Evolution of TxDOT’s Quality Assurance Programs

Design-Bid-Build, Design-Build, and Concession Projects

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Quality Assurance Program (QAP) Components

The QA Program utilizes a combination of quality procedures to meet program goals:

- Quality Control Testing (QC)
- Quality Assurance Testing (QA)
- Owner Verification Testing (OVT) (D-B & Concessions only)
- Referee Testing (RT)
- Independent Assurance Testing (IA)
Definitions

- **Quality Control (QC)** – Internal procedures used by the Contractor, Suppliers, and Subcontractors to ensure that development work meets project plans and specifications

- **Quality Assurance (QA)** – Inspection, testing, auditing, documenting, and reviewing of all materials, operations, and processes

- **Owner Verification Testing (OVT)** – Sampling and testing performed to validate the results of the QA acceptance sampling and testing, using statistical analysis

- **Referee Testing (RT)** – Dispute resolution tests using split samples to resolve testing discrepancies

- **Independent Assurance Testing (IA)** – An unbiased and independent evaluation of the sampling and testing techniques used in the Acceptance Program
High 5 interchange  DESIGN-BID-BUILD (D-B-B)
Baytown Cable Stay
DESIGN-BID-BUILD (D-B-B)
DESIGN-BID-BUILD

Quality Assurance Program Summary

- TxDOT utilizes this project delivery method throughout the state for most of its projects.
- Typically, no contractor QC for acceptance, but will be considered for very large complex projects with compressed construction schedules.
- Acceptance testing performed at Guide Schedule frequency by independent QA laboratory, most cases TxDOT.
- Personnel & equipment must be qualified/certified.
- System approach independent assurance (IA) program – annual personnel & equipment evaluations.
**Quality Assurance Program**

**DESIGN-BID-BUILD**

* Modeled after 23 CFR 637 B and TxDOT Quality Assurance Program

<table>
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<tr>
<th>Independent Assurance Program</th>
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<td><strong>System Approach</strong></td>
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<tr>
<td>Testing personnel and equipment must be qualified under the Quality Assurance Program</td>
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<tr>
<td>Evaluates sampling, testing, personnel, equipment used as a part of the acceptance decision</td>
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<td>Annual evaluations by split or proficiency sample testing</td>
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<td>Performed by Designated IA Laboratory (must be AASHTO accredited)</td>
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<td><strong>Project Testing</strong></td>
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<td><strong>Job Control</strong></td>
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<tr>
<td>(Quality Control) No Location or Frequency defined (Do not require on TxDOT Projects)</td>
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<tr>
<td><strong>Acceptance</strong></td>
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<tr>
<td>Location and Frequency defined in Guide Schedule of Sampling &amp; Testing (random sampling)</td>
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<td>Performed by CSTM&amp;P</td>
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SH 130 segments 1-4
DESIGN-BUILD-MAINTAIN (D-B-M)
Quality Assurance Program Summary

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

- Utilizes Contactor Acceptance testing to manage schedule risk without individual QC/QA specifications
- Developer Construction Quality Management Plan (CQMP)
- Developer/contractor acceptance testing at Guide Schedule frequency by independent Construction Quality Acceptance Firm (CQAF-AASHTO or ISO 17025)
- Owner Verification Testing & Inspection Plan (OVTIP)
- Owner verification testing (OVT) by the Owner's independent OVT testing firm
  - Required by 23CFR637B, complies with FHWA Technical Advisory 6120.3
  - Minimum 10% frequency of QA testing
  - Statistical validation of QA testing using F- and t-testing analysis
  - Quarterly statistical validation report to FHWA
- Dispute resolution (referee)
- Personnel & equipment certification
- System approach independent assurance (IA) program – annual personnel & equipment evaluations
Quality Assurance Program
DESIGN-BUILD

* Ref. 23 CFR 637 B, TxDOT Quality Assurance Program, & TA 6120.3

**Independent Assurance**
- **System Approach**
  - Testing personnel and equipment must be qualified under the project Quality Assurance Program.
  - Evaluates sampling, testing, personnel, equipment used as a part of the acceptance decision.
  - Annual evaluations by split or proficiency sample testing.
  - Performed by Designated IA Laboratory (must be AASHTO accredited).

**Acceptance Program**
- **Project Testing**
  - **Job Control**
    - (Quality Control)
    - No Location or Frequency defined
    - Performed by Contractor.
  - **Acceptance**
    - Location and Frequency defined in Guide Schedule of Sampling & Testing (random sampling)
    - Performed by Independent CQAFLab
  - **Verification**
    - Validates Acceptance Testing using statistical analysis, when contractor’s results used for acceptance.
    - Performed by OVT Laboratory
  - **Referee**
    - As necessary for dispute resolution.
    - Performed by CSTM&P
Original Design-Build Owner Verification Approach

- One Verification Approach
- F- & t- Test Verification on All Analysis Categories
  - Started at $\alpha = 0.05$
  - Updated to $\alpha = 0.01$
- OV Testing Frequency ~ 10% of QA Testing Frequency
- Quarterly FHWA Reporting
Updated Design-Build Owner Verification Approach

- Three-Tiered Verification Approach
  - Level 1: Continuous F- & t- Analyses
    - Almost Real-Time Verification
    - ~10% of QA Test Frequency
    - Allows for $a = 0.01, 0.025, 0.05$ Based on Importance
  - Level 2: Independent Verification
  - Level 3: Observation Verification

- Start-Up and Quarterly Split-Sample Tests

- Quarterly FHWA Reporting
Inspection and Materials Management System (I2MS)

- Owner Verification Application Developed Collaboratively by TxDOT, FHWA, and HDR
  - Testing and Inspection Verification
  - Automated Statistical, Data, and Trend Analysis
  - Web-Based Application
  - Robust Security Features
  - Robust Search Capabilities

- Satisfies All FHWA Requirements
SH 130 segments 5&6
CONCESSION (D-B-F-O)
Quality Assurance Program Summary

- Variation of the “Quality Assurance Program for Design-Build Projects” based on risk analysis on a per project basis
- Developer Facility Management Plan (FMP)
- QC testing by Concessionaire's D-Ber
- Design-Builder Construction Quality Management Plan (CQMP)
- Acceptance testing at Guide Schedule frequency by D-Ber’s Lab (AASHTO or ISO 17025)
- Owner verification testing (OVT) by Independent Engineer (IE) firm
  - Required by FHWA Technical Advisory 6120.3
  - 2–10% frequency of QA testing (frequency based on how much verification the concessionaire is performing)
  - Validation of QA testing using F- and t-test statistical analysis
  - Quarterly statistical validation report to FHWA
- Dispute resolution (referee) & independent assurance (IA) by IE firm
- Personnel & equipment certification
Design-Build vs. Concessions

TRADITIONAL DESIGN-BUILD

TxDOT

Design-Builder

Design Subs

Construction Subs

CONCESSIONS

TxDOT

Financial Markets, TxDOT, and LGs Furnish Money

Concessionaire

Design-Builder

Design Subs

Construction Subs

Independent Engineer
Concession Quality Assurance Structure

- TxDOT Quality Assurance Program
- Facility Management Plan (FMP) Concessionaire
- Construction Quality Management Plan (CQMP) Design-Builder
Quality Assurance Program

CONCESSIONS

Independent Assurance

System Approach
- Testing personnel and equipment must be qualified under the project Quality Assurance Program
- Evaluates sampling, testing, personnel, equipment used as a part of the acceptance decision
- Annual evaluations by split or proficiency sample testing
- Performed by IE Firm (AASHTO Accredited)

Acceptance Program

Project Testing
- Job Control
  - (Quality Control)
  - No Location or Frequency defined
  - Performed by Concessionaire

- Acceptance
  - Location and Frequency defined in Guide Schedule of Sampling & Testing (random sampling)
  - Performed by Concessionaire (AASHTO or ISO 17025 Accredited)

- Verification
  - Validates Acceptance Testing using statistical analysis, when contractor’s results used for acceptance
  - Performed by IE Firm (AASHTO Accredited)

- Referee
  - As necessary for dispute resolution
  - Performed by a different IE Firm (AASHTO Accredited)
Concession Owner Verification Approach

- Three-Tiered Verification Approach Similar to Design-Build Approach
- Modify Analysis Category Level and/or Alpha Table Based for each Concession Project’s specific Risk Profile
  - E.g., Some Level 1 Analysis Categories may be Moved to Level 2
References

- TxDOT Quality Assurance Program for Construction
- TxDOT Quality Assurance Program for Design-Build Projects
- 23 CFR 637 B – Quality Assurance Procedures for Construction
- FHWA Technical Advisory 6120.3 – *Use of Contractor Test Results in the Acceptance Decision, Recommended Quality Measures, and the Identification of Contractor/Department Risks*
- TxDOT’s Quality Assurance Program for Design-Bid-Build
- TxDOT’s Quality Assurance Program for Design-Build
Special Thanks

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Questions?