

Certification: Concrete Strength Tester

Background

The MnDOT Technical Certification Program is mandated by the FWHA Code of Federal Regulations [Code 23 CFR Ch. I (4–1–11 Edition) Title 23. Part 637]. For Minnesota and MnDOT to receive federal funding for highway and bridge projects, we must have a Quality Control, Quality Assurance, and Independent Assurance Program in place that ensures qualified and certified technicians are testing and inspecting materials used on those projects. Minnesota also has chosen to extend this requirement to all state and some local government aid highway projects.

The types of materials that are tested are aggregate (rocks), concrete, bituminous (asphalt), soil, and various other materials used in roadway and bridge construction.

MnDOT has four Specialty Units, each responsible for materials used on the roadways and bridges. MnDOT staff at these Units work collaboratively with each other, the Technical Certification program staff, industry representatives, and people working in the field. These Specialty Units are 1) Concrete, 2) Bituminous (asphalt), and 3) Grading & Base (soil, sand, and rocks) at the Maplewood Office of Materials and Road Research, and 4) the Oakdale Bridge Office.

There are three key levels to the materials Sampling and Testing process, done by people with **Tester** certifications (formerly known as Level 1 certifications).

Quality Control (QC) is done by qualified and certified **Testers** who work for the **contractor** (the company that is building the road or bridge) or a **producer** (the company that supplies the materials). At designated times throughout the project, the Testers sample, test, and record and report on the roadway and bridge materials to make sure they are meeting the specifications described in the contract.

Quality Assurance (QA) is done by qualified and certified **Testers** who work for the **“owner” of the roadway or bridge project** (MnDOT or other designated agencies). QA Testers test the same materials as the QC Testers, using what is known as “companion samples” that are split and shared by QC and QA testers. This QA testing is also done at designated times, but less often than the QC testing. The goal is for the owner to verify that the contractor/producer test results are accurate and confirm that the materials meet the specifications in the contract. These Testers are typically MnDOT staff, consultants hired by MnDOT, or county/city personnel.

The *Independent Assurance Program (IA)* provides a layer of oversight to the testing process on federally funded projects. The **IA staff members** do an independent, unbiased evaluation of all the **sampling procedures, testing procedures, and testing equipment** used to determine the quality of the products specified in every roadway or bridge project contract. Each MnDOT District has at least one IA staff member responsible to review and report on all Federal Aid projects in their district. As part of this work, they check the testing equipment, including the calibrations, and conduct annual reviews of all project Testers, both those doing Quality Control (for contractors and producers) and Quality Assurance (for MnDOT and other agencies).

In the system, there also is another important layer of oversight that is done by **Inspectors**. The Inspector holds an advanced certification (formerly known as Level 2), serves in a decision-making role providing project supervision or oversight (e.g., Chief Inspector, Mix Designer, etc.), and is employed by MnDOT or other designated agencies. The role of the Inspector is to represent the Project Engineer and **oversee, inspect, and evaluate the production and placement** of the roadway and bridge materials, as described in MnDOT plans, specifications, and contracts. It is the Inspector who gives final approval to the placements of materials, when the specifications have been met, and then authorizes payment from the owner to the contractor.

Use of this Certification

The **Concrete Strength Tester Certification** is required for anyone who performs testing for concrete compressive strength. This includes procedures such as curing, sample preparation, and capping and breaking cylinders. (See course objectives for a complete and detailed list of test procedures.)

Note: In lieu of MnDOT Concrete Strength Testing Technician Certification, MnDOT will accept personnel who hold a current ACI Strength Testing Technician Certification or Wisconsin Concrete Strength Certification.

Requirements and Relationship to Other Technical Certification Courses

Prerequisites needed before beginning the course→	Concrete Strength Tester Certification	→ Is one of the prerequisites for other certification courses
None	Requirements: Attend course (1-day), pass exam (70% or higher), attend lab session, pass performance exam Expiration: after 5 construction seasons (see Certification Card for expiration date) Recertification: no recertification course/exams; must repeat the certification course and exams Provisional certificates for specific tests: yes	None

Certification Course Description

This 1-day introductory course focuses on fundamental information about preparation and testing of concrete strength specimens and the key methods used to sample, conduct test procedures, and document test results to ensure these materials meet roadway and bridge construction quality requirements.

Instruction includes lecture, demonstration, discussion, practice activities, and hands-on lab experiences with the testing procedures. Course resources and content reviews are included to help participants prepare for the written exam and the performance exam. [Note: Depending on participants' prior knowledge and experience, they may want to do additional practice and review before taking the class and/or the exam.]

Objectives

This is a summary of the knowledge, skills, and attitudes students must demonstrate to receive and do the work of this certification.

Materials Testing & Inspecting (Note: #1-6 in all Certifications)

1. Know the basic **history** and **purpose** of roadway and bridge materials testing and inspection
2. Know the Quality Control (QC), Quality Assurance (QA), and Independent Assurance (IA) roles and responsibilities of people at MnDOT, consultants, other government agencies, and private companies (contractors, and producers)
3. Know the role of the **Tester** who samples and tests materials used in the roadway or bridge project to determine if the materials meet the required specifications.
4. Know the proper use of materials **testing for acceptance** (how to document and report when a test procedure shows the material tested does meet the required specifications and to how to communicate that information effectively)
5. Know the documentation and reporting requirements for **materials exception** (what to do when a test procedure shows a material does not meet the required specifications, how problems are resolved, and how to communicate this information effectively)

6. Know the role of the **Inspectors** who oversee, inspect, and evaluate the production and placement of the roadway and bridge materials and how they authorize payment

Key Background, Terms, Tools, and Formulas for the Certification

Safety, Tools, Calculations

7. Know about **safety** hazards related to the specific work and job sites of this certification; know how to follow safe operating procedures and to report unsafe conditions to supervisors.
8. Know and be able to use any special **tools** used for this certification's test procedures, including equipment for sampling, splitting, gradation, washing, drying, and weighing
9. Understand and use the **calculations**, formulas, and units of measurement used for this certification, including basic math, use of algebraic formulas, English and metric measures for weight and volume and how to convert from one to another, if needed

Key Content

10. Know key **terms and materials** related to this certification, including capping materials and processes; terms, tools, and formulas used to calculate compressive strength; and MnDOT defined compression strength fracture types

Procedures and Documentation

11. Know how to receive and process **samples**, according to requirements listed in the *MnDOT Schedule of Materials Controls (SMC)*, and properly assess concrete strength properties, using the proper testing and evaluating equipment and procedures defined in the *MnDOT Lab Manual* and the *MnDOT Concrete Strength Training Manual* (see Test Procedures section below for specifics); this includes sample **submittal** requirements
12. Know how to and be able to **document** concrete strength by utilizing the most up to date MnDOT resources, including the *Concrete Cylinder ID Card*, *28-Day Compressive Strength Report*, and *Control Cylinder Strength Report*
13. Know which **specification** to use for the concrete mix designs being tested, where to find the specification, and how to evaluate those materials for acceptance

Test Procedures

Know the rationale for and be able to complete all procedural steps for the following test procedures:

Cylinder Capping

14. ASTM C617: Capping Cylindrical Concrete Specimens (Sulfur Capping Procedure)
15. ASTM C1231: Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders (Unbonded Capping Procedure)

Cylinder Strength Test

16. ASTM C39 Modified: Compressive Strength of Cylindrical Concrete Specimens (MnDOT Lab Manual 1407) (Test Concrete Cylinder to Failure)

Making and Storing Cylinders

17. ASTM C 31 (AASHTO T23) (MnDOT Modified Specification 2461): Making and Curing Concrete Test Specimens in the Field
18. ASTM C511 (AASHTO M201): Standard Specification for Moist Cabinets, Moist Rooms, and Water Storage Tanks used in the Testing of Hydraulic Cements and Concretes

Recertification

None. Technicians must repeat the certification course and exams.