

Certification: Grading and Base 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 **Grading and Base Tester Certification** is required for anyone who performs Quality Control (QC), Quality Assurance (QA), or Independent Assurance (IA) sampling and testing of grading and base (the soil, sand, and rocks used in roadway and bridge construction). This includes procedures such as moisture test for soils and aggregates representative sampling, moisture-density (Proctor), and in-place field density test. (See course objectives for a complete and detailed list of test procedures.)

People who have and use this certification work at/for MnDOT, local agencies (counties and cities), consultants, and contractors (the businesses who are contracted to do construction work), and producers (the businesses that supply the materials).

Requirements and Relationship to Other Technical Certification Courses

Prerequisites needed before beginning the course→	Grading and Base Tester Certification	→ Is one of the prerequisites for other certification courses
Aggregate Production Tester Certification	<p>Requirements: Attend course (3 days), pass exam (70% or higher), attend lab session (day 2), pass performance exam</p> <p>Expiration: after 5 construction seasons (see Certification Card for expiration date)</p> <p>Recertification: yes, if completed before the certification expiration date; attend Recertification course and pass exam (70% or higher)</p> <p>Provisional certificates for specific tests: yes</p>	<p>Grading and Base Inspector Certification course</p> <p>Bridge Construction Inspector course</p>

Certification Course Description

This introductory 3-day course focuses on fundamental information about grading and base materials (the soil, sand, and rocks used in roadway and bridge construction) 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. Quizzes, course resources, and content reviews are included to help participants prepare for the written and lab-based performance exams. [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.]

Recertification Course Description

This 1-day recertification course reviews core knowledge and skills from the initial certification course and provides information on any recent changes to the relevant specifications and test procedures.

Instruction includes lecture, demonstration, discussion, and practice activities. Participants will also have an opportunity to discuss lessons learned in the field. Quizzes, course resources, and content reviews are included to help participants prepare for the written exam.

[Note: People who have had little or no experience working with their certification since their prior class will want to either 1) review the course content before taking the recertification class or 2) take the initial certification

course instead. The recertification course is **not** a complete re-teaching of the content but a review with updates for people who have a solid base of the required knowledge and skills.]

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 terms and definitions for the various grades, layers, and portions of a roadbed; soil categories, types, and terms used to describe them (e.g., permeability, density, granularity; and naming conventions and acronyms for materials and tests used in this work
11. Know key **background** related to the work of this certification, including plans and proposal, sources of materials such as borrow and gravel pits; planned quantities/limits of select soils; depth and disposition of topsoil; compaction and moisture requirements; disposal of unsuitable soils; preparation of sub-foundation and culverts; details of swamp (muck) excavation; and fill and overload limits

Procedures and Documentation

12. Know how to and be able to obtain verification samples, according to requirements listed in the *MnDOT Schedule of Materials Controls* (SMC), and properly assess grading and base properties, using the proper testing and evaluating equipment and **procedures** defined in the *MnDOT Lab Manual* and *MnDOT Grading and Base Manual* (see Test Procedures section below for specifics)

13. Know how to and be able to **document** grading and base properties by utilizing the most up to date MnDOT resources, including the *Grading and Base Report, Certification of Aggregate and Granular Materials, Moisture-Density Relationship, Daily Diaries*
14. Know how to and be able to conduct safe and current **sampling** procedures
15. Know which **specification** to use for the particular material being tested, where to find the specification, and how to submit documentation for test procedures completed
16. Know how to complete the identification and **submittal** of samples

Test Procedures

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

Proctor and Plotting

17. AASHTO T99: Method C Moisture-Density Relation (Proctor) (MnDOT G&B Manual 5-692.222)
18. AASHTO T99: Proctor – Plotting Test Results

Sand Cone Density Test

19. AASHTO T265: Moistures & Calculations (MnDOT G&B Manual 5-692.245)
20. AASHTO T191: Field Density Test (MnDOT G&B Manual 5-692.246)

Calibrations

21. Calibration of Sand Cone & Plate (MnDOT G&B Manual 5-692-231)
22. Calibration of Standard Sand (MnDOT G&B Manual 5-692-232)

Dynamic Cone

23. ASTM D6951: Dynamic Cone Penetrometer (DCP) (MnDOT G&B Manual 5-692.255)

Soil Identification

24. Soil Identification (Triaxial Chart) (MnDOT G&B Manual 5-692.601)

Speedy Moisture Test

25. AASHTO T217 Modified: Calcium Carbide Gas Pressure (CCGP) Method; 20-gram Speedy Moisture Meter (MnDOT G&B Manual 5-692.245)

Test Rollers

26. Test Roller 30k and 10k (MnDOT G&B Manual 5-692.270)

Recertification

27. In addition to all the objectives above, the technician will be familiar with all certification area updates from the past 4-5 years, including any changes to specifications and test procedures.