

Certification: Grading and Base Inspector

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 Inspector Certification** is required for agency/owner personnel acting as an Inspector on grading and base materials, activities, and placements done as part of roadway and bridge projects.

People who have and use this certification work as Inspectors at MnDOT and local agencies (counties and cities).

[Note: It is not always required that a local agency provide a Grading and Base Inspector for each grading and base project, although they may choose to do so. This Inspector may be assigned to several projects at one time in a Lead Inspector capacity.]

Requirements and Relationship to Other Technical Certifications Courses

Prerequisites needed before beginning the course →	Grading and Base Inspector Certification	→ Is one of the prerequisites for other certification courses
Grading and Base Tester	Requirements: Attend course (3 days), pass exam (70% or higher) Expiration: after 5 construction seasons (see Certification Card for expiration date) Recertification: yes, if completed before the certification expiration date; attend Recertification course and pass exam (70% or higher)	None

Certification Course Description

This advanced 3-day course focuses on the knowledge and skills needed to serve as an Inspector on grading and base projects, working to ensure these materials meet roadway and bridge construction quality requirements. Topics include Inspector roles and responsibilities, subgrade soils and soils identification, excavation and embankment construction, base construction, cold mix asphalt, pavement reclamation, turf establishment, geosynthetic applications, and compliance with labor laws.

Instruction includes lecture, demonstration, discussion, and practice activities. Quizzes, course resources, and content reviews are included to help participants prepare for the written 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.]

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

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; excavation and embankment terminology; 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
12. Understand the need for certified materials and the associated **materials testing** requirements and be able to interpret results from test procedures from the prerequisite certifications (Aggregate Production Tester, Grading and Base Tester), as defined in the MnDOT Lab Manual and MnDOT Grading and Base Manual

Inspector Tasks and Responsibilities

Inspection and Documentation

13. Know all steps, terms, and components for the initial **project review**, including the plans and proposal, sources of materials including borrow and gravel pits, planned 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 excavation, and fill and overload
14. Know and be able to complete inspections of project preparation at the **construction site**, including to ensure traffic control, to review plans and provisions, to use an effective communication system, and adapt to weather limitations.
15. Know how to and be able to conduct safe and current **sampling** procedures, including the rate of sampling, according to requirements listed in the MnDOT Schedule of Materials Controls (SMC) and when and how to use procedures for random sampling
16. Know how to and be able to **document** grading and base properties, project events, measurements, and pay items 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, and the Documentation of Pay Quantities
17. How to use **notes, photos, and videos** as part of the project documentation process
18. Know when and how **contract revisions** are made and how to use them
19. Know how to complete the identification and **submittal** of samples
20. Know how to **certify materials**, using the Schedule of Materials Control to identify which specification to use for the particular material being tested, including the minimum rate of sampling, the unit of sampling, and sample size; to ensure all MnDOT and Contractor personnel were certified for the tests they performed; that all Lab Companion samples compared to IA samples were in tolerances; and all exceptions were properly documented
21. Know how to give **final approval** to the placements of materials, when the specifications have been met, and then authorize payment from the owner to the contractor(s) doing the work and/or the supplier(s) providing the materials, using the Monetary Price Adjustment Tables

Communication and Project Supervision

22. Be able to **communicate** effectively, including listening to others, speaking and writing clearly, and taking notes on conversations and observations
23. Be able to **coordinate** project documents, including standard specifications, supplemental specifications, plans, and special provisions
24. Be able to **collaborate** with others to solve problems, including the use of conflict resolution techniques; this includes working with the Engineer and District Soils Engineer to get clarification of design intent and support in resolving any issues
25. Know the **contractor's** role and **responsibilities**
26. Know how to identify **unqualified** project **workers** and follow proper procedures to have them removed from a project
27. Know when and how to **suspend work** that is unauthorized, unacceptable, or not in compliance
28. Know issues around air, land, and water **pollution** and how to mitigate them
29. Identify common grading and base problems, know how to address them using clear **problem-solving** strategies, and then to document actions as needed

Grading and Base

Construction Specifications

30. Know **construction requirements** for maintaining a field office and laboratory, for clearing and grubbing, removing pavement and miscellaneous structures, and for excavation and embankment

Grading Construction

31. Know the **fundamentals** of **grading** construction, including preparation of embankment areas, maintaining proper excavation areas, excavation below grade, spreading and compacting, and control testing for embankment construction
32. Understand **frost susceptibility** in embankment or base construction and how to prevent frost damage
33. Know about issues around and methods for **erosion control**
34. Know about the types of **geosynthetics** and construction requirements for their use
35. Know **soil classification** methods and concepts and how used for soil selection, including classification by engineering properties, pedological, and texture; soil profiles and soil horizons; use of triaxial charts and dispersion tests; Plasticity Indices; and groundwater
36. Know how to complete all items on the **Grading Inspection Checklist**

Base Construction

37. Know the **fundamentals** of **base** construction, including placing and compacting for aggregate surfacing and shoulder base aggregate,
38. Know the requirements for **aggregates** for surface, base, and shoulder bases, for both virgin and recycled materials
39. Know the requirements for **granular material** for granular subbase, structural bedding, and backfill, for both virgin and recycled materials
40. Understand the uses and limits of **recycled materials**
41. Know how to complete all items on the **Base Construction Inspection Checklist**

Test Rolling

42. Know how to perform **test rolling** and interpret results to evaluate soil properties and locate unstable areas not detected during construction, including how to calibrate and evaluate the testing equipment

Pavement Reclamation

43. Know the fundamentals of the **pavement reclamation** process, including for Hot in-place Recycling (HIR), Cold In-place Recycling (CIR), Full Depth Reclamation (FDR) and Stabilized Full Depth Reclamation (SFDR), and when to what samples and test procedures are needed

Culvert installations and Special Situations

44. Know about the types of **lightweight embankment fill** and construction requirements for their use, including geofabric, shredded waste tires, and wood chips
45. Know basic construction **techniques for swamps**, including load reduction, excavation and replacement, swamp excavation, stabilization by consolidation, berms or flatter slopes, and reducing the water table
46. Know how **culverts** are used for the passage of surface water through embankments; what materials are used; how to install and inspect concrete, flexible metal, rigid pipes; appropriate compaction of backfilling; and how to complete all items on the **Culvert Installation Checklist**.

Recertification

47. 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.