



**STRUCTURAL
MASONRY
SPECIAL
INSPECTOR**

Study Guide

May 2017

Examination:

The Structural Masonry Inspector Examination is based on the references cited in this document. It is 3 hours in length, is an open-book examination, and contains 75 questions (multiple choice). An overall grade of 75 percent or greater with a minimum of 70 percent on the “plan reading” questions is required for certification. All of the required references can be used as long as there are no added markings. “Background” references are for information and training purposes.

Successful certification as a WACEL Level I Concrete Technician or an approved equivalent is a prerequisite to taking this examination.

As previously mentioned, the examination is open-book. Candidates should be highly familiar with the required references listed below. The background references are excellent tools to assist both instructors and exam candidates. However, the use of the background references during the examination is not recommended due to the large number of required references.

In addition, a significant number of the examination questions are based on actual project drawings and specifications related to the scope of his certification. Candidates should be capable of quickly and correctly extracting pertinent project information from such documents as structural drawings, project specifications, and manufacturers’ literature.

As will be evident from a review of the learning objectives contained in this Study Guide, a significant amount of the technical material covered by this certification is extracted from the National Concrete Masonry Association’s (NCMA) publication titled “Inspection and Testing of Concrete Masonry Construction.” Five specific topics covered by this manual are not addressed as part of this certification. They are:

1. The use of welding to accomplish the required splices of reinforcing steel since appropriate certification as a welding inspector would be required.
2. The various design and construction requirements dictated by Seismic Design Categories as these requirements should be included in the approved construction documents.
3. The construction of prestressed masonry due to the very low probability of it being encountered in most masonry construction.
4. The use and testing of self-consolidating grout due to the lack of common usage at this time.
5. Shoring and bracing during construction as Special Inspectors should not be classified as OSHA “Competent Persons.”

Inspectors should contact their supervisor if they encounter these topics on a specific project.

Another subject area that has been incorporated into this program is the monitoring of the installation of post-installed anchors. It is not uncommon for masonry inspectors to find themselves in a situation where dowel bars extending from foundation elements are either missing or are not within acceptable tolerances. A common solution that may be authorized by a project's structural engineer is to install new reinforcing steel using adhesive material.

- Questions in the proper inspection and observation of such dowel bars are based on both the Concrete Anchor Manufacturers' Association's (CAMA) "Special Inspection Guidelines for Post-Installed Anchors" and a selected ICC Evaluation Service Report for Post-Installed Reinforcing Bars.
- The questions based on the ICC Report will be considered as part of the "Plan Reading" component of the examination. ESR-3814 (reissued 01/2017) will be the basis for these questions.

The listed, required references and a basic calculator (i.e., no printing or programming capabilities) are the only items that can be brought into the examination. Authorized references brought into the examination can have no markings. Writing instruments and scratch paper will be provided; both must be turned in at completion of the examination.

Cell phones are not allowed in the examination area, and photo identification is required.

Required References:

1. NCMA TR 156B, "Inspection and Testing of Concrete Masonry Construction," 2013.
2. ASTM C 109-16a, "Standard Test Method for Compressive Strength of Hydraulic Cement Mortars."
3. ASTM C 780-15a, "Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry."
4. ASTM C 1019-16, "Sampling and Testing Grout."
5. ASTM C 1064-12, "Temperature of Freshly Mixed Hydraulic-Cement Concrete."
6. "Special Inspection Guidelines for Post-Installed Anchors," Concrete Anchor Manufacturers' Association (CAMA), 2011.
7. Chapter 17, "International Building Code;" 2012 or 2015.

Background References:

1. TMS 402-16 (formally also designated as ACI 530 and ASCE 5), "Building Code Requirements for Masonry Structures."
2. TMS 602-16 (formally also designated as ACI 530.1 and ASCE 6), "Specifications for Masonry Structures."
3. "Masonry Inspector's Handbook," Masonry Institute of America, 9th Edition.
4. "Masonry Inspector's Workbook," Masonry Institute of America, 9th Edition.

5. "Manual of Standard Practice," Concrete Reinforcing Steel Institute, 28th Edition (2009).
6. "Field Inspection of Reinforcing Bars," Concrete Reinforcing Steel Institute, (CRSI), First Edition.
7. ASTM C 270-14, "Mortar for Unit Masonry."
8. ASTM C 1314-16, "Constructing and Testing Masonry Prisms Used to Determine Compliance with Specified Compressive Strength of Masonry."

Learning Objectives:

- I. Is highly familiar with the full range of inspector tasks delineated in the National Concrete Masonry Association's "Inspection and Testing of Concrete Masonry Construction" (NCMA TR 156B). This publication organizes these tasks by specific stages of the construction process:
 - Preconstruction (PRE).
 - Materials (MAT).
 - Placement of Units (UNIT).
 - Placement of Reinforcement, Connectors and Metal Accessories (REINF).
 - Placement of Grout (GROUT).
 - Post-Masonry Construction (POST).
- A. Masonry Preconstruction (PRE).
 1. Knows to review construction drawings, specifications, approved shop drawings, and approved submittals to determine details and requirements of the specific project.
 2. Is aware of the need to confirm that required building permits have been issued.
 3. Confirms specific testing and observation requirements.
 4. Determines cold weather or hot weather construction procedures that apply.
 5. Verifies specific reporting and notification requirements for the project.
- B. Masonry Materials (MAT).
 1. Verifies that all masonry materials are in accordance with approved construction documents or submittals.
 2. Confirms acceptability of on-site materials using mill certificates, delivery tickets, product labels, manufacturers' literature, etc.
 3. Where applicable, knows how to properly check various products for size dimensions, gage, grade, type, etc.
- C. Placement of Masonry Units (UNIT).
 1. Can check concrete footings for size, locations, and alignment.

2. If required, knows how to check dowels for size, location and length.
3. Knows how to check that mortar is properly proportioned using correct materials, correctly proportioned, and properly mixed.
4. Can observe placement of masonry units to include type, joint thickness and joint tooling.
5. Knows how to confirm proper placement of units with regards to alignment, plumbness, levelness, and planeness.
6. For grout or partially grouted construction is aware of different mortar bedding requirements, grout barrier materials, and when cleanouts are required.
7. Can confirm the proper type and installation of movement joints in accordance with project drawings.
8. Knows how to monitor proper proportioning and placement of grout. See separate section below.
9. Checks that proper weep holes and other embedded items are installed in accordance with project requirements.
10. Knows to confirm that unfinished masonry construction is covered at the end of each day to protect it from the weather.
11. Can properly perform all required testing, sampling and specimen preparation in accordance with applicable ASTMs.

D. Masonry Reinforcement and Metal Accessories (REINF).

1. Knows to confirm foundation dowels for size, position, and length.
2. Knows the placement tolerance for both horizontal and vertical reinforcing steel.
3. Is familiar with the minimum clear distance between masonry and reinforcing steel for both fine grout and coarse grout.
4. Is aware of the minimum amount of masonry cover over reinforcing bars and joint reinforcement to reduce the potential for steel corrosion.
5. Knows that the type and length of reinforcing steel lap joints are required to be indicated on project drawings and are to be inspected.
6. Is aware of need to check all connection devices, anchor bolts, tie downs, and wall ties for required size, location, finish, and type.

E. Placement of Grout (GROUT).

1. Knows to check grout spaces for debris and unacceptable mortar protrusion that could restrict grout flow.
2. Is aware of the various methods that can be used to confine grout to specified locations such as mortared webs and mesh.
3. Can confirm prior to grouting that all required reinforcement, anchor bolts, and connectors are in place.
4. After debris removal and inspection, can confirm that all cleanouts are properly sealed.

5. Is aware of the difference between fine and coarse grained and the criteria by which one or the other is to be selected.
6. Knows the required slump ranges of the grout for grout lifts between 5 feet and 12.67 feet.
7. Can describe the differences between “Low-Lift” and “High-Lift” grouting.
8. Has the ability to fully describe and accomplish the proper preparation and handling of grout compressive strength specimens (see separate section of this Study Guide on ASTM C1019).
9. Is knowledgeable of the requirement to terminate a low lift grout placement at least 1 1/2 inch below the bed joint to allow for keying action if subsequent lifts are to be placed.
10. Is aware that the batch-to-placement time limit for grout is 90 minutes-similar to concrete.
11. Knows of the two mechanical consolidation steps required for any grout lifts greater than 12 inches as well as the approximate timing of each.

F. Post-Masonry Construction (POST). Not evaluated as part of this certification.

II. Field Testing & Specimen Preparation

The scope of field testing for this certification is limited to the preparation of mortar compressive strength test specimens prepared in accordance with ASTM C780 and C109 and grout compressive strength specimens prepared in accordance with ASTM C1019. Both topics are also covered in depth in NCMA’s TR 156B.

A. Mortar Specimens.

1. Understands that the compressive strength results of either cube or cylinder specimens are not representative of the mortar in the assembly.
2. Understands the compressive strength results of specimens prepared in the field are not required to equal or exceed the result of similarly proportioned mortar prepared in the laboratory in accordance with ASTM C270.
3. Is aware that the results of testing cylindrical specimens of mortar can be expected to produce results approximately 15 percent lower than results of cube specimens made from identical mortar.
4. Can properly prepare either cube or cylinder mortar specimens in accordance with ASTM C780 and ASTM C109.

B. Grout Specimens.

1. Knows the procedures and actions to be taken if grout specimens are formed or obtained other than by using masonry units similar to those being used on the project.

2. Can properly prepare masonry grout specimens in accordance with ASTM C1019.
- III. Knows the technical requirements and the inspection criteria for the proper monitoring of the installation of post-installed concrete anchors.
 - A. Can confirm that the type of post-installed anchors being used is approved by the structural engineer of record.
 - B. Ensures that manufacturer's printed installation instructions (MPII) and the applicable ICC Evaluation Reports are available and are being used.
 - C. Can confirm that drilled holes are correct with respect to drill bit type, diameter, depth, and cleanliness.
- IV. Has an overall knowledge of the Special Inspection Program as outlined in Chapter 17 of the International Building Code.
 - A. Understands the difference between periodic and continuous inspections.
 - B. Knows the specific masonry inspection requirements of the International Building Code.
 - C. Is aware of the purpose, the submission requirements, and the general content of a schedule of special inspections.
 - D. Is aware of who the Special Inspectors must be employed by and who must approve their qualifications.
 - E. Knows when Special Inspections are required.
 - F. Is aware of the reporting and notification requirements of the Special Inspection Program.
- V. Can interpret reinforced masonry plans, specifications, and details for materials, dimensions, sizes, and locations.
- VI. Can extract necessary inspection and observation criteria from a relevant ICC-ES Evaluation Report. As mentioned, plan-reading-type questions are based on ESR-3814 to include the related Manufacturer's Printed Installation Instructions (MPII). An extract of both documents can be obtained from WACEL or by clicking on the following link ([ESR-3814 Extract](#))