

CHAPTER 6

Sampling and Testing Materials

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6.01 Introduction

6.01.01 Chapter Content and Resources

This chapter contains information relevant to the sampling and testing of materials. To learn more about products used, typical applications, and expected performance, refer to the “Maintenance Technical Advisory Guide,” which is a complete technical document of materials and strategies.

While it is most economical to use local materials, when possible, there are times results will not be satisfactory unless suitable materials are used. The need for suitable materials takes precedence over local materials when justified and approved by the proper authority. Superintendents and Supervisors are not expected to be familiar with all materials tests or the full details of sampling required on a major project. It would be highly unusual for Maintenance staff to be sampling and testing materials. However, the person in charge of work should be familiar with routine sampling procedures. For additional information, refer to the following reference resources:

Authorized Materials Lists (AML): <https://dot.ca.gov/programs/engineering-services/authorized-materials-lists>

California Test Methods: [California Test Methods \(CTM\) | Caltrans](#)

Caltrans Electronic Forms System (CEFS): [CEFS - Forms \(ca.gov\)](#)

Construction Manual: <https://dot.ca.gov/programs/construction/construction-manual>

Data Interchange for Materials Engineering (DIME): <https://dime.dot.ca.gov/>

District Materials Engineers Contact List: [Materials Engineers Contact List \(ca.gov\)](#)

Independent Assurance Program and contact list: <https://dot.ca.gov/programs/engineering-services/independent-assurance-program>

List of Local Materials Engineering and Testing Services Representatives:
<https://mets.dot.ca.gov/metsrepresentatives.php>

Maintenance Technical Advisory Guide, Email: MTAG@dot.ca.gov

Southern Regional Laboratory Representative Contact – Concrete: srl.concrete@dot.ca.gov

Southern Regional Laboratory Representative Contact – Hot Mix Asphalt:
SRL.HMA@dot.ca.gov

6.01.02 Definitions

ACI – American Concrete Institute
ASR – Alkali Silica Reaction
ASTM – American Society for Testing Materials
Caltrans – California Department of Transportation
CEFS – Caltrans Electronic Forms System
DIME – Data Interchange for Materials Engineering
IA – Independent Assurance
ID - Identification
METS - Materials Engineering and Testing Services
TL – Transportation Laboratory
QA – Quality Assurance
QC – Quality Control
SRL – Southern Regional Laboratory

6.01.03 References and Hyperlinks

There are hyperlinked resource materials identified within this chapter. If any hyperlink is not accessible, please notify the appropriate personnel to inquire about that resource or reference.

6.01.04 Chapter Contact

This chapter of the Maintenance Manual is maintained by:

- Division of Maintenance, Office of Asphalt Pavements for all pavement related information.
- Division of Maintenance, Office of Structure Maintenance and Investigations for all concrete related information.

6.02 Sampling

It is critical that samples of materials submitted to the laboratory for testing be representative. Construction based on misleading test data may fail completely, or inexpensive suitable material may be unnecessarily excluded from use.

Under current California Department of Transportation (Caltrans) policy, all project personnel who perform tests on material being used must possess a valid Form TL-0111, “Tester Certificate of Proficiency.” listing the tests the individual is authorized to perform. This form and its applicable requirements may be found in the Independent Assurance (IA) Manual, Procedures for Accreditation of Laboratories and Qualification of Testers. To obtain a copy of the IA Manual, an IA Service Request must be completed via email (see reference link, in Section [6.01.01](#) of this chapter, to the Independent Assurance Program and Contact List.

Refer to Chapter 6 of the Construction Manual and California Test 125 as guides to sampling procedures and frequency.

Often, the quantities of some materials required on a maintenance project may be very small, or the intended use of the material may be such that strict quality controls are not feasible. Consult

the District materials laboratory or METS when questions arise regarding sampling and testing.

When materials are purchased in large volumes for stockpiling or a local source of aggregate is being considered for use, it may be advantageous to request assistance from the District Materials Laboratory or METS. Proper equipment and trained personnel can often save both time and money in the sampling and testing program.

6.03 Sample Identification

Each sample submitted to the laboratory for testing must come with a DIME Sample ID. DIME Sample IDs are generated in DIME, provided in Section [6.01.01](#) of this chapter. DIME is a web application developed by METS to allow samplers the ability to easily submit sample information and test data to Caltrans' database via the internet. DIME Sample IDs and sample identification forms can be obtained from DIME.

When DIME is not accessible, the following printable blank forms are available on the DIME website under “Help & Forms” and on the CEFS web page (reference link provided in Section [6.01.01](#) of this chapter):

- Form TL-0101 for all other materials

Instructions for generating the DIME Sample ID and forms are found in the Help section of the DIME website. After all required information is entered into DIME, a completed form can be printed to accompany the sample.

The Material’s Representative should inform the laboratory of field conditions pertinent to the sample by completing all required fields in DIME. Under “Notes,” add any more information such as difficulties with compaction, rolling, raveling, or degradation. If applicable, Notes should also include information regarding weather, moisture, traffic, and similar conditions to convey the Material’s Representative’s field observations to the laboratory. If the Material’s Representative is reasonably sure the material is suspect in only one or two of the specification requirements, they should advise DIME. This will prevent the expense of unnecessary testing.

6.04 Priority Testing of Samples

Schedule the sampling of materials far enough in advance of the work to allow necessary testing prior to use of the material. There will be occasions when advance testing is not possible. When immediate testing is necessary to avoid delays in the work, contact the appropriate representative to schedule for urgent test results as follows:

- For METS tests, contact the METS Representative
- For District tests, contact the District Materials Engineer
- For SRL testing, contact the SRL representative

See the Construction Manual, Section 6-102C Acceptance Samples and Tests, for additional information such as “Priority” and “Normal” processing times for acceptance tests of materials.

6.05 Receiving of Materials

The Material's Superintendent should assign a Material's Representative the responsibility for checking shipments of materials when received and ensure all have been properly inspected and released. For METS testing, the METS Representative is responsible for following up on the sample or checking DIME for any status update. For District and SRL, Materials should check with the corresponding representative in each division. Inspected materials may be identified by METS inspection release tags (orange or blue tagged) or a METS lot number on the package. An inspection report (Form TL-29 or TL-6014) should be received within a week to ten days after receiving the delivery.

Contact the METS Representative promptly after receiving shipments not covered by releases to ensure the necessary investigation can be made. Refer to Section [6.01.01](#) of this chapter for the METS Representatives hyperlink information.

If this investigation is delayed, the process of identifying and checking on the shipment may be extremely difficult.

6.06 Shipping of Samples

When shipping samples from the job to the District laboratory and/or METS, use the most economical mode of transportation that will meet time frame requirements. See Construction Manual, Section 6.102C Acceptance Samples and Tests, for additional information regarding shipping.

6.07 Sampling Failures of Existing Asphalt Surfaces

To determine the causes of roadway failures on existing pavements, obtain samples from both stable and unstable areas. Pavement cores are sufficient samples in some cases. In other cases, additional material should be submitted in sealed containers to test for moisture content on existing material. Consult the METS Representative or IA Representative for assistance when making these decisions. A sampling plan can then be developed to ensure enough material is collected to conduct a failure analysis.

Indicate the type of failure such as raveling, instability, or cracking of the surface in DIME or on the sample identification form (Form TL-0101). Provide a written list or a letter giving additional details such as traffic loads, condition of base material, date, and weather conditions at time of construction. This information will greatly help to properly analyze the cause of failure.

6.08 Road-Mixed Asphalt Surfacing

Road-mixed surfacing material should be sampled after the material has been laid out. Sampling from the windrow is permissible if the sampler is certain the oil is thoroughly mixed with the aggregate, and that the sample will be truly representative.

6.09 Paint

All paint manufactured under State Specifications is sampled at the factory, tested by the laboratory, and properly identified by lot numbers before being shipped to the job. If shipment is required for the job before tests can be completed, the manufacturer can ship at their own risk pending the laboratory report. The shipment of paint under these circumstances is not to be taken as an acceptance. It is merely an expedient way to save time.

During the job, check samples of the paint when the engineer suspects tampering with the paint, or at any other time, at the discretion of the engineer.

Proper sampling to obtain a representative portion of the paint is mandatory. Mix paint according to the manufacturer's written mixing instructions. Samples should be placed in a quart metal can with a lid.

Send the sample to the METS laboratory promptly. Use DIME to generate a DIME Sample ID and TL-0101. Include all essential data such as identification, lot number, manufacturer's formula number, and manufacturer's brand, if purchased locally, nature of trouble, and any other pertinent data. Refer to Chapter 6 of the Construction Manual for additional paint testing requirements.

6.10 Concrete

Concrete can be categorized into non-structural (minor) and structural.

6.10.01 Non-Structural (Minor) Concrete

Non-Structural Concrete (Minor) concrete has decreased amounts of cementitious materials when compared to general concrete because of the lower required strengths (e.g., aggregate gradation, uniformity, etc.). Examples of applications of minor concrete include, but are not limited to, vegetation control, curbs and gutter, sidewalks, etc. Concrete mix design for minor concrete must be reviewed and approved. Ensure a certificate of compliance is provided for minor concrete and each load is accompanied by a weighmaster certificate with the specified information.

6.10.02 Structural Concrete

Structural concrete is used for construction of a variety of concrete structures and members. These structures include, but are not limited to, bridge decks, piers and abutments, etc.

6.10.02.01 Sampling of Fresh Concrete

Structural concrete must go through a more rigorous sampling/testing/acceptance process than minor concrete. Structural concrete mix design must be reviewed and authorized for use by Caltrans.

QC/QA tests routinely performed in the field include the unit-weight test, the ball penetration test, temperature test, and the air content test. In addition, it is often required to cast cylinders to measure compressive strength of concrete to ensure compliance with requirements. These tests

must be performed on representative samples of freshly mixed concrete, acquired according to ASTM C172/C172M. Sampling must be performed by a certified ACI Concrete Field-Testing Technician, Grade I. A DIME record for the concrete sample must be first generated in DIME, which should include mix design ID, batch ticket information, etc. QA test results should be submitted under the generated DIME Record.

According to ASTM C172/C172M, multiple samples must be obtained from the production line to perform the required tests. Samples for tests to determine actual in-place strength at a particular time should be taken at the point of placement in the work, as close as practicable. The elapsed time between obtaining the first and final portions of the composite sample shall not exceed 15 minutes. If water is needed to be added to a truck mixer to adjust slump at the job site, the sample should be taken after the water has been added and the concrete thoroughly remixed. Never, should any water be added beyond the required mix design amount.

Start testing of fresh concrete with slump, temperature, and air content test within five minutes after obtaining the sample. Maximum of 15 minutes is allowed between obtaining of sample and starting molding of strength cylinders. A compressive strength test represents no more than 300 cubic yards of concrete and consists of the average compressive strength of two 6-inch by 12-inch cylinders, or three 4-inch by 8-inch cylinders made from material taken from a single load of concrete. Each cylinder must be clearly labeled, and must be traceable to the unique mix design, date of sampling, etc.

6.10.02.02 Samples from Hardened Concrete

Aside from sampling from fresh concrete, it is sometimes required to collect samples from hardened structural members. Examples include, but are not limited to, occasions where the properties of the concrete are unknown or are in question, distress in the structure is likely to be materials related (e.g., evidence of ASR is present), or the thickness of structural elements (e.g., slab thickness) is unknown. Collected samples from the structure can be used for further testing and more in-depth evaluation, or to perform compressive strength tests. Cores must be clearly labeled and should be accompanied with documentation about location of the core, reason for coring, visual observations, and necessary pictures. For more information on coring, see ASTM C42: Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. Each sample submitted to the laboratory for testing must be accompanied by a DIME Sample ID. Report all test results.