of import into the gINT program environment and utilize the templates provided by MDOT SHA.

TS-9.2 Final Test Boring Logs

Within three (3) calendar days after completion of the final test boring in the field, the Contractor shall submit to the MDOT SHA one (1) electronic copy of the Final Test Boring Logs on the appropriate borings log format. The only Final Test Boring Logs acceptable to the MDOT SHA shall be prepared by either the Contractor's Certified Driller or Soils Engineer/Geologist and shall have calculated N_{60} values shown, as per section 5.2.1 of the National Highway Institute Manual of Subsurface Investigations, unless otherwise requested by the MDOT SHA. In addition, the Final Test Boring Logs shall be entered into the gINT Computer Program or any other required computer program and submitted to the MDOT SHA within three (3) calendar days after completion of the final test boring. The MDOT SHA will provide the required library file in which the test boring data shall be entered into the MDOT SHA template by the

Contractor. The MDOT SHA will also provide the necessary training for the Contractor's personnel in using the computer program.

Payment will be made to the Contractor for entering the Final Test Boring Logs data in the required computer program which is approved by the MDOT SHA; quality control checking of the computer program output for accuracy of the test boring information; and the computer training time for the Contractor's personnel. Payment for this work will be under the bid price for "Quality Control Checking for Boring Data Output". No additional compensation will be allowed for the preparation of the Final Test Boring Logs by the Contractor's Certified Driller or Soils Engineer/Geologist. Preparation of the Final Boring Logs shall be incidental to the drilling items.

T-S 9.3 Electronic Field Data Logging

The Contractor will be required to provide two (2) fully functional hand-held computers with appropriate data logging systems, as specified herein, for use by contract driller and/or a MDOT SHA inspector (or a representative for MDOT SHA) to capture field information electronically that meets the above mentioned standards and the following field collection data collection system requirements:

- (1) Mobile hardware with touch screen and full alphanumeric key pad and wireless connectivity w/ 100MB of storage
- (2) Hardware and software maintenance service agreements for the duration of the contract
- (3) Loaded with gINT version 8.2 or later or gINT compatible applications
- (4) GPS compatible
- (5) AGS compliant schema
- (6) Initial setup and alterations to screen formats
- (7) Have antivirus software installed and configured

At the end of the contract, the hardware shall remain the property of the Contractor.

Payment for this data logging system will not be measured, but the cost will be incidental to the Unit price for the mobilization of drilling equipment.

TS-10 DELIVERY OF SAMPLES AND CORES

All samples and cores, suitably packed and identified as herein specified, shall be delivered to the Maryland State Highway Administration, Field Explorations Division, 7450 Traffic Drive, Hanover Maryland, 21076, or other location as may be specified, within five (5) Calendar days after completion of the last boring in the field unless otherwise specified in the criteria for each specific project. At the time of delivery, the Contractor will provide to the SHA Representative with a proper Chain of Custody and documentation summarizing the samples being delivered. Both the SHA Representative and Contractor must sign the summary documentation for acceptance.

All soil samples shall be handled in accordance with ASTM D4220 and shall be protected during handling, storage and shipment, from vibration, freezing, and excessive heat.

Sample Jar Lids are to be labeled with the date, MDOT SHA Charge Number, Boring Number, Sample Number, Blow Count and recovery.

Sample Jar Boxes shall be labeled with the MDOT SHA Charge Number, Project Description, Boring Numbers and Sample Numbers. The sample jar boxes shall be labeled as "Complete" if all the sample jars are contained in one box or shall be labeled "Continued" if the sample jars are continued in the next sample jar box.

TS-11 MEASUREMENT AND PAYMENT

Payment will be made only for borings, or portions thereof, accepted by the MDOT SHA. The unit prices bid for the respective items in the "Bid or Proposal" shall include the removal of the pipe casings or hollow stem augers from the ground; furnishing of sample containers; delivery of samples; preparation, duplication, and delivery of reports and record drawings; and the furnishing of all materials, labor, tools, equipment, machinery, and all other work incidental and necessary to complete the items as specified herein or as directed by the MDOT SHA, and/or as shown on the plans.

TS-12 STANDARD PENETRATION BORINGS

TS-12.1 General

Standard penetration borings through soil are required to be performed in accordance with AASHTO T206 and ASTM D1586 for subsurface exploration at the locations indicated on the plans and/or as directed by the MDOT SHA. The procedures for maintaining an open bore hole are specified in Section TS-7. In general, the selection of the procedure to be used for maintaining an open bore hole will be selected and approved by the MDOT SHA. The MDOT SHA reserves the right, however, to change the procedure to be used for maintaining an open bore hole if the procedure being used by the Contractor fails to maintain an open hole, results in the recovery of unsuitable or unrepresentative samples or is otherwise not satisfactory.

TS-12.2 Driving Casing

If casing is used to maintain an open bore hole, it shall be sunk vertically through earth and other materials, including boulders, to such depth below the ground surface as is, in the opinion of the MDOT SHA, consistent with good practice for conditions encountered. The casing shall be driven without the use of water unless the MDOT SHA specifically authorizes simultaneous washing and driving; in which case, the boring log shall record the depths between which such practice was followed. A continuous record shall be kept of the number of hammer blows per foot of penetration required in driving the casing. To maintain casing penetration data on a comparative basis, the same weight and fall of casing hammer shall be used for driving casings by all drilling rigs used on this work.

Should a boulder, layer of boulders, or cobbles, or a stratum of rock with soil beneath be encountered before the required depth of boring has been attained, the Contractor will be required to core drill through the boulder or rock stratum, case the hole, and extend the casing as hereinafter specified in Article TS-13

“Core Borings.” Payment for such core drilling will be made at the unit price per linear foot bid in the “Bid or Proposal” for core borings of the size specified by the MDOT SHA for the particular hole being drilled, provided that the boulder or rock stratum exceeds one (1) foot in thickness.

Blasting with small explosive charges to facilitate penetration of boulders and other obstructions will be not be permitted.

Between the depth intervals, as hereinafter specified, at which sampling is to be accomplished, loose material within the casing shall be removed by the usual wash pipe method or by other suitable means. In no case will the use of bottom discharge fishtail bits be permitted; however, side discharge fishtail bits may be used. The process of jetting through an open-tube sampler and then sampling when the desired depth is reached will not be permitted.

TS-12.3 Hollow Stem Augers

When hollow stem augers are used to maintain an open bore hole, the procedure to be used shall be in accordance with ASTM D6151. Generally, the process is as follows: the augers, with bit attached to the bottom section, shall be advanced by rotating the augers while a downward force is applied to the top section of auger until the depth is reached at which sampling is to be accomplished. When augering between samples, a center plug or drag bit assembly shall be in place to prevent loose material from entering the hollow stem auger. This assembly shall be held in place by a cap and drill rod connecting the auger and assembly to the rotating spindle on the drill rig. The hollow stem augers shall have a minimum outer diameter of 6-inches.

Hollow stem augers may be utilized provided the following conditions are met:

- (1) The auger flights retain at least 80% of their original width as measured perpendicularly from the edge of the flight to the outside of the center shaft.
- (2) The auger flights have not been “built-up” with weld beads.
- (3) The hollow stem augers are not more than 2 degrees out of plumb.
- (4) Hollow stem augers utilizing only one bolt to secure each section of auger will not be permitted.

Upon reaching the depth at which a soil sample is to be obtained, the center plug and drag bit assembly shall be removed to permit lowering of the soil sampling device or core barrel through the hollow stem auger.

Should a boulder or a stratum of rock with soil beneath be encountered before the required depth of boring has been attained, the Contractor will be required to core drill through the boulder or stratum of rock and obtain soil samples of the material beneath. The Contractor shall be responsible for maintaining an open hole through the material that lies below the depth interval in which rock coring was performed. If this cannot be accomplished by advancing the hollow stem augers, the Contractor shall use casing or drilling

mud, or altering his drilling procedures as required, to advance the boring to the depth required by the MDOT SHA.

Payment for core drilling will be made at the unit price per linear foot bid in the "Bid or Proposal" for core borings of the size specified by the MDOT SHA for the boring being drilled, provided that the boulder or rock stratum exceeds one (1) foot in thickness.

Blasting of boulders and other obstructions will not be permitted during drilling.

TS-12.4 Frequency of Sampling

At every change in the character of the material, and at intervals not to exceed five (5) feet, advancement of the hole shall be stopped, all loose material shall be removed from the hole, and a sample of the soil shall be procured as hereinafter specified. The five (5) foot sample interval shall be measured from the top of the first sample to the top of the second sample. The MDOT SHA reserves the right to require the procurement of additional samples at intermediate depths when it is determined that additional sampling is necessary for proper analysis of subsurface conditions.

TS-12.5 Sampling Procedure

The sampling device shall be driven until either eighteen (18) or twenty-four (24) inches, as specified by MDOT SHA, have been penetrated or 50 blows have been applied within a penetration of six (6) inches or less. The number of blows required to affect each six (6) inches of penetration or fraction thereof shall be recorded. The first six (6) inch penetration is considered to be a seating drive. The number of blows required for the second and third six (6) inches of penetration added together is considered the penetration resistance, N. The sample so obtained shall be representative of the material from which it is taken and shall be in an unwashed condition. Samples recovered from wash water, commonly termed "wash samples" will be unacceptable. After the recovered sample has been removed from the sampling device, the sampling device shall be thoroughly washed to prevent contamination of the next sample. The split barrel soil sampler shall not be driven more than 24 inches.

To facilitate comparison of the resistance to penetration of the various strata, the sampling device shall always be driven with the same weight and fall of drop hammer, which hammer shall consist of a weight of one hundred and forty (140) pounds freely falling through a vertical distance of thirty (30) inches. The driving of the split barrel sampler shall be accomplished using a fully automatic trip hammer. The use of manila or wire rope to raise the hammer will be permitted only when using skid rig or tri-pod drill equipment, and only with prior approval from MDOT SHA. The sampling hammer need not necessarily have the same weight and fall as the casing hammer. To prevent whipping of the drill rod under the impact of the drop hammer, the drill rod shall have a stiffness equal to or greater than "A" rod which has an outside diameter of 1-5/8 inches and an inside diameter of 1-1/8 inches. Penetration and sampling data shall be recorded as herein specified.

Sampling of soil by the above procedure shall be continued until refusal, defined as 50 blows or more per inch or less of penetration, is obtained. If further advancement of the hole is required, rock coring or Denison sampling will be employed.

TS-12.6 Sampling Devices

All sampling devices used by the Contractor shall have prior approval of the MDOT SHA. The split barrel sampler shall be 2.0 inches O.D. and 1.5 inches I.D., in conformance with AASHTO T206.

Sample retainers shall be used with the sampler, when necessary, to avoid loss of the sample. In cases where the material encountered is so cohesionless that the standard sampler fails to recover a sample on the second trial, a flapper valve, sand trap, or other approved device shall be used to recover a sample. The use of such a device shall be noted on the boring log.

TS-12.7 Preservation and Identification of Samples

A representative portion of each sample obtained with the standard split-barrel sampler shall be removed with as little disturbance as practicable, and immediately placed in a suitable, tightly capped, sample jar to be provided by the Contractor. These jars shall be of clear glass; shall have a large mouth, suitable gasket seal, and screw top; and shall be about sixteen (16) ounces in volume, and three- and one-half inches (3-½) inches at the minimum opening. Each sample jar shall be clearly and permanently labeled to show the project and section, the number of the test boring and station location, the elevation or depth at which the sample was taken, the number of blows of the sampler, and the sample number.

The Contractor shall pack all glass jar samples in containers acceptable to the MDOT SHA, and of sufficient durability to withstand handling without breakage of the sample jars. On the top and one end of each container, the Contractor shall neatly and legibly paint or stencil, using waterproof paint, the following identifying data: title of project and designation of section thereof; MDOT SHA Charge Number; location of site by name and/or survey station; boring numbers; and name of Contractor; or as required or directed by the MDOT SHA. Use of a label, approved by the MDOT SHA, is also acceptable.

The description of soils encountered shall be made by the driller in the field for use on the preliminary driller's log. On the final boring log, the description and identification of the boring data shall be furnished by the Contractor's Certified Driller or Soils Engineer/Geologist. Should the MDOT SHA indicate that the soils description and identification on the final boring logs will be performed by another party rather than the Contractor, then additional jar samples of the type specified herein shall be required. No additional compensation will be allowed for the required additional jars of samples or for the Soils Engineer/Geologist.

TS-12.8 Determination of Running Sand

Any time that sand, coarse or fine, is encountered, the MDOT SHA may order that the following test be made to determine if the water content and the pressure upon the material is sufficient to cause it to run when unconfined.

Upon encountering sand, a sample of the material shall be obtained by the method previously specified. The casing shall then be driven into the sand two (2) feet below the elevation at which the sand was encountered, and carefully washed out to the bottom. The hole shall then be allowed to stand ten (10)

minutes, and the elevation at which the sand then stands in the casing shall be measured. The water in the casing shall then be removed to a point five (5) feet above the bottom of the casing to produce an unbalanced hydrostatic condition, and the elevation of the top of the sand shall again be measured.

The foregoing test will ordinarily be required at sites of future construction excavation where sand is encountered at depths near or above the anticipated elevation of the bottom of such excavation.

The test for running sand will be considered a normal procedure in the drilling of standard penetration borings. No additional compensation will be allowed over and above that hereinafter specified for "Standard Penetration Borings".

TS-12.9 Ground Water

Ground water level during the drilling of the boring shall be determined by first bailing the water from the hole and then observing the rise in level as the ground water enters the hole. Ordinarily, the Contractor shall bail the hole at the completion of each day's work; and before starting work the following morning, shall measure and record the elevation of the water surface in the hole. The final water level reading shall be taken a minimum of twenty-four (24) hours after the completion of any boring. Water levels taken immediately upon completion will not be accepted in place of 24-hour readings.

Payment will not be authorized for any boring in which the ground water level was not obtained as specified herein unless the boring caved after completion or had to be backfilled for public safety. In this case, the reason for not obtaining the ground water level must be recorded on the boring log.

At any time that a ground water level is determined, the bottom depth of the hole shall also be measured and recorded.

It should be noted that if drilling mud is used to maintain an open bore hole, the MDOT SHA reserves the right to specify an organic self-destroying drilling fluid additive in place of bentonite or other inorganic clay so that accurate water table measurements can be made in the bore hole.

TS-12.10 Removal of Casing or Hollow Stem Augers from Ground

Upon completion of each boring, the casing or hollow stem augers shall be removed by the Contractor at his own cost and expense and shall remain the property of the Contractor. The Contractor should note that piezometers may be required in certain borings to provide long term groundwater level readings. Placement of the piezometer shall be coordinated with removal of the casing or hollow stem auger so that the sides of the hole do not collapse prior to placing the piezometers.

TS-12.11 Record Data

In addition to the data specified in Article TS-8, "Records and Logs," the Contractor shall record the following data on the boring logs:

- (1) Diameter of hole and description of sampling device.

- (2) Weight and fall of both casing hammer, if used, and sampling hammer.
- (3) Continuous record of number of hammer blows per foot penetration of casing, if used.
- (4) Number of blows of sampling hammer required to drive the sampling device a total of twenty-four (24) inches, recorded as four (4) six (6) inch increments. If driving is hard and requires in excess of 50 blows to drive the sampler six (6) inches, the driving shall be stopped at 50 blows and the penetration measured and recorded. Refusal shall be defined as resistance, which requires 50 or more blows to drive the sampling device one (1) inch or less.
- (5) Depth of each change or stratum of material.
- (6) Depth of bottom of sampler at start of driving for sample, and length at which driven.
- (7) Description of each material encountered based upon visual examination. On the Preliminary Logs, this description shall be made by the driller in the field. On the Final Log, this description and identification shall be furnished by the Contractor's Certified Driller or his qualified Soils Engineer or Geologist. Soils shall be described in accordance with AASHTO Standards and the following sequence of terms as described in SHA Standards:

A. Order of Description: Soils shall be described in the field in the following order:

- (1) Moisture Content
- (2) Density or Consistency
- (3) Color
- (4) Grain Size
- (5) Other descriptive information

Examples: (a) Wet Dense Red Silty Sand, Trace of Mica
(b) Moist Stiff Gray Silty Clay Little Sand, Trace of Organic

B. Water Content: The description of moisture content is defined as follows:

- (1) Dry: Little or no water in sample
- (2) Damp: Slight moisture on hands when handling sample. Sample must be squeezed to produce moisture.
- (3) Moist: Water on hands with minimal handling.
- (4) Wet: Sample contains free water.

- C. Density or Consistency:** The description for granular soil density and cohesive soil consistency is shown in the following table:

<u>Sand and Gravel</u>		<u>Silt and Clay</u>	
<u>BPF</u>	<u>Density</u>	<u>BPF</u>	<u>Consistency</u>
0-4	Very Loose	0-1	Very Soft
5-10	Loose	2-4	Soft
11-30	Medium Dense	5-8	Medium Stiff
31-50	Dense	9-15	Stiff
Over 50	Very Dense	16-30	Very Stiff
		31-60	Hard
		Over 60	Very Hard

Note the values contained in the above table are representative of a N_{60} . Descriptions of soils obtained through use of automatic hammers may need correction for final logs after correction factors are applied and true N_{60} is calculated.

- D. Color:** Common descriptive terms such as red, gray, brown with adjectives such as dark, light etc. are acceptable. Note that the word “mottled” will be acceptable for cohesive soils exhibiting multiple colors.
- E. Grain Size:** Most soils contain various proportions of gravel, sand, clay or silt. When describing the soils, the secondary constituents are considered as modifiers, e.g., sandy silt, gravelly sand, etc. The following definitions of secondary components are to be used:

<u>Percent in Soil Mixture</u>	<u>Description</u>
>0% to 10%	Trace
>10% to 25%	Little
>25% to 35%	Some (or use a modifying word)
>35% to 50%	And

- Examples:
- (a) Clay Some Silt (or silty clay)
 - (b) Silt and Sand
 - (c) Clayey Silt, Little Gravel, Trace sand
 - (d) Coarse Sand, Little Gravel

In granular soils, an abnormal particle size distribution may be visible. Note this type of soil as follows:

- (1) Coarse - uniformly sized large particles
- (2) Fine - uniformly small particles

Granular soils generally contain coarse, medium and fine particles. No adjective noting particle size is needed.

F. Residual Soils

- (1) Rock Penetrated by Split Barrel Sampler (RPBSBS):
Such conditions may exist when the split-barrel sampler penetrates a stratum with 50-blows and a penetration ranging from more than one (1) inch and less than five (5) inches. Sample may appear similar in structure to that of the parent formation.

Record depths and blow-counts and measure penetration depths. Record visual description of moisture, color, grain-size and structure of any sample obtained.

- (2) Rock Penetrated by Power Auger (RPBPA):
Such conditions may exist when the auger can advance through the stratum even after SPT refusal. Likely to observe “rough” drilling conditions with slow but noticeable continued advancement.

Record depths and rate of advancement measured while drilling. Record visual description of moisture, color and grain-size if sample is obtained.

G. Other Important Factors

Other items that may be found in a soil sample are to be described on the driller’s log. These items may include the following:

- (1) Organic material including root fragments, wood, vegetation.
- (2) Components in fill soils that may include rubble, paving fragments, metal, wood, glass, plastic or any other man-made objects.
- (3) Organic odors.
- (4) Petroleum products or odors.

H. Fill Soils

Fill soils are to be described on the driller’s log. The project area contains areas of varying thicknesses of soils placed as fill material during previous

construction. The fill soils may in some cases be difficult to distinguish from undisturbed, natural soils. To help distinguish the fill soils from undisturbed soils, the following list of items can be used:

- (1) Fill soils tend to have a strong “earthy” odor as compared to undisturbed soils.
 - (2) Fill soils do not generally exhibit the natural grain size distribution or layering. The soil particles are generally mixed and do not exhibit continuity from sample to sample
 - (3) Fill soils may exhibit rapid changes in moisture content.
- (8) Records of all tests for running sand and tabulation of results thereof.
 - (9) Record the elevation of boulders and boulder layers, the elevation where any loss of drilling fluids occurred, Artesian pressures.

TS-12.12 Measurement and Payment

Measurement of this item will be on a linear foot basis and will be the actual distance measured from the ground surface to the lowest elevation penetrated exclusive of all depth intervals over one (1) foot in thickness where rock coring was performed.

Payment for this item will be made at the unit price per linear foot bid in the Bid or Proposal for Standard Penetration Borings using the type of equipment and depth intervals contained in the Bid or Proposal” which price shall include the recovery, preservation and delivery of all samples, determining and recording groundwater levels, determination of running sand, and all incidental work required to complete the borings as specified herein. The cost of moving drilling equipment from boring to boring will not be measured separately but will be considered incidental to the work.

TS-13 CORE BORINGS

TS-13.1 General

Wherever boulders or other rock over one (1) foot in depth are encountered in obtaining standard penetration borings, and where directed by the MDOT SHA, the Contractor shall obtain a core sample in accordance with ASTM D2113. The core size to be recovered shall be NX (2-1/8" core) or correlative wireline sizes if the Contractor is specifically instructed in the letter soliciting proposals to use wireline coring equipment, or if drilling conditions indicate the need for wireline coring techniques. Fragments of rock, large gravel, hard strata, cobbles or boulders that may require drilling in the amount of one (1) foot or less will not be considered as being in this category and payment for such footage will be made at the unit price per linear foot bid in the "Bid or Proposal" for "Standard Penetration Borings. In cases where disintegrated rock or other hard but unconsolidated material is encountered, the Contractor shall wash and

chop by the usual wash pipe method or advance the hollow stem augers until material is reached which, in the opinion of the MDOT SHA, requires coring.

TS-13.2 Drilling Devices

The Contractor shall use either a rotary diamond drill or steel cutter bit, provided that the core obtained by the method is acceptable to the MDOT SHA. All core drilling shall be done using a swivel type, longitudinally split Group "M", double tube core barrel, unless the Contractor is specifically required to use wireline coring equipment. The Contractor may substitute wireline coring equipment for the swivel type, Group "M", longitudinally split double tube barrel if approved by the MDOT SHA.

TS-13.3 Maintaining an Open Bore Hole For Casing

The Contractor shall provide an open hole before beginning rock coring. If casing is used to maintain an open bore hole, the casing shall be properly seated on the rock to prevent seepage of overburden material into the hole from which the core is to be taken. If, in the opinion of the MDOT SHA, the hole in the boulder or rock requires casing so that an underlying soil stratum can be sampled, the Contractor shall case the hole with casing of such size that subsequent soil samples of the required diameter can be recovered. If necessary, flush joint casing shall be used for this purpose, the hole through the boulder or rock stratum being reamed before casing. The operation of reaming and casing shall be repeated as many times as necessary to drive the casing to the ordered depth to obtain the required soil samples.

If hollow stem augers are used to maintain an open bore hole, the Contractor shall seal the augers on top of the rock as required for casing. In the event this cannot be accomplished, the Contractor shall use casing or drilling mud to obtain a satisfactory seal. Where soil stratum underlying boulders or rock is encountered, an open hole will be required, which may also necessitate the use of casing or drilling mud.

TS-13.4 Coring Procedure

Cores shall be drilled in such a manner as to assure maximum percentage of recovery of each core. Should it be impractical at any depth or penetration of rock to obtain a core, or should a seam of soil be encountered, particular care shall be taken to obtain the best samples possible of the material, as well as correct measurements of the intervals of depth from which no core was obtainable. Unless otherwise directed by the MDOT SHA, the core barrel shall be pulled at intervals not exceeding approximately five (5) feet, and the core recovered.

TS-13.5 Preservation and Identification of Cores

All rock cores shall be carefully handled to insure their proper identification, and shall be placed in suitable core boxes in the exact order of their removal from the bore hole. Samples from more than one boring shall not be packed in the same core box without the specified approval of the MDOT SHA. Core boxes shall be of uniform size, shall be constructed of lumber, and shall have hinged lids with latches to prevent accidental opening of the lid during handling, shipment, and storage. Suitable partitions or dividing strips shall be provided in the boxes to prevent the possibility of any section of core becoming dislocated from its proper sequence. The top and bottom depth of each "pull" of core shall be clearly and permanently

marked on the frame of the core box and/or on the dividing strips, or in another suitable manner acceptable to the MDOT SHA. On the top of each core box lid, the Contractor shall neatly and legibly paint or stencil, using waterproof paint, the following identifying data: The MDOT SHA Charge Number, Title of project and designation of section thereof; location of site by name and/or survey station; boring number; and name of Contractor; and date; all as required or directed by the MDOT SHA.

On the inside of each core box lid, the Contractor shall neatly and legibly paint or stencil, using waterproof paint, the following identifying data: The boring number; start and end depth of each run; the percent of recovery (REC); percent of rock quality designation (RQD). Runs and calculations of each REC and RQD are not to exceed five (5) feet.

TS-13.6 Record Data

In addition to such portions of the data required under "Records and Logs," Article TS-8, as are deemed applicable by the MDOT SHA, the logs of core borings in rock shall record the following:

- (1) Size and type of core bit used.
- (2) Description of rock encountered in accordance with the following classifications. (On the Preliminary Driller's Log, this description shall be made by the driller in the field. On the Final Log, this description shall be furnished by the Contractor's Certified Driller or perform the rock classification using a qualified Soils Engineer or Geologist.

Type: Shale, gabbro, gneiss, serpentine, etc.

Continuity of the rock: Solid, blocky or broken.

Physical Features: Porous, dense, color, etc.

Gross Homogeneity: Massive or layered. If banded, indicate thickness of bands; if separations exist, indicate interval between separations.

Degree of Weathering: Fresh or weathered. If weathered, indicate approximate percent of weathered components.

- (3) Percent of recovery is equal to the length of recovered core sample divided by the length of rock core run, expressed as a percentage. The length of the cored rock used in this computation shall not exceed five (5) feet.
- (4) Rock Quality Designation (RQD) shall be calculated in accordance with ASTM D6032. RQD is the combined length of pieces four-inches or more in length divided by the length of the rock core run, expressed as a percentage. The length of the cored rock used in this computation shall not exceed five (5) feet.

- (5) Top and bottom elevation of all voids, cavities, and soft seams encountered in the rock.
- (6) Description of any conditions requiring use of casing.
- (7) Description of any unusual conditions encountered.
- (8) Loss of drilling water depths, and if applicable, recovery of drilling water.

TS-13.7 Measurement and Payment

Measurement of this item will be on a linear foot basis and will be the actual distance measured from the top of the boulder, cobbles, or rock to the lowest depth penetrated, exclusive of all intervals of depth where actual coring was not performed.

Payment for this item will be made at the unit price per linear foot in the "Bid or Proposal" for "Core Borings, Size NXM and NXWL" which price shall include the recovery, preservation and delivery of all samples, and all incidental work as specified herein. No additional compensation will be allowed for rock identification by the Soils Engineer or Geologist.

TS-14 THREE (3) INCH UNDISTURBED SAMPLES

TS-14.1 General

Three (3) Inch Undisturbed Samples will be required from standard penetration borings in accordance with AASHTO T207, where so directed by the MDOT SHA. The intent here is to procure, at locations and depths selected by the MDOT SHA, samples of silt, or clay, in such a manner that the soil will be subjected to a minimum degree of disturbance; that the samples will represent as accurately as practicable the natural condition of the soil; and that they will be suitable in all respects for the conducting of consolidation and other tests in the laboratory by the MDOT SHA.

TS-14.2 Sampling Devices

The type of sampling device used for obtaining undisturbed samples shall vary according to the nature of the material to be recovered, but in all cases, it shall provide a sample not less than three (3) inches in diameter, and sixteen (16) inches in length or as may be specified by the MDOT SHA. Silts and clays free from obstructions and significant amounts of granular materials shall be sampled with a sampler meeting the requirements for thin-walled tubes of the "Standard Method for Thin-Walled Sampling of Soils," AASHTO Designation T207, which shall be made of brass or stainless-steel material. Plastic materials too soft to be recovered by the thin-wall sampler shall be sampled with a Stationary Piston-Type Sampler. Firm clays and silts containing granular materials in sufficient amounts to interfere with the proper operation of unsupported thin-wall samplers shall be sampled with a split-barrel sampler complete with brass tubular lining.

The Contractor shall always have available both brass and stainless-steel samplers on the site and the MDOT SHA should determine which shall be used for any particular boring.

TS-14.3 Sampling Procedure

Where undisturbed samples are to be obtained, the boring procedure shall be the same as specified in Article TS-12 for Standard Penetration Borings, up to the cleaning out of the casing preparatory sampling. From this point, the procedure shall be modified as follows: Cleaning out of the casing shall be done with a jet auger, and in such a manner that the soil immediately below the bottom of the casing shall suffer minimum disturbance. When hollow stem augers are used to maintain an open bore hole, the center plug and drag bit shall be removed and the three (3) inch undisturbed sample obtained of the material beneath the augers. Where thin-walled samplers or split-barrel samplers with liners are used, they shall be connected to the string of drill pipe, lowered slowly to the bottom of the hole, and forced into the soil at a uniform rate for the proper distance, depending upon the type of sampler. Particular care shall be taken to avoid a rate of penetration which exceeds the rate at which air or water can escape from the venting device at the top of the sampler without distorting the upper portion of the sample by excessive pressure. A maximum penetration rate of one (1) inch per second will usually be satisfactory.

Except as thereafter specified, and unless expressly authorized by the MDOT SHA for a specific case, samplers shall not be driven with a drop hammer to obtain undisturbed samples. Penetration shall be affected by means of loading the drill pipe with a suitable static weight; by forcing the sampler down using rope and pulley tackle so designated to provide a downward force via manpower or power winch; by means of hydraulic jack; or by other suitable means approved by the MDOT SHA.

When a Stationary Piston-Type Sampler is used, the sampling procedure shall be as recommended by the manufacturer and approved by the MDOT SHA. Generally, the procedure is as follows: The casing is cleaned out as previously specified, and the sampler, with the piston set flush with the bottom cutting edge, is carefully lowered to rest on the bottom of the hole. The piston rod is then rigidly clamped to the top of the casing, and the sampling tube forced into the soil to the proper depth by one of the methods specified above. The piston rod and drill pipe are then locked together at the top, and the entire assembly slowly withdrawn.

Should any undisturbed soil sample become too difficult to be sampled with any of the above methods, then the Pitcher Sampler shall be used, and should be approved by the MDOT SHA.

TS-14.4 Preservation and Identification of Samples

Immediately upon recovery the undisturbed samples shall be handled in accordance with ASTM D4220. Generally, the undisturbed soil samples in the thin tubes shall be carefully squared up at each end for a distance not less than one-quarter (1/4) inch back from the ends of the tube, and these end spaces filled with microcrystalline wax (paraffin will not be permitted) heated to just above the melting point. All slough material shall be removed from the top end of the tube before sealing. The ends of the tube shall then be closed with snugly fitting caps secured in place with friction tape, and both ends of the tube dipped in melted wax to provide air- and moisture-proof seals.

The boring location, charge number, sample number, sample depth, and identification of the top end and bottom end of the sample shall be permanently marked on the outside, top end, and the bottom end of each sample tube by means of waterproof paint, scratching into the metal, or by other suitable means. This information, as well as other data, which may be required, shall also be permanently marked on a suitable waterproof label or tag securely wired to the top end of the tube.

Particular care shall be taken at all times in the handling of undisturbed samples to avoid dropping, jarring, or rolling so as to eliminate the possibility of any shock or sudden movement altering the original condition of the sample. The undisturbed sample shall be maintained and transported in a vertical position and in the same orientation as the sample was taken from the ground.

Undisturbed soil samples shall be delivered to the MDOT SHA designated facility within 12 hours after the tubes have been waxed and sealed.

TS-14.5 Record Data

In addition to the data hereinafter specified in Article TS-12.11 Record Data, the log shall record the rate of penetration of the sampler, the total length of penetration, the number of inches of sample recovered, the type of clean-out auger used. The log shall also record pocket shear vane (ASTM D8121) and pocket penetrometer test results from each end of the sample, and any other data which the MDOT SHA may deem pertinent to the proper recording of the sampling operation.

TS-14.6 Measurement and Payment

Measurement of this item will be on per each basis. Payment will be made at the unit price per each bid in the Proposal for "Three (3) Inch Undisturbed Samples;" which price shall include the recovery, preservation, and delivery of the samples.

TS-15 DENISON SAMPLES

TS-15.1 General

Denison samples shall be required from standard penetration borings where so directed by the MDOT SHA. The intent is to procure, at locations and depths selected by the MDOT SHA, samples of soft, highly weathered rock or indurated soil, in such a manner that the sample shall be subjected to a minimum degree of disturbance; that the samples shall represent as accurately as practicable the natural condition of the soil or rock; and that they shall be suitable in all respects for testing in the laboratory.

TS-15.2 Sampling Devices

The type of sampling device used for obtaining Denison samples consists of a Denison core barrel which contains a brass liner twenty-four (24) inches in length such as an Acker Denison Core Barrel, or approved equal. In all cases the sampling device shall provide a sample not less than 2-3/8 inches in diameter. The type of bit (sawtooth or carbide insert) will be determined by the MDOT SHA on the basis of the type of material to be sampled.

TS-15.3 Sampling Procedure

Where Denison samples are to be obtained in soil, the boring procedure shall be the same as specified in Article TS-12 for Standard Penetration Borings, up to cleaning out of the casing preparatory to taking a sample. From this point, the procedure shall be modified as follows: Cleaning out of the casing shall be done with a jet auger and in such a manner that the soil immediately below the bottom of the casing shall suffer minimum disturbance. When hollow stem augers are used to maintain an open bore hole, the center plug and drag bit assembly shall be removed and the Denison sample obtained of the material beneath the augers. Where Denison samples are to be obtained in material which has been sampled by the rock coring procedure, the boring procedure shall be the same as specified in Article TS-13 for Core Borings. The Denison core barrel then shall be connected to the string of drill pipe and lowered slowly to the bottom of the hole and started into the material at a uniform rate.

In all cases, the rate of penetration of the sampler shall be no greater than the speed at which the outer barrel is able to cut; that is, the downward force on the sampler should be the minimum. The extension of the inner barrel shoe beyond the outer barrel cutting teeth shall be the least amount, which will result in a fully filled inner barrel and which will not cause undercutting or contamination of the sample by drilling fluid. The pump pressure shall be the minimum amount necessary to circulate the drilling fluid freely and carry the cuttings from the hole.

The following procedure shall be used in assisting sample recovery. The sample shall be cored to about 1-1/2 to 2 inches of the final desired depth; then the drilling fluid is shut off and the coring operation completed. This will wedge the cuttings between the inner barrel shoe and the outer barrel shoe which will cause the inner barrel to rotate with the outer barrel, thus shearing the sample from the parent material.

TS-15.4 Preservation and Identification of Samples

Immediately upon recovery of the brass liner from the Denison core barrel, the sample material in the liner shall be carefully squared up at each end for a distance not less than one-quarter (1/4) inch back from the ends of the tube, and these end spaces filled with microcrystalline wax, (paraffin will not be permitted), heated to just above the melting point. All slough material shall be removed from the top end of the liner before sealing. The ends of the liner shall then be closed with snugly fitting caps secured in place with friction tape, and both ends of the liner dipped in melted wax to provide air and moisture-proof seals.

Any soil removed from the bottom of the tube shall be placed in a sample jar and placed with the Standard Penetration Samples from the same test boring. The sample shall be labeled with the Test Boring Number, Sample Number and Depth.

The boring location, sample number, sample depth, and identification of the top end of the sample shall be permanently marked on the outside of each sample by means of waterproof paint, scratching into the metal, or by other suitable means. This information, as well as other data that may be required, shall also be permanently marked on a suitable waterproof label or tag securely wired to the top end of the liner.

The samples shall be handled in accordance with ASTM D4220. Particular care shall be taken at all times in the handling of the Denison samples to avoid dropping, jarring, or rolling so as to eliminate the possibility of any shock or sudden movement altering the original condition of the sample.

TS-15.5 Record Data

In addition to the data herein before specified in Article TS-12.11, Record Data, the log shall record the total length of penetration, the type of clean-out auger used where samples are taken in soil, the number of inches of sample recovered, and any other data which the MDOT SHA may deem pertinent to the proper recording of the sample operation.

TS-15.6 Measurement and Payment

Measurement of this item will be on a “per each” basis. Payment will be made at the unit price per each bid in the Proposal for "Denison Samples," which price shall include the recovery, preservation and delivering of the samples.

TS-16 WELLS/PIEZOMETERS

TS-16.1 General

At certain locations where borings have been taken or at other locations specified, the MDOT SHA may require the installation of Piezometers or shallow monitoring wells consisting of a perforated screen wellpoint, with all necessary pipe and fittings, sand fill, and clay bentonite seal, for the purpose of determining the elevation or depth of the ground water over an extended period of time.

The MDOT SHA may require the drilling Contractor to take samples at specified boring locations during the installation of Piezometers or shallow monitoring wells for laboratory testing and for sample identification using the Munsell Notation for texture and color. Sampling of materials from these locations for laboratory testing shall be as specified in TS-19.

Where continuous water level monitoring is needed, the MDOT SHA may require the use of Electronic Automated Monitoring Wells for continuous well data reading. If required, the MDOT SHA will provide the Electronic Automated Well device to be attached to the Piezometers or shallow monitoring wells. The installation of the Electronic Automated Monitoring Wells shall be completed as described in the sections below.

Piezometers or Shallow Monitoring Wells shall be installed by a Master Well Driller, licensed by the State of Maryland. The Master Well Driller shall be at the drill site during the entire well installation process and shall perform the work in accordance with the current regulations of the Maryland Department of the Environment (MDE).

TS-16.2 Wellpoints

Both metal and plastic wellpoints may be used in the monitoring of ground water levels. If a metal wellpoint is used, the outer portion of the wellpoint cylinder shall consist of a bronze filter screen with a mesh equivalent to a No. 15 slot (0.015 inches). The screen shall be supported internally with a perforated steel shell with anti-corrosive coating. If a plastic wellpoint is used, the outer portion shall consist of a polyvinyl-chloride plastic filter screen with slot sizes of 0.010 inches or 0.020 inches, as directed by the MDOT SHA. The screen shall be supported internally by a perforated polyvinyl-chloride plastic shell. Both types of wellpoints shall have an inside diameter of two (2.0) inches, a nominal length of sixty (60.0) inches, and a watertight cap screwed onto the bottom of the wellpoint. As an alternate to the watertight cap on the bottom, the wellpoint may have a drive point, or pointed end. Additional lengths of wellpoint may be required by the MDOT SHA.

TS-16.3 Shallow Monitoring Wells Installation

Shallow Monitoring Wells shall be installed by auguring a 2.5 feet deep hole in the ground with a 3-in. bucket auger and placing 6-in. of silica sand in the bottom of the hole. The well shall be inserted into the hole with the vented well-point into but not through the sand and pouring and tamping more of the same sand in the annular space around the screens - this shall be at least 6-in. below the ground surface. The next step shall be pouring and wetting 2-in. of bentonite above the sand and then pouring of grout to the ground surface. A final mound of grout shall be placed around the pipe to prevent surface water from puddling around the pipe. A concrete pad may be used in place of the grout to prevent surface water from entering around the pipe.

TS-16.4 Piezometers Installation

Drilling mud will not be used to maintain an open bore hole in holes where piezometers are to be installed, unless specifically authorized by the MDOT SHA, in which case an organic self-destroying drilling fluid additive shall be used to produce the mud.

Upon completion of a boring at a location designated for a piezometer installation, the Contractor shall remove the wash pipe and/or any sampling devices from the bore hole. The casing or hollow stem augers shall then be withdrawn approximately two (2) feet. The wellpoint with pipe attached shall then be inserted into the casing or hollow stem augers and secured so that the bottom of the wellpoint will be approximately one (1) foot above the bottom of the hole. Medium sand, all of which shall pass a No. 8 screen, shall then be poured down the hole until the sand covers the bottom six (6) feet of the well point assembly. The casing or hollow stem augers shall then be withdrawn at such a rate that the level of the casing or hollow stem be maintained approximately at the level of the bottom of the casing or hollow stem augers until a point three (3) feet below the ground surface is reached. From this point, the hole shall be filled to the ground surface with impervious clay, tamped in place, to provide a seal against the entrance of surface water.

As an alternate method, depending upon the elevation of the water table as measured during the drilling operation, the MDOT SHA may order that the wellpoint be located at a certain depth other than one (1) foot above the bottom of the hole. In this case, the procedure shall be as herein before specified, except that as the casing or hollow stem augers are removed from the hole, the hole shall be filled with sand until

the elevation at which the wellpoint is to be placed is reached. The wellpoint and pipe shall then be inserted into the hole and the casing or hollow stem augers withdrawn the remaining distance while, at the same time, sand is deposited as herein before specified. The top three (3) feet of the hole shall be sealed with impervious clay in a manner similar to the previous method.

In lieu of the aforementioned well construction procedures, the Contractor may choose to use pre-packed well screens containing the well screen, filter medium and filter cloth. The use of pre-packed well screens will require the approval from the MDOT SHA before use and the screens must be designed for the subsurface conditions in which they will be installed. The pre-packed well screens shall be Johnson Screen VEE-PACK PVC Pre-Packed Screen, Size 3.63 O.D./2.00 I.D., as manufactured by U.S. Filter Company, or approved equal.

Upon completion of the installation of the piezometers, the top of the two-inch pipe shall extend a minimum of four (4) feet above the ground surface, terminating with a screw-on watertight cap through which has been drilled a 1/8-inch hole. If the piezometers are located in areas of pedestrian or vehicular traffic, the cap shall be flush with the surface of the ground, sidewalk or pavement. To mark the location of the piezometer, the Contractor shall neatly and legibly paint or stencil, using waterproof paint, the following identifying data on a stake, or on the pavement or concrete in pedestrians or vehicular areas: Survey station and elevation, piezometer number, and title of project.

The stake, if used, shall extend at least four (4) feet above the surface of the ground. The stake shall be painted bright orange upon which will be printed the identifying information in black marker. Above ground protective piezometer covers shall be painted bright orange for visibility and then printed with the identifying information in black marker. White flagging will be attached to all piezometer stakes or above ground covers.

Following the completion of the piezometer installation and the installation of the flush mount or above ground protective cover, the Maryland Department of the Environment (MDE) Well Identification Tag must be affixed to the well. The Maryland Department of the Environment Well Identification tag shall be attached to the outside of above ground protective covers or inside of flush mount protective covers immediately upon completion of the piezometer construction. In the case of flush mount cover installation, the tag shall be affixed to the 2.0 inch well pipe located beneath the protective cover. For above ground protective covers, the tag shall be affixed to the exterior of the above ground protective cover. The manner of affixing the tag to the well will be in accordance with MDE regulations.

The Contractor's log shall note that the well was installed and furnish the Well Identification number. The contractor shall furnish the MDOT SHA a copy of the MDE well permit and well completion report as an attachment to the test boring log for each well installed.

The Contractor should note that in certain cases either a steel flush mounted or steel above ground cover will be required at the top of the piezometer pipe. The price paid for a flush mounted or above ground cover will be as contained in the Proposal for "Protective Monitoring Well Covers".

TS-16.5 Monitoring Ground Water Levels

Twenty-four (24) hours after the installation of the piezometer, the Contractor shall measure and record the depth of the ground water. The Contractor should note however, that the MDOT SHA may require that the depth of the ground water also be determined at other times during the progress of the work.

TS-16.6 Measurement and Payment

Payment for Shallow Monitoring Wells will be made at the Contract unit price per each of "Shallow Monitoring Wells" installed. The price for this item shall include the installation, all permits, materials, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

Measurement of "Piezometers" will be on a linear foot basis and will be the actual length of two (2.0) inch pipe and perforated screen wellpoints left in place and accepted by the MDOT SHA, measured from the bottom of the wellpoints to the top of the pipe.

Payment for Piezometers will be made at the Contract unit price per linear foot for "Piezometers," which price shall include the installation, all permits, materials, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-16.7 Piezometers or Shallow Monitoring Wells Abandonment

Prior to the conclusion of the Contract or within one year from the date of the Piezometer installation, abandonment of the Piezometers may be required. The drilling firm that installed the Piezometers or the Shallow Monitoring Wells shall also be required to abandon them in accordance with the requirements of the Maryland Department of the Environment (MDE), the MD County Health Department Regulations, and in accordance with COMAR Regulation 26.04.04.11 entitled "Abandonment Standards". The Contractor shall provide the MDOT SHA with a copy of the well abandonment report within 30 days after performing this work. The MDOT SHA will contact each Contractor when Piezometers or Shallow Monitoring Wells abandonment are required.

Measurement of "Piezometer Abandonment" will be on a linear foot basis and will be the actual length of two-inch pipe and perforated well points so abandoned in accordance with (MDE) requirements and in accordance with COMAR Regulation 26.04.04.34 entitled "Abandonment Standards".

Payment for this item will be made at the Contract unit price per linear foot for "Well Abandonment" which price shall include all mobilization, materials, labor, tools, equipment, any permit process requirements, and all incidentals necessary to complete this item of work.

TS-17 INCLINOMETERS

TS-17.1 General

At certain locations where borings are to be taken or at other locations specified, the MDOT SHA may require the installation of Inclinerometers to monitor deformations in the earth or ground, long-term and short-term landslides and/ or stability of slopes. The inclinometers shall be installed in accordance with ASTM D6230, in combination with the requirements contained herein.

TS-17.2 Inclinerometer Installation

The MDOT SHA may require the drilling Contractor to take samples at the specified boring locations during the installation of Inclinerometers for laboratory testing and for sample identification. Drilling for the installation of inclinometers and sampling of materials from these locations for laboratory testing shall be as specified respectively in TS-12 and TS-19.

Inclinerometer casings shall be installed at the locations and depths as specified by the MDOT SHA. The casing shall be installed in the pre-drilled hole. After installation, the casing groove spiral shall not exceed one degree per 10 feet of length, the orientation of the grooves at the top of the casing shall be within 10 degrees of the planned orientation, and no part of the casing shall deviate from vertical by more than 4 percent of the depth to that part. The inclinometer and casing manufactured by Durham Geo Slope Indicator Co., or equivalent shall be acceptable. The specific size of inclinometer casing to be installed shall be approved by the MDOT SHA.

The bottom of the casing shall be a minimum of 10 feet anchored into hard ground to provide the required rigidity for the inclinometer casing. The groove orientation shall be in perpendicular with the direction of the potential movement or as may be specified by the MDOT SHA. Correct casing groove orientation shall be maintained throughout installation. Once installed, the casing shall not be rotated to align the grooves.

Grout mix shall consist of cement, bentonite and water and shall have a 28-day compressive strength of about 100-psi for hard and medium soils and about 4-psi for soft soils. Mix cement with water first, then mix in bentonite. Adjust the amount of bentonite to produce a heavy flowable consistency. The grout mix filled around the casing shall meet the shear strength of the in-situ material.

After completion of installation, a post-installation acceptance test shall be performed to verify that there is no grout in the inclinometer casing, that groove orientation and verticality are correct, and that the inclinometer probe tracks correctly in all four orientations. Groove alignment shall be checked and recorded with a spiral probe. The as-built location in horizontal position and elevation shall be determined to an accuracy of ± 0.01 foot. The point selected to determine location shall be marked on the casing and indicated on the installation record sheet. The post-installation acceptance test and location shall be verified by the MDOT SHA, or its designated agent in the field. In the event of any failed post installation acceptance test, the Contractor shall be required to re-install another inclinometer at a location approved by the MDOT SHA.

TS-17.3 Measurement and Payment

Measurement of "Inclinometer" will be on a linear foot basis and will be for the actual length of the specified size of casing and coupling installed.

Payment for Inclinometers will be made at the Contract unit price per each of "Inclinometer" installed. The price for this item shall include the SPT drilling of the Inclinometer hole, installation, acceptance test, all permits, materials, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-18 SOIL PERMEABILITY TESTS

TS-18.1 General

Soil permeability tests will be required during the drilling of standard penetration borings using casing only where so directed by the MDOT SHA. The use of hollow stem augers or drilling mud to maintain an open bore hole will not be permitted when soil permeability tests are to be performed. The intent here is to measure, at locations and depths selected by the MDOT SHA, the permeability of individual soil strata penetrated by the borings. The MDOT SHA will designate the testing procedure (Method A or Method B) to be used for each hole unless an alternative to Methods A and B is required by the MDOT SHA.

TS-18.2 Testing Procedure

Infiltration Testing (Method A)

Where Method A is required for infiltration testing a boring shall be drilled to a depth of four (4) feet below the proposed facility bottom with Standard Penetration Testing conducted at intervals of 2 feet, sampling the full 24 inches, unless otherwise specified by the MDOT-SHA. The depth to the groundwater table (if within 4 feet of the proposed facility bottom) shall be determined at the completion of the borehole and again twenty-four (24) hours later. Soil samples are to be collected for classification testing as specified in TS-12.

A companion boring (auger probe) for infiltration testing shall be drilled at a location offset five (5) feet from original SPT boring location. This boring shall be drilled to a depth of twenty-four (24) inches below the proposed facility bottom, unless another depth is specified by the MDOT-SHA. Install a solid five (5) inch diameter casing to that depth with the casing being seated two (2) to four (4) inches into the soil at the bottom of the borehole. Remove all loose material from the inside of the casing and provide a natural soil interface into which water may percolate. A two (2) inch layer of coarse sand or fine gravel may be placed to protect the bottom from scouring and sediment.

The casing shall be filled with clean water to a depth of twenty-four (24) inches above the testing interface (bottom of borehole) and allowed to pre-soak for twenty-four (24) hours. The top of the casing shall be

covered and the annular space around the casing should be filled at the ground surface to prevent precipitation and surface run-off from entering the casing or the casing borehole.

After the 24-hour pre-soak, record the depth of water in the casing. Refill the casing with clean water to a depth of twenty-four (24) inches above the testing interface. Monitor the water level in the casing and record the measured drop after one (1) hour. Repeat this procedure of filling the casing with water and recording the drop for a total of four (4) observations. Upon MDOT-SHA's discretion, the final field rate may either be the average of the four observations, or the value of the last observation. The final rate shall be reported in inches-per-hour. Upon completion of the testing, the casings shall be immediately pulled, and the boring shall be back-filled.

Permeability Testing Method B

Where Method B of soil permeability tests are required, the bottom of the boring will be at the bottom of the casing. The boring procedure shall be the same as specified in Article TS-12 for Standard Penetration Borings, up to the cleaning out of the casing prior to taking a sample. From this point, the procedure shall be modified as follows: Cleaning out of the casing shall be done with a clean-out auger to an elevation equal to the elevation of the bottom of the casing, and in such a manner that the soil immediately below the bottom of the casing shall suffer minimum disturbance. When the hole extends below the groundwater table, the hole shall be kept filled with water during cleaning and during withdrawal of tools to avoid the movement of soil into the bottom of the casing.

After the hole has been cleaned to the proper depth, the test shall begin by adding sufficient clean water at a constant rate through a metering system approved by the MDOT SHA to maintain a water level at a mark near the top of the casing. In tests that are above the water table, a stable and constant water level is rarely obtained and surging of the water level within a few tenths of a foot, at a constant rate of flow for about five minutes will be considered satisfactory.

The quantity of water required to maintain the water level at the mark near the top of the casing shall be measured at one (1) minute intervals for a period of five (5) minutes, unless otherwise directed by the MDOT SHA. Upon completion of the permeability test, a standard split barrel soil sample shall be taken.

Permeability Testing (Method C)

Where Method C of soil permeability tests are required, the bottom of the boring will be below the bottom of the casing. The boring procedure shall be the same as specified in Article TS-12 for Standard Penetration Borings except for the following modifications: A hole extending 1-1/2 feet below the bottom of the casing shall be drilled using a roller bit.

A split barrel soil sample shall then be obtained from a depth of 1-1/2 to 3 feet below the bottom of the casing. Following the taking of the soil sample, the hole that extends three (3) feet below the bottom of the casing shall be cleaned out using a clean-out auger. Cleaning out shall be done in such a manner that the soil immediately below the bottom of the hole will suffer a minimum disturbance. When the hole extends below the groundwater table, the hole shall be kept filled with water during cleaning and withdrawal of tools to avoid the movement of soil into the hole.

When unconsolidated materials are encountered which cave into the hole, the test can be performed in the following manner: First drive the casing so that the bottom of the casing is at the elevation of the bottom of the depth interval to be tested for permeability. Clean out the casing to the elevation of the bottom of the casing with a clean-out auger and accurately measure and record the depth of the hole. Then pour a measured and recorded volume of pea gravel (1/4" to 3/8") into the casing so that there is slightly more than 3 feet of gravel in the bottom of the casing. Withdraw the casing a distance of 3 feet, being careful not to pull the casing above the top of the gravel, and accurately measure and record the depth to the top of the gravel.

After the hole has been cleaned to the proper depth, the test is begun by adding sufficient clean water at a constant rate through a metering system approved by the MDOT SHA to maintain a water level at a mark near the top of the casing. In tests above the water table, a stable constant water level is rarely obtained and a surging of the level with a few tenths of a foot at a constant rate of flow for about five (5) minutes will be considered satisfactory.

The quantity of water required to maintain the water level at the mark near the top of the casing shall be measured at one (1) minute intervals for a period of five (5) minutes, unless otherwise directed by the MDOT SHA.

TS-18.3 Record Data

In addition to the data herein before specified in Article TS-12.11, the log shall record the following data:

- (1) For Test Method A:
 - (a) Dates and times of presoak and testing
 - (b) Depth of groundwater, if encountered
 - (c) Depth of testing interface
 - (d) Depth to water surface, after presoak and during testing
 - (e) Size and length of casing
 - (f) Rate of water drop expressed in inches-per-hour

- (3) For Test Method B:
 - (a) Size and length of casing
 - (b) Size and type of drill bit used
 - (c) Depth to the bottom of the casing
 - (d) Quantity of water expressed in gallons-per-minute

- (3) For Test Method C:
 - (a) Size and type of drill bit used
 - (b) Depth to the bottom of the casing
 - (c) Depth to the bottom of the hole

- (d) Volume of gravel used, if required to prevent caving
 - (e) Depth to top of gravel after withdrawal of casing
 - (f) Size and length of casing used.
 - (g) Quantity of water expressed in gallons-per-minute
- (4) Any other data which the MDOT SHA may deem pertinent to the proper recording of the soil permeability testing operation.

TS-18.4 Measurement and Payment

Measurement of Method A will be on a per each basis for all time required in the preparation for and the performance of the infiltration tests. Measurement of Methods B and C will be on a per hour basis for all time required in the preparation for and the performance of the permeability tests. Measurement of time will commence when the clean out auger or roller bit is first placed in the casing and continue until the water quantity measurements are complete.

Payment for Infiltration Testing (Method A) will be made at the Contract Unit price per each "Infiltration Testing." Payment for Permeability Testing (Method B or C) will be made at the Contract unit price per hour for "Soil Permeability Tests." Prices shall include all materials, including gravel, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MD SHA. No payment will be made for time used in repairing or maintaining equipment, or for time when the workmen are not actively engaged in performance of the test.

TS-19 AUGER BORINGS

TS-19.1 Boring and Sampling Procedure

Auger borings shall be made by power driven continuous flight augers of six (6) inch minimum outer diameter. Solid Flight Augers shall be supplied and utilized in accordance with AASHTO T 306 and ASTM 1452. Hollow-Stem Augers shall be supplied and utilized in accordance with ASTM D6151. Casing shall be of a size not more than one (1.0) inch larger than the outside diameter of the augers. Hand augers may be used only when their use is approved by the MDOT SHA, and only when the site of the boring is so inaccessible as to prevent a drilling machine from reaching the boring location. In any case, the equipment and procedures shall be subject to the approval of the MDOT SHA and shall be such that: the required sample can be recovered; the thickness of each soil strata can be measured; and the location of the top and bottom of each soil strata can be determined. All samples shall be representative of the strata from which they are taken.

All borings shall be left open at least twenty-four (24) hours, after which water table elevations shall be measured and recorded. Upon completion of the boring and determination of the 24-hour groundwater elevation, the hole shall be completely refilled with soil and tamped level with the original ground surface unless the borehole is to be sealed. Sealing the borehole will be performed only if directed by the MDOT SHA and in accordance with ARTICLE TS-20 SEALING BORE HOLES.

Failure to record the zero-hour and 24-hour water level and bottom depth of the hole at the recording times will require re-drilling of the boring (at the Contractor's expense) unless the depth of a caved hole or similar justification is recorded.

TS-19.2 Depth of Borings

In proposed fill areas, auger borings shall be drilled to a minimum depth of five (5) feet below the existing ground surface. Auger borings in proposed cut areas shall be drilled to a minimum depth of eight (8) feet below the proposed finished grade. In areas where soil strata of questionable bearing capacity or compressibility extend below the planned boring depth, the boring may be deepened to such depth as may be required to establish the thickness and qualities of such questionable material to the satisfaction of the MDOT SHA. However, should refusal be encountered in any auger boring, the boring shall be stopped, and enough additional borings made in the immediate vicinity, generally within a radius of fifteen (15) feet, to determine to the satisfaction of the MDOT SHA whether the refusal was caused by solid rock or a boulder. Auger borings in areas other than those described above shall be drilled to the depths as specified by the MDOT SHA.

TS-19.3 Frequency of Sampling

At every change in character of the material, a bag sample of the soil shall be procured. The MDOT SHA reserves the right to require the procurement of additional samples at intermediate depths, when it is determined that such additional sampling is necessary for proper analysis of subsurface conditions. Sample types, locations and frequencies will be specified by the MDOT SHA, or as otherwise specified herein.

TS-19.4 Preservation, Identification and Quantity of Samples

The representative samples shall be obtained as indicated in TS-19.3. The samples shall be placed in approved dust-tight bags and handled in accordance with ASTM D4220. The minimum weight of each bag sample shall be as follows:

(1) Classification Samples

Taken of all materials encountered. Stratification changes in the same boring should be sampled separately. Sample should contain 3-4 lbs. of material and marked for the required/approved laboratory testing which is indicated in the assignment letter. An eight (8) ounce tin container shall also be supplied, filled with a representative portion of soil, be sealed with masking tape and labeled with SHA Charge Number, boring number, depth, estimated moisture content and date.

(2) Bulk Sample

Taken of the predominant soils on a project and required for compaction determination. Sample should contain 15 – 25 lbs. (25-35 lbs. if coarse) of material and marked for Proctor T –180 testing. A moisture sample is also included with bag sample.

(3) California Bearing Ratio (CBR) Samples

Taken of the predominant subgrade soil encountered on the project. The amount of sample should be 100 – 120 lbs. and also contain a moisture sample marked CBR for testing. The table below shall be used to determine the number of samples to obtain for CBR Testing for the project.

(4) Resilient Modulus Testing Samples

Taken of the predominant subgrade soils encountered on the project. The amount of sample should be 30 – 35 lbs. and also contain a moisture sample marked Resilient Modulus for testing. The table below shall be used to determine the number of samples to obtain for Resilient Modulus Testing for the project.

Length of Project	One Predominant Soil, 80% +	Two Predominant Soils	No Predominant Soils
½ Mile or Less	3 Samples	3 Samples	3 Samples
½ - 1 Mile	3 Samples	3 to 4 Samples	3 Samples
1 – 2 Miles	3 Samples	4 to 5 Samples	4 Samples
2 – 3 Miles	3 to 4 Samples	4 – 6 Samples	5 Samples

Note: Half of the number of samples shall be taken at Subgrade Elevation and half in Cuts.

(5) Top Soil Samples

Sample shall be taken on all projects where the topsoil is salvageable to evaluate the quality of the topsoil on the project. Two pounds of top soil sample which is a blend of samples taken from a minimum of 10 different locations on the project shall be submitted for testing. Blending of the samples taken at the various locations on the project will be done at the laboratory. Vegetation must be removed from the sample.

(6) Storm Water Management Samples

Taken at predetermined locations. Sample taken for testing for Storm Water Management shall weigh 2-3 lbs. and shall be marked for USDA testing. These sites are drilled to a depth, which is 10 feet below the proposed bottom of the trench or pond.

All samples shall be listed with regards to the number of samples collected, type of sample and soil classifications.

If in the opinion of the MDOT SHA, more material will be required to properly run the required tests, then additional sample shall be procured in excess of the quantity specified above.

Each bag shall be labeled with one (1) tag on the inside of the bag and one (1) tag tied securely to the outside of the bag. All tags shall be waterproof and shall be marked with the following information.

- (1) Sample Date
- (2) Driller Name
- (3) Contract Number
- (4) Boring Number
- (5) Location Coordinates
- (6) Sample Type
- (7) Sample Depth
- (8) Requested Testing

TS-19.5 Protection of Samples and Records

The Contractor shall be responsible for the storage and preservation of all samples and records prior to completion of the work, or until such time as they are shipped to the MDOT SHA. Suitable storage facilities shall be provided so as to protect the samples and records against theft, loss, or damage. All samples to be tested in the laboratory shall be delivered to the MDOT SHA or other locations to be specified by the MDOT SHA within 5 days after completing any particular boring.

TS-19.6 Visual Description of Samples

The Contractor shall record on the boring log a visual description of all samples, in accordance with TS-12.11 and ASTM D2488. This description shall be in accordance with the TS-12.11 requirements for moisture content, color, grain-size, residual soils, fill soils and other important factors.

TS-19.7 Record Data

The Contractor shall record, on 8-1/2 inch by 11-inch standardized boring log forms provided by the MDOT SHA, the following information for each boring:

- (1) Title of project and designation of section thereof.
- (2) Date of starting and completing boring.
- (3) Hole number.
- (4) Names of Contractor, Inspector and Drilling Crew.
- (5) Location of site by name, and/or survey station and offset, if any, right or left of centerline.

- (6) Drill rig make, size, type and identification number.
- (7) Ground elevation at hole, as furnished by the MDOT SHA.
- (8) Depth of the top of groundwater after zero hours and 24 hours, if present, and bottom depth of hole recorded at the same time.
- (9) Size and type of auger.
- (10) Depth of top and bottom of each soil stratum encountered.
- (11) AASHTO or MDOT SHA approved/designated field classification of material in each stratum.
- (12) Depth of bottom of boring.
- (13) Depth of soil samples taken and sample number.

Within twenty-four (24) hours after the completion of each boring, the Contractor shall transmit to the MDOT SHA one (1) electronically formatted copy of the driller's log for the boring, prepared to show all relevant data herein specified.

TS-19.8 Measurement and Payment

Measurement of this item will be on a linear foot basis and will be the actual distance measured from the ground surface to the lowest depth penetrated. Payment for this item will be made at the unit price per linear foot bid in the proposal, for "Auger Borings, Six (6) Inch Diameter;" which price shall include the all materials necessary for the recovery, preservation, and delivery of all samples as herein specified.

TS-20 SEALING BORE HOLES

TS-20.1 Sealing Materials

Sealing materials shall consist of either neat cement and water or a cement grout. Neat cement and water shall be composed of one (1) bag of Portland cement to five (5) to eight (8) gallons of water. Cement grout shall be composed of not more than two (2) parts of sand and one (1) part of cement (per bag of cement) to five (5) to eight (8) gallons of water.

TS-20.2 Sealing Procedures

Upon the satisfactory completion of a boring, the measurement of the zero hour and 2- hour groundwater level as well as the bottom depth of hole at each reading, and the acceptance thereof by the MDOT SHA, the Contractor shall be required to seal the bore hole. The purposes of sealing the bore hole are to prevent possible contamination of the groundwater by infiltration from the surface and to confine water within an aquifer.

Sealing material shall be placed in such a way that the entire hole is completely filled without voids and that the sealing material is in close contact with the sides of the hole. In caving ground, the Contractor shall be responsible for maintaining an open hole until the 24-hour water table is obtained and the sealing material is placed. The method proposed by the Contractor to introduce sealing material into the hole will be subject to approval by the MDOT SHA before sealing begins. All applicable rules and regulations of local, state and Federal agencies pertaining to preventing contamination of groundwater shall be observed.

TS-20.3 Measurement and Payment

Measurement of this item will be on a linear foot basis and will be the actual distance from the ground surface to the lowest elevation penetrated. Payment for this item will be made at the Contract unit price per linear foot for "Sealing Bore Holes," which price shall include all removal and disposal of excess soil materials, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-21 PATCHING OF BORE HOLES IN BRIDGE DECKS

TS-21.1 Patching Procedure

The Contractor shall be required to repair all bore holes made on bridge decks prior to moving from the boring locations. The bridge deck bore hole shall be repaired as follows:

- (1) A "T" bar shall be fabricated from an iron, steel or aluminum bar by cutting a length of bar equal to the diameter of the bore hole plus two (2) inches. A length of threaded rod of the same material as the bar shall be welded to the bar at the center of the bar. The threaded rod shall be sufficiently long to reach through the bridge deck. A metal disk of diameter large enough to just pass through the bore hole shall be fabricated to be attached to the threaded rod by means of a nut.
- (2) The bridge shall be notched to receive the excess one (1) inch of bar of the "T" bar handle on either side of the bore hole. The notch shall be $\frac{1}{4}$ deeper than the diameter of the bar.
- (3) The "T" bar and the disk shall be inserted into the bore hole and adjusted to match the depth of the bridge deck.
- (4) The bore hole shall be filled with a rapid set cementitious material having a set time of one (1) hour maximum.
- (5) The surface of the filled bore hole shall be screeded to provide a smooth surface, even with the adjacent bridge deck.
- (6) The patched bore hole shall be protected from the weather and traffic until the cementitious material has set up according to the manufacturer's recommendations.

TS-21.2 Measurement and Payment

Measurement of this item will be for each Patching of Bore Hole in Bridge Decks as outline above.

Payment for this item will be made at the unit price per each Patching of Bore Hole in Bridge Decks in the "Bid or Proposal" which price shall include all materials, equipment, tools and all incidental work necessary to complete the patching of bore holes in bridge decks.

TS-22 PAVEMENT CORING

At locations designated by the MDOT SHA, pavement coring shall be required. The pavement cores shall be made in Bituminous Concrete, Portland Cement Concrete, or Composite Pavements. The Pavement Cores shall be obtained by utilizing a diamond bit attached to the end of the drill rod. The diamond bit will drill a "donut shape" hole in the pavement material and the center is retained and retrieved in the drill rod. The pavement core shall be appropriately labeled and delivered to MDOT SHA. The diameter of the pavement cores will be specified by the MDOT SHA in the work assignment request.

TS-22.1 Measurement and Payment

Measurement of this item will be for each pavement core made in Bituminous Concrete, Portland Cement Concrete, or Composite Pavement regardless of depth of the core.

Payment for this item will be made at the unit price per each pavement core in the "Bid or Proposal" which price shall include the coring, recovery, preservation, and delivery of all samples, and all incidental work as specified herein.

TS-23 PATCHING PAVEMENT CORE HOLES

Upon satisfactory completion of the pavement coring, the Contractor shall be required to patch the hole(s) created by the pavement coring operation. The core hole shall be patched with Bituminous Concrete for Bituminous pavements; Portland Cement for Portland Cement Concrete pavements or Composite patches in Composite Pavements. Patching material shall be placed and compacted in such a way that the entire core hole is completely filled without voids and that the patching material is in close contact with the sides of the core hole.

TS-23.1 Measurement and Payment

Measurement of this item will be for each pavement core hole patched with Bituminous Concrete, Portland Cement Concrete, or Composite Patches, regardless of depth of the core hole patched.

Payment for this item will be made at the unit price per each Patching Pavement Core Hole in the "Bid or Proposal" which price shall include the patching materials, equipment, tools and all incidental work necessary to complete this operation.

TS-24 MOBILIZATION AND DEMOBILIZATION OF EQUIPMENT ETC

TS-24.1 Specialized Equipment

Some work under this contract may require that specialized equipment such as a crane, an excavator, barge for boring over water or in marsh and swampland be utilized. Payment for such equipment, if agreed upon by the MDOT SHA to be used, shall be as per the bid prices for "Crane Rental, Including Mobilization and Demobilization"; "Barge Rental, Including Mobilization and Demobilization"; and "Excavator Rental, Including Mobilization and Demobilization" items.

TS-24.2 Measurement and Payment

Payment for moving all equipment on and off the general site of the work will be made at the lump sum price bid in the "Bid or Proposal" for "Mobilization and Demobilization of Equipment, Etc." which price shall include the cost of all materials, labor, tools, equipment, and all incidentals necessary to complete said movements. No specific payment will be made for moving equipment between various boring locations on the general site of this work, or for moving equipment on and off the site for the convenience of the Contractor, the cost thereof being taken to be included in, and covered by the various unit prices bid in the "Bid or Proposal."

It is expressly understood and agreed that the lump sum price bid by the Contractor and paid by the MDOT SHA for this item of work shall cover not only moving equipment on and off the site, but shall also be full payment to the Contractor for all work, risks, losses, damages, costs, and expenses of every kind and description, at the site which the Contractor is required by any of the provisions of the Contract Documents to do, assume, and/or pay, and which are not covered by the payments to be made under other items of provisions of the Contract.

TS-25 EMERGENCY MOBILIZATION

Some work assignments under this contract may require emergency mobilization. When it becomes necessary, the Contractor shall be required to mobilize to the job site on a very short notice (within 8 hours from time of call or when request was made). In such a case, the emergency mobilization cost will be 1.5 times the item bid price in the proposal for the equipment utilized for the work. No additional payment for delay time will be allowed for any time prior to the starting time specified in the request for Emergency Work assignment letter.

TS-26 NIGHT TIME AND HOLIDAY WORK PAYMENT DIFFERENTIAL

Some assignments under this contract shall be performed during night time and on holidays. The Contractor will be allowed additional lump sum payment for assignments performed during the night or on state holidays under the bid item "Night Time or State Holiday Work Payment Differential" for each work crew per day.

TS-27 EXTRA WORK

The MDOT SHA may require additional borings, over and above those shown on the Plans; after the Contractor has completed all required borings and has moved his equipment from the general site of the work, but before final acceptance of the work. Under these conditions, payment for moving said equipment on and off the general site of the work will be made in accordance with the provisions of a "Supplemental Agreement" between the MDOT SHA and Contractor, which agreement must be signed by both parties before extra work is begun. However, work done under these conditions will be paid for at the unit prices originally bid and accepted in the Proposal.

TS-28 SITE RECONNAISSANCE

TS-28.1 General

Examination of the work site shall be required of the Contractor in order to determine the type of equipment to be utilized on any specific job assignment. The Contractor will be compensated for site visits for the purpose of identifying and clarifying the field conditions identified in Table 3-4 of the NCHRP Manual of Subsurface Investigations and specific exploratory technique to be employed for the job assignment. Compensation for assignments which require traveling for a distance beyond 50 miles radius from the Contractor's home base will be paid for under the bid item "Site Reconnaissance beyond 50 Miles." Compensation for assignments which require traveling for a distance within 50 miles radius from the Contractor's home base will be paid for under the bid item "Site Reconnaissance within 50 Miles". At the discretion of the MDOT SHA, the Contractor may be required to complete the Site Reconnaissance for multiple assignments which are located less than ten (10) miles apart on the same day. When multiple assignments are completed on the same day, then the total mileage for the multiple assignments will be summed up to determine the appropriate category under which payment will be made. The Contractor shall be required to substantiate with documentation of such site reconnaissance by completing the "Site Reconnaissance Justification Form" which will be provided by the MDOT SHA in the request for assignment letter.

TS-28.2 Measurement and Payment

Measurement of this item will be for each Site Reconnaissance conducted for assignments to be completed under this contract. Site Reconnaissance completed for multiple assignments on the same day may not be double compensated.

Payment for this item will be made at the unit price per day for Site Reconnaissance in the "Bid or Proposal" which price shall include all travel expenses to and from the job site (i.e., vehicle use, gas, tolls) the daily wages for the Contractor's personnel conducting the site reconnaissance and any other materials, equipment, tools and all incidental work necessary to complete the site reconnaissance. Compensation under this item shall be for only assignments accepted in writing by the Contractor.

TS-29 SUPPLY OF DRILLING EQUIPMENT AND CREW

The Contractor shall supply Drilling Crew and Equipment to perform Auger borings for Subsurface Explorations as needed when requested by the MDOT SHA under the bid item "Supply of Drilling Equipment and Crew". The Contractor shall provide a drilling crew consisting of one experienced driller and one driller helper, the inspector shall not be included in the cost. The Contractor shall also provide the necessary drilling equipment capable of performing geotechnical borings as defined in TS-19. The Contractor shall provide an Experience and Equipment certification documents summarizing the qualification of their employee experience and equipment.

TS-29.1 Driller Qualifications

The Maryland State Highway Administration requires that all personnel involved in any subsurface explorations work for the Administration should have a minimum of three (3) years of experience and shall be qualified through an organization such as the National Highway Institute by having successfully completed the Subsurface Investigation Qualification Course (NHI-132079), or approved equivalent, once every three (3) years.

In order to remain qualified, the drilling personnel may successfully retake the NHI Subsurface Investigations Qualification or complete the NHI One-Day Training Refresher for Field Inspection of Geotechnical Investigations, or approved equivalent, every three (3) years. The drilling personnel may also maintain their qualifications by participating in an MDOT SHA Driller Qualification program.

The drilling work shall be overseen by a Qualified Drilling Inspector at all times and the drilling work performed by a Qualified Driller. The Inspector shall also be qualified through the NHI courses and shall possess a current MDOT SHA Maintenance of Traffic Certification.

TS-29.2 Measurement and Payment

Measurement for work performed under this bid item "Supply of Drilling Equipment and Crew" shall be lump sum per day basis for the auger borings work performed. Measurement of work time for the Equipment and Crew will commence when the drilling equipment and crew are physically performing drilling operations. The drilling equipment shall always be in maintained condition and the contractor shall be required to routinely provide maintenance, time used in repairing or maintaining equipment will be measured on a per-hour basis. Safety and Inspection records of the equipment being used shall be submitted as requested by MDOT SHA.

Payment for this item will be made at the Contract unit price per day for "Supply of Drilling Equipment and Crew." The price for one day shall be based on eight (8) hours and shall include all drilling equipment and accessories, drill crew, materials, labor, tools, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

No payment will be made for time used in repairing or maintaining equipment, or for time when the workmen are not actively engaged in performance of the test. This time shall be deducted from the bid item day-rate on a per hour basis, by dividing the bid item day-rate by eight (8).

TS-30 QUASI-STATIC CONE PENETROMETER TEST WITH PORE PRESSURE (CPTU)

At locations designated by the MDOT SHA, Cone Penetrometer Tests (CPTU) will be required. The CPTU testing to be performed shall be the quasi-static cone penetration test also known as the “Dutch Cone Test”.

The tests can be performed by a special vehicle equipped for CPTU testing or the testing can be performed utilizing modifications made to a test drilling rig.

The testing shall be performed in accordance with the Test Method for Deep, Quasi-Static, Cone and Friction Cone Penetration Tests of Soils, ASTM D 3441. The results of the CPTU testing shall include a computerized printout or series of graphical representations that depict the values of the following parameters with depth: sleeve stress, tip stress, friction ratio, pore pressure, friction angle, undrained shear strength, estimated soil classification, and estimated SPT values.

TS-30.1 Measurement and Payment

Should a separate special vehicle be utilized, a mobilization charge will be permitted in accordance with the appropriate unit price bid. If a test drilling rig, already on the project site, is modified for this test, then a Mobilization charge will be permitted in accordance with bid Cone Penetrometer Testing. Measurement for CPTU testing will be on per linear foot basis, or fraction thereof.

Payment for CPTU testing will be on a per linear foot basis, or fraction thereof, and will include all labor, tools, equipment, supplies and a computer printout of test results.

TS-31 FLAT PLATE DILATOMETER

At locations determined by the MDOT SHA, Flat Dilatometer Tests (DMT) shall be required. The testing may be performed using a special DMT vehicle equipped for this type of testing or from a test drilling machine especially modified to perform this test.

The testing may be performed from by pushing the plate into the ground from the surface or the testing may be started in a previously drilled test hole. The testing apparatus shall be capable of reaching a depth of 100 feet and shall also be capable of penetrating hard clay strata.

The testing shall be performed in accordance with the Standard Test Method for Performing the Flat Plate Dilatometer - ASTM Standard Designation D 6635.

The DMT testing shall be performed such that a computerized or printed table shall be produced that will depict the following: gauge pressure, thrust, A-pressure, B-pressure, dilatometer modulus, dimensionless dilatometer index, dimensionless dilatometer horizontal stress index, pore water pressure, undrained shear strength of cohesive soils, vertical effective stress in one-dimensional compression, over-consolidation ratio, Ko, Phi, constrained modulus of soil compressibility, and soil type.

TS-31.1 Measurement and Payment

Should a special vehicle be utilized for DMT testing, a Mobilization charge will be permitted in accordance with the price bid. If a test drilling rig, already on the project site, is modified for this test, then a Mobilization charge will be permitted in accordance with bid item. Measurement for DMT testing will be on per linear foot basis, or fraction thereof.

Payment for DMT testing will be on a per linear foot basis, or fraction thereof, as contained in the Proposal for Dilatometer Testing and will include all labor, tools, equipment, supplies, pore pressure dissipation, data reduction, and computer printout or table of results.

TS-32 PREBORING PRESSUREMETER (PBPM)

At locations designated by the MDOT SHA, Preboring Pressuremeter Tests (PBPM) shall be required. The PBPM tests will consist only of the preboring type where the probe is inserted into a predrilled borehole.

The PBPM test requires that a test hole be predrilled by the drilling Contractor and that the drilling personnel be available to lower and raise the pressuremeter probe. In boreholes where PBPM testing is to be performed, hollow stem augers will not be permitted. The casing and borehole dimensions shall be coordinated with the PBPM testing personnel so that the dimensions of the borehole and the shape of the borehole are compatible with the PBPM testing equipment.

The PBPM testing shall be performed in accordance with the Standard Test Method for Pressuremeter Testing in Soils, ASTM D 4719. The results of the testing shall include the type of test, boring number, size of probe, description of membrane and sheath on probe, depth of center point of probe, pressure readings at 30 and 60 seconds, volume versus pressure graph, pressuremeter modulus, limit pressure, calibration curves, in-situ stress-strain curve of the soil at each depth.

TS-32.1 Measurement and Payment

Measurement of the PBPM testing shall be on an hour basis, or fraction thereof, per hour of testing. The time will begin when personnel begin assembling the testing apparatus and will end when all testing equipment is removed from the ground and disassembled. The time spent by the drilling crew will be measured on a per hour basis and will be paid in accordance with the unit price bid for "Delay Time/Standby Time" in the bid or proposal.

Payment for PBPM testing will be on a per hour basis, or fraction thereof, for all time that personnel are engaged in the testing process as contained in the Proposal for "Preboring Pressuremeter Testing" which price will include all labor, tools, equipment, supplies and test results.

TS-33 VANE SHEAR TESTING

At locations determined by the MDOT SHA, Field Vane Shear Tests will be required. The testing shall be performed in conjunction with a test boring where soft, saturated cohesive soils are encountered. The

dimensions of the field vanes shall be coordinated with the test drilling casing sizes such that the recommended field vane dimensions are compatible with the drill casings. Hollow stem augers will not be permitted in boreholes where field vane shear tests are to be conducted.

The testing shall be performed in accordance with the Standard Method for Field Vane Shear Test in Cohesive Soils, ASTM D 2573. The test results shall indicate the calculated shear strength of the soil, the test date, boring number, size and shape of the vane, depth of the vane tip, and depth of vane below the bottom of the hole, torque readings, and time to failure of each test.

TS-33.1 Measurement and Payment

Measurement for Vane Shear testing will be on a per hour basis, or fraction thereof for testing. The drill crew time will also be measured on a per hour basis and payment for the drill crew will be at the price bid in the proposal for “Delay Time/Standby Time”.

Payment for Vane Shear testing will be on a per hour basis or fraction thereof for testing. The time will begin when the equipment is assembled and will end when the equipment has been removed from the soil and disassembled.

TS-34 LABORATORY TESTING OF RECOVERED SOIL SAMPLES

Laboratory testing consisting of both physical and strength tests of recovered soil samples will be required. The laboratory testing shall be performed in accordance with the latest edition of Standard Specifications for Transportation Materials and Methods of Sampling and Testing, as published by the American Association of State Highway and Transportation Officials (AASHTO) and /or the Annual Book of Standards as published by the American Society for Testing and Materials (ASTM).

The testing shall be performed in the laboratory of the drilling firm working under this contract or in a laboratory subcontracted by a drilling firm. The laboratory must be in compliance with and have been inspected in accordance with the Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction, ASTM D 3740. The testing laboratory shall produce inspection documentation if it has been inspected.

A testing laboratory can be under contract to more than one test-drilling firm. The MDOT SHA will inspect the testing laboratory for its conformance with the ASTM 3740 if the lab has not already been inspected.

The MDOT SHA will determine the type, number and sequence of soil testing to be performed. The tests will be selected on the basis of priority that will best meet with project schedules and the needs of the design engineers.

TS-34.1 Measurement and Payment

Measurement of the laboratory testing will be on a “per each” basis for each test successfully performed. The price paid for each test will include the test results and all laboratory work sheets. Tests that appear

to be in error or which have suspect results will be retested at no additional charge to the MDOT SHA. Should a retest indicate that the initial results were correct, the MDOT SHA would authorize payment for the retest(s).

Payment for laboratory testing will be on a per each basis for each successful test as bid in the Proposal for each indicated test. Payment will not be authorized until each individual test result has been received by the MDOT SHA and the unused samples, properly identified have been delivered to the designated MSHA storage facility. The price bid for each test is to include the performance of the test, the preparation and transmission of the test results to the MDOT SHA, and the delivery of unused soil samples to the MSHA.

TS-35 HYDROGEOLOGICAL TUBE SAMPLING

TS-35.1 Hydrogeological Tube Samples

Tube samples shall be required for the purpose of hydrogeological investigations and ground water monitoring. The intent is to procure samples in such a manner that sample shall be subjected to a minimum degree of disturbance. The samples shall represent as accurately as practical the natural condition of the soil and shall be suitable for testing in the laboratory.

TS-35.2 Sampling Devices

The sampler shall be a five (5) foot capacity split barrel type with a 2 ¼" ID or greater and have a removable plastic inner liner. The inner liner must be clear to allow visual inspection in the field, while keeping the sample intact to transport for further analysis. The plastic inner liner must have snug fitting caps for each end of the device to secure the sample.

TS-35.3 Sample Procedure

The rate of penetration for the sampler shall be no greater than the speed at which the outer barrel or auger is able to cut; that is, the downward force on the sampler shall be the minimum. Care should be taken to minimize shock or sudden movement which could alter the original condition of the sample.

TS-35.4 Preservation and Identification of Hydrogeological Tube Samples

All tube samples shall be carefully handled to insure their proper identification and shall be placed in suitable core boxes in the exact order of their removal from the bore hole. Samples from more than one boring can be packed in the same core box unless directed to do otherwise by the MDOT SHA. Core boxes shall be of uniform size, shall be constructed of lumber, and shall have hinged lids with latches to prevent accidental opening of the lid during handling, shipment, and storage. Suitable partitions or dividing strips shall be provided in the boxes to prevent the possibility of any section of tube samples becoming dislocated from its proper sequence. The top and bottom depth of each tube sample shall be clearly and permanently marked on the frame of the core box and/or on the dividing strips, or in another suitable manner acceptable to the MDOT SHA. On the top of each core box lid, the Contractor shall

neatly and legibly paint or stencil, using waterproof paint, the following identifying data: The MDOT SHA Charge Number, Title of project and designation of section thereof; location of site by name and/or survey station; boring number; and name of Contractor; and date; all as required or directed by the MDOT SHA.

TS-35.5 Sample Protection

The Contractor shall be responsible for the storage and preservation of all samples and records prior to completion of the work, or until such time as they are shipped to the MDOT SHA. Suitable storage facilities shall be provided so as to protect the samples and records against theft, loss, or damage. All samples to be tested in the laboratory shall be delivered to the MDOT SHA or other locations to be specified by the MDOT SHA within 5 days after completing any particular boring.

TS-35.6 Measurement and Payment

Measurement for work performed under this bid item "Hydrogeological Tube Samples" shall be lump sum per day basis for the work performed. Measurement of work time for the Equipment and Crew will commence when the drilling equipment and crew are actually performing drilling operation. No payment will be made for time used in repairing or maintaining equipment, or for time when the workmen are not actively engaged in performance of the test. The drilling equipment shall always be in maintained condition and the contractor shall be required to routinely provide maintenance and safety records of the equipment for inspection by the MDOT SHA.

Payment for this item will be made at the Contract unit price per day for "Hydrogeological Tube Samples," which price shall include all drilling equipment and accessories, drill crew, materials, labor, tools, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-36 SOFT DIG UTILITY LOCATING

Soft Dig Utility Locating, which involves physically exposing the underground utility for critical vertical measurement data via Air or Hydro Vacuum will be performed in accordance with Quality Level A Subsurface Engineering Data of the ASCE 38-02 Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data. Air or Hydro Vacuum Equipment provided by the Contractor for Soft Dig Utility Locating that does not perform in accordance with Quality Level A Subsurface Engineering Data of the ASCE 38-02 Standard Guidelines for the Collection and Depiction of Existing Subsurface Utility Data will not be paid for by the Administration.

TS-36.1 Measurement and Payment

Measurement for work performed under this item "Soft Dig Utility Locating" shall be lump sum per day basis for the Soft Dig Utility Locating work performed. The normal workday for all equipment items will be eight hours. On days when work is performed in four hours or less, the Contractor will be paid half of the daily rate for each equipment item used. On days when work is performed over four hours, the Contractor will be paid the contract daily rate for all equipment items used. Travel time will only be paid for vehicles having a total time (work hours plus applicable travel time) exceeding eight hours. Payment

for each hour the equipment is used beyond eight hours will be based on the Contract daily rate for the price of equipment divided by eight. Overtime will not be permitted without the Engineer's approval.

On days when work is canceled by the Engineer for the convenience of the Administration after the Contractor's personnel have reported to the job site or when work is canceled for rain or snow after the contractor's personnel have reported to the job site, the Contractor will be paid a minimum of two (2) hours based on the Contract daily rate for the price of equipment divided by eight. Additional travel time will only be paid for vehicles having a total time (work hours plus applicable travel time) exceeding two hours.

Payment for this item will be made at the Contract unit price per day for "Soft Dig Utility Locating," which price shall include all equipment and accessories, crew, materials, labor, tools, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-36.2 Sealing Materials

Sealing materials shall consist of either neat cement and water or a cement grout. Neat cement and water shall be composed of one (1) bag of Portland cement to five (5) to eight (8) gallons of water. Cement grout shall be composed of not more than two (2) parts of sand and one (1) part of cement (per bag of cement) to five (5) to eight (8) gallons of water.

TS-36.3 Sealing Procedures

Upon the satisfactory completion of the Soft Dig the Contractor shall be required to seal the hole. The purposes of sealing the hole is for safety and to prevent possible contamination of the groundwater by infiltration from the surface and to confine water within an aquifer.

Sealing material shall be placed in such a way that the entire hole is completely filled without voids and that the sealing material is in close contact with the sides of the hole. The method proposed by the Contractor to introduce sealing material into the hole will be subject to approval by the MDOT SHA before sealing begins. All applicable rules and regulations of local, state and Federal agencies pertaining to preventing contamination of groundwater shall be observed.

TS-36.4 Measurement and Payment

Measurement of this item will be on a linear foot basis and will be the actual distance from the ground surface to the lowest elevation penetrated. Payment for this item will be made at the Contract unit price per linear foot for "Sealing Bore Holes," which price shall include all removal and disposal of excess soil materials, labor, tools, equipment, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-37 METAL TRAFFIC BARRIER (GUARDRAIL) REMOVAL AND REPLACEMENT

Metal Traffic Barriers (Guardrail) removal and replacement must be performed by MDOT SHA Approved Certified Installers when required for a job assignment. The listing of Approved Certified Installers is

located at <https://www.roads.maryland.gov/OMT/trafbarrinst.pdf> Removal and Replacement of Guardrail shall be in accordance with the latest "Maryland State Highway Administration Book of Standards for Highway and Incidental Structures Category 6, Section 605 of the Specifications. The Book of Standard is located at [MDSHA: Book of Standards for Highway & Incidental Structures - Category 6 - Shoulders](#). Prior to removal of guardrail the MDOT SHA offices listed in GS-2.15, depending on the particular District in which the assignment is located, shall be contacted by the Contractor for the purpose of clearing removal within the SHA right of way.

TS-37.1 Measurement and Payment

Measurement for work performed under this item "Guardrail" shall be lump sum per day basis for the work performed. The normal workday for all equipment items will be eight hours. On days when work is performed in four hours or less, the Contractor will be paid half of the daily rate for each equipment item used. On days when work is performed over four hours, the Contractor will be paid the contract daily rate for all equipment items used. Travel time will only be paid for vehicles having a total time (work hours plus applicable travel time) exceeding eight hours. Payment for each hour the equipment is used beyond eight hours will be based on the Contract daily rate for the price of equipment divided by eight. Overtime will not be permitted without the Engineer's approval.

On days when work is canceled by the Engineer for the convenience of the Administration after the Contractor's personnel have reported to the job site or when work is canceled for rain or snow after the contractor's personnel have reported to the job site, the Contractor will be paid a minimum of two (2) hours based on the Contract daily rate for the price of equipment divided by eight. Additional travel time will only be paid for vehicles having a total time (work hours plus applicable travel time) exceeding two hours.

Payment for this item will be made at the Contract unit price per day for "Guardrail" which price shall include all equipment and accessories, crew, materials, labor, tools, and all incidentals necessary to complete this item as specified herein and/or as directed by the MDOT SHA.

TS-38 ACCESS PERMITS

This item is utilized to obtain entry agreements and access permits to drill borings located on properties where monetary payments are required to gain access. The cost of the permit, associated required training, permit required oversight, travel or any incidental cost incurred in pursuit of access permits can be billed to this item.

TS-38.1 Measurement and Payment

Measurement of this item will be on per each basis. Payment will be made at the dollar per dollar rate for the actual cost of access permits, associated required training, permit required oversight, travel or any incidental cost incurred in pursuit of access permits. The Contractor shall be required to submit receipts for items and/or services invoiced in pursuit of access permit to receive payment. Receipts must include the name of the company or agency, detail items or services provided, and date of purchase.