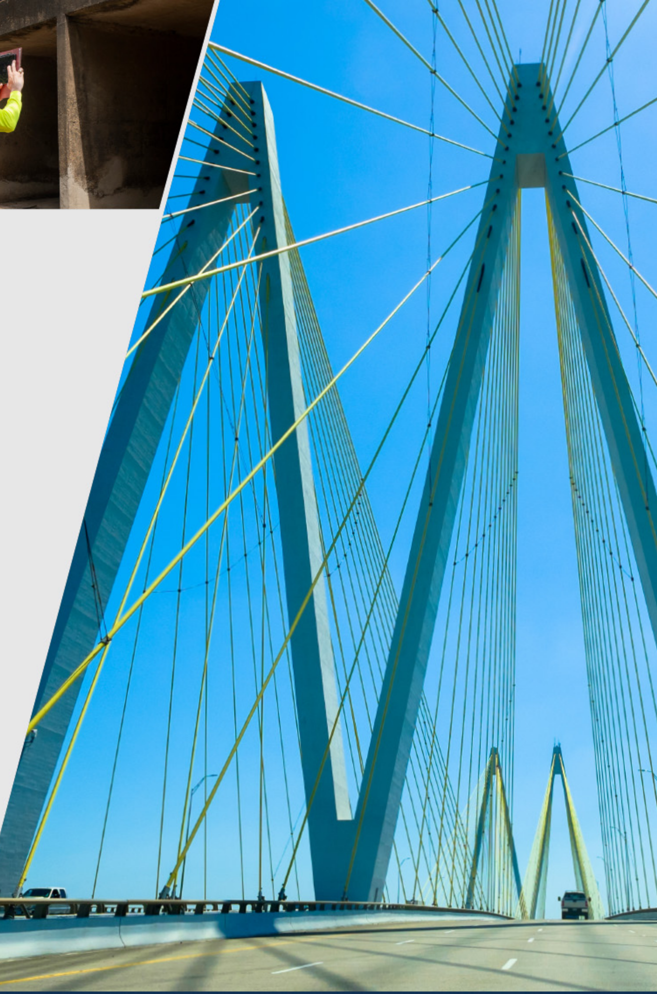


QA/QC Processes and Initiatives

TxDOT Bridge Division

May 17, 2022

Agenda

1. Review of Current Requirements
2. New Areas of Emphasis

QA/QC Process - What does QA/QC mean?

- QA/QC = Quality Assurance/Quality Control
- The process is intended to provide the highest quality products through review and checking by individuals not directly responsible for the initial work product.
- FHWA requires archived bridge design notes

The collapsed 35W bridge in Minneapolis seen on August 2, 2007.
Morry Gash/AP https://media.npr.org/assets/img/2017/07/31/ap_070802042989_wide-c477ec45152142c72ef58abb0b8962d578de97d1.jpg?s=1400

QA/QC Process – Why is QA/QC important?

- Helps to **minimize** errors and omissions
- Design is more **complete** and thorough
- Structure is appropriately **designed**
- **Conform** to policies and procedures
- Helps to deliver **constructible** plans

Complete

↓

Correct

↓

Chronicled

QA/QC Process – Why is QA/QC important?

- Process of checking the accuracy of calculations and consistency of drawings
- Detecting and correcting design errors
- Occurs prior to finalizing design plans and verifying the specifications
- Applies to designs, plans, spreadsheets, reports, etc
- Should be documented according to the TxDOT BRG QA/QC Guide

TxDOT BRG QA/QC Guide

http://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/bus/bridge/qa_qc_guide.pdf

FHWA Did A Limited QA/QC Audit of Bridge Design (Statewide)

- TxDOT Bridge Division is currently working with FHWA on review and improvements to quality control and quality assurance in the design of new bridges and the widening/rehabilitation of existing bridges in Texas
  - Nationally, information is partially synthesized in FHWA's "Guidance on QC/QA in Bridge Design in Response to NTSB Recommendation (H-08-17)" https://www.fhwa.dot.gov/bridge/h0817.pdf
  - TxDOT's policy in
    - *TxDOT Bridge Design Manual – LRFD* Chapter 6 http://onlinemanuals.txdot.gov/txdotmanuals/lrf/lrf.pdf
    - *QC/QA Guide* https://ftp.dot.state.tx.us/pub/txdot-info/library/pubs/bus/bridge/qa_qc_guide.pdf
- Process was Over the Last Year Through the Texas Office
- Six General Takeaways

Six General Outcomes/Recommendations

- 1: Independent Design Checks (IDC) for complex structures
- 2: Consultant QC Processes on File
- 3: Some Projects Lacking QC Coversheets or Not Filled Out Properly
  - QA Verifications
  - Includes “standard” bridges
- 4: QC Coversheet Consistency
  - Varied among consultants
  - Address design calcs and detail checks
- 5: Titleblocks filled out on detail sheets including bridge layouts
- 6: Designer and checker initials on all design calc packages

Independent Design Check (IDC) Requirements

- Complex Structure Definition (Draft)
  - Bridges having a difficult or unique foundation problem
  - Bridges with exceptionally long span (> 300 or 350 ft)
  - New or complex designs with unique operational or design features such as:
    - Cable-stayed
    - Suspension
    - Arch
    - Post-tension box girder
    - Segmental concrete
    - Moveable bridges
    - Truss bridges

Independent Design Check (IDC) Requirements DRAFT

- In addition to the QC/QA process when designing ordinary bridges:
  - IDC to validate complex or unique bridges that are pedestrian, rail, and vehicular and either impact a TxDOT facility or are owned by TxDOT
  - Independent verification of the design using different analysis and design software packages than what was used during initial design
  - All outstanding or unresolved comments shall be resolved prior to submittal and acceptance of 100% signed/sealed plans
- IDC shall be
  - Performed by an engineering firm independent from the engineer responsible for the initial design
  - Performed by an engineering firm having no other project involvement
  - Performed by an engineer precertified in work category 5.2.1 Bridge Design
  - Designated by TxDOT for both Design-Build and Design-Bid-Build

Consultant QA/QC Processes on File

- Considering requiring having the firm's general current documented QC/QA process on file
- Effectively this would be an additional requirement to perform structural design for TxDOT beyond the precertification process
- Information would be treated as confidential, as we recognize these processes vary somewhat and represent substantive development and performance attributes of our providers
- Will need to be in consultant contracts

QA/QC Guide:

Consultant Prepared Plans

For consultant-prepared plans, the consultants are required to submit their Quality Control Plan in writing prior to starting work or as otherwise directed in the contract. TxDOT reserves the right to review the consultants' quality control process.

QA/QC Coversheets

- Need to consistently have on design notes packages
- Need to have completely filled out
- Potential need for a consistent form (range of consultants, TxDOT, etc)
- Checking of calculations <u>and</u> details
- Include for standards bridges
  - Geometry
  - Foundation design notes
- We will be discussing if we need to go to a statewide form over the next months

TXDOT BRIDGE DIVISION		
	County:	Hamilton
	C-S-J:	0002-01-030
	Highway:	SH 106
	Project:	SH 106 at FM 20

Group Leader (Approval for Release): Rob Thompson

Date:

Calculations

Structure	Component	Design Engineer Assigned	Software Used	Software Version	Checker Assigned	Design Engineer Prepared Initial	Design Engineer Prepared Date	Checker Checked Initial	Checker Checked Date	Design Engineer Corrected Initial	Design Engineer Corrected Date	Checker Verified Corrections Initial	Checker Verified Corrections Date
SH 106 at FM 20	Geometry/Framing Plan	Charlie Brown	BGS		Elizabeth Tudor	CCB	12/05/19	EIT	01/05/20	CCB	01/08/20	EIT	01/19/20
SH 106 at FM 20	Superstructure	Charlie Brown	BridgeLink	5.0.2	Elizabeth Tudor	CCB	12/05/19	EIT	01/05/20	CCB	01/08/20	EIT	01/19/20
SH 106 at FM 20	Bent and Abutments	Charlie Brown	Cap 18		Joseph Strauss	CCB	12/25/19	JBS	01/17/20	CCB	01/18/20	JBS	01/19/20
SH 106 at FM 20	Columns	Charlie Brown	RISA 3-D	17.0	Joseph Strauss	CCB	12/25/19	JBS	01/17/20	CCB	01/18/20	JBS	01/19/20

Checker's Comments

- ☐ No Changes
- ☐ Revise Design as shown
- ☑ Other Comments/Conclusions
- ☑ Minor corrections: original design satisfactory

Missing Bearing Pad Calculations

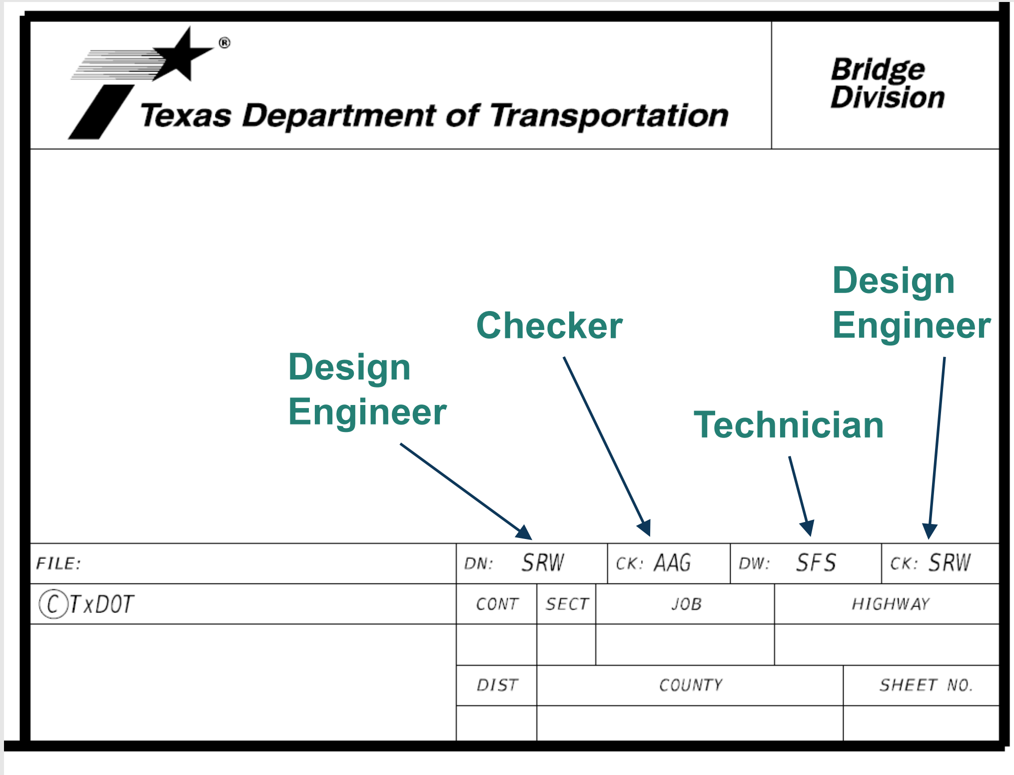
Details

Structure	Component	Bridge ID#	Technician Assigned	Technician Prepared Initial	Technician Prepared Date	Design Engineer Checked Initial	Design Engineer Checked Date	Technician Corrected Initial	Technician Corrected Date	Design Engineer Verified Corrections Initial	Design Engineer Verified Corrections Date
SH 106 at FM 20	Spans	7864	Issac Newton	ISN	12/12/19	CCB	1/20/20	ISN	1/25/20	CCB	1/26/20
SH 106 at FM 20	Substructure	7864	Issac Newton	ISN	12/30/19	CCB	1/20/20	ISN	1/25/20	CCB	1/26/20
SH 106 at FM 20	Layout	7864	Taylor Swift	TAS	12/05/19	CCB	1/02/20	TAS	1/03/20	CCB	1/03/20

The calculations specifically identified above have been completed by me or under my responsible supervision.

Checking of Bridge Layouts

- See Detailing Guide Update and presentation
- Need designer/technician/checker/detail check boxes on bridge layouts and need them filled out
- Multi-disciplinary review essential
  - Roadway design…e.g. does the layout match the P&P
  - Bridge design…consistency with structural details, etc.
  - Hydraulics…e.g. does the bridge info match the Hydraulic Data Sheet, frequency & freeboard?, etc
  - CHECKLISTS



Designer and Checker Initials in All Calculations

- Checker initials and checks clearly identified in calculations

unch Calculations

	Design:	HIJ	Date:	2/6/2015
y	Ck Dsn:	ABC	Date:	2/14/15
	Version:	1.08	ID #:	9999
d Bridge			Sheet:	of
			Units:	E

Input

1-4	5	5	9-10	9-10	
142	142	142	150	150	
2-5	1 &6	2-5	1 &7	2-6	
4	2	4	2	5	
8	8	8	8	8	
Tx62	Tx62	Tx62	Tx62	Tx62	
62	62	62	62	62	
42	42	42	42	42	
2.75	2.75	2.75	2.75	2.75	
0.356	0.356	0.356	0.334	0.334	
0.249	0.218	0.249	0.246	0.259	
0.02	0.02	0.02	0.02	0.02	
0	-0.04	-0.04	0	0	

HIJ ✓0.26

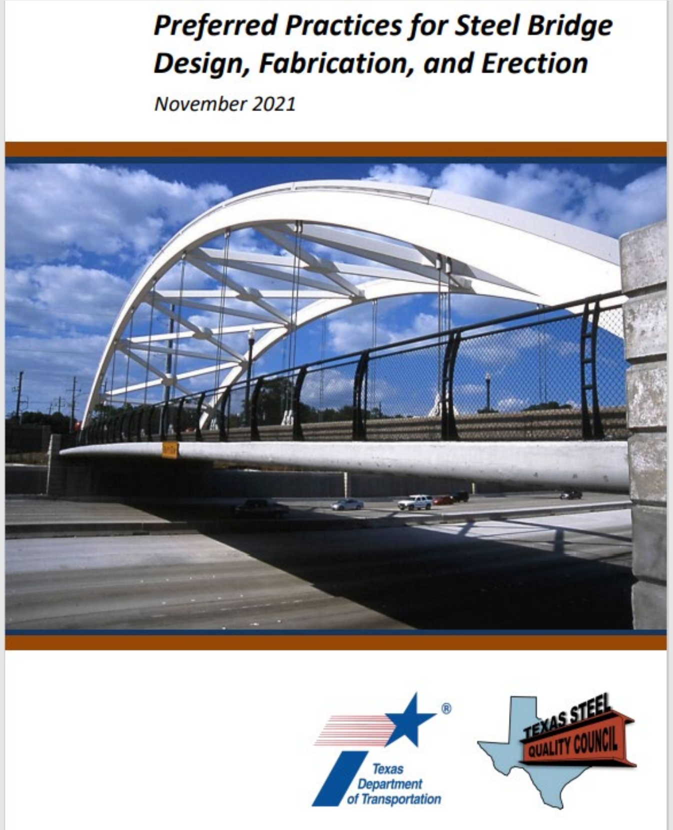
Some QA/QC Issues

- **Quantity Calculations and Missing Items**
  - Make sure you understand the spec book, unique pay items, and how work is paid
  - Substructure pay items expanded recently
  - AGC Structures Committee feedback…book-keeping not the greatest, causes ambiguity for bid day
  - Very likely change order scenario

BID ITEM / BID CODE	0400 6005	0403 6001	0403 6006	0405 6002	0409 6003	0420 6014	0420 6032
BID ITEM DESCRIPTION / BRIDGE ELEMENT	CEM STABIL BKFL	TEMPORARY SPL SHORING	TEMPORARY SPL SHORING (COFFERDAM)	FOUNDATION LOAD TEST (D4945) (PILE)	PRESTR CONC PIL (20 IN SQ) 5	CL C CONC (ABUT)(HPC)	CL C CONC 1 (CAP)(HPC)(MASS)
	CY	SF	SF	EA	LF	CY	CY
2 - ABUTMENTS	460			3	2189	168.9	
12 - INTERIOR BENTS		7416	3648	18	31179		1026.3
1 - 280.00' PRESTRESSED CONC. I-GIRDER UNIT							
1 - 357.00' PRESTRESSED CONC. I-GIRDER UNIT							
1 - 537.00' CONT. PRESTR. CONC. SPL. GIRDER UNIT							
1 - 124.47' PRESTRESSED CONC. I-GIRDER UNIT							
1 - 451.00' CONT. PRESTR. CONC. SPL. GIRDER UNIT							
1 - 140.00' PRESTRESSED CONC. I-GIRDER UNIT							
OVERALL TOTALS:	460	7416	3648	21	33368 5	168.9	1026.3 1

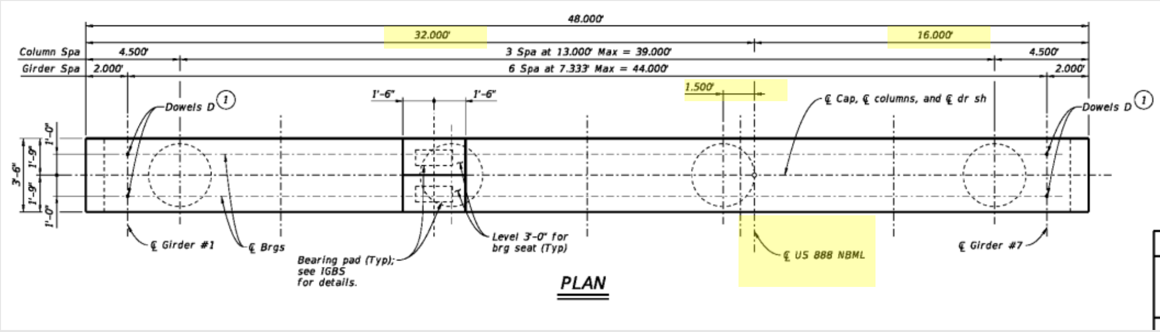
Some QA/QC Issues

- **Steel Bridges**
  - Steel Bridge Reviews in Bridge Division
  - Follow Preferred Practices Document
  - See Texas Steel Quality Council Presentations: Texas Steel Quality Council (txdot.gov)
  - Short Course 2021 Presentation: Steel Bridge Preferences and Fracture Critical Structures Oct 2021 Short Course
  - 30/60/90%
  - Example issues:
    - Designer consideration of erection constraints
    - Efficient designs, balanced designs
    - Diaphragm layout, especially for skewed bridges
    - Horizontal bracing (when needed…rare)
    - Camber curves



Some QA/QC Issues

- Geometry, Geometry, Geometry
  - If things don't fit or line up, you will see it in construction
  - Bridge Layout checklists
  - Verify any alignment or profile changes at/near final delivery
  - BCS sheets…call out geometry needs to match physical conditions



Some QA/QC Issues

- Project General Notes and Specifications
  - Ensure you review 400 series general notes, especially in situations for unique corrosion countermeasures
  - Master general notes in Districts might not cover nuanced structure items for your project

Project Number: **Sheet: 9**

County: MATAGORDA **Control: 0605-01-060**

Highway: FM 457

ITEM 426: POST-TENSIONING

Field mockup tests are required for post-tensioning operations. The field mockup tests should be performed in advance of production grouting. Provide the design engineer a written plan at least 4 weeks in advance of the mockup for approval. The plan must include test setup, materials, ducts, inlets, outlets, anchorages, pre-stressing elements, grouting and dissection procedure.

ITEM 427: SURFACE FINISHES FOR CONCRETE

Provide Surface Area I with the following finishes: Slurry Coat Finish per 427.4.3.2 for cast-in-place concrete surfaces, and Opaque Sealer per 427.4.2.2.3 for precast concrete surfaces. Unless otherwise directed by the Engineer, propose a color for Opaque Sealer that closely matches that of the Slurry Coat Finish. Conduct limited applications on a sample section of concrete for final approval of the color of the Opaque Sealer.

ITEM 432: RIPRAP

Place 1/2 inch expansion joint material between the two concrete areas or structures where riprap is placed against other concrete such as concrete pavement and structures unless otherwise shown on the plans or as directed. This work will not be paid for directly but will be subsidiary to the pertinent items.

Unless otherwise shown on the plans or directed, riprap will be 5" deep and reinforced; reinforced toewalls 6" wide and 12" deep will be placed around the perimeter of each location.

ITEM 440: REINFORCEMENT FOR CONCRETE

Provide corrosion resistant reinforcing as indicated in the plans.

ITEM 454: BRIDGE EXPANSION JOINTS

Paint all faces of Sealed Expansion Joints (including the face anchored into the concrete) with System II Primer in accordance with Item 446. After installation of joint seal, coat exposed steel surfaces with Epoxy Intermediate and finally a Urethane Appearance Coat.

General Notes Sheet I

Project Number: **Sheet: 9**

County: MATAGORDA **Control: 0605-01-060**

Highway: FM 457

ITEMS 464 & 467: REINFORCED CONCRETE PIPE & SAFETY END TREATMENT

If required, concrete collars, as approved, will be used at pipe joints. Collars will be reinforced as directed. No direct compensation will be made for concrete collars and they will be subsidiary to the pertinent items.

ITEM 467: SAFETY END TREATMENT

Precast safety end treatment sections will not be allowed.

Provide reinforced concrete riprap for all pipe safety end treatments. Round corners on safety end treatment riprap to a minimum 12 inch radius as directed. The riprap will not be paid for directly but will be subsidiary to Item 467.

Provide and use a form along the cut end of the pipe when placing the adjacent reinforced concrete riprap for pipe safety end treatment sections.

⚠ **ITEM 496: REMOVING STRUCTURES**

Remove the existing swing bridge, aprons, fender system, dolphin system, control house septic system, and any other existing items as shown in the plans unless otherwise directed. This work is considered subsidiary to Item 496, "Removing Structures".

Remove all debris within the limits as shown on the "Bridge, Bridge Substructure, and Fender Piling Removal" sheet a minimum of two feet below the natural bottom of the waterway. This work is considered subsidiary to Item 496, "Removing Structures".

⚠ REVISED 7/11/17

General Notes Sheet J

Questions?

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