Pennsylvania
Department of Transportation

Reference Guide for TA-TCI Module: Material Sampling

Acronyms, Key Important Terms, and Definitions

American Association of State Highway and Transportation Officials (AASHTO): A nonprofit, nonpartisan association representing transportation agencies in all 50 states, D.C., and Puerto Rico, covering all transportation modes (air, highways, rail, water, public transportation, etc.) and promoting an integrated national transportation system.

Aggregate: Materials like sand, gravel, or crushed stone that are mixed with cement and water to make concrete.

American Society for Testing and Materials (ASTM) International: A Pennsylvania-based international standards organization, formerly known as the American Society for Testing and Materials. It is a globally recognized leader in the development and delivery of voluntary consensus standards.

Acceptance Testing (AT): A PennDOT term used to denote the process of verifying the contractor's work through inspection using the Department's Specifications.

Concrete Testing – Air Content: This measures the amount of air in the concrete mixture.

Concrete Testing – Slump: This tests how far a concrete specimen falls when the cone is removed.

Concrete Testing – Strength: This measures the compressive strength of the cured concrete.

Concrete Testing – Temperature: This measures the temperature of fresh concrete.

Contract Documents: These contain details of how to build a project. They consist of the actual contract and plan sets that detail the work and list the work item numbers that correspond to the specifications found in Publication 408.

District Material Division: Pennsylvania's District Material Divisions are organized under PennDOT's 11 Engineering Districts, which manage transportation infrastructure across the state. Each district oversees roadway construction, maintenance, and materials testing within its geographic area.

Earthwork: The process of excavating, moving, and compacting soil and rock to prepare the land for building roads. It's a foundational phase that ensures the roadway has the correct shape, elevation, and stability.

Electronic Construction and Materials Management System (eCAMMS): The system streamlines construction materials testing and certifications, sampling standards and results,

product approvals, and quality assurance data into one platform that integrates with other PennDOT digital tools.

Electronic Certificate eCert: A certification of compliance in electronic form that the materials manufacturer produces and electronically signs. It is uploaded to a project via ECMS.

Engineering Construction Management System (ECMS): A website used to manage construction projects, contracts, and agreements.

eConcrete App: A mobile app that ensures all concrete-related activities are properly documented and traceable.

eTicketing App: A mobile app that allows Inspectors and Contractors to view supplier-generated tickets and take action.

Gradation Requirements: Gradation refers to the distribution of different-sized particles in each aggregate sample. Proper gradation ensures that the material compacts well, drains properly, and provides a stable base or surface for the road. The specifications should define the gradation requirements by including acceptable ranges for the percentage of material passing through various sieve sizes.

Heat Number: This is a unique identifier assigned to a batch of steel produced in a single melting or "heat" in a furnace. It serves as a traceability tool that links the steel product back to its chemical composition, production records, and quality control documentation.

Lot: A defined quantity of material from a single source, or a measured portion of construction work, produced using the same process. Lot sizes are specified in Publication 408, and additional guidance can be found in the Project Office Manual (Publication 2).

Material Testing Layer 1: Before the material is manufactured, the production plants must be certified.

Material Testing Layer 2: During the manufacturing process, Material Plant Inspectors test samples taken directly from the production line at the quarry or the plant.

Material Testing Layer 3: During construction, samples of production materials being incorporated into the project may be sent to the PennDOT Materials Lab for testing. Samples of ready-to-use products can be tested on-site or sent to third-party laboratories. Earthwork may be tested for compaction, moisture content, and other critical properties.

Material Testing Layer 4: After material installation and before final payment, any aspect of work on the project may be tested on-site or at the lab.

Mill Test Certifications (MTCs): Also known as material test certificates, are documents that verify a material's chemical and mechanical properties, especially in the steel industry, to confirm it meets required standards and customer specifications.

PennDOT Bulletin 14 (Publication 34): Approved aggregate producers - the list of producers can be searched on eCAMMS.

PennDOT Bulletin 15 (Publication 35): Qualified Products List for Construction. This bulletin is a listing of prequalified materials and producers that are eligible for use on PennDOT construction projects. This list can also be searched on eCAMMS.

PennDOT Bulletin 41 (Publication 41): Approved asphalt mixture producers - the list of producers can be searched on eCAMMS.

PennDOT Bulletin 42 (Publication 42): Approved ready mix concrete producers - the list of producers can be searched on eCAMMS.

PennDOT Form CS-458A: Documents the compressive strength test results of concrete cylinder samples collected from the jobsite. This is submitted in the eConcrete app.

PennDOT Form CS-472: Concrete Inspector's Daily Report (CIDR).

PennDOT From CS-4171B: Certificate of Compliance for Daily Asphalt Mixtures.

PennDOT Form TR-447 – Sample Identification: Every collected material sample requires an accompanying TR-447 form, to be completed by the Inspector or Engineer. The form includes bar-code stickers that must be attached to every copy of the form to allow for tracking and identification of samples. One copy of the form must accompany the sample itself to the Materials Testing Laboratory; one must be sent to the district office or kept by the CQAS representative, and one copy is filed with the project documentation.

PennDOT Publication 2 – Project Office Manual: A compilation of policies and procedures relating to field administration and inspection of construction contracts. Its purpose is to serve as a reference guide for the appropriate District staff.

PennDOT Publication 72M - Revisions to Standards for Roadway Construction: A standard for roadway construction that provides guidelines and specifications for both new and existing roadway designs, ensuring consistency and quality across construction projects.

PennDOT Publication 219M - Standards for Bridge Construction: Establishes standards for bridge construction. It includes specifications that can be adopted for new and existing projects, ensuring consistency and quality in bridge design and construction.

PennDOT Publication 408 - Specifications: The main rulebook and most frequently used publication by Inspectors. It provides detailed requirements for materials, construction methods, measurements, and payments, and is used to check whether construction is being done correctly.

Pennsylvania Test Methods (PTM): These are standardized procedures developed and maintained by the Pennsylvania Department of Transportation (PennDOT). These methods are used for field and laboratory testing of construction materials to ensure compliance with specifications and quality standards on infrastructure projects like roads, bridges, and buildings.

Quality Control for Materials: Several aspects of material control will combine to ensure the highest level of quality is achieved and maintained on a project. These include proper sourcing, testing, and certification of the materials incorporated into a project, compliance with contract specifications, and adhering to the approved Quality Control Plans.

Quality Control (QC) Plan: PennDOT Minimum Quality Control Plan for Field Placement Concrete Operations (Form CS-704). The form outlines the materials, specifications, and standards that the project must follow to ensure quality, safety, and compliance. It lists key contacts, contingency plans in case of unexpected issues, and procedures for the installation and evaluation of material.

Random Sampling: A way to collect material for testing that ensures fairness to the contractor and to PennDOT. The general idea is that any area of the project can be used as the source for the random sample.

Source of Supply (SOS): - This refers to the origin or provider of materials, products, or resources used in the construction process.

Subbase: A subbase is the layer of material placed directly beneath the base or pavement of a structure.

Sublot: A smaller segment within a lot. Sublots are used to divide sampling into more manageable portions. The results from each sublot are typically averaged to determine the outcome for the lot.

Transportation Construction Inspector (TCI): A person who performs technical inspections of highway and bridge construction projects and materials testing activities, with responsibilities that include project safety, records control, contractor payment verification, and oversight of major highway construction and reconstruction work. Projects may include roadway overlays, widening, stabilization, earthwork, guiderail installation, and drainage operations.

Verification Testing (VT): It is performed alongside the AT testing and compares the associated AT test results to applicable standards. It is not used to determine the material's acceptance.

Links to Reference Materials

AASHTO - American Association of State Highway and Transportation Officials: https://transportation.org/

eCAMMS - Electronic Construction and Materials Management System: https://www.ecamms.penndot.pa.gov/Public/Pages/Bulletins/BulletinSearch.aspx?BulletinTypeKey=1

PennDOT eConcrete App: https://mobile.penndot.pa.gov/econcrete

PennDOT eTicketing App: https://mobile.penndot.pa.gov/eticketing

ECMS - Engineering and Construction Management System: https://www.ecms.penndot.pa.gov/ECMS/SVCOMLogin

PennDOT Form CS-458A - Report of Compressive Strength of Portland Cement Concrete: https://www.pa.gov/content/dam/copapwp-pagov/en/penndot/documents/public/pubsforms/forms/cs-458a.pdf

PennDOT Form CS-704 - Minimum Quality Control Plan for Field Placement Concrete Operations: https://www.pa.gov/content/dam/copapwp-pagov/en/penndot/documents/public/pubsforms/forms/cs-704.pdf

PennDOT From CS-4171B - Certificate of Compliance for Daily Asphalt Mixtures: https://www.pa.gov/content/dam/copapwp-pagov/en/penndot/documents/public/pubsforms/forms/cs-4171b.pdf

PennDOT Publication 2 - Project Office Manual: https://digitalcollections.statelibrary.pa.gov/Documents/Detail/project-office-manual-pub.-2/465606

PennDOT Publication 72M - Revisions to Standards for Roadway Construction (change number 12): https://www.pa.gov/content/dam/copapwp-pagov/en/penndot/documents/public/pubsforms/publications/pub-72m/72m_2010_12/72m_2010_12.pdf

PennDOT Publication 219M: Standards for Bridge Construction: https://digitalcollections.statelibrary.pa.gov/Documents/Detail/standards-for-bridge-construction-pub.-219m/465745

PennDOT Publication 408 - Specifications: https://www.pa.gov/content/dam/copapwp-pagov/en/penndot/documents/public/pubsforms/publications/pub_408/pub%20408.pdf

PennDOT Quality Assurance Reporting System Portal: https://qars.penndot.pa.gov/