

Quality Assurance Reviews for Local Agency Bridges

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MDOT



Bridge Week

March 12, 2024

Today's Agenda

- Background and purpose for QA review program
- Overview of general QA review process
- Review of initial findings and trends

Purpose

- I-35W bridge failure in Minneapolis, Minnesota, August 2007
- NTSB Investigation revealed design flaw in gusset plate. QA process failed to reveal the error.
- FHWA Process Review for Local Agency Bridge Design. Draft Report October 2020



Purpose

- FHWA Process Review for Local Agency Bridge Design.
 - Findings
 - Missing, incomplete or non-conforming design guidance and calculations
 - Examples
 - Fascia beam design
 - Pile designs / scour depths
 - Hydraulic Models missing
 - Abutment and deck reinforcement

Purpose

- FHWA Process Review for Local Agency Bridge Design.
 - Recommendations
 - Prequalification for Local Agency Design Consultants
 - Develop QA/QC checklists for local agencies
 - Third Party review of designs
 - Training

QA Review Process

- Review of Design and Quantity Calculations
 - In addition to normal review of Plans, Specs & Estimate
- Previous LA reviews were after design and construction
- This review takes place during design development
 - Have time to incorporate comments
- Program is in addition to the projects own QA/QC process
 - This does not replace normal QC processes



QA Review Process

- Goal is to NOT impact your project schedule
- Review will work around your milestones
- Also need review material in a timely manner

Local Agency Programs (LAP) FY 2024 Project Planning Guide June 2023										
	LOCAL AGENCY SUBMITS ITS SECTION 106 and NEPA DOCUMENTATION (MDOT FORM 5323) TO LAP ENVIRONMENTAL, 2.4 MONTHS BEFORE GI SUBMITTAL. DATES SHOWN ARE APPROXIMATELY 4 MONTHS PRIOR TO GI SUBMITTAL DATES	FOR BRIDGE PROJECTS, LOCAL AGENCY SUBMITS TYPE, SIZE, AND LOCATION (T&E) DOCUMENTS WHEN REQUIRED, TO LAP		LOCAL AGENCY SUBMITS ITS ACCEPTABLE GRADE INSPECTION (GI) DOCUMENTS TO LAP	APPROXIMATE GRADE INSPECTION (GI) MEETING DATE		LOCAL AGENCY SUBMITS ITS FINAL PROPERTY ACQUISITION CERTIFICATION (ATTACHMENT B)	LOCAL AGENCY SUBMITS ITS COMPLETE BIDDABLE PACKAGE TO LAP	LAP FORWARDS FINAL BID PROPOSAL PACKAGE TO SPECS & ESTIMATES	LETTING DATE
<p>LA begins Project Design, requests ProjectWise (PWZ) folders, contacts LA Environmental for Section 106 consultation, prepares NEPA Form 5323 and documents, and places them in PWZ between 2 and 6 months before GI submittal.</p> <p>LA also begins utility notification and coordination, coordination with railroads if applicable, coordination with MDOT for traffic and pedestrian signal work, permit application, property acquisition, etc.</p>		04/10/23	<p>LA places GI documents in ProjectWise, including Program Application Requests for design exceptions or variances, recent 3-year crash history and analysis, Diagonal parking study and analysis, Diagnostic Safety Team Review for rail crossings, and similar documentation, and notifies LAP staff engineer. LA addresses Section 106 and NEPA Form 5323 review comments</p>	05/15/23	06/14/23	<p>LA completes section 106 and NEPA coordination, addresses GI review comments; prepares final plans, special provisions, and cost estimates; obtains property, permits, and approvals; places all documents in ProjectWise, and emails the LAP staff engineer</p>	07/14/23	07/28/23	08/18/23	10/09/23
		05/08/23		06/12/23	07/12/23		08/11/23	08/25/23	09/15/23	11/03/23
	03/13/23	06/05/23		07/10/23	06/09/23		09/01/23	09/15/23	10/13/23	12/01/23
	04/10/23	07/03/23		08/07/23	06/09/23		09/29/23	10/13/23	11/10/23	01/09/24
	05/01/23	07/24/23		08/28/23	06/27/23		10/27/23	11/10/23	12/08/23	02/02/24
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	12/11/23	03/04/24		04/06/24	05/08/24		06/07/24	06/21/24	07/19/24	09/09/24
	01/08/24	04/01/24		05/06/24	06/05/24		07/05/24	07/19/24	08/16/24	10/04/24
	02/05/24	04/29/24		06/03/24	07/03/24		08/02/24	08/16/24	09/13/24	11/01/24

QA Review Process

- Project selection and assignment – After TS&L approval
- Selecting a variety of project types
 - Bridge Replacements
 - Culvert Replacements
 - Superstructure Replacements
 - Rehabilitation projects
- Variety of agencies
- Variety of designers



QA Review Process

- QA review can begin at GI Phase
- The earlier the better
 - Helps expedite the review
 - Helps flush out comments/questions earlier in the project
- Provide materails that are ready at this stage:
 - Hydraulic and scour analyses
 - Geotechnical investigation, foundation report
 - Bridge Load Rating



QA Review Process

- Review at Final Plan Stage
 - Final design calculations (e.g. tremie, foundation, substructures, beams)
 - Quantity calculations (e.g. steel reinforcement, concrete , road items)
 - Documentation of QA/QC (Design criteria, assumptions, qualifications)
 - QA/QC form for Programming Application
- Calculation files
 - Send via email or Project Wise for larger files
 - Package can be one pdf file or individual per each design
 - Bookmarking pdf files and file naming to help keep track



QA Review Process

- Reivew at Final Plan Stage
 - Check calculations are provided for all components and signed off
 - Quantities for all items
 - Check calculations are following appropriate codes and standards
 - Spot checks to verify calcs are correct
 - May do independent check to confirm a particular design
 - Check of the calculations to the plans & specs
 - Check of design across disciplines
 - Bridge, Road, Hydraulics, Geotechnical, Etc.



QA Review Process



- Review at Final Plan Stage
 - Geotechnical Engineers review foundation designs, reports, plans
 - Hydraulic Engineers and Road Engineers also participate in reviews
 - Comments provided via spreadsheet
 - Markups may be provided to supplement the comments
 - Responses documented
 - Any updates to calculations, plans, etc. provided for back checking
 - Can meet for any specific comments that require discussion
 - Finalize review by final plan submittal



QA Review Process

- 5 Projects reviewed to date
- 2-4 projects planned for review in 2024
 - Pending project that are submitted and when
- Reviews to continue through 2027
- Focus on finding trends and areas for improvement



Findings

- Hydraulic and Scour Analyses
 - HEC-RAS or HY-8 models reviewed by staff that are prequalified for work with MDOT's Hydraulics Unit
 - Replacement projects typically have larger waterway areas. Still important to have accurate models to use for scour analysis.
 - MDOT Hydraulics does not accept HEC-RAS for scour analysis.
 - Follow MDOT Drainage Manual Chapter 6 for scour analysis (use HEC-18)



Findings

- Hydraulic and Scour Analyses
 - Superstructure replacement projects also need to be evaluated for hydraulics and scour, especially if;
 - Flood events overtopping the roadway
 - Bottom of beam elevations are reduced (or other features)
 - Documentation needs to include names and qualifications for staff performing and checking hydraulic and scour analyses.



Findings

- Geotechnical Investigation
 - Geotechnical Report and analyses reviewed by subconsultant prequalified for work with MDOT's Geotechnical Unit
 - Geotech investigation and report are often provided by subconsultant.
 - Need to coordinate with scour analysis results for design of pile depths
 - Design assumptions need to be documented, especially if they vary from AASHTO and/or MDOT guidelines



Findings

- Geotechnical Investigation
 - Document changes from original report to amended report
 - Culvert Replacement projects should have soil borings to evaluate poor soils and groundwater conditions
 - Documentation needs to reference Geotech report or staff performing and checking geotechnical analyses and design



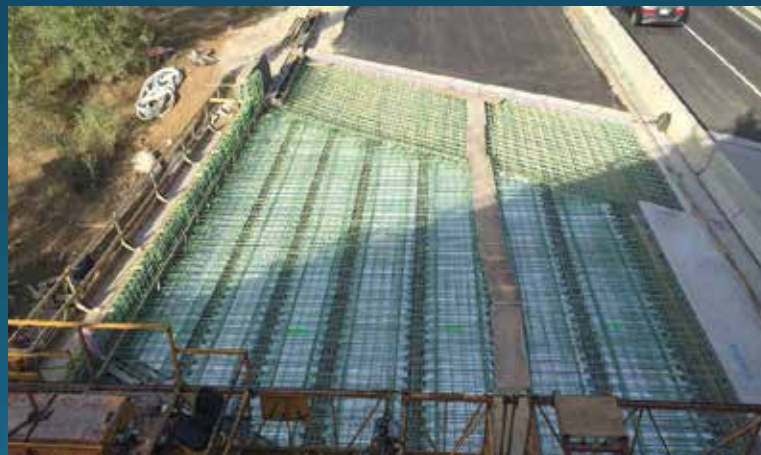
Findings

- Design
 - Select key design elements for checking
 - Checking calculations provided or perform independent calculations
 - Example – Tremie design for deep water foundations
 - Verify design note for tremie matches calculations
 - Verify area of tremie includes sheeting beyond neat lines



Findings

- Quantities
 - Select major bid items for checking
 - Checking calculations provided or perform independent calculations (AI tools)
- Example – Steel Reinforcement
 - Check bar counts (top and bottom, each side, etc)
 - Check bar weights
 - Check totals from spreadsheets (looking for missing lines)



Findings

- Special Provisions
 - Review for all projects (not just QA/QC reviews)
 - References for MDOT 2020 Standard Specifications for Construction
 - Pay item description needs to match Exactly to items in estimate and on plans
 - Abbreviations, Capital and small letters, no symbols (&)
 - Request that when changes are made that date of SP be updated.
 - Design file should include documentation of author and checker of SP

20RC710(A285)

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
CONCRETE SURFACE COATINGS

STR:JAB 1 of 3 APPR:SCK:RL:03-31-21

a. Description. This work consists of furnishing and applying an acrylic based concrete surface coating to concrete structures, including but not limited to barriers, median barriers, sound walls, screen walls, retaining walls, fascias, wing walls, piers and substructure locations as specified on the plans. Ensure all work and materials are in accordance with the standard specifications, except as modified herein.

b. Materials. Select the acrylic based concrete surface coating from the products listed herein.

The color(s) to be used for the concrete surface coatings and the location(s) of the specific colors are on the plan sheets. Ensure the color of the first coat is in contrast with both the bare concrete and the finish coat. On any single structure, use the same product for all areas to be coated with a specified color. Do not mix colors or products from more than one source.

Findings

- Plans
 - Follow MDOT Bridge Design Manual (BDM) for plan composition and notes
 - Pay items to match MDOT Standard Specs and unique Special Provisions
 - Example – Slab and Screed Tables per BDM 3.04.01, 7.02.22 and 8.07.04
 - Provide elevations on final plans
 - Determines haunches and bearing elevations
 - Quicker response to changes during construction

MICHIGAN DESIGN MANUAL BRIDGE DESIGN

8.07.04

Screed Notes

- Bottom of slab elevations (are at right angles to the beam centerline and*) are based on the condition that the beams and diaphragms are completely erected with no other loads applied. (No temporary supports are allowed at this time.) These elevations include allowance for vertical curve and deflection due to forms, steel reinforcement, concrete slab, (sidewalks, railing) (barrier) and utilities. [*Use when dual bottom of slab elevations are shown.]
- If screeds are affected by loads in other spans, set to the elevations shown before casting any concrete. Cast concrete in the suspended span(s) before the concrete in the anchor spans.
- Screed elevations are based on the condition that no slab concrete has been cast and that formwork (shear developers) and steel reinforcement are in place (and the temporary supports are brought to a snug fit under each beam).

8.07.04 (continued)

- Stage A is beams and diaphragms erected with no other loads applied. [For use with top of beam elevations.] (9-1-1988)
- Stage B is forms and steel reinforcement in place (all spans complete). [For use with top of beam and bulkhead elevations.] (9-1-1988)

8.07.05

Deck Replacement Notes (4-19-2021)

- Obtain the Engineer's written approval for proposed sequence and methods of removal before removing portions of the bridge superstructure according to Subsection 712.03 of the Standard Specifications.
- If removal operations result in damage to the retained portions of the structure, submit a corrective action plan to the Engineer according to Subsection 712.03 C. of the Standard Specifications. (9-18-1998)

Findings

- Documentation
 - Use checklists with definition of roles and phases of design
 - Include names and initials for designer, checker and QA reviewers
 - Include references, design criteria, design loading, special issues
 - Include responses to reviews by internal or external QA reviews
 - Include information for associated elements (subconsultant or staff)
 - Hydraulics
 - Geotechnical
 - Load Rating

Questions?

