



# Quality Assurance Program for CDA / Design-Build Projects

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# SECTION 1 - INTRODUCTION

## 1.1 Overview

The Quality Assurance Program (QAP) for Comprehensive Development Agreement (CDA)/Design-Build Projects (hereafter referred to as “the DB QAP”), established by the Texas Department of Transportation (TxDOT), ensures that materials and workmanship incorporated into the highway construction project are in reasonable conformance with the approved plans and specifications, including any approved changes.

Projects must use the recommended OV Levels for Materials Testing Validation/Verification in [Appendix D](#). Any proposed changes to the OV levels of analyses shall be discussed during a project-specific materials and inspection risk assessment workshop. Modifications to the OV Levels of Materials Validation/Verification will require approval from TxDOT Materials and Tests Division (MTD) and Federal Highway Administration (FHWA).

This program is developed based on 23 CFR 637B and FHWA Technical Advisory T6120.3, available at the following links.

- [23 CFR 637 Subpart B](#)
- [Technical Advisory 6120.3](#)

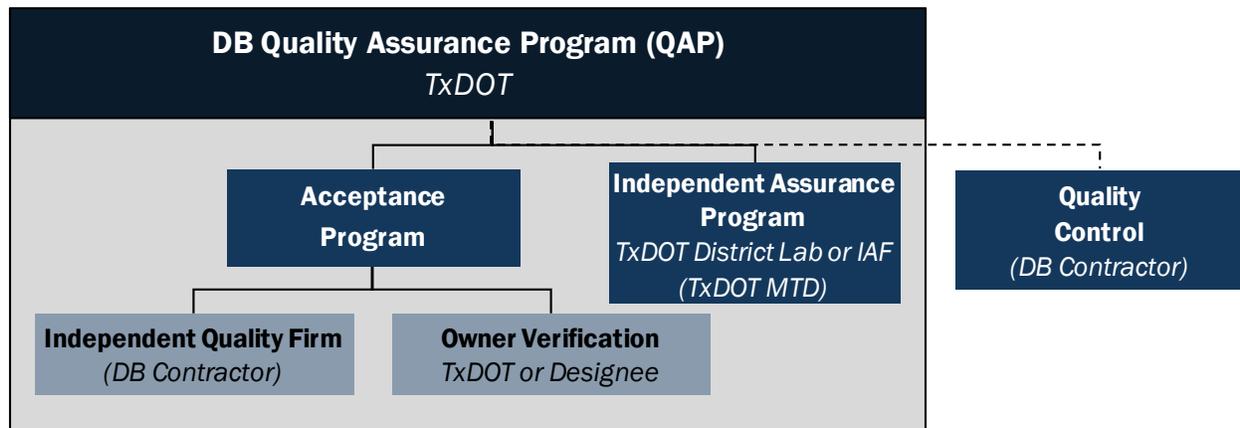
The QAP consists of a Quality Control (QC) Program ([Section 2](#)), an Acceptance Program ([Section 3](#)), and an Independent Assurance (IA) Program ([Section 4](#)). The QAP allows for the use of contractor-performed Independent Quality Firm’s (IQF) test results as part of an acceptance decision **only if the IQF’s results are verified by the Owner Verification (OV) testing results performed by TxDOT.**

The purpose of the QAP is to provide statewide consistency and a programmatic approach to Quality Assurance for design-build projects where the design-build contractor’s (DB Contractor) test results are used in the acceptance decision, regardless of how the project is funded. It clarifies federal requirements relating to quality assurance and owner verification. Any modification to a project-specific DB QAP requires review and approval by TxDOT and FHWA 90 days before construction starts.

The use of IQF test results as part of the acceptance decision should be carefully evaluated for each project because a significant TxDOT owner verification program is instrumental to its success.

Acronyms and definitions for terms used in this QAP are provided in [Appendix A](#).

The QAP is comprised of several components, and the relationships between the parties and functions are shown in Figure 1.



**Figure 1**—Components (Reporting Relationship) in the QAP

## 1.2 Construction Quality Management Plan

The DB Contractor’s Construction Quality Management Plan (CQMP) shall include both QC and IQF requirements with respect to performance of the Work. [Section 2 – Quality Control Program](#) describes requirements for the QC portion of the CQMP. [Section 3 – Acceptance Program](#) describes requirements for the IQF portion of the CQMP. The CQMP shall establish a clear distinction between QC and IQF activities, and the persons performing each function will not be the same. The DB Contractor shall submit the CQMP to TxDOT for review and approval. The CQMP shall be approved before construction starts.

## 1.3 Owner Verification Testing and Inspection Plan

TxDOT’s Owner Verification Testing and Inspection Plan (OVTIP) will describe TxDOT’s commitments to perform owner verification (OV) of the DB Contractor’s IQF testing and inspection. [Section 3 – Acceptance Program](#) describes requirements for the OVTIP. The OVTIP must be submitted to TxDOT for review and approval. The OVTIP shall be approved before construction starts.

## 1.4 Conflict of Interest

To avoid an appearance of a conflict of interest, any non-TxDOT entity will perform only one of the following functions on the same project:

- Quality Control testing and inspection;
- Independent Quality Firm testing and inspection;
- Owner Verification testing and inspection;
- Independent Assurance testing; or
- Referee testing.

## **SECTION 2 - QUALITY CONTROL PROGRAM**

### **2.1 General**

The DB Contractor will be responsible for the quality of the Work. Project quality will be enhanced through the daily efforts of all the workers involved with the Work, supported by the DB Contractor's CQMP. The DB Contractor's QC portion of the CQMP will include the internal procedures used by the DB Contractor to ensure that the Work is delivered in accordance with the Contract Documents, Early Start of Construction (ESOC) plans, Temporary Work plans, Released-For-Construction (RFC) plans, approved working and shop drawings, and specifications. This involves the active participation of the entire workforce in working to achieve "quality" initially and to minimize or eliminate re-work. The DB Contractor's QC will not be part of the acceptance program.

### **2.2 DB Contractor Quality Control Requirements**

The DB Contractor's CQMP will establish a systematic approach to define the processes, methods, procedures, and documentation for delivery of QC on the Project. These methods and procedures will clearly define the authority and responsibility for the administration of the DB Contractor's QC portion of the CQMP.

#### **2.2.1 Staffing**

During periods of construction, the DB Contractor will assign an on-site Construction Quality Control Manager (CQCM) responsible for management of the QC portion of the CQMP. The CQCM will not be involved with scheduling or production activities and will report directly to the DB Contractor's management team. The CQCM will ensure that the methods and procedures contained in the approved CQMP are implemented and followed by the DB Contractor and Subcontractors in the performance of the Work. The CQCM shall have at minimum of 10 years of experience on projects of similar complexity.

The DB Contractor's and Subcontractor's construction workforce are all considered to be members of the DB Contractor's QC staff, as each member is responsible for the quality of the Work. Personnel responsible for performing the QC inspection will be independent from IQF personnel, be knowledgeable in their duties, and receive documented training. Personnel performing QC sampling and testing will be knowledgeable in the testing methods and procedures. IQF personnel will not perform duties on behalf of QC personnel, although IQF equipment can be shared with QC personnel.

Although not used for the acceptance decision, documented QC testing and inspection will ensure quality has been incorporated into all elements of work before requesting IQF testing and inspection. The QC program should be sufficient in scope to pre-empt and avoid repeated discoveries—by TxDOT, IQF personnel, or DB Contractor's QC staff—of Nonconforming Work. Repeated discoveries of Nonconforming Work documented in Construction Deficiency Reports (CDRs) or Nonconformance Reports (NCRs) or excessive use of Engineering Judgment will be considered a breakdown of the QC program and will be cause for investigation and corrective action before recommencement of Work areas affected. Corrective action may include the addition of new QC procedures, revision to existing QC procedures, re-training of QC personnel, removal and replacement of QC personnel, or other such actions that will restore the effectiveness of the QC program.

## 2.2.2 CQMP Requirements

As it relates to QC, the DB Contractor's CQMP will clearly address, at minimum, how the DB Contractor's QC staff will address the following requirements.

- A. A construction QC organizational chart and staffing plan, which will include the period of time that the QC staff members will be present on the site and the experience, knowledge, and skill levels of QC staff.
- B. Procedures to ensure that the education, training, and qualification of personnel performing CQMP activities are achieved and maintained, and that all Work is performed in accordance with the designs, plans, and specifications.
- C. Procedures to ensure that the DB Contractor, Suppliers, and Subcontractors designate individuals on each crew responsible for performing daily field inspections of their own Work and for preparing a daily QC report to document the inspection performed. Report forms to be used by the responsible QC personnel will be included in the DB Contractor's CQMP.
- D. Documents specifying that all activities undertaken by or on behalf of the DB Contractor affecting the quality of the Work will be prescribed and accomplished by documented instructions, procedures, and appropriate drawings. Such instructions, procedures, and drawings will include quantitative and qualitative criteria to be used to determine compliance.
- E. Procedures to ensure that elements of the Work are not started or continued without formal communication with the Independent Quality Firm Manager (IQFM). Inspection or hold points must be identified and communicated to the IQFM, CQCM, and TxDOT. Procedures to progress beyond the inspection or hold points will be developed. The hold points will include, at a minimum, those described in [Appendix J](#). TxDOT will be provided the same advance notice as the IQF for all hold points. Milestones will be established at convenient opportunities to inspect the Work and to prevent significant cost of correction. No work may be covered until it has been subject to a hold point acceptance by IQF personnel. The IQFM and TxDOT may agree to modify established hold points to meet the needs of the project.
- F. Procedures for inspecting, checking, and documenting the Work. Inspection, examinations, and measurements will be performed for each operation of the Work to assure quality.
- G. Procedures for identification and control of materials, equipment, and elements of the Work. These procedures will ensure that identification of an item is maintained by appropriate means, either on the item or on records traceable to the item, as necessary, throughout fabrication, erection, installation, and use of the item.
- H. Procedures to ensure that materials, equipment, or elements of the Work that do not conform to requirements of the Contract Documents, the Governmental Approvals, applicable Law, or the Design Documents are not used or installed. These procedures will include identification, documentation, segregation, disposition, and notification to TxDOT, and, if appropriate, Governmental Entities and other affected third parties, as well as procedures for TxDOT to review Nonconforming Work and Construction Deficiency Items.
- I. Procedures for processing a request for information (RFI) to resolve discrepancies or questions on the plans and specifications so that all changes are documented and

approved by the Engineer of Record (EOR). Work cannot proceed until the RFI or notice of design change (NDC) have been approved by the EOR.

- J. Procedures to indicate—by the use of markings such as stamps, tags, labels, routing cards, or other suitable means—the status of inspections and tests performed upon individual items of the Work.
- K. A program for coordination of all IQF inspections and testing with Governmental Entities and Utility Owners.
- L. A program to ensure performance of all testing required to demonstrate that all materials, equipment, and elements of the Work will perform satisfactorily for the purpose intended and meet the standards specified in the Contract Documents. It will specify written test procedures that include provisions for ensuring that all prerequisites for the given test have been met and that adequate test instrumentation is available and used. The CQMP will require test results be documented and evaluated by the CQCM to ensure that test requirements have been satisfied.
- M. Measures to ensure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly maintained, controlled, calibrated, certified, and adjusted at specified periods to maintain accuracy within industry standards. Malfunctioning equipment or equipment out of calibration shall be tagged and put out of service until it is repaired or calibrated.
- N. The preparation of all Portland cement concrete, soil-lime treatment (stabilization or modification), soil-cement treatment, and hot-mix asphalt mix designs must be performed by personnel who hold the required certifications as specified in the Contract Documents. Additionally, the designs will be reviewed and sealed by a licensed professional engineer in the state of Texas attesting that the design meets TxDOT requirements for the specified class or grade for which it was prepared.
- O. Sampling and testing of all materials during the production or manufacturing processes so that only materials meeting the specifications are supplied for ultimate incorporation into the Work.
- P. Procedures to control the handling, storage, shipping, cleaning, and preservation of materials and equipment to prevent damage or deterioration.
- Q. Procedures to ensure that conditions adverse to quality—such as failures, malfunctions, deficiencies, defective material and equipment, deviations, and other Nonconforming Work and Construction Deficiency Items—are promptly identified and corrected. The procedures will ensure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken will be documented and reported in writing to TxDOT and to appropriate levels of the DB Contractor's management to ensure corrective action is promptly taken.
- R. Measures to control the receipt and issuance of documents—such as instructions, procedures, training manuals, and drawings, including changes thereto—that prescribe activities affecting quality. These measures will ensure that approved documents, including authorized changes thereto, are reviewed for adequacy and approved for release by authorized personnel of the DB Contractor and are distributed to and used at the location where the prescribed activity is performed.

Changes to documents will be reviewed and approved by the same organizations that performed the original review and approval, unless TxDOT consents in writing to another responsible organization.

- S. Requirements and methods for controlling documents.
- T. Procedures for checking and verifying the accuracy and adequacy of construction stakes, lines, and grades established by the DB Contractor.
- U. Procedures for ensuring that construction alignment and grades are in accordance with the requirements contained in the TxDOT Survey Guide.

### **2.2.3 Reporting, Record Keeping, and Documentation**

The DB Contractor will maintain construction workmanship and materials quality records of all inspections and tests performed per the approved CQMP. These records will include factual evidence that the required inspections or tests have been performed, including type and number of inspections or tests involved; results of inspections or tests; nature of defects, deviations, causes for rejection, etc.; proposed remedial action; and corrective actions taken. These records will cover both conforming and defective or deficient features, and will include a statement that all supplies and materials incorporated in the Work are in full compliance with the terms of the Contract Documents. These records shall be furnished to TxDOT in an electronic format specified in the CQMP.

QC inspection reports, process control material sampling or testing results, and control charts (for every subplot of each mix) will be reported within 48 hours following the inspection or test and be readily available for IQF and TxDOT review or audit.

## SECTION 3 - ACCEPTANCE PROGRAM

### 3.1 General

The testing and inspection frequencies for this QAP that are used in the Acceptance Program are based on a Project risk profile that includes the following:

- Scope of the Project;
- Public (TxDOT or FHWA) funding; and
- Appreciable schedule acceleration, relative to conventional design-bid-build.

The DB Contractor's CQMP shall include the internal procedures used by the IQF to ensure that the Work is inspected and tested to verify compliance with the Contract Documents. The DB Contractor's IQF shall be separate from the DB Contractor's QC program.

TxDOT's Owner Verification (OV) program will include internal procedures used by TxDOT to ensure that the DB Contractor's IQF program is performed in accordance with the approved CQMP and to validate or verify IQF testing and inspection. TxDOT will decide the extent and applicable use of Engineering Judgment and may delegate engineering authority for such decisions to the Independent Quality Firm Manager (IQFM) in writing.

**Both the IQF's and OVF's testing and inspection results together are the basis for the acceptance decision.** IQF testing results may be used for acceptance when they are either statistically validated or verified by the OVF testing results. IQ activities are performed by the IQF and OV is performed by TxDOT or its designee.

#### 3.1.1 TxDOT-Performed Materials Acceptance

TxDOT uses monitored materials from various manufacturers and producers. The list of TxDOT-monitored materials is maintained on the Material Producer List (MPL) and IQF can use results from TxDOT's MPL. For materials listed on the MPL, the IQF shall perform job control tests as defined by the TxDOT *Guide Schedule of Sampling and Testing for Design-Build Projects* (DB Guide Schedule). For example, mechanical couplers and multiple piece tie bars, although on the MPL, shall still be tested as described in DB Guide Schedule before installation of the item into any product.

Materials that are not monitored or not pre-approved by TxDOT are subject to sampling and testing as noted in the DB Guide Schedule, applicable material quality program, and DMS for approval of the material and job control tests as defined in the DB Guide Schedule. These materials shall be approved by TxDOT before use. The IQF shall audit and verify that materials delivered to the project site are in conformance with approved material submittals. Manufacturers' warranties, mill test reports, guarantees, instruction sheets, parts lists, and other materials that are furnished with articles or materials incorporated into the Work shall be collected and compiled by the IQF and made available to TxDOT upon request.

The DB Contractor shall, at TxDOT's request, furnish additional samples of materials to be incorporated into the Work.

## **3.2 Prefabricated Product Fabrication Plants**

For plants monitored or pre-approved by TxDOT MTD, Prefabricated Structural Materials Section, TxDOT may or may not be available to perform the inspection and testing at MPL-approved off-site prefabricated product fabrication plants and any jobsite prestressed concrete girder plants. When using prefabricated product fabrication plants listed on TxDOT's MPL, follow sections 3.2.1 and 3.2.2, as applicable. When the DB contractor uses non-pre-approved (non-MPL) prefabricated product fabrication plants, follow section 3.2.3.

The DB Contractor shall, at TxDOT's request, furnish additional samples of materials to be incorporated into the Work. Manufacturers' warranties, mill test reports, guarantees, instruction sheets, parts lists, and other materials that are furnished with articles or materials incorporated into the Work shall be collected and compiled by the IQF and made available to TxDOT upon request.

Material-on-hand shall only be paid for after each fabricated member or lot has been inspected, sampled, tested, and documented on approved forms and is in full conformance with no outstanding non-conformances or pending process that may determine that the product is not in full conformance. When requested, applicable documentation shall be submitted promptly to validate material-on-hand requests.

Supplier's QC, IQF, and OVF inspection, sampling, and testing results shall be independently performed and separately documented, dated, and signed.

Being listed on the MPL does not guarantee Supplier's QC will be allowed to perform inspection, sampling, and testing for acceptance. If supplier's QC program is not approved by MTD, follow section 3.2.2.2. Supplier's QC personnel shall have a minimum of one year experience producing applicable TxDOT product meeting all TxDOT project specifications in order for the Supplier's QC inspection and testing results to be considered for use in the acceptance decision. This decision is at the sole discretion of TxDOT MTD. Allowing Supplier's testing and inspection to be part of the acceptance decision does not constitute MPL approval.

For steel members, OVF does not have to perform non-destructive evaluation (NDE) verification provided OVF witnesses IQF performing the Work to ensure proper procedures are followed and interpretation and approval of all radiographic film is performed.

### **3.2.1 TxDOT MTD Performs the Services**

As may be requested in advance by the DB Contractor and agreed upon by TxDOT, the cooperative use of TxDOT resources for materials testing and product inspection services at a point in Texas where the State routinely provides resident inspection services for its own highway materials, and at other locations throughout the contiguous United States, can be used by the DB Contractor. Upon election by the DB Contractor to use TxDOT MTD, Prefabricated Structural Materials section services, the DB Contractor shall prepare work orders in full compliance with the terms of the Contract Documents.

If TxDOT services are agreed upon, the DB Contractor is responsible for having the manufacturers and producers furnish their scheduling of Work to TxDOT MTD, Prefabricated Structural Materials section and provide a minimum 21-day notice for performance of the services. Election to use and rely upon TxDOT services is at the DB Contractor's own option

and risk. No time extension or additional compensation will be granted for issues arising from the use of TxDOT resources. The DB Contractor shall be responsible for all direct and indirect costs or expenses involved in the performance of TxDOT's services.

If MTD is not available to provide such services for the suppliers, manufacturers, and producers, follow section 3.2.2.

### **3.2.2 TxDOT MTD Does Not Perform the Services (for MPL Approved-Plant)**

#### **3.2.2.1 Supplier's QC Approved by MTD For Acceptance Decision**

If approved in writing in advance by TxDOT MTD, Prefabricated Structural Materials section, qualified and certified Supplier's QC individuals may perform 100% inspection and testing, documentation, and certification of product per the applicable DMS requirements, material quality program, specifications, and other applicable documents required by the Contract Documents. In addition, the IQF shall independently document and perform, at minimum, 20% of Supplier's QC inspection, sampling, and testing of each approved QC responsibility or at a higher frequency as directed by TxDOT MTD.

Supplier's QC and IQF personnel qualifications and certifications shall be in accordance with the specifications, applicable material quality program and DMS. The required certifications shall be obtained by qualified Supplier's QC and IQF onsite individuals before fabrication of any product.

The OVF will review Supplier's QC and IQF inspection and testing results and all required documentation to verify compliance with the contract documents.

MTD will supply any existing audit checklists to the IQF, which shall be used to verify product compliance. The IQF shall contact MTD to receive current documents. The IQF shall create or modify the checklist to meet project requirements, and submit the IQF checklist to TxDOT for approval. The checklist (including inspection and testing checklists and procedures) shall meet or exceed TxDOT's documents or requirements.

#### **3.2.2.2 Supplier's QC Not Approved by MTD For Acceptance Decision**

When TxDOT MTD does not perform the services and Supplier's QC personnel is not approved by TxDOT MTD to perform the inspection, sampling, and testing, the IQF shall perform 100% of the required sampling, testing, and inspection for acceptance.

IQF's inspection, sampling, and testing responsibilities shall include those items listed as Supplier's QC in Section 3.2.2.1. At no time shall the sampling, testing, and inspection frequency be lower than the applicable TxDOT DMS, material quality program, specifications, and other applicable documents required by the Contract Documents.

The IQF shall provide the required documentation as defined by the TxDOT Standard specifications, applicable TxDOT DMS, material quality program, specifications, and other applicable documents required by the Contract Documents.

The IQF shall submit a plan, subject to TxDOT's approval, demonstrating how the IQF shall perform 100% upfront sampling, testing, and inspection (including checklists). This plan

shall meet or exceed TxDOT's current requirements and shall be approved before any product is fabricated or manufactured for the project.

During the fabrication of the first products, the IQF shall audit the fabrication plant and verify products are delivered to the project site in conformance with approved material procedures, submittals, and related specifications. Audits may be performed before the start of production provided the supplier's processes and products being produced are representative of the product supplied to the project. Audits shall be performed routinely to ensure compliance.

The OVF's inspections and testing frequency will be at a minimum of 10% of IQF's inspection and testing frequency. Inspection and testing frequency may be increased when non-compliance products are encountered as necessary to ensure product compliance.

The IQF and OVF personnel qualifications and certifications shall be in accordance with the applicable material quality program, specifications, contract documents, and applicable DMS. The required certifications shall be obtained by qualified IQF and OVF onsite individuals before fabrication of any product.

MTD will supply any existing audit checklists to the IQF, which shall be used to verify product compliance. The IQF shall contact MTD to receive all current documents. The IQF shall create or modify the checklist to meet project requirements and submit the IQF checklist to TxDOT for approval. The checklist (including inspection and testing checklists and procedures) shall meet or exceed TxDOT's documents or requirements.

### **3.2.3 Acceptance by IQF and OVF (Non-MPL-Approved Product)**

When the DB Contractor uses non-pre-approved (non-MPL) prefabricated product fabrication plants, the required Supplier's QC inspection and testing as outlined in the applicable material's quality program requirements will not be used as part of the acceptance decision for the duration of the project. Instead the IQF and OVF inspection and testing results will be used together to form the basis for the acceptance decision as described in the previous section.

Follow the same requirements included in section 3.2.2.2, except the OVF's inspections and testing frequency will be at a minimum 20% of IQF's inspection and testing frequency. A higher inspection and testing frequency will be used during start-up operations and when non-compliance products are encountered as necessary to ensure product compliance. A lower sampling and testing frequency may be performed with prior approval by TxDOT, however inspection frequency shall not be lower than 20%.

### **3.2.4 Staffing and Facility Requirements**

#### **3.2.4.1 Supplier QC Staffing Requirements**

Although not used for the acceptance decision, documented Supplier's QC testing and inspection will ensure quality has been incorporated into all elements of the Work before requesting IQF testing and inspection. The Supplier's QC program should be enough in scope to pre-empt and avoid repeated discoveries—by TxDOT, OVF, IQF, or Supplier's QC staff. Repeated discoveries of Nonconforming Work, Construction Deficiency Reports

(CDRs)/ Nonconformance Reports (NCRs) by the IQF, or, in the opinion of TxDOT, excessive use of Engineering Judgment shall be considered a breakdown of the supplier's QC program and shall be cause for investigation and corrective action before recommencement of Work areas affected. Corrective action may include an increase in testing and inspection by IQF, the addition of new Supplier's QC procedures, revision to existing Supplier's QC procedures, re-training of Supplier's QC personnel, removal and replacement of Supplier's QC personnel, or other such actions that will restore the effectiveness of the Supplier's QC program.

The Supplier shall meet all inspection and testing requirements in the applicable specifications and related material quality program, except Supplier's QC personnel are not required to be certified when they are not part of the acceptance decision. Personnel responsible for performing the Supplier's QC inspection requirements will be independent from IQF personnel, be knowledgeable in their duties, and receive documented training. Personnel performing Supplier's QC sampling and testing will be knowledgeable in the testing methods and procedures. IQF personnel shall not perform duties on behalf of Supplier's QC personnel, although if approved by TxDOT MTD/Prefabricated Structural Materials Section, equipment can be shared between IQF and Supplier's QC personnel.

#### **3.2.4.2 DB Contractor's IQF Staffing Requirements**

The Supplier's fabrication plant and products shall be subject to IQF inspection, sampling, and testing when IQF's results are used as part of the acceptance program. The IQF will verify daily fabrication processes and that product delivered to the project site are in conformance with approved material submittals and specifications. The IQF staff at the Supplier's fabrication plant must meet the requirements of [Section 3.5 – DB Contractor Independent Quality Firm Requirements](#).

For specialty materials and products (e.g., segmental concrete, bearings, etc.), the IQF inspectors shall have the nationally recognized certifications applicable to inspection or testing activities. Nationally recognized best practices for fabrication, testing, and inspection to be used on the project shall be submitted to TxDOT for approval at its sole discretion (e.g., *Construction Practices Handbook for Concrete Segmental and Cable-Supported Bridge*).

#### **3.2.4.3 Owner Verification Staffing Requirements**

TxDOT's OV will perform Owner Verification testing and inspection, and conduct audits to verify the DB Contractor's compliance with the approved CQMP in accordance with [Section 3.6 – Owner Verification Requirements](#) for the applicable quality program, when OVF's results are used as part of the acceptance. The OVF inspectors will have the same nationally recognized certifications as the IQF inspectors should have. Approved MTD personnel are not required to have the nationally recognized certifications.

#### **3.2.4.4 Supplier's Facilities and Equipment**

The Supplier's fabrication plant laboratory and equipment shall be approved through the requirements established in the DB QAP. The supplier shall furnish the laboratory, field office, and all applicable equipment listed in the TxDOT-established material's quality program and applicable DMS.

### **3.3 Sampling and Testing**

This Section provides FHWA's and TxDOT's requirements for sampling, testing, and acceptance requirements to be used in the acceptance decision.

#### **3.3.1 Sample Types and Uses**

Sampling is either random or fixed, depending on whether the location was selected randomly (random) or if a specific location was subjectively identified (fixed). Sampling is also either independent or dependent, based on whether the location was independently selected (independent) or whether it was based on the location of another sample (dependent or split). The F- and t- tests described in [Section 3.6.3.1 – Statistical Analysis](#) are only valid when using random independent or random split samples.

Split samples may be used outside of the statistical analysis for owner verification of contractor-performed IQF tests under TxDOT's Owner Verification Program. A comparison process for performing and analyzing split samples between OVF and IQF is necessary during the initial implementation of the QAP. TxDOT will analyze these samples and discuss the results with the IQF to assure laboratory and technician test results compare favorably. When the acceptable tolerance limits in [Appendix B – Split Sample Tolerance Limits](#) are exceeded, corrective actions for either or both parties will be identified and corrective actions will be incorporated as appropriate. This process will help provide initial alignment of the TxDOT and IQF laboratories and testing procedures.

Split samples may also be performed throughout the life of the project as necessary to investigate non-validating material categories and verify or realign testing equipment and personnel.

IQF and OVF will determine random sample locations using ASTM D3665.

#### **3.3.2 Notification**

On a weekly basis, the DB Contractor will update and provide the IQF and TxDOT with a rolling 3-week look-ahead schedule consistent with the current Project Baseline Schedule (PBS) and showing the anticipated start and finish of Work activities. The look-ahead schedule will include fabrication activities and planned construction activities. Anticipated inspection activities, reviewed by third parties, and all associated hold points will be shown in the look-ahead schedules for each of the Work activities. The DB Contractor will also, on a daily basis, communicate changes to the scheduled Work for each current day to the IQF and TxDOT and will notify the IQF and TxDOT when materials are ready for sampling and testing.

#### **3.3.3 Quantities and Testing Frequency**

The IQF will continuously track and record the quantities of materials incorporated into the Project. These quantities will be reported per [Section 3.6.3.5. Monthly Construction Certification](#). The IQF will generate this report monthly to ensure compliance with the DB Guide Schedule and submit it to TxDOT. TxDOT will use the report to verify compliance of both the IQF and OV testing frequency.

The IQF will perform material sampling at locations and timing defined in the DB Guide Schedule. At a minimum, material sampling and testing will be conducted at the frequency

of sampling specified in the DB Guide Schedule. This minimum testing frequency must be met with random independent or random split samples as defined in [Section 3.3.1 – Sample Types and Uses](#). During the start-up of new categories of Work and when there are any concerns over the quality of material, the IQF will conduct testing at a higher testing frequency as described in the preamble of the DB Guide Schedule.

While the testing of random independent or random split samples is required to meet the DB Guide Schedule requirements, the IQF will perform additional (fixed) tests when the quality of material is questionable at a location other than the randomly selected location. These fixed tests will constitute an acceptance test, and a failing result will be addressed in a similar manner to a failing random independent test. Fixed tests will not count towards meeting minimum IQF sampling and testing frequencies. If IQF is unavailable or unwilling to perform additional fixed tests when material quality is questionable at a location other than their random location, OVF should perform those fixed tests.

TxDOT, or its designee, will perform oversight inspection and material verification sampling or testing. To verify IQF test results, OV testing will be performed at a minimum frequency shown in [Appendix D – OV Levels for Materials Testing Validation/Verification](#), subject to project-specific recommendations to be approved by TxDOT MTD and FHWA. Split sample testing defined in [Appendix F](#) does not replace or relieve the requirements found in [Section 4 – Independent Assurance Program](#).

### **3.4 Risk-Based Inspection**

The OVF will implement a risk-based process for Owner Verification Inspection (OVI) for use in the acceptance decision, similar to [Appendix D – OV Levels for Materials Testing Validation/Verification](#). Risk-based inspection is a prioritizing and planning tool where elements of Work are identified for inspection based on their associated risk of failure. This approach allows the OVF to maximize the effectiveness of its inspection resources to oversee the IQF by concentrating on those assets that pose the highest risk of failure. In general, the higher the residual risk for the performance of the material after the DB Contractor's maintenance obligations expire, the higher the level of monitoring and verification that should be performed by the OVF. The OVF will use the risk-based inspection process to report the IQF's specification compliance on installed items of Work. If the IQF's processes and procedures do not result in acceptable specification compliance, the OVF will issue a process NCR and the IQF shall modify CQMP inspection procedures.

#### **3.4.1 Defining Risks**

In risk-based inspection, risk is determined as the product of the probability of failure and the consequences associated with a failure. Consequences include short- and long-term functional failures, reduced design life, reduced safety, increased maintenance cost, probability of failure, severability of failure, and ability to detect. In conjunction with TxDOT and FHWA, the OVF will develop and conduct an OVI risk assessment workshop in conjunction with a OVT risk assessment workshop, to define project-specific risks and provide details classifying appropriate levels of monitoring and verification for each element of Work constructed, based on their risk profiles. This workshop should be conducted at least 8 weeks before start of construction.

### **3.5 DB Contractor Independent Quality Firm Requirements**

DB Contractor's CQMP shall establish a systematic approach to define the processes, methods, procedures, and documentation for delivery of IQ on the Project. These methods and procedures should be based on the DB Guide Schedule or greater, and parts of the *TxDOT Construction Contract Administration Manual* that apply to DB projects and shall clearly define the authority and responsibility for the administration of the IQ portion of the CQMP.

The DB Contractor's IQF will assign an on-site Independent Quality Firm Manager (IQFM), responsible for management of the quality aspect of the DB Contractor's CQMP, which may be used in TxDOT's acceptance decision if validated or verified by the OVF. The IQFM will be a licensed professional engineer in the state of Texas and will be an employee of the IQF. The IQFM will report jointly to DB Contractor's management team and TxDOT. The IQFM will not report to any person or party directly responsible for design or construction Work and will not be involved in scheduling or production activities.

#### **3.5.1 Authority of the IQFM**

The IQFM will review, approve, authorize, examine, interpret, and confirm any methods or procedures requiring the Engineer's review, approval, authorization, examination, interpretation, confirmation, etc., as designated in the TxDOT Standard Specifications and DB Specifications. The IQFM is considered the "Engineer," for the purpose of this document, when interpreting the TxDOT Standard Specifications and DB Specifications, Contract Documents, standards, and policies during construction; however, the IQFM is not considered the Engineer of Record (EOR). Acceptance decisions by the IQFM must be verified through the Owner Verification program or through the NCR process.

The IQFM will have the authority to stop Work.

#### **3.5.2 IQF Staffing**

The IQF inspection and materials sampling or testing staff will be employed by the IQF and be under the direction of the IQFM to verify compliance with the Contract for any or all parts of the Construction Work and the materials used by any member of the DB Contractor's group. If approved in writing in advance by TxDOT, qualified individuals who are employees of or retained by manufacturers, Vendors, or Suppliers may inspect certain portions of the Work.

The size of the IQF's staff will reflect the volume of activities necessary for acceptance of the work in progress and will be maintained in accordance with the approved CQMP.

The IQF's staffing requirements will be updated as necessary throughout the term of the agreement to reflect changes in the actual construction schedule. The DB Contractor will ensure that adequate IQF staff is available and that CQMP activities are undertaken in a manner consistent with the Project Schedule and in a manner, that will enable DB Contractor to achieve the Substantial Completion and Final Acceptance deadlines.

#### **3.5.3 IQF Training and Experience**

IQF inspection and materials sampling or testing staff will have been trained in the applicable inspection and material sampling and testing procedures. The IQF's staff will be

experienced in highway inspection and materials testing. The training and experience of the IQF staff will be commensurate with the scope, complexity, and nature of the activity to be inspected and tested. IQF personnel qualifications will include appropriate TxDOT or State Highway Agency certification for testing and inspection as well as appropriate nationally recognized certifications applicable to inspection or testing activities. IQF materials sampling or testing personnel must be qualified under the IA program described in [Section 4 – Independent Assurance Program](#). Documentation of the training, certification, and experience will be maintained by the IQF and available for review and audit.

#### **3.5.4 IQF Facilities and Equipment**

The DB Contractor's IQF will use a laboratory meeting the requirements described in [Section 4 – Independent Assurance Program](#) for quality testing. Unless otherwise approved by TxDOT, the laboratory or field laboratory will be located on site or within 10 miles of the Project.

#### **3.5.5 CQMP Requirements**

The DB Contractor's CQMP will clearly address, at a minimum, how the DB Contractor's IQF staff will address the following requirements.

- A. The CQMP will be ISO 9001:2015 compliant for quality systems, quality plans, and quality audits, or most current version, as updated by the International Organization for Standardization, including methods and procedures that clearly define the authority and responsibility for the administration of the DB Contractor's CQMP.
- B. Procedures for inspecting, checking, and documenting the Work for acceptance. Inspection, examinations, and measurements will be performed for each operation of the Work to assure quality.
- C. Procedures to ensure that the education, training, and certification of personnel performing CQMP activities are achieved and maintained and that all Work is performed in accordance with the approved designs, plans, and specifications.
- D. Procedures to document and track the disposition of any identified nonconformance with the plans and specifications. These procedures will include a clearly defined process for communicating identified non-conformances to TxDOT and the DB Contractor.
- E. Measures to ensure that purchased materials, equipment, and services conform to the Contract Documents, the Governmental Approvals, applicable laws, rules, and the Design Documents. These measures will include provisions for source evaluation and selection, objective evidence of quality furnished by Subcontractors and Suppliers, inspection at the manufacture or vendor source, and examination of products upon delivery.
- F. Measures to ensure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly maintained, controlled, calibrated, certified, and adjusted at specified periods to maintain accuracy within industry standards. Malfunctioning equipment or equipment out of calibration shall be tagged and put out of service until it is repaired or calibrated.

- G. A comprehensive system of planned and periodic audits of DB Contractor's CQMP to determine adherence to and the effectiveness of the CQMP. Audits must be performed at least twice a year or more frequently as needed. IQF personnel will perform the audits in accordance with the written procedures or checklists. Audit results will be documented, reviewed, transmitted to TxDOT, and acted upon by the DB Contractor. Follow-up action, including re-audit of deficient areas following corrective action, will be taken where indicated.
- H. The requirements and methods for controlling documents. The DB Contractor's document control system will be compatible with TxDOT's.
- I. Inspection of all Work to verify and document that the Work has been constructed in conformance with the Released-for-Construction Documents, specifications, and approved working and shop drawings.
- J. Procedures on how IQF materials sampling and testing will be performed, including the processes for random sampling, tracking materials samples, processing materials samples, review and approval of test records, and tracking compliance with materials testing frequency.
- K. Procedures for addressing failed tests. For a failed random independent test, a fixed test at the original failing test location and a new random independent test at a new location in the same lot are required. For a failed fixed test, a new fixed test is required at the original failing test location.
- L. Procedures for reviewing IQF test results for compliance with mutually agreed-upon processes and naming conventions to ensure data integrity for accurate statistical analyses. The IQF shall coordinate with the OVF to mutually agreed on controlled vocabulary lists (CVLs) before the CVLs are implemented.
- M. Procedures for auditing of QC and IQF records, documentation, procedures, and processes to verify compliance with the Contract Documents and approved CQMP.
- N. Procedures for the review and verification of all Portland cement concrete, soil-lime treatment (stabilization or modification), soil-cement treatment, and hot-mix asphalt mix designs by a licensed professional engineer in the state of Texas.
- O. Procedures for ensuring IQF sampling and testing will be performed at the frequency stipulated in the DB Guide Schedule. IQF shall submit a monthly report to TxDOT showing quantity of materials incorporated into the Project during that month, so that TxDOT can verify compliance with the DB guide schedule. These quantities shall be broken down by material application, specification item, grade, source/supplier, and material (mix ID, design depth, source identification code, etc.). The number of tests required and performed for each material category in the prior sentence shall also be presented for each test method required for that material category.
- P. Procedures for ensuring IQF staff will provide oversight and perform audits of the quality control inspection, materials sampling or testing operation, and DB Contractor's survey documentation.
- Q. Procedures for ensuring that pre-approved materials used on the project maintain their approved status on the MPL. Materials shall be sampled and tested in accordance with [Section 3.1.1](#). For testing to be performed by MTD, results will be available after 30 days from receipt of the sample at TxDOT MTD. Each project is limited to 3 samples in 30 days.

- R. Procedures for sampling, testing, and inspection, in accordance with [Section 3.2.2](#), when MTD does not perform inspection, sampling, and testing services of off-site prefabricated product fabrication plants and any jobsite prestressed concrete girder plant.
- S. Procedures for addressing OV failing test results and non-validation or nonverification of IQF test results.
- T. Procedure for verifying traffic control setup and completion of hold point inspections before starting construction Work associated with the traffic control and appropriate correction actions are taken to ensure compliance with the traffic control plan (TCP) before allowing Work to proceed.
- U. Procedure for verifying that traffic control devices are in good working condition and appropriate correction actions are taken to remedy traffic control devices deficiencies. TxDOT Form 599, "Traffic Control Devices Inspection Checklist" shall be used when conducting the inspection.
- V. Procedures for reviewing and certifying the construction portion of the monthly draw request.

### **3.5.6 Reporting, Record Keeping, and Documentation**

The DB Contractor will document and maintain documentation showing how the IQF has complied with the CQMP requirements in [Section 3.5.5](#).

The DB Contractor's IQF will maintain electronically and transmit to TxDOT daily inspection reports within 48 hours after the work shift in a format acceptable to TxDOT. The daily inspection reports will document the day's events, activities, inspections conducted, results of inspections, location and nature of defects found, causes for rejection, and remedial or corrective actions taken or proposed. The responsible inspector and supervisor will sign the daily inspection reports.

The IQF will be responsible for establishing an electronic system for recording all materials test results. The responsible technician and his or her supervisor will sign the daily test reports and provide the results of the daily tests to TxDOT within 48 hours of test completion. The IQF's materials test results will be electronically transmitted to TxDOT in an extensible markup language (XML) format acceptable to TxDOT. Guidance on TxDOT requirements for XML data transfer is provided in [Appendix C – IQF Data Transfer Requirements](#). This electronic reporting is intended to allow the DB Contractor and TxDOT to make timely and accurate decisions on workmanship and materials quality issues.

If the IQF inspection and testing source documents are paper and then changed to an electronic document for project-level use, the original source paper document must be kept for 3 years after FHWA final voucher on the project and as detailed in the State of Texas Records Retention Schedule. The IQF inspection and materials test results will be simultaneously transmitted to both TxDOT and the DB Contractor. The DB Contractor will not receive the IQF inspection or materials test results before TxDOT.

## 3.6 Owner Verification Requirements

### 3.6.1 General

TxDOT has the ultimate responsibility for verifying that the Project is delivered in compliance with the Contract Documents. As such, TxDOT will perform Owner Verification sampling, testing, and inspection, and conduct audits to verify the DB Contractor's compliance with the approved CQMP.

TxDOT will establish a system for managing the materials acceptance process. This process will include the performance and approval of OV tests at the stipulated test frequency, review of IQF test results, performance of statistical analysis on OV and IQF test results, and any associated tasks arising out of the statistical analysis.

TxDOT's OV laboratory will meet the requirements described in [Section 4 – Independent Assurance Program](#).

### 3.6.2 Owner Verification Testing and Inspection Plan

TxDOT or its designated agent will develop a comprehensive Risk-Based Owner Verification Testing and Inspection Plan (OVTIP). The OVTIP shall be approved before construction starts. The OVTIP will clearly address, at the minimum, how TxDOT's OV staff will address the following requirements.

- A. Methods and procedures that clearly define the authority and responsibility for the administration of the OVTIP.
- B. Procedures for overseeing and inspecting the Work for compliance with the DB Contractor's CQMP for each operation.
- C. Procedures to ensure that the education, training, and certification of personnel performing OV activities are achieved and maintained and that all Work is performed in accordance with the approved OVTIP.
- D. Procedures to oversee the status and disposition of any identified noncompliance with the plans and specifications.
- E. Measures to ensure that tools, gauges, instruments, and other measuring and testing devices used in activities affecting quality are properly maintained, controlled, calibrated, certified, and adjusted at specified periods to maintain accuracy within industry standards.
- F. A system of planned and periodic audits of the DB Contractor's CQMP to determine adherence to and the effectiveness of the CQMP. Audits must be performed at least once a year or more frequently as needed. Audit results will be documented, reviewed, and sent to TxDOT and the DB Contractor. Follow-up action, including re-audit of deficient areas following corrective action, will be taken where indicated.
- G. A system of planned and periodic audits of the OV firm to determine adherence to and the effectiveness of the OVTIP. Audit results will be documented, reviewed, and sent to TxDOT. Follow-up action, including re-audit of deficient areas following corrective action, will be taken where indicated.
- H. Procedures for performing periodic risk-based inspection of Work to verify that the IQF has performed the Work in compliance with the ESOC plans, Temporary Work

plans, RFC plans, specifications, and approved working and shop drawings. The procedure should identify a target oversight inspection rate and methods for performing verification inspections for all QC and IQF inspectors.

- I. Procedures on how OV materials sampling and testing will be performed, including the processes for random sampling, tracking materials samples, processing materials samples, review and approval of test records, and tracking compliance with materials testing frequency.
- J. Procedures for reviewing IQF and OV test results for compliance with mutually agreed-upon processes and naming conventions to ensure data integrity for accurate statistical analyses.
- K. Procedures for ensuring that only tests performed by qualified IQF testing personnel are submitted to TxDOT.
- L. Procedures for auditing of QC and IQF records, documentation, procedures, and processes to verify compliance with the Contract Documents and approved CQMP.
- M. Procedures for reviewing Portland cement concrete, soil-lime treatment (stabilization or modification), soil-cement treatment, and hot-mix asphalt mix designs.
- N. Procedures for ensuring OV testing will be performed at the frequency stipulated in this QAP.
- O. Procedures for performing timely statistical analyses in compliance with procedures outlined in this DB QAP and reviewing and communicating the analysis results with QC and IQF on a minimum weekly basis.
- P. Procedures for review and approval of NCR resolutions proposed by the DB Contractor.
- Q. Procedures for verifying that the IQF is performing the required traffic control device inspections per the approved CQMP and that the IQF is verifying the traffic control implementation is consistent with the Temporary Work plans, ESOC plans, and RFC plans.

### **3.6.3 Reporting, Record Keeping, and Documentation**

TxDOT will submit OV Reports on a quarterly basis to FHWA for concurrence of TxDOT's compliance with the approved QAP. The reporting period for specific pay items or materials is dependent on the pace of construction and the number of tests performed in each analysis category, the time period of the sampling, and the specification and quality requirements. Each report will cover a period of construction not greater than 3 months. The first and last reports may cover a period of construction greater than 3 months with prior approval by TxDOT MTD.

If the OVF inspection and testing source documents are paper and then changed to an electronic document for project-level use, the original source paper document must be kept for 3 years after FHWA final voucher on the project and as detailed in the State of Texas Records Retention Schedule.

The OV Report will be submitted quarterly and address the following areas:

- A. Statistical analysis results, to include specification requirements (when analysis categories are not validating) and status of validation process during start-up and completion of an item;
- B. Non-validation and nonverification investigations, to include TxDOT's materials acceptance decision for materials represented by non-validated or nonverified IQF test results;
- C. Split-sample test results;
- D. Nonconformance log;
- E. IQF Engineering Judgment log;
- F. OVF Engineering judgment log;
- G. IQF's Monthly material certification (see Example in [Appendix G](#)); and
- H. Project-Specific Levels of Analysis.

### **3.6.3.1 Statistical Analysis**

For Level 1, F-tests and t-tests will be used to analyze OVF and IQF data. The F-test is a comparison of variances to determine if the OVF and IQF population variances are equal. The t-test is a comparison of means to determine if the OVF and IQF population means are equal. In addition to these two types of analyses, Level 2 independent verification and Level 3 observation verification will also be used to verify the IQF test results. The type of analysis and recommended level of significance for specific tests are shown in [Appendix D – OV Levels for Materials Testing Validation/Verification](#).

Before performing any statistical analyses, it is important to ensure that the data contained in each analysis category are in reasonable compliance with the underlying assumptions of the F-test and t-test. The implementation of CVLs is essential to parse data into appropriate analysis categories.

### **3.6.3.2 Nonverification Investigation**

If the OVF test results do not validate (Level 1) or verify (Level 2) the IQF test results, an investigation will be conducted to determine the reason for nonverification. Assuming that the analysis categories were established appropriately, other areas for investigation include data integrity and accuracy, technician reporting issues, testing equipment and procedures, sampling variability, and material variability. Material quality when nonverification occurs is further discussed in [Section 3.7 – Resolution of Differences in Materials Test Results](#). Results of the investigation should be reported for the nonverifying categories. If recurring nonverification continues, OV sampling and testing frequency must be increased to approach the minimum DB guide schedule testing frequency, so there is enough OVF data for assessing material quality during the period of nonverification.

### **3.6.3.3 Engineering Judgment**

Materials test results or other characteristics of the work that indicate reasonable conformance with specification requirements, but did not meet the minimum specification requirements, may be adequate for their intended use. As such, TxDOT has allowed the IQF to exercise Engineering Judgment to accept such materials or work; however, each occurrence shall include notification to TxDOT within 24 hours and be properly documented

in the EJ log and submitted to TxDOT monthly. EJs decisions shall be made as soon as test results are available and EJ log updated within one week. Documentation will include the location where the material is incorporated, the specification requirement, the recorded test value, deviation from specification, and the Engineering Judgment applied to allow use of that material, method, or product. If the IQF does not choose to exercise Engineering Judgment to accept failing materials or Construction Deficiency noted in CDRs, the Nonconforming Items in question may still be accepted through the NCR process and repaired if approved, brought into conformance with specifications, or removed from the project.

The OVF will also maintain an Engineering Judgment log and documentation for any OV test result that fails to meet the minimum specification requirements and remains in place.

A project-specific Engineering Judgment Agreement must be drafted by the IQFM in conjunction with the DB Contractor's EORs, and approved by TxDOT following the guiding principles below.

TxDOT, OVF, EORs, QC and the IQF will meet and discuss situations that may arise in the field during construction under the specification items anticipated to be used on the project. They will agree on whether the IQF will be allowed to use engineering judgment or not in each situation and how much latitude could be applied under what circumstances. Once agreed, each situation and its guidelines will be listed in the Agreement. TxDOT will transmit a finalized project-specific Agreement listing situations where judgment may and may not be used. This is a living document and may be changed at any time as new special specifications, special provisions, or plans, as situations change in the field or at the discretion of TxDOT. All changes will be made in writing, clearly modifying the agreement. An Example Engineering Judgment Agreement is shown in [Appendix K](#). It is only an example of some typical items that might be delegated or not, for reference and use in developing the Agreement that will apply to the Project.

The development of the Project must proceed with a reasonable approach to the quality duties of the IQF and the extension of the IQF's ability to render decisions in the field with regard to the Work performed. TxDOT recognizes that the IQF is an element of the DB Contractor's team working to progress the development of the Project for TxDOT, and working alongside DB Contractor who is responsible for compliance. TxDOT recognizes that the IQF should be afforded the opportunity, in concert with its independent role, to render engineering decisions with respect to appropriate documents for inspection and testing as long as the following conditions are met.

- A. Engineering decisions will be delegated no lower than an engineer in charge of a section of the Project. This engineer may be an employee of TxDOT, OVF, or IQF, and must be a licensed professional engineer registered in the State of Texas. Engineering decisions will be within an individual's area of expertise.
- B. Engineering Judgment to accept material or Work failing specifications will never be applied solely to promote "partnering" or to help the DB Contractor. The Project's quality will be regarded as the highest order of concern. Schedule is a secondary consideration with respect to quality delivery of the Project.
- C. If these guiding principles do not address the situation, the individual applying Engineering Judgment must provide a decision to TxDOT as to whether a material

failing to meet specification requirements and not within applicable tolerances should be accepted, or not accepted, based on sound engineering principles, experience, or related results of applicable material tests.

- D. Engineering Judgment to accept materials or Work failing specification requirements will be applied only in cases where natural resources may be lost that will otherwise meet the intent of the design (e.g., strength tests versus slump requirements); rejection of material endangers quality or loss of a larger or more significant item (e.g., by rejecting load of concrete, a structure element subject to a cold joint, reflective cracking); or some other issue that unduly threatens the overall quality or schedule of the Project. In general, engineering judgment is typically allowed on factors that are only indicators of final product quality, such as slump, or are “rule of thumb” as written into specifications, such as the number of mixing revolutions or time to discharge since batching. Use of judgment supported by logical engineering analysis of the actual situation or conditions can allow production to continue. Materials that failed to meet the specification requirement may continue to be used as long as adjustments are made by the contractor to correct the cause of the failing factor. (Concrete failing slump, mixing time, or over revolutions may actually still produce concrete exceeding design strength. It is advised that strength samples should be taken for concrete as fixed independent tests in these situations to verify the ultimate strength of the load of concrete, for instance.)
- E. Engineering judgment should not be used by the IQF on material test results that are the ultimate acceptance criteria for the item, such as concrete compressive strength, density of HMAC, pavement thickness, deck thickness, or cover on steel. These are generally not field situations that can be adjusted to correct during on-going production or are immediately necessary to sustain production. They are factors that ultimately determine if the product meets contract and design requirements and affect performance, durability, and maintenance. Accepting failing tests in these areas should be through the NCR process only after analysis and consideration by the EOR and TxDOT and may include assessment of liquidated damages.
- F. Failed results of material tests may be accepted only for individual tests. Patterns of failure will not be accepted, will be considered a breakdown in Quality Control activities, and will be addressed in the CQMP. Recurring use of Engineering Judgment for the same plan or specification deviation should result in process corrections to the construction operations to assure material and Work is conforming to plan and specification requirements. As a general rule of thumb, if failing tests are 5% or less and the process is consistent, then that process is generally under control. If failing tests rise to 8% or more, then increased process control testing and process adjustments are indicated as needed to get back to a uniform controlled process. The intent of delegating Engineering Judgment Authority to the IQF is not to allow widening of a specification requirement on a continuing basis, but is necessary to allow for reasonable production efforts to adjust and control their processes by the DB Contractor.
- G. The IQFM may use Engineering Judgment to direct that an amount of acceptance testing greater than the required minimum be performed when deemed necessary. The IQFM must document any variations from the prescribed frequencies.

- H. The individual making the Engineering Judgment will apply good engineering practices to ensure quality of accepted material by making additional tests, through engineering analysis, etc., and will document his or her acceptance and justification.
- I. Engineering Judgment in acceptance of material or Work not meeting specification requirements will be applied only to situations that are technically sound, in consideration of localized conditions. Engineering Judgment will not be used to waive specifications for conditions that have project-wide implications. The acceptance of materials or Work not meeting specifications in one instance at a location will not become a corridor-wide or project-wide decision. Each situation will be judged on the merits of its unique characteristics.
- J. TxDOT may, at any time, remove Engineering Judgment authority from the IQFM in specific circumstances.
- K. TxDOT and FHWA have oversight agreements in place that require specific documentation relating to nonconforming material that is allowed to remain in place. Any instance of the application of these guiding principles will be accompanied by appropriate documentation.
- L. The IQF is encouraged but not required to consult with TxDOT before making acceptance decisions.
- M. IQF personnel are not placed, and do not appear to be placed, in a position that exhibits signs that they were pressured by the DB Contractor to accept, approve, or continue the duties of the IQF scope of work as detailed in the Project under duress.
- N. Excessive use of Engineering Judgment in any specific area, as determined by the IQF or TxDOT, will require a Corrective Action Report (CAR) by the DB Contractor which will include a root cause analysis for the repeated noncompliance with the specification requirement and actions to eliminate or significantly reduce the use of engineering judgment in that area. Anyone in the project can initiate a CAR.

#### **3.6.3.4 Nonconformance and Construction Deficiency Logs**

Materials or workmanship nonconformances that do not meet the minimum specification requirements may be adequate for their intended use; however, the incorporation of the material or workmanship in question is subject to the review and approval by the EOR and must be documented through the Nonconformance Report (NCR) process. Workmanship deficiencies that do not require an engineering decision by the EOR can be addressed through rework using the Construction Deficiency Report (CDR) process. For example: reworking earth work, re-tying steel, etc. Construction deficiencies must be noted in the daily inspection report.

The DB Contractor will identify, document, and report to TxDOT all instances of Work that have not been constructed with the strictest adherence to the approved drawings and specifications and within the requirements of the Contract Documents, the Governmental Approvals, and applicable Law. This reporting will be in the form of an NCR as described below and will be submitted to TxDOT in writing within 24 hours of the DB Contractor obtaining knowledge of the same. The DB Contractor will simultaneously send a copy of each NCR to the DB Contractor's EOR and the IQF.

The NCR will clearly describe the element of Work that is nonconforming and the reason for the nonconformance. The EOR will evaluate the effect of the Nonconformance on the performance, safety, durability, and effect of the long-term maintenance of the project and the specific element affected. If the EOR determines remedial actions are necessary, the proposed remedial action will be documented and bear the stamp of the original responsible licensed professional engineer or the responsible licensed professional engineer from the same firm assigned to replace the original.

Any NCR resolution involving materials should be based on acceptance procedures in the ESOC plan, temporary work plan, RFC plans and specifications, random testing by IQF with OVF verification, using test methods qualified by IA, and consistent with the IQF's CQMP and OVTIP. OV testing must be increased if the IQ testing is in nonverification status. NCR resolutions that do not use this approach will not be consistent with 23 CFR 637B and may cause non-participation by FHWA. For NCR resolutions involving destructive testing, the EOR will determine frequency and location of IQF testing and the OVF will perform a level 2 independent verification of all IQF's sampling and testing. Alternatively, the EOR will determine the testing location and the OVF will perform the testing.

The DB Contractor will maintain a log of all NCRs and CDRs and submit these logs to TxDOT and the IQF on a bi-weekly basis. Each NCR and CDR will be numbered sequentially and given a brief description, status, and an expected date for closure, if not closed. All NCRs must be closed with the signature of the EOR or the qualified licensed professional engineer from the same firm if the EOR is not available, and TxDOT's approval. All NCRs that require changes to the original calculations or design must include the stamp of the EOR or the qualified licensed professional engineer from the same firm, and TxDOT approval. When TxDOT does not approve the NCR, resolution will be made in accordance with requirements of the Contract Documents, as applicable.

Excessive use of NCR and CDR in any specific area, as determined by the IQF or TxDOT, will require a CAR by the DB Contractor which will include a root cause analysis for the repeated noncompliance with the specification requirement and actions to eliminate or significantly reduce the cause of failing in that area. Anyone in the project can initiate a CAR.

#### **3.6.3.5 Monthly Construction Certification**

The DB Contractor will provide a monthly written certification by the IQFM, delivered to TxDOT with each payment request, indicating that the CQMP and all of the measures and procedures provided therein, are being fully complied with and are functioning properly. The IQF will maintain and submit records monthly that include factual evidence that required activities and tests have been performed, including the following:

- A. Type, number, and results of CQMP activities, including reviews, inspections, tests, audits, monitoring of Work performance, and materials analysis;
- B. Quantities of materials incorporated into the project;
- C. Inspector or data recorder, the type of test or observation employed, the results and the acceptability of the Work, and action taken in connection with deficiencies;
- D. Nature of Nonconforming Work and Construction Deficiency Items and causes for rejection;

- E. Proposed corrective action for Nonconforming Work and Construction Deficiency Items;
- F. Corrective actions taken with respect to Nonconforming Work and Construction Deficiency Items; and
- G. Results of such corrective actions.

### **3.6.3.6 End of Project Materials Certification Letter**

For projects with Federal oversight, the end of project materials certification letter will be signed by the District Engineer or designee. The end of project materials certification letter, along with all approved OV Reports attached as supporting documentation, will be the final materials certification to be submitted to the FHWA Division Administrator for each construction project before FHWA closes out the Project. Refer to 23 CFR 637, Subpart B, Appendix A for an example of a materials certification letter.

For projects without Federal oversight, the end of project materials certification, signed by the District Engineer or designee, along with all approved OV Reports, will be the final materials certification and will be kept at the district office. A copy of the end of project materials certification letter, signed by District Engineer or designee, will be submitted to MTD before TxDOT closes out the Project.

## **3.7 Resolution of Differences in Materials Test Results**

Through the life of the Project, there may be differences in individual materials test results or test result sample populations between the IQF and TxDOT. Due to the natural variability in construction materials testing and unavoidable biases in sampling and testing, these differences are often difficult to avoid. When the differences between IQF and TxDOT sample populations are large enough, TxDOT's OV sampling and testing will not verify IQF test results. IQF test results that are not verified will not be used for TxDOT's acceptance of the material.

All failing IQF and OVF tests results, verifying or nonverifying, must be accepted based on Engineering Judgment, NCR process, reworked, or removed and replaced.

Any OV or IQF results identified as an outlier needs to be confirmed using ASTM E178. An outlier may be excluded from validation or verification analysis but cannot be used to address failing materials or excluded from PWL calculations.

### **3.7.1 Material Quality**

Material quality addresses whether the material in question meets its intended purpose. If test results indicate that the specification requirements are met, the material is deemed to have met its intended purpose. If test results do not indicate that specifications requirements are met, but the test results are within reasonable conformance to the specification requirements, Engineering Judgment may be exercised to determine that the material met its intended purpose in accordance with [Section 3.6.3.3](#).

A material quality decision must be made on all IQ and OV test results regardless of whether the analysis category for that material is validating or not. If the material in question is in an analysis category that is validating, the OV performs its regular program-level oversight of

IQF and its engineering judgment decisions. If the material in question is in an analysis category that is non-validating, TxDOT must provide engineering justification for acceptance of the material in question and only OV results are used to make the acceptance decision because IQ results may not be used in the acceptance decision.

### **3.7.2 Validating Materials**

When either the IQF or OVF test results fail to meet specification requirements and if these materials have been historically validating, there are four possible combinations of passing or failing results between the IQF and the OVF that must be evaluated.

#### **3.7.2.1 Both the IQF and OV Test Results Pass Specification Limits**

Material may be left in place.

#### **3.7.2.2 IQF Test Results Fail and OV Test Results Pass Specification Limits**

Material may be left in place if the IQF exercises Engineering Judgment, as described in [Section 3.6.3.3](#), to accept the material, or if the material is accepted through the NCR process.

#### **3.7.2.3 Both the IQF and OV Test Results Fail Specification Limits**

Material may be left in place if the IQF and OV both determine that Engineering Judgment may be used to accept the material for their respective tests or if the material is accepted through the NCR process, unless reworked or replaced. Otherwise, the acceptance of material is subject to one of the two scenarios below.

- A. If the OV exercises Engineering Judgment to accept the material based on the OV test result but the IQF does not exercise Engineering Judgment to accept the material based on the IQF test result, the DB Contractor shall address this material that does not meet its intended purpose through the NCR process, unless reworked or replaced.
- B. If the IQF exercises Engineering Judgment to accept the material based on the IQF test result but TxDOT or OV does not immediately exercise Engineering Judgment to accept the material based on the OV test result, IQF will perform a fixed split test at the OV failing test location to assist with the investigation. This investigation may include additional fixed tests performed by the OVF. Based on the results of the investigation, TxDOT will decide to accept the material in question via engineering judgment, or not to accept the material and DB contractor shall address the failing material that does not meet its intended purpose through the NCR process, unless reworked or replaced.

#### **3.7.2.4 IQF Test Results Pass but OV Test Results Fail Specification Limits**

Material may be left in place if the OVF exercises Engineering Judgment to accept the material or if the material is accepted through the NCR process. This is subject to TxDOT response in the two scenarios below.

- A. OV test results indicate reasonable conformance with specification requirements, TxDOT exercises Engineering Judgment to accept the material.
- B. OV test results do not indicate reasonable conformance with specification requirements, the IQF will perform a fixed split test at the failing OV test location.

- a. If the IQF fixed-split tests does not meet specifications and the IQF does not exercise Engineering Judgment to accept the material, the DB shall address this material that does not meet its intended purpose through the NCR process, unless reworked or replaced.
- b. If the IQF fixed-split test meets specifications or the IQF exercises Engineering Judgment on the IQF fixed split test that does not meet specifications, TxDOT will further investigate the area in question. This investigation may include additional fixed tests performed by the OVF. Based on the results of the investigation, TxDOT will decide whether to accept the material as meeting its intended purpose via engineering judgment or not accept the material and the DB Contractor will have to address this material that does not meet its intended purpose through the NCR process, unless reworked or replaced

### **3.7.3 Non-Validating Materials**

When OV independent test results do not statistically validate the IQF test results as outlined in [Section 3.6.3.1 – Statistical Analysis](#) (Level 1), or TxDOT determines that independent OV sampling and testing does not verify IQF test results (Level 2), TxDOT and the IQF will jointly investigate to determine the sources of non-validation or nonverification.

TxDOT will work with the IQF and DB Contractor to immediately evaluate to determine if the material represented by the non-validation will remain in place, will be reworked, or will be removed and replaced. If material is to remain incorporated into the Project, the material in question will be evaluated using the process described in this Section.

There are four possible combinations of passing and failing results between the IQF and OVF test results. In the four cases below, the non-validation shall be investigated.

#### **3.7.3.1 Both the IQF and OV Test Results Pass Specification Limits**

Although statistical validation has not occurred, both the IQF and OVF test results are passing the established specification limits. Thus, material may be left in place.

#### **3.7.3.2 IQF Test Results Fail and OV Test Results Pass Specification Limits**

Material may be left in place if the IQF exercises Engineering Judgment, as described in [Section 3.6.3.3](#), to accept the material, and TxDOT's concurrence will be required since the material is in non-validation status or the material in question is accepted through the NCR process.

#### **3.7.3.3 Both the IQF and OV Test Results Fail Specification Limits**

Material may be left in place if the IQF and OV both determine that Engineering Judgment may be used to accept the material and TxDOT concurs with the IQF's EJ to accept the material in question otherwise the material is accepted through the NCR process, unless reworked or replaced. Otherwise, the acceptance of material is subject to one of the two scenarios below.

- A. The OV exercises Engineering Judgment to accept the material based on the OV test result but the IQF does not exercise Engineering Judgment to accept the material based on the IQF test result, the DB Contractor will have to address this material that

does not meet its intended purpose through the NCR process, unless reworked or replaced.

- B. The IQF exercises Engineering Judgment to accept the material based on the IQF test result but the OVF does not immediately exercise Engineering Judgment to accept the material based on the OV test result, the IQF will perform a fixed split test at the OV failing test location to assist with the investigation. This investigation may include additional fixed tests performed by the OVF. Based on the results of the investigation, TxDOT will decide to accept the material in question via Engineering Judgment, or not to accept the material and DB contractor shall address the failing material that does not meet its intended purpose through the NCR process, unless reworked or replaced.

#### **3.7.3.4 IQF Test Results Pass but OV Test Results Fail Specification Limits**

Material may be left in place if TxDOT determines that Engineering Judgment may be used to accept the material or if the material is accepted through the NCR process. This is subject to TxDOT response in the two scenarios below.

- A. OV test results indicate reasonable conformance with specification requirements, TxDOT exercises Engineering Judgment to accept the material.
- B. OV test results do not indicate reasonable conformance with specification requirement, the IQF will perform a fixed split test at the failing OV test location.
  - a. If the IQF fixed-split test does not meet specifications and the IQF does not exercise Engineering Judgment to accept the material, the DB Contractor will have to address this material that does not meet its intended purpose through the NCR process, unless reworked or replaced.
  - b. If the IQF fixed-split test meets specifications or the IQF exercises Engineering Judgment on the IQF fixed-split test that does not meet specifications, TxDOT will further investigate the area in question. This investigation may include additional fixed tests performed by the OVF. Based on the results of the investigation, TxDOT will decide whether to accept the material as meeting its intended purpose via Engineering Judgment or not accept the material and the DB Contractor will have to address this material that does not meet its intended purpose through the NCR process, unless reworked or replaced.

#### **3.7.4 Retesting after Reworking Material**

If material is reworked, test results on the material in question before the rework are excluded from any verification analyses. For the IQF, fixed tests at the location of the original failing test locations and new random-independent tests are required with OV verification to accept the material in question.

#### **3.7.5 Nonverifying Analysis Runs and Analysis Categories**

When OV test results do not statistically validate the IQF test results as outlined in [Section 3.6.3.1 – Statistical Analysis](#) (Level 1), or TxDOT determines that independent OV sampling and testing does not verify IQF test results (Level 2), TxDOT and the IQF will jointly investigate to determine the sources of non-validation/nonverification. TxDOT and the IQF will adjust sampling and testing processes to correct any sampling and testing deficiencies, align testing procedures, calibrate equipment, and reduce testing bias as identified during

the joint investigation. TxDOT may increase the OV sampling and testing frequency to provide additional OV data for potential continuing non-validation analyses.

If the non-validation persists (5 or more consecutive non-validations analysis runs on either the F- test or the t-test), a process NCR will be issued to formally document and seek resolution to the non-validation. This process NCR can only be closed out by TxDOT when the non-validation analysis category is brought back into validation on both the F-test and the t-test for 2 or more consecutive times and based on the results of the investigation.

If non-validation continues, TxDOT shall increase the OV sampling and testing frequency (close to minimum DB guide schedule testing frequency) to provide additional OV data to help in the non-validation investigation and to provide additional test results to use in the acceptance decision.

### **3.7.5.1 Level 1 – Continuous Analysis**

Level 1 verification is performed using continuous F- and t- tests at a predetermined level of significance ( $\alpha$ ) shown in the DB QAP, Appendix D. If either the F- or the t- test is not validating for a given analysis run, that analysis run is considered non-validating. An individual non-validating analysis run does not make the analysis category non-validating for that reporting period. The following criteria is used to determine if a Level 1 analysis category is validating or non-validating for the purposes of the quarterly OV Report.

- A. Analysis categories which have a maximum of 3 OV test results in the reporting time period with very small standard deviations that lead to statistically significant but not practically significant differences are not reported as non-validating.
- B. Analysis runs that trigger the “no test left behind” rule and have greater than 25 OV test results are not considered non-validating runs due to large OV sample size and the effect it has on the F- and t- test.
- C. It is natural for some analysis runs to be non-validating from time to time. Therefore, an analysis category is considered non-validating for a given quarter and the non-validation investigation is presented in the OV Report if the level of non-validation meets the criteria below:
  - a. One or more non-validating analysis runs when there are 5 or less analysis runs in the quarter;
  - b. Two or more non-validating analysis runs when there are between 6 and 20 analysis runs in the quarter;
  - c. Three or more non-validating analysis runs when there are between 21 and 40 analysis runs in a quarter; or
  - d. Four or more non-validating analysis runs when there are more than 40 analysis runs in the quarter.

### **3.7.5.2 Level 2 – Independent Verification**

If Level 2 does not verify, TxDOT will perform an investigation into the analysis categories that are not verifying and present the results of the nonverification investigation in a manner like that for Level 1.

### **3.7.5.3 Level 3 – Observation Verification**

If Level 3 observation does not find that the test is performed satisfactorily, the test performed is invalid and a re-test is needed. If the cause for the unsatisfactory test is the technician's performance of test procedure, the technician will be retrained and a follow-up observation performed. If the cause for the unsatisfactory test is related to the equipment, the equipment will be taken out of service until it is repaired or replaced and a follow-up observation performed.

### **3.7.6 Referee Testing**

Referee testing is only between OVF and IQF. Resolution of discrepancies over specific test results can be achieved in a reliable, unbiased manner by referee testing and evaluation performed by a referee laboratory. The referee laboratory will be TxDOT MTD central laboratory or its designee an independent third-party testing laboratory qualified according to [Section 4 – Independent Assurance Program](#). TxDOT's designee referee laboratory must be approved by TxDOT MTD. Referee testing is solely a TxDOT function; therefore, the third-party laboratory cannot be hired by the DB Contractor. The decision by the referee laboratory will be final. Referee test results will be signed and sealed by a licensed professional engineer registered in the state of Texas.

## SECTION 4 - INDEPENDENT ASSURANCE PROGRAM

### 4.1 General

TxDOT, or its designee, will implement the Independent Assurance (IA) Program. This 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.

This program provides uniform statewide procedures to ensure that tests are performed by qualified personnel and that laboratory facilities and equipment are adequate to perform the required sampling and testing methods.

The following frequencies and activities, as shown in Table 1 below, are required for evaluating sampling and testing personnel and equipment under the system approach to IA.

*Table 1: Frequencies and Activities Required Under the IA System Approach*

| Frequencies and Activities   |   |
|--|---|
| Time   | Activity  |
| Before performing acceptance sampling and testing.   | Qualification is required under <u>Sections 4.3 and 4.4</u> of this QAP.  |
| Within 12 months after Observation and Qualification, not to exceed 15 months.   | Each qualified technician is required to participate in the first available proficiency or split sample 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, not to exceed 27 months.   | 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. (Only required for certifications issued by TxDOT or TxAPA, which has a 3-year certification cycle.)                        | Qualification is again required under <u>Sections 4.3 and 4.4</u> of this QAP.  |
| Within 36 months after Observation and Qualification, not to exceed 39 months. (Only required for ACI certifications, which has a 5-year certification cycle.) | 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 48 months after Observation and Qualification, not to exceed 51 months.   | Each qualified technician is required to participate in one proficiency or split sample test  |

(Only required for ACI, which has a 5-year certification cycle.)

for each test method requiring IA. Results must compare to the IA test results to within the established tolerance.

Within 60 months of Qualification. (Only required for ACI, which has a 5-year certification cycle.)

Qualification is again required under the Sections 4.3 and 4.4 of this QAP.

Maintaining technician qualification under the IA system approach requires continuation of the above cycle of qualification and successful split or proficiency sample testing, as applicable. Failure to satisfactorily complete annual split or proficiency testing will result in certification revocation.

## **4.2 Independent Assurance Quality Plan**

TxDOT or its designated agent will develop an Independent Assurance Quality Plan (IAQP). The IAQP must be submitted to TxDOT MTD for approval before construction starts. The IAQP will clearly address, at minimum, how IA staff will address methods and procedures that clearly define the administration of the IA program, including all requirements in this Section.

## **4.3 Personnel Qualifications**

IA personnel must be qualified by TxDOT MTD or its designee to issue certifications for the project. Personnel performing tests on the Project must be qualified in the appropriate test methods.

### **4.3.1 Required Certifications**

Sampling and testing personnel must obtain and keep current the following certifications unless otherwise waived by governing specifications.

- A. ACI Concrete Field Testing Technician – Grade 1
- B. ACI Concrete Strength Testing Technician
- C. TXAPA Aggregate Specialists – AGG101
- D. TXAPA HMA Plant Production Specialist – Level 1A
- E. TXAPA HMA Roadway Specialist – Level 1B
- F. TXAPA HMA Mix Design Specialist – Level 2
- G. TXAPA Properties Specialist – SB 101
- H. TXAPA Field Specialist – SB 102
- I. TXAPA Materials Analysis Specialist – SB 103
- J. TXAPA Strength Specialist – SB 201
- K. TXAPA Compressive Strength Specialist – SB 202

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 Director of TxDOT MTD.

For those 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. Qualified Independent Assurance Laboratory personnel who have been authorized by TxDOT to perform personnel qualifications, and
- B. TxDOT Materials and Tests Division (MTD) personnel.

Note: For all other test procedures not covered by the above certification programs or authorized personnel, certification will be in accordance with the specifications, applicable material quality program, applicable DMS, and Contract Requirements.

#### **4.3.2 Provisional Certifications**

If the above listed certifications cannot be readily obtained due to course availability, schedule conflicts, or other extenuating circumstances, provisional certifications administered by the designated project IA laboratory will be allowed, per the following stipulations:

- A. Provisional certifications must be approved by the TxDOT project manager (PM);
- B. Provisional certifications will be valid for up to 6 months; and
- C. The candidate must show evidence of having enrolled in the required ACI or TXAPA course.

#### **4.3.3 IQF, OVF, and IA Personnel**

Any individual who performs tests on materials for acceptance must be qualified to perform tests in the areas of hydraulic cement concrete, soils and aggregates, and bituminous materials.

[Appendix E – Test Methods for Personnel Qualifications](#) provides test methods for which individuals are to be qualified. There may be other tests required, based on project-specific specifications, which may require qualification.

**Performance test:** An individual must successfully perform the specific test and the necessary calculations required to determine specification compliance in the presence of an authorized evaluator. 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. The maximum number of attempts cannot exceed 3 trials in a 90-day period of time.

**Written test:** An individual must also pass a written examination (minimum score of 80%) administered by an authorized evaluator. The maximum amount of time allocated per test will be one hour. If an individual cannot complete the written test in an hour, it will result in failure. An individual failing the written examination may request a retest. The retest must be scheduled and administered within 30 days of notification of failure; however, the maximum number of attempts cannot exceed 3 trials in a 90-day period of time.

Under unique circumstances, the qualification authority may grant a verbal examination upon request. The reasons for requesting a verbal examination must be presented and

documented before the individual being allowed to take the examination. Should the technician fail the retest examination, the technician will not be allowed to test again unless the IA Manager receives a letter from the technician's employer stating that the technician has received additional training. Failure to pass the third written examination will be considered as failing the entire qualification.

Successful qualification is defined as passing both the performance and written examinations.

In addition, for tests for which TxDOT MTD requires an annual split or proficiency sample evaluation, the individual must participate in split or proficiency samples given by the qualification authority to validate the qualification. If the individual performance ratings result in a rating of 2 or below, a Notice to Respond is required to maintain the certification in the pertinent proficiency program. [Appendix F – Test Methods for Split/Proficiency Evaluation](#) provides a list of testing procedures required for split or proficiency evaluation. TxDOT MTD determines the qualification authority for the split or proficiency sample. Split sample results will be evaluated against TxDOT's acceptable tolerance limits shown in [Appendix B – Alignment/Split Sample Tolerance Limits](#). Split sample test results must be within the sample tolerance limits. 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, before the individual performing additional testing on that test method.

Unless otherwise stated, qualification of an individual is valid for not more than 3 years. (except for ACI which has a 5-yr. certification), after which the individual must be re-qualified. Under the IA system approach, annual split or proficiency will be required as specified in *Table 1: Frequencies and Activities Required Under the IA System Approach*.

#### **4.3.4 Documentation**

The IA laboratory manager is responsible for maintaining documentation of all individuals qualified under their authority who perform required tests for acceptance of materials. Documentation to be maintained includes:

- A. Copies of any qualification certificates issued by ACI and TXAPA;
- B. Copies of the qualification certificates issued by the IA laboratory, with expiration dates;
- C. A report showing the examinations for test procedures administered to each technician by the IA laboratory, with clear identification of technician's name, qualifier's name, score, and date taken;
- D. Original performance examinations for test procedures administered to each technician by the IA laboratory, with clear identification of technician's name, qualifier's name, qualification status, and date; and
- E. Results of annual proficiency testing administered by the IA laboratory for each technician.

Documentation retention will be for the life of the qualification, as detailed in the State of Texas Records Retention Schedule. Qualification authority must be shown on the certificate given to each individual.

#### 4.3.5 Disqualification

Accusations of misconduct by testing technicians will be made to the responsible TxDOT representative. Table 2 defines the 3 levels of misconduct: neglect, abuse, and breach of trust.

*Table 2: 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: <ul style="list-style-type: none"> <li>▪ falsification of records;</li> <li>▪ being aware of improprieties in sampling, testing, or production by others and not reporting them to appropriate supervisors involved in the project;</li> <li>▪ re-sampling or retesting without awareness and consent of appropriate supervisors involved in the project; and</li> <li>▪ manipulating compensation or production.</li> </ul> |

Findings of any investigative activities performed will be promptly reported to the TxDOT PM and TxDOT MTD IA program manager.

Penalties may be implemented upon recommendation by the responsible TxDOT representative. Penalties may range from a reprimand to a permanent revocation of the certification.

Any technician found guilty of breach of trust will have their 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.

#### 4.4 Laboratory Qualifications

Laboratories where IA, IQF, and OVF tests will be performed must be qualified. [Appendix H](#) provides the minimum qualification requirements for laboratories.

Note: IQF and OVF project or field laboratories performing Tex-242-F, Tex-113-E, and Tex-117-E tests must be an approved laboratory from TxDOT’s MPL.

#### **4.4.1 Laboratory Qualification Responsibility**

The TxDOT MTD central laboratory will be accredited by one of the following, FHWA- and TxDOT-approved, AASHTO Accreditation Programs (AAP) accrediting bodies:

- A. AASHTO re:source and Cement and Concrete Reference Laboratory (CCRL);
- B. Construction Materials Engineering Council (CMEC); or
- C. Laboratory Accreditation Bureau (L-A-B).

TxDOT MTD is responsible for overseeing the statewide laboratory qualification program and for qualifying the IA laboratory. The IA laboratory is responsible for qualifying IQF and OV laboratories.

#### **4.4.2 Laboratories to be Qualified**

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

- A. TxDOT MTD central laboratory;
- B. TxDOT MTD field laboratories;
- C. IAF laboratory;
- D. Referee laboratory;
- E. IQF laboratory; and
- F. OVF laboratory.

#### **4.4.3 Qualification Process**

The laboratory qualifying authority will:

- A. Identify the scope of testing to be performed;
- B. Verify that manuals or test methods used to perform tests are available and up to date;
- C. Document that the laboratory has the required equipment to perform the tests; and
- D. Check the calibration or verification records for each piece of equipment, to include:
  - a. Description of equipment;
  - b. Identification of any traceable standard used;
  - c. Frequency of calibration;
  - d. Date of last calibration;
  - e. Date of next calibration;
  - f. Procedure used to calibrate equipment; and
  - g. Procedure used to identify equipment not in compliance.

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

#### **4.4.4 Independent Assurance Testing Equipment**

TxDOT MTD will qualify IA laboratory testing equipment used for IA sampling and testing according to [Section 4.4 – Laboratory Qualifications](#).

The IA laboratory will qualify all other IQF and OVF testing equipment and AASHTO re:source and CCRL -, CMEC-, or L-A-B-accredited commercial laboratory equipment used for IA sampling and testing.

The qualifying authority will qualify testing equipment according to the following guidelines:

- A. Frequency for qualifying IA sampling and testing equipment will not exceed 1 year;
- B. Calibration or verification is required whenever the laboratory or equipment is moved; and
- C. IA equipment will be other than that used for performing OV, IQ, or QC testing.

Any equipment used to perform OV and IQ sampling and testing in making an acceptance decision will be evaluated by IA sampling and testing personnel. This evaluation includes calibration checks and split or proficiency sample tests. The requirements for and frequency of equipment calibrations are shown in TxDOT's test procedures, as referenced in [Section 4.4.5 – Calibration Standards for Laboratory Equipment](#). Acceptable tolerance limits for the comparison of test results from split or proficiency samples are shown in [Appendix B – Alignment/Split Sample Tolerance Limits](#).

#### **4.4.5 Calibration Standards for Laboratory Equipment**

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

- A. Tex-198-E, "Minimum Standards for Acceptance of a Laboratory for Soils and Flexible Base Testing";
- B. Tex-237-F, "Minimum Standards for Acceptance of a Laboratory for Hot-Mix Testing";
- C. Tex-498-A, "Minimum Standards for Acceptance of a Laboratory for Concrete and Aggregate Testing"; and
- D. Tex-900-K Series, procedures for calibrating, verifying, and certifying equipment and devices.

#### **4.4.6 Frequency for Laboratory Qualification**

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

#### **4.4.7 Documentation**

The Project Owner is responsible for verifying that laboratories are qualified to perform TxDOT testing. Documentation must be kept by the qualified laboratory and the Project Owner. Calibration records will be maintained for a minimum of 3 years, unless another agency requires a longer period.

#### **4.4.8 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.

#### **4.4.9 Resolution of Disputes**

The next higher qualification authority will resolve disputes concerning calibration and verification of equipment. For disputes that cannot be resolved at the project level, TxDOT MTD will be the final authority.

#### **4.4.10 Laboratory Accreditation**

In addition to TxDOT laboratory qualification, IA, referee, and the central laboratories of IQ and OV firms will be accredited by one of the following FHWA- and TxDOT-approved AAP accrediting bodies:

- A. AASHTO re:source and CCRL;
- B. Construction Materials Engineering Council (CMEC); or
- C. Laboratory Accreditation Bureau (L-A-B).

The accreditation must be maintained throughout the life of the project. A copy of the accreditation certificates will be transmitted to TxDOT upon receipt by the testing laboratory. The accreditation will include all test methods equivalent to TxDOT's test methods shown in [Appendix H – Minimum Qualification Requirements for Laboratories](#) that the laboratory is performing. The IA, referee, and central laboratories of the IQF and OVF will be required to grant TxDOT MTD permission to monitor the laboratories' accreditation status. In the event of a suspension or revocation in a required method, the laboratory will provide formal documentation explaining why the suspension or revocation occurred and when it will be reinstated.

The IQF and OVF project or field laboratories do not have to be AAP accredited but will implement and follow the quality management system of their accredited central laboratory. Project or field laboratories must be qualified by the project IA laboratory.

To perform a test at the project laboratory, the firm's central laboratory AAP accreditation must include the methods shown in [Appendix H – Minimum Qualification Requirements for Laboratories](#). The project laboratory also must provide documentation that it has implemented the accredited central laboratory's quality system, including:

- A. A copy of the central laboratory quality manual revised to include project laboratory-specific location, test methods, and personnel; and
- B. Record of an internal audit by the central laboratory verifying compliance with the requirements of AASHTO R18-17, Section 5.6, Figures X1.3 and X1.4.

The IA qualification of the project laboratory will be based on review of the project laboratory quality manual and internal audit, and a laboratory visit to check equipment availability and calibration. Personnel qualification will be performed as discussed in [Section 4.3 – Personnel Qualifications](#).

The project laboratory quality system will be updated for each new mobilization of laboratory equipment. In addition, the IA laboratory will perform a project laboratory qualification before the start of testing using the added equipment.

In addition, the laboratory must participate in the proficiency sample testing as specified by the accrediting body. The firm's central laboratory will grant TxDOT MTD permission, before construction starts, to monitor the laboratory's performance on proficiency samples and allow TxDOT MTD to review corrective actions for low ratings.

#### **4.4.11 Annual Report**

The IA laboratory will compile and submit a project-level IA report to TxDOT MTD Quality Assurance, IA Program Manager.

TxDOT MTD will compose and submit an annual report to the FHWA Division Administrator summarizing the results of TxDOT's systems approach IA program. This report will identify:

- 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 5 - CDA / DESIGN-BUILD QAP IMPLEMENTATION GUIDE

The TxDOT [Quality Assurance Program for CDA/Design-Build Projects Implementation Guide](#) provides guidance for the finalization and implementation of the QAP for CDA and DB projects undertaken by the Texas Department of Transportation (TxDOT).

The guide covers four primary topics:

1. Finalization of the DB QAP;
2. Approval of the Owner Verification and Testing and Inspection Plan (OVTIP) and the Construction Quality Management Plan (CQMP);
3. Implementation of the approved DB QAP during construction; and
4. Closing out the project.

The primary objectives of the guide are to:

1. Provide consistency and practical guidance in the QAP implementation processes on TxDOT CDA/DB projects, and
2. Outline the processes for finalizing the CDA or DB QAP, approving the OVTIP and CQMP, implementing the approved CDA or DB QAP during construction, and closing out the project.

## Appendix A Acronyms and Definitions

The following terms and definitions are referenced in this manual and have the meanings set forth below.

|               |  |
|---------------|--|
| <b>AAP</b>    | AASHTO Accreditation Program                                   |
| <b>AASHTO</b> | American Association of State Highway Transportation Officials |
| <b>ACI</b>    | American Concrete Institute                                    |
| <b>AQMP</b>   | Aggregate Quality Monitoring Program                           |
| <b>CAR</b>    | Corrective Action Report                                       |
| <b>CCRL</b>   | Cement and Concrete Reference Laboratory                       |
| <b>CDA</b>    | Comprehensive Development Agreement                            |
| <b>CDR</b>    | Construction Deficiency Report                                 |
| <b>CFR</b>    | Code of Federal Regulations                                    |
| <b>CQCM</b>   | Construction Quality Control Manager                           |
| <b>CQMP</b>   | Construction Quality Management Plan                           |
| <b>CMEC</b>   | Construction Materials Engineering Council                     |
| <b>CVL</b>    | Controlled Vocabulary List                                     |
| <b>DBA</b>    | Design-Build Agreement   |
| <b>EOR</b>    | Engineer of Record   |
| <b>ESOC</b>   | Early Start of Construction                                    |
| <b>FHWA</b>   | Federal Highway Administration                                 |
| <b>HMAC</b>   | Hot-Mix Asphalt Center   |
| <b>IA</b>     | Independent Assurance  |
| <b>IAQP</b>   | Independent Assurance Quality Plan                             |
| <b>IQF</b>    | Independent Quality Firm                                       |
| <b>IQFM</b>   | Independent Quality Firm Manager                               |
| <b>L-A-B</b>  | Laboratory Accreditation Bureau                                |
| <b>MPL</b>    | Material Producer List   |
| <b>MTD</b>    | Materials and Tests Division                                   |
| <b>NCR</b>    | Nonconformance Report  |
| <b>NDC</b>    | Notice of Design Change  |
| <b>OV</b>     | Owner Verification   |

|               |  |
|---------------|--|
| <b>OVF</b>    | Owner Verification Firm                        |
| <b>OV TIP</b> | Owner Verification Testing and Inspection Plan |
| <b>PBS</b>    | Project Baseline Schedule                      |
| <b>QA</b>     | Quality Assurance                              |
| <b>QAP</b>    | Quality Assurance Program                      |
| <b>QC</b>     | Quality Control                                |
| <b>RFC</b>    | Released-for-Construction                      |
| <b>RFI</b>    | Request for Information                        |
| <b>TXAPA</b>  | Texas Asphalt Pavement Association             |
| <b>TxDOT</b>  | Texas Department of Transportation             |

**Acceptance Program**—all factors that comprise TxDOT’s program to determine quality of the product as specified in the contract requirements. These factors include acceptance and verification sampling, testing, and inspection, and may include results of quality control sampling and testing.

**Aggregate Quality Monitoring Program (AQMP)**—governed by Tex-499-A, provides the requirements and procedures for the Materials and Tests Division (MTD) to accept aggregate products that have demonstrated continuing quality and uniformity.

**Construction Deficiency Items**—work features that are typically still “work in progress”; are not a finished product and that do not require a design change; can be reworked in the field to be in compliance with the original requirements immediately or in a later construction phase. These will be documented and reworked in accordance with the governing design and/or specifications and re-inspected by construction QC and IQF staff for compliance. These deficiencies shall be noted in the daily inspection reports and entered in the CDR log.

**Construction Deficiency Report (CDR)**—a report of how Construction Deficiency Items have been documented and resolved.

**Contract Documents**—meaning set forth in the executed agreement between TxDOT and DB Contractor.

**Controlled Vocabulary List**—the list of agreed-upon nomenclature used to uniquely identify each IQF and OV testing report.

**Design Firm**—the qualified licensed professional engineer’s firm responsible for the design of the Project.

**Design Documents**—all drawings (including plans, profiles, cross-sections, notes, elevations, sections, details, and diagrams), specifications, reports, studies, calculations, electronic files, records, and submittals necessary for, or related to, the design of the Project and/or the Utility Adjustments in accordance with the Contract Documents, the Governmental Approvals, and applicable Law.

**DB Contractor**—the entity identified in the Agreement to perform Work under the Project, together with its successors and assigns.

**Engineer**—when interpreting standards, policies, and specifications referenced in the TxDOT Standard Specifications and DB Specifications, the following apply.

- A. References to the project owner mean TxDOT.
- B. References to the Engineer in the context of provider of compliance judgment may mean the Professional Services Quality Assurance Firm (PSQAF), the Independent Quality Firm (IQF), or it may mean a TxDOT representative, depending on the context, as determined by TxDOT in its discretion.

**Engineering Judgment**—determinations as to whether a material failing to meet specification requirements and not within applicable tolerances should be accepted, or not accepted, will be based upon sound engineering principles, experience, and/or related results of applicable material tests, and be made by a licensed professional engineer.

**Engineer of Record (EOR)**—the engineers in responsible charge of each item, element, or phase of the Work shall possess the necessary licenses and registrations in the state of Texas and will be personally responsible for directly supervising the Work. The EOR will sign and seal the Professional Services product for a given item, element, or phase of the Work as applicable.

**Final Acceptance**—the occurrence of all of the events and satisfaction of all of the conditions set forth in the CDA or DBA, as and when confirmed by TxDOT's issuance of a certificate of Final Acceptance.

**F-test**—the statistical analysis to compare the variances of two independent sets of data.

**Fixed Independent Test**—location that is not determined by random numbers, such as due to a localized concern, and is also independent.

**Fixed Split Test**—sample location of a split sample that is determined by any other method other than the use of random numbers.

**Governmental Approval**— meaning set forth in the executed agreement between TxDOT and DB Contractor.

**Governmental Entity**— meaning set forth in the executed agreement between TxDOT and DB Contractor.

**Independent Assurance Program**—all activities that are included in an unbiased and independent evaluation program for all the sampling and testing procedures used in the Acceptance Program.

**Independent Quality Firm (IQF)**—the independent firm identified in the Proposal (or such other firm approved by TxDOT in its discretion) responsible for managing the quality

assurance program for the Construction Work and performing independent quality sampling, testing, inspection, and audits of the CQMP.

**Independent Test**—sample location that is obtained independent of another sample location.

**Law or Laws**— meaning set forth in the executed agreement between TxDOT and DB Contractor.

**Level of Significance (alpha)**—the probability of erroneously rejecting the null hypothesis when it should have been accepted.

**Licensed Professional Engineer (PE)**—a person who is duly licensed and registered by the Texas Board of Professional Engineers to engage in the practice of engineering in the State.

**Material Producer List (MPL)**—TxDOT-approved products and materials from various manufacturers and producers, located at:  
<http://www.txdot.gov/business/resources/producer-list.html>

**Nonconforming Work (Nonconformance)**—Work that does not conform to the requirements of the Contract Documents, the Governmental Approvals, applicable Law, ESOC plans, or RFC Documents.

**Nonconformance Report (NCR)**—a report documenting Nonconforming Work and the ultimate disposition of such Nonconforming Work, including the efforts undertaken to repair, replace, or otherwise remediate such work in accordance with the Contract Documents.

**Owner Verification (OV) Report**—quarterly report developed by the OVF in conjunction with TxDOT to document the validation or verification of the materials quality and construction inspection requirements in accordance with the Contract documents.

**Owner Verification**—testing and inspection performed as part of the validation or verification processes.

**Owner Verification Firm**—TxDOT, or its designated agent tasked with performing OV services.

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

**Project**—meaning set forth in the Contract Documents.

**Project Baseline Schedule (PBS)**—the current project schedule submitted by the DB Contractor.

**Qualification**—a quality, ability, or accomplishment that makes a person technically competent for a particular position or task.

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

**Quality Assurance Program**—the program for quality management and control of the Project and Work, as described in this document.

**Quality Control**—all contractor or vendor operational techniques and activities that are performed or conducted to fulfill the contract requirements.

**Random Sampling**—a process whereby each element of the population has an equal chance of being selected.

**Random Test**—the sample location is identified by applying a random number methodology to the entire sample lot that each identifiable portion of the lot has an equal opportunity to be sampled and tested.

**Rules**—the Texas Administrative Code.

**Split Sample**—a sample that has been divided into two or more portions representing the same material.

**Substantial Completion**—the occurrence of all of the events and satisfaction of all of the conditions set forth in the Contract Documents, as and when confirmed by TxDOT's issuance of a Certificate of Substantial Completion.

**Subcontractor**—any party with whom the DB Contractor has entered into any Subcontract to perform any part of the Work or provide any materials, equipment, or supplies for the Project on behalf of the DB Contractor, and any other party with whom any Subcontractor has further subcontracted any part of the Work, at all tiers.

**Supplier**—any Person not performing work at or on the Site who supplies machinery, equipment, materials, hardware, software systems, or any other appurtenance to the Project to the DB Contractor or to any Subcontractor in connection with the performance of the Work. Persons who merely transport, pick up, deliver, or carry materials, personnel, parts, or equipment or any other items or persons to or from the Site will not be deemed to be performing Work at the Site.

**TxDOT Standard Specifications**—the *Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges* adopted by the Texas Department of Transportation, including all revisions thereto applicable on the effective date of the Contract Documents.

**t-test**—the statistical analysis to compare the means of two independent sets of data.

**Utility(ies) or utility(ies)**—a public, private, cooperative, municipal, and/or government line, facility, or system used for the carriage, transmission, and/or distribution of cable television, electric power, telephone, telegraph, water, gas, oil, petroleum products, steam, chemicals, hydrocarbons, telecommunications, sewage, storm water not connected with the drainage of the Project, and similar substances that directly or indirectly serve the public. The term “Utility(ies)” or “utility(ies)” also includes radio towers or transmission towers (including

cellular). Oil and gas gathering lines and production supply lines are included in this definition and are classified as a Utility.

**Utility Owner**—the owner or operator of any Utility (including both privately held and publicly held entities, cooperative utilities, and municipalities and other governmental agencies).

**Vendor**—a supplier of project-produced material that is not the DB Contractor.

**Verification Testing**—sampling and testing performed to verify the quality of the product. The sampling and testing must be performed by qualified testing personnel employed by TxDOT, excluding the DB Contractor and vendor.

**Work**—all of the work required under the Contract Documents, including all administrative, Professional Services, engineering, real property acquisition and occupant relocation, support services, utility adjustment work to be furnished or provided by the DB Contractor, reimbursement of Utility Owners for utility adjustment work furnished or provided by such Utility Owners or their contractors and consultants, procurement, professional, manufacturing, supply, installation, construction, landscaping, supervision, management, testing, verification, labor, materials, equipment, maintenance, documentation, and other duties and services to be furnished and provided by the DB Contractor as required by the Contract Documents, including all efforts necessary or appropriate to achieve Final Acceptance of the Project, except for those efforts that such Contract Documents expressly specify will be performed by Persons other than the DB Contractor-Related Entities.

## Appendix B Alignment/Split Sample Tolerance Limits

A minimum of five split samples for Level 1 and Level 2 tests will be performed during start-up operations to ensure alignment between IQF and OVF laboratories. Split sample test results must be within the tolerances established below.

| Procedure  | Test Method            | Tolerance   |
|--|------------------------|---|
| Pulverization Gradation  | Tex-101-E,<br>Part III | > No. 4 sieve: $\pm 5\%$ points<br>$\leq$ No. 4 sieve: $\pm 3\%$ points       |
| Determining Moisture Content in Soil Materials                                     | Tex-103-E              | $\pm 1\%$ point   |
| Liquid Limit of Soils  | Tex-104-E              | 15% of mean <sup>1</sup>  |
| Plastic Limit of Soils   | Tex-105-E              | 15% of mean <sup>1</sup>  |
| Plasticity Index of Soils  | Tex-106-E              | 20% of mean <sup>1</sup>  |
| Bar Linear Shrinkage   | Tex-107-E              | $\pm 2\%$   |
| Particle Size Analysis of Soils, Part I  | Tex-110-E              | > No. 4 sieve: $\pm 5\%$ points<br>$\leq$ No. 4 sieve: $\pm 3\%$ points       |
| Moisture-Density Relationship of Base Materials                                    | Tex-113-E              | Density: 2.0 pcf of mean <sup>1</sup><br>Moisture Content: $\pm 0.5\%$ points |
| Moisture-Density Relationship of Subgrade, Embankment Soils, and Backfill Material | Tex-114-E              | Density: 2.0 pcf of mean <sup>1</sup><br>Moisture Content: $\pm 0.5\%$ points |
| In-Place Density of Soils and Base Materials                                       | Tex-115-E              | $\pm 2.5\%$   |
| Wet Ball Mill  | Tex-116-E              | 10% of mean <sup>1</sup>  |
| Compressive Strength for Disturbed Soils and Base Materials                        | Tex-117-E              | $\pm 15$ psi  |
| Compressive Strength for Soil-Cement Materials                                     | Tex-120-E              | $\pm 15$ psi  |
| Compressive Strength for Soil-Lime Materials                                       | Tex-121-E              | $\pm 15$ psi  |
| Molding, Testing, and Evaluating Bituminous Black Base Materials                   | Tex-126-E              | $\pm 1.0\%$   |
| Determining Soil pH  | Tex-128-E              | $\pm 0.2$   |

| Procedure   | Test Method | Tolerance   |
|---|-------------|---|
| Measuring the Resistivity of Soil Materials                   | Tex-129-E   | ±1,000 ohm-cm   |
| Measuring Thickness of Pavement Layer                         | Tex-140-E   | 0.25 in.  |
| Determining Sulfate Content in Soils - Colorimetric Method    | Tex-145-E   | ±500 ppm  |
| Soil Organic Content Using UV-Vis Method                      | Tex-148-E   | ±0.2%   |
| Sieve Analysis of Fine and Coarse Aggregates                  | Tex-200-F   | > 5/8" sieve: ±5% points (individual % retained)<br>≤ 5/8" - No. 200 sieve: ±3% points (individual % retained)<br>Passing No. 200 sieve: ±1.6% points |
| Sand Equivalent Test  | Tex-203-F   | ±5  |
| Compacting Specimens Using the Texas Gyratory Compactor (TGC) | Tex-206-F   | ±1.0% laboratory-molded density calculated in accordance with Tex-207-F   |
| Determining Density of Compacted Bituminous Mixtures          | Tex-207-F   | Laboratory-molded density: ±1.0%<br>Laboratory-molded bulk specific gravity: ±0.020<br>In-place air voids (cores): ±1.0%                              |
| Determining Asphalt Content                                   | Tex-210-F   | ±0.3%   |
|   | Tex-228-F   | ±0.3%   |
|   | Tex-236-F   | ±0.3%   |
| Determining Moisture Content of Bituminous Mixtures           | Tex-212-F   | ±0.2%   |
| Determining Deleterious Material in Coarse Aggregates         | Tex-217-F   | ±0.3%   |
| Decantation Test for Coarse Aggregate                         | Tex-217-F   | 20% of mean <sup>1</sup>  |
| Flakiness Index   | Tex-224-F   | ±5%   |
| Indirect Tensile Strength                                     | Tex-226-F   | ±12 psi   |
| Theoretical Maximum Specific Gravity of Bituminous Mixtures   | Tex-227-F   | ±0.020  |
| Draindown Characteristic of Bituminous Mixture                | Tex-235-F   | ±0.70%  |

| Procedure  | Test Method | Tolerance   |
|--|-------------|---|
| Hamburg Wheel Tracker Testing  | Tex-242-F   | ±2 mm rut depth at specified number of passes                                 |
| Cantabro Loss  | Tex-245-F   | ±5%   |
| Permeability or Water Flow of Hot Mix Asphalt                                  | Tex-246-F   | ±6 seconds  |
| Sieve Analysis of Concrete Fine and Coarse Aggregate                           | Tex-401-A   | > No. 4 sieve: ±5% points<br>≤ No. 4 sieve: ±3% points                        |
| Fineness Modulus of Concrete Fine Aggregate                                    | Tex-402-A   | ±0.2  |
| Decantation Test for Concrete Aggregates                                       | Tex-406-A   | 20% of mean <sup>1</sup>  |
| Determining Deleterious Material in Concrete Mineral Aggregate                 | Tex-413-A   | ±0.3%   |
| Air Content of Freshly Mixed Concrete by the Volumetric Method <sup>2, 3</sup> | Tex-414-A   | ±1.0%   |
| Slump of Hydraulic Cement Concrete   | Tex-415-A   | ±1 in.  |
| Air Content of Freshly Mixed Concrete by the Pressure Method <sup>3</sup>      | Tex-416-A   | ±1%   |
| Compressive Strength of Cylindrical Concrete Specimens                         | Tex-418-A   | 17% of mean <sup>1</sup> (4 × 8 in.)<br>14% of mean <sup>1</sup> (6 × 12 in.) |
| Measuring Temperature of Freshly Mixed Portland Cement Concrete                | Tex-422-A   | 2 °F  |
| Concrete Thickness by Direct Measurement                                       | Tex-423-A   | ±0.25 inches  |
| Coarse Aggregate Angularity  | Tex-460-A   | ±5  |
| Micro-Deval Abrasion   | Tex-461-A   | ±2%   |
| Moisture Susceptibility of Bituminous Materials                                | Tex-530-C   | ±10%  |
| Dynamic Cone Penetrometer  | ASTM D6951  | ±1 ksi for a depth of 6 inches  |

1. The difference between compared test results will 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 when volumetric method is used.
3. Required only when air entrained concrete is specified.

## **Appendix C**

### **IQF Data Transfer Requirements**

XML submission allows for the transfer of all IQF's laboratory test results into I2MS from other IQF data systems without additional levels of data entry. An example XML sample submission and I2MS Test Form Fields are available at the following link:  
<http://ftp.dot.state.tx.us/pub/txdot-info/cst/I2MSTestFormFields.pdf>.

If there is a specific test that is not listed in the database that is required in I2MS, the schema and report set up will need to be submitted to TxDOT for approval, 60 days before testing submission.

## Appendix D OV Levels for Materials Testing Validation/Verification

### Start-Up Requirements

During start-up operations, in addition to random sample location testing, the IQF (Independent Quality Firm) and OVF (Owner Verification Firm) will perform a minimum of 5 split sample testing for all tests listed as Level 1 or Level 2 to ensure alignment. The OV firm will evaluate split sample results against TxDOT's split sample tolerance limits contained in Appendix B. For those test methods that do not verify during start-up operations, both the IQF and OVF firm will collaborate to determine the cause(s) of the nonverification and will both take appropriate corrective actions during the early phases of material production to align the testing operations. For tests listed as Level 3, the OV firm will observe and review the IQF's initial start-up testing operations.

The level of significance ( $\alpha$ ) used for statistical analyses are provided below unless otherwise approved in writing by TxDOT.

| Material Category                                       | Level of Significance ( $\alpha$ ) |
|---|------------------------------------|
| Embankment, Subgrades, Backfill, and Base Courses       | 0.01                               |
| Asphalt Treated Base (Plant-Mixed)                      | 0.01                               |
| Surface Treatments                                      | 0.01                               |
| Hydraulic Cement Concrete – Structural                  | 0.025                              |
| Hydraulic Cement Concrete – Non-Structural              | 0.01                               |
| Hydraulic Cement Concrete Pavements                     | 0.025                              |
| Hot-Mix Asphalt Pavement (Items 341, 342, 344, and 346) | 0.025                              |

**As a minimum, perform testing using the levels listed below.**

### Level 1 Tests: F- and t- tests

The OV firm will perform continuous F- and t- test analyses on Level 1 tests with the minimum OV testing frequency set at the higher of 10% of the IQF testing frequency or 3 OV tests per quarter. The continuous analysis, as described in [Appendix I – I2MS 3.2 Continuous Analysis Algorithm](#), will be run daily, with new OV test results being added to the OV sample population as older OV test results are removed. The analyses will be performed against the corresponding IQF sample population. Note: OV sampling and testing frequency will not be greater than the IQF sampling and testing frequency, so the number of OV tests will be the same as the number of IQF tests if the number of IQF tests required to meet the DB Guide Schedule is 3 or less.

### Level 2 Tests: Independent Verification

The OV firm will perform independent verification on Level 2 tests with the minimum OV testing frequency of three per quarter with lower frequency tests missed during one quarter being specifically targeted the next quarter. This verification will be performed by comparing the independent OV test results with a group of corresponding IQF test results as an independent check of the IQF test results. Note: For small materials quantities used per quarter where required IQF number of tests is three or less tests per quarter, OVF testing frequency will be the minimum guide schedule testing frequency.

### Level 3 Tests: Observation Verification

The OV firm will observe and review the IQF’s initial start-up testing operations and records, as appropriate. Periodic observation verification shall also be performed during ongoing production operations to verify compliance with test procedures. Split testing may be used during initial start-up testing to verify alignment between OVF and IQF laboratories.

| OV Levels for Materials Testing Verification               | Level 1          | Level 2                         | Level 3           |
|--|------------------|---------------------------------|-------------------|
| <b>E MBANKMENTS, SUBGRADES, BACKFILL, AND BASE COURSES</b> |                  |                                 |                   |
| MATERIAL OR PRODUCT  | TEST FOR         | TEST NO.                        | TxDOT RECOMMENDED |
| EMBANKMENT<br>(CUTS AND FILLS)                             | Liquid Limit     | Tex-104-E                       | 2                 |
|  | Plasticity Index | Tex-106-E                       | 1                 |
|  | Linear Shrinkage | Tex-107-E                       | 2                 |
|  | Gradation        | Tex-110-E                       | 2                 |
|  | Moisture/Density | Tex-114-E                       | 3                 |
|  | In-Place Density | Tex-115-E <sup>1</sup> , Part I | 1                 |
| RETAINING WALL<br>(NON-SELECT BACKFILL)                    | Liquid Limit     | Tex-104-E                       | 2                 |
|  | Plasticity Index | Tex-106-E                       | 1                 |

| OV Levels for Materials Testing Verification           |                                 | Level 1                                  | Level 2                         | Level 3        |
|--|---------------------------------|--|---------------------------------|----------------|
| RETAINING WALL<br>(NON-SELECT BACKFILL)<br>(CONTINUED) |                                 | Linear Shrinkage                         | Tex-107-E                       | 2              |
|  |                                 | Gradation                                | Tex-110-E                       | 2              |
|  |                                 | Moisture/Density                         | Tex-114-E                       | 3              |
|  |                                 | In-Place Density                         | Tex-115-E <sup>1</sup> , Part I | 1              |
| RETAINING WALL<br>(SELECT BACKFILL)                    |                                 | Plasticity Index (Ty CS)                 | Tex-106-E                       | 1              |
|  |                                 | Gradation (Backfill/Drainage Aggregate)  | Tex-401-A/Tex-110-E             | 2              |
|  |                                 | Resistivity                              | Tex-129-E                       | 2              |
|  |                                 | pH                                       | Tex-128-E                       | 2              |
|  |                                 | In-Place Density                         | Tex-115-E <sup>1</sup>          | 1              |
| UNTREATED SUBGRADE                                     |                                 | Uniformity: Dynamic Cone Penetration     | ASTM D6951                      | 2 <sup>2</sup> |
| UNTREATED BASE<br>COURSES                              |                                 | Liquid Limit                             | Tex-104-E                       | 2              |
|  |                                 | Plasticity Index                         | Tex-106-E                       | 1              |
|  |                                 | Linear Shrinkage                         | Tex-107-E                       | 2              |
|  |                                 | Gradation                                | Tex-110-E                       | 2              |
|  |                                 | Crushed Face Count                       | Tex-460-A, Part I               | 2              |
|  |                                 | Moisture/Density                         | Tex-113-E                       | 3              |
|  |                                 | Wet Ball Mill                            | Tex-116-E                       | 2              |
|  |                                 | Strength                                 | Tex-117-E                       | 2              |
|  |                                 | In-Place Density                         | Tex-115-E <sup>1</sup> , Part I | 1              |
|  |                                 | Moisture Content (when performed by IQF) | Tex-103-E                       | 2              |
|  |                                 | Ride Quality – Surface Test Type B       | Tex-1001-S                      | 2 <sup>3</sup> |
| TREATED SUBGRADE<br>AND BASE COURSES                   | Subgrade<br>Before<br>Treatment | Organic Content                          | Tex-148-E                       | 2              |
|  |                                 | Sulfate Content                          | Tex-145-E                       | 2              |
|  | New Base<br>Material            | Liquid Limit                             | Tex-104-E                       | 2              |
|  |                                 | Plasticity Index                         | Tex-106-E                       | 1              |
|  |                                 | Linear Shrinkage                         | Tex-107-E                       | 2              |

| OV Levels for Materials Testing Verification                               |   | Level 1  | Level 2                         | Level 3        |
|--|---|--|---------------------------------|----------------|
| TREATED SUBGRADE AND BASE COURSES (CONTINUED)                              | New Base Material                       | Gradation  | Tex-110-E                       | 2              |
|  |   | Wet Ball Mill  | Tex-116-E                       | 2              |
|  |   | Strength   | Tex-117-E                       | 2              |
|  | Uncompacted Mixture                     | Pulverization Gradation  | Tex-101-E, Part III             | 2              |
|  |   | Moisture Content (when performed by IQF)                             | Tex-103-E                       | 2              |
|  |   | Moisture-Density and Compressive Strength (Cement Treated Materials) | Tex-120-E, Part II              | 2              |
|  |   | Moisture-Density and Compressive Strength (Lime Treated Materials)   | Tex-121-E, Part II              | 2              |
|  | Compacted Mixture                       | In-Place Density   | Tex-115-E <sup>1</sup> , Part I | 1              |
|  |   | Uniformity: Dynamic Cone Penetration (for treated subgrade only)     | ASTM D6951                      | 2 <sup>2</sup> |
| RECLAIMED ASPHALT PAVEMENT (RAP), CRUSHED CONCRETE, AND RECYCLED MATERIALS | Sulfate Content (Crushed concrete only) | Tex-145-E  | 2                               |                |
|  | Deleterious Material                    | Tex-413-A  | 2                               |                |
|  | Decantation                             | Tex-406-A  | 2                               |                |

1. OV Use of IQF Proctors

- During startup operations, test 5 split samples with the IQF and ensure that all values are within the split sample tolerance, currently set at 2.0 pcf of mean, as specified in Appendix B.
- The IQF must provide OV lab with complete curve data for all proctor tests. Before testing in-place densities, IQF will furnish the selected curve for each in-place density point.
- The OV either agrees that the IQF proctor is representative of the material being tested or the OV will obtain in-place density values and sample the material to conduct a one-point proctor to ensure that proctor values are within 2.0 pcf of curve estimates.

2. With the exception of Dynamic Cone Penetration test, which will require a minimum 10% of IQF sampling and testing frequencies.

3. OVF shall perform Ride Quality verification testing in accordance with TxDOT's Standard Specification Item 585.3.3.2.2.1.

| OV Levels for Materials Testing Verification | Level 1                   | Level 2                | Level 3           |
|--|---------------------------|------------------------|-------------------|
| <b>ASPHALT TREATED BASE (Plant-Mixed)</b>    |                           |                        |                   |
| MATERIAL OR PRODUCT                          | TEST FOR                  | TEST NUMBER            | TxDOT RECOMMENDED |
| AGGREGATE                                    | Liquid Limit              | Tex-104-E              | 2                 |
|  | Plasticity Index          | Tex-106-E              | 1                 |
|  | Linear Shrinkage          | Tex-107-E              | 2                 |
|  | Wet Ball Mill             | Tex-116-E              | 3                 |
|  | Decantation               | Tex-406-A, part I      | 2                 |
| COMPLETE MIXTURE                             | Lab-Molded Density        | Tex-126-E              | 1                 |
|  | Gradation                 | Tex-200-F, Part I      | 2                 |
|  | Percent Asphalt           | Tex-236-F              | 1                 |
|  | Moisture Content          | Tex-212-F, Part II     | 2                 |
|  | Indirect Tensile Strength | Tex-226-F              | 3                 |
|  | Moisture Susceptibility   | Tex-530-C              | 3                 |
| ROADWAY                                      | Ride Quality              | Surface Test<br>Type A | 2                 |
|  | In-Place Air Voids        | Tex-207-F              | 1                 |

| OV Levels for Materials Testing Verification |  | Level 1              | Level 2           | Level 3           |
|--|--|----------------------|-------------------|-------------------|
| <b>SEAL COAT</b>                             |  |                      |                   |                   |
| MATERIAL OR PRODUCT                          |  | TEST FOR             | TEST NUMBER       | TxDOT RECOMMENDED |
| AGGREGATE                                    |  | Gradation            | Tex-200-F, Part I | 1                 |
|  |  | Crushed Face Count   | Tex-460-A, Part I | 2                 |
|  |  | Deleterious Material | Tex-217-F, Part I | 2                 |
|  |  | Decantation          | Tex-406-A         | 2                 |
|  |  | Flakiness Index      | Tex-224-F         | 3                 |
|  |  | Micro-Deval Abrasion | Tex-461-A         | 3                 |
| PRECOATED AGGREGATE                          |  | Asphalt Content      | Tex-236-F         | 2                 |

| OV Levels for Materials Testing Verification  |                  | Level 1                                 | Level 2                | Level 3           |
|---|------------------|---|------------------------|-------------------|
| <b>HYDRAULIC CEMENT CONCRETE – STRUCTURAL</b><br>(Classes: C, F, H, S, CO, K, LMC, or SS) |                  |   |                        |                   |
| MATERIAL OR PRODUCT   |                  | TEST FOR                                | TEST NUMBER            | TxDOT RECOMMENDED |
| MINERAL AGGREGATE   | COARSE AGGREGATE | Decantation                             | Tex-406-A              | 2                 |
|   |                  | Sieve Analysis                          | Tex-401-A              | 2                 |
|   |                  | Deleterious Materials                   | Tex-413-A              | 3                 |
|   | FINE AGGREGATE   | Sand Equivalent                         | Tex-203-F              | 2                 |
|   |                  | Organic Impurities                      | Tex-408-A              | 3                 |
|   |                  | Sieve Analysis                          | Tex-401-A              | 2                 |
|   |                  | Fineness Modulus                        | Tex-402-A              | 2                 |
|   |                  | Deleterious Material                    | Tex-413-A              | 3                 |
| CONCRETE  |                  | Compressive Strength                    | Tex-418-A              | 1                 |
|   |                  | Entrained Air (When specified by plans) | Tex-416-A or Tex-414-A | 1                 |

| OV Levels for Materials Testing Verification   | Level 1  | Level 2            | Level 3           |
|--|--|--------------------|-------------------|
| <b>HYDRAULIC CEMENT CONCRETE – STRUCTURAL</b><br>(Classes: C, F, H, S, CO, K, LMC, or SS)<br>(CONTINUED) |  |                    |                   |
| MATERIAL OR PRODUCT  | TEST FOR   | TEST NUMBER        | TxDOT RECOMMENDED |
| CONCRETE<br>(CONTINUED)  | Slump  | Tex-415-A          | 2                 |
|  | Temperature of Concrete  | Tex-422-A          | 2                 |
|  | Bridge Deck or Culvert Top Slab Thickness and Depth of Reinforcement | Tex-423-A, Part II | 2 <sup>1</sup>    |

1. OVF shall perform a minimum 10% of IQF testing frequency of total number of bays per span. A minimum of three concrete thickness and steel depth readings per bay are required by test procedure.

| OV Levels for Materials Testing Verification                                  | Level 1              | Level 2     | Level 3           |
|---|----------------------|-------------|-------------------|
| <b>HYDRAULIC CEMENT CONCRETE – NON-STRUCTURAL</b><br>(Classes: A, B, D, or E) |                      |             |                   |
| MATERIAL OR PRODUCT   | TEST FOR             | TEST NUMBER | TxDOT RECOMMENDED |
| CONCRETE  | Compressive Strength | Tex-418-A   | 2                 |

| OV Levels for Materials Testing Verification                                   |  | Level 1                | Level 2        | Level 3           |
|--|--|------------------------|----------------|-------------------|
| <b>HYDRAULIC CEMENT CONCRETE PAVEMENTS</b><br>(Classes: P, CO, LMC, K, or HES) |  |                        |                |                   |
| MATERIAL OR PRODUCT  |  | TEST FOR               | TEST NUMBER    | TxDOT RECOMMENDED |
| MINERAL AGGREGATE  | COARSE AGGREGATE                               | Decantation            | Tex-406-A      | 2                 |
|  |  | Sieve Analysis         | Tex-401-A      | 2                 |
|  |  | Deleterious Materials  | Tex-413-A      | 3                 |
|  | FINE AGGREGATE                                 | Sand Equivalent        | Tex-203-F      | 2                 |
|  |  | Organic Impurities     | Tex-408-A      | 3                 |
|  |  | Sieve Analysis         | Tex-401-A      | 2                 |
|  |  | Fineness Modulus       | Tex-402-A      | 2                 |
|  |  | Deleterious Material   | Tex-413-A      | 3                 |
| CONCRETE   | Strength                                       | Tex-448-A or Tex-418-A | 1              |                   |
|  | Slump (Formed Pavement)                        | Tex-415-A              | 2              |                   |
|  | Entrained Air (When specified by plans)        | Tex-416-A or Tex-414-A | 1              |                   |
|  | Temperature                                    | Tex-422-A              | 2              |                   |
|  | Thickness                                      | Tex-423-A, Part I      | 2 <sup>1</sup> |                   |
|  | Pavement Texture (only if carpet drag is used) | Tex-436-A              | 2              |                   |
|  | Ride Quality                                   | Tex-1001-S             | 2 <sup>2</sup> |                   |

1. OVF shall perform a minimum 10% of IQF testing frequency.
2. OVF shall perform Ride Quality verification testing in accordance with TxDOT's Standard Specification Item 585.3.3.2.2.1.

| OV Levels for Materials Testing Verification                             | Level 1                              | Level 2                   | Level 3           |
|--|--------------------------------------|---------------------------|-------------------|
| <b>HOT-MIX ASPHALT PAVEMENT (Items 341, 342, 344, 346, 347, and 348)</b> |                                      |                           |                   |
| MATERIAL OR PRODUCT  | TEST FOR                             | TEST NUMBER               | TxDOT RECOMMENDED |
| COARSE AGGREGATE   | Micro-Deval Abrasion                 | Tex-461-A                 | 3                 |
|  | Mix Design                           | Tex-204-F                 | 3                 |
| COMBINED AGGREGATE   | Sand Equivalent                      | Tex-203-F                 | 3                 |
| COMPLETE MIXTURE   | Asphalt Binder Content               | Tex-236-F                 | 1                 |
|  | Gradation                            | Tex-200-F                 | 2                 |
|  | Moisture Susceptibility              | Tex-530-C                 | 3                 |
|  | Indirect Tensile Strength (Dry)      | Tex-226-F                 | 3                 |
|  | Moisture Content                     | Tex-212-F, Part II        | 3                 |
|  | Theoretical Maximum Specific Gravity | Tex-227-F                 | 2                 |
|  | Lab-Molded Density                   | Tex-207-F, Parts I and VI | 1                 |
|  | Drain-Down                           | Tex-235-F                 | 3                 |
|  | Hamburg Wheel Test                   | Tex-242-F                 | 3                 |
|  | Cantabro Loss                        | Tex-245-F                 | 3                 |
| ROADWAY  | In-Place Air Voids                   | Tex-207-F, Parts I and VI | 1                 |
|  | Segregation Profile                  | Tex-207-F, Part V         | 3                 |
|  | Longitudinal Joint Density           | Tex-207-F, Part VII       | 3                 |
|  | Ride Quality                         | Tex-1001-S                | 2 <sup>1</sup>    |
|  | Thermal Profile                      | Tex-244-F                 | 3                 |
|  | Permeability                         | Tex-246-F                 | 3                 |

1. OVF shall perform Ride Quality verification testing in accordance with TxDOT's Standard Specification Item 585.3.3.2.2.1.

## Appendix E

### Test Methods for Personnel Qualifications

| Test Procedure | TXAPA Soils and Flexible Base Testing Certifications                                      |
|----------------|---|
|                | <b>Level SB 101</b>   |
| Tex-100-E      | Surveying and Sampling of Soils for Highways  |
| Tex-101-E      | Preparing Soil and Flexible Base Materials for Testing (Parts I and II)                   |
| Tex-102-E      | Determining Slaking Time  |
| Tex-103-E      | Determining Moisture Content in Soil Materials  |
| Tex-104-E      | Determining Liquid Limit of Soils   |
| Tex-105-E      | Determining Plastic Limit of Soils  |
| Tex-106-E      | Calculating the Plasticity Index of Soils   |
| Tex-107-E      | Determining Bar Linear Shrinkage of Soils   |
| Tex-110-E      | Particle Size Analysis of Soils (Part I)  |
| Tex-116-E      | Ball Mill Method for Determining the Disintegration of Flexible Base Material             |
| Tex-400-A      | Sampling Stone, Gravel, Sand, and Mineral Aggregates                                      |
| Tex-600-J      | Sampling and Testing Lime (Part I)  |
|                | <b>Level SB 102</b>   |
| Tex-100-E      | Surveying and Sampling of Soils for Highways  |
| Tex-101-E      | Preparing Soil and Flexible Base Materials for Testing (Parts I and II)                   |
| Tex-103-E      | Determining Moisture Content in Soil Materials  |
| Tex-115-E      | Field Method for Determining In-Place Density of Soils and Base Materials                 |
| Tex-140-E      | Measuring Thickness of Pavement Layer   |
| Tex-400-A      | Sampling Stone, Gravel, Sand, and Mineral Aggregates                                      |
| Tex-600-J      | Sampling and Testing Lime (Part I)  |
|                | <b>Level SB 103</b>   |
| Tex-100-E      | Surveying and Sampling of Soils for Highways  |
| Tex-101-E      | Preparing Soil and Flexible Base Materials for Testing (Parts I and II)                   |
| Tex-128-E      | Determining Soil pH   |
| Tex-129-E      | Measuring the Resistivity of Soils  |
| Tex-145-E      | Determining Sulfate Content in Soils, Colorimetric Method                                 |
| Tex-400-A      | Sampling Stone, Gravel, Sand, and Mineral Aggregates                                      |
| Tex-600-J      | Sampling and Testing Lime (Part I)  |
|                | <b>Level SB 201</b>   |
| Tex-100-E      | Surveying and Sampling of Soils for Highways  |
| Tex-101-E      | Preparing Soil and Flexible Base Materials for Testing (Parts I and II)                   |
| Tex-113-E      | Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials |
| Tex-142-E      | Laboratory Classification of Soils for Engineering Purposes                               |

| <b>Test Procedure</b> | <b>TXAPA Soils and Flexible Base Testing Certifications</b>   |
|-----------------------|---|
|                       | <b>Level SB 201 (Continued)</b>   |
| Tex-114-E             | Laboratory Compaction Characteristics and Moisture-Density Relationship of Subgrade and Embankment Soil |
| Tex-400-A             | Sampling Stone, Gravel, Sand, and Mineral Aggregates  |
| Tex-600-J             | Sampling and Testing Lime (Part I)  |
|                       | <b>Level SB 202</b>   |
| Tex-100-E             | Surveying and Sampling of Soils for Highways  |
| Tex-101-E             | Preparing Soil and Flexible Base Materials for Testing (Parts I and II)                                 |
| Tex-117-E             | Triaxial Compression for Disturbed Soils and Base Materials   |
| Tex-120-E             | Soil-Cement Testing   |
| Tex-121-E             | Soil-Lime Testing   |
| Tex-128-E             | Determining Soil pH   |
| Tex-400-A             | Sampling Stone, Gravel, Sand, and Mineral Aggregates  |
| Tex-600-J             | Sampling and Testing Lime (Part I)  |

| <b>Test Procedure</b> | <b>TXAPA Hot-Mix Asphalt Testing Certifications</b>   |
|-----------------------|---|
|                       | <b>Level 1A</b>   |
| Tex-200-F             | Sieve Analysis of Fine and Coarse Aggregate (Parts I and II)                                  |
| Tex-206-F             | Compacting Specimens Using the Texas Gyrotory Compactor (TGC)                                 |
| Tex-207-F             | Determining Density of Compacted Bituminous Mixtures (Parts I, VI, and VIII)                  |
| Tex-212-F             | Determining Moisture Content of Bituminous Mixtures (Part II)                                 |
| Tex-221-F             | Sampling Aggregate for Bituminous Mixtures, Surface Treatments, and Limestone Rock Asphalt    |
| Tex-222-F             | Sampling Bituminous Mixtures  |
| Tex-225-F             | Random Selection of Bituminous Mixture Samples (Parts I and II)                               |
| Tex-226-F             | Indirect Tensile Strength Test  |
| Tex-227-F             | Theoretical Maximum Specific Gravity of Bituminous Mixtures                                   |
| Tex-233-F             | Preparing Control Charts for Asphaltic Concrete Paving Projects                               |
| Tex-235-F             | Determining Draindown Characteristics in Bituminous Materials                                 |
| Tex-236-F             | Determining Asphalt Content of Asphalt Paving Mixtures by Ignition Method                     |
| Tex-241-F             | Superpave Gyrotory Compacting of Test Specimens of Bituminous Mixtures                        |
| Tex-242-F             | Hamburg Wheel-Tracking Test   |
| Tex-245-F             | Cantabro Loss   |
| Tex-251-F             | Obtaining and Trimming Cores of Bituminous Mixture  |
| Tex-500-C             | Sampling Bituminous Materials, Pre-Molded Joint Fillers, and Joint Sealers (Parts II and III) |
| Tex-530-C             | Effect of Water on Bituminous Paving Mixtures   |

| <b>Test Procedure</b> | <b>TXAPA Hot-Mix Asphalt Testing Certifications</b>   |
|-----------------------|---|
|                       | <b>Level 1B</b>   |
| Tex-207-F             | Determining Density of Compacted Bituminous Mixtures (Parts I, IV, V, VI, and VII)            |
| Tex-222-F             | Sampling Bituminous Mixtures  |
| Tex-225-F             | Random Selection of Bituminous Mixture Samples (Part II)                                      |
| Tex-244-F             | Thermal Profile of Hot-Mix Asphalt  |
| Tex-246-F             | Permeability or Water Flow of Hot-Mix Asphalt   |
| Tex-251-F             | Obtaining and Trimming Cores of Bituminous Mixture  |
| Tex-500-C             | Sampling Bituminous Materials, Pre-Molded Joint Fillers, and Joint Sealers (Parts II and III) |
|                       | <b>AGG101</b>   |
| Tex-107-F             | Determining the Bar Linear Shrinkage of Soils   |
| Tex-200-F             | Sieve Analysis of Fine and Coarse Aggregate (Parts 1 and 2)                                   |
| Tex-203-F             | Sand Equivalent   |
| Tex-212-F             | Determining Moisture Content of Bituminous Mixtures (Part 2)                                  |
| Tex-217-F             | Determining Deleterious Material and Decantation Test for Coarse Aggregates                   |
| Tex-221-F             | Sampling Aggregate for Bituminous Mixtures, Surface Treatments, and LRA                       |
| Tex-224-F             | Determining Flakiness Index   |
| Tex-280-F             | Determining Flat and Elongated Particles  |
| Tex-400-A             | Sampling Flexible Base, Stone, Gravel, Sand, and Mineral Aggregates                           |
| Tex-401-F             | Sieve Analysis of Fine and Coarse Aggregate   |
| Tex-402-F             | Fineness Modulus of Fine Aggregate  |
| Tex-404-F             | Determining Unit Mass (Weight) of Aggregates  |
| Tex-406-F             | Decantation Test for Concrete Aggregate   |
| Tex-408-F             | Organic Impurities in Fine Aggregate  |
| Tex-413-F             | Determining Deleterious Material in Mineral Aggregate   |
| Tex-460-F             | Determining Crushed Face Particle Count   |
| Tex-461-F             | Degradation of Coarse Aggregate by Micro-Deval Abrasion                                       |
|                       | <b>Level 2</b>  |
| Tex-204-F             | Design of Bituminous Mixtures   |
| Tex-205-F             | Laboratory Method of Mixing Bituminous Mixtures   |
| Tex-236-F             | Determining Asphalt Content from Asphalt Paving Mixtures by the Ignition Method               |

| <b>Test Procedure</b> | <b>American Concrete Institute (ACI) Certifications</b>             |
|-----------------------|---|
|                       | <b>Concrete Field Testing Technician – Grade I</b>                  |
| Tex-407-A             | Sampling Freshly Mixed Concrete                                     |
| Tex-414-A             | Air Content of Freshly Mixed Concrete by the Volumetric Method      |
| Tex-415-A             | Slump of Portland Cement Concrete                                   |
| Tex-416-A             | Air Content of Freshly-Mixed Concrete by the Pressure Method        |
| Tex-417-A             | Unit Weight, Yield, and Air Content (Gravimetric) of Concrete       |
| Tex-422-A             | Measuring Temperature of Freshly Mixed Portland Cement Concrete     |
| Tex-447-A             | Making and Curing Concrete Test Specimens (Part I)                  |
|                       | <b>Concrete Strength Testing Technician</b>                         |
| Tex-418-A             | Compressive Strength of Cylindrical Concrete Specimens              |
| Tex-448-A             | Flexural Strength of Concrete Using Simple Beam Third-Point Loading |
| Tex-450-A             | Capping Cylindrical Concrete Specimens                              |

## Appendix F Test Methods for Split/Proficiency Evaluation

After observation and qualification, each qualified technician is required to participate annually in one proficiency or split sample test for each test method requiring independent assurance. Split sample test results must compare to the independent assurance test results to within the established tolerance as described in [Appendix B – Alignment/Split Sample Tolerance Limits](#). Proficiency sample test results must be within  $\pm 2$  standard deviations of the proficiency sample mean.

The following table lists the test procedures required for evaluation.

| Proficiency Sample Test Procedures |   |
|------------------------------------|---|
| Test Procedure                     | Description   |
| Tex-104-E                          | Determining Liquid Limit of Soils   |
| Tex-105-E                          | Determining Plastic Limit of Soils  |
| Tex-106-E                          | Calculating the Plasticity Index of Soils   |
| Tex-107-E                          | Determining the Bar Linear Shrinkage of Soils   |
| Tex-110-E                          | Particle Size Analysis of Soils   |
| Tex-113-E                          | Laboratory Compaction Characteristics and Moisture-Density Relationship of Base Materials |
| Tex-117-E                          | Triaxial Compression for Disturbed Soils and Base Materials                               |
| Tex-200-F                          | Sieve Analysis of Fine and Coarse Aggregate   |
| Tex-207-F                          | Determining Density of Compacted Bituminous Mixtures                                      |
| Tex-227-F                          | Theoretical Maximum Specific Gravity of Bituminous Mixtures                               |
| Tex-236-F                          | Determining Asphalt Content of Asphalt Paving Mixtures by the Ignition Method             |
| Tex-241-F                          | Compacting Bituminous Specimens Using the Superpave Gyrotory Compactor (SGC)              |
| Split Sample Test Procedures       |   |
| Test Procedure                     | Description   |
| Tex-418-A                          | Compressive Strength of Cylindrical Concrete Specimens                                    |

## **Appendix G**

### **Material Certification Example Letter**

The intent of the material certification is to ensure that the quality of all materials incorporated into the project is in conformance with the plans and specifications, thus ensuring a service life equivalent to the design life. Any material represented by an acceptance test that does not meet the criteria contained on the plans and specifications is considered an exception. Exceptions should be investigated to determine if in fact the material is in reasonably close conformity with the plans and specifications. Nonconforming materials and workmanship will be tracked, monitored, and appropriately addressed. Submit a monthly IQFM Material Certification Letter in the OV Report. An example follows.

## Independent Quality Firm Certification

### Draw Request No. \_\_\_ Certification

The undersigned hereby certifies that:

1. Except as specifically noted in this certification, all Work that is the subject of the Draw Request, including Subcontractors, and Suppliers, has been checked or inspected by the Independent Quality Firm, with respect to the Construction Work;
2. Except as specifically noted in this certification, all Work that is the subject of the Draw Request has been inspected and tested in accordance with the approved CQMP (including the DB Guide Schedule), and there are no known deficiencies, non-conformances or other deviations that are outstanding associated with the Work that is the subject of this Draw Request. Therefore, the Work conforms to the requirements of the Contract Documents.
3. 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;
4. All the measures and procedures provided in the Construction Quality Management Plan are functioning properly and are being followed;
5. The construction percentages and incorporated material values indicated are accurate and correct; and
6. All quantities for which payment is requested on a unit price basis are accurate. Such quantities have been submitted to TxDOT as part of the payment request.

Exceptions:

---

---

Name: \_\_\_\_\_  
(Print)

Seal:



Signature:

\_\_\_\_\_  
Independent Quality Firm Manager

Date: \_\_\_\_\_

## Appendix H

### Minimum Qualification Requirements for Laboratories

All laboratories performing acceptance testing for TxDOT require qualification, at a minimum, in the test procedures identified in the tables below. Project-specific requirements may necessitate qualifications in additional test procedures. Qualification for IQF, OV, and IA central laboratories will be required through the AASHTO Accreditation Program (AAP) for those test methods identified in the tables below if those tests are performed by the laboratory. The accreditation must be maintained throughout the life of the project and the laboratory must participate in the AASHTO re:source Proficiency Sample Program (PSP)/ Concrete and Cement Reference Laboratory (CCRL) proficiency program. The project laboratory is required to implement the approved quality system from the central laboratory at the project laboratory, and provide documentation that this is complete. In addition, TxDOT MTD, or its designee, will qualify the laboratory in TxDOT test methods. The laboratory technicians must participate in the TxDOT Hot-Mix Asphalt, Concrete, and Soils statewide proficiency programs with the results documented as indicated in [Section 4 – Independent Assurance Program](#).

| Embankments, Subgrades, Backfill, and Base Materials |           |                        |   |
|--|-----------|------------------------|---|
| ASTM   | AASHTO    | TxDOT                  | Description   |
| ---  | ---       | Tex-100-E              | Surveying and Sampling of Soils for Highways  |
|  | T87       | Tex-101-E              | Preparing Soil and Flexible Base Materials for Testing  |
| ---  | ---       | Tex-102-E              | Determining Slaking Time  |
| D2216  | T265      | Tex-103-E              | Moisture Content in Soil Materials  |
| D4318  | T89 / T90 | Tex-104-<br>106-E      | Liquid Limit; Plastic Limit; Plasticity Index   |
|  | ---       | Tex-107-E              | Bar Linear Shrinkage  |
| ---  | T311      | Tex-110-E              | Particle Size Analysis  |
| D1140  | ---       | Tex-111-E              | Amount of Material in Soils Finer than the 75 µm (No. 200) Sieve                                  |
| D1557  | T180      | Tex-113-E <sup>1</sup> | Compaction and Moisture-Density Relationship of Base Materials                                    |
| D698   | T99       | Tex-114-E              | Compaction and Moisture-Density Relationship of Subgrade, Embankment Soils, and Backfill Material |
| D6938  | T310      | Tex-115-E              | Field Method for In-Place Density of Soils and Base Materials                                     |
| ---  | ---       | Tex-116-E              | Ball Mill Method for Disintegration of Flexible Base Material                                     |
| ---  | ---       | Tex-117-E <sup>1</sup> | Triaxial Compression for Disturbed Soils and Base Materials                                       |
| D558   | T134      | Tex-120-E              | Soil-Cement Testing   |
| D5102  | ---       | Tex-121-E              | Soil-Lime Testing   |

| Embankments, Subgrades, Backfill, and Base Materials |        |           |   |
|--|--------|-----------|---|
| ASTM   | AASHTO | TxDOT     | Description   |
| ---  | ---    | Tex-124-E | Potential Vertical Rise                                       |
| ---  | ---    | Tex-126-E | Laboratory Molded Density of Asphalt Treated Base             |
| D4972  | ---    | Tex-128-E | Soil pH   |
| ---  | ---    | Tex-129-E | Resistivity of Soil Materials                                 |
| ---  | ---    | Tex-140-E | Thickness of Pavement Layer                                   |
| D2487  | ---    | Tex-142-E | Laboratory Classification of Soils for Engineering Purposes   |
| ---  | ---    | Tex-145-E | Sulfate Content in Soils— Colorimetric Method                 |
| ---  | ---    | Tex-146-E | Conductivity Test for Field Detection of Sulfates in Soil     |
| ---  | ---    | Tex-148-E | Organic Content   |
| D3740  | ---    | Tex-198-E | Minimum Standards for Acceptance of a Laboratory (Soils/Base) |

1. IQF and OVF project/field laboratories performing Tex-113-E and Tex-117-E tests must be an approved laboratory from TxDOT's MPL.

| Bituminous Mixtures |        |           |  |
|---------------------|--------|-----------|--|
| ASTM                | AASHTO | TxDOT     | Description  |
| D3203               | T269   | Tex-206-F | Compacting Specimens Using the Texas Gyrotray Compactor                                      |
| D2726               | T166   | Tex-207-F | Density of Compacted Bituminous Mixtures (SSD Method)  |
| D6752               | T331   | Tex-207-F | Density of Compacted Bituminous Mixtures (Vacuum Method)                                     |
| D1461               | T110   | Tex-212-F | Moisture Content   |
| D1461               | T110   | Tex-213-F | Determining Hydrocarbon Volatile Content of Bituminous Mixtures                              |
| D75                 | ---    | Tex-221-F | Sampling Aggregate for Bituminous Mixtures, Surface Treatments, and Limestone Rock Aggregate |
| D979                | ---    | Tex-222-F | Sampling Bituminous Mixtures   |
| D6931               | ---    | Tex-226-F | Indirect Tensile Strength  |
| D2041               | T209   | Tex-227-F | Theoretical Maximum Specific Gravity of Bituminous Mixtures                                  |
| D6390               | ---    | Tex-235-F | Determining Draindown Characteristics in Bituminous Materials                                |
| D6307               | T308   | Tex-236-F | Asphalt Content by the Ignition Method   |
| D3666               | ---    | Tex-237-F | Minimum Standards for Acceptance of a Laboratory (HMA)                                       |

| Bituminous Mixtures |        |                        |  |
|---------------------|--------|------------------------|--|
| ASTM                | AASHTO | TxDOT                  | Description  |
| D6925               | T312   | Tex-241-F              | Compacting Specimens Using the Superpave Gyrotory Compactor                |
| ---                 | T324   | Tex-242-F <sup>1</sup> | Hamburg Wheel-Tracking Test  |
| ---                 | ---    | Tex-244-F              | Thermal Profile of Hot Mix Asphalt   |
| C131/<br>D7064      | TP108  | Tex-245-F              | Cantabro Loss  |
| D140                | R66    | Tex-500-C              | Sampling Bituminous Materials, Pre-Molded Joint Fillers, and Joint Sealers |
| ---                 | ---    | Tex-246-F              | Permeability or Water Flow of Hot Mix Asphalt                              |
| ---                 | ---    | Tex-530-C              | Effect of Water on Bituminous Paving Mixtures                              |

1. IQF and OVF project/field laboratories performing Tex-242-F must be an approved laboratory from TxDOT's MPL.

| Aggregates |        |           |  |
|------------|--------|-----------|--|
| ASTM       | AASHTO | TxDOT     | Description  |
| D5444      | T30    | Tex-200-F | Sieve Analysis of Fine and Coarse Aggregates                       |
| C128       | T84    | Tex-201-F | Bulk Specific Gravity and Water Absorption of Fine Aggregate       |
| D2419      | T176   | Tex-203-F | Sand Equivalent  |
| ---        | ---    | Tex-204-F | Design of Bituminous Mixtures                                      |
| ---        | ---    | Tex-217-F | Deleterious Materials and Decantation for Coarse Aggregate         |
| ---        | ---    | Tex-224-F | Flakiness Index  |
| D4791      | ---    | Tex-280-F | Flat and Elongated Particles                                       |
| C702       | T248   | Tex-400-A | Sampling Stone, Gravel, Sand, and Mineral Aggregates               |
| C136       | T27    | Tex-401-A | Sieve Analysis of Fine and Coarse Aggregate                        |
| ---        | ---    | Tex-402-A | Fineness Modulus of Fine Aggregate                                 |
| C127       | T85    | Tex-403-A | Saturated Surface-Dry Specific Gravity and Absorption              |
| C29        | T19    | Tex-404-A | Determining Unit Weight of Aggregate                               |
| C117       | T11    | Tex-406-A | Material Finer than the 75 µm (No. 200) Sieve in Mineral Aggregate |
| C40        | T21    | Tex-408-A | Organic Impurities in Fine Aggregate for Concrete                  |
| C566       | T255   | Tex-409-A | Free Moisture and Water Absorption                                 |
| C131       | T96    | Tex-410-A | Abrasion of Coarse Aggregate Using the Los Angeles Machine         |
| C88        | T104   | Tex-411-A | Magnesium Sulfate Soundness  |
| C142       | T112   | Tex-413-A | Deleterious Materials  |
| ---        | ---    | Tex-431-A | Pressure Slaking Test of Synthetic Coarse Aggregate                |
| ---        | ---    | Tex-432-A | Coarse Aggregate Freeze-Thaw                                       |

| Aggregates |        |           |  |
|------------|--------|-----------|--|
| ASTM       | AASHTO | TxDOT     | Description  |
| ---        | T103   | Tex-433-A | Absorption and Dry Bulk Specific Gravity of Lightweight Coarse Aggregate           |
| D5821      | ---    | Tex-460-A | Crushed Face Count   |
| D6928      | T327   | Tex-461-A | Micro-Deval Abrasion   |
| C1077      |        | Tex-498-A | Minimum Standards for Acceptance of a Laboratory (Concrete and Aggregate)          |
| ---        | ---    | Tex-499-A | Aggregate Quality Monitoring Program (AQMP) Surface Aggregate Classification (SAC) |
| ---        | ---    | Tex-612-J | Acid Insoluble Residue   |

| Hydraulic Cement Concrete |          |           |  |
|---------------------------|----------|-----------|--|
| ASTM                      | AASHTO   | TxDOT     | Description  |
| C172                      | T141     | Tex-407-A | Sampling Freshly Mixed Concrete  |
| C173                      | T196     | Tex-414-A | Air Content of Freshly Mixed Concrete by the Volumetric Method                               |
| C143                      | T119     | Tex-415-A | Slump of Hydraulic Cement Concrete   |
| C231                      | T152     | Tex-416-A | Air Content by the Pressure Method   |
| C138                      | T121     | Tex-417-A | Unit Weight, Yield, and Air Content (Gravimetric) of Concrete                                |
| C39                       | T22      | Tex-418-A | Compressive Strength of Cylindrical Concrete Specimens                                       |
| C1064                     | T309     | Tex-422-A | Measuring Temperature of Freshly Mixed Portland Cement Concrete                              |
| ---                       | ---      | Tex-423-A | Determining Concrete Thickness by Direct Measurement (Parts I and II)                        |
| C42/C174                  | T24/T148 | Tex-424-A | Determining and Testing Drilled Cores of Concrete  |
| E965                      |          | Tex-436-A | Measuring Texture Depth by Sand Patch Method   |
| C31                       | T23      | Tex-447-A | Making and Curing Specimens  |
| C78                       | T97      | Tex-448-A | Flexural Strength of Concrete Using Simple Beam Third Point Loading                          |
| C617                      | T231     | Tex-450-A | Capping Cylindrical Concrete Specimens   |
| C1231                     | ---      | Tex-450-A | Use of Unbonded Caps in Determination of Compressive Strength of Hardened Concrete Cylinders |
| C1077                     | ---      | Tex-498-A | Minimum Standards for Acceptance of a Laboratory (Concrete and Aggregate)                    |

| Miscellaneous Procedures |        |            |   |
|--------------------------|--------|------------|---|
| ASTM                     | AASHTO | TxDOT      | Description   |
| E329                     | ---    | ---        | Standard Specification for Inspection and Testing                                     |
| D6951                    | ---    | ---        | Dynamic Cone Penetrometer   |
| D3665                    | ---    | ---        | Standard Practice for Random Sampling of Construction Materials                       |
| ---                      | ---    | Tex-600-J  | Sampling and Testing Lime   |
|                          |        | Tex-900-K  | Calibration Procedures (calibrating, verifying, and certifying equipment and devices) |
|                          |        | Tex-1001-S | Ride Quality  |

|  |   |
|--|---|
|  | Preferred test procedure for AASHTO Accreditation               |
|  | Acceptable test procedure for AASHTO Accreditation              |
|  | Test procedure qualified by TxDOT MTD designee or IA Laboratory |

Note: Contact MTD Quality Assurance for qualifications in test procedures not covered by ASTM or AASHTO.

# Appendix I

## I2MS 3.2 Continuous Analysis Algorithm

The following describes the I2MS 3.2 algorithm used in the continuous statistical analysis referenced in [Appendix D – OV Levels for Materials Testing Validation/Verification](#).

### Categorizing for Analysis

When a test version record is saved to I2MS, the first step is to assign it to any applicable analysis categories. A test record must have Sample Type “Random-Independent” or “Random-Split” to be associated with any category<sup>1</sup>. Assignment to a category is made immediately when the record enters the system, but the record will not be included in any analyses until it is set “For Analysis” (i.e., it is Approved or intermediate break data is Reviewed).

Note: A new version of an existing record can actually belong to a different analysis category than a previous version if the header values were changed. This is not a problem, as an analysis run represents a snapshot of the current data in the system at the time the analysis was done.

### Finding Categories to Analyze

Every night, I2MS scans data in the system for categories that need to be analyzed. A category is triggered for analysis whenever a NEW OV record appears. A record is new if it is For Analysis and has never been analyzed before. Some examples of new OV records are:

- A test was added and approved today;
- A test was added a month ago and approved/reviewed today; or
- A test that was added and analyzed last week was revised and reapproved. This new version has never been analyzed, so it will trigger an analysis the same as if it were the first version of the record.

### Analyzing a Category

The first step in the analysis is to find the date range of the analysis populations. The age of a record is determined by its SAMPLED DATE.

I2MS has a desired maximum number of days that can be configured in Project Settings. By default, this is 90 days. Also configurable is the desired maximum number of OV records to include in one analysis run. This defaults to 25 records.

The end date of analysis will always be the current date. The start date of the analysis is determined by the following.

---

<sup>1</sup> These restrictions can be reconfigured at the analysis-group level (e.g., Concrete, Asphalt) if the list of Sample types or the business rule changes.

- If there is an unanalyzed record for either the OVF or IQF that is OLDER than 90 days, the start date is that record's Sampled Date. Analysis will run on ALL records from that date forward.
- If there are fewer than 25 OV records within the previous 90 days, the start date will be 89 days before the current date (i.e., 90 days total in the analysis).
- If there are 25 OV records or more within the previous 90 days, use a smaller date range. The Sampled Date of the 25th OV record before the current date will be the start date of the analysis.

The next step is to pull all of the data points for the analysis. Pull values for all "For Analysis" OVF and IQF records between the start date and the end date, using ONLY the latest versions of those records.

Finally, perform the F- and t- statistical analysis and save the P-values for review by the materials manager. The analysis requires at least 2 points from each population to calculate. If there are fewer than 2 data points for either OVF or IQF, skip the analysis. The category will be picked up again the next time an approved OV record comes in.

## **Appendix J**

### **Minimum Construction Hold Points**

The minimum milestones at which construction Independent Quality (IQ) hold points must be established include the following, but not limited to:

#### **Environmental Mitigation Measures**

- A. Prior to crossing any stream, dewatering, diverting watercourses, or building cofferdams
- B. Before beginning construction for conformance with the Storm Water Pollution Prevention Plan (SWPPP) and NPDES permit
- C. Bi-weekly and after each rainfall event of 1/2 in. or more, for monitoring and maintaining temporary erosion and pollution hold devices

#### **Embankments**

- A. One per shift per crew for drainage and utility installation with IQ pre-backfill inspection documentation for all associated work provided at the hold point
- B. After all clearing, grubbing, and excavation, before embankment placement
- C. Before beginning borrow pit excavation for permissions and materials testing
- D. Per specifications for lift requirements (applicable to all embankments, including walls)
- E. Before removal of surcharge
- F. Before placing embankment or MSE backfill on ground improvements

#### **Drainage**

- A. Before placing drainage pipe for bedding and pipe conditions
- B. After pipe placement and bedding compaction and before beginning backfill
- C. After backfill for roundness of pipe and other defects
- D. Before opening for structure grouting and pipe and structure cleanliness

#### **Structures**

##### **Bridges**

- A. At completion of bridge embankment settlement and before start of bridge foundation pile driving
- B. At IQ approval of pile-driving submittals (including design calculations, wave analysis, and hammer specification)
- C. After completion of pile driving at each structure support (pile group), including pile-driving results and records

- D. After excavation for drilled shafts and spread footings
- E. Before sonic logging drilled shafts
- F. Before beginning drilled shaft remediation, if needed
- G. Before placement of reinforced concrete in superstructure and substructure elements, including pre-drilled piling
- H. Before and after construction of MSE fill system behind abutments
- I. After removal of unsound bridge deck concrete from existing bridges
- J. Before and after structural steel erection
- K. Before allowing traffic below erected structural steel girders or concrete beams
- L. Before and after post-tensioning and grouting operations
- M. Before backfilling bridge components
- N. Before placement of reinforcing steel above permanent steel stay-in-place deck forms and above partial depth precast concrete deck panels
- O. Before filling full-depth concrete deck panels grout pockets

### **Walls**

- A. Before placement of wall on ground improvements
- B. Before placement of leveling pad for any retaining wall system
- C. After placement of every 10 ft. (measured vertically) of MSE wall panels or blocks
- D. Before placement of reinforced concrete
- E. After rebar placement but before final form placement for cast-in-place retaining walls
- F. Before backfilling at any type of retaining wall system
- G. Before and after post-tensioning and grouting operations for tie-back anchors and soil nails
- H. During soil nail anchor verification test (before production)
- I. During proof testing of production nails
- J. During placement of drains and welded wire mesh for soil nail walls
- K. Before placement of shotcrete for soil nail walls

### **Drainage Box Structures**

- A. After excavation for drainage box structures
- B. Before placement of reinforced concrete for drainage box structures
- C. After rebar placement but before final form placement for drainage box structures taller than 6 ft.
- D. Before backfilling drainage box structures

### **Sign, Signal, Lighting, and ITS Support Structures**

- A. Before installation of foundations for sign, signal, lighting, and ITS support structures
- B. During installation of sign, signal, lighting, and ITS structures

### **Signs and Pavement Markings**

- A. Before installation of material
- B. During installation

### **Temporary Structures**

- A. Before allowing traffic on, below, above, or adjacent to temporary structures, shoring, or bracing

### **Surfacing, Paving, and Concrete**

- A. After batch plants are set up, for calibration
- B. Before placement of each course above subgrade on permanent roadway components (treated base, granular base, etc.)
- C. Before placement of each lift of asphalt or PCC paving on permanent roadway components
- D. Before any placement of concrete

### **Traffic Devices and Management of Traffic**

- A. Before opening to traffic
- B. Before implementation of a full or partial closure on any roadway
- C. Before changing the traffic configuration or alignment on any roadway

## **Appendix K**

### **Example Engineering Judgment Agreement**

July 1, 2017

Mr. Q.M. Jones  
Independent Quality Firm Manager  
Top Quality Engineering  
1000 Mockingbird Lane  
Dallas, TX 75207

Reference: Example Design Build (DB) Project, TxDOT Contract No. 41-3XXDB012  
Subject: Delegation of Engineering Authority

Dear Mr. Jones:

Attached to this letter please find the guidelines for delegation of engineering authority and acceptance decisions for the Example DB project. This list may be revised periodically.

Sincerely,

Dusty Rhodes, P.E.  
Project Manager

cc: Bobby Builder, DB Project Constructors

## **Example DB Project Agreement for Delegation of Engineering Authority and Acceptance Decisions**

The intent of the delegation of engineering authority is to provide some latitude at the field level for the IQF to allow work to continue for minor deviations from the specification requirements where materials will otherwise meet the intent of the design or where a rejection of materials poses a larger threat to the quality of the project. Delegation to the IQF does not release TxDOT from responsibility to monitor and review the IQF decisions since TxDOT cannot delegate material acceptance.

TxDOT is required to provide FHWA with a Final Materials Certification when the project is complete. This Materials Certification is TxDOT's certification that materials used on the project meet the approved plans and specifications for the project, except as noted. The documentation for any exceptions must be provided to TxDOT for inclusion in the OV Reports.

When TxDOT submits the OV Reports to the FHWA, TxDOT must be in agreement that the IQF and OV Engineering Judgment Logs, and NCR portions of the report are complete and that TxDOT is in agreement with the decisions included in those logs.

### **Authority of the Engineer as specifically identified in the 2014 TxDOT Standard Specifications, Item 5.1.**

- 1) Acceptance of defective or unauthorized work will follow the guidance established in Item 5.3 in the current TxDOT Standard Specifications.
- 2) The IQFM may exercise engineering authority or may delegate to another Licensed Professional Engineer, registered in the State of Texas, within the IQF organization. However, the IQFM is ultimately responsible for all delegated engineering judgment decisions as demonstrated by signing the Monthly Materials Certification Letter.
- 3) Inspectors are limited to authority described in Item 5.10 in the current TxDOT Standard Specifications.
- 4) Where indicated in the current TxDOT Standard Specifications that the Engineer has approval of drawings, methods, etc. related to the design of elements of Work involving safety of the public or workers, the Engineer will be the Design Engineer responsible for the element.

## **Engineering judgment to accept material or work failing specification requirements:**

- 1) Engineering authority is delegated to the IQFM or designees with the exception of those inspection and testing items that might, 1) affect the safety of project personnel or the traveling public, or 2) conflict with approved shop drawings or erection manuals.
- 2) The individual making the engineering judgment will apply sound engineering practices to verify quality of accepted material and will document his or her acceptance and justification in the Engineering Judgment Log.
- 3) The IQF records management system will be capable of generating an Engineering Judgment Log that is sortable by test procedure, date range, and material from each specification. The log will include the comments explaining the logic in making each judgment and the magnitude of the deviation from specification requirements. This log will be available at all times to TxDOT.

The development of the Project must proceed with a reasonable approach to the quality duties of the IQF and the extension of the IQF's ability to render decisions in the field with regard to the Work performed. TxDOT recognizes that the IQF is an element of DB Contractor's team working to progress the development of the Project for TxDOT, and working alongside DB Contractor who is responsible for compliance. TxDOT recognizes that the IQF should be afforded the opportunity, in concert with their independent role, to render engineering decisions with respect to appropriate documents for inspection and testing as long as the following conditions are met.

- A. Engineering decisions will be delegated no lower than an engineer in charge of a section of the Project. This engineer may be an employee of TxDOT, OVF, or IQF, and must be a Licensed Professional Engineer in the State of Texas. Engineering decisions will be within an individual's area of expertise.
- B. Engineering Judgment to accept material or Work failing specifications will never be applied solely to promote "partnering" or to help out DB Contractor. The Project's quality will be regarded as the highest order of concern. Schedule is a secondary consideration with respect to quality delivery of the Project.
- C. If these guiding principles do not address the situation, the individual applying Engineering Judgment must provide a decision to TxDOT as to whether a material failing to meet specification requirements and not within applicable tolerances should be accepted, or not accepted, based on sound engineering principles, experience, and/or related results of applicable material tests.
- D. Engineering Judgment to accept materials or Work failing specification requirements will be applied only in cases where natural resources may be lost that will otherwise

meet the intent of the design (i.e., strength tests versus slump requirements); rejection of material endangers quality or loss of a larger or more significant item (i.e., by rejecting load of concrete, a structure element subject to a cold joint, reflective cracking, etc.); or some other issue that unduly threatens the overall quality/schedule of the Project. In general, engineering judgment is typically allowed on factors that are only indicators of final product quality, such as slump, or are “rule of thumb” type things as written into specifications such as the number of mixing revolutions or time to discharge since batching. Use of judgment supported by logical engineering analysis of the actual situation/conditions can allow production to continue. Materials that failed to meet the specification requirement may continue to be used as long as adjustments are made by the contractor to correct the cause of the failing factor (concrete failing slump, mixing time or over revolutions may actually still produce concrete exceeding design strength). It is advised that strength samples should be taken as fixed independent tests in these situations to verify the ultimate strength of the load of concrete, for instance.

- E. Engineering judgment should not be used by the IQF on test results that are the ultimate acceptance criteria for the item such as concrete compressive strength, density of HMAC, pavement thickness, deck thickness, cover on steel, etc. These are generally not field situations that can be adjusted to correct during on-going production or are immediately necessary to sustain production. They are factors that ultimately determine if the product that is furnished meets contract and design requirements or not and affect performance, durability, and maintenance of the product. Accepting failing tests in these areas should be through the NCR process only after analysis and consideration by the EOR and TxDOT and may include assessment of liquidated damages.
- F. Failed results of material tests may be accepted only for individual tests. Patterns of failure will not be accepted and will be considered a breakdown in Quality Control activities and will be addressed in the CQMP. Recurring use of Engineering Judgment for the same plan or specification deviation should result in process corrections to the construction operations to assure material and Work is conforming to plan and specification requirements. As a general rule of thumb, if failing tests are 5% or less and the process is consistent, then that process is generally under control. If failing tests rise to 8% or more, then increased process control testing and process adjustments are indicated as needed to get back to a uniform controlled process. The intent of delegating Engineering Judgment Authority to the IQF is not to allow widening of a specification requirement on a continuing basis, but is necessary to allow for reasonable production efforts to adjust and control their processes by the DB contractor.

- G. The IQFM may use Engineering Judgment to direct that an amount of acceptance testing greater than the required minimum be done when deemed necessary. The IQFM must document any variations from the prescribed frequencies.
- H. The individual making the Engineering Judgment will apply good engineering practices to ensure quality of accepted material by making additional tests, through engineering analysis, etc., and will document his or her acceptance and justification.
- I. Engineering Judgment in acceptance of material or Work not meeting specification requirements will be applied only to situations that are technically sound, in consideration of localized conditions. Engineering Judgment will not be used to waive specifications for conditions that have project-wide implications. The acceptance of materials or Work not meeting specifications in one instance at a location will not become a corridor-wide or project-wide decision. Each situation will be judged on the merits of its unique characteristics.
- J. TxDOT may, at any time, remove Engineering Judgment authority from the IQFM in specific circumstances.
- K. TxDOT and FHWA have oversight agreements in place that requires specific documentation relating to nonconforming material that is allowed to remain in place. Any instance of the application of these guiding principles will be accompanied by appropriate documentation.
- L. The IQF is encouraged but not required to consult with TxDOT before making acceptance decisions.
- M. IQF personnel are not placed, and do not appear to be placed, in a position that exhibits signs that they were pressured by DB Contractor to accept, approve, or continue the duties of the IQF scope of work as detailed in the Project under duress.
- N. Excessive use of Engineering Judgment in any specific area, as determined by the IQF or TxDOT, will require a Corrective Action Report (CAR) by the DB Contractor which will include a root cause analysis for the repeated noncompliance with the specification requirement and actions to eliminate or significantly reduce the use of engineering judgment in that area. Anyone in the project can initiate a CAR.

## Example DB Project Engineer Decision Delegation List

The following list represents opportunities extended to the IQFM to exercise Engineering Judgment with respect to reference within the TxDOT 2014 Standard Specifications. This is a supplement to Guiding Principles for Engineering Decisions on this project.

| Specification Issue  | Comment   |
|--|---|
| 1. Concrete slump deviation from specification   | The IQFM may exercise Engineering Judgment and accept materials that do not meet the specified requirement. The basis of acceptance will be documented on the test form and compiled into a list for attachment to the Letter to the FHWA of Certification of Materials Used. |
| 2. Concrete air content not meeting specification requirements (ref: Article 421.4.2.4 and 421.4.8)      | The IQFM may exercise Engineering Judgment and accept materials that do not meet the specified requirement. The basis of acceptance will be documented on the test form and compiled into a list for attachment to the Letter to the FHWA of Certification of Materials Used. |
| 3. Deviation from 1 hour time between successive concrete lifts (ref: Article 420.4.7.8 par 5)           | The IQFM may exercise Engineering Judgment for deviation from the 1 hr. specification when the first 2 sentences of this paragraph are attained.  |
| 4. Deviation from specified concrete discharge time (ref: Article 420.4.7.2, Article 421.4.6.2 Table 14) | The IQFM may exercise Engineering Judgment.   |
| 5. Materials acceptance while deviating from optimum moisture requirements.                              | The IQFM may exercise Engineering Judgment and accept materials that do not meet the specified requirement. The basis of acceptance will be documented on the test form and compiled into a list for attachment to the Letter to the FHWA of Certification of Materials Used. |
| 6. Construction Joint parallel to toewall of riprap under bridge structures involving streams or creeks. | The IQFM has the authority to permit construction joints in this example.   |

| Specification Issue  | Comment   |
|--|---|
| 7. Optimum Moisture Deviation specifications in embankment construction.   | The IQFM has the authority to render engineering decisions with respect to deviations in attainment of optimum moisture content based on sound engineering principles.  |
| 8. Standard Plan sheets for wingwalls and headwalls for box culverts (“When structure is founded on solid rock, depth of toewalls for culverts and wingwalls may be reduced or eliminated as directed by the Engineer.”) | TxDOT is comfortable with the IQFM making this decision with the following condition. If the toewall is deleted, please dowel #5 bars at 2’-0” C-C max. into the rock at the end of the apron. The dowels should be grouted into the rock at a depth of 6 in. min. and should extend up into the apron a distance of Z-2.”  |
| 9. Barricades, Signs, and Traffic Control  | <p>The IQFM is designated to be the Engineer in regards to decisions as the Engineer with exception to the following conditions held solely by TxDOT as operational items.</p> <ul style="list-style-type: none"> <li>• Lane closures and all associated items (time, duration, notification, etc.)</li> <li>• Narrow Lanes (&lt;12ft.)</li> <li>• Notifications (including message board wording)</li> </ul> <p>Items associated with proper implementation of traffic control items and making minor site specific adjustments to adapt the approved plan to field conditions are incorporated in this delegation list and handled by the IQFM.</p> |
| 10. Item 421   | The IQFM is delegated the decision to not perform air content tests on concrete where the specifications do not have a requirement for air content, but the supplier has chosen to include air entrainment admixture into the batch of concrete, as long as the amount of air entrainment admixture included is at or below the mix design requirement. The IQFM will maintain a database of concrete strength results for each class of concrete.  |

| Specification Issue             | Comment  |
|---------------------------------|--|
| 11.Special Provision 420--013   | The IQFM is delegated the Engineering decision to determine authorization for construction traffic before the application of concrete surface treatment.   |
| 12.Soil Retention Blanket       | The IQFM is delegated the Engineering decision to recommend and approve alternate placements of soil retention blankets than are shown on the ESOC plans, Temporary Work plans, or RFC documents. (NOTE: this example only applies if the ECM role is incorporated as part of the IQF.)  |
| 13.Article 440.3.4 Splices      | The IQFM is delegated the Engineering decision to approve splices in reinforcing steel deviating from Table 6 of Article 440.3.4 or the plan requirements. The Engineer choosing to make approval may either rest on his or her own engineering judgment or contact the engineer responsible for the design and obtain their approval for the deviation. |
| 14.Reinforcement projection     | The IQFM is delegated the Engineering decision to approve projections in reinforcing steel deviating from the RFC plan requirements. The Engineer choosing to make approval may either rest on his or her own engineering judgment or contact the engineer responsible for the design and obtain their approval for the deviation.                       |
| 15.CRCP groove depth            | The IQFM is delegated the Engineering decision to approve deviation from the specified depth of grooves (Reference Article 360.4.8.3.)   |
| 16.Non-Swell Zone PI Acceptance | The IQFM may accept materials within the Non-Swell Zone with the inclusion of % binder with the P.I. of the material placed.   |
| 17.Sprinkling of Aggregate      | The IQFM is delegated the decision authority for the sprinkling of stockpile aggregated.   |

| Specification Issue   | Comment  |
|---|--|
| 18. Bridge Beam Clearance to Backwall                             | The IQFM is delegated the decision to adjust clearances between the ends of beams on bridges. Clearances approaching 1-1/2 in. between the end of a beam to the face of the abutment backwall will require TxDOT concurrence.  |
| 19. Rock Riprap   | The IQFM is delegated the ability to make Engineering decisions with respect to the acceptance of Rock Riprap.   |
| 20. Hot-Mix Asphaltic Concrete Pavement Placement Air Temperature | The IQFM is delegated the engineering decision to determine acceptable limits of deviation from pertinent specification requirements for air temperature before placing mix.   |
| 21. Riprap Layout   | The IQF is delegated the Engineering Decision Authority from TxDOT to make decisions on alterations from riprap geometry indicated on RFC drawings.  |
| 22. CTSG PI>25  | The IQFM is delegated the decision ability to accept subgrade materials with a P.I. greater than 25 for treatment with cement.   |
| 23. Engineer for Hot-Mix Specification.                           | <ol style="list-style-type: none"> <li>1. TxDOT will be the engineer for the determination of lot size, incompleteness lot, and small quantity lot.</li> <li>2. A default lot size of 1600 tons will be used by the IQFM for the corridor-wide hot mix work, with the stipulation of (a) IQFM will close the lot as “incomplete” if the lot is not completed within 2 days; (b) IQFM will close the lot if the IQFM has taken the 4th IQF subplot sample and the production at the end of the day has not reached 1600 tons; and (c) lot size different from 1600 tons needs to be by request and approved by TxDOT on a case by case basis.</li> <li>3. TxDOT will make the call on Small Quantity Lots.</li> </ol> |

## **Appendix L Archived Versions**

The following archived versions of this document are available.

- Effective November 24, 2008–February 28, 2010:  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db\\_1108.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db_1108.pdf)
- Effective March 1, 2010–May 10, 2010:  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db\\_0310.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db_0310.pdf)
- Effective May 11, 2010–July 24, 2011:  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db\\_0510.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db_0510.pdf)
- Effective July 25, 2011–October 25, 2016  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db\\_0711.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db_0711.pdf)
- Effective October 26, 2016–August 28, 2017  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db\\_1016.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db_1016.pdf)
- Effective August 29, 2017– October 26, 2020  
[ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap\\_db.pdf](ftp://ftp.dot.state.tx.us/pub/txdot-info/cst/gap_db.pdf)