

<b>MANUAL CHANGE TRANSMITTAL</b>		NO. <b>19-9</b>
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SUBJECT AREA Sections 4-39 and 6-1	ISSUING UNIT  Division of Construction	
SUPERSEDES  Sections 4-39 and 6-1 of July 2019	DISTRIBUTION  All Requested Manual Holders	

The purpose of this manual change transmittal is to announce updates and corrections to the Caltrans *Construction Manual*. The following section or sections have been updated to reflect new policy and supersede the corresponding section of the *Construction Manual* as previously published. Updated sections are available at <https://dot.ca.gov/programs/construction/construction-manual> and are indicated by the date listed in the right-hand column on that page. Changes are identified by change lines in the margins in this document.

**Section 4-39, “Asphalt Concrete”**

Directs the use of California Test 384, “Method of Test to Determine Combined Gradation for Hot Mix Asphalt (HMA) Using up to 25% Reclaimed Asphalt Pavement (RAP)” instead of Lab Procedure 9, “Hot Mix Asphalt (HMA) using Up to 15% Reclaimed Asphalt Pavement (RAP).”

**Section 6-1, “Sample Types and Frequencies”**

Revises sample shipping from field to district materials laboratories from cash on delivery to prepaid.

## Section 39 Asphalt Concrete

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### Section 39 Asphalt Concrete

#### 4-3901 General

Section 39, “Asphalt Concrete,” of the *Standard Specifications* provides material and construction requirements for hot mix asphalt (HMA) including Type A, rubberized hot mix asphalt-gap graded (RHMA-G), open-graded friction course (OGFC), minor HMA, and hot mix asphalt with warm mix asphalt (WMA) additive technology. Unless WMA is specified, the term “hot mix asphalt” refers to all mixtures of aggregate and asphalt regardless of the mixing or placing temperature. Section 39 also provides construction requirements for work on existing asphalt concrete facilities.

All requirements including smoothness requirements in Section 39, except those in Section 39-3, “Existing Asphalt Concrete,” of the *Standard Specifications*, apply to all types of HMA.

*Construction of Hot Mix Asphalt Pavements (Manual Series No. 22)*, published by the Asphalt Institute, contains information on the uses of types of asphalts and the design and production of HMA. All personnel responsible for HMA should familiarize themselves with this publication.

#### 4-3901A Warm Mix Asphalt

WMA technologies allow production plants to produce HMA at Fahrenheit temperatures 45 degrees to 85 degrees lower than the traditional mixing temperature. Reductions in mixing temperature have the benefits of cutting fuel consumption and decreasing the production of greenhouse gases, with engineering benefits of better compaction on the road, the ability to haul paving mix for longer distances, and extending the paving season by being able to pave at lower temperatures.

WMA technologies are divided into two categories—additive technology and water injection technology, or foaming. When a WMA technology is used to aid mixing and compaction of HMA produced at reduced temperatures, it is defined as HMA with WMA technology. The contract allows that both categories of WMA technology may be used for Type A HMA, RHMA-G, and OGFC. The contract may include special provisions that require the use of WMA additive technology. When a WMA technology is used, Section 39-2.01A(1), “Summary,” of the *Standard Specifications* requires that contractors choose a technology that is on an Authorized Material List for WMA authorized technologies.

#### 4-3901B Rubberized Hot Mix Asphalt

RHMA is produced by mixing asphalt rubber and aggregate. Asphalt rubber is specified to include 18 percent to 22 percent crumb rubber modifier (CRM) by total mass of the asphalt rubber blend. The CRM must also include 25 percent, plus or minus 2 percent, high natural rubber content scrap rubber by mass of the CRM that

may come from scrap tires or other sources. Caltrans requires use of extender oil as an asphalt modifier in asphalt rubber. RHMA includes RHMA-G (gap graded), RHMA-O (open-graded), and RHMA-O-HB (open-graded high binder).

#### 4-3901C Paving Personnel

Producing HMA pavement requires a partnership among Caltrans, the plant producing the HMA, and the contractor placing the HMA. The resident engineer must clearly communicate assignments of responsibility and commensurate authority for all Caltrans personnel, both at the job site and at the plant.

Plant inspection and testing is essential to assure quality HMA. A plant inspector at the HMA plant usually performs the inspection and testing duties for the resident engineer. However, the resident engineer is responsible for enforcing contract specifications at the plant. The resident engineer must be kept informed of test results in a timely manner so appropriate contract administration action can be taken.

The paving inspector should have completed both “Hot Mix Asphalt Basics” and “Hot Mix Asphalt Inspection” training courses before assignment as the HMA paving inspector. In addition, a paving inspector who samples material must also be qualified on California Test 125, “Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections,” Appendix D, “Bituminous Materials.”

#### 4-3901D Hot Mix Asphalt Quality Assurance

HMA is placed using a specified quality assurance process. The process requires the contractor to perform quality control testing and Caltrans to perform acceptance testing and inspection.

For most quality control characteristics, the contractor samples and tests at a minimum frequency of once per 750 tons of produced HMA. For Caltrans acceptance sampling and testing, test at the frequency shown in Section 6-1, “Sample Types and Frequencies,” of this manual. For most tests, test a minimum of every fifth sample, but not less than once per day.

The contractor is responsible for providing a quality control plan (QCP). Review the QCP and verify that it includes the required elements and sufficiently describes the contractor’s proposed quality control processes. Verify that the contractor follows the QCP, and when required, verify that the contractor expeditiously makes changes necessary to control quality. Make sure that the contractor promptly reports quality control measures and test results to Caltrans personnel. The contractor is not required to have quality control inspectors onsite during placement operations. Caltrans performs all on-site inspection.

#### **4-3902 Before Work Begins**

Verify that the contractor submits a job mix formula and a QCP for HMA production and placement for all types of HMA. Job mix formula and QCP submittals are not required for HMA that is used for miscellaneous areas and dikes.

The contractor's laboratories used for testing aggregate and HMA qualities for determining the job mix formula and the independent third-party laboratory performing dispute resolution testing must be qualified under the American Association of State Highway and Transportation Officials (AASHTO), Materials Reference Laboratory (AMRL) program, and the Caltrans' Independent Assurance Program (IAP). The contractor's quality control laboratory is not required to be certified by AMRL or IAP, because the tests are not being used for acceptance.

Caltrans laboratories performing acceptance testing must be qualified under the AMRL and IAP. Caltrans' field laboratories meet the AMRL requirements when Caltrans' central materials laboratory meets the requirement. HMA plants must comply with the *Material Plant Quality Program (MPQP)* manual guidelines. A link to the manual may be found here:

<https://dot.ca.gov/programs/construction/material-plant-quality-program>

#### 4-3902A General

Before the work begins, the resident engineer will:

- Determine the type of HMA specified for the project and review the plans and the special provisions. The special provisions specify the type of HMA, aggregate size, and asphalt binder grade.
- Review the project specifications' measurement and payment clauses and determine what records must be kept.

#### 4-3902B Job Mix Formula Submittal

Review the documents in the contractor's job mix formula submittal information to verify they are complete. Notify the contractor immediately if the submittal is incomplete. Include:

- Form CEM-3511, "Contractor Job Mix Formula Proposal," which documents target values for aggregate sieves, percent of asphalt binder, and source information for all HMA component materials. If applicable, Form CEM-3511 will also include the percentage of reclaimed asphalt pavement and antistripping treatment method.
- Form CEM-3512, "Contractor Hot Mix Asphalt Design Data," which documents the testing data developed by the mix design laboratory. If Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," is not attached, the completed mix design data Form CEM-3512 must have been dated within the past 12 months.
- Form CEM-3513, if submitted, documents Caltrans' verification test results for the proposed job mix formula. Form CEM-3513 must have been signed by an engineer, preferably the district materials engineer, within 12 months of the start of planned HMA production.
- Safety Data Sheets in accordance with Section 39-2.01A(3)(b), "Job Mix Formula," of the *Standard Specifications*.

#### 4-3902C Job Mix Formula Review

The resident engineer must:

- Review the contractor's proposed job mix formula submitted on Form CEM-3511, "Contractor Job Mix Formula Proposal," for compliance with Section 39-2, "Hot Mix Asphalt," of the *Standard Specifications* and additional requirements in the special provisions. Notify the contractor immediately if the proposed job mix formula does not comply with the specifications.
- Review the contractor's proposed job mix formula submitted on Form CEM-3511, and verify the asphalt binder supplier is on the Caltrans list of approved suppliers at:

<https://dot.ca.gov/programs/engineering-services/asphalt-supplier-certification-program>

- If the asphalt binder supplier is not on Caltrans' list of approved suppliers, notify the contractor that asphalt binder supplied for the project must comply with Section Q, "Requirements for Suppliers Supplying Asphalt Without a Certificate of Compliance," in the *Program Guidelines Document* at the link above. If WMA technology (additive or water injection foam) or crumb rubber modifier are used, verify they are on the applicable Caltrans Authorized Material List at:

<https://dot.ca.gov/programs/engineering-services/authorized-materials-lists>

If the submitted job mix formula proposal complies with the specifications, notify the contractor within 5 days of submittal that:

1. The job mix formula is accepted if Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," was issued within 12 months of proposed HMA production. The resident engineer signs and returns Form CEM-3511.
2. The job mix formula must be verified if Form CEM-3513 was not issued within 12 months of proposed HMA production. The resident engineer requests that the contractor give notice for when HMA will be produced for verification and notifies the district materials engineer.
3. For open-graded friction course HMA, if Form CEM-3513 was not issued within 12 months of proposed HMA production, the resident engineer requests that the contractor give notice for sampling of aggregate, binder, and additives.

#### 4-3902D Job Mix Formula Verification

##### *4-3902D (1) General*

The contractor takes the following steps related to job mix formula verification for all types of mixes.

If the proposed job mix formula has not been verified within 12 months of production, the contractor must furnish material samples in accordance with Section 39-2.01A(3)(b), "Job Mix Formula," of the *Standard Specifications*, including:

- Coarse, fine, and supplemental aggregate from stockpiles, cold feed belts, or hot bins. Samples must include at least 120 pounds for each coarse aggregate, 80 pounds for each fine aggregate, and 10 pounds for each type of supplemental fines.
- Reclaimed asphalt pavement from stockpiles or reclaimed asphalt pavement system (if used). Samples must be at least 60 pounds.
- Asphalt binder from the binder supplier. Samples must be in two 1-quart cylindrical cans with open top friction lids.
- Asphalt rubber binder with the components blended in the proportions to be used. Samples must be in four 1-quart cylindrical cans with open top friction lids.
- Antistrip additives if used.

The resident engineer's verification process includes:

- Receiving notification from the contractor at least 2 business days before sampling material so that an inspector may be present during the sampling.
- Witnessing the contractor sampling HMA and component materials.
- Shipping the samples immediately to the district materials laboratory. They will be processed according to the instructions included on Form TL-0101, "Sample Identification Card." The TL-0101 should be marked "Priority" and include "Job Mix Formula Verification Sample" under "Remarks."
- Providing job mix formula verification results to the contractor on Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," within 20 days of receiving all samples.

#### *4-3902D (2) Verification Process for Open-Graded Friction Course*

For samples of aggregate, asphalt binder, and additives, if applicable:

- Request that the district materials lab determine if the aggregates comply with the contract quality requirements.
- Request that the district materials laboratory determine asphalt binder content under California Test 368, "Method of Test for Optimum Bitumen Content (OBC) for Open Graded Friction Course."
- Within 20 days of material sampling, Caltrans will determine asphalt binder content and provide the contractor with Form CEM-3513.
- Within 20 days of receipt of a complete job mix formula submittal and material sampling, the resident engineer signs and returns the accepted or rejected job mix formula on Form CEM-3511, "Contractor Job Mix Formula Proposal," with Form CEM-3513 attached, to the contractor immediately following receipt of Form CEM-3513 from the district materials laboratory.

#### 4-3902D (3) *Verification Process for Type A and Rubberized Hot Mix Asphalt-Gap Graded*

If the contractor's job mix formula proposal has not been verified, the contractor must provide aggregate and HMA verification samples from the plant that will be used for the project. The contractor samples in accordance with California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections."

Samples are obtained at the following locations:

- Aggregates are sampled from cold feed belts or hot bins.
- Reclaimed asphalt pavement, if used, is sampled from the reclaimed asphalt pavement system.
- HMA is sampled at the plant, in a truck, from a windrow, the paver hopper, or on the mat behind a paver.

Test verification samples for compliance with the specifications. Refer to Section 39-2.01A(4)(b), "Job Mix Formula Verification," of the *Standard Specifications*.

Make sure that the proposed job mix formula is verified by the district materials laboratory within 20 days of sampling HMA or when requested in writing by the contractor within 3 business days for rubberized HMA. Verification is done when the district materials engineer completes and returns Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," to the resident engineer. Form CEM-3511, "Contractor Job Mix Formula Proposal," must also be completed by the resident engineer and returned to the contractor along with Form CEM-3513 within this time frame.

For HMA using WMA technology:

- Obtain the result and a tested sample set for AASHTO T 324, "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," from the contractor.
- Verify the HMA compliance with the mix design requirements for both AASHTO T 324 and AASHTO T 324 (Modified).
- Verify RHMA-G-WMA quality requirements within 5 business days.

#### 4-3902D (4) *Unverified Proposed Job Mix Formula*

If the district materials laboratory does not verify the proposed job mix formula:

- The resident engineer notifies the contractor in writing on Form CEM-3511, "Contractor Job Mix Formula Proposal," of the rejected job mix formula, attaching Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," with Caltrans verification test results.
- The contractor may submit a new job mix formula on Form CEM-3511 with a new Form CEM-3512, "Contractor Hot Mix Asphalt Design Data," or the contractor may adjust the job mix formula on Form CEM-3511 with allowable adjustments specified in Section 39-2.01A(4)(b), "Job Mix Formula Verification," of the *Standard Specifications*.

- If the contractor disputes Caltrans' verification test results, make sure that the contractor complies with Section 39-2.01A(4)(i)(iv), "Dispute Resolution," of the *Standard Specifications*.

#### **4-3902D (5) Adjusted Job Mix Formula**

The contractor may adjust the job mix formula to meet the specifications. Justification for any adjustments outside the target values shown on Form CEM-3512, "Contractor Hot Mix Asphalt Design Data," must be listed on the modified Form CEM-3511, "Contractor Job Mix Formula Proposal."

If the adjusted job mix formula proposal complies with the specifications, arrange with the contractor a time to witness the sampling of plant produced HMA.

Make sure that the proposed job mix formula is verified by the district materials laboratory within 20 days of sampling HMA or when requested in writing by the contractor or within 3 days of sampling rubberized HMA. Verification is done when the district materials engineer completes and returns Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," to the resident engineer. Form CEM-3511 must also be completed by the resident engineer and returned to the contractor with Form CEM-3513 within 20 days of sampling HMA.

If the district materials laboratory does not verify the adjusted proposed job mix formula, notify the contractor in writing on Form CEM-3511 and attach Form CEM-3513 with Caltrans' verification test results.

If the adjustment failed to resolve the job mix formula verification problem, the contractor may propose a new job mix formula or dispute Caltrans test results in accordance with Section 39-2.01A(4)(i)(iv), "Dispute Resolution," of the *Standard Specifications*.

#### **4-3902E Job Mix Formula Renewal**

A verified job mix formula is good for only 12 months so the contractor may request a job mix formula renewal if the HMA production will be stopped for more than 30 days or the contractor wants to use the accepted job mix formula on another contract.

Verify that the contractor takes the following steps for job mix formula renewal:

- Submits the proposed job mix formula on Form CEM-3511, "Contractor Job Mix Formula Proposal," attaching the previously verified job mix formula on Form CEM-3513, "Caltrans Hot Mix Asphalt Verification," and the mix design information for previously verified job mix formula on Form CEM-3512, "Contractor Hot Mix Asphalt Design Data."
- Notifies the resident engineer prior to sampling materials.
- Samples materials at the locations and quantities shown in Section 4-3902D, "Job Mix Formula Verification," of this manual. HMA must be sampled at the location approved in writing by the resident engineer.

- Submits Form CEM-3514, “Contractor Job Mix Formula Renewal.” Contractors use Form CEM-3514 to submit to the resident engineer their test results for renewal of HMA job mix formula.

The resident engineer’s job mix formula renewal process includes:

- Reviewing the proposed job mix formula on Form CEM-3511. Refer to Section 4-3902C, “Job Mix Formula Review,” of this manual. If the submitted job mix formula proposal complies with the specifications, the resident engineer notifies the contractor within 5 days that split-sampled HMA and component materials must be provided.
- Witnessing the contractor sampling HMA and component materials. Take possession of the material samples and hold until receiving contractor test results.
- Reviewing the information on Form CEM-3514 to confirm that the contractor test results comply with the specifications. When the test results indicate that the sampled and tested HMA complies with the specification, request that the district materials laboratory perform HMA verification testing.
- Shipping material samples to the district materials laboratory if the contractor’s test results on Form CEM-3514 comply with the specifications. Samples will be processed according to the instructions on Form TL-0101, “Sample Identification Card.” The TL-0101 should include “Job Mix Formula Renewal Verification Sample” under “Remarks.”
- Providing job mix formula verification results to the contractor on Form CEM-3513 within 30 days of receiving Form CEM-3514 from the contractor.

#### 4-3902F Job Mix Formula Acceptance

Job mix formula acceptance requires the resident engineer to review and accept submitted Form CEM-3511, “Contractor Job Mix Formula Proposal,” with Form CEM-3512, “Contractor Hot Mix Asphalt Design Data,” and an accepted Form CEM-3513, “Caltrans Hot Mix Asphalt Verification,” attached. Refer to Section 4-3902C “Job Mix Formula Review,” of this manual for guidelines on reviewing Form CEM-3511.

#### 4-3902G Plant Operations

HMA plants must be qualified under the *MPQP*. Refer to Section 3-902E, “Weighing Equipment and Procedures,” of this manual for additional information.

Before production begins, take the following steps related to HMA plant operations:

- Verify with the district weights and measures coordinator that the proposed HMA plant and production equipment for performance grade modified asphalt binder with CRM is Caltrans-qualified under the *MPQP*. Batch HMA plants must be qualified annually, and continuous HMA plants must be qualified at least every 6 months, in accordance with Chapter 1, Section II-C, “Frequency,” of the *MPQP* manual.

- If the HMA plant is not qualified, notify the contractor in writing and provide the contact information for the district weights and measures coordinator. The contractor must give the district weights and measures coordinator 5 business days' notice to schedule HMA plant qualification.
- Accept HMA for up to 14 days from a nonqualified plant if start-up approval has been granted in writing by the district weights and measures coordinator.

#### 4-3902H Antistrip Treatment of Aggregates

HMA may be sensitive to moisture damage and require antistrip treatments. The treatment method can be either lime treatment (by dry lime, dry lime with marination, or lime slurry with marination) or liquid antistrip. Regardless of the type of antistrip treatment chosen by the contractor, the HMA must meet the requirements of AASHTO T 283, "Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage," and AASHTO T 324, "Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)."

When the contractor chooses to use antistrip treatment of aggregate, the contractor must test the proposed HMA aggregate blend for plasticity index in accordance with California Test 204, "Method of Tests for Liquid Limit, Plastic Limit, and Plasticity Index of Soils." When California Test 204 indicates clay is present in the aggregates, the plasticity index is used to determine the type of antistrip treatment. Refer to Section 39-2.01B(2)(b) "Hot Mix Asphalt Treatments," of the *Standard Specifications* for the treatment method allowed.

#### *4-3902H (1) Lime Treatment of Aggregates*

There are two methods for lime treatment of aggregates:

- Hot mix asphalt aggregate lime treatment—slurry method
- Hot mix asphalt aggregate lime treatment—dry lime method

Using the slurry method, treated aggregates are always marinated. Under the dry lime method, if the plasticity index is 4 through 10, aggregates must be marinated. When marination is required, the lime-treated aggregate must be stockpiled for 24 hours to 60 days before using in HMA.

Reclaimed asphalt pavement used in the production of HMA does not need to be lime treated.

Quality characteristic acceptance test limits for aggregate properties are based on untreated aggregates. Therefore, aggregate quality control and acceptance testing must be performed on aggregate samples taken before lime treatment.

During lime treatment, the sand equivalent test is used to signal a change in the presence of clays. If sand equivalent values decrease significantly, the plasticity index of the aggregate blend must be tested to verify that it continues to be in the acceptable range listed in the special provisions.

If clays are present in the aggregate blend, both lime treatment methods must be followed by marination.

For lime-treated aggregates, before lime treatment begins, take the following steps:

- Verify with the district weights and measures coordinator that the proposed lime treatment plant is Caltrans-qualified under the *MPQP*.
- Verify the lime proportions for the fine and coarse aggregate or for the combined aggregates shown on the job mix formula.

During lime treatment, take the following steps:

- Obtain aggregate samples from stockpiles in accordance with California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections," to field test for moisture content and sand equivalent at the frequency shown in Table 6-1.13, "Materials Acceptance Sampling and Testing Requirements: Asphalt Concrete," in Section 6-1, "Sample Types and Frequencies," of this manual.
- Test aggregate samples for sand equivalent at the frequency shown in Table 6-1.13 of this manual. Combine aggregate from individual stockpiles in the job mix formula proportions to test for sand equivalent. If the sand equivalent test result exceeds the specified limits, immediately notify the resident engineer.
- It is good practice to test aggregate samples for moisture content in accordance with AASHTO T 255, "Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying," or AASHTO T 329, "Standard Method of Test for Moisture Content of Asphalt Mixtures by Oven Method," because moisture influences proportioning. The plant inspector should confirm that the contractor is performing sampling and testing for moisture content at a frequency shown in Section 39-2.02A(4)(b)(ii), "Aggregates," of the *Standard Specifications*.
- Obtain aggregate samples from stockpiles or aggregate belts before lime treatment, in accordance with California Test 125. Sample aggregates at the frequency shown in Table 6-1.13 of this manual for aggregate acceptance testing.

Label each aggregate sample with the contract number, date, type of mix, aggregate gradation (for example, 1/2 inch), aggregate source, HMA producer, and producer's mix identification number. Indicate the number of tons produced when the sample was taken.

- Test aggregate at the frequency shown in Table 6-1.13. For samples that will be shipped to the district material laboratory or field construction laboratory for testing, complete Form TL-0101, "Sample Identification Card." Follow the instructions printed in the form booklet and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Record the type of mix, the HMA producer, and the producer's mix identification number. Check the acceptance tests box on the TL-0101. Under "Remarks," identify the tests to be performed:

1. Los Angeles Rattler

2. Percent of crushed particles coarse aggregate
3. Percent of crushed particles fine aggregate
4. Fine aggregate angularity
5. Flat and elongated particles
6. Other aggregate properties specified in the project special provisions, if applicable

If any test results exceed the specified limits, the materials laboratory will immediately notify the resident engineer.

- Verify that the aggregate treatment is adequate by witnessing contractor quality control testing, and be sure the contractor enters into a log the treatment data specified in the special provision.

For each day of aggregate lime treatment, obtain the treatment data log in electronic format for the resident engineer's project files.

#### *4-3902H (2) Marination of Lime-Treated Aggregates*

Marination of the lime-treated aggregates must be done when required in the special provisions or when California Test 204, "Method of Tests for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," indicates that the plasticity index is 4 through 10.

Lime-treated aggregate must marinate at least 1 day and no more than 60 days before use in HMA production. If rain is anticipated during the marination period, the contractor must protect the stockpiles. If the lime-treated aggregate has been exposed to rain, inspect the stockpiles. If aggregate lime coating has been damaged significantly, reject the aggregate. If only the outside surface of the stockpile has been damaged, require that the contractor remix the piles to redistribute the lime.

#### *4-3902H (3) Liquid Antistrip Treatment*

This treatment process requires the addition of the liquid antistrip to asphalt binder during HMA production.

Before production begins, take the following steps related to liquid antistrip treatment:

- Verify with the district weights and measures coordinator that the proposed liquid antistrip metering device and storage tank are Caltrans-qualified under the *MPQP*.
- Verify that the liquid antistrip is the same type and brand as shown on the accepted job mix formula.

#### 4-3902I Prepaving Conference

Before work begins, the resident engineer holds a prepaving conference with the contractor to discuss HMA production and placement:

- Review the accepted job mix formula and check that Form CEM-3513, “Caltrans Hot Mix Asphalt Verification,” has been signed by Caltrans within the past 12 months.
- Confirm that the accepted job mix formula has not changed.
- Discuss with the contractor what atmospheric and pavement temperatures the contractor has chosen that would result in a notification to stop production of HMA at the plant.
- Discuss method of incorporating WMA technology.
- Discuss with the contractor pavement areas to receive tapered edge and construction methods to be used.
- Discuss with the contractor pavement areas to receive shoulder backing and construction methods to be used.
- If crumb rubber modifier is to be used, discuss the requirement that the crumb rubber usage reports are submitted on a monthly basis and at the end of the contract.
- Verify if the contractor intends to use a tapered notch wedge device to construct the longitudinal joint. A tapered notch wedge can be used only on a divided highway and when the special provisions do not include a requirement that adjacent traveled-way lanes be squared up from 5 feet to 10 feet at the end of each work shift.
- Discuss the minimum taper requirements for temporary joint tapers when a transverse joint greater than 0.04 foot cannot be avoided before opening to traffic.
- Verify that the type of spreading equipment proposed by the contractor has the necessary attributes for the project. Permit wing-type spreading equipment only for areas not requiring an asphalt paver, and then only for such widths, typically less than 5 feet, that will not adversely affect the surfacing on the traffic lane.
- Verify that rollers have the specified attributes. For method process, make sure the specified number of rollers will be used based on the type of HMA being placed.
- Discuss the requirement to pull density cores from random locations determined by the engineer and that cores must be pulled in the engineer’s presence and provided to the engineer at least once every 5 business days.
- If there is a bid item for data cores, discuss the requirements for pulling the data cores and the requirements for submitting the data core summary and photographic record to the engineer and [Coring@dot.ca.gov](mailto:Coring@dot.ca.gov).
- Discuss the contractor’s method to produce smooth pavement that meets the specifications.
- If cold planing is required, discuss the requirement that the cold planer be equipped with automatic controls, such as a ski device or averaging system.

Discuss what practices will be used to promote a smooth cold-planed surface. When plans call for cold planing to match existing cross slope grader to a fixed depth, encourage the contractor to use best cold planing practices for promoting smoothness, which includes operating the cold planer using automatic controls tied to a ski device or to an averaging system, rather than only using a joint matcher.

- Discuss how smoothness quality control will be accomplished.
- Discuss the requirements for submitting smoothness submittals to the secure file sharing system at [Smoothness@dot.ca.gov](mailto:Smoothness@dot.ca.gov).
- If the contract includes prepaving grinding:
  - Emphasize that prepaving grinding work is only applicable to existing asphalt concrete surfacing that has not been cold planed or replaced.
  - Remind the contractor that replaced asphalt concrete surfacing must meet the 12-foot straightedge specification. Corrective grinding on replaced asphalt concrete surfacing is part of the replace asphalt concrete surfacing work, not part of the prepaving grinding work.
  - Discuss how correction locations will be determined, whether the contractor will be using ProVAL smoothness assurance module or some other method. Refer to Section 4-3602C, “Pavement Smoothness,” of this manual, for additional information on ProVAL computer software.
  - Discuss how locations identified in inertial profiles will be located in the field. Will the contractor be laying out locations using distance measurement instrumentation (DMI) tied to the beginning of the project, DMI measurement from intermediate fixed locations tied to “events” in the inertial profile, inertial profile stationing converted to GPS coordinates, or a combination of GPS and DMI methods?
  - Determine if the contractor plans to perform inertial profiling early as a means to control quality of smoothness or when the paving is completed.
  - In areas where smoothness must meet the 12-foot straightedge requirement, discuss if the contractor will have a straightedge available, and who on the paving crew is responsible for using it.
  - Suggest use of a rolling straightedge device for comparison in ProVAL, which will assist in identifying locations that should physically be checked with a 12-foot straightedge.
  - Discuss contingency plans to minimize or eliminate delamination of cold-planed surfaces. Discuss what criteria and methods will be used to identify and record locations where the contractor and engineer mutually agree may reflect through to the final surface.
  - Discuss the contractor’s plans for determining where corrective grinding will occur on the final surface.

- Discuss the contractor's plans for scheduling paving after cold planing to meet the time requirements specified in Section 39-3.04, "Cold Planing Asphalt Concrete Pavement," of the *Standard Specifications*.
- Discuss the contractor's plans for assuring that material transfer vehicles (MTVs), or other types of heavy paving equipment that exceed the California Vehicle Code, Division 15, weight limits for vehicles on highways, are prevented from crossing a structure without written authorization. The authorization may be from the Transportation Permit Office or from the engineer. Requests for authorization are subject to a 15-day review.
- Determine the type of tack coat the contractor has chosen to use, based on expected atmospheric conditions, tack coat material type availability, and local experience. Also, discuss the contractor's proposed application rates and how far in advance of the paving operation the tack coat will be placed. For additional information about tack coats and the website for *Tack Coat Guidelines*, refer to Section 4-3908A, "References," of this manual, and to the *Minimum Tack Coat Spray Rates* at:  
  
<https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>
- Emphasize that public traffic will not be allowed on pavement with tack coat and discuss how the contractor will apply additional tack coat to damaged areas immediately before placing HMA.
- Confirm that the trucks used for tack coat application have the specified attributes. For distributor attributes, refer to Section 37-1.03B, "Equipment," of the *Standard Specifications*.

Discuss:

- The contractor's quality control plan.
- The contractor's communication between the quality control manager and production and placement personnel.
- How the contractor will transmit required quality control testing reports.
- How the resident engineer will transmit required acceptance test results.

With the contractor, discuss who has responsibility in the field to:

- Monitor HMA temperatures.
- Monitor atmospheric temperatures.
- Monitor pavement temperatures.
- Direct HMA truck drivers when loads must be tarped.
- Define the length of windrow, if applicable.
- Direct the HMA plant to slow down or stop loading trucks because of truck queuing.
- Stop production when two consecutive quality control test results do not comply with the specifications.

Discuss the type of action that will be taken by the contractor when:

- The HMA plant shuts down unexpectedly.
- The HMA paver breaks down.
- The HMA compaction equipment breaks down.
- Atmospheric or pavement temperature drops.

Make sure that the contractor has coordinated any necessary cold-planing operations; signs for construction area drop-offs, shoulder, and uneven pavement; and temporary pavement delineation, if applicable.

Review with the contractor the production start-up evaluation requirements for the first 750 tons of mix. Except for AASHTO T 324 (Modified), "Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)," and AASHTO T 283, "Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage," test results, the contractor and engineer must report test results within 5 business days of sampling, and for AASHTO T 324 (Modified) and AASHTO T 283 test results within 15 days of sampling.

#### 4-3902J Paving Operations

Before work begins, take the following steps related to HMA paving operations:

- Review "Placing Hot-Mix Asphalt" in *Construction of Hot Mix Asphalt Pavements (Manual Series No. 22)*, published by the Asphalt Institute.
- Make sure that the subgrade has been prepared as specified. If any HMA leveling is required to smooth out an existing irregular surface, inform the contractor and determine the method of payment.
- Determine if crack sealing or digouts (removing and replacing existing pavement) is required to repair small areas. When contract items are not included, inform the contractor of any extra work for crack sealing or digouts.
- Review the accepted contractor's quality control plan.
- If resurfacing under structures will result in reduced clearance, follow the procedures in Section 3-703B, "Permanent Clearance and Bridge Permit Rating Changes," of this manual.
- Verify that personnel who will be taking mat acceptance samples and witnessing core sampling are qualified for California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections."
- Coordinate requests for authorization to cross a structure with a vehicle exceeding the weight limits established by California Vehicle Code, Division 15, through the project's structure representative. If the project has not been assigned a structure representative, coordinate the review through the bridge construction engineer. Structure construction personnel will review the overload proposal in accordance with the *Bridge Construction Records and Procedures*

manual, Vol. 2, Bridge Construction Memo 150-1.0, "Weight Overload Guidelines for Bridges on Construction Projects."

#### **4-3903 During the Course of Work**

##### 4-3903A General

Quality production and placement of HMA requires a quality assurance process that consists of quality control by the contractor and acceptance by Caltrans. While some of these functions may seem redundant, each serves a separate purpose.

##### *4-3903A (1) Quality Control*

Quality control, sometimes called process control, is the testing performed by the contractor to make sure that the HMA being produced or placed meets the requirements of the specifications. Quality control testing of aggregates and HMA quality characteristics must be performed at a specified minimum frequency. Sampling should be performed at locations such as plant, windrow, or mat to ensure that quality control test results are not influenced by sampling location. Sampling must be random and must not be split samples of Caltrans' random acceptance samples.

The contractor will want to know early on how closely the contractor's quality control test results replicate the quality acceptance test results. The job mix formula verification and production start-up evaluation both offer early opportunities for the contractor to compare quality control test results with acceptance test results. Unlike the comparison of contractor's quality control and Caltrans' acceptance test results during production and placement, the verification and production start-up evaluation test results are on the same split samples. Therefore, the results are a direct measure of the variation between the laboratories.

The contractor performs quality control testing for asphalt rubber binder, gradation, and fabric content of crumb rubber modifier; aggregate and reclaimed asphalt pavement moisture; and reclaimed asphalt pavement gradation and binder contents.

##### 4-3903A (1a) Hot Mix Asphalt Density

The contractor is required to conduct quality control testing on a regular basis. The specifications give required intervals in the quality control table of the specifications. If the total layer thickness is at least 0.15 foot, the contractor is required to conduct density testing. The contractor is required to perform quality control density testing using a nuclear gauge that has been calibrated to cores taken on the first day of production. If the total layer thickness is less than 0.15 foot, the contractor must follow the requirements of the method process listed in Section 39-2.01C(15)(b), "Method Compaction," and the "Construction" sections of the applicable type of HMA: 39-2.02C for Type A, 39-2.03C for RHMA-G, or 39-2.04C for OGFC, of the *Standard Specifications*.

#### 4-3903A (1b) Method Process

The contractor must comply with the specifications for placement such as temperature and roller requirements. Depending on the type of HMA, the minimum compaction's temperatures may be reduced when WMA additive technology is used, but not when WMA water injection technology is used. Caltrans' inspection process should include documenting and reporting surface temperatures and roller passes to assure that compaction operations meet the method specification requirements.

#### 4-3903A (2) Department Acceptance

Department acceptance of HMA consists of material acceptance testing and both plant and paving inspection. The resident engineer is responsible for coordinating necessary field personnel and taking contract administration action when required. Verify that Caltrans personnel who sample or test have met the requirements of the Caltrans Independent Assurance Program and are qualified to perform the sampling or testing.

Material acceptance sampling frequencies and material acceptance testing frequencies, shown in Table 6-1.13 of this manual, are not the same. Caltrans limited the risk to the contractor by specifying in Section 39, "Asphalt Concrete," of the *Standard Specifications* that no single test result may represent more than the smaller of 750 tons or one day's production, whichever is less, except AASHTO T 283, "Standard Method of Test for Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage," and AASHTO T 324 (Modified), "Standard Method of Test for Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)." Therefore, during the course of the work it is important to split all acceptance sample materials. Use one sample for acceptance testing and one for dispute resolution.

Test the samples in a field construction laboratory, or ship them to a district materials laboratory to be tested at the minimum testing frequency shown in Section 6-1, "Sample Types and Frequencies," of this manual. Store the remaining samples in case additional acceptance testing is necessary.

The contractor may request that the resident engineer split acceptance samples. If requested, split acceptance samples into four parts: test one, provide one to the contractor, and store two for dispute resolution.

Quality assurance must be performed regularly and the material acceptance test processed in a timely fashion. The resident engineer must make every effort to conduct the necessary inspection, make sure that sampling and testing staff are available, and have samples processed as quickly as possible so acceptance decisions can be made while there is time to make corrections.

Ship or transport acceptance samples to testing laboratories within the timeframes provided in Section 6-102C, "Acceptance Samples and Tests," of this manual. Assure the proper chain of custody is maintained throughout the process, including delivery to and receipt from a commercial shipping service. Use Form CEM-3701, "Test Result Summary," to summarize acceptance test frequency and results on each material. Use this form to record the dates samples were taken, shipped to

laboratory, test result received from laboratory, and the contractor notified of test results. Monitor timeliness of material testing turnaround against Table 6-1.2, "Time Required for Materials Acceptance Tests," of this manual and make sure corrective actions are taken and documented where deficiencies are encountered.

Notify contractor of all acceptance test results within 2 business days of receipt from laboratory.

Quality pavement is obtained by strictly enforcing the specifications and notifying the contractor of failed tests as soon as possible. When a single quality assurance test for a single quality characteristic indicates that material does not comply, follow guidance in Section 4-3904A (1), "Acceptance Test Results Outside Specified Limits."

Except for smoothness, when two consecutive acceptance tests for a single quality characteristic do not comply with the specifications:

- Immediately notify the contractor to stop production.
- Verify that the contractor takes corrective action.

After the corrective action has been taken and the contractor has quality control test results showing conformance, witness the contractor taking and splitting samples (into four parts) for the resident engineer's tests. The contractor must test one part for compliance with the specifications and submit three parts to the resident engineer, who tests one part for compliance with the specifications and stores two parts.

#### *4-3903A (3) Dispute Process*

A dispute resolution process for acceptance tests is specified in Section 39-2.01A(4)(i)(iv), "Dispute Resolution," of the *Standard Specifications*.

A contractor disputing the acceptance test results must notify the resident engineer within 5 business days of receiving a test result. Caltrans may also dispute the contractor's test results. To resolve disputed test results, the specifications require the use of an independent third party to perform referee testing. If the contractor disputes Caltrans' acceptance test results, and the resident engineer is satisfied with acceptance test results, before using the independent third party, suggest that the contractor test one of the split samples from the material in question. If the contractor agrees to perform this test, it would be good practice to have a tester or a district independent assurance representative witness the contractor's testing.

The specifications require the testing of split samples of disputed material. If split samples of the material tests being disputed are not available, the third party uses any available material representing the disputed HMA for evaluation. Caltrans must retain possession of the split samples. Caltrans may discard stored split samples 5 days after the contractor has received the associated acceptance test results.

#### 4-3903B Production Start-Up Evaluation

Section 39-2.01A(4)(h)(v), "Production Start-Up Evaluation," of the *Standard Specifications* applies to all construction processes. The production start-up evaluation allows:

- The contractor to compare quality control test results against Caltrans acceptance test results on split sample material.
- Caltrans to verify early in the project that the aggregate properties and HMA comply with the job mix formula and specifications.
- Both parties to examine results of tests performed on split sample material.

Split samples are used only for job mix formula verification, for production start-up evaluation, and when the contractor is demonstrating compliance with the specifications if production has been stopped for out-of-specification material. In all other circumstances, acceptance samples must always be taken independently of contractor's quality control samples.

#### 4-3903C Plant Operations

Before shift production begins, the plant inspector generally takes the following steps related to HMA plant operations:

- Verifies that the security seal has not been tampered with. If tampering is suspected, contact the district weights and measures coordinator.
- Verifies that the portioning equipment is interlocked as specified in the *MPQP*.
- Makes sure the job mix formula being used by the contractor is specific to the project and that no changes have been made to:
  1. Target asphalt binder percentage
  2. Asphalt binder supplier
  3. Asphalt rubber binder supplier
  4. Component materials or percentage of any component material used in asphalt rubber binder
  5. Combined aggregate gradation
  6. Aggregate sources
  7. Substitution rate for reclaimed asphalt pavement aggregate of more than 5 percent
  8. Any material in the job mix formula
- Notifies the resident engineer if there are changes in the job mix formula and asks if a new job mix formula will be required from the contractor before production can be started.
- Makes certain that the asphalt binder supplier is on the Caltrans approved supplier list or that asphalt binder samples have been taken from each truckload and tested in accordance with Section Q, "Requirements For Suppliers Supplying

Asphalt Without a Certificate of Compliance,” in the *Certificate Program for Suppliers of Asphalt*. Notifies the contractor and resident engineer if asphalt binder testing has not been completed for a supplier not on the approved supplier list.

- Makes sure that aggregate is stored separately, according to proposed sizes by comparing the material from each bin with Chapter 2, Section II-E, “Aggregate Storage,” of the *MPQP* manual. If any segregation, degradation, or intermingling occurs, require that the contractor empty the storage facility and waste or re-screen the material.
- Checks that supplemental fine aggregate remains dry and is stored separately as specified in *MPQP* guidelines.

During production, the plant inspector generally takes the following steps related to HMA plant operations:

- Records daily HMA plant production information on Form CEM-3501, “Hot Mix Asphalt Production Report.”
- Documents on Form CEM-4601, “Assistant Resident Engineer’s Daily Report,” additional information about plant production, including instructions to contractor’s personnel.

The plant inspector performs the following additional duties:

1. Verifies that contractor personnel who sample or witness the contractor sampling at the hot mix asphalt plant are qualified to perform California Test 125, “Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections.”
2. Obtains HMA samples for acceptance testing every 750 tons and tests at least once for every 5 samples or a minimum of once per day. Material samples must be split into two parts, one sample for potential acceptance testing and one for potential dispute resolution testing.
3. Samples for aggregate gradation at least once for every 750 tons, and tests at least once for every 5 samples or a minimum of once per day. Material samples must be split into two parts, one sample for potential acceptance testing and one for potential dispute resolution testing.
4. Monitors the contractor’s HMA plant inspection for compliance with the contractor’s quality control plan. Notifies the resident engineer of any noncompliance issues.

#### **4-3903C (1) Antistrip Treatment of Aggregates and Hot Mix Asphalt**

The HMA may be sensitive to moisture damage and may require one of the following antistrip treatments:

- Hot mix asphalt aggregate treatment—slurry method
- Hot mix asphalt aggregate treatment—dry lime method
- Liquid antistrip method

#### 4-3903C (1a)Marinated Lime-Treated Aggregate

Aggregate that has been lime treated and stockpiled for marination is handled in the HMA production process in the same manner as untreated aggregates. Refer to Section 4-3902H (1), “Lime Treatment of Aggregates,” of this manual for lime treatment plant operation requirements.

For aggregates that have been lime treated and stockpiled:

- Verify that aggregate quality characteristic acceptance samples and tests were performed and the aggregate meets the contract specifications.
- Do not perform sampling and testing for sand equivalent or aggregate quality characteristics as shown in Section 4-3903C (3), “Hot Mix Asphalt Production,” of this manual.
- Verify that the lime marination was performed within the past 60 days.

Reclaimed asphalt pavement used in the production of HMA does not need to be lime treated.

#### 4-3903C (1b)Hot Mix Asphalt Aggregate Treatment—Slurry Method

If an HMA production facility is using this process without marination, contact the METS Office of Flexible Pavement for assistance.

#### 4-3903C (1c)Hot Mix Asphalt Aggregate Treatment—Dry Lime Method

The quality characteristic acceptance test limits for aggregate properties are based on untreated aggregates. Aggregate testing must be performed on aggregate samples taken before lime treatment.

During lime treatment, the plant inspector takes the following steps:

- Obtain aggregate samples from stockpiles or from the aggregate belts before lime treatment for moisture content and sand equivalent testing at the frequency shown in Table 6-1.13, “Materials Acceptance Sampling and Testing Requirements,” of this manual. Sample aggregate in accordance with California Test 125, “Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections.”
- Test aggregate samples for sand equivalent at the frequency shown in Table 6-1.13 of this manual. If the aggregates are not combined before sampling, combine aggregate from individual stockpiles or belts in the job mix formula proportions to test for sand equivalent.
- It is good practice to test aggregate samples for moisture content in accordance with AASHTO T 255, “Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying,” or AASHTO T 329, “Standard Method of Test for Moisture Content of Asphalt Mixtures by Oven Method,” because moisture influences proportioning. For lime slurry aggregate treatment, the plant inspector should confirm that the contractor is performing sampling and testing for moisture content at least once every 2 hours of treatment. For lime-treated aggregate, the plant inspector should confirm that the contractor is performing sampling and

testing for moisture content at a frequency shown under the quality control section applicable to the type of HMA.

Compare the contractor's aggregate moisture quality control test results against the Caltrans test results. Notify both the contractor and the resident engineer if the test results are significantly different.

Verify that the contractor is adjusting the HMA plant controller based on the contractor's aggregate moisture quality control test results.

- Obtain aggregate samples from stockpiles or aggregate belts before lime treatment in accordance with California Test 125. Sample aggregates at the frequency shown in Table 6-1.13 of this manual for aggregate acceptance testing.
- Test aggregate for acceptance quality characteristics at the frequency shown in Table 6-1.13 of this manual for the following aggregate acceptance tests:
  1. Los Angeles Rattler
  2. Percent of crushed particles coarse aggregate
  3. Percent of crushed particles fine aggregate
  4. Fine aggregate angularity
  5. Flat and elongated particles
  6. Other aggregate properties specified in the project special provisions if applicable

If samples will be shipped to a district materials laboratory or to a construction laboratory, complete Form TL-0101, "Sample Identification Card," following the instructions in the book and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Record the type of mix, the HMA producer, and the producer mix identification number. Check the box on the sample TL-0101 for acceptance test. Ship the samples to the district materials laboratory or field construction laboratory for testing. If any test results exceed the specified limits, the testing laboratory will immediately notify the resident engineer.

Make sure that aggregate treatment is adequate by witnessing contractor quality control testing, and that the contractor enters the treatment data specified in the special provisions into a log. For each day of aggregate lime treatment, obtain the treatment data log electronically for the resident engineer's project file.

#### 4-3903C (1d) Liquid Antistrip Treatment

Make sure that data required in the liquid antistrip treatment section of the special provisions is entered into the production unit's treatment data log and submitted in the required format.

For each day of antistrip treatment, obtain the treatment data log electronically for the resident engineer's project files.

#### 4-3903C (2) *Production Start-Up Evaluation*

A production start-up evaluation occurs within the first 750 tons produced on the first day of HMA production. The evaluation is also required when production has stopped for more than 30 days and if a new job mix formula is being used.

The plant inspector generally takes the following steps related to a production start-up evaluation:

- During the first 750 tons of production, witnesses the contractor sampling aggregate, asphalt binder, and reclaimed asphalt pavement on the first day of production in accordance with Section 39-2.01A(4)(h)(v), "Production Start-Up Evaluation," of the *Standard Specifications*, and California Test 125, "Sampling Highway Materials and Products Used in the Roadway Structural Sections." The inspector retains three split samples for testing and dispute resolution as described earlier.
- Labels each HMA sample with enough information to identify the exact location. Refer to Section 4-3903C (3), "Hot Mix Asphalt Production," of this manual.
- Ships one sample of asphalt binder to METS for testing as detailed in Section 6-2, "Acceptance of Manufactured or Fabricated Materials and Products," of this manual, noting that it is a production start-up acceptance test.
- Immediately tests one aggregate sample for aggregate gradation and sand equivalent. If reclaimed asphalt pavement is used, determine aggregate gradation in accordance with California Test 384 "Method of Test to Determine Combined Gradations for Hot Mix Asphalt (HMA) Using up to 25% Reclaimed Asphalt Pavement (RAP)". California Test 384 is available at:

<https://dot.ca.gov/programs/engineering-services/california-test-methods-version-selection>

- When test results fall outside the specification limits, the inspector notifies the contractor, and requires and confirms that the contractor takes corrective action. If aggregate gradation or sand equivalent test results fall outside the specification limits, notify the resident engineer immediately.

- Tests one aggregate sample for aggregate acceptance quality characteristics.

For samples that will be shipped to the district material laboratory or field construction laboratory for testing, complete Form TL-0101, "Sample Identification Card," following the instructions printed in the form booklet and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Record the type of mix, the HMA producer, the producer's mix identification number, and the production tonnage that this sample represents.

Check the box on the sample TL-0101 for acceptance test, marked "Priority," and include "Production Start-Up Evaluation Test" under "Remarks." Under "Remarks," identify the tests to be performed:

1. Los Angeles Rattler
2. Percent of crushed particles coarse aggregate

3. Percent of crushed particles fine aggregate
4. Fine aggregate angularity
5. Flat and elongated particles
6. Other aggregate properties specified in the project special provisions, if applicable

The specifications require 3 days for test result turnaround, so samples must be shipped immediately. If any tests results fall outside the specified limits, the testing laboratory will immediately notify the resident engineer.

#### 4-3903C (3) Hot Mix Asphalt Production

During production, the plant inspector generally takes the following steps related to HMA plant operations:

- Observes the overall plant operation to make sure the contractor controls dust and smoke. Requests that the contractor corrects any obvious violation and ceases operation if necessary to prevent damage to HMA mixture.
- Obtains aggregate samples and performs AASHTO T 255, “Standard Method of Test for Total Evaporable Moisture Content of Aggregate by Drying,” or AASHTO T 329, “Standard Method of Test for Moisture Content of Asphalt Mixtures by Oven Method.”
- Confirms that the contractor is performing sampling and testing for moisture content at the frequency shown under the quality control section of the *Standard Specifications* applicable to the type of HMA. Because moisture influences proportioning, it is good practice to test both aggregate and reclaimed asphalt pavement for moisture content.
- Compares the contractor’s quality control test results with Caltrans test results and notifies both the contractor and resident engineer if the test results are significantly different.
- Verifies that the contractor is adjusting the HMA plant controller based on the contractor’s aggregate moisture quality control testing.
- Obtains aggregate samples for field testing for aggregate grading and sand equivalent at the frequency shown in Table 6-1.13, “Materials Acceptance Sampling and Testing Requirements,” of this manual. Tests aggregate samples before lime treatment for testing sand equivalent. (Reclaimed asphalt pavement does not need to be sampled for sand equivalent.) Do not use aggregate samplers that do not safely produce a manageable size sample.
- Labels each aggregate sample with the contract number, date, type of mix, aggregate gradation (for example, 1/2 inch), aggregate source, HMA producer, and producer’s mix identification number. Indicates the number of tons produced when the sample was taken.
- Tests aggregate samples for aggregate gradation and sand equivalent at the frequency shown in Table 6-1.13 of this manual. If reclaimed asphalt pavement is

used, determine aggregate gradation in accordance with California Test 384 “Method of Test to Determine Combined Gradations for Hot Mix Asphalt (HMA) using up to 25% Reclaimed Asphalt Pavement (RAP).” California Test 384 is available at:

<https://dot.ca.gov/programs/engineering-services/california-test-methods>

- Notifies the contractor of aggregate gradation and sand equivalent test results, and confirms that any required plant adjustment has been made to correct for out-of-specification aggregate gradation.
- If aggregate gradation or sand equivalent test results fall outside the specification limits, notifies the resident engineer immediately. If the contractor makes significant or numerous adjustments in bin aggregate proportions, increases the frequency of aggregate gradation testing.
- Obtains aggregate samples for aggregate acceptance quality characteristics at the sampling frequencies shown in Table 6-1.13 of this manual and sample in accordance with California Test 125. If lime-treated, aggregate samples must be taken before lime treatment for testing aggregate properties. Reclaimed asphalt pavement does not need to be sampled.
- Labels each aggregate sample with the contract number, date, type of mix, aggregate gradation, aggregate source, HMA producer, and producer’s mix identification number. Indicates the number of tons produced when the sample was taken. Refers to the guidance in Section 4-3903D (5), “Sampling and Testing Hot Mix Asphalt,” of this manual. Tests aggregate at the frequency shown in Table 6-1.13 of this manual. For samples that will be shipped to the district material laboratory or field construction laboratory for testing, completes Form TL-0101, “Sample Identification Card.” Follows the instructions printed in the book that contains the form and the information in Section 6-103, “Field Sampled Material Identification for Testing,” of this manual. Records the type of mix, the HMA producer, and the producer’s mix identification number. Checks the acceptance tests box on the TL-0101. Under “Remarks,” identifies the tests to be performed:
  1. Los Angeles Rattler
  2. Percent of crushed particles coarse aggregate
  3. Percent of crushed particles fine aggregate
  4. Fine aggregate angularity
  5. Flat and elongated particles
  6. Other aggregate properties specified in the project special provisions, if applicable

If any test results exceed the specified limits, the materials laboratory will immediately notify the resident engineer.

If any single quality characteristic has two consecutive acceptance or quality control tests not in compliance with the specifications, verify that before resuming production and placement of HMA on the project, the contractor:

1. Stops production
  2. Notifies the resident engineer
  3. Takes corrective action
  4. Provides a split sample for the engineer's testing
  5. Demonstrates compliance with the specifications before resuming production and placement of HMA on the project
- Samples asphalt binder at the frequencies shown in Section 6-1, "Sample Types and Frequencies," and in accordance with Section 6-2, "Acceptance of Manufactured or Fabricated Materials and Products," of this manual, and fills out Form TL-0101 before shipping samples to METS for testing.
  - Assures asphalt binder quality by following Section 4-92, "Asphalt Binders," of this manual.
  - For asphalt rubber binder components:
    1. Collect certificates of compliance for each truckload of crumb rubber modifier and asphalt modifier.
    2. Collect a "Buy America" certificate for each truckload of crumb rubber modifier. Refer to Section 3-604, "Buy America," of this manual for more information.
    3. Sample asphalt modifier binder at the frequencies shown in Section 6-1, "Samples Types and Frequencies," of this manual. Ship to METS as detailed in Section 6-2, "Acceptance of Manufactured or Fabricated Materials and Products," of this manual.
    4. Make sure the contractor submits Form CEM 4410, "Crumb Rubber Usage Report," monthly and at the end of the project. Refer to Section 7-108, "Crumb Rubber Usage Reporting," of this manual for more information.
  - Verify that the temperatures of the asphalt binder, aggregate, and HMA do not exceed the limits specified in Section 39-2.01B(8), "Hot Mix Asphalt Production," of the *Standard Specifications*.
  - Make sure that the batch size and feed rates do not exceed the mixing capacity range used during plant dynamic testing.
  - HMA must be tested for mix moisture content from samples taken behind the paver in accordance with AASHTO T 329, "Standard Method of Test for Moisture Content of Asphalt Mixtures by Oven Method." However, the HMA can be sampled and tested at the plant to determine if sampling and testing at the mat are necessary by performing the informal test described below. If HMA samples taken at the plant meet the mix moisture acceptance requirements, samples taken behind the paver will also meet the specification requirement.

To perform an informal, quick moisture content check at the plant, use the following procedure:

1. Have the contractor take a shovelful of aggregate from the dryer's discharge chute
2. Notice any steaming or dark spots on the aggregate
3. Pass a cool, shiny, clean mirror, spatula, or similar item in a slow, deliberate motion immediately above the aggregate
4. Observe the amount of condensed moisture on the item
5. Advise the contractor if moisture is seen

This informal method cannot be used for acceptance.

- Observe production to assure the specified HMA mixture conforms to project specifications and the *MPQP*.

#### 4-3903C (3a) Batch Plants

Do not approve a shorter mixing time than was used during the plant dynamic testing conducted for plant acceptance, in accordance with Chapter 3, Section II-B, "Dynamic Testing," of the *MPQP* manual.

Ensure that the automatic batching equipment functions within the limits specified in Chapter 2, Section II-F, "Batch Mixing HMA Plants," of the *MPQP* manual.

#### 4-3903C (3b) Continuous Mixing Plants

For continuous mixing plants (dryer drum or dryer drum pugmill), verify that the following are operating:

1. Vibrating unit on the fine bins
2. Low-level and no-flow interlock systems for aggregate and reclaimed asphalt pavement feeder bins
3. No-flow interlock system for asphalt binder storage and feed system
4. Automatic plant controller
5. Dust control systems
6. Segregation devices at HMA storage

The mixing time depends on the length of the mixing area and the rate of drop in the dryer drum during mixing. The most efficient pugmill mixing occurs when the material level remains at the top of the paddles along the length of the mixer. For best results, feeding must be continuous and uniform. Do not approve a production rate faster or slower than the range of production used during the plant dynamic testing conducted for plant acceptance in accordance with Chapter 3, Section II-B, "Dynamic Testing," of the *MPQP* manual.

#### 4-3903C (4) *Plant Weighing Systems*

Observe the operation of all weighing systems. Whenever scales and meters seem inaccurate, contact the district weights and measures coordinator for further assistance. Be aware of scale and meter security seals and set points.

For batch plants:

- Make sure that the weigh box containing the total batch does not come in contact with anything that prevents a true indication of the batch weight.
- When intermediate storage, such as a silo, is used for HMA, periodically check the batching by comparing the total weight of the batches in a truckload with the platform scale weight for the same load.
- Check the asphalt binder scales frequently to verify that they return to within zero tolerance limits and that the scale lever systems or load cells move freely.

When plants are used for only one project, the accuracy of meter-driven devices that proportion asphalt binder can be checked. To do so, compare meter totalizer readings with asphalt binder tank stabbings and, in conjunction with an onsite vehicle scale, with the combined aggregate totalizer readings. Take into account any wasted mix or individual ingredients wasted after proportioning.

#### 4-3903C (5) *Hot Mix Asphalt Storage*

Verify that HMA storage silos are in accordance with Chapter 2, Section II-J, “HMA Storage,” of the *MPQP* manual.

#### 4-3903C (6) *Hot Mix Asphalt Transporting*

Before the trucks are loaded, verify the absence of an excessive amount of parting agent or other contaminating material. Such material is excessive when it forms pools. Diesel or other petroleum-based products are prohibited from being used as parting agents.

After the trucks are loaded, be sure the HMA mixture aggregate is coated with asphalt binder and the load is not segregated). Notify the resident engineer if loads need to be rejected based on nonuniformity of HMA mixture.

Make sure that rubberized HMA gap-graded and open-graded friction course loads are completely covered with tarpaulins when the atmospheric temperature is below 70 degrees Fahrenheit. Tarps are not required if the time from discharge to truck until transfer to the paver’s hopper or to the pavement surface is less than 30 minutes. If the trucks are tarped, record that information on Form CEM-3501, “Hot Mix Asphalt Production Report.”

#### 4-3903D Paving Operations

During HMA placement, the paving inspector generally takes the following steps:

- Record daily HMA placement information on Form CEM-3502, “Hot Mix Asphalt Placement Report,” and additional information, including instructions to

contractor's personnel, on Form CEM-4601, "Assistant Resident Engineer's Daily Report."

- Refer to "Placing Hot-Mix Asphalt" in *Construction of Hot Mix Asphalt Pavements*, published by the Asphalt Institute, as guidance for best practices during HMA placement.

#### 4-3903D (1) Atmospheric and Pavement Temperature

- Verify that placement occurs within the specified temperature ranges by taking sufficient measurements of the atmosphere, pavement, and HMA. The temperature ranges vary based on the type of HMA being placed. For temperature range requirements, refer to Section 39-2.01C(1) "General," and 39-2.02C, "Construction," of the *Standard Specifications*.
- Record temperatures and the time taken on Form CEM-3502, "Hot Mix Asphalt Placement Report." Notify the contractor to stop HMA placement when temperatures are below specified limits.

#### 4-3903D (2) Tack Coat

- Make sure that tack coat is applied to surfaces to be paved and at a high enough rate to meet the minimum residual rate specified. Use guidance in Section 4-9403, "During the Course of Work," of this manual to determine the minimum required spray rate. The contractor may request and the paving inspector authorize that the application of tack coat is waived between layers when both of the following conditions apply:
  1. The surface to be paved does not have a film of dust or clay
  2. The temperature of the surface to be paved is at least 140 degrees Fahrenheit
- If the contractor uses asphaltic emulsion that has not yet been tested by Caltrans, verify that each delivery of asphaltic emulsion includes a certificate of compliance that covers items described in Section 94-1.01C, "Submittals," of the *Standard Specifications*. Also, check that each delivery includes a safety data sheet.
- Make sure that if asphaltic emulsion has been diluted, the contractor notifies the engineer of the dilution rate and includes the dilution information required by Section 39-2.01C(3)(f), "Tack Coat," of the *Standard Specifications*.
- For information on inspecting tack coat, refer to Section 4-3908A, "References," of this manual for the *Tack Coat Guidelines* website.

#### 4-3903D (3) Transporting and Spreading

- Verify that HMA delivery trucks have weighmaster certificates, and collect the certificates from the arriving trucks. If inspection resources are limited, collect weighmaster certificates on a daily basis. If HMA loads are rejected before placement, note on the back of the weighmaster certificate and Form CEM-4601,

“Assistant Resident Engineer’s Daily Report,” why the HMA was rejected, such as cold mix, segregated mix, or contaminated mix.

- Be aware that queuing of trucks may contribute to excessive cooling of HMA mixture.
- Make sure the contractor uses a material transfer vehicle (MTV) when required. Section 39 of the *Standard Specifications* requires the use of an MTV on all types of HMA except Type A and minor HMA. The special provisions may require the use of MTVs for Type A.
- Make sure the contractor does not cross a structure with an MTV or other heavy paving equipment that exceeds the weight limits for a vehicle on highways as defined in California Vehicle Code, Division 15, without written authorization. Coordinate all requests for authorization with the project’s structure representative. If the project has not been assigned a structure representative, coordinate the review through the bridge construction engineer.
- If windrowing is used, prevent overcooling of the HMA by not allowing excessive windrowing. When “method” compaction is used, verify that the windrow temperature does not fall below 260 degrees or below 250 degrees Fahrenheit when WMA “additive” technology is used. In all cases, check that the windrow length does not exceed 250 feet in front of the loading equipment.
  1. Windrow temperatures can be monitored with an infrared heat gun. Type A HMA may be rejected for not meeting minimum first coverage of breakdown surface temperature shown in Section 39-2.02C, “Construction,” of the *Standard Specifications*. RHMA-G also may be rejected for not meeting minimum first coverage of breakdown surface temperature shown in Section 39-2.03C.
  2. When using a heat gun on a windrow, be aware that the instrument measures only surface temperature and that the interior of the windrow is hotter. When the HMA is run through the material transfer vehicle, paver, or both, the mat temperature may be above the minimum specified breakdown temperature.
  3. If windrow temperatures are inadequate or visual inspection of the material in the windrow identifies segregation, poor mixing, or an over-rich mix, notify the contractor. If this material is incorporated into the paving, additional inspection and testing may be necessary to determine if the mix is acceptable.
- When HMA is placed against the edge of a longitudinal or transverse construction joint that is damaged or not placed in a neat line, make sure the contractor saw cuts or grinds the pavement straight and vertically along the joint and removes the extraneous material.
- Verify that longitudinal joints on the finished surface correspond to the edge of traffic lanes and in lower lifts are offset and alternated at least 0.5 foot from each side of the lane line.
- Assure that the paver spreads the HMA at the required thickness and that lift thickness for Type A complies with Section 39-2.02C “Construction,” of the

*Standard Specifications*, and for HMA placed under method compaction specifications, the lift thickness does not exceed 0.25 foot.

- Verify pavement thickness by comparing the HMA spread rate with the theoretical rate and, if necessary, order the contractor to make adjustments.

Below is an example spread-rate calculation assuming 12 feet wide, 0.15-foot thickness, mix 150 pounds per cubic foot, and 16 tons shown on a weighmaster certificate.

1. Calculate the weight of HMA 0.15-foot thick required for 1 square foot:  $150 \times 0.15 = 22.5$  pounds per square foot
2. Calculate the weight of HMA for 1 linear foot:  
 $22.5 \times 12 = 270$  pounds per linear foot
3. Calculate the linear feet that can be covered by one truckload:  
 $(16 \text{ tons} \times 2,000 \text{ pounds per ton}) \div 270 \text{ pounds per linear foot} = 118.5$  linear feet
4. Calculate the linear feet covered by 1 ton of HMA:  $2,000 \text{ pounds per ton} \div 270 \text{ pounds per linear foot} = 7.41$  feet

Check layer thickness and spread rate during placement, and check daily theoretical spread rate against the distance actually paved for the day. Note these on Form CEM-3502, "Hot Mix Asphalt Placement Report."

Payment for HMA is based on the weight shown on the weighmaster certificate. Because of the high cost of HMA, it is important to monitor the spread rate so an excess of HMA is not placed and project funding is not exceeded.

#### 4-3903D (4) *Production Start-Up Evaluation Samples*

Section 39-2.01A(4)(h)(v), "Production Start-Up Evaluation," of the *Standard Specifications* requires samples of HMA within the first 750 tons of production on the first day of production.

- Observe the contractor sampling from the mat behind the paver or other location approved by the resident engineer. The contractor must sample in accordance with California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections," and give the resident engineer three of the four split samples.
- Test the HMA production start-up evaluation sample for quality characteristics shown in Section 4-3903D (5), "Sampling and Testing Hot Mix Asphalt," of this manual.
- Test aggregate at the frequency shown in Table 6-1.13, "Materials Acceptance Sampling and Testing Requirements," of this manual. For samples that will be shipped to the district material laboratory or field construction laboratory for testing, complete Form TL-0101, "Sample Identification Card." Follow the

instructions printed in the form booklet and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Record the type of mix, the HMA producer, and the producer's mix identification number. Check the acceptance tests box on the TL-0101. Under "Remarks," identify the tests to be performed.

Label each HMA sample with enough information to identify the exact location. Refer to the description in Section 4-3903D (5) of this manual.

- Check the box on TL-0101 for acceptance test marked "Priority," and include "Production Start-up Evaluation Test" under "Remarks." Also under "Remarks," list all required acceptance tests. The resident engineer must report the test results to the contractor within 5 business days of sampling. For AASHTO T 324 (Modified), "Hamburg Wheel-Track Testing of Compacted Hot Mix Asphalt (HMA)" and AASHTO T 283, "Resistance of Compacted Hot-Mix Asphalt (HMA) to Moisture-Induced Damage," test results, report test results within 15 days of sampling. To meet these timelines, ship samples immediately.

#### *4-3903D (5) Sampling and Testing Hot Mix Asphalt*

- Obtain split samples of HMA from the mat behind the paver or other location approved by the resident engineer, in accordance with California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections." Table 6-1.13, "Materials Acceptance Sampling and Testing Requirements," of this manual provides the frequency for sampling HMA mix.

Label each HMA sample with the aggregate grading (for example, "1/2 inch"), asphalt binder target value, producer, and producer's mix identification number. Indicate both the stationing where the sample was taken and the area represented (for example, STA 100+50, NB, Lane 1, first layer). Also include the Form TL-0101, "Sample Identification Card," number if the sample is being shipped to the district material laboratory or field construction laboratory for testing. The label must have enough information to identify the exact location in the event the HMA is rejected and must be removed.

- Test aggregate at the frequency shown in Table 6-1.13 of this manual. For samples that will be shipped to the district material laboratory or field construction laboratory for testing, complete Form TL-0101. Follow the instructions printed in the form booklet and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Record the type of mix, the HMA producer, and the producer's mix identification number. Check the acceptance tests box on the TL-0101, and identify the acceptance tests to be performed under "Remarks." Include only the acceptance tests that you are requesting to meet the acceptance test frequency in Table 6-1.13 of this manual:
  1. Asphalt binder content
  2. Air voids content at  $N_{\text{design}}$
  3. Voids in mineral aggregate

4. Dust proportion (report only if an adjustment for asphalt binder content target value is less than plus or minus 0.3 percent from optimum binder content)
5. Maximum theoretical density AASHTO T 209, Method A
6. Hamburg Wheel Track (AASHTO T 324 (Modified))
7. Moisture susceptibility (AASHTO T 283), both dry strength and wet strength

If any single quality characteristic, except smoothness, has two consecutive acceptance or quality control tests not in compliance with the specifications, ensure that before resuming production and placement of HMA on the project, the contractor:

1. Stops production
2. Notifies the resident engineer
3. Takes corrective action
4. Provides a split sample for the engineer's testing
5. Demonstrates compliance with the specifications

#### 4-3903D (6) *Compaction*

The contractor must comply with the method process in Section 39-2.01C(2)(c), "Method Compaction Equipment," and in Section 39-2.01C(15)(b), "Method Compaction," of the *Standard Specifications* if:

- The total paved thickness is less than 0.15 foot
- The HMA is used in:
  1. Asphalt concrete remove-and-replace areas (digout)
  2. Leveling courses
  3. Detours not included in final roadway prism
  4. Areas in which the resident engineer determines that conventional compaction and compaction measurement methods are impeded

#### 4-3903D (6a) Method Process Compaction

For the method process HMA compaction:

- Use the MultiCool 3 program as a guide for determining the length of time available for achieving compaction, based on layer thickness, HMA temperature, existing pavement temperature, and atmospheric temperature. The MultiCool 3 program is available at:

<https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>

- Make sure that:
  1. Specified equipment performs the compaction in the specified order.
  2. A required number of coverages is made for each compaction type (first coverage, breakdown, and finish).

3. The HMA compaction is completed above the specified minimum temperature for each compaction type (first coverage, breakdown, and finish).
  4. When a vibratory roller is specified for compaction, the speed of the vibratory roller in miles per hour does not exceed the vibrations per minute divided by 1,000. When the HMA layer thickness is less than 0.08 foot, the vibratory roller must be in the off mode.
  5. When a pneumatic-tire roller is specified for compaction, the speed does not exceed 5 miles per hour.
- Inspect the finished HMA surface for marks, tearing, and irregular texture that may be caused by segregated mix. Notify the contractor of noncompliant areas.

#### 4-3903D (6b) Compaction Determination by Cores

When the total paved thickness is at least 0.15 foot:

- The contractor will determine the number of rollers and sequence necessary to meet the compaction requirements of the specifications.
- For quality control testing, the contractor must use nuclear gauges calibrated to cores under California Test 375, "Determining the In-Place Density and Relative Compaction of Hot Mix Asphalt Pavement Using Nuclear Gages," to determine the relative compaction.
- The contractor will obtain the cores for the resident engineer within 5 days of HMA placement. The resident engineer will use the cores to determine relative compaction.
  1. Randomly select core locations for every 250 tons of hot mix asphalt placed according to Part 3, "Section B, "Test Site Location," of California Test 375, "Determining the In-Place Density and Relative Compaction of Hot Mix Asphalt Pavement Using Nuclear Gages."
  2. Witness the contractor taking the cores, mark each core, and place the cores in a protective container before taking possession of the cores.
  3. Complete Form TL-0101, "Sample Identification Card," following the instructions printed in the form's book and the information in Section 6-103, "Field Sampled Material Identification for Testing," of this manual. Identify the stationing where samples were taken and the area they represent, for example, "lane #1, first layer." Label the samples with enough information that the exact location HMA was placed can be identified if it is rejected and has to be removed. On Form TL-0101, check the box for acceptance test.
  4. Transport the cores to the district materials laboratory or construction field laboratory where they will be tested for in-place density (California Test 375), except the density of each core will be determined using AASHTO T 275, Method A, and the theoretical maximum density of the mix will be determined using AASHTO T 209, Method A.

#### 4-3903D (7) Smoothness

Except for areas that must be tested for smoothness using a 12-foot straightedge, make sure the contractor tests all finish surfaces of HMA and the surface open-graded friction course (OGFC) is being placed on, with an inertial profiler.

Refer to Section 36-3.01D(3)(b) "Smoothness," and Section 39-2.01A(4)(h)(ix) "Pavement Smoothness," of the *Standard Specifications* for surfaces that are to be measured with a 12-foot straightedge.

Where a total thickness of 0.25 foot or less of HMA is overlaid on an existing or replaced asphalt concrete surface, prior to overlaying, make sure the surface being overlaid meets the following:

1. Where existing asphalt concrete that has been cold planed, the 12-foot straightedge tolerance required by Section 39-3.04C(2) "Grade Control and Surface Smoothness," of the *Standard Specifications*.
2. Where existing asphalt concrete surfacing has been replaced, the 12-foot straightedge tolerance as required by Section 36-3.01D(4) "Department Acceptance," of the *Standard Specifications*.
3. Where existing asphalt concrete surfacing has not been cold planed or replaced, the inertial profile specification required by Section 39-2.01C(3)(e) "Prepaving Grinding," of the *Standard Specifications*.

If notified by the contractor that an existing asphalt concrete surface, that has not been cold planed or replaced, cannot be corrected by grinding, respond within 5 business days with agreement or disagreement. Formulate the response based on field review of the defined locations and the inertial profile data.

- If in agreement that the contractor-defined areas cannot be corrected by grinding, make sure the response defines the lane, direction, and stationing limits where the 12-foot straightedge will be used in place of the inertial profiles to evaluate smoothness on the final HMA surface. The stationing in the response should correspond to the stationing in the contractor's inertial profile data file. Upon completion of the final HMA surface, use these stations to define "leave-out sections" in the profile data file covering the final HMA surface. It is recommended that in a duplicate inertial profile data file, these "leave-out sections" are converted to "generic sections." Use the ProVAL "rolling straightedge" comparison tool to assist in determining areas within the sections that should be checked with a 12-foot straightedge.
- If determined that the contractor-defined areas can be corrected by prepaving grinding, assure that the response defines the reasoning. The reasoning should include a ProVAL grind plan that demonstrates grinding can be performed to meet the requirements in Section 39-2.01C(3)(e), "Prepaving Grinding," of the *Standard Specifications*.

If the project has inadequate funds to cover "prepaving grinding," contact the project manager to determine if additional funds are available to cover the additional work.

Where testing with a 12-foot straightedge is required, the paving inspector checks pavement smoothness for acceptance by daily use of a straightedge to determine whether the finished surface complies with the tolerances specified in Section 36-3.01D(4), “Department Acceptance,” of the *Standard Specifications*. These checks are in addition to checks the contractor is required to make and report in accordance with Section 36-3.01C(4) “Straightedge Measurements” of the *Standard Specifications*.

The paving inspector records straightedge measurements on Form CEM-4601, “Assistant Resident Engineer’s Daily Report,” and notifies the contractor of all out-of-specification areas.

Where smoothness is to be measured with an inertial profiler, the contractor must measure smoothness with an inertial profiler that meets the requirements of Section 36-3, “Pavement Smoothness,” of the *Standard Specifications*. Follow the guidelines in Section 4-36, “Surfacing and Pavements—General,” of this manual to assure that the inertial profiler, inertial profiler operator, submittals, and measurements meet the requirements of Section 36-3, “Pavement Smoothness,” of the *Standard Specifications*.

Review Section 39, “Asphalt Concrete,” of the *Standard Specifications* for the specified smoothness acceptance requirements. Analyze the contractor’s inertial profiles using ProVAL software.

- Check that prepaving grinding is performed only on existing asphalt concrete surfaces. Do not allow prepaving grinding work on existing asphalt concrete surfaces that are designated to be cold planed for mill and fill type paving, or in areas where existing asphalt concrete is designated to be replaced, or has been replaced, such as digouts. Corrective grinding work on replaced asphalt concrete surfacing is considered part of the replace asphalt concrete surfacing work and is not prepaving grinding work. Make sure the contractor’s prepaving inertial profiles are used to determine where prepaving grinding work is required. Do not use profiles provided with the bid documents.
- Monitor the contractor’s planning for prepaving grinding. Document any concerns you have about methods planned for achieving smoothness on an existing surface. A handbook and training videos on using ProVAL to develop grind plans are available at:  
<https://dot.ca.gov/programs/construction/training>
- After making prepaving grinding corrections, make sure the contractor takes and submits the corresponding inertial profiles. Require the contractor to repeat prepaving grinding and inertial profile submittal process, if necessary.
- Verify that the profile data file covering the surface of the completed prepaving grinding work defines lane sections where the final pavement surface will and will not have the smoothness specifications applied to it.

- Unless authorized by a change order, reject any HMA placed over an existing asphalt concrete surface that is required to, but does not meet the prepaving grinding smoothness requirements.
- Make sure prepaving profiles are taken before cold planing, and after replacing asphalt concrete surfacing.
- Once it has been determined that the contractor's prepaving grinding profiles meet the requirements, request Caltrans' inertial profiler be run to verify the profiles within 10 percent.

Verify that the final HMA surface meets the smoothness requirements.

When OGFC is being placed atop HMA, make sure the HMA surface meets the smoothness requirements prior to placement of OGFC.

Retain one copy of profile information in ".ppf" ProVAL format.

#### *4-3903D (8) Miscellaneous Areas and Dikes*

The contractor must place HMA at miscellaneous areas and place dikes where shown on the plans and in accordance with Section 39-2.01B(11), "Miscellaneous Areas and Dikes," of the *Standard Specifications*.

#### *4-3903D (9) Fog Seal Coat*

The contractor applies fog seal coat to rumble strip ground areas and ground areas caused by smoothness correction grinding. If smoothness correction grinding is excessive, contact the Division of Maintenance Office of Asphalt Pavements before allowing the contractor to fog seal within the traveled way.

The contract item for "fog seal coat" is used when fog seal must be applied to shoulders, miscellaneous areas, and dikes. Prohibit the contractor from applying fog seal coat to the traveled way.

Fog seal coat applied to ground in rumble strips and smoothness correction areas is not paid separately. Refer to Section 4-37, "Seal Coats," of this manual for additional information.

#### *4-3903D (10) Open to Traffic*

Do not allow traffic on new HMA until its mid-depth temperature is below 160 degrees Fahrenheit. The contractor may request in writing and the resident engineer authorize cooling of HMA Type A with water when rolling is complete.

The contractor must spread sand at a rate of 1 to 2 pounds per square yard before opening to public traffic on new rubberized HMA.

Temporary construction signing and temporary pavement delineation must be in place before opening to public traffic.

#### *4-3903D (11) Temporary Transverse Joint Taper*

Make sure that the contractor constructs a temporary joint taper between the existing pavement and any newly placed paving or cold planing area when a transverse joint greater than 0.04 foot cannot be avoided before opening to traffic.

Verify that the taper transition rates meet the requirements of Section 7-1.03, "Public Convenience," of the *Standard Specifications*.

Check that the temporary joint taper surface is uniform and there is no more than a 0.02-foot gap from the lower edge of a 12-foot straightedge and the taper surface when placed parallel and perpendicular to traffic.

#### *4-3903D (12) Existing Asphalt Concrete*

Make sure the contractor makes a 2-inch deep saw cut along limits where asphalt is designated to be removed.

Check that the contractor schedules cold planing and placement of HMA in accordance with the timeline requirements covered by Section 39-3.04, "Cold Planing Asphalt Concrete Pavement," of the *Standard Specifications*.

Verify that cold planing equipment has automatic controls for the longitudinal grade and transverse slope of the cutter head. When cold planing, document contractor's methods to control grades of the cold planer.

Inspect the cold planed surface to verify that the planing operations result in a neat and uniform surface. Make sure the contractor replaces broken, missing, or worn teeth if the surface pattern indicates the surface is not uniform.

Inspect the cold planed surface for signs of delamination. To minimize the potential for differential compaction, if necessary, provide direction to make minor adjustments or second passes to the cold planer to decrease potential for delamination. Document any locations that may cause smoothness issues if left unaddressed. Document any locations where you and the contractor disagree that delamination may be significant enough to cause differential compaction. Documentation should include high-resolution digital photographs or videos.

#### **4-3904 Contract Administration**

The resident engineer must review the notice of materials to be used, review and accept the job mix formula for HMA, review and accept the contractor's quality control plan when applicable, and verify Caltrans inspection reports and acceptance testing results for contract compliance. The resident engineer makes decisions regarding noncompliant materials and placement.

The Federal Highway Administration requires Caltrans to have a quality assurance program. As part of that program, this chapter defines quality assurance and contract administration requirements for HMA. Caltrans requires that these same quality assurance standards be met for state-funded projects. If the requirements are not met, there is a risk that federal funds will be withheld or withdrawn. The resident engineer takes the following steps for HMA contract administration:

- Verifying that Form CEM-3101, “Notice of Materials to Be Used,” includes all component materials and materials sources used in HMA. Refer to Section 6-202, “Responsibilities for Acceptance of Manufactured or Fabricated Materials and Products,” of this manual for details.
- Making sure that the job mix formula for the project is verified and accepted before placement of HMA.
- Verifying that the contractor’s quality control plan is submitted and complies with the requirements of Section 39-2.01A(3)(c) “Quality Control Plan,” of the *Standard Specifications*. The quality control plan must describe the organization and procedures used by the contractor to control HMA quality, sampling, implementing and maintaining quality, when corrective actions are needed based on the contractor’s action limit, implementing corrective actions, and method used to backfill core locations.

The submitted quality control plan must also address the following elements affecting HMA quality: aggregate, asphalt binder, additives, and production paving.

#### 4-3904A Acceptance Testing and Evaluation

The resident engineer makes sure that acceptance testing is performed at least at the minimum frequency shown in Table 6-1.13, “Materials Acceptance Sampling and Testing Requirements: Asphalt Concrete,” of this manual. Record test results on Form CEM-3701, “Test Result Summary,” so that minimum acceptance testing frequency is documented and easily verified.

The resident engineer verifies that acceptance samples are shipped or transported to testing laboratories within the timeframes specified in Example 6-1.2, “Sample Cylinder Label,” of this manual, except where specific sampling or test method requirements preclude doing so, for example, curing of specimens prior to transport. Test within 1 business day from sampling for projects within 50 miles of the testing laboratory or within 2 business days from sampling for projects more than 50 miles from the testing laboratory. Make sure the proper chain of custody is maintained throughout the process, including delivery to and receipt from a commercial shipping service. Use Form CEM-3701, “Test Result Summary,” to summarize acceptance test frequency and results on each material. Use this form to record dates for sampling, shipping to laboratory, receiving test results from laboratory, and notifying the contractor of test results. Monitor timeliness of material testing turnaround against Table 6-1.2, “Time Required for Materials Acceptance Tests,” of this manual, and make sure corrective actions are taken, and document where deficiencies are encountered. Notify contractor of all acceptance test results within 2 business days of receipt from laboratory. Advise the contractor that all test results are available for inspection and provide copies of these test results upon request. Maintain copies of the test results within the project files.

The resident engineer verifies that final inertial profile submittals meet the requirements for mean roughness index and areas of localized roughness. Use 4-3603B, “Pavement Smoothness,” of this manual as a guide in reviewing submittals.

The resident engineer compares the contractor's and Caltrans' International Roughness Index values over each 0.1-mile section of lane. The resident engineer uses the contractor's final inertial profiles for acceptance when they are within 10 percent of Caltrans' values.

The resident engineer assures that production start-up evaluation testing is completed and recorded on Form CEM-3703, "Production Start-Up Evaluation," and that the contractor is provided with a copy of the completed form.

#### *4-3904A (1) Acceptance Test Results Outside Specified Limits*

If any acceptance test result, except smoothness, is outside the limits specified, notify the contractor in writing that the material represented by the tests is noncompliant, and include a statement that the noncompliant material is rejected and must be removed or remedied in accordance with Section 5-1.30, "Noncompliant and Unauthorized Work," of the *Standard Specifications*. Attach a copy of the acceptance test result.

Ask the contractor if any corrective action has been taken based on quality control test data for the period when the acceptance sample was taken.

For every in-place density test failure notify the contractor in writing that the material represented by the failed in-place density test is noncompliant, and include the following statements:

"The noncompliant material is rejected and must be removed or remedied in accordance with Section 5-1.30, 'Noncompliant and Unauthorized Work,' of the *Standard Specifications*.

"At the engineer's option, noncompliant material may be accepted based on the engineer's evaluation of the effectiveness of your corrective actions. If the engineer decides to accept the noncompliant material, payment will be based on the table "Reduced Payment Factors for Percent of Maximum Theoretical Density," in Section 39-2.01A(4)(i)(ii), 'In-Place Density,' of the *Standard Specifications*."

For two consecutive density test failures, follow guidance in Section 4-3904A (2) "Two Consecutive Acceptance Test Results Outside of Specification Limits," of this manual.

If acceptance test results are disputed within the period specified in Section 39-2.01A(4)(i)(iv), "Dispute Resolution," of the *Standard Specifications*, try to resolve these issues at the project level before involving the independent third party.

If an acceptance test is outside the acceptance specification limits, immediately direct the field construction lab, district materials lab, or METS to test the most recent acceptance sample for compliance with the specifications. There may be additional samples that have not been tested. Always test the most recently pulled sample first. Designate this sample for priority testing.

If the most recent sample fails, follow guidance in Section 4-3904A (2) of this manual.

If the most recent sample passes, test the samples immediately before and after the initial failed sample. At a minimum, continue testing samples taken before and after the initial failed sample until a sample passes. If during this testing there are two consecutive failures, and there are passing results after these failures that indicate necessary corrective actions were already implemented, do not follow the guidance in Section 4-3904A (2) of this manual.

#### *4-3904A (2) Two Consecutive Acceptance Test Results Outside Specification Limits*

If two consecutive acceptance test results do not comply with the specifications:

- Immediately inform the contractor to stop production both verbally and in writing.
- Inform the contractor in writing that the material represented by the two out-of-specification acceptance tests is noncompliant, and include a statement that the noncompliant material is rejected and must be removed or remedied in accordance with Section 5-1.30 “Noncompliant and Unauthorized Work,” of the *Standard Specifications*. Attach copies of both test results that indicate the material is outside specification limits.
- Submit any samples taken between the two failed tests to the appropriate lab for priority testing to define the amount of material not in compliance with the specifications.
  1. Notify the appropriate lab that two consecutive acceptance tests are outside the acceptance specification limits.
  2. Direct the testing labs to test all samples between the first and second out-of-specification acceptance tests and any remaining samples immediately before or after any failure. Use their test results to define the quantity of hot mix asphalt that will be rejected.
- Notify the contractor in writing of results of all additional acceptance tests conducted to determine the extent of the out-of-specification material. In the notice, include language that the material represented by out-of-specification material is noncompliant and rejected and must be removed or remedied to comply with Section 5-1.30, “Noncompliant and Unauthorized Work,” of the *Standard Specifications*.
- Require the contractor to:
  1. Take corrective action to remedy the cause of out-of-specification material.
  2. Provide written documentation of corrective action taken.
  3. Demonstrate compliance by providing quality control testing of material produced but not delivered to the project.
  4. Provide samples of HMA for both the resident engineer and contractor to test. The contractor samples this material in the engineer’s presence and splits the samples into four parts.

5. Test one part of the split sample to verify that the corrective action taken by the contractor was successful.

If both Caltrans' and the contractor's test results are within specifications, the contractor has demonstrated compliance with the specifications and may resume production.

Since the samples tested by the contractor and resident engineer are from a split sample, the test results should not be significantly different. If there is a significant difference, the resident engineer and the contractor should investigate the reason for the discrepancy. Contractors can choose to begin production during this investigation but proceed at their own risk.

- The contractor may dispute any out-of-specification acceptance test result within the specified number of days of receiving the test result by notifying the resident engineer in writing in accordance with Section 39-2.01A(4)(i)(iv), "Dispute Resolution," of the *Standard Specifications*. Try to resolve testing or sampling issues at the project level before involving the independent third party.

#### *4-3904A (3) Contractor Requests for Accepting Noncompliant Work*

If the contractor agrees that the HMA placed is noncompliant, the contractor may propose to the resident engineer in writing that the noncompliant material will be remedied or that the noncompliant material will be left in place for reduced compensation. Consult with the district materials engineer and either the Division of Maintenance, Office of Asphalt Pavements, or the district's construction field coordinator, or both, about acceptance of the contractor's proposal. Document material remediation or reduced pay by issuing a contractor-requested change order. Document all noncompliant materials test results including the action taken on the final Project Materials Certification. Refer to Section 6-106, "Project Materials Certification," of this manual for documentation requirements.

#### 4-3904B Testing for Significant Difference

The resident engineer should compare the contractor's test results against Caltrans' test results to determine if they are significantly different. Compare the test results in one of two ways:

1. A one-to-one comparison of the test results of a single split sample (job mix formula verification and production startup).
2. The comparison of groups of test results, that is, the average of all acceptance tests compared to the average of all quality control tests.

The resident engineer should always examine the differences between contractor and Caltrans test results for job mix formula verification, production start-up, and dispute resolution based on a one-to-one comparison of the test results. For job mix formula verification and production start-up evaluation, the test result comparison will show whether the contractor and Caltrans can test properly sampled and split samples for aggregate and HMA and get reasonably close test results. If a significant difference exists, the resident engineer should notify the contractor. Then

both the resident engineer and contractor should examine what is causing the difference and try to find a way to bring their results closer.

The resident engineer should never consider a one-to-one comparison of two test results from different samples, such as Caltrans' acceptance result of a sample taken in the morning compared to a contractor's quality control test result of a sample taken in the afternoon. If examination of the contractor's and Caltrans' test results shows large differences, compare the test result groups to determine if the results are significantly different. Compare the average of all acceptance test results to the average of the contractor's quality control test results, and use Table 4-39.1, "Precision Index," of this manual, to determine if the difference between the test results is reasonable or significantly different. If the comparison between the test results indicates a significant difference, notify the contractor. Then both the resident engineer and contractor should examine and investigate the cause of test result differences.

Use the reasonable testing difference values in Table 4-39.1 to evaluate whether a significant testing difference exists.

Table 4-39.1. Precision Index

Quality Characteristic	Test Method	Reasonable Testing Differences	
		Single Results	Averages
Sand equivalent	AASHTO T 176	6	2
Theoretical maximum specific gravity (see Note 1)	CT 375	0.05	0.02
Percentage of maximum specific gravity (see Note 1)		3% (see Note 2) 2% (see Note 4)	1% (see Note 3)
Design air voids content (see Note 1)	MS-2 Asphalt Mix Design Methods	2.8%	4.5%
Asphalt binder content	AASHTO T 308, Method A	0.3% 0.5%	0.1% 0.2%
Aggregate gradation	AASHTO T 27		
3/4" or 1/2"		3%	1%
3/8"		3%	1%
No. 4		3%	1%
No. 8		3%	1%
No. 30		3%	1%
No. 200		3%	1%

NOTES:

1. Examine the AASHTO T 209, Method A values for theoretical maximum density also. Determine whether resolution of AASHTO T 209, Method A is necessary and sufficient to resolve issues with percent MTD or design air void content.
2. Comparing one core to the average of quality control test results within the same 250 tons.
3. Comparing the average of Caltrans' cores to the average of quality control test results for the same volume of HMA or the same area.
4. Comparing the average of three of Caltrans' cores in 3 lots of 250 tons each to the average of quality control test results for the same 3 lots of HMA.

#### 4-3904C Certificates of Compliance

The resident engineer obtains certificates of compliance for each delivery of asphalt binder (attach bill of lading), crumb rubber modifier, tack coat, and fog seal.

Keep track of total quantity of material delivered and check that inspectors have obtained an adequate number of certificates of compliance to cover the quantity of material received.

In addition, perform the following contract administration reviews for certificates of compliance:

- Refer to the *Certification Program for Suppliers of Asphalt* to determine what information must be shown on the certificate of compliance for asphalt binders.
- Obtain “Buy America” certification for each shipment of crumb rubber modifier.

Assure that asphalt binder contract administration requirements are met by following Section 4-92, “Asphalt Binders,” of this manual.

#### **4-3905 Level of Inspection**

Suggested levels of field inspection for typical concrete pavement activities are:

- Benchmark inspection of subgrade for compaction and elevation requirements
- Intermittent inspection of HMA production operations
- Continuous inspection of HMA delivery, placement
- Continuous inspection of HMA compaction operation using “method” compaction specifications
- Benchmark inspection of HMA compaction operation using the “core density” compaction specifications
- Continuous acceptance sampling and testing of HMA
- Intermittent monitoring of the contractor’s adherence to their quality control plan
- Benchmark evaluation of pavement surfacing for signs of segregation, raveling, or other distresses
- Benchmark inspection for smoothness

#### **4-3906 Quality Control**

Guidance for quality control activities included in this section is summarized as follows:

- Review contractor’s quality control plan.
- Verify that the contractor submits a copy of the AASHTO Materials Reference Laboratory (AMRL) accreditation for the laboratory performing the mix design. A current list of AMRL accredited labs is available at:

<http://aashtoresource.org/aap/accreditation-directory>

- Review the contractor’s quality control test results to assure testing meets the specifications for Caltrans acceptance. For most quality control characteristics, the contractor samples and tests at a minimum frequency of once per 750 tons of produced HMA.
- Verify that, when any quality characteristic is beyond the action limits shown in the quality control plan, the contractor is taking corrective action. The contractor must document the corrective action in accordance with Section 39-2.01A(4)(h), “Quality Control,” of the *Standard Specifications*.
- Verify that the contractor is complying with the minimum quality control testing frequencies specified in Section 39-2.01 “General,” of the *Standard Specifications*, and the frequencies specified under “Quality Control” for the type of HMA being produced.
- Make sure the contractor stops production when two consecutive quality control or acceptance tests are out of specification, notifies the resident engineer, takes corrective action, and demonstrates compliance with the specifications before resuming production and placement of HMA.
- Verify that certifications for the inertial profiler and operator have not expired. The corresponding expiration dates are available at:

<https://dot.ca.gov/programs/engineering-services/inertial-profiler-certification-program>

- Review the contractor’s monitoring of best paving practices that promote smoothness. Encourage the contractor to monitor and record locations where paving practices commonly known to negatively affect smoothness occur, then to follow up and compare those locations to the localized roughness reports of the corresponding International Roughness Index values. Examples of common occurrences are: paver stops, excessive screed angle adjustments, excessive variation in head of material in front of screed (paving width adjustments, poor controls), variations in paving speed, poor or lack of automated grade controls using a ski or averaging system, or poor roller practices.
- Prior to paving, use MultiCool software to estimate how rapidly a freshly placed HMA mat will cool as a function of the mix properties and site conditions. The MultiCool software is available at:

- <https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>

A MultiCool application is also available for smartphones using either the Android or iOS operating systems.

- Prior to placing tack coat, make sure the contractor plans to spray tack coat at a rate required to achieve the minimum residual rate. Rates vary based on the application and the dilution rate. To determine the minimum rate, calculate your own rate as shown in the example at 4-9403, “During the Course of Work,” of this manual or use the “*Minimum Tack Coat Spray Rates (PDF)*” at:

<https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>

#### **4-3907 Payment**

For details of payment, review the applicable, “Payment” subsection of Section 39 “Asphalt Concrete,” of the *Standard Specifications*.

For guidelines on how to weigh HMA, refer to Section 3-902E, “Weighing Equipment and Procedures,” of this manual.

For measuring asphalts, liquid asphalts, and asphaltic emulsions used as tack coat, refer to Sections 4-92, “Asphalt Binders”; and 4-94, “Asphaltic Emulsions,” of this manual.

##### 4-3907A Payment Adjustment for Core Density

Determine if a deduction is required for cores outside specification limits for the percent of maximum theoretical density. Use the table, “Reduced Payment Factors for Percent of Maximum Theoretical Density,” in Section 39-2.01A(4)(i)(ii), “In-Place Density,” of the *Standard Specifications*. The core density (compaction) deduction should be taken on the next monthly estimate as an administrative deduction.

##### 4-3907B Compensation Adjustment for Price Index Fluctuation

For compensation adjustments for price index fluctuation for asphalt binder, use the guidance provided in Section 4-9205A “Compensation Adjustments for Price Index Fluctuations” of this manual.

##### 4-3907C Payment After Dispute Resolution for Independent Third Parties

If applicable, when the dispute resolution process determines the contractor’s test results are correct, Caltrans pays the independent third party testing costs and adjusts the contract time. The resident engineer adjusts payment and contract time in accordance with Section 8-1.07, “Delays,” of the *Standard Specifications* and processes a change order to allow for payment and adjustment.

##### 4-3907D Compensation and Contract Time for Delays

When failing to comply with the specified times to return test results to the contractor, the resident engineer must adjust payment and contract time under Section 8-1.07, “Delays,” of the *Standard Specifications*:

- Within 20 days of sampling for job mix formula verification
- Within 3 days of rubberized HMA production sampling for job mix formula verification
- Within 3 days of sampling for production start-up evaluation

Make compensation and contract time adjustments only when work completion is delayed.

#### **4-3908 References and Resources**

The following provide construction personnel with additional sources of information:

#### 4-3908A References

- Authorized Materials Lists (AML)  
<https://dot.ca.gov/programs/engineering-services/authorized-materials-lists>
- California Test Methods, METS:  
<https://dot.ca.gov/programs/engineering-services/california-test-methods>
- Certification Program for Suppliers of Asphalt, METS:  
<https://dot.ca.gov/programs/engineering-services/asphalt-supplier-certification-program>
- CEM forms, Division of Construction:  
<https://dot.ca.gov/programs/construction/forms>
- *Independent Assurance Manual*, Procedures for Accreditation of Laboratories and Qualification of Testers, METS:  
<https://dot.ca.gov/programs/engineering-services/manuals>
- METS, Caltrans:  
<https://dot.ca.gov/programs/engineering-services/>
- Material Plant Quality Program, Division of Construction:  
<https://dot.ca.gov/programs/construction/material-plant-quality-program>
- Principles of Construction of Hot Mix Asphalt Pavements, Asphalt Institute.  
<http://www.dot.ca.gov/hq/construc/publications/qcqaman1.pdf>
- *Standard Specifications*, Caltrans:  
<https://dot.ca.gov/programs/design/ccs-standard-plans-and-standard-specifications>
- *Tack Coat Guidelines*, Division of Construction:  
<https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>
- Minimum Tack Coat Spray Rates, Division of Construction  
<https://dot.ca.gov/programs/construction/hot-mix-asphalt-construction>

#### 4-3908B Resources

Use available experts within your district or region to resolve issues and obtain additional information about HMA production and placement. Contact the construction engineer and Division of Construction coordinator for issues about contract administration related to HMA specifications. Contact the district materials engineer for issues about materials and the district independent assurance coordinator for issues concerning testing.

When questions about Section 39, “Asphalt Concrete,” of the *Standard Specifications* or related special provisions cannot be addressed by district or region

experts, or the construction engineer refers the resident engineer to the Division of Construction or Engineering Services for assistance, contact the following:

For materials or testing issues:

Chief, Office of Roadway Materials Testing  
Materials Engineering and Testing Services and Geotechnical Services  
California Department of Transportation

For contract administration, measurement or payment issues:

Chief, Office of Construction Standards  
Division of Construction  
California Department of Transportation

# Chapter 6

# Sampling and Testing

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## Section 1 Sample Types and Frequencies

### 6-101 General

Sampling and testing materials and products must be in accordance with contract specifications. Sampling and testing are of equal importance for assuring materials and products meet acceptance specifications.

Caltrans representatives must be familiar with materials handling and processing methods to assure representative samples are obtained. Caltrans representatives should be sufficiently knowledgeable about test methods to ensure compatibility between sample and test procedure.

Samples for acceptance must be taken in accordance with California Test 125, "Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections," or sampling requirements in specifications. For California Tests, Caltrans representatives must be qualified testers in accordance with the *Independent Assurance Manual*.

It is the resident engineer's responsibility to assure the safety of the Caltrans representative. In accordance with *Material Plant Quality Program* or California Test 109, "Method for Testing of Material Production Plants," the district weights and measures coordinator inspects material plants for safety in areas that the Caltrans representative will enter.

In certain situations, to assure the Caltrans representative's safety, the contractor will take acceptance samples for Caltrans. The Caltrans representative must witness the contractor taking acceptance samples. The Caltrans representative must determine when the sample is taken and observe that the sample is taken in accordance with California Test 125, or sampling requirements in specifications. The Caltrans representative must take possession of the sample from the contractor and transport it to a Caltrans office or the testing laboratory. The Caltrans representative must properly fill out form TL-0101 "Sample Identification Card."

The resident engineer is responsible for the chain of custody for material acceptance samples. Material acceptance samples and dispute resolution samples must be in Caltrans' possession from the sampling point. Adequate sample storage facilities must be arranged for at construction field offices or other Caltrans facilities. The chain of custody for material samples is an important part of the Caltrans quality assurance program.

### 6-101A References

- *Independent Assurance Manual*, Division of Engineering Services, Materials Engineering and Testing Services (METS), Caltrans:

<https://dot.ca.gov/programs/engineering-services/manuals>

- California Test Methods, METS, Caltrans, available at:  
<https://dot.ca.gov/programs/engineering-services/california-test-methods>
- American Association of State Highway and Transportation Officials (AASHTO), American Society for Testing and Materials International (ASTM), and other test methods are available at the IHS Standards Expert intranet website, which can be accessed from a link on the METS website:  
<http://des.onramp.dot.ca.gov/materials-engineering-and-testing-services-mets>
- *Material Plant Quality Program*, Division of Construction, Caltrans, available at:  
<https://dot.ca.gov/programs/construction/material-plant-quality-program>

## 6-102 Types of Sampling and Testing

The following are the types of sampling and testing used by Caltrans.

### 6-102A Preliminary Samples and Tests

Preliminary samples and tests are made prior to award of a contract. Construction personnel rarely perform preliminary sampling and testing. The district materials engineer is responsible for preliminary sampling and testing. Such tests are used for design purposes, and to provide data for the materials information package for prospective bidders.

### 6-102B Initial Samples and Tests

Initial samples and tests are performed on materials proposed for use in the project. These initial tests determine whether proposed materials sources, local materials, or products meet the specifications.

Construction personnel may sample potential sources. For soils and aggregate tests, send samples to the district materials laboratory. Tests may be performed by the district materials laboratory or METS, depending on their respective capabilities.

Sampling and testing potential local materials is not mandatory unless specified. Charge the contractor for the cost of sampling and testing potential local materials sources in accordance with Section 6, "Control of Materials," of the *Standard Specifications*.

The normal time required for testing initial source samples of potential local materials sources is shown in Table 6-1.1.

Table 6-1.1. Time Required for Source Testing

Material	Time
Aggregates for hot mix asphalt	2 weeks
Aggregates for cement treatment	4 weeks
Aggregates for concrete mixture	4 weeks
Aggregates for concrete pavement	60 days

Material	Time
Screenings for seal coats	2 weeks
Soils (R-Value)	3 weeks
Untreated base materials	3 weeks

### 6-102B (1) *Unprocessed Soils and Aggregates*

The discussion on unprocessed soils and aggregates is primarily applicable to preliminary and initial sampling, although the same precautions apply when sampling for specification compliance.

#### 6-102B (1a) Stone from Ledges and Quarries

Inspect the ledge or quarry face to determine any variations in strata, or in portions of the ledge. Observe and record differences in color and structure. Obtain separate samples of unweathered stone from all strata that appear to vary in color and structure.

#### 6-102B (1b) Material Sites of Sand, Gravel, or Soil

Select samples representing the different materials available in the deposit. If the deposit is worked as an open face or pit, take the samples by channeling the face so that they will represent material that visual inspection indicates may be used. It is necessary, especially in small deposits, to excavate test holes some distance in back of, and parallel to, the face to determine the extent of the supply. The number and depth of these test holes depend on the quantity of material to be used from the deposit. Obtain samples from open test pits by channeling a face of the test pit in the same manner as sampling a face of a materials site. Do not include material in the sample that will be stripped from the pit as overburden. Obtain separate samples from the face of the bank and from the test holes. If visual inspection indicates that there is considerable variation in the material, obtain separate samples at different depths.

Use test holes to sample deposits that have no open faces. When sampling material sites, select depth and spacing of test holes considering the probable method of operating the pit. In general, dozers will combine the material laterally. A shovel will remove the material vertically. Test results in a “spotty” pit may be misleading to the extent that operations may be too expensive to make the required grading.

If possible, use a dozer or shovel to open up the pit before sampling rather than depending on test holes.

### 6-102B (2) *Processed Aggregates*

Sample processed aggregates from locations such as stockpiles, transportation units, conveyors, or windrows in accordance with California Test 125, “Methods of Test for Sampling Highway Materials and Products Used in the Roadway Structural Sections.”

### 6-102C Acceptance Samples and Tests

Acceptance tests are generally performed on materials that will be incorporated into the work. Some acceptance tests are performed on materials already incorporated into

the work. Acceptance sampling and testing should begin as soon as the material is delivered or in place.

Sample materials at the locations specified in the *Standard Specifications*, the special provisions, or as required by California Test 125. If the sampling location is not specified, sample at the location indicated in the materials acceptance sampling and testing requirements tables in Section 6-107, "Materials Acceptance Sampling and Testing" of this manual. Regardless of location, sample randomly and within the frequency specified to obtain representative samples of the material used in the work.

On Form TL-0101, "Sample Identification Card," use the "Priority" designation for the first few acceptance samples of each construction material. Use "Priority" for verification tests for acceptance. Use the "Priority" designation for all samples if the material being supplied is of questionable quality or if the construction means and methods or source of materials changes. For "Priority" tests, indicate if there is a preference for telephoned, faxed, or emailed test results on Form TL-0101, "Sample Identification Card," along with the telephone number of the person who is to receive them.

For "Priority" and "Normal" processing times for acceptance tests of materials, refer to Table 6-1.2, "Time Required for Materials Acceptance Tests," of this manual.

The minimum time required for acceptance tests of products is shown in Table 6-1.2, of this manual.

Make sure acceptance samples are shipped or transported to testing laboratories within the following timeframes:

1. Within 1 business day from sampling for projects within 50 miles of the testing laboratory
2. Within 2 business days from sampling for projects more than 50 miles from the testing laboratory

The above timeframes are not applicable where specific sampling or test method requirements preclude doing so, for example, curing of specimens prior to transport.

Assure that proper chain of custody is maintained throughout the process, including delivery to and receipt from commercial shipping services.

Use Form CEM-3701, "Test Result Summary," to summarize acceptance test frequency and test results on each material. Use this form to record sampling and testing related dates and monitor timeliness of acceptance testing. Compare timeliness of material testing turnaround against Table 6-1.2, and verify that corrective actions are taken and documented where repeated deficiencies are detected.

Notify contractor of all acceptance test results within 2 business days of receipt from laboratory. Advise the contractor that all test results are available for their inspection, and provide copies of these test results upon their request. Maintain copies of the test results within the project files for ready accessibility.

Table 6-1.2. Time Required for Materials Acceptance Tests (1 of 4)

Material and Test	Sample to Lab (Note 1) (business days)	Lab Time Priority (Note 2) (business days)	Lab Time Normal (Note 2) (business days)	Reporting to Contractor (Note 3) (business days)	Total (business days)
<b>SOILS</b>					
Gradation (CT 202)	1 to 2	1	3	2	4 to 7
Sand Equivalent (CT 217)	1 to 2	1	3	2	4 to 7
Relative Compaction (CT 231/216)	1 to 2	1	2	2	4 to 6
Plasticity Index (Geosynthetic Reinforced Embankment)	1 to 2	3	7	2	6 to 11
pH (Geosynthetic Reinforced Embankment)	1 to 2	2	3	2	5 to 7
Percentage Crushed Particles (Shoulder Backing – CT 205)	1 to 2	2	5	2	5 to 9
Durability Index (Shoulder Backing – CT 229)	1 to 2	2	5	2	5 to 9
R-value (Imported Borrow – CT 301)	1 to 2	4	6	2	7 to 10
<b>SUBBASES AND BASES</b>					
Relative Compaction (CT 231/216)	1 to 2	1	2	2	4 to 6
Gradation (CT 202)	1 to 2	1	3	2	4 to 7
Sand Equivalent (CT 217)	1 to 2	1	3	2	4 to 7
R-value (CT 301)	1 to 2	4	6	2	7 to 10
Durability Index (CT 229)	1 to 2	2	5	2	5 to 9
Compressive Strength (CTB aggregate – CT 312)	-	Age based	Age based	2	Age +2
Compressive Strength (LCB–ASTM C39)	-	Age based	Age based	2	Age +2
Compressive Strength (LCB – rapid setting – CT 521)	-	Age based	Age based	2	Age +2
Modulus of Rupture (Concrete base – CT 523)	-	Age based	Age based	2	Age +2
Modulus of Rupture (Rapid strength concrete base – CT 524)	-	Age based	Age based	2	Age +2
Percentage of Crushed Particles (CT 205)	1 to 2	2	5	2	5 to 9
Los Angeles Rattler (CT 211)	1 to 2	2	4	2	5 to 8
Cleanness Value (CT 227)	1 to 2	2	3	2	5 to 7
Film Stripping (CT 302)	1 to 2	2	7	2	5 to 11
Asphalt Content (ATPB – CT 382)	1 to 2	1	5	2	4 to 9
Soundness (CTPB – CT 214)	1 to 2	8	10	2	11 to 14
<b>SEAL COATS</b>					
Los Angeles Rattler (CT 211)	1 to 2	2	4	2	5 to 8
Percentage of Crushed Particles (CT 205)	1 to 2	2	5	2	5 to 9
Film Stripping (CT 302)	1 to 2	2	7	2	5 to 11
Gradation (CT 202)	1 to 2	1	3	2	4 to 7

Table 6-1.2. Time Required for Materials Acceptance Tests (2 of 4)

Material and Test	Sample to Lab (Note 1) (business days)	Lab Time Priority (Note 2) (business days)	Lab Time Normal (Note 2) (business days)	Reporting to Contractor (Note 3) (business days)	Total (business days)
<b>SEAL COATS (Cont.)</b>					
Gradation (ASTM C136)	1 to 2	1	3	2	4 to 7
Cleanness Value (CT 227)	1 to 2	2	3	2	5 to 7
Durability Index (CT 229)	1 to 2	2	5	2	5 to 9
Sand Equivalent (CT 217)	1 to 2	1	3	2	4 to 7
Viscosity (AASHTO T 59)	1 to 2	3	15	2	6 to 19
Viscosity (ASTM D7741)	1 to 2	3	15	2	6 to 19
Viscosity (ASTM D445)	1 to 2	3	15	2	6 to 19
Flash Point (ASTM D92)	1 to 2	3	15	2	6 to 19
Aromatics (ASTM D2007)	1 to 2	7	15	2	10 to 19
Cone Penetration (ASTM D217)	1 to 2	3	15	2	6 to 19
Resilience (ASTM D5329)	1 to 2	3	15	2	6 to 19
Settlement (AASHTO T 59)	1 to 2	7	30	2	10 to 34
Sieve Test (AASHTO T 59)	1 to 2	3	15	2	6 to 19
Demulsibility (AASHTO T 59)	1 to 2	3	15	2	6 to 19
Torsional Recovery (CT 332)	1 to 2	3	15	2	6 to 19
Penetration (AASHTO T 49)	1 to 2	3	15	2	6 to 19
Ring and Ball Softening Point Temperature (AASHTO T 53)	1 to 2	3	15	2	6 to 19
Field Softening Point (ASTM D36)	1 to 2	3	15	2	6 to 19
Elastic Recovery (AASHTO T 301)	1 to 2	4	15	2	7 to 19
Ductility (AASHTO T 51)	1 to 2	4	15	2	7 to 19
BBR (AASHTO T 313)	1 to 2	5	8	2	8 to 12
<b>HMA</b>					
Gradation (AASHTO T 27)	1 to 2	1	3	2	4 to 7
Sand Equivalent (AASHTO T 176)	1 to 2	1	3	2	4 to 7
Los Angeles Rattler (AASHTO T 96)	1 to 2	2	4	2	5 to 8
Percent of Crushed Particles (Coarse) (AASHTO T 335)	1 to 2	2	5	2	5 to 9
Percent of Crushed Particles (Fine) (AASHTO T 335)	1 to 2	2	5	2	5 to 9
Flat and Elongated Particles (ASTM D4791)	1 to 2	2	4	2	5 to 8
Fine Aggregate Angularity (AASHTO T 304, Method A)	1 to 2	2	4	2	5 to 8
<b>Asphalt Binder</b>					
Flash Point (AASHTO T 48)	1 to 2	3	15	2	6 to 19
Solubility (AASHTO T 44)	1 to 2	3	15	2	6 to 19
Viscosity (AASHTO T 316)	1 to 2	3	15	2	6 to 19

Table 6-1.2. Time Required for Materials Acceptance Tests (3 of 4)

Material and Test	Sample to Lab (Note 1) (business days)	Lab Time Priority (Note 2) (business days)	Lab Time Normal (Note 2) (business days)	Reporting to Contractor (Note 3) (business days)	Total (business days)
<b>HMA (Cont.)</b>					
Dynamic Shear – Original Phase (AASHTO T 315)	1 to 2	3	15	2	6 to 19
Dynamic Shear – RTFO Phase (AASHTO T 315)	1 to 2	4	15	2	7 to 19
Dynamic Shear – PAV Phase (AASHTO T 315)	1 to 2	5	15	2	8 to 19
RTFO Test (AASHTO T 240)	1 to 2	3	15	2	6 to 19
Ductility (AASHTO T 51)	1 to 2	3	15	2	6 to 19
Elastic Recovery (AASHTO T 301)	1 to 2	3	15	2	6 to 19
PAV (AASHTO R 28)	1 to 2	4	15	2	7 to 19
Creep and Stiffness (AASHTO T 313)	1 to 2	5	15	2	8 to 19
Binder Recovery (AASHTO T164 / ASTM D1856)	1 to 2	2	15	2	5 to 19
Binder Recovery (AASHTO R 59)	1 to 2	4	15	2	7 to 19
<b>Asphalt Rubber Binder</b>					
Cone Penetration (ASTM D217)	1 to 2	4	15	2	7 to 19
Resilience (ASTM D5329)	1 to 2	4	15	2	7 to 19
Softening Point (ASTM D36)	1 to 2	3	15	2	6 to 19
Viscosity (ASTM D7741)	1 to 2	3	15	2	6 to 19
Asphalt Modifier Properties (ASTM D445, ASTM D92, ASTM D2007)	1 to 2	3	15	2	6 to 19
Crumb Rubber Modifier (CRM) properties (CT 208, CT 385, ASTM D297)	1 to 2	7	30	2	10 to 34
<b>Hot Mix Asphalt Mix</b>					
Moisture Content (AASHTO T 329)	1 to 2	2	5	2	5 to 9
Asphalt Binder Content (AASHTO T 308, Method A)	1 to 2	2	5	2	5 to 9
Hamburg Wheel Track (AASHTO T 324 [Modified])	1 to 2	7	30	2	10 to 34
Bulk Specific Gravity (AASHTO T 275)	1 to 2	2	7	2	5 to 11
Maximum Theoretical Density (AASHTO T 209)	1 to 2	2	7	2	5 to 11
Field Softening Point (ASTM D36)	1 to 2	3	15	2	6 to 19
Elastic Recovery (AASHTO T 301)	1 to 2	4	15	2	7 to 19
Ductility (AASHTO T 51)	1 to 2	4	15	2	7 to 19
BBR (AASHTO T 313)	1 to 2	5	8	2	8 to 12

Table 6-1.2. Time Required for Materials Acceptance Tests (4 of 4)

Material and Test	Sample to Lab (Note 1) (business days)	Lab Time Priority (Note 2) (business days)	Lab Time Normal (Note 2) (business days)	Reporting to Contractor (Note 3) (business days)	Total (business days)
<b>CONCRETE PAVEMENT</b>					
Los Angeles Rattler (CT 211)	1 to 2	2	4	2	5 to 8
Cleanness Value (CT 227)	1 to 2	2	3	2	5 to 7
Gradation (CT 202)	1 to 2	1	3	2	4 to 7
Sand Equivalent (CT 217)	1 to 2	1	3	2	4 to 7
Modulus of Rupture (CT 523)	-	Age based	Age based	2	Age +2
Thickness (CT 531)	2	2	7	2	6 to 11
Dowel bar alignment and concrete consolidation	2	2	5	2	6 to 9
Tie bar alignment and concrete consolidation	2	2	5	2	6 to 9
Coefficient of Friction (CT 342)	7*	2	5	2	11 to 14
Inertial Profiler (AASHTO R 56 & R 57)	7*	3	7	2	12 to 16
<b>CONCRETE STRUCTURES</b>					
Los Angeles Rattler (CT 211)	1 to 2	2	4	2	5 to 8
Cleanness Value (CT 227)	1 to 2	2	3	2	5 to 7
Gradation (CT 202)	1 to 2	1	3	2	4 to 7
Sand Equivalent (CT 217)	1 to 2	1	3	2	4 to 7
Compressive Strength (CT 521)	-	Age based	Age based	2	Age +2
<b>CONCRETE</b>					
Gradation (CT 202)	1 to 2	1	3	2	4 to 7
Cement (Various)	1 to 2	35	60	2	38 to 64
Supplementary Cementitious Materials (Various)	1 to 2	35	60	2	38 to 64
Shrinkage (AASHTO T 160)	1 to 2	42	60	2	45 to 64

Notes:

1. Time to testing laboratory begins from time of sampling and includes any required field curing time and time required for transport to the testing laboratory.
2. Time in laboratory begins from time laboratory receives the sample and includes any required laboratory curing time prior to testing and time required to prioritize samples. This time also includes the lab manager's review of test results and the time to notify the resident engineer.
3. Reporting time is the time from when the test is provided to the resident engineer to when the contractor is notified of the test results.

\* Days to schedule lab for testing

Table 6-1.3. Time Required for Products Acceptance Tests

<b>Product</b>	<b>Minimum Time (Business Days)</b>
Coating tests	3
Expansion joint material	3
Fencing, all types	2
Guide posts	3
Geosynthetic fabrics	3
Geosynthetic fabrics (UV testing)	45
Metal guardrail	7
Pavement markers	4
Prestressing steel	10
Reinforcing steel and wire	2
Rubber (accompanied by manufacturer test report)	3
Rubber (without test report)	14
Structural steel	10
Type B joint seal	7

#### 6-102D Dispute Resolution Samples

Code of Federal Regulations, Title 23, Section 637.207, (23 CFR 637.207), "Quality Assurance Program," paragraph (a)(1)(iii), states, "If the results from the quality control sampling and testing are used in the acceptance program, the STD (state transportation department) shall establish a dispute resolution system. The dispute resolution system shall address the resolution of discrepancies occurring between the verification sampling and testing and the quality control sampling and testing." When specified, the engineer must split acceptance test samples and store the split samples in case of a disputed test result. Caltrans requires split samples to be stored in a facility under state control in case they are needed for dispute resolution.

#### 6-102E Investigation Samples and Tests

Specific materials or quality problems such as pavement failures, difficulty in achieving percent of maximum theoretical density, or inconsistent test results may require special samples and tests. When materials problems are encountered, contact the district materials engineer. The district materials engineer may request help from METS and the Division of Construction. METS will request all acceptance test results and contractor quality control test results along with material-specific additional samples and tests in order to conduct a forensic investigation.

#### 6-102F Research Samples and Tests

Pilot projects usually have special requirements for sampling and testing of materials. Projects developed around research needs usually require larger samples and more frequent testing than what is required by Caltrans' acceptance testing minimum

frequencies. The unit that requested the research project will provide oversight for all of the special sampling and testing requirements.

### **6-103 Field Sampled Material Identification for Testing**

Samples must be properly identified so the testing laboratory can function efficiently and report results to the project in a timely manner. In addition, accuracy in identifying where the material was placed in the project can be very useful if the material must be rejected by the engineer and then removed by the contractor.

For requesting faster processing of samples, use the “priority” designation as discussed in Section 6-102C, “Acceptance Samples and Tests,” of this manual.

For field material samples, except for concrete cylinder compressive strength, use Form TL-0101, “Sample Identification Card.” For concrete cylinder compressive strength, use Form TL-0502, “Field Sample of Portland Cement Concrete Sample Card.”

In general, prepare Form TL-0101 as follows:

- Fill in every blank space with complete information, including the quantity and lot of material sampled.
- The “Location of Source” must clearly indicate the place (that is, behind paver, stockpile, cold feed belt) where the sample was taken.
- Indicate “Normal” for laboratory processing of sample or “Priority” if test result is needed quickly.
- If the sample was taken at the request of the contractor from local deposits as a potential source in accordance with Section 6-1.03, “Local Materials,” of the *Standard Specifications*, note this under “Remarks.” Request that the district materials laboratory provides the cost of testing so that Caltrans can be reimbursed by the contractor.
- To protect the sample identification card against moisture or stains, place it in a plastic bag or shipping label protector and tape it to the sample container.
- Distribute copies as shown on the form on the same day the sample is shipped.
- Prepare Form TL-0101 in accordance with the following details based on the type of material:
  - Aggregate sources must be in compliance with or not subject to the State Mining and Reclamation Act (SMARA). Verify that sources of aggregates are indicated and include the SMARA listing number. For additional information, refer to Section 7-103H (2), “Surface Mining and Reclamation Act,” of this manual.
  - For hot mix asphalt (HMA) sample be sure to:
    1. Identify the HMA plant producing the material.
    2. Identify the job mix formula (JMF) producer identification number.
    3. Include the type of mix and aggregate grading specified.
    4. Under “Remarks,” include the grade and source of the asphalt binder.

5. Under “Remarks,” include the percentage of asphalt binder designated in the JMF.

- For asphalt binder sample be sure to:
  1. Identify the HMA plant using the material.
  2. Identify the source of asphalt binder.

A list of approved asphalt suppliers is available at:

<https://dot.ca.gov/programs/engineering-services/asphalt-supplier-certification-program>

For nonapproved suppliers identify the refinery and shipment number for each truckload.

- For tack coat or asphalt emulsion samples be sure to:
  1. Identify the source of the asphalt binder or asphaltic emulsion.
  2. Under “Remarks” include the dilution rate (50/50 or 60/40) for asphaltic emulsions or enter “Not Diluted.”
- If the specification has requirements based on the use of the material, include the intended use under “Remarks.” This is especially important for electrical conductors, as the applicable specifications depend on where and how the conductor is used.
- Prepare Form TL-0502, “Field Sample of Portland Cement Concrete Sample Card,” for each pair of cylinders shipped in the same carton as follows:
  - Fill in every blank space with complete information.
  - Indicate sources of aggregates and include the SMARA listing number. Aggregate sources must be in compliance with or not subject to SMARA. For additional information, refer to Section 7-103H (2), “Surface Mining and Reclamation Act,” of this manual. Indicate in the space for water the total weight of water used per cubic yard of cementitious material in the mix based on actual weight (not design weight).
  - Under “Remarks,” indicate the specified concrete strength.
  - Under “Remarks,” indicate if the unit weight of the hardened concrete cylinders is required. The testing laboratory will not furnish unit weight data unless it is specifically requested.
  - To protect the sample card against moisture or stains, place it in a plastic bag or shipping label protector, and tape it to the sample container.
  - Distribute copies as shown on the form on the same day the sample is shipped.

A uniform system for marking cylinders is used. This system consists of the contract number and the sample number. The sample number consists of a series of digits separated by dashes (-) to indicate: method of storage for curing; age at which cylinders are to be tested; the cylinder number of the pair, or group of five, that is to be tested; and project coding. Use a flow pen to mark the cylinders.

Following are examples of the cylinder marking system.

Example 6-1.1. Sample Cylinder Label

Contract No. 03-100844  
Sample No. 1-28-1/5\_ \_ \_ \_ \_  
Date Cast \_\_\_\_\_

For sample shown in Example 6-1.1:

- The first digit indicates method 1 storage for curing.
- The second two digits indicate that the cylinder is to be tested at 28 days.
- The 1/5 set indicates that it is the No. 1 cylinder of 5 cylinders. The No. 2 cylinder would be marked 2/5, and so on, for the remaining cylinders of the group.
- The last four spaces are reserved for any project coding consisting of numbers, letters, or a combination.

Note if only one sample card was made for two cylinders, the third symbol on the card would be 1,2/5.

Example 6-1.2. Sample Cylinder Label

Contract No. 03-100844  
Sample No. 2-14-2/2\_ \_ \_ \_ \_  
Date Cast \_\_\_\_\_

For sample shown in Example 6-1.2:

- The first digit indicates method 2 storage for curing.
- The second two digits indicate that the cylinder is to be tested at 14 days.
- The 2/2 set indicates that it is the No. 2 cylinder of a group of 2 cylinders.
- The last four spaces are reserved for any project coding consisting of numbers, letters or a combination.

Note if one sample card is made for the two cylinders, the third symbol on the card would be 1,2/2.

### **6-104 Shipping of Field Samples**

Based on turnaround time needed to receive a test result, ship samples from the job site to the laboratory using the most economical mode of transportation available consistent with the time element involved. Do not accumulate samples at the project site to save transportation costs.

Concrete cylinders are shipped to the laboratory in accordance with California Test 540, "Method of Test for Making, Handling, and Storing Concrete Compressive Test Specimens in the Field." Cylinders are shipped without removing the mold and are packed in cardboard containers available at the district warehouse. Each carton holds two cylinders.

If the district laboratory is equipped to test concrete cylinders, they should be shipped there. Otherwise cylinders may be delivered either to the Southern Regional Lab at 13970 Victoria Street, Fontana, CA 92336, or METS at 5900 Folsom Boulevard, Sacramento, CA 95819, whichever is more convenient. Ship concrete cylinders within the time limits specified in California Test 540 or the test result cannot be used as an acceptance test.

Shipping costs to district materials laboratories, the Southern Regional Lab, or METS, are to be prepaid.

### **6-105 Acceptance Records**

Keep records of all samples and tests in the project files as permanent job records. Monitor acceptance testing frequency, results, and timelines by using Form CEM-3701, "Test Result Summary." Corrective action or retesting of failing tests must be noted in the "Remarks" column of the form.

Documentation of the reason materials represented by failing tests were incorporated into the project must be included in the project files. For more information on procedures to follow in the case of failing tests, refer to Section 3-6, "Control of Materials," of this manual.

It is not necessary to secure separate samples for each project when two or more projects receive materials from the same source. File a copy of the test report with each project.

### **6-106 Project Materials Certification**

When construction work on the project is complete, prepare Form CEM-6302, "Final Materials Certification." Use the form to certify that, other than for the exceptions listed on the form, the results of tests performed on acceptance samples show that the materials used in the work controlled by sampling and testing conform to the approved plans and specifications.

If exceptions exist, check the exceptions box and note all nonconforming materials on the form. The following are examples of nonconforming materials that must be noted as exceptions:

- Materials accepted by applying a specified pay factor or deficiency adjustment, such as for hot mix asphalt, concrete pavement, or rapid-strength concrete.
- Materials out of "operating range" but within "contract compliance" for which a specified payment deduction was made.
- Materials not in compliance with the as-bid contract plans or specifications for which a change order was approved to accept the material.
- Materials that require certificates of compliance but one or more have not been submitted.

Sign the form and put the original in the project files. Send a copy to district construction and, if the project is subject to Federal Highway Administration (FHWA) construction oversight activities, send another copy to the FHWA California division

administrator. The name and address of the FHWA California division administrator is available at:

<https://www.fhwa.dot.gov/cadiv/directory.cfm>

### **6-107 Materials Acceptance Sampling and Testing**

Sampling and testing materials and products must be in accordance with contract specifications. Sampling and testing are of equal importance for assuring materials and products meet acceptance specifications.

The tables that make up Table 6-1.4 contain Caltrans' minimum sampling and testing requirements for materials acceptance. The frequency of sampling and testing indicated in the tables is to be used under normal conditions. Materials that are marginal in meeting the specifications should be sampled and tested on a more frequent basis. Request "Priority" testing for samples taken on potentially marginal materials.

When shown in the tables that testing frequencies may be adjusted, document any adjustment through a "Memo to File." Place the "Memo to File" in the appropriate part of Category 37, "Initial Tests and Acceptance Tests," of the project files.

Adherence to the sample size requirements shown in the tables will prevent unnecessary delays and expense of obtaining supplementary samples to complete tests.

Refer to Section 6-105 "Acceptance Records," of this manual for documenting acceptance tests results. For more information on procedures to follow in the case of failing tests, refer to Section 3-6, "Control of Materials," of this manual.

Table 6-1.4. Materials Acceptance Sampling and Testing Requirements:  
Earthwork (*Standard Specifications* Section 19) (1 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>STRUCTURE BACKFILL (Section 19-3.02C)</b>					
Sieve Analysis	California Test 202	50 lb	Materials site or stockpile	1 every 3,000 tons or 2,000 cu yd	If uniform material is within specification limits, test frequency may be decreased to 1 per day
Sand Equivalent	California Test 217	50 lb	Materials site or stockpile	1 every 3,000 tons or 2,000 cu yd	If uniform material is within specification limits, test frequency may be decreased to 1 per day
Relative Compaction	California Test 231	Sample for California Test 216	Project site in accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 8 in. of thickness	Relative compaction test is required at each location structure backfill is placed
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	1 every relative compaction test	Wet common-composite test maximum value may be used in accordance with California Test 231
<b>PERVIOUS BACKFILL MATERIAL (Section 19-3.02D)</b>					
Sieve Analysis	California Test 202	50 lb	Stockpile	1 every 3,000 tons or 2,000 cu yd	If uniform material within specification limits, test frequency may be decreased to 1 per day
<b>COMPACTION (Section 19-5)</b>					
R-Value	California Test 301	50 lb	Project site	Test to verify R-value if differing site conditions are encountered	If R-value testing in the materials report is incomplete because of preproject conditions, then test to verify design R-value
Relative Compaction	California Test 231	Sample for California Test 216	California Test 216	1 every 2,000 sq yd	
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	1 every relative compaction test	

Table 6-1.4. Materials Acceptance Sampling and Testing Requirements:  
Earthwork (*Standard Specifications* Section 19) (2 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>EMBANKMENT CONSTRUCTION (Section 19-6)</b>					
Relative Compaction	California Test 231	Sample for California Test 216	Project site in accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 8 in. of thickness	
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	1 every relative compaction test	Wet common-composite test maximum value may be used in accordance with California Test 231
<b>GEOSYNTHETIC REINFORCED EMBANKMENT (Section 19-6.02B)</b>					
Plasticity Index	California Test 204	50 lb	Materials site or stockpile	1 per source prior to use	
pH	California Test 643	50 lb	Materials site or stockpile	1 per source prior to use	
Sieve Analysis	California Test 202	50 lb	Stockpile	Prior to use, 1 every 3,000 tons or 2,000 cu yd	If material is uniform and well within specification limits, the test frequency may be decreased to 1 per day
<b>BORROW MATERIAL (Section 19-7)</b>					
R-Value	California Test 301	50 lb	Import borrow source	1 per source	Test for R-value only when an R-value is specified for import borrow in the special provisions; if material at import borrow source is not uniform, increase testing frequency

Table 6-1.4. Materials Acceptance Sampling and Testing Requirements:  
Earthwork (*Standard Specifications* Section 19) (3 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>SHOULDER BACKING (Section 19-9)</b>					
Crushed Particles	California Test 205	50 lb	Materials site or stockpile	1 per project prior to use	
Durability	California Test 229	50 lb	Materials site or stockpile	1 per project prior to use	
Unit Weight	California Test 212 Rodding Method	50 lb	Materials site or stockpile	1 per project prior to use	
Sieve Analysis	California Test 202	50 lb	Materials site or stockpile	1 every 3,000 tons or 2,000 cu yd	If uniform material is within specification limits, test frequency may be decreased to 1 per day
Sand Equivalent	California Test 217	50 lb	Materials site or stockpile	1 every 3,000 tons or 2,000 cu yd	If uniform material is within specification limits, test frequency may be decreased to 1 per day

Note:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.5. Materials Acceptance Sampling and Testing Requirements:  
Stabilized Soils (*Standard Specifications* Section 24) (1 of 2)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>LIME (Section 24-2.02)</b>					
Various properties	See <i>Standard Specifications</i> Section 24-2.02	One 10-lb sample for each type and source of lime; use a 2-qt airtight container	Initial sample provided by contractor; subsequent sampling from mid-point of delivery	Each 100 tons of lime, 2 per day maximum	Must be on an Authorized Material List and certificate of compliance must accompany each shipment; recommend 1 acceptance test per 5 samples of lime
<b>LIME TREATMENT</b>					
<b>DETERMINATION OF LIME APPLICATION RATE (Section 24-2.01D)</b>					
Unconfined Compressive Strength	California Test 373	100 lb	Native soils; test each type of material to be treated	Prior to soil stabilization work and if source of lime changes	To determine appropriate lime content
Optimum Moisture Content	California Test 373	100 lb	Native soils; test each type of material to be treated	Prior to soil stabilization work	
<b>VERIFICATION OF LIME APPLICATION RATE AND STABILIZED SOIL MIXTURE (Section 24-2.01D)</b>					
Lime Application (Dry Form)	Calibrated tray method or equal	Building paper or pan of known area	Surface receiving lime	Each 40,000 sq ft, 2 per day minimum	To determine if application rate is within $\pm 5\%$ of ordered application rate
Lime Application (Slurry Form)	Volumetric measurement that is then reduced to lime weight	Determined over known area	Slurry holding tank	Each 40,000 sq ft, 2 per day minimum	To determine if application rate is within $\pm 5\%$ of ordered application rate
Uniformity of Mixed Stabilized Soil	Phenolphthalein alcohol indicator solution spray	N/A	Representative areas	Each day at five separate locations	Taken after completion of initial mixing

Table 6-1.5. Materials Acceptance Sampling and Testing Requirements:  
Stabilized Soils (*Standard Specifications* Section 24) (2 of 2)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>VERIFICATION OF LIME APPLICATION RATE AND STABILIZED SOIL MIXTURE (Section 24-2.01D)</b>					
Moisture Content of Mixed Stabilized Soil	California Test 226	0.25 lb each sample	Representative areas at mid depth	Each day at five separate locations to verify contractor's quality control tests	Taken during mellowing period
Gradation of Mixed Stabilized Soil	California Test 202	25 lb	Representative areas	1 every 4,000 sq yd, 1 per day minimum	Taken prior to compaction
<b>MIXED STABILIZED SOIL (Sections 24-2.01 and 24-2.03)</b>					
Relative Compaction	California Test 231	Sample for California Test 216	Project site in accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 6 in. of thickness	
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	1 every relative compaction test	Wet common-composite test maximum value may be used in accordance with California Test 231
Dimensions	Measurement	N/A	Random locations in place after compaction	As necessary for verification of stabilized soil thickness and surface grades	
<b>CURING SEAL-ASPHALTIC EMULSION (Section 24-1.02C)</b>					
Various properties based on asphaltic emulsion type used	Based on asphaltic emulsion type used; see <i>Standard Specifications</i> Section 94	1/2-gal plastic jug with screw-on lid	Sampling line leading to the spray bar	1 each shipment	Each shipment must be accompanied by a certificate of compliance; recommend 1 random test from samples taken

Note:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.6. Materials Acceptance Sampling and Testing Requirements:  
Aggregate Subbases (*Standard Specifications* Section 25)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE SUBBASE</b>					
Gradation (Sieve Analysis)	California Test 202	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd (See Note 2)	If uniform material is within specification limits, frequency may be decreased to 1 test per day
Sand Equivalent	California Test 217	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd (See Note 2)	If uniform material is within specification limits, frequency may be decreased to 1 test per day
R-Value	California Test 301	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd	R-value testing may be reduced to 1 acceptance test per project when test records demonstrate that comparable material from the same source meets minimum R-value requirements
Relative Compaction	California Test 231	Sample for California Test 216	Roadway in accordance with California Test 231	Every 2,000 sq yd	
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	Every 2,000 sq yd	Wet common-composite test maximum value may be used in accordance with California Test 231
Dimensions	N/A	N/A	Random locations	As necessary for acceptance	Verify thickness of aggregate subbase

Notes:

1. Refer to California Test 125 for sampling procedures.
2. If material is outside the specification limits, sample and test representative material every 500 cu yd so that deductions may be taken for noncompliant material.

Table 6-1.7. Materials Acceptance Sampling and Testing Requirements:  
Aggregate Bases (*Standard Specifications* Section 26)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE BASES</b>					
Gradation (Sieve Analysis)	California Test 202	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd (See Note 2)	If uniform material is within specification limits, frequency may be decreased to 1 test per day
Sand Equivalent	California Test 217	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd (See Note 2)	If uniform material is within specification limits, frequency may be decreased to 1 test per day
R-Value	California Test 301	50 lb	Windrow or roadway	Every 3,000 tons or 2,000 cu yd	R-value testing may be reduced to 1 acceptance test per project when test records demonstrate that comparable material from the same source meets minimum R-value requirements
Durability Index	California Test 229	50 lb	Windrow or roadway	1 per project	Durability test not required for Class 3 aggregate base
Moisture	California Test 226	25 lb	Materials site or stockpile	2 daily when aggregate base is paid for by weight	
Relative Compaction	California Test 231	Sample for California Test 216	Roadway in accordance with California Test 231	Every 2,000 sq yd	
Maximum Wet Density	California Test 216	35 lb	Relative compaction test site locations	Every 2,000 sq yd	Wet common-composite test maximum value may be used in accordance with California Test 231
Dimensions	N/A	N/A	Random locations	As necessary for acceptance	Verify thickness of aggregate base

Notes:

1. Refer to California Test 125 for sampling procedures.

2. If material is outside the specification limits, sample and test representative material every 500 cu yd so that deductions may be taken for noncompliant material.

Table 6-1.8. Materials Acceptance Sampling and Testing Requirements:  
Cement Treated Bases (*Standard Specifications* Section 27) (1 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CEMENT TREATED BASE Class A or Class B</b>					
<b>AGGREGATE</b>					
Gradation (Sieve Analysis)	California Test 202, California Test 105	40 lb	Plant, truck, windrow, or roadway	1 every 3,000 tons or 2,000 cu yd, minimum 1 per day of production	
Sand Equivalent	California Test 217	40 lb	Plant, truck, windrow, or roadway	1 every 3,000 tons or 2,000 cu yd, minimum 1 per day of production	
<b>AGGREGATE Class B</b>					
R-Value (with and without cement)	California Test 301	100 lb for aggregate qualification	Windrow or roadway	Before production	
<b>CEMENT Type II Portland Cement</b>					
Various Properties Must comply with <i>Standard Specifications</i> Section 90-1.02B(2)	See <i>Standard Specifications</i> Section 90-1.02B(2)	8 lb	Cement treated base plant or cement spreader	1 each 100 tons of cement, 2 per day maximum	Recommend 1 acceptance test per project for cement from approved suppliers and certificate of compliance with each shipment
<b>WATER</b>					
Chlorides	California Test 422	Clean 2-qt plastic jug with lined, sealed lid	1 per source; at point of use		Water supplies for domestic use do not need to be tested

Table 6-1.8. Materials Acceptance Sampling and Testing Requirements:  
Cement Treated Bases (*Standard Specifications* Section 27) (2 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>WATER (Cont.)</b>					
Sulfates	California Test 417	Clean 2-qt plastic jug with lined, sealed lid	1 per source; at point of use		Water supplies for domestic use do not need to be tested
<b>COMPLETED MIX Class A</b>					
Compressive Strength	California Test 312	See California Test 312, Part II	Windrow or roadway before compaction	1 per day	If first 3 days of production test records demonstrate materials are in compliance, recommend test every 5 days of production
<b>COMPLETED MIX Class B</b>					
R-Value	California Test 301	50 lb	Windrow or roadway before compaction	1 every 3,000 tons or 2,000 cu yd	Recommend R-value testing be reduced to 1 every 10,000 cu yd when test records demonstrate that material from the same source, and having comparable grading and sand equivalent values, meets the minimum R-value requirements

Table 6-1.8. Materials Acceptance Sampling and Testing Requirements:  
Cement Treated Bases (*Standard Specifications* Section 27) (3 of 3)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>COMPLETED MIX Class A and Class B</b>					
Cement Content	California Test 338	See California Test 338, Part I	Windrow or roadway prior to compaction	1 every 1,500 tons or 1,000 cu yd, minimum 1 per day of production	
Optimum Moisture	California Test 312	See California Test 312	Windrow or roadway	Prior to production	
Moisture Content	California Test 226	10 lb in sealed container	Roadway prior to compaction	2 daily	
Relative Compaction	California Test 312 or 231	Sample for California Test 216	Roadway in accordance with California Test 231	1 every 2,000 sq yd	
Maximum Wet Density	California Test 216, California Test 312	35 lb	Relative compaction test site locations	1 every 2,000 sq yd	Wet common-composite test maximum value may be used in accordance with California Test 231
Dimensions	N/A	N/A	Random locations	As necessary for acceptance	Verify thickness of cement treated base

Note:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.9. Materials Acceptance Sampling and Testing Requirements:  
Concrete Bases (*Standard Specifications* Section 28)  
Lean Concrete Base

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>LEAN CONCRETE BASES</b>					
Compressive strength (7-days)	ASTM C39	2 cylinders - 6x12 inches	Concrete truck discharge chute	1,000 cu yd or 1 day's production if less than 1,000 cu yd	
<b>RAPID STRENGTH CONCRETE BASE</b>					
Modulus of rupture (7-days)	California Test 524	3 beams - 6x6x20 inches	Concrete truck discharge chute	1 per 500 cu yd or 1 day's production if less than 500 cu yd.	
<b>LEAN CONCRETE BASE RAPID SETTING</b>					
Compressive strength (7-days)	California Test 521	2 cylinders - 6x12 inches	Concrete truck discharge chute	1 per 500 cu yd or 1 day's production if less than 500 cu yd.	
<b>CONCRETE BASE</b>					
Modulus of rupture (7-days)	California Test 523	2 beams of 6x6x32 in. for centerpoint loading or 6x6x20 in. for third-point loading	Concrete truck discharge chute	1,000 cu yd or 1 day's production if less than 1,000 cu yd	
Dimensions	N/A	N/A	Random locations	As necessary for acceptance	Verify thickness of base

Note:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.10. Materials Acceptance Sampling and Testing Requirements:  
Treated Permeable Bases (*Standard Specifications* Section 29)  
Asphalt Treated Permeable Base (ATPB) (1 of 4)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE</b>					
Percentage Crushed Particles	California Test 205	Combined two 40-lb canvas bags (See Note 2) or Batch 160 lb (proportioned per bin percentages)	Plant	Prior to production and minimum 1 random for every 50,000 tons or less of paving	
Los Angeles Rattler (at 500 revolutions)	California Test 211	Combined two 40-lb canvas bags (See Note 2) or Batch 160 lb (proportioned per bin percentages)	Plant	Prior to production and minimum 1 random for every 50,000 tons or less of paving	
Film Stripping	California Test 302	Combined two 40-lb canvas bags (See Note 2) or Batch 160 lb (proportioned per bin percentages)	Plant	Prior to production and minimum 1 random for every 50,000 tons or less of paving	
Gradation (Sieve Analysis)	California Test 202	Combined two 20-lb canvas bags (See Note 3) or Batch 40 lb (proportioned per bin percentages )	Plant	1 for every 4 hours of production	

Table 6-1.10. Materials Acceptance Sampling and Testing Requirements:  
Treated Permeable Bases (*Standard Specifications* Section 29)  
Asphalt Treated Permeable Base (ATPB) (2 of 4)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE (Cont.)</b>					
Cleanness Value	California Test 227	Combined two 20-lb canvas bags (See Note 3) or Batch 40 lb (proportioned per bin percentages )	Plant	1 for every 4 hours of production	Recommend 1 acceptance test per day if 3 consecutive results exceed 62
<b>ASPHALT</b>					
Various properties based on asphalt type used; see <i>Standard Specification</i> Section 92	Based on asphalt type used; see <i>Standard Specifications</i> Section 92	1-qt can	Asphalt feed line connecting plant storage tanks	1 per day	Certificate of compliance required for each shipment; if asphalt binder source is not on approved list, sample and test asphalt before use
<b>COMPLETED MIX</b>					
Asphalt Content	California Test 382	40 lb in metal containers	Plant, truck, windrow, or roadbed	1 for every 4 hours of production	
<b>AGGREGATE</b>					
Los Angeles Rattler (loss at 500 revolutions)	California Test 211	50 lb	Plant	Prior to production and minimum 1 random for every 25,000 cu yd	
Soundness	California Test 214	50 lb	Plant		
Sieve Analysis (Gradation)	California Test 202	40 lb	Plant	1 for every 4 hours of production; (See Note 4)	

Table 6-1.10. Materials Acceptance Sampling and Testing Requirements:  
Treated Permeable Bases (*Standard Specifications* Section 29)  
Asphalt Treated Permeable Base (ATPB) (3 of 4)

Test	Test Method	Sample Size & Container Size	Sampling Location (See Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE (Cont.)</b>					
Cleanness Value	California Test 227				
<b>CEMENT</b>					
Cement, various properties; must comply with <i>Standard Specifications</i> Section 90-1.02B(2)	Must comply with <i>Standard Specifications</i> Section 90-1.02B(2)	8 lb	Concrete plant	1 for each 100 tons, 2 per day max	Recommend 1 acceptance test per project for cement from approved suppliers with certificate of compliance
<b>WATER</b>					
Chlorides	California Test 422	Clean 2-qt plastic jug with lined, sealed lid At point of use; see Remarks	1 per source		Water supplies for domestic use do not need to be tested
Sulfates	California Test 417	Clean 2-qt plastic jug with lined, sealed lid At point of use; see Remarks	1 per source		Water supplies for domestic use do not need to be tested
Setting Time	ASTM C 191 or ASTM C 266	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Mortar Compressive Strength	ASTM C109	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Coloring Agents	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested

Table 6-1.10. Materials Acceptance Sampling and Testing Requirements:  
Treated Permeable Bases (*Standard Specifications* Section 29)  
Asphalt Treated Permeable Base (ATPB) (4 of 4)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>WATER</b>					
Alkalis	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Specific Gravity	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested

Notes:

1. Refer to California Test 125 for sampling procedures.
2. Store one 40-lb canvas bag for dispute resolution.
3. Store one 20-lb. canvas bag for dispute resolution.
4. If test records determine that aggregate gradation or cleanness value is close to specification limit or outside the specification limits, sample and test concrete every 300 cu yd so that deductions may be taken for noncompliant material.

Table 6-1.11. Materials Acceptance Sampling and Testing Requirements:  
Reclaimed Pavement (*Standard Specifications* Section 30)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>PULVERIZED ROADBED (Section 30-2)</b>					
Thickness	Thickness-Field Measurement	Field Measurement	Random location	3 per lot	
Relative Compaction (% min)	California Test 231	Sample for California Test 216	In accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 6 in. of thickness	
<b>FULL DEPTH RECLAMATION—FOAMED ASPHALT (Section 30-3)</b>					
Relative Compaction (% min)	California Test 231	Sample for California Test 216	In accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 6 in. of thickness	
Thickness	Thickness	California Test 531. 4- or 6-in.-diameter core, full thickness	3 random location per lot	See Section 4-4004 of this manual	
<b>FULL DEPTH RECLAMATION—Cement (Section 30-4)</b>					
Thickness	Thickness-Core thickness measurement	California Test 531, 4- or 6-in.-diameter core, full thickness	3 random locations per lot	See Section 4-4004 of this manual	
Cement application rate	Calibrated tray or equal	Building paper or pan of known area	Surface receiving cement	Each 40,000 sq ft, 2 per day minimum	To determine if application rate is within $\pm 5\%$ of mix design rate
Relative Compaction (% min)	California Test 231	Sample for California Test 216	In accordance with California Test 231	1 every 2,000 sq yd and test compaction at every 6 in. of thickness	

Notes:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (1 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>ASPHALTIC EMULSION AND ASPHALTIC EMULSION FOR FLUSH COAT</b>					
Various properties in accordance with Section 37 of <i>Standard Specifications</i>	See Section 37-2.02A(4)(b)(ii) of <i>Standard Specifications</i>	1/2-gal plastic jug with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Asphaltic emulsion spread rate	CT 339	Per test method	Full width of boot truck	Once per project	
<b>POLYMER MODIFIED ASPHALTIC EMULSION</b>					
Viscosity	AASHTO T 59	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Sieve Test	AASHTO T 59	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Demulsibility	AASHTO T 59	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Torsional Recovery	California Test 332	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Penetration	AASHTO T 49	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment
Ring and Ball	AASHTO T 53	1-qt wide-mouth plastic jar with screw-on lid	Transport tanker	Each shipment	Certificate of compliance required with each shipment

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (2 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>ASPHALT MODIFIER FOR ASPHALT RUBBER BINDER</b>					
Viscosity	ASTM D445	1-qt round wide-mouth can with friction top lid or 1-qt rectangular can with screw-on lid	Sample port on tanker truck	1 random per project	
Flash Point	ASTM D92	1-qt round wide-mouth can with friction top lid or 1-qt rectangular can with screw-on lid	Sample port on tanker truck	1 random per project	
Molecular Analysis	ASTM D2007	1-qt round wide-mouth can with friction top lid or 1-qt rectangular can with screw-on lid	Sample port on tanker truck	1 random per project	
<b>CRUMB RUBBER MODIFIER FOR ASPHALT RUBBER BINDER</b>					
Wire in CRM (max %)	CT 385	CRM scrap tire: Two 2.5 lb in gallon zip-lock bags  CRM high natural: Two 2.5 lb in gallon zip-lock bags	CRM bulk bag	Minimum 1 random per project	

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (3 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CRUMB RUBBER MODIFIER FOR ASPHALT RUBBER BINDER</b>					
Fabric in CRM (max %)	CT 385	CRM scrap tire: Two 2.5 lb in gallon zip-lock bags  CRM high natural: Two 2.5 lb in gallon zip-lock bags	CRM bulk bag	Minimum 1 random per project	
CRM particle length	---	CRM scrap tire: Two 2.5 lb in gallon zip-lock bags  CRM high natural: Two 2.5 lb in gallon zip-lock bags	CRM bulk bag	Minimum 1 random per project	
CRM specific gravity	CT 208				
Natural rubber content in high nature CRM (%)	ASTM D297				
<b>ASPHALT RUBBER BINDER OR MODIFIED ASPHALT BINDER</b>					
Cone Penetration		1-qt round wide-mouth can with friction top lid	Asphalt feed line connecting to the HMA plant	Production start-up evaluation and 1 random per 5 samples	Certificate of compliance required with each shipment

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (4 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>ASPHALT RUBBER BINDER OR MODIFIED ASPHALT BINDER (CONT.)</b>					
Resilience		1-qt round wide-mouth can with friction top lid	Asphalt feed line connecting to the HMA plant	Production start-up evaluation and 1 random per 5 samples	Certificate of compliance required with each shipment
Softening point		1-qt round wide-mouth can with friction top lid	Asphalt feed line connecting to the HMA plant	Production start-up evaluation and 1 random per 5 samples	Certificate of compliance required with each shipment
Asphalt Rubber Binder Viscosity	ASTM D7741	Five 1-qt round wide-mouth cans with friction top lids	Asphalt storage tank	The greater of 1 every 5 lots or once a day	For safety, engineer may witness contractor perform test
Base Asphalt Binder Properties	See <i>Standard Specification</i> Section 92	Five 1-qt round wide-mouth cans with friction top lids	Asphalt storage tank	The greater of 1 every 5 lots or once a day	Certificate of compliance required for each shipment; if asphalt binder source is not on approved list, test before use
<b>SCREENINGS/AGGREGATE FOR CHIP SEALS</b>					
LA Rattler	California Test 211	50 lb in canvas bags or 5-gal buckets	Stockpile	Once per project	
% Crushed Particles	AASHTO T 335	50 lb in canvas bags or 5-gal buckets	Stockpile	Once per project	

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (5 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>SCREENINGS/AGGREGATE FOR CHIP SEALS</b>					
Film Stripping	California Test 302	50 lb in canvas bags or 5-gal buckets	Stockpile	Once per project	
Sieve Analysis	California Test 202	30 lb	Stockpile	Twice daily	
Cleanness Value	California Test 227	30 lb	Stockpile	Once daily	
<b>SAND FOR FLUSH COAT</b>					
Sieve Analysis	California Test 202	25 lb	Stockpile	Once per project	
<b>CRACK TREATMENTS</b>					
Crack Treatment Material					
Softening point	ASTM D36	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of crack treatment material on the TL-0101
Cone penetration	ASTM D5329	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of crack treatment material on the TL-0101
Resilience	ASTM D5329	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of crack treatment material on the TL-0101

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (6 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CRACK TREATMENTS (Cont.)</b>					
Crack Treatment Material					
Tensile adhesion	ASTM D5329	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of material on the TL-0101
Asphalt compatibility	ASTM D5329	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of material on the TL-0101
Flexibility	ASTM D3111	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of material on the TL-0101
Specific gravity	ASTM D70	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of material on the TL-0101
Sieve test	See note in Section 37-6.01D(3) "Department Acceptance" of the <i>Standard Specifications</i>	2 each 3-lb minimum samples in silicone release boxes	From crack treatment material dispensing wand	Once per project	Indicate the specified type of material on the TL-0101

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (7 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>SAND FOR CRACK TREATMENT</b>					
Sieve Analysis	California Test 202	25 lb	Stockpile	Once per project	
<b>SLURRY SEAL AGGREGATE</b>					
Los Angeles Rattler (loss at 500 revolutions)	California Test 211	50 lb	Stockpile	Once per project	
Percentage of Crushed Particles	California Test 205	50 lb	Stockpile	Once per project	
Film Stripping	California Test 302	50 lb	Stockpile	Once per project	
Durability Index	California Test 229	50 lb	Stockpile	Once per project	
Sieve Analysis	California Test 202, California Test 105	30 lb	Stockpile	Once daily	
Sand Equivalent	California Test 217	30 lb	Stockpile	Once daily	
<b>MICRO-SURFACING AGGREGATES</b>					
Los Angeles Rattler (loss at 500 revolutions)	California Test 211	50 lb	Stockpile	Once per project	
Percentage of Crushed Particles	California Test 205	50 lb	Stockpile	Once per project	
Durability Index	California Test 302	50 lb	Stockpile	Once per project	

Table 6-1.12. Materials Acceptance Sampling and Testing Requirements:  
Seal Coats (*Standard Specifications* Section 37) (8 of 8)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>MICRO-SURFACING AGGREGATES (Cont.)</b>					
Sieve Analysis	California Test 202	30 lb	Stockpile	Once daily	
Sand Equivalent	California Test 217	30 lb	Stockpile	Once daily	

Note:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (1 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>AGGREGATE: All Types of HMA</b>						
Gradation (Sieve Analysis) (see See Note 2)	AASHTO T 27, California Test 105, California Test 384	Combined six 20-lb canvas bags (see See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant	1 for each 750 tons, 1 per day minimum	Production start-up evaluation. Minimum 1 per day of paving	
Sand Equivalent	AASHTO T 176	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation. Minimum 1 per day of paving	Not required for OGFC (open graded friction course)
Percent Crushed Particles (Coarse)	AASHTO T 335	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 25,000 tons or less of paving	
Percent Crushed Particles (Fine)	AASHTO T 335	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 25,000 tons or less of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (2 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>AGGREGATE: All Types of HMA (Cont.)</b>						
LA Rattler (500 Revolutions)	AASHTO T 96	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 50,000 tons or less of paving	
LA Rattler (100 Revolutions)	AASHTO T 96	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 50,000 tons or less of paving	
Fine Aggregate Angularity	AASHTO T 304, Method A	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 50,000 tons or less of paving	Not required for OGFC or Minor HMA
Flat and Elongated Particles	ASTM D4791	Combined six 20-lb canvas bags (See Note 3) or Batch 30 lb (proportioned per bin percentages)	HMA plant or before lime treatment	1 for each 750 tons, 1 per day minimum	Production start-up evaluation, and minimum 1 random for every 50,000 tons or less of paving	Not required for Minor HMA

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (3 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>ASPHALT BINDER</b>						
Various properties based on asphalt type used (see <i>Standard Specifications</i> Section 92)	See <i>Standard Specifications</i> Section 92	1-qt round wide-mouth can with friction top lid	Asphalt feed line connecting the plant storage tanks	1 per day of HMA production	1 random for every 5 samples	Certificate of compliance required for each shipment; if asphalt binder source is not on approved list, sample and test asphalt before use
<b>ASPHALT RUBBER BINDER</b>						
Asphalt Rubber Binder Properties	See <i>Standard Specifications</i> Section 39-2.03A(4)(e)(ii)	1-qt round wide-mouth can with friction top lid	Asphalt rubber feed line from the HMA plant	1 every lot	Production start-up evaluation and 1 random per 5 samples	Certificate of compliance required for each lot
Asphalt Rubber Binder Viscosity	ASTM D7741	1-qt round wide-mouth can with friction top lid	Asphalt rubber feed line connecting to the HMA plant	1 every lot	1 every lot	For safety, engineer may witness contractor perform test

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (4 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>ASPHALT RUBBER BINDER (Cont.)</b>						
Base Asphalt Binder Properties	See <i>Standard Specifications</i> Section 92	1-qt round wide-mouth can with friction top lid	Asphalt storage tank	Each shipment	Production start-up evaluation and 1 random per 5 samples	Certificate of compliance required for each shipment; if asphalt binder source is not on approved list, sample and test asphalt before use
Asphalt Modifier Properties	ASTM D445 ASTM D92 ASTM D2007	1-qt round wide-mouth can with friction top lid. or 1-qt rectangular can with screw-on lid	Sample port on tanker truck	Each shipment	1 random per project	
Crumb Rubber Modifier (CRM) Properties	California Test 208, California Test 385, ASTM D297	CRM scrap tire: Two 2.5 lb in gallon zip-lock bags; CRM high natural: Two 2.5 lb in gallon zip-lock bags	CRM bulk bag	Each shipment	1 random per project	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (5 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>HOT MIX ASPHALT: Type A</b>						
Moisture Content	AASHTO T 329	10 lb, sealed metal container	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, and minimum 1 per project	Production start-up evaluation, and minimum 1 per project during paving	Test within 1 hour of sampling
Asphalt Binder Content	AASHTO T 308, Method A	60 lb (See Note 5) (8x8x3=8 boxes, 8x8x4=6 boxes, 8½x8½x4½=4 boxes) (See Note 5)	Loose mix from behind the paver (See Note 4)	1 for each 750 tons, 1 per day minimum	Production start-up evaluation; minimum 1 per day of paving	
Maximum Theoretical Density	AASHTO T 209	60 lb (See Note 5) (8x8x3=8 boxes, 8x8x4=6 boxes, 8½x8½x4½=4 boxes) (See Note 5)	Loose mix from behind the paver (See Note 4)	1 for each 750 tons, 1 per day minimum	Production start-up evaluation. 1 random test per day of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (6 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (See Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>HOT MIX ASPHALT: Type A (Cont.)</b>						
Air Void Content	AASHTO T 269	100 lb (See Note 5) (8x8x3=12 boxes, 8x8x4=10 boxes, 8½x8½x4½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start-up evaluation, and minimum 1 random for every 25,000 tons of paving	
Voids in Mineral Aggregate	SP-2 Asphalt Mixture Volumetrics	100 lb (See Note 5) (8x8x3=12 boxes, 8x8x4=10 boxes, 8½x8½x4½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start-up evaluation, and minimum 1 random for every 25,000 tons of paving	
Dust Proportion	SP-2 Asphalt Mixture Volumetrics	100 lb (See Note 5) (8x8x3=12 boxes, 8x8x4=10 boxes, 8½x8½x4½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start-up evaluation, and minimum 1 random for every 25,000 tons of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (7 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>HOT MIX ASPHALT: Type A (Cont.)</b>						
Hamburg Wheel Track	AASHTO T 324 (Modified)	70 lb (See Note 5) (8x8x3=9 boxes, 8x8x4=7 boxes, 8½x8½x4½=6 boxes)	Loose mix at plant, truck, or windrow	Production start-up evaluation, 1 every 10,000 tons of paving	Production start-up evaluation, and minimum 1 random for every 10,000 tons or less of paving	Not required for Minor HMA
Moisture Susceptibility	AASHTO T 283	140 lb (See Notes 5 & 6) (8x8x3=18 boxes, 8x8x4=15 boxes, 8½x8½x4½=12 boxes)	Loose mix at plant, truck, or windrow	Production start-up evaluation, 1 every 50,000 tons of paving	Production start-up evaluation, and minimum 1 random test for every 50,000 tons of paving	Test for dry strength and wet strength; not required for Minor HMA
<b>HOT MIX ASPHALT: With RAP/RAS</b>						
Binder Recovery	AASHTO T 164  ASTM D1856	10 lb (8x8x3=1 box, 8x8x4=1 box, 8½x8½x4½=1 box)	Loose mix from behind the paver  (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	1 random for every 25,000 tons or less of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (8 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>RUBBERIZED HOT MIX ASPHALT: Gap Graded</b>						
Moisture Content	AASHTO T 329	10 lb, sealed metal container	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, and minimum 1 per project	Production start-up evaluation, and minimum 1 per project during paving	Test within 1 hour of sampling
Asphalt Binder Content	AASHTO T 308, Method A	60 lb (See Note 5) (8x8x3=8 boxes, 8x8x4=6 boxes, 8½x8½x4½=4 boxes)	Loose mix from behind the paver (See Note 4)	1 for each 750 tons, 1 per day minimum	Production start-up evaluation; 1 random test per day of paving	
Theoretical Maximum Density	AASHTO T 209	60 lb (See Note 5) (8x8x3=8 boxes, 8x8x4=6 boxes, 8½x8½x4½=4 boxes)	Loose mix from behind the paver (See Note 4)	1 for each 750 tons, 1 per day minimum	Production start-up evaluation; minimum 1 per day of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (9 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>RUBBERIZED HOT MIX ASPHALT: Gap Graded</b>						
Air Void Content	AASHTO T 269	100 lb (See Note 5) (8x8x3=1 2 boxes, 8x8x4=10 boxes, 8½x8½x4 ½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start- up evaluation, and minimum 1 random test for every 25,000 tons of paving	
Voids in Mineral Aggregate	SP-2 Asphalt Mixture Volumetrics	100 lb (See Note 5) (8x8x3=1 2 boxes, 8x8x4=10 boxes, 8½x8½x4 ½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start- up evaluation, and minimum 1 random test for every 25,000 tons of paving	
Dust Proportion	SP-2 Asphalt Mixture Volumetrics	100 lb (See Note 5) (8x8x3=1 2 boxes, 8x8x4=10 boxes, 8½x8½x4 ½=8 boxes)	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, 1 every 25,000 tons of paving	Production start- up evaluation, and minimum 1 random test for every 25,000 tons of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (10 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>RUBBERIZED HOT MIX ASPHALT: Gap Graded (Cont.)</b>						
Hamburg Wheel Track	AASHTO T 324 (Modified)	75 lb (See Note 5) (8x8x3=9 boxes, 8x8x4=7 boxes, 8½x8½x4½=6 boxes)	Loose mix at plant, truck, or windrow	Production start-up evaluation, 1 every 10,000 tons of paving	Production start-up evaluation, and minimum 1 random test for every 10,000 tons or less of paving	
Moisture Susceptibility	AASHTO T 283	75 lb (See Notes 5 & 6) (8x8x3=18 boxes, 8x8x4=15 boxes, 8½x8½x4½=12 boxes)	Loose mix at plant, truck, or windrow	Production start-up evaluation, 1 every 50,000 tons of paving	Production start-up evaluation, and minimum 1 random test for every 50,000 tons of paving	Test for dry strength and wet strength
<b>OPEN GRADED FRICTION COURSE (OGFC)</b>						
Asphalt Binder Content	AASHTO T 308, Method A	20 lb (See Note 5) 4, 1-gal metal containers with friction lids	Loose mix from behind the paver (See Note 4)	1 for each 750 tons, 1 per day minimum	Production start-up evaluation; minimum 1 per day of paving	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements: Asphalt Concrete (*Standard Specifications* Section 39) (11 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>OPEN GRADED FRICTION COURSE (OGFC)</b>						
Moisture Content	AASHTO T 329	10 lb, sealed metal container	Loose mix from behind the paver (See Note 4)	Production start-up evaluation, and minimum 1 per project	Production start-up evaluation, and minimum 1 per project during paving	Test within 1 hour of sampling
<b>BONDED WEARING COURSE: Gap Graded (BWC-G) (See Note 7)</b>						
Asphalt Binder Content	AASHTO T 308, Method A	20 lb (See Note 5) 4, 1-gal metal containers with friction lids	Loose mix at plant	1 for each 750 tons, 1 per day minimum	Production start-up evaluation. Minimum 1 per day of paving	
Moisture Content	AASHTO T 329	10 lb sealed metal container	Loose mix at plant	Production start-up evaluation, and minimum 1 per project	Production start-up evaluation, and minimum 1 per project during paving	Samples should be tested within 1 hour of sampling
<b>PAVEMENT DENSITY</b>						
Density of cores (% of maximum theoretical density) (See Note 8)	California Test 375	4- or 6-in cores	Final layer, cored to the specified total paved thickness	1 for each 250 tons	1 for each 250 tons	Density applies to HMA thickness of 0.15 ft or greater

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (12 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (See Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>PAVEMENT SMOOTHNESS</b>						
Straightedge	N/A	N/A	Pavement surface (See Note 9)	Entire final surface	Entire final surface	Areas exempt from Inertial Profiler
Inertial Profiler for Mean Roughness Index and Areas of Localized Roughness	California Test 387 AASHTO R 56 & AASHTO R 57	Each 0.1 mile	Pavement surface	Entire final surface	Entire final surface	Entire final surface excluding areas requiring straightedge; use contractor-furnished profiles for IRI values within 10% of Caltrans' IRI values
<b>TACK COAT</b>						
Asphalt Binder	Based on asphalt type used (see <i>Standard Specifications</i> Section 92)	1-qt round wide-mouth can with friction top lid	Spray bar on asphalt distributor truck	Each truckload	1 random per project	
Asphaltic Emulsion	Based on emulsion type used (see <i>Standard Specifications</i> Section 94)	1/2-gal plastic jug with screw-on lid	Spray bar on emulsion distributor truck	Each truckload	1 random per project	

Table 6-1.13. Materials Acceptance Sampling and Testing Requirements:  
Asphalt Concrete (*Standard Specifications* Section 39) (13 of 13)

Test	Test Method	Sample Size & Container Type	Sampling Location (Note 1)	Sampling Frequency	Acceptance Test Frequency	Remarks
<b>TACK COAT</b>						
Spread Rate	California Test 339	N/A	Pavement	N/A	As necessary for verification of tack coat spread rate	Verify tack coat spray rate is sufficient to meet the minimum specified residual rate. (see example in Section 4-9403, "During the Course of Work," in this manual)

Notes:

1. Refer to California Test 125 for sampling procedures.
2. When using RAP, RAS or RAP/RAS, adjust gradation by the correction factor determined under California Test 384.
3. Store three 20-lb canvas bags for dispute resolution.
4. Sampling HMA behind the paver is the preferred location. You may also take samples from the windrow, production plant, or truck.
5. Sample sizes are based on split samples—one sample for acceptance testing, and one for dispute resolution. Store one-half of the boxes or cans for dispute resolution.
6. Contractor ships directly to district material laboratory.
7. For BWC using RHMA-G, RHMA-O, or HMA-O, sampling and testing must comply with requirements for RHMA-G, RHMA-O, or HMA-O.
8. Determine percent of theoretical maximum density under California Test 375, except use AASHTO T 275 to determine in-place density of each core and AASHTO T 209, Method A to determine theoretical maximum density instead of calculating maximum density.
9. May use Inertial Profiler data and ProVAL Smoothness Assurance "Rolling Straightedge Comparison Tool" to assist in determining where to check with 12-foot straightedge.

Table 6-1.14. Materials Acceptance Sampling and Testing Requirements:  
Concrete Pavement (*Standard Specifications* Section 40) (1 of 2)  
See Table 6-1.17 for concrete materials

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CONCRETE</b>					
Modulus of Rupture (28-days)	California Test 523	2 beams of 6x6x32 in. for centerpoint loading or 6x6x20 in. for third-point loading	Concrete truck discharge chute	1 set per age for each 1,000 cu yd, 1 per day minimum (See Note 2)	Recommend frequency of every 2,000 cu yd if after 10 sets all tests are in compliance
Air Content	California Test 504	See test method	Concrete truck discharge chute	1 every day of production	Only test when air entrainment is specified
<b>PAVEMENT</b>					
Thickness	California Test 531	4-in. diameter core, full thickness of pavement	See Section 4-4004, "Level of Inspection," of this manual	1 every 1,200 sq yd	
Dowel Bar Alignment and Concrete Consolidation	Measurement and Inspection	4-in. diameter core size	Transverse pavement joints	1 test every 700 sq yd	Each test consists of 2 cores, one on each end of dowel bar
Tie Bar Alignment and Concrete Consolidation	Measurement and Inspection	4-in. diameter core size	Longitudinal pavement joints	1 test every 4,000 sq yd	Each test consists of 2 cores, one on each end of tie bar
Coefficient of Friction	California Test 342	N/A	Pavement surface	1 test for each day of paving	Each test consists of 5 measurements
Smoothness - Straightedge	Measurement with 12-ft straightedge	N/A	Pavement surface	Entire final surface requiring straightedge	

Table 6-1.14. Materials Acceptance Sampling and Testing Requirements:  
 Concrete Pavement (*Standard Specifications* Section 40) (2 of 2)  
 See Table 6-1.17 for concrete materials

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>PAVEMENT</b>					
Smoothness - Inertial Profiler for Mean Roughness Index and Areas of Localized Roughness	AASHTO R 56, AASHTO R 57, and California Test 387	0.1 mile	Pavement surface	Entire final surface	Entire final surface excluding specified areas

Notes:

1. Refer to California Test 125 for sampling procedures.
2. If concrete modulus of rupture is close to specification limit or outside the specification limits, sample and test concrete every 1,000 cu yd so that deductions may be taken for noncompliant material.

Table 6-1.15. Materials Acceptance Sampling and Testing Requirements:  
Existing Concrete Pavement (*Standard Specifications* Section 41)

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>INDIVIDUAL SLAB REPLACEMENT WITH RAPID STRENGTH CONCRETE (Section 41-9)</b>					
Coefficient of Friction	California Test 342	N/A	Pavement surface	1 every 1,200 sq yd	Each test consists of 5 measurements
Smoothness - Straightedge	Measurement with 12-ft straightedge	N/A	Pavement surface	Entire final surface	Areas exempt from Inertial Profiler
Modulus of rupture (3-days)	California Test 524	3 beams of 6x6x20 inches	Concrete truck discharge chute	1 per shift	

Notes:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.16. Materials Acceptance Sampling and Testing Requirements:  
Concrete Structures (*Standard Specifications* Section 51) )  
See Table 6-1.17 for concrete materials

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>JOINT SEALS TYPE B (Section 51-2.02C(2))</b>					
Various properties; must comply with <i>Standard Specifications</i> Section 51-2.02C(2)	See <i>Standard Specifications</i> Section 51-2.02(C)	1 piece, 3 ft	Job site	Each lot	Certificate of compliance and certified test report required for each lot; test report must include the seal movement rating, manufacturer minimum uncompressed width and test results; submit samples at least 30 days before use
<b>JOINT SEALS Type A and Type AL (Section 51-2.02B)</b>					
Various properties; must comply with <i>Standard Specifications</i> Section 51-2.02B(2)	See <i>Standard Specifications</i> Section 51-2.02B(2)	1 qt of each component and primer	Job site	1 sample from each component of each batch	Certificate of compliance required for each batch of sealant; submit samples at least 30 days prior to use

Notes:

1. Refer to California Test 125 for sampling procedures.

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (1 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE: Coarse Aggregate</b>					
Los Angeles Rattler (loss at 500 revolutions)	California Test 211	See Note 2	Stockpile	Prior to production and minimum 1 random test for every 25,000 cu yd	1 for every 4,000 cu yd, if initial test shows abrasion loss greater than 40%
Cleaness Value	California Test 227	25 lb	Stockpile	Prior to production and minimum 1 for every 600 cu yd, 1 per day minimum	Recommend 1 acceptance test per day if 3 consecutive results exceed 80; increase sampling to 1 for every 300 cu yd (deductive lot) with engineer's authorization
Sieve Analysis	California Test 202	50 lb	Belt Feed	Prior to production and minimum 1 for every 600 cu yd, 1 per day minimum	Recommend 1 acceptance test per day if 3 consecutive results are within operating range; increase sampling to 1 for every 300 cu yd (deductive lot) with engineer's authorization
<b>AGGREGATE: Fine Aggregate</b>					
Organic Impurities	California Test 213	See Note 2	Stockpile	Prior to production or when contamination is suspected	
Durability	California Test 229	See Note 2	Stockpile	Prior to production	
Sand Equivalent	California Test 217	25 lb	Stockpile	Prior to production and minimum 1 for every 600 cu yd, 1 per day minimum	Recommend 1 acceptance test per day if 3 consecutive results exceed 80; increase sampling to 1 for every 300 cu yd (deductive lot) with engineer's authorization

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
 Concrete (*Standard Specifications* Section 90) (2 of 9)  
 Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>AGGREGATE: Fine Aggregate</b>					
Sieve Analysis	California Test 202	50 lb	Belt feed	Prior to production and minimum 1 for every 600 cu yd, 1 per day minimum	Recommend 1 acceptance test per day if 3 consecutive results are within operating range; increase sampling to 1 for every 300 cu yd (deductive lot) with engineer's authorization
<b>AGGREGATE: Coarse &amp; Fine Aggregate</b>					
Specific Gravity and Absorption	California Test 206, California Test 207	See Note 2	Stockpile	Prior to production and when aggregate source changes	
Soundness	California Test 214	See Note 2	Stockpile	Prior to production	Soundness for fine aggregate waived if durability is $\geq 60$
Sieve Analysis (combined gradation determined with fine and coarse aggregate sieve analyses)	California Test 202		N/A	Prior to production and minimum 1 for every 600 cu yd, 1 per day minimum	Recommend 1 acceptance test per day if 3 consecutive results are within operating range. Increase sampling to 1 for every 300 cu yd (deductive lot) with engineer's authorization

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (3 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CEMENTITIOUS MATERIALS</b>					
Cement, various properties; must comply with <i>Standard Specifications</i> Section 90-1.02B(2)	See <i>Standard Specifications</i> Section 90-1.02B(2)	8 lb	Concrete plant	Sample each 100 tons of cement, 2 per day maximum	Cement must be on Authorized Material List; cement accepted based on certificate of compliance with each shipment; recommend 1 verification test per 5 samples
Supplementary Cementitious Materials (SCM), various properties; must comply with <i>Standard Specifications</i> Section 90-1.02B(3)	See <i>Standard Specifications</i> Section 90-1.02B(3)	8 lb	Concrete plant	Sample each 100 tons of SCM, 2 per day maximum	SCMs must be on Authorized Materials List; SCM accepted based on certificate of compliance with each shipment; recommend 1 verification test per 5 samples
<b>WATER</b>					
Chlorides	California Test 422	Clean 2-qt plastic jug with lined, sealed lid	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Sulfates	California Test 417	Clean 2-qt plastic jug with lined, sealed lid	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Setting Time	ASTM C 191 or ASTM C 266	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (4 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>WATER</b>					
Mortar Compressive Strength	ASTM C109	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Coloring Agents	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Alkalis	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
Specific Gravity	Must comply with <i>Standard Specifications</i> Section 90-1.02D	Contact METS for required quantity of water sample	At point of use	1 per source	Water supplies for domestic use do not need to be tested
<b>ADMIXTURES: Air Entraining Agent</b>					
Air entraining properties Must comply with <i>Standard Specifications</i> Section 90-1.02E	See <i>Standard Specifications</i> Section 90-1.02E	1-qt can or plastic bottle of liquid, 2 lb of powder	Concrete plant	Sample each shipment	Must be on Authorized Materials List and certificate of compliance must accompany each shipment; recommend 1 verification test per 5 samples

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (5 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CHEMICAL ADMIXTURE: Water Reducers or Set Retarders</b>					
Claimed properties, chloride identification	ASTM C494 Type A, B, D, F or Type G California Test 415	1-qt can of liquid, 2 lb of powder	Concrete plant	Sample each shipment	Must be on Authorized Materials List and certificate of compliance must accompany each shipment; recommend 1 verification test per 5 samples
<b>CONCRETE for Pavement and Structures</b>					
Shrinkage	AASHTO T 160 Modified See <i>Standard Specifications</i> Section 90-1.01D(3)	Set of three: 4x4x11¼ in.	During mix design process	Prior to production	Engineer may use contractor-provided test result for acceptance; test results must be within 3 years of contract authorization date
<b>CONCRETE Designated Compressive Strength 3600 psi or Greater</b>					
Yield	California Test 518	See test method	Concrete truck discharge chute; (See Note 3)	As necessary to assure accuracy of mix design; minimum 2 per each mix design	No deductions for cement content will be made based on the results of California Test 518
Concrete Uniformity	ASTM C143, California Test 533	See test method	Concrete truck discharge chute (See Note 3)	When compressive test specimen is fabricated and when consistency or uniformity is questionable, minimum 2 per day	

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (6 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (See Note 1)	Acceptance Test Frequency	Remarks
<b>CONCRETE Designated Compressive Strength 3600 psi or Greater (Cont.)</b>					
Concrete Uniformity	California Test 529	100 lb	Concrete truck discharge chute (See Note 3)	When uniformity is questionable	
Compressive Strength	ASTM C172, California Test 540	1 set of 2 cylinders 6x12 in. for each test	Concrete truck discharge chute (See Note 3)	1 set per age for every 300 cu yd concrete or as required for acceptance, minimum 1 set per project	For trial batches, see <i>Standard Specifications</i> or job special provisions and Section 6-3, "Field Tests," of this manual
Air Content	California Test 504	See test method	Concrete truck discharge chute (See Note 3)	1 every 4 hours of production and when test specimens are fabricated	Where air is specified for freeze-thaw resistance, a minimum of 1 every 30 cu yd
<b>CONCRETE WITH COMPRESSIVE STRENGTH LESS THAN 3,600 psi</b>					
Concrete Uniformity	ASTM C143, California Test 533	See test method	Concrete truck discharge chute (See Note 3)	When compressive test specimen is fabricated and when uniformity is questionable	

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (7 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CONCRETE WITH COMPRESSIVE STRENGTH LESS THAN 3,600 psi</b>					
Concrete Uniformity	California Test 529	100 lb	Concrete truck discharge chute (See Note 3)	When uniformity is questionable	
Compressive Strength	California Test 540, California Test 521	1 set of 2 cylinders, 6x12 in., for each test	Concrete truck discharge chute (See Note 3)	1 set per age for every 300 cu yd, minimum 1 set per project	
Air Content	California Test 504	See test method	Concrete truck discharge chute (See Note 3)	When compressive test specimens are fabricated	Where air is specified for freeze-thaw resistance, a minimum of 1 every 100 cu yd
<b>CURING COMPOUND</b>					
Curing Compound; must comply with <i>Standard Specifications</i> Section 90-1.03B(3)	ASTM C309	1-qt can	At time of use (See Note 1)	1 every shipment	Each shipment must have certificate of compliance that includes: 1. Test results for tests specified in Section 90-1.01D(6) of <i>Standard Specifications</i> 2. Certification that material was tested within 12 months before use

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
Concrete (*Standard Specifications* Section 90) (8 of 9)  
Concrete, Except Minor Concrete and Rapid Strength Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location (Note 1)	Acceptance Test Frequency	Remarks
<b>CEMENTITIOUS MATERIALS</b>					
Cement, various properties; must comply with <i>Standard Specifications</i> Section 90-1.02B(2)	See <i>Standard Specifications</i> Section 90-1.02B(2)	8 lb	Concrete plant	Sample and test if cement quality is questionable	Cement source must be shown on Authorized Materials List; certificate of compliance must accompany each cement shipment
Supplementary Cementitious Materials (SCM), various properties; must comply with <i>Standard Specifications</i> Section 90-1.02B(3)	See <i>Standard Specifications</i> Section 90-1.02B(3)	8 lb	Concrete plant	Sample and test if SCM quality is questionable	SCM source must be shown on Authorized Materials List; certificate of compliance must accompany each SCM shipment
<b>ADMIXTURES: Air Entraining Agent</b>					
Air entraining properties; must comply with <i>Standard Specifications</i> Section 90-1.02E	See <i>Standard Specifications</i> Section 90-1.02E	N/A	N/A		Must be on Authorized Materials List and certificate of compliance must accompany each shipment
<b>CHEMICAL ADMIXTURES: Water Reducers or Set Retarders</b>					
Claimed properties, chloride identification	ASTM C494 Type A, B, D, F or Type G California Test 415	N/A	N/A		Must be on Authorized Materials List and certificate of compliance must accompany each shipment

Table 6-1.17. Materials Acceptance Sampling and Testing Requirements:  
 Concrete (*Standard Specifications* Section 90) (9 of 9)  
 Minor Concrete

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>CONCRETE</b>					
Yield	California Test 518	See test method	Concrete truck discharge chute (See Note 3)	As necessary to assure accuracy of mix design; minimum 1 per each mix design	No deductions for cement content will be made based on the results of California Test 518
Compressive Strength	California Test 540, California Test 521	1 set of 2 cylinders, 6x12 in., for each test	Concrete truck discharge chute; (See Note 3)	Sample and test if concrete quality is questionable; minimum 1 per mix design	Minor concrete must have the strength described or 2,500 psi, whichever is greater; see <i>Standard Specifications</i> Section 90-1.02A
Air Content	California Test 504	See test method	Concrete truck discharge chute (See Note 3)	Where air is specified for freeze-thaw resistance, minimum of 1 every 100 cu yd	Where air is specified for freeze-thaw resistance, a minimum of 1 every 100 cu yd
<b>CURING COMPOUND</b>					
Curing Compound; must comply with <i>Standard Specifications</i> Section 90-1.03B(3)	ASTM C309	1-qt can	At time of use; (See Note 1)	1 every shipment	Each shipment must have certificate of compliance that includes: 1. Results for tests specified in Section 90-1.01D(6) of <i>Standard Specifications</i> 2. Certification that material was tested within 12 months before use

Notes:

1. Refer to California Test 125 for sampling procedures.

2. For initial testing, provide 100 lb of 1-1/2 in. x 3/4 in., 75 lb of 3/4 in. x No. 4, 75 lb of pea gravel, and 50 lb of sand. Use this material for California Test 202, 206, 207, 211, 213, 214, 217, 227 and 229.
3. Refer to California Test 539 for method of sampling fresh concrete.

Table 6-1.18. Materials Acceptance Sampling and Testing Requirements:  
Miscellaneous Materials (1 of 5)

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>BARBED WIRE AND WIRE MESH FENCES (Section 80-2)</b>					
Barbed Wire, various properties; must comply with <i>Standard Specifications</i> Section 80-2.02D	ASTM A121	1 yd length	Job site	As necessary for verification if quality is questionable	
<b>BOLTS AND HARDWARE (Section 75)</b>					
		2 samples each diameter		Each lot	Sample and test if not previously inspected at the source
<b>CHAIN LINK FENCES (Section 80-3)</b>					
Wire Mesh, various properties; must comply with <i>Standard Specifications</i> Section 80	ASTM A116, Class 1	2 ft width	Job site	Each lot for verification if quality is questionable	Certificate of compliance required for vinyl clad fencing
<b>CONCRETE PIPE (Section 65)</b>					
Compliance with specifications		Contact METS for instructions		Contact METS for instructions	Sample and test if not previously inspected at source
<b>CONDUIT (Section 86-1.02B)</b>					
Conduit, various properties; must comply with <i>Standard Specifications</i> Section 86-1.02B	See <i>Standard Specifications</i> Section 86-1.02B	2 ft. long from center of length, 2 samples each size	Job site	As necessary for verification if quality is questionable	

Table 6-1.18. Materials Acceptance Sampling and Testing Requirements:  
Miscellaneous Materials (2 of 5)

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>ELECTRICAL CONDUCTORS AND CABLES (Section 86-1.02F)</b>					
Electrical Conductors and Cables, various properties; must comply with <i>Standard Specifications</i> Section 86-1.02F	See <i>Standard Specifications</i> Section 86	2 ft. long, include markings, 2 samples per gauge	Job site	Each lot for verification if quality is questionable	
<b>EXPANSION JOINT FILLER</b>					
Compliance with specifications		6 in. long, full width of sheet		Each 1,000 sq ft not less than 2 per shipment	
<b>GEOSYNTHETICS (Section 96)</b>					
Various properties; must comply with <i>Standard Specifications</i> Section 96	See <i>Standard Specifications</i> Section 96	1 piece, 3 ft x full width of roll	Job site	Each lot for verification if quality is questionable. See Remarks	Certificate of compliance required for each lot; unroll at least 1 circumference before sampling
<b>PAINT (Section 91)</b>					
Paint, various properties; must comply with <i>Standard Specifications</i> Section 91	See <i>Standard Specifications</i> Section 91	For miscellaneous painting, 1 qt (see Section 6-2 of this manual)	Job site	Each batch	If less than 20 gallons, testing not required and resident engineer must field release. Zinc-rich primer must be on the Authorized Materials List
<b>PAVEMENT MARKERS (Section 81-3)</b>					
Pavement Markers, various properties; must comply with <i>Standard Specifications</i> Section 81-3	See <i>Standard Specifications</i> Section 81-3	20 markers	Job site	As necessary for verification if quality is questionable	Each shipment must have certificate of compliance

Table 6-1.18. Materials Acceptance Sampling and Testing Requirements:  
Miscellaneous Materials (3 of 5)

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>PERMEABLE MATERIALS: (Section 68-2.02F)</b>					
Durability Index	California Test 229	50 lb	Stockpile	Prior to use	
Sieve Analysis	California Test 202	50 lb	Stockpile	Prior to use, 1 every day	
<b>PERMEABLE MATERIALS: Class 3 (Section 68-2.02F)</b>					
Crushed Faces	California Test 205	50 lb	Stockpile	Prior to use	
<b>PRESTRESSED TENDON GROUT (Section 50)</b>					
Efflux time	California Test 541	One 6x12 in. cylinder mold can	From batch immediately after mixing for prequalification, thereafter from outlet end of tendon and/or storage tank	At the start of each day's work, and thereafter 1 test per each 5% of ducts; see Remarks	Repeat acceptance tests whenever source of material is changed
<b>RAISED BARS (PRECAST)</b>					
Compliance with specifications		1 unit or full size bar		Each lot	Sample and test if not previously inspected at the source
<b>REINFORCING STEEL (Section 52)</b>					
Reinforcing Steel, various properties	See <i>Standard Specifications</i> Section 52	2 samples, 30 in., except 40 in. for No. 14 and No. 18	Job site	As necessary for verification if quality is questionable	Each shipment must be accompanied by a certificate of compliance
<b>SLOPE PROTECTION (Section 72)</b>					
Size	N/A		Quarry or stockpile	As required for acceptance	Adequate size of slope protection documented by measuring or weighing the material
Apparent Specific Gravity	California Test 206	75 lb	Quarry or stockpile	Prior to use	

Table 6-1.18. Materials Acceptance Sampling and Testing Requirements:  
Miscellaneous Materials (4 of 5)

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>SLOPE PROTECTION (Section 72) (Cont.)</b>					
Absorption	California Test 206	75 lb	Quarry or stockpile	Prior to use	
Durability Index	California Test 229	75 lb	Quarry or stockpile	Prior to use	
<b>STEEL PRODUCTS</b>					
		Contact METS for instructions		Contact METS for instructions	
<b>STRUCTURAL STEEL AND MISCELLANEOUS METAL (Sections 55 &amp; 75)</b>					
		2 samples, 30-in., cut parallel to direction of rolling		Each heat or melt or 10 tons or fraction	Sample and test if not previously inspected at the source
<b>STRUCTURAL STEEL COATINGS (Section 59)</b>					
Paint, various properties; must comply with <i>Standard Specifications</i> Section 59	See <i>Standard Specifications</i> Section 59	For bridge or major structure, send an unopened 5-gal can	Job site	Each batch; see Remarks	Unused portion of 5-gal sample will be returned to job; see Section 6-2, "Acceptance of Manufactured or Fabricated Materials and Products," of this manual
<b>WATER-PROOFING MATERIALS (Section 54)</b>					
Glass Fiber	ASTM D1668, Type 1	9 sq ft of asphalt saturated cotton fabric	Job site	1 sample from each lot	
Asphalt	ASTM D449	5 lb of asphalt	Job site	1 sample from each lot	
Primer	ASTM D41	1 qt of asphalt primer	Job site	1 sample from each lot	

Table 6-1.18. Materials Acceptance Sampling and Testing Requirements:  
Miscellaneous Materials (5 of 5)

Test	Test Method	Sample Size & Container Size	Sampling Location	Acceptance Test Frequency	Remarks
<b>WELDED WIRE REINFORCEMENT (Section 52-1.02C)</b>					
Welded Wire Reinforcing Steel, must comply with <i>Standard Specifications</i> Section 52-1.02C	ASTM A 1064/A 1064M	9 sq ft	Job site	As necessary for verification if quality is questionable	Each shipment must be accompanied by a certificate of compliance