

Job-Task Analysis (JTA) for ACI Certification of Concrete Laboratory Testing Technician—Level 2

HOW TO USE THIS JTA:

For each of the following assessment methods, the Candidate must:

On the written examination:

- **Understand** the following general concepts, which may not have specified values, procedures, or measurements; *and*
- **Know** the following specific procedures or values; performance of these items may also be assessed on the performance examination.

On the performance examination:

- **Perform**—or describe verbally, where allowed—the following tasks or steps, which are part of the specified procedure; knowledge of these items may also be assessed on the written examination.

RESOURCES IN THIS PROGRAM:

ACI 211.1, *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*

ACI 214R, *Guide to Evaluation of Strength Test Results of Concrete*

ASTM C157/C157M, *Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete*

ASTM C42/C42M, *Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete*

ASTM C192/C192M, *Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory*

ASTM C496/C496M, *Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens*

ASTM C470/C470M, *Standard Specification for Molds for Forming Concrete Test Cylinders Vertically*

ACI 211.1, *Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete*

- Know concrete's basic constituent materials and their behavior in concrete in the plastic and hardened state.
- Know the physical properties of concrete in the plastic and hardened state and how they may be adjusted.
- Know the potential effects of admixtures and supplementary cementitious materials (SCMs) on the basic material proportions and concrete properties.
- Understand the interactions between the various admixtures and SCMs.
- Understand the use of background data.
- Know how to select the appropriate slump if not specified.
- Understand the reasons that dictate the maximum size of aggregate.
- Know how to estimate the approximate mixing water and air content.
- Understand selecting the proper air content for service exposure.
- Understand the evaluation process for the use of chemical admixtures.
- Understand the different exposure conditions.
- Understand the relationship between w/c or w/c+p materials ratio and compressive strength of concrete.
- Know how to select the appropriate w/c or w/(c+p).
- Know how to determine the equivalent w/(c+p) to the w/c by equivalent weight.

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- Know how to determine the equivalent $w/(c+p)$ to the w/c by equivalent absolute volume.
- Know how to calculate cementitious materials content for a mix.
- Know how to estimate coarse and fine aggregate content for a mix.
- Know how to proportion mixtures by weight basis and by volume basis.
- Know how to adjust the mix to account for aggregate moisture.
- Know what tests to conduct on the trial batches and how to interpret the results.
- Understand the importance of verifying a mix through the testing of trial batches.
- Understand the importance of maintaining workability and finishing properties, and minimizing segregation.
- Know how to adjust a trial batch to achieve desired plastic and hardened concrete properties.

ACI 214R, Guide to Evaluation of Strength Test Results of Concrete

- Understand that variations in the measured strength of concrete originate from two sources: batch-to batch variations and within-test variations.
- Understand the principal sources of strength variation due to batch-to-batch variations.
- Understand the principal sources of strength variation due to within-test variations.
- Understand statistical values in relation to strength variations.
- Understand data criteria used to establish minimum required average strength.
- Know criteria for strength requirements.
- Understand evaluation of data.
- Understand quality control charts.

ASTM C157/C157M, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete

- Understand the scope of the method.
- Know the definition for length change.
- Understand the significance and use of the method.
- Know the equipment required for the procedure.
- Know the requirements for the drying room.
- Understand the requirements for an atmometer.
- Understand the requirements for sampling.
- Know the requirements for test specimen sizes.
- Know the requirements for mixing mortar and concrete.
- Know the procedure for fabricating mortar specimens.
- Know the procedure for fabricating concrete specimens.
- Know the procedure for curing specimens.
- Know the environmental conditions for storing specimens.
- Know the procedure for reading specimens.
- Know the procedure for calculating length change.
- Know the requirements for reporting results.

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ASTM C42/C42M, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

- Understand scope of test method.
- Understand why specimens are required.
- Understand what affects concrete test results.
- Understand results are affected by core orientation (strength lower when parallel).
- Understand parameters that affect strength of concrete.
- Understand that there is not a standard procedure to condition the specimen.
- Understand core result will typically be lower than molded specimens.
- Understand that the "85 %" rule does not apply to all projects.
- Understand the length-diameter ratio affects test results.
- Understand that the concrete needs to be sufficiently hardened so that the specimen is not damaged by the removal process.
- Know not to use damaged specimens unless the undamaged portion is long enough.
- Know to report untested specimens and the reason why they are not tested.
- Know not to use cylinders with rebar unless permitted by the specifier of the test.
- Know to drill perpendicular to surface and at least 150 mm [6 in.] away from joints and edges.
- Know to record the date cored.
- Know to measure the length of the core.
- Know the minimum diameter of the core.
- Know what to do if the core is too long ($L > 2.1 * D$).
- Know what to do if the core is too short ($L < 1.75 * D$).
- Know the procedure for conditioning the specimens.
- Know the ends of cores need to be sawed perpendicular.
- Know how to calculate density.
- Know that surface preparation of the ends is required and how to do the surface preparation.
- Know that if the specimen is capped, the length measurement includes the caps.
- Know not to test cores if the difference between the largest and smallest diameter exceeds 5 % of their average.
- Know to test according to C39/C39M.
- Know to use the correction factor if the ratio of length to diameter (L/D) of the specimen is 1.75 or less.
- Know what is required to be reported.
- Know that bearing surface of cores for splitting-tensile strength are the sides.

ASTM C192/C192M, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

- Understand the scope of the procedure.
- Understand the use of the data.
- Know the tolerances for beam or prism molds.
- Understand that there are two sizes of rods and what determines which rod to use.
- Know the vibrator requirements, including that the frequency requirements of the vibrators are different depending on whether internal vibration or external vibration.
- Know the accuracy of the scales.

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- Understand when a pan mixer is preferable over a revolving drum mixer.
- Understand that the nominal maximum size of the aggregate dictates the specimen size.
- Understand making specimens involving a given variable.
- Know concrete temperature requirements.
- Know cement mixing and sieving requirements.
- Know coarse aggregate proportions for grading.
- Know the conditions under which to maintain aggregates.
- Know how to mix powder admixtures with the cement.
- Understand powdered admixtures.
- Understand water-soluble and liquid admixtures and how to use them.
- Know what is included in the calculation of the water content of the concrete.
- Know the limits of hand-mixing procedures (when hand mixing is not applicable).
- Know that hand mixing should be limited to batches of 0.007 m³ [1/4 ft³] or less.
- Know mixing procedure.
- Perform required tests.
- Perform making the required specimens.
- Know the number of layers and the rod size.
- Know the penetration depths of the rodding.
- Know when sufficient rodding has occurred.
- Know the initial curing requirements.
- Know when to remove specimens from molds.
- Know the final curing requirements.
- Know the curing requirement for flexural strength specimens.

ASTM C496/C496M, Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

- Understand scope of test method.
- Understand that the load is applied along the side of the specimen.
- Understand why tensile failure occurs.
- Understand the typical ranking of splitting tensile strength, tensile strength, and flexural strength.
- Understand the application of splitting tensile strength.
- Understand when the supplementary bearing bar or plate is required.
- Understand the reason and location of the plywood strips.
- Know bearing strips are not to be reused.
- Know the curing procedure for lightweight specimens.
- Know that drawing diametral lines on each end of the specimen is required.
- Know that three measurements of the diameter are required.
- Know that two length measurements are required and that the measurements are taken in the plane containing the lines marked on the two ends.
- Know the rate of loading.
- Know to note type of failure and appearance of concrete.
- Know how to calculate the splitting tensile strength.
- Know what to report.

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ASTM C470/C470M, *Standard Specification for Molds for Forming Concrete Test Cylinders Vertically*

- Understand scope of the specification.
- Understand there are separate requirements for single-use and reusable molds.
- Understand the durability requirements for the molds and the specific areas.
- Understand dimension requirements.
- Know the flatness requirement of the bottom of the mold.
- Know the maximum dimensions of the fillet.
- Understand that reusable molds need to be tested for water leakage.
- Know the requirements for retesting frequency.
- Know the physical requirements of single-use molds.
- Understand there are separate requirements for plastic, paper, and sheet metal single-use molds.
- Know that paraffin-coated molds cannot be used above 49 °C [120 °F], either before or after filling with concrete.
- Understand that to evaluated resistance to damage, dry-rodded rocks are part of the test.
- Understand plastic and sheet metal molds need not be tested for elongation and absorption, but should be tested for water leakage.
- Know that the mold is not filled with water for the absorption and elongation test and for the water-leak test.
- Know that the time frame for the water leakage test is shorter than the time frame for the absorption and elongation test.
- Understand that the purchaser must sample three molds from each shipment.
- Understand that the test result is not the average of the three molds, but that each mold must be evaluated separately.
- Understand that the purchaser needs to fill out the report.
- Know what is required on the report.