Chapter 8
Material Sampling And Testing

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8 MATERIAL SAMPLING AND TESTING

Introduction

Chapter 6 of the Caltrans Construction Manual contains information and instructions that govern materials sampling and testing on State highway projects. The administrative provisions and all sampling and testing methods and procedures included therein apply to all construction work including structure construction. Bridge engineers are expected to become familiar with the Construction Manual provisions that apply to sampling and testing of structure concrete materials.

In general, materials used to produce concrete from commercial plants in urban areas will be sampled on a routine basis by personnel assigned to the District Materials Laboratory (Lab), and test results made available to construction projects. For concrete plants in rural areas or projects where portable plants are used, samples will usually be taken by project personnel. Depending on circumstances, to properly control the work it may be necessary for project personnel, including bridge personnel, to sample materials on any project at any time. Accordingly, bridge field engineers must be familiar with sampling procedures and test methods that are applicable to structure concrete work.

Personnel handling, sampling or testing concrete materials need to follow all applicable safety regulations, including Office of Structure Construction (OSC) Bridge Construction Records and Procedures Manual, Section 14, OSC Code of Safe Practices, Caltrans Safety Manual, CalOSHA Construction and General Industry Safety Orders, and the plant's safety regulations and safety precautions addressed in California Test 125.

Test Types

The various tests performed on concrete materials, and all other materials used in the work as well, are classified according to the purpose of the test. Field tests are performed under supervision of licensed engineers in strict accordance with the Code of Professional Conduct of the California Board of Professional Engineers and Land Surveyors. Bridge field personnel are typically concerned with four types of testing.

Initial Samples And Tests

These tests (also sometimes referred to as Process Control Samples and Tests) are made after the award of a contract to determine whether a particular material, such as concrete aggregate, is suitable for use.

Acceptance Tests

These tests are made to verify that the materials being used in the work meet contract requirements. Samples may be taken by lab or construction personnel. Aggregate samples are processed and tested in the District Materials lab or in a construction field lab. Other materials (cementitious materials, SCMs, water and admixtures, if used) will be tested in the Headquarters Offices of Materials Engineering and Testing Services (METS) labs in Sacramento.

Independent Assurance Tests

These tests are made on samples taken (or witnessed) by personnel who are not assigned to the project to verify the reliability of the acceptance test results. These tests are not used to verify compliance with contract requirements. Samples are processed and tested in the District Materials lab or the METS labs in Sacramento, as appropriate for the material sampled.

FHWA Samples And Tests

On Federal-aid projects the FHWA reviewer may request that a particular material be sampled and tested. Such samples are taken as directed by the FHWA, marked for identification as "FHWA Check Sample" and sent for testing to the appropriate District or Headquarters lab.

Test Frequency

The required test frequency for materials used in highway and structure construction is found in Chapter 6 Sampling and Testing of the Construction Manual.

The sample frequency shown in the tabulation is intended as a guide for minimum testing under normal conditions. When materials being furnished on a routine basis are uniformly and consistently within contract requirements, a prudent decrease in the frequency interval may be warranted; however, adequate documentation describing the basis for lower testing frequency needs to be filed in the project files. Materials of marginal quality or where past results are erratic, or materials furnished on an intermittent basis, may require more frequent testing to ensure contract compliance.

Sample Identification

When submitted for testing, all samples must be accompanied by a sample identification card, which is Form TL-101 for all samples (aggregate, water and admixtures) except cementitious materials. The sample identification card for cementitious materials is Form TL-518, which is available from the District Materials Lab.

Form TL-101 is reproduced in Figure 8-1. Although the form is generally self-explanatory, care must be taken to ensure that all entries are completed and that the information entered is correct.

All Form TL-101s are to be marked "normal" or "priority". Under current practice, the priority designation is used for the first few samples of each construction material submitted for testing, and at any other time when expeditious testing and reporting of results are necessary to properly control the work.

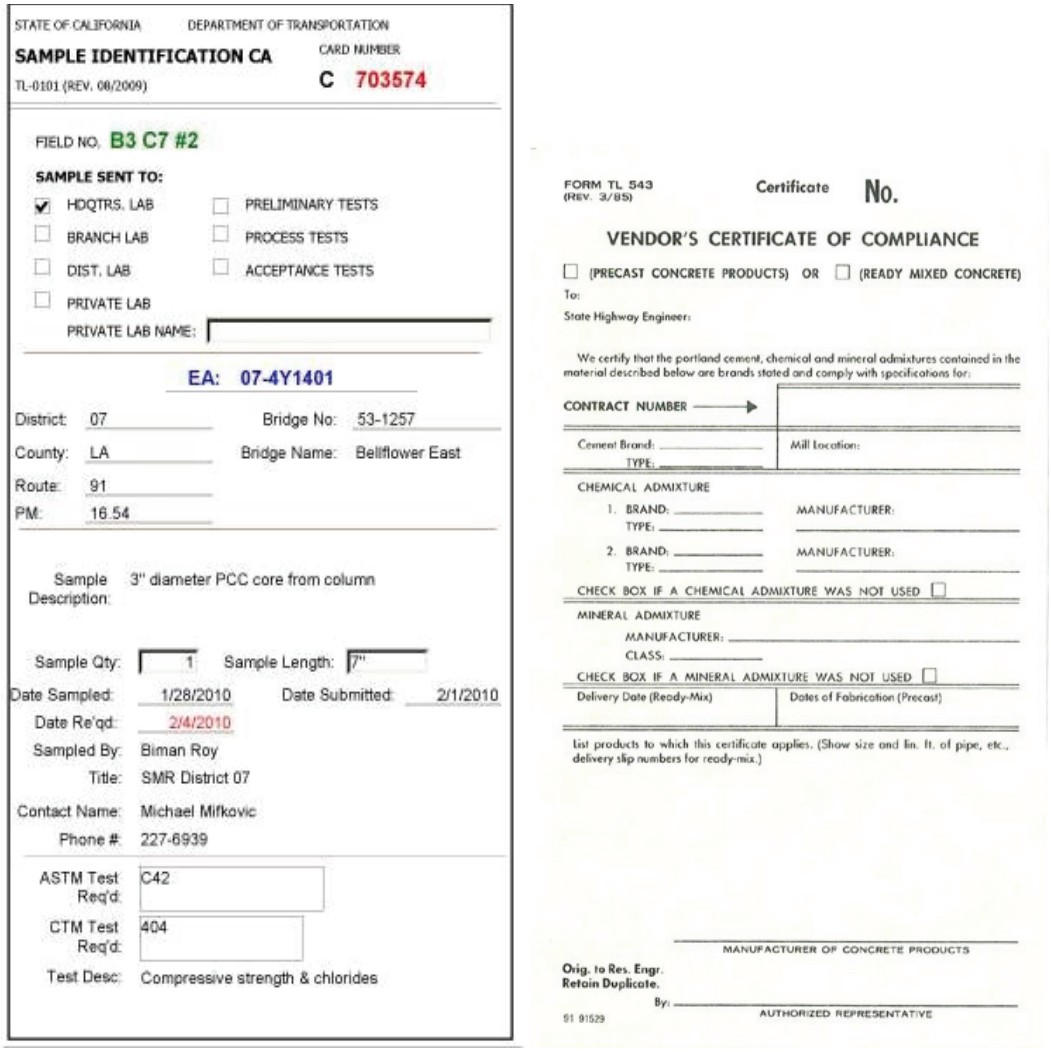
Normally, the lab will e-mail the test results. However, the lab will send results via telephone or FAX results, if requested. If this service is desired, it should be indicated in the remarks section of the sample identification card along with the telephone or FAX number of the person to notify.

Acceptance Testing and Sampling

Present policy requires representative sampling and testing of contractor-furnished materials used in the work. Such tests, because they form the basis of acceptance of the materials, are referred to as "acceptance" tests.

Because acceptance test results are used to accept or reject material, the importance of accurate, representative sampling cannot be overemphasized. It should be obvious that unless the sample is truly representative of the material to be tested, the test will apply to the sample only, and not to the material from which the sample was taken. Likewise, standard test methods and procedures must be followed to ensure the credibility of the test results.

Acceptance testing begins the first day that materials are used, and continues throughout the contract.



STATE OF CALIFORNIA DEPARTMENT OF TRANSPORTATION

SAMPLE IDENTIFICATION CA CARD NUMBER C 703574

TL-0101 (REV. 08/2009)

FIELD NO. B3 C7 #2

SAMPLE SENT TO:

☑ HDQTRS. LAB ☐ PRELIMINARY TESTS
☐ BRANCH LAB ☐ PROCESS TESTS
☐ DIST. LAB ☐ ACCEPTANCE TESTS
☐ PRIVATE LAB
PRIVATE LAB NAME:

EA: 07-4Y1401

District: 07 Bridge No: 53-1257
County: LA Bridge Name: Bellflower East
Route: 91
PM: 16.54

Sample Description: 3" diameter PCC core from column

Sample Qty: 1 Sample Length: 7"
Date Sampled: 1/28/2010 Date Submitted: 2/1/2010
Date Re'qd: 2/4/2010
Sampled By: Biman Roy
Title: SMR District 07
Contact Name: Michael Mifkovic
Phone #: 227-6939

ASTM Test Req'd: C42
CTM Test Req'd: 404
Test Desc: Compressive strength & chlorides

FORM TL 543 (REV. 3/85) Certificate No.

VENDOR'S CERTIFICATE OF COMPLIANCE

☐ (PRECAST CONCRETE PRODUCTS) OR ☐ (READY MIXED CONCRETE)

To:
State Highway Engineer:

We certify that the portland cement, chemical and mineral admixtures contained in the material described below are brands stated and comply with specifications for:

CONTRACT NUMBER →

Cement Brand: TYPE: Mill Location:

CHEMICAL ADMIXTURE
1. BRAND: TYPE: MANUFACTURER:
2. BRAND: TYPE: MANUFACTURER:
CHECK BOX IF A CHEMICAL ADMIXTURE WAS NOT USED ☐

MINERAL ADMIXTURE
MANUFACTURER:
CLASS:
CHECK BOX IF A MINERAL ADMIXTURE WAS NOT USED ☐

Delivery Date (Ready-Mix) | Dates of Fabrication (Precast)

List products to which this certificate applies. (Show size and lin. ft. of pipe, etc., delivery slip numbers for ready-mix.)

MANUFACTURER OF CONCRETE PRODUCTS

Orig. to Res. Engr.
Retain Duplicate.

By: AUTHORIZED REPRESENTATIVE

91 91529

Figure 8-1. TL-0101 and TL 543 Forms.[1]

[1] New form is No.8-C78

Certification of Project Personnel

Under Caltrans policy, all project personnel who perform sampling and testing of materials used in the work must be prequalified by the District Independent Assurance (IA), and must possess a current Form TL-0111, "Tester Certificate of Proficiency."

Form TL-0111 is issued by the District IA, and lists the tests which the individual is authorized to perform. Form TL-0111, which is valid in all Districts, must be renewed every year.

While the District IA will issue a Form TL-0111 to qualified project personnel, including bridge personnel, the OSC Structures Representative assigned to the project is responsible to see that all bridge field personnel are qualified and possess a valid certificate before they perform any acceptance sampling or testing.

Sampling and Testing Aggregate

Most sampling of concrete aggregate, and virtually all testing, will be performed by District Materials lab or District construction field lab personnel. However, from time to time there may be circumstances that will require the bridge engineer to obtain aggregate samples; consequently, bridge engineers must be familiar with recommended sampling procedures, and with the applicable test methods as well.

Sampling methods and procedures shall be in accordance with California Test 125, Appendix A, and at sampling rates described in the Construction Manual.

Aggregate, particularly coarse aggregate, should be sampled as close as practicable to the point of incorporation into the work. This is important because segregation and degradation of the natural material along with the addition of deleterious substances may seriously reduce aggregate quality between the point of production and point of use. The Construction Manual lists the following sample locations in suggested order of preference:

- Conveyor belt between the weigh hopper and the central mixer or transit mix truck
- Conveyor belt feeding the batch plant bins immediately preceding the weigh hopper
- Weigh hopper discharge gate
- Discharge gates of bins feeding the batch plant weigh hopper

The required sample sizes for the various primary aggregate sizes are given in Chapter 6 of the Construction Manual. Note that when a sample taken from the weigh hopper discharge gate is to be used for a grading analysis, the sample size is approximately 400 pounds. Such samples are split or quartered to the test size.

Except for samples for grading analysis, samples from discharge gates should consist of the combination of three "grab-sample" increments taken from the entire stream of material. Obtain each increment at random from an amount of aggregate approximating the batch quantity, or mixer capacity if greater, for that aggregate size. The sampling container must be large enough to intercept the entire discharge, and must not overflow.

When sampling from conveyor belts, the sample should consist of the combination of three increments taken at random from an amount of aggregate approximating the batch quantity, or mixer capacity if larger, for that size of aggregate. Use of a pair of templates, preferably conforming to the shape of the belt, is recommended to isolate each increment on the belt. Care must be taken to recover all material between the templates, including all fine particles and dust. Note that the belt must be stopped while the samples are taken.

Sampling from storage bins and/or stockpiles is not permitted for acceptance testing because it is too difficult to obtain a representative sample.

Aggregates for polyester concrete shall comply with the Standard Specifications and the applicable standard special provisions. In such aggregates, low absorption, roundness, and gradation are controlled to minimize resin content. Coarse and fine aggregates are bagged separately. Sampling aggregates for polyester concrete are similar to sampling at Portland cement concrete batch plants and is covered by California Test 125, Appendix A.

When sampling aggregates all safety precautions need to be observed including awareness of hot aggregate and equipment, dust, ascent and descent of ladders and stairs, and lifting of heavy bags or buckets of aggregate samples. California Test 125 also contains helpful advice on safe practices of aggregate sampling. The plant's safety manual also needs to be reviewed for applicable safety regulations.

Test Methods for Aggregates

Tests normally performed in a District or construction field lab to check aggregate for compliance with specification requirements are briefly described in the following sections. The tests are identified by their California Test numbers. A complete description of each test may be found at Caltrans Materials Engineering and Testing Services – California Test Methods web site http://www.dot.ca.gov/hq/esc/ctms/index.html. Certain ASTM or AASHTO test methods may also apply or may be used. Such tests may be accessed at Caltrans Office of Structural Materials web site at http://onramp.dot.ca.gov/hq/oscnet/, click "Field Resources" and select "ASTMs, etc." from the drop-down menu. For reference, a table is provided below showing California Tests and comparable ASTM or AASHTO tests where available.

Table 8-1. California Test Methods for Aggregates.

Material	California Test	Comparable Test	Description
Coarse Aggregate	202	ASTM C136	Sieve Analysis
	205	ASTM D5821	Percent of crushed particles
	227	ASTM C117	Cleanness of coarse aggregates
	211	ASTM C131	Resistance to abrasion loss
	214	ASTM C88	Soundness (sodium sulfate)
	229	------	Durability index
	224	AASHTO T85	Bulk specific gravity (field method)
	223	------	Surface moisture (field method)
Fine Aggregate	202	ASTM C136	Sieve analysis
	217	ASTM D2419	Sand equivalent
	213	ASTM C40	Organic impurities
	515	------	Relative mortar strength
	214	ASTM C88	Soundness (sodium sulfate)
	225	AASHTO T84	Bulk specific gravity (field method)
	223	ASTM C70	Surface moisture (field method)
Combined Aggregate	202	ASTM C136	Sieve analysis
	226	ASTM C566	Moisture content by oven drying

Sieve Analysis (California Test 202)

This test is used to determine the particle size distribution of both fine and coarse aggregates by separation with standard sieves. Average time to be allowed for testing in the lab: 1/2 day.

Percentage of Crushed Particles (California Test 205)

This test determines the percentage, by weight, of particles that by visual inspection have the characteristics of crushed aggregates.

Resistance to Abrasion Loss (California Test 211)

For concrete used in highway and bridge construction, one of the most important factors in aggregate selection is the ability of the aggregate to withstand wear. This aggregate property is commonly referred to as “abrasion resistance”. Abrasion resistance is often used as a general indication of overall aggregate quality.

The abrasion resistance of a given aggregate is determined by California Test 211, which is commonly known as the Los Angeles Rattler Test. This test measures the ability of coarse aggregate to resist disintegration caused by impact in a rotating cylinder containing small steel balls (note that only coarse aggregate is tested for abrasion resistance). Average time to be allowed for testing in the lab: 1/2 day.

Soundness and Durability (California Tests 214 and 229)

The term "soundness" is used to describe the ability of an aggregate to withstand splitting and fracturing when exposed to severe weather conditions. This aggregate quality is measured by California Test 214, which is referred to as the "soundness" test. This test is used to determine the soundness of both fine and coarse aggregates.

In California Test 214, a sample of aggregate is immersed in a sodium sulfate solution for at least 16 but not more than 18 hours. During this period salt crystal growth in the aggregate pores creates a pressure that is similar to that produced by freezing water. After the immersion period, the sample is oven-dried until a constant weight is obtained. The test sample is then cooled and the test repeated. Average time to be allowed for testing in the lab: 7 days

The immersion, drying, weighing, and cooling cycle is repeated five times. The sample is then shaken through sieves having openings one-half the size of those on which the aggregate was originally retained. The percentage loss is determined on each individual fraction of the original sample and a weighted average loss is calculated. Total material loss is limited to not more than 10%.

The Durability Index provides a measure of the relative resistance of an aggregate to producing clay-sized fines when subjected to prescribed methods of interparticle abrasion in the presence of water. California Test 229 provides direction for evaluating the Durability Index. Four procedures are provided for use with materials with various nominal sizes and specific gravities. Average time to be allowed for testing in the lab: 1/2 day

Sand Equivalent (California Test 217)

This test provides a rapid means of determining the amount of detrimental fine particles (silt or clay) present in a sample of fine aggregate. The test result is expressed in terms of a "sand equivalent" value, or "SE".

In this test, a test specimen prepared from the aggregate sample is placed in a graduated cylinder containing a calcium-chloride solution, and allowed to soak for 20 minutes. The cylinder is then secured in a mechanical shaker and agitated for 45 seconds. Additional solution is added, using an irrigator to flush the clay-size particles from the sample and into suspension in the solution. The cylinder is then allowed to stand undisturbed for 20 minutes. Following the 20-minute settlement period, the clay sediment and sand sediment height "readings" are determined in accordance with the procedure explained in the test method. The sand-equivalent value is the sand reading divided by the clay reading multiplied by 100, and then rounded up to the next higher whole number.

Since the sand-equivalent value is inversely proportional to the percentage of fine particles present in the sample, higher values indicate a better (cleaner) material. Average time to be allowed for testing in the lab: 1/2 day

Surface Moisture (California Test 223)

Surface moisture is defined as moisture in excess of the moisture present in the aggregate when the aggregate is in a saturated surface-dry condition.

This test is used in the field as a rapid means of determining the amount (percent) of surface moisture present in a sample of fine or coarse aggregate having a known specific gravity. The test requires only 2 or 3 minutes to perform and is accurate within about 0.2% (plus or minus) of the true value.

In this test a sample weighing approximately 18 lb is placed in a pail with enough water to cover the sample, and stirred to remove any entrapped air. The pail is then filled with water, suspended from a weighing device, and the pail with sample is immersed in a container of water, and weighed. The weight of the sample in water is equal to the weight in water of the pail and sample minus the weight in water of the pail alone (previously determined). From this information the approximate surface moisture percentage can be calculated, using the formula given in the test method instructions.

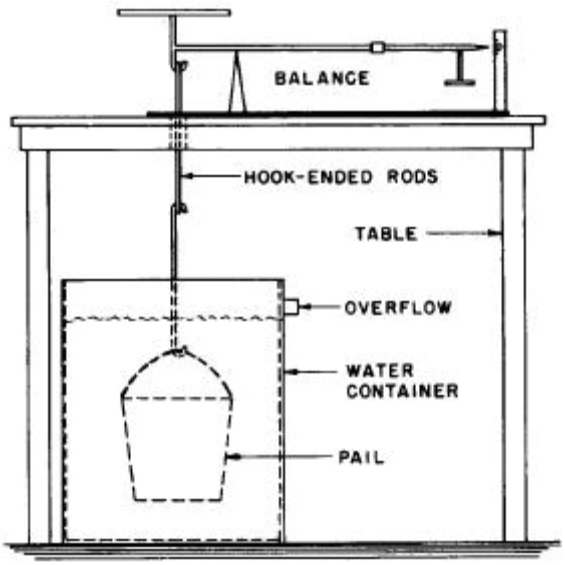


Figure 8-2. Surface Moisture Test.

Specific Gravity of Coarse Aggregate (California Test 224)

This test provides a rapid means of determining the bulk specific gravity of coarse aggregate. The test procedure is similar to California Test 223 for determining surface moisture by the displacement method. In this test, however, the sample is first brought to an approximate saturated surface-dry condition by wetting the sample and then rolling the wet sample in an absorbent cloth to remove excess moisture. The sample is then placed into the pail, and the California Test 224 procedure is followed.

Specific Gravity of Fine Aggregate (California Test 225)

This test provides a rapid means of determining the bulk specific gravity of fine aggregate. Except for the method of drying the sample, the test procedure is similar to California Test 224 for coarse aggregate.

Moisture Content by Oven Drying (California Test 226)

This test is used to determine the water content of a material by drying the sample to a constant weight at a specified temperature. The water content is expressed as a percentage, by weight, of the dried sample. Average time to be allowed for testing in the lab: 1 day.

Cleanness of Coarse Aggregate (California Test 227)

This test is used to determine the quantity of detrimental fine particles present in a sample of coarse aggregate. It is similar in purpose and procedure to the sand equivalent test which is performed on fine aggregate; however, in this test the fine material is removed from the aggregate by washing and the exact test procedure varies with the size of the coarse aggregate being tested.

Test results are rounded up to the nearest whole number, which is the “cleanness value” of the tested material. Average time to be allowed for testing in the lab: 1/2 day.

Alkali Reactivity of Aggregates

Two ASTM test methods are acceptable methods of determining the susceptibility of an aggregate to react with alkali materials.

Short Method, ASTM C 1260

This test method provides a means of detecting, within 16 days, the potential of an aggregate intended for use in concrete for undergoing alkali-silica reaction resulting in potentially deleterious internal expansion. It is especially useful for aggregates that react slowly or produce expansion late in the reaction. However, it does not evaluate combinations of aggregates with cementitious materials nor are the test conditions representative of those encountered by concrete in service. Since the specimens are exposed to a NaOH solution, the alkali content of the cement is not a significant factor in affecting expansions.

Long Method, ASTM C 1293

This test method covers the determination of the susceptibility of an aggregate or combination of an aggregate with pozzolan or slag for participation in expansive alkali-silica reaction by measurement of length change of concrete prisms. This test method is considered the most reliable test method for assessing ASR on an aggregate. Its main disadvantage is the 1-year duration needed for the testing.

Material Sampling

Sampling Cementitious Materials

Cementitious materials are one of few construction materials accepted for use in the work on the basis of a certificate of compliance. However, cementitious materials samples are still required, as explained in the following section. Cementitious materials to be used in Caltrans projects are required to be on the Authorized Materials List (AML) at the time of mix design submittal. The list can be found at http://www.dot.ca.gov/hq/esc/approved_products_list/.

For cementitious materials used in precast concrete products or in ready-mixed concrete, the certification is made on Form TL-543[2], Vendor's Certificate of Compliance. A copy of this form is reproduced in Figure 8-1. The certificate will be signed by the manufacturer of the precast product or by the ready-mix concrete supplier, as the case may be.

Cementitious materials used in ready-mix concrete may be certified by a single certificate, for each brand of cementitious materials used, covering all concrete delivered to the project on a given day. The certificate must show the brand name and mill location, and each delivery covered by the certificate must be identified by the delivery slip number.

[2] New form is No.8-C78

For precast products, such as precast concrete piles, the required certificate of compliance will be furnished to the Caltrans' representative who is inspecting the manufacturing of the product. The certificate of compliance will form part of the required documentation for acceptance and release of the precast product.

If cementitious materials are delivered directly to the site of the work, as will be the case if the contractor or a supplier has set up a portable batch plant at the job site, the certificate of compliance is signed by the cementitious materials manufacturer. One certificate is required for each shipment.

For cementitious materials delivered directly to the job site, the certification may be on a State form or on the manufacturer's own form. In either case, the certificate must show the name of the cementitious materials mill, the date of shipment and quantity shipped, and a serial number traceable to a specific silo, bin or lot of cementitious materials as identified by the manufacturer. The certification must show the contract number and type and brand of cementitious material, and must state that the cementitious material meets contract requirements. Sampling cementitious materials shall be in conformance with California Test 125, Appendix C.

Even though the cementitious material is covered by a certificate of compliance, samples must be taken periodically and submitted to the METS lab in Sacramento. Cementitious materials sampling frequency is given in Chapter 6 of the Construction Manual. The lab does not test all samples submitted, but samples are tested randomly to monitor the manufacturer's quality control procedures and to independently verify that the cementitious material used in the work meets all specification requirements.

Cementitious material samples may be taken from the weigh hopper or from the conveyor belt or feed line leading to the weigh hopper. Note that the full 8 lb sample should be taken at one time, not in smaller increments. The sample bag should be closed immediately and a flexible tie placed high on the bag to leave room for the cement to shift in the bag. The sealed bag is placed in a second plastic bag with the white copy of Form TL-518, and the outer bag closed with a flexible tie.

Cementitious material samples should be shipped to the lab in special cartons (which are designed to hold a single 8 lb sample) provided for this purpose. If more convenient, samples may be shipped in concrete test cylinder cartons which will conveniently hold six samples. However, no more than six samples should be shipped in any one container.

The outside of the shipping carton should be marked "Cementitious Material Sample". Cementitious material samples, if tested, will be tested soon after being received at the lab; therefore, samples should be shipped promptly rather than accumulated merely to facilitate packaging.

Supplementary cementitious materials are sampled similar to cementitious materials if in powdery form. If in liquid form, supplementary cementitious materials will be sampled similar to admixtures.

Sampling Water

Samples of water to be used in Portland cement concrete should be sent to the lab for analysis unless there is definite evidence of suitability. For example, water intended for domestic use need not be tested unless it is suspected of having a high chloride or sulfate content. If there is doubt, a sample should be submitted prior to use.

Water obtained from a non-commercial source, such as a well or a river, should be sampled and tested, even though the water may be potable and free of obvious impurities. Testing will be in accordance with California Test 405 (methods for chemical analysis of water), 417 (testing for sulfate content), and 422 (testing for chloride content). Water reclaimed from mixer wash-out operations may be used in mixing concrete. The alkali content and specific gravity requirements are specified in Section 90 of Standard Specifications. Reclaimed water, also known as recycled water, has been recovered from domestic, municipal, and industrial wastewater treatment plants, where impurities were removed. The treated water must meet the cleanliness standards for use in concrete as specified in the Standard Specifications. Chapter 2 of this manual discusses the water requirements in detail.

Samples of water are shipped in special plastic containers which are available for this purpose. Leave room in the container for expansion.

Sampling Admixtures

Most commercially available admixtures in common use have been tested for their suitability in structure concrete work on State highway projects, and those that are acceptable are included in the Authorized Materials List (AML), referenced before.

Admixtures on the authorized list, if accompanied by a certificate of compliance stating that the admixture furnished is the same as the admixture previously authorized, may be used prior to testing. Admixtures not on the authorized list, shall not be used but may be submitted for inclusion in the AML, see the website for the prequalification process. For

admixtures on the authorized list but supplied without the required certificate of compliance, the sample must be received in the lab at least one week prior to the intended use.

Samples of liquid admixtures should be taken from the delivery tube at the batch plant by filling a 1 quart can or plastic bottle [3]

The sample identification card (Form TL-101) must include the manufacturer's lot number and the type of work in which the admixture will be used; i.e., prestressed concrete, reinforced concrete, etc. This information is needed by the lab to determine the suitability of the admixture for the intended use and to determine the maximum allowable dosage.

Sampling for Polyester Concrete

Initially, manufacturers need to send samples along with available QC documents to the METS lab at least 15[4] days prior to shipping their products to the jobsite. The sample shipment shall include:

- Polyester Resin
- Promoter
- Initiator
- Aggregate

The Manufacturers will include the specific polyester concrete mix design for that project to the METS lab.

For sampling at the site, it is recommended that polyester concrete samples be taken from the back of the machine. The samples should be no larger than 2″ deep by 4″ in diameter. When sending the sample to the METS lab for processing, attach the TL-101 to the sample. Additionally, request unit weight and burn off tests for resin content. The resin content information on the dispensing machine at the time that the sample is pulled should be provided on the TL-101. For gradation analysis, aggregate samples taken prior to addition of the resin can be sent to the METS lab. Typically no more than 2 pounds of dry material is required.

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[3]2006 Standard Specifications 90-4.10 require each liquid admixture dispensing system to be equipped with a sampling device consisting of a valve located in a safe and readily accessible position, or 2010 Standard Specifications 90-1.02 F(4)(b)

[4]2010 Standard Specifications 15-5.06 A(2).

Sampling in the field for quick verification of aggregate ratios will require 3/8" and No.4 sieves, pan and scale for weighing. A sample of dry aggregate that has been combined but not yet mixed with the resin can be pulled from the belt, hand shaken and weighed to check the coarse to fine ratio of the aggregate. There should be no material retained on the 3/8" sieve.

The resin, catalyst and promoter are not sampled in the field. That work is done in advance as it is not possible to sample these items and receive results once the material has arrived on the project. Test methods for resin for polyester concrete are addressed in the applicable Specifications[5]. These test methods attempt to measure a number of properties of the resin including viscosity, specific gravity, elongation, tensile strength, bond strength and styrene content.

The aggregate should be delivered to the site in kiln-dried sealed bags or buckets. Should a bag be torn or a bucket damaged on arrival and open to the elements, the material is to be rejected.

[5] 2010 Standard Specifications 15-5.06 B.