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

- 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

- 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
- Understand 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

- 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

- 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

- 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