



STUDY GUIDE

WACEL

FOUNDATION INSPECTOR

LEVEL I

February 2016

Foundation Inspector Study Guide

Scope: “WACEL Foundation Inspector” is an intermediate certification that builds on both “WACEL Soils I” and “WACEL Concrete I.” Obtaining this certification demonstrates that the qualifying technician is capable of monitoring and inspecting building foundation systems – with a particular emphasis on shallow foundations – as well as related site-work and structures.

The range of topics included in this certification include:

- a. A comprehensive review of the basic soil topics addressed in Soils I.
- b. The ability to properly review typical geotechnical reports and extract relevant information.
- c. The skills necessary to properly monitor the proper installation of shallow foundation systems to include bearing capacity, footing dimensions, correct reinforcing steel placement, and concrete placement.
- d. The knowledge necessary to monitor the installation of rammed (densified) aggregate piers used as an intermediate foundation system.
- e. The knowledge necessary to correctly inspect the construction of segmental retaining walls.
- f. An understanding of the Special Inspection Program of the International Building Code and how it relates to the technical topics of this certification.

Many of the other-than-shallow foundation systems and segmental retaining wall systems are proprietary systems that have been developed and patented by geotechnical experts. This certification has selected two of these systems to standardize training and evaluation. They have been selected for their common usage, for the scope of their complexity, and for the availability of their installation manuals. A detailed understanding of the selected systems should be readily transferable to competing systems. It is not WACEL’s intent to endorse the selected systems over any competing systems.

Purpose: The purpose of this study guide is twofold:

- a. To be an informational document to owners, engineers, and code officials describing the depth and breadth of knowledge expected of individuals in order to obtain the WACEL Foundation Inspector certification.
- b. To be a source document for individuals seeking this certification so they know the scope of the evaluation, the applicable references, and a clear delineation of the learning objectives that they are expected to master.

Prerequisites:

All candidates applying for the Foundation Inspector I Certification must possess current certifications in both – Concrete Field Technician (or Inspector) and Soils Technician (Field). WACEL does not require candidates to possess these prerequisite certifications through WACEL – other certification programs deemed equivalent by the certification Committee (State DOT, ACI, etc.) are acceptable. If the prerequisite certifications are not obtained through WACEL, evidence of these certifications must accompany the application.

General: The WACEL Foundation Inspector I Certification Program is currently the only level of certification. This examination measures an individual's knowledge primarily of shallow foundations. It is WACEL's goal to develop an additional, higher level certification for deep foundation systems, Foundation Inspector II, in the future.

Evaluation: The examination is a 3-hour, open book examination. It consists of 75 multiple-choice questions. The first section (approximately 25 questions) requires an understanding of general knowledge topics. The remaining section (approximately 50 questions) is generated from an example geotechnical report, specifications, and sets of plans that are given as attachments with the examination.

An overall minimum score of 80 percent (with a minimum of 70 percent on the "plan reading" sections) is required for certification.

The drawings that will be provided for the plan-reading portion of the examination are a partial set of drawings from an actual project. Select sheets have been extracted from:

- a. Retaining wall plan – notes and details.
- b. Foundation plan, including footing schedule.
- c. Foundation section details
- d. Rammed (densified) aggregate pier details and notes.

Safety: This certification program – to include the examination – does not address the safety issues or health hazards associated with testing or observations. It is the responsibility of each candidate and their employer to be knowledgeable and to comply with all health and safety requirements specified by code officials, governmental agencies, and their employer's health and safety program.

References:

- a. Required:
 1. "International Building Code," (Chapters 17, 18, and 19), International Code Council, 2012.
 2. "Field Inspection of Reinforcing Bars," Concrete Reinforcing Steel Institute, First Edition, 2014.
 3. "Van Shear and Cone Penetration Resistance Testing of In-Situ Soils," ASCE STP 399, 1966.
 4. National Readymix Concrete Association (NRMCA) Publication, CIP 17, "Flowable Fill Materials," 2000.
- b. Optional:
 1. "Geotechnical Testing, Observation, and Documentation," Second Edition, ASCE Press, 2008. (OPTIONAL)
 2. "Soils, Earthwork, and Foundations – A Practical Approach", International Code Council, 2006. (OPTIONAL)
 3. "Inspection Guide for Segmental Retaining Walls," National Concrete Masonry Association, 2012.

Application: The exam candidate must submit a completed WACEL Examination Application prior to taking the exam. The individuals who are cleared to take this examination are expected to be experienced construction inspectors and/or should have relevant education/training background.

A section of the application requires a Professional Engineer who is knowledgeable of the candidate's skills, knowledge, and abilities to formally confirm and document the individual's eligibility to take this examination as well as attest that the candidate has access to the previously cited required reference materials.

The application is located on the WACEL web site, www.wacel.org, in the "Tech Cert Program" section, left margin.

Learning Objectives:

The learning objectives listed below are topics which successful candidates will have thorough knowledge. They are intended to provide candidates with a relatively definitive outline of what is expected from them.

- A. Soil Characteristics: See Study Guide for WACEL Soils I, which is located in the same web section as this Study Guide and the aforementioned WACEL application.
- B. Specialized Topics:
 - 1. Has a basic knowledge of the characteristics of, use of, and advantages of controlled low strength material (also known as flowable fill).
 - 2. Understands the different types of and use of geosynthetics.
- C. Knowledge of Geotechnical Reports:
 - 1. Knows how to read and interpret a boring log to find:
 - a. Boring elevation.
 - b. Groundwater elevation.
 - c. Soil type for each strata.
 - d. SPT blow counts and N value (sum of 2nd and 3rd increments if not provided directly).
 - 2. Can locate foundation recommendations in report:
 - a. Understand the differences between shallow and deep foundations.
 - b. Can locate the recommended soil bearing pressure.
 - c. Can locate the recommended footing frost depth.
 - d. Understand what type of soils strata the foundations should be founded.
 - 3. Can locate the earthwork recommendations in the report.
 - a. What type of soils are suitable for structural fill.
 - b. What are the compaction requirements.
 - c. Can determine if any undercuts are recommended.

D. Evaluation of Shallow Foundations:

1. Can identify different types of soil in the field.
 - a. Able to differentiate between silt and clay.
 - b. Identify high plasticity vs low plasticity.
2. Verify recommended soil bearing.
 - a. Know how to use a Dynamic Cone Penetrometer.
 - b. Know how to locate soft spots in the foundation subgrade.
 - c. Use boring logs to be aware of possible deeper, unsuitable soils.
3. Reinforcing steel placement:
 - a. Understands the differences between and the applicability of design drawings and placing drawings to determine the complete and proper installation of reinforcing steel.
 - b. Demonstrate an ability to extract dimensions, placement and material requirements from plans and supporting tables and sections.
 - c. Have working knowledge of the proper placement of reinforcing steel to include size, condition, type, proper identification and placement tolerances, lap splices, lap splice tolerances, cover, condition, bar supports, tying, and field bending.
 - d. Can easily convert reinforcing sized in the inch-pound system to the "soft metric" requirements, and from "soft metric" to inch-pounds.

E. Segmental Retaining Walls.

1. Understands how segmental retaining walls function and are constructed.
2. Knows the criticality of proper construction and inspection of segmental retaining walls to ensure they function as intended without failure.
3. Is familiar with the major components of most segmental retaining walls and how they work within the overall system. Components include the facing units, the foundation and leveling pad, the reinforced zone and geogrid, retained soil, and possible drainage systems.
4. Can follow manufacturer's installation instructions to monitor correct installation with a particular emphasis on:
 - Construction of the leveling pad.
 - Required embedment depth.
 - Facing block levelness.
 - Pin location to establish setback or batter.
 - Installage of unit drainage fill and backfill and compaction.
 - Proper orientation and installation of geogrid used as reinforcement.
 - Correct installation of top-of-wall finishes and other accessories.

- F. Rammed (Densified) Aggregate Piers:
1. Understand Rammed (Densified) Aggregate Piers as a method of reinforcing or replacing a compressible soil stratum with compacted aggregate in order to improve footing bearing conditions and control settlement.
 2. Understand the general concept of the ramming process displacing aggregate laterally into the more compressible soils and thereby strengthening these soils.
 3. Understand the general installation procedure, i.e., drilled excavation or probe sufficiently penetrates the compressible soils to predetermined depths and then aggregate materials are placed from the bottom and either vibrated or compacted to create a stiff/compact aggregate pier element.
 4. Can interpret plans and determine Rammed (Densified) Aggregate Piers element diameter, length and bottom elevation.
 5. Understands the requirement that exposed footing subgrade soil and tops of Rammed (Densified) Aggregate Piers elements must be compacted prior to footing concrete placement.
 6. Understands importance of modulus test and can interpret plans and notes to determine the location of the modulus test and the nearby boring.
 7. Can determine from the project drawings the quality control and quality assurance requirements of the Rammed (Densified) Aggregate Pier system being installed.