

## **QUALITY ASSURANCE STEWARDSHIP REVIEW SUMMARY REPORT FOR FISCAL YEARS 2003 THROUGH 2008**

### **Executive Summary**

This report summarizes the 24 State reviews that were conducted from 2003 through 2008. The majority of the States that were reviewed (20 of the 24 States reviewed) used contractor test results in the acceptance decision.

In most States where contractor test results were used in the acceptance decision it was found that the States' system for comparing test results between the contractor and State needed to be strengthened. The major issues in this area include: the lack of independent samples for verification, lack of statistical comparison of contractor results, low ratio of State to contractor test results, lack of State control of sampling locations, and custody of State verification samples.

Although the Independent Assurance programs are generally well developed there were a couple of areas of improvement that were noted in several States. The first being the lack of timely resolution of non-comparing results and the second is the review of the values that are used for comparing test results.

No fraudulent activities have been discovered as the result of the stewardship reviews.

The stewardship reviews will continue along with the continued development and updating of resources in order to continuously improve the QA program.

### **Background**

FHWA's sampling and testing regulations titled, "Quality Assurance Procedures for Construction," was published on June 29, 1995, as Title 23, Code of Federal Regulations, Part 637 (23 CFR 637). The regulations require each State agency to have in place an approved Quality Assurance (QA) Program for materials used in Federal-aid highway construction projects. Provided certain checks and balances are in place, the regulations provide flexibility in sampling and testing by allowing the use of contractor test results in the overall Agency acceptance decision. In addition, consultants may be used in performing Dispute Resolution or Independent Assurance (IA) if the laboratories have been AASHTO accredited. The States may also use a system approach to IA instead of establishing frequencies based on individual project quantities.

The regulations also include several additional requirements: (1) the State agency's central laboratory was required to become accredited by the AASHTO Accreditation Program by June 30, 1997, and (2) all testing personnel and laboratories must be qualified using State procedures by June 29, 2000.

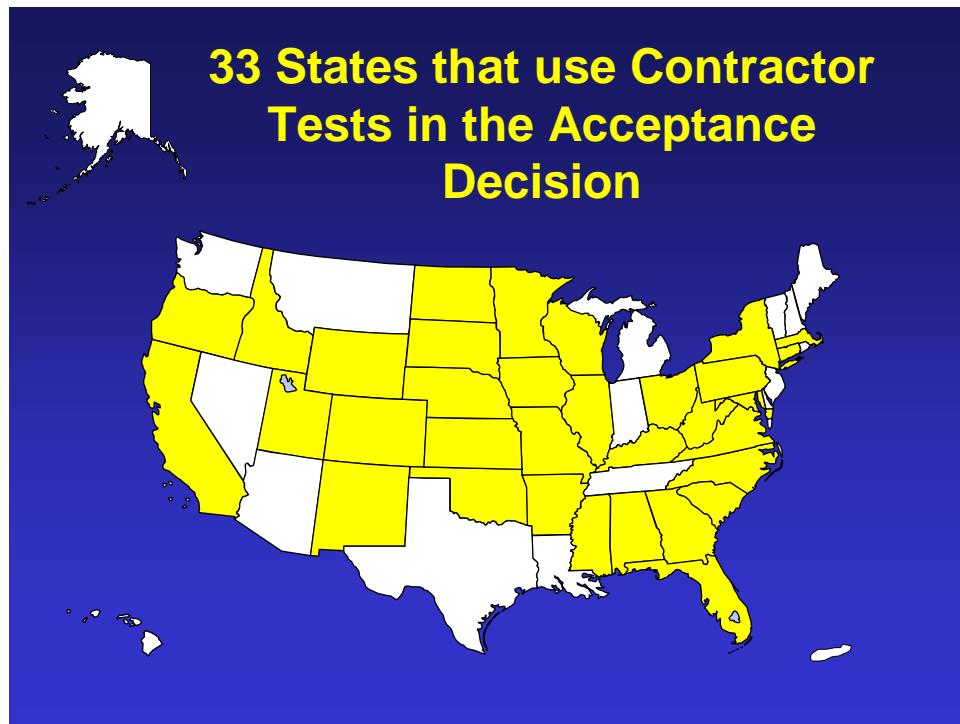
During fiscal year (FY) 2007 a National Program Review (NPR) on Quality Assurance was also conducted by the Office of Professional and Corporate

Development. The NPR covered the actions taken by the Division Office in approving and reviewing State's QA Programs. This report will not discuss the results from the NPR and only summarizes the results of the reviews that have been conducted by the Office of Infrastructure.

### **Objective**

The objective of this activity is to review the State agencies' QA Program practices and procedures, and to ascertain the status of the States' implementation of the QA regulation, 23 CFR 637. These reviews are conducted by the Office of Infrastructure as part of the Federal Highway Administration's overall stewardship activities for State agency QA Programs.

Each State review looked at the entire QA Program in each State. Prior to the start of the reviews in FY 2004 there was some concern expressed over the use of contractor supplied test results in the acceptance decision. Thirty-three (33) States currently allow the use of contractor testing in the acceptance decision. As a result of the number of States that are using contractor test results and the concerns over the implementation of that provision, the review has focused on states that use contractor tests results in the acceptance decision with 20 out of the 24 reviews have been conducted in States using contractor test results in the acceptance decision.



The assessments were a joint effort involving the State agency and FHWA Headquarters, Resource Center, and Division Office personnel. Material practices involving the regulation were examined at the State's headquarters, Region/District, and construction project level.

Four stewardship reviews have been conducted each Fiscal Year since 2003 as shown on the following map.

<b>Year</b>	<b>States Reviews</b>
2003	Maine, Missouri, Colorado, and Oklahoma.
2004	California, Georgia, North Carolina, and New York.
2005	Maryland, Oregon, Minnesota and Connecticut
2006	Virginia, Wisconsin, Nebraska and Nevada
2007	Pennsylvania, South Carolina, New Mexico and Wyoming
2008	Delaware, Kansas, Rhode Island, and Idaho



### Assessment Procedures

The stewardship reviews included (1) interviews with State agency headquarters, Region/District and field office personnel and FHWA personnel, (2) review of State agency implementation strategies including policy and procedure documents and office records where applicable, (3) visits to construction projects to assess field practices as appropriate, and (4) identification of best practices.

Entrance conferences were held, as appropriate, with top FHWA Division Office and State agency personnel to explain the assessment intent and process. Closeout meetings were held with the Division and State agency offices to share information obtained from the assessment.

## **Organization of Report**

This is a “state of the practice” report that covers the reviews completed during FY 2003 through FY 2008. The report will cover best practices, opportunities for improvement, and fraudulent activities that were found during the reviews along with resources that are available. The best practices and opportunities for improvement will be further subdivided by the Quality Assurance categories of Acceptance, Independent Assurance, Technician Qualification, Laboratory Qualification and Dispute resolution.

### **1. Best Practices**

#### **a. Acceptance**

- (1) Electronic Materials Management Systems. States are making progress in electronic management of materials data. Several States are using the AASHTO Site Manager software, while some States have either an in-house developed system or a third-party developed system. The creation of databases has allowed the States to examine their specification limits more easily and ultimately will allow analysis of data to create performance related specifications.

One State is customizing an off-the-shelf PROLOG program to store construction and materials data. As part of the system the State is also using PC tablets in the field to collect the data.

- (2) Materials reference sample program. Several States have developed internal materials reference sample programs to verify qualification of laboratories and or technicians. Some States are also using the proficiency samples that are prepared by the AASHTO Material Reference Laboratory.
- (3) In most States, except as noted below, the qualification programs for manufactured items have been designed well and implemented properly.
- (4) Participation and use of the National Transportation Product Evaluation Program (NTPEP). The NTPEP is an AASHTO program which tests select manufactured materials. A number of States are moving toward further use of the NTPEP program. In particular, States are specifying in their specifications that materials need to be tested by NTPEP before the material is considered for approval. The results of the program can be used as part of a State’s approved products list program. The NTPEP program can result in increased assurance of product quality. Some States are also scheduling a peer review by

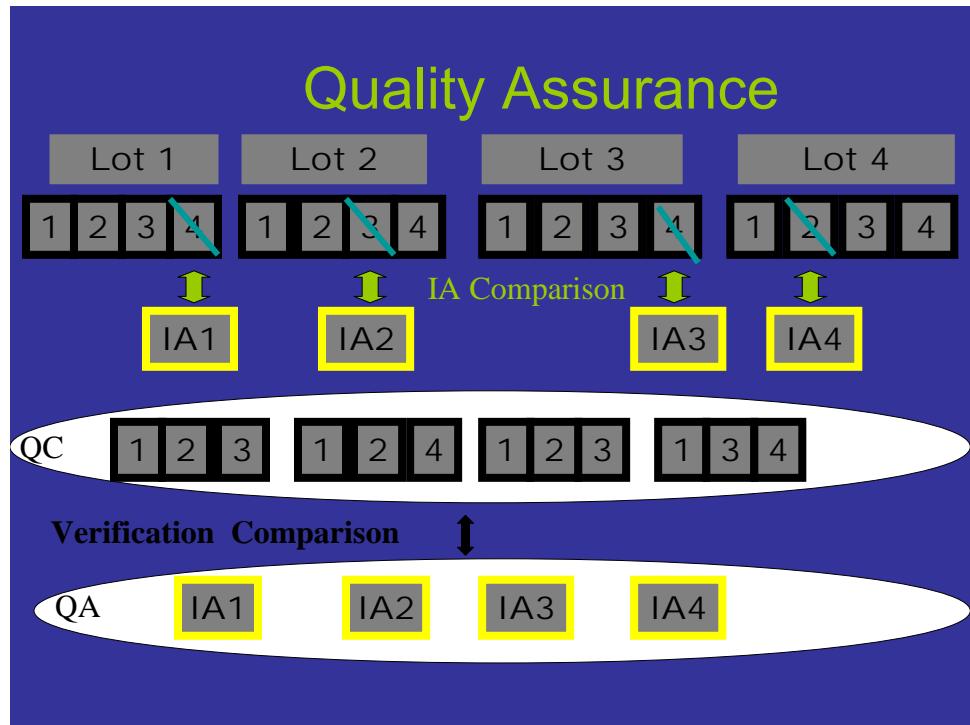
National Transportation Product Evaluation Program (NTPEP) to assist the States in using NTPEP data.

- (5) Several States are requiring suppliers of precast items to be certified by the National Precast Concrete Association or the Prestressed Concrete Institute
- (6) Meetings with field materials personnel. Most States hold monthly or quarterly meetings with district or regional materials engineers to discuss materials testing issues. This is a good forum for ensuring consistency of interpretation of specifications, test procedures and policy. These meetings also ensure that problems with specifications are identified in a timely manner.
- (7) One State is performing Statewide Quality Assurance Reviews. These reviews are performed from the Central office and review the materials and construction procedures to ensure uniform application of specifications and procedures.
- (8) One State has a comprehensive materials certification process, which requires the supplier to sign a specification compliance certification. The system allows lots of materials to be tied to specific test results that the supplier is performing. When the State performs their periodic verification tests the State can not only verify that specification material is being supplied but also provides an opportunity to verify that the supplier is performing accurate testing which provides additional confidence in the supplier. In those cases where the State verification results do not indicate that specification material was supplied it allows the State an opportunity to trace the location of the material down easier and may reduce the amount of analysis to determine the scope of the problem.
- (9) Many States are using Percent Within Limits specifications for accepting and paying for materials.
- (10) A State is leading the development and use of the AASHTO Product Evaluation List (APEL).
- (11) Several States are performing a statistical correlation of contractor and State test results at beginning of production.
- (12) A State has established different levels of testing based on the risks involved for material use and or traffic volumes. This concept is used in the HMA, structural concrete and paving concrete.

- (13) A State is determining soil support values on in-place soil materials and making adjustments to the pavement structure if appropriate.
- (14) Sample Control System. Several States allow contractors to transport cores for asphalt density and asphalt box samples. However, they use security tape on the box samples that indicates tampering if removed. The cores are shipped in plastic totes or coolers that have numbered security tags to prevent tampering.
- (15) Multiple layers of materials review by the State. Several States have different groups of highly qualified personnel that observe the operations at the plant. This process allows for identifying issues before they become serious problems.
- (16) Reduce variability by performing split sample testing prior to production on PCC and HMA Paving. Several State require split sample testing by all contractor and State testing personnel prior to the beginning of production. This testing has reduced the amount of variability between contractor and State test results.
- (17) Improved specifications for PCC. A State developed an incentive/disincentive program for PCC paving which includes water to cement ratio, aggregate quality and gradation.
- (18) Several States have adopted or are moving toward adopting the use of specifying and measuring smoothness using inertial profilometers.
- (19) Calibration of smoothness measurement devices. Several States are calibrating their smoothness measurement devices at a test facility. The calibration process includes the recordation of the filter settings used at the time of certification. Many States are specifying incentives and disincentives on pavement smoothness. States need to calibrate smoothness measurement devices to ensure proper and equitable payment for smoothness.
- (20) **Several States are also certifying operators of smoothness measuring devices.**
- (21) Sampling Hot Mix Asphalt (HMA). Many States sample loose HMA from behind the paver where the final "in place" properties are evaluated. This ensures that the sample includes the as placed material and reduces the potential notification of plant personnel of sampling times.

- (22) Verification of contractor test data. Several States are using F and t test to verify contractor test results.
- (23) Several States are taking proactive actions to mitigate Alkali Silica Reactivity including the use of fly ash, ground granulated blast furnace slag and blended cement.
- (24) One State is statistically analyzing State and Contractor data in an innovative manner to accomplish both verification and IA.

The contractor performs sampling and testing at the rate of 4 samples per lot. The State takes verification samples, at the beginning of production; a minimum of 4 samples are taken the first week of production and at least 1 per lot. The State's verification samples are taken at the plant by contractor personnel under the direction of the State personnel. The verification samples are split and one split is given to the contractor. Analysis is performed in two ways. First, for IA, the split results are compared using IA comparison tolerances. In the figure below IA1 is compared to the contractor split of that sample, sample 4 of lot 1. For validation, the State verification samples are made independent by removing the corresponding contractor splits. In the figure below samples 1, 2, 3 from lot 1; samples 1, 2, 4 from lot 2; samples 1, 2, 3 from lot 3; and samples 1, 3, 4 from lot 4 are compared to the State's IA1, IA2, IA3, and IA4 with the F& t tests.



- (25) Several States are specifying low permeability Portland Cement Concrete mixes to increase durability on bridge decks.
- (26) Several States provide a list of required samples and tests along with required certification requirements to the project office based on the testing requirements and estimated quantities of the bid items on the project.
- (27) Several States have developed specifications to improve density of HMA at the longitudinal Joints.
- (28) Several States are modifying test procedures to eliminate multiple testing options which reduce the amount of testing variability.

**b. Independent Assurance**

- (1) In most States, except as noted below, the Independent Assurance (IA) programs are well designed and understood. IA is a program of split sampling and testing or reference sample testing to help ensure that the testing is being performed correctly on properly calibrated equipment. The programs are being implemented properly and are yielding the desired results.
- (2) Joint biannual reviews of the IA program. Although it is not a requirement, one State and Division Office perform a biannual review of the IA program. The review covers all aspects of the

IA program including implementation at the project and the regional office.

- (3) Several States have developed comprehensive annual IA reports which include the number of certified technicians, the number of active technicians, the number of technicians that were covered by the IA program, the number of IA reports that had deficiencies, and an analysis of the deficiencies along with the potential systemic solutions to reoccurring deficiencies.
- (4) One State is performing an annual analysis of the tolerances that are used for comparing IA results to verification results. As test procedures are reviewed, options are eliminated, and certification programs have been developed it is expected that variability will decrease and so it is appropriate to reduce the tolerances for comparing IA and verification results.

**c. Laboratory Qualification**

- (1) In most States, except as noted below, the Laboratory Qualification Programs have been designed well and implemented properly.
- (2) Accreditation of district/region laboratories. Some States are requiring their district/region laboratories (in addition to the central laboratory) to be accredited by the AASHTO Accreditation Program. Requiring additional qualification of the State's laboratories reduces the chances of having test results successfully questioned in disputes.
- (3) Calibration of angle of gyration on gyratory compactors. Several States have procedures to ensure that the internal angle of gyration is being checked.
- (4) Several States are requiring qualification of laboratories that perform mix designs. Some States are requiring laboratories that perform mix designs to be accredited by the AASHTO Accreditation program.

**d. Technician Qualification**

- (1) In most States, except as noted below, the Technician Qualification Programs for project-produced materials have been understood, designed, and implemented properly.
- (2) A State is requiring technicians who perform HMA mix designs to participate in the AMRL proficiency testing program.

## 2. Opportunities for Improvement

### a. Acceptance

- (1) Use of Contractor Test Results. In most States it was found that the States' validation system needed to be strengthened. The following items were noted:
- (a) Not using independent samples for State verification samples,
  - (b) No statistical comparison of contractor and State data,
  - (c) Low State to contractor test comparison ratio of 1 vs. 10 results, and one vs. one comparisons of test results for validation,
  - (d) Lack of control of contractor supplied data,
  - (e) Lack of a defined time for comparing test results,
  - (f) Not increasing testing frequencies when test results don't compare,
  - (g) States are not controlling the sampling location and timing,
  - (h) States are allowing biased retesting provisions, and
  - (i) Lack of security for samples.
  - (j) **Lack of Verification of ride data.**
  - (k) **Lack of Random sampling**

The following is a further explanation of each of the areas noted above:

- (a) Use of independent samples. It was noted in several States that verification testing was being performed based on split samples taken by the contractor. Verification of test data needs to be based on independent samples taken by the State. Split samples are an important part of the overall system and can help determine problems associated with sampling and testing procedures and equipment problems. That is why IA testing is required. However, split samples taken by the contractor will not detect fraudulent activity by the contractor which may consist of fabricating samples, switching samples, or taking samples from biased locations. **Observation of contractor sampling and testing can not be the sole means of verifying contractor test results.**
- (b) Use of a statistical comparison. It was noted in some States that a statistical comparison was not being performed between the contractor's results and the State's results. The comparison was being based solely

on a one vs. one comparison of results. This method of verification is very weak and will only detect severe problems with contractor test results. The strongest statistical method is the F and t tests

- (c) Number of independent samples being compared for validation. It was noted in some States that comparison ratio's of State to contractor results was one vs. five or one vs. 10. When the *F*-test and *t*-test are used for comparing test results, a minimum of seven to 10 State test results and a maximum of 20 to 30 contractor test results should be used for a reasonable comparison. It is suggested that a method of rolling comparison be incorporated to solve this problem. The number of, or size of the lots for pay do not have to be the same as the lots that are used in the comparison. States can also increase their sampling frequency at the beginning of projects in order to accumulate test results to start the comparison earlier. It was noted in some States that there is no limit to the number of contractor test results that are included in the comparison procedure. It is recommended that the number of contractor test results be limited to a maximum of 20 to 30 results because large number of tests in the comparison can mask problems in individual test results. **The level of significance ( $\alpha$ ) should be set between 0.01 and 0.05.**
- (d) Control of contractor supplied data. A need to control the documentation for contractor supplied test results was noted in some States. In some cases the State is not receiving the documentation until three days after the paving. Some States also do not require the contractors to retain the source documentation for the required 3 years and are not periodically reviewing the records. The States should be reviewing source documentation, requiring proper retention of documents and require the submission of test results the next day and before the State supplies their results. **State test results should not be transmitted to the contractor until the corresponding contractor's results are received.**
- (e) Defined time frame for comparing test results. It was noted that in some cases there were no limits on the time required for validating contractor test results with the State verification test results. Validation of test results should occur as soon as possible due to the risks to both the State and the contractor that the material being

supplied and incorporated into the project does not meet specifications.

- (f) Increasing test frequency. When contractor and State tests do not validate, the State should increase their frequency of testing. This will increase the ability of the validation process to detect differences and also reduce risks for both parties if the States results are ultimately used for payment.
- (g) Control of sampling location. It was noted in several States that the time and or location of sampling was being telegraphed to the contractor. In one case separation paper was being placed on the existing hot mix asphalt mat before placement of the next lift. The paper located the area that cores were going to be taken before the lift was placed and compacted. In other cases the random numbers for the sample locations are being given to the contractors for the entire project at the beginning of the project or at the beginning of the day for the entire day. The State must control the sampling location and timing, limit the pre-notification of sampling, and limit the ability of the contractor to modify sampling locations. Also, sampling behind the paver can avoid telegraphing sampling times to the plant operators. Saws can also be provided to separate the layers of cores instead of using paper to separate the layers.
- (h) Biased retesting provisions. It was noted that some States allow the retesting of material any time a failing test result occurs and replace the failing test result with the new result. This practice is highly biased toward the contractor. Under no circumstances should a test result be thrown out unless it is known that the sample is flawed, i.e. poor or damaged sample, or poor test procedures. If additional tests are taken the analysis process needs to be modified to take into consideration the additional number of test results.
- (i) Security of samples. There have been issues with the security of the retained (i.e. third party) sample being in the possession of the contractor. The possession and storage of retained, third party samples, or dispute resolution/backup samples, should be taken immediately by the State. Manipulation of the samples or replacement by known passing material could occur when the contractor takes possession of these samples.

- (j) Lack of Verification of ride data. States need to provide independent verification of contractor supplied ride data quality.
  - (k) Lack of Random sampling. All QC sampling used in the acceptance decision and verification sampling and testing must be random.
- (2) Hot Mix Asphalt (HMA)
- (a) Several States did not include volumetric properties as part of the acceptance decision for HMA mix and should move towards using volumetric properties.
  - (b) States should consider using a percent of the maximum theoretical density as a target for roadway density instead of percent of control strip.
  - (c) The maximum theoretical density of the mixture needs to be verified at the start of production and throughout production. The values can change with differences in gradation and binder content.
  - (d) When nuclear gages are used for acceptance of HMA density the State should develop and implement an effective procedure to correlate gages using cores.
  - (e) States should develop density specifications which include the entire longitudinal joint in the evaluation, i.e., eliminate the different requirements for mainline vs. edge of pavement and confined vs. unconfined edge.
  - (f) States should verify that moisture susceptibility has been mitigated during production of HMA mixtures by running a moisture susceptibility test during production.
  - (g) States should verify the volumetric properties of HMA during initial production of the mix.
  - (h) States should take HMA mixture samples behind the paver to insure that the samples include all potential for segregation.
  - (i) States should require preproduction sampling and testing process to ensure that the plant can produce the mix, the mix can be placed and adjust target values to reduce changes to the JMF during production.

- (j) At the beginning of production, the frequency of verification testing should be increased along with using split sample testing to ensure the testing equipment is working properly and the technicians are performing the tests properly.
  - (k) The State should move toward validation of the internal angle of gyration on the gyratory compactor.
  - (l) New technology is available to reduce the potential for segregation including the Kansas density profile test and paver segregation modification kits.
  - (m) Binder content should be accepted by test procedures run throughout the day and not on invoices or tank stabbings. Invoices or tank stabbings will not pick up variability during production.
- (3) Other acceptance issues
- (a) Testers' names were not indicated on reports. All test reports should indicate the person that was responsible for sampling and testing the material. The reports should also include the testers' certification number.
  - (b) States need to develop comprehensive electronic materials management systems to allow continuous analysis of specifications in order to improve their specifications based on the actual results obtained within the State.
  - (c) Absolute Average Deviation or other inefficient quality measures are being used for acceptance and pay adjustments. States should move toward a more rigorous statistical system such as Percent Within Limits (PWL) for specifications.
  - (d) States should move toward larger lot sizes (7- 20 samples) to reduce risks for both the State and contractors. Very large lot sizes (> 30) will not allow defective materials to be identified toward the end of the lot.
  - (e) Many States allow multiple options in their test procedures and sampling locations. This provides an increased variability in sampling and testing. A single test method and sampling location will reduce the overall variability of the test results.

- (f) Specified periodic re-evaluation for each product that appears on the Qualified Products List should be established. Higher risk products may need to include additional validation and higher test frequencies.
- (g) When setting up qualified products lists States should take advantage of the data that is available through the testing that is performed on some manufactured items by the National Transportation Product Evaluation Program (NTPEP).
- (h) As States evaluate new products they should add their data to the AASHTO Product Evaluation List (APEL).
- (i) The smoothness specification requirements should be reevaluated to ensure the present parameters are acceptable.
- (j) Reduce the amount of exclusion areas to improve ride in those areas.
- (k) Ride bonus - ensure an incentive is only provided for superior ride quality and not allow the majority of contractors (regardless of quality) to achieve the full ride incentive.
- (l) Balance the material quality and payment, with the smoothness quality and payment so contractors won't only put an emphasis on one or the other during production and laydown.
- (m) Specifications should not allow the contractor to grind the pavement into an incentive. Grinding should be limited to must grind areas.
- (n) The States need to verify the contractor's data when contractor data is used in the acceptance decision.
- (o) States are encouraged to have the Central Office assess the QA programs to assure consistent implementation statewide.
- (p) States should require the QC technicians to certify each of their test results. As an example, most states require a certification (i.e. statement) for the technician's signature to indicate that the report reflects the actual test results obtained.
- (q) State testing procedures should be more accessible either in hardcopy or electronic format.
- (r) States should move away from a stepped

incentive/disincentive specification to a continuous pay adjustment specification. With step specifications there may be a significant change in pay at the step which may increase the potential for fraud to occur.

- (s) There are concerns related to the amount of available staff when contractor test results are used in the acceptance decision to:
  - (t) Monitor field operations;
  - (u) Analyze the data on a daily basis as part of the validation program; and
  - (v) Support the staff in the development and implementation of the overall QA program to ensure timely development of a QA system that is in compliance with the regulation.
- (w) States should consider establishing mix design criteria for rapid chloride permeability testing for bridge deck concrete in order to reduce the permeability in bridge decks.
- (x) Security of field cured PCC cylinders should be improved.

**b. Independent Assurance**

- (1) States should review their test result comparison tolerances. In some instances tolerances were developed in the early 1970s and have not been thoroughly examined since then. In many cases the testing variability has improved due to certification programs and improvements to test procedures. Therefore, the tolerances may be too large.
- (2) The IA inspectors taking independent samples. IA should consist of a program of split sampling and testing or reference sample testing to help ensure that the testing is being performed correctly on properly calibrated equipment. Independent samples do not efficiently isolate issues or detect problems associated with sampling, testing and equipment, unless large numbers of independent samples are taken.
- (3) IA forms refer to specification compliance. IA is specifically intended for determining testing competence, not specification compliance.
- (4) Gyratory compaction not included in the IA program. The IA program should cover all test procedures that are used in the acceptance decision.

- (5) The IA program did not cover technicians in the QC laboratories. All technicians including State personnel, contractor personnel or consultant personnel that are performing testing that is used in the acceptance decision must be qualified.
- (6) Methods need to be developed to standardize comparison of IA and acceptance test results including having both test results on the IA form.
- (7) Timely resolution of discrepancies in IA, specification, compliance, and validation need to be documented and included in the project files.
- (8). A goal of 90 percent coverage of the active testing personnel per year should be established when the system approach is used for IA.
- (9) States should require technicians to calibrate the air meters used for testing air content on Portland cement concrete.
- (10) Comparison tolerances should be developed for all tests that are covered by the IA program. Additionally the steps to be taken once an IA sample result does not compare should be documented.
- (11) IA programs should include some observation of test procedures.

**c. Laboratory Qualification**

In some States the qualification programs for all contractor and State laboratories used in the QA program were not established.

**d. Technician Qualification**

- (1) States should require qualification of contractor/supplier personnel that are performing mix designs.
- (2) The technician qualification programs should be the same for both the State personnel and contractor personnel.
- (3) Qualification programs for technicians need to be developed for all technicians that are sampling or testing, including testing soils, sampling asphalt mixtures and sampling cores.

- (4) The technician Qualification programs should include a proficiency component, written exam and re-qualification components.

e. **Dispute Resolution**

- (1) In some States the dispute resolution system is not formally established and documented. When contractor test results are used in the acceptance decision, the State must establish a dispute resolution system to address the resolution of discrepancies occurring between the verification sampling and testing and the contractor sampling and testing.
- (3) When the State's test results do not verify the contractor's test results the specifications should include a process for handling the situation. This could include a review by knowledgeable district and central office personnel. In addition the validation lot should be terminated and the validation process restarted after corrections are made. The F & t tests should include a tolerance for use until the State has 3 tests in the analysis.

**3. Fraudulent Activities**

No fraudulent activities were discovered during the reviews.

However, questions concerning fraudulent activities were asked during the reviews in the twenty States that were assessed during FY 2004 thru FY 2008. In response to those questions, two States indicated current ongoing investigations and two States indicated that they had revoked technician certifications due to fraudulent activities. Questions concerning fraudulent activities or the revocation of technician certifications were not asked during the reviews performed in FY 2003.

**4. Available Resources**

The following resources are currently available for assistance in dealing with issues raised in this report:

- a. The guideline for these reviews is available on the FHWA Pavements web site at <http://www.fhwa.dot.gov/pavement/materials/qareview.cfm>
- b. "23 CFR Part 637," Subpart B - Quality Assurance Procedures for Construction, Federal Highway Administration, *Federal Register*, Washington, DC published on June 29, 1995, and amended on December 10, 2002, and September 24, 2007,  
[http://www.access.gpo.gov/nara/cfr/waisidx\\_03/23cfr637\\_03.html](http://www.access.gpo.gov/nara/cfr/waisidx_03/23cfr637_03.html)

- c. Non-regulatory supplement for 23 CFR Part 637, Subpart B - Quality Assurance Procedures for Construction, Federal Highway Administration. The non-regulatory supplement was updated on July 19, 2006.  
<http://www.fhwa.dot.gov/legsregs/directives/fapg/0637bsup.htm>
- d. Technical Advisory 6120.3, "Use of Contractor Test Results in the Acceptance Decision, Recommended Quality Measures, and the Identification of Contractor/Department Risks", Federal Highway Administration, August 9, 2004.  
<http://www.fhwa.dot.gov/legsregs/directives/techadvs/t61203.htm>
- e. Frequently asked questions (FAQ) on the Quality Assurance Regulation. The FAQs were updated on November 26, 2006.  
<http://www.fhwa.dot.gov/pavement/materials/matnote11.cfm - qaa>
- f. NHI Course 134042, "Materials Control and Acceptance –Quality Assurance." The course is four days long and covers the basic essentials of QA. A two-day version of the course is also available.  
[http://www.nhi.fhwa.dot.gov/training/brows\\_catalog.aspx](http://www.nhi.fhwa.dot.gov/training/brows_catalog.aspx)
- g. A 1-day workshop titled "Introduction to Percent within Limits" is being offered by the FHWA.  
[http://www.fhwa.dot.gov/pavement/pwl/basic\\_pwl.cfm](http://www.fhwa.dot.gov/pavement/pwl/basic_pwl.cfm)
- h. A 1-day workshop "Basic Pavement Warranty" is being offered by the FHWA. <http://www.fhwa.dot.gov/pavement/warranty/index.cfm>
- i. "Optimal Procedures for Quality Assurance Specifications", *Publication No. FHWA-RD-02-095*, Federal Highway Administration, Washington, DC, April 2003,  
[http://www.fhwa.dot.gov/pavement/pub\\_details.cfm?id=89](http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=89)
- j. "Evaluation of Procedures for Quality Assurance Specifications", *Publication No. FHWA-HRT-04-046*, Federal Highway Administration, Washington, DC, October 2004,  
[http://www.fhwa.dot.gov/pavement/pub\\_details.cfm?id=367](http://www.fhwa.dot.gov/pavement/pub_details.cfm?id=367)
- k. AASHTO Standard Recommended Practice R 9-05, "Acceptance Sampling Plans for Highway Construction" has been published in the 2005 AASHTO Standards. This guide will assist the States in developing specifications.
- l. A software package SPECRISK has been developed by FHWA as a tool to help analyze risks associated with Percent Within Limit (PWL) specifications. The software is completed is being distributed through NHI course 134070 which is available from NHI as a web based training course.

- m. NHI Course 134064 – “Transportation Construction Quality Assurance” is available in a 2 or 3 day version.

## **5. Status of other Quality Assurance Activities**

The following resources are being developed to address issues that are not being covered by existing resources:

- a. A contract for developing NHI Course 134059 – “Quality Assurance Specification Development and Validation Course” has been awarded. The course is expected to be available by the end of 2009. The course will use the SPECRISK software that was developed to assist the States in developing and validating the risks associated with PWL specifications.

## **Conclusion**

The stewardship reviews will continue next year and beyond along with the continued development and updating of resources in order to continuously improve the QA program.