# "TxDOT's Programmatic "Quality Assurance Program for Design-Build Projects" and "Implementation Guide"

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**Quality Assurance Program
for
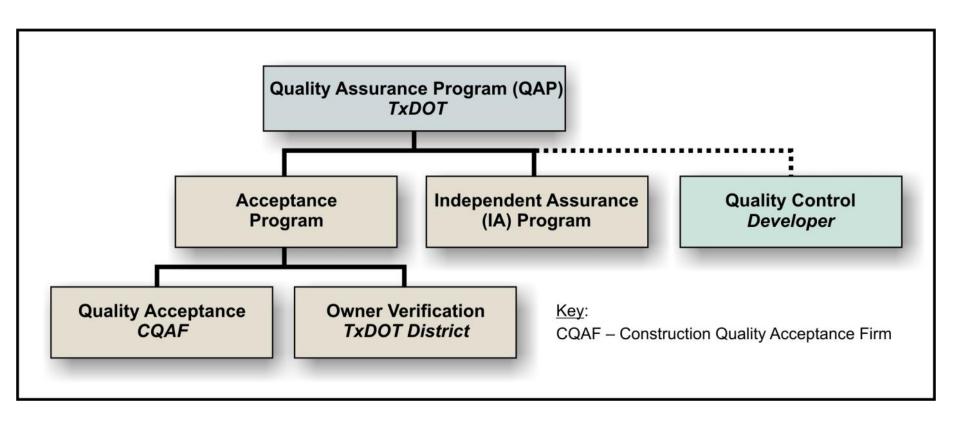Design-Build Projects with an Optional 15-Year
Capital Maintenance Agreement**

**Texas
Department
of Transportation**

July 25, 2011

[Quality Assurance Program for Design-Build Projects](#)

# Risk allocation comparisons of TxDOT D-B-B, D-B, and Concession projects.

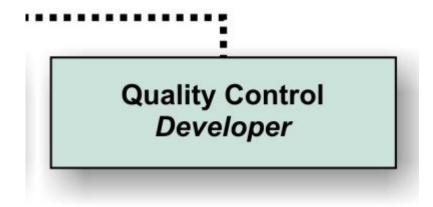| Risk Allocations Comparison | | | |
|---|---|---|---|
| **Risk** | **Design-Bid-Build** | **Design-Build** | **Concession** |
| **Project Scope** | Owner | Owner | Owner |
| **Right of Way** | Owner | Shared/Owner | Shared/Contractor |
| **Utilities** | Owner | Shared | Shared |
| **Design** | Owner | Contractor | Contractor |
| **Construction** | Contractor | Contractor | Contractor |
| **Site Conditions** | Owner | Shared | Contractor |
| **QA/QC** | Owner | Shared | Contractor |
| **Hazmat** | Owner | Shared | Shared |
| **Operation & Maintenance** | Owner | Shared/Owner<br>3-5yr. Optional Terms | Concessionaire<br>50yr. Required |
| **Traffic (Demand / Revenue)** | Owner | Owner | Concessionaire |
| **Financial** | Owner | Owner | Owner/Concessionaire |
| **Toll Technology** | Owner | Owner | Concessionaire |
| **Force Majeure** | Shared | Shared | Shared |

Risk transfer from the Owner to the Contractor/ Concessionaire will generally increase in proportion to the length of the maintenance agreement including long-term preservation and responsibilities for traffic and revenue.
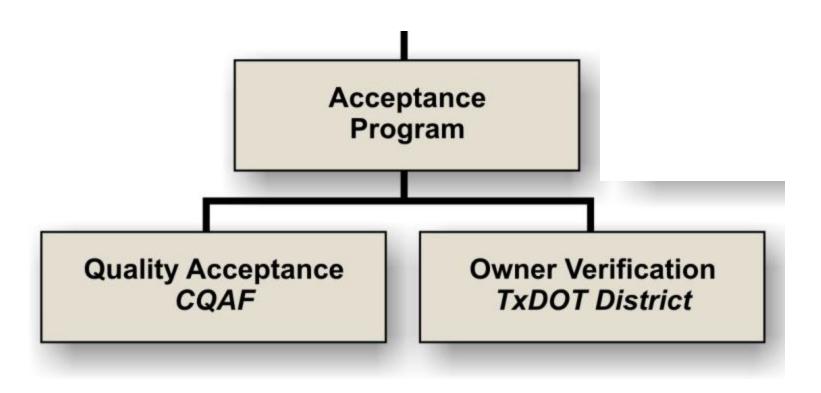
# Testing Components and Relationships in the QAP

# Quality Control

# Testing Acceptance Program

# Testing Quality Assurance
# by
# Contractor's Quality Acceptance Firm

# Testing Quality Acceptance
# by
# TxDOT District with

# Appendix D – OVT Levels for Materials Testing Validation

## Start-Up Requirements

During start-up operations, the CQAF (Construction Quality Acceptance Firm) and OV (owner verification) firm will perform split sample testing for all tests listed as Level 1 or Level 2. 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 validate during start-up operations, both the CQAF and OV firm will collaborate to determine the cause(s) of the non-validation 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 CQAF'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 Stabilized Base (Plant Mix) | 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 |
| Asphalt Concrete Pavement (Items 341, 342, 344, and 346) | 0.025 |
| Asphalt Concrete Pavement (Items 330 and 334) | 0.01 |
| Asphalt Concrete Pavement (Item 340) | 0.025 |

## Level 1 Tests: F & t-test and Split Samples

F- and t- Tests: The OV firm will perform continuous F- and t- test analyses on Level 1 tests with the OV testing frequency at approximately ten percent of the QA testing frequency. The continuous analysis, as described in Appendix I – I2MS 3.0 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 QA CQAF sample population.

## Level 2 Tests: Independent Verification and Split Samples

Independent Verification: The OV firm will perform independent verification on Level 2 tests with the OV testing frequency once per quarter with lower frequency tests missed during one quarter being specifically targeted the next quarter. This verification shall be performed by comparing the independent OV test results with a group of corresponding QA test results as an independent check of the QA test results.

## Level 3: Observation Verification
The OV firm will observe and review the CQAF's initial start-up testing operations and periodically during ongoing production operations to verify compliance with test procedures.

# "Quality Assurance Program for Design-Build Projects"

| OVT Levels for Materials Testing Validation | | Level 1 | Level 2 | Level 3 |
|---|---|---|---|---|
| **HYDRAULIC CEMENT CONCRETE – STRUCTURAL**<br>**(Classes: C, F, H, S, DC, 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 | 2 |
| | | Los Angeles Abrasion | Tex-410-A | 3 |
| | | 5-cycle Magnesium Sulfate Soundness | Tex-411-A | 3 |
| | FINE AGGREGATE | Sand Equivalent | Tex-203-F | 2 |
| | | Organic Impurities | Tex-408-A | 2 |
| | | Sieve Analysis | Tex-401-A | 2 |
| | | Fineness Modulus | Tex-402-A | 2 |
| | | Deleterious Material | Tex-413-A | 2 |
| | | Acid Insoluble Residue | Tex-612-J | 3 |
| | MINERAL FILLER | Sieve Analysis | Tex-401-A | 3 |
| CONCRETE | | Compressive Strength | Tex-418-A | 1 |
| | | Slump | Tex-415-A | 2 |
| | | Entrained Air (When not waived by plans) | Tex-416-A or Tex-414-A | 1 |
| | | Temperature of Concrete | Tex-422-A | 3 |

| OVT Levels for Materials Testing Validation | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| **HYDRAULIC CEMENT CONCRETE – NON-STRUCTURAL**<br>**(Classes: A, B, D, or E)** | | | |
| **MATERIAL OR PRODUCT** | **TEST FOR** | **TEST NUMBER** | **TxDOT RECOMMENDED** |
| CONCRETE | Compressive Strength | Tex-418-A | 3 |
| | Entrained Air (When not waived by plans) | Tex-416-A or Tex-414-A | 3 |

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# Risk based tiered verification testing table for SH 130 Segments 5 and 6 Concession project

| Category Levels for Analysis | 1 - F & t-test with Paired t-test | | 2 - IA Split with Independent Verification | | 3 - Observation Verification |
|---|---|---|---|---|---|

### HYDRAULIC CEMENT CONCRETE – STRUCTURAL
### (Classes: A, C, F, H, S, DC, CO, K, LMC, or SS)

| MATERIAL OR PRODUCT | | TEST FOR | TEST NUMBER | TxDOT RECOMMENDED |
|---|---|---|---|---|
| MINERAL AGGREGATE | COARSE AGGREGATE | Decantation | Tex-406-A | 3 |
| | | Sieve Analysis | Tex-401-A | 3 |
| | | Deleterious Materials | Tex-413-A | 3 |
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| | | Temperature of Concrete | Tex-422-A | 2 |

| Category Levels for Analysis | 1 - F & t-test with Paired t-test | | 2 - IA Split with Independent Verification | | 3 - Observation Verification |
|---|---|---|---|---|---|

### HYDRAULIC CEMENT CONCRETE – NON-STRUCTURAL
### (Classes: A, B, D, or E)

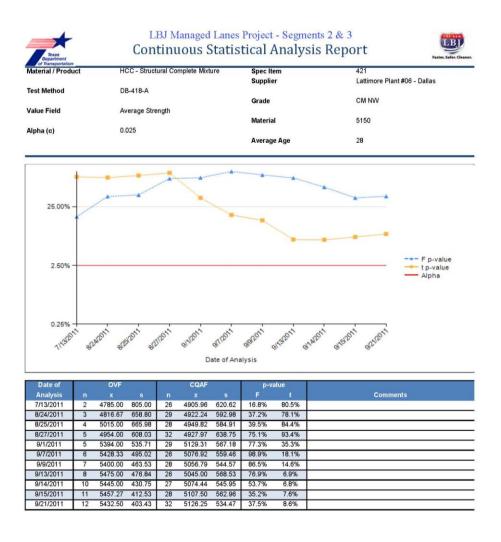| MATERIAL OR PRODUCT | TEST FOR | TEST NUMBER | TxDOT RECOMMENDED |
|---|---|---|---|
| CONCRETE | Compressive Strength | Tex-418-A | 3 |
| | Entrained Air (When not waived by plans) | Tex-416-A or Tex-414-A | 3 |

# FHWA Requirements
# "Quarterly Report"

- Statistical analysis results, to include specification requirements and status of validation process during start-up and completion of an item
- Non-validation investigation
- Engineering judgment log
- Non-conformance log
- Materials certification

# I2MS - Purpose

- Assist with statistical analysis portion for the Quarterly Report to FHWA

- Automates

  - Report generation

  - Analyzing QA and OV results

  - Verification of certifications/accreditations and key parameters

# Report Generation – What to Expect Level 1



**LBJ Managed Lanes Project - Segments 2 & 3**
**Continuous Statistical Analysis Report**
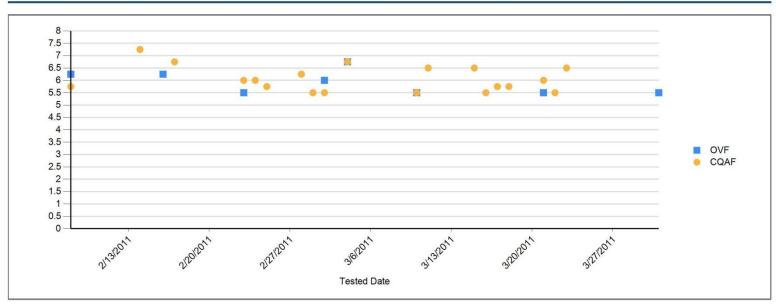
| Material / Product | HCC - Structural Complete Mixture | Spec Item | 421 |
| --- | --- | --- | --- |
| | | Supplier | Lattimore Plant #06 – Dallas |
| Test Method | DB-418-A | | |
| | | Grade | CM NW |
| Value Field | Average Strength | | |
| | | Material | 5150 |
| Alpha (α) | 0.025 | | |
| | | Average Age | 28 |

| Date of Analysis | OVF | | | CQAF | | | p-value | | Comments |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | n | x | s | n | x | s | F | t | |
| 7/13/2011 | 2 | 4785.00 | 805.00 | 26 | 4905.96 | 620.62 | 16.8% | 80.5% | |
| 8/24/2011 | 3 | 4816.67 | 658.80 | 29 | 4922.24 | 592.98 | 37.2% | 78.1% | |
| 8/25/2011 | 4 | 5015.00 | 665.98 | 28 | 4949.82 | 584.91 | 39.5% | 84.4% | |
| 8/27/2011 | 5 | 4954.00 | 608.03 | 32 | 4927.97 | 638.75 | 75.1% | 93.4% | |
| 9/1/2011 | 5 | 5394.00 | 535.71 | 29 | 5129.31 | 567.18 | 77.3% | 35.3% | |
| 9/7/2011 | 6 | 5428.33 | 495.02 | 26 | 5076.92 | 559.46 | 98.9% | 18.1% | |
| 9/9/2011 | 7 | 5400.00 | 463.53 | 28 | 5056.79 | 544.57 | 86.5% | 14.6% | |
| 9/13/2011 | 8 | 5475.00 | 476.84 | 26 | 5045.00 | 568.53 | 76.9% | 6.9% | |
| 9/14/2011 | 10 | 5445.00 | 430.75 | 27 | 5074.44 | 545.95 | 53.7% | 6.8% | |
| 9/15/2011 | 11 | 5457.27 | 412.53 | 28 | 5107.50 | 562.96 | 35.2% | 7.6% | |
| 9/21/2011 | 12 | 5432.50 | 403.43 | 32 | 5126.25 | 534.47 | 37.5% | 8.6% | |

# Report Generation – What to Expect Level 2

# Report Generation – What to Expect Level 3

| Test Method | Value Field | Observed On | Observed By | Comments |
|---|---|---|---|---|
| DB-113-E | Max Density (pcf) | 3/27/2010 | Eric Walston | 03171017-24-S1, Not tested according to procedure - no dry points<br>- EW 6/21/2010 |
| DB-113-E | Max Density (pcf) | 4/28/2010 | Eric Walston | 03171066-16-S1, Not tested according to procedure - only one dry point<br>- EW 6/21/2010 |
| DB-113-E | Max Density (pcf) | 5/1/2010 | Eric Walston | 03171016-51-S1, Tested according to procedure<br>- EW 6/21/2010 |
| DB-113-E | Max Density (pcf) | 5/6/2010 | Eric Walston | 03171016-63, Tested according to procedure<br>- EW 6/21/2010 |
| DB-113-E | Max Density (pcf) | 5/10/2010 | Eric Walston | 03171004-143-S1, Tested according to procedure.<br>- EW 6/21/2010 |
| DB-113-E | Max Density (pcf) | 5/13/2010 | Mark Valdez | 03171017-107-S1, Not tested according to procedure - only one dry point<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 3/27/2010 | Eric Walston | 03171017-24-S1, Not tested according to procedure - no dry points<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 4/28/2010 | Eric Walston | 03171066-16-S1, Not tested according to procedure - only one dry point<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 5/1/2010 | Eric Walston | 03171016-51-S1, Tested according to procedure<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 5/6/2010 | Eric Walston | 03171016-63, Tested according to procedure<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 5/10/2010 | Eric Walston | 03171004-143-S1, Tested according to procedure.<br>- EW 6/21/2010 |
| DB-113-E | Optimum Moisture | 5/13/2010 | Mark Valdez | 03171017-107-S1, Not tested according to procedure - only one dry point<br>- EW 6/21/2010 |

# "Trust but Verify"
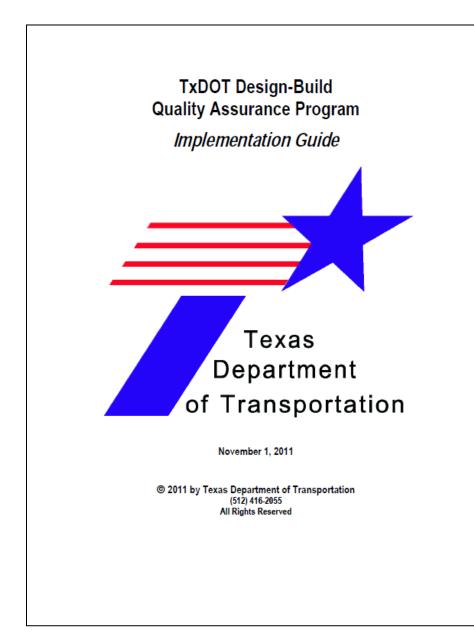
Construction Quality Management Plan

**Table 3.3-1: Typical CQMP Components**
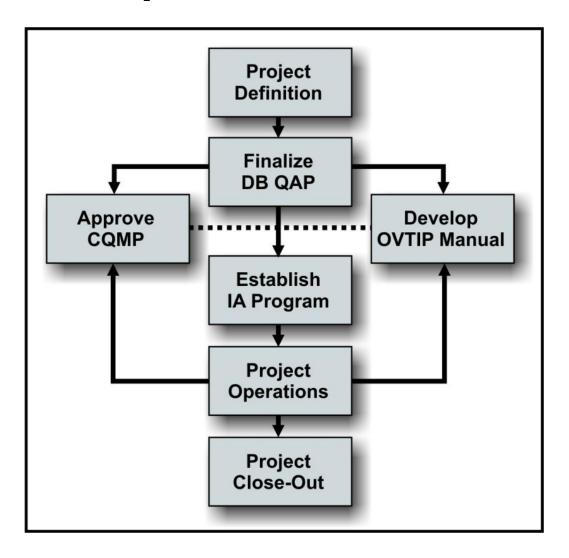
| Section | Description |
|---|---|
| **Volume I** | |
| Introduction | |
| Definitions Acronyms | |
| 1.0 | Responsibilities, Organization, and Staffing Plans |
| 2.0 | Construction Quality Management Plan |
| 3.0 | Contract/Subcontract Reviews |
| 4.0 | Design Control |
| 5.0 | Document and Data Control |
| 6.0 | Purchasing |
| 7.0 | Control of TxDOT- or Developer-Supplied Product |
| 8.0 | Product Identification and Traceability |
| 9.0 | Process Control |
| 10.0 | Inspection and Testing |
| 11.0 | Inspection, Measuring, and Testing Equipment |
| 12.0 | Inspection and Testing Status Reporting |
| 13.0 | Control of Nonconforming Product |
| 14.0 | Corrective and Preventive Action |
| 15.0 | Handling, Storage, Packaging, and Delivery |
| 16.0 | Quality Records |
| 17.0 | CQMP Audits |
| 18.0 | Education, Training, and Certification |
| 19.0 | Statistical Techniques |
| **Volume II** | |
| 1.0 | General QC/QA Procedures |
| 2.0 | General QC/QA Forms |
| 3.0 | QC Procedures |
| 4.0 | QC Forms |
| 5.0 | QA Procedures |
| 6.0 | QA Forms |
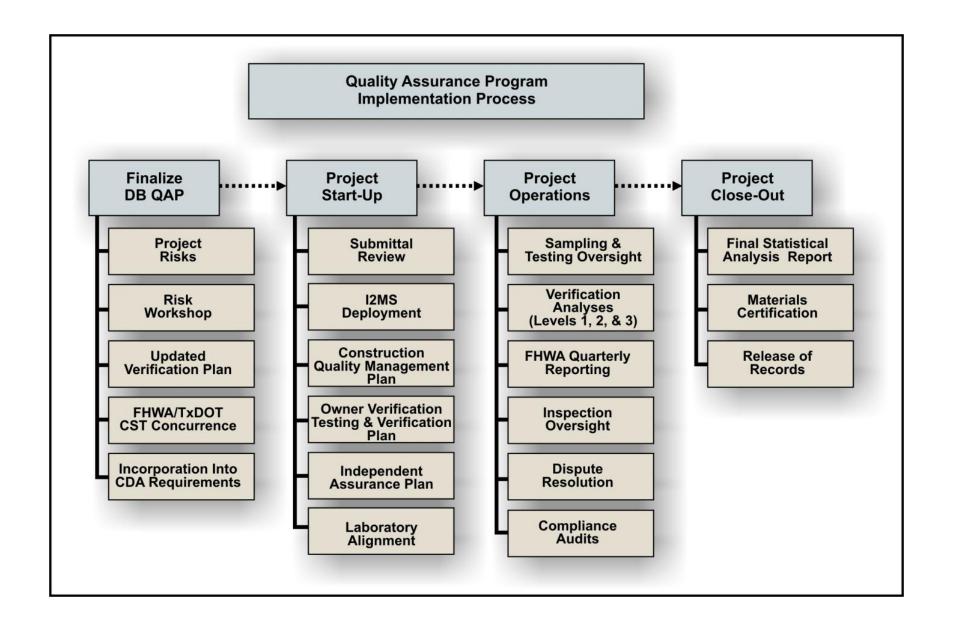
Owner Verification Testing & Verification Plan

TxDOT Design-Build
Quality Assurance Program

*Implementation Guide*

Texas
Department
of Transportation

November 1, 2011

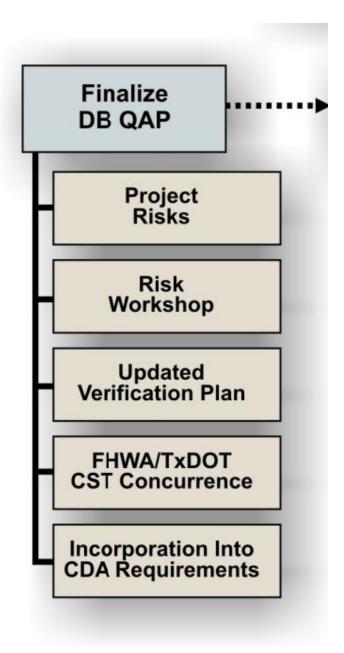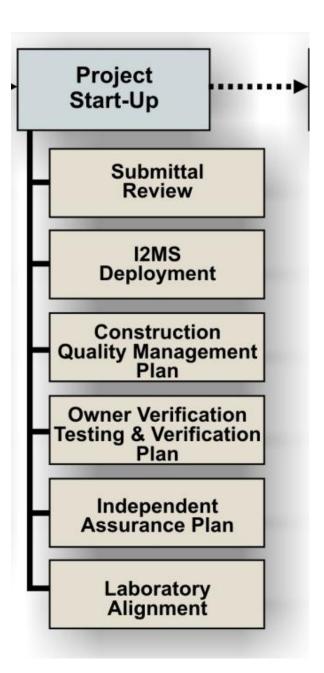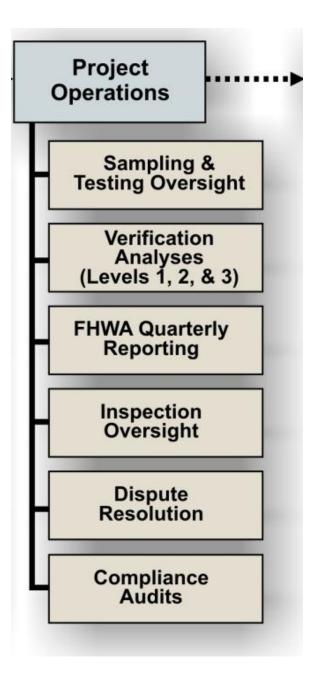© 2011 by Texas Department of Transportation
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Design-Build Quality Assurance Program Implementation Guide

# QAP Implementation Process

Quality Assurance Program Implementation Process

| Finalize DB QAP | Project Start-Up | Project Operations | Project Close-Out |
|---|---|---|---|
| Project Risks | Submittal Review | Sampling & Testing Oversight | Final Statistical Analysis Report |
| Risk Workshop | I2MS Deployment | Verification Analyses (Levels 1, 2, & 3) | Materials Certification |
| Updated Verification Plan | Construction Quality Management Plan | FHWA Quarterly Reporting | Release of Records |
| FHWA/TxDOT CST Concurrence | Owner Verification Testing & Verification Plan | Inspection Oversight | |
| Incorporation Into CDA Requirements | Independent Assurance Plan | Dispute Resolution | |
| | Laboratory Alignment | Compliance Audits | |

# Questions?