**Job Task Analysis (JTA) for ACI Shotcrete Inspector 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.

**RESOURCES:**

- ACI 305R Guide to Hot Weather Concreting
- ACI 305.1 Specification for Hot Weather Concreting
- ACI 306R Guide to Cold Weather Concreting
- ACI 306.1 Standard Specification for Cold Weather Concreting
- ACI 506R Guide to Shotcrete
- ACI 506.1R Guide to Fiber-Reinforced Shotcrete
- ACI 506.2 Specification for Shotcrete
- ACI 506.4R Guide for the Evaluation of Shotcrete
- ACI 506.6T Visual Shotcrete Core Quality Evaluation
- ACI CCS-4 Shotcrete for the Craftsman
- ASTM C1140 Standard Practice for Preparing and Testing Specimens from Shotcrete Test Panels
- ASTM C1604 Standard Test Method for Obtaining and Testing Drilled Cores of Shotcrete
- ASA Safety Guidelines for Shotcrete

---

**ACI 506R Part 1**

- Understand the scope and limitations of the guide
- Understand what is structural shotcrete
- Understand what are the characteristics of the processes
- Understand the different types of shotcrete (refractory, fiber-reinforced, etc)
- Understand the information needed to satisfy submittals required by project documents (PD)
- Understand the purpose of preconstruction testing as required by the PD
- Understand who conducts QA
- Understand who conducts QC
- Understand the QA and QC requirements as required by the PD
- Understand the different type shotcrete panels and their purpose
- Understand what size material panel is required by the PD
- Understand the reason for different size panels
- Understand the terminology related to shotcrete
- Understand standards related to shotcrete testing

**ACI 506R Part 2**

- Knows the difference between cement and supplementary cementitious materials
- Knows the cement/supplementary cement requirements per PD
- Knows where to find the aggregate grading limits and applicable ASTM documents
Job Task Analysis (JTA) for ACI Shotcrete Inspector Certification (Continued)

• Knows what is acceptable water for shotcrete and what tests are needed if the water source is questionable
• Can list and describe purpose of admixtures
• Knows the minimum amount of air entraining required by PD and when/where the test is taken
• Knows the potential challenges presented by reinforcement and steps to be taken to reduce interference
• Knows why epoxy coated steel should be tested prior to being incorporated into project
• Knows and describe the different type and size fibers
• Knows the potential limitations of adding fibers
• Knows the range of compressive strength that can be expected from shotcrete
• Knows the compressive strength of shotcrete as required by the PD
• Knows the expected air content of the in-place shotcrete
• Knows the maximum water soluble chloride ion concentration
• Knows the purpose and limitations of boiled water absorption (BWA) test
• Knows the purpose of flexural testing
• Knows the purpose and can describe bond test
• Knows the typically expected bond test results of shotcrete to properly prepared concrete surface
• Knows what factors contribute to early-age plastic & long-term drying shrinkage
• Knows how to measure slump and what is the typical range for encasing steel
• Knows the proportions of a typical shotcrete mixture for both wet and dry mix shotcrete
• Knows the range of w/cm ratio for typical shotcrete
• Knows the methods used to mix and batch shotcrete
• Knows the visual indicators of an appropriate mixture
• Knows the common time limits for wet-mix and dry-mix shotcrete
• Knows the advantages of pre-dampening pre-packaged dry materials
• Knows the use of curing compounds for shotcrete
• Understands the use of bonding compounds for shotcrete
• Knows the factors that affect strength of a shotcrete mixture

ACI 506R Part 3

• Knows the purpose of surface preparation as require by the PD
• Knows what is SSD and how it is achieved
• Knows the results of insufficient surface preparation
• Knows the visual indications of excessive bruising or surface moisture
• Knows the advantages of non-contact laps and spacing
• Knows that shotcrete & reinforcement can be installed in single or multiple layers
• Knows lap requirements for mesh reinforcement
• Knows why anchor spacing is important
• Knows what characteristics are required for formwork
• Knows whether form release agent can be used
• Knows tolerance for inflated forms, if specified
• Knows and can describe different types of joints
• Knows what is permitted alignment control
• Knows and describe different ways vertical shotcrete walls can be shot
• Knows what limits height of bench shooting
• Knows limitations of layering shotcrete
Job Task Analysis (JTA) for ACI Shotcrete Inspector Certification (Continued)

- Knows what areas need protection from overspray and rebound
- Knows the importance of maintaining a safe distance from electrified power lines
- Knows the importance of ventilation, visibility and access
- Knows appearance of consistent mixture
- Knows proper angle to receiving surface
- Knows importance of proper impact velocity
- Knows when to shoot corners
- Can describe rebound and how to control
- Can describe overspray and how to control
- Knows when blow pipe is beneficial
- Identify laitance and how to address when present
- Knows procedures to prepare surfaces for application of multiple layers of shotcrete
- Knows what factors control and what to look for to ensure proper encasement of reinforcement
- Knows what weather conditions control placement of shotcrete
- Knows factors that affect finishing
- Knows the finishing requirements of PD
- Knows why curing is important and purpose of curing
- Knows acceptable methods of curing and required curing time
- Knows ways to protect shotcrete and under what conditions
- Knows when adjacent surfaces are to be protected
- Knows tolerances as required by PD
- Knows why shotcrete is suitable for repair
- Knows what are the acceptance criteria for shotcrete
- Knows methods to help reduce early age plastic shrinkage cracking
- Understand steel surface conditions
- Understand methods to maintain consistency
- Know time limits for shotcrete placement
- Know the acronym SSD

ACI 506R Part 4

- Can describe different types of dry-mix and wet-mix equipment
- Knows the difference between delivery line pressure in dry-mix and wet-mix
- Knows what is the recommended amount (in cfm) of air needed for dry-mix and wet-mix operations
- Describe different type batching operations
- Knows what minimum water pressure is needed for dry-mix
- Knows the effect of the nozzle wear condition on the placement of shotcrete
- Can describe auxiliary equipment
- Knows what is the main factor controlling equipment layout for dry-mix and wet-mix operations
- Knows why communication is vital between operator and nozzleman
- Knows who is in charge of the shotcrete crew

ACI 506.2

- Understand required submittals
- Understand and describe the requirements of preconstruction testing
Job Task Analysis (JTA) for ACI Shotcrete Inspector Certification (Continued)

- Understand the types of tests and inspection that may be required by contract documents during construction
- Understand and describe types of surface preparation
- Know and describe types of joint requirements and methods
- Understand tolerance requirements and alignment control methods
- Know and understand that type, location and frequency of inspection will differ with different types of shotcrete projects
- Understand the curing requirements
- Understand that each project has distinct and specific requirements that will be required from the Specification Checklist
- Know the acceptance criteria
- Know form requirements
- Know when to use a compressed air blow pipe

**ACI 306R, ACI 306.1**

- Understand the significance of use of practice
- Know what is considered cold weather concreting (Temps, Ambient Air Changes etc)
- Know parameters and constituents of concrete mix designs needed for cold weather concrete
- Know substrate preparation for cold weather concrete
- Know concrete protection methods needed in cold weather concrete
- Know forming techniques in and around protection devices
- Know any special placement equipment necessary for cold weather concreting
- Identify temperature testing mechanisms for in-place, protected concrete
- Know curing procedures with regard to protection mechanisms and ambient temperature fluctuations above and below freezing
- Identify differences in strength gain based on temperature (maturity concept)
- Know impact on concrete from large steel members at temperatures below freezing
- Know the objectives of cold weather concreting practices
- Understand cold-weather factors that affect strength development

**ACI 305R, ACI 305.1**

- Know the properties of concrete / wet - dry process shotcrete
- Understand the relationship between slump and concrete temperature
- Know the max temperature allowed for placing concrete
- Understand hydration
- Understand how wind, humidity and ambient temperature can affect concrete
- Understand methods for cooling concrete
- Understand the importance of advance planning for hot weather placement
- Understand how to prepare the substrate in hot weather conditions
- Understand how reinforcing and embeds can affect concrete in hot weather
- Understand the importance and methods of curing concrete
- Understand what is needed to cool the aggregates before batching in hot weather

**ACI 506.4R**

- Understand the objectives of a specific test program for a particular project
- Understand the concept of testing shotcrete vs form and poured concrete
Job Task Analysis (JTA) for ACI Shotcrete Inspector Certification (Continued)

- Understand the different tests for fresh properties of dry vs wet mix shotcrete
- Understand the relationship between equipment, material, nozzleman skills and shotcrete quality
- Know how shotcrete test specimens are obtained
- Understand the difference between pre-construction, and during construction, testing
- Understand tests to detect lack of bond and voids
- Understand variations in homogeneity of shotcrete
- Understand in-place density of shotcrete

**ACI 506.1R**
- Know the difference between Micro and Macro Fibers
- Know the difference between metallic and synthetic fibers
- Understand the effects of fibers on shotcrete placement
- Understand the general purpose of fiber reinforcement
- Understand hardened properties of fiber-reinforced shotcrete
- Understand proportioning fiber-reinforced shotcrete mixtures

**ACI CCS-4**
- Understand the basic properties of concrete
- Know composition of concrete (main ingredients, proportions & how mixed)
- Understand concrete proportioning
- Know the definition of shotcrete
- Know the difference between wet-mix and dry-mix shotcrete processes
- Understand the requirements for proper encapsulation of reinforcement
- Understand the w/cm and how water content affects concrete
- Know what equipment is required for both shotcrete processes
- Understand the effect of equipment layout
- Understand the importance of substrate surface preparation
- Understand how curing affects concrete strength and durability
- Understand how compaction and proper encasement of rebar affect the quality of shotcrete
- Understand hot and cold weather shotcrete placement
- Understand the finishing process

**ASTM C1140**
- Understand the scope and significance of use of practice
- Know the allowable geometry and materials for test panel forms
- Know the appropriate test mixtures for the tests
- Know the appropriate number of panels, equipment, personnel and application of shotcrete for test panels
- Know curing requirements for test panels
- Know proper procedures for obtaining, conditioning and testing specimens from test panels
- Know the reporting requirements for the test procedure

**ASTM C1604**
- Understand the scope and significance of use of practice
- Know the apparatus required for the test
- Know the requirements for proper sampling and handling of cores from hardened concrete
Job Task Analysis (JTA) for ACI Shotcrete Inspector Certification (Continued)

- Know the geometric constraints on core samples
- Know the test requirements for moisture conditioning
- Know the sawing or capping requirements of compressive strength core samples
- Know the measurement, testing, calculation and reporting requirements for compression strength core tests
- Know the bearing surface requirements for splitting tensile strength cores
- Know the measurement, testing, calculation and reporting requirements for splitting tensile strength core tests
- Know when correction factors are applied and why

ASA Safety Guidelines

- Know and Understand the hazards of the shotcrete process
- Know PPE
- Know project specific personal safety requirements

ACI 506.6T

- Understand the scope and significance of the TechNote
- Know and describe process for visual examination of cores
- Know and describe what imperfections visual evaluation can provide
- Know and describe the categories of core quality
- Know and describe the two criteria used for assigning categories
- Know and describe when the licensed design professional may modify visual evaluation criteria
- Know and describe how Figure 1 is used to graphically enumerate the evaluation criteria