

CALIFORNIA DEPARTMENT OF TRANSPORTATION



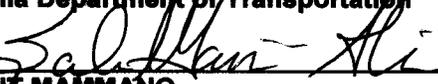
# Quality Assurance Program (QAP) Manual for Use by Local Agencies

This manual provides quality assurance guidelines for materials used in Federal-aid projects off the State Highway System.

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Note: Quality Assurance Programs should be reviewed and updated every five years or more frequently.

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# Quality Assurance Program (QAP) Manual for Use by Local Agencies

## 1.0 INTRODUCTION

A Quality Assurance Program (QAP) consists of an Acceptance Program and an Independent Assurance (IA) Program that will provide assurance that the materials and workmanship incorporated into a construction project are in conformance with the contract specifications. A QAP should be updated as needed, and at least once every five years.

When transportation projects are constructed on the National Highway System (NHS), it is required by federal regulations that each State Transportation Department (STD) has a QAP that meets federal requirements.

There are no federal QAP regulations for local agency administered Federal-aid projects off the NHS. However, to ensure that a local agency is a good steward of public funds and to ensure that the materials and workmanship incorporated in a construction project are in conformance with the contract specifications, the use of a QAP is essential. Consequently, Caltrans has included the requirement in the Local Assistance Procedures Manual that every local agency receiving funds for a Federal-aid transportation project must have a QAP. This manual provides guidelines that local agencies can use to develop a QAP for all Federal-aid projects off the State Highway System (SHS) which would include agency transportation projects off the NHS and the essential connecting roads on the NHS that are off the SHS.

## 2.0 STATE AND LOCAL AGENCY PROJECTS ON THE NHS

When local agencies need assistance concerning Federal-aid projects on the SHS, they are encouraged to contact their Caltrans District Local Assistance Engineer (DLAE) for guidance.

### 2.1 THE NATIONAL HIGHWAY SYSTEM (NHS)

In California, the NHS consists of approximately 7,500 miles of roadways on the SHS, all roadways on the Interstate System, and **324** miles of essential connecting (city or county) roads off the SHS. For the locations of California roadways on the NHS, refer to the following website:

<http://www.fhwa.dot.gov/planning/nhs/index.html>

### 2.2 CODE OF FEDERAL REGULATIONS TITLE 23, PART 637 FOR PROJECTS ON THE NHS

The Code of Federal Regulations (Title 23, Section 637.205), defines the general policy for quality assurance programs on the NHS. It reads:



*“Each State Transportation Department (STD) shall develop a quality assurance program which will assure that the materials and workmanship incorporated into each Federal-aid highway construction project on the NHS are in conformity with the requirements of the approved plans and specifications, including approved changes.”*

Appendix A contains the entire text of Part 637, including the “Guide Letter of Certification by State Engineer” required for transportation projects on the NHS.

## **2.3 QAP REQUIREMENTS FOR PROJECTS ON THE SHS**

In California, the STD (Caltrans) has determined that California test (CT) methods will be used to meet the QAP requirements.

### **2.3.1 QAP DOCUMENTS**

These QAP documents are to be used:

- The California Department of Transportation (Caltrans) Construction Manual
- The Caltrans Independent Assurance (IA) Manual

The Caltrans Construction Manual provides the frequency of acceptance testing and outlines the acceptance testing program. The Caltrans IA Manual details the Caltrans Independent Assurance program to be followed that has been approved by FHWA.

These manuals are available at the following websites:

[http://www.dot.ca.gov/hq/construc/manual2001/chapter6/chp6\\_1.pdf](http://www.dot.ca.gov/hq/construc/manual2001/chapter6/chp6_1.pdf)

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

### **2.3.2 PLANS AND SPECIFICATIONS**

Caltrans and local agency projects on the SHS are required to use Caltrans approved plans and specifications.

### **2.3.3 TEST METHODS**

On Caltrans and local agency projects on the SHS, CT methods are required to be followed. All CT methods are available at the following website:

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

## **2.4 TRANSPORTATION PROJECTS ON THE NHS, BUT OFF THE SHS**

### **2.4.1 QAP DOCUMENTS**

For projects on the NHS but off the SHS, federal requirements mandate a QAP. The local agency may adopt the information contained in this manual for their QAP as outlined in Section 3, or follow the Caltrans QAP documents outlined in Section 2.3. The QAP in Section 3 consists of:

- An acceptance testing program
- An independent assurance program

An example of a simple QAP that can be used by a local agency is shown in Appendix Y.



## **2.4.2 PLANS AND SPECIFICATIONS**

For local agencies with Federal-aid projects on the NHS, but off the SHS, approved plans and specifications shall be one of the following:

- Plans and specifications based upon a nationally-recognized standard (i.e., AASHTO, ASTM, etc.)
- Caltrans Standard Plans and Specifications
- Greenbook Standard Plans and Specifications

## **2.4.3 TEST METHODS**

To receive Federal-aid funding for local agency administered projects off the SHS but on the NHS, local agencies are required to use test methods based upon a national standard or CT methods. Examples of national standards include:

- American Society for Testing and Materials (ASTM)
- American Association of State Highway and Transportation Officials (AASHTO)

It is beneficial if local agencies decide which testing standards are best suited for transportation projects in their geographical area. Local agencies should consider selecting the testing standards predominantly used by the professional groups in their geographical area. A list of testing standards is located in Appendix C.

## **2.5 CALTRANS INDEPENDENT ASSURANCE PROGRAM**

Per the Caltrans IA Manual, IA services are provided by Caltrans IA staff for all locally-administered projects on the NHS or SHS, when CT methods are used. It should be noted that Caltrans will not perform IA services for these projects when ASTM or AASHTO standards are used to test the construction materials. When CT methods are used for local agency administered projects on the SHS or NHS, typical IA services performed by Caltrans include:

- Qualifying samplers and testers
- Accrediting laboratories
- Providing equipment calibration verification



### 3.0 LOCAL AGENCY TRANSPORTATION PROJECTS OFF THE NHS

For local agency Federal-aid transportation projects off the NHS, a QAP is required by the Caltrans Local Assistance Procedures Manual and is recommended by FHWA. The local agency has flexibility on how to develop and implement their QAP. It is recommended that ASTM standards, AASHTO standards, the Greenbook and/or Caltrans standards be used for the local agency's QAP.

#### 3.1 DEVELOPING A QAP USING CT METHODS

- Caltrans QAP – Local agencies may use the Caltrans QAP documents outlined previously in Section 2.3.
- QAP Developed by the Local Agency – Chapter 16 of the Local Assistance Procedures Manual and this manual provide QAP guidelines using CT methods that will assist local agencies in developing a QAP for projects off the NHS. An example of a simple QAP that can be used by a local agency is shown in Appendix Y.
- ~~When local agencies use CT methods, and construct one or more projects on the SHS or NHS each year, Caltrans is required to provide IA services for those local agency projects. After the samplers and testers are qualified and laboratories are accredited by Caltrans, they can then be used on other local agency projects while the accreditation and qualifications are still valid.~~
- ***When local agencies use CT methods on a Federal-aid project, Caltrans can provide IA services (certification of samplers, testers and laboratories) for that Federal-aid project.***
- If the local agency does not have a current ***Federal-aid or State funded project, or project on the SHS or NHS, or does not use CT methods, then*** the local agency must make its own arrangements for IA services.

#### 3.2 RECOMMENDED GUIDELINES FOR DEVELOPING A QAP

For local agencies that do not use the Caltrans QAP documents outlined previously in Section 2.3, it is recommended that they develop their own QAP that includes as a minimum:

- **Acceptance Testing** - sampling and testing to determine the degree of compliance with contract requirements. This includes:
  - a) Testing Frequency Tables – construction sampling and acceptance testing should be outlined in a frequency table. An example of a frequency table is shown in Appendix D.
  - b) Qualifying testing laboratories and acceptance samplers and testers through an independent assurance program.
  - c) A testing laboratory tied to a nationally known proficiency (or correlation) testing program or the Caltrans Reference Sample Program. Proficiency testing programs are explained in Appendix B.
  - d) Thorough acceptance testing documentation. This is explained in detail in Section 4. “Maintaining Acceptance Testing Records and Materials Documentation.”



- **Independent Assurance Program** – procedures to verify that acceptance testing is being performed correctly by qualified testers and laboratories. These include, but are not limited to:
  - a) Verifying that equipment used for acceptance testing is properly calibrated and in good working condition. Records of equipment calibrations should be kept with the equipment.
  - b) Witnessing sampling and testing by the acceptance tester.
  - c) Performing corroboration testing between the acceptance tester and independent assurance personnel.
  - d) A written procedure for dispute resolution.

Section 5, “Developing an Independent Assurance Program” provides further guidelines and recommendations in developing a local agency IA program.

- **Testing of Manufactured materials** - procedures for inspecting, accepting and testing manufactured and prefabricated materials either by source inspection, job inspection, or certificate of compliance.
- **QAP approval** - The QAP shall be approved by the Public Works Director. A non-registered Public Works Director must delegate the approval to a staff engineer if such individual is appropriately registered. If no registered staff engineer is available, the delegation can be made to a registered consultant engineer retained by the agency. Copies of the QAP shall be kept on file for review; one copy shall be submitted to the Caltrans District Local Assistance Engineer.

#### **4.0 MAINTAINING ACCEPTANCE TESTING RECORDS AND MATERIALS DOCUMENTATION**

Local agencies shall maintain accurate acceptance testing records during the construction of their Federal-aid projects. It is the responsibility of the Resident Engineer to keep all acceptance testing records current. After the completion of each transportation project, all materials records should be stored at a convenient location, with easy access, for a minimum of three years after final project voucher.

To assist the Resident Engineer, a check list of acceptance sampling and testing items is shown in Appendix E. During an FHWA or Caltrans process review, the Resident Engineer is usually asked to present the following items:

- Local Agency Quality Assurance Program
- A log summary of acceptance tests (Appendix H)
- Individual acceptance test records (Appendix G)
- Certificates of Compliance (Appendix J.1, J.2)
- Documentation of Qualified Testing Personnel and Testing Laboratories
- Materials Certification signed at the completion of the project (Appendix K)

See Appendix F for a list of the construction materials accepted by a Certificate of Compliance. Appendices G, H, J.1, J.2 and K are examples of acceptance testing records that should be maintained by the Resident Engineer.



#### **4.1 ACCEPTANCE TESTING DOCUMENTATION FOR LOCAL AGENCIES WITHOUT MATERIALS TESTING LABORATORIES**

Many local agencies cannot justify the cost of having a fully functional materials testing laboratory to perform their acceptance tests. In these cases, a local agency's only option is to "contract-out" all sampling and testing services. These types of activities are usually contracted to a consultant within the geographical area. Some consultant laboratories may already be qualified by Caltrans or other professional organizations (i.e., AASHTO, Asphalt Institute, American Concrete Institute, National Institute of Certification of Engineering Technologies, etc.). Whenever possible, consultant laboratories with these types of qualifications should be considered.

Throughout the construction of a project, it is important that a local agency employee frequently check with the consultant to ensure that all elements of the required acceptance sampling and testing are being performed. All test records for specification compliance should be accurately compiled using examples in this manual and they should be regularly presented to a local agency employee for review and acceptance.

Prior to construction, a representative from the local agency should present the consultant with a copy of the local agency's approved QAP. It is the responsibility of the consultant to forward all test records (and final documents) to the Resident Engineer each day and to the local agency within one week of completing testing.

Should a local agency need to confirm the certifications and/or qualifications of their consultant's samplers, testers, and/or laboratory; or to verify the accuracy of the consultant's test results, the local agency should use a second qualified consultant with different IA services to ensure there is no conflict of interest and that the sampling, testing, and laboratory equipment are truly independent. Differences between the construction contractor's test results and the local agency consultant's test results of the same materials, if significant, can also require sampling, and laboratory testing by a third independent qualified material's consultant.

#### **4.2 ACCEPTANCE TESTING DOCUMENTATION FOR LOCAL AGENCIES WITH MATERIALS TESTING LABORATORIES**

Local agencies that perform acceptance testing using their own facilities and trained staff should perform the sampling and testing per an approved QAP. The acceptance samplers and testers should also use documentation similar to that shown in Appendices G, H, J.1, J.2 and K. Personnel may not have dual roles; namely, being an acceptance sampler and tester and concurrently performing IA duties. This is a conflict of interest and is not allowed.

### **5.0 DEVELOPING AN INDEPENDENT ASSURANCE (IA) PROGRAM**

When local agencies have Federal-aid projects off the NHS they may choose to:

- Hire an outside qualified consultant to perform IA services, or
- Have a qualified employee from within the local agency to perform IA services, or
- ***Request Caltrans provide IA services if California Test Methods are used.***

~~Note: Using Caltrans IA services is currently not an option for local agencies with Federal-aid projects off the NHS even if the local agency's QAP uses CT methods.~~

When local agencies hire a consultant to perform the acceptance sampling and testing, they may choose to:

- Perform IA services using a qualified person from within the agency, or
- Hire a second consultant from another firm to perform IA services, or
- ***Request Caltrans provide IA services for the consultant if California Test Methods are used.***

A check list of IA items is presented in Appendix L to help the local agency monitor all the required IA activities.

Prior to performing any acceptance tests on a local agency project, IA personnel should ensure laboratories are accredited and acceptance samplers and testers are qualified. This generally includes verifying test equipment, checking for current calibration stickers, reviewing the testing laboratory's Quality Control Manual, issuing written examinations to qualify samplers and testers, and issuing Certificates of Proficiencies.

## **5.1 QUALIFICATIONS FOR THE LOCAL AGENCY'S IA PERSON**

Local agencies should ensure their IA person is qualified to verify equipment calibration, perform witness tests, perform proficiency tests, issue sampler and tester qualification certificates, issue laboratory accreditation and prepare accurate records associated with all IA services. This person can be a consultant or an employee from within the local agency.

Suggested minimum qualifications for the IA person are noted below:

- The consultant (or local agency employee) should have at least three years of experience in materials testing and/or construction.
- When non-CT methods are used, the consultant (or local agency) laboratory that will be used for IA activities should regularly perform proficiency tests with AMRL and/or CCRL, or the laboratory and tester to be used should be demonstrating proficiency by splitting samples with a laboratory that is certified by AMRL and/or CCRL.
- When CT methods are used, the consultant or local agency laboratory that performs IA services for the local agency should perform proficiency tests with a laboratory that is accredited by Caltrans.
- Caltrans Reference Sample Program (RSP) or the laboratory and tester to be used should be demonstrating proficiency by splitting samples with a laboratory that is certified by Caltrans. See Appendix P.
- The consultant (or local agency employee) should maintain accurate IA records, as outlined in the local agency's approved QAP. The IA person selected by the local agency should have a good knowledge of all facets of the construction process. Specifically, the IA person should have a good understanding of transportation construction practices, standard test procedures, equipment calibration and materials testing. The IA person should be organized and familiar with the local agency's approved QAP. When an IA person is selected by the local agency, the local agency should prepare a letter, stating that the local agency has approved this person to perform their IA services. See Appendix M.

## **5.2 PROFICIENCY TESTING (BY THE IA PERSON)**

It is suggested that the IA person work in a laboratory that performs annual proficiency tests using AMRL, CCRL and/or CT methods. Proficiency tests are also called



corroboration tests, round-robin tests and split-sample tests. For local agencies that use ASTM and AASHTO standards, the qualified laboratory should be accredited by AASHTO and perform annual proficiency tests with AMRL and/or CCRL. For local agencies that use CT methods on their projects, annual proficiency tests should be performed with the Caltrans Reference Sample Program.

If the IA person is not working through an AMRL, CCRL or a Caltrans accredited laboratory; at a minimum, the following tests should be performed by the IA person with the accredited laboratory:

- Sieve Analysis
- Sand Equivalent
- Cleanness Value

When an IA person working from an unaccredited laboratory performs proficiency tests with a tester from an accredited laboratory, material samples for proficiency tests should be prepared by the accredited laboratory. The IA person should perform the material tests, using IA person's own equipment, and forward the test results to the accredited laboratory for evaluation. See Appendix N for a corroboration chart used to determine acceptable comparisons between an IA person and a tester from an accredited laboratory. The IA person must receive acceptable test results on each test performed (i.e., "Good" or "Fair" rating for each test performed) to be eligible as an IA person. An example of acceptable round-robin testing between a tester from an accredited laboratory and an IA person is shown in Appendix P.

## **5.3 IA PERSONNEL RESTRICTIONS**

### **5.3.1 TESTER TRAINING AND TESTER CERTIFICATION SHOULD BE PERFORMED BY DIFFERENT IA STAFF**

To avoid a conflict of interest, the local agency IA person should not train acceptance testers and also qualify them for the same tests. For example, the IA person should not teach acceptance testers how to calibrate testing equipment and then verify that the testing equipment is properly calibrated. The training activities should be conducted by a different person.

However, it is totally acceptable for an IA person from another agency to train the acceptance samplers and testers for your agency. If a local agency does not have adequate staff to train acceptance samplers and testers, excellent training personnel are usually available in the private sector. (i.e., American Concrete Institute, Asphalt Institute, National Institute of Certification of Engineering Technologies, etc.)

### **5.3.2 IA STAFF MUST REMAIN INDEPENDENT FROM ACCEPTANCE TESTING**

The IA person should not perform both IA services and acceptance testing for an agency. The IA person should remain totally separate (or independent) from all elements of the specification compliance process. The main function of the IA Person is to "test the acceptance tester" and not be directly involved with the acceptance of materials.

### **5.3.3 USE SEPARATE TESTING EQUIPMENT FOR IA ACTIVITIES**

When acceptance testers perform proficiency tests, the IA person should not use testing equipment that is also used for acceptance testing. Separate testing equipment should be used. This separate equipment should never be used by others, especially workers who perform acceptance testing for the local agency.

## **5.4 ISSUING CERTIFICATES OF PROFICIENCY FOR ACCEPTANCE SAMPLERS AND TESTERS**

Annually the IA person should issue a Certificate of Proficiency to each local agency's sampler and tester to qualify the person to perform work for the local agency. To assist with this qualification process, samplers and/or testers may be asked to take a standard written examination to demonstrate knowledge of the test procedure. An example of standard test method questions is shown in Appendix R. In addition, the IA person should review the calibration status of the equipment used for acceptance testing.

The Certificate of Proficiency should include the following items:

- The printed full name of the acceptance sampler and/or tester
- The company and address of the qualified sampler and/or tester
- A list of the test methods the sampler and/or tester is qualified to perform
- The re-qualification date (month and year) for each test
- The printed name (and signature) of the IA person
- The date the certificate is issued

Each sampler and/or tester should receive a copy of the Certificate of Proficiency. Prior to sampling and testing on a local agency transportation project, the IA person should provide the Resident Engineer with a copy of the Certificate of Proficiency for each sampler and tester on the project. See Appendix Q for an example of a Certificate of Proficiency.

## **5.5 ISSUING LABORATORY ACCREDITATION CERTIFICATES**

At least once during each calendar year, the IA person should review each materials testing laboratory that performs work for the local agency to verify the laboratory has the following:

- A current copy of the local agency's QAP (signed and dated by a city or county engineer).
- A current copy of all test methods used by the local agency.
- Proper test equipment (with firmly attached calibration stickers dated within 12 months of the current date), supporting calibration records and round-robin test results (from an accredited laboratory tied to AMRL, CCRL or Caltrans' RSP).
- Current Certificates of Proficiency for all samplers and/or testers expected to be on the project.



The Laboratory Accreditation Certificate should include the printed name and address of the laboratory, the accreditation date, a list of the tests the laboratory is accredited to perform and the full name of the IA person, and a statement that all of the above requirements have been met.

See Appendix S for an example of a Laboratory Accreditation Certificate for a materials testing laboratory.

## **5.6 PERFORMING WITNESS TESTS**

At least once during each calendar year, the IA person should meet with the local agency acceptance sampler and tester, and observe the person perform the test (or tests) that the person is qualified to perform. The meeting location may be designated by the IA person. Materials used for the witness testing may be from any source or location determined by the IA person. If the IA person observes that the sampling and/or testing procedures are performed correctly, the successful witness test is documented. See Appendix T for an example of a Witness Test Report.

However, if a test is not performed correctly, or the equipment does not have a proper calibration sticker, the IA person is required to immediately notify the acceptance sampler and/or tester that they are disqualified for that test. The disqualified person should also be handed a notice stating the terms of the decertification. An example would be: “the acceptance tester improperly used a wooden stake instead of the required tamping rod to consolidate the concrete during fabrication of the test cylinders.” The disqualified person should then wait at least seven days before requesting another witness test for the test that was incorrectly performed. It should be noted, that when a person is disqualified for one or more tests, the person is still qualified to perform the other tests identified on the Certificate of Proficiency.

## **5.7 PERFORMING PROFICIENCY TESTS (ALSO KNOWN AS CORROBORATION TESTS, ROUND-ROBIN TESTS AND SPLIT-SAMPLE TESTS)**

At least once during each calendar year, the local agency IA person should present each acceptance tester with a representative sample of soil or aggregate for proficiency testing. Corroboration samples are prepared by the IA person using materials either on or off the project site. One split sample is tested by the IA person, using test equipment not used for acceptance testing. These test results are used as a standard to evaluate the results obtained by the acceptance tester.

After a second split sample is presented to the acceptance tester, the acceptance tester is asked to go to the laboratory and perform the following tests: sand equivalent, cleanness value and sieve analysis.



The acceptance tester’s results should be e-mailed or faxed to the IA person within three days after the split sample is presented. Test results from the acceptance tester are then compared to the test results of the IA person using the following table. An example of a Proficiency Test Report (corroboration) is shown in Appendix U.

Type of Test	Degree of Corroboration		
	Good (Satisfactory)	Fair (Satisfactory)	Poor (Unsatisfactory)
<b>Sieve Analysis (Percent Passing)</b>			
<b>No. 4 Sieve and Larger</b>	2 or less	3 to 4	5 or more
<b>No. 8 – No. 30</b>	2 or less	3	4 or more
<b>No. 50 – No. 100</b>	2 or less	3	4 or more
<b>No. 200</b>	1 or less	2	3 or more
<b>Sand Equivalent (Nearest whole number)</b>	3 or less	4 to 5	6 or more
<b>Cleanness Value (Nearest whole number)</b>	3 or less	4 to 6	7 or more

NOTE: When Caltrans performs IA services for a local agency, only three proficiency tests are evaluated. These tests include: sieve analysis, sand equivalent and cleanness value.

When an acceptance tester receives an “unsatisfactory rating”, the IA person immediately meets with the tester, examines the test equipment, the equipment calibration scores, and the test procedures used by the acceptance tester and witnesses the acceptance tester perform the test using their own test equipment. If the non-corroboration can be resolved and a satisfactory score achieved by the acceptance tester, the acceptance tester may continue to perform testing on the project. If the non-corroboration cannot be resolved, both the tester and equipment cannot continue to be used for acceptance testing and the tester is disqualified for the test in question until the problem is resolved. Usually this is done by presenting a second split sample for testing. It should be noted, that when a tester is disqualified for one test, the tester is still qualified to perform the other tests identified on the Certificate of Proficiency. The disqualified tester should also be handed a notice stating the terms of the disqualification. The tester must wait at least seven days before requesting another witness test for the test that was incorrectly performed. All Resident Engineers or project engineers should immediately be notified once an acceptance tester becomes disqualified.



When a local agency wishes to perform additional proficiency tests (other than the standard soils or aggregate tests), the local agency is encouraged to include tests on fresh concrete and the compaction of hot mix asphalt using guidelines from the table below:

<b>Degree of Corroboration</b>			
<b>Type of Test</b>	<b>Good (Satisfactory)</b>	<b>Fair (Satisfactory)</b>	<b>Poor (Satisfactory)</b>
<b>Air Content of Fresh Concrete (%)</b>	1/4 or less	1/2 to 3/4	1 or more
<b>Unit Weight of Fresh Concrete (lb/cu.ft.)</b>	2 or less	3 to 4	5 or more
<b>Slump (or Penetration) of Fresh Concrete (%)</b>	Less than 1/4	1/4 to 1/2	3/4 more
<b>Compaction of Hot Mix Asphalt (%)</b>	Less than 1	1 to 2	3 or more

### 5.7.1 PROCEDURES FOR TESTER REINSTATEMENT

Once a tester has been disqualified, the tester must wait at least 7 days before contacting the IA person to request a meeting to become re-qualified. After the waiting period, the IA person may decide to give the acceptance tester another written examination, ask the acceptance tester to present test equipment with a current calibration sticker, perform another witness test, and/or conduct another split sample test. Once satisfied that the acceptance tester is now performing the test satisfactorily (using properly calibrated test equipment and correct test procedures), the IA person is required to reissue an updated Certificate of Proficiency. It is the responsibility of the IA person to record and maintain all IA documents pertaining to the reinstatement of the acceptance sampler and/or tester, (i.e., copy of the written disqualification notice, record of written examinations, recertification notice, etc.). It is the responsibility of the acceptance tester to immediately show their updated Certificate of Proficiency to the Resident Engineer or project engineer.

### 5.8 PROCEDURE FOR DISPUTE RESOLUTION

Dispute resolution refers to the process of denial, suspension, revocation, appeals, and reinstatement of an IA person, an acceptance sampler and tester, or a laboratory. If the contractor or member of a private laboratory has a dispute with the local agency involving a quality assurance item, a manager from the local agency shall be selected to review the dispute. The Resident Engineer and/or IA person and the party in dispute will submit his/her substantiating paperwork to the management person, within 10 days after requested to do so. In some cases, one or more meetings may be needed to resolve disputes. Within a 30-day period, the local agency management person should try to resolve the dispute, based on the evidence presented. Appeals by the contractor, Resident Engineer, the IA person, or acceptance sampler and tester may be made after the final decision by the local agency management person. The person making the appeal should be directed to contact the District Local Assistance Engineer no more than 14 days after receiving written notice of the final decision by the local agency management person.

The District Local Assistance Engineer will head up the appeal process. Again, evidence will be presented and a final decision should be made within 30 days after receipt of the appeal. For additional guidelines concerning the dispute resolution process, refer to Caltrans IA Manual.

## **5.9 MAINTAINING ACCURATE RECORDS**

It is the responsibility of the local agency's IA person (consultant or employee of the local agency) and the Resident Engineer to create, and maintain accurate records for all IA and acceptance materials testing performed on local agency construction projects. Per CFR Title 49, Section 18.42, a local agency using federal funds for a transportation project must maintain pertinent construction records for three years subsequent to final project voucher reimbursement or through the period of litigation, whichever is later. A complete set of Resident Engineer records should include the following:

- A log summary of the acceptance tests taken on the project
- Copies of all tester qualification and lab certifications
- All acceptance tests taken on the project
- Copies of all IA testing performed on the project
- Copies of Certificates of Compliance
- Records of pre-manufactured materials (collection of release tags)
- Materials certificate (signed by the Resident Engineer at the completion of the project)
- A copy of the approved QAP with the date of approval

(See Appendices G, H, J.1, J.2, K, P, Q, S, T, U, V.I, V.2, and W for examples of these records.)

## **6.0 FHWA/CALTRANS PROCESS REVIEWS**

FHWA and/or Caltrans process review teams randomly visit California local agencies to examine their materials records on selected Federal-aid construction projects. During a FHWA or Caltrans process review, the IA person and the Resident Engineer may only have five to seven days to retrieve all their project files and review the materials testing elements on their project. Under these conditions, it is imperative that all materials records for each construction project are accurate, well organized and stored in an easily retrievable place.

The process review team may typically ask several questions pertaining to the quality assurance process. They are especially interested in examining the written documentation collected during the construction of the project, to verify that proper amounts of sampling and testing were performed in accordance with the local agency's QAP and determine if all failed tests were resolved.

From project plans, quantities of materials used, and the local agency's QAP frequency tables, it is relatively easy to determine the minimum number of acceptance tests that are required on the project. In the past, California local agencies have not always had the proper number of acceptance tests and other required items in their project files. It should be noted that the role of



the review team is to examine all areas of the local agency's QAP and observe whether or not the local agency has done what is required. Their main objectives are to assist state and local agencies with their control of materials and encourage them to fully document all required materials records as noted in their QAP. This manual is intended to help local agencies fulfill material testing and record requirements on their Federal-aid projects and to help ensure both state and federal compliance with future Caltrans or FHWA process reviews. See Appendix X for commonly asked questions during a Caltrans or FHWA process review.

**Note: The following pages contain quality assurance forms and information to assist local agencies to maintain required quality assurance and independent assurance records. The pages include Appendices A to X. Appendices I and O have been purposely excluded from the appendices.**



## Appendix A - Code of Federal Regulations that Govern Transportation Quality Assurance Programs – 23 CFR 637

- Chapter 1 – Federal Highway Administration, Department of Transportation
- Title 23 Code of Federal Regulations (CFR) – Highways
- Part 637 – Construction Inspection and Approval

Caltrans Editorial Comment: Currently, there are no Code of Federal Regulations (CFR) pertaining to Quality Assurance Program requirements for local agency Federal-aid projects off the NHS. However, for local agencies that have projects on the NHS, the provisions of 23 CFR 637 which includes "Subpart B – Quality Assurance Procedures for Construction" apply.

Title 23 CFR 637 can be found at:

[http://www.access.gpo.gov/nara/cfr/waisidx\\_01/23cfr63701.html](http://www.access.gpo.gov/nara/cfr/waisidx_01/23cfr63701.html)

The following are the specific requirements set forth in "Subpart B – Quality Assurance Procedures for Construction" for projects on the NHS (not all Sections are shown):

### Section 637.201 – Purpose

To prescribe policies, procedures, and guidelines to assure the quality of materials and construction in all Federal-aid highway projects on the National Highway System.

### Section 637.207 – Quality Assurance Program

- (a) Each State Transportation Department's (STD)\* quality assurance program shall provide for an acceptance program and an independent assurance (IA) program consisting of the following:

\*(Caltrans Editorial Comment: Local agencies administering construction contracts on the NHS must follow the requirements for the STD which is Caltrans in California.)

(1) Acceptance program

- (i) Each STD's acceptance program shall consist of the following:

- (A) Frequency schedules for verification sampling and testing personnel responsible for the program and allow adaptation to specific project conditions and needs.
- (B) Identification of the specific location in the construction or production operation at which verification sampling and testing is to be accomplished.
- (C) Identification of the specific attributes to be inspected which reflect the quality of the finished product.

- (ii) Quality control sampling and testing results may be used as part of the acceptance decision provided that:

- (A) The sampling and testing has been performed by qualified laboratories and qualified sampling and testing personnel.
- (B) The quality of the material has been validated by the verification sampling and testing. The verification testing shall be performed on samples that are taken independently of the quality control samples.
- (C) The quality control sampling and testing is evaluated by an IA program.



## Appendix A (continued)

- (iii) If the results from the quality control sampling and testing are used in the acceptance program, the STD shall establish a dispute resolution system. The dispute resolution system shall address the resolution of discrepancies occurring between the verification sampling and testing and the quality control sampling and testing. The dispute resolution system may be administered entirely with the STD.
- (iv) In the case of a design-build project on the NHS, warranties may be used where appropriate. See 23 CFR 635.413 (e) for specific requirements.
- (2) The IA program shall evaluate the qualified sampling and testing personnel and their testing equipment. The program shall cover sampling procedures, testing procedures, and testing equipment. Each IA program shall include a schedule of frequency for IA evaluation. The schedule may be established based on either a project basis or a system basis. The frequency can be based on either a unit of production or on a unit of time.
  - (i) The testing equipment shall be evaluated by using one or more of the following:  
Calibration checks, split samples or proficiency samples.
  - (ii) Testing personnel shall be evaluated by observations and split samples or proficiency-samples.
  - (iii) A prompt comparison and documentation shall be made of test results obtained by the tester being evaluated and IA tester. The STD shall develop guidelines including tolerance limits for the comparison of test results.
  - (iv) If the STD uses the system approach to the IA program, the STD shall provide an annual report to the FHWA summarizing the results of the IA program.
- (3) The preparation of a materials certification conforming in substance to Appendix A of this subpart, shall be submitted to the FHWA Division Administrator for each construction project which is subject to FHWA construction oversight activities.
- (b) In the case of a design-build project funded under Title 23, U.S Code, the STD's quality assurance program should consider the specific contractual needs of the design-build project. All provisions of paragraph (a) of this section are applicable to design build projects. In addition, the quality assurance program may include the following:
  - (1) Reliance on a combination of contractual provisions and acceptance methods.
  - (2) Reliance on quality control sampling and testing as part of the acceptance decision, provided that adequate verification of the design-builder's quality control sampling and testing is performed to ensure that the design-builder is providing the quality of materials and construction required by the contract documents.
  - (3) Contractual provisions which require the operation of the completion facility for a specific time period.



## Appendix A (continued)

### Section 637.209 – Laboratory and sampling and testing personnel qualifications

(a) Laboratories

- (1) After June 29, 2000, all contractor, vendor, and STD testing used in the acceptance decision shall be performed by qualified laboratories.
- (2) After June 30, 1997, each STD shall have its central laboratory accredited by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA.
- (3) After June 29, 2000, any non-STD designated laboratory which performs IA sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA.
- (4) After June 29, 2000, any non-STD laboratory that is used in dispute resolution sampling and testing shall be accredited in the testing to be performed by the AASHTO Accreditation Program or a comparable laboratory accreditation program approved by the FHWA.
- (5) After September 24, 2009, laboratories that perform crash testing for acceptance of roadside hardware by the FHWA shall be accredited by a laboratory accreditation body that is recognized by the National Cooperation for Laboratory Accreditation (NACLA), is a signatory to the Asia Pacific Laboratory Accreditation Cooperation (APLAC) Mutual Recognition Arrangement (MRA), is a signatory to the International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement (MRA), or another accreditation body acceptable to FHWA.

(b) Sampling and testing personnel. After June 29, 2000, all sampling and testing data to be used in the acceptance decision or the IA program, shall be executed by qualified sampling and testing personnel.

(c) Conflict of interest. In order to avoid an appearance of a conflict of interest, any qualified non-STD laboratory shall perform only one of the following types of testing on the same project: Verification testing, quality control testing, IA testing or dispute resolution testing.



## Appendix A (continued)

### Appendix A to Subpart B of Part 637 – Guide Letter of Certification by State Engineer

Date \_\_\_\_\_

Project No. \_\_\_\_\_

This is to certify that:

The results of the tests used in the acceptance program indicate that the materials incorporated in the construction work, and the construction operations controlled by sampling and testing, were in conformity with the approved plans and specifications. (The following sentence should be added if the IA testing frequencies are based on project quantities. All independent assurance samples and tests are within tolerance limits of the samples and testes that used in the acceptance program.) Exceptions to the plans and specifications are explained on the back hereof (or on attached sheet).

\_\_\_\_\_  
Director of STD Laboratory or other appropriate STD Official.



## **Appendix B - Proficiency Testing Through AMRL, CCRL and Caltrans Reference Sample Program**

Whenever possible, local agencies should perform annual proficiency tests (also known as round-robin tests and split-sample tests) with one or more laboratories to ensure that the laboratories are obtaining consistent test results. Three organizations that perform proficiency tests and utilize statistical methods to evaluate their test results are: the AASHTO Materials Reference Laboratory (AMRL), Cement and Concrete Reference Laboratory (CCRL) and Caltrans Reference Samples Program (RSP).

It should be noted that AMRL and CCRL use ASTM and AASHTO standards when evaluating their proficiency samples. Caltrans uses only CT methods to evaluate proficiency samples in their RSP. California local agencies that use Caltrans plans and specifications are encouraged to have their city, county or consultant's laboratories regularly participate in Caltrans' RSP.

Each program tests the following materials:

### **AASHTO Materials Reference Laboratory (AMRL)**

- Soil
- Bituminous Asphalt Concrete (or Hot Mix Asphalt)
- Emulsified Asphalt
- Bituminous Concrete Design
- Bituminous Concrete Analysis
- Coarse Aggregate
- Fine Aggregate

### **Cement and Concrete Reference Laboratory (CCRL)**

Portland Cement Concrete (or Hydraulic Cement Concrete)  
Mineral Admixtures (Types C, F and N)  
Portland Cement (Chemical Tests)  
Portland Cement (Physical Tests)

### **Caltrans Reference Samples Program (RSP)**

- Soils
- Asphalt Concrete
- Fine Aggregate
- Coarse Aggregate

Note: AMRL and CCRL prepare thousands of representative samples each year for correlations testing. These samples are then shipped to materials testing laboratories throughout the world. The various material types are noted above. When a laboratory determines its final results, according to specified ASTM and/or AASHTO standards, the results are mailed to AMRL (100 Bureau Drive, Stop 8619, Building 202, Room 211, Gaithersburg, Maryland, 0899-8619); or CCRL (100 Bureau Drive, Stop 8618, Building 220, Room A63, Gaithersburg, Maryland, 0899-8618); for data analysis. Each laboratory is then mailed an individual rating (from 0 to 5) for the testing standards that were performed by the laboratory. When all results are finalized, CCRL mails their finding to AMRL. For laboratories with test ratings of 3 (or greater), AMRL mails certificates to these laboratories, stating they are an accredited laboratory by AMRL and/or CCRL. Caltrans RSP is conducted at 5900 Folsom Blvd, Sacramento, CA 95825.



## Appendix B (continued)

Laboratory Ratings (by AMRL and CCRL)	Test Results	Testing Laboratories
<b>5 (Best Rating)</b>	mean $\pm$ 1.0 $\sigma$	within the middle 68.26 percent
4	mean $\pm$ 1.5 $\sigma$	within the middle 86.64 percent
3	mean $\pm$ 2.0 $\sigma$	within the middle 95.44 percent
2	mean $\pm$ 2.5 $\sigma$	within the middle 98.76 percent
1	mean $\pm$ 3.0 $\sigma$	within the middle 99.74 percent
0 (Worst Rating)	mean $\pm$ > 3.0 $\sigma$	N/A



## Appendix C - Websites of Nationally Known Testing Standards

- American Society for Testing and Materials (ASTM)  
<http://www.astm.org/cgi-bin/SoftCart.exe/index.shtml?E+mystore>
- American Association of State Highway and Transportation Officials (AASHTO)  
<https://www.transportation.org/publication/bookstore.nsf/Home?openForm>
- National Institute of Standards and Technology (NIST)  
<http://www.nist.gov/>
- California Test (CT) Methods  
<http://www.dot.ca.gov/hq/esc/ctms>

## Appendix D - Acceptance Sampling and Testing Frequencies

Note: It may be desirable to sample and store some materials. If warranted, testing can be performed at a later date.

### Portland Cement (Hydraulic Cement)

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Cement/fly ash (Sampling only)	8-lb. sample	If possible, take a least one sample per job, even if the material is accepted based on a Certificate of Compliance.	ASTM D75, C494 CT 125 AASHTO T127, M85, M295	Standard for sampling hydraulic cement or fly ash.
Cement (Testing Only)	8-lb. sample	If the product is accepted based on a Certificate of Compliance, testing is not required. If the product is not accepted using a Certificate of Compliance, test at least once per job.	ASTM C109 CT 515 AASHTO T106	If testing appears warranted, fabricate six 2-in. mortar cubes using the Portland (or hydraulic cement). Test for compressive strength.

### Portland Cement Concrete (Hydraulic Cement Concrete)

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Aggregate for Hydraulic Cement Concrete (Sampling & Testing)	50-lb. sample	Take one aggregate sample for each 1000 cu. yd. of PCC/HCC concrete. Test at least one sample per job.	ASTM D75 CT 125 AASHTO M6, T2, M80	Sample aggregate from belt or hopper (random basis).
Water (Sampling & Testing)	Take a two-quart sample using a clean plastic jug (with lining) and sealed lid. Sample at the point of use.	If the water is clean with no record of chlorides or sulfates greater than 1%, no testing is required. If the water is dirty do not use it. Test only when the chloride or sulfates are suspected to be greater than 1%.	CT 405, CT 422, CT 417 AASHTO R23	If testing appears warranted, test for chlorides and sulfates.

## Appendix D (continued)

### Portland Cement Concrete (Hydraulic Cement Concrete) – Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description of Comments
Air Entraining Admixtures (Sampling & Testing)	Take a one-quart sample using a clean, lined can or plastic bottle, if liquid. If powder, take a 2.5 lb. sample.	If the product is accepted based on a Certificate of Compliance, testing is not required. Take one sample per job. Prior to sampling, check with Caltrans (METS) for acceptable brands and dosage rates.	ASTM C233 AASHTO M154, T157, C260	If testing appears warranted, test for sulfates and chlorides Admixtures with sulfates and chlorides greater than 1% should not be used.
Water Reducers or Set Retarders (Sampling & Testing)	If liquid, take a 1-qt. sample using a clean plastic can. If powder, take a 2.5 lb. sample.	If the product is accepted based on a Certificate of Compliance, no testing is required. If not, test once per job. Prior to using this product, please check with Caltrans (METS) for acceptable brands and dosage rates.	ASTM C494 AASHTO M194	If testing appears warranted, test for sulfates and chlorides. Admixtures with sulfates and chlorides greater than 1% should not be used.
Freshly-Mixed Concrete (Sampling)	Approx. 150lb. (or 1 cu. ft.) near mixer discharge.	When tests are required, take at least one sample for each 500 to 1000 cu. yd. of PCC/HCC.	ASTM C172, C685 CT 539 AASHTO T141, M157	This describes a method to sample freshly-mixed concrete.
Freshly-Mixed Concrete (Testing)	Approx. 150 lb/ (or 1 cu. ft.) near mixer discharge.	On projects with 500 cu. yd., or more, test at least one sample per job.	ASTM C143 AASHTO T119	This test determines the slump of the freshly-mixed concrete.
Freshly-Mixed Concrete (Testing)	Approx. 150 lb/ (or 1 cu. ft.) near mixer discharge	On projects with 500 cu. yd., or more, test at least one sample per job.	ASTM C360 CT 533	This test determines the ball penetration of the freshly-mixed concrete.
Freshly-Mixed Concrete (Testing)	Approx. 150 lb/ (or 1 cu. ft.) near mixer discharge	On projects with 500 cu. yd., or more, test at least one sample per job.	ASTM C231 CT 504 AASHTO T152	This test determines the air content of freshly-mixed concrete (pressure method).
Freshly-Mixed Concrete (Testing)	Approx. 150 lb/ (or 1 cu. ft.) near mixer discharge	On projects with 500 cu. yd., or more, test at least one sample per job.	ASTM C138 CT 518 AASHTO T121	This test determines the unit weight of freshly mixed concrete.

## Appendix D (continued)

### Portland Cement Concrete (Hydraulic Cement Concrete) – Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Freshly-Mixed Concrete (Testing)	Approx. 150 lb/ (or 1 cu. ft.) near mixer discharge	Fabricate at least two concrete cylinders per project. Test for compressive strength at least once for each 500 to 1,000 cu. yd. of structural concrete.	ASTM C39 CT 521 AASHTO T22	This test is used to fabricate 6" x 12" concrete cylinders. Compressive strengths are determined, when needed.
Freshly-Mixed Concrete (Testing)	Approximately 210 lb. of concrete are needed to fabricate three concrete beams.	One sample set for every 500 to 1,000 cu. yd. of concrete.	ASTM C78 CT 31 AASHTO T97 & T23	This test is used to determine the flexural strength of simple concrete beams in third-point loading

### Soils and Aggregates

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Aggregate (Sampling)	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D75 CT 125 AASHTO T2	This test describes the procedures to sample aggregate from the belt or hopper (random basis).
Fine Aggregates (Testing)	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM C128 CT 208 AASHTO T84	This test determines the apparent specific gravity of fine aggregates for bituminous mixes, cement treated bases and aggregate bases.
Fine Aggregate (Testing)	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM C128 CT 207 AASHTO T84	This test determines the bulk specific gravity (SSD) and the absorption of material passing the No. 4 sieve.
Coarse Aggregate (Testing)	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	CT 206	This test determines the cleanness of coarse aggregate.

## Appendix D (continued)

### Soils and Aggregates - Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Coarse Aggregate <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM C127 CT 227 AASHTO T85	This test determines the specific gravity and absorption of coarse aggregate (material retained on the No. 4 sieve).
Soils and Aggregates <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM C136 CT 202 AASHTO T27	This test determines the gradation of soils and aggregates by sieve analysis.
Soils and Aggregates <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D2419 CT 217 AASHTO T176	This test determines the Sand Equivalent of soils and aggregates.
Soils and Aggregates <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM C117 AASHTO T11	This test determines the gradation for materials finer than the No. 200 sieve (by washing method).
Soils and Aggregates <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D3744 CT 229 AASHTO T210	This test determines the Durability Index of soils and aggregates.
Soils and Aggregates <b>(Testing)</b>	One 50-lb. sample	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D2844 CT 301 AASHTO T190	This test determines the Resistance Value (R-) and expansion pressure of compacted materials.
Soils and Aggregates <b>(Testing)</b>	One random location for every 2,500 sq. ft.	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D2922 CT 231 AASHTO T238	This test determines field densities using the nuclear gage.
Soils and Aggregates <b>(Testing)</b>	One random location for every 2,500 sq. ft.	Take one sample for every 500 to 1,000 tons of materials. Test at least one sample per project.	ASTM D3017 CT 231 AASHTO T239	This test determines the water content using the nuclear gage.

## Appendix D (continued)

### Asphalt Binder

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Asphalt Binder ( <b>Sampling</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Sample once per job at the asphalt concrete plant.	CT 125 ASTM D 979 AASHTO T 168, T48	This procedure describes the proper method to sample the asphalt binder.
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Sample once per job at the asphalt concrete plant.	ASTM D92, D117 AASHTO T 48	This test determines the flash point of the asphalt binder (by Cleveland open cup).
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D2872 & D92 CT 346 AASHTO T240 &T48	This test determines the rolling thin-film oven test (RTFO).
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D2042 AASHTO T44	This test determines the solubility of asphalt material in trichloroethylene.
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D2171 AASHTO T202	This test determines the dynamic viscosity, (absolute viscosity of asphalt @ 140 degrees F by the Vacuum Capillary Viscometer Poises).
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D5 AASHTO T49	This test determines the penetration of bituminous material @ 77 degrees F and percentage of original penetration from the residue.
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D113 AASHTO T51	This test determines the ductility of asphalt @ 77 degrees F.
Asphalt Binder ( <b>Testing</b> )	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D2170 AASHTO T201	This test determines the kinematic viscosity of asphalt @275 degrees F (Centistoke).

## Appendix D (continued)

### Asphalt Binder - Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Asphalt Binder (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D2171 AASHTO T202	This test determines the dynamic viscosity. (absolute viscosity of asphalt @ 140 degrees F by the Vacuum Capillary Viscometer Poises).
Asphalt Binder (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D36 AASHTO T53	This test determines the softening point of asphalt.

### Asphalt Emulsified

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Emulsified Asphalt (Sampling)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D140, D979 CT 125 AASHTO T 40, T168	This test describes the procedure to sample the emulsified asphalt.
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D244 AASHTO T59	This test determines the sieve retention of emulsified asphalt.
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D244 AASHTO T59	This test determines the weight per gallon of emulsified asphalt.
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D244 AASHTO T59	This test determines the penetration of the emulsified asphalt.
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D244 CT 330 AASHTO T59	This test determines the residue @ 325 degrees F evaporation of emulsified asphalt.

## Appendix D (continued)

### Asphalt Emulsified - Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D4402 AASHTO T201	This test determines the Brookfield viscosity.
Emulsified Asphalt (Testing)	One 0.5-gal. sample placed in a clean, sealed can.	Obtain one sample at the asphalt concrete plant for each 1,000 tons of asphalt concrete placed.	ASTM D88 AASHTO T72	This test determines the Saybolt-Furol viscosity of emulsified asphalt @ 77 degrees F (seconds).

### Hot Mix Asphalt (Asphalt Concrete) – Concrete

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Asphalt Concrete (Sampling)	Obtain one 30-lb. sample each day of production	Obtain one sample at the asphalt concrete plant for each 5,000 tons of asphalt concrete placed.	ASTM D75, D140, D979 CT 125 AASHTO T 40, T168	This test describes the procedure to sample the asphalt concrete.
Asphalt Concrete (Testing)	4" x 8" cores	Take one 4" x 8" core for every 500 ft of paved roadway.	ASTM D1188, D1560, D1561, D5361 CT 304 AASHTO T246, T247	This test determines the field density of street samples.
Asphalt Concrete (Testing)	Obtain one 30-lb. sample for each day of production	Obtain one sample for every five cores taken.	ASTM D1188, D1560, D1561, D5361 CT 304 AASHTO T246, T247	This test determines the laboratory density and relative compaction of asphalt concrete.
Asphalt Concrete (Testing)	4" x 8" cores	Obtain one sample for every five cores taken.	ASTM D2726, D1188, D5361	This test determines the specific gravity of compacted bituminous mixture dense-graded or non-absorptive.

## Appendix D (continued)

### Hot Mix Asphalt (Asphalt Concrete) –Continued

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Asphalt Concrete (Testing)	One 30-lb sample	Obtain one sample for every 1,000 tons of asphalt concrete.	ASTM D1559 AASHTO T245	This test determines the resistance to plastic flow of prepared mixes as determined by the Marshall Method.
Asphalt Concrete (Testing)	One 30-lb sample	Obtain one sample for every 1,000 tons of asphalt concrete.	ASTM C117, D2172 (use Method B) AASHTO T164	This test determines the screen analysis of aggregates recovered from asphalt materials.
Geotextile Fabric (Placed Under the Asphalt Concrete) (Testing)	One 12 ft. x 3 ft. sample	Obtain one sample per job.	ASTM D4632 AASHTO M288	This test determines the weight per sq. yd. and grabs strength of geotextile fabrics.
Asphalt Concrete (Testing)	Sample any test location (random basis)	Obtain one sample for every 1,000 tons of asphalt concrete.	ASTM D2950 CT 375	This test determines the nuclear field density of in-place asphalt concrete.
Asphalt Concrete (Testing)	One 10-lb sample	Obtain one sample during every day of production.	ASTM D1560, D1561 CT 366 AASHTO T246, T247	This test determines the stability value of asphalt concrete.
Slurry Seals (Sample)	One 0.5 gal. sample in a clean, dry plastic container.	Obtain one sample per truck	ASTM D979 CT 125 AASHTO T 40, T168	This test describes the procedure for sampling the slurry seal.
Aggregate for Slurry Seals (Testing)	One 30-lb. sample.	Obtain at least one sample per project from the belt or hopper or stockpile and test for Sand Equivalent	ASTM D2419 CT 217 AASHTO T176	This test determines the Sand Equivalent of aggregates.

## Appendix D (continued)

### Slurry Seals

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Aggregate for Slurry Seals (Testing)	One 30-lb. sample.	Obtain at least one sample per project from the belt, hopper, or stockpile and test for sieve analysis of fine sand.	ASTM C117 AASHTO T11	This test determines the sieve analysis of fine sand (gradation of materials finer than No. 200 sieve by wash grading).
Slurry Seals (Testing)	One 0.5 gal. sample in a clean, dry plastic container.	Test one sample per project and test for Abrasion.	ASTM D3910	This test determines the Wet Track Abrasion Test (2) (WTAT).

### Steel

Materials to be Sampled or Tested	Sample Size	Sampling/Testing Frequency	Typical Test Methods	Description or Comments
Steel Strand (Testing)	Sample strand at various sizes.	This item may be accepted using a Certificate of Compliance. Sample and test at least two steel strands per job when a Certificate of Compliance is not used.	ASTM A370, A416, E328 AASHTO T244	This test determines the tensile strength of uncoated seven-wire stress-relieved strand for pre-stressed concrete.
Steel Rebar (Testing)	Sample rebar at various sizes.	This item may be accepted using a Certificate of Compliance. Sample and test at least two steel rebar per job when a Certificate of Compliance is not used.	ASTM A615, A370 AASHTO T244	This test determines the steel reinforcement bar tensile strength and bend capability.



## Appendix E - Check List to Assist Local Agencies Monitor Acceptance Testing Requirements

No.	Item	Yes, No or N/A
1	Was the Resident Engineer able to present an approved QAP, when requested to do so?	
2	Were there Certificates of Compliance in the project files for materials that were accepted (without testing) on the project?	
3	Did the type and number of acceptance tests taken on the project match (or exceed) the minimum type and number required in the frequency tables of the approved QAP?	
4	Did all acceptance samplers and testers (local agency employees and/or consultants) have valid Certificates of Proficiency for the duration of the project?	
5	Were there calibration stickers firmly affixed to all the test equipment used by the acceptance samplers and testers on the project?	
6	Were the calibration dates on the stickers (affixed to the test equipment) within 12 months of the current date?	
7	Did the Resident Engineer have a log summary sheet of all acceptance tests performed on the project?	
8	If plant inspection and/or source inspection were performed on this project, were there test records to show that testing was performed for the items used?	
9	Did any acceptance samplers and testers get decertified for any test during the construction of the project?	
10	Did the Resident Engineer provide written approval of the PCC mix designs used on the project?	
11	Did the Resident Engineer provide written approval of the hot mix asphalt designs used on the project?	
12	If materials did not meet minimum specifications but were still used on the project, did the Resident Engineer fully document all testing and attach justifications for use and cost reduction information to the Materials Certificate?	
13	Did the Resident Engineer sign and date the Materials Certificate after the project was completed?	

Note (for No. 3 above):

Assume that a concrete structure was 50% complete and approximately 1000 cubic yards of PCC will be used on the project. If the testing frequency in the local agency's QAP states that two concrete cylinders will be tested for compressive strength every 500 cubic yards, did the Resident Engineer have at least two compressive-strength tests in the project file? Likewise if the structure was 100% complete, were there four compressive-strength tests in the project file?

Printed Name of the Local Agency: \_\_\_\_\_

Printed Name of the Resident Engineer: \_\_\_\_\_

Printed Name of the Reviewer: \_\_\_\_\_

Date of Review: \_\_\_\_\_



## **Appendix F - Construction Materials Accepted by a Certificate of Compliance \***

Soil Amendment  
Fiber  
Mulch  
Stabilizing Emulsion  
Plastic Pipe  
Lime  
Reinforcing Steel  
Structural Timber and Lumber  
Treated Timber and Lumber  
Timber and Lumber  
Culvert and Drainage Pipe Joints  
Reinforced Concrete Pipe  
Corrugated Steel Pipe and Corrugated Steel Pipe Arches  
Structural Metal Plate Pipe Arches and Pipe Arches  
Perforated Steel Pipe  
Polyvinyl Chloride Pipe and Polyethylene Tubing  
Steel Entrance Tapers, Pipe Down drains, Reducers, Coupling Bands and Slip Joints  
Aluminum Pipe (Entrance Tapers, Arches, Pipe Down drains, Reducers, Coupling Bands and Slip Joints)  
Metal Target Plates  
Electrical Conductors  
Portland Cement  
Minor Concrete  
Waterstop

\* If Caltrans Standard Specifications May 2006 is part of contract specifications.

Note: Usually these items are inspected at the site of manufacture or fabrication and reinspected after delivery to the job site.



## Appendix G - Example of an Acceptance Testing Record

Material Tested:  Fresh Concrete

Location of Test:  Station 100 + 50 (50 feet right of centerline)

Type of Work:  Retaining Wall Foundation .

Date	Test Number	Description of Test	Test Results	Specification
07/07/07	CT 504	Air Content	4.2%	4.0% Minimum
07/07/07	CT 533	Ball Penetration	1.5 in.	0.5 to 2.0 in.

Printed Name of Acceptance Tester:  Bill Johnson .

Company:  ABC Engineering Company .(Middletown, CA)

Date:  07/07/07 .

**Note:** An air content test was recommended because the foundation elevation was over 5,000 feet.



## Appendix H - Example of a Log Summary Sheet

### Subgrade Materials

Date	CT	Station	Elevation	Test Results	Minimum Spec.	Passed or Failed	Action Taken
5/15/07	231	1+ 00 (30' L)	99.00	93	90 or greater	Passed	N/A
5/16/07	231	1+ 50 (20' R)	100.50	94	90 or greater	Passed	N/A
5/17/07	231	2+ 25 (25' R)	101.00	96	90 or greater	Passed	N/A
5/18/07	231	1+ 50 (30' L)	101.50	95	95 or greater	Passed	N/A
5/19/07	231	2+ 50 (20' L)	102.00	92 *	95 or greater	Failed	See Note 1
5/19/07	231	2+ 50 (20' L)	102.00	95	95 or greater	Passed	N/A

CT 231 = Compaction (Nuclear Gage)

\* Note 1: The Contractor used a water tank to dampen the soil surface at the failed subgrade location. Using a sheep's foot compactor, he reworked the subgrade (making at least 10 passes) from Station 2+ 00 to Station 3+ 00. After approximately 30 minutes, another compaction test was taken. This time the relative compaction was 95.

### Aggregates and Base Materials

Date	CT	Station	Elevation	Test Results	Minimum Spec.	Passed or Failed	Action Taken
6/20/07	202	1+ 00 (10' R)	102.50	See data sheet	See data sheet	Passed	N/A
6/20/07	202	2+ 00 (20' L)	102.50	See data sheet	See data sheet	Passed	N/A
6/22/07	217	1+ 00 (10' R)	102.50	75	25 or greater	Passed	N/A
6/22/07	217	2+ 00 (20' L)	102.50	83	25 or greater	Passed	N/A
6/20/07	227	1+ 00 (20' R)	102.50	86	71 or greater	Passed	N/A
6/20/07	227	1+ 50 (20' L)	102.50	85	71 or greater	Passed	N/A
6/24/07	231	2+ 00 (20' R)	102.50	98	95 or greater	Passed	N/A
6/24/07	231	2+ 50 (20' L)	102.50	97	95 or greater	Passed	N/A

CT 202 = Sieve Analysis,    CT 217 = Sand Equivalent,    CT 227 = Cleanness Value,  
 CT 231 = Compaction (Nuclear Gage)



## Appendix H (continued)

### Hot Mix Asphalt

Date	CT	Station	Elevation	Test Results	Minimum Spec.	Passed or Failed	Action Taken
7/10/07	339	1+ 00 (10' R)	103.00	0.08 gal/ sq yd	0.05 -0.10 gal/sq yd	Passed	N/A
7/10/07	366	2+ 00 (20' L)	103.00	32	>23	Passed	N/A
7/10/07	366	1+ 00 (10' R)	103.00	41	>23	Passed	N/A
7/10/07	375	2+ 00 (20' L)	103.00	94	RC = 93 to 97	Passed	N/A
7/15/07	375	1+ 00 (20' R)	103.00	96	RC = 93 to 97	Passed	N/A
7/15/07	375	1+ 50 (20' L)	103.00	95	RC = 93 to 97	Passed	N/A

CT 339 = Distributor Spread Rate,      CT 366 = Stabilometer Value  
 CT 375 = In-Place Density & Relative Compaction

### Portland Cement Concrete

Date	CT	Station	Elevation	Test Results	Minimum Spec.	Passed or Failed	Action Taken
9/25/07	504	10 + 50 (50' R)	102.50	6.5%	>6.0%	Passed	N/A
9/25/07	533	12 + 50 (50' R)	102.50	1.5"	<2"	Passed	N/A
9/25/07	518	11 + 50 (50' R)	102.50	151 lb/cu ft	> 145 lb/cu ft	Passed	N/A
9/25/07	521	10 + 50 (50' R)	102.50	28 day = 4200 psi	>3800 psi	Passed	N/A
9/28/07	521	11 + 50 (50' R)	102.50	28 day = 4290 psi	>3800 psi	Passed	N/A
9/30/07	521	12 + 50 (50' R)	102.50	28 day = 4160 psi	>3800 psi	Passed	N/A

CT 504 = Air Content,      CT 518 = Unit Weight,      CT 521 = Compressive Strength,  
 CT 533 = Ball Penetration



## Appendix J.1 - Example of a Vendor's Certificate of Compliance

No. 583408

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION  
**VENDOR'S CERTIFICATE OF COMPLIANCE**  
 MR-0543 (REV. 5/93) #CT-7541-6020-2

PRECAST CONCRETE PRODUCTS OR  SOUNDWALL  
 TO: BILL SYNDER

STATE HIGHWAY ENGINEER  
RESIDENT ENGINEER - CITY OF FLATLAND

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

CONTRACT NUMBER:	
CEMENT BRAND <u>XYZ CEMENT CO.</u>	MILL LOCATION <u>MIDLAND, CALIFORNIA</u>
TYPE <u>II MODIFIED</u>	
CHEMICAL ADMIXTURE	
1. BRAND <u>ABC. ADMIXTURE</u>	MANUFACTURER <u>XYZ SUPPLIER</u>
TYPE <u>WATER REDUCER</u>	
2. BRAND	MANUFACTURER
TYPE	

CHECK BOX IF A CHEMICAL ADMIXTURE WAS NOT USED

MINERAL ADMIXTURE	
MANUFACTURER <u>POZZ. INC.</u>	CLASS <u>F</u>

CHECK BOX IF A MINERAL ADMIXTURE WAS NOT USED

DELIVERY DATE (Ready-Mix) <u>7/7/07</u>	DATES OF FABRICATION (Precast)
--	--------------------------------

LIST PRODUCTS TO WHICH CERTIFICATE APPLIES. (Show size and lin. ft. of pipe, etc., delivery slip numbers for ready-mix.)

Portland Cement  
Flyash  
Water Reducer

MANUFACTURER OF CONCRETE PRODUCTS <u>A. &amp; B. READY MIX</u>
By: AUTHORIZED REPRESENTATIVE SIGNATURE <u>Joe Anderson</u>

FM 93 1839

Original to Res. Engr. Retain Duplicate.

OSP 01 55624



## Appendix J.2 - Example of a Certificate of Compliance for Portland Cement (continued)

This is to certify that the

Portland Cement.

Supplied by ABC Cement Company complies with all requirements for Type II Portland Cement when tested in accordance with ASTM C - 494.

Local Agency Project No.

HP21L – 5055 – 111

*Albert Howakowa*

Quality Assurance Engineer  
ABC Cement Company

Date: 07/07/07.



**Appendix K - Examples of Materials Certificates/Exceptions  
 (Signed by the Resident Engineer at the Completion  
 of the Project)**

Federal-aid Project No.: Project HP21L – 5055 – 111

**Subject: Materials Certification**

This is to certify that the results of the tests on acceptance samples indicate that the materials incorporated in the construction work and the construction operations controlled by sampling  and testing were in conformity with the approved plans and specifications.

All materials exceptions to the plans and specifications on this project are noted below.

No exceptions were found to the plans and specifications on this project.

Bill Sanders  
 Resident Engineer (Print Name)

*Bill Sanders*  
 Resident Engineer (Signature)

7/7/07  
 (Date)

**Note:** The signed original of this certificate is placed in the Resident Engineer’s project files and one copy is mailed to the DLAE and filed under “Report of Expenditures.”

**See the attachment (next page)**



## Appendix K (continued)

### Attachments: Materials Exceptions (Acceptance Testing)

Type of Test	Description of Work	Total Tests Performed On the Project	Number of Failed Tests	Action Taken
Slump Test	Concrete Sidewalk	8	1	When the measured slump exceeded the maximum limit, the entire concrete load was rejected.
Sand Equivalent	Aggregate for Structural Concrete	10	1	The tested S.E. was 70 and the contract compliance specification was 71 minimum. However, the concrete 28-day compressive strength was 4800 psi. The concrete was considered adequate and no materials deductions were taken.
Compaction	Sub grade Material	12	1	One failed test was noted. The failed area was watered and reworked. When this was completed, a retest was performed. The retest was acceptable.
Compaction	Hot Mix Asphalt	12	1	One failed area was noted. It was reworked and retested. The second test met specifications.

Bill Sanders  
 Resident Engineer (Print Name)

Bill Sanders  
 Resident Engineer (Signature)

July 4, 2007  
 Date



## Appendix L - Check List for Local Agencies to Help Monitor Independent Assurance Requirements

No.	Item	Yes, No Or N/A
1	Did the IA person have a letter (or contract) stating he (or she) was authorized to perform IA services for the city or county?	
2	Did the IA person have a recent Qualification Certificate from a qualified tester from a qualified laboratory that regularly participates in Reference Samples Programs with AMRL and CCRL?	
3	Did the IA person maintain separate files for each acceptance sampler and tester for all local agency projects?	
4	Did the IA person have annual Split-Sample Test records for each acceptance tester for all local agency projects?	
5	Did the Split-Sample Testing include the following tests: sieve analysis, sand equivalent, cleanness, slump (or penetration) of fresh concrete air content of fresh concrete, unit weight of fresh concrete, compaction of hardened hot mix asphalt?	
6	Did the IA person have annual Witness Test records for each acceptance sampler and tester for all local agency projects?	
7	On each project, did the IA records include: certification, decertification, and recertification for each acceptance sampler and tester?	
8	Did the IA person have annual Certificates of Proficiency for each acceptance sampler and tester for all local agency projects?	
9	Did the IA person issue annual Laboratory Certificates for each laboratory that performed tests for all local agency projects?	
10	Did the IA person verify that all test equipment for each acceptance tester conformed to current test standards and the equipment had firmly affixed calibration stickers (dated within the last 12 months)?	
11	Did the IA person train acceptance samplers and testers and also perform IA services involving these people?*	
12	Did the IA person use separate materials testing equipment than used by the acceptance testers?	

Printed Name of the City or County: \_\_\_\_\_

Printed Name of the IA Person: \_\_\_\_\_

Printed Name of the Reviewer: \_\_\_\_\_

Date of Review: \_\_\_\_\_

**\*Answer is “no”, others should be “yes” or “not applicable”**



## **Appendix M - Authorization Letter (To Allow the IA Person to Provide Services for the Local Agency)**

August 13, 2007

ABC Engineering  
123 Main Street  
Maintown, CA 95678

Dear Mr. John Smith,

This letter authorizes you, as a 5-year employee with ABC Engineering, to perform all independent assurance (IA) services for the City of Maintown, effective August 25, 2007.

I acknowledge that on August 13, 2007, you performed a series of split-sample tests (California Tests 202, 217, 227, 375, 504, 518 and 533) with Bill Jones of XYZ Construction Company in Middleton, CA 95678. Mr. Jones' laboratory, at XYZ Construction Company, is qualified by AMRL and CCRL and he is their quality assurance engineer.

Thank you for your willingness to assist the City of Maintown with our IA activities. A copy of the test result comparisons between you and Mr. Jones is attached.

Sincerely,

*Justin Hammer*

Justin Hammer, City Engineer  
City of Maintown  
111 Main Street  
Maintown, CA 95678

Attachment



## Appendix N - Corroboration Chart (To Determine Proficiency Ratings)

Description of Test Procedure	Degree of Corroboration		
	Good (Satisfactory)	Fair (Satisfactory)	Poor (Unsatisfactory)
<b>Sieve Analysis (Percent Passing)*</b>			
No. 4 Sieve and Larger	2 or less	3 to 4	5 or more
No. 8 – No. 30	2 or less	3	4 or more
No. 50 – No. 100	2 or less	3	4 or more
No. 200	1 or less	2	3 or more
<b>Sand Equivalent* (Nearest whole number)</b>	3 or less	4 to 5	6 or more
<b>Cleanness Value* (Nearest whole number)</b>	3 or less	4 to 6	7 or more
<b>Air Content of Fresh Concrete ** (Percent)</b>	1/4 or less	1/2 to 3/4	1 or more
<b>Unit Weight of Fresh Concrete ** (Pounds/Cu. Ft.)</b>	2 or less	3 to 4	5 or more
<b>Slump (or Penetration) of Fresh Concrete ** (In.)</b>	Less than 1/4	1/4 to 1/2	3/4 or more
<b>Compaction of Hot Mix Asphalt *** (Percent)</b>	Less than 1	1 to 2	3 or more

Note:

### **Soil and Aggregate Tests\***

If any split-sample produces a “Poor” Degree of Corroboration, the test is deemed “Unsatisfactory.” If this occurs, another split sample shall immediately be presented for retesting. A “Satisfactory” result will occur when a “Good” or “Fair” Degree of Corroboration is achieved between the testers.

### **Fresh Concrete Tests \*\***

If a “Poor” Degree of Corroboration is achieved on any of the fresh concrete tests, the concrete materials shall be recombined and thoroughly mixed prior to any retesting. A “Satisfactory” result will occur when a “Good” or “Fair” Degree of Corroboration is achieved between the testers.

### **Hot Mix Asphalt Tests \*\*\***

If a “Poor” Degree of Corroboration is achieved on a hardened asphalt concrete surface, a new test site must be found. A “Satisfactory” result will occur when a “Good” or “Fair” Degree of corroboration is achieved between the testers.

All split-sample test results (Satisfactory and Unsatisfactory) must be fully documented.

See Appendix U



## Appendix P - Example of Proficiency Testing (Between a Tester from an Accredited Laboratory and IA Person who is a Local Agency Consultant or Employee)

Name of the Local Agency's IA Person: John Smith (City of Redlands)  
 Name, Company & City of the Qualified Tester: Bill Jones, XYZ Construction Co. (Middleton, CA)  
 The Qualified Tester gave the Local Agency's IA Person Aggregate and Concrete samples on: August 13, 2007  
 The Local Agency's IA Person e-mailed test results to the Qualified Tester on: August 18, 2007

Test Results of the Qualified Tester from an Accredited Laboratory	Test Results of the IA Person (Consultant or Employee of the Local Agency)	Numerical Difference Between the Qualified Tester from an Accredited Laboratory and IA Person	Were the Corroboration Results Acceptable per Appendix N? (Yes or No)
<b>Sand Equivalent = 92</b> (CT 217)	<b>Sand Equivalent = 90</b> (CT 217)	<b>2</b>	<b>Yes</b>
<b>Cleanness Value = 80</b> (CT 227)	<b>Cleanness Value = 85</b> (CT 227)	<b>5</b>	<b>Yes</b>
<b>Percent Passing Sieve Analysis: (CT 202)</b> 1-1/2" = <b>95 %</b> 1" = <b>77 %</b> 3/4" = <b>68 %</b> 1/2" = <b>60 %</b> 3/8" = <b>43 %</b> No. 4 = <b>38 %</b> No. 8 = <b>25 %</b> No. 16 = <b>20 %</b> No. 30 = <b>15 %</b> No. 50 = <b>7 %</b> No. 100 = <b>4 %</b> No. 200 = <b>2 %</b>	<b>Percent Passing Sieve Analysis: (CT 202)</b> 1-1/2" = <b>95 %</b> 1" = <b>80 %</b> 3/4" = <b>65 %</b> 1/2" = <b>58%</b> 3/8" = <b>40 %</b> No. 4 = <b>35 %</b> No. 8 = <b>27 %</b> No. 16 = <b>21 %</b> No. 30 = <b>18 %</b> No. 50 = <b>8 %</b> No. 100 = <b>5 %</b> No. 200 = <b>2 %</b>	<b>0</b> <b>3</b> <b>3</b> <b>2</b> <b>3</b> <b>3</b> <b>2</b> <b>1</b> <b>3</b> <b>1</b> <b>1</b> <b>0</b>	<b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b> <b>Yes</b>
<b>Unit Weight = 150.0 pcf</b> (Fresh Concrete - CT 518)	<b>Unit Weight = 151.7 pcf</b> (Fresh Concrete - CT 518)	<b>1.7</b>	<b>Yes</b>
<b>Air Content = 2.9 %</b> (Fresh Concrete - CT 504)	<b>Air Content = 3.2 %</b> (Fresh Concrete - CT 504)	<b>0.3</b>	<b>Yes</b>
<b>Penetration = 1-1/2 "</b> (Fresh Concrete - CT 533)	<b>Penetration = 1-3/4"</b> (Fresh Concrete - CT 533)	<b>1/4</b>	<b>Yes</b>
<b>AC Compaction = 95%*</b> (CT 375)	<b>AC Compaction = 93%*</b> (CT 375)	<b>2</b>	<b>Yes</b>

Hot Mix Asphalt tests were performed in the IA person's parking lot.

Printed Name (Tester from the Accredited Lab): Bill Jones  
 Signature of the Tester (Accredited Lab): Bill Jones  
 Date: August 18, 2007

**Note:** The test equipment used by the IA person conformed to the test standards and methods shown above.



## Appendix Q - Example of a Certificate of Proficiency (Acceptance Sampler and Tester)

This is to certify that Harry J. Jones is a consultant for XYZ Construction Company in Midtown, CA. He has been evaluated by the City of Midtown and is shown to be fully qualified to perform the following tests:

<u>Standard Test Method</u>	<u>Date Certified</u>	<u>Recertification Date</u>
CT 125 – Sampling Materials	4/07	4/10
CT 202 – Sieve Analysis	4/07	4/10
CT 217 – Sand Equivalent	4/07	4/10
CT 227 – Cleanness Value	4/07	4/10
CT 375 – Relative Compaction (AC)	4/07	4/10
CT 504 – Air Content (PCC)	4/07	4/10
CT 518 – Unit Weight (PCC)	4/07	4/10
CT 533 – Penetration (PCC)	4/07	4/10

Issued By: Mary Harrington  
 (Printed Name)  
 IA Person for the City of Midtown

Signed By: Mary Harrington  
 (Signature)  
 IA Person for the City of Midtown

Date Issued: April 15, 2007  
 (Date)

**Note:** This certificate is valid until April 15, 2010, provided the acceptance sampler and tester successfully:

1. Maintains test equipment in good working condition and has current calibration stickers.
2. Passes all witness tests, and
3. Achieves acceptable split sample test results, as noted in the City of Midtown’s approved QAP.



## Appendix R - Example of Test Method Questions to Help the IA Person Qualify Acceptance Samplers and Testers (Consultants and/or Employees of the Local Agency)

Printed Name of Acceptance Tester: \_\_\_\_\_  
Printed Name of Company: \_\_\_\_\_  
Printed Name of IA Person: \_\_\_\_\_  
Date of Written Examination: \_\_\_\_\_  
Pass or Fail? \_\_\_\_\_

### California Test 540 - Making, Handling, and Storing Concrete Compressive Test Specimens in the Field

Below is a sample written examination (supplied by the Division of Local Assistance) to help the local agency's IA person certify consultant (or local agency) samplers and testers for California Test 540. A minimum score of seven correct answers is required to pass this examination. All written examinations are confidential. All examinations taken by acceptance samplers and testers shall remain in the custody of the IA person. Before and after each examination, the local agency IA person is responsible to make sure that all examinations are returned to a locked, storage area. At each local agency, only the IA person should have access to the standard written examinations. The correct answer "(a), (b), or (c)" should be circled by the sampler or tester.

- (1) The inside dimensions of a cylinder mold used to fabricate concrete cylinders are:  
Hint: ASTM Designation: C 470
  - (a) 6" diameter x 12" high, (approximately 150 mm x 300 mm)
  - (b) 4" diameter x 8" high, (approximately 100 mm x 200 mm)
  - (c) C4" diameter x 12" high, (approximately 100 mm x 300 mm)
- (2) The tamping rod used to consolidate the concrete test specimens is:
  - (a) 1/2 " diameter x 18" long, with one or more hemispherical ends (approximately 13 mm x 460 mm)
  - (b) 1/2 " diameter x 24" long, with one or more hemispherical ends (approximately 13 mm x 610 mm)
  - (c) 5/8 " diameter x 24" long, with one or more hemispherical ends (approximately 16 mm x 460 mm)
- (3) When fabricating concrete test specimens, how many equal layers are consolidated?
  - (a) Four
  - (b) Two
  - (c) Three
- (4) How many times does a qualified tester rod each layer of fresh concrete (when fabricating concrete test specimens)?
  - (a) 25
  - (b) 15
  - (c) 20
- (5) When fabricating concrete test specimens, what action is taken immediately after each concrete layer is rodded?
  - (a) The tester firmly pats (or taps) the outer surface of the mold several times
  - (b) The tester gently levels the top of each layer, using a metal spatula
  - (c) The tester rotates the mold 90 degrees

## Appendix R (continued)

- (6) When all layers of the mold have been properly consolidated (and the top layer of concrete is struck off), what action is then taken?
  - (a) The tester quickly takes the molded cylinder to a protected area
  - (b) The tester places the lid on the mold and takes the cylinder to a protected area
  - (c) The tester securely places the lid on the mold and uses masking tape to seal the lid to the cylinder mold. He or she takes the cylinder to a protected area, free from vibration
- (7) For structural concrete that requires a minimum 28-day compressive strength (and steam curing is not used), when should the concrete test specimens be stripped and the concrete be placed into a water tank?
  - (a) From 44 to 52 hours after fabrication
  - (b) From 20 to 28 hours after fabrication
  - (c) From 32 to 40 hours after fabrication
- (8) What key items are written on the outside of a cylinder mold (using permanent ink) after fabrication of the concrete test specimen?
  - (a) The tester's name, the fabrication date and the contract number
  - (b) The certified tester's ID-number, the break date and the sample number
  - (c) The sample number, date cast and contract number
- (9) When concrete cylinders are fabricated to determine when to apply loads (or stresses), where are the concrete cylinders stored prior to testing?
  - (a) Near the structure, at a shaded/semi-sheltered location or in a plywood box
  - (b) Near the testing facility, in a sunny, protected area away from all moving Traffic
  - (c) Inside the testing facility, submerged in a water tank
- (10) In the field, assume that a water bath is used to cure concrete test specimens that will be tested for compressive strength. At what age should the test specimens be removed from the water bath, resealed (with the lid on) and ship to a testing laboratory?
  - (a) Two to five days
  - (b) Seven to ten days
  - (c) Fourteen to twenty days



## Appendix S - Example of a Laboratory Accreditation Letter

This is to certify that on August 10, 2007, I inspected the City of Maintown's testing laboratory at 1500 Main Street, Maintown, California. I hereby certify that this laboratory is accredited to perform acceptance testing for all City of Maintown projects from August 10, 2007 to August 10, 2008.

The laboratory samplers and testers all had current Certificates of Proficiency records. The laboratory was clean and equipped with adequate safety items (a plastic shield on their compression machine, a nearby emergency shower, two fire extinguishers and a first-aid kit). All testing equipment inspected conformed to the requirements noted in their updated California Test manual. In addition, calibration stickers were firmly affixed to all scales and testing equipment. All calibration stickers had dates on or after July 1, 2007.

The laboratory also had a QAP that was approved by the City of Maintown in 2007. The City of Maintown regularly participates in Caltrans Reference Samples Program and achieved ratings of 3 (or better) on the tests they normally perform.

Printed Name of IA Person: Mary Harrington  
City of Maintown

Signature of IA Person: Mary Harrington

Date Signed: August 10, 2007





## Appendix U - Example of a Proficiency Test Report (Comparisons Between the Local Agency's IA Person and an Acceptance Tester for the Local Agency)

Name of the IA Person: John Smith  
 Name, Company and City of the Acceptance Tester: Mary Liu - XYZ Consultants (Maintown, CA)  
 The IA Person gave the Acceptance Tester an aggregate sample on: July 13, 2007  
 The Acceptance Tester e-mailed the test results to the IA Person on: July 18, 2007

Test Results of the IA Person (Consultant or Employee of the Local Agency)	Test Results of the Acceptance Tester (Consultant or Employee of the Local Agency)	Numerical Difference Between the Local Agency's Acceptance Tester and IA Person	Per Appendix N, were the Corroboration Results Acceptable? (Yes or No)
<b>Percent Passing Sieve Sieve Analysis: (CT 202)</b> 1-1/2" = 95 % 1" = 77 % 3/4" = 68 % 1/2" = 60 % 3/8" = 43 % No. 4 = 38 % No. 8 = 25 % No. 16 = 20 % No. 30 = 15 % No. 50 = 7 % No. 100 = 4 % No. 200 = 2 %	<b>Percent Passing Sieve Analysis: (CT 202)</b> 1-1/2" = 95 % 1" = 80 % 3/4" = 65 % 1/2" = 58% 3/8" = 40 % No. 4 = 35 % No. 8 = 27 % No. 16 = 21 % No. 30 = 18 % No. 50 = 8 % No. 100 = 5 % No. 200 = 2 %	0 3 3 2 3 3 2 1 3 1 1 0	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes
<b>Sand Equivalent = 83 (CT 217)</b>	<b>Sand Equivalent = 85 (CT 217)</b>	2	Yes
<b>Cleanness Value = 50 (CT 227)</b>	<b>Cleanness Value = 55 (CT 227)</b>	5	Yes
<b>AC Compaction = 94% (CT 375)</b>	<b>AC Compaction = 93% (CT 375)</b>	1	Yes
<b>Air Content = 4.0 % (Fresh Concrete - CT 504)</b>	<b>Air Content = 3.7 % (Fresh Concrete - CT 504)</b>	0.3	Yes
<b>Unit Weight = 151.5 pcf (Fresh Concrete - CT 518)</b>	<b>Unit Weight = 149.8 pcf (Fresh Concrete - CT 518)</b>	1.7	Yes
<b>Penetration = 2 " (Fresh Concrete - CT 533)</b>	<b>Penetration = 2-1/4" (Fresh Concrete - CT 533)</b>	1/4	Yes

Printed Name of IA Person: John Smith  
 Signature of IA Person: John Smith  
 Date: July 18, 2007

**Note: To remain certified, the Acceptance Tester should perform a new series of Split-Sample Tests by: July 18, 2008.**

The test equipment used by the IA person and the acceptance tester conformed to the California Tests shown above and had current calibration stickers firmly attached to the test equipment.



## Appendix V.1 - Example of an IA Log Summary Sheet

This is to certify that all IA services (Witness Tests, Split-Samples Tests, verification of equipment calibration and accreditation of laboratories, and qualification of samplers and testers) on Project HP21L-5055-111 were performed in accordance with the requirements in the local agency QAP.

This local agency project was completed on August 19, 2007 and it was not on the State Highway System or National Highway System.

IA person: John Smith  
(Printed Name)

IA person: John Smith  
(Signature)

Date: September 2, 2007

Exceptions to the above statement are noted below:

There were no exceptions on this project.

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**Note:** Also see "Appendix V2" for a more detailed IA log summary sheet. Either one would be acceptable if approved by the local agency.



### Appendix V.2 - Example of an IA Log Summary Sheet (Detailed)

Printed Name of Acceptance Tester: Bill Johnson  
 Company and City: ABC Engineering, Maintown, CA

Date	Witness Test (Write the Appropriate CT No.)	Did the Acceptance Tester Successfully Pass the Witness Test?	Was the Equipment in Good Working Condition?	Did the Equipment have a Calibration Sticker Firmly Affixed to the Equipment and was the Date within 12 Months of the Current Date?	Was the Split-Sample Corroboration Rating "Good" or Fair per Table 1?	Comments or Follow-Up Action
4/4/07	202	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	217	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	227	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	231	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	375	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	504	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	518	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	521	Yes	Yes	Yes	N/A	Witness Test Only
4/4/07	531	Yes	Yes	Yes	N/A	Witness Test Only
5/1/07	202	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	217	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	227	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	504	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	518	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	521	N/A	Yes	Yes	Yes	Split-Sample Test Only
5/1/07	531	N/A	Yes	Yes	Yes	Split-Sample Test Only

Note: Bill Johnson's next series of Witness Tests and Split-Sample Tests must be completed on or before 4/08 and 5/08, respectively

IA person: John Smith  
 (Signature)

Agency: City of Redlands Date: May 2007



## Appendix W - Example of an Annual IA Report (City of Maintown)

During the 2007 calendar year, the following activities were performed by John Smith, the IA person for the City of Maintown.

- On February 16, 2007, I received a letter from the City Engineer of Maintown, stating I was selected to perform IA services for the city.
- On March 1, 2007, I performed corroboration tests with Bill Smith (of ABC Testing Lab – qualified by AMRL & CCRL). The following tests were performed: Sieve Analysis, Sand Equivalent, Cleanness Value, Air Content of Fresh Concrete, Unit Weight of Fresh Concrete, Penetration of Fresh Concrete and Compaction of Asphalt Concrete by both parties. All tests had acceptable corroboration values, per Table 1 (Split-Sample Results between the IA person and a Representative from a Testing Laboratory Qualified by AMRL & CCRL).
- During 2007, Proficiency Certificates were issued to 30 acceptance testers (6 Maintown testers, 24 consultant testers.)
- During 2007, all 30 acceptance testers received split-sample tests and witness tests for the tests each person was qualified to perform. All passed the witness tests and 29 of the 30 acceptance testers had “good” or “fair” corroboration scores. Within a 7-day period, a second aggregate sample was presented to the tester who received the poor comparison. This time, the retest revealed a “Good” comparison. all test records were documented.
- During 2007, the test equipment of all 30 acceptance testers was checked. All equipment appeared in good condition with firmly affixed calibration stickers. All calibration dates on the stickers were in the year 2007.
- During 2007, I visited 3 consultant labs and the Maintown lab. I issued a Qualification Certificate to each lab. I checked to make sure that each lab had an approved QAP, current test methods, and calibration stickers on their equipment with current dates, that each acceptance tester had a Proficiency Certificate, and recent round-robin test data.
- See Attachment A for a list of the qualified labs that can perform acceptance tests for the City of Maintown.
- See Attachment B for a list of testers that are qualified to perform acceptance tests for the City of Maintown.

*John Smith*

(Signature of John Smith)

IA Person for the City of Maintown

July 15, 2007

(Date)



## **Appendix X - Typical Questions Asked During a FHWA/Caltrans Process Review**

During a FHWA/Caltrans process review, the local agency's Resident Engineer and the IA person are usually asked specific questions pertaining to the control of materials on a city or county Federal-aid transportation project. Typical questions include:

- Do you have a copy of your agency's approved Quality Assurance Program?
- May we see your log summary sheet for all the acceptance tests performed on your project?
- Who certifies your laboratory or your consultant's laboratory?
- Who calibrates your test equipment? May we see your calibration records?
- Do you have written evidence that your laboratory is qualified?
- Do you have Certificates of Proficiency for the samplers and testers on your project?
- Do you know the difference between acceptance and assurance testing?
- Can you show me with the acceptance tests that were performed on this project?
- Can you show me the independent assurance tests that were performed on this project?
- Who approves your mix designs?
- Can you show me Certificates of Compliance for materials accepted on your project, but were not tested by your laboratory?
- Can you show me your local agency's ratings from your last few Reference Samples Programs?
- Do you have plant inspection and/or source inspection records?
- If your test records indicated that some materials did not meet minimum standards (but the materials were used on your project), who approved this action? Do you have a copy of this authorization?
- Please show me signed copies of the Materials Certificates and any Materials Exceptions when the Resident Engineer closed out the project.



## Appendix Y - Example of a QAP

# QUALITY ASSURANCE PROGRAM (QAP)

AGENCY: City / County of \_\_\_\_\_

The purpose of this program is to provide assurance that the materials incorporated into the construction projects are in conformance with the contract specifications. This program should be updated every five years or more frequent if there are changes of the testing frequencies or to the tests themselves. To accomplish this purpose, the following terms and definitions will be used:

### DEFINITION OF TERMS

- Acceptance Testing (AT) – Sampling and testing, or inspection, to determine the degree of compliance with contract requirements.
- Independent Assurance Program (IAP) – Verification that AT is being performed correctly by qualified testers and laboratories.
- Quality Assurance Program (QAP) – A sampling and testing program that will provide assurance that the materials and workmanship incorporated into the construction project are in conformance with the contract specifications. The main elements of a QAP are the AT, and IAP.
- Source Inspection – AT of manufactured and prefabricated materials at locations other than the job site, generally at the manufactured location.

### MATERIALS LABORATORY

The AGENCY will use their own materials laboratory or a private consultant materials laboratory to perform AT on Federal-aid and other designated projects. The materials laboratory shall be under the responsible management of a California registered Engineer with experience in sampling, inspection and testing of construction materials. The Engineer shall certify the results of all tests performed by laboratory personnel under the Engineer's supervision. The materials laboratory shall contain certified test equipment capable of performing the tests conforming to the provisions of this QAP.

The materials laboratory used shall provide documentation that the laboratory complies with the following procedures:

1. Correlation Testing Program – The materials laboratory shall be a participant in one or more of the following testing programs:
  - a. AASHTO Materials Reference Laboratory (AMRL)
  - b. Cement and Concrete Reference Laboratory (CCRL)
  - c. Caltrans' Reference Samples Program (RSP)
2. Certification of Personnel – The materials laboratory shall employ personnel who are certified by one or more of the following:
  - a. Caltrans District Materials Engineer
  - b. Nationally recognized non-Caltrans organizations such as the American Concrete Institute, Asphalt, National Institute of Certification of Engineering Technologies, etc.
  - c. Other recognized organizations approved by the State of California and/or Recognized by local governments or private associations.



## Appendix Y (continued)

3. Laboratory and Testing Equipment – The materials laboratory shall only use laboratory and testing equipment that is in good working order. All such equipment shall be calibrated at least once each year. All testing equipment must be calibrated by impartial means using devices of accuracy traceable to the National Institute of Standards and Technology. A decal shall be firmly affixed to each piece of equipment showing the date of the last calibration. All testing equipment calibration decals shall be checked as part of the IAP.

### **ACCEPTANCE TESTING (AT)**

AT will be performed by a materials laboratory certified to perform the required tests. The tests results will be used to ensure that all materials incorporated into the project are in compliance with the contract specifications.

Testing methods will be in accordance with the CT Methods or a national recognized standard (i.e., AASHTO, ASTM, etc.) as specified in the contract specifications.

Sample locations and frequencies may be in accordance with the contract specifications. If not so specified in the contract specifications, samples shall be taken at the locations and frequencies as shown in Attachment #1 (Appendix D, “Acceptance Sampling and Testing Frequencies” of the QAP Manual).

### **INDEPENDENT ASSURANCE PROGRAM (IAP)**

IAP shall be provided by personnel from Caltrans, the Agency’s certified materials laboratory, or consultant’s certified materials laboratory. IAP will be used to verify that sampling and testing procedures are being performed properly and that all testing equipment is in good condition and properly calibrated.

IAP personnel shall be certified in all required testing procedures, as part of IAP, and shall not be involved in any aspect of AT.

IAP shall be performed on every type of materials test required for the project. Proficiency tests shall be performed on Sieve Analysis, Sand Equivalent, and Cleanness Value tests. All other types of IAP shall be witness tests.

Poor correlation between acceptance tester’s results and other test results may indicate probable deficiencies with the acceptance sampling and testing procedures. In cases of unresolved discrepancies, a complete review of AT shall be performed by IAP personnel, or an independent materials laboratory chosen by the Agency. IAP samples and tests are not to be used for determining compliance with contract requirements. Compliance with contract requirements is determined only by AT.

### **REPORTING ACCEPTANCE TESTING RESULTS**

The following are time periods for reporting material test results to the Resident Engineer:

- When the aggregate is sampled at material plants, test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Resident Engineer within 24 hours after sampling.
- When materials are sampled at the job site, test results for compaction and maximum density should be submitted to the Resident Engineer within 24 hours after sampling.
- When soils and aggregates are sampled at the job site:
  - (1) Test results for Sieve Analysis, Sand Equivalent and Cleanness Value should be submitted to the Resident Engineer within 72 hours after sampling.
  - (2) Test results for “R” Value and asphalt concrete extraction should be submitted to the Resident Engineer within 96 hours after sampling.

When sampling products such as Portland Cement Concrete (PCC), cement-treated base (CTB), hot mix asphalt (HMA), and other such materials; the time of such sampling shall be varied with respect to the time of the day insofar as possible, in order to avoid a predictable sampling routine. The reporting of AT results, if not performed by the Resident Engineer’s staff, shall be done on an expedited basis such as by fax or telephone.





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