Quality Assurance Reviews for Local Agency Bridges

Mario Quagliata, Colliers Engineering & Design
Kim O'Rear, OHM Advisors

OHM Advancing Communities®

Colliers Engineering & Design

MDOT

Bridge Week

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Today's Agenda

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

QA Review Process

- New process started in 2022
  - In addition to normal review of Plans, Specs & Estimate
  - Review of Design and Quantity Calculations
  - 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

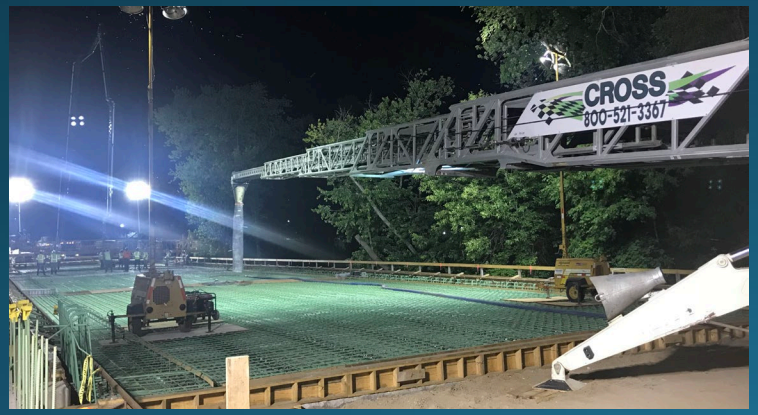
- Project selection and assignment – After TS&L approval
- Selecting a variety of project types
  - Bridge Replacements
  - Culvert Replacements
- Variety of agencies
- Variety of designers

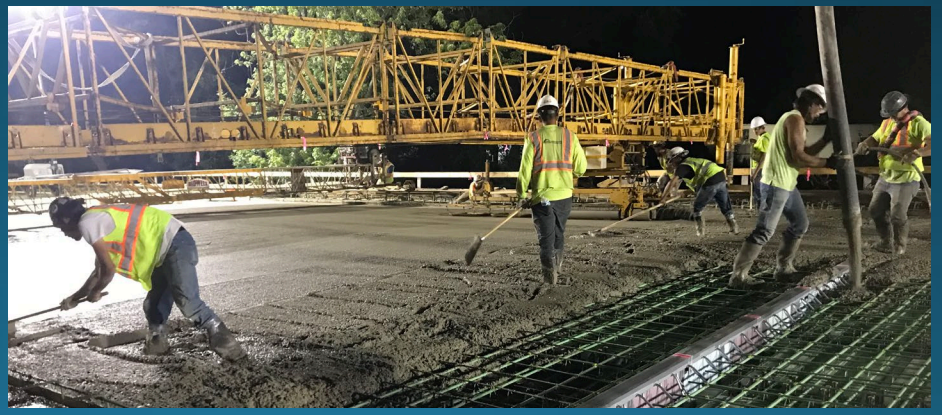
QA Review Process

- 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 materials 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

- 6 Projects reviewed to date
  - 4 Bridge Replacements
  - 2 Culverts
- 2-4 projects planned for review in 2025
  - 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
  - Boring depth 10' min below estimated pile tip
  - 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 preforming 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

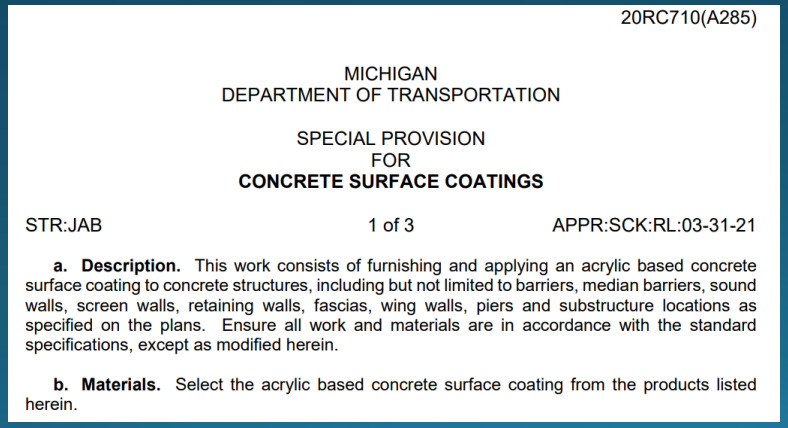
- Design
  - Follow MDOT BDM Guidelines for prestressed concrete strength
    - 7 ksi max at release
    - 8 ksi max 28-day strength
  - Load Rating
    - Check shear for P/S beams (not checked by default)
  - Guardrail
    - Provide calc for each run
    - Ensure new guardrail items are MASH compliant

Findings

- Quantities
  - Select major bid items for checking
  - Ensure all structure lump sum items include SN in the item name
  - 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)
  - Pay item description needs to match Exactly to items in estimate and on plans
    - Abbreviations, Capital and small letters, no symbols (&)
  - All "7000" items have an associated unique, previously approved, or FUSP
  - 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

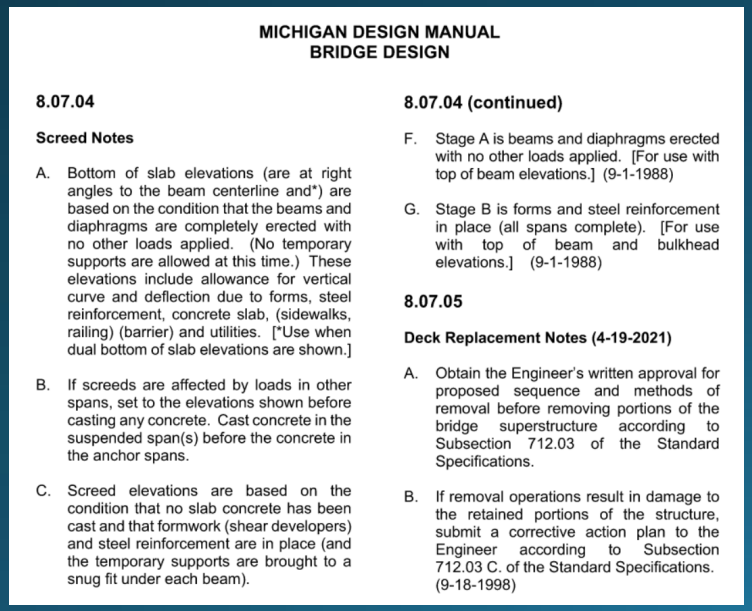
STR:JAB 1 of 3 APPR:SCK:RL:03-31-21

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.

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

A. 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.]

B. 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.

C. 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)

F. Stage A is beams and diaphragms erected with no other loads applied. [For use with top of beam elevations.] (9-1-1988)

G. 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)

A. 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.

B. 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?


WEIGHT LIMIT
16 T
24 T
40 T
WEIGHT LIMIT 3 TONS
END WEIGHT LIMIT
4-H CLUB MEMBER
LIVES HERE
NFO
COLLECTIVE BARGAINING