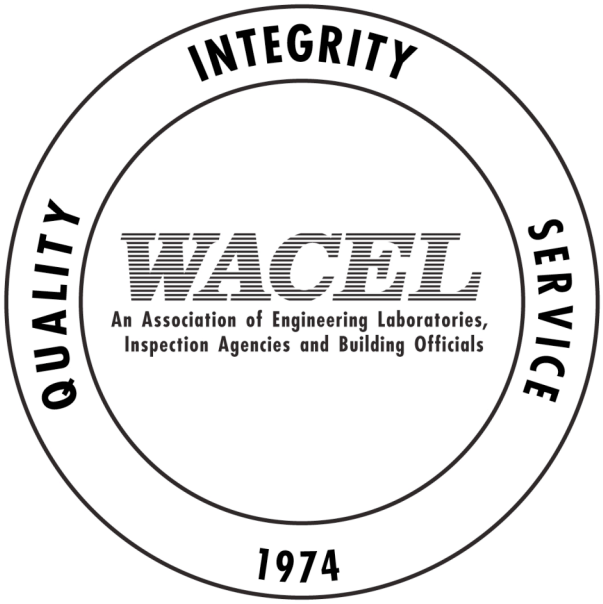

WACEL

SOILS LABORATORY TECHNICIAN

STUDY GUIDE

June 2012

STUDY GUIDE

Examination: The Soils Laboratory Technician examination is based on the following references. It will be 3 hours in length and is an open–book examination. The examination will consist of 75 multiple-choice questions. All of the listed references can be used and will be provided along with the examination. A basic calculator (i.e., no printing or programming capabilities) is also authorized.

References:

A. ASTM D421-85 (2007), Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

B. ASTM D422-63 (2007), Standard Test Method for Particle-Size Analysis of Soils.

C. ASTM D698-07, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.

D. ASTM D854-10, Standard Test Methods for Specific Gravity of Soil Solids by Water Pycnometer.

E. ASTM D1557-09, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Mofified Effort.

F. ASTM D1883-07, Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils.

G. ASTM D2216-10, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.

H. ASTM D2487-10, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).

I. ASTM D4318-10, Standard Test Methods for Liquid Limit, Plastic Limit, and Plastic Index of Soils.

Learning Objectives

I. ASTM D421

A. Familiar with the scope of D421
- Knows the applicable test methods that D421 prepares a soil sample for.

B. Familiar with the procedure of D421
- Knows the proper processing of soil to prepare for particle size analysis.

- Knows the proper processing of soil to prepare for soil constants testing (liquid limit and plastic limit).
- Knows the proper sample size requirements.

II. ASTM D422

A. Familiar with the scope of D422
   - Knows that this is a grain size distribution test. The distribution of particles larger than #200 sieve is determined by sieving, and the distribution of particles smaller than #200 sieve is determined by a sedimentation process using a hydrometer.

B. Familiar with the test procedure and required equipment.
   - Knows what sieve(s) may be used as the separation sieve.
   - Knows how to prepare the dispersing agent.
   - Knows proper sample sizes based upon nominal particle size.
   - Understands how to determine a composite correction and the need for this correction.
   - Understands the hygroscopic moisture sample.
   - Familiar with both stirring apparatus, A and B, and the necessary stirring times for each.
   - Able to manually calculate (non-programmable calculator permitted) "% Retained" (or "% Passing") for the coarse fraction given some laboratory test results.
   - Able to manually calculate (non-programmable calculator permitted) "% Finer" for the fine fraction given some laboratory test results.

III. ASTM D698 & ASTM D1557

A. Familiar with the scope of the Standards
   - Knows that ASTM D698 is the "Standard Proctor" and produces a compactive effort of 12,400 ft-lbf/ft^3 (Standard Effort).
   - Knows that ASTM D1557 is the "Modified Proctor" and produces a compactive effort of 56,000 ft-lbf/ft^3 (Modified Effort).
   - Knows what material that the ASTM Proctors are applicable to and what material that these test methods are not applicable to.
   - Knows which compaction method (A, B, or C) is applicable based on sample gradation.

B. Familiar with the test procedures and the required equipment.
   - Knows that ASTM D698 utilizes a "standard hammer" (5.5 lb sliding hammer with 12" drop) and is compacted in 3 equal layers.
   - Knows that ASTM D1557 utilizes a "modified hammer" (10 lb sliding hammer with 18" drop) and is compacted in 5 equal layers.
   - Knows what equipment is required based on compaction method (A, B, or C), and the procedures for preparing and compacting the material.

- Familiar with the calibration/verification of the equipment.
- Able to manually calculate (non-programmable calculator permitted) moisture contents, wet densities, and dry densities. Also able to plot Proctor points and draw compaction curves.
- Able to determine optimum moisture content and maximum dry density from compaction curve.

IV. ASTM D854

A. Familiar with the scope of ASTM D854
   - Knows that there are two different acceptable methods for performing specific gravity tests according to D854.
   - Knows the differences between performing these two methods.

B. Familiar with the test procedure and the required equipment.
   - Knows what the following equipment are, as well as the proper readabilities, capacities, settings, etc.: pycnometer, balance, drying oven, thermometric device, desiccator, entrapped air removal apparatus (hot plate, Bunsen burner, and vacuum system), and the type of water necessary.
   - Knows the proper specimen size for different types of soil and test method performed.
   - Knows the procedure for calibration of the pycnometer.
   - Knows the procedures for performing the test methods (Method A and Method B).
   - Able to manually calculate (non-programmable calculator permitted) the specific gravity of a soil, given the critical testing data/results.

V. ASTM D1883

A. Familiar with the scope of ASTM D1883
   - Knows that this method determines the bearing ratio of pavement subgrades, subbase, and base course materials.
   - Knows that this method is primarily intended for materials with maximum particle sizes less than ¾", but provisions are made to test materials with maximum particle sizes greater than ¾".

B. Familiar with the procedure and required equipment
   - Knows the different methods of compaction of soil in the mold(s), dependent upon the specifier.
   - Knows the surcharge weights and what they simulate/represent.
   - Knows the soaking time(s).
   - Knows when and how to take the initial and final swell readings.
   - Knows what the Standard says about the penetrations at 0.1" and 0.2".
   - Knows how to correct stress curves for upward concavity and surface irregularities.

- Able to manually calculate (non-programmable calculator permitted) a CBR value, given some of the starting laboratory test results.

VI. ASTM D2216

A. Familiar with the scope of ASTM D2216
   - Understands the differences between Method A and Method B moisture content tests.

B. Familiar with the test procedure and required equipment
   - Knows minimum specimen size requirements for samples based on maximum particle size and desired accuracy.
   - Knows balance readability requirements for samples based on maximum particle size and desired accuracy.
   - Knows the proper oven temperature settings.
   - Knows how the Standard defines constant dry mass.
   - Knows when open containers are acceptable and when a dessicator and/or containers with close-fitting lids are requied.
   - Able to manually calculate (non-programmable calculator permitted) moisture content.

VII. ASTM D2487

A. Familiar with the scope of ASTM D2487
   - Knows that this standard for classification is applicable only to naturally occurring soils.
   - Understands that this is a qualitative application and not quantitative. If quantitative information is required – supplemental testing results are necessary.
   - Knowledgeable of the history of the standard. It is based on an old airfield classification system, also known as the Casagrande system – named after the individual who developed it. It then became known as the USCS after adoption by several US government agencies.

B. Familiar with the terminology used in the standard
   - Understands what organic soils are.
   - Understands what clay is.
     - Knows that the ‘Fat Clay’ is a ‘highly plastic clay’.
     - Knows that “Lean Clay’ is a ‘low plasticity clay’.
   - Understands what silt is.
   - Understands what gravel is, and differences between coarse and fine gravels.
   - Understands what sand is, and the differences between coarse, medium, and fine sands.

C. Familiar with the procedure for classification of soil
   - Knows the soil classification names and group symbols.

- Able to classify soil when given the necessary basic laboratory test results.

VIII. ASTM D4318

A. Familiar with the scope of ASTM D4318
   - Knows that the material used for the test is obtained from either *wet preparation* or *dry preparation*, and that the *wet preparation* method is the default or ASTM preferred method.
   - Knows that there are two methods for determining the liquid limit, *Method A – Multipoint* and *Method B – One-Point*, and that *Multipoint* method is preferred when greater precision is required.
   - Knows that the liquid limit and plastic limit tests are often collectively called the Atterberg limits.

B. Familiar with the procedure and required equipment
   - Knows how to prepare the test sample(s)
   - Knows the testing procedures for both *one-point* and *multipoint* liquid limit testing.
   - Knows how to proceed with and conclude testing when non-plastic soils are encountered.
   - Knows the testing procedure for testing the plastic limit.
   - Familiar with the testing equipment (liquid limit device, grooving tool, scale/balance, specimen containers, ground glass plate, etc.)
   - Able to manually calculate (non-programmable calculator permitted) liquid limit, plastic limit, and plasticity index when given the starting laboratory test results.