2019 Iowa Transportation Conference

Iowa DOT Bridges and Structures Bureau Update

Michael Nop

September 11, 2019

Presentation Outline
- BSB Personnel
- Summary of Work
- AMP
- Bridge Standards
- Design Policy
- Specifications
- Construction Issues
- Research

Bridges and Structures Bureau Personnel

Consultant Coordination Unit
- Ron Meyer - Unit Leader
- Tim Dunlay
- Steve Maifield
- Christian Yi
- Vacant – <Karen Kontos retired>
- Consultant supplements

Methods Unit
- Jesse Peterson - Methods Engineer/Unit Leader
- Jim Denny - Design Support Engineer
- Kimball Olson - Aesthetic Bridge Specialist
- Brett Kloss - Methods Detailer

Accelerated Migration Program (AMP)
- Bentley’s program to assist DOTs to migrate to CONNECT edition applications
- Includes migration to Microstation CONNECT and OpenRoad Designer with implementation of OpenBridge Designer, ProStructures and ConceptStation for Iowa DOT
- Initial workspace development July through December 2019
- Pilot projects start December 2019 to determine any adoption blockers, test the proposed workspace standards and develop new workflows
- December 2019 beta version of workspace to be released to consultants for information only

Program Highlights
- Microstation CONNECT – new ribbon interface, integrated search and 64 bit platform
- OpenBridge Designer – combines modeling capabilities of OpenBridge Modeler and the analysis and design features of LEAP Bridge Concrete and LEAP Bridge Steel into one comprehensive bridge product
- ProStructures – BIM software comprising of ProSteel and ProConcrete allowing creation of accurate 3D models for structural steel and reinforced concrete structures with integrated tools for design drawings, fabrication details, and schedules

Primary and Interstate
Construction Cost - Bridge & Culvert Bid Items
(Millions)

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<th>FY16</th>
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FY16 18 82
FY17 8 92
FY18 20 80
FY19 20 80
FY20 19 81
FY21 21 79
Implementation Dates
- February 2020: All new Survey information to be developed in OpenRoads Designer
- July 1, 2020:
  - All projects where design development has not started will be developed in OpenRoads Designer.
  - Use of OBD and Prostructures workflows will be expected.

Proposal for Active Projects
- Letting date of January 2021 or earlier finish in software version design was started with.
- Letting date of July 2021 and later will be converted and completed in OpenRoads Designer.

All dates tentative and subject to change.

CIP and Precast Box Culvert Standards
- CulvertCalcA software update (latest version not yet available on website)
- ET Culvert used for precast box culvert updates
- Lap and development length updates for all existing culvert standards
- New CIP and Precast Single Box Culvert Sizes:
  - Span x Height 14" x 4" to 14" x 14" and 16" x 4" to 16" x 14"
- New(ish) Flared Wing Headwalls for CIP Single Box Culverts
- New Parallel Wing Headwalls for CIP Twin and Triple Box Culverts
- CIP and Precast Pedestrian Tunnel Standards
  - CIP 12" x 11.33" 12" x 12.33" 14" x 12.33" no bottom corner frost troughs
  - Precast 12" x 11" 12" x 12" 14" x 12" no bottom corner haunches
  - CIP flared wing headwalls with concrete texture and safety rails, 0 degree skew
  - Conduit and lighting

PPCB Standards
- Phase 1 – BTB, BTC, BTD, BTE update
- Preliminary development of a BTF beam
- Excel worksheet for PPCB design (to be made available on website)
- Lap and development length updates in beams based on ECR
- Rail updates required
- Increased deck thickness (i.e. 8.50")
- Eliminate intermediate concrete diaphragms and heavy steel diaphragms
- Camber based on ISU research

Three Span CCS Bridge Standards
- MASH Compliant Products
- Otherwise: Choose the Best Product Available

Bridge Barrier Rail
Three Tiered Approach
- MASH Compliant Products
- NCHRP 350 Compliant Products
- Otherwise: Choose the Best Product Available
Primary items to consider in order to comply with our MASH policy:
1. FHWA memos and crash tests for rail options.
2. Available in-service records.
3. Adoption by other states and their feedback.
4. Long term rail maintenance.
5. Other safety considerations such as sight distance.
6. Incorporation of rail in bridge and roadway design standards.
7. Affect of rail choice on projects under development.

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**Deck Pour Sequences (another look)**

**Construction Manual, Chapter 11.62 Sequence of Pouring**
https://iowadot.gov/erl/current/CM/content/CM%2011.60.htm

**Continuous Steel Girders**

Since the beams of this structure are continuous over the piers, upward deflection can be transmitted to span 2 during concrete placement in span 3. Therefore, it is important for the concrete to remain plastic in the major portion of span 2 until placement is complete throughout the positive moment section of span 3. Experience indicates that stress cracking will not occur if the concrete in the positive moment section of span 2 remains plastic until such time as placement is complete in span 3 positive moment section.

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**E926: Prestressed concrete beam bridge, deck placement**

**NOTE:** CONCRETE DECK SHALL BE PLACED IN SECTIONS AND SEQUENCES INDICATED. (AN APPROVED ALTERNATE PROCEDURE IS TO PLACE THE CONCRETE DECK IN ONE CONTINUOUS POUR BEGINNING AT ONE END OF THE BRIDGE. << OR >> PLACING THE CONCRETE DECK IN ONE CONTINUOUS POUR IS PROHIBITED AND WILL NOT BE CONSIDERED FOR APPROVAL AS AN ALTERNATE PROCEDURE.) ALTERNATE PROCEDURES FOR PLACING DECK CONCRETE MAY BE SUBMITTED FOR APPROVAL. If the total volume of concrete deck is 500 CY or less and the designer has no structural or constructability concerns, then allow the contractor to place the deck in one continuous pour. If the continuous deck pour should start at a specific end of the bridge then modify the note accordingly. If the designer determines a continuous deck pour is not permissible, then explicitly exclude the option in the note.

If the total volume of deck concrete exceeds 500 CY then consider allowing a series of sequential pours sized between 300 to 500 CY from one end of the bridge to another. Consider showing a separate concrete placement diagram for this additional option. The concrete placement diagram shall specify a 2-day waiting period between subsequent pours. See BDM 5.2.4.1.2 for additional information.

Average deck retarders are pre-approved for about 10 hours. Contractors typically pour concrete decks at a rate of 50 CY per hour which results in the volume limit of 500 CY per pour.
Zone Painting for Weathering Steel Bridges

The following criteria is in BDM 5.5.2.4.1.2, but should be detached from tunnel-like conditions.

When to zone paint (draft):
- Vertical clearance is 20 feet or less, because these bridges are more susceptible to "tunnel-like" conditions.
- Bridges over interstates in urban corridors, since deicer treatment in these areas is typically more concentrated.
- ADTT = 10% or more under the bridge, since trucks generate more misting with deicers.
- Posted speed limit is 55 mph or greater, since higher speeds generate more misting with deicers.

What to zone paint (draft):
- Paint to a bolted field splice when doing zone painting. If the field splice is at least 40' from edge of shoulder then you can stop there or else you may need to carry painting over the pier and to the splice in the next span.
- Paint all diaphragms in the zone.
- When doing zone painting the exterior girders shall be fully painted in the zone, but shall be partially painted for the full length of the bridge according to BDM 5.5.2.4.2. Painting only a portion of the height may not matter much when doing shop painting, but it may be beneficial for future field painting since you only need to go part way up on a portion of the girder.
- If painting the entire surface of all girders still use weathering steel but forgo the 1/16" added thickness requirement.
- If doing zone painting or no painting use weathering steel and include the 1/16" extra thickness for all girders everywhere.

Transparent Stay-In-Place Deck Forms (Draft)

Projects with the following criteria may allow transparent stay-in-place forms in the plans:
1. Bridge spanning over a railroad.
2. Bridge spanning over non-navigable high water.
3. Tub girder bridges.
4. Bridges requiring top down construction, i.e. utilities or obstructions inhibiting access from below.

Possible Note:
At the contractors option transparent stay-in-place deck forms may be used for this project. The stay-in-place forms shall have a minimum average transparency of 70%. Shop drawings and calculations shall be submitted for the engineers review. The transparent stay-in-place form material and installation cost shall be included in the pay item for structural concrete for the concrete bridge deck.

Traffic on 4" x 8" tube deck drains

Curb for Overlay Projects:
- Cold joint between curb and deck.
- Sound interior curb fascia for hollows.
- Underside of deck overhang and/or exterior fascia of deck or curb has staining and leaching.
- Curb rebar may have up to 100% section loss.

Missing rebar due to corrosion.
Developmental Specifications in the Works:

New DS for “Mass Concrete – Control of Heat of Hydration”

- Based on current Special Provision (existing DS-15032 is now obsolete)
- Produce a mass concrete placement free of cracks caused or worsened by concrete heat of hydration.
- Accomplish this through appropriate concrete mix design and control of concrete temperatures and temperature differences.
- Use of concrete pre-cooling, concrete post-cooling, application of insulation or external heat, and/or selection of reduced heat of hydration concrete mix may be appropriate for this purpose.
- Mass concrete is defined as any concrete placement with a least dimension greater than 4.5’.
- Tier 1 thermal control plan - mass concrete with a least dimension between 4.5’ and 6.5’.
- Tier 2 thermal control plan - mass concrete with a least dimension greater than 6.5’.
  - Requires PE design
  - Thermal modeling

Developmental Specifications in the Works:

New DS for “Girder Erection Plan”

- Based on current Special Provision
- This work shall consist of developing, engineering and submitting a detailed Girder Erection Plan which shall include erection plans and procedures substantiated with appropriate erection engineering calculations.
- Currently required when:
  - Shoring towers and/or strong-backs are used by the contractor.
  - Erection is from floating equipment.
  - The girder system includes lateral bracing.
  - Girder radius of curvature is less than 20 times the span length.
  - The bridge is over or adjacent to a railroad.

Construction Issues

Too much top of concrete deck removal on a CCS bridge with staged construction?

Too much full depth concrete deck removal on a PPCB bridge with staged construction?

Research

Evaluation of D.S. Brown Steelflex Strip Seal Expansion Joint Systems at Skew

The Iowa DOT LRFD Manual currently specifies that strip seals lose movement capacity and may not be practical for skew values greater than 30-degrees.

This study seeks to test and verify this for the D.S. Brown A2R-400 and A2R-XTRA strip seals installed with D.S. Brown’s SSA2 Railing.
Pile Footing Optimization

- **Optimization Goal**
  - Minimum number of piles.
  - If two pile arrangements yield the same number of piles then the secondary goal is minimal footing area.

- **Constraints**
  - Maximum and minimum pile spacing
  - Maximum and minimum pile load
  - One-way and two-way shear

- DOT and 6 consulting firm examples