



Quality Control Quality Assurance Manual for Asphalt Concrete Production and Placement



10

**Professional Development Hours (PDH) or
Continuing Education Hours (CE)
Online PDH or CE course**

STATE OF CALIFORNIA
Quality Control/Quality Assurance Manual

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Definitions

Acceptance is determined using a statistically based acceptance procedure in combination with the assurance that the Contractor has fulfilled the specification requirements for materials quality and workmanship. Visual inspection of material is also a major consideration in acceptance. Acceptance is the responsibility of the Engineer.

Acceptance

Independent Assurance is a process provided by the Engineer, through trained and certified staff, to ensure that all testing (process control, quality control, and verification) is performed correctly. For complete and detailed Independent Assurance processes and procedures, see Caltrans *Independent Assurance Program (IAP)* manual.

Independent Assurance

A **Lot** is defined as the quantity of asphalt concrete that is being evaluated. A “lot” is all asphalt concrete which has been produced using a single mix design and has been placed without suspending production due to failure to meet the specification requirements or to an extended “suspension” in paving activities due to project staging or seasonal work stoppage.

Lot

A **Sublot** is defined as the quantity of asphalt concrete that is being sampled and tested for quality control. A “sublot” is generally 500 tonnes or any part thereof. Pay factors are always applied to the lot only, not sublot.

Sublot

Nuclear Density Test Strip is defined as the process by which asphalt concrete is tested to establish a gauge bias correction for nuclear density gauges and to demonstrate that the contractor can attain the specified compaction. During the nuclear density test strip, nuclear gauge density readings taken at 10 random locations, as per the random sampling plan, on the asphalt concrete are compared to core densities taken from the same locations.

Nuclear Density Test Strip

Production Start Up Evaluation is the process that ensures the contractor can produce the mix as designed and where the contractor’s and Caltrans program are compared to ensure they are adequate. The aggregates and the asphalt concrete are evaluated for compliance to the mix design parameters and to the specifications – gradation, oil content, sand equivalent, stability and voids. The production start up evaluation is conducted using aggregate taken from the production process and asphalt concrete taken from the material placed behind the paver. The production start up evaluation and the nuclear density test strip may be conducted separately or at the same time. Regular production cannot begin until the contractor has placed asphalt concrete that meets the conditions for both production start-up and relative compaction as defined by the specifications.

Production Start Up Evaluation

Quality Assurance	Quality Assurance is defined as those planned and systematic operations conducted to ensure that the operation and/or product meets specifications. “Quality Assurance” encompasses the engineer’s oversight of the Contractor’s quality control plan; review of inspector, sampler, tester and laboratory qualifications (per Caltrans Independent Assurance Program); verifying the results of quality control and process control testing; and inspecting for conformance to plans and specifications. Quality Assurance is the responsibility of the Engineer.
Quality Control	Quality Control is defined as all those planned and specified actions or operations necessary to produce asphalt concrete that will meet requirements for quality as specified. QC includes, but should not be limited to, inspection of the production and placement operation, quality control and process control testing and inspection of the finished roadway. QC is the responsibility of the Contractor.
Quality Control Inspection	Quality Control Inspection is defined as the inspection conducted by the Contractor to determine if the asphalt concrete has been produced and placed in compliance with the specifications. QC Inspection should be conducted at the production plant and on the roadway preceding, during and after asphalt concrete placement. QC Inspection is the responsibility of the Contractor.
Quality Control Plan	Quality Control Plan is developed by the Contractor and approved by the Engineer. The QC Plan addresses the actions, inspection, sampling and testing necessary to keep the production and placement operations in control, to quickly determine when an operation has gone out of control and to respond to correct the situation and bring it back into control. Developing, implementing, maintaining and supplementing the QC Plan is the responsibility of the Contractor. Oversight of the activities required to fulfill the QC Plan is the responsibility of the Engineer.
Quality Control Testing and Process Control Testing	Quality Control Testing and Process Control Testing are defined as the testing conducted by the contractor to determine if the asphalt concrete has been produced and placed in compliance with the specifications. Process control testing is conducted to demonstrate that the asphalt concrete being produced continues to meet the mix design requirements. Process control testing shall also be used to determine whether or not the asphalt concrete plant continues or ceases production. QC tests, when verified, are used in the statistical evaluation and determination of the pay factor(s). QC test results are presented to the engineer on a daily basis along with a summary that has been reviewed and signed by the QC Manager. QC and process control sampling and testing are to be performed by testers with Caltrans Independent Assurance Program (IAP) certification. QC and process control testing are the responsibility of the Contractor.

Statistical Quality Analysis is defined as the method used to evaluate the “value” of the asphalt concrete. The Variability-Unknown/Standard Deviation Method of statistical analysis of the quality characteristics determines the estimated percentage of the lot may be outside specification limits and assigns an **Individual Pay Factor** (PF_i) for each quality characteristic. All the individual pay factors are combined using weighting factors to establish a **Composite Pay Factor** (PF_c) for project control, acceptance and final pay. Both the Individual Pay Factor and the Composite Pay Factor are used together with the evaluation of workmanship by the Contractor and the Engineer to determine whether production and placement may continue.

Statistical Quality Analysis

Verification testing is defined as the sampling and testing which is carried out independent of the QC sampling and testing to verify that the Contractor’s QC test results are representative, within statistical parameters, of the material being produced. After QC test results have been verified they will be used by the Engineer in making acceptance decisions and determining pay factors. Verification sampling and testing is to be performed by testers with Caltrans Independent Assurance Program (IAP) certification. Verification testing is the responsibility of the Engineer.

Verification testing

Visual inspection is defined as the Engineer’s visual review of the Contractor’s production and placement procedures. Visual inspection is used to identify problem areas such as segregation, rock-pockets, poorly placed and/or compacted joints, flushing or bleeding, aggregate crushing due to over compaction, and poorly placed transverse joints and other areas of concern that fail to meet the quality standards of practice. Visual inspection is the responsibility of both the Contractor and the Engineer.

Visual inspection

In spite of an “acceptable” composite pay factor, the Engineer may require corrective action or even reject asphalt concrete which does not meet the specification requirements for workmanship or placement.

Program Goals

The Quality Control/Quality Assurance (QC/QA) Program for asphalt concrete was implemented by Caltrans in 1995 with the following goals:

- Improve the quality of the materials and processes used in the construction of highway projects, and reduce the life cycle costs for the facilities involved.
- Redirect responsibility for quality to the Contractor
- Reduce disputes between the Department and its Contractors

Flowchart I - The Big Picture – Details the major components of the QC/QA program. These components will be discussed in more detail in this manual.

General Principles

The QC/QA specifications for asphalt concrete have been developed with emphasis on QC during production and placement of the material. Acceptance and payment are based on measurements of specified properties; on the Contractor's fulfillment of process and QC inspection, sampling and testing; and on the Engineer's inspection, sampling and testing to confirm (and verify) that the work conforms to the plans and specifications.

Acceptance and Payment

Payment for asphalt concrete covered by the QC/QA specifications is based on "payment for value received." Pay factors have been set to encourage quality. They attempt to relate payment received to the percentage of material outside specified limits that exceed acceptable levels. Pay factors are based on a curvilinear relationship rather than straight-line, and adjustments become more significant as quality levels diminish. This will result in a small adjustment if the asphalt concrete is only slightly out of allowable specification range but more severe adjustments will result as the quality level continues to drop. In like manner, the pay factors provide for an incentive payment for quality that significantly exceeds the acceptable quality levels. The Engineer may reject a quantity of material that is determined to be defective based on visual inspection.

Flowcharts X - Verification

Flowcharts XI - Acceptance

Program Goals

General Principles

Acceptance and Payment

Quality Control Quality Control

The Contractor shall be responsible for quality throughout the production and placement operations. Therefore, the Contractor must ensure that the materials and work provided by Subcontractors, Suppliers and Producers are adequate by the standards of the project.

The Contractor shall be responsible for developing, presenting, implementing and supplementing, if needed; a production and quality control procedure to ensure that all aspects of asphalt concrete production and placement meet the standards set forth in the specifications.

Quality Assurance Quality Assurance

The Department, through the Engineer, shall be responsible for oversight of the Contractor's fulfillment of a QC Plan and for independently verifying that the QC test results being submitted by the Contractor are representative of the asphalt concrete being produced. In addition, the Engineer shall be responsible for determining acceptance based on conformance to the plans and specifications, and determining payment based on statistical quality assurance procedures.

The essential members of the QA portion of the QC/QA Program are:

- Resident Engineer
- Inspectors (Plant and Street)
- Verification Testers (Plant and Street)
- QC/QA Coordinator

Each District will provide a QC/QA Coordinator who will, at the request of the Resident Engineer, review all Contractor submitted documents pertaining to QC/QA. The Coordinator will demonstrate an in-depth knowledge of the QC/QA Program. The Coordinator will be responsible for providing QC/QA training to District personnel.

Dispute Resolution Dispute Resolution

Dispute resolution is an integral part of the QC/QA Program. The aim of the dispute resolution process is to resolve differences between the Contractor and the Engineer that may arise from a disagreement regarding test result comparisons. When results are not verified by QA testing, production shall be suspended until the differences are resolved and the Engineer is satisfied. When the Engineer and the Contractor are unable to determine the source of error, an Independent Third Party shall act as witness and referee. Dispute resolution is addressed in various phases of the QC/QA projects.

Flowchart V - Dispute Resolution Process During Mix Design

**Flowchart VII - Dispute Resolution Process During Production Start-Up
Evaluation**

Flowchart IX – Dispute Resolution Process During Production

Independent Assurance Program (IAP)

The Federal Highway Administration (FHWA) requires that each state transportation agency have a QA Program for federal aid highway construction projects. It is required that each state highway agency develop sampling and testing programs that will provide assurance that materials and workmanship incorporated in federal aid highway construction projects are in conformance with all requirements of approved plans and specifications.

Caltrans Independent Assurance (IA) representatives will certify all testers and will 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 IA representative to verify the reliability of the tester by witnessing sampling and testing and by splitting samples and comparing results. Caltrans Independent Assurance representative has the authority to decertify testers that deviate from accepted sampling and testing procedures.

It is the responsibility of the Contractor to keep the IA certification current. Testers whose certification has been revoked or whose certification has lapsed may not provide materials test results for acceptance consideration. It is the responsibility of the tester to make timely arrangements with the IA for both split-sample and witness testing.

Each QC Testing Laboratory shall be qualified in accordance with the Caltrans *Independent Assurance Program* (IAP) and as outlined in this manual. The IAP Manual can be obtained by contacting your local District IA representative or Headquarter IA Coordinator. A QC Testing Laboratory shall be qualified to perform testing on Caltrans projects only after fulfilling these requirements.

Independent Assurance Program (IAP)

Introduction

The success of any of QC/QA project depends, among other things, on its QC Plan. The need for and the use of a QC Plan cannot be overemphasized. Quality can not be tested or inspected into a product. It must be “built in.” It is imperative that the Contractor has a functional, responsive QC Plan.

This manual contains the minimum requirements which the Contractor is expected to fulfill with the quality control system and which must be documented in the QC Plan. It is intended that these minimum requirements will be a starting point for all Contractors and will ensure the Department a minimum level of quality control of the materials being produced and placed into the project.

A QC Plan must address actions needed, including inspection, sampling and testing, 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(s) and bring the process back into control.

If a QC Plan is rejected for any reason the contractor shall submit a complete revised QC Plan. Each page of any revised QC Plan submitted for review, shall indicate appropriate revision number and date of revision. The Engineer will use the QC Plan outlined in this manual to evaluate the Contractor’s QC Plan when submitted. Three copies shall be submitted for the review process. One copy each shall be submitted to the Engineer, the QC/QA Coordinator and the District Independent Assurance representative. Upon approval by the Engineer, five copies of the QC Plan, along with approval documentation shall be returned to the Engineer. Two copies each shall be submitted to the Engineer and QC/QA Coordinator and one copy to District Independent Assurance representative.

Elements of the QC Plan

It is suggested that the Contractor use the QC Plan outlined in this manual or develop a QC Plan that incorporates at least the elements included in this manual. The QC Plan and the mix design shall be submitted, by the Contractor to the Engineer, at least 14 calendar days prior to the production start-up evaluation and the nuclear density test strip.

Flowchart II – QC Plan and Mix Design Submittal & Approval

The QC Plan elements include: QC Plan Overview, QC Organization, QC Inspection Plans, QC Sampling and Testing Plans, QC Random Sampling Plans, Linear Control Charts, Corrective Action Plans, Production Start up Evaluation and Nuclear Density Test Strip Plan, QC Documents, and Mix Design. These elements are discussed in more detail in the following pages.

Introduction

Elements of the QC Plan

QUALITY CONTROL PLAN OVERVIEW

1. QUALITY CONTROL PLAN OVERVIEW

A short overview of the QC Plan that has been established to fulfill the needs of production and placement of asphalt concrete which will meet the contract requirements. This overview is in the form of a letter (or memo) from the Prime Contractor. Below is a sample of a QC Plan Overview.

QUALITY CONTROL PLAN OVERVIEW

The purpose of the Quality Control Plan is to direct the activities of Big Orange Construction Company to assure that the construction materials meet or exceed the quality requirements of the contract specifications.

This Quality Control Program includes personnel from seven organizations. The Sacramento office of Big Orange Construction is the contractor that will place the asphalt concrete. Materials Testers, Inc. of Elk Grove will provide Street and Plant Inspection and Quality Control and Process Control testing. The asphalt concrete mix will be provided by and shipped by AC Producer Corporation of Auburn. Paraway Refinery of Sacramento will provide the Asphalt. Quality Aggregates of Grass Valley will provide the coarse and fine aggregates. asphalt concrete mix design will be provided by Best Mixes of Elk Grove, and if necessary, Third Party Dispute will be provided by Acme Dispute Resolvers of Fresno.

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 which will affect solutions, including action which will preclude 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.

The management of Big Orange Construction has approved this plan, has 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



2. QUALITY CONTROL ORGANIZATION

QUALITY CONTROL ORGANIZATION

The QC organization shall include the names of the QC Manager, Inspectors, Samplers, Testers and Laboratories involved. The person's qualifications, duties, responsibilities and reporting hierarchy shall be part of the organizational chart.

A QC Plan distribution list must be developed. The list shall include:

- Locations of the QC Plan (i.e. QC Manager(s), AC Plants, Laboratories, Aggregate Suppliers, Transportation Providers, Inspectors, Testers, etc.)
- Responsible person for distributing the QC Plan amendments to the Engineer and all non-agency QC Plan holders.

Success of the QC operation will require that the QC Manager, inspectors, laboratories and testers act as a team to accomplish desired results. Assignment of responsibility and commensurate authority of all personnel involved must be clear. The Contractor must ensure that adequate communication exists among the inspectors at all locations.

The following table outlines minimum numbers of QC staff for asphalt production and placement:

Expected Daily Tonnage of Asphalt Concrete	Staffing Levels (excluding the QC Manager)
< 1000*	3
≥1000**	4

*Duties are defined as one street inspector, one compaction tester and one plant inspector.

**The additional staff member will serve as a plant inspector/sampler.

The organization chart shall show all contractors, subcontractors, laboratories and QC staff involved in asphalt concrete production, placement or evaluation; and how these various organizations and personnel interact and communicate. The organization chart shall identify all QC staff by name and function and will identify the total staff required to implement all elements of the QC program. The organizational chart shall show who is the primary person in each area of responsibility and secondary person. Also, the organization chart shall include contact phone numbers for all personnel.

Flowchart III - Sample Organization Chart

If an outside organization or independent testing laboratory is used for implementation of all or part of the QC Plan, the personnel assigned will be indicated on the organization chart including name, function, and employer.

The following quality control staff and laboratories should be included on the organization chart and in the documentation:

- **Quality Control Manager** - The QC Manager shall be an employee of the Contractor or a consultant employed by the Contractor. The QC Manager will not report to those responsible for the construction and production operations. If the entire asphalt concrete production and paving is subcontracted, the QC Manager may report to the CEO of the subcontractor if the Contractor so delegates in the letter of submittal for the QC Plan.

The QC Manager shall have prior quality control experience on a project of comparable size and scope. The QC Plan shall include the name, qualifications and experience of the QC Manager. The QC Manager shall review test results, inspection reports, material certificates, and production processes to ensure that all materials and completed items of construction conform to the contract requirements. The QC Manager shall have full authority to institute any and all actions necessary for the successful operation of the QC Plan to ensure compliance with the specifications.

- **Quality Control Inspectors** - The Contractor is responsible for inspection of plant operations, asphalt concrete transportation and placement, the paving and compacting operation and the finished roadway surface. Inspectors shall be familiar with plans, special provisions, plant operations and/or paving operations, special requirements and potential problem areas, and records and reports. The QC Inspector(s) shall also be familiar with the approved QC Plan. Plant and roadway inspectors' qualifications are certified by the QC Manager and submitted on the "Affidavit of Proficiency for QC Inspector" Each inspector's duties and assignments, along with their being named the primary or secondary person on the site shall be provided. In addition, the contractor must complete in the "Request for Assignment of Inspectors, Samplers and Testers." (See Appendix, Form AF-01)
- **Quality Control Samplers and Testers** - The Contractor is responsible for sampling and testing aggregates, asphalt concrete and compacted pavement. Samplers and testers must be familiar with sampling and/or testing requirements of the contract, procedures for sampling and/or testing, proper care of materials samples and testing equipment, and documentation needs of the testing process and the project. The sampler and tester shall also be familiar with the approved QC Plan.

All samplers and testers who provide information that will be submitted to the Engineer must be certified by the Department's Independent Assurance Program (IAP). It is the Contractor's responsibility to see that all testers maintain current certification and qualifications.

Testers names, certifications and assignments will be included in the "Request for Assignment of Inspectors, Samplers and Testers." Copies of current IAP Certifications should be attached to the request. (See Appendix, Form AF-01)

- **Quality Control Laboratories** - The Contractor is responsible for providing testing facilities that are adequate to fulfill the testing requirements of the specifications and the quality control needs for design, production and placement of asphalt concrete. The QC Laboratory personnel shall also have in-depth knowledge of the approved QC Plan. Where required, laboratories must be inspected and qualified by the Department's Independent Assurance Program (IAP).

Laboratory names and IAP qualification statement will be included in the "Request for Assignment of Inspectors, Samplers and Testers." Copies of the current IAP qualification statement shall be attached to the request. (See Appendix Form AF-01)

Success of the QC operation will require that the QC Manager, inspectors, laboratories and testers act as a team to accomplish desired results. The assignment of responsibility and the commensurate authority of all personnel involved must be clear to *all* parties. The Contractor must ensure that adequate communication exists among the inspectors at all locations

3. QUALITY CONTROL INSPECTION PLANS

The QC Plan shall include an outline of planned inspections and testing that will be provided by the Contractor (or designated agent), and reported to the Engineer, during production and placement of the asphalt concrete. In addition to the QC organization chart, is recommended that a Caltrans organization chart be developed to facilitate communication and enhance the partnering spirit.

QUALITY CONTROL INSPECTION PLANS

Flowchart XII – Sample Caltrans Organization Chart

Specifications require that the plant operations be inspected and reported within 24 hours. The QC Plan shall include the inspection duties assigned at the plant and should name the person responsible for overseeing these inspections. The person responsible for taking the aggregate plant samples during production must be Caltrans IAP certified for CT125.

Street inspection includes inspection of all activities involved in the placement of asphalt concrete for the finished roadway surface. If needed, the street inspector may provide street samples in compliance with CT125. If the inspector is also going to sample, the inspector must be Caltrans IAP certified for CT125. The QC Plan shall include a list of duties that have been assigned to the street inspector, along with listing who are the primary and secondary inspectors.

The Contractor shall be responsible for inspection of plant operations, asphalt concrete transportation and placement, the paving and compacting operation and the finished roadway surface. Inspectors must be familiar with plans, special provisions, plant operations and/or paving operations, special requirements and potential problem areas, and records and reports.

Plant and roadway inspector qualifications are certified by the QC Manager and submitted on the “Affidavit of Proficiency for Quality Control Inspection”. Each inspector’s duties and assignments will be included in the “Request for Assignment of Inspectors, Samplers and Testers.” (See Appendix, Form AF-01) These inspectors qualifications should be from recognized organizations such as the American Concrete Institute (ACI), the National Institute for Certification in Engineering Technology (NICET), National Ready Mixed Concrete Association (NRMCA), and the Caltrans Independent Assurance Program (IAP).

Plant and street inspectors who will also serve as samplers must be certified for sampling (CTM 125) by the Department’s Independent Assurance Program (IAP).

Plant Inspection Plant Inspection

Plant inspection encompasses the following:

- **Aggregate Inspection**

Aggregate inspection requires the following:

- a. Determine that the materials being used for asphalt concrete production is consistent with materials submitted for mix design approval.
- b. Observe aggregate storage and determine that it meets requirement as specified.
- c. Determine that supplemental fine aggregate is stored separately and kept thoroughly dry.
- d. File a report so that the QC Manager will be able to certify that the aggregate quality and the asphalt mixture requirements are consistent with the verified mix design and the specifications.

- **Plant Inspection Requirements Prior to Production**

Hot asphalt concrete mix production inspector shall be familiar with the asphalt concrete plant that is to be inspected. Plant inspection prior to production requires the following:

- a. Observe the aggregate storage areas and facilities to ensure that storage is as specified.
- b. Determine whether the stockpiled aggregate is similar to the material used for the mix design.
- c. See that scales and meters are sealed or tested as required (CT109).
- d. Examine the plant to determine if it has a temperature-indicating device on the drier and that it meets requirement set forth in the specifications.

- e. Check that the method to be used for proportioning supplemental fine aggregate or baghouse dust is as required by specifications.
- f. Check that the plant is equipped with a functional dust collection system is as required by specifications.
- g. Determine if there are safety provisions for sample collection is as required by specifications.
- h. Check asphalt storage tanks and determine if all required devices are within specification limits.

- Plant Inspection Requirements During Production

Plant inspection during production requires the following:

- a. Maintain a daily plant record. Use a form that has been approved by the Engineer.
- b. Ascertain that the production rate for the mix plant does not exceed those established during the CT109 inspection.
- c. Monitor plant proportioning and all interlocks settings required for the proportioning process being used.
- d. Obtain the required Certificates of Compliance for all asphalt binder loads and provide to the Engineer (Section 92-1.03, “Test Results” of the Standard Specifications). Certificates should go through the QC manager and then be submitted to the Engineer.
- e. Observe aggregate storage and determine that it meets requirements set forth in the specifications.
- f. Determine that supplemental fine aggregate is kept dry, stored properly and metered correctly.
- g. Monitor and record the temperature of the liquid asphalt and the asphalt concrete mix and determine that they meet requirements set forth in the specifications.
- h. Review aggregate grading test results to determine that it meets specifications and initiate any changes that may be required to bring the gradings back into conformance with the specifications.
- i. Observe plant production to assure that a homogeneous uniformly coated mixture is being produced at discharge from the mixer.

- m. Observe storage of materials in silos to ensure that segregation is prevented, that specified temperatures are maintained, that minimum silo levels are maintained, and any time the material is stored for a period of time that it meets the time constraints of Section 39.
- n. Examine truck beds prior to loading to ensure that petroleum products, such as diesel fuel or kerosene, are not used and that parting agents are used sparingly.
- o. Record all information that will support payment and will assist in determination of causes for out of specification materials.

Street Inspection

During street operations, inspector(s) will be present throughout asphalt concrete placement and as needed for control of the operation. The street inspector(s) will have no other duties during the paving operation unless the daily production is less than 1000 tonnes (sampling from the mat is the only exception).

• Inspection of Roadway Prior to Asphalt Concrete Placement

To ensure that the roadway surface has been prepared for paving operations, the roadway must be inspected by Caltrans, as well as by the Contractor's QC inspector(s). Inspection of the roadway prior to asphalt concrete placement requires the following:

- a. Ensure that the subgrade or previous roadway surface has been prepared as specified - remove all loose material and have problems corrected. Ensure that the working surface is dry, stable, compacted, and smooth. Report problems to the QC Manager.

Street Inspection

- j. Monitor temperatures at batch type plants to assure that asphalt binder does not exceed specification limits and that aggregate maximum and minimum temperatures are within limits. Both ingredients require that these ingredient temperatures are continuously recorded and included with the daily plant record.
- k. Monitor temperatures at continuous mixing type plants to assure that asphalt binder does not exceed specification limits and that completed mix maximum and minimum temperatures are within limits. Both temperatures for asphalt binder and completed mix require continuously recordation and must be included with the daily plant record.
- l. Check to see that all equipment is functioning properly and within specifications.

- b. Ensure that tack coat, prime coat or paint binder is being applied properly
 - Determine temperature of the liquid asphalt.
 - Ensure that asphalt is being applied at the specified rate.
 - Ensure that asphalt is being applied at the proper distance in advance of the paving operation
 - c. Ensure that the tack coat, prime coat or paint binder has broken prior to paving
 - d. Ensure that Certificates of Compliance have been received for each shipment and that weight and load slips for each liquid asphalt load are accurate
- Inspection of Roadway During Asphalt Concrete Placement

Inspection during asphalt concrete placement requires the following:

- a. Make measurements of air and asphalt concrete temperatures and record.
- b. Observe spreading
 - Check paving and rolling equipment being used to ensure it meets specifications and is appropriate for the needs of the project.
 - Monitor thickness and observe that the roadway width is being met.
 - Record number of layers.
 - Check spread rate against theoretical rate and correct if any problems are found.
 - Ensure that longitudinal joints are offset as specified.
 - Ensure that longitudinal joints and transverse joints are smooth.
- c. Confirm that rolling pattern and compaction effort determined during the test section are being complied with the requirements. If changed – notify the QC Manager and make a note on the daily report.
- d. Observe construction at cold transverse joints to see that specifications are being met.
- e. Observe that segregation and visual pavement deformities are being avoided or corrected.
- f. Ensure that smoothness of the surface is as specified.
- g. Ensure that defective areas have not developed. Check pavement for pooling of asphalt, bleeding, raveling, rock pockets, consistent color, etc.
- h. Check miscellaneous areas to ensure that they meet plans and specifications.

It is the inspector's responsibility to ensure that the paving operation placement and compaction is conducted in a manner that meets both the specifications and the standards of the practice for workmanship and placement. The Engineer can reject portions, or all, of the pavement based on visual inspection – in spite of the pay factor for the materials qualities.

The QC Plan shall include a list of the tests required by the specifications, the frequency of sampling and testing, the sampling location, the QC staff responsible for sampling and/or testing, and the test method that will be used and the laboratory where the test will be run.

The Contractor's QC Plan for both production facilities and field operation will contain appropriate information regarding the inspection activities that will be performed by the Contractor's personnel. Inspection is as important to QC as it is to acceptance.

Inspection is necessary to minimize visually detectable problems such as stockpiles or equipment maintenance practices or needs that may affect the quality of material produced.

The Contractor's QC Plan shall contain a detailed inspection plan outlining the item, characteristic, action, piece of equipment, process, and procedure to be inspected, and the type of inspection. The plan shall include the frequency, location, and designation of the responsible inspector, as well as the tolerances, standards, or attributes to be inspected. Where placement, production control, or specification tolerances are applicable, they are to be included in the outline.

It is important during placement to minimize construction problems that may affect the final asphalt concrete pavement surface and life. Field inspection is conducted to assure operations such as tack application, pavement reinforcing fabric placement, windrow placement and paver pickup, equipment maintenance and operation, joint placement, compaction sequence and timing or pavement finishing are in compliance with the Contractor's placement procedures and the requirements of the specifications.

Inspectors shall be thoroughly familiar with their duties and shall be aware of all the areas and qualities that must be inspected. They shall be provided with the proper equipment necessary to complete their tasks, and shall have been trained in both the tasks, the reasons for performing them, the potential problems, and the means necessary to correct the situation.

In addition, all inspectors shall be familiar with the reporting forms that they will use to record their days activities. These records shall be completed on a daily basis and submitted to the QC Manager for review. The QC Manager shall compile all daily records of inspection and submit a summary report to the Engineer at the time agreed to in the QC Plan. The following pages contain examples of QC Inspection Plans for plant and street operations. These examples are to be used as guidelines for submittal in the QC Plan. Frequencies shall not deviate from this list.

SAMPLE - QUALITY CONTROL INSPECTION PLAN
Plant Operations

Quality Characteristic	Type of Inspection	Frequency	Location	Responsibility	Tolerance
Mix Designation	Visual	Daily	Plant Control Room	Plant Inspector	Per Approved Mix
Aggregate Storage	Visual	Daily	Bins and Cold Feeds	Plant Inspector	Graded and Separated
Aggregate Source	Visual	Daily	Plant	Plant Inspector	Per Approved Mix
Baghouse Fines	Visual	Daily	Plant	Plant Inspector	Metering
Scales and Meters	Visual/Certification	Daily	Plant	Plant Inspector	Sealed per CT 109
Controller Interlocks	Visual	Daily	Plant	Plant Inspector	Per Specifications.
Temperature Devices	Visual	Daily	Plant	Plant Inspector	Verify Operational
AC Binder Temperature	Temperature Equip.	Continuous	Plant	Plant Inspector	Per Specifications
AC Binder Grade	Certificate	Daily	Plant	Plant Inspector	Per Approved Mix
Belts and Feeds	Visual	Daily	Plant	Plant Inspector	Industry Standards
Composite Agg. Grading	Test Report	Hourly	Plant	Plant Inspector	Per Approved Mix
Aggregate Temperature	Temperature Equip.	3/day min.	Plant	Plant Inspector	Per Specifications
Mix Temperature	Temperature Equip.	3/day min.	Plant	Plant Inspector	Per Specifications
Truck Beds	Visual	Daily	Plant	Plant Inspector	No Petroleum Based
Storage Silos	Visual	Daily	Plant	Plant Inspector	Per Specifications

SAMPLE - QUALITY CONTROL INSPECTION PLAN
Street Operations

Inspection Item	Type of Inspection	Frequency	Location	Responsibility	Attribute or Tolerance
Subgrade Preparation	Visual	Daily	Jobsite	Field Inspector	Smooth and Clean
Prime Coat Spread Rate	Visual & Wt. Tickets	Per Load	Jobsite	Field Inspector	Per Specifications
Prime Coat Temperature	Temperature Equip.	Per Load	Jobsite	Field Inspector	Per Specifications
Tack Coat	Visual & Wt. Tickets	Per Load	Subgrade Surface	Field Inspector	Rate and Cover
Paving Fabric	Visual	Daily	Jobsite	Field Inspector	Per Specifications
Windrow Temperature	Temperature Equip.	Hourly	Jobsite	Field Inspector	Per Specifications
Windrow Segregation	Visual	Hourly	Jobsite	Field Inspector	Industry Standard
Pick-Up Machine	Visual	Daily	Jobsite	Field Inspector	Manufacturer Standards
Asphalt Paver & Hopper	Visual and Measure	Daily	Jobsite	Field Inspector	Manufacturer Standards
Paving Process	Visual	Continuous	Jobsite	Field Inspector	Industry Standards
Compaction Equipment	Visual and Measure	Daily	Jobsite	Field Inspector	Manufacturer Standards
Compaction Process	Visual	Continuous	Jobsite	Field Inspector	Industry Standards
AC Temp. @ Breakdown	Temperature Equip.	Hourly	Behind Paver	Field Inspector	Industry Standards
AC Temp. @ Finish	Temperature Equip.	Daily	@ Finish Roller	Field Inspector	Industry Standards
Lift Thickness	Measured	Hourly	Behind Paver	Field Inspector	Per Specifications
Long./Transverse Joints	Visual	Continuous	Pavement Joints	Field Inspector	Industry Standards
Pavement Smoothness	3.6 M Straightedge	Hourly	Finished Surface	Field Inspector	(P) 3 mm (T) 6 mm Max.
Pavement Transitions	Visual	Daily	AC Transitions	Field Inspector	Per Specifications

4. QUALITY CONTROL SAMPLING AND TESTING PLANS

QUALITY CONTROL SAMPLING AND TESTING PLANS

The description of sampling and testing processes during production is covered in Flowchart VIII. The QC sampling and testing plans are required as part of the process.

The Contractor's QC Plan shall contain appropriate information regarding the sampling and testing that shall be performed by the Contractor's personnel. The sampling and testing plan should contain testing information that will be used by the Contractor to maintain control of the production and placement of the asphalt concrete and to ensure a product that complies with the specifications.

The Contractor's QC Plan shall contain a detailed testing program outlining the characteristic or quality to be inspected, the test method to be used, the frequency, the sampling location, and designation of responsibility. Each quality characteristic shall define the tolerances that are allowed or specified. The following pages contain a sample "QC Sampling and Testing Plan" and "Process Control Sampling and Testing Plan."

The Contractor is responsible for sampling and testing aggregates, asphalt concrete and compacted pavement for quality control. Samplers and testers must be familiar with sampling and/or testing requirements of the contract, procedures for sampling and/or testing, proper care of materials samples and testing equipment, and documentation needs of the testing process and the project.

All samplers and testers, who provide information that will be submitted to the Engineer must be certified by Caltrans Independent Assurance Program (IAP). It is the Contractor's responsibility to see that all testers maintain current certification and qualifications. Testers who have not kept their certifications current or have been de-certified cannot perform testing which will be submitted to the Engineer. Tests from the date of lapse of certificate or de-certification will be considered invalid for the purpose of quality testing.

Testers names, certifications and assignments will be included in the "Request for Assignment of Inspectors, Samplers and Testers." Copies of current IAP Certifications should be attached to the request. (See Appendix, Form AS-01)

Samplers and testers shall be familiar with:

1. Their individual duties and responsibilities.
2. Contract requirements as they relate to their duties.
3. Proper care of materials sampling and/or testing equipment.
4. Documentation needs of the contract.
5. Be familiar with sampling equipment and techniques.
6. Be certified to perform sampling as outlined in CT 125.
7. Be prepared to perform the sampling procedure for the Engineer or IAP representative as required.

If an inspector may serve as a sampler, the inspector must be Caltrans IAP certified for sampling (CT 125).

In addition to sampling requirements, testers shall:

1. Be familiar with testing equipment and test methods.
2. Be certified by the Caltrans IAP.
3. Be prepared to perform the sampling or testing procedure for the Engineer or IAP representative.

Testers who will be operating nuclear gages must be trained and certified in nuclear gage operation and transportation safety. Testers must be provided with nuclear safety badges, and the employer must maintain a record of the results of the badge analyses as required. The training certificates shall be issued by qualified instructors, as defined by the California Department of Health.

Sample - QUALITY CONTROL SAMPLING AND TESTING PLAN

Asphalt Concrete

Quality Characteristic	Test Standard	Frequency	Sample Location	Responsibility	Tolerance
Asphalt Content	Ignition Oven	1/500 tonnes	Mat Behind Paver	Field Insp./Tester	Design \pm 0.5%
Aggregate Gradation	CT 202	1/500 tonnes	Plant	Plant Insp./Tester	19 mm TV \pm 5% 9.5 mm TV \pm 6% 4.75 mm TV \pm 7% 2.36 mm TV \pm 5% 600 μ m TV \pm 4% 75 μ m TV \pm 2%
Sand Equivalent*	CT 217	1/2500 tonnes	Plant	Plant Insp./Tester	Per Specification
Relative Compaction	CT 375	1/500 tonnes	Mat Behind Paver	Field Insp./Tester	96% Minimum
Test Maximum Density Sample	CT 125	Per CT 375	Mat Behind Paver	Field Insp./Tester	Per CT 125
Test Maximum Density Test	CT 375	Per CT 375	Mat Behind Paver	Plant Insp./Tester	Per CT 375
Mix Moisture Content Sample	CT 125	1/500 tonnes	Mat Behind Paver	Field Insp./Tester	Per CT 125
Mix Moisture Content Sample	CT 125	1/500 tonnes	Mat Behind Paver	Field Insp./Tester	Per CT 125
Mix Moisture Content Test	CT 370	1/500 tonnes	Mat Behind Paver	Plant Insp./Tester	< 1%
Stability *	CT 366	1 per day**	Mat Behind Paver	Field Insp./Tester	Per Specification
Asphalt Temp.	Recorded	Continuous	Plant	Plant Inspector	120 - 190
Plant Mix Temperature	Recorded	Continuous	Plant	Plant Inspector	165 Maximum

TV = Target Value from Contractor's proposed mix design

*Process Control Test

** Sampled and tested for the first 5 days of production and may be decreased to one for each 5 days unless the stability falls below the action limit.

Sample - PROCESS CONTROL SAMPLING AND TESTING PLAN

Type B 19 Maximum Medium Asphalt Concrete and Type B 12.5 mm Maximum Coarse Asphalt Concrete

Characteristic	Action Limit	California Test Method	Frequency	Sample Location	Responsibility	Report Time Allowance
Sand Equivalent (min.)	42	217 (Average of three)	1/500 Tonnes Min. one per day	Hot Bins/Cold Feed	Tester	24 hours
Stability	35	366 (Without 15 hour cure) Avg. of three *	First 5 days, then every five days thereafter*	Mat Behind the Paver	Tester	48 hours

*Refer to Table 39-4 Special Provisions

5. QUALITY CONTROL RANDOM SAMPLING PLAN

QUALITY CONTROL RANDOM SAMPLING PLAN

The QC Plan should include the random sampling plan which will be used for sampling each quality – aggregate, asphalt content, compaction, stability and sand equivalent. The Random Sampling Plan shall address partial lot and end of day tonnage.

The Contractor's QC Plan shall contain appropriate information regarding the method that shall be used to determine and implement the random sampling that shall be performed by the Contractor's personnel. The random sampling plan shall contain a copy of the table of random numbers that shall be used and the procedure by which sampling times and locations have been determined. Process control samples may be taken at the same time as the QC samples.(see Table 39-4 of the specifications for the frequency of sampling).

Approval of the QC Plan does not imply a warranty by the Engineer that adherence to the plan will result in production of asphalt concrete that complies with the specifications.

- SAMPLE -

QUALITY CONTROL RANDOM SAMPLING PLAN

Quality control samples will be obtained at milestones using a random sampling plan. The sampling milestones will be determined prior to the start of production using the following procedure:

Random Sampling Procedure

The specified lot size is the total quantity of asphalt concrete to be placed for the project. The lot is defined by a single approved mix and shall be terminated if the mix is changed or if the production pay factors do not meet standards specified in the contract.

Specified lot size = 12,500 tonnes. (per Engineers estimate)

Asphalt concrete tests are required at a frequency of 1 for every 500 tonnes

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 (*Tonnes 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.

Lot Number	Sublot Number	Random No. (a)	Sublot Quant. (b)	Sublot Factor (c)	MILESTONE (a) X (b) +(c)
1	1	.31	500	0	155
1	2	.12	500	500	560
1	3	.29	500	1000	1145
1	4	.86	500	1500	1930
1	5	.14	500	2000	2070
1	6	.74	500	2500	2870
1	7	.53	500	3000	3265

6. LABORATORIES AND EQUIPMENT

LABORATORIES AND EQUIPMENT

It is the Contractor's responsibility to see that the testing laboratories and laboratory testers that support the Contractor's QC/QA sampling and testing meet the following requirements:

When reference is made to a Quality Control (QC) Testing Laboratory, it shall mean any Laboratory participating in the QC Process for this contract (i.e. main QC laboratory, field, remote, and mobile QC laboratories, mix design laboratory, third party dispute resolution, and sub-contractor laboratories). In addition, the Third Party Dispute Resolution Laboratory shall be AASHTO accredited.

Each QC Testing Laboratory shall be qualified in accordance with the Caltrans *Independent Assurance Program* (IAP) and as outlined in this manual. The IAP Manual can be obtained by contacting your local District IA representative or Headquarters IA Coordinator. A QC Testing Laboratory shall be qualified to perform testing on Caltrans projects only after fulfilling these requirements.

It is desirable that QC Testing Laboratories be accredited or certified by an independent accreditation/ certification organization (i.e., AASHTO, AMRL, CCRL), or that they substitute a reasonable program to assure Caltrans of their ability to become certified. All permanent-testing laboratories shall participate in the Caltrans *Reference Sample Program* (RSP), for the materials it will be testing. A permanent testing laboratory is defined as any testing laboratory (main, field, remote, mobile, etc.) that will be in place for one (1) year or longer.

The following is a list of items that will be required to be in the QC Plan:

1. A detailed list of all laboratories participating in the QC process

The list shall include the following items:

- The QC Labs name, address, phone, fax, and e-mail
- Laboratory QC Manager's name and if different from above, address, phone, fax, and e-mail
- Tests to be performed

2. Caltrans Qualified Laboratory Inspection Report (Caltrans Form TL-0113, in the IAP Manual) and/or

3. Request for Initial Qualification, Requalification, or Expansion of Testing Capabilities of a QC Laboratory (see Appendix, Form AF-04)

This form is to be used only in the following situations:

- When requesting initial qualification for a QC Testing Lab or
- For the re-qualification of a previously qualified QC Testing Lab whose qualification has expired or
- When expanding the testing capabilities of a currently qualified QC Testing Lab

It is required that a list of all testing equipment, which are planned for use on this project, be made available to the Engineer. This list will also document the latest calibration date for each piece of equipment. Equipment requiring calibration must be calibrated every year in accordance with accepted standards, manufacturers recommendations and/or the applicable test procedure. Equipment not requiring calibration will require service certificates. All equipment will bear a sticker with the most recent calibration or service date.

All laboratory testing and sampling personnel must show evidence of being trained, qualified and experienced in the material(s) to be sampled or tested and be certified to be proficient. Certification from recognized certifying organizations is preferable (i.e., ACI, NICET, NRMCA, past Caltrans Certification). All QC Samplers and Testers shall possess a valid and current Caltrans Certificate of Proficiency for those tests that the sampler and tester has been assigned to perform. All QC Testing Laboratories shall have a documented Laboratory QC Manual, detailing laboratory QC/QA, and equipment calibration programs, and a Laboratory Procedures Manual, describing the methods used for recording, processing, and reporting data. Each QC Testing Laboratory shall have a person responsible for test result review and certification, laboratory management and laboratory testing for QC. (See Appendix in the IAP Manual, Form TL-0111)

The Laboratory QC Manager shall be responsible for seeing that these standards and practices are fulfilled. This person shall report the test results to the Contractor's QC Manager, assuring compliance with specifications, testing procedure requirements and the QC Plan submitted by the laboratory to the Contractor.

Nuclear gauge operation and transportation requires licensing by the California Department of Health (DOH). Nuclear gauge operators must be certified for safety operation and transportation as required by DOH.

The Engineer will visit the laboratory to review the following:

- Facility Safety Manual
- Safety Equipment
- Laboratory Procedures Manual
- Laboratory QC Manual
- Copies of current applicable test procedures
- Proper test equipment
- Calibration and service documentation
- Calibration and service decals on all testing equipment
- Availability of Contract Plans and Specifications
- Availability of applicable Standard Specifications
- Production capacity

State of California Department of
LABORATORY QUALIFICATION
Form TL-0113

Expiration date: February 02, 2002

Inspection by: Harry Roberts

IA No.: 105

Phone: (999) 888-7777

File: Materials Category 500

Laboratory: Besters Testers Inc.

Address: 5900 Ft. Long Fall Road

City: Flat Top Mountain

State: CA

Zip: 66666-5555

Lab QC Mgr.: Al Zook

e-mail: Alz@bti.com

Phone #: (444) 333-2222

Fax #: (444) 222-1111

A certified Independent Assurance (IA) Sampler and Tester visited this laboratory on February 02, 2001. Only equipment to be used on Caltrans construction projects and/or local construction projects on the National Highway System projects was checked for qualification.

At the time of Caltrans Qualification, 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.

CT 105	CT 125	CT 201	CT 202	CT 205	CT 206	CT 208	CT 211	CT 217
CT 226	CT 227	CT 303	CT 304	CT 305	CT 366	CT 367	CT 370	CT 375
CT 382	T 209							

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

- ☐ A written in-house Safety Program
- ☐ A written in-house Quality Control Program
- ☐ Copies of current (applicable) test procedures
- ☐ A test equipment summary for calibration/service of equipment
- ☐ Calibration/Service stickers affixed to test equipment (dated within the last 12 months)

On February 02, 2001 this laboratory was qualified by Harry Roberts

(IA Signature)

7. LINEAR CONTROL CHARTS

LINEAR CONTROL CHARTS

Linear control charts display individual measurements of all quality characteristics as designated in the contract. These charts shall be used as part of the process control system to identify potential problems and assignable causes before they occur. The charts shall be updated daily and posted daily in a location agreed to by the Engineer.

It is the Contractor's obligation to see that testing is performed at the specified intervals and that the sampling and testing is in conformance with the random sampling plan developed in the QC Plan. It is also required that the Contractor submit records of test results to the Engineer within the time agreed to before the start of production, and to develop, post daily, and maintain linear control charts which are a continuous record of the QC test results for the asphalt concrete being produced. Up-to-date copies of the linear control charts shall be included in the submittals to the Engineer of each day's test results.

There are some software applications that may be used to develop the charts, or the charts may be kept by hand. Charts will clearly reflect the following:

- Date of posting
- Project information
- Lot Number
- Item identification
- Sample identification (including plant mix identification if used)

Examples of the Quality Control and Process Control Linear Control Charts shall be included for each Quality characteristic. If multiple mix designs are specified, Linear Control Charts for each mix design shall be included. The examples shall reflect the actual mix design target values including upper and lower specification limits.

8. QUALITY CONTROL CORRECTIVE ACTION PLANS

QUALITY CONTROL CORRECTIVE ACTION PLANS

It is the Contractor's responsibility to understand what is necessary to keep the process in control, quickly determine when the process has gone out of control, and respond adequately to correct the problem 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 which document that the Contractor has considered some of the potential problems and is prepared to correct them.

The QC Plan shall include a list of anticipated corrective action plans that may be needed in the event that inspection or test results indicate production or construction processes, which do not meet the minimum quality characteristics, or minimum placement standards. Corrective Action Plans are developed to provide the Contractor an opportunity to review the production and placement processes for the purpose of identifying potential trouble spots and anticipate actions to correct or remediate the situation. Corrective actions may range from minor process adjustments to temporary termination of

production depending on the severity of the problem. Corrective action options will be included in the QC Plan and may be developed in tabular form.

Should problems arise, the Contractor is expected to: notify the Engineer; identify the problems; and note the actions being taken to identify the cause and the anticipated corrections. Requirements for notification and production termination are contained in the specifications. The Corrective Action Plan will outline the Contractor's understanding of these conditions. At a minimum, the Corrective Action Plan should contain contingencies to address the following potential problems:

At the Production Site:

Asphalt content, aggregate gradation, aggregate moisture, mix moisture, asphalt cement temperature, aggregate temperature, mix temperature, sand equivalent, mix segregation, uncoated aggregate, sand equivalent, mixing time, mix storage time.

At the Placement Site:

Subgrade preparation, prime and tack coat, ambient temperature, mix temperature, joint construction, thickness, cross slope, joint offset, mix segregation, compaction testing, equipment and placement yield.

Each of the above items requires a course of action to correct the noted deficiency. The corrective action may be presented in table form as shown in the example provided. Should there be a need for any corrective action it shall be documented in the records of inspection.

An Example of a QC Corrective Action Plan:

SAMPLE - ASPHALT CONCRETE PRODUCTION

Test Item	Corrective Action
Asphalt Content	If test results are outside tolerance (4.5 - 5.5%) an immediate investigation will be conducted to determine the cause. Corrections will be made and material will be tested immediately to assure that the correction has been effective.
Aggregate Gradation	If test results are outside tolerance (per table 39-3) an immediate investigation will be conducted to determine the cause. Corrections will be made in piles, bins, belts or scales and material will be tested immediately to assure that the correction has been effective.
Aggregate Moisture	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 Temperature	If the asphalt temperature exceeds the range allowed (120°C to 190°C) 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	If the mix temperature exceeds 165°C 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. Asphalt concrete that exceeds 165°C will be disposed of.
Mix Moisture Content	If the mix moisture exceeds 1%, the plant operator will be notified and corrective action will be taken to reduce the moisture in the mix. Aggregate piles may be spread to dry, aggregate time in the heater may be increased, etc.

SAMPLE - ASPHALT CONCRETE PLACEMENT

Test Item	Corrective Action
Subgrade Preparation	If inspection indicates that the subgrade is not prepared as specified, and as required, immediate action will be taken. Subgrade problems will be corrected - dried, cleaned, compacted, graded, etc. Asphalt concrete will not be placed until the corrections have been made and the QC Manager has inspected and approved.
Prime/Tack Coat	If inspection indicates that the prime or tack coat material or application are not in accordance with the specifications, immediate action will be taken. Prime coat will be reapplied, changed, time for break will be lengthened, etc. Asphalt concrete will not be placed until the corrections have been made and the QC Manager has inspected and approved.
Ambient Temperature	If physical measurements indicate that the ambient temperature is less than specified (10°C) the paving foreman will be notified and placement will cease as soon as safety concerns have been provided for.
Mix Temperature	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, asphalt concrete will be held in tarped trucks and not windrowed until necessary.
In-Place Density	If field density determination indicates that the asphalt concrete is not being placed to a minimum relative compaction of 96%, 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, etc. Relative compaction will be tested immediately following the corrective action to assure that the action as been effective.

9. PRODUCTION START UP EVALUATION AND NUCLEAR DENSITY TEST STRIP PLAN:

The purpose of the production start-up is to ensure that the asphalt concrete conforms to the specified quality characteristics. The purpose of the nuclear density test strip is to develop a correlation between core densities taken on the test strip and the Contractor's and the Engineer's nuclear gage readings. The location of the start up evaluation and the nuclear density test strip shall be approved by the Engineer.

Flowchart VI. - Production Start up Evaluation and Nuclear Density Test Strip

The QC Plan shall include the location(s) of the production start up evaluation and the nuclear density test strip(s). It shall include the approximate quantity of asphalt concrete to be placed.

A method of tracking and logging the multiple nuclear gage conversion factors shall be developed and included in this section of the QC Plan. In addition, the following items must be included:

- Location of placement, with beginning and ending stations (include sketch or contract plan sheet)

PRODUCTION START UP EVALUATION AND NUCLEAR DENSITY TEST STRIP PLAN

- Contract item number
- The type of material and Structural Section
- The layer number, width and thickness
- Date and time of placement
- Time the asphalt concrete production plant is due to begin producing material
- Estimated total tonnage (be accurate)

QUALITY CONTROL DOCUMENTS

10. QUALITY CONTROL DOCUMENTS

The QC Plan will identify the forms and charts that will be used to document the quality control process. The forms will be detailed enough to provide the information required both for quality control and for meeting contract requirements. The specifications require the following documentation:

Asphalt Concrete Construction Daily Record of Inspection - These documents are required daily. It shall be submitted by noon the following day or within 24 hours of sampling. It is a summary of all inspection activities that have taken place. Separate inspection reports should be prepared for both the production (plant) and the placement of the asphalt concrete (street). (See Appendix-Forms AF-07 & AF-08.)

Asphalt Concrete Daily Testing Records - The document is required for each day's production and placement for each quality that must be reported. These records should contain all data collected and calculations performed. Individual test records shall be signed by the tester who performed the test and initialed by the person who reviewed the test results for correctness. These forms will be submitted by noon the next day or within 24 hours of sampling. This is a contractor supplied form as included in the QC Plan.

Summary of QC & Progress Control Testing – This document is required for each day's production and placement. It is a checklist showing the inspection, sampling and testing (both quality control and process control) that were conducted on the day being reported. This summary is certified and signed by the QC Manager. This form to be submitted by noon the next day or within 24 hours of sampling. (See Appendix-Form AF-09)

Production Start-up Evaluation – This document is used to ensure the material placed has met the specified quality characteristics and it is okay to move to full production. This form or a similar form is to be included in the QC Plan. The Contractor's and State's tests are entered to determine if the testing has passed the minimum passing requirements. (See Appendix-Form AF-10)

11. ASPHALT CONCRETE MIX DESIGN

The QC Plan shall identify the aggregates, asphalt binder and additives that will be used in the asphalt concrete. Each material type (i.e. asphalt, aggregate, additives, etc) shall be identified by producer and source. The laboratory or laboratories providing mix design information, shall be identified together with the source of materials.

Contractor's Mix Design Sampling and Testing

The Contractor is responsible for preparing a mix design for review by the Engineer. The mix design must be prepared and evaluated using CT 367 and the contract special provisions. Each mix design submitted shall have a unique number or designation. Subsequent mix designs submitted shall have a new number or designation. Test information submitted with the mix design shall include the appropriate mix design number or designation.

Flow Chart IV - Mix Design Process

Aggregate Samples

The specifications require that the aggregate samples be “representative of the aggregate to be used.” However, it is in the Contractor’s best interest to have the samples submitted for use in the mix design and in the mix design review be “representative” of the aggregate that will be used during production. It is the Contractor’s responsibility to submit aggregate samples that will meet the grading tolerances of the specifications and will duplicate the mix design qualities as required. Furthermore, it is suggested that when the aggregate samples are obtained for the mix design that the samples be split and that half of the samples be retained for submittal to the Engineer for the mix design verification.

Asphalt Binder

Asphalt binder from the same source or (producer) that will be supplying the asphalt concrete producer during the project is required. Changes in asphalt binder source shall be considered a change in the asphalt concrete mixture and shall require a new mix design proposal.

Antistrip Additives

Lime or liquid antistrip additives when required by the specifications shall be supplied to the state in required amounts per Section 11, 39-3.01 of the Contract Special Provisions. The Contractor is responsible to submit the type and specific product which will be used during production.

Engineer's Verification of the Mix Design Proposal

During the mix design verification, the State laboratory will follow the CT 367 and the contract special provisions procedure for preparing the asphalt concrete using the target value submitted for the asphalt content and the target values for the coarse aggregates (retained on the 4.75 mm sieve). The aggregates passing the 4.75 mm sieve will be verified for conformance to the specification limits defined by the target values submitted by the contractor and the production tolerances allowed as specified in Section 11, Table 39-9

ASPHALT CONCRETE MIX DESIGN

Contractor's Mix Design Sampling and Testing

Aggregate Samples

Asphalt Binder

Antistrip Additives

Engineer's Verification of the Mix Design Proposal

of the Contract Special Provisions. The asphalt concrete mixture shall be prepared as prescribed in CT 304. The Engineer's verification of the mix design proposal may consist merely of a review of the State's historical records and/or the contractor's test results. The review of the proposed aggregate and asphalt concrete mixture shall be in conformance with Section 11 of the Contract Special Provisions. The proposed asphalt concrete mixture will be reviewed at the proposed target values for aggregate grading and asphalt content. The Engineer will have 14 days to review each submittal of a proposed mix design. The production of Asphalt Concrete shall not begin until written notification has been received from the Engineer that the proposed mix design meets the requirements of the Contract Special Provisions.

The Engineer will reject a proposed asphalt concrete mixture that, during review, fails to meet the quality requirements of the Contract Special Provisions. The Contractor will resubmit a mix design letter providing new test results, plots, and material samples. The Engineer will have 14 days to review each submittal of a proposed mix design.

Disagreements in the mix design review shall be resolved in conformance with Section 39-6, "Dispute Resolution" of Section 11 of the Contract Special Provisions.

The Engineer will review one proposed asphalt concrete mix design for each asphalt concrete type and aggregate size from each plant proposed for use on the project at the State's expense. Costs for additional reviews due to failure to conform to the quality requirements and for reviewing other proposed asphalt concrete mix designs will be deducted from moneys due or to become due the Contractor. The cost for each review will be as stated in the Contract Special Provisions.

- SAMPLE -
ASPHALT CONCRETE MIX DESIGN INFORMATION

Date: July 22, 1996

This asphalt concrete mix design is submitted with attached test reports for:

1. Project Information:

Contract Number	EA 15-151514				
Location: County	Sacramento	Route	199	Post Mile	43.5/55.4
Contract Description:	Blacktop Highway Rehabilitation				
Contractor:	Big Orange Construction, 1555 Buildit Circle, Sacramento, CA 97777				
Subcontractor:	Black Top Paving, 2222 Rough Road, Galt, CA 98888				
Producer:	Quality Stuff AC, 1111 Asphalt Road, Auburn, CA 99999				

2. Materials Source Information:

Aggregate:		
Source:	SMARA No. xxx	SMARA No. xxx
	Coarse Aggregate:	Quality Stuff AC Pit, 9000 Rock Road, Sacramento
	Fine Aggregate (Sand):	Sandy Bottom Gravel and Sand, 2275 Pit Road, Sacramento
Asphalt Binder:		
Type:	AR400	
Source:	Black Stuff Asphalt Refinery, 5050 Oil Tank Avenue, Sacramento	
Anti-Strip Additive:		
Type:	Granulated Lime	
Source:	Lime Producers USA, 33 White Street, Sacramento	

3. Sampling Information:

Aggregate:			
Source:	Coarse Aggregate:	1 X 1/2 Stockpile	3/4 x #4 Stockpile
	Fine Aggregate (Sand):	#4 Minus Stockpile, Quality Stuff AC Plant, 9100 Rock Road, Sacramento	

4. Mix Design Laboratory:

Company Name	Good Works Labs		
Address	4544 Testers Way, Elk Grove, California 97777		
Phone:	(916)999-8888	FAX:	(916)888-8888
Lab Manager:	Pat A. Bench		
Lab QC Manager:	Mitchell B. Careful		

Asphalt Concrete – Production Daily Record.

Plant Inspection - Aggregates

Materials per: Ensure all materials used are the same that is called for in the approved mix design.

Aggregate storage: Observe storage areas and facilities to ensure that storage is as specified and that there is positive separation between the various sized aggregates.

Supplemental fine aggregate: the fine aggregates that are collected in the plant bag house but also may include other fines, such as cement, fly ash, or hydrated lime which could be added to the mix as a corrective additive. Observe that this ingredient is stored separate and kept dry.

Plant Inspection - Prior To Production

Aggregate storage areas: Observe storage areas and facilities to ensure that storage is as specified and that there is positive separation between the various sized aggregates.

Temperature indicating device on drier: Examine the drier or drier drum area to ensure that there is a temperature-sensing device. The temperature-sensing device may protrude into the mainstream of heated material leaving the drier or the drier drum mixer or it may be an infrared type device. The indicator for said device shall be located and maintained at the point where proportioning operations are controlled.

Sampling devices: Examine aggregate and asphalt sampling devices to ensure safe and suitable sampling can be performed.

Asphalt sampling device: Shall be located in the feed line connecting storage tanks to the asphalt weighing system for batch plants and spray bars for continuous mixing plants. The sampling device shall be readily accessible and free of obstructions. The sampling device shall consist of a valve that has a diameter of 10 mm - 20 mm and located between 600 mm and 750 mm above the sampling platform.

Aggregate sampling device(s): Batch-mixing plants, a device shall be made available at each of the hot bins in the area just before weigh hopper. The sample size shall be adequate enough to perform required testing. Continuous-mixing plants a device shall be made available to obtain samples in the area after cold feed proportioning and in advance of entering the drier while plant is in full operation. The sample size shall be between 25 - 40 kg of combined aggregate.

Stockpiles: Observe aggregate stockpiles to ensure there is no intermingling of aggregates and that the source of materials are those indicated in mix design.

Plant Inspection Aggregates

Plant Inspection Prior To Production

Supplemental fine aggregate: When baghouse collected fines are used in the mix, ensure that; a.) where anything less than 100% of the collected fines are used in the mix, the utilized portion is proportioned by a meter. and b.) this material is returned at a point in advance of the sampling device for a batch-mixing plants and at or before mixing in continuous mixing plants. Observe that supplemental fines (if used) are stored separate and kept dry. A sampling device shall be installed in each feed line or surge tank preceding the proportioning device for the supplemental fine aggregate. Sample size shall be adequate to perform required testing.

Asphalt storage area(s): Observe asphalt tank area to ensure tanks are being properly heated and that an appropriate sampling device is in place. In addition, a temperature-sensing device shall be located in the asphalt feed line with an automatic continuous recording device located at the point of proportioning for maintaining accurate records during production.

CT 109 certification: Observe the certified operating ranges and date the certification was performed on Caltrans 109 Sticker CP-CEM-0017. Batch-mixing plant certification is valid for 1 year and continuous-mixing plant certification is valid for 6 months from the date performed. If there are problems with the plant certification, contact the Caltrans District Weights and Measures Coordinator.

Dust collection systems: Observe that the plants primary dust collection systems cyclone or knockout box are in place. Ensure that this material is returned at a point in advance of the sampling device for batch-mixing plants and at or before mixing in continuous mixing plants. On either plant type, when less than 100% of baghouse collected fines are used in the mix, these fines must be metered.

Plant specification compliance: Ensure all of the above items are within Caltrans plant requirements.

Plant Inspection During Production

Plant Inspection - During Production

Plant records: Ensure that plant records are adequate and the applicable records are kept and made available for review and/or copying.

Aggregate temperature (record) Batch plant only: Monitor and ensure the aggregate temperature recording device is functioning and temperatures are not exceeding allowable tolerances.

Asphalt temperature (record): Monitor and ensure asphalt temperature recording device is functioning and temperatures are not exceeding allowable tolerances.

Silo-segregation/temp./level: Monitor and ensure that the hot mix silos have functioning surge batchers and that the weighing or height mechanism is operating. Ensure that silos are holding minimum temperatures by checking the material loaded into the truck. Ensure that the minimum quantity of 18 tonnes is maintained in each silo used for storage while plant is in operation. Ensure that asphalt concrete stored in excess of 18 hours is discarded or not used.

Mixing time: With either continuous mixing plants or batch-mixing plants, the mixing time used shall produce a homogeneous mixture of thoroughly and uniformly coated aggregates of unchanging appearance. In addition batch-mixing plants shall not have a mixing time of less than 30 seconds. Monitor mixing times accordingly.

Proportioning devices: Batch-mixing plant proportioning devices would include but are not limited to aggregate weigh hopper, asphalt and supplemental fine aggregate weighing mechanisms. Continuous mixing plants, individual aggregate feeders, combined aggregate weigh-belt, asphalt meters and supplemental fine meters are used for ingredient proportioning. Monitor all of the above devices and ensure they are in good operating condition and able to produce and maintain consistent asphalt concrete mixtures at the allowable rates set by CT 109.

Sample asphalt/aggregates: Sample asphalt and aggregates as required by the approved random sampling plan and/or required frequencies and CT 125. Visually inspect aggregate samples to ensure they appear well graded. In batch-mixing plants check aggregate temperatures from samples pulled to compare with aggregate temperature recording device. When pulling asphalt samples use extreme caution and in all cases have plant personnel assist in sampling. Check asphalt sample temperature to compare with asphalt temperature recording device.

Production rate per CT 109: Monitor all proportioning devices and ensure they do not exceed allowable metered rates or mass ranges set by CT 109.

Aggregate storage: Monitor aggregate storage area to ensure different size aggregates are being placed in proper areas, there is no intermingling of the different sizes and that the source is as indicated on the approved mix design.

Review aggregate gradings: Review results of gradation analysis to ensure that combined gradations meet the allowable ranges for the target values from the approved mix design. Enforce any necessary adjustments made to the proportions to control quality.

Mix temperature (record) Continuous mixing plants only: Monitor and ensure the mix temperature recording device is functioning and temperatures are not exceeding allowable tolerances.

Truck beds (diesel/tarps): Monitor trucks used for hauling, ensure that petroleum based substances are not used as release agents. If the specifications require the tarping of trucks, ensure that tarps are being used in as required.

Belts and feeders (aggregate): Monitor aggregate weigh-belt and aggregate feeders used for proportioning ensure rate of flow indicators and totalizers are functioning properly.

Screens: Ensure that chutes for oversized or reject aggregates are functioning properly.

Plant interlocks/shutdowns: Monitor and ensure interlocking devices are functioning so that the desired proportions for aggregates, asphalt and supplemental fine materials meet production tolerances. In continuous mixing plants, monitor and ensure shutdown devices on the proportioning controller

function when an aggregate, asphalt, or supplemental fine material no flow or low flow situation occurs. When a signal from these flow control devices is received by the continuous plant controller, material production must stop automatically.

Supplemental fine aggregate dry/storage: If bag-house collected fines are used, monitor and ensure that this material is returned at a point in advance of the sampling device for a batch-mixing plants and at or before mixing in continuous mixing plants. Observe that supplemental fines (if used) are stored separate and kept dry, and they are returned at a uniform rate. Ensure, when less than 100% of baghouse collected fines are used, that the usage is being metered correctly.

Homogeneous mix: Monitor and ensure completed asphalt concrete for both batch-mixing and continuous mixing plants is a homogeneous mixture of thoroughly and uniformly coated aggregates of unchanging appearance. Monitor and ensure batch-mixing plants have a minimum mixing time of 30 seconds. Take appropriate action such as requiring longer mixing times if necessary.

Plant operation & specifications: Monitor all plant equipment and their controlling devices and ensure that functioning properly and meet all applicable specifications.

Payment support records: Monitor and ensure weight certificates are accurate and have all applicable information required for proper payments. The person signing the weigh document must be a currently licensed weighmaster administered by California Department of Agriculture, Division of Measurement Standards.

Dust collection: Monitor the plants primary dust collection systems cyclone or knockout box are in place. Ensure that this material is returned at a point in advance of the sampling device for batch-mixing plants and at or before mixing in continuous mixing plants. If bag-house collected fines are used, monitor and ensure that this material is returned at a point in advance of the sampling device for a batch-mixing plants and at or before mixing in continuous mixing plants. Also see “Supplemental Fine Aggregate Dry/Storage” above.

Asphalt ratio: Monitor and ensure that the asphalt to 100% of the dry aggregate ratio is maintained as per the approved mix design. The plant shall not be operated unless an automatic system to control and interlock aggregate, supplemental fines and asphalt is operating and in good working condition during production.

Asphalt Concrete - Placement Daily Record

Prior to Placement

Prior to Placement

Review special provisions: Review the projects special provisions for any special requirements. The special provisions will also have the specifications for QC/ QA for Asphalt Concrete.

Paving / Compaction equipment: Ensure paving or spreading equipment meets specifications. Ensure that the paving machine being used is spreading material correctly and that the screed is not effecting the surface texture adversely. Ensure compaction equipment being used is providing proper compaction of the mix, ensure that the rollers are equipped with pads and water systems to prevent pickup of the material on the mat.

Tack / Prime spread rate: Check spread rate through measurements to ensure tack and prime coats are as specified or required per plans / specials or determined by Resident Engineer.

Paving fabric type: Ensure that paving fabric is as specified in contract plans or special provisions.

Subgrade Preparation: Ensure that the subgrade is or previous roadway surface has been prepared as specified and that it has been tested and accepted. Ensure any loose materials or grade deficiencies have been corrected before any AC placement.

Tack / Prime Certificate of Compliance: Obtain Certificate of Compliance for material being used for tack and or prime coat, Ensure material on certificate is that being used. Attach certificates obtained with Daily Inspection Report.

Tack / Prime temperature: Monitor and record tack and prime coat temperatures upon application. Ensure temperatures do not exceed the allowable tolerances in section 93 and 94 of the Standard Specifications for material being used.

Paving fabric Certificate of Compliance: Obtain Certificate of Compliance for paving fabric material being used. Ensure that material on certificate is that being used. Attach certificates obtained with Daily Inspection Report.

Manholes / valves marked: Ensure that manhole and valve covers are clearly marked to obtain their locations for adjustment to finished grade after paving operations.

Tack / Prime application rate: Tack coats shall be applied in one application at a rates in the specifications. Exact rate will be determined by Resident Engineer. Prime coats shall be applied at an approximate rate of 1.15 L per square meter. Exact rate and number of applications will be determined by the Resident Engineer.

Tack / Prime broken: If asphalt emulsions are used as tack or prime coat ensure that they are broken or the emulsion has cured before placing pavement.

Paving fabric placement: Ensure paving asphalt is applied to the surface to receive the paving fabric. Ensure that the fabric is aligned and there is no wrinkles that lap. Refer to the Special Provisions for further details and requirements for the placement of paving fabric.

During Placement

During Placement

Ambient air temperature (record): Monitor and record ambient temperatures. Ensure asphalt concrete is not placed when temperatures fall below minimum requirements. Minimum ambient temperature requirement for Type A and B asphalt concrete is 10° C.

Pickup/ capacity: Ensure the pickup machine is adequate for the windrow size and that it supplies the paving machine with an adequate amount of material for the desired production rate.

Lift thickness: Ensure that the pavement lift thickness requirement is being satisfied; check loose thickness with compacted thickness to use as a gauge for later measurements. Ensure pavement thickness does not exceed the requirements in the specifications.

Longitudinal joints offset: Ensure that if pavement operation requires multiple lifts, the longitudinal joints are offset and the final or finish course corresponds to the edges of the proposed traffic lanes.

Rolling pattern/ process: Ensure that the rolling patterns are consistent with the patterns established to achieve required compaction. Ensure that the process used is consistent and meets specifications.

Cold transverse joints in spec.: Ensure cold transverse joints are trimmed to a vertical face and to a neat line before placing adjacent layers.

Miscellaneous areas: Ensure all miscellaneous areas are taken care of appropriately and that an additional 1% binder is added above what is being used in travel way.

Visual – defective areas: Ensure defective areas e.g. bleeding, raveling, rock pockets and heavy segregation do not develop take immediate actions to correct these situations.

Delivery/ dumping: Ensure that delivery and dumping equipment is independent of the paving machine, all hauling equipment must be adequate for work being performed and in no case shall the mass of the haul vehicle or loading equipment be supported by the paving machine.

Dump/ Windrow temperature (record): Monitor and record asphalt concrete dumping and windrow temperatures. Ensure asphalt concrete is not placed when temperatures fall below minimum requirements.

Spread rate vs. theoretical: Calculate from load slip quantities and field measurements the spread rate vs. theoretical quantities and make the necessary changes.

Longitudinal joints smooth: Ensure longitudinal joints are smooth, trim if necessary.

Breakdown temperature (record): Record AC temp. behind paving machine ensure that breakdown rolling is performed timely.

Pavement smoothness: Using a 3.6 m +/- 0.06 m straightedge laid on the finished surface parallel with the centerline, ensure that the surface does not vary more than 3 mm from the lower edge of the straightedge. Ensure the transverse slope of the finished surface does not exceed more than 6 mm for the centerline extending from edge to edge.

Number of lifts: Record number of lifts being placed, ensure that they are proper thickness and being placed according to the plans and specifications.

Visual - segregation: Examine mat before and after rolling to ensure there is no segregation of coarse material and finer material.

Windrow condition: Ensure windrow is uniform, no hardened lumps of AC or foreign materials present. Ensure that windrow is in direct line with pick-up machine.

Paving width: Ensure that the widths are not outside plans and specifications or what the paving machine can adequately place. Ensure that longitudinal joint spacing is within specifications.

Street mix samples: Ensure that the completed mix samples are taken from the mat in accordance with CT 125 and in compliance with the approved random sampling plan.

Transverse joints smooth: Ensure transverse joints are smooth, trim if necessary.

Straightedge: Ensure that straight edge being used for the checking smoothness of pavement is 3.6 m +/-0.06 m.

Finish temperature (record): Record AC temp. on finished mat. Ensure that no rolling is performed when the asphalt concrete temperature is below 60° Centigrade.

Visual inspections: Inspect the pavement for any problems with smoothness, segregation, rock pockets, bleeding or raveling. Ensure that the asphalt pavement is uniform, well compacted, and that there is no segregation before and after rolling.

Flowchart and Forms are provided in this appendix to assist in clarifying the process and aiding the accomplishments of the requirements.

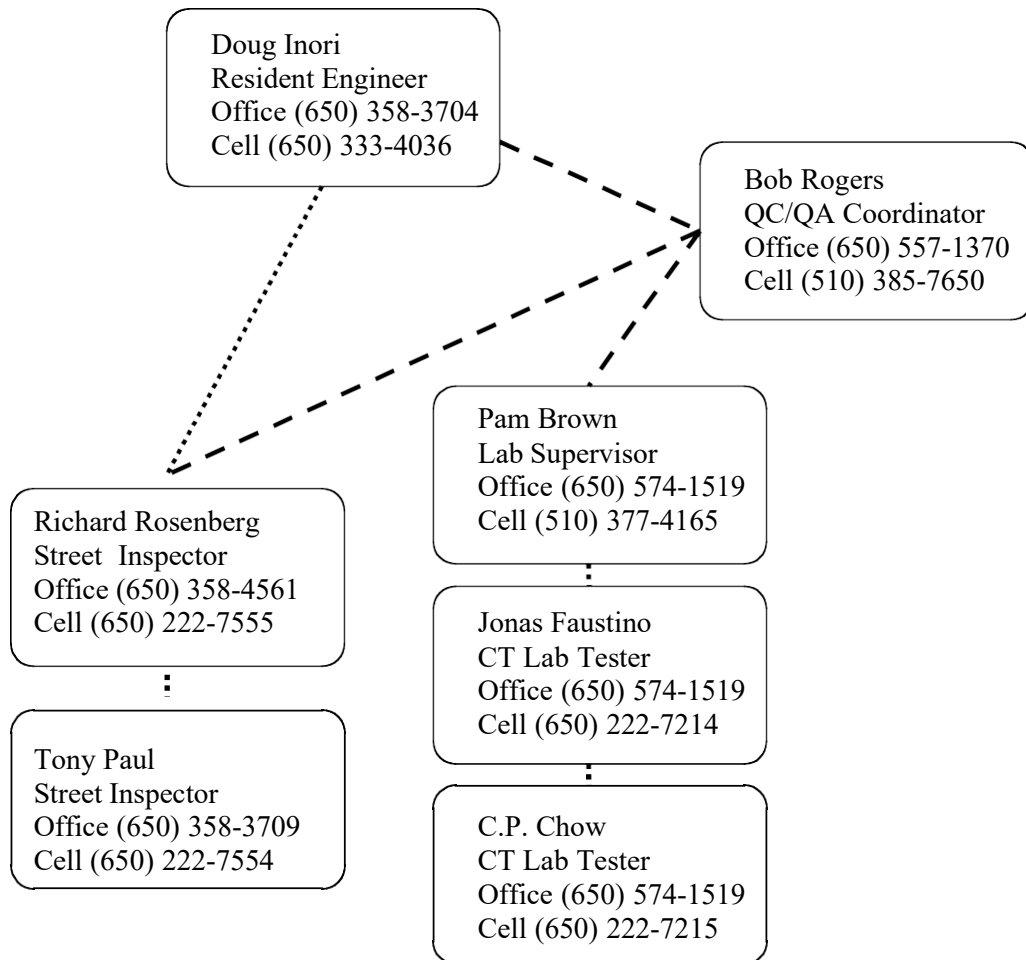
Flowcharts included in the appendix.

FL-I	The Big Picture
FL-II	QC Plan and Mix Design Submittal and Approval, FL-II (14 calendar days prior to production)
FL-III	Sample Organization Chart
FL-IV	Mix Design Process
FL-V	Dispute Resolution Process During Mix Design
FL-VI	Production Evaluation Start-Up Evaluation and Nuclear Density Test Strip
FL-VII	Dispute Resolution Process During Production Start-Up Evaluation
FL-VIII	Sampling and Testing During Asphalt Concrete Production
FL-IX	Dispute Resolution During Production
FL-X	Verification
FL-XI	Acceptance
FL-XII	Sample Caltrans Organization Chart

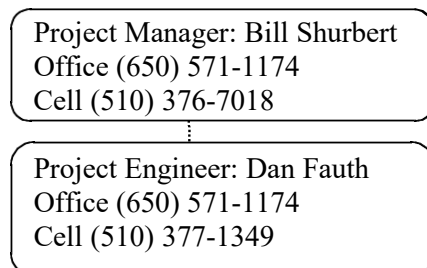
IV-2 Flowcharts

Flowcharts provided in this section are meant to be for clarification only. The QC/QA specifications should be the final guide on the process.

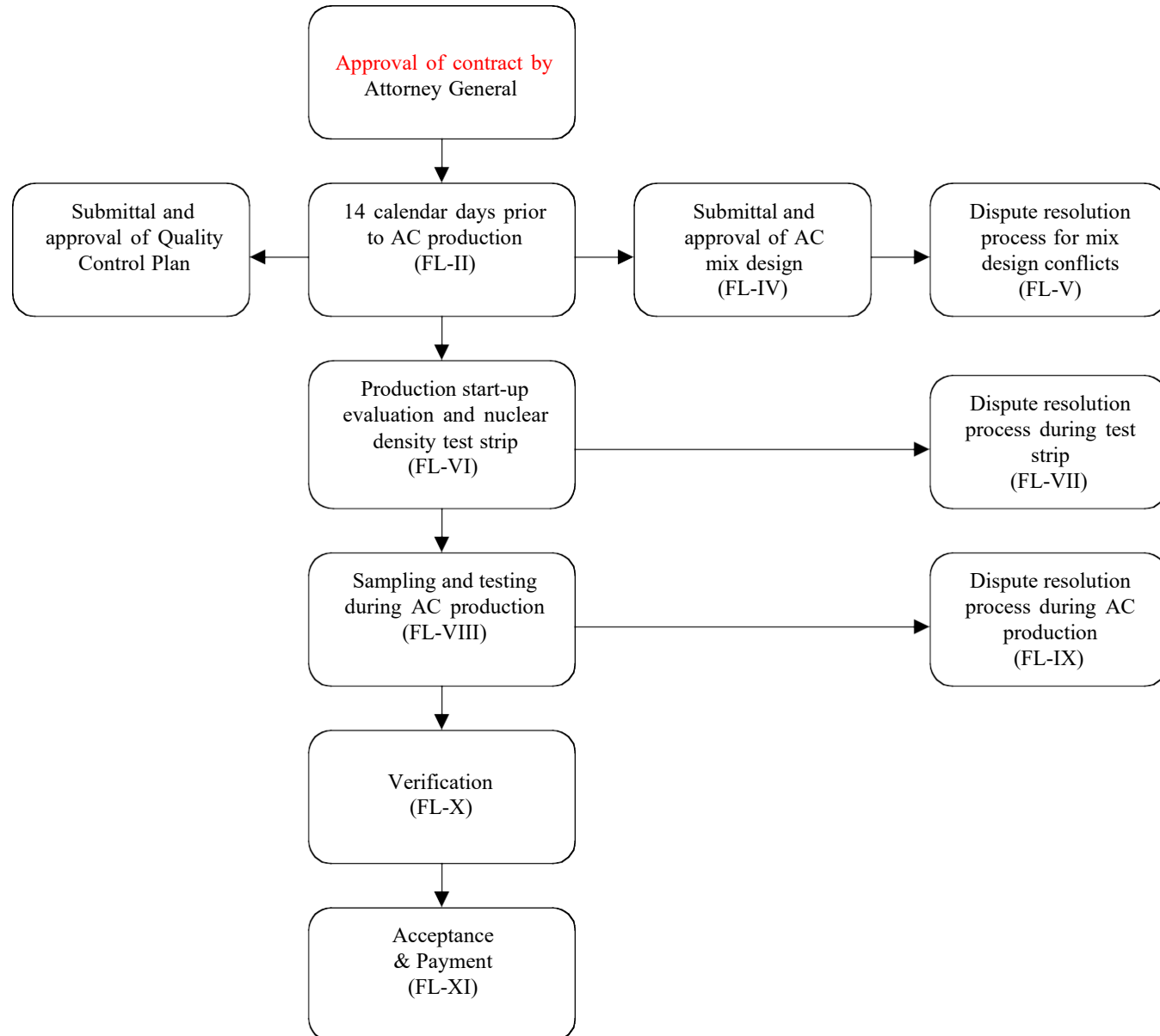
Caltrans Organization Chart for Contract 04-235724



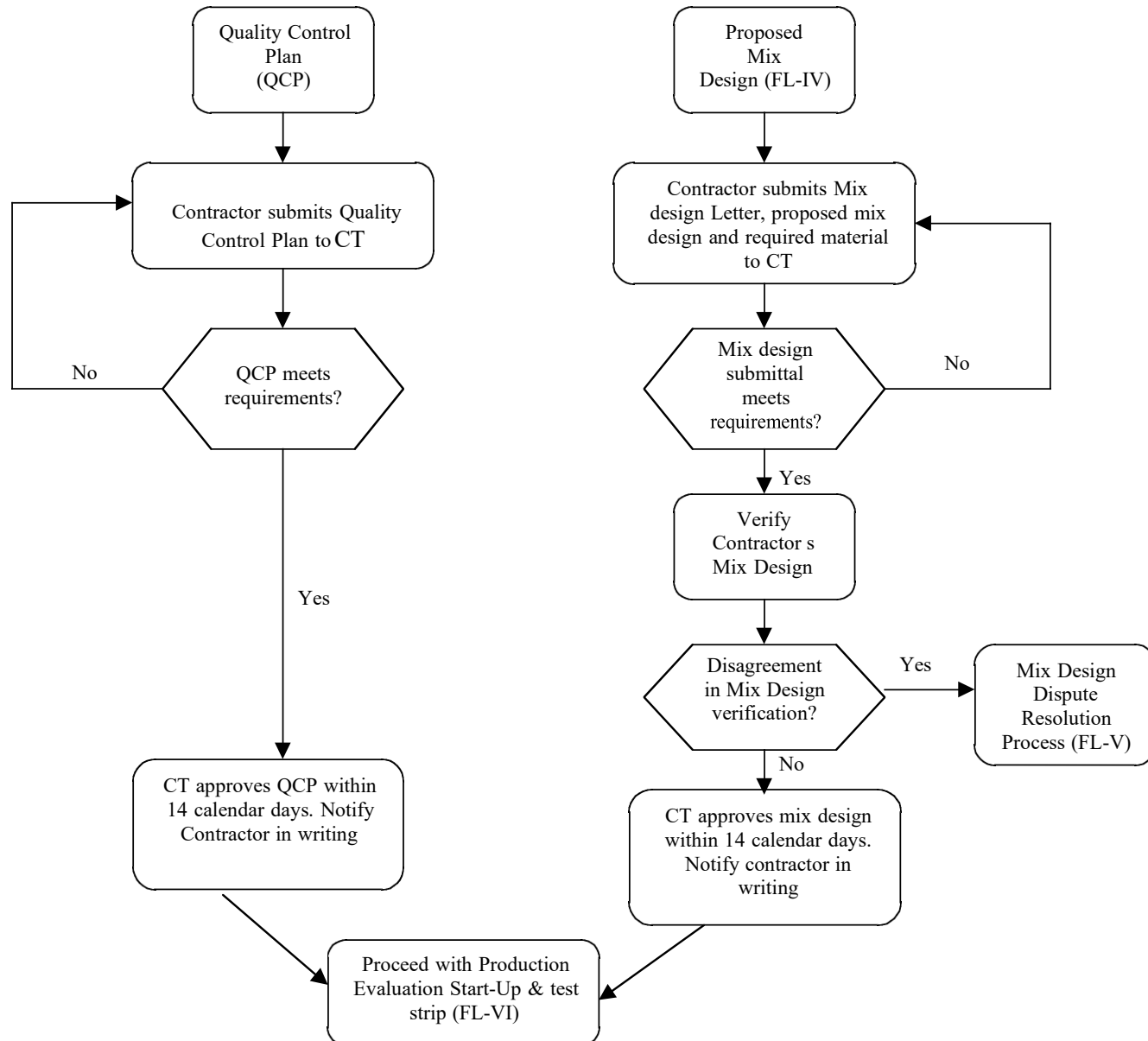
RGW Construction



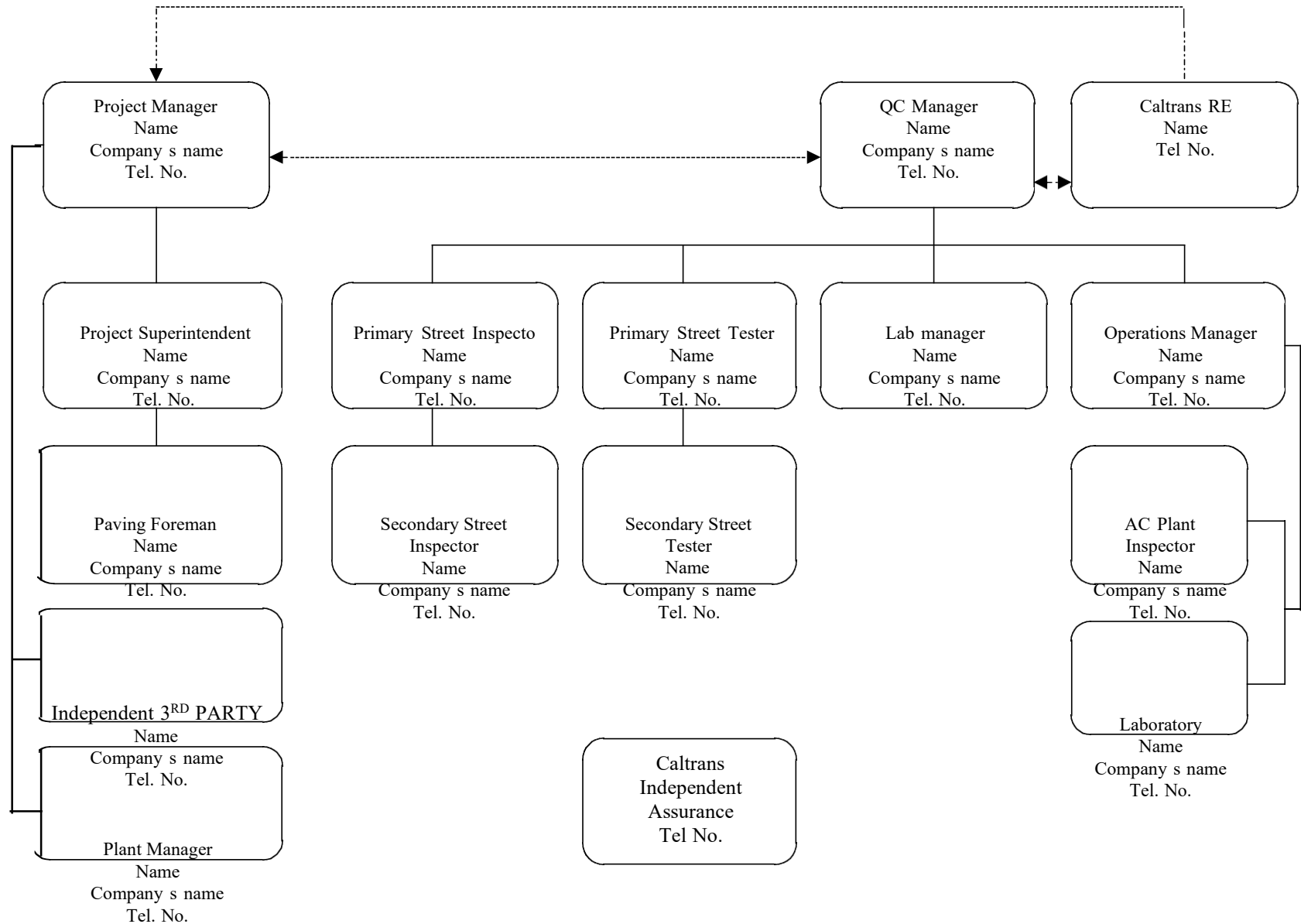
The Big Picture, FL - I



14 Calendar Days Prior to AC Production, FL — II

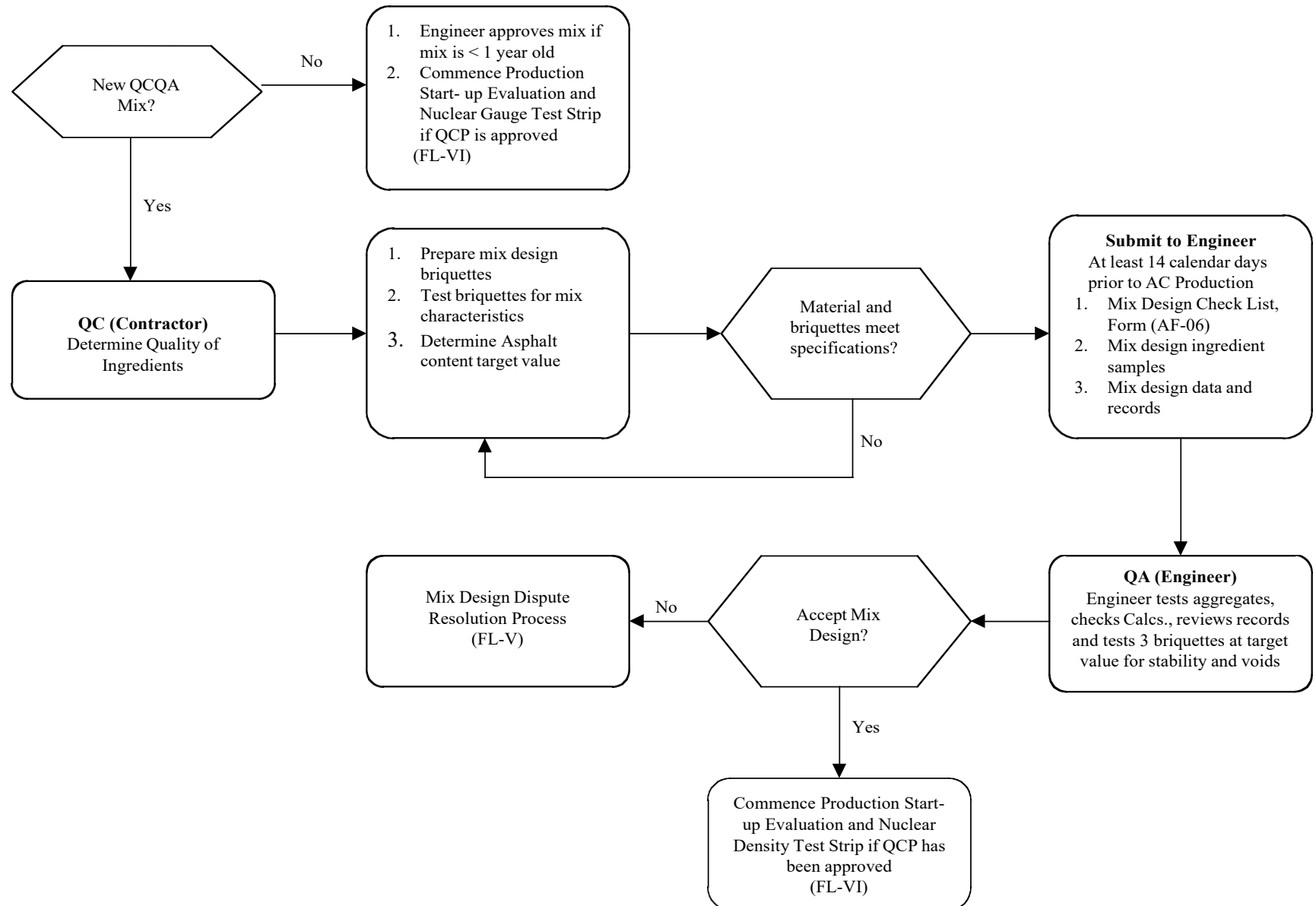


Sample Organization Chart, FL - III

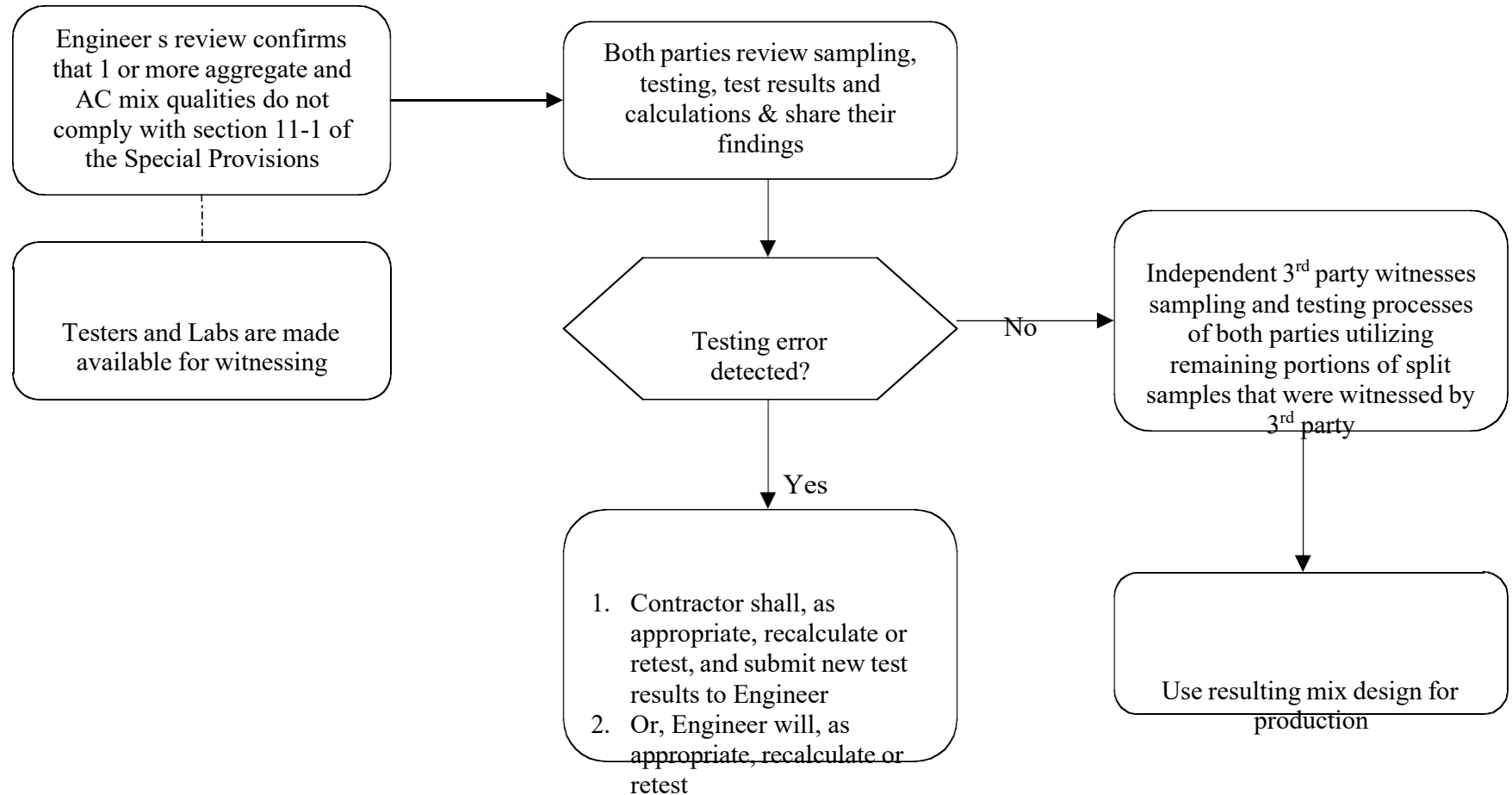


Differing Organization Structures May Require Different Charts

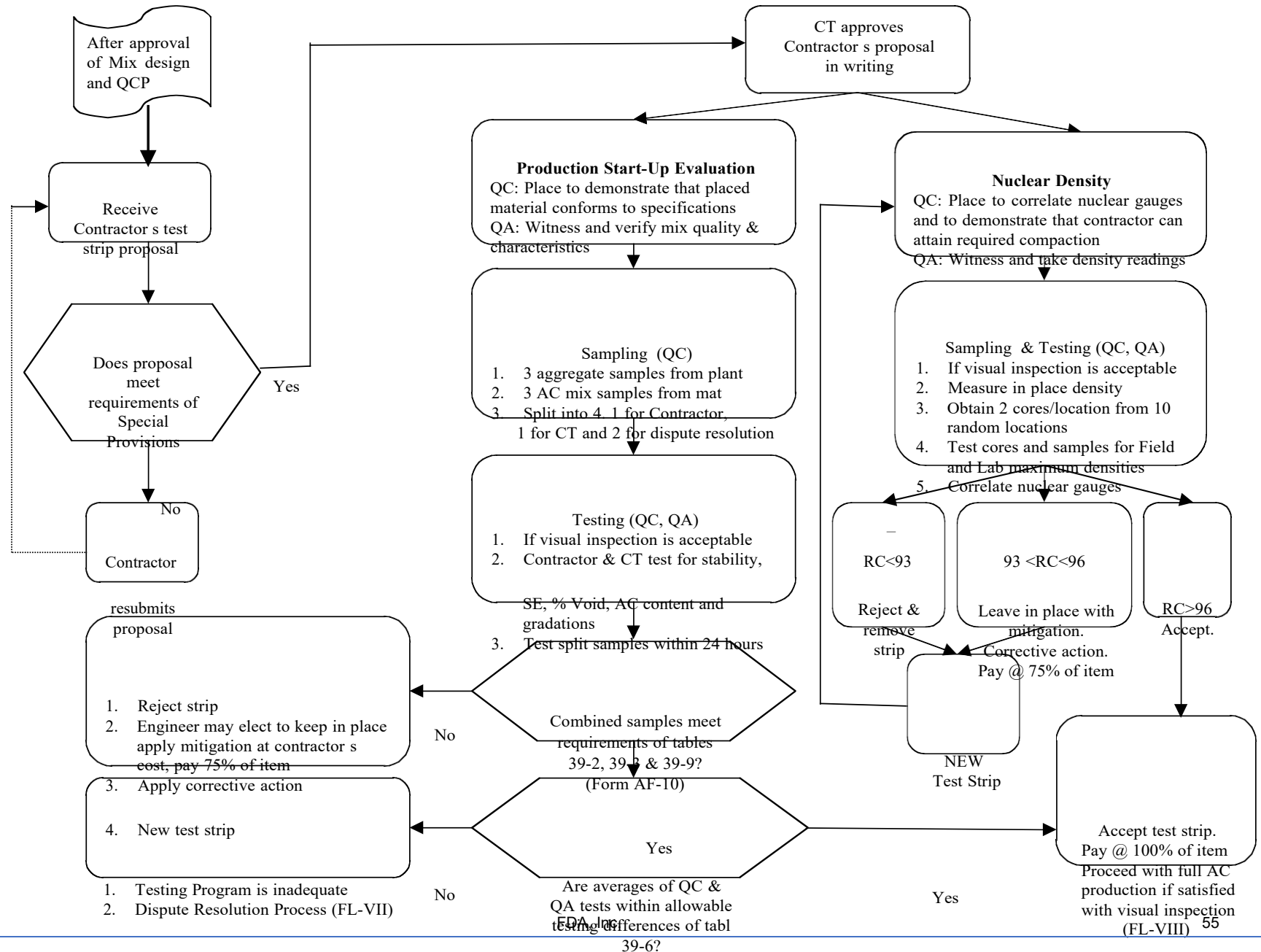
Mix Design Process, FL - IV



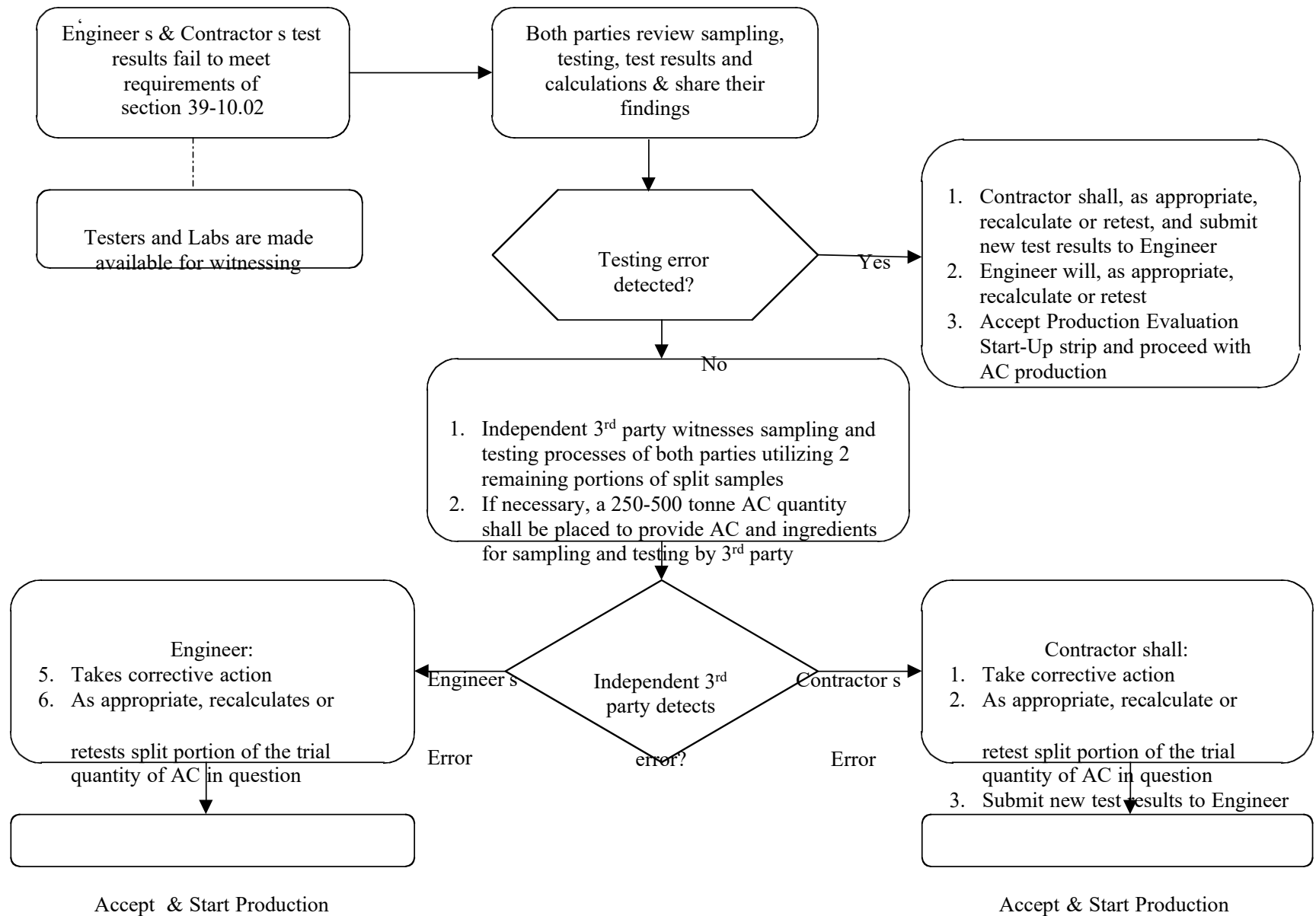
Dispute Resolution Process during Mix Design, FL -V



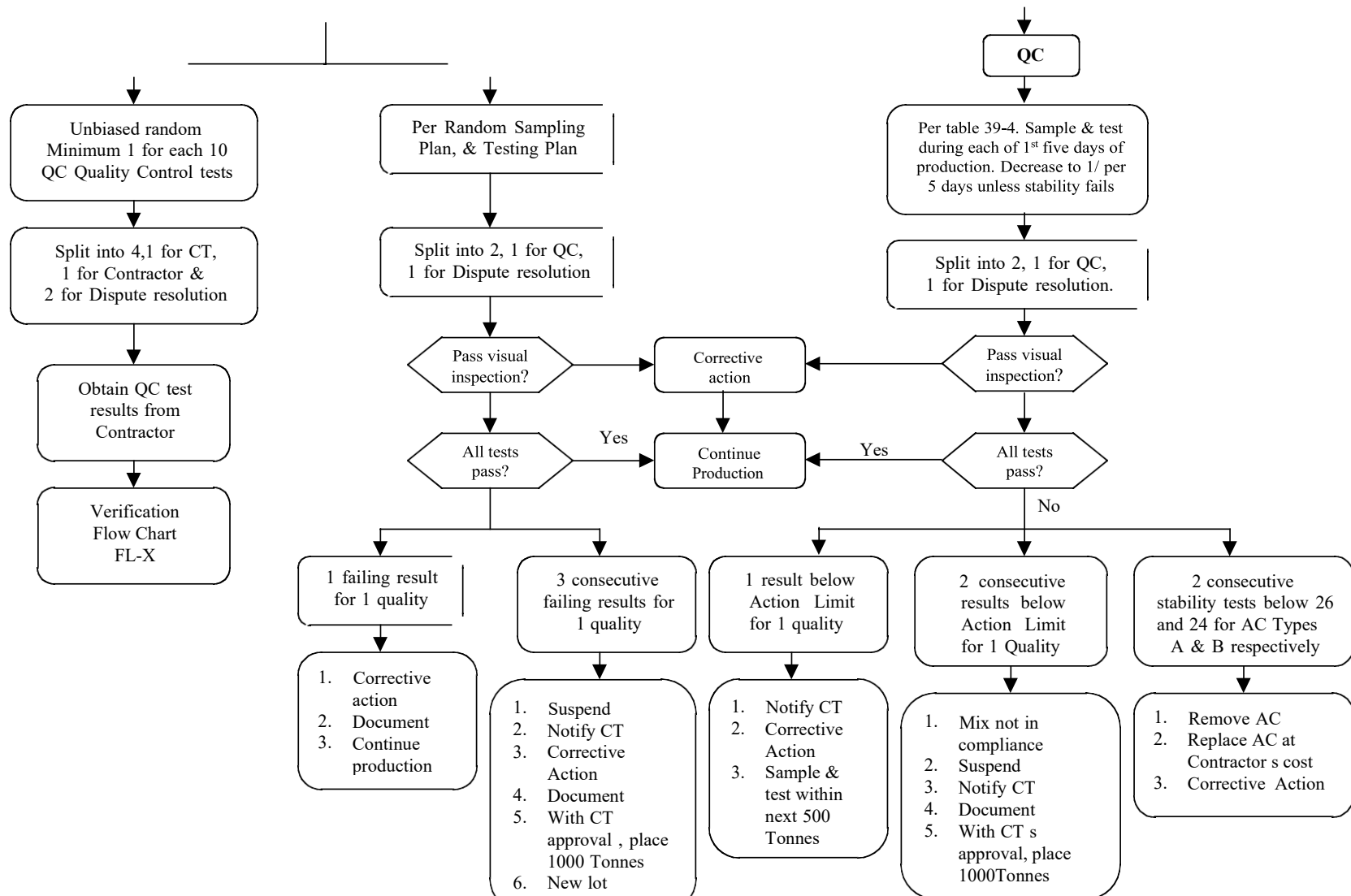
Production Evaluation Start Up & Nuclear Density Test Strip, FL-VI



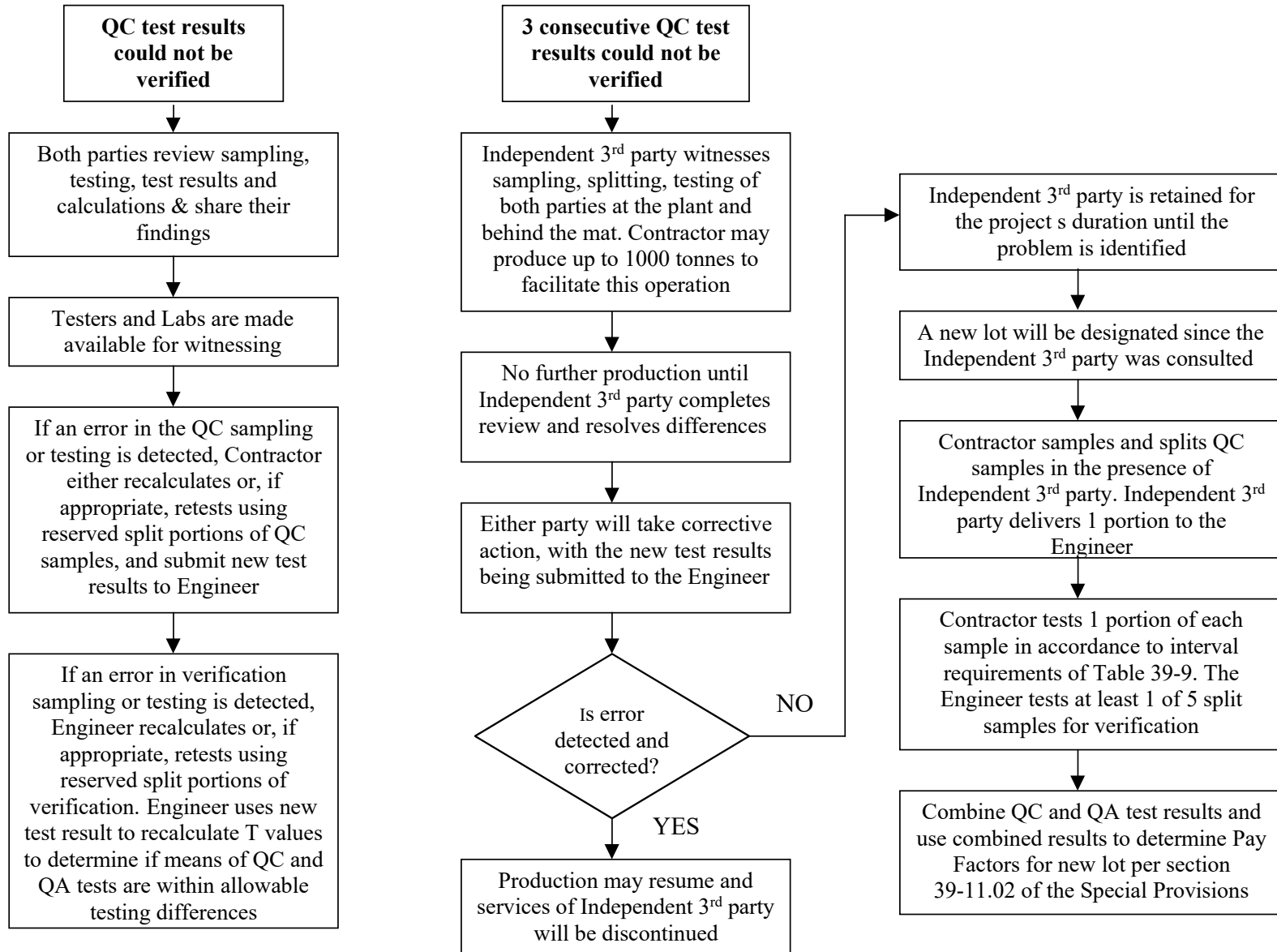
Dispute Resolution Process During Production Start-Up Evaluation, FL -VI



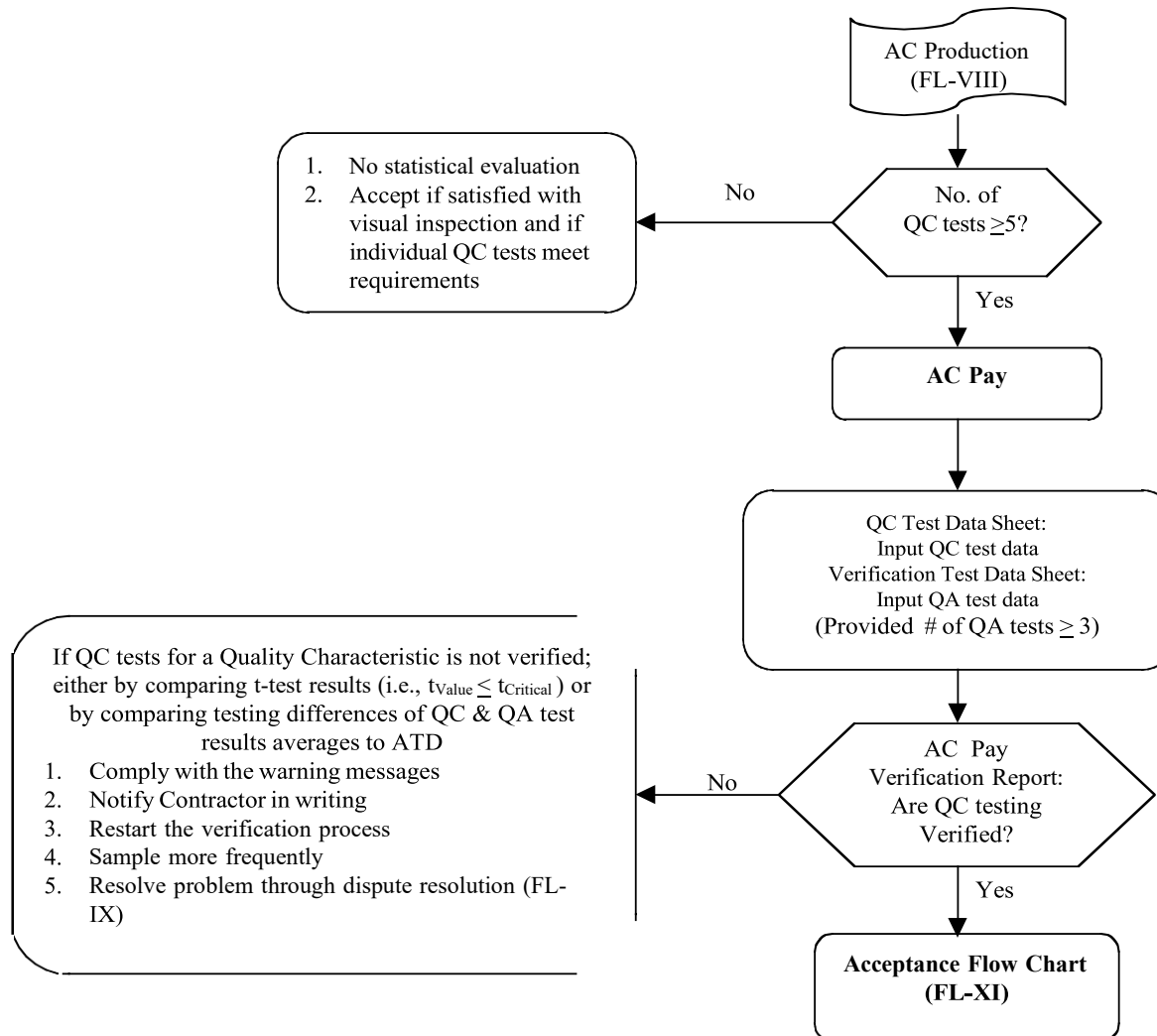
Sampling & Testing During Asphalt Concrete Production, FL - VIII



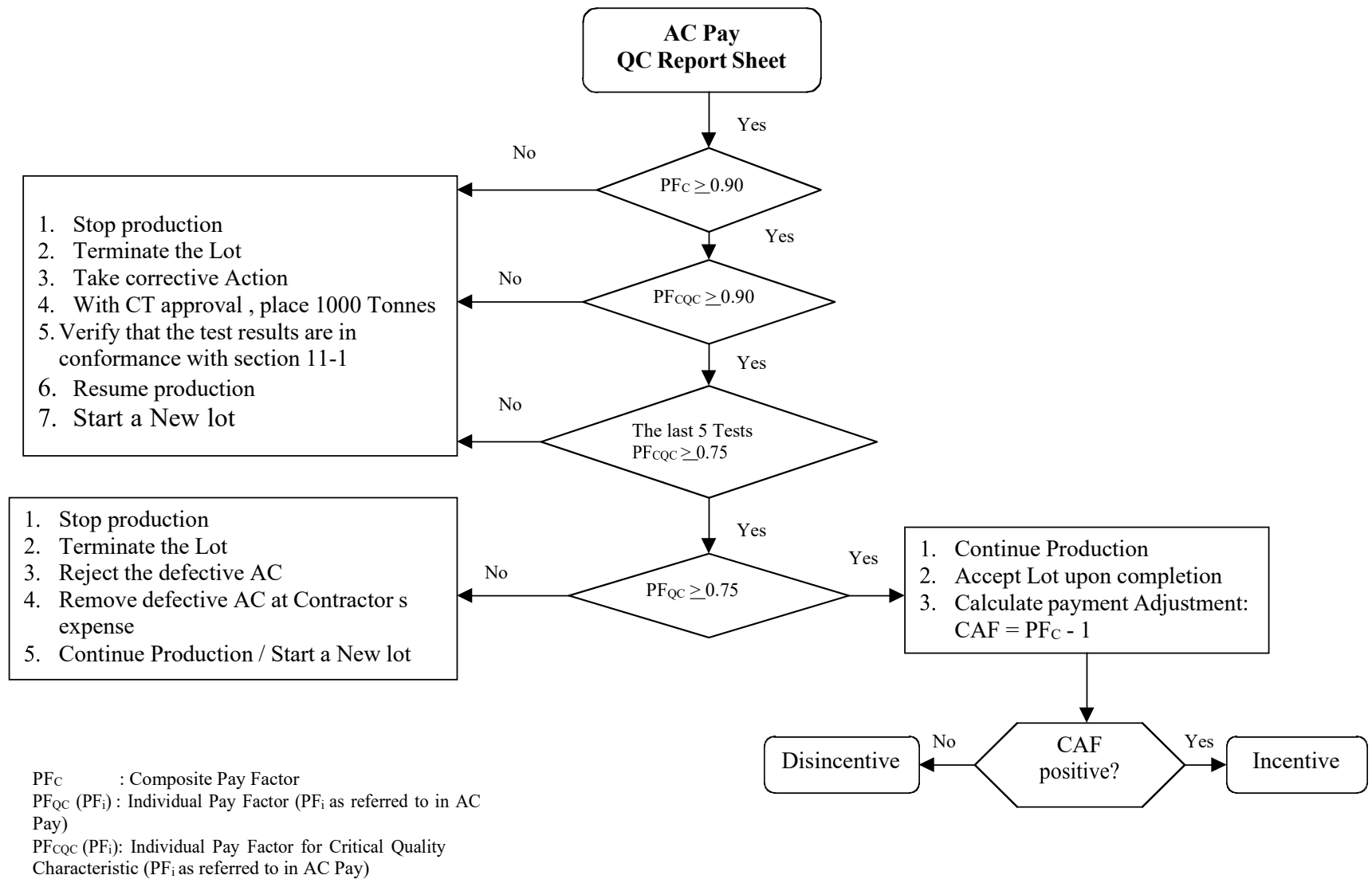
Dispute Resolution Process During Production, FL -IX



Verification, FL - X



Acceptance, FL-XI



IV-2 Forms

All sample forms and tables in this manual are required to be used by the Contractor for submittal of pertinent information and all quality control test results.

Forms included in the appendix.

AF-01	Request for Assignment of Inspectors, Samplers and Testers	Form
AS-01	Request for Assignment of Inspectors, Samplers and Testers	Filled, Sample Form
AF-02	Affidavit of Proficiency for Quality Control Inspector	Form
AS-02	Affidavit of Proficiency for Quality Control Inspector	Filled, Sample Form
AF-03	Employer Affidavit of Testing Proficiency & Request for Certification	Form
AS-03	Employer Affidavit of Testing Proficiency & Request for Certification	Filled, Sample Form
AF-04	Request for Initial Qualification, Requalification, or Expansion of Testing Capabilities of a Quality Control Laboratory	Form
AS-04	Request for Initial Qualification, Requalification, or Expansion of Testing Capabilities of a Quality Control Laboratory	Filled, Sample Form
AF-05	Inventory of Materials Testing Equipment	Form
AS-05	Inventory of Materials Testing Equipment	Filled, Sample Form
AF-06	QC/QA Mix Design Submittals Check List	Form
AS-06	QC/QA Mix Design Submittals Check List	Filled, Sample Form
AF-07	Asphalt concrete Construction Daily Record of Inspection - PLANT	Form
AS-07	Asphalt concrete Construction Daily Record of Inspection - PLANT	Filled, Sample Form
AF-08	Asphalt concrete Construction Daily Record of Inspection - STREET	Form
AS-08	Asphalt concrete Construction Daily Record of Inspection - STREET	Filled, Sample Form
AF-09	Daily Summary of Quality Control and Process Control Testing	Form
AS-09	Daily Summary of Quality Control and Process Control Testing	Filled, Sample Form
AF-10	Production Evaluation/Nuclear Gage Test Strip Results Summary	Form
AS-10	Production Evaluation/Nuclear Gage Test Strip Results Summary	Filled, Sample Form

Forms referred to in the text of this manual but not included in the appendix.

Certificates of Compliance	page 15
Quality Control Inspection Plan – Plant Operations	page 19
Quality Control Inspection Plan – Street Operations	page 20
Quality Control Sampling and Testing Plan	page 23
Process Control Sampling and Testing Plan	page 24
Quality Control Random Sample Plan	page 26
Caltrans Qualified Laboratory Inspection Report (Caltrans Form TL-0113)	page 27
Caltrans Certificate of Proficiency (Caltrans Form TL-0111)	page 28
Asphalt Concrete Production	page 32
Asphalt Concrete Placement	page 33
Asphalt Concrete Mix Design Information	page 37

REQUEST FOR ASSIGNMENT OF INSPECTORS, SAMPLERS, AND TESTERS (Form AF-01)

To: _____, Resident Engineer
Contract Number: _____
Co.-Rte.-kp: _____

Instructions: Check appropriate boxes: Inspector (Street and/or Plant), Sampler and/or Tester, and appropriate boxes for additional documents attached: Caltrans Form TL-0111 (Certificate of Proficiency), and/or Employer Affidavit of Testing Proficiency. Employer Affidavit of Testing Proficiency is required for all uncertified samplers and testers, and when requesting additional certifications for a previously certified sampler/tester.

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Position:

Request
Submitted by: _____ Date: _____
(Signature):

REQUEST FOR ASSIGNMENT OF INSPECTORS, SAMPLERS, AND TESTERS (Form AS-01)

To: Robert Smith, Resident Engineer
Contract Number: 03-66471T8
Co.-Rte.-kp: Sac — I10 — 19.6/38.4

Instructions: Check appropriate boxes: Inspector (Street and or Plant), Sampler and/or Tester, and appropriate boxes for additional documents attached: Caltrans Form TL-0111 (Certificate of Proficiency), and/or Employer Affidavit of Testing Proficiency. Employer Affidavit of Testing Proficiency is required for all uncertified samplers and testers, and when requesting additional certifications for a previously certified sampler/tester.

Name: Tom Jensen
Employer: U.S. Testing
Inspector: Street: ☒ Plant: ☒ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☒ Tester: ☒ Current TL-0111: ☒ Employer Affidavit of Testing Proficiency: ☒

Name: Frank Jefferson
Employer: U.S. Testing
Inspector: Street: ☒ Plant: ☒ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☒ Tester: ☒ Current TL-0111: ☒ Employer Affidavit of Testing Proficiency: ☒

Name: Andrea Thompson
Employer: U.S. Testing
Inspector: Street: ☒ Plant: ☒ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☒ Tester: ☒ Current TL-0111: ☒ Employer Affidavit of Testing Proficiency: ☒

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Name: _____
Employer: _____
Inspector: Street: ☐ Plant: ☐ If either box is checked, Inspector Affidavit shall be attached.
☐ ☐ ☐
Sampler: ☐ Tester: ☐ Current TL-0111: ☐ Employer Affidavit of Testing Proficiency: ☐

Printed name: James Roth
Position: QC Manager

AFFIDAVIT OF PROFICIENCY FOR QUALITY CONTROL INSPECTOR (Form AF-02)
(this form to be used for all quality control inspection personnel, plant and street)

To: _____, Resident Engineer
Contract Number: _____
Co.-Rte.-kp: _____

From: _____, QC Manager
Employer: _____

In accordance with the requirements of the Manual for Quality Control and Quality Assurance for Asphalt Concrete (QC/QA Manual), I am submitting for your approval, the following inspector qualification. I have reviewed this inspector's qualifications and am satisfied that this inspector meets or exceeds the requirements detailed in this contract. This inspector is fully aware of the required duties and responsibilities.

Name: _____
Employer: _____

Summary of AC Related Construction Inspection Experience. Be Specific. (attach full resume)

QC Manager: _____
(Signature)

Date: _____

AFFIDAVIT OF PROFICIENCY FOR QUALITY CONTROL INSPECTOR (Form AS-02)

(this form to be used for all quality control inspection personnel, plant and street)

To: Robert Smith, Resident Engineer
Contract Number: 03-6471T8
Co.-Rte.-kp: Sac — I10 — 19.6/38.4

From: James Roth, QC Manager
Employer: U.S. Testing

In accordance with the requirements of the Manual for Quality Control and Quality Assurance for Asphalt Concrete (QC/QA Manual), I am submitting for your approval, the following inspector qualification. I have reviewed this inspector's qualifications and am satisfied that this inspector meets or exceeds the requirements detailed in this contract. This inspector is fully aware of the required duties and responsibilities.

Name: Tom Jensen
Employer: U.S. Testing

Summary of AC Related Construction Inspection Experience. Be Specific. (attach full resume)

U.S. Highway 35, Castle Rock to Pleasant Rock, Los Angeles County, California

- Performed field testing on this 175,000 tonne, 36 mile Caltrans QC/QA asphalt paving project.

Interstate — 5 Overlay Paving, Stockton, California

- Performed field inspection for this 135,000 tonne Caltrans QC/QA asphalt paving project.

QC Manager: James Roth
(Signature)

Date: 7/14/01

(this form is necessary when requesting certification for a new tester or expanding the certifications of a previously certified tester)

Affidavit
Of Testing
Proficiency For: _____

EMPLOYER AFFIDAVIT OF TESTING PROFICIENCY & REQUEST FOR CERTIFICATION (Form AS-03)

(this form is necessary when requesting certification for a new tester or expanding the certifications of a previously certified tester)

To: Robert Smith, Resident Engineer-Copy to QC/QA Coord.
Address: 1234 Lake Road Date: 7/14/01

City: Sacramento State: CA Zip: 95555

Submitted by: James Roth

Company: U.S. Testing

Address: 5678 River Road

City: Stockton State: CA Zip: 96666

Phone No: 565-555-5555 Fax No: 666-777-7777 e-mail: jroth@ustesting.com

Affidavit
Of Testing
Proficiency For: Tom Jensen

I have reviewed and witnessed his or her testing procedures. I submit that this individual is proficient in the following Tests:

Test Method No.	Test Description
CT — 105	Calculations Pertaining to Gradings and Specific Gravities
CT — 125	Method for Sampling Highway Materials
CT — 201	Method of Soil and Aggregate Sample Preparation
CT — 202	Method of Test for Sieve Analysis
CT — 217	Method of Test for Sand Equivalent
CT — 226	Method for Determining Moisture Content by Drying Oven
CT — 370	Moisture Content of Asphalt Mixtures or Mineral Aggregate Using Microwave Ovens
CT — 375	In-Place Density and Relative Compaction of Asphalt Concrete
CT — 308	Test Bulk Specific Gravity and Density of Bituminous Mixtures
CT — 382	Asphalt Content of Bituminous Mixtures by Ignition Method

In accordance with the requirements of the Caltrans Independent Assurance Program Manual, I submit that the above named individual meets or exceeds the requirements and is prepared for California IA Certification. All required documents are attached (current certifications, training documents, and r sum s).

Submitted by: James Roth

(Signature)

Date: 7/14/01

(This form to be used only when requesting initial qualification for a quality control laboratory, requalification of a previously qualified quality control laboratory whose qualification has expired, or when expanding the testing capabilities of a currently qualified quality control laboratory. All quality control laboratories require qualification: main labs, field labs, mobile labs, mix design labs, sub-contract labs, and etc. When applicable, attach recent Caltrans Qualified Laboratory Inspection Report(s) (Caltrans form TL-0113)).

In accordance with the requirements of Caltrans Manual for Quality Control and Quality Assurance for Asphalt Concrete (QC/QA Manual) and the Caltrans Independent Assurance Program Manual (IAP), I am submitting the following laboratory information for your approval. I have reviewed the laboratory qualifications and find that this laboratory meets or exceeds the requirements detailed in this contract. This Laboratory is prepared for Caltrans Qualification.

List of tests (initial/recertification/expansion) to be performed at this facility.

[illegible]

FDA, Inc.

**REQUEST FOR INITIAL QUALIFICATION, REQUALIFICATION, OR EXPANSION OF TESTING
CAPABILITIES OF A QUALITY CONTROL LABORATORY (Form AS-04)**

(This form to be used only when requesting initial qualification for a quality control laboratory, requalification of a previously qualified quality control laboratory whose qualification has expired, or when expanding the testing capabilities of a currently qualified quality control laboratory. All quality control laboratories require qualification: main labs, field labs, mobile labs, mix design labs, sub-contract labs, and etc. When applicable, attach recent Caltrans Qualified Laboratory Inspection Report(s) (Caltrans form TL-0113)).

To: Robert Smith, Resident Engineer
Contract Number: 03-6471T8
Co.-Rte.-kp: Sac — I10 — 19.6/38.4
Contractor: American Paving
QC Manager: James Roth
Employer: U.S. Testing
Request for: New Laboratory Qualification: _____ Laboratory Requalification or Expansion: X

In accordance with the requirements of Caltrans Manual for Quality Control and Quality Assurance for Asphalt Concrete (QC/QA Manual) and the Caltrans Independent Assurance Program Manual (IAP), I am submitting the following laboratory information for your approval. I have reviewed the laboratory qualifications and find that this laboratory meets or exceeds the requirements detailed in this contract. This Laboratory is prepared for Caltrans Qualification.

Laboratory Name: U.S. Testing Lab
Address: 5678 River Road
City: Stockton State: CA Zip: 96666
Phone: 565-555-5555 Fax: 666-777-7777
Lab Manager: James Roth
Lab QC Manager: James Roth

List of tests (initial/recertification/expansion) to be performed at this facility.

Test number	Test Title	Test number	Test Title
<u>CT — 105</u>	<u>Grading and SG Calculations</u>	_____	_____
<u>CT — 125</u>	<u>Sampling Highway Materials</u>	_____	_____
<u>CT — 201</u>	<u>Sample Preparation</u>	_____	_____
<u>CT — 202</u>	<u>Sieve Analysis</u>	_____	_____
<u>CT — 217</u>	<u>Sand Equivalent</u>	_____	_____
<u>CT — 226</u>	<u>Moisture Content —Drying Over</u>	_____	_____
<u>CT — 370</u>	<u>Moisture Content - Microwave</u>	_____	_____
<u>CT — 375</u>	<u>Relative Compaction</u>	_____	_____
<u>CT — 308</u>	<u>BSG and Density of AC</u>	_____	_____
<u>CT — 382</u>	<u>AC Content by Ignition Method</u>	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Request submitted by:
Quality Control
Manager: James Roth Date: 7/14/01
(Signature): _____

INVENTORY OF MATERIALS TESTING EQUIPMENT (Form AF-05)

Laboratory: _____ **Updated:** _____

[illegible]

INVENTORY OF MATERIALS TESTING EQUIPMENT (Form AS-05)

Laboratory: U.S. Testing — Stockton Lab

Updated: 7/14/01

[illegible]

QC/QA MIX DESIGN SUBMITTALS CHECK LIST (Section 39-2) (Form AF-06)

Reviewed by the Resident Engineer and submitted to the District or Regional Laboratory at least two (2) weeks prior to production

Contract Number: _____ Asphalt Grade: _____
Date Submitted: _____ Mix Design #: _____
Mix Design by: _____ Mix Type: _____

AC Producer and plant location: _____

Cover Letter (clearly indicating Target Values (TV) for Gradation, % Asphalt Binder, and % Air Voids.)
AASHTO 209 proposed: contact the District QC/QA Coordinator for additional information & requirements
Certified Test Data, Test Reports, and supporting calculations (required for all mix design submittals)
Plots of combined aggregate showing the production tolerances
Plots of unit weight, stability, percent air voids versus asphalt content, and completed figures 1, 2, & 3 from CT 367

Target values submitted must agree with combined gradation values. Sieve analysis shall be per CT 202.

AGGREGATE GRADATION - 19mm Maximum

AGGREGATE GRADATION - 12.5mm Maximum

TV % Asphalt Binder

TV % Asphalt Binder

TV Sieve	Sieve size	Target Value Limits		TV Sieve
		Coarse	Medium	
	25mm	100	100	
	19mm	90-100	90-100	
	9.5mm	60-75	65-80	
	4.75mm	45-50	49-54	
	2.36mm	32-36	36-40	
	600µm	15-18	18-21	
	75µm	3-7	3-8	

Sieve size	Target Value Limits	
	Coarse	Medium
19mm		
12.5mm	100	100
9.5mm	95-100	95-100
4.75mm	75-90	80-95
2.36mm	55-61	59-66
600µm	40-45	43-49
75µm	20-25	22-27
	3-7	3-8

Aggregate Quality Requirements

Submittals	CTM	Type A	Type B
Coarse (Min)			
Fine (Min)	205	90%	25%
100 Rev. (Max)	205	70%	20%
500 Rev. (Max)	211	12%	-----
SE (Min)	211	45%	50%
	217	47	42
KcFactor (Max)	303	1.7	1.7
KfFactor (Max)	303	1.7	1.7
Spg, Coarse Agg*	206		
Spg, Fine Agg*	208		

AC Mix Requirements @ target values (stab/voids/swell)

Submittals, 3 @ TV	Average	CTM	Type A	Type B
Stab		366	37	35
%Voids				
Swell		305		
CV: 227	Min. coarse agg.			
Abrasion: 360	0.04g/cc max.			
Lime Ratio:	1.2% - 1.5%			
Other:				

* If greater than 0.2 difference in coarse and fine specific gravities adjust gradings

Source of Aggregates

Source of each aggregate to be used including producer, location, and California Mine ID No. (e.g. 91-01-0000)

Gradation and Percentage of each aggregate stockpile, cold feed bin, or hot bin to be used

Aggregate Samples (each)

60 kg coarse agg. 40 kg intermediate & fine agg. 5 kg filler 60 kg of RAP (if used)

Asphalt Binder

Asphalt binder source
Four (4) individual one (1) liter samples of the binder to be used in each proposed asphalt concrete mixture
Results of the asphalt binder quality tests as specified in Section 92 of the Standard Specifications

Additives, when applicable

A 5 kg sample of dry additive or a one (1) liter sample of liquid additive, name of product, manufacturer, manufacturer's numerical designation (if any), and proposed rate, location and method of addition

Material Safety Data Sheets

Material Safety Data Sheets (MSDS) for all products (i.e., aggregates, binder, additives, completed mix)

QC/QA MIX DESIGN SUBMITTALS CHECK LIST (Section 39-2) (Form AS-06)

Reviewed by the Resident Engineer and submitted to the District or Regional Laboratory at least two (2) weeks prior to production

Contract Number: 03-6471T8

Asphalt Grade AR 8000

Date Submitted: 7/17/01

Mix Design #: 463

Mix Design by: American Paving

Mix Type: 19-mm Max Med

AC Producer and plant location:

American Paving

4783 Mining Rd

Sacramento, CA

- ☒ Cover Letter (clearly indicating Target Values (TV) for Gradation, % Asphalt Binder, and % Air Voids.)
- ☒ AASHTO 209 proposed: contact the District QC/QA Coordinator for additional information & requirements
- ☒ Certified Test Data, Test Reports, and supporting calculations (required for all mix design submittals)
- ☒ Plots of combined aggregate showing the production tolerances
- ☒ Plots of unit weight, stability, percent air voids versus asphalt content, and completed figures 1, 2, & 3 from CT 367

Target values submitted must agree with combined gradation values. Sieve analysis shall be per CT 202.

AGGREGATE GRADATION - 19mm Maximum

AGGREGATE GRADATION - 12.5mm Maximum

4.3 TV % Asphalt Binder

TV % Asphalt Binder

TV Sieve	Sieve size	Target Value Limits		
		Coarse	Medium	TV Sieve
100	25mm	100	100	
97	19mm	90-100	90-100	
70	9.5mm	60-75	65-80	
50	4.75mm	45-50	49-54	
38	2.36mm	32-36	36-40	
20	600µm	15-18	18-21	
5	75µm	3-7	3-8	

Sieve size	Target Value Limits	
	Coarse	Medium
19mm	100	100
12.5mm	95-100	95-100
9.5mm	75-90	80-95
4.75mm	55-61	59-66
2.36mm	40-45	43-49
600µm	20-25	22-27
75µm	3-7	3-8

Aggregate Quality Requirements

AC Mix Requirements @ target values (stab/voids/swell)

Submittals

CTM Type A Type B

98	Coarse (Min)	205	90%	25%
91	Fine (Min)	205	70%	20%
6.3	100 Rev. (Max)	211	12%	----
24.6	500 Rev. (Max)	211	45%	50%
65	SE (Min)	217	47	42
1.4	KcFactor (Max)	303	1.7	1.7
1.2	KfFactor (Max)	303	1.7	1.7
	Spg, Coarse Agg*	206		
	Spg, Fine Agg*	208		

Submittals, 3 @ TV

40.1	41.7	42
3.8	4	4.2
0.002	0.004	0

Average CTM Type A Type B

41.2	366	37	35
4.2			
0.002	305		

%Voids

Swell

	CV:	227	Min. coarse agg.
	Abrasion:	360	0.04g/cc max.
	Lime Ratio:	1.2% - 1.5%	
	Other:		

* If greater than 0.2 difference in coarse and fine specific gravities adjust gradings

Source of Aggregates

- ☒ Source of each aggregate to be used including producer, location, and California Mine ID No. (e.g. 91-01-0000)
- ☒ Gradation and Percentage of each aggregate stockpile, cold feed bin, or hot bin to be used

Aggregate Samples (each)

- ☒ 60 kg coarse agg.
- ☒ 40 kg intermediate & fine agg.
- ☒ 5 kg filler
- ☐ 60 kg of RAP (if used)

Asphalt Binder

- ☒ Asphalt binder source
- ☒ Four (4) individual one (1) liter samples of the binder to be used in each proposed asphalt concrete mixture
- Results of the asphalt binder quality tests as specified in Section 92 of the Standard Specifications

Additives, when applicable

- ☒ A 5 kg sample of dry additive or a one (1) liter sample of liquid additive, name of product, manufacturer, manufacturer's numerical designation (if any), and proposed rate, location and method of addition

Material Safety Data Sheets

- ☒ Material Safety Data Sheets (MSDS) for all products (i.e., aggregates, binder, additives, completed mix)

ASPHALT CONCRETE CONSTRUCTION DAILY RECORD OF INSPECTION — PLANT (Form AF-07)

Contract Number: _____ Date: _____ Inspector: _____

Co.-Rte.-kpi: _____

Lot No.: _____ Sublot No.: _____ Total Tonnage Represented: _____

Begin time: _____ End time: _____ *Note: use 24 hr clock throughout form*

Weather — Clear _____ Partly Cloudy: _____ Cloudy: _____ Night: _____ Rain: _____ Breezy: _____ Windy: _____

TEMPERATURE	Begin Temp	Time	Temp	Time	Temp	Time	Temp	End Temp
Asphalt:								
Aggregate:								
Mix:								

Mix Design Number: _____ Approval Date: _____

Plant type: Batch: _____ Drum: _____ Sub category: _____

AGGREGATES (see QC/QA manual for further descriptions)

_____ Materials per spec _____ Aggregate storage _____ Supp. fine agg. dry/storage

PRIOR TO PRODUCTION (see QC/QA manual for further descriptions)

_____ Aggregate storage areas _____ Stockpile _____ CT 109
_____ Temperature indicator on drier _____ Supp. fine agg./baghouse _____ Dust collection
_____ Sampling devices _____ Asphalt storage _____ Plant spec. compliance

DURING PRODUCTION (see QC/QA manual for further descriptions)

_____ Plant records _____ Aggregate storage _____ Plant operation & spec.
_____ Cert. of Compliance for Asphalt _____ Review aggregate grading _____ Payment support records
_____ Aggregate temperature (record) _____ Mix temperature (record) _____ Dust collection
_____ Asphalt temperature (record) _____ Truck beds (diesel/tarps) _____ Asphalt ratio
_____ Silo-segregation/temp./level _____ Belts & feeders asphalt/agg. _____ Lime
_____ Mixing time _____ Screens _____ RAP
_____ Proportioning devices _____ Plant interlocks/shutdowns _____ Liquid Antistrip
_____ Sample asphalt/aggregates _____ Supp. fine agg. dry/storage _____
_____ Production rate per CT 109 _____ Homogeneous mix _____

Testing (reported separately)

_____ Sieve Analysis _____ % AC _____ LTMD _____ FTMD _____ S.E. _____ S Value _____ C.V.

Non-compliance: 1. _____ 2. _____

3. _____ 4. _____

Corrective Action(s): _____

Remedial Action(s): _____

Remarks: _____

Inspector: _____ Date: _____

Printed name Signature

Q.C. Manager _____ Date: _____

Printed name Signature

ASPHALT CONCRETE CONSTRUCTION DAILY RECORD OF INSPECTION — PLANT (Form AS-07)Contract Number: 03-6471T8 Date: 8/11/01 Inspector: Frank JeffersonCo.-Rte.-kp: Sac — I10 — 19.6/38.4Lot No.: 2 Sublot No.: 14-18 Total Tonnage Represented: 2600Begin time: 2117 End time: 0636 *Note: use 24 hr clock throughout form*Weather — Clear Partly Cloudy: Cloudy: Night: X Rain: Breezy: Windy:

TEMPERATURE	Begin Temp	Time	Temp	Time	Temp	Time	Temp	End Temp
Asphalt:	372	2336	327	0247	328	0418	327	327
Aggregate:	N/A	2336	N/A	0247	N/A	0418	N/A	N/A
Mix:	308	2336	312	0247	310	0418	314	312

Mix Design Number: 463 Approval Date: 7/21/01Plant type: Batch: Drum: X Sub category: _____

AGGREGATES (see QC/QA manual for further descriptions)

X Materials per spec X Aggregate storage X Supp. fine agg. dry/storage

PRIOR TO PRODUCTION (see QC/QA manual for further descriptions)

X Aggregate storage areas X Stockpile X CT 109X Temperature indicator on drier X Supp. fine agg./baghouse X Dust collectionX Sampling devices X Asphalt storage X Plant spec. compliance

DURING PRODUCTION (see QC/QA manual for further descriptions)

X Plant records X Aggregate storage X Plant operation & spec.X Cert. of Compliance for Asphalt X Review aggregate grading X Payment support recordsAggregate temperature (record) X Mix temperature (record) X Dust collectionAsphalt temperature (record) X Truck beds (diesel/tarps) X Asphalt ratioX Silo-segregation/temp./level X Belts & feeders asphalt/agg. LimeX Mixing time X Screens RAPX Proportioning devices X Plant interlocks/shutdowns Liquid AntistripX Sample asphalt/aggregates Supp. fine agg. dry/storageX Production rate per CT 109 X Homogeneous mix

Testing (reported separately)

X Sieve Analysis X % AC LTMD X FTMD X S.E. X S Value C.V.Non-compliance: 1. Old AC in Truck Bed 2. _____

3. _____ 4. _____

Corrective Action(s): Truck operator removed old AC

Remedial Action(s): _____

Remarks: _____

Inspector: Frank Jefferson Frank Jefferson Date: 8/11/01

Printed name Signature

Q.C. Manager James Roth James Roth Date: 8/11/01

Printed name Signature

ASPHALT CONCRETE CONSTRUCTION DAILY RECORD OF INSPECTION- STREET (Form AF-08)

Contract Number: _____ Date _____ Inspector: _____

Co.-Rte.-kp: _____

Location: _____ Stations: _____

Structural Section: _____ Lift Number: _____ Lift Thickness: _____

Begin time: _____ End time: _____ Note: use 24 hr clock throughout form

Weather — Clear _____ Partly Cloudy: _____ C _____ Night: _____ Rain: _____ Breezy: _____ Windy: _____

TEMPERATURE	Begin Temp	Time	Temp	Time	Temp	Time	Temp	End Temp
Ambient:								
Dump/Windrow:								
Breakdown:								
Finish:								

Mix Design Number: _____ Approval Date: _____

PRIOR TO PLACEMENT (see QC/QA manual for further descriptions)

_____ Review special provisions	_____ Subgrade preparation	_____ Manholes/valves marked
_____ Paving/Compaction equipment	_____ Tack/Prime Cert. of Comp	
_____ Tack/Prime spread rate	_____ Tack/Prime temperature	_____ Tack/Prime broken
_____ Paving fabric type	_____ Paving fabric Cert. of Comp.	_____ Paving fabric placement

DURING ASPHALT CONCRETE PLACEMENT (see QC/QA manual for further descriptions)

_____ Ambient air temp. (record)	_____ Delivery/dumping	_____ Windrow condition
_____ Pickup/capacity	_____ Dump/Windrow temp. (record)	_____ Paving width
_____ Lift thickness	_____ Spread rate vs. theoretical	_____ Completed mix samples
_____ Longitudinal joints offset	_____ Longitudinal joints smooth	_____ Transverse joints smooth
_____ Rolling pattern/process	_____ Breakdown temp. (record)	_____ Transitions/ending/steps
_____ Cold transverse joints in spec.	_____ Pavement smoothness	_____ Straight edge
_____ Miscellaneous areas	_____ Number of lifts	_____ Finish temperature (record)
_____ Visual — defective areas	_____ Visual - segregation	_____ Visual - deformities/appearance

Non-compliance: 1. _____ 2. _____

3. _____ 4. _____

Corrective Action(s): _____

Remedial Action(s): _____

Remarks: _____

Inspector: _____ Date: _____

Printed name _____ Signature _____

QC Manager: _____ Date: _____

Printed name _____ Signature _____

ASPHALT CONCRETE CONSTRUCTION DAILY RECORD OF INSPECTION — STREET(Form AS-08)

Contract Number: 03-6471T8 Date 8/11/01 Inspector: Tom Jensen

Co.-Rte.-kp: Sac — I10 — 19.6/38.4

Location: Northbound Lane 1 Stations: 185+00 190+00

Structural Section: _____ Lift Number: 1 Lift Thickness: 45-mm

Begin time: 2117 End time: 0640 Note: use 24 hr clock throughout form

Weather — Clear Partly Cloudy: _____ Cloudy: _____ Night: X Rain: _____ Breezy: _____ Windy: _____

TEMPERATURE	Begin Temp	Time	Temp	Time	Temp	Time	Temp	End Temp
Ambient:	76	2250	73	0136	72	0448	70	69
Dump/Windrow:	300	2250	300	0136	302	0448	307	297
Breakdown:	206	2250	210	0136	200	0448	214	223
Finish:	140	2250	135	0136	120	0448	115	115

Mix Design Number: 463

Approval Date: 7/21/01

PRIOR TO PLACEMENT (see QC/QA manual for further descriptions)

X Review special provisions X Subgrade preparation Manholes/valves marked
X Paving/Compaction equipment _____ Tack/Prime Cert. of Comp
X Tack/Prime spread rate _____ Tack/Prime temperature _____ Tack/Prime broken
_____ Paving fabric type _____ Paving fabric Cert. of Comp. _____ Paving fabric placement

DURING ASPHALT CONCRETE PLACEMENT (see QC/QA manual for further descriptions)

X Ambient air temp. (record) X Delivery/dumping X Windrow condition
X Pickup/capacity X Dump/Windrow temp. (record) X Paving width
X Lift thickness _____ Spread rate vs. theoretical X Completed mix samplesX
_____ Longitudinal joints offset X Longitudinal joints smooth X Transverse joints smooth
X Rolling pattern/process X Breakdown temp. (record) X Transitions/ending/steps
X Cold transverse joints in spec. X Pavement smoothness _____ Straight edge
_____ Miscellaneous areas X Number of lifts X Finish temperature (record)
_____ Visual — defective areas _____ Visual - segregation _____ Visual - deformities/appearance

Non-compliance: 1. Minor Bleeding in Mix 2. _____

3. _____ 4. _____

Corrective Action(s): Notified Hot Plant

Remedial Action(s): _____

Remarks: _____

Inspector: Frank Jefferson Frank Jefferson Date: 8/11/01

Printed name Signature

Q.C. Manager James Roth James Roth Date: 8/11/01

Printed name Signature

DAILY SUMMARY OF QUALITY CONTROL AND PROCESS CONTROL TESTING (Form AF-09)

This form shall be submitted with all daily testing reports. Use additional sheets as necessary.

To: _____, Resident Engineer
 Contract Number: _____ Sheet #: _____ of _____
 Co.-Rte.-kp: _____ AC Type: _____
 Mix Design #: _____ Contract Item No.: _____
 Sample Milestone: _____ Lot Number: _____

Note: Attach copies of all individual test worksheets. Indicate by circling, all test results that are not within the Target Values. Insure sub-lot numbers match test worksheets.

Test Title	Sub-lot numbers:		Test Result	Test Result	Test Result	Test Result	Test Result	Target Value & Spec. Limits	
	Test Number								
Asphalt Content:	CT 379	CT 382						-	-
Gradation:	CT 202	25 mm						-	-
(per gradation)	19 or 12.5 mm							-	-
	9.5 mm							-	-
	4.75 mm							-	-
	2.36 mm							-	-
	600 m							-	-
(report to the tenth)	75 m							-	-
Relative Compaction:	CT 375							≥ 96%	
Test Maximum Density:	CT 375							NA	
Mix Moisture Content:	CT 370							≤ 1%	
Air Voids:	CT 367							-	-
Swell:	CT 305							≤ 0.76	
Sand Equivalent:	CT 217							A-47	B-42
S Value:	CT 366							A-37	B-35

"It is hereby certified that the information contained in this record is accurate, and that all tests and calculations documented herein comply with the requirements of the contract and the standards set forth in the testing procedures. Any exceptions to this certification are documented as a part of this record."

Q.C. Manager: {Sign} _____ Date: _____
 {Print} _____

DAILY SUMMARY OF QUALITY CONTROL AND PROCESS CONTROL TESTING (Form AS-09)

This form shall be submitted with all daily testing reports. Use additional sheets as necessary.

To: Robert Smith, Resident Engineer

Contract Number: 03-6471T8 Sheet #: 1 of 1

Co.-Rte.-kp: Sac — I10 — 19.6/38.4 AC Type: 19mm Max/Med AR 8000

Mix Design #: 463 Contract Item No.: 47

Sample Milestone:

261	876	1285	1908	2290
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 Lot Number: 14-18

Note: Attach copies of all individual test worksheets. Indicate by circling, all test results that are not within the Target Values. Insure sub-lot numbers match test worksheets.

	Sub-lot numbers:		2-14	2-15	2-16	2-17	2-18			
Test Title	Test Number		Test Result	Test Result	Test Result	Test Result	Test Result	Target Value & Spec. Limits		
Asphalt Content:	CT 379	CT 382	4.2	4.3	4.3	4.4	4.3	3.8-	4.3	-4.8
Gradation:	CT 202	25 mm	100	100	100	100	100	100-	100	-100
(per gradation)	19 or 12.5 mm		98	98	98	98	97	95-	97	-100
	9.5 mm		70	70	71	69	70	65-	70	-80
	4.75 mm		49	49	49	49	49	45-	50	-55
	2.36 mm		37	37	36	37	37	33-	38	-43
	600 m		20	21	21	22	21	15-	20	-25
(report to the tenth)	75 m		5.4	5.3	5.2	5.2	5.3	3-	5.0	-8
Relative Compaction:	CT 375		98.3	98.3	98.0	97.3	98.3	≥ 96%		
Test Maximum Density:	CT 375		2.45					NA		
Mix Moisture Content:	CT 370		0	0	0.02	0.01	0	≤ 1%		
Air Voids:	CT 367							-		-
Swell:	CT 305							≤ 0.76		
Sand Equivalent:	CT 217			69				A-47	B-42	
S Value:	CT 366					46		A-37	B-35	

"It is hereby certified that the information contained in this record is accurate, and that all tests and calculations documented herein comply with the requirements of the contract and the standards set forth in the testing procedures. Any exceptions to this certification are documented as a part of this record."

Q.C. Manager: {Sign} James Roth Date: 8/11/01

{Print} James Roth

PRODUCTION EVALUATION/NUCLEAR GAGE TEST STRIP RESULTS SUMMARY (Form AF-10)

Contract Number: _____

Prod/Test Strip Date: _____

Resident Engineer: _____

Mix Design Number: _____

QC/QA Manager: _____

Evaluation Date: _____

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Quality Characteristic	QC 1	QC 2	QC 3	QA 1	QA 2	QA 3	Spec. Limit TV – tolerance (From Approved Mix design or specification)	Total Passing Results (QC + QA)	Min. Passing Requirements. for Combined Results	Is Column J True / False	Average of the 3 QC Tests	Average of the 3 QA Tests	Allow Testing Difference (Per Table 39-6)	Is Absolute value of Cols. L-M ≤ Col. N, True / False	Are entries in columns K & O True, Yes / No
2	Sand Equiv.									5 of 6				≤ 8		
3	Stability									5 of 6				≤ 10		
4	% Voids									5 of 6				≤ 1.5		
5	AC Content									5 of 6				≤ 0.3%		
6	19 or 12 mm									3 of 6				≤ 2		
7	9.5 mm									3 of 6				≤ 4		
8	4.75 mm									3 of 6				≤ 3		
9	2.36 mm									3 of 6				≤ 2		
10	600 m									5 of 6				≤ 2		
11	75 m									5 of 6				≤ 1.0		
12	RC									2 of 2						

If all entries in column P is Yes the Contractor can proceed to production.

If all entries in column O are True, the testing program is adequate, if any entry is False go to dispute resolution.

If any entry in rows 1-11 of column K is False a new production start-up evaluation strip is required.

If the entry in row 12 of column K is False a new nuclear density test strip is required.