

# Job Task Analysis (JTA) for ACI Nondestructive Testing Specialist—Concrete Strength Certification

## 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:

ASTM C597 Standard Test Method for Pulse Velocity Through Concrete

ASTM C803/C803M Standard Test Method for Penetration Resistance of Hardened Concrete

ASTM C805/C805M Standard Test Method for Rebound Number of Hardened Concrete

ASTM C873/C873M Standard Test Method for Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds

ASTM C900 Standard Test Method for Pullout Strength of Hardened Concrete

ASTM C1074 Standard Practice for Estimating Concrete Strength by the Maturity Method

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## Pulse Velocity Through Concrete

- Understand the scope of test method
- Be familiar with the referenced documents
- Understand terminology
- Understand summary of test method
- Know significance and use
- Know the apparatus to be used in this test
- Know and understand the different components of the apparatus
- Know the use of the different components of the apparatus
- Know and perform zeroing of apparatus
- Know and perform procedure to determine transit distance
- Know and perform procedure for calculating the pulse velocity and knowledge of the formula
- Know and perform requirements of reporting results

## Penetration Resistance of Hardened Concrete

- Understand scope
- Understand significance and use
- Know about variation for specific energy loading of probe
- Know about hardness and shape of probes to be used
- Know about measuring instrument for probes
- Know about reference base plate
- Know about driver unit
- Know and understand verification of spring-actuated units
- Know about hardness and uniformity of pins

## **Job Task Analysis (JTA) for ACI Nondestructive Testing Specialist—Concrete Strength Certification (Continued)**

- Know about measuring instrument for pins
- Understand diameter requirement of depth gage
- Understand air blower requirement
- Know and understand hazards of unexpected or inadvertent discharge of probes or pins
- Know hazards of reinforcing steel or other metal embedment's within the concrete
- Know sampling for probe
- Know sampling for pins
- Know and perform requirements for surface preparation for probes
- Know and perform procedure for driving of probes
- Know and perform procedure checking probes for rebound and firm embedment
- Know and perform requirements for placement of the reference base plate & measurement of probes
- Know and perform procedures for testing of light weight concrete with probes
- Know and perform surface preparation of the test area where the test is to be performed
- Know and perform loading and driving of pins
- Know and perform cleaning of pin holes
- Know and perform measurement of pin hole depths
- Understand reporting requirements

### **Rebound Number of Hardened Concrete**

- Understand the scope of the method
- Understand simple math conversion principles associated with this technique
- Knowledge of the following terms – as defined in ASTM C125 (related to ASTM C805): Aggregate, air void, cellular concrete, concrete, crushed gravel, grout, crushed stone, gravel
- Understand the significance and use of performing this method
- Know the parameters which affect the rebound number
- Understand that variations in hammers will create significant differences in value therefore use the same hammer
- Know and perform how to develop a strength-rebound number correlation curve to estimate strength; know accuracy of estimate
- Know that method is not suitable for acceptance or rejection of concrete
- Know how to apply a manufacturer correlation factor based on hammer orientation
- Know the required apparatus and calibration
- Understand importance of thickness of sample
- Understand importance of surface preparation
- Understand impact of frozen concrete
- Understand impact of rebar location on test results
- Know and perform proper operation of the hammer
- Know, understand, and perform importance of orientation of the hammer
- Know and perform the minimum distances between the tests and test/edges
- Know and perform observation of impact location
- Know and perform calculation and acceptance criteria
- Know reporting of results

## **Job Task Analysis (JTA) for ACI Nondestructive Testing Specialist—Concrete Strength Certification (Continued)**

### **Compressive Strength of Concrete Cylinders Cast in Place in Cylindrical Molds**

- Understand the scope and the range of concrete slab depths the test can be used for
- Understand the purpose of the components of the apparatus
- Understand the significance and use of the test
- Know how the test assembly is installed
- Know the geometrical requirements for the specimen molds
- Know procedures and requirements relevant to placement
- Know procedures and requirements relevant to consolidation and curing
- Know procedures and requirements relevant to removal and testing
- Know components of the report relative to the field portion of this method

### **Pullout Strength of Hardened Concrete**

- Understand scope of method
- Know values are stated in SI units only, no other measure
- Understand two methods of inserting pullout stem: cast-in-place or post-installed
- Understand test only provides pullout strength, must be correlated to compressive strength
- Understand lightweight aggregate can affect readings
- Understand pullout tests are used for 4 purposes
- Understand variation of concrete strength due to depth of placement
- Understand pullout tests are indicative of outer surface quality of concrete
- Understand 3 parts of apparatus: bearing ring; tensile loading apparatus; load-measuring device
- Know diameter of the insert head is the basis for defining test geometry
- Know insert head diameter shall be at least 2/3 of the nominal maximum size aggregate
- Know, for cast-in-place inserts, the distance from the insert head to the concrete surface shall equal the diameter of the insert head
- Perform, for post-installed inserts, the groove to accept the expandable insert shall be cut so that the distance between the bearing surface of the groove and the concrete equals the insert diameter after expansion
- Know the bearing ring shall have an inside diameter of 2.0 to 2.4 times the insert head diameter
- Know force gauge can be digital or analog; analog read to 0.5 kN, digital to 0.1 kN
- Know force gauge must hold maximum value during load test
- Know pullout apparatus shall be standardized in accordance with Annex A1 at least once a year and after all repairs
- Know pullout test locations shall be separated so that the clear spacing between inserts is at least 7 times the pullout insert head diameter
- Know pullout test locations shall be at least 3.5 times the pullout insert head diameter from the edge of concrete
- Know pullout stem placed so that reinforcement is outside the expected conical failure surface by more than 1 bar diameter
- Know at least 5 tests performed when used to assess the in-place strength to allow the start of critical construction operations
- Understand inserts shall be located in portions of the structure that are critical in terms of exposure conditions and structural requirements
- Understand all inserts embedded to the same depth, perpendicular to formed surface
- Understand requirements for placing inserts into unformed surfaces
- Perform removal of any debris or surface abnormalities to ensure a flat bearing surface
- Perform drilling core perpendicular to the surface

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- Know use of impact drill is not permitted
- Know when to use a surface planning tool
- Perform removal free-standing water from the hole at completion of drilling and undercutting operations
- Know loading rate of 70 +/- 30 kPa/S
- Know load uniformly until rupture if testing to rupture
- Know load and hold for 10 seconds if tested for a minimum in-place strength
- Understand testing surrounding frozen concrete
- Know reasons to reject the test
- Know information to report

### **Estimating Concrete Strength by the Maturity Method**

- Understand scope
- Understand terminology
- Understand summary of practice
- Understand significance and use
- Know maturity functions
- Know how to compute temperature-time factor
- Knowledge of the apparatus to perform test and the accuracy needed
- Know limits on time intervals between measurements
- Know procedure for developing strength/maturity relationship
- Know number of samples needed
- Know requirements if 2 batches are needed to prepare number of cylinders
- Know location requirement for embedded sensor
- Know time requirement to start test
- Know conditioning of samples
- Know required testing on samples
- Understanding recording requirements and graphing requirements
- Know procedure for estimating in place strength
- Know how to read off the graph to estimate compressive strength
- Understand determination of datum temperature
- Understand maturity functions