

Quality Control Manual for Hot Mix Asphalt

for the Quality Control Quality Assurance Process



STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION
Division of Construction
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Please send comments or suggestions regarding this manual to:

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PREFACE

Caltrans implemented the Quality Control Quality Assurance (QCQA) program for hot mix asphalt in 1995 with the following goals:

- Improve the quality of materials and processes used in the construction of highway projects and reduce the life-cycle costs for the facilities involved.
- Place some responsibility for quality on the contractor.
- Reduce disputes between contractors and Caltrans.

The QCQA specifications for hot mix asphalt were developed with emphasis on quality control during the production and placement of material. Hot mix asphalt acceptance and payment are based on:

- The contractor's fulfillment of quality control inspection, sampling, and testing.
- The resident engineer's inspection, sampling, and testing to verify that the contractor's quality control inspection, sampling, and testing comply with specifications.
- Statistical evaluation of specified quality characteristics.

The objective of the *Quality Control Manual for Hot Mix Asphalt* is to help the contractor fulfill the quality control responsibilities for hot mix asphalt projects that require the QCQA construction process.

INTRODUCTION

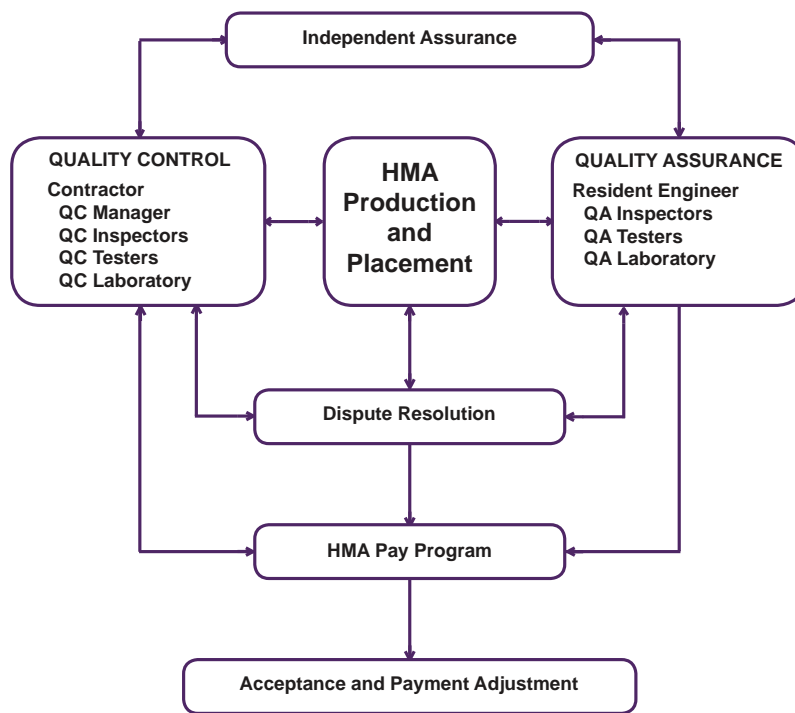
The contractor is responsible for quality throughout hot mix asphalt production and placement. Therefore, the contractor must ensure that the materials and work provided by subcontractors, suppliers, and producers are adequate and meet the specifications of the project. The contractor provides the necessary quality control so that a QCQA program is effective in producing materials that comply with the specifications.

The following are the major components of the QCQA program:

- Quality control
- Quality assurance
- Independent assurance
- Dispute resolution
- Acceptance and payment

Figure 1 is a flowchart of the major components of the QCQA program and their relationships.

Figure 1 QCQA Components and Relationships



QUALITY CONTROL PLAN

The contractor is responsible for developing and implementing a quality control plan for inspection, testing, and other specified actions so that all aspects of hot mix asphalt production and placement meet the specifications. A quality control plan must address contractor process monitoring including inspection, sampling, and testing. Process monitoring has action limits and specified steps to be taken if the action limits are breached. The specified steps are taken for the following reasons:

- To keep the process in control.
- To quickly determine when the process has gone out of control.
- To respond adequately to correct the situation and bring the process back into control.

General Requirements

The contractor must submit a project-specific quality control plan to the resident engineer for acceptance. The contractor's quality control plan submittal letter should briefly describe key elements of the quality control plan that have been developed to fulfill the contract requirements. The submittal letter should identify the contractor, hot mix asphalt paving subcontractor (if applicable), hot mix asphalt producer, and quality control manager. If hot mix asphalt production and placement are subcontracted, the quality control manager may report to the subcontractor if the contractor has so delegated in the letter of submittal for the quality control plan. Appendix A shows a sample quality control plan submittal letter.

The resident engineer uses the quality control plan minimum requirements outlined in this manual to evaluate the quality control plan for acceptance. If the resident engineer does not accept the quality control plan, the contractor submits a revised quality control plan. Each page of a revised quality control plan indicates the revision number and date. The resident engineer has five business days to review each submitted quality control plan. The contractor cannot begin hot mix asphalt production and placement without the resident engineer's acceptance of the quality control plan.

During work progress, the contractor must submit in writing to the resident engineer quality control plan supplements for changes to quality control procedures, personnel, tester qualification status, or laboratory accreditation. The contractor must retain hard copies of all documents for three years after final contract acceptance.



Elements

At a minimum, the quality control plan must include the following elements:

- Quality control plan certification by the quality control manager
- Quality control organization
- Quality control plan distribution list
- Quality control inspection plans
- Sampling and testing plan
- Random sampling plan
- Laboratories and equipment
- Action limits and corrective action plans
- Quality control documents

Certification

The quality control manager must certify that the quality control plan developed for a project meets the requirements of the contract specifications and this manual. The manager must review the qualifications of proposed quality control personnel and verify that proposed samplers, testers, and laboratories meet the requirements of the Caltrans Independent Assurance Program.

The quality control plan cover must contain a signed statement by the quality control manager:

It is hereby certified that the information contained in this quality control plan for contract (insert contract number) meets the requirements of contract specifications and the Quality Control Manual for Hot Mix Asphalt. This quality control plan contains qualified testing personnel and laboratories accredited in accordance with the Independent Assurance Manual.

Appendix B shows a sample quality control plan cover with the quality control manager certification statement.

Organization

The quality control plan must include the contractor's quality control organization for the project. The organization must at a minimum identify the following: quality control manager, inspectors, samplers, testers, and laboratories. The organization section must provide the following information:

- Quality control organization chart
- Quality control manager's qualifications and experience
- Request for assignment of inspectors, samplers, and testers
- Quality control inspector affidavit of proficiency
- Sampler and tester qualification certificates of proficiency
- Laboratory accreditation

The following table outlines minimum numbers of field quality control staff for hot mix asphalt production and placement:


Expected Daily Tonnage of Hot Mix Asphalt	Quality Control Staffing Levels (excluding the manager)
< 1500	3*
≥ 1500	4**

* One hot mix asphalt production inspector, one hot mix asphalt placement inspector, and one hot mix asphalt sampler.

** The additional quality control staff member serves as a hot mix asphalt placement inspector or sampler.

The organization chart must show the contractor and each subcontractor laboratory and identify all quality control staff involved in hot mix asphalt production, placement, or evaluation. The chart must show how these organizations and personnel will interconnect and communicate. Appendix C shows a sample quality control organization chart. The chart must show the following:

- Reporting hierarchy of quality control organization, contractor, subcontractors, and hot mix asphalt producers.
- All quality control staff by name and function.
- The primary and secondary person for each function.

- 
- The contact phone numbers and email addresses for all quality control staff.
 - The name, contact name, and telephone number of each quality control laboratory.
 - When the contractor is using a testing laboratory independent of the quality control testing laboratory to confirm quality control testing, the name, contact name, and telephone number of the independent testing laboratory.
 - The roles and responsibilities for staff and laboratories.

Success of the contractor's quality control program requires the quality control manager, inspectors, samplers, laboratories, and testers to act as a team to accomplish desired results. The contractor must ensure that adequate communication exists among quality control staff and production and placement staff at all locations.

Quality control manager—The quality control manager must be an employee of the contractor, the hot mix asphalt production or placement subcontractor, or a consultant employed by the contractor. The manager must not report to those responsible for the construction and production operations and cannot perform other quality control functions such as hot mix asphalt inspection, sampling, or testing. The manager provides training to the contractor, subcontractor, producer, and quality control personnel.

The quality control manager must have previous quality control experience on a project of comparable size and scope and previous QCQA training. The quality control plan must include the manager's name, qualifications, and experience. See Appendix D for sample qualifications and experience.

The quality control manager is responsible for administering the quality control program, including preparing the quality control plan, and reviewing test results, inspection reports, material certificates, and production processes to ensure that all materials and completed hot mix asphalt pavement conform to contract requirements. The quality control manager must indicate review of quality control documents (test reports and inspection reports) by initialing each document. The quality control manager must have full authority to institute all actions necessary for a successful quality control program to ensure that hot mix asphalt complies with the specifications.

The manager must prepare and submit quality control plan supplements to the contractor when there are changes to quality control procedures, personnel, tester qualification status, or laboratory accreditation. The contractor submits the supplements to the resident engineer. The manager must assure that quality control plan supplements are distributed in a timely way.

Quality control inspectors—The contractor is responsible for inspecting the production, transportation, placement, and compacting operations of hot mix asphalt and the finished roadway surface. As representatives of the contractor, the quality control inspectors, are responsible for inspection of hot mix asphalt production and placement to ensure compliance with the specifications. Inspectors must be familiar with:


- Plans
- *Standard Specifications*
- Special provisions
- Hot mix asphalt production and placement operations
- Potential problem areas
- Inspection documentation requirements

The hot mix asphalt quality control inspectors should have inspection experience on projects of similar type and size and have attended some hot mix asphalt training. The quality control manager certifies and submits the hot mix asphalt production and hot mix asphalt placement inspectors' qualifications on form CEM-3802, "Quality Control Inspector Affidavit of Proficiency," (Appendix F). The quality control manager includes the names of proposed quality control inspectors on form CEM-3801, "Request for Assignment of Inspectors, Samplers, and Testers," (Appendix E).

Hot mix asphalt production and placement inspectors, when qualified by the Caltrans Independent Assurance Program (IAP) for California Test 125, "Methods for Sampling Highway Materials and Products Used in Roadway Structural Section," may obtain aggregate samples at hot mix asphalt production facility or hot mix asphalt samples. Inspectors who may perform sampling must have both the box for inspection and for sampling checked on form CEM-3801 with the attached form TL-0111, "Qualified Certificate of Proficiency," (Appendix G) indicating that California Test 125 is attached.

Quality control samplers and testers—The contractor is responsible for sampling and testing aggregates and hot mix asphalt mix. Samplers and testers must be familiar with sampling and testing requirements of the quality control plan, procedures for sampling and testing, proper care of materials samples and testing equipment, and sampling and testing documentation requirements.

The Caltrans IAP must qualify all samplers and testers who perform quality control sampling and testing. It is the contractor's responsibility to see that all samplers and testers maintain a current qualification, as shown on TL-0111, for the test methods required for hot mix asphalt.



The quality control manager must include samplers and testers on form CEM-3801 with a copy of a current TL-0111 for each sampler and tester attached.

Quality control laboratories—The contractor is responsible for providing adequate laboratory facilities to fulfill the specified testing requirements and quality control needs for production and placement of hot mix asphalt. Quality control laboratory personnel must be qualified by the Caltrans IAP and have in-depth knowledge of the project quality control plan. Where required, the Caltrans IAP must inspect and accredit quality control laboratories. Copies of the current Caltrans IAP accreditation (Appendix H) for each quality control laboratory must be included in the quality control plan. See the “Laboratories and Equipment” section of this manual for more information about quality control laboratory requirements.

Distribution

The contractor develops a quality control plan distribution list that must include:

- Individuals and locations to receive the quality control plan (quality control manager, resident engineer, paving foreman, inspectors, samplers, testers, hot mix asphalt production facility, laboratories, aggregate suppliers and hot mix asphalt (HMA) transportation providers)
- The person responsible for distributing the quality control plan and its supplements

Inspection Plans

The contractor is responsible for inspecting the production, transportation, placement, and compaction of hot mix asphalt and the finished roadway surface. The quality control plan must include an outline of planned inspections and list hot mix asphalt inspectors’ duties for the production facility and roadway. A sample hot mix asphalt production inspection plan is shown in Appendix I, and a sample hot mix asphalt placement inspection plan is shown in Appendix J.

All inspectors must be familiar with the reporting forms used to record their daily activities. They must complete these records each day and submit them to the quality control manager for review. The manager must, in turn, compile all daily records of inspection and submit them with a summary report to the resident engineer. The reporting form for hot mix asphalt production inspection is shown in Appendix K, and the reporting form for hot mix asphalt placement inspection is shown in Appendix L.

The contractor's quality control inspection plans must address, at a minimum, the requirements shown below for Hot Mix Asphalt Production Inspection and Hot Mix Asphalt Placement Inspection.

Hot Mix Asphalt Production Inspection

Before the first day of hot mix asphalt production, the production inspector must ensure the requirements are met for hot mix asphalt plant qualification and moisture sensitivity treatment of aggregates.

Hot Mix Asphalt Plant Qualification

Hot mix asphalt plants must be qualified under the Caltrans *Materials Plant Quality Program*.

Before production begins, the hot mix asphalt production inspector takes the following steps related to hot mix asphalt plant operations:

- Verify with the Caltrans district weights and measures coordinator that the proposed hot mix asphalt plant is Caltrans-qualified under the *Materials Plant Quality Program*. Batch hot mix asphalt plants must be qualified annually and continuous hot mix asphalt plants at least every six months, in accordance with “MPQP Frequency” of the *Material Plan Quality Program*.
- If hot mix asphalt plant is not qualified, notify the quality control manager.
- If applicable, accept hot mix asphalt from a non-qualified plant if a “Startup Approval” letter (completion of dynamic testing not to exceed 14 days) has been granted by the district weights and measures coordinator.

Moisture Sensitivity Treatment

The hot mix asphalt may be sensitive to moisture damage and require one of the following antistrip treatments, to be identified on Form CEM-3511, “Contractor Job Mix Formula Proposal”:

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

Lime Treatment of Aggregates

Lime treatment of aggregates has two processes:

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

Quality control test limits for aggregate properties were established without lime treatment, so aggregate testing must be performed before lime treatment.

Before production begins, verify with the Caltrans district weights and measures coordinator that the proposed lime plant is Caltrans-qualified under the *Materials Plant Quality Program*.

During lime treatment of aggregates, ensure that:

- Aggregate samples for sand equivalent, gradation and moisture content are taken at the frequency shown in the Quality Control Sampling and Testing Plan. Sample aggregate from stockpiles in accordance with California Test 125.
- Aggregate samples for sand equivalent and gradation are tested at the frequency shown in the Quality Control Sampling and Testing Plan. Combine aggregate from individual stockpiles in the job mix formula (JMF) proportions as necessary for testing.
- Aggregate samples are tested for moisture content in accordance with California Test 226 “Method for Determining Moisture Content by Oven Drying” or California Test 370, “Determining Moisture Content of Asphalt Mixtures or Mineral Aggregates.” Notify the contractor of the test results and confirm that any required plant adjustment has been made.
- Aggregate samples for aggregate quality characteristic testing are obtained from stockpiles in accordance with California Test 125 and at the frequency shown in the Quality Control Sampling and Testing Plan. Ensure that aggregate samples are tested for aggregate properties including:
 1. Los Angeles Rattler
 2. Percent of crushed particles course 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

- For slurry method and dry lime method, ensure that aggregate treatment is adequate by witnessing plant operation and that the data is entered by the contractor into the treatment data log as required by the specifications.

For each day of aggregate lime treatment, obtain the treatment data log in tab-delimited format on a CD. Provide the quality control manager with the lime treatment data for submittal to the resident engineer.

Liquid Antistrip Treatment

This treatment process requires the treatment of the asphalt binder with liquid antistrip. Before production begins, the hot mix asphalt production inspector takes the following steps related to liquid antistrip treatment:

- Verify with the Caltrans district weights and measures coordinator that the proposed antistrip metering device and storage tank are Caltrans-qualified under the *Materials Plant Quality Program*.
- Verify that the liquid antistrip is the same type and brand as shown on the accepted JMF.

During antistrip treatment of aggregates, ensure that liquid antistrip treatment is adequate by witnessing the contractor record the data into treatment data log as required by the specifications.

For each day of antistrip treatment, obtain the treatment data log in print and electronic media in tab-delimited format. Provide the quality control manager with the antistrip data for submittal to resident engineer.

Inspection Requirements Before Daily Start of Production

The hot mix asphalt production inspector must be familiar with the hot mix asphalt production facility to be inspected. The inspectors must document each day's hot mix asphalt plant production information on form CEM-3501, "Hot Mix Asphalt Production Report," (Appendix K). CEM forms are available online:

<http://www.dot.ca.gov/hq/construc/>

Before daily start of production, hot mix asphalt production inspection requires:

- Recording hot mix asphalt plant inspection information on form CEM-3501 (see Appendix K) to document compliance with the specifications.

- Ensuring that aggregate is stored separately according to the specified sizes. For proper storage of specified sizes, compare the material from each bin with requirements in “Aggregate Storage” of the *Material Plant Quality Program*. If any segregation, degradation, or intermingling occurs, require the contractor to empty the storage facility and to waste or re-screen the material.
- Ensuring that the supplemental fine aggregate remains dry and is stored separately as specified in *Material Plant Quality Program*.
- Ensuring that the security seal has not been tampered with.
- Ensuring that the proportioning equipment is interlocked as specified in *Material Plant Quality Program*. Also refer to the *Weights and Measures Handbook* for the procedure on checking interlocks.
- Ensuring that the JMF being used by the contractor is for 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 used in asphalt rubber binder or percentage of any component material.
 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 JMF. Notify the quality control manager if there has been any change in the JMF.
- Ensuring 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,” of the *Certificate Program for Suppliers of Asphalt*. Immediately notify the contractor and quality control manager if asphalt binder testing has not been completed for a supplier not on the approved supplier list.

Inspection Requirements During Production

Hot mix asphalt production inspection during production requires the following:

- Recording daily hot mix asphalt plant production information on form CEM-3501. Document additional information about plant production, including instructions to the contractor's personnel.
- Observing the overall plant operation to ensure that the contractor controls dust or smoke as specified.
- On the first day of production, ensuring that samples of aggregate, asphalt binder, and—if applicable—reclaimed asphalt pavement are obtained during the first 750 tons of production according to Section 39-1.07, "Production Start-Up Evaluation," of the *Standard Specifications*. Sample according to California Test 125, and provide three split samples to resident engineer.
- Ensuring that the production start-up evaluation aggregate sample for aggregate gradation and sand equivalent are tested immediately. If reclaimed asphalt pavement is used, determine aggregate gradation according to Lab Procedure LP-9, "Hot Mix Asphalt (HMA) using up to 15% Reclaimed Asphalt Pavement (RAP)."
- For continuous mixing plants, ensuring that aggregate samples are obtained at least twice a day for aggregate moisture content testing according to California Test 125.
- Ensuring that aggregate samples are tested for moisture content according to California Test 226 or California Test 370. Notify the contractor of the aggregate moisture test results, and confirm that any required plant adjustment has been made.
- If applicable, obtaining reclaimed asphalt pavement samples for moisture content at least twice a day using California Test 125 with the modifications in Lab Procedure LP-9.
- Ensuring that reclaimed asphalt pavement samples are tested for moisture content using California Test 226 or California Test 370. Notify the contractor of the reclaimed asphalt pavement moisture test results, and confirm that any required plant adjustment has been made.
- Ensuring that aggregate samples for aggregate grading and sand equivalent testing are obtained at the frequency shown in the Quality Control Sampling and Testing Plan. Sample aggregate according to California Test 125. If applicable, take aggregate samples before lime treatment for testing sand equivalent. Reclaimed asphalt pavement does not need to be sampled for aggregate gradation or sand equivalent.

- Ensuring that aggregate samples for aggregate gradation and sand equivalent are tested at the frequency shown in the Quality Control Sampling and Testing Plan. If reclaimed asphalt pavement is used, determine aggregate gradation using Lab Procedure LP-9. Notify the contractor of aggregate gradation and sand equivalent test results, and confirm that any required plant adjustment has been made to correct for out-of-action limit aggregate gradation.
- Ensuring that aggregate samples are obtained according to California Test 125 at the frequency shown in the Quality Control Sampling and Testing Plan for testing aggregate properties including:
 1. Los Angeles Rattler
 2. Percent of crushed particles course 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 applicableIf applicable, aggregate samples must be taken before lime treatment for testing aggregate properties. Reclaimed asphalt pavement does not need to be sampled for aggregate properties.
- Obtaining the required Certificates of Compliance (see Section 92-1.03, “Test Results,” of the *Standard Specifications*) for all loads of asphalt binder and providing them to the quality control manager for submittal to the resident engineer.
- Ensuring that a sample of asphalt binder is obtained and submit it to the resident engineer. Sample the asphalt binder at the frequency shown in the Quality Control Sampling and Testing Plan.
- Ensuring that asphalt rubber binder:
 1. Complies with the specifications by witnessing the contractor measure asphalt rubber binder viscosity using Laboratory Procedure LP-11, “Rotational Viscosity Measurement of Asphalt Rubber Binder.”
 2. Is not used during the first 45 minutes of the reaction period.

3. Is not reheated more than twice.
 4. Temperature and viscosity hourly logs are obtained each day from the contractor.
- 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.
 3. Obtain samples of crumb rubber modifier using Lab Procedure LP-10, “Sampling and Testing Crumb Rubber Modifier,” and at the frequency shown in the Quality Control Sampling and Testing Plan. Provide the samples to the resident engineer.
 4. Obtain samples of asphalt modifier, and provide them to the resident engineer. Sample asphalt modifier binder at the frequencies shown in the Quality Control Sampling and Testing Plan.
 - If a single quality characteristic has two consecutive acceptance or quality control tests not in compliance with the specifications, ensuring that the contractor stops production, notifies the resident engineer, takes corrective action, and demonstrates compliance with the specifications before resuming production and placement of hot mix asphalt on the project.
 - Ensuring that the temperatures of the asphalt binder, aggregate, and hot mix asphalt mixture are within limits specified in Section 39-1.08B, “Mixing,” of the Standard Specifications. Record temperatures and times taken in the daily hot mix asphalt production report.
 - Ensuring that the batch size and feed rates do not exceed the mixing capacity range used during plant dynamic testing conducted in accordance with the Material Plant Quality Program.
 - Ensuring that samples of hot mix asphalt mixture for mix moisture are obtained according to California Test 125 at the frequency shown Quality Control Sampling and Testing Plan.
 - Ensuring that samples of hot mix asphalt mixture are tested to determine hot mix asphalt mix moisture in accordance with California Test 370 and at the frequency shown in the Quality Control Sampling and Testing Plan.

- For batch plants:
 1. Observing production to ensure that the mixing time and sequence of withdrawal from the bins produce the specified homogeneous hot mix asphalt mixture.
 2. Ensuring that the automatic batching equipment functions within limits specified in “Hot Mix Asphalt Plant Equipment” of *Material Plant Quality Program*.
- For continuous mixing plants (drier drum or drier drum pugmill), ensuring that the following are operating properly:
 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 hot mix asphalt storage
- Observing the operation of all weighing systems. Whenever scales and meters seem inaccurate, contacting the district weights and measures coordinator for further assistance. Be aware of scale and meter security seals and set points.
- For batch plants ensuring that the equipment is operating properly:
 1. For the batching process, consider the weight of the material falling from the bin gates to the weighing hopper after the gates are closed (in-air weight compensation).
 2. Ensure that the weigh box containing the total batch does not contact anything that prevents a true indication of the batch weight.
 3. When intermediate storage (silo) of hot mix asphalt does not occur, periodically check the batching by comparing the total weight of the batches in a truckload with the platform scale weight for the same load.
 4. Check the asphalt binder scales frequently to ensure that they return to within zero tolerance limits and that the scale lever systems or load cells move freely.

- For hot mix asphalt storage silos, ensuring that proper hot mix asphalt storage, in accordance with “Hot Mix Asphalt Storage,” of *Material Plant Quality Program*:
 1. Does not cause obvious segregation.
 2. Maintains specified temperature.
 3. Maintains the minimum silo level.
 4. Does not exceed the maximum storage time.
- Before trucks are loaded, ensuring the absence of an excessive amount of parting agent or other contaminating material. The amount of parting agent is excessive when it forms pools absorbed by the mix. Diesel or other petroleum based products are prohibited from use as parting agents.
- After trucks are loaded, ensuring that the hot mix asphalt mixture is homogeneous (aggregate is coated with asphalt binder and load is not segregated). Notify the contractor and quality control manager if loads need to be rejected based on non-homogeneous hot mix asphalt mixture.
- If trucks are being tarped, recording data on form CEM-3501.

Hot Mix Asphalt Placement Inspection

For hot mix asphalt placement operations, one or more inspectors must always be present during hot mix asphalt placement. When daily production is less than 1500 tons, the hot mix asphalt placement inspector may perform sampling of hot mix asphalt from the mat. The placement inspector documents the data on form CEM-3502 (Appendix L), available online:

<http://www.dot.ca.gov/hq/construc/>

Before Hot Mix Asphalt Placement

To ensure that the subgrade has been prepared for hot mix asphalt placement, the subgrade must be inspected by Caltrans as well as by the contractor’s quality control placement inspector. Inspect the subgrade before hot mix asphalt placement:

- Ensure that the subgrade is dry, stable, compacted, and smooth. The subgrade to receive hot mix asphalt must comply with compaction and elevation tolerance specifications for the material involved. Report any subgrade problems to the contractor and quality control manager.

- Ensure that the existing pavement surface is clean by removing loose paving particles, dirt, and other extraneous material by any means, including flushing and sweeping.
- Ensure that the pavement surface is both dry and thawed before application of tack coat and paving.

During Hot Mix Asphalt Placement

As guidance for best practices for hot mix asphalt placement, refer to “Placing Hot-Mix Asphalt” in *Principles of Construction of Hot-Mix Asphalt Pavements* published by the Asphalt Institute. Inspection during hot mix asphalt placement requires the following:

- Recording daily hot mix asphalt placement information on form CEM-3502, documenting additional information about hot mix asphalt placement, including instructions to contractor’s personnel.
- Ensuring that tack coat is applied to surfaces to be paved. For guidelines for inspecting tack coat, refer to *Tack Coat Guidelines* published by Caltrans.
- On the first day of production, during the first 750 tons of production, ensuring that hot mix asphalt mix is sampled according to Section 39-1.07, “Production Start-Up Evaluation,” of the Standard Specifications. Sample according to California Test 125, and provide the resident engineer with three split samples.
- Ensuring that the hot mix asphalt production startup evaluation sample is tested for compliance with the specifications for the quality characteristics specified in Section 39-1.07, “Production Start-Up Evaluation” of the Standard Specifications. If applicable, ensuring that an adequate material sample is obtained for California Test 371, “Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.”
- Ensuring that when hot mix asphalt compaction is done by method process, hot mix asphalt placement occurs within the specified temperature ranges by taking sufficient measurements of the atmosphere, pavement, and hot mix asphalt mixture (not to exceed 325°F). Refer to Section 39-3.04, “Transporting, Spreading, and Compacting,” of the Standard Specifications for atmospheric and surface temperature minimum requirements. Record temperatures and the times taken on form CEM-3502. When temperatures are below specified limits, notify the contractor to stop hot mix asphalt placement.
- Ensuring that when placing hot mix asphalt against the edge of a longitudinal or transverse construction joint that is damaged or not placed to a neat line, extraneous material is removed by sawcutting or grinding the pavement straight and vertical along the joint.

- Ensuring that longitudinal joints between layers are offset 0.5 foot and on finished surfaces correspond to the edge of traffic lanes.
- Ensuring that samples of hot mix asphalt mix are obtained according to California Test 125 at the frequency shown in the Quality Control Sampling and Testing Plan.
- Ensuring that hot mix asphalt samples are tested at the frequency shown in Quality Control Sampling and Testing Plan for:
 1. Asphalt binder content
 2. Stability
 3. Voids filled with asphalt (report only if an adjustment for asphalt binder content target value is less than ± 0.3 percent from optimum binder content)
 4. Voids in mineral aggregate (report only if an adjustment for asphalt binder content target value is less than ± 0.3 percent from optimum binder content)
 5. Dust proportion (report only if an adjustment for asphalt binder content target value is less than ± 0.3 percent from optimum binder content)
 6. Maximum theoretical density (California Test 309), if applicable
 7. California Test 371, “Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage” (report only), if applicable
 8. Any test specified in the project special provisions and included in the sampling and testing plan.

If a single quality characteristic quality control test is not in compliance with the specifications, ensuring that the contractor and quality contractor manager are notified.

If a single quality characteristic has two consecutive quality control tests not in compliance with the specifications, ensuring that the contractor stops production and placement, notifies the resident engineer, takes corrective action, and demonstrates compliance with the specifications before resuming production and placement of hot mix asphalt on the project.

- Ensuring that hot mix asphalt delivery trucks have load slips, and collect them from arriving trucks. If hot mix asphalt loads are rejected before placement, note on the back of the load slip and on the daily form CEM-3502 why the hot mix asphalt was rejected (cold mix, segregation, contamination).

- Ensuring that the paver performs hot mix asphalt spreading at the required thickness and that layer thickness does not exceed 0.25 feet when method compaction is required. Compare the hot mix asphalt spread rate with the theoretical rate, and, if necessary, order the contractor to make adjustments. Check the daily theoretical spread rate against distance actually paved for the day. Indicate the spread rate and layer thickness checks on form CEM-3502.
- When hot mix asphalt trucks are queuing, taking action to avoid excessive cooling of hot mix asphalt mixture. If windrowing is used, preventing excessive length of windrow to avoid overcooling of the hot mix asphalt.
- Monitoring windrow temperatures with an infrared heat gun. Be aware when using a heat gun that the instrument measures surface temperature only and the interior of the windrow is hotter. When the hot mix asphalt is run through the paver, the mat temperature may be above the minimum specified.
- Confirming that the rolling pattern and compaction effort determined by the contractor are being met. If the rolling pattern has changed, notify the quality control manager and make a note on form CEM-3502.
- Ensuring that compaction (percent of maximum theoretical density) quality control testing is performed at the frequency shown in Quality Control Sampling and Testing Plan.
- When the method process is used for hot mix asphalt compaction, ensuring that compaction equipment complies with the specifications:
 1. Specified equipment performs the compaction in the specified order.
 2. The required number of coverages is made for each compaction type (first coverage, breakdown, and finish).
 3. The hot mix asphalt compaction is completed above the specified minimum temperature for each compaction type.
 4. When a vibratory roller is specified for compaction, its speed in miles per hour must not exceed the vibrations per minute divided by 1,000. When the hot mix asphalt layer thickness is less than 0.08 foot, the vibratory must be in the off mode.
 5. When a pneumatic-tired roller is specified for compaction, the speed does not exceed five miles per hour.

Refer to Section 39-3.03, “Spreading and Compacting Equipment,” of the *Standard Specifications* for additional compaction equipment requirements and to Section 39-3.04, “Transporting, Spreading, and Compacting,” of the *Standard Specifications* for detailed compaction temperature and coverage requirements.

- Visually inspect the finished hot mix asphalt surface for marks, tearing, and irregular texture that may be caused by segregated mix. Notify the contractor of any defective areas.
- Obtain pavement smoothness by daily use of a straightedge to determine whether the finished surface complies with the tolerances specified in Section 39-1.12B, “Straightedge,” of the *Standard Specifications*. Record such measurements on the Hot Mix Asphalt Placement Report, and notify the contractor and quality control manager of all out-of-specification areas.

It is the inspector’s responsibility to ensure that hot mix asphalt placement and compaction are conducted to meet specifications and hot mix asphalt industry standards of practice.


Sampling and Testing Plan

The quality control plan must contain a quality control sampling and testing plan that details the sampling and testing to be performed by quality control personnel. The sampling and testing plan should include each quality characteristic that requires quality control as specified in the contract. The plan should be the basis of information used by the contractor to maintain control of hot mix asphalt production and placement.

The quality control plan must also contain a detailed testing program that outlines the quality characteristic to be tested, test method to be used, frequency, and sampling location. The Quality Control Sampling and Testing Plan must meet the minimum quality control requirements of the specifications. Appendix M. shows a sample plan. Samplers and testers who perform quality control sampling and testing for gradations and asphalt content must be qualified by Caltrans independent assurance.

For hot mix asphalt compaction, the contractor chooses the quality control test for determining the percent maximum theoretical density. Possible quality control tests for the determination include nuclear density, non-nuclear devices, and cores. The samplers and testers for determining the percent maximum theoretical density do not have to be qualified by Caltrans independent assurance.

If the contractor chooses to use nuclear devices, testers who operate nuclear gages must be trained and certified in nuclear gage operation and transportation safety. Testers must be provided with nuclear safety badges, and the contractor must maintain a record of the results



of the badge analyses as required. Testing certificates must be from qualified instructors as defined by the California Department of Health.

Caltrans independent assurance must qualify samplers and testers who perform quality control, except quality control for compaction. The contractor is responsible for samplers and testers maintaining current Qualified Certificate of Proficiency. Those who have not kept their qualifications current or have been de-qualified cannot perform sampling and testing for QCQA process contracts. Tests after the date of lapse of qualification or de-qualification are considered invalid for the purpose of quality control testing, and associated test results cannot be used for acceptance or payment adjustments.

Random Sampling Plan

The quality control plan should include a random sampling plan for each quality characteristic that requires quality control testing as specified in the contract. The sampling plan must address partial subplot, end-of-day tonnage, and the method used to determine random sampling. The sampling plan must also contain a copy of the table of random numbers and procedures for quality control personnel to determine sampling times and locations. Appendix N shows a random sampling plan.

Laboratories and Equipment

A quality control testing laboratory includes the following laboratory types that participate in quality control for a contract:

- Main quality control laboratory
- Field laboratory
- Remote laboratory
- Mobile laboratory

The contractor must see that each quality control testing laboratory used for mix design, gradations, and asphalt content is accredited in accordance with the *Caltrans Independent Assurance Manual*. The manual is available from your district independent assurance representative or online:

<http://www.dot.ca.gov/hq/esc/translab/fpm/IAP.htm>

For each quality control laboratory, the quality control plan must include:

- Laboratory name, address, phone, fax, and e-mail.

- Laboratory quality control manager's name and—if different from above—address, phone, fax, and email.
- Tests to be performed.
- Form TL-0113, "Caltrans Accredited Laboratory Inspection Report," (Appendix H) for labs used for mix design, gradation testing, or asphalt content determination.


Any quality control laboratory that performs nuclear gauge operation and transportation must be licensed by the California Department of Health, which requires that nuclear gauge operators be certified for safety operation and transportation. Testing laboratories using nuclear gauges on Caltrans projects must be licensed.

The resident engineer or a designee may visit the quality control laboratories to review the following:

- Facility safety manual
- Safety equipment
- Laboratory procedures manual
- Laboratory quality control manual
- Copies of current applicable test procedures
- Proper test equipment
- Equipment calibration and service documentation
- Calibration and service decals on all testing equipment
- Availability of contract plans and specifications
- Availability of applicable *Standard Specifications*
- Availability of contract-specific quality control plan

Corrective Action Plans

The contractor is responsible for understanding what is necessary to keep the process in control, quickly determine when the process has gone out of control, correct the situation, and bring the process back into control.



Corrective action plans are not intended to cover all possible problems and their solutions. They are a beginning point to document that the contractor has considered potential breach of action limits and established procedures to correct them.

The contractor must determine and establish action limits for each quality characteristic, based on process control experience and the variability of test results expected between quality control and acceptance testing. When specified minimum quality characteristics or placement standards are used as action limits, the contractor's risk for out-of-specification material is increased.

The quality control plan must include a list of anticipated corrective actions needed in the event inspection or test results indicate that production or construction processes do not meet the specified minimum quality characteristics or minimum placement standards. Depending on the severity of the problem, corrective actions may range from minor process adjustments to temporary termination of hot mix asphalt production.

The quality control corrective action plan may be presented in table form as shown in Appendix O. At a minimum, the plan should contain actions required to address the following potential situations:

Hot Mix Asphalt Production

- Asphalt content
- Aggregate gradation
- Aggregate moisture
- Mix moisture
- Asphalt binder temperature
- Aggregate temperature
- Mix temperature
- Sand equivalent
- Mix segregation
- Uncoated aggregate
- Mixing time
- Mix storage time

Hot Mix Asphalt Placement

- Subgrade preparation
- Tack coat
- Ambient temperature
- Mix temperature
- Joint construction
- Thickness
- Placement yield
- Cross slope
- Joint offset
- Mix segregation
- Compaction testing
- Smoothness

Should problems arise during hot mix asphalt production and placement, the contractor must notify the resident engineer, identifying the problems, the means undertaken to pinpoint the cause, and anticipated corrections. The specifications contain requirements for notification and production termination. Corrective actions must be documented in the records of inspection.

Documents

The quality control plan identifies the forms to use to document the contractor's quality control process, detailed enough to provide the contract required information. The following documentation must be provided to the resident engineer:

Hot Mix Asphalt Construction Daily Record of Inspection

Two daily inspection reports, form CEM-3501, "Hot Mix Asphalt (HMA) Production Report," (Appendix K) and form CEM-3502, "Hot Mix Asphalt Placement Report," (Appendix L) must be submitted to the resident engineer by noon the day following the inspection.

Hot Mix Asphalt Daily Summary of Quality Control Testing


Form CEM-3803, "Hot Mix Asphalt Daily Summary of Quality Control Testing," required for each day's production and placement, summarizes the results of each quality characteristic tested (Appendix P).

Individual test records showing all data collected and calculations performed must be attached to form CEM-3803, signed by the tester, and initialed by the quality control manager. The test result data shown on this form for each subplot should be the quality control data entered into the QCQA Pay program (HMA Pay) program and sent to the resident engineer. For more information on the HMA Pay program, see the section later in this manual.

Test results outside action limits or specification limits must be circled on CEM-3803. Initial submittal of the form is required within the maximum time for reporting 24-hour results, usually by noon the next business day. Within 48 hours of sampling, submit a final CEM-3803 with all test results specified to be reported within 48 hours of sampling.

Hot Mix Asphalt Inspection and Testing Summary

Form CEM-3804, "Hot Mix Asphalt Inspection and Testing Summary," (Appendix Q) is required for each day's production and placement. This form includes a checklist showing the inspections and testing conducted for the day.



For quality control test results on the form that are outside the action limit or specification limit, the contractor must take corrective action to bring the process back to control and document the action on form CEM-3804. If the contractor must stop production and placement because of quality factors or two consecutive quality control tests out of action or specification limit, the contractor documents all steps taken on form CEM-3804 before resuming production and placement.

Form CEM-3804 contains the following statement:

It is hereby certified that the information contained in this record is accurate and that information, tests, or calculations documented herein comply with contract specifications and standards set forth in the testing procedures. Exceptions to this certification are documented as part of this record.

The quality control manager signs CEM-3804 for certification and submits it to the resident engineer by noon the next business day following hot mix asphalt production and placement. For test results specified to be reported within 48 hours, the quality control manager submits to the resident engineer the final daily CEM-3804, showing all test results within 48 hours of sampling.

For at least three years after final acceptance, the contractor must retain for inspection the records generated as part of quality control, including the quality control plan and its supplements, inspection reports, daily summary of testing, test results, and hot mix asphalt inspection and testing summary.

Quality Control Plan Checklist

To ensure that quality control plans are submittals are complete and that resident engineers' reviews of hot mix asphalt quality control plans are consistent statewide a "Quality Control Plan Review Checklist for Hot Mix Asphalt" is available. Contractors should use the "Quality Control Plan Review Checklist for Hot Mix Asphalt" (Appendix R) as a guide when reviewing quality control plans for completeness prior to submittal. The checklist has a column the contractor can check for submittal completeness and columns for the resident engineer to use during review of the quality control plan to indicate whether each section of quality control plan is complete or incomplete.

QUALITY CONTROL IMPLEMENTATION

Quality Control Plan Submittal and Acceptance

The contractor should submit the quality control plan to the resident engineer with the submittal of the job mix formula submittal. The resident engineer has five business days to review the quality control plan and either return the plan with comments or accept the submitted quality control plan.

A supplemental quality control plan needs to be submitted to the resident engineer when any of the following occur:

1. Quality control staff is added to a project.
2. A testing laboratory is changed or additional laboratory is added to a project.
3. The Qualified Certificate of Proficiency (Form TL-0111) is expired and a revised Form TL-0111 is submitted.
4. Testing laboratory receives an updated accreditation.

Independent Assurance

It is important for the contractor to use qualified testers and accredited laboratories so that the quality control test results can be used for hot mix asphalt acceptance tests and therefore payment adjustment. The contractor needs to perform periodic reviews of tester qualifications and laboratory accreditation that were submitted as part of the quality control plan.

The Federal Highway Administration requires that each state transportation agency have a quality assurance program for federal-aid highway construction projects. Each state highway agency must develop sampling and testing programs to assure that materials and workmanship incorporated in federal-aid highway construction projects conform to requirements of approved plans and specifications.

Caltrans independent assurance representatives qualify all testers and verify that equipment used for required testing is properly calibrated and in good working condition and that testers are trained in the testing procedures and can demonstrate a level of proficiency. During construction, it may be necessary for an independent assurance representative to verify the reliability of any quality control tester by witnessing sampling and testing and by splitting samples and comparing results. A Caltrans independent assurance representative has the authority to decertify testers who deviate from accepted sampling and testing procedures.

It is the responsibility of the contractor to keep the quality control tester's Qualified Certificate of Proficiency (Form TL-0111) current. Testers whose qualification has lapsed or been revoked may not provide materials test results for acceptance consideration.

Each quality control testing laboratory must be accredited in accordance with the Caltrans Independent Assurance Manual, Procedures for Accreditation of Laboratories and Qualification of Testers, available online:

<http://www.dot.ca.gov/hq/esc/Translab/IAPMasterList/2005%20IA%20Manual.pdf>

Quality Control During Hot Mix Asphalt Production and Placement

The contractor must establish, maintain, and change if necessary a quality control program to provide assurance that the hot mix asphalt complies with the specifications. The quality control program must be implemented early when lime treatment of hot mix asphalt aggregates for moisture sensitivity is required, so aggregate quality characteristics of untreated aggregates can be sampled and tested.

For most projects, the hot mix asphalt quality control program is implemented on the first day of hot mix asphalt production. The contractor must provide daily reports of inspection for both hot mix asphalt production and placement. For each 750 tons of hot mix asphalt production and placement, the contractor must provide documented inspection, sampling, and testing in compliance with the specifications.

For any quality control test result outside action limit or specification limit, the contractor must take corrective action to bring the process back to control and document the action on form CEM-3804. If the contractor must stop production and placement because of quality factors or two consecutive quality control tests out of action or specification limit, the contractor documents all steps taken on CEM-3804 before resuming production and placement.

When a quality control test result is outside the action limit or specification limit, the contractor must stop asphalt production and placement, notify the resident engineer in writing, take corrective action to bring process back to control, document actions on CEM-3804, and demonstrate compliance with specifications before resuming production and placement on the state highway if:

- A lot's composite quality factor (Q_{FC}) or an individual quality factor (QF_{QC_i} for $i = 3, 4,$ or 5) is below 0.90 determined under Section 39-4.03F, "Statistical Evaluation," of the *Standard Specifications*.
- An individual quality factor (QF_{QC_i} for $i = 1$ or 2) is below 0.75.

- A quality characteristic for which a quality factor (QF_{QCi}) is not determined has two consecutive quality control tests not in compliance with the specifications.

Before resuming production and placement, the contractor documents all steps taken on CEM-3804.

As part of quality control implementation, the contractor must enter quality control test results into the Caltrans-provided HMA Pay program. The HMA Pay program has a quality control subprogram that calculates a set of quality factors (QF_{QCi}) for the following quality requirements:

- Aggregate gradation on the 1/2", 3/8", or no. 4 sieve based on specified aggregate gradation
- Aggregate gradation on the no. 8 sieve
- Aggregate gradation on the no. 200 sieve
- Asphalt binder content
- Percentage of maximum theoretical density

Documentation is an important aspect for the success of a quality control program and can show clearly that a contractor is in control of hot mix asphalt production and hot mix asphalt placement processes. Quality control documentation includes the quality control plan and its supplements. During the progress of the work, the contractor must submit plan supplements in writing to the resident engineer for changes to quality control procedures, personnel, tester qualification status, or laboratory accreditation.

For each day of hot mix asphalt production and placement, the following documents must be submitted to the resident engineer:

- CEM-3501, "Hot Mix Asphalt Production Report"
- CEM-3502, "Hot Mix Asphalt Placement Report"
- CEM-3803, "Daily Summary of Quality Control Testing" (with attached test forms)
- CEM-3804, "Hot Mix Asphalt Inspection and Testing Summary"

The contractor must maintain hard copies of all quality control documents for three years after final contract acceptance.

Production Startup Evaluation

The two main purposes of the production startup evaluation are to ensure that the hot mix asphalt conforms to the verified job mix formula for the project and to ensure that the contractor's quality control test results agree with the resident engineer's test results, and vice versa. Disagreement regarding test result comparisons must be resolved early to prevent potential disputes.

On the first day of hot mix asphalt production, the production startup evaluation must occur within the first 750 tons of hot mix asphalt produced. The contractor must take samples of aggregate, reclaimed asphalt pavement, asphalt binder, and hot mix asphalt from the same production run and in the resident engineer's presence. The samples are split into four parts. Three parts are submitted to the resident engineer, and one is tested by the contractor.

For percentage of maximum theoretical density, the contractor must take one 4-inch or 6-inch diameter core for every 250 tons of production startup evaluation hot mix asphalt at locations the resident engineer designates. The resident engineer must perform and report the bulk specific gravity (California Test 308, Method A) and the percent of maximum theoretical density. The contractor may test for in-place density at the core locations and calibrate nuclear gauges based on production startup evaluation test results.

The production startup evaluation test results are recorded on form CEM 3703, "Caltrans Production Startup Evaluation," (Appendix S). All test results must be reported in writing within three business days of sampling.

Both contractor and resident engineer test results should meet specification requirements for all quality characteristics except those with quality factors. Results should be within the target value \pm tolerance for each quality characteristic with a quality factor, except density. The resident engineer's test results for density should be within specification acceptance limits.

Production startup evaluation test results are based on split-sampled material, eliminating the variability in sampling from the test results. Since the resident engineer's test results are used to verify the contractor's quality control test results, the contractor should pay special attention to the differences between the contractor's and resident engineer's test results for split sample results. If the contractor finds any testing differences unacceptable, the contractor may want to resolve these testing differences with the resident engineer before proceeding with hot mix asphalt production and placement.

Dispute Resolution

Dispute resolution is an integral part of the hot mix asphalt QCQA program. The aim of the dispute resolution process is to resolve contractor and the resident engineer disagreements regarding test result comparisons.

When the resident engineer or contractor disputes a test result, the dispute should be resolved at the lowest level possible. The resident engineer and contractor should review test results and witness each party's performance with a disputed test result to determine the source of any testing error including sampling, testing, or testing equipment. If they are unable to determine the source for a testing error, an independent third party (ITP) laboratory must act as witness and referee to resolve the dispute.

When an ITP laboratory is used to resolve testing disputes for quality characteristics without quality factors, the laboratory must test the dispute resolution sample for the test result contested. The laboratory must determine whether the test result for the dispute resolution sample indicates that the resident engineer's test result is beyond the expected test results of a reasonable laboratory conducting the same test on the same sample. Only after the ITP testing has shown that the resident engineer's test result is unreasonable, is that test result replaced by the ITP test result for acceptance of the quality characteristic.

When an ITP laboratory is used to resolve testing disputes involving quality characteristics compliance determined by quality factors, the laboratory must examine all the test results for the lot. If the verification result of a particular lot is disputed, the laboratory performs the same number of ITP tests as the number of resident engineer's quality assurance tests (normally four in a lot) used in the verification of the disputed lot. If the (QF_{QC_i}) for a particular lot is disputed, the ITP laboratory must determine its own (QF_{QC_i}) for the disputed lot. The number of test results used to compute the ITP's (QF_{QC_i}) must be no less than eight and no more than the number of sublots represented in the disputed lot.

Quality assurance test results (normally four in a lot) can be used to compute the ITP's (QF_{QC_i}) if they are not disputed. Additional test results should be obtained by testing engineer samples. If there are not enough engineer samples, then the contractor samples can be used if mutually agreeable. Otherwise, mutually agreed-upon representative samples must be taken and tested by the ITP laboratory to generate enough test results to compute the ITP's (QF_{QC_i}) .

- If the difference between the quality factors (QF_{QC_i}) using the referee test result and the disputed test result is less than or equal to 0.01, the original test result is correct.
- If the difference between the quality factor for (QF_{QC_i}) using the referee test result and the disputed test result is more than 0.01, the quality factor determined from the referee tests supersedes the previously determined quality factor.

If the quality factor for percent maximum theoretical density (QF_{QC5}) for a particular lot is disputed, the ITP laboratory determines the QF_{QC5} using materials representing the disputed lot. If the ITP's QF_{QC5} is within 0.01 of the engineer's, the engineer's QF_{QC5} is used. If the ITP's QF_{QC5} is greater than 0.01 of the engineer's, the ITP's QF_{QC5} is used.

QCQA Pay Program

The contractor must submit the quality control test results by entering data into the Caltrans-provided QCQA (HMA Pay) program. The HMA Pay program has a subprogram that calculates individual and composite quality factors based on quality control test results input by the contractor. A set of quality factors consists of the composite (QF_c) and five individual quality factors (QF_{QCi} where $i = 1$ to 5). The quality control subprogram starts the first set of quality factors computation at the fifth subplot using quality control test data from all first five sublots.

The pay program continues calculating the set of quality factors from sixth to twentieth sublots using quality control test data from all previous sublots. Beginning with the twenty-first subplot and thereafter, the pay program calculates the set of quality factors using a running 20 sublots (for example, the set of quality factors for subplot 23 would use quality control data from subplot 4 to subplot 23). The contractor must stop production, notify the resident engineer in writing, take corrective action, and demonstrate compliance with specifications before resuming production and placement on the state highway if:

- The composite quality factor (QF_c) is less than 0.90
- The individual quality factors (QF_{QCi} for $i = 3, 4, \text{ or } 5$) is below 0.90
- The individual quality factors (QF_{QCi} for $i = 1, \text{ and } 2$) is below 0.75

The contractor documents all steps taken before resuming production and placement on form CEM-3804, "Hot Mix Asphalt Inspection and Testing Summary."

The composite quality factor calculated by the quality control subprogram is not used to determine pay adjustment until the quality control data has been verified. QF_{QC5} , the individual quality factor for compaction, is not included in composite quality control quality factor because it is based on the state's core density measurement.

The contractor must submit the HMA Pay program to the resident engineer with quality control data entered. The resident engineer enters quality assurance test data into the HMA Pay program and uses the verification and pay factor subprograms to monitor the progress of the work. The resident engineer identifies a lot for payment. A lot size must have at least eight sublots, but no more than 27. The verification subprogram verifies the quality control

data using quality assurance data for the resident engineer's identified lot, and the pay factor subprogram calculates the composite quality factor. The subprogram selects the verified quality control data except compaction (maximum theoretical density percentage) quality control data to calculate four individual quality factors— QF_{QC1} , QF_{QC2} , QF_{QC3} , and QF_{QC4} . The pay factor subprogram substitutes the compaction data with the resident engineer's compaction quality assurance data and calculates QF_{QC5} . Finally, the subprogram calculates the composite quality factor for the engineer's identified lot. The resident engineer uses this composite quality factor for acceptance and pay adjustment for the identified lot.

The HMA Pay program and user guide are online:

<http://www.dot.ca.gov/hq/construc/hma/index.htm>

REFERENCES AND RESOURCES

The following list provides contractor personnel with additional sources of information:

California Test (CT-__), Materials and Engineering Testing Services (METS), California Department of Transportation

<http://www.dot.ca.gov/hq/esc/ctms/index.html>

Certificate Program for Suppliers of Asphalt, (METS), California Department of Transportation

<http://www.dot.ca.gov/hq/esc/Translab/fpmcoc/index.html>

CEM Forms, Division of Construction, California Department of Transportation

<http://www.dot.ca.gov/hq/construc/>

Independent Assurance Manual, Procedures for Accreditation of Laboratories and Qualification of Testers, METS, California Department of Transportation

<http://www.dot.ca.gov/hq/esc/translab/fpm/IAP.htm>

Lab Procedure (LP-__), METS, California Department of Transportation

<http://www.dot.ca.gov/hq/esc/ctms/index.html>

Materials Plant Quality Program, Division of Construction, California Department of Transportation

<http://www.dot.ca.gov/hq/construc/>

Principles of Construction of Hot-Mix Asphalt Pavements, published by the Asphalt Institute

Standard Specifications, published by the California Department of Transportation

Tack Coat Guidelines, Division of Construction, California Department of Transportation

<http://www.dot.ca.gov/hq/construc/>

Weights and Measures Handbook, Division of Construction, California Department of Transportation

<http://www.dot.ca.gov/hq/construc/>

FEEDBACK

Contractors should contact the resident engineer for the project specific questions and comments about the hot mix asphalt QCQA program. Caltrans invites feedback regarding the Quality Control Manual for Hot Mix Asphalt and welcomes users' suggestions for making the QCQA program more effective. Please contact:

Headquarters QCQA Program Coordinator
California Department of Transportation
Division of Engineering Services
Materials Engineering and Testing Services
Office of Flexible Pavement, MS 5
5900 Folsom Boulevard
Sacramento, CA 95819-4612
Telephone: (916) 227-7162



Quality Control Manual for Hot Mix Asphalt

Appendixes

Appendix A

Sample Contractor Quality Control Plan Submittal Letter

CONTRACT 00-111114

ABC-180-R97.1/R103.1

June 22, 2009

The purpose of this quality control plan is to direct the activities of Big Orange Construction Company to ensure that the construction materials and construction meet or exceed the quality requirements of the contract specifications.

The quality control program includes personnel from seven organizations. Paraway Refinery of Sacramento will provide the asphalt, Quality Aggregates of Grass Valley will provide the coarse and fine aggregate, and Best Mixes of Elk Grove will provide hot mix asphalt design. AC Producer Corporation of Auburn will provide and ship the hot mix asphalt, and the Sacramento office of Big Orange Construction will place the hot mix asphalt. Materials Testers, Inc. of Elk Grove will provide street and plant inspection and quality control testing.

Quality control personnel in all organizations involved in this contract are independent from the pressures of production and have the organizational freedom to identify quality problems and initiate action that will affect solutions, including action that precludes recurrence. All quality control personnel have been provided with a clearly defined level of authority.

The quality control manager and the alternate quality control manager are employees of Materials Testers, Inc. of Elk Grove. The quality control manager is given full responsibility and authority to implement and maintain the quality control plan.

Big Orange Construction management has approved and required implementation of this plan by producers and suppliers and directs that compliance to this plan is mandatory.

BIG ORANGE CONSTRUCTION COMPANY
George B. Orange
President

APPENDIX B Sample QCP Certification

Contractor Quality Control Plan

for

Contract 00-111114
ABC-180-R97.1/R103.1

June 22, 2009

Prepared for

Big Orange Construction Company
P.O. Box #87
Sacramento, California

by

Material Testers LLC.
215 West Main Street
Elk Grove, California 96000

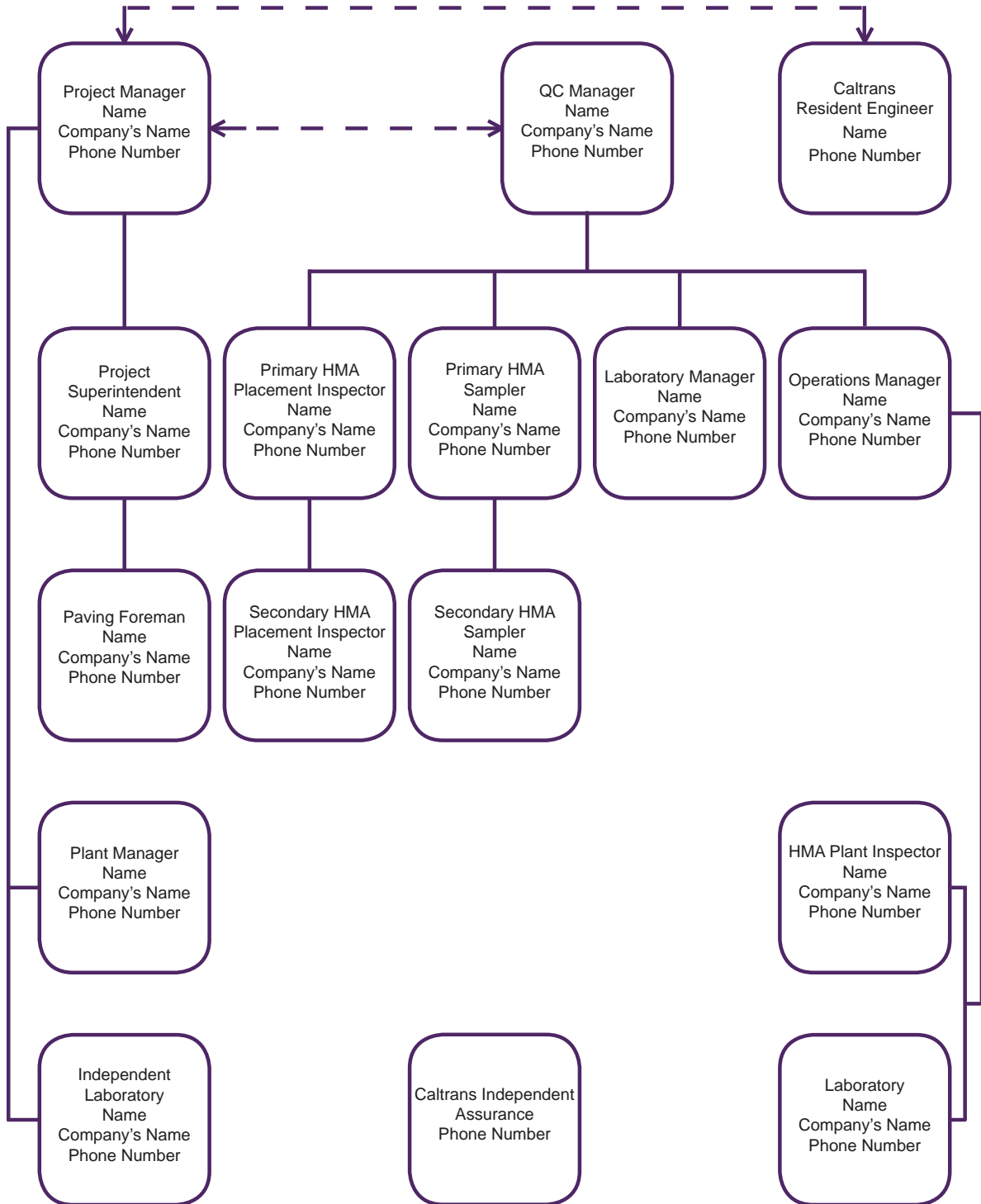
It is hereby certified that the information contained in this quality control plan for contract 00-111114 meets the requirements of contract specifications and the *Quality Control Manual for Hot Mix Asphalt* dated June 2009. This quality control plan contains qualified testing personnel and laboratories accredited in accordance with the *Independent Assurance Manual*.

Ira M. Quewcey, Quality Control Manager

Date

APPENDIX C

Sample Organization Chart



APPENDIX D

Sample Quality Control Manager's Qualifications

IRA M. QUEWCEY
24 Curved Bridge Road
Elverta, CA 95673
(916) 555-1234

Professional Registration: Civil Engineer, California # C XXXXX

Education: B.S.C.E. Sacramento State University, 1995
A.A. American River Community College, 1968

Background: More than 40 years' experience with construction materials in various capacities. Hot mix asphalt experience includes field sampling, testing, mix designs, and field inspection in both public and private sectors.

Employment History: **2001-Present—Quality Control Manager**
Materials Testers, Inc.

- Responsible for the operation of three material laboratories.
- Perform inspection of laboratory equipment to ensure calibration and operating conditions.
- Schedule technicians and inspectors for both field and laboratory assignments.
- Provide professional development and training for staff.
- Review test results and inspection reports for accuracy or deficiencies.

1985-2001—Laboratory Technician

Materials Testers, Inc.

- Performed aggregate, concrete, and hot mix asphalt sampling and testing.
- Performed both PCC and asphalt concrete mix designs.

1970-1985—Plant Inspector

Napa County

- Performed both PCC and asphalt concrete plant inspection.
- Sampled and tested aggregate for gradation and sand equivalent.
- Performed asphalt extraction tests.

1968-1970—Survey Technician

State of California

- Rear chain man on a Division of Highways survey party.

Testing Qualifications: CTM-125 TL-0111 CTM-366 TL-0111
(Attached) CTM-202 TL-0111 CTM-367 TL-0111
 CTM-217 TL-0111 CTM-371 TL-0111
 CTM-227 TL-0111 CTM-382 TL-0111
 CTM-304 TL-0111

APPENDIX E

Sample Form CEM-3801

Request for Assignment Inspectors, Samplers, and Testers

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

REQUEST for ASSIGNMENT of INSPECTORS, SAMPLERS, and TESTERS

CEM-3801 (NEW 02/2009)

Contractor Name, Address, and Phone Number:	Contract Number/Co/Rte/PM:
	Project Information/Name:

Instructions: Check appropriate boxes for Plant or Placement, Sampler or Tester, and appropriate boxes for additional documents attached such as CEM-3802, "Quality Control Inspector Affidavit of Proficiency" or Form TL-0111, "Certificate of Proficiency."

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Name:

Employer:

Inspector Plant Placement QC Inspector Affidavit of Proficiency (CEM-3802)

Sampler Tester Certificate of Proficiency (TL-0111) #

Quality Control Manager: _____ Date:

(Signature)

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3980 or write Records and Forms Management, 1120 N Street, MS-69, Sacramento, CA 95814.

APPENDIX F

Sample Form CEM-3802

Quality Control Inspector Affidavit of Proficiency

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION	
QUALITY CONTROL INSPECTOR AFFIDAVIT of PROFICIENCY	
CEM-3802 (NEW 02/2009)	
CONTRACTOR NAME, ADDRESS, AND PHONE NUMBER	CONTRACT NUMBER/CO/RTE/PM
	PROJECT INFORMATION/NAME
<p>Instructions: This form is used for all quality control inspection personnel, plant, and placement.</p> <p>In accordance with the requirements of the <i>Quality Control Manual for Hot Mix Asphalt</i>, submitted for your approval is the following Hot Mix Asphalt (HMA) inspector.</p> <p style="margin-left: 40px;">Name <input style="width: 300px;" type="text"/></p> <p style="margin-left: 40px;">Employer <input style="width: 300px;" type="text"/></p> <p>Summary of HMA related construction inspection experience and training. Be specific. (attach full resume)</p> <div style="border: 1px solid black; padding: 20px; min-height: 200px; margin-top: 10px;"><p style="margin-left: 40px;">– Installation of Individual Strands by Pushing</p></div> <p>I have reviewed this inspector's qualifications and am satisfied that this inspector meets or exceeds the requirements for this contract. This inspector is fully aware of the required duties and responsibilities.</p> <p>Quality Control Manager: _____ Date: <input style="width: 80px;" type="text"/></p> <p style="text-align: center; margin-left: 150px;">(Signature)</p> <hr/> <p><small>ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.</small></p>	



APPENDIX G

Caltrans IAP Qualified Certificate of Proficiency


TL-0111 (REV.06/00)

CALIFORNIA DEPARTMENT OF TRANSPORTATION

Presents this

CERTIFICATE OF PROFICIENCY

to



who is qualified to perform the following tests:

<p>_____</p> <p>_____</p> <p>Installation of Individual Strands by Pushing</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p style="text-align: center; font-size: x-small;">Test method & expiration date</p>	<p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p>_____</p> <p style="text-align: center; font-size: x-small;">Test method & expiration date</p>
--	---

Certified Independent Assurance (IA)

Date Issued: _____

Note: This certificate is valid as long as the Tester complies with applicable requirements in Caltrans' Independent Assurance Program Manual.

APPENDIX H

Sample Form TL-0113

Caltrans Accredited Laboratory Inspection Report

State of California Department of Transportation
CALTRANS ACCREDITED LABORATORY INSPECTION REPORT
 Form TL-0113 (Rev. 06/00)

Expiration date: _____
 Inspected by: _____
 IA No.: _____
 Telephone: _____
 File: Materials Category 500

Laboratory: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Lab QC Mgr.: _____ E-mail: _____
 Telephone: _____ Fax #: _____

A certified Independent Assurance (IA) visited this laboratory on (Date) _____.
 Only the equipment to be used on Caltrans construction projects and/or local construction projects on the National Highway System was checked for qualification.

At the time of Caltrans Accreditation, this laboratory had all necessary equipment to perform the tests methods indicated below. Testing personnel shall be Caltrans Qualified and possess a current Caltrans Certificate of Proficiency Form TL-0111 prior to performing any sampling or testing.

A visual check was performed and documents provided as necessary for the following items:

- _____ Facility Safety Manual
- _____ Laboratory Procedures Manual
- _____ Laboratory Accreditation Manual
- _____ Proper test equipment
- _____ Copies of current applicable test procedures
- _____ Calibration and service documentation
- _____ Calibration stickers affixed to test equipment (dated within the last 12 months)

On _____ this laboratory was accredited by _____
 (Date) (Printed name of IA staff)

 (Signature of IA staff)

APPENDIX I

Sample Hot Mix Asphalt Production Inspection Plan

Contract 00-111114 Hot Mix Asphalt Placement Inspection Plan

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
HMA Designation	Visual	Daily	Plant Control Room	Plant Inspector	Per Approved JMF
Aggregate Storage	Visual	Daily	Bins and Cold Feeds	Plant Inspector	Graded and Separated
Aggregate Source	Visual	Daily	Plant	Plant Inspector	Per Approved JMF
Baghouse Fines	Visual	Daily	Plant	Plant Inspector	Metering
Scales and Meters	Visual and Certification	Daily	Plant	Plant Inspector	Sealed per MPQP
Controller Interlocks	Visual	Daily	Plant	Plant Inspector	Per MPQP
Temperature Devices	Visual	Daily	Plant	Plant Inspector	Verify Operational
Asphalt Binder Temperature	Temperature Equipment	Continuous	Plant	Plant Inspector	Per Specifications
Asphalt Binder Grade	Certificate	Daily	Plant	Plant Inspector	Per Approved JMF
Belts and Feeds	Visual	Daily	Plant	Plant Inspector	Industry Standards
Composite Aggregate Grading	Test Report	Hourly	Plant	Plant Inspector	Per Approved JMF
Aggregate Temperature	Temperature Equipment	3 per day minimum	Plant	Plant Inspector	Per Specifications
HMA Temperature	Temperature Equipment	3 per day minimum	Plant	Plant Inspector	Per Specifications
Truck Beds	Visual	Daily	Plant	Plant Inspector	No Petroleum Based
Storage Silos	Visual	Daily	Plant	Plant Inspector	Per MPQP

Contract 00-111114 Lime Treatment Inspection Plan

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
Lime Treatment Designation	Visual	Daily	Plant Control Room	Plant Inspector	Per Approved JMF
Aggregate Storage	Visual	Daily	Stockpiles	Plant Inspector	Graded and Separated
Aggregate Source	Visual	Daily	Plant	Plant Inspector	Per Approved JMF

APPENDIX I (continued) Sample Hot Mix Asphalt Production Inspection Plan

Contract 00-11114 Lime Treatment Inspection Plan (continued)

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
Scales and Meters	Visual and Certification	Daily	Plant	Plant Inspector	Sealed per MPQP
Controller Interlocks	Visual	Daily	Plant	Plant Inspector	Per MPQP
Treatment Data Collection	Visual	Daily	Plant	Plant Inspector	Per Specifications

Contract 00-11114 Liquid Antistrip Inspection Plan

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
Liquid Antistrip Treatment	Visual	Daily	Plant Control Room	Plant Inspector	Per Approved JMF
Antistrip Source	Visual and Certificate of Compliance	Daily	Plant	Plant Inspector	Per Approved JMF
Scales and Meters	Visual and Certification	Daily	Plant	Plant Inspector	Sealed per MPQP
Controller Interlocks	Visual	Daily	Plant	Plant Inspector	Per MPQP
Treatment Data Collection	Visual	Daily	Plant	Plant Inspector	Per Specifications

Contract 00-11114 Liquid Asphalt Pavement Inspection Plan

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
Reclaimed Asphalt Pavement	Visual	Daily	Plant Control Room	Plant Inspector	Per Approved JMF
RAP Source	Visual	Daily	Plant	Plant Inspector	Per MPQP
Scales and Meters	Visual and Certification	Daily	Plant	Plant Inspector	Sealed per MPQP
Controller Interlocks	Visual	Daily	Plant	Plant Inspector	Per MPQP
RAP Moisture Content	Test Report	Daily	Plant	Plant Inspector	Per Specifications
RAP Grading	Test Report	Daily	Plant	Plant Inspector	Per Approved JMF

APPENDIX J

Sample Hot Mix Asphalt Placement Inspection Plan

Contract 00-11114 Hot Mix Asphalt Placement Inspection Plan

Inspection Item	Type of Inspection	Frequency	Location	Responsibility	Attribute or Tolerance
Subgrade Preparation	Visual	Daily	Jobsite	Placement Inspector	Smooth and Clean
Tack Coat	Visual and Weight Tickets	Per Load	Subgrade Surface	Placement Inspector	Application Rate and Cover
Paving Fabric	Visual	Daily	Jobsite	Placement Inspector	Per Specifications
Windrow Temperature	Temperature Equipment	Hourly	Jobsite	Placement Inspector	Per Specifications
Windrow Segregation	Visual	Hourly	Jobsite	Placement Inspector	Industry Standard
Pick-Up Machine	Visual	Daily	Jobsite	Placement Inspector	Manufacturer Standards
Asphalt Paver and Hopper	Visual and Measure	Daily	Jobsite	Placement Inspector	Manufacturer Standards
Paving Process	Visual	Continuous	Jobsite	Placement Inspector	Industry Standards
Compaction Equipment	Visual and Measure	Daily	Jobsite	Placement Inspector	Manufacturer Standards
Compaction Process	Visual	Continuous	Jobsite	Placement Inspector	Per Contractor Established Rolling Pattern
HMA Mat Temperature at Breakdown	Measure Temperature	Hourly	Behind Paver	Placement Inspector	Industry Standards or per Specifications for Method
HMA Mat Temperature at Finish	Measure Temperature	Hourly	Behind Finish Roller	Placement Inspector	Industry Standards or per Specifications for Method
HMA Mat Temperature Before Open to Traffic	Measure Temperature	Prior to Opening	Finished Mat	Placement Inspector	Per Specifications
Lift Thickness	Measure	Hourly	Behind Paver	Placement Inspector	Per Specifications
Longitudinal Transverse Joints	Visual	Continuous	Pavement Joints	Placement Inspector	Industry Standards
Pavement Smoothness	12-foot Straightedge	Hourly	Finished Surface	Placement Inspector	Per Specifications
Pavement Transitions	Visual	Daily	At Transitions	Placement Inspector	Per Specifications

APPENDIX K (continued) Sample Form CEM-3501 Hot Mix Asphalt Production Report

**HOT MIX ASPHALT (HMA)
PRODUCTION REPORT**
CEM-3501 (REV. 07/2008)

Page 2 of 2

Grading By _____ Tons mix out at sample _____ percent
 Sampling Time _____ Sample moisture _____
 Sampling Location _____ of _____ for this shift and this plant
 EA _____ Grading _____

Sieve Size	Combined Grading Results, HMA batch												Total Bin %	Combined Grading				
	Bin Number 4			Bin Number 3			Bin Number 2			Bin Number 1					Supplemental Fines			
	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used			Agg. Description	Bin Use %	Weight Retain	% Retain
2"																		
1 1/2"																		
1"																		
3/4"																		
1/2"																		
3/8"																		
No. 4																		
No. 8																		
No. 16																		
No. 30																		
No. 50																		
No. 100																		
No. 200																		

Sieve Size	Plus No. 4 material						Minus No. 4 material						Combined Grading
	Sample Weight			Sample Weight			Sample Weight			Sample Weight			
	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	
2"													
1 1/2"													
1"													
3/4"													
1/2"													
3/8"													
No. 4													
No. 8													
No. 16													
No. 30													
No. 50													
No. 100													
No. 200													

Sieve Size	RAP Grading - HMA						Supp. Fine Grading - HMA Continuous					
	RAP			Supplemental Fines			RAP			Supplemental Fines		
	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used	Weight Retain	% Retain	Sample Weight grams Used
2"												
1 1/2"												
1"												
3/4"												
1/2"												
3/8"												
No. 4												
No. 8												
No. 16												
No. 30												
No. 50												
No. 100												
No. 200												

Time	Remarks

APPENDIX L (continued) Sample Form CEM-3502 Hot Mix Asphalt Placement Report

HOT MIX ASPHALT PLACEMENT REPORT			Page 3 of 4
CEM-3502 (NEW 07/2008)			
METHOD COMPACTION			
<input type="checkbox"/> Appropriate Number of Rollers Per Section 39-3.03, "Spreading and Compacting Equipment," of <i>Standard Specifications</i>			
SPECIFICATION REQUIREMENTS	Minimum 1st Breakdown Compaction Temp. _____ °F	Minimum Breakdown and Intermediate Compaction Temp. _____ °F	Minimum Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
TIME	1st Breakdown Compaction Temp. _____ °F	Breakdown and Intermediate Compaction Temp. _____ °F	Finish Compaction Temp. _____ °F
<small>See section 39-3.04, "Transporting, Spreading, and Compacting," of the <i>Standard Specifications</i> For Standard and QC/QA process projects use this section for documenting temperatures for information only. Contractor must comply with finish compaction temperature.</small>			
FINAL COMPACTION			
For Standard & QC/QA Construction Process Projects:			
Total Tons HMA Placed / 250 Tons = No. of Cores Needed: _____			
Cores Taken? <input type="checkbox"/> Yes <input type="checkbox"/> No No. of Cores Taken? _____			
SMOOTHNESS			
Surface Checked with Straightedge? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Meets Straightedge Requirement	
Profilograph Must-Grind? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Meets Must-Grind	
Profilograph PI ₀ ? <input type="checkbox"/> Yes <input type="checkbox"/> No		<input type="checkbox"/> Meets PI ₀	
<small>* See Section 39-1.12, "Smoothness," of the <i>Standard Specifications</i></small>			
COMPLIANCE			
Non-Compliance	Corrective Action	Remediation	
REMARKS			
PAVING INSPECTOR'S SIGNATURE		TITLE	DATE
<small>ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3980 or write Records and Forms Management, 1120 N Street, MS-99, Sacramento, CA 95814.</small>			

APPENDIX L (continued)

Sample Form CEM-3502

Hot Mix Asphalt Placement Report

HOT MIX ASPHALT PLACEMENT REPORT - INSTRUCTIONS

Page 4 of 4

CEM-3502 (NEW 07/2008)

Random Sampling Instructions

For Method and Standard process projects, the specified lot size is the total quantity of HMA to be placed for the project. A lot is defined by a single accepted JMF. For QC/QA, the lot must be terminated if the JMF is changed, 20 sublots are completed, or if the production quality factors do not meet standards specified in the contract.

Specified lot size = 5,250 ton (per Engineers estimate)
Hot mix asphalt samples are required at a frequency of 1 for every 750 tons

1. Using the Random Number Table, randomly select a block of numbers (*Note: ASTM D 3665 provides random number tables*).
2. Multiply the random number by the subplot quantity.
3. Add this value to the subplot factor to determine the first sampling milestone (*Tons of production at which a sample will be taken*).
4. Continue this process for additional samples as required. Return to step 1 if lot is terminated and a new lot is begun.

The following is an example:

Lot Number	Sublot Number	Random Number (a)	Sublot Quantity (b)	Sublot Factor (c)	MILESTONE (Tons) (a) X (b) + (c)
1	1	.31	750	0	233
1	2	.12	750	750	840
1	3	.29	750	1500	1718
1	4	.86	750	2250	2895
1	5	.14	750	3000	3105
1	6	.74	750	3750	4205
1	7	.53	750	4500	4898

Appendix M

Sample Quality Control Sampling and Testing Plan

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location of Sampling	Maximum Reporting Time Allowance
Aggregate Gradation	CT 202	1 per 750 tons	Plant	24 hours
Reclaimed Asphalt Pavement Gradation	LP-9	Daily	RAP System	24 hours
Asphalt Binder Content	CT 379 or 382	1 per 750 tons	Loose Mix Behind Paver	24 hours
Percent of Maximum Theoretical Density	CT 308	1 per 750 tons	Loose Mix Behind Paver	24 hours
Maximum Theoretical Density	CT 309	Per CT 375	Loose Mix Behind Paver	24 hours
Aggregate moisture content at continuous mixing plants and RAP moisture content at continuous mixing plants and batch mixing plants	CT 226 or CT 370	2 per day during production	Stock-piles or Cold Feed Belts	24 hours
Sand Equivalent (minimum)	CT 217	1 per 750 tons	Plant	24 hours
HMA Moisture Content (maximum)	CT 370	1 per 2,500 tons but not less than 1 per paving day	Loose Mix Behind Paver	24 hours
Stabilometer Value (minimum) No. 4 and 3/8" gradings 1/2" and 3/4" gradings	CT 366	1 per 4,000 tons or 2 per five business days, whichever is greater	Loose Mix Behind Paver	48 hours
Air Voids Content (%)	CT 367	1 per 4,000 tons or 2 per five business days, whichever is greater	Loose Mix Behind Paver	48 hours
Percent of crushed particles coarse aggregate (% minimum) One fractured face Two fractured faces Fine aggregate (% minimum) (Passing No. 4 sieve and retained on No. 8 sieve)	CT 205	1 every 6,000 tons	Plant	48 hours

Appendix M (continued)

Sample Quality Control Sampling and Testing Plan

Quality Characteristic	Test Method	Minimum Sampling and Testing Frequency	Location of Sampling	Maximum Reporting Time Allowance
Los Angeles Rattler (% maximum) Loss at 100 revolutions Loss at 500 revolutions	CT 211	1 every 6,000 tons	Plant	48 hours
Fine aggregate angularity (% minimum)	AASHTO T-304, Method A	1 every 6,000 tons	Plant	48 hours
Flat and elongated particle (% maximum at 5:1)	ASTM D 4791	1 every 6,000 tons	Plant	48 hours
Voids in mineral aggregate (% minimum)	LP-2	1 every 6,000 tons	Loose Mix Behind Paver	48 hours
Voids filled with asphalt (%)	LP-3	1 every 6,000 tons	None Calculation	48 hours
Dust proportion	LP-4	1 every 6,000 tons	None Calculation	48 hours
Asphalt rubber binder viscosity at 350°F in centipoises	LP-11	1 every four hours of production	Feed Line to HMA Plant	24 hours
Crumb Rubber Modifier Scrape Tire Gradation (% passing Number 8 sieve)	LP-10	1 every 10,000 pounds	CRM Bag	48 hours
Crumb Rubber Modifier High Natural Gradation (% passing Number 10 sieve)	LP-10	1 every 3,400 pounds	CRM Bag	48 hours
Wire in CRM (% maximum)	LP-10	1 every 10,000 pounds for scrap tire, 1 every 3,400 pounds for high natural	CRM Bag	48 hours
Fabric in CRM (% maximum)	LP-10	1 every 10,000 pounds for scrap tire, 1 every 3,400 pounds for high natural	CRM Bag	48 hours
Moisture Sensitivity	CT-371	1 every 5,000 tons	Loose Mix Behind Paver	NA

Appendix N

Sample Quality Control Random Sampling Plan

Daily quality control samples will be obtained at milestones using a random sampling plan. (Refer to ASTM D 3665 for random number tables.) Use the following procedure to determine the sampling milestones before the start of each day's production:

Random Sampling Procedure

1. Using the Random Number Table (attached), randomly select a block of numbers.
2. Multiply the random number by the "sublot" quantity.
3. Add this value to the subplot factor to determine the first sampling milestone (tons of production at which a sample will be taken).
4. Continue this process for additional samples as required.

Example:

Planned Day's Production = 3100 tons

Sampling Frequency = 1 sample per 750 tons

Lot Number	Sublot Number	Random Number (a)	Sublot Quantity (b)	Sublot Factor (c)	Milestone (a) x (b) + (c)
1	1	.31	750	0	233
1	2	.12	750	750	840
1	3	.29	750	1500	1718
1	4	.86	750	2250	2895

Appendix O

Sample Corrective Action Plan—Hot Mix Asphalt Production

Quality Characteristic	Action Limit	Corrective Action
Asphalt Binder Content	JMF \pm 0.45	If test results are outside tolerance, an immediate investigation will be conducted to determine the cause. Corrections will be made and material tested immediately to ensure that the correction has been effective.
Aggregate Gradation	JMF \pm Specification Tolerance	If test results are outside tolerance, an immediate investigation will be conducted to determine the cause. Corrections will be made to piles, bins, belts, or scales; and material will be tested immediately to ensure that the correction has been effective.
Aggregate Moisture	None Adjust	When individual or composite aggregate moisture values differ from those of the plant computer, the plant computer will be adjusted to reflect the most recent aggregate moisture.
Asphalt Binder Temperature	275°F–375°F	If the asphalt binder temperature exceeds the range allowed, the plant operator will immediately take corrective action to raise or lower the temperature as needed. Temperature will be closely monitored to verify that the correction was adequate.
Mix Temperature	325°F	If mix temperature exceeds 325°F, the plant operator will immediately take corrective action to lower the temperature as needed. Temperature will be closely monitored to verify that the correction was adequate. HMA that exceeds 350°F will be disposed of.
Mix Moisture Content	> 1%	If the mix moisture exceeds 1 percent, the plant operator will be notified and corrective action taken to reduce the moisture in the mix. Aggregate piles may be spread to dry, aggregate time in the heater may be increased, and so forth.

Sample Corrective Action Plan—Hot Mix Asphalt Placement

Placement Standard	Action Limit	Corrective Action
Subgrade Preparation	Zero Tolerance	If inspection indicates that the subgrade is not prepared as specified, immediate action will be taken. Subgrade problems will be corrected—dried, cleaned, compacted, graded. HMA will not be placed until the corrections have been made and the QC Manager has inspected and approved them.
Tack Coat	\pm .01 gal./sq. yd.	If inspection indicates that the tack coat material or applications are not in accordance with the specifications, immediate action will be taken. Tack coat will be re-applied or changed, time for “break” will be lengthened, and so on. HMA will not be placed until the corrections have been made and the QC Manager has inspected and approved them.
Ambient Temperature	< 55°F	If physical measurements indicate that the ambient temperature is less than specified, the paving foreman will be notified, and placement will cease as soon as safety concerns have been provided for.
Mix Temperature	< 260°F	If physical measurements indicate that the mix temperature is below the temperature which the paving foreman has requested for placement and breakdown, corrective action will be taken immediately. Cool mix will be returned to the plant, the operation will be changed to correct the situation which is causing the problem, HMA will be held in tarped trucks and not windrowed until necessary.
In-Place Density	93%–95%	If field density determination indicates that the HMA is not being placed within the density range, immediate action will be taken. Roller operations will be investigated and may be changed, plant will be notified and mix quality will be examined, temperature will be determined, and so forth. Density will be tested immediately following the corrective action to assure that the action has been effective.

Appendix P

Sample Form CEM-3803

Daily Summary of Quality Control Testing

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION DAILY SUMMARY OF QUALITY CONTROL TESTING CEM-3803 (NEW 04/2009)			Page 1 of 2			
CONTRACTOR NAME, ADDRESS, AND PHONE NUMBER			DATE			
			CONTRACT NUMBER/CO/RTE/PM			
			PRODUCER MIX IDENTIFICATION NUMBER			
			HMA TYPE			
			LOT NUMBER			
This form must be submitted with all daily testing reports. Circle all test results that are not within the Action Limits. Use additional sheets as necessary.						
Quality Characteristic	Test Method	Testing Frequency	Test Result Sublot Number	Test Result Sublot Number	Test Result Sublot Number	Test Result Sublot Number
Asphalt binder content (%)	CT 379 or CT 382	1 per sublot				
Aggregate gradation (% passing, report to tenth)	CT 202	1 per sublot				
Sieve Size						
2"						
1 1/2"						
1"						
3/4"						
1/2"						
3/8"						
No. 4						
No. 8						
No. 16						
No. 30						
No. 50						
No. 100						
No. 200						
Density	QC Plan	1 per sublot				
Sand Equivalent	CT 271	1 per sublot				
Aggregate Moisture Content	CT 266 or 370	2 per production day				
HMA Moisture Content (%)	CT 370	1 per 2500 tons (1 per day)				
Stabilometer value	CT 366	1 per 4000 tons (2 per 5 days)				
Modified Stabilometer value	CT 366	1 per 4000 tons (2 per 5 days)				

Appendix P (continued)

Sample Form CEM-3803

Daily Summary of Quality Control Testing

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION

Page 2 of 2

DAILY SUMMARY OF QUALITY CONTROL TESTING

CEM-3803 (NEW 04/2009)

CONTRACTOR NAME, ADDRESS, AND PHONE NUMBER	DATE
	CONTRACT NUMBER/CO/RTE/PM
	PRODUCER MIX IDENTIFICATION NUMBER
	HMA TYPE
	LOT NUMBER

Quality Characteristic	Test Method	Testing Frequency	Test Result Sublot Numbers	Test Result Sublot Numbers	Test Result Sublot Numbers	Test Result Sublot Numbers
			_____	_____	_____	_____
Los Angeles Rattler, Loss at 500 Rev. (%)	CT 211	1 per project				
Crushed particles, course aggregate (%) One fractured face	CT 205	1 per project				
Crushed particles, course aggregate (%) Two fractured faces	CT 205	1 per project				
Crushed particles, fine aggregate (%) One fractured face	CT 205	1 per project				
Fine aggregate angularity (%)	AASHTO T 304 (Method A)	1 per project				
Flat and elongated particles (% by mass 3:1)	ASTM D 4791	1 per project				
Flat and elongated particles (% by mass 5:1)	ASTM D 4791	1 per project				
Air Voids Content (%)	CT 367	1 per project				
Voids in mineral aggregate (%)	LP-2	1 per project				
Voids filled with asphalt (%)	LP-3	1 per project				
Dust proportion	LP-4	1 per project				
*						

* When the special provisions require additional quality control testing, use the blank lines above to record quality characteristics test methods, testing frequencies, and test results.

ADA Notice For individuals with sensory disabilities, this document is available in alternate formats. For information call (916) 654-6410 or TDD (916) 654-3880 or write Records and Forms Management, 1120 N Street, MS-89, Sacramento, CA 95814.

Appendix R

Quality Control Plan Review Checklist for Hot Mix Asphalt

Quality Control Plan Review Checklist for Hot Mix Asphalt

Project Information	
Resident Engineer (RE):	
Contract Number(EA):	
Description:	
County/Route/Post Mile:	

Quality Control Plan Submittal Letter					
	Quality Control Quality Assurance Program Overview (Letter)	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
SL.1	Identify Prime Contractor				
SL.2	Identify Paving Subcontractor				
SL.3	Identify hot mix asphalt producer (company and plant location)				
SL.4	Identify quality control manager				
SL.5	Prime contractor's signature (Be sure it's the prime, the same person who signed the contract)				

Element 1—Quality Control Plan Certification					
Element Number	Quality Control Organization	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
1.1	Quality control plan certification				
1.1.a	Contract number				
1.1.b	Quality control plan manager signature				

Appendix R (continued)

Quality Control Plan Review Checklist for Hot Mix Asphalt

Element 2—Quality Control Organization					
2.1	Organization chart				
2.1.a	Show all involved (quality control manager, quality control inspectors, quality control samplers and testers, quality control laboratories, and so on)				
2.1.b	Show how they interact and communicate				
2.1.c	Identify all by name, function and contact phone number				
2.1.d	Identify number of staff for each function				
2.1.e	Show primary and secondary person per area of responsibility				
2.2	Quality control staff				
2.2.a	Quality control manager qualifications and experience				
2.2.b	Form CEM-3801 "Request for Assignment of Inspectors, Samplers, and Testers"				
2.2.b.1	Form CEM-3802, "Quality Control Inspector Affidavit of Proficiency" for each inspector				
2.2.b.2	Form TL-0111, "Qualified Certificate of Proficiency" for each sampler and tester				
2.3	Laboratories				
2.3.a	Main quality control laboratory—IAP accreditation form TL-0113, "Caltrans Accredited Laboratory Inspection Report"				
2.3.a.1	Include name, address, phone, fax and email address				
2.3.a.2	Include laboratory manager name and contact information				
2.3.a.3	Include tests to be performed				
2.3.b	Field quality control laboratory - IAP accreditation form TL-0113, "Caltrans Accredited Laboratory Inspection Report"				
2.3.b.1	Include name, address, phone, fax and email address				
2.3.b.2	Include laboratory manager name and contact information				
2.3.b.3	Include tests to be performed				
2.3.c	Provide nuclear gage radioactive license				

Appendix R (continued)

Quality Control Plan Review Checklist for Hot Mix Asphalt

Quality Control Plan Review Checklist for Hot Mix Asphalt

Element 3—Quality Control Plan Distribution					
Element Number	Quality Control Organization	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
3.1	Distribution list				
3.1.a	List locations of quality control plans				
3.1.b	Name person responsible for distributing quality control plan supplements				

Element 4—Quality Control Inspection Plans					
Element Number	Quality Control Inspection Plans	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
4.1	Submit quality control inspection plan for plant operations				
4.2	Submit quality control inspection plan for placement operations				

Element 5—Quality Control Sampling and Testing Plan					
Element Number	Quality Control Sampling and Testing Plan	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
5.2	QC Plan for sampling and testing (list quality characteristic, test method, frequency, sample location)				

Element 6—Quality Control Random Sampling Plan					
Element Number	Quality Control Random Sampling Plan	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
6.1	Submit random sampling plan, including table of random numbers				
6.2	Submit an example of the Random Sampling Plan				

Appendix R (continued)

Quality Control Plan Review Checklist for Hot Mix Asphalt

Quality Control Plan Review Checklist for Hot Mix Asphalt

Element 7—Corrective Action Plans					
Element Number	Corrective Action Plans	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
7.1	Include list of anticipated corrective actions. At a minimum include:				
7.1.a	<i>At production site:</i> Asphalt content, aggregate gradation, aggregate moisture, mix moisture, asphalt binder temperature, aggregate temperature, mix temperature, sand equivalent, mix segregation, uncoated aggregate, mixing time, and mix storage time.				
7.1.b	<i>At placement site:</i> Subgrade preparation, tack coat, ambient temperature, mix temperature, joint construction, thickness, placement yield, cross slope, joint offset, mix segregation, compaction testing, and smoothness.				

Element 8—Quality Control Documents					
Element Number	Quality Control Documents	Contractor's check	Engineer's Check		Comments
			Complete (Yes)	Incomplete (No)	
8.1	Identify forms to be used				
8.1.a	Hot mix asphalt daily record of inspection form CEM-3501 "Hot Mix Asphalt Production Report"				
8.1.b	Hot mix asphalt daily record of inspection form CEM-3502 "Hot Mix Asphalt Placement Report"				
8.1.c	Hot mix asphalt daily summary of testing form CEM-3803 "Hot Mix Asphalt Daily Summary of Testing"				
8.1.d	Hot mix asphalt inspection and testing summary form CEM-3804 "Hot Mix Asphalt Inspection and Testing Summary"				

Appendix R (continued) Quality Control Plan Review Checklist for Hot Mix Asphalt

Quality Control Plan Review Checklist for Hot Mix Asphalt	Additional Comments																								

Appendix S Sample Form CEM-3703 Caltrans Production Startup Evaluation

Page 1 of 4

STATE OF CALIFORNIA • DEPARTMENT OF TRANSPORTATION
CALTRANS PRODUCTION START-UP EVALUATION
 CEM-3703 (NEW 3/2008)

Contractor Name and Address:		Contract Number/Co/Rev/PM	Date:
Hot Mix Asphalt (HMA) Producer Name and Address:		Project Information/Name:	
Resident Engineer:		Producer Mix Identification Number:	HMA Type:

The information provided in this form must be in accordance with Standard Specifications, Section 38, "Hot Mix Asphalt," and the California Test Method Indicated. For information concerning this form, contact the Office of Flexible Pavement Materials at (916) 227-6383.

Split Sample	Combined Aggregate Gradation												Meets Specifications?				
	Virgin Aggregate Gradation % of blend		RAP Aggregate Gradation (after CT 382)		RAP Gradation Correlation Factor ¹		Corrected RAP Gradation % of blend		Combined Aggregate Gradation ²		TV				Tolerance	Yes	No
	State	Contractor	State	Contractor	State	Contractor	State	Contractor	State	Contractor	State	Contractor	State	Contractor			
Sieve Size	% Passing																
2"																	
1½"																	
1"																	
¾"																	
½"																	
¾"																	
No. 4																	
No. 8																	
No. 16																	
No. 30																	
No. 50																	
No. 100																	
No. 200																	

¹ The correlation factor for each sieve is determined by taking the average RAP gradation of three ASTM D 2772 samples minus the average RAV gradation of three CT 382 samples (See Form CEM-3812) determined for each ignition oven to be used for acceptance testing.
² When determining the combined virgin and RAP aggregate gradation, burn off the RAP sample in accordance with CT 382. Perform a sieve analysis on recovered aggregate in accordance with CT 202, Appendix A. Add the correlation factor established for each ignition oven. Mathematically combine the virgin and corrected RAP aggregate gradations at the correct proportions to obtain the combined gradation.

Appendix S (continued) Sample Form CEM-3703 Caltrans Production Startup Evaluation

CALTRANS PRODUCTION START-UP EVALUATION						Page 2 of 4	
CEM-3703 (NEW 3/2008)							
Contractor Name and Address:		Contract Number/Co/Rta/PM		Date:			
Hot Mix Asphalt (HMA) Producer Name and Address:		Project Information/Name:					
Resident Engineer:		Producer Mix Identification Number:		HMA Type:			
Aggregate ¹							
Quality Characteristic/Property	Test Method	Test Result				Meets Specifications?	
		State	Contractor	Specification Limits	Meets Specifications?		
					Yes	No	
Crushed particles, coarse aggregate One fractured face (%)	CT 205						
Crushed particles, coarse aggregate Two fractured faces (%)	CT 205						
Crushed particles, fine aggregate (Passing No. 4 sieve and retained on No. 8 sieve) One fractured face (%)	CT 205						
Los Angeles Rattler, Loss at 100 Rev. (%)	CT 211						
Los Angeles Rattler, Loss at 500 Rev. (%)	CT 211						
Sand equivalent	CT 217						
Fine aggregate angularity (%)	AASHTO T 304 (Method A)						
Flat and elongated particles (% by mass at 3:1)	ASTM D 4791						
Flat and elongated particles (% by mass at 5:1)	ASTM D 4791						
Plasticity Index	CT 204						
Sodium sulfate soundness	CT 214						
Cleaness Value	CT 227						
Fine aggregate Durability Index	CT 229						
Coarse aggregate Durability Index	CT 229						
Note:							
¹ Aggregate must comply with the quality specifications before it is treated with lime. Lime treated aggregate will not be tested.							

Appendix S (continued) Sample Form CEM-3703 Caltrans Production Startup Evaluation

CALTRANS PRODUCTION START-UP EVALUATION
CEM-3703 (NEW 3/2008)

Page 3 of 4

Contractor Name and Address:		Contract Number/Co/Rte/PM				Date:	
Hot Mix Asphalt (HMA) Producer Name and Address:		Project Information/Name:					
Resident Engineer:		Producer Mix Identification Number:				HMA Type:	

Hot Mix Asphalt

Quality Characteristic	Test Method	Test Result										Meets Specifications?	
		State				Contractor				Spec. Limits	Yes	No	
		1	2	3	avg	1	2	3	avg				
Asphalt binder content (%)	CT 379/382												
Briquette bulk specific gravity	CT 308 (Method A)									N/A			
Maximum specific gravity	CT 309									N/A			
Air voids content (design value $\pm 2\%$)	CT 308 (A) and CT 309												
Core bulk specific gravity	CT 308 (Method A)												
% of maximum theoretical density	—												
Voids in mineral aggregate (%) ¹	LP-2												
Effective specific gravity of RAP aggregate	LP-2									N/A			
Voids filled with asphalt (%) ^{1,4}	LP-3												
Dust proportion ^{1,4}	LP-4												
Effective specific gravity of aggregate	LP-4									N/A			
Stabilometer value	CT 366												
Modified stabilometer value	CT 366												
Surface abrasion (%)	CT 360												
Tensile strength ratio (TSR) untreated ^{2,3}	CT 371									N/A			
Tensile strength ratio (TSR) treated ^{2,3}	CT 371									N/A			

Note:

- 1 Report only if the adjustment for asphalt binder content TV < 0.3% from OBC.
- 2 Report only. Do not delay acceptance waiting for test results.
- 3 Attach Figure 1 from CT 371.
- 4 Use aggregate specific gravities from mix verification form (CEM-3513) for calculating HMA qualities.

Notes:

Appendix S (continued) Sample Form CEM-3703 Caltrans Production Startup Evaluation

CALTRANS PRODUCTION START-UP EVALUATION

Page 4 of 4

CEM-3703 (NEW 3/2008)

Contractor Name and Address:	Contract Number/Co/Rte/PM	Date:
Hot Mix Asphalt (HMA) Producer Name and Address:	Project Information/Name:	
Resident Engineer:	Producer Mix Identification Number:	HMA Type:

Crumb Rubber Modifier (CRM)

Quality Characteristic/Property	Test Method	Test Result				
		State	Contractor ¹	Specification Limits	Meets Specifications?	
					Yes	No
Scrap tire CRM gradation (% passing No. 8 sieve)	LP-10			100		
High natural CRM gradation (% passing No. 10 sieve)	LP -10			100		
Wire in CRM (% max.)	LP-10			0.01		
Fabric in CRM (% max.)	LP-10			0.05		
CRM particle length (inch max.)	—			3/16		
CRM specific gravity	CT 208			1.1 - 1.2		
Natural rubber content in high natural CRM (%)	ASTM D 297			40.0 - 48.0		

Note:

¹ May be provided with Certificate of Compliance with testing performed by an AASHTO certified laboratory.

Notes:

Production Start-Up Evaluation

Accepted By: (Print Name and Sign):	Title:	Date:
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