
# Quality Assurance Program for Design-Bid-Build Projects

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# SECTION 1 - INTRODUCTION

## 1.1 Overview

The Texas Department of Transportation (TxDOT) established the Quality Assurance Program (QAP) for Design-Bid-Build (D-B-B) Projects to ensure that materials and workmanship incorporated into highway construction projects are in reasonable conformity with the requirements of the approved plans and specifications, including any approved changes. This program conforms to the criteria in 23 CFR 637 B. It consists of an "Acceptance Program" and "Independent Assurance (IA) Program" based on test results obtained by qualified persons and equipment.

The QAP allows for the use of validated Contractor-performed quality control (QC) test results as part of an acceptance decision. It also allows for the use of test results obtained by commercial laboratories in acceptance decisions, as well as in the IA program. The acceptance of all materials and workmanship is the responsibility of the Engineer.

## 1.2 Definitions

This document references the following terms and definitions.

Abuse—Careless or deliberate deviation from testing procedures or specifications.

Acceptance Program—All factors that comprise the State highway agency's (SHA) determination of the quality of the product as specified in the Contract requirements. These factors include verification sampling, testing, and inspection and may include results of QC sampling and testing.

Breach of Trust—Violation of the trust placed in the certified technician including, but not limited to, acts such as: falsification of records; being aware of improprieties in sampling, testing, and/or production by others and not reporting them to appropriate supervisors involved in the project; re-sampling and/or retesting without awareness and consent of appropriate supervisors involved in the project; and/or manipulating compensation and/or production.

Independent Assurance (IA) Program—Activities that are an unbiased and independent evaluation of all the sampling and testing procedures, equipment and personnel qualifications used in the acceptance program. Test procedures used in the acceptance program that are performed in the SHA's central laboratory are not covered by an IA Program.

Neglect—Unintentional deviations from testing procedures or specifications.

Proficiency Samples—Homogenous samples that are distributed and tested by 2 or more laboratories and/or personnel. The test results are compared to assure that the laboratories and/or personnel are obtaining the same results.

**Qualified Laboratories**—Laboratories that are capable as defined by appropriate programs established by the SHA. As a minimum, the qualification program must include provisions for checking testing equipment, and the laboratory must keep records of calibration checks.

**Qualified Sampling and Testing Personnel**—Personnel who are capable as defined by appropriate programs established by the SHA.

**Quality Assurance (QA)**—All planned and systematic actions necessary to provide confidence that a product or service will satisfy given requirements for quality.

**Quality Control (QC)**—All Contractor operational techniques and activities performed or conducted to fulfill the Contract requirements.

**Verification Sampling and Testing**—Sampling and testing performed to validate the quality of the product.

## 1.3 Remarks

For more information regarding the information and procedures in the program, contact the Construction Division's Materials and Pavements Section (CST/M&P).

# SECTION 2 - ACCEPTANCE PROGRAM

## 2.1 Overview

Materials incorporated into any highway construction project are subject to verification sampling and testing, as well as quality control (QC) sampling and testing when required by the specifications.

## 2.2 Sampling and Testing Frequency and Location

Verification sampling and testing will be performed at the location and frequency established in the Department's *Guide Schedule of Sampling and Testing* or specifications specific to each project.

## 2.3 Quality Control Sampling and Testing

Contractor-performed QC sampling and testing may be used as part of an acceptance decision when required or allowed by specification.

QC sampling and testing personnel, laboratories, and equipment will be qualified in accordance with Section 6 – Technician Qualification Program and Section 7 – Laboratory Qualification Program and will be evaluated under the Independent Assurance Program, as described in Section 3 of this document.

QC test results will be validated by verification test results obtained from independently taken samples. Qualified TxDOT personnel or their designated agents will perform verification sampling and testing.

## 2.4 Dispute Resolution System

When QC test results are used in the acceptance decision, the CST/M&P central laboratory will perform referee testing or evaluation to resolve disputes that arise between TxDOT or its designated agents and the Contractor. The CST/M&P central laboratory decision will be final.

# SECTION 3 - INDEPENDENT ASSURANCE PROGRAM

## 3.1 Overview

The Independent Assurance (IA) program evaluates all sampling and testing procedures, personnel, and equipment used as part of an acceptance decision.

The IA program evaluates the qualified sampling and testing personnel and testing equipment and is established using the system approach. The system approach bases frequency of IA activities on time—regardless of the number of tests, quantities of materials, or numbers of projects tested by the individual being evaluated.

## 3.2 Sampling and Testing Frequency

Perform IA sampling and testing at the frequency established in Section 9.2 – Required Frequencies and Activities.

NOTE: Testing procedures performed at the CST/M&P central laboratory are not subject to the IA program.

## 3.3 Testing Equipment

CST/M&P will qualify district laboratory testing equipment used for IA sampling and testing, in accordance with Section 7 – Laboratory Qualification Program. Any non-TxDOT commercial laboratory used for IA sampling and testing must be accredited in accordance with Section 7.3 – Laboratory Qualification Responsibility.

CST/M&P may designate the district laboratory to qualify other Department testing equipment used for IA sampling and testing.

Qualify testing equipment in accordance with the following guidelines.

A. Frequency for qualifying IA sampling and testing equipment must not exceed 1 year.

B. Calibration/verification is required whenever the laboratory or equipment is moved.

C. IA equipment must be other than that used for performing verification or quality control (QC) testing.

IA sampling and testing personnel will evaluate any equipment used to perform verification and/or QC sampling and testing in making an acceptance decision. This evaluation includes calibration checks and split or proficiency sample tests. The Department test procedures referenced in Section 7.5 – Calibration Standards and Frequencies for Laboratory Equipment give the requirements for, and frequency of, equipment calibrations. Section 8 – Split/Proficiency Sample Evaluation gives the acceptable tolerance limits for the comparison of test results from split or proficiency samples.

## 3.4 Testing Personnel

CST/M&P will qualify district and commercial laboratory personnel performing IA sampling and testing, in accordance with Section 6 – Technician Qualification Program.

CST/M&P may designate a district laboratory to qualify other Department personnel and accredited commercial laboratory personnel performing IA sampling and testing. When a district qualifies commercial laboratory personnel, they must notify CST/M&P in writing.

Individuals performing IA sampling and testing will be other than those performing verification or QC testing.

IA sampling and testing personnel will evaluate any individual performing verification or QC sampling and testing. This evaluation includes observations and split or proficiency sample testing.

## 3.5 Comparing Test Results

The Engineer performs a prompt comparison of the test results obtained by the individual being evaluated and the IA tester. Section 8 – Split/Proficiency Sample Evaluation gives the acceptable tolerance limits for comparing test results from split and proficiency samples.

If the comparisons of the test results do not comply with the tolerances, an engineering review of the test procedures and equipment will be performed immediately to determine the source of the discrepancy.

Identify and incorporate corrective actions as appropriate and as approved by the qualifying authority.

Document and report test results from all samples involved in the IA Program in the appropriate district or project files.

## 3.6 Annual Report of IA Program Results

CST/M&P will compose and submit an annual report to the Federal Highway Administration (FHWA) summarizing the results of TxDOT's systems approach IA program. This report identifies:

A. Number of sampling and testing personnel evaluated by the systems approach IA testing;
B. Number of IA evaluations found to be acceptable;
C. Number of IA evaluations found to be unacceptable; and
D. Summary of any significant system-wide corrective actions taken.

# SECTION 4 - MATERIALS CERTIFICATION

## 4.1 Overview

The TxDOT Area Engineer will submit a materials certification, conforming in substance to the example Letter of Certification of Materials Used, to the FHWA for each construction project that is subject to FHWA construction oversight activities.

# SECTION 5 - CONFLICT OF INTEREST

## 5.1 Overview

To avoid an appearance of a conflict of interest, any qualified non-TxDOT laboratory will perform only one of the following types of testing on the same project:

A. Verification testing;
B. QC testing;
C. IA testing; or
D. Dispute resolution testing.

# SECTION 6 - TECHNICIAN QUALIFICATION PROGRAM

## 6.1 Purpose

This program provides uniform statewide procedures for technician qualification to ensure that tests required by the specifications are performed according to the prescribed sampling and testing methods.

## 6.2 Technician Qualification

Sampling and testing personnel will be qualified to perform tests for the acceptance of materials in the areas of soils, bituminous, aggregate, and concrete materials.

The test methods for which individuals can be qualified are included in the following series of the TxDOT Test Procedures.

- 100-E Series (Soils)
- 200-F Series (Bituminous)
- 400-A Series (Aggregates and Concrete)
- 500-C Series (Asphalt – Tex-500-C and Tex-530-C)

## 6.3 Who Must Be Qualified?

Any individual who performs tests on the materials listed in Section 6.2, for acceptance, must be qualified in each test procedure they perform.

NOTE: Reciprocity may be granted to individuals who have been successfully qualified under another state's program. These situations will be considered on a case-by-case basis and must meet the approval of the Construction Division/Materials and Pavements Section Director.

## 6.4 Who Can Qualify Sampling and Testing Personnel?

The following personnel may qualify an individual to perform the required sampling and testing of materials:

A. Construction Division, Materials and Pavements (CST/M&P) personnel;

B. Qualified district materials engineer/laboratory supervisor;

C. Qualified district laboratory personnel who have been authorized by the district materials engineer/laboratory supervisor to qualify others; and

D. Department-approved entities such as the Texas Asphalt Pavement Association (TXAPA) and the American Concrete Institute (ACI). Certifications received from these institutions may be used to satisfy the written exam and observation part of the Technician Qualification Program.

Each district laboratory will maintain a minimum of one individual qualified by CST/M&P or its designated agent, for each test procedure performed within the district.

## 6.5 Required Certifications for Commercial Laboratory and Contractor Personnel

Non-TxDOT laboratory personnel performing testing for TxDOT, or as required by specification, must obtain and keep current the following certifications pertinent to their scope of testing:

A. ACI Concrete Field Testing Technician – Grade I;
B. ACI Concrete Strength Testing Technician;
C. TXAPA HMA Level 1A – Plant Production Specialist;
D. TXAPA HMA Level 1B – Roadway Specialist;
E. TXAPA HMA Level 2 – Mix Design Specialist;
F. TXAPA SB 101 – Property Specialist;
G. TXAPA SB 102 – Field Specialist;
H. TXAPA SB 103 – Materials Analysis Specialist;
I. TXAPA SB 201 – Strength Specialist;
J. TXAPA SB 202 – Compressive Strength Specialist.

For testing procedures not covered by the above certifications, the following personnel may qualify an individual to perform the required sampling and testing of materials:

A. District laboratory personnel who have been authorized to perform technician qualifications; and
B. CSTM&P personnel.

## 6.6 Qualification Procedure

To qualify, an authorized evaluator must witness an individual successfully perform the specific test and the necessary calculations required to determine specification compliance. Successful performance is defined as demonstrating the ability to properly perform the key elements for each test method. If the individual fails to demonstrate the ability to perform a test, the individual will be allowed one retest per test method at the evaluator's convenience.

In addition to successful performance of a test method, the individual must pass a written examination (minimum score of 80%) administered by an authorized evaluator. An individual failing the written examination may request a retest. The retest must be scheduled and administered within 30 days of notification of failure. Failure to pass the second written examination will be considered as failing the entire qualification.

Under unique circumstances, the qualification authority may grant a verbal examination upon request. The reason(s) for requesting a verbal examination must be presented and documented prior to the individual being allowed to take the examination.

If an individual fails to qualify on a specific test method or the qualification is revoked, the individual must obtain and provide evidence of additional adequate training before the individual can retest on that specific test. CSTM&P or its representative will determine the adequacy of the additional training.

In addition, the individual must participate in split/proficiency samples administered by the qualifying authority to validate the qualification. Section 8 – Split/Proficiency Sample Evaluation provides a list of test procedures required for split/proficiency evaluation. CST/M&P determines the qualifying authority for the split/proficiency sample. The results of the samples will be evaluated against TxDOT's acceptable tolerance limits shown in Section 8.1 – Tests and Tolerances for Split/Proficiency Sample Evaluation. If the comparisons of the test results do not comply with the tolerances, an engineering review of the test procedures and equipment will be performed immediately to determine the source of the discrepancy. Corrective actions must be identified and incorporated as appropriate and written concurrence given by the qualifying authority prior to the individual performing additional testing on that test method.

Unless otherwise stated, qualification of an individual is valid for not more than 3 years, after which the individual must be re-qualified. Under the IA system approach, annual split/proficiency evaluations will be required as specified in Section 9 – Independent Assurance Qualification Frequencies. Failure to satisfactorily complete annual split or proficiency testing may result in certification revocation.

## 6.7 Documentation

CST/M&P and the district materials engineer/laboratory supervisor are responsible for maintaining documentation of all individuals qualified under their authority who perform required tests for acceptance of materials. TxDOT's Labinator will be the official system of record for qualified/certified TxDOT and commercial laboratory personnel. Issuance of qualification certificates by the TxDOT qualifying authority is not required. A qualification summary listing all tests for which an individual is qualified is available in Labinator and may be printed/signed at the district's discretion. Documentation to be maintained external to Labinator for all qualified personnel includes:

A. Copies of any certificates issued by ACI and TXAPA;

B. Original written examinations for test procedures administered to each technician by the TxDOT qualifying authority, with clear identification of technician's name, qualifier's name, score, and date taken;

C. Original performance examinations for test procedures administered to each technician by the TxDOT qualifying authority, with clear identification of technician's name, qualifier's name, qualification status, and date;

D. Results of annual split/proficiency testing administered by the TxDOT qualifying authority for each technician.

Documentation retention will be for the life of the qualification.

## 6.8 Disqualification

Accusations of misconduct by testing technicians are made to the responsible TxDOT district representative and reported to CST/M&P. Table 1 defines the 3 levels of misconduct: neglect, abuse, and breach of trust.

**Table 1 – Levels of Misconduct**

| Term | Definition |
|---|---|
| Neglect | Unintentional deviations from testing procedures or specifications |
| Abuse | Careless or deliberate deviation from testing procedures or specifications |
| Breach of Trust | Violation of the trust placed in the certified technician including, but not limited to, acts such as:<br>• Falsification of records;<br>• Being aware of improprieties in sampling, testing, and/or production by others and not reporting them to appropriate supervisors involved in the project;<br>• Re-sampling and/or retesting without awareness and consent of appropriate supervisors involved in the project; and/or<br>• Manipulating compensation and/or production. |

CST/M&P will investigate accusations of misconduct with the assistance of the responsible district. CST/M&P may impose penalties ranging from a written reprimand to a permanent revocation of the certification, contingent upon the findings of the investigation.

Any technician found guilty of breach of trust will have his/her certification permanently revoked. Any technician with a revoked certification will be removed from the project and will not be allowed to be employed on any TxDOT project statewide.

# SECTION 7 - LABORATORY QUALIFICATION PROGRAM

## 7.1 Purpose

This program provides uniform statewide procedures to ensure that laboratory facilities and equipment are qualified for the performance of required sampling and testing methods.

## 7.2 Laboratories to be Qualified

All laboratories performing testing for TxDOT require qualification. These include, but are not limited to the following:

A. Construction Division, Materials & Pavements (CST/M&P) central laboratory;
B. District laboratories;
C. Area/project laboratories (including field laboratories at hot mix and concrete plants);
D. CST/M&P field laboratories; and
E. Commercial laboratories.

## 7.3 Laboratory Qualification Responsibility

CST/M&P central laboratory will be accredited under the AASHTO Accreditation Program (AAP).

CST/M&P is responsible for overseeing the statewide laboratory qualification program and for qualifying district laboratories. At the district level, the district laboratory will be the qualifying authority for area office and commercial laboratories. When a district qualifies a commercial laboratory, they must notify CST/M&P in writing and submit a copy of the laboratory qualification certificate.

Any non-TxDOT commercial laboratory used for IA or dispute resolution sampling and testing must also be accredited by one of the following FHWA- and TxDOT-approved accrediting bodies:

- AASHTO Accreditation Program (AAP);
- Construction Materials Engineering Council (CMEC); or
- Laboratory Accreditation Bureau (L-A-B).

## 7.4 Qualification Process

The laboratory qualifying authority will:

A. Identify the scope of testing to be performed;

B. Verify that test methods used to perform tests are available and current;

C. Document that the laboratory has the required equipment to perform the tests;

D. Check the calibration/verification records for each piece of equipment, to include:

   1. Description of equipment;
   2. Identification of any traceable standard used;
   3. Frequency of calibration;
   4. Date of calibration;
   5. Date of last calibration;
   6. Date of next calibration;
   7. Calibrating technician;
   8. Procedure used to calibrate/verify equipment; and
   9. Detailed results of calibration; and

E. Verify that the laboratory has qualified/certified technicians to perform required testing.

In addition, all equipment may be subjected to calibration verification or other inspection by the qualifying authority.

## 7.5 Calibration Standards and Frequencies for Laboratory Equipment

The standards for calibration and the frequencies for laboratory equipment calibrations are shown in:

- Tex-198-E, "Minimum Standards for Acceptance of a Laboratory for Soils and Flexible Base Testing,"
- Tex-237-F, "Minimum Standards for Acceptance of a Laboratory for Hot Mix Testing," and
- Tex-498-A, "Minimum Standards for Acceptance of a Laboratory for Concrete and Aggregate Testing."

## 7.6 Frequency for Laboratory Qualification

Laboratories are qualified at an interval not to exceed 3 years. Calibration/verification is required whenever the laboratory or equipment is moved.

## 7.7 Non-Compliance

A laboratory that does not meet the above requirements is subject to disqualification. Any equipment in a qualified laboratory failing to meet specified equipment requirements for a specific test method will not be used for that test method.

## 7.8 Documentation

The qualifying authority is responsible for verifying that laboratories are qualified to perform TxDOT testing. Documentation will be required to be kept by the qualifying authority and the qualified laboratory. Calibration records will be maintained for a minimum of 3 years. Upon satisfactory completion of the laboratory qualification process, the qualifying authority will issue a certificate covering the scope of testing in which the laboratory has been qualified.

Laboratory qualification documentation to be maintained by the qualifying authority includes:

A. Qualification checklist evidencing verification of the following:
    1. Availability of equipment pertinent to the laboratory's scope of testing;
    2. Required equipment calibration/verification records for each piece of equipment; and
    3. Personnel qualified/certified to perform required testing; and
B. Copy of laboratory qualification certificate issued.

## 7.9 Dispute Resolution

The next higher qualification authority will resolve disputes concerning calibration and verification of equipment. For disputes that cannot be resolved at the district level, CST/M&P will be the final authority.

# SECTION 8 - SPLIT/PROFICIENCY SAMPLE EVALUATION

## 8.1 Tests and Tolerances for Split/Proficiency Sample Evaluation

The test methods listed in Table 2 require independent assurance. After observation and qualification, each qualified technician is required to participate annually in one proficiency or split sample test for each of these test methods. Split sample results must be within the tolerances established in Table 2. Proficiency sample results must be within ± 2 standard deviations of the mean.

**Table 2 – Laboratory Testing Procedures and Tolerance Limits**

| Test Procedure | Description | Tolerance |
|---|---|---|
| Tex-104-E | Liquid Limit of Soils | 15% of mean[1] |
| Tex-105-E | Plastic Limit of Soils | 15% of mean[1] |
| Tex-106-E | Plasticity Index of Soils | 20% of mean[1] |
| Tex-107-E | Bar Linear Shrinkage of Soils | ± 2% |
| Tex-110-E | Particle Size Analysis of Soils, Part I | > No. 4 sieve: ± 5% |
| | | ≤ No. 4 sieve: ± 3% |
| Tex-113-E | Moisture-Density Relationship of Base Materials | Density ± 2.0 PCF |
| | | Moisture Content ± 0.5% |
| Tex-117-E | Triaxial Compression for Disturbed Soils and Base Materials, Part II | Strength ± 10 psi |
| Tex-200-F | Asphaltic Concrete Combined Aggregate | > 5/8" sieve: ± 5.0% (individual % retained) |
| | | 5/8" sieve–No. 200: ± 3.0% (individual % retained) |
| | | Passing No. 200: ± 1.6% (% passing) |
| Tex-206-F | Compacting Test Specimens of Bituminous Mixtures | ± 1.0% laboratory-molded density in accordance with Tex-207-F |
| Tex-207-F | Laboratory-Molded Density | ± 1.0% |
| | Laboratory-Molded Bulk Specific Gravity | ± 0.020 |
| Tex-227-F | Theoretical Maximum Specific Gravity of Bituminous Mixtures | ± 0.020 |
| Tex-236-F | Asphalt Content of Asphalt Paving Mixtures by the Ignition | ± 0.3% |

| Test Procedure | Description | Tolerance |
|---|---|---|
| | Method | |
| Tex-241-F | Superpave Gyratory Compacting of Test Specimens of Bituminous Mixtures | ± 1.0% laboratory-molded density in accordance with Tex-207-F |
| Tex-415-A | Slump of Portland Cement Concrete | ± 1" |
| Tex-414-A | Air Content of Freshly Mixed Concrete by the Volumetric Method[2] | ± 1% |
| Tex-416-A | Air Content of Freshly Mixed Concrete by the Pressure Method[2] | ± 1% |
| Tex-418-A | Compressive Strength of Cylindrical Concrete Specimens | 17% of mean[1] (4 × 8" specimen) |
| | | 14% of mean[1] (6 × 12" specimen) |

1. The difference between compared test results must not exceed the indicated percentage of the mean of the compared test results, where the mean is the average of the two test results.
2. Required only in districts that specify air entrainment.

EXAMPLE: Plasticity Index

Tolerance = 20% of the mean

| | |
|---|---|
| Technician test value | 18 |
| IA technician test value | 22 |
| Mean | 20 |
| 20% difference | 4 |

Both values are within 20% of the mean.

# SECTION 9 - INDEPENDENT ASSURANCE QUALIFICATION FREQUENCIES

## 9.1 Overview

The system approach for Independent Assurance (IA) requires IA activities to occur on a time basis, as opposed to occurring on a quantity of material or project basis.

## 9.2 Required Frequencies and Activities

Table 3 gives the frequencies and activities required for evaluating sampling and testing personnel and equipment under the system approach to IA.

**Table 3 – Frequencies and Activities Required Under IA System Approach**

| Time | Activity |
|---|---|
| Prior to performing acceptance sampling and testing | Qualification is required under Section 6 – Technician Qualification Program and Section 7 –Laboratory Qualification Program |
| Within 12 months after Observation and Qualification | Each qualified technician is required to participate in one proficiency or split sample test for each test method requiring IA. Results must compare to the IA test results to within the established tolerance. |
| Within 24 months after Observation and Qualification | Each qualified technician is required to participate in one proficiency or split sample test for each test method requiring IA. Results must compare to the IA test results to within the established tolerance. |
| Within 36 months of qualification | Qualification is again required under Section 6 – Technician Qualification Program and Section 7 –Laboratory Qualification Program |

NOTE: For American Concrete Institute (ACI) certification, Field Testing Technician Grade I and Strength Testing Technician, the above frequency is extended to 5 years.

Maintaining technician qualification under the IA system approach requires continuation of the above cycle of qualification and successful split or proficiency sample testing.